RIO SALADO • MASTER PLAN • APPENDICES

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PRELIMINARY DRAFT

Rio Salado Master Plan • Appendices

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A. EXISTING PHYSICAL AND SOCIAL CONDITIONS

Existing Physical and Social Conditions

Character and Topography

The Rio Salado Development District lies within Maricopa county and includes parts of the Gila River Indian Community in the west and the Salt River Pima-Maricopa Community in the east. The Planning Area also falls across the political jurisdictions of the cities of Mesa, Tempe, Phoenix, and Avondale. It is a narrow strip of land which includes the natural bed of the Salt River and adjoining lands in the one hundred year floodplain. It begins at the Granite Reef Dam in the east and follows the riverbed for approximately 40 miles to the west. The width of the planning area varies from one to five miles, and it covers about 100 square miles. The Rio Salado Development district derives its name from the Spanish name for the Salt River, Rio Salado, on early maps of the area. The old Spanish name and the current legal English name for the river are both commonly used.

Approaching Phoenix by air, one sees a study in contrasts. The sprawling grid of green agricultural fields rests the eye from the bright, highly reflective manmade surfaces throughout the residential and commercial areas. The flatness of the landscape is randomly pierced by the jutting forms of solitary basalt buttes. Large, irregularly shaped industrial parks and housing developments scattered through the region seem to be consuming the remaining agricultural fields. Man's efforts to tame and develop the desert have been impeded only by the mountain ranges bordering the region and by the winding, gravelly bed of the Salt River, whose periodic flooding has kept development back from its banks.

Once on the ground, the topographic contrasts are more dramatic. The skyline of Phoenix's central business district competes for attention with the Papago, Tempe and South Buttes and the farther horizons of the Superstition, McDowell and Sierre Estrella ranges.

Within this context, the Salt River basin seems even more vast than from the air. During the 1980 flood, the waters breached the steeply sloped banks and in places covered a six-and-one-half mile wide area. Aerial photography taken before and after major floods indicates that major changes occur in the stream cross-section and also in the stream profile. Where previously an island or protruding bank may have existed, the erosion and scour can wash materials downstream and create new islands or filled in areas as the floodwaters recede. A typical section of the Salt River would show rocks and boulders at the river's edges, sandy to very soft material in the center, and alluvial deposits of gravels and river rock scattered intermittently throughout. The riverbed is therefore very dry except for some areas of standing water--those being below the sewer treatment plants, in deep gravel pits which contain ground and rain water, and just below the dam where water has spilled over and become trapped. The river banks enclose a floodplain which consists largely of sand and gravel. There are two dozen commercial sand and gravel operations along the river, and as many known landfills. The mining operations are continually changing the shape of the riverbed. Unofficial dumping occurs frequently, creating unsightly piles of decaying household appliances, automobile tires, and the like.

The Rio Salado Development District is segmented north/south by bridges and temporary roads through the wash. The area comprises three types of landscape: the upper and lower six-mile reaches are still largely undeveloped; the adjacent eight-mile stretches consist of agricultural and residential areas, interspersed with occasional industrial development; the central fourteen miles from the Mesa/Tempe line to Phoenix's 40th Avenue is highly urbanized.

The landscape of today is far different from that of the past, prior to the construction of the up-stream storage dams. Because the Rio Salado was once a flowing river it supported a rich array of plants, including large galleries of cottonwood and extensive mesquite bosques similar to what is now found above Granite Reef. Tamarisk trees also began to increase after their

introduction in the late 1800's.

The landscape is spotted with plants which are structurally adapted for life and growth with a limited water supply. Common plants with xerophytic characteristics include creosotebush, mesquite, desert salt bush and burroweed. A richer habitat exists west of the 91st Street sewage treatment plant, where one finds willow, cottonwood and tamarisk along the banks of the flowing stream.

Although wildlife is scarce, muledeer and smaller mammals and reptiles can be found. Below 91st Street, one can find indigenous streamside breeding birds and migratory and wintering birds. A concentration of small animals and birds is also found at the easternmost end of the planning area.

Climate

The area is characterized by long hot summers with maximum temperatures reaching over 110°F and short mild winters with minimum temperatures averaging 38°F. One of the principal attractions of this area is the high percentage of sunshine (86% of the year).

The mean annual precipitation range is 6" to 9", with more than 50% of the total rainfall occurring between November and March. Winds and precipitation generally move into the area from two distinct directions--in summer from the south, originating in the Gulf of Mexico, and in the winter from the west, originating at the Pacific Ocean.

The character of the rains is also varied. In summer, the rains appear as short intense thunder showers, occurring over small areas and sometimes producing destructive flash floods. In winter, the rains may last for several days and usually occur as gentle showers over large regions.

The design implications of these climate conditions should include the following:

1. Shade structures and low water shade trees--to modify the intensity of sun, heat and glare.

2. Location of buildings, shade structures and plantings--to take advantage of and to channelize cooling summer winds.

Geology and Soils

The planning area is largely a basin and range formation: a series of broad alluvial basins enclosed by widely separated hills that extend southward from Camelback Mountain to Tempe and Bell Buttes. These "basins" or valleys are filled to a substantial depth with unconsolidated sedimentary material. Most of the hills and higher lands of the project area are underlaid with basalt, and in some places, such as the band between the Tempe and Bell Buttes, this basalt even appears over the surface.

Within the study area there is an abundance of sand, gravel and stone cobbles. Within the Salt River channel, particularly in the narrower, deeper areas of the riverbed, the finer particles of sand, clay and silt have washed downstream, leaving an abundance of larger cobbles in the 4" to 10" range. In the wider areas there is normally a depositation of fines, as the floodwater recedes. The gravelly, stoney material usually extends to a depth of more than 100', with mixtures of silty, clay materials and occasional clay-silt lenses.

Outside the Salt River area, within about two miles, the same soil conditions exist, except that there normally is an overburden up to about 12' thick consisting of sandy, silty fines with some small stones and gravel. This is covered with topsoil to a depth of about 1" to 6".

The bottom lands of the Rio Salado District, being composed of very course soils of low water holding capacity, are generally unsuited for agriculture. The broad plains and side slopes of the valleys and river on the other hand, being

composed of potentially very productive soils when irrigated, will be very suitable for agriculture. Any intensive development of green ways would be most easily developed within the broad plain areas. With soil improvement, including increased water holding capacity, some green spaces could be developed within the bottom lands.

In both soil situations, if exogenous plant materials are to be introduced, high saline levels may make it necessary to separate soils via semi-permeable membranes to keep the salt from injuring or killing the plants. Constant and well maintained drip or trickle irrigation systems will need to be incorporated into any planting design except one utilizing naturalized plantings.

The chance of earthquakes occurring in the Rio Salado project area is extremely low. However, some tremors from earthquakes in California and Mexico have been felt here.

Present Use of the Riverbed

The uses of the bed and banks of the Rio Salado are varied. Sand and Gravel mines are found in extensive operation throughout the Rio Salado district. In 1981, 8 million tons of excellent quality gravel were mined from the river bed, most of which was used locally. Figures show that two-thirds to three-fourths of all sand and gravel mined in Maricopa County is taken from this river. Also, contrary to previous belief, sand and gravel are expendable resources with the life of the existing mines on the river varying from 10-50 years. At the end of their productivity, with some forethought, these gravel mines can be reclaimed and reused for active and passive recreational uses. A site is currently being prepared in Phoenix near 7th Street for an industrial park, for example.

More than 20 landfills occur along the Salt River. Only five of these are active. These landfills present numerous constraints for the development of the project area. The details will be outlined in later sections of this evaluation. There are also three sewage treatment plants found within the District. Two are in Phoenix at 27th and 91st Avenues and the other is in Mesa at Dobson Road. The environmental problems associated with these will also be discussed later.

Silt extraction occurring by the stockyards in the western part of Phoenix is a minor operation in the riverbed. This mine could be an excellent source of supply for planting medium for any new landscape development in the project area. In addition, with their machinery and knowledge of the riverbed and grading techniques, the silt extractor company could be instrumental in reshaping and terracing some of the landforms within the Rio Salado District.

Finally, the river's bed and bank are presently being used as "free" dumping grounds for old cars and garbage. Future development should discourage these negative activities by eliciting a strong positive sense and character for the river.

Recreation

In planning for recreation in Rio Salado it is important to be aware of existing recreational resources. Also important are the trends in recreation based upon user needs and economic factors.

Following is a list of local parks and recreational facilities which should be considered in future planning.

a) Casey Abbot Recreational Area

b) Papago Park--(Phoenix)-picnic facilities and ballfields.

c) South Mountain Park--(Phoenix)-picnic facilities and ballfields

d) Arizona State Fairgrounds

e) Phoenix Municipal Stadium

f) Phoenix Zoo

g) A.S.U. Sun Devil Stadium (Tempe)

h) Moeur Park--(Tempe)- 10 acre picnic area with playground for handicapped individuals on Mill Ave.

i) Tempe Beach Park--15 acres of picnic, ballfields, swimming pool, and playground facilities at 1st Street and Mill Ave.

j) Playa Margarita--(Phoenix, 36th Ave. and Roeser)- 5 acre neighborhood playground

k) El Prado--(Phoenix, 19th Ave. and Alta Vista)-a large 40 acre open, largely passive recreation area with one basketball court and some picnic benches

l) Lindo Park--(Phoenix, 23rd Ave. and Roeser)- 10 acre neighborhood park

m) Rio Salado Industrial Park--(Phoenix, 12th St. and Elwood)-now under constructon, this facility will have picnic facilities, ball courts, and a golf course.

In addition, there are resources scattered throughout the metropolitan area such as riding stables, numerous public and private golf courses, race tracks, and man-made lakes. Most of these facilities, however, are not central to the populations of these cities.

Although recreation resources appear to be plentiful in the region, more are needed. As the price of gasoline increases and unemployment continues, the need for local recreation will also be expanded. Table A-1 shows the recreation needs identified for Phoenix in the needs' assessment workshop for the Arizona Statewide Comprehensive Outdoor Recreation Plan. Similarly, the Statewide Comprehensive Outdoor Recreation Plan also lists recreation needs for the metropolitan area shown in Table A-2.

TABLE A-1 Recreation Needs in Phoenix

Rank	Need		
1	Picnicking	8	Swimming, river or lake
2	Tennis	9	Boating, non-powered
3	Baseball/Softball	10	Swimming pool
4	Bicycling	11	Volleyball/Basketball/Badminton
5	Handball/Squash/Racquetball	12	Hiking/Backpacking
6	Water-skiing	13	Horseback Trails
7	Rafting/Tubing	14	Trailbiking

Source: Arizona Statewide comprehensive Outdoor Recreation Plan.

TABLE A-2 Outdoor Recreation Needs Maricopa County, 1981

Priority	Need	Priority	Need
1	Additional public parks that provide large areas of undeveloped open-space and small pockets of development for structured recreation activities and support facilities.		Fields for organized or unorganized sports are also needed.
2	Centrally located recreation areas with indoor and outdoor recreation facilities and programs that meet the recreation needs of both the young and old.	4	Additional public land for future recreation development and open-space requirements.
3	An open-air or domed multiple-use sports complex for track and field, football, soccer, and other organized sports needs to be developed in Maricopa County.	5.	A complex of lighted game courts. The complex should be designed to accommodate a variety of games such as tennis, handball, four-square, shuffleboard, and basketball played simultaneously. Turf or sand areas for games like volleyball and tetherball could also be included into the court complex design.

Source: Statewide Comprehensive Outdoor Recreation Plan.

The Rio Salado District is ideally located to serve many of these needs. In developing this area, particular thought should be given to designing places to support the following activities:

a) Lakes for fishing, swimming, and non-power boating

b) Locat wilderness and camping areas

c) Scenic drives and walking trails

d) Horseback riding trails

e) Public golf courses

f) Courtgames

g) Rollerskating--specially paved and graded "loops" and "hills" can be designed for this revived sport. Such could also become tracks for go-carting, tricycling and skateborading.

h) Grass fields for field games

Areas of New Development

As one would expect in a fast growing metropolitan area, there are many new developments now occurring and being planned. Following is a list of principal projects within the area. Some projects outside the project boundary have been included because they may have a direct impact upon the project area.

Phoenix

1. The City has targeted an area in South Mountain (Neighborhood Strategy Area B) for a major rehabilitation and infusion of public aid for housing and commercial development.

2. New industrial parks are developing along 24th Street near the airport, in the areas adjacent to I-10 on the south side of the river between 32nd and 48th Streets, on the north side of the river at 7th Street, and scattered throughout the South Mountain area.

These industrial parks are primarily warehouse and shipping/distribution centers and not manufacturing operations.

3. An office complex for the Salt River Project is being planned for the old Legend City site.

4. The central Phoenix (downtown) area has a street improvement program as part of an overall downtown revitalization program starting in 1983 and wants to become the cultural center of the city. Several high-rise office structures are planned in an effort to redevelop downtown as an active primary center of commerce.

5. Several new bridges have recently replaced those washed out in the last flood.

Tempe

1. Trailer courts and apartments are developing on the east side adjacent to Mesa.

2. A.S.U. is considering a large research park in South Tempe on their existing property. They also plan to construct a new golf course at Rural Rd. in the near future.

3. A major new hotel is planned across from Tempe's City Hall which will also front on Mill Ave. Other hotels are also being discussed.

4. Several mixed use developments are being discussed for parcels near Papago Park and near Indian Bend Wash.

Mesa

1. A major new contributor to Mesa employment will be the Hughs Helicopter plant in northeast Mesa.

2. A new bridge is planned at Thomas and McDowell to connect across to the Salt River Pima-Maricopa Indian Community.

3. The first phase of a city park adjacent to the Dobson Rd. Sewage Treatment Plant is under construction.

Gila River Indian Community:

1. Maricopa County plans to construct or improve roads and river crossings at 91st and 115th Avenues.

Salt River Pima-Maricopa Indian Community

1. Industrial areas will be expanded along the river edge.

2. Agricultural land will remain constant.

3. Health care facilities will be increased to serve residential clusters.

4. There are plans to develop a commercial office park at their boundary to Scottsdale and where new Thomas Road Bridge will be constructed.

5. Commercial recreation is contemplated near the dam in the future.

Public Land Ownership

The table below of publicly owned land within or adjacent to the Rio Salado gives the impression that much of the planning area might be available for easy redevelopment. Such publicly owned parcels generally reduce the time consuming and costly process of land assembly, and insure a greater degree of land use control in the development process. The case here, however, is that much of this public land is in use for vital public facilities such as sewage treatment plants, electric power facilities, an

TABLE A-3 Public Land Ownership

(estimate)

Location	Acres[1/]
Phoenix	1,030
Tempe	660
Mesa	130
Total	1,820

Note:

1/ This does not include publicly owned land which will continue in its current use such as the existing sewage treatment sites.

airport, etc. Except for some small holdings by the State Land Trust, the Indian Communities, and the Federal Government, there is little publicly owned land now available to help steer or stimulate development. Indian community land is, of course, tightly guarded for the primary benefit of its residents.

The State Land Trust holds more than 500,000 acres of land in the Phoenix area, a tiny part of which falls within the project area boundaries. The Trust now earns revenues for education by leasing this land, primarily for grazing and agricultural uses. The average value of this land is $3,000 per acre, leased at less than $1.00 per acre. The State is also entitled to receive 200,000 additional acres from the Federal Government in the future. Some of this acreage may be in the river bottom.

Another resource is the 9.5 million acres the State Land Department holds throughout the State. These Trust lands, and especially those in the Phoenix area, may potentially be a valuable resource for the Rio Salado through exchanges with private landowners in the District who may be interested in acquiring State land at another location.

The recent thinking of the State Land Trust is favorable to Rio Salado Development. Current policy is to promote development of urban lands for income to the Trust. The Trust recognizes that far greater earnings are possible if lands are leased or sold for commercial uses rather than for grazing. They see their lands in particular as a resource for increased housing development.

Some policies of the Trust, however, may limit its involvement in the development of the Rio Salado. For example, the statute allows land exchanges, but prohibits these exchanges from crossing county lines. Another limiting factor may be the small staff and operating budget of the Trust. Land exchanges are complex and legally cumbersome and the Trust can presently manage only four or five per year on a state-wide basis. For land exchanges to be a significant factor in development of the Rio Salado, the Trust must be given more staff to manage them.

Transportation

The majority of Phoenix area residents have private means of transportation--most often a passenger car. One-third of area residents own pickup trucks. In a recent consumer survey, 3% of those interviewed indicated that they use public transportation. In fact, most residents complain about the mass transportation system, reporting that there are too few bus lines and that scheduled pickups are infrequent and unreliable.

The heavy reliance on private automobiles has caused a steady flow of traffic on the roadways in the planning area. While traffic tieups are relatively minimal compared to most other large urban centers, there is indeed quite a bit of traffic on the area's wide and well maintained streets. This is especially so in Tempe where traffic is funnelled through from the rapidly developing areas of Mesa and Tempe to Phoenix. It is

estimated that 24,000 cars use Mill Street each day. Additionally, 70,000 people attend football games at the Sun Devil Stadium at A.S.U., causing severe traffic problems. Backups also occur daily on the I-10 freeway during the peak rush periods.

The planning area is primarily served by numerous major arteries, the Maricopa freeway (I-10), the Hohokam Freeway, and the Bee Line Highway. The road system is in relatively good condition and each municipality has planned to continue upgrading these thoroughfares in the coming years. The City of Phoenix, for example, has programmed $179.5 million to be spent on major street improvements from 1981-1987. Phoenix road construction projects which will affect the planning area are: University Drive in Phoenix between 40th and 48th Streets; 40th Street from Broadway Road north to University Drive; and, Broadway Road from 19th Avenue to 27th Avenue. The proposed extension of I-10 westward through Village A would likely stimulate growth of new industrial parks, and would diminish agricultural land.

The City of Tempe has begun construction of a parkway system which will run along the river bottom connecting into the freeway system. The City of Mesa is considering the continuation of this parkway system through its boundaries. Maricopa County has recently obtained a right of way to improve the river crossings at 91st Avenue and 115th Avenue. The Salt River Pima-Maricopa Indian Community is planning the extension of Curry Road easterly from Hayden Road across Pima Road.

Bridges across the Salt River serve an important function for the proper flow of workers and industrial goods to and from their destinations. During the last major floods of 1978 and 1980, most bridges were washed away. Some of these have now been replaced, while others are planned for construction during the next three to four years.

Table A-4 is an inventory of the bridge crossings and their status.

TABLE A-4 Rivercrossings

Bridge	Status
67th Avenue	desirable, but not programmed
51st Avenue	newly constructed
35th Avenue	programmed
19th Avenue	newly constructed
7th Avenue	programmed
Central Ave.	withstood the floods; still in place
7th Street	programmed
16th Street	newly constructed
24th Street	newly constructed
I-10, east of 24th St.	withstood the floods; still in place
Hohokam Expressway	programmed
Mill Avenue	withstood the floods; still in place, but needs repairs
Rural Road	newly constructed
Hayden Road	under construction
Pima-Price Road	programmed
County Club Drive	newly constructed
Gilbert Road	programmed
Alma School Road	newly constructed

Fire Protection

Fire protection is supplied by the Phoenix, Tempe, Mesa, and Rural Metropolitan Fire Departments. Except for one fire station needed, but not funded, at 35th and Southern Avenue in Phoenix, service seems quite satisfactory for the existing population and businesses. Future needs will depend on the amount and type of new development proposed.

Existing engine companies which border the Rio Salado are shown in Table A-5.

Coverage is determined on the basis of a one and a half mile service radius. Engine company 19, located at Phoenix Sky Harbor International Airport, is not considered to have a service radius because of its specialized function and also because the runway configuration precludes any effective north or south movement from this location.

TABLE A-5 Engine Companies

o	21	27th Avenue and Buckeye (near Murphy School)
o	6	7th Avenue (near Memorial Hospital)
o	16	16th Street and Henshaw (near Sleiff School)
o	19	Sky Harbor International Airport
o	29	Van Buren and 40th (at Grand Canal)
o	13	48th Street and Thomas
o	39	Southern at 39th Avenue
o	22	Broadway at Central Avenue
o	23	Broadway at 24th

Police Protection

Although the Phoenix metropolitan area is 26th in size nationally, it ranks 9th in crime. Phoenix police report numerous burglaries and thefts in areas along the river. Much of this is crime against businesses carried out by adults. Other than high crime areas around public housing developments and within downtown, the Phoenix Rio Salado area seems to have an average crime rate for household burglaries and crime against individuals. As in most cities, juveniles are responsible for 50-75% of all burglaries in the City.

Only two police stations are located within the Phoenix Rio Salado boundaries, at Sky Harbor Airport and on 5th Street in Tempe. There is also a small sub-station just outside the planning area at 114th and Southern Avenues. The County Sheriff is responsible for all unincorporated areas and small municipalities, and the Salt River Pima-Maricopa and Gila River Indian Communities are policed by their own departments, funded by the Bureau of Indian Affairs.

Solid Waste Disposal

The tremendous problem of what to do with urban solid waste has not evaded the Phoenix area. Only two sites are now open to serve the City of Phoenix. One of the two will be filled to capacity within five years. The City is seeking an alternative site within South Mountain due to the prohibitive costs of hauling waste to new sites that may be located in outlying suburban areas. The Salt River banks have traditionally served as the dumping ground. Pressure to establish a new landfill along its shores may be strong if another suitable site away from the river is not found soon.

The Cities of Mesa and Tempe also operate landfills on the River. Future alternatives for these sites have not been considered. The Salt River Pima-Maricopa Indian Community also leases a landfill site to the City of Scottsdale. Plans for this community imply that this activity may continue for some time. The negative aspects of all landfills along the river are not only aesthetic. They also create foul odors which may inhibit development and they have contaminated ground water. This is discussed in greater detail in the Environmental Problems section of this summary.

Physical Barriers

The barriers considered here are physical elements that separate neighborhoods or districts by restricting movement and connection physically, socially, psychologically or visually. Many such barriers are found throughout Rio Salado and generally fall under one of two categories: lineal barriers or mass barriers. Lineal barriers include the railroad tracks, I-10, transmission lines, airline flight paths, and Rio Salado itself.

The impact of the railroad tracks as a barrier is particularly strong at Central Avenue where the street passes under the tracks. The underpass creates a "dark pit" which makes the southbound driver feel he is coming up on the "wrong side of the tracks." Ways of opening up this underpass should be explored in the design process. On other streets such as 7th Avenue, and 7th and 16th Street, where the street passes over the railroad, the barrier effect is less. Neighborhoods all along the route are, of course, affected.

The elevated I-10 is an even more significant barrier, which closely parallels the river from Central Phoenix to Tempe. It also crosses the river in a broad swath. Because it is elevated on the earth beam, this barrier can only be penetrated at major streets. Further, since it is becoming lined with industrial developments, its zone of influence and separation of the Rio Salado from residential areas is much extended. This barrier will likely prove very resistant to change but local connections may be improved at key crossings. Particular crossings needing attention are Central Avenue, 16th Street, 7th Avenue and 7th Street from the North, and 32nd and 40th Street from the South, where important pedestrian connections to the Rio Salado should be made.

Transmission lines allow free movement under them, but create a problem in several ways. First, the high poles and wires are a visual barrier, dividing a long stretch of land. Second, the static electricity given off from the current is somewhat dangerous and pedestrian activity below these wires should be restricted. The noise of the current through the wires is also unpleasant and distracting. Third, building codes do not permit the building of structures under high voltage power lines, although parking and paving is allowed with the permission of the utility company.

The Salt River itself is a lineal barrier between the northern and southern parts of the Phoenix metropolis. Many residents of South Mountain appear to feel that the area has been accorded second class status by the City government. They feel they are on "the wrong side" of the river. The fact that Tempe and Mesa have become major centers of regional, industrial and residential growth has made separation from Phoenix a more acute problem than in the past. Mill Avenue in Tempe has become a daily commuter bottleneck as a result and the isolation of this area during the last major flood created severe problems. The new bridges now under way, together with the development of the Rio Salado should have as a primary goal the knitting together of the northern and the southern metropolis.

Mass barriers include sanitary landfills, sewage treatment plants, large industrial dis-

tricts, the airport, large areas used primarily for junkyards and open lot storage, unplanned "free" dumping areas, and the sand and gravel mines. The sanitary landfills, sewage treatment plants, and airport are necessary operations which cannot be relocated in the short run, but by minimizing pedestrian and residential uses within close proximity, the negative impact of these large barriers can be lessened. Special planting and grading at the edges of these operations can also help to screen them from view. Nonetheless, they will continue to influence the type of development possible in their vicinity.

So too, the large industrial parks, some of which are made up of well designed and well landscaped buildings, will not be moved. Unfortunately, these "parks" create no useful park areas, and instead are substantial barriers to approaching the river. Care should be taken in the future to avoid such large areas of a single use along the Rio Salado.

One of the most visually disturbing of the mass barriers are the areas of open lot storage and junkyards. These are especially prevalent on the north and south banks west of Central Avenue. They are intermixed with areas where people have sporadically and thoughtlessly dumped their old cars, broken household items and trash. The image of the Rio Salado as a place where such activity can occur must be changed, since this type of use makes for very unpleasant connections to the rest of the city. If the proposed development is successful, these areas will be gradually upgraded. In the short run, they must at least be screened along key approach routes.

Landfills

There are 24 official landfill sites along the river's edge and some unofficial dumping areas. Following complaints about the contamination of well water in the area of the closed Estes Landfill, located adjacent to the active 40th Street Landfill, the Arizona Department of Health Services investigated conditions at this site. What these experts found was that leachate had been produced at the Estes sites for a period of three years (1978-81).

This was caused when the water table rose as a result of recharging from the major flood of 1978. The water mixed with the landfill matter to produce leachate which migrated through the aquifer and contaminated local ground water and wells.

The ground water testing in 1982 revealed an excess of common cations and anions. The most dangerous substance present was a potential carcinogen, vinyl chloride. Fortunately, the present water use down gradient from this landfill is for industrial and irrigation purpose. The two industrial wells are contaminated. This ground water is now unsuitable for domestic use without prior treatment for trace metals and organics. Although other landfills have not been similarly tested, there is a fear that they too may have caused contamination of the major portion of the ground water within the river bed and close by areas. The City of Phoenix has budgeted several surface modifications and monitoring programs for these landfills into its Capital Improvements Budget. Total correction of this problem, however, is doubtful.

This problem has implications for Rio Salado Development. New water bodies must be isolated from these fills, and water used for irrigation also kept away. Water pumped from the vicinity of the fills, which is desirable to prevent further leaching, must be carefully monitored for possible toxic substances and, if reused for water features, must be heavily diluted with unpolluted water.

Another problem documented by the Department of Health is the build-up of explosive gases. Methane gases are created within the landfill matter as a by-product of solid waste decomposition. The gases become dangerous when the volume exceeds a suitable level. This gas also migrates and collects in structures such as buildings, sheds,

utility lines, and drainage lines, causing fires and explosions. The City has also been ordered to install gas monitoring systems and migration control systems for gases at its landfills. This problem may also limit the ability to place structures near certain landfill sites.

Sewage Treatment Plants

Three sewage treatment plants are found along the Rio Salado, one in Mesa and two in Phoenix. Odors from the sludge beds of these treatment plants, especially those near 91st Street north of the Gila River Indian Community, can be very offensive and the plan must take this factor into account. New residential and recreational areas must be located upwind and far enough from these operations so that the odors will not intrude.

The undrinkable water from these plants is a positive resource. After secondary treatment, water from the plants could be reused for the irrigation of golf courses, special plant communities to create small lush oases along the Rio Salado, and for the irrigation of other landscape and recreational uses.

Air Quality

The EPA reports that airborne dust is the dominant particulate pollutant in the Phoenix air. The Zoning Administration, therefore, has placed emphasis on enforcing regulations regarding the paving of the parking areas and roadways. This factor will be important in the design and cost of developing the desert character of the Rio Salado. Its recreational uses must not exacerbate this pollution problem.

Noise

The presence of Sky Harbor Airport presents a significant factor in the noise levels and development possibilities within the project area. Much of the central portion of the project area is severely impacted with noise. To assess the noise impacts as a guide for development noise contour lines must be generated. These lines are either shown as Ldn levels (24-hour sound levels weighted for nighttime annoyance) or NEF levels (noise exposure forecast). With either measure one is able to judge which kinds of uses are possible within a particular zone and what the community response might be.

Given the standards shown in Table A-6 several areas within the project area are currently severely impacted. The land area bounded by 7th Avenue on the west, Apache Blvd. on the south, Scottsdale Rd. on the east, and Van Buren Rd. on the north, exceeds a level of Ldn 65. This means that residential areas currently located within this boundary are already experiencing unduly high noise levels and that the placement of new housing there must be seriously evaluated. It should be noted here that federal housing assistance such as FHA mortgage insurance is not available for sites where the noise levels exceed Ldn 65.

TABLE A-6 Noise Levels

Uses	Maximum Levels NEF	Ldn
Residential	30	65
Commercial/ Retail	40-45	75
Research or Scientific Activities	30	65
Industrial/ Manufacturing	45-50	75
Recreation	40	70

Another, smaller area exceeds the Ldn 70 level and is therefore, somewhat incompatible for recreation as well. This area is bounded by 16th Street on the west, Priest Drive on the east, the railroad right of way on the north, and University Drive and Buckeye Road on the south.

Obviously, the closer one moves to the airport, runways, and

other activities, the higher the noise level becomes and thus more and more uses are eliminated.

All structures, regardless of use, within areas that exceed Ldn 65 will need to have noise level reduction measures built in.

In a 1974 study, experts predicted that the noise impact would increase by 1985 unless modifications are made in the engines of aircraft, the source of most noise. Many proposed means have been recommended to try to alleviate this increase. However, market conditions, the economy, and a national government reluctant to force changes have thwarted these attempts.

The City of Phoenix intends to expand the airport within the next 20 years by adding a third runway for general aviation purposes. Based upon current air traffic patterns and schedules and the projection that all business jets would probably be powered by turbo-fan engines by the year 2000, we believe that the Ldn 65 noise contour will expand only directly to the south of the airport. Little change in levels to the southeast or southwest is envisioned.

Archaeological Sites

A regional archaeological overview of the Phoenix metropolitan area has been prepared by the Office of Cultural Resource Management, Department of Anthropology, Arizona State University. This office has developed an inventory of all recorded aboriginal archaeological sites and has ranked them in terms of their potential scientific and historical significance. The designations are as follows: very high sensitivity, high sensitivity, moderate sensitivity, and low sensitivity. In all cases, an intensive, on-foot survey of areas that will be directly affected by construction must be conducted before archaeological clearance is given. The Environmental Protection Agency will not award 201 Facility Construction Grants without a demonstration of archaeological clearance.

Areas along the Salt River in the agricultural district west of Phoenix have been ranked as high sensitivity districts. There are also several other areas which have been ranked as moderately sensitive, since they contain extensive evidence of past Hohokam habitation sites and irrigation systems. Although no surface evidence of any kind remains, sub-surface materials are a real possibility.

Those areas mapped as archaeological sites and therefore subject to an examination before construction grants are awarded are:

1. The flood plain from Price Road in Tempe to the easternmost boundary of the planning area.
2. Mill Avenue to Scottsdale Road in Tempe on the north bank of the Salt River.
3. 40th and 48th Street at Buckeye Road in Phoenix.
4. 35th Avenue and Southern Avenue in South Mountain.
5. 99th Avenue and Baseline Road on the south bank of the river.
6. 107th Avenue from Baseline north to Broadway Road.
7. The river bottom and extending southward in the westernmost section of the planning area from just west of Litchfield Road to Reems Road.

Policies and Development Controls

This section highlights those policies and development control issues that will influence the Master Plan for the Rio Salado.

Mesa

The development of new housing in Mesa is concentrating along the freeway corridor considerably south of the River. The City is discouraging new housing in the northern sector by withholding the extension of water and sewer services. This policy has been supported by the residents of this low density area and by owners of agricultural

land along the river. Although city planners envision little change within the project area, the construction of the Hughes Helicopter plant and other new major employers may create a demand for increased housing and commercial development along the Rio Salado, requiring a change in current Mesa policy.

Salt River Pima-Maricopa Indian Community

Since 1960, this Indian community has had a General Development Plan which has been updated from time to time. To enforce this plan, the Land Management Board assisted by staff makes recommendations to the Community Council which acts on each development proposal. This process involves a complex and time-consuming schedule of hearings and other evaluations. Major features of the General Development Plan include increasing land for commercial use on sites along the major arterials such as McDowell Road, encouraging commercial and recreation development at the eastern boundary with the Rio Salado District and the western tip of the Indian community at Hayden Rd., prohibiting new non-Indian housing, encouraging low density housing development which preserves the existing natural characteristics of the land, and maintaining the amount of land devoted to agriculture. The two Indian housing clusters are located away from the major arterials and some distance north of the river.

This land development policy currently indicates that sand and gravel mining as well as other industrial uses will continue to be the predominant landscape feature near the river. These economic activities are a vital resource to the overall health of this community. There will be little or no chance of bringing housing or people-oriented activity close to the river.

Tempe

The City of Tempe has invested significant staff time, volunteer energy and public resources in developing a Master Plan for the Tempe portion of the Rio Salado Development District. The City has carefully considered the current use and several future development options based upon the absence of additional upstream flood controls. It has recently adopted a final plan and zoning overlay, which are now the documents which give guidance to the City Council and its Boards and Commissions in making decisions. City officials have indicated that proposed changes to this plan will be considered.

The Tempe Plan is a moderate water development scheme encompassing 200 acres of multi-use lakes, ponds and interconnecting streams. The reclaimed river bed and flood plain would have several new recreational facilities such as an equestrian center, an auto course, and a new golf course at A.S.U. Additional high quality, low density housing on the north edge of the River from 48th Street to Priest Priest Drive would be created, light and heavy industrial uses would be continued at their current locations, a new highrise resort hotel, restaurant and lakeside retail site would be created at Curry Road, and Mill Avenue, and a new commercial area east of Mill Avenue, wrapping partially around the base of Tempe Butte, is envisioned. The plan also features a proposed Rio Salado parkway system on the south and north of the channel, connecting to the regional freeway system.

Phoenix

Working with citizens throughout the City, the City of Phoenix developed the "Phoenix concept Plan 2000: A Program for Planning" in 1979. This plan is intended to help public and private decision makers shape the growth in Phoenix in the most desirable, efficient, and equitable manner. Also created was the Interim 1985 Plan, which outlines development trends desired by the year 1985. Overall, the development of Rio Salado for multiple use is stated as a goal within Concept Plan 2000 and has been restated many times by numerous public officials.

Concept Plan 2000 is based upon the Urban Village concept. This is an approach which divides the City into 11 distinct sub-areas and proposes that each village be a mini-community with an

identifiable core. Each village will have its own character and emphasis, but it is intended that each village will have an adequate housing supply and mix, employment opportunities, and other physical and social resources for its residents.

In considering planning options for the Rio Salado District, development plans for Village 8 (the Inner City), Village 9 (South Mountain), and Village A must be examined. A principal feature of Village A is the reservation of the Rio Salado area for agricultural and industrial use. No new residences are recommended.

The Inner City Area Plan (Village 8) shows a solid industrial strip between the freeway and the river, except for a 5 block residential pocket west of 16th Street. If implemented, this industrial strip would create a barrier constraining the mixed use character of Rio Salado Development and making it more difficult to create active connections between South Mountain and Downtown.

The cores for both Village 8 and 9 are located along Central Avenue. Within these cores, higher density housing, commercial development and other intense activities are encouraged. This concept offers the Rio Salado District the opportunity to consider higher density development in the Central Avenue Corridor, without conflicting with current City planning policies.

Although the Concept Plan 2000 is designed to serve as a guide for decisions by the Planning and Zoning Commission, City officials made it clear that new industrial uses are a high priority. A Single User Employment District zone was created in 1981. This allows single companies to create campus-like light manufacturing or research plants on sites of 20 acres or greater in residential areas. Generous building setbacks and landscaping are required.

Even with such specifications, however, the end result is not always desirable to the neighborhood. The land use plan for Village 9, for example, restricts industrial activity to areas east of 32nd Street. Citizens of Village 9 indicate the proposals to rezone land to industrial designations west of 32nd Street have continued to be approved by the City. They believe that such approvals are destroying neighborhoods in South Mountain. A continued failure to follow industrial location plans in the future could undermine the success of the Rio Salado project.

The City has also begun making changes in the zoning ordinance to stimulate the development of a higher density, multifamily housing stock. A new residential zoning district was created which calls for 22 units per acre. The previous zones allowed either 14.5 in the R-3 or 29 units per acre in the R-4 zone, leaving a considerable gap in between. There are also fee waivers and density bonuses available for multi-family and highrise development. These policies offer opportunities for higher density development within the Rio Salado Development District.

County

The County has very minimal control over the development of its land. This is particularly true for plots of 5 acres or more or for agricultural, mining, or railroad holdings, all of which are exempt from zoning requirements.

This is particularly troublesome for a large site between Rural Rd. and Indian Bend Wash on the north edge of the river. This site is called County Island as it is unincorporated land under the County's jurisdiction which is totally surrounded by the City of Tempe. Over the years this area has come to be very dilapidated and the home of pornographic establishments and other undesirable activities. It may be that increased State Land Trust ownership of land here would be a desirable and more effective approach to controlling the future development of this section of the project area.

Gila River Indian Community

Although the precise plans of this community have not yet been identified, it appears that little change in current land

use is envisioned. Agricultural use with a small housing settlement represents its current land use. The Community has total control over its land area and development proposals are generally slow to be considered and difficult to have accepted by the Tribal Council.

Socio-Demographic Analysis

An analysis of 1980 census data for tracts located within the boundaries of the Rio Salado project area, compared with estimates of socio-economic characteristics for the Phoenix metropolitan area obtained through a consumer survey in 1981, has revealed several interesting conditions. The Rio Salado planning area has a younger population, greater concentration and percentage of non-white residents, a lower ratio of home-ownership, and lower rents and home values than metropolitan area averages. Recent data on income levels has not been available. Based upon all other indicators, however, it is reasonable to assume that individual and family incomes are also lower than the metropolitan average.

Residents of Rio Salado have a median age of 23.8 versus 29.9 regionally. In outlying Avondale and the unincorporated areas, the median ages are 35 and 31 respectively. On the other hand, Tempe has an extremely young population with a median age of 22 due to the University. The percentage of children under 18 is 30%, normal for the region. The senior population over 65 years of age, however, represents a smaller percentage than the metropolitan average (7% in the Rio Salado area versus 11% in the metropolitan area).

The Rio Salado project area has a much higher percentage of non-white individuals than does the metropolitan area. 81% of the region's residents are white, whereas 58% in the Development District are white. In the Phoenix sector this group is only 30%. The white population ranges from 72-100% in other jurisdictions, except for the Indian communities. The Hispanic population is 29% in the Rio Salado District, nearly twice the metropolitan average of 15%. This group is strongly represented in the Phoenix portion (33%), but is less than the metropolitan average in Tempe, Mesa, and Avondale. Blacks account for 10% of the Rio Salado population, whereas the metro total is 3%. In the Phoenix sector 19% of the population is black, but there are negligible numbers in all other jurisdictions. Indians are scarcely represented in any jurisdiction outside the Indian communities except for a 15% showing within the unincorporated area.

Housing statistics show that the Rio Salado has a higher than average percentage of renters. Twenty-two percent of the metro area units are renter occupied versus 38% in the project area. This percentage is highest in Tempe (90%). Rent levels are low in the project area. The median rent in the metro area is $263; the median rent in the Rio Salado is $180. Rents average $150 in the Phoenix sector, compared to Mesa and Tempe's higher averages of $275 and $225 respectively. Rio Salado's lower rents suggest that project area renters may be limited in their ability to move to more expensive areas of the region, to pay higher rents resulting from an increase in property values, or to afford home ownership without significant subsidies. These statistics suggest that the present Rio Salado population is quite vulnerable to speculation, and will therefore be significantly impacted by rising land values in the District.

Following is an overview of the major sociological features of each jurisdiction:

Avondale

There are 42 white people living here divided into 14 households. Rent averages less than $100 per month.

Unincorporated Areas

One-third of the households are small two-person families. Forty-five percent (45%) of the housing stock is mobile homes with low rents. Indians represent 17% of the population, possibly as a result of a housing shortage at the Gila River Indian Community.

TABLE A-7 Residents' Social Characteristics

	Metro Area	County	Phoenix	Mesa	Tempe	Avondale	Salt River P.-M. Indian Community	Gila River Indian Community	Rio Salado Area Total
1. Population	1,592,000	6,321	24,164	10,711	9,452	42	1,200 est.	500 est.	50,350
2. Race:									
a. White	81%	72%	30%	89%	89%	100%	-	-	58%
b. Hisp.	15%	13%	33%	10%	7%	-	11%	-	29%
c. Indian	1%	15%	1%	<1%	<1%	-	89%	100%	3%
d. Black	3%	-	19%	1%	2%	-	-	-	10%
e. Others (Asian, etc.)	1%	-	17%	1%	2%	-	-	-	1%
3. Age:									
a. Median Age	29.9 yrs.	31 yrs.	23 yrs.	25 yrs.	22 yrs.	35 yrs.	N.I.	N.I.	23.8 yrs.
b. Under 18	33%	30%	37%	32%	14%	50%	N.I.	N.I.	30%
c. 18-64	46%	58%	53%	61%	82%	43%	N.I.	N.I.	63%
d. 65 and over	11%	12%	10%	7%	4%	7%	N.I.	N.I.	7%
4. Female Heads of Households with Children Under 18	N.I.	5%	12%	6%	8%	N.I.	N.I.	N.I.	9%
5. Housing:									
a. Homeownership	78%	82%	66%	72%	30%	57%	N.I.	N.I.	62%
b. Renters	22%	18%	34%	28%	70%	43%	N.I	N.I.	38%
c. Trailers	27%	45%	11%	21%	14%	21%	N.I.	N.I.	18%
d. Median Value of Houses	$63,943	$65,000	$25,000	$65,000	$45,000	$35,000	N.I.	N.I.	$35,000
e. Median Rent	$ 263	$ 200	$ 150	$ 275	$ 225	<$ 100	N.I.	N.I.	$ 180

NOTE: N.I. = No Information

Gila River Indian Community

District Seven of this community within the Rio Salado, has a population of 500. Unemployment is reported to be extremely high.

Phoenix

The population within the Phoenix portion of the Rio Salado District is 24,164. Thirty-seven percent (37%) of the residents are under 18. Only 30% of this population is white, another 33% is Hispanic, and 19% is black. The homeownership rate is low for the region at 66%. The median value of homes is also low for the region at $25,000. The median rent is $150 and nearly all units have a rent under $400. The fact that 16% of all households in this jurisdiction have 6 or more occupants suggests overcrowding. Females head up 31% of all households, a statistic that also implies strained socio-economic conditions.

The Inner City Area Plan of 1979 provides an even greater insight into the difficult conditions of

some Phoenix Rio Salado residents showing that roughly 17% of the families which reside adjacent to I-10 on its north side receive public assistance. This area also had a high and persistent unemployment rate of 8.6% versus 3-4% in most other areas of the City. Although the profile shown in Table A-8 of the inner city of Phoenix north of the river to Buckeye Road is largely based on 1970 census, conditions have not changed significantly.

Tempe

9,542 individuals populate this sector of the project area. College students seem to dominate, resulting in a median age of 22. There are few children (14%) and few senior citizens (4%). The children tend to be pre-school age, probably families of graduate students and faculty. The great majority of the population is white (89%). The homeownership rate is the lowest of all jurisdictions at 30%, a result of a market which serves students. Most non-whites in these boundaries are homeowners, perhaps reflecting the minority middle class that has migrated to this suburban setting.

TABLE A-8 Summary of Inner City Demographics

Characteristic	City-wide	Inner City
Population under 18	25.7	40%
Female heads of households with children under 18	7%	15%
Median Income	$9,952	$5,786
Receiving public assistance	4%	17%
High school graduates	59%	17%
Overcrowded households	9%	27%
Unemployed Males	6.5%	9.7%

Mesa

This area is heavily white (89%) with some Hispanics and only 112 blacks. The median age is 25, with a strong representation of retirees (13% over 54 years of age). Twenty-one percent (21%) of the households live in mobile homes. As in Tempe, all non-whites are homeowners. There are many homes which are valued at amounts greater than $100,000 with 26 valued at more than $200,000.

Salt River Pima-Maricopa Indian Community

There are some 3,500 residents in this entire community. Only about 1,200 live within the project boundaries. Eleven percent (11%) or 400 persons are Hispanic. Only 7% of this community is over 65 years of age.

Housing

The project area has a wide variety of low density housing. It is mostly single family with some apartments and many mobile homes, and it ranges widely in age, size, style and quality. Housing conditions tend to be worst along the Rio Salado or near industrial areas. According to the Housing Condition Survey conducted in 1980, one-third of all Phoenix housing units which were judged in good condition in 1972, had slipped to the substandard category by 1980.1/ This report stated that the City would be faced with a housing crisis by the end of the decade if this trend continues. The study reveals that a significant portion of these substandard dwellings were found within the project boundaries.

The predominant housing style in the Rio Salado District is a small, flat-roofed, single-family dwelling of vaguely Spanish ori-

1/ When repairs required to bring a unit up to code compliance exceeds $5,000.

gin, made of stuccoed concrete block, painted in a bright color. These houses are typically surrounded by dirt yards, adorned by an occasional shade tree, trellis, fence, arched gateway, or low concrete wall. Occasionally, terra cotta statues and raised pools can be sighted. Almost always there are large TV antennas, swamp coolers or air-conditioner boxes and cars. Frequently, several ancient relics linger in the front or backyards for spare parts or play, together ith other discarded equipment.

The streets in these areas often become playgrounds for the area residents. Basketball hoops mounted on telephone poles and hop-scotch games drawn on the pavement attest to the inventiveness of children whose own yards are too restricted for group games. At night, adults and children gather in groups in the streets, seeking out the cool evening breezes.

Clearly established residential neighborhoods are numerous throughout the development district and within each of these areas, one will find a broad range of conditions and types. Although the current homeownership rate is surprisingly high at 55%, this neighborhood will require a significant infusion of public and private investment to bring about stabilization.

For purposes of this evaluation residential areas will be characterized as follows:

- Healthy (H): These neighborhoods show few signs of decay. Homes are generally well-maintained and public facilities are in relatively good condition and repair. In-fill development of vacant land and occasional buffers against incompatible uses are the extent of actions needed.

- Declining (Dec.): A neighborhood is in generally good condition, although there are beginning signs of blight and deterioration. Public facilities, including roads and parks, may be in a poor state of repair. Burned-out, vacant buildings, population decline and lack of private investment generally characterize such areas. Assistance to these neighborhoods would include in-fill development, loans to owners for improvements, repair of public facilities, demolition of some structures, and buffering from incompatible uses.

- Deteriorated (Det.): These neighborhoods have already experienced years of decline. Building maintenance is poor and much of the housing is renter occupied and in substandard condition. Public facilities are generally in poor condition or insufficient. Homes and businesses are vacant, and industrial use, junkyards and storage areas are growing. In order to reverse this trend, a major infusion of assistance would be required, although in some cases, the transition to industrial use may be appropriate if the remaining residents can be relocated to more attractive locations.

- Destroyed (Des.): These areas have passed the point of residential rehabilitation and consist of vacant land, some industrial use, and some poor quality residential or commercial development. For those remaining low income residents, the best solution will be subsidized relocation. This will leave the area open to improved industrialization.

- Forming (F): These generally rural areas are scattered with small residential pockets which will likely become the core of larger communities in the future. There will be a future need for public services in these areas.

Moving through the development district from west to east, the following residential areas have been identified and rated:

Avondale

1. 115th Avenue - west for several blocks, north of the river (F)
   Small pockets of houses and

mobile homes forming along Southern Avenue. Housing is modest to middle income.

County

1. 115th Avenue - 100th Avenue along Southern Avenue, north of the river (F)
   Mostly trailer homes of moderate quality.

2. 60th Avenue - 67th Avenue along Baseline, south of the river (H)

3. 48th Avenue - 35th Avenue, south of the river (H)
   There is a medium-sized trailer community at 40th and Southern Avenue.

Gila River Indian Community

1. One small residential area and scattered low income housing characterize the Indian community.

Phoenix

1. 23rd Avenue - 16th Avenue, south of the river (H)
   There is a trailer park at Broadway Road and 29th Avenue.

2. 16th Avenue - 16th Street, south of the river (Dec. - Det.)
   A wide range of housing types and conditions and increasing industrial use. There are several small trailer parks scattered between 7th Avenue and 7th Street.

3. 9th Avenue - Central Avenue, north of the river (Det.)
   Mostly modest housing with mobile homes mixed in. The area is suffering from the encroachment of industrial use. There are two dense public housing complexes in fair condition.

4. 7th Street - 20th Street, north of the river (Det.)
   Mostly low income, modest housing, some mobile homes, suffering from increasing industrial use.

5. 16th Street - 32nd Street, south of the river (Dec.)
   Low income homes, but in reasonably good condition. In need of strengthening and protection from industrial use.

6. 32nd Street - 48th Street, south of the river (Des.)
   Only scattered houses are left in this area, now characterized by industrial use, storage, and vacant parcels.

Tempe

1. Priest Drive and University Avenue south of the river (H)

2. University and Mill, south of the river (Dec.-Det.)
   This residential area is mixed with industrial usage.

3. Scottsdale Road, north of the river (Dec.)
   This modest area is mixed with industrial use and undesirable adult commercial establishments.

Mesa

1. Alma School Road - Mesa Drive, south of the river (H)
   This stable area also has middle income mobile home communities along McKellips.

2. East Mesa, south of the river (H)
   This low density area has middle to upper income homes mixed in with orange groves.

Salt River Pima-Maricopa Indian Community

Only one modest mobile home community and scattered low income houses lie within the project boundaries. New single-family homes within the Indian community are northwest of the project area.

These conditions correlate with the statistics related to median housing values, rent levels, and ownership status in a previous section of this summary.

Overall, there is a severe problem of the slow deterioration and undermining of residential areas in favor of non-residential usage. This is particularly true within the City of Phoenix. This trend was documented in a study of multi-family housing in Phoenix. It showed that most rezoning cases within the project boundaries in recent years have been to remove land zoned for housing use to non-residential uses.

This study also highlighted another problem - the inadequate supply of multi-family units. The Planning Department has recommended that "every conceivable effort be made to encourage high density development (in Village 8)." Further, they pointed out that "development of the Rio Salado project may be necessary to facilitate substantial multi-family development (in Village 9)." The City's policy of encouraging the creation of multi-family housing stock and the sheer availability of land in the project area may represent positive opportunities for the Rio Salado District.

Opportunities also exist to strengthen several residential areas, to create improved living conditions for many Rio Salado residents, and to bring about a better usage of land. Some of these opportunities come about as a result of new trends in the housing market. The favorable climate and characteristically simple construction have helped maintain the cost of new construction and rehabilitation at a relatively low figure in the Phoenix area. New houses in South Mountain are being offered for $40,000 and rehabilitation costs average $15,000 - $20,000 per unit. Efforts on the part of the City's Planning Department to streamline approval procedures should help lower construction costs further. The City's Housing and Urban Redevelopment Department is also encouraging higher density cluster developments which offer cost savings per unit.

Local private builders should be looked to for their experience in building moderate income housing. Tiempo Real Estate Development, an off-shoot of Chicanos Por La Causa, represents a potential new source for funding lower income housing development.

A full set of programs and mechanisms designed to stimulate housing construction and rehabilitation in Phoenix represent key resources in achieving the goals of the Rio Salado. Some are available city-wide, some are currently restricted to target areas. All of them will require additional funding in the future if an impact is to occur within this project area. The experience of these programs, however, is definitely an asset. They are as follows:

1. BMIR Loans provides 3% - 11% rehab loans to qualified owner-occupants of homes in the Target Area. They are processed through local lending institutions with the City-subsidized interest rates.

2. Deferred Loans allow eligible single family owner-occupants to apply for rehab funds with no payback interest. The loan is forgiven after ten (10) years of continuous occupancy.

3. Home Emergency Loan Program (HELP). Under this program, repairs to homes to correct emergency or critical maintenance problems may be made without bringing homes up to code standard. In order to qualify, a home must be determined to be too costly to rehabilitate or be located in the sub-area designated for HELP assistance.

4. Emergency Home Repair Program. Under this program City staff may make emergency improvements up to $800.00 to substandard homes where owners qualify as low income in accordance with Federal guidelines.

5. Urban Homestead. The Urban homestead project provides for purchase of HUD repossessed dwellings, resale to qualified owners, and rehabilitation financing.

6. Neighborhood Assistance Program. Under this program the City may provide public improvements including landscaping along major roads at entrances to neighborhoods and at various key locations within neighborhoods to improve appearance and pride in the area. The City may also provide technical and financial assistance to homeowners of property in standard condition who want to paint, landscape or otherwise improve the appearance of their homes or screen outdoor storage areas.

7. New Development Incentive Program. Through this program, incentives may be provided to developers to expedite the development of vacant land in the Target Area. Incentives may include the provision of public improvements, aid in land assembly and clearance, and help in securing financing.

8. Operation Paintbrush provides funds to reimburse property owners in Target Areas for paint and other materials used to improve home and building exteriors.

9. Major Home Repair Program. The Citywide program provides repairs to low and moderate income homeowners. The repairs correct major deficiencies and eliminate conditions threatening the health and safety of homeowners.

10. Weatherization Home Repair Program. This fund supplements home weatherization repairs beyond the $100 limit imposed on the use of the Department of Energy funds for this program. The program reduces cooling and heating costs of low income homeowners.

11. Neighborhood Rehabilitation Loan Pool. Continuation funding for loan pools providing financing tools for housing and commercial rehabilitation projects in Target Areas. Approximately 200 residential units will be addressed in 1982-83.

12. Fair Housing Counseling/ CHIPS. Comprehensive housing counseling, mortgage default and delinquency counseling, counseling to participants in HUR housing assistance programs, and the provision information to the community on fair housing laws.

13. Section 8 Moderate Rehabilitation Loan Pool. Funds to provide interest buy downs on approximately 50 rehabilitation loans on investor-owned subsidized rental property leased to Section 8 certificate holders. The program is designed to upgrade and prevent further deterioration of substandard, but basically sound housing.

14. Project Shipshape. Funding for the home maintenance and repair program for the elderly in Target Area B.

Finally, some attention must be paid to the presence and future role of mobile homes in the project area. Eighteen percent of all households (2,925) within the project boundaries reside in mobile homes. This ratio is highest in the unincorporated area (45%) and in Mesa (21%). Although Mesa officials report that their trailer parks house middle income retired and seasonal people, statistics reveal that the income of retirees is nearly half the area median ($12,872 vs. $21,933) suggesting limitations in their ability to move. A visual observation of trailer parks in Phoenix and the County suggest that residents of mobile homes here are economically limited. These parks appear to be occupied by younger, lower income families, in keeping with the characteristics of mobile home dwellers nationwide.

The location and design of mobile home parks in the area present aesthetic problems. The Rio Salado development offers an opportunity to integrate this important low cost housing alternative into its overall design and development.

Social Services

Social services delivery to the existing population varies from jurisdiction to jurisdiction as follows:

County

There are no social service facilities located within the project area.

Gila River Indian Community

There are no social service facilities located in District 7. The nearest health care is 10 miles southeast.

Phoenix

The City of Phoenix provides a wide range of social services and neighborhood health care to low income individuals. They are organized and administered through Neighborhood Councils and Human Resource Centers. They are relatively accessible to most current residents of the Rio Salado area. At least two are located within the project boundaries in Central Phoenix. Memorial Hospital is located north of the river on 7th Avenue.

Several private organizations and churches also provide social services. Some of these are:

The Urban League, located on 7th Avenue, provides job training, basic education, job placement, summer camp, and housing repair services.

Community Legal Services, Inc. is located on 16th Street, and provides legal assistance to low income persons.

Friendly House, Inc., located on 1st Avenue, offers counseling, job placement, youth and senior citizens activities, and alcoholism programs.

Valle Del Sol is located on 1st Avenue and coordinates programs in improved education, employment, health, and drug treatment and rehabilitation.

Wesley Community Center is located on 10th Street. This Center specializes in youth and child development, community organizing, senior citizens activities, and cultural development.

Chicanos Por La Causa operates several facilities within and near the Rio Salado project area. Its services and programs include sports activities, elderly services and counseling, cultural development, educational development, nutrition and food distribution, health screening, parenting education, alcoholism services, employment training and job placement, a credit union, and entrepreneurial development assistance.

Although the planning area is generally well served, there are some shortcomings. Social services of all types are needed for the residents of North Mesa, the unincorporated County area, and the Gila River Indian Community. These shortcomings must be addressed if new housing development is desired in any of these areas.

Cultural Analysis

Probably the most important cultural influences in the Valley are historical: the three heritage strands, Indian, Hispanic, and Pioneer American West. Art, architecture, events, and literature all reflect the strong influence and attraction of these cultural strands to present day residents. The iconography, materials, shapes, colors, textures, motifs, and artifacts of these cultures are visible everywhere in the Phoenix landscape. The design vocabulary of the area is largely drawn from the design expressions of these three cultures.

Indian

The longest influence is that of the Indians. Because of findings at Ventana Cave, archaeologists believe that human beings resided in Arizona for at least 10,000 years. Archaelogical finds of Indian culture in the Rio Salado project area date as early as 800 A.D. The Indian culture is varied, from the Basket Maker prehistoric cultures through the Great Pueblo Period of the

Hohokam era to the remaining tribal cultures of today. Arizona has one of the largest Indian populations of any state. More than 16,000 are living in the Phoenix area according to the 1980 Census. The Indian Nations primarily represented appear to be the Pima, the Maricopa, the Navajo, the Apache, and the Papago.

The Indian culture is--and has always been--influential in this state. Many of the national monuments in the state are artifacts of Indian culture (such as Walnut Canyon, Tuzigoot, Montezuma Castle, Tonto, and Casa Grande). Three of the state's foremost museums feature Indian Culture: the Arizona State Museum in Tucson, the Museum of Northern Arizona in Flagstaff, and the Heard Museum in Flagstaff.

Indian influence is subtle but pervasive, especially in terms of arts and crafts. The iconography of the area borrows heavily from Indian motifs (for example, the new Phoenix airport). Indian art is widely appreciated and displayed. It is also easy to trace Indian influences in the building types, since many buildings seem to echo forms, shapes, and colors of the Indian pueblos as well as Indian building materials. The canals that nourish the Salt River Valley were originally laid out by Indians.

Hispanic

Hispanics have also contributed greatly to the area. The credit for the first European visit is usually given to Fray Marcos de Niza, sent by the Viceroy of New Spain (Mexico). Coronado led an expedition to Arizona in 1540. Efforts of missionaries in the early 17th century were not overly successful, culminating in the Pueblo Revolt in 1680. However, by 1711, Father Eusebio Francisco Kino had established a number of missions in southern Arizona. Mission San Xavier del Bac is still in use, near Tucson. Tumacacori's partially restored ruins are part of a national monument north of Nogales.

The area was part of Mexico until 1848. The Mexican-Spanish influence is readily apparent. Not only are a number of persons of Mexican descent, (the Chicano population of Phoenix is said to be 16%), the influence of Spanish motifs is visible everywhere in decorative detail, in architecture, and in lifestyle. Mexican cuisine is popular, as is Hispanic style "patio-living" (a fusing of indoor and outdoor space for private living), as is the guayabera, a man's dress shirt with short sleeves.

The Spanish were brilliant water engineers, a skill learned from the Moors. They make very small amounts of water seem endless through ingenious fountain and reflecting pool designs. The pervasive Spanish influence in architecture can be seen most notably in the Churches and missions of the region.

Black American

The history of the settlement of Black Americans is not unlike that of Whites and Hispanics. Blacks came to the Phoenix area during the same time periods and very often for the same reasons. More often than not, however, Blacks tended to take on subordinate roles and positions because of racism and a lack of capital. There are numerous recordings of black prospectors who came in search of gold such as the case of Celeste Jones, a one-time concert singer from Detroit, who came in search of the Lost Dutchman's Mine.

As early as the 1500's, history records the story of the flamboyant Estevanico, a Black former slave, who came from Spain to lead a daring seven-year expedition of Spanish gold seekers through the area winning the admiration of hostile Indian tribes along the way.

Black cowboys played a significant role in western adventure and commerce. Between 1870 and 1900 Black cowboys were a recognized and viable force throughout the region. They were some of the best horsemen and cattle drivers. Nat Love, alias "Deadwood Dick", "Black John" Slaughter, and Crawford Goldsby, alias "Cherokee Kid" are just some of the more famous of these pioneers.

Most of the early Black settlers, however, were much like Mary Green, the first Black woman to arrive in Phoenix in 1868. She

and her four children came as house servants to a white family. Many others were agricultural workers, barbers, teachers, etc. The results of the hard manual labor performed by these individuals is at the heart of the total development of the City of Phoenix which is visible today.

Over the years, of course, the positions of many Blacks have improved. They are involved and represented in most sectors including the Phoenix City Council. As is the case throughout the nation, the Black American in Phoenix, with his African cultural roots, has contributed much to area culture in the form of music, dance, language, fashion, food and overall leadership and ingenuity.

White American

The White American influence began with the first trappers, early settlers, cattle ranchers, and prospectors of the region. As the area became settled in the 1880's, the culture of the American West played an important part in shaping Arizona's cultural style. Arizona prides itself on its western heritage, reflected in its clothes, its interest in the outdoors, its sense of entrepreneural independence.

Phoenix began as a place where hay was raised for the horses of Ft. McDowell. It was an unlikely place to become a large metropolitan area: it was not on a transcontinental railroad; it was oppressively hot; it had no water storage facilities for irrigation. It did have bold, imaginative and energetic leadership by persons like Dwight Heard who came from Chicago in 1895. These individuals successfully utilized the ancient Indian irrigation ditches and developed a system of canals and dams that led Phoenix to its prominent position. In 1889, the Territorial capital was moved from Prescott to Phoenix, and in 1912, Arizona became the 48th state.

By 1914, the Salt River project was a going concern with 240,000 acres of land under irrigation. The valley became a thriving agriculture enterprise, growing long staple cotton, sugar beets, oranges, melons, fruits of all kinds, and even boasting of ostrich farms.

Agriculture was the first important economic endeavor. After World War II, the five C's--cattle, cotton, copper and climate--were supplanted by manufacturing and tourism.

The rapid influx of new residents coming from the East and other areas of the U.S. since World War II has influenced the outdoor Western culture of the past. These newcomers have brought theater, classical music, and other diversities to the culture of the area.

Existing Cultural Resources and Organizations

The following is a partial list of principal cultural resources in the metropolitan area. These facilities usually lie outside the project area. Those within or very close to the project area are starred.

Phoenix

* Arizona State Capitol Museum
Arizona State Fairgrounds
* Desert Botanical Gardens
Heard Museum
Maricopa County Fairgrounds
Phoenix Art Museum
* Phoenix Civic Plaza
Phoenix Historical Society Museum
Phoenix Main Library
* Phoenix Municipal Stadium
* Phoenix Zoo
Pioneer Arizona History Museum (north of city)
* Pueblo Grande Indian Ruins and Museum
* Arizona History Room (First Interstate Bank Plaza)
Arizona Museum
Japanese Gardens
Arizona Mineral Museum
Veteran's Memorial Coliseum (1965)
Scottsdale Center for the Arts
Rosson House
Talies in West
Cosanti Foundation
Central Arizona Museum of History

* Harmon Library
Medical Museum, Phoenix Baptist Hospital
The Galeria (Arizona Bank Building
House of the Future (ah wua tukee)
Arizona Military Museum
McDowell Exhibit Plaza, Indian Bend Wash

Tempe

Grady Gammage Memorial Auditorium
Community Cultural Center
Escalante Community Service Center
Plazita de Descanso
University Art Collection
Salt River Project Exhibit
Gammage Center
Tempe Historical Museum
Kerr Cultural Center

Mesa

Mesa Community Center
Mesa Museum
Champlin Fighter Museum
The Museum for Youth

Cultural organizations

Phoenix Symphony Orchestra
Valley Shakespeare Theater, Inc.
Arizona Ballet Theater
University Dance Theater
The Heritage Foundation of Arizona
Office of Cultural Resource Management, Arizona State University
Pierre's Playhouse (Cave Creek), Stone Soup Players
Jazz in AZ
Classical Film Society
Arizona Theater Company
Open Stage II
Scottsdale Community Players
Scottsdale Center for the Arts
The Sunshine Players (Glendale)
Esoteric Speakers Platform
Arizona Authors Association
Phoenix Art Museum League
Glendale Little Theater
Arizona State University Theater
The Cookie Company Children's Theater
City of Tempe Parks and Recreation Dept.
City of Phoenix Parks and Recreation Dept.
City of Mesa Parks and Recreation Dept.
Metropolitan Youth Symphony
League of Arizona Metropolitan Ballet
Mesa Youth Center
Lyric Opera Theater (ASU)
Tempe Symphony Orchestra
Tempe Little Theater
Tempe Historical Society
Phoenix Historical Society
Phoenix Arts Coming Together, Inc. (PACT)
Arizona Humanities Council
Arizonians for Cultural Development
Helen Mason's Black Theater Troupe
Artists in the Black Community in Arizona
Arts Council of Phoenix
Arizona Theater Company
Actors Lab

Although this list implies a wealth of culture within the Phoenix area, there are indeed some problems which in turn provide the development of the Rio Salado opportunities for filling voids. First, this list of resources reveals minimal offerings of the cultures of the Hispanic, Indian, or Black population despite the importance of these groups to the history of this area. The rapid influx of people to the area suggests an attraction of the romantic aspects of the Indian, Hispanic and Old West heritage, but there is no direct grounding in these heritages.

The Phoenix Indian Center's annual report, for example, cites a lack of understanding between the Indian and non-Indian communities and has made the increase of cross-cultural understanding one of its goals.

Other than special arts programs from time to time sponsored by the Indian Center, and small exhibits of Indian artifacts in local museums, there are few opportunities to gain a full understanding of the Indian

culture. Thirty-eight percent of Indians surveyed in Phoenix indicated a need for a cultural center. The Hispanic community is similarly without a substantial mechanism through which to educate others of its rich cultural heritage. Except for small programs sponsored periodically within area schools, there is little opportunity to find Chicano culture.

"Racism is still a significant factor in the lives of blacks in Phoenix. Discrimination and barriers are more subtle than they used to be...but it is still here," according to Brenda Smith, Deputy Director of the Governor's Office of Small Business. One factor that perpetuates racism is lack of contact and understanding of black culture by non-blacks. Despite the fact that 60,000 blacks reside in the metropolitan area, there is no standing African or Afro-American exhibit.

Black student groups at local colleges sometimes offer art exhibits for 2 or 3 day durations, and one small black theater group struggles to stay alive in Phoenix. The local branch of the Opportunities Industrialization Center of America (O.I.C.) located in downtown Phoenix is currently working on a project to construct an addition to its career development facility which will include a gallery, exhibit area, and small theater.

The development of the Rio Salado offers an opportunity to bring about better cross-cultural understanding. A center or series of facilities could provide space within which various cultural groups, including that of the Pioneer West, would share their cultures.

Cultural resources are particularly lacking for the residents of South Mountain. Many residents of South Mountain have cited a need for space for carnivals, public meetings, and outdoor concerts and plays. Neighborhood cultural centers with an emphasis upon amateur participation in the arts might also be created within the Rio Salado District. One small amphitheater is planned for construction at 35th Baseline in Alvord Park. More are needed. A library facility for the residents of southwest Phoenix and the adjacent unincorporated areas is also needed.

The Rio Salado project will need local attractions to bring people from other parts of the community to this area and to bridge the gap between north and south in Phoenix and between the individual municipalities. Some residents indicate that people in the north, west and east of Phoenix are not interested in what happens in South Phoenix, Tempe or Mesa. People do not circulate much. For this project to succeed, there must be widely based community support. This will necessitate some strong, community-wide attractions. Some possibilities would include: a Children's Youth Science Center being considered by the Junior League, Youth Art Museum being discussed in Mesa, and a small scale World's Fair.

It might also be wise to re-evaluate the city's plan to construct a 15,000 seat amphitheater at the base of South Mountain. Residents are fearful of the negative impact that heavy traffic will have on their neighborhoods nearby. Locating such a facility within the Rio Salado project area could serve South Mountain and attract residents from North Phoenix as well. Many of Phoenix's major cultural facilities are also seeking to relocate into new, larger buildings. There is talk of locating a cultural center area within downtown Phoenix. Some have also suggested that this cultural area be centered within the Rio Salado project boundaries.

Schools

The Phoenix area is divided into numerous public school districts which operate independently of one another. They are separately funded and each has its own school board and administrative structure. These school districts also have little relationship to jurisdictional boundaries. Thus, children in Tempe, for example, may be attending Scottsdale High School, Tempe Union, or Mesa High School, de-

pending on which part of Tempe they live in.

Five high school districts and thirteen elementary school districts serve children in the Rio Salado Development District:

Aqua Fria Union High School District
- Avondale Elementary School District

Tolleson Union High School District
- Fowler Elementary School District
- Union Elementary School District
- Littleton Elementary School District

Phoenix Union High School District
- Phoenix Elementary School District
- Riverside Elementary School District

Wilson Elementary School District

Murphy Elementary School District

Balsz Elementary School District

Roosevelt Elementary School District

Laveen Elementary School District

Tempe Union High School District
- Tempe Elementary School District

Mesa High School District
- Mesa Elementary School District

In addition to the public school system, there are numerous privately run schools and special schools operated by the Indian Communities. In Phoenix alone, there are 24 private elementary schools and 11 private high schools. The Salt River Pima-Maricopa Indian Community operates the Salt River Day School which currently serves approximately 200 students through grade six. Some children in District 7 of the Gila Indian Community attend the Indian school in District 6 within the Community. Others attend the Union Elementary School District. Some high school students from both Indian communities attend the Phoenix Indian High School.

There are some nine post-secondary schools which serve the Phoenix area. Among them is Arizona State University in Tempe, the 6th largest University in the country with a student population of 39,000.

The others include:

- o Glendale Community College
- o Scottsdale Community College
- o Grand Canyon College
- o American Graduate School of International Management (Glendale)
- o Phoenix College
- o Rio Salado Community College
- o South Mountain Community College
- o Maricopa Community College

Generally, there appears to be an adequate number of schools for current residents of the area. In fact, some schools in the City of Phoenix are underpopulated and threatened with closure. An exception is the area south of the river west of 51st Avenue. This particular area has been experiencing an increase in residential use and students must travel a great distance to existing schools. Although the number of schools seems adequate, the quality of many of the public schools has been criticized. This may partially explain the presence of numerous private schools, and why the majority of white children in South Phoenix attend private schools, or public schools in North Phoenix. Mesa schools seem to enjoy the greatest confidence amongst those interviewed.

According to 1970 Census data within the Inner City Plan, adult residents living within the project boundaries just north of the river have completed an average of only eight years of school, well below the 12.3 average of the City as a whole. In addition, a needs assessment survey conducted by the Phoenix Indian Center revealed recently that 32% of Phoenix's adult Indian population is in need of basic education. The inadequate educational attainment of some of the current Rio Salado residents, has serious implications on their ability to participate in future development or employment oppor-

tunities within the project area. The quality of shcools will also affect the willingness of families with children to live within the project boundaries.

The Rio Salado project may offer a unique opportunity to create outstanding new educational facilities that will draw students from all parts of the City, similar to the Skyline High School in Dallas. A bold educational concept and facility will have great appeal.

The non-white population of the area is also concerned about the dearth of courses which should concentrate on the history and culture of the various minority groups in the area. This oversight deprives minority groups of taking pride in the contribution of their culture to the overall fabric of American life and perpetuates the lack of understanding between minorities and the white population. The Rio Salado schools should consider this important issue as an opportunity to expand and broaden their curricula.

Finally, the area currently lacks a high technology post secondary educational facility similar to Lowell Tech in Massachusetts. The availability of such institutions is important to high tech firms' decisions to locate in an area. The administration of A.S.U. is discussing the expansion of its engineering division to fill this void. It may be possible to locate this school within the Rio Salado Development District.

B. SUMMARY OF ECONOMIC CONDITIONS

Growth Projections

The following analysis examines regional growth trends and Rio Salado development potentials.

Regional Growth

To begin, population and employment projections complied by local planning officials are presented to get a sense of what knowledgeable people in the area think might happen.

A variety of regional projections have been reviewed. Those sources include the Arizona Department of economic Security and the Maricopa Association of Governments. A summary of the projected Maricopa County population trends is show in Table B-1.

TABLE B-1 Maricopa County Growth Projections

	1980	1990	2005	2035
Population	1,508,030	2,033,200	2,945,900	4,812,883
Dwelling Units	597,497	805,480	1,148,889	1,915,368
Residential Development (acres)	169,229	207,304	274,256	452,205
Population per Dwelling Unit	2.457	2.458	2.495	2.458
Dwelling Units per Acre	3.531	3.886	4.189	4.236

Source: Maricopa Association of Governments Transportation Planning Office.

Population

As seen in this table, the population of Maricopa County is expected to almost double by the year 2005 and to triple by the year 2035. The projected increase from 1.5 million in 1980 to 2.9 million in 2005 represents an average annual growth rate of 3.8 percent. The increase from 2.9 million in 2005 to 4.8 million in 2035 represents an annual average growth rate of 2.1 percent. The average number of dwelling units per acre is expected to increase from 3.5 in 1980 to 3.9 in 1990 and 4.2 in 2005 and 2035. Since the initial planning stages and implementation of flood control will take approximately 10 years, projected population growth from the period 1990 to 2005 is especially important. The regional population is projected to increase 45 percent from 1990 to 2005, or 3 percent per year.

Employment

The Department of Economic Security has projected Maricopa County employment, by category, to the year 2005, as seen in Table B-2. Total employment is projected to increase by 99.4% percent from 1980 to 2005, at an average annual rate of 4.0 percent. Employment categories, ranked according to the projected increase in the numbers of jobs, are shown in Table B-3. The greatest increases will occur in manufacturing, trade, and services. These three categories account for 62 percent of the increase in employment.

TABLE B-2 Employment Projections for Metropolitan Phoenix

	1980	1990	2005	Absolute Increase 1980-2005	Percent Increase 1980-2005	Absolute Increase 1990-2005	Percent Increase 1980-2005
Agriculture							
Proprietors	2,654	2,400	2,064	(590)	(22.2%)	(336)	(14.0%)
Labor	6,232	5,092	3,761	(2,471)	(39.7%)	(1,331)	(26.1%)
Mining	346	1,200	2,696	2,350	679.2%	1,496	124.7%
Construction	55,201	65,342	88,168	32,967	59.7%	22,826	34.9%
Manufacturing	111,503	177,046	298,874	187,371	168.0%	121,828	68.8%
T.C.P.U.1/	30,082	38,949	57,920	27,838	92.5%	18,971	48.7%
Wholesale/ Retail Trade	162,196	213,816	300,471	138,275	85.3%	86,655	40.5%
F.I.R.E.2/	45,184	55,684	75,183	29,999	66.4%	19,499	35.0%
Services	133,905	172,272	242,229	108,324	80.9%	69,957	40.6%
Government	111,618	145,109	208,069	96,451	86.4%	62,960	43.4%
Other	50,919	80,611	135,855	84,936	166.8%	55,244	38.1%
Total	709,841	957,522	1,415,285	705,444	99.4%	457,763	47.8%

Notes:
1/ Transportation, communications, public utilities.
2/ Finance, insurance, and real estate.

Source: Arizona Department of Economic Security.

TABLE B-3 Projected Employment Growth — Maricopa County, 1980-2005

Category	Number of New Jobs	Rank
Manufacturing	187,371	1
Trade	138,275	2
Services	108,275	3
Government	96,451	4
Other	84,936	5
Construction	32,967	6
F.I.R.E.	29,999	7
T.C.P.U.	27,838	8
Mining	2,350	9
Agriculture	-3,061	10
Total	705,444	--

Growth Within Rio Salado District

In this section, we examine what officials of the cities of Phoenix, Tempe and Mesa think will happen within the Rio Salado District. Existing data has been compiled on projected growth in population, dwelling units and employment within the Rio Salado Development District for the cities of Phoenix, Mesa, and Tempe. The projections of population and employment were prepared by the Planning Departments of these cities for planning areas in zones which fall within the District, and reflect their knowledge of current population, land use trends and zoning within these areas.

Phoenix

The Phoenix Planning Department has projected the socio-economic profiles of traffic analysis zones (TAZ) throughout the city, including projections of population, dwelling units, employment and land use. We have compiled data on the 43 traffic analysis zones which fall within the Rio Salado Development District boundaries in Phoenix. The relevant traffic analysis zones lie within three "villages" and one "area" as defined in the Concept Plan 2000.

In making their projections, the City Planning Department assumed that 1) there would be a reduction of the flood plain through upstream flood controls by 1995 limiting maximum flow to 50,000 c.f.s, and 2) the Rio Salado project would occur in some form. Thus, the TAZ projections have taken into account an increase in developable land.

The Planning Department also took into account several factors and policies. First, the Concept 2000 Plan, adopted by the City Council in 1979, designates Area A for industrial use. The City plans to convert this agricultural area into an industrial area on a phased basis to ensure suitable employment sites in Phoenix over the next 30 to 40 years. Because of this policy, most of the TAZ's within Area A will experience a decline in resident population and an increase in employment. Population is projected to increase only in TAZ 575 and 576, for an overall Area A population increase of 900 between 1980 and 2005. Employment is projected to increase by 8,200 or 273 percent. The residential development projected is low density, at 5 units per acre.

Most of the TAZ's in Village 8 which are within the District are in high noise level zones, restricting potentials for residential development.

Village 9 TAZ's are seen as having the greatest potential for residential development. The density of development projected ranges from 1.1 dwelling units per acre in TAZ 654 to the west, to 16 dwelling units per acre in TAZ 580 on Central Avenue and the Salt River. By comparison, along Indian Bend Wash in Scottsdale, approximately two-thirds of new residential developments are townhouses and most of the apartments, with densities as follows:

Townhouses: 6-8 units per acre
Apartments: 22 units per acre
Overall density: 12 units per acre

Portions of Rio Salado can be expected to be more intensely developed than Indian Bend Wash, which is located in an essentially "suburban" area. In a recent analysis of the economic impact of Rio Salado Development projects under Plan Six, residential densities in some lakefront areas were projected at 29 dwelling units per acre. This type of density could be realized in some of the core areas of the District which take maximum advantage of the presence of water bodies.

Projections for the Phoenix portion of Rio Salado are shown in Table B-4.

Mesa

Growth in population, employment, and dwelling units has been projected by the Mesa Planning Department for Mesa Planning Districts and Zones within the Rio Salado Development District. These projections assume that there is upstream flood control by 1990 and that Rio Salado will occur. From 1980 to 2005 population is projected to increase by 115 percent and employment by 780 percent. From 1990 to 2005,

TABLE B-4 Growth Projections — Phoenix Portion of the Rio Salado Development District

	1980	1990	2005	Average Annual Increase 1990-2005
Population	31,500	32,400	55,000	1,500
Employment	36,000	51,500	77,900	1,800
Dwelling Units	9,900	11,800	23,700	800
Residential Acres	3,100	3,600	6,100	200

TABLE B-5 Growth Projections — Mesa Portion of the Rio Salado Development District

	1980	1990	2005	Average Annual Increase 1990-2005
Population	13,400	17,500	28,800	800
Employment	2,300	11,300	20,300	600
Dwelling Units	5,600	5,900	11,400	400

which correlates more closely with Rio Salado, population is expected to increase by 4.3 percent per year and employment 5.3 percent per year. The projected Maricopa County growth rates for the same time period are 3.5 percent and 3.8 percent respectively.

The Mesa Land Use Plan for 2000 shows areas bordering Rio Salado as primarily industrial, with sand and gravel operations dominating the area. Once depleted (or removed), there will be potentials for other types development there.

Tempe

Projections prepared by the Tempe Planning Department for planning "sections" in Tempe within the Rio Salado Development District are for "saturation", which is expected to occur between 1990 and 1995.[1/] Employment projections are not available by section. These projections were made based on flood control through channelization, not upstream flood control. The Tempe Planning Department feels that a small amount of additional population growth would occur above the saturation figures if upstream flood control were achieved. The City of Tempe has adopted a Rio Salado Plan which defines the City's goals and objectives for their portion of Rio Salado and which conceptualizes a land use plan for a moderate water development.

Current residential density in the District in Tempe is 13 dwelling units per acre and 2.2 persons per dwelling unit. Airport noise is a factor in reducing the residential development potential in Tempe.

1/ Projections by section are found in the Tempe '81 Statistical Report and Land Use Inventory '82.

TABLE B-6 Growth Projections — Tempe Portion of the Rio Salado Development District

	1980	1990[1/]	2005[2/]	Average Annual Increase 1990-2005
Population	13,637	16,300	23,000	500
Dwelling Units	4,859	5,800	9,600	300

Notes:
1/ Saturation.
2/ ERA estimate based on undeveloped residential acres.

Summary

We have combined the population, employment, and land use projections for Phoenix, Mesa, and Tempe. These totals represent the growth potentials for the District, as seen by persons knowledgeable about the three largest municipalities within the District. A summary of these projections is shown in Table B-7.

As seen in Tables B-8 and B-9, these projections reflect slightly higher growth rates than is projected for Maricopa County as a whole. Once underway, the Rio Salado growth rate should be higher than that of the County as a whole, because there is such a small existing base of employment and population, and because Rio Salado should become one of the more attractive development areas in the region.

These are preliminary demand figures, intended to give an idea of the magnitude of the project relative to regional growth trends. The Rio Salado planning process itself could alter the potentials for growth, through such action as limiting densities for development in certain areas, restricting industrial development in some areas, or encouraging more residential development. The ultimate level of water use in the Rio Salado will also affect growth patterns and potentials.

TABLE B-7 Growth Projections for the Rio Salado Development District by Jurisdictions

	Population			Dwelling Units			Employment		
	1980	1990	2005	1980	1990	2005	1980	1990	2005
Phoenix	31,449	32,411	55,981	9,880	11,768	23,712	35,998	51,521	77,886
Mesa	13,387	17,500	28,829	5,623	5,900	11,355	2,300	11,300[1/]	20,268
Tempe	13,637	16,000	23,000	6,314	7,620	9,050	NA	NA	NA
Totals	58,473	65,911	107,816	21,817	25,288	44,117	33,698	62,821	97,618
Absolute Change from prior period	--	7,438	41,905	--	3,471	18,829	--	29,123	34,797
Percent Change	--	12.7%	63.6%	--	15.9%	74.5%	--	86.4%	55.4%
Average annual percent change	--	1.3	4.2%	--	1.3%	5.0%	--	8.6%	3.7%

Notes:
1/ Includes 8,000 new employees at Hughes Helicopter plant in Mesa.
NA: Information not available.
Source: Tempe '81 Statistical Report, Mesa Planning Department data, Phoenix Planning Department Data and Economics Research Associates.

TABLE B-8 Growth Projections for the Rio Salado Development District

	Absolute Increase 1981-1990	Absolute Increase 1991-2005	% of Maricopa County Increase 1981-1990	% of Maricopa County Increase 1991-2005
Population	7,400	44,200	1.4%	4.6%
Employment 2/	29,100	34,800	11.7%	7.6%
Dwelling Units	3,500	22,300	1.7%	6.5%
Residential Acres 3/	300-400	1,900-2,800	0.1%	2.8-4.1%

Notes:
1/ Phoenix, Tempe and Mesa only.
2/ Employment figures are not available for Tempe.
3/ ERA estimate based on 8 to 12 dwelling units per acre.

TABLE B-9 Projected Annual Growth Rates, 1990-2005

	Maricopa County	Rio Salado Baseline Condition
Population	2.9%	4.2%
Employment	3.2%	3.7%

Regional Demand

This section presents an analysis of the regional market characteristics and future demand for light industrial, office, retail, residential, and hotel space.

Industrial

As of the end of 1981, there were approximately 63,000,000 square feet of industrial building space in metropolitan Phoenix, including 5,000,000 square feet of vacant space. Absorption of industrial building space in metropolitan Phoenix over the past three years was as shown in Table B-10.

As seen in Table B-11, the greatest concentration of industrial space is in Southwest Phoenix, (including the area west of the airport to Avondale) which accounts for 30 percent of total industrial space in the metropolitan area. The airport area of Phoenix accounts for 28 percent of space and Tempe 13 percent of space. While the southwest Phoenix and Airport areas combined represent 58 percent of the industrial space concentration in the region, Mesa and

TABLE B-10 Industrial Space Absorption

	Industrial Space Absorption (sq. ft.)
1979	3,925,000
1980	3,600,000
1981	3,800,000
Annual Average	3,775,000

Source: Coldwell Banker.

TABLE B-11 Industrial Space Concentration, 1982

Area	Industrial Space Concentration, 1982 Percent of Space
Airport Area (Villages 8, 9)	28%
Northwest (Villages, 1, 3, 4)	11%
Central East (Villages 7, 5, 2)	0.2%
Southwest (Villages A, 6, 7, Avondale, Tolleson)	30%
Tempe	13%
Mesa/Chandler	7%
Glendale/Sun City	7%
Scottsdale	2%

Source: Coldwell Banker.

TABLE B-12 Light Industrial Employee Projections for Metropolitan Phoenix, 1981-2005

Category	Sector Employment Increase [1]	Percent Using Light Industrial Space	Light Industrial Employment Increase
Manufacturing	187,371	75%	140,500
Trade	138,275	25%	24,600
Services	108,324	5%	5,400
Total	--	--	180,500

Notes:
1/ Arizona Department of Economic Security projections.

Source: As noted above and Economics Research Associates.

TABLE B-13 New Light Industrial Space Requirement for Metropolitan Phoenix, 1981-2005

Projected Light Industrial Employment [1]	180,500
Average Employees per Industrial Acre [2]	30
Resultant Acreage Requirement	6,000
Average Annual Acreage Requirement	240

Notes:
1/ From previous table.
2/ ERA estimate based on Industrial Development Handbook, Urban Land Institute and ERA experience.

Source: Economics Research Associates.

Chandler are expected to capture an increasing share of the metropolitan industrial space market.

The primary types of tenants occupying industrial space in the region are as follows:

Manufacturing	58%
Wholesalers	25%
Transportation and Utilities	9%
Other	8%

The most likely type of industrial space to occur within the Rio Salado Development District will be light industry. The regional demand for new light industrial space is shown in Table B-12, based on projected employment increases in sectors using such space. Based on the these employment projections, acreage requirements for light industrial space are shown in Table B-13.

Office

The total metropolitan Phoenix office base (in buildings in excess of 10,000 square feet) at the end of 1981 was 16.5 million square feet. Metropolitan Phoenix has six major submarkets: the largest submarket is the midtown area, followed by northeast Phoenix, Downtown Phoenix, and Scottsdale, Tempe and Mesa.

The overall vacancy rate in the metropolitan area is 20 percent, with the highest vacancy rate (40 percent) being experienced in Mesa/Chandler.

While the Camelback corridor has recently been the "hottest" office market in the Valley, the availability of land for office development on east Camelback is rapidly being depleted and should be exhausted within the next five to ten years.

The downtown and mid-town office markets encompass the "Central Corridor," including properties between 7th Avenue and 7th Street and extending from downtown north to the Arizona Canal. This area contains nearly all of the high-rise office buildings in the metropolitan area. The City of Phoenix is committed to encouraging office development in its Downtown. Current office space absorption is listed in Table B-15.

The future regional demand for office space is projected through analysis of anticipated increases in key-sector employment and of replacement demand. The projected growth among the office-using employment sectors is shown in Table B-16. The second column in the table indicates the approximate percentage of employees within each category typically located in commercial office structures.

As shown, 80 percent of the Finance, Insurance and Real Estate categories are typically located in commercial office buildings, while 40 percent of the Services categories are so located. The other categories are less intensive users of office space, ranging from 3 to 6 percent. Using these factors results in the projected increase in office using employment.

TABLE B-14 Office Space Concentration

Area	Percent of Space	Vacancy Rate[1/]
Phoenix		
Midtown	37%	16%
Downtown	14%	6%
Northeast (Villages 2,5)	18%	26%
Northwest (Villages 1,3,4)	8%	34%
Airport Area	3%	8%
Scottsdale	10%	21%
Tempe	6%	21%
Mesa/Chandler	3%	40%
Glendale/Sun City	0.5%	7%

Notes:
1/ Vacancy rate in completed buildings only.

Source: Coldwell Banker.

Given an average space utilization of 225 square feet per employee results in a new employment-generated demand for 19.4 million square feet of office space over the next 25 years, or 776,000 square feet per year.

This fundamental demand does not account for the absorption of new space required to replace deteriorating or obsolete existing inventory. This gradually becomes a major demand source for larger metropolitan areas, and though most of metropolitan Phoenix's major office buildings are relatively new, it is nevertheless appropriate to estimate the impact of replacement demand upon the need for new office space development.

Assuming an annual replacement demand of 2 percent of a given year's base results in an average annual replacement demand of 430,000 square feet from 1981 to 2005.

TABLE B-15 Annual Office Space Absorption

	(sq. ft.)
1979	1,900,000
1980	1,300,000
1981	1,800,000
Average Annual	1,500,000

Source: Coldwell Banker.

TABLE B-16 Office-Using Employment Projections for Metropolitan Phoenix, 1981-2005

Category	Sector Employment Increase 1/	Percent Office Users	Office-Using Employment Increase
F.I.R.E.	29,999	80%	24,000
Services	108,324	40%	43,300
T.C.P.U.	27,838	6%	1,700
Construction	32,967	5%	1,700
Manufacturing	187,371	4%	7,500
Government	96,451	4%	3,900
Wholesale/Retail Trade	138,275	3%	4,200
Total	--	--	86,300

Notes:
1/ Arizona Department of Economic Security.

Source: Economics Research Associates.

This replacement demand, added to the employment-generated demand developed above, results in a combined average annual demand of approximately 1 million square feet as summarized in Table B-17. The acreage requirements for this level of demand for office space will vary depending on the distribution of space among low, mid and high rise developments. Site coverage for an office building may range from 10 percent for a high rise building to 45 percent for a two story building. Assuming an overall site coverage of 25 to 30 percent for metropolitan Phoenix results in an estimated demand for between 100 and 120 acres per year for office development from 1981 to 2005.

TABLE B-17 Annual Office Space Demand, 1981-2005

Demand Component	New Office Space Required (sq. ft.)
New Employment	776,000
Replacement	430,000
Total	1,206,000

Retail

Based on an analysis of retail sales levels and the number of retail employees in Maricopa County, it is estimated that there is a total of 64 million square feet of retail space in the County. This space is comprised of sixteen major regional shopping centers, as well as community centers, neighborhood centers, and strip commercial centers. The two malls most recently completed are the Paradise Valley Mall and the Westridge Mall. A list of the major regional shopping centers and their locations is shown in Table B-19. Construction of retail space over the past decade is shown in Table B-18.

Based on an analysis of projected population growth, per capita retail sales, and average sales per square foot, it is estimated that there will be an average annual demand for an additional 1.3 million square feet of new retail space between 1981 and 2005. In terms of acreage requirements, this translates into a demand for 3,250 acres from 1981 to 2005, or 130 acres per year.

TABLE B-18 Retail Construction

	(sq. ft.)
1970	400,000
1971	900,000
1972	400,000
1973	1,100,000
1974	2,100,000
1975	300,000
1976	800,000
1977	500,000
1978	1,300,000
1979	1,500,000
1980	1,700,000
1981	1,600,000
Average Annual	1,100,000

Source: Coldwell Banker.

TABLE B-19 Major Regional Shopping Centers — Phoenix Metropolitan Area

	Name	Location	Year Completed	Square Footage
1.	Metrocenter	Black Canyon Freeway & Peoria	1973	1,600,000
2.	Valley West Mall	59th Avenue & Northern	1973	600,000
3.	Maryvale Mall	Indian School Rd. & 51st Avenue	1960, 65, 79	503,400
4.	Westridge Mall	75th Avenue & Thomas Road	1981	800,000
5.	Chris-Town Shopping Center	Bethany Home Rd. & 19th Avenue	1961, 73, 77	1,250,000
6.	Park Central Shopping Center	Central Avenue & Earll	1957	762,000
7.	The Colonnade	Camelback Rd. & 29th Street	1963, 77, 79	721,000
8.	Biltmore Fashion Park	Camelback Rd. & 24th Street	1963, 79	330,884
9.	Tower Plaza	Thomas Rd. & 36th Street	1960, 67	575,000
10.	Thomas Mall	Thomas Rd. & 44th Street	1963	698,000
11.	Paradise Valley Mall	Cactus Rd. & Tatum Blvd.	1979	697,668
12.	Camelview Plaza	Camelback Rd. & 70th Street	1974, 77	374,108
13.	Scottsdale Fashion Square	Camelback Rd. & Scottsdale Rd.	1959, 62, 74	332,000
14.	Los Arcos Mall	McDowell Rd. & Scottsdale Rd.	1969	643,000
15.	Tri-City Mall	Main Street & North Dobson	1968	600,000
16.	Fiesta Mall	Southern Avenue & Alma School Rd.	1977	1,068,963

Note: Includes malls containing 300,000 square feet or more.

Source: Coldwell Banker Commercial Real Estate Services, Phoenix, Arizona.

Hotel

The Phoenix metropolitan area, with a total inventory of over 21,000 units, has an extraordinarily high number of first-class hotel rooms for a city of its size--over 15,000 rooms. This is, of course, due to the winter resort business.

Phoenix's popularity as a resort area came into being following World War II, with the advent of air travel. With a current total passenger volume of approximately 7 million, climbing to an estimated 17 million total enplanements plus deplanements in the next 20 years, Sky Harbor International Airport is now one of the busiest in the nation. The number of out-of-state travelers seeking respite from cold winters or on business trips has shown strong growth as has the booking of conventions in Phoenix. Phoenix is in the process of doubling the size of its convention facilities. The prospects of continued strong tourism and economic growth in the metropolitan Phoenix area indicate a good potential for additional ho-

tel space in the region. In a recent prior study, the future hotel demand in the Phoenix Metropolitan area was projected as shown in Table B-20. The cumulative regional hotel room demand over the 1981-2000 forecast period is estimated at over 12,000 new rooms, or 600 rooms per year. Based on an estimate of 0.05 acres per room results in an acreage requirement of 600 acres, or 30 acres per year.

In addition to its resort trade, Phoenix has also serviced the nonresort business as well--the old highway-oriented motels catering to overnight visitors, several hotels in downtown and north central areas oriented to business and convention visitors, and the two large convention/business visitor hotels downtown. Downtown Phoenix facilities account for roughly 20 percent of the rooms listed in the AAA, Hotel and Travel Index and Mobil Guides.

TABLE B-20 Projected Hotel Demand for Metropolitan Phoenix, 1980-2000

	1981-1985	1986-1990	1991-1995	1996-2000
Total Employment	745,000	853,000	975,000	1,099,000
Incremental New Employees	74,000	108,000	122,000	124,000
Room Nights per Employee 1/	2.8	2.8	2.8	2.8
Total Room Nights Demanded	207,200	302,400	341,600	347,200
Occupancy 2/	70%	75%	75%	75%
Business (35 percent)	811	1,105	1,248	1,268
Tourist (40 percent)	927	1,263	1,426	1,450
Convention (25 percent)	579	789	891	906
Total Hotel Rooms	2,317	3,156	3,565	3,624
Cumulative New Demand	2,317	5,473	9,038	12,662

1/ Room nights per employee factor derived by taking business-related demand of current inventory (21,000 rooms) over current employment (671,000) multiplied by 365 nights per year per room at stated occupancy

2/ Based on historical occupancy rates as reported by Harris, Kerr, Forster & Co., and Arizona Hotel/Motel Association.

Source: Economics Research Associates.

TABLE B-21 Residential Building Permits — Phoenix Metropolitan Area, 1973-1982

	Single Family		Townhouse-Condominium		Multiple Dwelling		
Year	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Grand Total
1973	18,539	58.4	3,971	12.5	9,231	29.1	31,741
1974	11,280	57.2	2,354	11.9	6,073	30.8	19,707
1975	8,705	87.4	409	4.1	845	8.5	9,959
1976	11,081	81.7	491	3.6	1,995	14.7	13,567
1977	22,281	80.3	1,213	4.4	4,254	15.3	27,748
1978	28,851	66.4	3,467	8.0	11,119	25.6	43,437
1979	18,843	55.8	3,463	10.3	11,469	34.0	33,775
1980	11,485	51.2	2,606	11.6	8,343	37.2	22,434
1981	10,649	47.4	3,921	17.5	7,891	35.1	22,461
1982-Q1	2,134	56.1	261	6.9	1,406	37.0	3,801
1982-Q2	2,676	60.8	621	14.1	1,103	25.1	4,400

Source: Mountain West Research-Southwest, July 1982.
Maricopa County Housing Study Committee.

Residential

The metropolitan Phoenix area has experienced a strong housing demand in the past decade, as the result of its explosive population growth. Over half of the area's entire housing stock has been built since 1970. An overview of residential building permits in the Phoenix market on an annual basis since 1973 is provided in Table B-21. As will be noted, the metropolitan area has averaged 25,000 new unit permits per year since 1973. Single family units as a percent of total units ranged from 87 percent in 1975 to 47 percent in 1981.

Projection of the increase in dwelling units and residential acres in Maricopa County have been developed by the Maricopa Association of Governments and are shown in Table B-22. We have projected dwelling unit increase by unit type in Table B-23.

TABLE B-22 Housing Projections for Maricopa County, 1980-2005

	1981-1990	1990-2005
Dwelling Units	207,983	343,409
Residential Acres	38,075	66,952

Source: Maricopa Association of Governments.

TABLE B-23 Dwelling Unit Projections by Type

	Number of Units	
Unit Type	1980-1990	1990-2005
Single family	108,200	161,400
Multi-family	99,900	182,000
Townhouse	22,900	61,800
Apartment style	77,000	120,200

Source: Economics Research Associates.

TABLE B-24 Projected Regional Space Requirements

	Total New Acreage 1981 - 2005	Average Annual New Acreage 1981-2005
Light Industrial	6,000	240
Office	2,500	100
Retail	3,250	130
Hotel	750	30
Residential	105,000	4,200

Summary

The preceding analysis has projected regional space requirements for industrial, office, retail, residential and hotel space, as listed in Table B-24. This table indicates that the greatest employment acreage requirements regionally will be generated by light industrial uses, followed by retail and then office uses.

Projected Absorption in the Rio Salado District

In this section, a first cut is made by the consultant at estimating the share of the market demand which is likely to occur in the Rio Salado District. These are preliminary estimates of acreage absorption which will be refined and changed as this planning process continues and as various alternative development scenarios are discussed. The following discusses some of the considerations in estimating the capture rates.

Industrial

A large share of regional industrial growth can be expected to occur within the Rio Salado Development District. In fact, development trends already support that trend, with the current proliferation of industrial parks along the borders of the District. Locations within the Rio Salado Development District will be attractive to industry because of their central locations relative to area labor markets. Locations in Phoenix will offer access to Highway I-10, when completed.

There is also an opportunity to develop a high tech/R&D industrial area near Arizona State University, capitalizing on the need by high tech companies for skilled technicians and scientists.

Office

Rio Salado is likely to capture a much lesser share of the demand for office space, which has been more concentrated in the Central and Camelback Corridors. As office development is more subject to image and prestige than industrial development, the greatest potentials for office development may be realized after Rio Salado has been in place for a time and has had time to begin to change the image of the River and South Phoenix. The City of Phoenix would like to strengthen its downtown area through office development, and is opposed to creating a competing office center in the Phoenix portion of the District.

Area real estate brokers do not see major office development occurring in the District in the near future. However, the decreasing availability of land in the Camelback Corridor, a popular location for low to mid-rise office development, could have implications for Rio Salado. Low to mid-rise office space, if linked to Rio Salado water or recreation amenities, could ultimately be an attractive new market. Office development in Rio Salado will rely especially on two markets: 1) offices and businesses linked to high tech manufacturing and 2) professional services linked to eventual residential growth.

Retail

The most likely types of retail to occur in Rio Salado are specialty retail centers, taking advantage of the water and recreation orientation, and small neighborhood shopping centers serving new residential developments. Initially, there does not appear to be a demand for a large regional shopping mall within the District.

Hotel

Riverfronts and lakefronts have been the focus of hotel development in many places, including such cities as San Antonio and Austin, Texas. However, one of the major components of hotel development in San Antonio has been the convention business, with a major convention facility on the river itself.

In Phoenix, the convention center is in the downtown, which is a considerable distance away from the Rio Salado Development District. Scottsdale is also the location of considerable convention activity.

Resort hotels which take advantage of waterfront locations and recreational opportunities could locate in areas within the District which are not adversely impacted by airport noise. The lakes, golf courses and other amenities likely to occur in the district should attract a portion of the resort tourist business, particularly in areas away from the central core of the District.

More business oriented hotels, of higher density and more internally oriented could be developed in some areas too noisy for resort hotel development. The numerous new businesses occupying industrial and perhaps office space within the District will generate a need for nearby business oriented hotel space.

Residential

The Rio Salado Development District is likely to capture a somewhat larger share of multi-family than single family residential development. The projected capture of dwelling unit increase by type has been calculated for the District in Table B-25. The projected acres of residential development has then been calculated, assuming 5 single family units per acre and 15 multi-family units per acre within the District.

Summary

A preliminary estimate of acreage absorption by use for the Rio Salado Development District is shown in Table B-25. These figures are based on the overall regional demand figures discussed in the previous section, and on "guestimates" of the District's potential share of this demand. The ranges shown do not reflect detailed market analyses for each use or for each sub area of the District, but are intended to give an indication of the development potentials of Rio Salado from a market perspective, and to provide a basis for estimating the development period for the Rio Salado Development District.

TABLE B-25 Preliminary Estimate of Land Absorption for the Rio Salado Development District

Category	Annual Regional Absorption	RSDD Capture Rate 1981-1990	RSDD Capture Rate 1991-2005	RSDD Annual Absorption 1981-1990	RSDD Annual Absorption 1991-2005	Total RSDD Absorption 1981-1990 1/	Total RSDD Absorption 1991-2005	Total RSDD Absorption Total 1981-2005
Light Industrial	240a	10-20%	15-25%	25-50a	35-60a	250 - 500a	525 - 900a	775 - 1400a
Office	120a	--	5-10%	--	5-12a	--	75 - 150a	75 - 150a
Retail	130a	--	5-10%	--	5-15a	--	75 - 230a	75 - 230a
Hotel	30a	--	10-20%	--	5-10a	--	75 - 150a	75 - 150a
Residential:		--		--				
Single family 2/	10,760 units	--	3-4%	--	320-400 units	--	4800-6000 units 960-1200	960-1200
Multi family 3/	12,130 units	--	5-7%	--	600-850 units	--	9100-12,750 units 600-850	600-850

Notes:
1/ Phase I absorption depends on level of amenities provided in that phase and is very difficult to predict at this stage for uses other than industrial.
2/ Assumes 5 units per acre.
3/ Assumes 15 units per acre.
a = acres

Source: Economics Research Associates.

Impact of Comparable Projects

The creation of an urban recreational and scenic amenity, such as a large park or water body with a protected publicly owned shoreline, will result in a changing development pattern over the long term. This analysis examines six urban areas (Austin, Boston, Chicago, Dallas, San Antonio and San Diego) which have created such water-related amenities to determine changes in land use, density and quality of development.

Austin, Texas — Town Lake

Austin's Town Lake was created in 1960 with the damming of the Colorado River. This lake extends generally east and west through the south side of the city, roughly paralleling First Avenue. It can best be described as a ribbon lake with approximately seven miles of shoreline on each side.

Since its creation, Town Lake has stimulated certain types of development. Along Riverside Drive, about 15 blocks southeast of the heart of downtown, several rental apartment projects containing an estimated 2,000 units have been constructed. These units are in low-rise buildings of no more than three stories and are all located within 400 feet of the shoreline.

Four hotels have been developed in recent years along Town Lake, including a Hyatt, Sheraton, Holiday Inn and Ramada Inn, for a total of over 1,800 rooms. Construction of a 350 room hotel on Town Lake, The Mansion, is due to begin in late 1982.

According to Mr. Jack Klitgaard of the Tax Assessor's office in Austin, the assessed valuation of land surrounding Town Lake increased by some 860 percent from 1960 to 1978. Allowing for normal increases in property values and inflation, Mr. Klitgaard estimated that as much as 590 percent of the increase could be attributed to the creation of Town Lake.

In spite of the above development generated by Town Lake, there are several factors which have had the effect of limiting its impact on development. Most important is the fact that a sizable amount of land around Town Lake is a public park which is not on the tax rolls and which cannot be developed for either commercial or residential use. A second factor is that certain portions of the shoreline were already developed in stable land uses which have not changed. Finally, despite its relatively rapid pace of growth, Austin is still a limited market for higher density development, such as high-rise residential units. The lifestyle and preference tends toward low density development.

Boston, Massachusetts — Charles River Basin

The impact of the Charles River Basin on urbanization patterns on both the Boston and Cambridge sides has been the subject of more research and examination than any other comparable discussed here.1/

Waterfront and parkway amenities have exerted a significant influence on development patterns in Boston and Cambridge. Along the northwestern edge of downtown Boston, the Charles River Basin begins an extensive waterway and park system that extends through the City's more affluent and fashionable neighborhoods, including the Charlesgate, Beacon Hill, and Back Bay residential communities. These are among the

1/ For example, see Weismantel, William; How the Landscape Affects Neighborhood Status: The Conserving and Renewing Influence of Boston's Charles River Basin and Park System; Landscape Architecture - April, 1966.

most densely developed and highest income residential areas in the city, and have, over the years, contrasted sharply with other inner-city neighborhoods, which have experienced physical deterioration and out-migration.

The tidal basin of the Charles River was dammed in 1910, to form a sheet of water of constant level between 300 and 2,000 feet wide and two miles long. This was the last leg of the Boston parkway system, begun in the 1880's according to plans by landscape architect Frederick Law Olmstead (who designed New York's Central Park, among other major urban park systems). The Parkway converted the troublesome Muddy River and Fens into a continuous landscape of water, gardens, paths and drives, called Charlesgate at the Charles River Basin, Riverway where the parkway is threaded by the Muddy River, Jamaicaway where the parkway widens to encircle Jamaica Pond, and Arborway where the parkway connects to Arnold Arboretum and Franklin Park.

While Beacon Hill, Back Bay, and Fenway along the river and parkways have historically been areas of high occupancy and consistent reinvestment, overall market factors in metropolitan Boston constrained extensive new development until recent years. Since the early 1960's, the pattern of downtown residential development has favored locations within immediate proximity of the river and parkways. During 1961 and 1962, for example, 67 building permits for projects of $100,000 or more each were issued within 3,000 feet of the Charles River Basin or the Charlesgate-Arborway area. Only 25 projects of similar scale were executed during this time in other inner city neighborhoods. Of 120 major institutions listed in the 1966 directory of the Metropolitan Transit Authority bus and subway rides, 100 were along the Charles River/Boston Parkway landscape frame. This included 11 associations and assembly halls, 15 major churches, 22 colleges and schools, 3 hospitals, 22 hotels and 11 museums.

The West End of Boston, immediately adjacent to the headwaters of the Charles River Basin, was the first residential redevelopment area in the downtown Boston vicinity. It is located less than 1 mile from the City's Government Center and financial districts. Charles River Park apartments in the West End added 1,500 new units, which today rent for amounts substantially higher than the City average, with views of the Charles River commanding the highest rents. Per capita wealth in Charles River Park is five times greater than the City average. Similar, though not so dramatic, reinvestments have taken place along most of the Boston side of the Charles River Basin, principally along Beacon and Marlborough Streets, within less than 1,000 feet of the river. No studies have been made of the property tax impacts of these developments, but in both density and value per square foot, residential development along the Charles River exceeds norms for the area as well as the City as a whole.

Chicago, Illinois — Lake Michigan Shoreline

Chicago has developed from the Lake Michigan shoreline to the west. While Lake Michigan is, of course, a major natural inland body of fresh water, much larger in extent and influence than the other comparables examined, the development pattern along the lakefront bears examination for purposes of this study.

An important characteristic of Chicago's lakefront is the manner in which it has been preserved and protected for public use, rather than allowed to be developed totally according to the desires of private developers. The observable result is a much higher density and quality of development in the adjacent, privately-developed, influence areas than that which has emerged in other cities on the Great Lakes (for example, Buffalo, Cleveland, Detroit and Milwaukee).

Extensive development has taken place immediately across Lake Shore Drive from the lakefront. Aside from Chicago's Central

Business District, which is separated from the shoreline by a large major park system, the development pattern is almost exclusively high-rise residential. The residential character of Lake Shore Drive in 1952 was well established. By 1973 the predominant land use was still residential, but the density of development, as indicated by the much larger, taller buildings, had been greatly increased. It is significant that even one block to the west of the existing high-rise concentrations, the density of development has not generally changed.

The major urban renewal projects undertaken on the south side of Chicago (Prairie Shores and Lake Meadows) are also immediately west of Lake Shore Drive and the lakefront itself. The development pattern in Chicago, of course, benefits from a much larger market area and a longer tradition of high-rise living near the central business district (the "loop"). This situation does not prevail in Phoenix.

Dallas, Texas — Turtle Creek Area

Turtle Creek Boulevard and Park in Dallas were built in the early 1900's. They were constructed at the outer fringe of early Dallas and their surroundings were largely undeveloped. The park extends from Reverchon Park on the south (in Dallas) north to the Dallas Country Club (in Highland Park). The boulevard, creek and park are among the most beautiful areas in the City and adjoin some of the most prestigious housing areas. The stream at some points is in its natural bed, and at other points is impounded to form long ribbon-like lakes. The adjoining park areas are lavishly landscaped.

The park has had considerable adjoining development within a 600 foot influence zone. There are five high-rise residential towers which are considered prestige addresses, together with garden density condominium and townhouse groupings in the upper price range. Some of the finest estate-sized single-family detached housing adjoins the creek. There are in addition, numerous middle priced apartment complexes within the influence zone.

There is a considerable amount of office space on Turtle Creek Boulevard, notably in the vicinity of Lee Park at mid-point of the creek. There are several corporate headquarters buildings in generously landscaped settings, totaling about 750,000 square feet of floor area. There are a number of speculative office buildings, of high-rise, mid-rise and garden density, and these amount to approximately 1,250,000 square feet.

There is a limited amount of commercial space directly adjoining the creek. Turtle Creek Village, a hybrid commercial and boutique center of about 100,000 square feet, is directly adjacent. In addition, several blocks of strip shopping along Oaklawn Avenue are roughly parallel to the creek, and perhaps 800 feet away.

The Dallas Theater Center, with its existing noteworthy building and planned expansion, are the only institutional uses within the Turtle Creek area.

San Antonio — The Riverwalk

In 1921, flood waters in the San Antonio River rose to a height of ten feet, causing millions of dollars in damage and requiring years of work to rebuild. Following this catastrophe, construction of Olmos Dam began and was completed in 1927. The dam established a holding area in the Olmos basin so flood waters could be released slowly and held within the banks of the river. In conjunction with the dam, a bypass cutoff was built between the existing bends in the river, creating a channel that high water could flow through more directly. The area between the bends (called Horseshoe Bend,) which twists through the downtown shopping district, is thus protected from the main stream flow during floods by floodgates.

In 1938, a landscape architect was commissioned as part of a WPA effort to prepare designs for the development of the downtown meanderings of the river. This work, implemented by the WPA, resulted in most of the improvements which can be seen today. The broad

walks, the arched bridges, the steps at various entrances, were all accomplished during this time. Careful attention was given to the detailing of walks, steps, bridges, landings, and other structures such as the Governor's Palace on Military Plaza, the Alamo, and the early Texas buildings and houses which dotted the town plan.

For the next twenty years, most buildings and businesses faced away from the River, ignoring its presence. With the exceptions of the opening of Casa Rio Restaurant in 1946 and Lung Jeu Restaurant in 1959, no significant business ventures and/or tourist attractions were established along the river walk until more planned steps were taken to improve the river's potential in the 1960's.

In March, 1962, the City Council passed an ordinance which established a River Walk Commission consisting of seven members appointed by the City Council. This ordinance delegates to the River Walk Commission what actually amounts to practical zoning control. The Commission may "review proposed construction concerning appearance, color texture of materials, and architectural design of buildings whereby it is proposed to alter, modify, repair, or construct improvements, as well as install signs, or proposed lighting arrangements."

Also in 1962 a Paseo del Rio (Riverwalk) master plan study was undertaken which laid the groundwork for development. Sketches of each block of the river were prepared to show property owners what could happen through private rehabilitation. As a result, newer property changed hands and remodeling of spaces to take advantage of the Riverwalk began.

The City of San Antonio committed over $300,000 for Riverwalk improvements, all of which have become a reality. These include extension of the river walk, installation of dramatic and aesthetic lighting along the walk, new entranceways, and a marina for the party barges, river taxis, pedal boats, and the maintenance and work boats of the City Parks and Recreation Department.

In 1968 the Hemisfair was held in San Antonio. Through Hemisfair, the city obtained federal money for a convention center linked to the Riverwalk, which has been the catalyst for the development of five hotels on the River, beginning with La Mansion in 1968. Most of the development on the Riverwalk has occurred since 1968.

Today, the Riverwalk is bordered by sidewalk cafe's, specialty boutiques, nightclubs and restaurants. Water taxis ferry visitors from one spot to another, and groups dine aboard open-air barges. Unlike some of the other cities discussed so far, development along the Riverwalk has been primarily commercial. However, residential development is now beginning to occur along the River with the development of luxury condominiums and apartments.

The Riverwalk is credited with keeping downtown-San Antonio alive, while many other downtowns were dying. Local property owners estimate that property values have increased 15 times since 1968. In the last 4 years, rents have increased dramatically, sometimes as much as 800 percent.

San Diego — Mission Bay

San Diego's Mission Bay Park is one of the largest and most comprehensive aquatic parks ever created. It is over seven square miles in size and contains in excess of 1,800 acres of useable land and 2,200 surface acres of navigable water. Mission Bay Park is a small boat harbor as well as a public park and it is estimated that during 1974 over 12,000,000 residents and tourists visited the park, engaged in such diverse activities as waterskiing, boating, swimming, fishing, golf, tennis, baseball, picnicking, camping, and sightseeing.

Mission Bay Park is in a constant state of evolution and its ongoing development consists of both public and private projects providing a wide variety of water oriented uses. Mission

Bay Park was formerly a little used, unnavigable backwater made up of tidal basins, sand dunes, salt marshes, swamps and salt flats. For centuries the San Diego River emptied into the tidelands of the Pacific Ocean, alternating between San Diego Bay on the south and False Bay (now Mission Bay) on the north. In 1852, the U.S. Army Corps of Engineers decided to create a permanent route for the San Diego River, primarily to prevent silting in San Diego Bay which resulted from periodic flooding. The Engineers constructed a dike just south of the present flood channel which deflected the flow of the San Diego River into Mission Bay, and the Bay gained a permanent southern boundary.

Even with channelization of the river, the unattractive odors of the salt marshes and the unstable condition of the tidelands precluded any major use of the area for the next fifty years. With the exception of the development of the sea side bathing beaches in what is now Mission Beach, utilization of Mission Bay was limited to clamming, mud-fishing, duck hunting and dumping garbage.

The City of San Diego's interest in shaping the future of Mission Bay was first expressed in a "Preliminary Plan for Mission Bay," prepared by the City's Planning Department in 1930; other plans were prepared in 1935, 1939, 1944 and 1945.

Toward the end of World War II, partly due to an interest in attracting tourist revenue in a post-war economy, the City began to actively encourage the State to transfer Mission Bay to City control and in 1945 the Preliminary Development Plan of "Mission Bay" was submitted to the State to indicate the City's intentions toward developing the area. As a result, in April 1945, the State granted the Mission Bay tidelands to the City of San Diego subject to maritime improvement, construction, education and recreation purposes.

The first improvement and acquisition of additional acreage to the Bay began almost immediately after the State transferred ownership to the City in 1945. The citizens of San Diego quickly passed a $2 million bond issue and the first large purchase of 500 acres was made from the civic-minded Mission Bay Land Corporation at the same $300 per acre it had paid for the land 20 years earlier. The remaining acreage needed to complete today's boundaries of the Park was acquired through neogtiated settlement and condemnation at an average price of less than $1,500 an acre.

By 1946, the Federal government had approved a multi-purpose project for flood control of the San Diego River and for small boat navigation on Mission Bay. The Federal work was accomplished on the condition that the City dredge and develop the remainder of Mission Bay. The work began in the spring of 1948, and included the improvement of the flood channel, so that the river would not dump silt into Mission Bay, as well as the dredging of a new entrance channel.

The City continued to make improvements to the Bay throughout the late 1940's, including the commencement of dredging activities in 1946. Additional Mission Bay bond measures passed by the citizens of San Diego in 1950 for $2 million and in 1956 for $5 million, provided necessary capital for the dredging. Initial dredging was concentrated in the West Bay, and in 1959, after enactment of the Land and Water Use Plan, dredging of the whole Bay was begun.

Although a considerable portion of Mission Bay was already committed to park and recreation purposes through the requirements of a tidelands grant from the State, the City Council determined that the entire park should be dedicated in accordance with the City's Charter to preserve the area as a park in perpetuity. On April 24, 1962, an Ordinance to dedicate Mission Bay Park was adopted by the Council. The amount of land within the Park which could ultimately be leased was set at 25 percent, with the remaining 75 percent to be reserved for the use of the general public.

In June of 1962 a $12.6 million bond issue to continue the development of Mission Bay Park failed to receive the necessary two-thirds vote required for approval. From 1962 to 1967 the rate of public investment in Mission Bay Park was reduced due to the failure of the 1962 bond proposal. The rate of expansion of leased recreational facilities, restaurants and hotel accommodations increased during this period and eases, such as Perez Cove, Dana Marina, Campland, the Hilton Inn, and Sea World, were developed.

In 1966, a $7.4 million bond issue was passed by the voters to continue development of public park and recreation improvements in Mission Bay Park. The bond funds, which were first used in 1967 and are nearing depletion, have provided for the development of areas such as the East Shore, Mission Point, Bonita Cove, and portions of Vacation Island. At this time, with all major dredging operations completed, the major land forms of the Park in their final configurations, and over four-fifths of the leasable land under long-term lease, Mission Bay Park is still only 50 percent completed.

It is estimated that by the time Mission Bay Park is completed, the total cost for its development will exceed $200,000,000, coming half from public funds and half from private lessee investment. As of July 1, 1970, when figures stopped being kept, total public and private expenditures in Mission Bay Park were as follows:

City	
Bonds	16,400,000
Capital Outlay	12,500,000±
State	4,500,000±
Federal	10,100,000±
Private Lease Investments	31,000,000+
Total	74,500,000±

Mission Bay Park is itself the site of considerable private recreational development, including private marinas, restaurants, boat sales, motels and hotels.

The areas adjacent to Mission Bay Park are primarily residential, with higher densities than found in other parts of the City. Mission Beach, with 6,000 persons and 3,000 dwelling units is the most densely populated area in the City. Pacific Beach, with a population of 41,000 is heavily residential with a mix of single-family and multiple-family units.

Because of the proximity of these neighboring communities to the ocean as well as Mission Bay, it is difficult to determine how much Mission Bay has affected development patterns in the City.

Other Examples

Other cities benefitting from a major urban amenity, either in the form of a large park or a lake with park lands surrounding it, illustrate the influence of such an amenity on the pattern of development on the private property immediately adjacent to it.

The development pattern surrounding all four sides of Central Park in New York City is predominately residential. Any illustration of this area would demonstrate clearly that there is a much higher density of residential development, in the form of high-rise apartment buildings, immediately adjacent to Central Park. This pattern is perhaps most pronounced on the 5th Avenue side, but the Central Park West and 59th Street frontages also display this pattern dramatically. Further, immediately behind this concentration of high-rise residential development, the character of land use is still residential, though at a lower density, but has been restrained by the poor environmental influences associated with the Harlem neighborhood. The Central Park influence area includes a considerable number of public and semi-public uses. These include the Museum of Natural History, the Hayden Planetarium, the Guggenheim Museum, the Frick Collection and several synagogues and churches. Also in evidence are a number of high-quality hotels near Grand Army Plaza, at the intersection of Fifth Avenue and 59th Street.

Forest Park in St. Louis is the second-largest urban park in the United States. Due to the much

smaller demand for residential development in St. Louis, compared to that in Manhattan, the character of development around Forest Park is much less pronounced, though in evidence. On the Kings Highway, or eastern boundary of the park, high-rise residential development occupies all parcels of land which are not developed with major hospitals (Jewish Hospital, Children's Hospital and the Barnes Hospital/ Washington University Medical Center Group). The pattern of development along the Lindell Boulevard frontage has been restricted by prevailing zoning. The Portman Place and Westminister Place private subdivisions are historically the highest quality, most aristocratic neighborhoods within the City of St. Louis proper. This area constitutes the City's "Millionaires Row;" therefore, its development is presently single-family, large-lot residential. At the corner of Kingshighway and Lindell, across from the primary eastern entrance to Forest Park are the City's major highest-quality hotels -- the Chase and the Park Plaza. The southern boundary of Forest Park has traditionally been in public ownership. At the time of the St. Louis World's Fair in 1903-04, the Highlands Amusement Park was developed in this area. It continued to operate until the mid-1960's, when it was acquired by the St. Louis Junior College District, and is now a college campus. The Skinker Boulevard side (the western boundary of the Park) was also restricted single-family residential in character until the early 1960's. At that time, the zoning was changed to permit high-rise development. Since then, two new high-rise apartment buildings have materialized and more await improvement in the City's political and economic climate. Again, the prevailing development immediately behind the border with the Park is still residential in character, though the density of development declines substantially.

Conclusions

What is to be observed and concluded regarding the influence of a large urban amenity on long-term land use and development patterns? These findings become immediately obvious:

1. The predominant type of development attracted to the privately-owned parcels adjacent to a major publicly-owned and maintained amenity are residential, in those cases where residential use is compatible with surrounding land uses. However, in areas such as San Antonio where the amenity occurs in an already developed commercial area, intense commercial development also occurs.

2. Over time, the density of development increases as land values and market demand materialize or increase. Additionally, their value as measured by either sales prices or rental rates is demonstrably higher. Thus, the assessed valuation per unit of land area (either per acre or per square foot) is also demonstrably greater.

3. The zone of influence in which the increase in density and value of development occurs is very narrow. On Lakeshore Drive in Chicago, for example, it extends only to the blockfront immediately to the west.

4. The time frame for development of areas adjacent to such amenities can be very long -- the projects discussed here are still in the process of development, 20 and 50 years after initiation.

In relating these findings to Rio Salado, several things must be taken into account. First, the size of the Rio Salado Development District dwarfs some of the previously mentioned projects. The sheer size and scale of Rio Salado affect the magnitude of its impacts and the types of development that will occur there. Adjacent uses will not just be residential, but will be a mix of uses. Also the presence of the airport, power lines, sewage treatment plants and the like will restrict the types of development which can occur in some areas of Rio Salado.

C. WATER AVAILABILITY

Overview

Water is available from several sources for potential Rio Salado Project uses. These sources are described in varying degrees of detail, depending on their relative value to the Project and the problems involved.

In general, there will be two classes of water use within the Project boundaries. First there will be residential and commercial development for which potable domestic supplies will be needed. Second will be water for recreation and irrigation, including grass, trees, lakes, fountains and minor artificial waterways within the area.

A logical solution to the first category would be to obtain a CAP (Central Arizona Project) allotment, if it becomes available when reallocations are made, for the necessary potable supplies. Such allotment would be turned over to the cities in exchange for services to the Project area. A second option for potable water would be to obtain irrigation rights, both surface and underground, from lands in the District, turn those rights over to the cities in exchange for domestic water service.

The second general category of water use is that of aesthetic and recreational purposes. It is likely that water for these purposes can be obtained in sufficient quantities to meet a substantial demand by extracting contaminated water and other poor quality groundwater through industrial type permits. These sources will diminish with time, but can be replaced by the growing availability of effluent sources.

A discussion of the various sources of water supplies and the problems associated with their acquisition follows. A summary of all sources is compiled in the Water Availability Rating Matrix (Table C-11). Sources with the greatest potential for use in this project are listed below and are priorities for further investigation.

We believe that the first six sources on the list will not change, except that poor quality leachate and CAP (for domestic use only) might share the first priority. The order of these sources may change over time as local conditions change. For example, some of the lower items could move up the list if the conversion of irrigated lands to urban uses takes a long period of time.

Water Source Priority List

1. Leachate
2. High TDS (Total Dissolved Solids)
3. Effluent
4. Exempt wells
5. CAP (cities)
6. CAP (domestic)
7. Grandfathered Groundwater Rights
8. Class A SRP (Salt River Project)
9. Class A SRIC (Salt River Indian Community)
10. Class B SRP
11. Class B SRIC
12. Other SRP
13. Vacant Groundwater
14. CAP (support)
15. Irrigation Districts (other than SRP)
16. Storm Runoff
17. Motorola Power Plant
18. Ocotillo Power Plant

Surface Water

Central Arizona Project Water

The Central Arizona Project (CAP) is expected to deliver some 1.1 to 1.6 million acre-feet per year of Colorado River water to Arizona. Initial delivery is scheduled for 1985, although funding problems may alter this date.

The Arizona Department of Water Resources (DWR) has the responsibility of recommending to the Secretary of the Interior, the allocation of CAP water among competing applicants. The Secretary of the Interior will subsequently make the allocations which may or may not conform with the DWR recommendations. The Central Arizona Water Conservation District (CAWCD) will then modify and validate its master contract for delivery of the water and for the repayment of CAP costs. Each successful applicant will then enter into individual subcontracts to receive the allocated water and repay their appropriate share of the costs. On January 18, 1982,, DWR sent to the Secretary of the Interior the latest allocation recommendation. DWR recommends that 640,000 acre-feet of CAP supply be allocated to non-Indian municipal and industrial uses, with specific amounts recommended for each applicant. Rio Salado Development District had requested an allocation of 21,000 acre-feet. DWR recommended no allocation to Rio Salado. In denying the request, DWR recognized "the desirability of the Rio Salado Project," but did not include an allocation because "that allocation would have to come from the already short supplies identified for cities."

The Department further stated that, "while the request for an allocation is valid for the Rio Salado Project, a portion of the CAP water allocated to cities involved in this project can provide the needed water supply in the early years with effluent taking over in later years as the cities need their full CAP entitlements to meet municipal needs."

It should be noted that one of the final eight alternative Central Arizona Water Control Study (CAWCS) plans for regulatory storage and flood control would provide a source of water for Rio Salado. Plan 7, which is structurally identical to the selected Plan 6, would be operated to "emphasize opportunities for environmental enhancement." Enough water would be made available to provide "minimum flows in the Salt and Verde Rivers and to provide the potential for recreation and fish and wildlife enhancement in the Salt River through Phoenix." As a means of achieving this, "30,000 acre-feet of water could be made available to Rio Salado." Thus, a decision to amend the choice of Plan 6 to include this provision could provide a source of CAP water to Rio Salado. Such a decision could be made as a result of the environmental impact assessment of Plan 6 which is currently underway.

The use of CAP water by Rio Salado is most likely under one or more of the following four scenarios:

1.) An allocation would be made to Rio Salado of a portion of any surplus water that resulted from the inability of any successful applicant to contract for the water. DWR estimated that at least 50,000 acre-feet of the initial municipal and industrial allocation will not be placed under contract and will be available for reallocation.

a.) There are two different uses, for which separate requests should be sought by the Rio Salado District for CAP water under this reallocation. First, and of greatest priority is 8,000 acre-feet of water per year for domestic use. This request is based on an estimate that the Rio Salado development will attract a core population with a potential magnitude in excess of 25,000 people, creating a demand for water for domestic use. The needs of these fixed and transient populations using the facilities within the Rio Salado boundary demonstrate a definite ability to beneficially use the CAP water.

b.) The second use for which a separate allocation should be sought is for population support systems. This would include recreation, green strip irrigation, improvement of the Salt River environment throughout Rio Salado and any other supportive water needs.

2.) The Secretary of Interior would approve an allocation for Rio Salado, either as a direct change in DWR's recommendation or through the modification of Plan 6 to include the environmental enhancement provisions of Plan 7.

3.) The cities would assign a portion of their CAP allocations for Rio Salado uses. Some cities have recently emphasized that they may be willing to contract with Rio Salado for all or part of their CAP allocation. This provides a potential opportunity for Rio Salado to use CAP water during the early years of the project with a transition to waste effluent usage as the cities' water demands grow and they need their CAP allocations. Table C-1 lists the CAP allocations for several cities. The entire allocation is considered as the potential maximum available.

The City of Tempe in particular, has shown an interest in this plan. Discussions with Tempe and other cities should be pursued in order to further quantify this potential source.

4.) Rio Salado water developments could be used as groundwater recharge facilities for the storage of CAP water. Such a system would provide a means of banking the state's entitlement of CAP water during the early years, when other storage and delivery facilities were unavailable or before contracts had been executed for the entire amount.

TABLE C-1 CAP Municipal and Industrial Allocations

(acre feet)

Municipality	Year 1985	2005	2034
Phoenix	54,454	79,431	113,877
Mesa	7,063	14,500	20,129
Tempe	1,112	3,376	4,315
Scottsdale	7,050	13,070	19,702
Other	27,833	77,648	121,543
Total[1/]	97,512	188,025	279,566

Notes:

1/ does not include the County's direct allocation.

Source: Water Resources Associates

The latest projections of the cost of CAP water for M & I purposes is $82.50 per acre-foot at the canal. This figure includes a capital cost of $32.50 plus $50.00 for operation, maintenance and replacement. Transportation costs to the location of use would be additional. The cost of 30,000 acre-feet would be $2,475,000 per year plus transportation costs.

Kent Decree Water Rights

In 1910 the Kent Decree established the water rights in a large portion of the Salt River Valley. It identified three classes of land, each possessing a different right. Class A lands have the highest right. Those are lands which were under continuous cultivation beginning in 1869 and subsequent years and continuing through 1909.

Class B lands have a lesser right. It pertains to those lands that were irrigated intermittently during this same period of 1869-1909. The irrigation of these lands began during times of good water supply and was suspended during times of scarcity of flow in the river. The failure to continuously irrigate was the result of a lack of dependable water supply rather than a desire to terminate the use of the land.

Class C pertains to irrigable lands adjacent to and at a lower elevation from the canals for which no appropriation of water from the river had been made at the time of the decree.

The majority of the land affected by the Kent Decree is within the Salt River Project (SRP) and outside the Rio Salado's major areas of potential development.

The term "Salt River Project" refers strictly to the Project authorized by the Congress and built by the U.S. Bureau of Reclamation. The term is used loosely throughout the region to include the operating entity established under Arizona law having the same "Salt River Valley Water Users Association," (SRVWUA). For convenience, and conforming to general usage, Salt River Project is used in this report to mean the operating entity SRVWUA. The remainder of land affected by the Kent Decree is located and controlled by the Salt River Pima-Maricopa Indian Community (SRIC).

Salt River Project Water

The use by Rio Salado of water delivered through the SRP system would be contingent upon the purchase of land within the Project area. The right to the water would be acquired with the land. The extent of the water rights would depend upon which lands were acquired. As development occurs it is suggested that the assessments for the water could be picked up by the District and the rights turned over to the cities in exchange for water service. This exchange could involve effluent as well as other sources. Treatment cost of water related to Rio Salado would be paid by the District.

For the purpose of quantifying these rights, an allocation of 3 acre-feet per acre per year has been assumed for both Class A and Class B lands. Due to the poor water rights and small percentage of Class C lands within the Rio Salado boundary, they were neglected. Table C-2 lists the location, area, quantity of water and other pertinent data for each section of land within both the Rio Salado boundary and the Salt River Project boundary.

It is important to realize, that for this analysis, three acre-feet per acre per year has been assumed to be the quantity available for use including both groundwater and surface water. In other words, the total quantity of water which may be realized from both groundwater and surface water rights for any given parcel of land is three acre-feet per acre per year. Groundwater rights cannot be severed or transferred.

Some of the best rights are attached to lands close to the Salt River. A portion of these is urbanized or otherwise retired from cultivation. Purchase of such lands could provide premium water rights as well as potential for development. However, the lands

TABLE C-2 Kent Decree Water Rights — Rio Salado District

Township	Range	Section	Administrator	Class	Acres	Quantity (ac-ft/yr)	Political Jurisdiction
T2N	R6E	30	Salt River Project	A	6	18	Maricopa Co.
		31	"	A	425	1275	Mesa
T1N	R5E	1	"	A	210	630	Mesa
		2	"	A	486	1458	Mesa
		3	"	A	188	564	Mesa
		8	"	A	98	294	Maricopa Co.
		9	"	A	139	417	Mesa
		10	"	A	83	249	Mesa
		11	"	A	47	141	Mesa
		17	"	A	233	699	Mesa
		18	"	A	224	672	Mesa
T1N	R3E	14	"	A	113	339	Phoenix
		18	"	A	52	156	Phoenix
		19	"	A	42	126	Phoenix
		21	"	A	80	240	Phoenix
T1N	R3E	22	Salt River Project	A	96	288	Phoenix
		28	"	A	64	192	Phoenix
T1N	R2E	13	"	A	127	381	Phoenix
		19	"	A	320	960	Maricopa Co.
		20	"	A	240	720	Maricopa Co.
		21	"	A	230	690	Maricopa Co.
		22	"	A	288	864	Phoenix
		23	"	A	30	90	Phoenix
T1N	R1E	25	"	A	22	66	Maricopa Co.
				Totals	3841	11522	
T2N	R6E	28	Salt River Project	B	20	60	Mesa
		29	"	B	75	224	Mesa
		31	"	B	22	66	Mesa
		32	"	B	265	795	Maricopa Co.
		19	"	B	200	600	Maricopa Co.
		20	"	B	320	960	Maricopa Co.
		30	"	B	125	375	Maricopa Co.
				Totals	1027	3081	

must be within the Project area. Water derived from rights on Project land cannot be used on lands outside the Project area. Thus, it is unlikely that water derived from lands close to the river could be used within the channel, since most of the channel is off-Project. Since only 10% of the District is in this category, it is not an important potential source of water.

Another potential source for obtaining SRP water is through the direct purchase of water from cities which possess Kent Decree rights for their jurisdictional areas. The City of Mesa, for example, had a surplus of approximately 7,000 acre-feet of SRP water last year, for which they paid assessments. In order to lessen the financial burden of paying for water not used, the City may decide to sell this water in the future. Due to the nature of this situation, action may be taken by the City of Mesa to alleviate the burden within a year, thus requiring the prompt attention of the Rio Salado Development District.

Another potential source for this type of water is the City of Tempe. They have estimated that they have a maximum of 5.42 acre-feet per acre per year of ground and surface water available to them and a maximum historic use of approximately three acre-feet per acre per year. This indicates that there may be an excess of 2.42 acre-feet feet per acre per year available for purchase by Rio Salado. These and other potential city-sources should be throughly investigated.

The right to the water is acquired with the purchase of the land. The only additional cost is the assessment to cover the expense of delivering the water. The current assessment is $15.00 per acre, which entitles the owner to two acre-feet of water. Thus the current cost of the assessment water is $7.50 per acre-foot. The SRP Board of Governors has also allotted an additional acre-foot of stored and developed water for $7.50.

Salt River Indian Community Water

The use of Salt River Indian Community Kent Decree water would be contingent upon successful negotiations with the appropriate Indian authorities. The amount of land and corresponding available water which lies within the Rio Salado District boundary is tabulated by location, and class of water right in Table C-3. Here again a combined surface and groundwater assessment of three acre-feet per acre per year is used. The location of these lands is in the upstream reaches of the Rio Salado District, and borders the Salt River.

Other Sources

In addition to the Salt River Project, several smaller irrigation districts are located along the Salt River. These include the New State Irrigation and Drainage District, St. Johns Irrigation and Drainage District, the Peninsula (Horowitz) Ditch Company, Maricopa Garden and Lakin Cattle Company.

The New State Irrigation and Drainage District originally had water rights adjudicated under the Benson-Allison Decree (1917). Since that time the New State District has entered into a permanent contract with the Salt River Valley Water Users' Association to furnish the District lands with a supply of water equal in quantity to the amount allocated to project lands, acre for acre. This water has been supplied from wells and thus, the District has not maintained its diversion from the River.

St. Johns District and the Peninsula Ditch Company also have rights adjudicated under the Benson-Allison Decree. They also have contracts to buy water from the Salt River Project.

Maricopa Garden Farms has water delivered by the SRP. The lands are "Class C" lands as described in the Kent Decreee of 1910.

The Lakin Cattle Company has waste water delivered by the Salt River Valley Water Users' Association in lieu of the ordered gravity water due to

TABLE C-3 Kent Decree Water Rights — Salt River Indian Community Portion

Township	Range	Section	Administrator	Class	Acres	Quantity (ac-ft/yr)	Political Jurisdiction
T2N	R5E	27	Salt River Indian Community	A	320	960	Salt River Indian Community
		35	"	A	475	1425	"
		36	"	A	640	1920	"
				Totals	1435	4305	
T1N	R5E	4	Salt River Indian Community	B	200	600	Salt River Indian Community
		5	"	B	400	1200	"
		6	"	B	200	600	"
		7	"	B	200	600	"
				Totals	1000	3000	

them by authority of the Benson-Allison Decree.

These entities are all located along the downstream and of the Rio Salado District. The necessity to convey pump water upstream may eliminate them as to main source of water. It is a potential source for local use in the lower end of the District. Table C-4 lists the land areas and the potential water available to Rio Salado. As with the SRP water, this water would be acquired by purchasing the land. Institutional, political, and technical problems are inherent in possible transfers of this kind. Each possibility would have to be individually assessed.

Municipal Storm Runoff

In the Phoenix area it has been estimated that the average annual storm runoff yield is 38 acre-feet per square mile. Based on an urban area of 325 square miles, this represents a total runoff of approximately 12,000 acre-feet per year. Because of variables, climate and others, this is not a reliable source of

TABLE C-4 Other Irrigation Districtions With Water Rights

Township	Range	Section	Administrator	Acres	Quantity (ac-ft/yr)	Political Jurisdiction
1N	2E	32	Peninsula (Horowitz)	240	720	Phoenix
		31	Ditch Company	480	1440	Phoenix
1N	1E	36	"	602	1806	Phoenix
		35	"	152	456	Phoenix
1S	2E	6	"	119	357	Phoenix
1S	1E	1	"	293	879	Maricopa Co.
			Totals	1886	5658	
1N	1E	25	New State Irr. & Drainage Company	211	633	Maricopa Co.
		26	"	520	1560	Maricopa Co.
		27	"	341	1023	Maricopa Co.
		28	"	451	1353	Maricopa Co.
			Totals	1523	4569	
1N	1E	29	St. John's Irrig. & Drainage Co.	154	462	Maricopa Co.
		30	"	154	462	Maricopa Co.
1N	1E	25	"	160	480	Maricopa Co.
		26	"	158	474	Maricopa C.
		27	"	80	240	Maricopa Co.
1N	1E	32	"	239	717	Maricopa Co.
		31	"	289	867	Maricopa Co.
1N	1W	36	"	193	579	Maricopa Co.
		35	"	203	609	Maricopa Co.
1N	1W	34	"	82	246	Maricopa Co.
			Totals	1712	5136	
	Maricopa Garden Farms			1258	3774	
	Lakin Cattle Co.			160	480	

water. Due to storm water detention structures, dry wells and other abstractions, not all the storm water reaches the river. It is assumed that three quarters of the total, or an average of 9,000 acre-feet per year, may be reaching the River. This water discharges into the River, at approximately 25 major storm discharge points. Another discharge source is the Salt River Outfall Channel (Tempe Ditch Number 2). This drainage ditch is reported to flow at a moderate level periodically, and have a continual flow of nuisance water.

Although these sources represent a significant amount of water annually, the nature of the source makes it difficult and expensive to fully utilize. Since the majority of rainfall occurs during the two rainy seasons, some storage system would be required.

Storm runoff generally contains a variety of pollutants, making some of this flow unsuitable for lakes.

Groundwater

Groundwater Management Act

The State of Arizona has an estimated dependable supply of surface and groundwater of 2.6 million acre-feet per year. Once CAP water delivery begins, the dependable supply will increase to 4.3 million acre-feet per year. The current consumption rate is 4.8 million acre-feet per year, resulting in a current overdraft of 2.2 million acre-feet and a future overdraft of .5 million acre-feet annually.

This critical groundwater situation in Arizona led to the passage of the Groundwater Management Act in the year 1980. The potential use of groundwater by the Rio Salado Project will be governed by this very complex act. The law is intended to institute comprehensive groundwater conservation and management in Arizona. Prior to its passage, few controls existed on the use of groundwater. Under the new Act, the amount of water that may be withdrawn will be subject to strict conservation requirements.

A major provision of the law created four Active Management Areas (AMA's). Groundwater withdrawals in AMA's will be managed pursuant to management plans to be prepared by the State Director of Water Resources. The Phoenix AMA includes the entire Rio Salado Development District, but is divided between two sub-basins. Thus, any use of groundwater by Rio Salado will be controlled by the statute, with specifics provided by the Phoenix AMA Management Plan. The management goal of the Phoenix AMA is the maintenance by 2,025, of a long-term balance between groundwater withdrawals and natural and artificial groundwater recharge.

The groundwater code provides for three categories of grandfathered rights: Irrigation, Type 1 non-irrigation, and Type 2 non-irrigation. Grandfathered irrigation rights exist on land which was irrigated between 1975 and 1980. Type 1 non-irrigation grandfathered rights are attached to land that is retired from irrigation to a non-irrigation use. Type 2 non-irrigation grandirrigation use when the AMA was initiated. Such rights may be purchased and moved within a sub-basin. At this time, no Certificates of Right have been issued, and Type 1 and Type 2 rights have not been verified.

In addition to grandfathered rights, groundwater may be withdrawn pursuant to a permit from the Department of Water Resources (DWR). These permits may only be issued for designated purposes and under specified conditions.

The use of groundwater by Rio Salado might occur under any of the three approaches named above. However, groundwater derived from one designated sub-basin may not be transported and used in another sub-basin, subject to legal action for damages by other water users in the sub-basin where the pumping occurs.

Use of Grandfathered Water Rights

Type 1 grandfathered rights lying within city limits are subject to acquisition by the city (or cities) through contracts with the Salt River Valley Water Users' Association, whereby the cities pick up the assessments on those water right lands. This inheres to the benefit of the District as development proceeds within the water service areas of the cities. Type 1 grandfathered rights are probably not available to river bottom (green belt) areas.

Type 2, which is also a non-irrigation grandfather right, could be obtained for Rio Salado purposes. The Type 2 right is the maximum amount legally withdrawn in any one of the five years preceding the designation of the AMA. Thus, the amount of water available to Rio Salado would depend upon the previous use of the water. This right can be anywhere in a sub-basin or out of a sub-basin, subject to action by or compensation to others in the sub-basin who may claim damages.

Areas within the Rio Salado district boundary which have a potential grandfathered right have been illustrated in Volume I. These include both irrigated areas which would qualify for a Type 1 permit and non-irrigated areas which would qualify for a Type 2 permit. The location, areas, quantity of water and political sub-division in which each area is located is given in Table C-5. Quantities have been based on an allocation of three acre-feet per acre annually.

As with the surface water rights, the Indian Community lands also have potential groundwater grandfathered rights. The use of this water would be sought through negotiation with Indian officials.

TABLE C-5 Land With Potential Groundwater Rights

Township	Range	Sec.	Acres Type 1	Acres Type 2	a.ft./yr.	Political Subdivision
T2N	R6E	28	60	--	180	S.R.I.C.[2]/Maricopa Co.
		29	90	50	420	" "
		30	40	50	270	" "
		31	595	--	1785	Mesa/Maricopa County
		32	400	--	1200	Maricopa County
		33	320	--	960	Mesa/Maricopa County
T1N	R6E	06	30	--	90	Mesa
T2N	R5E	23	460	--	1380	S.R.I.C.
		26	116	--	348	"
		27	545	--	1635	"
		33	400	--	1200	"
		34	70	120	570	"
		35	500	--	1500	"
		36	640	--	1920	"
T1N	R5E	01	220	--	660	Mesa
		02	500	--	1500	"
		03	320	120	1320	S.R.I.C./Mesa
		04	97	60	471	S.R.I.C./Maricopa Co.
		05	490	3	1479	S.R.I.C.
		06	638	--	1914	S.R.I.C.
		07	220	--	660	S.R.I.C.
		08	120	135	765	S.R.I.C./Maricopa Co.
		09	210	48	774	Mesa/Maricopa Co.
		10	260	--	780	Mesa
T1N	R5E	11	120	--	360	Mesa
		17	24	--	72	Mesa
		18	36	130	498	Tempe/Mesa
T1N	R4E	08	180	--	540	Phoenix/Tempe/Maricopa Co.
		09	75	--	225	" " "
		12	530	--	1590	S.R.I.C.
		13	--	165	495	Tempe/Maricopa County
		14	--	70	210	" "
		17	--	48	144	Tempe

TABLE C-5 (Cont.)

Township	Range	Sec.	Acres Type 1	Acres Type 2	a.ft. /yr.	Political Subdivision
T1N	R3E	13	--	125	375	Phoenix
		14	140	--	420	"
		15	--	20	60	"
		16	--	5	15	"
		18	65	--	195	"
		19	30	38	204	"
		20	--	140	420	"
		21	80	23	309	"
		22	84	100	552	"
		23	--	50	150	"
		24	--	16	48	"
		28	70	--	210	"
		30	125	--	375	"
T1N	R2E	13	130	--	390	Phoenix
		16	10	--	30	Maricopa County
		17	15	--	45	"
		18	25	--	75	"
		19	640	--	1920	"
		20	620	--	1860	"
		21	330	--	990	"
		22	240	100	1020	Phoenix
		23	20	140	480	Phoenix
		24	--	40	120	Phoenix
		25	290	--	870	Maricopa County
		26	510	--	1530	"
		27	240	--	720	"
		28	510	--	1530	"
		29	260	95	1065	"
		30	135	60	585	"
		31	480	--	1440	"
		32	600	--	1800	"
		33	480	--	1400	"
T1S	R2E	04	280	--	840	"
		05	240	--	720	"
		06	300	--	900	"
T1N	R1E	22	40	--	120	Maricopa County
		23	80	--	240	"
		24	80	--	240	"
		25	350	25	1125	"
		26	530	--	1590	"
		27	300	--	900	"
		28	640	--	1920	"
		29	470	--	1410	"
		30	410	--	1230	"
		31	280	--	840	"
		32	210	--	630	"
		33	130	--	390	"
		34	110	--	330	"
		35	190	--	570	"
		36	600	--	1800	"
T1S	R1E	01	300	--	900	"
		02	30	--	90	"
		03	600	--	1800	"
		04	420	--	1260	"
		05	20	--	60	"
T1N	R1W	23	110	--	330	"
		24	120	--	360	"
		25	640	--	1920	"
		26	575	--	1725	"
		27	360	--	1080	"
		34	115	--	345	"
		35	210	--	630	"
		36	200	--	600	"
	Totals		23375	1976[1/]	76053	

Notes:

1/ Type 2 Grandfathered rights have only a pumping right (acre feet) with no acreage. The figures in this column represent approximate acres of sand and gravel operations. Application of a duty to these figures is not accurate. Sand and gravel uses are relatively minor and totals are not affected significantly.

2/ S.R.I.C. = Salt River Pima-Maricopa Indian Community

Source: Water Resources Associates

Contaminated Water

Use of Special Permits

Special permits may be granted by DWR for five categories of use, two of which are applicable to Rio Salado. First would be the "General Industrial Use" permit which includes, all non-irrigation uses except mineral processing and sub-divisions. Included could be such uses as commercial centers, landscaping, parks, golf courses, fish and wildlife, recreation and industry.

The issuance of general industrial use permits is subject to restricting conditions, which generally could limit the District's ability to obtain such a permit. The Rio Salado is likely to be granted this type of permit when poor quality water is withdrawn. Using the available assessments of groundwater quality as a guide, zones could be delineated, wherein permits could be issued to applicants who could show an improvement of groundwater conditions by withdrawal and use. Limits on amounts of water that could be so withdrawn could be set to develop flow patterns that would allow use of the poor quality water without unreasonably impacting other users or interfering with the local AMA's management goal.

The second special use permit, and the most promising, would be the withdrawal of contaminated water. Permits could be issued where the groundwater quality was impaired through pollution. Such a permit would allow extraction where the intention was to control and eventually eliminate the migration of the contaminated water.

Groundwater Contamination Along the Salt River

Quality of water in the Salt River groundwater basin is varied and complex. In general, it is of better quality away from the Salt River, except in a large area south of Mesa and Tempe where total salts increase toward the Gila River. There is a continual downstream increase in the concentration of dissolved salts in the area of the Salt River.

The U.S. Public Health Service recommends that water containing a Total Dissolved Solids (TDS) concentration greater than 500 mg/l not be used for public supplies. The TDS concentrations have been identified by the U.S. Geological Survey in the Phoenix valley. From approximately Granite Reef Dam to Rural/Scottsdale Road, the concentrations of TDS range from 500 to 1000 mg/l and from Rural/Scottsdale Road down to the confluence of the Salt River and the Agua Fria River, the concentrations range fom 1000 to 3000 mg/l. These zones have been delineated in Volume I.

Another source which results in contaminated groundwater in localized areas is sanitary landfills located along the banks of the Salt River. At various locations between Gilbert Road and 43rd Avenue, there are 17 landfills for the disposal of domestic waste and 9 for the disposal of either hazardous waste or sludge. Not all of these sites are presently in active use, but they still have a high potential for groundwater contamination.

The major problem exists at the domestic waste landfills. During periods of high groundwater level, such as floods or near intensive recharge locations, the water table moves up through the bottom of the landfill, saturating the decomposing material and creating a leachate which follows the groundwater as levels recede. These saturated landfills probably continue to drain leachate into the groundwater for extended periods of time. If not controlled, the plume of leachate will move into, and contaminate larger areas of higher quality groundwater.

Each landfill has been prioritized based on the degree to which they contribute to the pollution of the groundwater. Nine of the municipal landfills and three hazardous waste disposal sites have received the highest priority and should be the first to receive corrective attention. The remainder of sites received a moderate or low priority as outlined in Table C-6.

TABLE C-6 Landfill Sites

Site	Priority	Operator	Status	Assumed Production Wells Needed	Total Pumpage(gpm)
40th Street	High	Unknown	Inactive/M.W.	2	1000
Estes	High	Phoenix	"	2	1000
16th Street	High	Phoenix	"	2	1000
Del Rio	High	Phoenix	"	2	1000
7th Avenue	High	Phoenix	"	2	1000
North 19th Avenue	High	Phoenix	"	2	1000
South 19th Avenue	High	Phoenix	"	2	1000
40th Avenue	High	Unknown	Active/M.W.	2	1000
27th Avenue	High	Phoenix	Inactive/M.W.	2	1000
Tempe Shops	High	Unknown	Inactive/H.W.	1	250
Resource Recovery Conservation Assoc.	High	Private	Active/H.W.	Unknown	250
Wayne Oxygen Inc.	High	WOI	Inactive/H.W.	1	250
Feedlot	Moderate	Unknown	Inactive/Feedlot	1	250
Phoenix Sludge Disposal	Moderate	Phoenix	Inactive/S.D.	1	250
Scottsdale Sludge Disposal	Moderate	Scottsdale	"	1	250
Mesa WWTP	Moderate	Mesa	Active/Sludge	1	250
Phoenix WWTP (23rd Avenue)	Moderate	Phoenix	"	1	250
Phoenix WWTP (91st Avenue)	Moderate	Phoenix	"	1	250
Tri-City	Low	Unknown	Inactive/M&C	1	250
SRP Mesa Drive	Low	SRP	Active/M&C	1	250
Mesa	Low	Mesa	"	1	250
SRR	Low	SRR	Inactive/M&C		
Country Club Drive	Low	Unknown	"	1	250
SRP McClintock Road	Low	SRP	Active/M&C	1	250
Arizona State U.	Low	ASU	Inactive/M&C	1	250
SRP (56th Street)	Low	SRP	Active/M&C	1	250
Central	Low	Union Rock	"	1	250

Source: Water Resources Associates

Notes: M.W. = Municipal Waste
H.W. = Hazardous Waste
M&C = Municipal and Construction

Use of Contaminated Groundwater

Use of poor quality groundwater, both high TDS and leachate, presents the Rio Salado District with an excellent opportunity in the early stage of the Project, to meet its non-potable water needs, as well as to assist in cleaning up a pollution source which is a detriment to the entire Valley.

To withdraw poor quality groundwater, the District would need to apply to DWR for a "General Industrial" or a "Poor Water Quality" permit. Withdrawal could continue throughout the duration of the permit or as long as the water quality remained poor. Based on the findings of a comprehensive hydrogeologic investigation, which would need to be performed to determine the feasibility and impact by this type of withdrawal, a permit might be issued for as long as 35 years and then renewed if conditions allowed.

Pumping at landfill locations would also draw higher quality of water from surrounding areas. This water could dilute the leachate, resulting in a mixture which would probably be acceptable for use on parks, golf courses and in large water bodies.

Preliminary calculations show that a properly placed well field downstream of a typical landfill could considerably reduce and control the size of a contaminant plume. At each site the pumping requirements might be about 1000 gallons per minute (gpm). If such a plan was implemented at each of the 17 domestic landfill sites, a total of 24,000 acre-feet of water could be pumped annually. Because of a variable demand, the practical limit would probably be approximately 15,000 acre-feet per year. If more water were needed as conditions changed, additional industrial permit wells, could be placed along the river at various locations to pump poor quality groundwater at points removed from the landfills. The impact of such utilization would have to be investigated.

This type of water may need additional treatment prior to

body contact with humans. Additional studies and investigations should indicate the quantity, quality and constraints associated with this potential supply.

The cost of groundwater includes expenses associated with the following items; land acquisition (when applicable), well drilling, installing pump equipment, distribution facilities, where necessary, and the continued operation of the system. Numerous wells already exist in the area. The need for new wells would depend upon which land was acquired. It can be expected that each well could produce up to 3,000 acre-feet per year. Thus, the production of 30,000 acre-feet would require a minimum of ten to fifteen wells. Each new well could cost about $250,000. Pumping costs are estimated to be $30.00 to $50.00 per acre-foot.

Existing Wells

Within the Rio Salado boundary there are numerous wells which might be used to deliver water to the District. Some of these wells are located on the diagram in Volume I. Table C-7 summarizes the important data for each well. The right to pump these wells would have to be obtained.

A limited source that could be used without a permit is the small exempt wells which the law limits to a pumping rate of not more than 35 gpm for domestic purposes, including the non-commercial irrigation of less than two acres of land. These wells might be used for localized commercial development or for limited public use such as a small park area.

TABLE C-7 Tabulation of Wells by Location

Location			Quadrant	Yield	DWR
Qdt.	Twp.-Rng.	Section	1,2,3,	(gpm)	No.
(A - 1 - 1)		25	a b a		9
"		"	d a a	300	10
"		"	d c c		11
"		"	d d a		12
"		"	d d a	8	13
"		"	d d d	30	14
"		26	a a	2500	15
"		"	b b b		16
"		27	b d a	1500	18
"		"	d d d		20
"		28	b a a		1
"		"	b c b		21
"		"	d a a		23
"		31	b c c	35	24
"		32	b a a		26
"		"	b c c	40	27
"		33	b b a	20	31
"		"	b b a	20	32
"		35	a a d	20	34
"		"	a c d		2
"		"	a d d	1000	35
"		"	a d d	8	36
"		"	a d d	1500	37
"		"	b d a		38
"		"	b d d		39
"		36	a b b		42
"		"	b a b		43
"		"	b b c		44
"		"	d d	2400	45
(A - 1 - 2)		19	a a b	24	53
"		"	b a a		54
"		"	c a d	1300	56
"		"	c c b	10	57
"		"	c c c	15	58
"		"	c d c		59
"		21	a d d		60
"		"	b b a		61
"		"	b a		62
"		"	b c b		63
"		"	b c c		64
"		22	b c d		65
"		"	d a a		66
"		24	d a b		70

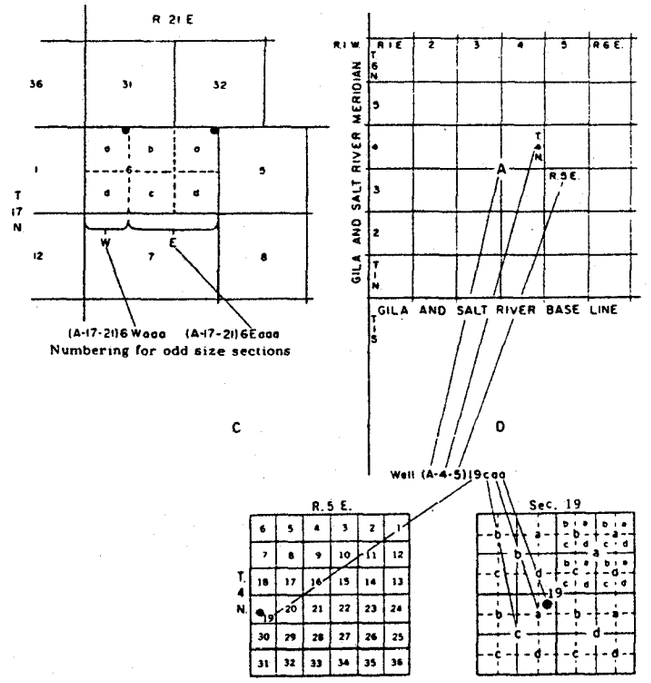
TABLE C-7 (Cont.)

Location Qdt. Twp.-Rng.	Section	Quadrant 1,2,3,	Yield (gpm)	DWR No.
(A - 1 - 2)	25	d d d	3000	72
"	26	a a a		73
"	"	d c d		74
"	"	d d b	450	75
"	"	d d d		76
"	27	a d a		77
"	27	d a a		78
"	28	a d c		80
"	"	b d b		81
"	"	c a a		4
"	"	c a a	1500	82
"	29	d d a	2800	83
"	30	a a a	1200	84
"	"	d c d	3250	85
"	31	c b b		88
"	31	c b b	183	90
"	32	b a a		93
"	"	b b	3500	94
"	"	d d d	600	95
(A - 1 - 3)	14	c c c		96
"	19	c c c		99
(A - 1 - 4)	2	d d b	1052	112
"	11	a a a		113
"	"	a b	2014	T-1 *
"	11	a c	2200	114
"	"	d c a		118
"	13	a d c	400	119
"	"	a d d		120
"	"	b a c		6
"	"	c d a	600	121
"	15			123
"	17	b c d	150	125
"	18	c a d		126
"	"	d a d		127
"	19	d a a	2000	129
"	22	c b		T-2 *
"	23	b b		T-3 *
"	24	b a		T-4 *
(A - 1 - 5)	8	b a d	3200	144
"	9	b b b	770	145
"	10	d b c	280	148
"	"	d b d	280	149
"	14	b c		M-1 *
"	15	a c		M-2 *
"	"	d c		M-3 *
"	18	a a a		152
"	"	b a d		153
"	"	d b a		156
"	19	b b		T-5 *
(A - 1 - 6)	3	a a		M-4 *
(A - 2 - 5)	34	c c a	1200	159
(A - 2 - 6)	27	c a a	2244	163
"	29	c d a		167
"	"	d d d		7
"	33	c b a		178
"	"	d b d		8
(B - 1 - 1)	33	c b b	460	185
"	34	d c d	2690	186
"	36	c a	300	187
"	"	c a b		188
"	"	d b b		189
(C - 1 - 1)	2	b d a	750	
"	3	a a d		
"	"	c c a	1200	
"	"	d b c		
"	"	d c a		
"	"	d c d		
"	4	a a d		
"	"	d d a		

Note:

* Not DWR No.

Well Numbering System



Wastewater Effluent

The reuse of wastewater effluent as a means of augmenting available water resources is presently receiving increased attention. As other sources become scarcer and more expensive, this source becomes more attractive. Although this situation will cause competition for the available effluent, it represents a significant potential for Rio Salado.

The existing system for the management of wastewater in the Phoenix urban area is evolving to meet the demands of an expanding population. Recently, the Maricopa Association of Governments (MAG) revised their Water Quality Management Plan that outlined the facilities and procedures needed to treat and manage the area's wastewater.

This plan calls for the continued use and expansion of the two major existing treatment plants at 91st Avenue and 23rd Avenue. The 91st Avenue plant is presently being expanded from a capacity of 90 million gallons per day (mgd) to 120 mgd. The revised plan provides for another 30 mgd expansion to a total capacity of 150 mgd by 1985-87. The 23rd Avenue plant needs to be expanded initially from its present 37.2 mgd to 42.5 mgd, with an eventual expansion to 50 mgd.

A significant feature of the new plan is the option for the individual communities to construct selected small plants to provide a portion of the needed treatment capacity instead of sending all wastewater to the two large plants.

While providing some excess treatment capacity, this provision will allow greater flexibility in planning and operation of the total system. It will especially increase the potential for the reuse of treated effluent. It will allow the treatment of wastewater at locations upstream from Rio Salado facilities, thus increasing the possibilities for its use in the project. The smaller plants could be in either of two categories.

First, satellite plants could be built by the individual communities. Plants with a capacity larger than two mgd would have to be named specifically in the MAG Plan. Second, plants smaller than two mgd could be built after receiving approval through a specified review process. These smaller plants could be designed to provide treated effluent for reuse in a particular development.

Critical to the use of treated effluent by Rio Salado is the amount of wastewater that will be generated and the existing obligations for its reuse. A major question is whether there will be sufficient future effluent to serve the needs of Rio Salado.

Four agreements for the use of treated effluent now exist. These agreements represent commitments that would need to be satisfied before wastewater would be available to Rio Salado. They are as follows:

1. A contract between the cities of Glendale, Mesa, Phoenix, Scottsdale, Tempe and Youngtown, and APS/SRP to provide water for electrical generation. The intended use is for cooling at the Palo Verde Nuclear Generating Station, although it is not limited to this facility. The contract calls for a maximum of 125 mgd (140,000 acre-feet per year) to be delivered from the 91st Avenue plant, and if necessary, from the 23rd Avenue plant. However, the maximum need for the three units of the PVNGs that will be completed is estimated to be 58 mgd (65,000 acre-feet per year). Also, the current contract is subject to renegotiation.

2. A contract between the city of Phoenix and the Buckeye Irrigation District to provide 26.8 mgd (30,000 acre-feet per year) until 2011.

3. A contract between the city of Phoenix and the Roosevelt Irrigation District for 17.9 mgd (20,000 acre-feet per year) from the 23rd Avenue plant until 2000. This agreement has never been implemented because of the difference between the quality of the needed water and

that of the effluent produced by the plant.

4. An informal agreement between the city of Phoenix and the Arizona Game and Fish Department for 6.5 mgd (7,280 acre-feet per year). The Department claims a right to this amount based on historical effluent flow in the Salt River bed. This claim may be subject to challenge.

The total amount of effluent now commited under contract is therefore 176.2 mgd (about 197,280 acre feet per year). However, if only actual use is considered, the total is about 91.3 mgd (about 102,280 acre-feet per year).

Projections of future effluent availability have been made by MAG. These projections have been compared to the contractual obligations. The analysis concluded that the two treatment plants would be able to meet their contracts by 1995. If only the actual use is considered, sufficient effluent is available at all times. In fact, under this assumption, the 91st Avenue plant alone could supply the contracted amounts and still have a surplus.

If satellite plants are built in East Mesa and the Northeast area, the situation is only slightly changed. Contract obligations could then be met by 2000. Again, if only the actual use is considered, the need can be met at all times even from the reduced flow of the 91st Avenue plant.

Tables C-8 and C-9 are from the MAG plan and provide the details. As can be seen from these tables, the excess production, assuming only actual use, ranges from 97.2 mgd in 1980 to 199.5 mgd in 2020. If the committed amounts are assumed, the surplus ranges from 0.4 mgd in 1995 to 132.5 mgd in 2020. The assumed average annual need for Rio Salado is 26.2 mgd, with a peak monthly demand of 56.2 mgd. Thus, it can be concluded that there will be a surplus of effluent. This surplus is more than enough to meet the assumed Rio Salado need. Under the current contractual obligations for the effluent, the surplus would begin to be available in 1995. However, if only actual use is considered, the surplus is available immediately. Additionally, there is the possibility of a CAP/effluent swap with the Indians. The difference between effluent committed and actual use, for the most part, will result from lesser demands in off-peak season.

The quality of wastewater to be reused is obviously very important. Quality standards vary depending on the use to which the effluent will be put. In general, three aspects must be considered in determining these standards. First, the public health must be protected. Strict standards are required where the water will be used for unrestricted irrigation of playgrounds, parks and recreational water bodies. Contamination of existing groundwater supplies must also be avoided. Second, the water must not contain substances that will have an adverse effect on the use itself. For example, water in recreational lakes must meet certain standards in order to minimize the growth of algae. Third, the water must be treated so that it is aesthetically acceptable for unrestricted irrigation and recreation.

Treatment of sewage is done in stages, referred to as primary, secondary and tertiary. The primary stage removes solids. Biological action in the secondary stage begins the purification process. Tertiary treatment achieves higher standards.

Effluent from the existing treatment plants has received secondary treatment. A review of existing standards indicates that this level of treatment is insufficient for the uses contemplated by Rio Salado. Thus, any effluent used from existing treatment plants will require additional treatment. Any new facility that might be constructed to provide wastewater for Rio Salado would have to be designed for a higher level of treatment.

One method of producing the higher quality water would be the construction of plants capable of tertiary treatment. While technically possible, such facilities would be extremely expensive for the large capacities needed.

TABLE C-8 Effluent Availability From Phoenix Plants

Year	Available Effluent 23rd Ave.	Available Effluent 91st Ave.	Total	Committed/Used AGEF (1)	BIC (2)	ANPP (3)	RID (4)	Total	Available Less Committed Effluent (mgd)	Available Less Effluent Actually Used (mgd)
1980	42.6	87.9	130.5	6.5/6.5	26.8/26.8	125/0	17.9/0	175.9/33.3	(45.4)	97.2
1985	42.4	105.6	148.0	6.5/6.5	26.8/26.8	125/38.7	17.9/0	175.9/72.0	(27.9)	76.0
1990	42.5	119.1	161.6	6.5/6.5	26.8/26.8	125/58	17.9/0	175.9/91.3	(14.3)	70.3
1995	42.5	133.8	176.3	6.5/6.5	26.8/26.8	125/58	17.9/0	175.9/91.3	0.4	85.0
2000	43.6	152.21	195.8	6.5/6.5	26.8/26.8	125/58	17.9/0	175.9/91.3	19.9	104.5
2010	46.5	186.2	232.7	6.5/6.5	26.8/26.8	125/58	---	158.3/91.3	74.4	141.4
2020	48.3	215.7	264.0	6.5/6.5	---	125/58	---	131.5/64.5	132.5	199.5

Notes:

(1) Verbal Agreement for 6.5 Mgd between City of Phoenix and Arizona Game and Fish Department
(2) Buckeye Irrigation company had contracted for 30,000 acre-feet per year (26.8 mgd).
(3) 125 mgd from 91st Avenue and/or the 23rd Avenue plants to Arizona Public Service/Salt River Project
(4) Roosevelt Irrigation District has contract for 17.9 mgd from 23rd Avenue Plant until 2000 (required additional treatment before implementation).

Source: Water Resources Associates

TABLE C-9 Effluent Availability Using Satellite Plants

Year	Available Effluent 23rd Ave.	Available Effluent 91st Ave.	Available Effluent Total	Committed/Used AGEF (1)	Committed/Used BIC (2)	Committed/Used ANPP (3)	Committed/Used RID (4)	Committed/Used Total	Available Less Committed Effluent (mgd)	Available Less Effluent Actually Used (mgd)
1980	42.6	87.9	130.5	6.5/6.5	26.8/26.8	125/0	17.9/0	175.9/33.3	(45.4)	97.2
1985	42.4	96.2	138.6	6.5/6.5	26.8/26.8	125/38.7	17.9/0	175.9/72.0	(37.3)	66.6
1990	42.5	107.2	149.7	6.5/6.5	26.8/26.8	125/58	17.9/0	175.9/91.3	(26.2)	58.4
1995	42.5	120.3	162.8	6.5/6.5	26.8/26.8	125/58	17.9/0	175.9/91.3	13.1	71.5
2000	43.6	134.3	177.9	6.5/6.5	26.8/26.8	125/58	17.9/0	175.9/91.3	2.0	86.6
2010	46.5	163.5	210.0	6.5/6.5	26.8/26.8	125/58	---	158.3/91.3	51.7	118.7
2020	48.3	188.0	236.3	6.5/6.5	---	125.58	---	131.5/64.5	104.8	171.8

Notes:

(1) Verbal agreement for 6.5mgd between City of Phoenix and Arizona Game and Fish Department
(2) Buckeye Irrigation company had contracted for 30,000 acre-feet per year (26.8 mgd)
(3) 125 mgd from 91st Avenue and/or the 23rd Avenue plants to Arizona Public Service/Salt River Project.
(4) Roosevelt Irrigation District has contract for 17.9 mgd from 23rd Avenue plant until 2000 (requires additional treament before implementation).

Source: Water Resources Associates

TABLE C-10 Wastewater Treatment Plants

Plant	Existing	Proposed	Location	Effluent Flow (mgd.)	Remarks
91st Avenue	X		91st Ave.	87.9	Expansion being planned
23rd Avenue	X		23rd Ave.	37.2	Expansion being planned
Mesa/Dobson Rd.	X		Dobson & 8th St.	3	
Mesa/Dobson Rd.		X	Dobson & 8th St.	10-15	Expansion
Leisure World/Turner Ranch		X	6312 E. Baseline	6	May be too far away
Salt River/Falcon Field		X	north of Falcon Field	6	
Tempe/48th St.		X	48th Str. North of Salt	-	remote chance
Gainey Ranch		X	Glendale & Scotsdale Rd.	-	
North Scotsdale		X	Bell Rd. & Scotsdale Rd.	.5	

An alternative method of achieving the needed wastewater quality has been developed by Dr. Herman Bouwer, Director of the U.S. Water Conservation Laboratory, U.S. Department of Agriculture. In this system the effluent from the treatment plant is subjected to a land treatment process. The effluent is placed into infiltration basins and allowed to seep into the ground. The soil, sand and gravel layers act as a natural filter that purifies the water as it percolates into the groundwater. It can then be pumped from wells and used for unrestricted irrigation and recreation purposes.

Experiments using the Bouwer process have been conducted at both the 91st Avenue and the 23rd Avenue plant. In these cases, effluent that had received secondary treatment was utilized. Results of these experiments indicated that such a system can indeed yield renovated water of sufficient quality for unrestricted irrigation and recreation. Chlorination of the water may also be indicated in order to completely eliminate the possi-

bility of adverse effects. The Bouwer process can also be applied to effluent that has received only primary treatment, thus eliminating the need for secondary plants.

Costs of operating the infiltration systems can be substantially less than conventional treatment plants. However, a major need is land. Such a system can be designed to produce approximately 200 acre-feet per year from each acre of land. Thus the production of the estimated 21,000 acre-feet need for this project, would require approximately 100 acres of land.

Given the general availability of wastewater, the next question relates to the means by which it could be used in Rio Salado. Several possibilities exist.

1. Effluent From Current System

   Under the existing system, treated wastewater would be available from the 23rd Avenue and 91st Avenue plants. As noted above, additional treatment would be required. This source presents problems of transporting the water to the point of its use. While the exact location of Rio Salado water facilities is not yet known, it is very likely that most, if not all, of the initial sites will be upstream from these two plants. The use of this water directly would involve the exchange of effluent for other water that could be more easily delivered. For example, the effluent could be provided to SRP or another irrigation district for use downstream in exchange for water that has its origin upstream from the desired Rio Salado use. Details of this type of possibility are being studied by the District. Location and effluent flows for existing and proposed plants are given in Table C-10

2. Package Treatment Plants

   One method of producing the treated water at locations upstream from the described sites would be the construction of small treatment plants at or near the point of use. The Salt River Outfall (SRO), which collects and delivers sewage to the large treatment plants, passes through the length of the Rio Salado area. Raw sewage could be taken directly from this line and treated in package plants of one to three mgd capacity. Solids would be returned to the SRO for transportation to the large plants. The package plants would provide tertiary treatment and would supply high quality water for use on the site. Such water could provide the source for lake evaporation and irrigation of adjoining landscaped areas. This type of facility could be repeated several times along the length of the project. Such a technique is now being implemented in Scottsdale for the Gainey Ranch development. The City of Phoenix is also beginning a feasibility study for such a project in north Phoenix.

3. Satellite Treatment Plants

   Another method would be the construction or expansion of medium-sized satellite treatment plants by the cities at upstream locations. The existing Mesa plant, at Dobson Road and 8th Street, could be retained and expanded. In Tempe, the proposed plant location at 48th Street could be used. These actions would be consistent with the flexibility of the updated MAG plan. The treated water would then be upstream from the location of use and could be transported by gravity flow.

Two Mesa locations, Falcon field and the existing Dobson Plant, offer a particularly good opportunity. Sufficient land exists at the sites to enable the use of the Bouwer process. The city could expand the present plant, perhaps adding only primary treatment facilities, in conjunction with the construction of infiltration basins needed for the Bouwer process. Renovated water could then be delivered to

Rio Salado. As much as 10,000 annual acre-feet, one-half of the needed supply, could come from such a facility. The City of Mesa would then have a guaranteed market for the water, thus enabling the reduction of its treatment costs.

The Falcon field site is currently planned to treat 6 mgd (6,700 acre-feet per year). This is approximately 32% of the District's proposed use. The potential supply from these two Mesa plants may ultimately provide up to 80% of the district's requirements.

Experience at the larger treatment plants indicates that the total cost of secondary treatment is approximately $150 to $170 per acre foot. Of this amount, costs of operation, maintenance and replacement are about $60 to $70 per acre foot. The remainder is for capital costs and debt service. The capital cost of the Bouwer process includes the acquisition of the land and the construction of the filtration basins.

Operating costs are essentially the costs of pumping, which are estimated to be about $30.00 per acre-foot. Thus, the operating costs of a system that included secondary treatment plus the Bouwer process (equivalent to tertiary treatment) could approach $100 per acre foot. The inclusion of capital costs could double this figure. The cost would be less if only primary treatment plus the Bouwer process was used. It is unlikely that the Rio Salado project would have to sustain the total treatment costs. The wastewater must be treated in any case. The cities will incur these costs whether or not the treated water is reused. Thus, an agreement could be reached that will provide water to Rio Salado at a reasonable cost while partially off-setting the expenses of the cities.

The most expensive treated wastewater would likely be associated with the small package plants. It is estimated that the capital cost of three mgd tertiary treatment facility would be about $8,000,000. Operating costs should approximate $135.00 per acre-foot. One such plant would produce about 3,400 acre-feet per year or 16% of the calculated need for Rio Salado water.

Another secondary source of potential effluent available to Rio Salado is from local industries with large water consumptions. Each industrial site could be tapped directly and the effluent treated at small local treatment facilities according to need.

Two possible sources include the Arizona Public Service Ocotillo Power Plant at Hayden Road and University Drive, which discharges 210,000 gallons per day (236 acre ft./yr.), and the Motorola Plant at 52nd Street and McDowell Road, which discharges 2 million gallons per day (2,240 acre ft./yr.).

The Ocotillo Power Plant discharges water at temperatures slightly greater than ambient river water temperatures. This would need cooling but no other treatment. The Motorola plant effluent would require secondary treatment before use.

TABLE C-11 Water Availability Rating Matrix

SOURCE	DESIRABILITY FACTORS					CONSTRAINTS			COMMENTS
	ANNUAL QUANTITY af/yr	QUALITY[4]	LOCATION[5]	ADDITIONAL COSTS[6]	WRA RATING	POLITICAL[8]	PHYSICAL[7]	AQUISITIONS[9]	
CAP/domestic use	5,000	Fair/4	Very good/5	5	14	2	1	1	(1) This represents less than half of the existing wells within the District's boundary. The remaining yields were not available.
CAP/support use	5,000	Fair/4	Very good/5	5	14	2	1	1	
CAP/CAWCS Plan 7	30,000	Fair/4	Very good/5	5	14	2	1	1	
CAP from Cities:									
Mesa	7,063	Fair/4	Very good/5	5	14	2	1	2	(2) This quantity is the available, less the percent committed, which could come from the 91st Ave. Plant.
Tempe	1,112	Fair/4	Very good/5	5	14	2	1	2	
Scottsdale	7,050	Fair/4	Very good/5	5	14	2	1	2	
Phoenix	54,454	Fair/4	Very good/5	5	14	2	1	2	
SRP Class A	11,500	Good/5	Very good/5	3	13	2	3	5	(3) This quantity is the available, less the percent committed, which could come from the 23rd Ave. Plant.
SRP Class B	3,080	Good/5	Very good/5	3	13	2	3	5	
SRP From Cities	7,000	Good/5	Very good/5	3	13	2	2	3	
Salt River Indian Reservation Class A	4,300	Good/5	Good/4	4	13	2	2	2	(4) Quality rating is based upon the following criteria: Good/5 - highest quality available, Fair/4 - slightly lower but acceptable, Poor/3 - may need some treatment, Very Poor/2 - requires at least secondary treatment, Very Poor/1 - requires tertiary treatment.
Salt River Indian Reservation Class B	3,000	Good/5	Good/4	4	13	2	2	2	
Irrigation Districts									
New State	4,569	Fair/4	Poor/1	3	8	0	2	2	(5) Location rating is based upon the following criteria: Very good/5 - many possible delivery locations near Salt River, Good/4 - several possible delivery locations near Salt River, Fair 3 - limited delivery locations, but near Salt River, Poor/2 - single delivery removed from development area, Very poor/1 - single delivery location far removed from development area.
St. Johns	5,136	Good/5	Poor/1	3	9	0	2	2	
Penninsula	5,658	Good/5	Poor/1	3	9	0	2	2	
Maricopa Gardens	3,774	Good/5	Poor/1	3	9	0	2	2	
Lakin Cattle Co.	480	Good/5	Poor/1	3	9	0	2	2	
Storm Runoff	9,000	Poor/3	Fair/3	3	9	0	3	4	
Grandfathered Groundwater	76,000	Fair/4	Very good/5	1	10	0	3	5	
Grandfathered Groundwater/Vacant	24,000	Fair/4	Fair/3	1	8	0	3	5	
Existing Wells	49,000[1]	Fair/4	Good/4	2	10	2	2	2	
Exempt Wells	56/well	Fair/4	Very good/5	1	10	0	3	3	
Poor Quality Water									(6) Cost rating is based on the following criteria: 5 - cost of transport, 4 - cost of transport, plus negotiated benefit 3 - cost of transport, plus land 2 - cost of treatment or existing pumping facilities 1 - cost of pumping plus capital costs
Leachate	11,250.	Poor/3	Good/4	1	8	0	2	3	
High TDS	10,000.	Poor/3	Very good/5	1	8	0	2	3	
Wastewater Effluent:									
91st Ave. WWTP	71,000[2]	Very poor/1	Very poor/1	2	4	0	2	1	(7) Physical limitations are based on the following criteria: a designation of zero is given if any of the following are required - new facility construction, upstream pumping, construction of delivery systems, construction of other structures, placement of new groundwater pumps. Otherwise it will receive a 2.
23rd Ave. WWTP	34,000[3]	Very poor/1	Poor/2	2	5	0	2	1	
Existing Mesa/Dobson Rd.	3,360	Very poor/1	Good/3	2	6	0	2	1	
Proposed Mesa/Dobson Rd.	11,200	Very poor/1	Good/3	2	6	0	1	1	
Proposed Falcon Field	6,720	Very poor/1	Fair/3	2	6	0	1	1	
Proposed 48th Street		Very poor/1	Good/4	2	7	0	1	1	
Other Medium Plants	11,000	Very poor/1	Good/4	2	7	0	1	1	
Oth. Small Plants	2,240	Very poor/1	Good/4	2	7	0	1	1	
Industrial Waste:									(8) Political limitations ratings are based on the following: 0 if it is of political nature 2 if it is a mildly political and 3 if it is a non political
Ocotillo	236	Poor/3	Fair/3	5	11	0	2	4	
Motorola	2,200	Very poor/2	Poor/2	2	6	0	2	4	
									(9) Aquisitional ratings are based on the following: 1 if political 2 if negotiation is required 3 if a permit is required 4 if limited negotiation is required 5 if it is routine

Source: Water Resources Associates

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D. CALCULATIONS OF MASTER PLAN WATER NEEDS

Domestic Water Requirements

TABLE D-1 Domestic Water Needs — Total Project

Land Use	Units/ Acre	Occup. Unit	Total Acres/Projected Population					gpd/ Capita	Average Annual Demand (ac/ft) Years				
			Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25		1-5	6-10	11-15	16-20	21-25
High Density Res	15	2.1	66/2079	143/4505	262/8253	400/12600	568/17893	150	349	757	1386	2118	3006
Low Density Res	4	2.8	--/--	--/--	100/1120	254/2845	1042/11670	180	--	--	226	574	2354
Office	10	5	20/1000	20/1000	60/3000	1625/4500	118/5900	25	28	28	84	126	165
Indust. Park	1	20	161/3220	269/5380	730/14600	971/19420	1027/20540	30	108	181	491	652	690
Mixed Ind & Off	5	15	168/3220	394/29550	230/17250	350/26250	456/34200	27	381	893	521	794	1034
Institutional	--	50	--/--	--/--	--/--	--/--	--/--	100	--	--	--	--	--
Resort/Hotel	1	15	--/--	16/240	89/1335	121/1815	121/1815	125	--	34	187	254	254
Mixed Off/Ind/Res	1	10	80/800	130/1300	300/3000	553/5530	553/5530	60	54	87	202	372	372
Commercial	6	4	8/192	17/408	115/2760	120/2880	187/4488	40	9	18	124	129	201
Commercial/Rec.	1	20	--/--	51/1020	72/1440	93/1860	93/1860	50	--	57	80	104	104
Fairgrounds	--	1000	--/--	--/--	240/1000	240/1000	240/1000	--	--	--	22	22	22
Golf	--	400	--/--	83/400	340/1200	431/1600	531/2400	30	--	13	40	53	81
Totals			503/19891	1123/43803	2538/54958	3623/80300	4936/107296		929	2068	3363	5198	8282

Notes:

1) 892.7 gpd = 1 acft/yr
2) # Units/ac x Occup/Unit x Acres x gpd/capita ÷ 892.7 gpd/acft/yr = Average Annual Demand
3) Fairgrounds occupancy is estimated to be 1000 persons per day
4) Golf Occupancy is estimated to 400 persons per day

TABLE D-2 Domestic Water Needs — Phoenix Portion

Land Use	Units/ Acre	Occup. Unit	Total Acres/Projected Population Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25	gpd/ Capita	Average Annual Demand (ac/ft) Years 1-5	6-10	11-15	16-20	21-25
High Density Res	15	2.1	--/--	21/662	100/3150	200/6300	325/10238	150	--	111	529	1059	1720
Low Density Res	4	2.8	--/--	--/--	50/560	154/1725	852/9542	180	--	--	113	348	1924
Office	10	5	20/1000	20/1000	35/1750	65/3250	93/4650	25	28	28	49	91	130
Indust. Park	1	20	--/--	--/--	430/8600	646/12920	677/13540	30	--	--	289	434	455
Mixed Ind & Off	5	15	168/12600	352/26400	80/6000	100/7500	119/8925	27	381	798	181	227	270
Institutional	--	50	--/--	--/--	--/--	--/--	--/--	100	--	--	--	--	--
Resort/Hotel	1	15	--/--	--/--	55/825	87/1305	87/1305	125	--	--	116	183	183
Mixed Off/Ind/Res	1	10	80/800	130/1300	300/3000	553/5530	553/5530	60	54	87	202	372	372
Commercial	6	4	--/--	--/--	90/2160	90/2160	156/3744	40	--	--	97	97	168
Commercial/Red.	1	20	--/--	--/--	20/400	41/820	41/820	50	--	--	22	46	46
Fairgrounds	--	1000	--/--	--/--	240/1000	240/1000	240/1000	20	--	--	22	22	22
Golf	--	400	--/--	--/--	160/400	160/400	260/800	30	--	--	13	13	27
Totals			268/14400	523/29362	1560/27845	2336/42910	3403/60094		463	1024	1633	2892	5317

Notes:
1) 892.7 gpd = 1 acft/yr
2) # Units/ac x Occup/Unit x Acres x gpd/capita ÷ 892.7 gpd/acft/yr = Average Annual Demand
3) Fairgrounds occupancy is estimated to be 1000 persons per day
4) Golf Occupancy is estimated to be 400 persons per day

TABLE D-3 Domestic Water Needs — Tempe, Mesa and S.R. Indian Community

Land Use	Units/ Acres	Occup. Unit	Total Acres/Projected Population Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25	gpd/ Capita	Average Annual Demand (ac/ft) Years 1-5	6-10	11-15	16-20	21-25
High Density Res	15	2.1	66/2079	122/3843	162/5103	200/6300	243/7655	150	349	646	857	1059	1286
Low Density Res	4	2.8	--/--	--/--	50/560	100/1120	190/2128	180	--	--	113	226	429
Office	10	5	--/--	--/--	25/1250	25/1250	25/1250	25	--	--	35	35	35
Indust. Park	1	20	161/3220	269/5380	300/6000	325/6500	350/7000	30	108	181	202	218	235
Mixed Ind & Off	5	15	--/--	42/3150	150/11250	250/18750	337/25275	27	--	95	340	567	764
Institutional	--	50	--/--	--/--	--/--	--/--	--/--	100	--	--	--	--	--
Resort/Hotel	1	15	--/--	16/240	34/510	34/510	34/510	125	--	34	71	71	71
Mixed Off/Ind/Res	1	10	--/--	--/--	--/--	--/--	--/--	60	--	--	--	--	--
Commercial	6	4	8/192	17/408	25/600	30/720	31/744	40	9	18	27	32	33
Commerical/Rec.	1	20	--/--	51/1020	52/1040	52/1040	52/1040	50	--	57	58	58	58
Fairgrounds	--	1000	--/--	--/--	--/--	--/--	--/--	20	--	--	--	--	--
Golf	--	400	--/--	83/400	180/800	271/1200	271/1600	30	--	13	27	40	54
Totals			235/5491	600/14441	978/27113	1287/37390	1533/47202		466	1044	1730	2306	2965

Notes:
1) 892.7 gpd = 1 acft/yr
2) # Units/ac x Occup/Unit x Acres x gpd/capita - 892.7 gpd/acft/yr = Average Annual Demand
3) Fairgrounds occupancy is estimated to be 1000 persons per day
4) Golf occupancy is estimated to be 400 persons per day

Non-Potable Water Requirements

TABLE D-4 Non-Potable Water Needs — Total Project

Land Use	Master Plan Development (acres) Years 1-5 Net	Years 1-5 Gross	Years 6-10 Net	Years 6-10 Gross	Years 11-15 Net	Years 11-15 Gross	Years 16-20 Net	Years 16-20 Gross	Years 21-25 Net	Years 21-25 Gross	Evap. or Applic. Rate (ft)	Non-Potable Demand (acft) Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 21-25
Waterways/Lakes/Ponds	20	20	94	94	1140	1154	1390	1404	1390	1404	6.25 ft[2]	125	587	7126	8689	8689
Water Features	10	10	66	66	98	98	124	124	124	124		47	397	597	754	688
Grass Channel	40	40	40	40	1570	1615	1820	1865	1820	1865	4.5 ft[3]	180	180	7065	8190	8190
Parks	95	137	125	137	215	307	275	427	335	542	4.7 ft[4]	447	588	1011	1293	1575
Golf Course	--	--	--	--	160	340	193	464	293	564	4.7 ft[4]	--	--	752	907	1377
Fairgrounds[5]	--	--	--	--	240	240	240	240	240	240	4.7 ft[4]	--	--	376	376	376
Resort Hotel	--	--	16	16	44	89	44	121	44	121	4.7 ft[4]	--	75	207	207	207
Totals	165	207	341	353	3467	3843	4086	4654	4246	4860		799	1827	17134	20416	21168

Notes:

1) Net acres refers to acreages outside of SRP service boundary. Gross acres refers to total project area.
2) 6.25 ft/yr = Lake surface evaporation
3) 4.5 ft/yr = annual consumptive use of Bermuda lawn (43.5 in/yr ÷ 12 in/ft) ÷ 80% applicable efficiency
4) 4.7 ft/yr = assumes 90% lawn and 10% lake surfaces
5) Assumes 1/3 of acreage irrigated

TABLE D-5 Non-Potable Water Needs — Phoenix Portion

Land Use	Master Plan Development (acres) Years 1-5 Net	Years 1-5 Gross	Years 6-10 Net	Years 6-10 Gross	Years 11-15 Net	Years 11-15 Gross	Years 16-20 Net	Years 16-20 Gross	Years 21-25 Net	Years 21-25 Gross	Evap. or Applic. Rate (ft)	Non-Potable Demand (acft) 1-5	6-10	Years 11-15	16-20	21-25
Waterways/Lakes Ponds	--	--	74	74	460	474	710	724	710	724	6.25 ft[2]	--	462	2875	4438	4438
Water Features	--	--	56	56	88	88	110	110	110	110	6.25 ft	--	350	550	688	688
Grass Channel	--	--	--	--	700	725	950	975	950	975	4.5 ft[3]	--	--	3150	4275	4275
Parks	30	60	60	60	80	160	140	280	200	395	4.7 ft[4]	141	282	376	658	940
Golf Course	--	--	--	--	160	160	160	160	260	260	4.7 ft[4]	--	--	752	752	1222
Fairgrounds[5]	--	--	--	--	240	240	240	240	240	240	4.7 ft[4]	--	--	376	376	376
Resort Hotel	--	--	--	--	10	55	10	87	10	87	4.7 ft[4]	--	--	47	47	47
Totals	30	60	190	190	1738	1902	2320	2576	2480	2791		141	1094	8126	11234	11986

Notes:

1) Net acres refers to acreages outside of SRP service boundary. Gross acres refers to total project area.
2) 6.25 ft/yr = Lake surface evaporation
3) 4.5 ft/yr = annual consumptive use of Bermuda lawn (43.5 in/yr ÷ 12 in/ft) ÷ 80% applicable efficiency
4) 4.7 ft/yr = assumes 90% lawn and 10% lake surfaces
5) Assumes 1/3 of acreage irrigated

TABLE D-6 Non-Potable Water Needs — Tempe Portion

Land Use	Master Plan Development (acres) Years 1-5 Net	Gross	Years 6-10 Net	Gross	Years 11-15 Net	Gross	Years 16-20 Net	Gross	Years 21-25 Net	Gross	Evap. or Applic. Rate (ft)	Non-Potable Demand (acft) Years 1-5	6-10	11-15	16-20	21-25
Waterways/Lakes/Ponds	20	20	20	20	390	390	390	390	390	390	6.25 ft[2]	125	125	2438	2438	2438
Water Features	10	10	10	10	10	10	14	14	14	14		47	47	47	66	66
Grass Channel	40	40	40	40	200	200	200	200	200	200	4.5 ft[3]	180	180	900	900	900
Parks	65	77	65	77	135	147	135	147	135	147	4.7 ft[4]	306	306	635	635	635
Golf Course	--	--	--	--	--	--	33	33	33	33	4.7 ft[4]	--	--	--	155	155
Fairgrounds	--	--	--	--	--	--	--	--	--	--	4.7 ft[4]	--	--	--	--	--
Resort Hotel	--	--	16	16	34	34	34	34	34	34	4.7 ft[4]	--	75	160	160	160
Totals	135	147	151	163	769	781	806	818	806	818		658	733	4180	4354	4354

Notes:

1) Net acres refers to acreages outside of SRP service boundary. Gross acres refers to total project area.
2) 6.25 ft/yr = Lake surface evaporation
3) 4.5 ft/yr = annual consumptive use of Bermuda lawn (43.5 in/yr ÷ 12 in/ft) ÷ 80% applicable efficiency
4) 4.7 ft/yr = assumes 90% lawn and 10% lake surfaces
5) Assumes 1/3 of acreage irrigated

TABLE D-7 Non-Potable Water Needs — Mesa Portion

Land Use	Master Plan Development (acres) Years 1-5 Net	Gross	Years 6-10 Net	Gross	Years 11-15 Net	Gross	Years 16-20 Net	Gross	Years 21-25 Net	Gross	Evap. or Applic. Rate (ft)	Non-Potable Demand (acft) 1-5	6-10	Years 11-15	16-20	21-25
Waterways/Lakes/Ponds	--	--	--	--	90	90	90	90	90	90	6.25 ft(2)	--	--	563	563	563
Water Features	--	--	--	--	--	--	--	--	--	--		--	--	--	--	--
Grass Channel	--	--	--	--	160	180	160	180	160	180	4.5 ft(3)	--	--	720	720	720
Parks	--	--	--	--	--	--	--	--	--	--	4.7 ft(4)	--	--	--	--	--
Golf Course	--	--	--	--	--	180	--	271	--	271	4.7 ft(4)	--	--	--	--	--
Fairgrounds (5)	--	--	--	--	--	--	--	--	--	--	4.7 ft(4)	--	--	--	--	--
Resort Hotel	--	--	--	--	--	--	--	--	--	--	4.7 ft(4)	--	--	--	--	--
Totals	--	--	--	--	250	450	250	541	250	541		--	--	1283	1283	1283

Notes:

1) Net acres refers to acreages outside of SRP service boundary. Gross acres refers to total project area.
2) 6.25 ft/yr = Lake surface evaporation
3) 4.5 ft/yr = annual consumptive use of Bermuda lawn (43.5 in/yr ÷ 12 in/ft) ÷ 80% applicable efficiency
4) 4.7 ft/yr = assumes 90% lawn and 10% lake surfaces
5) Assumes 1/3 of acreage irrigated

TABLE D-8 Non-Potable Water Needs — S.R. Indian Community Portion

Land Use	Master Plan Development (acres) Years 1-5 Net	Gross	Years 6-10 Net	Gross	Years 11-15 Net	Gross	Years 16-20 Net	Gross	Years 21-25 Net	Gross	Evap. or Applic. Rate (ft)	Non-Potable Demand (acft) Years 1-5	6-10	11-15	16-20	21-25
Waterways/Lakes/Ponds	--	--	--	--	200	200	200	200	200	200	6.25 ft[2]	--	--	1250	1250	1250
Water Features	--	--	--	--	--	--	--	--	--	--		--	--	--	--	--
Grass Channel	--	--	--	--	510	510	510	510	510	510	4.5 ft[3]	--	--	2295	2295	2295
Parks	--	--	--	--	--	--	--	--	--	--	4.7 ft[4]	--	--	--	--	--
Golf Course	--	--	--	--	--	--	--	--	--	--	4.7 ft[4]	--	--	--	--	--
Fairgrounds[5]	--	--	--	--	--	--	--	--	--	--	4.7 ft[4]	--	--	--	--	--
Resort Hotel	--	--	--	--	--	--	--	--	--	--	4.7 ft[4]	--	--	--	--	--
Totals	--	--	--	--	710	710	710	710	710	710		--	--	3545	3545	3545

Notes:

1) Net acres refers to acreages outside of SRP service boundary. Gross acres refers to total project area.
2) 6.25 ft/yr = Lake surface evaporation
3) 4.5 ft/yr = annual consumptive use of Bermuda lawn (43.5 in/yr ÷ 12 in/ft) ÷ 80% applicable efficiency
4) 4.7 ft/yr = assumes 90% lawn and 10% lake surfaces
5) Assumes 1/3 of acreage irrigated

E. FLOOD MANAGEMENT BACKGROUND

Flood Management Background

Existing Conditions

The Salt River Drainage basin is comprised of 13,700 square miles, from the headwaters to its confluence with the Gila River. The major tributary within the basin is the Verde River which has approximately 6,600 square miles of drainage area.

Elevations within the drainage basin range from more than 12,000 feet at the San Francisco Peaks in the Verde River basin to approximately 900 feet near the mouth of the Agua Fria River. The area is extremely irregular and rugged, and the soils and vegetative types are widely varied.

Thirteen major floods occurred between 1891 and 1980. The peak discharges from these floods have ranged from 67,000 cfs to 271,000 cfs, as shown in Table E-1.

Return periods of hypothetical flows at various locations along the Salt River are shown in Table E-2.

TABLE E-1 Floods on the Salt River

Date	Peak Flow (cfs)
February 1891	271,000[a]
April 1905	115,000[a]
November 1905	200,000[a]
January 19-20, 1916	120,000[a]
January 29-30, 1916	105,000[a]
February 1920	130,000[a]
March 1938	95,000[a]
March 1941	40,000[a]
December 1965/January 1966	67,000[a]
March 1978	138,000[b]
December 1978	140,000[a]
January 1979	100,600[b]
March 1979	67,400[b]
February 1980	170,000[b]

Source: [a] Salt River Project
[b] USGS Records at Jointhead Dam

TABLE E-2 Discharge Frequency Values

Location:	Return Period 500-year	200-year	100-year	50 year	20-year	10-year	5-year
Below confl w/Verde River	360,000	290,000	245,000	175,000	141,000	102,000	45,000
Gilbert Road	345,000	285,000	230,000	170,000	139,000	100,000	44,000
Tempe Bridge	330,000	265,000	215,000	160,000	135,000	93,000	40,000
Central Avenue	325,000	265,000	200,000	155,000	130,000	91,000	39,000
67th Avenue	315,000	255,000	190,000	150,000	126,000	90,000	38,000
Above confl w/Gila River	310,000	250,000	185,000	145,000	125,000	85,000	36,000

Source: "Gila River and Tributaries - Central Arizona Water Control Study, Hydrology Report," U.S. Army Corps of Engineers, L.A. District, May, 1982.

The Salt River is regulated by four major dams and reservoirs; Theodore Roosevelt, Horse Mesa, Morman Flat and Stewart Mountain. The Verde River is regulated by Horseshoe and Bartlett dams and reservoirs. Water impounded in these reservoirs is used for irrigation, municipal and industrial purposes in the Salt River Valley. As a result, the river through the Rio Salado Development District is generally dry. During flood periods, when the reservoir capacity is exceeded, releases from the reservoirs can cause flood stages in the Salt River.

The Central Arizona Water Control Study (CAWCS), proposes two additional dams and reservoirs to assist in regulating these unusual flooding events. These proposed structures would be the new Cliff Dam and reservoir on the Verde River and a new or modified Roosevelt Dam on the Salt River. With these structures in place, the estimated 100 year peak discharge in the Salt River will be reduced from 200,000 cfs to 55,000 cfs.

The general characteristics of the Salt and Gila river channels for existing conditions were determined using available data. They are as follows:

- Varying width ranging from 550 feet to 5,000 feet.
- Depth of water for the 200,000 cfs flood ranges from between 7 feet to almost 27 feet and 4 feet to 15 feet for 55,000 cfs.
- Invert slopes range from nearly level to 0.5% (0.005 ft/ft) with the average slope for the entire reach from Agua Fria to Granite Reef of approximately 0.2% (0.002 ft/ft).
- The size of the bed material ranges from clays to large cobbles.
- The median size material has an approximate D_{50} (50% diameter) of 8 mm or 0.026 ft.
- Major bridge crossing and channelization works have altered portions of the Salt River from its natural state to more defined and rigid, sides and inverts.
- Excavations for sand and gravel mining operations alter localized areas on a continual basis.
- Old abandoned landfills, trash dumps and general misuse of the dry river bed are apparent throughout its reach.

Mapping

Water surface profiles were developed for flow rates of 50,000, 100,000 and 200,000 cfs. to be used in the evaluation of alternatives and phasing scenarios. Due to the fact that no unified topography was available for the investigation, the Master Plan relied heavily on previous work by others, including generalized hydraulic design reports from federal agencies, channelization plans by federal, state, county and municipal agencies and site specific bridge plans from approximately 14 private consultants.

The primary data acquired for the study include comprehensive and detailed hydraulic analyses and bridge designs, final concept reports, channel plans and construction documents. Specific aspects of the engineering plans and reports were verified through oral communications from key individuals.

The Camp Dresser & McKee Report provided profiles showing the most recent invert profile of the Salt River and the associated water surface elevations for a 300,000 cfs flood. These data were supplemented by U.S. Army Corps of Engineers computer model profiles, for the 50,000 cfs, 100,000 cfs and 200,000 cfs floods.

Secondary data were from two reports, 1) "Salt and Gila River Hydraulic Analysis for Central Arizona Water Control Study,"

prepared by the U.S. Army Corps of Engineers, Los Angeles District (USCE) and 2) "Stage II Structural Design and Cost Memorandum-Channelization Elements," prepared by Camp, Dresser and McKee, Inc., for the Central Arizona Water Control Study (CAWCS), through the U.S. Army Corps of Engineers, Los Angeles District.

Included in the USCE Reports are two sets of floodplain delineation plans. One set shows the floodplain delineation for discharges of 50,000 cfs, 100,000 cfs, 150,000 cfs and 200,000 cfs in the Salt River from the western boundary of the Rio Salado District to Granite Reef Diversion Dam. The second set of plans defines the limit of flooding for the same reach of the Salt and Gila rivers for the 1978, 1979 and 1980 floods.

The many datums encountered in these plans varied widely, some as much as 10 feet vertically at the same location. Judgement was exercised in shifting and adjusting profiles to produce one unified map for the Master Plan. The water surface profiles shown on Figure 1 agree substantially with Corps of Engineers, county and private profiles.

When unified topography becomes available for the study area, it should be used to calibrate the invert and water surface profiles.

Flood contours for 50,000, 100,000 and 200,000 cfs were determined by interpolating from the plans and reports mentioned above. These were then adjusted by visual comparison with topography and aerial photographs of flood events.

Both the water surface profile and flood contour map can be used to determine the preliminary suitability for proposed site developments. They should indicate the approximate conditions of depth, velocity and extent of flooding for the various sites. The contour and profile maps should only be used as a general planning tool and not for final design or construction.

Constraints

Preliminary work concentrated on the investigation of the suitability of the Salt River bed for development. The development scenarios that were considered included gross channels of various widths (with and without river bottom lakes), natural earthen channels, limited levees and various combinations and configurations of the above elements. The selected alternative adopted by the District for development is a grass floodway of varying width (minimum width=1100 ft.) with river bottom lakes and water features. The constraints encountered in developing this alternative are as follows:

Flooding

Before the construction of Orme Dam or a suitable alternative to control the upstream flooding, discharges in the Salt River will remain basically unregulated for a time. The 100 year event ranges from 245,000 cfs at Granite Reef to approximately 190,000 cfs at 67th Avenue as was shown in Table E-2.

The potential for development within the river bed is extremely limited, due to the destructive forces associated with flows of such magnitudes. The concept of grass channel floodway is not appropriate for the Salt River bed without the ability of upstream flood control to regulate the 100 year flood event to a manageable rate.

Limited development is possible at numerous locations along the riverbed during Phase I, however. Many of these areas are located such that they would receive only minimal flooding from the 100 year event and can be protected from, or designed to accept such floods without significant damage. Levees or other flood protection can be realized at relatively low cost. However, all design must conform to federal, state and local flood regulations.

Another concern is the periodic release of excess water from upstream dams in the future. Any park and lake areas developed within the floodplain will be subject to both controlled and uncontrolled flooding of the Salt River.

The construction of upstream dams will reduce the 100 year flood event to approximately 55,000 cfs. This rate of flow can be managed successfully within a grassed floodway.

Local Runoff

The local drainage affecting the Rio Salado Project consists of runoff from approximately 1,100 square miles of urban, agricultural and desert lands. The peak discharge from this source is expected to be less than the 55,000 cfs (100 year event).

The Rio Salado may be subject to runoff from numerous annual storms less than the 100 year event. These flows can be managed satisfactorily by the use of low flow channels and other devices throughout the reach of the project.

Bridges

Nine major bridges crossing the Salt River have been completed and three additional structures are in the design stage. There is approximately seven miles of existing river channelization associated with the bridge projects and five additional miles of channel work existing or under construction, the major portion of which is within the City of Phoenix. The design criteria for the various flood control elements ranges from 75,000 to 200,000 cfs. The grassed floodway will not create any major modification to the existing flood works. Rather, it will fit within the existing confines of the new bridges and channels.

F. DEVELOPMENT AND OPERATING COSTS

Notes and Assumptions

Development Costs

Channel Relocation

This refers to a segment of the riverbed south of the Sky Harbor Airport in Phoenix which must be relocated further south to make room for the construction of a third runway.

Neighborhood Street Improvements

Areas designated in Phoenix as rehabilitation sites are in need of sidewalks, paved streets, street lights, and landscaping.

Land Preparation for Private Development

Land within the parkways to be owned by the Development District and designated for lease to private enterprise will need basic improvements such as utilities, local streets, and grading. These figures do not include properties to be owned by the State Land Trust.

Downpayment Loans/Grants to Renters

These funds would assist renters within rehabilitation areas of Phoenix who wish to purchase houses also within these special neighborhoods.

Schools

These figures include furnishings and equipment.

Riverbed Development Costs

TABLE F-1 Development Costs — Phoenix Riverbed

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Armored Channel	$4 mil./mile	.75 mi	$3,000									$ 3,000
Waterways, Lakes and Ponds	$90,000/acre			74a	$6,660	47/a	$42,390	180a	$16,200			65,250
Grass Channel, Parks and Islands	$60,000/acre					725a	43,500	250a	15,000			58,500
Horsetrails	$40,000/acre			20a	800							800
Drop Structures	$1.5 mil./ea					4	6,000					6,000
Pumps and Wells	$100,000/ea	2	200	2	200	2	200	1	100	1	100	800
Channel Relocation	$6.6 mil/mile					2.25	14,850					14,850
Bridges						1	8,000					8,000
Land Acquisition	$20,000/acre	297a	5,940	297a	5,940							11,880
Total			$ 9,140		$13,600		$114,940		$31,300		$100	$169,080

TABLE F-2 Development Costs — Tempe Riverbed

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Armored Channel	$4 mil./mile	1.2 mi	$ 4,800									$ 4,800
Armored Channel	$200,000/mi	.3 mi	60									60
Waterways, Lakes, and Ponds	$ 90,000/acre	20 a	1,800			370 a	$33,300					35,100
Grass Channel, Parks, and Islands	$ 60,000/acre	40 a	2,400			160 a	9,600					12,000
Horsetrails	$ 40,000/acre	35 a	1,400									1,400
Golf Course (public)	$7 mil./ea					1	7,000					7,000
Drop Structures	$1.5 mil/ea					1	1,500					1,500
Pumps & Wells	$100,000/ea	2	200	1	$ 100	1	100	1	$ 100			500
Bridges						3	15,200					15,200
Land Acquisition	$ 20,000/acre	162a	3,240	162a	3,240							6,480
Total			$13,900		$3,340		$66,700		$ 100			$84,040

TABLE F-3 Development Costs — Mesa Riverbed

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Waterway, Lakes and Ponds	$90,000/acre					90 a	$ 8,100					$ 8,100
Grass Channel and Island	$60,000/acre					180 a	10,800					10,800
Pumps and Wells	$100,000/ea					2	200					200
Land Acquisition	$20,000/acre			1622	$3,240							3,240
Total					$3,240		$19,100					$22,340

TABLE F-4 Development Costs — S.R.Indian Community Riverbed

		Time Period in Years										
		1 - 5		6 - 10		11 - 15		16 - 20		21 - 25		
Item	Unit Cost	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Total
Waterway, Lakes and Ponds	$ 90,000/acre					200a	$18,000					$18,000
Grass Channel, Parks and Island	$ 60,000/acre					510a	30,600					30,600
Sediment Basin						1	14,000					14,000
Drop Structures	$1.5 mil./ea					2	3,000					3,000
Pumps and Wells	$100,000/each					6	600					600
Total							$66,200					$66,200

Riverbank Development Costs

TABLE F-5 Development Costs — Phoenix Riverbank

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Water Features	$90,000/acre			56a	$5,040	32a	$2,280	22a	$ 1,980			$ 9,300
Parks	$30,000/acre	60a	$ 1,800			100a	3,000	110a	3,300	115	$ 3,450	11,550
Equestrian Ctr.	$ 6,000/acre			30a	180							180
Public Golf	$3 mil/ea					1	3,000					3,000
Neighborhood Street Improvements	$22,400/acre	200a	4,480			90a	2,000	45a	1,000	66	1,480	8,960
Parkway	$1.3 mil/mile	1 mi	1,300			6 mi.	7,800	6 mi.	7,800	5 mi	6,500	23,400
Housing Rehab Loans/Grants	$15,000/unit	100 u.	1,500	100 u	1,500	100 u	1,500	100 u	1,500			6,000
New Relocation Housing	$54,000/unit	75 u.	4,050	100 u	5,400	100 u	5,400	25 u	1,350			16,200
Land Acquisition	$40,000/acre	631 a	25,240	632 a	25,280							50,520
Land Preparation for Private Development	$26,000/acre			185 a	4,810	75 a	1,190	185	4,810	296	7,696	19,266
Total			$38,370		42,210		$26,930		$21,740		$ 19,126	$148,376

TABLE F-6 Development Costs — Tempe Riverbank

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Water Features	$90,000/acre	10a	$ 900					2.62	$ 240			$ 1,140
Parks	$30,000/acre	77a	2,310			70a	$2,100					4,410
Equestrian Center	$ 6,000/acre	90a	540									540
Parkway	$1.3 mil/mile			1 mi	1,300			4 mi	5,200	4 mi.	5,200	11,700
Land Acquisition	$60,000/acre	270a	16,200	180a	10,800							27,000
Land Preparation for Private Development	26,000/acre	205 a	5,330	68a	1,768							7,098
Total			$25,280		$13,868		$2,100		$5,440		$5,200	$51,888

TABLE F-7 Development Costs — Mesa Riverbank

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Public Golf					$ 3,000							$ 3,000
Parkway	$ 1.3 mil/mi							3 mi.	$3,900	2.6 mi	$3,380	7,280
Land Acquisition	$50,000/acre	142 a	$7,100	143 a	7,150							14,250
Land Preparation for Private Development	$26,000/acre			25 a	650	26 a	676					1,326
Total			7,100		10,800		676				$3,380	$25,856

TABLE F-8 Development Costs — S.R. Indian Community Riverbank

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Parks	$30,000/acre							35a	$1,050			$1,050
Parkways	$1.3 mil/mi							1 mi	1,300			1,300
Total									2,350			$2,350

Development Costs for Services

TABLE F-9 Development Costs — Phoenix Services

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Police	$50/acre	300 a	$ 15	300 a	$ 15	697a	$ 35	797a	$ 40	797a	$ 40	$ 145
Fire	$100/acre	"	30	"	30	"	70	"	80	"	80	290
Utilities	$200/acre	"	60	"	60	"	140	"	160	"	160	580
Powerline Relocation	$1.5 mil/mile			2 mi	3,000	4.5 mi.	7,000					10,000
Elementary Schools	$4 mil/each	(land)	200	(land)	200			2	8,000	2	8,000	16,400
Secondary Schools				1	30,000							30,000
Downpayment Loans/ Grants to Renters	$15,000/unit	25 u	375	25u	375	25u	375	25 u	375	10 u	150	1,650
Total			$680		$33,680		$7,620		$8,655		$8,430	$59,065

TABLE F-10 Development Costs — Tempe Services

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Police	$50/acre	235a	$12	235	$12	213a	$11	156a	$ 8			$ 43
Fire	$100/acre	235a	24	"	24	"	22	"	16			86
Utilities	$200/acres	"	48	"	48	"	44	"	32			172
Powerline Relocation	$1.5/mil/mile	4 mi.	6,000			4 mi	6,000					12,000
Relocation Payments	$4,000/unit	15	60									60
Total			$6,144		$84		$6,077		$56			$12,361

TABLE F-11 Development Costs — Mesa Services

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Police	$50/acre			42a	$ 2			193a	$ 10	164a	$ 8	$ 20
Fire	$100/acre			"	4				20		16	40
Utilities	$200/acre			"	8				40		32	80
Elementary Schools	$4mil/each	(land)	$300					1	4,000			4,300
Total			$300		$14				$ 4,070		$56	$ 4,440

F-12 Development Costs — S.R. Indian Community

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)	Total
Powerline Relocation	$1.5 mil/mile					5.5 mi.	$8,250					$8,250
Total							8,250					8,250

Notes and Assumptions

Operating Costs

Property Maintenance

Land purchased by the Development District will require general upkeep prior to the time it is developed for use designated in the plan.

Project Administration

Although personnel is generally included in the operating costs shown (e.g. parks and parkways), tasks such as property acquisition, water acquisition, property management, and overall project coordination will also require additional staff for the Development District.

Police, Fire and Utilities

The operating costs for these items are based upon the number of acres expected to be developed for private purposes.

Special Public Institutions

Operating costs have not been listed for such institutions as the Southwest Cultural Center, equestrian centers, State Fairground, or Exposition which may also require some level of public subsidy.

Riverbed Annual Operating Costs

TABLE F-13 Annual Operating Costs — Phoenix Riverbed

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Waterway, Lakes and Ponds	$1500/acre			74a	$111	474a	$ 616	724a	$1,086	724a	$1,086
Grass Channel, Parks and Islands	$1500/acre					725a	1,087	975a	1,462	975a	1,462
Bridges	2000/ea			1	2	1	2	1	2		2
Total					$113		$1,705		$2,550		$2,550

TABLE F-14 Annual Operating Costs — Tempe Riverbed

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Waterway, Lakes and Ponds	$1,500/acre	20a	$30	20a	$30	390a	$ 585	390	$ 585	390a	$ 585
Grass Channel, Parks and Islands	$1,500/acre	40a	60	40a	60	420	630	420	630	420a	630
Bridges	$2,000/each					2	4	2	4	2	4
Total			$90		$90		$1,219		$ 1,219		$ 1,219

TABLE F-15 Annual Operating Costs — Mesa Riverbed

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Waterway and Lakes	$1500/acre					90a	$135	90a	$135	90a	$135
Grass Channel, Parks and Islands	$1500/acre					180a	270	180a	270	180a	270
Total							$405		$405		$405

TABLE F-16 Annual Operating Costs — S.R. Indian Community Riverbed

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Waterway, Lakes and Ponds	$1,500/acre					200a	$ 300	200a	$ 300	200a	$ 300
Grass Channel, Parks and Islands	$1,500/acre					510a	765	510a	765	510a	765
Total							$1,065		$1,065		$1,065

Riverbank Annual Operating Costs

TABLE F-17 Annual Operating Costs — Phoenix Riverbank

		Time Period in Years									
		1 - 5		6 - 10		11 - 15		16 - 20		21 - 25	
Item	Unit Cost	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)
Water Features	$1,500/acre			56a	$ 84	88a	$132	110a	$ 165	110a	$ 165
Parks	$1,500/acre	60a	$ 90	60a	90	160a	240	280a	420	395a	593
Public Golf	$1,500/acre					120a	180	120a	180	120a	180
Neighborhood Street Improvements	225/acre	200a	45	200a	45	290a	65	335a	75	401a	90
Parkways	$5,900/mile	1 mi.	6	1 mi.	6	7 mi.	41	13 mi.	77	18 mi	106
Property Maintenance	$ 300/acre	600a	180	1100a	330	700a	210	300a	90		
Total			$321		$555		$868		$1,007		$1,134

TABLE F-18 Annual Operating Costs — Tempe Riverbank

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Water Features	$1,500/acre	10a	$ 15	10a	$ 15	10a	$ 15	14a	$ 21	14a	$ 21
Parks	$1,500/acre	77a	115	77a	115	147a	221	147a	221	147a	221
Public Golf	$1,500/acre							33a	50	33a	50
Parkway	$5,900/mile			1 mi.	6	1 mi	6	5 mi	30	9 mi	54
Property Maintenance	$ 300/acre			100a	30						
Total			$130		$166		$242		$322		$346

TABLE F-19 Annual Operating Costs — Mesa Riverbank

		Time Period in Years									
		1 - 5		6 - 10		11 - 15		16 - 20		21 - 25	
Item	Unit Cost	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)
Public Golf	$1,500/acre			100a	$150	100a	$150	100a	$150	100	$150
Parkway	$5,900/mile							3 mi.	18	5.6 mi	33
Property,Maintenance	$ 300/acre	140 a	$ 42	180a	54	80a	24	80a	24		
Total			42		204		174		192		$183

TABLE F-20 Annual Operating Costs — S.R. Indian Community Riverbank

		Time Period in Years									
		1 - 5		6 - 10		11 - 15		16 - 20		21 - 25	
Item	Unit Cost	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)	Units	Cost(000)
Parks	$1,500/acre							35	$52	35	$52
Parkways	$5,900/mile							1 mi.	6	1 mi.	6
Total									$58		$58

Annual Operating Costs for Services

TABLE F-21 Annual Operating Costs — Phoenix Services

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Police	$125/acre	200a	$ 25	400a	$ 50	1200a	$ 150	2000a	$ 250	2900a	$ 362
Fire	$250/acre	"	50	"	100	"	300	"	500	"	725
Utilities	$100/acre	"	20	"	40	"	120	"	200	"	290
Elementary Schools	$1.5mil/yr							2	3,000	4	6,000
Secondary School	$2,000/ student			2000st	4,000	2000st	4,000	2,000st	4,000	2000st	4,000
Water Acquisition	(see F-26)		14		119		1,625		2,179		2,322
Water Pumping	(see F-26)		7		38		159		210		240
Project Admin.			150		150		150		150		150
Total			$266		$4,497		$6,504		$10,489		$14,089

TABLE F-22 Annual Operating Costs — Tempe Services

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Police	$125/acre	235a	$ 29	470a	$ 59	680a	$ 85	830a	$ 104	830a	$ 104
Fire	$250/acre	"	58	"	118	"	170	"	208		208
Utilities	$100/acre	"	24	"	47	"	68	"	83		83
Water Acquisition	(see F-27)		119		135		836		871		871
Water Pumping	(see F-27)		28		31		65		70		70
Project Admin.			75		75		75		75		75
Total			$333		$465		$1,299		$1,411		$1,411

TABLE F-23 Annual Operating Costs — Mesa Services

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Police	$125/acre			40a	$ 5	40a	$ 5	235a	$ 29	400a	$ 50
Fire	$250/acre			"	10	"	10	"	58	"	100
Utilities	$100/acre			"	4	"	4	"	24	"	40
Elementary Schools	$1.5mil/eacl							1	1,500	1	1,500
Water Acquisition	(see F-28)						257		257		257
Water Pumping	(see F-28)						25		25		25
Project Admin.			$45		45		45		45		45
Total			$45		$64		$346		$1,938		$2,017

TABLE F-24 Annual Operating Costs — S.R. Indian Community Services

Item	Unit Cost	Time Period in Years: 1 - 5 Units	1 - 5 Cost(000)	6 - 10 Units	6 - 10 Cost(000)	11 - 15 Units	11 - 15 Cost(000)	16 - 20 Units	16 - 20 Cost(000)	21 - 25 Units	21 - 25 Cost(000)
Water Acquisition	(see F-29)						$709		$709		$709
Water Pumping	(see F-29)						75		75		75
Project Admin.			$30		$30		30		30		30
Total			$30		$30		$814		$814		$814

Pumping and Acquisition Costs of Non-Potable Water

TABLE F-25 Costs of Non-Potable Water — Total Project

TOTALS

Land Use	Average Daily Pumping Rate (gpm)					Years 1-5		Years 6-10		Years 11-15		Years 16-20		Years 21-25	
	1-5	6-10	11-15	16-20	21-25	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.
Waterways/ Lakes/Canals	78	364	4419	5388	5388	$ 3200	$12600	$14700	$58700	$44300	$1425500	$54000	$1738000	$54000	$1738000
Water Features	29	246	370	468	468	1200	4700	9900	39700	3700	119400	4700	150900	4700	150900
Grass Channel	112	112	4380	5078	5078	8400	18000	8400	18000	206300	1412900	239100	1638100	239100	1638100
Parks	277	365	627	802	977	21400	44600	32700	68200	29600	202300	37800	258700	46100	315200
Golf Course	--	--	466	562	854	--	--	--	--	22000	150300	26400	181300	40200	275500
Fairgrounds	--	--	233	233	233	--	--	--	--	11000	75200	11000	7500	11000	7500
Resort/Hotel	--	47	128	128	128	--	--	3600	7500	6000	41200	6100	41300	6100	41300
Totals	496	1134	10623	12659	13126	$34200	$79900	$69300	$192100	$322900	$3426800	$379100	$4015800	$401200	$4166500

Notes:

1) Avg. pumping rate in gpm = # acft/yr x 0.62
2) Annaul Pumping Costs = gpm x H x 0.2004
3) Water supply in years 1-10 from groundwater only - estimated depth to groundwater is 200 feet.
4) Water supply in years 11-25 from effluent only - estimated depth to effluent is 50 feet.
5) Acquired costs - $100/acft for groundwater leachate or of poor quality - years 1-10; $200/acft for effluent, years 11-25.

TABLE F-26 Costs of Non-Potable Water — Phoenix Portion

Land Use	Average Daily Pumping Rate (gpm)					Head		Years 1-5		Years 6-10		Years 11-15		Years 16-20		Years 21-25	
	1-5	6-10	11-15	16-20	21-25	1-10	11-25	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.
Waterways/ Lakes/Canals	--	286	1783	2752	2752	200	50	--	--	$11500	$46100	$17900	$575200	$27600	$887700	$27600	$887700
Water Features	--	217	341	427	427	200	50	--	--	8700	35000	3400	110000	4300	137700	4300	137700
Grass Channel	--	--	1953	2651	2651	385	235	--	--	--	--	92000	630000	124800	855200	124800	855200
Parks	87	175	233	408	583	385	235	6700	14000	18000	37600	11000	75200	19200	131600	27500	188100
Golf Course	--	--	466	466	758	385	235	--	--	--	--	22000	150300	21900	150300	35700	244500
Fairgrounds	--	--	233	233	233	385	235	--	--	--	--	11000	75200	11000	7500	11000	7500
Resort/Hotel	--	--	29	29	29	385	235	--	--	--	--	1300	9300	1400	9400	1400	9400
Totals	87	678	5038	6966	7433			$6700	$14000	$38200	$118700	$158600	$1625200	$210200	$2179400	$232300	$2330100

Notes:

1) Avg. pumping rate in gpm = # acft/yr x 0.62
2) Annual Pumping Costs = gpm x H x 0.2004
3) Water supply in years 1-10 from groundwater only - estimated depth to groundwater is 200 feet.
4) Water supply in years 11-25 from effluent only - estimated depth to effluent is 50 feet.
5) Acquired costs - $100/acft for groundwater leachate or of poor quality - years 1-10; $200/acft for effluent, years 11-25

TABLE F-27 Costs of Non-Potable Water — Tempe Portion

Land Use	Average Daily Pumping Rate (gpm)					Head		Years 1-5		Years 6-10		Years 11-15		Years 16-20		Years 21-25	
	1-5	6-10	11-15	16-20	21-25	1-10	11-25	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.
Waterways/ Lakes/Canals	78	78	1512	1512	1512	200	50	$ 3200	$12600	$ 3200	$12600	$15100	$487700	$15100	$487700	$15100	$487700
Water Features	29	29	29	41	41	200	50	1200	4700	1200	4700	300	9400	400	13200	400	13200
Grass Channel	112	112	558	558	558	385	235	8400	18000	8400	18000	26300	180000	26300	180000	26300	180000
Parks	190	190	394	394	394	385	235	14700	30600	14700	30600	18600	127100	18600	127100	18600	127100
Golf Course	--	--	--	96	96	385	235	--	--	--	--	--	--	4500	31000	4500	31000
Fairgrounds	--	--	--	--	--	385	235	--	--	--	--	--	--	--	--	--	--
Resort/Hotel	--	47	99	99	99	385	235	--	--	3600	7500	4700	31900	4700	31900	4700	31900
Totals	409	456	2592	2700	2700			$27500	$65900	$31100	$73400	$65000	$836100	$69600	$870900	$69600	$870900

Notes:

1) Avg. pumping rate in gpm = acft/yr x 0.62.
2) Annual Pumping Costs = gpm x H x 0.2004.
3) Water supply in years 1-10 from groundwater only - estimated depth to groundwater is 200 feet, costs here allow for possibility of higher cost effluent.
4) Water supply in years 11-25 from effluent only - estimated depth to effluent is 50 feet.
5) Acquired costs - $100/acft for groundwater leachate or of poor quality - years 1-10; $200/acft for effluent, years 11-25.

TABLE F-28 Costs of Non-Potable Water — Mesa Portion

Land Use	Average Daily Pumping Rate (gpm)					Head	Years 1-5		Years 6-10		Years 11-15		Years 16-20		Years 21-25	
	1-5	6-10	11-15	16-20	21-25	11-25	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.
Waterways/ Lakes/Canals	--	--	349	349	349	50	--	--	--	--	$ 3500	$112600	$ 3500	$112600	$ 3500	$112600
Water Features	--	--	--	--	--	50	--	--	--	--	--	--	--	--	--	--
Grass Channel	--	--	446	446	446	235	--	--	--	--	21000	143900	21000	143900	21000	143900
Parks	--	--	--	--	--	235	--	--	--	--	--	--	--	--	--	--
Golf Course	--	--	--	--	--	235	--	--	--	--	--	--	--	--	--	--
Fairgrounds	--	--	--	--	--	235	--	--	--	--	--	--	--	--	--	--
Resort/Hotel	--	--	--	--	--	235	--	--	--	--	--	--	--	--	--	--
Totals	--	--	795	795	795		--	--	--	--	$24500	$256500	$24500	$256500	$24500	$256500

Notes:

1) Avg. pumping rate in gpm = acft/yr x 0.62
2) Annual Pumping Costs = gpm x H x 0.2004
3) Water supply in years 1-10 from groundwater only - estimated depth to groundwater is 200 feet.
4) Water supply in years 11-25 from effluent only - estimated depth to effluent is 50 feet.
5) Acquired costs - $100/acft for groundwater leachate or of poor quality - years 1-10; $200/acft for effluent, years 11-25.

TABLE F-29 Costs of Non-Potable Water — S.R. Indian Community Portion

Land Use	Average Daily Pumping Rate (gpm)					Head	Years 1-5		Years 6-10		Years 11-15		Years 16-20		Years 21-25	
	1-5	6-10	11-15	16-20	21-25	11-25	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.	Pumping	Acq.
Waterways/ Lakes/Canals	--	--	775	775	775	50	--	--	--	--	$ 7800	$250000	$ 7800	$250000	$ 7800	$250000
Water Features	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Grass Channel	--	--	1423	1423	1423	235	--	--	--	--	67000	459000	67000	459000	67000	459000
Parks	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Golf Course	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fairgrounds	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Resort/Hotel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Totals	--	--	2198	2198	2198		--	--	--	--	$74800	$709000	$74800	$709000	$74800	$709000

Notes:

1) Avg. pumping rate in gpm = # acft/yr x 0.62.
2) Annual Pumping Costs = gpm x H x 0.2004
3) Water supply in years 1-10 from groundwater only - estimated depth to groundwater is 200 feet.
4) Water supply in years 11-25 from effluent only - estimated depth to effluent is 50 feet.
5) Acquired costs - $100/acft for groundwater leachate or of poor quality - years 1-10; $200/acft for effluent, years 11-25.

G. ECONOMIC METHODOLOGY AND ASSUMPTIONS

Calculation of Tax Increments

Property tax revenue impacts have been calculated taking into account the following:

- Taxes have been calculated on building value and land value, despite the fact that land would be publicly owned and leased. This practice is common in the West.

- Tax increments include a 5 percent annual appreciation of existing property values within the Tax Increment District. According to Development District Staff, primary assessed values have been increasing at 11 percent per year, but this includes inflation. Taking out inflation, it is not unreasonable to assume an increase in real value of 5 percent per year.

- The Tax Increment District as proposed in the Plan is slightly smaller than the Rio Salado Development District. We estimated the Tax Increment District at 85 percent of the existing Development District and applied this ratio to the assessed value figure for the Development District of $113 million; to obtain a year 1 Tax Increment District, we assessed value of $96 million.

Calculating property tax revenues involved the following steps:

1. Estimating construction cost per square foot for varying types of uses and relating this to the acreage figures provided for each phase.

2. Market value was estimated to be 1.3 times construction cost.

3. "Full Cash Value", which is the value of property given by assessors, is then determined as a percent of market value, depending on use.

4. Assessed value is then calculated depending on use.

5. Tax revenues are calculated based on a tax rate of $10 per $100 assessed value.

6. Property, once developed, is assumed to appreciate at 5 percent per year.

The factors and assumptions used to do the above are as follows:

1. Construction Costs:

   Industrial - $30/s.f. with 8 percent of acreage for roads and remainder at 33 percent coverage;

   Hotel - $100,000 per room;

   Retail - $25 per square foot, 25 percent coverage;

   Residential - $75,000 per high density unit, $90,000 per low density unit;

   Office - $45/s.f. with 40 percent coverage;

   Commercial Recreation - $400,000 per acre;

   Private Golf/Commercial Recreation - $15,000 per hole + $1,500 per acre (Source: Pete Kappas, County Assessor's Office).

2. Land values have been calculated based on the following values per acre:

Industrial	$160,000
Retail	261,360
Hotel	348,000 1/
Residential	160,000
Office	200,000
Commercial Recreation	160,000
Golf	160,000

1/ 17,423 per room

3. Full cash value as a percent of market value was obtained from Bob Gloudenans of the Property Valuation Section, Arizona Department of Revenue. These are for 1983 and are more recent estimates than those used by Pollack. Full cash value is estimated as the following percent of market value:

Industry	60%
Retail	65%
Hotel	65%
Office	65%
Residential	70%
Golf/Commerc. Recr.	65%

4. Assessed value is calculated on the full cash value as follows:

Industry	25%
Retail	25%
Office	25%
Hotel	25%
Low Density Residential 1/	10%
High Density Residential	15%
Golf/Commerc. Recr.	25%

1/ Assumes 1/3 owners (10%) and 2/3 renters (18%)

TABLE 29 Tax Increment Revenues

Year/ Phase	New Assessed Value Increment	Value of New Construction (Cum.)	Existing Property Assessed Value	Annual Assessed Value Increment	Tax Rate (/$100)	Annual Tax Increment
1/I	5000	5000	96200	5000	10.00	0
2/I	9000	14250	101010	19060	10.00	500
3/I	11000	25963	106061	35823	10.00	1906
4/I	12000	39261	111364	54424	10.00	3582
5/1	13000	54224	116932	74955	10.00	5442
6/I	14000	70935	122778	97513	10.00	7496
7/I	15000	89482	128917	122199	10.00	9751
8/I	17000	120956	135363	150119	10.00	12220
9/I	17000	133503	142131	179435	10.00	15012
10/I	17000	157179	149238	210216	10.00	17943
11/II	20000	185038	156700	245537	10.00	21022
12/II	22000	216289	164535	284624	10.00	24554
13/II	27000	254104	172761	330665	10.00	28462
14/II	32000	298809	181399	384009	10.00	33067
15/II	37000	350750	190469	445019	10.00	38401
16/II	37000	405287	199993	509080	10.00	44502
17/II	32000	457551	209993	571344	10.00	50908
18/II	27000	507429	220492	631721	10.00	57134
19/II	22000	554800	231517	690117	10.00	63172
20/II	22000	604540	243093	751433	10.00	69012
21/II	20000	654767	255247	813815	10.00	75143
22/II	20000	707506	268010	879315	10.00	81381
23/II	17000	759881	281410	945091	10.00	87932
24/II	17000	814875	295481	1014156	10.00	94509
25/II	17000	872619	310255	1086674	10.00	101416
			Cumulative Total			944467

Notes:

Annual induced appreciation from development	5%
Starting tax rate (per $100 value)	$10.00
Annual rate of tax increase	0%
Lag from construction to tax collection	1 Year

Source: Economics Research Associates

Explanation of Computer Run

Table 29 shows the calculation of tax increments from new development and appreciation of existing development. The following describes each column in this table:

Column 1: New Assessed Value Increment

This figure is based on acreage figures used for Phase I and II shown in Table G-1. For each use under each phase, the number of acres is multiplied times the factors for construction cost, land value, full cash value and assessed value described previously. A total assessed value increment is thus calculated for each phase. Then, this assessed value increment is distributed by year within each phase, taking into account the following basic assumptions:

- Development would increase over Phase I as some improvements were made and as evidence of the commitment to the project becomes more obvious (much of the early development would be industrial).
- The amount of development would be especially large after the dams were first completed and land became available for development.
- Absorption would level off in the latter years of the project.

TABLE G-1 Private Development in the Master Plan

Use	Phase I	Phase II	Total
Industrial	649	924	1,573 1/
Low Density Residential	0	1,135	1,135
High Density Residential	136	556	692 2/
Office	75	170	245 3/
Retail	10	225	235
Commercial Recreation	45	50	95
Hotel	15 4/	10 5/	25
Resort Hotel	65 6/	105 7/	170
Private Golf	0	160	160
Totals	995	3,335	4,330

Notes:

1/ Includes 85% of Industrial and Office Land Use Category, plus 50% of Industrial, Office and Residential Land Use Category.
2/ Includes 40% of Industrial, Office and Residential Land Use Category.
3/ Includes 15% of Industrial and Office Land Use Category, plus 10% of Industrial, Office and Residential Land Use Category.
4/ One hotel.
5/ Two hotels.
6/ One resort hotel.
7/ Four resort hotels.

Source: Carr, Lynch Associates and Economics Research Associates

Column 2: Value of New Construction (Cum.)

This column shows the total of the amount of each year's new assessed value plus the assessed value of the previous years' development, which has appreciated at 5 percent annually.

Column 3: Existing Property Assessed Value

In year 1, the Tax Increment District assessed value is estimated at $96.2 million, which is 85 percent of the Development District assessed value of $113 million, as shown on the computer

printout provided to me by Development District staff. Each year, this assessed value increases at 5 percent over the previous year, as shown in the printout. The number of importance here is the increment in each year over the Year 1 value of $96.2 million, which represents the year the assessed value was "frozen" for the Tax Increment District.

Column 4: Annual Assessed Value Increment

In a given year, this column is the total of the value of new construction (cumulative) in that year plus the difference in that year's existing property assessed value and $96.2 million (numbers shown are in thousands).

For example, in Year 3, Column 4 =

(Col.2)		(Col.3)		(Col.4)
25,963	+	(106,061 - 96,200)	=	35,823

Column 5: Tax Rate

Tax rate per $100 assessed value reflects project area's total property tax bill.

Column 6: Annual Tax Increment

Calculated based on tax rate on annual assessed value increment (Column 5). There is a lag of one year from construction to tax collection.

Summary

Calculation across Year 4 is as follows:

1)	Col. 1 12,000	+	Col. 2 (25,963 X 1.05)	=	Col. 2 39,261
2)	Col. 2 39,261	+	Col. 3 (111,364 - 96,200)	=	Col. 4 54,424
3)	Col. 4 54,424	x	Col. 5 $10 per 100 assessed value	=	Col. 6 5,442 shown Year 5

Calculation of Land Lease Revenues

Table 28 in Vol. I shows calculation of land lease revenues for each year in Phases I and II, based on the acreages found in Table 27. Following are the assumptions used:

- Land lease revenues are 10 percent of land value in the year the lease is signed;
- Land values are assumed to appreciate in real terms at 5 percent per year, so that land first leased in Year 5 will be based on a different land value than in Year 1;
- No escalators are factored into existing leases;
- The RSDD share is 60 percent of all land lease revenues. The remaining 40 percent will accrue to the State Land Trust.

TABLE 27 New Development Within the Parkways

(acres)

Use	Phase I	Phase II	Total
Industrial	266	616 1/	882
Low Density Residential	0	327	327
High Density Residential	38	439 2/	477
Office	0	116 3/	116
Retail	17	68	85
Commercial, Recreation	37	14	51
Hotel	0	10 4/	10
Resort Hotel	65 5/	105 6/	170
Private Golf	0	160	160
Totals	423	1,855	2,278

Notes:

1/ Includes 85% of Industrial and Office Land Use Category, or 70 acres, plus 50% of Industrial, Office and Residential Land Use Category, or 183 acres.

2/ Includes 40% of Industrial, Office and Residential Land Use Category, or 147 acres.

3/ Includes 15% of Industrial and Office Land Use Category, or 14 acres, plus 10% of Industrial, Office and Residential Land Use Category, or 37 acres.

4/ Two hotels (800 rooms).

5/ One resort hotel (400 rooms).

6/ Four resort hotels (1,600 rooms).

Source: Carr-Lynch Associates and Economics Research Associates.

- Land values have been calculated based on the following values per acre in year 1:

Industrial	$160,000
Retail	261,360
Hotel	348,000 per acre/17,423 per room
Residential	160,000
Office	200,000

- Land lease revenues are calculated for 70 percent of high density residential. The remaining residential development is assumed to be sold outright.

- Hotel values are based on 400 rooms per hotel, including resort hotels.

- The value of areas developed which will pay land leases have been estimated as shown in Table G-2 for Phase I and II using the above land values.

TABLE G-2 Land Value of Leased Land

Use	Phase II[1/]	Phase I
Industrial	$ 42,560,000	$ 98,560,000
HDR (70%)	4,256,000	49,168,000
Office	0	23,200,000
Retail	4,443,120	17,772,480
Hotels	6,969,200	41,815,200
Private/Golf	0	160,000
Totals	$ 58,228,320	$230,675,680
RSDD Share (60%)	$ 34,936,992	$138,405,408

Notes:

1/ Values given at year one levels; appreciation is factored into results shown in Table 28

Explanation of Computer Model

Because the value of land was assumed to appreciate at 5 percent a year, each year's new amount of land leased has to be added to the previous years' land lease amounts, based on a different land value.

Therefore, Column 2 in Table 28 shows the total value of land leased in Phase I ($34,936,992), Year 1, and increases its value by 5 percent each year through Year 10. During Phase I, the amount of newly leased land coming on-stream each year is shown as a percent of the total amount of land leased in Phase I. This percent is then applied to the value of leased land in Column 2 for that year.

The increment of new land leases in that year is then calculated at 10 percent of land value and is added to the previous year's lease revenues.

The calculation in Year 3 is as follows:

(Col.1) (Col.2)
6.1% x $38,518 x 10% + prior yrs. Col.5 figure

In Year 11, the value of land in Column 2 changes to reflect the total value of land leased in Phase II. This was projected at $138,405,408 on a previous page, and was increased at 5 percent a year to $225,448,000 in Year 11 in the computer model.

TABLE 28 Land Lease Revenues

Year/ Phase	Percent Completed	Value of Master Plan Land	Value of Land Leased	New Increment of Lease Proceeds	Annual Lease Proceeds
1/I	0	34937	0	0	0
2/I	2.5	36684	917	92	92
3/I	6.1	38518	2350	235	327
4/I	7.4	40444	2993	299	626
5/I	9.8	42466	4162	416	1042
6/I	11.1	44589	4949	495	1537
7/I	14.7	46819	6882	688	2225
8/I	14.7	49160	7227	723	2948
9/I	16	51618	8259	826	3774
10/I	17.2	54199	9322	932	4706
11/II	6.6	225448	14880	1488	6194
12/II	7	236720	16570	1657	7851
13/II	7.5	248556	18642	1864	9715
14/II	8.5	260984	22184	2218	11934
15/II	10.3	274033	28225	2823	14756
16/II	11.3	287735	32514	3251	18008
17/II	9.4	302122	28399	2840	20847
18/II	8.5	317228	26964	2696	23544
19/II	7.5	333089	24982	2498	26042
20/II	5.6	349744	19586	1959	28001
21/II	4.7	367231	17260	1726	29727
22/II	4.2	385593	16195	1619	31346
23/II	3.3	404872	13361	1336	32682
24/II	3.3	425116	14029	1493	34085
25/II	3.3	446372	14730	1473	35558
				Cumulative Total	347567

Notes:
Annual lease payments based on 10% of land value
Annual induced appreciation from development 5%

Source: Economics Research Associates

Calculation of Land Sales

Assumptions

- All low density residential and 30 percent of high density residential are to be sold rather than leased.
- The land value is assumed to be $160,000 per acre.
- Land values have not been appreciated at 5 percent a year because the above $160,000 is already quite high for low density residential and reflects an average price over the life of the project. Also, much of the low density development will occur on the fringes where property values may be slower to increase.
- Phasing for land sales is based on approximately 5% sold in years 5-10, 30% in years 10-11, 35% in years 15-20, and 30% in years 20-25.

TABLE 30 Land Sales Revenues

Years	Acres	Value	Sales Revenue (Millions)
1- 5	0	$ 0	$ 0
5-10	24	160,000	3.84
10-15	141	160,000	22.56
15-20	164	160,000	26.24
20-25	141	160,000	22.56
Totals	470		$ 75.20

H. FUNDING SOURCES

TABLE H-1 Summary of Funding Sources

Category	Characteristics	Current Use of Funds	Advantages	Disadvantages	Implementation
Property Taxes	Property taxes are levied on land and improvements and on business personal property by the State, County, cities, school districts, special districts community colleges.	County Treasurer dispenses funds to all taxing entities for government operations, interest payments, etc.	Land based tax which can capture increment from development.	Property taxes are under severe public scrutiny & growth limits.	Rio Salado D.D. does not currently have taxing authority. Establishment of RSDD as a special district with taxing powers might be desirable. Requires approval of current property owners. Otherwise, funds would have to come from county or from individual jurisdiction for projects within their boundaries.
Sales Tax Revenue	Levied on goods and some services by State and some cities and towns.	State sales tax goes to general fund, state aid to education, and to cities and towns. City sales tax may be earmarked for a specific use.	Stable source of revenue.	Inherently regressive.	County cannot levey a sales tax. Individual cities could levy a sales tax earmarked for RSDD.
Income Tax	Levied by State on income for individuals, estates, and trusts.	15% to Revenue Sharing Fund for cities and towns, balance to general fund.	Potentially less regressive than general sales tax.	----------	Not Appropriate for Rio Salado.
Corporate Income Tax	Levied by State on income of businessess doing business in Arizona.	Revenue Sharing Fund and General Fund.	----------	Discriminatory against certain businesses and specific consumers.	Not appropriate for Rio Salado.

TABLE H-1 (Cont.) Funding Sources

FUNDING SOURCES FOR RIO SALADO

Category	Characteristics	Current Use of Funds	Advangages	Disadvantages	Implementation
Excise Tax	Special sales tax applied to specific retail items. In Arizona this includes but is not limited to:	----------	Provides stable flow of funds.	----------	Cities may impose excise taxes on goods & services not already pre-empted by the State, through a vote of City Council.
	Tobacco & alcohol tax	Unemployment compensation and state school aid fund.	Luxury tax, somewhat related to ability to pay	----------	Alcohol and tobacco taxes are pre-empted by the State. Municipalities may not tax these items.
	Room tax levied in some cities.	In Phoenix used for Civic Center funding.	----------	----------	----------
Utility Tax	Taxes on electric, gas, telephone, and water companies.	State General Fund.	----------	Tax yield small; public acceptance questionable.	Not appropriate
Pari-mutual tax	Tax on handle of dog and horse racing.	As county fairs award & promotion fund; State General Fund.	----------	----------	Possible source of funds for State Fairgrounds in RSDD?
Commuter tax	Charges thoses who work in a community but who do not live there.	None existing.	Tends to shift municipal costs to those who benefit from the city services.	Discourages economic development.	Not appropriate.
Lotteries	State-run method of tapping human gambling instincts.	Transportation Fund & State Fiscal Emergency Fund.	Voluntary form of taxation.	----------	Funds can be earmarked for specific uses.

TABLE H-1 (Cont.) Funding Sources

Category	Characteristics	Current Use of Funds	Advangages	Disadvantages	Implementation
Business Contributions	Direct contribution by businesses & merchants directly benefitting.	----------	Logicial source of revenue where businesses are clear beneficiaries.	----------	----------
Amusement Tax/ World's Fair	State or local tax on ticket sales, rides, amusements, & shows at a World's Fair or State Fair in RSDD.	See sales tax revenue.	Taxes actual users of RSDD facilities & events.	Not a continual source of revenue	Amusements are currently taxed under the state sales tax.
Land Lease Revenues	Leasing of publicly owned land acquired by the District to private developers.	None existing.	Captures increment in land values from Rio Salado improvements.	Requires aquisition of large amounts of land.	Requires cooperation of State Land Trust and municipalieies to acquire land.
Grants and Loans	Federal, state, non-profit grants or loans for specific projects.	----------	Does not effect local tax burdens		Source of funds for schools, transportation, recreation, flood, control, etc.

Source: Economics Research Associates.