WHITE TANKS

FRS #3

Basin Concepts Design Issues Memorandum

Prepared by:

DAMES & MOORE

A DAMES & MOORE GROUP COMPANY

Submitted February 10, 2000

Flood Control District of Maricopa County

Job No. 15448-007-058

Contract No. FCD 98-11 PCN 4700430

DESIGN ISSUES MEMORANDUM

WHITE TANKS FRS #3 MODIFICATIONS DESIGN PROJECT

Prepared for
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Contract # FCD98-11
PCN 4700430

Prepared by
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D&M Job No. 15448-007-058

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A DAMES & MOORE GROUP COMPANY

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February 10, 2000

Flood Control District of Maricopa County
Mr. Tom Renckly
2801 W. Durango Street
Phoenix, AZ 85009

Re: Design Issues Memorandum
White Tanks FRS #3 Modifications Design Project
D&M Job No. 15448-007-058

Dear Mr. Renckly:

Dames & Moore is pleased to submit the Design Issues Memorandum (DIM) for development of basin concepts as part of the White Tanks FRS #3 Modifications Design Project. This memo presents five basin concepts, providing variations of active to passive recreation orientations. The concepts were developed with consideration of site and regional opportunities and constraints. The memo includes a discussion of the engineering design issues in relation to general design and to each of the basin concepts.

We look forward to discussing the contents of this document during the DIM meetings planned for February 28 and March 2, 2000. If you have any questions please call me or Todd at (602) 371-1110.

Sincerely,

DAMES & MOORE

Alexander W. Gourlay, P.E.
Project Manager

Todd E. Ringsmuth, P.E.
Assistant Project Manager

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

White Tanks Flood Retarding Structure (FRS) #3 is located on alluvial fan deposits east of the White Tank Mountains, approximately 20 miles west of Phoenix, Arizona. The north end of the embankment is approximately 1 mile south of the intersection of Northern Avenue and the Beardsley Canal in Maricopa County (Figure 1-1). Since its construction in 1954, the crest of the dam has settled approximately 3.6 feet at the north end of the alignment. This settlement is in response to regional land subsidence associated with excessive groundwater withdrawal in the area. The amount of settlement appears to decrease steadily along the alignment until virtually no settlement is observed at the southern end of the embankment. Transverse and, to a lesser extent, longitudinal cracks have been observed through the embankment.

The fact that the dam has experienced such settlement and cracking problems, along with the safety and inspection requirements by federal and state agencies, prompted the Flood Control District of Maricopa County (District) to consider engineered dam replacement alternatives. Interim dam safety analysis is being developed so that the dam would perform its functions adequately and safely, while a dam replacement option is being studied, designed, funded, and implemented. The alternative being considered and discussed in this memorandum is the excavation of a basin or multiple basins. This basin(s) will provide the storage capacity expected for the 100-year, 24-hour storm event, in addition to active and passive recreational potentials.

1.2 PURPOSE OF THE DESIGN ISSUES MEMORANDUM

This memorandum gives an overview of the general environmental conditions in the area, a visual analysis, evaluation of the cultural and biological resources, and how these site characteristics would relate to the regional analysis needed in the development of possible concepts.

Five concepts are discussed in this memorandum. These concepts include a single or multiple basins that promote an active or passive use concept, or a combination of the two. For each of these concepts, a concise aesthetic evaluation of engineering components is included to provide an assessment of the proper components to be considered for active or passive uses.

The discussion of basin design issues is a key part of this memorandum, and provides the necessary geotechnical and hydrologic background information and the to basin sizing, basin configurations, and necessary design components to be incorporated in each of the five concepts.

2.0 BASIN CONCEPTS

Five basin concepts were developed in consideration of environmental resource issues and the need for flood prevention measures in the vicinity of FRS#3, which no longer meets State of Arizona dam safety requirements. Baseline environmental data are summarized in Section 2.1, which concludes with a description of the regional analysis that informed the basin concept development. The five basin concepts are presented in Sections 2.2 through 2.6.

2.1 CONCEPT DEVELOPMENT

The District proposes to replace FRS#3 with one or a series of flood control basins that also will provide recreational opportunities. For purposes of this study, five environmental resource areas were evaluated: land use, socioeconomics, visual, biological, and cultural resources. Land use and socioeconomic conditions were combined into a general environmental category. The study area for these resources encompassed lands within a 5-mile radius of FRS#3 and also identified potentially relevant existing and proposed recreational developments within an even broader area, which included portions of the Agua Fria and Gila rivers. Visual, cultural, and biological resources were considered individually. The study area for these resources generally was confined to a 2.5-square-mile parcel immediately proximal to FRS#3, but visual considerations included viewsheds beyond the smaller parcel. Following the acquisition of baseline data, individual resource qualities were used to identify opportunities for, and constraints to, the development of landscape recreation design concepts.

2.1.1 General Environmental Analysis

Potential regional influences are depicted on a series of geographic information systems (GIS) Arc/Info maps and cover the larger study area. Figure 2-1 portrays the land jurisdiction and ownership identified in the study area. Existing and future infrastructure, residences, and mixed uses are depicted on Figures 2-2 and 2-3, respectively. These maps show the expected population flux within the study area, which will influence future development including recreational needs. Figure 2-4 illustrates existing recreational opportunities and future potentials that eventually may be linked to the FRS#3 recreational development.

2.1.2 Visual Resources

The assessment of visual resources included two components. Characteristics of the landscape within the 2.5-square-mile study area are presented first. Thereafter, viewsheds beyond the smaller study area are addressed.

2.1.2.1 Landscape Character Unit Description

There are several unique landscape character units found within the study area (Figure 2-5). Each of the units displays unique physical features including landform, vegetation, color, and/or cultural (manmade) disturbances. The units consist primarily of desert washes and creosote plain landscapes characterized by dry sandy drainages cutting across areas of relatively flat desert scrub areas. Additional units include a basin area identified by a relatively smooth depressed area that sometimes holds water. This basin was created by the construction of FRS#3 which has sharp uniform edges and a flat top that contrast sharply with the surrounding desert washes and plains landscapes. A substantially disturbed area exhibits numerous manmade "scars" including trenches, pits, roads, and an industrial area where offices, storage buildings, and so forth were erected to support past and present proving grounds for heavy machinery.

2.1.2.2 Views

The landscapes in the FRS#3 vicinity are open and expansive, permitting extensive views and vistas of adjacent landscapes. There are several views into and out of the smaller study area (Figure 2-6). The views from within the study area to adjacent landscapes take advantage of elevated terrain along the existing embankment (dam). The change in elevation allows for panoramic views to the west/northwest of the White Tank Mountains and foothills leading up to the mountains. The White Tank Mountains display several unique features, including sharp peaks and steep slopes with areas of rock outcrops. Additionally, there are panoramic views to the east/southeast/south of agricultural lands as well as the distant Sierra Estrella Mountains. The agricultural lands consist of a patchwork of colors ranging from shades of green to brown/tan. Views of the Caterpillar Proving grounds to the west show several areas where the landscape has been "scarred" as a result of equipment testing.

Advantage should be taken of these views of undisturbed landscapes when considering future design concepts and modifications in the vicinity of FRS#3. Likewise, views where there is extensive "scarring" should be avoided or screened when possible, unless efforts are taken to mitigate the disturbance.

2.1.3 Cultural Resources

Cultural resources can be either prehistoric or historic in age and include sites, buildings, structures, districts, and objects as those properties are defined by the National Historic Preservation Act. Not all cultural resources warrant preservation or protection. The importance or significance of cultural resources is assessed in consideration of criteria for listing on the National Register of Historic Places (National Register).

An intensive pedestrian survey to identify archaeological resources was undertaken within the 2.5-square-mile study area, covering all acreage that had not been inspected during earlier studies (Figure 2-7). In addition, the importance of FRS#3 was assessed because the structure is close to 50 years old, and thus possibly of historic significance. Nine isolated occurrences were recorded. These are artifacts (for example, a prehistoric ceramic sherd or fragments of a historic bottle or can) or small features (for example, a rock pile) that reflect human activity but fall below the threshold for identification as archaeological sites. None of the isolated artifacts are regarded as significant. A single historic-age archaeological site was recorded and designated site AZ T:7:175 (ASM). Because recording has essentially exhausted the information potential of the surface accumulation of trash and concrete and metal fragments, the site is recommended as not eligible for National Register listing. Likewise, the assessment of FRS#3 concludes that the structure does not retain sufficient integrity (because of alterations subsequent to its initial construction) to be considered for National Register listing. Thus, no constraints to development were identified related to cultural resources, nor were any opportunities such as public interpretation of an interesting archaeological site or historic building discovered.

2.1.4 Biological Resources

A reconnaissance survey of the entire 2.5-square-mile study area was undertaken to assess the vegetation resources and to make note of any wildlife species that might be observed. Lists of potentially occurring plants, mammals, birds, and herpetofauna were generated using existing literature on the distribution of habitat requirements of Arizona flora and fauna.

The vegetation of the entire area falls into the Lower Colorado River Valley subdivision of Sonoran desertscrub. A number or xeroriparian washes dissect the area and a bosque occurs northwest of FRS#3. Blue paloverde is the most common tree species along the washes; interfluvial flats are dominated by creosote. Species of special concern are those listed as threatened or endangered or otherwise sensitive plants known to exist within Maricopa County. Those that could occur within the FRS#3 study area include the lowland leopard frog, Sonoran tortoise, California leaf-nosed bat, lesser long-nosed bat, southern yellow bat, peregrine falcon, cactus ferruginous pygmy-owl, and crested saguaro.

The field reconnaissance determined that of these species, just the pygmy-owl is a potential concern in the vicinity of FRS#3. Although there are no records of pygmy-owls from this area and vegetation is generally sparse, the FRS#3 study area does contain potential pygmy-owl habitat in the form of a bosque and stringers of trees along dry washes (Figure 2-8). A pygmy-owl survey is recommended; new protocols for such a survey have been developed but not yet formally adopted as regulations to implement the Endangered Species Act.

2.1.5 Regional Analysis and Design Concept Development

The overall objective of the regional analysis—and the recreation design concepts developed in consideration of that analysis—was to identify recreational uses. These uses were to be consistent with the primary need to provide flood protection. Inventoried information regarding existing and future land uses, visual resources, and potentially relevant projects within the vicinity of FRS#3 was utilized to assess anticipated community recreational needs. This information allowed for the development of a range of concepts that meet community recreational needs and can be incorporated into a flood retention basin design. There were no cultural resource opportunities or constraints identified. Biological issues, specifically potential impacts on cactus ferruginous pygmy-owl, were recognized and will need to be considered in conjunction with all of the basin designs.

Five recreational design concepts and program elements were developed for the project including passive recreational use for a single basin or multiple basins, and active recreational use of a single basin or multiple basins. Description of the design concepts is presented in the following sections.

2.2 CONCEPT 1 – SINGLE BASIN, ACTIVE USE

2.2.1 Description

Concept 1 would entail developing the site as an active recreation facility by creating a major sports complex, an equestrian facility, and a golf course as shown on Figure 2-9. Stormwater retention would be concentrated into the lowest, flattest part of the site. Runoff would be brought into the basin by the wash channels; then a series of terraces would allow the park, soccer fields, and parts of the golf course to be integrated into the basin, but only inundated during a major flood event.

2.2.2 Aesthetic Evaluation of Engineering Components

Several engineering components are integrated in the design of the different concepts. Following is a commentary on the aesthetic values of these engineering components as related to this concept:

- Basin Configuration: Steeper side slopes or ground slopes would not affect the function of this active concept significantly, while flatter side slopes would be more aesthetically pleasing. It is also preferred that the basin be located in an area of mild slopes (0.5 percent or less) to reduce the volume and cost of excavation required.

- Drainage Options: Total drainage would be preferred due to the presence of active-use facilities to minimize the presence of standing water.

- Inlet Structures: Concrete inlet structures are likely to be more applicable for this concept due to the active nature of the functions taking place within this concept, which would also require the use of other concrete structures.

- Sediment Basins: There is a higher potential for sediments to impact the facilities in an active use concept. Hence, it is preferred that the sediment basins are constructed outside the facilities and upstream into the washes to avoid interference with the type of activities promoted by this concept.

- Impoundment Dike: For an active-use facility, construction of a dike would be less intrusive visually.

- Disposal of Excavated Material: Excavated material can be disposed of on or off site. If it is to be left on site, it can be used to create the features for the golf course and improve the aesthetic value of this concept.

- Land Acquisition: The single-basin concept used here will minimize the need for additional land.

Further details of the engineering components are provided in Section 3.0. The cost and aesthetics of the engineering components are evaluated in Table 2-1.

2.3 CONCEPT 2 – SINGLE BASIN, PASSIVE USE

2.3.1 Description

Concept 2, shown on Figure 2-10, would entail developing the site for passive recreation, wildlife habitat, and native plant open space. The lakes and streams in the park would use diverted water from the Beardsley Canal to supply and circulate the water, as well as providing water storage for the canal. The retention basin would be located on the lowest, mildest slope of the site, with flat side slopes that spread out over a large area. Vegetation islands would be scattered throughout the basin to provide wildlife habitat and break up the visual size of the basin.

2.3.2 Aesthetic Evaluation of Engineering Components

Several engineering components are integrated in the design of the different concepts. Following is a commentary on the aesthetic values of these engineering components as related to this concept:

- Basin Configuration: To provide for a more natural terrain that is suitable for a passive-use concept, the basin would be located within the mildest ground slope of the area with flatter side slopes.
- Drainage Options: Partial drainage will be more acceptable in a passive-use concept than in an active one.
- Inlet Structures: The use of natural or natural-looking material like soil cement is recommended in a passive-use concept. Flattening the side slope of the basin at the inlet location can be used to provide a natural alternative to constructing an inlet structure.
- Sediment Basins: Sediment basins can be constructed within the facility with minimal interference with the type of activities promoted by this concept.
- Impoundment Dike: For a passive-use facility, construction of a dike would be more intrusive visually than in an active-use facility.
- Disposal of Excavated Material: Excavated material can be disposed of on or off site. If it is to be left on site, it can be used to create features and improve the aesthetic value of this concept.
- Land Acquisition: The single-basin concept used here will minimize the need for additional land.

Further details of the engineering components are provided in Section 3.0. The cost and aesthetics of the engineering components are evaluated in Table 2-1.

2.4 CONCEPT 3 – MULTIPLE BASINS, ACTIVE USE

2.4.1 Description

Concept 3, shown on Figure 2-11, would entail developing the site as an active use recreation attraction by creating a major sports complex, an equestrian facility, and a golf course. Two retention basins would be excavated: a northern basin, which would be grassed and integrated into the park and sports complex, and a southern basin that would be revegetated with natural plants. Runoff would be brought into the northern basin by the wash channel and as the water rises, it would gradually inundate some of the soccer fields. As for the southern basin, a major flood event would encroach onto non-played parts of the golf course.

2.4.2 Aesthetic Evaluation of Engineering Components

Several engineering components are integrated in the design of the different concepts. Following is a commentary on the aesthetic values of these engineering components as related to this concept:

- Basin Configuration: Steeper side slopes or ground slopes would not affect the function of this active concept significantly, while flatter side slopes would be more aesthetically pleasing. It is also preferred that the basins be located in areas of mild slopes (0.5 percent or less) to reduce the volume and cost of excavation required.

- Drainage Options: Total drainage would be preferred due to the presence of active-use facilities to minimize the presence of standing water.

- Inlet Structures: Concrete inlet structures are likely to be more applicable for this concept due to the active nature of the functions taking place within this concept, which would also require the use of other concrete structures.

- Sediment Basins: There is a higher potential for sediments to impact the facilities in an active-use concept. Hence, it is preferred that the sediment basins be constructed outside the facilities and upstream into the washes to avoid interference with the type of activities that this concept promotes.

- Impoundment Dike: For an active-use facility, construction of a dike would be less intrusive visually.

- Disposal of Excavated Material: Excavated material can be disposed of on or off site. If it is to be left on site, it can be used to create the features for the golf course and improve the aesthetic value of this concept.

- Land Acquisition: This multiple-basin concept would require additional land acquisition.

Further details of the engineering components are provided in Section 3.0. The cost and aesthetics of the engineering components are evaluated in Table 2-1.

2.5 CONCEPT 4 – MULTIPLE BASINS, PASSIVE USE

2.5.1 Description

Concept 4, shown on Figure 2-12, contains three shallower retention basins that would be developed into three distinct-use areas linked together by the Beardsley Canal. A sports complex would provide athletic fields and courts for different kinds of activities. The stormwater recharge basins would combine the need for groundwater recharge and wildlife habitat. A park would provide passive recreation and learning opportunities while integrating with a softened dam remnant. The northern basin would provide an opportunity for hiking and low-land trail riding from the nearby equestrian facility.

2.5.2 Aesthetic Evaluation of Engineering components

Several engineering components are integrated in the design of the different concepts. Following is a discussion of the aesthetic values of these engineering components as related to this concept:

- Basin Configuration: To provide for a more natural terrain that is suitable for a passive-use concept, the basins would be located within the mildest ground slope of the area with flatter side slopes.
- Drainage Options: Partial drainage will be more acceptable in a passive-use concept than in an active one.
- Inlet Structures: The use of natural or natural-looking material like soil cement is recommended in a passive-use concept. Side slope flattening at the inlet location can be used to provide a natural alternative to constructing an inlet structure.
- Sediment Basins: Sediment basins can be constructed within the passive-use facilities and outside the active use ones to avoid interference with active functions promoted by this concept.
- Impoundment Dike: Dikes can be constructed within the active-use facilities and avoided in passive-use locations.
- Disposal of Excavated Material: Excavated material can be disposed of on or off site. If it is to be left on site, it can be used to create features and improve the aesthetic value of this concept.
- Land Acquisition: This multiple-basin concept will require additional land acquisition.

Further details of the engineering components are provided in Section 3.0. The cost and aesthetics of the engineering components are evaluated in Table 2-1.

2.6 CONCEPT 5 – SINGLE BASIN, PASSIVE USE (Minimum Facilities)

2.6.1 Description

Concept 5, shown on Figure 2-13, would entail developing the site for minimal passive recreational uses. A large single basin would be located adjacent to the existing dam and breach the dam in several locations. The remaining areas of the dam would be blended with some of the resulting spoils to create high points and overlooks. The site would be revegetated to a native desert condition with a blend of four general seed mixes that follow the water distribution patterns of the site.

2.6.2 Aesthetic Evaluation of Engineering Components

Several engineering components are integrated in the design of the different concepts. Following is a discussion of the aesthetic values of these engineering components as related to this concept:

- Basin Configuration: To provide for a more natural terrain that is suitable for a passive-use setting, the basin would be located within the mildest ground slope of the area with flatter side slopes.

- Drainage Options: Partial drainage will be more acceptable in a passive-use concept than in an active one.

- Inlet Structures: The use of natural or natural-looking material like soil cement is recommended in a passive-use concept. Side slope flattening at the inlet location can be used to provide a natural alternative to constructing an inlet structure.

- Sediment Basins: Sediment basins can be constructed within the facility with minimal interference with the type of activities promoted by this concept.

- Impoundment Dike: For a passive-use facility, construction of a dike would be more intrusive visually than in an active-use facility.

- Disposal of Excavated Material: Excavated material can be disposed of on or off site. If it is to be left on site, it can be used to create features and improve the aesthetic value of this concept.

- Land Acquisition: The single basin concept used here will minimize the need for additional land.

Further details of the engineering components are provided in Section 3.0. The cost and aesthetics of the engineering components are evaluated in Table 2-1.

3.0 BASIN DESIGN ISSUES

3.1 GEOTECHNICAL INFORMATION

This section provides information on geotechnical issues identified for the project. These issues include the excavation conditions that would be encountered in creating basins, seepage and infiltration parameters, and the potential for commercial sand and gravel mining form basins.

3.1.1 Excavation Conditions and Effort

Excavation conditions were evaluated using field exploration methods, which were in the form of borings, test pits, and refraction seismic surveys. Borings and test pits were performed in 1998, and again in 1999, while seismic refraction survey work was performed in a recent 1999 exploration. The 1999 exploration is described in the report *"Work Scope for Geotechnical Investigation, August 1999"* prepared for the District by Dames and Moore.

3.1.1.1 Borings

The 1999 exploration included six borings in the prospective basin areas as shown on Figure 3-1. Borings were drilled with a truck-mounted rig using auger methods. Samples were obtained by standard split barrel methods, the Standard Penetration Test (ASTM D1586). Standard Penetration Tests (SPT) in these borings generally show low SPT values in the top 10 to 15 feet where the soil is generally fine silty sand. SPT values vary from 5 to 34 in the top 5 feet, which indicates a relative density from loose to dense. At a depth of 10 feet, SPT varies from 5 to greater than 50, indicating relative density that varies from loose to very dense. SPT generally increases below 15 feet to 30 or greater, although some borings indicate an SPT lower than 30 at these depths. Higher relative densities with an SPT greater than 50 were encountered at depths greater than 20 feet.

SPT and drilling efforts generally indicate soil that is easily excavated from the top 10 feet. Judging by boring information, excavation would require a moderate effort below 10 feet.

3.1.1.2 Test pits

The 1999 exploration included four test pits as shown on Figure 3-1. Test pits were excavated with a track-mounted excavator to depths of 18 to 20 feet and indicated similar soil conditions as those shown in the borings. Easy to moderate effort was needed to excavate the test pits to depths of 16 to 20 feet. None of the pits reached refusal, or material that the excavator could not remove from the pit. Difficult excavation was encountered in only one pit, TP-1, near a depth of 16 feet.

3.1.1.3 Seismic Survey

The 1999 exploration included a seismic refraction survey, which consisted of six separate lines of geophones, each 120 feet long. The survey resulted in shear wave velocity measurement through the soil profile.

Survey results show that at a depth of 0 to 5 feet, velocity varies from 1,141 to 1,175 feet per second (ft/s). At depths of 5 to 20 feet, velocity varies from 1,811 to 2,216 ft/s. Below 20-feet depth, velocity varies from 2,726 to 3,233 ft/s. These velocities generally indicate no ripping required in the top 5 feet, soft ripping possibly required to 20-feet depth, and medium ripping below 20-feet depth. This characterization is based upon medium-weight tractor equipment with 200 to 300-horsepower engine and a 60,000- to 90,000-pound working load.

3.1.2 Sand and Gravel Potential

The District is in the process of promoting the site as a prospect for a sand and gravel operation. Depending on the level of interest, the alternatives can range from a full-scale operation where the sand and gravel contractor would excavate and haul the soil offsite, to finding parties that would accept any soil volumes in excess of landscaping needs to be delivered to their location.

Dames & Moore has evaluated sand and gravel mining through exploration (at two different times), and through contacting commercial sand and gravel suppliers. Exploration by use of test pits was performed in the reservoir area in 1998, and again recently in the 1999 exploration discussed above.

Dames & Moore previously addressed sand and gravel mining for the District in a memorandum submitted in December 1998. In that assessment, we concluded that commercial mining was probably not viable, primarily due to the silt content in soils encountered.

The latest exploration and evaluation supports the previous conclusions about commercial mining. Evaluation of soils encountered in the test pits indicates that the top 10 to 20 feet of soil is generally very silty, with a relatively high fine fraction. Lab testing generally indicates fine fraction in the range of 54 to 61 percent in the top 10 feet. For commercial sand and gravel sales, such soils would probably require extensive processing in order to wash out fines. Such processing is not economical without a major watercourse close by. Consequently, in the assessment of Dames and Moore and the commercial sand and gravel suppliers, commercial sand and gravel mining appears to be impractical.

3.1.3 Infiltration Potential

Permeability of in-situ soils by means of down-hole permeability tests were evaluated in the borings, while infiltration tests were conducted within the test pits. The permeability tests indicate a coefficient of permeability in the range of 10^{-3} to 10^{-4} centimeters per second (cm/s). Coefficients of permeability in this range indicate fair to low drainage characteristics. In 1998, Dames & Moore performed four single ring infiltrometer tests within the reservoir. These tests showed the sediments to have a coefficient of permeability of approximately 10^{-6}.

The test results from field explorations represent in-situ soils in their excavated state, without any covering of sediment. The sediment layer currently in place would result in an infiltration rate that is about two orders of magnitude lower than that calculated in the test pits.

Sediment basins can be used to reduce sedimentation within the basins and maintain a higher infiltration rate to better meet the drainage requirements of the District and other regulating agencies. Further analysis is needed to quantify the volume of water expected to be lost due to infiltration, which will be incorporated in basin drainage calculations.

3.2 BASIN SIZING

The required storage capacity of the basin is dependent on the estimate of stormwater runoff and method of handling sediment. The basin must be sized to provide the level of flood protection required by the District. The potential exists to divert flows out of the watershed (north and south) to reduce the required storage of the basin. The issue of sedimentation in the basin, and the impact on storage, is discussed in Section 3.4.3. Following is a brief discussion of the watershed hydrology and water diversion analysis results.

3.2.1 Hydrology

The design criterion for sizing the basin is the 100-year, 24-hour storm event runoff volume. Several analyses have been conducted with runoff estimates from the watershed ranging from 850 to 2,205 acre-feet. The District performed additional hydrologic analyses to refine the runoff estimate to account for site-specific conditions. The District's October 19, 1999 report presented a range of runoff estimates, with the largest at 2,167 acre-feet. It is our understanding that the District intends to perform field tests to refine this estimate. For purposes of the information presented in this memorandum, a design runoff volume of 2,200 acre-feet was used.

3.2.2 Diversions

Three diversions have been evaluated to divert water from the contributing watershed and reduce the basin storage requirements. The first diversion is the Bedrock Wash Diversion, also known as the Caterpillar/Foothills Drainage Way, located west of the FRS#3. This diversion ditch would divert up to 550 acre-feet away from the dam and into the Caterpillar/Foothills Drainage Way.

The Waterfall Wash Diversion, located west of McMicken Dam, would divert 521 acre-feet of stormwater into McMicken Dam. The Cholla Wash Diversion consists of three diversion ditches located southwest and west of McMicken Dam, which would divert a total of 740 acre-feet of flow into McMicken Dam. The layout and location of these suggested diversions are shown on Figure 3-2. Table 3-1 lists the different suggested diversions along with their potential diversion volumes, construction cost, basin excavation cost reduction, and the total savings in project cost. Waterfall Wash Diversion would provide the highest project cost savings.

3.3 BASIN CONFIGURATIONS

Several basin configurations were analyzed using different combinations of shape, size, side slopes, and freeboard options. Unregulated downstream basin height and drainage considerations also would affect the selection of basin configuration. According to Arizona Department of Water Resources (ADWR) requirements, the downstream height shall be less than 6 feet to avoid being a regulated structure. Provisions for access for scheduled and emergency maintenance are also to be considered in the design. Basin design, excavation volume, and cost are affected by parameters such as ground slope (parametric analysis and slope mapping), drainage options, and the choice of single or multiple basins.

3.3.1 Parametric Analysis

Due to the nature of the area and the active and passive project utilization concepts being considered, different possible basin design alternatives were analyzed. These alternatives involved the evaluation of location (ground slope), length to width dimension ratios, side slopes, depth, and excavation volumes, which was conducted through parametric analysis. Also, because of the large number of variables associated with basin design, it would be necessary to fix some of these variables, like basin dimensions, while calculating other parameters such as basin depth.

Slope ranges for the area were identified for consideration in the alternatives to be evaluated. The slopes in the areas adjacent to the FRS #3 range from flat to 2.5 percent. Different basin(s) dimensions were considered that would fit different locations within the project area. A storage volume of 2,200 acre-feet was used, which is the expected inflow from the 100-year, 24-hour storm. This volume does not include any freeboard requirements.

Different design configurations were evaluated for different ground and side slopes. Table 3-2 shows, as an example, five different options that discuss the use of a non-jurisdictional dam with a basin of 3 horizontal to 1 vertical side slopes excavated at an area of 1 percent ground slope. Figure 3-3 depicts the cross-sections for these five options.

A map with slope-ranges existing in the study area is shown on Figure 3-4. The slopes range from flat to over 2.5 percent. This map was helpful as a visual aid showing areas of steep slopes and others of milder slopes that may be more suitable and cost effective as a location for the basin(s). This map also would be helpful in selecting possible locations for stockpiles.

Excavation volumes and cost estimates also were evaluated for the different alternatives as shown in Table 3-2. The cost estimates were based on a unit price of approximately $2.5 per cubic yard of excavation. This unit cost is approximate and incorporates excavation of the basin and the construction of relevant design components, which will be discussed later in this section. Table 3-3 illustrates the effect of different design variations such as side slopes, ground slopes, drainage options, and multiple basins on the construction cost when compared to that of the 3 vertical to 1 horizontal side slopes and 1 percent ground slope basin.

The parametric analysis conducted at this stage is geometric in terms of excavation volume estimation and does not follow specific site features, which would make the cost analysis conducted here an approximate one. For example, the effect of dike construction on the volume of necessary excavation may be exaggerated, mainly due to the assumption that the dike would increase the elevation of the entire downstream side of the basin instead of the locations where the washes exist. Locating the basin(s) at other areas where these washes are deeper would further reduce the effect of the dike on decreasing the excavation volumes.

3.3.2 Basin Drainage

In order to be able to drain the basin partially or completely, a gravity outlet pipe would be needed with inlet and outlet invert elevations set to provide the slope necessary to produce a minimum cleaning velocity of 3 feet per second in the pipe. The two possible drainage scenarios are as follows:

- Partial drainage: The pipe would be at a level higher than the bottom elevation of the basin, which would result in partial drainage.

- Total drainage: In most cases, total drainage would require a larger basin with a shallower depth than that for partial drainage. Additional land may be needed to satisfy the larger basin area requirements, which would affect the project cost. Table 3-3 shows the effect of total drainage as compared to partial drainage on excavation cost.

If the invert elevation of the outlet pipe is not at the bottom of the basin, it will provide partial drainage to prevent from overflow during multiple storm events. In this case, the remaining water would have to be pumped out or left to evaporate and infiltrate. The District requires drainage to be complete within 36 hours as stated in Section 8.2.1.4 of Volume II (Hydraulics) of the *Drainage Design Manual for Maricopa County, Arizona.* The Arizona Department of Health Services (ADHS) requires drainage to be complete within 72 hours (per telephone communication with John Townson of the ADHS). If drainage is not possible, a maintenance plan that involves the addition of larvicides for mosquito control should be implemented. More discussion of the design issues related to the outlet structure is included in Section 3.4.2.

3.3.3 Single and Multiple Basins

Containing the 100-year, 24-hour inflow volumes can be achieved through the construction of a single large basin or multiple smaller basins. Each alternative would have its own pros and cons that are related either to cost or aesthetic values. A single basin would be more cost effective than constructing multiple basins at a similar ground slope. It would require less inlet and outlet structures, minimal equipment and personnel mobilization and demobilization, and little or no new land purchase. A single basin, however, is potentially less flexible than multiple basins in combining active and passive recreational concepts.

Multiple basins should be designed to minimize uncontrolled overflow resulting from the 100-year, 24-hour storm events and would require a series of inlet and outlet/overflow structures, additional land, and a more complex design and construction process. Also, a multiple-basin option would mean the construction of one or more of these basins at areas of steeper slopes, that would increase the volume and cost of excavation as shown in Table 3-3. Nevertheless, a multiple-basin option is much more attractive for perspective developers, maximizes both active and passive recreational benefits, and is more likely to be favored by the public.

3.4 DESIGN COMPONENTS

The engineering design components discussed in this section are necessary to ensure that the basin would perform its intended active or passive purposes adequately. The choice of configurations or materials used in the construction of these components can affect the cost and aesthetic values of the different concepts to be considered. A discussion of the cost and aesthetic values of these components is presented in Table 2-1. In this table each component incorporates different material and design alternatives, which are evaluated using a scoring system for cost and aesthetics to provide a comparison tool.

3.4.1 Inlet Structures

The construction of inlet structures at locations of inflow into the basin would ensure the protection of the basin's side slopes against erosion and head cutting. Some of the alternatives for an inlet structure may include a baffle chute, vertical hard basin, vertical riprap basin, sloping concrete, or low-flow check structures. Possible materials that can be used in the construction of inlet structures for the basin include natural materials, soil cement, riprap, and concrete. The following possible design alternatives were evaluated for cost and aesthetic values in Table 2-1:

- Concrete inlet structure: An example of such a structure would be the baffle chute. In this case, the concrete structure can withstand high velocities and no reduction of the upstream natural channel slope would be necessary. Concrete is more durable than the other alternatives and would be more acceptable in an active-use concept. It has a higher initial cost and poor aesthetic value if used in a passive-use concept.

- Riprap inlet structure: Reduction of the upstream natural slope can result in a smaller stone size for the riprap. The use of riprap may be more appropriate than concrete for both active and passive-use concepts and would have a lower cost.

- Soil cement structure: This mixture of soil and cement produces a natural looking material that can fit both active and passive concepts. It would prove durable especially if combined with a reduction of the natural channel slope upstream of the basin.

- Natural inlet structure: This alternative has the lowest cost and good aesthetic value, but would require more frequent maintenance than the other alternatives, especially after storm events. Reducing the slope of the upstream natural channel is recommended.

3.4.2 Low-Level Outlet Structures

It is required to construct an outlet structure (outlet pipe) for the basin to provide either total or partial drainage. It is also necessary as a safety precautionary measure for the release of water during multiple storm events or for aesthetic and health protection purposes.

The following design criteria are applicable for the outlet pipe:

- Size of the outlet pipe: The size of the outlet pipe depends mainly on the rate of drainage for the total or partial drainage of the basin. This volume may include losses to infiltration and evaporation during the drainage period required by the regulating agency, in this case being the District and the ADHS. Drainage requirements are discussed in Section 3.3.2.

- Flow velocity: A minimum cleaning velocity of 3 feet per second would be necessary to maintain the pipe free of sediments. The inlet and outlet invert elevations of the pipe should be set to provide an adequate slope to produce this velocity. That slope would be approximately half a percent for a 36-inch pipe.

- Layout and orientation: The layout and orientation of the outlet pipe can be influenced by the basin layout, topography of the area, pipe slope, waters of the United States, excavation volumes, and cost.

- Drainage options: For complete drainage, the invert elevation of the outlet pipe has to be close to the bottom of the basin, which may require a shallower but larger basin to provide adequate slope for gravity flow. Another alternative is that the invert elevation can be at an elevation higher than the bottom of the basin, hence, bringing the water in the basin to a certain level instead of total drainage. The remaining volume would be pumped out or allowed to evaporate and infiltrate.

- District requirements: The district requires that the minimum allowable pipe size for the primary outlet structure be 12 inches. Also, a galvanized steel trash rack is required for pipe and orifice outlets, which has to be hinged or removable to allow access to the outlet construction. Energy dissipation at the end of the outlet pipe may be necessary for safety purposes and to prevent erosion, which can be accomplished by using a concrete, soil cement, or riprap structure.

- Discharge control: At the outlet of the pipe, provisions such as energy dissipation and providing the necessary areas that may be needed to cope with the flow volumes being released. This is especially needed if the discharge is to flow over Beardsley Canal, which may require the construction of an overflow chute or increasing the size of an existing one.

3.4.3 Sediment Basins

Inflows into the basin act as conveyors for soil particles of different sizes. The volume and size of those particles depend mainly on the inflow volume and velocity. Over time, sediments accumulate in the basin and reduce its storage capacity, which would require increasing the basin volume to account for sedimentation.

Sediment basins can be constructed to settle and retain soil particles upstream within the inlet channel, which may be more appropriate for an active-use concept or downstream within the basin itself for a passive-use concept. The cost of constructing the sediment basin upstream can be low in comparison to the cost of additional excavation in the basin to account for sedimentation.

The size of the sediment basin to be constructed depends mainly on flow rate (design storm), particle size to be captured, and the type and frequency of implementation of a sediments removal plan. Sediment basin design references recommend the use of an average runoff from a storm smaller (more frequent) than the 100-year, 24-hour storm. The *Erosion and Sediment Control Handbook* recommends "...determining the surface area by the average runoff of a 10-year, 6-hour storm instead of the peak flow." The average rainfall per hour is 17 percent of the total rainfall in a 6-hour storm. Using this average rate in the design would result in substantial savings in size with no significant decrease in efficiency.

The minimum particle size to be trapped can significantly affect the dimensions of the sediment basin. As an example, for a moderately high clay content area (62 percent larger than 0.02 millimeters) and under ideal settling conditions, a sediment basin designed to trap 0.02 millimeters particles or larger can capture about 62 percent of the particles. The size of this basin would triple to capture 8 percent more particles. Its size would also triple if it were designed for the peak rather than the average flow rate.

According to the Drainage Design Manual of the District, the length to width ratio for the sediment basin should be at least 2 to 1, with the length being along the flow line. Other references recommend a length to width ratio as high as 10 to 1. Total drainage and sediment removal with heavy equipment should also be accounted for in the design of the sediment basin.

3.4.4 Impoundment Dike

An impoundment dike can be constructed to provide additional storage capacity, reduce excavation volume, or act as an overflow structure. A proper location for the dike would start at the low points created by the natural drainage channel at the downstream side of the basin. It can be constructed either up to the elevation of the downstream side of the basin or to a higher elevation to provide additional freeboard or contribute to the basin's storage capacity. The downstream height of the impoundment dike is to remain below the ADWR regulated height of 6 feet (3 and 5-foot-high dikes were used in the parametric analysis as discussed in Section 3.3.1).

There are three design alternatives for construction of an impoundment dike, which are listed in Table 2-1 and described as follows:

- Non-erodible: This dike would be built of earthen material with a concrete core, which would be highest in cost and of fair aesthetic value.

- Erodible: Earthen or natural material is used in the construction of this dike. Maintenance would be needed for the dike following storm events. This dike would be of lower cost than the concrete core dike and would hold the same aesthetic value.

- The third alternative is not to use a dike, which would hold the highest aesthetic value especially for the passive-use concepts.

Downstream protection at the overflow locations may be needed and can be constructed of concrete, soil cement, or riprap for energy dissipation. It can also be left in its natural state and maintained after major overflow events.

3.4.5 Land Acquisition

A single basin concept can be constructed within the boundaries of the area owned by the District, with minimal additional land acquisition needed except for placement of excavation material. Concepts involving the use of multiple basins would likely require additional land be acquired. In addition to the property owned by the District, where the current dam is located, adjacent land is owned by the Maricopa Water District and the State Trust.

3.4.6 Dam Breach

Following basin construction, the existing dam will be breached according to the ADWR dam-breach requirements. The dam can be breached while maintaining parts of it as land features to be included in the five concepts discussed before. Also, portions of the dam can be used in place of an impoundment dike, if a basin is to be located upstream of the dam. If portions of the dam are to be used as a dike, the crest of the dam should be no higher than 6 feet in order for the structure to be non-jurisdictional (as per ADWR requirements).

3.5 COST AND AESTHETIC ANALYSIS

A preliminary cost evaluation for the different design components of the basin was performed. Table 2-1 presents a comparative analysis of the basin design components and their relation to cost and aesthetics. The cost and aesthetics for each component have been ranked high to low for cost, and good to poor for aesthetics. The ranking does not identify differences for passive and active concepts, and may vary for specific concepts.

TABLES

TABLE 2-1
COST AND AESTHETIC EVALUATION OF DESIGN COMPONENTS

Design Component	Design Alternative	Cost Evaluation			Aesthetic Evaluation			Total Points
		High 1	Moderate 3	Low 6	Poor 1	Fair 3	Good 6	
Basin Configurations	3:1 side slopes			✓		✓		9
	6:1 side slopes		✓			✓		6
	10:1 side slopes	✓					✓	7
	0.5 percent ground slope			✓		✓		9
	1 percent ground slope		✓			✓		6
	2 percent ground slope	✓				✓		4
Drainage Options	Total Drainage via outlet pipe	✓					✓	7
	Partial Drainage			✓		✓		9
Inlet Structures	Concrete inlet structure (baffle chute for example) with no reduction of upstream natural channel slope	✓			✓			2
	Riprap inlet structure with reduction of upstream natural channel slope		✓			✓		6
	Soil cement structure with reduction of upstream natural channel slope		✓				✓	9
	Natural material with reduction of side slope and upstream natural channel			✓			✓	12
Sediment Basin	Internal sediment basin		✓				✓	9
	External sediment basin	✓				✓		4
Impoundment Dike	Non-erodible (concrete core)	✓			✓			2
	Erodible (natural material)		✓			✓		6
	None			✓			✓	12
Disposal of excavated materials	On-site							
	Off-site							
Land Acquisition	Single Basin (within FCDMC property)		✓			✓		6
	Multiple Basins (additional land is needed outside FCDMC property)	✓					✓	7

TABLE 3-1
DIVERSIONS COST-REDUCTION EFFECT ON PROJECT COST

Diversion	Volume Diverted (ac-ft)	Diversion Cost ($)	Basin Excavation Cost Reduction ($)	Project Cost Savings ($)
Cholla Wash	740	1,732,000	3,032,000	1,300,000
Waterfall Wash	521	239,000	2,135,000	1,896,000
Bedrock Wash[1,2]	370	330,000	1,516,000	1,186,000
Bedrock Wash[1,3]	550	661,000	2,254,000	1,593,000

Basin Capacity = 2,200 ac-ft = 3,549,348 CY
Basin Cost = 3,549,348 CY x $2.54/CY = $9,015,000
[1]Also known as Caterpillar/Foothills Drainage Way
[2]Sta 35+00 to Foothills Basin
[3]Sta 0+00 to Foothills Basin

TABLE 3-2
BASIN PARAMETRIC EVALUATION FOR BASIN ALTERNATIVES

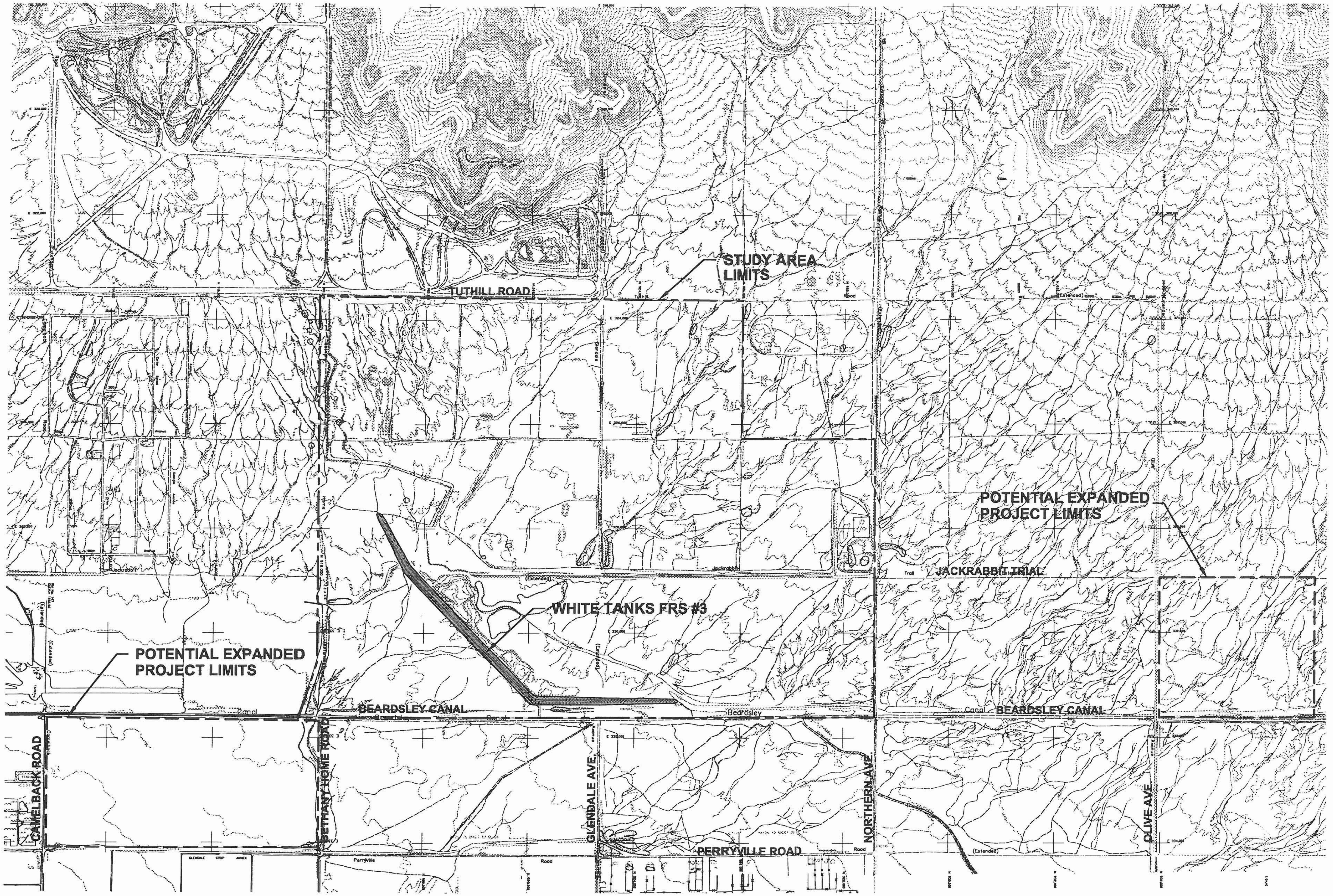
Option #	Option	3:1 Side slopes, 1 Percent Ground Slope Excavation Volume (million CY)	Cost (million $)	Percent Change from Base Case
1	Five-foot dike, with no freeboard – Base Case	3.9	10.0	0.0
2	Five-foot dike, with three feet of freeboard	4.6	12.0	19.0
3	Three-foot dike with three feet of free board	5.1	13.0	31.9
4	Undammed, with no freeboard	5.1	13.0	31.9
5	Undammed, with three feet of freeboard	5.9	15.0	51.6

Note: The reduction in excavations shown for the basin options constructed with a dike (Options 1-3) may be less, depending on actual topography. The parametric analysis conducted at this stage is geometric in nature and does not reflect site specific features and their actual effect on excavated volumes.

TABLE 3-3
DESIGN VARIATIONS

Side Slope Variations	
Side Slopes	**Average Percent Change of Volume/Cost**
6:1	+5.5
10:1	+13.5
Ground Slope Variations	
Ground Slopes	
0.5 percent	-16.3
2.0 percent	+34.1
Total Drainage	
Description	
7' Deep Basin (1190 ft – 1183 ft)	+142.3
Multiple Basins	
Description	
Two 1,100 acre-ft Basins	+56.0

FIGURES



Flood Control District of Maricopa County

DAMES & MOORE
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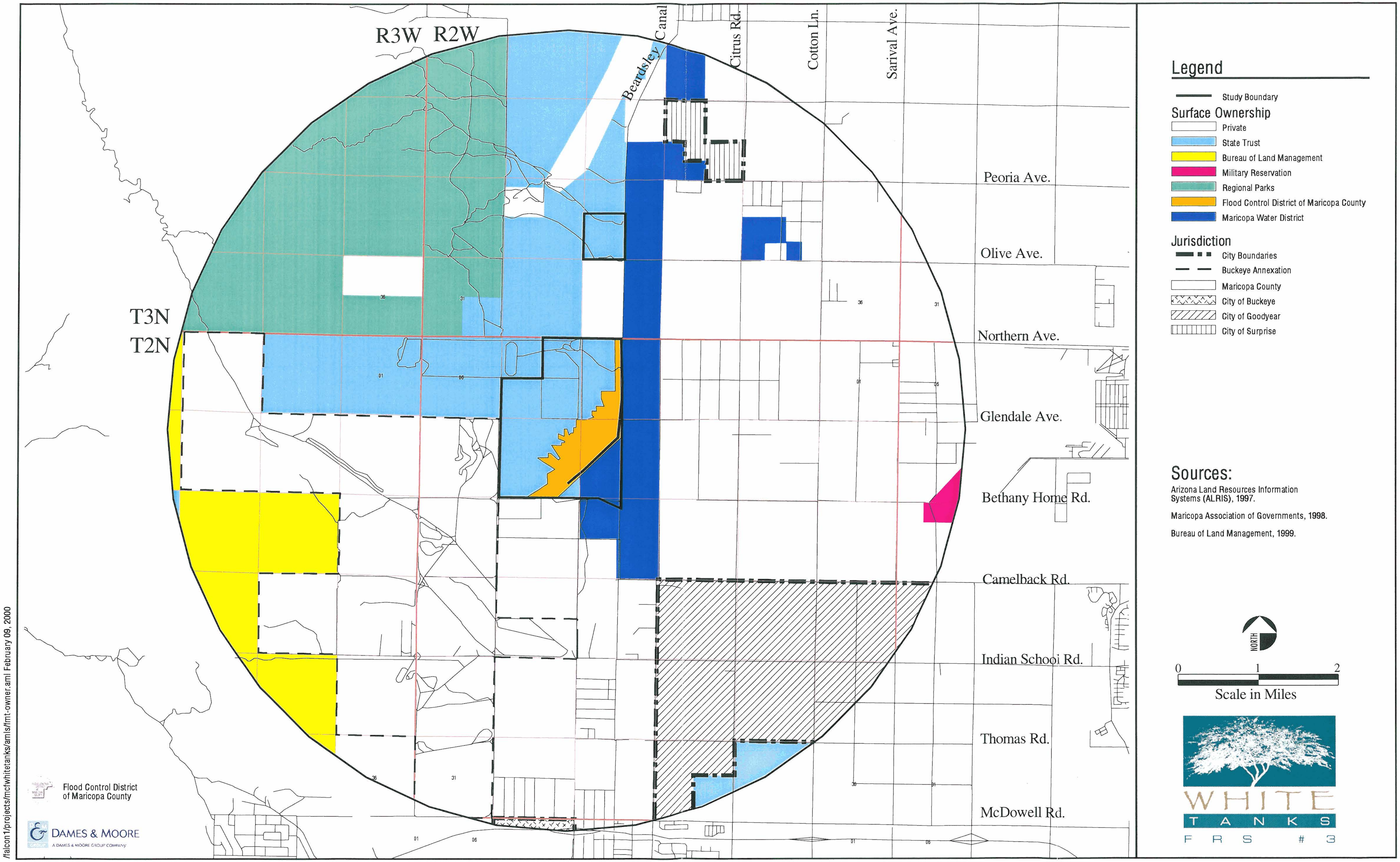
SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

A13694.DWG 2-10-00 XREF:VTOPO

WHITE TANKS FRS #3

Dames & Moore Job No. 15448-007-058

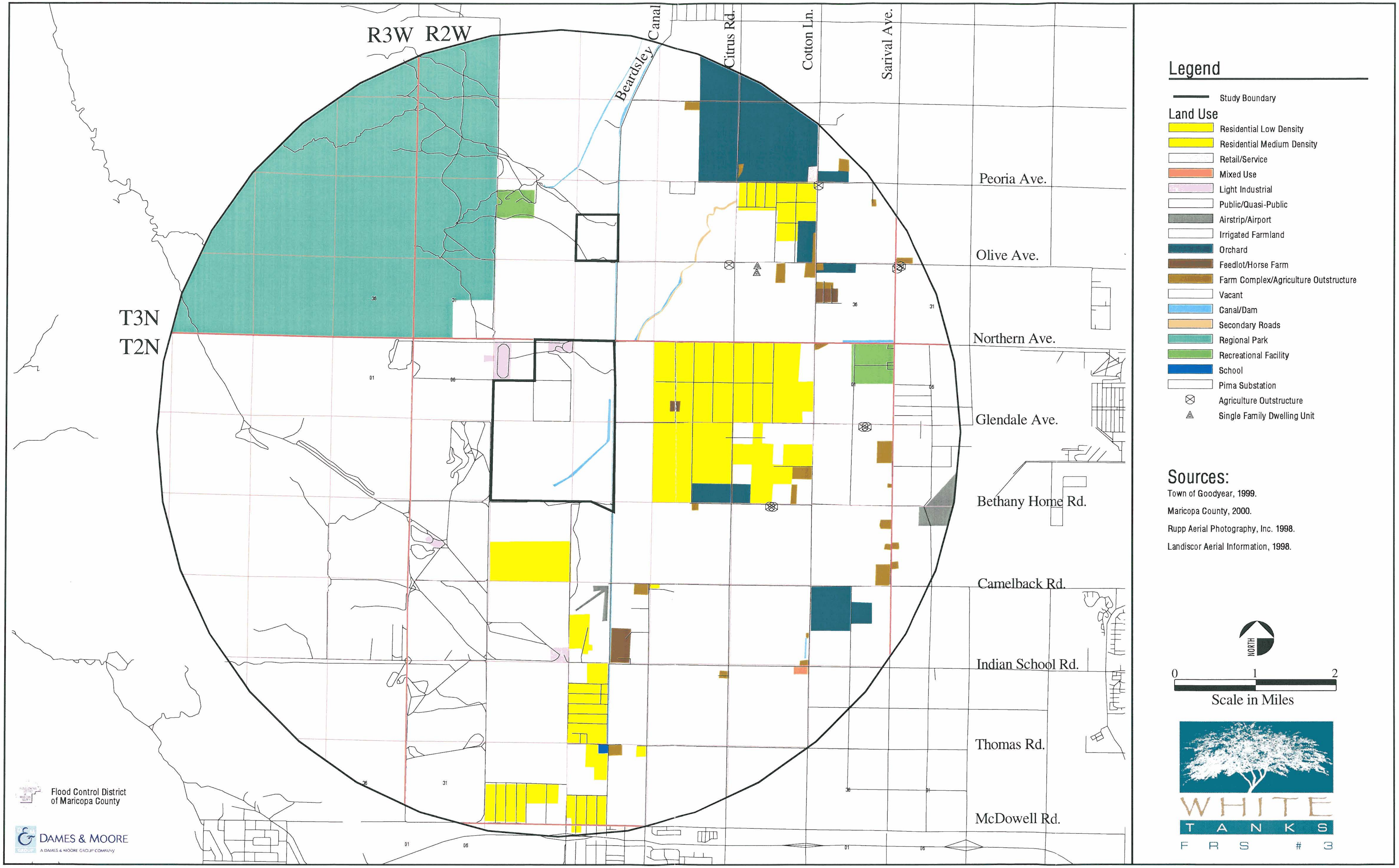
General Site Location
Figure 1-1



Dames & Moore Job No. 15448-007-058

Surface Ownership and Jurisdiction

Figure 2-1

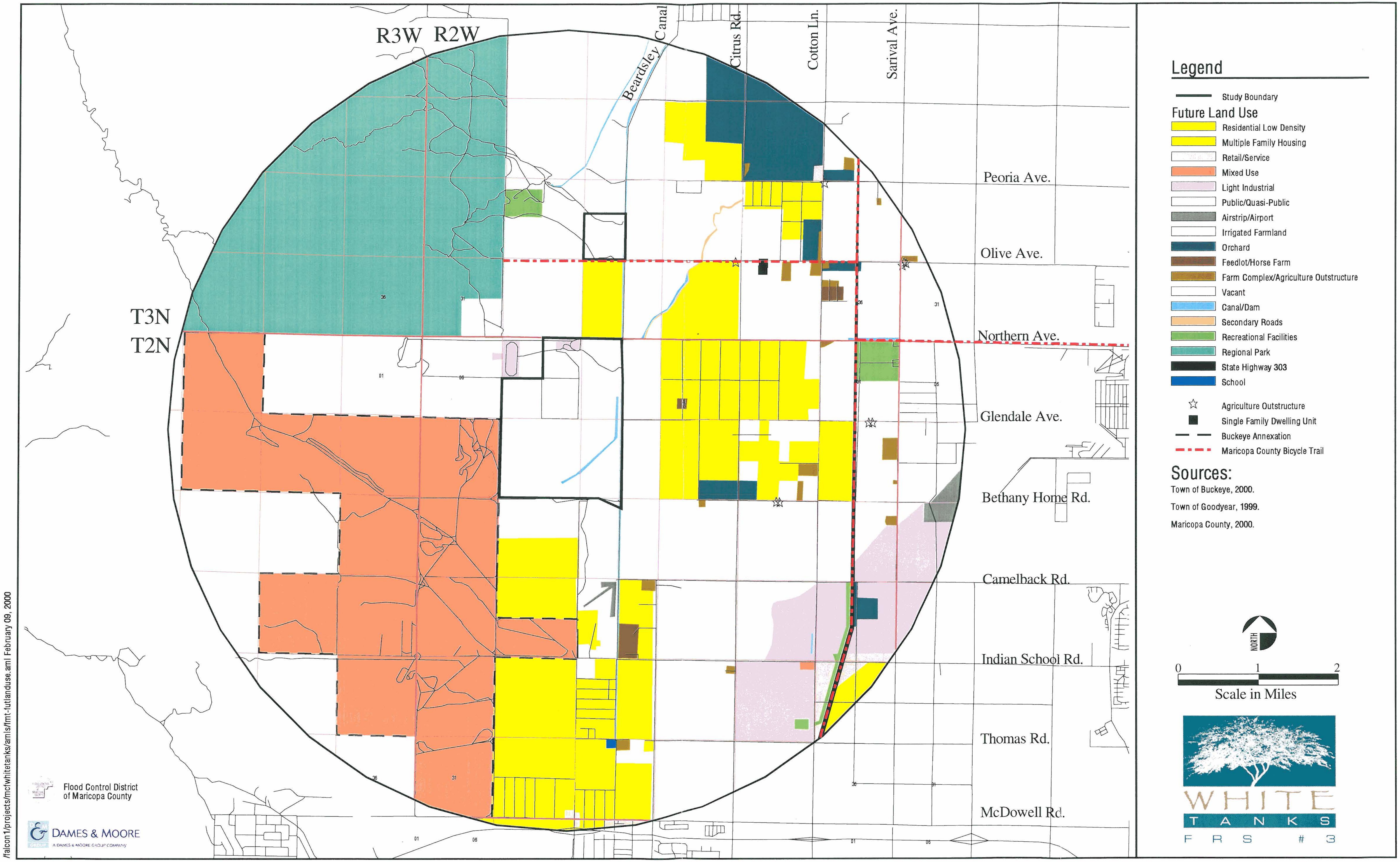


/falcon1/projects/mcfwhitetanks/amls/frnt-landuse.aml February 09, 2000

Dames & Moore Job No. 15448-007-058

Existing Land Use

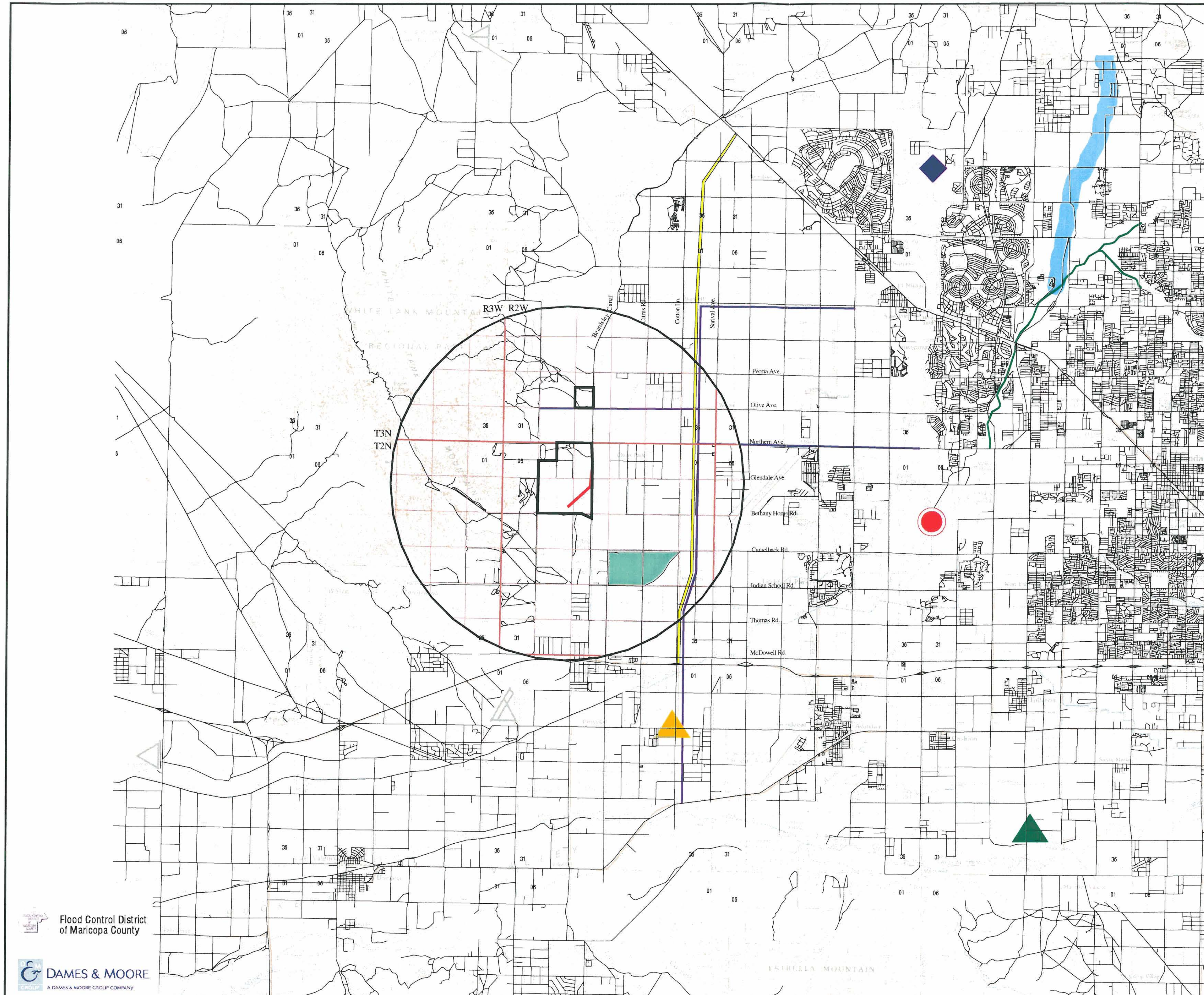
Figure 2-2



Dames & Moore Job No. 15448-007-058

Future Land Use

Figure 2-3



Legend

Study Boundary

Projects

- City of Peoria Trails and Rivers Master Plan
- Maricopa County Bicycle Network Plan
- Loop 303
- Drainage Master Plan for White Tanks Area
- Beardsley Wastewater Treatment Plant
- West Area Water Reclamation Facility
- Tres Rios Constructed Wetlands Demonstration Project
- Goodyear Groundwater Recharge
- Middle New River Watercourse Master Plan
- Special Use Area

Sources:

Maricopa County, 2000.

City of Peoria, 1999.

City of Glendale, 2000.

Flood control District of Maricopa County, 2000.

Maricopa Association of Governments, 1999.

City of Phoenix, 1999.

NORTH

Scale in Miles

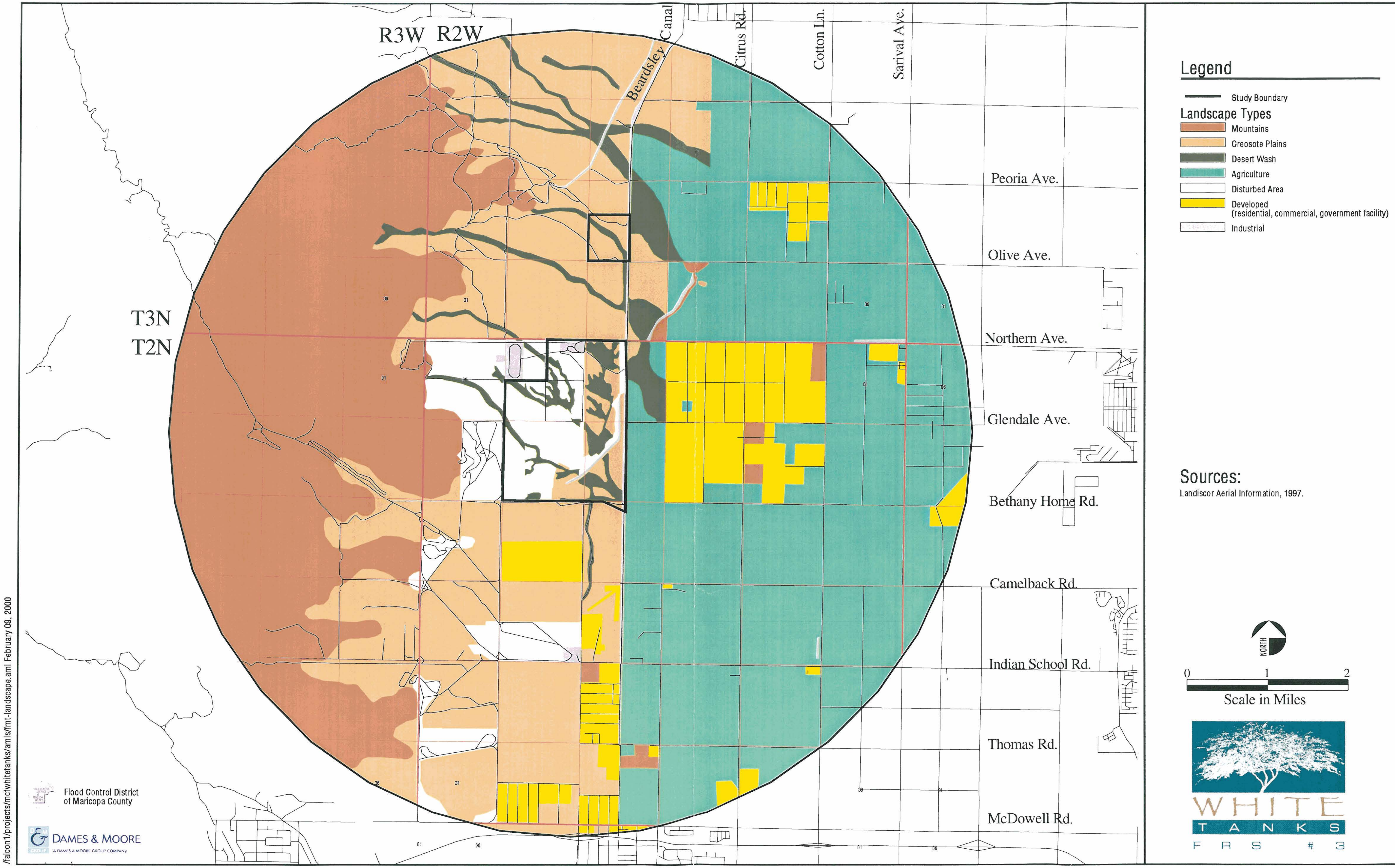
WHITE TANKS FRS # 3

/falcon1/projects/mcfwhitetanks/amls/fmt-pot.aml February 09, 2000

Dames & Moore Job No. 15448-007-058

Potentially Relevent Projects

Figure 2-4

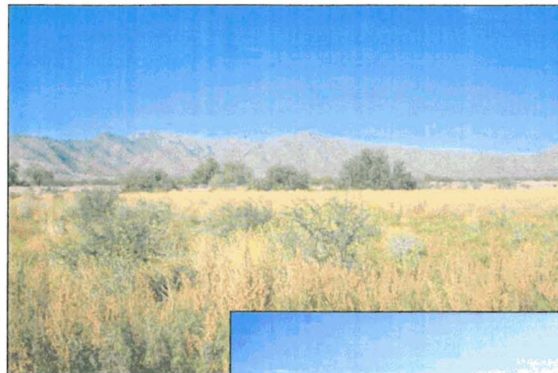


Dames & Moore Job No. 15448-007-058

Landscape Characteristic Types

Figure 2-5

1

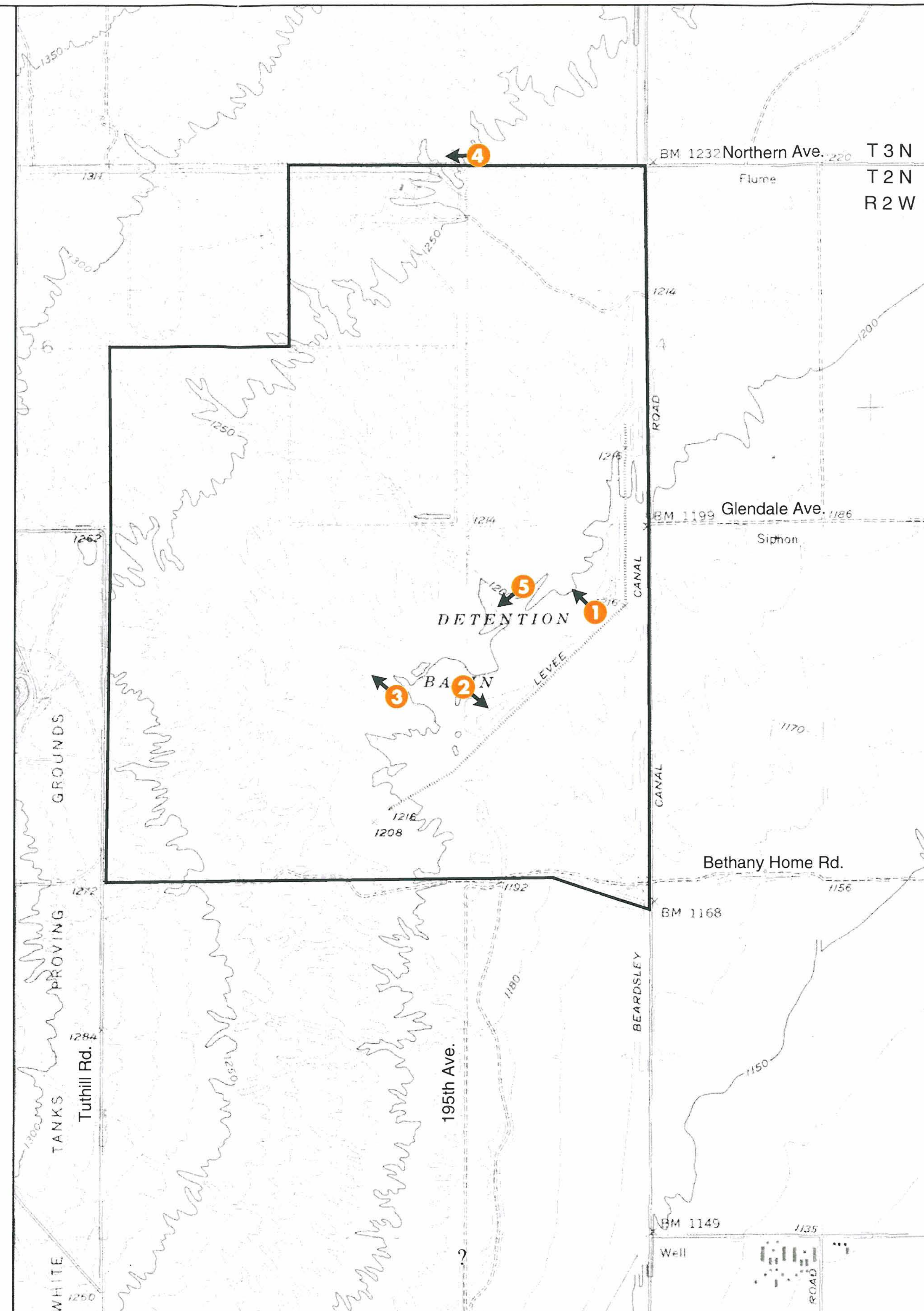


2

3

4

5



Legend

1 Viewpoint Location

Sources:

Waddell, 7.5' USGS Quadrangle (west-central portion) Arizona 1975

NORTH

0 1/2 1

Scale in Miles

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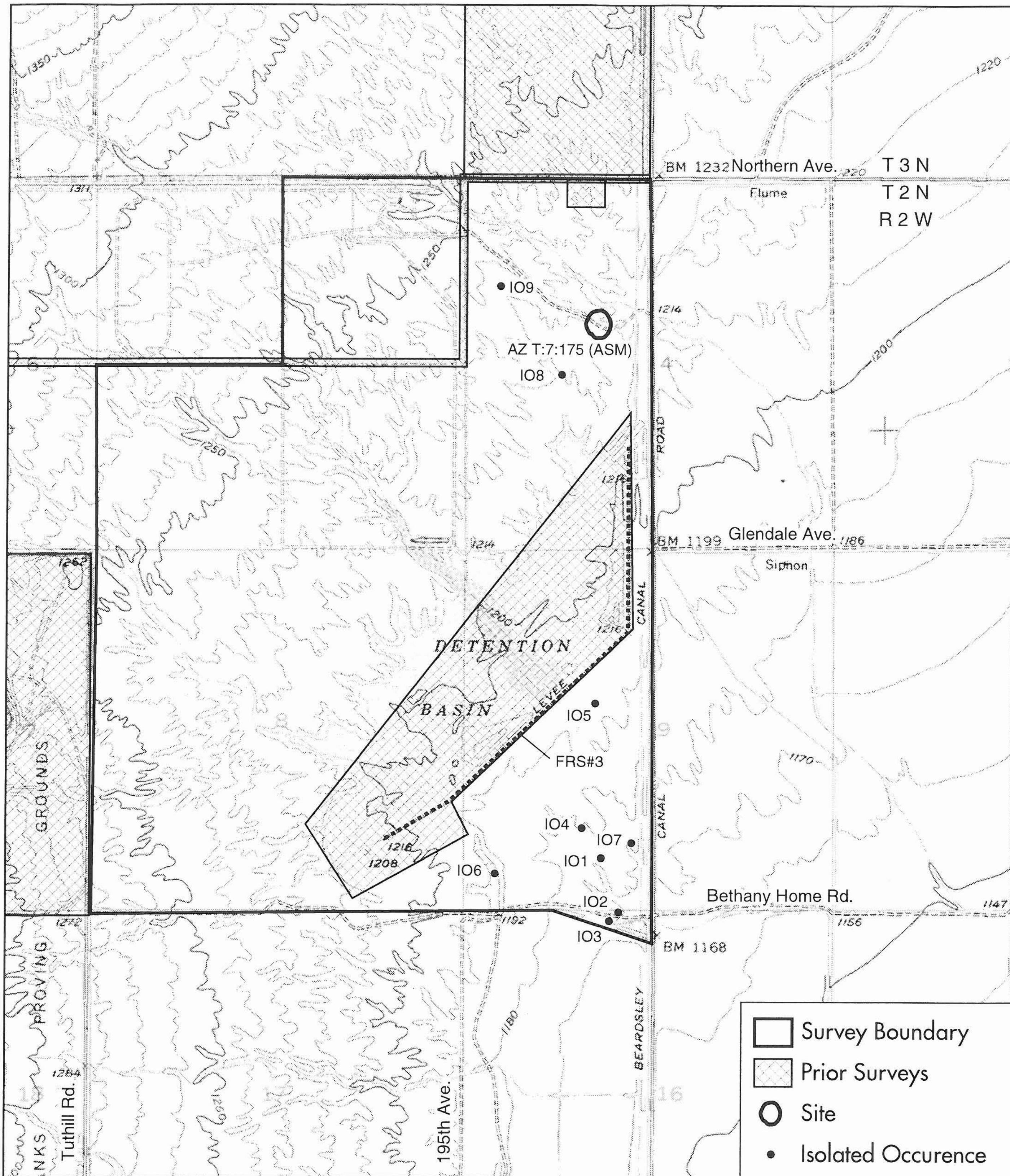
Typical Views and Photograph Locations

Figure 2-6



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NORTH

0 .25 .5 .75 1
Scale in Miles

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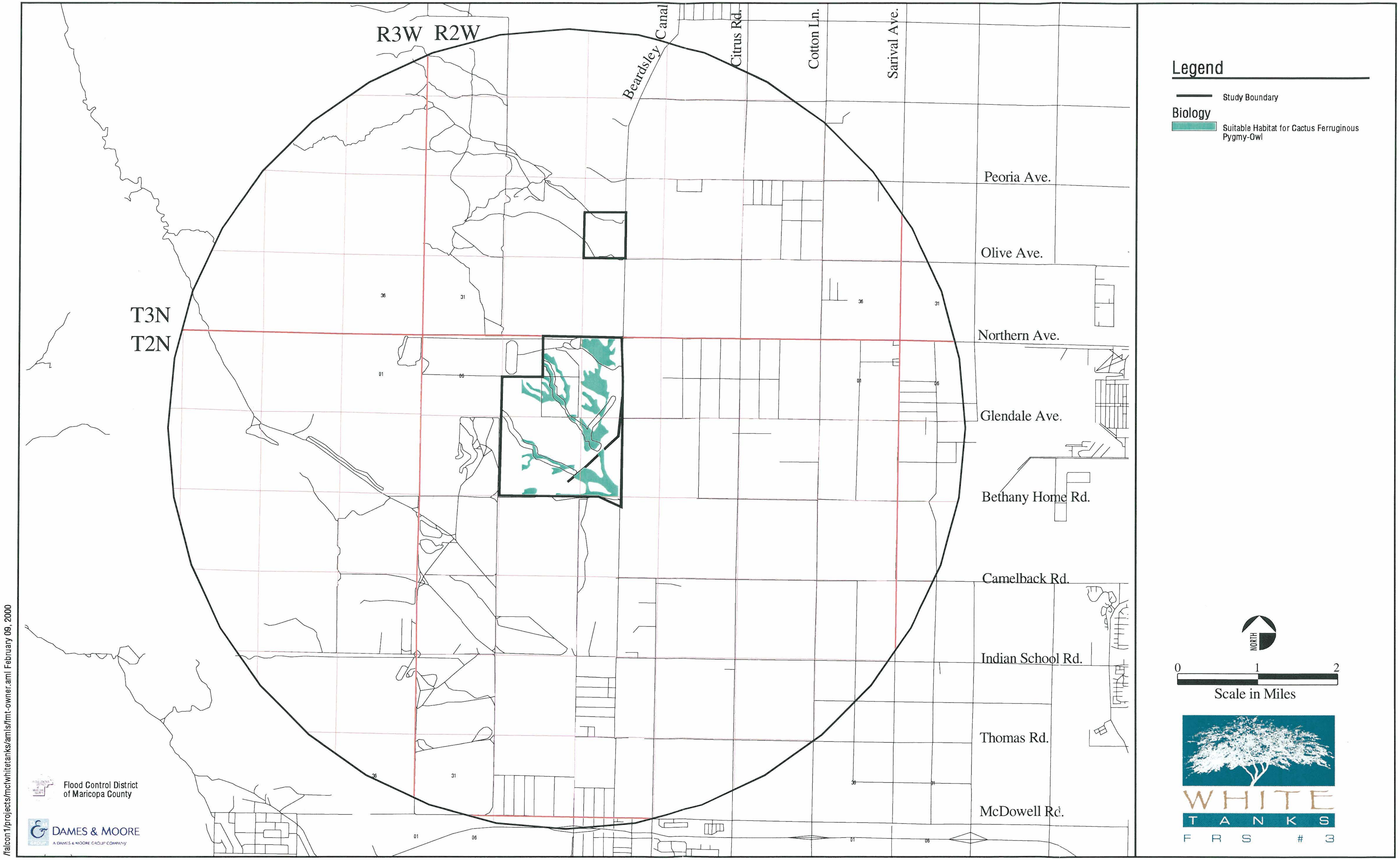
Cultural Resources

Figure 2-7



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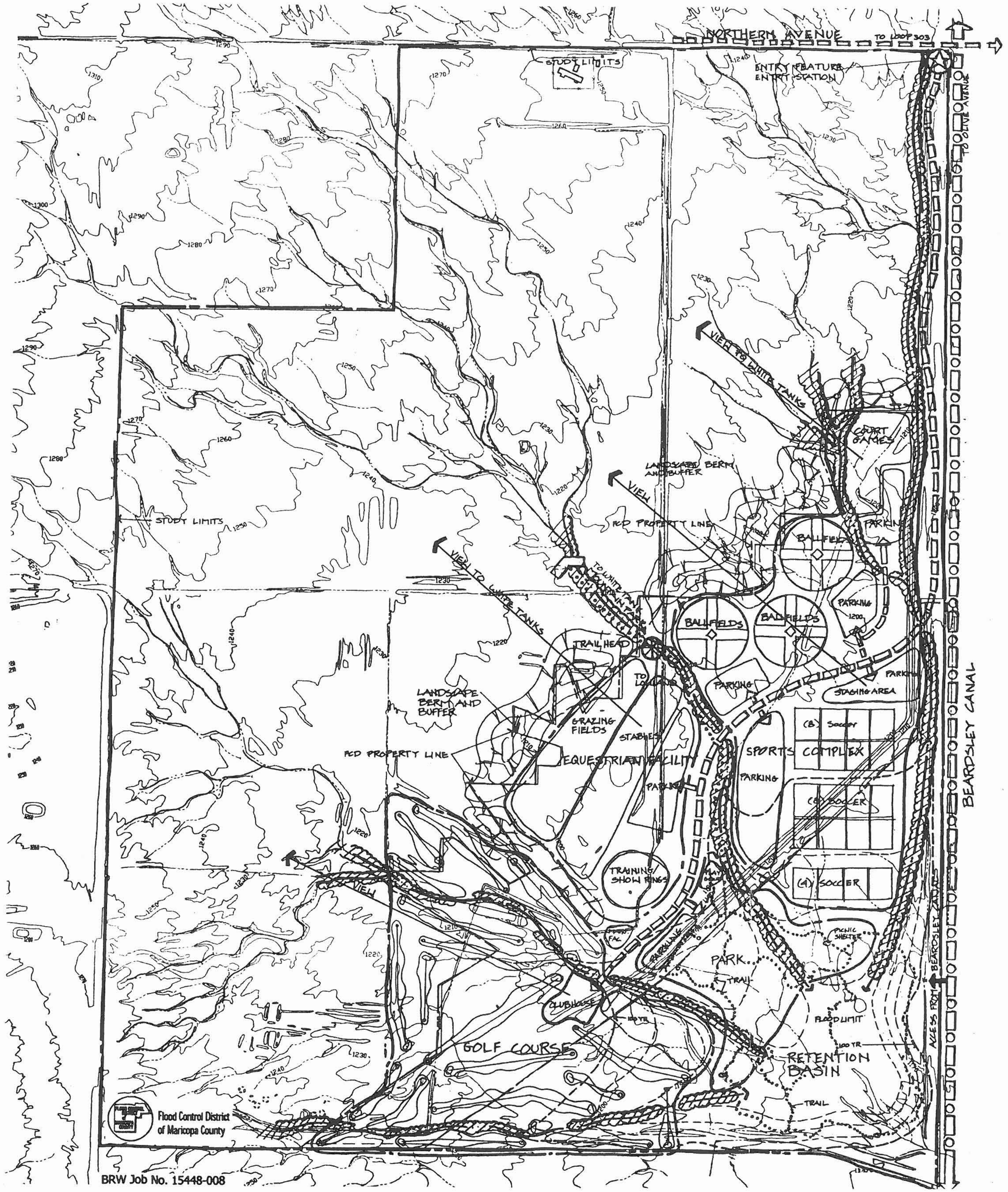
Biological Resources

Figure 2-8



SITE FEATURES

A. SPORTS COMPLEX- 172 ac.
- 12 Ballfields
- 20 Soccer Fields
- Court Games
  - Basketball Courts
  - Volleyball Courts
  - Roller Hockey Rink
  - Tennis Courts
  - Recreation Building
- Tournament Staging Area
- Parking

B. EQUESTRIAN FACILITY- 72.3 ac.
- Stables and Boarding
- Grazing/ Exercise fields
- Training/ Show Rings
- Trailheads
  - to White Tank Mountain Park
  - to Retention Basin (Low Land Riding)
- Hitching Posts
- Oversized Parking Lot for Horse Trailers

C. COMMUNITY PARK- 48.4 ac.
- Playground
- Multi-use Decomposed Granite Trails
- Picnic Shelters/ Shaded Wildlife Viewing Areas
- Revegetate with Native Desert Vegetation
- Parking

D. GOLF COURSE- 178.7 ac.
- 18 Hole Championship Golf Course
- Clubhouse & Grill
- Practice Range & Green
- Maintenance Facility
- Parking

E. RETENTION BASIN- 221 ac.
- Multi-use Decomposed Granite Trails
- Overlook Areas
- Revegetate with Native Desert Vegetation
- Access to Beardsley Canal
- The Basin Contains:
  - 12 Soccer Fields
  - Community Park
  - Driving Range
  - 4 Golf Holes

F. NATIVE DESERT WASH
- Wildlife Habitat
- Provides Link into White Tank Mountain Park

G. BEARDSLEY CANAL
- Access Link to White Tank Mountain Park and Lake Pleasant

H. SITE ISSUES
- Land Acquisition
  - MCWD Land
  - Some State Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and to screen visually invasive elements of the site.
- Site Access
  - Vehicular Access from Northern Avenue
  - Pedestrian, Bicycle, & Horse Access from the Beardsley Canal

LEGEND

- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trailhead
- Multi-use Trail
- Dominant View Shed Line
- Landscape Berm
- Entry Feature

Concept Statement

Concept #1 develops the site as an active use recreation attraction for the far west valley region by creating a major sports complex, an equestrian facility, and a golf course. Storm water retention is concentrated into the lowest, flattest part of the site. Run-off is brought into the basin by the wash channels; then a series of terraces allows the park, soccer fields, and parts of the golf course to integrated into the basin, but only inundated during a major flood event.

0 400 800 1200

WHITE TANKS
FRS #3

Flood Control District of Maricopa County

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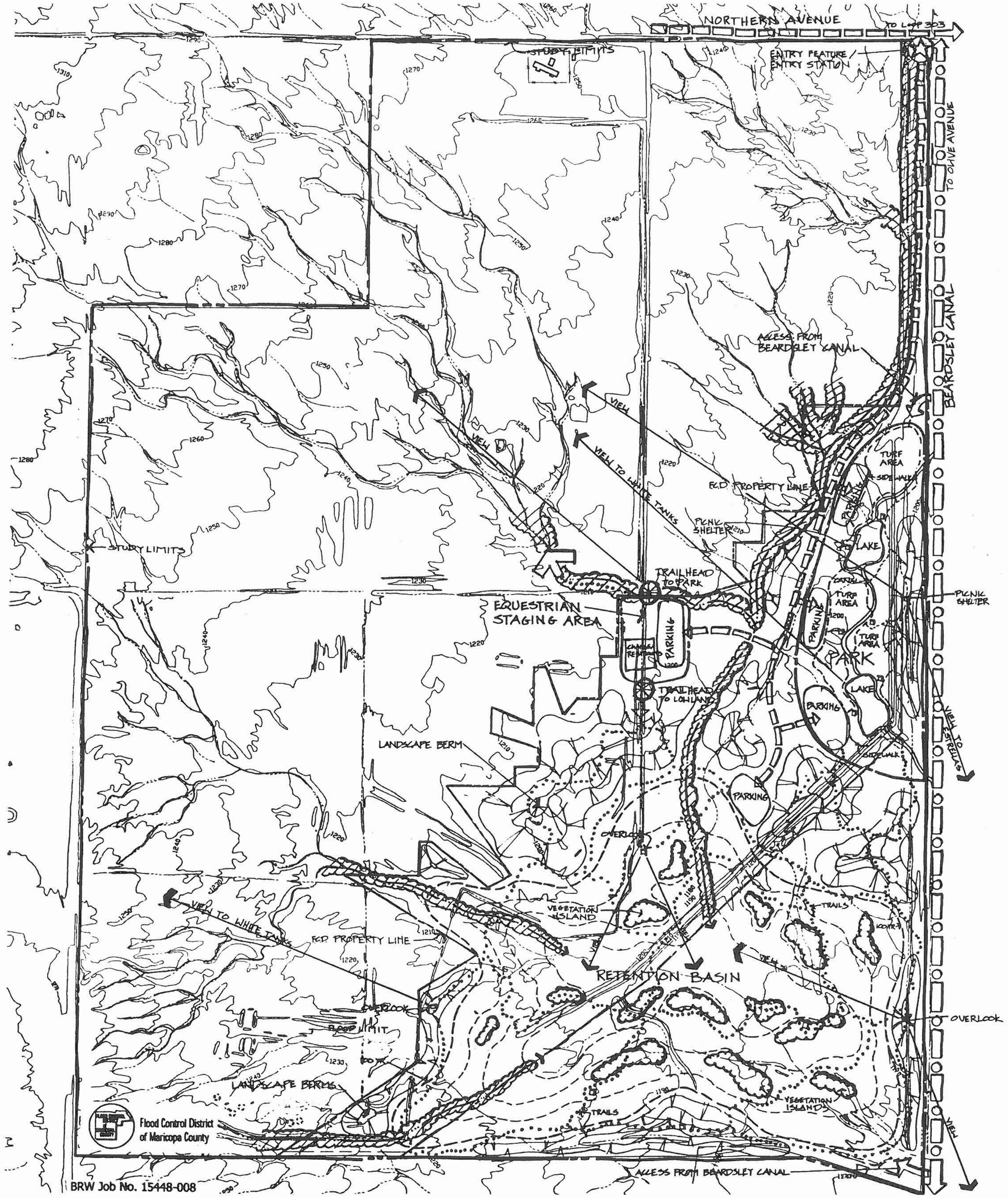
Concept #1 - Single Basin, Active Use

Figure 2-9



SITE FEATURES

A. COMMUNITY PARK- 73.8 ac.
- 2 Water Feature Lakes & Streams
- Water from the Beardsley Canal
- Concrete Sidewalks
- Open Turf Grass Fields
- Picnic Shelters & Overlooks
- Playground
- Parking

B. EQUESTRIAN STAGING AREA- 11.5 ac.
- Change/ Restrooms
- Trailheads
  - to White Tank Mountain Park
  - to Retention Basin (Low Land Riding)
- Hitching Posts
- Oversized Parking Lot for Horse Trailers

C. RETENTION BASIN- 256 ac.
- Raised Vegetation Islands
  - Wildlife Habitat
  - Visual Relief
- Multi-use Decomposed Granite Trails
- Overlook Areas with Shade Structures
- Revegetate with Native Desert Vegetation
- Access to Beardsley Canal
- Parking

D. NATIVE DESERT WASH
- Wildlife Habitat
- Provide Links with White Tank Mountain Park and Future Developments

E. BEARDSLEY CANAL
- Access Link to White Tank Mountain Park and Lake Pleasant

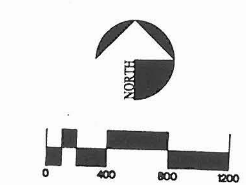
F. SITE ISSUES
- Land Acquisition
  - MCWD Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and to screen the basin from the park and equestrian area.
- Site Access
  - Vehicular Access from Northern Avenue
  - Pedestrian, Bicycle, & Horse Access from the Beardsley Canal

LEGEND

- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trailhead
- Multi-use Trail
- Dominant View Shed Line
- Landscape Berm
- Entry Feature

Concept Statement

Concept #2 develops the site for passive recreation users, wildlife habitat, and native plant open space. The lakes and streams in the park use diverted water from the Beardsley Canal to supply and circulate the water, as well as providing water storage for the canal. The retention basin is located on the lowest, flattest part of the site and it has flatter slopes that spread out over a larger area. Vegetation islands are scattered through out the basin and are meant to provide wildlife habitat and break up the visual size of the basin.



WHITE
TANKS
FRS # 3

Flood Control District of Maricopa County

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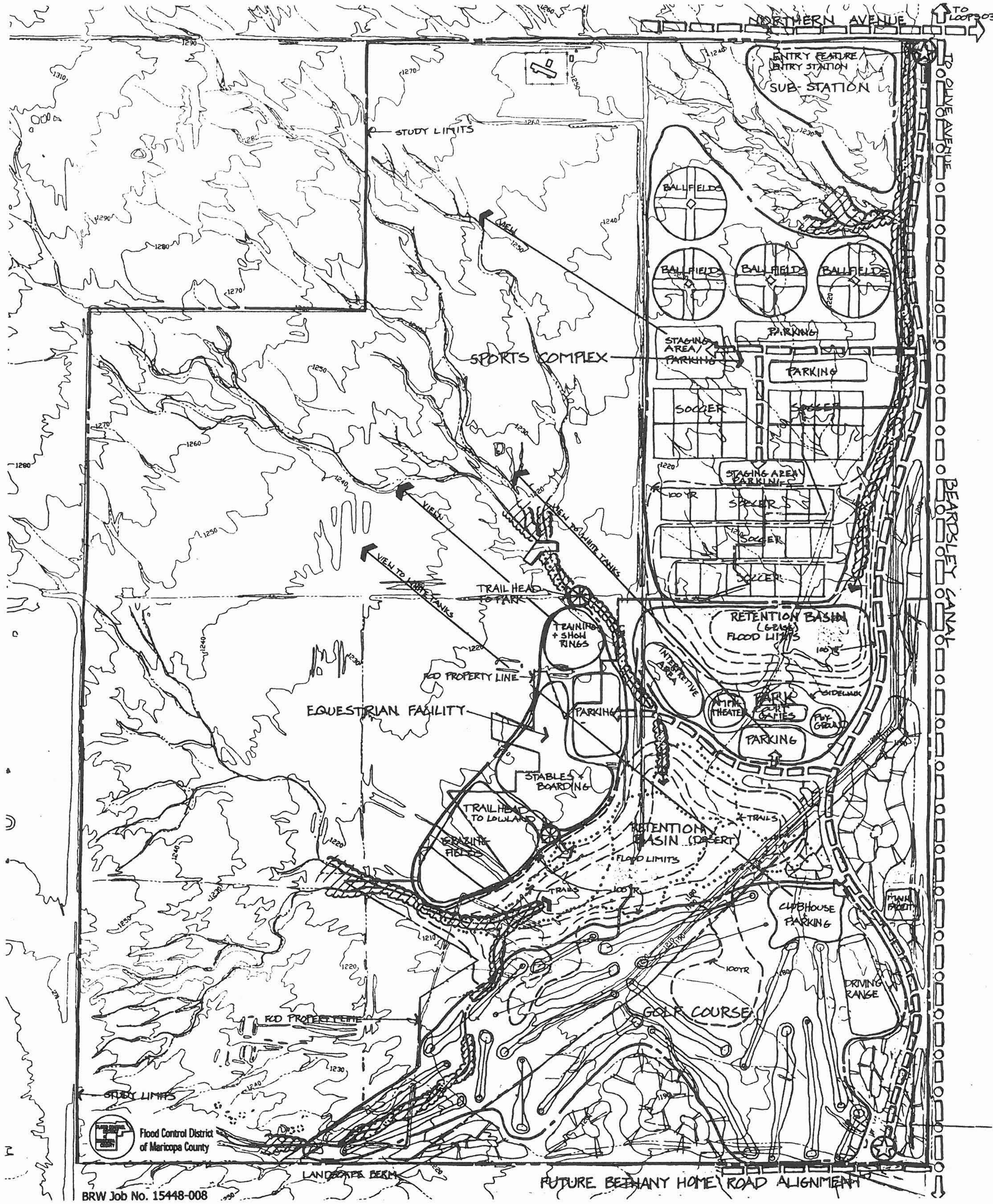
Concept #2 - Single Basin, Passive Use

Figure 2-10



SITE FEATURES

A. SUB-STATION- 29 AC.
- Police or Fire Sub-Station
- Municipal Buildings
- Commercial Parcel

B. SPORTS COMPLEX- 190.1 ac.
- 16 Ballfields
- 36 Soccer Fields
- Tournament Staging Areas
- Concrete Sidewalks
- Parking

C. COMMUNITY PARK- 61.8 ac.
- Playground
- Court Games
  - Basketball Courts
  - Volleyball Courts
  - Roller Hockey Rink
  - Tennis Courts
  - Recreation Building
- Amphitheater
- Interpretive/ Educational Center
- Concrete Sidewalks
- Open Turf Grass Fields
- Parking

D. EQUESTRIAN FACILITY- 64.2 ac.
- Stables and Boarding
- Grazing/ Exercise fields
- Training/ Show Rings
- Trailheads
  - to White Tank Mountain Park
  - to Retention Basin (Low Land Riding)
- Hitching Posts
- Oversized Parking Lot for Horse Trailers

E. GOLF COURSE- 207.1 ac.
- 18 Hole Championship Golf Course
- Clubhouse & Grill
- Practice Range & Green
- Maintenance Facility
- Parking

F. RETENTION BASIN- North Basin 92.5 ac. South Basin 93.2 ac
- Multi-use Decomposed Granite Trails
- Overlook Areas
- Revegetate North Basin with Turf Grass
- Revevetate South Basin with Native Desert Vegetation
- Access to Beardsley Canal
- The Basins Contain:
  - 20 Soccer Fields
  - Non-playing areas of the golf course
  - Open Grass Fields for pick-up field games
  - Multi-use Trails

G. NATIVE DESERT WASH
- Wildlife Habitat
- Provide Links with White Tank Mountain Park and Future Developments

H. BEARDSLEY CANAL
- Access Link to White Tank Mountain Park and Lake Pleasant

I. SITE ISSUES
- Land Acquisition
  - MCWD Land
  - Some State Land
  - BLM Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and to screen visually invasive elements of the site and focus views on the White Tank Mountains.
- Site Access
  - Vehicular Access from Northern Avenue
  - Pedestrian, Bicycle, & Horse Access from the Beardsley Canal

LEGEND

- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trailhead
- Multi-use Trail
- Dominant View Shed Line
- Landscape Berm
- Entry Feature

Concept Statement

Concept #3 develops the site as an active use recreation attraction for the far west valley region by creating a major sports complex, an equestrian facility, and a golf course. The retention basins are split into two smaller basins. The north basin is grassed and integrated into the park and sports complex. Run-off is brought into the basin by the wash channel and as the water rises it will gradually inundate some of the soccer fields. The south basin is revegetated with native plants; a major flood event will encroach onto non-played parts of the golf course.

NORTH

0 400 800 1200

WHITE TANKS FRS #3

Flood Control District of Maricopa County

BRW
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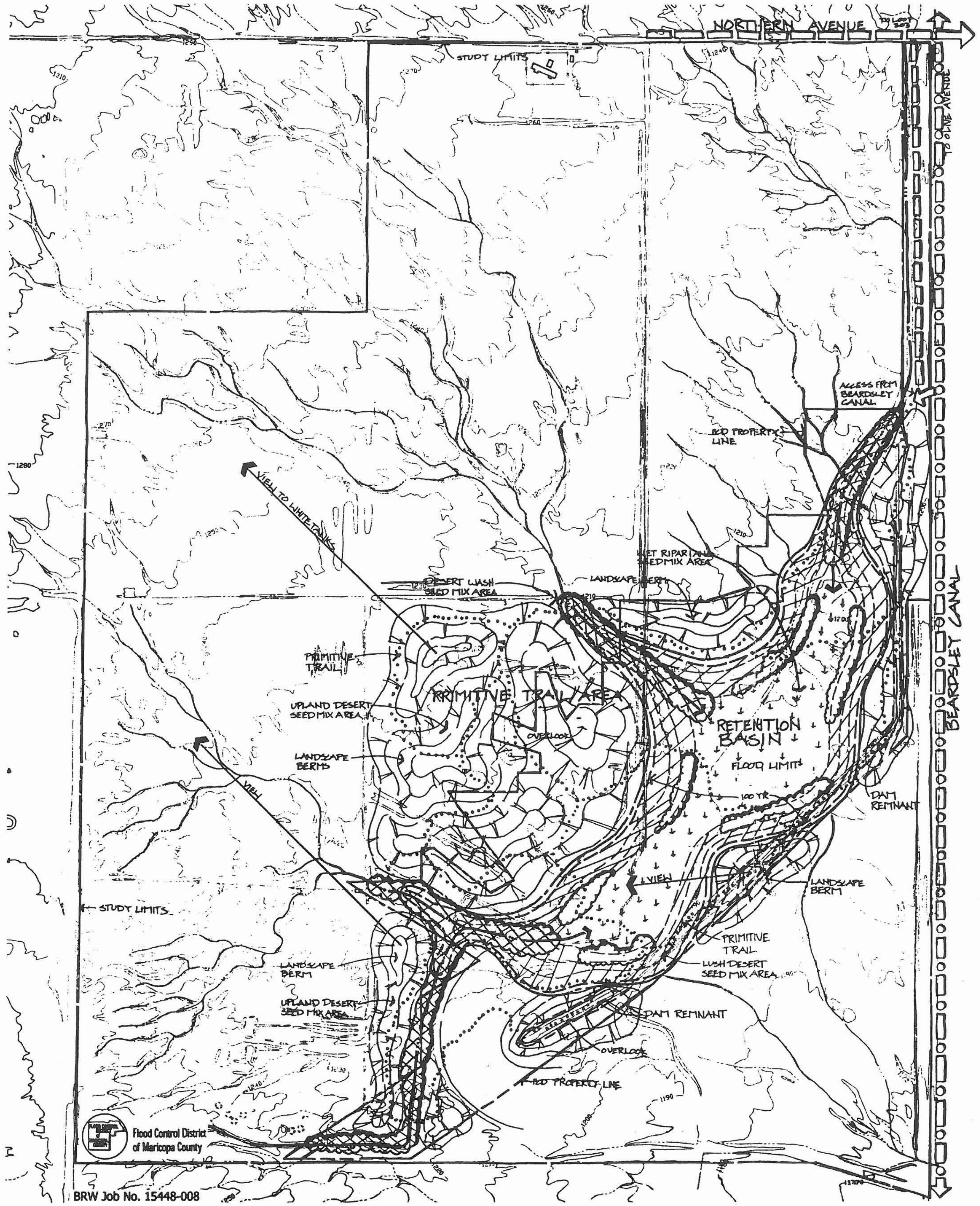
BRW003.DWG 2-8-00

Dames & Moore Job No. 15448-007-058

Concept #3 - Multiple Basins, Active Use

Figure 2-11



SITE FEATURES

A. PRIMITIVE TRAIL AREA- 221 ac.
- Non-Developed Trails
- Landscape Berms
- Overlook Points
- Wildlife Habitat
- Access from Beardsley Canal

B. RETENTION BASIN- 158 ac.
- Non-Developed Trails
- Wildlife Habitat
- Revegetate with Native Desert Seed Mixes

C. NATIVE DESERT WASH
- Wildlife Habitat
- Provide Links with White Tank Mountain Park and Future Developments

D. BEARDSLEY CANAL
- Access Link to White Tank Mountain Park and Lake Pleasant

E. SITE ISSUES
- Land Acquisition
  - State Land
- Spoils
  - Spread spoils over entire non-basin site. The spoils should be used to create topography and enhance views.
- Site Access
  - Vehicular/ Maintenance Access from Northern Avenue.
  - Pedestrian, Bicycle, & Equestrian Access from the Beardsley Canal
- Revegetation Seed Mixes
  - Upland Desert Seed Mix (landscape berms & non-basin areas)
  - Desert Wash Seed Mix (wash & channel corridors)
  - Lush Desert Seed Mix (25-100 year flood event)
  - Wet Riparian Seed Mix (0-25 year flood event)

LEGEND

- Property Line
- Area Division Line
- Access Road
- Beardsley Canal
- Flood Event Line
- Wash Corridor
- Trail
- Landscape Berms
- Upland Desert Seed Mix Area
- Desert Wash Seed Mix Area
- Lush Desert Seed Mix Area
- Wet Riparian Seed Mix Area
- Dominant View Shed Line

Concept Statement

Concept #5 develops the site for minimal passive recreational uses. A large single basin is located adjacent to the existing dam and breaches the dam in several locations. The remaining dam remnants are blended with some of the resulting spoils to create high points and overlooks. The site will be revegetated to a native desert condition with a blend of four general seed mixes that follow the water distribution patterns of the site.

NORTH

0 400 800 1200

WHITE TANKS FRS #3

Flood Control District of Maricopa County

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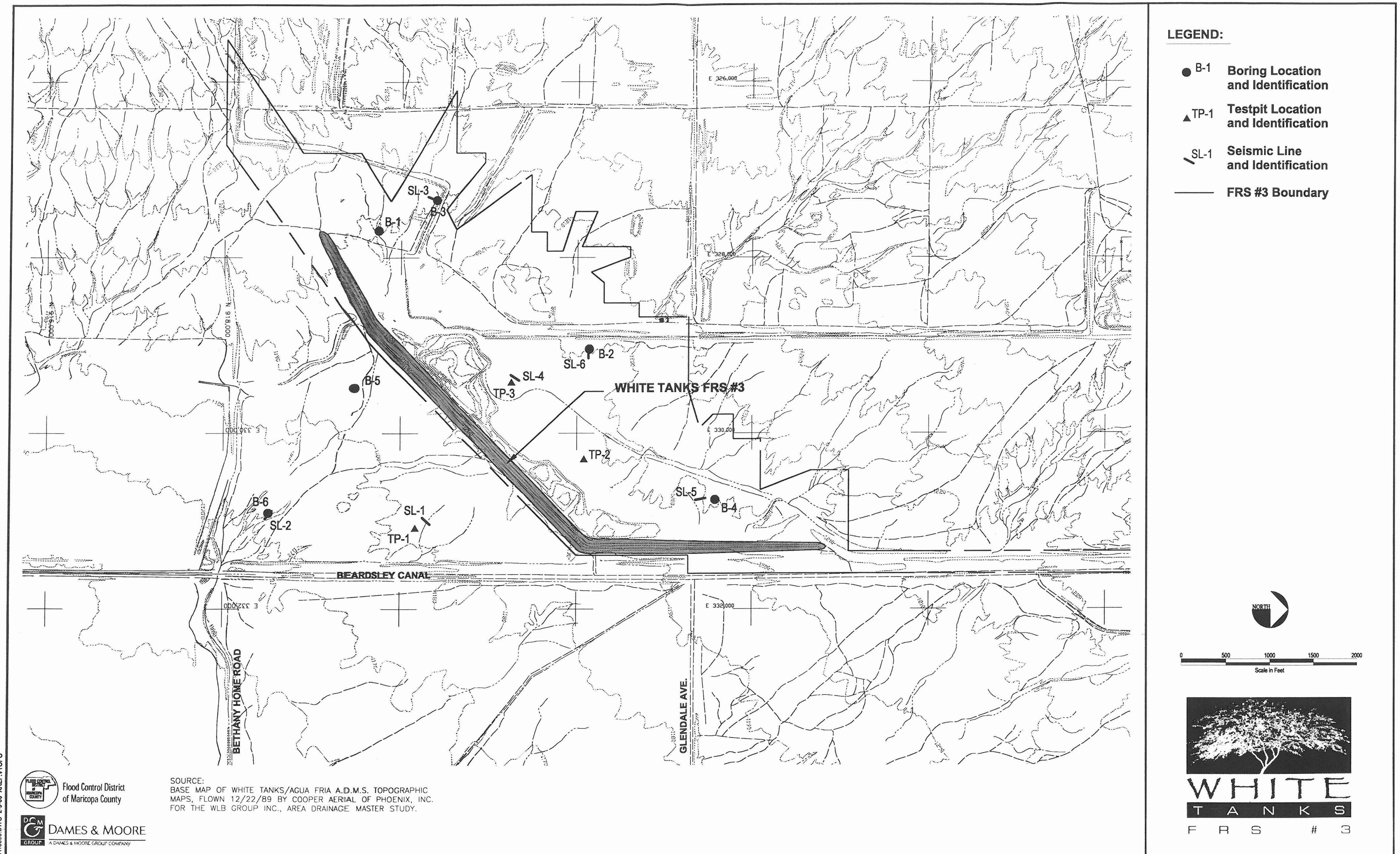
Concept #5 - Single Basin, Passive Use

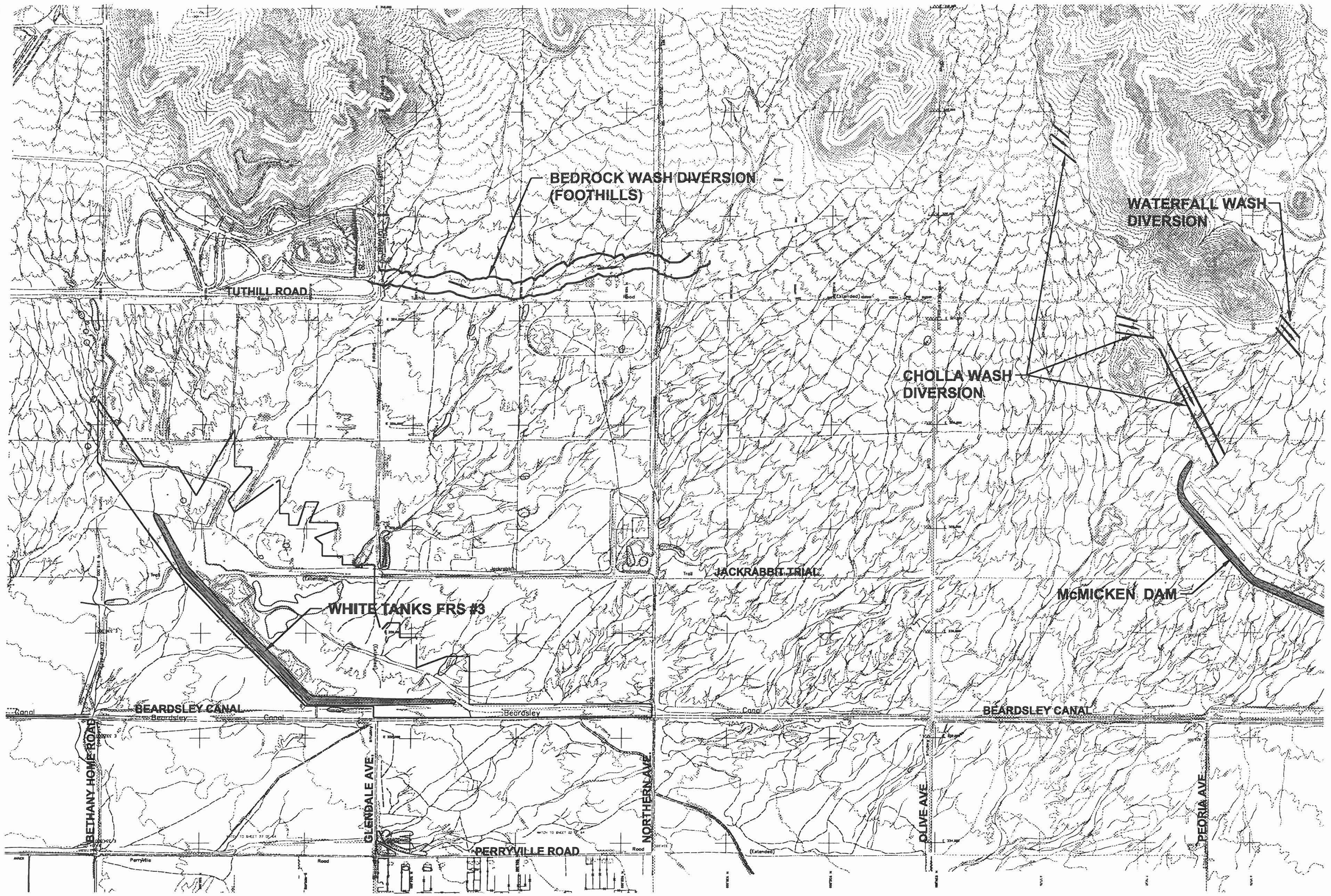
Figure 2-13



Dames & Moore Job No. 15448-007-058

Location of Borings, Testpits and Seismic Lines

Figure 3-1



Flood Control District of Maricopa County

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

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WHITE TANKS FRS #3

A13680.DWG 2-8-00 XREF:VTOPO

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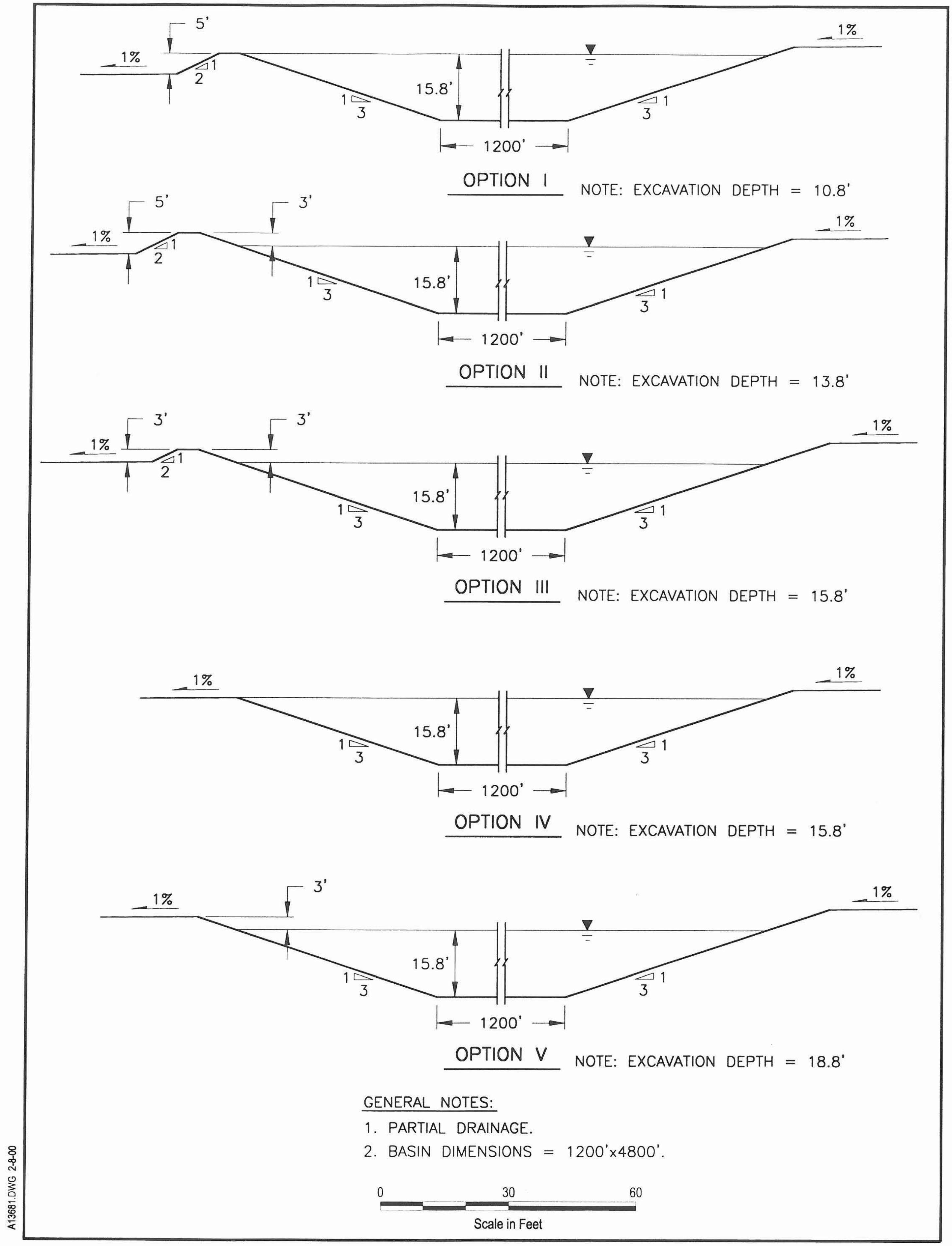
Diversion Ditch Locations

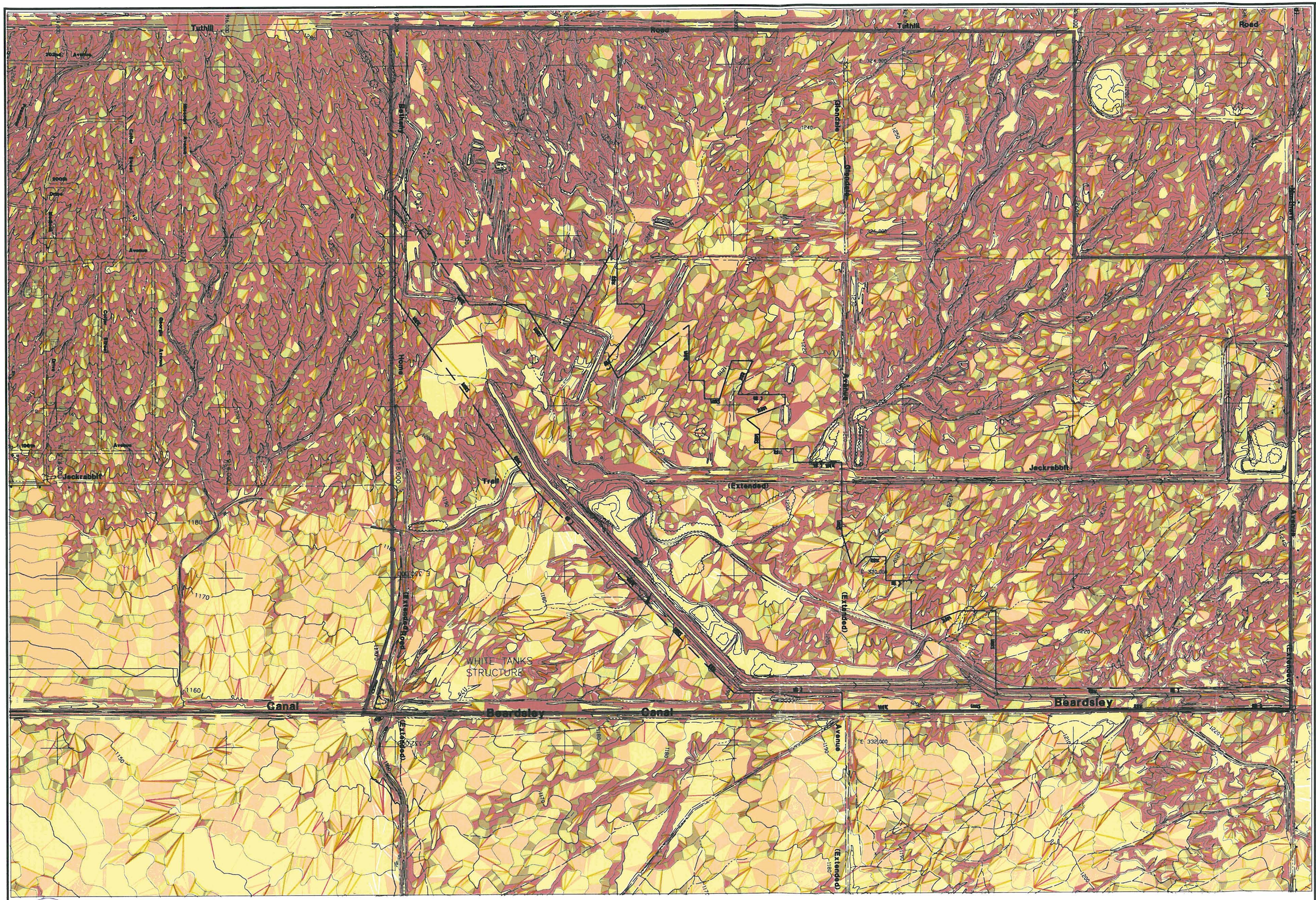
Figure 3-2



Dames & Moore Job No. 15448-007-058

Basin Parametric Evaluation - Basin Option Cross-Sections

Figure 3-3



LEGEND:

SITE SLOPE LEGEND

Color	Range Begin	Range End	Percent Coverage	Area (Sq. Ft.)
	0.00	0.50	12.2	21512161
	0.50	1.00	9.3	16373901
	1.00	1.50	15.0	26528887
	1.50	2.00	11.6	20494697
	2.00	2.50	9.3	16369710
	2.50	100.00	42.7	75464710

APPROXIMATE PROJECT BOUNDARY

SOURCE:
BASE MAP OF WHITE TANKS/AGUA FRIA A.D.M.S. TOPOGRAPHIC MAPS, FLOWN 12/22/89 BY COOPER AERIAL OF PHOENIX, INC. FOR THE WLB GROUP INC., AREA DRAINAGE MASTER STUDY.

NORTH

0 600 1200
SCALE IN FEET
2 FOOT CONTOUR INTERVAL

WHITE TANKS FRS #3

SLOPEMAP.DWG 2-9-00

Flood Control District of Maricopa County

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Slope Classification Site Plan

Figure 3-4