# FINAL
# REHABILITATION PLAN/
# ENVIRONMENTAL ASSESSMENT
**FOR THE**

# W H I T E  T A N K S  NO. 3
# P R O J E C T
**M a r i c o p a  C o u n t y,  A r i z o n a**

***Photo Year 2004***

Prepared by:

*Flood Control District of Maricopa County*
*Agua Fria - New River Natural Resource Conservation District*
*Buckeye Valley Natural Resource Conservation District*

Assisted by:

*UNITED STATES DEPARTMENT OF AGRICULTURE*
*Natural Resources Conservation Service*

**June 2004**

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# REHABILITATION PLAN – ENVIRONMENTAL ASSESSMENT

# for the

# White Tanks No. 3 Project

# Maricopa County, Arizona

This document describes Rehabilitation Plan for the White Tanks No. 3 Floodwater Retarding Structure (hereinafter referred to as White Tanks No. 3 FRS) and associated measures. The White Tanks No. 3 FRS was built under a pilot watershed project authorized under the heading "Flood Prevention" of the Department of Agriculture Appropriation Act of 1954 (Public Law 156, 67 Stat. 214) known as the White Tank Watershed Protection Project in 1954. In January 2002, the Sponsors requested funding under the rehabilitation bill to complete planning for a more permanent solution to the dam safety problems and at the same time investigate additional measures to protect the downstream residents from flooding. For this reason, the watershed plan, as written and approved in 1996, will not be installed. This Rehabilitation Plan for the White Tanks No. 3 Project replaces the original document signed in 1954, modifies the existing FRS and extends its useful design life for an additional 100 years.


Prepared by:

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June 2004

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# WATERSHED AGREEMENT FOR THE REHABILITATION PLAN FOR THE WHITE TANKS NO. 3 PROJECT

Flood Control District of Maricopa County
Agua Fria - New River Natural Resource Conservation District
Buckeye Valley (formerly Buckeye- Roosevelt) Natural Resource Conservation District
(Referred to herein as Sponsors)

State of Arizona

and the

Natural Resources Conservation Service
United States Department of Agriculture
(Referred to herein as NRCS)

Whereas, the U.S. Soil Conservation Service (SCS) built Floodwater Retarding Structure No. 3 called White Tanks No.3(AZ00108) in 1954 under a pilot watershed project, authorized under the heading "Flood Prevention" of the Department of Agriculture Appropriation Act of 1954 (Public Law 156, 67 Stat. 214), and known as the White Tank Watershed Protection Project; and

Whereas, it has become necessary to modify said White Tank Watershed Protection Project and agreement; and to extend the effective life for said White Tanks No. 3 FRS beyond its previously evaluated life; and

Whereas this document is being prepared under the authorities of The Watershed Protection and Flood Prevention Act (PL-83-566) as amended by the Watershed Rehabilitation Amendments (PL-106-472); and

Now, the Secretary of Agriculture, through NRCS and the Sponsors hereby agree on this rehabilitation plan for the White Tanks No. 3 Project, and that the works of rehabilitation be evaluated with consideration of a useful life of 100 years and thus the term of this Agreement cover the term of the useful life. The works of improvement for this rehabilitation project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this rehabilitation watershed agreement and including the following:

1. The Sponsors hereby agree that they will comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4601 et. seq. as implemented by 7 C.F.R. Part 21) when acquiring real property interests for this Federally assisted project. If the Sponsor is legally unable to comply with the real property acquisition requirements of the Act, it agrees that, before any Federal financial assistance is furnished, it will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement

may be accepted as constituting compliance. In any event, the Sponsor agrees that it will reimburse owners for necessary expenses as specified in 7 C.F.R. 21.1006(c) and 21.1007.

The Sponsors and NRCS will share the costs of relocation payments in connection with the displacements under the Uniform Act as follows:

| | **Sponsors** | **NRCS** | **Estimated Relocation Payment Costs** |
|---|---|---|---|
| | **35%** | **65%** | |
| **Relocation Payments** | **$0** | **$0** | **$0** |

2. The Sponsors will be responsible for the costs of water, mineral, and other resource rights and will acquire or provide assurance that landowners or resource users have acquired such rights pursuant to state law as may be needed in the installation and operation of the works of improvement. The costs associated with the subject rights are not eligible as part of the Sponsor's cost-share requirement.

3. The Sponsors will obtain all necessary Federal, state, and local permits required by law, ordinance, or regulation for installation of the works of improvement. The cost of such permitting is not eligible as part of the Sponsor's cost-share requirement.

4. Only eligible service performed and landrights acquired by the Sponsor after November 9, 2000 (date of enactment of PL-106-472), may be credited to the Sponsors cost-share requirement..

5. The percentages of cost-share includes construction, engineering services, relocation, land rights, integral land treatment, and project administration.

The amount of Federal funds that may be made available for rehabilitation shall be equal to 65 percent of the total rehabilitation costs, but shall not exceed 100 percent of the actual construction costs incurred in the rehabilitation. The Sponsors shall be responsible for the non-Federal share of the cost of the rehabilitation project. The value of in-kind contributions provided by non-Federal entities may be credited to the Sponsor when determining the total cost of the rehabilitation project and the 35 percent cost-share requirement. The Sponsor will not receive cash reimbursement for in-kind contributions that exceed the 35 percent cost-share amount. The actual rehabilitation cost share in consideration of the Sponsors in-kind contributions are shown as follows:

| Works of Improvement | NRCS | Sponsors | Total |
|---|---|---|---|
| Cost Sharable Items | | | |
| Rehabilitation of dam (Construction Costs) | $16,005,100 | $1,349,200 | $17,354,300 |
| Relocation, Replacement in-kind | $0 | $0 | $0 |
| Relocation, Required Decent, Safe, Sanitary | $0 | $0 | $0 |
| Sponsors Planning Costs | NA | $1,158,000 | $1,158,000 |
| Sponsors Engineering Costs | NA | $1,481,900 | $1,481,900 |
| Sponsors Project Administration | NA | $100,000 | $100,000 |
| Land Rights Acquisition Cost | NA | $4,529,000 | $4,529,000 |
| **Subtotal: Cost-Share Costs** | $16,005,100 | $8,618,100 | $24,623,200 |
| **Cost-Share Percentages a/** | 65.0% | 35.0% | 100.0% |
| Non Cost-Sharable Items b/ | | | |
| NRCS Engineering & Project Administration | $130,000 | NA | $130,000 |
| Natural Resource Rights | NA | $0 | $0 |
| Federal, State and Local Permits | NA | $50,500 | $50,500 |
| Relocation, Beyond Required decent, safe, sanitary | NA | $0 | $0 |
| **Subtotal: Non Cost-Share Costs** | $130,000 | $50,500 | $180,500 |

a/ Maximum NRCS cost-share is 65% of Cost-Sharable items not to exceed 100% of construction cost (including Replacement–in-Kind; Required Decent, Safe, Sanitary; and flood proofing of downstream properties).

b/ If actual Non Cost-Sharable item expenditures vary from these figures, the responsible party will bear the change.

6. The Sponsors will ensure that 50 percent of the drainage area of White Tanks No. 3 FRS is adequately protected before rehabilitation of the floodwater retarding structure.

7. The Sponsors will be responsible for the operation, maintenance, and any needed replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with agreements to be entered into before issuing invitations to bid for construction work. The Sponsors will obtain agreement with landowners or operators to operate and maintain the land treatment practices for the protection and improvement of the watershed. The Sponsors will provide leadership for the preparation of an Emergency Action Plan prior to construction and will update it annually.

A new O&M agreement effective for the life of the installed measures (100 years plus installation period) will be developed for White Tanks No. 3 FRS and associated measures utilizing the NRCS National Operation and Maintenance Manual, and will be executed prior to construction. The O&M agreement will specify responsibilities of the Sponsors and will include detailed provisions for retention, use, and disposal of property acquired or improved with PL-106-472 cost share funds. Annual operation, maintenance and replacement costs are estimated to be $48,700. Should a raise in the dam crest elevation be required due to a rate of subsidence greater than expected, the Sponsors will be responsible for the full cost of the works of improvement.

8. The costs shown in this agreement are preliminary estimates. Final costs to be paid by the parties hereto will be the actual costs incurred in the installation of works of improvement.

9. This agreement is not a fund-obligating document. Financial and other assistance to be furnished by NRCS in carrying out the Rehabilitation Plan is contingent upon the fulfillment of applicable laws and regulations (and the availability of appropriations for this purpose).

10. This agreement does not commit the NRCS to assistance of any kind beyond the 100-year project life.

11. A separate agreement will be entered into between NRCS and the Sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. This Rehabilitation Plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may de-authorize or terminate funding at any time it determines that the Sponsors have failed to comply with the conditions of this agreement. In this case, NRCS shall promptly notify the Sponsors in writing of the determination and the reasons for the de-authorization of project funding, together with the effective date. Payments made to the Sponsors or recoveries by NRCS shall be in accord with the legal rights and liabilities of the parties when project funding has been de-authorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the Sponsors having specific responsibilities for the measure involved.

13. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

14. By signing this agreement the recipient assures the U.S. Department of Agriculture that the program or activities provided for under this agreement will be conducted in compliance with all applicable Federal civil rights laws, rules, regulations, and policies.

15. The Sponsors agree to participate in and comply with applicable Federal, state and local flood plain management and flood insurance programs before project construction commences. The Flood Control District of Maricopa County will continue to adopt, administer and enforce floodplain management regulations, for the purpose of the delineation of floodplains and floodways; the preservation of the capacity of the floodplain to carry and discharge floods; the minimization of flood hazards; and the regulation of the use of land in the floodplain; participation in flood insurance programs. This includes working with local units of government to zone the designated 100-year floodplain, special flood hazard areas, and the designated floodways as defined in the Official Flood Studies. Floodplain regulations shall be based on adequate technical data, competent engineering advice and dam breach impact maps will be provided by competent technical authorities.

16. Certification Regarding Drug-Free Workplace Requirements
(7CFT 3017, Subpart F).

By signing this watershed agreement, the Sponsors are providing the certification set out below. If it is later determined that the Sponsors knowingly rendered a false certification, or otherwise violated the requirements of the Drug-Free Workplace Act, the NRCS, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

*Controlled substance* means a controlled substance in Schedules I through V of the Controlled Substances Act (21 U.S.C. 812) and as further defined by regulation (21 CFT 1308.11 through 1308.15);

*Conviction* means a finding of (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statues;

*Criminal drug statute* means a Federal or non-Federal criminal statute involving the manufacturing, distribution, dispensing, use, or possession of any controlled substance;

*Employee* means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all direct charge employees; (ii) all indirect charge employees unless their impact or involvement is insignificant to the performance of the grant; and (iii) temporary personnel and consultants who are directly engaged in the performance or work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement; consultants or independent contractors not on the grantees' payroll; or employees of sub-recipients or subcontractors in covered workplaces).

A. The Sponsors certify that they will or will continue to provide a drug-free workplace by:

(1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(2) Establishing an ongoing drug-free awareness program to inform employees about --

(a) The danger of drug abuse in the workplace;

(b) The grantee's policy of maintaining a drug-free workplace;

(c) Any available drug counseling, rehabilitation, and employee assistance programs; and

(d) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace.

(3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1);

(4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee will --

(a) Abide by the terms of the statement; and

(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.

(5) Notifying the NRCS in writing, within ten calendar days after receiving notice under paragraph (4) (b) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4) (b), with respect to any employee who is so convicted--

(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1), (2), (3), (4), (5), and (6)

B. The Sponsors may provide a list of the site(s) for the performance or work done in connection with a specific project or other agreement.

C. Agencies shall keep the original of all disclosure reports in the official files of the agency.

17. Certification Regarding Lobbying (7 CFR 3018)
(applicable if this agreement exceeds $100,000).

A. The Sponsors certify to the best of their knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Sponsors, to any person for influencing or attempting to influence an officer or employee of an agency, Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The Sponsors shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

B. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

18. Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions (7 CFR 3017).

A. The Sponsors certify to the best of their knowledge and belief, that they and their principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause of default.

B. Where the primary Sponsors are unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this agreement.

**Signatures:**
**********
****

Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, Arizona 85009

By _____

Date _____

The signing of the Rehabilitation Plan/EA for the White Tanks No. 3 Project was authorized by a resolution of the governing body of the Flood Control District of Maricopa County and adopted at a meeting held
_____ .
(date)

_____
Secretary

2801 W. Durango St.
Phoenix, Arizona 85009

Date _____
**********
****

Agua Fria - New River Natural Resource
Conservation District
12409 W. Indian School Road
Building B, Suite 201
Avondale, Arizona 85323

By _____

Title _____

Date _____

The signing of the Rehabilitation Plan/EA for the White Tanks No. 3 Project was authorized by a resolution of the governing body of the Agua Fria - New River NRCD and adopted at a meeting held _____ .
(date)

_____
Secretary

3150 N. 35th Ave.,
Phoenix, Arizona 85017

Date _____
**********
****

Buckeye Valley Natural Resource
Conservation District
12409 W. Indian School Road
Building B, Suite 201
Avondale, Arizona 85323

By _____

Title _____

Date _____

The signing of the Rehabilitation Plan/EA for the White Tanks No. 3 Project was authorized by a resolution of the governing body of the Buckeye Valley NRCD (formally Buckeye - Roosevelt NRCD) and adopted at a meeting held _____ .
(date)

_____
Secretary

Date _____

**********
****

United States Department of Agriculture
Natural Resources Conservation Service
3003 N. Central Ave., Suite 800
Phoenix, Arizona 85012

Approved By:

_____
Michael Somerville
State Conservationist

Date: _____

**********
*****

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# SUMMARY

## REHABILITATION PLAN -- ENVIRONMENTAL ASSESSMENT
**For**
## WHITE TANKS NO. 3 PROJECT

**Project Name:** WHITE TANKS NO. 3 PROJECT **County:** MARICOPA **State:** ARIZONA

**Latitude:** 33ºN 32' 01
**Longitude:** 112ºW 28' 14

**Project Purpose(s):**

- to address current dam deficiencies in order to meet current NRCS and State of Arizona dam standards, and
- to provide flood protection to approximately 6,000 current downstream inhabitants of the White Tanks No. 3 FRS and all future residents in this rapidly urbanizing watershed.
- To extend the useful life of the White Tanks No. 3 FRS

**Description of recommended plan:**

Rehabilitation of the White Tanks No. 3 Floodwater Retarding Structure (Class C, NRCS classification) to include the following measures:

a) Dam modification to address dam safety issues pertaining to embankment cracking, foundation issues and, where applicable, earth fissures.
b) Increase in dam crest elevation and width to account for past and future land subsidence.
c) Modification of auxiliary spillway to prevent a breach due to spillway erosion and rehabilitatation of spillway discharge training dike;
d) New concrete encased steel pipe outlets;
e) New upstream diversion and flood channel and modifications to culverts and washes to safely convey floodwaters into White Tanks No. 3 FRS;
f) Landscaping to mitigate construction impacts and reduce the visual impact of the White Tanks No. 3 FRS on the surrounding viewshed, and
g) Acquire land rights for project features and to create downstream buffer zone for emergency spillway discharges and to monitor for earth fissures.

**Alternative plans considered:**

1. Future Without Project (or No Action) – The assumption is that the structure would be Sponsor's breach in year 3 and a dam modification in year 7.

2. Dam Modification Alternative

3. Single Basin

4. Sponsor's Breach (without provision for flood protection)

5. Decommissioning of the Existing Structure

6. Other non-structural: Relocation, Flood Proofing, etc.

| Estimated Project Costs: White Tanks No. 3 Project<br>Maricopa County, Arizona | | | |
|---|---|---|---|
| **Item** | **PL83-566 Funds** | **Other Funds** | **Total** |
| **Construction Cost** | 16,005,100 | 1,349,200 | 17,354,300 |
| **Project administration** | 20,000 | 100,000 | 120,000 |
| **Technical assistance** | 110,000 | 1,481,900 | 1,591,900 |
| **Land Rights** | 0 | 4,529,000 | 4,529,000 |
| **Required Permits** | 0 | 50,500 | 50,500 |
| | | | |
| **TOTAL** | **16,135,100** | **7,510,600** | **23,645,700** |

Price Base 2003 June 2004

**Resource information:**

- Watershed size: 8,100 acres in the downstream breach inundation area; approximately 13,120 acres upstream of the dam

- Wetlands: No natural wetlands present. Landforms which could conceivably be classified as wetlands are agricultural irrigation tailwater recovery systems. Floodwater does eventually flow into Gila River but flow is overland and there are no perennially wet "channels".

- Flood plains: The 100-year floodplain area (area that would be flooded without White Tanks No. 3 FRS) is approximately 285 acres. This does not include the overlapping Gila River floodplain.

- Highly erodible cropland: None

- Threatened and Endangered species: None known to inhabit the area.

- Cultural resources: A Cultural Resources/Archeological survey was conducted in the area which could be impacted by construction activities. No eligible sites were discovered.

- Land ownership: Private land - 80 %, State Land - 20 %, Federal Land - 0 %

- Cropland: currently approximately 4,400 acres of cropland (rapidly being converted to urban uses)

- Population of the White Tanks No. 3 Inundation (Impacted) Area

| | | |
|---|---|---|
| 1. Institutional (Perryville State Prison) | 2,400 | (women) |
| 2. Prison Shift Employees | 300 | est. |
| 3. Other Residents | 3,300 | |
| | --- | |
| | 6,000 | |

**Project benefits:**

An estimated 800 structures and 6,000 people protected from a sudden breach inundation.

An estimated 360 residential and commercial properties protected at the 100-year flood event. Project benefits are as follows:

| White Tanks No. 3 Project, Monetary Benefits | |
|---|---|
| | Average Annual Equivalent $ |
| Beneficial annual | $1,784,600 |
| Adverse annual | $1,234,900 |
| Net beneficial | $501,000 |
| | |
| Benefit-Cost Ratio | 1.39:1.0 |
| | |
| Operation /Maintenance/Replacement | $48,700 |

Price Base 2003 June 2004

Flood protection benefits will continue to increase during the lifetime of the project as the benefited area will grow over 1200 percent by the year 2050. A residential area subject to floodwater breakouts from the North Inlet will no longer be subject to frequent flooding.

**Other Impacts:**

1. The downstream face of the FRS will be mitigated by plantings, placement of overburden, and desert-colored soil veneer.

2. There will be no impact on threatened and endangered species.

3. There will be no impact on wetlands.

4. No land use changes will be hastened or slowed by this project action. There is a potential that land use changes could be slowed if the project were not accomplished.

**Environmental values changed or lost:**

1. Habitat - Habitat quality will not be negatively impacted by this project. Low value or previously impacted land upstream of the structure will be either restored after construction materials are removed or improved by hydroseeding and selected plantings.

2. Visual aspect - The negative visual impact of the existing floodwater retarding structure will be improved with the implementation of this rehabilitation plan which has a significant landscaping mitigation component.

3. Construction activity mitigation - The dam modification will primarily take place only on previously impacted project land. Additional fill will be obtained from 2 borrow areas

upstream of the dam. The borrow area totals approximately 90 acres. The borrow area and other disturbed areas will be hydroseeded with a mix of desert shrubs and trees.

Approximately 11.5 acres of "Waters of the United States" will be restored by land forming followed by hydroseeding.

In the North Inlet Channel area approximately 19 acres of disturbed area will be restored by extensive landscaping and hydroseeding of native desert plants.

4. The project area is located within the PM10 Non-attainment Area of Maricopa County as designated by the U.S. Environmental Protection Agency. Project activities will comply with all permits, rules, and regulations associated with the Maricopa County Air Quality Dust Control Program.

**Project beneficiary profile:** The project beneficiary profile shows distinct differences in the benefited population. A primary group of beneficiaries is the approximately 2,400 (female) inmate population and estimated 300 employees at the Perryville State Prison which lies at the centerline of the sudden breach inundation flow. The inmate population is disproportionately minority. Approximately 45 percent are of Hispanic, American Indian, or Asian ancestry.

The remaining residential population is more representative of the county population at large. Estimates show 82 percent white, 4.2 percent African-American, 1.1 percent American Indian, 3.1 percent Asian and Pacific Islander and 9.6 percent of two or more races.

Per capita income in Goodyear is $22,506 which should be reflective of the benefited non-institutional downstream population. This compares to the state average of $ 20,275.

Median home value in the benefited area (Goodyear) is $156,800 compared to the median home value in Phoenix of $146,000.

**Civil rights implications:** There are no proposed policy actions connected with this project which will negatively and/or disproportionately affect the operations of an estimated 1,800 minority inhabitants of the downstream benefited area. This number includes approximately 1,100 non-white women inmates of the Perryville State Prison.

**Major Conclusions:** This project will assist Sponsors to meet project formulation goals and address problems identified during the scoping sessions. These include health and safety concerns, subsidence and the resulting problems of earth fissures, embankment cracking, embankment foundation issues, other dam safety issues and reducing flood damages. This project also addresses concerns related to cultural resource protection, habitat preservation, threatened and endangered species, the visual landscape and wetland concerns.

It will also address the goals of the Flood Control District of Maricopa County, the Agua Fria Natural Resource Conservation District and the Buckeye Valley Natural Resource Conservation District to rehabilitate an existing FRS with identified dam safety deficiencies and maintain the economic growth of the downstream benefited area.

**Areas of Controversy/Issues to be resolved:** There are no areas of controversy or issues to be resolved

**The project area is located in:**

**Arizona Congressional District 2**

# INTRODUCTION

The White Tanks No. 3 Floodwater Retarding Structure (FRS) was built by the Soil Conservation Service (SCS) (now the Natural Resources Conservation Service–NRCS) in 1954 under a pilot watershed project known as the White Tank Watershed Protection Project. The pilot watershed program was authorized under the heading "Flood Prevention" of the Department of Agriculture Appropriation Act of 1954 (Public Law 156; 67 Stat. 214). The Flood Control District of Maricopa County operates and maintains the White Tanks No. 3 Floodwater Retarding Structure.

Originally, the project was to consist of four primary detention structures to reduce damages to down-slope farmland caused by flash flooding from the southern portion of the White Tank Mountains and Trilby Wash watersheds. Due to the existence of military installations in the Trilby Wash watershed, however, the U.S. Army Corps of Engineers undertook works of improvement to protect these Federal properties from flooding. The Corps' McMicken Dam on Trilby Wash provided coincidental protection to farmland in that watershed and eliminated the need for White Tanks structures No.1 and No.2. SCS completed design and construction of White Tanks No. 3 and No. 4 to provide protection to farmland in the southern portion of the watershed. Although the structure was non-classified at the date of construction, it would have been classified as a NRCS Class A Floodwater Retarding Structure under current guidelines.

In 1982, the SCS implemented a remedial action program to address the issue of transverse cracking through the embankment of White Tanks No.3. A section of the embankment was breached and re-constructed and a partially penetrating central chimney drain was installed along the entire length of the embankment. Finger drains were provided at the location of the selected transverse cracks to convey water intercepted by the chimney drain. Additional deficiencies due to subsidence, fissuring, and cracking were not noted but were anticipated due to recent geological findings.

In May 1996, the Flood Control District of Maricopa County, with the assistance of the NRCS, completed a Watershed Plan and Environmental Assessment to rehabilitate the White Tanks No. 3 FRS.

Before remedial efforts could be initiated, Sponsors noticed an increase in subsidence and fissuring in the nearby McMicken Dam constructed by the US Army Corps of Engineers. Radar interferometry measurement, surveys and geotechnical investigations have confirmed the presence of ongoing subsidence near both dams and fissures approaching the McMicken structure. Since its construction in 1954 the crest of White Tanks No.3 has settled approximately 4.0 feet at the north end of the alignment. The Sponsors currently believe that efforts to rehabilitate dam structures in Maricopa County must take into account the increased risk and uncertainty of rehabilitation under the threats of subsidence and fissuring.

In 2000, the Arizona Department of Water Resources classified Structure No.3 as a "significant" safety hazard and, thus, was a high priority for rehabilitation.

The very real threats of these phenomena and the resulting long-term risk to public safety prompted the Flood Control District to consider additional engineered dam replacement alternatives such as excavated basins. However, the Flood Control District completed interim works of improvement in 2002 to insure that White Tanks No.3 performs its functions until all alternatives have been evaluated and a practical and cost-effective plan selected and permanent improvements installed.

The Flood Control District of Maricopa County submitted an application for assistance under this program in order to consolidate all previous planning activities, address all the structural deficiencies and required modifications, and complete the dam rehabilitation in a timely manner. In 2001, NRCS completed a priority ranking process, the Failure and Risk Indices, in order to rank the White Tanks No. 3 with other structures nationally. Based on the risk of failure and the potential impacts to life and property, the White Tanks No. 3 FRS ranked first in the nation.

## NEED FOR THE DAM REHABILITATION

Because the White Tanks No. 3 FRS has dam safety deficiencies, the Sponsors propose a dam modification to correct these deficiencies resulting from subsidence and the proximity of the White Tanks No. 3 FRS to a potential fissure risk zone. Other dam safety deficiencies and potential dam safety deficiencies are noted in the Problems and Opportunities section.

Through the scoping process the Sponsors, with input from the impacted downstream residents have identified three project purposes. They are:

- Correct dam deficiencies and address potential dam safety deficiencies in order to meet current NRCS and State of Arizona dam standards, and
- to provide flood protection to approximately 6,000 current downstream inhabitants of the White Tanks No. 3 Watershed and all future residents in this rapidly urbanizing watershed.
- To extend the useful life of the White Tanks No. 3 FRS.

Structure No.3 was, and still is, classified by the Arizona Department of Water Resources as having significant deficiencies. Therefore it is a high priority for rehabilitation. It carries a Class C NRCS hazard classification.

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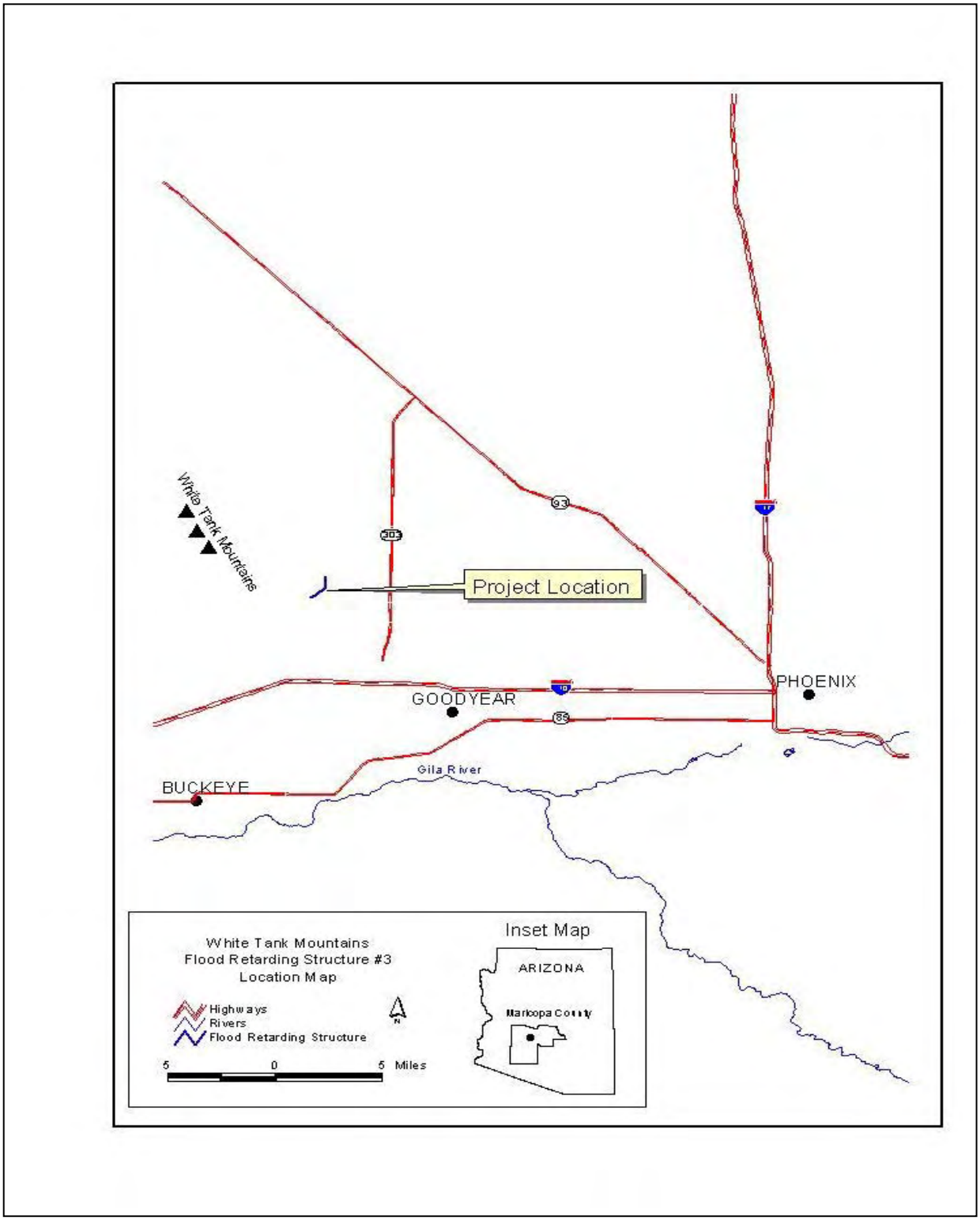
## SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The Rehabilitation Plan identifies the National Economic Development (NED) plan and a recommended replacement plan to solve the identified problems and reduce the risk and uncertainty caused by the placement of a floodwater retarding structure in an area subject to subsidence and fissures. The Rehabilitation Plan will describe the economic, environmental, and social impacts and discuss the impacts of the rehabilitated structure on resources of local, state, and national concern.

A scoping process was conducted to determine objectives and primary concerns of the project Sponsors and to identify other relevant issues and environmental effects associated with this rehabilitation project. The objective of project Sponsors is to rehabilitate the existing dam to meet current design and safety criteria in order to restore flood protection at least to the level of the 100-year event and extend the service life of the dam for the coming 100 years. Several meetings and watershed site visits were held with the watershed stakeholders to discuss watershed issues and potential impacts from the implementation of remedial measures. Areas of potential concern were evaluated and are listed in Table I along with their significance to decision making. The NRCS finds that no significant negative environmental effects will result from the rehabilitation of the White Tanks No. 3 Project and associated measures. Therefore, a Finding of No Significant Impact (FONSI) will be prepared.

Rehabilitation projects shall be in compliance with all National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA) provisions (see 503.43, NRCS National Watershed Manual (NWSM)). The formulation and evaluation of this Rehabilitation Plan for the White Tanks No. 3 Project have been developed using "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) which is required by all Federal water resources development agencies.

White Tanks No. 3 FRS – General Location Map



# PLAN SETTING

## Study Location

The White Tanks No. 3 Floodwater Retarding Structure (FRS) lies approximately 10 miles west of Phoenix. (See Location Map on opposite page and Project Map in Appendix D). The contributing watershed, the FRS, and the downstream breach impacted area lie wholly within Maricopa County, Arizona. The total contributing acreage inflow to the structure is 13,120 acres. Downstream from the White Tanks No. 3 FRS, the study area consists of the local drainage into what would have been the normal unobstructed watershed drainage south to the Gila River, a distance of approximately 12 miles. The downstream "uncontrolled" drainage is approximately 142,700 acres.

## Original Justification for the Dam

Following the disastrous floods of 1951, the Agua Fria Soil Conservation District (now the Agua Fria-New River Natural Resource Conservation District) with the technical assistance of the Soil Conservation Service prepared plans designed to reduce the damages caused by flash runoffs from the White Tank-Trilby Wash watersheds.

Runoff from the White Tank Mountains and the intervening foothills flow over the Beardsley Canal located at the western edge of the flood plain. After passing over the Canal, floodwater spreads out over the flat terrain due to the absence of defined channels. As sheet flow concentrates in roads and irrigation ditches it breaks over into adjoining fields. Previous attempts by farmers in the area to control floodwater, once it had crossed the Beardsley Canal, were not successful.

Farm property incurred the greatest damage due to field flooding, crop yield reduction, and damage to irrigation pumping facilities and conveyance structures.

Roadways and rail conveyance were also damaged. Over time, roadways had been eroded below original grade and thus served as channelways. The proximity of irrigation conveyance to roadways did not allow adequate roadway drainage, causing water-logged sub-standard

roads. Railroads would lose ballast where floodwater over-topped the railbed. When the railbed was degraded, major repair work was required before trains could move again.

The Work Plan for the White Tanks Watershed indicated that damaging floods occurred, on the average, every two years, although the extent, magnitude, duration and severity were not quantified. Eighty-five percent of the floods occurred during the summer months when crops were most susceptible to damage. The flood of August 28, 1951, caused direct damage of more than $200,000 (1951 prices). At the time the watershed plan was completed, estimated average annual damages were estimated at $35,350 for both the White Tanks No. 3 and No. 4 watersheds. No 100-year and 500-year floodplains were delineated at that time.

Average annual costs for the construction of the measures was $20,860 and the benefit-cost ratio was estimated at 1.7:1.0.

**Original Planning Efforts**

Efforts to control high runoff in the White Tank-Trilby Wash watersheds date back to at least 1939. At that time, efforts were made by local interested groups to establish a soil erosion demonstration project. In 1945, the Agua Fria Soil Conservation District was organized for the express purpose of unifying flood control efforts. At various times, plans to alleviate the flood problem were prepared, but inability to finance delayed construction. Minor works of improvement, however, were periodically done by individual landowners.

At that time, engineering and hydrologic studies determined that the most effective methods of controlling surface runoff from the watershed of Avondale Wash above the Beardsley Canal was by the construction of two retarding structures and 11 miles of diversions. The diversions were designed to divert runoff from small subwatersheds into retarding structures (No. 3 and No. 4) located in the larger subwatersheds. Small stabilizing and sediment control structures were planned in the upper watershed to provide sediment storage and desilting basins to increase the design life of the retarding structures. The cost of White Tanks No. 3 as shown in the planning document was $229,500 (1951 dollars).

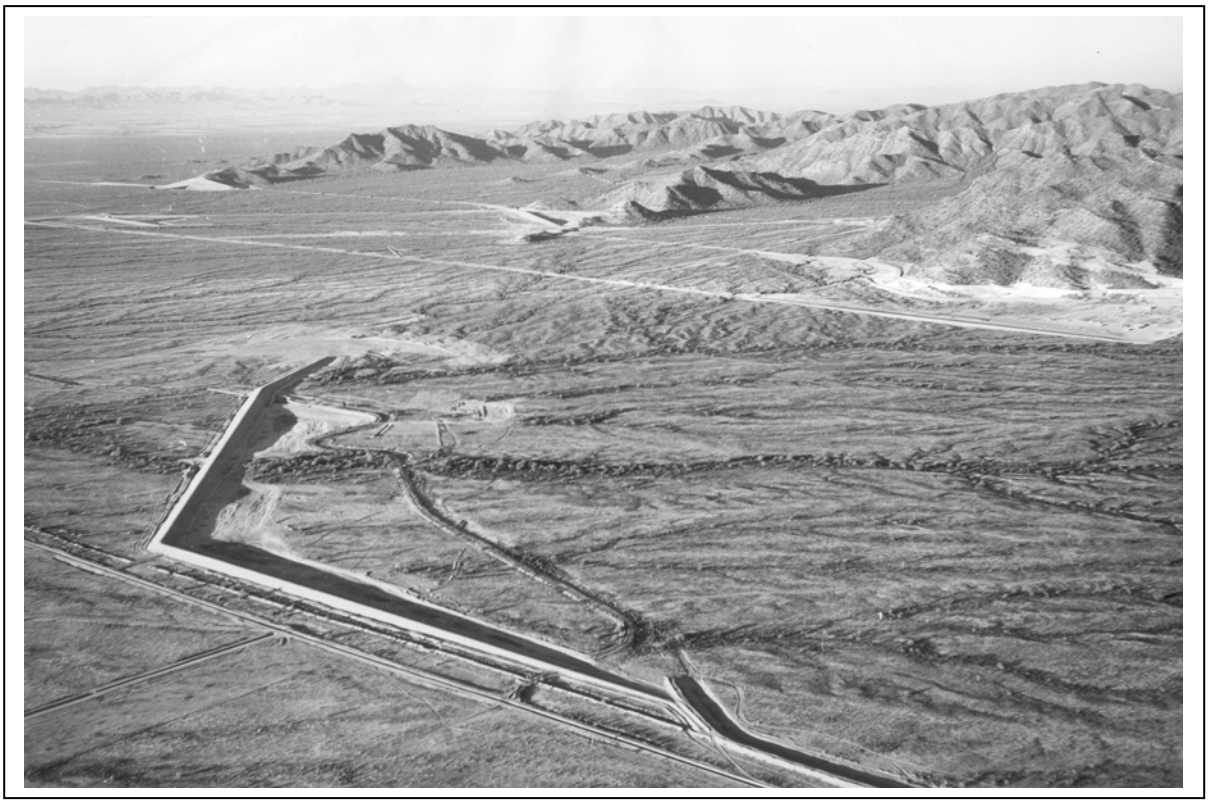


*Photo Year 1955*

For design purposes, the area-depth-duration relationship for storm rainfall was developed from a number of high intensity storms which occurred in central and southern Arizona. For reservoir design, a storm of four-inch point rainfall was used. This was estimated to have a reoccurrence interval of more than 100 years. Retarding structure No. 3 discharges would flow into the Beardsley Canal. Maximum evacuation time for the detention reservoirs was not to exceed five days.

The spillway capacities were based on the occurrence of design storms centered over each watershed so that the maximum runoff would be detained at the structure. Flood pool design included sufficient capacity to store 50 years of sediment without degrading overall detention capacity.

After construction of the White Tanks structures, the Soil Conservation Service and the Sponsors executed agreements to assure adequate maintenance by periodic inspections, at least annually, were made by a responsible local agency with representatives of the SCS.

**Existing Structure**

The White Tanks No. 3 FRS was built as a flood control structure in 1954 under the Pilot Watershed Program authorized by the Department of Agriculture Appropriation Act of 1954. It was initially a homogenous earth dam, constructed by the NRCS (then the Soil Conservation Service, SCS). Filter/drainage works were added in later renovations.

The structure is a compacted earthfill embankment, constructed using material borrowed from the pool area of the dam. It has a crushed caliche and coarse gravel facing on the upstream and downstream surfaces, and on the crest. The dam consists of two segments; the southwesterly segment and the northerly segment which parallels the Beardsley Canal. Total length of the dam is approximately 7,670 feet.

The embankment is approximately 30 feet high. The structure crest width varies between 10 and 11 feet at the crest to a maximum of about 134 feet at the base. The upstream and downstream faces are sloped at 2.5:1 (horizontal to vertical) and 2:1, respectively.

Three gated corrugated metal pipes (CMPs) through the embankment serve as the principal outlets from the impoundment. Two of the outlets are 48 inches in diameter and one outlet is 24 inches in diameter. The northernmost outlet drains into to the Beardsley Canal via a shotcrete-lined channel, while the other two outlets discharge into desert washes. Each outlet is gated with inlet flush with the upstream face of the dam. The auxiliary spillway is cut into natural ground at the right (southern) abutment of the dam.

The FRS was originally planned with a detention pool of 2,460 ac. ft. and a sediment storage volume of 193 acre feet. Existing total capacity volumes obtained from recent topographic surveys show an actual combined flood storage and sediment volume of 3,250 acre feet. To date, the reservoir has never impounded more than 300 acre feet of water.

As part of the original project, the north inlet diversion channel was constructed to direct water from the Waterfall and Cholla Washes into the Beardsley Canal Wash. The flows were then routed into the White Tanks No. 3 detention basin.

The area immediately upstream of the existing FRS consists primarily of desert washes and creosote-plain landscapes characterized by dry sandy drainages cutting across relatively flat desert scrub areas. The water retention basin area is a relatively smooth depressed area that sometimes holds water. The basin was created by the construction of the FRS which has sharp uniform edges and a flat top that contrasts with the surrounding desert washes and relatively flat landscapes. There is a two-year flood pool immediately above the FRS which was created during original construction. This flood pool, along with the desert washes total approximately 60 acres and are considered to be Waters of the U.S. as defined by the U.S. Army Corps of Engineers.

**Geographic Setting**

The White Tanks No. 3 downstream breach inundation area is located in the planning area of the City of Goodyear, a rapidly growing community located approximately 20 miles west of downtown Phoenix in western Maricopa County, Arizona. The expanding patterns of growth and subsequent roadway extensions in the Phoenix Metropolitan Area have increased the area's attractiveness and accelerated its development.

The incorporated area of Goodyear exhibits an elongated rectangular shape, ranging between 6 and 7 miles from east to west, and 22 miles from north to south. The White Tanks No. 3 inundation area runs northwest of the city center in a north to south direction. At the highest part of the contributing watershed, the slopes are steep with little vegetative cover. Once the alluvial fan reaches the flatter portions of the watershed (the agricultural area), the majority of the terrain slopes are less than 3 percent and drain to the middle of the planning area. It then drains south into the Gila River which flows from east to west. Goodyear's natural vegetation includes primarily Sonoran Desert species such as cacti, creosote bush, and Palo Verde. Plant species located along the Gila River include cottonwood, willow, mesquite, and salt cedar.

**Demographics**

The City limits of Goodyear, which includes a significant part of the inundation area, has increased its population almost 400 percent (from 6,258 residents in 1990 to 26,716 in 2002*). Growth is attributed to the availability of affordable and plentiful land for new housing development as well as the considerable growth in the economic sectors of the City and region.

Non-prison population by race/ethnic status included 82 percent Caucasian, 4.2 percent African-American, 1.1 percent American Indian, 3.1 percent Asian/Pacific Islander and the remainder of "other" or more than one race. An estimated 19.8 percent of the population is of Hispanic heritage. Based on an average household size of 2.69 persons per house, the estimated current (non-institutional) population of the White Tanks No. 3 downstream breach inundation area is currently 3,600 (includes estimates of numbers of prison staff).

North of Interstate 10 (I-10), between Cotton Lane and Perryville Roads, is the sprawling Perryville Prison Complex and farm, an Arizona Department of Corrections facility housing approximately 2,400 female inmates. In May 2003, the facility contained 54.8% Caucasian inmates, 13.2 % African-American inmates, 6.8 % Native American inmates, 21.6 % Mexican-American inmates, and 3.6 Mexican nationals and others.

The total population in the downstream breach inundation area is currently 6,000.

**********

* Goodyear General Plan Update 2002-2003

Per capita income for all persons in Goodyear in 1999 average $22,506 while per capita income in the State of Arizona for the same period was $20,275. Per capita income amounts do not include the institutionalized prison population.

In 2002, owner occupied housing in Goodyear had a median value of $156,800 which is 8.1 percent higher than the median home cost in the Phoenix Metropolitan Area. Average household income in Goodyear averages $57,492 versus the Maricopa County average of $45,358.

Although there are an estimated 4,400 acres of land in the downstream breach inundation area still utilized for cropland and several hundred acres are utilized for ranching, there are few remaining farmsteads in the area. Much of the land used for agriculture is currently owned by trusts, partnerships and development and land holding companies. As the farmland continues to be converted to housing developments, the remaining farmsteads will be converted to urban uses.

A number of horse-properties, sometimes referred to as ranchettes (homes with attached acreage used for pasture or other uses) remain as “islands” in a sea of housing developments.

**Future Population and Housing Outlook**

As previously noted, in the past 13 years (from 1990-2003), the City of Goodyear experienced a population growth rate that exceeded 400 percent. Even though the City's population was very small in 1990 (6,258), by 2000 its expansion was significant (18,911) (U.S. Census, 2000). By late 2002, the City's population was estimated at 26,716 (MAG 2002).

If the City were to maintain the average annual population growth rate (20.2 percent) that it experienced over the last 10 years, it could contain a population of approximately 162,000 residents by the year 2012. A population growth rate that is 50 percent of the growth over the past 10 years would produce a total population of 67,000. If the population maintained a growth rate that was 75 percent of the increase that occurred over the last 10 years, the City could grow to a population of 104,000 in the same timeframe. Additional population projections are shown in the following table:

| Table A: Projected Growth Rates – Project Area | | | | | |
|---|---|---|---|---|---|
| | **2000** | **2010** | **2020** | **2030** | **2050** |
| Upstream of FRS (est.) | 500 | 3,100 | 8,200 | 10,760 | 10,760 |
| Downstream of FRS (est.) | 6,000 | 12,500 | 31,800 | 38,300 | 38,300 |
| Goodyear 1/ | 18,500 | 38,100 | 92,600 | 172,400 | 293,100 |
| Phoenix 1/ | 1,298,121 | 1,544,100 | 1,795,500 | 2,132,800 | 2,567,900 |
| Maricopa 1/ | 2,954,200 | 3,709,600 | 4,516,100 | 5,390,800 | 7,264,731 |
| Arizona 1/ | 4,962,000 | 6,145,100 | 7,363,600 | 8,621,100 | 11,171,000 |

1/ from the Arizona Department of Economic Security

Based upon the amount and types of land uses designated on the draft land use plan, the population buildout of the Goodyear Planning Area could eventually total approximately 360,000 residents. (Goodyear General Plan Update 2002-2003)

The White Tanks No. 3 FRS is expected to have growth patterns similar to that of the City of Goodyear.

According to the Goodyear General Plan Update 2002-2003, there are more that 12,000 platted housing units in the City at the present time. More than 100,000 dwelling units have been granted zoning approvals by the City.

Photos on the following page show recent development in the area immediately downstream of the White Tanks No. 3 FRS.

Typical development in area downstream of White Tanks No. 3 FRS

Perryville State Prison downstream of White Tanks No. 3 FRS

**General Economy of the Impacted Area**

The history of human occupation in the region began in 500 A.D. when the Hohokam Indians inhabited the Salt River Valley. Like the Hohokam Indians, early European settlers made their livelihood hunting and trapping in the Gila and Agua Fria Rivers. Later, settlers established homesteads on the fertile soil north of the river. Several farm operations remain in western Goodyear. These working vegetable, fruit, and cotton farms and research centers assist in showcasing Goodyear's extensive agricultural roots.

Goodyear was founded in 1916 by the Goodyear Tire and Rubber Company, which grew cotton in the area for use in tire manufacturing. The City later expanded to accommodate the Goodyear Aircraft plant and its employees in the 1940s. The City incorporated on November 19, 1946. At the time of its incorporation, Goodyear consisted of 151 homes and 250 apartments. Local amenities included a grocery store, drug store, barbershop, beauty shop, and a service station.

The community's access to major transportation corridors accelerated its growth. Goodyear now has a strong and diverse economic base. Several industries are represented in the City of Goodyear including the aerospace industry, food processing, and manufacturing. The aerospace industry is primarily centered on the Phoenix/Goodyear Airport. The three largest employers within the City include the State of Arizona Perryville Prison, McLane Sunwest (a division of Wal-Mart), and Lockheed Martin Management and Data Systems.

Outside of central Goodyear, the project area has been primarily rural with the local communities providing supply and transportation functions for agricultural commodities, produced in the area. In the last several years more light manufacturing and commercial enterprises have moved into the area reducing the community's dependence on the agricultural economy.

Currently Goodyear's incorporated area contains approximately 116 square miles (74,240 acres) of land. Since 1980, however, there has been a significant growth of light manufacturing

and of goods and services industries around in the Interstate 10 (I-10) corridor and south toward State Route 85 and the airport. Since Goodyear began experiencing an increase in these types of industries and growth in the home building sector, its economy has become much less reliant on agriculture. Goodyear, like most of the smaller communities between Phoenix and Buckeye, has diversified their economic base to include manufacturing, trade, and services. This expansion and diversification has been facilitated by its location in the major growth corridor between Phoenix and Buckeye along the I-10 corridor.

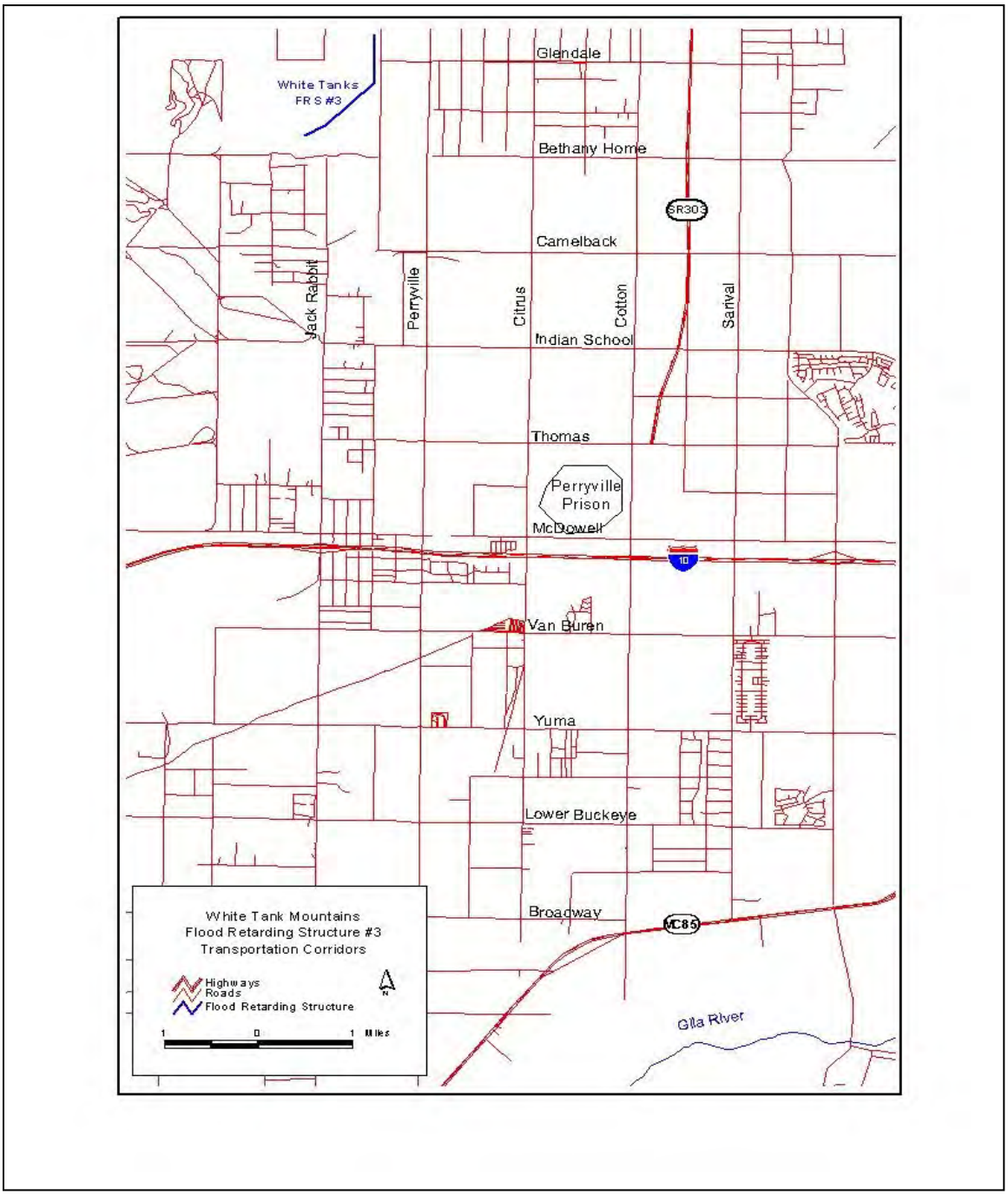
**Transportation**

The existing and proposed high capacity vehicular transportation corridors are primarily located in the northern half of the Goodyear Planning Area. Interstate 10 extends east-west and State Route 303 (SR 303) is sited on a north-south orientation. State Route 85 (SR 85) runs north-south and located on the western side of Goodyear and is in the process of being upgraded to a full freeway between Gila Bend and I-10 (See Figure 1).

On I-10 through the planning area, current average daily traffic (ADT) volumes (i.e., 53,000 to 92,000) are approaching and slightly exceeding the 75 percent volume level predicted for 2020, (i.e., 115,000-162,000 ADT) in the existing Goodyear General Plan. Improvement plans identified in the Maricopa Association of Governments' (MAG) 2002 Long Range Transportation Plan Update call for widening I-10 to 8 lanes west to 83 rd Avenue, and 6 lanes west to Dysart Road, 1 mile east of the study area.

Future improvements to SR 303 and Maricopa County 85 (MC-85) are currently in the planning stages. Proposed improvements to SR 303 north of Goodyear include crossing Grand Avenue and connecting with Interstate 17 (I-17). South of I-10, the Maricopa County Department of Transportation (McDOT) has recently completed a Design Concept Report (DCR) for the section of SR 303 extending south from Indian School Road to MC-85. McDOT is currently performing a corridor study for the southern most segment (MC-85 to Riggs Road) to evaluate various location and design alternatives. This will most likely run through the White Tanks No. 3 downstream breach inundation area.

**Figure 1: Primary Transportation Corridors in White Tanks No. 3 Planning Area**




With Goodyear's continued growth, traffic congestion is increasing. All of Goodyear's arterial roadways are, however, currently functioning at acceptable levels of service (LOS).

**Agricultural Economy**

With the arrival of settlers in the White Tanks area, natural vegetation was replaced with crops including cotton, vegetables, fruit, and alfalfa. The fields were irrigated with groundwater and surface water conveyed through the Buckeye and Roosevelt Irrigation District Canals.

Three irrigation districts currently hold surface water rights and distribute irrigation water throughout the area to their agricultural-based clients. The Buckeye Irrigation Company (BIC) supplies water to approximately 1,070 acres, or 1 percent of the City of Goodyear planning area.

The Maricopa County Municipal Water Conservation District No. 1 (MWD) supplies irrigation water to approximately 3,840 acres within the Goodyear Planning Area. The Roosevelt Irrigation District supplies irrigation water to approximately 13,000 acres of land, comprising 15 percent of the planning area. In 1990, the average annual potable water deliveries for the supplied area were 0.75 acre-feet per acre.

More recently, agricultural land has been converted to urban uses as housing developments have been constructed in the White Tanks area. The remaining farmers in the project area generate income from the sale of crops, primarily cotton and alfalfa. Except for cropland owned by the Perryville Prison for the provision of food for the inmate population, much of the cropland is owned by real estate developers. Agricultural lands north of I-10 are beginning to be subdivided and housing construction has begun. Although the long-range Plan for the Goodyear Planning Area envisions agriculture as a continuing industry, the proximity of homes and schools may make traditional agricultural activities difficult to continue.

There are an estimated 4,400 acres of land in the breach inundation zone still utilized for farming and several hundred acres utilized for grazing in the White Tanks No. 3 inundation area. Much of the land is owned by trusts, partnerships, development and holding companies. It is likely that all the currently held privately-owned farm and ranch land will be converted to urban uses within the next 10-20 years. The State Prison at Perryville owns a significant

amount of land which is currently farmed. It is likely that this farmland will continue to be farmed as the farmland also provides a buffer around the prison to prevent the encroachment of developments to the prison itself. The State of Arizona has made a significant investment in the Prison Complex and it is unlikely that the prison would ever move from its current location.

Agricultural land in Maricopa County has declined from 1.43 million acres in 1982 to 708,650 acres in 1997. From 1992 to 1997 agricultural land lost in Maricopa County was approximately 3 percent. Based on current data for the White Tanks No. 3 area, it is expected that agricultural land conversion is proceeding at a rapid pace. In Maricopa County, agricultural cash receipts from crops have declined from $414.0 million in 1994 to $293.1 million in 2002. Maricopa County currently ranks second in Arizona in cash receipts for crops behind Yuma County and ahead of Pinal County.

Cotton, although the predominant crop in Maricopa County, is produced on approximately 13.4 % of the farmland in the White Tanks No. 3 area (depending on the year). Alfalfa, small grain, and vegetables are grown on the remaining farmland. In recent years, the proximity of the White Tanks No. 3 downstream area to Phoenix has increased the attractiveness of horticultural crops. But even returns from the high value horticultural crops cannot match the economic return of residential and commercial development. Thus, it is likely that the agricultural lands will eventually be converted to urban land uses. The estimate of planted acres for the 2003 crop year was approximately 2,990 acres.

Table B shows a recent survey of crops grown in the breach inundation area of the White Tanks No. 3 FRS.

| Table B: Cropping Pattern, White Tanks No. 3 Inundation Area, 2003 | | |
|---|---|---|
| | **Acreage** | **Percent Of Total** |
| **Cotton** | 590 | 13.4 |
| **Alfalfa** | 640 | 14.6 |
| **Wheat** | 530 | 12.0 |
| **Vegetables** | 470 | 10.7 |
| **Potatoes** | 420 | 9.6 |
| **Corn** | 280 | 6.3 |
| **Not planted** | 1,410 | 32.0 |
| **Pasture** | 60 | 1.4 |
| **Total** | **4,400** | **100.0%** |

June 2004

**Surface Water Resources**

Although the City only provides its customers with drinking water from groundwater, it has an available source of imported surface water through the Central Arizona Project (CAP). Unfortunately, the City does not have the facilities necessary to convey it to the City. Approximately 7,100 acre feet of CAP water has been allotted to the City as a result of a water settlement. The City is also pursuing an additional 7,100 acre feet of CAP water from an Arizona tribal community. The purchase of these additional supplies is anticipated to occur in 2005 or 2006.

The White Tanks Regional Water Treatment Plant, a project to put CAP water to potable use within the Goodyear area, is being led by the Arizona-American Water Company (AAWC), who purchased a 45-acre site at the northwest corner of Cactus and Perryville Roads. The site, which will eventually treat a minimum capacity of 80 million gallons per day (mgd), is located adjacent to the Beardsley Canal, which will act as a conduit to convey water from the CAP canal. Thus a major portion of this transport system lies within the benefited area.

The Beardsley Canal is capable of delivering 80 mgd of CAP water to the treatment plant. Once treated, the water will be conveyed in a distribution system that will connect to the City of Goodyear along Camelback Road, between Sarival Avenue and Perryville Road. The City hopes to negotiate with the AAWC to secure a pro-rata share of the treatment facility capacity in order to utilize its CAP allocation for future potable use.

**Land Use/Land Ownership**

The Goodyear Land Use Plan was developed to illustrate the general location of appropriate land uses to guide future growth and revitalization. The planning area consists of approximately 86,400 acres comprising 135 square miles. The biggest portion of the land within the planning area is privately held, accounting for approximately 63,800 acres or 74 percent. The majority of this privately-held land is utilized for agricultural and residential uses. State lands account for nearly 11,000 acres or 13 percent of the planning area. Their holdings are comprised of developed and vacant land including Perryville Prison and additional land to the west. Additional state trust land is located on scattered tracts south of the Gila River along the western boundary of the City with a major holding located south of Estrella Mountain Regional Park. Land use for the White Tanks No. 3 downstream breach inundation area is shown in Table C.

**Table C: Acreage by Land Use, Downstream breach inundation Area White Tanks No. 3**

| | Acres | Percent of Area |
|---|---|---|
| **Agricultural** | 4,400 | 54 |
| **Urban** | 2,000 | 25 |
| **Other** | 1,700 | 21 |
| **Total** | **8,100** | **100** |

June 2004

Land use trends for the county project a rapid increase in the urban component and a decrease in agricultural land as in-migration into the area continues. Land use plans for both Goodyear and Maricopa County project the conversion of all agricultural lands in the inundation zone to residential and commercial development.

The largest single landholder in the White Tanks No. 3 area is the State of Arizona (Perryville State Prison, State Land Department) followed by various individuals and corporations (See Table D).

**Table D: Acreage by Land Ownership, Downstream Area White Tanks No. 3**

| | Acres | Percent of Area |
|---|---|---|
| **Private** | 6,450 | 80.0 |
| **State** | 1,650 | 20.0 |
| **Total** | **8,100** | **100** |

June 2004

**Climate**

Annual precipitation averages less than 8 inches in nearby Litchfield Park. Rainfall is biseasonal and late spring is especially dry. Summer rains result from intense, but highly localized thunderstorms. Winter rains are gentler and more widespread, but amounts of precipitation vary greatly from year to year. Maximum summer temperatures are hot and average more than 100 degrees F from June through September, but diurnal temperatures vary as much as 40 degrees. Minimum winter temperatures are usually in the 30s but reach the 60s and 70s during the day.

There are two separate precipitation and flooding seasons in Arizona. The first occurs from November to March, when the region is subjected to occasional storms from the Pacific Ocean.

These storms have the potential to cause the most damage. The second rainfall season occurs in July, August, and most of September, when the area experiences widespread thunderstorm activity associated with moist air moving into Maricopa County from the south and southeast. These thunderstorms are extremely variable in intensity and location, and some of the heaviest precipitation in a short period occurs during these months. The flooding that results is also more localized and of a shorter duration. However, the damages, resulting from a flood of this nature, can be just as devastating.

**Regional Geology**

The White Tanks FRS No.3 is located in the Desert Section of the Basin and Range physiographic province which is characterized by steep, discontinuous subparallel mountain ranges, separated by broad, deep, alluvium-filled basins. These alluvial basins consist of unconsolidated to moderately consolidated silts, sands, clays, and gravels. The project area is located on alluvial fan deposits at the margin of the western Salt River Valley and near the base of the White Tank Mountains. Depth to bedrock in the western Salt River Valley is more than 11,000 feet in the central part of the basin. Depth to bedrock at the dam site is unknown. However, from water well information (ADWR 1998), it appears that depth to bedrock along the northern portion of the dam is at least 1100 feet. Depth to bedrock at the southwestern part of the dam is less, probably around 800 ft., because of closer proximity to the White Tank Mountains.

**Soils**

The NRCS Maricopa County, Arizona, Central Part, soil survey contains engineering information intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction.

It also predicts soil behavior for selected land uses such as embankments and dikes and levees. Critical soil characteristics such as flooding, geologic age, susceptibility to piping, and shear strength are addressed. The development of alternatives to address natural resource problems must consider detailed physical characteristics, soil maps, soil description, and other data provided in the soil survey.

Of particular importance for later discussion of problems, affecting the White Tanks No. 3 FRS is the issue of collapsible soils. White Tanks No. 3 is constructed on the lower reaches of alluvial fans east of the White Tank Mountains. In the arid southwest, the soils within these landforms, formed in the Holocene (recent era), are often collapsible. Collapsible soils have relatively high bearing capacities and are stiff in a dry condition, but can exhibit severe collapse-type settlement upon inundation. The movement of a wetting front through foundation soils and the corresponding wetting-induced collapse (or settlement) of the foundation soils could cause longitudinal and transverse cracking within the embankment. The depth of the Holocene in the White Tanks No. 3 FRS area ranges from 0 to 25 feet

Underlying the Holocene-age soils is an older and usually more structured layer of soils formed in the Pleistocene era (approximately 1 million years old). While these soils may vary greatly, they are often characterized by being more cemented and maintaining their structure in the face of a wetting zone. The depths of the Pleistocene in the White Tanks No. 3 area may reach up to 250 feet.

A detailed soils map of the project area is provided in Appendix B. Detailed descriptions of the soils in the project area can be found in the Soil Survey of Maricopa County, Central Part, published by the NRCS in 1977.

**Important Farmlands**

Prime farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses (USDA Handbook No. 18, Oct. 1993). The loams, clay loams, and sandy clay loams comprising most of the project's irrigated cropland, are among the most productive of Arizona's cropland soils. These are deep, well-drained soils and when irrigated, meet the USDA criteria for prime farmland. The remaining cropland soils consist of inclusions of sandy loams, loamy sands, and loamy fine sands. These deep, well-drained but somewhat droughty soils meet the criteria for additional farmland of statewide importance as established by State officials. All croplands in the downstream area are prime farmland.

**Viewshed**

The viewshed in the White Tanks No. 3 FRS vicinity is open and expansive, permitting extensive views and vistas of adjacent landscapes. The views from the study area to adjacent landscapes take advantage of elevated terrain along the existing 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.

**Threatened and Endangered Species and Other Biological Resources**

The study area lies within the Sonoran Basin and Range Major Land Resource Area (USDA-NRCS, 2004). The area supports desert shrub vegetation. The giant saguaro cactus is a major species. Bursage, ocotillo, cholla, brittlebush, desert broom, catclaw acacia, and creosotebush are dominant shrubs. Palo verde, velvet mesquite, and ironwood are dominant trees. Much of the area within the general vicinity of the existing FRS is highly disturbed due to previous construction activities and vehicle use.

U.S. Fish and Wildlife Service Species Lists, the Arizona Game and Fish Department (AGFD) Heritage Database, and the Arizona Department of Agriculture Protected Native Plant Lists were consulted. A number of protected species are known to occur in Maricopa County within the larger Agua Fria River Basin, which contains the White Tank No. 3 watershed (See Appendix C). Federally-listed Species of Concern include the western burrowing owl, Sonora sucker, greater western mastiff bat, cave myotis, Sonoran desert tortoise, and the Mexican garter snake. State-listed Wildlife of Special Concern includes the bald eagle, black-bellied whistling duck, Sonoran desert tortoise and Mexican garter snake. Protected plants under the Arizona Native Plant Law include Arizona agave, toumey agave, and prickly pear. No Federally-listed or state-listed animal or plant species exist within the vicinity. No designated critical habitat exists within the vicinity of White Tanks No. 3 FRS.

With the exception of the burrowing owl and desert tortoise, no potential habitat for protected animal species exists within the vicinity of the FRS. The whistling-duck and Sonora sucker require permanent water, which is absent in the area. The Mexican garter snake typically occupies diverse riparian areas and its closest known existence is along the Agua Fria River. It is not expected to reside in the vicinity of the FRS. The nearest known nesting site for the bald eagle is approximately 28 miles away near Lake Pleasant. Any occurrences of bald eagle would be extremely rare, brief and transient. The area in the vicinity of the FRS does not provide suitable roosting sites for the bat species. The western burrowing owl and Sonoran desert tortoise may occur in the area. These species are not Federally recognized as Threatened

or Endangered. They are, however, listed as Species of Concern and are considered to be in decline.

**Wetlands**

No naturally-occurring wetlands occur in the study area. Several man-made wetlands do exist, in the form of tailwater recovery reservoirs, downstream from the proposed dam rehabilitation site. In the event of sudden failure of the existing dam, these wetlands and their dependent wildlife may be at risk.

**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 (the potential construction area in and around the White Tank No.3 FRS), covering all acreage (1,934 acres) that had not been inspected during earlier studies. In addition, the importance of FRS No.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 shard of 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. 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.

The Beardsley Canal runs north to southeast of the FRS. Although the Canal is associated with events that have made a significant contribution to the broad patterns of local history, the assessment of the Canal 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. The history of the Beardsley Canal is known as a result of the Historic American Engineering Record (HAER) documentation that was previously prepared for the Waddell Dam project, and therefore no additional documentation is considered to be warranted.

Likewise, the assessment of FRS No. 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.

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## PROBLEMS AND OPPORTUNITIES

Since its construction in 1954, multiple problems have been identified during the annual inspections conducted by the Flood Control District of Maricopa County, the Arizona Department of Water Resources Dam Safety Office, and the Natural Resources Conservation Service. These problems did not result from a specific event or other catastrophic occurrence but have appeared over time.

## POTENTIAL DAM FAILURE MODES

### Land Subsidence

Groundwater occurs in unconfined to semi-confined conditions in the alluvial sediments that underlie the valley floor. In 1923, before large scale pumping began in the western Salt River Valley, the direction of groundwater flow was to the south, and then west. Prior to pumping, the groundwater system was in equilibrium. Groundwater was recharged or replenished mainly by seepage and streamflow along mountain fronts and by groundwater underflow into the area.

Large scale pumping of groundwater began in the area in the 1930s primarily for irrigation of agricultural lands. By the 1950s, a cone of depression had developed southwest of Luke Air Force Base. This cone of depression became more pronounced and the center shifted as greater amounts of groundwater were withdrawn over the years. From 1923 to 1977, groundwater levels declined in the western Salt River Valley by up to 350 ft. Regional groundwater levels have nearly stabilized recently or rebounded somewhat. However, overall historical regional groundwater declines of up to 300 ft. still are prevalent (Schurmann and O'Day, 1995; Hammett and Herther 1995; ADWR 1998).

Water-level declines, due to aquifer depletion, result in a decreased bearing capacity in the deeper strata of the alluvial basin causing it to compress. When the water table declines because of excessive groundwater withdrawal, the buoyant support the water gives the sediment decreases causing the newly-drained zone to compact. Compaction occurs when the volume of space decreases between sediment grains (Slaff, 1993). This compaction of

typically finer-grained alluvial material results in an irreversible lowering of the ground surface.

Comparisons of water-level declines and the areas of measured land subsidence indicate that the areas of maximum subsidence correspond to those areas of maximum water-level decline. Differential subsidence has damaged buildings, wells, irrigation canals, roads, and drainage structures. Differential land subsidence has adversely affected drainage patterns in the vicinity of Luke AFB and the Dysart Drain Diversion Channel (See Representative Well Hydrograph in Appendix C). Subsidence studies completed by the U.S. Geological Survey (USGS) show that subsidence of up to more than 18 ft. has occurred in the western Salt River Basin. Subsidence rates have been estimated for the area based on available historic leveling data and from groundwater level measurements and trends. A subsidence rate of 0.0357 feet per year (ft/yr.) was estimated for the White Tanks No. 3 FRS for years 1991 to 2046 in a study completed by NRCS (1992). The Flood Control District performs annual field surveys of the dam to evaluate embankment settlement and land subsidence trends.

Due to differential subsidence, the crest of the White Tanks No. 3 dam has settled approximately 4.0 feet at the northern end of the alignment. The amount of settlement appears to decrease steadily along the alignment until virtually no settlement is observed at the southern end of the embankment. As a result, the White Tanks No. 3 FRS can no longer safely pass the designated inflow design flood.

**Earth Fissures**

Earth fissures, or cracks, may occur in the alluvial sediments of the basins that have had large scale withdrawal of groundwater, typically where water levels have declined by 300 ft. or more. These earth fissures are tensional features that typically form at the margins of the subsiding basin. They usually form from differential subsidence over buried bedrock ridges, fault scarps, or other subsurface irregularities in the unconsolidated alluvium. Fissures may also develop in areas where there are discontinuous beds of clay, silt, sand, and gravel. The clay layers with their much lower permeabilities may not drain and consolidate at the same rate

as the more permeable sand and gravel beds. These clay beds may act in a similar fashion as bedrock highs. The fissures appear as long narrow linear features, sometimes as a series of small holes or depressions, and may become much wider from surface water erosion. They also typically form perpendicular to and cut across either historic or prehistoric surface water drainage features. The drainages originate within the mountains and trend toward the basin. The fissures form at the margins of these basins so that they typically cut across drainages. The fissures may be only a few tens of feet long to more than a mile in length. Some earth fissures form parallel or in echelon to other earth fissures. Several earth fissures have been mapped near Luke AFB (these are associated with a subsurface salt dome). A larger fissure occurs about 2 ¼ miles to the northeast of the White Tanks No.3 FRS.

Historic and recent aerial photographs of the White Tanks No. 3 FRS area and new applications using low sun angle photography and synthetic aperture radar interferometry (INSAR) were used to evaluate potential subsidence-induced earth fissures. Additional investigation methods included Bouger Gravity data, seismic refraction, deep shear wave profiling (refraction microtremor), test pits, borings, and test trenches. These field methods were supplemented with laboratory testing of field soil samples using both undisturbed and disturbed samples. These methods were also used on the McMicken Dam, a U.S. Army Corps of Engineers dam, located 1.5 miles north of White Tanks No. 3, and substantiated by field observations of an existing fissure.

Several linear features were noted in the recent aerial photographs and in the interferograms that were not obvious features such as washes, roads, off-road vehicle tracks, or animal pathways. These areas are described as potential earth fissure zones. A preliminary map of the earth fissure risk zone can be found following page 62 (Figure 3).

Although there are currently no known earth fissures near the White Tanks No. 3 FRS, water flowing through a undetected fissure along the embankment foundation contact, containing the more erodible Holocene soils, could create voids that the dam embankment would be unable to span. These voids could cause a progressive seepage-erosion or piping failure of the dam foundation. The development of the failure mode could be sudden or progressive resulting in

the uncontrolled release of the reservoir. The depth of Holocene soils in the project area range from 0 at the south end of the dam where soils were removed for the excavation of the auxiliary spillway to a maximum depth of 25 feet near Station 60+00. The depth varies along the length of the dam. Near the north end of the dam (station 10+00) the depth is in the range of 5 to 10 feet increasing in depth upstation or further south. Immediately under the Holocene soils are the Pleistocene soils which are several hundred feet deep.

**Embankment Cracking**

Transverse and, to a lesser extent, longitudinal cracks have been observed through the embankment since the 1970s. An Arizona regional study (Sterns et al., 1978) reported that "Certainly, the movement associated with subsidence as a result of ground water removal may well have aggravated the cracking in some areas". It added that the principal cause of the transverse cracking is tension released because of shrinkage as the embankments dry from placement moisture content in the severely hot, arid climatic conditions in the area. Secondary causes included tension zones resulting from differential settlement because of shallow foundation compression and stress differences resulting from variations in type of material, degree of compaction, and moisture content in fill materials as placed.

During construction of the partially penetrating center filter between 1981 and 1982, NRCS engineers made the following observations:

- 400 transverse cracks were noted (on average, 1 crack every 19 feet)
- The majority of the cracks were described as "Hairline". The maximum crack width was approximately 2" but typically less than 3/8 inches.
- The maximum length of crack was 15 feet.

Continuous seepage along a transverse crack, below the partially penetrating center filter, and through the embankment could cause enlargement of the crack and uncontrolled release of the water behind the reservoir.

**Center Filter and Outlets**

The NRCS designed and installed a granular filter along the centerline of the embankment to mitigate any adverse impacts of the transverse cracking. The filter was installed for the entire length of the embankment and is approximately 30 inches wide. Potential defects in the center filter could allow the transverse crack to extend through the entire cross-section of the embankment. Potential causes for defects in granular filters include segregation, open cracks supported by re-cementation of the granular fill, and arching of the filter sand due to settlement of the sand caused by wetting. The following points pertain to the center filter:

- The center filter does not extend to the foundation soils. However, it appears that outlets were installed at all locations where the transverse cracks extended below the bottom of the center filter trench.
- The trench was backfilled with a medium to coarse sand, the D15 for the allowable gradation ranges from 0.2 mm to 1.0 mm. As per Chapter 26 of the National Engineering Handbook, the NRCS requires that the D15 be less than 0.7 mm for soil retention. Therefore, there is a slight chance that the embankment soils will pipe into the filter material.
- A total of about 68 outlets were installed. Each outlet includes a 2-foot by 2-foot section of open graded gravel to increase flow capacity. Based on Chapter 26 criteria (National Engineering Handbook, Part 623), NRCS 1994), the coarse graded gravel of the drain will not contain the filter material.

**Foundation Conditions**

The foundation footprint was cleared and grubbed, during original construction. However, there appears to have been no attempt to excavate and re-compact the near-surface soils, or to remove granular channels that intersected the alignment. The following is a summary of soil conditions at the base of the embankment as tested by Dames & Moore in 1998:

- The soils underlying the embankment are predominantly silty and clayey sands with lesser amounts of sandy clays, and occasional layers of relatively clean sands.
- The non-plastic soils (SP, SM, SP-SM, SW-SM) have fines contents typically ranging from 1 percent to 41 percent, and a (fine) gravel content of 10 to 30 percent.

- The clayey sands have fines contents ranging from 26 to 50 percent, gravel contents of less than 10 percent, and plasticity indices (PIs) ranging from 7 to 22.
- The fine-grained soils are typically sandy clays and silts with fines contents from 52 to 93 percent, with PIs ranging from 10 to 20.
- Response-to-wetting tests indicate that the near-surface foundation soils could exhibit 1 to 5 percent of self-weight collapse upon saturation.
- SPT blow counts were generally (all but 2) greater than 30 (for 12 inches). One sample with an N-value of 14 exhibited nearly 5 percent collapse upon inundation. Thus, foundation soils appear to have a low to moderate potential for collapse.

Foundation soil collapse could result in voids developing beneath the embankment. The collapse could be progressive and ultimately lead to a seepage-erosion breach (failure) of the embankment.

**Embankment Soils**

The embankment soils are predominantly clayey sands and lesser amounts of sandy clays. The fines contents of the clayey sands vary from 23 to 35 percent and the PIs vary from 6 to 17. The gravel content is as high as 40 percent, but typically less than 10 percent.

The sandy clays are of low to medium plasticity (PI = 7 to 13) with fines contents ranging from 53 to 70 percent, but typically less than 60 percent. The gravel content of the fine grained soils is less than 5 percent.

Dames & Moore (1998, now URS Corporation) performed laboratory tests to evaluate shear strength parameters for the embankment soils at White Tanks No. 3 FRS. Triaxial tests were performed on three relatively undisturbed samples of embankment soils. These tests were performed under consolidated, undrained conditions with pore water pressure measurements. The results of these tests are summarized below:

- For effective stress conditions, the internal angle of friction ($\Phi$) ranged from 34 to 36 degrees, and the cohesion ranged from zero (0) to 150 pounds per square foot (psf).

- For total stress conditions, the internal angle of friction ranged from 21 to 31 degrees, and the cohesion ranged from 50 to 300 psf.

The White Tanks No. 3 FRS is not located within an area of significant seismic risk; therefore, seismic/slope stability does not create a potential for failure of the dam.

**Auxiliary Spillway Conditions**

The auxiliary spillway for White Tanks No. 3 FRS is unlined with an approximate width of 800 feet. Dames & Moore (1998, now URS Corporation) estimated that during discharge under the full probable maximum flood conditions, the flow depths and velocities at the crest of the spillway would range from 2 to 4 feet, and 5 to 6 feet per second (fps), respectively. Based on these depths and flow velocities, Dames & Moore (1998) predicted scour and head cutting at the auxiliary spillway.

URS Corporation used the Erodibility Index method (Annandale 1995) to evaluate the scour at the auxiliary spillway. One boring by Dames & Moore (1998) at the auxiliary spillway, identified approximately 6 feet of Holocene soils overlying Pleistocene soils. URS assumed that the Holocene soils were erodible, and that the Pleistocene soils had a Headcut Erodibility Index of approximately 2100. Using the approach presented by Annandale (1995), URS estimated that the threshold of erosion of the Pleistocene soils was approximately 800 kilowatts per square meter (kW/M2), while the applied stream power was approximately 300 kW/M2. In order to account for variability in the Pleistocene soils, URS assumed that the upper 8 feet of soil at the auxiliary spillway were erodible.

Even when erodible soils are removed or stabilized, there remains the potential for dam failure resulting from conditions at the auxiliary spillway. Potential failures may result from several specific conditions:

- Gullies that exist at the foot of the auxiliary spillway can progress upward toward the spillway crest and cause the spillway control section to fail rapidly. These gullies may form when the exit channel is not graded properly.
- The angle of discharge and an ineffective dike protecting the downstream toe of the dam from flows from the auxiliary spillway

**Corrugated Metal Pipe (CMP) Principal Spillway**

There are 3 CMP outlets that were originally installed without seepage control. Current standards require filter diaphragms around the outlet pipes to prevent internal erosion of soil in a seepage path along the outlet pipe. Investigations (Speedie & Associates, 1998) have identified potential voids around the outlet pipes within the embankment. These voids were confirmed during the recent 2002 installation of interim dam safety improvements, which included extending these pipes and installing an earth bench and filter diaphragm at the downstream portion of the dam. Voids, where they may exist, pose a potential seepage path that could result in a piping failure. Although the CMP in the White Tanks No. 3 FRS is currently in fair condition, the use of CMP as the principal spillway is not a desired option.

## OTHER PROBLEMS

**Principal Spillway Outlets**

Currently, the principal spillway outlets flow either into Beardsley Irrigation Canal or over natural desert terrain. Currently, there is no safe outlet to a stream channel. A future master drainage plan is currently being developed by the Sponsor to address this issue. In the meantime, the issue is addressed as part of the Emergency Action Plan for the White Tanks No. 3 FRS.

**North Inlet Diversion Channel Breakouts**

The North Inlet Diversion Channel was originally designed to direct water from the Waterfall and Cholla Washes into the White Tanks No. 3 detention basin. The effect of the channel is to increase the watershed area by approximately one third. The channel runs for approximately 2 miles from north of Olive Avenue to the north end of White Tanks No. 3 embankment. The channel crosses Olive and Northern Avenues and runs parallel to and on the west side of the Beardsley Canal.

During storm events as frequent as the 25-year return interval, breakouts from the north inlet diversion channel occur and water flows across the Beardsley Canal between Peoria Avenue and the White Tanks No. 3 FRS. These floodwaters damage the Beardsley Canal and several road crossings as it flows into the Clearwater Farms subdivision impacting approximately 118 homes.

**Downstream Flooding**

With the construction of White Tanks No. 3 FRS in 1954, flooding problems in the downstream watershed were greatly diminished. There have been few reports of flooding damage in the downstream watershed area since the structure was built. At the time the watershed plan was completed, it was estimated that 100 percent of the damages would be eliminated with the installation of the White Tanks No. 3 FRS.

In 1954, there was very little development in the White Tanks area. The area was almost entirely farmland criss-crossed by farm roads, several state highways and a railroad. In 1954, the downstream watershed area (White Tanks Nos. 3 & 4) consisted of 34,100 acres of intensively irrigated land, lying on a broad, gently sloping alluvial fan. Channels were very poorly defined or even non-existent.

Analysis of flood damage tables, completed for the White Tanks Watershed Work Plan, indicated average annual damages for the White Tanks No. 3 downstream area at an estimated $25,310. Very little of the estimated damage was attributable to non-agricultural components which is an indication of the primarily agricultural nature of the watershed.

In the almost 50 years since the White Tanks No. 3 FRS was constructed, there has been tremendous development in the watershed. The Phoenix Metropolitan area has grown from a population of 106,800 in 1950 to a Year 2000 Census population of 1,321,000 making it the sixth largest city in the country. Goodyear, which was little more than farm town in 1980, has grown to more than 28,000 in 2003.

Consequently, the agriculture sector, which was the primary beneficiary of the White Tanks Watershed Plan, is decreasing yearly in the downstream watershed. In 2002, only 4,400 acres of agricultural land remained in the watershed, much of it owned by development corporations waiting for the right moment to convert the land to housing subdivisions. Construction of new homes is occurring rapidly in the Goodyear planning area which has an expected population of 360,000 in 2050. A good deal of this growth will be downstream of the White Tanks No. 3 FRS where the land which can be developed lies.

A flood damage analysis was conducted in 2003. This analysis estimated average annual equivalent flood damages for the 100-year planning period without the White Tanks No. 3 FRS. This estimate takes into account the past development in the floodplain since 1954 when the FRS was constructed and projected future development based on general plans for Goodyear and Maricopa County. The requirement that first floor elevations be above the 100-year flood plain was considered. These estimates are shown in Table E.

Appendix B-1 shows the 100-year water surface area that would occur if the dam were removed.

**Table E: Estimated Flood Damages Without FRS – 2003**
**White Tanks No. 3 Downstream Area, Arizona**
(Dollars)

| Item | Estimated Current (2003) Damages | Estimated Average Annual Equivalent Damage (Life of Project) |
|---|---|---|
| **Cropland** | $65,300 | $35,300 |
| **Residential** | $573,900 | $1,471,500 |
| **Commercial** | $100,700 | $384,400 |
| **Other 1/** | $56,200 | $159,600 |
| **Total** | **$796,100** | **$2,050,800** |

**PriceBase2003**
**1/IncludesFloodInsuranceProgramAdministrationCosts**

# CONSEQUENCES OF DAM FAILURE

## Introduction

In 1991, the Sponsors conducted a dam break analysis to determine the area that would be at substantial risk of loss of life and property in the event of a failure of White Tanks Flood Retarding Structure (FRS) No. 3. This analysis is required by the Arizona Department of Water Resources (ADWR), Office of Dam Safety, under Arizona Revised Statutes 45-701 through 45-717. AGK Engineers, Inc. performed the analysis using the DAMBRK computer model.

## Breach Scenario

Despite recent interim measures to repair the outlets and to modify the auxiliary spillway of the White Tanks No. 3 FRS, dam deficiencies remain. Thus, the White Tanks No. 3 FRS and associated structures are a high priority for rehabilitation. While any number of scenarios, describing the failure of White Tanks No. 3 FRS and many downstream hydraulic regimes can be conceived, the breach inundation analysis used only “worst case" scenario. Three breach location scenarios were modeled.

The time of failure was assumed to be relatively short, and the sizes of the breach opening were assumed to be large. The dam failure was assumed to be caused by piping. The resulting inundation zone is illustrated in both Appendices B and D.

## Design Inflow

Based on the dam safety criteria, White Tanks No. 3 FRS was classified by the Arizona Department of Water Resources (ADWR) as medium-sized dam. In the NRCS classification system it is currently a Class C structure. In addition, because of the potential loss of lives and excessive property damage that could occur in the event of failure, the structure was classified by ADWR as high hazard potential. Therefore, according to ADWR and the District, the magnitude of design inflow for White Tanks No. 3 FRS was determined to be the full probable maximum flood (PMF).

The design inflow for White Tanks No. 3 FRS was estimated by the District in October 1989 and subsequently revised in June 1990. The results of the District's study, using the HEC-1 computer program, are summarized below:

| White Tanks No. 3 FRS | |
|---|---|
| Size Designation | Medium |
| Hazard Designation | High |
| Design Inflow Magnitude | PMF |
| Peak Design Inflow (cfs) | 41,554 |
| Spillway Crest Elevation | 1212.0 (1988 NGVD Datum) |

**Parameters of Breach Geometry**

Since the purpose of the study was to model the extent of flooding which would result from the worst case scenario, the parameters, such as time of failure and size of breach, were estimated on the conservative side in order to produce a maximum outflow. The following values were selected for use in this study:

| Parameters | White Tanks No. 3 FRS |
|---|---|
| Time of Failure (hrs) | 1.0 |
| Breach Bottom Width (ft) | 275 |
| Breach Side Slope | 1:1 |

**Downstream Routing**

In modeling the downstream effect of White Tanks No. 3 FRS, it was assumed that all culverts under Interstate Highway 10 were blocked and that the embankment of Interstate Highway 10 would act as a dam and would be able to sustain the flood without collapsing. Interstate 10 will not be overtopped. The outflow from the breach would pass through the underpasses at Citrus Road and Cotton Lane, and over the freeway embankments. After consultation with the Maricopa Flood Control District staff, it was further assumed, that the outflow would flow

across Roosevelt Canal and run southerly toward the Gila River, instead of turning southwesterly along the Roosevelt Canal embankment to the Buckeye area.

**Conclusion**

As indicated, the inundation areas derived from three studied breach locations virtually coincided with one another between the sections approximately one mile downstream of the dam and the Gila River. The flood velocities are quickly reduced in the downstream sections as the flow spreads laterally. The flow depth and velocity increase drastically at I-10, as the flood water runs through a relatively confined cross-sectional area. The flow again spreads laterally as it exits the I-10 underpass.

Two areas were identified as being ineffective flow areas. One area is immediately east of Cotton Lane, where water must pond to approximately 3 feet in depth before flow will pass under Interstate 10 at Cotton Lane. The other area, at Cross-Section 3.2, is a result of flow rising to a sufficient elevation to spill over into a slightly depressed area near Perryville Road. It is expected that the flow velocity in this area will be very low even at the maximum flow stage.

The combination plotting of flow depth and velocity at each downstream section indicates that the impact of the breach to downstream houses, built on foundations, would be alarmingly significant.

The major public facilities, that are expected to be damaged or have service interrupted due to failure of White Tanks No. 3 FRS, are listed below:

1. Beardsley Canal
2. Perryville Prison
3. Interstate Highway 10 (I-10)
4. Roosevelt Canal
5. Town of Goodyear
6. Southern Pacific Railroad
7. Buckeye Canal

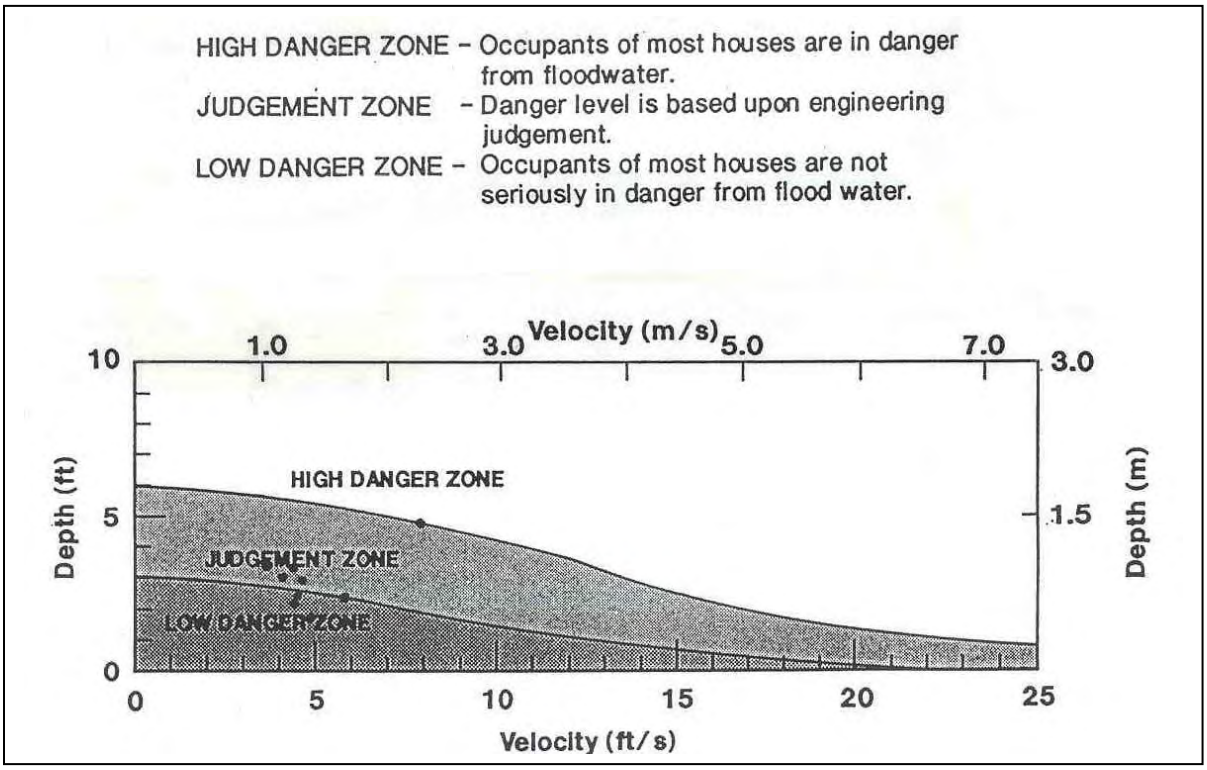
| Table F: Highlights of DAMBRK Modeling<br>White Tanks No. 3 FRS | | |
|---|---|---|
| | | **Breach Location No. 2** |
| Water Surface Elevation at the beginning of breach | | 1,209.0 |
| Peak Outflow at Dam (cfs) | | 97,378 |
| | | |
| **Perryville Prison - Mile 4.25** | | |
| | Maximum Flow (cfs) | 85,632 |
| | Maximum Depth (feet) | 4.00 |
| | Travel Time (hours) | 1.80 |
| | Maximum Velocity (fps) | 5.17 |
| | | |
| **Interstate Highway 10 - Mile 5.45** | | |
| | Maximum Flow (cfs) | 54,716 |
| | Maximum Depth (feet) | 11.16 |
| | Travel Time (hours) | 2.52 |
| | Maximum Velocity (fps) | 8.25 |
| | | |
| **Roosevelt Canal - Mile 5.75** | | |
| | Maximum Flow (cfs) | 54,167 |
| | Maximum Depth (feet) | 3.98 |
| | Travel Time (hours) | 2.60 |
| | Maximum Velocity (fps) | 6.04 |
| | | |
| **Southern Pacific Railroad-Mile 9.25** | | |
| | Maximum Flow | 52,971 |
| | Maximum Depth (feet) | 4.17 |
| | Travel Time (hours) | 3.50 |
| | Maximum Velocity (fps) | 3.77 |
| | | |
| **Gila River** | | |
| | Maximum Flow (cfs) | 42,100 |
| | Maximum Depth (feet) | 4.59 |
| | Travel Time (hours) | 4.50 |
| | Maximum Velocity (fps) | 3.81 |

Because of the high degree of agriculture and the lack of a defined channel in the downstream area, the flood wave quickly spreads laterally. The travel time of the water does allow a small

window for warning, but would make evacuation difficult. The potential for loss of life exists and destruction of property is unavoidable in any case. In the aftermath of the flooding, rescue and relief efforts would be hampered by the destruction of portions of roads. The destruction of electrical, telephone, water, and sewage utilities in the affected area is also likely. As expected development in the area takes place, the potential for destruction will increase greatly.

An additional measure of the threat is in a reference, cited in the Dam Break Analysis for White Tanks No. 3 and No. 4 Flood Retarding Structures, January 1991. This figure, shown below, computes a danger factor based on a combination of water depth and velocity.

**Figure 2: Depth-Velocity Flood Danger Level Relationship For Houses Built On Foundations.**




Source of Information: Bureau of Reclamation ACER Tech. Memo. No. 11, 1988.

Plotting depth and damage for cross-sections utilized in the Dambreak Analysis shows that most locations in the White Tanks No. 3 FRS downstream area would result in a High or

Judgment danger zone for structures and certainly for people downstream. A High Danger Zone is one where occupants of most houses are in danger from floodwater. A "Judgment Zone" is one where the danger level is based upon engineering judgment. Under a sudden and rapid dam failure scenario, a threat to life and property exists due to insufficient warning time.

A flood damage analysis, conducted in 2003, used floodwater release amounts (97,000 cfs) from the dam break analysis conducted in 1991. A flood damage analysis, using a recent survey of properties in the downstream breach inundation watershed since the construction of the White Tanks No. 3 FRS, permitted NRCS to estimate the numbers of properties and people that would be impacted by a catastrophic flood event. The parameters, such as time of failure and size of breach, were conservative in order to produce a maximum outflow. Table G shows the results of the flood damage analysis for the breach inundation. It should be noted, however, that the damage analysis takes into account only the depth of flooding. Expected damages would be strongly impacted by the velocity of the flow as well as the depth.

Table G: White Tanks No. 3 FRS Breach Inundation, Downstream Impacts, 2003

| **Categories of Damage Damage from Rehabilitation Plan** | **Impacted Properties/Acres** | **Estimated Damages (Dollars)** |
|---|---|---|
| | | |
| Residential | 500 properties | $18,907,000 |
| Commercial | 40 properties | $7,688,000 |
| Agricultural | 4,100 acres | $2,923,000 |
| Other (Transportation) | | $27,800,000 |
| | | |
| | | **$57,318,000** |

Price Base 2003 June 2004

If a dambreak were to occur today, the depth and velocity of floodwater released through a sudden and catastrophic dam break event, would have severe and devastating consequences and put an estimated 6,000 people at extreme risk. For example, approximately half of the prisoners at the Perryville State Prison are housed at approximately 4 feet below the ground

elevation. Because of the anticipated growth in the downstream area the numbers of people at risk will increase rapidly in the future.

The District had developed an Emergency Action Plan (EAP) to evacuate the affected population should a dam breach or auxiliary spillway discharge occur. However, under a sudden and rapid dam failure scenario the amount of warning the downstream population would receive before inundation is minimal.

Appendix B-2 shows the dam breach inundation area that would occur in the event of a catastrophic dam breach as well as the 100-year floodplain in the absence of the White Tanks No. 3 FRS.

**Other Potential Impacts**

Where wetlands exist, large flows may separate fish and amphibian species from their wetland habitat and deposit them far from any water source. Additionally, the sediment likely to exist from such a sudden breach event may bury and destroy these species and/or their wetland habitat.

**Failure and Risk Index**

In order to evaluate and rank (for funding purposes) potential rehabilitation projects across the nation, the NRCS completed a failure and risk index for the White Tanks No. 3 FRS. The index included evaluations of the static failure potential, hydrologic failure potential, and seismic failure potential. The index also included measures of the potential adverse impacts on life, property and the environment. Based on the evaluation, the White Tanks No. 3 FRS ranked number one in the entire nation.

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# SCOPE OF THE PLAN/EA

**Scoping of Concerns**

The scoping process for rehabilitation projects followed the general procedures contained in Section 504.37 of the NRCS National Watershed Manual. The procedures require that environmental and cultural resources be considered early in the planning process by an interdisciplinary team of technical specialists, in consultation with all interested parties.

To focus planning efforts on those concerns that may be affected by the project or that may affect the project, the scoping process was used to solicit comments of diverse viewpoints from stakeholders in the downstream watershed. This includes farm owners and operators; interested citizens; members of state, local, and Federal agencies; and scientific and special interest groups. Thus, the public, government agencies, and the scientific community were invited to a widely-advertised public meeting held specifically to begin the scoping process.

The scoping process was used during the planning for the White Tanks No. 3 Project/Environmental Assessment to focus planning efforts on problems and opportunities of most importance to all interested parties. Scoping was utilized to narrow the objectives of the planning effort and thereby narrow the range of reasonable alternatives. Comments and questions were solicited from local citizens, groups, and local, state, and Federal agencies throughout the planning effort.

The scoping process began when Sponsors held a public meeting on March 22, 1994 at the Maricopa Water District office. Due to poor attendance at the meeting, Sponsors and NRCS decided a more effective method of public involvement might be a direct mailing to every watershed property owner. In early May, 1994, such a mailing was made, which included a public notice and scoping response sheet. Fifty-eight response sheets were received back from

the public. Sponsors and NRCS reviewed the responses. It was determined that some responses related directly to localized flooding problems, which the Flood Control District of Maricopa County agreed to handle. The remaining responses dealt primarily with watershed issues. These comments were considered during planning. A primary concern expressed by many respondents related to the need for adequate flood protection in the area.

Sponsors continued the scoping process by holding a widely-advertised public meeting on November 8, 2000. A total of 20 people attended this meeting and gave often differing responses to several project-related questions. All comments received, were considered during development of the Plan/EA.

Some concerns that were determined to neither directly affect nor be directly affected by the project included long-term effects on air quality, on fish or other aquatics, or on wetland habitat. All highly erodible lands in the watershed are operated under erosion control plans so that no Food Security Act restrictions apply.

Opportunity for public input has been available throughout the planning process through public meetings regularly held by the Sponsors. Written comments will be solicited during review periods.

The scoping process has been in effect throughout the planning process via public meetings held frequently by the Sponsors. In addition, many of the public and agencies prefer to provide written or verbal comments during the review period for the draft document. Such comments were welcomed during the planning process.

| Table H: Evaluation of Identified Economic, Social, Cultural, and Environmental Concerns White Tanks No. 3 FRS Downstream Area, Arizona | | | |
|---|---|---|---|
| Economic, Social, Environmental, and Cultural Concerns | Degree of Concern | Degree of Significance to Decision making 1/ | Remarks |
| Health & Safety | High | High | Increasing population at risk |
| Subsidence | High | High | Region-wide Problem. Although little can be done to reduce subsidence, the effects of subsidence can be mitigated. |
| Fissures | High | High | Reduce the threat of fissures to FRS |
| Cracking | High | High | Reduce threat of failure due to cracking |
| Flooding Damages | High | High | Reduce threat of flooding downstream |
| Aquifer Health | High | Medium | Increase potential for recharge |
| Economic stability | Medium | Medium | Maintain protection for future growth |
| Cultural resources | Medium | High | Assess continually during construction |
| Wildlife habitat | Medium | Medium | Maintain existing habitat |
| T&E species | Medium | High | Assess continually AZ protected species |
| Viewscape | High | High | Improve existing viewscape with plantings |
| Plant Resources | Low | Low | Maintain cover during/after construction |
| Important farmland | Low | Low | Maintain production |
| Air Resources | Low | Low | Should be considered during construction |
| Social effects | Low | Low | Maintain quality of life |
| Erosion | Low | Low | Do not increase with activities |
| Soil Resources | Low | Low | Maintain soil quality |
| Fish Habitat | Low | Low | No habitat present in watershed |
| Wetlands | Low | High | None Present |

1/ High - Must be considered in the analysis of alternatives June 2004
Medium - May be affected by alternative solutions
Low - To be considered, but not too significant

Scoping of concerns caused the Sponsors' direct planning efforts to reduce the threats posed by a Floodwater Retarding Structure with recognized deficiencies. The Sponsors believe that the rehabilitation of the White Tanks No. 3 FRS will meet the goals of the Arizona Department of Water Resources Dam Safety concerns to provide a safe structure while addressing the concerns resulting from cracking, fissures, and subsidence. Table H displays a synopsis of the results of the scoping process including concerns expressed in addition to those of previous scoping meetings.

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# FORMULATION AND COMPARISON OF ALTERNATIVES

## General

The Goodyear area, which includes the White Tanks No. 3 FRS downstream watershed, is one of the fastest growing areas of the state. Rapid development has occurred in the downstream impacted area and additional development is planned. Population is expected to grow exponentially well into the foreseeable future. Population growth in the watershed has underscored the urgency to develop a plan to correct the structural deficiencies and to reduce the risk to the White Tanks No. 3 FRS caused by subsidence in the Central Arizona area and the resulting threats of earth fissures.

The White Tanks No. 3 FRS has nearly reached the end of its design life. Additionally, over the years, the pumping of water for agriculture and the fast-growing Phoenix metro area have contributed to conditions that affect the physical condition of the White Tanks No. 3 FRS.

The Sponsors' formulation goals are:

- to address current dam deficiencies in order to meet current NRCS and State of Arizona dam standards as well as extend the life of the structure for 100 years, and
- to provide flood protection to approximately 6,000 current downstream inhabitants of the White Tanks No. 3 FRS downstream area and all future residents in this rapidly urbanizing watershed.

The Sponsors desire to provide flood protection while reducing the likelihood of future problems to the structure due to subsidence, earth fissures, and cracking of the FRS embankment. This goal will be achieved by applying recent technological improvements in dam rehabilitation to ensure that the applied measures will permit the dam to remain safe until the end of its useful planned life of 100 years.

**Formulation Process**

In 2001 and 2003, the project Sponsors conducted a series of studies to recommend concepts and potential alternatives to solve the identified problems. Additional planning studies were conducted to investigate the geologic conditions of the foundations underlying the White Tanks No. 3 FRS in order to determine the risks posed by subsidence and to define the fissure risk zone in the vicinity of the structure. Cracking, which has long been a problem for structures in the arid southwest, was also an identified problem which could be intensified by subsidence and collapsible foundation soils.

A series of alternatives was developed by the Sponsors and various combinations of the alternatives were analyzed. In a meeting, held in December 2003 and attended by the Sponsors, NRCS, AMEC (Geotechnical Consulting Firm) and URS (the lead engineering consultant), the alternatives were discussed in detail and ranked by the following issues:

- Flood Protection
- Social
- Aesthetics and Multi-use
- Direct Costs
- Time and Schedule
- Constructability
- Ability to Stage Construction
- Environmental Impacts

Two of the alternatives were selected for additional analysis as to effectiveness, efficiency, completeness and acceptability. Additionally, according to rehabilitation policy (NWSM 390-V, Circular No. 7), the following alternatives and expected consequences shall be evaluated:

- Future Without Project Condition (or No Action)
- Decommissioning (removal of the dam and stabilizing the site)
- Rehabilitation of the existing dam, (100-year evaluated life)

- National Economic Development (NED) alternative (may be one of the other alternatives or combination of alternatives). This is not a separate plan, as such, but is the name of that plan which produces the highest net benefits.

The following alternatives (in conjunction with the alternatives listed above) shall be evaluated where applicable:

- Relocation of "at risk" dwellings and non-structural alternatives if inhabitable property exists in the downstream breach inundation area. One potential non-structural measure is the purchase of development rights or rezoning of area within the breach inundation area downstream from the dam.
- Rehabilitation of the existing dam with added purposes
- Additional alternatives as appropriate.

**Studies Supporting Alternative Formulation**

The subsidence and cracking problems at the White Tanks No. 3 FRS have been noted since the 1970s and early analysis of the problems indicated that further investigations were necessary to determine the extent and magnitude of needed repairs. In 1981 NRCS installed a partially penetrating filter in the dam as a defensive mechanism to address the embankment cracking. However, the adequacy of the filter is in question because the embankment cracking may extend below the installed filter which does not extend to the foundation of the dam.

The Sponsors have responded with a series of special studies (Phase II Special Studies) to identify and analyze these dam safety deficiencies for White Tanks No. 3 FRS and to develop alternatives for a dam rehabilitation solution, inclusive of alternatives to address the fissure risk zone.

Preliminary geotechnical investigations designed to support an evaluation to identify preferred alternatives was conducted by Sponsor consultants. The approach included several

components: 1) acquisition and analysis of existing data; 2) acquisition and interpretation of project-specific low-sun-angle aerial photography; 3) ground reconnaissance and geologic mapping; 4) a surficial geophysical program utilizing gravity, seismic refraction and resistivity techniques; 5) subsurface exploration, including drilling, test pit, and test trenching programs; and 6) laboratory testing of representative samples.

At the beginning of the planning process, it was believed that extending the embankment over foundation materials that were not subject to fissures that result from differential settlement following subsidence, would provide a lower cost alternative than dam modification. It was thought that a realigned structure could be designed and constructed more easily than the modification and retrofit of an existing structure.

The major concern was the existence of a "collapsible" Holocene era deposit which could undermine the foundation of the FRS if it were impacted by an earth fissure. Dam realignment would permit an easy excavation of the Holocene layer down to the more stable Pleistocene soils and replacement with a more stable fill material. The Pleistocene soils are several hundred feet thick under the project area.

The Flood Control District of Maricopa County initiated geologic investigations to determine the location and extent of the fissure risk zone with the expectation that, if a more stable location were discovered out of the risk zone, the existing dam could be realigned in a manner to decrease future risks.

Radar interferometry (interferograms) and low sun angle photography revealed, however, that the fissure risk zone extended and became more extensive as it spread into locations initially thought suitable for dam realignment (Station 30+00 to 55+00). This would increase the risk to

the structure instead of decrease risk. Although the trenching program did not discover identifiable fissures, a zone of strain was revealed (See Figure 3).

**Existing Conditions**

While recent interim dam safety measures mitigated certain high priority dam safety deficiencies at the outlets and the auxiliary spillway, White Tanks No. 3 FRS still has significant dam deficiencies that require correction. Additionally, the dam does not meet NRCS or State Dam Safety Standards. Underlying geologic conditions threaten the foundation of the dam.

The White Tanks No. 3 FRS is unable to safely pass the Inflow Design Flow (which is the Probable Maximum Flood) with the required freeboard. The State dam safety office is currently required to send monthly status letters until the deficiency is corrected. The State Agency expects that the deficiencies will be addressed in a timely manner.

Other conditions which exist at the dam which are of concern to the integrity of the dam and associated features include: dam embankment cracking, highly erosive dam foundation soils, collapse potential of dam foundation soils, a recently identified earth fissure risk zone, CMP outlets, and hydraulic erodibility of the earth materials in the excavated auxiliary spillway.

Additionally, the 100-year flood protection intended by the White Tanks No. 3 FRS Project is not being met, and an upstream diversion which was constructed to direct floodwaters into the structure is not functioning correctly. During storms that have produced less than the 50-year flood, there have been breakouts in the diversion which have damaged an irrigation canal and caused flooding in an adjacent neighborhood. In addition, White Tanks No. 3 FRS does not have a downstream flood channel and flows discharged from two of the three gated outlets have resulted in downstream flooding.

With the continuing dynamics of subsidence and the potential of earth fissures, an unacceptable near-term risk to public safety can be anticipated at White Tanks No. 3 FRS. The District has indicated that without Federal funding assistance, sufficient funds are not available to rehabilitate or replace the dam in a timely manner. In the 1970's the District experienced a similar situation with McMicken Dam when an unsafe condition was determined to exist due to dam embankment cracking. In 1977, two segments of McMicken Dam were removed by the Corps of Engineers until repair funds became available. The dam was repaired in 1985. Should removal of segments of White Tanks FRS No.3 become necessary due to dam safety issues, the significant flood protection currently provided by this important project would be lost for an indefinite period of time resulting in a severe threat of flooding and associated potential impact to the increasingly urbanized downstream community.

**Description of the Alternative Plans**

***ALTERNATIVE 1* - Future Without Project (FWOP) (or No Action Alternative)**

The Sponsors have indicated that without financial assistance of the NRCS, eventually they would either be required by ADWR to breach and abandon the dam or to fully address the deficiencies. Fully addressing the deficiencies, however, would not be possible for years into the future and the financial requirements of the dam rehabilitation would likely cause them to significantly delay the correction of other dam safety issues at other Flood Control District dams that also require overall rehabilitation. The Flood Control District of Maricopa County currently estimates that the cost to repair all District dams is $225 million.

A likely remedy in the interim would be a Sponsor's Breach**.** A Sponsor's Breach is the creation of a minimum size hole in the dam from top of dam down to the valley floor, which would eliminate the structure's ability to store water. This would, in effect, be a removal of the flood protection offered by the White Tanks No. 3 FRS. A description of the Application to

Breach or Remove a High or Significant Hazard Potential Dam (from the Arizona Department of Water Resources – Dam Safety Office) is found in Appendix C.

A less expensive alternative than decommissioning**,** a Sponsor's Breach may be the best interim remedy if faced in the future with the potential for a sudden breach following a significant storm event. When serious deficiencies were noted at McMicken Dam, several miles away, the structure was breached by the U.S. Army Corps of Engineers. When the Flood Control District of Maricopa County was able to obtain funding 8 years later, the structure was repaired and brought back into service.

A similar scenario could occur at White Tanks No. 3. The potential for flooding conditions downstream of White Tanks No. 3 would be similar to those that existed prior to the construction of the dam with the exception that monetary damages would be significantly higher. Much of the downstream residential and commercial development, in fact, occurred because of the protection offered by the White Tanks No. 3 FRS. Without funding assistance to rehabilitate the dam, the District would have to breach the dam and remove existing flood protection. The FWOP scenario, Alternative 1, assumes a Sponsor's Breach in Year 3 and a dam reconstruction in Year 7 as occurred at the McMicken FRS. The FWOP also assumes that no Federal assistance or money will be used for the Sponsor's Breach or the eventual reconstruction.

***ALTERNATIVE 2* - Dam Modification**

The Dam Modification Alternative was developed to address current identified structural deficiencies and potential threats to the FRS resulting from continued ground subsidence and the presence of a fissure risk zone at the location of the dam. This alternative would also extend the life of the FRS for the next 100-year project period and increase auxiliary spillway

capacity so that it can pass the probable maximum flood or inflow design flow without overtopping. Flood protection with the Dam Modification Alternative will provide a 100-year level of protection (2,750 acre-feet) plus an estimated 500 acre-feet of sediment storage. The dam was originally designed to contain back-to-back 100-year 10-day storms with no release from the impoundment. This was because there was no downstream channel to contain the release.

Foundation conditions and structural problems differ at various locations on the dam structure. Therefore two different structural cross-sections will be applied to the dam modification.

For the sections of the dam not subject to potential earth fissuring but vulnerable to embankment cracking, the measures will consist of an upstream raise, geosynthetic and, if required, earthfill material elements on the upstream face to minimize infiltration through the embankment, and an upstream cut-off to address foundation issues.

Pre-alternative studies which considered the geological, geophysical, photolineament, interferometric and terrestrial survey data and interpretations identified a risk of earth fissuring. This is an area where sufficient horizontal strain could develop between the area of less deformation to the west-southwest and a region of more pronounced subsidence to the east-northeast. Several factors indicate a greater probability of fissure development. These include a distinct break in the measured leveling profiles along the dam crest, possibly greater interferometric gradients, an increased density of prominent photolineaments, and the presence of deflation features in the Holocene alluvium

In the earth fissure risk zone, delineated in Figure 6, there will be a soil cement section constructed with double cutoff walls into the foundation upstream from the existing compacted earthfill embankment. The rigid fill material will span any voids that are generated due to erosion along the fissure zone and maintain the dam's integrity.

Both cross-sections will address existing conditions of cracking of the embankment and erodible and potentially collapsible foundation soil conditions. Cut-offs will supplement previously constructed partially penetrating central drain filters to reduce the seepage rate and the potential erosion of foundation materials.

Dam crest elevation will be 1220' (NGVD 1988 Datum) which provides one foot of freeboard for future predicted subsidence. A broader crest width will be included in the design to allow the Sponsor to increase the dam crest elevation should subsidence continue at a rate greater than predicted.

The final auxiliary spillway configuration includes a concrete cut-off wall across the 800 foot wide spillway crest. The wall would be 3 feet wide and extend down approximately 15 feet vertically into the Pleistocene soils. For protection, a riprap launch apron would be constructed that would extend for 40 feet downstream of the cut-off wall. The riprap apron would be covered with soil for safety and aesthetic reasons.

The three CMPs would be removed or abandoned and replaced with concrete encased steel pipe or reinforced concrete pipe with new sand filter diaphragms. It is noted that the filter diaphragms, installed by the District, were approved by ADWR and NRCS as an interim dam safety measure.

Alternative 2 also addresses breakouts in the north inlet diversion channel that impact the Clearwater Farms subdivision just east of White Tanks No. 3 FRS. The North Inlet Channel part of the Dam Modification Alternative captures breakout flows and directs it to an additional native desertscaped earthen channel on the east side of the Beardsley Canal. It also includes a new diversion. This diversion would require that flows drop into a box culvert to cross under a road and an irrigation canal. There would also be alterations to culverts and washes to safely convey the runoff into the White Tanks No. 3 FRS.

Alternative 2 will require the purchase of an additional 42 acres of private land in addition to the approximately 160 acres of land the FCDMC has acquired for the rehabilitation project..

Additionally, NRCS policy requires mitigation for proposed negative visual impacts to the environment as a result of the rehabilitation of the existing structure. Also, NRCS policy may allow for the mitigation of negative visual impacts of certain past construction efforts if the project's visibility increases over time. Accordingly, the rehabilitation plan proposes mitigation features to soften the appearance of the FRS to the surrounding residential areas.

Figure 4 shows a plan view of the Dam Modification Alternative. Figure 8 shows the location of the North Channel Inlet project area in relation to the White Tanks No. 3 FRS.

Several additional advantages of this alternative include:

- The Dam Modification Alternative will address current NRCS and Arizona Department of Water Resources dam safety standards.
- This alternative can also be modified in the future, if ground subsidence continues, with minimum site disturbance and cost.
- Construction of the dam modification can be staged in such a manner that flood protection will continue during construction.

With Alternative 2, some flood damages will continue to occur in the downstream reaches because of the size and extent of the uncontrolled drainage. However, damage reductions with the dam modification in place are significant and will continue to increase with the future rapid development of the area.

With Alternative 2, Dam Modification, flood protection benefits would continue without interruption for the 100-year life of the rehabilitated structure. At the 100-year event, approximately 110 structures would experience some remaining flood damage due to uncontrolled drainage.

***ALTERNATIVE 3* –Single Basin**

As an alternative to dam modification, the FCDMC evaluated large regional flood control basin alternatives. Although several variations with larger storage volumes were considered, the primary alternative considered the excavation of a single basin which will permit the decommissioning of the current FRS. The other basin options were prohibitively expensive.

The single basin would be located immediately upstream of the existing White Tanks No. 3 FRS and would be sited on District property. This plan is compatible with surrounding land uses.

This alternative has a storage volume requirement of 1,967 acre-feet which was the storage volume estimated by the District to be the runoff volume of the 100-year, 24-hour storm event and which provides significantly less flood protection than the Dam Modification Alternative.

The development of the basin reduces the potential impact from flooding downstream of the flood retention structure due to a dam break. The existing dam has the potential for a large flood wave to occur in the event of a dam failure. The basin will only have a small dike (less than 6 ft. tall), with most of the storage capacity below the base of the dike. Therefore, only a small volume of water could exit the basin during a dam failure. The downstream flooding due to dike failure is significantly reduced. It is noted, however, that the basin would also require design measures to reduce downstream impacts due to earth fissures.

Figure 5 shows a plan view of Alternative 3, the Single Basin.

With the Single Basin Alternative, the existing dam will no longer be needed and can be removed. The breaching of the dam will be performed according to requirements established

by the Arizona Department of Water Resources (ADWR) dam breach requirements. The dam structure is blended into the contouring of the spoil piles with the breach located at lower contours. NRCS and ADWR dam safety standards would no longer be applicable with the construction of the Single Basin Alternative.

The main design features of the Single Basin Alternative will include the low flow channels, sediment basins, and potential reconstruction of natural washes. Also, a recharge basin would be located within the retention basin to provide an opportunity for recharge from adjacent sources, such as Beardsley Canal.

This alternative will also address breakouts in the north inlet diversion channel that impact the Clearwater Farms subdivision. The measures include a new diversion and flood channel. The diversion would require a drop into a box culvert to cross under a road and a canal. There would also be additional modifications to culverts and washes in order to safely convey the stormwater into the White Tanks No. 3 FRS. Figure 8 shows the location of the North Channel Inlet project area in relation to the White Tanks No. 3 FRS.

Other advantages of this alternative include the least visual impact to adjacent neighborhoods and no additional required land or landrights beyond the 160 acres that has been acquired by FCDMC for the rehabilitation project.

The basin outlet only provides partial drainage of stormwater. The presence of water during all flood events will require the mitigation for potential mosquito nuisance by draining standing water bodies or by use of safe chemical and bacterial larvicides. Additionally the Single Basin Alternative provides a relatively natural landscape that blends with the surrounding area.

The environmental impacts were judged to be the greatest with a basin due to the volume of excavation required (4.8 million cubic yards) and the surface area disturbance from both the basin excavation and the removal of the existing dam. The large amount of ground disturbance

would require extensive landscape mitigation per both NRCS and Flood Control District policy. This would include land shaping and smoothing and possibly the offsite transport of the excavated materials. Efforts would be made to reduce the visual impact of the disturbed area to adjacent neighborhoods by the planting of native vegetation screens.

With Alternative 3, future subsidence and the resulting loss of basin capacity are anticipated to be significantly more expensive than Alternative 2, the Dam Modification Alternative, due to additional ground excavation.

**Alternatives Considered but not Studied in Detail**

Decommissioning, as defined in NRCS dam rehabilitation guidance, is the removal of the storage function of the dam and also the reconnection, restoration and stabilization of the stream and floodplain functions. It requires the removal of a large part of or the entire footprint of the dam. The quantity and quality and ultimate destination of stored sediment must be disposed of in an environmentally sensitive manner or stabilized in place. Within this alternative several variations are possible. The entire structure could be removed and the site graded to the natural grade which existed before the structure was constructed.

The dam could also be breached 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 channel and floodplain system would be reconnected in a stable manner.

Alternate uses of the County land could be recreation or the land could be sold to private developers who are currently constructing homes in the areas adjacent to the county-owned land.

Sponsors do not think that this alternative is a viable long-term solution for several reasons. First, the Decommissioning Alternative does not meet the Sponsor's project purpose or

formulation goals to protect the health and safety of the downstream inhabitants. The FRS collects flows from a number of small normally dry washes near the base of an alluvial fan. There is no perennial stream and there are no natural values that would be improved by the removal of the floodwater retarding structure. The alluvial fan flattens into a relative level basin primarily used as cropland but in transition to more mixed or urban development.

The removal of the structure would permit water and sediment from the contributing watersheds to flow down the braided alluvial fan and flood both cropland and urban developments. Because there is no defined channel, the floodwaters would flow uncontrolled across cropland and through housing subdivisions as it flowed nearly 12 miles to the Gila River. The extent of flooding would be similar to flooding that which existed prior to the construction of the White Tanks No. 3 FRS except that development downstream of the dam would increase the resulting flood damages by a large factor.

A preliminary estimate of the cost of decommissioning is $2.3 million. This cost does not include mitigation costs for the North Inlet Channel area and for the extensive downstream channel improvements which would be required to convey the floodwaters approximately 11 miles to a safe outlet at the Gila River.

Without the channel improvements the damaging impacts of removing the dam could possibly reach into the hundreds of millions of dollars. The loss of flood protection and associated downstream impacts to private property, critical facilities and public infrastructure make this alternative unacceptable to the community which currently benefits from the flood protection provided by the dam.

Sponsor's Breach (without provision for flood protection) - As a permanent remedy to White Tanks No. 3 FRS deficiencies, the Sponsor's Breach, although a cheaper alternative than

decommissioning**,** is not acceptable to Sponsors and downstream residents for the same reasons mentioned above. A Sponsor's Breach, as described in NRCS guidance, is the creation of a minimum size hole in the dam from top of dam down to the valley floor, which would eliminate the structure's ability to store water. This would, in effect, be a removal of the flood protection offered by the White Tanks No. 3 FRS. Downstream flooding conditions would also be similar to those that existed prior to the construction of the dam although the monetary damages would be much higher. Much of the downstream development, in fact, occurred because of the protection offered by the White Tanks No. 3 FRS. Like decommissioning, the resulting impacts would be unacceptable to the community protected from flooding by the dam. The Sponsors would, if required by State Dam safety officials, permit a Sponsor's Breach as a short-term remedy until dam rehabilitation funding could be obtained.

Dam Realignment – An initial alternative was the realignment of a major section of the FRS to an area less subject to subsidence and fissure risk. With the identification of the fissure risk zone (See Figure 3) in the area just downstream of the current dam, it was determined that the additional cost to mitigate the risk became prohibitive for the Realignment Alternative and it was dropped from consideration. The thickness of the Holocene-aged alluvial materials was also much greater than originally thought. The Realignment Alternative would have required removal of the Holocene layer and replacement with compacted fill. Therefore, this alternative is not technically acceptable. Holocene soils can be utilized for compacted fill.

Relocation of At-Risk Properties – In some watersheds, the relocation of "at risk" dwellings and other non-structural alternatives is a potential alternative if inhabitable property exists in the downstream breach inundation area. This is appropriate when the number of affected properties is relatively small and the costs of relocation are not too great.
This alternative, unfortunately, is not feasible in the downstream portion of the White Tanks No. 3 FRS. There are too many residential and commercial properties in addition to critical

facilities and significant public infrastructure to make this a realistic alternative to the project Sponsors. There would also remain great risk to roads, culverts, and utilities in the downstream impacted area.

Another potential non-structural measure is the purchase of development rights or rezoning of area within the breach inundation area downstream from the dam. Unfortunately, because the area is already quite developed or held by developers, it is too late for such an alternative to be useful. To be effective, this non-structural alternative must be accomplished before urban development and construction of public infrastructure has occurred in the watershed. Additionally, the purchase of development rights on land in the downstream breach inundation zone already slated for development would be excessively expensive. This alternative does not meet the identified project purposes nor is it socially acceptable.

## Effects of the Alternative Plans

Potential impacts were evaluated for existing and planned land uses based on the issues and concerns that emerged during the scoping process. Impacts have been defined to include physical restrictions on an existing and planned land use or incompatibility with existing land use and transportation plans.

Environmental impacts or modifications to the watershed and the environment, that are brought about by an outside action, can be beneficial or adverse. The following is a brief description of the predicted consequences of the alternatives on those concerns important to the watershed community and government agencies. The following discussion and summary display at the end of this section permit a quick comparison of the impacts for each alternative identified in the scoping process.

**Costs and Benefits**

<u>Alternative 1 – Future Without Project</u>

The cost of the Future Without Project Alternative is $25,529,700. Average annual equivalent benefits for this alternative are $1,580,200. The estimated average annual equivalent cost for the Future Without Project is $1,129,900. The benefit cost ratio is 1.35:1.0. Net benefits for this alternative are $407,700. Annual Operation and Maintenance costs are $42,600.

Alternative 2–Dam Modification -

The cost of the Dam Modification Alternative is $23,646,000. Average annual equivalent benefits for this alternative are $1,784,600. The estimated average annual equivalent cost for Alternative 2 is $1,283,600. The benefit cost ratio is 1.39:1.0. Net benefits for this alternative are $501,000. Annual Operation and Maintenance costs are $48,700.

Alternative 3 –Single Basin –

The cost of the Single Basin Alternative is $27,238,000. Average annual equivalent benefits for this alternative are $1,637,000. The estimated average annual equivalent cost for Alternative 3 is $1,419,900. The benefit cost ratio is 1.10:1.0. Net benefits for this alternative are $155,000. Annual Operation and Maintenance costs are $62,100.

**Health and Safety**

Alternative 1 – Future Without Project

The Future Without Project leaves the White Tanks No. 3 FRS with threats to the integrity of the FRS and deficiencies that threaten the health and safety of the downstream community. An estimated 6,000 people would be impacted by a sudden breach of the structure. As with the nearby McMicken Dam, the Sponsors can anticipate an order from the State Dam Safety Officials to breach the structure should subsidence hasten the development of earth fissures that could threaten the structure.

During the dam breach interval, the downstream watershed would be without the protection offered by the White Tanks No. 3 FRS. This threat to health and safety would remain until the

structure was brought up to current dam safety standards. Additionally, there would be significant damages to public and private infrastructure if a severe flooding event occurred under this scenario.

With this alternative, flood protection would be present until the Sponsor's Breach and again after the dam was reconstructed by the Sponsors in year 7. At the present time, approximately 470 residential and commercial structures would be damaged at the 100-year storm event without the protection of the White Tanks No. 3 FRS. When flood protection is restored in year 7, approximately 110 structures would still experience flooding due to uncontrolled drainage.

Alternative 2–Dam Modification -

Under Alternative 2, the threat to health and safety would be minimized by immediately addressing deficiencies in the physical structure of the White Tanks No. 3 FRS. Effects of current and future land subsidence and the potential for earth fissuring would be addressed with structural components designed to current dam safety standards and through monitoring programs for the life of the structure. Current and future development in the downstream watershed would receive protection under a rehabilitated structure with an estimated design life of 100 years.

Alternative 3 –Single Basin –

Under Alternative 3, the White Tanks No. 3 FRS would be replaced by an excavated basin that would provide storage capacity expected for the 100-year, 24-hour storm event. This alternative would include a small impoundment structure of less than jurisdictional dam height (less than 6 feet). Failure of this structure, while having the potential to cause downstream impacts, would be significantly less severe than a dam breach.

Flood damages with Alternative 3 will continue to occur in the downstream reaches because of the size and extent of the uncontrolled drainage. Damage reductions with the single basin are significant but not as large as those with the Dam Modification Alternative due to the overbuild of the existing dam. Damage reduction, however, will continue to increase with the future rapid development of the area.

With Alternative 3, the Single Basin, approximately 110 structures would still experience flooding at the 100-year, 24 hour storm event due to uncontrolled drainage.

**Subsidence, Fissures and Cracking**

Alternative 1 – Future Without Project

Although it is not within the scope of any alternatives to impact subsidence directly, it will be necessary to address the fissure problems that result from subsidence during the rehabilitation that will occur in the future. Additionally, specific measures to address cracking will be designed on any future rehabilitation. During the period of Sponsor's Breach there will be no impacts of subsidence, fissuring or cracking.

Alternative 2–Dam Modification

As with Alternative 1, the Dam Modification Alternative will address the fissure problem that results from subsidence. There will be specific measures to address cracking of the structure. Should subsidence occur at a faster rate, the dam crest could be easily raised by the local Sponsor. The Flood Control District of Maricopa County has indicated it will perform any such future raise, if needed, without Federal assistance.

Alternative 3- Single Basin - Under Alternative 3, the dam will be removed but the single basin could be impacted by continued subsidence and the threat of fissures. Continued monitoring would be required. Should subsidence cause a loss of storage, the basin could be enlarged but at a significantly greater cost than raising the dam crest elevation (Alternative 2).

**Floodwater Damages**

Alternative 1 – Future Without Project

Under the Future Without Project Alternative, the White Tanks No. 3 FRS will remain in a deficient condition until breached. It is anticipated that subsidence will continue and may threaten the integrity of the structure by the resulting fissures and cracking. The FRS would not be able to pass the Probable Maximum Flood (PMF) and the downstream community will continue to face the threat of a sudden breach. After the Sponsor's breach was forced, flood and sediment damages could result until dam modification was completed in year 7. After year 7 the threat of a catastrophic breach will be minimized.

Alternative 2–Dam Modification

With Alternative 2, the FRS will again provide the high level of flood protection that was planned and existed at the time of its construction in 1954. It is expected that there will be additional improvement of the diversion to direct floodwater into the retention basin and prevent floodwater from breaking through and crossing the Beardsley Canal. The potential for sudden inundation will be diminished due to measures undertaken to protect the foundation against earth fissures due to subsidence.

Alternative 3- Single Basin - Under Alternative 3, the White Tanks No. 3 FRS would be replaced by an excavated basin that would provide the storage capacity expected for the 100-year, 24-hour storm event. Flooding and sediment damages would be controlled to an acceptable level although protection would be provided only up to the 100-year storm event. There would be minimal risk of downstream impacts due to structural failure.

**Economic Stability**

Alternative 1 – Future Without Project - There would be very little change in the local economy or in the existing social setting until the Flood Control District was forced to conduct

a Sponsor's Breach or there was a sudden dam failure. Knowledge of the flood risk without the White Tanks No. 3 FRS is not widely known because many residents are newly-arrived in the watershed. If a significant flooding event occurred during the time the structure was breached or there was a sudden failure, it would slow down economic growth considerably. It would, however, raise the community's awareness of the importance of the White Tanks No. 3 FRS.

Positive short-term impacts on local services may occur from the increase in construction activity when modification of the structure in the future. Construction firms may hire local skilled workers, which also would provide a positive impact on the local as well as regional economy.

Alternative 2 – Dam Modification - Positive short-term impacts on local services may occur from the increase in construction activity due to the rehabilitation of the existing structure. Construction firms may hire local skilled workers, which also would provide a positive impact on the local as well as regional economy.

Additionally, development in the downstream watershed would continue undiminished due to the protection offered by the newly-rehabilitated White Tanks No. 3 FRS.

Alternative 3 –Single Basin– The Single Basin Alternative would provide protection to the downstream residents up to the 100-year level of protection. Any protection above the 100-year 24-hour flood event currently offered by the FRS would not be provided. Thus average annual benefits of the basin would not be as large as the benefits provided by the current structure. The increased cost of the structure is significant. Aesthetic improvements would increase the social value of the area.

Positive short-term impacts on local services may occur from the increase in construction activity during excavation of the single basin. Construction firms may hire local skilled workers, which also would provide a positive impact on the local as well as regional economy.

**Cultural Resources**

The criteria defined by regulations for Protection of Historic Properties (36 CFR Part 800) were used to assess effects of the alternative plans on historic properties. Those regulations define effects as direct or indirect alterations of the characteristics of a historic property that make it eligible for inclusion in the National Register of Historic Places. Such effects that diminish a property's integrity of location, design, setting, materials, workmanship, feeling, or association are considered to be adverse.

The potential for indirect impacts on cultural resources was considered. Any cultural properties within the project area have been or will be affected by recent and ongoing urban development. Within that context, development within the White Tanks No. 3 FRS area is unlikely to have any significant indirect effects on cultural resources.

Alternative 1 – Future Without Project – Although no cultural resources were identified in the immediate area of the FRS, the downstream area which could be impacted by a breach inundation or short-term Sponsor's breach has not been surveyed. Flooding in the downstream area could impact undiscovered cultural resources.

Alternative 2 – Dam Modification – The area that would be impacted by a Dam Modification Alternative was surveyed. No significant impacts to cultural resources are anticipated and no mitigation measures are required unless buried archaeological resources or human remains or funerary objects are discovered during construction.

Alternative 3 – Single Basin - The area that would be impacted by the excavation of the single basin was surveyed. No significant impacts to cultural resources are anticipated and no

mitigation measures are required unless buried archaeological resources or human remains or funerary objects are discovered during construction.

**Threatened and Endangered Species (and Other Biological Resources)**

NRCS will adhere to the Federal agency requirements set forth in the Endangered Species Act regarding endangered, threatened, and proposed species. Regulations governing consultations are found in 50 CFR 402 and 7 CFR 650. These regulations apply to all actions in which there is discretionary Federal involvement or control.

Alternative 1 – Future Without Project - Under present conditions, no threatened or endangered animal or plant species is known to occur within the general vicinity of the existing FRS. No protected species are expected to inhabit the area in the future whether a project is undertaken or not.

Alternative 2 – Existing Structure Modification - Alternative 2 is not expected to affect any threatened or endangered animal or plant species. There are no expected off-site effects. The Area of Potential Effect (APE) for this alternative includes the FRS and its immediate surrounding area, the existing north inlet diversion channel and its immediate surrounding area, a flood pool of approximately 45 acres located up-slope of the FRS, and borrow areas totaling approximately 90 acres located up-slope of the FRS. The total APE is estimated at 220 acres. Much of the APE is moderately to severely disturbed due to previous construction activities and vehicle use.

There are no known occurrences of protected species within the APE. Should individual western burrowing owls or Sonoran desert tortoises or any other special status species be discovered during construction, applicable avoidance and consultation procedures will be followed

Alternative 3 – Single Basin: - Alternative 3 will not affect any threatened or endangered animal or plant species. The APE for this alternative includes the existing FRS and the immediately surrounding area, the north inlet channel and the immediately surrounding area, a detention basin and associated channels. The total APE is estimated at 565 acres.

**Wildlife Habitat**

Alternative 1 – Future Without Project– No additional land would be impacted in the future without project. There would, however, be disturbance of the existing structure if it undergoes a short-term Sponsor's breach. Additionally, an eventual dam modification could impact the current area of the structure depending of the rehabilitation alternative selected.

Alternative 2 --Dam Modification – There would be a total of approximately 220 acres disturbed by the rehabilitation of the existing structure and construction of the north inlet diversion channel. Much of this area was previously disturbed due to construction activities and vehicle use. The remainder is low value desert habitat. Environmental mitigation and landscaping of the White Tanks No 3 FRS and vicinity would be necessary to replace native vegetation disturbed by excavation of the borrow areas and other construction activities

The construction activities would have an impact on designated waters of the United States. Excavation of the borrow areas would extend into and impact an estimated 12 acres of designated waters.

Alternative 3 –Single Basin Alternative - The Single Basin Alternative would replace the existing structure with a basin which would detain storm waters up to the 100-year, 24 hour event. Some areas in the vicinity of the current structure, which had returned to equilibrium since the dam was constructed, would be disturbed. This alternative would require environmental mitigation and landscaping to replace native vegetation, disturbed by excavation of the basin and other construction activities.

The construction activities would have an impact on designated waters of the United States. A permanent impact would occur where spoils piles are placed in washes and behind the existing dam. Temporary impacts may occur during construction of the basins and channels. The estimated area of impact on waters of the U.S. is 24 acres.

**Viewshed**

Alternative 1 – Future Without Project - In the Future Without Project, a forced Sponsor's breach could impact the visual resources in a negative way by leaving significant portions of the dam in place during a period when it does not provide flood protection. When dam modification is eventually completed, visual impacts will be mitigated by extensive landscaping improvements.

Alternative 2 – Dam Modification - With the Dam Modification Alternative there will be improvements to the visual qualities of the landscape due to extensive landscape mitigation of the rehabilitated White Tanks No. 3 structure. There will be some additional changes to the landscape just north of the existing structure when the north inlet diversion channel is constructed to prevent "breakouts" of floodwaters across the Beardsley Canal. Construction activities will be mitigated with native plantings where they do not interfere with the flood prevention function of the structure.

Alternative 3 – Single Basin - With the Single Basin Alternative there will be improvements to the visual qualities of the landscape due to the removal of the FRS footprint and extensive landscape mitigation of the newly-constructed basin. Construction activities to prevent "breakouts" of floodwaters across the Beardsley Canal will be mitigated by design and grading to re-naturalize the channel corridor to be reflective of topography and character of nearby

washes. Construction activities will be mitigated with native plantings where they do not interfere with the flood prevention function of the structure.

**Wetlands**

Alternative 1 – Future Without Project

There is no effect on wetlands in either the without project or the with project scenario as there are no naturally-occurring wetlands in the watershed.

Alternative 2 – Existing Dam Modification - There is no effect on wetlands in either the without project or the with project scenario as there are no naturally-occurring wetlands in the watershed.

Alternative 3 – Single Basin Alternative - There is no effect on wetlands in either the without project or the with project scenario as there are no naturally-occurring wetlands in the watershed.

**Civil Rights and Environmental Justice Implications**

Title IV of the Civil Rights Act of 1964 and related statutes ensure that individuals are not excluded from participation in, denied the benefits of, or subjected to discrimination under any program or activity receiving Federal assistance on the basis of race, color, national origin, age, sex, or disability. Executive Order 12898 on Environmental Justice directs that programs, policies, and activities not have a disproportionately high and adverse human health and environmental effect on minority and low-income populations. No minority or low-income residences or businesses would be relocated or directly impacted by alternatives considered in this study. Therefore, the project is not anticipated to have any disproportionately high and adverse effects on populations protected by Title IV of the Civil Rights Act.

It can be argued that several of the alternatives considered in the alternatives analysis of the White Tanks No. 3 FRS would result in increased flooding damages to the community downstream of the current floodwater retarding structure. The alternatives considered, however, do not propose solutions or policy actions which will negatively and/or disproportionately effect one group of residents more than any other group of residents of the watershed.

**Comparison of Alternative Plans**

The plans displayed in Table J are the most realistic alternatives that could be selected as the recommended plan. Table J is presented so the effects of candidate plans may be compared against the future without project condition.

**Risk and Uncertainty**

The degree of risk and uncertainty involved in the project elements was considered throughout the planning process.

In project formulation, the risk involves selecting a locally acceptable alternative that meet the Sponsor formulation goals to bring the White Tanks No. 3 FRS up to current NRCS and State of Arizona standards and provide flood damage reduction benefits for the 100-year life of the project.

Uncertainty is a characteristic of future conditions and their relationship of those conditions to project effectiveness to meet formulation goals. Conditions that could impact the project's effectiveness include changes in subsurface geologic processes, such as the rate of subsidence and fissuring. Although these conditions have impacted the White Tanks No. 3 FRS in the past, there is uncertainty whether or not these conditions will continue to impact the

rehabilitated structure over its projected lifetime. However, projections for future land subsidence and potential for earth fissuring will be evaluated and addressed as part of project design.

Local construction and/or modification of the downstream impacted area will impact existing and future properties in the delineated breach inundation area and in the 100-year floodplain area. As agricultural land is converted to urban use, both hydrologic and hydraulic processes will be modified causing less infiltration of precipitation and more runoff. The impacts of this trend will be itself modified by the response of local communities to address water management through local flood control ordinances.

Another cause of uncertainty is the occurrence of catastrophic weather phenomena. The White Tanks No. 3 FRS has not been severely tested since it was constructed in 1954. Currently the desert southwest is undergoing a drought of historic proportions. The future of local weather patterns will continue to be uncertain due to the lack of long-term weather statistics.

Economic uncertainty arises due to the uncertainty of future economic development of the White Tanks No. 3 watershed area. Current growth trends could be moderated by external conditions which cause fluctuations in the local economy such as the occurrence of economic recessions or changes in interest rates.

These uncertainties impact the estimated flood damage reduction, both with and without dam rehabilitation, and the estimated benefits and costs. Nevertheless, benefits and costs presented in this rehabilitation plan/environmental assessment are the best estimates that can be made, given the project scope and available planning resources.

Other uncertainty involves the possibility of hidden archeological resources which may not be discovered until the earth's surface is disturbed. There is a risk that the cost of the project will be affected because of actions taken to recover or mitigate for these cultural resources.

Although the White Tanks No. 3 FRS and associated structures will continue to be monitored over the 100-year lifetime of the project, structural integrity of the structure could be impacted by as yet undiscovered geological processes. The best available science has been utilized to study and design for potential unforeseen events. However, as with all dams, there will always remain an extremely low, but potential risk of failure.

**Rationale for Plan Selection**

The alternative preferred by the project Sponsors is Alternative 2, the Dam Modification Alternative.

The Dam Modification Alternative meets project purposes identified through the scoping and planning process:

- to address current dam deficiencies in order to meet current NRCS and State of Arizona dam standards as well as extend the life of the structure for 100 years, and
- to provide flood protection to approximately 6,000 current downstream inhabitants of the White Tanks No. 3 FRS downstream area and all future residents in this rapidly urbanizing watershed.

The following are additional advantages of the Dam Modification Alternative that led project Sponsors to prefer it for the White Tanks No. 3 FRS rehabilitation:

- The Dam Modification Alternative also provides the highest level of flood protection (2,750 acre-feet) at the lowest cost. It will impact 11.5 acres of "waters of the U.S." The impacted acres will be graded and restored using native plants and hydroseeding.

- The Dam Modification Alternative can also be constructed in such a manner that flood protection would be provided during construction.
- The construction of the Dam Modification can be staged in a way that will allow construction to proceed in conjunction with anticipated funding.
- The Dam Modification Alternative had the least amount of negative environmental impact of all the alternatives studied

This Dam Modification Alternative is considered the NED (National Economic Development) Alternative since it is the alternative that reasonably maximizes net national economic development benefits, consistent with protecting the Nation's environment and with other Federal planning requirements.

The Dam Modification Alternative is complete and effective in that it addresses all the identified problems while addressing all concerns. It is efficient in that it identifies a cost-effective method of achieving the goals. Additionally, it is acceptable to the Sponsors and other stakeholders, who will ensure its successful implementation. A summary and comparison of candidate plans is shown in Table I.

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**Table I: Summary and Comparison of Candidate Plans**
**White Tanks No. 3 FRS, Maricopa County, Arizona**

| Effects Project | Alt. 1 Future w/o Project | Alt. 2 Dam Modification | Alt. 3 (Basin) |
|---|---|---|---|
| | | | |
| **Total Project Cost 1/** | $25,529,700 | $23,646,000 | $27,238,000 |
| PL83-566 share 2/ | $0 | $16,135,100 | $18,502,300 |
| Other share 2/ | $25,529,700 | $7,510,600 | $8,735,800 |
| | | | |
| **National Economic Development Account** | | | |
| Beneficial annual | $1,580,200 | $1,784,600 | $1,637,000 |
| Adverse annual | $1,129,900 | $1,234,900 | $1,419,900 |
| Operation & Maintenance | $42,600 | $48,700 | $62,100 |
| Total Adverse Annual | $1,172,500 | $1,283,600 | $1,482,000 |
| Net beneficial | $407,700 | $501,000 | $155,000 |
| Benefit-Cost Ratio | .35:1.0 | 1.39:1.0 | 1.10:1.0 |
| | | | |
| **Environmental Quality Account** | | | |
| Important farmland | Will decrease to 400 acres | Will decrease to 400 acres | Will decrease to 400 acres |
| Soil Resources | No change | No change | No change |
| Cultural resources | Potential to degrade | Much reduced potential to degrade | Reduced potential to degrade |
| Wildlife habitat | Improvement in Future | Probable Improvement | Probable Improvement |
| Threatened & endangered species | None in area | None in area | None in area |
| Plant resources | No change | No change | No change |
| Air Resources | Temporary increase in future | Temporary increase | Temporary increase |
| Fish Habitat | No change | No change | No change |
| Visual effect | Improvement in future | Significant improvement | Significant improvement |
| Wetlands | No change | No change | No change |

1/ Rounded to nearest $100
2/ Total Project Cost for Economic Analysis differs from Total Cost utilized for determination of Cost Share.

| Table I: Summary and Comparison of Candidate Plans (continued)<br>White Tanks No. 3 FRS, Maricopa County, Arizona | | | |
|---|---|---|---|
| **Effects Project** | **Alt. 1<br>Future w/o Project** | **Alt. 2<br>Dam Modification** | **Alt. 3<br>(Single Basin)** |
| **Other Social Effects Account** | | | |
| Health & Safety | Multi-year decrease with Sponsor's breach – 6,000 persons at significant risk | Greatest safety improvement Reduce risk to 6,000 person living downstream | Slightly less safety improvement Than Alt. 2<br>Reduce risk to 6,000 persons living downstream |
| Economic Stability | Increased threat to stability during time of breach | Protection of infrastructure for next 100 years | Protection of infrastructure for next 100 years |
| Social Effects | Inc. level of insecurity to 6,000 current and additional future residents living with threat | Increased sense of well-being to 6,000 current residents and additional future residents | Increased sense of well-being to 6,000 current residents and additional future residents |
| Agricultural economy | Temporary increase potential ag flood damage | Reduced potential for flood damages | Reduced potential for flood damages |
| Minorities, aged, etc. | Potential impacts due to multi-year Sponsor's Breach especially to prison inmates | Increased level of protection to all residents including high minority population in prison | Increased level of protection to all residents including high minority population in prison |
| Standard of living | Increased threat to standard of living to 6,000 current residents and many more in the future | Reduced threats to standard of living for the next 100 years | Reduced threat to standard for the next 100 years |
| Dam Safety in Maricopa County | Would cause delay in provision of flood protection at other locations in county | Would permit county to address dam safety concerns at other FRSs in the county | Would permit county to address<br>dam safety concerns at other FRSs in the county |
| **Regional Economic Development Account** | | | |
| Employment | No significant impact | No significant impact | No significant impact |
| Beneficial effect (average annual equivalents) | | | |
| Region | $1,580,200 | $1,784,200 | $1,637,000 |
| Rest of Nation | ----- | ----- | ----- |
| Adverse effect (average annual equivalents) | | | |
| Region | $1,129,900 | $432,200 | $497,000 |
| Annual O&M expenditure | $42,600 | $48,700 | $62,100 |
| Rest of Nation | --------- | $802,700 | $922,900 |
| Total Adverse(average annual equivalents) | $1,172,500 | $1,283,600 | $1,482,000 |

Price Base 2003; based of 5.625% interest rate

June 2004

# CONSULTATION AND PUBLIC PARTICIPATION

Agency consultation and public participation were integral to all phases of planning and environmental evaluation.

The first public scoping meeting to solicit input to address dam deficiencies and to meet current dam safety standards was held March 22, 1994. Meeting notices were published in local newspapers, posted in conspicuous public locations, and mailed to landowners prior to the meeting. A supply of scoping response sheets was available at the meeting. Local participants were encouraged to disseminate comment sheets to others who might be interested in making their concerns a part of the project.

In June, 1994, the Sponsors provided Arizona's single point of contact, the Arizona Department of Commerce, with notification of application for Federal Public Law 83-566 assistance from USDA, Natural Resources Conservation Service to undertake a flood prevention project in the White Tank Mountains Watershed (contains the White Tanks No. 3 FRS). Also in June, 1994, the Natural Resources Conservation Service completed and circulated a preauthorization planning report and plan of work for this proposed project. A Watershed Plan/Environmental Assessment was ultimately authorized in 1996. However, because of new concerns with the geological and foundation conditions, the plan was not implemented.

The Sponsors then decided to study additional dam rehabilitation alternatives. The Sponsors presented a dam modification and a range of basin alternatives to replace the White Tanks No. 3 FRS in a widely-advertised public scoping meeting held November 8, 2000. While the basin alternatives were acceptable to the vast majority of attendees, almost all expressed a desire to limit developed recreation areas and maintain a quiet desert environment.

In December 2001, the Flood Control District of Maricopa County submitted a request for NRCS assistance to address the dam deficiencies using the newly-authorized Dam Rehabilitation Amendments to the Small Watershed Program. The need for the dam rehabilitation was confirmed by the Arizona Department of Water Resources, Dam Safety Office, who ranked White Tanks No. 3 FRS as the State's top priority for rehabilitation due to the physical deficiencies of the structure and the resulting health and safety issues for the downstream population.

On February 4, 2002, the Arizona Natural Resources Conservation Service was granted authorization to assist the Flood Control District of Maricopa County with the White Tanks No. 3 FRS rehabilitation.

Another widely-publicized meeting was held in June 5, 2002, to solicit public input about the measures considered to prevent breakouts from the north inlet diversion channel. Public comment sheets were completed by 19 interested citizens. The public was supportive of the project to reduce floodwater breakouts but expressed strong feelings that the area should retain a natural, desert-like setting. There was also a desire that the area remain accessible for hikers and equestrians but be restricted to motorized recreation vehicles.

On January 21, 2004, a much-advertised public meeting was held to present the range of dam rehabilitation alternatives studied to the affected public. The two primary alternatives, the single basin and the dam modification, were presented and the Sponsor presented its rationale for its choice of the Dam Modification Alternative. A sample of the comment sheet utilized to solicit comments is shown in Appendix C.

Nineteen members of the impacted area attended the meeting. At the open house presentation, public comments/input was accepted. A sign-up sheet was provided so that those interested

could receive the draft rehabilitation plan/environmental assessment. Comments received were very supportive and similar to those received in previous public meetings.

Specific comments included:

- "Do it ASAP!"
- I much approve of the modified dam.
- I trust your judgment and would approve of the least expensive route.
- This alternative is the best of the 3 shown. The cost for any of the options appears to be high. But I'm sure in today's economic situation that is probably close to reasonable.
- The alternative seems logical and well thought out.

One comment suggested that the project tie into the McDOT trail system and be accessible to local equestrians. Another suggested that the structure be realigned to the southernmost side of the site.

The following agencies and groups were invited to participate during any or all of the planning process including and during inter-agency review of documents:

**U.S. Government**

**Environmental Protection Agency**

**Department of Agriculture**

Agricultural Research Service
Water Conservation Lab
Farm Service Agency (FSA), State and Local
Rural Development (RD), State and Local
Forest Service Regional Office, Albuquerque, NM.

**Department of Defense**

U.S. Army Corps of Engineers.

**Department of Interior**

Geological Survey
Bureau of Reclamation
Fish and Wildlife Service, Ecological Services
National Park Service, Southern Arizona Office

**State and Local Government**

**State of Arizona**

Department of Agriculture

Arizona Game and Fish Department
State Historic Preservation Officer
State Land Department
Department of Environmental Quality
Arizona Department of Water Resources
ADWR, Dam Safety
Arizona State University, Library
Arizona Department of Corrections

**Local Government**

Maricopa Association of Governments
Maricopa County Board of Supervisors
City of Goodyear

**Tribal Governments (Cultural Resources Consultation Only)**

6 tribes in Arizona have indicated they wish to be informed of projects that will take place in this geographical location

**Summary of Comments and Actions Taken**

Comments received during state and local agency review of the INFORMAL REVIEW Plan/EA were used to prepare the DRAFT Plan/EA. Although comments, received during interagency/public review of the DRAFT Plan/EA, were not considered significant, they are included in Appendix A and were used to prepare the FINAL Plan/EA.

# RECOMMENDED PLAN

**Purpose and Summary**

Alternative 2, the Dam Modification Alternative is the NED plan as well as the recommended plan. This alternative meets the formulation goals of the Sponsors to address current identified structural deficiencies and potential threats to the FRS, resulting from continued ground subsidence and the presence of a fissure risk zone at the location of the dam. The plan restores the dam crest elevation and the auxiliary spillway capacity so that it will pass the probable maximum flood or inflow design flood without overtopping and will maintain the original 2,750 acre-feet of flood storage. It also restores the design crest of the dam to eliminate the effects of past subsidence. The modification provides protection to the potentially collapsible foundation materials (Holocene age soils). If foundation soils were to collapse, a seepage-erosion failure of the structure could result. The rehabilitated structure will be designed for a 100-year project life. The Dam Modification Alternative is estimated to cost $23,646,000.

**Project Measures**

Differing geologic conditions and the potential for earth fissures along the dam require a design with two distinct structural cross-sections. The typical design cross-section used will depend on the dam station location with respect to the "Fissure Risk Zone" or the "Embankment Cracking Zone". Both cross-sections will address the identified problems of transverse cracking and potentially collapsible foundation soil conditions.

<u>Fissure Risk Zone</u>

In the Typical Section for the fissure risk zone (Stations 30+00 to 55+00), the Holocene soils within the footprint of the new upstream embankment will be excavated and removed (See Figure 6). The excavation will extend 2 feet into the underlying Pleistocene soils. Cutoffs will be installed at the upstream and downstream toes of a new embankment. The trenches will extend 15 feet into the Pleistocene soils as measured from the Holocene. There will be a newly constructed soil-cement central core with a crest width of 10 feet. The downstream face of the upstream cutoff and the upstream face of the downstream cutoff will be lined with a geotextile

and a geomembrane. In the event the fissure risk zone extends beyond the currently identified areas, this design modification would be extended.

Embankment Cracking Zone

The Typical Section for the embankment cracking zone (Stations -3+80 to 30+100 and 55+00 to 76+96) is shown in Figure 7. The design consists of an upstream raise, using geosynthetic and, if required, earthfill material elements on the upstream face. The geotextile would serve as a cushion to minimize the risk of puncturing the geomembrane liner during installation and service, and also as a filter to promote formation of a filter cake and reduce infiltration/seepage into the embankment through the upstream face. There will also be a cut-off at the upstream toe to address the foundation issues. The upstream cut-off will extend 2 feet into the more highly cemented Pleistocene soils. This will reduce the potential for the foundation under the existing dam from becoming saturated and collapsing thus leading to a progressive seepage-erosion failure of the foundation and/or dam.

Dam Crest Elevation

The modified crest elevation is a function of the flow depth through the auxiliary spillway and the predicted rate of subsidence. The PMF routing uses NRCS hydrologic design criteria. It has been determined that the dam crest elevation should be 1220' (NGVD 1988 Datum). This provides one foot of freeboard for predicted subsidence. It also provides sufficient crest width to allow the Sponsors to raise the crest an additional foot if future subsidence exceeded the predicted rate. The capability to raise the crest height has been incorporated into the Dam Modification Alternative as a prudent measure given the uncertainty about the rate of future subsidence.

Auxiliary Spillway

The final configuration includes the installation of a concrete cut-off wall across the 800 foot-wide earthen spillway crest. The wall would be 3 feet wide and extend down approximately 15 feet vertically into the Pleistocene soils. For protection, a riprap launch apron would be constructed that would extend for 40 feet downstream of the cut-off wall. The riprap would be covered with soil for safety and aesthetic reasons.

The spillway crest will be set at an elevation of 1212 feet (NAVD 1988 Datum), which was the original crest elevation.

**Table J: Comparison of As-built, Existing, and Rehabilitated FRS White Tanks No. 3 FRS, Maricopa County, Arizona**

| | | 1929 NGVD | | 1988 NGVD | |
|---|---|---|---|---|---|
| **Item** | **Unit** | **As-Built** | **Existing** | **Existing** | **Rehabilitated** |
| Sediment Storage | Acre-feet | 6/ | 500 | 500 | 500 |
| Dead Storage | Acre-feet | 6/ | 190 1/ | 190 | 100 1/ |
| Principal Spillway | Elev. (feet) | 1190.0/ | 1186.0 2/ | 1188.0 | 1199.2 |
| P.S. Conduit diameter | Inches | 24&48 2/ | 24&48 2/ | 24&48 2/ | 48 3/ |
| P.S. Discharge | CFS | 435 4/ | 435 4/ | 435 4/ | 170 |
| Detention Storage | Acre-feet | 6/ | 2750 | 2750 | 2750 |
| Aux. Spillway | Elev. (feet) | 1210.0 | 1207.0 6/ | 1209.0 | 1212.0 |
| Top of Dam | Elev. (feet) | 1216.0 | 1211.9. 5/ | 1213.9.0 | 1220.0 |

1/ Dead storage created by significant subsidence since the structure was built in 1954.
2/ Release rates from the structure were manually controlled by two 48-inch and on 24-inch CMP conduits. The control invert elevations varied.
3/ A 48-inch gated emergency drawdown conduit will also be installed. The combined 48 inch riser and 48-inch drawdown conduit can provide 3-day drawdown under emergency conditions.
4/ Maximum discharge capability at auxiliary spillway crest with all three CMP's fully opened.
5/ Low point in top of dam due to subsidence.
6/ Unclear or unavailable; may be clarified during final design.

Outlets

The three current CMP outlets will be removed or abandoned and replaced with two steel concrete encased or reinforced concrete pipe outlets. A standard NRCS covered top riser with a 36 to 48 inch conduit will be installed. The outlet will initially be gated and operated in accordance with an outlet operation plan that will be developed during the final design. The plan process will address downstream flood protection issues as identified in FCDMC's current operation plan. As soon as a suitable downstream outlet channel can be established, the gated restriction will be removed from the principal spillway conduit. The final dimension of the principal spillway conduit will be sized to remove 85 percent or more of a 100-year, 10-day storm within 10 days after maximum storage is obtained. A second gated steel concrete encased conduit will be installed to facilitate an emergency drawdown which can occur after the downstream flood channel is established sometime in the future. Variation to this plan may

be implemented during the final design process through mutual concurrence between NRCS and FCDMC.

North Inlet Channel

The rehabilitation includes constructing a new diversion and flood channel for the North Inlet to the White Tanks No. 3 FRS (See Figure 8). The new diversion would require a drop inlet into a box culvert to cross under a road and an irrigation canal. There would also be alterations to culverts and washes in order to safely convey the runoff into the White Tanks No. 3 FRS.

The new flood channel will include a two-mile long unlined ditch running from just north of Olive Avenue to the Glendale Avenue alignment, and will contain associated drainage structures and erosion protection. The Channel will also include landscaping and aesthetic treatments per the District's Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects. The North Inlet Channel Project will prevent the breakout of flood runoff and the subsequent overtopping of the Beardsley Canal for up to the 100-year flood.

This Project is proposed as a partnership between the Flood Control District of Maricopa County (District) and Maricopa Water District (MWD), and includes a diversion structure, culvert crossings under roadways and the Beardsley Canal, channel construction, and erosion protection. Landscaping, irrigation, trails, and other multi-use facilities will be provided along the flood channel alignment. MWD intends to provide land rights for the new diversion structure to be located east of Beardsley Canal from Olive Avenue to Northern Avenue.

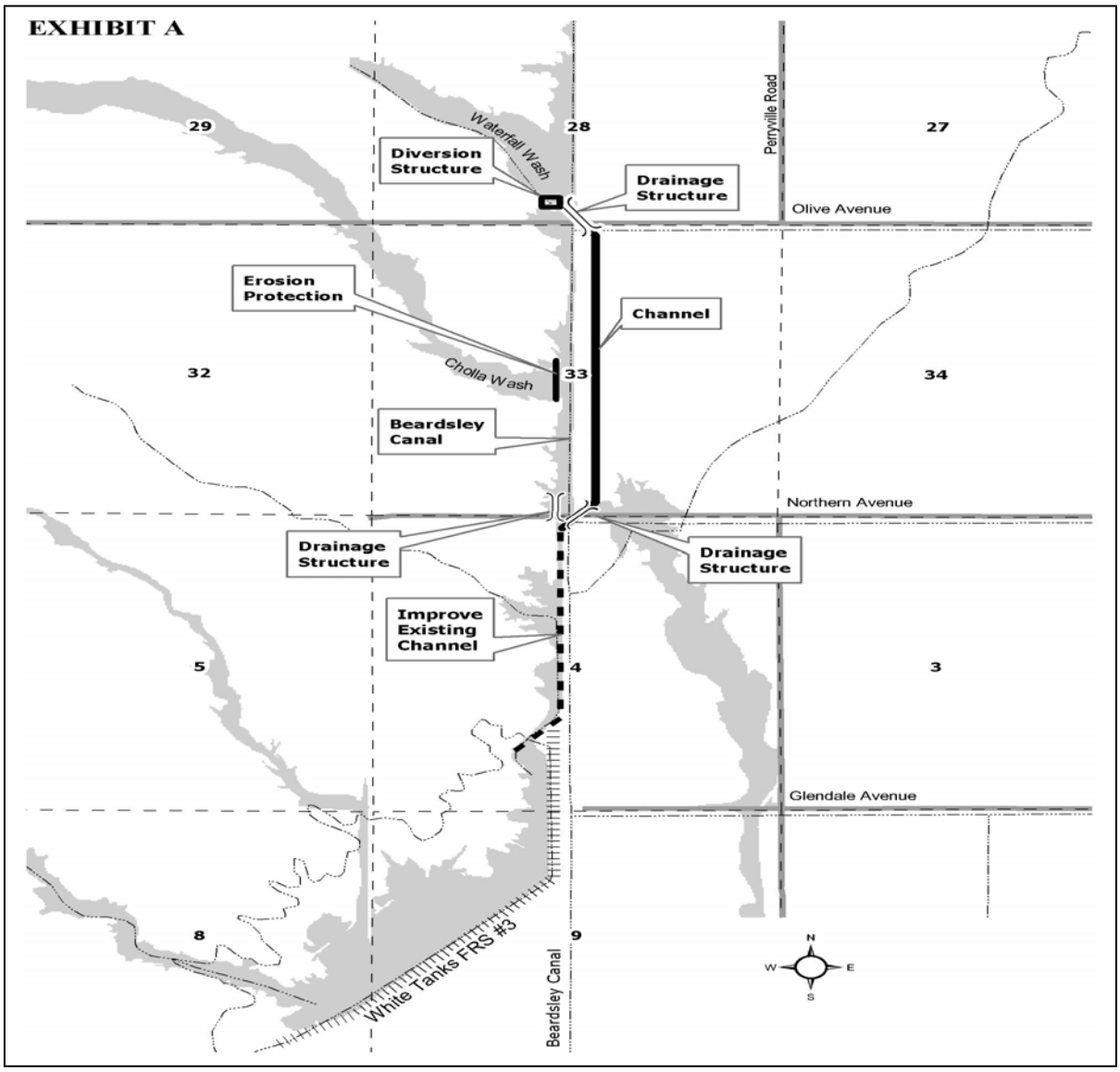
The new North Inlet Channel will be designed to convey runoff from the 100-year storm. Culverts to accommodate storm flows will be designed at Olive Avenue and Northern Avenue.

**Sediment and Flood Storage**

Current contour mapping shows the existing dam has a combined sediment and floodpool volume of 3,250 acre feet. Recent hydrology studies of the watershed for the White Tanks No. 3 FRS indicate that the 100-year, 24-hour design flood storage, is actually 1,967 acre feet. The

available sediment storage for the recommended design alternative is 500 acre-feet for the 100 year design life. The available flood storage, existing less sediment, equates to 2,750 acre-feet.

**Figure 8: North Inlet Channel Project Area**




This storage volume would contain back-to-back 100-year, 10-day storms. The back-to-back events are required because the outlet pipes are gated and assumed to be closed during the storm events.

**Mitigation Features**

The rehabilitation of the White Tanks No. 3 FRS will require actions to mitigate for impacts within waters of the United States (WUS) per Section 404 of the Clean Water Act (See Permits and Compliance). Areas designated by the U.S. Army Corps of Engineers as WUS include the washes upstream of the dam and the two-year flood pool (former borrow area of the dam). Permanent impacts to approximately eight acres of WUS will occur in the flood pool due to the proposed modified cross-sections of the existing dam. Temporary impacts to approximately three acres of WUS will occur in the proposed borrow areas which will minimally impinge upon the flood pool.

The former borrow area has been disturbed and is sparsely vegetated with low value habitat. The proposed borrow areas consist of approximately 90 acres of previously disturbed barren land and areas of low to moderate value desert habitat adjacent to some unnamed washes (see Figure 9).

Following construction of the dam, excavated areas will be revegetated and graded to blend into the surrounding terrain and will include drainages to convey flows into the impoundment behind the dam. Habitat loss resulting from construction will be mitigated by applying a hydroseed mix of native desert plants. Areas within the impoundment disturbed by construction will be hydroseeded with a mix of native forbs, grasses and shrubs, including globemallow, Indian wheat, purple three-awn, triangleleaf bursage, and brittle bush. The borrow areas and other disturbed areas will be hydroseeded with a mix of desert shrubs and trees, including velvet mesquite, palo verde, acacia, ironwood, creosote bush and brittle bush. The embankment will be hydroseeded with native grasses, forbs, and other non-deep rooting shrubs. The vegetation will be seeded during the fall after completion of construction. The compacted ground will be scarified and graded to promote passive water collection and to improve soil moisture.

Construction of the North Inlet Channel will disturb approximately 19 acres of low to moderate value desert habitat. Following construction of the channel, extensive revegetation and hydroseeding of native desert plants will be performed.

Mitigation with respect to cultural resources that may be discovered during construction will consist of avoidance and/or data collection and clearance. Mitigation will be conducted under the supervision of the NRCS state archeologist in accordance with established procedures with the Arizona State Historic Preservation Office. A total of 6 tribal governments have been consulted/informed of the White Tanks No. 3 FRS rehabilitation project.

A vector control management plan is required for any activity that results in standing water for durations exceeding 36 hours. To address mosquito populations that develop after storm events, a vector control management plan will be developed and implemented by the Sponsor in consultation with Maricopa County Vector Control Division.

There are no protected species in either the FRS impoundment area or the North Inlet Channel area.

**Visual Impact Mitigation**

Both NRCS and Flood Control District of Maricopa County policies require that environmental considerations and landscape resource issues are included in the planning and design of flood control projects. Additionally, NRCS policy may allow for the mitigation of negative visual impacts of certain past construction efforts if the project's visibility increases over time. Because of the increase in visibility due to rapid development in the project are the rehabilitation plan proposes mitigation features to soften the appearance of the FRS upon the surrounding residential areas.

The proposed dam modification will create major negative visual impacts to most of the existing and planned residential subdivisions north, east and south of the site. The structure is not visible from the regional park and was slightly visible from the area west of the site. For that reason, visual impact mitigation will be applied to the more highly visible downstream side

of the structure. The enhancement of the upstream side of the modified FRS is excluded from NRCS cost-sharing.

Specific visual impact mitigation measures include the placement of overburden upon the repaired structure to soften its geometric form, the placement of a soil veneer layer of carefully-collected on-site surface soils over the lighter-colored overburden soils, and the planting of a screen of native desert trees (tall pots or container grown plants) downstream of the structure to obscure or block views of the dam from existing and planned residential subdivisions (See Figure 10). Nursery plants will require frequent watering for a period of one to two years dependent on the weather.

The Flood Control District of Maricopa County will undertake enhancement of the upstream side of the modified FRS in a manner compatible with the planned visual mitigation of the downstream slope of the FRS. These enhancement measures would be positive improvements for future upstream development and future recreation and multi-use activities upstream of the dam.

**Permits and Compliance**

Installation of the proposed measures will be performed in full compliance with all Federal, state, and local laws and policies. The project will require a 401 Permit from Arizona Department of Environmental Quality and a 404 Permit from the U.S. Army Corp of Engineers prior to construction. The purpose of the 401 permit is to ensure that the proposed construction activities do not violate state surface water quality standards. The purpose of the 404 permit is to protect the chemical, physical, and biological integrity of the Waters of the U.S.. The District has filed both the 401 and 404 permit applications. The project Sponsors have the responsibility to obtain all required permits.

Additionally, an Authorization to Modify the Structure is required from the Arizona Department of Water Resources Department (ADWR). ADWR has state jurisdiction for the structure.

The project area is located within the PM10 Non-attainment Area of Maricopa County as designated by the U.S. Environmental Protection Agency. Project activities will comply with all permits, rules, and regulations associated with the Maricopa County Air Quality Dust Control Program.

The Flood Control District completed an updated Emergency Action Plan for the White Tanks No. 3 FRS on August 8, 2003.

**Costs and Benefits of Measures**

Project installation cost for the Dam Modification Alternative is $23,646,000.

Tables 1, 4, 5A, and 6 show the estimated average annual equivalent costs and benefits of the Dam Modification Alternative. The recommended plan is also the National Economic Development Plan because it returns the highest net benefits. The following table shows benefits of the Dam Modification Alternative for year 1 (2003) and the average annual equivalent benefits over the life of the project.

Non-Federal technical assistance includes costs for planning and local permits. Federal engineering and Federal project administration are not included in the project installation costs.

NRCS technical assistance totals $110,000 and technical assistance provided by the project Sponsors totals $2,639,900. Technical assistance includes costs for planning and engineering design services.

**Table K Summary of Benefits**

| White Tanks Project, Maricopa County, Arizona | | |
|---|---|---|
| | **Year 2003** | **Average Annual Equivalent Benefits (Life of Project)** |
| Cropland | $14,600 | $7,900 |
| Residential | $522,900 | $1,240,400 |
| Commercial | $76,100 | $290,500 |
| Other 1/ | $56,200 | $159,600 |
| | | |
| Total | $669,800 | $1,784,800 |

Price Base 2003 June 2004

1/ Includes Avoidance of Flood Insurance Administrative Costs

Project administration includes cost of administration of the construction contracts. The NRCS and the project Sponsors will bear about $20,000 and $100,000 respectively in project administration costs. Construction management costs including construction management, quality assurance testing and engineering support during construction are included in the dam rehabilitation construction cost estimates.

**Installation and Financing**

The plan will be carried out within the framework of a construction plan developed by the project Sponsor and approved by NRCS. During construction, equipment will not be allowed to operate when conditions are such that soil erosion, and water, air, and noise pollution cannot be satisfactorily controlled.

The NRCS will provide technical assistance to the Sponsors with the design and/or construction of the rehabilitation project. NRCS will:

- Provide contract administration technical assistance
- Provide construction management technical assistance.
- Provide financial assistance equal to 65% of project costs, not to exceed 100% of actual construction costs.

- Execute a project agreement with the Sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

The Sponsors will:

- Secure all needed environmental permits, easements, and rights for installation, operation and maintenance of rehabilitated structure.
- Maintain an updated Emergency Action Plan for the White Tanks No. 3 FRS.
- Execute an updated Operation and Maintenance agreement with NRCS for White Tanks NO. 3 FRS.
- Execute a project agreement with NRCS before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
- Provide nonfederal funds for cost-sharing of the project at a rate equal to, or greater than, 35% of project costs.
- Provide local administrative and construction management services necessary for installation of the project.
- Acquire the required permits from the Arizona State Dam Safety agency.
- Comply with all applicable Federal, State, and local floodplain management laws, ordinances and regulations.
- Sponsors are responsible for enforcing all associated project easements and rights-of-way.
- Sponsors will undertake, at their own expense, a raise in the height of the dam crest elevation should the rate of subsidence be greater that anticipated.

The Flood Control District of Maricopa County will provide technical leadership for the installation, operation, and maintenance of the structural measures installed under the

rehabilitation plan. The NRCS will work closely with the Sponsors in the development of an operation and maintenance plan and will participate in annual inspections jointly with the Sponsors and State Dam Safety officials. The Natural Resource Conservation Districts will receive copies of the annual inspection reports and will be informed of any important issues that may affect landusers in the watershed. The NRCD is a legally constituted subdivision of the State of Arizona.

Contracts to implement dam modification measures will be between the FCDMC and the selected engineering construction firm. The Natural Resources Conservation Service will facilitate the request for funding from monies appropriated for the dam rehabilitation program. The NRCS will provide the financial assistance funding (FA) to the FCDMC by means of a Cooperative Agreement.

All works of improvement will be installed in accordance with NRCS standards and specifications as found in the Field Office Technical Guide. It will also meet all applicable local, state, and Federal regulations.

**Operation and Maintenance**

Operation includes the administration, management, and performance of non-maintenance actions needed to keep a completed practice safe and functioning as planned. This includes being cognizant of changes in watershed conditions, both above and below completed practices, which alter the overall function of the FRS, so appropriate actions can be taken promptly.

Maintenance activities include routine work required to prevent deterioration of the installed measures, to repair damage, or to replace practice components. It includes recurring needs, such as repairing, fertilizing, and managing vegetation on dams. Maintenance also includes

repairing damage to completed practices caused by normal deterioration, drought, vandalism, or flooding from other than a sudden breach event.

Measures installed as part of this plan will be operated and maintained by the Sponsors with technical assistance from Federal, state, and local agencies in accordance with their delegated authority. A new O&M agreement will be developed for White Tanks No. 3 FRS and associated measures utilizing the NRCS National Operation and Maintenance Manual, and will be executed prior to signing project agreements. The O&M agreement will specify responsibilities of the Sponsors and will include detailed provisions for retention, use, and disposal of property acquired or improved with PL-106-472 cost share funds. The term of the O&M Agreement will be for the project evaluation period (project life plus installation period-103 years). Provisions will be made for free access of district, state, and Federal representatives to inspect all structural measures and their appurtenances at any time.

The Sponsors will maintain the works of improvement in accordance with standards and specifications as referenced in the NRCS Field Office Technical Guide and the O&M agreement.

The Sponsors will prepare an Emergency Action Plan to cover the period during construction when the embankment is excavated for installation of the new principal spillway and other related flood protection measures to ensure that emergency action procedures are in place when higher frequency storms may impact downstream residents, businesses, and transportation routes that were previously protected by the dam.

**Planned sequence of installation:** Construction to rehabilitate White Tanks No. 3 FRS will begin the first year after the rehabilitation project is authorized by the Chief, NRCS. Due to limited annual funding, the construction will be staged over a 3-year installation period. The

North Inlet Channel will be constructed in Year 3. Flood protection will be maintained throughout the construction sequence.

Should additional funding become available, the construction would be completed sooner.

## Table 1: Estimated Installation Cost
**White Tanks No. 3 Project, Maricopa County, Arizona**
**(Dollars) 1/**

| Installation Cost Item | Unit | Number | PL 83-566 Funds | Other Funds | T otal 1/ |
|---|---|---|---|---|---|
| **Structural Measures** | | | | | |
| Floodwater Retarding Structure | each | 1 | 13,466,800 | 5,806,099 | 19,273,700 |
| Rehabilitation | | | | | |
| | | | | | |
| North Inlet Channel | each | 1 | 2,668,300 | 1,703,700 | 4,372,000 |
| Improvement | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| **Total Project** | | | **16,135,100** | **7,510,600** | **23,645,700** |

Price Base 2003, amortized at 100 years; discount rate 5.625 %. June 2004

# Table 2: Estimated Cost Distribution

**White Tanks No. 3 Project, Maricopa County, Arizona**

| Item | Installation Costs – Federal 1/ | | | | Installation Costs – Non – Federal 1/ | | | | | | Total Installation Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Construction | Engineering | Project Admin. | Total Federal Cost | Construction | Engineering | Real Property | Required Permits | Project Admin. | Total Non-Federal Cost | |
| Rehabilitation of dam | $16,005,100 | $110,000 | $20,000 | $16,135,100 | $1,349,200 | $1,481,900 | $4,529,000 | $50,500 | $100,000 | $7,510,600 | $23,645,700 |

1/ Prices Base 2003

June 2004

## Table 3: Structural Data—Dam Modification 9/
**White Tanks No. 3 Project Rehabilitation, Maricopa County, Arizona**

| Item | Unit | Quantity | Item (Continued) | Unit | Quantity |
|---|---|---|---|---|---|
| Structure class | | C | Principal spillway design | | |
| | | | Rainfall volume (1-day) | in. | 3.85 |
| | | | Runoff volume (1-day) | in | 2.14 |
| Seismic zone | | 0.1g 1/ | Rainfall volume (10-day) | in. | 6.40 |
| Controlled drainage area | mi² | 20.49 | Runoff volume (10-day) | in. | 1.48 |
| | | | Capacity of low stage (max.) | $ft^3$/sec | 170 |
| Runoff curve No. (1-day ARCII) | varies | 77.3-87.2 | Dimensions of conduit (2) | | |
| Time of concentration ($T_c$) | hr. | 1.85 | NRCS Std. Cov. Top Riser | in. | 48 |
| | | | Emergency Gated Outlet | in | 48 |
| Top of Dam. | Elev. | 1220.0 2/ 8/ | Frequency operation- | % chance | <1.0 |
| Maximum height of dam | ft | 32 | Auxiliary spillway | | |
| Volume of fill | $yd^3$ | 676,000 6/ | Auxiliary spillway hydrograph | | |
| | | | Rainfall volume | in. | 5.29 |
| Auxiliary Spillway Crest | Elev. | 1212.0 3/ | Runoff volume | in. | 3.27 |
| Auxiliary spillway type | | Earth Cut 4/ | Storm duration | hr. | 6.0 |
| Auxiliary spillway bottom width | ft | 800.0 | Velocity of flow ($V_e$) | ft/sec | 6-10 |
| Auxiliary spillway exit slope | % | 2.0 | Max. reservoir water surface | Elev. 5/ | 1217.8 |
| Principal Spillway Crest | Elev. | 1199.2 | Rainfall volume | in. | 12.70 |
| Total capacity | | | Runoff volume | in. | 10.22 |
| Sediment – dead storage | acre-ft | 100 | Storm duration | hr. | 6.0 |
| Sediment – total (100 yr.) | acre-ft | 500 | Max. reservoir water surface elevation | Elev. 5/ | 1217.8 |
| Floodwater retarding | acre-ft | 2750 | | | |
| Freeboard | acre-ft | 3900 | Velocity of flow ($V_e$) | ft/sec | 6-10 |
| Surface area | | | Capacity equivalents | | |
| Sediment pool | acres | 99.0 | Sediment volume (100yr.) | in. | 0.46 |
| Floodwater retarding pool 7/ | acres | 460.0 | Floodwater retarding volume | in. | 2.52 |

June 2004

1/ Based on "Seismic Exposure Evaluation" prepared for Flood Control District By AMEC Earth and Environmental, Inc. (May 2002)
2/ Final crest elevation to be determined during final design (Elevations in 1988 NGVD Datum)
3/ Spillway crest elevation to be restored to original design elevation.
4/ Earth cut spillway with concrete cut-off wall and riprap downstream of cut-off.
5/ Preliminary – maximum water surface elevation to be confirmed during final design
6/ Includes existing (222,000 cu. yds.) plus proposed modification
7/ Crest of auxiliary spillway (Elevation 1212.0).
8/ Includes 1foot of freeboard (required by State (ADWR) and 1 foot for future subsidence.
9/ Note change in datum: Original plan used 1929 NGVD; current plan uses 1988 NGVD.
10/ Discharge is at impoundment elevation of 1212.0 (auxiliary spillway crest elevation).

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# Table 3b, Structural Data—Channel Work

## (White Tanks No. 3 FRS Project), (Arizona)

| Channel name (reach) | Station | Drain. area ($mi^2$) | (100)Year freq/ design dischg. ($ft^3/s$) | Water surface elev. feet (msl) | Hydrau. gradient (ft/ft) | ----Channel dimensions 1/ Gradient (ft/ft) | Bottom width (ft) | Elev. (ft/msl) | Side slope | ----n Value--- aged built | as | Velocities (ft/s) aged | as built | Excava-tion volume ($yd^3$) | Type of work 2/ | Existing Channel type 3/ | Present flow cond. 4/ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NIC - | (a1.) | | 1000 | 5 | 5.15 | 0.0015 | 50 | | 4:1 | 0.045 | 0.045 | 5/ | 5/ | 8300 | I | O | E |
| North | | | | | | | | | | | | 3.1 Design | 3.1 Design | | | | |
| | | | | | | | | | | | | | | | | | |
| NIC - South | (B) | | 6387 | (C) | | | | | | | | | | (D) | V | N | E |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

1/ Where excavation is not planned, show cross sectional area and wetted perimeter below hydraulic grade lines.

June 2004

2/ I Establishment of new channel including necessary stabilization measures.
II Enlargement or realignment of existing channel or stream.
III Cleaning out natural or manmade channel (including bar removal and major clearing and snagging operations).
IV Clearing and removal of loose debris within channel section.
V Stabilization as primary purpose (by continuous treatment or localized problem areas—present capacity adequate).

3/ N An unmodified, well defined natural channel or stream.
N ( ) Manmade ditch or previously modified channel or stream ( show approximate date of original construction in parenthesis).
O None or practically no defined channel.

4/ Pr Perennial—Flows at all times except during extreme drought.
I Intermittent—Continuous flow through some seasons of the year.
E Ephemeral—Flows only during periods of surface runoff, otherwise dry.
S Ponded water with no noticeable flow—Caused by lack of outlet or high ground water table.

5/ Explain discharge upon which velocities are based, i.e. design, bankfull, 10-year.

**Note:** A subscript "L" should be added to the Roman numeral classification to indicate an impervious lining.

(A) New channel located on the east side of the Beardsley Canal between Olive and Northern Avenues
(B) Existing channel located on the west side of the Beardsley Canal between Olive and Northern Avenues
(C) Existing channel. Channel design parameters to be determined as part of final design.
(D) The excavation in the existing channel is required to construct bank protection for the Beardsley Canal that is adjacent to the flood channel. The bank protection will be covered with the excavated material from the channel for aesthetic reasons.

## Table 4: Estimated Average Annual National Economic Development (NED) Costs

**White Tanks No. 3 Project, Maricopa County, Arizona**

**(Dollars) 1/**

| Item | Amortization of Installation Cost | OM&R Costs | Other Direct Costs | Total |
|---|---|---|---|---|
| **Structural Measures** | | | | |
| Floodwater Retarding Structure | 1,234,900 | 48,700 | | 1,283,600 |
| | | | | |
| **Total** | **1,234,900** | **48,700** | | **1,283,600** |

1/ Price Base 2003, amortized at 100 years; discount rate 5.625 %.

June 2004

## TABLE 5: Estimated Flood Damage Reduction Benefits (Avg. Annual Equivalents) 1/

**White Tanks No. 3 Project, Maricopa County, Arizona**

**(Dollars) 1/**

| | Est. Avg. Annual Damage Without Project | | Est. Avg. Annual Damage With Project | | Damage Reduction Benefit | | |
|---|---|---|---|---|---|---|---|
| **Item** | **Ag. Related** | **Non-ag. Rel.** | **Ag. Related** | **Non-Ag. Re** | **Ag. Related** | **Non-ag. Rel.** | **Total** |
| **Floodwater** | | | | | | | |
| **Crop & Pasture** | 35,300 | | 27,400 | | 7,900 | | 7,900 |
| **Residential** | - | 1,471,500 | | 144,900 | | 1,326,600 | 1,326,600 |
| **Commercial** | | 384,400 | | 93,900 | | 290,500 | 290,500 |
| **Flood Plain Admin** | | 159,600 | | 0 | | 159,600 | 159,600 |
| | | | | | | | |
| **Grand Total** | **35,300** | **2,015,500** | **27,400** | **238,800** | **7,900** | **1,776,700** | **1,784,600** |

1/ Price Base 2003, amortized at 100 years; discount rate 5.625 %.

June 2004

**TABLE 6: Comparison of National Economic Development (NED) Benefits and Costs 1/**
**White Tanks No. 3 Project, Maricopa County, Arizona**
**(Dollars)**

| Item | Annualized Benefit | Annualized Cost 2/ | Benefit Cost Ratio |
|---|---|---|---|
| **Structural Measures** | **1,784,600** | **1,283,600** | **1.39: 1.0** |

June 2004

1/Price Base 2003, amortized at 100 years; discount rate 5.625 %.
2/ From Table 4

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# LIST OF NRCS PREPARERS FOR THE WHITE TANKS NO. 3 REHABILITATION PLAN/EA

| Name | Job Title | Experience | Education | Other |
|---|---|---|---|---|
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# Appendix A

## Record of Comments

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# Appendix B - Support Maps

Soils Map of the Project Area

Breach Inundation/100-YR Floodplain

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# Appendix C - Supporting Information

1. Representative Well Hydrograph

2. Public Meeting Comments (Q&A)

3. Application to Breach or Remove a High or Significant Hazard Potential Dam

4. Sample Comment Sheet from Public Meeting, January 21, 2004

5. Protected Species in Maricopa County, Arizona, within the Agua Fria River Basin (Watershed Code 15070102)

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## Examples of Comments Received during Public Scoping Meeting of November 8, 2000

**Question:** Do you understand the need for the project?

**Answer:** "Yes, the current structure is in need of repair." "Flood control is very important."

**Question:** "The FCDMC would like to provide opportunities for others to build multi-use facilities, such as recreation facilities, as part of this project. What type of facilities are you interested in for this project?"

**Answers:** "None - leave the desert in its natural state"
"I love both multi-use project concepts."

**Question:** "What do you like and dislike about the three basin alternatives?"

**Answers:** Most respondents indicated a high degree of concern with flood control. One respondent mentioned "cost-effective alternatives."

**Other comments:**

"Repair existing dam at significant savings over other alternatives."

"I would like to see the land preserved for our wildlife."

"I'm in favor of planning for recreation and open space."

"I would like to see as little development as possible. Keep traffic on Northern to a minimum. Keep lights to an absolute minimum."

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**R12-15-1209. Application to Breach or Remove a High or Significant Hazard Potential Dam**

**A.** An applicant shall excavate the dam down to the level of the natural ground at the maximum section. Upon approval of the Director, additional breaches may be made. This provision shall not be construed to require more than total removal of the dam regardless of the flood magnitude. The breach or breaches shall be of sufficient width to pass the greater of:

**1.** The 100-year flood at a depth of less than 5 feet, or

**2.** The 100-year flood at a normal flood depth of not more than 2 feet at a distance of 2,000 feet downstream of the dam.

**B.** The sides of each breach shall be excavated to a slope ratio that is stable and not steeper than 1 horizontal to 1 vertical.

**C.** Each breach shall be designed to prevent silt that has previously been deposited on the reservoir bottom and the excavated material from the breach from washing downstream.

**D.** Before breaching the dam, the reservoir shall be emptied in a controlled manner that will not endanger lives or damage downstream property. The applicant shall obtain approval from the Director for the method of breaching or removal.

**E.** An application package to breach or remove a high or significant hazard potential dam shall include the following prepared by or under the supervision of an engineer as defined in R12-15-1202(11).

**1.** The construction drawing or drawings for the breach or removal of a dam, including the location, dimensions, and lowest elevation of each breach.

**2.** A long-term budget plan and evidence of financing, prepared using customary accounting principles, that demonstrate that the applicant has the financial capability to breach or remove the dam in a safe manner. If the applicant does not have evidence that can be verified by an independent audit of the financial capability to breach or remove the dam in a safe manner, the Director may require a performance bond for the entire cost of the proposed construction work.

**3.** A construction quality assurance plan describing all aspects of construction supervision.

**F.** Reduction of a high or significant downstream hazard potential dam to nonjurisdictional size may be approved by letter under the following circumstances:

**1.** The owner shall submit a completed application form and construction drawings for the reduction and the appropriate specifications, prepared by or under the supervision of an engineer as defined in R12-15-1202(11).

**2.** The construction drawings and specifications shall contain sufficient detail to enable a contractor to bid on and complete the project.

**3.** The plans shall comply with all requirements of this Section except that the breach is not required to be to natural ground.

**4.** Upon completion of an alteration to nonjurisdictional size, the engineer shall file as-constructed drawings and specifications with the Department.

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## Protected Species in Maricopa County, Arizona, within the Agua Fria River Basin (Watershed Code 15070102) (Includes White Tank No. 3 Watershed)

| TAXON | SCIENTIFIC NAME | COMMON NAME | COUNTY | ESA | WSCA | NPL |
|---|---|---|---|---|---|---|
| | | | | | | |
| BIRD | ATHENE CUNICULARIA HYPUGAEA | WESTERN BURROWING OWL | MARICOPA | SC | | |
| BIRD | DENDROCYGNA AUTUMNALIS | BLACK-BELLIED WHISTLING-DUCK | MARICOPA | | WSC | |
| BIRD | HALIAEETUS LEUCOCEPHALUS | BALD EAGLE | MARICOPA | LT | WSC | |
| FISH | CATOSTOMUS INSIGNIS | SONORA SUCKER | MARICOPA | SC | | |
| MAMMAL | EUMOPS PEROTIS CALIFORNICUS | GREATER WESTERN MASTIFF BAT | MARICOPA | SC | | |
| MAMMAL | MYOTIS VELIFER | CAVE MYOTIS | MARICOPA | SC | | |
| MAMMAL | NYCTINOMOPS FEMOROSACCUS | POCKETED FREE-TAILED BAT | MARICOPA | | | |
| PLANT | AGAVE ARIZONICA | ARIZONA AGAVE | MARICOPA | LE | | HS |
| PLANT | AGAVE TOUMEYANA VAR BELLA | TOUMEY AGAVE | MARICOPA | | | SR |
| PLANT | OPUNTIA PHAEACANTHA VAR FLAVISPINA | PRICKY PEAR | MARICOPA | | | SR |
| REPTILE | GOPHERUS AGASSIZII (SONORAN POPULATION) | SONORAN DESERT TORTOISE | MARICOPA | SC | WSC | |
| REPTILE | THAMNOPHIS EQUES MEGALOPS | MEXICAN GARTER SNAKE | MARICOPA | SC | WSC | |

**KEY**

ESA Endangered Species Act (1973 as amended)
LE: Listed Endangered: imminent jeopardy of extinction
LT: Listed Threatened: imminent jeopardy of becoming Endangered
SC: Species of Concern. The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the US Fish and Wildlife Service, but neither term has official status (currently all former C2 species).

WSCA Wildlife of Special Concern in Arizona (1996 in prep) Arizona Game and Fish Department
WSC: Wildlife of Special Concern in Arizona. Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Arizona Game and fish Department's listing of Wildlife of Special Concern in Arizona (WSCA, in prep).

NPL Arizona Native Plant Law (1993), Arizona Department of Agriculture
HS: Highly Safeguarded: no collection allowed SR: Salvage Restricted: collection only with permit

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# Appendix D - Project Map

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