

The White Tanks Story and Related Articles

By: Julian J. Turner
Soil Conservation Service

WHITE TANKS
WATER

WATERSHED
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Julian J. Turner
Soil Conservation Service
6015 Federal Building
Phoenix, Arizona

THE WHITE TANKS STORY

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State Conservation Engineer, Soil Conservation Service

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The Soil Conservation District and the Soil Conservation Service redoubled their efforts after the 1951 flood. Meanwhile, because of the length of time required to complete the detailed plans, and because of lawsuits arising from the diversion of flood waters by minor dikes and channels within the District, the cooperators of the Soil Conservation and Irrigation Districts pooled their Production and Marketing Administration payments for soil conservation practices for 1952. With \$34,000 of FMA funds, \$108,000 contributed by the Irrigation District, and with SCS technical direction a dam 4 miles long and 23 feet high was constructed that effectively controlled all nine floods occurring in the Trilby Wash area subsequent to that time. So well planned and constructed was this structure that it is now a part of the 9 mile long McMicken Dam completed by the Corps of Engineers in 1956.

Throughout all the years of dreaming and planning, the SCD Supervisors also had the foresight to keep their political leaders at all levels of government acquainted with their needs.

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Minnesota, were responsible for the inclusion of \$5,000,000 in the annual Agricultural Appropriations Bill to be used for a Pilot Watershed Protection Program administered by the Soil Conservation Service. In the same 83rd Congress, Arizona's Senator Carl Hayden sponsored legislation authorizing the Secretary of the Air Force to construct the Trilby Wash Detention Basin and Outlet Channel, later dedicated as McMicken Dam.

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As neither the Soil Conservation District or the Irrigation District had the legal authorities required for Federal cooperation of this type, supplemental agreements were made whereby the County of Maricopa acted as official sponsor for both projects.

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the White Tanks project. This was 121 miles more lined ditches and pipelines than were installed during the 5 years prior to 1954. The land leveling is now of a higher quality and irrigation water is being applied with greater efficiency. In total, farmers in the District have lined or tiled over 400 miles of irrigation ditches and precisely leveled over 52,000 acres of the 70,000 acres of farm land. These practices and care in the use of irrigation water are credited with preventing water loss and waste of over 40,000 acre feet of water annually. Enough water to produce 16,000 bales of cotton or 8,000 carloads of lettuce.

With flood prevention, more farmers turned to such high cost, high income crops as lettuce, asparagus, grapes, etc. and the per acre gross income rose from less than \$200 to over \$400 between 1950 and 1960. The 36 miles of farm roads paved since 1954 is 10 miles more than all the roads previously paved. A one million dollar housing development has been built adjacent to one of the White Tanks dams. Census figures show that the Towns of Goodyear and Avondale have more than doubled in population and assessed valuation of property in these two incorporated towns tripled between 1950 and 1960.

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Gordon Corbin, Engineer, Soil Conservation
Service, Phoenix, Arizona

March 3, 1954

W. E. Anderson, Engineering Specialist, Soil
Conservation Service, Phoenix, Arizona

**White Tanks Watershed Protection Project -
Engineering Responsibilities**

You are instructed to assume the duties of Resident Engineer on the White Tanks Watershed Protection Project. I have been designated as the official government representative as provided for under the terms of Construction Contract Number Asc-1142. In your capacity of Resident Engineer you will exercise this authority which has been delegated to me.

Accordingly, it will be your duty to supervise the construction project in accordance with the plans, specifications, and contract provisions. You will interpret such documents where necessary, issue appropriate instructions to the contractor or his representative, establish necessary grades and lines, and take such other action as may be proper and necessary for the satisfactory completion of the project.

You will call upon me for additional instructions as you may feel are necessary. Where you are unable to amicably settle any question relating to the project, you will promptly refer such question to me for settlement. Where the interest of the government or the technical needs of the project requires, you will assume full authority and take such action as shall fully protect the interest of the government, reporting such action to me as expeditiously as may be possible.

You will receive all instructions concerning this project from me. You will not accept any changes in the plans or specifications except from me and then only in writing for your own protection. In addition, you will accept direction with regard to contract provisions, in writing, from Mr. Martin V. Compton, official representative of the Contracting Officer, or from his properly accredited representative. You will immediately report to me the receipt of such instructions.

You will receive assistance as may be required upon request to this office. You will also receive from this office all materials and supplies necessary for the proper execution of your duties. Where an exigency exists you will obtain such services or supplies locally within the provisions of current regulations.

You are headquartered near the project and no official travel away from headquarters is contemplated. You are cautioned not to undertake such travel without prior authorization in writing. You will conduct your operations and those under your control in accordance with recognized safety precautions as provided for in safety regulations and contract provisions.

In addition, you will maintain such records that may reflect completely the operations of the project, including daily diary or other narrative record, notes

or other appropriate data indicating progress, including those necessary for the accurate determination of quantities; sketches or diagram of the work and its progress; a record of all instructions issued; a record of all official visitors insofar as possible; and such other records as may be necessary. You will make or direct the making of necessary surveys. You will make reports as may be required. In particular, you will make recommendations to me as to changes in specifications, extra or additional work, or such other affairs as should be called to the attention of the Contracting Officer. You will prepare for my certification progress reports concerning the project and will obtain and forward to me all necessary documents to be submitted by the Contractor, including weekly labor affidavits and periodic claims or statements for interim payments.

Attached hereto you will find a copy of a letter from Mr. R. C. Wright, dated March 3, 1954, establishing the authority for these directions.

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Washington 25, D. C.

March 3, 1954

William E. Anderson, Engineer
Soil Conservation Service
Phoenix, Arizona

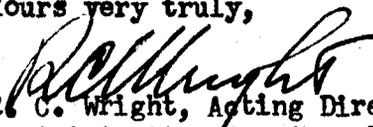
Dear Mr. Anderson:

You are hereby appointed Government Representative under Contract No. Asc-11142 which was awarded to J. A. Danens & Son, Inc. and Shelton-Betts Company for construction work on White Tanks Structures Nos. 3 and 4 in Maricopa County, Arizona.

It will be your responsibility to:

1. Determine whether or not all of the contract provisions and requirements regarding inspection, safety of the public, performance, etc., are being complied with by the contractor; and in the case of non-compliance to take such action as you deem necessary and as provided for in the contract to insure protection of the Government's interests and the safety of the public; for protection of public interests and private, personal, or property interests, etc;
2. Issue work-suspension orders when in your opinion weather conditions are such as to prevent work being properly carried on; and work-resumption orders when in your opinion conditions are such as to warrant orderly prosecution of the work, as provided for in Paragraph 2 of the General Conditions;
3. Make recommendations to the Contracting Officer's Representative, Martin V. Compton, or to the contracting officer, through regular channels, concerning proposed specification changes, extra work, material substitutions, extension of the contractor's performance time, or any other item which will require action by either of these officers;
4. Do all things necessary and as directed by the contracting officer or his representative in connection with the prosecution of the work.

Yours very truly,


R. C. Wright, Acting Director,
Administrative Services Division

Washington 25, D. C.
March 1, 1954

J. A. Danens & Son, Inc. and Shelton-Betts Co.
Wickenburg, Arizona

Gentlemen:

Your copy of Contract No. Asc-1142 covering construction work on White Tanks Structures Nos. 3 and 4 in Maricopa County, Arizona, is attached, in accordance with our telegram of March 1.

Weekly affidavits, as required by the Secretary of Labor, should be addressed to:

William E. Anderson, Engineer
Soil Conservation Service
DeBerge Building, 39 N. 6th Street
Phoenix, Arizona

A copy of Title 29, Part 3, of the Labor Regulations is attached. This shows the prescribed form of affidavit which should be reproduced for your needs. The affidavit must be executed and sworn to by any sub-contractor also, as well as by the principal contractor; or by any authorized officer or employee of the contractor or sub-contractor who supervises the payment of wages. The weekly affidavits, together with a certified copy of the weekly payroll, should be delivered to the above-named government representative within 7 days after the regular payment date of the payroll period.

Copies of letters of appointment of Contracting Officer's Representative and Government Representative, setting forth the responsibilities and defining the authorities of each are attached. Should changes become necessary during the progress of the work this information will be helpful to you.

Attached also are two copies of wage determination decision issued by the U. S. Department of Labor. These copies are for posting by you at the site of the work in a prominent place, where they may be easily seen by workers.

Yours very truly,

R. C. Wright, Acting Director,
Administrative Services Division

~~CONFIDENTIAL~~
cc: M. V. Compton, Chief, RASD, SCS, Albuquerque, N.M.

William E. Anderson, Engineer, SCS, Phoenix, Ariz.

SOIL CONSERVATION SERVICE

1242267(10)-W(WP-80)

Washington, D. C. March 1, 1954

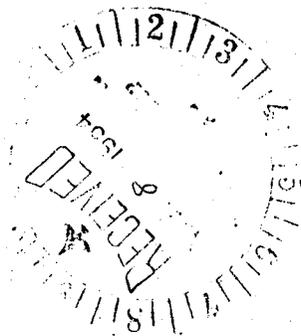
J. A. Tanens & Son, Inc., and Shelton-Betts Co.
Wickenburg, Arizona

Contract No. Asc-1142 covering construction of earth filled dykes known as White Tanks Structures Nos. 3 and 4, Maricopa County, Arizona, formally approved. You are hereby notified to commence work within 20 calendar days and to complete all work within 210 calendar days after date of receipt of this notice. Contract and instructions follow.

R. C. Wright, Acting Director,
Administrative Services Division

cc: M. V. Compton, Chief, RASD, SCS, Albuquerque, New Mexico

William E. Anderson, Engineer, SCS, DeBerge Bldg., 39 N. 6th, Phoenix, Ariz.



CONSTRUCTION CONTRACT
(See instructions on reverse)

CONTRACT NO.
Asc-1142

DATE OF CONTRACT
Feb. 17, 1954

NAME AND ADDRESS OF CONTRACTOR

J. A. Danens & Son, Inc. and Shelton-Betts Co.
Box 1044
Wickenburg, Arizona

CHECK APPROPRIATE BOX

- Individual
- Partnership
- Incorporated in the State of
- Joint Venture**

DEPARTMENT OR AGENCY

UNITED STATES DEPARTMENT OF AGRICULTURE

CONTRACT FOR (Work to be performed)

Construction of earth filled dykes known as White Tanks Structures Nos. 3 and 4

PLACE

Maricopa County, Arizona, approximately 26 miles west of Phoenix

AMOUNT OF CONTRACT (Express in words and figures)

One Hundred Sixty-three Thousand, Three Hundred Thirty-four and No/100 Dollars
.....**\$163,334.00**.....

ADMINISTRATIVE DATA (Optional)

THIS CONTRACT, entered into this date by the United States of America, hereinafter called the Government, represented by the Contracting Officer executing this contract, and the individual, partnership, or corporation named above, hereinafter called the Contractor, witnesseth that the parties hereto do mutually agree as follows:

Statement of Work. The Contractor shall furnish all labor, equipment, and materials and perform the work above described for the amount stated above in strict accordance with the General Provisions (Standard Form 23a), specifications, schedules, drawings, and conditions all of which are made a part hereof and designated as follows:

- Invitation for Bids, dated January 14, 1954 - No. Reg.6-3202**
- Addendum No. 1, dated February 1, 1954**
- Bidder's proposal, dated February 6, 1954**
- Acceptance of Proposal, dated February 17, 1954**
- Performance Bond**
- Payment Bond**

WORK SHALL BE STARTED

Within 20 calendar days after date of receipt of notice to proceed

WORK SHALL BE COMPLETED

within 210 calendar days after date of receipt of notice to proceed

Alterations. The following changes were made in this contract before it was signed by the parties hereto:

In witness whereof, the parties hereto have executed this contract as of the date entered on the first page hereof.

THE UNITED STATES OF AMERICA

CONTRACTOR

By /s/ R. C. Wright
R. C. Wright
Acting Director,
Administrative Services Division
(Official title)

J. A. Danens & Son, Inc. and
Shelton-Betts Co. (Joint Venture)
(Name of Contractor)

By /s/ C. J. Danens
C. J. Danens, (Signature) Partner

By /s/ Henry F. Shelton
Henry F. Shelton, (Signature) Partner

INSTRUCTIONS

1. This form shall be used, as required by GSA regulations, for contracts for the construction, alteration, or repair of public buildings or works.

2. The full name and business address of the Contractor must be inserted in the space provided on the face of the form. The Contractor shall sign in the space provided above with his usual signature and typewrite or print name under all signatures to the contract and bonds.

3. An officer of a corporation, a member of a partnership, or an agent signing for the Contractor shall place his signature and title after the word "By" under the name of the Contractor. A contract executed by an attorney or agent on behalf of the Contractor shall be accompanied by two authenticated copies of his power of attorney, or other evidence of his authority to act on behalf of the Contractor.

Washington 25, D. C.
February 17, 1954

ACCEPTANCE OF PROPOSAL
Inv. Reg. 6-3202
Contract No. Asc-1142

J. A. Danens & Son, Inc. and
Shelton-Betts Co.
Box 1044
Wickenburg, Arizona

Gentlemen:

Your proposal in response to Invitation No. Reg. 6-3202,
and Addendum No. 1 thereto, is accepted as to all items
at the unit prices quoted.

Your bid covers the furnishing of all labor and materials
and performing all work in the construction of earth filled
dykes, known as White Tanks Structures Nos. 3 and 4, approx-
imately 26 miles west of Phoenix in Maricopa County, Arizona.

Yours very truly,

R. C. Wright, Acting Director,
Administrative Services Division

11. PERMITS AND RESPONSIBILITY FOR WORK, ETC.

The Contractor shall, without additional expense to the Government, obtain all licenses and permits required for the prosecution of the work. He shall be responsible for all damages to persons or property that occur as a result of his fault or negligence in connection with the prosecution of the work. He shall also be responsible for all materials delivered and work performed until completion and final acceptance, except for any completed unit thereof which theretofore may have been finally accepted.

12. OTHER CONTRACTS

The Government may undertake or award other contracts for additional work, and the Contractor shall fully cooperate with such other contractors and Government employees and carefully fit his own work to such additional work as may be directed by the Contracting Officer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor or by Government employees.

13. PATENT INDEMNITY

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents and employees against liability, including costs and expenses, for infringement upon any Letters Patent of the United States (except Letters Patent issued upon an application which is now or may hereafter be, for reasons of national security, ordered by the Government to be kept secret or otherwise withheld from issue) arising out of the performance of this contract or out of the use or disposal by or for the account of the Government of supplies furnished or construction work performed hereunder.

14. ADDITIONAL BOND SECURITY

If any surety upon any bond furnished in connection with this contract becomes unacceptable to the Government, or if any such surety fails to furnish reports as to his financial condition from time to time as requested by the Government, the Contractor shall promptly furnish such additional security as may be required from time to time to protect the interests of the Government and of persons supplying labor or materials in the prosecution of the work contemplated by this contract.

15. COVENANT AGAINST CONTINGENT FEES

The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration the full amount of such commission, percentage, brokerage, or contingent fee.

16. OFFICIALS NOT TO BENEFIT

No member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

17. BUY AMERICAN ACT

The Contractor agrees that in the performance of the work under this contract the Contractor, subcontractors, material men and suppliers shall use only such unmanufactured articles, materials and supplies (which term "articles, materials and supplies" is hereinafter referred to in this clause as "Supplies") as have been mined or produced in the United States, and only such manufactured supplies as have been manufactured in the United States substantially all from supplies mined, produced, or manufactured, as the case may be, in the United States. Pursuant to the Buy American Act (41 U. S. C. 10a-d), the

foregoing provisions shall not apply (i) with respect to supplies excepted by the head of the department from the application of that Act, (ii) with respect to supplies for use outside the United States, or (iii) with respect to the supplies to be used in the performance of work under this contract which are of a class or kind determined by the head of the department or his duly authorized representative not to be mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, or (iv) with respect to such supplies, from which the supplies to be used in the performance of work under this contract are manufactured, as are of a class or kind determined by the head of the department or his duly authorized representative not to be mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, provided that this exception (iv) shall not permit the use in the performance of work under this contract of supplies manufactured outside the United States if such supplies are manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.

18. CONVICT LABOR

In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment at hard labor.

19. NONDISCRIMINATION IN EMPLOYMENT

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin; and further agrees to insert the foregoing provision in all subcontracts hereunder except subcontracts for standard commercial supplies or for raw materials.

20. DAVIS-BACON ACT (40 U. S. C. 276a-a(7))

(a) All mechanics and laborers employed or working directly upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Copeland Act (Anti-Kickback) Regulations (29 CFR, Part 3)) the full amounts due at time of payment, computed at wage rates not less than those contained in the wage determination decision of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor or subcontractor and such laborers and mechanics; and a copy of the wage determination decision shall be kept posted by the Contractor at the site of the work in a prominent place where it can be easily seen by the workers.

(b) In the event it is found by the Contracting Officer that any laborer or mechanic employed by the Contractor or any subcontractor directly on the site of the work covered by this contract has been or is being paid at a rate of wages less than the rate of wages required by paragraph (a) of this clause, the Contracting Officer may (1) by written notice to the Government Prime Contractor terminate his right to proceed with the work, or such part of the work as to which there has been a failure to pay said required wages, and (2) prosecute the work to completion by contract or otherwise, whereupon such Contractor and his sureties shall be liable to the Government for any excess costs occasioned the Government thereby.

(c) Paragraphs (a) and (b) of this clause shall apply to this contract to the extent that it is (1) a prime contract with the Government subject to the Davis-Bacon Act or (2) a subcontract under such prime contract.

21. EIGHT-HOUR LAWS—OVERTIME COMPENSATION

No laborer or mechanic doing any part of the work contemplated by this contract, in the employ of the Contractor

or any subcontractor contracting for any part of said work contemplated, shall be required or permitted to work more than eight hours in any one calendar day upon such work, except upon the condition that compensation is paid to such laborer or mechanic in accordance with the provisions of this clause. The wages of every laborer and mechanic employed by the Contractor or any subcontractor engaged in the performance of this contract shall be computed on a basic day rate of eight hours per day and work in excess of eight hours per day is permitted only upon the condition that every such laborer and mechanic shall be compensated for all hours worked in excess of eight hours per day at not less than one and one-half times the basic rate of pay. For each violation of the requirements of this clause a penalty of five dollars shall be imposed for each laborer or mechanic for every calendar day in which such employee is required or permitted to labor more than eight hours upon said work without receiving compensation computed in accordance with this clause, and all penalties thus imposed shall be withheld for the use and benefit of the Government: *Provided*, That this stipulation shall be subject in all respects to the exceptions and provisions of the Eight-Hour Laws as set forth in 40 U. S. C. 321, 324, 325, 325a, and 326, which relate to hours of labor and compensation for overtime.

22. APPRENTICES

Apprentices will be permitted to work only under a bona fide apprenticeship program registered with a State Apprenticeship Council which is recognized by the Federal Committee on Apprenticeship, U. S. Department of Labor; or if no such recognized Council exists in a State, under a program registered with the Bureau of Apprenticeship, U. S. Department of Labor.

23. PAYROLL RECORDS AND PAYROLLS

(a) Payroll records will be maintained during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records will contain the name and address of each such employee, his correct classification, rate of pay, daily and weekly number of hours worked, deductions made and actual wages paid. The Contractor will make his employment records available for inspection by authorized representatives of the Contracting Officer and the U. S. Department of Labor, and will permit such representatives to interview employees during working hours on the job.

(b) A certified copy of all payrolls will be submitted weekly to the Contracting Officer. The Government Prime Contractor will be responsible for the submission of certified copies of the payrolls of all subcontractors. The certification will affirm that the payrolls are correct and complete, that the wage rates contained therein are not less than the applicable rates contained in the wage determination decision of the Secretary of Labor attached to this contract, and that the classifications set forth for each laborer or mechanic conform with the work he performed.

24. COPELAND (ANTI-KICKBACK) ACT—NONREBATE OF WAGES.

The regulations of the Secretary of Labor applicable to Contractors and subcontractors (29 CFR, Part 3), made pursuant to the Copeland Act, as amended (40 U. S. C. 276c) and to aid in the enforcement of the Anti-Kickback Act (18 U. S. C. 874) are made a part of this contract by reference. The Contractor will comply with these regulations and any amendments or modifications thereof and the Government Prime Contractor will be responsible for the submission of affidavits required of subcontractors thereunder. The foregoing shall apply except as the Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances, and exemptions.

25. WITHHOLDING OF FUNDS TO ASSURE WAGE PAYMENT

There may be withheld from the Contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics employed by the Contractor or any subcontractor the full amount of wages required by this contract. In the event of failure to pay any laborer or mechanic all or part of the wages required by this contract, the Contracting Officer may take such action as may be necessary to cause the suspension, until such violations have ceased, of any further payment, advance, or guarantee of funds to or for the Government Prime Contractor.

26. SUBCONTRACTS—TERMINATION

The Contractor agrees to insert Clauses 20 through 26 hereof in all subcontracts and further agrees that a breach of any of the requirements of these clauses may be grounds for termination of this contract. The term "Contractor" as used in such clauses in any subcontract shall be deemed to refer to the subcontractor except in the phrase "Government Prime Contractor."

GENERAL PROVISIONS (CONSTRUCTION CONTRACTS)

1. DEFINITIONS

(a) The term "head of the department" as used herein shall mean the head or any assistant head of the executive department or independent establishment involved, and the term "his duly authorized representative" shall mean any person authorized to act for him other than the Contracting Officer.

(b) The term "Contracting Officer" as used herein, shall include his duly appointed successor or his authorized representative.

2. SPECIFICATIONS AND DRAWINGS

The Contractor shall keep on the work a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In any case of discrepancy either in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without this determination shall be at his own risk and expense. The Contracting Officer shall furnish from time to time such detail drawings and other information as he may consider necessary, unless otherwise provided.

3. CHANGES

The Contracting Officer may at any time, by a written order, and without notice to the sureties, make changes in the drawings and/or specifications of this contract and within the general scope thereof. If such changes cause an increase or decrease in the amount due under this contract, or in the time required for its performance, an equitable adjustment shall be made and the contract shall be modified in writing accordingly. Any claim of the Contractor for adjustment under this clause must be asserted in writing within 30 days from the date of receipt by the Contractor of the notification of change: *Provided, however,* That the Contracting Officer, if he determines that the facts justify such action, may receive and consider, and adjust any such claim asserted at any time prior to the date of final settlement of the contract. If the parties fail to agree upon the adjustment to be made the dispute shall be determined as provided in Clause 6 hereof. But nothing provided in this clause shall excuse the Contractor from proceeding with the prosecution of the work as changed. Except as otherwise herein provided, no charge for any extra work or material will be allowed.

4. CHANGED CONDITIONS

The Contractor shall promptly, and before such conditions are disturbed, notify the Contracting Officer in writing of: (1) subsurface or latent physical conditions at the site differing materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in this contract. The Contracting Officer shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or the time required for, performance of this contract, an equitable adjustment shall be made and the contract modified in writing accordingly. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given notice as above required; provided that the Contracting Officer may, if he determines the facts so justify, consider and adjust any such claim asserted before the date of final settlement of the contract. If the parties fail to agree upon the adjustment to be made, the dispute shall be determined as provided in Clause 6 hereof.

5. TERMINATION FOR DEFAULT—DAMAGES FOR DELAY—TIME EXTENSIONS

(a) If the Contractor refuses or fails to prosecute the work, or any separable part thereof, with such diligence as will insure its completion within the time specified in this contract, or any extension thereof, or fails to complete said work within such time, the Government may, by written notice to the Contractor, terminate his right to proceed with the work or such part of the work as to which there has been delay. In such event the Government may take over the work and prosecute the same to completion, by contract or otherwise, and the Contractor and his sureties shall be liable to the Government for any excess cost occasioned the Government thereby, and for liquidated damages for delay, as fixed in the specifications or accompanying papers, until such reasonable time as may be required for the final completion of the work, or if liquidated damages are not so fixed, any actual damages occasioned by such delay. If the Contractor's right to proceed is so terminated, the Government may take possession of and utilize in completing the work such materials, appliances, and plant as may be on the site of the work and necessary therefor.

(b) If the Government does not terminate the right of the Contractor to proceed, as provided in paragraph (a) hereof, the Contractor shall continue the work, in which event he and his sureties shall be liable to the Government, in the amount set forth in the specifications or accompanying papers, for fixed, agreed, and liquidated damages for each calendar day of delay until the work is completed or accepted, or if liquidated damages are not so fixed, any actual damages occasioned by such delay.

(c) The right of the Contractor to proceed shall not be terminated, as provided in paragraph (a) hereof, nor the Contractor charged with liquidated or actual damages, as provided in paragraph (b) hereof because of any delays in the completion of the work due to unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Government, in either its sovereign or contractual capacity, acts of another contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather, or delays of subcontractors or suppliers due to such causes: *Provided,* That the Contractor shall within 10 days from the beginning of any such delay, unless the Contracting Officer shall grant a further period of time prior to the date of final settlement of the contract, notify the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of the delay and extend the time for completing the work when in his judgment the findings of fact justify such an extension, and his findings of fact thereon shall be final and conclusive on the parties hereto, subject only to appeal as provided in Clause 6 hereof.

6. DISPUTES

Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. Within 30 days from the date of receipt of such copy, the Contractor may appeal by mailing or otherwise furnishing to the Contracting Officer a written appeal addressed to the head of the department, and the decision of the head of the department or his duly authorized representatives for the hearings of such appeals shall, unless determined by a court of competent jurisdiction to have been fraudulent, arbitrary, capricious, or so grossly erroneous as necessarily to imply bad faith, be final and conclusive: *Provided,* That, if no such appeal to the head

of the department is taken, the decision of the Contracting Officer shall be final and conclusive. In connection with any appeal proceeding under this clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision.

7. PAYMENTS TO CONTRACTORS

(a) Unless otherwise provided in the specifications, partial payments will be made as the work progresses at the end of each calendar month, or as soon thereafter as practicable, or at more frequent intervals as determined by the Contracting Officer, on estimates made and approved by the Contracting Officer. In preparing estimates the material delivered on the site and preparatory work done may be taken into consideration.

(b) In making such partial payments there shall be retained 10 percent on the estimated amount until final completion and acceptance of all work covered by the contract: *Provided, however,* That the Contracting Officer, at any time after 50 percent of the work has been completed, if he finds that satisfactory progress is being made, may make any of the remaining partial payments in full: *And provided further,* That on completion and acceptance of each separate building, public work, or other division of the contract, on which the price is stated separately in the contract, payment may be made in full, including retained percentage thereon, less authorized deductions.

(c) All material and work covered by partial payments made shall thereupon become the sole property of the Government, but this provision shall not be construed as relieving the Contractor from the sole responsibility for all materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Government to require the fulfillment of all of the terms of the contract.

(d) Upon completion and acceptance of all work required hereunder, the amount due the Contractor under this contract will be paid upon the presentation of a properly executed and duly certified voucher therefor, after the Contractor shall have furnished the Government with a release, if required, of all claims against the Government arising under and by virtue of this contract, other than such claims, if any, as may be specifically excepted by the Contractor from the operation of the release in stated amounts to be set forth therein. If the Contractor's claim to amounts payable under the contract has been assigned under the Assignment of Claims Act of 1940, as amended (41 U. S. C. 15), a release may also be required of the assignee at the option of the Contracting Officer.

8. MATERIALS AND WORKMANSHIP

Unless otherwise specifically provided for in the specifications, all equipment, materials, and articles incorporated in the work covered by this contract are to be new and of the most suitable grade of their respective kinds for the purpose and all workmanship shall be first class. Where equipment, materials, or articles are referred to in the specifications as "equal to" any particular standard, the Contracting Officer shall decide the question of equality. The Contractor shall furnish to the Contracting Officer for his approval the name of the manufacturer of machinery, mechanical and other equipment which he contemplates incorporating in the work, together with their performance capacities and other pertinent information. When required by the specifications, or when called for by the Contracting Officer, the Contractor shall furnish the Contracting Officer for approval full information concerning the materials or articles which he contemplates incorporating in the work. Samples of materials shall be submitted for approval when so directed. Machinery, equipment, materials, and articles installed or used without such approval shall be at the risk of subsequent rejection. The Contracting Officer may

in writing require the Contractor to remove from the work such employee as the Contracting Officer deems incompetent, careless, insubordinate, or otherwise objectionable, or whose continued employment on the work is deemed by the Contracting Officer to be contrary to the public interest.

9. INSPECTION

(a) Except as otherwise provided in paragraph (d) hereof all material and workmanship, if not otherwise designated by the specifications, shall be subject to inspection, examination, and test by the Contracting Officer at any and all times during manufacture and/or construction and at any and all places where such manufacture and/or construction are carried on. The Government shall have the right to reject defective material and workmanship or require its correction. Rejected workmanship shall be satisfactorily corrected and rejected material shall be satisfactorily replaced with proper material without charge therefor, and the Contractor shall promptly segregate and remove the rejected material from the premises. If the Contractor fails to proceed at once with the replacement of rejected material and/or the correction of defective workmanship the Government may, by contract or otherwise, replace such material and/or correct such workmanship and charge the cost thereof to the Contractor, or may terminate the right of the Contractor to proceed as provided in Clause 5 of this contract, the Contractor and surety being liable for any damage to the same extent as provided in said Clause 5 for terminations thereunder.

(b) The Contractor shall furnish promptly without additional charge, all reasonable facilities, labor, and materials necessary for the safe and convenient inspection and test that may be required by the Contracting Officer. All inspection and tests by the Government shall be performed in such manner as not unnecessarily to delay the work. Special, full size, and performance tests shall be as described in the specifications. The Contractor shall be charged with any additional cost of inspection when material and workmanship are not ready at the time inspection is requested by the Contractor.

(c) Should it be considered necessary or advisable by the Government at any time before final acceptance of the entire work to make an examination of work already completed, by removing or tearing out same, the Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective or nonconforming in any material respect, due to fault of the Contractor or his subcontractors, he shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, the actual direct cost of labor and material necessarily involved in the examination and replacement, plus 15 percent, shall be allowed the Contractor and he shall, in addition, if completion of the work has been delayed thereby, be granted a suitable extension of time on account of the additional work involved.

(d) Inspection of material and finished articles to be incorporated in the work at the site shall be made at the place of production, manufacture, or shipment, whenever the quantity justifies it, unless otherwise stated in the specifications; and such inspection and written or other formal acceptance, unless otherwise stated in the specifications, shall be final, except as regards latent defects, departures from specific requirements of the contract, damage or loss in transit, fraud, or such gross mistakes as amount to fraud. Subject to the requirements contained in the preceding sentence, the inspection of material and workmanship for final acceptance as a whole or in part shall be made at the site. Nothing contained in this paragraph (d) shall in any way restrict the Government's rights under any warranty or guarantee.

10. SUPERINTENDENCE BY CONTRACTOR

The Contractor shall give his personal superintendence to the work or have a competent foreman or superintendent, satisfactory to the Contracting Officer, on the work at all times during progress, with authority to act for him.

PERFORMANCE BOND

(See Instructions on Reverse)

DATE BOND EXECUTED

PRINCIPAL

**J. A. DANENS & SON, INC., AND SHELTON-BETTS CO., - A joint venture
 Wickenburg, Arizona**

SURETY

**PEERLESS CASUALTY COMPANY, a corporation duly organized under the laws
 of the State of New Hampshire and having its home office in Keene, County of
 Cheshire, and State of New Hampshire.**

PENAL SUM OF BOND (express in words and figures)

**One Hundred Sixty-three Thousand, Three Hun-
 dred Thirty-four and No/100 Dollars
 \$163,334.00**

CONTRACT NO.

100-1142

DATE OF CONTRACT

Feb. 17, 1954

KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the United States of America, hereinafter called the Government, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the Government, numbered and dated as shown above and hereto attached;

NOW THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the Government, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:

	WITNESS		INDIVIDUAL PRINCIPAL
1.	-----	as to	----- (SEAL)
2.	-----	as to	----- (SEAL)
3.	-----	as to	----- (SEAL)
4.	-----	as to	----- (SEAL)
	WITNESS Attest:		CORPORATE SURETY Corporate Principal
xxx	/s/ C. A. Roberts	as to	SHELTON-BETTS CO. Wickenburg, Arizona (SEAL)
xxx			/s/ Arthur G. Betts (SEAL)

Attest:	/s/ C. A. Roberts	CORPORATE PRINCIPAL	
		J. A. DANENS & SON, INC.	
Attest:	/s/ C. D. Liddy	BUSINESS ADDRESS	
		Wickenburg, Arizona	
		BY	AFFIX CORPORATE SEAL
		/s/ C. J. Danens	
		TITLE	
		Sec'y	
Attest:	/s/ C. D. Liddy	CORPORATE SURETY	
		PEERLESS CASUALTY COMPANY	
Attest:	/s/ C. D. Liddy	BUSINESS ADDRESS	
		Keene, New Hampshire	
		BY	AFFIX CORPORATE SEAL
		/s/ J. A. Price	
		TITLE	
		Attorney-in-fact	

The rate of premium on this bond is 7.50 per thousand.

Total amount of premium charged, \$1225.00

(The above must be filled in by corporate surety)

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the _____ secretary
of the corporation named as principal in the within bond; that _____,
who signed the said bond on behalf of the principal, was then _____ of said
corporation; that I know his signature, and his signature thereto is genuine; and that said bond was duly
signed, sealed, and attested for and in behalf of said corporation by authority of its governing body.

_____ [CORPORATE
SEAL]

INSTRUCTIONS

1. This form shall be used for construction work or the furnishing of supplies or services, whenever a performance bond is required. There shall be no deviation from this form except as authorized by the General Services Administration.

2. The surety on the bond may be any corporation authorized by the Secretary of the Treasury to act as surety, or two responsible individual sureties. Where individual sureties are used, this bond must be accompanied by a completed Affidavit of Individual Surety for each individual surety (Standard Form 28).

3. The name, including full Christian name, and business or residence address of each individual party to the bond shall be inserted in the space provided therefor, and each such party shall sign the bond with his usual signature on the line opposite the scroll seal, and if signed in Maine or New Hampshire, an adhesive seal shall be affixed opposite the signature.

4. If the principals are partners, their individual names shall appear in the space provided therefor, with the recital that they are partners composing a firm, naming it, and all the members of the firm shall execute the bond as individuals.

5. If the principal or surety is a corporation, the name of the State in which incorporated shall be inserted in the space provided therefor, and said instrument shall be executed and attested under the corporate seal as indicated in the form. If the corporation has no corporate seal the fact shall be stated, in which case a scroll or adhesive seal shall appear following the corporate name.

6. The official character and authority of the person or persons executing the bond for the principal, if a corporation, shall be certified by the secretary or assistant secretary, according to the form herein provided. In lieu of such certificate there may be attached to the bond copies of so much of the records of the corporation as will show the official character and authority of the officer signing, duly certified by the secretary or assistant secretary, under the corporate seal, to be true copies.

7. The date of this bond must not be prior to the date of the instrument in connection with which it is given.

PAYMENT BOND
 (See Instructions on Reverse)

DATE BOND EXECUTED
February 16, 1954

PRINCIPAL

J. A. DANENS & SON, INC., AND SHELTON-BETTS CO., - A joint venture
Wickenburg, Arizona

SURETY **PERLESS CASUALTY COMPANY**, A corporation duly organized under the laws of the State of New Hampshire and having its home office in Keene, County of Cheshire and State of New Hampshire

PENAL SUM OF BOND (express in words and figures)

Eighty-one Thousand, Six Hundred Sixty-seven
and No/100 Dollars
. \$81,667.00

CONTRACT NO.
Asc-1142

DATE OF CONTRACT
Feb. 17, 1954

KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the United States of America, hereinafter called the Government, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the Government, numbered and dated as shown above and hereto attached;

NOW THEREFORE, if the principal shall promptly make payment to all persons supplying labor and material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:

WITNESS

INDIVIDUAL PRINCIPAL

- 1. ----- as to ~~XXXXXXXXXX~~ (SEAL)
- 2. ----- as to ~~XXXXXXXXXX~~ (SEAL)
- 3. ----- as to ~~XXXXXXXXXX~~ (SEAL)
- 4. ----- as to ~~XXXXXXXXXX~~ (SEAL)

Attest: ~~XXXXXX~~
 WITNESS

Corporate Principal ~~XXXXXXXXXX~~
 INDIVIDUAL SURETY

- 1. **/s/ C. A. Roberts** xxx **SHELTON-BETTS CO.** (SEAL)
 as to **Wickenburg, Arizona**
- 2. ----- xxx **/s/ Arthur G. Betts** (SEAL)
 as to -----

Attest:	CORPORATE PRINCIPAL J. A. Danens & Son, Inc.		AFFIX CORPORATE SEAL
	BUSINESS ADDRESS Wickenburg, Arizona		
	BY /s/ C. J. Danens,	Sec'y	
/s/ C. A. Roberts	TITLE		

Attest:	CORPORATE SURETY PERLESS CASUALTY COMPANY		AFFIX CORPORATE SEAL
	BUSINESS ADDRESS Keene, New Hampshire		
	BY /s/ J. A. Price		
/s/ C. D. Liddy	TITLE Attorney-in-fact		

See Performance Bond

The rate of premium on this bond is per thousand.

Total amount of premium charged, \$.....

(The above must be filled in by corporate surety)

CERTIFICATE AS TO CORPORATE PRINCIPAL

I,, certify that I am the secretary of the corporation named as principal in the within bond; that who signed the said bond on behalf of the principal, was then of said corporation; that I know his signature, and his signature thereto is genuine; and that said bond was duly signed, sealed, and attested for and in behalf of said corporation by authority of its governing body.

..... [CORPORATE SEAL]

INSTRUCTIONS

1. This form, for the protection of persons supplying labor and material, shall be used whenever a payment bond is required under the act of August 24, 1935, 49 Stat. 793, as amended (40 U. S. C. 270a-270e). It may also be used in any other case in which a payment bond is to be required. There shall be no deviation from this form except as authorized by the General Services Administration.

2. The surety on the bond may be any corporation authorized by the Secretary of the Treasury to act as surety, or two responsible individual sureties. Where individual sureties are used, this bond must be accompanied by a completed Affidavit of Individual Surety for each individual surety (Standard Form 28).

3. The name, including full Christian name, and business or residence address of each individual party to the bond shall be inserted in the space provided therefor, and each such party shall sign the bond with his usual signature on the line opposite the scroll seal, and if signed in Maine or New Hampshire, an adhesive seal shall be affixed opposite the signature.

4. If the principals are partners, their individual names shall appear in the space provided therefor, with the recital that they are partners composing a firm, naming it, and all the members of the firm shall execute the bond as individuals.

5. If the principal or surety is a corporation, the name of the State in which incorporated shall be inserted in the space provided therefor, and said instrument shall be executed and attested under the corporate seal as indicated in the form. If the corporation has no corporate seal the fact shall be stated, in which case a scroll or adhesive seal shall appear following the corporate name.

6. The official character and authority of the person or persons executing the bond for the principal, if a corporation, shall be certified by the secretary or assistant secretary, according to the form herein provided. In lieu of such certificate there may be attached to the bond copies of so much of the records of the corporation as will show the official character and authority of the officer signing, duly certified by the secretary or assistant secretary, under the corporate seal, to be true copies.

7. The date of this bond must not be prior to the date of the instrument in connection with which it is given.

STANDARD FORM 21
REVISED MARCH 1953
GENERAL SERVICES ADMINISTRATION
GENERAL REGULATION NO. 13

BID FORM
(CONSTRUCTION CONTRACT)

REFERENCE

Invitation No. Reg. 6-3202

*Read the Instructions to Bidders (Standard Form 22)
This form to be submitted in*

DATE OF INVITATION

January 14, 1954

NAME AND LOCATION OF PROJECT

White Tanks Structures Number 3 and 4. Maricopa County, approximately
26 miles west of Phoenix, Arizona.

February 6, 1954

(Date)

TO: Soil Conservation Service
P. O. Box 1348
Albuquerque, New Mexico

In compliance with your invitation for bids of the above date, the undersigned hereby proposes to furnish all labor, equipment, and materials and perform all work for the construction of earth filled dikes known as White Tanks Structures Number 3 and 4

at Job site: Maricopa County, approximately 26 miles west of Phoenix,
Arizona.

in strict accordance with the specifications, schedules, drawings, and conditions for the consideration of the following amount(s)

Total sum of: \$163,334.00

and agrees that, upon written acceptance of this bid, mailed, or otherwise furnished, within calendar days (60 calendar days unless a shorter period be inserted by the bidder) after the date of opening of bids, he will within 10 calendar days (unless a longer period is allowed) after receipt of the prescribed forms, execute Standard Form 23, Construction Contract, and give performance bond and payment bond on Government standard forms, if these forms are required, with good and sufficient surety or sureties.

The undersigned agrees that if awarded the contract, he will commence the work within 20 calendar days after the date of receipt of notice to proceed, and that he will complete the work within 210 calendar days after the date of receipt of notice to proceed.

The undersigned acknowledges receipt of the following addenda to the drawings and/or specifications (Give number and date of each):

Addendum No. 1, February 1, 1954

The undersigned represents (Check appropriate boxes): (1) that the aggregate number of employees of the bidder and its affiliates is 500 or more, less than 500; (2) (a) that he has, has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure this contract; and (b) that he has, has not, paid or agreed to pay to any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and agrees to furnish information relating thereto as requested by the contracting officer. (Note: For interpretation of the representation, including the term "bona fide employee," see General Services Administration Regulations, Title 44, secs. 150.7 and 150.5 (d) Fed. Reg., Dec. 31, 1952, Vol. 17, No. 253.)

Enclosed is bid guarantee, consisting of

in the amount of 10% of total bid

NAME OF FIRM OR INDIVIDUAL (Type or print) Joint Venture J. A. Danens & Son, Inc. and Shelton-Betts Co.	FULL NAME OF ALL PARTNERS (Type or print) C. J. Danens and Henry F. Shelton, Arthur G. Betts
BUSINESS ADDRESS (Type or print) Box 1044 Wickenburg, Arizona	
BY (Signature in ink. Type or print name under signature)	
TITLE (Type or print) C. J. Danens	Henry F. Shelton
/s/ C. J. Danens	/s/ Henry F. Shelton
STATE OF INCORPORATION (Type or print)	/s/ Arthur G. Betts

DIRECTIONS FOR SUBMITTING BIDS

Envelopes containing bids, guarantee, etc., must be sealed, marked, and addressed as follows:

Bid for Construction

To be opened: 2:00 p.m., MST
February 8, 1954

Soil Conservation Service
P. O. Box 1348
Albuquerque, New Mexico.

CAUTION: Do not include in the envelope any bids for other work.
Bids should not be qualified by exceptions to the bidding conditions.

INVITATION NO. REG. 6-3202

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SCHEDULES, SPECIFICATIONS AND GENERAL CONDITIONS
FOR THE CONSTRUCTION OF EARTH FILLED DIKES KNOWN
AS WHITE TANKS STRUCTURES NUMBERS 3 AND 4.

JOB SITE: MARICOPA COUNTY, ARIZONA,
APPROXIMATELY 26 MILES WEST OF PHOENIX,
ARIZONA.

BIDS WILL BE RECEIVED IN THE
OFFICE OF THE SOIL CONSERVATION
SERVICE, 106 BROADWAY, S. E.,
P. O. BOX 1348, ALBUQUERQUE,
NEW MEXICO, UNTIL 2:00 P.M.,
MST, FEBRUARY 8, 1954

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INVITATION FOR BIDS
(CONSTRUCTION CONTRACT)

Invitation No. Reg. 6-3202

DATE

January 14, 1954

NAME AND LOCATION OF PROJECT

White Tanks Structures Numbers 3 and
4, Maricopa County, approximately
26 miles west of Phoenix, Arizona.

DEPARTMENT OR AGENCY

U. S. Department of Agriculture
Soil Conservation Service

BY (Issuing office)

Soil Conservation Service
P. O. Box 1348
Albuquerque, New Mexico

Sealed bids in single copy for furnishing all labor, equipment, and materials and performing all work for the project described herein will be received until 2:00 p.m., MST, February 8, 1954,

in office of Chief, Administrative Services Division, Balcomb Building, 106 Broadway, S. E., Albuquerque, New Mexico

and then publicly opened.

Information regarding bidding material, bid guarantee, and bonds

Interested bidders may obtain a set of plans covering the proposed work from Soil Conservation Service, DeBerge Building, 39 North Sixth Avenue, Phoenix, Arizona, or Soil Conservation Service, 106 Broadway S. E., P. O. Box 1348 Albuquerque, New Mexico.

Bidders desiring to visit proposed work site should make arrangements through Mr. William E. Anderson, Engineer, Soil Conservation Service, DeBerge Building, 39 North Sixth Avenue, Phoenix, Arizona.

Each bidder must submit with his bid a bid guarantee in an amount equal to and not less than 10 per cent of the total bid. Guaranty may be in the form of a bid bond on Standard Form 24, copy enclosed, or as provided in Article 4, Standard Form 22. Should the bidder elect to submit a bid guarantee in the form of a postal money order or certified or cashier's check, the money order or check must be made payable to: Treasurer of the United States. When individual sureties are offered, there must be two sureties, each of whom shall justify in the full amount of the bond.

~~XXXXXXXXXXXX~~
Description of Work The successful bidder will be required to execute Standard Form 23 "Construction Contract", furnish performance bond on Standard Form 25, and payment bond on 25A. Performance bond to be equal to 100 per cent and payment bond, 50 per cent of total contract amount. These forms will be furnished to the successful bidder after acceptance of his bid.

Description of Work: Construction of earth filled dikes known as White Tanks Structures Numbers 3 and 4, located in Maricopa County, approximately 26 miles west of Phoenix, Arizona.

Information regarding liquidated damages (if any), payments, etc., is attached or made a part of the specifications. Bids shall be submitted on the forms furnished or copies thereof.

LIQUIDATED DAMAGES: Liquidated damages for delay will be assessed at the rate of fifty dollars (\$50.00) per day for each calendar day's delay until the work is satisfactorily completed. (See Article 5, Standard Form 23A).

PAYMENTS: Payments to the contractor will be made in accordance with Article 7, Standard Form 23A.

Any invoice or voucher submitted for a partial or final payment under this contract MUST contain the following certifications:

I certify that the above bill is correct and just and that payment therefor has not been received.

I certify that I have complied with all the labor regulations pertinent to this contract, as prescribed by the Secretary of Labor.

.....

STANDARD GOVERNMENT FORMS. The following forms, referred to herein, are either included in this invitation, or are available for inspection as indicated below:

<u>U. S. Standard Form</u>	<u>Title</u>
* No. 20 (Revised March 1953)	Invitation for bids
* No. 21 (Revised March 1953)	Bid Form
* No. 22 (Revised March 1953)	Instructions to Bidders
* No. 23 (Revised March 1953)	Construction Contract
* No. 23A (Revised March 1953)	General Provisions
* No. 24 (Revised Nov. 1950)	Bid Bond
** No. 25 (Revised Nov. 1950)	Performance Bond
** No. 25A (Revised Nov. 1950)	Payment Bond

* Included - U. S. Standard Forms Nos. 23 and 23A are marked "Sample" and are included for the information of prospective bidders. These "Sample" forms should be detached and retained by the bidder for future reference. They will not be furnished with future invitations for bids, but will be incorporated into the invitations by reference only.

** Forms are available for inspection at the offices indicated on Standard Form 20.

PROPOSAL

The Bid Schedule following, lists the various divisions of construction contemplated in these specifications. It is expressly understood that all the various phases of work enumerated in the plans and specifications, with all their individual jobs and overhead, whether specifically enumerated, included by implication or ~~appurtenant~~ thereto are to be performed by the contractor under one of the items in the schedule, irrespective of whether it is named in said list.

Bids will be considered on the following schedules, and offers for only a part thereof will not be for consideration. A contract will be awarded to the lowest responsible bidder whose proposal fully conforms to the requirements of the Invitation to Bid as may be deemed most advantageous to the Government. Bids will be evaluated on the basis of the lowest aggregate price.

A bid may be rejected if the bidder fails to furnish bid security or to submit the data required with his bid or cannot show that he has the necessary capital and experience, and owns, controls, or can procure the necessary equipment to commence the work at the time prescribed in the invitation and thereafter to prosecute and complete the work at the rate or time specified; and that he is not already obligated for the performance of other work which would delay the commencement, prosecution or completion of the work contemplated in this invitation.

BID SCHEDULE

<u>Item No.</u>	<u>Article or Services</u>	<u>Quantity</u>	<u>Unit</u>	<u>Price</u>	<u>Total</u>
1	Cleaning and Stripping	1	job	xxx	\$ <u>950.00</u>
2	Excavation	1280	cu. yds.	\$ <u>.30</u>	\$ <u>384.00</u>
3	Subgrade Preparation	1	job	xxx	\$ <u>900.00</u>
4	Earth Fill (Structure No. 3)	Approx. 375,000	cu. yds.	\$ <u>.372</u>	<u>140,000.00</u>
5	Sprinkling Embankment Materials (Structure No. 3)	Approx. 375,000	cu. yds.	\$ <u>.02</u>	<u>7,500.00</u>
6	Earth Fill (Structure No. 4)	Approx. 175,000	cu. yds.	\$ <u>.212</u>	<u>37,100.00</u>
7	Sprinkling Embankment Materials (Structure No. 4)	Approx. 175,000	cu. yds.	\$ <u>.02</u>	<u>3,500.00</u>
8	Rolling	Approx. 550,000	cu. yds.	\$ <u>.02</u>	<u>11,000.00</u>

Note: Bidders are invited to review Technical Specifications attached for clarification of the work involved under the above items.

EVALUATION OF BIDS AND AWARD: Only one contract will be awarded for the entire job, namely, to the lowest responsible bidder for Items 1 through 8. In case of variation between unit price and totals shown by the bidders, the unit price will be considered to be the bid. All bids must be for the entire job and must have each blank space filled in. The price bid for each item must allow for all collateral, overhead, or indirect cost connected with it.

1. EXPERIENCE: (See Article 3, Standard Form 22)

The bidder is requested to furnish below a statement of his experience in performing similar or comparable work as described herein. Also furnish name and address of at least two individuals or companies that are familiar with your qualifications.

Flood control dykes for Bureau of Indian Affairs, Sells, Arizona
(now in progress)
Paradise Valley Country Club Golf Course
(completed January 1, 1954)

Arizona Machinery Company, Phoenix, Arizona
W. H. Ziegler Co., Inc., Minneapolis, Minnesota
Owen Layton, Sr., Resident Engr. Arizona Highway Dept.
P. W. Tomack Const. Co., Phoenix, Arizona

2. STATEMENT ESTABLISHING PERMANENT PLACE OF BUSINESS AND FINANCIAL STATUS:
(See Article 3, Standard Form 22)

Bidder is requested to furnish a brief statement as to his net worth (exclusive of plant and equipment), credit rating, or other information which will establish his ability to properly finance the work covered herein:

Box 1044, Wickenburg, Arizona.

Total cash net worth of Companies participating in this
Joint Venture \$125,000.00

(a) Name and address of financial references:

Valley National Bank, Wickenburg, Arizona
Midland National Bank, Minneapolis, Minnesota

3. PLANT AND EQUIPMENT TO BE USED ON THE WORK: (See Article 3, Standard Form 22).

Under the headings shown below, bidder is requested to list and describe all equipment (i.e., trucks, tractors, draglines, etc.,) which will be required to properly perform the work.

<u>Quantity</u>	<u>Type</u>	<u>Manufacturer</u>	<u>Capacity</u>	<u>Age</u>	<u>Condition</u>
5	D8	Caterpillar		1 yr.	Perfect
2	DW21	"	10-23 cu. yds.	1 yr.	"
2	DW10	"	10-12 cu. yds.	6 yrs.	Good
1	No.12	" Power Control		3 yrs.	"
1	99	Austin-Western "			

Water pumps, water tanks, sheepsfoots

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

P. O. Box 1348
Albuquerque, New Mexico
February 1, 1954

ADDENDUM NO. 1

TO

INVITATION NO. REG. 6-3202 FOR
CONSTRUCTION OF EARTH FILLED
DIKES KNOWN AS WHITE TANKS
STRUCTURES NUMBERS 3 AND 4

The purpose of this addendum is to reflect a change in Wage Rate Decision Number and effective date thereof.

It is requested that sheet titled "RATE OF WAGES" be replaced with attached sheet which contains the above change.

IMPORTANT: BIDDERS ARE REQUESTED TO ACKNOWLEDGE THIS ADDENDUM BY SIGNING IN THE SPACE PROVIDED BELOW AND RETURNING IT WITH THEIR BID.

Attachment.

Bidder's signature:
J. A. Danens & Son, Inc.
/s/ C. J. Danens

/s/Arthur G. Betts
/s/Henry F. Shelton

Soil Conservation Service
Martin V. Compton, Chief
Regional Administrative
Services Division

RATES OF WAGES. (See Articles 20 through 26, Standard Form 23A)

Pursuant to the provisions of the Davis-Bacon Act, as amended, 40 U.S.C. 276(a) et. seq., the Secretary of Labor by Decision N-7808 has determined that the following rates of wages are the prevailing rates of wages for the classifications specified in the locality of the work covered by these specifications, and said rates of wages shall be the minimum rates per hour to be paid for the work covered by these specifications. The following wage rates are effective January 26, 1954.

<u>Classification</u>	<u>Per Hour</u>	<u>Classification</u>	<u>Per Hour</u>
Laborers, general or construction	1.925	Truck Drivers: (Continued)	
Power Equipment Operators:		Industrial lift truck	
Material loader or conveyor	2.25	driver	2.00
Motor patrol, including any type of power blade.	2.625	Water truck driver-under 2500 gal.	2.05
Oshkosh, DW, Tournapull, Terra Cobra, Euclid and similar equipment	2.625	Water truck driver-2500 gal. but less than 7000 gal.	2.175
Roller	2.45	Water truck driver-7000 gal. or more	2.30
Skip loader - wheel type	2.375	Shop greaser and/or tireman	2.05
Tow blade or grader	2.375	Heavy duty repairman and/or welder	2.50
Tractor hi-lift shovel	2.70	Heavy duty repairman helper and/or welder helper and/or field equipment serviceman helper	2.125
All wheel-type tractor operators, except as otherwise classified	2.375	Field equipment serviceman	2.25
Tractor- bulldozer, tamper or scraper	2.50	Dumpster Truck Drivers:	
Trenching machine	2.575	6.9 cu. yd. or less, water level capacity	2.125
Universal equipment (shovel, dragline, clamshell, derrick, and crane-both crawler and pneumatic type)	2.70	7 cu. yd. but less than 16 cu. yd. water level capacity	2.25
Truck drivers:		16 cu. yd. or more, water level capacity	2.35
Teamsters	1.925	Dumpster truck driver	2.35
Dump trucks:		Euclid type spreader truck driver	2.35
Less than 4 yds. water level capacity	2.00	Ross Carrier-driver	2.375
4 yds., but less than 8 yds. water level capacity	2.025		
8 yds., but less than 12 yds. water level capacity	2.075		
12 yds., but less than 16 yds. water level capacity	2.15		
16 yds., or more, water level capacity	2.35		
Flat rack:			
Less than 6-ton, legal payload capacity	2.00		
6-Ton but less than 10-Ton legal payload capacity	2.025		
10-Ton but less than 15-Ton legal payload capacity	2.075		
15-Ton but less than 20-Ton legal payload capacity	2.15		
20-Ton or more, legal payload capacity	2.35		

RATES OF WAGES (Continued)

The wage rates contained in this decision are straight hourly wage rates. In some areas, management and labor organizations in the construction industry have collectively bargained for health and welfare fund contributions. Such contributions are not included in wage rates determined by the Secretary of Labor for construction projects.

Any class of laborers and mechanics (including apprentices) not listed above, which will be employed on this contract, shall be classified or reclassified conformably to the foregoing schedule. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question, accompanied by the recommendation of the contracting officer, shall be referred to the Secretary of Labor for final determination.

Apprentices may be employed at wage rates specified herein (or if none are specified, at rates subsequently supplied and agreed to by the contracting parties) for such classifications.

RATES OF WAGES. (See Articles 20 through 26, Standard Form 23A)

Pursuant to the provisions of the Davis-Bacon Act, as amended, 40 U.S.C. 276(a) et seq., the Secretary of Labor by Decision N-5437 has determined that the following rates of wages are the prevailing rates of wages for the classifications specified in the locality of the work covered by these specifications, and said rates of wages shall be the minimum rates per hour to be paid for the work covered by these specifications. The following wage rates are effective November 6, 1953.

<u>Classification</u>	<u>Per Hour</u>	<u>Classification</u>	<u>Per Hour</u>
Laborers, general or construction	1.925	Truck Drivers: (Continued)	
Power Equipment Operators:		Industrial lift truck	
Material loader or conveyor	2.25	driver	2.00
Motor patrol, including any type of power blade	2.625	Water truck driver-under 2500 gal.	2.05
Oshkosh, DW, Tournapull, Terra Cobra, Euclid and similar equipment	2.625	Water truck driver-2500 gal. but less than 7000 gal.	2.175
Roller	2.45	Water truck driver-7000 gal. or more	2.30
Skip loader - wheel type	2.375	Shop greaser and/or tireman	2.05
Tow blade or grader	2.375	Heavy duty repairman and/or welder	2.50
Tractor hi-lift shovel	2.70	Heavy duty repairman helper and/or welder helper and/or field equipment serviceman helper	2.125
All wheel-type tractor operators, except as otherwise classified	2.375	Field equipment serviceman	2.25
Tractor - bulldozer, tamper or scraper	2.50	Dumpster Truck Drivers:	
Trenching machine	2.575	6.9 cu. yd. or less, water level capacity	2.125
Universal equipment. (shovel, dragline, clamshell, derrick, and crane-both crawler and pneumatic type)	2.70	7 cu. yd. but less than 16 cu. yd. water level capacity	2.25
Truck drivers:		16 cu. yd. or more, water level capacity	2.35
Teamsters	1.925	Dumpster truck driver	2.35
Dump trucks:		Euclid type spreader truck driver	2.35
Less than 4 yds. water level capacity	2.00	Ross carrier-driver	2.375
4 yds. but less than 8 yds. water level capacity	2.025		
8 yds. but less than 12 yds. water level capacity	2.075		
12 yds. but less than 16 yds. water level capacity	2.15		
16 yds. or more, water level capacity	2.35		
Flat rack:			
Less than 6-ton, legal payload capacity	2.00		
6-Ton but less than 10-Ton legal payload capacity	2.025		
10-Ton but less than 15-Ton legal payload capacity	2.075		
15-Ton but less than 20-Ton legal payload capacity	2.15		
20-Ton or more, legal payload capacity	2.35		

GENERAL CONDITIONS

1. **SUBCONTRACTORS.** The contractor shall notify the contracting officer in writing of the names of all subcontractors proposed for the work, the extent of the work to be done by each, and the general terms and conditions of each proposed subcontract. If, for sufficient reason, at any time during the progress of the work, the contracting officer determines that any subcontractor is incompetent or undesirable, he will notify the contractor accordingly and immediate steps will be taken for cancellation of such subcontract. Subletting by subcontractors shall be subject to the same regulations. Nothing contained in this contract shall create any contractual relation between any subcontractor and the Government.

2. **CLIMATIC CONDITIONS.** The contracting officer or the Government Representative may order the contractor to suspend any work that may be subject to damage by climatic conditions, when, in his opinion, weather conditions are such as to prevent the work from being properly carried out. When delay is caused by such order, an extension of time may be granted but no claims for damage due to such delay will be considered by the Government. (See Article 5(c), Standard Form 23A). All stop and start orders shall be in writing.

3. **RIGHTS-OF-WAY.** All permanent rights-of-way and/or easements for the works to be constructed under the contract will be furnished the contractor. The work sites will be entirely within such rights-of-way. Use by the contractor of any adjacent property for ingress and egress to project site for working area, or for other purposes (i.e., temporary ingress and egress to the project site over and above those furnished, equipment parking areas, etc.), shall be the responsibility of the contractor. The right to enter, remove, alter or make use of any existing road, culvert, canal, pipeline, levee, lines of communication or improvement of any nature, or the trespassing on privately owned lands, shall be the responsibility of the contractor who shall indemnify and save the Government harmless from any and all claims for damages occasioned by such entering, removing, altering, using or trespassing.

In cases of serious interference to the work by delay of the Government in arranging for permanent rights-of-way or permanent or temporary easements, the contractor will be allowed an extension of time equivalent to the time lost by unavoidable delay in the completion of the contract as a result of the Government's failure to furnish the rights-of-way on time, but no damages will be allowed or paid for such delay.

4. **WATER.** Water for use in moistening the embankment materials will be furnished without charge by the Maricopa County Municipal Water Conservation District No. 1, otherwise known as the Beardsley Project. This water will be made available in the Beardsley Canal at the nearest point to the proposed work. Arrangements for delivery of water as required at these points shall be made by the contractor with the Superintendent of the Beardsley Project. Delivery of water from the canal to points of use will be a responsibility of the contractor and all costs incident thereto will be borne by the contractor and will be considered to be a part of the bid price for sprinkling and not as a separate item.

5. **CONTRACTOR'S LIABILITY.** All damage and loss (whether caused by fire, flood, or any other casualty or happening) to improvements or work to be constructed or performed pursuant to the contract (whether or not covered by partial payments made by the Government) shall be at the risk of the contractor until final acceptance of such improvements or work by the Government, and no such damage or loss shall relieve the contractor of, or in any way affect, his obligations to complete and deliver the work in accordance with the contract requirements, irrespective of any insurance carried by the contractor.

The contractor shall assume full responsibility and expense for removing, protecting, and returning to the work site, any and all equipment under his care, which might be endangered by said fires, flood, or happening; also, for any interference or delay in operations which might be caused by such incident(s).

Any reclearing, re-excavation or re-filling made necessary by damage from floods, storms, or water of whatever source or quantity during the course of construction and until final acceptance by the Government, shall be performed by the contractor at his expense except as otherwise provided herein.

6. QUANTITIES AND UNIT PRICES. Any quantities shown in the bid schedule as approximations are solely for comparison and no claims shall be made against the Government for excess or deficiency therein, actual or relative. Payment at the prices agreed upon will be in full for the completed work and will cover materials, supplies, labor, tools, machinery, and all other expenditures incident to satisfactory compliance with the contract, unless otherwise specifically provided herein.

7. STAKING OUT WORK. The work to be done will be staked out by the Government.

8. BENCH MARKS AND SURVEY STAKES. Bench marks and survey stakes shall be preserved by the contractor, and in case of their destruction or removal by him or his employees, they will be replaced by the Government at the contractor's expense by deductions from payments due the contractor.

9. EXTRAS AND CHANGES: The contractor shall, when ordered in writing by the contracting officer, perform extra work not covered by the specifications or included in the schedules, but forming an essential part of the work contracted for. Such extra work will ordinarily be paid for at a lump-sum or unit price agreed upon by the contractor and the contracting officer and as stated in the order. Whenever in the judgment of the contracting officer, it is impracticable because of the nature of the work or for any other reason to fix the price in the order, the extra work shall be paid for at actual necessary cost as determined by the contracting officer, plus an allowance of ten (10) per cent, for superintendence, general expense, and profit. The actual necessary cost will include all expenditures for labor (including compensation insurance and social security taxes) furnished by the contractor, and a reasonable allowance for the use of his plant and equipment, where required, to be agreed upon in writing before the work is begun, but will in no case include any allowance for office expenses, general superintendence, or other general expenses.

The Government reserves the right to increase or decrease up to twenty-five (25) per cent, at the unit price shown, the unit quantities of work to be performed, as set forth in the schedule of work.

Contractor may request certain changes in plans to be made to facilitate the performance of work by the contractor. Such requests shall be made in writing to the contracting officer. Approval may be granted by the contracting officer when proposed changes are not detrimental to the work or to the best interests of the Government. (For further reference, see Articles 3 and 4, Standard Form 23A).

10. CLEANING UP. Upon completion of the work the contractor shall remove from the vicinity of the work all plant, buildings, rubbish, unused materials, concrete forms, and other like material, belonging to him or used under his direction during construction, and in the event of his failure to do so the same may be removed by the Government at the expense of the contractor, and his surety or sureties shall be liable therefor.

11. ACCIDENT PREVENTION AND SAFETY MEASURES. The contractor shall at all times exercise reasonable precautions for the safety of employees on the work and shall comply with all applicable provisions of Federal, State, and Municipal safety laws. The contractor shall indemnify and save harmless the Government from any and all claims for damages arising from loss of life, injury to person or damage to property due to operations of the contractor.

12. WORKING CONDITIONS. While the wage rates as determined by the Secretary of Labor are the minimum hourly rates required to be paid during the life of the contract, it is the responsibility of bidders to inform themselves as to the local labor conditions, such as the length of workday and workweek, overtime compensation, health and welfare contributions, labor supply, and prospective changes or adjustment of wage rates. The contractor shall abide by and conform to all applicable laws, executive orders, rules, regulations, and orders of Federal agencies authorized to pass upon and determine wage rates. No increase in contract prices shall be allowed or authorized on account of payment of wage rates in excess of those listed herein.

13. CONSTRUCTION PROGRAM. Within ten (10) calendar days after the date of receipt of notice to proceed, the contractor shall furnish the Government representative a complete construction program showing in detail his proposed program of operations. The construction program shall be in such form and in such detail as may be required by the Government representative. The contractor shall immediately advise the Government representative of any proposed changes in his construction program. If any construction program is inadequate to secure completion of the work within the specified period of time, or is otherwise not in accordance with the specifications, or the work is not being prosecuted adequately or properly, the Government representative shall have the right to require the contractor to submit a new construction program providing for proper and timely completion of the work and the contractor shall be entitled to no claim for additional compensation on account of such requirement.

14. APPLICABLE LAWS. The contractor, in the performance of this work, shall at all times observe and comply with, and shall cause his agents and employees to observe and comply with, any and all applicable laws, ordinances, statutes, regulations, etc., and shall hold and save the Government harmless from any and all claims or liabilities arising from or based upon the violation of any such law, ordinance, statute, regulation, etc., whether by himself or his employees or agents.

TECHNICAL SPECIFICATIONS

Part I. General Provisions

1. Definition of Terms:

Whenever in these specifications, or in any document or instrument where these specifications govern, the following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

Government: Government of the United States of America or its legally authorized representative.

Contractor: An individual, partnership, or corporation who has entered into a contract with the Government or his, their, or its duly authorized representative.

Materials: In addition to material incorporated in the project, equipment and other material used and/or consumed in the performance of the work.

Subcontractor: Those having a direct contract with the Contractor whereby labor and/or material worked to a special design according to the plans or specifications for this work is furnished, but does not include those who merely furnish material not so worked.

Contracting Officer: The duly authorized officer who executes the contract with the Contractor or his authorized representative who will be designated at the time the contractor is notified to proceed with the work.

Engineer: The Government Representative who will be designated at the time the Contractor is notified to proceed with the work.

Plans: The official plans, profiles, typical cross-sections, general cross-sections, working drawings, and supplemental drawings, or exact reproductions thereof, approved by the Engineer, which show the location, character, dimensions, and details of the work to be done, and which are to be considered as a part of the contract supplementary to these specifications.

Specifications: The directions, provisions, and requirements contained herein as supplemented by such special provisions as may be necessary, pertaining to the method and manner of performing the work or to the quantities and qualities of materials to be furnished under the contract.

2. Scope of Work:

The work to be done under these specifications consists of furnishing all labor, materials, equipment, methods and processes necessary for the construction and completion of two wet rolled earth filled dikes known respectively as White Tanks Structures No. 3 and No. 4. Both of these dikes are located at the foot of the east side of the White Tank Mountains and west of the Beardsley Irrigation Canal in Maricopa County, Arizona. Structure No. 3 is approximately 7,667 feet in length, approximately 30 feet in height at its maximum section and with a 10 foot crest width. It contains an estimated 375,000 cubic yards of embankment. There are three outlet structures to be installed in this structure. Structure No. 4 is approximately 6,839 feet in length with a maximum height of 20 feet and a 10 foot crest width. It contains an estimated 175,000 cubic yards of embankment with two outlet structures to be installed, and a spillway training dike at the west end. The total length of both structures is approximately 14,508 lineal feet, and the embankment totals 550,000 cubic yards, approximately. The outlet structures for these dikes will be installed by force account by crews of Maricopa County Municipal Water Conservation District No. 1. concurrently with the placement of embankment by the Contractor. All work shall conform to maps, plans, profiles, and specifications which are part of this contract and to such other drawings and directions relating thereto as may be furnished to the bidder prior to the opening of proposals, and to such drawings and directions in explanation of details or minor modifications as may be furnished from time to time during construction, including such minor modifications in plans and specifications as the Engineer may consider necessary on account of conditions found during the prosecution of the work. Scaled dimensions shall not be used in the construction of the work.

3. Sequence of Work: In view of the danger of summer floods originating in the White Tank Mountains, it is the intent that Structure No. 3 shall be completed first and that completion of this structure should be accomplished not later than July 1, 1954. The Contractor should have sufficient equipment and men on the job to insure that the completion date is obtained. Nothing in this paragraph will be construed as to prohibit work being carried forth on Structure No. 4 concurrently with Structure No. 3, providing the Contractor has adequate equipment available for this purpose.

In view of the extreme danger of flood damage during the summer rainy season, which normally starts about July 1, all work on Structure No. 4 subsequent to that date shall be accomplished in sections in such a manner that open floodways will be maintained through the structure to permit passage of floods which may occur during the course of construction. The closing of these floodways shall be done expeditiously and shall be scheduled at such time as weather conditions would indicate the probability of an extended period of clear weather sufficient for the purpose.

While it is intended that Structure No. 3 shall be completed prior to the time the summer rainy season is normally expected to start, similar considerations will govern in the scheduling of work on this structure, since occasional or unusual floods may be encountered at this location during other than normal rainy seasons. For this reason, it will be required that the spillway excavation for Structure No. 3, and the construction of the adjacent portion of the embankment which is to be composed of materials excavated from the spillway, will be the first portion of the work to be accomplished. Succeeding sections of the embankment construction will extend northward from this first section and work on each section will be completed insofar as practicable before work on the next section is started. Placement of facing materials will proceed

concurrently in all cases with the construction of the main core of the embankment. (See Article 5 - General Conditions).

4. Source of Supply and Quality of Materials:

Extensive laboratory testing has been done on materials proposed for use as embankment and areas containing suitable deposits have been outlined on the ground. Inasmuch as the embankment will contain a central core and a separate blanket of facing material, different sources of supply of these materials have been determined. Alternate sources of suitable materials proposed by the Contractor and lying within the limits of rights of way or easements that have been obtained will be approved for use providing they meet all the requirements of these specifications and are otherwise suitable as determined by laboratory tests. Only materials conforming to the requirements of these specifications and approved by the Engineer shall be used in the work. All materials proposed for use may be inspected or tested at any time during their preparation and use. If, after trial, it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved materials from other approved sources. No material which, after approval, has in any way become unfit for use shall be used in the work.

Sites from which material has been removed shall be left in a neat and presentable condition satisfactory to the Engineer upon completion of the work, and all fences removed for purposes of entry shall be replaced in as good a condition as they were before being removed.

5. Relations With Other Organizations:

Installation of outlet works and structures will be accomplished by force account crews employed by the Beardsley Irrigation District for this purpose and will proceed concurrently with the construction of the earth fill. The Contractor will be required to schedule his work so as to permit minimum delay or interference with the forces of the Beardsley Irrigation District. Installation of these outlet works will be carried on expeditiously and in such a manner as to interfere to the least extent possible with the activities of the Contractor in the construction of the embankment.

Part II. Earthwork

Section 1. Clearing and Stripping

1. Description:

All clearing and stripping of the structure bases and spillway areas and disposition of these stripped materials will be accomplished by force account in advance of the operations of the Contractor.

Clearing and stripping of borrow areas will be required, and will consist of removing all grass, brush, trees, stumps, and other deleterious materials from the surface, and will also include the loosening, removing, loading, transporting and disposal of all such materials and of all organic soil and other substances unsuitable for embankment purposes. Clearing and maintenance of Contractor's haul roads will be included in this item.

2. Disposal of Cleared Materials:

The Contractor shall dispose of all cleared materials by burning at a location within the limits of the cleared area. The time and place of burning will be decided by the Engineer. Incombustible materials will be disposed of by placement in a neat and inconspicuous manner in gullies or low areas within or immediately adjacent to the cleared area, in a manner to be prescribed by the Engineer.

3. Basis of Payment:

Clearing and stripping will be paid for at the contract price lump sum for CLEARING AND STRIPPING, which price shall include all materials, labor, work and equipment necessary to complete the item.

Section 2. Excavation

1. Description:

Upon completion of embankment construction to an elevation of not less than 12 inches above the elevation of the top of the anti-seep rings for the various outlet pipes, and upon receipt of instructions from the Engineer, excavation of trenches for the installation of the outlet pipes will be performed by the Contractor. These trenches will be machine excavated to full carryall width and to a bottom grade to be established by the Engineer. Fine grading and necessary hand trimming and final hand excavation will be accomplished by forces of the Maricopa County Municipal Water Conservation District No. 1, who will also install the pipes and place backfill.

2. Disposal of Excavated Material:

Excavated material will be stock-piled on the fill and adjacent to the excavation, in such a manner that it may readily be used for backfill by the District forces, following placement of outlet pipe.

3. Excavation Limits:

All excavation under this section will be made to neat lines as staked in the field by the Engineer. Any excavation which is carried beyond or below the lines and grades as established shall be refilled by the Contractor at his

own expense, with materials satisfactory to the Engineer, and such materials shall be compacted by the Contractor at his own expense, to the satisfaction of the Engineer.

4. Estimated Quantities:

Estimated total quantities for excavation are 1,280 cubic yards.

5. Measurement:

All excavation shall be measured in the original space occupied and the volume computed in cubic yards by the average end area method.

6. Basis for Payment:

The basis of payment for excavation shall be the contract unit price a cubic yard for EXCAVATION, which price shall be the full compensation for excavation, removal and disposal of all materials and the furnishing of all equipment, tools, labor and incidentals necessary to complete the work. No payment will be made for excavation carried beyond the lines or grades established, nor will any payment be allowed for replacement of such unauthorized excavation.

Section 3. Subgrade Preparation

1. Description:

This item will cover all work required to prepare the sites of the structures prior to placement of embankment materials. It will include ripping of the base area to provide bond between the embankment and the foundation, moistening or sprinkling and compaction of the base and all loose materials in the same manner as is required for the embankment.

2. Basis of Payment:

Subgrade preparation will be paid for at the contract price lump sum for SUBGRADE PREPARATION, which price shall include all materials, labor, work and equipment necessary to complete the item.

Section 4. Rolled Earth Fill

1. Description:

The rolled earth fill consists of two earth dikes previously described in Part I of these specifications.

2. Borrow Area:

Suitable borrow material in adequate quantities has been located in the immediate vicinity. Borrow for the south 2,200 feet of core of Structure No. 3 will be composed of material excavated from the northeast 800 foot area of the proposed spillway. This material will consist of 80,500 cubic yards and will involve an average haul of 1,400 feet. Spillway borrow area will be excavated to finished grade by contractor. The balance of the core material for this structure will be taken from side borrow located generally immediately adjacent to the embankment and with a minimum of haul involved. This

amounts to approximately 187,500 cubic yards. Facing material for this structure will come from a borrow area located approximately 2,000 feet west of the south end of the dike. There will be a total of approximately 107,000 cubic yards of facing material to be installed and the average haul for this material will be approximately 5,500 feet.

The borrow area for Structure No. 4 is located adjacent to and throughout the length of this dike. Core material will consist of approximately the upper three feet of the borrow area and facing will consist of those materials lying below this depth. Facing material may be used on this structure within the core section where necessary or desirable to facilitate the construction operations.

A limited amount of borrow for Structure No. 4 will be required from the proposed spillway areas in order that these may be excavated and leveled to finished grade. No additional payment will be made for this excavation, as the materials will be used as embankment and payment made, therefore, in the form of rolled earth fill.

Total earthwork in Structure No. 4 is approximately 175,000 cubic yards.

All materials used in the embankment of both structures shall be taken only from these specified borrow areas. No waste material or deleterious substances shall be employed in the construction of the embankments.

A minimum 25 foot wide berm shall be maintained between the toe of the embankment slopes and the edge of adjacent borrow pits.

3. Construction Methods:

The embankment shall be constructed in approximately horizontal layers with no abrupt breaks in the top grade of the fill. The layers shall be evenly spread to a thickness of not greater than six (6) inches after rolling. The full cross-section of the embankment shall be maintained as each successive layer is rolled. Fill material shall be laid down evenly and not in piles or windrows.

The embankment shall be constructed in sections in such a manner to most economically use the equipment available. In the case of Structure No. 4 these sections will be so planned as to permit flood protection to be obtained from the open gaps. Ends of the embankment sections shall be placed on a slope not steeper than 1:20 and closure between sections shall be made by means of thorough ripping or discing and rerolling of adjacent materials.

The Contractor shall route his hauling equipment over the layers so as to obtain the maximum amount of compaction possible, and to avoid excessive compaction anywhere along the hauling route. All excessively packed layers will be chiseled at Contractor's expense to the full depth of such over compaction, at the direction of the Engineer.

Mixing or blending of embankment materials on this project will be required only where adequate and satisfactory compaction cannot be obtained due to lack of uniformity of moisture distribution in the materials.

The embankment shall be placed as continuously and rapidly as possible after the required subgrade preparation has been accomplished as directed by the Engineer. The surface of all embankment shall be carefully graded to the lines shown on the plans and as staked by the Engineer. In addition, it will be required that both slopes of the embankment be faced with caliche and/or gravel for one carryall width, and the crown of the embankment shall have a minimum capping of one foot of this same material. The slope facing of the structures shall be carried on continuously with the placing of the core of the embankment. Materials for the facing will come from selected borrow areas previously described.

When embankments are on sloping ground or existing fills are widened, the surface shall be deeply plowed or ripped, or shall be stepped, as the Engineer may direct.

4. Measurement:

The earth fill will be measured in cubic yards of fill in place after compaction. Volumes will be determined by the average end area method. No distinction will be made between facing and core materials.

5. Basis of Payment:

The basis of payment for earth fill as specified herein shall be the contract unit price a cubic yard for EARTH FILL, measured as hereinbefore specified, which price shall be full compensation for excavating, transporting, placing, forming of embankment, mixing and finishing, and the furnishing of all equipment, tools, labor and incidentals necessary to complete the work.

Section 5. Sprinkling

1. Description:

Sprinkling or moistening of the embankment materials will be required to obtain adequate compaction. Water for sprinkling or moistening will be made available without charge in the canal of the Beardsley Irrigation Project at a point specified by the Contractor and as close to the proposed works as is possible. Delivery of this water from that point to the project and distribution as needed on the project will be a responsibility of the Contractor, and the cost thereof shall be considered as a part of the bid price. Certain facilities exist for delivery of water to certain portions of the borrow areas in Structure No. 3, and the Contractor may utilize these facilities to the greatest extent possible consistent with his operating conditions.

2. Construction Methods:

Water shall be evenly applied to each layer of the fill, prior to rolling, to secure a uniform moisture content for maximum compaction. The amount of water to be applied shall be enough to give a water content of approximately 12% as shown by laboratory reports. This water will be sprinkled evenly on the embankment, or if the Contractor so desires, he may add a portion of it in the borrow pits. Before compaction each wetted layer shall be thoroughly mixed or stirred, if necessary, until moisture is uniformly distributed. Embankment facing materials shall also be moistened or sprinkled in the same manner as core materials. The Contractor shall employ adequate pumping and sprinkling facilities to maintain the construction pace set by the earth moving equipment.

3. Basis for Payment:

The basis for payment for SPRINKLING EMBANKMENT MATERIALS shall be the contract unit price per cubic yard of compacted embankment for Structures Nos. 3 and 4 separately, as determined by methods described elsewhere in these specifications, which price shall be full compensation for pumping, loading, hauling, handling, sprinkling and distribution of the water and the furnishing of all equipment, tools, supplies, labor and incidentals necessary to complete the work.

Section 6. Rolling

1. Description:

Compaction of all embankment materials to 95% of Standard Proctor Density as determined by laboratory tests will be required. The material will compact readily by the use of sheepsfoot rollers.

2. Construction Methods:

Compaction of material in place probably will be accomplished by about six passes with a roller which has a weight of at least 2,500 pounds per linear foot including ballast.

Except by approval of the Engineer, no rolling shall be done within three feet of any structural work and no other heavy equipment shall be operated within five feet of any such work.

Embankment facing material shall be compacted at the same time and to the same extent as is adjacent core materials.

3. Basis for Payment:

The basis for payment shall be the contract unit price for ROLLING per cubic yard of compacted embankment determined as described elsewhere in these specifications, which price shall be full compensation for all labor, materials, equipment, supplies and incidentals necessary to complete the work.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

E ohx
White
Tanks
Emec

6029 Federal Building, Phoenix, Arizona 85025

SUBJECT: **REG - Systematic Surveys of SCS Designed Structures** DATE: August 7, 1973

TO: **Paul O. Tilker, Head**
ES&P Unit
Portland, Oregon

White Tanks Reservoir No. 3 is one of the Arizona reservoirs selected for periodic sedimentation surveys in accordance with Engineering Memorandum-70. Since its selection, its watershed has been disturbed appreciably by the expansion of Goodyear Tire and Rubber Company's testing grounds. Large areas, including mountainous topography, have been laid bare. For this reason, we believe that sediment yield to White Tanks Reservoir No. 3 is no longer representative of watersheds in the surrounding area.

We are requesting approval to delete White Tanks No. 3 from the list and to substitute the Guadalupe Floodwater Retarding Structure, which is authorized for construction.

George C. Marks

George C. Marks
State Conservationist

cc:

C. A. Maguire
R. H. Arrington
D. G. Burns



CASE. . . Phx ^{1/11} White Tanks

Room 6029 Federal Bldg., Phoenix, AZ 85025

November 30, 1971

Col. John Lowry
Manager and Chief Engineer
Flood Control District of Maricopa County
3325 West Durango Street
Phoenix, Arizona 85009

Dear Col. Lowry:

In accordance with a request by Lee Ohlsiek of your staff, we are submitting for your reference and file the plans and specifications for the White Tanks Pilot Watershed Project.

We are unable to find in our files the inspection reports prepared during the construction of the two structures. We do, however, confirm the fact that a soils laboratory was set up on the job and frequent tests were taken to confirm compliance with the specifications. No controversies arose during construction concerning adequate compaction of the earth fill embankments.

Please call if we can be of further assistance in evaluating these White Tank structures.

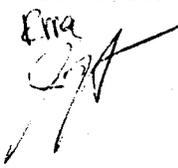
Sincerely,


M. E. Strong
State Conservationist

Attachments

bcc: Chris Williams
Gerald Welsh

USDA-SCS
RMA-JJT:ks



White Tanks

See letter of 8-7-78
to Ken Wroo. re Eng Design
(refer to Magna file)



**Flood Control District
of
Maricopa County**

3325 WEST DURANGO STREET
PHOENIX, ARIZONA 85009

April 26, 1972

PP *1-2*
Marka *Don*
Maguire

1-2
White Tanks
Phx. W.G.

Mr. Charles Brandt
Caterpillar Tractor Company
Box 636
Litchfield Park, Arizona 85340

Dear Mr. Brandt:

Reference is made to your letter of March 6, 1972, furnishing information on the capacity of a rainfall storage pit in the Proving Ground and outlining a method of diverting runoff northward into Dam No. 3. On April 19 Messrs. Ohsiek and Arrington visited the site with you.

Confirming a statement by Mr. Ohsiek, it is requested that you proceed, as part of the testing programs by your company, to extend the existing dike in the southeast quarter of Sec. 18 generally toward the southwest to tie-in to Camelback Road. Also, that you study the feasibility of raising Camelback Road westwardly from the proposed junction of the dike, to insure that runoff will be contained and carried to the north.

We appreciate your interest and cooperation in performing this work at no cost to the County to assist in controlling flooding in this area.

Sincerely,

John C. Lowry
Chief Engineer and General Manager

JCL/LEO/aa

cc: R. Arrington, Soil Conservation Service ✓

Hayden

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE Room 6029 Federal Bldg., Phoenix, AZ 85025

SUBJECT: ENG - White Tanks Structure

DATE: August 10,
1972 ✓

S-111

TO: Ralph Arrington
State Conservation Engineer

On August 9, 1972 Mr. Lee Ohsiek and I met with Mr. Brandt of the Caterpillar Proving Ground to make a field inspection of the diversions constructed to redivert some of the drainage back from the No. 4 White Tanks Structure to the No. 3 Structure.

The work appeared adequate to do the job. About four square miles of drainage flows into a holding pond adequate to hold about 2 inches of runoff. The overflow from this pond is diverted by a channel with a 12' bottom, 5' deep and 1½:1 side slopes on a .0025 grade to Structure No. 3. This would carry about 450 CFS. This diversion also catches drainage from about one square mile of uncontrolled drainage area. It appears the system could handle about the 100-year event.

It was planned to enlarge the inlet to the holding pond some more to make certain the inlet would carry any flood to the pond.

George Watt
George Watt
Design Engineer



Eng 5 -
FHX

Arizona State Office
May 16, 1967

M. D. Burdick, State Conservationist
SCS, Phoenix, Arizona

J. J. Turner, State Conservation Engineer

*re file
White
Lands*

ENG - Trip Report - Watershed Protection

On the afternoon of Wednesday, May 10, 1967, Messrs. Melvin M. Culp, Chief, Design Branch, Washington, D. C.; F. K. Mucus, Head, Design Section, Portland, Oregon; Ralph M. Arrington, Head, Design Unit, Phoenix, and I inspected the White Tanks Pilot Project dam #3 built in 1954 and the nearby McMicken flood control dam built by the Corps of Engineers in 1956.

Evidence of former cracking and some existing open cracks were noted in the McMicken structure. It appears that annual dragging of the surface of the dam together with local rainfall has healed at least the surface of some of the cracking that was quite prevalent during the period 1958-1960.

No appreciable cracking was noted on White Tanks Dam #3.

The Lowerline Dam in the Apache Junction-Gilbert project, the Lowerline channel route and the Florence Area flood prevention dam were inspected on the morning of May 11. Both visitors were highly complementary regarding the adequacy of design and the quality of construction.

A preference was expressed for the drop inlet type of outlet structure as used on the Florence Area over the headwall type used at the Magma and Lowerline dams because the hydraulic characteristics lessen the possibility of negative pressures or cavitation in the outlet conduit.

Where differences in elevation permit we will use the drop inlet, "Florence" type. Where situations dictate the headwall type, the entrance to the pipe will be streamlined to improve the hydraulic characteristics. Headwall type conduit entrances will be avoided where water heads in excess of approximately 25 ft. will be encountered.

The cracking of the fill of the Magma dam was inspected on the afternoon of May 11. It was noted that longitudinal cracking was more prevalent than transverse cracking. It appeared that some transverse cracks may extend from the front to the downstream face of the dam. The cracks at the surface vary in width from very minute to as much as 1-1/2 in. Depth of cracks is not known but some are in excess of 3 ft. The cracking appears to be most severe in the upper 5 ft. to 8 ft. of the structure.

IT WAS AGREED that the sponsors should be encouraged to drag the surface of the dam with a farm type spike-tooth harrow, a heavy ship anchor chain or other equipment that would create a thin surface mulch that would tend to fill up the cracks and provide loose material that could trickle into the cracks under natural conditions of rain, wind and insect action. Dragging the surface will also tend to reduce annual vegetation that, when dead, may tend to keep soil from filtering to the bottom of the cracks.

The cracking on the Magma Dam is unique in that the soil types used in construction are not normally susceptible to severe swelling and/or cracking. These low plastic, loam clays with plastic indexes ranging from 3-11 generally would not yield deep surface tension cracks which are evidenced at the site. It was agreed that further study must be made to determine the internal moisture distribution and more closely the soil characteristics to correlate the two for future consideration in proper design of earth structures using these soils.

Messrs. Kenneth Brust and Bill Mildner of the Watershed and River Basin Planning Staff accompanied the group on May 11.

At an hour long conference on May 12 Messrs. Culp and Mucus exchanged technical ideas with the engineering and geology members of the State Office staff.

cc to:

E. J. Core, Head, E&M Unit, Portland, Oregon
M. M. Culp, Chief, Design Br., Washington, D. C.
R. M. Arrington, Head, Design Unit, Phoenix
J. R. Ferrin, WUC, Phoenix
W. E. Parsons, WUC, Coolidge

Frank B. Harper, Editor, SOIL CONSERVATION
SCS, Washington, D. C.

October 31, 1962

R. V. Boyle, State Conservationist
SCS, Phoenix, Arizona

RECEIVED
EMERSON

INFORMATION - Manuscript - White Tanks Story

Enclosed is the draft of the "White Tanks" story Herb Boddy requested this office to prepare. We recognize that the story is somewhat longer than requested, but we felt it important to the success of the Rural Development and 566 Programs that prospective sponsors realize ultimate improvements of a permanent nature generally require years of effort and long range planning.

Encl. 1 sketch
12 photographs

cc: Herb Boddy, Berkeley, Calif. ✓
Harper Sims, Washington, D.C.

Please feel free to edit and deal directly with Editor Harper on changes you feel appropriate.

Maguer

Room 6029 Federal Bldg, Phoenix, AZ 85025 *AM*

Mr. Herbert P. Donald
Chief Engineer and General Manager
Flood Control District of Maricopa County
3325 West Durango Street
Phoenix, Arizona 85009

December 4, 1974

Dear Mr. Donald:

In response to your memo of November 21, 1974 concerning the reservoir maps for White Tanks 3 and 4, we have duplicated the construction drawings for you.

The hydrology for the structures includes storage of the 100-year flood event to the crest of the emergency spillway. The 100-year inundation area may be taken from the information provided in the drawings.

If there are further questions, please call.

Sincerely,

For:

GC
George C. Marks
State Conservationist

Attachments

USDA-SCS
RMA:ks

AM

FLOOD CONTROL DISTRICT of Maricopa County

3325 West Durango Street • Phoenix, Arizona 85009 • Telephone (602) 262-3630/262-3639

November 21, 1974



*From [unclear]
Copy to [unclear]
Ralph - who has the
maps for this?*

United States Department of Agriculture
Soil Conservation Service
230 North First Avenue
Phoenix, Arizona 85025

ATTENTION: Mr. George C. Marks

Dear Mr. Marks:

RE: Delineation of the Reservoirs of White Tanks Dams 3 and 4

As you are aware, Title 45-2342 of the Arizona Revised Statutes requires that floodplains be delineated and that these delineations be submitted to the Arizona Water Commission. Paragraph 6, Section 1, Article 4, ARS 45-2341 defines "Floodplain" as "... areas where drainage is or may be restricted by man-made structures which have been or may be covered partially or wholly by floodwater...". Also, the "1974 Floodplain Regulations for the Unincorporated Area of Maricopa County" require that all floodplains be delineated on the Maricopa County Zoning District Maps.

In order to comply with the State statutes and County regulations, we respectfully request that you supply us with maps of the subject reservoir areas. If the design of any of the structures is such that they would be less than full in a 100-year flood event, please delineate both the 100-year inundation area and the inundation area when full. Thank you for your assistance in this matter.

Sincerely,

Herbert P. Donald
Herbert P. Donald, P.E.
Chief Engineer and General Manager

HPD/LAB/ly

White Tanks

Room 6029 Federal Building, Phoenix, AZ 85025

Herbert P. Donald
Chief Engineer and General Manager
Flood Control District of Maricopa Co.
3325 West Durango Street
Phoenix, Arizona 85009

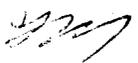
June 9, 1975

Dear Herb:

We are sending a copy of a condensed summary containing information on the White Tanks and Trilby Wash Projects that had been requested by Mr. Cahle.

Please call us if we can be of further help.

Sincerely,



George C. Marks
State Conservationist

Attachment (Condensed Summary)

USDA-SCS
RMA:ks

luc

42714

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE Room 6029 Federal Bldg., Phoenix, AZ 85025

SUBJECT: ENG - White Tanks

5 P
DATE: May 3, 1972

TO: Ralph Arrington
State Conservation Engineer

On April 19, 1972 Lee Ohsiek and I met with Mr. Brandt of the Caterpillar Tractor Company at the Caterpillar Tractor Proving Ground regarding the re-diverting of some of the drainage area from the south structure to the center structure so the drainage areas for the structures are as designed.

Attached is a sketch of their planned system of diversion. The large holding pond shown on the sketch will take most of the peak so there is no reason why the diversion dike could not be made to work satisfactorily. They did not have any details for the job so there was not anything to check other than the general plan.

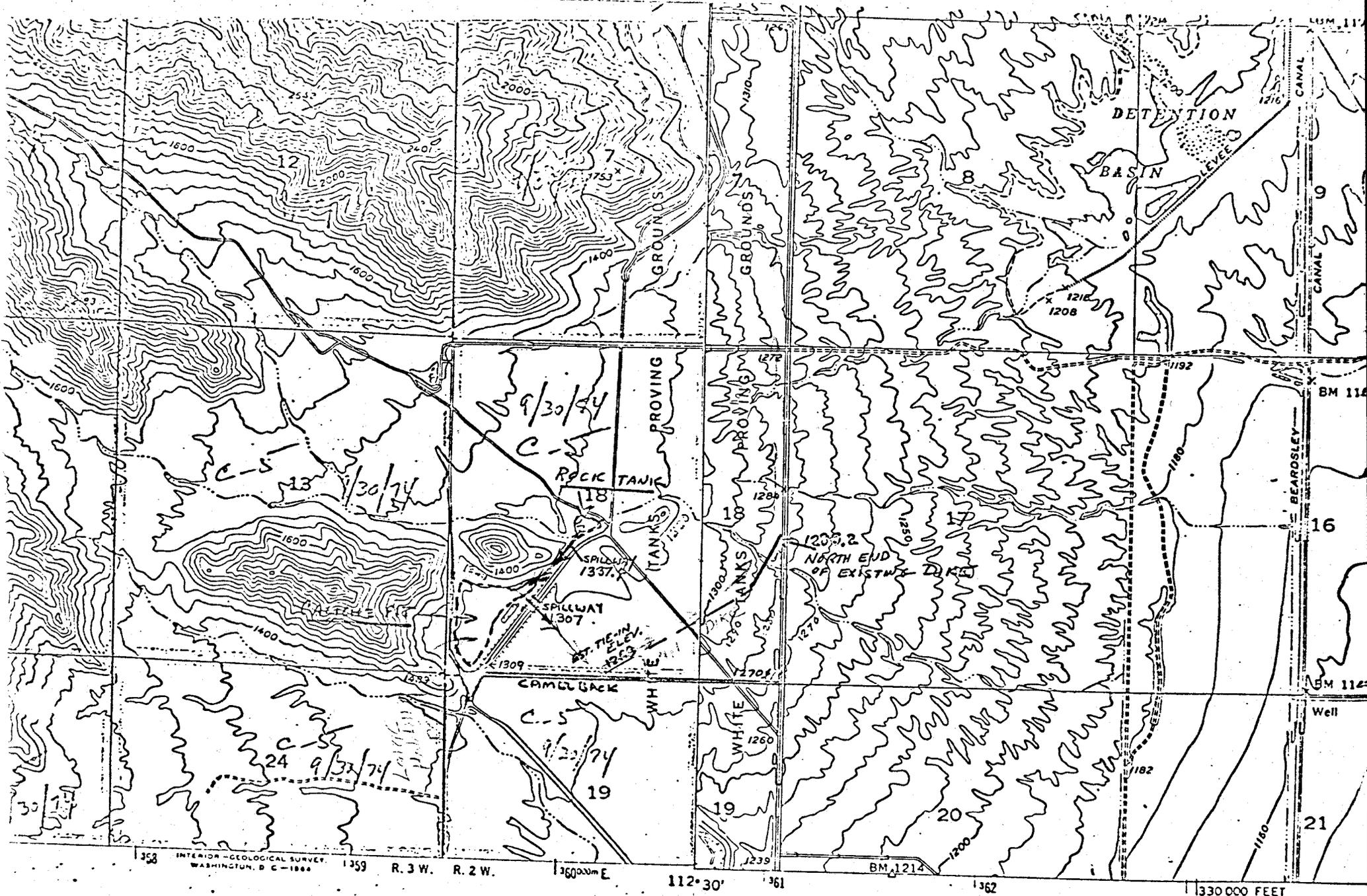
Lee Ohsiek said he would write Mr. Brandt a letter approving the overall plan.



George Watt
Design Engineer

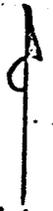
Attachment





358 INTERIOR GEOLOGICAL SURVEY WASHINGTON, D. C. - 1984 359 R. 3 W. R. 2 W. 1360000 E 112° 30' 361 1362 1330000 FEET

ARIZONA



Light-duty

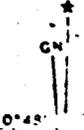
ROAD CLASSIFICATION

Unimproved dirt

Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods and by planimeter surveys 1957. Aerial photographs taken 1954.

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system.



Room 6029 Federal Bldg., Phoenix, AZ 85025

April 7, 1972

Col. John C. Lowry
Chief Engineer and General Manager
Flood Control District of
Maricopa County
3325 West Durango Street
Phoenix, Arizona 85009

Dear Col. Lowry:

We have reviewed the data submitted with your letter of March 10, 1972 concerning the caliche pit in Section 18 of the Caterpillar Proving Ground. We find the caliche pit and adjacent rock pit adequate in storage capacity to contain the runoff of a 50-year storm (447 acre-feet). This is assuming the pits are empty at the beginning of the storm and that all the runoff from the 3.5 square mile drainage area is channeled to the pits.

The construction of a diversion dike diagonally along the southeast corner of Section 18 to divert flows northward is still recommended. We feel this will provide additional protection for the less frequent storms and will allow usage of the pits for other purposes than flood storage.

Please advise if we can be of further assistance.

Sincerely yours,



Clifton A. Maguire
Acting State Conservationist

bcc: Chris Williams

USDA-SCS
RMA:ks



Water Balance No 7.

Area = 3.5 sq mi

Top of mountain 11

Top of average Area Elev. 3611

Top of city 1 lev. 1307

Slope = $2364/19,000 = 12.4\%$

$P = \frac{A}{wp} = \frac{100}{150} = 0.67$

Plant cover = Desert Brush

Plant cover = 15%
D

Pratip = 34 m. 3.8"

$TA = 3.8 \times 125 = 3.74"$

1.5 ft of 15' slope (approx. 1000 ft)

EB

1.28 hrs.

$1.28 \times 1100/1100 = 490$

1.5 ft of 15' slope (approx. 1000 ft)

$1.5 = 2.4"$

$490/3.1/2.4 = 4116 \text{ cfs.}$

$$\frac{A}{WP} \quad \frac{WP}{A}$$

12hr

TP

$$Q = 2.1''$$

$$Vol = 2.4 \times 53.3 \times 3.5 = 447.1 \text{ ft}^3$$



Flood Control District
of
Maricopa County
3325 WEST DURANGO STREET
PHOENIX, ARIZONA 85009

March 10, 1972

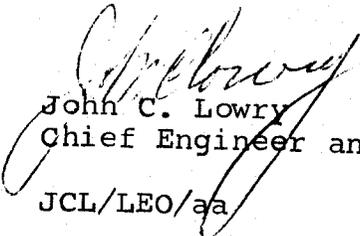
Soil Conservation Service
Room 6029 Federal Building
230 North First Avenue
Phoenix, Arizona 85025

Attention Mr. Ralph Arrington

Gentlemen:

In accordance with a conference between Messrs. Ohsiek and Arrington, there is enclosed a letter, with accompanying data, from Mr. C. R. Brandt, at the Caterpillar Proving Ground.

Sincerely,


John C. Lowry
Chief Engineer and General Manager

JCL/LEO/aa

Enclosure



CATERPILLAR TRACTOR CO.

PEORIA LITCHFIELD PARK, ARIZONA

DATE November 12, 1971

PLANT OR OFFICE ENGINEERING G. O.

DEPT. VT&E Arizona Proving Ground

ATTN. C. R. Brandt.

PLANT OR OFFICE	DEPARTMENT	ATTENTION	
<input type="checkbox"/> DESTROY		FILE UNTIL (DATE)	

Subject: Volume of Caliche Pit in Section 18,
at the Arizona Proving Ground.

We determined the approximate volume of the Caliche Pit in Section 18 to be about 460 acre-feet. We layed the pit off into a 100-ft. grid, read elavations at each location and calculated the volume by using the average end-area method.

The spillway from the rock tank is directed into the caliche pit to prevent the run-off from flowing down to the east boundary dyke and then southward to the S.C.S. flood control pond.

Discussion with the S.C.S. people led us to understand that this flow should be diverted norhtward. Discussion with people who have been here for 25 years and observations of aerial photographs indicate that this flow was never diverted northward and that the natural flow was always S.E.

The present spillway is about 3-feet lower than the dyke along the north side of the rock tank. I did not measure the capacity of the rock tank but estimate it at no more than 50 acre-feet.

The possibility of diverting the flow from the spillway of the caliche pit back to the north exists. This would require a fairly long levee be constructed connecting with the small diversion presently existing near the east boundary in Section 18. See attached map.

Also enclosed is the approximate shape and volume of the caliche pit.

R. A. Hahn
/crr

RHHahn
Vehicle Test & Evaluation
Arizona Proving Ground
attach/jk
Telephone 935-3582



CATERPILLAR TRACTOR CO.

REMANUFACTURED P.O. Box 636
Litchfield Park, Arizona 85340
March 6, 1972

Mr. L. E. Ohsiek
Flood Control District of Maricopa County
3325 West Durango Street
Phoenix, Arizona 85009

Dear Mr. Ohsiek:

As per your phone request of March 3, 1972 I am enclosing the report from R. Hahn to me that contains the data used to determine the 460 acre-ft volume of the caliche pit in the SW corner of Section 18.

Since that time we have run an elevation from the Bench Mark in Section 20 (1214 ft) and determined the spillway elevation in (1337.4 ft, outlet Rock Tank) and out (1307 ft) of the pit plus an expected elevation of around 1288 ft for the dike extension. These elevations, the dike extension, and general location of the pit are shown on the attached topographic map.

In our checking of the elevations we discovered Ray Hahn had assumed the water would flow out of the pit at the point marked 1309 on the map; it will actually leave the pit at the 1307 ft point. Thus his 460 acre-ft volume should be reduced by an estimated 50 acre-ft (25 acres x 2 ft). Thus the present pit volume is approximately 410 acre-ft; we could increase this by raising the present 1307 spillway level to 1309 ft but prefer to leave it as it is. We have a good well defined spillway area at present. If your office feels its needed, the dike extension would provide adequate diversion should the pit overflow.

If you need more information or wish to see the site again, please call.

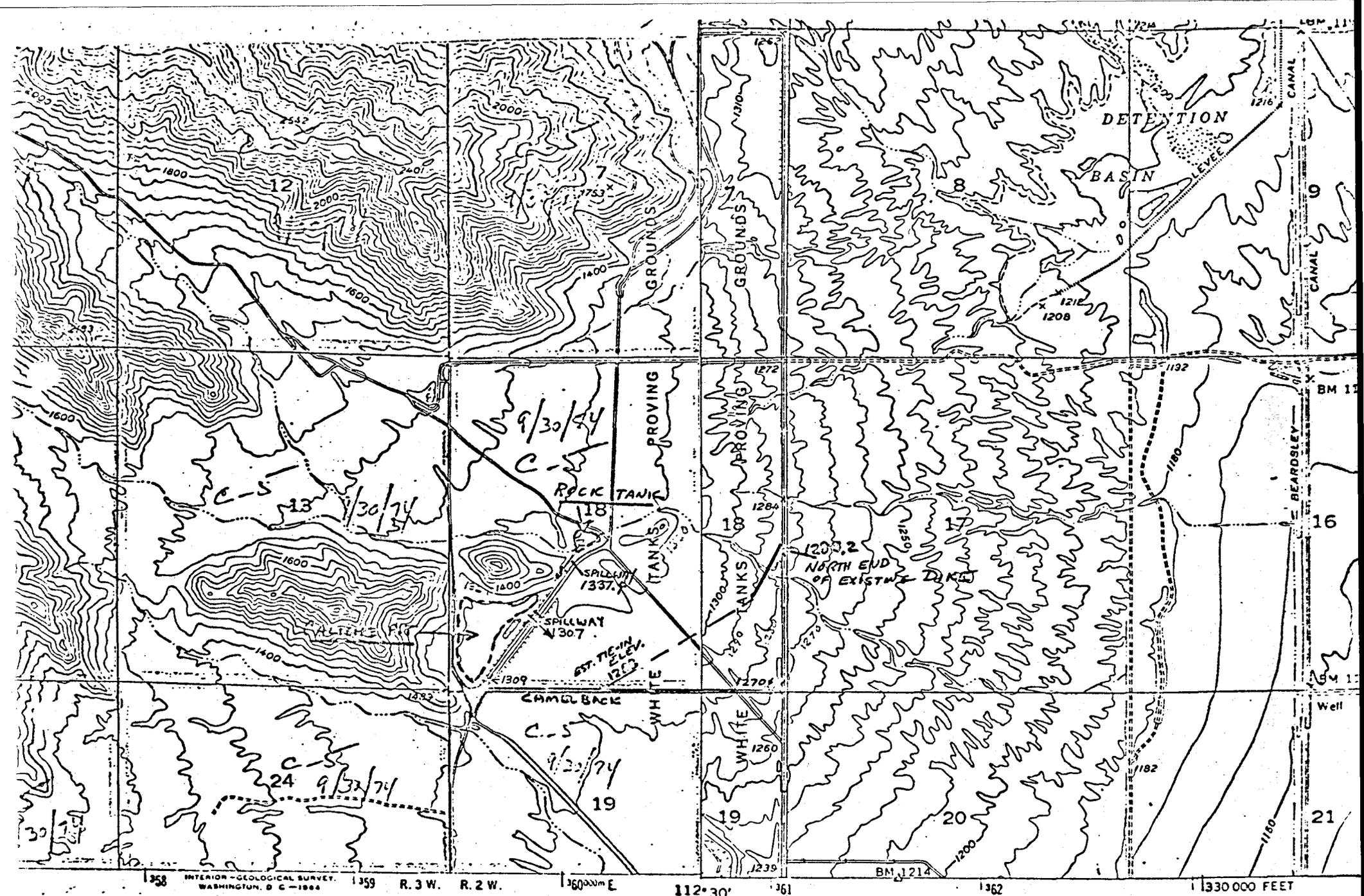
Sincerely,

CATERPILLAR TRACTOR CO.


Manager

CRBrandt
Arizona Proving Ground
attach/jk
Telephone 935-3582





1358 INTERIOR GEOLOGICAL SURVEY 1359 R. 3 W. R. 2 W. 1360 0000 E 112° 30' 1361 1362 1330000 FEET

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods and by planetable surveys 1957. Aerial photographs taken 1954

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system,

ROAD CLASSIFICATION

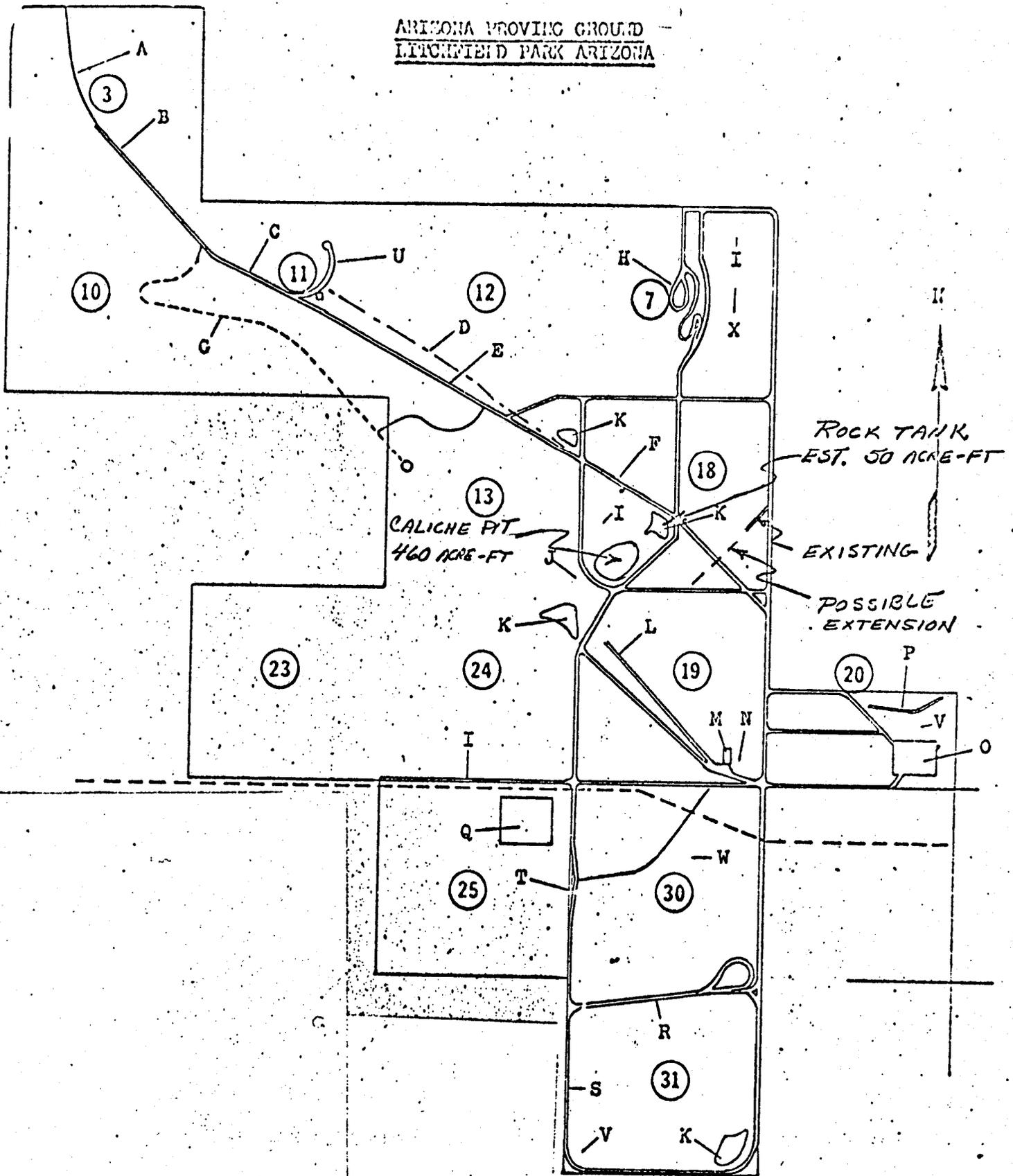
Light-duty

Unimproved dirt

ARIZONA

0° 49' 14" N

ARIZONA PROVING GROUND
MITCHELL PARK ARIZONA



ROCK TANK
EST. 50 ACRE-FT

CALICHE PIT
460 ACRE-FT

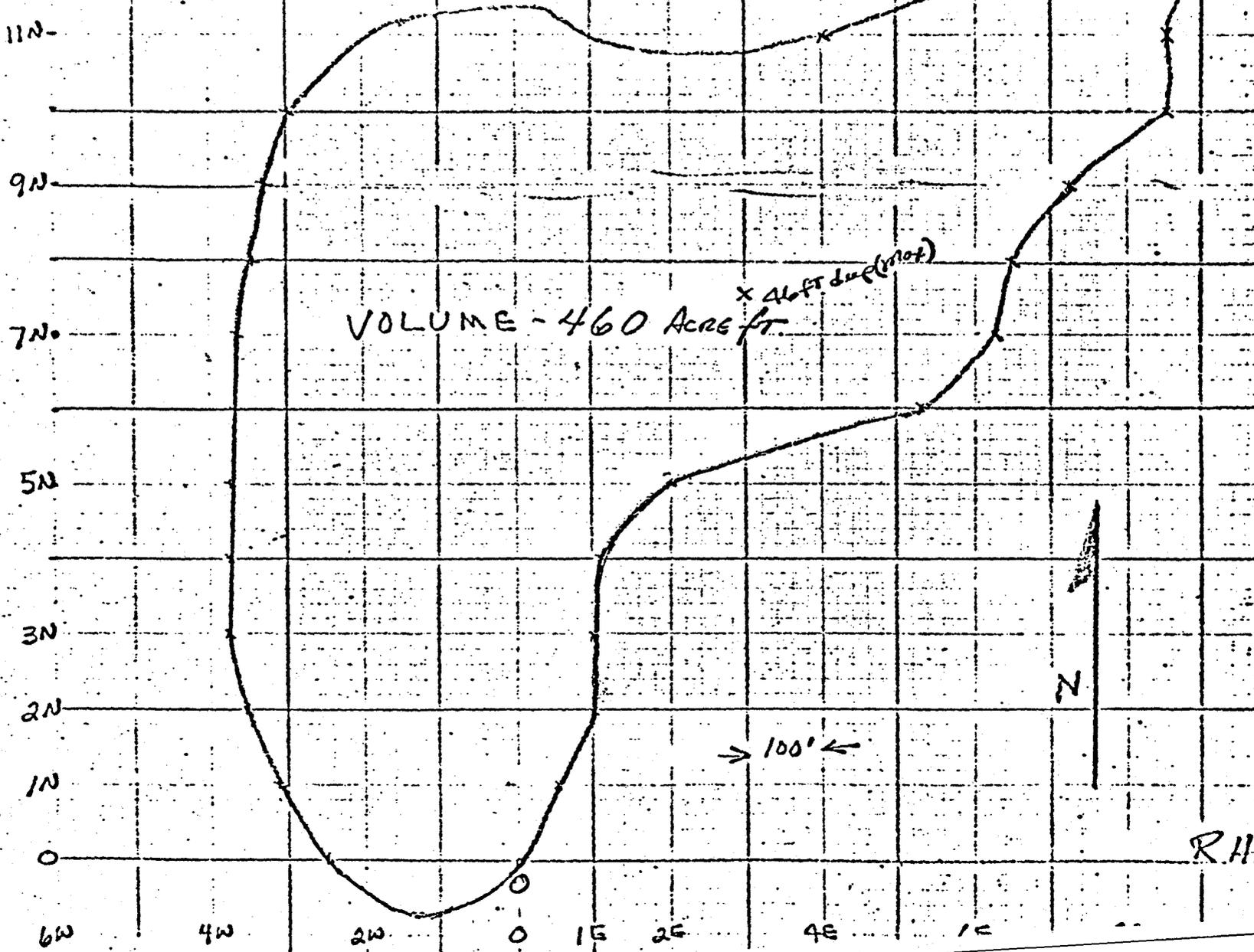
EXISTING

POSSIBLE
EXTENSION

==== Gravel Roads
—— Other Roads

SHEET NO. OF
JOB NO.
SUBJECT
CHKO. BY DATE

13N. APPROXIMATE SHAPE OF CALICHE PIT
IN SECTION 18 ARIZONA PROVING
GROUND 10-8-71



SECTION	END AREA	AVERAGE	VOLUME
		1060	106,000
0N	2120	4315	431,500
1N	6510	7,950	795,000
2N	9400	10,465	1,046,500
3N	11,530	13,320	1,332,000
4N	15,110	16,695	1,669,500
5N	18,280	21,910	2,191,000
6N	25,540	27,355	2,735,500
7N	29,170	29,175	2,917,500 ft ³
8N	29,180	28,590	2,859,000
9N	28,000	23,915	2,391,500
10N	19,830	12,485	1,248,500
11N	5140	3,480	348,000
12N	1820	910	91,000

TOTAL VOLUME
29,162,500 cu ft

43,560 cu ft/Ac

= 463 Acres

White Tanks -

Mills - ~~Balide~~ 463 Ac Ft ^{1' minimum spill}
Pond 50 Ac Ft - See 18 ^{3' level of road}
Pond to Right
off road -
outlet

Deep Dike
extend ~~road~~ ^{SW} to
Carnelback
to fore well to North

11-23
RA
November 23, 1971

MEMO TO FILES - WHITE TANKS PROJECT

Phone call from Larry Jones, Caterpillar Tractor Representative,
Peoria, Illinois 309-675-4175

Mr. Jones advised that he had received a letter from Phoenix Manager
Chuck Brandt stating that the capacity of the caliche pit was 460
acre-feet and the pond in the center of Section 18 would hold 50
acre-feet.

He wanted to talk about possible use of pit to store water for
proving ground use. I encouraged him to do so, but pointed out that
any pond capacity used for storage of water must be deducted from
that storage available for flood protection.

It was agreed that he would suggest to Mr. Brandt that he continue to
negotiate with the Flood Control District who would, if they chose
to do so, confer with SCS.

Ohsiek advised.

JJT:ks

JWA
November 17, 1971

MEMO TO THE FILES:

Bill,

Lee Ohsiek called about information from Bryant of
Caterpillar.

He says the Caliche pit hold 463 acre-feet.

The pond in Sec. 18 to right of road spilling into caliche pit
holds 50 acre-feet.

He indicates that the diagonal dike along the mid section line
needs to be extended SW to Camelback Road to divert flows to
the north into #3 St. Caterpillar can perform this work.

.. Ralph

Ralph

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE Room 6029 Federal Bldg., Phoenix, AZ 85025

ECT: WS - White Tanks Pilot Project

DATE: October 22, 1971

TO: M. E. Strong
State Conservationist

On Tuesday, October 19 I accompanied Mr. Lee Ohsiek, Flood Control Engineer for the Maricopa County Flood Control District; Mr. Charles Brandt, Manager; and Mr. McDonald of the Caterpillar Proving Grounds; on a tour of the surface drainage on their grounds.

It was agreed that I would record my understandings of what transpired on the trip and send copies to Mr. Ohsiek who would feel free to supplement or amend the report according to his understandings.

Inspection verified the drainage pattern of the September 5, 1970 storm as shown on the map that accompanied Mr. Turner's report to SCS State Conservationist M. E. Strong dated November 20, 1970 except as follows:

1. Drainage from the wash in Section 13 was not diverted southward into Section 24 as shown, but continued to flow to the east into the small pond in the center of Section 18.
2. After entering the pond in Section 18, some of the water spilled to the south and entered Structure #4. The roadway forming the east embankment of the pond was breached and some water continued eastward to the east line of Section 18; thence, northward toward Structure #3.

Since the September, 1970 storm, the pond in Section 18 has been modified so that now there is a spillway from the pond that diverts water into a man-made caliche pit in the southwest 1/4 of Section 18.

Mr. Brandt indicated that as time permits he will have his engineers make a topographic map of the caliche pit to determine its capacity.

It will be helpful if the topographic maps will include the pond and its embankments as well as the area for several hundred feet north of the pond. This is suggested because if the spillway will not pass the design storm or the caliche pit will not contain the design storm, consideration should be given to modifying the pond to insure that any excess water be directed northward toward Structure #3 and insure against any water overflowing into Structure #4.



M. E. Strong, October 22, 1971

- 2 -

There was some discussion regarding replacement of the existing road spillway at the SE corner of Section 31 with pipe to reduce the peak of the flows entering Structure #4. This appeared questionable because the major portion of the drainage area above Structure #4 passes this point.

An extra copy of this report is being sent to the Maricopa County Flood Control District, for transmittal to Mr. Brandt.


J. J. Turner
State Conservation Engineer

cc: C. Williams
Lee Ohsiek, MCFCD (2)

USDA-SCS
JJT:ks



ARIZONA HIGHWAY DEPARTMENT
BRIDGE DIVISION

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

LOCATION DATA:

Highway WHITE TANK #4 County MARKOPA
 Location SEC 11, N 1/2 13 & parts of Sec. 7, 3, 10-12-14+18 @ Center
 Project No. _____ Station SEC. 18
 Name of Stream _____

DESIGN DATA:

2.5 Design Frequency 7.5 years *ok*
 3.5 Drainage Area 3.5 square miles *ok*
 1.0-1.5 Drainage Length 1900 feet *ok*
 Elevation
 3.0-1 Top of Drainage Area 3,671 feet
 1307 At Structure 1,370 feet $\frac{2,300'}{1,900} =$ *ok*
 12.4 Drainage Area Slope 12% $(\frac{1.2}{100})$
 Drainage Width 9000 feet *ok*
 Width factor W_f 0.89
 Vegetative Cover Type Desert Brush *ok*
 Vegetative Cover Density 15% *ok*
 Soil Group 7 *ok*
 Precipitation
 P = 6 hour = 3.0 inches
 P = 24 hour = 3.3 inches

DESIGN COMPUTATION:

Precipitation P = 1 hour = 2.2 inches
 Curve Number 91.5
 Runoff Q = 1.7 inches $1.7 \times 53.2 \times 3.5 = 310$
 Time of Concentration T_c 0.8 hours *acrf*
 Time of Peak $T_p = (T_c)(W_f)$ 0.72 hours
 Peak Discharge $Q_p = \frac{484 A Q}{T_p}$ $\frac{484 \times 3.5 \times 1.7}{.72}$

$C_1 = 100$
 $Q = (P - .25)^2$
 $(P = .85)$

Computed by [Signature] Date Oct. 71

REPORT ON WHITE TANKS STRUCTURES NOS. 3 AND 4

Introduction. By letter of January 28, 1971, from the Assistant District Engineer, the Maricopa County Municipal Water District proposed to transfer to the Flood Control District, at no cost, all lands it controls for White Tanks Structures Nos. 3 and 4. When the matter was presented to the Citizens Advisory Board for recommendation, they requested that a study be made of the desirability of having tests performed and a stability analysis prepared, probably by a consultant, before further action be considered.

Inasmuch as these were known to be Soil Conservation Service structures, the matter was discussed with the SCS staff to determine what information they could furnish. They stated that construction information was undoubtedly available and on December 2, 1971, they furnished a copy of the specifications, together with laboratory analyses of the soils used, under which the dams were constructed. These data have been studied and the following report is furnished.

Name. The structures are designated "White Tanks Project retarding structure No. 3 and No. 4" in the agreement between SCS and the Agua Fria SCD November 30, 1953. The contract specifications describe them as "White Tanks Structures Numbers 3 and 4".

CONSTRUCTION

Period. The invitation for bids was issued January 14, 1954; bids were opened February 8, 1954; work was to start within 20 days and be completed within 210 days after receipt of notice to proceed. The dams were completed in 1954.

Scope of Work.

Structure No. 3: 7667' long, 30' high, 10' crest, 375,000 cu. yds. embankment, 3 outlet structures.

Structure No. 4: 6839' long, 20' high, 10' crest, 175,000 cu. yds. embankment, 2 outlet structures.

Quality of Materials. Extensive laboratory testing was performed on materials from specified areas proposed for use, and only materials conforming to the requirements of the specifications were approved. A number of the reports of soils analyses (dated September and October 1952) were furnished. They included data on maximum density, composition, slope design, tests of facing material against erosion, and optimum moisture content. The curves showed generally that the optimum moisture content for maximum density was about 12%; that percentage was later used in the specifications. The embankments consisted of a central core and a blanket of granular facing material, all compacted to specification.

Borrow Areas. Borrow areas were specified, and clearing and stripping of these areas were required before borrow materials could be removed.

Outlet Structures. These were installed by the Maricopa County Municipal Water Conservation District No. 1. Anti-seep rings were installed around the outlet structures.

Subgrade Preparation. The subgrade was ripped for bonding, sprinkled and compacted in the same manner as the embankment.

Construction Method. Embankment materials, both core and facing, were compacted in layers not greater than 6", for the full width of the embankment. Material was required to have a water content, by sprinkling or moistening of approximately 12% prior to compaction. All embankment materials were required to be compacted to 95% of Standard Proctor Density as determined by laboratory tests.

Performance of Work. Laboratory tests and field inspection reports of the work performed during construction cannot be located after a lapse of 18 years since work was performed. However, Mr. J. J. Turner, now State Construction Engineer for SCS, supervised this project and states he will, if required, give personal certification that all work was performed in accordance with the specifications. The State Conservationist confirms that a soils laboratory was set up on the job and frequent tests were taken to confirm compliance with the specifications, and that no controversies arose during construction concerning adequate compaction of earth fill embankments.

HISTORY

The soundness and stability of the dams may also be measured by their condition 18 years after construction. By visual inspection, both dams are in good condition, with no cracks or slides or apparent subsidence. The largest storm in the area within recent years occurred in September 1970. Because of alterations in watershed limits, the inflow into Structure No. 4 exceeded its designed capacity and water exited in the designed emergency spillway on the west, and also around the east side of the dam. However, this greater-than-design inflow caused no visible damage to the structure.

Maintenance Obligation. I have examined the files for documents spelling out the obligation of the FCD to maintain these structures, and note the following:

a. In resolution adopted January 14, 1954, the County of Maricopa assumed the obligation of maintenance and operation of the Trilby Wash (Mc Micken Dam), flood control structure. There has been no subsequent formal transfer of this responsibility to the FCD and it may be advisable to obtain a legal opinion whether it is desirable that this be done. There was no mention in this resolution of White Tanks Structures Nos. 3 and 4.

b. (1) By agreement, dated November 30, 1953, between the Agua Fria Soil Conservation District and the Soil Conservation Service, the Agua Fria SCD agreed to maintain and operate White Tanks Structures Nos. 3 and 4.

(2) By Cooperative Agreement, dated December 3, 1953, Maricopa County Municipal Water Conservation District Number One agreed to accept the obligation of operation and maintenance of the structures.

(3) By agreement, dated November 28, 1966, between the Flood Control District of Maricopa County and Maricopa County Municipal Water Conservation District No. 1, it was stated that the FCD "has the responsibility of operating and maintaining certain flood control works, consisting in the main of McMicken Dam and outlet channel, SCS Dams No. 3 and No. 4 and interconnecting dikes and channels", etc. I am not sure that this constitutes a legal transfer of responsibility, and again it may be advisable to obtain a legal opinion whether it is desirable that a more formal transfer or acceptance be made.

Conclusions. It is concluded that White Tanks Structures Nos. 3 and 4 were constructed in accordance with standard flood control construction practices by Soil Conservation Service Contract; that suitable laboratory analyses were made of proposed borrow materials; that the design was based on obtaining embankments compacted to densities which are currently used by SCS; and that the supervisor of construction and the State Conservationist state that Standard SCS construction inspection and laboratory investigations of the work were made during construction.

L. E. Ohsiek

. OHSIEK

LEO/aa

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE River Basin-Watershed Planning Staff

xxxxxxx Suite 326, Arizona Title Bldg., 111 West Monroe St.
Phoenix, Arizona 85003

WS - PL 566 - White Tanks Dam No. 4

DATE: December 14, 1970

J. J. Turner

WHITE TANKS FLOOD REPORT

1. In the summer of 1954 two flood control structures, identified as White Tanks No. 3 and No. 4, were built by the Soil Conservation Service in cooperation with the County of Maricopa and the Municipal Water Conservation District No. 1.
2. The project was known as the White Tanks Erosion Control Project and SCS participation was under the Pilot Watershed Program.
3. It is reported that 4.5" of precipitation were recorded in a gauge near the intersection of Jack Rabbit Road (195th Avenue) and West Indian School Road. According to the Salt Lake City R.F.C. map, dated October 20, 1970, the total area was in the 4" rainfall area. The 100-year, 24-hour storm for this area is 4.0 inches.
4. The rain is reported to have started about midafternoon on Saturday, September 5, 1970. The maximum intensity is believed to have occurred between 6:00 and 8:00 p.m. It was reported that water started flowing across Jack Rabbit Road in the vicinity of Thomas Road about 7:00 p.m. and ceased to flow across the road about 9:00 p.m.
5. The elevation of the high point of the watershed is 3671'. The spillways of Structure No. 4 are at elevation 1050' with the top of the structure at 1056'. The elevation at the rain gauge is approximately 1165'.
6. Structure No. 4 was designed to impound 1036 acre-feet from a drainage area of 10.3 square miles.
7. Since 1954 developments north and west of Indian School Road and Tuthill road have caused four square miles of watershed originally designed to flow into Structure No. 3 and an additional 1.8 square miles of watershed to flow into Structure No. 4 along Tuthill Road. Additional land developments between Jack Rabbit Road and Tuthill Road plus improvements of Jack Rabbit Road divert still another 2.7 square miles of watershed into the east end of Structure No. 4 along Jack Rabbit Road.



been diverted into the watershed of Structure No. 4. These four square miles are located in the area where the rainfall was 4 inches or more and where the storm was quite intense.

14. Based on current SCS criteria for a Class C Structure this storm was equal to the design storm for the principal spillway hydrograph. Because of the extra drainage area there was some flow through the emergency spillways.
15. Based on a Class C Structure Classification and a drainage area of 10.3 square miles an emergency spillway hydrograph was routed through the existing Structure No. 4. This routing showed that the earth spillways would have a discharge of 8300 cfs. with the water surface at elevation 1054.2 and a velocity of 7.0 ft/sec in the west spillway and 7.6 ft/sec in the north spillway.
16. A Freeboard Hydrograph based on 10.3 square miles was routed through the existing Structure #4 and it was found to overtop the existing structure while the inflow was still increasing. If it is desired to keep the same size spillway in width at the present location it will be necessary to raise the dam approximately 5 feet to handle the freeboard storm. The existing structure has a maximum storage capacity of 2,000 acre feet, while to handle the freeboard storm it would be necessary to store around 3,200 acre feet, when the spillways are flowing 29,000 cfs.
17. Since the original drainage area cannot be handled by the existing Structure No. 4, it is recommended that consideration be given to correct the overloading of Structure No. 4 by combinations of the following alternatives:
- A. Redesign the roadway fills and channels in Sections 18 and 13 so as to permit the four square mile area in parts of Sections 2, 3, 10, 11, 12, 13 and 14 so the area will drain into structure No. 3 as originally planned. (See map attached.)
 - B. Construct one or more small retarding structure north of Indian School Road to control runoff from all or parts of Sections 13, 14, 17, 18, 19 and 20. (Structure No. 4 was not designed to receive runoff from this area but since 1954 the runoff has been directed into Structure No. 4).
 - C. Enlarge Structure No. 4 to enable it to safely handle runoff from the original drainage area plus the drainage from Section 29 and 32 that was not originally planned to be handled by Structure No. 4.

Top 1056.0
ES 1058.0

been diverted into the watershed of Structure No. 4. These four square miles are located in the area where the rainfall was 4 inches or more and where the storm was quite intense.

14. Based on current SCS criteria for a Class C Structure this storm was equal to the design storm for the principal spillway hydrograph. Because of the extra drainage area there was some flow through the emergency spillways.
15. Based on a Class C Structure Classification and a drainage area of 10.3 square miles an emergency spillway hydrograph was routed through the existing Structure No. 4. This routing showed that the north spillways would have a discharge of 8300 cfs. with the water surface at elevation 1054.2 and a velocity of 7.0 ft/sec in the west spillway and 7.6 ft/sec in the north spillway.
16. A Freeboard Hydrograph based on 10.3 square miles was routed through the existing Structure #4 and it was found to overtop the existing structure while the inflow was still increasing. If it is desired to keep the same size spillway in width at the present location it will be necessary to raise the dam approximately 5 feet to handle the freeboard storm. The existing structure has a maximum storage capacity of 2,000 acre feet, while to handle the freeboard storm it would be necessary to store around 3,200 acre feet, when the spillways are flowing 29,000 cfs.
17. Since the original drainage area cannot be handled by the existing Structure No. 4, it is recommended that consideration be given to correct the overloading of Structure No. 4 by combinations of the following alternatives:
 - A. Redesign the roadway fills and channels in Sections 18 and 13 so as to permit the four square mile area in parts of Sections 2, 3, 10, 11, 12, 13 and 14 so the area will drain into structure No. 3 as originally planned. (See map attached.)
 - B. Construct one or more small retarding structure north of Indian School Road to control runoff from all or parts of Sections 13, 14, 17, 18, 19 and 20. (Structure No. 4 was not designed to receive runoff from this area but since 1934 the runoff has been directed into Structure No. 4).
 - C. Enlarge Structure No. 4 to enable it to safely handle runoff from the original drainage area plus the drainage from Section 29 and 32 that was not originally planned to be handled by Structure No. 4.

This enlargement can be done by widening the existing spillway so the dam will not be overtopped or by raising the dam to prevent the overtopping or a combination of the two.

- (1) The existing spillways will discharge 12,000 cfs. with a velocity of approximately 8.5 fps. If the existing spillway is retained and the problem is corrected by raising the dam it may be necessary to protect the spillways from erosion by lining with concrete or some other type of protection.
- D. If it is desired to control the entire 18.9 sq. mi. drainage area with Structure #4 and the spillways are kept at their present location and elevation, it will be necessary to raise the top of the dam to elevation 1063. At this elevation the storage will be approximately 4,000 ac. ft. with the spillways discharging 55,000 cfs. The above numbers reflect the routing of a Class "C" freeboard storm through the structure.
- The Emergency Hydrograph routed through the structure for the 18.9 sq. mi. drainage shows the spillways would need to handle 16,000 cfs with the upstream water surface at elevation 1056.0. The velocity in the west spillway would be 9.1 fps and the velocity in the north spillway would be 9.7 fps.
- E. If it is not feasible to increase the size of the existing Structure No. 4, additional flood control structures should be built upstream from Structure No. 4. One possible location would be in the S.E. corner of Section No. 23. Another possible location would be in Section No. 25.
- F. The existing principal spillway pipes are not being used as designed. The downstream outlet channels for these pipes have never been constructed.

Conclusions:

It is apparent that structure No. 4 as it exists today is not a safe structure according to our criteria for a Class "C" Structure. Since the original 10.3 square mile drainage area cannot be safely handled by the structure, the extra drainage area diverted into the structure can be controlled before it gets to Structure No. 4 or the structure can be enlarged to handle it.

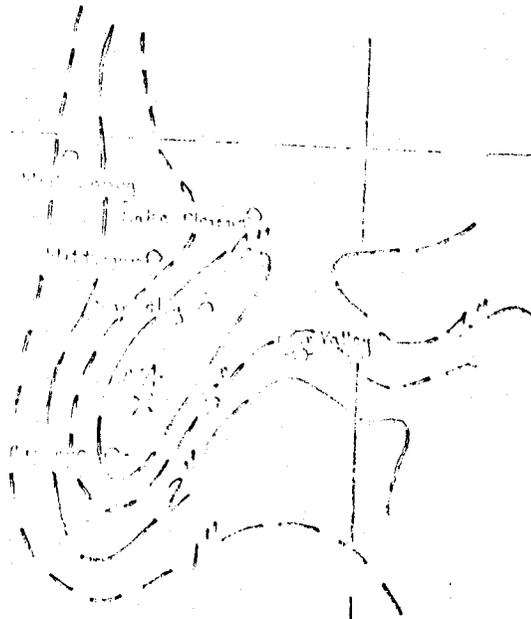
James M. Malone
Hydraulic Engineer

Robert M. Bartels
Engineering Specialist

Attachments

cc: R. E. Rallison - Portland
G. Watt
C. Maguire

JMM/RMB:mh

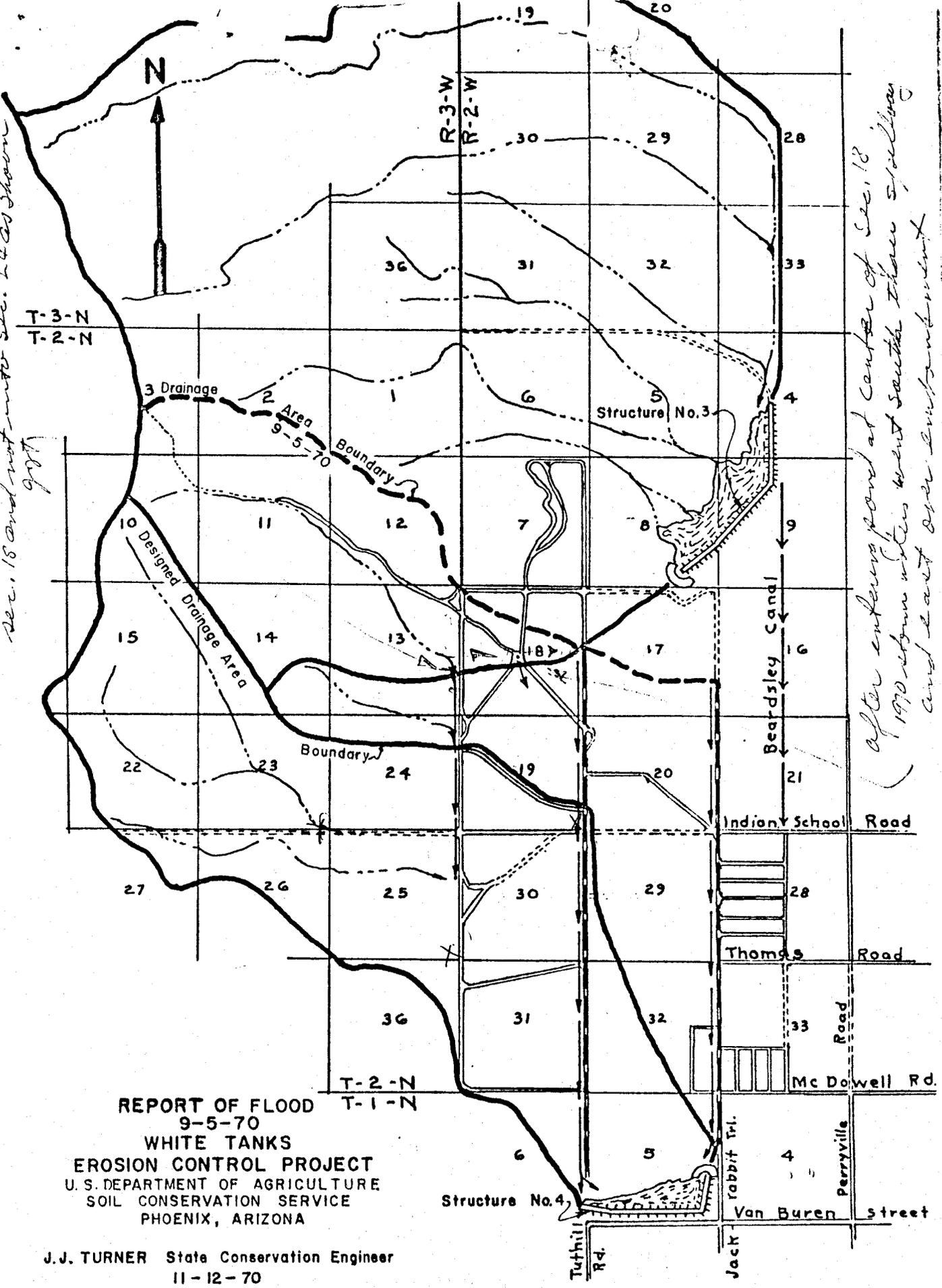


Preliminary Storm Total
Sept. 5th, 1970
Salt Lake City B.C.C.
10/20/70

Traced 12/10/70
R.M. Bartels

500 5, 170 D Storm went east into Sec. 18 and not into Sec. 24 as shown 9/27

(after entrance pond at center of Sec. 18 1970 storm water went south then S.W. and east over embankment)



REPORT OF FLOOD
 9-5-70
WHITE TANKS
EROSION CONTROL PROJECT
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 PHOENIX, ARIZONA

J.J. TURNER State Conservation Engineer
 11-12-70

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Room 6029 Federal Building, Phoenix, Arizona 85025

SUBJECT: WS - Engineering - Powerline Channel,
White Tanks Project

DATE: October 12,
1971

TO:

Marion E. Strong
State Conservationist

On October 12 I discussed the powerline channel situation briefly with Mr. Lee Ohsiek, Flood Control Engineer with the Maricopa County Flood Control District.

Mr. Ohsiek advised that they have graded the access roads paralleling the concrete lined channel to improve surface drainage and prevent surface runoff from overflowing the channel banks.

Mr. Ohsiek also advised that he would request us to accompany him on a field inspection of the channel damage as soon as the water has ceased to run in the channels.

We agreed to meet Mr. Brand of the Caterpillar Proving Grounds for an on-site review on October 19 of the changes in drainage patterns that have occurred on the watershed of the White Tanks Pilot Watershed Project.

J. J. Turner
State Conservation Engineer

cc: J. Hickerson
WFP
Design Section
P. Tilker

JJT:ks



UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

6029 Federal Bldg., 230 N. 1st Ave., Phoenix, Arizona 85025

SUBJECT: Watershed - White Tanks Wash

DATE: July 20, 1971

TO: Gerald B. Welsh
Asst. State Conservationist-RB/WS

As follow up to your request as to the disposition of the O&M agreement and notification of sponsors and the Caterpillar people concerning the contributing watershed to Str # 4 the following is submitted:

1. O&M agreement dated 28 November 1966 for White Tank Str # 3 and 4.
2. Copy of Turner's letter indicating discussion with Caterpillar Manager, L. A. Jones, of their main office on the flood report and the watershed boundary conditions - with notice that they should work through Col. Lowry.
3. I talked with Leo Ohsiek, MCFCO. He will call the local Caterpillar office and discuss the watershed boundary problem with them again, and see what action, if any, they might have taken. He will advise later.

Ralph M. Arrington
Asst. State Conservation Engineer

Attachment

RMA:mp

EMA
copy checked
W. J. Williams
Phoenix
8/13/71

On 8/10/71 Leo Ohsiek
and Turner agreed to
meet with Caterpillar
people on the site as
soon as possible after
Sep. 10. GBT



UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Arizona State Office, 6029 Federal Building, Phoenix, Arizona 85025

SUBJECT: ENG - White Tanks Watershed Project -
Caterpillar Proving Ground

DATE April 14, 1971

TO: M. E. Strong, State Conservationist
SCS, Phoenix, Arizona

On the morning of April 13, 1971 SCS District Conservationist Chris Williams and I conferred with Mr. L. A. Jones, Civil Engineer, Caterpillar Tractor Company, Peoria, Illinois, relative to a plan of conservation operations on their 13-1/2 square mile tract of land which is their testing facility west of Litchfield Park.

In the course of the discussion a copy of my report of the September 5, 1970 flood, dated November 12, 1970, was handed to Mr. Jones.

As a result of the discussions it was understood that the company would request formal assistance from SCS through the Agua Fria-New River Soil Conservation District and that any long-range plan must of necessity include provision for handling surface waters.

Mr. Jones understands that flood control aspects must be planned with the Flood Control District of Maricopa County and we gave him Col. Lowry's name and address.

They are hopeful that the ultimate plan can include development of surface water that may be put to beneficial use in connection with their testing operations. We agreed that there were possibilities for this and explained the procedure for acquiring rights to store surface water for beneficial use in Arizona.

It is anticipated that at some future date Mr. Jones will return to make a more thorough study of the matter and arrange for on-site discussions with local agencies.

J. J. Turner
State Conservation Engineer

cc Chris P. Williams, DC, Phoenix, Arizona
Col. John C. Lowry, Gen. Mgr. and Chief Engr.
Flood Control District of Maricopa County
3325 W. Durango St., Phoenix, Arizona 85009

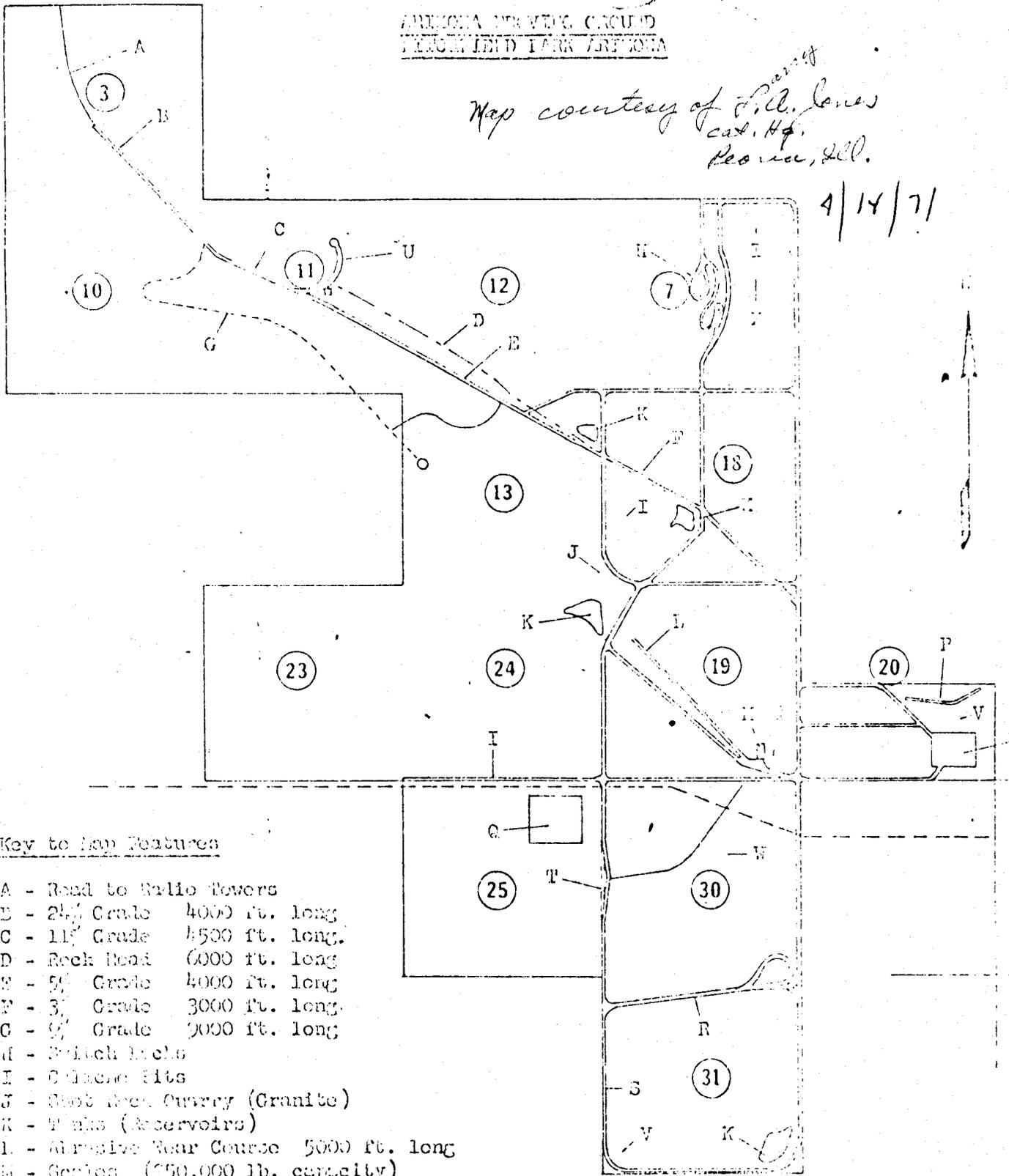
JJT:csw



ARIZONA POWER AND LIGHT COMPANY
TECHNICAL DRAWING
ARIZONA

Map courtesy of Bill Jones
 cat. Hq.
 Peoria, Ill.

4/14/71



Key to Map Features

- A - Road to Radio Towers
- B - 24% Grade 4000 ft. long
- C - 11% Grade 4500 ft. long
- D - Rock Road 6000 ft. long
- E - 5% Grade 4000 ft. long
- F - 3% Grade 3000 ft. long
- G - 9% Grade 9000 ft. long
- H - Switch Boxes
- I - Concrete Pits
- J - Spent Area Quarry (Granite)
- K - Tanks (Reservoirs)
- L - Abrasive Wear Course 5000 ft. long
- M - Series (150,000 lb. capacity)
- N - Wire Cutting Course
- O - Shop and Office Area
- P - M.G. (M.C.) Wire Following Road (2000 ft. long)
- Q - Sales Demonstration Area 1967
- R - Level Mile
- S - Tire Tread Course
- T - 14% and 20% Grade 1000 ft. long
- U - Safety Escape Ramp
- V - East Area Soils
- W - Sand Deposit
- X - Scanner Loading Area (Sandy Loan)

==== Grand Roads
 --- Other Roads

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

~~WASHINGTON, D.C. 20250~~ Arizona State Office, Phoenix, Arizona

file
JJT

SUBJECT: WATERSHEDS - White Tanks - Report of Flood on
September 5, 1970

DATE: December 29, 1970

TO: Kenneth E. Grant, Administrator
SCS, Washington, D. C.

Attached for your information is a report of a recent flood involving the White Tanks Watershed.

The structure functioned beautifully in spite of the additional drainage that has been diverted into it subsequent to its construction.

The sponsoring agency has taken official notice of the added drainage area and we are providing them with up-to-date hydrology, flood routing, and current SCS criteria for Class "C" structures.



Acting

M. E. Strong
State Conservationist

Attachment

JJT:csw



UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Arizona State Office, Phoenix, Arizona

SUBJECT:

ENG - Trip Report - White Tanks Project

DATE: December 17, 1969

TO:

M. D. Burdick, State Conservationist
SCS, Phoenix, Arizona

- On December 12, 1969 I accompanied District Conservationist Arnold Nowotny and Inspector General Auditors Nils Dahlstrand and Duane Maddox on a tour of the White Tanks Pilot Watershed Project.

The following deficiencies were noted that should be corrected:

1. The principal spillway gate valve at the west end of structure #4 is partially covered with rocks and dirt. The same is true of the outlet gate at the southeast corner of the structure.
2. A trash dump situation in the reservoir at the north end of the structure should be eradicated. It is unsightly, unsanitary, could cause principal spillway stoppages and causes one to wonder if the people benefitting really appreciate the project.
3. The valve stem is bent on the south principal spillway gate of structure #3 and is inoperative. The current position of the gate is about 15% open.
4. The center and north gates of structure #3 are relatively clean.
5. All gates should be cleaned up, tested for proper opening and closing, and repaired or serviced as needed.

Upon returning to Phoenix I made courtesy calls to Mr. Lee Ohsiek, Assistant Chief Engineer of the Flood Control District of Maricopa County, and Dick Yancy, engineer for the Beardsley Project. I learned from them that the Flood Control District inspected the project twice a year, that the county had a maintenance agreement with the Beardsley Project, that both were aware of the need for maintenance and a part of the items noted in their last inspection had been taken care of. Dick Yancy further agreed to try to perform the outlet gate maintenance before the end of January 1970.

J. J. Turner
State Conservation Engineer

cc Geo. Stone, Asst. State Conservationist- Watersheds
Arnold Nowotny, DC, Phoenix

JJT:cw



Engineering & Watershed Planning Unit, ETSC, Portland, Oregon

EMC - Hydrology - PMP for Buckeye and White Tanks Project, Arizona

December 16, 1970

C. J. Francis, Director, Engineering Division
SCS, Washington, D. C.

We have received a request from the Arizona state conservationist to provide estimates of probable maximum precipitation for use in designing emergency spillways for two project areas west of Phoenix. All structures on both projects are class (c) from a hazard standpoint (location maps are attached).

The White Tanks project was constructed as a pilot project during the mid-fifties and has much smaller spillway capacities than present day criteria require. One structure in this project had substantial flow through the emergency spillway this past September and at present the safety of this structure and others in the system are being evaluated.

The Buckeye project is approaching the final design stage. The work plan was prepared some years ago using criteria that are substantially lower than present day criteria. The structures will be designed using the most current values of PMP. Because of recent refinements in estimating PMP, we wondered if an updated estimate might be significantly different than values published in Weather Bureau Technical Paper 38-A which have generally proven to be on the high side. Although the White Tank mountains are not a major barrier, they still effect considerable influence on precipitation frequency and amount. Please note that the White Tank project is adjacent to the Buckeye project, but on the opposite side of the mountains.

We are hopeful that the special studies branch of the Weather Bureau can provide us with an updated estimate of PMP or an indication of little expected change within a comparatively short period of time. We understand that many of the relationships developed in making the revised TP-40 maps are applicable to the methods used for estimating PMP so less time is required where this study has been completed.

Arizona would like an indication of whether this area merits further study by January 15 and if it does, we would like an estimate of PMP for 6 and 24 hours together with areal correction factors for areas ranging from 10 to 75 square miles by February 1.

Please advise what you can do in this matter.

E. J. Gore
Head, ESWF Unit

Attachments

cc:
K. M. Kent, Washington, D. C.
George Watt, Phoenix
J. J. Turner, Phoenix
James Malone, Phoenix

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Arizona State Office, Phoenix, Arizona

SUBJECT: WATERSHEDS - White Tanks Project -

DATE: November 12, 1970

Report on Flood of September 5, 1970

10 M. E. Strong, State Conservationist
SCS, Phoenix, Arizona

*Copy handed to
Mr. L. A. Jones
Civil Engineering
Phoenix, AZ.*

1. In the summer of 1954 two flood control structures, identified as White Tanks No. 3 and No. 4, were built by the Soil Conservation Service in cooperation with the County of Maricopa, the Municipal Water Conservation District No. 1, and the Agua Fria-New River Soil Conservation District.
2. The project was known as the White Tanks Erosion Control Project and SCS participation was under the Pilot Watershed Program.
3. It is reported that 4.5" of precipitation were recorded in a gauge near the intersection of Jackrabbit Road (195th Avenue) and West Indian School Road. (See attached map.) This is believed to have been near the center of maximum rainfall with somewhat lesser intensity near the summit of the White Tanks Mountains about five miles to the west.
4. The rain is reported to have started about midafternoon on Saturday, September 5, 1970. The maximum intensity is believed to have occurred between 6:00 and 8:00 p.m. It was reported that water started flowing across Jackrabbit Road in the vicinity of Thomas Road about 7:00 p.m. and ceased to flow across the road about 9:00 p.m.
5. The elevation of the high point of the watershed is 3671'. The spillways of Structure No. 4 are at elevation 1050' with the top of the structure at 1056'. The elevation of the rain gauge is approximately 1165'.
6. Structure No. 4 was designed to impound 1036 acre-feet from a drainage area of 10.3 square miles.
7. Since 1954 developments north of Indian School Road and west of Tuthill Road have caused four square miles of watershed originally designed to flow into Structure No. 3, and an additional 1.8 square miles of watershed to flow into Structure No. 4 along Tuthill Road. Additional land developments between Jackrabbit Road and Tuthill Road plus improvement of Jackrabbit Road divert still another 2.7 square miles of watershed into the north end of Structure No. 4 along Jackrabbit Road.



8. Thus at the time of the storm there was a total of 18.8 square miles of watershed contributing to Structure No. 4. This is 8.5 square miles more than the 10.3 square miles for which the structure was designed.

9. It should be noted that chronic deposition of coarse sands in the borrow channel on the west side of Jackrabbit Road limits the flow of water diverted into Structure No. 4. Excess flood waters flowing south along Jackrabbit Road overflowed the pavement in the vicinity of Thomas and McDowell Roads causing damage to an unknown number of homes in the subdivisions east of Jackrabbit Road.

10. High water marks indicate that the Structure No. 4 filled and the 165' wide Tuthill Road (west) emergency earth spillway flowed for a short period at a depth averaging about 0.8'. There was no erosion in the channel except for a small 1' deep headcut at the extreme south end where it emptied into a flood channel along the north side of an auxiliary Air Force landing field that appeared to have been carrying 10 to 20 times the spillway flow.

11. Flow through the Jackrabbit Road (north) emergency earth spillway, also 163' wide, averaged about 1.6' in depth. Surveys after the flood indicate that the crest of this spillway is now about 0.4' below the elevation at the time of completion. It is believed that most of the lowering of the earth spillway crest resulted from wind erosion and from use of the cleared spillway crest area as a driveway for vehicles and as a practice ground for horsemen and motorcyclists during the 16 years since its construction. The high water marks indicate that the water surface was 0.4' higher at the Jackrabbit Road spillway than at the Tuthill Road (west) spillway. This could have been the result of wave action or a west wind across the one-mile reach of the reservoir. Erosion in this spillway from this storm was negligible. Floodwater through the spillway crossed unimproved desert for one-half mile before co-mingling with larger onslaughts of water flowing from the north and west.

12. The two principal spillways equipped with gates remained closed during the storm. Had they been open they would have had little effect upon the reservoir hydrograph because of the intense short-period of runoff. The reservoir was emptied in a matter of a few days through seepage into the ground.

13. Structure No. 3 with a capacity of 2655 acre-feet and a designed watershed area of 24.1 square miles, received an inflow of approximately 350 acre-feet. The rainfall was less intense on this watershed than on the watershed of Structure No. 4 and as mentioned in paragraph seven above. As mentioned above, four square miles of this watershed has been diverted into the watershed of Structure No. 4. Runoff from this four-square mile area was quite heavy.

It is recommended that consideration be given to correcting the overloading of Structure No. 4 by combinations of the following alternatives:

- A. Redesign the roadway fills and channels in Sections 18 and 13 so as to permit the four-square-mile area in parts of Sections 2, 3, 10, 11, 12, 13, and 14 to drain into Structure No. 3 as originally planned. (See map attached.)
- B. Construct one or more small retarding structures north of Indian School Road to control runoff from all or parts of Sections 13, 14, 17, 18, 19, and 20. (Structure No. 4 was not designed to receive runoff from this area but since 1954 the runoff has been directed into Structure No. 4.)
- C. Enlarge Structure No. 4 to enable it to safely accommodate runoff from Section 29 and that part of Section 32 that was not originally designed to contribute to Structure No. 4.
- D. If it is not practical to materially increase the capacity of Structure No. 4 additional structures should be built upstream, possibly in Sections 23 and 25.


J. J. Turner
State Conservation Engineer

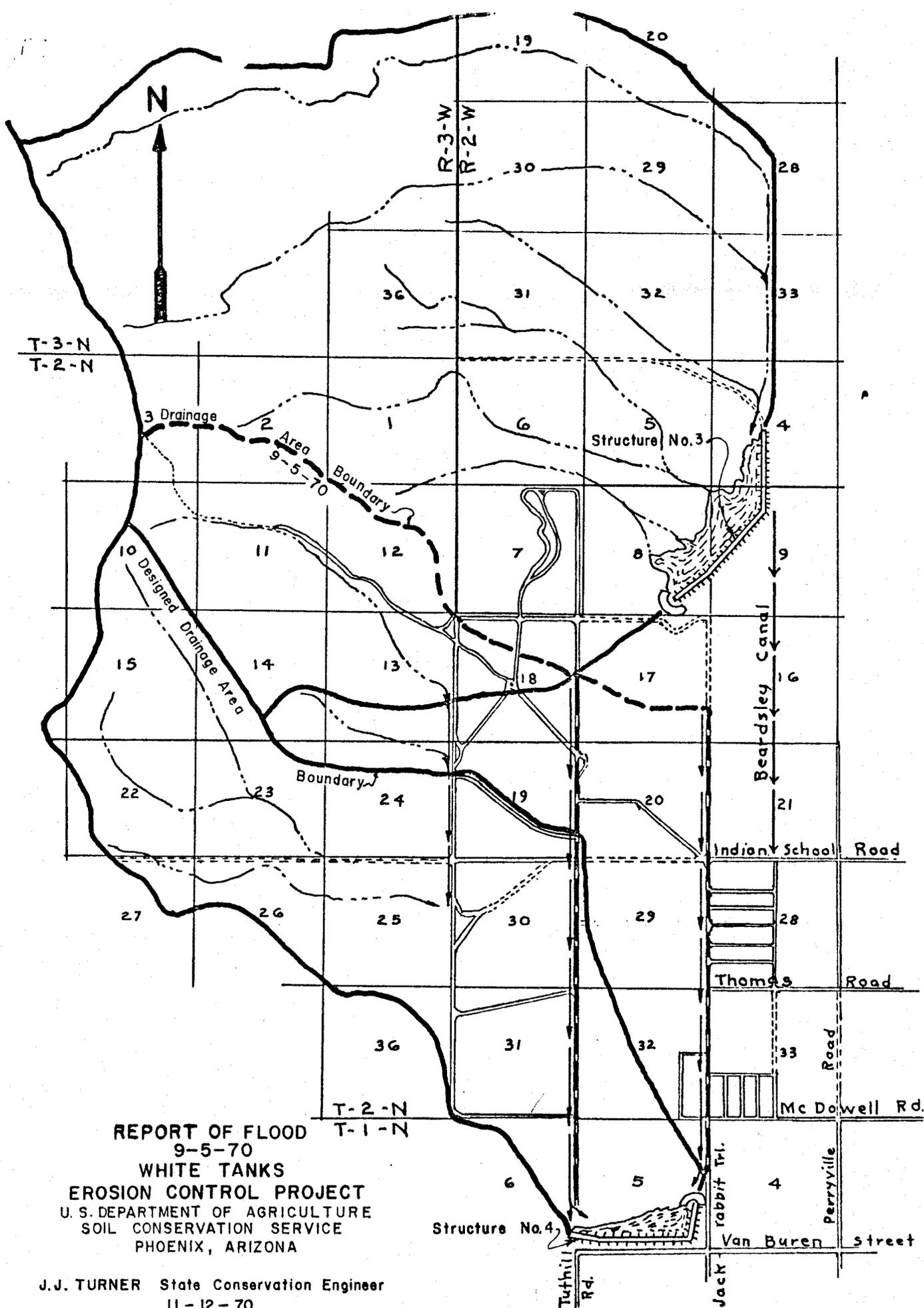
Attachment

cc to:

E. J. Core, Head, E&F Unit, SCS, Portland, Oregon
Kenneth E. Grant, Administrator, SCS, Washington, D. C.

Chris Williams, DC, Phoenix Wd.
Wau Samerougl DC, Buckeye - sent 1/7/70

JJT:csW



REPORT OF FLOOD
 9-5-70
WHITE TANKS
EROSION CONTROL PROJECT
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 PHOENIX, ARIZONA

J. J. TURNER State Conservation Engineer
 11-12-70

STATE		PROJECT		
BY	DATE	CHECKED BY	DATE	JOB NO.
SUBJECT		SHEET 2 OF 2		

There was a time when channels were a problem in Arizona - For ~~Except~~ for those in rock walled ~~or man revetted~~ ~~the~~ canyons or revetted by man

They silt during low flow + Eved h flows during high

There are no stable channels in Arizona. EITHER NATURAL OR MAN MADE Engineering Memorandum 72. Has solved our problem. It is well worded.

Paragraph #3 refers to SIGNIFICANT aggradation, degradation and bank erosion.

The next to last paragraph permits - with EWP concurrence the deviation from certain of judgement with of experienced judgement when appropriate. exercise

ON the 12th of next month we are ^{with EWP assistance} conducting a workshop for professional engineers. ON CHANNEL STABILIZATION.

After reviewing the technical aspects of the various components of the practice such as HYDRAULICS - GEOLOGY of the site. FRACTIVE FORCE - BED LOAD SEDIMENT TRANSPORT etc. We will study channels

We will make onsite study of ~~the~~ earth channels built ^{under} on the desert during the past 20 years. conditions

I feel confident Hopefully we can arrive at a common understanding with the EWP unit regarding significant aggradation, degradation and bank erosion.

I have briefly expressed my opinion of the memo. if there overlooked bugs in it we have at least 25 more minutes for discussion from the floor.

Condensed Summary

WHITE TANK PROJECT
ARIZONA

Constructed, Spring 1954

	<u>Structure No. 3</u>	<u>Structure No. 4</u>
Capacity	2655 ac.ft.	1036 ac.ft.
Length	7700 ft.	6800 ft.
Drainage Area	24.1 sq.mi.	10.3 sq.mi.
Max. Fill Height	30 ft.	20 ft.
Spillway Size	1100' x 3'	2 @ 165' x 3'
Spillway Capacity	16150 cfs.	4400 cfs.
Capacity in inches of runoff	2.06	1.89
Crest width	10'	10'
Side Slope	2½:1 & 2:1	2:1 & 2:1
No. of outlet pipes	3	2
Size of outlet pipes	48", 48" & 24"	30" & 36"
Evacuation time	80 hrs.	118 hrs.
Sediment production:		
0.3 A.F. per Sq.Mi. per yr. est.	<i>16X12X3 = 48 AF due in "a" by 1970</i>	
Total embankment	351,481 c.y.	171,728 c.y.
Cost emb.	.272 c.y.	.212 c.y.
Cost Rolling	.02 c.y.	.02 c.y.
Cost Sprinkling	.02 c.y.	.02 c.y.
Total structural excavation - 1455 c.y. @ .30		
Site preparation - total cost	\$900.00	
Clearing & Stripping - " "	\$950.00	
Estimated total cost of project - - - - -		\$417,375.00
Estimated private contributions - - - - -		218,287.00
Estimated public " - - - - -		199,088.00
Annual O & M Cost (non-federal) - - - - -		3,750.00
Estimated annual cost of project (50 yr. amortization) - - - - -		20,860.00
Estimated annual benefits (same basis) - - - - -		35,220.00
Benefit - cost ratio	1.7 to 1	

Spillway Flood design Frequency: 6" tropical summer type storm
(.005 Probability)

Reservoir Flood design Frequency: 4" tropical summer type storm
(.01 Probability)

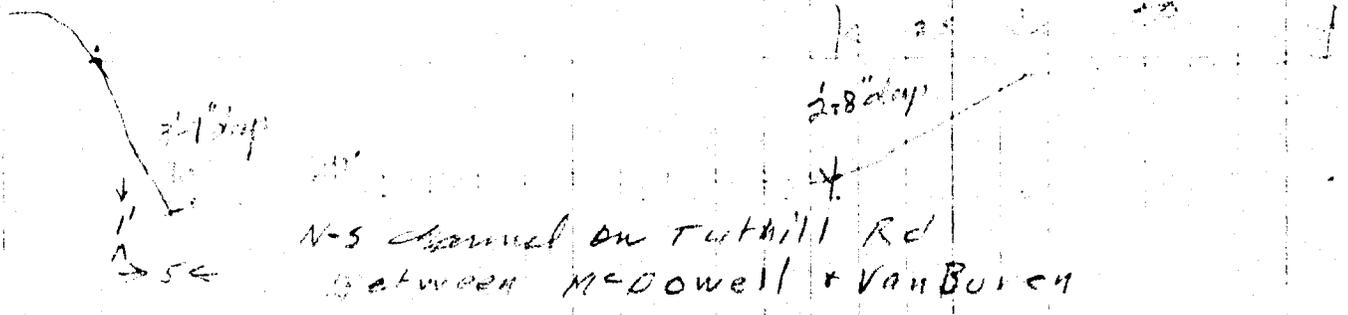
STATE		PROJECT <i>White Tank Detention Dam #4</i>		
BY	DATE <i>10/15/70</i>	CHECKED BY	DATE	JOB NO.
SUBJECT				SHEET _____ OF _____

in flood report
100' ditch (some) destroyed 1/8 mi East of
195th Ave and Van Buren

Water depth est. 100' wide V=4'/s. Van Buren Hwy -
100' ditch (some) destroyed 1/8 mi East of
195th Ave and Van Buren

200' x 400' c/s parallel cor. 195th + Van Buren

Water 2' deep 1/8 mi approx. 100'



Flow at 195th Ave. 2' to 6" water across 195th for 1/4 mi
Lacy, R.C. 3221 N. 195th Ave Water in house
Flowing toward Sakava, approx. 7 to 9 P.M.
PR. Holiday same address.

10/26/70
 Project: Est. Work to raise
 White Tanks No 4 Str 3 feet
 Vertical Area of Dam

$$40.9 \text{ sq m} = 40.9 \times 5 \times 500 = 102,250 \text{ Sq ft}$$

To raise dam 3' on 2:1 downstream
 2:1 upstream

$$\text{Width} = 3 \times 2 \times 2 = 12'$$

$$102,250 \times \frac{12}{27} = 45,444 \text{ cu yd}$$

$$+ \text{Top} = \frac{10 + (10 + 3 \times 4) 3}{2 \times 27} 1.77 \text{ cu yd/ft}$$

$$177 \times 6839$$

$$12,156$$

Total

$$57,600$$

Also additional Wings
 & dike across spillway

$$4,500 - 10 \text{ cu yd}$$

$$11,100$$

$$68,700 \text{ cu yd}$$

not R.
USDA River Basin Staff
Suite 326, Arizona Title Bldg.
111 W. Monroe Street
Phoenix, Arizona 85003

March 8, 1968

E. S. Plym.

Mr. Jack Leavitt
Henningson, Durham and Richardson, Inc.
Suite 1222
100 W. Clarendon
Phoenix, Arizona

Dear Jack:

Enclosed is the information you requested in relation to
the White Tanks Project. If you need further information,
please call me.

Yours truly,

Marvin C. Sheldon
Hydraulic Engineer

Enclosure

MS
MCS:bb

USDA River Basin Staff
Suite 326, Arizona Title Bldg.
111 W. Monroe Street
Phoenix, Arizona 85003

March 7, 1968

Mr. Lee Ohsiek
Maricopa County Flood Control District
3325 W. Durango
Phoenix, Arizona 85009

Dear Lee:

Enclosed is the work plan for the White Tanks pilot project you requested on March 7. We also have other files on "as built" plans and construction notes. I will check with Bill Turner when he returns in a couple of weeks and tell him you would desire what other information we have in our file in relation to this project.

Yours truly,

Marvin C. Sheldon
Hydraulic Engineer

Enclosure

MCS
MCS:bb

Arizona State Office
Room 6015, Federal Bldg.
Phoenix 25, Arizona

January 17, 1962

Mr. Orvis H. Lowry
P. O. Box 268
Sayre, Oklahoma

Dear Mr. Lowry:

I am happy that you took the time to read my White Tanks Story, and greatly appreciate your taking the time to tell me.

Thanks, also, for sending me the excellent brochures on the nationally famous Sandstone Creek Watershed.

Please be assured I had no intention of stealing any of Sandstone Creek's thunder. As a matter of fact, my manuscript was entitled "The White Tanks Story", and the two watersheds were treated under different programs.

As mentioned in your brochure, Sandstone Creek Watershed was treated as a part of the large Washita River Watershed authorized for treatment by the Flood Control Act of 1944. Sandstone Creek and similar areas treated under that Act led to the appropriation of funds by Congress in 1953 for treatment of approximately 50 small (under 250,000 acre) "pilot" watersheds.

White Tanks, as stated in my story, was the first project completed under this Pilot Watershed Protection Program. This, in turn, led to the enactment in 1954 of the current Public Law 566, the Watershed Protection and Flood Prevention Act as amended in 1956.

I hope someday to have the pleasure of visiting the Sandstone Creek Watershed. Should you ever visit Arizona, I hope you will give me the opportunity to help you become acquainted with Soil and Moisture Conservation activities in Arizona.

Sincerely,

JJTurner:nr

bcc: Ray Walker
State Conservationist
Agricultural Center Bldg.
Farm and Admiral Road
Stillwater, Oklahoma

J. J. Turner
State Conservation Engineer

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

January 4, 1962

Honorable Carl Hayden
U. S. Senator
Federal Building
Phoenix 25, Arizona

Dear Senator Hayden:

Enclosed for your information is a copy of the January '62 issue of SOIL CONSERVATION magazine. You will recall that on November 21 I mailed to you a copy of the manuscript for the White Tanks Story which appears on page 126 of this issue.

I am sure that you are well aware that the personal attention you gave to the problems of the Agua Fria Soil Conservation District is recognized and cherished by everyone interested in that area.

Sincerely,

J. J. Turner
State Conservation Engineer

Enclosure
cc: L. A. Hill
JJTurner:nr

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

January 4, 1962

Mr. John McDaniels
Stanley-McDaniels Farms, Inc.
Route 1
Tolleson, Arizona

Dear Mr. McDaniels:

Enclosed is a copy of the January ' 62 issue of SOIL CON-
SERVATION which I promised to send you in my letter of
November 16.

I regret that space did not permit the editors to use all
of the statements in my original manuscript.

You were very kind to give Dick Schwab the statement for my
use, and I want you to know that I appreciate it very much.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure
cc: L. A. Hill
JJTurner:nr

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

January 4, 1962

Mr. Wayne Thornburg
2749 N. Central Avenue
Phoenix, Arizona

Dear Mr. Thornburg:

Attached is the copy of the January '62 issue of SOIL CONSERVATION magazine that I promised to send in my letter of November 16. I sincerely regret that the editor devoted space to only one of the several excellent statements that you and your neighbors so courteously prepared for my use.

I enjoyed very much, however, the opportunity of visiting with you, Hank Raymond and L. A. Hill and sincerely hope that our paths will cross again in the near future.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure
cc: L. A. Hill
JJTurner:nr

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

January 4, 1962

Mr. Henry S. Raymond
208 LaCrescenta Avenue
Goodyear, Arizona

Dear Hank:

I am sending you an extra copy of the January '62 issue of SOIL CONSERVATION and want to thank you again for your courtesy in helping me with the article. I am embarrassed that the editors found the space to use only one of the excellent statements you and your friends so kindly gave.

For your information I have sent copies of the magazine and a letter similar to this to Wayne Thornburg and others, who were kind enough to give us statements.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure
cc: L. A. Hill
JJTurner:mr

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

January 4, 1962

Mr. Karl Abel
8636 N. 59th Avenue
Glendale, Arizona

Dear Mr. Abel:

Enclosed is a copy of the January '62 issue of SOIL CONSERVATION which I promised to send you in my letter of November 16.

I regret that space did not permit the editors to use all of the statements in my original manuscript.

You were very kind to give Lloyd Howland the statement for my use, and I want you to know that I appreciate it very much.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure
cc: L. A. Hill
JJTurner:ax

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

January 4, 1962

Mr. Russell Badley
8316 North 10th Avenue
Phoenix, Arizona

Dear Mr. Badley:

Enclosed is a copy of the January '62 issue of SOIL CONSER-
VATION which I promised to send you in my letter of November
16.

I regret that space did not permit the editors to use all of
the statements in my original manuscript.

You were very kind to give Lloyd Howland the statement for
my use and I want you to know that I appreciate it very much.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure
cc: L. A. Hill
JJTurner:nr

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

January 4, 1962

Mr. W. N. Kring, Vice Pres.,
Goodyear Farms
Goodyear, Arizona

Dear Newell:

Enclosed is a copy of the January '62 issue of SOIL CONSER-
VATION in which our White Tanks story appears. I am happy
that the editors used your statement which appears on page 128.

Please, again, accept my thanks for your courtesy in helping
me with the story.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure
cc: L. A. Hill
JJTurner:nr

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

November 21, 1961

Honorable Carl Hayden
U. S. Senator
Federal Building
Phoenix, Arizona

Dear Senator Hayden:

As promised yesterday I am enclosing a copy of a recent magazine release that I believe will answer your question regarding the success of the White Tanks Flood Prevention works.

I prepared the article at the request of the editor of the SCS Publication, "Soil Conservation". The article, I understand, is scheduled for the January '62 issue, the theme of which is Rural Area Development.

I trust that I have used your name in accuracy on page 5, and I am sure you will be interested in Mr. Wayne Thornburg's statement on pages 8 and 9.

You are probably aware that the Watershed Protection and Flood Prevention Program authorized by P. L. 566 is getting quite a play in Arizona. The first dam under the Frye Creek-Stockton Wash Project in the Gila Valley SCD is now being built to protect Thatcher. The Mogas Project has been authorized for construction and Work Plans have been completed on projects at Douglas, Florence and the farming area south of Willcox.

We are now preparing Work Plans for several projects sponsored by the Maricopa County Flood Control District and benefited Soil Conservation Districts.

This office will be happy to answer any detailed questions you may have regarding this or other programs administered by SCS in Arizona.

Sincerely,

J. J. Turner
State Soil Conservation Engineer

Enclosure

J.J. Turner:nr

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

November 16, 1961

Mr. W. N. Kring, Vice Pres.,
Goodyear Farms
Goodyear, Arizona

Dear Newell:

This is to thank you for your courtesy in giving me a statement for my "White Tanks Story".

Your statement, as I have used it, appears on page 6 of the enclosed copy of the manuscript I mailed to the magazine, SOIL CONSERVATION.

Your statement adds a great deal to the article, and I trust that I have recorded your statement correctly.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure

cc: L. A. Hill

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

November 16, 1961

Mr. Russell Badley
8316 North 10th Avenue
Phoenix, Arizona

Dear Mr. Badley:

This is to thank you for your courtesy in giving Mr. Howland a statement for my use in a story on the White Tanks flood prevention project.

Your statement, as I have used it, appears on page 9 of the enclosed copy of the manuscript.

I trust that I have accurately recorded your statement and feel that your statement adds a great deal to the story.

The article should appear in the January issue of the magazine, SOIL CONSERVATION.

I have requested extra copies of the publication for the purpose of sending a copy to you.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure

cc: L. A. Hill

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

November 16, 1961

Mr. Karl Abel
8636 North 59th Avenue
Glendale, Arizona

Dear Mr. Abel:

This is to thank you for your courtesy in giving Mr. Howland a statement for my use in a story on the White Tanks flood prevention project.

Your statement, as I have used it, appears on page 9 of the enclosed copy of the manuscript.

I trust that I have accurately recorded your statement and feel that your statement adds a great deal to the story.

The article should appear in the January issue of the magazine, SOIL CONSERVATION.

I have requested extra copies of the publication for the purpose of sending a copy to you.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure

cc: L. A. Hill

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

November 16, 1961

Mr. Henry S. Raymond
208 LaCrescenta Avenue
Goodyear, Arizona

Dear Hank:

Enclosed is a copy of the "White Tanks Story" as I sent it to Soil Conservation. It should appear in the January issue, the theme of which is "Rural Area Development".

I also mailed a copy to Wayne Thornburg.

Thanks again, Hank, for your help.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure

cc: L. A. Hill

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

November 16, 1961

Mr. Wayne Thornburg
2749 North Central Avenue
Phoenix, Arizona

Dear Mr. Thornburg:

This is to thank you again for your courteous expenditure of time and effort in preparing a statement for my "White Tanks Story".

I am enclosing a copy of the manuscript I mailed to the magazine, SOIL CONSERVATION. The story should appear in the January issue. The theme of the issue is to be "Rural Area Development".

I have requested extra copies of the magazine and plan to send at least two copies to you.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure

cc: L. A. Hill

Arizona State Office
Room 6015, Federal Building
Phoenix 25, Arizona

November 16, 1961

Mr. John McDaniels
Stanley-McDaniels Farms, Inc.
Route 1
Tolleson, Arizona

Dear Mr. McDaniels:

This is to thank you for your courtesy in giving Mr. Dick Schwab a statement for my use in a story on the White Tanks flood prevention project.

I am enclosing a copy of the manuscript I sent to the magazine, SOIL CONSERVATION. Your statement appears on page 9. I trust I have accurately recorded your statement and feel that it adds a great deal to the story.

The article should appear in the January issue of the magazine, SOIL CONSERVATION. I have requested extra copies of the publication for the purpose of sending a copy to you.

Very truly yours,

J. J. Turner
State Conservation Engineer

Enclosure

Frank B. Harper, Editor, SOIL CONSERVATION
SCS, Washington, D. C.

October 31, 1961

J. S. Taylor
R. V. Boyle, State Conservationist
SCS, Phoenix, Arizona

INFORMATION - Manuscript - White Tanks Story

Enclosed is the draft of the "White Tanks" story Herb Boddy requested this office to prepare. We recognize that the story is somewhat longer than requested, but we felt it important to the success of the Rural Development and 566 Programs that prospective sponsors realize ultimate improvements of a permanent nature generally require years of effort and long range planning.

Encl. 1 sketch
12 photographs

cc: Herby Boddy, Berkeley, Calif.
Harper Sims, Washington, D.C.

Please feel free to edit and deal directly with Editor Harper on changes you feel appropriate.

Frank B. Harper, Editor, SOIL CONSERVATION
SCS, Washington, D.C.

November 16, 1961

J. J. Turner, State Conservation Engineer,
SCS, Phoenix, Arizona

INFORMATION - Manuscript - White Tanks Story

If you use the "White Tanks Story" that I mailed you on October 31, 1961, I am requesting you to send me a dozen extra copies of the issue carrying the story.

I propose to send copies to those individuals who contributed to the article.

Julian J. Turner
Soil Conservation Service
6015 Federal Building
Phoenix, Arizona

*State office file
Casper*

THE WHITE TANKS STORY

Julian J. Turner

Construction of the two White Tanks flood retarding dams in 1954 under the Pilot Watershed Protection Program of the Soil Conservation Service, and the Mellicken Dam in 1936 by the Corps of Engineers, completed an over-all flood protection plan conceived many years ago by the developers and leaders of the Agua Fria* Soil Conservation District. The late Kenneth E. Mellicken, W. W. Lane, Col. Dale Burstead, and others realized in the 1920's and 1930's the necessity of protecting the fertile, newly irrigated desert lands and the growing communities lying between the usually dry Agua Fria River and the White Tank, Wickenburg, and Hieroglyphic Mountains to the west and north.

During the following one-quarter century the Agua Fria story is basically a story of local leaders with vision, determination, and a deep sense of community responsibility working together and with all available agencies of government to solve their watershed problems of land management, soil and moisture conservation, and flood prevention. An early step in this direction was their cooperation with the Soil Conservation Service on a demonstration basis in the early 1940's.

*Agua Fria: Spanish for "cold water"

State Conservation Engineer, Soil Conservation Service

The unusually severe thunderstorms of 1941 prompted Lucien A. Hill, then Demonstration Conservationist, now Area Conservationist at Phoenix, and Warren V. Turner, then Area Conservationist, to assign SCS Engineers Frank Flint and Ben Woodson the task of studying the flood and damage pattern and making recommendations for controlling future floods.

Progress was slow during the early 1940's. A world war was in progress and SCS demonstrations were on the wane. The local leaders, however, continued to explore ways and means for putting together an organization to solve their common problems, and on June 23, 1945, the Agua Fria Soil Conservation District was voted into being with the previously mentioned Messrs. McVicken, Lane, and Bumstead, as its first Supervisors. The following is an excerpt from the initial WORK PLAN prepared by the Agua Fria SCD:

PURPOSE

1. Obtain aerial and ground surveys, study flood control practices that may be desirable on the several major drainages. The assistance of Federal, State, county, and other public and private agencies will be requested.
2. Provide necessary assistance to meet the soil and water conservation problems on the individual farms.
3. Study methods of controlling noxious plants and rodents.
4. Promote restoration of wildlife.
5. Develop an educational program to encourage people, the communities and District to obtain benefits of soil and water conservation.

That Work Plan prepared 16 years ago would serve today as a basic outline for rural area development in hundreds of the Nation's small watersheds.

Immediately following World War II the SCS was requested to prepare detailed flood prevention plans based on the preliminary engineering report prepared by SCS in 1941. The Soil Conservation District Supervisors also requested the assistance of the Maricopa County Municipal Water Conservation District Number One, an irrigation district lying within the boundaries and comprising about one-half of the irrigated lands of the Agua Fria Soil Conservation District. The irrigation district, with Scott L. Libby, President, Wayne Thornburg, Vice President, and J. C. Wetzel, member of the Board of Directors, agreed to loan equipment for clearing brush and digging test pits and to contribute the services of its people. The combined resources were still meager for the needed planning and investigations. Furthermore, dissenters argued that the planning was a waste of effort as there was no program under which the actual construction could be accomplished.

The SCD Supervisors were firm in their belief that if they had a sound and detailed plan, a way would be found to carry it out.

Efforts were spurred by frequent damaging flash floods from heavy rains on the sparsely vegetated desert watershed. These floods culminated in late August of 1951 when direct flood damage from a single storm amounted to \$3,000,000. Rich farm lands and ripening crops were washed away, miles of highways and many sections of railroad tracks were washed out, and telephone lines were swept away. Luke Air Force Base and roads leading to it were inundated. Training of combat pilots vitally needed in Korea was suspended for several days. Homes of people living on farms in in the Towns

of Litchfield Park, Goodyear, and Avondale were severely damaged. The Goodyear Aircraft Plant and the Litchfield Naval Air Facility were under water.

The Soil Conservation District and the Soil Conservation Service redoubled their efforts after the 1931 flood. Meanwhile, because of the length of time required to complete the detailed plans, and because of lawsuits arising from the diversion of flood waters by minor dikes and channels within the District, the cooperators of the Soil Conservation and Irrigation Districts pooled their Production and Marketing Administration payments for soil conservation practices for 1952. With \$34,000 of PMA funds, \$108,000 contributed by the Irrigation District, and with SCS technical direction a dam 4 miles long and 23 feet high was constructed that effectively controlled all nine floods occurring in the Trilby Wash area subsequent to that time. So well planned and constructed was this structure that it is now a part of the 9 mile long McMilliken Dam completed by the Corps of Engineers in 1956.

Throughout all the years of dreaming and planning, the SCD Supervisors also had the foresight to keep their political leaders at all levels of government acquainted with their needs.

Realizing that ultimate solution of the watershed protection problem would require cooperation of the Federal Government, the local leaders took special pains to thoroughly acquaint each member of Arizona's Congressional delegation with their problems and needs and requested them to support such legislation as might be proposed to permit the kind of Federal assistance needed.

The long awaited break came in the spring of 1933 when in the 83rd Congress, Congressman Clifford Hope of Kansas, and August Andersen of

Minnesota, were responsible for the inclusion of \$5,000,000 in the annual Agricultural Appropriations Bill to be used for a Pilot Watershed Protection Program administered by the Soil Conservation Service. In the same 83rd Congress, Arizona's Senator Carl Hayden sponsored legislation authorizing the Secretary of the Air Force to construct the Trilby Wash Detention Basin and Outlet Channel, later dedicated as McHicken Dam.

Thanks to the long range planning of the SCD Supervisors and Irrigation District officials, rights-of-way had been arranged for, water rights settled, and detailed plans were ready.

A contract for construction was awarded early in 1954 and by July 1954 the White Tanks Pilot Watershed Project, the first in the Nation, was completed at a cost of \$420,000. The Federal Government contributed \$200,000 and the remaining \$220,000 was contributed by local interests.

Damage to defense installations was caused by flood waters from Trilby Wash and the sponsors chose to cooperate with the Corps of Engineers in the control of that portion of the watershed. Local interests contributed another \$200,000 to this project.

As neither the Soil Conservation District or the Irrigation District had the legal authorities required for Federal cooperation of this type, supplemental agreements were made whereby the County of Maricopa acted as official sponsor for both projects.

Completion of the White Tanks and McHicken Dams had a tremendous effect on rural development and triggered a boom in the application of conservation practices and neighborhood and community-wide improvements of all kinds.

SCD cooperators replaced 233 miles of wasteful earth ditches with concrete lined ditches or pipe lines during the 5 years after completion of

the White Tanks project. This was 121 miles more lined ditches and pipelines than were installed during the 5 years prior to 1954. The land leveling is now of a higher quality and irrigation water is being applied with greater efficiency. In total, farmers in the District have lined or tiled over 400 miles of irrigation ditches and precisely leveled over 52,000 acres of the 70,000 acres of farm land. These practices and care in the use of irrigation water are credited with preventing water loss and waste of over 40,000 acre feet of water annually. Enough water to produce 16,000 bales of cotton or 8,000 carloads of lettuce.

With flood prevention, more farmers turned to such high cost, high income crops as lettuce, asparagus, grapes, etc. and the per acre gross income rose from less than \$200 to over \$400 between 1930 and 1960. The 36 miles of farm roads paved since 1954 is 10 miles more than all the roads previously paved. A one million dollar housing development has been built adjacent to one of the White Tanks dams. Census figures show that the Towns of Goodyear and Avondale have more than doubled in population and assessed valuation of property in these two incorporated towns tripled between 1930 and 1950.

The multi-million dollar Phoenix Air Defense Center has been established at Luke Air Force Base and the Capehart Housing Project of 1,000 homes for Luke Air Force Base personnel has been built on land that was under water during the floods of 1931. Three thousand acres of fertile land, previously abandoned have been reclaimed and are now producing crops valued at over one million dollars annually.

Mr. W. H. Kring, Vice President of Goodyear Farms, says:

"Prior to the start of this program, our property had on several

occasions, suffered extensive damage from flash floods, having their origin in the White Tank Mountain Area. We feel that with the diversion and detention Dam now in place, that our property is, for the first time, adequately protected from this type of damage."

Wesley Thorburg, an old timer in the area, made the following written statement:

"Our Soil Conservation Service deserves great credit for the leadership and very important part they played in bringing into being the White Tanks Flood Control Project in Western Maricopa County, Arizona."

"Before this protection was given our community, flood hazards and actual damage were so great that properties and developments were losing values and risks involved discouraged capital investment and expansion.

"Our community flood control project has effectively protected more than 70,000 acres of valuable and highly productive agricultural land. Lake Air Force Base, the Naval Air Facility at Goodyear, Goodyear Aircraft, the Towns of Goodyear, Avondale, and Litchfield Park have all profited more than dollars can express. All these areas had suffered heavy damage and would have continued always highly vulnerable without effective flood control.

"Special credit and recognition should be given outstanding leaders whose tireless efforts finally brought White Tanks Flood Control Project into being and made our homes and

properties, our total community, secure and safe from the ravaging damages and losses we had before suffered so frequently.

"Kenneth McNichen, one of the finest and most effective citizens any country ever had, was our captain. Lucien Hill, our Area Conservationist, was never known to say 'It can't be done'. His effective cooperation along with our Soil Conservation State Engineer, Bill Turner, turned the tide in our favor. General Charley Bern, then commander at Luke Field, was a great power in developing recognition and cooperation in the military services. Our, all Arizona's and all America's Carl Hayden ran true to form and got the job done for the good of his fellow man. Then, finally with united backing put together, made effective, and brought into action by Hank Raymond (who has many titles, but his leadership here was through our Agus Fria Soil Conservation District), our community won its long, and many times discouraging fight.

"These men and men others in community, state, county and federal service have served their country well and our Soil Conservation Service has again proven its worth to present and coming generations in America."

Henry S. Raymond, Engineer and Manager for the Irrigation District said:

"The floods forced the District to abandon its post World War II efforts to line irrigation canals. Since flood protection has been provided our District has lined with concrete 20 miles of its canals and plans to line another 12 miles this winter.

It formerly cost the District \$10,000 to \$12,000 annually to repair the flood damage to canals and installations. Since 1974 our flood damage has been negligible."

John McDaniels of Stanley McDaniels Farms told Dick Schwab, SCS Area Engineer, that:

"The money spent constructing the White Tanks Mountain project is the best money spent in this area since I have been farming here. We can make improvements, put in roads and crops without the risk of being washed away."

Mr. Karl Abel said:

"Our lands are directly in the path of previous floods and the dams have been a lifesaver to us. We can now line our irrigation ditches and accurately level our land without fear of having to constantly repair flood damage."

Mr. Russell Badley, large scale vegetable grower said:

"My now valuable farm was practically worthless prior to flood protection."

As members of the original board of SCD Supervisors retired, members of the present Board of Directors were elected to succeed them. Chairman of the present Board is Mr. Jess C. Watt, a prominent farmer who replaced the late Col. Dale Burstead. Mr. W. Newell Kring, Vice President of Goodyear Farms, known to over 1200 SCD Supervisors and cooperators who have won GOODYEAR AWARD trips to Arizona, was appointed to fill the unexpired term of the late Kenneth B. McMicken. Mr. Henry S. Raymond, Engineer and Manager of the Irrigation District was elected to fill the vacancy created by the retirement of the late W. W. Lane. Mr. Raymond has for the past eight years

very ably handled the job of spokesman for both the Soil Conservation District and the Irrigation District in the construction and maintenance of the works of improvement in the area.

"1

White Tanks Dam #3. The main canal of the Irrigation District is immediately left of the dam. Cultivated lands are to the left, off the picture.

12

White Tanks Dam #3 near center of picture. Irrigation Canal is immediately to the right of the dam and the farm lands are in the right background.

#3

White Tanks Dam #4. A portion of the protected irrigated cropland may be seen at the upper left of the picture.

#4

White Tanks Dam #4, center foreground, irrigated farm land in foreground and desert and mountains in the background.

#5A

Corner of Western Avenue and Litchfield Road during flood of 1951.

#5B

Same view in 1961 showing modern building where airplanes were previously parked.

#50

completing
Modern shopping center on opposite corner of same intersection.

#6A

Flood waters at Luke Airforce Base, 1951.

#6B

recently completed

Same view taken in 1961. Corner of large new building at extreme left,
~~was recently completed.~~

#6C

Luke Airforce Base Housing Project. Checkered water tower in center background is the same tower that appears at extreme right in views 6A and 6B.

#7

Stalled car on flooded county road in 1951.

#8

Irrigating fall lettuce. Road pavement, concrete ditch lining, and precise land leveling installed since flood protection.

Sketch showing the Flood Retarding Basins in relation to the drainage area, the farm lands (shown shaded), and the communities and military installations they are designed to protect.

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - -			4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1 *Maintenance cost of \$25/yr.*
= 1/5 of 1% / year.

Maint cost of 3,330/year is 1/7 of 1% / year

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE Room 6029, Federal Bldg., Phoenix, Arizona 85025

XXXXXXXXXXXXXXXXXXXX

SUBJECT: P.L. 565 - Hydrology

DATE: December 10, 1970

TO: E. J. Coro, Head
E&WP Unit
Portland, Oregon

White Tanks

We are currently making final designs on the Buckeye Watershed, 3 dams with one having a drainage area of 74 square miles. The emergency spillway design and excavation is a significant portion of the total project costs.

We are also working on the Cottonwood Wash dam with a drainage area of 250 square miles.

The White Tanks Dam No. 4 had water flow through the emergency spillway in September 1970 and we are evaluating the safety of this structure.

All three projects involve Class C dams. We would like for the U.S. Weather Bureau special studies section to have a close look at probable maximum precipitation values and area correction factors for these watersheds.

Enclosed are watershed maps of all three projects.

M. E. Strong

Acting

M. E. Strong
State Conservationist

Enclosures

cc: G. Watt
W. Turner

JMM:rh



UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE River Basin-Watershed Planning Staff

~~XXXXXXXXXXXXXXXXXXXX~~ Suite 326, Arizona Title Bldg., 111 West Monroe St.
Phoenix, Arizona 85003

SUBJECT: WS - PL 566 - White Tanks Dam No. 4

DATE: December 14, 1970

TO: J. J. Turner

WHITE TANKS FLOOD REPORT

1. In the summer of 1954 two flood control structures, identified as White Tanks No. 3 and No. 4, were built by the Soil Conservation Service in cooperation with the County of Maricopa and the Municipal Water Conservation District No. 1. *and the Agua Fria Soil Conservation District*
2. The project was known as the White Tanks Erosion Control Project and SCS participation was under the Pilot Watershed Program.
3. It is reported that 4.5" of precipitation were recorded in a guage near the intersection of Jack Rabbit Road (195th Avenue) and West Indian School Road. According to the Salt Lake City R.F.C. map, dated October 20, 1970, the total area was in the 4" rainfall area. The 100-year, 24-hour storm for this area is 4.0 inches.
4. The rain is reported to have started about midafternoon on Saturday, September 5, 1970. The maximum intensity is believed to have occurred between 6:00 and 8:00 p.m. It was reported that water started flowing across Jack Rabbit Road in the vicinity of Thomas Road about 7:00 p.m. and ceased to flow across the road about 9:00 p.m.
5. The elevation of the high point of the watershed is 3671'. The spillways of Structure No. 4 are at elevation 1050' with the top of the structure at 1056'. The elevation at the rain gauge is approximately 1165'.
6. Structure No. 4 was designed to impound 1036 acre-feet from a drainage area of 10.3 square miles.
7. Since 1954 developments north and west of Indian School Road and Tuthill road have caused four square miles of watershed originally designed to flow into Structure No. 3 and an additional 1.8 square miles of watershed to flow into Structure No. 4 along Tuthill Road. Additional land developments between Jack Rabbit Road and Tuthill Road plus improvements of Jack Rabbit Road divert still another 2.7 square miles of watershed into the east end of Structure No. 4 along Jack Rabbit Road.



8. Thus at the time of the storm there was a total of 18.9 square miles of watershed contributing to Structure No. 4. This is 8.6 square miles more than the structure was designed to handle.
9. It should be noted that deposition of coarse sands in the ~~west~~^{borrow} channel ~~on the~~
west side of Jack Rabbit Road limit the flow of water diverted into Structure No. 4. Excess flood waters flowing south along Jack Rabbit Road overflowed the pavement in the vicinity of Thomas and McDowell Roads causing damage to an unknown number of homes in the subdivisions east of Jack Rabbit Road.
10. High water marks indicate that Structure #4 filled and the 160' wide west emergency earth spillway flowed for a short period at a depth averaging about 0.8 ft. The approximate maximum discharge from the spillway was 250 cfs. There was no erosion in the channel except for a small 1' deep headcut at the extreme south ~~and~~^{end} where it emptied into a flood channel along the north side of an auxiliary Air Force Landing Field. The flood channel appeared to have been carrying ten to twenty times the spillway flow.
11. Flow through the 175' wide north emergency earth spillway averaged about 1.6' in depth. The approximate maximum discharge was 650 cfs. Surveys after the flood indicate that the crest of this spillway is now about 0.4' below the elevation it was at the time of completion. It is believed that most of the lowering of the earth spillway crest resulted from wind erosion and from use of the cleared spillway crest area as a driveway for vehicles and as a practice ground for horsemen and motorcyclists during the 16 years since its construction. The high water marks indicate that the water surface was 0.4' higher at the Jack Rabbit Road spillway than at the Tuthill Road (west) spillway. This could have been the result of wave action or a west wind across the one mile reach of the reservoir. Erosion in this spillway from this storm was negligible. Flood water through the spillway crossed unimproved desert for one-half mile before co-mingling with water flowing from the north and west.
12. The two gated principal spillways remained closed during the storm. Had they been open they would have had little effect upon the reservoir hydrograph because of the intense short period of runoff. The reservoir was emptied through seepage into the reservoir area.
3 or 6 days
13. Structure No. 3, with a capacity of 2655 acre-feet and a design watershed area of 24.1 square miles, received an inflow of approximately 350 acre-feet. The rainfall on this watershed was from 3 inches to 4 inches according to the Salt Lake City R.F.C. Preliminary Storm Total Map. As mentioned in paragraph 7, four square miles of this watershed have

been diverted into the watershed of Structure No. 4. These four square miles are located in the area where the rainfall was 4 inches or more and where the storm was quite intense.

14. Based on current SCS criteria for a Class C Structure this storm was equal to the design storm for the principal spillway hydrograph. Because of the extra drainage area there was some flow through the emergency spillways.
15. Based on a Class C Structure Classification and a drainage area of 10.3 square miles an emergency spillway hydrograph was routed through the existing Structure No. 4. This routing showed that the earth spillways would have a discharge of 8300 cfs. with the water surface at elevation 1054.2 and a velocity of 7.0 ft/sec in the west spillway and 7.6 ft/sec in the north spillway.
16. A Freeboard Hydrograph based on 10.3 square miles was routed through the existing Structure #4 and it was found to overtop the existing structure while the inflow was still increasing. If it is desired to keep the same size spillway in width at the present location it will be necessary to raise the dam approximately 5 feet to handle the freeboard storm. The existing structure has a maximum storage capacity of 2,000 acre feet, while to handle the freeboard storm it would be necessary to store around 3,200 acre feet, when the spillways are flowing 29,000 cfs.
17. Since the original drainage area cannot be handled by the existing Structure No. 4, it is recommended that consideration be given to correct the overloading of Structure No. 4 by combinations of the following alternatives:
 - A. Redesign the roadway fills and channels in Sections 18 and 13 so as to permit the four square mile area in parts of Sections 2, 3, 10, 11, 12, 13 and 14 so the area will drain into structure No. 3 as originally planned. (See map attached.)
 - B. Construct one or more small retarding structure north of Indian School Road to control runoff from all or parts of Sections 13, 14, 17, 18, 19 and 20. (Structure No. 4 was not designed to receive runoff from this area but since 1954 the runoff has been directed into Structure No. 4).
 - C. Enlarge Structure No. 4 to enable it to safely handle runoff from the original drainage area plus the drainage from Section 29 and 32 that was not originally planned to be handled by Structure No. 4.

J. J. Turner

This enlargement can be done by widening the existing spillway so the dam will not be overtopped or by raising the dam to prevent the overtopping or a combination of the two.

- (1) The existing spillways will discharge 12,000 cfs. with a velocity of approximately 8.5 fps. If the existing spillway is retained and the problem is corrected by raising the dam it may be necessary to protect the spillways from erosion by lining with concrete or some other type of protection.

D. If it is desired to control the entire 18.9 sq. mi. drainage area with Structure #4 and the spillways are kept at their present location and elevation, it will be necessary to raise the top of the dam to elevation 1063. At this elevation the storage will be approximately 4,000 ac. ft. with the spillways discharging 55,000 cfs. The above numbers reflect the routing of a Class "C" freeboard storm through the structure.

The Emergency Hydrograph routed through the structure for the 18.9 sq. mi. drainage shows the spillways would need to handle 16,000 cfs with the upstream water surface at elevation 1056.0. The velocity in the west spillway would be 9.1 fps and the velocity in the north spillway would be 9.7 fps.

E. If it is not feasible to increase the size of the existing Structure No. 4, additional flood control structures should be built upstream from Structure No. 4. One possible location would be in the S.E. corner of Section No. 23. Another possible location would be in Section No. 25.

F. The existing principal spillway pipes are not being used as designed. The downstream outlet channels for these pipes have never been constructed.

Conclusions:

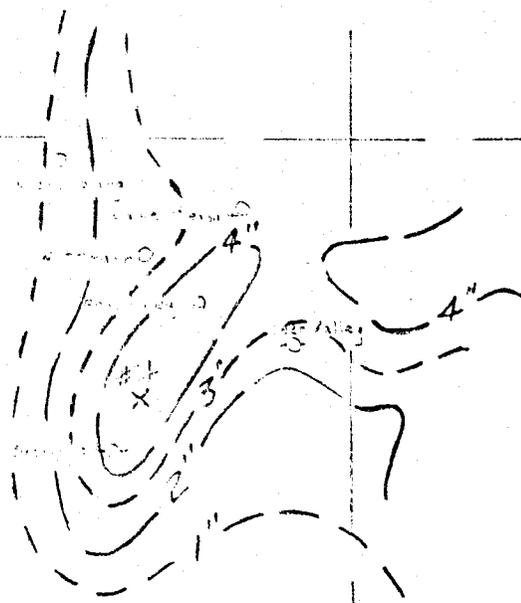
It is apparent that structure No. 4 as it exists today is not a safe structure according to our criteria for a Class "C" Structure. Since the original 10.3 square mile drainage area cannot be safely handled by the structure, the extra drainage area diverted into the structure can be controlled before it gets to Structure No. 4 or the structure can be enlarged to handle it.

James M. Malone
James M. Malone
Hydraulic Engineer

Robert M. Bartels
Engineering Specialist

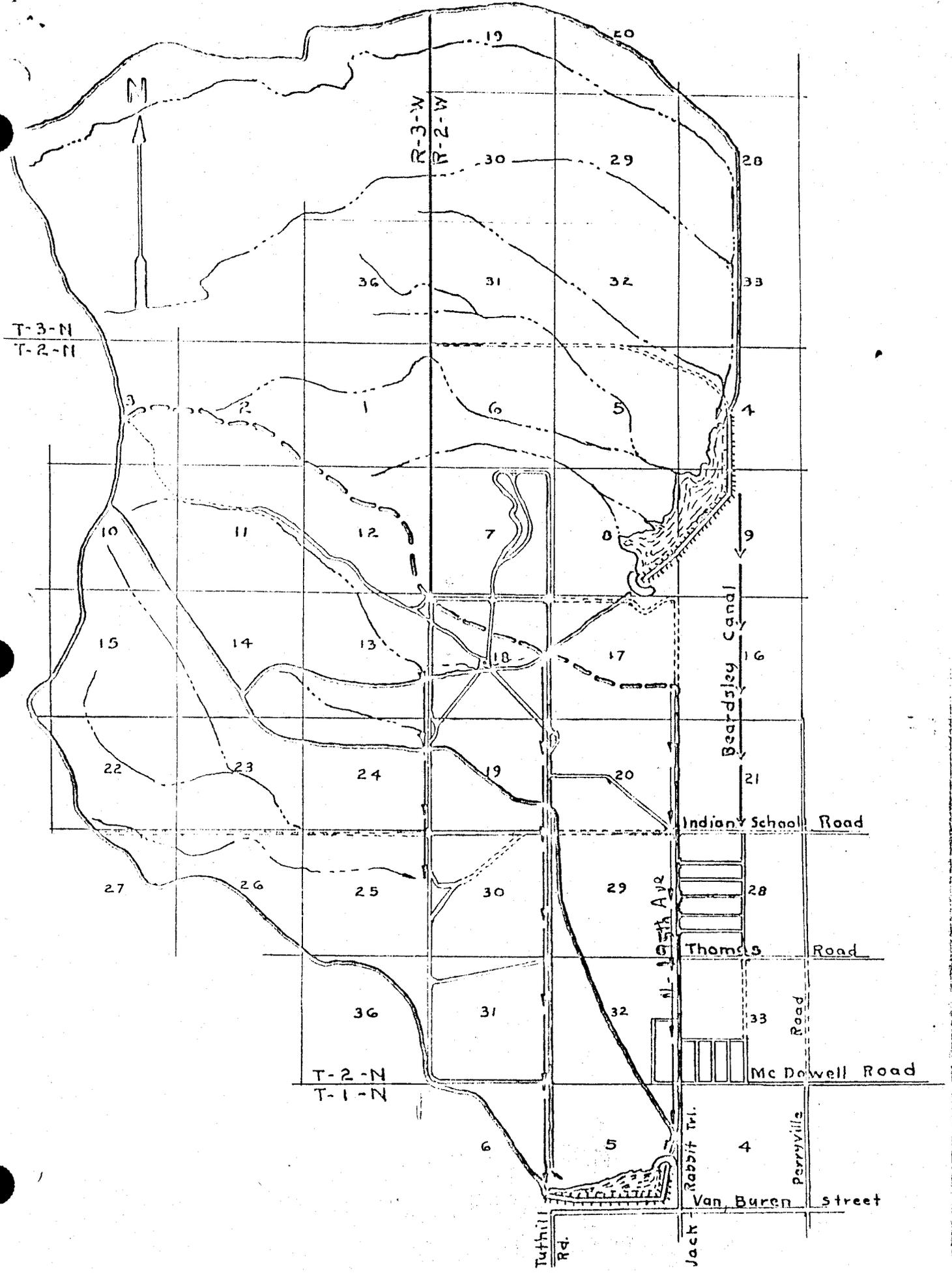
Attachments

- cc: R. E. Rallison - Portland w/Attachments
- G. Watt "
- C. Maguire "



Preliminary Storm Total
Sept. 5 & 6, 1970
Salt Lake City R.F.C.
10/20/70

Traced 12/10/70
R.M. Bartels



N

R-3-W
R-2-W

T-3-N
T-2-N

T-2-N
T-1-N

Beardsley Canal

Indian School Road

Thomas Road

McDowell Road

Van Buren Street

Tuthill Rd.

Jack Rd.

Perryville Road

11th Ave

Rabbit Trl.

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Arizona State Office, 6029 Federal Building, Phoenix, Arizona 85025

December 29, 1970

Col. John C. Lowry
General Manager and Chief Engineer
Flood Control District of Maricopa County
3325 West Durango Street
Phoenix, Arizona 85009

Dear Col. Lowry:

Enclosed is a report prepared by J. J. Turner, State Conservation Engineer, SCS, dated November 12, 1970, of the storm of September 5, 1970 as it affected Structure No. 4 of the White Tanks Project.

We note from copies of minutes of the Citizens Advisory Board that the Flood Control District of Maricopa County has taken note of the fact that the drainage area contributing to Structure No. 4 is now considerably greater than originally designed.

Since the storm we have made some hydrologic studies and flood routings of the area and the reservoir and will be happy to make any of this data available to your district.

Sincerely yours,


For:
M. E. Strong
State Conservationist

Attachment

bbc:
Gerald Welsh, Asst. State Cons.-W/sheds
Cliffon Maguire, RB-Watershed PP
George Watt, State Design Engineer
Chris Williams, D.C., Phoenix U.A.

JJT:csW

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE Room 6029 Federal Bldg., Phoenix, AZ 85025

STILL UNDER
AND
Packer

File White
books.

SUBJECT: ENG - Discussion with Lee Ohsiek
of MCFCD regarding Caterpillar
Proving Grounds

DATE: February 23, 1972

TO: M. B. Strong
State Conservationist

February 22 I met with Lee Ohsiek, MCFCD, to discuss the watershed drainage into White Tanks No. 4 from Caterpillar Proving Grounds. The following action items were agreed to:

1. Lee Ohsiek will inquire concerning the topographic maps of the caliche pit and pond in Section 18 suggested to be prepared by the proving ground personnel in the report dated October 22, 1971 by Mr. Turner. If the maps have been prepared, Ohsiek will request the survey information so a storm routing may be made by SCS to determine adequacy of the storage to contain the runoff or if modification will be necessary.
2. Lee Ohsiek will inquire as to the status of the diagonal dike along the mid-section line (Section 18) to be extended SW to Camelback Road to divert flows to the north into Structure No. 3.

Concerning the Buckeye Watershed Project, the following was accomplished:

1. Mr. Arrington delivered a cost estimate for the ramp crossings at Johnson Road and Palo Verde Road, a sponsor's cost item - \$81,121. Mr. Ohsiek stated this figure will be included in their budget requests for 1973 fiscal year.

Concerning the Guadalupe Watershed Project, the following was done:

1. Mr. Arrington suggested the MCFCD include in the current land rights map prepared for Guadalupe Project sufficient area to relocate the sewage leaching field downstream of the Saddle Dike. Lee Ohsiek agreed.
2. Arrington will send the MCFCD a copy of the land rights work map and a sketch of the existing leaching field with the dimensions of the field. He also will notify the AHD that the MCFCD desires to include this relocation in the current land rights map and request that they work with the MCFCD.

Ralph Arrington
Assistant State Conservation Engineer

cc: John Lowry - Chris Williams

RMA



M. D. Burdick, State Conservationist
SCS, Phoenix, Arizona

Arizona State Office
May 16, 1967

J. J. Turner, State Conservation Engineer

White Tanks Pilot Proj

ENG - Trip Report - Watershed Protection

On the afternoon of Wednesday, May 10, 1967, Messrs. Melvin M. Culp, Chief, Design Branch, Washington, D. C.; F. K. Muceus, Head, Design Section, Portland, Oregon; Ralph M. Arrington, Head, Design Unit, Phoenix, and I inspected the White Tanks Pilot Project dam #3 built in 1954 and the nearby McMicken flood control dam built by the Corps of Engineers in 1956.

Evidence of former cracking and some existing open cracks were noted in the McMicken structure. It appears that annual dragging of the surface of the dam together with local rainfall has healed at least the surface of some of the cracking that was quite prevalent during the period 1958-1960.

No appreciable cracking was noted on White Tanks Dam #3.

The Powerline Dam in the Apache Junction-Gilbert project, the Powerline channel route and the Florence Area flood prevention dam were inspected on the morning of May 11. Both visitors were highly complementary regarding the adequacy of design and the quality of construction.

A preference was expressed for the drop inlet type of outlet structure as used on the Florence Area over the headwall type used at the Magma and Powerline dams because the hydraulic characteristics lessen the possibility of negative pressures or cavitation in the outlet conduit.

Where differences in elevation permit we will use the drop inlet, "Florence" type. Where situations dictate the headwall type, the entrance to the pipe will be streamlined to improve the hydraulic characteristics. Headwall type conduit entrances will be avoided where water heads in excess of approximately 25 ft. will be encountered.

The cracking of the fill of the Magma dam was inspected on the afternoon of May 11. It was noted that longitudinal cracking was more prevalent than transverse cracking. It appeared that some transverse cracks may extend from the front to the downstream face of the dam. The cracks at the surface vary in width from very minute to as much as 1-1/2 in. Depth of cracks is not known but some are in excess of 3 ft. The cracking appears to be most severe in the upper 5 ft. to 8 ft. of the structure.



IT WAS AGREED that the sponsors should be encouraged to drag the surface of the dam with a farm type spike-tooth harrow, a heavy ship anchor chain or other equipment that would create a thin surface mulch that would tend to fill up the cracks and provide loose material that could trickle into the cracks under natural conditions of rain, wind and insect action. Dragging the surface will also tend to reduce annual vegetation that, when dead, may tend to keep soil from filtering to the bottom of the cracks.

The cracking on the Magma Dam is unique in that the soil types used in construction are not normally susceptible to severe swelling and/or cracking. These low plastic, loam clays with plastic indexes ranging from 3-11 generally would not yield deep surface tension cracks which are evidenced at the site. It was agreed that further study must be made to determine the internal moisture distribution and more closely the soil characteristics to correlate the two for future consideration in proper design of earth structures using these soils.

Messrs. Kenneth Brust and Bill Mildner of the Watershed and River Basin Planning Staff accompanied the group on May 11.

At an hour long conference on May 12 Messrs. Culp and Mucus exchanged technical ideas with the engineering and geology members of the State Office staff.

cc to:
E. J. Core, Head, E&MP Unit, Portland, Oregon
M. M. Culp, Chief, Design Br., Washington, D. C.
R. M. Arrington, Head, Design Unit, Phoenix
J. R. Ferrin, WUC, Phoenix
W. E. Parsons, WUC, Coolidge

L. A. Hill, Area Conservationist
DCC, Phoenix, Arizona

May 4, 1964

J. J. Turner, State Conservation Engineer
DCC, Phoenix, Arizona

ENGINEERING - White Tanks Watershed

In company with William W. Stanley, Construction Specialist ESWF Unit, John Sater, Bill Wildner and I visited the Hoffcken and White Tanks structures on May 1. The purpose was to study the transverse cracking previously noted in the top surface of the embankments with relation to similar structures we are now designing.

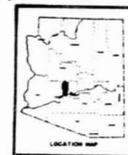
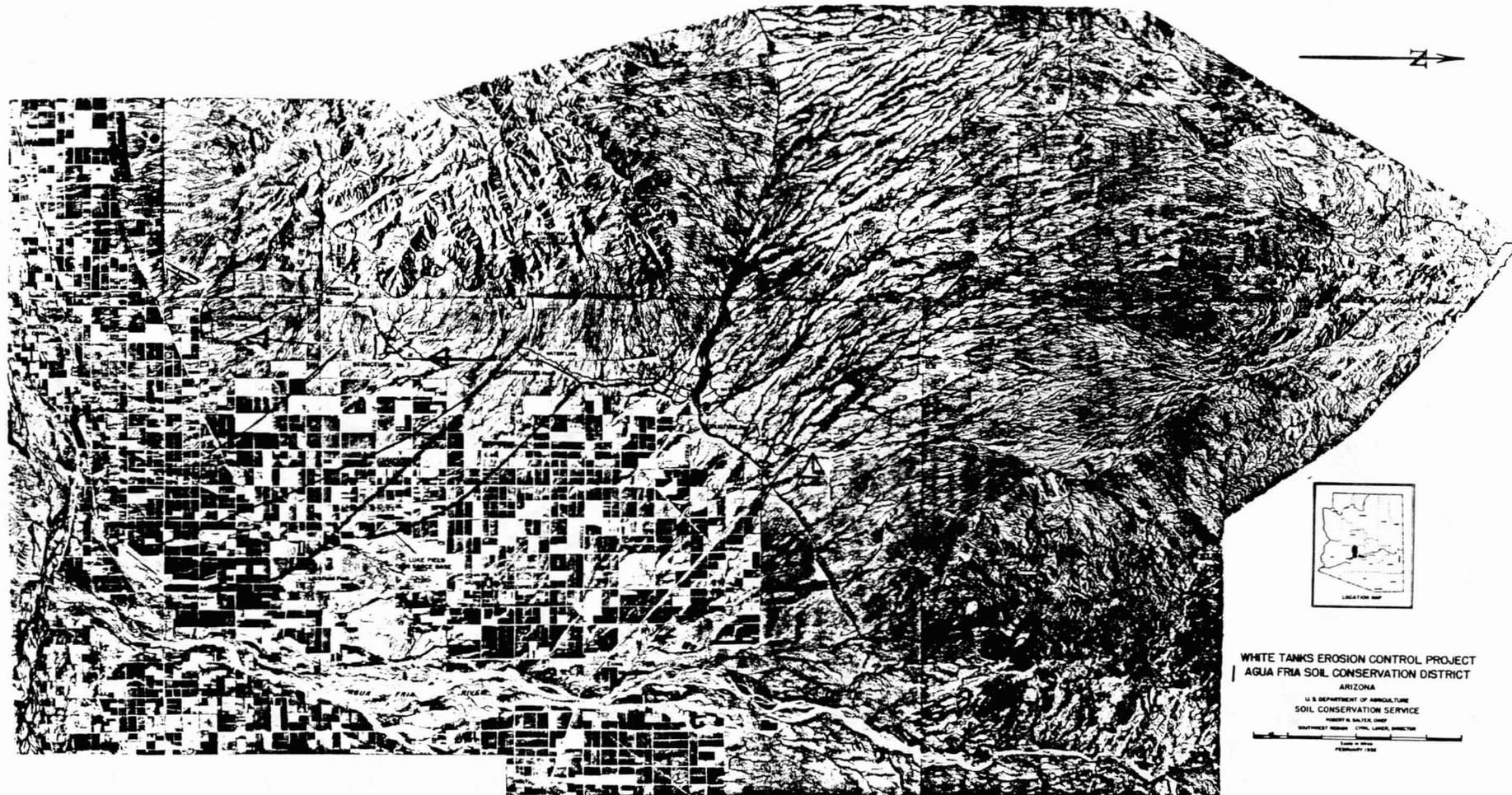
We were pleased to note that the cracking appears to be less severe now than noted at visits two and three years ago. It appears that local rains together with surface maintenance of the structures has caused considerable filling of the cracks.

We noted that traffic on dms number three and four has caused some concentrations of rainwater that is causing some small gully cutting at the top outside edges of the fill. I suggest that at the time of the next joint inspection of the structures consideration be given to increasing the crown of the roadway on the crest of both dms three and four, the object being to cause rainwater^{to} runoff in a sheet rather than at points of concentration.

cc to:

D. A. Watkins, Asst. State Conserv.- Watersheds
L. H. Portland, WUC, Phoenix
W. W. Stanley, ESWF Unit, Portland

JJT:cw

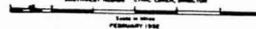


WHITE TANKS EROSION CONTROL PROJECT
AGUA FRIA SOIL CONSERVATION DISTRICT
ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WINTER & BAILEY, INC.

SOUTHWEST REGION - CIVIL ENGINEER



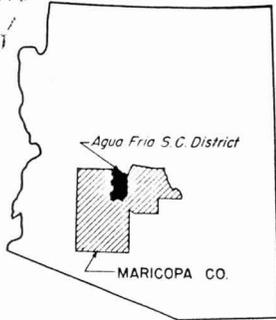
Scale in Feet
February 1966

AGUA FRIA
SOIL CONSERVATION DISTRICT
MARICOPA COUNTY, ARIZONA

MAY 1959

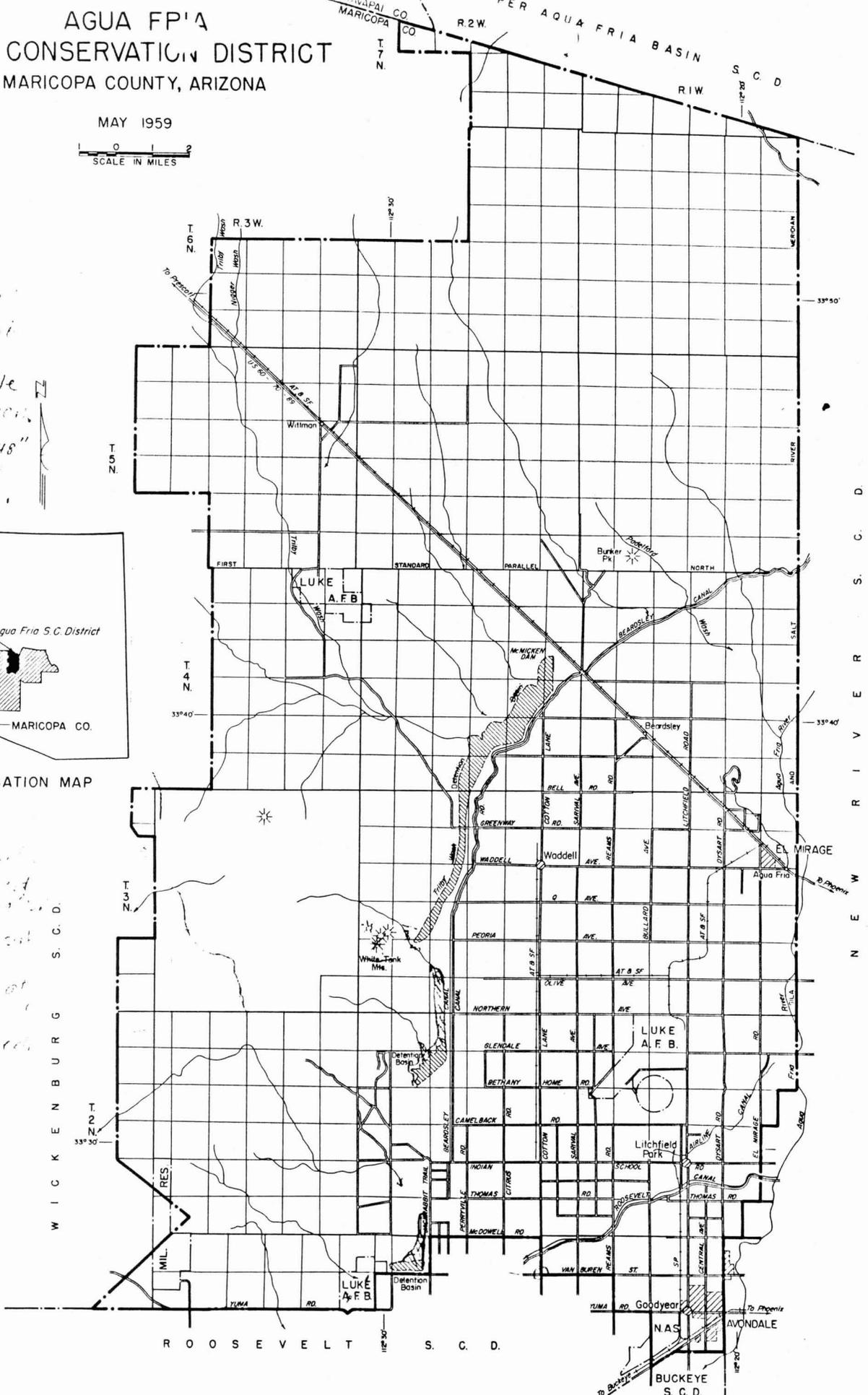


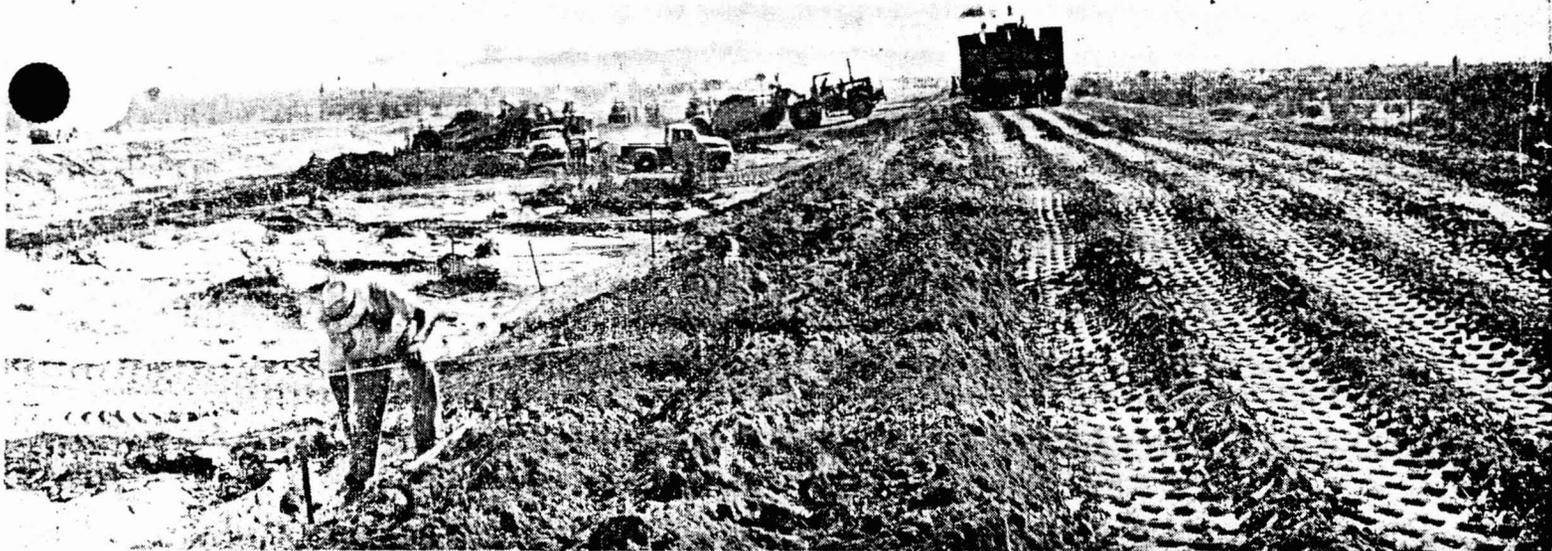
17 ft
1 ft
South outlet 24"
1/2" stem hole
cut at 15°
Dred impassable
at approx 15° open
center outlet 48"
should be blocked
for overability.
Sewer for North
outlet



LOCATION MAP

10 ft
4 ft
11 ft water table
also and effect
of operation of gate
Some water in cut
1. outlet.
Unightly dump of
at 15° and
Try to get removed





Photos Jay C. Robertson

Overall view of the work at Trilby Wash. At right is CATERPILLAR DW-21 pulling a 50-ton compaction roller. In center a TDT EUCLID is going up on levee. Left center, other EUCLIDS are loading. View is west with White Tank Mountains in background.

arizona construction

Work Gets Underway At Trilby Wash

Fredericksen and Kasler, Fontana, Calif., are well into their work on the Trilby Wash Detention Basin and Out-Channel northwest of Luke AFB.

\$1,393,273 contract is with the Corps of Engineers, U. S. Army, Los Angeles District Office.

A battery of earth moving equipment, including the most modern coming off manufacturers' production lines, is currently engaged in moving the tons of earth necessary for the project which is near the foot of the White Tank Mountains and will control flood waters in a drainage area of over 300 square miles. In the past these flood waters have caused several millions of dollars damage at Luke AFB, Litchfield Park Naval Air Facility, such towns as

Litchfield Park, Goodyear and Avondale, and about 50,000 acres of highly developed farmland.

Because of the lack of natural channel capacity below the Trilby Wash Basin, the outflow from it will be directed northeasterly through the outlet channel toward the Agua Fria River, which flows south and joins the Gila River south of the Naval Air Facility.

The detention basin at spillway crest (el. 1354) will have a water surface area of 2230 acres and a capacity of 19,300 acre feet, including 2500 acre feet for sediment. No storage for water is provided.

The basin will reduce the standard project flood — from a drainage area

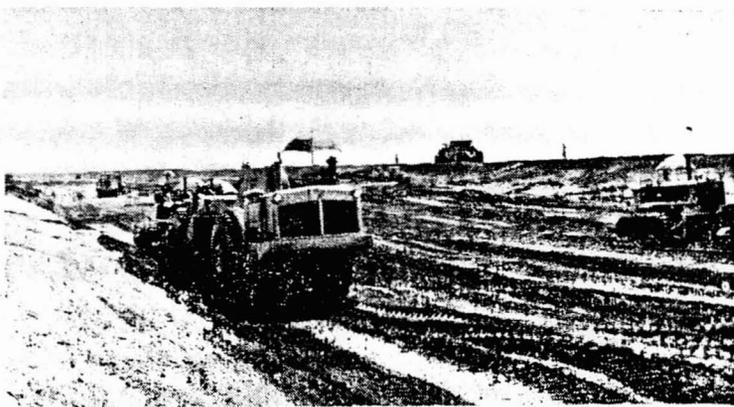
of 247 square miles — from 35,000 cfs to a maximum outflow of 4450 cfs.

The dam will be an earthfill structure, 50,100 feet long and 31.5 feet in maximum height above stream bed. The outlet channel will be about 30,000 feet long and will intercept flow from a drainage area of 71 square miles lying between Trilby Wash drainage area and the Agua Fria River. Flow entering the outlet channel will be prevented from overflowing by a levee extending almost continuously along the downhill side of the channel. The levee will have an average height of 8.5 feet above ground level and a top width of 12 feet.

(Continued on Page 27)



Left — First of its kind in Arizona, this Model S-18 overhung EUCLID scraper dumps its load atop levee. Right — The new Model S-18 overhung EUC loads in

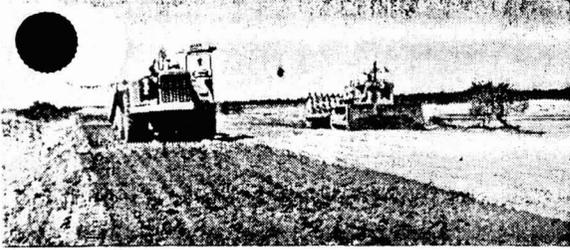


pit while a TDT is seen dumping on the levee in background. At right is a Bulldozer and in left background another EUCLID scraper comes in for a strike.

trilby wash

(Continued from Page 24)

Photos Jay C. Robertson

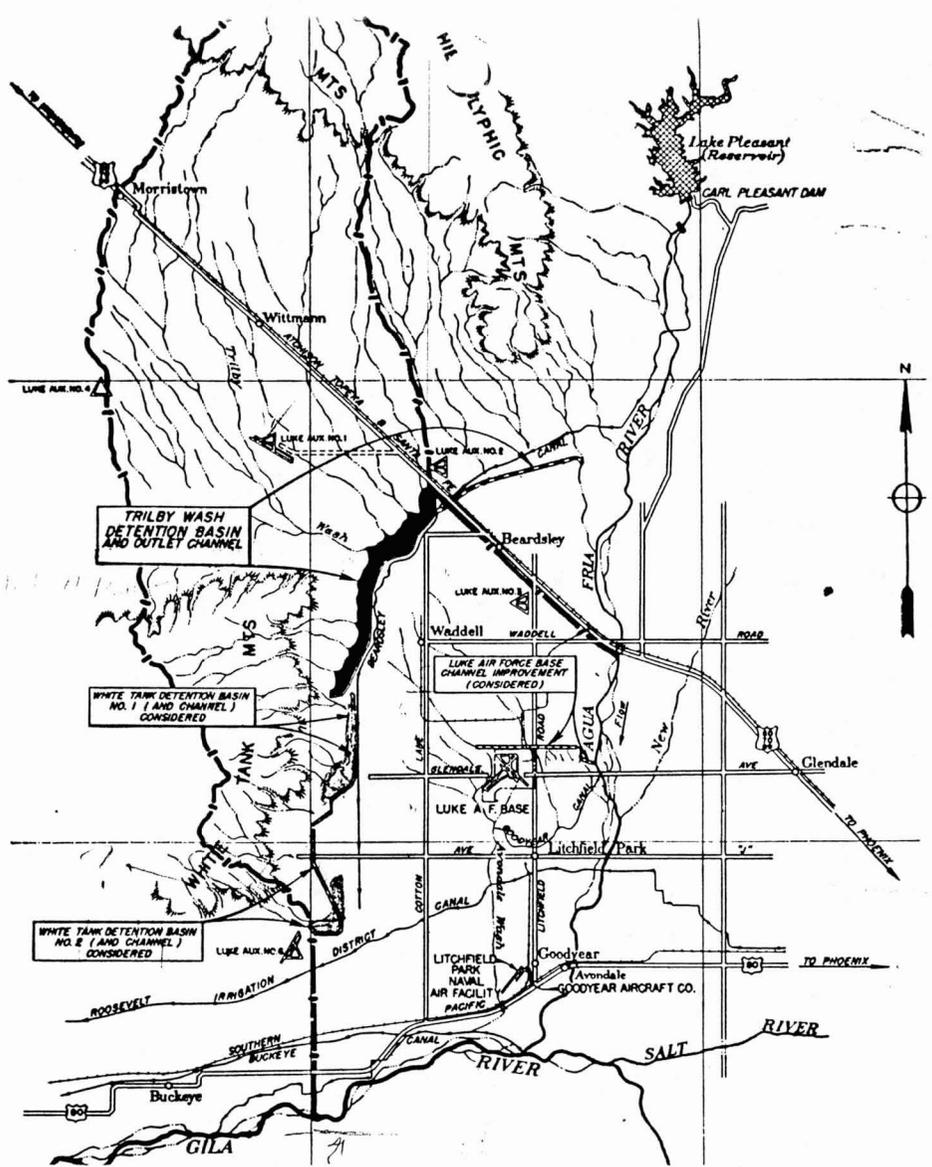


A brand new CATERPILLAR DW21 gets its baptism of dust pulling a huge pneumatic compaction roller. On right is a D-8 pulling a sheepfoot roller. Both machines are working on levee.



On left a new Model 14 TDT EUCLID scraper is loading at pit as the Model S-18 heads up the wash to dump load.

Sketch by Corps of Engineers, U.S. Army, Angeles District Office of Trilby Wash and Outlet Channel in relation to the drainage area and the military installations, towns, and farm section they are designed to protect.



Kitchell-Phillips On Phoenix Water Main Installation

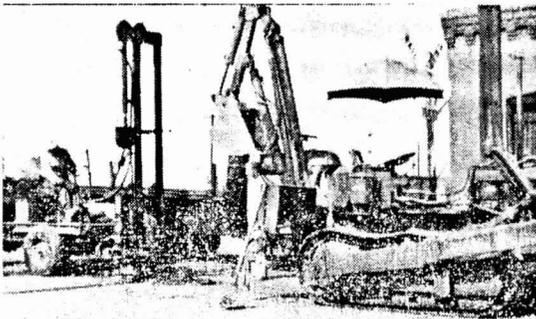
Kitchell-Phillips Contractors, Inc., Utility Division, plans to complete its big water main installation job for the City of Phoenix in early October. Contract was \$240,575 for installation only, the pipe, hydrants and miscellaneous items being city-furnished.

Material includes 62,000 ft. of 12", 8,500 ft. of 8", and 4,350 ft. of 6" cast iron pipe, 15,071 ft. of 12", and 5,900 ft. of 8" asbestos pipe, and hydrants, fittings, etc.

Two sections are benefiting by the improvements— from Van Buren to Jackson between 20th and 24th Sts.,

and from Van Buren to Grant, between Central Ave. and 16th St.

Top left — OTTAWA Hammer breaking pavement and ALLIS-CHALMERS with hydraulic backhoe digging trench on S. 7th St. near the Southern Pacific R. R. Top right — CLEVELAND trenching on S. 3rd St. after pavement was broken up. Excavated dirt is kept from scattering on to street by temporary wood baffles. Bottom, left and right — The ALLIS-CHALMERS backhoe at work, and a small crane swinging pipe into position on 3rd St.



Condensed Summary

WHITE TANK PROJECT
ARIZONA

Constructed, Spring 1954

	<u>Structure No. 3</u>	<u>Structure No. 4</u>
Capacity	2655 ac.ft.	1036 ac.ft.
Length	7700 ft.	6800 ft.
Drainage Area	24.1 sq.mi.	10.3 sq.mi.
Max. Fill Height	30 ft.	20 ft.
Spillway Size	^{500'} 1100' x 3'	2 @ 165' x 3'
Spillway Capacity	^{11,700 cfs} 16150 cfs.	4400 cfs.
Capacity in inches of runoff	2.06	1.89
Crest width	10'	10'
Side Slope	2½:1 & 2:1	2:1 & 2:1
No. of outlet pipes	3	2
Size of outlet pipes	48", 48" & 24"	30" & 36"
Evacuation time	80 hrs.	118 hrs.
Sediment production:		
0.3 A.F. per Sq.Mi. per yr. est.		
Total embankment	351,481 c.y.	171,728 c.y.
Cost emb.	.272 c.y.	.212 c.y.
Cost Rolling	.02 c.y.	.02 c.y.
Cost Sprinkling	.02 c.y.	.02 c.y.

Total structural excavation - 1455 c.y. @ .30

Site preparation - total cost \$900.00
Clearing & Stripping - " \$950.00

Estimated total cost of project - - - - -	\$417,375.00
Estimated private contributions - - - - -	218,287.00
Estimated public " - - - - -	199,088.00
Annual O & M Cost (non-federal) - - - - -	3,750.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00
Estimated annual benefits (same basis) - - - - -	35,220.00
Benefit - cost ratio 1.7 to 1	

Spillway Flood design Frequency: 6" tropical summer type storm
(.005 Probability)

Reservoir Flood design Frequency: 4" tropical summer type storm
(.01 Probability)

FREQUENCY

2 yr 24 hr. Rainfall = 1.25" (Fig. 17 W.B. Paper 25)

100 yr. 6 hr. " = 1.25 x 2.5 = 3.25" (Fig. 35 W.B. Paper 25)

Drainage area = 24.1 sq. mi.

From Fig. 3.10-4 (of 3.21) for 24 sq. mi. Dorrati curve = 0.7

100 yr. 6 hr. Rain = 3.25 x 0.7 = 2.27

Cover Per. Soil C. from table 3.9-1 Cond. II use curve # 86
 Then go into Table 3.10-1 with curve 86 for Cond. II and find Curve # 97 for Cond. III

From Fig. 3.10-1 enter on 2.27 move up to Curve 97 read 1.9" for Q
 $1.9 \times \frac{640}{12} \times 24.1 = \underline{2,400}$ Acre feet expected runoff.

Dike #3 has 2,455 AF capacity.

(check for 100 yr. 24 hr. rain = ~~1.5" for 2 yr~~

2 yr 24 hr. rain = 1.5" for 100 yr. multiply by 3 = 4.5" from Fig. 35

From table 3.10-1 runoff for (4.5 x 7) = 31.5 = 2.7"

$2.7 \times \frac{640}{12} \times 24.1 = 3,470$ AF - assuming discharge for 24 hrs @ 375 cfs x 7
 are 262 cfs discharge = Volume discharge = 524 ac

Earth spillway operation frequency is ok for Moderate Hazard.
 using procedure 3.21.

WHITE TANK #3 SPILLWAY REQUIREMENTS

Use 5" (min) Fig. 3.21-2
 from Fig. 3.21-4 for 24.1 sq. mi. use factor 0.7

W/ of catchment = 5/10 mi. P. area.

$A = 24.1 \text{ sq. mi.}$

$\Delta D = 0.5 \text{ hrs.}$

$T_c = 2.6 \text{ hrs.}$ (max. min) 1.5 sec

$T_p = \frac{D}{2} + 1.6 T_c = 1.82 \text{ hrs.}$ (Equation 19 of 3.2)

III-curve number = 97

$T_b = 2.67 \times 1.82 = 4.86$ (-11-)

$P = 5"$

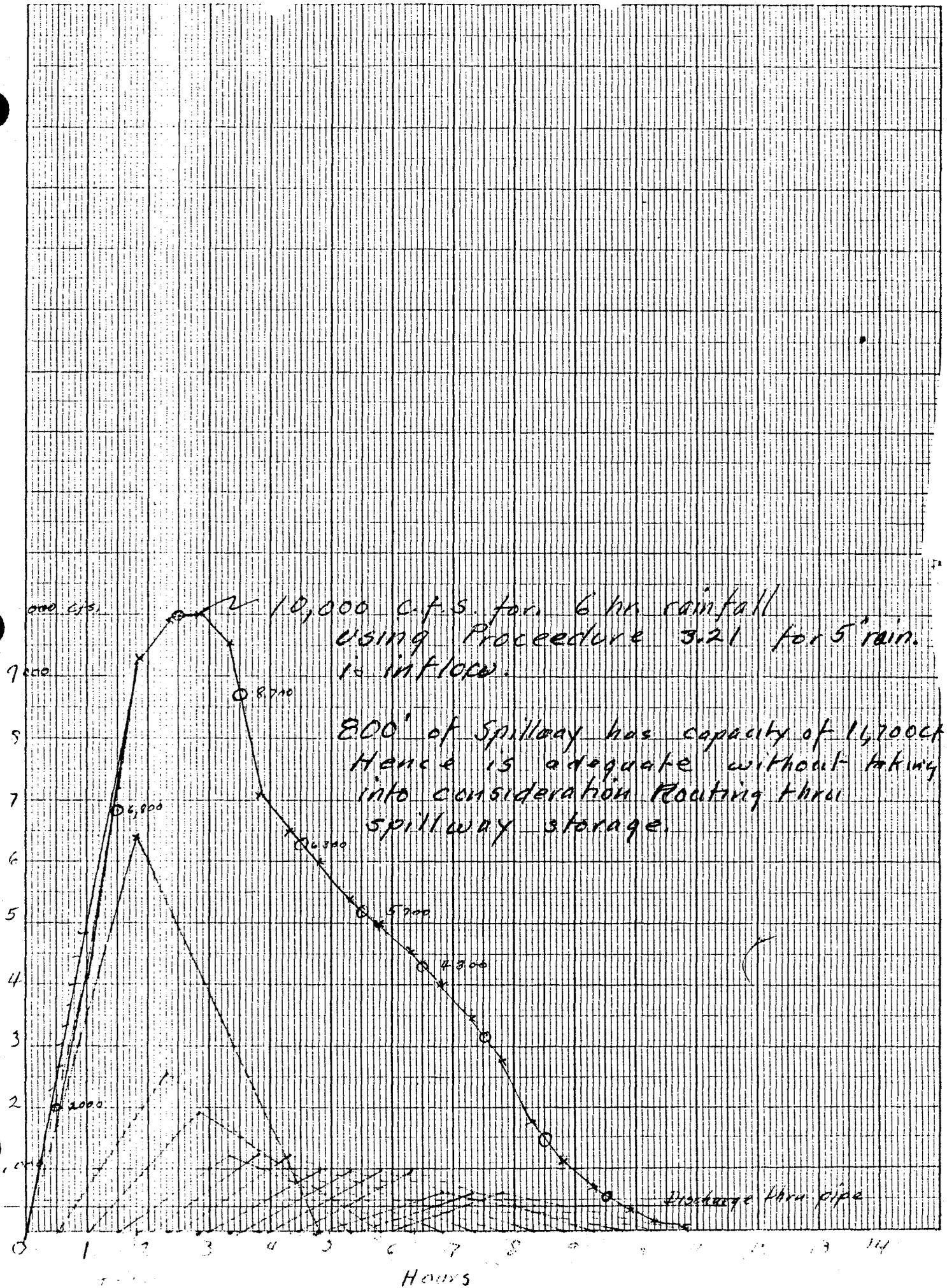
$Q_p = \frac{483 A P^{0.7}}{T_p} = 6400 \text{ cfs}$

Modified P: $5 \times .7 = 3.5"$

Time	Accum. P in in.	Curve No.	ΔP - inches	CA00 ΔP	CF5
0.0	0	97	0	0	6000
0.5	1.3	97	1.0	6400	
1.0	1.7	97	.4	2520	5200
1.5	2.03	97	.3	1920	
2.0	2.24	97	.2	1280	4000
	2.45	97	.2	1280	
3.0	2.64	97	.2	1280	3000
3.5	2.80	97	.15	960	
4.0	2.96	97	.15	960	2000
4.5	3.10	97	.15	960	
5.0	3.24	97	.15	960	1000
5.5	3.38	97	.10	640	100
6.0	3.5	97	.10	640	

1 2 3 4 5 6 7 8 9 10

KEUFFEL & ESSER CO., N. Y. NO. 139412
DRAWING FOR THE PROJECT, THE GREAT FALLS
NEW YORK

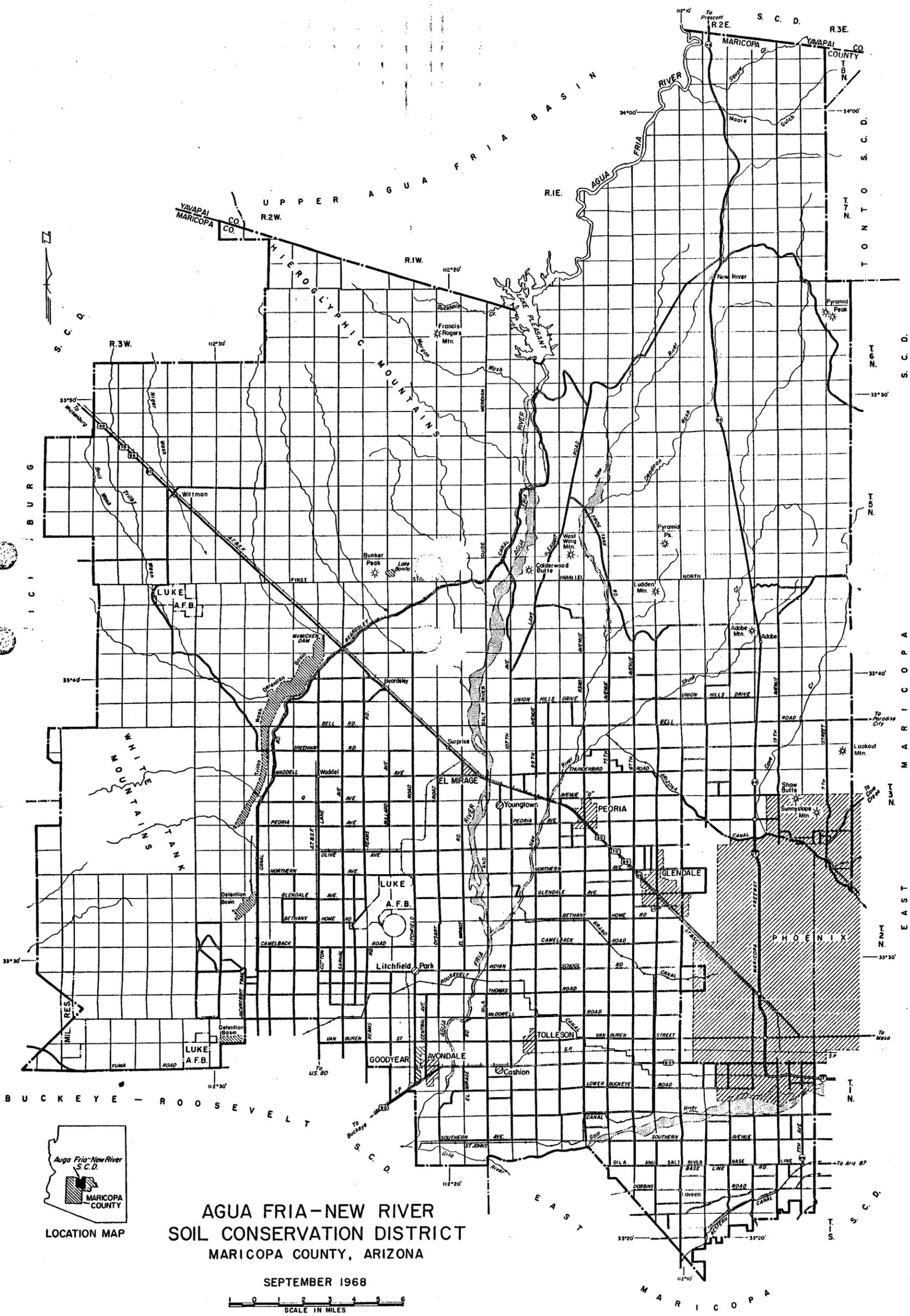


10,000 c.f.s. for 6 hr rainfall
using Procedure 3.21 for 5" rain.
is inflow.

800' of Spillway has capacity of 16,700 cft.
Hence is adequate without taking
into consideration Routing thru
spillway storage.

Discharge thru pipe

Hours



**AGUA FRIA-NEW RIVER
SOIL CONSERVATION DISTRICT
MARICOPA COUNTY, ARIZONA**

SEPTEMBER 1968





Western Ave. and Litchfield Rd. during 1951 flood.



Same corner as developed in 1961.

from this watershed-rural area improvement:

Vice-President W. N. Kring of Goodyear Farms:

"Prior to the start of this program, our property had on several occasions suffered extensive damage from flash floods, having their origin in the White Tank Mountain Area. We feel that with the diversion and detention dams now in place, our property is, for the first time, adequately protected."

Teamwork

Saves a Bridge

By Leon J. McDonald

THE taxpayers got a bargain when supervisors of the South Caddo County Soil Conservation District and County Commissioner George Nixon in Oklahoma teamed up to do a \$30,000 bridge-saving job that neither could do alone.

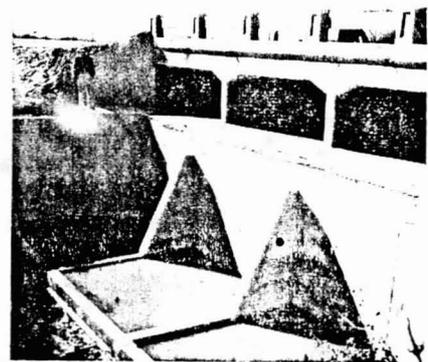
Because drainage from 1,800 acres was diverted from its natural course to the bridge area, the bridge, built of reinforced concrete in 1948 as a part of a farm-to-market road project, was almost ready to fall into a huge gully and follow the soil down the creek. The concentration of runoff water was flowing through and under the bridge, and had created the gully by washing 30,000 cubic yards of soil from the area below the structure. The gully was so large that it was estimated it would have taken dump trucks hauling 30 loads a day for 5 days a week 40 weeks to refill it.

Commissioner Nixon went to the district for help. The supervisors told him the Soil Conservation Service technicians assigned to the district could help him. They helped him develop a plan, which included an 8-foot concrete drop from the base of the bridge, and a 5-foot apron which brought the bottom of the structure to base grade.

Doyle Dirickson, district cooperator and owner of adjacent land, granted the county a 100-foot right-of-way for one-half mile. The gully banks and all disturbed areas were sprigged to bermudagrass to prevent erosion and make the road safe



Gully that threatened bridge.



Concrete drop and apron built to base grade.

for motorists.

The project cost \$6,500 and the "will to work together."

Note:—The author is assistant State conservationist, Soil Conservation Service, Stillwater, Okla.

in the Trilby Wash area, and is now a part of the 9-mile-long McMicken Dam.

But the big break came in 1953 when Congress appropriated money to carry on flood-prevention and watershed-protection work in more than half a hundred selected tributary watersheds over the country, one of which was the White Tanks "pilot" watershed project. Meanwhile, Arizona's Senator Carl Hayden sponsored legislation authorizing the Secretary of the Air Force to construct the Trilby Wash detention basin and outlet channel, later dedicated as McMicken Dam.

Thanks to the long range planning of the SCD supervisors and irrigation district officials, rights-of-way had been arranged for, water rights settled, and detailed plans were ready for the White Tanks project. A contract for construction was awarded early in 1954, and by July of the same year, the White Tanks work was completed, at a cost of \$420,000, which the local interests contacted \$220,000 and the Federal Government \$200,000.

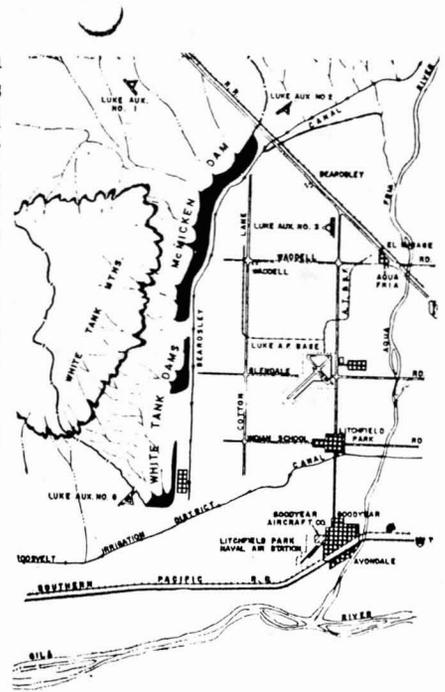
It was because damage to defense installations was caused by

floodwaters from Trilby Wash that the County of Maricopa as sponsor for both projects called upon the Corps of Engineers for help in the control of that portion of the watershed, for which local interests contributed another \$250,000.

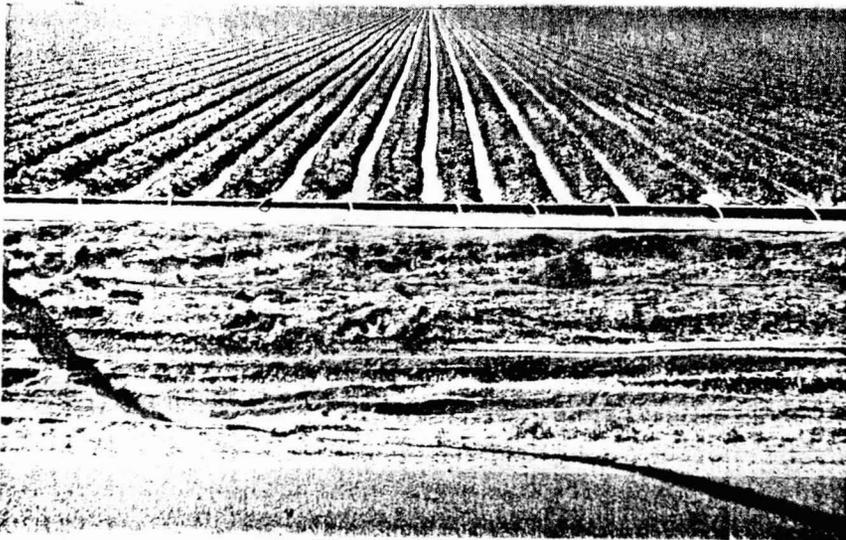
The White Tanks and McMicken Dams have had a tremendous effect on rural development and triggered a boom in the application of conservation practices and communitywide improvements of all kinds:

SCD cooperators replaced 233 miles of wasteful earth ditches with concrete-lined ditches or pipelines during the 5 years after completion of the White Tanks project—121 miles more than were installed during the 5 years prior to 1954. District farmers have lined or tiled more than 400 miles of irrigation ditches and precisely leveled more than 52,000 acres of the 70,000 acres of farmland. These measures, plus more efficient use of irrigation water, are credited with preventing water loss and waste of more than 40,000 acre-feet annually, or enough water to produce 8,000 earloads of lettuce.

With the protection of flood pre-



White Tanks project area with protected farmlands, communities, and installations at right.



Irrigating leveled field of fall lettuce from concrete-lined ditch.

vention, more farmers turned to such high-cost, high-income crops as lettuce, asparagus, and grapes. Their per-acre gross income rose from less than \$200 to better than \$400 between 1950 and 1960. The 36 miles of farm roads paved since 1954 is 10 miles more than all the roads previously paved. A million-dollar housing development has been built adjacent to one of the White Tanks dams. Census figures show that the towns of Goodyear and Avondale have more than doubled in population, and assessed valuation of property in these two incorporated towns tripled between 1950 and 1960.

The multi-million dollar Phoenix Air Defense Center has been established at Luke Air Force Base, and the Capehart Housing Project of 1,000 homes has been built on land that was under water during the 1951 floods. Three thousand acres of fertile land, previously abandoned, has been reclaimed and is producing crops valued at more than \$1 million a year.

This is a typical comment by those who are benefiting directly

Nation's First Small-Watershed Project Spurs Arizona Area's Economy

By Julian J. Turner

THE Nation's first small-watershed project to be completed continues to pay individual and community dividends in increased income and expanded business and public improvements.

It is the White Tanks pilot watershed protection project in Maricopa County, Ariz. Two flood-retarding dams were built in 1954 through the pilot flood-prevention program; and 9-mile-long McMicken Dam was finished in 1956 by the Corps of Army Engineers to control flooding on the Trilby Wash portion of the watershed. Together, they made reality the dream of local leaders as early as the 1920's and 1930's of protecting the fertile, newly irrigated desert lands, and the growing communities lying between the usually dry Agua Fria River and the White Tank, Wickenburg, and Hieroglyphic Mountains to the west and north.

For a quarter of a century, the Agua Fria story was basically one of local leaders with vision, determination, and a deep sense of community responsibility working together and with all available agencies of Government to solve their watershed problems of land management, soil and moisture conservation, and flood prevention. It included their enlisting the cooperation of the Soil Conservation Service in demonstrations in the early 1940's, before World War II slowed them down, and organization of the Agua Fria Soil Conservation District in 1945.

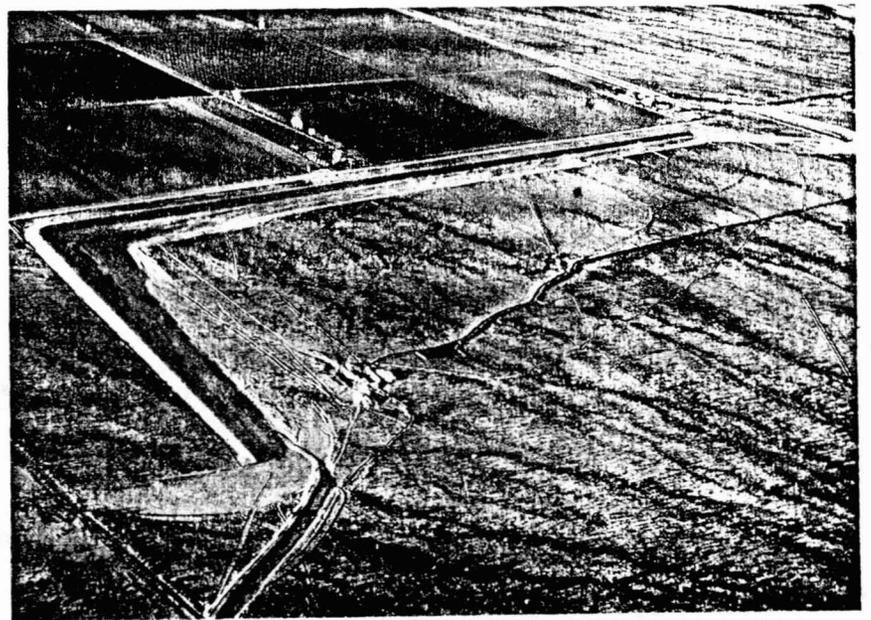
Note:—The author is State conservation engineer, Soil Conservation Service, Phoenix, Ariz.

The story also included preparation of detailed flood-prevention plans after World War II, based on a preliminary engineering report prepared by SCS in 1941; and agreement of the Maricopa County Municipal Water Conservation District No. 1, an irrigation district comprising about one-half of the irrigated lands of the soil conservation district, to lend the Agua Fria district equipment for clearing brush and digging test pits and to contribute other services.

Efforts were spurred by frequent damaging flash floods from heavy rains on the sparsely vegetated desert watershed, culminated in August 1951 when direct flood damage from a single storm amounted to \$3 million. Rich farmlands and ripening crops were

washed away, miles of highways and many sections of railroad tracks were washed out, and telephone lines were swept away. Luke Air Force Base and roads leading to it were inundated. Training of combat pilots vitally needed in Korea was suspended for several days. Homes of people living on farms in the town of Litchfield Park, Goodyear, and Avondale were damaged severely. The aircraft plant and the Litchfield Naval Air Facility were under water.

With \$34,000 of 1952 Production and Marketing Administration funds and \$108,000 contributed by the irrigation district, and with SCS technical direction, a dam 4 miles long and 23 feet high was built that effectively controlled all nine subsequent floods



One of White Tanks dams with protected irrigated land (upper left).

dams was made a dual-purpose structure to store 190,500,000 gallons of water as an extra supply for Culpeper, or more than half a year's supply at the present rate of consumption. The other two dams are wholly for flood prevention.

The entire Mountain Run watershed project cost \$545,000, of which \$377,000 was the local share and only \$168,000 the Federal Government's share, primarily for the flood-prevention part of the project. For every dollar spent on the project, a return of \$1.18 in benefits is being realized. Here are some of those benefits in communitywide rural area improvement:

Because of plentiful water and protection from flooding, things are looking up in the Culpeper area. Three new industries have set up branches there, and others have sought information about possible sites. Without the watershed development, there would be none—nor the new jobs now open to several hundred local people.

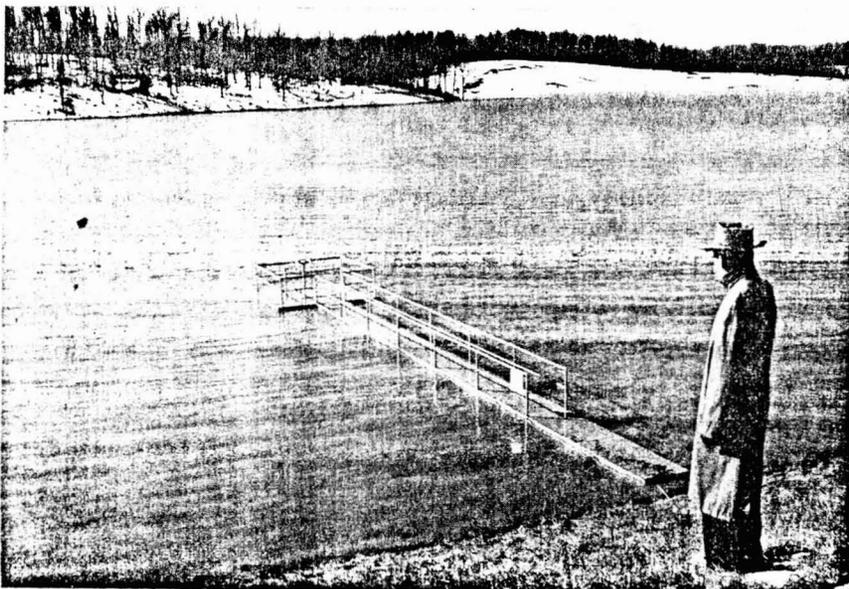
Culpeper also now has a new hospital, the building of which likewise had been held up because of lack of water. And new home developments, made possible by the extension of water mains, are go-

ing up, along with a shopping center on a previously swampy area.

The town of Culpeper has eliminated most of its flood hazards; and once-hazardous flood plains are being converted to higher value uses for farming and commerce, broadening the community's tax base in the process. Roads in the watershed have been protected and beautified by roadbank erosion control measures.

The entire trading and residential area has been enhanced by the three new lakes, with total maximum flood pool storage capacity of 2,860 acre-feet, and by the channel improvements. Recreational space has been multiplied for boating and fishing; and a 4-acre picnic area is being developed at Mountain Run Lake, the first park ever developed in Culpeper County.

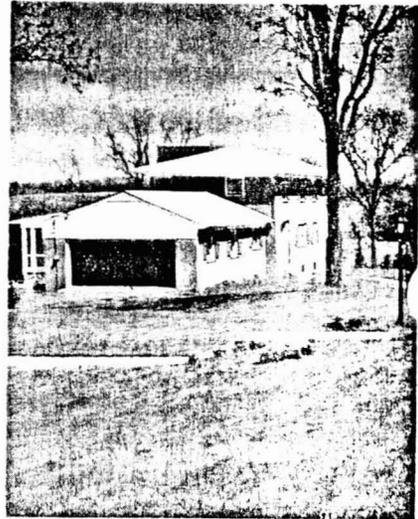
While the town of Culpeper is enjoying these many benefits from the Mountain Run watershed project, perhaps the greatest gains will come to the area's agricultural land in reduced flood damages. Protection and improvement of the farmland through stepped-up application of conservation measures makes possible more intensive and profitable use of that land



New Lake:—SCS WUC L. B. Henretty has reason to admire dual-purpose lake supplying Culpeper's new water.



New Hospital:—Water developed in watershed project made it possible.



New Homes:—Extra water made them possible, too.

and increases farm values.

These and other returns from the Mountain Run project explain why it was selected over all other watershed developments in the country to receive the National Watershed Congress' "Watershed Project of the Year" award for 1961. Meanwhile, the people of the Culpeper area are happy over their bargain of so many substantial returns for their investment, and the low cost of only \$1,160 a year to maintain and operate the project.

Note:—The author is field information specialist, Soil Conservation Service, Upper Darby, Pa.

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency - - - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets - - - - -	- - - - -	- - - - -	4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - - -
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00
Benefit - cost ratio	1.7 to 1		

Arizona
 Reichhead Aug. 30, 1971
 Watershed Projects

Preparation of State Stories

1 4

Completed	Completed Date	Total Area In Acres	Flood Damage Reduction (Dollars)
<u>White Tanks</u>	1954	59,136	\$ 250,000 1' 50,000 3'
			Subtotal \$ 300,000
Frye Creek Stockton Wash	1965	153,714	\$ 825,000 3'
Florence Area	1966	55,702	\$ 570,000 4'
		<u>268,552</u>	<u>Total</u>

Virgin Valley
 3,950 in Mohave County (27,300 Ac Total)
 271,502 \$ 1,695,000

Operation	Total Area In Acres	Flood Damage Reduction (Dollars)
Magma	70,064	\$ 887,000 5'
Vanar 32,723 in Az	47,772	\$ 90,000 6'
Buckhorn-Mesa	69,172	
Apache Junction Gilbert	89,983	
Williams - Chandler	154,976	
Buckeye	128,319	
Havqua Lake Valley	239,360	
Fredonia	7,965	
	<u>792,562</u>	<u>\$ 977,000</u>

1,064,064 Ac \$ 2,672,000
 Includes 3,950 Virgin Valley
 32,723 Vanar Wash

Arizona
Reichhead
Watershed Projects

Aug. 30, 1971

Preparation of State Stories

2 4

- 1/ White Tanks Pilot Project - "Flood damage prevention benefits from minor floods to date are estimated to be \$250,000" Arizona Watershed Progress Report (Public Law 566) Jan. 1970 p. 2
- 2/ White Tanks Pilot Project - 8/27/71 Telephone call to Bill Turner - Structure No. 4 contained 1,000 AcFt. from Sept 1970 flood.
Economics Guide for Watershed Protection and Flood Prevention ch 3 p. 150
White Tanks Watershed Acres Flooded Per Acre-Foot = 1.2 @ \$45.45
1,000 AcFt Floodwater Stored x 1.2 = 1,200 Acres could have been flooded
1,200 Ac Flood x \$45.45 = \$54,540 @ 50,000
- 3/ Frye Creek - Stockton Wash - In addition to the more than \$825,000 estimated savings from flood damage since the first portion of the project was completed in 1962 - " Arizona Watershed Progress Report (Public Law 566) Jan. 1971 p. 2
No storage last fiscal year - Turner + Watt
- 4/ Florence Area: Friday Aug 15, 1971 Watt + G. England report stored water at the 56' elevation Bill Turner reported that floodwaters had been to the bottom of principle spillway at an earlier time. I therefore estimate one flood storage at the 55' el. + one at the 56' el.
Watt 10-19-65 Water Surface Elev vs Prevented Damages

Water Surface Elev	Prevented Damage	Storage Ac Ft
1553	\$150,000	720
1556	420,000	1,470
Total \$570,000		2,190

5/ Magma - Water Depth - Prevented Damage Relation Watt 11-3-66 + Turner This damage figure includes floods of 8/3/71 and 8/19/71

6/ Vanar - Turner felt flood was about twice the size of the 1961 flood
Watershed Work plan

p. 9: 3,284 cultivated acres

p. 10: 1961 Flood - reoccurring frequency of about seven years, over 1700 acres were inundated $1/7 = 14.28\%$ Frequency

p. 10: 1961 Floodwater \$52,500

p. 11: 1961 Sediment 24,500

1961 Indirect 6,160

\$63,160 $(52,500 + 24,500) \times .08 = 6,160$

0.7242 $(34,780 \div 48,020 = 0.7242)$ [p. 26]

\$60,224

Saved \$60,000 if near 1961 size flood

Watt - Design for 97% Event 80% Capacity washed out rip rap 1971

$\therefore 1700 \text{ Ac} \times 2 = 3,400$ more than in w/s so estimate 3284 Ac = 3400 Ac = 96.58%

$96.58\% \times 80\% \text{ Capacity} = 77\%$ $60,000 \times 2 = 120,000 \times 0.77 = 92,400$ @ 90,000

Summer which to be
and field

State ARIZ. Project White Tank Dams 3+4
 Subject Maintenance Costs Per Beardley Proj.
 Job No. _____ Date 1-31-63 By JGH Sheet No. 1

Item	YEAR		
	1960	1961	1962
Labor	\$ 367	\$ 423	632
Industrial Insurance	7	9	13
Materials + Supplies	9	212	8
Equipment Rental	<u>640</u>	<u>60</u>	<u>70</u>
	\$ 1023	\$ 704	\$ 715

This average cost of \$814 per year represents maintenance on two earth embankments from 5 to 30' in height totaling 2.8 miles in length.

Cost per mile per year has been \$290/mi/yr.

Wagon

Field - \$1,073

Chassis

from field \$430

Concrete Ditches 460

earth & rock 6916

State ARIZ. Project M. MICKEN DAM.
 Subject Maintenance Costs Re. Bardsky Project Records
 Job No. _____ Date 1-31-63 By J. J. Gunn Sheet No. 1

Item	Year		
	1960	1961	1962
Labor	\$ 2629	\$ 1044	\$ 823
Industrial Insurance	53	21	17
Material & Supplies	786	1351	983
Equipment Rental	1080	267	433
	\$ 4,528	\$ 2,683	\$ 2,256

This average cost of \$3,156 represents the cost of maintenance on 9.3 miles of earth embankment from to 40 in height and 3.4 miles of earth channel having a bottom width of about 50'.

Cost of channel maintenance has not been kept separate but is estimated to be 10% of total.

Cost per mile of dam maintenance = $\frac{3,156}{9.3} = 316$
 $\frac{2,840}{9.3} = 305$ /mile /year.

Cost of maintenance of earth channel
 $\frac{316}{3.4} = \$93$ /mile/year.

Note: This should be doubled for a channel that receives tailwater or is wetted often than twice per year.

COMPUTATION SHEET

State ARIZ. Project M^c MICKEN DAM.
 Subject Maintenance Costs B. Bondsky Project Records
 Job No. _____ Date 1-31-63 By J. J. Munn Sheet No. 1

Item	YEAR		
	1960	1961	1962
Labor	\$ 2609	\$ 1044	\$ 823
Industrial Insurance	53	21	17
Material + Supplies	786	1351	983
Equipment Rental	<u>1080</u>	<u>267</u>	<u>433</u>
	\$ 4,528	\$ 2,683	\$ 2,256

This average cost of \$3,152 represents the cost of maintenance on 9.3 miles of earth embankment from 10 to 40' in height and 3.4 miles of earth channel having a bottom width of about 50'.

Cost of channel maintenance has not been kept separate but is estimated to be 10% of total.

Cost per mile of dam maintenance = $\frac{3,156}{9.3} = 339.35$

$\frac{316}{3.4} = 93$

$\frac{2,840}{9.3} = 305$

Cost of maintenance of earth channel

$\frac{316}{3.4} = \$93/\text{mile}/\text{year}$

Note: This should be doubled for a channel that recedes tailwater or is wetted other than twice per year.

COMPUTATION SHEET

State ARIZ. Project White Tank Dams #3 & 4.
Subject Maintenance Costs Per Year
Job No. _____ Date 1-31-63 By J. J. V. Sheet No. 1

Item	YEAR		
	1960	1961	1962
Labor	\$ 367.	\$ 423	632
Industrial Insurance	7.	9	13
Materials & Supplies	9.	212	9
Equipment Rental	<u>640</u>	<u>60</u>	<u>70</u>
	\$ 1023	\$ 704	\$ 715

This average cost of \$814 per year represents maintenance on two earth embankments from 5' to 30' in height totaling 2.8 miles in length.

Cost per mile per year has been \$290/mi./yr.

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of E
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Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - -			4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - - :	196,057.00		180,000.00
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Estimated annual cost of project			
(50 yr. amortization) - - - - :	20,860.00		115,000.00
Estimated annual benefits - - - - :			
(50 yr. amortization) - - - - :	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1

*benefit cost of \$25/yr.
= 3 1/2 / 100 / yr.*

*benefit cost of
3,220/yr. is
1/31 of 100/yr.*

FLOOD PREVENTION

*Suggested special
for guidelines with the
Louisiana Banker - cons.
prep. 7/22/71*

The Hieroglyphic Mountains to the north of us and the WHITE TANK Mountains to our west with their deserts have been the source of devastating floods in the past.

The irrigated lands between us and the WHITE TANK Mountains sustained a severe flood in 1941 and numerous nuisance-type floods during the late 1940's and the AGUA FRIA SCD assumed leadership for flood prevention.

In late August 1951 a storm of the frequency of once in one hundred years caused \$3,000,000 damage - "PRE-INFLATION DAMAGE.

In addition LUKE AIR FORCE BASE was closed for 3 days at the height of the KOREAN WAR.

LUKE gives fighter pilots their final training before shipment to war zones! Senator CARL HAYDEN and Congressman JOHN RHODES and others became active in pushing FLOOD PREVENTION legislation in Congress.

When the PILOT WATERSHED PROGRAM was inaugurated in 1953 the AGUA FRIA SCD and the SCS had plans and specifications ready for contract and in the summer of 1954 completed the two WHITE TANK DAMS near the base of the mountains to the west. THIS WAS THE FIRST "PILOT PROJECT" CONTRACT TO BE COMPLETED IN THE U.S.

The CORPS OF ENGINEERS completed the MCMICKEN Dam that you see over there in 1956.

The MCMICKEN Dam is NINE MILES long and will retard a 24,000 acre-feet storm.

Since construction of this and the two SCS-SCD built dams there has been no flood damage from the watersheds.

One of these dams filled and spilled only last LABOR DAY WEEKEND. THERE WAS NO DAMAGE BELOW THE DAM.

Much development and many beautiful homes have been added to the flood plain and should the 1951 \$3,000,000-damage storm occur again next August, WITHOUT the dams damage might amount to 13 or 15 MILLION DOLLARS.

File
White Tanks
Phoenix W.U.

INVITATION NO. REG. 6-3202

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SCHEDULES, SPECIFICATIONS AND GENERAL CONDITIONS
FOR THE CONSTRUCTION OF EARTH FILLED DIKES KNOWN
AS WHITE TANKS STRUCTURES NUMBERS 3 AND 4.

JOB SITE: MARICOPA COUNTY, ARIZONA,
APPROXIMATELY 26 MILES WEST OF PHOENIX,
ARIZONA.

BIDS WILL BE RECEIVED IN THE
OFFICE OF THE SOIL CONSERVATION
SERVICE, 106 BROADWAY, S. E.,
P. O. BOX 1348, ALBUQUERQUE,
NEW MEXICO, UNTIL 2:00 P.M.,
MST, FEBRUARY 8, 1954

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Bid Form (Standard Form 21)
Instructions to Bidders (Standard Form 22)
Bid Bond (Standard Form 24)

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4	Water	1
5	Contractor's Liability	1 & 2
6	Quantities and Unit Prices	2
7	Staking Out Work	2
8	Bench Marks and Survey Stakes	2
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13	Construction Program	3
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Part I. General Provisions

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INVITATION FOR BIDS
(CONSTRUCTION CONTRACT)

Invitation No. Reg. 6-3202

DATE
January 14, 1954

NAME AND LOCATION OF PROJECT

White Tanks Structures Numbers 3 and
4, Maricopa County, approximately
26 miles west of Phoenix, Arizona.

DEPARTMENT OR AGENCY

U. S. Department of Agriculture
Soil Conservation Service

BY (Issuing office)

Soil Conservation Service
P. O. Box 1348
Albuquerque, New Mexico

Sealed bids in single copy for furnishing all labor, equipment, and materials and performing all work for the project described herein will be received until 2:00 p.m., MST, February 8, 1954,

in office of Chief, Administrative Services Division, Balcomb Building, 106 Broadway, S. E., Albuquerque, New Mexico

and then publicly opened.

Information regarding bidding material, bid guarantee, and bonds

Interested bidders may obtain a set of plans covering the proposed work from Soil Conservation Service, DeBerge Building, 39 North Sixth Avenue, Phoenix, Arizona, or Soil Conservation Service, 106 Broadway S. E., P. O. Box 1348 Albuquerque, New Mexico.

Bidders desiring to visit proposed work site should make arrangements through Mr. William E. Anderson, Engineer, Soil Conservation Service, DeBerge Building, 39 North Sixth Avenue, Phoenix, Arizona.

Each bidder must submit with his bid a bid guarantee in an amount equal to and not less than 10 per cent of the total bid. Guaranty may be in the form of a bid bond on Standard Form 24, copy enclosed, or as provided in Article 4, Standard Form 22. Should the bidder elect to submit a bid guarantee in the form of a postal money order or certified or cashier's check, the money order or check must be made payable to: Treasurer of the United States. When individual sureties are offered, there must be two sureties, each of whom shall justify in the full amount of the bond.

~~XXXXXXXXXXXX~~
Description of Work The successful bidder will be required to execute Standard Form 23 "Construction Contract", furnish performance bond on Standard Form 25, and payment bond on 25A. Performance bond to be equal to 100 per cent and payment bond, 50 per cent of total contract amount. These forms will be furnished to the successful bidder after acceptance of his bid.

Description of Work: Construction of earth filled dikes known as White Tanks Structures Numbers 3 and 4, located in Maricopa County, approximately 26 miles west of Phoenix, Arizona.

Information regarding liquidated damages (if any), payments, etc., is attached or made a part of the specifications. Bids shall be submitted on the forms furnished or copies thereof.

LIQUIDATED DAMAGES: Liquidated damages for delay will be assessed at the rate of fifty dollars (\$50.00) per day for each calendar day's delay until the work is satisfactorily completed. (See Article 5, Standard Form 23A).

PAYMENTS: Payments to the contractor will be made in accordance with Article 7, Standard Form 23A.

Any invoice or voucher submitted for a partial or final payment under this contract MUST contain the following certifications:

I certify that the above bill is correct and just and that payment therefor has not been received.

I certify that I have complied with all the labor regulations pertinent to this contract, as prescribed by the Secretary of Labor.

.....

STANDARD GOVERNMENT FORMS. The following forms, referred to herein, are either included in this invitation, or are available for inspection as indicated below:

<u>U. S. Standard Form</u>	<u>Title</u>
* No. 20 (Revised March 1953)	Invitation for bids
* No. 21 (Revised March 1953)	Bid Form
* No. 22 (Revised March 1953)	Instructions to Bidders
* No. 23 (Revised March 1953)	Construction Contract
* No. 23A (Revised March 1953)	General Provisions
* No. 24 (Revised Nov. 1950)	Bid Bond
** No. 25 (Revised Nov. 1950)	Performance Bond
** No. 25A (Revised Nov. 1950)	Payment Bond

* Included - U. S. Standard Forms Nos. 23 and 23A are marked "Sample" and are included for the information of prospective bidders. These "Sample" forms should be detached and retained by the bidder for future reference. They will not be furnished with future invitations for bids, but will be incorporated into the invitations by reference only.

** Forms are available for inspection at the offices indicated on Standard Form 20.

INSTRUCTIONS TO BIDDERS (CONSTRUCTION CONTRACTS)

(These instructions are not to be incorporated in the contract)

1. *Explanation to Bidders.* Any explanation desired by bidders regarding the meaning or interpretation of the drawings and specifications must be requested in writing and with sufficient time allowed for a reply to reach them before the submission of their bids. Oral explanations or instructions given before the award of the contract will not be binding. Any interpretation made will be in the form of an addendum to the specifications or drawings and will be furnished to all bidders and its receipt by the bidder shall be acknowledged.

2. *Conditions at Site of Work.* Bidders should visit the site to ascertain pertinent local conditions readily determined by inspection and inquiry, such as the location, accessibility and general character of the site, labor conditions, the character and extent of existing work within or adjacent thereto, and any other work being performed thereon.

3. *Bidder's Qualifications.* Before a bid is considered for award, the bidder may be requested by the Government to submit a statement of facts in detail as to his previous experience in performing similar or comparable work, and of his business and technical organization and financial resources and plant available and to be used in performing the contemplated work.

4. *Bid Guaranty.* Where security is required, failure to submit the same with the bid may be cause for rejection. The bidder, at his option, may furnish a bid bond, postal money order, certified check, or cashier's check, or may deposit, in accordance with Treasury Department regulations, bonds or notes of the United States (at par value) as security in the amount required: *Provided*, That where the total amount of the bid is \$2,000 or less, the contracting agency may declare a bid bond unacceptable by so stating in the specifications or Invitation for Bids.

In case security is in the form of postal money order, certified check, cashier's check, or bonds or notes of the United States, the Government may make such disposition of the same as will accomplish the purpose for which submitted.

Checks may be held uncollected at the bidder's risk. Checks, or the amounts thereof, and bonds or notes of the United States deposited by unsuccessful bidders will be returned as soon as practicable after the opening.

5. *Preparation of Bids.* (a) Bids shall be submitted on the forms furnished, or copies thereof, and must be manually signed. If erasures or other changes appear on the forms, each such erasure or change must be initialed by the person signing the bid.

(b) The form of bid will provide for quotation of a price, or prices, for one or more items which may be lump sum bids, alternate prices, scheduled items resulting in a bid on a unit of construction or a combination thereof, etc. Where required on the bid form, bidders must quote on all items and *they are warned* that failure to do so may disqualify the bid. When quotations on all items are not required, bidders should insert the words "no bid" in the space provided for any item on which no quotation is made.

(c) Alternative bids will not be considered unless called for.

(d) Unless specifically called for, telegraphic bids will not be considered. Modification by telegraph of bids already submitted will be considered if received prior to the time fixed in the Invitation for Bids. Telegraphic modifications shall not reveal the amount of the original or revised bid.

6. *Submission of Bids.* Bids must be submitted as directed on the bid form.

7. *Receipt and Opening of Bids.* (a) Bids will be submitted prior to the time fixed in the Invitation for Bids. Bids received after the time so fixed are late bids; and the exact date and hour of mailing such bids, as shown by the cancellation stamp or by the stamp of an approved metering device will be recorded. Such late bids will be considered, *Provided*, They are received before the award has been made, *And provided further*, The failure to arrive on time was due solely to a delay in the mails for which the bidder was not responsible; otherwise late bids will not be con-

sidered but will be held unopened until the time of award and then returned to the bidder, unless other disposition is requested or agreed to by the bidder.

(b) Subject to the provisions of paragraph 5(d) of these instructions, bids or bid modifications which were deposited for transmission by telegraph in time for receipt, by normal transmission procedure, prior to the time fixed in the Invitation for Bids and subsequently delayed by the telegraph company through no fault or neglect on the part of the bidder, will be considered if received prior to the award of the contract. The burden of proof of such abnormal delay will be upon the bidder and the decision as to whether or not the delay was so caused will rest with the officer awarding the contract.

(c) No responsibility will attach to any officer for the premature opening of, or the failure to open, a bid not properly addressed and identified.

8. Withdrawals of Bids. Bids may be withdrawn on written or telegraphic request received from bidders prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

9. Bidders Present. At the time fixed for the opening of bids, their contents will be made public for the information of bidders and others properly interested, who may be present either in person or by representative.

10. Bidders Interested in More than One Bid. If more than one bid be offered by any one party, by or in the name of his or their clerk, partner, or other person, all such bids will be rejected. A party who has quoted prices to a

bidder is not thereby disqualified from quoting prices to other bidders or from submitting a bid directly for the work.

11. Award of Contract. (a) The contract will be awarded as soon as practicable to the lowest responsible bidder, price and other factors considered, provided his bid is reasonable and it is to the interest of the Government to accept it.

(b) The Government reserves the right to waive any informality in bids received when such waiver is in the interest of the Government. In case of error in the extension of prices, the unit price will govern.

(c) The Government further reserves the right to accept or reject any or all items of any bid, unless the bidder qualifies such bid by specific limitation; also to make an award to the bidder whose aggregate bid on any combination of bid items is low.

12. Rejection of Bids. The Government reserves the right to reject any and all bids when such rejection is in the interest of the Government; to reject the bid of a bidder who has previously failed to perform properly or complete on time contracts of a similar nature; and to reject the bid of a bidder who is not, in the opinion of the Contracting Officer, in a position to perform the contract.

13. Contract and Bonds. The bidder to whom award is made shall, within the time established in the bid and when required, enter into a written contract with the Government and furnish performance and payment bonds on Government Standard Forms. The bonds shall be in the amounts indicated in the specifications or the Invitation for Bids.

STANDARD FORM 21
REVISED MARCH 1953
GENERAL SERVICES ADMINISTRATION
GENERAL REGULATION NO. 15

BID FORM
(CONSTRUCTION CONTRACT)

REFERENCE

Invitation No. Reg. 6-3202

*Read the Instructions to Bidders (Standard Form 22)
This form to be submitted in*

DATE OF INVITATION

January 14, 1954

NAME AND LOCATION OF PROJECT

White Tanks Structures Number 3 and 4. Maricopa County, approximately
26 miles west of Phoenix, Arizona.

TO: Soil Conservation Service
P. O. Box 1348
Albuquerque, New Mexico

(Date)

In compliance with your invitation for bids of the above date, the undersigned hereby proposes to furnish all labor, equipment, and materials and perform all work for the construction of earth filled dikes known as White Tanks Structures Number 3 and 4

at Job site: Maricopa County, approximately 26 miles west of Phoenix,
Arizona.

in strict accordance with the specifications, schedules, drawings, and conditions for the consideration of the following amount(s)

and agrees that, upon written acceptance of this bid, mailed, or otherwise furnished, within calendar days (60 calendar days unless a shorter period be inserted by the bidder) after the date of opening of bids, he will within 10 calendar days (unless a longer period is allowed) after receipt of the prescribed forms, execute Standard Form 23, Construction Contract, and give performance bond and payment bond on Government standard forms, if these forms are required, with good and sufficient surety or sureties.

The undersigned agrees that if awarded the contract, he will commence the work within 20 calendar days after the date of receipt of notice to proceed, and that he will complete the work in 210 calendar days after the date of receipt of notice to proceed.

The undersigned acknowledges receipt of the following addenda to the drawings and/or specifications (Give number and date of each):

The undersigned represents (Check appropriate boxes): (1) that the aggregate number of employees of the bidder and its affiliates is 500 or more, less than 500; (2) (a) that he has, has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure this contract; and (b) that he has, has not, paid or agreed to pay to any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract, and agrees to furnish information relating thereto as requested by the contracting officer. (Note: For interpretation of the representation, including the term "bona fide employee," see General Services Administration Regulations, Title 44, secs. 150.7 and 150.5 (d) Fed. Reg., Dec. 31, 1952, Vol. 17, No. 253.)

Enclosed is bid guarantee, consisting of

in the amount of

OF FIRM OR INDIVIDUAL (Type or print)	FULL NAME OF ALL PARTNERS (Type or print)
BUSINESS ADDRESS (Type or print)	
BY (Signature in ink. Type or print name under signature)	
TITLE (Type or print)	
STATE OF INCORPORATION (Type or print)	

DIRECTIONS FOR SUBMITTING BIDS

Envelopes containing bids, guarantee, etc., must be sealed, marked, and addressed as follows:

Bid for Construction

To be opened: 2:00 p.m., MST
February 8, 1954

Soil Conservation Service
P. O. Box 1348
Albuquerque, New Mexico

CAUTION: Do not include in the envelope any bids for other work.
Bids should not be qualified by exceptions to the bidding conditions.

BID BOND
 (See Instructions on Reverse)

DATE BOND EXECUTED

PRINCIPAL

SURETY

PENAL SUM OF BOND (express in words and figures)

DATE OF BID

KNOW ALL MEN BY THESE PRESENTS, That we, the **PRINCIPAL** and **SURETY** above named, are held and firmly bound unto the United States of America, hereinafter called the Government, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.
THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal has submitted the accompanying bid, dated as shown above, for

NOW THEREFORE, if the principal shall not withdraw said bid within the period specified therein after the opening of the same, or, if no period be specified, within sixty (60) days after said opening, and shall within the period specified therefor, or, if no period be specified, within ten (10) days after the prescribed forms are presented to him for signature, execute such further contractual documents, if any, as may be required by the terms of the bid as accepted, and give bonds with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of the resulting contract, and for the protection of all persons supplying labor and material in the prosecution of the work provided for in such contract, or in the event of the withdrawal of said bid within the period specified, or the failure to enter into such contract and give such bonds within the time specified, if the principal shall pay the Government the difference between the amount specified in said bid and the amount for which the Government may procure the required work, supplies, and services, if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:

WITNESS

INDIVIDUAL PRINCIPAL

- 1. _____ as to _____ [SEAL]
- 2. _____ as to _____ [SEAL]
- 3. _____ as to _____ [SEAL]
- 4. _____ as to _____ [SEAL]

WITNESS

INDIVIDUAL SURETY

- 1. _____ as to _____ [SEAL]
- 2. _____ as to _____ [SEAL]

Attest:

CORPORATE PRINCIPAL

BUSINESS ADDRESS

BY

TITLE

AFFIX
CORPORATE
SEAL

Attest:

CORPORATE SURETY

BUSINESS ADDRESS

BY

TITLE

AFFIX
CORPORATE
SEAL

PROPOSAL

The Bid Schedule following, lists the various divisions of construction contemplated in these specifications. It is expressly understood that all the various phases of work enumerated in the plans and specifications, with all their individual jobs and overhead, whether specifically enumerated, included by implication or appurtenant thereto are to be performed by the contractor under one of the items in the schedule, irrespective of whether it is named in said list.

Bids will be considered on the following schedules, and offers for only a part thereof will not be for consideration. A contract will be awarded to the lowest responsible bidder whose proposal fully conforms to the requirements of the Invitation to Bid as may be deemed most advantageous to the Government. Bids will be evaluated on the basis of the lowest aggregate price.

A bid may be rejected if the bidder fails to furnish bid security or to submit the data required with his bid or cannot show that he has the necessary capital and experience, and owns, controls, or can procure the necessary equipment to commence the work at the time prescribed in the invitation and thereafter to prosecute and complete the work at the rate or time specified; and that he is not already obligated for the performance of other work which would delay the commencement, prosecution or completion of the work contemplated in this invitation.

BID SCHEDULE

<u>Item No.</u>	<u>Article or Services</u>	<u>Quantity</u>	<u>Unit</u>	<u>Price</u>	<u>Total</u>
1	Cleaning and Stripping	1	job	xxx	\$ _____
2	Excavation	1280	cu. yds.	\$ _____	\$ _____
3	Subgrade Preparation	1	job	xxx	\$ _____
4	Earth Fill (Structure No. 3)	Approx. 375,000	cu. yds.	\$ _____	\$ _____
5	Sprinkling Embankment Materials (Structure No. 3)	Approx. 375,000	cu. yds.	\$ _____	\$ _____
6	Earth Fill (Structure No. 4)	Approx. 175,000	cu. yds.	\$ _____	\$ _____
7	Sprinkling Embankment Materials (Structure No. 4)	Approx. 175,000	cu. yds.	\$ _____	\$ _____
8	Rolling	Approx. 550,000	cu. yds.	\$ _____	\$ _____

Note: Bidders are invited to review Technical Specifications attached for clarification of the work involved under the above items.

EVALUATION OF BIDS AND AWARD: Only one contract will be awarded for the entire job, namely, to the lowest responsible bidder for Items 1 through 8. In case of variation between unit price and totals shown by the bidders, the unit price will be considered to be the bid. All bids must be for the entire job and must have each blank space filled in. The price bid for each item must allow for all collateral, overhead, or indirect cost connected with it.

1. EXPERIENCE: (See Article 3, Standard Form 22)

The bidder is requested to furnish below a statement of his experience in performing similar or comparable work as described herein. Also furnish name and address of at least two individuals or companies that are familiar with your qualifications.

2. STATEMENT ESTABLISHING PERMANENT PLACE OF BUSINESS AND FINANCIAL STATUS:
(See Article 3, Standard Form 22)

Bidder is requested to furnish a brief statement as to his net worth (exclusive of plant and equipment), credit rating, or other information which will establish his ability to properly finance the work covered herein:

(a) Name and address of financial references:

3. PLANT AND EQUIPMENT TO BE USED ON THE WORK: (See Article 3, Standard Form 22).

Under the headings shown below, bidder is requested to list and describe all equipment (i.e., trucks, tractors, draglines, etc.,) which will be required to properly perform the work.

Quantity Type Manufacturer Capacity Age Condition

RATES OF WAGES. (See Articles 20 through 26, Standard Form 23A)

Pursuant to the provisions of the Davis-Bacon Act, as amended, 40 U.S.C. 276(a) et seq., the Secretary of Labor by Decision N-5437 has determined that the following rates of wages are the prevailing rates of wages for the classifications specified in the locality of the work covered by these specifications, and said rates of wages shall be the minimum rates per hour to be paid for the work covered by these specifications. The following wage rates are effective November 6, 1953.

<u>Classification</u>	<u>Per Hour</u>	<u>Classification</u>	<u>Per Hour</u>
Laborers, general or construction	1.925	Truck Drivers: (Continued)	
Power Equipment Operators:		Industrial lift truck driver	2.00
Material loader or conveyor	2.25	Water truck driver-under 2500 gal.	2.05
Motor patrol, including any type of power blade	2.625	Water truck driver-2560 gal. but less than 7000 gal.	2.175
Oshkosh, M, Tournapull, Terra Cobra, Euclid and similar equipment	2.625	Water truck driver-7000 gal. or more	2.30
Roller	2.45	Shop greaser and/or tireman	2.05
Skip loader - wheel type	2.375	Heavy duty repairman and/or welder	2.50
Tow blade or grader	2.375	Heavy duty repairman helper and/or welder helper and/or field equipment serviceman helper	2.125
Tractor hi-lift shovel	2.70	Field equipment serviceman	2.25
All wheel-type tractor operators, except as otherwise classified	2.375	Dumpster Truck Drivers:	
Tractor - bulldozer, tamper or scraper	2.50	6.9 cu. yd. or less, water level capacity	2.125
Trenching machine	2.575	7 cu. yd. but less than 16 cy. yd. water level capacity	2.25
Universal equipment. (shovel, dragline, clamshell, derrick, and crane-both crawler and pneumatic type)	2.70	16 cu. yd. or more, water level capacity	2.35
Truck drivers:		Dumpster truck driver	2.35
Teamsters	1.925	Euclid type spreader truck driver	2.35
Dump trucks:		Ross carrier-driver	2.375
Less than 4 yds. water level capacity	2.00		
4 yds. but less than 8 yds. water level capacity	2.025		
8 yds. but less than 12 yds. water level capacity	2.075		
12 yds. but less than 16 yds. water level capacity	2.15		
16 yds. or more, water level capacity	2.35		
Flat rack:			
Less than 6-ton, legal payload capacity	2.00		
6-Ton but less than 10-Ton legal payload capacity	2.025		
10-Ton but less than 15-Ton legal payload capacity	2.075		
15-Ton but less than 20-Ton legal payload capacity	2.15		
20-Ton or more, legal payload capacity	2.35		

RATES OF WAGES (Continued)

The wage rates contained in this decision are straight hourly wage rates. In some areas, management and labor organizations in the construction industry have collectively bargained for health and welfare fund contributions. Such contributions are not included in wage rates determined by the Secretary of Labor for construction projects.

Any class of laborers and mechanics (including apprentices) not listed above, which will be employed on this contract, shall be classified or reclassified conformably to the foregoing schedule. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question, accompanied by the recommendation of the contracting officer, shall be referred to the Secretary of Labor for final determination.

Apprentices may be employed at wage rates specified herein (or if none are specified, at rates subsequently supplied and agreed to by the contracting parties) for such classifications.

GENERAL CONDITIONS

1. **SUBCONTRACTORS.** The contractor shall notify the contracting officer in writing of the names of all subcontractors proposed for the work, the extent of the work to be done by each, and the general terms and conditions of each proposed subcontract. If, for sufficient reason, at any time during the progress of the work, the contracting officer determines that any subcontractor is incompetent or undesirable, he will notify the contractor accordingly and immediate steps will be taken for cancellation of such subcontract. Subletting by subcontractors shall be subject to the same regulations. Nothing contained in this contract shall create any contractual relation between any subcontractor and the Government.

2. **CLIMATIC CONDITIONS.** The contracting officer or the Government Representative may order the contractor to suspend any work that may be subject to damage by climatic conditions, when, in his opinion, weather conditions are such as to prevent the work from being properly carried out. When delay is caused by such order, an extension of time may be granted but no claims for damage due to such delay will be considered by the Government. (See Article 5(c), Standard Form 23A). All stop and start orders shall be in writing.

3. **RIGHTS-OF-WAY.** All permanent rights-of-way and/or easements for the works to be constructed under the contract will be furnished the contractor. The work sites will be entirely within such rights-of-way. Use by the contractor of any adjacent property for ingress and egress to project site for working area, or for other purposes (i.e., temporary ingress and egress to the project site over and above those furnished, equipment parking areas, etc.), shall be the responsibility of the contractor. The right to enter, remove, alter or make use of any existing road, culvert, canal, pipeline, levee, lines of communication or improvement of any nature, or the trespassing on privately owned lands, shall be the responsibility of the contractor who shall indemnify and save the Government harmless from any and all claims for damages occasioned by such entering, removing, altering, using or trespassing.

In cases of serious interference to the work by delay of the Government in arranging for permanent rights-of-way or permanent or temporary easements, the contractor will be allowed an extension of time equivalent to the time lost by unavoidable delay in the completion of the contract as a result of the Government's failure to furnish the rights-of-way on time, but no damages will be allowed or paid for such delay.

4. **WATER.** Water for use in moistening the embankment materials will be furnished without charge by the Maricopa County Municipal Water Conservation District No. 1, otherwise known as the Beardsley Project. This water will be made available in the Beardsley Canal at the nearest point to the proposed work. Arrangements for delivery of water as required at these points shall be made by the contractor with the Superintendent of the Beardsley Project. Delivery of water from the canal to points of use will be a responsibility of the contractor and all costs incident thereto will be borne by the contractor and will be considered to be a part of the bid price for sprinkling and not as a separate item.

5. **CONTRACTOR'S LIABILITY.** All damage and loss (whether caused by fire, flood, or any other casualty or happening) to improvements or work to be constructed or performed pursuant to the contract (whether or not covered by partial payments made by the Government) shall be at the risk of the contractor until final acceptance of such improvements or work by the Government, and no such damage or loss shall relieve the contractor of, or in any way affect, his obligations to complete and deliver the work in accordance with the contract requirements, irrespective of any insurance carried by the contractor.

The contractor shall assume full responsibility and expense for removing, protecting, and returning to the work site, any and all equipment under his care, which might be endangered by said fires, flood, or happening; also, for any interference or delay in operations which might be caused by such incident(s).

Any re-clearing, re-excavation or re-filling made necessary by damage from floods, storms, or water of whatever source or quantity during the course of construction and until final acceptance by the Government, shall be performed by the contractor at his expense except as otherwise provided herein.

6. QUANTITIES AND UNIT PRICES. Any quantities shown in the bid schedule as approximations are solely for comparison and no claims shall be made against the Government for excess or deficiency therein, actual or relative. Payment at the prices agreed upon will be in full for the completed work and will cover materials, supplies, labor, tools, machinery, and all other expenditures incident to satisfactory compliance with the contract, unless otherwise specifically provided herein.

7. STAKING OUT WORK. The work to be done will be staked out by the Government.

8. BENCH MARKS AND SURVEY STAKES. Bench marks and survey stakes shall be preserved by the contractor, and in case of their destruction or removal by him or his employees, they will be replaced by the Government at the contractor's expense by deductions from payments due the contractor.

9. EXTRAS AND CHANGES: The contractor shall, when ordered in writing by the contracting officer, perform extra work not covered by the specifications or included in the schedules, but forming an essential part of the work contracted for. Such extra work will ordinarily be paid for at a lump-sum or unit price agreed upon by the contractor and the contracting officer and as stated in the order. Whenever in the judgment of the contracting officer, it is impracticable because of the nature of the work or for any other reason to fix the price in the order, the extra work shall be paid for at actual necessary cost as determined by the contracting officer, plus an allowance of ten (10) per cent, for superintendence, general expense, and profit. The actual necessary cost will include all expenditures for labor (including compensation insurance and social security taxes) furnished by the contractor, and a reasonable allowance for the use of his plant and equipment, where required, to be agreed upon in writing before the work is begun, but will in no case include any allowance for office expenses, general superintendence, or other general expenses.

The Government reserves the right to increase or decrease up to twenty-five (25) per cent, at the unit price shown, the unit quantities of work to be performed, as set forth in the schedule of work.

Contractor may request certain changes in plans to be made to facilitate the performance of work by the contractor. Such requests shall be made in writing to the contracting officer. Approval may be granted by the contracting officer when proposed changes are not detrimental to the work or to the best interests of the Government. (For further reference, see Articles 3 and 4, Standard Form 23A).

10. CLEANING UP. Upon completion of the work the contractor shall remove from the vicinity of the work all plant, buildings, rubbish, unused materials, concrete forms, and other like material, belonging to him or used under his direction during construction, and in the event of his failure to do so the same may be removed by the Government at the expense of the contractor, and his surety or sureties shall be liable therefor.

11. ACCIDENT PREVENTION AND SAFETY MEASURES. The contractor shall at all times exercise reasonable precautions for the safety of employees on the work and shall comply with all applicable provisions of Federal, State, and Municipal safety laws. The contractor shall indemnify and save harmless the Government from any and all claims for damages arising from loss of life, injury to person or damage to property due to operations of the contractor.

12. WORKING CONDITIONS. While the wage rates as determined by the Secretary of Labor are the minimum hourly rates required to be paid during the life of the contract, it is the responsibility of bidders to inform themselves as to the local labor conditions, such as the length of workday and workweek, overtime compensation, health and welfare contributions, labor supply, and prospective changes or adjustment of wage rates. The contractor shall abide by and conform to all applicable laws, executive orders, rules, regulations, and orders of Federal agencies authorized to pass upon and determine wage rates. No increase in contract prices shall be allowed or authorized on account of payment of wage rates in excess of those listed herein.

13. CONSTRUCTION PROGRAM. Within ten (10) calendar days after the date of receipt of notice to proceed, the contractor shall furnish the Government representative a complete construction program showing in detail his proposed program of operations. The construction program shall be in such form and in such detail as may be required by the Government representative. The contractor shall immediately advise the Government representative of any proposed changes in his construction program. If any construction program is inadequate to secure completion of the work within the specified period of time, or is otherwise not in accordance with the specifications, or the work is not being prosecuted adequately or properly, the Government representative shall have the right to require the contractor to submit a new construction program providing for proper and timely completion of the work and the contractor shall be entitled to no claim for additional compensation on account of such requirement.

14. APPLICABLE LAWS. The contractor, in the performance of this work, shall at all times observe and comply with, and shall cause his agents and employees to observe and comply with, any and all applicable laws, ordinances, statutes, regulations, etc., and shall hold and save the Government harmless from any and all claims or liabilities arising from or based upon the violation of any such law, ordinance, statute, regulation, etc., whether by himself or his employees or agents.

TECHNICAL SPECIFICATIONS

Part I. General Provisions

1. Definition of Terms:

Whenever in these specifications, or in any document or instrument where these specifications govern, the following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

Government: Government of the United States of America or its legally authorized representative.

Contractor: An individual, partnership, or corporation who has entered into a contract with the Government or his, their, or its duly authorized representative.

Materials: In addition to material incorporated in the project, equipment and other material used and/or consumed in the performance of the work.

Subcontractor: Those having a direct contract with the Contractor whereby labor and/or material worked to a special design according to the plans or specifications for this work is furnished, but does not include those who merely furnish material not so worked.

Contracting Officer: The duly authorized officer who executes the contract with the Contractor or his authorized representative who will be designated at the time the contractor is notified to proceed with the work.

Engineer: The Government Representative who will be designated at the time the Contractor is notified to proceed with the work.

Plans: The official plans, profiles, typical cross-sections, general cross-sections, working drawings, and supplemental drawings, or exact reproductions thereof, approved by the Engineer, which show the location, character, dimensions, and details of the work to be done, and which are to be considered as a part of the contract supplementary to these specifications.

Specifications: The directions, provisions, and requirements contained herein as supplemented by such special provisions as may be necessary, pertaining to the method and manner of performing the work or to the quantities and qualities of materials to be furnished under the contract.

2. Scope of Work:

The work to be done under these specifications consists of furnishing all labor, materials, equipment, methods and processes necessary for the construction and completion of two wet rolled earth filled dikes known respectively as White Tanks Structures No. 3 and No. 4. Both of these dikes are located at the foot of the east side of the White Tank Mountains and west of the Beardsley Irrigation Canal in Maricopa County, Arizona. Structure No. 3 is approximately 7,667 feet in length, approximately 30 feet in height at its maximum section and with a 10 foot crest width. It contains an estimated 375,000 cubic yards of embankment. There are three outlet structures to be installed in this structure. Structure No. 4 is approximately 6,839 feet in length with a maximum height of 20 feet and a 10 foot crest width. It contains an estimated 175,000 cubic yards of embankment with two outlet structures to be installed, and a spillway training dike at the west end. The total length of both structures is approximately 14,508 lineal feet, and the embankment totals 550,000 cubic yards, approximately. The outlet structures for these dikes will be installed by force account by crews of Maricopa County Municipal Water Conservation District No. 1. concurrently with the placement of embankment by the Contractor. All work shall conform to maps, plans, profiles, and specifications which are part of this contract and to such other drawings and directions relating thereto as may be furnished to the bidder prior to the opening of proposals, and to such drawings and directions in explanation of details or minor modifications as may be furnished from time to time during construction, including such minor modifications in plans and specifications as the Engineer may consider necessary on account of conditions found during the prosecution of the work. Scaled dimensions shall not be used in the construction of the work.

3. Sequence of Work: In view of the danger of summer floods originating in the White Tank Mountains, it is the intent that Structure No. 3 shall be completed first and that completion of this structure should be accomplished not later than July 1, 1954. The Contractor should have sufficient equipment and men on the job to insure that the completion date is obtained. Nothing in this paragraph will be construed as to prohibit work being carried forth on Structure No. 4 concurrently with Structure No. 3, providing the Contractor has adequate equipment available for this purpose.

In view of the extreme danger of flood damage during the summer rainy season, which normally starts about July 1, all work on Structure No. 4 subsequent to that date shall be accomplished in sections in such a manner that open floodways will be maintained through the structure to permit passage of floods which may occur during the course of construction. The closing of these floodways shall be done expeditiously and shall be scheduled at such time as weather conditions would indicate the probability of an extended period of clear weather sufficient for the purpose.

While it is intended that Structure No. 3 shall be completed prior to the time the summer rainy season is normally expected to start, similar considerations will govern in the scheduling of work on this structure, since occasional or unusual floods may be encountered at this location during other than normal rainy seasons. For this reason, it will be required that the spillway excavation for Structure No. 3, and the construction of the adjacent portion of the embankment which is to be composed of materials excavated from the spillway, will be the first portion of the work to be accomplished. Succeeding sections of the embankment construction will extend northward from this first section and work on each section will be completed insofar as practicable before work on the next section is started. Placement of facing materials will proceed

concurrently in all cases with the construction of the main core of the embankment. (See Article 5 - General Conditions).

4. Source of Supply and Quality of Materials:

Extensive laboratory testing has been done on materials proposed for use as embankment and areas containing suitable deposits have been outlined on the ground. Inasmuch as the embankment will contain a central core and a separate blanket of facing material, different sources of supply of these materials have been determined. Alternate sources of suitable materials proposed by the Contractor and lying within the limits of rights of way or easements that have been obtained will be approved for use providing they meet all the requirements of these specifications and are otherwise suitable as determined by laboratory tests. Only materials conforming to the requirements of these specifications and approved by the Engineer shall be used in the work. All materials proposed for use may be inspected or tested at any time during their preparation and use. If, after trial, it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved materials from other approved sources. No material which, after approval, has in any way become unfit for use shall be used in the work.

Sites from which material has been removed shall be left in a neat and presentable condition satisfactory to the Engineer upon completion of the work, and all fences removed for purposes of entry shall be replaced in as good a condition as they were before being removed.

5. Relations With Other Organizations:

Installation of outlet works and structures will be accomplished by force account crews employed by the Beardsley Irrigation District for this purpose and will proceed concurrently with the construction of the earth fill. The Contractor will be required to schedule his work so as to permit minimum delay or interference with the forces of the Beardsley Irrigation District. Installation of these outlet works will be carried on expeditiously and in such a manner as to interfere to the least extent possible with the activities of the Contractor in the construction of the embankment.

Part II. Earthwork

Section 1. Clearing and Stripping

1. Description:

All clearing and stripping of the structure bases and spillway areas and disposition of these stripped materials will be accomplished by force account in advance of the operations of the Contractor.

Clearing and stripping of borrow areas will be required, and will consist of removing all grass, brush, trees, stumps, and other deleterious materials from the surface, and will also include the loosening, removing, loading, transporting and disposal of all such materials and of all organic soil and other substances unsuitable for embankment purposes. Clearing and maintenance of Contractor's haul roads will be included in this item.

2. Disposal of Cleared Materials:

The Contractor shall dispose of all cleared materials by burning at a location within the limits of the cleared area. The time and place of burning will be decided by the Engineer. Incombustible materials will be disposed of by placement in a neat and inconspicuous manner in gullies or low areas within or immediately adjacent to the cleared area, in a manner to be prescribed by the Engineer.

3. Basis of Payment:

Clearing and stripping will be paid for at the contract price lump sum for CLEARING AND STRIPPING, which price shall include all materials, labor, work and equipment necessary to complete the item.

Section 2. Excavation

1. Description:

Upon completion of embankment construction to an elevation of not less than 12 inches above the elevation of the top of the anti-seep rings for the various outlet pipes, and upon receipt of instructions from the Engineer, excavation of trenches for the installation of the outlet pipes will be performed by the Contractor. These trenches will be machine excavated to full carryall width and to a bottom grade to be established by the Engineer. Fine grading and necessary hand trimming and final hand excavation will be accomplished by forces of the Maricopa County Municipal Water Conservation District No. 1, who will also install the pipes and place backfill.

2. Disposal of Excavated Material:

Excavated material will be stock-piled on the fill and adjacent to the excavation, in such a manner that it may readily be used for backfill by the District forces, following placement of outlet pipe.

3. Excavation Limits:

All excavation under this section will be made to neat lines as staked in the field by the Engineer. Any excavation which is carried beyond or below the lines and grades as established shall be refilled by the Contractor at his

own expense, with materials satisfactory to the Engineer, and such materials shall be compacted by the Contractor at his own expense, to the satisfaction of the Engineer.

4. Estimated Quantities:

Estimated total quantities for excavation are 1,280 cubic yards.

5. Measurement:

All excavation shall be measured in the original space occupied and the volume computed in cubic yards by the average end area method.

6. Basis for Payment:

The basis of payment for excavation shall be the contract unit price a cubic yard for EXCAVATION, which price shall be the full compensation for excavation, removal and disposal of all materials and the furnishing of all equipment, tools, labor and incidentals necessary to complete the work. No payment will be made for excavation carried beyond the lines or grades established, nor will any payment be allowed for replacement of such unauthorized excavation.

Section 3. Subgrade Preparation

1. Description:

This item will cover all work required to prepare the sites of the structures prior to placement of embankment materials. It will include ripping of the base area to provide bond between the embankment and the foundation, moistening or sprinkling and compaction of the base and all loose materials in the same manner as is required for the embankment.

2. Basis of Payment:

Subgrade preparation will be paid for at the contract price lump sum for SUBGRADE PREPARATION, which price shall include all materials, labor, work and equipment necessary to complete the item.

Section 4. Rolled Earth Fill

1. Description:

The rolled earth fill consists of two earth dikes previously described in Part I of these specifications.

2. Borrow Area:

Suitable borrow material in adequate quantities has been located in the immediate vicinity. Borrow for the south 2,200 feet of core of Structure No. 3 will be composed of material excavated from the northeast 800 foot area of the proposed spillway. This material will consist of 80,500 cubic yards and will involve an average haul of 1,400 feet. Spillway borrow area will be excavated to finished grade by contractor. The balance of the core material for this structure will be taken from side borrow located generally immediately adjacent to the embankment and with a minimum of haul involved. This

amounts to approximately 187,500 cubic yards. Facing material for this structure will come from a borrow area located approximately 2,000 feet west of the south end of the dike. There will be a total of approximately 107,000 cubic yards of facing material to be installed and the average haul for this material will be approximately 5,500 feet.

The borrow area for Structure No. 4 is located adjacent to and throughout the length of this dike. Core material will consist of approximately the upper three feet of the borrow area and facing will consist of those materials lying below this depth. Facing material may be used on this structure within the core section where necessary or desirable to facilitate the construction operations.

A limited amount of borrow for Structure No. 4 will be required from the proposed spillway areas in order that these may be excavated and leveled to finished grade. No additional payment will be made for this excavation, as the materials will be used as embankment and payment made, therefore, in the form of rolled earth fill.

Total earthwork in Structure No. 4 is approximately 175,000 cubic yards.

All materials used in the embankment of both structures shall be taken only from these specified borrow areas. No waste material or deleterious substances shall be employed in the construction of the embankments.

A minimum 25 foot wide berm shall be maintained between the toe of the embankment slopes and the edge of adjacent borrow pits.

3. Construction Methods:

The embankment shall be constructed in approximately horizontal layers with no abrupt breaks in the top grade of the fill. The layers shall be evenly spread to a thickness of not greater than six (6) inches after rolling. The full cross-section of the embankment shall be maintained as each successive layer is rolled. Fill material shall be laid down evenly and not in piles or windrows.

The embankment shall be constructed in sections in such a manner to most economically use the equipment available. In the case of Structure No. 4 these sections will be so planned as to permit flood protection to be obtained from the open gaps. Ends of the embankment sections shall be placed on a slope not steeper than 1:20 and closure between sections shall be made by means of thorough ripping or discing and rerolling of adjacent materials.

The Contractor shall route his hauling equipment over the layers so as to obtain the maximum amount of compaction possible, and to avoid excessive compaction anywhere along the hauling route. All excessively packed layers will be chiseled at Contractor's expense to the full depth of such over compaction, at the direction of the Engineer.

Mixing or blending of embankment materials on this project will be required only where adequate and satisfactory compaction cannot be obtained due to lack of uniformity of moisture distribution in the materials.

The embankment shall be placed as continuously and rapidly as possible after the required subgrade preparation has been accomplished as directed by the Engineer. The surface of all embankment shall be carefully graded to the lines shown on the plans and as staked by the Engineer. In addition, it will be required that both slopes of the embankment be faced with caliche and/or gravel for one carryall width, and the crown of the embankment shall have a minimum capping of one foot of this same material. The slope facing of the structures shall be carried on continuously with the placing of the core of the embankment. Materials for the facing will come from selected borrow areas previously described.

When embankments are on sloping ground or existing fills are widened, the surface shall be deeply plowed or ripped, or shall be stepped, as the Engineer may direct.

4. Measurement:

The earth fill will be measured in cubic yards of fill in place after compaction. Volumes will be determined by the average end area method. No distinction will be made between facing and core materials.

5. Basis of Payment:

The basis of payment for earth fill as specified herein shall be the contract unit price a cubic yard for EARTH FILL, measured as hereinbefore specified, which price shall be full compensation for excavating, transporting, placing, forming of embankment, mixing and finishing, and the furnishing of all equipment, tools, labor and incidentals necessary to complete the work.

Section 5. Sprinkling

1. Description:

Sprinkling or moistening of the embankment materials will be required to obtain adequate compaction. Water for sprinkling or moistening will be made available without charge in the canal of the Beardsley Irrigation Project at a point specified by the Contractor and as close to the proposed works as is possible. Delivery of this water from that point to the project and distribution as needed on the project will be a responsibility of the Contractor, and the cost thereof shall be considered as a part of the bid price. Certain facilities exist for delivery of water to certain portions of the borrow areas in Structure No. 3, and the Contractor may utilize these facilities to the greatest extent possible consistent with his operating conditions.

2. Construction Methods:

Water shall be evenly applied to each layer of the fill, prior to rolling, to secure a uniform moisture content for maximum compaction. The amount of water to be applied shall be enough to give a water content of approximately 12% as shown by laboratory reports. This water will be sprinkled evenly on the embankment, or if the Contractor so desires, he may add a portion of it in the borrow pits. Before compaction each wetted layer shall be thoroughly mixed or stirred, if necessary, until moisture is uniformly distributed. Embankment facing materials shall also be moistened or sprinkled in the same manner as core materials. The Contractor shall employ adequate pumping and sprinkling facilities to maintain the construction pace set by the earth moving equipment.

3. Basis for Payment:

The basis for payment for SPRINKLING EMBANKMENT MATERIALS shall be the contract unit price per cubic yard of compacted embankment for Structures Nos. 3 and 4 separately, as determined by methods described elsewhere in these specifications, which price shall be full compensation for pumping, loading, hauling, handling, sprinkling and distribution of the water and the furnishing of all equipment, tools, supplies, labor and incidentals necessary to complete the work.

Section 6. Rolling

1. Description:

Compaction of all embankment materials to 95% of Standard Proctor Density as determined by laboratory tests will be required. The material will compact readily by the use of sheepsfoot rollers.

2. Construction Methods:

Compaction of material in place probably will be accomplished by about six passes with a roller which has a weight of at least 2,500 pounds per linear foot including ballast.

Except by approval of the Engineer, no rolling shall be done within three feet of any structural work and no other heavy equipment shall be operated within five feet of any such work.

Embankment facing material shall be compacted at the same time and to the same extent as is adjacent core materials.

3. Basis for Payment:

The basis for payment shall be the contract unit price for ROLLING per cubic yard of compacted embankment determined as described elsewhere in these specifications, which price shall be full compensation for all labor, materials, equipment, supplies and incidentals necessary to complete the work.

STANDARD FORM 23
REVISED MARCH 1953
GENERAL SERVICES ADMINISTRATION
GENERAL REGULATION NO. 13

CONSTRUCTION CONTRACT

(See instructions on reverse)

CONTRACT NO.

DATE OF CONTRACT

NAME AND ADDRESS OF CONTRACTOR

CHECK APPROPRIATE BOX

- Individual
 Partnership
 Incorporated in the
State of

DEPARTMENT OR AGENCY

CONTRACT FOR (Work to be performed)

PLACE

AMOUNT OF CONTRACT (Express in words and figures)

ADMINISTRATIVE DATA (Optional)

THIS CONTRACT, entered into this date by the United States of America, hereinafter called the Government, represented by the Contracting Officer executing this contract, and the individual, partnership, or corporation named above, hereinafter called the Contractor, witnesseth that the parties hereto do mutually agree as follows:

Statement of Work. The Contractor shall furnish all labor, equipment, and materials and perform the work above described for the amount stated above in strict accordance with the General Provisions (Standard Form 23a), specifications, schedules, drawings, and conditions all of which are made a part hereof and designated as follows:

WORK SHALL BE STARTED

WORK SHALL BE COMPLETED

Alterations. The following changes were made in this contract before it was signed by the parties hereto:

In witness whereof, the parties hereto have executed this contract as of the date entered on the first page hereof.

THE UNITED STATES OF AMERICA

CONTRACTOR

By _____

(Name of Contractor)

(Official title)

By _____

(Signature)

(Title)

INSTRUCTIONS

1. This form shall be used, as required by GSA regulations, for contracts for the construction, alteration, or repair of public buildings or works.
2. The full name and business address of the Contractor must be inserted in the space provided on the face of the form. The Contractor shall sign in the space provided above with his usual signature and typewrite or print name under all signatures to the contract and bonds.
3. An officer of a corporation, a member of a partnership, or an agent signing for the Contractor shall place his signature and title after the word "By" under the name of the Contractor. A contract executed by an attorney or agent on behalf of the Contractor shall be accompanied by two authenticated copies of his power of attorney, or other evidence of his authority to act on behalf of the Contractor.

GENERAL PROVISIONS (CONSTRUCTION CONTRACTS)

EXAMPLE COPY

1. DEFINITIONS

(a) The term "head of the department" as used herein shall mean the head or any assistant head of the executive department or independent establishment involved, and the term "his duly authorized representative" shall mean any person authorized to act for him other than the Contracting Officer.

(b) The term "Contracting Officer" as used herein, shall include his duly appointed successor or his authorized representative.

2. SPECIFICATIONS AND DRAWINGS

The Contractor shall keep on the work a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In any case of discrepancy either in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without this determination shall be at his own risk and expense. The Contracting Officer shall furnish from time to time such detail drawings and other information as he may consider necessary, unless otherwise provided.

3. CHANGES

The Contracting Officer may at any time, by a written order, and without notice to the sureties, make changes in the drawings and/or specifications of this contract and within the general scope thereof. If such changes cause an increase or decrease in the amount due under this contract, or in the time required for its performance, an equitable adjustment shall be made and the contract shall be modified in writing accordingly. Any claim of the Contractor for adjustment under this clause must be asserted in writing within 30 days from the date of receipt by the Contractor of the notification of change: *Provided, however*, That the Contracting Officer, if he determines that the facts justify such action, may receive and consider, and adjust any such claim asserted at any time prior to the date of final settlement of the contract. If the parties fail to agree upon the adjustment to be made the dispute shall be determined as provided in Clause 6 hereof. But nothing provided in this clause shall excuse the Contractor from proceeding with the prosecution of the work as changed. Except as otherwise herein provided, no charge for any extra work or material will be allowed.

4. CHANGED CONDITIONS

The Contractor shall promptly, and before such conditions are disturbed, notify the Contracting Officer in writing of: (1) subsurface or latent physical conditions at the site differing materially from those indicated in this contract, or (2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in this contract. The Contracting Officer shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or the time required for, performance of this contract, an equitable adjustment shall be made and the contract modified in writing accordingly. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given notice as above required; provided that the Contracting Officer may, if he determines the facts so justify, consider and adjust any such claim asserted before the date of final settlement of the contract. If the parties fail to agree upon the adjustment to be made, the dispute shall be determined as provided in Clause 6 hereof.

5. TERMINATION FOR DEFAULT—DAMAGES FOR DELAY—TIME EXTENSIONS

(a) If the Contractor refuses or fails to prosecute the work, or any separable part thereof, with such diligence as will insure its completion within the time specified in this contract, or any extension thereof, or fails to complete said work within such time, the Government may, by written notice to the Contractor, terminate his right to proceed with the work or such part of the work as to which there has been delay. In such event the Government may take over the work and prosecute the same to completion, by contract or otherwise, and the Contractor and his sureties shall be liable to the Government for any excess cost occasioned the Government thereby, and for liquidated damages for delay, as fixed in the specifications or accompanying papers, until such reasonable time as may be required for the final completion of the work, or if liquidated damages are not so fixed, any actual damages occasioned by such delay. If the Contractor's right to proceed is so terminated, the Government may take possession of and utilize in completing the work such materials, appliances, and plant as may be on the site of the work and necessary therefor.

(b) If the Government does not terminate the right of the Contractor to proceed, as provided in paragraph (a) hereof, the Contractor shall continue the work, in which event he and his sureties shall be liable to the Government, in the amount set forth in the specifications or accompanying papers, for fixed, agreed, and liquidated damages for each calendar day of delay until the work is completed or accepted, or if liquidated damages are not so fixed, any actual damages occasioned by such delay.

(c) The right of the Contractor to proceed shall not be terminated, as provided in paragraph (a) hereof, nor the Contractor charged with liquidated or actual damages, as provided in paragraph (b) hereof because of any delays in the completion of the work due to unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Government, in either its sovereign or contractual capacity, acts of another contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather, or delays of subcontractors or suppliers due to such causes: *Provided*, That the Contractor shall within 10 days from the beginning of any such delay, unless the Contracting Officer shall grant a further period of time prior to the date of final settlement of the contract, notify the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of the delay and extend the time for completing the work when in his judgment the findings of fact justify such an extension, and his findings of fact thereon shall be final and conclusive on the parties hereto, subject only to appeal as provided in Clause 6 hereof.

6. DISPUTES

Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. Within 30 days from the date of receipt of such copy, the Contractor may appeal by mailing or otherwise furnishing to the Contracting Officer a written appeal addressed to the head of the department, and the decision of the head of the department or his duly authorized representatives for the hearings of such appeals shall, unless determined by a court of competent jurisdiction to have been fraudulent, arbitrary, capricious, or so grossly erroneous as necessarily to imply bad faith, be final and conclusive: *Provided*, That, if no such appeal to the head

of the department is taken, the decision of the Contracting Officer shall be final and conclusive. In connection with any appeal proceeding under this clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision.

7. PAYMENTS TO CONTRACTORS

(a) Unless otherwise provided in the specifications, partial payments will be made as the work progresses at the end of each calendar month, or as soon thereafter as practicable, or at more frequent intervals as determined by the Contracting Officer, on estimates made and approved by the Contracting Officer. In preparing estimates the material delivered on the site and preparatory work done may be taken into consideration.

(b) In making such partial payments there shall be retained 10 percent on the estimated amount until final completion and acceptance of all work covered by the contract: *Provided, however,* That the Contracting Officer, at any time after 50 percent of the work has been completed, if he finds that satisfactory progress is being made, may make any of the remaining partial payments in full: *And provided further,* That on completion and acceptance of each separate building, public work, or other division of the contract, on which the price is stated separately in the contract, payment may be made in full, including retained percentage thereon, less authorized deductions.

(c) All material and work covered by partial payments made shall thereupon become the sole property of the Government, but this provision shall not be construed as relieving the Contractor from the sole responsibility for all materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Government to require the fulfillment of all of the terms of the contract.

(d) Upon completion and acceptance of all work required hereunder, the amount due the Contractor under this contract will be paid upon the presentation of a properly executed and duly certified voucher therefor, after the Contractor shall have furnished the Government with a release, if required, of all claims against the Government arising under and by virtue of this contract, other than such claims, if any, as may be specifically excepted by the Contractor from the operation of the release in stated amounts to be set forth therein. If the Contractor's claim to amounts payable under the contract has been assigned under the Assignment of Claims Act of 1940, as amended (41 U. S. C. 15), a release may also be required of the assignee at the option of the Contracting Officer.

8. MATERIALS AND WORKMANSHIP

Unless otherwise specifically provided for in the specifications, all equipment, materials, and articles incorporated in the work covered by this contract are to be new and of the most suitable grade of their respective kinds for the purpose and all workmanship shall be first class. Where equipment, materials, or articles are referred to in the specifications as "equal to" any particular standard, the Contracting Officer shall decide the question of equality. The Contractor shall furnish to the Contracting Officer for his approval the name of the manufacturer of machinery, mechanical and other equipment which he contemplates incorporating in the work, together with their performance capacities and other pertinent information. When required by the specifications, or when called for by the Contracting Officer, the Contractor shall furnish the Contracting Officer for approval full information concerning the materials or articles which he contemplates incorporating in the work. Samples of materials shall be submitted for approval when so directed. Machinery, equipment, materials, and articles installed or used without such approval shall be at the risk of subsequent rejection. The Contracting Officer may

in writing require the Contractor to remove from the work such employee as the Contracting Officer deems incompetent, careless, insubordinate, or otherwise objectionable, or whose continued employment on the work is deemed by the Contracting Officer to be contrary to the public interest.

9. INSPECTION

(a) Except as otherwise provided in paragraph (d) hereof all material and workmanship, if not otherwise designated by the specifications, shall be subject to inspection, examination, and test by the Contracting Officer at any and all times during manufacture and/or construction and at any and all places where such manufacture and/or construction are carried on. The Government shall have the right to reject defective material and workmanship or require its correction. Rejected workmanship shall be satisfactorily corrected and rejected material shall be satisfactorily replaced with proper material without charge therefor, and the Contractor shall promptly segregate and remove the rejected material from the premises. If the Contractor fails to proceed at once with the replacement of rejected material and/or the correction of defective workmanship the Government may, by contract or otherwise, replace such material and/or correct such workmanship and charge the cost thereof to the Contractor, or may terminate the right of the Contractor to proceed as provided in Clause 5 of this contract, the Contractor and surety being liable for any damage to the same extent as provided in said Clause 5 for terminations thereunder.

(b) The Contractor shall furnish promptly without additional charge, all reasonable facilities, labor, and materials necessary for the safe and convenient inspection and test that may be required by the Contracting Officer. All inspection and tests by the Government shall be performed in such manner as not unnecessarily to delay the work. Special, full size, and performance tests shall be as described in the specifications. The Contractor shall be charged with any additional cost of inspection when material and workmanship are not ready at the time inspection is requested by the Contractor.

(c) Should it be considered necessary or advisable by the Government at any time before final acceptance of the entire work to make an examination of work already completed, by removing or tearing out same, the Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective or nonconforming in any material respect, due to fault of the Contractor or his subcontractors, he shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, the actual direct cost of labor and material necessarily involved in the examination and replacement, plus 15 percent, shall be allowed the Contractor and he shall, in addition, if completion of the work has been delayed thereby, be granted a suitable extension of time on account of the additional work involved.

(d) Inspection of material and finished articles to be incorporated in the work at the site shall be made at the place of production, manufacture, or shipment, whenever the quantity justifies it, unless otherwise stated in the specifications; and such inspection and written or other formal acceptance, unless otherwise stated in the specifications, shall be final, except as regards latent defects, departures from specific requirements of the contract, damage or loss in transit, fraud, or such gross mistakes as amount to fraud. Subject to the requirements contained in the preceding sentence, the inspection of material and workmanship for final acceptance as a whole or in part shall be made at the site. Nothing contained in this paragraph (d) shall in any way restrict the Government's rights under any warranty or guarantee.

10. SUPERINTENDENCE BY CONTRACTOR

The Contractor shall give his personal superintendence to the work or have a competent foreman or superintendent, satisfactory to the Contracting Officer, on the work at all times during progress, with authority to act for him.

11. PERMITS AND RESPONSIBILITY FOR WORK, ETC.

The Contractor shall, without additional expense to the Government, obtain all licenses and permits required for the prosecution of the work. He shall be responsible for all damages to persons or property that occur as a result of his fault or negligence in connection with the prosecution of the work. He shall also be responsible for all materials delivered and work performed until completion and final acceptance, except for any completed unit thereof which theretofore may have been finally accepted.

12. OTHER CONTRACTS

The Government may undertake or award other contracts for additional work, and the Contractor shall fully cooperate with such other contractors and Government employees and carefully fit his own work to such additional work as may be directed by the Contracting Officer. The Contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor or by Government employees.

13. PATENT INDEMNITY

Except as otherwise provided, the Contractor agrees to indemnify the Government and its officers, agents and employees against liability, including costs and expenses, for infringement upon any Letters Patent of the United States (except Letters Patent issued upon an application which is now or may hereafter be, for reasons of national security, ordered by the Government to be kept secret or otherwise withheld from issue) arising out of the performance of this contract or out of the use or disposal by or for the account of the Government of supplies furnished or construction work performed hereunder.

14. ADDITIONAL BOND SECURITY

If any surety upon any bond furnished in connection with this contract becomes unacceptable to the Government, or if any such surety fails to furnish reports as to his financial condition from time to time as requested by the Government, the Contractor shall promptly furnish such additional security as may be required from time to time to protect the interests of the Government and of persons supplying labor or materials in the prosecution of the work contemplated by this contract.

15. COVENANT AGAINST CONTINGENT FEES

The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration the full amount of such commission, percentage, brokerage, or contingent fee.

16. OFFICIALS NOT TO BENEFIT

No member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

17. BUY AMERICAN ACT

The Contractor agrees that in the performance of the work under this contract the Contractor, subcontractors, material men and suppliers shall use only such unmanufactured articles, materials and supplies (which term "articles, materials and supplies" is hereinafter referred to in this clause as "Supplies") as have been mined or produced in the United States, and only such manufactured supplies as have been manufactured in the United States substantially all from supplies mined, produced, or manufactured, as the case may be, in the United States. Pursuant to the Buy American Act (41 U. S. C. 10a-d), the

foregoing provisions shall not apply (i) with respect to supplies excepted by the head of the department from the application of that Act, (ii) with respect to supplies for use outside the United States, or (iii) with respect to the supplies to be used in the performance of work under this contract which are of a class or kind determined by the head of the department or his duly authorized representative not to be mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, or (iv) with respect to such supplies, from which the supplies to be used in the performance of work under this contract are manufactured, as are of a class or kind determined by the head of the department or his duly authorized representative not to be mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, provided that this exception (iv) shall not permit the use in the performance of work under this contract of supplies manufactured outside the United States if such supplies are manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.

18. CONVICT LABOR

In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment at hard labor.

19. NONDISCRIMINATION IN EMPLOYMENT

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin; and further agrees to insert the foregoing provision in all subcontracts hereunder except subcontracts for standard commercial supplies or for raw materials.

20. DAVIS-BACON ACT (40 U. S. C. 276a-a(7))

(a) All mechanics and laborers employed or working directly upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Copeland Act (Anti-Kickback) Regulations (29 CFR, Part 3)) the full amounts due at time of payment, computed at wage rates not less than those contained in the wage determination decision of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor or subcontractor and such laborers and mechanics; and a copy of the wage determination decision shall be kept posted by the Contractor at the site of the work in a prominent place where it can be easily seen by the workers.

(b) In the event it is found by the Contracting Officer that any laborer or mechanic employed by the Contractor or any subcontractor directly on the site of the work covered by this contract has been or is being paid at a rate of wages less than the rate of wages required by paragraph (a) of this clause, the Contracting Officer may (1) by written notice to the Government Prime Contractor terminate his right to proceed with the work, or such part of the work as to which there has been a failure to pay said required wages, and (2) prosecute the work to completion by contract or otherwise, whereupon such Contractor and his sureties shall be liable to the Government for any excess costs occasioned the Government thereby.

(c) Paragraphs (a) and (b) of this clause shall apply to this contract to the extent that it is (1) a prime contract with the Government subject to the Davis-Bacon Act or (2) a subcontract under such prime contract.

21. EIGHT-HOUR LAWS—OVERTIME COMPENSATION

No laborer or mechanic doing any part of the work contemplated by this contract, in the employ of the Contractor

any subcontractor contracting for any part of said work contemplated, shall be required or permitted to work more than eight hours in any one calendar day upon such work, except upon the condition that compensation is paid to such laborer or mechanic in accordance with the provisions of this clause. The wages of every laborer and mechanic employed by the Contractor or any subcontractor engaged in the performance of this contract shall be computed on a basic day rate of eight hours per day and work in excess of eight hours per day is permitted only upon the condition that every such laborer and mechanic shall be compensated for all hours worked in excess of eight hours per day at not less than one and one-half times the basic rate of pay. For each violation of the requirements of this clause a penalty of five dollars shall be imposed for each laborer or mechanic for every calendar day in which such employee is required or permitted to labor more than eight hours upon said work without receiving compensation computed in accordance with this clause, and all penalties thus imposed shall be withheld for the use and benefit of the Government: *Provided*, That this stipulation shall be subject in all respects to the exceptions and provisions of the Eight-Hour Laws as set forth in 40 U. S. C. 321, 324, 325, 325a, and 326, which relate to hours of labor and compensation for overtime.

22. APPRENTICES

Apprentices will be permitted to work only under a bona fide apprenticeship program registered with a State Apprenticeship Council which is recognized by the Federal Committee on Apprenticeship, U. S. Department of Labor; or if no such recognized Council exists in a State, under a program registered with the Bureau of Apprenticeship, U. S. Department of Labor.

23. PAYROLL RECORDS AND PAYROLLS

(a) Payroll records will be maintained during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records will contain the name and address of each such employee, his correct classification, rate of pay, daily and weekly number of hours worked, deductions made and actual wages paid. The Contractor will make his employment records available for inspection by authorized representatives of the Contracting Officer and the U. S. Department of Labor, and will permit such representatives to interview employees during working hours on the job.

(b) A certified copy of all payrolls will be submitted weekly to the Contracting Officer. The Government Prime Contractor will be responsible for the submission of certified copies of the payrolls of all subcontractors. The certification will affirm that the payrolls are correct and complete, that the wage rates contained therein are not less than the applicable rates contained in the wage determination decision of the Secretary of Labor attached to this contract, and that the classifications set forth for each laborer or mechanic conform with the work he performed.

24. COPELAND (ANTI-KICKBACK) ACT—NONREBATE OF WAGES.

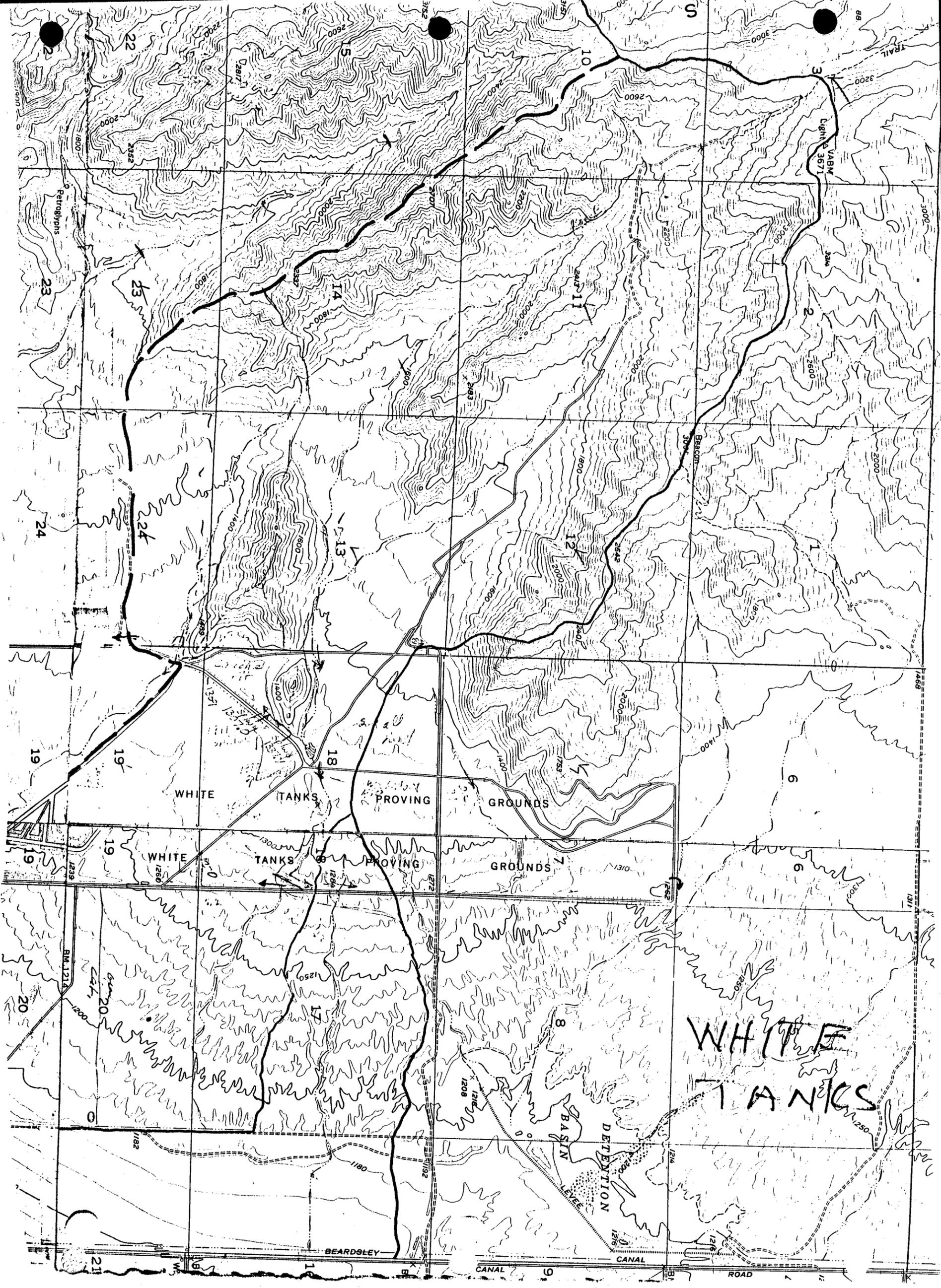
The regulations of the Secretary of Labor applicable to Contractors and subcontractors (29 CFR, Part 3), made pursuant to the Copeland Act, as amended (40 U. S. C. 276c) and to aid in the enforcement of the Anti-Kickback Act (18 U. S. C. 874) are made a part of this contract by reference. The Contractor will comply with these regulations and any amendments or modifications thereof and the Government Prime Contractor will be responsible for the submission of affidavits required of subcontractors thereunder. The foregoing shall apply except as the Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances, and exemptions.

25. WITHHOLDING OF FUNDS TO ASSURE WAGE PAYMENT

There may be withheld from the Contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics employed by the Contractor or any subcontractor the full amount of wages required by this contract. In the event of failure to pay any laborer or mechanic all or part of the wages required by this contract, the Contracting Officer may take such action as may be necessary to cause the suspension, until such violations have ceased, of any further payment, advance, or guarantee of funds to or for the Government Prime Contractor.

26. SUBCONTRACTS—TERMINATION

The Contractor agrees to insert Clauses 20 through 26 hereof in all subcontracts and further agrees that a breach of any of the requirements of these clauses may be grounds for termination of this contract. The term "Contractor" as used in such clauses in any subcontract shall be deemed to refer to the subcontractor except in the phrase "Government Prime Contractor."



Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of E
Length - - - - - :	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
Embankment	351,481 cy.	171,728 cy	
Reservoir Capacity in inches of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets:			4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	
Sediment Production:			
Ac.Ft. Per sq.mi. per yr. est. :	.3	.3	.25
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - - :	196,057.00		180,000.00
Public Contributions - - - - :	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - :	20,860.00		115,000.00
Estimated annual benefits - - - :			
(50 yr. amortization) - - - - :	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1 *maintains cost of \$25/yr.*
= 5% / yr.

annual cost of \$2,180,000 is 1% / yr.

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of E
Length - - - - - :	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches :			
of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - :			4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	- - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - :	196,057.00		180,000.00
Public Contributions - - - :	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project			
(50 yr. amortization) - - - :	20,860.00		115,000.00
Estimated annual benefits - - :			
(50 yr. amortization) - - - :	35,220.00		200,000.00
Benefit - cost ratio 1.7 to 1			

*Estimated annual cost of \$25/yr.
= 3 1/2% / year*

*Estimated cost of
2,300,000 in
1/2 of 1% / year*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets - - -			4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00
Benefit - cost ratio 1.7 to 1			

*Estimated cost of 1954
= 3 1/2 million*

*Estimated cost of
1956 project
= 4 1/2 million*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dsm
Cooperating Federal Agency - - - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - -	- - - - -	- - - - -	4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - - -
Sediment Production: Ac.Ft.Per sq.mi.par yr.est.:	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1 *Maintenance cost of \$25/yr.*
= 1/5 of 1% / year

Maint cost of 3,350/year is 1/7 of 1% / year

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - -	- - - - -	- - - - -	4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - - -
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1 *Maintenance cost of \$825/yr.*
= 1/3 of 1% / year. *Maint cost of \$3,350/yr. is*
1/2 of 1% / year.

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - -			4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - - -
Sediment Production:			
Ac.Ft. Per sq.mi. per yr. est.: .3	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1 *Maintenance cost of \$25/yr.*
= 3 of 100/yr.

*Spent out of
2,180,000.00
4 of 100/yr.*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency - -:	1954, SCS	1954, SCS	1956, C of B
Length - - - - -:	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -:	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -:	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -:	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -:	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - -:	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -:	2.1	1.9	1.6
Crest Width - - - - -:	10'	10'	12'
Side slope - - - - -:	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -:	3 pipes	2 pipes	1 box
Size of outlets - - - - -:	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets:	- - - -	- - - -	4400 cfs.
Evacuation time - - - - -:	80 hrs.	118 hrs.	- - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - -:	\$395,145.00		\$2,180,000.00
Private Contributions - - - -:	196,057.00		180,000.00
Public Contributions - - - -:	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - -:	20,860.00		115,000.00
Estimated annual benefits - -:			
(50 yr. amortization) - - - -:	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1

*with interest cost of \$25/yr.
= 1/3 of 1% / year*

*annual cost of
\$3,110/year is
1/7 of 1% / year*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - - - -	1954, SCS	1954, SCS	1956, C of B
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - -	- - - - -	- - - - -	4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - - -
Sediment Production:			
Ac.Ft. Per sq.mi. per yr. est.:	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00
Benefit - cost ratio 1.7 to 1			

*Maintenance cost of \$825/yr.
= 1/5 of 1% / year.*

*Maint cost of
3,350/year is
1/7 of 1% / year*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of B
Length - - - - - :	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - -			4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	- - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - - :	196,057.00		180,000.00
Public Contributions - - - - :	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project			
(50 yr. amortization) - - - - :	20,860.00		115,000.00
Estimated annual benefits - - - - :			
(50 yr. amortization) - - - - :	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1

*Maintenance cost of \$825/yr.
= 1/5 of 1%/year.*

*Maint cost of
\$3,320/year is
1/7 of 1%/year*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of E
Length - - - - - :	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - -			4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	- - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.: .3	.3	.3	.25
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - - :	196,057.00		180,000.00
Public Contributions - - - - :	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - :	20,860.00		115,000.00
Estimated annual benefits - - - - :	35,220.00		200,000.00
(50 yr. amortization) - - - - :			
Benefit - cost ratio 1.7 to 1			

*Maintenance cost of \$825/yr.
= 1/5 of 1% / year.*

*Maint cost of
\$3,350/year is
1/7 of 1% / year*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of E
Length - - - - - :	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - -	- - - -	- - - -	4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	- - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - - :	196,057.00		180,000.00
Public Contributions - - - - :	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project			
(50 yr. amortization) - - - - :	20,860.00		115,000.00
Estimated annual benefits - - - - :			
(50 yr. amortization) - - - - :	35,220.00		200,000.00
Benefit - cost ratio 1.7 to 1			

*Maintenance cost of \$25/yr.
= 1/3 of 1 1/2% / year.*

*Maint cost of
3,350/year is
1/7 of 1 1/2% / year*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets - - -	- - - -	- - - -	4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - -
Sediment Production: Ac.Ft. Per sq.mi. per yr. est. :	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - -			
(50 yr. amortization) - - - - -	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1 *maintenace cost of 825/yr*
= 5 1/2 % / year *2% cost of 2,180,000 is 47 1/2 % / year*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of E
Length - - - - - :	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - -			4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	- - - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.: .3	.3	.3	.25
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - - :	196,057.00		180,000.00
Public Contributions - - - - :	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - :	20,860.00		115,000.00
Estimated annual benefits - - - - :			
(50 yr. amortization) - - - - :	35,220.00		200,000.00
Benefit - cost ratio 1.7 to 1			

*insurance cost of \$25/yr.
= 3 1/2 %/yr.*

*7% interest cost of
\$3,322/yr. as
1/2 of 1 1/2 %/yr.*

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	: 1954, SCS	: 1956, C of E
Length - - - - - :	1.5 Mi.	: 1.3 Mi.	: 9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	: 10 sq. mi.	: 223 sq. mi.
Max. Fill height - - - - - :	30 ft.	: 20 ft.	: 38 ft.
Spillway Size - - - - - :	800 ft.	: 2 @ 165 ft.	: 2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	: 4400 cfs.	: 60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	: 1036 AF	: 19,000 AF
Reservoir Capacity in inches :	:	:	:
of runoff - - - - - :	2.1	: 1.9	: 1.6
Crest Width - - - - - :	10'	: 10'	: 12'
Side slope - - - - - :	2½:1 & 2:1	: 2:1 & 2:1	: 2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	: 2 pipes	: 1 box
Size of outlets - - - - - :	48", 48" & 24"	: 30" & 36"	: 11' x 20'
Max. Discharge through outlets: - - - - :		: - - - -	: 4400 cfs.
Evacuation time - - - - - :	80 hrs.	: 118 hrs.	: - - - -
Sediment Production:	:	:	:
Ac.Ft.Per sq.mi.per yr.est.:	.3	: .3	: .25
Total cost of Project - - - - :	\$395,145.00	:	: \$2,180,000.00
Private Contributions - - - :	196,057.00	:	: 180,000.00
Public Contributions - - - :	199,088.00	:	: 2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00	:	: 17,000.00
Estimated annual cost of project :	:	:	:
(50 yr. amortization) - - - :	20,860.00	:	: 115,000.00
Estimated annual benefits - - :	:	:	:
(50 yr. amortization) - - - :	35,220.00	:	: 200,000.00
Benefit - cost ratio 1.7 to 1			

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	: 1954, SCS	: 1956, C of E
Length - - - - - :	1.5 Mi.	: 1.3 Mi.	: 9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	: 10 sq. mi.	: 223 sq. mi.
Max. Fill height - - - - - :	30 ft.	: 20 ft.	: 38 ft.
Spillway Size - - - - - :	800 ft.	: 2 @ 165 ft.	: 2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	: 4400 cfs.	: 60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	: 1036 AF	: 19,000 AF
Reservoir Capacity in inches of runoff - - - - - :	2.1	: 1.9	: 1.6
Crest Width - - - - - :	10'	: 10'	: 12'
Side slope - - - - - :	2½:1 & 2:1	: 2:1 & 2:1	: 2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	: 2 pipes	: 1 box
Size of outlets - - - - - :	48", 48" & 24"	: 30" & 36"	: 11' x 20'
Max. Discharge through outlets: - - - -		: - - - -	: 4400 cfs.
Evacuation time - - - - - :	80 hrs.	: 118 hrs.	: - - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.: .3	: .3	: .25	
Total cost of Project - - - - :	\$395,145.00	: \$2,180,000.00	
Private Contributions - - - - :	196,057.00	: 180,000.00	
Public Contributions - - - - :	199,088.00	: 2,000,000.00	
Annual O & M cost(Non-Federal):	3,750.00	: 17,000.00	
Estimated annual cost of project (50 yr. amortization) - - - - :	20,860.00	: 115,000.00	
Estimated annual benefits - - - - :	35,220.00	: 200,000.00	
(50 yr. amortization) - - - - :			
Benefit - cost ratio 1.7 to 1			

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - - - -	1954, SCS	: 1954, SCS	: 1956, C of E
Length - - - - -	1.5 Mi.	: 1.3 Mi.	: 9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	: 10 sq. mi.	: 223 sq. mi.
Max. Fill height - - - - -	30 ft.	: 20 ft.	: 38 ft.
Spillway Size - - - - -	800 ft.	: 2 @ 165 ft.	: 2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	: 4400 cfs.	: 60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	: 1036 AF	: 19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	: 1.9	: 1.6
Crest Width - - - - -	10'	: 10'	: 12'
Side slope - - - - -	2½:1 & 2:1	: 2:1 & 2:1	: 2½:1 & 2:1
No. of outlets - - - - -	3 pipes	: 2 pipes	: 1 box
Size of outlets - - - - -	48", 48" & 24"	: 30" & 36"	: 11' x 20'
Max. Discharge through outlets: - - - - -		: - - - -	: 4400 cfs.
Evacuation time - - - - -	80 hrs.	: 118 hrs.	: - - - -
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.: .3	.3	: .3	: .25
Total cost of Project - - - - -	\$395,145.00		: \$2,180,000.00
Private Contributions - - - - -	196,057.00		: 180,000.00
Public Contributions - - - - -	199,088.00		: 2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		: 17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		: 115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		: 200,000.00
Benefit - cost ratio 1.7 to 1			

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
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Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - -	- - - - -	- - - - -	4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - - -
Sediment Production: Ac.Ft. Per sq.mi. per yr. est.:	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00
Benefit - cost ratio	1.7 to 1		

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency - -:	1954, SCS	1954, SCS	1956, C of E
Length - - - - -:	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -:	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -:	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -:	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -:	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - -:	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -:	2.1	1.9	1.6
Crest Width - - - - -:	10'	10'	12'
Side slope - - - - -:	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -:	3 pipes	2 pipes	1 box
Size of outlets - - - - -:	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - -	- - - -	- - - -	4400 cfs.
Evacuation time - - - - -:	80 hrs.	118 hrs.	- - - -
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - -:	\$395,145.00		\$2,180,000.00
Private Contributions - - - -:	196,057.00		180,000.00
Public Contributions - - - -:	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - -:	20,860.00		115,000.00
Estimated annual benefits - - - -:			
(50 yr. amortization) - - - -:	35,220.00		200,000.00
Benefit - cost ratio	1.7 to 1		

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	: 1954, SCS	: 1956, C of E
Length - - - - - :	1.5 Mi.	: 1.3 Mi.	: 9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	: 10 sq. mi.	: 223 sq. mi.
Max. Fill height - - - - - :	30 ft.	: 20 ft.	: 38 ft.
Spillway Size - - - - - :	800 ft.	: 2 @ 165 ft.	: 2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	: 4400 cfs.	: 60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	: 1036 AF	: 19,000 AF
Reservoir Capacity in inches of runoff - - - - - :	2.1	: 1.9	: 1.6
Crest Width - - - - - :	10'	: 10'	: 12'
Side slope - - - - - :	2½:1 & 2:1	: 2:1 & 2:1	: 2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	: 2 pipes	: 1 box
Size of outlets - - - - - :	48", 48" & 24"	: 30" & 36"	: 11' x 20'
Max. Discharge through outlets:	- - - -	: - - - -	: 4400 cfs.
Evacuation time - - - - - :	80 hrs.	: 118 hrs.	: - - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	: .3	: .25
Total cost of Project - - - - :	\$395,145.00		: \$2,180,000.00
Private Contributions - - - - :	196,057.00		: 180,000.00
Public Contributions - - - - :	199,088.00		: 2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		: 17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - :	20,860.00		: 115,000.00
Estimated annual benefits - - - :			
(50 yr. amortization) - - - - :	35,220.00		: 200,000.00
Benefit - cost ratio 1.7 to 1			

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi. .
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets:	- - - -	- - - -	4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - -	196,057.00		180,000.00
Public Contributions - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - -	20,860.00		115,000.00
Estimated annual benefits - - -			
(50 yr. amortization) - - - -	35,220.00		200,000.00
Benefit - cost ratio	1.7 to 1		

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - - - -	1954, SCS	1954, SCS	1956, C of E
Length - - - - -	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - - - -	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -	2.1	1.9	1.6
Crest Width - - - - -	10'	10'	12'
Side slope - - - - -	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -	3 pipes	2 pipes	1 box
Size of outlets - - - - -	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - -			4400 cfs.
Evacuation time - - - - -	80 hrs.	118 hrs.	- - - - -
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.: .3	.3	.3	.25
Total cost of Project - - - - -	\$395,145.00		\$2,180,000.00
Private Contributions - - - - -	196,057.00		180,000.00
Public Contributions - - - - -	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00		115,000.00
Estimated annual benefits - - - - - (50 yr. amortization) - - - - -	35,220.00		200,000.00
Benefit - cost ratio	1.7 to 1		

OPERATION AND MAINTENANCE PLAN FOR
WHITE TANKS NO. 3 AND NO. 4

GENERAL

A regular program of inspection and maintenance will be required to assure that the dams are at all times ready to control storm runoff. The following items are to be used as a guide to properly operate and maintain the dam.

OPERATION

The five gated outlets are designed to be operated independently of each other. The design permits either open or closed pre-storm conditions, but anticipates best performance to leave all five gates closed until after the storm to allow sediment to settle. Then open fully until pool is drained and reclose.

MAINTENANCE

Slide Gates

Open and close each gate at least annually to be sure gates are functioning properly. Clear gate assembly and also the trash rack of any obstructions and make any needed repairs. Check for any soil erosion near the gates.

Outlets

Check the conduits for obstructions or irregularities. Particularly, look for unusual wear on flow lines within the conduits that might indicate problems with high-velocity flow. Debris should be removed and disposed of. Any need for repairs should be reported to the Soil Conservation Service for evaluation of cause and repaired as necessary.

Check outlet basins for debris, sediment, cracks in concrete and concrete displacement. Sediment and debris should be removed whenever they approach the pipe invert elevation. Any major cracks in the concrete or displacement of concrete should be reported to the Soil Conservation Service for evaluation of cause.

Channels

The outlet channels should be checked periodically and cleared of sediment and debris after every major storm. The concrete linings should be checked for cracks and displacement and reported to the Soil Conservation Service for evaluation of cause.

Embankment

Inspection of the embankments should be performed at least annually and after major storms or earth movements. Check for transverse and longitudinal cracks in the surface of the fill, excessive erosion due to four-wheel drive vehicles, motorcycles, livestock travel or burrowing animals, and gullies and rills on the slopes. Make the necessary repairs. Check the downstream toe for irregularities.

Emergency Spillway

Check the emergency spillways annually and after any flows that occur. Look for excessive erosion, rills, and gullies or sediment and debris accumulation. Make repairs as necessary.

O&M COSTS AND FINANCIAL RESOURCES

Financial resources for O&M costs shall come from the Flood Control District of Maricopa County.

O&M RESPONSIBILITY AND PROCEDURES

The responsibility for maintenance belongs to the Flood Control District of Maricopa County. Technical assistance and advice may be obtained from the Soil Conservation Service.

CRITICAL ITEMS

All items listed under Maintenance are considered important and critical to the operation of the system. All of these items will be considered in special and recurring on-site inspections.

ENVIRONMENTAL CONCERNS

At present, the dams are not considered a threat to the environment. However, should an adverse environmental effect occur, every reasonable effort should be made to correct the problem.

O&M INSPECTION AND FOLLOW-UP

The sponsors will inspect the dams at least annually and after each significant flow or after the occurrence of any unusual condition that might adversely affect the dam. Any supplemental inspections then determined necessary will be scheduled and agreed to at that time. A written report will be made of each inspection, describing the conditions found and the corrective action needed. A copy of each report will be provided to the Soil Conservation Service within ten (10) days of the date on which the inspection was made. All deficiencies found in the inspection shall be corrected within an agreed-to time frame between the sponsors and the Soil Conservation Service.

STATE O&M HANDBOOK

The book entitled "State of Arizona Watersheds Operation and Maintenance Handbook for Projects Installed with Assistance from the Soil Conservation Service," U.S. Department of Agriculture, Soil Conservation Service, dated May 1971, shall be made a reference to this O&M Plan.

TIME OF RESPONSIBILITY

The sponsor's responsibility operation and maintenance began when the structures were first completed and will continue when a part or all of the work of installing the repairs is completed and accepted or is determined complete by the Soil Conservation Service. This responsibility shall continue until the expiration of the evaluated life of all the installed project measures. This does not relieve the sponsor's liability which continues throughout the life of the measure or until the measure is modified to remove potential loss of life or property.

PROVISIONS FOR THE SPONSOR'S PUBLICATION

Not applicable.

RECORDS

The sponsors will maintain a record of all inspections and significant actions taken by the sponsors with respect to operation and maintenance. The Soil Conservation Service may inspect these records at any reasonable time.

CONSTRUCTION SPECIFICATION

2. CLEARING AND GRUBBING

1. SCOPE

The work shall consist of the clearing and grubbing of designated areas by removal and disposal of trees, snags, logs, stumps, shrubs and rubbish.

2. MARKING

The limits of the areas to be cleared and grubbed will be marked by means of stakes, flags, tree markings or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunks at a height of about six feet above the ground surface.

3. REMOVAL

All trees not marked for preservation and all snags, logs, brush, stumps, shrubs and rubbish shall be removed from within the limits of the marked areas. Unless otherwise specified, all stumps, roots and root clusters having a diameter of one inch or larger shall be grubbed out to a depth of at least two feet below subgrade elevation for concrete structures and one foot below the ground surface at embankment sites and other designated areas.

4. DISPOSAL

Unless otherwise specified, all materials removed from the cleared and grubbed areas shall be burned or buried at locations approved by the Engineer or otherwise disposed of as approved by the Engineer.

5. MEASUREMENT AND PAYMENT

(Method 1) For items of work for which specific unit prices are established in the contract, the cleared and grubbed area will be measured to the nearest 0.1 acre. Payment for clearing and grubbing will be made for the total area within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to the completion of the work.

(Method 2) For items of work for which specific unit prices are established in the contract, the length of the cleared and grubbed area will be measured to the nearest full station (100 feet) along the line designated on the drawings or in the specifications. Payment for clearing and grubbing will be made for the total length within the designated limits at the contract unit price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to completion of the work.

(Method 3) For items of work for which specific unit prices are established in the contract, each tree, stump and snag having a diameter of 4 inches or greater and each log having a diameter of 4 inches or greater and a length of 10 feet or greater will be measured prior to removal. The size of each tree and snag will be determined by measuring its trunk at breast height above the natural ground surface. The size of each log will be determined by measuring the butt and by measuring its length from butt to tip. The size of each stump will be measured at the top. Diameter shall be determined by dividing the measured circumference by 3.14.

Payment for clearing and disposal of each tree, stump and snag having a diameter of 4 inches or greater and each log having a diameter of 4 inches or greater and a length of 10 feet or greater will be made at the contract unit price for its size designation as determined by the following schedule:

<u>Measured Diameter</u>	<u>Size Designation</u>
4 inches to 8 inches	6-inch size
Over 8 inches to 12 inches	10-inch size
Over 12 inches to 24 inches	18-inch size
Over 24 inches to 36 inches	30-inch size
Over 36 inches to 60 inches	48-inch size
Over 60 inches	60-inch size

The sum of such payments shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to the work of completely clearing and grubbing the designated areas, including clearing, grubbing and disposal of smaller trees, stumps, snags and logs and brush, shrubs, roots and rubbish.

(Method 4) For items of work for which specific lump sum prices are established in the contract, payment for clearing and grubbing will be made at the contract lump sum price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to completion of the work.

(Use with all Methods) Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Clearing and Grubbing

- (1) This item shall consist of clearing and grubbing as required to perform the work required for the repair of White Tanks No. 3 Dam.
- (2) No separate payment will be made for this item. Compensation will be included in the payment for Bid Item 3, Embankment Excavation, Common.

Condensed Summary

WHITE TANK PROJECT
ARIZONA

Constructed, Spring 1954

	<u>Structure No. 3</u>	<u>Structure No. 4</u>
Capacity	2655 ac.ft.	1036 ac.ft.
Length	7700 ft.	6800 ft.
Drainage Area	24.1 sq.mi.	10.3 sq.mi.
Max. Fill Height	30 ft.	20 ft.
Spillway Size	1100' x 3'	2 @ 165' x 3'
Spillway Capacity	16150 cfs.	4400 cfs.
Capacity in inches of runoff	2.06	1.89
Crest width	10'	10'
Side Slope	2½:1 & 2:1	2:1 & 2:1
No. of outlet pipes	3	2
Size of outlet pipes	48", 48" & 24"	30" & 36"
Evacuation time	80 hrs.	118 hrs.
Sediment production:		
0.3 A.F. per Sq.Mi. per yr. est.		
Total embankment	351,481 c.y.	171,728 c.y.
Cost emb.	.272 c.y.	.212 c.y.
Cost Rolling	.02 c.y.	.02 c.y.
Cost Sprinkling	.02 c.y.	.02 c.y.
Total structural excavation - 1455 c.y. @ .30		
Site preparation - total cost	\$900.00	
Clearing & Stripping - " "	\$950.00	
Estimated total cost of project - - - - -	\$417,375.00	^{27,230} = 395,145
Estimated private contributions - - - - -	218,287.00	= 196,057
Estimated public " - - - - -	199,088.00	= 199,088
Annual O & M Cost (non-federal) - - - - -	3,750.00	
Estimated annual cost of project (50 yr. amortization) - - - - -	20,860.00	
Estimated annual benefits (same basis) - - - - -	35,220.00	
Benefit - cost ratio	1.7 to 1	

Spillway Flood design Frequency: 6" tropical summer type storm
(.005 Probability)

Reservoir Flood design Frequency: 4" tropical summer type storm
(.01 Probability)

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of E
Length - - - - - :	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
<i>Embarkment</i> - - - - - :	35,000 cy	172,000 cy	
Reservoir Capacity in inches :			
of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	1½' x 20'
Max. Discharge through outlets: - - - - - :			4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	- - - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - - :	196,057.00		180,000.00
Public Contributions - - - - :	199,088.00		2,000,000.00
Annual C & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project			
(50 yr. amortization) - - - - :	20,860.00		115,000.00
Estimated annual benefits - - - - :			
(50 yr. amortization) - - - - :	35,220.00		200,000.00
Benefit - cost ratio 1.7 to 1			

200

Condensed Summary

WHITE TANK PROJECT
ARIZONA

Constructed, Spring 1954

	Structure No. 3	Structure No. 4	McMillen Dam
Capacity	2655 ac.ft.	1036 ac.ft.	19,000 AF V
Length	7700 ft.	6800 ft.	incl. 2,500 FF. Sediment
Drainage Area	24.1 sq.mi.	10.3 sq.mi.	49,500 = 9 1/2 mi
Max. Fill Height	30 ft.	20 ft.	2.23 sq. mi. f
Spillway Size	1100' x 3'	2 @ 165' x 3'	30' r (conc. 14x20'
Spillway Capacity	16150 cfs.	4400 cfs.	4,000 cfs
Capacity in inches of runoff	2.06	1.89	1.5
Crest width	10'	10'	12'
Side Slope	2 1/2:1 & 2:1	2:1 & 2:1	
No. of outlet pipes	3	2	
Size of outlet pipes	48", 48" & 24"	30" & 36"	12' x 20' box
Evacuation time	80 hrs.	118 hrs.	
Sediment production:			
0.3 A.F. per Sq.Mi. per yr. est.			unexpected peak 85,000 cfs Vol. 82,800 cu ft in 4 days
Total embankment	351,481 c.y.	171,728 c.y.	
Cost emb.	.272 c.y.	.212 c.y.	
Cost Rolling	.02 c.y.	.02 c.y.	
Cost Sprinkling	.02 c.y.	.02 c.y.	

Total structural excavation - 1455 c.y. @ .30

Site preparation - total cost \$900.00
Clearing & Stripping - " " \$950.00

218,287
22,230
196,057

Estimated total cost of project	\$417,375.00	
Estimated private contributions	218,287.00	150,000
Estimated public	199,088.00	2,000,000
Annual O & M Cost (non-federal)	3,750.00	17,000
Estimated annual cost of project (50 yr. amortization)	20,860.00	115,000
Estimated annual benefits (same basis)	35,220.00	200,000
Benefit - cost ratio	1.7 to 1	
Value of property protected	\$64,800,000	\$80,000,000

Spillway Flood design Frequency: 6" tropical summer type storm
(.005 Probability)

Reservoir Flood design Frequency: 4" tropical summer type storm
(.01 Probability)

High water \$8,800,000 - 9,000,000
 Trans Facil 2,900,000 - 3,000,000
 Mill & Ref. Ind. 42,000,000 - 42,000,000
 Town - 7,000,000 - 3,000,000
 Total 125,500,000 *1955

CONSTRUCTION SPECIFICATION

6. SEEDING AND MULCHING FOR PROTECTIVE COVER

1. SCOPE

The work shall consist of preparing the area for treatment, furnishing and placing seed, mulch, fertilizer, inoculant, soil amendments and asphalt emulsion as specified in the designated areas.

2. MATERIALS

Seed - All seed shall conform to the current rules and regulations of the state where it is being used and from the latest crop available. It shall meet or exceed the standards for purity and germination listed in Section 7.

Seed shall be labeled in accordance with the state laws and the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures will be evidence of purity and germination. No seed will be accepted with a date of test of more than 9 months prior to the date of delivery to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable shall be as defined in the current state laws relating to agricultural seeds. Each type of seed shall be delivered in separate sealed containers and fully tagged unless exception is granted in writing by the contracting officer.

Fertilizer - Unless otherwise specified the fertilizer shall be a commercial grade fertilizer or as specified in Section 7. The fertilizer shall meet the standard for grade and quality specified by state law. Where fertilizer is furnished from bulk storage, the Contractor shall furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer shall be furnished the Government Representative for chemical analysis.

Inoculants - The inoculant for treating legume seeds shall be a pure culture of nitrogenfixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed. Two times the amount of the inoculant

recommended by the manufacturer shall be used, except when seed is applied by use of hydraulic seeder, four times the amount of inoculant recommended by the manufacturer shall be used. Seed shall be sown within 24 hours of treatment and shall not remain in the hydraulic seeder longer than 4 hours.

Soil amendments - Lime shall consist of Standard Ground Agricultural Limestone, or approved equivalent. Standard Ground Agricultural Limestone is defined as ground limestone meeting current requirements of the State Department of Agriculture. Agricultural lime or other needed soil amendments will be uniformly applied at the rate specified in Section 7 of this specification.

Asphalt emulsion shall conform to the requirements of ASTM D-977, "Emulsified Asphalt." The emulsified asphalt may be rapid setting, medium setting, or slow setting.

Straw mulch materials shall consist of wheat, oat, or rye straw, hay, grass clippings cut from any native grasses or other plants approved by the Government Representative. The mulch material shall be air dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds will not be permitted. The Contractor shall provide a method satisfactory to the Government Representative for determining weight of mulch furnished.

Other mulch materials - Mulching materials, such as wood cellulose fiber mulch, emulsion type, synthetic fiber mulch, netting, and mesh are other mulching materials that may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturers' recommendations for methods of application.

3. SEEDING MIXTURES AND DATES OF PLANTING

Seed mixtures per acre rates and date of seeding shall be as specified in Section 7, shown on the vegetating plan, or as otherwise approved by the Government Representative.

4. SEEDBED PREPARATION AND TREATMENT

Disturbed areas will be treated with seed, sod, sprigs, mulch, fertilizer, and soil amendments as specified in this construction specification. Areas to be treated shall be dressed to a reasonably smooth, firm surface. Fertilizer shall be uniformly applied at the rate specified in Section 7 of this specification. The seed mixture or sprigs shall be applied at the rate specified in Section 7 of this specification. Where mulch is needed it shall be uniformly applied at the rate specified in Section 7 of this specification.

On sites where equipment can operate, (generally slopes flatter than 1-½ to 1), the seedbed shall be adequately loosened (4 to 6 inches deep) and smoothed. Disking or cultipacking or both may be necessary as determined by the Engineer.

On sites where equipment cannot operate, the seedbed shall be prepared by hand by scarifying to provide a roughened surface so that broadcast seed will stay in place.

If seeding is to be done immediately following construction, seedbed preparation may not be required except on compacted, polished, or freshly cut areas.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance shall be removed or disposed of as directed by the Engineer.

Seedbed preparation shall be suspended when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the Engineer.

5. SEEDING, FERTILIZING, MULCHING, AND STABILIZING

All seeding operations shall be performed in such a manner that the seed is applied in the specified quantities uniformly on the designated areas. The method of seed applications shall be as specified in Section 7 and may consist of any combination of: drilling, hydroseeding, pneumatic seeding, and broadcasting seeding. Unless otherwise specified, seeding shall be done within 2 days after final grading is complete.

Fertilizer and soil amendments shall be applied as specified in Section 7. When specified the fertilizer and soil amendments shall be thoroughly incorporated into the soil as soon as possible after being applied.

The rate, amount, and kind of mulching or mesh shall be as specified in Section 7. Mulches shall be applied uniformly to the designated areas, and shall be applied to the seeded areas not later than 2 work days after seeding has been performed. Straw mulch materials shall be stabilized by the use of a disk or by the use of asphalt emulsion. An adequately weighted disk harrow shall have the disks set straight and the harrow shall be used to adequately anchor the straw mulch into the soil.

The asphalt emulsion shall be applied uniformly over the mulch material at the specified rate, or by injecting it into the mulch material as it is being applied. The mesh or netting stabilizing materials shall be applied smoothly but loosely on the designated areas, and the edges shall be buried or securely anchored by means of spikes or staples.

The Contractor shall maintain the mesh or netting areas until all the work on the entire contract has been completed and accepted. Maintenance shall consist of the repair of areas damaged by erosion, wind, fire, or other causes. Such areas shall be repaired to re-establish the condition and grade of the soil and shall be re-fertilized, reseeded, and remulched as directed prior to application of the mesh or netting.

6. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, each area treated as specified will be measured to the nearest 0.1 acre. Payment for treatment will be made at the contract unit price for the designated treatment which shall constitute full compensation for all materials, labor, equipment, tools, and other items necessary and incidental to the completion of the work.

Mesh or netting will be measured to the nearest square yard of surface area covered. Payment will be made at the contract unit price and shall constitute full compensation for all labor, equipment, materials and other items necessary and incidental to the completion of work, including the mesh or netting and necessary anchors.

For items of work for which specified lump sum prices are established in the contract, the quantity of seeding and mulching for protective cover will not be measured for payment. Payment for this item will be made at the contract lump sum price for the item and shall constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule, will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 1, Seeding

- (1) This item shall consist of furnishing and placing seed for replanting the following surface areas which are disturbed as a result of construction activities.
 - (a) The side slopes of the dam.
 - (b) The borrow area.
 - (c) The waste area.
 - (d) The haul road to the borrow area.
- (2) On slopes flatter than 3 to 1, ripping shall be used to loosen the soil in lieu of discing or cultipacking as required by Paragraph Two, Section 4, Seedbed Preparation and Treatment. Ripping to a minimum depth of 6 inches shall be on 18-inch centers (maximum) and shall be parallel to the dam where practicable.
- (3) Seed shall be applied at the rate of 15.8 pounds of pure live seed (PLS) per acre as specified in the seeding mixture.
- (4) Seed placement shall be 1/4 to 1/2 inch deep on slopes flatter than 3 to 1.
- (5) Seeding on slopes flatter than 3 to 1 shall be done with a rangeland type drill equipped with depth bands and packer wheels. Seeding on slopes of 3 to 1 or steeper may be broadcast or drilled.

- (6) Seeding shall be done between October 15 and January 1.
- (7) Seeding mixture shall be of the species and percentage of mix as shown below.

SEEDING MIXTURE

<u>Common Name</u>	<u>Scientific Name</u>	<u>Seed/lb</u>	<u>Seeding rate/ac</u>	<u>Mix %</u>	<u>Lbs/ac needed</u>
brittlebush	Encelia farinosa	189,778	4.2#	25%	2.3 PLS
triangleleaf bursage	Franseria deltoides	48,124	18.1#	25%	9.0 PLS
bufflegrass	Cenchrus ciliare	225,000	3.8#	50%	4.0 PLS
schismus	Schismus barbatus	1,000,000	0.9#	50%	0.5 PLS

- (8) Fertilizer and soil amendments will not be required.
- (9) Mulching will not be required.
- (10) Payment will be in accordance with Section 6.

CONSTRUCTION SPECIFICATION

8. MOBILIZATION

1. SCOPE

The work shall consist of the mobilization of the Contractor's forces and equipment necessary for performing the work required under the contract.

It shall include the purchase of contract bonds; transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities at the site; and other preparatory work at the site.

It shall not include mobilization for any specific item of work for which payment for mobilization is provided elsewhere in the contract.

The specification covers mobilization for work required by the contract at the time of award. If additional mobilization costs are incurred during performance of the contract as a result of change or added items of work for which the Contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the items of work changed or added.

2. PAYMENT

Payment will be made as the work proceeds, after presentation of invoices by the Contractor showing his own mobilization costs and evidence of the charges of suppliers, subcontractors, and others for mobilization work performed by them. If the total of such payments is less than the contract lump sum for mobilization, the unpaid balance will be included in the final contract payment. Total payment will be the lump sum contract price for mobilization, regardless of actual cost to the Contractor.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

Payment of the lump sum contract price for mobilization will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 3 of this specification.

3. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 2, Mobilization

- (1) This item shall consist of the mobilization of the contractor's equipment and forces to perform the work required for the repair of White Tanks No. 3 Structure.
- (2) There are no additional construction details.
- (3) Measurement and payment will be in accordance with Section 2.

CONSTRUCTION SPECIFICATION

10. WATER FOR CONSTRUCTION

1. SCOPE

The work shall consist of furnishing, transporting, and using water for construction purposes in accord with the applicable specifications.

2. FACILITIES AND EQUIPMENT

The Contractor shall build and maintain such access and haul roads as are needed, and shall furnish, operate, and maintain all pumps, piping, tanks, and other facilities needed to load, transport, and use the water as specified.

These facilities shall be equipped with meters, tanks, or other devices by which the volume of water supplied can be measured.

3. DUST ABATEMENT AND HAUL ROAD MAINTENANCE

Water for dust abatement and haul road maintenance shall be applied to haul roads and other dust-producing areas as needed to prevent excessive dust and to maintain the roads in good condition for efficient operation while they are in use.

4. EARTH FILL, DRAIN FILL, ROCK FILL

Water for earth fill, drain fill, or rock fill shall be used in the fill materials as specified in the applicable construction specifications.

5. CONCRETE, MORTAR, GROUT

Water used in mixing or curing concrete, pneumatically applied mortar, or other portland cement mortar or grout shall meet the requirements of the applicable construction specifications and shall be used in conformance with those specifications.

6. MEASUREMENT AND PAYMENT

For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1000 gallons.

Except as otherwise specified, the measurement for payment will include all water needed at the construction site to perform the work required under the contract in accordance with the specifications but will not include water wasted or used in excess of the amount needed. It will not include water used in concrete which is mixed elsewhere and transported to the site.

Payment for water will be made at the contract unit price which shall be the price per 1000 gallons shown in the Bid Schedule. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to furnishing, transporting, and using the water.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Water

- (1) This item shall consist of all water as required to perform the work required for the repair of White Tanks No. 3 Dam.
- (2) No separate payment will be made for water. Compensation for this item will be included in the payment for Embankment Backfill, Bid Item 5.

CONSTRUCTION SPECIFICATION

11. REMOVAL OF WATER

1. SCOPE

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the specifications. It shall include (1) building and maintaining all necessary temporary impounding works, channels, and diversions, (2) furnishing, installing and operating all necessary pumps, piping and other facilities and equipment, and (3) removing all such temporary works and equipment after they have served their purposes.

2. DIVERTING SURFACE WATER

The Contractor shall build, maintain, and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, a diversion must discharge into the same natural drainageway in which its headworks are located.

Unless otherwise specified, the Contractor shall furnish to the Engineer, in writing, his plan for diverting surface water before beginning the construction work for which the diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

3. DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches and other parts of the construction site shall be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all drains, sumps, pumps, casings, wellpoints, and other equipment needed to perform the dewatering as specified. Dewatering methods that cause a loss of fines from foundation areas will not be permitted.

Unless otherwise specified, the Contractor shall furnish to the Engineer, in writing, his plan for dewatering before beginning the construction work for which the dewatering is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

4. DEWATERING BORROW AREAS

Unless otherwise specified in Section 7, the Contractor shall maintain the borrow areas in drainable condition or otherwise provide for timely and effective removal of surface waters that accumulate, for any reason, within the borrow areas.

5. REMOVAL OF TEMPORARY WORKS

After the temporary works have served their purposes, the Contractor shall remove them or level and grade them to the extent required to present a sightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

Except as otherwise specified, pipes and casings shall be removed from temporary wells and the wells shall be filled to ground level with gravel or other material approved by the Engineer.

6. MEASUREMENT AND PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for diverting surface water, dewatering construction sites, and dewatering borrow areas will be made at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Dewatering

- (1) This item shall consist of dewatering the work site, including the borrow areas, to the extent that construction operations can be performed under dry, stable conditions.
- (2) Dewatering operations shall include diverting surface water and removing subsurface waters, if required.
- (3) No advance plan of dewatering will be required.
- (4) No separate payment will be made for dewatering. Compensation for dewatering will be included in the payment for Bid Item 3, Embankment Excavation, Common.

CONSTRUCTION SPECIFICATION

21. EXCAVATION

1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. CLASSIFICATION

Excavation will be classified as common excavation or rock excavation in accordance with the following definitions or will be designated as unclassified.

Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrappers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.

Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

Excavation will be classified according to the above definitions by the Engineer, based on his judgment of the character of the materials and the site conditions.

The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

For the purpose of this classification, the following definitions shall apply:

Heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of 200-300 net horsepower (at the flywheel).

Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12-20 yards.

Pusher tractor shall be defined as a track type tractor having a power rating of 200-300 net horsepower (at the flywheel) equipped with appropriate attachments.

3. UNCLASSIFIED EXCAVATION

Items designated as "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section 2 of this specification shall apply.

4. BLASTING

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements in Section 12 of this specification.

5. USE OF EXCAVATED MATERIALS

(Method 1) To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

(Method 2) Suitable materials from the specified excavations may be used in the construction of required earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer.

6. DISPOSAL OF WASTE MATERIALS

(Method 1) All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the locations shown on the drawings.

(Method 2) All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of by the Contractor at sites of his own choosing away from the site of the work.

7. BRACING AND SHORING

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The Contractor shall furnish, place and subsequently remove such supporting installations.

8. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earth fill is placed or any piles are driven within the limits of the excavation.

9. BORROW EXCAVATION

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as directed by the Engineer.

Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

10. OVEREXCAVATION

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the Engineer. Concrete that will be exposed to the atmosphere when

construction is completed shall contain not less than 6 sacks of cement per cubic yard of concrete. Concrete that will be permanently covered shall contain not less than 4 1/2 sacks of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved compacted earth fill, except that, if the earth is to become the subgrade for riprap, rock fill, sand or gravel bedding, or drain fill, the voids may be filled with material conforming to the specifications for the riprap, rock fill, bedding or drain fill.

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Regardless of quantities excavated, the measurement for payment will be made to the specified pay limits, except that excavation outside the specified lines and grades directed by the Engineer to remove unsuitable material will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

(Method 1) The pay limits shall be as designated on the drawings.

(Method 2) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be modified ground surface resulting from the specified previous excavation or fill.
- b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

(Method 3) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated

for previous excavation or fill and the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.

- b. The lower and lateral limits shall be the true surface of the completed excavation as authorized by the Engineer.

(Method 4) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.
- b. The lower limit shall be at the bottom surface of the proposed structure.
- c. The lateral limits shall be 18 inches outside of the outside surfaces of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d, below.
- d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the under-side of the proposed lining or structure.
- e. For the purpose of the definitions in b, c, and d, above, any specified bedding or drain fill directly beneath or beside the structure will be considered to be a part of the structure.

(Use with all Methods) Payment for each type and class of excavation will be made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work, except that extra payment for backfilling required overexcavation will be made in accordance with the following provisions:

- a. Payment for backfilling overexcavation, as specified in Section 10 of this specification, will be made only if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's operations.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 12 of this specification.

12. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 3, Embankment Excavation, Common

- (1) This item shall consist of all required embankment and foundation excavation between Station 56+10± and Station 59+90± as shown on the drawings and staked in the field. Approximate depths are shown on the drawings. Final depths will be determined by the Engineer after examination of the materials encountered.
- (2) In Section 5, Use of Excavated Materials, Method 2 shall apply.
- (3) In Section 6, Disposal of Waste Materials, Method 1 shall apply. Waste material shall be stockpiled at slopes no steeper than 3 horizontal to 1 vertical.
- (4) Measurement and payment will be by Method 3 and will include compensation for Subsidiary Items, Clearing and Grubbing, and Dewatering.

b. Bid Item 4, Trench Excavation, Common

- (1) This item shall consist of all excavation, including support of the trench and disposal of excavated material, required for the construction of the trench for the embankment drain and outlets as shown on the drawings and staked in the field.
- (2) Excavation shall consist of performing the following operations and shall include removal and disposal of all materials resulting from these operations.
 - (a) Excavation of trenches located between the following stations:

Station 17+00± and Station 19+00±
Station 28+00± and Station 30+00±
Station 41+00± and Station 43+00±
- (3) All cracks in the downstream face of the embankment drain trench that extend below the trench excavation limit shown on the drawings shall be provided with an auxiliary embankment drain outlet at the immediate location. An auxiliary embankment drain outlet shall also be provided at the immediate location where there is located an open crack greater than 3/8 inch wide at depths below three (3) feet from the top of the dam.

- (4) The trench excavation limits given in Section 12.b.(2)(a) above and on the drawings shall be modified as follows.
 - (a) For all cracks encountered that are deeper than one (1) foot below the surface, the horizontal distance from the crack to the termination of the trench shall be ten (10) times the depth of the crack.
 - (b) The depth of excavation beyond the limits given in Section 12.b.(2)(a) above and on the drawings shall be a minimum of three (3) feet below the governing crack.
 - (c) Auxiliary embankment drain outlets shall be provided within the extended trench limits where required for drainage as directed by the Engineer.
 - (5) Support of the trench shall consist of furnishing, placing and removal of sheeting, bracing, shoring or portable shields required for safe inspection and construction operations. The support works shall be placed in a manner permitting washing and inspection of the downstream face of the trench. A minimum shored length of 25 feet shall be provided prior to commencing inspection or construction operations in the trench.
 - (6) Section 5, Use of Excavated Materials, does not apply.
 - (7) In Section 6, Disposal of Waste Materials, Method 1 shall apply. Waste material shall be spread on the slopes of the dam within the limits shown on the drawings.
 - (8) Measurement and payment will be by Method 3.
- c. Subsidiary Item, Borrow Excavation, Common
- (1) This item shall consist of all excavation required for obtaining fill materials not available from required excavations including embankment excavation and trench excavation to complete the construction of the permanent works and removal of sediment overburden in the borrow area to a depth of approximately one (1) foot.
 - (2) In Section 5, Use of Excavated Materials, Method 1 shall apply.
 - (3) In Section 6, Disposal of Waste Materials, Method 1 shall apply. After waste operations are completed, the waste fill area shall be smoothed and dressed to drain and blend with the surrounding terrain and not interfere with the natural drainage pattern.
 - (4) No separate payment will be made for borrow excavation. Compensation for borrow excavation will be included in the payment for embankment backfill, Bid Item 5.

CONSTRUCTION SPECIFICATION

23. EARTH FILL

1. SCOPE

The work shall consist of the construction of earth embankments and other earth fills required by the drawings and specifications.

2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing and disposition of materials in the various fills shall be subject to approval by the Engineer.

Fill materials shall contain no sod, brush, roots or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of materials used in the various fills shall be as listed and described in the specifications and drawings.

3. FOUNDATION PREPARATION

Foundations for earth fill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earth fill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earth fill as specified for subsequent layers of earth fill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture content that the earth fill can be compacted against them to effect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose materials by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earth fill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be not steeper than 1 horizontal to 1 vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earth fill conforming to the specifications for the earth fill to be placed upon the foundation.

4. PLACEMENT

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the Engineer. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of fill compacted by manually directed power tampers.

Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earth fill in dams, levees and other structures designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

- a. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks or layers of material differing substantially in texture or gradation from the surrounding material.

- b. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.
- c. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of not less than 2 percent shall be maintained to insure effective drainage, and except as otherwise specified for drain fill zones. If the drawings or specifications require or the Engineer directs that fill be placed at a higher level in one part of an embankment than another, the top surface of each part shall be maintained as specified above.
- d. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of stream flow during construction are specifically authorized in the contract.
- e. Embankments built at different levels as described under c or d above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all loose material, and shall be scarified, moistened and recompacted when the new fill is placed against it as needed to insure a good bond with the new fill and to obtain the specified moisture content and density in the junction of the in place and new fill.

5. CONTROL OF MOISTURE CONTENT

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary. Uniform moisture distribution shall be obtained by discing, blading or other approved methods prior to compaction of the layer.

Material that is too wet when deposited on the fill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted fill or a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall be scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

6. COMPACTION

Earth fill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

Class B compaction. Each layer of fill shall be compacted to a mass density not less than the minimum density specified.

Class C compaction. Each layer of fill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified, or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping if permitted by the Contracting Officer, or manually directed power tampers or plate vibrators. Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist will not be permitted.

The passage of heavy equipment will not be allowed: (1) over cast-in-place conduits prior to 14 days after placement of the concrete; (2) over cradled precast conduits prior to 7 days after placement of the concrete cradle; or (3) over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 2 feet, whichever is greater.

Compacting of fill adjacent to structures shall not be started until the concrete has attained the strength specified in Section 10 for this purpose. The strength will be determined by compression testing of test cylinders cast by the Engineer for this purpose and cured at the work site in the manner specified in ASTM Method C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of fill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

<u>Structure</u>	<u>Time Interval</u>
Retaining walls and counterforts	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and spillway risers, cast-in-place (with inside forms in place)	7 days
Conduits and spillway risers, cast-in-place (inside forms removed)	14 days
Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Antiseep collars and cantilever outlet bents	3 days

7. REMOVAL AND PLACEMENT OF DEFECTIVE FILL

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

8. TESTING

During the course of the work, the Engineer will perform such tests as are required to identify materials, to determine compaction characteristics, to determine moisture content, and to determine density of fill in place. These tests performed by the Engineer will be used to verify that the fills conform to the requirements of the specifications. Such tests are not intended to provide the Contractor with the information required by him for the proper execution of the work and their performance shall not relieve the Contractor of the necessity to perform tests for that purpose.

Densities of fill requiring Class A compaction will be determined by the Engineer in accordance with ASTM Method D 1556 (or by equivalent methods), except that the volume and moist weight of included rock particles larger than those used in the compaction test method specified for the type of fill will be determined and deducted from the volume and moist weight of the total sample prior to computation of density. The density so computed will be used to determine the percent compaction of the fill matrix.

9. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earth fill within the specified zone boundaries and pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified, no deduction in volume will be made for embedded conduits and appurtenances.

The pay limits shall be as defined below, with the further provision that earth fill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only where such overexcavation is directed by the Engineer to remove unsuitable material and where the unsuitable condition is not a result of the Contractor's operations.

(Method 1) The pay limits shall be as designated on the drawings.

(Method 2) The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the specified neat lines of the fill surface.

(Method 3) The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the measured surface of the completed fill.

(Method 4) The pay limits shall be the specified pay limits for excavation and the specified neat lines of the fill surface.

(Method 5) The pay limits shall be the specified pay limits for excavation and the measured surface of the completed fill.

(Use method 6 or 7 with all method 1 through 5)

(Method 6) Payment for each type and compaction class of earth fill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

(Method 7) Payment for each type and compaction class of earth fill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work, except furnishing, transporting, and applying water to the foundation and fill materials.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 5, Embankment Backfill

- (1) This item shall consist of placing and compacting the embankment backfill between Station 56+10± and Station 59+90± within the limits shown on the drawings.
- (2) Embankment backfill materials shall consist of suitable silts and clays obtained from the designated excavations or the borrow area.
- (3) In Section 6, Compaction, Class A shall apply. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained in compaction tests of the fill materials performed by Method A, ASTM D 698 (Standard Proctor Test). The compaction shall be performed in such a manner to assure proper bonding of materials throughout the fill matrix.
- (4) The maximum size of rock fragments incorporated in the fill shall be six (6) inches.
- (5) The maximum thickness of a layer before compaction shall be nine (9) inches.
- (6) The moisture content of the material incorporated in the fill shall be maintained with the range of three (3) percentage points below to one (1) percentage point above the optimum moisture content by Standard Proctor Test.
- (7) Measurement and payment will be by Methods 2 and 6 and shall include compensation for Subsidiary Items, Borrow Excavation, Common, Water and Grading.

b. Subsidiary Item, Grading

- (1) This item shall consist of all grading, shaping and smoothing required to bring the top of the dike to its original ground elevations with drain fill as staked in the field.
- (2) No separate payment will be made for this item. Compensation will be included in the payment for Bid Item 5, Embankment Backfill.

CONSTRUCTION SPECIFICATION

24. DRAIN FILL

1. SCOPE

The work shall consist of furnishing, placing and compacting drain fill required in the construction of structure drains and filters.

2. MATERIALS

(Method 1) Drain fill materials shall conform to the requirements of Material Specification 521. At least 30 days prior to delivery of the materials to the site the Contractor shall inform the Contracting Officer in writing of the source from which he intends to obtain them. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing.

(Method 2) Drain fill materials shall be sand, gravel or crushed stone or mixtures thereof obtained from the specified sources. They shall be selected as necessary to avoid the inclusion of organic matter, clay balls, excessive fine particles or other substances that would interfere with their free-draining properties.

3. BASE PREPARATION

Foundation surfaces and trenches shall be clean and free of organic matter, loose soil, foreign substances, and standing water when the drain fill is placed. Earth surfaces upon or against which drain fill will be placed shall not be scarified.

4. PLACEMENT

Drain fill shall not be placed until the subgrade has been inspected and approved by the Engineer. Drain fill shall not be placed over or around pipe or drain tile until the installation of the pipe or tile has been inspected and approved.

Drain fill shall be placed uniformly in layers not more than 12 inches deep before compaction. When compaction is accomplished by manually controlled equipment, the layers shall be not more than 8 inches deep. The material shall be placed in a manner to avoid segregation of particle sizes and to insure the continuity and integrity of all zones. No foreign materials shall be allowed to become intermixed with or otherwise contaminate the drain fill.

Traffic shall not be allowed to cross over drains at random. Equipment crossovers shall be maintained, and the number and location of such crossovers shall be established and approved prior to the beginning of drain fill placement. Each crossover shall be cleaned of all contaminating materials and shall be inspected and approved by the Engineer before additional drain fill is placed.

Any damage to the foundation surface or to the sides or bottoms of trenches occurring during placement of drain fill shall be repaired before drain fill placement is continued.

The upper surface of drain fill constructed concurrently with adjacent zones of earth fill shall be maintained at an elevation at least one foot above the upper surface of the adjacent fill.

Drain fill over or around pipe or drain tile shall be placed in a manner to avoid any displacement of the pipe or tile in line or grade.

5. CONTROL OF MOISTURE

The moisture content of drain fill materials shall be controlled as specified in Section 9. When the addition of water is required, it shall be applied in such a way as to avoid excessive wetting of adjacent earth fill. Except as specified in Section 9, control of the moisture content will not be required.

6. COMPACTION

Drain fill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of drain fill shall be compacted to a relative density of not less than 70 percent as determined by ASTM Method D 2049-64T.

Class I compaction. Each layer of drain fill shall be compacted by at least 2 passes, over the entire surface, of a steel-drum vibrating roller weighing not less than 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at least 1200 times per minute, or by an approved equivalent method.

Class II compaction. Each layer of drain fill shall be compacted by one of the following methods or by an approved equivalent method:

- a. At least 2 passes, over the entire surface, of a pneumatic-tired roller exerting a pressure of not less than 75 pounds per square inch.
- b. At least 4 passes, over the entire surface, of the track of a crawler-type tractor weighing not less than 20 tons.
- c. Controlled movement of the hauling equipment so that the entire surface is traversed by not less than one tread track of the loaded equipment.

Class III compaction. No compaction will be required beyond that resulting from the placing and spreading operations.

When compaction other than Class III compaction is specified materials placed in trenches or other locations inaccessible to heavy equipment shall be compacted by means of manually controlled pneumatic or vibrating tampers or by approved equivalent methods.

7. TESTING

The Engineer will perform such tests as are required to verify that the drain fill materials and the drain fill in place meet the requirements of the specifications. These tests are not intended to provide the Contractor with the information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his own tests for that purpose.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of drain fill within the neat lines shown on the drawings or limits established by the Engineer will be measured and computed to the nearest cubic yard. Where the Engineer directs placement of drain fill outside the neat lines to replace unsuitable foundation material, the volume of such drain fill will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

Payment for drain fill will be made at the contract unit price for each type of drain fill, complete in place. Except as otherwise specified in Section 9, such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 6, Drain Fill

- (1) This item shall consist of furnishing and placing the drain fill materials in the embankment between Station 17+00± and Station 19+00±, Station 28+00± and Station 30+00±, Station 41+00± and Station 43+00±, Station 56+10± and Station 59+90± as shown on the drawings.
- (2) In Section 2, Materials, Method 1 shall apply.
- (3) The gradation of the drain fill shall meet the following requirements:

<u>Sieve Size</u>	<u>Percent Passing (Dry Weight Basis)</u>
1½ inch	100
1 inch	80-100
¾ inch	70- 90
⅜ inch	50- 60
#4	35- 50
#8	25- 40
#30	10- 25
#200	0- 6.5

- (4) Drain fill shall be placed in horizontal layers not to exceed 18 inches deep. Drain fill shall not be dropped more than 30 inches vertically unless suitable equipment is used to prevent segregation.
- (5) In Section 6, Compaction, Class III shall apply.
- (6) The moisture content shall be maintained in a range, as determined by the Engineer, that will minimize segregation.
- (7) The material passing the #200 sieve shall be non-plastic.
- (8) The coefficient of permeability of the drain fill shall not exceed 250 feet per day when measured in accordance with ASTM D 2434 at the same in place density as achieved and measured in the fill after placement.
- (9) Measurement and payment will be in accordance with Section 8 except no payment for drain fill lost during construction of outlets will be made.

b. Bid Item 7, Coarse Aggregate

- (1) This item shall consist of furnishing and placing the coarse aggregate materials in the embankment at Station 18+00±, Station 29+00±, Station 42+00±, and Station 58+00± and in auxiliary outlets as required.
- (2) In Section 2, Materials, Method 1 shall apply.
- (3) The required gradation of the coarse aggregate shall be:

<u>Sieve Size</u>	<u>Percent Passing (Dry Weight Basis)</u>
3 inch	100
2½ inch	90-100
2 inch	35- 70
1½ inch	0- 15
¾ inch	0- 5

- (4) In Section 6, Compaction, Class III shall apply.
- (5) Control of moisture content will not be required.
- (6) The coarse aggregate drain materials shall be placed in a suitable manner to prevent segregation.
- (7) Measurement and payment will be in accordance with Section 8 except no payment for drain fill lost during construction of outlets will be made.

MATERIAL SPECIFICATION

521. AGGREGATES FOR DRAIN FILL AND FILTERS

1. SCOPE

This specification covers the quality of mineral aggregates for the construction of drain fill and filters.

2. QUALITY

Drain fill and filter aggregates shall be sand, gravel or crushed stone or mixtures thereof. They shall be composed of clean, hard, durable mineral particles free from organic matter, clay balls, soft particles or other substances that would interfere with their free-draining properties. Not more than 15 percent, by weight, shall be flat, elongated particles.

Aggregates of crushed limestone shall be thoroughly washed and screened. Coarse aggregates containing crushed limestone shall have not more than 3 percent, by weight, of particles finer than the No. 4 sieve. Crushed limestone shall not be used for fine aggregates except in combination with other materials such that not more than 5 percent of the portion finer than the No. 4 sieve shall be crushed limestone.

Aggregates shall be tested for soundness according to ASTM Method C 88, and shall have a weighted average loss in five cycles of not more than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

3. GRADING

Drain fill and filter aggregates shall conform to the specified grading limits after being placed in the work, and after being compacted if compaction is specified. Grading shall be determined by ASTM Method C 136, but the percentage of material finer than a No. 200 sieve shall be not more than 3 percent when determined by ASTM Method C 117.

4. STORING AND HANDLING

Drain fill and filter aggregates shall be stored and handled by methods that prevent segregation of particle sizes or contamination by mixing with other materials.

OPERATION AND MAINTENANCE PLAN FOR
WHITE TANKS NO. 3 AND NO. 4

GENERAL

A regular program of inspection and maintenance will be required to assure that the dams are at all times ready to control storm runoff. The following items are to be used as a guide to properly operate and maintain the dam.

OPERATION

The five gated outlets are designed to be operated independently of each other. The design permits either open or closed pre-storm conditions, but anticipates best performance to leave all five gates closed until after the storm to allow sediment to settle. Then open fully until pool is drained and reclose.

MAINTENANCE

Slide Gates

Open and close each gate at least annually to be sure gates are functioning properly. Clear gate assembly and also the trash rack of any obstructions and make any needed repairs. Check for any soil erosion near the gates.

Outlets

Check the conduits for obstructions or irregularities. Particularly, look for unusual wear on flow lines within the conduits that might indicate problems with high-velocity flow. Debris should be removed and disposed of. Any need for repairs should be reported to the Soil Conservation Service for evaluation of cause and repaired as necessary.

Check outlet basins for debris, sediment, cracks in concrete and concrete displacement. Sediment and debris should be removed whenever they approach the pipe invert elevation. Any major cracks in the concrete or displacement of concrete should be reported to the Soil Conservation Service for evaluation of cause.

Channels

The outlet channels should be checked periodically and cleared of sediment and debris after every major storm. The concrete linings should be checked for cracks and displacement and reported to the Soil Conservation Service for evaluation of cause.

Embankment

Inspection of the embankments should be performed at least annually and after major storms or earth movements. Check for transverse and longitudinal cracks in the surface of the fill, excessive erosion due to four-wheel drive vehicles, motorcycles, livestock travel or burrowing animals, and gullies and rills on the slopes. Make the necessary repairs. Check the downstream toe for irregularities.

Emergency Spillway

Check the emergency spillways annually and after any flows that occur. Look for excessive erosion, rills, and gullies or sediment and debris accumulation. Make repairs as necessary.

O&M COSTS AND FINANCIAL RESOURCES

Financial resources for O&M costs shall come from the Flood Control District of Maricopa County.

O&M RESPONSIBILITY AND PROCEDURES

The responsibility for maintenance belongs to the Flood Control District of Maricopa County. Technical assistance and advice may be obtained from the Soil Conservation Service.

CRITICAL ITEMS

All items listed under Maintenance are considered important and critical to the operation of the system. All of these items will be considered in special and recurring on-site inspections.

ENVIRONMENTAL CONCERNS

At present, the dams are not considered a threat to the environment. However, should an adverse environmental effect occur, every reasonable effort should be made to correct the problem.

O&M INSPECTION AND FOLLOW-UP

The sponsors will inspect the dams at least annually and after each significant flow or after the occurrence of any unusual condition that might adversely affect the dam. Any supplemental inspections then determined necessary will be scheduled and agreed to at that time. A written report will be made of each inspection, describing the conditions found and the corrective action needed. A copy of each report will be provided to the Soil Conservation Service within ten (10) days of the date on which the inspection was made. All deficiencies found in the inspection shall be corrected within an agreed-to time frame between the sponsors and the Soil Conservation Service.

STATE O&M HANDBOOK

The book entitled "State of Arizona Watersheds Operation and Maintenance Handbook for Projects Installed with Assistance from the Soil Conservation Service," U.S. Department of Agriculture, Soil Conservation Service, dated May 1971, shall be made a reference to this O&M Plan.

TIME OF RESPONSIBILITY

The sponsor's responsibility operation and maintenance began when the structures were first completed and will continue when a part or all of the work of installing the repairs is completed and accepted or is determined complete by the Soil Conservation Service. This responsibility shall continue until the expiration of the evaluated life of all the installed project measures. This does not relieve the sponsor's liability which continues throughout the life of the measure or until the measure is modified to remove potential loss of life or property.

PROVISIONS FOR THE SPONSOR'S PUBLICATION

Not applicable.

RECORDS

The sponsors will maintain a record of all inspections and significant actions taken by the sponsors with respect to operation and maintenance. The Soil Conservation Service may inspect these records at any reasonable time.

CONSTRUCTION SPECIFICATION

8. MOBILIZATION

1. SCOPE

The work shall consist of the mobilization of the Contractor's forces and equipment necessary for performing the work required under the contract.

It shall include the purchase of contract bonds; transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities at the site; and other preparatory work at the site.

It shall not include mobilization for any specific item of work for which payment for mobilization is provided elsewhere in the contract.

The specification covers mobilization for work required by the contract at the time of award. If additional mobilization costs are incurred during performance of the contract as a result of change or added items of work for which the Contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the items of work changed or added.

2. PAYMENT

Payment will be made as the work proceeds, after presentation of invoices by the Contractor showing his own mobilization costs and evidence of the charges of suppliers, subcontractors, and others for mobilization work performed by them. If the total of such payments is less than the contract lump sum for mobilization, the unpaid balance will be included in the final contract payment. Total payment will be the lump sum contract price for mobilization, regardless of actual cost to the Contractor.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

Payment of the lump sum contract price for mobilization will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 3 of this specification.

3. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 1, Mobilization

- (1) This item shall consist of the mobilization of the contractor's equipment and forces for the construction of the White Tanks No. 4 Drain.
- (2) There are no additional construction details.
- (3) Measurement and payment will be in accordance with Section 2.

CONSTRUCTION SPECIFICATION

10. WATER FOR CONSTRUCTION

1. SCOPE

The work shall consist of furnishing, transporting, and using water for construction purposes in accord with the applicable specifications.

2. FACILITIES AND EQUIPMENT

The Contractor shall build and maintain such access and haul roads as are needed, and shall furnish, operate, and maintain all pumps, piping, tanks, and other facilities needed to load, transport, and use the water as specified.

These facilities shall be equipped with meters, tanks, or other devices by which the volume of water supplied can be measured.

3. DUST ABATEMENT AND HAUL ROAD MAINTENANCE

Water for dust abatement and haul road maintenance shall be applied to haul roads and other dust-producing areas as needed to prevent excessive dust and to maintain the roads in good condition for efficient operation while they are in use.

4. EARTH FILL, DRAIN FILL, ROCK FILL

Water for earth fill, drain fill, or rock fill shall be used in the fill materials as specified in the applicable construction specifications.

5. CONCRETE, MORTAR, GROUT

Water used in mixing or curing concrete, pneumatically applied mortar, or other portland cement mortar or grout shall meet the requirements of the applicable construction specifications and shall be used in conformance with those specifications.

6. MEASUREMENT AND PAYMENT

For water items for which specific unit prices are established in the contract, the volume of water furnished and used in accordance with the specifications will be measured to the nearest 1000 gallons.

Except as otherwise specified, the measurement for payment will include all water needed at the construction site to perform the work required under the contract in accordance with the specifications but will not include water wasted or used in excess of the amount needed. It will not include water used in concrete which is mixed elsewhere and transported to the site.

Payment for water will be made at the contract unit price which shall be the price per 1000 gallons shown in the Bid Schedule. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to furnishing, transporting, and using the water.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 2, Water

- (1) This item shall consist of furnishing, measuring and applying all water required for the pressure washing of the downstream face of the trench, prior to the placement of the drain fill, as shown on the drawings and directed by the Engineer.
- (2) Water used shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.
- (3) Water used for the pressure washing of the trench shall be applied at a rate of from 5 to 10 gpm at a pressure of 20 to 40 psi.
- (4) Measurement and payment shall be in accordance with Section 6.

b. Subsidiary Item, Water for Construction

- (1) This item shall consist of furnishing and applying all water required for dust abatement, haul road maintenance, and any other water not required in Bid Item 2, Water.
- (2) No separate payment will be made for water for construction. Compensation for this item will be included in the payment for Drain Fill, Bid Item 5.

CONSTRUCTION SPECIFICATION

11. REMOVAL OF WATER

1. SCOPE

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the specifications. It shall include (1) building and maintaining all necessary temporary impounding works, channels, and diversions, (2) furnishing, installing and operating all necessary pumps, piping and other facilities and equipment, and (3) removing all such temporary works and equipment after they have served their purposes.

2. DIVERTING SURFACE WATER

The Contractor shall build, maintain, and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, a diversion must discharge into the same natural drainageway in which its headworks are located.

Unless otherwise specified, the Contractor shall furnish to the Engineer, in writing, his plan for diverting surface water before beginning the construction work for which the diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

3. DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches and other parts of the construction site shall be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all drains, sumps, pumps, casings, wellpoints, and other equipment needed to perform the dewatering as specified. Dewatering methods that cause a loss of fines from foundation areas will not be permitted.

Unless otherwise specified, the Contractor shall furnish to the Engineer, in writing, his plan for dewatering before beginning the construction work for which the dewatering is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

4. DEWATERING BORROW AREAS

Unless otherwise specified in Section 7, the Contractor shall maintain the borrow areas in drainable condition or otherwise provide for timely and effective removal of surface waters that accumulate, for any reason, within the borrow areas.

5. REMOVAL OF TEMPORARY WORKS

After the temporary works have served their purposes, the Contractor shall remove them or level and grade them to the extent required to present a sightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

Except as otherwise specified, pipes and casings shall be removed from temporary wells and the wells shall be filled to ground level with gravel or other material approved by the Engineer.

6. MEASUREMENT AND PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for diverting surface water, dewatering construction sites, and dewatering borrow areas will be made at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Dewatering

- (1) This item shall consist of dewatering the work site, to the extent that construction operations can be performed under dry, stable conditions.
- (2) Dewatering operations shall include diverting surface water, if required, and removing subsurface waters and water required for pressure washing of the trench.
- (3) No advance plan of dewatering will be required.
- (4) No separate payment will be made for dewatering. Compensation for dewatering will be included in the payment for trench excavation, common, Bid Item 3.

CONSTRUCTION SPECIFICATION

21. EXCAVATION

1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. CLASSIFICATION

Excavation will be classified as common excavation or rock excavation in accordance with the following definitions or will be designated as unclassified.

Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrappers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.

Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

Excavation will be classified according to the above definitions by the Engineer, based on his judgment of the character of the materials and the site conditions.

The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

For the purpose of this classification, the following definitions shall apply:

Heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of 200-300 net horsepower (at the flywheel).

Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12-20 yards.

Pusher tractor shall be defined as a track type tractor having a power rating of 200-300 net horsepower (at the flywheel) equipped with appropriate attachments.

3. UNCLASSIFIED EXCAVATION

Items designated as "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section 2 of this specification shall apply.

4. BLASTING

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements in Section 12 of this specification.

5. USE OF EXCAVATED MATERIALS

(Method 1) To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

(Method 2) Suitable materials from the specified excavations may be used in the construction of required earth fill or rock fill. The suitability of materials for specific purposes will be determined by the Engineer.

6. DISPOSAL OF WASTE MATERIALS

(Method 1) All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the locations shown on the drawings.

(Method 2) All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of by the Contractor at sites of his own choosing away from the site of the work.

7. BRACING AND SHORING

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The Contractor shall furnish, place and subsequently remove such supporting installations.

8. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earth fill is placed or any piles are driven within the limits of the excavation.

9. BORROW EXCAVATION

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as directed by the Engineer.

Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

10. OVEREXCAVATION

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the Engineer. Concrete that will be exposed to the atmosphere when

construction is completed shall contain not less than 6 sacks of cement per cubic yard of concrete. Concrete that will be permanently covered shall contain not less than 4 1/2 sacks of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved compacted earth fill, except that, if the earth is to become the subgrade for riprap, rock fill, sand or gravel bedding, or drain fill, the voids may be filled with material conforming to the specifications for the riprap, rock fill, bedding or drain fill.

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Regardless of quantities excavated, the measurement for payment will be made to the specified pay limits, except that excavation outside the specified lines and grades directed by the Engineer to remove unsuitable material will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

(Method 1) The pay limits shall be as designated on the drawings.

(Method 2) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be modified ground surface resulting from the specified previous excavation or fill.
- b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

(Method 3) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated

for previous excavation or fill and the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.

- b. The lower and lateral limits shall be the true surface of the completed excavation as authorized by the Engineer.

(Method 4) The pay limits shall be defined as follows:

- a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.
- b. The lower limit shall be at the bottom surface of the proposed structure.
- c. The lateral limits shall be 18 inches outside of the outside surfaces of the proposed structure or shall be vertical planes 18 inches outside of and parallel to the footings, whichever gives the larger pay quantity, except as provided in d, below.
- d. For trapezoidal channel linings or similar structures that are to be supported upon the sides of the excavation without intervening forms, the lateral limits shall be at the underside of the proposed lining or structure.
- e. For the purpose of the definitions in b, c, and d, above, any specified bedding or drain fill directly beneath or beside the structure will be considered to be a part of the structure.

(Use with all Methods) Payment for each type and class of excavation will be made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work, except that extra payment for backfilling required overexcavation will be made in accordance with the following provisions:

- a. Payment for backfilling overexcavation, as specified in Section 10 of this specification, will be made only if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's operations.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 12 of this specification.

12. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 3, Trench Excavation, Common

- (1) This item shall consist of all excavation, including support of the trench and disposal of excavated material, required for the construction of the trench for the embankment drain and outlets as shown on the drawings and staked in the field.
- (2) Excavation shall consist of removal and disposal of all materials resulting from excavation required to intercept embankment cracks. Approximate depths are shown on the drawings. Final depths will be determined by the Engineer.
- (3) All cracks in the downstream face of the embankment drain trench that extend below the trench excavation limit shown on the drawings shall be provided with an auxiliary embankment drain outlet at the immediate location. An auxiliary embankment drain outlet shall also be provided at the immediate location where there is located an open crack greater than 3/8 inch wide at depths below 3 feet from the top of the dam.
- (4) No more than 500 feet length of trench shall be opened at any time.
- (5) Support of the trench shall consist of furnishing, placing and removal of sheeting, bracing, shoring or portable shields required for safe inspection and construction operations. The support works shall be placed in a manner permitting washing and inspection of the downstream face of the trench. A minimum shored length of 25 feet shall be provided prior to commencing inspection or construction operations in the trench.
- (6) Section 5, Use of Excavated Materials, does not apply.
- (7) In Section 6, Disposal of Waste Materials, Method 1 shall apply. Waste material shall be spread on the slopes of the dam within the limits shown on the drawings.
- (8) Measurement and payment will be by Method 3.

b. Bid Item 4, Grading

- (1) This item shall consist of all grading, shaping and smoothing required to bring the top of the dike to its original ground elevations with drain fill as staked in the field.

- (2) For items of work for which specific lump sum prices are established in the contract, payment for grading will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

CONSTRUCTION SPECIFICATION

24. DRAIN FILL

1. SCOPE

The work shall consist of furnishing, placing and compacting drain fill required in the construction of structure drains and filters.

2. MATERIALS

(Method 1) Drain fill materials shall conform to the requirements of Material Specification 521. At least 30 days prior to delivery of the materials to the site the Contractor shall inform the Contracting Officer in writing of the source from which he intends to obtain them. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing.

(Method 2) Drain fill materials shall be sand, gravel or crushed stone or mixtures thereof obtained from the specified sources. They shall be selected as necessary to avoid the inclusion of organic matter, clay balls, excessive fine particles or other substances that would interfere with their free-draining properties.

3. BASE PREPARATION

Foundation surfaces and trenches shall be clean and free of organic matter, loose soil, foreign substances, and standing water when the drain fill is placed. Earth surfaces upon or against which drain fill will be placed shall not be scarified.

4. PLACEMENT

Drain fill shall not be placed until the subgrade has been inspected and approved by the Engineer. Drain fill shall not be placed over or around pipe or drain tile until the installation of the pipe or tile has been inspected and approved.

Drain fill shall be placed uniformly in layers not more than 12 inches deep before compaction. When compaction is accomplished by manually controlled equipment, the layers shall be not more than 8 inches deep. The material shall be placed in a manner to avoid segregation of particle sizes and to insure the continuity and integrity of all zones. No foreign materials shall be allowed to become intermixed with or otherwise contaminate the drain fill.

Traffic shall not be allowed to cross over drains at random. Equipment crossovers shall be maintained, and the number and location of such crossovers shall be established and approved prior to the beginning of drain fill placement. Each crossover shall be cleaned of all contaminating materials and shall be inspected and approved by the Engineer before additional drain fill is placed.

Any damage to the foundation surface or to the sides or bottoms of trenches occurring during placement of drain fill shall be repaired before drain fill placement is continued.

The upper surface of drain fill constructed concurrently with adjacent zones of earth fill shall be maintained at an elevation at least one foot above the upper surface of the adjacent fill.

Drain fill over or around pipe or drain tile shall be placed in a manner to avoid any displacement of the pipe or tile in line or grade.

5. CONTROL OF MOISTURE

The moisture content of drain fill materials shall be controlled as specified in Section 9. When the addition of water is required, it shall be applied in such a way as to avoid excessive wetting of adjacent earth fill. Except as specified in Section 9, control of the moisture content will not be required.

6. COMPACTION

Drain fill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of drain fill shall be compacted to a relative density of not less than 70 percent as determined by ASTM Method D 2049-64T.

Class I compaction. Each layer of drain fill shall be compacted by at least 2 passes, over the entire surface, of a steel-drum vibrating roller weighing not less than 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at least 1200 times per minute, or by an approved equivalent method.

Class II compaction. Each layer of drain fill shall be compacted by one of the following methods or by an approved equivalent method:

- a. At least 2 passes, over the entire surface, of a pneumatic-tired roller exerting a pressure of not less than 75 pounds per square inch.
- b. At least 4 passes, over the entire surface, of the track of a crawler-type tractor weighing not less than 20 tons.
- c. Controlled movement of the hauling equipment so that the entire surface is traversed by not less than one tread track of the loaded equipment.

Class III compaction. No compaction will be required beyond that resulting from the placing and spreading operations.

When compaction other than Class III compaction is specified materials placed in trenches or other locations inaccessible to heavy equipment shall be compacted by means of manually controlled pneumatic or vibrating tampers or by approved equivalent methods.

7. TESTING

The Engineer will perform such tests as are required to verify that the drain fill materials and the drain fill in place meet the requirements of the specifications. These tests are not intended to provide the Contractor with the information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his own tests for that purpose.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of drain fill within the neat lines shown on the drawings or limits established by the Engineer will be measured and computed to the nearest cubic yard. Where the Engineer directs placement of drain fill outside the neat lines to replace unsuitable foundation material, the volume of such drain fill will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

Payment for drain fill will be made at the contract unit price for each type of drain fill, complete in place. Except as otherwise specified in Section 9, such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 5, Drain Fill

- (1) This item shall consist of furnishing and placing all the drain fill materials required in the trench as shown on the drawings.
- (2) In Section 2, Materials, Method 1 shall apply except delete the third sentence of paragraph one in Section 2 of Material Specification 521.
- (3) The drain fill shall meet the following gradation requirements.

<u>Sieve Size</u>	<u>Percent by Wt. Passing</u>
1½"	100
1"	80-100
¾"	70- 90
⅜"	50- 60
No. 4	35- 50
No. 8	25- 40
No. 30	10- 25
No. 200	0-6.5

- (4) Drain fill shall be placed in horizontal layers not to exceed 18 inches deep. Drain fill shall not be dropped more than 30 inches vertically unless suitable equipment is used to prevent segregation.
- (5) In Section 6, compaction shall be Class III.
- (6) The moisture content shall be maintained in a range, as determined by the Engineer, that will minimize segregation.
- (7) The material passing the No. 200 sieve shall be nonplastic.
- (8) The coefficient of permeability of the drain fill shall not exceed 250 feet per day when measured in accordance with ASTM D 2434 at the same in place density as achieved and measured in the fill after placement.
- (9) Measurement and payment will be made in accordance with Section 8 except no payment for drain fill lost during construction of outlets will be made.

b. Bid Item 6, Coarse Aggregate Drain

- (1) This item shall consist of furnishing and placing all the coarse aggregate drain materials required in the embankment drain outlet trenches as shown on the drawings.

- (2) In Section 2, Materials, Method 1 shall apply.
- (3) The gradation of the coarse aggregate drain materials shall meet the requirements of size No. 2 coarse aggregate in accordance with ASTM C33.
- (4) The coarse aggregate drain materials shall be placed in a suitable manner to prevent segregation.
- (5) In Section 6, compaction shall be Class III.
- (6) Control of moisture content will not be required.
- (7) Measurement and payment will be made in accordance with Section 8 except no payment for drain fill lost during construction of outlets will be made.

MATERIAL SPECIFICATION

521. AGGREGATES FOR DRAIN FILL AND FILTERS

1. SCOPE

This specification covers the quality of mineral aggregates for the construction of drain fill and filters.

2. QUALITY

Drain fill and filter aggregates shall be sand, gravel or crushed stone or mixtures thereof. They shall be composed of clean, hard, durable mineral particles free from organic matter, clay balls, soft particles or other substances that would interfere with their free-draining properties. Not more than 15 percent, by weight, shall be flat, elongated particles.

Aggregates of crushed limestone shall be thoroughly washed and screened. Coarse aggregates containing crushed limestone shall have not more than 3 percent, by weight, of particles finer than the No. 4 sieve. Crushed limestone shall not be used for fine aggregates except in combination with other materials such that not more than 5 percent of the portion finer than the No. 4 sieve shall be crushed limestone.

Aggregates shall be tested for soundness according to ASTM Method C 88, and shall have a weighted average loss in five cycles of not more than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

3. GRADING

Drain fill and filter aggregates shall conform to the specified grading limits after being placed in the work, and after being compacted if compaction is specified. Grading shall be determined by ASTM Method C 136, but the percentage of material finer than a No. 200 sieve shall be not more than 3 percent when determined by ASTM Method C 117.

4. STORING AND HANDLING

Drain fill and filter aggregates shall be stored and handled by methods that prevent segregation of particle sizes or contamination by mixing with other materials.

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE River Basin-Watershed Planning Staff

~~XXXXXXXXXXXX~~ Suite 326, Arizona Title Bldg., 111 West Monroe St.
Phoenix, Arizona 85003

SUBJECT: WS - PL 566 - White Tanks Dam No. 4

DATE: December 14, 1970

TO: J. J. Turner

WHITE TANKS FLOOD REPORT

1. In the summer of 1954 two flood control structures, identified as White Tanks No. 3 and No. 4, were built by the Soil Conservation Service in cooperation with the County of Maricopa and the Municipal Water Conservation District No. 1.
2. The project was known as the White Tanks Erosion Control Project and SCS participation was under the Pilot Watershed Program.
3. It is reported that 4.5" of precipitation were recorded in a gauge near the intersection of Jack Rabbit Road (195th Avenue) and West Indian School Road. According to the Salt Lake City R.F.C. map, dated October 20, 1970, the total area was in the 4" rainfall area. The 100-year, 24-hour storm for this area is 4.0 inches.
4. The rain is reported to have started about midafternoon on Saturday, September 5, 1970. The maximum intensity is believed to have occurred between 6:00 and 8:00 p.m. It was reported that water started flowing across Jack Rabbit Road in the vicinity of Thomas Road about 7:00 p.m. and ceased to flow across the road about 9:00 p.m.
5. The elevation of the high point of the watershed is 3671'. The spillways of Structure No. 4 are at elevation 1050' with the top of the structure at 1056'. The elevation at the rain gauge is approximately 1165'.
6. Structure No. 4 was designed to impound 1036 acre-feet from a drainage area of 10.3 square miles.
7. Since 1954 developments north and west of Indian School Road and Tuthill road have caused four square miles of watershed originally designed to flow into Structure No. 3 and an additional 1.8 square miles of watershed to flow into Structure No. 4 along Tuthill Road. Additional land developments between Jack Rabbit Road and Tuthill Road plus improvements of Jack Rabbit Road divert still another 2.7 square miles of watershed into the east end of Structure No. 4 along Jack Rabbit Road.



8. Thus at the time of the storm there was a total of 18.9 square miles of watershed contributing to Structure No. 4. This is 8.6 square miles more than the structure was designed to handle.
9. It should be noted that deposition of coarse sands in the west channel of Jack Rabbit Road limit the flow of water diverted into Structure No. 4. Excess flood waters flowing south along Jack Rabbit Road overflowed the pavement in the vicinity of Thomas and McDowell Roads causing damage to an unknown number of homes in the subdivisions east of Jack Rabbit Road.
10. High water marks indicate that Structure #4 filled and the 160' wide west emergency earth spillway flowed for a short period at a depth averaging about 0.8 ft. The approximate maximum discharge from the spillway was 250 cfs. There was no erosion in the channel except for a small 1' deep headcut at the extreme south and where it emptied into a flood channel along the north side of an auxiliary Air Force Landing Field. The flood channel appeared to have been carrying ten to twenty times the spillway flow.
11. Flow through the 175' wide north emergency earth spillway averaged about 1.6' in depth. The approximate maximum discharge was 650 cfs. Surveys after the flood indicate that the crest of this spillway is now about 0.4' below the elevation it was at the time of completion. It is believed that most of the lowering of the earth spillway crest resulted from wind erosion and from use of the cleared spillway crest area as a driveway for vehicles and as a practice ground for horsemen and motorcyclists during the 16 years since its construction. The high water marks indicate that the water surface was 0.4' higher at the Jack Rabbit Road spillway than at the Tutbill Road (west) spillway. This could have been the result of wave action or a west wind across the one mile reach of the reservoir. Erosion in this spillway from this storm was negligible. Flood water through the spillway crossed unimproved desert for one-half mile before co-mingling with water flowing from the north and west.
12. The two gated principal spillways remained closed during the storm. Had they been open they would have had little effect upon the reservoir hydrograph because of the intense short period of runoff. The reservoir was emptied through seepage into the reservoir area.
13. Structure No. 3, with a capacity of 2655 acre-feet and a design watershed area of 24.1 square miles, received an inflow of approximately 350 acre-feet. The rainfall on this watershed was from 3 inches to 4 inches according to the Salt Lake City R.F.C. Preliminary Storm Total Map. As mentioned in paragraph 7, four square miles of this watershed have

been diverted into the watershed of Structure No. 4. These four square miles are located in the area where the rainfall was 4 inches or more and where the storm was quite intense.

14. Based on current SCS criteria for a Class C Structure this storm was equal to the design storm for the principal spillway hydrograph. Because of the extra drainage area there was some flow through the emergency spillways.
15. Based on a Class C Structure Classification and a drainage area of 10.3 square miles an emergency spillway hydrograph was routed through the existing Structure No. 4. This routing showed that the earth spillways would have a discharge of 8300 cfs. with the water surface at elevation 1054.2 and a velocity of 7.0 ft/sec in the west spillway and 7.6 ft/sec in the north spillway.
16. A Freeboard Hydrograph based on 10.3 square miles was routed through the existing Structure #4 and it was found to overtop the existing structure while the inflow was still increasing. If it is desired to keep the same size spillway in width at the present location it will be necessary to raise the dam approximately 5 feet to handle the freeboard storm. The existing structure has a maximum storage capacity of 2,000 acre feet, while to handle the freeboard storm it would be necessary to store around 3,200 acre feet, when the spillways are flowing 29,000 cfs.
17. Since the original drainage area cannot be handled by the existing Structure No. 4, it is recommended that consideration be given to correct the overloading of Structure No. 4 by combinations of the following alternatives:
 - A. Redesign the roadway fills and channels in Sections 18 and 13 so as to permit the four square mile area in parts of Sections 2, 3, 10, 11, 12, 13 and 14 so the area will drain into structure No. 3 as originally planned. (See map attached.)
 - B. Construct one or more small retarding structure north of Indian School Road to control runoff from all or parts of Sections 13, 14, 17, 18, 19 and 20. (Structure No. 4 was not designed to receive runoff from this area but since 1954 the runoff has been directed into Structure No. 4).
 - C. Enlarge Structure No. 4 to enable it to safely handle runoff from the original drainage area plus the drainage from Section 29 and 32 that was not originally planned to be handled by Structure No. 4.

This enlargement can be done by widening the existing spillway so the dam will not be overtopped or by raising the dam to prevent the overtopping or a combination of the two.

- (1) The existing spillways will discharge 12,000 cfs. with a velocity of approximately 8.5 fps. If the existing spillway is retained and the problem is corrected by raising the dam it may be necessary to protect the spillways from erosion by lining with concrete or some other type of protection.
- D. If it is desired to control the entire 18.9 sq. mi. drainage area with Structure #4 and the spillways are kept at their present location and elevation, it will be necessary to raise the top of the dam to elevation 1063. At this elevation the storage will be approximately 4,000 ac. ft. with the spillways discharging 53,000 cfs. The above numbers reflect the routing of a Class "C" freeboard storm through the structure.

The Emergency Hydrograph routed through the structure for the 18.9 sq. mi. drainage shows the spillways would need to handle 16,000 cfs with the upstream water surface at elevation 1056.0. The velocity in the west spillway would be 9.1 fps and the velocity in the north spillway would be 9.7 fps.
- E. If it is not feasible to increase the size of the existing Structure No. 4, additional flood control structures should be built upstream from Structure No. 4. One possible location would be in the S.E. corner of Section No. 23. Another possible location would be in Section No. 25.
- F. The existing principal spillway pipes are not being used as designed. The downstream outlet channels for these pipes have never been constructed.

Conclusions:

It is apparent that structure No. 4 as it exists today is not a safe structure according to our criteria for a Class "C" Structure. Since the original 10.3 square mile drainage area cannot be safely handled by the structure, the extra drainage area diverted into the structure can be controlled before it gets to Structure No. 4 or the structure can be enlarged to handle it.

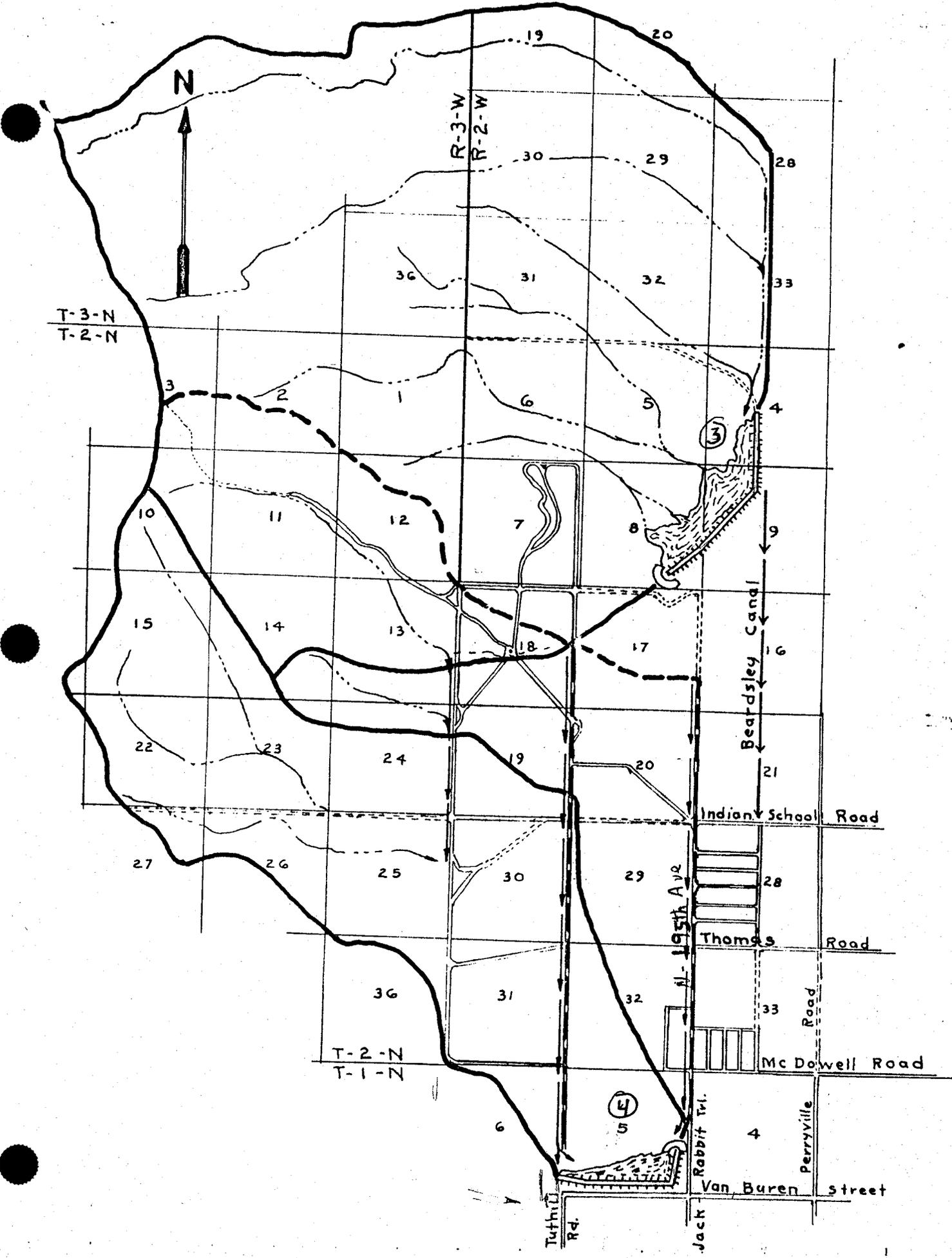
James M. Malone
Hydraulic Engineer

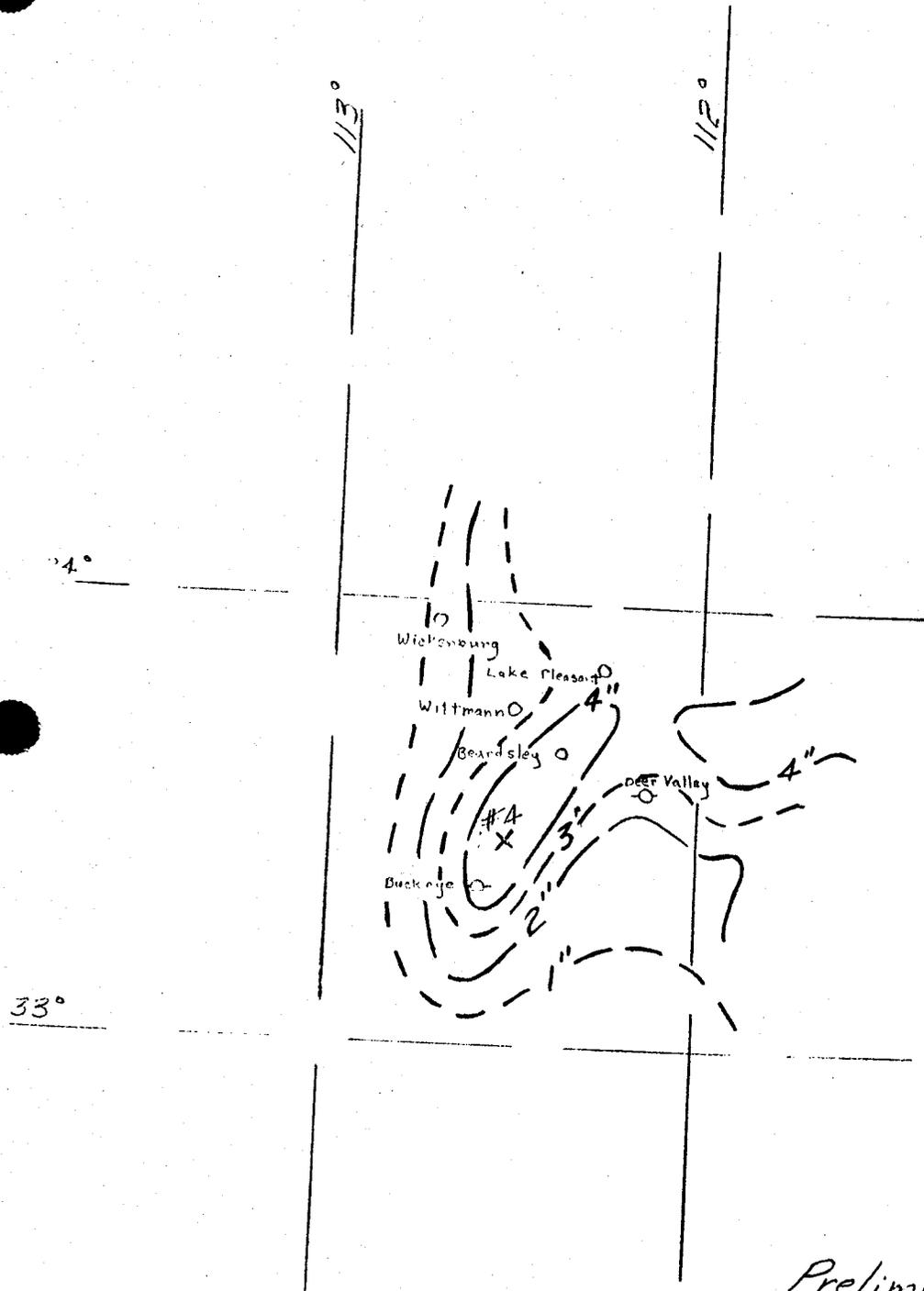
Robert M. Bartels
Engineering Specialist

Attachments

cc: R. E. Rellison - Portland
G. Watt
C. Maguire

JMM/RMB:mh





Preliminary Storm Total
 Sept. 5&6, 1970
 Salt Lake City R.F.C.
 10/20/70
 Traced 12/10/70
 R.M. Bartels

ADMINISTRATIVE SERVICES DIVISION
 ARIZONA HIGHWAY DEPARTMENT

N^o 765
 206 SOUTH 17th AVENUE
 PHOENIX, ARIZONA 85007
 Date 1-17-70
 Name Soil Conservation Service
 Address 230 N 1st Ave. Phoenix

SOLD BY		CASH	C. O. D.	CHARGE	ON ACCT.	MOSE. RETD.	PAID OUT
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QUAN.		DESCRIPTION				PRICE	AMOUNT
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Rec'd *Richard M. Butts*

ARIZONA HIGHWAY DEPARTMENT
PHOTOGRAMMETRY AND MAPPING DIVISION

WORK ORDER - PHOTO LAB

DATE 11/16/70
SUSPENSE DATE 11/17/70
DOCUMENT NO.

ADMINISTRATIVE	BLC. NO.	FUNCTION	OBJECT	AMOUNT
	<u>B 250</u>	<u>3030</u>		
PROJECT NO.	P/N	BLC. NO.	FUNCTION	OBJECT

DIRECT PRINTING B & W, BLUELINE PRINTS, REDLINE PRINTS, ETC.

NO. OF ORIG.	TYPE OF PRTS.	NO. PRTS. EA.	SQ. FT. EA.	TOTAL SQ. FT.	PRICE/SQ. FT.	TOTAL PRICE	SPECIAL INSTRUCTIONS

PHOTO COPY CONTACT NEGATIVES, POSITIVES, COMPOSITES

NO. OF ORIG.	NEG. EA.	POS. EA.	TYPE MATERIAL	SIZE OF COPY	TOTAL COPIES	TOTAL PRICE	SPECIAL INSTRUCTIONS

AERIAL PHOTOGRAPHS DOUBLE-WEIGHT OR SINGLE-WEIGHT

JOB NO.	FLIGHT	EXPOSURE NOS.	PHOTO DATE	PHOTO SCALE	ROLL NO.	S/W	D/W	NO. EA.	TOTAL PRTS.	TOTAL PRICE
<u>1016</u>	<u>1</u>	<u>5, 6, 7</u>	<u>3/2/69</u>	<u>11/5000'</u>	<u>5011</u>		<input checked="" type="checkbox"/>	<u>1</u>	<u>3</u>	<u>3.75</u>
	<u>2</u>	<u>6, 7, 8</u>	↓	↓	↓		↓	<u>1</u>	<u>3</u>	<u>3.75</u>
	<u>3</u>	<u>6, 7, 8</u>	↓	↓	↓		↓	<u>1</u>	<u>3</u>	<u>3.75</u>

EXPOSITIVES

JOB NO.	FLIGHT	EXPOSURE NOS.	PHOTO DATE	PHOTO SCALE	ROLL NO.	PRIORITY	TOTAL B & L	TOTAL KELSH	TOTAL PRICE

AERIAL PHOTOGRAPH ENLARGEMENTS DOUBLE-WEIGHT, SINGLE-WEIGHT, CRONAFLEX, CRONAPAQUE, ETC.

JOB NO.	FLIGHT	EXPOSURE NOS.	PHOTO DATE	ROLL NO.	NO. EA.	TYPE MATL.	ENL. SCALE	MOUNTING	TOTAL PRICE

REMARKS:

NO SALE

\$17.25
9.00

PREPARED BY:

Tom Sloucom

DIVISION

Soil Cons. Service

TEL. NO.

261-4031

ARIZONA HIGHWAY DEPARTMENT
PHOTOGRAMMETRY AND MAPPING DIVISION

WORK ORDER - PHOTO LAB

DATE 11/16/70
SUSPENSE DATE 11/17/70
DOCUMENT NO.

ADMINISTRATIVE	BLC. NO.	FUNCTION	OBJECT	AMOUNT
	<u>B 250</u>	<u>3030</u>		
PROJECT NO.	P/N	BLC. NO.	OBJECT	

DIRECT PRINTING B & W, BLUELINE PRINTS, REDLINE PRINTS, ETC.

NO. OF ORIG.	TYPE OF PRTS.	NO. PRTS. EA.	SQ. FT. EA.	TOTAL SQ. FT.	PRICE/SQ. FT.	TOTAL PRICE	SPECIAL INSTRUCTIONS

PHOTO COPY CONTACT NEGATIVES, POSITIVES, COMPOSITES

NO. OF ORIG.	NEG. EA.	POS. EA.	TYPE MATERIAL	SIZE OF COPY	TOTAL COPIES	TOTAL PRICE	SPECIAL INSTRUCTIONS

AERIAL PHOTOGRAPHS DOUBLE-WEIGHT OR SINGLE-WEIGHT

JOB NO.	FLIGHT	EXPOSURE NOS.	PHOTO DATE	PHOTO SCALE	ROLL NO.	S/W	D/W	NO. EA.	TOTAL PRTS.	TOTAL PRICE
<u>TRV6</u>	<u>1</u>	<u>5, 6, 7</u>	<u>3/2/67</u>	<u>11/5000</u>	<u>5CM</u>		<input checked="" type="checkbox"/>	<u>1</u>	<u>3</u> ✓	<u>300</u>
<u>↓</u>	<u>2</u>	<u>6, 7, 8</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	<u>1</u>	<u>3</u> ✓	<u>300</u>
<u>↓</u>	<u>3</u>	<u>6, 7, 8</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>		<u>↓</u>	<u>1</u>	<u>3</u> ✓	<u>300</u>

DIAPPOSITIVES

JOB NO.	FLIGHT	EXPOSURE NOS.	PHOTO DATE	PHOTO SCALE	ROLL NO.	PRIORITY	TOTAL B & L	TOTAL KELSH	TOTAL PRICE

AERIAL PHOTOGRAPH ENLARGEMENTS DOUBLE-WEIGHT, SINGLE-WEIGHT, CRONAFLEX, CRONAPAQUE, ETC.

JOB NO.	FLIGHT	EXPOSURE NOS.	PHOTO DATE	ROLL NO.	NO. EA.	TYPE MATL.	ENL. SCALE	MOUNTING	TOTAL PRICE

REMARKS:

RESALE: 1⁰² each - 900 total [Signature]

ORDERED BY:

Ron Sloucom

DIVISION

SOIL CONS. SERVICE

TEL. NO.

261-4031

White Tanks Flood Report

DRAFT (TURNER) - 11-12-70

1. In the summer of 1954 two flood control structures, identified as White Tanks No. 3 and No. 4, were built by the Soil Conservation Service in cooperation with the County of Maricopa and the Municipal Water Conservation District No. 1.
2. The project was known as the White Tanks Erosion Control Project and SCS participation was under the Pilot Watershed Program.
3. It is reported that 4.5" of precipitation were recorded in a gauge near the intersection of Jack Rabbit Road (195 Avenue) and West Indian School Road. This is believed to have been near the center of maximum rainfall with somewhat lesser intensity near the summit of the White Tank Mountains about five miles to the west.

The rain is reported to have started about midafternoon on Saturday, September 5, 1970. The maximum intensity is believed to have occurred between 6:00 and 8:00 p.m. It was reported that water started flowing across Jack Rabbit Road in the vicinity of Thomas Road about 7:00 p.m. and ceased to flow across the road about 9:00 p.m.

5. The elevation of the high point of the watershed is 3671'. The spillways of Structure No. 4 are at elevation 1050' with the top of the structure at 1056'. The elevation at the rain gauge is approximately 1165'.
6. Structure No. 4 was designed to impound 1036 acre-feet from a drainage area of 10.3 square miles.
7. Since 1954 developments north and west of Indian School Road and Tuthill Road have caused four square miles of watershed originally designed to flow into

Structure No. 3 and an additional 1.8 square miles of watershed to flow into Structure No. 4 along Tuthill Road. Additional land developments between Jack Rabbit Road and Tuthill Road plus improvement of Jack Rabbit Road divert still another 2.7 square miles of watershed into the east end of Structure No. 4 along Jack Rabbit Road.

8. Thus at the time of the storm there was a total of 18.8 square miles of watershed contributing to Structure No. 4. This is 8.5 square miles more than the 10.3 square miles for which the structure was designed. ✓ 18.8 ✓ 8.5
9. It should be noted that chronic deposition of coarse sands in the west borrow channel of Jack Rabbit Road limit the flow of water diverted into Structure No. 4. Excess flood waters flowing south along Jack Rabbit Road overflowed the pavement in the vicinity of Thomas and McDowell Roads causing damage to an unknown number of homes in the subdivisions east of Jack Rabbit Road.
10. High water marks indicate that the Structure No. 4 filled and the 165' wide Tuthill Road emergency earth spillway flowed for a short period at a depth averaging about 0.8'. There was no erosion in the channel except for a small 1' deep headcut at the extreme south end where it emptied into a flood channel along the north side of an auxiliary Air Force Landing Field that appeared to have been carrying ten to twenty times the spillway flow.
11. Flow through the (Jack Rabbit) Road emergency earth spillway, also 165' wide, averaged about 1.6' in depth. Estimated discharge of this spillway Surveys after the flood indicate that the crest of this spillway is now about 0.4' below the elevation at the time of completion. It is believed that most of the lowering of the earth spillway crest resulted from wind erosion and from use of the cleared spillway crest area as a driveway for vehicles and as a practice ground for horsemen and

motorcyclists during the 16 years since its construction. The high water marks indicate that the water surface was 0.4' higher at the Jack Rabbit Road spillway than at the Tuthill Road (west) spillway. This could have been the result of wave action or a west wind across the one mile reach of the reservoir. Erosion in this spillway from this storm was negligible. Flood-water through the spillway crossed unimproved desert for one-half mile before co-mingling with larger onslaughts of water flowing from the north and west.

12. The two-rated principal spillways remained closed during the storm. Had they been open they would have had little effect upon the reservoir hydrograph because of the intense short-period of runoff.
13. Structure No. 3 with a capacity of 2655 acre-feet and a designed watershed area of 24.1 square miles, received an inflow of approximately 350 acre-feet. The rainfall was less intense on this watershed than on the watershed of Structure No. 4 and as mentioned in paragraph seven above. Four square miles of this watershed has been diverted into the watershed of Structure No. 4. Runoff from this four square mile area was quite heavy.

It is recommended that consideration be given to correcting the overloading of Structure No. 4 by combinations of the following alternatives:

A. Redesign the roadway fills and channels in Sections 18 and 13 so as to permit the four square mile area in parts of Sections 2, 3, 10, 11, 12, 13 and 14 so the area will drain into Structure No. 3 as originally planned.

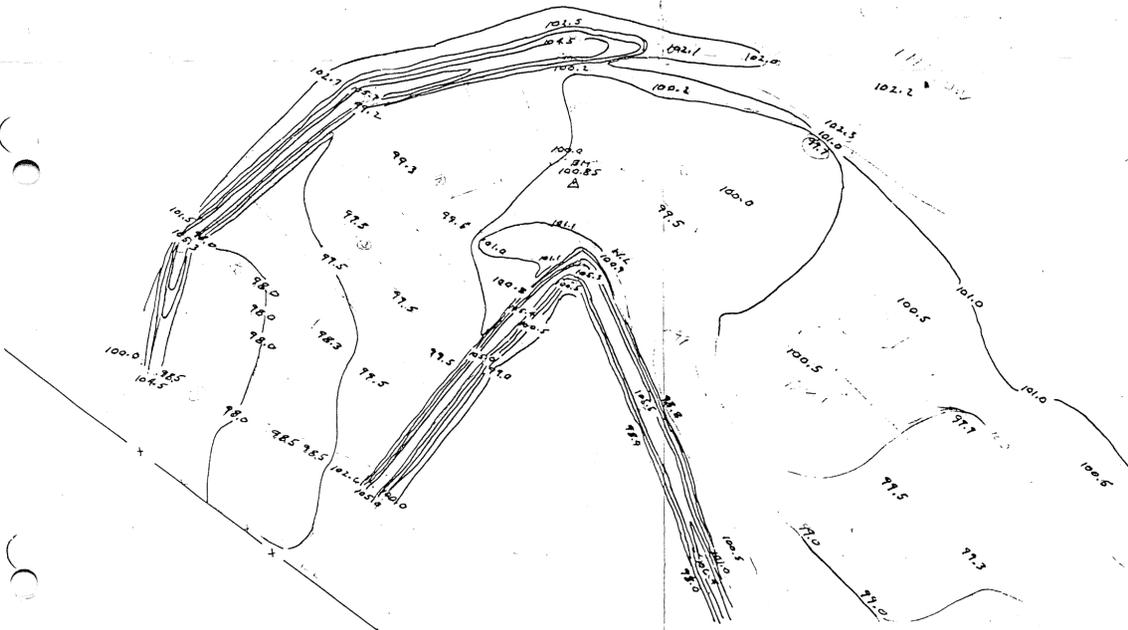
See map attached.

B. Construct one or more small retarding structures north of Indian School Road to control runoff from all or parts of Sections 13, 14, 17, 18, 19, and 20. (Structure No. 4 was not designed to receive runoff from) this area but

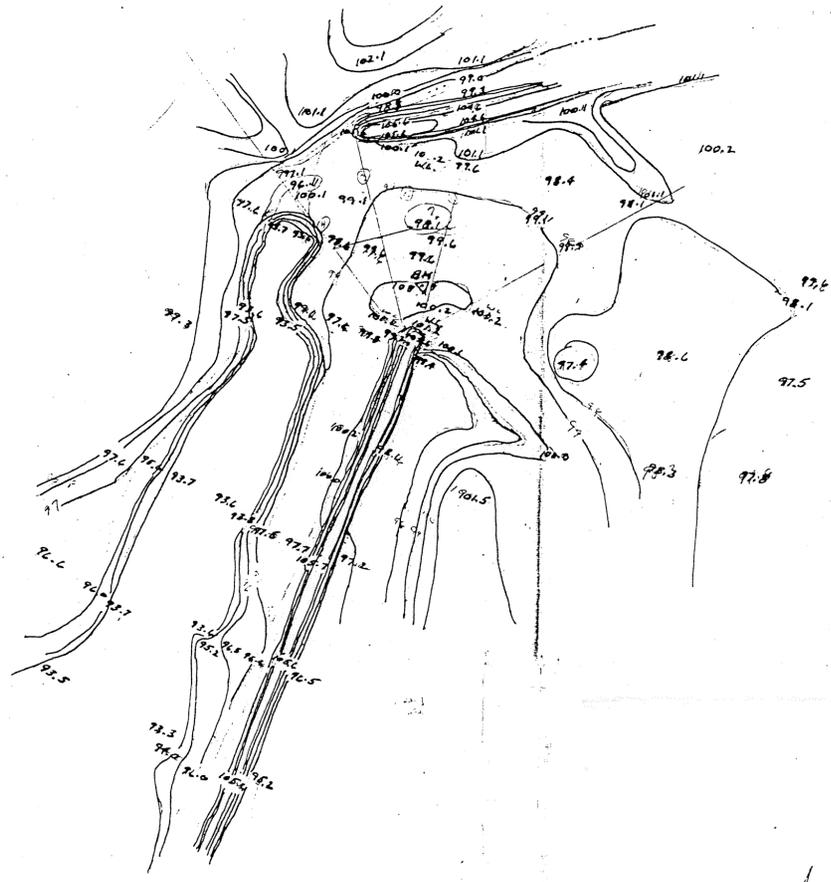
since 1954⁷¹ runoff has been directed into Structure No. 4.)

C. Enlarge Structure No. 4 to enable it to safely accommodate runoff from Section 29 and that part of Section 32 that was not originally designed to contribute to Structure No. 4.

D. If alternatives "A" and "B" are carried out it is physically possible to enlarge Structure No. 4 to safely accommodate the runoff from the entire 18.8 square miles now contributing to it.



White Tanks DAM
 SOUTH Spillway Topo 9/13-70



White Tanks DAM
 North Spillway Topo
 SCALE 1" = 100'
 9/13/70

STATE <i>Arizona</i>	PROJECT <i>White Tanks # 4</i>		
BY <i>R.M.B.</i>	DATE <i>16 Nov 70</i>	CHECKED BY	DATE
SUBJECT <i>D.A. (Planimeter)</i>			JOB NO.
			SHEET <i>1</i> OF

Area # 1 (North of Camelback)

Planned Area

Area Sept 1970

20.26 10.15 } 10.13 ^{sq}"
 10.11 10.11 }
 0.00

94.11 47.03 } 47.05 ^{sq}"
 47.08 47.08 }
 0.00

Area # 2

Between Camelback & Thomas

Planned

Area Sept 1970

80.48 40.28 } 40.24
 40.20 40.20 }
 0.00

122.61 61.29 } 61.30 ^{sq}"
 61.32 61.32 }
 0.00

Area # 3

Thomas to Structure

Planned

Area Sept 70

38.19 19.13 } 19.10 ^{sq}"
 19.06 19.06 }
 0.00

47.78 23.91 } 23.89 ^{sq}"
 23.87 23.87 }
 0.00

Scale = 1" = 2000' or 0.143 sq mi = 1 in or 1 in = 91.83 Acres

Planned Area = 10.13
 40.24
 19.10

Area 1970 47.05
 61.30
 23.89

Note: Letters

Round up to get
 10.3 orig. Designed = 9.95 ^{sq} mi.

= 18.92 sq mi.

fin
 R.M.B. → = 6350 Acres

= 12,100 Acres

STATE	Arizona.	PROJECT	White Tanks # 4
BY	R. M. B.	CHECKED BY	
DATE	17 Nov 70	DATE	
SUBJECT	RCN Calculation		JOB NO.
			SHEET 3 OF

D.A. Sept. 1970
 "D" Soil Old D.A. = 4.2 sq mi = 2688 Acres
 "D" Soil 21.9%^A + 2.49%^D = 24.45% = 3.5 sq mi. = 2240 Acres
 7.7 sq mi 4928 Acres

Total D.A. = 18.92 sq mi = 12,100 Acres

C Soil = 35% remainder = 0.35 (18.92 - 7.7) sq mi = 3.93 sq mi
 = 0.35 (12,100 - 4928) Ac = 2510 Acres

B Soil = 65% remainder = 0.65 (11.22) sq mi = 7.29 sq mi
 0.65 (7172) Ac = 4662 Acres

			RCN	weighted RCN
% D =	4928 / 12,100 =	40.73%	92	37.5
% C =	2510 / 12,100 =	20.74%	89	18.4
% B =	4662 / 12,100 =	38.53%	83	<u>32.0</u>
				87.9

Use 88

STATE <i>Arizona</i>		PROJECT <i>White Tanks #4</i>		
BY <i>R.M.B.</i>	DATE <i>17 Nov 70</i>	CHECKED BY	DATE	JOB NO.
SUBJECT <i>RCN Calculation</i>				SHEET <i>2</i> OF

Original D.A.

Total D.A. = 10.3 sq. mi.

All Drainage has 10% cover of Desert Brush

"D" Soil = $29.40 \text{ sq. mi.} = 4.2 \text{ sq. mi.} = 2688 \text{ Ac.}$

"C" Soil = $(10.3 - 4.2) (.35) = 2.14 \text{ sq. mi.} = 1370 \text{ Ac}$

"B" Soil = $(10.3 - 4.2) (.65) = 3.96 \text{ sq. mi.} = 2532 \text{ Ac}$

6590 Ac

$\% D = \frac{2688}{6590} = 40.8$

RCN
92

Weighted RCN
37.7

$\% C = \frac{1370}{6590} = 20.8$

89

18.5

$\% B = \frac{2532}{6590} = 38.4$

83

31.9

88.1

Use 88.0

STATE	Arizona	PROJECT	White Tanks #4		
BY	R.M.B.	DATE	17 Nov 70	CHECKED BY	DATE
SUBJECT	1-10 Day Precip. Amount			JOB NO.	
					SHEET 4 OF

$$1) \text{ 2 yr } 24 \text{ hr} = 1.5 \text{ inch}$$

$$\text{ 2 yr } 6 \text{ hr} = 1.2 \text{ inch}$$

$$\text{ 2 yr } 1 \text{ hr} = 0.8 \text{ inch}$$

(From Fig. 2 TP40)

$$2) \text{ 2 yr } 10 \text{ Day} = 2.4 \text{ inches}$$

(Fig 6 TP 49)

$$3) \text{ 2 yr } 10 \text{ day} = 3.0 \text{ inches}$$

$$100 \text{ yr } 10 \text{ day} = 8.0 \text{ inches}$$

$$\frac{100}{2} = \frac{8.0}{3.0} = 2.67$$

} TP 49

$$4) \text{ from 2 above } (2.4)(2.67) = 6.4 \text{ inches}$$

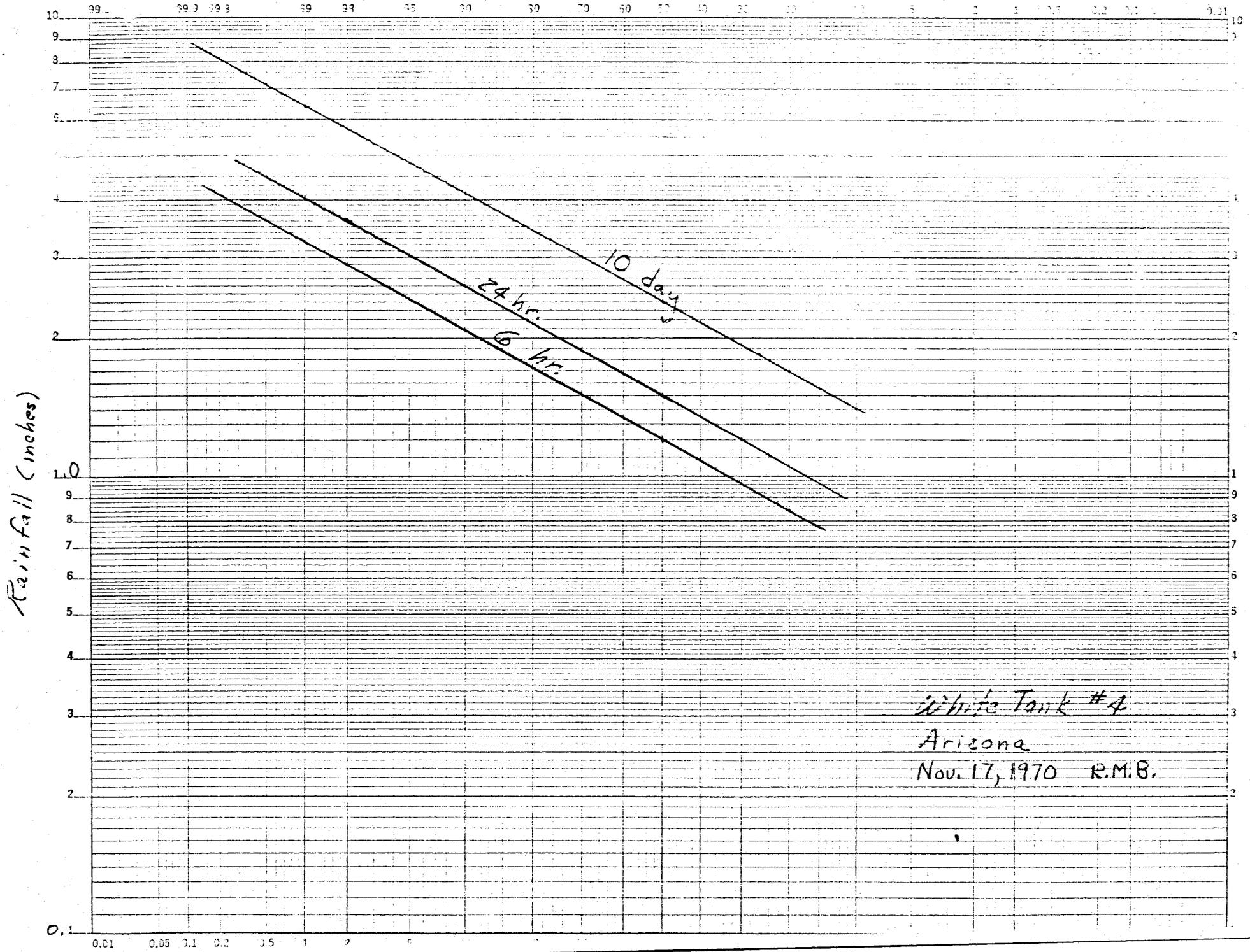
$$= \text{Rev } 100 \text{ yr } 10 \text{ day amount}$$

~~$$5) 100 \text{ yr } 24 \text{ hr} = \text{ (Rev Maps)}$$~~

$$5) 50 \text{ yr } 24 \text{ hr} = 3.6 \text{ in.}$$

Rev Map

$$6) 50 \text{ yr } 6 \text{ hr} = 2.9 \text{ in.}$$



STATE <i>Arizona</i>	PROJECT <i>W. H. ...</i>
BY <i>R. M. B.</i>	DATE <i>...</i>
CHECKED BY	DATE
JOB NO.	
SHEET <i>...</i> OF <i>...</i>	

Old D.A.

Reach	Length	Avg Slope	Est v	Δ time
1	500	24%	15 fps	33.3
2	5000	12.8%	15 fps	733.3
3	6000	6.7%	15 fps	
4	6000	3.3%	14 fps	
5	13000	1.5%	9.5 fps	1368.4
6	12500	1.2%	8.0 fps	1562.5
	<u>43000</u>			<u>4126.0</u>

= 1.15 hrs

New D.A. Long Reach

1	750	10.6	15	50.0
2	2750	21.8	15	783.3
3	2750	14.5	15	
4	6250	6.4	15	
5	6500	3.1	14	464.3
6	13000	1.5	9.5	1368.4
7	12500	1.2	8.0	1562.5
	<u>44500</u>			<u>4228.5</u>

= 1.17 hrs

Flat Section East Side

1	3250	3.1	13.5	240
2	6000	1.7	10.0	600
3	8,500	1.6	6.0	1417
4	14,500	1.7	6.0	2417
				<u>4,674</u> sec

= 1.29 hrs

do 1.2 hrs.

STATE <i>Illinois</i>		PROJECT <i>White Tank #2</i>			
BY	DATE <i>17 Nov 70</i>	CHECKED BY	DATE	JOB NO.	
SUBJECT <i>Velocity in channel</i>				SHEET	OF

Assume $r = 2.0$

$n = 0.03$

$$V = 1.486 \frac{r^{2/3} s^{1/2}}{n}$$

$$V = 1.486 \frac{(1.587)}{0.03} s^{1/2}$$

$$V = 78.609 s^{1/2}$$

S = 0.5%	v =			5.5 fps
S = 1.0%	v =	0.10 (78.6)	=	7.86
S = 2.0%	v =	0.14 (78.6)	=	11.1
S = 3.0%	v =	0.17 (78.6)	=	13.6
S = 5.0%	v =			
S = 8.0%	v =	0.28 (78.6)	=	22 fps
S = 10%	v =			
S = 12%	v =			
S = 14%	v =	0.37 (78.6)	=	29.6 fps

} Max
of 15 fps

STATE <u>Arizona</u>		PROJECT <u>White Tank #4</u>		
BY <u>R.H.P.</u>	DATE <u>19 Nov 70</u>	CHECKED BY	DATE	JOB NO.
SUBJECT <u>Hydraulic Pipe Prin. Spill</u>				SHEET _____ OF _____

Orifice flow

$$Q = 0.6 (4.91) \sqrt{2gh}$$

$$= 23.641 \sqrt{h}$$

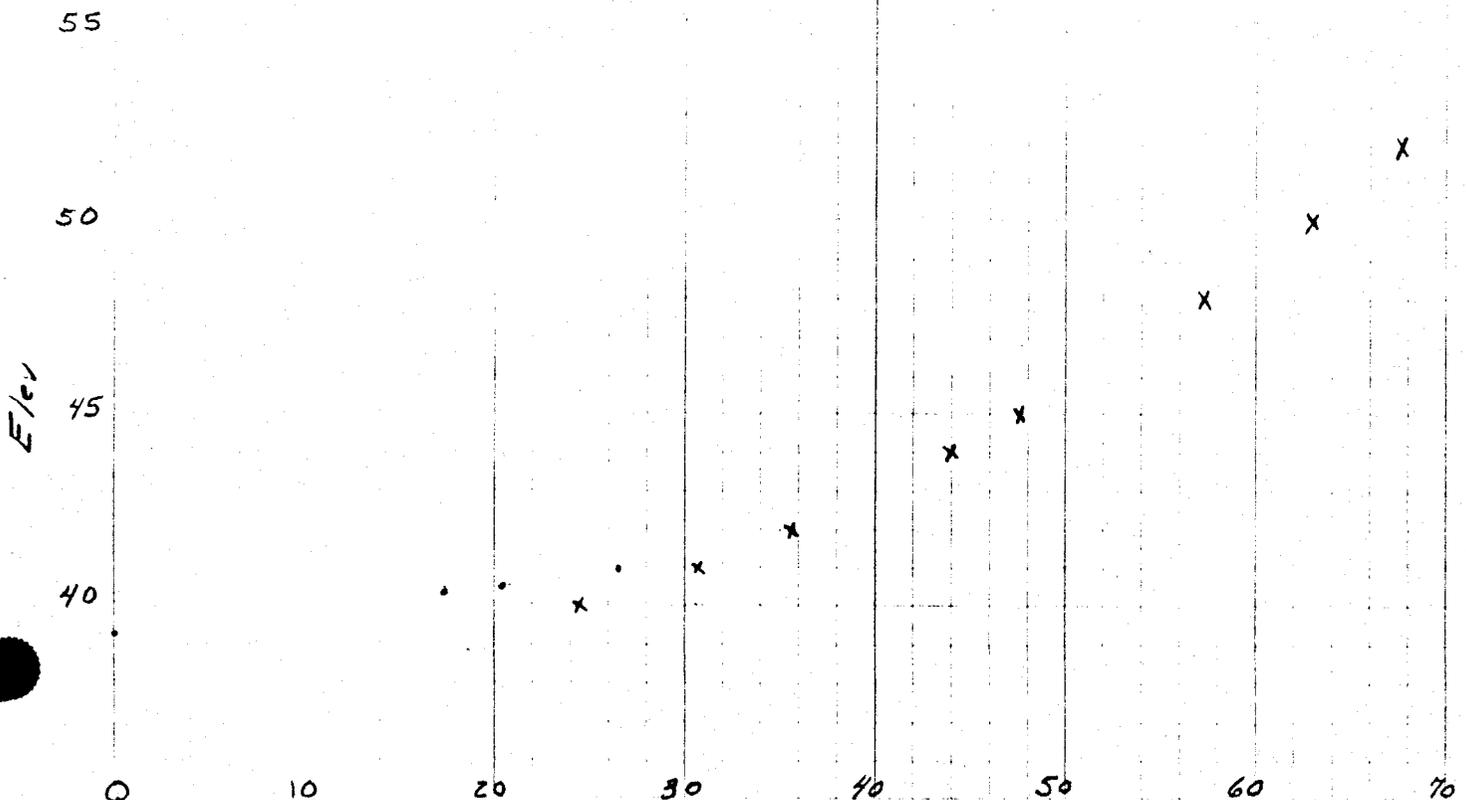
Crest @ 39.18

Top Pipe @ 40.30

2.5' on 2:1 slope = 1.12' in elev

Elev	h	Q
Elev 40.3	h @ water @ top pipe = 0.56'	17.47
Elev 40.5	h = 0.76'	20.5
Elev 41.0	h = 1.26'	26.4
Elev 42.0	h = 2.26'	35.4

Plot Outflow Curve



STATE <i>Arizona</i>	PROJECT <i>White tank #4</i>		
BY <i>R.M.B.</i>	DATE <i>17 Nov 70</i>	CHECKED BY	DATE
SUBJECT <i>Pipe Flow Prim. Sp. II</i>			JOB NO.
			SHEET _____ OF _____

Pipe Flow			
Elev	H	\sqrt{H}	Q
40.0	1.75	1.322	24.2
41.0	2.75	1.658	30.4
42.0	3.75	1.936	35.5
43.0	4.75	2.179	39.9
44.0	5.75	2.398	43.9
45.0	6.75	2.598	47.6
48.0	9.75	3.122	57.2
50.0	11.75	3.428	62.8
52.0	13.75	3.708	67.9
54.0	15.75	3.969	72.7
56.0	17.75	4.213	77.18

$$Q = A \frac{\sqrt{2gH}}{1 + K_f L}$$

$$= 4.91 \frac{\sqrt{67.4}}{1 + 1.034(77)} \sqrt{H}$$

$$= 4.91 \frac{\sqrt{67.4}}{4.626} \sqrt{H}$$

$$= 4.91(3.73)$$

$$= 18.32 \sqrt{H}$$

With Free outflow

$$Dn str \text{ eff. elev} = 36.75 + 0.6(2.5)$$

$$= 36.75 + 1.50 = 38.25$$

With just friction Loss

Reqd elev	Q	Frict. Loss/ft	fric Loss (77)ft	$v^2/2g$	Ent + Bend = 1.0(v ² /g)	
39.46	20 cfs	0.009	0.69 ft	0.26 ft	0.26	1.21
40.95	30 cfs	0.02	1.54 ft	0.58 ft	0.58	2.70
43.08	40 cfs	0.036	2.77 ft	1.03 ft	1.03	4.83
45.86	50 cfs	0.057	4.39 ft	1.61	1.61	7.61
49.28	60 cfs	0.083	6.39 ft	2.32	2.32	11.03
53.04	70 cfs	0.11	8.47 ft	3.16	3.16	14.79

n = 0.025

STATE	Arizona	PROJECT	White Tank #4
BY	R.M.B.	CHECKED BY	
DATE	19 Nov 70	DATE	
SUBJECT	Prim. Spill Hydraulics		JOB NO.
			SHEET ____ OF ____

37.5
38.5
36.0

Gate Lip Elev. 39.18

H.P. pipe Outlet Elev 36.75

L = 77 L.F. of 30" CMP

Max W.S. @ outlet @ 50 cfs flow = 1.2 + 36.75 = 37.95 Say 38.0

~~@ 100 cfs flow @ outlet =~~

b = 8' s = 0.01 n = 0.03 ss = 1.1

Assume 1.6' depth A = 15.36 r = 1.23

$$Q = \frac{1.486 (15.36) (1.23)^{2/3} (0.01)^{1/2}}{0.03}$$

$$= \frac{1.486 (15.36) (1.148) (0.1)}{0.03} = 87.3 \text{ cfs}$$

Elev 38.35

Assume 2.0 depth

A = 20.00 r = 1.46

$$Q = \frac{1.486 (20.00) (1.287) (0.1)}{0.03}$$

$$= 127.5 \text{ cfs} = \text{Elev } 38.75$$

From original plotting
Discharge @

STATE <i>Arizona</i>	PROJECT <i>White Tank #4</i>		
BY <i>R.M. B.</i>	DATE <i>Nov 19, 1970</i>	CHECKED BY	DATE
SUBJECT <i>Draw Down</i>			JOB NO.
			SHEET OF

Capacity @ 50 = 1036 Ac Ft
 @ 45 = 420 Ac Ft
 @ 40 = 100 Ac Ft

Avg discharge elev 50 to 45 \approx 55 cfs

$$55 \text{ cfs} = 1.98(55) = 108.9 \text{ Ac Ft/day}$$

$$108.9 / 19.6 = 5.65 \text{ days}$$

Avg discharge 45-40 \approx 38 cfs

$$38 \text{ cfs} = 1.98(38) = 75.24 \text{ Ac Ft/day}$$

$$75.24 / 18 = 4.25 \text{ days}$$

Get to Elev 40.0 in 9.90 days

Use \approx elev 40.0 for routing equation.

STATE	Arizona	PROJECT	White Tank #4
BY	R.M.B.	DATE	17 Nov 70
CHECKED BY		DATE	
SUBJECT	Profile Spillways	JOB NO.	
			SHEET 5 OF

Station @ Control S. Spillway #2

Top @ 105.3

Top 105.3

140 Dn @ 77.3

70 up 100.0

270 Dn @ 77.5

300 up 100.0

400 Dn @ 78.2

AVG 97.6

600 Dn @ 78.5

450 up 99.2

Station @ Control

N. Spillway

Top 103.6

100 @ 100.0

Dn 150 = 97.0

200 = 97.0

Dn 300 = 98.0

400 93.5

STATE <u>Arizona</u>		PROJECT <u>White Tank #4</u>		
BY <u>R.M.B.</u>	DATE <u>17 Nov 70</u>	CHECKED BY	DATE	JOB NO.
SUBJECT <u>Spillway Hydraulics</u>				SHEET <u>6</u> OF

South Spillway

Assume Distr. end spillway controls

Effective width = 200 ft. Elev = 98.5

$s = 0.5\%$

~~check for critical depth & critical slope~~

~~Assume Discharge = 400 cfs $q/ft = 2.0$~~

~~SS = 3:1~~

~~$\frac{3}{b} = \frac{3}{200} = 0.015$~~

Assume $R = d$

\therefore channel slope $> 14.56 n^2 d m / r^{4/3}$ if vel ^{supercrit.}

$$0.05 = 14.56 (.03)^2 d m / d m^{4/3}$$

for depth = 1.0

$$\text{Required slope} = 14.56 (.03)(.03)$$

$$\text{Reqd slope} = 1.3\%$$

for depth = 2.0

$$\begin{aligned} \text{reqd slope} &= 14.56 (.03)(.03) \frac{(2)^{2/3}}{2^{4/3}} \\ &= 1.04\% \end{aligned}$$

for depth = 3.0

$$\begin{aligned} \text{reqd slope} &= 14.56 (.03)^2 \frac{(3)^{2/3}}{3^{4/3}} \\ &= 0.91\% \end{aligned}$$

\therefore Need to calc. backwater curve

1.5
1.56
1.09
0.13104

STATE	Arizona		PROJECT	White Tank #4	
BY	R.M.B.	DATE	CHECKED BY	DATE	JOB NO.
SUBJECT	Hydraulics			SHEET 7 OF	

South Spillway (Cont.)

for depth of 4.0 ft

Reqd slope for flow to be critical

$$= 14.56 (1.03)^2 (4) / 4^{4/3}$$

$$= 0.825\%$$

depth = 5.0 ft

$$s_c = 0.77\%$$

depth = 6.0 ft

$$s_c = 0.72\%$$

∴ Control of South Spillway
not at spillway crest but @
end of dikes.

STATE <i>Arizona</i>	PROJECT <i>White Tank #4</i>		
BY <i>R.M. B.</i>	DATE <i>17 Nov 70</i>	CHECKED BY	DATE
SUBJECT <i>Backwater curves for S. Spillway</i>			JOB NO.
			SHEET <i>8</i> OF

outlet $s = 0.5\%$ BW = 160 ft $n = 0.03$

Design Q Dn

300 cfs

500 cfs

1000 cfs

Assume $d = 0.5$ ft

$$v = \frac{1.486}{n} r^{2/3} s^{1/2}$$

$$\text{for } d = 0.5 \quad r = \frac{A}{WP} = \frac{\frac{1}{2}(160) + zd^2}{160 + 2(zd)} = \frac{80.75}{163} = 0.4953$$

$$v = \frac{0.0658}{0.03} = 2.19 \text{ fps}$$

$$Q = 2.19 (80.75) = 177.1 \text{ cfs}$$

$$d = 1.0 \quad r = \frac{160 + 3}{160 + 6} = \frac{163}{166} = 0.98$$

$$v = \frac{0.1037}{0.03} = 3.46 \text{ fps}$$

$$Q = 563.4 \text{ cfs}$$

$$d = 1.5 \quad r = \frac{240 + 3(1.5)^2}{160 + 2(2d)} = \frac{246.75}{169} = \frac{242.25}{169} = 1.43$$

$$v = \frac{0.1334}{0.03} = 4.45 \quad \frac{0.1352}{0.03} = 4.5066$$

$$Q = 1077.2 \text{ cfs} \quad 1112.0$$

STATE	Arizona	PROJECT	White Tank		
BY	R.M.B.	DATE	17 Nov 70	CHECKED BY	DATE
SUBJECT	Discharge stage @ Dn @ Control				JOB NO.
					SHEET 9 OF

$$d = 2.0$$

$$r = \frac{320 + 12}{160 + 2(3 \times 2)} = \frac{332}{172} = 1.93$$

$$v = \frac{0.1629}{0.03} = 5.43 \text{ fps}$$

$$Q = 1802.8 \text{ cfs}$$

$$d = 3.0$$

$$r = \frac{480 + 27}{160 + 18} = \frac{507}{178} = 2.848$$

$$v = 0.2116 / .03 = 7.05 \text{ fps}$$

$$Q = 3576$$

$$d = 4.0$$

$$r = \frac{640 + 3(16)}{160 + 24} = \frac{688}{184} = 3.739$$

$$v = 0.2532 / 0.03 = 8.44$$

$$Q = 5806.7 \text{ cfs}$$

STATE <i>Arizona</i>	PROJECT <i>White Tank # 4</i>		
BY <i>R.M.B</i>	DATE <i>Nov 18, 1970</i>	CHECKED BY	DATE
SUBJECT <i>Hydraulics N. Spillway</i>			JOB NO.
			SHEET <i>10</i> OF

$$\text{Width} = 175 \text{ ft} \quad s = 0.005 \text{ ft/ft} \quad n = 0.03$$

$$SS = 3:1$$

Assume $d = 0.5 \text{ ft}$ (outlet channel control) ^{Assume}

$$V = \frac{1.486 r^{2/3} s^{1/2}}{n}$$

$$r = A/WP$$

From Hyd Tables

$$r = 0.50$$

$$V = \frac{.0662}{0.03} = 2.207 \text{ fps from Kings Handbook}$$

$$Q = AV = 88.25 (2.207) = 194.77 \text{ cfs}$$

Assume $d = 1.0 \text{ ft}$

$$r = 0.98$$

$$V = 0.1037 / 0.03 = 3.457$$

$$Q = 178.0 (3.457) = 615.3 \text{ cfs}$$

Assume $d = 1.6 \text{ ft}$

$$r = 1.55$$

$$V = 0.11402 / 0.03 = 4.673$$

$$Q = AV = 287.68 (4.673) = 1344.4$$

Assume $d = 2.0 \text{ ft}$

$$r = 1.93$$

$$V = 0.1629 / 0.03 = 5.43 \text{ fps}$$

$$Q = 362.0 (5.43) = 1965.7$$

295.68
774.68
16.00

WATER SURFACE PROFILE CALCULATION SHEET

Project: White Tank #4 (Nath Sall) Location: Buckeye
 Date: Dec 8, 1970 By: R.M.R. Sheet 1 of Appropriation:

Q = 105 b = 175 z = 3 n = 0.03 $f^2 = 0.0009$

Station	Depth, D	Bottom Width, b	Area, A	Velocity, $V = \frac{Q}{A}$	Velocity Head $h_v = \frac{V^2}{2g}$	$\frac{D}{b}$	α (table 97 King)	Hydraulic Radius $R = \frac{A}{P}$	$\frac{1}{2.2083R^{1/3}}$ (table 107, King)	V^2	$n^2 V^2$	Friction Slope $\frac{n^2 V^2}{4.74R^{4.75}}$ $S_f = \frac{2.2083R^{-1.49}}{4.74}$	Invert Slope S_i ft./ft.	Energy Head $H_e = D + h_v$	$H_e - H_e$	$S_f - S_i$	$\frac{H_e - H_e}{S_f - S_i}$	Remarks	
0+00	0.5	175	88.28	2.208	.0757			0.50						0.5757					
0+08	0.6	175	106.08	2.023	.0524			0.545	1.02	4.09	.0037	.0038	.0005	0.6524	.0767	.0088	8.1		
2+35	0.8	175	141.92	1.838	.0293			0.59	1.43	2.58	.0023	.0017	"	0.8293	.1540	.0067	26.4	35.1	
1+03.6	1.2	175	214.32	1.606	.0128			0.69	1.65	1.304	.0012	.0006	"	1.2128	.3835	.0056	68.5	103.6	
	1.6	175		1.374				0.79											
				1.142				0.98											
				0.910				1.17											

Elev 100.52
0.68 above crest

WATER SURFACE PROFILE CALCULATION SHEET

Project: 11-1-10
 Date: Dec 8 1970
 By: R. B.
 Sheet 2 of 2
 Location: Station 11-1-10
 Appropriation: Flow

$D = 6.15$ $b = 1.75$ $n = 0.03$ $S = 3.0$ $n^2 = 0.0009$

Station	Depth, D	Bottom Width, b	Area, A	Velocity, $V = \frac{Q}{A}$	Velocity Head $h_v = V^2/2g$	$\frac{D}{b}$	(table 97 King)	Hydraulic Radius $R = cD$	$\frac{1}{2.2033R^{1/3}}$ (table 107, King)	V^2	$n^2 V^2$	Friction Slope $S_f = \frac{n^2 V^2}{2.2033R^{1/3}}$	Invert Slope S_i ft./ft.	Energy Head $H_e = D + h_v$	$H_e'' - H_e'$	$S_f - S_i$	$I = \frac{H_e'' - H_e'}{S_f - S_i}$	Remarks	
2+00	1.0	1.75	1.780	3.555	0.35			0.92	0.412	10.90	1.009	1.0031	0.0005	1.185					
2+16	1.2	"	2.132	3.162	0.1209			1.045	0.301	6.21	1.0056	1.0017	0.0005	1.3279	0.1409	1.0031	16.4		
2+67	1.6	"	2.8768	2.504	0.0209			1.14	0.216	4.18	1.0033	1.0017	"	1.6709	0.3739	1.0057	51.2	67.6	
2+33	2.0	"	3.62.0	1.914	0.0118			1.25	0.160					2.0219					
2+4	2.4	"	4.37.22	1.552	0.0300			1.33						2.4306					

← 1.334 Stage @ 100 ft. Sta. = 1.3

WATER SURFACE PROFILE CALCULATION SHEET

Project: White Tank #4 (1100 ft) Location: Parsons
 Date: Dec 8, 1978 Egr: R. M. B. Sheet 3 of Appropriation:

Q = 1344 B = 175 S = 3 n = 0.03 n² = 0.009

Station	Depth, D	Bottom Width, b	Area, A	Velocity, V = Q/A	Velocity Head h _v = V ² /2g	D/b	c (table 97 King)	Hydraulic Radius R = cD	$\frac{1}{2.2083R^{1/3}}$ (table 107, King)	V ²	n ² v ²	Friction Slope $\frac{n^2 v^2}{4.75^2 R^{1/3}}$	Invert Slope S _i ft./ft.	Energy Head H _e = D + h _v	H _e ¹ - H _e ²	S _f - S _i	$\frac{H_e^1 - H_e^2}{S_f - S_i}$	Remarks
5+00	1.6	175	282.68	4.75	2.292			1.55	.232	19.40	.0195	.0041	-.005	1.9380	0.1271	.0091	14.0	
2+14	1.8		324.72	4.405	1.686			1.74	.201	15.41	.0139	.0028	"	2.066	0.1480	.0078	19.0	33.0
1+33	2.0		360.0	3.926	0.214			1.93	.166	11.51	.0104	.0017	"	2.214	0.3326	.0067	49.6	82.6
1+26.6	2.4		437.28	3.303	0.111			2.12	.135	8.09	.0073	.0010	"	2.5466	0.3597	.0060	56.0	138.6
1+38.6	2.8	V	513.52	2.825	0.103			2.48						2.9063				

WATER SURFACE PROFILE CALCULATION SHEET

Project: White Pine Location: Oradere
 Date: Dec 8, 1970 By: E.M.S. Sheet 2 of 2
 Appropriation: _____

$Q =$ 196.6 $b =$ 17.5 $n =$ 0.03 $n^2 =$ 0.0009

Station	Depth, D	Bottom Width, b	Area, A	Velocity, $V = \frac{Q}{A}$	Velocity Head $h_v = \frac{V^2}{2g}$	$\frac{D}{b}$	c (table 97 King)	Hydraulic Radius $R = \frac{A}{P}$	$\frac{1}{2.2083R^{1/3}}$ (table 107, King)	V^2	$n^2 V^2$	Friction Slope $\frac{n^2 V^2}{S_f = \frac{2.2083R^{1/3}}{n^2 V^2}}$	Invert Slope S_i ft./ft.	Energy Head $H_e = D + h_v$	$H_e'' - H_e'$	$S_f - S_i$	$\frac{H_e'' - H_e'}{S_f - S_i}$	Remarks	
0+00	2.0	17.5	368.0	5.431	0.158			1.93						2.458	0.118	0.0093	12.7		
0+12.1	2.2	15	399.52	4.921	0.130			2.11						2.576	0.290	0.0078	37.2	49.9	
0+49.9	2.6	1	475.28	4.529	0.106			2.33						2.866	0.381	0.0066	50.1	150.0	
1+00	3.0		552.0	3.561	0.101			2.48						3.107	0.354	0.0060			
	3.4		628.68	3.041	0.151			2.84						3.551	0.354	0.0060			
	3.8	V	703.28	2.772	0.119			3.20						3.919	0.508	0.0057			

Elev 102.4 2.50 = Stage

EV'F-E
 2-57
 PORTLAND, ORE

U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE CALCULATION SHEET

Project: White Oak #4 Location: Buckeye
 Date: Dec 8, 1950 By: RMB Sheet 5 of Appropriation:

Q = 3882 b = 175 z = 3 n = 0.03 n² = 0.0009

Station	Depth, D	Bottom Width, b	Area, A	Velocity, V = Q/A	Velocity Head h _v = V ² /2g	D/b	c (table 97 King)	Hydraulic Radius R = cD	$\frac{1}{2.2083R^{1/3}}$ (table 107, King)	V ²	n ² V ²	Friction Slope $\frac{n^2 V^2}{4.74R^{4/3}}$	Invert Slope S _i ft./ft.	Energy Head H _e = D + h _v	H _e '' - H _e	S _f - S _i	$\frac{H_0'' - H_e}{S_f - S_i}$	Remarks	
0+00	3.0	175	552.0	7.033	0.768			2.845		46				3.768					
D+10.8	3.2		590.72	6.572	0.6705			2.93	0.108	27	.0416	.0045	-0.005	3.8705	0.1025	.0095	10.8		
0+41.2	3.6		668.88	6.188	0.5230			3.02		29	.0345	.0033		4.1230	0.2525	.0083	30.4	41.2	
0+81.6	4.0	✓	748.00	5.497	0.4182			3.20	0.0960	30	.0272	.0023	↓	4.4182	0.3952	.0073	40.4	81.6	
1+30.5	4.4		828.08	4.939	0.3412			3.38		30	.0220	.0016		4.7412	0.3230	.0066	48.9	130.5	
				4.688				3.56	0.0833										
				5.190				3.73											
				5.804				3.91	0.0735										
				6.188				4.08											

3.768
 3.8705
 4.1230
 4.4182
 4.7412
 5.59 Above
 3.768
 5.59 103.55

$D = 4.0$ $A = 748.0$ $V = 3.735$ $v = \frac{2530}{103} = 8.433$ $Q = 6308$

FWP-E
1-57
PORTLAND, ORE

WATER SURFACE PROFILE CALCULATION SHEET

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Project: White Tank #2, North Location: Buckeye
 Date: Jan 0 1970 By: KJLB Sheet 6 of Appropriation:

$Q = 6308$ $b = 15$ $n = 0.03$ $n^2 = 0.0009$

Station	Depth, D	Bottom Width, b	Area, A	Velocity, V = Q/A	Velocity Head $h_v = V^2/2g$	D/b	c (table 97 King)	Hydraulic Radius R = cD	$\frac{1}{2.203R^{4/3}}$ (tab's 107, King)	V^2	$n^2 V^2$	Friction Slope $S_f = \frac{n^2 V^2}{2.203R^{4/3}}$	Invert Slope S_i ft/ft	Energy Head $H_e = D + h_v$	$H_o - H_e$	$S_f - S_i$	$\frac{H_o - H_e}{1 - S_f - S_i}$	Remarks	
0+00	4.0	175	748.00	8.433	1.104			3.735		66.15	.0601			5.104					
0+20.5	4.2		787.02	8.150	0.9952			3.82	0.0758	67.25	.0601	.0046	-0.005	5.1952	.0912	.0096	9.5		
0+35.5	4.6		868.48	7.634	0.819			3.91	0.0695	58.28	.0525	.0036	↓	5.419	.2238	.0086	26.0	35.5	
0+70	5.0		950.00	6.952	0.685			4.35	0.0624	48.33	.0435	.0027	↓	5.685	.2660	.0077	34.5	70.0	
	5.4		1032.48	6.375	0.579			4.42	0.0624	40.64	.0366	.0021		5.685	.2940	.0071	41.4	111.4	
				6.100				4.94						5.979					

(c) 100' Slope = 480 E. to 104.7' 5.1043 65

Project: Bluff Tank #4 Location: Rocky Spool
 Date: 1029 1970 By: R. J. B. Sheet: 6 of
 Appropriation:

Q = 2406 b = 1.75 z = 3 n = 0.03 r_s = 0.009

Station	Depth, D	Bottom Width, b	Area, A	Velocity, V = Q/A	Velocity Head h _v = V ² /2g	D/b	(table 97 King)	Hydraulic Radius, R = cD	$\frac{1}{2.2083R^{1/3}}$ (table 107, King)	V ²	n ² v ²	Friction Slope $\frac{n^2 v^2}{S_f 2.2083R^{1/3}}$	Invert Slope S _i ft./ft.	Energy Head H _e = D + h _v	H _e ¹ - H _e ²	S _f - S _i	$L = \frac{H_e^1 - H_e^2}{S_f - S_i}$	Remarks
0+00	4.4	175	828.08	8.023	1.242			4.08	.0675	46.30	.0081	.0046	.0005	5.642	.081	.0096	9.1	
0+19.1	4.6		818.48	8.587	1.129			4.17	.0624	66.0	.0599	.0037		5.729	.215	.0027	24.7	33.8
0+33.8	5.0		850.00	8.161	0.924			4.60	.0564	56.0	.0504	.0028		5.944	.255	.0078	32.7	66.5
0+66.5	5.4		1032.48	6.905	0.799			4.94	.0515	47.0	.0429	.0022		6.100	.285	.0072	39.6	106.1
	5.8	V	115.00	6.34	0.684			5.27						6.484				

2.5 = 4.25 1.50 105.17

WATER SURFACE PROFILE CALCULATION SHEET

Project: White Tank #4 South Location: Buckeye
 Date: 8 Dec 70 By: R. M. B. Sheet 1 of Appropriation:

Q = 155 b = 160 z = 3 n = 0.03 n² = 0.0009

Station	Depth, D	Bottom Width, b	Area, A	Velocity, V = Q/A	Velocity Head h _v = V ² /2g	D/b	a (table 97 King)	Hydraulic Radius R = Q/A	$\frac{2.207R^{1/3}}{a}$ (table 97, King)	V ²	n ² V ²	Friction Slope $\frac{n^2 V^2}{4.74 R^{4.75}}$	Invert Slope S _i ft/ft	Energy Head H _e = D + h _v	H _e - H _e	S _f - S _i	$\frac{H_e - H_e}{L} = \frac{S_f - S_i}{L}$	Remarks	
2+00	0.5	160	80.75	2.19	0.074			0.495						1.5746	1.0368				
2+04.6	0.55	160	88.90	2.09	0.0614			0.517	1.09	4.37	.0039	.0043	-.005	1.6114	1.0322	.0093	4.104		
2+15.6	0.65	160	105.27	1.84	0.055			0.54						1.7085	1.0824	.0077	11.0	14.6	15.6
2+28.6	0.75	160	121.68	1.68	0.0438			0.59	0.95	3.385	.0030	.0027	-.005	1.6938	1.0888	.0066	13.45	28.0	28.6
2+51.8	0.90	160	146.53	1.57	0.0326			0.64						1.7882	1.0857	.0066	17.98	31.4	31.8
2+86.6	1.10	160	179.63	1.33	0.0224			0.69	0.743	2.465	.0022	.0016	-.005	1.7826	0.11401	.0060	23.35	51.8	51.8
2+96.6	1.10	160	179.63	1.21	0.0227			0.712	0.597	1.77	.0016	.0010	-.005	1.885	0.1392	.0060	23.2	86.3	86.6
2+98.0	1.40	160	220.87	1.10	0.0150			0.885						1.9227	0.11923	.0055	34.96	142.9	143.0
2+25	1.80	160	290.72	0.98	0.0109			0.98	0.465	1.21	0.0011	.0005	-.005	1.1150	0.12942	.0055	56.59	220.6	220.5
				0.78	0.0092			1.075	0.347	0.77	.0007	.0002	-.005	1.415	1.2942	.0052	56.4		
				0.58	0.0054			1.36	0.253	0.462	.0004	.0001	-.005	1.4002	1.302	.0051	77.68		
				0.59	0.0054			1.55						1.305	1.305	.0051	77.68		

0.70 Above Crest Elev 100.9

WATER SURFACE PROFILE CALCULATION SHEET

Project: W. Tank #2 Location: Buckeye
 Date: Dec 8, 1950 By: R.W.B. Sheet 2 of Appropriation:

Q = 563 b = 160 z = 3 n = 0.03 n² = 0.0009

Station	Depth, D	Normal Width, b	Area, A	Velocity, V = Q/A	Velocity Head h _v = V ² /2g	D/b	Hydraulic Radius R = cD	$\frac{1}{2.2033R^{1/3}}$ (table 107, King)	V ²	n ² V ²	Friction Slope $\frac{n^2 V^2}{4.74 R^{4/3}}$	Invert Slope S _i ft./ft.	Energy Head H _e = D + h _v	H _e - H _e	S _f - S _i	$\frac{H_0 - H_e}{S_f - S_i}$	Remarks
0+00	1.0	160	160.0	3.46	0.1258		0.98						1.1258				
1+07.1	1.1	160	179.63	3.13	0.1152		1.028	0.436	10.86	.0098	.0043	-0.005	1.2521	.0663	0.0093	7.1	
2+16.3	1.2	160	196.32	2.87	0.1127		1.075	0.389	9.00	.0081	.0032	-0.005	1.3279	.0758	0.0082	9.2	16.3
3+29.6	1.4	160	220.98	2.55	0.0932		1.12	0.331	7.07	.0064	.0021	-0.005	1.4932	.1653	0.0071	23.3	39.6
4+57.8	1.6	160	253.28	2.22	0.0707		1.17	0.2945	5.25	.0047	.0013	-0.005	1.6707	.1775	0.0063	28.2	67.8
5+33.8	2.0	160	332.0	1.71	0.0446		1.265	0.217	3.67	.0033	.0007	-0.005	2.0446	.3739	0.0057	65.6	133.4
6+36.2	2.4	160	401.28	1.40	0.0305		1.36	0.1675	2.25	.0020	.0003	-0.005	2.4305	.3859	0.0053	72.8	206.2
7+8.5	2.8	160	451.52	1.25	0.0221		1.455	0.136	1.68	.0015	.0002	-0.005	2.822	.3916	0.0052	75.3	281.5

Elev 101.59
239 Above Crest

WATER SURFACE PROFILE CALCULATION SHEET

Project: White Tank #4 Location: Buckeye
 Date: 8 Dec 70 By: RWB Sheet 3 of Appropriation:

Q = 112.0 b = 160 z = 3 n = 0.03 n² = 0.0009

Station	Depth, D	Bottom Width, b	Area, A	Velocity, V = Q/A	Velocity Head h _v = V ² /2g	D/b	Hydraulic Radius R = CD	$\frac{1}{2.2083R^{4/3}}$ (table 107, King)	V ²	n ² V ²	Friction Slope $\frac{n^2 V^2}{4.74 R^{4/3}}$	Invert Slope S _i ft./ft.	Energy Head H _e = D + h _v	H _e ' - H _e	S _f - S _i	$\frac{H_e' - H_e}{S_f - S_i}$	
0+0	1.5	160	240.75	4.507	0.13154		1.46						1.8154				
0+06.4	1.6	160	263.68	4.362	0.12761		1.55	.262	19.03	.0171	.0045	-0.005	1.8761	.0607	.0095	6.4	
0+23.3	1.8	160	297.72	3.976	0.2166		1.645	.233	15.8	.0142	.0033	-0.005	2.0166	.1405	.0023	16.9	23
0+70.6	2.2	160	366.52	3.324	0.1427		1.925	.189	11.45	.0103	.0019	-0.005	2.3429	.3263	.0069	47.3	70
1+29.1	2.6	160	436.28	2.787	0.1101		2.129	.150	7.97	.007	.0011	-0.005	2.7001	.3572	.0061	58.5	129
1+96	3.0	160	507.00	2.366	0.0946		2.65	.124	5.60	.005	.0006	-0.005	3.0746	.3745	.0056	66.9	196
2+02.7	3.6	160	614.78	2.100	0.0597		3.095	.101	4.0	.0036	.0004	-0.005	3.6507	.5761	.0052	106.7	302
2+53.4	4.0	160	688.00	1.712	0.0455		3.535	.082	2.93	.0026	.0002	-0.005	4.0405	.3393	.0052	75.0	37



WATER SURFACE PROFILE CALCULATION SHEET

Project: White Tank #2 Location: Buckeye
 Date: Dec 8, 1970 By: C.M.B Sheet 4 of Appropriation:

Q = 1803 b = 160 n = 3 n' = 0.03 n'' = 0.0039

Station	Depth, D	Bottom Width, b	Area, A	Velocity, $V = \frac{Q}{A}$	Velocity Head $h_v = V^2/2g$	$\frac{D}{b}$	(table 97 King)	Hydraulic Radius $R = \frac{A}{P}$	$\frac{2.208R^{1/3}}{(\text{table 107, King})}$	V^2	$n^2 V^2$	Friction Slope $\frac{n^2 V^2}{S_f 2.208^3 R^{1/3}}$	Invert Slope S_i ft./ft.	Energy Head $H_e = D + h_v$	$H_e'' - H_e'$	$S_f - S_i$	$\frac{H_e'' - H_e'}{S_f - S_i}$	Remarks
0+00	2.0	160	332.00	5.43	0.1578			1.92						2.4578				
0+12.7	2.2	160	366.52	4.92	0.1358			2.05	.178	26.78	.0241	.0043	-0.005	2.5758	.1180	.0093	12.7	
0+40.7	2.6	160	436.28	4.13	0.1268			2.29	.150	20.47	0.0184	.0028	-0.005	2.8648	.2890	.0078	37.0	49.7
0+99.9	3.0	160	507.0	3.556	.1063			2.65	.124	14.77	.0133	.0016	-0.005	3.1963	.3315	.0066	50.2	99.9
1+20.4	3.6	160	644.88	2.932	.1334			3.05	.101	10.52	.0095	.0010	-0.005	3.7334	.5371	.0060	89.5	189.4
2+56	4.0	160	688.00	2.621	.1066			3.535	.084	7.71	.0069	.0006	-0.005	4.1066	.3732	.0056	66.6	256.0 ✓
3+62	4.6	160	779.48	2.255	.0789			3.97	.072	5.94	.0053	.0004	-0.005	4.6789	.5723	.0054	106.0	362.0
	5.4	160	951.48	1.825	.0551			4.535	.0598	4.31	.0039	.0002	-0.005	5.4557	.7768	.0052	149.4	511.4
								4.90										

Elev 103.04 7.84 Above Crest 2.84 Below Crest

WATER SURFACE PROFILE CALCULATION SHEET

Project: W. H. TANK # 4 Location: Cooke
 Date: 8 Dec 70 By: R. W. B. Sheet 5 of 5 Appropriation: _____

Q = 3576 b = 150 z = 3 n = 0.03 r_s = 0.0009

Station	Depth, D	Bottom Width, b	Area, A	Velocity, V = Q/A	Velocity Head h _v = V ² /2g	D/b	a (table 97 King)	Hydraulic Radius R = cD	$\frac{1}{2.2083R^{1/3}}$ (table 107, King)	V ²	n ² v ²	Friction Slope $\frac{n^2 v^2}{5f \cdot 2.2083R^{1/3}}$	Invert Slope S _i ft./ft.	Energy Head H _e = D + h _v	H _e ¹ - H _e ²	S _f - S _i	$\frac{H_e^1 - H_e^2}{S_f - S_i}$	Remarks
0+00	3.0	150	507.0	7.05	.7717			2.83	.108	.4651	.0419	.0045	-.0005	3.7717	.1024	.0095	10.8	
0+10.8	3.2	"	542.72	6.589	.6411			3.01	.0968	.3846	.0346	.0033	-.0005	3.8941	.2510	.0023	30.2	41.0
0+41	3.6	"	614.88	6.202	.5251			3.18	.0839	.3033	.0273	.0023	"	4.1251	.2944	.0073	40.3	81.3
0+81.3	4.0	"	688.00	5.504	.405			3.36	.0743	.2445	.0220	.0016	"	4.4105	.3223	.0066	49.8	130.1
1+30.1	4.4	"	762.08	4.945	.3418			3.71	.0646	.1926	.0178	.0011	"	4.9418	.3223	.0066	49.8	130.1
2+41.9	5.0	"	895.0	4.387	.2593			4.06	.0567	.1481	.0133	.0008	"	5.2593	.3223	.0066	49.8	130.1
2+81.5	5.5	"	990.08	3.849	.2005			4.57	.0567	.1481	.0133	.0008	"	5.8025	.3223	.0066	49.8	130.1

Fkv 104.26 4.06 above crest

WATER SURFACE PROFILE CALCULATION SHEET

Project: W. H. Ford Rd Location: Beckee
 Date: 8 Dec 70 By: RWB Sheet 6 of Appropriation:

C = 5807 b = 150 n = 0.03
 S = 3 n₂ = 0.039

Station	Depth, D	Bottom Width, b	Area, A	Velocity, V = Q/A	Velocity Head h _v = V ² /2g	D/b	c (table 97 King)	Hydraulic Radius R = cD	$\frac{1}{2.2083R^{4/3}}$ (table 107, King)	V ²	n ² v ²	Friction Slope $\frac{n^2 v^2}{S_f 2.2083R^{4/3}}$	Invert Slope S _i ft./ft.	Energy Head H _e = D + h _v	H _e ⁱ - H _e	S _f - S _i	$I = \frac{H_e^i - H_e}{S_f - S_i}$	Remarks	
2+00	4.0	160	668.0	8.44	1.106			3.71						5.1060					
2+21	4.4	"	762.08	7.98	1.016			4.06						5.3016					
2+50.9	4.8	"	839.12	7.97	1.012			4.23						5.5472					
2+72	5.2	"	933.12	7.48	1.008			4.40						5.828					
2+93	5.6	"	990.08	6.12	1.008			4.93						6.1341					
3+26	6.0	"	1067.50	5.45	1.008			5.07						6.4590					
3+50	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
3+76	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
3+97	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
4+28	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
4+59	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
4+90	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
5+21	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
5+52	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
5+83	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
6+14	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
6+45	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
6+76	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
7+07	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
7+38	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
7+69	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
8+00	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
8+31	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
8+62	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
8+93	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
9+24	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
9+55	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
9+86	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
10+17	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
10+48	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
10+79	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
11+10	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
11+41	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
11+72	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
12+03	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
12+34	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
12+65	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
12+96	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
13+27	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
13+58	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
13+89	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
14+20	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
14+51	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
14+82	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
15+13	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
15+44	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
15+75	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
16+06	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
16+37	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
16+68	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
16+99	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
17+30	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
17+61	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
17+92	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
18+23	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
18+54	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
18+85	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
19+16	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
19+47	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
19+78	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
20+09	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
20+40	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
20+71	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
21+02	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
21+33	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
21+64	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
21+95	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
22+26	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
22+57	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
22+88	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
23+19	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
23+50	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
23+81	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
24+12	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
24+43	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
24+74	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
25+05	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
25+36	6.0	"	1067.50	5.45	1.008			5.23						6.4590					
25+																			

ARIZONA

WHITE TANKS

12-8-70

J. W. ALONG

X-SEC 1

↑

	$\frac{104.0}{0}$	$\frac{101.1}{10}$	$\frac{99.6}{10}$	$\frac{101.1}{40}$	$\frac{99.6}{50}$	$\frac{99.6}{135}$	$\frac{100.0}{180}$	$\frac{100.2}{200}$
--	-------------------	--------------------	---	--------------------	-------------------	--------------------	---------------------	---------------------

↓

40'

	$\frac{101.2}{120}$	$\frac{105.6}{230}$
--	---------------------	---------------------

↓

X-SEC 2

↑

	$\frac{105.6}{0}$	$\frac{100.0}{20}$	$\frac{99.0}{60}$	$\frac{100.0}{155}$	$\frac{100.0}{200}$	$\frac{105.6}{210}$
--	-------------------	--------------------	-------------------	---------------------	---------------------	---------------------

↓

30'

X-SEC 3

↑

	$\frac{105.6}{0}$	$\frac{100.0}{8}$	$\frac{99.0}{70}$	$\frac{99.6}{120}$	$\frac{100.0}{155}$	$\frac{101.0}{208}$	$\frac{105.6}{270}$
--	-------------------	-------------------	-------------------	--------------------	---------------------	---------------------	---------------------

↓

50'

X-SEC 6

	$\frac{105.0}{0}$	$\frac{101.0}{90}$	$\frac{100.0}{120}$	$\frac{97.1}{150}$	$\frac{96.1}{160}$	$\frac{100.0}{170}$	$\frac{98.6}{235}$	$\frac{108.1}{320}$	$\frac{99.3}{390}$	$\frac{105.3}{500}$
--	-------------------	--------------------	---------------------	--------------------	--------------------	---------------------	--------------------	---------------------	--------------------	---------------------

ARIZONA

WHITE TANKS

J. M. HEDGECOCK 12-7-70

W. Emergency Spillway X-Sections
from Topog 9-13-70

X-sec 1

$\frac{105.0}{3}$	$\frac{102.6}{25}$	$\frac{99.0}{40}$	$\frac{98.5}{70}$	$\frac{98.5}{110.0}$	$\frac{98.0}{160}$	$\frac{98.5}{240}$	$\frac{104.5}{250.0}$
.002, .027, 50, 52							

X-sec 2

$\frac{105.0}{10}$	$\frac{100.0}{15}$	$\frac{99.5}{70}$	$\frac{98.3}{128}$	$\frac{98.0}{210}$	$\frac{98.0}{290}$	$\frac{105.3}{305}$
.002, .027, 50, 50						

X-sec 3

$\frac{105.0}{8}$	$\frac{100.0}{12}$	$\frac{99.5}{70}$	$\frac{99.5}{90}$	$\frac{99.5}{190}$	$\frac{100.0}{270}$	$\frac{105.0}{290}$
.002, .027, 50, 50						

sec 4

$\frac{105.4}{8}$	$\frac{100.8}{20}$	$\frac{101.0}{70}$	$\frac{99.5}{110}$	$\frac{99.3}{190}$	$\frac{99.2}{250}$	$\frac{105.7}{270}$
.002, .027, 50, 67.5						

$\frac{70}{50} = 1.4$
 $\frac{117.5}{100} = 1.175$
 $\frac{100.5}{100} = 1.005$

X-sec 5

$\frac{105.3}{8}$	$\frac{107.0}{18}$	$\frac{101.0}{22}$	$\frac{101.0}{40}$	$\frac{100.85}{100}$	$\frac{100.0}{120}$	$\frac{100.0}{200}$	$\frac{104.5}{230}$
.002, .027, 67.5, 50							

X-sec 6

$\frac{105.3}{8}$	$\frac{101.0}{18}$	$\frac{101.0}{28}$	$\frac{99.5}{100}$	$\frac{100.0}{140}$	$\frac{100.0}{230}$	$\frac{101.0}{250}$	$\frac{102.0}{300}$	$\frac{105.0}{410}$
.002, .027, 50, 125								

X-sec 7

$\frac{106.0}{8}$	$\frac{100.0}{18}$	$\frac{99.0}{40}$	$\frac{99.0}{85}$	$\frac{100.0}{100}$	$\frac{100.5}{200}$	$\frac{100.5}{300}$	$\frac{101.0}{365}$	$\frac{105.0}{575}$
.002, .027, 125, 125								

>PLOT 1
 >CL 1
 16:27 13/20
 CROSS SECTION NUMBER 1
 108.500 20.5000

RELATIVE	DEPTH	REFLECTOR	VELOCITY	DISCHARGE
FT	FT	FT	FT/SEC	CFS
100.00	57.55	173.05	2.69	154.41
100.50	105.25	174.09	4.37	523.29
101.00	321.50	177.14	5.75	1274.51
101.50	377.10	213.56	6.61	2161.98
102.00	433.33	215.50	7.90	3427.51
102.50	571.01	216.71	9.07	4918.01
103.00	651.20	220.57	10.19	6538.15
103.50	768.05	224.05	11.21	8539.50
104.00	876.01	226.23	12.20	10664.00
104.50	966.53	227.38	13.19	13014.24
105.00	1100.21	228.43	14.13	15581.34
105.50	1212.15	229.51	15.05	18269.55

$Q_{29} \times 10^5$
 E4
 225 223 101.82
 72 580 102.47
 182 365 103.30
 375 570 104.06
 684 209 104.70
 132 925

>PLOT 1
 >CL 1
 >LOAD EQUATION
 >LOAD EQUATION
 >LOAD EQUATION
 16:27 13/20
 CROSS SECTION NUMBER 2
 108.500 20

RELATIVE	DEPTH	REFLECTOR	U +	U -
FT	FT	FT		
100.00	16.41	64.01	0.0000685353915	-0.0000753412188
100.50	63.67	130.02	0.0000382776531	0.0000111546316
101.00	130.25	159.10	0.000062068966	0.0000034517969
101.50	232.50	183.18	0.000023614618	0.0000010361057
101.99	316.86	187.33	0.000011859463	0.000000291097
102.00	410.69	189.49	0.000006484972	0.0000001811536
102.50	505.99	192.67	0.000002169709	0.0000000359265
103.00	603.72	195.84	0.000002114723	0.00000002631213
103.50	700.20	199.02	0.000002135713	0.0000001950278
104.00	800.21	202.19	0.000001626185	0.0000001511218
104.50	901.57	204.33	0.000001275114	0.0000001196340
105.00	1004.11	207.51	0.000001023795	0.0000000967340
105.50	1107.02	209.64	0.000000638024	0.0000000727147

>PLOT 1
 >CL 1
 >LOAD EQUATION
 >LOAD EQUATION

105.500
ELEVATION

3
PERIMETER

U -

ELEVATION	AREA	PERIMETER	U +	U -
FT	SQ FT	FT		
71.00	11.16	71.01	0.0003521558401	-0.0003561350958
100.00	73.40	126.01	0.000380537374	0.000332671290
100.50	152.37	173.40	0.000058359353	0.000026111525
101.00	277.30	201.46	0.000017804035	0.000012266680
101.50	390.58	232.75	0.000003031802	0.000000901349
102.00	505.75	265.33	0.000005253222	0.000000735085
102.50	632.00	299.12	0.000003733550	0.000000267505
103.00	784.25	311.46	0.000003700251	0.000000170555
103.50	953.75	312.55	0.000001777353	0.0000002161212
104.00	1135.77	312.32	0.000001362407	0.0000001257355
104.50	1377.05	312.21	0.000001075612	0.0000001004727
105.00	1678.00	312.25	0.000000869041	0.0000000811007
105.50	1978.00	312.35	0.000000716032	0.0000000677124

3399 DATA
 >CLOSE
 >END
 >L001
 >END
 16:30 11/20
 CROSS SECTION 4

100.000 OF DATA
 >LIST 5000-6000
 5000 1410 2.0,105.50.,90.,101.,120.,100.,150.,97.1,160.,96.,170.,100
 5010 140000.,25.6,320.,101.0,340.,99.3,360.,105.5
 5000 1670 .31.,030,25.25
 >5580 1730 0.00
 >END

16:31 11/20
 CROSS SECTION 4

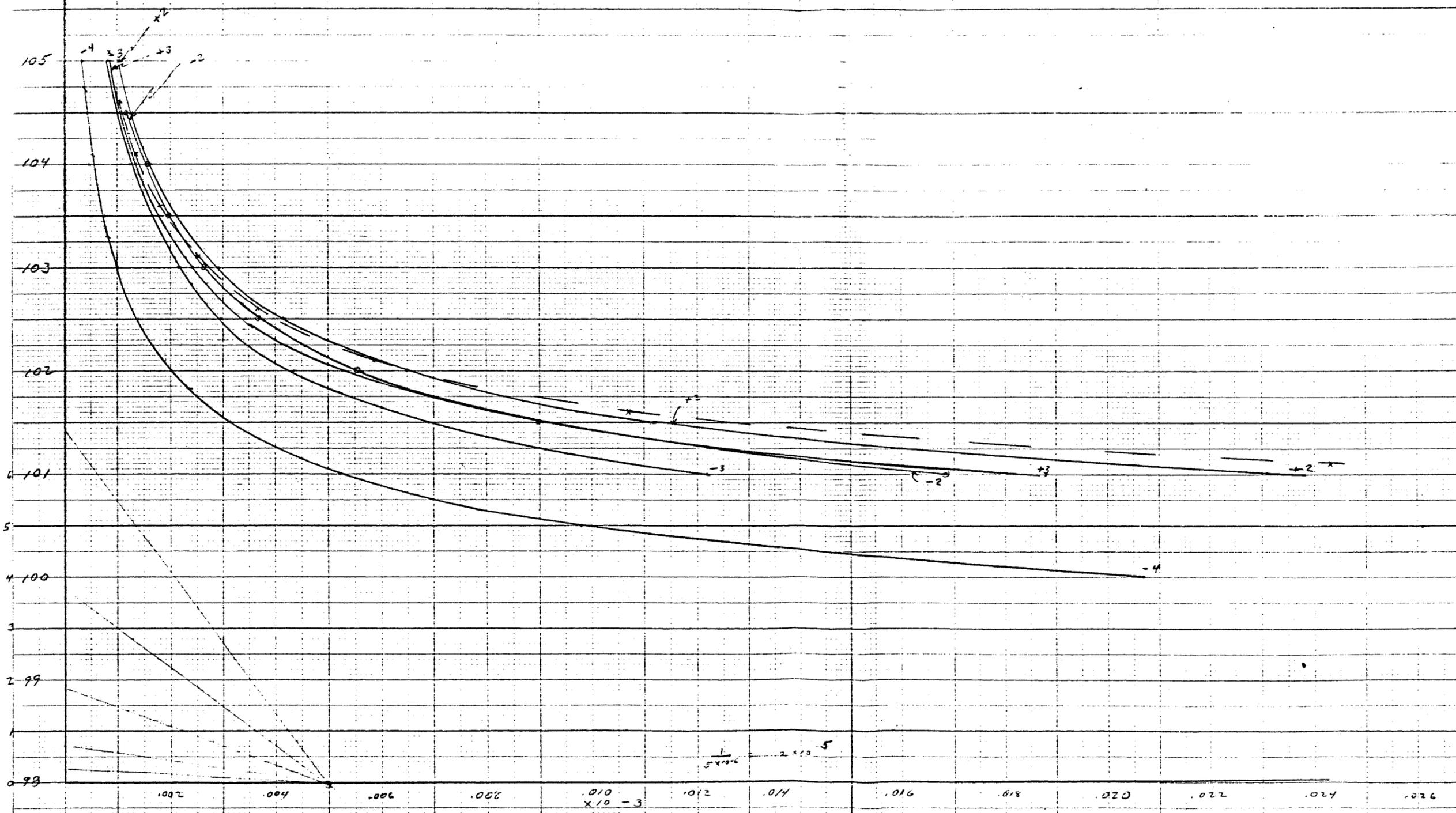
105.500
ELEVATION AREA PERIMETER U + U -

ELEVATION	AREA	PERIMETER	U +	U -
FT	SQ FT	FT		
96.50	1.50	6.11	1.388040619516	-0.492151730696
97.00	5.04	11.21	0.052215481686	0.00422912249
97.50	12.18	16.31	0.008676814362	0.000330627108
98.00	23.79	24.42	0.002388019773	0.000172663166
98.50	37.50	31.59	0.000896858277	0.000525363245
99.00	61.03	69.70	0.000373582533	0.000160362337
99.50	106.15	119.53	0.000117656192	0.000053345226
100.00	181.22	175.05	0.000039634567	0.000020726558
100.50	279.45	212.21	0.000015752014	0.000009853500
101.00	397.80	255.34	0.000007493938	0.000005182917
101.50	521.14	270.45	0.000002068129	0.000002102171
102.00	655.55	282.51	0.000002494553	0.000002020620
102.50	809.37	295.61	0.000001657745	0.000001321374
103.00	959.59	307.67	0.000001164486	0.000001007808
103.50	1116.31	321.77	0.000000852819	0.000000752136
104.00	1279.41	332.58	0.000000644629	0.000000577202
104.50	1446.96	346.24	0.000000499656	0.000000452963
105.00	1628.20	359.04	0.000000395431	0.000000362063
105.50	1803.71	360.09	0.000000319205	0.000000315545

WHITE TANKS DAM NO 4
 NORTH SPILLWAY
 U-CURVES

J.M.
 12-9-70

MILL 5-10116 20 DIETZEN GRAPH PAPER
 20 X 20 PER INCH



RUN: 100000

WEST SPILLWAY

>RUN

14:14 12/09

S = 1.0057

CROSS SECTION NUMBER 5

n = 1.027

ELEVATION

AREA

PERIMETER

VELOCITY

DISCHARGE

FT

SQ FT

FT

FT/SEC

CFS

$\frac{Q}{Z}$ EL

ELEVATION (FT)	AREA (SQ FT)	PERIMETER (FT)	VELOCITY (FT/SEC)	DISCHARGE (CFS)
100.50	43.79	95.04	2.52	110.42
101.00	99.32	162.09	3.05	302.89
101.50	123.00	189.18	4.28	526.85
102.00	269.35	195.29	5.50	1589.99
102.50	388.55	201.37	6.55	2546.38
103.00	490.75	207.45	7.51	3684.33
103.50	596.00	214.55	8.36	4960.68
104.00	704.27	219.62	9.20	6475.94
104.50	815.57	225.70	9.96	8122.31
105.00	929.32	229.76	10.74	9977.91

10 616.1 101.5
 39 255 102.1
 100 653 103.4
 210 780 104.05
 385 099 104.55
 651 409 exceeds 1
 1 024 330
 1 545 942

870 001
 >SAVE DATA CH
 XSYS

EDIT
 *COPY CH DATA R-CHAN,1,1
 ..COPY
 ..COPY

>PLOT
 14:58 10/7
 CROUCH SPEED 24.5000
 105

(3)

BLVD (FT)	AREA	PERIMETER	U +	U -
100.00	106.29	286.08	0.000035620608	-0.000050611747
100.50	135.63	281.81	0.000022588609	0.000007032353
101.00	368.65	264.35	0.000009396394	0.000004651292
101.50	501.35	267.50	0.000004697741	0.000003069206
102.00	535.23	270.55	0.000002395675	0.000002051342
102.50	772.00	273.79	0.000001908557	0.000001452263
103.00	909.13	278.02	0.000001340704	0.000001075348
103.50	1049.25	281.17	0.000000992101	0.000000824552
104.00	1190.25	284.31	0.000000761739	0.000000642297
104.50	1332.43	287.46	0.000000601819	0.000000527025
105.00	1475.66	289.52	0.000000466573	0.000000430733

9999 HALT
 >CLEAR
 >LOAD 000000
 >LOAD 0
 >PLOT
 14:58 10/7
 CROUCH SPEED 24.5000
 105.700

BLVD (FT)	AREA	PERIMETER	U +	U -
105.70	151.26	147.96	0.001155628555	-0.000589760566
106.00	183.57	152.17	0.00103215271	0.000001685480
106.50	413.70	176.23	0.000030903671	0.000009734745
107.00	300.52	235.39	0.000013221425	0.000005023323
107.50	249.23	241.49	0.000006367705	0.0000063491556
108.00	562.12	246.67	0.000003726829	0.000002405244
108.50	655.74	249.76	0.000003421560	0.000001728277
103.00	111.20	253.93	0.000001691997	0.000001806286
103.70	938.43	257.04	0.000001243193	0.000000989657
104.00	1067.65	261.19	0.000000948969	0.000000780518
104.70	1196.68	264.30	0.000000745577	0.000000622476
105.00	1331.42	268.45	0.000000599686	0.000000513242
105.70	1465.32	269.50	0.000000491769	0.000000430579

9999 HALT
 >CLEAR
 >LOAD 000000

BASIC

>LOAD CHAN

>LOW

17:53 12/06

CROSS SECTION NUMBER 1

105

98

ELEVATION

AREA

PERIMETER

VELOCITY

DISCHARGE

FT

SQ FT

FT

FT/SEC

CFS

4/29

EL@ 7

FT	SQ FT	FT	FT/SEC	CFS
95.00	43.45	167.00	0.99	41.97
99.00	130.25	180.08	1.98	258.35
99.50	138.12	186.81	2.77	614.96
100.00	216.23	192.40	3.43	1087.58
100.50	314.35	198.59	4.02	1665.63
101.00	414.71	204.79	4.55	2342.63
101.50	517.22	209.81	5.06	3125.80
102.00	622.01	215.00	5.51	3992.77
102.50	730.13	221.19	5.96	4964.53
103.00	844.72	226.39	6.35	5995.24
103.50	965.15	232.52	6.73	7130.55
104.00	1177.27	240.76	7.10	8352.51
104.50	1395.31	247.79	7.47	9697.69
105.00	1622.15	250.97	7.83	11132.22

5872
18367
43079
85216
151640
247549
382710
558157

102.8
103.3
703.3
104.3
0.48 105.2
0.04 105.0

1460 329

470 12/06

>LOAD CHAN

>LOW

17:53 12/06

CROSS SECTION NUMBER

105

98

6900 12/06

>LOAD CHAN

>LOW

BASIC

>LOAD 000000

>LOAD 2

>LOAD

14:26 12/21

ELEVATION AREA PERIMETER

+ 0

- 0

CROSS SECTION NUMBER

105.000

ELEVATION AREA PERIMETER

0 +

0 -

FT

90 FT

FT

98.50	69.23	173.11	0.000567323733	-0.000172353674
99.00	100.23	195.23	0.000064005477	0.000010509735
99.50	137.23	223.35	0.000019760218	0.00000733303
100.00	183.37	275.46	0.000008631789	0.000004200053
100.50	233.63	352.65	0.000004313705	0.000002570003
101.00	278.02	382.55	0.000002554355	0.000001302519
101.50	317.79	395.07	0.000001593664	0.000000823216
102.00	361.73	390.24	0.000001197960	0.000000959795
102.50	1107.09	293.46	0.000000890185	0.000000738850
103.00	1253.29	295.32	0.000000585277	0.000000584237
103.50	1401.30	296.54	0.000000543927	0.000000473807
104.00	1550.30	301.01	0.000000441073	0.000000390077
104.50	1700.33	304.83	0.000000364325	0.000000325385
105.00	1851.32	305.34	0.000000305710	0.000000276943

9900 104.7

>578

>C...
 >...
 14:52 14:00
 CROSS SECTION NUMBER 5

100.00 100 PERIMETER U + 0 -

FT	SO FT	FT	U +	0 -
100.00	73.95	96.04	0.0001551321109	-0.000259531213
101.00	101.35	132.96	0.000228989439	-0.00000067332
101.50	135.00	159.18	0.000042433319	0.000012377087
102.00	171.35	195.25	0.000016745569	0.00000813743
102.50	207.55	251.37	0.000004505400	0.000005113004
103.00	243.75	297.45	0.000005053770	0.000003425834
103.50	280.00	314.55	0.0000093309675	0.000002416176
104.00	706.87	213.51	0.000002308983	0.000001771211
104.50	117.87	225.70	0.000001659869	0.000001354526
105.00	231.33	237.75	0.000001281538	0.000001057375

>...
 >...
 >...
 >...
 >...
 15:01 15:00
 CROSS SECTION NUMBER 6

100.00 100 PERIMETER U + 0 -

FT	SO FT	FT	U +	0 -
100.00	13.00	63.01	0.013751964192	-0.021228531051
100.50	101.50	137.02	0.000213374218	-0.000193703133
101.00	300.00	221.04	0.000038239416	-0.000011436871
101.50	336.75	259.13	0.000013020463	0.000000924211
102.00	405.11	336.19	0.000005958217	0.000001326113
102.50	411.81	396.26	0.000003243167	0.000001257367
103.00	757.77	327.32	0.000001975462	0.000000261576
103.50	737.35	327.33	0.000001296661	0.000000733115
104.00	1117.12	357.45	0.000000898245	0.000000858501
104.50	1305.25	388.51	0.000000648153	0.000000430830
105.00	1508.31	403.57	0.000000482579	0.000000387740

WHITE TANKS DAM NO 4
 W. EMERGENCY SPILLWAY
 U-CURVES

JMM
 12-9-70

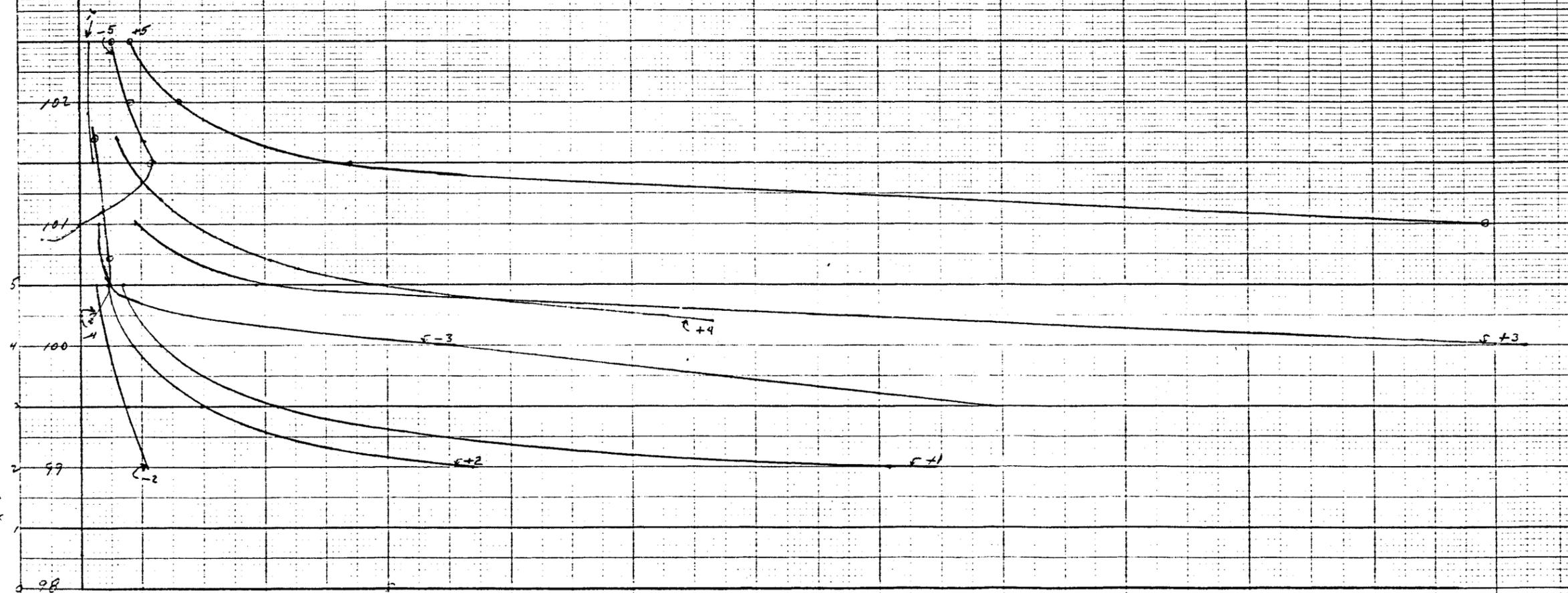
105
 104
 103
 102
 101
 100
 99
 98

$\times 10^5$

0 .02 .04 .06 .08 .10 .12 .14 .16 .18 .20 .22 .24

$\times 10^{-3}$

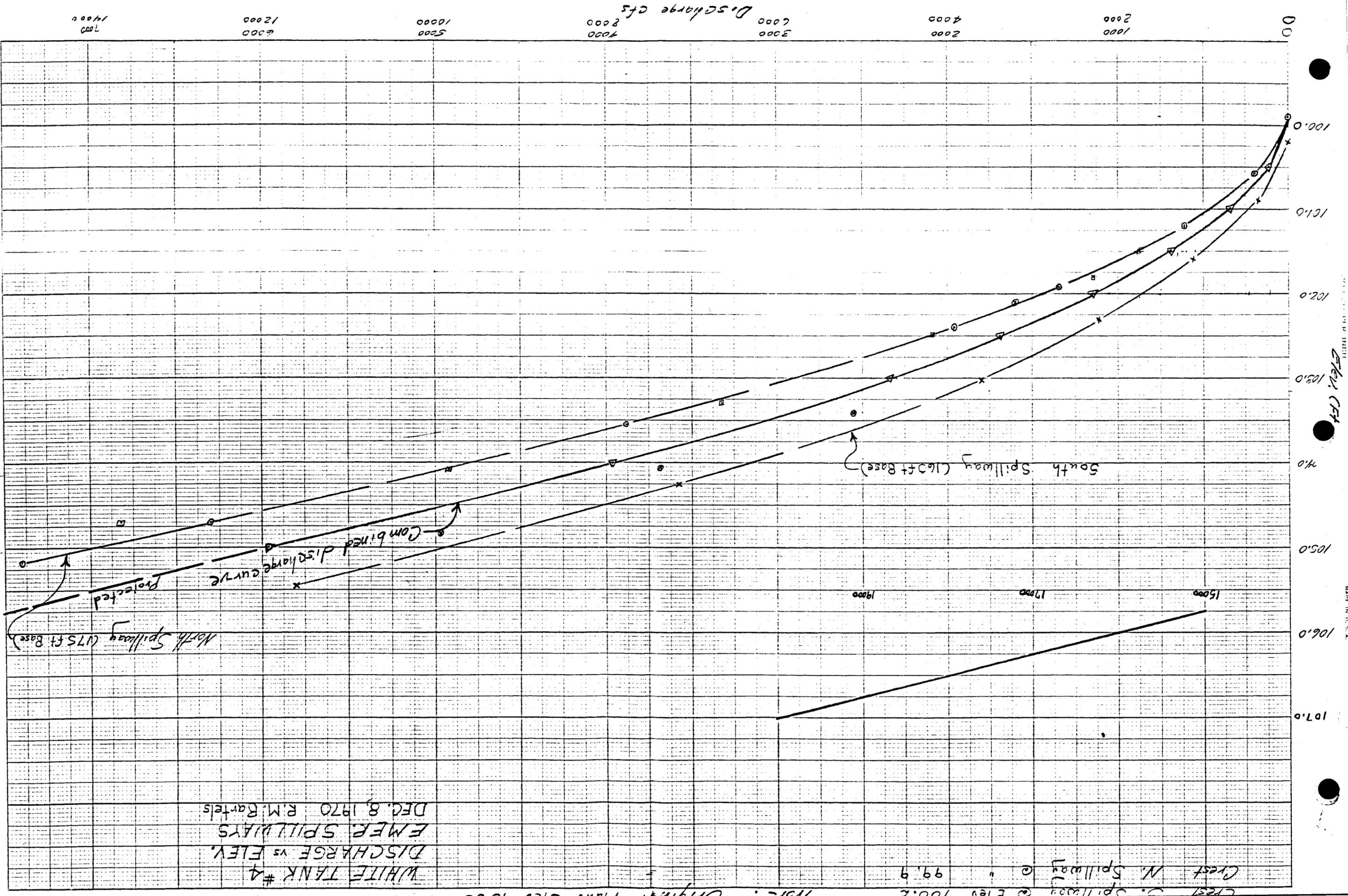
$5 \times 10^{-5} \dots 2 \times 10^{-5}$



EUGENE DIETZEN CO.
 MADE IN U.S.A.

DIETZEN GRAPH PAPER
 20 PER INCH





STATE Arizona PROJECT White Tanks #4
 BY R.M.B. DATE Dec 11, 1970 CHECKED BY _____ DATE _____ JOB NO. _____
 SUBJECT North Spillway (Proj V for cyclin Ht.) SHEET _____ OF _____

Stage @ Control	Stage Upstream	Velocity Control	Δ Stage
0.5	0.68	2.21	0.18
1.0	1.3	3.45	0.30
1.6	2.02	4.67	0.42
2.0	2.50	5.43	0.50
3.0	3.65	7.03	0.65
4.0	4.80	8.43	0.80
4.4	5.27	8.94	0.87
5.0	5.95	9.92	0.95
6.0	7.20		
7.0	8.35		
8.0	9.50		

Proj.

Avg increase of 0.15 ft for each ft up

@ 5.0 flow at Control $r = \frac{4.60}{\cancel{4.67}}$
 $v = \frac{\cancel{2906}}{103}$
 $= 9.69 \text{ fgs}$

STATE <i>Arizona</i>		PROJECT <i>White Tanks #4</i>		
BY <i>RMB</i>	DATE <i>11 Dec 70</i>	CHECKED BY	DATE	JOB NO.
SUBJECT <i>West Spillway (Proj. velocity for Eptic Ht)</i>				SHEET _____ OF _____

@ 4.0 Depth 5.26 upstream increasing 0.20/ft
 4.6 Depth @ control 6.00 upstream

v @ control will be

v = 4.23

v = 12740 / 103 = 9.13 fps

Arizona

White Tank #4

R.M.B. 20 Nov 70

Stage Storage Curve

Elev	Ac Ft	cfs-days	Crest Spill @ 39.18	Eff. Storage = 0
1137	0	0	0	
1139.18			0	
1140	95	47.88	17.88	
43	260	131.04	101.04	
45	425	214.2	184.2	
48	760	383.04	353.	
50	1036	522.14	492	
52	1360	685.44	655	
54	1770	892.08	862	
55	2000	1008.00	978	

$$\text{cfs-days} = 0.504 \text{ Ac Ft}$$

Apr 1970

White Tank #4.

20 Nov. 70

White Tank #4 (Cathedral) D.A. D.A.N

41% "D" Soils
21% "B" Soils
38% "A" Soils

White Tank #4 Memo

$$\begin{aligned} \text{L.F. "D" Soil} &= 1.0 - 0.75(1 - \text{LF}) \\ &= 1.0 - 0.75(1 - .6) = 0.70 \end{aligned}$$

$$\begin{aligned} \text{L.F. "B" Soil} &= 1.0 - 0.50(1 - \text{LF}) \\ &= 1.0 - 0.50(1 - .6) = 0.80 \end{aligned}$$

$$\begin{aligned} \text{LF "D" Soil} &= 1.0 - 0.25(1 - \text{LF}) \\ &= 1.0 - 0.25(1 - 0.6) = 0.90 \end{aligned}$$

$$\begin{aligned} \text{Weighted L.F.} &= 0.41(0.90) + 0.21(0.80) + 0.38(0.70) \\ &= 0.369 + 0.168 + 0.266 \\ &= 0.803 \end{aligned}$$

Same for new D.A. % of Soils
within 0.5%

State Arizona

Watershed White Tank

Site No. 4

PRINCIPAL SPILLWAY HYDROGRAPH

By RMB Date 20 Nov 70 CK'd _____ Date _____

① ② ③ ④ ⑤

DA <u>10.3</u> Sq. Mi.	Source of Data
T _c <u>1.2</u> Hrs.	
Structure Class <u>C</u>	
Design Storm Freq. <u>100</u>	
Pa <u>7.52</u> in.	
Ta <u>69.0</u> °F	
Pm <u>0.70</u> in.	
Tm <u>59.7</u> °F	
Ci <u>0.157</u>	

Time (Days)	PSMC OR PSH 1/			
	Prelim. PSMC PSH	Base flow Snowmelt	Upstream Releases	Total PSMC PSH
	()	()	()	()
	Table 21.10 x or Q 10 or (11)	① x (16) or (22) (14) or (20) (15) or (21)		② + ③ + ④
0	0			
0.1	11.0			
0.5	14.8			
1.0	17.6			
2.0	20.2			
3.0	27.2			
3.5	35.0			
4.0	45.7			
4.2	63.9			
4.4	89.7			
4.6	107.0			
4.7	130.7			
4.8	142.7			
4.9	154.7			
5.0	171.2			
5.1	183.2			
5.2	189.6			
5.3	198.7			
5.4	199.8			
5.5	195.7			
5.6	80.2			
5.8	63.0			
6.0	50.9			

at Buckeye

	1 Day	10 Day	
(1) Point P	<u>4.0</u> "	<u>6.4</u> "	
(2) Areal Corr.	x <u> </u>	x <u> </u>	
(3) Areal P	<u>1.0</u> "	<u>6.4</u> "	
(4) CN	<u>88</u>	<u>77</u>	
(5) Gross Q	<u>7.8</u> "	<u>3.8</u> "	
(6) Channel Loss Factor	x <u>0.503</u>	x <u>0.503</u>	when Ci < 1
(7) Net Q	<u>7.25</u> "	<u>3.25</u> "	
(8) Q _{1/10}	<u>3.05</u> "	<u>2.737</u>	
(9) Hydrograph Serial No.		<u>6</u>	
(10) I" Q	<u>549.3</u> ac. ft.		
(11) DA x Q ₁₀	<u>1.2</u> x <u>3.05</u>	= <u>3.66</u>	
(12) Q ₁₀ x ac. ft./in.	<u>3.05</u> x <u>549.3</u>	= <u>1675.4</u>	

(13) Baseflow	csf.	
(14)	in./da	(13) + 26.89
(15)	csf	(13) x DA
(16)	ac. ft./da	(15) x 2
(17) Minimum	csf.	
(18)	in./da	(17) + 26.89

(19) Snowmelt	csf.	
(20)	in./da	(19) + 26.89
(21)	csf	(19) x DA
(22)	ac. ft./da	(21) x 2

1/ Mark out items not applicable.

State Arizona

Watershed White Tank #45

Site No. 1

PRINCIPAL SPILLWAY HYDROGRAPH

By Date Ck'd Date

① ② ③ ④ ⑤

DA <u>1.2</u> Sq. Mi.	Source of Data
T _c <u> </u> Hrs.	
Structure Class <u>C</u>	
Design Storm Freq. <u>100 yr</u>	
Pa <u> </u> in.	
Ta <u> </u> °F	
Pm <u> </u> in.	
Tm <u> </u> °F	
Ci <u> </u>	

Time (Days)	PSMC OR PSH 1/			
	Prelim. PSMC PSH ()	Base flow Snowmelt ()	Upstream Releases ()	Total PSMC PSH ()

- (1) Point P 1 Day 10 Day
- (2) Areal Corr. x x
- (3) Areal P " "
- (4) CN
- (5) Gross Q " "
- (6) Channel Loss Factor x x when Ci < 1
- (7) Net Q " "
- (8) $Q_{1/Q_{10}} = \frac{Q_{10}}{Q_1} = \frac{5.75}{3.15} = 1.82$
- (9) Hydrograph Serial No. i
- (10) I" Q ac. ft.
- (11) DA x Q₁₀ x = 56.87
- (12) Q₁₀ x ac. ft./in. 3.01 x =

	Table 21.10 x or Q ₁₀ or (11)	① x (16) or (22) (14) or (20) (15) or (21)		② + ③ + ④
0	0			
0.1	30.0			
0.5	26.7			
1.0	31.8			
2.0	36.5			
3.0	47.3			
3.5	63.3			
4.0	82.7			
4.4	162.4			
4.6	175.7			
4.7	236.3			
4.8	320.1			
4.9	516.0			
5.0	443.6			
5.1	503.1			
5.2	543.7			
5.3	572.2			
5.4	597.5			
5.5	619.5			
5.6	638.2			
5.7	653.4			
6.0	677.3			
6.5	718.0			
7.0	511.3			

- (13) Baseflow csm.
- (14) in./da. (13) + 26.89
- (15) cfs (13) x DA
- (16) ac. ft./da. (15) x 2
- (17) Minimum csm.
- (18) in./da. (17) + 26.89

- (19) Snowmelt csm.
- (20) in./da. (19) + 26.89
- (21) cfs (19) x DA
- (22) ac. ft./da. (21) x 2

1/ Mark out items not applicable.

State Michigan

Watershed St. Joseph River

Site No. 4

PRINCIPAL SPILLWAY HYDROGRAPH

By _____ Date _____ Ck'd _____ Date _____

DA <u>1.23</u> Sq. Mi.	Source of Data
T _c <u>1.5</u> Hrs.	
Structure Class <u>1</u>	
Design Storm Freq. _____	
Pa _____ in.	
Ta _____ °F	
Pm <u>0.001</u> in.	
Tm <u>0.001</u> °F	
Ci _____	

Time (Days)	PSMC OR PSH ^{1/}			
	Prelim. PSMC PSH	Base flow Snowmelt	Upstream Releases	Total PSMC PSH
	()	()	()	()
	Table ⁽¹²⁾ 21.10 x or Q ₁₀ or ⁽¹¹⁾	① x ⁽¹⁶⁾ ⁽¹⁴⁾ or ⁽²²⁾ ⁽¹⁵⁾ or ⁽²¹⁾		② + ③ + ④
0	0			
0.1	16.6			
0.5	21			
1.0	24			
2.0	29			
3.0	38			
3.5	47			
4.0	63			
4.2	88			
4.5	111			
4.8	130			
5.0	155			
5.2	173			
5.3	185			
5.4	197			
5.5	210			
5.6	224			
5.8	280			
6.0	64			
6.5	53			

	1 Day	10 Day	
(1) Point P	<u>1.23</u> "	<u>1.23</u> "	
(2) Areal Corr.	x _____	x _____	
(3) Areal P	<u>1.23</u> "	<u>1.23</u> "	
(4) CN			
(5) Gross Q	<u>1.23</u> "	<u>1.23</u> "	
(6) Channel Loss Factor	x <u>0.001</u>	x <u>0.001</u>	when Ci < 1
(7) Net Q	<u>1.23</u> "	<u>1.23</u> "	
(8) Q _{1/10}	<u>1.23</u> "		
(9) Hydrograph Serial No.		<u>15</u>	
(10) I" Q		ac. ft.	
(11) DA x Q ₁₀	<u>1.23</u> x _____	=	<u>1.23</u>
(12) Q ₁₀ x ac. ft./in.	<u>1.23</u> x _____	=	<u>1.23</u>

(13) Baseflow	ac. ft./da.	(13) + 26.89
(14)	in./da.	(13) + 26.89
(15)	cfs	(13) x DA
(16)	ac. ft./da.	(15) x 2
(17) Minimum	ac. ft./da.	(15) x 2
(18)	in./da.	(17) + 26.89
(19) Snowmelt	ac. ft./da.	(19) + 26.89
(20)	in./da.	(19) + 26.89
(21)	cfs	(19) x DA
(22)	ac. ft./da.	(21) x 2

^{1/} Mark out items not applicable.

White Tank #4.

1000

1000

Flow	Flow	Flow	Flow	$S_{21} \pm$	$S_{21} + O_2$	$S_{21} \pm$	$\frac{S_{21}}{24} + O_2$
0	0	0	0	0	0	0	0
39.5	5.0	7	2.5	14	10.5	70	72.5
79.0	10.0	15	5.0	26	20.5	120	125.5
118.5	15.0	20	7.5	38	30.5	170	178.5
158.0	20.0	25	10.0	50	40.5	220	230.5
197.5	25.0	30	12.5	62	50.5	270	282.5
237.0	30.0	35	15.0	74	60.5	320	332.5
276.5	35.0	40	17.5	86	70.5	370	372.5
316.0	40.0	45	20.0	98	80.5	420	412.5
355.5	45.0	50	22.5	110	90.5	470	452.5
395.0	50.0	55	25.0	122	100.5	520	492.5
434.5	55.0	60	27.5	134	110.5	570	532.5
474.0	60.0	65	30.0	146	120.5	620	572.5
513.5	65.0	70	32.5	158	130.5	670	612.5
553.0	70.0	75	35.0	170	140.5	720	652.5
592.5	75.0	80	37.5	182	150.5	770	692.5
632.0	80.0	85	40.0	194	160.5	820	732.5
671.5	85.0	90	42.5	206	170.5	870	772.5
711.0	90.0	95	45.0	218	180.5	920	812.5
750.5	95.0	100	47.5	230	190.5	970	852.5
790.0	100.0	105	50.0	242	200.5	1020	892.5
829.5	105.0	110	52.5	254	210.5	1070	932.5
869.0	110.0	115	55.0	266	220.5	1120	972.5
908.5	115.0	120	57.5	278	230.5	1170	1012.5
948.0	120.0	125	60.0	290	240.5	1220	1052.5
987.5	125.0	130	62.5	302	250.5	1270	1092.5
1027.0	130.0	135	65.0	314	260.5	1320	1132.5
1066.5	135.0	140	67.5	326	270.5	1370	1172.5
1106.0	140.0	145	70.0	338	280.5	1420	1212.5
1145.5	145.0	150	72.5	350	290.5	1470	1252.5
1185.0	150.0	155	75.0	362	300.5	1520	1292.5
1224.5	155.0	160	77.5	374	310.5	1570	1332.5
1264.0	160.0	165	80.0	386	320.5	1620	1372.5
1303.5	165.0	170	82.5	398	330.5	1670	1412.5
1343.0	170.0	175	85.0	410	340.5	1720	1452.5
1382.5	175.0	180	87.5	422	350.5	1770	1492.5
1422.0	180.0	185	90.0	434	360.5	1820	1532.5
1461.5	185.0	190	92.5	446	370.5	1870	1572.5
1501.0	190.0	195	95.0	458	380.5	1920	1612.5
1540.5	195.0	200	97.5	470	390.5	1970	1652.5
1580.0	200.0	205	100.0	482	400.5	2020	1692.5
1619.5	205.0	210	102.5	494	410.5	2070	1732.5
1659.0	210.0	215	105.0	506	420.5	2120	1772.5
1698.5	215.0	220	107.5	518	430.5	2170	1812.5
1738.0	220.0	225	110.0	530	440.5	2220	1852.5
1777.5	225.0	230	112.5	542	450.5	2270	1892.5
1817.0	230.0	235	115.0	554	460.5	2320	1932.5
1856.5	235.0	240	117.5	566	470.5	2370	1972.5
1896.0	240.0	245	120.0	578	480.5	2420	2012.5
1935.5	245.0	250	122.5	590	490.5	2470	2052.5
1975.0	250.0	255	125.0	602	500.5	2520	2092.5
2014.5	255.0	260	127.5	614	510.5	2570	2132.5
2054.0	260.0	265	130.0	626	520.5	2620	2172.5
2093.5	265.0	270	132.5	638	530.5	2670	2212.5
2133.0	270.0	275	135.0	650	540.5	2720	2252.5
2172.5	275.0	280	137.5	662	550.5	2770	2292.5
2212.0	280.0	285	140.0	674	560.5	2820	2332.5
2251.5	285.0	290	142.5	686	570.5	2870	2372.5
2291.0	290.0	295	145.0	698	580.5	2920	2412.5
2330.5	295.0	300	147.5	710	590.5	2970	2452.5
2370.0	300.0	305	150.0	722	600.5	3020	2492.5
2409.5	305.0	310	152.5	734	610.5	3070	2532.5
2449.0	310.0	315	155.0	746	620.5	3120	2572.5
2488.5	315.0	320	157.5	758	630.5	3170	2612.5
2528.0	320.0	325	160.0	770	640.5	3220	2652.5
2567.5	325.0	330	162.5	782	650.5	3270	2692.5
2607.0	330.0	335	165.0	794	660.5	3320	2732.5
2646.5	335.0	340	167.5	806	670.5	3370	2772.5
2686.0	340.0	345	170.0	818	680.5	3420	2812.5
2725.5	345.0	350	172.5	830	690.5	3470	2852.5
2765.0	350.0	355	175.0	842	700.5	3520	2892.5
2804.5	355.0	360	177.5	854	710.5	3570	2932.5
2844.0	360.0	365	180.0	866	720.5	3620	2972.5
2883.5	365.0	370	182.5	878	730.5	3670	3012.5
2923.0	370.0	375	185.0	890	740.5	3720	3052.5
2962.5	375.0	380	187.5	902	750.5	3770	3092.5
3002.0	380.0	385	190.0	914	760.5	3820	3132.5
3041.5	385.0	390	192.5	926	770.5	3870	3172.5
3081.0	390.0	395	195.0	938	780.5	3920	3212.5
3120.5	395.0	400	197.5	950	790.5	3970	3252.5
3160.0	400.0	405	200.0	962	800.5	4020	3292.5
3199.5	405.0	410	202.5	974	810.5	4070	3332.5
3239.0	410.0	415	205.0	986	820.5	4120	3372.5
3278.5	415.0	420	207.5	998	830.5	4170	3412.5
3318.0	420.0	425	210.0	1010	840.5	4220	3452.5
3357.5	425.0	430	212.5	1022	850.5	4270	3492.5
3397.0	430.0	435	215.0	1034	860.5	4320	3532.5
3436.5	435.0	440	217.5	1046	870.5	4370	3572.5
3476.0	440.0	445	220.0	1058	880.5	4420	3612.5
3515.5	445.0	450	222.5	1070	890.5	4470	3652.5
3555.0	450.0	455	225.0	1082	900.5	4520	3692.5
3594.5	455.0	460	227.5	1094	910.5	4570	3732.5
3634.0	460.0	465	230.0	1106	920.5	4620	3772.5
3673.5	465.0	470	232.5	1118	930.5	4670	3812.5
3713.0	470.0	475	235.0	1130	940.5	4720	3852.5
3752.5	475.0	480	237.5	1142	950.5	4770	3892.5
3792.0	480.0	485	240.0	1154	960.5	4820	3932.5
3831.5	485.0	490	242.5	1166	970.5	4870	3972.5
3871.0	490.0	495	245.0	1178	980.5	4920	4012.5
3910.5	495.0	500	247.5	1190	990.5	4970	4052.5
3950.0	500.0	505	250.0	1202	1000.5	5020	4092.5
3989.5	505.0	510	252.5	1214	1010.5	5070	4132.5
4029.0	510.0	515	255.0	1226	1020.5	5120	4172.5
4068.5	515.0	520	257.5	1238	1030.5	5170	4212.5
4108.0	520.0	525	260.0	1250	1040.5	5220	4252.5
4147.5	525.0	530	262.5	1262	1050.5	5270	4292.5
4187.0	530.0	535	265.0	1274	1060.5	5320	4332.5
4226.5	535.0	540	267.5	1286	1070.5	5370	4372.5
4266.0	540.0	545	270.0	1298	1080.5	5420	4412.5
4305.5	545.0	550	272.5	1310	1090.5	5470	4452.5
4345.0	550.0	555	275.0	1322	1100.5	5520	4492.5
4384.5	555.0	560	277.5	1334	1110.5	5570	4532.5
4424.0	560.0	565	280.0	1346	1120.5	5620	4572.5
4463.5	565.0	570	282.5	1358	1130.5	5670	4612.5
4503.0	570.0	575	285.0	1370	1140.5	5720	4652.5
4542.5	575.0	580	287.5	1382	1150.5	5770	4692.5
4582.0	580.0	585	290.0	1394	1160.5	5820	4732.5
4621.5	585.0	590	292.5	1406	1170.5	5870	4772.5
4661.0	590.0	595	295.0	1418	1180.5	5920	4812.5
4700.5	595.0	600	297.5	1430	1190.5	5970	4852.5
4740.0	600.0	605	300.0	1442	1200.5	6020	4892.5
4779.5	605.0	610	302.5	1454	1210.5	6070	4932.5
4819.0	610.0	615	305.0	1466	1220.5	6120	4972.5
4858.5	615.0	620	307.5	1478	1230.5	6170	5012.5
4898.0	620.0	625	310.0	1490	1240.5	6220	5052.5
4937.5	625.0	630	312.5	1502	1250.5	6270	5092.5
4977.0	630.0	635	315.0	1514	1260.5	6320	5132.5
5016.5	635.0	640	317.5	1526	1270.5	6370	5172.5
5056.0	640.0	645	320.0	1538	1280.5	6420	5212.5
5095.5	645.0	650	322.5	1550	1290.5	6470	5252.5
5135.0	650.0	655	325.0	1562	1300.5	6520	5292.5
5174.5	655.0	660	327.5	1574	1310.5	6570	5332.5
5214.0	660.0	665	330.0	1586	1320.5	6620	

W. 100' 100' 100'

Monday (Orig. Data)

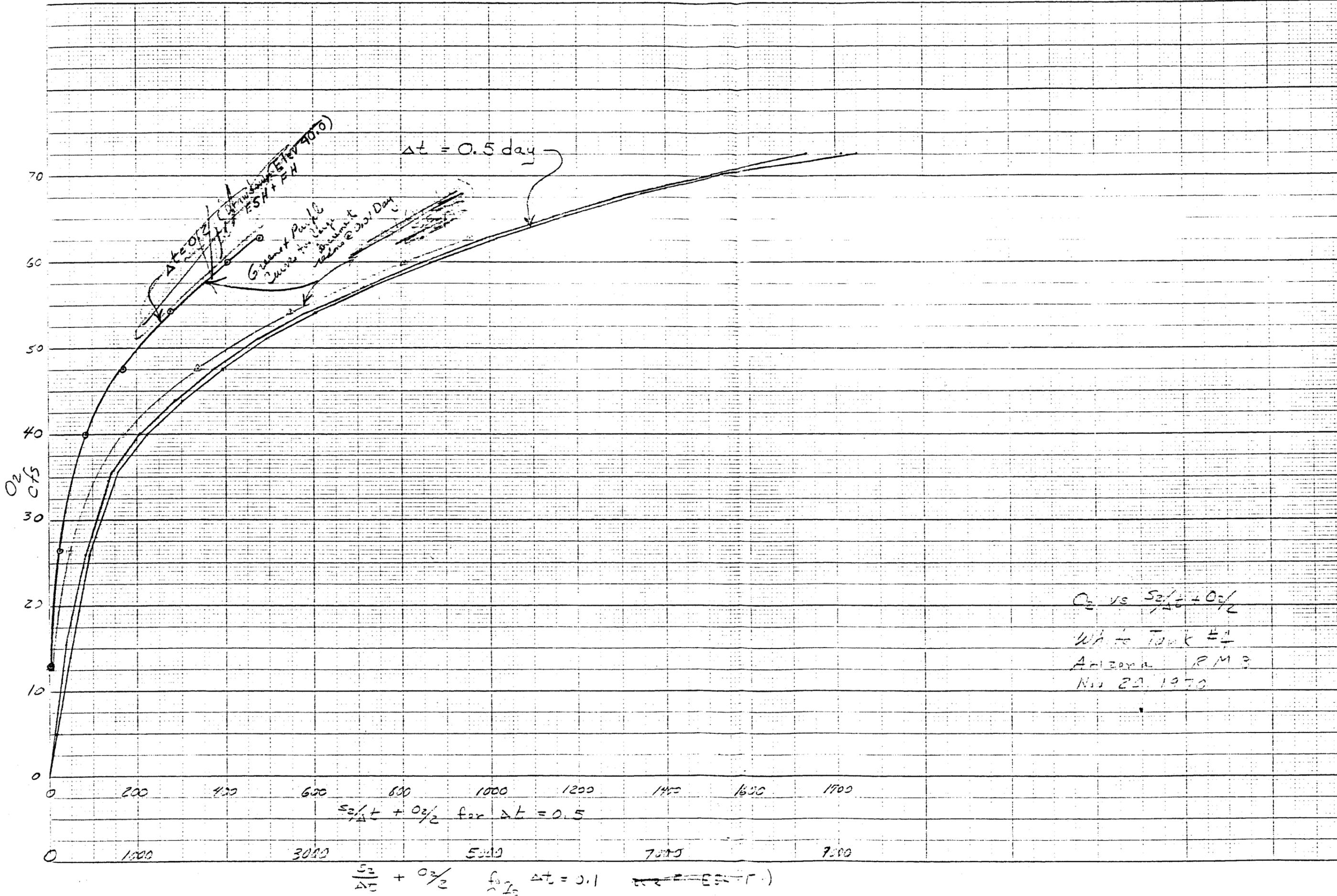
	MIN 82 (1 Day)	$s_2/t + 0.5/2$	Outflow
0	0	0	0
10	10.5	10.5	32.0
20	21.0	30.0	72.0
30	31.5	47.0	112.0
39	37.5	60.5	152.0
49	44	74	192.0
58	50.5	88.5	232.0
67	57.5	106.5	272.0
76	64	124.5	312.0
85	70.5	143	352.0
94	77.5	161.5	392.0
103	84	180	432.0
112	91.5	198.5	472.0
121	99	217	512.0
130	106.5	235.5	552.0
139	114	254	592.0
148	121.5	272.5	632.0
157	129	291	672.0
166	136.5	309.5	712.0
175	144	328	752.0
184	151.5	346.5	792.0
193	159	365	832.0
202	166.5	383.5	872.0
211	174	402	912.0
220	181.5	420.5	952.0
229	189	439	992.0
238	196.5	457.5	1032.0
247	204	476	1072.0
256	211.5	494.5	1112.0
265	219	513	1152.0
274	226.5	531.5	1192.0
283	234	550	1232.0
292	241.5	568.5	1272.0
301	249	587	1312.0
310	256.5	605.5	1352.0
319	264	624	1392.0
328	271.5	642.5	1432.0
337	279	661	1472.0
346	286.5	679.5	1512.0
355	294	698	1552.0
364	301.5	716.5	1592.0
373	309	735	1632.0
382	316.5	753.5	1672.0
391	324	772	1712.0
400	331.5	790.5	1752.0
409	339	809	1792.0
418	346.5	827.5	1832.0
427	354	846	1872.0
436	361.5	864.5	1912.0
445	369	883	1952.0
454	376.5	901.5	1992.0
463	384	920	2032.0
472	391.5	938.5	2072.0
481	399	957	2112.0
490	406.5	975.5	2152.0
499	414	994	2192.0
508	421.5	1012.5	2232.0
517	429	1031	2272.0
526	436.5	1049.5	2312.0
535	444	1068	2352.0
544	451.5	1086.5	2392.0
553	459	1105	2432.0
562	466.5	1123.5	2472.0
571	474	1142	2512.0
580	481.5	1160.5	2552.0
589	489	1179	2592.0
598	496.5	1197.5	2632.0
607	504	1216	2672.0
616	511.5	1234.5	2712.0
625	519	1253	2752.0
634	526.5	1271.5	2792.0
643	534	1290	2832.0
652	541.5	1308.5	2872.0
661	549	1327	2912.0
670	556.5	1345.5	2952.0
679	564	1364	2992.0
688	571.5	1382.5	3032.0
697	579	1401	3072.0
706	586.5	1419.5	3112.0
715	594	1438	3152.0
724	601.5	1456.5	3192.0
733	609	1475	3232.0
742	616.5	1493.5	3272.0
751	624	1512	3312.0
760	631.5	1530.5	3352.0
769	639	1549	3392.0
778	646.5	1567.5	3432.0
787	654	1586	3472.0
796	661.5	1604.5	3512.0
805	669	1623	3552.0
814	676.5	1641.5	3592.0
823	684	1660	3632.0
832	691.5	1678.5	3672.0
841	699	1697	3712.0
850	706.5	1715.5	3752.0
859	714	1734	3792.0
868	721.5	1752.5	3832.0
877	729	1771	3872.0
886	736.5	1789.5	3912.0
895	744	1808	3952.0
904	751.5	1826.5	3992.0
913	759	1845	4032.0
922	766.5	1863.5	4072.0
931	774	1882	4112.0
940	781.5	1900.5	4152.0
949	789	1919	4192.0
958	796.5	1937.5	4232.0
967	804	1956	4272.0
976	811.5	1974.5	4312.0
985	819	1993	4352.0
994	826.5	2011.5	4392.0
1003	834	2030	4432.0
1012	841.5	2048.5	4472.0
1021	849	2067	4512.0
1030	856.5	2085.5	4552.0
1039	864	2104	4592.0
1048	871.5	2122.5	4632.0
1057	879	2141	4672.0
1066	886.5	2159.5	4712.0
1075	894	2178	4752.0
1084	901.5	2196.5	4792.0
1093	909	2215	4832.0
1102	916.5	2233.5	4872.0
1111	924	2252	4912.0
1120	931.5	2270.5	4952.0
1129	939	2289	4992.0
1138	946.5	2307.5	5032.0
1147	954	2326	5072.0
1156	961.5	2344.5	5112.0
1165	969	2363	5152.0
1174	976.5	2381.5	5192.0
1183	984	2400	5232.0
1192	991.5	2418.5	5272.0
1201	999	2437	5312.0
1210	1006.5	2455.5	5352.0
1219	1014	2474	5392.0
1228	1021.5	2492.5	5432.0
1237	1029	2511	5472.0
1246	1036.5	2529.5	5512.0
1255	1044	2548	5552.0
1264	1051.5	2566.5	5592.0
1273	1059	2585	5632.0
1282	1066.5	2603.5	5672.0
1291	1074	2622	5712.0
1300	1081.5	2640.5	5752.0
1309	1089	2659	5792.0
1318	1096.5	2677.5	5832.0
1327	1104	2696	5872.0
1336	1111.5	2714.5	5912.0
1345	1119	2733	5952.0
1354	1126.5	2751.5	5992.0
1363	1134	2770	6032.0
1372	1141.5	2788.5	6072.0
1381	1149	2807	6112.0
1390	1156.5	2825.5	6152.0
1399	1164	2844	6192.0
1408	1171.5	2862.5	6232.0
1417	1179	2881	6272.0
1426	1186.5	2899.5	6312.0
1435	1194	2918	6352.0
1444	1201.5	2936.5	6392.0
1453	1209	2955	6432.0
1462	1216.5	2973.5	6472.0
1471	1224	2992	6512.0
1480	1231.5	3010.5	6552.0
1489	1239	3029	6592.0
1498	1246.5	3047.5	6632.0
1507	1254	3066	6672.0
1516	1261.5	3084.5	6712.0
1525	1269	3103	6752.0
1534	1276.5	3121.5	6792.0
1543	1284	3140	6832.0
1552	1291.5	3158.5	6872.0
1561	1299	3177	6912.0
1570	1306.5	3195.5	6952.0
1579	1314	3214	6992.0
1588	1321.5	3232.5	7032.0
1597	1329	3251	7072.0
1606	1336.5	3269.5	7112.0
1615	1344	3288	7152.0
1624	1351.5	3306.5	7192.0
1633	1359	3325	7232.0
1642	1366.5	3343.5	7272.0
1651	1374	3362	7312.0
1660	1381.5	3380.5	7352.0
1669	1389	3399	7392.0
1678	1396.5	3417.5	7432.0
1687	1404	3436	7472.0
1696	1411.5	3454.5	7512.0
1705	1419	3473	7552.0
1714	1426.5	3491.5	7592.0
1723	1434	3510	7632.0
1732	1441.5	3528.5	7672.0
1741	1449	3547	7712.0
1750	1456.5	3565.5	7752.0
1759	1464	3584	7792.0
1768	1471.5	3602.5	7832.0
1777	1479	3621	7872.0
1786	1486.5	3639.5	7912.0
1795	1494	3658	7952.0
1804	1501.5	3676.5	7992.0
1813	1509	3695	8032.0
1822	1516.5	3713.5	8072.0
1831	1524	3732	8112.0
1840	1531.5	3750.5	8152.0
1849	1539	3769	8192.0
1858	1546.5	3787.5	8232.0
1867	1554	3806	8272.0
1876	1561.5	3824.5	8312.0
1885	1569	3843	8352.0
1894	1576.5	3861.5	8392.0
1903	1584	3880	8432.0
1912	1591.5	3898.5	8472.0
1921	1599	3917	8512.0
1930	1606.5	3935.5	8552.0
1939	1614	3954	8592.0
1948	1621.5	3972.5	8632.0
1957	1629	3991	8672.0
1966	1636.5	4009.5	8712.0
1975	1644	4028	8752.0
1984	1651.5	4046.5	8792.0
1993	1659	4065	8832.0
2002	1666.5	4083.5	8872.0
2011	1674	4102	8912.0
2020	1681.5	4120.5	8952.0
2029	1689	4139	8992.0
2038	1696.5	4157.5	9032.0
2047	1704	4176	9072.0
2056	1711.5	4194.5	9112.0
2065	1719	4213	9152.0
2074	1726.5	4231.5	9192.0
2083	1734	4250	9232.0
2092	1741.5	4268.5	9272.0
2101	1749	4287	9312.0
2110	1756.5	4305.5	9352.0
2119	1764	4324	9392.0
2128	1771.5	4342.5	9432.0
2137	1779	4361	9472.0
2146	1786.5	4379.5	9512.0
2155	1794	4398	9552.0
2164	1801.5	4416.5	9592.0
2173	1809	4435	9632.0
2182	1816.5	4453.5	9672.0
2191	1824	4472	9712.0
2200	1831.5	4490.5	9752.0
2209	1839	4509	9792.0
2218	1846.5	4527.5	9832.0
2227	1854	4546	9872.0
2236	1861.5	4564.5	9912.0
2245	1869	4583	9952.0
2254	1876.5	4601.5	9992.0
2263	1884	4620	10032.0
2272	1891.5	4638.5	10072.0
2281	1899	4657	10112.0
2290	1906.5	4675.5	10152.0
2299	1914	4694	10192.0
2308	1921.5	4712.5	10232.0
2317	1929	4731	10272.0
2326	1936.5	4749.5	10312.0
2335	1944	4768	10352.0
2344	1951.5	4786.5	10392.0
2353	1959	4805	10432.0
2362	1966.5	4823.5	10472.0
2371	1974	4842	10512.0
2380	1981.5	4860.5	10552.0
2389	1989	4879	10592.0
2398	1996.5	4897.5	10632.0
2407	2004	4916	10672.0
2416	2011.5	4934.5	10712.0
2425	2019	4953	10752.0
2434	2026.5	4971.5	10792.0
2443	2034	4990	10832.0
2452	2041.5	5008.5	10872.0
2461	2049	5027	10912.0
2470	2056.5	5045.5	10952.0
2479	2064	5064	10992.0
2488	2071.5	5082.5	11032.0
2497	2079	5101	11072.0
2506	2		

White Lane #1

20.160 40

Run Spill Pooling (Orig. O.A.)
 1000 ft (1 day)

	\bar{z}	$s_{2t} + \frac{Q_2}{c}$	Outflow
0	0	0	0
110	5.5	5.5	0.5
220	11.0	11.0	6.0
330	16.5	16.5	7.0
440	22.0	22.0	13.0
550	27.5	27.5	15.0
660	33.0	33.0	17.5
770	38.5	38.5	21.0
880	44.0	44.0	26.5
990	49.5	49.5	27.0
1100	55.0	55.0	28.0
1210	60.5	60.5	29.5
1320	66.0	66.0	31.5
1430	71.5	71.5	33.5
1540	77.0	77.0	35.5
1650	82.5	82.5	36.5
1760	88.0	88.0	38.5
1870	93.5	93.5	40.5
1980	99.0	99.0	41.0
2090	104.5	104.5	43.5
2200	110.0	110.0	45.5
2310	115.5	115.5	46.5
2420	121.0	121.0	46.5
2530	126.5	126.5	47.2
2640	132.0	132.0	47.5
2750	137.5	137.5	47.6
2860	143.0	143.0	47.6
2970	148.5	148.5	47.6
3080	154.0	154.0	47.6
3190	159.5	159.5	47.6
3300	165.0	165.0	47.6
3410	170.5	170.5	47.6
3520	176.0	176.0	47.6
3630	181.5	181.5	47.6
3740	187.0	187.0	47.6
3850	192.5	192.5	47.6
3960	198.0	198.0	47.6
4070	203.5	203.5	47.6
4180	209.0	209.0	47.6
4290	214.5	214.5	47.6
4400	220.0	220.0	47.6
4510	225.5	225.5	47.6
4620	231.0	231.0	47.6
4730	236.5	236.5	47.6
4840	242.0	242.0	47.6
4950	247.5	247.5	47.6
5060	253.0	253.0	47.6
5170	258.5	258.5	47.6
5280	264.0	264.0	47.6
5390	269.5	269.5	47.6
5500	275.0	275.0	47.6
5610	280.5	280.5	47.6
5720	286.0	286.0	47.6
5830	291.5	291.5	47.6
5940	297.0	297.0	47.6
6050	302.5	302.5	47.6
6160	308.0	308.0	47.6
6270	313.5	313.5	47.6
6380	319.0	319.0	47.6
6490	324.5	324.5	47.6
6600	330.0	330.0	47.6
6710	335.5	335.5	47.6
6820	341.0	341.0	47.6
6930	346.5	346.5	47.6
7040	352.0	352.0	47.6
7150	357.5	357.5	47.6
7260	363.0	363.0	47.6
7370	368.5	368.5	47.6
7480	374.0	374.0	47.6
7590	379.5	379.5	47.6
7700	385.0	385.0	47.6
7810	390.5	390.5	47.6
7920	396.0	396.0	47.6
8030	401.5	401.5	47.6
8140	407.0	407.0	47.6
8250	412.5	412.5	47.6
8360	418.0	418.0	47.6
8470	423.5	423.5	47.6
8580	429.0	429.0	47.6
8690	434.5	434.5	47.6
8800	440.0	440.0	47.6
8910	445.5	445.5	47.6
9020	451.0	451.0	47.6
9130	456.5	456.5	47.6
9240	462.0	462.0	47.6
9350	467.5	467.5	47.6
9460	473.0	473.0	47.6
9570	478.5	478.5	47.6
9680	484.0	484.0	47.6
9790	489.5	489.5	47.6
9900	495.0	495.0	47.6
10010	500.5	500.5	47.6
10120	506.0	506.0	47.6
10230	511.5	511.5	47.6
10340	517.0	517.0	47.6
10450	522.5	522.5	47.6
10560	528.0	528.0	47.6
10670	533.5	533.5	47.6
10780	539.0	539.0	47.6
10890	544.5	544.5	47.6
11000	550.0	550.0	47.6
11110	555.5	555.5	47.6
11220	561.0	561.0	47.6
11330	566.5	566.5	47.6
11440	572.0	572.0	47.6
11550	577.5	577.5	47.6
11660	583.0	583.0	47.6
11770	588.5	588.5	47.6
11880	594.0	594.0	47.6
11990	599.5	599.5	47.6
12100	605.0	605.0	47.6
12210	610.5	610.5	47.6
12320	616.0	616.0	47.6
12430	621.5	621.5	47.6
12540	627.0	627.0	47.6
12650	632.5	632.5	47.6
12760	638.0	638.0	47.6
12870	643.5	643.5	47.6
12980	649.0	649.0	47.6
13090	654.5	654.5	47.6
13200	660.0	660.0	47.6
13310	665.5	665.5	47.6
13420	671.0	671.0	47.6
13530	676.5	676.5	47.6
13640	682.0	682.0	47.6
13750	687.5	687.5	47.6
13860	693.0	693.0	47.6
13970	698.5	698.5	47.6
14080	704.0	704.0	47.6
14190	709.5	709.5	47.6
14300	715.0	715.0	47.6
14410	720.5	720.5	47.6
14520	726.0	726.0	47.6
14630	731.5	731.5	47.6
14740	737.0	737.0	47.6
14850	742.5	742.5	47.6
14960	748.0	748.0	47.6
15070	753.5	753.5	47.6
15180	759.0	759.0	47.6
15290	764.5	764.5	47.6
15400	770.0	770.0	47.6
15510	775.5	775.5	47.6
15620	781.0	781.0	47.6
15730	786.5	786.5	47.6
15840	792.0	792.0	47.6
15950	797.5	797.5	47.6
16060	803.0	803.0	47.6
16170	808.5	808.5	47.6
16280	814.0	814.0	47.6
16390	819.5	819.5	47.6
16500	825.0	825.0	47.6
16610	830.5	830.5	47.6
16720	836.0	836.0	47.6
16830	841.5	841.5	47.6
16940	847.0	847.0	47.6
17050	852.5	852.5	47.6
17160	858.0	858.0	47.6
17270	863.5	863.5	47.6
17380	869.0	869.0	47.6
17490	874.5	874.5	47.6
17600	880.0	880.0	47.6
17710	885.5	885.5	47.6
17820	891.0	891.0	47.6
17930	896.5	896.5	47.6
18040	902.0	902.0	47.6
18150	907.5	907.5	47.6
18260	913.0	913.0	47.6
18370	918.5	918.5	47.6
18480	924.0	924.0	47.6
18590	929.5	929.5	47.6
18700	935.0	935.0	47.6
18810	940.5	940.5	47.6
18920	946.0	946.0	47.6
19030	951.5	951.5	47.6
19140	957.0	957.0	47.6
19250	962.5	962.5	47.6
19360	968.0	968.0	47.6
19470	973.5	973.5	47.6
19580	979.0	979.0	47.6
19690	984.5	984.5	47.6
19800	990.0	990.0	47.6
19910	995.5	995.5	47.6
20020	1001.0	1001.0	47.6
20130	1006.5	1006.5	47.6
20240	1012.0	1012.0	47.6
20350	1017.5	1017.5	47.6
20460	1023.0	1023.0	47.6
20570	1028.5	1028.5	47.6
20680	1034.0	1034.0	47.6
20790	1039.5	1039.5	47.6
20900	1045.0	1045.0	47.6
21010	1050.5	1050.5	47.6
21120	1056.0	1056.0	47.6
21230	1061.5	1061.5	47.6
21340	1067.0	1067.0	47.6
21450	1072.5	1072.5	47.6
21560	1078.0	1078.0	47.6
21670	1083.5	1083.5	47.6
21780	1089.0	1089.0	47.6
21890	1094.5	1094.5	47.6
22000	1100.0	1100.0	47.6
22110	1105.5	1105.5	47.6
22220	1111.0	1111.0	47.6
22330	1116.5	1116.5	47.6
22440	1122.0	1122.0	47.6
22550	1127.5	1127.5	47.6
22660	1133.0	1133.0	47.6
22770	1138.5	1138.5	47.6
22880	1144.0	1144.0	47.6
22990	1149.5	1149.5	47.6
23100	1155.0	1155.0	47.6
23210	1160.5	1160.5	47.6
23320	1166.0	1166.0	47.6
23430	1171.5	1171.5	47.6
23540	1177.0	1177.0	47.6
23650	1182.5	1182.5	47.6
23760	1188.0	1188.0	47.6
23870	1193.5	1193.5	47.6
23980	1199.0	1199.0	47.6
24090	1204.5	1204.5	47.6
24200	1210.0	1210.0	47.6
24310	1215.5	1215.5	47.6
24420	1221.0	1221.0	47.6
24530	1226.5	1226.5	47.6
24640	1232.0	1232.0	47.6
24750	1237.5	1237.5	47.6
24860	1243.0	1243.0	47.6
24970	1248.5	1248.5	47.6
25080	1254.0	1254.0	47.6
25190	1259.5	1259.5	47.6
25300	1265.0	1265.0	47.6
25410	1270.5	1270.5	47.6
25520	1276.0	1276.0	47.6
25630	1281.5	1281.5	47.6
25740	1287.0	1287.0	47.6
25850	1292.5	1292.5	47.6
25960	1298.0	1298.0	47.6
26070	1303.5	1303.5	47.6
26180	1309.0	1309.0	47.6
26290	1314.5	1314.5	47.6
26400	1320.0	1320.0	47.6
26510	1325.5	1325.5	47.6
26620	1331.0	1331.0	47.6
26730	1336.5	1336.5	47.6
26840	1342.0	1342.0	47.6
26950	1347.5	1347.5	47.6
27060	1353.0	1353.0	47.6
27170	1358.5	1358.5	47.6
27280	1364.0	1364.0	47.6
27390	1369.5	1369.5	47.6
27500	1375.0	1375.0	47.6
27610	1380.5	1380.5	47.6
27720	1386.0	1386.0	47.6
27830	1391.5	1391.5	47.6
27940	1397.0	1397.0	47.6
28050	1402.5	1402.5	47.6
28160	1408.0	1408.0	47.6
28270	1413.5	1413.5	47.6
28380	1419.0	1419.0	47.6
28490	1424.5	1424.5	47.6
28600	1430.0	1430.0	47.6
28710	1435.5	1435.5	47.6
28820	1441.0	1441.0	47.6
28930	1446.5	1446.5	47.6
29040	1452.0	1452.0	47.6
29150	1457.5	1457.5	47.6
29260	1463.0	1463.0	47.6
29370	1468.5	1468.5	47.6
29480	1474.0	1474.0	47.6
29590	1479.5	1479.5	47.6
29700	1485.0	1485.0	47.6
29810	1490.5	1490.5	47.6
29920	1496.0	1496.0	47.6
30030	1501.5	1501.5	47.6
30140	1507.0	1507.0	47.6



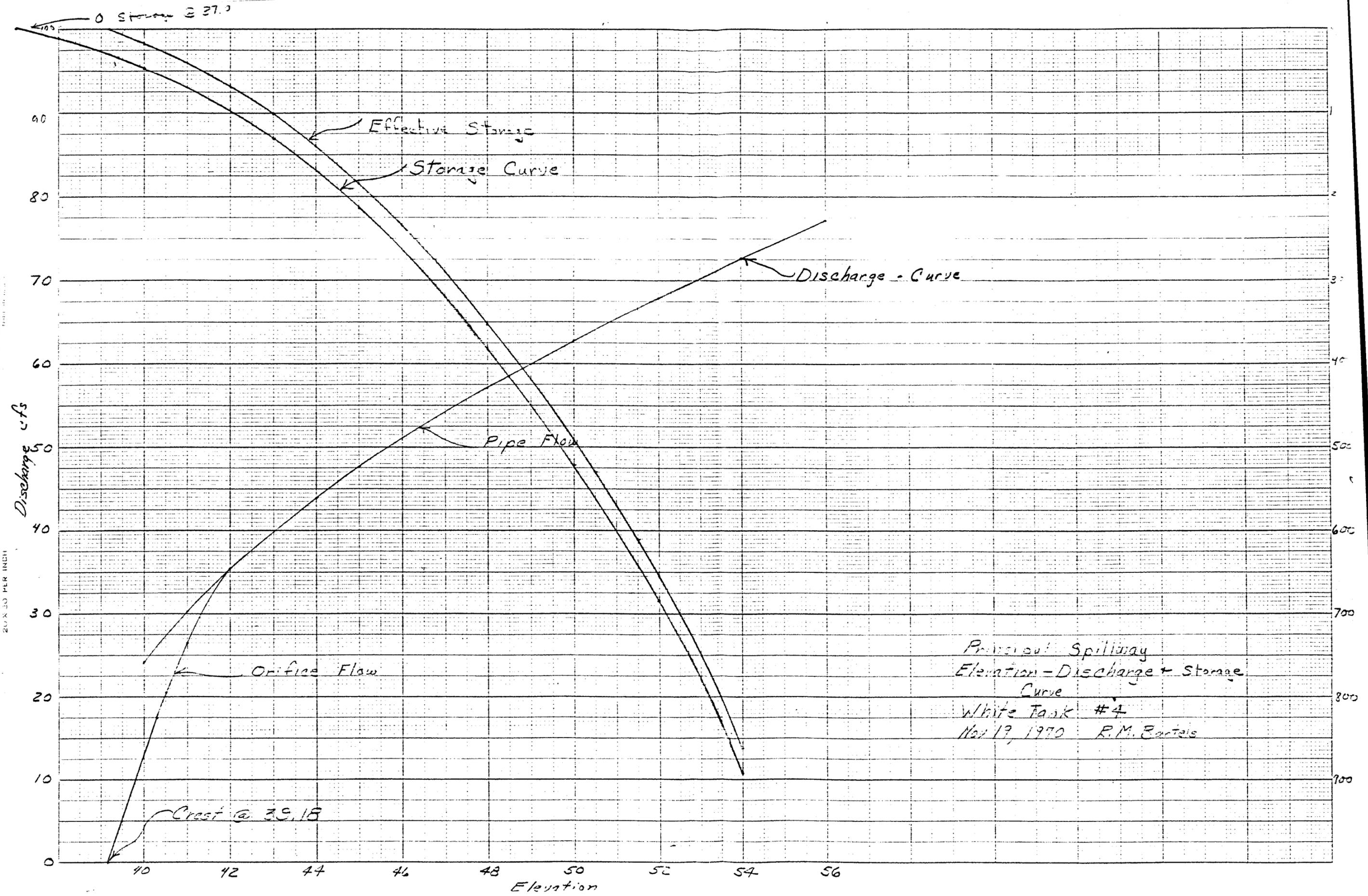
O_2 vs $\frac{S_2}{\Delta t} + \frac{O_2}{2}$
 White Tank #4
 Arizona R.M. #
 Nov 22, 1950

$\frac{S_2}{\Delta t} + \frac{O_2}{2}$ for $\Delta t = 0.5$

$\frac{S_2}{\Delta t} + \frac{O_2}{2}$ for $\Delta t = 0.1$ ~~ESH + PH~~

NO. 3-100R-20 DIETZGEN GRAPH PAPER
20 X 30 PER INCH

EUGENE, MINNESOTA



Practical Spillway
Elevation-Discharge + Storage
Curve
White Tank #4
Nov 17, 1970 R.M. Bartals

STATE	Arizona	PROJECT	White Tank #4
BY	R.M.B.	CHECKED BY	
DATE	9 Dec 70	DATE	
SUBJECT	Emer. Spill. Hydro. Routing (18.9 sq mi)		SHEET OF

hrs	Time Days	Inflow cfs	\bar{I} cfs	$S \frac{1}{2} \Delta t + O \frac{1}{2}$ cfs	Outflow cfs
0	0	0	0	0	13
1.24	0.01	100	50	37	13
1.48	2	300	200	224	15
1.72	3	700	500	709	18
1.96	4	1100	900	1591	23
1.20	5	2050	1575	3143	29
1.44	6	3400	2725	5839	36
1.68	7	5200	4300	10103	42
1.82	8	7000	6100	16161	47
2.06	9	10000	8500	24614	53
2.30	0.10	17000	13500	38061	58
2.54	11	22,100	19550	57553	1000
8	12	25,600	23850	80403	5800
3.02	13	24,600	25,100	99703	11300
3.26	14	22,300	23,450	111,853	13900
3.50	15	19,300	20,800	118,753	15400
3.74	16	16,600	17,950	121,303	16000
3.98	17	14,100	15,350	120653	15900
4.22	18	12,300	13,200		
4.46	19	10,600	11,450		
4.70	0.20	9,400	10,000		
4.94	21				
5.18	22				

1215

over Top Dam

Top @ 1056.0
@ 16,000 cfs
Flow

~~Area 60 Depth~~

D = 5.0 ft velocity in Spillway North will be 9.7 fps
D = 4.6 ft " " West " " 9.1 fps

STATE <i>Arizona</i>	PROJECT <i>White Tank #4</i>		
BY <i>R.M.B.</i>	DATE <i>Dec 11, 1978</i>	CHECKED BY	DATE
SUBJECT <i>F.H. (18.9 sq mi.)</i>			JOB NO.

Time	Inflow	I	$\frac{5}{8}I + \frac{1}{2}$	Outflow	SHEET	OF
0	0	0	0	13		
.24	250	125	112	13		
1.98	500	375	474	16		
1.72	1600	1050	1508	23		
1.96	2600	2100	3585	30		
1.20	5100	3850	7405	38		
1.44	8200	6650	14017	46		
1.57	12200	10200	24169	53		
1.82	16000	14100	38216	58		
2.06	23500	19750	57908	1000		
2.30	38000	30750	87658	7800		
2.54	56000	47000	126858	17100		over Dam
2.78	65500	60750	170508	29400		
3.02	72500	69000	210108	40800		
3.26	67500	70000	239308	49400		
3.50	61000	64250	254158	53800		
3.74	55000	58000	258358	55000		
3.98	45500	50250	253608	53600		
4.22	39000	42250				
4.46	34000	36500				
4.70	29500	31750				
4.94	26500	28000				

$\frac{258358}{55}$
 $\frac{2033}{.504}$ cf Day
 $203,358$

Approx Elev 1063

4034 Ac FT

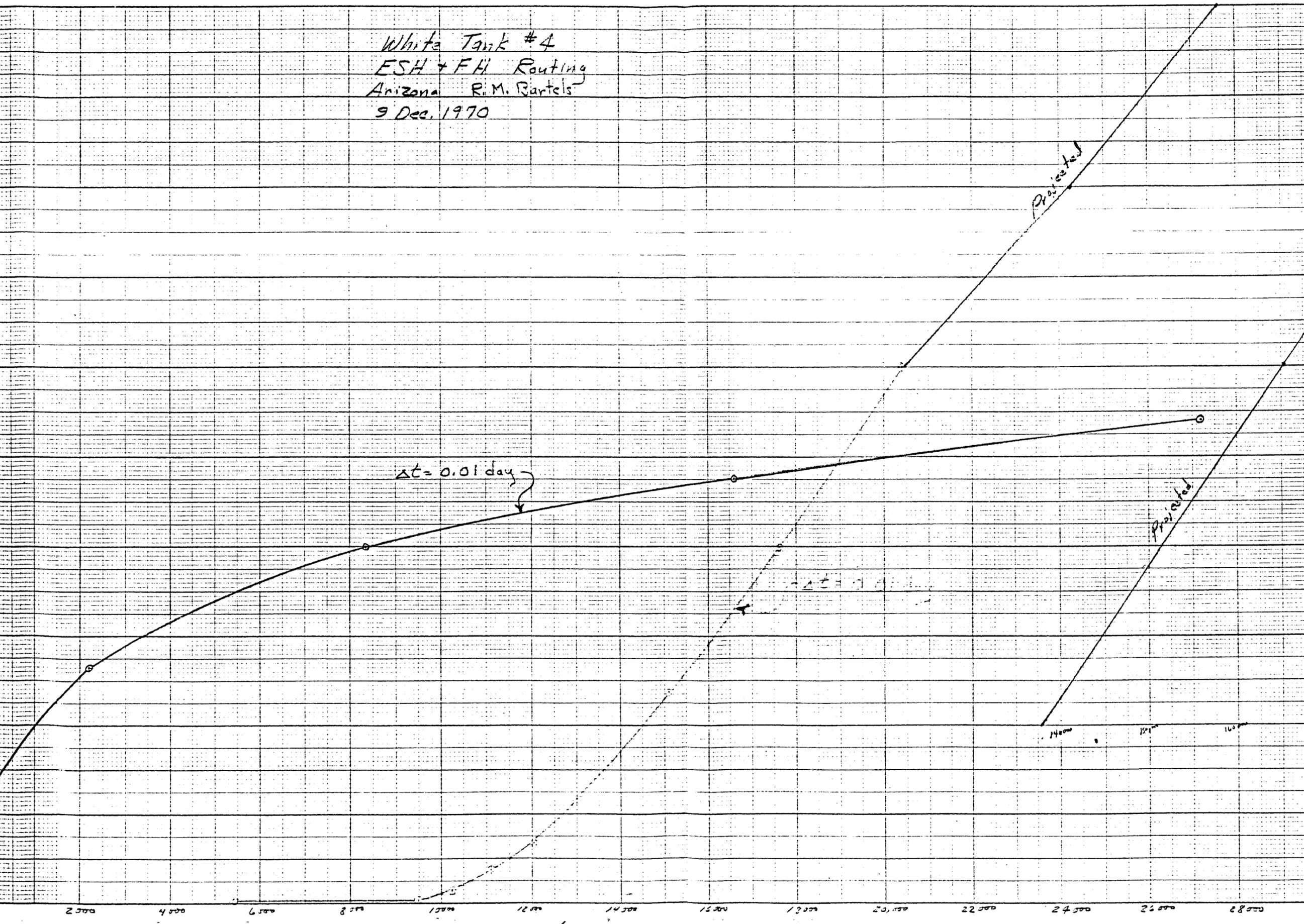
Discharge of 55000 cfs

White Tank #4
 ESH + FH Routing
 Arizona R.M. Bartels
 9 Dec. 1970

NO. 340DR-20 DIETZGEN GRAPH PAPER
 20 X 20 PER INCH
 EUGENE DIETZGEN CO.
 MADE IN U.S.A.

20,000
 18,000
 16,000
 14,000
 12,000
 10,000
 8,000
 6,000
 4,000
 2,000
 0

28,000
 26,000
 24,000
 22,000
 20,000
 18,000
 16,000
 14,000
 12,000
 10,000
 8,000
 6,000
 4,000
 2,000
 0



$S_2/AT + 0.2/2$

Projected

Projected

White Tank #4 © Buckeye
Spillway Hydrology Calculations

Arizona Dec 9, 1970

R. M. Bartels

Emer. Spillway (class e Structure)

$$\begin{aligned} \text{Emer. Proc.} &= 6 \text{ hr } P_{100} + 0.26(PMP - P_{100}) \\ &= 3.25 + 0.26(19.0 - 3.25) \\ &= 3.25 + 4.10 = 7.35 \text{ inches} \end{aligned}$$

$$\text{Freeboard} = PMP = 19.0 \text{ inches}$$

HYDROGRAPH COMPUTATION

DATE 3/10/70
 COMPUTED BY [Signature]
 CHECKED BY [Signature]

WATERSHED OR PROJECT _____

STATE _____

STRUCTURE SITE OR SUBAREA _____

DR. AREA _____ SQ. MI. STRUCTURE CLASS 2

T_c _____ HR. STORM DURATION 6 HR.

POINT RAINFALL 7.35 IN.

ADJUSTED RAINFALL:

AREAL : FACTOR 0.7 IN. 6.62

DURATION : FACTOR 0.7 IN. 6.62

RUNOFF CURVE NO. _____

Q 5.3 IN.

HYDROGRAPH FAMILY NO. 1

COMPUTED T_p 0.84 HR.

T_o 5.5 HR.

(T_o / T_p) :
 COMPUTED 6.54 ; USED 6

REVISED T_p 0.9166

$q_p = \frac{484A}{REV. T_p} = \underline{9980}$ CFS.

$(Q \times q_p) = \underline{52,894}$ CFS.

$t(\text{COLUMN}) = (t / T_p) REV. T_p$ $q(\text{COLUMN}) = (q_c / q_p) (Q \times q_p)$

$Q(\text{COLUMN}) = (Q_t / Q) Q$

	$t = (t/T_p) Rev. T_p$	$q = (q_c/q_p)(Q)(q_p)$	$Q_t = (Q_t/Q)Q$
	t HOURS	q CFS	Q INCHES
1	0	0	0
2	0.40	158.7	
3	0.90	952	
4	1.21	2169	
5	1.613	4443	
6	2.02	9309	
7	2.42	20717	
8	2.82	26878	
9	3.23	28774	
10	3.63	17717	
11	4.03	13646	
12	4.44	10685	
13	4.84	8675	
14	5.24	7352	
15	5.65	6559	
16	6.05	5289	
17	6.45	3174	
18	6.86	1745	
19	7.26	952	
20	7.66	476	
21	8.07	264	
22	8.47	159	
23	8.87	106	
24	9.28	53	
25	9.68	0	
26			
27			
28			
29			
30			
31			
32			
33			
34			

6.5473

Amesbury HYDROGRAPH COMPUTATION

DATE _____
COMPUTED BY J. J. B.
CHECKED BY _____

WATERSHED OR PROJECT White Tank #7

STATE MA

STRUCTURE SITE OR SUBAREA 1

DR. AREA _____ SQ. MI. STRUCTURE CLASS e

T_c _____ HR. STORM DURATION 6 HR.

POINT RAINFALL 7.35 IN.

ADJUSTED RAINFALL:

AREAL : FACTOR 1.0 IN. -

DURATION : FACTOR 1.0 IN. -

RUNOFF CURVE NO. 88

Q 5.95 IN.

HYDROGRAPH FAMILY NO. 1

COMPUTED T_p 0.84 HR.

T_o 5.5 HR.

(T_o / T_p) :
COMPUTED 6.54 ; USED 6.0

REVISED T_p 0.9166

$q_p = \frac{484A}{REV. T_p} = \frac{5439}{6.0} = 906.5$ CFS.

$(Q \times q_p) = 32,362$ CFS.

$t(COLUMN) = (t / T_p) REV. T_p$ $q(COLUMN) = (q_c / q_p) (Q \times q_p)$

$Q(COLUMN) = (Q_t / Q) Q$

	$t = (t/T_p) Rev. T_p$	$q = (q_c/q_p)(Q \times q_p)$	$Q_t = (Q_t/Q) Q$
	t HOURS	q CFS	Q INCHES
1	0	0	0
2	.40	97	
3	.90	582	
4	1.21	1327	
5	1.61	2718	
6	2.02	5696	
7	2.42	12492	
8	2.82	16084	
9	3.23	13916	
10	3.63	10841	
11	4.03	8349	
12	4.44	6537	
13	4.84	5307	
14	5.24	4498	
15	5.65	4013	
16	6.05	3236	
17	6.45	1942	
18	6.86	1068	
19	7.26	583	
20	7.66	291	
21	8.07	162	
22	8.47	97	
23	8.87	65	
24	9.28	32	
25	9.68	0	
26			
27			
28			
29			
30			
31			
32			
33			
34			

STATE <i>Arizona</i>		PROJECT <i>White Tank #4</i>		
BY <i>R.M.B.</i>	DATE <i>Dec 9, 1970</i>	CHECKED BY	DATE	JOB NO.
SUBJECT <i>Emer. Spillway H. Routing (10.3 sqmi)</i>				SHEET _____ OF _____

Time		Inflow	I	$\frac{S}{At} + 0\frac{1}{2}$	Outflow
Hrs	Day				
	0	0	0	0	13
.24	0.01	50	25	12	13
.48	0.02	100	75	74	13
.72	0.03	400	250	311	15
.96	0.04	700	550	845	19
1.20	0.05	1300	1000	1826	25
1.44	0.06	2150	1725	3525	30
1.68	0.07	3350	2750	6245	36
1.82	0.08	4200	3775	9984	42
2.06	0.09	6100	5150	15092	46
2.30	0.10	10500	8300	23346	52
	0.11	13600	12050	35344	56
2.3	0.12	15700	14650	49938	200
3.02	0.13	15000	15350	65088	2350
3.26	0.14	13700	14350	77088	5050
3.50	0.15	11750	12725	84763	7050
3.74	0.16	10100	10925	88638	8000
3.98	0.17	8600	9350	89988	8500
4.22	0.18	7500	8050	89538	8350
4.46	0.19	6400			
4.70	0.20	5700			
4.94	0.21	5050			
5.18	0.22	4550			
5.42	0.23	4150			
5.66	0.24	4000			
5.90	0.25	3500			
6.14	0.26	2900			
6.38	0.27	2100			
6.62	0.28	1550			
6.86	0.29	1050			
7.10	0.30	780			

$$\text{Rej'd Storage} = .01(89988 - 4250)$$

$$= 857.38 \text{ (J. Dany)}$$

$$= 1701 \text{ Ac Ft}$$

$$= \text{Elev. } 54.2$$

STATE *Arizona*

PROJECT *White Tank #4*

DATE

BY *A. M. E.* *9 Dec 70*

CHECKED BY

DATE

JOB NO.

SUBJECT

Furnace F. B. Hydragraph

Elev	Discharge			Storage	O ₂ /2	^{4+0.2} S ₂ /at		^{at = 0.5} S ₂ /at	
	Prin	Emer	Total			S ₂ /at	S ₂ /at + 1/2	S ₂ /at	S ₂ /at + 0 1/2
40.0	13.0	—	13.0	0	6.5	0	6.5	0	6.5
41.0	26.5	—	26.5	22	13.2	110	123.2	220	233
43.0	39.9	—	39.9	83	20.0	415	435	830	850
45.0	47.6	—	47.6	166	23.8	830	854	1660	1684
47.0	54.2	—	54.2	272	27.1	1360	1387	2720	2747
49.0	59.9	—	59.9	400	30.0	2000	2030	4000	4030
50.0	62.8	—	62.8	474	31.4	2370	2401	4740	4771
50.5	64.1	220	284.1	512	142	2560	2702	5120	5262
51.0	65.4	675	740	552	370	2760	3130	5520	5890
51.5	66.6	1380	1446	595	723	2975	3698	5950	6673
52.0	67.9	2300	2368	640	1184	3200	4384	6400	7584
53.0	70.2	4680	4750	732	2375	3660	6035	7320	9695
54.0	72.6	7925	7998	844	3999	4220	8219	8440	12439
55.0	75.0	11925	12000	960	6000	4800	10800	9600	15600

SHEET OF

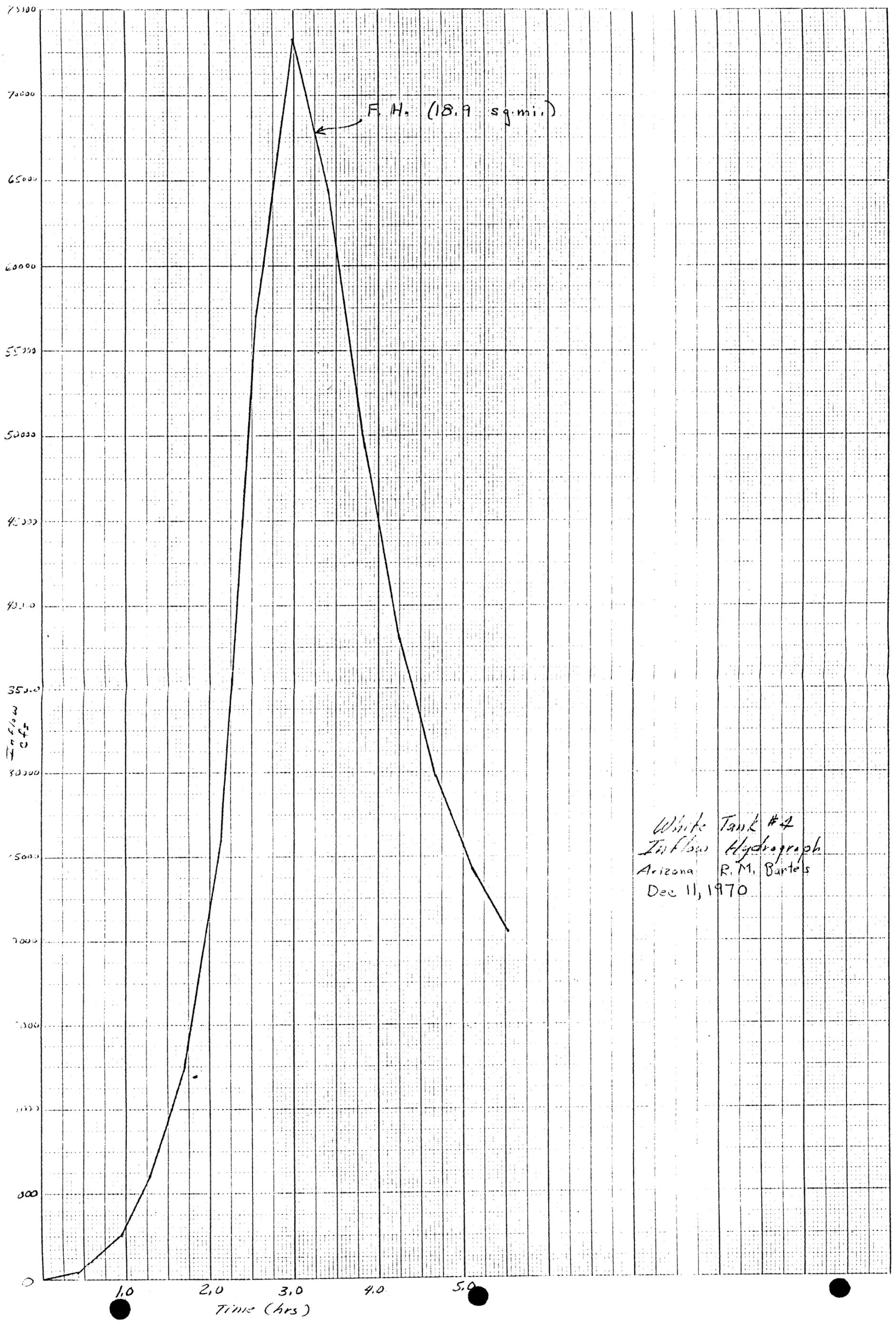
STATE Ala. PROJECT White Tank #4
 BY L.M.B. CHECKED BY _____ DATE Dec 9, 1970 JOB NO. _____

SUBJECT Calc. for $S_2/\Delta t + O_2/2$ vs Outflow curve

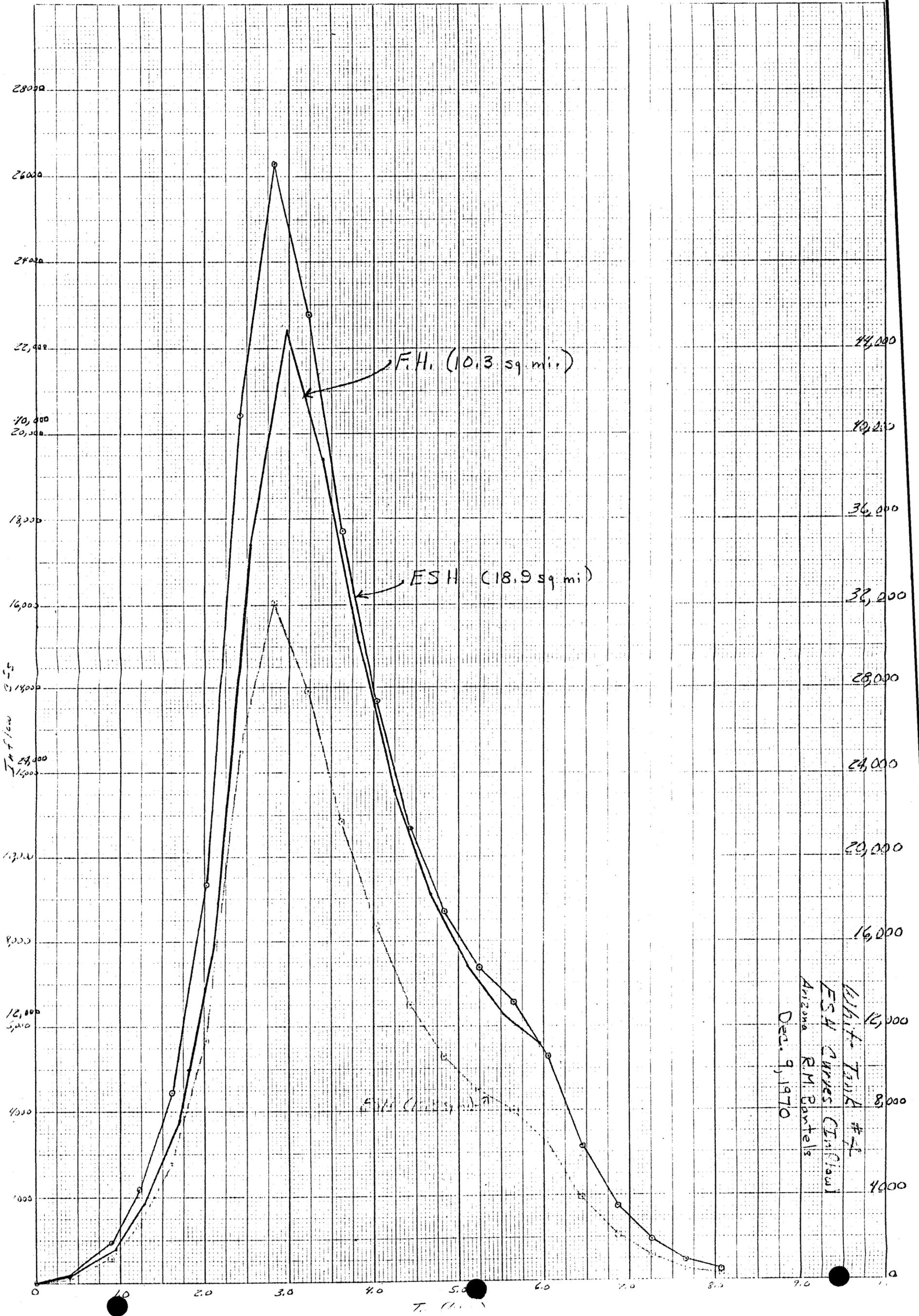
$\Delta t = 0.01$ days

Elev	Discharge Q	Storage $d_i \text{ Dam}^3$	$O_2/2$	$S_2/\Delta t$	$S_2/\Delta t + O_2/2$
40.0	13.0	0	6.5	0	6.5
41.0	26.5	22	13.2	2200	2213
43.0	39.9	83	20	8300	8320
45.0	47.6	166	24	16600	16624
47.0	54.2	272	27	27200	27227
50.0	62.8	474	31	47400	47431
50.5	284.1	512	142	51200	51342
51.0	740	552	370	55200	55570
51.5	1446	595	723	59500	60223
52.0	2368	640	1184	64000	65184
53.0	4750	732	2375	73200	75575
54.0	7998	844	3999	84400	88399
55.0	12000	960	6000	96000	102,000
56.0	16000	1134	8000	113400	121400
57.0	20000	1260	10000	126000	136000
58.0	24000	1386	12000	138600	150600
59.0	28000	1512	14000	151200	165200
60.0	34000				
	40000				
	47000				
	55000				

63 } Estimates



White Tank #2
Inflow Hydrograph
Arizona R.M. Bartels
Dec 11, 1970



ENGINEER USE

NO. 3400R-20 DIETZGEN GRAPH PAPER
200 X 250 PER INCH

Discharge
CFS

36,000

30,000

20,000

12,000

5,000

5,200

4,200

230,000

240,000

250,000

260,000

100,000

120,000

140,000

$S_2/\Delta t + O_2/2$

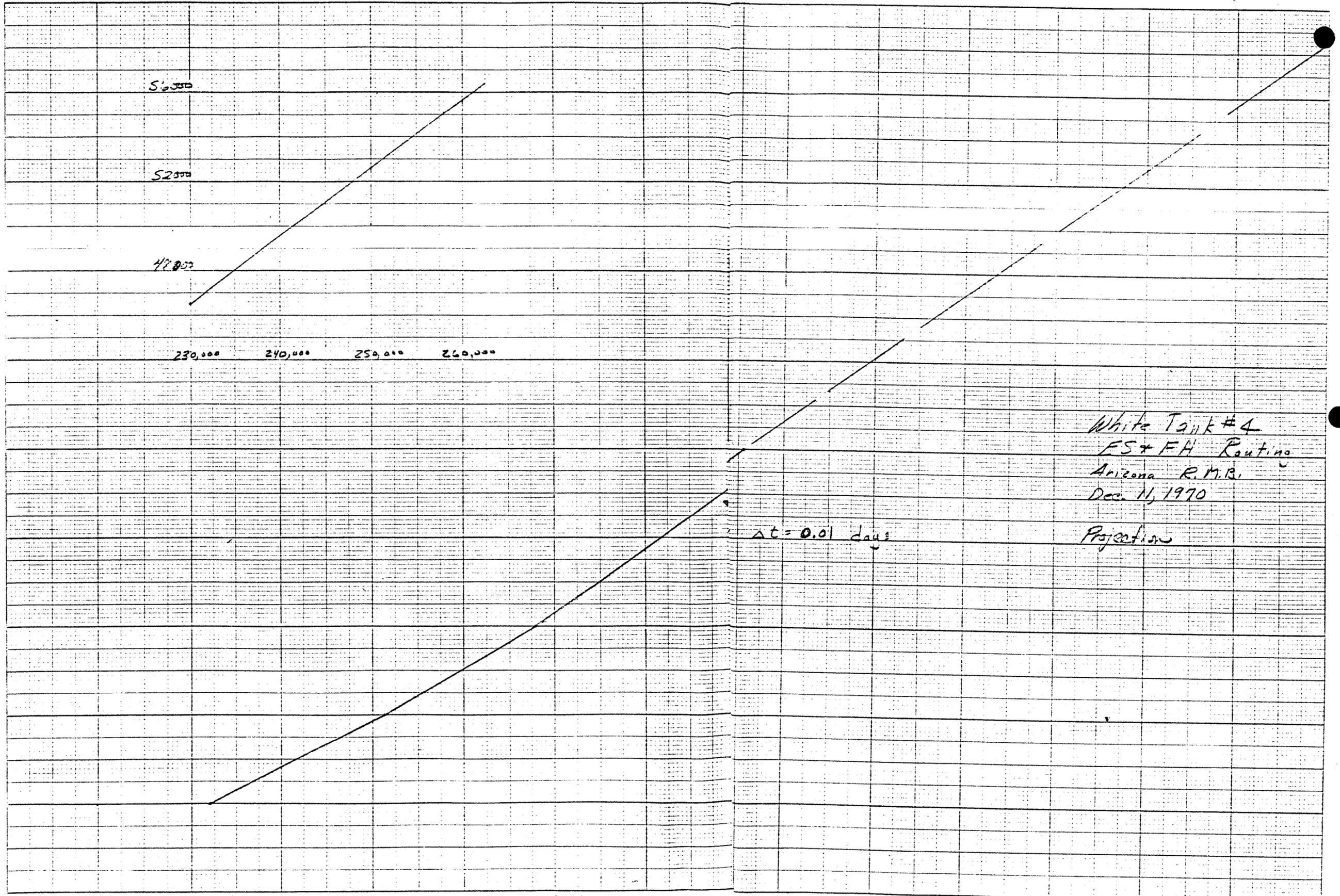
16

180,000

200,000

$\Delta t = 0.01$ days

White Tank #4
ES + FH Routing
Arizona R.M.B.
Dec. 11, 1970
Projection



STATE <i>Arizona</i>		PROJECT <i>White Tank #4</i>			JOB NO. <i>1214</i>	
BY <i>R.N.B</i>	DATE <i>11 Dec 70</i>	CHECKED BY	DATE	JOB NO.		
SUBJECT <i>Projecting F.H. to see needed raise of Dam</i>				SHEET _____ OF _____		

Cont. From F.H. that goes over top Dam

	Inflow	I	$S_{1/2} + O_{1/2}$	Outflow
<i>2.54 hr</i>				<i>8750</i>
<i>2.78</i>	<i>40400</i>	<i>37500</i>	<i>114531</i>	<i>13100</i>
<i>3.02</i>	<i>44200</i>	<i>42300</i>	<i>143731</i>	<i>21600</i>
<i>3.26</i>	<i>40600</i>	<i>38550</i>	<i>160680</i>	<i>26700</i>
<i>3.50</i>	<i>36500</i>	<i>34150</i>	<i>168130</i>	<i>28800</i>
<i>3.74</i>	<i>31800</i>	<i>29700</i>	<i>169030</i>	<i>29100</i>
<i>3.98</i>	<i>27600</i>	<i>25700</i>	<i>165630</i>	<i>28000</i>
<i>4.22</i>	<i>23800</i>	<i>22,200</i>		
<i>4.46</i>	<i>20600</i>	<i>19,250</i>		
<i>4.70</i>	<i>17900</i>	<i>16,950</i>		

Require Peak outflow of 29 000 cfs

Approx elev. 1059.3 for Top Dam (sett)

STATE <u>Arizona</u>		PROJECT <u>White Tank #4</u>			
BY <u>R.M.B.</u>	DATE <u>10 Dec 70</u>	CHECKED BY	DATE	JOB NO.	
SUBJECT <u>Freeboard Routing (10.3 sq. mi)</u>					SHEET _____ OF _____

Time Hrs	Time Days	Inflow	I	$\frac{5}{8}I + \frac{1}{2}$	Outflow
0	0	0	0	0	13
0.24	0.01	200	100	87	13
0.48	0.02	400	300	374	16
0.72	0.03	1000	700	1058	20
0.96	0.04	1600	1300	2338	27
1.20	0.05	3200	2400	4711	33
1.44	0.06	5100	4150	8828	41
1.68	0.07	7400	6250	15037	47
1.82	0.08	10000	8700	23690	52
2.06	0.09	14600	12300	35938	57
2.30	0.10	24000	19300	55181	700
2.54	0.11	34600	29300	83781	6750
2.78	0.12	40400	37500	114531	12000+ (over top of Dam)
3.02	0.13	44200	42300	144831	12000
3.26	0.14	40600	42400	175831	12000
3.50	0.15	36500	38550	201781	12000
3.74	0.16	31800	34150	223931	12000
3.98	0.17	27600	29700	241631	12000
4.22		23800	25700	255831	12000
4.46		20600	22,200	265831	12000
4.70		17900	19,250	272531	12000
4.94		16000	16,950	277481	12000

277481
12000
265481

2654 cfs days

= 5265 Ac Ft

Have 2000 Ac Ft

HYDROGRAPH COMPUTATION

DATE 50 Nov 70
 COMPUTED BY R J B
 CHECKED BY _____

WATERSHED OR PROJECT White Tank #1

STATE _____

STRUCTURE SITE OR SUBAREA _____

DR. AREA _____ SQ. MI. STRUCTURE CLASS e

T_c _____ HR. STORM DURATION 6 HR.

POINT RAINFALL 19.0 IN.

ADJUSTED RAINFALL:

AREAL : FACTOR _____ IN. 17.10

DURATION : FACTOR _____ IN. 17.1

RUNOFF CURVE NO. _____

Q 15.6 IN.

HYDROGRAPH FAMILY NO. 1

COMPUTED T_p 0.84 HR.

T_o 5.8 HR.

(T_o / T_p) :
 COMPUTED 6.90 ; USED 6.0

REVISED T_p 0.967

$q_p = \frac{484A}{REV. T_p} = \frac{9460}{0.967} = 9772$ CFS.

$(Q \times q_p) = 147,576$ CFS.

$t(COLUMN) = (t / T_p) REV. T_p$ $q(COLUMN) = (q_c / q_p) \times Q \times q_p$

$Q(COLUMN) = (Q_t / Q) Q$

	$t = (t/T_p) Rev. T_p$	$q = (q_c/q_p)(Q)(q_p)$	$Q_t = (Q_t/Q)Q$
	t HOURS	q CFS	Q INCHES
1	0	0	0
2	0.4255	443	
3	0.95	2656	
4	1.28	6050	
5	1.70	12396	
6	2.13	25974	
7	2.55	56964	
8	2.98	78345	
9	3.40	64458	
10	3.83	49138	
11	4.25	38375	
12	4.68	30710	
13	5.11	24202	
14	5.53	20013	
15	5.96		
16	6.38		
17	6.81		
18	7.23		
19	7.66		
20	8.08		
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			

STATE <i>Arizona</i>		PROJECT <i>White Tank #2</i>		
BY <i>J.P. C.</i>	DATE <i>18 Dec 70</i>	CHECKED BY	DATE	JOB NO.
SUBJECT <i>Storage, Und.</i>				SHEET OF

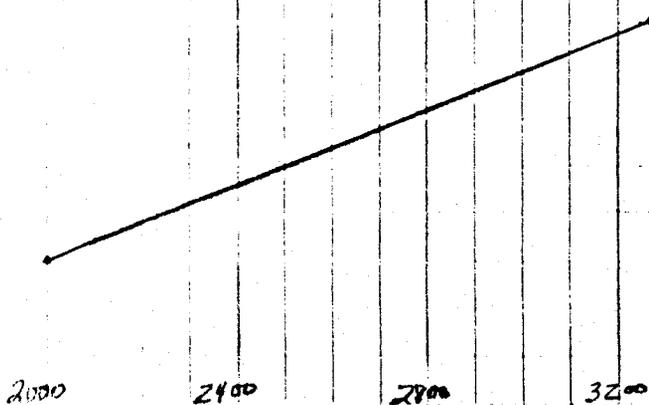
Elev	Area
Area	Elev
1145	90 Ac FT
1150	155 Acres
1153	195 Acres
1155	220 Acres

Storage @ 1155 =	Area	Avg	Ht	Int Storage	Total Storage
	220			2000 Ac. Ft	
1155	220				
1160	287	253	5	1265 Ac. Ft.	3265
1165	355	321	5	1605 Ac. Ft.	4870
1168	400	377	3	1131 Ac. Ft.	6000 Ac. Ft.

To get additional 3000 - 3500 Ac. Ft.
 raise Dam 10-12 ft

60

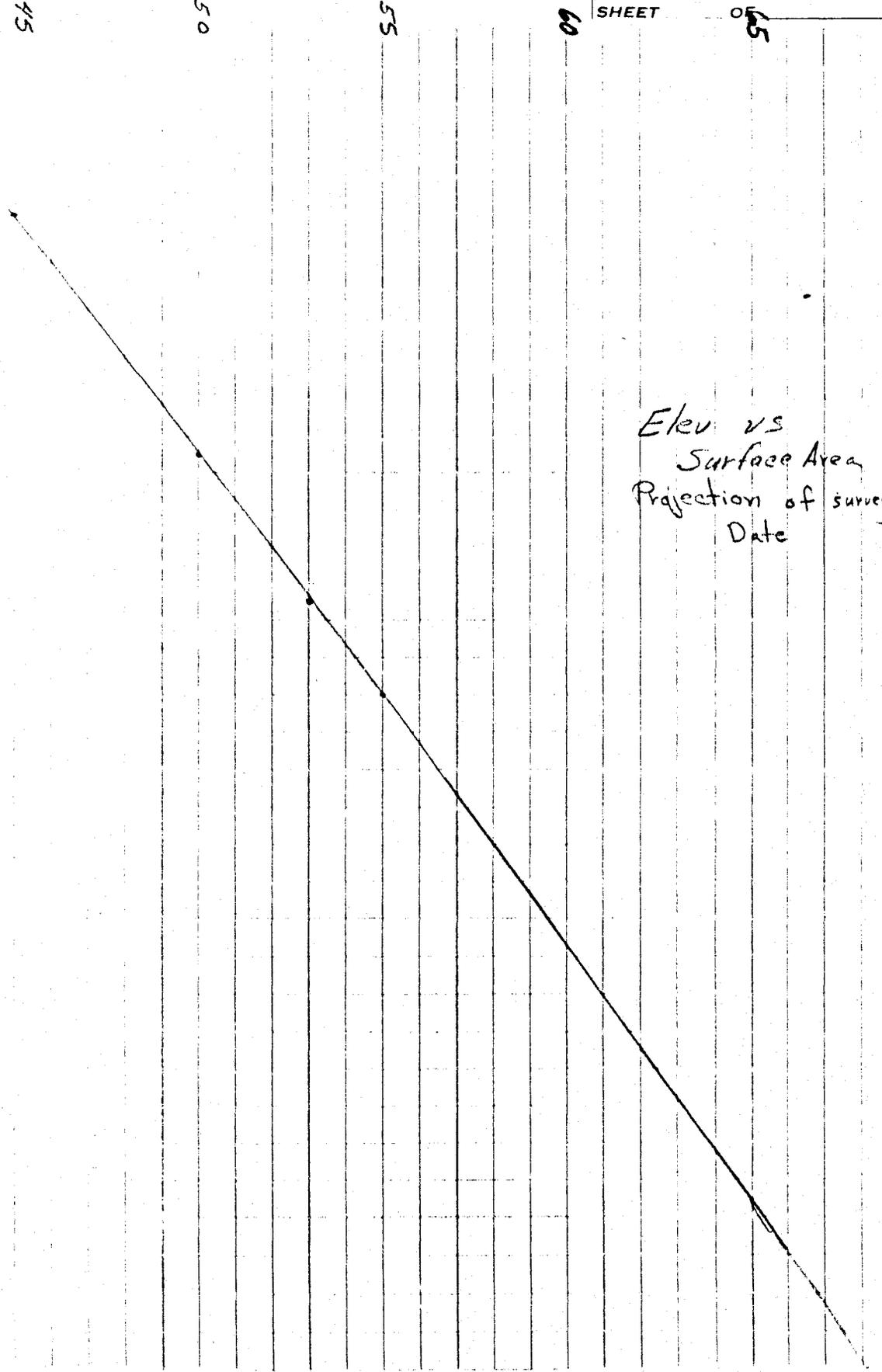
55



3265	1512 Ac. Ft.
2000 Ac. Ft.	1386
2150 Ac. Ft.	1260
2500 Ac. Ft.	1134
2250 Ac. Ft.	

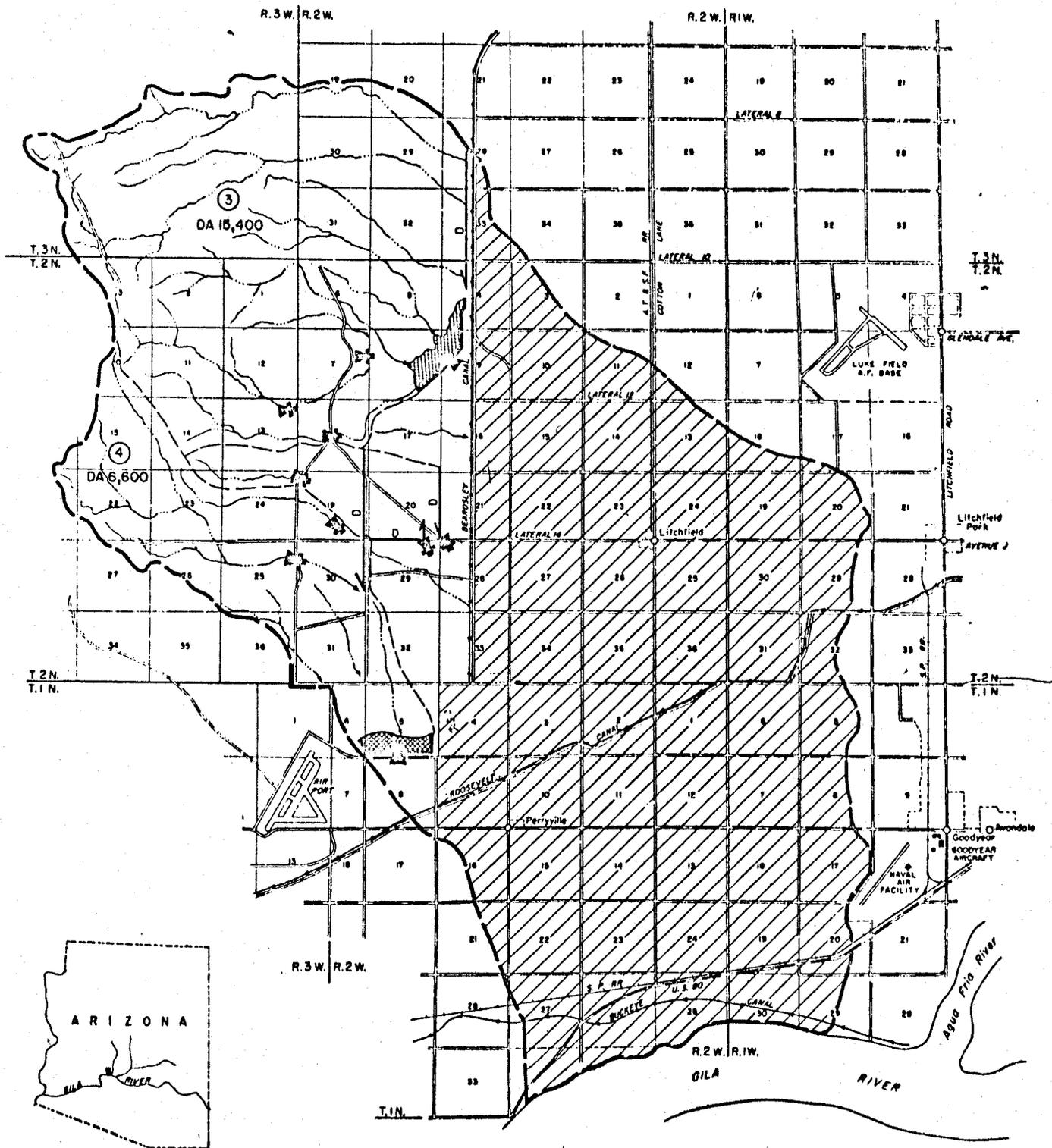
STATE <i>Arizona</i>		PROJECT <i>White Tank # 4</i>		
BY <i>R.H.B.</i>	DATE <i>10/20/70</i>	CHECKED BY	DATE	JOB NO.
SUBJECT				SHEET

Area
80
120
160
200
240
280
320
360



*Elev vs
Surface Area
Projection of survey
Date*

WORK PLAN WHITE TANKS WATERSHED ARIZONA



PREPARED BY
SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE
APRIL, 1954

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS *after amend*
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency - - :	1954, SCS	1954, SCS	1956, C of E
Length - - - - - :	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - - :	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - - :	30 ft.	20 ft.	38 ft.
Spillway Size - - - - - :	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - - :	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - - :	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - - :	2.1	1.9	1.6
Crest Width - - - - - :	10'	10'	12'
Side slope - - - - - :	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - - :	3 pipes	2 pipes	1 box
Size of outlets - - - - - :	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets: - - - - :	- - - -	- - - -	4400 cfs.
Evacuation time - - - - - :	80 hrs.	118 hrs.	- - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.: .3	.3	.3	.25
	<i>\$1256,500 ±</i>	<i>\$129,400 ±</i>	
Total cost of Project - - - - :	\$395,145.00		\$2,180,000.00
Private Contributions - - - - :	196,057.00		180,000.00
Public Contributions - - - - :	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project :			
(50 yr. amortization) - - - - :	20,860.00		115,000.00
Estimated annual benefits - - - - :			
(50 yr. amortization) - - - - :	35,220.00		200,000.00
Benefit - cost ratio 1.7 to 1			

WORK PLAN

WHITE TANK WATERSHED PROTECTION PROJECT
Agua Fria River Watershed
Maricopa County, Arizona

Participating Agencies

Agua Fria Soil Conservation District
Maricopa County Municipal Water Conservation District
Soil Conservation Service, USDA

*Harb Raymond, Mgr. Beardsley
Project advised in Feb. 1963
that cost of maintaining the 9.4 mile
McMicken dam & 3.5 miles of channel
averaged \$306 per mile of dam per year
1960-61 & 62.
structures on White Tank
for same period. JPT
2-12-63*

Prepared by
Soil Conservation Service
United States Department of Agriculture
April 1964

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WORK PLAN
WHITE TANK WATERSHED PROTECTION PROJECT
AGUA FRIA RIVER WATERSHED
MARICOPA COUNTY, ARIZONA.

INTRODUCTION

Authority - The Federal participation outlined in this work plan is expected to be performed under the authority of the Soil Conservation Act of 1935 (Public Law No. 46 74th Congress) and other authorities of the national programs of concerned agencies.

Purpose and Scope of the Plan - The purpose of this plan is to state specifically the practices and measures required and feasible and how they will be carried out to achieve the maximum practicable reduction of erosion, floodwater and sediment damages. Application of this mutually developed plan will provide protection and improvement of land and water resources which it has been agreed can be undertaken at this time with the combined facilities of local interests, State and Federal agencies. Upon completion and continued maintenance of the measures set forth in this plan, agricultural production will be sustained at a level corresponding to the capability of the land, and the welfare of the landowner's and operators, the community, and State and the Nation will be promoted thereby. The area in the subwatershed is entirely in Maricopa County and contains 69,136 acres, or 92.4 square miles.

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SUMMARY OF PLAN

This plan is a combination of land treatment practices and measures used for the conservation of water and watershed lands which contribute directly to flood prevention, and of measures primarily for flood prevention. The works of improvement as listed in combined Tables 1 and 2 are planned to be completed entirely during calendar year 1954, at an estimated total cost of \$417,375, said cost to be shared \$218,287, by the non-Federal interests and \$199,088 by the Federal Government. These estimates include the current costs of local interests and Federal agencies under the going national programs pertaining to the objectives of this plan.

The Agua Fria Soil Conservation District hereafter referred to as the "District" will assume overall responsibility for future operation and maintenance of this project. This District has arranged with the Maricopa County Municipal Water Conservation District #1 (Locally known and hereinafter referred to as the Beardsley Project) an irrigation district organized under laws of Arizona to assume specific responsibility for overall periodic inspection of the measures primarily for flood prevention and for maintenance of the floodwater retarding structures and directly associated measures at an estimated annual cost of \$3,750.

Comparison of Benefit and Cost - When the works of improvement are applied and operating at full effectiveness, the ratio of the estimated average annual benefit (\$35,350) to the estimated average annual value of the cost \$20,860 is 1.7 to 1 based on current price levels for costs and long term prices for benefits.

DESCRIPTION OF THE WATERSHED PROTECTION PROJECT AREA

The White Tank Mountains generally form the western edge of the Agua Fria River Watershed near its confluence with the Gila River. Drainage from the eastern face of the White Tank Mountains is divided between Trilby Wash on the north, tributary to the Agua Fria River, and an intermittent stream locally known as Avondale Wash, tributary to the Gila River on the south. It is this southern portion of the White Tank Mountain drainage area that comprises the subwatershed area covered by this plan. The watershed has a gross area of 59,136 acres, of which 25,024 acres are mountain and foothill slopes comprising the drainage area and flood source. The remaining 34,112 acres are intensively irrigated land lying on a broad, gently sloping alluvial fan and terrace which have an average slope to the southeast of about 0.4 percent. Channels are very poorly defined or even non-existent through the cultivated areas, making the construction of floodways through the farmland to the Gila River impractical.

Following the disastrous floods of 1951, the Agua Fria Soil 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. Construction of a series of four primary detention structures numbered (1) to (4) respectively were planned, near the mouths of Trilby and Avondale Washes. Damage to military and national defense installations in the area, however, led to the initiation by the Corps of Engineers of plans for the protection of these installations from water originating in the Trilby Wash drainage. These plans of the Corps of Engineers also protect the irrigated lands from floods from Trilby Wash so no further

consideration was given by the Soil Conservation Service for structures (1) and (2) of their original plan.

The Avondale Wash watershed has no protection and therefore active interest in watershed protection has been maintained in this area. The necessity for structures 3 and 4 remains, if adequate protection to farm lands is to be obtained. Since the numerical designation has become recognized through usage, it has been retained throughout this report. Costs of original planning on these four structures have been prorated and those applying to structures 3 and 4 are charged as a portion of the engineering costs incident to this plan.

The soils of the area comprise recent alluvial soils along the Gila River, the moderately developed fan soils of the intermediate slopes and the shallow soil materials and rocks in the White Tank Mountains. The soils of the intermediate slopes, including the bulk of the cultivated lands, are moderately deep, deep or very deep, calcareous, moderately developed fan soils. They are derived principally from granites and schists.

Soils derived from these parent materials compact badly as a rule and as a result water penetrates slowly and they are highly susceptible to erosion. The organic matter content is low but the general fertility level is good with the possible exception of nitrogen.

The soils of the area have been classified according to their permanent limitations and hazards into five capability classes. The non-arable lands fall into classes VI, VII and VIII, whereas the cultivated lands fall into classes I and II. See Map 2. Irrigation is required for successful crop production. Water for irrigation is available and exceptionally high crop yields are obtained.

Class I lands are productive farm lands with very few or no permanent hazards or limitations. These lands are subject to a moderate overflow hazard at the present time. The proposed program will greatly reduce this hazard. Class II lands have a few recognized limitations and under the conservation farming being practiced in this area safe and continuing production is assured. The limitation which places these lands in Class II is the greater slope which creates an erosion hazard. Land leveling and adjustment of length of irrigation runs keep erosion at a minimum. Class II lands are also subject to a moderate overflow hazard which will be greatly reduced by this project works. Good land management, including the use of fertilizers and crop rotations to improve soil structure, is essential to keep the soils of both classes I and II productive.

Class VI lands consist of desert bottom intermingled with rolling desert plain. The soils are medium textured and subject to gullying when the vegetative cover is depleted. The dominant climax vegetation is sacaton and big galleta. Class VI lands have moderate rates of runoff.

Class VII lands consist of medium textured soils of varying depth with plane to slightly rolling topography. The climax vegetation is mixed desert grass and shrub. Class VII lands have high rates of runoff

The upper portion of the watershed is mapped as desert mountains and includes capability classes VII and VIII. These lands consist of bare rock or rough, stony, mostly shallow soils. Vegetation consists of desert shrubs such as encelia, bursage, cactus cholla, lycium, mariola and grasses such as bush muhly, tobosa, Arizona Cotton grass and black grama. Runoff rates are very high. Infiltration rates for

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classes VI, VII and VIII vary from .10 inches per hour on the less permeable shallow soils to .60 inches per hour for the desert bottoms. Sediment production rates are relatively low in this area.

The elevation of the watershed varies from about 950 feet above sea level at its confluence with the Gila River to 3,500 feet at the crest of the White Tank Mountains. Mean temperatures range from 50 degrees Fahrenheit in winter to 91 degrees in summer, with recorded extreme temperatures ranging from a low of 17 degrees to a high of 117 degrees. The average date of the last killing frost is March 3 and that of the first killing frost is November 22, or a normal frost free period of 264 days. The mean annual precipitation is 8.04 inches, which generally occurs in two well defined rainy seasons. The winter rainy season usually extends through December, January and February, while the summer season includes July and August and early September. During the summer flood season the damage potential is very high due to the fact that crops, especially cotton which is the staple crop in the area, are very susceptible to damage. In contrast, during the winter flood season the value of crops is much lower. Most of the cotton has been harvested at this time and the growing crops consist of alfalfa, small grain and a small acreage of winter vegetables. Offsetting the lower crop values during the winter rainy season, to some extent, is the higher damage that land sustains due to the fact that it is not so well protected. Other direct flood damages are not usually affected by the season in which the flood occurs.

The range land in the upper, mountainous part of this watershed has sparse vegetation of the desert grassland type. Forage production is low and generally grazing occurs only after periods of unusually high precipitation. Because of the low precipitation, difficulty of

access, and scarce watering facilities, grazing use has not significantly affected the vegetative cover in the upper portion of this watershed.

The cultivated land is highly productive under irrigation and is intensively farmed with cotton being the principal cash crop. Alfalfa, barley and various varieties of sorghums are the principal feed crops. Some winter vegetables are grown on the less calcareous soils. Double cropping is practiced to some extent, but not to the degree found in the Salt River Valley to the east. Farm units vary from small family-size farms of forty to eighty acres to large commercial farms covering several thousand acres. The value of crop production in the watershed is estimated at seven million dollars annually.

The White Tank Watershed includes parts of three soil conservation districts, the Agua Fria, Roosevelt and Buckeye. Because of the nature of the enabling legislation prior to an amendment adopted by the legislature in 1954 soil conservation districts in Arizona are limited to areas used primarily for crop production. The non-arable flood producing portion of the watershed is, therefore, not included within the boundaries of any district. The Agua Fria Soil Conservation district sponsored this project as major structures and principal damage areas are in this district.

Approximately 53 percent of the land in the watershed is privately owned. Ownership of the remainder is about equally divided between the State of Arizona and the Federal Government. The Federal land is all included in Arizona Grazing District Number 3 and is administered by the Bureau of Land Management. Most of the high runoff producing portion of the watershed is publicly owned, whereas the flood plain is

privately owned. See map 3.

The watershed is adequately served by a network of county roads aggregating 62 miles. U. S. Highway No. 80 crosses the lower portion of the flood plain for a distance of four miles. Drainage ways are poorly defined or non-existent in the flood plain, so destruction of bridges does not constitute an important part of highway damage. The Southern Pacific railroad crosses the lower portion of the flood plain, generally paralleling U. S. Highway No. 80. In addition, the Santa Fe Railway has a branch line from Ennis extending about $2\frac{1}{2}$ miles into the flood plain from the north. Portions of the supply canals of the Beardsley, Roosevelt, Goodyear and Buckeye Irrigation Districts lie within the flood plain. All are subject to damage by floods. Many miles of farm laterals serve the farm land in the watershed.

There are no incorporated towns within the watershed. Phoenix, within 20 miles of the watershed, is the trade center for this part of Arizona. The small unincorporated villages of Liberty and Perryville are in the lower end of the watershed. Cotton gins are located at various places throughout the farming area. The Caterpillar Tractor Company has a proving ground for testing various types of earth moving equipment near the central part of the watershed.

FLOOD AND EROSION PROBLEMS AND DAMAGES

Storm runoff from the White Tank Mountains and intervening foothill areas strike the Beardsley Canal at the western edge of the flood plain. Siphons have been installed along this canal at natural drainageways so that floodwater may pass over without damage. However, past experience has shown that these siphons are inadequate both as to capacity or number

to handle anything but small flows. Occasionally even small flows damage the canal because aggradation causes shifts in the channels above the canal and floodwater may strike a section of the canal where there is no siphon. After the water passes over the Beardsley Canal it tends to spread out because of the flat terrain and absence of defined channels. This sheet flow is, however, modified by roads and irrigation ditches which tend to concentrate the water until sufficient volume is attained to cause it to break over into adjoining fields. Improved roads have eroded in some cases to depths of 3 to 4 feet. Ponding usually occurs in the lower ends of flooded fields until water over-tops and breaches the irrigation lateral that has caused the ponding. Other obstructions such as railroad grades or flood dikes may shift the area of overflow but seldom reduce it. Attempts to control floodwater, once it has crossed the Beardsley Canal, have not been successful. Farm property incurs the greatest damage of any type of property within the flood plain. Crop yields are reduced by scouring of soil from the plant roots, ponding and scalding due to high temperatures. Irrigation furrows and field laterals may be so badly damaged late in the irrigation season that it is not possible to make the final irrigation needed to develop a profitable yield. In many cases where land damage is severe the land cannot be cultivated until it has been releveled. Growing alfalfa usually is not seriously damaged, but hay that has been cut is a complete loss. Land damage is greatest where water concentrates and flows with considerable velocity as it does below breaks in irrigation laterals, road fills, or other obstructions and where there is no protective cover from growing crops or crop stubble.

Farm irrigation systems are damaged by even relatively small floods. Earthen ditches generally require rebuilding after a flood, and the case of ditches formed above the ground surface considerable dirt has to be hauled in to build a new ditch. Concrete lined ditches generally withstand small floods, but scouring of the soil away from the lining causes structural failures that are expensive to repair. Occasionally pump motors are fouled by sediment and have to be repaired before they can be used. In a few cases, irrigation wells have caved in and have been abandoned. Farm improvements are frequently damaged, though not seriously because water does not attain great depths. Farm machinery is damaged if the water reached sufficient depth to deposit mud on moving parts. Stored crops and supplies sustain damages. The lower tiers of stacked baled hay that are flooded usually rot and this also requires the rebuilding of the stack.

Flood flows from the upper watershed first strike the Beardsley Canal with sufficient force to breach it in many places. Larger floods also damage other canals. Siphons and unloaders to spill floodwater that gets into canals have been installed, but these measures have been of only minor benefit. The floods of 1951 breached canals in many places and tore out many sections of canal lining, ruined two irrigation wells and washed out training dikes. In some places the canal embankments have been washed out so many times that it is becoming increasingly difficult to secure earth within reasonable distances to patch them. The Beardsley District has been forced to defer replacing some canal lining until the flood hazard is reduced except where the canal gradient is so steep that lining is necessary to prevent damaging erosion. As a result, water losses from seepage have increased. County roads are

very susceptible to damage by floodwater. This is due primarily to two reasons: first, road beds have eroded below ground level and now serve as channelways, and second, the location of irrigation laterals on the downstream side of east and west roads provide a natural barrier to prevent water from draining off the road. As a result, most roads are sub-standard and until such time as the flood hazard is reduced, permanent road improvements are not practicable.

Railroads in the flood plain experience some damage in each flood. The principal damage is loss of ballast where floodwaters over-top the roadbed. Occasionally, the roadbed is washed out and requires major repair work before trains can again move over the line.

Damage to power and telephone lines is usually limited to undermining a few poles, thereby necessitating resetting or straightening. The cost associated with this type of damage in this area is comparatively small.

The true value of property subject to damage in the flood plain is estimated at \$23,900,000, distributed as follows (1951 prices):

Agricultural	\$22,110,000.00
Irrigation Works	1,320,000.00
Transportation Facilities	370,000.00
Rural Non-Farm	100,000.00

Flood records of the past 25 years indicate that damaging floods occur once in two years on the average. Analysis of high intensity storms and examination of past flood records show that fully 85 percent of the floods can be expected during the summer months when crops are most susceptible to damage. The most damaging recent flood year was 1951 when floods in January, July and two in August occurred. The flood of August 28, 1951, caused direct damage of more than \$200,000.

The total primary direct floodwater damage is estimated to average \$28,220 annually, of which 47 percent is crop damage. About 23 percent is irrigation system damage including farm laterals, 15 percent is land damage and the remainder consists of damage to transportation facilities and farm improvements. None of this floodwater damage occurs in the area which will be inundated by proposed detention structures. These figures are based on all floods up to and including those of 100-year frequency. In addition, there are important indirect primary damages such as the reduction in crop yields arising from interruption of irrigation schedules, travel interruptions or detouring costs, losses of income to cotton gins and reduction of income to cotton workers. The estimated annual value of these indirect primary damages is \$7,000. See Table 4.

Erosion Damage - Soil erosion, exclusive of flood plain scour, is a factor only on the upper desert portion of the watershed. In this part of the watershed sheet erosion has progressed to the point where the soil surface consists principally of desert pavement. Gully erosion is confined chiefly to the rough mountainous part of the watershed and the alluvial outwash at the base of the mountains. Because of watershed characteristics, it is not considered feasible to apply a program designed primarily to reduce the present rate of erosion. There is little likelihood that the present rate of erosion will change under existing use and management practices. Erosion damage of watershed land has not been evaluated for the reason that erosion has not seriously impaired the productivity of these lands, and it is apparent that a program which would significantly reduce the rate of erosion is not practical.

Sedimentation Damage - Deposition of sediment has caused considerable channel changes above works that have been installed to protect irrigation canals. As a result, each successive flow may strike canals or other property at unprotected places. Sediment deposition on farm land makes more frequent leveling necessary to maintain the precise grade of irrigated land. Both of these types of sediment damage are closely associated with floodwater damage and have been evaluated as floodwater damage. None of the sediment from this watershed reaches irrigation reservoirs.

EXISTING OR PROPOSED WATER MANAGEMENT PROJECTS

Efforts to control high runoff in the White Tank-Trilby Wash watersheds date back at least to 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 have been prepared, but inability to finance delayed construction. For practical purposes work being done by local interests is continuous. Some structures have been completed recently and others are being built concurrently with work being done by the Federal Government (See combined Table 1 and 2 attached).

Measures Primarily for Flood Prevention - Engineering and hydrologic studies show that the most effective method of controlling surface runoff from the watershed of Avondale Wash above the Beardsley Canal is by the construction of two retarding structures and 11 miles of diversions. The diversions will divert runoff from small subwatersheds into retarding structures numbers 3 and 4, located in the larger drainage channels. Eight small stabilizing and sediment control structures

in the upper watershed will provide sediment storage and desilting basins and thereby lengthen the effective life of the retarding structures. The total cost of these measures is shown in combined Table 1 and 2 attached. The location of these structures is shown on map 2. These measures are located on nonarable land.

For design purposes, the area-depth-duration relationship for storm rainfall was developed from a number of high intensity storms which have occurred in central and southern Arizona. For reservoir design a storm of four-inch center was used. This is estimated to have a recurrence interval of more than 100 years. Retarding structure Number 3 will discharge into the Beardsley Canal. Retarding Structure Number 4 will discharge into existing waterways at a safe rate. Maximum evacuation time for the detention reservoirs will not exceed five days. The spillway design storm selected was one of six-inch rainfall center. The frequency of such a storm is estimated to substantially exceed the 100-year expectancy. Reservoir and spillway designs are based on the occurrence of design storms centered over each watershed so that the maximum runoff would occur at the structure. Because adequate detention storage is developed at each structure paved emergency spillways are unnecessary. Sediment capacity has been provided in the design of the retarding structures for 50 years of sedimentation without encroachment on the effective detention capacity.

Measures for Conservation of Water and Watershed Lands Which Contribute Directly to Flood Prevention - Sixty-four hundred acres of private and state range land are being retired permanently from grazing. The lands retired from grazing include those areas immediately above the retarding structures and any improvement in cover will reduce reservoir sedimentation.

Measures for Evaluating the Effects of the Program - The hydrologic, economic and other effects of this watershed program will be measured in the future. A plan for the installations and procedures required to evaluate these results is now being developed in cooperation with other interested fact-finding agencies. This plan will be distributed later as a supplement to this work plan.

Effect of These Measures on Damages and Benefits - The measures described above will prevent damage from all floods of the size used in the damage evaluation series. Hence, the floodwater damage reduction benefit is equal to the average annual damage under present conditions or \$35,220 in Table 4.

Approximately 79 percent of the flood damage reduction benefit is credited to the two retarding structures and 18 percent is credited to the diversions. The remainder is credited to the stabilization and sediment control structures and the range improvement program. The flood prevention benefit is distributed by measures in Table 5.

It is not believed that any significant land use changes will occur from the measures described above. An examination of land use in the flood plain indicates that the presence of a flood hazard is not a primary determinant of land use. This conclusion is confirmed by local people. Hence, no land enhancement benefit is expected to accrue from these measures.

Range forage production on the watershed is extremely limited. Hence, the conservation benefit is insignificant and only \$130.00 per year is credited to range improvement in Table 5. As previously mentioned, about one-third of the total watershed above the structures has been retired from grazing use. The remaining area consisting of steep rocky desert mountains is under adequate management by the Bureau of Land

Management. The program is not expected to improve ground or surface water supply significantly and no water conservation benefit is credited to it.

Comparison of Costs and Benefits - The ratio of the average annual benefit from measures primarily for flood prevention (\$35,100) to the average annual cost of the measures (\$20,730) is 1.7 to 1. The ratio of the average annual benefit (\$250) from the range improvement measure to the average annual cost (\$130) is about 1.9 to 1. The ratio of total average annual benefits (\$35,350) to total average annual value of costs (\$20,860) is 1.7 to 1. See Table 5.

ACCOMPLISHING THE PLAN

The sponsoring agency, the Agua Fria Soil Conservation District, and the Soil Conservation Service have mutually agreed to the sharing of costs set forth in combined Table 1 and 2. Specifically, the Soil Conservation District (or the Beardsley Irrigation District or others in behalf of the Agua Fria Soil Conservation District) will:

1. Acquire all lands, easements and rights of way needed for the floodwater retarding structures. This has been done.
2. Purchase and install all outlet pipes in the retarding structures together with gates and appurtenant works. The pipe and gates have been ordered.
3. Clear, strip and excavate the sites for the retarding structures. This has been done.
4. Excavate 300 feet of the spillway on Structure Number 3.
Arrangements for accomplishing this are now being negotiated.
5. Arrange to complete the installation of all stabilization and sediment control structures and diversions by December 31, 1964.

6. Provide for periodic inspection of the measures to insure that they are maintained in a satisfactory manner.
7. Bring about the retirement from grazing use of 6,400 acres (about one-third) of watershed above the Structures 3 and 4.

The above items of local contribution are valued at \$218,287.

The sponsoring agency has sufficient funds or commitments to meet its obligations within the specified time.

The Soil Conservation Service will:

1. Contract for the earth work for Structures 3 and 4, except for Item 4 above.
2. Design Structures 3 and 4 with appurtenances and will provide engineering supervision and inspection during construction.
3. Transfer to the Agua Fria District the sum of \$14,000 to help defray costs of the Districts' portion of the work.

The above items of Federal contribution, plus Program evaluation and development of the work plan are valued at \$199,088.

PROVISIONS FOR MAINTENANCE

Executed agreements provide for adequate future maintenance by assuring that periodic inspections, at least annually, will be made by a responsible local agency with representatives of the Soil Conservation Service, annual levies will be made for maintenance purposes and repairs will be made promptly when needed.

COMBINED TABLE 1 & TABLE 2 *
ESTIMATED INSTALLATION COST ** - TOTAL NEEDED PROGRAM

MEASURES	UNIT	NO. TO BE APPLIED	ESTIMATED TOTAL COSTS		
			Federal	Private ***	Total
<u>A-Measures Primarily for Flood Protection</u>					
Floodwater Retarding Structures	No.	2	192,088	119,664	311,752
Stabilization and Sediment Control Measures					
Diversion Dykes & Ditches	Mile	11		77,805	77,805
Debris & Desilting Basins	No.	8		18,068	18,068
SUB TOTAL			192,088	215,537	407,625
<u>B-Measures</u>					
Range Improvement	Ac.	64.00		2,750	2,750
TOTAL A & B MEASURES			192,088	218,287	410,375
<u>Facilitating Measures</u>					
SCS					
Program Evaluation			2,000		2,000
Work Plan Development			5,000		5,000
TOTAL SOIL CONSERVATION SERVICE			7,000		7,000
GRAND TOTAL			199,088	218,287	417,375

* For practical purposes, the work being done by local interests is a continuous job. Some items have been completed recently and others are now being constructed concurrently with the work being done by the Federal Government. For convenience, all parts of the program are shown in combined Table 1 and 2.

** All items to be installed during calendar year 1954.

*** It is impractical to distinguish between contributions from Maricopa County and the Beardsley project, which are local units of government, and from strictly private sources. Hence, no separate column has been shown for Non-Federal Gov't costs and these items are included in Private costs.

TABLE 3
ANNUAL COSTS

MEASURES	AMORTIZATION OF INSTALLATION COSTS			OPERATION AND MAINTENANCE			OTHER ECONOMIC COSTS	GRAND TOTAL
	FEDERAL	PRIVATE	TOTAL	FEDERAL	PRIVATE	TOTAL		
<u>A MEASURES</u>								
Floodwater Retarding Structures	(1) \$6,950	(2) \$5,570	\$12,520	--	\$2,950	\$2,950	--	\$15,470
Stabilization and Sediment Control Measures								
Debris & Desilting Basins	--	840	840	--	150	150	--	990
Diversion Dikes & Ditches	--	3,620	3,620	--	650	650	--	4,270
SUB TOTAL	\$6,950	\$10,030	\$16,980	--	\$3,750	\$3,750	--	\$20,730
<u>B MEASURES</u>								
Range Improvement	--	\$ 130	\$ 130	--	--	--	--	\$ 130
TOTAL A & B	\$6,950	\$10,160	\$17,110	--	\$3,750	\$3,750	--	\$20,860

(1) Amortization factor .035258 (50 yrs. @ 2 $\frac{1}{2}$ % interest).
 (2) Amortization factor .04655 (50 yrs. @ 4% interest).

TABLE 4

SUMMARY OF AVERAGE ANNUAL MONETARY FLOODWATER AND SEDIMENT DAMAGE AND FLOOD PREVENTION BENEFIT FROM THE PLAN
(LONG TERM PRICES)

<u>DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE</u>			<u>AVERAGE ANNUAL BENEFIT</u>		
	PRESENT CONDITION	B-MEASURES ONLY	A and B MEASURES	B-MEASURES ONLY	A-MEASURES ONLY	TOTAL FLOOD BENEFIT FROM A & B MEASURES
	DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
FLOODWATER & SEDIMENT DAMAGE CROP	\$13,260	\$13,140	0	\$ 120	\$13,140	\$13,260
LAND	4,380	4,380	0	0	4,380	4,380
IMPROVEMENTS	1,310	1,310	0	0	1,310	1,310
TRANSPORTATION FACILITIES	2,790	2,790	0	0	2,790	2,790
DITCH SYSTEMS	6,480	6,480	0	0	6,480	6,480
POWER & PHONE ETC.	--	--	--	--	--	--
INDIRECT DAMAGE	7,000	7,000	0	0	7,000	7,000
TOTAL DAMAGE	\$35,220	\$35,100	0	XXX	XXXXX	XXXXX
BENEFIT FROM REDUCTION OF DAMAGE	XXXXX	XXXXX	XXXXX	\$ 120	\$35,100	\$35,220
BENEFIT FROM MORE INTENSIVE USE OF FLOOD PLAIN	XXXXX	XXXXX	XXXXX	0	0	0
TOTAL FLOOD PREVENTION BENEFIT	XX	XXXXX	XXXXX	\$ 120,	\$35,100	\$35,220

TABLE 5

DISTRIBUTION OF COSTS AND BENEFITS BY MEASURES AND GROUPS OF MEASURES

ITEM	TOTAL COST	AVERAGE ANNUAL COST	FLOODWATER & SEDIMENT BENEFIT	MORE INTENSIVE USE OF LAND	CONSERVATION BENEFIT	TOTAL	BENEFIT COST RATIO
<u>A MEASURES</u>							
Floodwater Retarding Structures	\$316,752	\$15,470	\$27,970	-	-	\$27,970	1.8 to 1
Stabilization and Sediment Control Measures							
Debris & Desilting Basins	18,068	990	990	-	-	990	1.0 to 1
Diversion Dikes & Ditches	77,805	4,270	6,140			6,140	1.4 to 1
TOTAL A MEASURES	\$412,625	\$20,730	\$35,100			\$35,100	1.7 to 1
<u>B MEASURES</u>							
Range Improvement	2,750	130	120		\$130	250	1.9 to 1
TOTAL	\$415,375¹	\$20,860	\$35,220		\$130	\$35,350	1.7 to 1

¹ Does not include the cost of program evaluation (\$2,000).

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TABLE 6

FLOODWATER RETARDING STRUCTURE DATA

SITE NO.	DRAINAGE AREA SQ. MI.	STORAGE CAPACITY			SURFACE AREA			FLOOD PLAIN AREA INUNDATED			VOL. OF FILL	DRAW DCWN OF RATE	TYPE OF SPILL- WAY	EST. TOTAL COST				
		SEDI-MENT POOL	DETE-N-TION POOL	TOTAL AC.FT.	SEDI-MENT POOL	DETE-N-TION POOL	TOTAL ACRES	TOP OF SED. POOL	TOP OF DET. POOL	MAXI-MUM HT. OF DAM					UNDER SED. POOL	UNDEP DET. POOL	TOTAL ACRES	C.Y.
3*	24.1	193	2,462	2,655	.14	1.92	2.06	30	384	30	---	---	---	375,000	375	Earth	\$229,50	
4*	10.3	72	964	1,036	.13	1.76	1.89	14	221	20	---	---	---	175,000	100	Earth	\$124,15	
																		353.65

Sediment Storage based on 50 Year estimated accumulation (including structures on Drainage Area).

*Note discussion of numerical designations in narrative portion of report.

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TABLE 7

SUMMARY OF PROGRAM DATA

ITEM	UNIT	QUANTITY
YEARS TO COMPLETE PROGRAM	YEAR	1
TOTAL INSTALLATION COST		
FEDERAL	DOLLARS	199,088
NON-FEDERAL	DOLLARS	218,287
ANNUAL O & M COST		
FEDERAL	DOLLARS	---
NON-FEDERAL	DOLLARS	3,750
ANNUAL BENEFITS	DOLLARS	35,350
FLOODWATER RETARDING STRUCTURES	EACH	2
AREA INUNDATED BY STRUCTURES		
FLOODPLAIN	ACRES	0
UPLAND	ACRES	605
WATERSHED AREA ABOVE STRUCTURES	ACRES	22,000
REDUCTION IN FLOODWATER AND SEDIMENT DAMAGE		
A MEASURES	PERCENT	99.7
B MEASURES	PERCENT	0.3
REDUCTION OF EROSION DAMAGE		
A MEASURES	PERCENT	---
B MEASURES	PERCENT	---
OTHER BENEFITS		
A MEASURES	DOLLARS	---
B MEASURES	DOLLARS	130

TABLE 8

SUMMARY OF PHYSICAL DATA

ITEM	UNIT	QUANTITY WITHOUT PROGRAM	QUANTITY WITH PROGRAM
WATERSHED AREA	SQ. MI.	92.4	92.4
WATERSHED AREA	ACRES	59,136	59,136
AREA OF CROPLAND	ACRES	<u>34,112</u>	34,112
AREA OF GRASSLAND	ACRES	<u>25,024</u>	25,024
AREA OF WOODLAND	ACRES	---	---
FLOODPLAIN SUBJECT TO DAMAGE BY DESIGNATED STORM	ACRES	<u>4,800</u>	0
ANNUAL RATE OF EROSION (FLOOD PRODUCING PORTION)			
SHEET	TONS/YR)		
GULLY	TONS/YR)		
STREAMBANK	TONS/YR)	33,900	31,900
SCOUR	TONS/YR)		
AREA DAMAGED ANNUALLY BY:			
SEDIMENT	ACRES)	660	0
FLOODPLAIN SCOUR	ACRES)		
SWAMPING	ACRES	---	---
STREAMBANK EROSION	ACRES	---	---
SHEET EROSION	ACRES	Not determined	
SEDIMENT PRODUCTION (FLOOD PRODUCING PORTION)	TONS/AC/YR	.77	<u>1/</u>
SEDIMENT ACCUMULATION IN RESERVOIRS	AC/FT/YR	---	---
FREQUENCY OF FLOODING	EVENTS/YR	.5	0
AVERAGE ANNUAL RAINFALL	INCHES	8	8
AVERAGE ANNUAL RUNOFF	INCHES	.3	.3

1/ Amount depends on trap efficiency of retarding structures. No basis for accurate estimate at this time.

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Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency - -:	1954, SCS	1954, SCS	1956, C of E
Length - - - - -:	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area - - - - -:	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height - - - - -:	30 ft.	20 ft.	38 ft.
Spillway Size - - - - -:	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity - - - - -:	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F. - -:	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff - - - - -:	2.1	1.9	1.6
Crest Width - - - - -:	10'	10'	12'
Side slope - - - - -:	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets - - - - -:	3 pipes	2 pipes	1 box
Size of outlets - - - - -:	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets:	- - - -	- - - -	4400 cfs.
Evacuation time - - - - -:	80 hrs.	118 hrs.	- - - -
Sediment Production:			
Ac.Ft.Per sq.mi.per yr.est.:	.3	.3	.25
Total cost of Project - - - -:	\$395,145.00		\$2,180,000.00
Private Contributions - - - -:	196,057.00		180,000.00
Public Contributions - - - -:	199,088.00		2,000,000.00
Annual O & M cost(Non-Federal):	3,750.00		17,000.00
Estimated annual cost of project			
(50 yr. amortization) - - - -:	20,860.00		115,000.00
Estimated annual benefits - -:			
(50 yr. amortization) - - - -:	35,220.00		200,000.00

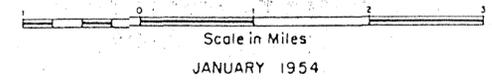
Benefit - cost ratio 1.7 to 1

Maintenance costs 1960-61-62 are 795/mile/yr. are 306/mile/yr.

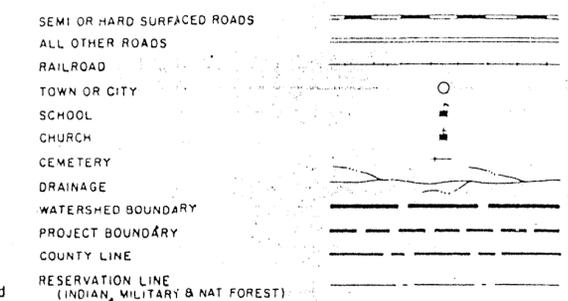
GENERALIZED USE CAPABILITY MAP WHITE TANKS WATERSHED

ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO



LEGEND



- CLASS I LAND - Few or no permanent limitations after existing moderate flood hazard removed by proposed treatments.
- CLASS II LAND - Moderate erosion hazard; special practices required to protect land after flood hazard removed.
- CLASS VI LAND - Desert bottom, at least 40% desert bottom, sacaton, big galleta, deep medium textured soils, gentle slopes.
- CLASS VII LAND - Desert plain, mixed desert grass and shrub, variable depth, medium textured soils, plain to slightly rolling.
- CLASS VII - VIII LAND - Desert hills and mountains, desert shrub, some grass, stony shallow soils, rough.

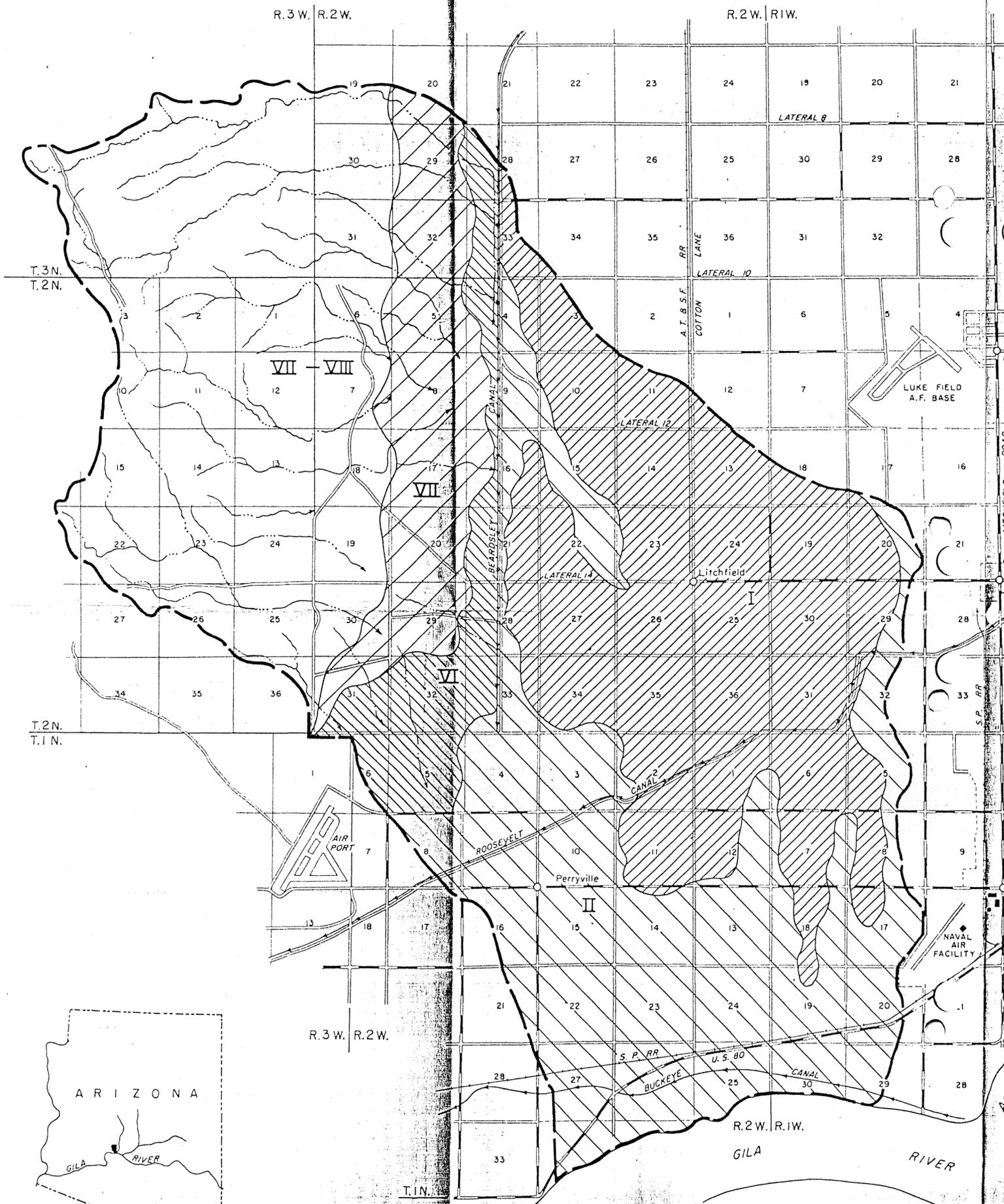
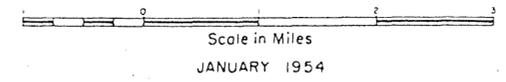


Figure 1

LAND OWNERSHIP STATUS WHITE TANKS WATERSHED

ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO



LEGEND

- SEMI OR HARD SURFACED ROADS
- ALL OTHER ROADS
- RAILROAD
- TOWN OR CITY
- SCHOOL
- CHURCH
- CEMETERY
- DRAINAGE
- WATERSHED BOUNDARY
- PROJECT BOUNDARY
- COUNTY LINE
- RESERVATION LINE (INDIAN, MILITARY & NAT. FOREST)
- PRIVATE LAND
- STATE LEASE
- PUBLIC DOMAIN

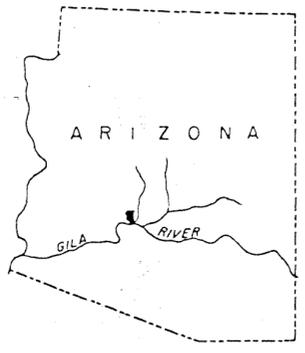
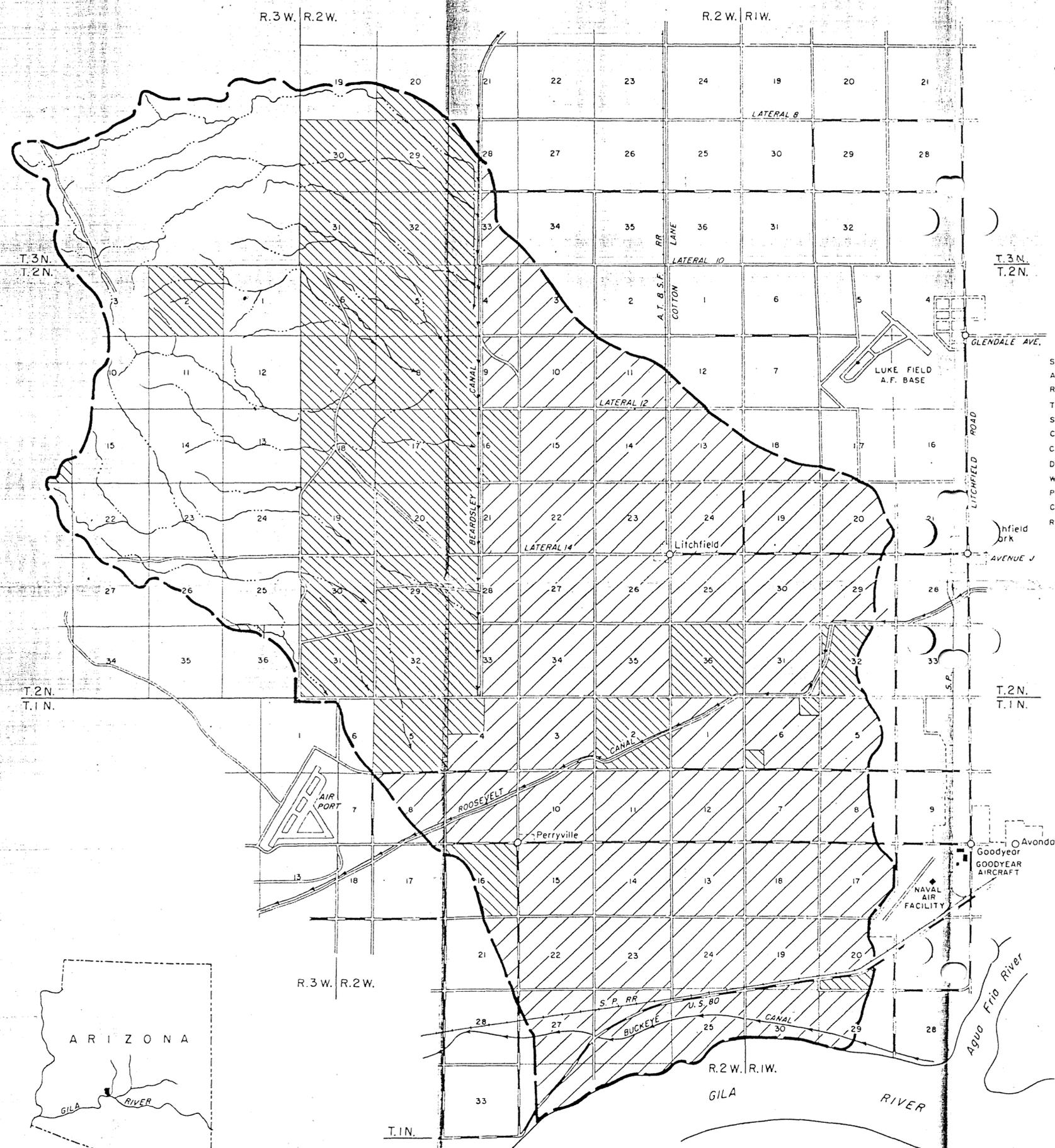
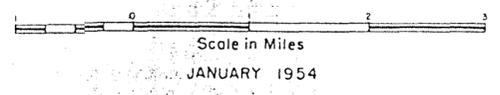


Figure 2

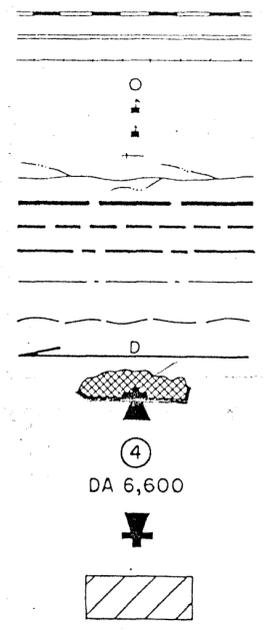
WORK PLAN WHITE TANKS WATERSHED

ARIZONA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALBUQUERQUE, NEW MEXICO



LEGEND

- SEMI OR HARD SURFACED ROADS
- ALL OTHER ROADS
- RAILROAD
- TOWN OR CITY
- SCHOOL
- CHURCH
- CEMETERY
- DRAINAGE
- WATERSHED BOUNDARY
- PROJECT BOUNDARY
- COUNTY LINE
- RESERVATION LINE (INDIAN, MILITARY & NAT. FOREST)
- DRAINAGE AREA BOUNDARY
- DIVERSION DIKE
- DETENTION STRUCTURE
- ACRES DRAINAGE AREA
- DEBRIS BASIN
- FLOOD DAMAGE AREA



NOTE: All Diversion Dikes and Debris Basins have been constructed. Detention Structures remain to be constructed.

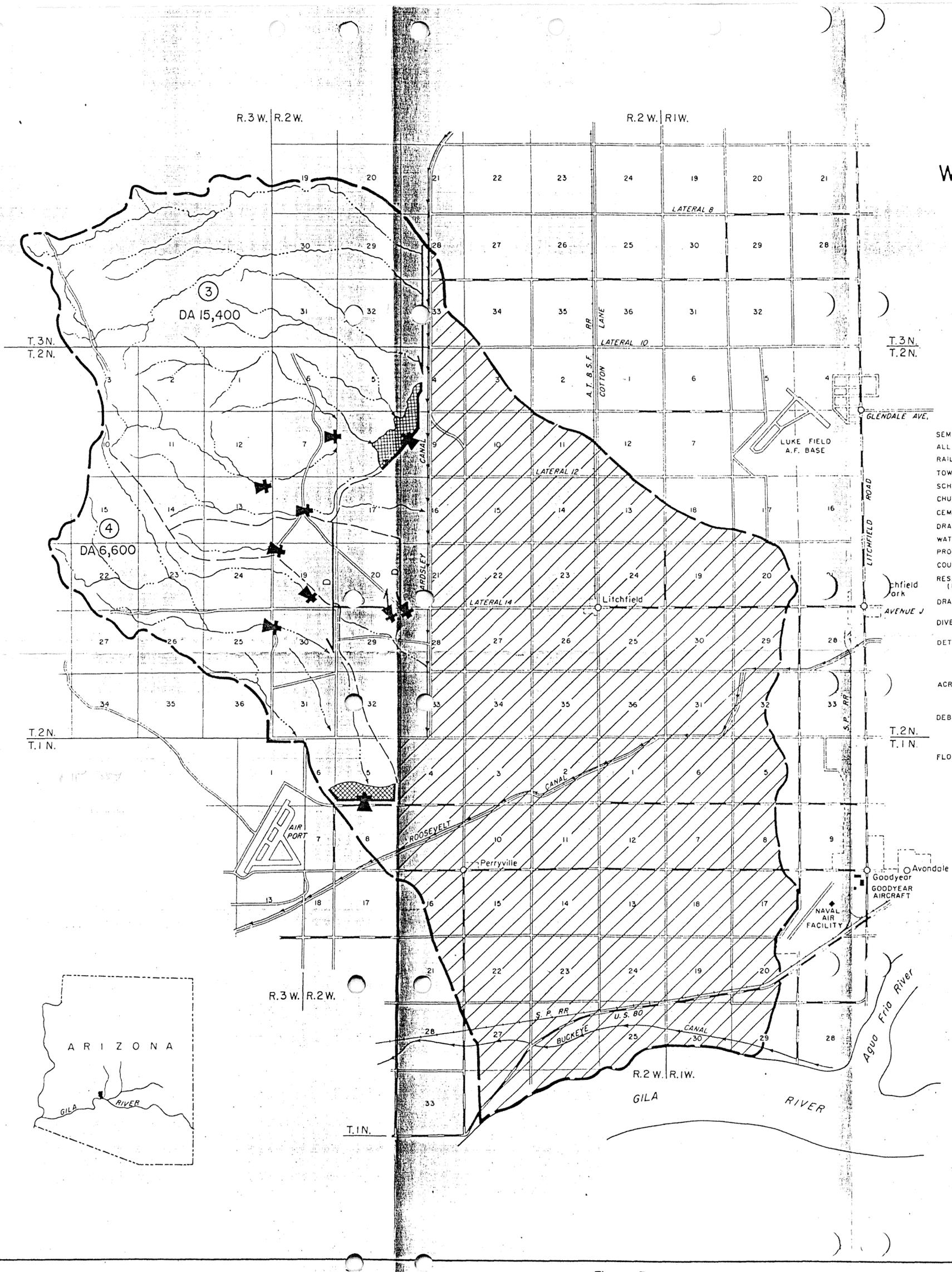


Figure 3