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PHASE IV.1 - FINAL DESIGN REPORT

BULLDOG FLOODWAY
AND
APACHE JUNCTION OUTLET

BUCKHORN - MESA WATERSHED PROTECTION AND FLOOD PREVENTION PROJECT

VOLUME II

Prepared for

THE SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE
Phoenix, Arizona

APRIL 1986

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EBASCO SERVICES INCORPORATED
3000 West MacArthur Boulevard
Santa Ana, California 92704

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V SPECIFICATIONS

V. SPECIFICATIONS

Specifications are based upon the NEH20 standards. The standards cover all of the Project elements, and no special sections are required. The standard sections were modified as needed to fit the Project requirements. The list of specifications used is included herein.

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USDA-SOIL CONSERVATION SERVICE
APACHE-BULLDOG FLOOD CONTROL PROJECT

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BULLDOG FLOODWAY AND APACHE JUNCTION OUTLET

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SECTION C - DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

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

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.

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.

(2-2)

6. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

Bid Item 1, Clearing and Grubbing

(1) This item shall consist of clearing and grubbing of all areas shown on the drawings and staked in the field.

(2) If waste materials are disposed of burying, they shall be buried a minimum of 18 inches below the existing ground surface in the waste disposal areas shown on the drawings. When disposal is complete, the waste disposal areas shall be smoothed and graded to blend into the surrounding terrain.

(3) If materials removed from the cleared and grubbed area are to be burned, burning must be carried out in accordance with Pinal and Maricopa County Health Department regulations.

(4) Compensation for Subsidiary Item, Structure Removal, will be included in this bid item.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

3. STRUCTURE REMOVAL

1. SCOPE

The work shall consist of the removal, salvage and disposal of structures (including fences) from the designated areas.

2. MARKING

Each structure unit to be removed will be marked by means of stakes, flags, painted markers or other suitable methods.

3. REMOVAL

All structures designated in the contract for removal shall be removed to the specified extent and depth.

4. SALVAGE

Structures that are designated to be salvaged shall be carefully removed and neatly placed in the specified storage areas. Salvaged structures that are capable of being disassembled shall be dismantled into individual members or sections. Such structures shall be neatly match marked with paint prior to disassembly. All pins, nuts, bolts, washers, plates and other loose parts shall be marked or tagged to indicate their proper locations in the structure and shall be fastened to the appropriate structural member or packed in suitable containers. Materials from fences designated to be salvaged shall be placed outside the work area on the property from which they were removed. Wire shall be rolled into uniform rolls of convenient size. Posts and rails shall be neatly piled.

5. DISPOSAL OF REFUSE MATERIALS

Unless otherwise specified, refuse materials resulting from structure removal shall be burned or buried at locations approved by the Engineer or otherwise disposed of as specified or as

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.

Use Std Form 36

6. MEASUREMENT AND PAYMENT

. . 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.

Use Std Form 3?

7. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and construction details are:

Subsidiary Item, Structure Removal

(1) This item shall consist of the removal and disposal of:

(a) fences as shown on the drawings,

(b) automobiles, bed springs, mattresses, and other garbage within the area designated for clearing and grubbing.

(2) In Section 3, Removal, wires and posts shall be removed with minimal disturbance to soil and vegetation.

(3) Disposal of materials covered under this item shall be the responsibility of the contractor.

(4) No separate payment will be made for this item. Compensation for this work will be included in Bid Item 1.

BULLDOG FLOODWAY/ APACHE JUNCTION OUTLET

5. POLLUTION CONTROL

1. SCOPE

The work shall consist of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air during construction operations in accordance with these specifications.

2. MATERIALS

All materials furnished shall meet the requirements of the Material Specifications listed in Section 8 of this specification.

3. EROSION AND SEDIMENT CONTROL MEASURES AND WORKS

The work and measures shall include but not be limited to the following, as shown on the drawings or as specified in Section 8 of this specification.

Staging of Earthwork Activities - The excavation and moving of soil materials shall be scheduled so that the smallest possible areas will be unprotected from erosion for the shortest time feasible.

Seeding - Seeding to protect disturbed areas shall be used as specified on the drawings or in Section 8 of this specification.

Mulching - Mulching shall be used to provide temporary protection to soil surfaces from erosion.

Diversions - Diversions shall be used to divert water away from work areas and/or to collect runoff from work areas for treatment and safe disposition.

Stream Crossings - Stream crossings shall be used where fording of streams by equipment is necessary.

Sediment Basins - Sediment basins shall be used to settle and filter out sediment from eroding areas to protect properties and streams below the construction site.

Straw Bale Filters - Straw bale filters shall be used to trap sediment from areas of limited runoff. Bales are temporary and shall be removed when permanent measures are installed.

Waterways - Waterways shall be used for the safe disposal of runoff from fields, diversions and other structures or measures.

4. CHEMICAL POLLUTION

The Contractor shall provide tanks or barrels or construct a sump sealed with plastic sheets to be used to dispose of chemical pollutants produced as a by-product of the project's work such as drained lubricating or transmission oils, greases, soaps, asphalt, etc. At the completion of the construction work, the sump shall be covered or filled as directed by the Engineer. Storage tanks or barrels shall be removed from the site.

Sanitary facilities such as pit toilets, chemical toilets, or septic tanks shall not be placed adjacent to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water sources.

5. AIR POLLUTION

Local and state regulations concerning the burning of brush or slash or disposal of other materials shall be adhered to.

Fire prevention measures shall be taken to prevent the start or the spreading of fires which result from project work. Fire breaks or guards shall be constructed at locations as shown on the drawings.

All public access or haul roads used during construction of the project shall be sprinkled as required to fully suppress dust.

6. MAINTENANCE REMOVAL AND RESTORATION

All measures and works shall be adequately maintained in a functional condition as long as needed during the construction operation. All temporary measures shall be removed and the site restored to as nearly to original conditions as practicable as directed by the Engineer.

7. MEASUREMENT AND PAYMENT

Compensation for 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 subsidary. Such items, and the items to which they are made subsidary, are identified in Section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

Subsidiary Item, Pollution Control

(1) This item shall consist of all measures required to control dust, erosion, sedimentation or any other form of pollution resulting from the Contractor's activities in constructing the project.

(2) No separate payment will be made for this item. Compensation for this work will be included in the payment for Bid Items 4 through 7.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

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 changed 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, subcontractos, 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 price 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.

3. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and construction details are:

Bid Item 2, Mobilization

(1) This item shall consist of the mobilization of the Contractors's equipment and forces for construction of all work required under this contract.

(2) Payment will be made in accordance with Section 2.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

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. EARTHFILL, DRAINFILL, ROCKFILL

Water for earthfill, drainfill, or rockfill 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.

(10-2)

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.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and construction details are:

Bid Item 3, Water

(1) This item shall consist of furnisning and applying all water necessary for performance of the work described in this contract.

(2) Measurement and payment will be in accordance witn Section 6.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

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 drainage way 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.

(11-2)

4. DEWATERING BORROW AREAS

Unless otherwise specified in Section 8, the Contractor shall maintain the borrow areas in drainable condition or otherwise provide for timely and effective removal of surface and ground waters that accumulate within the borrow areas from any source. Borrow material shall be processed as necessary to achieve proper and uniform moisture content for placement.

5. EROSION AND POLLUTION CONTROL

Removal of water from the construction site, including the borrow areas shall be accomplished in such a manner that erosion and the transmission of sediment and other pollutants are minimized.

6. 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.

7. MEASUREMENT AND PAYMENT

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 8 of this specification.

(11-3)

8. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

Subsidiary Item, Removal of Water

(1) This item shall consist of the removal or diversion of surface, ground and construction water, or direct rainfall from the construction area as needed to construct water, or direct rainfall from the construction area as needed to construct the work.

(2) The Contractor's plans for control of surface water and any dewatering necessitated by rainfall or runoff into construction areas shall be furnished to the Engineer prior to performance of any excavation or earthfill work.

(3) No separate payment will be made for the Removal of Water. Compensation for this work will be included in the payment for Bid Items 4 through 7.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

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-scrapers with pusher tractors or that can be excavated and dumped into place or loaded on to 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

To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitablity of materials for specific purposes will be determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

6. DISPOSAL OF WASTE MATERIALS

All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the location shown on the drawings.

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 workers, 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 earthfill 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 4.5 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 compacated earthfill, except that, if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding or drainfill.

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. Excavation required because unsuitable conditions result from the Contractor's improper construction operations, as determined by the Engineer, will not be included for measurement and payment.

Method 1 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 area 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 and laterial limits shall be the true surface of the completed excavation as authorized by the Engineer.

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 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 purposes of the definitions in b, c, and d, above, any specified bedding or drainfill directly beneath or beside the structure will be considered to be a part of the structure.

All Methods The following provisions apply to all methods of measurement and payment.

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:

> 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 improper construction operations as determined by the Engineer.

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 - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 4, Structure Excavation, Common

(1) This item shall consist of all excavation required for the installation of the concrete lined Apache Junction Outlet channel and Bulldog Floodway between stations 101+50 and 206+00, including side channel inlets numbers 1 through 7 and weir inlets numbers 3 through 9 as shown on drawings and staked in field.

(2) Measurement and payment will be by Method 2; and will include compensation for Subsidiary Items: Removal of Water, Pollution Control and Spoil Disposal.

b. Bid Item 5, Channel Excavation, Common

(1) This items shall consist of all excavation required to construct;

a. The Bulldog Floodway Earth Channel between stations 206+00 and 210+00;

b. The approach channels to side channel inlets numbers 1 through 7 and weir inlets numbers 3 through 9, as shown on drawings and staked in the field.

(2) Suitable materials in (1) above in excess of the amount needed to construct the required earthfill shall be stockpiled for construction of the FRS, unless otherwise directed by the Engineer.

(3) Measurement and payment will be by Method 1; and will include compensation for Subsidiary Items: Removal of Water, Pollution Control and Spoil Disposal.

BULLDOG FLOODWAY/APACHE JUCTION OUTLET

23. EARTHFILL

1. SCOPE

The work shall consist of the construction of earth embankments and other earthfills 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 earthfill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified.

Except as otherwise specified, eath 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 earthfill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earthfill.

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 earthfill 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

USE STD FORM 36

standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, 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.

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 now, 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 exeed 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.

Earthfill 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, moisture content, 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.

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c. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of approximately 2 percent shall be maintained to insure effective drainage, and except as otherwise specified for drainfill or sectional 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 fills.

5. <u>CONTROL OF MOISTURE CONTENT</u>

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 disking.

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 compacated 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.

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6. 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 protion of the fill material finer than the maximum particle size used in the compaction test method specified.

Fill adjacent to strutures 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. Unless otherwise specified, heavy equipment including backhoe mounted power tampers, or vibrating compactors and manually directed vibrating rollers, shall not be operated within 2 feet of any structure. Towed or self-propelled 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 or bedded precast conduits prior to 7 days after placement of the concrete cradle or bedding; 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 determing 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.

Structure	Time Interval
Retaining walls and counterforts (Impact basins)	14 days
Walls backfilled on both sides simultaneously	7 days

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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 (Backfilled both sides simultaneously)	3 days

7. REWORKING OR REMOVAL AND REPLACEMENT 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, 2167, 2922 or 2937 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 or if using the nuclear gauge, added to the specified

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density to bring it to the measure of equivalent compostion for comparision. The density so computed will be used to determine the percent compaction of the fill matrix. Moisture content will be determined by one of the following methods: ASTM Method D-2216, D-3017 unless otherwise specified.

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 earthfill 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 earthfill required to fill voids resulting from over excavation 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 improper construction operations as determined by the Engineer.

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 4 The pay limits shall be the specified pay limits for excavation and the specified neat lines of the fill surface.

All Methods The following provisions apply to all methods of measurement and payment. 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 10 of this specification.

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10. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and construction details:

(a) Bid Item 6, Structure Backfill

(1) This item shall consist of placing and compacting all earth fill required adjacent to all structures as shown on the drawings.

(2) Earthfill shall be obtained from the required excavations as approved by the Engineer.

(3) The maximum rock size placed shall be two (2) inches.

(4) The maximum thickness of a layer prior to compaction shall be six (6) inches.

(5) The moisture content of the fill material at the time of compaction shall be not less than 1% below optimum moisture content as determined by ASTM D 2216-80 with the drying oven controlled at 110 plus or minus 5 degrees Celsius.

(6) Compaction shall be as specified in Section 6. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained from compaction tests performed by Method A, ASTM D698.

(7) Measurement and payment will be by Method 4, and will include compensation for Subsidiary Items, Removal of Water and Pollution Control.

(b) Bid Item 7, Earthfill

(1) This item shall include placing and compacting all earthfill required to construct the earth dikes and road ramps.

(2) Earthfill shall be obtained from the required excavations as approved by the Engineer.

(3) The maximum rock size shall be six (6) inches.

(4) The maximum thickness of a layer prior to compaction shall be six (6) inches.

(5) The moisture content of the fill material at the time of compaction shall be not less than 1% below optimum moisture content as determined by ASTM D 2216-80 with drying oven controlled at 110 degrees plus or minus 5 degrees Celsius.

(6) Compaction shall be as specified in Section 6. The fill matrix shall be compacted to at least 95 percent of the maximum density obtained from compaction tests performed by Method A, ASTM D968.

(7) Measurement and payment will be by Method 2, and will include compensation for Subsidiary Items, Removal of Water and Pollution Control.

(c) Subsidiary Item, Spoil Disposal

(1) This item shall consist of placing or stockpiling all spoil in the spoil disposal areas, as shown on the drawings.

(2) Spoil material shall consist of all material resulting from the required excavations not suitable for construction of required earthfill.

(3) Section 6, Compaction, does not apply to this item.

(4) Spoil material shall be placed in layers not to exceed two (2) feet in depth.

(5) The finished surface shall not vary more than one-half (0.5) foot, plus, or minus, from the average grade.

(6) Fill slopes resulting from the deposition of spoil shall not be steeper than 2:1.

(7) No special moisture content of spoil material will be required.

(8) No separate payment will be made for spoil disposal. Compensation for this work will be included in the payment for Bid Items 4 and 5.

24. DRAINFILL

1. SCOPE

The work shall consist of furnishing, placing and compacting drainfill required in the construction of structure drainage systems.

2. MATERIALS

Drainfill materials shall conform to the requirements of Material Specification 521. At least 30 days prior to the 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.

3. BASE PREPARATION

Foundation surfaces and trenches shall be clean and free of organic matter, loose soil, foreign substance, and standing water when the drainfill is placed. Earth surfaces upon or against which drainfill will be placed shall not be scarified.

4. PLACEMENT

Drainfill shall not be placed until the subgrade has been inspected and approved by the Engineer. Drainfill shall shall not be placed over or around pipe or drain tile until the installation of the pipe or tile has been inspected and approved.

Drainfill 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 drainfill.

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 drainfill placement. Each crossover shall be cleaned of all contaminating materials and shall be inspected and approved by the Engineer before additional drainfill is placed.

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Any damage to the foundation surface or the sides or bottoms of trenches occurring during placement of drainfill shall be repaired before drainfill placement is continued.

The upper surface of drainfill constructed concurrently with adjacent zones of earthfill shall be maintained at an elevation at least one foot above the upper surface of the adjacent fill.

Drainfill over or around pipe or drain tile shall be placed in manner to avoid any displacement in line on grade of the pipe or tile.

Drainfill shall not be placed adjacent to structures until the concrete has attained the strength specified in Section 9 of this specification. The strength shall 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-C-31 for determining when a structure may be put in service.

When the required strength of the concrete is not specified as described above, placement of drainfill adjacent to structures shall not be started until the following item intervals have elapsed after placement of the concrete.

Structure	Time Interval
Retaining walls and counterforts (impact basins)	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and galleries, cast-in-place (with inside forms in place)	7 days
Conduits and galleries, cast-in-place (inside forms removed)	14 days
Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Antiseep collars and cantilever outlet bents backfilled on both sides simultaneously	3 days

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5. CONTROL OF MOISTURE

The moisture content of drainfill 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 to adjacent earth fill. Except as specified in Section 9, control of moisture content will not be required.

6. COMPACTION

Drainfill shall be compacted as specified in Section 9.

Class A compaction. Each layer of drainfill shall be compacted to a relative density of not less than 70 percent as determined by ASTM Method D-2049.

Class I compaction. Each layer of drainfill 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 drainfill 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 pnuematic-tired roller exerting a pressure of not less than 75 pounds per square inch. A pass is defined as at least one complete coverage of the roller wheel, tire or drum over the entire surface of the layer.

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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.

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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 cranes or hoists will not be permitted.

7. TESTING

The Engineer will perform such tests as are required to verify that the drainfill materials and the drainfill in place meet the requirements of the specifications. These tests are not intented to provide the Contractor with 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 drainfill 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 drainfill outside the neat lines to replace unsuitable foundation material, the volume of such drainfill will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

Payment for drainfill will be made at the contract unit price for each type of drainfill, complete in place. Except as otherwise specified in Section 9, such payment will consititute 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. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

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9. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

(a) Bid Item 8, Transition Fill

(1) This item consists of furnishing and installing the Transition Fill material necessary to construct tne:

(a) Transition fill portion of the structure drain along the reinforced concrete channel and side channel inlets;

(b) Transition fill portion of the drainage and bedding systems under all grouted and loose rock riprap.

(2) The Transition Fill material shall be well graded within the following limits of gradation:

Sieve Size	Percent Passing
2"	100
3/4"	90-100
#4	60-100
#10	40-100
#20	20-75
#40	0-55
#60	0-40
#100	0-25
#200	0-5

(3) The Transition Fill material shall contain sufficient moisture to permit placing with minimum segregation.

(4) No compaction is required beyond that resulting from the placing and spreading oerations.

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(b) Bid Item 9, Drainfill

(1) This item consists of furnishing and installing the Drainfill material necessary to construct the:

(a) Drainfill portion of the structure drain along the reinforced concrete channel and side inlet structures,

(b) Drainfill portion of the drainage and bedding systems under all grouted and loose rock riprap.

(2) The drainfill material shall be well graded within the following limits of gradation:

Sieve Size	Percent Passing
3/4"	100
1/2 "	90-100
3/8"	40-80
#4	5-25
#10	0-8
#20	0-5

(3) The drainfill material shall contain sufficient moisture to permit placing with minimum segregation.

(4) No compaction is required beyond that resulting form the placing and spreading operations.

2" 100
3/4 90-100
1/2 60-100
3/8 40-80
4 5-25
10 0-8
20 0-5

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

31. CONCRETE

1. SCOPE

The work shall consist of furnishing, forming, placing, finishing and curing portland cement concrete as required to build the structures designated in Section 26 of this specification.

2. MATERIALS

Portland cement shall conform to the requirements of Material Specification 531 for the specified type. One brand only of any type of cement shall be used in any single structure as defined in Section 26.

Aggregates shall conform to the requirements of Material Specification 522 unless otherwise specified. The grading of coarse aggregates shall be as specified in Section 26.

Water used in mixing or curing concrete shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Air entraining admixtures shall conform to the requirements of Material Specification 532. If air-entraining cement is used, any additional air-entraining admixture shall be of the same type as that in the cement.

Pozzolan shall conform to ASTM C618, Class F except the loss of ignition shall not exceed 5.0 percent.

Water-reducing, set-retarding admixture shall conform to the requirements of Material Specification 533.

Shear plates shall conform to the requirements of Material Specification 581 for structural quality or commercial or merchant quality steel. Structural quality shall be used if specifically designated in the drawings or specifications.

Preformed expansion joint filler shall conform to the requirements of Material Specification 535.

Waterstops shall conform to the requirements of Material Specifications 537 and 538 for the specified kinds.

Curing compound shall conform to the requirements of Material Specification 534.

3. CLASSES OF CONCRETE

Concrete shall be classified according to the required compressive strength. The strength of the concrete at 28 days shall equal or exceed the Minimum Compressive Strength at 28 days tabulated below for the class of concrete specified.

Class of Concrete	Minimum Compressive Strength at 28 days (psi)
5000	5000
4000	4000
3000	3000
2500	2500

4. AIR CONTENT AND CONSISTENCY

The air content (by volume) of the concrete at the time of placement shall be:

Maximum Size Aggregate	Air Content (%)
3/8 inch to 1/2 inch	6 to 9
Over 1/2 inch to 1 inch	5 to 8
Over 1 inch to 2-1/2 inches	4 to 7

The consistency of the concrete shall be such as to allow it to be worked into place without segregation or excessive laitance. Unless otherwise specified, the slump shall be:

Type of Structure	Slump (inches)
Massive sections, pavements, footings	2 ± 1/2
Heavy beams, thick slabs, thick walls (over 12 in.)	3 ± 1/2
Colums, light beams, thin slabs, thin walls (12 in. or less)	4 ± 1

5. DESIGN OF THE CONCRETE MIX

The Contractor will be responsible for the design of the concrete mixtures. At least 5 days prior to any placement of concrete he shall furnish the Contracting Officer a statement of the materials and mix proportions (including admixtures, if any) he intends to use for each specified class of concrete. The statement shall include evidence satisfactory to the Engineer that the materials and proportions selected will produce concrete of the quality, consistency and strength specified.

The materials and proportions so stated shall constitute the "job mix". After a job mix has been designated, neither the source, character or grading of the aggregates nor the type or brand or quantity of cement or admixture shall be changed without prior notice to the Engineer and establishment of a new job mix supported by evidence, as required for the initial job mix, that the proposed new materials and mix proportions will produce concrete of the quality, consistency, and strength specified.

When specified, a water-reducing, set-retarding admixture shall be used. When conditions are such that the temperature of the concrete at the time of placement is consistently above 75° F, a water-reducing , set retarding admixture may be used, at the option of the Contractor. The cement content shall be the same as that required in the mix without the admixture.

The use of calcium chloride or other accelerators or antifreeze compounds will not be allowed.

When it is anticipated that a water-reducing, set-retarding admixture will be used, the Contractor shall furnish to the Engineer a sample ofthe admixture he proposes to use sufficient for the tests required by Material Specification 533, Section 4. Concrete containing the admixture shall not be placed until test results have been obtained showing that its performance in the job mix meets the requirements of Material Specification 533, Section 4.

Before placing concrete containing a water-reducing, set retarding admixture, the Contractor shall furnish test results to the Engineer showing that its performance in the job mix meets the requirements of Material Specification 533, Section 4.

When specified, mixes that include fly ash as a partial substitution for portland cement shall be based on absolute volume with a maximum substitution of 20 percent.

6. INSPECTING AND TESTING

The following tests will be performed by the methods indicated:

Test	Method (ASTM) Designation)
Sampling	C 172 1/
Slump Test	C 143 1/
Air Content	C 231 1/ or C 713 1/
Compression Test Specimens	C 31 1/ or C 42
Compressive Strength	C 39 2/ C 42 or C 684 2/
Unit Weight	C 138

1/ Test of portion of a batch may be made on samples representative of that portion for any of the following purposes:

(1) Determining uniformity of the batch.

(2) Checking compliance with requirements for slump and air content when the batch is discharged over an extended period of time.

(3) Checking compliance of the concrete with the specifications when the whole amount being placed in a small structure, or a distinct portion of a larger structure, is less than a full batch.

2/ For each strength test of specimens made according to ASTM Designation C 39, 3 standard test specimens shall be made. The test result shall be the average of the strength of the 3 specimens, except that if one specimen in the test shows manifest evidence of improper sampling, molding or testing, it shall be discarded and the strengths of the remaining 2 specimens shall be averaged. Should more than one speciment representing a test show such defects, the entire test shall be discarded.

The Engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the Engineer to inspect materials, equipment and processes, to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with the manufacture and delivery of the concrete.

7. HANDLING AND MEASUREMENT OF MATERIALS

Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size will be avoided and that various sizes will not become intermixed before proportioning. Methods of handling and transporting aggregates shall be such as to avoid contamination, excessive breakage, segregation or degradation, or intermingling of various sizes.

Scales for weighing aggregates and cement shall be beam type or springless dial type. They shall be accurate within 1 percent under operating conditions. All exposed fulcrums, clevises and similar working parts of scales shall be kept clean.

The quantities of cement and aggregates in each batch of concrete, as indicated by the scales, shall be within the following percentage of the required batch weights:

Cement	plus or minus 1.0 percent
Aggregates	plus or minus 2.0 percent

Measuring tanks for mixing water shall be of adequate capacity to furnish the maximum amount of mixing water required per batch and shall be equipped with outside taps and valves to provide for checking their calibration unless other means are provided for readily and accurately determining the amount of water in the tank.

Except as otherwise provided in Section 8, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 lbs. each. When cement is measured by weight, it shall be weighed on a scale separate from that used for other materials, and in a hopper entirely free and independent of the hopper used for weighing the aggregates. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight corrected by the weight of surface moisture it contains.

Mixing water shall consist of water added to the batch, ice added to the batch, water occurring as surface moisture on the aggregates and water introduced in the form of admixtures. The added water shall be measured by weight or volume to an accuracy of 1 percent of the required total mixing water. Added ice shall be measured by weight. Wash water shall not be used as a portion of the mixing water for succeeding batches.

Dry admixtures shall be measured by weight, and paste or liquid admixtures by weight or volume, within a limit of accuracy of 3 percent.

8. MIXERS AND MIXING

Mixers and mixing shall be in accordance with recommended standards set forth in ACI 304, some specific interpretations of which are stated below.

Concrete may be furnished by batch mixing at the site of the work or by ready-mix methods.

Mixers shall be capable of thoroughly mixing the concrete ingredients into a uniform mass within the specified mixing time and of discharging the mix without segregation. Each mixer or agitator shall bear a manufacturer's rating plate indicating the rated capacity and recommended speeds of rotation, and shall be operated in accordance with these recommendations.

Concrete shall be uniform and thoroughly mixed when delivered to the forms. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by changing batching procedures, increasing mixing time, changing mixers or other means. Mixing time shall be within the limits specified below unless the Contractor demonstrates by mixer performance tests that adequate uniformity is obtained by different times of mixing.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point. If less water than the design maximum water-cement ratio has been incorporated in the batch, water to compensate for up to 1-inch loss in slump may be added, up to the design maximum water cement ratio. Withholding some of the mixing water until the concrete arrives on the job, then adding the remaining water and turning the mixer 30 revolutions at mixing speed may overcome transporting conditions. When loss of slump or workability cannot be offset by these measures, complete mixing shall be performed on the job using centrally dry batched materials, or by on site batching and mixing.

<u>Batch mixing at the site</u>. For concrete mixed at the site of the work with paving mixers or stationary construction mixers, the time of mixing after all cement and aggregates are in the mixer drum shall be not less than 1-1/2 minutes. The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates and all mixing water shall be introduced into the drum before one-fourth of the mixing time has elapsed.

Control shall be provided to insure that the batch cannot be discharged until the required time has elapsed.

If truck mixers are used, the requirements below for truck mixers and truck-mixed concrete shall apply

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Volumetric batching and continous mixing at the site. Volumetric batching and continuous mixing at the construction site will be permitted if approved by the Contracting Officer. The batching and mixing equipment shall conform to the requirements of ASTM Specification C 685 and shall be demonstrated prior to placement of concrete, by tests with the job mix, to produce concrete meeting the specifed proportioning and uniformity requirements. Concrete made by this method shall be produced, inspected, and certified in conformance with Sections 6, 7, 8, 13, and 14 of ASTM Specification C 685.

Ready-mixed concrete. Ready-mixed concrete shall be mixed and delivered to the site of the work by one of the following methods:

a. Truck-mixed concrete--Mixed completely in a truck mixer.

b. Shrinked-mixed concrete.--Mixed partially in a stationary mixer, and the mixing completed in a truck mixer.

c. Central-mixed concrete.--Completely in a stationary mixer and the mixed concete transported to the point of delivery in a truck agitator or in a truck mixer operating at agitating speed or in nonagitating equipment.

Truck mixers and agitators shall be equipped with revolution counters by which the number of revolutions of the drum or blades may be readily verified.

When ready-mixed concrete is furnished, the Contractor shall furnish the Engineer a statement-of-delivery ticket showing the time of loading, the revolution counter reading at the time of loading and the quantities of materials used for each load of concrete.

Truck-mixed concrete. When concrete is mixed in a truck mixer loaded to its maximum capacity, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100. If the batch is at least 1/2 cubic yard less than maximum capacity, the number of revolutions at mixing speed may be reduced to not less than 50. Mixing in excess of 100 revolutions shall be at the speed designated by the manufacturer of the equipment as agitating speed. The mixing operation shall begin within 30 minutes after the cement has been added to the aggregates and the water shall be added during mixing. When mixing is begun during or immediately after charging, a portion of the mixing water shall be added ahead of, or with, the other ingredients.

Shrink-mixed concrete. When concrete is partially mixed at a central plant and the mixing is completed in a truck mixer, the mixing time in the central plant mixer shall be the minimum required to intermingle the ingredients and shall be not less than 30 seconds. The mixing shall be completed in a truck mixer and the number of revolutions of the drum or blades at mixing speed shall be not less than 50 nor more than 100. Mixing in excess of 100 revolutions shall be at the speed designated by the manufacturer of the equipment as agitating speed.

Central-mixed concrete. For central-mixed concrete, mixing in the stationary mixer shall meet the same requirements as batch mixing at the site.

When an agitator, or truck mixer used as an agitator, transports concrete that has been completely mixed in a stationary mixer, mixing during transportation shall be at the speed designated by the manufacturer of the equipment as agitating speed.

The use of nonagitating equipment to transport concrete to the site of the work will be permitted only if the consistency and uniformity of the concrete as discharged at the point of delivery meet the requirments of this specification. Bodies of nonagitating hauling equipment shall be so constructed that leakage of the concrete mix, or any part thereof will not occur. Concrete hauled in open-top vehicles shall be protected from rain, and from more than 20 minutes exposure to the sun when the air temperature is above 75°F.

9. FORMS

Forms shall be of wood, plywood, steel or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a nonstaining form oil before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed shall be chamfered, unless finished with molding tools as specified in Section 20.

10. PREPARATION OF FORMS AND SUBGRADE

Prior to placement of concrete, the forms and subgrade shall be free of hips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed.

Rock surfaces shall be cleaned by air-water cutting, wet sand blasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth, uncompacated fill or frozen subgrade will not be permitted. All ice, snow and frost shall be removed and the temperature of all surfaces to be in contact with the new concrete shall be no colder than 40°F.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous materials.

11. CONVEYING

Concrete shall be delivered to the site and discharged into the forms within 1-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85°F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

The Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable, by methods that will prevent segregation of the aggregates or loss of mortar.

12. PLACING

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved.

The Contractor shall have all equipment and materials required for curing available at the site ready for use before placement of concrete begins.

No concrete shall be placed except in the presence of the Engineer. The Contractor shall give reasonable notice to the Engineer each time he intends to place concrete. Such notice shall be far enough in advance to give the Engineer adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with specifications.
Other preparations include but are not limited to the concrete batching plant, mixing and delivery equipment and system, placing and finishing equipment and system, schedule of work, work force and heating or cooling facilities as applicable. All deficiencies are to be corrected before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. The depositing of concrete shall be regulated so that the concrete can be consolidated with a minimum of lateral movement.

Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation.

13. LAYERS

Unless otherwise specified, slab concrete shall be placed to design thickness in one continuous layer. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Hoppers and chutes, pipes or "elephant trunks" shall be used as necessary to prevent splashing of mortar on the forms and reinforcing steel above the layer being placed.

Successive layers shall be placed at a fast enough rate to prevent the formation of "cold joints". If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when vibrated, the Contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified in Section 15.

If placing is discontinued when an incomplete layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

14. CONSOLIDATING

Unless otherwise specified, concrete shall be consolidated with internal type mechanical vibrators capable of transmitting vibration to the concrete at frequencies not less than 6000 impulses per minute.

The location, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without causing segregation of the mortar and coarse aggregate, and without causing water or cement paste to flush to the surface.

The Contractor shall provide a sufficient number of vibrators to properly consolidate the concrete immediately after it is placed in the work. Vibration shall be applied to the freshly deposited concrete by slowly inserting and removing the vibrator at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibily effective. The vibrator shall extend into the previously placed layer of fresh concrete, at all points, to insure effective bond between layers.

Vibration shall not be applied directly to the reinforcement steel or the forms nor to concrete that has hardened to the degree that it does not become plastic when vibrated.

The use of vibrators to transport concrete in the forms or conveying equipment will not be permitted.

Vibration shall be supplemented by spading and hand tamping as necessary to insure smooth and dense concrete along form surfaces, in corners and around embedded items.

15. CONSTRUCTION JOINTS

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed which are not shown on the drawings, they shall be placed in locations approved by the Engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, stains or debris by either wet sandblasting after the concrete has gained sufficient strength to resist excessive cutting, or air-water cutting as soon as the concrete has hardened sufficiently to prevent the jet from displacing the coarse aggregates, or both. The surface of the concrete in place shall be cut to expose clean, sound aggregate but not so deep as to undercut the edges of larger particles of the aggregate. After cutting, the surface shall be thoroughly washed to remove all loose material. If the surface is congested by reinforcing steel, is relatively inaccessible, or it is considered undesirable to disturb the concrete before it is hardened, cleaning of the joint by air-waterjets will not be permitted and the wet sandblasting method will be required after the concrete has hardened.

The surfaces shall be kept moist for at least one hour prior to placement of new concrete. The new concrete shall be placed directly on the cleaned and washed surface.

16. EXPANSION AND CONTRACTION JOINTS

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

When open joints or weakened plane "dummy" joints are specified, the joints shall be constructed by the insertion and subsequent removal of a wood strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of the concrete at the joints shall be finished with an edging tool prior to removal of the joint strips.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

17. WATERSTOPS

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal watershops shall be brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the manufacturer.

18. REMOVAL OF FORMS

Forms shall be removed only when the Engineer is present and shall not be removed without his approval. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

Forms shall not be removed sooner than the following minimum times after the concrete is placed. These periods represent the cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is above 50°F.

Element	Time
Beams, arches - supporting forms and shoring	14 days
Conduits, deck slabs - supporting (inside) forms and shoring	7 days
Conduits (outside forms), sides of beams, small structures	24 hours
Columns, walls, spillway riser - with side or vertical load	7 days

Concrete supporting more than 30 feet of wall in place above it 1/	7 days
Concrete supporting 20 to 30 feet of wall in place above it 1	3 days
Concrete supporting not more than 20 feet of wall in place above it 1/	24 hours

1/ Age of stripped concrete shall be at leat 7 days before any load is applied other than the weight of the column or wall, forms and scaffolds for succeeding lifts.

19. FINISHING FORMED SURFACES

All concrete surfaces shall be true and even, and shall be free from open or rough spaces, depressions or projections.

Immediately after the removal of forms:

All bulges, fins, form marks or other irregularities which in the judgment of the Engineer will adversely affect the appearance or function of the structure shall be removed. All form bolts and ties shall be removed to a depth at least 1 inch below the surface of the concrete. The cavities produced by form ties and all other holes of similar size and depth shall be thoroughly cleaned and, after the interior surfaces have been kept continuously wet for at least 3 hours, shall be carefully packed with a dry patching mortar mixed not richer than 1 part cement to 3 parts sand. Patching mortar shall be mixed in advance and allowed to stand without addition of water until it has reached the stiffest consistency that will permit placing. Manipulation of the mortar with a trowel during this period shall be performed as required to insure the proper consistency.

Holes left by form bolts or straps which pass through the wall shall be filled solid with mortar.

Patching mortar shall be thoroughly compacted into place to form a dense, well-bonded unit, and the in-place mortar shall be sound and free from shrinkage cracks.

All repaired areas shall be cured as specified in Section 21.

20. FINISHING UNFORMED SURFACES

All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished.

After placing and consolidating the concrete, all exposed surfaces shall be accurately struck off to grade. Following strike-off, the surfaces shall be immediately smoothed by darbying or bull floating before any free water has bled to the surface. The concrete will then be allowed to rest until the bleed water and water sheen has left the surface and the concrete has stiffened to where it will sustain foot pressure with only about 1/4 inch (6 mm) indentation. At this time all joints and edges that will be exposed to view that are not chamfered shall be finished with edging and/or molding tools. After edging and hand-jointing is complete, all exposed surfaces shall be floated with wood or magnesium floats. The floating should work the concrete no more than necessary to remove screed, edger and jointer marks and produce a compact surface, uniform in texture.

Joints and edges on unformed surfaces shall be chamfered or finished with molding tools.

21. CURING

Concrete shall be cured in accordance with the recommended practice of ACI 308, of which some specific interpretations are set forth below.

Concrete shall be prevented from drying for a period of at least 7 days after it is placed. Exposed surfaces and concrete in formed absorbative wood forms shall be kept continually wet during the entire curing period or until the forms have been removed. After forms have been removed, the exposed surface shall be kept continuously wet until patching and repair are complete and until the curing period iscompleted or until a curing compound is applied.

Moisture can be maintained by sprinkling, flooding or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand or an approved material. Water and/or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Curing compound may be used for exposed surfaces or formed surfaces after patching and repair have been completed. Unless otherwise specified, the curing compound shall be white pigmented and conform to ASTM C 309 Type 2, Class A or B. If surface coatings are to be applied to concrete where curing compound is used, Type 2, Class B shall be used and allowed to age a minimum of 30 days prior to the application of the coating. Clear curing compound (Type 1) or clear with fugitive dye (Type 10) may only be used when specified in Section 26.

Curing compound shall be thoroughly mixed before applying and agitated during application. It shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface. It shall form a uniform continuous, adherent film that shall not check, crack or peel and shall be free from pinholes or other imperfections.

All surfaces covered with curing compound shall be continuously protected from damage to the protective film during the required curing period.

Surfaces subjected to heavy rainfall or running water within 3 hours after the compound has been applied, or surfaces damaged by subsequent construction operations during the curing period shall be resprayed in the same manner as for the original application.

Unless otherwise specified in Section 26, curing compound shall not be applied to construction joints or other areas that are to receive additional concrete, paint or other material that require a positive bond.

Water for curing shall be clean and free from any substances that will cause discoloration of the concrete.

22. REMOVAL OR REPAIR

When concrete is honeycombed, damaged or otherwise defective, the Contractor shall remove and replace the structure or structural member containing the defective concrete, or correct or repair the defective parts. The Engineer will determine the required extent of removal, replacement or repair.

Prior to starting repair work the Contractor shall obtain the Engineer's approval of his plan for making the repair. Such approval shall not be considered a waiver of the Contracting Officer's right to require complete removal of defective work if the completed repair does not produce concrete of the required quality and appearance.

Repair work shall be performed only when the Engineer is present.

Repair of formed surfaces shall be started within 24 hours after removal of the forms.

Except as otherwise approved by the Engineer, the appropriate methods described in Chapter VII of the Concrete Manual, Bureau of Reclamation, U.S. Department of the Interior, shall be used. If approved in writing by the Contracting Officer, proprietary compounds for adhesion or as patching ingredients may be used. Such compounds shall be used in accordance with the manufacturer's recommendations.

Curing as specified in Section 21 shall be applied to repaired areas immediately after the repairs are completed.

23. CONCRETING IN COLD WEATHER

Concreting in cold weather shall be performed in accordance with ACI 306 Recommended Practice for Cold Weather Concreting, of which some specific interpretations are set forth below.

When the atmospheric temperature may be expected to drop below 40°F at the time concrete is delivered to the work site, during placement, or at any time during the curing period, the following provisions also shall apply:

a. The temperature of the concrete at time of placing shall not be less than 50°F nor more than 90°F. The temperature of neither aggregates nor mixing water shall be more than 140°F just prior to mixing with the cement.

b. When the daily minimum temperature is less than 40°F, concrete structures shall be insulated or housed and heated after placement. The temperature of the concrete and air adjacent to the concrete shall be maintained at not less than 50°F nor more than 90°F for the duration of the curing period.

c. Methods of insulating, housing and heating the structure shall conform to "Recommended Practice for Cold Weather Concreting" ACI Standard 306.

d. When dry heat is used to protect concrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the concrete has been coated with curing compound as specified in Section 21 or is covered tightly with an approved impervious material.

24. CONCRETING IN HOT WEATHER

Concreting in Hot Weather shall be in accordance with the recommended practice of ACI 305, of which some specific interpretations are set forth below.

For the purpose of the specification, hot weather is defined as any combination of high temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise resulting in abnormal properties.

When climatic or other conditions are such that the temperature of the concrete may reasonably be expected to exceed 90°F at the time of delivery at the work site, during placement, or during the first 24 hours after placement, the following provisions shall apply;

a. The Contractor shall maintain the temperature of the concrete below 90°F during mixing, conveying, and placing.

b. The concrete shall be placed in the work immediately after mixing. Truck mixing shall be delayed until only time enough remains to accomplish it before the concrete is placed.

c. Exposed concrete surfaces which tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or other means acceptable to the Engineer to maintain adequate moisture during the time between placement and finishing, and after finishing.

d. Finishing of slabs and other exposed surfaces shall be started as soon as the condition of the concrete allows and shall be completed without delay. The subgrade shall be prewetted or sealed with a vapor barrier and either wet cure or a white pigmented curing compound ASTM C309 Type 2 applied promptly to the fresh concrete.

e. Formed surfaces shall be kept completely and continuously wet for the duration of curing period (prior to, during and after form removal) or until curing compound is applied as specified in subsection g, below.

f. Concrete surfaces, especially flatwork placed with large areas of surface, shall be covered as soon as the concrete has sufficiently hardened and shall be kept continuously wet for at least 72 hours of the curing period. This protective method may be continued for the required curing period or until curing compound as specified in (g) below is applied:

g. Moist curing may be discontinued before the end of the curing period if white pigmented curing compound is applied immediately, following the procedures specified in Section 21.

h. In extreme conditions it may be necessary to (1) restrict placement to late afternoon or evening (2) restrict the depth of layers to assure coverage of the previous layer while it will still respond readily to vibration, (3) suspend placement until conditions improve, and (4) remove forms, repair, patch and reapply wet curing by small areas at a time.

25. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, concrete will be measured to the neat lines or pay limits shown on the drawings, and the volume of concrete will be computed to the nearest 0.1 cubic yard. No deduction in volume will be made for chamfers, rounded or beveled edges, or for any void or embedded item that is less than five cubic feet in volume. Where concrete is placed against the sides or bottom of an excavation without intervening forms, drainfill, or bedding, the volume of concrete required to fill voids resulting from over excavation outside the neat lines or pay limits will be included in the measurement for payment where such over excavation is directed by the Engineer to remove unsuitable foundation material; but only to the extent that the unsuitable condition is not a result of the Contractor's improper construction operations, as determined by the Engineer.

Payment for each item of concrete will be made at the contract unit price for that item. The payment for concrete will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, falsework, bracing and all other items necessary and incidental to completion of the concrete work, such as joint fillers, waterstops, dowels or dowel assemblies and shear plates, but not including reinforcing steel or other items listed for payment elsewhere in the contract.

Measurement and payment for furnishing and placing reinforcing steel will be made as specified in Construction Specification 34.

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 26 of this specification.

(31-19)

26. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

(a) Bid Item 10, Concrete, Class 4000

(1) This item shall consist of furnish, forming and placing all concrete required to construct the Bulldog Floodway and Apache Junction Outlet Channel including all side inlets and appurtenant structures except those specified in Paragraph 26(b).

(2) Concrete shall be Class 4000 as described in Section 3.

(3) Cement shall be Type II or IIA

(4) Coarse aggregate shall be sized number 57 in accordance with ASTM C-33

(5) Preformed expansion joint filler shall conform to ASTM D-1751 and shall be Type I.

(6) Waterstops shall be Class II, Type B or D, size designation 20 with a center bulb diameter of not less than two inches.

(7) Joint sealing compound shall be Type II, Class A, conforming to Material Specification 536 and Federal Specification TT-S-227.

(8) Curing compound shall meet the requirements of ASTM C309-81 for Type ID, Class B. If concrete is placed during hot weather (Section 24), treated surfaces shall be shaded for at least the first three days after application. The curing compound shall be continuously stirred or agitated during application.

(9) Concrete for Bid Item 10 shall be integrally colored. The concrete color shall blend with the natural earth tones at the site and can be produced using Davis Colors' Miami Buff additive or similar quality products produced by Colorful Admixtures or L.M. Scofield. The Contractor shall construct an unexposed footing or a sample slab to verify color.

Color matching of concrete patching materials shall also be established by the Contractor in the trial sample. The color tone or finished concrete and patching materials shall be approved by the Engineer prior to full production.

(31-20)

b. Subsidiary Item, Concrete, Class 2500

(1) This item shall consist of furnishing, forming and placing all concrete to construct post anchors for fences, guardposts and signs; and sag weights.

(2) Concrete shall be Class 2500 as described in Section 3.

(3) Cement shall be Type II of Type IIA.

(4) Coarse aggregate shall be Size No. 57 in accordance with ASTM-C-33.

(5) No separate payment will be made for Concrete, Class 2500. Compensation for this item will be included in Bid Items 15 and 16.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

34. STEEL REINFORCEMENT

1. SCOPE

The work shall consist of furnishing and placing steel reinforcement for reinforced concrete or pneumatically applied mortar.

2. MATERIALS

Steel reinforcement shall conform to the requirements of Material Specification 539. Before reinforcement is placed, the surfaces of the bars and fabric and any metal supports shall be cleaned to remove any loose, flaky rust, mill scale, oil, grease or other coatings or foreign substances. After placement, the reinfor cement shall be maintained in a clean condition until it is completely embedded in the concrete.

3. BAR SCHEDULE, LISTS AND DIAGRAMS

Any supplemental bar schedules, bar lists or bar-bending diagrams required to accomplish the fabrication and placement of reinforcement shall be provided by the Contractor. Prior to placement of reinforcement, the Contractor shall furnish three prints or copies of any such lists or diagrams to the Contracting Officer. Acceptance of the reinforcement will not be based on approval of these lists or diagrams but will be based on inspection of the reinforcement after it has been placed.

4. BENDING

Reinforcement shall be cut and bent in compliance with the requirements of the American Concrete Institute Standard 315. Bars shall not be bent or straightened in a manner that will injure the material. Bars with kinks, cracks or improper bends will be rejected.

5. SPLICING BAR REINFORCEMENT

Splices of reinforcement shall be made only at locations shown on the drawings and provided by the steel schedule. Placement of bars at the lap splice locations shown, when not in contact, shall not be farther apart than one-fifth the shown lap length and in any case no greater than 6 inches.

6. SPLICING WELDED WIRE FABRIC

Unless otherwise specified, welded wire fabric shall be spliced in the following manner:

a. Adjacent sections shall be spliced end to end (longitudinal lap) by overlapping a minimum of one full mesh plus 2 inches plus the length of the two end overhangs. The splice length is measured from the end of the longitudinal wires in one piece of fabric to the end of the longitudinal wires in the lapped piece of fabric.

b. Adjacent sections shall be spliced side to side (transverse lap) a minimum of one full mesh plus 2 inches. The splice length shall be measured from the centerline of the first longitudinal wire in one piece of fabric to the centerline of the first longitudinal wire in the lapped piece of fabric.

7. PLACING

Reinforcement shall be accurately placed and secured in poistion in a manner tht will prevent its displacement during the placement of concrete. Tack welding of bars will not be permitted. Metal chairs, metal handers, metal spacers and concrete chairs may be used to support the reinforcement. Metal handers, spacers and ties shall be placed in such a manner that they will not be exposed in the finished concrete surface. The legs of metal chairs or side form spacers that may be exposed on any face of slabs, walls, beams or other concrete surfaces shall have a protective coating or finish by means of hot dip galvanizing, epoxy coating, plastic coating, or by stainless steel. Metal chairs and spacers not fully covered by a protective coating or finish shall have a minimum cover of 3/4 inch of concrete over the unprotected metal portion except for those with plastic coatings may have a minimum cover of 1/2 inch of concrete over the unprotected metal portion. Precast concrete chairs shall be manufactured of the same class of concrete as that specified for the structure and shall have tie wires securely anchored in the chair or a V-shaped groove at least 3/4 inch in depth molded into the upper surface to receive the steel bar at the point of support. Precast concrete chairs shall be moist at the time concrete is placed.

Reforcement shall not be placed until the prepared site has been inspected and approved by the Engineer. After placement of the reinforcement, concrete shall not be placed until the reinforcement has been inspected and approved by the Engineer.

8. STORAGE

Steel reinforcement stored at the work site shall be placed above the ground surface on platforms, skids or other supports and protected from mechanical damage or corrosion.

9. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the weight of reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest pound by computation from the placing drawings. Measurement of hooks and bends will be based on the requirements of ACI Standard 315. Computation of weights of reinforcement will be based on the unit weights established in Tables 34-1 and 34-2. Computation of weights for welded wire fabric not shown in Table 34-2 shall be based on ACI Standard 315. The area of welded wire fabric reinforcement placed in the concrete in accordance with the drawings will be determined to the nearest square foot by computation from the placing drawings with no allowance for laps. The weight of steel reinforcing in extra splices of extra-length splices approved for the convenience of the Contractor or the weight of supports and ties will not be included in the measurement for payment.

Payment for furnishing and placing reinforcing steel will be made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work including preparing and furnishing bar schedules, lists or diagrams; furnishing and attaching ties and supports; and furnishing, transporting, storing, cutting, bending, cleaning and securing all reinforcements.

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 to which they are made subsidiary are identified in Section 10 of this specification.

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TABLE 34-1. STANDARD REINFORCING BARS

Bar Size No.	Wt. (lb./ft).
3	0.376
4	0.668
5	1.043
6	1.502
7	2.044
8	2.670
9	3.400
10	4.303
11	5.313
14	7.65
18	13.60

TABLE 34-2. RECTANGULAR WELDED WIRE FABRIC[1]

Style Designation By Steel Wire Gauge	By W-Number	Weight, lb. Per 100 Sq. Ft.
6 x 6 - 10 x 10	6 x 6 - WI.4 x W1.4	21
6 x 6 - 8 x 8	6 x 6 - W2.1 x W2.1	30
6 x 6 - 6 x 6	6 x 6 - W2.9 x W2.9	42
6 x 6 - 4 x 4	6 x 6 - W4.0 x W4.0	58
4 x 4 - 10 x 10	4 x 4 - W1.4 x W1.4	31
4 x 4 - 8 x 8	4 x 4 - W2.1 x W2.1	44
4 x 4 - 6 x 6	4 x 4 - W2.9 x W2.9	62
4 x 4 - 4 x 4	4 x 4 - W4.0 x W4.0	85
[2]4 x 12 - 8 x 12	4 x 12 - W2.1 x W0.9	25
[2]4 x 12 - 7 x 11	4 x 12 - W2.5 x W1.1	31

[1]Style designation is defined in ACI Standard 315 of the American Concrete Institute.

[2]Welded smooth wire fabric with wires smaller than Size WI.4 is manufactured from galvanized wire.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 11, Steel Reinforcment

(1) This item consists of furnishing and installing all steel reinforcement requried in the construction of:

(a) The Bulldog Floodway

(b) The Apache Junction Outlet Channel

(c) Side Channel Inlets

(d) All appurtenant structure

(2) All steel bars shall be Grade 40 or 60.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

61. LOOSE ROCK RIPRAP

1. SCOPE

The work shall consist of the construction of loose rock riprap revetments and blankets, including filter layers or bedding where specified.

2. MATERIALS

Rock for loose rock riprap shall conform to the requirements of Material Specification 523 or, if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

At least 30 days prior to delivery of rock from other than designated sources, the Contractor shall designate in writing the source from which he intends to obtain the rock and information satisfactory to the Contracting Officer that the material meets the requirements of the contract. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in Section 9 of this specification.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the quality and grading requirements in Section 9 of this specification. The rock shall conform to the specified grading limits when installed in the riprap.

Filter or bedding materials when required, shall, unless otherwise specified, conform to the requirements of Material Specification 521.

3. SUBGRADE PREPARTION

The subgrade surfaces on which the riprap or bedding course is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of the specified class of fill.

Riprap shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Engineer.

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4. EQUIPMENT-PLACED ROCK RIPRAP

The rock shall be placed by equipment on the surfaces and to the depths specified. The riprap shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks.

Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to the permanent works.

5. HAND-PLACED RIPRAP

The rock shall be placed by hand on the surfaces and to the depths specified. It shall be securely bedded with the larger rocks firmly in contact one to another. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rock. Flat slab rock shall be laid on edge.

6. FILTER LAYERS OR BEDDING

When the drawings specify filter layers or bedding beneath riprap, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or bedding will not be required, but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

7. TESTING

The Engineer will perform such tests as are required to verify that the riprap, filter, and bedding materials and the completed work 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.

USE STD FORM 3C

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type of riprap will be measured within the specified limits and computed to the nearest cubic yard by the method of average cross-sectional end areas. Payment for each type of riprap will be made at the contract unit price for that type of riprap. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap.

~~Payment for each type of riprap will be made at the contract unit price for that type of riprap. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to completion of the riprap.~~ delete

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 to which they are made subsidiary are identified in Section 9 of this specification.

USE STD FORM 36

9. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

Bid Item 12, 24-inch Loose Rock Riprap

(1) This item consist of furnishing and placing 24 inch loose rock riprap at the locations shown on the drawings.

(2) The riprap shall be well graded from 3 inches to 24 inches in diameter with: a minimum of 50 percent by weight greater than 15 inches in diameter,a minimum of 15 percent by weight greater than 20 inches in diameter, and a maximum of 15% by weight less than 9 inches in diameter.

(3) Riprap shall be placed to the thicknesses shown on the drawings.

(4) The riprap shall be equipment placed.

(5) Payment for drainfill and transition fill material, where called for under the loose rock riprap, is made under the "Drainfill Specification", Construction Specification 24.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

62. GROUTED ROCK RIPRAP

1. SCOPE

The work shall consist of furnishing, transporting, and placing rock and concrete grout in the construction of grouted rock riprap sections.

2. MATERIALS

Rock for grouted rock riprap shall conform to the requirements of Material Specification 523, or if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines, and other materials not meeting the required gradation limits.

At least 30 days prior to delivery of rock from other than designated sources, the Contractor shall designate, in writing, the source from which he intends to obtain the rock and information satisfactory to the Contracting Office that the material meets the requirements of the contract. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in Section 13 of this specification.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the quality and grading requirements in Section 13 of this specification. The rock shall conform to the specified grading limits when installed in the riprap.

Filter or bedding materials when required, shall unless otherwise specified, conform to the requirements of the Material Specification 521.

Portland cement shall conform to the requirements of Mateiral Specification 531 for the specified type.

Pozzolan. Unless otherwise specified in Secion 13 of this specification, pozzolans conforming to Specification ASTM C-618 Class F in amounts not to exceed 20 percent, based on absolute volume, may be substituted for an equivalent amount of portland cement in the grout mixture.

USE STD FORM 36

Aggregates shall conform to the requirements of Material Specification 522, except that the grading for coarse aggregate shall be as specified in the construction details.

Water shall be clean and free from injurious amounts of oils, acid, alkali, organic matter or other deleterious substances.

Air-entraining admixtures shall conform to the requirements of Material Specification 532.

Curing compound shall conform to the requirements of Material Specification 534.

Other admixtures, when required, shall be as specified in the construction details.

3. SUBGRADE PREPARATION

Riprap or filter shall not be placed until the subgrade surfaces have been inspected and approved by the Engineer.

4. FILTER LAYERS OR BEDDING

When filter layers or bedding beneath the riprap is specified, the material shall be spread uniformly on the prepared subgrade surfaces to the depth shown on the drawings. Compaction of the material will not be required but the surfaces of such layers shall be finished reasonably free of mounds, dips, or windrows.

5. PLACING ROCK

The rock shall be placed on the surfaces and to the depths specified in such a manner as to avoid displacement of the underlying materials. The rock may be equipment or hand placed as necessary to produce a surface in which the tops of the individual rocks do not vary more than the specified deviation from the neat lines shown on the drawings. Double decking of thin, flat rocks to bring the surface up to the required grade will not be permitted.

6. DESIGN OF THE GROUT MIX

The mix proportions for the grout mix shall be as specified in the construction details. During the course of the work the Engineer will require adjustment of the mix proportions whenever necessary. After the mix has been designated, it shall not be changed without the approval of the Engineer.

USE STD FORM 36

7. HANDLING AND MEASUREMENT OF MATERIAL

Materials shall be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Except as otherwise provided in Section 11, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

Water shall be measured, by volume or by weight, to an accuracy within one percent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of ± 3 percent.

8. MIXERS AND MIXING

The mixer, when loaded to capacity, shall be capable of combining the ingredients of the grout mix into a thoroughly mixed and uniform mass and of discharging it with a satisfactory degree of uniformity.

Mixer shall be operated within the limits of the manufacturer's guaranteed capacity and speed of rotation.

The time of mixing after all cement and aggregates are in the mixer drum shall be not less than one minute for mixers having a capacity of one cubic yard or less. For mixers of larger capacities, the minimum time shall be increased fifteen seconds for each cubic yard or fraction thereof of additional capacity. The batch shall be so charged into the mixer that some water will enter in advance of cement and aggregate, and all mixing water shall be introduced into the drum before one-fourth of the mixing time has elapsed.

When ready-mixed grout mix is furnished, the Contrator shall furnish to the Engineer a delivery ticket showing the time of loading and the quantities of materials used for each load of grout mix.

Use STD Form 34

No mixing water in excess of the amount called for by the job mix shall be added to the grout mix during mixing or hauling or after arrival at the delivery point.

9. CONVEYING AND PLACING

The grout mix shall be delivered to the site and placed within 1-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. The Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the final placement as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar.

Grout mix shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segretation.

The grout mix shall not be placed until the rock riprap has been inspected and approved by the Engineer.

Rock to be grouted shall be kept wet for at least 2 hours immediately prior to grouting.

The rock riprap shall be flushed with water to remove the fines from the rock prior to placing the grout. The rock shall be kept moist just ahead of the actual placing, but the grout shall not be placed in standing or flowing water. Grout placed on inverts or other nearly level areas may be placed in one course. On slopes, the grout shall be placed in two (2) courses in successive lateral strips approximately ten (10) feet in width starting at the toe of the slope and progressing to the top. The grout shall be delivered to the place of final deposit by approved means and discharged directly on the surface of the rock, using a splash plate of metal or wood to prevent displacement of the rock directly under the discharge. The flow of grout shall be directed with brooms, spades or baffles to prevent it from flowing excessively along the same path and to assure that all intermittent spaces are filled. Sufficient barring shall be done to loosen tight pockets or rock and otherwise aid the penetration of grout so that all voids shall be filled and the grout fully penetrates the rock blanket. All brooming on slopes shall be uphill and after the grout has stiffened, the entire surface shall be rebroomed to eliminate runs and to fill voids caused by sloughing.

USE STD FORM 36

After completion of any strip or panel, no workman or other load shall be permitted on the grouted surface for a period of twenty-four (24) hours. The grouted surface shall be protected from injurious action by the sun, rain, flowing water and mechanical injury.

10. <u>CURING AND PROTECTION</u>

The surface of treatment materials shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

The grouted rock may be coated with an approved curing compound in lieu of continued application of moisture. The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until finishing of that surface is completed. The compound shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above.

Grout mix shall not be placed when the daily minimum temperature is less than 40°F unless facilities are provided to insure that the temperature of the materials is maintained at not less than 50°F nor more than 90°F during placement and the curing period. Grout mix shall not be placed on frozen surfaces. When freezing conditions prevail, rock to be grouted must be covered and heated to a range of 50°F to 90°F for at least 24 hours prior to placing treatment materials.

11. <u>INSPECTING AND TESTING FRESH GROUT</u>

The Engineer will inspect and test grout during the course of the work. Sampling of fresh grout will be done by the methods prescribed in ASTM Designation C 172. The volume of each batch will be determined by the methods prescribed in ASTM Designation C 138.

Use STD FORM 36

The Engineer shall have free entry to all parts of the Contractor's plant and equipment which concern mixing and placing the grout while work on the contract is being performed. Proper facilities shall be provided for the Engineer to inspect materials and processes used in mixing and placing the grout as well as for securing samples of the grout mix. All tests and inspections shall be so conducted as not to interfere unnecessarily with the mixing and placing of the grout.

When ready-mixed grout is furnished, the Contractor shall furnish to the Engineer a statement-of-delivery ticket for each batch delivered to the job site. The ticket shall show the total weights in pounds of cement, water, and fine and coarse aggregates, amount of air-entraining agent, time of loading, and the revolution counter reading at the time of batching.

12. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of grouted rock riprap will be determined from the specified thickness shown on the drawings and the area on which acceptable placement has been made. Payment for grouted rock riprap will be made at the contract unit price. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the grouted rock riprap.

The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in he payment for the itme of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 13 of this specification.

USE STD FORM 36

13. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 13, 24 inch Grouted Rock Riprap

(1) This item consists of furnishing and placing 24-inch grouted rock riprap, including the cement grout, at the locations shown on the drawings.

(2) The riprap shall be graded from 6 inches to 24 inches in diameter with: minimum of 50 percent by weight greater than 15 inches in diameter, a minimum of 15 percent by weight than 20 inches, and a maximum of 15 percent by weight less than 9 inches in diameter.

(3) The riprap shall be equipment placed.

(4) In Section 6, Design of the Grout Mix, the contractor shall be responsible for proportioning the grout mix. The grout shall consist of Portland Cement, fine and corse aggregate, water,and an air entraining agent. The cement content shall be 5-1/2 bags per cubic yard of concrete. The maximum nominal size of coarse aggregate shall be 3/4 inch. the slump shall be within the range of 6 to 10 inches. The air content (by volume) of the grout mixture at the time of placement shall five (5) to seven (7) percent. At least five (5) days prior to placement of the grout, the contractor shall furnish the Engineer with a statement of the mix proportions for approval.

(5) Cement shall by Type II or Type IIA.

(6) The grout shall be integrally colored. The color grout shall blend with the natural earth tones at the site and can be produced using Davis Colors' Miami Buff additive or similar quality products produced by Colorful Admixtures or L.M. Scofield. The color tone of the grout mix shall be approved by the Engineer prior to full production.

(7) Grout shall be placed such that a smooth surface is not created. Rock edges shall protrude 2 to 4 inches above the grout surface upon completion of the grouting process.

(8) Payment for drainfill and transition fill material where called for under the grouted rock riprap is made under the "Drainfill Specification", Construction Specification 24.

b. Bid Item 14, 12-inch Grouted Rock Riprap

(1) This item consists of furnishing and placing 12-inch grouted rock riprap, including the cement grout, at the locations shown on the drawings.

(2) The riprap shall be graded from 1 inch to 12 inches in diameter with: a minimum of 50 percent by weight greater than 6 inches in diameter, a minimum of 15 percent by weight greater than 9 inches in diameter, and a maximum of 15 percent by weight less than 3 inches in diameter.

(3) The riprap shall be equipment placed.

(4) In Section 6, Design of the Grout Mix, the Contractor shall be responsible for proportioning the mix. The grout shall consist of Portland cement, fine and coarse aggregate, water and an air entraining agent. The cement content shall be 5 1/2 bags per cubic yard of concrete. The maxmium nominal size of coarse aggregate shall be 3/4 inch. The slump shall be within the range of 6 to 10 inches. The air content (by volume) of the grout mixture at the time of placement shall be five (5) to seven (7) percent. At least five (5) days prior to placement of the grout, the Contractor shall furnish the Engineer with a statement of the mix proportions for approval.

(5) Cement shall be Type II or Type IIA.

(6) The grout mix shall be integrally colored. The color grout shall blend with the natural earth tones at the site and can be produced using Davis Colors' Miami Buff additive or similar quality products produced by Colorful Admixtures or L.M. Scofield. The color tone of the goruted mix shall be approved by the Engineer prior to full production.

(7) Grout shall be placed such that a smooth surface is not created. Rock edges shall protrude 2 to 4 inches above the grout surface upon completion of the grouting process.

(8) Payment for drainfill and transition fill material where called for under the grouted rock riprap is made under the "Drainfill Specification", Construction Specification 24.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

82. CLEANING AND PAINTING METALWORK

1. SCOPE

The work shall consist of cleaning metal surfaces and applying paints and protective coatings.

2. PAINTS

For the purposes of this specification paints shall be designated by types as defined below:

Type 1 paint shall conform to the requirements of Federal Specification TT-P-86, Type IV, Red Lead Base Paint.

Type 2 paint shall conform to the requirements to Federal Specification TT-P-86, Type II or Type III, Red Lead Base Paint.

Type 3 paint shall conform to the requirements of Federal Specification TT-P-86, Type I, Red Lead Base Paint.

Type 4 paint shall conform to the requirements of Federal Specification TT-P-636, Synthetic Primer.

Type 5 paint shall be prepared by mixing aluminum paste conforming to the requirements of Federal Specification TT-P-320, Type II, Class 2 with phenolic resin spar varnish conforming to the requirements of Federal Specification TT-V-119 at the rate of two pounds of aluminum paste per gallon of varnish. The paints shall be mixed at the time of use.

Type 6 paint shall be prepared by mixing aluminum paste conforming to Federal Specification TT-P-320, Type II, Class 2 with mixing varnish conforming to the requirements of Federal Specification TT-V-81, Type II, Class B (Class 2) at the rate of two pounds of aluminum paste per gallon of varnish. The paint shall be mixed at the time of use.

Type 7 paint shall conform to the requirements of Federal Specificaition TT-E-489, Alkyd Semi Gloss Enamel.

Use STD FORM 36

Type 8 paint shall conform to the requirements of Federal Specification TT-E-529, Alkyd Semi Gloss Enamel.

Type 9 paint shall conform to the requirements of Federal Specification TT-P-641, Type I or Type II, Zinc Dust-Zinc Oxide Primer.

Type 10 paint shall conform to the requirements of Federal Specification TT-P-641, Type III Zinc Dust-Zinc Oxide Primer.

Type 11 paint shall conform to the requirements of Material Specification 583. The paint shall be mixed at the time of use.

Paints of Types 1, 2, 3, 5 and 6 may be thinned with mineral spirits as necessary for proper application but the amount of thinner used shall not exceed one pint per gallon of paint. Other paints may be thinned in accordance with the manufacturer's instructions only if such thinning is approved by the Engineer.

When tinting is required, it shall be accomplished by the addition of pigment-in-oil tinting colors conforming to the requirements of Federal Specification TT-P-381.

Mineral spirits shall conform to the requirements of Federal Specification TT-T-291, Grade 1, Light Thinner.

3. SURFACE PREPARATION

Surfaces to be painted shall be thoroughly cleaned prior to the application of the paint. For the purposes of this specification methods of surface preparation shall be designated as defined below:

Method 1 surface preparation shall consist of the removal of all grease and oil by means of steam cleaning or solvent cleaning methods and removal of all dirt, rust, mill scale and other coatings by means of sandblasting, grit blasting or pickling. The finished surface shall uniformly expose the base metal and shall present an etched, but not polished or peened, appearance. Not more than 5 percent of the surface may exhibit very light shadows, light streaks, or slight discolorations caused by rust stain, mill scale oxides, or slight, tight residues of paint or coating.

Use Sp Form (36)

Method 2 surface preparation shall consist of the removal of all grease and oil by means of steam cleaning or solvent cleaning and the removal of all dirt, surface rust and loose scale by means of wire brushing, flame cleaning, use of rotary abrading tools or light sandblasting.

Method 3 surface preparation shall consist of the treatment of the surface with a dilute acid solution. The surface shall be thoroughly wetted with a dilute (about 5 percent strength) phosphoric acid solution. After the acid has dried, the surface shall be thoroughly rinsed with clear water and allowed to dry. Dirt, grease and oil shall be removed from the surface by solvent cleaning prior to the acid treatment.

Cleaning solvent shall be mineral spirits. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface being cleaned.

The final cleaning and wiping shall be done with clean solvent and clean cloths. Grit blasting shall be accomplished using compressed air blast nozzles and grit made of steel, malleable iron or cast iron crushed shot. Abrasives used shall have a maximum particle size that will pass the No. 16 sieve (U.S. Standard) and a minimum size that will be retained on the No. 50 sieve (U.S. Standard). The equipment used for sandblasting shall be equipped with adequate separators and traps to insure that the compressed air shall be free of detrimental amounts of water and oil. Blast cleaned surfaces shall be brushed, blown or vacuum cleaned to remove any trace of blast products or abrasives prior to painting.

Surfaces that are not to be painted immediately after cleaning shall be treated with one brush coat of metal conditioner conforming to the requirements of Military Specificaiton MIL-M-10578, except that surfaces cleaned by pickling in phosphoric acid solution shall not require such treatment.

Surfaces shall be thoroughly dry when paint is applied.

No field coats of paint shall be applied until the prepared surfaces have been inspected and approved by the Engineer.

4. PAINT SYSTEMS

For the purposes of this specification, systems of preparing and painting metalwork will be designated as defined below:

Paint System A shall consist of the preparation of the surfaces to be painted by Method 1 and the application of two priming coats of Type 1 paint and two or more top coats of Type 5 paint as necessary to provide a total dry paint film thickness of 6 mils.

Paint System B shall consist of the preparation of the surfaces to be painted by Method 1 and the application of one priming coat of Type 1 paint and two top coats of Type 5 paint.

Paint System C shall consist of the preparation of the surfaces to be painted by Method 2 and the application of one priming coat of Type 2, Type 3 or Type 4 paint and two top coats of Type 6 paint.

Paint System D shall consist of the preparation of the surfaces to be painted by Method 2 and the application of one priming coat of Type 2 paint and two top coats of Type 7 paint.

Paint System E shall consist of the preparation of the surfaces to be painted by Method 2 and the application of one priming coat of Type 2 paint and two top coats of Type 8 paint.

Paint System F shall consist of the preparation of the surfaces to be painted by Method 3 and the application of two coats of Type 9 paint.

Paint System G shall consist of the preparation of the surfaces to be painted by Method 3 and the application of two coats of Type 10 paint.

Paint System H shall consist of the preparation of the surfaces to be painted by Method 1 and the application of four or more coats of Type 1 paint as necessary to provide total dry paint film thickness of 6 mils.

USE STD FORM 36

Paint System I shall consist of the preparation of the surfaces to be painted by Method 1 and the application of two or more coats of Type II paint as neccessary to provide a total dry paint film thickness of at least 16 mils.

5. APPLICATION OF PAINT

Surfaces shall be painted immediately after preparation (or within two days after preparation and treatment with metal conditioner) with at least one coat of the type of priming paint required by the specified paint system. Surfaces not required to be painted shall be protected against contamination and damage during the cleaning and painting operation.

Paints shall be thoroughly mixed at the time of application.

After erection or installation of the metalwork, all damage to shop applied coats shall be repaired and all bolts, nuts, welds and field rivet heads shall be cleaned and painted with one coat of the specified priming paint.

Except on surfaces accessible only to spray equipment, initial priming coats shall be applied by brush. All other coats may be applied by brush or spray. Each coat shall be applied in such a manner as to produce a paint film of uniform thickness with a rate of coverage within the limits recommended by the paint manufacturer.

The drying time between coats shall be prescribed by the manufacturer of the paint but not less than that required for the paint film to dry through. The elapsed time between the application of the first and second prime coats of Paint System A shall not exceed 60 hours. In the application of Paint System I, if, for any reason, the first dries hard before the second coat is applied or the elapsed time between coats exceeds 48 hours, the method of application must be modified in any of the following ways: (1) the first coat must be wiped down with MIBK with the application of the second coat following the wipedown by not more than 6 feet; or (2) the first coat must be lightly brush blasted or given a fog coat of the paint before application of the full second coat; or (3) a special bonding additive supplied by the paint manufacturer must be mixed with the paint applied in the second coat.

Use Std Form 3

The finished surface of each coat shall be free from runs, drops, ridges, laps or excessive brushmarks and shall present no variation in color, texture and finish.

The surface of each dried coat shall be cleaned as necessary before application of the next coat.

Except for Paint System I, the first coat of each two-coat system shall be tinted for contrast. The first coat of red-lead paint shall be tinted by the addition of 3 ounces per gallon of 1B black pigment. The first coat of machinery paint shall be tinted off color with 3 ounces per gallon of a pigment suitable to the color of the paint.

6. ATMOSPHERIC CONDITIONS

Paint shall not be applied with the temperature of the item to be painted or if the surrounding air is less than 50°F. For Paint System I, the temperature of the coated surface must be maintained at not less than 50°F for 6 hours after the application of each coat. Painting shall be done only when the humidity and temperature of the surrounding air and the temperature of the metal surfaces are such that evaporation rather than condensation will result during the period of time required for application and drying. Surfaces protected from adverse atmospheric conditions by special cover, heating or ventilation shall remain so protected until the paint is dry.

7. TESTS

Acceptance of dry paint film thickness for Paint Systems A, H, and I will be based on the measurement of paint film thickness by means of an Elcometer or other suitable dry film thickness gauge.

8. PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for painting metalwork will be at the contract lump sum price. Such payment will consititute full compensation for furnishing, preparing and applying all materials and for the cleaning, painting and coating of metal work including labor, tools, equipment and all other items necesary and incidental to the completion of the work.

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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.

USE STD FORM 36

9. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

Sudsidiary Item, Cleaning and Painting

(1) This item shall consist of cleaning and painting the identification sign.

(2) Paint System E (except that Type 4 paint shall be used in place of Type 1 paint for the priming coat) shall be used. The two coats of paint shall be white and the letters painted with a dark green enamel.

(3) No separate payment will be make for Cleaning and Painting. Compensation will be included in Bid Item 17.

91. CHAIN-LINK FENCE

1. SCOPE

The work shall consist of furnishing and installing chain link fencing complete with all posts, braces, gates and all other appurtenances.

2. MATERIALS

Chain-link fence fabric, fence posts, top rails, braces, gates and accessories shall conform to the requirements of Federal Specification RR-F-191. Types, classes, and materials shall be as follows except as otherwise specified.

Fabric: Type I. 2-inch mesh, 9-gage, minimum weight of zinc coating - 1.8 ounces per square foot.

Posts: Type I, Class 1, zinc-coated

Top Rails: Type II, Class I, zinc-coated

Braces: Zinc-coated steel

Gates: Type I, zinc-coated steel

3. INSTALLING FENCE POSTS

Unless otherwise specified, line posts shall be placed at intervals of 10 feet measured from center to center of adjacent post. In determining the post spacing, measurement will be made parallel with the ground surface.

Posts will be set in concrete backfill in the manner shown on the drawings.

Posts set in the tops of concrete walls shall be grouted into performed holes to a depth of 12 inches.

All corner posts, end posts, gate posts, and pull posts shall be embedded, braced and trussed as shown on the drawings.

Use Std Form 34)

4. INSTALLING WIRE FABRIC

Fencing fabric shall not be stretched until at least 4 days after the posts are grouted into walls or 14 days after the posts are set in the concrete backfill.

Fencing shall be installed on the side of the posts designated on the drawings.

The fabric shall be stretched taut and securely fastened, by means of tie clips, to the posts at intervals not exceeding 15 inches and to the top rails or tension wires at intervals not exceeding 2 feet. Care shall be taken to equalize the tension on each side of each post.

Barbed wire shall be installed as shown on the drawings and shall be pulled taut and fastened to each post with tie wires or metal tie clips.

5. MEASUREMENT AND PAYMENT

Measurement and payment will be as specified in Section 6.

Use Std Form 36

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6. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

Bid Item 15, Chain Link Fence

(1) This item consists of furnishing and installing the chain link fence at the locations shown on the drawings.

(2) The fence shall be chain link, 9 guage, Type I, Grade A, with tow-inch mesh and a nominal height of 4 feet.

(3) In Section 5, Measurement and Payment, the work will not be measured, payment will be lump sum and shall include all labor, materials and equipment, incidental to completion of the work. Payment will include compensation for Subsidiary Item, Concrete, Class 2500.

92. FARM FIELD FENCES

1. SCOPE

The work shall consist of furnishing and installing farm field fences, including gates and fittings.

2. MATERIALS

Materials for farm field fences shall conform to the requirements of Material Specification 591. All wooden posts shall be of the same species.

3. SETTING POSTS

Concrete or wood posts shall set in holes and backfilled with earth except where otherwise specified. Steel posts shall be driven unless otherwise specified.

Posts holes shall be at least 6 inches larger than the diameter or side dimension of the posts.

Earth backfill around posts shall be thoroughly tamped in layers not thicker than 4 inches and shall completely fill the post hole up to the ground surface. Concrete backfill around posts shall be rodded into place in layers not thicker than 12 inches and shall completely fill the post hole up to the ground surface. Backfill, either earth or concrete, shall be crowned up around posts at the ground surface.

No stress shall be applied to posts set in concrete until at least 24 hours after the concrete has set.

4. CORNER ASSEMBLY

Unless otherwise specified, corner assemblies shall be installed at all points where the fence alignment changes 15 degrees or more.

5. END PANELS

End panels shall be built at gates and fence ends.

Use Std Form 36

6. PULL POST ASSEMBLY

Pull post assemblies shall be installed at the following locations:

a. In straight fence sections, at intervals of no more than 660 feet.

b. At any point where the vertical angle described by two adjacent reaches of wire is upward and exceeds 10 degrees (except as provided in Section 9 of this specification).

c. At the beginning and end of each curve.

7. ATTACHING FENCING TO POSTS

The fencing shall be stretched and attached to posts as follows:

a. The fencing shall be placed on the side of the post opposite the area being protected, except on curves.

b. The fencing shall be placed on the outside of curves.

c. The fencing shall be fastened to each end post, corner post and pull post by wrapping each horizontal strand around the post and tying it back on itself with not less than three tightly wound wraps.

d. The fencing shall be fastened to wooden line posts by means of staples. Woven wire fencing shall be attached at alternate horizontal strands. Each strand of barbed wire shall be attached to each post. Staples shall be driven diagonally with the grain of the wood and at a slight downward angle and shall not be driven so tightly as to bind the wire against the post.

e. The fencing shall be fastened to steel or concrete line posts with either two turns of 14 gauge galvanized steel or iron wire or the post manufacturer's special wire fasteners.

f. Wire shall be spliced by means of a Western Union splice or by suitable splice sleeves applied with a tool designed for the purpose. The Western Union splice shall have not less than 8 wraps of each end about the other. All wraps shall be

USE STD FENCE 36

tightly wound and closely spaced. Splices made with splice sleeves shall have a tensile strength no less than 80 percent of the strength of the wire.

8. STAYS

Stays shall be attached to the fencing in a manner to insure maintenance of the proper spacing of the fence wire strands.

9. CROSSINGS AT DEPRESSIONS AND WATERCOURSES

Where fencing is installed parallel to the ground surface, the line posts subject to upward pull shall be anchored by means of extra embedment or by special anchors as detailed on the drawings.

a. If the fence wire is installed parallel to the ground surface, the line posts subject to upward pull shall be anchored by means of extra embedment or by special anchors as detailed on the drawings.

b. If the wire fence is installed with the top wire straight and parallel to the ground surface on either side of the depression, extra length posts shall be used to allow normal post embedment. Unless otherwise specified, excess space between the bottom of the fence and the ground shall be closed with extra strands of barbed wire.

10. MEASUREMENT AND PAYMENT

The length of each type and kind of fence will be measured to the nearest foot along the profile of the fence, including gate openings. Payment for each type and kind of fence will be made at the contract unit price for that type and kind of fence. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work including fabricating and installing gates.

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 11 of this specification.

USE STD FORM 3C

11. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 16, Fence

(1) This item shall consist of furnishing and installing barbed wire fence, including gates, post anchors and appurtenances as shown on the drawings and staked in the field. This item included replacement fence where disignated.

(2) The barbed wire shall be Type I, with two strands of 12 1/2 gauge line wires and 14 gauge barbs spaced on approximately 5-inch centers in accordance with Material Specification 591 and Federal Specification RR-F-221-1. The zinc coating on the barbed wire shall be a minimum weight of 0.3 oz. per square foot.

(3) Gates, corners, pull and end post assemblies shall be as shown on the drawings. Line posts shall be Type 1, Style 1, painted in accordance with Material Specification 591 and Federal Specification RR-F-221/3.

(4) Chains shall be welded, case hardened straight link pattern of 5/16 inch stock diameter, 18 inches long. Padlocks will be furnished by the Flood Control District of Maricopa County so as to provide continuity with existing security measures.

(5) Measurement and payment will include compensaton for Subsidiary Item, Concrete, Class 2500 (post anchors and sag weights).

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

93. IDENTIFICATION MARKERS OR PLAQUES

1. SCOPE

The work shall consist of furnishing and installing identification markers or plaques at the designated locations.

2. MATERIALS

The markers or plaques shall be constructed of the specified materials, and shall meet all requirements for lettering, painting, finishing, and related items as shown on the drawings or as specified in Section 6 of this specification.

3. CONSTRUCTION METHODS

The markers or plaques shall be installed at locations and in the manner or condition specified.

4. MONUMENTS

Unless otherwise specified the markers or plaques shall be mounted on concrete monuments or on existing structures. The monuments shall be of the type, kind, and size and located as specified.

5. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, payment for each type, kind, and size of marker or plaque complete in place, will be made at the contract unit price for that type, kind, and size.

For items of work for which specific lump prices are established in the contract, payment for identification markers or plaques 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

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.

USE STD FORM

(93-2)

6. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 17, Identification Sign

(1) This item shall consist of the fabrication, painting and installation of the identification sign as shown on the drawings.

(2) Materials shall conform to the requirements of Material Specification 581.

(3) Measurement and payment will be made in accordance with Section 5, and will include compensation for Subsidiary Item, Cleaning and Painting as applicable.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

207. PLASTIC PIPE DRAINS

1. SCOPE

The work shall consist of the furnishing and installing poly (vinyl chloride) (PVC) plastic pipe and the necessary fittings as shown on the drawings.

2. MATERIALS

The poly (vinyl chloride)(PVC) pipe and fittings shall conform to the requirements of the following American Society for Testing and Materials (ASTM) Standard Specifications:

a. D 1785 Poly (Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120.

b. D 2466 Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40.

c. D 2467 Socket-Type Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80.

d. D 3034 Type PSM Poly (Vinyl Chloride)(PVC) Sewer Pipe and Fittings.

e. D 2241 Poly (Vinyl Chloride)(PV) Plastic Pipe (SDR-PR).

The Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe and fittings shall conform to the requirements of the following ASTM Standard Specifications:

a. D 2282 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR).

b. D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.

c. D 2468 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40.

d. D 2469 Socket-type Acrylonitrile-Butadiene-Stryrene (ABS) Plastic Pipe Fittings, Schedule 80.

LKE STD FORM 36

Rubber gasket joints shall conform to ASTM Specification D 3139 or D 3212, as appropriate for PVC pipe.

Solvent for cemented joints shall conform to ASTM Specification D 2564 (PVC) or D 2235 (ABS) as appropriate.

Perforations for perforated pipe shall be as provided by ASTM C 508 unless otherwise specified in Section 9.

The compound used in manufacturing the pipe shall meet the requirements of one of the following materials:

1. Poly (vinyl chloride)(PVC) as specified in ASTM D 1784.

Material	Code Classification
Type I, Grade 1	12454 B
Type I, Grade 3	12454-C
Type II, Grade 1	14333-D

2. Acrylonitrile-butadiene-styrene (ABS) as specified in ASTM D 1788.

Material	Code Classificaton
Type I, Grade 2	5-2-2
Type I, Grade 3	3-5-5
Type II, Grade 1	4-5-5

The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign matter, or other defects. The pipe shall be as uniform in color, opacity, density, and other physical properties as is commercially practicable.

3. HANDLING THE PIPE

Pipe stored outdoors for prolonged periods shall be covered. Pipe must be delivered to the job site and handled by means that shall provide adequate support and not subject it to undue stresses or damage. The load shall be so supported that the bottom rows of

USE STD FORM 36

pipe are not damaged by crushing. All special handling requirements of the manufacturer shall be strictly observed. Pipe shall be unloaded carefully and stored as close as practical to the final point of placement. When handling and placing the pipe, care shall be taken to prevent severe impact blows, abrasion damage, and gouging or cutting by metal surfaces or rocks.

4. LAYING AND BEDDING THE PIPE

Pipe shall be laid to the lines and grades shown on the drawings and as specified in Section 9.

Construction shall progress in the upstream direction with the bell ends pointed upstream. The spigot ends shall be pulled into the bell ends of previously laid sections. The ends of pipes and fittings shall be free of all foreign material when assembled.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions when the pipe is laid.

Care shall be taken to prevent permanent distortion and damage when handling the pipe during unusually warm or cold weather. The pipe shall be firmly and uniformly bedded throughout its entire length to the specified depth with the material and in the manner specified in Section 9, or as shown on the drawings. Blocking or mounding shall not be used to bring the pipe to final grade.

For pipe with bell joints, the bedding material shall be excavated at the locations of the bells to provide continuous equal support for the bells as well as for the entire length of pipe.

5. JOINTS

Pipe joints shall conform to the details shown on the drawings, and except where sealed joints are indicated, shall be sound, watertight, and shall equal or exceed the strength requirements of the pipe specified. Joints and connections shall leave the inside of the line free of any obstructions that may tend to reduce its capacity. When a lubricant is required to facilitate joint assembly, it shall have no deleterious effect on the gasket or pipe materials.

USE STD FORM 36

Pipe shall be installed and joined in accordance with the manufacturer's recommendations except as otherwise specified in Section 9.

6. PRESSURE TESTING

Pressure testing of the completed drain pipe will not be required. The drain pipe shall be pressure tested before completing the placement of backfill, except in some cases it may be necessary to partially backfill around the drain pipe before testing in order to hold the drain pipe in place. Where this occurs, the partial backfill shall be placed and compacted in accordance with Section 9 of this specification. Only the body of the pipe sections shall be covered leaving the joints and connections uncovered for inspection purposes. Any leaks shall be repaired and the drain pipe shall be retested. The procedure shall be repeated until the drain pipe is watertight. The pipe joints shall show no leakage.

7. BACKFILL

Backfill shall be in accordance with Construction Specification 23 or 24, and/or Section 9 of this specification, as appropriate, and as shown on the drawings.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined to the nearest foot by measurement of the laid length of pipe along the invert centerline of the drain pipe.

Payment of each kind, size, and class of pipe will be made at the contract unit price for that kind, size, and class of pipe. Such payment will constitute full compensation for furnishing, transporting, and installing the pipe, including excavation, backfill, fittings, and other appurtenances or items necessary and incidental to installing the drain pipe complete in place.

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.

Use Std Form 34

9. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 18, 6-inch Diameter Plastic Pipe Drains

(1) This item shall consist of furnishing and installing all the 6-inch diameter PVC pipe and appurtenances including wire screens for the drain outlets, as shown on the drawings.

(2) Pipe shall be 6-inch diameter PVC, Sd R-21, ASTM D 2241. Joints shall conform to ASTM D 3139, and fittings shall be watertight.

(3) The 6" tee shall be perforated as provided by ASTM C 508.

BULLDOG FLOODWAY/APACHE JUNCTION OUTLET

401 SURVEYS

1. SCOPE

This work shall consist of performing all surveys required for construction layout and quantity measurements, including the furnishing of equipment and materials.

2. EQUIPMENT AND MATERIALS

Equipment for surveys shall be of sufficient quality and condition to provide the accuracy required. Equipment shall be in good condition and in proper adjustment at all times.

Materials shall include all stakes, spikes, steel pins, tools and other accessories as may be required in laying out any part of the work from the primary control points established by the Government.

3. QUALITY OF WORK

Surveys shall be certified by a Land Surveyor licensed by the State of Arizona and shall be performed to a degree of accuracy and detail compatible with location and position data, work tolerances, and measurement units for payment specified in the drawing and specifications and in accordance with good engineering practices.

All work shall be performed in a workmanlike manner. Notes, sketches, and other data shall be complete, recorded neatly, and organized in a manner that will allow reproduction of copies and incorporation in reports with a minimum of editing and revision.

Bench level traverses shall be of such precision that the error of closure (in feet) shall not exceed plus or minus 0.1 times the square root of the length of the traverse (in miles). The elevations of points on profiles and cross sections shall be determined and recorded to the nearest 0.1 foot.

Transit traverses shall be of such precision that: (1) the linear error of closure shall not exceed one in 3,000 and (2) the angular error of closure shall not exceed one minute times the square root of the number of stations.

USE STD FORM 36

Surveys will be reviewed periodically and be subject to random spot checks by the Government to assure that quality is being maintained.

4. PRIMARY CONTROL

The primary control required to establish the lines and grades needed for construction will be furnished by the Government. The control will consist of bench marks and reference points set at approximately 500-foot intervals.

In case of damage to or destruction of any of the Government's primary control points by the Contractor's forces they will be replaced by the Government at the Contractor's expense. The actual cost to the Government of replacing primary control points will be deducted from the payments due to the Contractor.

Complete information concerning the primary control system will be provided to the Contractor immediately following the receipt of the notice to proceed.

5. CONSTRUCTION SURVEYS AND MEASUREMENTS

Primary control points and bench marks shall be used as the origin of surveys needed to establish lines and grades for construction.

All survey data shall be recorded in bound field notebooks furnished by the Government with consecutively numbered pages. These books shall be turned over to and become the property of the Government upon completion of the work, prior to the preparation of the final pay estimate. All entries shall be legible and follow the format specified in Section 9. The bound field notebooks shall be available at all times during the progress of the work for examination and use by the Government.

Where pay limits are specified, sufficient cross sections shall be taken to verify and document that the works have been completed in accordance with the plans and specifications. Maximum spacing of cross sections for quantity computations shall vary from 200 feet in areas of even topography to 25 feet or less in areas of uneven topography (influenced by hills, washes, ridges, etc.). The surveyor shall submit a list of stations for cross sections to the Government Representative for review and approval.

Surveys (including cross sections) and measurements shall be taken prior to and after construction at each location for each bid item that requires measurement. Sufficient surveys and measurements shall be performed to document the monthly pay estimates. All cross sections are to be taken at the same stations as the original surveys.

Use Std Form 34

Survey information needed for "AS-BUILT" construction drawings and monthly pay estimates and progress reports will be kept current as work progresses and will be made available to the Government by the 25th of each month.

6. STAKING

The location and marking of all stakes shall be as specified in Section 9 and as follows:

a. Clearing and grubbing - The boundary of the clearing and grubbing areas shall be staked or flagged at 300-foot intervals, or less if needed to clearly mark the work to be done.

b. Excavation - Cut stakes shall be placed on the centerline and the intersection of the side slopes and natural ground line. All stakes shall have the required cut, distance, slope, and stationing, plus offset reference stakes.

c. Earth Fill - Fill stakes shall be placed at the toe of the slope and shall have the required fill, distance, slope and stationing, plus offset reference stakes.

d. Structures - Centerline stakes for location and alignment and elevation offset reference stakes and hubs for apron, sidewalls and upstream headwall.

Cut and fill stakes shall be placed at full stations, breaks in the original ground surface and at other intermediate stations as necessary to insure accurate determination of payment quantities.

Stakes and cross sections shall be at right angles to the centerline. Rod and chain readings shall be taken at all breaks in topography for the full extent of the cross section. Chain distances shall be taken horizontally and rod readings shall be taken vertically and shall be recorded to the nearest 0.1 foot, except that subgrade for structures shall be to the nearest 0.01 foot.

7. AS-BUILT

Cross sections shall be taken on all earth fill and excavation areas before construction begins, after excavation and in advance of placing any earth fill.

Final cross sections of excavation and earth fill shall be taken after finish operations are completed to determine compliance.

USE STD FORM 36

8. PAYMENT

Payment will be made as the work proceeds, after presentation of invoices by the contractor showing his surveying costs and evidence of the charges for suppliers, and for subcontractors, for the survey work performed by them. If the total of such payments is less than the contract lump sum for surveys, the unpaid balance will be included in the final contract payment. Total payment will be the lump sum contract price for surveys, regardless of actual cost to the contractor.

Payment will not be made under this item for the purchase cost of materials and equipment having residual value, the purchase costs of operating supplies, or for other survey type work such as grade checking which shall be included in the prices bid for the items of work for which such surveys are required.

Payment of the lump sum contract price for surveys 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 or 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.

USE STD FORM 34

9. ITEMS OF WORK AND CONSTRUCTION DETAILS - Bulldog Floodway/Apache Junction Outlet

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 19, Surveys

(1) This item shall consist of furnishing personnel, equipment, materials and performing surveys required for:

(a) Construction layout

(b) Computation of quantities

(c) "As-Built" construction drawings

(2) Primary control consists of bench marks and reference points sets at approximately 500-foot intervals.

(3) The Contractor shall provide the Contracting Officer a statement of qualifications, including specific experience of each of the survey personnel assigned to the job.

(4) The Contractor shall provide the Contracting Officer a schedule of surveys to be performed each month.

(5) In Section 5, Construction Survey and Measurements, all entries in the bound field notebook shall follow the format shown on pages 2-40 and 2-42 of the Soil Conservation Service National Engineering Handbook, Section 19.

(6) In Section 6, Staking the location and marking of stakes shall follow the format shown on pages 2-13, 2-15, 2-17 and 2-20 of the Soil Conservation National Engineering Handbook, Section 19.

(7) Payment will be in accordance with Section 8.

VI BID SCHEDULE

VI. BID SCHEDULE

The Bid Schedule follows the pattern established for other project units of the Buckhorn-Mesa Watershed. All items will be bid on a unit price basis except mobilization, chain link fence, surveys and identification sign. Certain small items and required procedures are included as subsidiary to other bid categories.

CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED | PAGE | OF | PAGES

NAME OF OFFEROR OR CONTRACTOR

BID SCHEDULE
BULLDOG FLOODWAY AND APACHE JUNCTION OUTLET

Item No.	Work or Material	Spec. No.	Quantity	Unit	Unit Price	Amount
1.	Clearing & Grubbing	2		Acres	$	$ 9,336
2.	Mobilization	8	1	Lump Sum	$	$ 34,000
3.	Water	10				
	a. First 40,000 MG		40,000	M.G.	$ 5.25	$ 210,000.00
	b. Over 40,000 MG		xxx	M.G.	$ 4.25	$ XXX
4.	Structure Excavation, Common	21		Cu. Yd.	$	$
5.	Channel Excavation, Common	21		Cu. Yd.	$	$
6.	Structure Backfill	23		Cu. Yd.	$	$
7.	Earth Fill	23		Cu. Yd.	$	$
8.	Transition Fill	24		Cu. Yd.	$	$
9.	Drain Fill	24		Cu. Yd.	$	$
10.	Concrete, Class 4000 (colored)	31		Cu. Yd.	$	$
11.	Steel Reinforcement	34		Lbs.	$	$
12.	24-inch Loose Rock Riprap	61		Cu. Yd.	$	$
13.	24-inch Grouted Rock Riprap	62		Cu. Yd.	$	$
14.	12-inch Grouted Rock Riprap	62		Cu. Yd.	$	$
15.	Chain Link Fence	91	1	Lump Sum	$	$
16.	Farm Fence	92		Lin. Ft.	$	$
17.	Identification Sign	93	1	Lump Sum	$	$
18.	6-inch Plastic Pipe Drains	207		Lin. Ft.	$	$
19.	Surveys	401	1	Lump Sum	$	$
				TOTAL............		$

VII COST ESTIMATE

VII. COST ESTIMATE

Good cost estimates for the type of construction involved in this Project are available as a result of recently contracted work of a similar nature. This includes other project units of the Buckhorn-Mesa Watershed.

Cost estimates are based upon contract conditions which can be met by small to medium-sized contractors.

CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED | PAGE OF PAGES

NAME OF OFFEROR OR CONTRACTOR

CONSTRUCTION COST ESTIMATE
BULLDOG FLOODWAY AND APACHE JUNCTION OUTLET

Item No.	Work or Material	Spec. No.	Quantity	Unit	Unit Price	Amount
1.	Clearing & Grubbing	2	24	Acres	$ 389	$ 9,336.00
2.	Mobilization	8	1	Lump Sum	$ N/A	$ 34,000.00
3.	Water	10				
	a. First 40,000 MG		40,000	M.G.	$ 5.25	$ 210,000.00
	b. Over 40,000 MG		xxx	M.G.	$ 4.25	$ XXX
4.	Lined Channel Excavation, Common	21	126,740	Cu. Yd.	$ 2.16	$ 273,758.00
5.	Channel Excavation, Common	21	55,340	Cu. Yd.	$ 1.56	$ 86,330.00
6.	Structure Backfill	23	6,120	Cu. Yd.	$ 11.44	$ 70,013.00
7.	Earth Fill	23	29,000	Cu. Yd.	$ 1.46	$ 42,340.00
8.	Transition Fill	24	2,200	Cu. Yd.	$ 23.66	$ 52,052.00
9.	Drain Fill	24	3,010	Cu. Yd.	$ 21.84	$ 65,738.00
10.	Concrete, Class 4000 (colored)	31	13,850	Cu. Yd.	$185.00	$2,562,250.00
11.	Steel Reinforcement	34	1,834,100	Lbs.	$ 0.40	$ 733,640.00
12.	24-inch Loose Rock Riprap	61	671	Cu. Yd.	$ 22.46	$ 15,070.00
13.	24-inch Grouted Rock Riprap	62	4,124	Cu. Yd.	$ 55.12	$ 227,315.00
14.	12-inch Grouted Rock Riprap	62	3,060	Cu. Yd.	$ 33.07	$ 101,194.00
15.	Chain Link Fence	91	1	Lump Sum	$ N/A	$ 2,500.00
16.	Farm Fence	92	21,700	Lin. Ft.	$ 2.60	$ 56,420.00
17.	Identification Sign	93	1	Lump Sum	$ N/A	$ 1,560.00
18.	6-inch Plastic Pipe Drains	207	235	Lin. Ft.	$ 12.50	$ 2,938.00
19.	Surveys	401	1	Lump Sum	$ N/A	$ 52,400.00
				SUB TOTAL..............		$4,598,854.00
				10% Contingency......		$ 459,885.00
				TOTAL..................		$5,058,739.00

NSN 7540-01-152-8067
PREVIOUS EDITION USABLE

36-109

STANDARD FORM 36 (REV. 10-83)
Prescribed by GSA
FAR (48 CFR) 53.112

1

EBASCO SERVICES INCORPORATED

BY ________ DATE 4/9/86 SHEET ____ OF ____

CHKD. BY ________ DATE ________ OFS NO. ________ DEPT. NO. ________

CLIENT ________

PROJECT ________

SUBJECT REBAR & CONCRETE QUANTITIES

Bending Schedule No.	Bending Schedule Sh. No	Quantities Rebar (LBS)	Quantities Concrete (C.Y)
1	2-27	92139	465
2	28	163460	915
3	29	596826	4776
4	35	28920	175
5	37	51666	372
6	39	121780	1000
7	40	47830	330
8	42	34100	237
9	44	48100	360
10	46	26674	193
11	48	312800	2645
12	50	77702	554
13	52	SEE TOTAL SHT 58	
14	54	30100	206
15	57	21165	284
16	58	180630	1337
	TOTALS	1,834,092	13,849
		1,834,100	13,850

581/8-81

EBASCO SERVICES INCORPORATED

BY DG DATE 4/7/86 SHEET ____ OF ____

CHKD. BY ____ DATE ____ OFS NO. ____ DEPT. NO. ____

CLIENT ____

PROJECT ____

SUBJECT Quantity Summaries

Bid No / Descr. / Location	CY (8) Transition Fill	(9) Drain Fill	(12) 24" Loose Riprap	(13) 21" Grtd Riprap	(14) 12" Grtd Riprap
Floodway	1503	752			
Energy Diss #2	716	2,062			
Energy Diss. #2 (add)		195			
	2,219	2,009			
Total (use)	2,220	2,010			
Energy Diss.			671		
Energy Diss				4,124	
Weir Inlets					3,060

581/8-81

EBASCO SERVICES INCORPORATED

BY DG DATE 4/4/86 SHEET ____ OF ____

CHKD. BY ____ DATE ____ OFS NO. ____ DEPT. NO. ____

CLIENT ____

PROJECT ____

SUBJECT Quantity Summaries

Location \ Bd Item No Descr	(4) Struct Excav Common	(5) Channel Excav comm	(6) Struct Backfill	(7) Earth Fill	
	cy.				
Floodway - 101+50 to 205+50	115,360				
205+50 to 206+00	2,530				
Add. 10'-0 depth	5,550				
Inlets	3,300				
Total	126,740				
Earth Channel 206+00 - 210+00 } Add. 10'-0 Depth		55,040			
Inlet Approach Chnls		300			
Total		55,340			
Earthfill adjacent to Str. 101+50 - 206+00			6,120		
Dikes & Ramps				29,000	

EBASCO SERVICES INCORPORATED

BY DG DATE 4/8/86 SHEET ___ OF ___

CHKD. BY ___ DATE ___ OFS NO. ___ DEPT. NO. ___

CLIENT ___

PROJECT ___

SUBJECT Qty & Price Notes – Estimate

CLEAR & GRUB — Unit price for Est from Signed Estimates

FRS

Bidder	1	2	3	4	5
Unit price/Acre	$277.28	417	300	1,000	1,500

Average Bidders 1 thru 5 = $789

" 1 thru 3 = $331.43

Esc (1.04)(331.43) = $344.69 USE $345/A

Floodway

393.92 427 300 1,000 1,500

Ave Bidders 1 thru 3 = $373.64 Esc = 388.59 USE $389/A

MOBILIZATION

FRS: Ave = $55,759.49 x1.04 = $57,989.85 USE $58,000

Floodway: Ave = 32,037.85 x1.04 = 33,319.36 " 34,000

RIPRAP

Let labor 12" = 70% 24"

Let material 12" = 50% 24"

Then cost = $\left(\frac{50\% + 70\%}{2}\right)$ $55.12 = $33.07/cy

EBASCO SERVICES INCORPORATED

BY R. DRILLER DATE 4/8/86 SHEET 1 OF 2

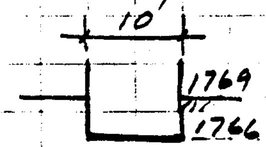
CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT U. S. D. A.

PROJECT BULLDOG FLOODWAY

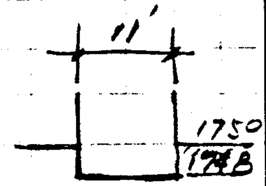
SUBJECT EXCAVATION - SIDE CHANNEL INLETS

S.C. INLET #1 (SHT 2-6)



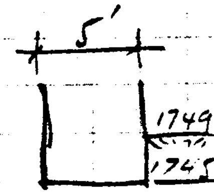
$\frac{10' \times 3' \times 100'}{27}$ = 112 CY.

S.C. INLET #2 (SHT 2-15)



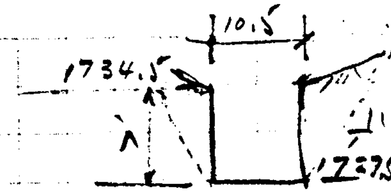
$\frac{11' \times 2' \times 120'}{27}$ = 98 cy.

S.C. INLET #4 (SHT 2-17)



$\frac{5' \times 4' \times 100'}{27}$ = 74 cy.

S.C. INLET #5 (SHT 2-21)

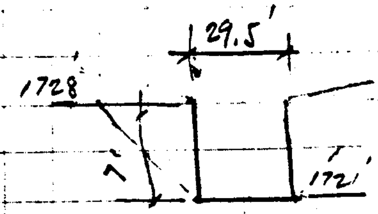


$\frac{10.5' \times 7' \times 110'}{27}$ = 299 cy.

$\frac{9 \times 9 \times 100'}{27}$ 300 cy

599 cy.

S.C. INLET #3 (2-16)



$\frac{29.5' \times 7' \times 260'}{27}$ = 1989 cy.

7 × 7 × 260 = 472 cy

2461 cy.

581/8-81

EBASCO SERVICES INCORPORATED

BY R. Driller DATE 4/8/86 SHEET 2 OF 2

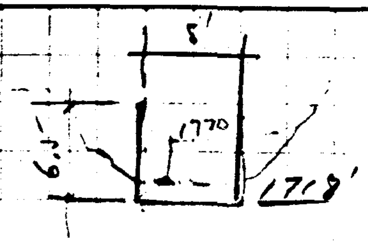
CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT U.S.D.A.

PROJECT BULLDOG FLOODWAY

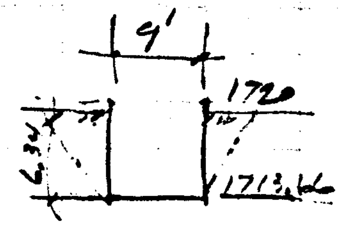
SUBJECT EXCAVATION - SIDE CHANNEL INLETS

S.C. INLET # 6 (SHT 2-23)



$\frac{5 \times 2 \times 50}{27} = 19 \text{ cy.}$

S.C. INLET # 7 (SHT 2-25)



$\frac{9' \times 6.34' \times 60'}{27} = 127 \text{ cy.}$

$\frac{6.34^{2} \times 60}{27} = 90 \text{ cy.}$

217 cy.

SUMMARY:

SIDE CHANNEL INLET #1	=	112 cy.
" " " #2		98 "
" " " #4		74 "
" " " #5		299 "
" " " #3		2461 "
" " " #6		19 "
" " " #7		217 "
		3280 CU YDS.

581/8-81

EBASCO SERVICES INCORPORATED

BY R. DRILICH DATE 4/8/86 SHEET 1 OF 1

CHKD. BY _____ DATE _____ OFS NO. _____ DEPT. NO. _____

CLIENT U.S.D.A.

PROJECT BULLDOG FLOODWAY

SUBJECT EXCAVATION

NET INCREASE IN EXCAVATION RESULTING FROM DEPTH OF CHANNEL INCREASE APPROX 10'

NET INCREASE TO STA 206+00 = 5,552 cy.

TOTAL NEW EXCAVATION QUANTATIE STA. 206+00 TO 210+00

55036 cy.

EBASCO SERVICES INCORPORATED

BY R. ORILLO DATE 4/9/86 SHEET 1 OF 1

CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT U.S.D.A.

PROJECT BULLDOG FLOODWAY

SUBJECT EXCAVATION - TAKEOFF

SIDE CHANNEL INLET APRON:-

SC INLET #1 (SHT 2-6)

$$\frac{10+35.17}{2} \times \frac{13.33 \times 1'}{27} = 11 \text{ cy.}$$

SC. INLET #2 (SHT 2-15)

$$\frac{11+39.17}{2} \frac{\times 20 \times 2}{27} = 37 \text{ cy.}$$

SC. INLET #3 (SHT 2-16)

$$\frac{30+62.17}{2} \frac{\times 17 \times 6}{27} = 174 \text{ cy.}$$

SC INLET #4 (SHT. 2-17)

$$\frac{5+30.17}{2} \times \frac{13.33}{27} \times 4.5 = 39 \text{ cy.}$$

S.C. INLET #5 (SHT. 2-21)

NO APRON!!

SC. INLET #6 (SHT 2-23)

$$\frac{5+32.17}{2} \times \frac{14.33}{27} \times 2 = 20 \text{ cy.}$$

SC. INLET #7 (SHT. 2-25)

$$\frac{9+36.17}{2} \times \frac{14.33}{27} \times 6.34 = 76 \text{ cy.}$$ TOTAL = 357 CY.

581/8-81

EBASCO SERVICES INCORPORATED

BY M.BACHAREL DATE 2-14-86 SHEET 2-11 SHEET 10 OF ____

CHKD. BY ____ DATE ____ OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A.

PROJECT BULLDOG FLOODWAY / APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE "d" FT.	EXCAVATION AREA FT²	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT²	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT²	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
1	190+00		100.	568.	2086	—	—	19.5	73	58 215
		200.								
2	192+00		150	1664	3389	—	—	19.5	109	90 300
		100.								
3	193+00		98.	568	2062	25.5	98.	19.5	71.	63 229
		96.								
4	193+96		86.5	10	32.	182.6	585.	19.5	63.	— —
		77.								
5	194+73		222.	621	5106	—	—	19.5	161.	83 632
		367.								
6	198+40		373.5	789.	10915	—	—	19.5	270.	120 1660 / 3300
		380.								
7	202+20		230.	386	3288	—	—	19.5	167.	
		80.								
8	203+00		65.	82.	197.	67	162	19.5	47.	
		50.								
9	203+50		75.	749 ~~1166~~	2081 ~~3234~~	—	—	—	—	-⟨1153⟩
		100.								
10	204+50		100.	2283 ~~3942~~	8456 ~~10896~~	—	—	—	—	-⟨2440⟩ / ⟨3593⟩
		100								
	205+50		50.	5202 ~~3784~~	9635 ~~5063~~	—	—	—	—	+4572
	TO NEXT PAGE				46567		840.		961	

381/9-81

EBASCO SERVICES INCORPORATED

BY M. BACHAE DATE 2-14-86 SHEET 2-12 SHEET 12 OF ____

CHKD. BY ______ DATE ______ OFS NO. 3767.000 DEPT. NO. 523

CLIENT U.S.D.A.

PROJECT BULLDOG FLOODWAY / APACHE FLOODWAY PROTECTION

SUBJECT BULL DOG FLOODWAY

NO.	STATION	DISTANCE FT.	DIST. 1/2 FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
	206+00		50		9636 8063					+ 4573
	~~205+50~~		75	5203 ~~2784~~	14453 ~~7594~~	(4817)				+ 6859
								NET	INCREASE	7838 To 206+25
		150								
	207+00		100	4133 ~~1845~~	14937 ~~6883~~					~~+ [illegible]~~
		50								
	207+50		75	3168 ~~1231~~	8800 ~~3392~~					~~[illegible]~~
		100								
	208+50		125 ~~200~~	3596 ~~1532~~	~~[illegible]~~ ~~11348~~ 16648					~~+ [illegible]~~
		150 ~~300~~								
	210+00		75	3540	9834					55,036 206+25 To 210+00
	211+50		192.5	1090	7771					
		85								
	212+35		160	777	4604					
		235								
	214+70		207.5	914	7024					
		180								
	216+50		235	392	5152					
		290								
	219+40		162.6	446	2686					
		3513								
	TOTAL TO NEXT PAGE				56404					

301/9-81

EBASCO SERVICES INCORPORATED

BY M. BACHASEL DATE 2-16-86 SHEET 2-11 SHEET 11 OF ____

CHKD. BY ____ DATE ____ OPS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY / APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE FT.	EXCAVATION AREA FT²	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT²	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT²	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
	FROM PREVIOUS PAGE				46567		840		961	
ADD	DIKE @									
	202+20						219			
	DIKE @									
	203+00						169			
	TOTAL				46567		1228		961	

EBASCO SERVICES INCORPORATED

BY M. BACHART DATE 2-14-86 SHEET 2-13 SHEET 13 OF

CHKD. BY DATE OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY / APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	AVERAGE FT.	DISTANCE "d" FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
					56404					
		35.13								
	219+75.13		17.6	55	36					
					56440					

801/8-81

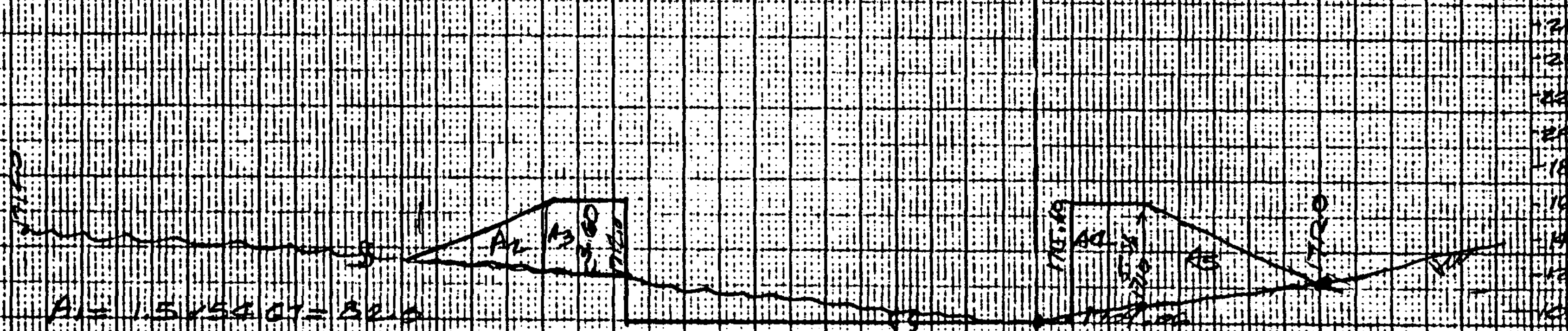
STATION A' SHEET 2-11

L = 50'-0 + 1'-8' + 3'-0 = 54.67'

W = 6'-8 + 10' - (6) - 8' = 6.75

STA ... +0...

Dis... 80'-0

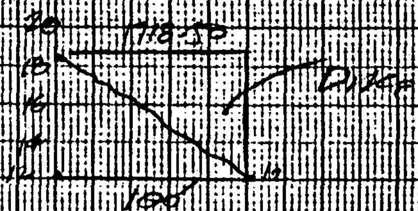


A1 = 1.5 x 54.67 = 82.0

AF1 = 67

A2 = 3.6^2 = 12.96
A3 = 3.6 x 2.5 = 9
A4 = 5.56 x 2.5 = 13.9
A5 = 5.56^2 = 30.92

AF2 = 19.50



V DIKE = 149 C.Y.

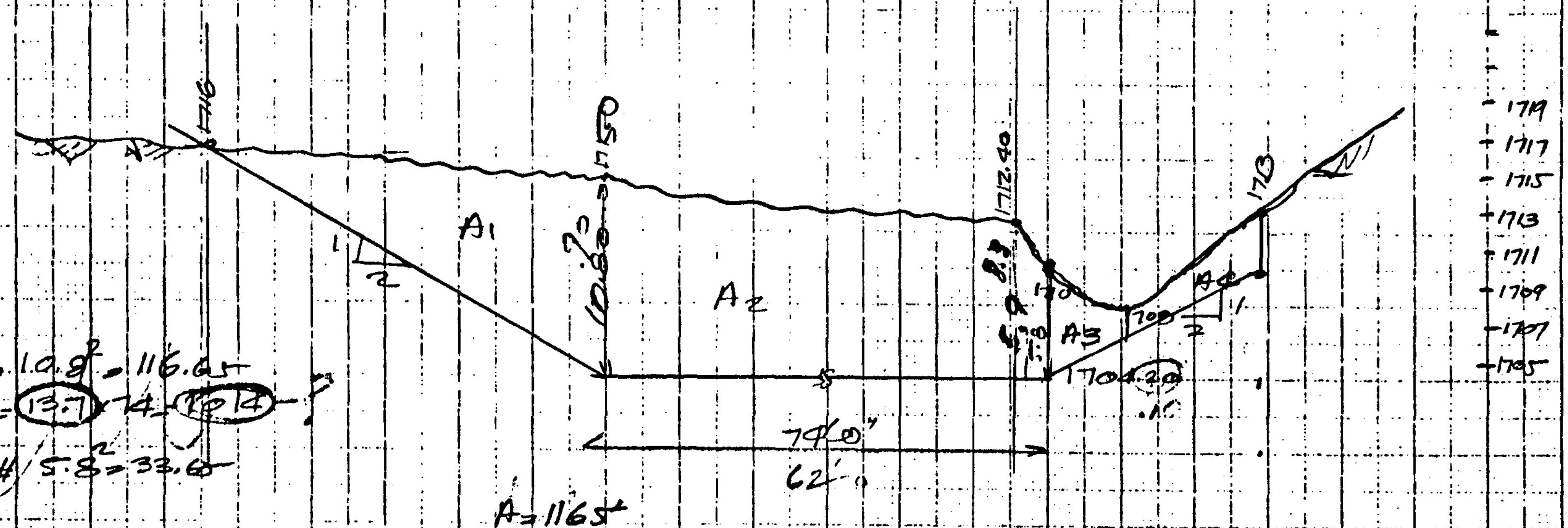
STATION 2 50
DISTANCE 0'

$A_1 = 10.9^2 = 118.81$

$A_2 = 16 \times \quad 595.2$

$A_3 = 5.9^2 = 34.81$

$A = 717$



$A_1 = 10.8^2 = 116.65$

$A_2 = 13.7 \times 14 = 7014$

$A_3 = 5.8^2 = 33.60$

$A = 1165^{\pm}$

12-138

National

1715.0
1704.10
10.9.0

STATION 4+050
DISTANCE 70

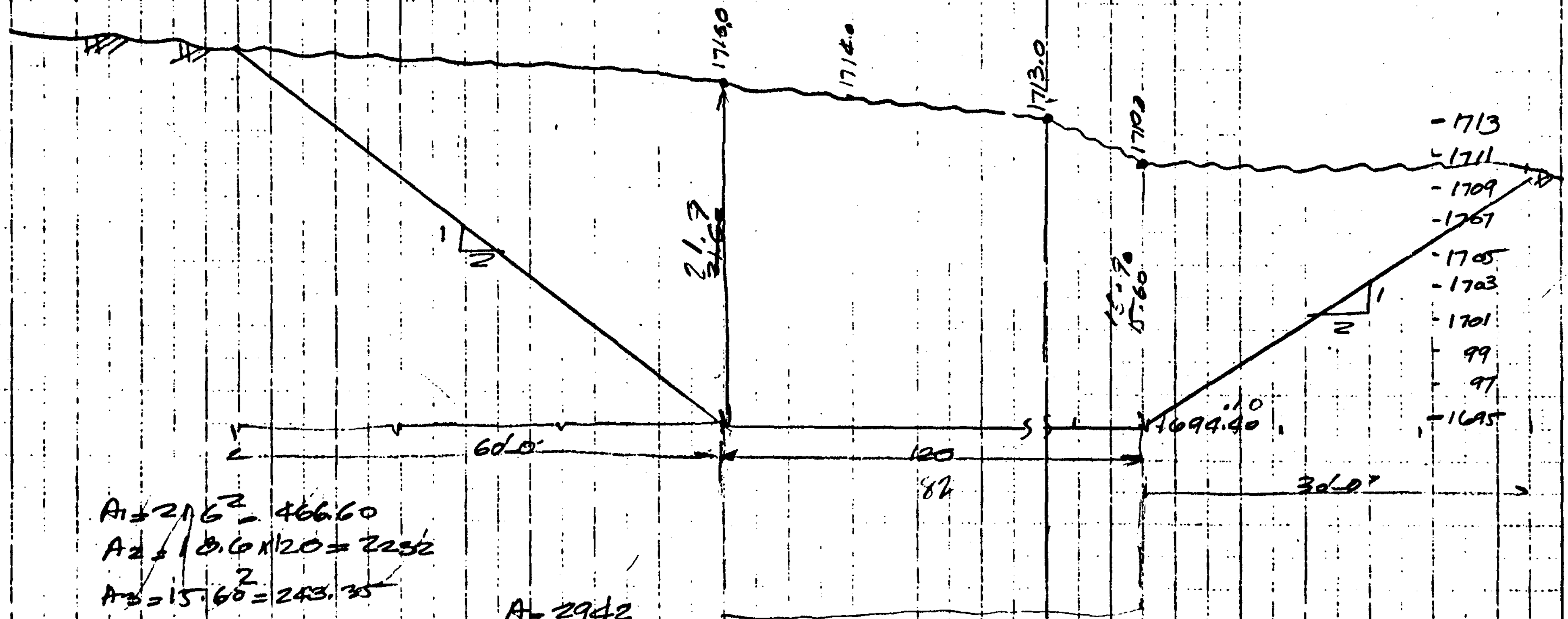
FLOODWAY REF. LINE

$A_1 = 21.9^2 = 479.61$

$A_2 = 18.9 \times 82 = 1549.80$

$A_3 = 15.9^2 = 252.81$

$A = 2283$



$A_1 = 21.6^2 = 466.60$

$A_2 = 18.6 \times 120 = 2232$

$A_3 = 15.60^2 = 243.35$

$A = 2942$

12-138
National
Millimeters to the Centimeter

STATION 205-
Distance 100

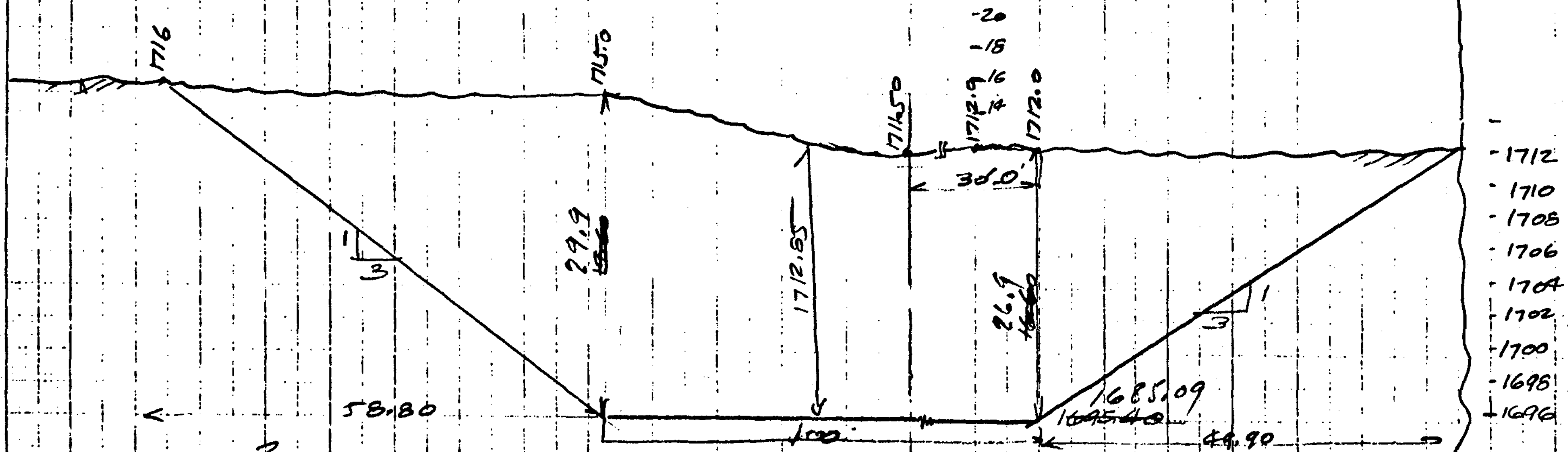
FLOODWAY REF LINE

$A_1 = 29.9^2 \times 1.5 = 1341$

$A_2 = 27.76 \times 100 = 2776$

$A_3 = 1.5 \times 26.9^2 = 1086$

$A = 5203$



$A_1 = 19.6^2 \times 1.5 = 576$

$A_2 = 17.45 \times 100 = 1745$

$A_3 \; 1.5 \times 16.6^2 = 413.3$

$A = 2734$

National 12-138
Millimeters to the Centimeter

L = 100.0'

STATION 207+00 SHEET 2-12

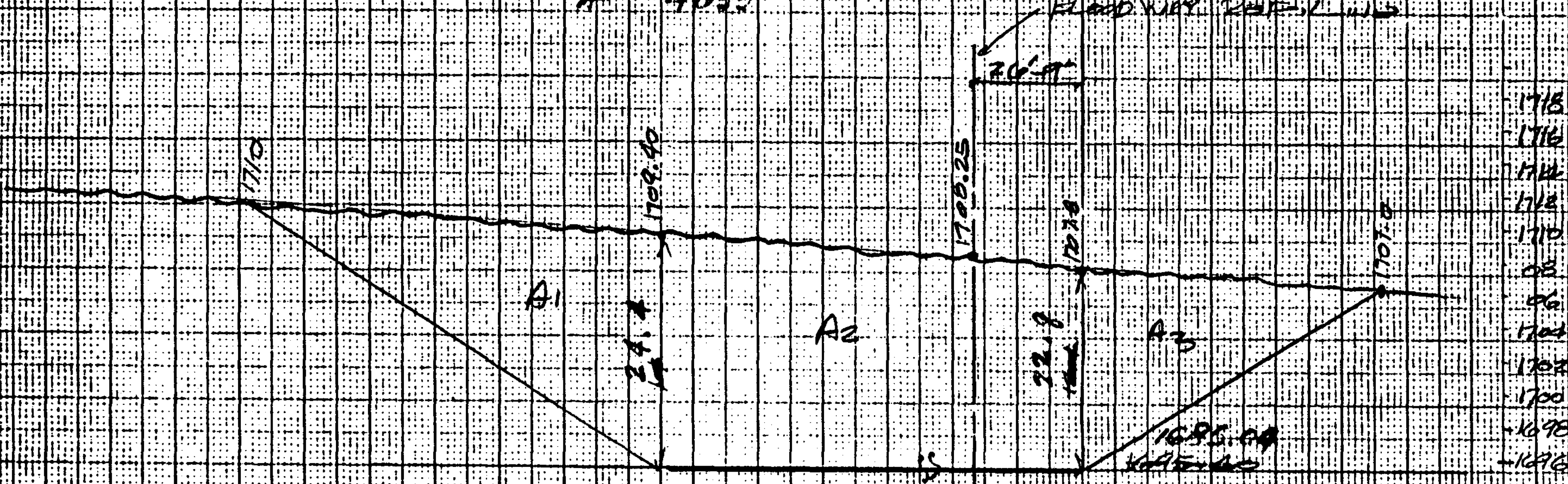
DISTANCE ~~56~~ 100'

$A_1 = 24.4^2 \times 1.5 = 893$

$A_2 = 23.6 \times 100 = 2360$

$A_3 = 22.8^2 \times 1.5 = 780$

A = 4033



Ac = 1845

$A_1 = 1.5 \times 14^2 = 294$

$A_2 = 13.2 \times 100 = 1320$

$A_3 = 1.5 \times 12.4^2 = 231$

Made in USA

10 Millimeters to the Centimeter

L = 100'-0'   STATION 201+50   SHEET E-12

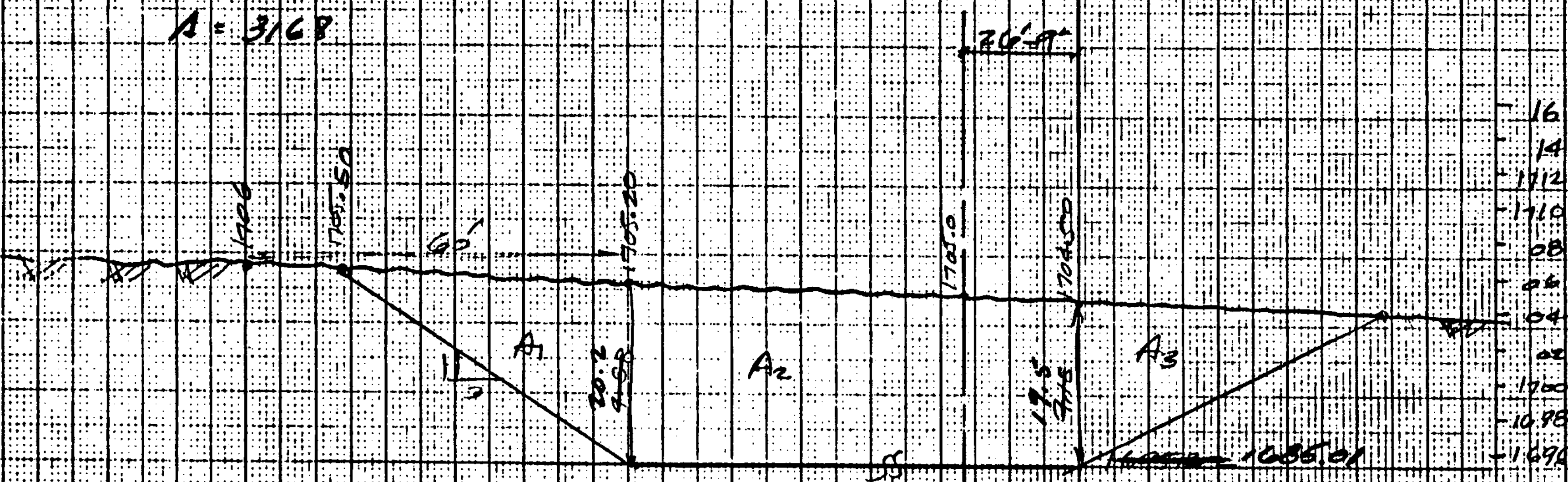
DISTANCE 50'

$A_1 = 20.2^2 \times 1.5 = 612$

$A_2 = 19.85 \times 100 = 1985$

$A_3 = 19.5^2 \times 1.5 = 571$

$A = 3168$



~~A = 1221~~

~~$A_1 = 1.5 \times 9.83^2 = 145$~~

~~$A_2 = 9.49 \times 100 = 949$~~

~~$A_3 = 1.5 \times 9.18^2 = 126.5$~~

1710

1709

50

ADD FILL ... LINE

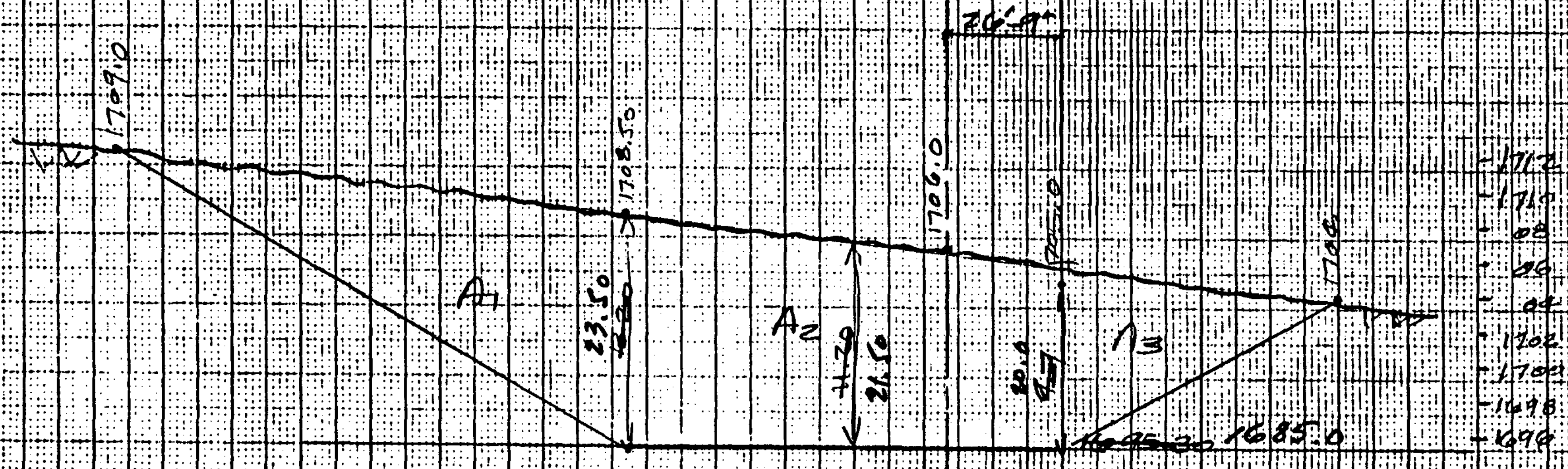
$V = \frac{(12)(50)}{2} \times \frac{14}{27} = 13$ C.Y.

Made in USA

10 Millimeters to the Centimeter

L = 100'-0'   STATION 208+50   SHEET E-12

DISTANCE 1.00'



~~$A_1 = 1.5 \times 13.45^2 = 271.40$~~

~~$A_2 = 11.20 \times 100 = 112.0$~~

~~$A_3 = 1.5 \times 9.7^2 = 141$~~

~~$A_c = 1532$~~

ADD DIKE

ADD INLET

$A_1 = 1.5 \times 23.75'^2 = 840$

$A_2 = 21.50 \times 100 = 2150$

$A_3 = 1.5 \times 20.0^2 = 600$

$A_c = 3590$

Made in USA
10 Millimeters to the Centimeter

EBASCO SERVICES INCORPORATED

BY ______ DATE ______ SHEET ______ OF ______

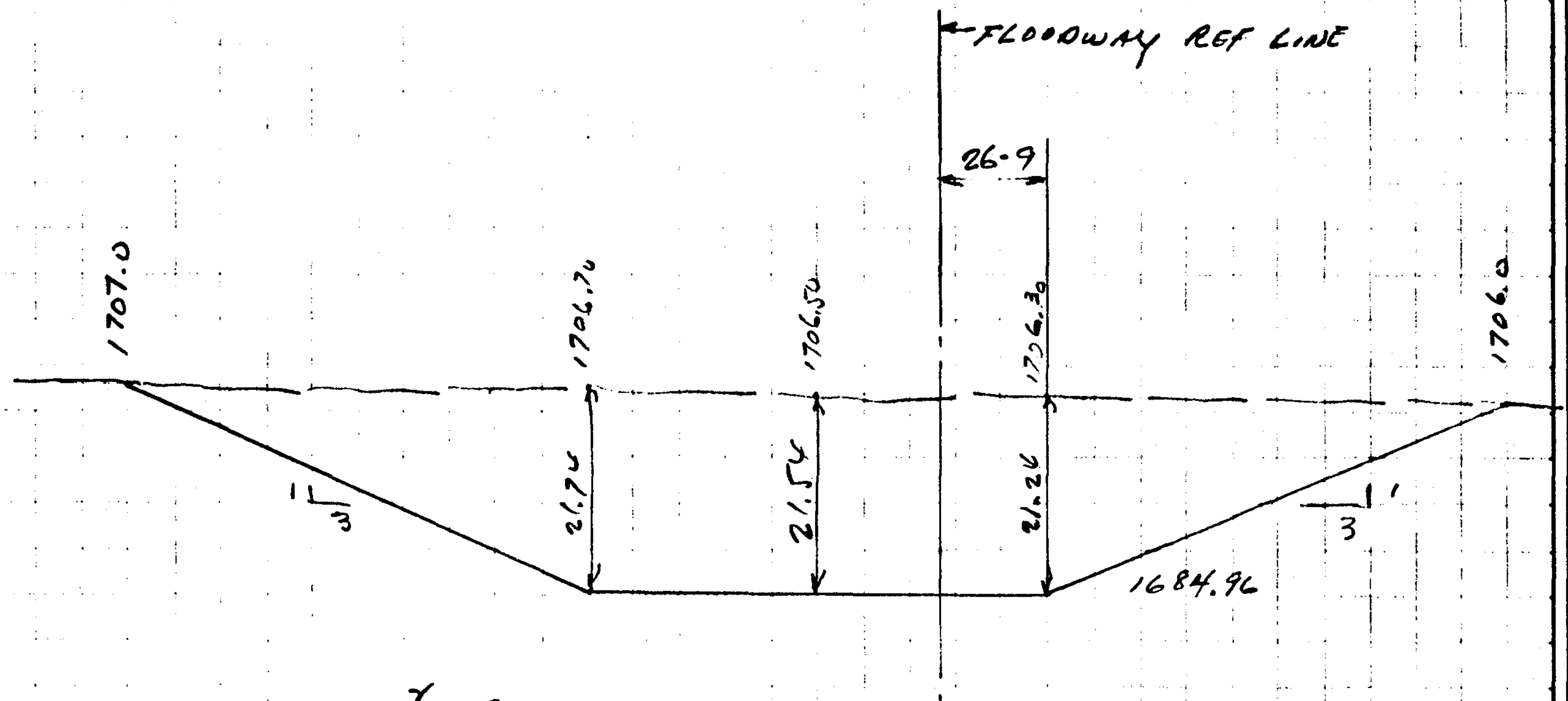
CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT ______

PROJECT ______

SUBJECT ______

STATION 210+00
DISTANCE



$A_1 = 21.74^2 \times 1.5 = 709$

$A_2 = 21.54 \times 100 = 2154$

$A_3 = 21.24^2 \times 1.5 = 677$

$A_c = 3540$

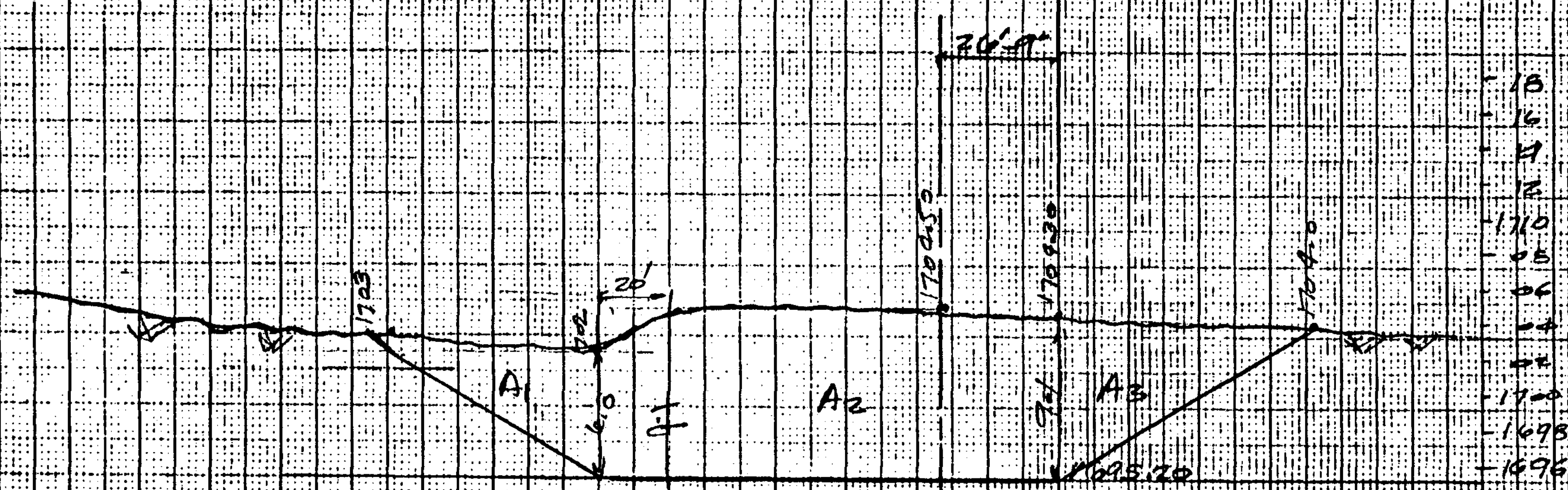
561/8-81

L = 100'-0'

STATION 211+50

SHEET E-12

DISTANCE 300'



$A_C = 1090$

$A_1 = 1.5 \times 6.8^2 = 69.40$

$A_2 = 8 \times 20 + 80 \times 9.2 = 896.40$

$A_3 = 1.5 \times 9.1^2 = 124.20$

EBASCO SERVICES INCORPORATED

BY R. ORILLO DATE 9/7/86 SHEET 1 OF 4

CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT USDA.

PROJECT BULLDOG FLOODWAY

SUBJECT MAT'L TAKEOFF

SUMMARY:

WEIR INLET	#3	=	76 cy.
" "	#4	=	210 "
" "	#5	=	80 "
" "	#6	=	101 "
" "	#7		101 "
" "	#8		130 "
" "	#9		2362 "

TOTAL 3060 cy. (12" GROUTED ROCK RIPRAP)

EBASCO SERVICES INCORPORATED

BY R. DRILLER DATE 4/7/86 SHEET 2 OF 4

CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

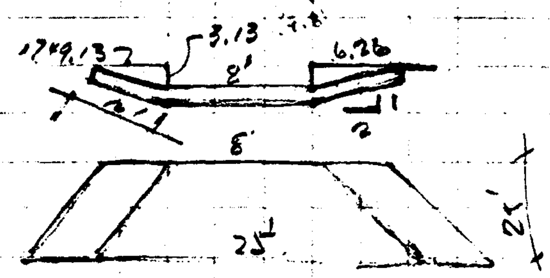
CLIENT USAA.

PROJECT BULLDOG FLOODWAY

SUBJECT MATL TAKE OFF

18" GROUTED ROCK RIP RAP 2'-0 THICK (DET Z SHT 2-5)

WEIR INLET #3 SHT 2-8 SHT 2-18

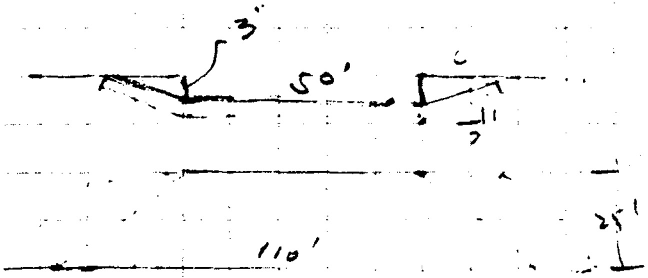


$\frac{28+45}{2} \times 25 \times 2 = \frac{1825 \text{ cu. ft.}}{27} = 67.6 \text{ cy.}$

HAUNCH. $\frac{2 \times 2.5 \times 45}{27}$ = 8.4 cy.

76 cy.

WEIR INLET #4 SHT 2-8 2-19



$\frac{70+130}{2} \times 25 \times 2 = \frac{5000 \text{ cu ft.}}{27} = 185.2 \text{ cy.}$

HAUNCH. $\frac{2 \times 2.5 \times 130}{27}$ 24.1 cy.

209.3 cy.

EBASCO SERVICES INCORPORATED

BY R. ORILLA DATE 4/7/86 SHEET 3 OF 4

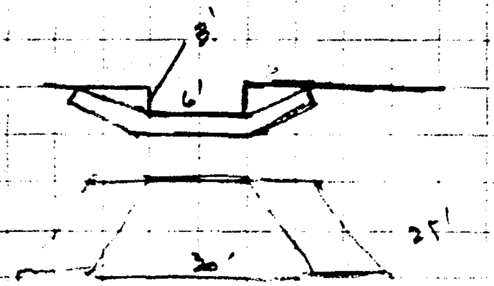
CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT USDA

PROJECT BULLDOG FLOODWAY

SUBJECT MATL. TAKEOFF

WEIR INLET #5 SHT 2-9
" 2-20

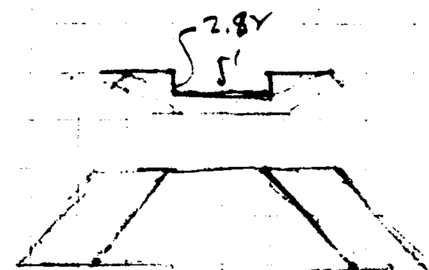


$\frac{26+50}{2} \times 25 \times 2 = \frac{1900}{27}$ cu ft. $= 70.4$ cy.

HAUNCH $2 \times \frac{2.5 \times 50}{27}$ $= 9.3$ cy.

79.7 cy.

WEIR INLET #6 SHT. 2-9
" 2-22



$\frac{25+70}{2} \times 25 \times 2 = \frac{2375}{27}$ cu ft $= 88$ cy.

HAUNCH. $2 \times \frac{2.5 \times 70}{27}$ $= 13$ cy.

101 cy.

EBASCO SERVICES INCORPORATED

BY R. DRILLER DATE 4/7/86 SHEET 4 OF 4

CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT USDA.

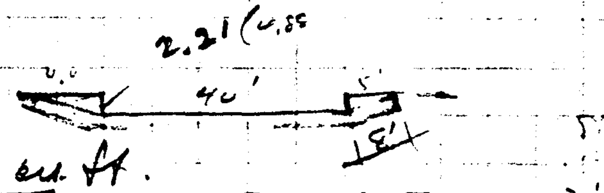
PROJECT BULLDOG FLOODWAY

SUBJECT MAT'L. TAKE-OFF

WEIR INLET #7 SHT. 2-24 / 2-10

USE SAME QUANTITIES AS FOR #6 = 101 cy

WEIR INLET #8 SHT. 2-26 / 2-11



$\frac{56+70}{2} \times 25 \times 2 = \frac{3150 \text{ cu. ft.}}{27} = 116.7$ cy.

HAUNCH. $\frac{2 \times 2.5 \times 70}{27} = 13.$ cy

129.7 cy.

WEIR INLET #9 SHT.

$150' \times 210' \times 2 = \frac{63000 \text{ cu.ft.}}{27} = 2334$ cy.

HAUNCH. $\frac{2 \times 2.25 \times 150}{27} = 28$ cy.

2362 cy.

EBASCO SERVICES INCORPORATED

BY R. DRILLER DATE 4/4/86 SHEET 1 OF 2

CHKD. BY ________ DATE ________ OFS NO. ________ DEPT. NO. ________

CLIENT USDA

PROJECT BULLDOG FLOODWAY

SUBJECT ENERGY DISSIPATOR №2 (MATL TAKEOFF)

ENERGY DISSIPATOR №2 SHT 2-30

GROUTED RIP RAP

BOTT. $\frac{50+100}{2} \times 241.2 = 18090$ ft²

$100 \times 60 = 6000$ "

SIDES: $37 \times 175 = 6615$ "

$37.8 \times 60 \times 2 = 4536$ "

$\frac{35241 \times 3}{27} = 3915.7$ cy.

(ADD) $(85 \times 4 \times 3) \times 2 = \frac{1920 \text{ cu ft.}}{27} = 72$ cy.

HAUNCH

$3.5 \times \frac{5}{27} \times 210 = 136.1$ cy.

18"- GROUTED RIPRAP TOTAL ~~4051.8~~ 4123.8 cy.

LOOSE ROCK RIPRAP

$210 \times \frac{25}{27} \times 3 = 583.3$ cy.

HAUNCH $210 \times \frac{2.5}{27} \times 4.5 = 87.5$ "

24" LOOSE ROCK RIPRAP TOTAL 670.8 cy.

CONT. SHT 2

EBASCO SERVICES INCORPORATED

BY R. DRILLER DATE 4/7/86 SHEET 2 OF 2

CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT USDA

PROJECT BULL DOG FLOODWAY

SUBJECT ENERGY DISSIPATOR No 2 (MAT'L TAKEOFF)

ENERGY DISSIPATOR No 2 (CONT.) SHT. 2-30

1'-6 DRAIN FILL

△ (ADD) 72/2 = 36 △

△ $\frac{4052 \text{ cy.}}{2}$ (3'-0 THICK GROUTED ROCK RIPRAP) = ~~2026 cy.~~ 1'-6 DRAIN FILL

△ 2062

1'-0 TRANSITION FILL

$\frac{50+80}{2} \times 145$ = 9425 cu ft.

$37 \times 140 \times 2$ = 9240 " "

$\frac{18665}{27}$ = ~~691.3~~ TRANS FILL.

△ (ADD) 72/3 △ 24

1'-0 DRAIN FILL △ 715.3 cy.

$\frac{584 \text{ cy.}}{3}$ (3'-0 THICK LOOSE ROCK RIPRAP) = 194.7 cy. DRAIN FILL

6" ϕ PVC PERFORATED

4 × 37.7 = 151 LIN FT. w/ 4 TEE CAPS

10 × 8.4 'lg. = 84 LIN FT. w/ 10 TEE CAPS

235 LIN FT. w/ 14 TEE CAPS

ANIMAL GUARD

14 sq. FT. 1/2" MESH 11 GA. STAINLESS STEEL SCREEN

EBASCO SERVICES INCORPORATED

BY R DRILLER DATE 4/7/86 SHEET 1 OF 1

CHKD. BY ______ DATE ______ OFS NO. ______ DEPT. NO. ______

CLIENT USDA.

PROJECT BULLDOG FLOODWAY

SUBJECT MATL TAKEOFF

FENCE ALONG RIGHT OF WAY SHT 2-2

4,220
2,140
1,930

8,290 SOUTH LINE

1,450
750
900
2000
2700
1500
480
1,700

10,480 NORTH LINE

18,770 LIN FT. TOTAL

EBASCO SERVICES INCORPORATED

BY M BAGHAEI DATE 2-26-86 SHEET 1 OF 1

CHKD. BY ______ DATE ______ OFS NO USDA 3767400 DEPT. NO. 523

CLIENT U.S.D.A.

PROJECT BULLDOG FLOODWAY & APACHE JUNCTION FLOOD PROTECTION

SUBJECT EXCAVATION & FILL FOR BULLDOG FLOODWAY & APACHE JCT OUTLET CHANNEL

SHEET NO.	STATION	EXCAVATION CU.YD.	FILL (1) CU.YD.	FILL (2), BEHIND WALL CU.YD	TOTAL FILL CU.YD
2-3	101+50 115+00	2840	2497	524	3021
2-4	115+00 129+76.16	1541	3277	764	4041
2-7	129+76.16 145+00	4858	14476	996	15472
2-8	145+00 160+00	14291	602	947	1549
2-9	160+00 175+00	22400	681	951	1632
2-10	175+00 190+00	22863	6233	975	7208
2-11	190+00 205+50	46567 115,360	1228	961	2189
2-12	205+50 219+75.13	56440	15	—	15
GRAND TOTAL	101+50 219+75.13	171801.	29009	6118	35127
APPROX		172000	29000	6,120 6200	35200

581/8-81

EBASCO SERVICES INCORPORATED

BY M.BAGHAEI DATE 2-14-86 SHEET 1 OF 4

CHKD. BY ________ DATE ________ OFS NO. USDA37167400 DEPT. NO. 523

CLIENT U.S.D.A.

PROJECT BULLDOG FLOODWAY & APACHE JUNCTION FLOOD PROTECTION

SUBJECT BULLDOG FLOODWAY, EXCAVATION

"EXCAVATION"

DRAWING NO. SHEET NO.	STATION	EXCAVATION W/OLD SECTION CU.YD.	EXCAVATION W/NEW SECTION CU.YD.	DIFFERENCE CU.YD.
2-7	129+76.16 145+00	5298	4858	439
2-8	145+00 160+00	17291.	14291	3000
2-9	160+00 175+00	27400	22400	5000
2-10	175+00 190+00	25363	22863	2500
2-11	190+00 205+50	49867	46567	3300
2-12	205+50 219+75.13	56440	56440	—
GRAND TOTAL	129+76.16 219+75.13	~~181659~~ "SUPERSEDED"	167420	14239

581/8-81

EBASCO SERVICES INCORPORATED

BY M. BAGHAEI DATE 2-26-86 SHEET 2 OF 4

CHKD. BY ______ DATE ______ OFS NO. USDD3767-400 DEPT. NO. 533

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE JUNCTION FLOOD PROTECTION

SUBJECT APACHE JCT OUTLET CHANNEL

"EXCAVATION"

DRAWING NO. SHEET NO.	STATION	EXCAVATION W/OLD SECTION CU.YD.	EXCAVATION W/NEW SECTION CU.YD.	DIFFERENCE CU.YD.
2-3	101+50 115+00	2781	N.A.	—
2-4	115+00 129+76.16	1541	N.A.	—
GRAND TOTAL	101+50 129+76.16	4322	N.A.	—

4,322

EBASCO SERVICES INCORPORATED

BY M.BAGHAEI DATE 2-14-86 SHEET 3 OF 4

CHKD. BY ________ DATE ________ OFS NO. USDA 3767.400 DEPT. NO. 523

CLIENT U.S.D.A.

PROJECT BULLDOG FLOODWAY & APACHE JUNCTION FLOOD PROTECTION

SUBJECT BULLDOG FLOODWAY "EXCAVATION"

"FILL"

DRAWING NO. SHEET NO.	STATION	FILL(1) CU.YD.	FILL(2) "BEHIND WALL" CU.YD.	TOTAL FILL CU.YD.
2-7	129+76.16 145+00	14476	996	15472
2-8	145+00 160+00	602	947	1549
2-9	160+00 175+00	681	951	1632
2-10	175+00 190+00	6233	975	7208
2-11	190+00 205+50	1228	961	2189
2-12	205+50 219+75.13	15	——	15
TOTAL	129+76.16 219+75.13	23235	4830	28065

581/8-81

EBASCO SERVICES INCORPORATED

BY M BAGHAEI DATE 2-26-86 SHEET 4 OF 4

CHKD. BY ______ DATE ______ OFS NO USDA3767-400 DEPT. NO. 623

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE JUNCTION FLOOD PROTECTION

SUBJECT APACHE JCT OUTLET CHANNEL

"FILL"

DRAWING NO SHEET NO.	STATION	FILL (1) CU.YD.	FILL (2) CU.YD.	TOTAL FILL CU.YD.
2-3	101+50 115+00	2497	524	3021
2-4	115+00 129+76.16	3277	764	4041
GRAND TOTAL	101+50 129+76.16	5774	1288	7062

581/8-81

EBASCO SERVICES INCORPORATED

BY N. Hung DATE 3/26/86 SHEET ____ OF ____

CHKD. BY ____ DATE ____ OFS NO. ____ DEPT. NO. ____

CLIENT ~~USDA SOIL CONSERVATION SERVICE~~

PROJECT APACHE-BULLDOG FLOOD CONTROL PROJECT

SUBJECT QUANTITIES

APACHE FLOODWAY: 1537.5'

DRAIN FILL = 1537.5 (1' x 2) = 3075 cu.ft = 113.9 cu.yd

TRANSITION FILL = 1537.5 (2)(3 - 1) = 6150 cu.ft = 227.8 cu.yd

BULLDOG FLOODWAY: 10,145'

DRAIN FILL = 10145 x 2 x 1 = 20290 cu.ft = 751.5 cu.yd

TRANSITION FILL = 10145 x 2 x (3 - 1) = 40580 cu.ft = 1503 cu.yd

EBASCO SERVICES INCORPORATED

BY M. BAGHAEI DATE 2-24-86 SHEET 2-3 SHEET 1 OF ____

CHKD. BY ____ DATE ____ OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT APACHE ~~CF~~ OUTLET CHANNEL

NO.	STATION	DISTANCE FT.	DISTANCE 'd' FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
—	101+50		230	117	997	—	—	11.10		d = 460/2 = 230
		460								
	106+10		255	39	369	—	—	11.10		d = (460+50)/2 = 255
		50								
	106+60		37.5	24	34	23.	32	11.10		d = (50+25)/2 = 37.5
		25								
	106+85		120	28	124	9.5	43	11.10		d = (25+215)/2 = 120
		215								
	109+00		202.5	114	855	—	—	11.10		d = (215+190)/2 = 202.5
		190								
	110+90		150	10.	56	55	306	11.10		d = (190+110)/2 = 150
		110								
	112+00		130	21	102	33	68	11.10		d = (110+150)/2 = 130
		150								
	113+50		150	29	161	16	34	11.10		d = 150
		150								
	115+00		75	51	142	—	—	11.10		d = 150/2 = 75
	@DIKE sta 114+00				2840		2014		524	
							2497			

EBASCO SERVICES INCORPORATED

BY M. BAGHAEI DATE 2-24-86 SHEET 2-4 SHEET 2 OF ____

CHKD. BY ____ DATE ____ OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT APACHE JCT OUTLET CHANNEL

NO.	STATION	DISTANCE FT.	DISTANCE "d" FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
	115+00		5	51	10	—	—	11.10	2	
		10								
	115+10		31.5	30	35	—	—	11.10	13	
		53								
	115+63		326.5	44	532	57	690	14.75	179	
		600								
	121+63		645.56	15	359	40	957	14.0	335	
		691.11								
	128+54.11		406.58	34	512	63	949	13.5	204	
		122.05								
	129+76.16		61	42	95	301	681	13.5	31	
					1541		3277		764	

EBASCO SERVICES INCORPORATED

BY M.BAGHAEI DATE 2-14-86 SHEET 2-7 SHEET 3 OF ____

CHKD. BY ______ DATE ______ OFS NO. 3767.400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY / APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE "d" FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
	129+76.10		50	42	78.	301	557	17		
		99.90								
	130+76.		79.5	22.	65.	320	942	17		
		59								
	131+35		114	12	51	626	2643	17		
		55								
	131+90		55.5	25	52	330	678	17		
		56								
	132+46		41	20	31	419	636	17		
		26								
	132+72		114.5	23	98	352	1492.	17		
		203								
	134+75		251.5	33	308	280	2608	17		
		300								
	137+75		275.5	89	908	162	1653	17		
		251								
	140+26		362.5	112	1504	4	54	17		
		474								
	145+00		237	251	2203	—	—	17		
	TO NEXT PAGE				5298		11263		996	

891/8-81

EBASCO SERVICES INCORPORATED

BY M. BRECHAEL DATE 2-14-86 SHEET 2-7 SHEET 4 OF ____

CHKD. BY ______ DATE ______ OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULL DOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE FT.	EXCAVATION AREA FT²	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT²	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT²	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
					5298		11263		996	
	DIKE ①									
	132+46						2322			
	137+75						891			
					5298		14476		996	4858

301/8-81

EBASCO SERVICES INCORPORATED

BY M.BAGHAEI DATE 2-14-86 SHEET 2-8 SHEET 5 OF

CHKD. BY DATE OFS NO. 3767.400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULL DOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE "d" FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION	
1	145+00		112.5	251	1046	—	—	17	71	50	200
		225									
2	147+25		187.5	213	1479	—	—	17	118	29	201
		150									
3	148+75		137.5	239	1217	4.4	22.5	17	87	44	224
		125									
4	150+00		162.5	225	1354	36	217	17	103	40	240
		200									
5	152+00		215	267	2126	45.4	362	17	136	58	462
		230									
6	154+30		200	226	1674	—	—	17	126	39	359
		170									
7	156+00		190	264	1858	—	—	17	120	65	456
		210									
8	158+10		200	286	2119	—	—	17.	126	59	437
		190									
9	160+00		95	403	1418	—	—	17	60	96	338
					14291		602		947		3000

881/8-81

EBASCO SERVICES INCORPORATED

BY M. BAGHAS' DATE 2-14-86 SHEET 2-9 SHEET 6 OF ____

CHKD. BY ______ DATE ______ OFS NO. 3767.400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULL DOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE 'd' FT.	EXCAVATION AREA FT²	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT²	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT²	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
	160+00		100	403	1493	—	—	17	63.	96 356
		200								
	162+00		200	426	3156	—	—	17	126	103 763
		200								
	164+00		137.5	400	2037	—	—	17	87	97 494
		75								
	164+75		50.	292	541	—	—	17	32	56 104
		25								
	165+00		105	378	1470	7.5	30	17	67	86 335
		185								
	166+85		150	395	2195	21	117	17	95	94 523
		115								
	168+00		100.5	387	1441	45	168	17	64	91 339
		86								
	168+86		55.5	484	995	—	—	17	35	124 235
		25								
	169+11		34.	630	794	—	—	17	22	122 154
		43								
	169+54		112	558	2315	—	—	17	71	108 448
	TO NEXT PAGE				16437		315		662.	3771

EBASCO SERVICES INCORPORATED

BY M. BAGHAEI DATE 2-14-86 SHEET 2-9 SHEET 1 OF ____

CHKD. BY ________ DATE ________ OFS NO. 3767-400 DEPT. NO. 528

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE 'd' FT.	EXCAVATION AREA FT²	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT²	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT²	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION	
		181			16437		315		662		3771
	171+35		1055	420	1642.	—	—	17	67	104	407
		30									
	171+65		32.5	256	309	—	—	17	21	24	29
		35									
	172+00		167.5	326	2023	—	—	17	106	10	62
		300									
	175+00		150	358	1989	16	89	17	95	45	267
	FILL @ DIKE STA										
	164+00						9				
	164+75						52				
	165+00						7				
	168+00						73				
	171+65						65				
	172+00						71				
					22400		681		751		5000

881/8-81

EBASCO SERVICES INCORPORATED

BY M.BAGHAEI DATE 2-14-86 SHEET 2-10 SHEET 8 OF

CHKD. BY DATE OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE d FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
1	175+00		145.	358	1923.	16.0	86	16.5	89	24 129
		290.								
2	177+90		155.	333	1912	68.0	390.	16.5	95.	23.9 138
		20.								
3	178+10		110.	231.	942.	120.	489.	16.5	68.	10 41
		200.								
4	180+10		120.	229.	1018	266.5	1185.	16.5	74.	1 4.5
		40.								
5	180+50		45.	237.	395.	342.	570.	16.5	28.	2. 3.4
		50.								
6	181+00		40.	89.	132	664	984.	16.5	25.	—
		30								
7	181+30		90.	115.	383	209.	697.	16.5	55.	—
		150.								
8	182+80		155.	616	3536	36.	207	16.5	95	29 167
		160.								
9	184+40		160.	688	4077	—	—	16.5	98	22 190
		160.								
10	186+00		130	591	2845	—	—	19.5	94	70 [illegible]
	TOTAL TO NEXT PAGE				17163		4608		721	1011

581/8-81

EBASCO SERVICES INCORPORATED

BY M. BAGHAEI DATE 2-14-86 SHEET Z-10 SHEET 9 OF ____

CHKD. BY ____ DATE ____ OFS NO. 3767.400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULL DOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE d FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
					17163		4608		721	1011
		100.								
11	187+00		65	286	688	127.	306.	19.5	47.	21 195
		30.								
12	187+30		32.5	156.	187	126.5	153.	19.5	24	
		35.								
13	187+65		135	475	2375	—	—	19.5	98	34 656
		235								
14	190+00		117.5	563	2450	—	—	19.5	85	58 255
					22863				975	2500
DIKE	180+50						11666.			
							6233			

EBASCO SERVICES INCORPORATED

BY M. BAGHAEI DATE 2-14-86 SHEET 2-11 SHEET 10 OF ______

CHKD. BY ______ DATE ______ OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE "d" FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
1	190+00		100.	563.	2085	—	—	19.5	73	58 215
		200.								
2	192+00		150	664	3689	—	—	19.5	109	90 500
		100.								
3	193+00		98.	568	2062	25.5	93.	19.5	71.	63 220
		96.								
4	193+96		86.5	10	32.	182.6	585.	19.5	63.	- -
		77.								
5	194+73		222.	621	5106	—	—	19.5	161.	83 682
		367.								
6	198+40		373.5	789.	10915	—	—	19.5	270.	120 1660
										3300
		380.								
7	202+20		230.	386	3288	—	—	19.5	167.	
		80.								
8	203+00		65.	82.	197.	67	162	19.5	47.	
		50.								
9	203+50		75.	1165	3234.	—	—	—	—	
		100.								
10	204+50		100.	2942	10896	—	—	—	—	
		100								
	205+50		50.	2734	5063	—	—	—	—	
	TO NEXT PAGE				46567		840.		961	

EBASCO SERVICES INCORPORATED

BY M. BAGHAEI DATE 2-14-86 SHEET 2-11 SHEET 11 OF

CHKD. BY DATE OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE FT.	EXCAVATION AREA FT²	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT²	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT²	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
	FROM PREVIOUS PAGE				46567		840		961	
ADD	DIKE @ 202+20						219			
	DIKE @ 203+00						169			
	TOTAL				46567		1228		961	

881/8-81

EBASCO SERVICES INCORPORATED

BY M.BAGHAE DATE 2-14-86 SHEET 2-12 SHEET 12 OF ____

CHKD. BY ____ DATE ____ OFS NO. 3767.400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULL DOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE 'd' FT.	EXCAVATION AREA FT²	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT²	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT²	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
	205+50		75	2734	~~7594~~					
		150								
	207+00		100	1845	6833					
		50								
	207+50		75	1221	3392					
		100								
	208+50		200	1532	11348					
		300								
	211+50		192.5	1090	7771					
		85								
	212+35		160	777	4604					
		235								
	214+70		207.5	914	7024					
		180								
	216+50		235	592	5152					
		290								
	219+40		162.6	446	2686					
		35.13								
	TOTAL TO NEXT PAGE				56404					

1594
2530
5064
6,833
3,392
11,348
3,886
30,523

891/8-81

EBASCO SERVICES INCORPORATED

BY N. BAGHAEI DATE 2-14-86 SHEET 2-12 SHEET 13 OF

CHKD. BY DATE OFS NO. 3767-400 DEPT. NO. 523

CLIENT U.S.D.A

PROJECT BULLDOG FLOODWAY & APACHE FLOODWAY PROTECTION

SUBJECT BULLDOG FLOODWAY

NO.	STATION	DISTANCE FT.	DISTANCE "d" FT.	EXCAVATION AREA FT^2	EXCAVATION VOLUME CU.YD.	FILL (1) AREA FT^2	FILL (1) VOLUME CU.YD.	FILL (2) AREA FT^2	FILL (2) VOLUME CU.YD.	REMARKS & CALCULATION
					56404					
		35.13								
	219+75.13		17.6	55	36					
					56440					

881/9-81

SECTION A, SHEET 2-3

STATION 101+50

DISTANCE

$L_1 = (3'-6") + (1'-8") + (3'-0") = 8'-2" \Rightarrow 8.17$

$H_1 = (3'-3") + (1") - (6") = 3'-8" \Rightarrow 3.7'$

$F.R.L = (1'-6") + (10") + (1'-9") = 4'-1"$

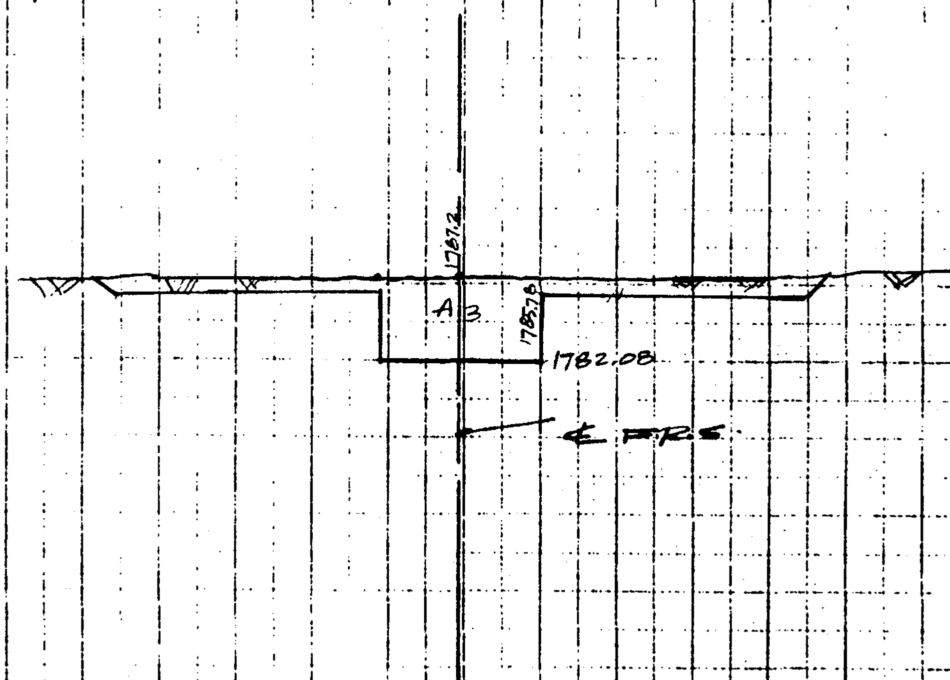
$A_{G_1} = 117$

$A_1 = 1.42^2 = 2.02 \times 2 = 4.04$

$A_2 = 2 \times 12.5 \times 1.42 = 35.5$

$A_3 = 5.12 \times 8.17 = 41.84$

$A_{F_2} = 2 \times 1.5 \times 3.7 = 11.10$



SECTION A, SHEET 2-3

STATION 106+10

$L_1 = (3'\text{-}6") + (1'\text{-}8") + (3'\text{-}0") = 8'\text{-}2" \Rightarrow 8.17$

DISTANCE 460'-0"

$H_1 = (3'\text{-}3") + (1') - (6") = 3'\text{-}8" \Rightarrow 3.7$

$HRL = (1'\text{-}6") + (10") + (1'\text{-}9") = 4'\text{-}1"$

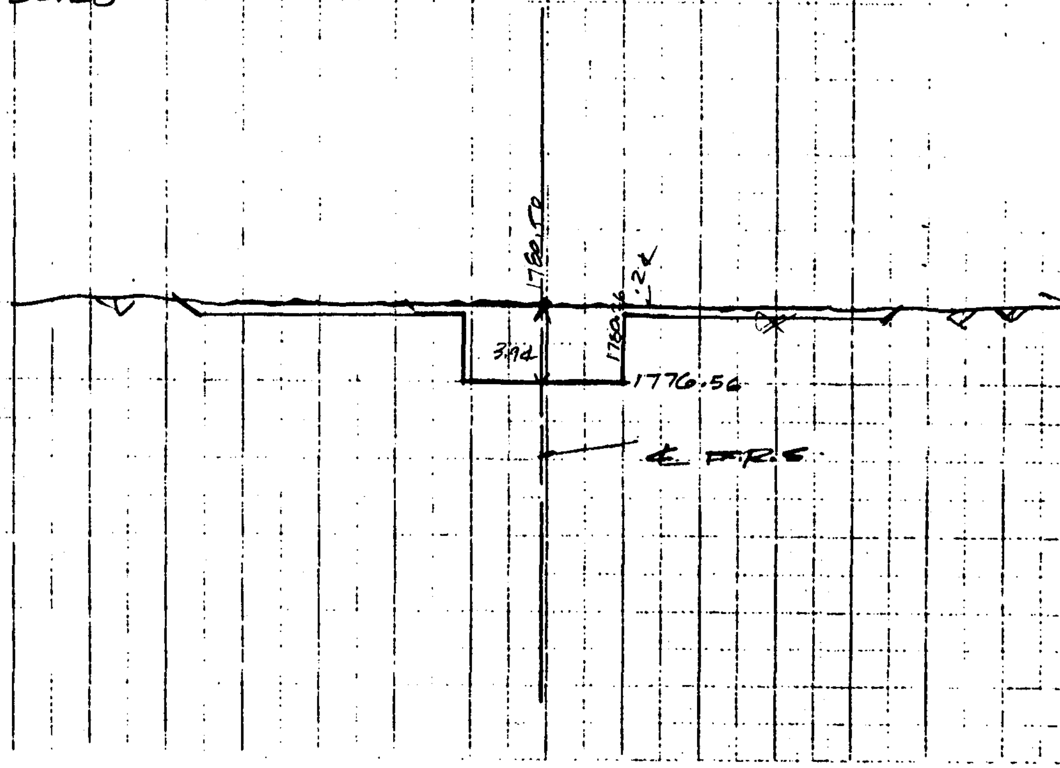
$A_{G1} = 39$

$A_1 = 2 \times 0.24^2 = 0.12$

$A_2 = 2 \times 12.5 \times 0.24 = 6$

$A_3 = 3.94 \times 8.17 = 32.20$

$A_{F2} = 11.10$



SECTION A, SHEET 2-3

STATION 106+60

DISTANCE 5.0

$L_1 = (3'-6'') + (1'-8'') + (3'-0'') = 8'-2'' \Rightarrow 8.17$

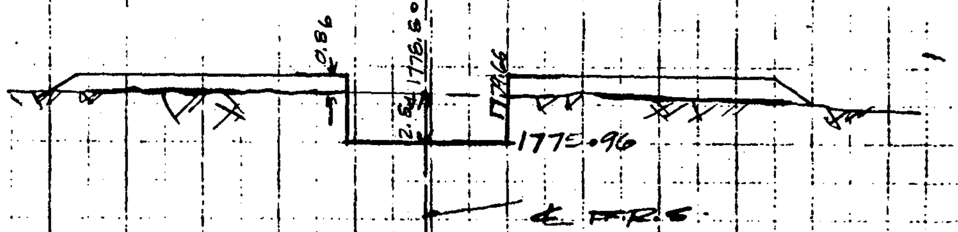
$H_1 = (3'-3'') + (1'') - (6'') = 3'-8'' \Rightarrow 3.7$

$FRL = (1'-6'') + (10'') + (1'-9'') = 4'-1''$

$A_{C1} = 2.84 \times 8.17 = 23.21$

$A_{F1} = 2 \times 0.86^2 + 2 \times 2.5 \times 0.86 = 23$

$A_{F2} = 2 \times 1.5 \times 3.7 = 11.10$



SECTION A, SHEET 2-3

STATION 106 + 86

DISTANCE 25

$H_1 = (3'\text{-}6") + (1'\text{-}8") + (3'\text{-}0") = 8'\text{-}2" \Rightarrow 8.17$

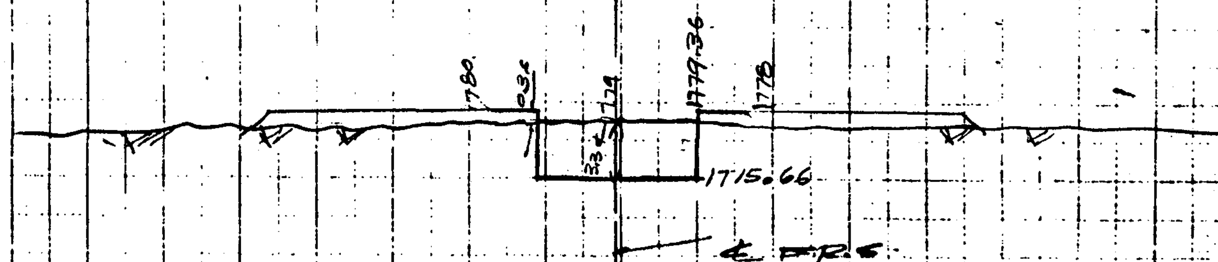
$H_1 = (3'\text{-}3") + (1") - (6") = 3'\text{-}8" \Rightarrow 3.7$

$FRL = (1'\text{-}6") + (10") + (1'\text{-}9") = 4'\text{-}1"$

$A_{C1} = 3.34 \times 8.17 = 27.30$

$A_{F1} = 2 \times 0.36^2 + 2 \times 12.5 \times 0.36 = 9.26$

$A_{F2} = 11.10$



National 12-188 Made in USA

SECTION A, SHEET 2-3

STATION 109+00

DISTANCE 215

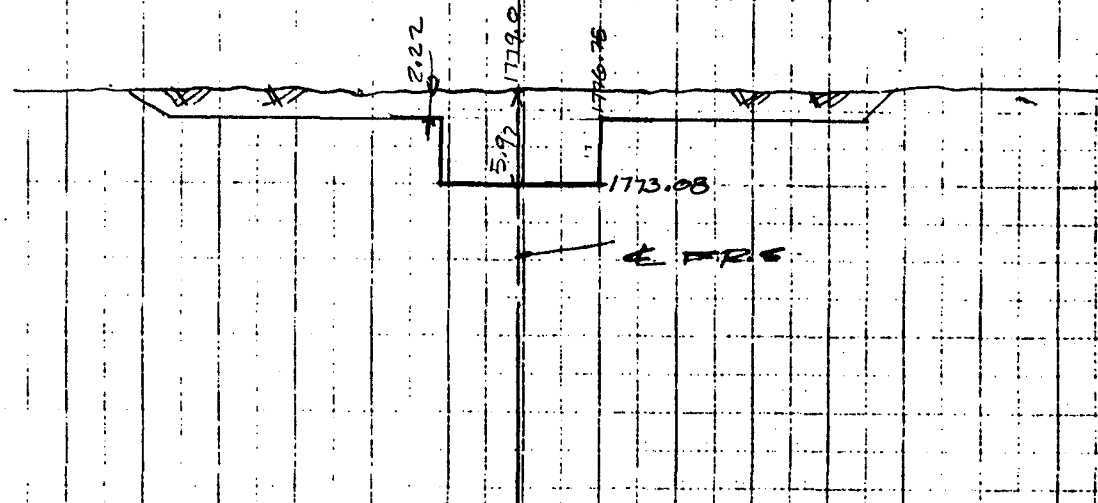
$H_1 = (3'-6") + (1'-8") + (3'-0") = 8'-2" \Rightarrow 8.17$

$H_1 = (3'-3") + (1") - (6") = 3'-8" \Rightarrow 3.7$

F.B.L = (1'-6") + (10") + (1'-9") = 4'-1"

$A_G = 114 \begin{cases} A_1 = 2 \times 2.22^2 = 9.86 \\ A_2 = 2 \times 2.5 \times 2.22 = 55.5 \\ A_3 = 5.92 \times 8.17 = 48.40 \end{cases}$

$A_{F2} = 11.10$



National 12-188
10 Millimeters to the Centimeter

SECTION A, SHEET 2-3

STATION 110+90

DISTANCE 190

L1 = (3'-6") + (1'-8") + (3'-0") = 8'-2" ⇒ 8.17

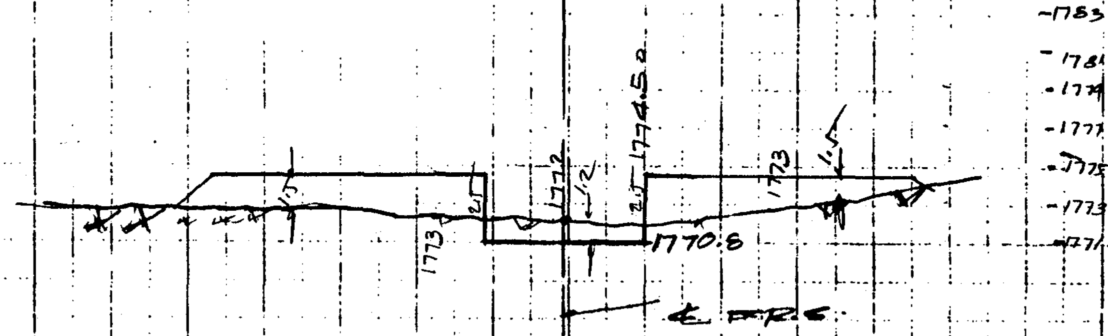
H1 = (3'-3") + (1") - (6") = 3'-8" ⇒ 3.7

HR.L = (1'-6") + (10") + (1'-9") = 4'-1"

AC1 = 1.2 × 8.17 = 9.80

AFF1 = 2×1.50² + 2×12.5×2 = 54.5

AF2 = 2×1.5×3.7 = 11.10



12-188
National

ECTION A, SHEET 2-3 STATION 112+00

DISTANCE 110

$L_1 = (3'-6") + (1'-8") + (3'-0") = 8'-2" \Rightarrow 8.17$

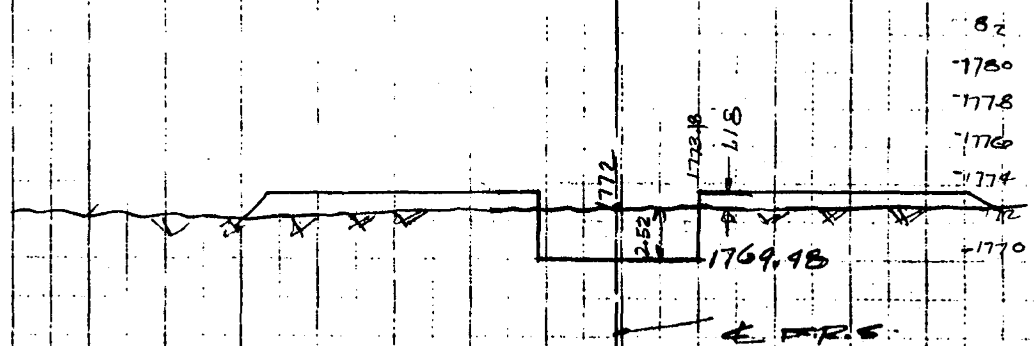
$H_1 = (3'-3") + (1") - (6") = 3'-8" \Rightarrow 3.7$

$FRL = (1'-6") + (10") + (1'-9") = 4'-1"$

$AC = 2.52 \times 8.17 = 20.60$

$AF1 = 2 \times 1.18^2 + 2 \times 2.5 \times 1.18 = 323$

$AF_2 = 11.10$



National 12-188

SECTION A, SHEET 2-3 STATION 113+50

$H_1 = (3'-6") + (1'-8") + (3'-0") = 8'-2" \Rightarrow 8.17$ DISTANCE 150

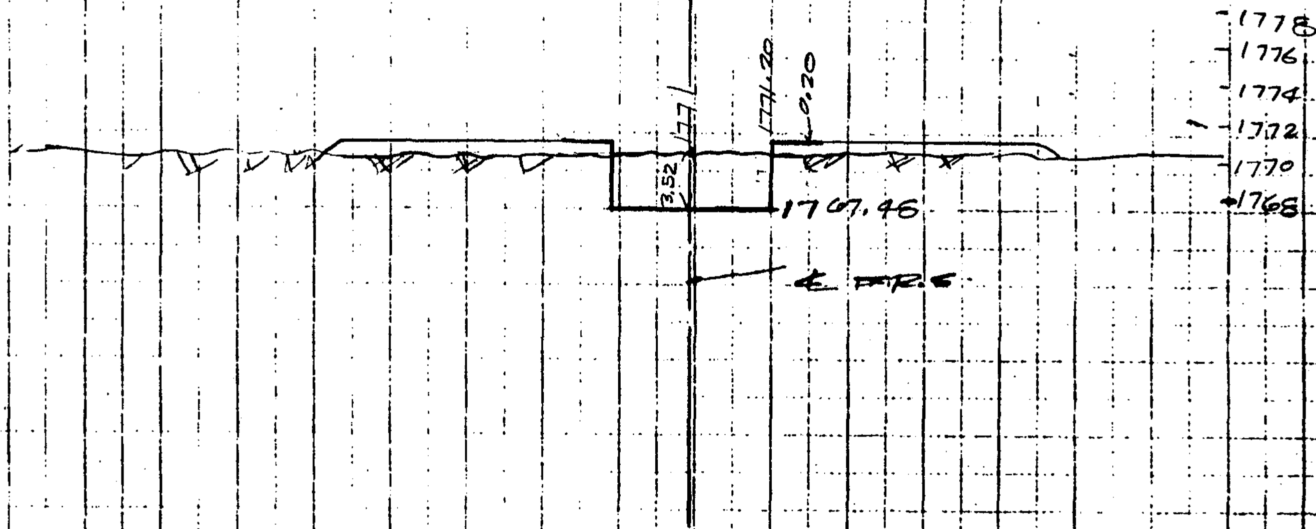
$H_1 = (3'-3") + (11") - (6") = 3'-8" \Rightarrow 3.7$

$\#R.4 = (1'-6") + (10") + (1'-9") = 4'-1"$

$A_G = 3.52 \times 8.17 = 28.76$

$AF_1 = 2 \times 0.20^2 + 2 \times 12.5 \times 0.20 = 5.10$

$AF_2 = 11.10$



National 12-188 Made in USA
10 Millimeters to the Centimeter

SECTION A, SHEET 2-~~3~~ 4

STATION 115+00

DISTANCE 150

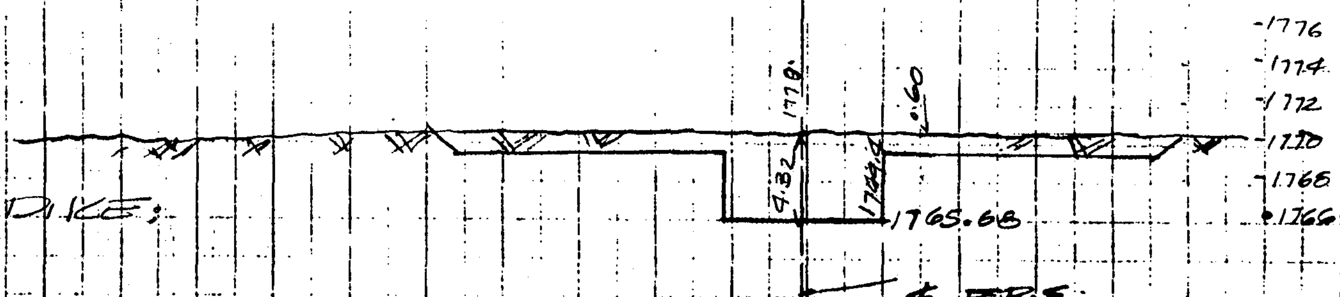
$L_1 = (3'\text{-}6'') + (1'\text{-}8'') + (3'\text{-}0'') = 8'\text{-}2'' \Rightarrow 8.17$

$H_1 = (3'\text{-}3'') + (1'') - (6'') = 3'\text{-}8'' \Rightarrow 3.7$

$F.R.L = (1'\text{-}6'') + (10'') + (1'\text{-}9'') = 4'\text{-}1''$

$A_{C_1} = 51$ $\begin{cases} A_1 = 2 \times 0.60^2 = 0.72 \\ A_2 = 2 \times 12.5 \times 0.6 = 15 \\ A_3 = 4.32 \times 8.17 = 35.30 \end{cases}$

$A_{F_2} = 11.10$



ADD FILL FOR DIKE:

$V_{@ DIKE} = \left(\frac{217.50}{2}\right)\left(\frac{500}{27}\right) = 2014\ C.Y.$

12-188
Made in USA
National

SECTION A, SHEET 2-4

STATION 115+10

$H_1 = (3'-6") + (1'-8") + (3'-0") = 8'-2" \Rightarrow 8.17$

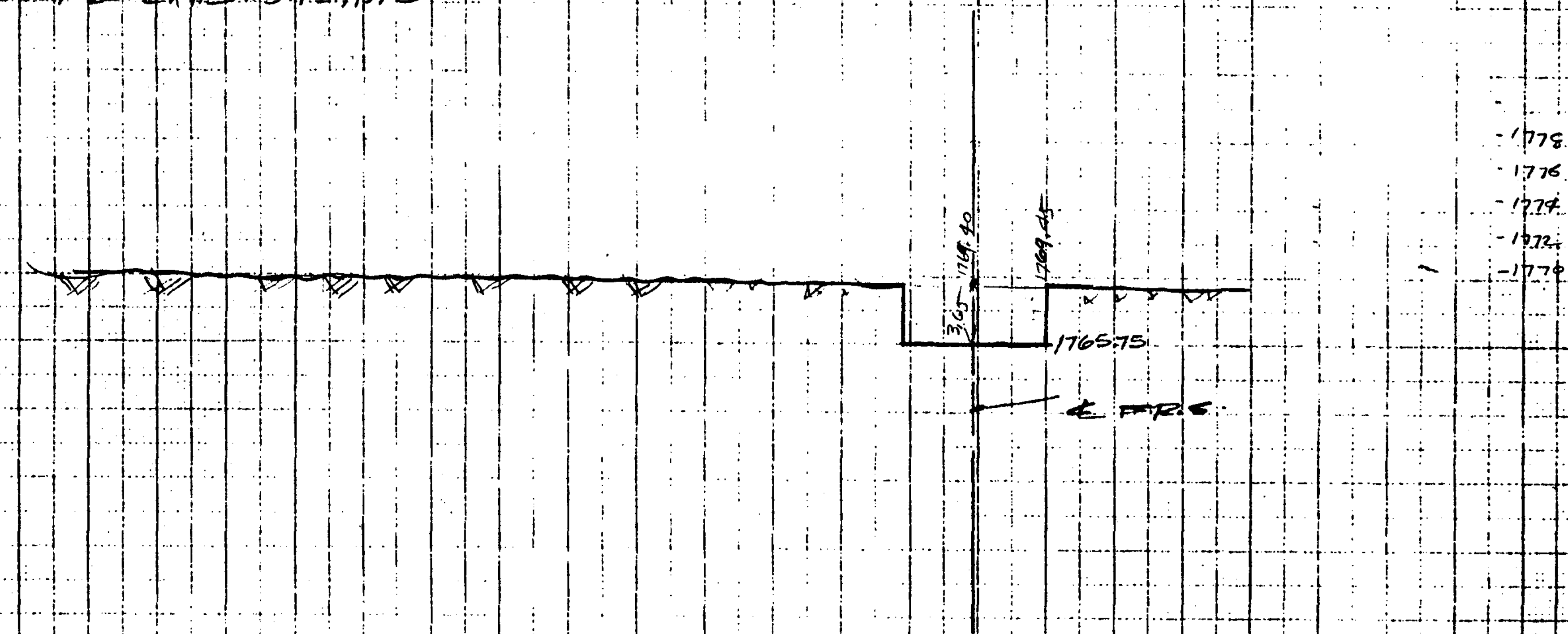
DISTANCE 1.0

$H_1 = (3'-3") + (11") - (6") = 3'-8" \Rightarrow 3.7$

FIR.L = (1'-6") + (10") + (1'-9") = 4'-1"

$AC_1 = 3.65 \times 8.17 = 29.82$

$AT_2 = 2 \times 1.5 \times 3.7 = 11.10$



National 12-188 Made in USA

SECTION A&B , SHEET 2 A

STATION 115+63

$L_1 = (10'0") + (1'8") + (3'0") = 14'8" \Rightarrow 14.67'$

DISTANCE 53

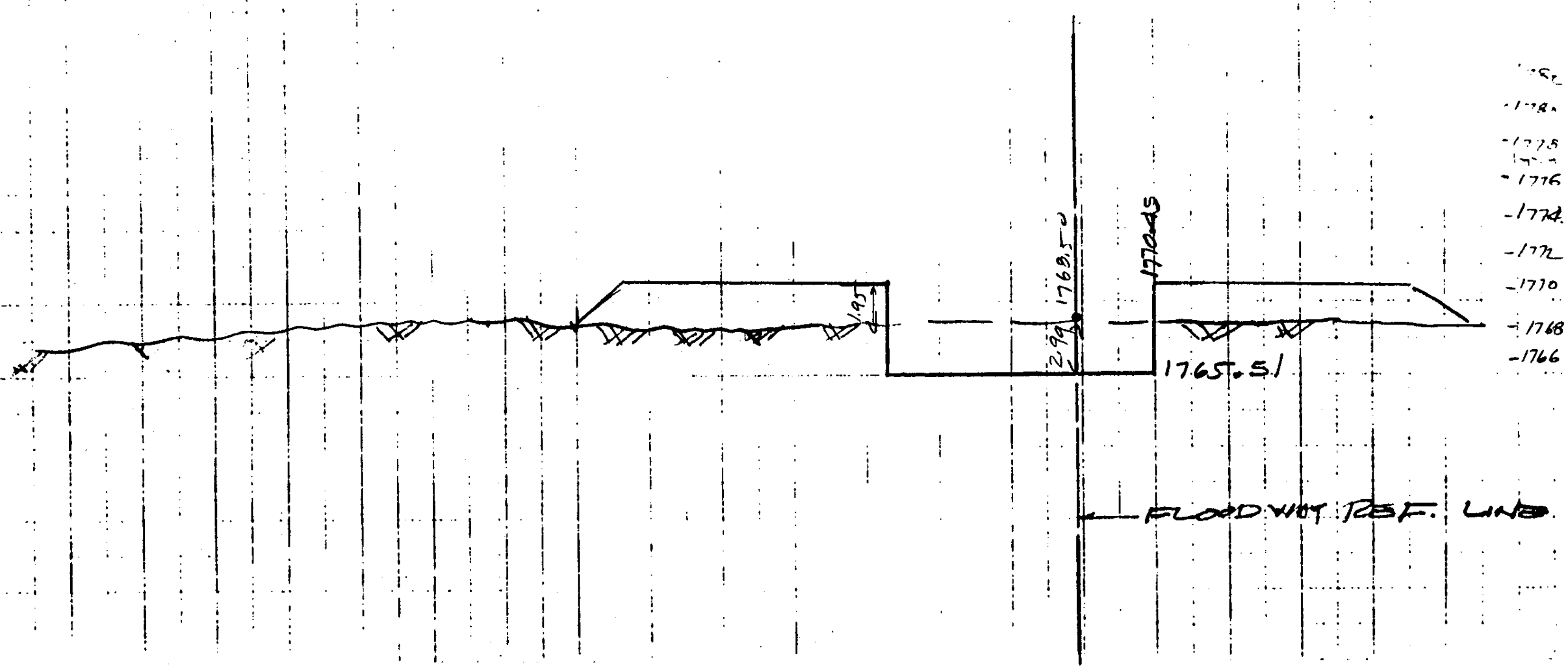
$H_1 = (4'6") + (11") - (6") = 4'11" \Rightarrow 4.92'$

$F.R.C = (1'6") + (10") + (1'9") = 4'1" \Rightarrow 4'.08$

$A_{C1} = 2.99 \times 14.67 = 43.87$

$A_{F1} = 2 \times 1.95^2 + 2 \times 12.5 \times 1.95 = 56.36$

$A_{F2} = 2 \times 1.5 \times 4.92 = 14.76$



National 12-138

ECTION A&B , SHEET 2 A

STATION 121+63

DISTANCE 600

$L_1 = (10'0") + (1'8") + (3'0") = 14'8" \Rightarrow 14.67'$

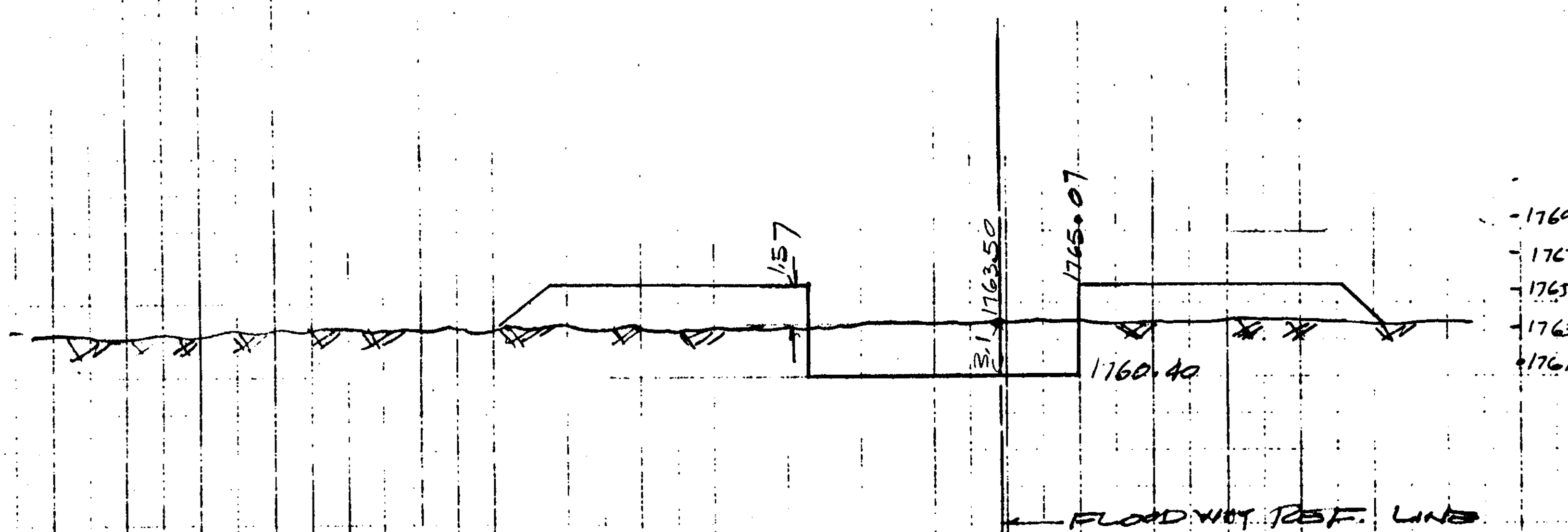
$H_1 = (4'\cancel{8}^{3}") + (11") - (6") = 4'11" \Rightarrow 4.\cancel{92}^{67}'$

$FRC = (1'6") + (10") + (1'9") = 4'1" \Rightarrow 4'.08$

$AC_1 = 3.1 \times 4.67 = 14.48$

$AF_1 = 2 \times 1.57^2 + 2 \times 12.5 \times 1.57 = 39.25$

$AF_2 = 2 \times 1.5 \times 4.67 = 14.$



12-138
National

ECTION A&B, SHEET 2 A

STATION 128+54.11

$L_1 = (10'0") + (1'8") + (3'0") = 14'8" \Rightarrow 14.67'$

DISTANCE 691.11

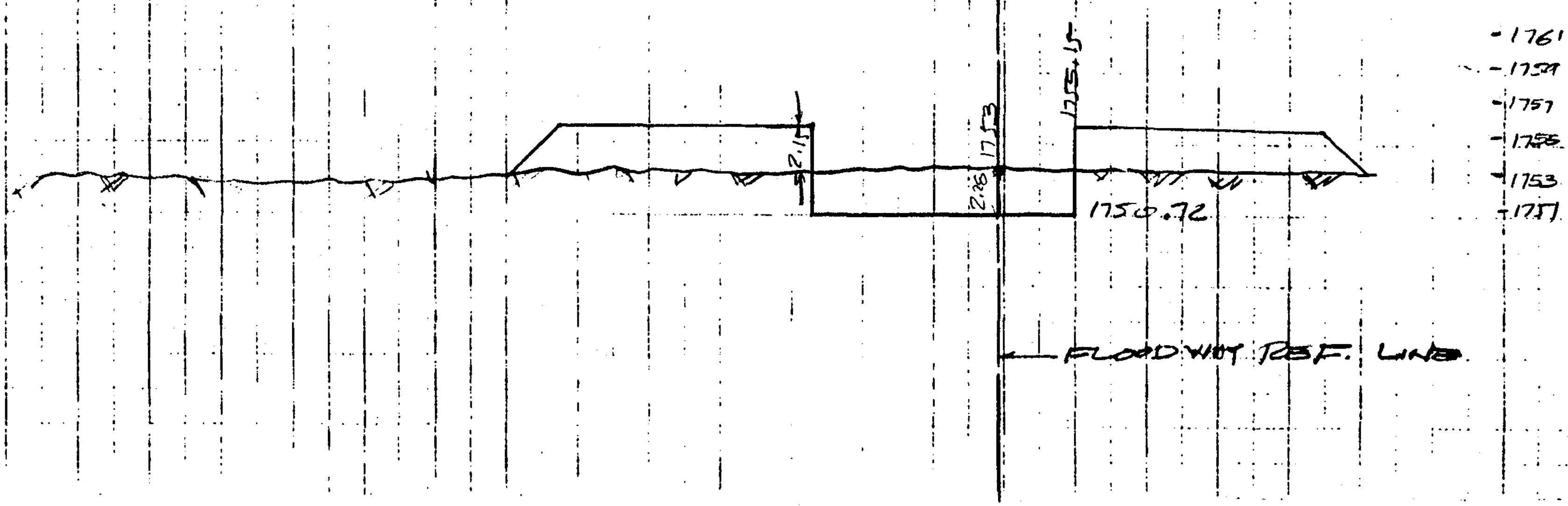
$H_1 = (4'6") + (11") - (6") = 4'11" \Rightarrow 4.92'$ (corrected: 4'0", 4.42')

$FB_c = (1'6") + (10") + (1'9") = 4'1" \Rightarrow 4'.08$

$A_{C1} = 2.28 \times 14.67 = 33.45$

$A_{F1} = 2 \times 2.15^2 + 2 \times 12.5 \times 2.15 = 63$

$A_{F2} = 2 \times 1.5 \times 4.42 = 13.26$



12-138
National

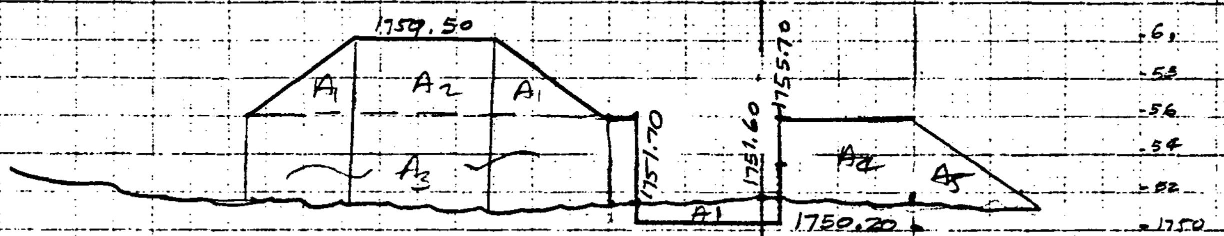
Made in USA

$L_1 = 10'0 + 2'0 + 2(1'6") = 15'0"$ SECTION "A" SHEET 2-7

$H_1 = 5'0 + 1'0" - 6" = 5'6"$

STATION 129+76.16

SHEET 2-7



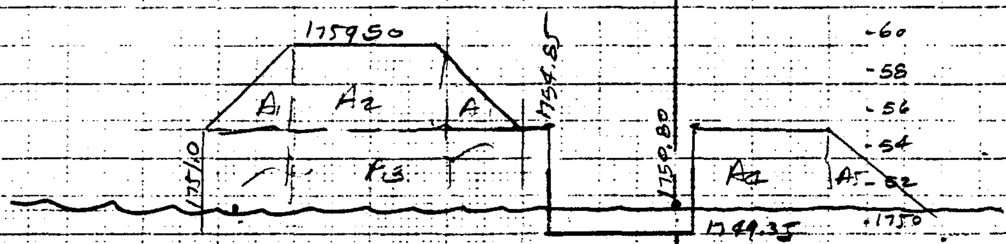
Ac = 42. { A1 = 15 x 2.8 = 42.0

AF1 = 301

A1 = 3.8^2 x 2 = 28.9
A2 = 3.8 x 14 = 53.2
A3 = 29.2 x 3.8 = 111
A4 = 5.5 x 14 = 77
A5 = 5.5^2 = 30.25

AF2 = 2x6.5x1.5 = x17

STATION 130+76



A1 = 4.65^2 x 2 = 43.3
A2 = 4.65 x 14 = 65
A3 = 4.05 x 32.6 = 132
A4 = 4 x 14 = 56
A5 = 4.65^2 = 23.13

AF1 = 320

Ac = 21.75 { A = 1.45 x 15 = 21.75

AF2 = 17

10 Millimeters to the Centimeter

10 Millimeters to the Centimeter

National 12-188 Made in USA

L = 18'-0"

W = 5'-6"

SHEET 2-7

SECTION A

SHEET 2-7

STATION 131+35

FLOODWAY REF. LINE

$A_1 = 5.5^2 \times 2 = 53$

$A_2 = 5.15 \times 14 = 72$

$A_3 = 3.46 \times 46 = 161$

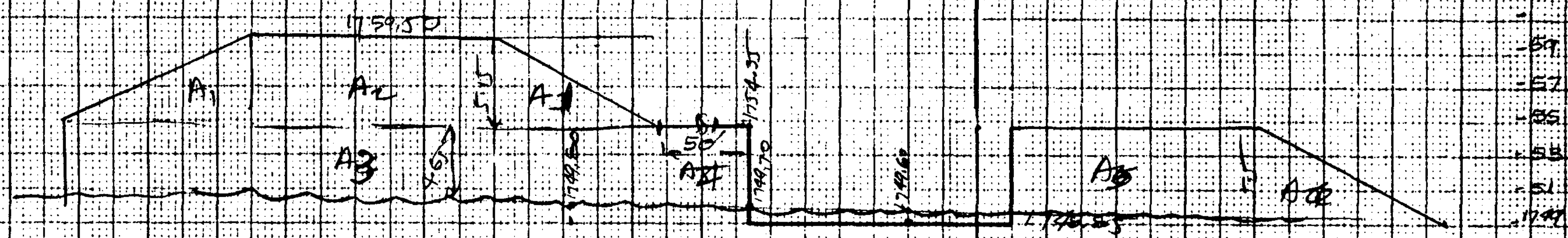
$A_4 = 4.65 \times 50 = 232$

$A_5 = 5.5 \times 14 = 77$

$A_6 = 5.5^2 \times 3 = 25$

FILL $A_T = 626$

$A_{F2} = 17$



$A_C = 12$

A_T - $0.85 \times 15 = 12$

SHEET 2-7

10 Millimeters to the Centimeter

National 12-188 Made in USA

L=16'-0"   SECTION A   STATION 131+90

FLOODWAY REF. LINE

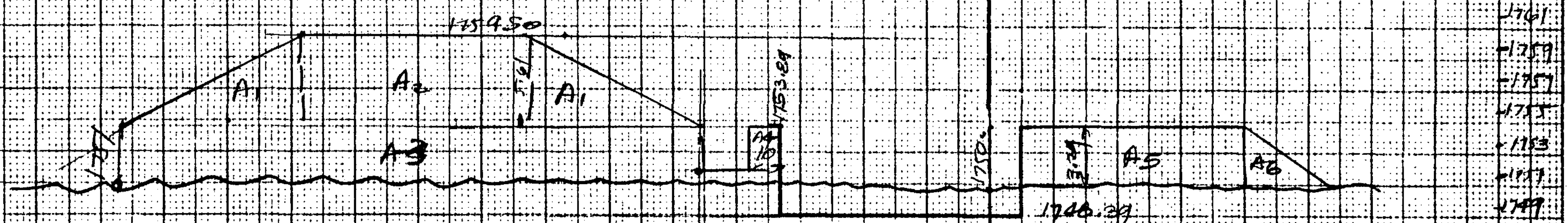
W=5'-6"

SHEET 2-7

FILL AP=330

A1=5.6²x2=63
A2=5.61x14=78.5
A3=36.44x2.89=105.5
A4=2.84x10=28.4
A5=3.29x14=46
A6=3.29²=10.8

AFR=17



Ac— {A1=1.61x15=24.15

10 Millimeters to the Centimeter

National 12-188 Made in USA

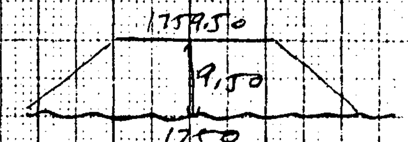
L = 16'-0" SECTION A STATION 132+46

W = 5'-0"

SHEET 2-7

FLOODWAY REF. LINE

Dike

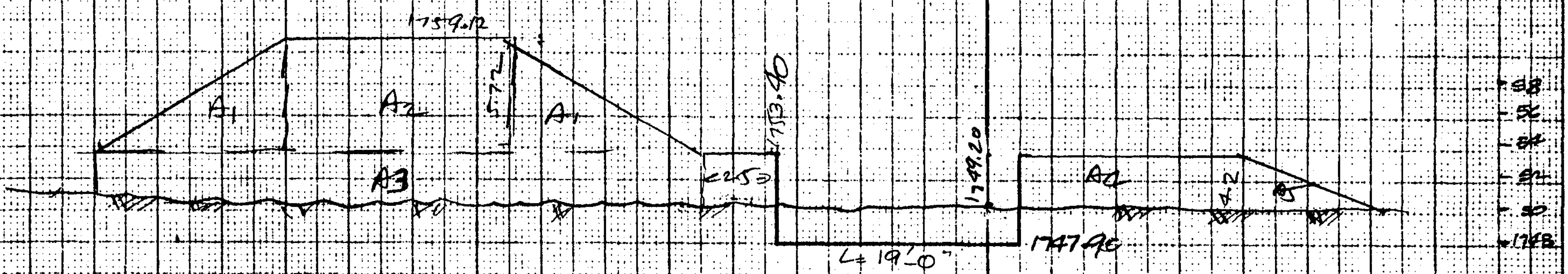


$V = \frac{(313.50)}{2} \times \frac{400}{27} = 2322$

AF1 = 49

$A_1 = 5.72^2 \times 2 = 65.5$
$A_2 = 5.72 \times 14 = 80$
$A_3 = 4.2(39.38) = 165.40$
$A_4 = 5.5 \times 14 = 77$
$A_5 = 5.5^2 = 30.25$

AF2 = 17



AC = { $A_1 = 1.3 \times 15 = 19.5$

10 Millimeters to the Centimeter

National Brand

TZ-188 Made in USA

$L = 18' + 2' + 3' = 23'0"$ SECTION B STATION 132+72

$H = (5' + 1') = 6'$ ~~4'~~ 5

SHEET 2-7

$A_1 = 5.84^2 \times 2 = 68.20$

$A_2 = 5.84 \times 14 = 82$

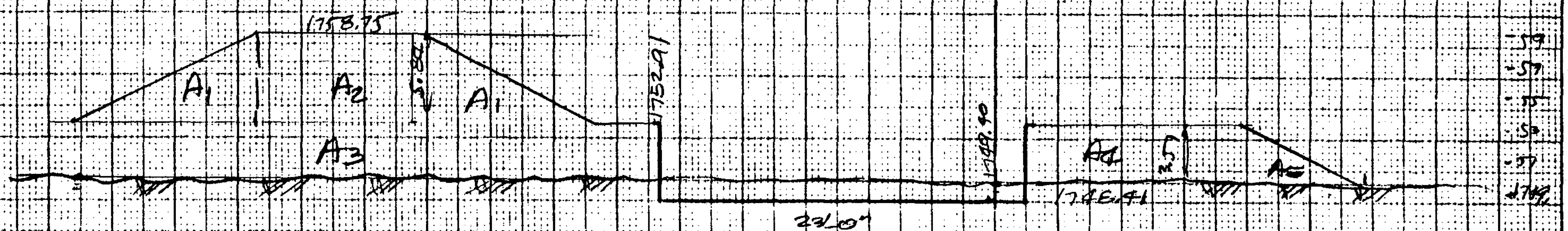
$A_3 = 39.86 \times 3.51 = 140$

$A_4 = 3.51 \times 14 = 49$

$A_5 = 3.51^2 = 12.30$

FILL $A_{F1} = 352$

$A_{F2} = 17$



$A_C = 23 \times 1 = 23$

10 Millimeters to the Centimeter

National 12-188 Made in USA

L1 = 18'+2'+3' = 23'0" SECTION B STATION 134+75

H1 = 5'+1' − 6" = 4'6"

SHEET 2-7

A_T = 280

A_1 = 5.36×2² = 57.50

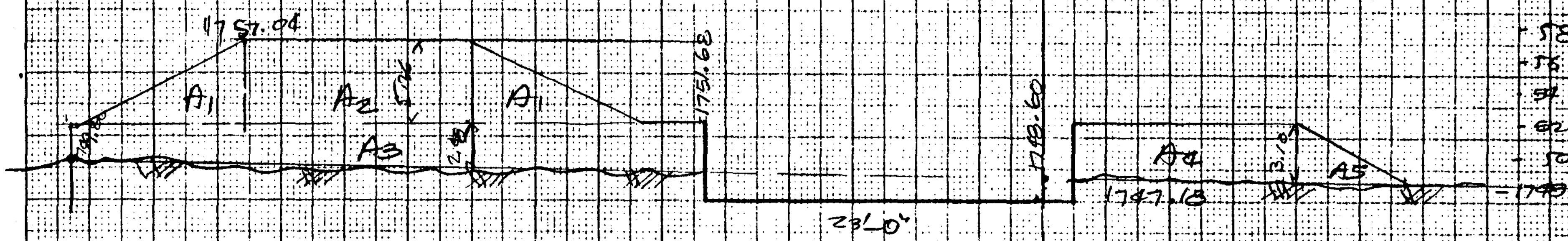
A_2 = 5.36×14 = 75

A_3 = 37.94×2.48 = 94.10

A_4 = 14×3.10 = 43.4

A_5 = 3.10² = 9.62

A_F = 17



A_c = 23×1.42 = 32.66

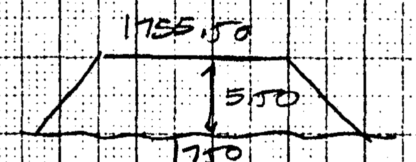
10 Millimeters to the Centimeter

National 12-188 Made in USA

$L_1 = 18' + 2' + 3' = 23'0"$ SECTION B STATION 137+75

$H_1 = 5' + 1' - 6" =$

SHEET 2-7



FILL @ DIKE

$V = \left(\frac{137.50}{2}\right)\left(\frac{350}{27}\right) = 891$ CD.

$A_1 = 5.91^2 \times 2 = 69.90$

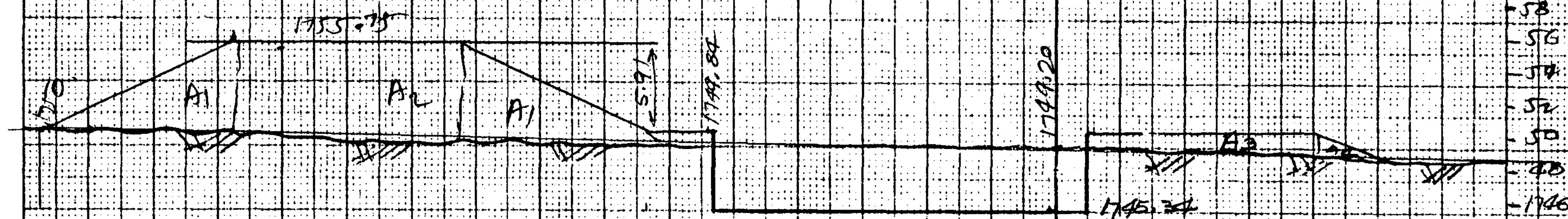
$A_2 = 5.91 \times 14 = 82.75$

$A_3 = .64 \times 14 = 9$

$A_4 = .64^2 = 0.41$

FILL $A_{F1} = 162$

$A_{F2} = 17$



$A_C = 23 \times 3.86 = 88.78$

10 Millimeters to the Centimeter

National 12-188 Made in USA

L1 = 18'+2'+3' = 23'0"   SECTION B   STATION 140+26

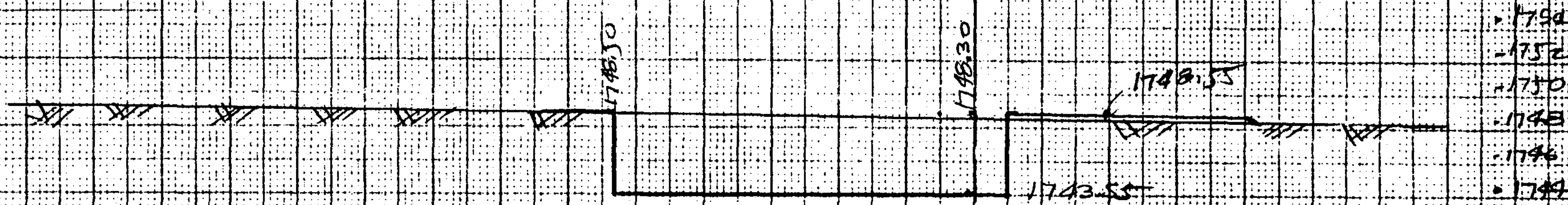
~~W1 = 5'4"~~

5'-6" (-6") = 5'-0" x 5.5

SHEET 2-7

FILL AF1 = 3.5   A1 = 0.25 x 14 = 3.5

AF2 = 17

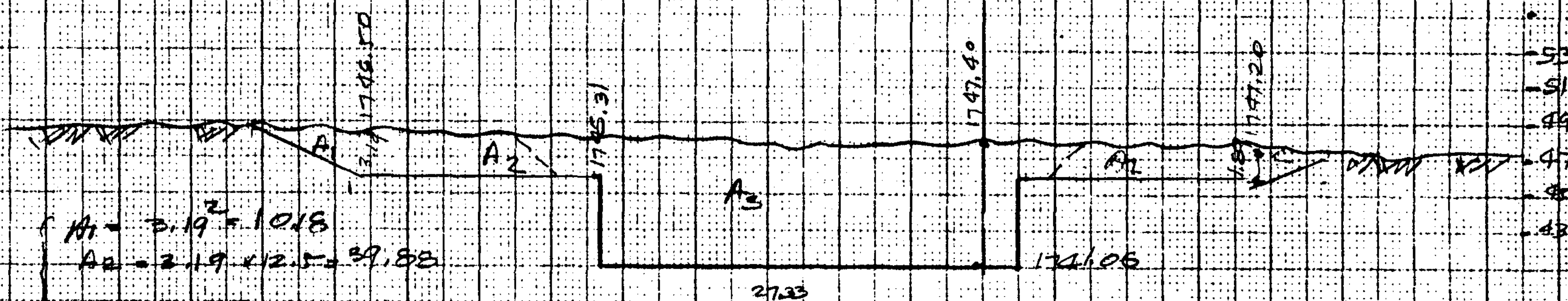


AC = 23 x 4.85 = 111.55

$L = \cancel{18'}$ = 27.33 ~~...~~ SECTION ~~B~~ C SHT 2-7 STATION 145+00

$H = \cancel{...}$ (4'-9") + (1'-0") - ~~8"~~ = 5.25

~~SHEET~~ 2-7



$A_1 = 3.19^2 = 10.18$

$A_2 = 3.19 \times 12.5 = 39.88$

$A_3 = 6.34 \times 27.33 = 173.28$

$A_4 = 1.89 \times 12.5 = 23.63$

$A_5 = 1.89^2 = 3.58$

$A_{c_1} = 251$

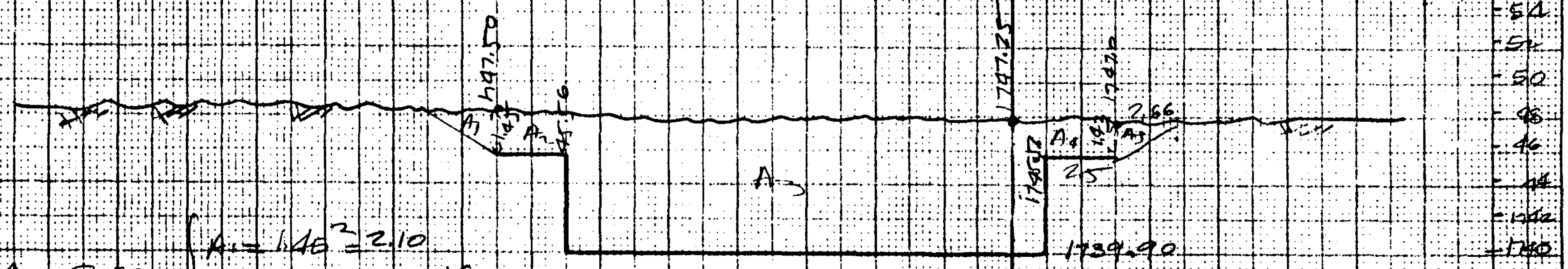
AF = .17

$A_{c_2} = 251 - 10 \times 3.19 - 10 \times 1.89 = 201$

10 Millimeters to the Centimeter

National® 12-188 Made in USA

ection A Sheet 2-8 St... 147+...
...= 22 + 2'4" + 3'0" = 27.33' ... 225'
H = 5'0" + 1'2" - (6") = 68" = 5' 8"



$A_{c_1} = 242$

$A_1 = 1.45^2 = 2.10$
$A_2 = 1.45 \times 12.5 = 18.13$
$A_3 = 7.35 \times 27.33 = 200.88$
$A_4 = 1.45 \times 12.5 = 18.13$
$A_5 = 1.45^2 = 2.10$

$A_{c_2} = 242 - 2 \times 10 \times 1.45 = 213$

$A_f = 17$

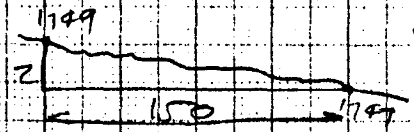
12-188
Made in USA
National

...CTION A SHEET 2-8 STA... 148+75

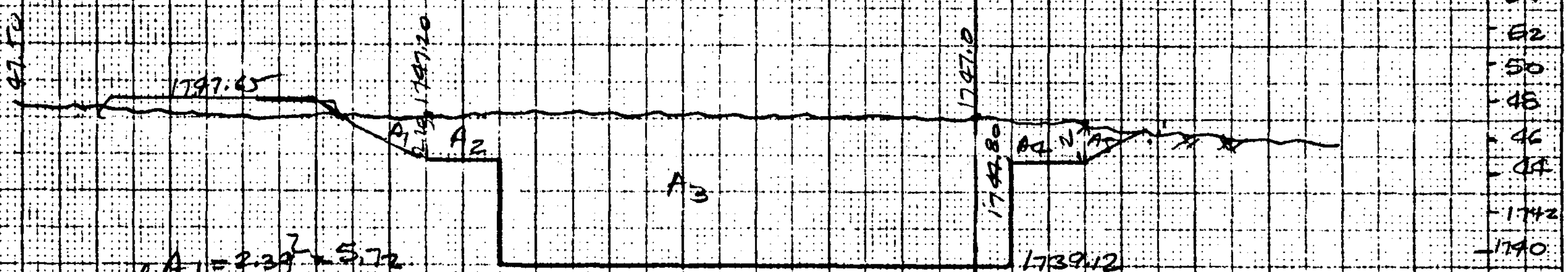
... = 22 + 2'4" + 3'0" = 27.33' DIST... 150'

H = 5'0" + 1'-2" - (6") = 68" = 5'-8"

ADD DIKE FILL



$V = \frac{2 \times 150 \times 2}{2} \times 14/27 = 156$



$A_1 = 2.39^2 = 5.72$

$A_2 = 2.39 \times 12.5 = 29.88$

$A_3 = 7.88 \times 27.33 = 215.36$

$A_4 = 2 \times 12.5 = 25$

$A_5 = 2^2 = 4$

$AC_1 = 280$

FILL $A_1 = 2.30^2 \times 2 + 14.03 = 438$

$AF_2 = 17$

$AC_2 = 280 - 2.39 \times 10 - 2 \times 10 = 236$

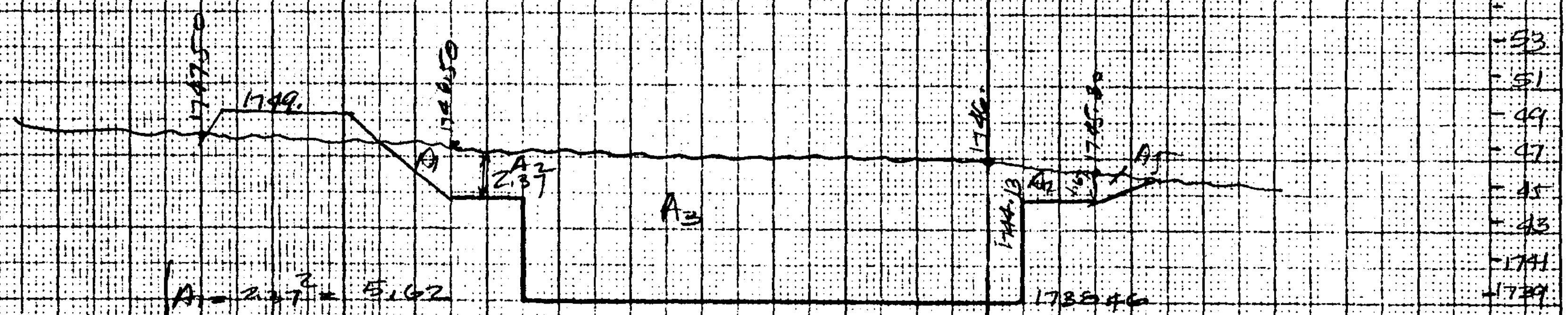
National 12-188 Made in USA

10 Millimeters to the Centimeter

…CTION A SHEET 2-B STA 150+00

= 22 + 2'-4 + 3'-0 = 27.33' Dist. = 125'

$H_1 = 5'\text{-}0 + 1'\text{-}2" - (6") = 68" = 5'\text{-}8"$



$AC_1 = 265$

$A_1 = 2.37^2 = 5.62$

$A_2 = 2.37 \times 12.5 = 29.63$

$A_3 = 7.54 \times 27.33 = 206$

$A_4 = 1.67 \times 12.5 = 20.88$

$A_5 = 1.67^2 = 2.79$

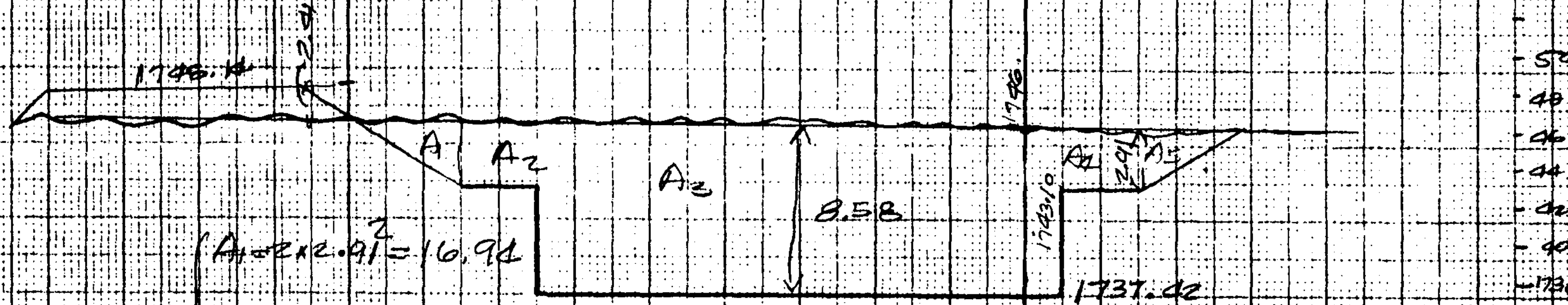
$AF_1 = 2^2 \times 2 + 14 \times 2 = 36$

$AF_2 = 17$

$AC_2 = 265 - 10 \times 2.37 - 10 \times 1.67 = 225$

National 12-188 Made in USA
10 Millimeters to the Centimeter

SECTION A SHEET 2-8 STATION 1.62+00
+ 22 + 2'4" + 3'0 = 27.33' DISTANCE 200
H = 5'-0 + 1'-2" - (6") = 68" = 5' 8"



$A_{c1} = 325$

$A_1 = 2 \times 2.91^2 = 16.94$

$A_2 = 2.91 \times 12.5 = 36.38$

$A_3 = 8.58 \times 27.33 = 234.50$

$A_4 = 2.91 \times 12.5 = 36.38$

$A_5 = 2.41^2 \times 2 + 2.41 \times 14 = 45.36$

$A_{F2} = 17$

$A_c = 325 - 2 \times 10 \times 2.91 = 267$

12-188 Made in USA

National Brand

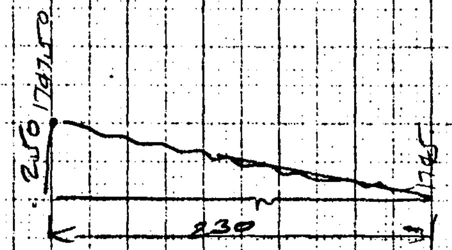
10 Millimeters to the Centimeter

ction A SHEET 2-8 STA 154+30

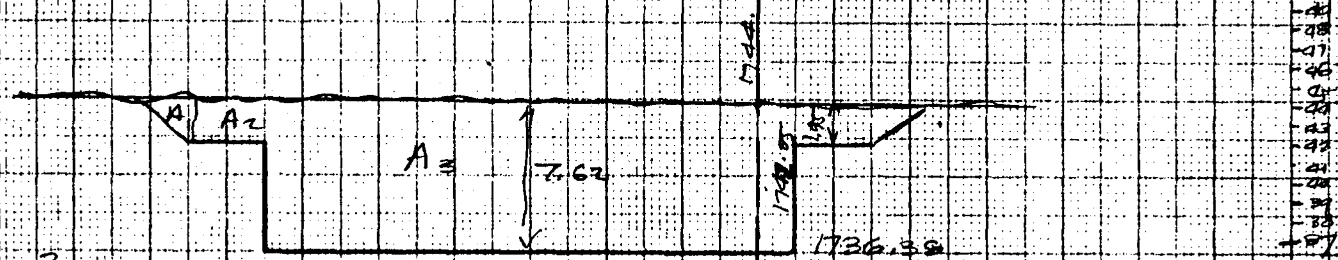
+ 22 + 2'-4 + 3'-0 = 27.33' Dist = 230

H = 5'-0 + 1'-2" (6") = 68" = 5'-8"

ADD DIKE FILL



$V = 2 \times \frac{230 \times 2.50}{2} \times 1/27 = 298$ cy.



$A_{c1} = 265$

$A_1 = 2 \times 1.95^2 = 7.61$

$A_2 = 2 \times 12.5 \times 1.95 = 48.75$

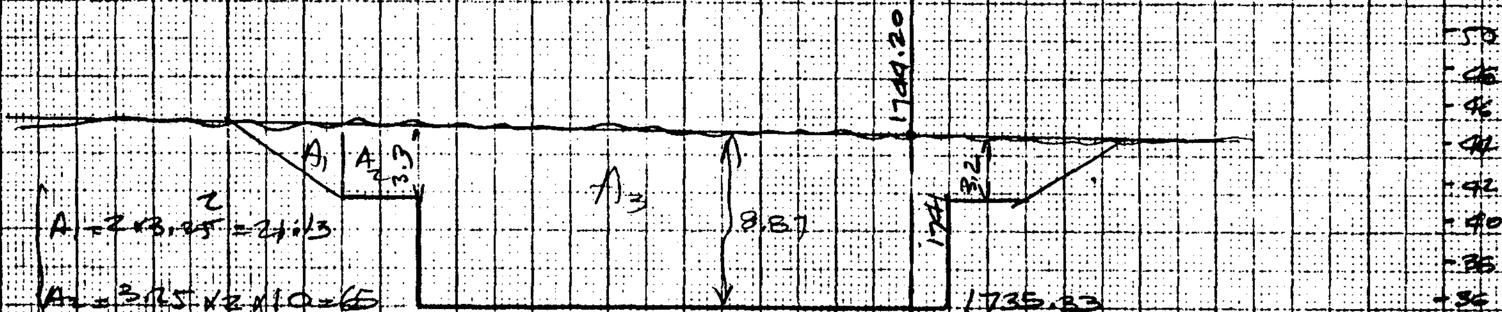
$A_3 = 7.62 \times 27.33 = 208.25$

$A_{F2} = 17$

$A_{c2} = 265 - 2 \times 10 \times 1.95 = 226$

National
12-188
Made in USA
10 Millimeters to the Centimeter

ctION A SHEET 2-8 STA ' 156+00
= 22 + 2'4 + 3'0 = 27.33' Dist = 170'
H = 5'-0 + 1'-2" - (6") = 68" = 5'-8"



2

$A_1 = 2 \times 3.25 = 21.13$

$A_{c1} = 329$

$A_2 = 3.25 \times 2 \times 10 = 65$

$A_3 = 8.87 \times 27.33 = 242.42$

FILL $A_{F2} = 2 \times 5.67 \times 1.5 = 17$

$A_{c2} = 329 - 2 \times 10 \times 3.25 = 260$

National
12-188
Made in USA
10 Millimeters to the Centimeter

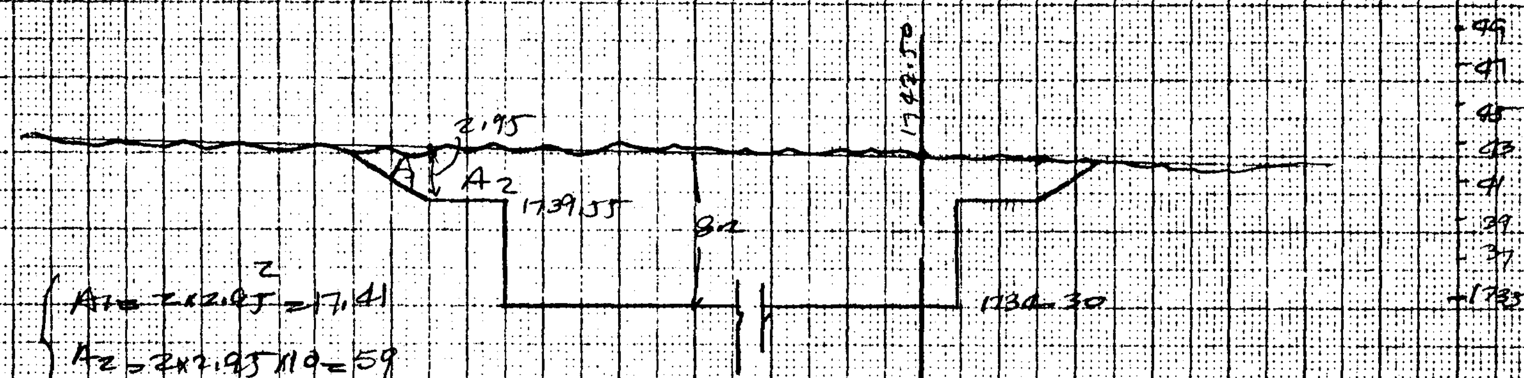
SECTION B SHEET 8

STATION 38+0

DISTANCE 210'

$L_1 = 28'\text{-}0" + (1'\text{-}8") + 3'\text{-}0" = 32.67$

$H = 4'\text{-}9" + 1'\text{-}0" - (6") = 5.25'$



$A_{c1} = 345$

$A_1 = 2 \times 2.95^2 = 17.41$

$A_2 = 2 \times 2.95 \times 10 = 59$

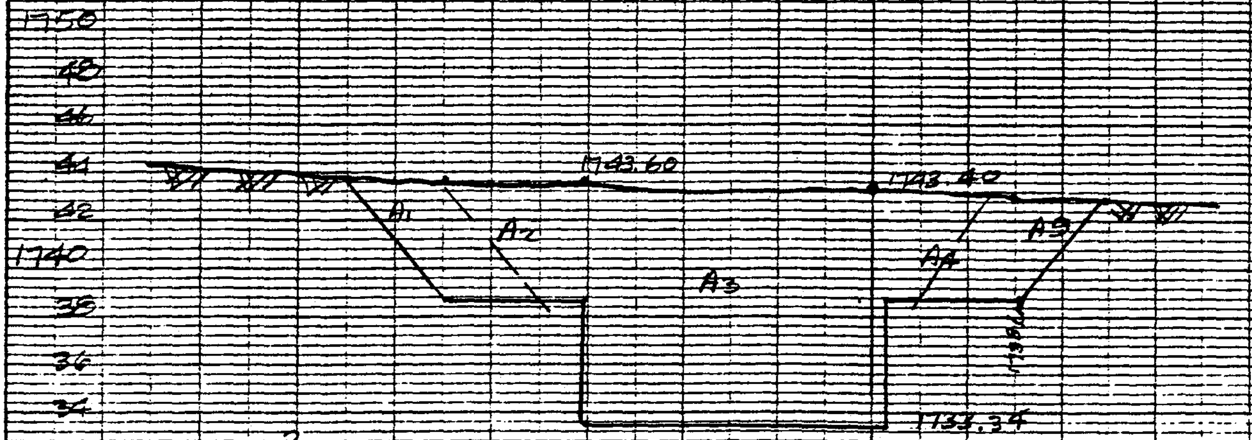
$A_3 = 8.2 \times 32.67 = 267.90$

$A_{F2} = 2 \times 5.25 \times 1.5 = 15.75$

$A_{c2} = 345 - 2 \times 10 \times 2.95 = 286$

SHEET 29

STATION 160+00



$A_1 = 5^2 = 25$

$A_2 = 5 \times 12.50 = 62.50$

$A_3 = 10.16 \times 32.67 = 331.92$

$A_4 = (4.6)12.5 = 57.50$

$A_5 = (4.6)^2 = 21.16$

$A_0 = 498.10\ ft^2$

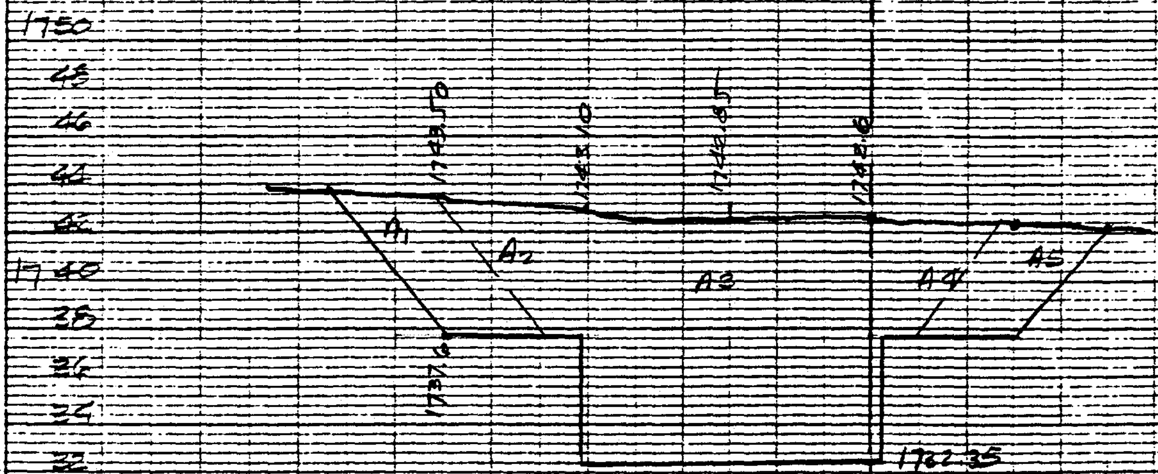
$A_c = 5 \times 2.5 = 12.5$

$A_d = 4.6 \times 2.5 = 11.50$

$A_N = 403$

$A_{F2} = 2 \times 5.67 \times 1.5 = 17$

STATION 162+00
200



$A_1 = 5.85^2 = 34.22$

$A_2 = 5.5 \times 12.5 = 68.75$

$A_3 = 10.5 \times 32.67 = 343.04$

$A_4 = 4.8 \times 12.5 = 60$

$A_5 = 4.8^2 = 23.04$

$A_0 = 529.05\ ft^2$

$A_c = 5.5 \times 2.5 = 13.75$

$A_4 = 4.8 \times 2.5 = 12$

$A_N = 426\ ft^2$

$A_{F2} = 17$

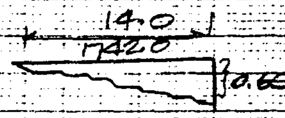
0 10 20

46 1323
K&E 10 X 10 TO 1/2 INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

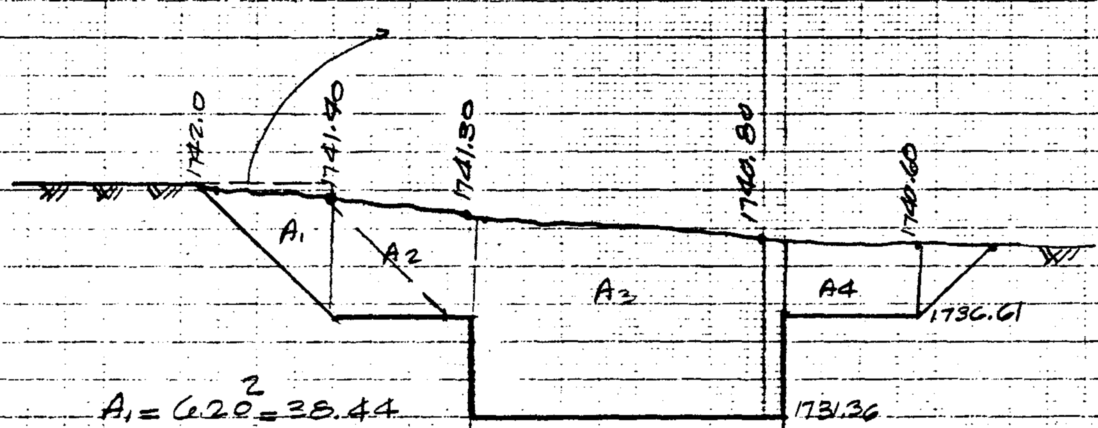
STATION 164+00 SHEET 2-9

200

DIKE



$V_{DIKE} = \frac{0.66 \times 14}{2} \times 150 / 27 = 25$ C.Y.



$A_1 = 6.20^2 = 38.44$

$A_2 = 4.89 \times 12.5 = 61.13$

$A_3 = 9.69 \times 32.67 = 316.57$

$A_4 = 4.69 \times 12.5 = 58.63$

$A_5 = 4.69^2 = 22$ $A_0 = 496.77\ ft^2$

$A_2 = 4.89 \times 2.5 = 12.23$

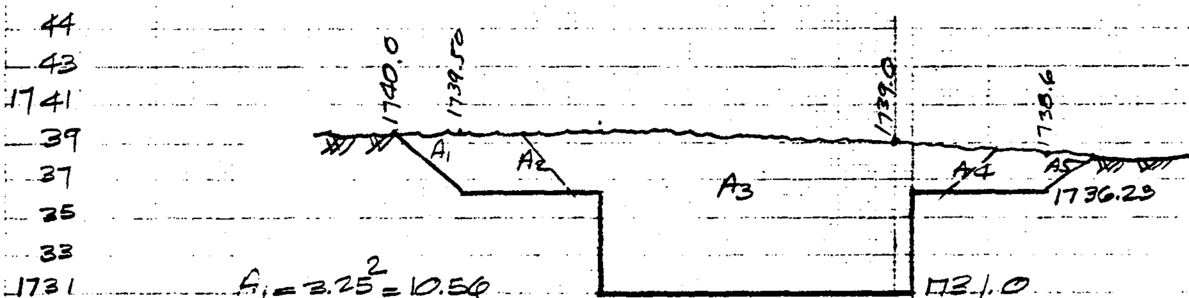
$A_4 = 4.69 \times 2.5 = 11.73$

$A_N = 400$

$A_{F_2} = 17$

STATION 164+75

75'



$A_1 = 3.25^2 = 10.56$

$A_2 = 3.23 \times 12.5 = 40.38$

$A_3 = 32.7 \times 8 = 261.60$

$A_4 = 2.37 \times 12.5 = 29.63$

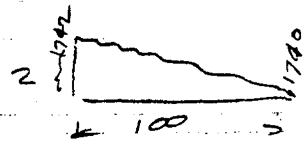
$A_5 = 2.37^2 = 5.62$ $A = 347.80\ ft^2$

$A_2 = 3.23 \times 2.5 = 8.10$

$A_4 = 2.37 \times 2.5 = 5.93$

$A_N = 292.$

$A_{F_2} = 17$



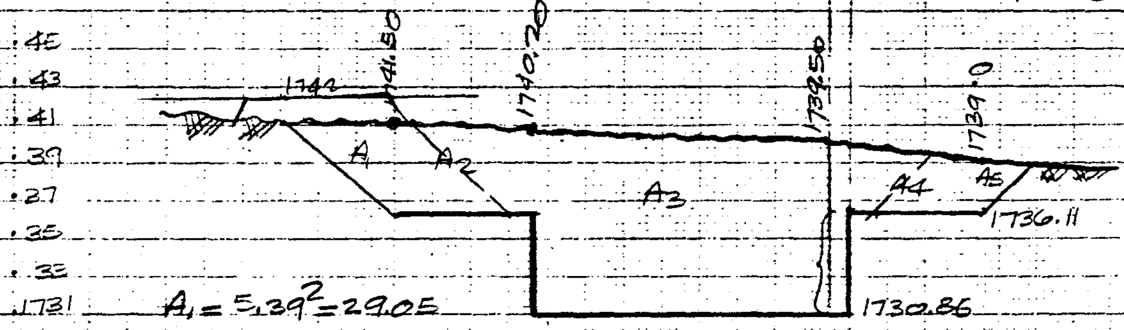
$V_{DKE} = 2 \times 100/2\ (14)/27 = 52$

STATION 165+00 ~~25~~ SHEET 2-9

ADD EXTRA FILL FOR DIKE

$V = \frac{(1)(80)}{2} \times 14/3 \times 27$

$V = 7.0$ C.Y.

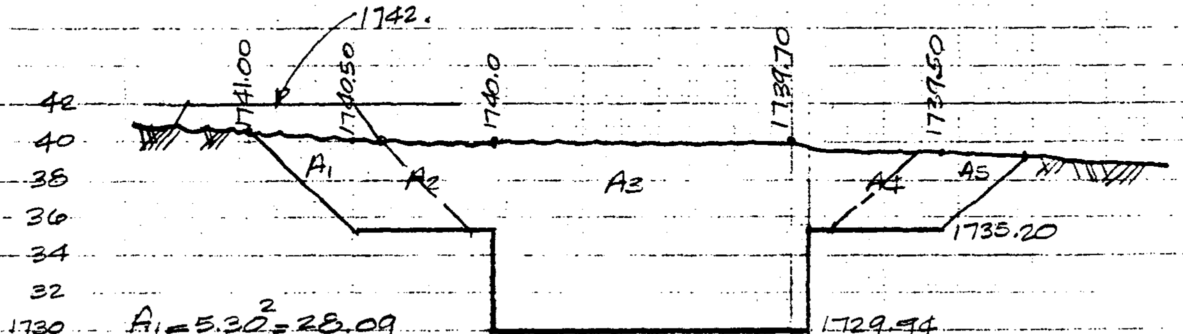


$A_1 = 5.39^2 = 29.05$
$A_2 = 5.24 \times 12.5 = 65.50$
$A_3 = 32.7 \times 9.74 = 318.50$
$A_4 = 3.39 \times 12.5 = 42.38$
$A_5 = 2.89^2 = 8.35$ $A = 463.80$ ft^2

$A_2 = 5.24 \times 2.5 = 13.0$
$A_4 = 3.39 \times 2.5 = 8.50$
$A_N = 378$ ft^2

$A_{F1} = 0.5^2 \times 2 + 0.5 \times 14 = 7.5$
$A_{F2} = 2 \times 5.25 \times 1.5 = 15.75$ $\times 16$

STATION 166+85 ~~185~~



$A_1 = 5.30^2 = 28.09$
$A_2 = 5.05 \times 12.50 = 63.13$
$A_3 = 9.91 \times 32.70 = 324.06$
$A_4 = 4.40 \times 12.50 = 55$
$A_5 = 4.31^2 = 18.58$ $A = 488.86$

$A_2 = 5.05 \times 2.5 = 12.63$
$A_4 = 4.4 \times 2.5 = 11.0$
$A_N = 395$

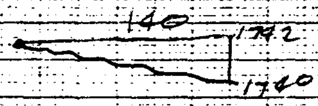
$A_{F1} = 2 \times 1.25^2 + 1.25 \times 14 = 20.63$
$A_{F2} = 15.75 \times 16$

0 10 20

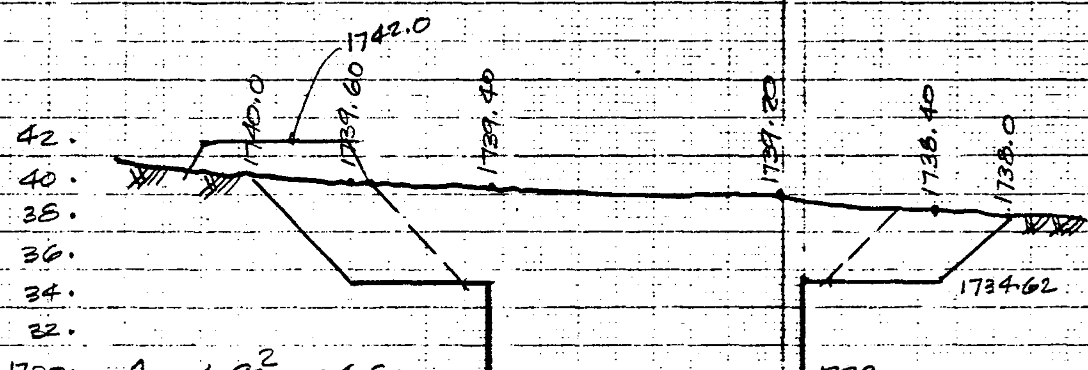
STATION 168+00 SHEET 2-9

116'

DIKE FILL



$V = \frac{(2)(140)}{2} \times 14 / 27 = 73$



$A_1 = 4.92^2 = 24.80$

$A_2 = 4.92 \times 12.5 = 61.50$

$A_3 = 9.93 \times 32.70 = 324.71$

$A_4 = 4.18 \times 12.5 = 52.25$

$A_5 = 3.78^2 = 14.29$ $A = 477.60\ FT^2$

$AF_1 = 2.4^2 \times 2 + 2.4 \times 14 = 45$

$AF_2 = 16\ Ft^2$

$A_2 = 4.92 \times 2.5 = 12.3$

$A_4 = 4.18 \times 2.5 = 10.45$

$AW = 387$

STATION 168+86

86'

$A_1 = 6.40^2 = 40.96$

$A_2 = 6.30 \times 12.5 = 78.75$

$A_3 = 11.50 \times 32.70 = 376.05$

$A_4 = 6.05 \times 12.5 = 75.63$

$A_5 = 6.0^2 = 36$ $A = 607.39\ FT^2$

$A_2 = 6.30 \times 2.5 = 15.75$

$A_4 = 6.05 \times 2.5 = 15.13$

$AW = 484.$

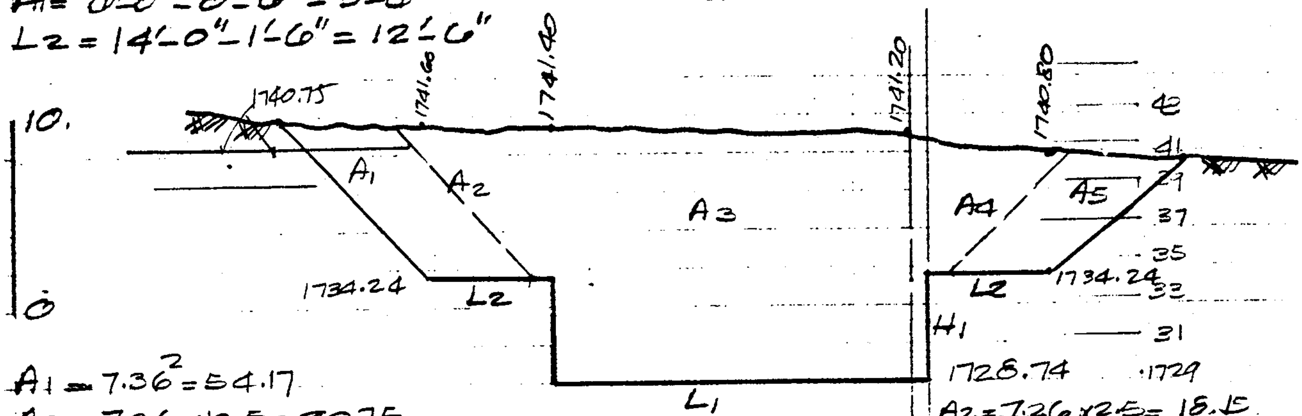
$AF_1 = 0$

$AF_2 = 16$

35'-0" CHANNEL STA 169+11
25'

SHEET 2-9

$L_1 = 35'\text{-}0" + 1'\text{-}8" + 2(1'\text{-}6") = 38'\text{-}8"$
$H = 5'\text{-}0" + 1'\text{-}0 = 6'\text{-}0"$
$H_1 = 6'\text{-}0" - 0'\text{-}6" = 5'\text{-}6"$
$L_2 = 14'\text{-}0" - 1'\text{-}6" = 12'\text{-}6"$



$A1 = 7.36^2 = 54.17$
$A2 = 7.26 \times 12.5 = 90.75$
$A3 = 38.67 \times 12.56 = 485.70$
$A4 = 6.26 \times 12.5 = 78.25$
$A5 = 6.56^2 = 43.03$

$A_g = 751.90$

$A_{F2} = 16$

$A2 = 7.26 \times 2.5 = 18.15$

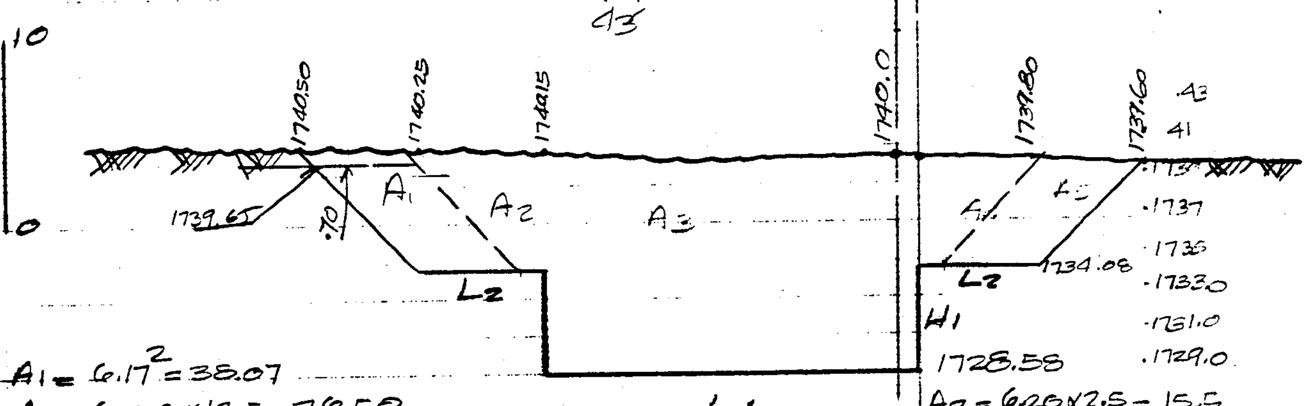
$A4 = 6.26 \times 2.5 = 15.65$

FLOOD WAY R.L.

$A_{H_1} = 617$ FT² +
$A_{H_2} = 0.85^2 \times 2 + 0.85 \times 14 = 13.35$

$A_H = 630$ FT²

STATION 169+54
43



$A1 = 6.17^2 = 38.07$
$A2 = 6.20 \times 12.5 = 76.50$
$A3 = 11.52 \times 38.67 = 445.48$
$A4 = 5.82 \times 12.5 = 72.75$
$A5 = 5.72^2 = 32.72$

$A_g = 665.52$

$A_{F2} = 16$

$A2 = 6.20 \times 2.5 = 15.5$

$A4 = 5.82 \times 2.5 = 14.55$

FLOOD WAY E.L.

$A_{H_1} = 547.0$
$A_{H_2} = 0.75^2 \times 2 + 0.70 \times 14$
$= 10.78$

$A_H = 556$ ft²

0 10 20

STATION 171+35

181

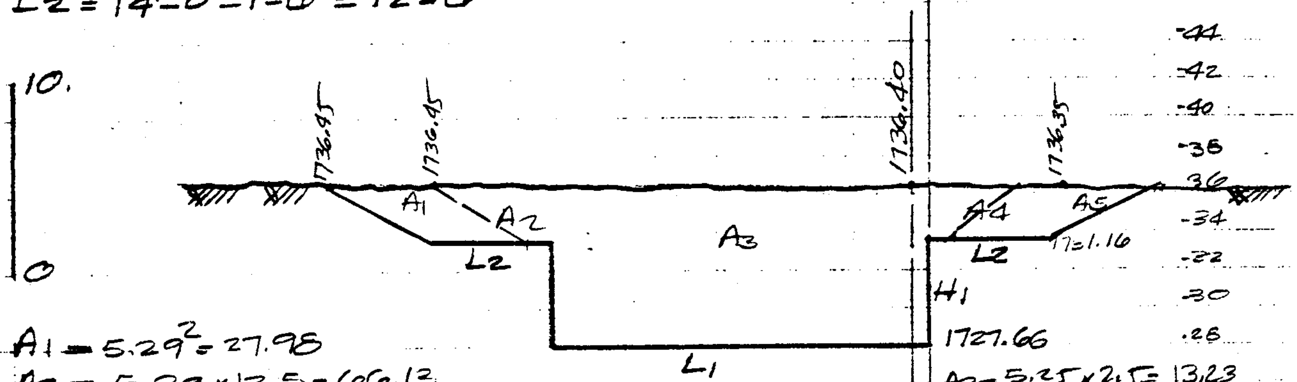
SHEET 2-9

$L_1 = 35'\text{-}0" + 1'\text{-}8" + 2(1'\text{-}6") = 38'\text{-}8"$

$H = 5'\text{-}0" + 1'\text{-}0 = 6'\text{-}0"$

$H_1 = 6'\text{-}0" - 0'\text{-}6" = 5'\text{-}6"$

$L_2 = 14'\text{-}0" - 1'\text{-}6" = 12'\text{-}6"$



$A_1 = 5.29^2 = 27.98$

$A_2 = 5.29 \times 12.5 = 66.13$

$A_3 = 8.74 \times 38.67 = 337.98$

$A_4 = 5.19 \times 12.5 = 64.88$

$A_5 = 5.19^2 = 26.94$

$A = 523.91\ Ft^2$

$A_2 = 5.25 \times 2.5 = 13.23$

$A_4 = 5.19 \times 2.5 = 13.0$

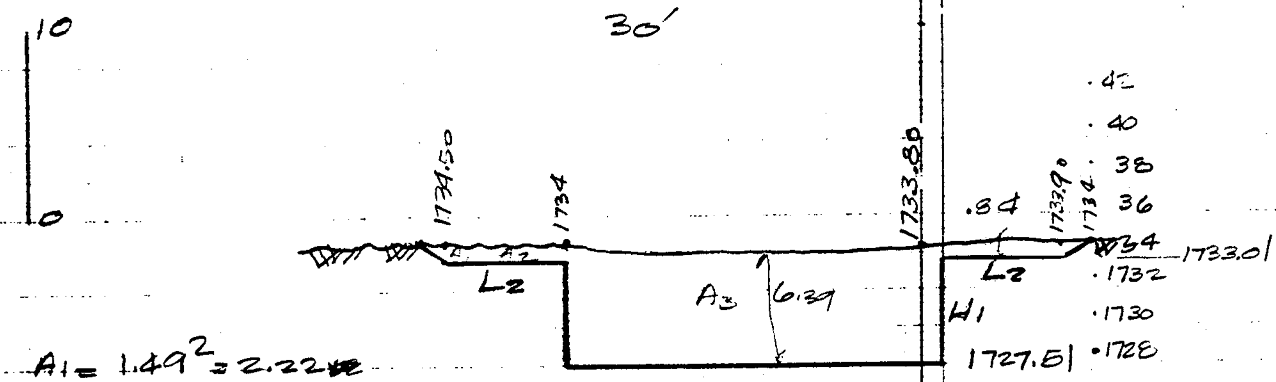
FLOOD WAY R.L.

$AH_1 = 420$

$AF_2 = 17$

STATION 171+65

30'



$A_1 = 1.49^2 = 2.22$

$A_2 = 1.49 \times 12.5 = 18.63$

$A_3 = 6.39 \times 38.67 = 247.10$

$A_4 = 0.84 \times 12.5 = 10.5$

$A_5 = 0.84^2 = 0.71$

$A_2 = 3.73$

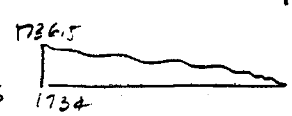
$A_4 = 2.1$

$A_N = 256$

FLOOD WAY E.L.

$A_{OLD} = 280$

$AF_2 = 17$



$DIKE = \frac{1}{2}(25)(100)(1\phi)/27 = 65$

0 10 20

National 12-188
Made in USA

~~L1 = 33' 2" ... ~~

~~= 32.67'~~

~~H1 = 5' 9" - 0' 6" = 5.25~~

STATION 172' + 00

DISTANCE 35

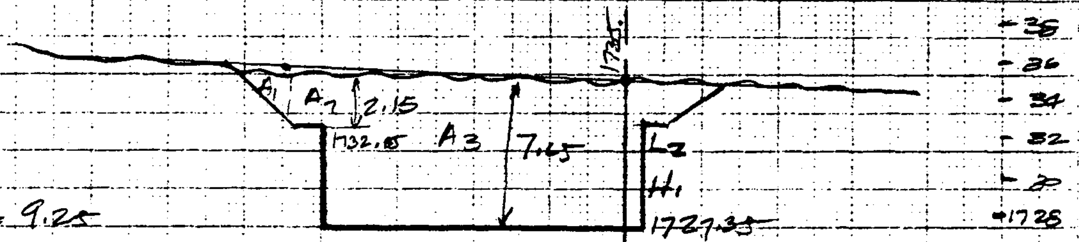
L2 (4' 0") - 1' 6" = 2.5'

D. $L_1 = 35' 0" + 1' 8" + 2(1' 6") = 35' 8"$

$H = 5' + 1' = 6'$

$H_1 = 6' - (6") = 5.5$

D.



$A_1 = 2.15^2 \times 2 = 9.25$

$A_2 = 2 \times 2.15 \times 12.5 = 53.75$ 2 x 2.15 x 2.5 L1 = 10.75

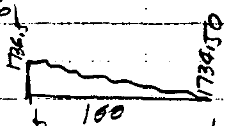
$A_3 = 7.65 \times 35.67 = 272.88$

~~A4 =~~

~~A5 =~~ ~~A =~~ 336 AH = 326

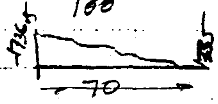
FLOODWAY REF. LINE

AF1 = ~~DIKE~~



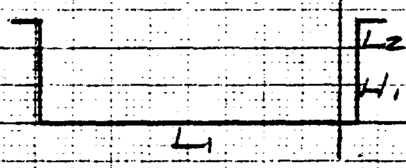
$V = \frac{2(100)}{2} \times 14/27 = 52$

AF2 = 17



$V = \frac{(1)(70)}{2} \times 14/27 = 19$

STATION



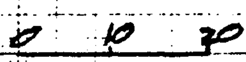
~~A1 =~~

~~A2 =~~

~~A3 =~~

~~A4 =~~

~~A5 =~~ ~~A =~~



10 Millimeters to the Centimeter

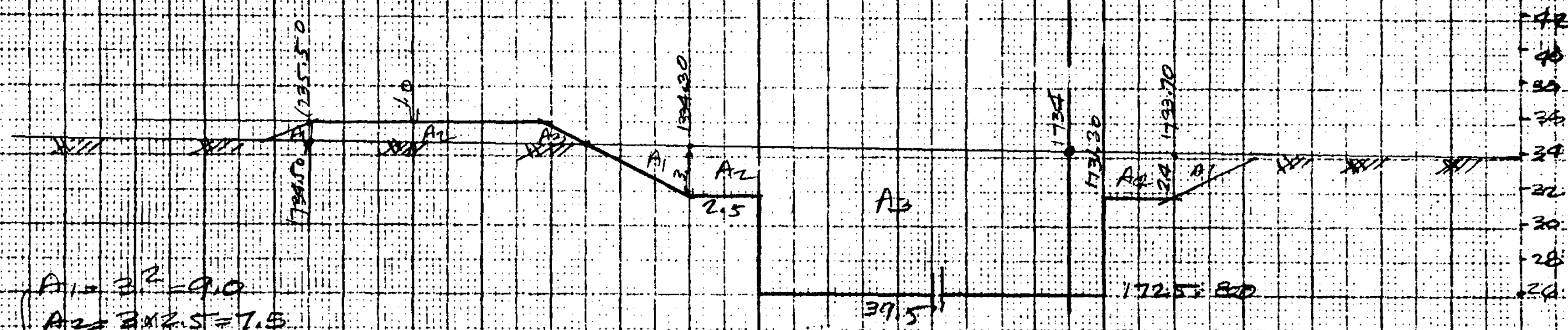
SECTION A, SHEET 2-10

STATION 173+00

FLOODWAY REF. LINE

L = 35'-0 + 1'-6" + 3'-0 = 39.5

H = 5 + 1 (0'-6") = 5'-6"



Cut
$A_1 = 3^2 = 9.0$
$A_2 = 3 \times 2.5 = 7.5$
$A_3 = 8.35 \times 39.5 = 330$
$A_4 = 2.4 \times 2.5 = 6.0$
$A_5 = 2.4^2 = 5.76$

$A = 358\ ft^2$

Diff = $10 \times 2.4 = 24$

Fill
$A_1 = 1.0$
$A_2 = 14 \times 1.0 = 14$
$A_3 = 1.0$

$A_{F_1} = 16.0$

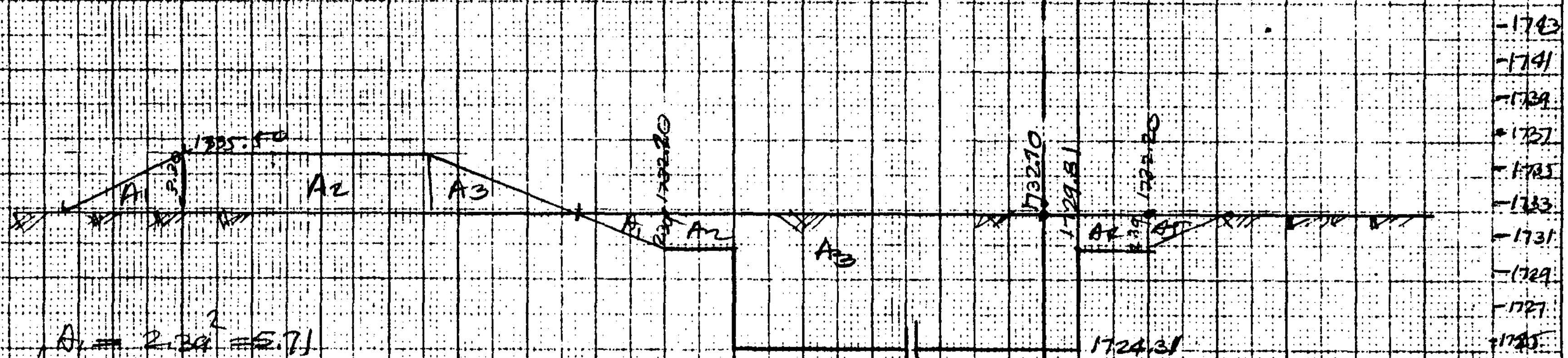
$A_{F_2} = 2 \times 5.5 \times 1.5 = 16.5$

12-188
Made in USA
National Brand

SECTION A, SHEET 2-10
L = 35'0 + 1'8" + 3'0 = 39.5
H = 5 + 1 (0-6") = 5'6"

STATION 177+90
DISTANCE 290'

FLOODWAY REF. LINE



Cut
$A_1 = 2.39^2 = 5.71$
$A_2 = 2.39 \times 2.5 = 5.98$
$A_3 = 7.84 \times 39.5 = 309.7$
$A_4 = 5.98$
$A_5 = 2.39^2 = 5.71$

$A_c = 333\ FT^2$

$D = 10 \times 2.39 = 23.9 = 47.8$

FILL
$A_1 = 3.3^2 = 10.89$
$A_2 = 14 \times 3.3 = 46.2$
$A_3 = 10.89$

$A_F = 68$

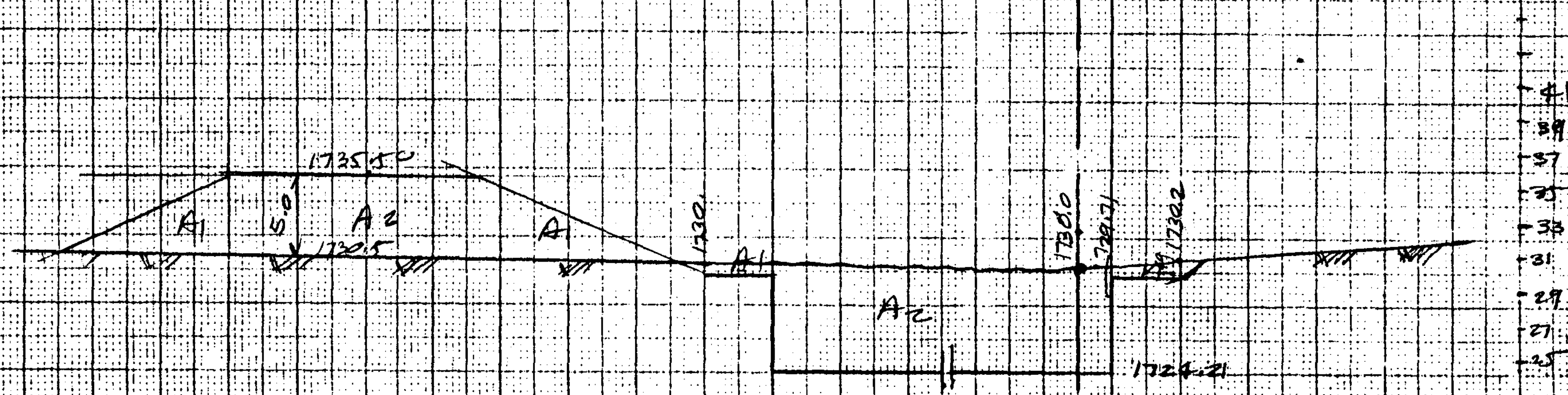
$AF_2 = 2 \times 5.5 \times 1.5 = 16.5$

12-188
Made in USA
National

SECTION A, SHEET 2-10
L = 35'-0 + 1'-8" + 3'-0 = 39.5
H = 5 - 1 - (0'-6") = 5'-6"

STATION 178+10
DISTANCE 20'

FLOODWAY REF. LINE



Cut $\begin{cases} A1 = 0.3 \times 2.5 = 0.75 \\ A2 = 5.79 \times 39.5 = 229 \\ A3 = 0.75 \end{cases}$

$A_C = 231 \text{ ft}^2$

D = 10 x 1 = 10

FILL $\begin{cases} A1 = 2 \times 5^2 = 50 \\ A2 = 5 \times 14 = 70 \end{cases}$

$A_F = 120$

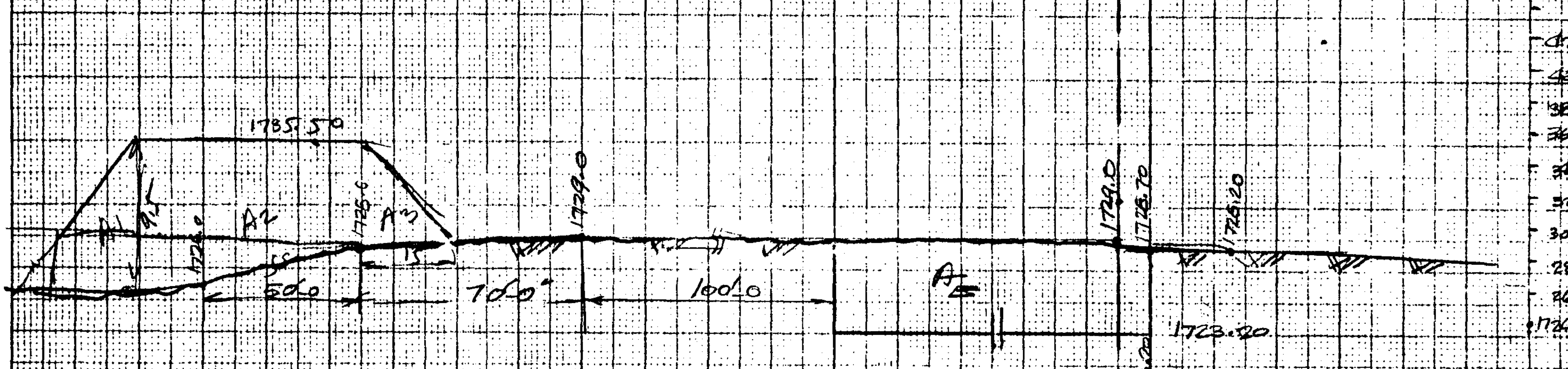
AF2 = 2 x 5.5 x 1.5 = 16.5

12-188
Made in USA
National Brand

SECTION A, SHEET 2-10
L = 35'0 + 1'8" + 3'0 = 39.5
H = 5 + 1 - (0'-6") = 5'6"

STATION 180+10
DISTANCE 200

FLOODWAY REF. LINE



$A_E = 5.8 \times 39.5 = 229$

$A_F \begin{cases} A_1 = 9.5^2 = 90.25 \\ A_2 = 8.5 \times 14 = 119 \\ A_3 = 7.5^2 = 56.25 \end{cases}$

$A_{F1} = 266.5$

$A_{F2} = 2 \times 5.5 \times 1.5 = 16.5$

DA = 1

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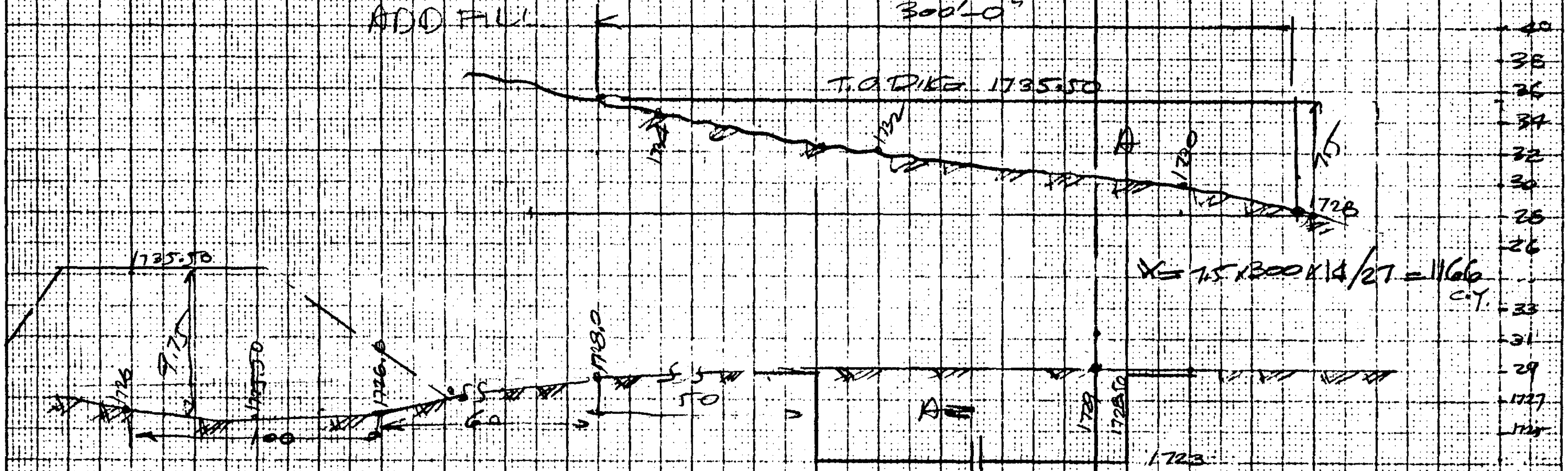
National Brand

SECTION A, SHEET 2-10
L = 35'0 + 1'8" + 3'0 = 39.5
H = 5 + 1 (0-6") = 5'6"

STATION 180+50
DISTANCE 40

FLOODWAY REF. LINE



$X = 7.5 \times 300 \times 14/27 = 1166$ C.Y.

$A_2 = 6 \times 39.5 = 237$

ADD

DA = 2.

FILL
$A_1 = 9.75^2 = 95$
$A_2 = 7.75 \times 14 = 136.5$
$A_3 = 10.5^2 = 110.25$

$A_F = 342$

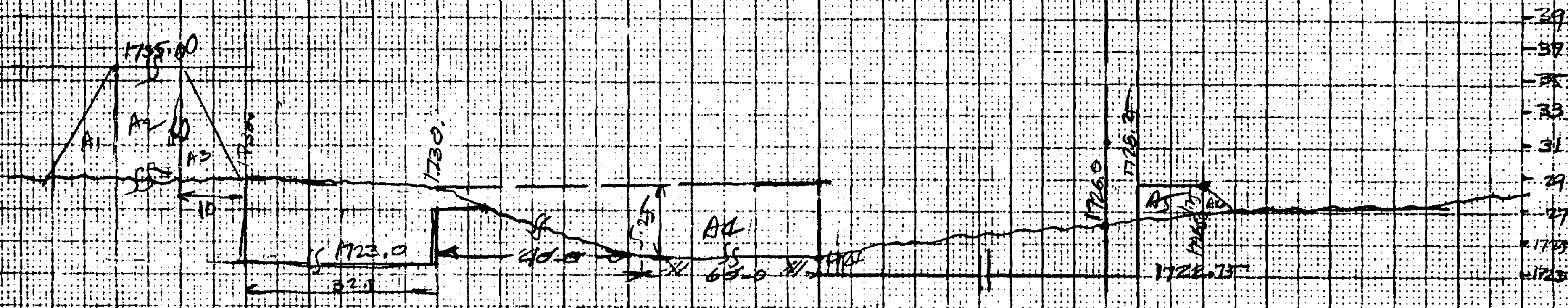
$A_{FL} = 165$

12-188 Made in USA
National Brand

SECTION A, SHEET 2-10
L = 35'-0 + 1'-8' + 3'-0 = 39.5
H = 6 - 1 - (0'-6') = 5'-6"

STATION 181+00
DISTANCE 50

FLOODWAY REF. LINE



$A_C = 2.25 \times 39.5 = 88.90$

FILL
$A_1 = 5^2 \times 2 = 50.$
$A_2 = 5 \times 18 = 90.$
$A_4 = 5.25 \times 98.5 = 517.15$
$A_5 = 1.75 \times 2.5 = 4.38$
$A_6 = 1.75^2 = 3.10$

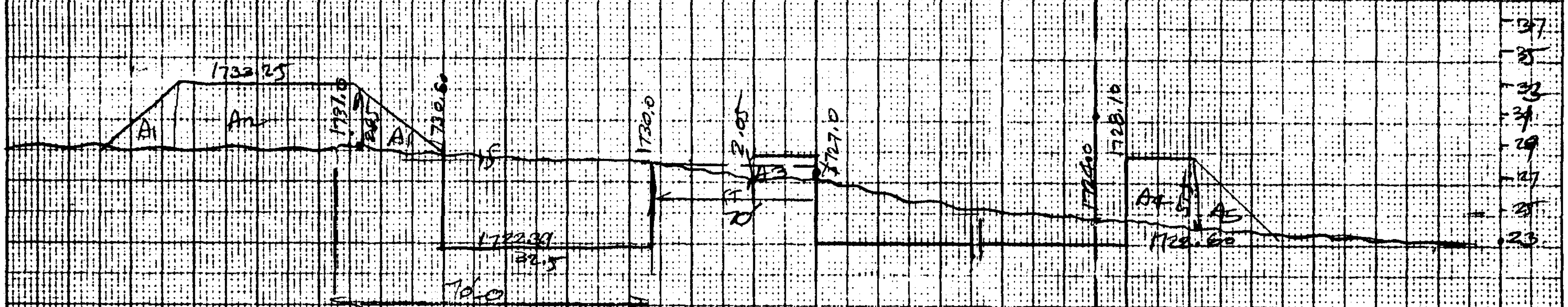
$A = 664$
F1
$A_{F2} = 165$

12-188 Made in USA
National

SECTION A, SHEET 2-10
L = 35'0 + 1'-8" + 3'0 = 39.5
H = 5 + 1 (0'-6") = 5'6"

STATION 181+30
DISTANCE 30

FLOODWAY REF. LINE



$A_C = 2.9 \times 39.5 = 115$

FILL
$A_1 = 2.95^2 \times 1.2 = 10.20$
$A_2 = 2.25 \times 14 = 14$
$A_3 = 2.05 \times 68.5 = 140$
$A_4 = 5.5 \times 2.5 = 13.8$
$A_5 = 5.5^2 = 30.25$

$A_{F_1} = 209$
$A_{F_2} = 10.5$

SECTION A, SHEET 2-10
L = 35'0 + 1'8" + 3'0 = 39.5
H = 6 - 1 (0'-6") = 5'6"

STATION 182+80
DISTANCE 150'

FLOODWAY REF LINE

Cut
$A_1 = 8.35 \times 32.5 = 271$
$A_2 = 8.35 \times 39.5 = 329.82$
$A_3 = 2.89 \times 2.5 = 7.25$
$A_4 = 2.89^2 = 8.35$

$A_c = 616$

$A_B = 10 \times 2.89 = 28.9$

Fill
$A_5 = 2^2 \times 2 = 8$
$A_6 = 2 \times 14 = 28$

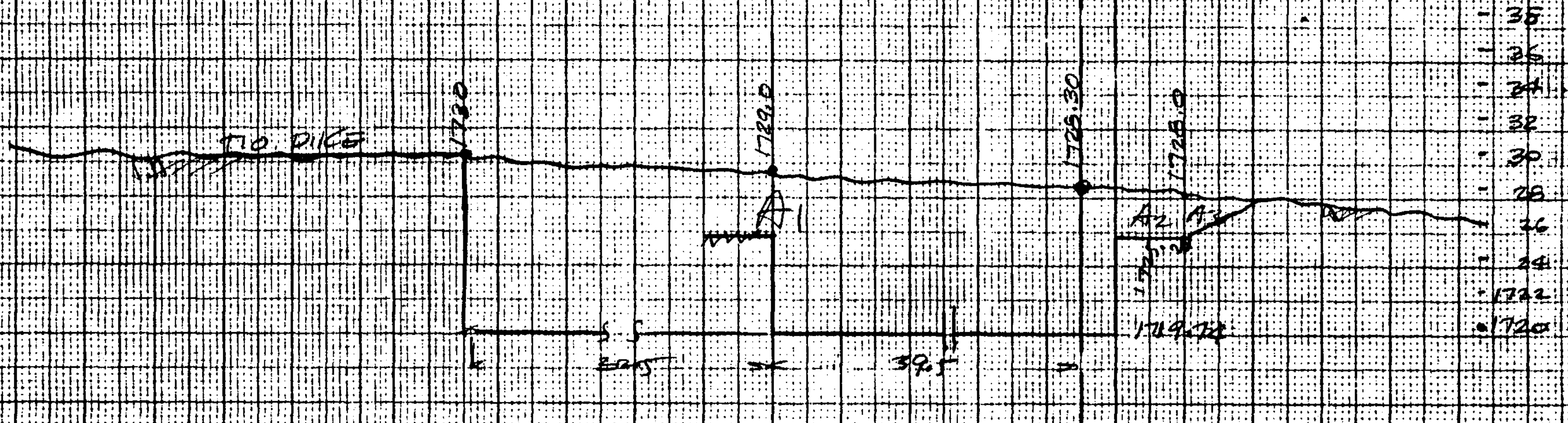
$A_{F_1} = 36$
$A_{F2} = 16.5$

12-188 Made in USA
National Brand

SECTION A, SHEET 2-10
L = 35'0 + 1'8 + 3'0 = 39.5
H = 5 + 1 (0.6') = 5'6"

STATION 184+40
DISTANCE 160'

FLOODWAY REF LINE



$A_1 = 72 \times 9.36 = 673.92$

$A_2 = 2.76 \times 2.5 = 6.9$

$A_3 = 2.76^2 = 7.61$

A = 688

$\Delta A = 3.15 \times 10 = 31.5$

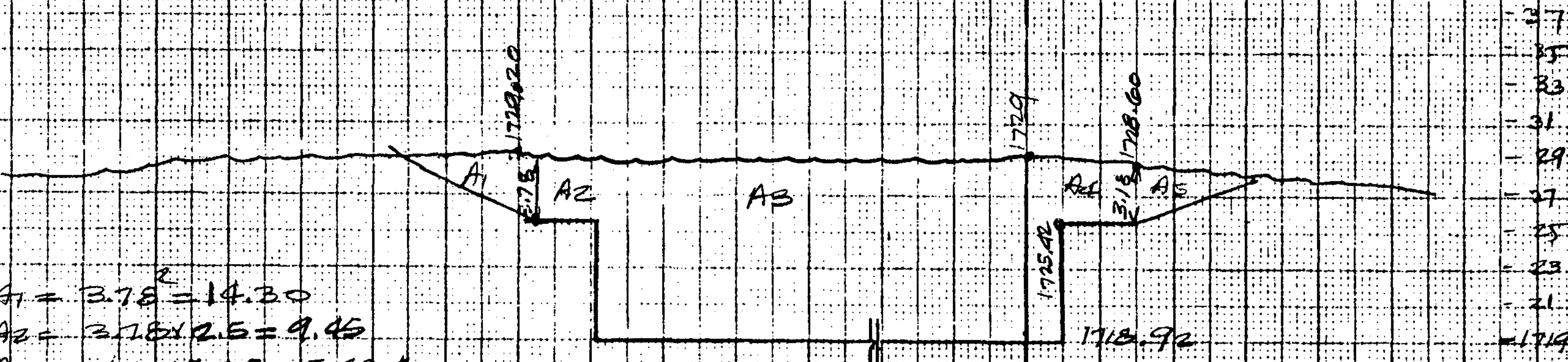
$A \div 2 = 16.5$

National Brand 12-188 Made in USA

SECTION B, SHEET 2-10
L = 50'-0 + 1'-8" + 3'-0 = 54.5'
H = (6'-0") + (1'-0") - (6") = 6'-6"

STATION 186+00
Distance 160'-0"

FLOODWAY [illegible] LINE



$A_1 = 3.78^2 = 14.30$
$A_2 = 3.78 \times 2.5 = 9.45$
$A_3 = 10 \times 54.5 = 549.4$
$A_4 = 3.18 \times 2.5 = 7.95$
$A_5 = 3.18^2 = 10.1$

$A = 591$

$D_A = 2 \times 10 \times 3.5 = 70$

$A_F = 2 \times 6.5 \times 1.5 = 19.5$

10 Millimeters to the Centimeter
Made in USA

~~SECTION B, SHEET 2-10~~

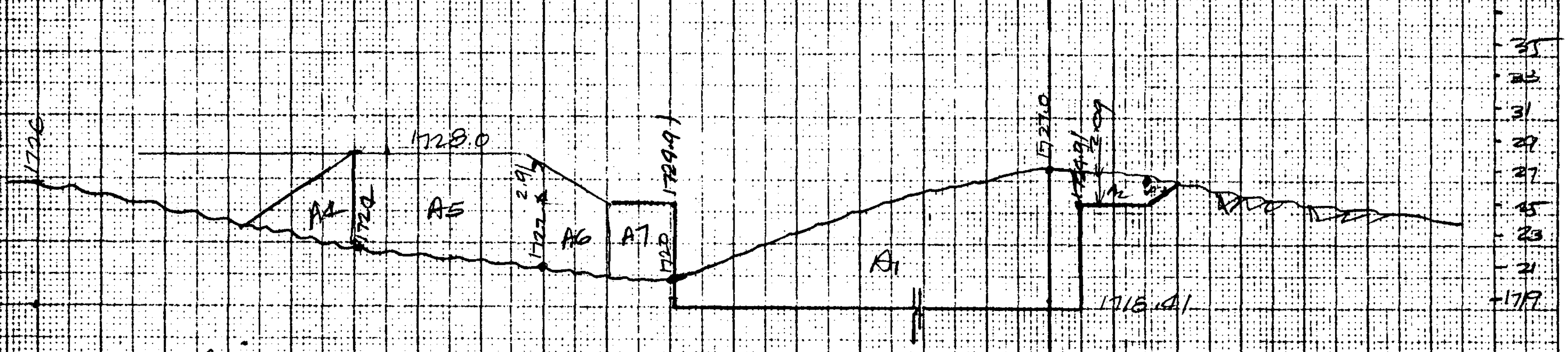
$L_1 = 50'\text{-}0 + 1'\text{-}8'' + 3'\text{-}0 = 54.5'$

$H_1 = (6'\text{-}0'') + (1'\text{-}0'') - (6'') = 6'\text{-}6''$

STATION 187+00

DISTANCE 100'

FLOODWAY REF LINE



Cut
$A_1 = 5.06 \times 54.5 = 277$
$A_2 = 2.09 \times 2.5 = 5.23$
$A_3 = 2.09^2 = 4.36$

$A = 286$

$OA = 10 \times 2.09 = 21.0$

FILL
$A_4 = 4^2 = 16$
$A_5 = 5 \times 18 = 90$
$A_6 = 2.91^2 = 8.48$
$A_7 = 4.91 \times 2.5 = 12.28$

$A_{F1} = 127$
$A_{F2} = 19.5$

12-100 Made in USA
10 Millimeters to the Centimeter

SECTION B, SHEET 2-10

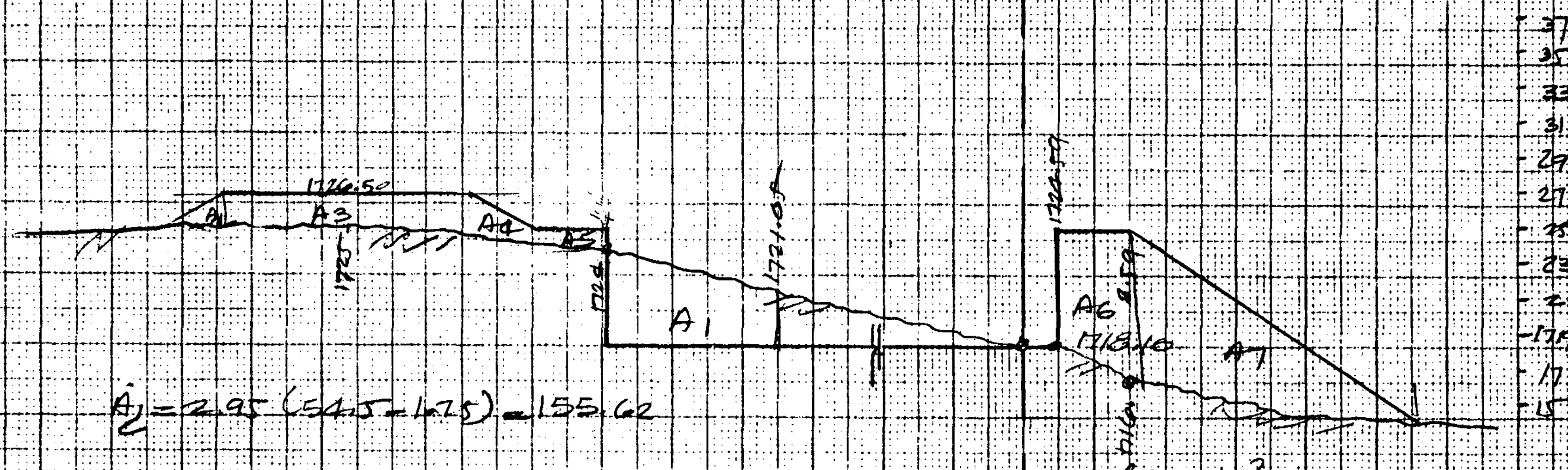
$L_1 = 50'\text{-}0 + 1'\text{-}6'' + 3'\text{-}0 = 54.5'$

$H_1 = (6'0'') + (1'0'') - (6'') = 6'6''$

STATION 187+30

Distance 30

FLOODWAY REF LINE



$A_1 = 2.95\,(54.5 - 1.25) = 155.62$

FILL

$A_2 = 1.5^2 = 2.25$

$A_3 = 1.5 \times 14 = 21$

$A_4 = 2^2 = 4$

$A_5 = 2.5 \times 1.59 = 4.0$

$A_6 = 8.59 \times 2.5 = 21.5$

$A_7 = 8.59^2 = 73.80$

$A_F = 126.5$

$A_{F2} = 19.5$

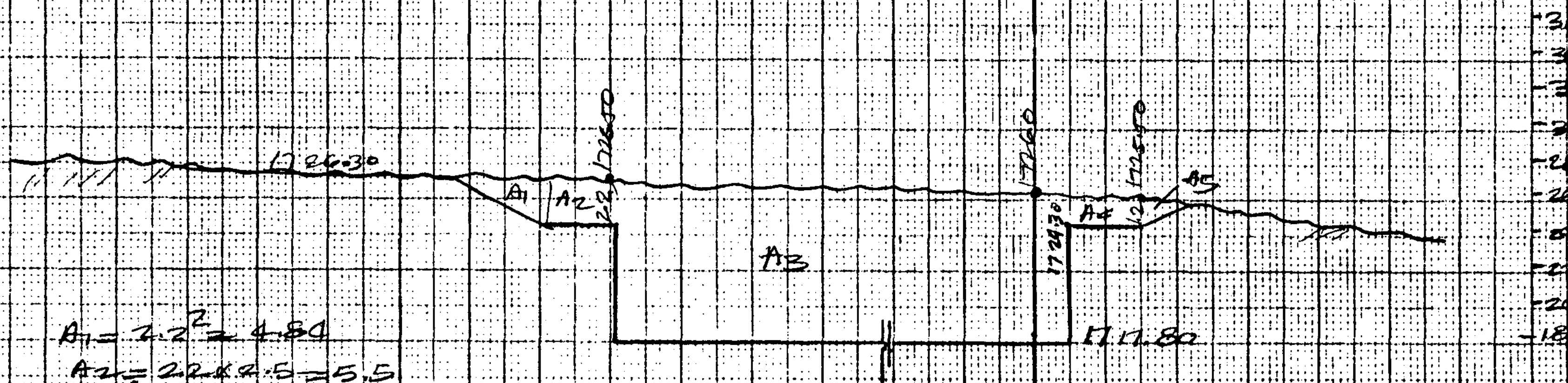
National Brand 12-100 Made in USA

10 Millimeters to the Centimeter

SECTION B, SHEET 2-10
$L_1 = 50'0 + 1'8'' + 3'0 = 54.5'$
$H_1 = (6'0'') + (1'0'') - (6'') = 6'6''$

STATION 187+65
DISTANCE 35'-0"

FLOODWAY BASELINE



$A_1 = 2.2^2 = 4.84$
$A_2 = 2.2 \times 2.5 = 5.5$
$A_3 = 8.45 \times 54.5 = 460.5$
$A_4 = 1.2 \times 2.5 = 3.0$
$A_5 = 1.2^2 = 1.44$

$A = 475$

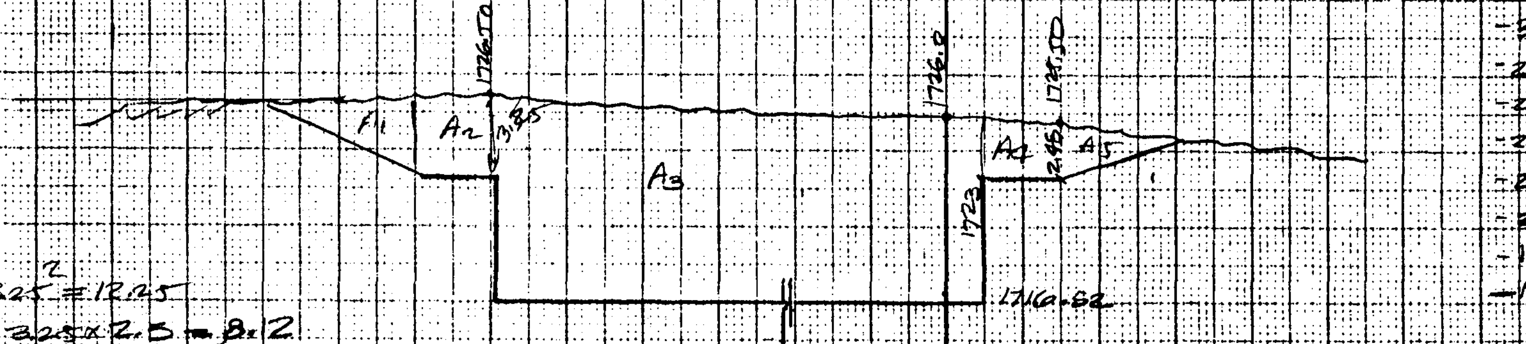
$AF_2 = 19.5$

$DA = 2 \times 10 \times 1.7 = 34$

SECTION B, SHEET 2-10
L = 50'-0 + 1'-8" + 3'-0 = 54.5'
H = (6'-0") + (1'-0") - (6") = 6'-6"

STATION 190+00
DISTANCE 235' to 187+65
to 192+00

FLOODWAY BASELINE



A1 = 3.25² = 12.25
A2 = 3.25 x 2.5 = 8.12
A3 = 9.73 x 51.5 = 530.30
A4 = 2.48 x 2.5 = 6.2
A5 = 2.48² = 6.15

A = 563 Ft²

DA = 2 x 10 x 2.87 = 57.3

AFF2 = 19.6

Made in USA

10 Millimeters to the Centimeter

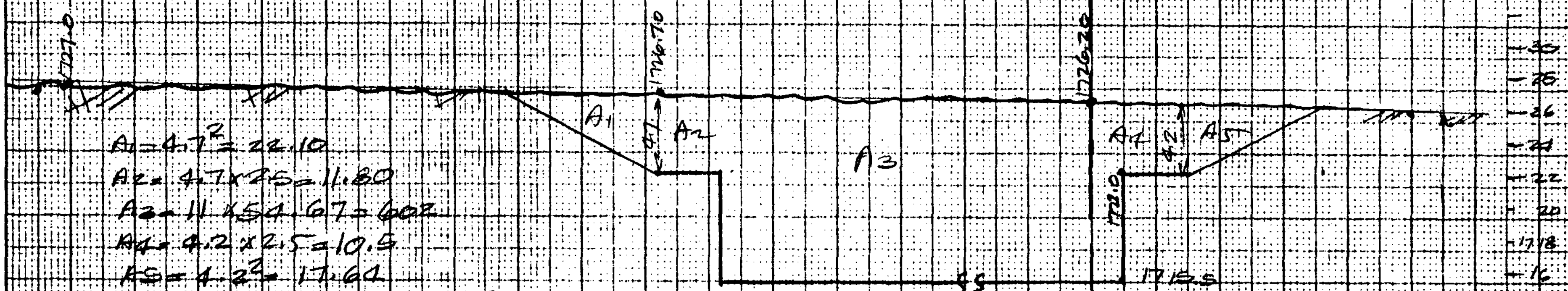
SECTION A" SHEET 2-11

$L = 50'\text{-}0 + 1'\text{-}8'' + 3'\text{-}0 = 54.67'$

$W = 6'\text{-}\cancel{0} + 1'6'' - (6'') - \cancel{8''} \Rightarrow 6.\cancel{0}5'$

STATION 1+72+00

DISTANCE 200



$A_1 = 4.7^2 = 22.10$

$A_2 = 4.7 \times 2.5 = 11.80$

$A_3 = 11 \times 54.67 = 602$

$A_4 = 4.2 \times 2.5 = 10.5$

$A_5 = 4.2^2 = 17.64$

$A = 664$

$DA = 2 \times 10 \times 4.5 = 90$

$A = 2 \times 6.5 \times 1.5 = 19.5$

12-188 Made in USA National

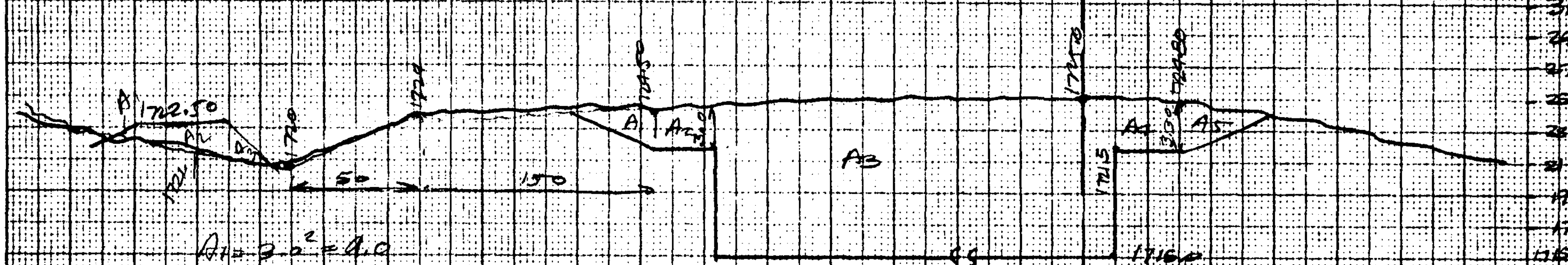
SECTION "A" SHEET 2-11

$L = 50'\text{-}0 + 1'\text{-}8" + 3'\text{-}0 = 54.67'$

$H = 6'\text{-}8" + 1'\text{-}6" - (6") - 8' \Rightarrow 6.75'$

STATION 193+00

DISTANCE 100'



$A_1 = 3.0^2 = 9.0$

$A_2 = 3.0 \times 2.5 = 7.5$

$A_3 = 9.75 \times 54.67 = 533$

$A_4 = 3.3 \times 2.5 = 8.25$

$A_5 = 3.3^2 = 10.89$

$A = 568\ ft^2$

$DA = 2 \times 10 \times 3.15 = 63$

$AF_1 = 25.5$ $\begin{cases} A_1 = 2.25 \\ A_2 = 1.5 \times 14 = 21 \\ A_3 = 2.25 \end{cases}$

$AF_2 = 19.5$

National Brand 12-188 Made in USA

SECTION A" SHEET 2-11

$L = 50'\text{-}0 + 1'\text{-}8" + 3'\text{-}0 = 54.67'$

$W = 6'\text{-}8" + 1'\text{-}0" - (6") - 8' \Rightarrow 6.75$ 5.01

STATION 193+96
DISTANCE 96'

$A_E = 1.0\ FT^2$

$A_{F1} = 182.6$

$A_1 = 6.5^2 = 42.25$
$A_2 = 6.5 \times 14 = 91$
$A_3 = 6.5 \times 2.5 = 16.25$
$A_4 = 5.75^2 = 33.10$

$A_{F2} = 19.5$

12-188 Made in USA National

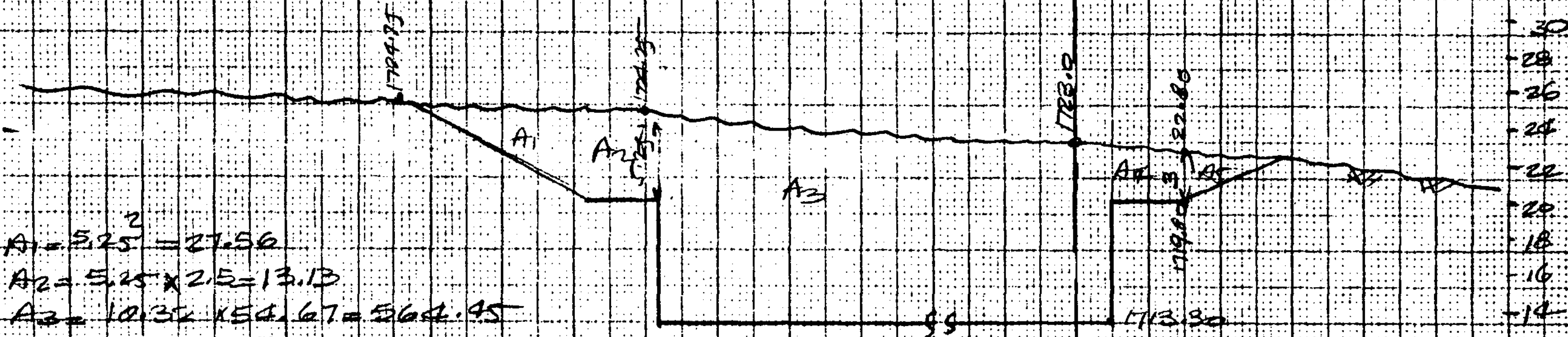
SECTION A' SHEET Z-11

$L = 50'\text{-}0 + 1'\text{-}8" + 3'\text{-}0 = 54.67'$

$W = 6'\text{-}3" + 1'\text{-}0" - (6") - .81' = 6.75'$

STATION 197+73

DISTANCE 77'



$A_1 = 5.25^2 = 27.56$

$A_2 = 5.25 \times 2.5 = 13.13$

$A_3 = 10.32 \times 54.67 = 564.45$

$A_4 = 3 \times 2.5 = 7.5$

$A_5 = 3^2 = 9.0$

$A = 621 \ FT^2$

$PA = 2 \times 10 \times 4.15 = 83$

$AFE = 19.5$

National Brand 12-188 Made in USA

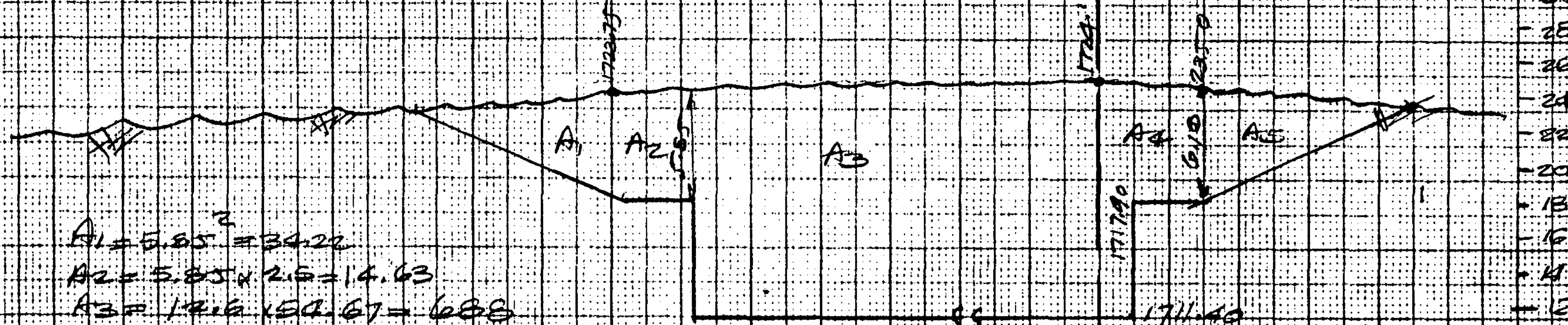
SECTION A' SHEET 2-11

$L = 50'-0 + 1'-8" + 3'-0 = 54.67'$

$W = 6'-3" + 1'-6" - (6") = 8' \Rightarrow 6.25$ 50'

STATION 198+40

DISTANCE 367'-0



$A1 = 5.85^2 = 34.22$

$A2 = 5.85 \times 2.5 = 14.63$

$A3 = 12.6 \times 54.67 = 688$

$A4 = 6.10 \times 2.5 = 15.25$

$A5 = 6.1^2 = 37.21$

$A = 789\ Ft^2$

$PA = 2 \times 10 \times 6 = 120$

$AF2 = 19.5$

National 12-188 Made in USA

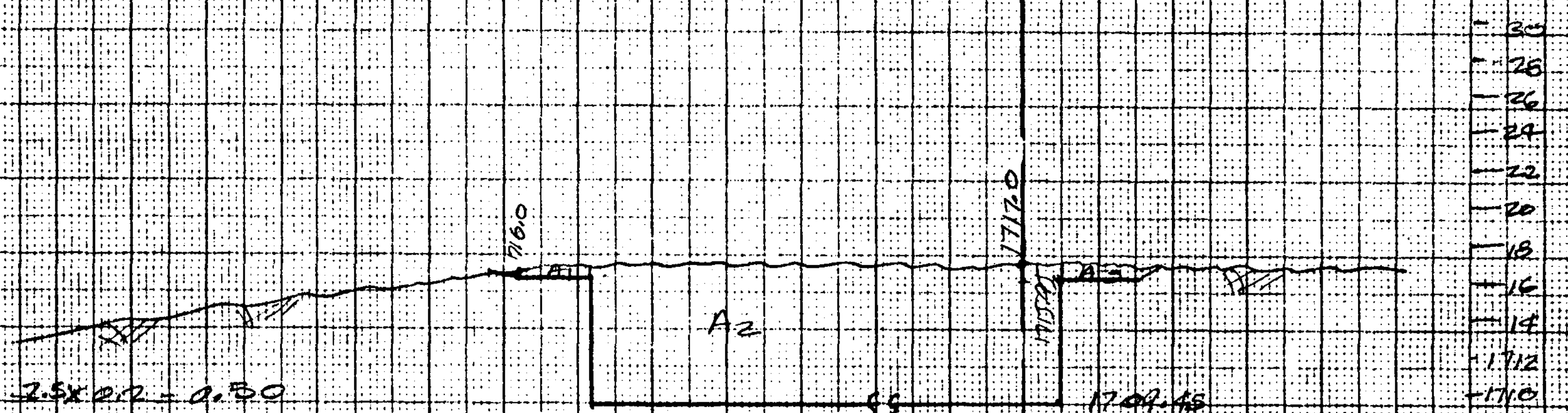
SECTION A' SHEET 2-11

L = 50'-0 + 1'-8" + 3'-0 = 54.67'

W = 6'-8" + 1'-0" - (6") - 8" => 6.75 / 6.01

STATION 202+20

DISTANCE 38.0'-0



A1 2.5 x 0.2 = 0.50

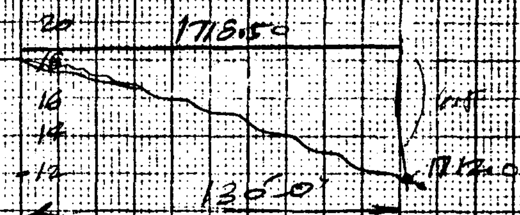
A2 = 7.05 x 54.67 = 385

A3 = 1.1 x 2.5 = 2.75

A = 386 Ft^2

A = 19.5

ADD FILL



V = 219 CU YD.

12-188
Made in USA

National Brand

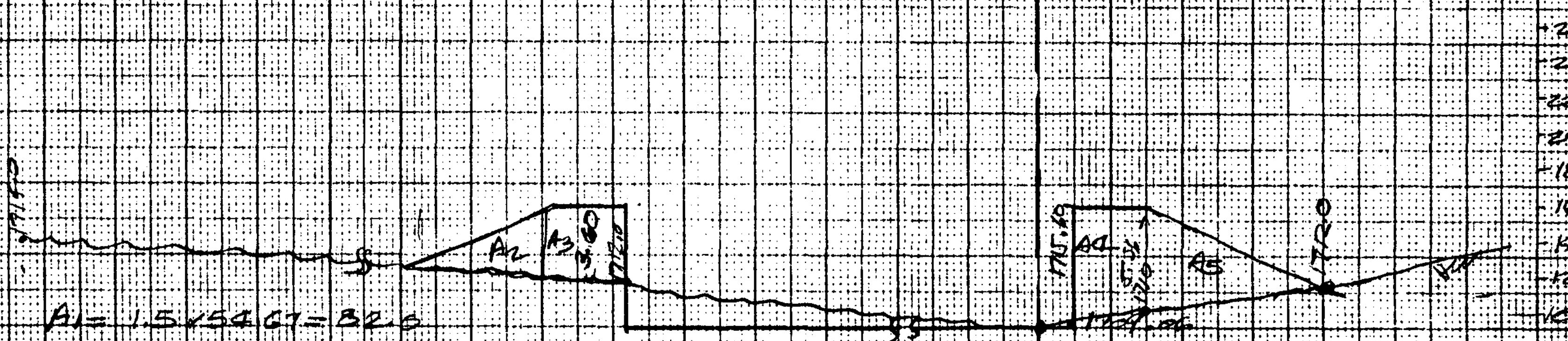
SECTION "A" SHEET 2-11

$L = 50'\text{-}0 + 1'\text{-}8" + 3'\text{-}0 = 54.67'$

$W_1 = 6'\text{-}9" + 16" - (6") - 8' \Rightarrow 6.75$ 5.9

STATION 203+00

DISTANCE 80'-0'



$A_1 = 1.5 \times 54.67 = 82.0$

$AF_1 = 67$

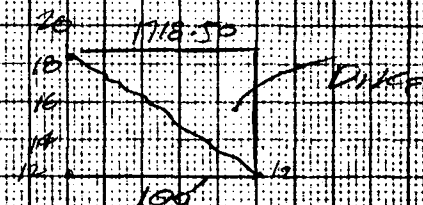
$A_2 = 3.6^2 = 12.96$

$A_3 = 3.6 \times 2.5 = 9$

$A_4 = 5.56 \times 2.5 = 13.9$

$A_5 = 5.56^2 = 30.92$

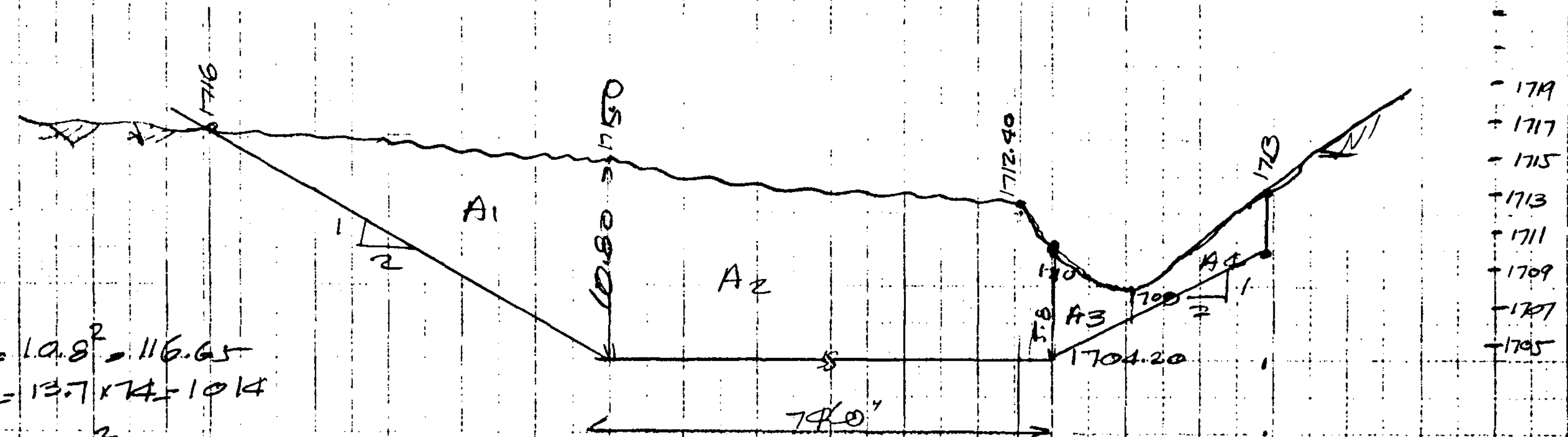
$AF_2 = 19.50$



$V_{DIKE} = 169$ C.Y.

National 12-188 Made in USA

STATION 203+50
DISTANCE 50'-0"



$A_1 = 10.8^2 = 116.65$

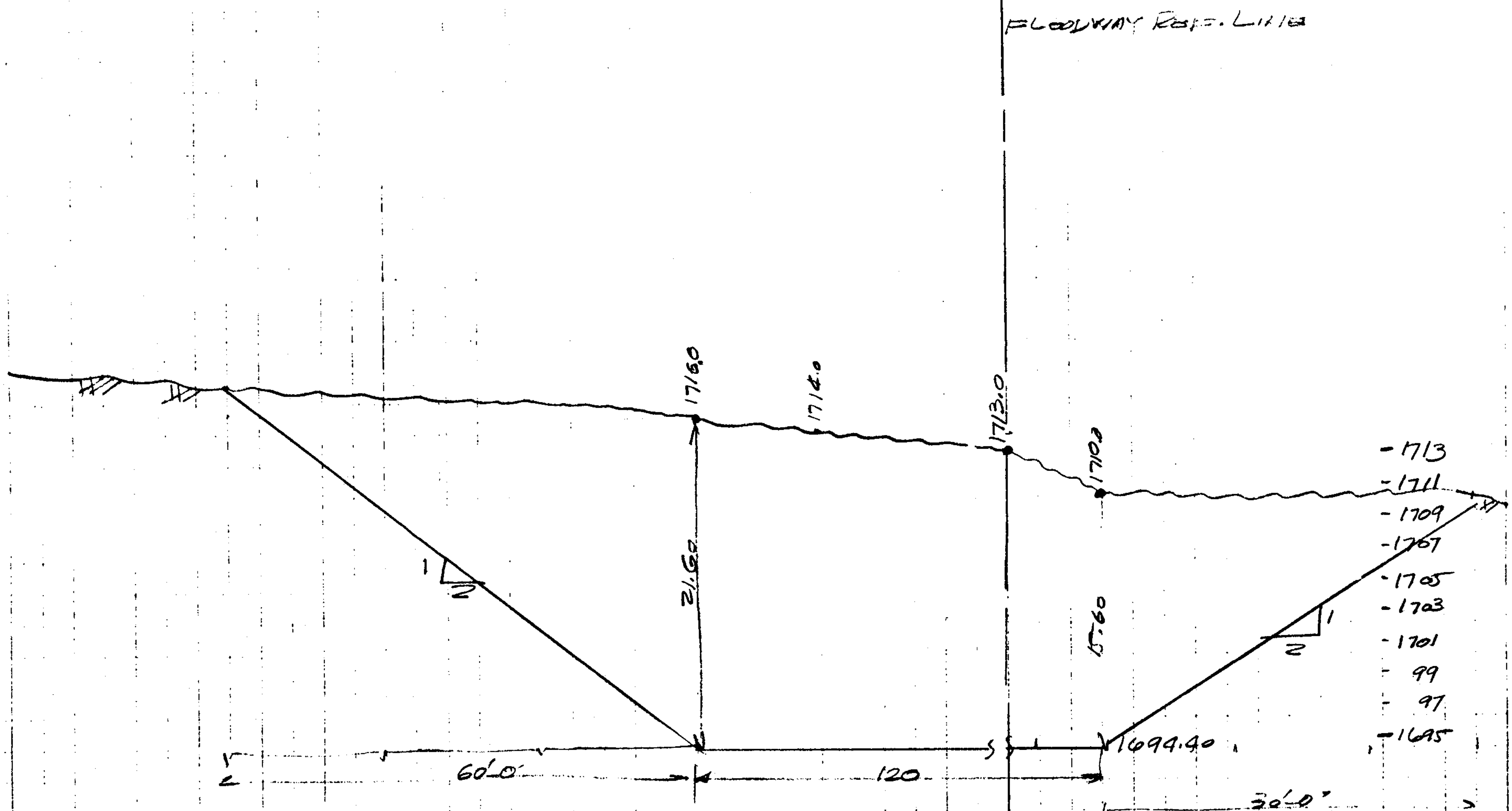
$A_2 = 13.7 \times 74 = 1014$

$A_3 = 5.8^2 = 33.60$

A = 1165

National® 12-188

STATION 204+50
DISTANCE 100'-0"



$A_1 = 21.6^2 = 466.60$

$A_2 = 18.6 \times 120 = 2232$

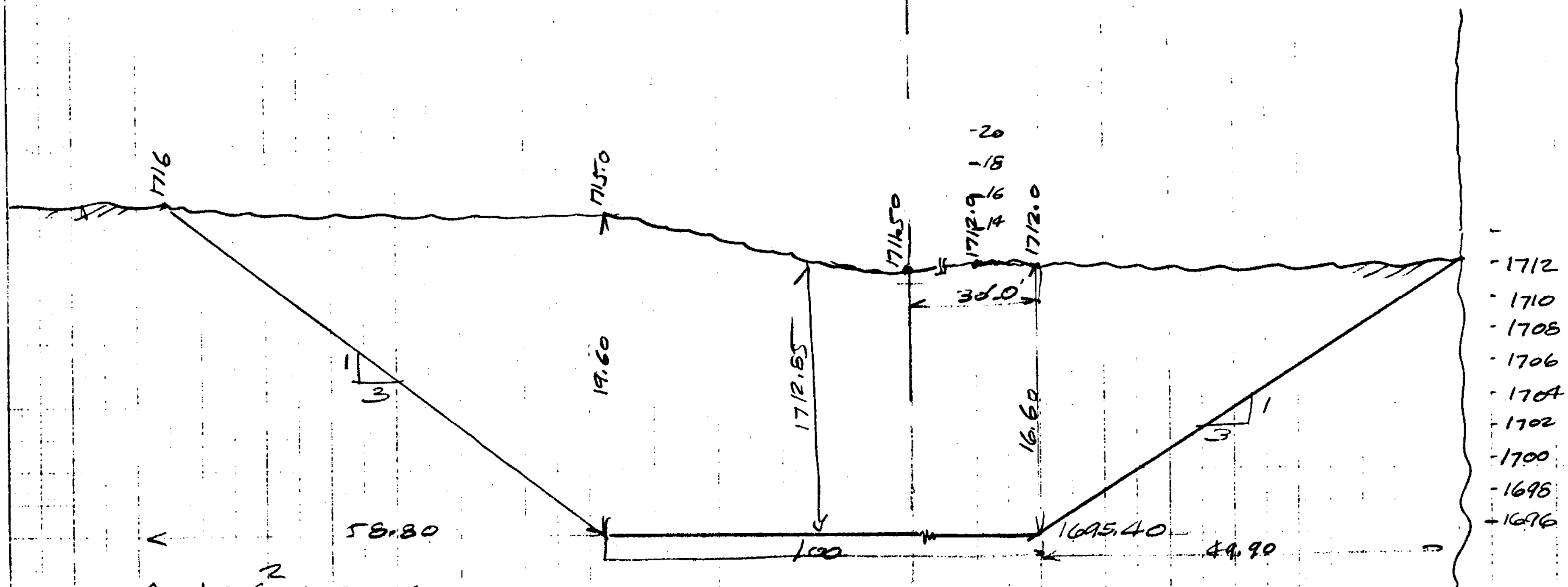
$A_3 = 15.60^2 = 243.35$

$A = 2942$

12-138
National

STATION 205+50
DISTANCE 100'-0

FLOODWAY REF. LINE



$A_1 = 19.6^2 \times 1.5 = 576$

$A_2 = 17.45 \times 100 = 1745$

$A_3 \; 1.5 \times 16.6^2 = 413.3$

$A = 2734$

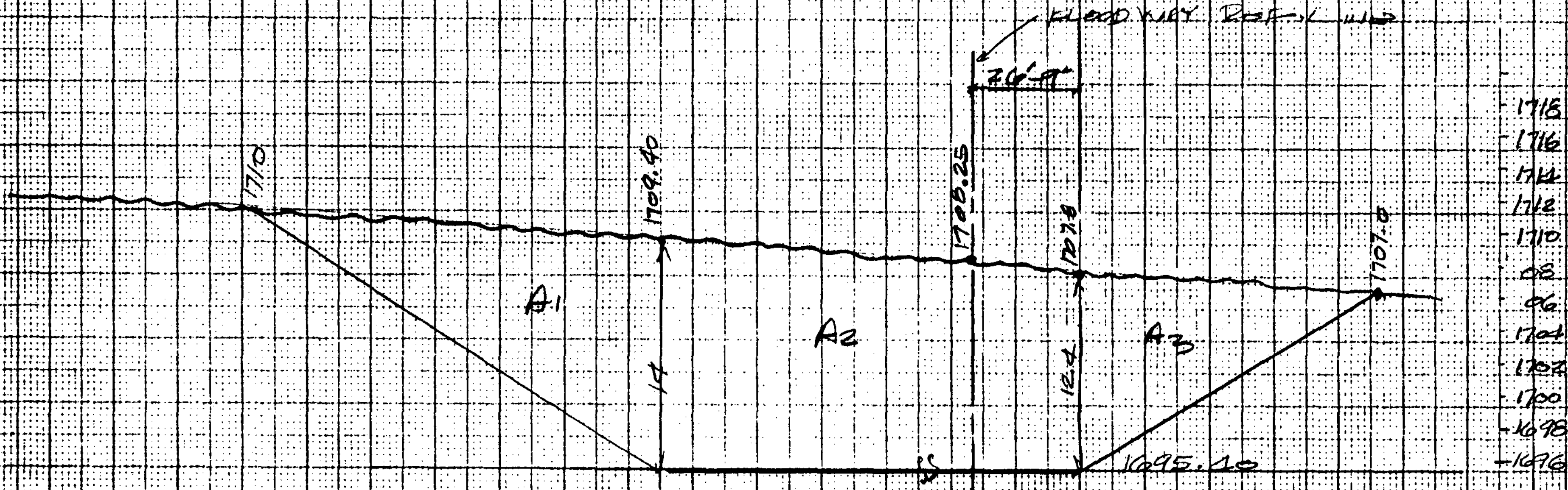
12-38
National

L = 100'-0"

STATION 207+00

SHEET E-12

DISTANCE 150'



Ac = 1845

$A_1 = 1.5 \times 14^2 = 294$

$A_2 = 13.2 \times 100 = 1320$

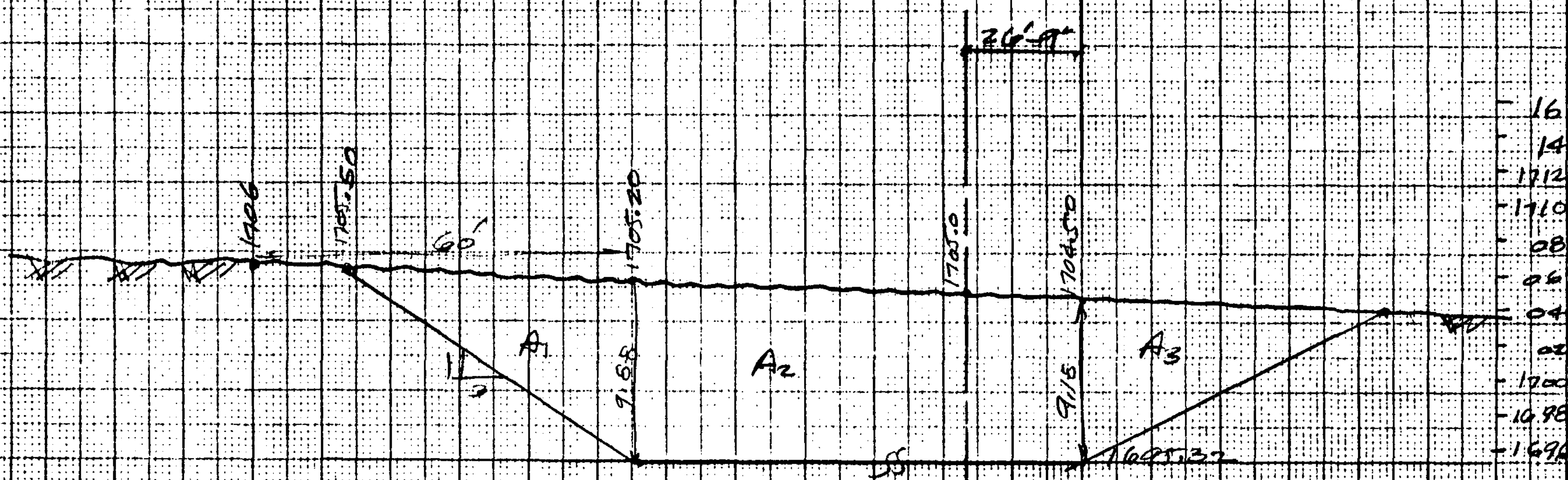
$A_3 = 1.5 \times 12.4^2 = 231$

L = 100'-0'

STATION 207+00

SHEET E-12

DISTANCE 50'



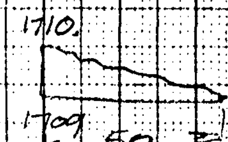
$A_1 = 1.5 \times 9.83^2 = 145$

$A_c = 1221$

$A_2 = 9.49 \times 100 = 949$

$A_3 = 1.5 \times 9.18^2 = 126.5$

ADD FILL FOR UVG=



$V = \frac{12(50)}{2} \times \frac{1}{27} = 13$ C.Y.

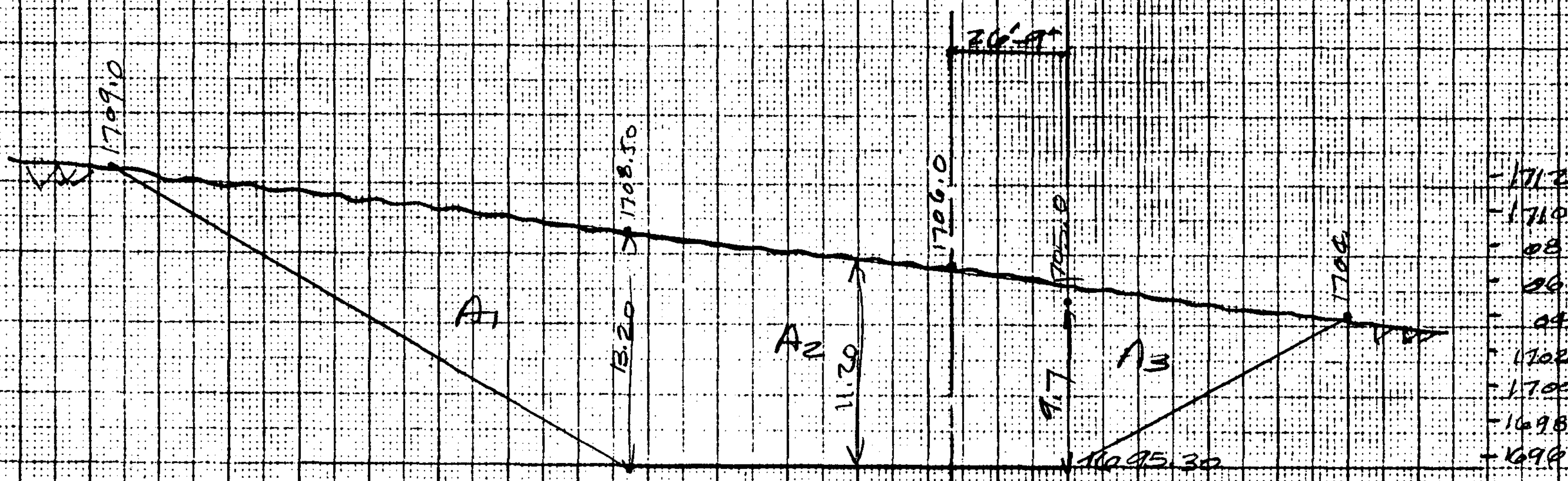
Made in USA

10 Millimeters to the Centimeter

L=100.0'

STATION 208+50 SHEET Z-12

DISTANCE 100'



ADD DIKE $A_c = 1532$

ADD INLET

$A_1 = 1.5 \times 13.45^2 = 271.40$

$A_2 = 11.20 \times 100 = 1120$

$A_3 = 1.5 \times 9.7^2 = 141$

Made in USA

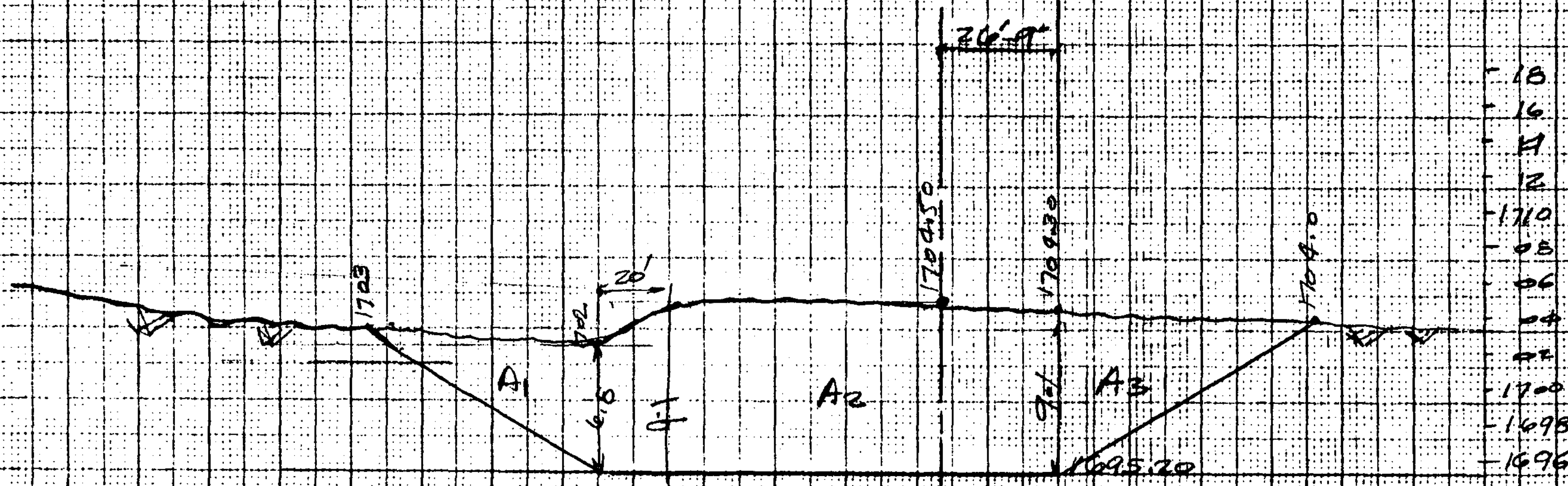
10 Millimeters to the Centimeter

L=100'-0'

STATION 211+50

SHEET 2-12

DISTANCE 300'



$A_C = 1090$

$A_1 = 1.5 \times 6.8^2 = 69.40$

$A_2 = 8 \times 20 + 80 \times 9.2 = 896.40$

$A_3 = 1.5 \times 9.1^2 = 124.20$

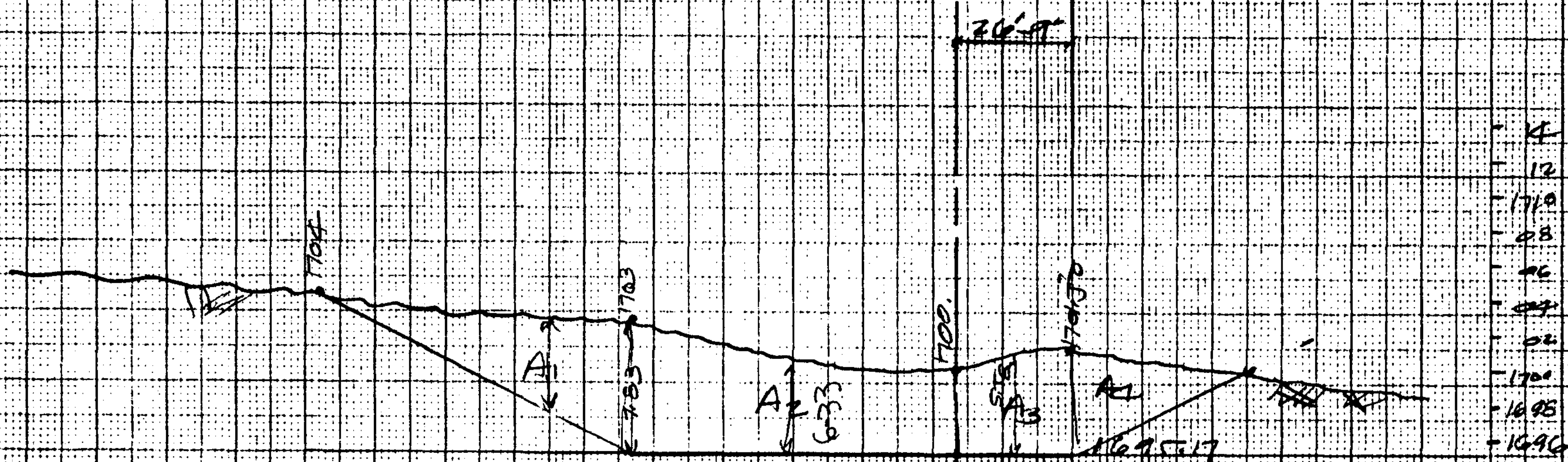
Made in USA

10 Millimeters to the Centimeter

L = 100'-0'

STATION 212_35 SHEET 2-12

DISTANCE 83



$A_C = 777$

$A_1 = 1.5 \times 8.3^2 = 104$

$A_2 = 6.33 \times 73.2 = 463$

$A_3 = 5.58 \times 26.75 = 149$

$A_4 = 1.5 \times 6.4^2 = 61$

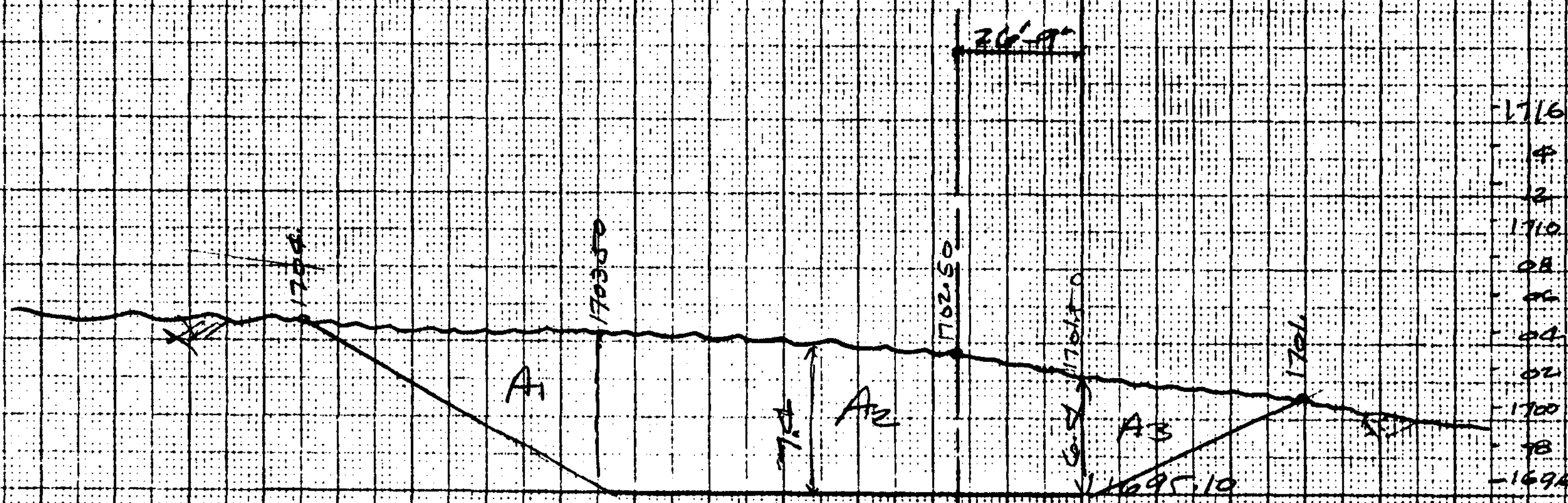
Made in USA

10 Millimeters to the Centimeter

L = 100'-0'

STATION 214+70 SHEET Z-12

DISTANCE 235'



$A_1 = 1.5 \times 8.65^2 = 113$

$A_C = 914$ $A_2 = 7.4 \times 100 = 740$

$A_3 = 1.5 \times 6.9^2 = 61$

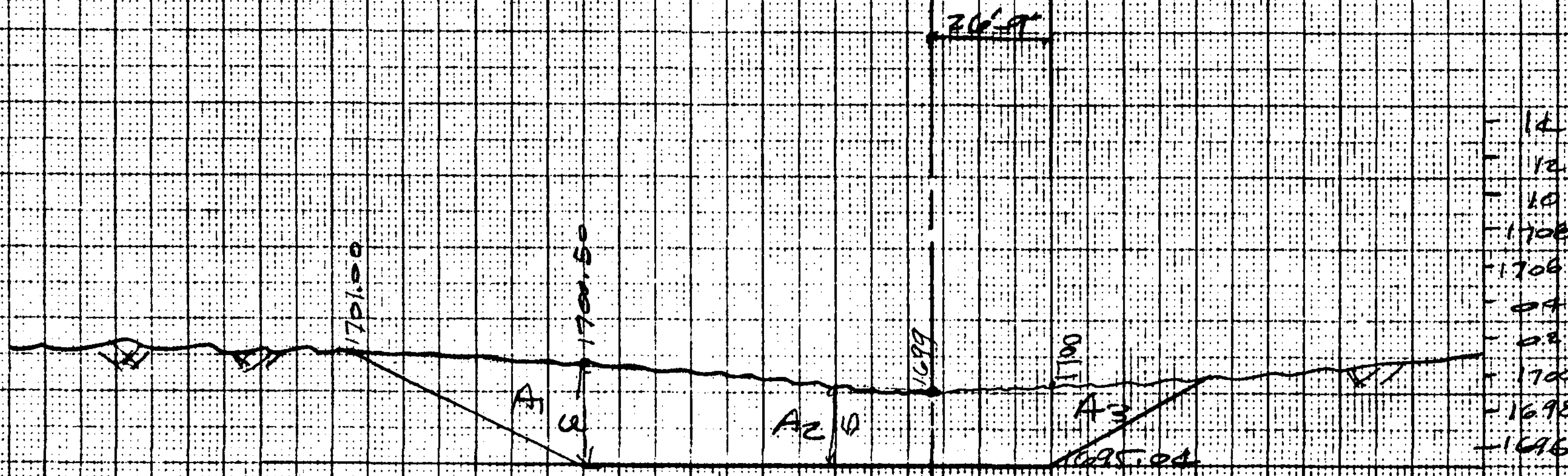
Made in USA

10 Millimeters to the Centimeter

L = 160.0'

STATION 216+50 SHEET 2-12

DISTANCE 180'



$A_1 = 1.5 \times 6^2 = 54$

$A_C = 592$ $A_2 = 5 \times 160 = 500$

$A_3 = 5^2 \times 1.5 = 37.5$

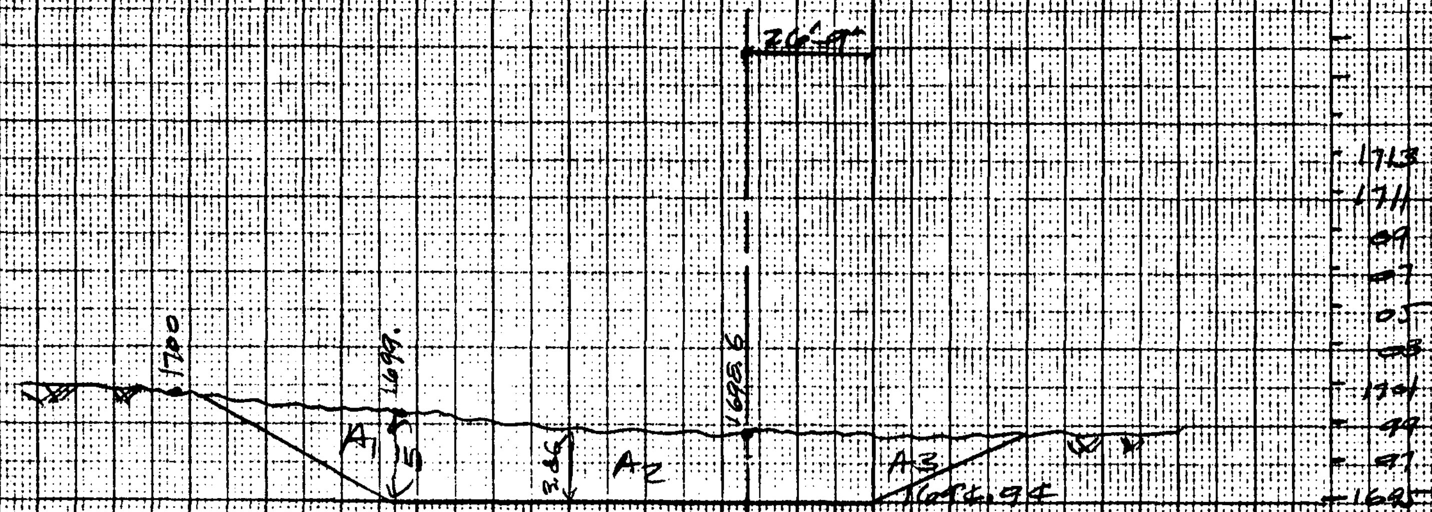
Made in USA

10 Millimeters to the Centimeter

L = 100.0'

STATION 219+40 SHEET Z-12

DISTANCE 296'



$A_C = 446$

$A_1 = 1.5 \times 5^2 = 37.5$

A_2 $3.86 \times 100 = 386$

$A_3 = 1.5 \times 3.86^2 = 22.5$

L = 100.0'

STATION 219+75.13 SHEET E-12

DISTANCE 35.13

$A_1 = 0.55 \times 100 = 55$

$A_c = 55$

Made in USA

10 Millimeters to the Centimeter

VIII CONSTRUCTION SCHEDULE

VIII. CONSTRUCTION SCHEDULE

The Project construction schedule provides for starting construction in November, 1987, and completing the work in approximately one year.

There are no serious constraints upon construction related to whether or seasonal conditions. Control of concrete placement requires more care in the hottest part of the summer, but construction need not be curtailed during that period.

The schedule is based upon what is considered achievable by a small contractor with two concurrent concreting operations, one for the side channel inlets and one for the main channel. Excavation will be done to fit the channel construction schedule requirements, backfilling, maintenance road construction and final grading will follow the channel concrete placement.

An itemized schedule based upon precedence analysis is included and follows.

USDA PRIMAVERA PROJECT [illegible]R BULLDOG FLOODWATER/APPAC[illegible]CTION

REPORT DATE 9APR86 RUN NO. 10 BULLDOG FLOODWATER/APPACHE JUNCTION START DATE 3NOV86 FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET DATA DATE 3NOV86 PAGE NO. 1

WEEKLY-TIME PER. 1

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............ACTIVITY DESCRIPTION.............                  01   05  02  02   06  04  01   06  03   07  05  02   07  04  01   07
ACTIVITY NO  OD   RD  PCT    CODES       FLOAT  SCHEDULE           DEC  JAN FEB MAR  APR MAY JUN  JUL AUG  SEP OCT NOV  DEC JAN FEB  MAR
-----------  ---- ---- ---  ------------ -----  --------           86   87  87  87   87  87  87   87  87   87  87  87   87  88  88   88
                                                               -------------------------------------------------------------------------
     task duration (days)
MOBILIZATION                                    PROPOSED   E   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
     100001     3    3   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

ESTABLISH POLLUTION CONTROLS                    PROPOSED   E   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
     100002     5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

SURVEY - EARTH CHANNEL                          PROPOSED   *E  .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
     190000     5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

CLEARING & GRUBBING - EARTH CHANNEL             PROPOSED   * E .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
     190001     5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

EXCAVATION - EARTH CHANNEL                      PROPOSED   *  EEEEEE.   .   .    .   .   .    .   .    .   .   .    .   .   .    .
     190002    25   25   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

EXCAVATION - ENERGY DISSIPATOR NO.2             PROPOSED   *   .   EEEEE.   .    .   .   .    .   .    .   .   .    .   .   .    .
     100902    20   20   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

ECAVATION - STA 203+50 TO 219+32.52             PROPOSED   *   .    .  EE   .    .   .   .    .   .    .   .   .    .   .   .    .
     100802     5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

WATER CONTROL - ENERGY DISSIPATOR NO.2          PROPOSED   *   .    .  EE   .    .   .   .    .   .    .   .   .    .   .   .    .
     100903     5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

WATER CONTROL - STA 203+50 TO 219+32.52         PROPOSED   *   .    .   E   .    .   .   .    .   .    .   .   .    .   .   .    .
     100803     2    2   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

REINFORCING STEEL - STA 203+50 TO 219+32.52     PROPOSED   *   .    .   .EEEE    .   .   .    .   .    .   .   .    .   .   .    .
     100804    18   18   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

REINFORCING STEEL - STA 183+85 TO 203+50        PROPOSED   *   .    .   .   EEEEEE   .   .    .   .    .   .   .    .   .   .    .
     100704    24   24   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

REINFORCING STEEL - STA 170+00 TO 183+85        PROPOSED   *   .    .   .   .    EEEEE   .    .   .    .   .   .    .   .   .    .
     100604    18   18   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

REINFORCING STEEL - STA 154+55 TO 170+00        PROPOSED   *   .    .   .   .    .   EEEE.    .   .    .   .   .    .   .   .    .
     100504    18   18   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

REINFORCING STEEL STA - 140+00 TO 154+55        PROPOSED   *   .    .   .   .    .   .   EEEE .   .    .   .   .    .   .   .    .
     100404    18   18   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

REINFORCING STEEL - STA 132+20 TO 140+00        PROPOSED   *   .    .   .   .    .   .   .  EEE   .    .   .   .    .   .   .    .
     100304     7    7   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
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USDA PRIMAVERA PROJECT ER BULLDOG FLOODWATER/APPACH CTION

REPORT DATE 9APR86 RUN NO. 10 BULLDOG FLOODWATER/APPACHE JUNCTION START DATE 3NOV86 FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET DATA DATE 3NOV86 PAGE NO. 2

WEEKLY-TIME PER. 1

ACTIVITY DESCRIPTION / ACTIVITY NO	OD	RD	PCT	CODES	FLOAT	SCHEDULE	01 DEC 86	05 JAN 87	02 FEB 87	02 MAR 87	06 APR 87	04 MAY 87	01 JUN 87	06 JUL 87	03 AUG 87	07 SEP 87	05 OCT 87	02 NOV 87	07 DEC 87	04 JAN 88	01 FEB 88	07 MAR 88
REINFORCING STEEL - STA 115+63 TO 132+20 100204	20	20	0			PROPOSED								EEEEE								
REINFORCING STEEL - STA 101+46 TO 115+63 100104	18	18	0			PROPOSED									EEEE							
FORMS - STA 101+46 TO 115+63 100105	14	14	0			PROPOSED									.EEE							
CONCRETE - 101+46 TO 115+63 100106	10	10	0			PROPOSED									.EEE							
FILL - STA 101+46 TO 115+63 100107	5	5	0			PROPOSED									EE.							
FORMS - STA 115+63 TO 132+20 100205	16	16	0			PROPOSED								.EEEE								
CONCRETE - STA 115+63 TO 132+20 100206	12	12	0			PROPOSED								. EEE								
FORMS - STA 132+20 TO 140+00 100305	5	5	0			PROPOSED								EE								
FORMS STA - 140+00 TO 154+55 100405	15	15	0			PROPOSED							EEEE									
FORMS - STA 154+55 TO 170+00 100505	14	14	0			PROPOSED						.EEEE										
CONCRETE - STA 154+55 TO 170+00 100506	14	14	0			PROPOSED							EEEE									
CONCRETE - STA 140+00 TO 154+55 100406	12	12	0			PROPOSED							. EEE.									
CONCRETE - STA 132+20 TO 140+00 100306	8	8	0			PROPOSED								EEE								
ECAVATION - STA 183+85 TO 203+50 100702	5	5	0			PROPOSED			EE													
WATER CONTROL - STA 183+85 TO 203+50 100703	2	2	0			PROPOSED			.E													

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USDA                                    PRIMAVERA PROJEC[illegible]NER                    BULLDOG FLOODWATER/APPA[illegible]NCTION

REPORT DATE   9APR86   RUN NO.    10   BULLDOG FLOODWATER/APPACHE JUNCTION               START DATE   3NOV86   FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET                                              DATA DATE   3NOV86    PAGE NO.     3

                                                                                                      WEEKLY-TIME PER.    1

 .............ACTIVITY DESCRIPTION.............                  01   05  02  02   06  04  01   06  03   07  05  02   07  04  01   07
 ACTIVITY NO  OD    RD   PCT    CODES       FLOAT   SCHEDULE     DEC  JAN FEB MAR  APR MAY JUN  JUL AUG  SEP OCT NOV  DEC JAN FEB  MAR
 ----------- ----  ----  ---  -----------  -----   --------      86   87  87  87   87  87  87   87  87   87  87  87   87  88  88   88

 FILL - STA 115+63 TO 132+20                        PROPOSED *   .    .   .   .    .   .   .    .   EE   .   .   .    .   .   .    .
      100207     5     5    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FORMS - STA 170+00 TO 183+85                       PROPOSED *   .    .   .   .    .EEEE   .    .   .    .   .   .    .   .   .    .
      100605    14    14    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 WATER CONTROL - EARTH CHANNEL                      PROPOSED *   .   EE   .   .    .   .   .    .   .    .   .   .    .   .   .    .
      190003     5     5    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FORMS - STA 183+85 TO 203+50                       PROPOSED *   .    .   .   .EEEEE   .   .    .   .    .   .   .    .   .   .    .
      100705    20    20    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FILL - STA 132+20 TO 140+00                        PROPOSED *   .    .   .   .    .   .   .    .EE .    .   .   .    .   .   .    .
      100307     5     5    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 SURVEY - ENERGY DISSIPATOR NO.2                    PROPOSED * E .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
      100900     5     5    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 CLEARING & GRUBBING - ENERGY DISSIPATOR NO.2       PROPOSED *  E.    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
      100901     4     4    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FORMS - STA 203+50 TO 219+32.52                    PROPOSED *   .    .   .EEEE    .   .   .    .   .    .   .   .    .   .   .    .
      100805    16    16    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 CONRETE  - STA 170+00 TO 183+85                    PROPOSED *   .    .   .   .    .EEEE   .    .   .    .   .   .    .   .   .    .
      100606    14    14    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 CONCRETE - STA 183+85 TO 203+50                    PROPOSED *   .    .   .   . EEEE   .   .    .   .    .   .   .    .   .   .    .
      100706    19    19    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FILL STA - 140+00 TO 154+55                        PROPOSED *   .    .   .   .    .   .   .   EE   .    .   .   .    .   .   .    .
      100407     5     5    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 EXCAVATION - STA 170+00 TO 183+85                  PROPOSED *   .    .   .EE .    .   .   .    .   .    .   .   .    .   .   .    .
      100602     5     5    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 CONCRETE -STA 203+50 TO 219+32.52                  PROPOSED *   .    .   .EEEEE   .   .   .    .   .    .   .   .    .   .   .    .
      100806    17    17    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 WATER CONTROL - STA 170+00 TO 183+85               PROPOSED *   .    .   . EE.    .   .   .    .   .    .   .   .    .   .   .    .
      100603     2     2    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 SURVEY - STA 203+50 TO 219+32.52                   PROPOSED *  EE    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
      100800     5     5    0                                *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
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USDA PRIMAVERA PROJECT [illegible]ER BULLDOG FLOODWATER/APPACH[illegible]CTION

REPORT DATE 9APR86 RUN NO. 10 BULLDOG FLOODWATER/APPACHE JUNCTION START DATE 3NOV86 FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET DATA DATE 3NOV86 PAGE NO. 4

WEEKLY-TIME PER. 1

ACTIVITY DESCRIPTION / ACTIVITY NO	OD	RD	PCT	CODES	FLOAT	SCHEDULE	01 DEC 86 · 05 JAN 87 · 02 FEB 87 · 02 MAR 87 · 06 APR 87 · 04 MAY 87 · 01 JUN 87 · 06 JUL 87 · 03 AUG 87 · 07 SEP 87 · 05 OCT 87 · 02 NOV 87 · 07 DEC 87 · 04 JAN 88 · 01 FEB 88 · 07 MAR 88
SURVEY - WEIR INLET NO. 7						PROPOSED	* EE . . . .
170000	5	5	0				* . . . .
SURVEY - WEIR INLET NO. 8						PROPOSED	* EE . . . .
180000	5	5	0				* . . . .
CLEARING & GRUBING - STA 203+50 TO 219+32.52						PROPOSED	* .E . . . .
100801	3	3	0				* . . . .
CLEARING & GRUBBING - WEIR INLET NO. 7						PROPOSED	* .E . . . .
170001	2	2	0				* . . . .
CLEARING & GRUBBING - WEIR INLET NO. 8						PROPOSED	* .E . . . .
180001	2	2	0				* . . . .
EXCAVATION - WEIR INLET NO. 7						PROPOSED	* .EE . . . .
170002	5	5	0				* . . . .
EXCAVATION - WEIR INLET NO. 8						PROPOSED	* .EE . . . .
180002	5	5	0				* . . . .
WATER CONTROL - WEIR INLET NO.7						PROPOSED	* . E . . . .
170003	2	2	0				* . . . .
WATER CONTROL - WEIR INLET NO.8						PROPOSED	* . E . . . .
180003	2	2	0				* . . . .
FILL - STA 154+55 TO 170+00						PROPOSED	* . . . . . . .EE . . . .
100507	5	5	0				* . . . .
IDENTIFICATION MARKERS						PROPOSED	* . . . . EE . . . .
100007	5	5	0				* . . . .
REINFORCING STEEL - WEIR INLET NO. 7						PROPOSED	* . EE. . . . .
170004	8	8	0				* . . . .
REINFORCING STEEL - WEIR INLET NO. 8						PROPOSED	* . EE. . . . .
180004	8	8	0				* . . . .
EXCAVATION - STA 154+55 TO 170+00						PROPOSED	* . . . EE. . . . .
100502	5	5	0				* . . . .
WATER CONTROL - STA 154+55 TO 170+00						PROPOSED	* . . . EE . . . .
100503	2	2	0				* . . . .

USDA　　PRIMAVERA PROJECT P[illegible]ER　　BULLDOG FLOODWATER/APPACH[illegible]TION

REPORT DATE 9APR86 RUN NO. 10　　BULLDOG FLOODWATER/APPACHE JUNCTION　　START DATE 3NOV86 FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET　　DATA DATE 3NOV86 PAGE NO. 5

WEEKLY-TIME PER. 1

............ACTIVITY DESCRIPTION............ ACTIVITY NO	OD	RD	PCT	CODES	FLOAT	SCHEDULE		01 DEC 86	05 JAN 87	02 FEB 87	02 MAR 87	06 APR 87	04 MAY 87	01 JUN 87	06 JUL 87	03 AUG 87	07 SEP 87	05 OCT 87	02 NOV 87	07 DEC 87	04 JAN 88	01 FEB 88	07 MAR 88
SURVEY - STA 183+85 TO 203+50						PROPOSED	*	EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100700	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SURVEY - SIDE CHANNEL NO.3						PROPOSED	*	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
103000	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SURVEY - SIDE CHANNEL NO.7						PROPOSED	*	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
107000	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING & GRUBING - STA 183+85 TO 203+50						PROPOSED	*	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100701	3	3	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING & GRUBBING - SIDE CHANNEL NO.3						PROPOSED	*	. E	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
103001	1	1	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING & GRUBING - SIDE CHANNEL NO.7						PROPOSED	*	. E	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
107001	1	1	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EXCAVATION - SIDE CHANNEL NO.3						PROPOSED	*	. EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
103002	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EXCAVATION - SIDE CHANNEL NO.7						PROPOSED	*	. EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
107002	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WATER CONTROL - SIDE CHANNEL NO.3						PROPOSED	*	. E	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
103003	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WATER CONTROL - SIDE CHANNEL NO.7						PROPOSED	*	. E	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
107003	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EXCAVATION - 140+00 TO 154+55						PROPOSED	*	.	.	.	EE	.	.	.	.	.	.	.	.	.	.	.	.
100402	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WATER CONTROL STA - 140+00 TO 154+55						PROPOSED	*	.	.	.	EE	.	.	.	.	.	.	.	.	.	.	.	.
100403	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FILL - STA 170+00 TO 183+85						PROPOSED	*	.	.	.	.	.	EE	.	.	.	.	.	.	.	.	.	.
100607	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FORMS - WEIR INLET NO.7						PROPOSED	*	.	EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
170005	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FORMS - WEIR INLET NO.8						PROPOSED	*	.	EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
180005	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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USDA                                         PRIMAVERA PROJECT PLANNER                     BULLDOG FLOODWATER/APPACHE JUNCTION

REPORT DATE   9APR86   RUN NO.    10        BULLDOG FLOODWATER/APPACHE JUNCTION            START DATE   3NOV86   FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET                                                DATA DATE   3NOV86    PAGE NO.     6

                                                                                                     WEEKLY-TIME PER.    1
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 .............ACTIVITY DESCRIPTION.............                        01   05   02   02   06   04   01   06   03   07   05   02   07   04   01   07
 ACTIVITY NO  OD   RD  PCT     CODES      FLOAT    SCHEDULE            DEC  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  JAN  FEB  MAR
 -----------  ---- ---- --- ------------ -----    --------             86   87   87   87   87   87   87   87   87   87   87   87   87   88   88   88
                                                                     ------------------------------------------------------------------------------------
 CONCRETE  - WEIR INLET NO. 7                      PROPOSED       *   .    EEE .    .    .    .    .    .    .    .    .    .    .    .    .    .
      170006   10   10   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 CONCRETE - WEIR INLET NO. 8                       PROPOSED       *   .    EEE .    .    .    .    .    .    .    .    .    .    .    .    .    .
      180006   10   10   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 SURVEY - STA 170+00 TO 183+85                     PROPOSED       *   .EE  .    .    .    .    .    .    .    .    .    .    .    .    .    .
      100600    5    5   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 SURVEY - WEIR INLET NO. 6                         PROPOSED       *   . EE .    .    .    .    .    .    .    .    .    .    .    .    .    .
      160000    5    5   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 CLEARING & GRUBBING - STA 170+00 TO 183+85        PROPOSED       *   .  E .    .    .    .    .    .    .    .    .    .    .    .    .    .
      100601    2    2   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 CLEARING & GRUBBING - WEIR INLET NO. 6            PROPOSED       *   .  E .    .    .    .    .    .    .    .    .    .    .    .    .    .
      160001    2    2   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 EXCAVATION - WEIR INLET NO. 6                     PROPOSED       *   .  EE.    .    .    .    .    .    .    .    .    .    .    .    .    .
      160002    5    5   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 REINFORCING STEEL - SIDE CHANNEL NO.3             PROPOSED       *   .  EEE    .    .    .    .    .    .    .    .    .    .    .    .    .
      103004    6    6   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 WATER CONTROL - WEIR INLET NO.6                   PROPOSED       *   .   EE    .    .    .    .    .    .    .    .    .    .    .    .    .
      160003    2    2   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 REINFORCING STEEL - SIDE CHANNEL NO.7             PROPOSED       *   .  EE.    .    .    .    .    .    .    .    .    .    .    .    .    .
      107004    5    5   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 EXCAVATION STA 132+20 TO 140+00                   PROPOSED       *   .    .    .    EE   .    .    .    .    .    .    .    .    .    .    .
      100302    5    5   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 WATER CONTROL 132+20 TO 140+00                    PROPOSED       *   .    .    .    .EE  .    .    .    .    .    .    .    .    .    .    .
      100303    2    2   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 EXCAVATION - STA 115+63 TO 132+20                 PROPOSED       *   .    .    .    .EE  .    .    .    .    .    .    .    .    .    .    .
      100202    5    5   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 WATER CONTROL - STA 115+63 TO 132+20              PROPOSED       *   .    .    .    . EE .    .    .    .    .    .    .    .    .    .    .
      100203    2    2   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .

 FORMS - SIDE CHANNEL NO.3                         PROPOSED       *   .    EEE .    .    .    .    .    .    .    .    .    .    .    .    .    .
      103005   10   10   0                                        *   .    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
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USDA                                   PRIMAVERA PROJECT     ER                       BULLDOG FLOODWATER/APPAC     CTION
REPORT DATE  9APR86  RUN NO.   10    BULLDOG FLOODWATER/APPACHE JUNCTION             START DATE  3NOV86  FIN DATE 31OCT87
BULLDOG FLOODWATER & APACHE JUNCTION OUTLET                                          DATA DATE  3NOV86   PAGE NO.    7
                                                                                               WEEKLY-TIME PER.    1
-------------------------------------------------------------------------------------------------------------------------
.............ACTIVITY DESCRIPTION.............              01  05  02  02  06  04  01  06  03  07  05  02  07  04  01  07
ACTIVITY NO  OD   RD  PCT    CODES      FLOAT   SCHEDULE   DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR
-----------  ---- ---- --- ------------ -----   --------    86  87  87  87  87  87  87  87  87  87  87  87  87  88  88  88
                                                          ------------------------------------------------------------------
CONCRETE   -SIDE CHANNEL NO.3                   PROPOSED  *  .   . EEE  .   .   .   .   .   .   .   .   .   .   .   .   .
     103006   10   10   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

FORMS - SIDE CHANNEL NO.7                       PROPOSED  *  .  EE   .   .   .   .   .   .   .   .   .   .   .   .   .   .
     107005   10   10   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

REINFORCING STEEL - WEIR INLET NO. 6            PROPOSED  *  .  EE   .   .   .   .   .   .   .   .   .   .   .   .   .   .
     160004    8    8   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

CONCRETE   -SIDE CHANNEL NO.7                   PROPOSED  *  .   . EEE  .   .   .   .   .   .   .   .   .   .   .   .   .
     107006   10   10   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

FILL - STA 183+85 TO 203+50                     PROPOSED  *  .   .   .   .  EE   .   .   .   .   .   .   .   .   .   .   .
     100707    5    5   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

SURVEY - STA 154+55 TO 170+00                   PROPOSED  *  . EE .  .   .   .   .   .   .   .   .   .   .   .   .   .   .
     100500    5    5   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

SURVEY - WEIR INLET NO. 5                       PROPOSED  *  .  EE.  .   .   .   .   .   .   .   .   .   .   .   .   .   .
     150000    5    5   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

CLEARING & GRUBBING - STA 154+55 TO 170+00      PROPOSED  *  .   E.  .   .   .   .   .   .   .   .   .   .   .   .   .   .
     100501    2    2   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

CLEARING & GRUBBING - WEIR INLET NO. 5          PROPOSED  *  .   E.  .   .   .   .   .   .   .   .   .   .   .   .   .   .
     150001    2    2   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

EXCAVATION - WEIR INLET NO. 5                   PROPOSED  *  .  EE   .   .   .   .   .   .   .   .   .   .   .   .   .   .
     150002    5    5   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

WATER CONTROL - WEIR INLET NO.5                 PROPOSED  *  .  EE   .   .   .   .   .   .   .   .   .   .   .   .   .   .
     150003    2    2   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

SURVEY - SIDE CHANNEL NO.5                      PROPOSED  *  .  EE.  .   .   .   .   .   .   .   .   .   .   .   .   .   .
     105000    5    5   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

CLEARING & GRUBING - SIDE CHANNEL NO.5          PROPOSED  *  .   E.  .   .   .   .   .   .   .   .   .   .   .   .   .   .
     105001    1    1   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

EXCAVATION - SIDE CHANNEL NO.5                  PROPOSED  *  .  EE   .   .   .   .   .   .   .   .   .   .   .   .   .   .
     105002    5    5   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .

WATER CONTROL - SIDE CHANNEL NO.5               PROPOSED  *  .   E   .   .   .   .   .   .   .   .   .   .   .   .   .   .
     105003    2    2   0                                 *  .   .   .   .   .   .   .   .   .   .   .   .   .   .   .   .
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REPORT DATE 9APR86 RUN NO. 10 BULLDOG FLOODWATER/APPACHE JUNCTION START DATE 3NOV86 FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET DATA DATE 3NOV86 PAGE NO. 8

WEEKLY-TIME PER. 1

ACTIVITY DESCRIPTION / ACTIVITY NO	OD	RD	PCT	CODES	FLOAT	SCHEDULE		01 DEC 86	05 JAN 87	02 FEB 87	02 MAR 87	06 APR 87	04 MAY 87	01 JUN 87	06 JUL 87	03 AUG 87	07 SEP 87	05 OCT 87	02 NOV 87	07 DEC 87	04 JAN 88	01 FEB 88	07 MAR 88
FORMS WEIR INLET NO.6						PROPOSED	*	.	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
160005	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CONCRETE - WEIR INLET NO. 6						PROPOSED	*	.	.	EE	.	.	.	.	.	.	.	.	.	.	.	.	.
160006	10	10	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SURVEY - STA 140+00 TO 154+55						PROPOSED	*	.	EE.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100400	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SURVEY - WEIR INLET NO. 4						PROPOSED	*	.	EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
140000	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING & GRUBBING - WEIR INLET NO. 4						PROPOSED	*	.	EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
140001	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING & GRUBBING STA - 140+00 TO 154+55						PROPOSED	*	.	.E	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100401	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
REINFORCING STEEL - WEIR INLET NO. 5						PROPOSED	*	.	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
150004	8	8	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EXCAVATION - WEIR INLET NO. 4						PROPOSED	*	.	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
140002	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WATER CONTROL - WEIR INLET NO.4						PROPOSED	*	.	. E	.	.	.	.	.	.	.	.	.	.	.	.	.	.
140003	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ECAVATION - STA 101+46 TO 115+63						PROPOSED	*	.	.	.	.	EE .	.	.	.	.	.	.	.	.	.	.	.
100102	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WATER CONTROL - STA 101+46 TO 115+63						PROPOSED	*	.	.	.	.	EE.	.	.	.	.	.	.	.	.	.	.	.
100103	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SURVEY - WEIR INLET NO. 3						PROPOSED	*	.	EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
130000	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING & GRUBBING - WEIR INLET NO. 3						PROPOSED	*	.	E	.	.	.	.	.	.	.	.	.	.	.	.	.	.
130001	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EXCAVATION - WEIR INLET NO. 3						PROPOSED	*	.	EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
130002	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WATER CONTROL - WEIR INLET NO.3						PROPOSED	*	.	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
130003	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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USDA                                           PRIMAVERA PROJECT P[illegible]ER                         BULLDOG FLOODWATER/APPACH[illegible]CTION

REPORT DATE  9APR86  RUN NO.   10            BULLDOG FLOODWATER/APPACHE JUNCTION              START DATE  3NOV86   FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET                                                   DATA DATE  3NOV86    PAGE NO.    9

                                                                                                            WEEKLY-TIME PER.   1

 ............ACTIVITY DESCRIPTION..............                01   05  02  02   06  04  01   06  03   07  05  02   07  04  01   07
 ACTIVITY NO  OD   RD  PCT    CODES     FLOAT     SCHEDULE     DEC  JAN FEB MAR  APR MAY JUN  JUL AUG  SEP OCT NOV  DEC JAN FEB  MAR
 ----------- ---- ---- --- ----------- -----      --------     86   87  87  87   87  87  87   87  87   87  87  87   87  88  88   88

 REINFORCING STEEL - SIDE CHANNEL NO.5           PROPOSED  *   .    .E  .   .    .   .   .    .   .    .   .   .    .   .   .    .
      105004    5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FORMS - SIDE CHANNEL NO.5                       PROPOSED  *   .    . EEE   .    .   .   .    .   .    .   .   .    .   .   .    .
      105005   10   10   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 CONCRETE  -SIDE CHANNEL NO.5                    PROPOSED  *   .    .   EEE .    .   .   .    .   .    .   .   .    .   .   .    .
      105006   10   10   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FILL - STA 203+50 TO 219+32.52                  PROPOSED  *   .    .   .  EE    .   .   .    .   .    .   .   .    .   .   .    .
      100807    5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FORMS - WEIR INLET NO.5                         PROPOSED  *   .    .  E.   .    .   .   .    .   .    .   .   .    .   .   .    .
      150005    5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 CONCRETE  - WEIR INLET NO. 5                    PROPOSED  *   .    .   EE  .    .   .   .    .   .    .   .   .    .   .   .    .
      150006   10   10   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 REINFORCING STEEL - WEIR INLET NO. 4            PROPOSED  *   .    .  EE   .    .   .   .    .   .    .   .   .    .   .   .    .
      140004    8    8   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FILL - ENERGY DISSIPATOR NO.2                   PROPOSED  *   .    .   EEE .    .   .   .    .   .    .   .   .    .   .   .    .
      100907   10   10   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FORMS - WEIR INLET NO.4                         PROPOSED  *   .    .   EE  .    .   .   .    .   .    .   .   .    .   .   .    .
      140005    5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 CONCRETE  - WEIR INLET NO. 4                    PROPOSED  *   .    .   .EEE.    .   .   .    .   .    .   .   .    .   .   .    .
      140006   10   10   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 REINFORCING STEEL - WEIR INLET NO. 3            PROPOSED  *   .    . EE.   .    .   .   .    .   .    .   .   .    .   .   .    .
      130004    8    8   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 FORMS - WEIR INLET NO.3                         PROPOSED  *   .    .   E   .    .   .   .    .   .    .   .   .    .   .   .    .
      130005    5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 CONCRETE  - WEIR INLET NO.3                     PROPOSED  *   .    .   .EEE.    .   .   .    .   .    .   .   .    .   .   .    .
      130006   10   10   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 SURVEY - STA 132+20 TO 140+00                   PROPOSED  *   .   EE   .   .    .   .   .    .   .    .   .   .    .   .   .    .
      100300    5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

 SURVEY - SIDE CHANNEL NO.4                      PROPOSED  *   .    EE  .   .    .   .   .    .   .    .   .   .    .   .   .    .
      104000    5    5   0                                 *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
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USDA PRIMAVERA PROJECT [illegible]ER BULLDOG FLOODWATER/APPACH[illegible]NCTION

REPORT DATE 9APR86 RUN NO. 10 BULLDOG FLOODWATER/APPACHE JÚNCTION START DATE 3NOV86 FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET DATA DATE 3NOV86 PAGE NO. 10

WEEKLY-TIME PER. 1

............ACTIVITY DESCRIPTION............ ACTIVITY NO	OD	RD	PCT	CODES	FLOAT	SCHEDULE		01 DEC 86	05 JAN 87	02 FEB 87	02 MAR 87	06 APR 87	04 MAY 87	01 JUN 87	06 JUL 87	03 AUG 87	07 SEP 87	05 OCT 87	02 NOV 87	07 DEC 87	04 JAN 88	01 FEB 88	07 MAR 88
CLEARING & GRUBING - SIDE CHANNEL NO. 4						PROPOSED	*	.	.E	.	.	.	.	.	.	.	.	.	.	.	.	.	.
104001	1	1	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EXCAVATION - SIDE CHANNEL NO. 4						PROPOSED	*	.	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
104002	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WATER CONTROL - SIDE CHANNEL NO. 4						PROPOSED	*	.	. EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
104003	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
REINFORCING STEEL - SIDE CHANNEL NO. 4						PROPOSED	*	.	. EE		.	.	.	.	.	.	.	.	.	.	.	.	.
104004	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FORMS - SIDE CHANNEL NO. 4						PROPOSED	*	.	.	EEE	.	.	.	.	.	.	.	.	.	.	.	.	.
104005	10	10	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CONCRETE -SIDE CHANNEL NO. 4						PROPOSED	*	.	.	. EEE		.	.	.	.	.	.	.	.	.	.	.	.
104006	10	10	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING & GRUBBING - STA 132+20 TO 140+00						PROPOSED	*	.	.E	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100301	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SURVEY - STA 115+63 TO 132+20						PROPOSED	*	.	EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100200	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SURVEY - SIDE CHANNEL NO. 2						PROPOSED	*	.	.EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102000	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING &GRUBBING - STA 115+63 TO 132+20						PROPOSED	*	.	. E	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100201	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
CLEARING & GRUBING - SIDE CHANNEL NO. 2						PROPOSED	*	.	. E	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102001	1	1	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EXCAVATION - SIDE CHANNEL NO. 2						PROPOSED	*	.	. EE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
102002	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
WATER CONTROL - SIDE CHANNEL NO. 2						PROPOSED	*	.	. EE		.	.	.	.	.	.	.	.	.	.	.	.	.
102003	2	2	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FILL - EARTH CHANNEL						PROPOSED	*	.	EEE	.	.	.	.	.	.	.	.	.	.	.	.	.	.
190004	10	10	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FILL - WEIR INLET NO. 4						PROPOSED	*	.	.	. EE		.	.	.	.	.	.	.	.	.	.	.	.
140007	5	5	0				*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

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.............ACTIVITY DESCRIPTION.............
ACTIVITY NO  OD   RD  PCT    CODES     FLOAT   SCHEDULE      01   05  02  02   06  04  01   06  03   07  05  02   07  04  01   07
                                                             DEC  JAN FEB MAR  APR MAY JUN  JUL AUG  SEP OCT NOV  DEC JAN FEB  MAR
-----------  ---  ---  ---  -----------  -----  --------     86   87  87  87   87  87  87   87  87   87  87  87   87  88  88   88
                                                          ------------------------------------------------------------------------
REINFORCING STEEL - SIDE CHANNEL NO.2              PROPOSED  *   .    .   EE  .    .   .   .    .   .    .   .   .    .   .   .    .
     102004    6    6    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

FILL - SIDE CHANNEL NO.3                           PROPOSED  *   .    .   EE  .    .   .   .    .   .    .   .   .    .   .   .    .
     103007    5    5    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

FORMS - SIDE CHANNEL NO.2                          PROPOSED  *   .    .   .EEE.    .   .   .    .   .    .   .   .    .   .   .    .
     102005   10   10    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

CONCRETE  -SIDE CHANNEL NO.2                       PROPOSED  *   .    .   .  EEE   .   .   .    .   .    .   .   .    .   .   .    .
     102006   10   10    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

FILL - SIDE CHANNEL NO.2                           PROPOSED  *   .    .   .   .EE  .   .   .    .   .    .   .   .    .   .   .    .
     102007    5    5    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

SURVEY - STA 101+46 TO 115+63                      PROPOSED  *   .    .EE .   .    .   .   .    .   .    .   .   .    .   .   .    .
     100100    5    5    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

SURVEY - SIDE CHANNEL NO.1                         PROPOSED  *   .    . EE.   .    .   .   .    .   .    .   .   .    .   .   .    .
     101000    5    5    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

CLEARING & GRUBING - SIDE CHANNEL NO.1             PROPOSED  *   .    .  E.   .    .   .   .    .   .    .   .   .    .   .   .    .
     101001    1    1    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

EXCAVATION - SIDE CHANNEL NO.1                     PROPOSED  *   .    .  EE   .    .   .   .    .   .    .   .   .    .   .   .    .
     101002    5    5    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

FILL - SIDE CHANNEL NO.7                           PROPOSED  *   .    .   EE  .    .   .   .    .   .    .   .   .    .   .   .    .
     107007    5    5    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

WATER CONTROL - SIDE CHANNEL NO.1                  PROPOSED  *   .    .   EE  .    .   .   .    .   .    .   .   .    .   .   .    .
     101003    2    2    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

REINFORCING STEEL - SIDE CHANNEL NO.1              PROPOSED  *   .    .   .EE .    .   .   .    .   .    .   .   .    .   .   .    .
     101004    5    5    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

FORMS - SIDE CHANNEL NO.1                          PROPOSED  *   .    .   . EEE    .   .   .    .   .    .   .   .    .   .   .    .
     101005   10   10    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

FILL - SIDE CHANNEL NO.5                           PROPOSED  *   .    .   . EE.    .   .   .    .   .    .   .   .    .   .   .    .
     105007    5    5    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .

CONCRETE  -SIDE CHANNEL NO.1                       PROPOSED  *   .    .   .   EEE  .   .   .    .   .    .   .   .    .   .   .    .
     101006   10   10    0                                   *   .    .   .   .    .   .   .    .   .    .   .   .    .   .   .    .
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ACTIVITY DESCRIPTION / ACTIVITY NO	OD	RD	PCT	CODES	FLOAT	SCHEDULE	01 DEC 86	05 JAN 87	02 FEB 87	02 MAR 87	06 APR 87	04 MAY 87	01 JUN 87	06 JUL 87	03 AUG 87	07 SEP 87	05 OCT 87	02 NOV 87	07 DEC 87	04 JAN 88	01 FEB 88	07 MAR 88
FILL - SIDE CHANNEL NO.4 104007	5	5	0			PROPOSED				EE												
FILL - SIDE CHANNEL NO.1 101007	5	5	0			PROPOSED				EE												
FILL - WEIR INLET NO. 7 170007	5	5	0			PROPOSED		E														
FILL - WEIR INLET NO. 8 180007	5	5	0			PROPOSED		E														
FILL - WEIR INLET NO. 6 160007	5	5	0			PROPOSED			E													
FILL - WEIR INLET NO. 5 150007	5	5	0			PROPOSED			EE													
FILL - WEIR INLET NO. 3 130007	5	5	0			PROPOSED			EE													
CLEARING & GRUBING - STA 101+46 TO 115+63 100101	2	2	0			PROPOSED		E														
RIP RAP - WEIR INLET NO.4 140008	2	2	0			PROPOSED				EE												
RIP RAP - WEIR INLET NO.3 130008	2	2	0			PROPOSED				E												
RIP RAP - WEIR INLET NO.5 150008	2	2	0			PROPOSED			E													
RIP RAP - WEIR INLET NO.6 160008	2	2	0			PROPOSED			E													
RIP RAP W/DRAINS - EARTH CHANNEL 190005	10	10	0			PROPOSED		EEE														
RIP RAP - WEIR INLET NO.7 170008	2	2	0			PROPOSED			E													
RIP RAP - WEIR INLET NO.8 180008	2	2	0			PROPOSED			E													

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USDA                                  PRIMAVERA PROJECT [illegible]NER                 BULLDOG FLOODWATER/APPA[illegible]NCTION

REPORT DATE  9APR86  RUN NO.   10   BULLDOG FLOODWATER/APPACHE JUNCTION                START DATE  3NOV86   FIN DATE 31OCT87

BULLDOG FLOODWATER & APACHE JUNCTION OUTLET                                            DATA DATE  3NOV86    PAGE NO.   13

                                                                                                 WEEKLY-TIME PER.   1
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.............ACTIVITY DESCRIPTION.............                          01   05  02  02   06  04  01   06  03   07  05  02   07  04  01   07
ACTIVITY NO  OD   RD  PCT    CODES     FLOAT   SCHEDULE                 DEC  JAN FEB MAR  APR MAY JUN  JUL AUG  SEP OCT NOV  DEC JAN FEB  MAR
----------- ---- ---- --- ----------- -----   --------                 86   87  87  87   87  87  87   87  87   87  87  87   87  88  88   88
                                                                   --------------------------------------------------------------------------
CHAIN LINK FENCE                               PROPOSED        *    .   .EE .   .    .   .   .    .   .    .   .   .    .   .   .    .
      100006    5    5   0                                     *    .    .  .   .    .   .   .    .   .    .   .   .    .   .   .    .

FARM FIELD FENCE                               PROPOSED        *    . EEEEE .   .    .   .   .    .   .    .   .   .    .   .   .    .
      100005   20   20   0                                     *    .    .  .   .    .   .   .    .   .    .   .   .    .   .   .    .
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IX OPERATION & MAINTENANCE

PLAN FOR

OPERATION AND MAINTENANCE

OF THE

APACHE JUNCTION OUTLET

AND

BULLDOG FLOODWAY

EBASCO SERVICES INCORPORATED
Two World Trade Center
New York, New York
10048

PLAN FOR

OPERATION AND MAINTENANCE

OF THE

APACHE JUNCTION OUTLET AND BULLDOG FLOODWAY

This plan applies to the Apache Junction Outlet and Bulldog Floodway along with all associated works of improvement. The Flood Control District of Maricopa County is responsible for the features covered under this plan.

I. GENERAL

The Apache Junction Outlet and Bulldog Floodway are flood control measures designed as part of the Buckhorn-Mesa Watershed Project. These features extend from the Apache Junction Floodwater Retarding Structure to the Signal Butte Floodwater Retarding Structure. They are designed to carry the 100-year flood flows from their own uncontrolled drainage areas together with the controlled discharge from the drainage area above the Apache Junction Floodway and FRS. The works of improvement consist of a rectangular reinforced concrete channel having a total length of approximately 10000 feet with weir and side channel inlets, a grouted rock drop energy dissipator, and a trapezoidal earth exit channel.

Although the structures included as part of this project and covered under this plan have been designed based upon the best available technical knowledge, it must be recognized that to function properly they must be periodically inspected and properly operated and maintained. A regular system of inspection and maintenance will assure that they perform as planned and designed.

All features will be inspected immediately after completion and then at least annually. They should also be inspected after significant natural occurrences such as major storms or earthquakes.

II. OPERATION

The Sponsor will be responsible for and will operate without cost to the Service the structures covered under this plan in compliance with all applicable Federal, State, and local laws in a manner that will assure that they serve the purposes for which they were installed as set forth in the "Buckhorn-Mesa Watershed Work Plan" and Supplements thereto.

The Service will, to the extent that its resources permit and upon request of the Sponsor, provide consultative assistance on the operation and maintenance of the structural measures.

The structural measures associated with this plan are designed to function without supervision.

III. INSPECTION

The following list should be utilized in making Annual inspections:

1. Concrete Structures in General

   a. Concrete Surfaces. The condition of the concrete surfaces should be examined to evaluate any deterioration and continuing serviceability of the concrete.

   b. Structural Cracking. Concrete structures should be examined for structural cracking resulting from overstress due to applied loads, shrinkage and temperature effects, or differential movements. All findings should be evaluated.

   c. Movement - Horizontal and Vertical Alignment. Concrete structures should be examined for evidence of any abnormal settlements, heaving, deflections, or lateral movements.

   d. Junctions. The conditions at the junctions of the structure with abutments or embankments should be determined and evaluated.

e. Drains - Foundation. All drains should be examined to determine that they are capable of performing their design function.

f. Water Passages. All water passages and other concrete surfaces subject to running water should be examined for erosion, cavitation, obstructions, leakage, or significant structural cracks.

g. Seepage or Leakage. The faces, abutments, and toes of the concrete structures should be examined for evidence of seepage or abnormal leakage. The sources of seepage should be determined and evaluated.

h. Monolith Joints - Construction Joints. All monolith and construction joints should be examined to determine the condition of the joint and filler material, any movement of joints, or any indication of distress or leakage.

2. Grouted Rock Riprap Structures. The grouted rock riprap structures should be examined for evidence of settlement, cracking, or movement. Erosion of the mortor should be noted. The drainage system on the grouted rock riprap energy dissipator will be checked for evidence of loss of bedding material or plugging of the outlet pipes.

3. Earth Diversions

a. Settlement. The fill and toe area should be examined for any evidence of localized or overall settlement, depressions or erosion.

b. Slope Stability. Slopes should be examined for irregularities in alignment and variances from smooth uniform slopes, unusual changes from original crest alignment and evidence of movement at or beyond the toe, and surface cracks which indicate movement.

5. Spillway Structures. Examination should be made of the weir and side channel inlets on the floodway for any condition which may impose operational constraints on their functioning.

   a. Approach and Outlet Channels. The approach and outlet channels should be examined for any conditions which may impose constraints on their proper functioning and present a potential hazard to the safety of the floodway.

   b. Drop Inlet Structures. The structure and all features should be examined for any conditions which may impose operational constraints on the outlet works. Entrances to intake structure should be examined for conditions such as silt or debris accumulation which may reduce the discharge capabilities of the outlet works.

   c. Conduits, Sluices, Water Passages, Etc. The interior surfaces of conduits should be examined for erosion, cracks, joint separation, or leakage at cracks or joints.

6. Upstream Areas. The ponding area upstream of the inlets should be examined for new features subject to potential backwater flooding.

7. Watershed Runoff Potential. The drainage basin should be examined for any extensive alterations to the surface of the drainage basin such as changed agriculture practices, highway construction or real estate developments that might extensively affect the runoff characteristics. Upstream projects that could have impact on the safety or operation of the floodway should be identified.

8. Reports. A written report will be made of each inspection. A copy of each report will be provided by the inspecting party to the other party within 10 days of the date on which the inspection was made. The report will describe the conditions found and list any corrective action needed with a time frame to complete each action.

1344v

IV. MAINTENANCE

All deficiencies identified the inspection as defined in Section IV sha

A. Structural Maintenance

1. Vehicles. All vehicles nce- work, should be exclud nage caused by vehicles.

2. Structure Drainage. Remove obstructions from foundation drain outlets. Replace small animal guards if necessary.

3. Riprap. Replace or reshape riprap as necessary to protect structure and outlet channel.

4. Fences. Maintain, repair, or replace all fencing as necessary.

5. Reinforced Concrete Channels and Inlets. Repair cracks restore concrete that has deteriorated. Replace loose or missing joint sealer. Remove debris, trash, and other obstructions. Check for evidence of breaks in waterstops and notify SCS if evidence that break has occurred. Notify SCS if there is any evidence of differential movement or loss of drainfill at weep holes.

6. Grouted Rock Riprap. Replace missing mortor and rock. Clean drain holes on energy dissipators. Check for evidence of excessive erosion at interface of natural soil and grouted rock structures that could lead to undermining of the structure and repair as required.

7. Earth Outlet Channel. Repair eroded areas. Remove debris and obstructions.

B. Vegetative Maintenance

1. Vegetation is to be encouraged to thrive and spread.

2. Large dead or dying vegetation near the inlet structures that could effect flow to the inlets or in the channels should be removed.

3. Remove deep rooted plants from the earth diversions along the weir and side channel inlets.

V. EXPIRATION DATE

This agreement is in effect for the evaluated life of the project as defined in the "Buckhorn-Mesa Watershed Work Plan". The Sponsor's duties and responsibilities under other Federal, State, and local laws are not affected by the expiration of this O&M Agreement.

VI. ARIZONA WATERSHED OPERATION AND MAINTENANCE HANDBOOK

Guidelines for performing operation and maintentnace contained in Arizona Watershed Operation and Maintenance Handbook will be followed in implementing this Agreement.

VII. RECORDS

The Sponsor will maintain in a centralized location a record of all inspections and significant actions taken, cost of performance, and completion date with respect to operation, maintenance, and replacement.

X MEMORANDUM TO CONSTRUCTION ENGINEER

MEMORANDUM TO CONSTRUCTION ENGINEER

1. The loose rock riprap called for downstream of the grouted rock riprap chutes at the end of Bulldog Floodway and Apache Junction Floodway may be eliminated if the chutes outlet on sound caliche.

2. The principal spillway conduit has been designed according to TR-5 using the "nonyielding foundation condition" based on the site investigation indicating that it will rest on caliche over its entire length. If it is found during construction that there are segiments along the conduit where the specified cradle thickness is less than that required to reach caliche, the thicknees of the cradle shall be increased as needed to reach caliche.

3. Tests show that there is the possibility of dispersive material in the borrow areas and on the site. Pinhole tests are to be run on the earth fill material during placement. Particular attention should be paid to that fill being placed adjacent to structures including the baffle block chute emergency spillway, the principal spillway conduit, and the channel walls. Material found to be dispersive shall not be placed within twenty (20) feet of any structure or within three (3) feet of the surface of the Apache Junction FRS embankment.

4. Care shall be taken not to contaminate the transition fill material in the Apache Junction FRS during placement of earth fill. This is especially important since only a three (3) foot thickness of transition fill is being specified.

5. Washes uncovered in the process of foundation and cutoff trench excavation are to be removed to caliche.

6. Washes uncovered by excavation in the borrow area are to be blanked with three (3) feet of compacted earth fill placed as required for "Earth Fill".

APPENDIX A

MINUTES OF MEETINGS

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAYS, AND FRS
AND
BULLDOG FLOODWAY

MINUTES OF PRELIMINARY DESIGN CONFERENCE
FEBRUARY 5 AND 6, 1986

SOIL CONSERVATION SERVICE
PHOENIX, ARIZONA

ATTENDEES:	Donald Paulus	- SCS, Phoenix,
	John Sullivan*	- SCS, Phoenix
	Teresa Dominguez**	- Flood Control District of Maricopa County
	Cora Fernandez**	- Flood Control District of Maricopa County
	Jan Warriner**	- Flood Control District of Maricopa County
	Carl Montana,	- Ebasco, New York
	Glen Rockwell	- Ebasco, Santa Ana

* Part-time, February 5, 1986
** Site Visit Only, February 6, 1986

The meeting began at 1:00 PM in the Phoenix Office of SCS and continued until approximately 4:15 PM. The activities on February 6 were a walk through the project from Apache Trail to the end of the Bulldog Floodway, with personnel from the Flood Control District of Maricopa County and an observation of construction activities on the Signal Butte FRS and Pass Mountain Diversion.

1. A draft of written comments forming a supplement to the Phase II Soil Mechanics Report was reviewed. When finalized, these comments will be issued as a bound volume to supplement the original report.

2. SCS believes that specifying a maximum size of three inches (3") in the FRS fill is too restrictive and not necessary to achieving design conditions. Ebasco agrees and will change the maximum size to six inches (6").

3. It was agreed that some further discussion among geotechnical specialists will be scheduled to finalize the specified foundation treatment for the FRS.

4. Discussion of the width of the transition zone in the FRS focused on methods of placement and compaction. Placement methods will be left to the contractor with a minimum width of three feet (3') and compaction by Class II Specification. Contamination during pacement and compaction of the transition zone and surrounding fill are the major concerns. This will be mentioned in the construction notes of the Design Report.

5. Pinhole tests for dispersion will not be part of the contractor's responsibility but will be covered as a recommended procedure for the SCS construction inspection in the constructon notes of the Design Report.

6. Question No. 5 of the Supplement to the Phase II Report is no longer applicable because new criteria govern. The answer to Question No. 12 will be expanded to provide more detail.

7. The design of grouted riprap was reviewed and found to be generally acceptable, with a maximum rock size of 24 inches. The "n" valve of 0.020 used for the grouted riprap with six inches (6") of rock exposed was questioned as being low. The choice will be reviewed and explained. However, since this provides a conservative result for the riprap design which SCS and Ebasco are comfortable with, no change in the design results is expected.

8. A preliminary copy of the review comments on the Phase III, Preliminary Design Report was provided to Ebasco. All items will be incorporated in the design drawings and specificatons or addressed in the Phase IV, Final Design Report.

9. The calculations for the water surface profile will be provided to SCS for review. Item 2 in the minutes of the meeting of January 8 and January 9, 1986 was questioned with regard to effect of a downstream inlet upon an upstream one in supercritical flow. The paper, "Side Weir Flows into Supercritical Channels," is the basis of design and shows the distance upstream of a weir inlet that the swell extends. When inlet 4F was significantly re-located, this distance exceeded the distance from 4G to 4F, indicating interference.

10. The design of floodway curves was discussed. The intended compound radius curve near the end of the concrete portion of the Bulldog Floodway will not fit into the existing alinement without interfering with the Meridian Road bridge. Therefore, Ebasco proposes to use a single radius and raise the wall height the necessary amount. It was pointed out that SCS TR20 requires that added wall height on curves be limited to one foot (1'); therefore, the proposed approach will require a letter request for a waiver of the design standard. The options will be re-examined.

11. Descriptive material on preformed joint filler and sealant was given to Ebasco with SCS preferences indicated. Ebasco will confirm the availability of these products. The availability of other specified products, including waterstop, will also be checked.

12. Several drawings showing reinforcing steel detailing were handed over to SCS for review and comment. A cursory review resulted in several suggestions.

13. SCS usually includes on drawings a table of reinforcing bar lap lengths for additional clarity.

14. It was clarified that the channel bottom slab in floodways with supercritical flow should have an extra inch of thickness above the top layer of reinforcing. This is incorporated in the original placement rather than as an added wearing layer.

15. Nomenclature on the drawings will be coordinated with specifications to assure clarity as to construction requirements.

16. Details of drain filter material around weep holes in walls will be reviewed and modified.

17. Comments resulting from the site visit are covered in a separate memorandum.

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAYS, AND FRS
AND
APACHE JUNCTION OUTLET AND BULLDOG FLOODWAY

NOTES ON SITE FIELD TRIP
FEBRUARY 6, 1986

The following are noted observations as tape-recorded during the walk along the route of the floodways, FRS and outlet. The visit to the site took place between about 9:00 AM and 12:00 NOON on February 6, 1986.

The following people participated in the visit:

Donald Paulus	-	SCE, Phoenix
Teresa Dominguez	-	Flood Control District of Maricopa County
Cora Fernandez	-	Flood Control District of Maricopa County
Jan Warriner	-	Flood Control District of Maricopa County
Carl Montana	-	Ebasco, New York
Glen Rockwell	-	Ebasco, Santa Ana

1. <u>Apache Junction Floodway near Apache Trail</u>

   Natural drainage channels are not well defined. Earthwork grading will be required to collect water and divert it into the inlet.

2. <u>Approximate Station 22+00 on Apache Junction Floodway</u>

   There is a well-maintained road which crosses the floodway. This road is not identified on the land map. A bridge crossing of the floodway may be required. SCS will check with proper authorities to determine the status of the road.

3. <u>End of Apache Junction Floodway</u>

   Everything seems to be as shown on the plans other than the fact that there are a number of minor road networks that may need to be identified.

4. <u>Approximate Station 61+90 on Apache Junction FRS</u>

   Nothing of particular note so far on the FRS.

5. <u>Apache Junction FRS at Idaho and Lost Dutchman (Brown) Roads</u>

   An AT&T manhole for access to the fiber optic cable was noted well in the upstream direction from the FRS. The Flood Control District noted that the City of Apache Junction would like to have the side slopes on the road fills to be 2:1. The Flood Control District is acquiring the property and buildings along the south side of lost Dutchman Road affected by the road ramp.

6. <u>Approximate Station 97 on Apache Junction FRS</u>

   There is an abandoned car located here. Provisions will have to be included in the specifications to cover removal of this vehicle and garbage and junk that has been dumped in the vicinity of the FRS and borrow areas.

7. <u>Junction of Apache Junction Outlet and Bulldog Floodway</u>

   Nothing of particular note from the FRS to this point.

8. <u>Near Beginning of Bulldog Floodway</u>

   There is a major arroyo whose location coincides fairly accurately with the plans.

9. <u>Bulldog Floodway at Ironwood Road</u>

   The road is an asphalt paved road.

10. <u>Bulldog Floodway at Salt River Project Transmission Tower</u>

    The offset distance between the tower footing and the channel wall should be checked again; there may not be enough room for the maintenance road. Also, check that no special treatment is needed where washes will be filled leading to the Bulldog Floodway.

11. <u>Bulldog Floodway near Meridian Road</u>

    Deep gullies exist which floodway must cross. These will be filled for some distance upstream. Where the floodway crosses washes, provisions should be made to assure cutoffs so that water does not pass under the structure and undermine it.

12. <u>Bulldog Floodway West of Meridian Road</u>

    There are boundary fences for the park which must be removed during construction and replaced afterwards. The Flood Control District will obtain the location of the fences. A well-defined wash exists at Station 707+00. Additional surveying may be required at the inlet into the earth channel portion of Bulldog Floodway. The end of the channel is in an area staked as a borrow area for the Signal Butte FRS. The Bulldog Floodway waste excavation should be disposed of off-site from the Signal Butte job.

13. General

A discussion on grouted rock for drop structures led to the Ebasco suggestion that test sections be constructed to evaluate the degree of penetration of the grout into the rock.

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAY, FRS
OUTLET AND BULLDOG FLOODWAY

AGENDA FOR MONTHLY MEETING
FEBRUARY 5 & 6, 1986

SOIL CONSERVATION SERVICE
PHOENIX, ARIZONA

1. Embankment foundation treatment
2. Embankment transition zone width
3. Grouted riprap design
4. Revised water profile calculations
5. Floodway curve design
6. Floodway structural design
7. Excavation spoil disposal
8. Bridge elevations
9. Divisions of Bulldog FW contract
10. Flood inundation study
11. Status of requested extra work contract modification (Nov. 12, 1985)
12. Field trip to project site (Feb. 6)

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAY AND FRS

AND

APACHE JUNCTION OUTLET AND BULLDOG FLOODWAY

MINUTES OF PRELIMINARY DESIGN REVIEW MEETING

JANUARY 8 AND 9, 1986

SOIL CONSERVATION SERVICE - WNTC

PORTLAND, OREGON

ATTENDEES: Donald Paulus - SCS, Phoenix
Donald Wallin* - SCS, Portland
Leland Saele - SCS, Portland
Paul Monville - SCS, Portland
Clifton Deal* - SCS, Portland
Carl Montana - Ebasco, New York
Glen Rockwell - Ebasco, Santa Ana
Dave Groner - Ebasco, Santa Ana

*Part-time

The meeting began at 1:00 PM on January 8, 1986, and continued through business hours until approximately 4:15 PM on January 9, 1986.

The subject of the meeting was the presentation and discussion of SCS comments on the Phase III - Preliminary Design Report and, to a lesser degree, the Phase II - Soil Mecahnics Report.

1. SCS pointed out a general difficulty in reviewing drawings along with supporting designs because of apparent changes in one or the other which are not reflected in both. Ebasco acknowledged that the latest calculations, which correspond to the current topographic information and decisions related to the type of inlet structures to be used, were not included in the Phase III Report. Also, the drawings, in the preliminary state, have not been fully coordinated or checked.

2. SCS requested that the Phase III Report include a calculated water surface profile throughout the lengths of the floodways. This will demonstrate the extent of the effect of the inlet flow upon normal depth. Calculations for the profile have been done and resulted in changing inlet no. 4G on the Bulldog Floodway from an overflow weir to a curved side channel because of flow effects upon inlet 4F. A sketch showing the full profile will be included with the final version of the Report.

3. Additional exploration of changes from the conceptual design presented earlier in the job were requested and will be provided. These are identified in a marked-up copy of the Phase III Report which SCS gave to Ebasco at the meeting. A set of marked-up drawings was also discussed and delivered to Ebasco. SCS confirmed that the bearings given on the revised topographic drawings issued in October, 1985 were still valid.

4. It was agreed that the freeboard in the diked channels leading to the inlets will be governed by the appropriate percentage of the depth rather than a one foot minimum. It was also confirmed that the capacities of the natural washes and approach channels have been checked to verify ability to handle flow to the inlets.

5. Floodway wall thicknesses were discussed to verify criteria and extent of various wall thicknesses. The drawings which detail the walls at the inlets generally show thicknesses of fourteen inches. Since the drawings presented did not detail the walls between inlets, the impression was left that the major portion of the walls was fourteen inches thick. The true case is that most of the walls are the minimum thickness of ten inches. This will be more clearly shown as drawings are completed. Also, the calculations resulting in the fourteen inch thicknesses will be rechecked. An independent check by SCS during the meeting showed close agreement with the Ebasco design.

6. Ebasco also will be looking at the possibility of reducing the fill height against the floodway walls for reaches where the top of the floodway is above the natural ground surface. This could reduce concrete thickness and/or steel requirements in some places. A related consideration will be balance of cut and fill, which has not yet been studied. Also, SCS will check to see whether outside wall exposure is architecturally acceptable. *changed by phone 1-14-86*

7. Colored concrete will be specified for floodway channel walls as well as any other exposed concrete.

8. The Ebasco design will consider the alternatives in the floodway design of a U-section or separate cantilever walls with a separate slab between them. Sample designs using SCS' computer program indicate that quantities for the U-section design are less up to about fifty foot width. This is based upon following SCS standards which call for two layers of reinforcement in the slab portion associated with cantilever walls, hence a total slab thickness of about twelve inches. Ebasco will study further.

9. A discussion of criteria for grouted riprap design resulted in the following conclusions:

   A. Maximum rock size can be specified in the order of 2/3 of the total riprap thickness. Maximum size available is 24 inches.

B. Partial projection of the rock should be specified to increase roughness where flow passes over the grouted riprap at the entrances to the energy dissipation structures.

C. The effects of the greater roughness (higher "n" value) upon velocity and resultant riprap thickness will be evaluated.

D. A drainage system under the riprap will be considered as a means to relieve hydrodynamic pressures which might otherwise develop.

E. The full 100 year flow will be used as the basis for design of the floodway, including energy dissipation structures.

F. Cutoff walls to caliche at the ends of the concrete channels will be included in the design.

G. The possible maintenance requirements associated with grouted riprap will be covered in the O&M section of the Design Folder.

10. It was agreed that it will be best not to disturb the caliche surrounding the concrete encasement of the AT&T cable. The filter material will be brought down to the top of the encasement and will not be drained. This is contrary to the procedure agreed to in the meeting of September 30, 1985, in Santa Ana. Not surrounding the encasement with filter material will require a waiver of SCS design requirements. Ebasco will submit a letter recommending such a waiver.

11. The transition zone in the embankment will be extended all the way to the bottom of the cutoff section. The width of the transition zone can be reduced to three feet if that is considered consistent with economical construction procedures.

12. It was agreed that the embankment top elevation will remain at 1810.0 feet to include a settlement allowance of about 0.2 feet. Crown of road at top of dam will be El. 1810.25 ft.

13. The Phase II - Soil Mechanics Report (page 37) refers to riprap adjacent to emergency spillway walls. Instead of riprap protection, the fill material will be sloped away from the structure, and non-dispersive soils will be placed adjacent to the structures. Dispersive soils also will be prohibited in the portion of the fill within three feet of the surface.

14. Procedures referenced in the Phase II - Soil Mechanics Report regarding embankment foundation preparation (pp. 35, 38) will be modified to eliminate the need to determine and maintain optimum moisture content of the foundation materials.

15. Classification of various types of excavation was discussed. It was agreed that "structure excavation" should be limited to that which requires special equipment and the remainder will be a category of "common excavation" at a lesser unit price. Payment for channel excavation can be to excavation pay limits shown on the drawings.

16. Floodway invert elevations will not be lowered to accommodate bridge elevations. It is preferred to raise bridge as required to provide necessary clearance above water surface.

17. The start of Apache Junction Floodway will remain at Sta. 12+00.

18. The funds available for construction in FY86 are limited to $4.0 million. If the estimated cost of the Apache Junction Outlet and Bulldog Floodway cannot be reduced below that figure, modifications should be made to allow the extent of that contract to be reduced to correspond to the money available.

19. Ebasco delivered a plan for the Flood Inundation Study. This will be reviewed and comments communicated by SCS.

20. The next monthly meeting will be in Phoenix on February 5 and 6. The last two meetings were changed to March 10 and 11 in Phoenix and April 7 and 8 in Portland.

BUCKHORN-MESA WATERSHEAD

APACHE JUNCTION FLOODWAYS,
FRS, OUTLET AND
BULLDOG FLOODWAY

PRELIMINARY DESIGN REVIEW MEETING
JANUARY 8 & 9, 1986

SOIL CONSERVATION SERVICE - WNTC
PORTLAND, OREGON

I REVIEW OF PRELIMINARY DESIGN:

A. Description, Purpose and Standards

B. Hydrology

C. Foundations and Embankment

D. Layout and Design:

1. Apache Junction Floodway

2. Apache Junction FRS

3. Apache Junction Principal Spillway

4. Apache Junction Emergency Spillway

5. Idaho Road and Brown Road Ramps

6. Apache Junction Outlet and Bulldog Floodway

E. Specifications

F. Bid Schedule

G. Cost Estimate

II DESIGNS FOR GROUTED RIPRAP

III SCHEDULE FOR FUTURE MEETINGS

EBASCO

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAYS, AND FRS
AND
BULLDOG FLOODWAY

MINUTES OF PRELIMINARY DESIGN CONFERENCE
DECEMBER 9 & 10, 1985

SOIL CONSERVATION SERVICE
PHOENIX, ARIZONA

ATTENDEES:

Donald Paulus - SCS, Phoenix,
Bill Payne - SCS, Phoenix
John Sullivan - SCS, Phoenix

Paul Monville - SCS, Portland

Cora Fernandez - Flood Control District of Maricopa County
Nick Kanan - Flood Control District of Maricopa County
David Johnson - Flood Control District of Maricopa County

Jerry Brady - City of Apache Junction

Carl Montana, - Ebasco, New York

Glen Rockwell - Ebasco, Santa Ana
David Groner - Ebasco, Santa Ana

The meeting began at 10:15 AM. All of the above attendees were present on December 9, 1985. Further discussions took place among D. Paulus, P. Monville and the Ebasco representatives during a field trip on December 10.

Discussions were based upon the attached agenda.

1. <u>Presentation of Preliminary Design</u>

The design review concentrated on the layout and design as presented in the preliminary drawings which were delivered to SCS. The Preliminary Design Report and twenty-two (22) of an expected forty-five (45) drawings were submitted for the Apache Junction FRS and Floodway, and the Preliminary Design Report and twenty (20) of an expected thirty-two (32) drawings were submitted for the Apache Junction Outlet and Bulldog Floodway.

Items which were discussed in some detail were:

A. Disagreement of Ebasco and SCS coordinates and alinement bearings. Ebasco will check.

B. Loading on channel walls. This appears reasonable, but will be reviewed.

C. Reinforcing bar cover for walls and slab of channel relative to design. It was pointed out that the top one inch of the bottom slab should not be considered in the structural design.

D. Methods of detailing reinforcing bars. Ebasco will prepare a sketch of suggested presentation for SCS comment.

E. Note that drawings will be reduced; therefore lettering and details should be large enough to accommodate without sacrificing clarity.

F. Coordination of design of channel with bridges at Ironwood and Meridian Roads. It was agreed that acceptable details can be worked out using the bridge abutments as channel side walls.

G. Inlet ponding was confirmed as being within the right-of-way. Also, the west end of the FRS will be checked for interference with the Salt River Project transmission line ROW.

H. The division between the Apache FRS and Bulldog contracts will be at the downstream outlet (principal spillway) pipe headwall.

I. Spoil for structures or for fill: spoil has a required use, it should be covered in specifications and paid for.

J. Spoil quantity may be a problem. Quantities will be calculated and spoil berms will be shown. A decision will be made as to whether to waste or stockpile spoil from Bulldog Floodway excavation.

K. Colored concrete may be required for emergency spillway and exit channel.

L. Washes may be excluded from borrow areas in order to maintain areas for seed generation.

M. Specifications drafted to date, the list of those which will be required, the Bid Schedule and the Cost Estimate will be reviewed by SCS.

The material presented by Ebasco will be reviewed by SCS, and further comments will be provided.

2. Size of Riprap for Grou~~nd~~ted Riprap.

Design procedure for grouted riprap will be worked out by Ebasco. Probably no more than three (3) specification items can be used for grouted riprap. Selected thickness of side slope grouted riprap in the stilling basin will be justified by Ebasco.

3. Settlement Allowance for FRS:

   The Ebasco position, as presented in the Phase II - Soil Mechanics Report, is that no allowance for settlement is required in the constructed height of the FRS.

4. Final Design Folder Format

   The documents prepared in Phases I through III can be incorporated in the Phase IV Final Design Folder. The newly created material will be sufficiently detailed to present a complete picture, repeating some of the explanatory material when necessary, and will explain changes in concept or design that occurred in the course of the project development.

5. Schedule for Future Meetings:

   The next meeting is scheduled for January 8 and January 9, 1986 in Portland, Oregon.

GR/lf

Attachment

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAYS,
FRS, OUTLET AND
BULLDOG FLOODWAY

PRELIMINARY DESIGN CONFERENCE
DECEMBER 9 & 10, 1985

SOIL CONSERVATION SERVICE
PHOENIX, ARIZONA

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1. Presentation of Preliminary Design

    A. Description, Purpose & Standards
    B. Hydrology
    C. Foundations & Embankment
    D. Layout & Design
        a. Apache Junction Floodway
        b. Apache Junction FRS
        c. Apache Junction Principal Spillway
        d. Apache Junction Emergency Spillway
        e. Idaho & Brown Roads Ramps
        f. Apache Junction Outlet & Bulldog Floodway
    E. Specifications
    F. Bid Schedule
    G. Cost Estimate

2. Size of riprap for grouted riprap. See SCS letter dated 6/27/83 from J C Stevenson to R Arrington.

3. Settlement allowance for embankment.

4. Final Design Folder Format

5. Schedule for Future Meetings

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAYS, AND FRS
AND
BULLDOG FLOODWAY

MINUTES OF MONTHLY MEETING
NOVEMBER 7, 1985

EBASCO SERVICES INCORPORATED
3000 WEST MacARTHUR BOULEVARD
SANTA ANA, CALIFORNIA

ATTENDEES: Donald Paulus - SCS, Phoenix,
David Lambson - SCS, Phoenix
Carl Montana, - Ebasco
Glen Rockwell - Ebasco
David Groner - Ebasco

The meeting began at 7:30 AM.

Discussions were based upon the attached agenda.

1. Approval of Phase I Report

   The Report has been reviewed and approved by SCS. It is understood that continuing development of the design will be reviewed for conformance with SCS or other acceptable standards. SCS will process payment of the 5% retainage.

2. Phase II Report Status

   The Phase II Report will be completed and submitted to SCS by November 15. Review discussions will be by telephone and correspondence, with presentation by Ebasco of key points at the Portland review meeting in January, 1986.

   Copies of Clifton Deal's written summary of the September 30, October 1 meeting in Santa Ana were distributed, since the copy sent to Carl Montana had not reached him.

   A letter is in preparation by SCS stating that SCS believes the embankment filter system can accommodate 0.1 ft. of settlement for each foot of embankment height. Ebasco will evaluate available information and recommend the amount of extra fill height to be added to the embankment to provide an allowance for probable settlement.

Ebasco's current recommendation is that extra compaction effort be done on the first lift of the embankment to reduce later settlement. Ebasco's Chief Civil Engineer, J. Ehasz, will discuss the subject with C. Deal in more detail. It was noted that saturation of the embankment foundation prior to compaction would be relatively inexpensive; however, the effectiveness of doing so is still in question.

3. Spillway Conduit Profile

A check of geological drawings and the spillway conduit drawing confirmed that the base for the conduit is well into the caliche foundation. This will result in minimal settlement and joint movement. It was agreed that foundation exploration logs will be included in the bid documents and referenced on the appropriate drawings.

4. Relocation of Apache Junction Floodway Start

The relocation has been discussed with the City and the Flood Control District. These entities will write a letter to SCS suggesting a change in the start location. SCS will recommend a new starting location at station 12+00. This will be finalized in a week or two.

5. Status of Surveying, Mapping Additions

The surveying and mapping requested for all construction has been done and provided by SCS. Additional mapping will probably be required to define inundated areas at some of the inlets.

Final determination of ROW requirements for construction and inundation was requested and will be furnished by Ebasco by November 12.

6. Location and Design of Side Inlets

Inundation limits relate to the type of inlet selected for locations 6A, 4C and 5B. SCS will evaluate comparative costs and advise Ebasco on their choice for these inlets within a few days.

The advantages of filling gullies upstream of inlets to avoid ponding was discussed. SCS will advise Ebasco of their preference on this matter. The gullies should at least be shaped to provide for the service road crossings.

A review of drawings disclosed the need for inlets at locations 6B and 6C; 6B into the Bulldog Floodway concrete channel just upstream of the energy dissipator and 6B into a suitably protected location of the earth channel.

7. Design of Floodway Curves for Supercritical Flow

It was noted that Ebasco intends to use compound curves with a non-superelevated channel floor. This will minimize construction costs and reduce the amount of extra wall height on both inside and outside walls to contain standing waves.

8. Coordination of Bridge Design with Floodway

The bridge design sketches provided by the Flood Control District were examined. It was agreed that Ebasco will provide the District with geometry, requirements and criteria for the bridge design which will be compatible with the channel on either side of the bridge. This is needed as soon as possible.

The District has the necessary information to locate the bridges.

Freeboard between the 100 year flood water surface in the floodway and the bottom of the bridge will be one foot (1').

9. Ebasco Drawing List

Copies of the Drawing List were provided to SCS.

10. Ebasco-Flood Control District Contract Status

The contract is in effect, and the District has provided Ebasco with topographic information and design standards.

The District in consultation with others will make the decision on the width of the top of the roadway fill (whether to provide for present or future paving width).

It was noted that a power line has recently been installed along Idaho Road in the vicinity of the FRS, which will be noted on the drawings.

11. Specification and Bid Schedule Questions

In response to questions, the following was decided:

A. Use water costs from Pass Mountain Documents. Provide rationale for quantity. SCS will send backup used for Pass Mountain and Signal Butte.

B. For mark-up of specs, use the NH20 specs as a basis.

C. Ebasco will type the bid schedule. SCS will type all other parts of the specs.

D. Use SCS specs for the road ramps.

E. All clearing of valuable plants, landscaping and seeding will be by others.

F. Make any small item subsidiary to others.

G. SCS will advise on how to incorporate pay methods.

H. Spoil areas should be designated.

I. Provisions should be made for a 14 ft. wide roadway on each side of the floodway with payment for placement of material.

J. Make floodway walls of uniform thickness from bottom to top. SCS will check and advise on whether to use 12 inches as a minimum thickness for walls higher than 5 feet.

K. Include standard drop inlet boxes with pipe through channel wall for intermediate drainage between major inlets. Provide a roadway grating over the top of the box.

L. "Measurement and Payment" section of standard NEH 20 specification will be included in "Items of Work" section or will follow it. Only applicable methods of payment will be included.

12. <u>Curved Inlet Design Standard (TR-25) Clarification</u>

SCS will check the use of the standard for cases of entering flow greater than main channel flow to see if Ebasco's interpretation is correct.

13. <u>Ebasco's Extra Work Evaluation</u>

The evaluation of extra design work related to the need for corrected topography and the revision in construction contract limits was presented. Ebasco will submit this to SCS for approval of a contract modification.

14. Requested Change in Deliverables

The following changes have been requested by SCS and agreed to by Ebasco:

Submittal	PER CONTRACT		AGREED REVISION	
	Blue Line Drawings	Reproducible Drawings	Blue Line Drawings	Reproducible Drawings
Phase III - Preliminary Design	6	0	9	0
Phase IV - Final Design	7	1	9	0
Phase IV - Final Approved	10	0	5	1

15. Schedule of Ebasco Work and Meetings

The Phase II Report will be mailed by November 15.

The Phase III work and documents will be presented for review on December 9, and as final by mid-January. Phase III Reports will follow the format as presented at the meeting and discussed in regard to contents and details. Separate reports will be prepared for 1) Apache Junction Floodway and FRS and 2) Bulldog Floodway and Apache Outlet.

The Phase IV work and documents will be presented for review on March 3 and as final by April 7, or as soon thereafter as all SCS comments are in hand and one (1) week is allowed for changes.

Meetings are scheduled as follows:

- Preliminary Design Conference (Phoenix) — December 9 and 10
- Preliminary Design Review (Portland) — January 8 and 9*
- Monthly Meeting (Phoenix) — February 5 and 6*
- Final Design Conference (Phoenix) — March 3 and 4
- Final Design Review (Portland) — March 31 and April 1

*Tentative

16. Other Items

With regard to the filter around the AT&T cable, SCS will check with AT&T to see if they have special requirements for construction or insurance.

GR/lf

APACHE JUNCTION FLOODWAY, FRS, OUTLET & BULLDOG FLOODWAY

MINUTES OF MONTHLY MEETING

SEPTEMBER 30, OCTOBER 1, 1985

LOCATION: Ebasco Services Inc.
3000 W. MacArthur Blvd.
Santa Ana, CA 92704

ATTENDANCE: Donald Paulus, SCS-Phoenix
Clifton Deal, SCS-Portland
Carl Montana, Ebasco
Victor Bolano, Ebasco
Glen Rockwell, Ebasco
David Groner, Ebasco

The meeting was begun at 1:00 PM

Discussions were based upon the agenda (attached) although the order was changed to accommodate schedules of individuals.

1. Review of Comments on Phase I - Feasibility Study Report

   A. Some of the referenced correspondence was not included in the report. Copies of this correspondence will be sent for insertion.

   B. Report indicates backfill material can be the same as embankment fill. Backfill would normally have smaller allowable sizes. Ebasco explained that, since the embankment fill is not expected to have rocks in it, it will be specified with a maximum size of 1 inch. This will also be suitable for backfill.

   C. A question was raised about removal of an item from page IV-6. This was the paragraph on cracking prevention and was removed because it has been decided that it is not applicable in consideration of present design.

   D. Was the additional computer run for hydrological assessment as earlier agreed to included in the revised report? Ebasco will check that and supply it if not included.

   E. Ebasco agreed to furnish an index to locate where in the report SCS's comments and questions have been addressed.

   F. It was pointed out by SCS that there may be additional comments from the Portland office review. Replies to comments at this stage can be put in an addendum.

2. Review of Memo of August 29, 1985

   It was confirmed that the telephoned comments and agreements as described in the memo are correct. The grouted riprap design referenced has been provided to Ebasco.

3. Review and Discussion of Preliminary Phase II Report

A. SCS pointed out that the report should be a "stand alone" document which discusses all aspects of soil mechanics which affect the design and operation of the project. To accomplish that, the report should include a more complete description of the project. Also, there should be an explanation of why additional testing was done in Phase I.

B. (Page 9) Dispersion tests were done by the double hydrometer method. SCS suggested that pin-hole tests be run during construction for better confirmation of dispersion potential. It was recommended that the erodibility of the soils also be discussed as this will be a concern, especially at the interface of earth and concrete structures. This aspect should also be covered in the O&M section of the Design Report. SCS has portable pinhole tester - cost about $600.-

C. (Pages 11 and 14) Reference to average values should be changed. SCS normally uses conservative or "worst case" values rather than average. Ebasco concurred that the values used are "worst case" rather than average.

D. (Page 12) SCS pointed out that when tests show negative pore pressures, the effective stress rather than total stress should be used for rapid drawdown analysis. If results of infinite slope analysis show instability, this does not require an adjustment of slopes but can be handled by maintenance since the sloughing, if it occurs, would be shallow and of rare occurrence.

E. (Page 13) The reference to horizontal permeability is questionable since the testing method allowed permeability in both horizontal and vertical directions.

F. (Pages 15 and 26) Provide for and describe drainage system for concrete channel walls and service and emergency spillway structures.

G. (Page 18) Reference to the infinite slope stability analysis should reflect the SCS approach that low safety factors can be justified as acceptable because of the shallow failures and rare occurrences.

H. (Page 19) SCS pointed out that blockage of the outlet ports of the spillway could lead to a steady state seepage case. This should be analyzed and may indicate a need for design modification. Ebasco will analyze that condition. The result may be a provision of drainage of the transition filter zone.

I. (Page 19) Report should state that the indicated cohesion in the total strength parameters is a transient condition and should not be relied upon.

J. (Page 20) Further backup for conclusions would be beneficial to the reader.

K. (Page 23) SCS disagrees with the need for or effectiveness of the alternatives presented for handling collapsibility. It was agreed that present data on potential for collapse is inconclusive, and additional tests, unless very extensive, also would leave the issue uncertain. Stripping or compaction under saturated conditions would be expensive and might not control the collapsing. SCS believes that cohesionless transition zone will control seepage resulting from embankment settlement and cracking from whatever cause. SCS will provide their estimate of the amount of embankment settlement they believe the transition can handle. Ebasco will then evaluate this and decide on concurrence or a recommended alternate approach.

L. The report should discuss the transition zone, potential for service spillway settlement and all other soil-related questions.

M. The report should include the compaction requirements and the method of compaction control to be used and described in the specifications.

4. Status of Additional Topographic Mapping

Three additional mylars (five previously received by Ebasco) were delivered at the meeting. The remainder will be sent as they are completed. The status of the mapping is no longer delaying the design work. Extension of the topography at the ends of the earth channels and the Emergency Spillway will be completed soon.

5. SRP Transmission Tower Footing Dimensions and Stationing Reference

The footings for the tower legs are 2 ft. diameter. The dimensions on the sketch provided earlier are thought to be to the outside of the footings. The correct stationing is on the mylars.

6. Topography Reference Controls

In addition to the coordinates given in SCS's letter of September 24 to Ebasco-Santa Ana, there are coordinates provided along the alignment in the work plan provided to Ebasco at the start of the job. Ebasco will note on the drawings the coordinates of all P.I.'s and starting and ending points. A suggested alignment change of Bulldog Floodway was delivered to Ebasco (part of SCS letter of September 24 to Ebasco-NY).

7. SCS Standard Mylars for Riser and Conduit

These were delivered to Ebasco at the meeting.

8. Signal Butte Construction Schedule

This was delivered to Ebasco.

9. Review Drawing Title Block Layout

   SCS approved of proposed Title block.

10. Change of Floodway Centerline to "Reference Line"

    This is acceptable. Other jobs have called the alignment line "survey line".

11. Concrete Floodway Design Criteria for Loading Conditions

    The soil loading parameters are as presented in the Preliminary Soil Mechanics Report. SCS agrees with the Ebasco approach to provide drainage of the walls. Loading should allow for vehicles travelling on the upstream berm as well as the roadway on the downstream side.

12. Joint Configuration, Spacing and Waterstops

    These design details were discussed. Joint spacing should agree with NH6. Details not covered by SCS standards are to be developed by Ebasco and sent to SCS for comment.

13. Filters and Filter Gradation

    Design of filters will be governed by SCS Design Note No. 1 dated July, 1985, copies of which were handed to Ebasco.

14. Runoff Flows to be Channeled to Inlets

    It was agreed that drainage between inlets at washes should be directed to those inlets rather than passing over the channel walls. In some cases, topography may dictate a separate pipe inlet for these flows.

15. AT&T Cable Crossing Status

    The cable encasement should have a transition filter around it. This will be drained, probably to the transition zone in the embankment, then to the embankment toe.

16. Status of Ebasco-Flood Control District Contract

    The contract is in effect and work on the roadway will be starting as soon as topography and design standards are received from the District. The District construction items will be included in the Apache Junction FRS construction documents, but will be kept separate for identification.

17. Flood Control District Bridge Plans

Coordination of the floodway reference line at the bridge locations will be provided to the District. Also, there are monuments on the reference line on either side of Ironwood and Meridian Roads which can serve as references for bridge locations. Details of the bridges are not known. Ebasco will request details in order to assure coordination with the floodway design.

18. Telephone and Water Line Crossing of FRS

The roadways over the embankment will be raised above the embankment crest enough to handle burying of utilities without infringing on the embankment. Water lines will be designed to provide drainage away from the embankment of leakage or flow from a pipe break.

19. Schedule of Ebasco Work and Meetings

The impact of the following items on the Ebasco contract was discussed:

- Completion of SCS review of Phase I Report later than scheduled
- Requirements to develop new topographic survey information
- Change of limits of two contruction contracts

It was agreed that Ebasco will evaluate these in more detail and submit a revised schedule and a request for a Contract Modification to cover the additional cost and extended schedule. The new schedule will maintain the original number of meetings and the same locations. SCS explained that the budget allows start of contruction of the Bulldog Floodway portion in the fall of 1986. This requires that the documents be in SCS hands by early April, 1986. Ebasco will make every effort to meet this schedule objection.

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAY, FRS, OUTLET
AND BULLDOG FLOODWAY

AGENDA FOR MONTHLY MEETING

OCTOBER 1-2, 1985

EBASCO SERVICES INCORPORATED
SANTA ANA, CALIFORNIA

1. REVIEW OF COMMENTS ON
   PHASE I - FEASIBILITY STUDY REPORT

2. REVIEW OF MEMO OF AUGUST 29, 1985 (Attached)

   A. Grouted Riprap Design Reference
   B. Corrugated Metal Culverts Under Road Enbankments
   C. Flow Downstream of Emergency Spillway
   D. Design Criteria for Idaho and Brown Roads

3. Review and Discussion of Preliminary Phase II Report

4. Status of Additional Topographic Mapping, including
   Extension for Earth Channels and Emergency Spillway

5. SRP Transmission Tower Footing Dimensions and Stationing Reference

6. Topography Reference Controls

7. SCS Standard Mylars for Riser and Conduit

8. Signal Butte Construction Schedule

9. Review Drawing Title Block Layout

10. Change of Floodway Centerline to "Reference Line"

11. Concrete Floodway Design Criteria for Loading Conditions

12. Joint Configuration, Spacing and Waterstops

13. Filters and Filter Gradation

14. Runoff Flows to be Channeled to Inlets

15. AT&T Cable Crossing Status

16. Status of Ebasco--Flood Control District Contract

17. Flood Control District Bridge Plans

18. Telephone and Water Line Crossing of FRS

19. Schedule of Ebasco Work and Meetings

GR/lf 9-17-85
0023/Wang

EBASCO

Interoffice Correspondence

DATE 29 August 1985 FILE REF.

TO Distribution OFFICE LOCATION

FROM C J Montana OFFICE LOCATION Los Angeles

SUBJECT BULLDOG FLOODWAY AND APACHE JUNCTION PROJECT
RECORD OF PHONE CALL CONVERSATION 8/28/85
BETWEEN C MONTANA AND D PAULUS

Shiam Goyal and I were in Santa Ana from August 27 thru August 29 to work with Dave Groner and Glen Rockwell on the Bulldog Floodway and Apache Junction project. While there a number of questions arose. We called Don Paulus on August 28th. The following is a record of the conversation: (Questions & Responses).

Q. Who will SCS have in attendance at the October 1st meeting in Santa Ana?

R. Don Paulus and Cliff Deal will attend the meeting. Cliff Deal is the Soil Mechanics Engineer from the Portland Regional Office.

Q. Why is the Riprap shown by SCS on all previous projects grouted? Is the rock sized by some criteria and then grouted anyway?

R. In general, we have found that the rock size required is so large that it is not available. No design procedure has been used for the side inlets; the rock is grouted in lieu of rock design procedures being used. We have used a Corp of Engineers procedure for design of the rock in the chutes which I will provide you.

Q. Will you make a TR-50 run for us for channel design if we provide the input data?

R. No. Make sure you use TR-67 and DN-21.

Q. I believe it is not in our or your best interest to modify the standard specifications by deleting options not used. In many cases, more than one option may be used. It just seems like a potential source of error.

R. I agree, but we have been directed by our administrative office that this procedure must be used. Some claims have resulted from options having not been deleted. The deletions must be made.

Q. In Section VI, Studies, Para. 5)4.2 of your review comments on the Feasibility Study, you asked for the design criteria to be used in design of the culverts under the roads; we will not be designing these culverts under this contract.

R. We realize this, however, they must be designed in accordance with SCS criteria since they are considered to be part of this project.

Q. Can we use corrugated metal for these conduits under the road?

R. Yes, we do not want the pipe coated on the inside, only on the outside. Fires have been started in pipes coated on the inside.

Q. The regional office comments ask that a joint extensibility calculation be made for the principal spillway conduit. Since the pipe will be bedded on Caliche for its entire length, there is no anticipated settlement. The procedures in TR-18 require that there be settlement for the calculation to be made. It seems to me that under the circumstances the calculation is not appropriate.

R. I agree. Just document your reasoning.

Q. The City of Apache Junction has again raised the question regarding the flow below the emergency spillway. We believe this issue should be resolved so that changes in design are not required at some later date. It also appears that the peak discharges from subwatershed 3 without the dam exceed the corresponding discharges from the emergency spillway down the flow area they are concerned about.

R. No changes will be made in design. The decision on spillway location has been made. The question of inundated area will be answered in Phase IV.

Q. The City of Apache Junction has asked that the roads through the reservoir area be designed for 45 mile per hour speed limit and that they be widened to 4 to 6 lane widths. All the work we have done has been based on the previously-agreed-to 30 MPH speed limit with a 64 foot width. Will this work have to be redone? The work required to do the increased width is minimal since we will only have to increase the culvert size. However, the higher speed limit will result in a longer elevated section through the reservoir which will reduce the weir length for flow across the roads through the reservoir. This could result in higher dam elevations. Will we be compensated for this additional work?

R. I will resolve this with the City and get back to you.

Q. Do you want maintenance ramps into the concrete channels?

R. No.

Q. Have you been placing bedding under the concrete channel slabs?

R. No. We have been excavating to grade and pouring without bedding. We have used waterstops. Do not use cork joint filler. We have had good success with the two part joint sealer that is in the signal butte specs.

CJM:JAS
0016u:78

Distribution

G Rockwell
C Montana
D Groner
S Goyal
V Bolano
D Paulus

MINUTES OF MEETING
COMPARATIVE DESIGN STUDY CONFERENCE
BULLDOG FLOODWAY AND APACHE JUNCTION FLOODWAY, FRS, AND OUTLET
JULY 24, 25, 1985

LOCATION: USDA SCS STATE OFFICE
201 E. INDIANOLA AVE.
PHEONIX, ARIZONA

ATTENDANCE: SEE ATTACHED LIST

The meeting was opened by Don Paulus at 1:00 P.M.

A presentation was made by Ebasco in accordance with the attached agenda with some reorganization to accomadate the schedule of the engineers from the Maricopa County Flood Control District.

Following a review of the revised schedule the following issues were raised pertaining to the material presented:

* Ebasco will check extent of backwater at each side inlet.

* The assumption of sediment laden water in the design of the earth portions of both the Apache Junction Floodway and Bulldog Floodway was questioned by SCS. Don Paulus agreeded to provide Ebasco with calculations used on a previous project for projecting sediment load.

* Nick Karan asked if the cost of landrights as considered in the recomemdation that a rectangular channel be build instead of a rectangular channel for the Apache Junction Floodway. The reply was that they had not been but all agreeded that less land would be required for the rectangular channel.

* Ebasco was asked to check extent of backwater behind each side inlet.

* The question was raised regarding the extend of sediment build up in the concrete lined channels. It was agreeded that the velocities were high enough to keep the channels flushed of sediment.

* Ebasco is recommending that a 30 inch principal spillway be used instead of the 36 inch that was in the work plan. When asked, SCS was not aware as to why a 36 inch pipe was recommemded but thought it might be for maintenance purposes. SCS will doccumment their decision on pipe size in their review comments.

* There was general discusson regarding the design of Idaho and Brown Roads. Main concerns involved the speed limit and use of a four way stop at the intersection. SCS and Maricopa County will provide Ebasco with the design criteria needed.

* A general discussion insued regarding the design of the culverts under Idaho and Brown roads. It was agreeded that the approach used by Ebasco was conservative and acceptable.

* Hydrologists from the MCFCD asserted that there is a depression in Apache Trail approximately 1000 feet upstream of the floodway and that additonal drainage area should be included east of Apache Trail. Ebasco pointed out that this area was looked at in detail in April and that it had been agreed that the area east of Apache Trail did not contribute to the Apache Junction Floodway (see minutes of April meeting). Ebasco also pointed out that increasing the drainage area would have no effect on the FBH since the floodway is not designed to carry the flow which would overflow the channel a go around the FRS.

* There was general discussion over the defination of "complete cutoff". Earlier statements by SCS indicated to Ebasco that they desired a cutoff to caliche due to the possibility of buried and incised channels. The SCS TSC representative stated that he did not believe it was necessary to provide a cutoff to caliche to have a complete cutoff and that something less than a cutoff to caliche might be acceptable. It was agreeded that this alternative would be considered in Phase II of the work. Additional investigation needed would be defined by Ebaso with the objective of having field work complete in early August.

* The issue involving the collapsibility of the soil was addressed. Nick Koran pointed out that it is normal practice to run the SPT in a saturated state which the SCS had not done. After general discussion it was agreeded that the additional field work would include SPT in a saturated state adjacent to previous holes where SPT were obtained in the dry state.

* The issue of the use of anti-seep collars was raised and it was pointed out that SCS no longer uses them and that a diaphram is the method utilized.

* SCS stated that they would like a Type A-1 bedding used under the principle spillway conduit. (TR-5)

* Discussion on Design Criteria:

    * SCS asked that Ebasco document its use of .025 for Mannings n for both the aged and as-built conditions. They generally use .027 for aged and .024 for as-built.

    * Page II.3, Para. 2.5.1 - Describe transition to be used in narritive.

* Page II.8 - It was agreeded that the freeboard used in all cases would be 20% of the depth or 1 foot which ever is greater.

* Page II.8 - Curves in subcritical flow require superelevation.

* Page II.13 - SCS requested that we document that no steady state seepage conditon exists. A stability analysis will have to be made for the drawdown condition on the upstream slope after partial saturation.

* Discussion on Suitability Assessment:

  * Page IV.6 para. 1 - SCS requested that Ebasco show agreement that the design can be completed based on correlated data.

  * Page IV.6 para. 3 - SCS agrees with the statement but would like it written with a more positive approach.

  * Page IV.6 para. 2 - SCS would like to have the depth of cutoff to be defined on the plans but incorporate in the Specifications that the final depths will be as determined by the engineer in the field at the time of construction. A sample specification was provided.

  * Page IV.6 para. 4 - Regarding the question of the soil being collapsibility, it was agreeded that SPT would be run as discussed earlier subject to agreement with this approach by Ebasco's Chief Civil Engieer. SCS also stated that they were not concerned with the material be dispersive and would document this belief in their review comments.

SCS agreed to provide Ebasco with the following:

* Revised copy of SM-1

* A copy of the procedure to be used in estimating the degree of scour downstream from the baffle chute

* Sample of previous calculations they have made to estimate the amount of sediment in runoff water for use in the stability analysis of the earth channels

* NEH-20 on a floppy disk

Name	.zation	Phone
C. Montana	Ebasco Services Inc.	212-839-1421
D. Hunter	"	212-839-1409
S Goyal	"	212-839-3722
V Bolano	"	212-839-1483
G. Rockwell	"	714-662-4122
S Leckband	SCS	602-241-5144
Jeff Bell	City of Apache Jct	602-982-8002
Bill Payne	SCS	[illegible]-5152
Ray Koffman	SRP (Power)	236-2765
[illegible] Phillips	SRP (Power)	236-2732
Paul Monville	SCS	503.221.2357
Don Paulus	SCS	602-241-5743
Nick Karan	FCD	262-1501
Joe Tram	FCD	262-1501
Dave Johnson	"	"
Cora Fernandez	"	"
Dick McNamara	"	"
R.W. [illegible]	"	"
John Sullivan	SCS	241-5149
John Weaver	SCS	241-5147

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAY, FRS, OUTLET, AND BULLDOG FLOODWAY

COMPARATIVE DESIGN CONFERENCE AGENDA

JULY 24, 25, 1985

INTRODUCTIONS	DON PAULUS
PROJECT SCHEDULE AND STATUS	CARL MONTANA
SUITABILITY ASSESSMENT - SOIL MECHANICS	VIC BOLANO
HYDROLOGY	DAVE HUNTER
BREAK	
STUDIES	
APACHE JUNCTION FLOODWAY	CARL MONTANA
INLETS	
CHANNEL	
ENERGY DISSIPATOR	
APACHE JUNCTION FRS	SHIAM GOYAL
PRINCIPAL SPILLWAY	
EMERGENCY SPILLWAY	
EARTH	
MODIFIED EARTH	
TYPE C DROP	
BAFFLE CHUTE	
EMBANKMENT	
IDAHO AND BROWN ROAD CROSSING	
APACHE JUNCTION OUTLET & BULLDOG FLOODWAY	CARL MONTANA
INLETS	
CHANNEL	
ENERGY DISSIPATOR	
COUNTY CONTRACTS	GLENN ROCKWELL

MINUTES OF MEETING

Phase I : Monthly Meeting and Hydrology Review
May 22, 23, 1985
Phoenix, Arizona

Attended by:

SCS - Don Paulus, Bill Payne, S. Leckband, Aubrey Sanders

EBASCO - Carl Montana, Shiam Goyal, Glenn Rockwell

FCD - Nick Karan, Cora Fernandez, R. W. Shobe

NOTE: In reviewing these minutes one should refer to Ebasco letter USDA 3767-L005 and attachments (Agenda, Preliminary Design Criteria and Preliminary Findings on Suitability of Soils Data).

I. AGENDA ITEMS

1. Status of AT&T Cable

SCS referred to their letter to AT&T of May 13, 1985. Lee Kupfer was contacted by SCS following the receipt of letter and has been informed that AT&T agrees to its content and will supply the requested data and reimburse the county for added costs. AT&T's main concern right now is to get necessary permits and approvals to start work. EBASCO's contract will be modified accordingly prior to needed reviews and coordination.

2. Status of EBASCO's Contract with FCD

EBASCO has provided the FCD with a proposal to design Ironwood and Brown Roads based on current alignment and includes known utilities (water and telephone) in SCS' construction package for Apache Junction FRS. FCD to review proposal and get back to EBASCO. Pay items relative to the road crossings will be separate from Apache Junction FRS but one package of plans and specs will be produced including both the road crossings and associated work with the FRS. FCD will locate all utilities and provide information to EBASCO.

FCD stated that it did not appear at this time that they were responsible for the proposed maintenance and horse crossing over Bulldog Floodway. They will coordinate with the Town of Apache Junction to resolve this issue.

A general discussion arose over the width of Bulldog Floodway at the three crossing locations (Meridian Road, Ironwood Road and horse trail). FCD was not aware that the channel width in these areas would range from approximately 20 to 40 feet. They had assumed that box culverts with a span not exceeding 12 feet could be constructed across the channel. After detailed discussion it was agreed by SCS and EBASCO that piers would not be allowed in the channel and that EBASCO would minimize the width as much as possible within site conditions and design considerations. The FCD asked that they be provided with the channel widths ASAP; it was agreed that the widths would be agreed upon at the end of Phase I, which should be about August 2, 1985.

3. Design Note 21 Requirements

SCS provided EBASCO with a letter defining requirements and intent of DN 21. EBASCO will review the letter and respond to SCS.

4. Type C Drop Structure Modification

It was agreed to withhold the issuance of this modification until further analysis was made on the use of an earth spillway at Alternate 2 location. If an earth spillway is feasible there may be no need to study the use of a Type C Drop at that location. SCS does not intend to utilize a Type C Drop at the currently proposed Baffle Chute location.

5. Reference for Design of Curved Side Inlets

SCS will check Signal Butte Floodway Design Procedure and get back to EBASCO.

6. Review of Design Criteria

See II., which follows.

7. Review of Preliminary Findings on Geologic and Soils Data

See III., which follows.

8. Regional Subsidence Considerations

SCS stated that this is not an issue at the location of this project.

9. Hydrology Review

See IV., which follows.

10. Billing Procedures

All correspondence and contract modifications will go to C. Montana. Payment will be made to the address shown on the invoice.

11. Freeboard Requirements for the Apache Junction FRS

SCS criteria will be met. When site configuration is established contact will be made with the Division of Safety of Dams (D. Lawrence) for concurrence.

12. Transmission Line Location

SCS provided EBASCO with survey notes locating the transmission line tower along Bulldog Run.

13. Location and Type of Emergency Spillway Used on Signal Butte

The plans provided EBASCO showed an emergency spillway at Signal Butte that could have conflicted with the Bulldog Floodway Outlet. SCS informed EBASCO that this was not constructed and that a structural spillway was used at a different location.

14. Apache Junction FRS Conduit

The Apache Junction FRS Conduit will discharge directly into the concrete channel without the use of an energy dissipator. SCS agreed, but asked that the reasoning be documented in the design report.

15. Bulldog Floodway Centerline

It was pointed out by EBASCO that since the concrete channel widens at the side inlets as you move downstream, the centerline becomes offset at these locations. A "control line" will be established starting with the most upstream centerline with offsets and adjustments made as progression is made downstream.

16. Minimum Embankment Slopes on the Apache Junction FRS

SCS agreed that the minimum slopes would be those established by stability analysis and that an upstream slope of 2.5:1 and a downstream slope of 2:1 could be utilized.

17. Baffle Chute Design Criteria

SCS provided EBASCO with an additional reference published by the Bureau of Reclamation "Baffled Apron as a Spillway Energy Dissipator." The maximum discharge per foot of width requirement of 60 cfs has been exceeded many times. SCS stated that they have exceeded 100 cfs/foot on some of their designs and would not have any difficulty with a design based on discharges in this range. SCS also provided the following additional design requirement:

- o Inlet designed for the freeboard discharge.
- o Chute designed for 2/3 of freeboard discharge.
- o Exit Channel designed for Emergency Spillway flow.

18. Use of High Density Polyethylene Membrane

This method of crack control will not be used on this site.

II. DESIGN CRITERIA

Don Paulus (SCS) and S. Goyal (EBASCO) discussed the EBASCO Specification USDA 3767.001 S01 (Preliminary) Design Criteria, "Bulldog Floodway and Apache Junction Flood Control." The following comments and suggestions were given by SCS:

Para. 3.2.2 For the design of earth channels, tractive stress analysis should be performed to find the economical cross-section. However, it was acceptable to design the Apache Junction Floodway earth channel without the tractive stress analysis because the excavations can be used for the FRS embankment. In caliche higher velocities, as much as 8 ft/sec may be permitted.

Para. 3.3.4 EBASCO should check freeboard requirement with the State. Emergency spillway hydrograph storm is considered as the design flood.

Para. 3.3.6 For flood routing, EBASCO should document and confirm in letter form if the loss of storage volume due to the road embankments is negligible. If not, delete the sentence.

Para. 3.4.1 EBASCO will size the culverts under the two roads. The design of the culverts will be part of the other contract with Maricopa County Flood Control District.

Para. 5.1.11 (a) The coefficient of friction 'n' should be .02 and modified as required by Supplement B to NEH 5.

(b) See comment on Para. 3.2.2 for velocity. For silt content documentation should be provided from sedimentation report.

Para. 5.2.1 The SCS computer program works out the principal spillway conduit discharge rating curve. Reference to TR29 and the equation is not necessary. The standard detail for inlet riser has half-round slope at the base. If k = .7 is applicable it should be noted in the criteria.

Para. 5.3.5 Reference should be made to the new literature, A Baffled Apron As a Spillway Energy Dissipator" by T. J. Rhone, supplied by SCS. Restriction of 60 cfs will not be necessary, and should be deleted. The paragraph may be modified if required.

Para. 5.4.1 SCS provided a copy of Hydraulic Design of Energy Dissipators for Culverts and Channels; Hydraulic Engineering Circular No. 14, U.S. Dept. of Transportation for design of plunge pool energy dissipator.

Para. 6.1.1 & 6.1.6 Delete High Density Polyethylene Membrane.

Para. 6.1.5 Corrosion protection should be in accordance with SCS Specification NEH 20, Chapter 2.

Para. 6.2.3 The end of construction and long-term properties for the material should not be different. Therefore, condition 1 and the property identification can be deleted.

Para. 6.4.2 The width of the service road should be a minimum of 14 feet.

Para. 6.6.3 Because of low permeability, drawdown condition may not apply.

Para. 6.7.1 For size of riprap HRP 108 should be used. If grouted riprap is used provide a cutoff key at the upstream end. If riprap with bedding is used upstream of the grouted riprap it should be drained.

Para. 6.9.1 EBASCO should provide specifications of the material to be used as joint filler.

Para. 6.9.3 In the concrete spillway waterstop should be provided at articulated joint (see Signal Butte Dwg.).

General - The criteria should be reviewed against SCS Engineering Design Standard for the Western states.

III. REVIEW OF PRELIMINARY FINDINGS ON SUITABILITY OF GEOLOGIC AND SOILS DATA

SCS pointed out that the stationing is wrong in the Geologic Report and that the field permeability tests reported at Stations 97 + 50 and 92 + 00 were actually run at 97 + 00 and 91 + 00, respectively. All tests were run in caliche only. SCS agrees that constructing a cutoff over 20 feet deep to caliche does not seem reasonable for a dam of this size; however, at the time the site investigation was conducted it was assumed that a cutoff to caliche was going to be built, so no tests were run in the material above the caliche. SCS is concerned that buried channels of clean sand in unidentified buried washes exist as deep as the top of caliche at 24 feet. It would be unreasonable to conduct an investigation extensive enough to be certain that all of the buried washes were identified. It was agreed that a reasonable approach might be to construct a cutoff to a predetermined depth (say 5 feet) or to caliche, whichever is shallower and conduct further investigations, including field permeability tests, in those areas where a cutoff to caliche will not be provided. After further discussion, SCS stated they would prefer that a cutoff to caliche be constructed.

SCS agrees that Method C should have been used in preparing soil samples and not Method A. They also agree that the moisture contents of the samples on which tests were run were too high. SCS is not in agreement on placing the fill on the dry side of optimum. SCS is not in agreement in-house that placing the fill on the dry side of optimum is the solution to the cracking problem and believe that placing the material on the dry side is detrimental to obtaining a well constructed homogeneous fill. A "crack control drain" will be included in the design regardless of the moisture content at which the fill is placed and they prefer that we stay with a range of ±2% of optimum in our specifications.

SCS agrees to have the tests rerun using Method C compaction with the moisture contents lower than those previously used; i.e., closer to optimum.

The SCS Soil Mechanics Laboratory in Lincoln, Nebraska was contacted and the soil samples previously tested were located. Four samples with gravel content ranging from 17 to 24 percent gravel will be prepared by Method C compaction at 95% S.P.D. and tests run at optimum moisture. It will take about 1 month before a report will be available from the laboratory. SCS feels that soil parameters (strength, permeability and consolidation) will not vary enough to make a difference in design and that EBASCO should proceed with embankment design using the previously provided parameters. (It is the belief of SCS engineers that the coarse material content must exceed 30% before any significant variation will be noticed in the soil parameters.) The test results will be used to verify the values used in design and in preparing the Construction Specifications.

SCS agrees that all foundation parameters, other than permeability, can be determined from correlations with available Standard Penetration Tests and classification data. They do not anticipate consolidation or strength problems with the foundation material. SCS agreed that additional investigation would be required if the structural spillway exceeds 300 feet in length.

The final point of discussion concerned adequacy of investigation and design procedures to be used involved the earth emergency spillway Alternate 2. SCS requires the following:

- The calichi be treated as an easily erodable soil (Class E) and the spillway be designed using TR-52 requirements with Oe/b resulting from the freeboard storm.

- The stability of the spillway be checked using TR-25 tractive stress procedures against the Emergency Spillway Storm Discharge.

The second condition is an addition to that agreed to at the pre-design meeting.

IV. HYDROLOGY REVIEW

A thorough review was made of the completed hydrologic calculations. The following recommendations were made:

- The storm distribution used in developing the "local storm" should be HMR-5, which is closest to the SCS Type B.

- TR-52 requires that Oe/b be checked for the freeboard storm; TR-60 requires that the PMP used for an area like Arizona be of the duration and distribution that produces the maximum reservoir level in the reservoir when routed through the spillway system. SCS agrees that for this site it is most likely the 6-hour storm and would accept a 6-hour routing only if EBASCO can document this, otherwise they would like a 24-hour storm routed also.

- SCS noted that the Channel Loss Factor used by EBASCO was obtained from NEH-4 and was not modified as required by TSC Technical Note PO-4 Hydrology. Upon further discussion, it was noted that EBASCO had never received this Technical Note. EBASCO was provided with a copy which will be utilized in making the necessary change to the input data. It was agreed that DAMS II could be used but that the data would have to be adjusted.

There was discussion on EBASCO's Drainage Area and Tc computation. It was agreed the drainage areas are within acceptable tolerances. SCS provided cross-section data on some of the drainage ways in the basin and requested that EBASCO look at it to see if it will effect velocities and therefore the time-of-concentration.

SCS pointed out that the current reference to be used in obtaining the 10-Day Curve Numbers is TR-60 and not NEH-4, Table 21.2. In this case the results are the same.

V. ADDITIONAL MATERIAL FURNISHED BY SCS

- TSC Technical Note - Hydrology - PO-4.
- A Baffled Apron as a Spillway Energy Dissipator by T. J. Rhone, U.S. Department of the Interior Bureau of Reclamation Engineering and Research Center, Denver, Colorado.
- Hydraulic Design of Energy Dissipators for Culverts and Channels, Hydraulic Engineering Circular 14, U.S. Department of Transportation, Federal Highway Administration.

MINUTES OF MEETING
PHASE I PREDESIGN CONFERENCE
BULLDOG FLOODWAY AND APACHE JUNCTION FLOODWAY, FRS, AND OUTLET
APRIL 16, 1985

LOCATION: USDA SCS STATE OFFICE
201 E. INDIANOLA AVE.
PHOENIX, ARIZONA

Attendance: See attached list

The meeting was opened by Don Paulus at 8:30 a.m. The following items were addressed:

1. Crossing of Project Area by AT&T fiber-optic cable

Lee Kupfer of Black & Veatch, AT&T's engineers, explained the need for AT&T to install a fiber optic cable through the dam site. The cable is to run east-west, 40 ft. north of the present alignment of Brown Road. The installation is to take place between June 1985 and February 1986. AT&T requested guidance on requirements regarding method of installation and depth of burial under the dam. Ebasco pointed out that we had not yet studied the geologic material supplied by SCS and that a final decision would probably not be reached on foundation treatments until the end of August. It was also pointed out that the cable would be crossing the proposed borrow area. Various options were discussed including depth of burial into the caliche, method of backfill, and impacts on the operation of the borrow area. It was decided that AT&T would submit a proposal to SCS and that SCS would review the proposal with Ebasco.

2. Idaho Road and Brown Road Crossings

The original proposal, as included in the scope-of work, was to have the intersection of Idaho Road and Brown Road (also called Lost Dutchman Road) occur coincident with the centerline of the dam. This had been agreed to between the SCS and project sponsor, the Maricopa County Flood Control District (MCFCD). The City of Apache Junction took exception with this alignment. A second proposal was made by the MCFCD of moving the western portion of Brown Road south from the dam and eastern portion north from the dam. This proposal presents problems with the recreation area to be developed upstream of the dam. No decisions were reached; however, the MCFCD asked Ebasco to submit a proposal to them to serve as their engineer in resolving land rights issues including roads and utilities.

3. Impacts of Idaho Road and Brown Road Alignment on Phase I

The alignment and cross-section of Idaho Road and Brown Road affect the hydrologic and hydraulic analysis of the Apache Junction FRS inasmuch as they reduce storage volume and restrict drainage patterns in the flood pool.

Ebasco requested the width and side slopes of the road embankments to use in developing the reservoir capacity. Since this cannot await final decisions on the road locations, Ebasco must assume the maximum volumes, which correspond to the original crossing location on the crest. The FCD gave the roadway width as 48 feet curb-to-curb plus 10'-wide shoulders, with side slopes of 3:1 or steeper. It was noted that this configuration may exceed the proposed 100-foot wide right-of-way at the base of the embankments. A new configuration for the intersection may affect Ebasco's effort beyond the original scope of work. It was agreed that the hydrologic and hydraulic analysis would be completed based on the assumption that the roads would cross the reservoir as originally proposed i.e.: in a straight line following their current alignments meeting at the top of the dam. The roadways within the flood pool area will be kept above the 25-year flood level.

4. Crossings on Apache Junction Floodway and Bulldog Floodway:

Additional crossings including Tomahawk Road (north-south) which crosses the Apache Floodway, and Ironwood Road, Meridian Road (north-south) and a horse trail which will cross Bulldog Floodway, were brought up by the MCFCD. No piers in the floodways will be allowed for these structures. Ebasco will provide the hydraulic information at these crossings. Various utilities, including telephone, gas, and water lines, exist or are planned for these crossings. The Maricopa County Flood Control District inquired whether Ebasco could act as the County's engineer for all land rights issues related to these roads and utilities. A proposal to this effect will be prepared by Ebasco and submitted to the District.

The horse trail crossing and Tomahawk Road Crossings were not included in the contract scope-of-work. Clarification will have to be reached on the input from the County, SCS, City of Apache Junction and Ebasco.

5. Emergency Spillway Alignment

The SCS, FCD, Ebasco and Dan Lawrence, the Dam Safety Engineer of the Arizona Department of Water Resources, discussed the Emergency Spillway. SCS reminded Ebasco that the earth channel "shoe" Alternate #1 passing to the north of the Salt River Project transmission line has been eliminated because transmission towers would have to be moved. The remaining alternatives to be considered are moving the earth channel south so as not to interfere with any transmission towers, Alternate #2, or the structural spillway in the main dam. Ebasco inquired whether the excess capacity (above the 100-year flow) of the Apache FRS Outlet and the Bulldog Floodway have been considered in computing inflows to the Signal Butte FRS for the ESH and the FBH. Harry Millsaps later advised Ebasco that these excess flows had been included.

We examined aerial photos of the areas downstream from both spillway alternatives. It was observed that development was denser downstream from the proposed structural spillway and also closer to it than the development in the area downstream of the earth spillway site, posing a likelihood of greater damage in the event of the spillway flowing. Ebasco suggested moving the structural spillway to the west limb of the dam so that it discharged into the same area as the earth spillway alternative. SCS will evaluate this change and advise Ebasco during the week of April 22.

6. Hydrologic Analysis

The Ebasco and SCS hydrologists met separately to discuss methodology and provide additional data to Ebasco. Mr. Millsaps noted that the version of TR-20 used on the studies to date is not the most recent and used the Modified Coefficient Method for routing rather than the Att-Kin Method. Although it would be desirable to have the Signal Butte and Apache/Bulldog parts of the project done by the same methods, for Ebasco to obtain and get an old version of TR-20 operable would delay the schedule 2 to 4 weeks; therefore Ebasco will proceed with the available version, which is up-to-date. Also, Ebasco obtained information on Curve Number reduction factors from Mr. Millsaps, as well as a Soil Survey map. Ebasco purchased two aerial photographs directly from Landis Aerial Surveys for use in drainage basin delineation.

The hydrology studies for developing inflows at the side inlets of Bulldog Floodway are not yet complete but are estimated to be available by Friday, April 26. Ebasco requested SCS to delay issuing the Notice to Proceed until this data is available. SCS agreed to delay the Notice to Proceed until all hydrologic data to be supplied by them is available.

7. Design Note 21

SCS personnel inquired of Ebasco how it intended to carry out the provisions of Design Note 21 and if Ebasco had any questions regarding it. Ebasco was not familiar with this document since it was not included in the package of material previously supplied to Ebasco by SCS nor was it listed in the "Topics of Discussion" in the agenda of the predesign meeting prepared by SCS. It was agreed that Ebasco would review Design Note 21 and evaluate its impact on the project cost and schedule and get back to SCS in the week of April 22, 1985.

8. Responses to "Questions for Pre-Design Meeting" from Ebasco

Question: What are landrights based on? How high can we raise the top-of-dam?
Answer: The sponsors have rights or will obtain rights to flood to the limits of the land rights boundaries shown on the landrights map.

Question: The emergency spillway earth channel as proposed will outlet directly into the Apache Junction outlet channel and could cause its loss should it flow. Has a pipe been considered for the Apache Junction outlet channel?
Answer: A pipe is not to be considered. SCS prefers an open channel. There was also some discussion regarding the ability of the concrete channel to carry more than the design flows due to freeboard capacity and the impact of that on the sizing of downstream structures in the watershed. SCS informed Ebasco that this had been taken into account in the watershed planning stage.

Question: Does the stage storage data provided contain the volume for material excavated as borrow material?
Answer: A new stage storage curve will have to be developed to incorporate the volume occupied by the road fills.

Question: Can SCS supply copies of the appropriate soil surveys?
Answer: SCS provided the soil survey data.

Question: What purpose does running the emergency spillway storm serve?
Answer: The ESH is used to determine the limits of area required for purchase of flowage easements. It will be used as in completing the innundation map preparation required in Phase IV. There was discussion about moving the portion of the innundation map preparation for the ESH and FBH flows to Phase I to aid in a decision on whether or not the structural spillway alternative should be eliminated. It was decided that SCS could make the decision without the use of the maps (see 5 above) and Ebasco was not requested to change the sequence of work.

Question: Can we obtain copies of construction costs on recently completed projects?
Answer: Yes, SCS will supply copies of abstracts on recently advertised work when bids are received.

Question: Procedures to be used for conduit design. Can manufacturers' recommendations be used? Are TR-5, TR-18, and DN-2, to be used. Can we get copies of TN-1, TN-2, and SN-5 that are listed in the list of references?
Answer: Manufacturers' recommendations cannot be used. TR-5 and TR-18 must be followed. TN-1, TN-2, and SN-5, do not apply.

Question: What procedures are being used by SCS to design the energy dissipators at the ends of the concrete channels?
Answer: Design Note 22 to be provided by SCS. HEC-14 and COE 110-2-1603. SCS will also send copies of plans for Signal Butte Project.

Question: What procedure is used by SCS to estimate depth of scour below the baffle chute structure?
Answer: U. S. Bureau of Rec. Technical Note 25, Queen Creek Dam Study done by Lauretson at the University of Arizona.

Question: Has SCS considered using the material excavated during channel construction for the FRS fill?
Answer: Yes, it is generally not economical due to increased haul distances.

Question: What have you used as allowable velocities in the Calachi?
Answer: Allowable velocities in the Calachi range from 0 to 8 feet per second depending on the type of Calachi and its characteristics. Velocity should not be used in the ES spillway design, use TR-52 procedures.

Question: Is there any flow in the Apache Junction Floodway from the area east of Apache Trail?
Answer: There is no inflow to Apache Junction Floodway from the area east of Route 88 (Apache Trail). There is significant inflow along the western edge of Apache Trail.

Question: Will we be required to use SCS standard computation sheets?
Answer: SCS intended to supply standard computation sheets for TR-5 computations and TR-18 computations. Ebasco is not required to use them but they make the use of the TR's easier. SCS will supply these.

9. Additional items:

a. Soil Mechanics Note 1 is being revised but was not available at the time of the meeting. SCS will send copies ASAP.

b. SCS does not allow the use of filter fabrics in the earth fill.

c. Environmental Impact Statement Considerations: Ebasco will not design an irrigation system. The 6:1 side slopes will not be used, Ebasco will design for stability. No top soil will be included on the dam in Ebasco's design; top soil will be added under the landscape contract if needed.

d. Ebasco suggested that consideration be given to placing fill on dry side of optimum and inquired if SCS would entertain the idea of additional testing for this purpose. SCS stated that they have recently completed a report on this subject that they will make available to Ebasco. Options to SCS standard fill placement procedures were not ruled out.

ATTENDANCE LIST

Name	Organization	Phone
Don Paulus	SCS	241-5143
Lee Kupfer	Black & Veatch	(913) 967-2000
Ken Reinert	Coates Field Serv.	266-8116
Myron Temchin	Ebasco	(212) 839-1408
Dan Lawrence	Az. Dept. of Water Resources	245-1541
Bill Payne	SCS	241-5152
Bob Payette	FCD	262-1501
Leonard Eddy	FCD	262-1501
M J McNulty	City of Apache Junction	982-8002
Jeff Bell	City of Apache Junction	982-8002
Richard W. Broman	City of Apache Junction	982-8002
Wm. Ruddick	BLM	863-4464
Vic Bolano	Ebasco	(212) 839-1483
Glen Rockwell	Ebasco	(714) 662-4122
Carl Montana	Ebasco	(212) 839-1421
David Hunter	Ebasco	(212) 839-1409
Shiam Goyal	Ebasco	(212) 839-3722
Nick Karan	MCFCD	262-1501
Cora Fernandez	MCFCD	262-1501
Erv McLuty	MCFCD	262-1501
Ray Koffman	SRP	236-2768

APPENDIX B

CORRESPONDENCE

INCLUDING DESIGN REVIEW COMMENTS

EBASCO SERVICES INCORPORATED
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

EBASCO

12 March 1986

Mr Donald R Paulus, Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola Avenue
Phoenix, AZ 85012

Dear Mr Paulus:

Subject: APACHE - BULLDOG FLOOD CONTROL PROJECT
SRP TOWER FOOTINGS

Enclosed are two (2) prints of Bulldog Floodway, Plan and Profile, Sheet No. 2-8.

The footings for an existing SRP Transmission Tower have been plotted on the Plan based upon survey information received from SCS. The tower is located on the north side of the floodway near Station 150 +00.

Two of the tower legs are within the dike fill. We need details of the tower and its foundation to include dimensions, elevations and configuration for the footing and lower part of tower.

That portion of the steel leg below grade will be protected from direct contact with soil by providing a vertical open barrier, probably a corrugated iron standpipe around the tower leg.

You may wish to send the extra print of the enclosed sheet 2-8 to SRP for their information and comment.

Very truly yours,

Glen Rockwell

for Carl Montana
Project Manager

DG:JAS
Enclosures
2514A

cc: J L Ehasz
D Groner
G Rockwell

Recd 2/7/86

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

ARIZONA STATE OFFICE

PHOENIX, ARIZONA

FEBRUARY 5, 1986

DESIGN REVIEW REPORT

Job: Apache Junction/Bulldog Flood Control Project

Project: Buckhorn-Mesa WPP

Location: Maricopa and Pinal Counties, Arizona

Authority: Public Law 566

Phase: Phase III, Preliminary Design, Contract #53-9457-5-00475

SUMMARY: On December 9 and 10, 1985, EBASCO Services Inc. gave a presentation of the preliminary design in Phoenix, Arizona. January 8 and 9, 1986, a design review meeting was held at the SCS, WNTC in Portland, Oregon. All review items were discussed at this meeting and red lined review comments of the design reports and drawings were given to EBASCO.

Minutes of the review meeting were taken by EBASCO and submitted to the SCS January 20, 1986. These minutes are an attachment to this report.

This report represents both the Arizona State Office and the WNTC reviews.

Additional analysis, calculations or documentation not mentioned in this report may be required as they become apparent during the final design phase.

DESCRIPTION OF JOB: This job consists of the design and preparation of contract construction drawings and specifications for (1) Bulldog Floodway and Apache Junction Outlet, and (2) Apache Junction Floodway and Flood Retarding Structure in conformance with the functional requirements of the Buckhorn-Mesa Watershed Work Plan and Supplemental Work Plan No. 1, and the Environmental Impact Statement dated June 1976. The work is being carried out in accordance with specifications for design and engineering services, Architect-Engineering Contract #53-9457-5-00475.

SCOPE OF REVIEW: This review is for the Phase III Preliminary Design report and drawings submitted by EBASCO to the Soil Conservation Service December 9, 1985. Contents for review include, 1.) Design Report including design summary, list of construction drawings, specifications, bid schedule, cost estimate and supporting design calculations, 2.) Set of plans showing layout of project features.

PURPOSE OF REVIEW: The purpose of this review is to determine that the A&E has; 1.) proper supporting documentation for the project features shown; 2.) is presenting these project features properly on a set of plans 3.) has made reasonable design assumptions, and 4.) properly set up contract specification bid schedule, and cost estimate.

BASIS OF REVIEW: The basis of review has been listed in the preliminary design reports presented by EBASCO for their "basis for design".

REVIEW COMMENTS: Combined red lined drawings and red lined reports showing the review comments from the Flood Control District, SCS WNTC, and SCS Arizona State Office are considered attachments to this preliminary design review report. Minor comments red lined within these documents will not be repeated in this written report.

Minutes of the preliminary design review meeting held at the WNTC in Portland, Oregon January 8 and 9, 1986, are attached and will be referred to for appropriate items. Note: not all the comments mentioned in the minutes will be referred to and, therefore, those comments should not be considered as part of this report. Further discussions on these items have changed our point of view and will be mentioned below.

GENERAL:

1. As shown on the red lined drawings, coordinate data needed to be checked and corrected. As of this report this item has been completed.

2. Recommend steel layout such that it will be easy to tie in construction. Some of the spacings noticed in the design calculations seem questionable.

3. Discrepancies between plans and design calculations. (See minutes Item #1).

4. Address dispersive materials in design report and construction notes to the Project Engineer. Do not address this item in the specifications.

5. When comparing the costs between construction of a channel U-section versus a center slab section, take into consideration the differential excavation needed to install the thinner center slab. Also, if single layer reinforcement is used in the center slab a waiver of SCS design requirements will be required. EBASCO will submit a letter recommending such a waiver. (See minutes Item #8).

6. We prefer to use a dowel detail at the expansion/contraction joints and use a fibre joint filler ASTM D 1751.

7. All specification shall include a section for Items of Construction and Details.

8. Water Surface Profiles: (see minutes Item #2).

9. Freeboard criteria for side weir inlets. (See minutes Item #4).

10. Do the washes handle the flow capacity the side inlets are designed for, or will you need to contain and direct these flows upstreams? (See minutes Item #4).

11. Excavation quantities: (See minutes Item #15).

12. Design of grouted drop structures. (See minutes Item #9).

13. Has extra channel wall height been added for super elevation?

14. Conceptual design: (See minutes Item #3).

<u>REPORT:</u> <u>Apache Junction Floodwater Retarding Structure and Floodway:</u>

1. Top of dam elevation. (See minutes Item #12).

2. Specification 21-7: Include a statement such that the vegetation within the washes in the borrow area will not be destroyed.

3. Colored concrete: (See minutes Item #7).

4. We recommend that the waterline which extends over the top of the dam along Idaho road have shut off valves upstream of the reservoir area and downstream of the dam.

5. AT&T design of FAD diaphragm. (See minutes Item #10).

6. Riprap at emergency spillway. (See minutes Item #13).

<u>DRAWINGS:</u> <u>Apache Junction Floodwater Retarding Structure and Floodway:</u>

1. Pages 1-12; Draw the elevation view of the drop structure to a larger scale for more detail.

2. Pages 1-13 to 17: a) show the drainage channel to the principal spillway outlet. b) show sections with clearing and grubbing limits.

3. Beginning station for Apache Outlet is not correct.

4. Remove the gate from the principal spillway. It is not needed.

5. Transition zone width (see minutes Item #11).

6. Show sediment guard on low inlet to principal spillway.

7. Keep shear plates in the standard baffle riser.

8. Show low drainage hole in principal spillway steel detail plans. Steel needs to be designed according to TR-37.

REPORT: Bulldog Floodway and Apache Junction Outlet:

1. Pages III-3; mention the fact that the channel and side inlet calculations have been revised from that shown in the Phase I report, due to the decrease in flow from the principal spillway.

2. Numbering of side inlets are inconsistent in both the report and the specifications.

3. Colored concrete; (see minutes Itm #7).

4. Excess excavated materials will be spoiled between side inlet structures.

5. The downstream maintenance road shall be kept to within 6 inches of the top of the channel wall.

DRAWINGS: Bulldog Floodway and Apache Junction Outlet:

1. Pages 2-11; Was a compound curve used in this reach?

2. Pages 2-30; Draw the elevation view of this structure to a larger scale.

Submitted: Donald E. Paulus, Government Representative Date

Concurred: Leland Saele, Design Engineer Date

Approved: Ralph M. Arrington, State Conservation Engineer Date

F.U.

EBASCO SERVICES INCORPORATED EBASCO

Two World Trade Center, New York, N.Y. 10048

February 4, 1986

Mr. Donald E. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Dear Mr. Paulus:

Subject: Apache Junction - Bulldog Flood Control Project
Waiver of SCS Design Requirements

We discussed in our meeting in Portland on January 8 and 9, 1986 the treatment of the Apache Junction FRS embankment where it interacts with the AT&T cable in the foundation.

Because the special construction of this cable installation resulted in a trench entirely in caliche and backfilled with concrete, it was agreed by all participants in the Portland meeting that this caliche/concrete interface should not be disturbed when the embankment is constructed. The construction drawings will show the granular transition zone of the FRS extending down to the top of the concrete encasement, but not around it.

This treatment does not agree with the recommendations of SCS TR-60, which specifies that any construction under a water-retaining embankment should be surrounded by a graded filter material. Due to the particular conditions associated with the installation of the AT&T cable, we recommend that the treatment specified in SCS TR-60 be waived for this case.

Very truly yours,

Carl J. Montana

Carl J. Montana
Project Manager

CMJ:rg

cc: V M Bolano
D Groner
G E Rockwell

United States
Department of
Agriculture

Soil
Conservation
Service

USDA-Soil Conservation Service
201 E. Indianola, Suite 200
Phoenix, Arizona 85012

January 22, 1986

Carl Montana
Consulting Engineer
EBASCO
Two World Trade Center
New York, N.Y. 10048

RE: Apache/Bulldog Flood Control Project

Dear Mr. Montana:

As we discussed by phone we would like for you to develop the plans, specifications and bid schedule for Bulldog Floodway and Apache Junction outlet in the following manner:

1. Divide the floodway channel into reaches that will show cut-off points in the most logical areas which will represent approximately \$4.5 million, \$5.5 million, and \$6.5 million of construction money. If the total estimate changes greatly from the preliminary estimate, we will need to discuss the location of the second cut-off point.

2. Each reach shall be defined on the drawings with beginning/ending stationing.

3. Specifications shall be written such that they may be used for any one of the reaches.

4. Develop a bid schedule and cost estimate for each reach.

We have reviewed your proposed revised schedule and have agreed to the following dates:

March 10 and 11	Final design presentation in Phoenix, AZ.
April 7 and 8	Final design review in Portland, OR.
April 18	All corrections complete and final documents for completion and acceptance of work in hand

As a result,the contract completion date will be modified for April 18, 1986.

Sincerely,

Donald E. Paulus

Donald E. Paulus
Government Representative

cc: Ralph M. Arrington
Dave Lambson
Glen Rockwell, EBASCO, Santa Ana

United States
Department of
Agriculture

Soil
Conservation
Service

USDA-Soil Conservation Service
201 E. Indianola, Suite 200
Phoenix, Arizona 85012

January 22, 1986

Glen Rockwell
EBASCO Services, Inc.
3000 W. MacArthur Blvd.
Santa Ana, CA 92704

RE: Apache/Bulldog Flood Control Project
Alignment Variance

Dear Mr. Rockwell:

In response to your letter dated January 16, 1986, this is to confirm that the bearings and station used under the "October 1985" heading are correct.

In reviewing the coordinate data supplied to us during the January 8 and 9, 1986 meeting we found our coordinates to agree. However, please review the four highlighted sheets attached in which we have questions.

Sincerely,

Donald E. Paulus

Donald E. Paulus
Government Representative

Enclosures

Arizona ____ Buckhorn-Mesa W.P.P. - Bulldog Floodway
J.E.B. 14 Jan 86
Check plane coordinates

2

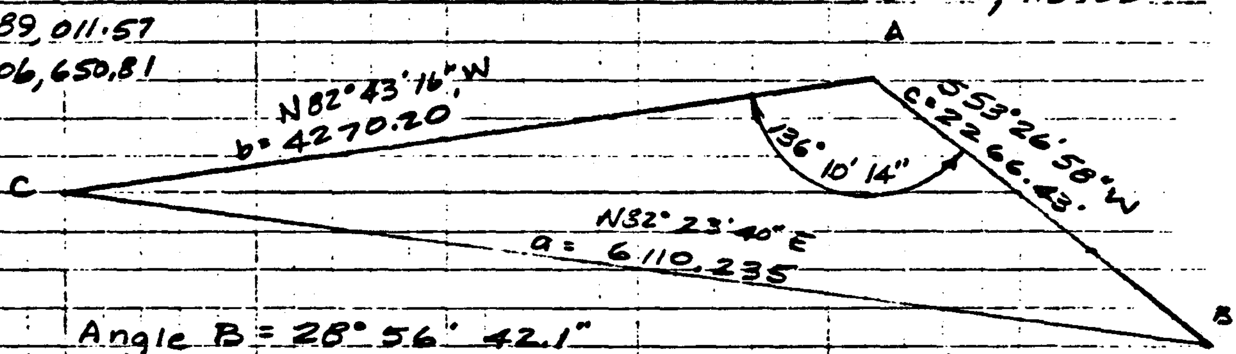
Given P.I sta 197+20.9
Use Tan dist 105.18 ft (Calculated from 200 ft length of arc and Δ 43° 49' 46")

197+20.9 − 105.18 = P.C. Sta. 196+15.72

196+15.72 + 200.00 = P.T. Sta. 198+15.72

Distance from P.I. to end of Bulldog Floodway

Sta. 219+76.97 − 198+15.72 + 105.18 = 2266.43'



Angle B = 28° 56' 42.1"

Angle C = 14° 53' 03.8"

1•
Side b 4,270•2000
3•
Side c 2,266•4300
6•
∡A 136 10 14•0

1•
Side b 4,270•2000 A
Angle B 28 56 42•1
3•
Side c 2,266•4300 A
Angle C 14 53 3•8
5•
Side a 6,110•2353 A
Angle A 136 10 14•0

3,351,113•106

Arizona Buckhorn-Mesa W.P.P. - Bulldog Floodway
J.E.B. 14 Jan 86
CURVE @ MERIDIAN ROAD

Previous Computations for curve #8
now shown as curve #6

PLANNING	DESIGN
CURVE #8	CURVE #6
Δ 41°00'00"	Δ 43°49'48"
D 21°25'57"	D 21°54'54"
R 267.33'	R 261.44'
T 99.95'	T 95.90'
L 191.30'	L 200.00'

$180° - 82°43'16" - 53°26'58" = 43°49'46"$

Δ = 43°49'46"
L = 200.00 assumed design distance wanted

2.
Δ 43 49 46.0
3.
L.Arc 200.0000
1.
Radius 261.4488
2.
Δ 43 49 46.0
3.
L.Arc 200.0000
4.
Tan 105.1797
5.
Chord 195.1590

P.T. sta 160+42.2 - 591.5 = Back P.I. sta. 154+50.70

Project plan sta. 197+20.9 - 154+50.70 = 4270.20 ft.

SURVEY 4100.0 ft. P.L. moved 170.2 ft west

EBASCO SERVICES INCORPORATED

BY N. H. DATE 12/12/85 SHEET ___ OF ___

CHKD. BY [illegible] DATE 12/19/85 OFS NO. 3767-300 DEPT. NO. 243

CLIENT ~~USDA-SOIL CONSERVATION SERVICE~~

PROJECT APACHE-BULLDOG FLOOD CONTROL PROJECT

SUBJECT APACHE + BULLDOG FLOODWAY COORDINATE

STA No	N	E	
10+00	884,689.68 689.43	E 616,518.81 618,582.14	
12+00	N 884,756.98	E 618,393.47	
26+25 (29+50)	N 885,236.51 236.29	E 617,051.58 051.84	
29+70	N 885,352.60 352.33	E 616,726.70 726.93	
45+98.58	N 884,596.72 596.56	E 615,532.21 532.63	
100+92.50	N 888,248.85 249.07	E 611,376.79 376.77	
129+76.16	N 887,437.26 437.57	E 608,609.72 609.95	
154+80.87	N 889,011.12 011.57	E 606,650.75 650.51	
197+20.9	N 889,552.12 552.60	E 602,415.18 415.02	

219+76.97 N 888,202.87 E 600 594.33 computed 14 Jan 1996 JSB

PREVIOUS Ending Bulldog N 888,204.10 E 600 595.83

391/0-01

EBASCO SERVICES INCORPORATED

BY N Hung DATE 11/18/85 SHEET ____ OF ____

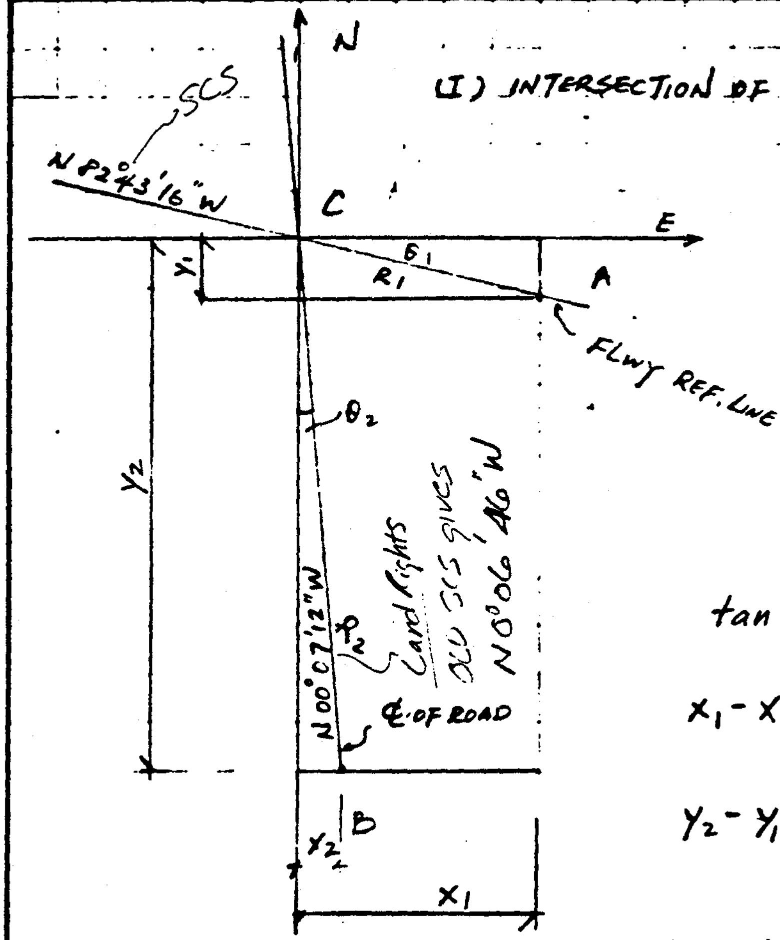
CHKD. BY R. Barn DATE 11/20/85 OFS NO. 3767-300 DEPT. NO. 243

CLIENT ~~USDA-SOIL CONSERVATION SERVICE~~

PROJECT APACHE-BULLDOG FLOOD CONTROL PROJECT

SUBJECT MERIDIAN ROAD BRIDGE LOCATION

(I) INTERSECTION OF ℄ MERIDIAN ROAD & FLWY REF. LINE



A: N 889,011.12
E 606,650.75

$\theta_1 = 90° - (82°43'16) = 7°16'44''$
$= 7.278889$

B: N 886,563.54
E 602,616.89

$\theta_2 = 00°07'12'' = 0.12°$

$\tan\theta_1 = 0.1277284, \quad \tan\theta_2 = .0020943$

$X_1 - X_2 = 606,650.75 - 602,616.89$
$= 4033.86$

$Y_2 - Y_1 = 889,011.12 - 886,563.54$
$= 2447.58$

$X_2 = Y_2 \tan\theta_2, \quad X_1 = Y_1 / \tan\theta_1$

$X_1 - X_2 = Y_1/\tan\theta_1 - Y_2 \tan\theta_2 = 4033.86$

$Y_1/\tan\theta_1 - (2447.58 + Y_1)\tan\theta_2 = 4033.86$

$7.8291124 Y_1 - 5.125967 - .0020943 Y_1 = 4033.86$

$7.8270181 Y_1 = 4038.986, \quad Y_1 = 516.03$

$X_1 = Y_1/\tan\theta_1 = 4040.07, \quad X_2 = 6.21$

$Y_2 = 2963.61$

COORDINATION C N 889,011.12 + 516.03 = N 889,527.15 (530.03 LANDRIGHTS Bear; 527.00) MIXED)

E 606,650.75 - 4040.07 = E 602,610.68 (610.75 Bear; 610.78 LANDRIGHTS Bear)

$R_1 = (X_1^2 + Y_1^2)^{1/2} = (4040.07^2 + 516.03^2)^{1/2} = 4072.87$

$R_2 = (X_2^2 + Y_2^2)^{1/2} = (6.21^2 + 2963.61^2)^{1/2} = 2963.62$

EBASCO SERVICES INCORPORATED

EBASCO

3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

16 January 1986

Mr Donald R Paulus, Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, AZ 85012

Dear Mr Paulus:

Subject: APACHE-BULLDOG FLOOD CONTROL PROJECT
ALIGNMENT VARIANCE

Variances still exist in the alignment information provided by SCS to Ebasco. A sketch is attached to illustrate.

The alignment for the FRS and floodways was established by SCS on the revised topographic drawings issued to Ebasco in mid-October, 1985. Bearings and stations were unchanged except for one minor change issued with SCS letter dated September 24, 1985. This required the extension of P.1.6 to Sta. 197 + 20.9 "on the same bearing". Underlining is ours.

At the December 8, 9, 1985 meeting, SCS comments were submitted in regard to discrepancies in Ebasco coordinate values. Ebasco reviewed the SCS comments and adjusted those values that required change.

However, judging from mark-ups received at the recent January 8, 9, 1986 meeting, there still exists an area of discrepancy. It occurs on lines P.1.4 - P.1.5 and P.1.5 - P.1.6. Apparently, the recent SCS coordinate calculations are not based upon the data shown on the mid-October, 1985 issue.

The tabulation below illustrates the discrepancies:

	DRAWINGS OCTOBER, 1985	COMMENTS JANUARY 1986
P.1.4 - P.1.5	N 51° - 13' - 16" W	N 51' - 13' - 08" W
P.1.5 - P.1.6	N 82° - 43' - 16' W	N 82° - 41' - 14" W
Sta. P.1.6	197 + 20.9	195 + 50.91

In a telephone conversation between Don Paulus and D Groner on December 13, 1985, SCS confirmed that the October 1985 bearings were to be used (see memo dated December 17, 1985). Information regarding bearings was reconfirmed orally at the January 8, 9, 1986 meeting.

We are continuing to develop all of our design, drawings and calculations based upon the values listed under the "October, 1985" heading above.

0036u

Mr Donald R Paulus
16 January 1986
Page Two....

We would appreciate written confirmation by SCS that the October 1985 data is valid, or a written request to change to whatever is now desired.

Very truly yours,

Glen Rockwell

for Carl J Montana
Project Manager

DG:JAS/0036u
Attach.

cc: G Rockwell
D Groner

EBASCO SERVICES INCORPORATED

SHEET ____ OF ____

CLIENT ____ USDA-SOIL CONSERVATION SERVICE

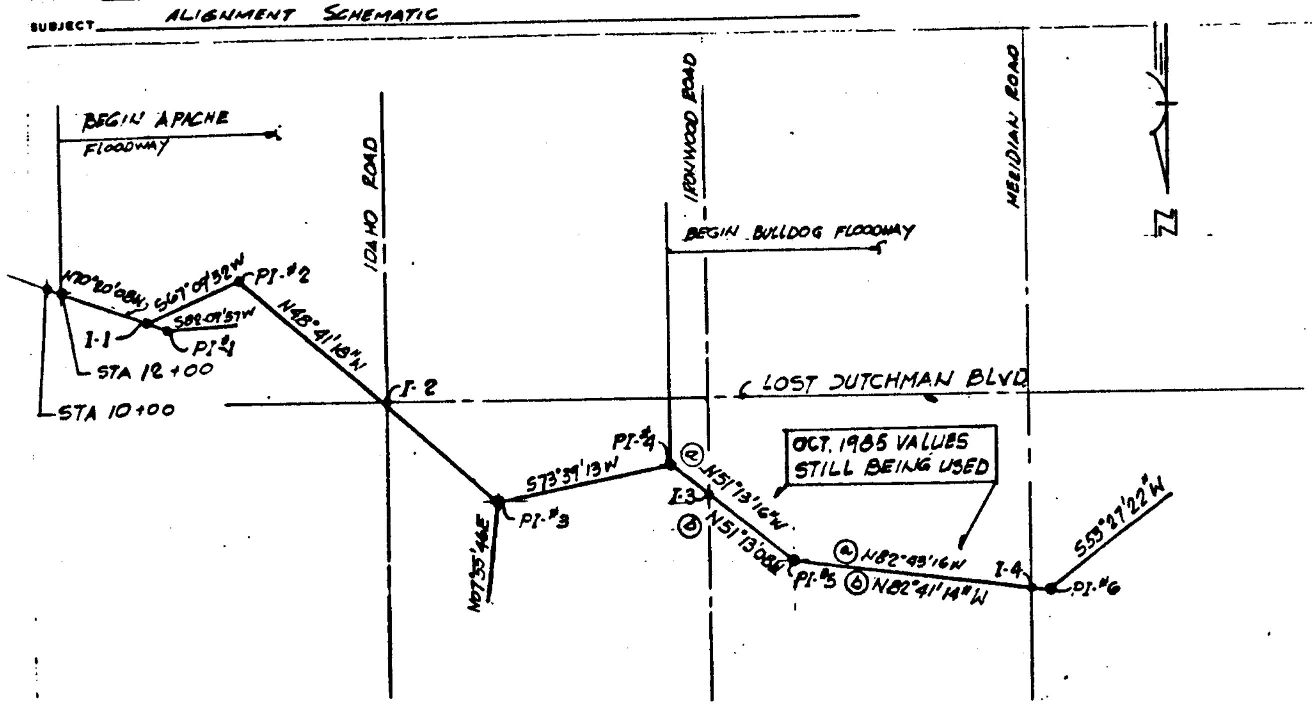
PROJECT ____ APACHE-BULLDOG FLOOD CONTROL PROJECT

SUBJECT ____ ALIGNMENT SCHEMATIC

OFS NO. 3167.400 DEPT. NO. ____

BY CAC DATE ____

CHECKED BY NH DATE 1-16-86



I-4

a. N889,527.15
E602,610.68

b. N889,530.03
E602,610.71

c. N889,530.03
E602,610.78

PI-#6

a. N889,552.10
E602,415.38

b. N889,531.03
E602,583.09

c. N889,534.68
E602,415.76

NOTES:

a. EBASCO CALCULATION, BASED UPON OCTOBER 1985 VALUES AND BEING USED.

b. SCS MARK-UP, APPARENTLY BASED UPON JAN. 1986 VALUES SHOWN IN LETTER.

c. EBASCO CALCULATIONS, BASED UPON JAN. 1986 VALUES SHOWN IN LETTER.

30 DEC 1985 AZ

United States Department of Agriculture

Soil Conservation Service

West National Technical Center
511 N. W. Broadway, Room 547
Portland, Oregon 97209-3489

EB/… COPY

Subject: ENG - Phase II, Final Review of SM Report, Bulldog Floodway and Apache Junction Flood Control Project, Arizona

Date: December 26, 1985

To: Ralph M. Arrington, State Conservation Engineer, SCS, Phoenix, Arizona

File Code:

Our comments on the final report for Phase II are itemized below. The comments were discussed with Don Paulus by telephone on December 16, 1985.

1. Page 25, Item II-0.3, last sentence - Calculations indicate saturation water content of 11.5±%, approximately 87±% saturation, for the borrow soils, not the 18% and 50% respectively noted in the text. An optimum moisture content being only 50% of saturation water content could be indicative of questionable data.

2. Page 32, Item II-C.7 - The gradation limits for embankment material are too restrictive. We suggest an upper and lower limit, such as 100% passing the 6" size and 15% or more passing the No. 200.

3. Page 33, Item II-C.8 - We recommend extending the transition zone limits from 1.0 foot below the top of dam down to the bottom of the cutoff trench. The last sentence in the first paragraph is not a valid condition at this site.

4. Page 35, Item II-C.9, 2 and page 38, Item III-2 - Class A compaction is suggested for the embankment foundation at ±2% of optimum moisture and 95% of maximum γ_d rather than the method specification.

5. Page 38, Item III-3 - A method specification for compaction similar to NEH 20-24 - Class 1, is suggested for the transition zone where less than 5% of the material will pass the No. 200. No moisture control other than sufficient water to prevent bulking should be satisfactory.

6. Page 39, Item III-A - Even though the settlement analysis indicates that no allowance for settlement is required, we believe an overfill of 0.2 foot to account for construction uncertainties is worthwhile.

Ralph M. Arrington
December 26, 1985

7. Table V - delete note 1

Table VI to IV - Footnotes should be indexed to proper table heading.

One copy of the report is being returned for your disposal.

JACK C. STEVENSON
Head, Engineering Staff

Attachment

cc:
Verne Bathurst, State Conservationist,
SCS, Phoenix Arizona
Donald E. Wallin, Head, Design Unit, WNTC
Clifton Deal, Soil Mechanics Engineer, WNTC

EBASCO COPY

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

ARIZONA STATE OFFICE

ENGINEERING STAFF

PHOENIX, ARIZONA

DECEMBER 13, 1985

DESIGN REVIEW REPORT

Job: Apache Junction/Bulldog Flood Control Project

Project: Buckhorn-Mesa WPP

Location: Maricopa and Pinal Counties, Arizona

Authority: Public Law 566

Phase: Phase II, Soil Mechanics Report, Contract #53-9457-5-00475

SUMMARY: On the day of 9/30 and 10/1, 1985 a meeting was held at the EBASCO office in Santa Ana to review the preliminary soil mechanics report. From this meeting minutes were prepared by EBASCO and a trip report was prepared by the SCS WNTC Soil Mechanics Engineer. Overall the final soil mechanics report submitted here has followed the comments presented in these reference reports.

Additional comments made as part of this review are generally asking for more discussion on some of the topics mentioned. These discussions are needed for clarity or because of omissions.

Additional analysis, calculations or documentation may be required as they become apparent during the preliminary and final design phases.

DESCRIPTION OF JOB: This job consists of the design and preparation of contract construction drawings and specifications for (1) Bulldog Floodway and Apache Junction Outlet, and (2) Apache Junction Floodway and Flood Retarding Structure in conformance with the functional requirements of the Buckhorn-Mesa Watershed Work Plan and Supplemental Work Plan No. 1, and the Environmental Impact Statement dated June 1976. The work is being carried out in accordance with specifications for design and engineering services, Architect-Engineering Contract #53-9457-5-00475.

SCOPE OF REVIEW: This review is for the Phase II-Soil Mechanics Report, submitted by EBASCO Services Incorporated to the Soil Conservation Service November 1985. Contents for review include, 1) Summary of tests performed, 2) Summary of Test results, 3) Analysis and Interpretation, 4) Conclusions and recommendations, 5) Calculations, and 6) Summary of Slope Stability computer runs.

PURPOSE OF REVIEW: The purpose of this review was made to determine that the A&E has, 1) properly documented site conditions and engineering properties of soils, 2) used reasonable preliminary design assumptions, 3) made proper interpretations of the soil properties and sufficient analysis to evaluate project features and, 4) made reasonable and sufficient recommendations for design.

BASIS FOR REVIEW:

1) Minutes of monthly meeting, September 30, October 1, 1985 by EBASCO dated October 11, 1985.

2) Trip Report - Review of Phase II A&E preliminary report, by Cliff Deal, Soil Mechanics Engineer, SCS, WNTC. Dated October 24, 1985.

3) Geological Investigation Report; Apache Junction FRS, Apache Junction Floodway, Bulldog Floodway, July 1983.

4) Soil Test Results - November 20, 1984; February 5, 1985; June 24, 1985

5) Correspondence EBASCO to SCS dated August 13, 1985, containing additional field testing requirements.

6) Correspondence SCS to EBASCO date 9/24/85 containing a) Permeability test results, b) log of test holes, c) grain size distribution, d) in-place moisture density, e) compaction and, f) Atterberg limits, for additional testing requested by A&E.

7) SCS-TR-60, Earth Dams and Reservoirs, June 1976.

8) SCS-SMN-1, Guide for determining the gradation of filter materials, July 1985.

9) SCS-SMN-3, Soil Mechanics considerations for embankment drains, May 1971.

10) SCS-SMN-7, The mechanics of seepage analysis, October, 1979.

11) Appendix V, EM 1110-2-1902, April 1, 1970
"Infinite Slope Analysis fo Cohesionless Soils"

REVIEW COMMENTS:

1.) page 11; pinholes tests are suggested here for determining whether dispersive clay material is present in borrow soils for embankment fill. We need to elaborate on pinhole tests for contact areas between structures and earth materials. In addition, recommendations should be made when dispersive material is found.

2.) page 13; and throughout report we need to indicate what the appropriate method of compaction is, per ASTM-D698.

3.) page 32; we suggest a gradation for earth embankment material not be specified in the contract. Upper and lower limits may be all that needs to be specified.

4.) page 33; criteria for transition zone upper and lower limits have been set by SCS. This information will be given in SCS, WNTC comments.

5.) page 34; a coefficient of uniformity is suggested to be specified with the filter material gradations shown.

6.) page 34; address outlet to FAD diaphragm in accordance with TR-60.

7.) page 35; specify either a work specification (eight passes of a large vibratory...) or method specification (98 percent per ASTM-D698) but can not use both.

8.) page 37; here riprap is suggested alongside of the emergency spillway. We have the following concerns:

   a. Riprap and bedding material will collect direct rainfall and runoff. Do we want this moisture around the structure or within the embankment?

   b. If dispersion is tested for in this area would there be a need for riprap?

9.) page 38; Foundation Preparation - give better guidance on the type of material that shall be removed. For example, classifications and/or general material sizes.

10.) page 9 of 60 of calculations missing.

11.) Table V; tests results have been supplied.

12.) Foundation and drainge requirements should be mentioned for the Emergency Spillway and Grouted Drop Chutes.

13.) Side slopes for earth floodways should be addressed for flow stresses and stability and the calculations done in the Phase I report referenced.

14.) We suggest a common moisture range and compaction requirement be used for both the foundation and embankment materials. We do not feel you have demonstrated a strong argument for the additional effort suggested within the foundation. In fact, you have argued very well for the case of minor settlement and supported this with calculations.

15.) Principal Spillway - Describe what will be done in the case where it is found during construction that the principal spillway will not be resting on a caliche (non-yielding) foundation.

Donald E. Paulus 12-26-85

Submitted, Donald E. Paulus, Government Representative Date

Leland A. Brady, acting for 12-31-85

Approved, Ralph M. Arrington, State Conservation Engineer Date

COMMENTS FOR APACHE JUNCTION FRS AND FLOODWAY
AND
BULLDOG FLOODWAY AND APACHE JUNCTION OUTLET

From Flood Control District

Preliminary Design Report

1. Request moving the starting point of Apache Junction Floodway to Sta. 11+87 to accommodate more flows coming from west of Apache Trail.

2. A premold joint is required between the bridge abutment and channel floor to insure independence from each other and minimize leaks at Meridian and Ironwood Roads.

3. Cold joints should be used between channel walls and adjacent bridge abutments at Ironwood and Meridian Roads.

4. The channel invert elevation in the bridge areas at Meridian and Ironwood Roads should be set low enough to provide proper freeboard without causing a hump on the road.

5. A rain gauge similar to the one to be installed for Signal Butte FRS is desireable for this project.

Preliminary Plans

I. Bulldog Floodway and Apache Junction Outlet General Comments.

a. Sheets improperly numbered.

b. Details improperly labeled and not referenced in drawings.

c. Need maintenance roads on both sides of structure. No dead ends or tight radius turns.

1. Sheet 2-2

Show Signal Butte FRS

2. Sheet 2-3
a. Section at STA. 101+50 to STA. 115+00 - The symbol for concrete is easily mistaken for drainfill.

b. Side Channel Inlet No. 1 should be indicated in the plan and profile.

3. Sheet 2-4

a. Drainage should be provided for maintenance roads.

b. Flows from small washes should be accommodated.

c. Side inlet is not labeled.

4. Sheet 2-6

b. Indicate which section of the floodway are elevation walls 1 to 4.

5. Sheet 2-7

State if there is an Inlet No. 3.

6. Sheet 2-10

a. It appears that drainage directly to the east should also be picked up by the collector channel.

b. Two side channel inlets are labeled as Inlet No. 5 on sheets 2-9 and 2-10.

7. Sheet 2-11

a. Label energy dissipator in the profile.

b. Put a symbol for bridge at Meridian Road in the plan and profile.

c. Floodway reference line needs an arrow pointing to the line.

d. How will cross-drainage be handled that impinges on channel just upstream of the end of the concrete lined channel?

8. Is there any concern on the impact of cross-drainage on the earth-lined portion of the earth channel?

9. Sheet 2-12

a. Show a cross-section of the earth channel.

b. Is the earth channel above ground?

10. Sheet 2-15

Show details of wingwalls for the side inlet.

11. Sheet 2-16

Indicate construction joints and expansion joints.

12. Sheet 2-18

Indicate if water stops are necessary at construction joints.

13. Sheet 2-30

a. Details for Elevation:

Assign depth for downstream cut off and slope for the 56 foot long grouted riprap.

II. Apache Junction FRS

1. Sheet 1-2

Label energy dissipator on Apache Junction Floodway.

2. Sheet 1-4

a. State why there is an emergency spillway east of Apache Trail.

b. Drainage for run off on access and maintenance road should be provided.

c. Drainage for minor washes without inlets should be provided.

d. The plan and profile should make reference to details of all inlets.

3. Sheet 1-12

Comments are marked in red.

4. Sheet 1-13

Show typical section of FRS

5. Sheet 1-16

Show road ramps for Idaho and Lost Dutchman Roads.

6. Sheet 1-20

Comments are marked in red.

Suite 200
Phoenix, Arizona 85012

December 2, 1985

RECEIVED
DEC.-4 1985
G. ROCKWELL

Carl Montana
Consulting Engineers
EBASCO Services, Inc. 91st Floor
Two World Trade Center
New York, N.Y. 10048

RE: Side Inlets 4C, 5B, and 6A

Dear Mr. Montana:

As you are aware, shortly after the November 7, 1985 monthly meeting, the SCS selected one of the two design approaches for the subject inlets which were submitted by EBASCO October 29, 1985. This letter is to document the SCS decision.

The selected design will use the reinforced concrete curved inlet over the weir drop inlet for the following reasons:

1. The configuration allows the water to enter the main channel without ponding. Backwater caused by ponding would be extensive and require additional maintenance of the sediment pool and collector dikes.

2. Uniform flow will be maintained through the inlet reach. Thus the design will not require excessive wall heights along the main channel, caused by a standing wave that would occur with the weir drop inlet.

3. The natural vegetation will not be disturbed within the wash upstream of the entrance channel.

Sincerely,

Donald E Paulus

Donald E. Paulus
Government Representative

CC: Ralph Arrington
Bill Payne
Jack Stevenson, WNTC w/attachment
Glen Rockwell, EBASCO, Santa Ana

EBASCO SERVICES INCORPORATED EBASCO
3000 W. MacArthur Blvd., Santa Ana, CA 92711, (714) 662-4000

27 November 1985

Mr Nicholas P Karan, Chief - Engineering Div.
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, AZ 85009

Dear Mr Karan:

Subject: APACHE - BULLDOG FLOOD CONTROL PROJECT
ROAD INTERSECION AT FRS

Enclosed are two (2) sketches of the intersection of Lost Dutchman Road and Idaho Road at the Apache Junction Flood Retarding Structure titled:

a. Road Intersection Plan
b. Road Profiles

The following parameters were used in developing these study sketches:

1. The road intersection is set at El. 1812., two feet above the crest of the dam. This will allow for the water supply lines and Mountain Bell Telephone lines to be embedded in the road fill clear of the dam.

2. The maximum road grade used is 4%.

3. Side slopes for fill are 1.5 horizontal to 1 vertical. This is the steepest slope recommended. It is used to reduce the width of right-of-way needed and also to stay clear of existing buildings on the downstream side of Lost Dutchman Road.

Construction of the new Lost Dutchman Road will cut off direct access to the buildings along the road. It seems that a new access entrance will have to be provided starting at least 1200 ft west of the intersection.

After your review, please contact us so that we can discuss the need for right-of-way requirements in further detail.

Very truly yours,

Carl Montana
Project Manager

DG:JAS
Encls.

cc: G Rockwell
D Groner

2390A

United States Department of Agriculture

Soil Conservation Service

West National Technical Center
511 N. W. Broadway, Room 547
Portland, Oregon 97209-3489

November 18, 1985

Carl L. Montana,
Project Manager
EBASCO Services, Inc.
Two World Trade Center
New York, New York 10048

Dear Mr. Montana:

During the September 30, 1985 meeting in Santa Ana, we agreed to supply you with an estimate of the amount of differential settlement a transition zone can tolerate without failing.

Based on our experience a differential settlement of 0.1 ft./ft. should not be an excessive value.

A more important concern than differential settlement is the loss of free-board. We believe you will need to address this problem before becoming too overly concerned with differential settlement values.

If we can be of further assistance, please do not hesitate to contact Don Paulus, Government Representative.

Jack Stevenson by HM
JACK C. STEVENSON
Head, Engineering Staff

Attachment

cc:
George C. Bluhm, Director, WNTC
Verne M. Bathurst, State Conservationist, SCS, Phoenix, Arizona
Ralph M. Arrington, State Conservation Engineer, SCS, Phoenix, Arizona
Don Paulus, Government Representative, SCS, Phoenix, Arizona

EBASCO SERVICES INCORPORATED **EBASCO**

Two World Trade Center, New York, N Y 10048

File Ref: USDA 3767-L

October 29, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project

Dear Mr. Paulus:

A review of the hydraulic parameters and the actual contours in the vicinity of Inlet 6A of Station 194 + 20 of Bulldog Floodway during the Phase III effort indicates that the crest of the inlet weir as proposed in Phase I is very high as compared to the general elevations of the arroyo. This will result in raising the water level in the arroyo and cause flooding in the area.

An alternate study was performed to provide a side channel inlet with a straight inlet at the beginning of the side channel instead of a box drop. The study indicates that the water level in the arroyo will be lowered by about 4.5 feet as compared to that with the weir inlet. This will reduce flooding in the area significantly.

The layouts of inlet 6A with a weir inlet (as in the feasibility report) and a side channel with a straight inlet are shown in Attachments 1 and 2.

Please note that the side channel inlet will require a shift in the bend in the Bulldog Floodway in a downstream direction and a shift in the center line of the floodway by about 50 feet to the north. Also, that the bed elevation of the floodway will be lowered by about 10 inches downstream of the inlet.

A similar treatment to change the weir inlets to side channel inlets may be required for inlets 4C and 5B.

If you have any questions please contact us.

Very truly yours,

Carl J. Montana
Carl J. Montana
Project Manager

CJM:rg
attachments

cc: J L Ehasz - w/o atts.
[redacted]
S N Goyal - w/atts.

Paulus, ...

United States
Department of
Agriculture

Soil
Conservation
Service

West National Technical Center
511 NW Broadway, Room 547
Portland, Oregon 97209-3489

Subject: MGT - Trip Report - Review of Phase II A&E Report by EBASCO for Bulldog Floodway and Apache Junction FRS, AZ - 9/30-10/1/85

Date: October 24, 1985

To: Jack C. Stevenson, Head, Engineering Staff, WNTC

File Code:

Participants.

Carl L. Montana, Project Manager, EBASCO, New York, New York
Victor M. Bolano, Geotechnical Engineer, EBASCO, New York, New York
David Groner, EBASCO, Santa Ana, California
Glen Rockwell, EBASCO, Santa Ana, California
Don Paulus, Government Representative, SCS, Phoenix, Arizona
Clifton E. Deal, Soil Mechanics Engineer, WNTC, SCS, Portland, Oregon

Purpose. This trip was made to provide soil mechanics assistance to Arizona during the review of the Phase II report prepared in accordance with the A&E contract with EBASCO Service, Incorporated of New York, New York.

Background. On April 8, 1985, EBASCO Services, Incorporated was awarded a contract by the Soil Conservation Service for design of Bulldog Floodway and Apache Junction Floodway, Floodwater Retarding Structure, and Outlet. This contract consists of five phases: Phase I - Site characterization and Comparative Design Studies; Phase II - Soil Mechanics Report; Phase III - Preliminary Design; Phase IV - Final Design, and Phase V - Service during construction.

During the review of Phase I it was agreed that a meeting to review the Phase I comments and the preliminary Phase II report would be beneficial. The attached agenda provides the items discussed during the September 30 and October 1 meeting in Santa Ana at the EBASCO Services, Incorporated Office.

The Phase I comments were not discussed because EBASCO had made revisions and the WNTC had not received those revisions before this meeting. It was decided that some of those revisions would possibly be reflected in the Phase II comments and discussion.

A lengthy discussion was held on the preliminary Phase II - Soil Mechanics Report. The following is a list of major items discussed:

1. Stability analysis for Apache Junction FRS.

2. Need for pin hole testing during construction of the floodways and FRS.

3. Negative pore pressures in triaxial test results.

4. Using average soil values in stability analyses or other analyses.

5. Collapsibility of foundation and recommendations for design.

6. Drainage needs for structures.

7. Use and understanding of the new Soil Mechanics Note No. 1.

8. Filter and drainage diaphragm outlet needs, sizing and placement.

9. Central transition zone; with or without outlets.

10. The need for the report to include all soil mechanics related items.

Item 1. Stability Analysis. A basic philosophy difference exists between the Soil Conservation Service and the A&E over the interpretation of slope stability values less than indicated in TR-60 for dry dams and C=0 conditions. It was agreed that a steady seepage and rapid drawdown analyses will be made and proper engineering explanations of these results will be presented in the report. Even though the infinite slope stability analysis may result in values less than listed in TR-60 the explanations given on pages 18, 19, and 20 can provide reasons for accepting the lower values without a change in the slope configuration.

Item 2 - Pin Hole Testing. The dispersion test results are based on double hydrometer analyses. Consequently, it was agreed that a statement about running pin hole tests during construction will be included in the report. This will also cover our concern about the statement on page 9. The statement implies that erodibility of the materials due to their low plasticity is not a concern. This is a concern adjacent to concrete structures when these materials are used as structural backfill which is intended according to statements on page 15.

Item 3 - Negative Pore Pressure. Due to the transitory nature of negative pore pressures, SCS does not use the total stress values in a stability analysis. Therefore, it was agreed that the effective stress values will be used instead.

Item 4 - Use of Average Soil Values. It was agreed that the use of "average" for soil parameters in the report should be changed. SCS has normally used the worst case situation when using soil parameters in an analysis. Averaging soil parameters is not good practice.

Item 5 - Collapsibility of Foundation Soils. Based on the investigational report and laboratory report, the collapse potential for the foundation is uncertain. SCS experience indicates that dams built on similar foundations have had some movement causing cracking of the dam. The cracking appears to be the result of wetting and loading of the foundation during the life of the dam causing strains the embankment materials are unable to adjust for.

It is our judgment that cracking will occur whether we know the magnitude of the collapse or not. Cracking has occurred even on sites where SCS has removed a significant portion of the foundation. For this reason, we do not agree with the statements made on pages 24 and 25. Therefore, it is our opinion that a central transition zone can be used to control the cracking due to potential foundation movements.

It was agreed that EBASCO will consider our comments about using the transition zone and SCS will provide EBASCO with an estimate of the amount of differential settlement a transition zone can tolerate without failure.

Item 6 - Structural Drainage. Drainage needs for the FRS and concrete structures were not addressed in the report. It was agreed that a discussion of required drainage measures will be added to the report. This discussion is not to be a complete design but rather the need for and type of system or systems which address the soils to be used as backfill or built upon.

Item 7 - New Soil Mechanics Note #1. It was agreed that the new Soils Note will be used to design all filter systems needed for this project. An advance copy of this note was given to EBASCO with the understanding that some editorial changes may occur when the official copy is issued. We do not anticipate any changes that will affect any designs based on the advance copy.

Item 8 - Filter and Drainage Diaphragm. It is our interpretation of TR 60 that any utilities through or under the FRS shall be protected by a Filter and Drainage (FAD) diaphragm. Consequently, the AT&T cable crossing will need a FAD diaphragm which can be included with the proposed central transition zone. Outlets are needed for the FAD diaphragm. Pipe can be used but we suggest EBASCO consider enveloping the PS conduits with a drain aggregate encased in filter aggregate. Doing this will eliminate the need for hand compacted backfill.

EBASCO agrees to provide a FAD diaphragm for the cable with an appropriate outlet.

Item 9 - Central Transition Zone. Nowhere in the report is there a discussion of the transition zone and the method of compaction control for the embankment and backfill materials.

EBASCO agreed to provide a discussion of the transition zone and the compaction control for the embankment and backfill.

Item 10 - General Format of the Report. Numerous items that should be in the soil mechanics report have been discussed in other reports or correspondence. It is SCS's desire that all soil mechanics items should be discussed in this report, regardless of whether the analysis results are negative or positive.

EBASCO agreed to including all soil mechanics related items such as a better description of the project and an explanation for the additional testing.

COMMENDABLE WORK

Don Paulus has done an excellent job in coordinating this meeting with EBASCO. The meeting was very productive and the members of EBASCO that participated were very professional in their comments and discussion. An exit conference to review these recommendations was not conducted.

Clifton E. Deal

CLIFTON E. DEAL
Soil Mechanics Engineer

Attachment

cc:
George C. Bluhm, Director, WNTC
Verne M. Bathurst, State Conservationist, SCS, Phoenix, Arizona
Ralph M. Arrington, State Conservation Engineer, SCS, Phoenix, Arizona
James N. Talbot, National Soil Mechanics Engineer, SCS, Washington, D.C.
Carl Montana, Project Manager, EBASCO Services, Inc., New York, New York
Don Paulus, GR, SCS, Phoenix, Arizona

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAY, FRS, OUTLET
AND BULLDOG FLOODWAY

AGENDA FOR MONTHLY MEETING

OCTOBER 1-2, 1985

EBASCO SERVICES INCORPORATED
SANTA ANA, CALIFORNIA

1. REVIEW OF COMMENTS ON
   PHASE I - FEASIBILITY STUDY REPORT

2. REVIEW OF MEMO OF AUGUST 29, 1985 (Attached)

   A. Grouted Riprap Design Reference
   B. Corrugated Metal Culverts Under Road Enbankments
   C. Flow Downstream of Emergency Spillway
   D. Design Criteria for Idaho and Brown Roads

3. Review and Discussion of Preliminary Phase II Report

4. Status of Additional Topographic Mapping, including
   Extension for Earth Channels and Emergency Spillway

5. SRP Transmission Tower Footing Dimensions and Stationing Reference

6. Topography Reference Controls

7. SCS Standard Mylars for Riser and Conduit

8. Signal Butte Construction Schedule

9. Review Drawing Title Block Layout

10. Change of Floodway Centerline to "Reference Line"

11. Concrete Floodway Design Criteria for Loading Conditions

12. Joint Configuration, Spacing and Waterstops

13. Filters and Filter Gradation

14. Runoff Flows to be Channeled to Inlets

15. AT&T Cable Crossing Status

16. Status of Ebasco--Flood Control District Contract

17. Flood Control District Bridge Plans

18. Telephone and Water Line Crossing of FRS

19. Schedule of Ebasco Work and Meetings

GR/lf 9-17-85

D023/Wang

United States Department of Agriculture

Soil Conservation Service

201 E. Indianola
Suite 200
Phoenix, Arizona 85012

October 21, 1985

Glen Rockwell
EBASCO Services, Inc.
3000 W. MacArthur Blvd.
Santa Anna, CA 92704

RE: Apache/Bulldog Flood Control Project, Contract No. 53-9457-5-00475

Dear Mr. Rockwell:

The proposed construction joint submitted by EBASCO October 9, 1985 has been reviewed by our staff and the WNTC, and we feel that this would be an adequate method to use. However, particular attention should be mentioned to keep the key area clean.

For your information I have enclosed a paper on construction joints which was prepared by our California Design Section. This paper shares some of SCS experiences and knowledge with examples and listed references.

Because computations involving lateral earth pressures has been a problem area found in other SCS offices dealing with A&E design contracts, I have enclosed two papers on the subject for your information. This information is currently being put together in a SCS Technical Release (TR).

Under separate cover you will find the following:

✓ 1. One blueline each of Meridian and Ironwood bridge preliminary details.

✓ 2. One mylar and two bluelines of sheet ~~16~~, Apache Junction FRS, station 90+00 to 105+00.

✓ 3. Two bluelines of the extended emergency spillway centerline topography.

Sheet 16 and the extension of the emergency spillway completes the revised and additional topography required.

October 21, 1985

Glen Rockwell

In reference to the bridge details the Flood Control District has asked that we include their construction contract for bridges with our construction contract. Therefore, we will be building the bridges and floodway simutaneously and should coordinate the two designs. Our plan is to use the bridge abutments shown as our floodway side walls and to design the floor slab as part of the SCS project.

If you have any questions please call.

Sincerely,

Donald E Paulus

Donald E. Paulus
Government Representative

cc: Ralph Arrington
Bill Payne
Carl Montana

file cc
L. T.

EBASCO SERVICES INCORPORATED EBASCO

3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

9 October 1985

Mr Donald R Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, AZ 85012

Dear Mr Paulus:

Subject: APACHE-BULLDOG FLOOD CONTROL PROJECT
FLOODWAY DETAILS

Supplementing our telephone conversation of October 8, 1985, we enclose a sketch, as requested, to clarify proposed details for floodway construction.

Confirming the discussion, design is being prepared to include details conforming to the attached sketch and explained below.

Waterseal

The vertical steel plate (1/4-in. by 6-in.) waterseal between wall and base slab is eliminated. No waterseal will be provided between wall and slab.

The entire floodway is below grade. Its function is to conduct floodwater, not to conserve water suply. Pressure heads exterior and interior are low and in most cases are almost balanced. Eliminating the W.S. plate will eliminate not only the materials cost, but also the added cost of forming a raised key and building a temporary support to secure the steel plate during concrete placement. Rubber or PVC waterseals will be used at joints between abutting wall and/or slab joints.

Transverse Slope

The "Far West States Engineering Design Standards", p. 6-23, Par. B9, states:

" 9. Transverse Slope

Inverts in lined channels wider than 10' shall have a transverse slope toward centerline. The drop in invert from the walls to centerline shall be 0.4 inch per linear foot. "

The floodway on this project will carry occasional flows for limited periods. Construction of a center gutter as described above seems to be an unnecessary refinement.

cc to G.M.
S. G.
N. H.
L. N.
G. R.

0290T

The floodway invert will be shown flat across its transverse section and no centerline gutter will be provided. This reduces the construction cost of shaping subgrade and building slab transitions to accommodate.

Weepholes

Weepholes in floodway walls will be 2 1/2-in. diam. to comply with FWSEDS p. 6-22, Par. B4.

Bottom Key

The construction key between floodway wall and base slab will be as shown on the attached sketch.

Superelevation

The superelevation required by FWSEDS, p. 6-7, Par. A6, will be provided by increasing the height of wall on the outside of the curve. The transverse section of the base slab will be level.

Vehicle Load Surcharge

The surcharge load due to construction and maintenance will comply with FWSEDS p. 2-2, Par. D quoted as follows:

> " SURCHARGE LOADS
>
> Where a heavy crawler-type tractor might be expected to operate close to the top of a wall, a live load surcharge pressure equal to not less than two feet of earth shall be included in the analysis of lateral earth pressures. "

Very truly yours,

Glen Rockwell
for Carl J Montana
Project Manager

DG:JAS

cc: G Rockwell
D Groner

0290T

EBASCO SERVICES INCORPORATED

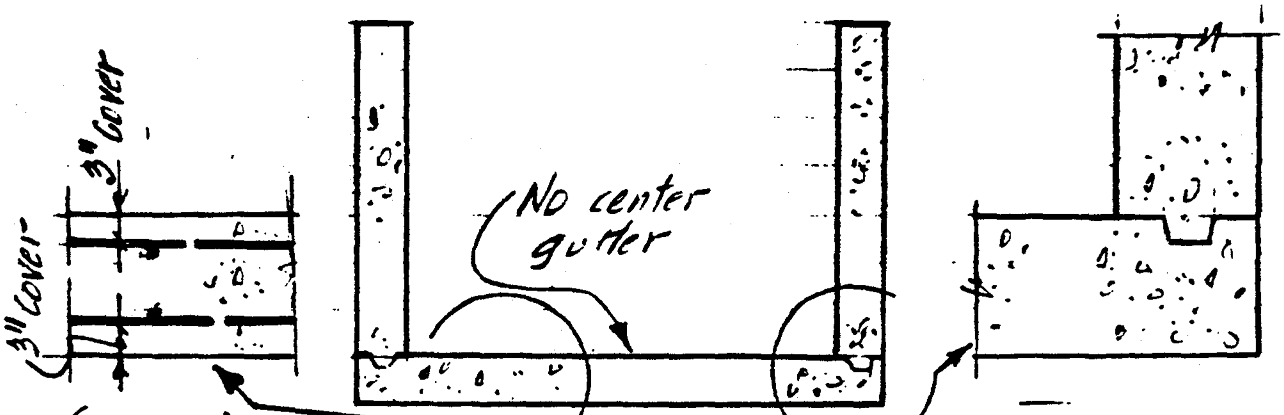
BY DG DATE 10/8/85 SHEET ___ OF ___

CHKD. BY N.H. DATE 10/9/85 OFS NO. ___ DEPT. NO. ___

CLIENT ~~USDA SOIL CONSERVATION SERVICE~~

PROJECT APACHE-BULLDOG FLOOD CONTROL PROJECT

SUBJECT Floodway Details

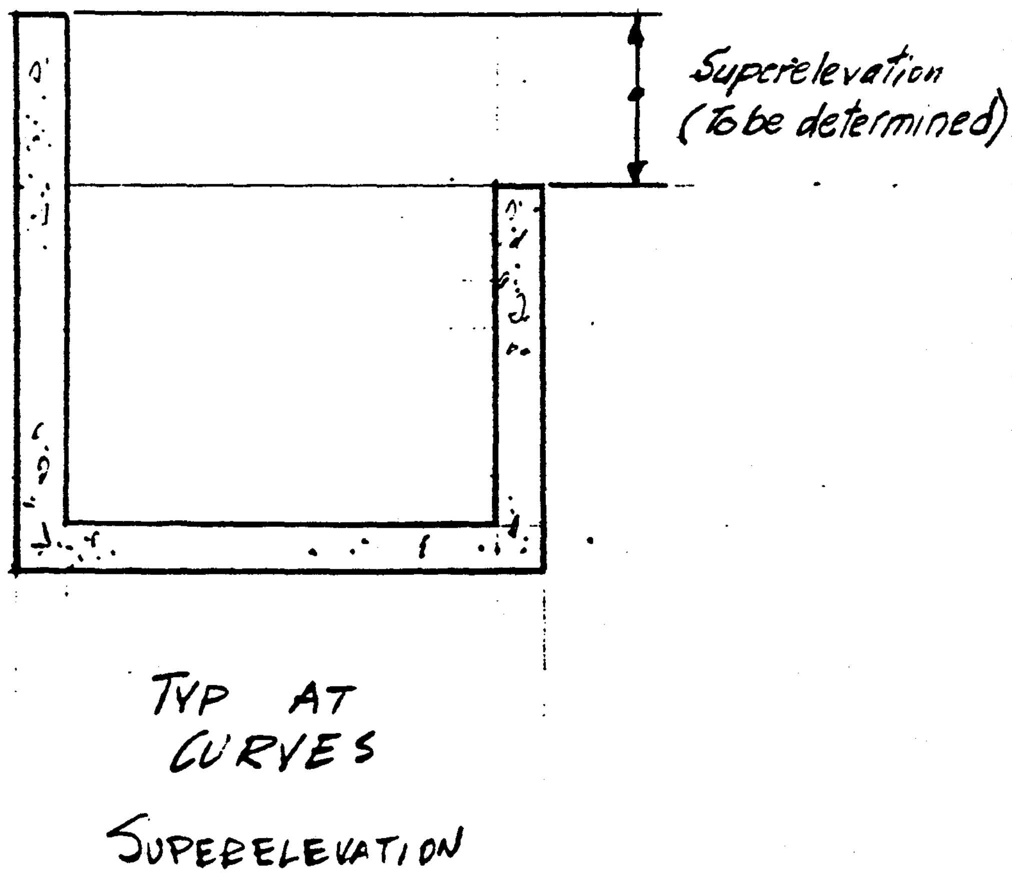


(Where one layer rebar is used cover will be 3" T & B)

SUMMARY OF WIDTHS

Apache Junction
8.5'
25.0'
37.5'

Bulldog
3.5'
10.0'
18.0'
22.0'
28.0'
35.0'
50.0'



TYP AT CURVES

SUPERELEVATION

Nttg - Li, 5
Li

United States Department of Agriculture

Soil Conservation Service

201 E. Indianola
Suite 200
Phoenix, Arizona 85012

October 8, 1985

dg Rec'd 10-11-85

Glen Rockwell
EBASCO Servces, Inc.
3000 W. MacArthur Blvd.
Santa Anna, CA 92704

RE: Apache/Bulldog Flood Control Project, Contract No. 53-9457-5-00475

Dear Mr. Rockwell:

The following are responses to questions which were asked at our October 1, 1985 meeting in Santa Anna.

Q. Is there going to be a problem with specifying 1 inch or less material for embankment and structure backfill?

A. Yes, we feel there is. When we say 1 inch or less in the specification that is exactly what the inspector will look for and knowingly the contractor may increase his prices for these items. We recommend using six inch and three inch maximum particle sizes for embankment and structure backfill respectively. With these limitations, you may also specify a required percent of fines.

The general write-up of the EARTHFILL Specification, under (4) Placement, states material may not differ substantially in texture or gradation from the surrounding material. Therefore, the contractor would not be able to place a load of gravel, for example, within the fill even though we specify the 6 inch and 3 inch limits.

Q. What water line do we show on the plans?

A. The water surface of the emergency spillway hydrograph routing.

Q. How do we want to show the survey base lines on the plan and profile sheets?

A. Show parallel lines downstream of the project centerlines at the following distances:

1.	Apache Junction Floodway	100 feet
2.	Apache Junction FRS	100 feet
3.	Apache Junction Outlet	50 feet
4.	Bulldog Floodway	100 feet

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50

U.S. Government Printing Office: 1983—420-938/1578

These distances will make the best use of already existing survey.

A note shall also be added stating that the maximum distance between baseline monuments is 500 feet.

Q. Do we want to elevate the floor of the channel at the curves for super elevation?

A. No, additional height will be added to the wall according to TR-25.

Q. Do we want to use a transverse slope toward the centerline of the lined channels which exceed 10 feet in width according to Far West States criteria?

A. No. I have talked with our Regional Office and they confirmed that this is not hard rule that we must follow.

Sincerely,

Donald E Paulus

Donald E. Paulus
Government Representative

cc: Ralph M. Arrington
Bill Payne
Carl Montana

City of Apache Junction

October 2, 1985

Mr. Dan Sagramoso, P.E.
Chief Engineer/General Manager
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, AZ 85009

Attention: Nick Karan, P.E.
Chief, Engineering Division

Regarding: Apache/Bulldog Flood Control Project;
Response to Comments for the Phase I
Feasibility Report

Gentlemen:

We have reviewed the correspondence from the State Conservation Engineer and attachments provided by EBASCO Services, Inc., and are providing you with a response as requested. Due to recent construction of Lost Dutchman Boulevard (Brown Road) between Idaho Road and S.R. 88, it is most likely that Tomahawk Road will be developed in the very near future. As such, we understand the structure at this point will be designed to accommodate a 100-year storm, and we recommend that it be built in conjunction with the initial flood control project.

Comments provided in regard to Idaho and Brown Roads state that road profiles and width used in design were based upon information provided at earlier meetings. We agree that the back-of-curb dimensions for the full width of the future street would be 64-feet; however, we have continually maintained that consideration should be given to accommodate a future 5-foot sidewalk on each side, plus an appropriate shoulder at the back of sidewalk, before beginning the embankment slope. In addition, we have previously stated that the initial improved (paved) roadway section may only need to be 28-foot, which would be comparable to the existing paved roadway. However, should it be preferred to improve the roadway section to the ultimate future section, we would have no objection. Our main emphasis has remained that at least the earthwork should be performed in order to allow future expansion without major earthwork construction.

In regard to the speed limit, and our previous discussions in regard to a 4-way stop or signalization, it appears reasonable that, due to the unique design of the flood control structure at the intersection of major arterials, traffic would be required to slow in advance of the intersection. This being the case, we would not object to an advance warning for a reduction in speed to 30 MPH approaching the intersection.

We hope these comments respond accordingly to the State Conservation Engineer's request. Should you have any further question in these regards, please advise.

Cordially,

Richard

Richard W. Broman
Director of Public Works

RWB:sh

xc: Mike McNulty, City Manager
Ralph Arrington, State Conservation Engineer
Bill Payne, State Conservation Services
Don Paulus, Representative USDA
Carl Montana, EBASCO Services, Inc.

File 307.06

United States Department of Agriculture

Soil Conservation Service

Suite 200
201 E. Indianola Ave.
Phoenix, AZ 85012

Glen Rockwell
EBASCO Services, Inc.
3000 W. MacArthur Blvd
Santa Ana, CA 92704

September 24, 1985
Rec'd 9-26-85 - S.A.

RE: Apache/Bulldog Flood Control Project, Contract No. 53-9457-5-00475, Revised contours and profiles on mylars.

Dear Mr. Rockwell:

The following revised mylars are enclosed:

Sheet No.	Title
3	Bulldog Floodway, Sta 129+76.16 to 145+00.
20	Apache Junction FRS Outlet, Sta 100+76.34 To Sta 115+00.
21	Apache Junction FRS Outlet, Sta 115+00 to Sta 129+76.16.
3	Apache Junction Floodway, Sta 11+00 to Sta 25+00.
4	Apache Junction Floodway, Sta 25+00 to Sta 39+50.

Arizona State Plane coordinates for Station 10+00, east of Apache Trail, are N884,689.68 E618,581.81. You will find this point (#25) and others in the SCS design folder titled; Apache Junction FRS & Floodway, Bulldog Floodway, sent to Carl Montana at the start of the project.

We will continue to send revised mylars as they are completed.

Sincerely;

Donald E Paulus

Donald E. Paulus
Government Representative

cc: Bill Payne
Ralph Arrington

cc C. Montana
N. Hung
L. Nguen
D. G.

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United States
Department of
Agriculture

Soil
Conservation
Service

Suite 200
201 E. Indianola Ave.
Phoenix, AZ 85012

September 24, 1985

Carl Montana
Consulting Engineer
EBASCO Service, Inc. 91st Floor
Two World Trade Center
New York, N.Y. 10048

RE: Apache Junction/Bulldog, Contract No. 53-9457-5-00475 Permeability test results, Soils Test results, and other materials as requested.

Dear Mr. Montana:

Enclosed are the following:

1.) Permeability Test results, 8-28-85.
2.) Log of Test holes, SCS-Eng-533T, 8-21-85.
3.) Grain Size distributions, sample No.'s 1 thru 7, SCS-353 and TSC-PO-ENG-9, 9-6-85.
4.) Inplace moisture-density determination Sample No.'s 1 thru 6, SCS-ENG-530G and SCS-ENG-541, 8-22-85.
5.) Compaction worksheets Sample No.'s 1 thru 6, SCS-ENG-359 and SCS-ENG-352, 9-10-85.
6.) Atterberg limits, Samples 1 thru 6, SCS-ENG-361, 9-6-85.
7.) Sample calculations of determining thickness of grouted rock drop structures, letter by Jack Stevenson dated June 27, 1983.
8.) Approximate layout change of Bulldog Floodway.

Materials provided as discribed in numbers 1,4,5, and 6 provide doumentation for the results given to you over the phone.

The layout change of Bulldog Floodway shows P.I. Station 195+50.9 changing to 197+20.9. The angle may be determined by the Designer.

Sincerely;

Donald E Paulus

Donald E. Paulus
Government Representative

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Department of Agriculture

in loss of section thickness during high flow. To minimize this loss we recommend increasing the d_{50} rock size such that the maximum rock size approaches the depth of section.

If there are any questions on these comments, please call.

C. C. Stevenson acting

JACK C. STEVENSON
Head, Engineering Staff

Attachments

cc:
Donald E. Wallin, Head, Design Unit, Engineering, WNTC

COMPUTATION SHEET
SCS-ENG-523 Rev. 5-69

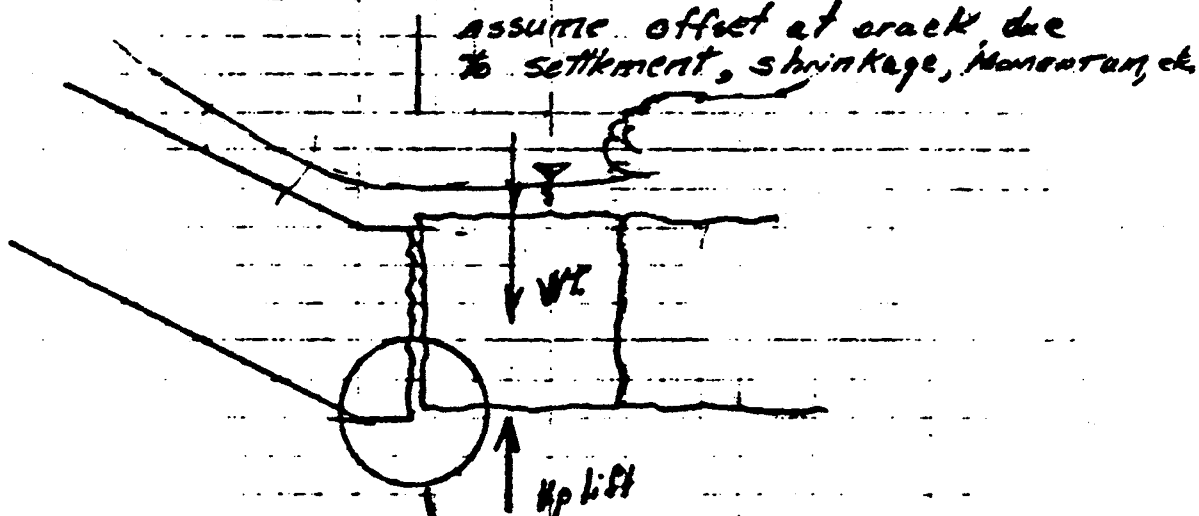
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Az	PROJECT Pass Mountain Div.		
BY LMS	DATE 6/9/83	CHECKED BY	DATE	JOB NO.
SUBJECT Rock Chutes			SHEET 1 OF

Assume cracks develop through structure during service life.

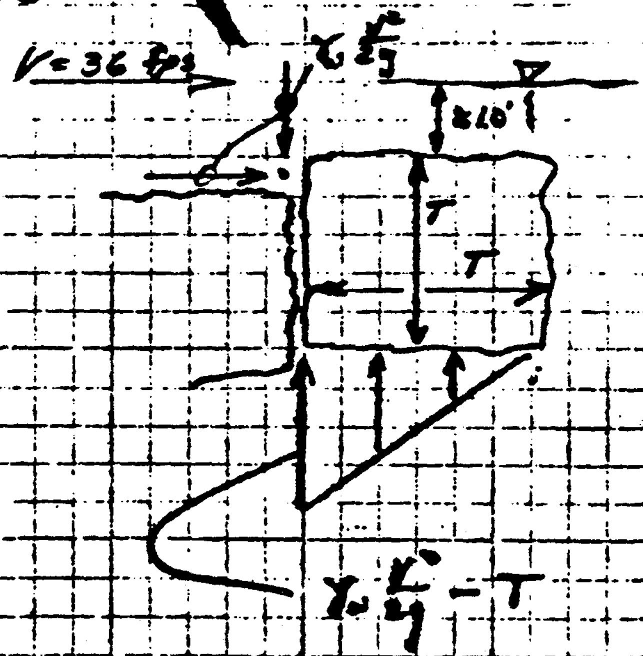
Assume the cracks are no closer together than thickness of chute section.

Apron of chute will be subject to dynamic pressure surges through cracks.



REF:

C.E.-EM 1110-2-1603
Hyd. DESIGN of Spwy.



COMPUTATION SHEET
SCS-ENG-523 Rev. 5-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE AZ	PROJECT Pass Mountain Div.		
BY LMS	DATE 6/9/83	CHECKED BY	DATE	JOB NO.
SUBJECT Rock Chutes			SHEET 2 OF

RECOMMEND FACTOR OF SAFETY ≥ 1.0

Try thicker section

T	UPLIFT ↑	WEIGHT ↓	F.S.
2.5	3437 ~~3563~~	2734 ~~2733~~	0.8
3.0	4908 ~~7989.6~~	4612	0.94 ~~0.92~~
3.5	6354 ~~5600~~	7196	1.13 ~~1.1~~

$$Uplift = \frac{\left(\frac{V^2}{2g} - T\right)(62.4)(T)^2}{2}$$

$$Weight = (T^3)(150) + (T^2)(62.4)$$

$$F.S. = \frac{Weight}{Uplift}$$

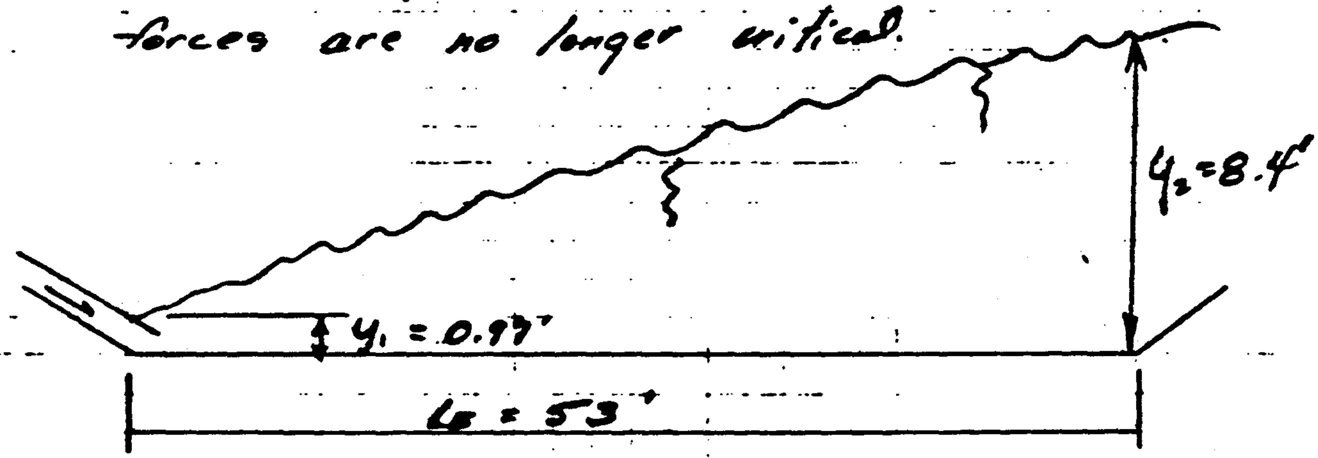
Neglecting friction, a "factor of safety" equal to 1.0 is adequate.

COMPUTATION SHEET
SCS-ENG-523 Rev. 5-60

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE		PROJECT		
	DATE	CHECKED BY	DATE	JOB NO.
JECT				SHEET 3 OF

Maximum dynamic forces occur at and immediately downstream of the break-in-grade. As flow proceeds downstream it is reasonable to assume loss of energy, therefore grouted rock section could be thinner. Suggest a linear adjustment in velocity to determine when dynamic forces are no longer critical.

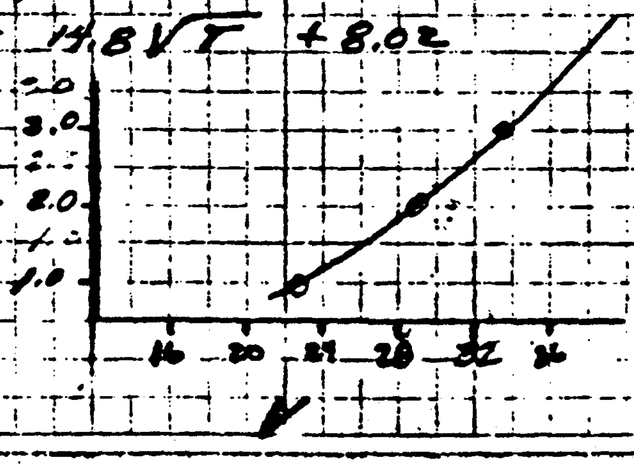


$$FS = \frac{Weight}{Uplift} = 1.0 \quad \text{from sheet 2}$$

Solving for velocity

$$V = 14.8\sqrt{T} + 8.02$$

T = THICKNESS OF GROUTED ROCK



COMPUTATION SHEET
SCS-ENG-523 Rev. 5-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE	PROJECT			
BY	DATE	CHECKED BY	DATE	JOB NO.
SUBJECT				SHEET 4 OF

It is apparent that uplift ~~forces~~ due to dynamic forces decreases rapidly as the velocity drops. Below 26 fps uplift from velocity head is not a critical factor.

I would arbitralky extend the 3.5' thick section downstream of the break-in-grade approximately 1/3 of the basin length 15' to 20'. Beyond this point the thickness could be reduced.

Eighteen inches is probably a minimum for any grouted rock section subject to flow velocities > 10 fps.

COMPUTATION SHEET

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE

PROJECT PASS MOUNTAIN DIV.

SUBJECT ROCK CHUTES

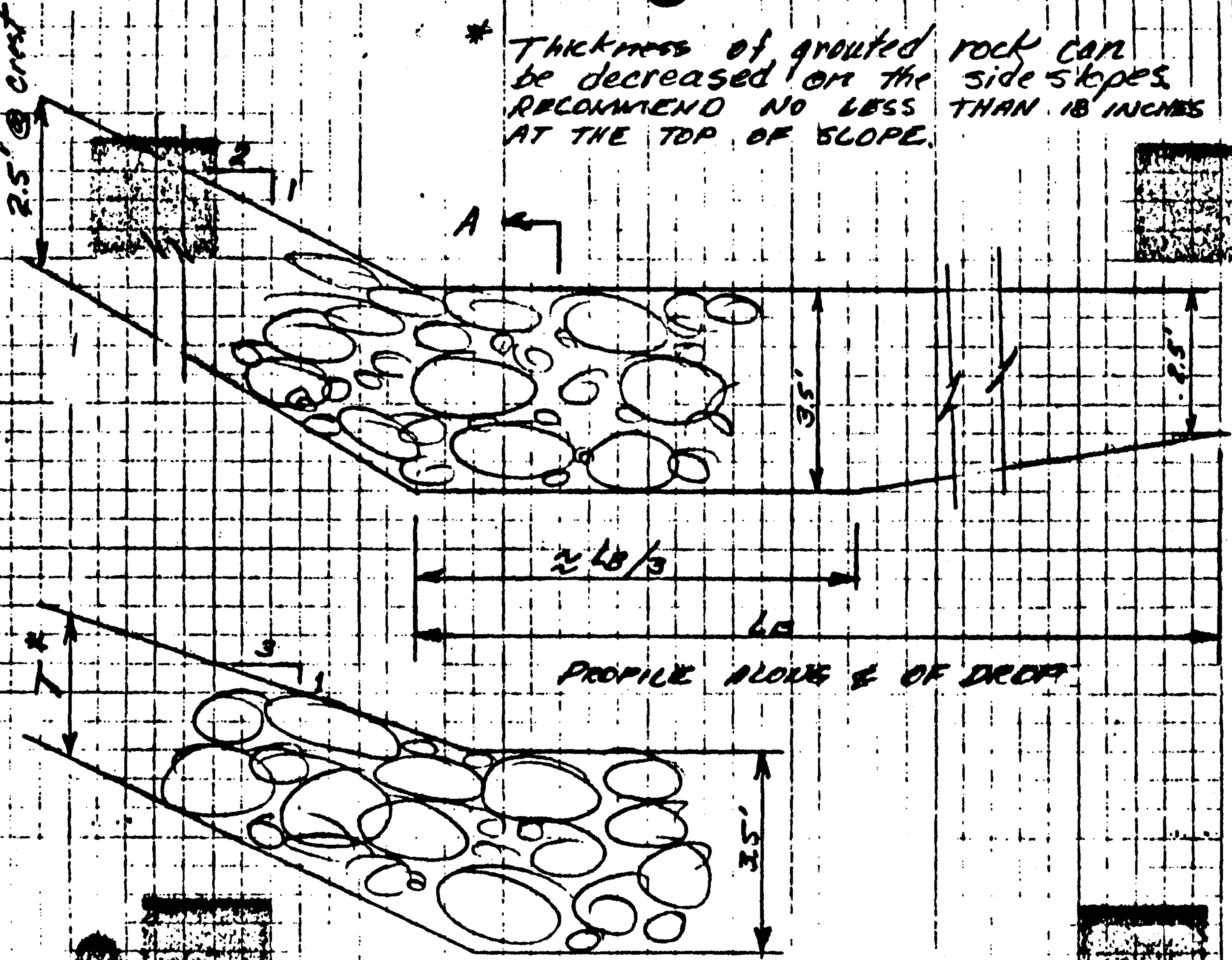
BY LMS DATE 6/83

CHECKED BY DATE

JOB NO.

SHEET 5 OF

* Thickness of grouted rock can be decreased on the side slopes. RECOMMEND NO LESS THAN 18 INCHES AT THE TOP OF SLOPE.



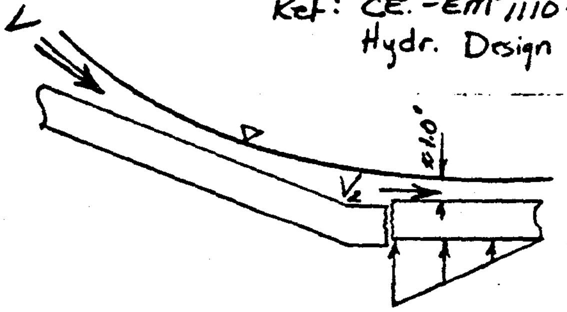
SECTION A

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Az.	PROJECT Buck-horn Mesa; Pass Mountain		
BY ICC / DATE 2/2/84	CHECKED BY DSP / DATE 2-3-84	JOB NO.	
SUBJECT Rock Chutes thickness		SHEET 1 OF 2	

Note:
work done by Lee M.S. will be duplicated ~~to~~ design drop structures along the diversion. — see Rock Chute Calc. 6-3-83 — by LMS
Ref: CE.-EM 1110-2-1603
Hydr. Design of Spwy.



$$Uplift = \frac{\left(\frac{V^2}{2g} - T\right)\gamma_w (T^2)}{2}$$

$$Weight = T^3(\gamma_c) + T^2\gamma_w$$

$$F.S. = \frac{Weight}{Uplift}$$

$$F.S.\left(\frac{V^2}{2g} - T\right)\frac{62.4}{2}(T^2) = T^3(150) + T^2(62.4)$$

$$F.S.\left(\frac{V^2}{2g} - T\right) = \frac{(300)T}{62.4} + 2$$

$$\frac{V^2}{2g} = \frac{\frac{300T}{62.4} + 2}{F.S.} + T$$

$$V = \left[\left[\frac{\frac{300T}{62.4} + 2}{F.S.} + T\right] 64.4\right]^{1/2} \quad eq. 1$$

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE	PROJECT		
Az.	Pass Mountain		
BY ICC	DATE 2/2/84	CHECKED BY DEP	DATE 2-9-84	JOB NO.

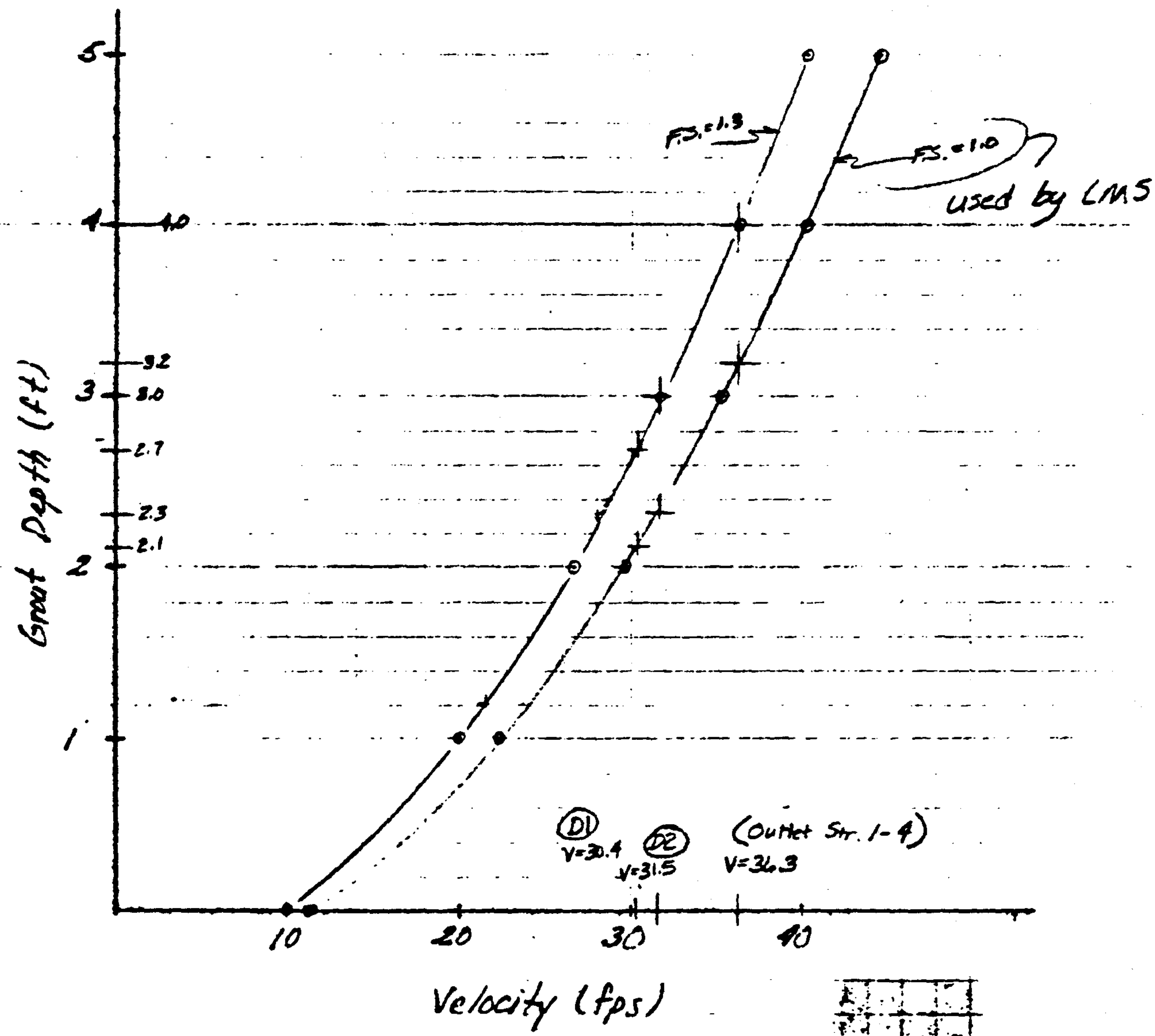
SUBJECT Rock Chute thickness — SHEET 2 OF 2

(F.S. = 1.3)

T	Vel
5	40.15
4	36.2
3	31.73
2	26.59
1	20.0
0	9.95

(F.S. = 1.0)

T	vel
5	44.71
4	40.31
3	35.37
2	29.61
1	22.42
0	11.35



Structure	Basin thickness (F.S. = 1.0)
#2	2.1 } use 2.5'
#1	2.3 }
#3-#6	3.2 use 3.5'

FEAS REP
- final

EBASCO SERVICES INCORPORATED

Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref: USDA 3767-L0023

September 5, 1985

R'd 9-13-85

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Response to City and County Comments
Phase I Feasibility Study

Dear Mr. Paulus:

Your review of the Phase I Feasibility Study resulted in four sets of comments, one each from your office, the SCS regional office, the City of Apache Junction, and the Flood Control District of Maricopa County. The SCS comments are being responded to through revision to the Phase I Feasibility Study Report. Most of the City and County comments are more general in nature and will be responded to through this letter. Their letters should be referred.

City of Apache Junction:

Apache Junction Floodway - If and when Tomahawk Road is constructed the culvert should be designed to pass the design storm (the 100-year storm) in the Apache Junction Floodway at that point. Idaho and Brown Road culverts are designed to pass flows through segments of the reservoir which should not be the basis of design for Tomahawk Road.

Emergency Spillway - The depths and inundated area resulting from discharges through the Emergency Spillway will be determined in Phase IV of the contract.

Idaho and Brown Roads - The road profiles and widths used in design were based on information provided at earlier meetings. It had been agreed that the fill width would be 64 feet and the speed limit 30 mph. The increased width will have minimal effect on the current design since it will only increase the culvert sizes under the roads. An increase in speed limit will have a more significant effect since it will result in longer elevated sections through the reservoir, thus reducing the weir length for flow across the roads for the emergency and freeboard storms. This in turn would affect the top of dam elevation. SCS has agreed to resolve this issue with the City.

EBASCO SERVICES
INCORPORATED

Flood Control District:

1.a. A structural concrete spillway is being used.

1.b. At the present time we are recommending a 2-1/2 to 1 upstream slope. The final determination will not be made until the completion of slope stability analysis in Phase II.

1.c. "Uncontrolled" means there are no manually operated gates or other devices, such as flashboards, which must be manipulated for the spillway to function.

1.d. Ebasco will design these roads under a separate contract with the County.

1.e. The levees referred to were in the earth emergency spillway. At the time paragraph 6.6.2 was written there was the possibility that an earth spillway would be used for the emergency spillway. SCS criteria requires that extremely wide earth spillways be divided by levees running parallel to the direction of flow. An earth spillway is not being used on this site, therefore no levees will be used.

1.f. The 10-day criteria is standard for SCS. Exactly how the drawdown time on this site compares to other sites in the project will have to be answered by SCS.

2.a. The AT&T proposal is currently being reviewed. Ebasco's recommendations will be provided in a separate letter.

2.b. This appears to be a statement.

2.c. Yes

2.d. The cable will have to be relocated. It will also have to be rerouted or otherwise handled during construction. We are in contact with Mountain Bell.

2.e. No comment.

2.f. The final alignment is as shown as Alternate 1 on the plans provided by SCS. The inundated area will be established in Phase IV.

EBASCO SERVICES
INCORPORATED

Mr. D. R. Paulus
USDA Soil Conservation Service

September 5, 1985

2.g. We understand the urgency of this information and will make this item one of the first things done in Phase III. It has been agreed with SCS that no flows from the area east of Apache Trail will be included in the design.

3.a. Future condition curve numbers were used in the design.

3.b. This is an issue that will have to be addressed by the government entity having control over that area.

Very truly yours,

Carl J. Montana
Project Manager

CJM:rg

cc: J L Ehasz
G E Rockwell
D Groner
S N Goyal
V M Bolano

37 67 Fi: FI -
30 Comm
Rec'd 8/27/85

United States Department of Agriculture

Soil Conservation Service

201 E. Indianola
Suite 200
Phoenix, Arizona 85012

August 15, 1985

Consulting Engineer
EBASCO Services, Inc. 91st Floor
Two World Trade Center
New York, N.Y. 10048

RE: Apache Junction/Bulldog Flood Control Project, Contract #53-9457-5-00475 Phase I Review - Site Characterization and Comparative Design Studies

Dear Mr. Montana:

The reviews of Phase I for the above subject have been completed. Enclosed you will find the following:

1. Arizona Design Review Report
2. WNTC Design Review Report
3. Flood Control District of Maricopa County review comments
4. City of Apache Junction review comments
5. Appendix V "Infinite slope analysis for cohesionless soils", EM 1110-2-1902, U.S. Army Corp of Engineers
6. Infinite slope analysis chart-prepared by WNTC
7. Engineering practice standards, "Open Channel"
8. Combined red line copy from WNTC and Arizona of the Phase I - Feasibility Study Report

The result of the reviews show that we are in agreement with the selected project features being recommended by EBASCO in the Phase I-Feasibility Study Report.

For completion of Phase I EBASCO shall revise the Feasibility Study Report in accordance with both the comments in the reviews and those red lined on the report. As agreed to during the Phase I presentation conference a copy of all the review comments shall be included in the final revised report. In addition, address all questions that have been raised in the reviews and include these responses in the final report.

The completion of this report will provide adequate documentation for this phase of work, however, additional documentation may be required for subsequent phases.

If you have any questions about the review comments please call Don Paulus.

Sincerely,

David O. Lambson
Contracting Officer

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U.S. Government Printing Office: 1983-420-630/1579

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

ARIZONA STATE OFFICE

ENGINEERING STAFF

PHOENIX, ARIZONA

8/12/85

DESIGN REVIEW REPORT

JOB: Apache Junction/Bulldog Flood Control Project

PROJECT: Buckhorn-Mesa WPP

LOCATION: Maricopa and Pinal Counties, Arizona

AUTHORITY: Public Law 566

Phase: Phase 1, Site Characterization and Comparative Design Studies. Contract # 53-9457-5-00475

SUMMARY: With concurrence of the comments and modifications established in this review we are in agreement with the project features recommended and presented by EBASCO in their report for Phase I, Site Characterization and Comparative Design Studies.

DESCRIPTION OF JOB: This job consists of the design and preparation of contract construction drawings and specifications for (1) Bulldog Floodway and (2) Apache Junction Floodway, Flood Retarding Structure, and Outlet in conformance with the functional requirements of the Buckhorn-Mesa Watershed Work Plan and Supplemental Work Plan No. 1, and the Environmental Impact Statement dated June 1976. The work is being carried out in accordance with specifications for design and engineering services, Architect-Engineering Contract #53-9457-5-00475.

SCOPE OF REVIEW: Review of Phase I-Feasibility Study Report submitted by EBASCO Services Incorporated to the Soil Conservation Service July 1985. Contents for review include: 1) Design Criteria, 2) Suitability Assessment for Soil Mechanics, 3) Hydrology for Apache Junction FRS & Floodway, 4) Study alternatives and 5) Supporting data

PURPOSE OF REVIEW: This review will determine: 1) if the correct design criteria for the project features have been established by the A&E. 2) If the A&E has pursued reasonable design concepts in evaluating the geological and soil mechanics testing information for its suitability for design 3) the completeness of the design hydrology study for Apache Junction FRS and Floodway and 4) the acceptance of the recommended project feature alternatives.

BASIS FOR REVIEW:

1) Buckhorn-Mesa Watershed Work Plan
2) National Engineering Manual
3) TR-48, (DAMS-2 Program)
4) TR-60, Earth Dams and Reservoirs
5) Sedimentation Report, 1974 Supplement, Buckhorn-Mesa Watershed
6) TR-25, Design of Open Channels
7) NEH-5, Hydraulics
8) NEH-14, Chute Spillways
9) Engineering Design Standards, Far West States
10) TR-2, Earth Spillways
11) TR-52, Layout of Earth Emergency Spillways...
12) Engineering Monograph No. 25, Bureau of Reclamation
13) NEH-11, Drop Spillways
14) "A Baffled Apron as a Spillway Energy Dissipator", by T. J. Rhone
15) Hydraulic Engineering Circular No. 14, U.S. Department of Transportation
16) NEH-20, Construction Specifications
17) Highway Research Program Report No. 108
18) Apache Junction/Bulldog Geology Report by Aubrey Sanders
19) Soil mechanics testing results from Lincoln Soils Laboratory
20) Hydrometerological Report No. 49
21) NOAA Atlas 2
22) NTC/TSC Note PO-6
23) Signal Butte FRS design Hydrology
24) TR-55, Urban Hydrology for Small Watersheds
25) NEH-4, Hydrology
26) NTC/TSC Tech Note PO-4
27) TR-16, Rainfall-Runoff Tables for Selected Run Off Curve Numbers
28) "Hydrologic Design Manual for Drainage Area less than 25 square miles for Arizona" by Department of Agriculture, February 1972
29) "Runoff Curve Numbers for Semiarid Range and Forest Conditions" ASAE June 1973
30) "Addition of Sideflow from a Broad Crested Weir to flow in a Open Channel at Supercritical Flow" by SCS, Agricultural Research Service

REVIEW COMMENTS:

SECTION I, INTRODUCTION:

1) Change watershed area to read 10.8 square miles.

SECTION II, DESIGN CRITERIA:

1) 2.6 - Mention transition from pipe principal spillway to rectangular channel. Also is this flow in the outlet channel supercritical or subcritical?

2) 3.3.4 - Frost?

3) 5.1.8 - A minimum of 1 foot of freeboard is required for subcritical flow channels. Documentation will be needed to allow a 6-inch freeboard in supercritical flow channels. Without this documentation 1 foot freeboard is a minimum.

4) 6.1.8 - Consideration should be given to structure backfill in accordance with NEH-20. -

N.I.D * 5) 6.1.9 - Check sources for size and soundness to determine if riprap is feasible.

ok 6) 6.1.11 - Mention filter material for diaphragm around principal spillway conduit in accordance with TR-60.

N.I.D 7) 6.2.3 - Sudden drawdown conditions will be of concern for sloughing at the upstream face. Partial seepage shall be taken into account with a infinite slope stability analysis.

8) 6.4.3 - See comment #1 this section.

9) 6.7.1 - Caution: Loose rock riprap and bedding material has been used upstream of grouted rock side inlets unsuccessfully on a previous project.

10) 6.8.1 - Provide drainage for the AT&T conduit in accordance with TR-60. Drainage will be required for the principal spillway conduit, again in accordance with TR-60.

N.I.D SECTION IV, SUITABILITY ASSESSMENT SOIL MECHANICS:

N.I.D 1) The definitions of "partial" and "full" cutoffs as given in the write up are misleading. We are looking for a full cutoff whether the depth extends to caliche or another suitably defined soil layer.

2) The soils in the fundation and those to be used in the embankment are nearly all coarse-grained SM and SC. Identification of dispersion properties is generally restricted to fine grained soils, since the dispersive property is at odds with "normal" clay behavior, (i.e. cohesion and impermeability). The design of the dam will not depend on those properties of the clay fines, so it is not necessary to do additional testing for dispersion.

3) Conclusions and Recommendations: Rework this section as per our discussions at the 7/25/85 morning meeting.

4) Submit a plan of testing for additional field permeability tests and standard penetration tests (wet & dry). Discuss with our Geologist, Aubrey Sanders to determine if additional investigations are necessary at the outlet of the baffle emergency spillway site.

N.Y.O. SECTION V, HYDROLOGY:

In an initial review by the SCS June 26, 1985 the comment was made to apply the channel loss factor to the entire contributing drainage area rather than each sub-basin as shown in the report. An additional computer run was done to study the effects.

The results of applying the channel loss factor in this manner lowered the top of dam by approximately 0.5 foot.

As a result, we feel the slight additional costs in construction for the added conservatism does not warrant the added engineering time and costs to make changes to all the related hydraulic computations already established for the project features in this phase of work. Therefore, we will accept the hydrology as submitted.

NOTE: EBASCO shall submit the additional computer run as mentioned above for SCS documentation.

SECTION VI. STUDIES:

S.H. 1) 2.4 - Include a gated outlet in the principal spillway design. Seepage will be controlled by a diaphragm and outlet drain material.

N.Y.O. 2) 2.5d - Show reference for statement, "Surface protection by soil cement is not considered satisfacatory because the velocity of water increases to about 10 feet per second.

3) 2.5e - Why was the comparision of spillway width and embankment height for economics stopped at a 100' wide spillway?

4) 2.5f - Documentation of scour, and plunge pool effect of the baffle emergency spillway needs to be included.

5) 4.2 - What will be the criteria followed in the structural design of the culverts?

SECTION VIII, SUPPORTING DATA:

N.Y.O. 1) For each energy dissipator, calculations need to be shown for discharges less than full flow to confirm that the hydraulic jump does not move further downstream. Erosion due to low flows is especially of concern at the Bulldog Floodway drop structure where the design does not include a stilling basin before flows enter the earth channel. (See enclosed criteria for analysis of flows less than Q100.)

2) Page 3 of 15, Apache Junction Floodway - increasing the slope to 0.0024 appears to put you in the unstable flow zone (0.7 Sc to 1.3Sc). 16%

N.Y.O. 3) Document silt laden flow.

S.H. 4) For ease of construction with steel in both faces of the channel walls we recommend that 10 inch minimum walls be used in design.

5) Additional concrete cover is required where flow velocities exceed 10 fps or is carrying an abrasive bed load. A minimum of 3 inch cover shall be provided over the top steel in the invert. This 1 inch additional thickness shall not be used in computations as increasing effective depth.

6) Make sure references are used consistantly throughout the supporting calculations.

7) For each floodway establish high water contour lines at the upstream banks and side inlet locations. - Use N.Y.O. ... 100 yr ...

8) Establish dimensions for the "needed" rights-of-way throughout the project area. Flood Control District will adjust to these. - which form used

N.Y.O. 9) Run final water surface profiles to establish all water depths.

Donald E Paulus 8-15-85

Submitted by: Don Paulus, Government Representative Date

William E. Payne Jr. 8-15-85

Recommended by: Bill Payne, State Design Engineer Date

Ralph M Arrington 8-15-85

Approved by: Ralph Arrington, State Conservation Engineer Date

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WEST NATIONAL TECHNICAL CENTER
Engineering Staff
Portland, Oregon
August 12, 1985

DESIGN REVIEW REPORT

Job : Apache Junction FRS & Bulldog Floodway
Project : Buckhorn-Mesa WPP
Location : Pinal County, Arizona
Authority: PL-566 (WF 08)
Phase : Phase 1 - Site characterization and comparative design studies.

Summary:
This phase is considered adequate. Suggestions for improvement of the report or for use in subsequent design phases are given in the review comments below or redlined on the report.

Description of Job:

The job consists of approximately 9000 feet of open channel and approximately 8000 feet of earth dam with a reinforced concrete pipe principal spillway and a reinforced concrete emergency spillway.

Purpose of Review

The review was made to determine the adequacy of the design criteria established and recorded; the validity of requests for additional data; the adequacy of the design hydrology study for Apache Junction FRS and Floodway; and acceptability of the general features of the structural installations as developed.

Scope of Review:

The Phase 1 - Feasibility Study, Bulldog Floodway & Apache Junction Flood Control Project, Phoenix, Arizona, prepared by Ebasco Services Incorporated was reviewed.

Basis for Review:

The following references were used as a basis for the review:

1. National Engineering Manual
2. TR 25 Design of Open Channels
3. TR 60 Earth Dams and Reservoirs
4. U.S. Dept. of Transportation HEC 14
5. Buckhorn Mesa Watershed Supplemental Watershed Work Plan No. 1, June 1976.

Review Comments:

General

1. Specific reference is suggested for clarity. Redline comments are given in the returned report.

2. Editorial comments and suggestions concerning minor items are redlined in the report.

3. Adequate documentation has been provided for this phase. Additional documentation may be required for subsequent phases.

Design Criteria

1. Section II, Item 6.1.8. Engineering Design Standards - Far West States is suggested as criteria for determination of lateral earth pressure, particularly figures 2.11 through 2.14.

2. Section II, Item 6.2.3

a. Based on the potential for the riser to plug it is suggested that the steady and rapid draw down conditions be analyzed in accordance with TR60.

b. It is suggested that the infinite slope analysis be run on cohesionless embankment soils rather than the normal slip circle or random type analysis. The following material may be used for analysis by this method:

1. Appendix V "Infinite Slope Analysis for Cohesionless Soils", EM 1110-2-1902 U.S. Army Corps of Engineers.

2. Infinite slope analysis chart - prepared by WNTC

3. Section II Item 6.4.4. Because caliche is not uniform it is suggested that computations be made for pipe joint extensibility and provide articulation in the conduit to compensate for the lack of uniformity in the foundation and the stresses imposed by the strains in the embankment over time.

Suitability Assessment: Soils Mechanics

1. Section IV, Page IV-2, Third paragraph. A full cutoff to caliche or other relatively impermeable materials can be provided by designating the approximate cutoff trench limits on the drawings and noting that final depths will be determined in the field. It is suggested that discussion of the above alternative be included in Section IV and that it be compared to the other alternatives available.

2. Section IV, Page IV-6, Item 1. This statement is inaccurate. It is suggested that this statement be rewritten to reflect the true representations of the material tested and that the test results be used in the required settlement and stability analysis.

3. Section IV, Page IV-6, Item 2. As stated in comment 1 above full cutoff can be accomplished without excavating to caliche. It is suggested that this method be included as a viable cutoff alternative. It is further suggested that additional permeability data be provided for the completion of this item in the studies.

4. Section IV, Page IV-6, Item 3. This statement does not contain the designer's recommendation for crack control other than a request for conducting a laboratory testing program.

It is suggested that this statement be rewritten to provide the designer's recommendation for crack control.

5. Section IV, Page IV-6, Item 4. Based on this statement, it is suggested that additional data be obtained for assessing the collapsibility of the foundation. Lack of dispersion data is not in evidence and it is suggested that no additional dispersion data be provided.

Hydrology

O.K.

The design hydrology seems to be in order. Channel loss factors were done correctly by Chapter 21 NEH 4 & TSC Technical Note Hydrology PO-4. The results are more conservative than if the entire drainage area was considered as one watershed rather than the 5 that were used.

Chapter 19 NEH 4 (revised) is recommended for use in this area. It is based on a more complete analysis of recent data than Chapter 21 procedure. The 10 day runoff would probably be reduced and the 6 & 24 hr. to a lesser degree. Therefore, the hydrology is conservative but acceptable.

Studies

1. Section VI, Page VI-2, Item 1.4.

a. The documentation in Section VIII for the earth channel assumes silt laden flow. (sheet 6 of 15). It is suggested that clear water flow be assumed unless sediment laden flows can be documented in accordance with the procedures as given in Geology Note No. 2.

b. It is suggested that documentation of Mannings "n" value be included in Section VIII.

2. Section VI, Page VI-1, Item 1.2, Second paragraph. In order to arrive at a cost comparison between trapezoidal and rectangular channels the supporting data (Section VIII, sheet 9 of 15), assumes that the excavation limits for the rectangular channel will begin at the bottom outside edge of the concrete. It is suggested that these limits be moved during final design to approximately 2 feet beyond the channel to permit installation and maintenance of forms.

Excav Spec

3. Section VI, Page VI-2, Item 1.3. A baffled block chute was studied for the energy dissipator and determined more costly than the grouted riprap chute. No documentation is found showing this comparison. It is suggested that the documentation be provided.

4. Section VI, Page VI-4, Item 2.4.

a. A statement that the 36 inch diameter pipe was the work plan choice is suggested to be included in this item.

NYO

b. It is suggested that reference to use of a seepage diaphragm be included in this section.

NYO

5. Section VI, Page VI-7, Item 2.5 f). No discussion is give to the part the caliche plays in protecting the structure. On its own the rock riprap "control section" is inadequate but combined with the caliche a strong case could be made that the structure will not be undermined during passage of the freeboard event. It is suggested that discussion of the role caliche plays in protecting the structure be included in item 2.5 f); the conclusions be documented in Section VIII; and that scour be addressed in the preliminary design phase.

N.Y.O.

6. Section VI, Page VI-8. The outlet of the Bulldog Floodway was designed as a sloping apron at design discharge of 4709 cfs. It is suggested that the apron be checked during final design at discharges less than design discharge to determine if the basin is adequate.

N.Y.O.

Paul J. Monville

Submitted

Donald E. Walker

Approved

8-12-85

Date

City of Apache Junction

August 12, 1985

Mr. Don Paulus
Engineering Section
Soils Conservation Service
201 East Indianola
Phoenix, AZ 85012

RE: Bulldog Floodway and Apache Junction F.R.S.
Phase I - FEASIBILITY STUDY - July 1985

Dear Mr. Paulus,

At the request of the FCDMC, we have reviewed the above-referenced study and submit the following comments for your consideration:

1. Apache Junction Floodway

   Should the floodway be designed to cross in the vicinity of the EAST line of Section 16, T1N, R8E, which is an alignment for Tomahawk Road (mile roadway), a culvert should be designed for the same storm frequency as considered for Idaho and Brown (Lost Dutchman Boulevard) Roads.

2. Emergency Spillway

   Observing that alternatives have been considered for different types of an emergency spillway, has consideration been given to the routing of storm flows to the South? If yes, we would appreciate reviewing those limits and estimated flow depths.

3. The preliminary road profile of Idaho and Brown (Lost Dutchman) Roads, with a 30 MPH design speed should be reconsidered for an ultimate design speed of 45 MPH, as ultimately these roadways have the potential to be developed into 4 to 6 lane roadways in the long term. As the City of Apache Junction street sections for mile roadways are similar to Pinal County, the roadway base (ramp) should be graded to accommodate the future pavement, curb and sidewalk section, even though only a 2-lane (24-28' roadway) may be constructed in the interim with this project.

1001 NORTH IDAHO • APACHE JUNCTION, ARIZONA 85220-0190 • TELEPHONE (602) 982-8002

Mr. Don Paulus
Soils Conservation Service
August 12, 1985
Page Two

4. In regard to road closures, no objection is expressed to completely closing an area to traffic, so long as only a one-mile roadway is closed at any one time.

We appreciate the opportunity to comment on this project, and will be happy to assist you further.

Cordially,

Richard

Richard W. Broman
Director of Public Works

RWB:sh

xc: City Manager
FCDMC

File 307.06

FLOOD CONTROL DISTRICT
of
Maricopa County
3335 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 262-1501

D. E. Sagramoso, P.E., Chief Engineer and General Manager

BOARD of DIRECTORS
Tom Freestone, Chairman
George L. Campbell
Carole Carpenter
Fred Koory, Jr.
Ed Pastor

AUG 14 1985

Mr. Verne M. Bathurst, State Conservationist
Soil Conservation Service
201 East Indianola
Phoenix, Arizona 85012

Re: Apache Junction/Bulldog Flood Control Project
Phase I - Site Characterization and Comparative Design Studies

Dear Mr. Bathurst:

We have completed our review of the report for the referenced project. The following are our comments:

1. Section II

a. 5.32 - We recommend the use of a structural concrete spillway instead of an earth emergency spillway due to erosive velocities.

b. 6.2.1 - The upstream slope for the dam should be consistent in the report. In some parts of the report, 3.0 horizontal to 1 vertical is recommended.

c. 6.2.3 - Explain the word "uncontrolled" in the 3rd sentence of this section. Water behind the embankment is released slowly and stays up to 10 days.

d. 3.4.1 - The profile of the road embankments will be determined by Ebasco for the Flood Control District.

e. 6.6.2 - The Operations and Maintenance section of our office request the top width of the levee to be 14 feet.

f. 3.3 - How does the 10 day retention compare with other FRS structures in the Buckhorn-Mesa Watershed?

2. Section III - Minutes of Meetings

a. 1 - Crossing of Project Area by AT&T fiber-optic cable. We want to know your decision on the foundation treatment for the AT&T cable.

b. 4 - Crossings on Apache Junction Foodway and Bulldog Floodway.

c. Will concrete box culvert be suitable for Tomahawk Road?

d. A telephone cable is located at the intersection of Apache Trail and Tomahawk. Attached is the information submitted by Mountain Bell. Please inform us if this needs to be relocated. Also, in the same attachment, another telephone cable exists along Idaho Road. The depth of these cables are 30" to 36" below the existing ground.

e. The City of Apache Junction cancelled their plans for construction of a horse crossing over Bulldog Floodway.

f. 5. - Emergency Spillway Alignment - Please inform us of the final location of the emergency spillway and the extent of inundation downstream.

g. 8. - Responses to "Questions for Pre-Design Meeting" - Land rights for the structures should be finalized as soon as possible, in order to provide enough time for acquisition. The land area required around the side inlets should be defined together with the easements for the right to flow. Flows from east of Apache Trail contribute to the project watershed.

3. Section V - Hydrology

a. Potential for development upstream of the structures should be checked.

b. How will flow splits be maintained?

We appreciate the opportunity for this review. If you have any questions, please call us.

Sincerely,

Stanley L. Smith

for D. E. Sagramoso, P.E.

Mountain Bell

Phoenix, Arizona
May 15, 1985

Flood Control District
of Maricopa County
3335 W. Durango Street
Phoenix, Arizona 85009

Dear Sirs:

Project No. Apache Junction FRS and Outlet, Bulldog Floodway

The above referenced development plans have been reviewed and the following items were noted:

> Buried cable on west side of Idaho Road from McKellips to Superstition. Two cables located at intersection of Apache Trail and Tomahawk. There will be billing if relocation is necessary.

Telco engineer assigned to this project:

Wayne
W. Pollard
(602) 835-2725

460 N. Mesa Dr Rm 105

Yours truly,

Patricia Falck

Distribution Services-Liaison
3033 North Third Street, Room 806A
Phoenix, Arizona 85012

Attachment

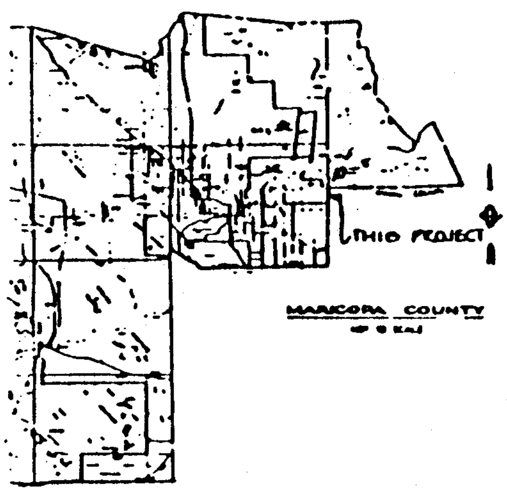
1 MPK
ACCF

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RIGHTS OF WAY PLAN

APACHE JUNCTION F.R.S., OUTLET & BULLDOG FLOODWAY

FLOOD CONTROL DISTRICT of MARICOPA COUNTY



Greiner Engineering
Phoenix — Arizona

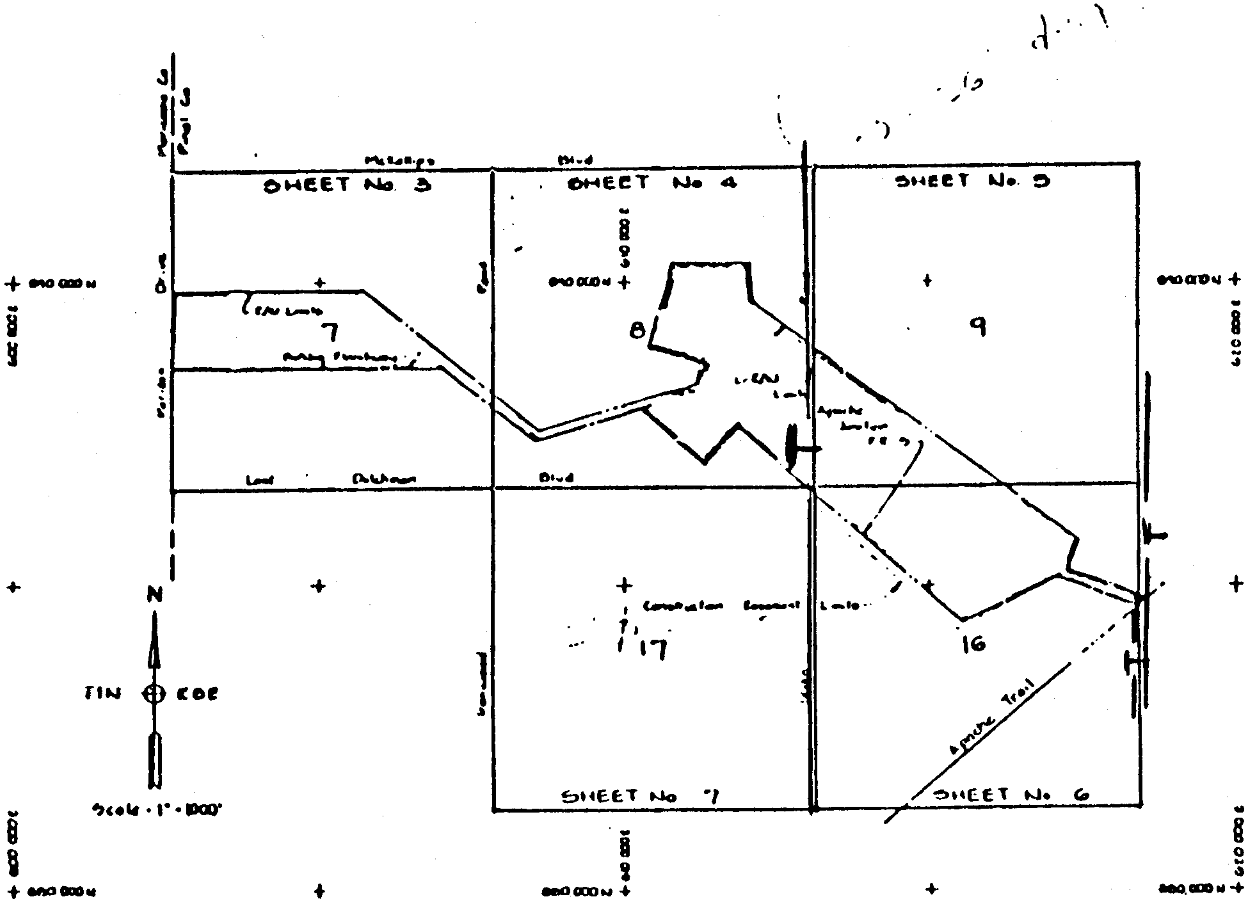
D.E. SAGRAMOSO P.E.
CHIEF ENGINEER AND GENERAL MANAGER

F.C.D. CONTRACT NO.

FLOOD CONTROL DISTRICT of Maricopa County

R.O.S. RIGHTS OF WAY
APACHE JUNCTION F.R.S.
BULLDOG FLOODWAY

1 7



NOTE

[illegible]

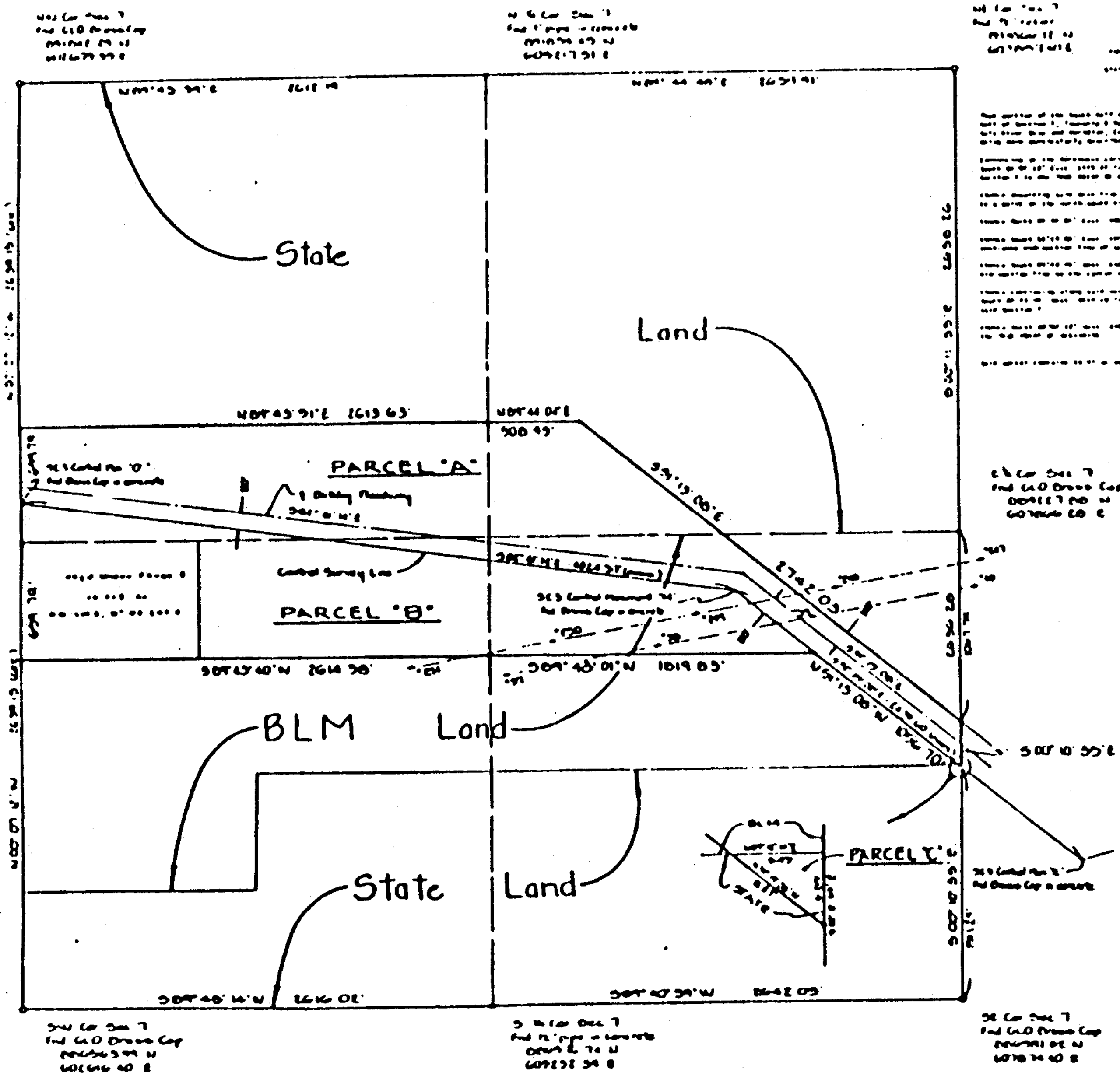
FLOOD CONTROL DISTRICT of Maricopa County

SHEET INDEX

R.O.S. (RIGHTS OF WAY)
APACHE JUNCTION F.R.S.
BULLDOG FLOODWAY

2 - 7

Greiner
Engineering



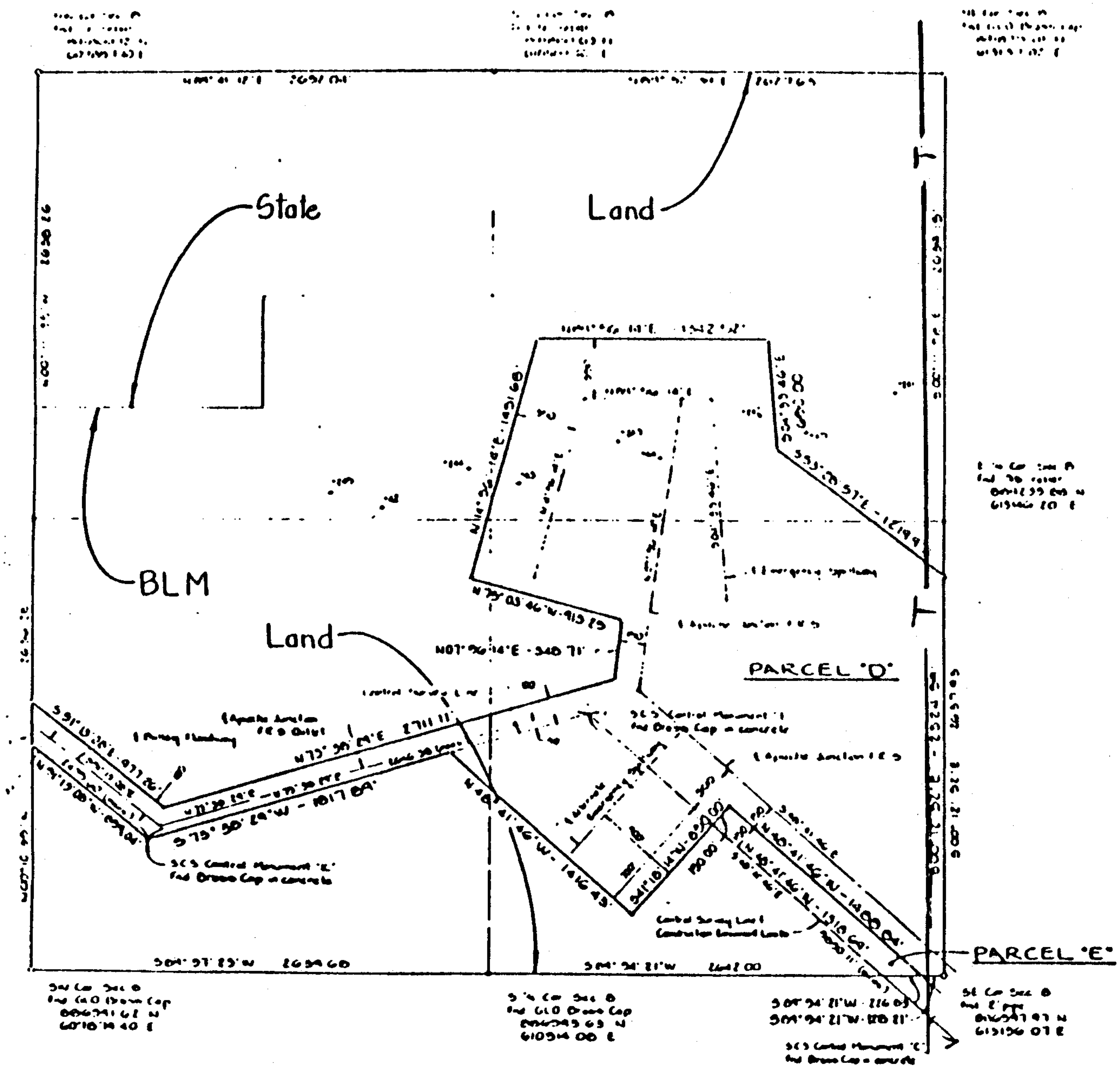
FLOOD CONTROL DISTRICT of Maricopa County

SECTION 7, T1N, R8E

R.O.S. & RIGHTS OF WAY
APACHE JUNCTION F.R.S.
BULLDOG FLOODWAY

3.7

Greiner Engineering



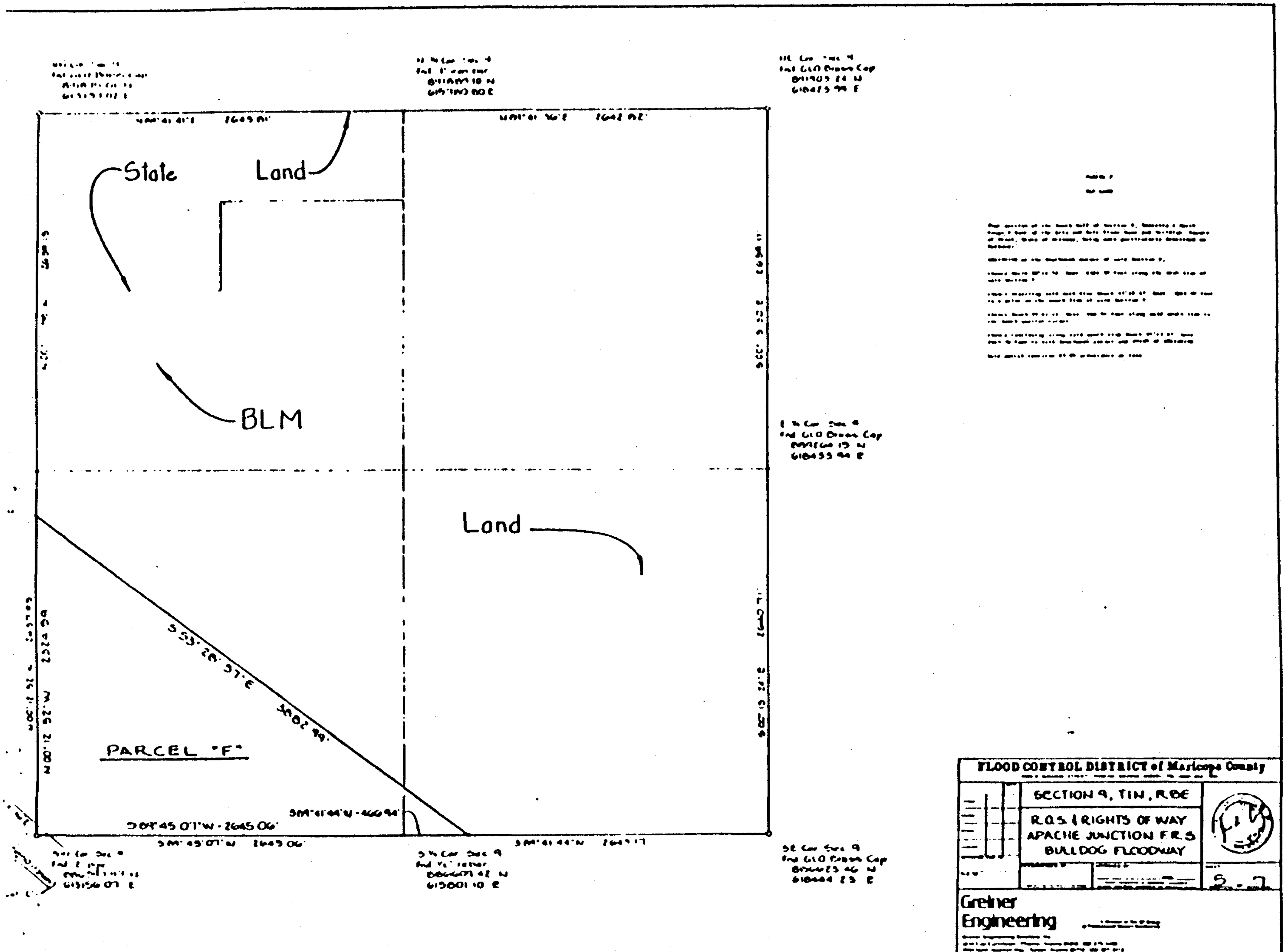
FLOOD CONTROL DISTRICT of Maricopa County

SECTION 8, T1N, R8E

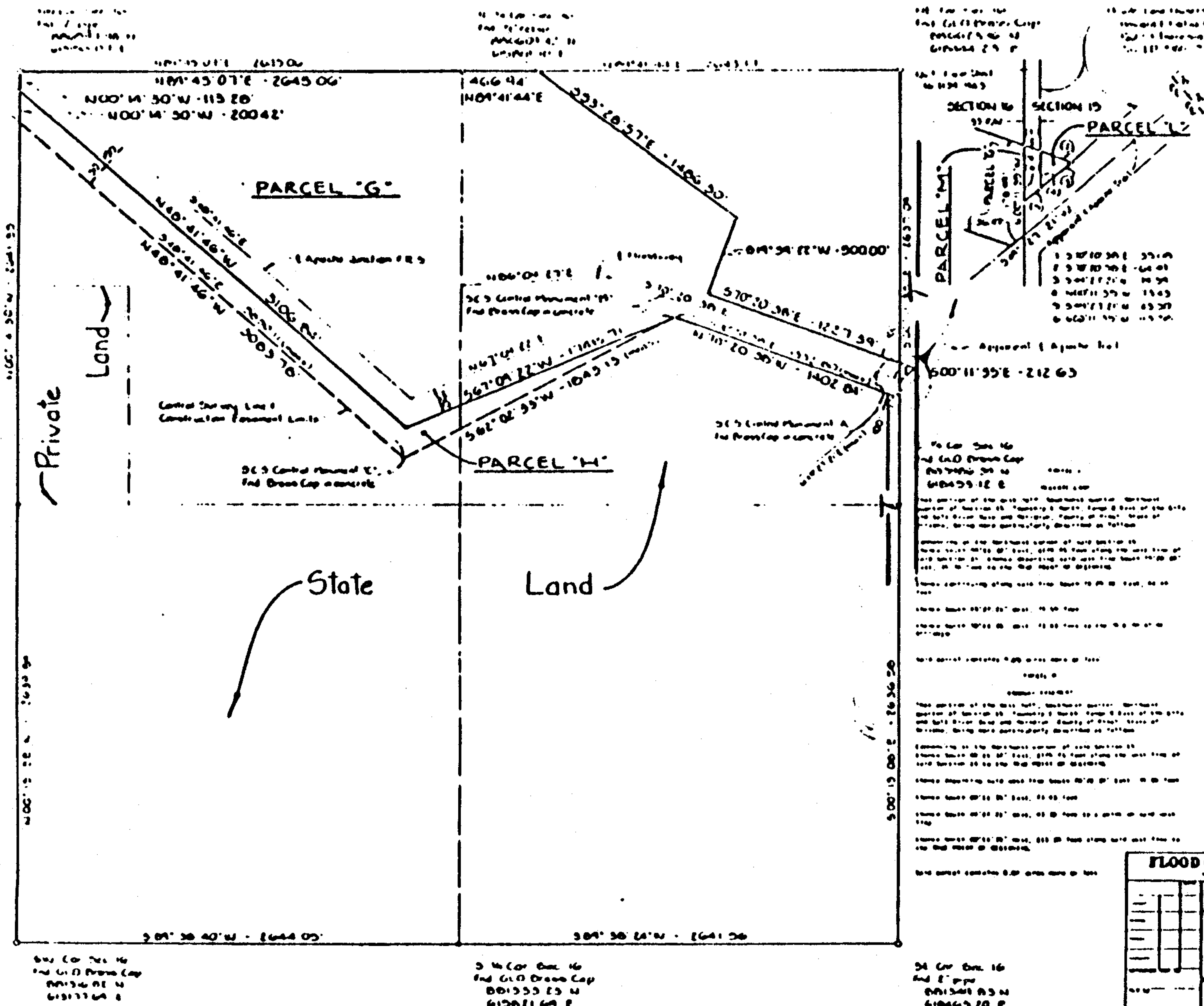
R.O.S / RIGHTS OF WAY
APACHE JUNCTION FRS
BULLDOG FLOODWAY

4 - 7

Greiner Engineering



State Land
BLM
Land
PARCEL "F"
S 53°26'37"E
3402.99
FLOOD CONTROL DISTRICT of Maricopa County
SECTION 9, T1N, R8E
R.O.S. & RIGHTS OF WAY
APACHE JUNCTION F.R.S
BULLDOG FLOODWAY
Greiner
Engineering



FLOOD CONTROL DISTRICT of Maricopa County

SECTION 16, T1N, R8E

R.O.S. & RIGHTS OF WAY
APACHE JUNCTION F.R.S.
BULLDOG FLOODWAY

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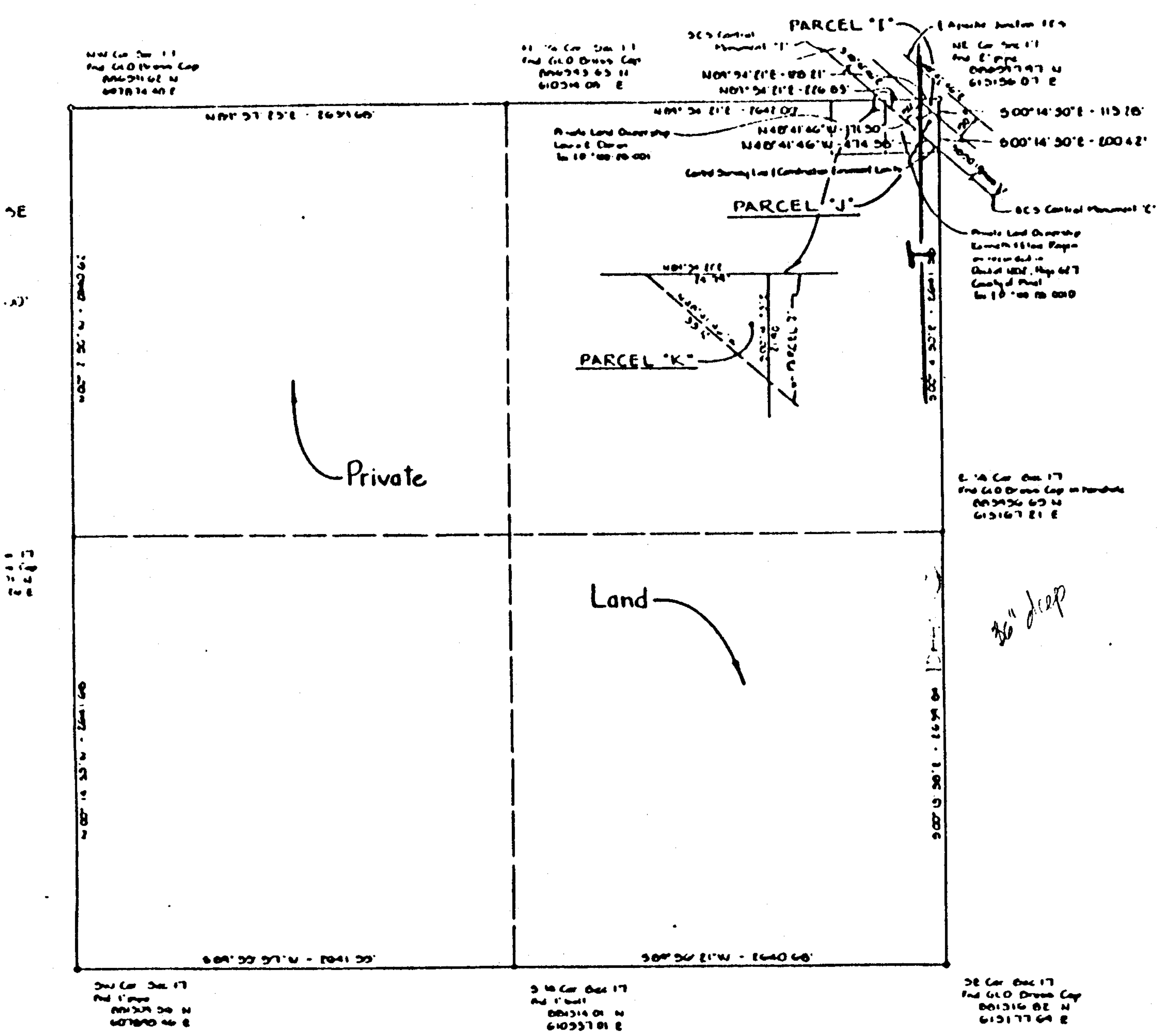
Engineering



FLOOD CONTROL DISTRICT of Maricopa County

SECTION 17, T1N, R8E

R.O.S. (RIGHTS OF WAY
APACHE JUNCTION F.R.S.
BULLDOG FLOODWAY

Greiner
Engineering

ROAD CROSSINGS Norman Luan

EBASCO SERVICES INCORPORATED EBASCO

Two World Trade Center, New York, N.Y. 10048

File Ref. USDA 3767-L0019

August 5, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction Flood Control Project Meridian and Ironwood Road Crossings

Dear Mr. Paulus:

At the end of the Comparative Design Study Conference on July 24, 1985, the following tentative information was provided to the Flood Control District regarding floodways and road intersections:

Meridian Road Crossing

Approximate Location	STA 195 + 10 ±
Channel Width	50 feet
Depth of Water	5.1 feet
Channel Bed Elevation	1714.66 feet
Height of Wall (Min.)	6'3" Add for floating debris – Add 1'-0

Ironwood Road Crossing

Approximate Location	STA 139 + 20
Channel Width	22 feet
Depth of Water	3.76 feet
Channel Bed Elevation	1744.57 feet
Height of Wall (Min.)	4'7" Add for floating debris – Add 1'-0

On July 25, 1985 the Flood Control District requested similar information regarding the intersection of Apache Junction Floodway and Tomahawk Road.

EBASCO SERVICES
INCORPORATED

Mr. D. R. Paulus
USDA Soil Conservation Service

August 5, 1985

Since Tomahawk Road is neither located on the Apache Junction Floodway drawings, nor since the exact bearing and coordinates of the road are known, it will not be possible to furnish the channel characteristics. However, the following information regarding the channel in that area may be useful for initial planning:

From Northing 618021 to 618485

Channel Width	8.5 feet
Depth of Water	5.48 feet
Channel Bed Elevation	1806.17 to 1806.67 feet
Height of Wall	6 feet Add for floating debris Add 1'-0

Please note that all the information is subject to change, depending upon SCS comments on the Comparative Design Study and the final designs.

Please pass this information on to the Flood Control District. If they need further information please let us know.

Very truly yours,

Carl J. Montana
Project Manager

CJM/SG:rg

cc: J L Ehasz
S Goyal
[redacted]

EBASCO SERVICES INCORPORATED
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

EBASCO

18 September 1985

Mr Donald R Paulus, Government Representative
U.S.D.A. Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, AZ 85012

Dear Mr Paulus:

Subject: APACHE-BULLDOG FLOOD CONTROL PROJECT
RETURN OF SCS MYLARS FOR REVISION

As discussed in the telephone conversation on September 18, 1985, between yourself and Carl Montana, the following SCS mylars are enclosed:

APACHE JUNCTION
FLOOD RETARDING STRUCTURE AND FLOODWAY

SHEET NO.	TITLE
3	Floodway - Plan and Profile - STA 11 + 00 to STA 25 +00
4	Floodway - Plan and Profile - STA 25 + 00 to STA 39 + 50
12	FRS - Plan and Profile - STA 29 + 50 to STA 45 + 00
13	FRS - Plan and Profile - STA 45 + 00 to STA 60 + 00
14	FRS - Plan and Profile - STA 60 + 00 to STA 75 + 00
15	FRS - Plan and Profile - STA 75 + 00 to STA 90 + 00
16	FRS - Plan and Profile - STA 90 + 00 to STA 105 + 00
17	FRS - Plan and Profile - STA 105 + 00 to STA 115 + 60
20	Princ. Spwy. - Plan and Profile - STA 100 + 76.34 to STA 115 + 00
21	Princ. Spwy. - Plan and Profile - STA 115 + 00 to STA 129 + 76.16

BULLDOG FLOODWAY

SHEET NO.	TITLE
3	Floodway Plan and Profile - STA 129 + 76.16 to STA 145 + 00
4	Floodway Plan and Profile - STA 145 + 00 to STA 160 + 00
5	Flocdway Plan and Profile - STA 160 + 00 to STA 175 + 00
6	Floodway Plan and Profile - STA 175 + 00 to STA 190 + 00
7	Floodway Plan and Profile - STA 190 + 00 to STA 205 + 00
8	Floodway Plan and Profile - STA 205 + 00 to STA 219 + 32.52

We understand that you will revise and return the sheets as quickly as possible, because this has caused temporary suspension of activity here, which may delay completion of the project.

Please show the Arizona State coordinates for starting Station 11 + 00.

Attention is called to the modified title box as shown on Apache Junction Drawing Sheet 3.

Very truly yours,

Glen Rockwell

for Carl Montana
Project Manager

DG:JAS
Encls.
0018u/3

cc: G Rockwell
D Groner

EBASCO SERVICES INCORPORATED

Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref: USDA 3767-L0024

September 6, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Review of Proposed AT&T Cable Crossing

Dear Mr. Paulus:

We have completed our review of the information you provided with your letter of August 7, 1985 regarding the proposed AT&T cable crossing and have the following comments:

Drawing WR-52932 Section 4 - The slope of the excavated trench should not be steeper than 1 horizontal to 0.5 vertical. For proper compaction of the backfill adjacent to the concrete encasement, the distance between the formed concrete face and the side of the excavated trench should be a minimum of 4 feet. If this minimum width is not provided, concrete should be provided the full width of the excavated trench up to the top of the encasement.

Drawing WR-52608

1. The RGS 4-inch pipe embedded at a depth of 10 feet below existing ground should be kept at that depth for at least 10 feet beyond the upstream and downstream toes of the embankment.

2. Section 4 detail (Drawing WR-52932) should apply for the concrete encasement from sta. 4875+00 to 4880+00 to avoid the possible flow of water in and out of the conduit in the vicinity of the embankment in case the conduit is damaged at the bottom; i.e., the conduit should have concrete encasement entirely around it including the bottom.

3. A piping and seepage control diaphragm will be provided around the concrete encasement as required by TR-60.

Very truly yours,

Carl J. Montana
Project Manager

CJM:rg
cc: J L Ebasz
G E Rockwell
D Groner
S K Goyal

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York, N.Y. 10048

File Ref: USDA 3767-L0023

September 5, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Response to City and County Comments
Phase I Feasibility Study

Dear Mr. Paulus:

Your review of the Phase I Feasibility Study resulted in four sets of comments, one each from your office, the SCS regional office, the City of Apache Junction, and the Flood Control District of Maricopa County. The SCS comments are being responded to through revision to the Phase I Feasibility Study Report. Most of the City and County comments are more general in nature and will be responded to through this letter. Their letters should be referred.

City of Apache Junction:

Apache Junction Floodway - If and when Tomahawk Road is constructed the culvert should be designed to pass the design storm (the 100-year storm) in the Apache Junction Floodway at that point. Idaho and Brown Road culverts are designed to pass flows through segments of the reservoir which should not be the basis of design for Tomahawk Road.

Emergency Spillway - The depths and inundated area resulting from discharges through the Emergency Spillway will be determined in Phase IV of the contract.

Idaho and Brown Roads - The road profiles and widths used in design were based on information provided at earlier meetings. It had been agreed that the fill width would be 64 feet and the speed limit 30 mph. The increased width will have minimal effect on the current design since it will only increase the culvert sizes under the roads. An increase in speed limit will have a more significant effect since it will result in longer elevated sections through the reservoir, thus reducing the weir length for flow across the roads for the emergency and freeboard storms. This in turn would affect the top of dam elevation. SCS has agreed to resolve this issue with the City.

Flood Control District:

1.a. A structural concrete spillway is being used.

1.b. At the present time we are recommending a 2-1/2 to 1 upstream slope. The final determination will not be made until the completion of slope stability analysis in Phase II.

1.c. "Uncontrolled" means there are no manually operated gates or other devices, such as flashboards, which must be manipulated for the spillway to function.

1.d. Ebasco will design these roads under a separate contract with the County.

1.e. The levees referred to were in the earth emergency spillway. At the time paragraph 6.6.2 was written there was the possibility that an earth spillway would be used for the emergency spillway. SCS criteria requires that extremely wide earth spillways be divided by levees running parallel to the direction of flow. An earth spillway is not being used on this site, therefore no levees will be used.

1.f. The 10-day criteria is standard for SCS. Exactly how the drawdown time on this site compares to other sites in the project will have to be answered by SCS.

2.a. The AT&T proposal is currently being reviewed. Ebasco's recommendations will be provided in a separate letter.

2.b. This appears to be a statement.

2.c. Yes

2.d. The cable will have to be relocated. It will also have to be rerouted or otherwise handled during construction. We are in contact with Mountain Bell.

2.e. No comment.

2.f. The final alignment is as shown as Alternate 1 on the plans provided by SCS. The inundated area will be established in Phase IV.

EBASCO SERVICES
INCORPORATED

Mr. D. R. Paulus
USDA Soil Conservation Service

2.g. We understand the urgency of this information and will make this item one of the first things done in Phase III. It has been agreed with SCS that no flows from the area east of Apache Trail will be included in the design.

3.a. Future condition curve numbers were used in the design.

3.b. This is an issue that will have to be addressed by the government entity having control over that area.

Very truly yours,

Carl J. Montana
Project Manager

CJM:rg

cc: J L Ehasz
G E Rockwell
D Groner
S K Goyal
V M Bolano

EBASCO SERVICES INCORPORATED EBASCO

Two World Trade Center New York, N Y 10048

File Ref: USDA 3767-L0022

September 3, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Request for Standard Drawings

Dear Mr. Paulus:

As a result of the studies completed in Phase I of the contract, it has been agreed that a 30-inch conduit will be used in lieu of the 36-inch conduit proposed in the Work Plan. It has also been decided to use the SCS Standard Baffle Riser on this site.

Please provide us with reproducible copies of:

ES 3230-1010-R - (Standard Baffle Riser)

ES 5030-CR - (Standard Conduit Detail)

If at all possible we would like to have a structural engineer from the regional office attend the meeting in Santa Ana in October. We will have started into design at that time and I believe there will be significant issues that would best be resolved at this early date. I would appreciate you giving this serious consideration in light of the short schedule.

Very truly yours,

Carl Montana

Carl J. Montana
Project Manager

CJM:rg

cc: J L Ehasz
G E Rockwell
D Groner
S Goyal
V M Bolano

EBASCO SERVICES INCORPORATED
EBASCO
2000 W. MacArthur Blvd., Santa Ana, CA 92711, (714) 662-4000

29 August 1985

Mr Wayne Pollard
Mountain Bell Telephone Company
460 North Mesa Drive, Room 105
Mesa, AZ 85201

Dear Mr Pollard:

Confirming our telephone conversation on August 29, 1985, I am enclosing one copy each of the following:

1. Letter dated 15 May, 1985 from Moutain Bell to FCDMC.
2. Pertinent attachment pages to said letter.

Schematic location of three (3) telephone cable locations were marked on the attached sheets 2, 4, 6 and 7 by Mountain Bell. I've highlighted these in yellow crayon.

We need the distance from the centerline of road to the cable and the depth of cable. It is assumed that all three cables cross completely across the rights-of-way.

Thanks in advance for your information and help.

Very truly yours,

D Groner

D Groner
Consulting Engineer

DG:JAS
Encls.

cc: C Montana
G Rockwell

EBASCO

Interoffice Correspondence

DATE 29 August 1985 FILE REF.

TO Distribution OFFICE LOCATION

FROM C J Montana OFFICE LOCATION Los Angeles

SUBJECT BULLDOG FLOODWAY AND APACHE JUNCTION PROJECT
RECORD OF PHONE CALL CONVERSATION 8/28/85
BETWEEN C MONTANA AND D PAULUS

Shiam Goyal and I were in Santa Ana from August 27 thru August 29 to work with Dave Groner and Glen Rockwell on the Bulldog Floodway and Apache Junction project. While there a number of questions arose. We called Don Paulus on August 28th. The following is a record of the conversation: (Questions & Responses).

Q. Who will SCS have in attendance at the October 1st meeting in Santa Ana?

R. Don Paulus and Cliff Deal will attend the meeting. Cliff Deal is the Soil Mechanics Engineer from the Portland Regional Office.

Q. Why is the Riprap shown by SCS on all previous projects grouted? Is the rock sized by some criteria and then grouted anyway?

R. In general, we have found that the rock size required is so large that it is not available. No design procedure has been used for the side inlets; the rock is grouted in lieu of rock design procedures being used. We have used a Corp of Engineers procedure for design of the rock in the chutes which I will provide you.

Q. Will you make a TR-50 run for us for channel design if we provide the input data?

R. No. Make sure you use TR-67 and DN-21.

Q. I believe it is not in our or your best interest to modify the standard specifications by deleting options not used. In many cases, more than one option may be used. It just seems like a potential source of error.

R. I agree, but we have been directed by our administrative office that this procedure must be used. Some claims have resulted from options having not been deleted. The deletions must be made.

Q. In Section VI, Studies, Para. 5)4.2 of your review comments on the Feasibility Study, you asked for the design criteria to be used in design of the culverts under the roads; we will not be designing these culverts under this contract.

R. We realize this, however, they must be designed in accordance with SCS criteria since they are considered to be part of this project.

Q. Can we use corrugated metal for these conduits under the road?

R. Yes, we do not want the pipe coated on the inside, only on the outside. Fires have been started in pipes coated on the inside.

Q. The regional office comments ask that a joint extensibility calculation be made for the principal spillway conduit. Since the pipe will be bedded on Caliche for its entire length, there is no anticipated settlement. The procedures in TR-18 require that there be settlement for the calculation to be made. It seems to me that under the circumstances the calculation is not appropriate.

R. I agree. Just document your reasoning.

Q. The City of Apache Junction has again raised the question regarding the flow below the emergency spillway. We believe this issue should be resolved so that changes in design are not required at some later date. It also appears that the peak discharges from subwatershed 3 without the dam exceed the corresponding discharges from the emergency spillway down the flow area they are concerned about.

R. No changes will be made in design. The decision on spillway location has been made. The question of inundated area will be answered in Phase IV.

Q. The City of Apache Junction has asked that the roads through the reservoir area be designed for 45 mile per hour speed limit and that they be widened to 4 to 6 lane widths. All the work we have done has been based on the previously-agreed-to 30 MPH speed limit with a 64 foot width. Will this work have to be redone? The work required to do the increased width is minimal since we will only have to increase the culvert size. However, the higher speed limit will result in a longer elevated section through the reservoir which will reduce the weir length for flow across the roads through the reservoir. This could result in higher dam elevations. Will we be compensated for this additional work?

R. I will resolve this with the City and get back to you.

Q. Do you want maintenance ramps into the concrete channels?

R. No.

Q. Have you been placing bedding under the concrete channel slabs?

R. No. We have been excavating to grade and pouring without bedding. We have used waterstops. Do not use cork joint filler. We have had good success with the two part joint sealer that is in the signal butte specs.

CJM:JAS
0016u:78

Distribution

G Rockwell
C Montana
D Groner
S Goyal
V Bolano
D Paulus

F J

EBASCO SERVICES INCORPORATED EBASCO

Two World Trade Center, New York, N.Y. 10048

File Ref: USDA 3767-L0022

September 3, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Request for Standard Drawings

Dear Mr. Paulus:

As a result of the studies completed in Phase I of the contract, it has been agreed that a 30-inch conduit will be used in lieu of the 36-inch conduit proposed in the Work Plan. It has also been decided to use the SCS Standard Baffle Riser on this site.

Please provide us with reproducible copies of:

ES 3230-1010-R - (Standard Baffle Riser)

ES 5030-CR - (Standard Conduit Detail)

If at all possible we would like to have a structural engineer from the regional office attend the meeting in Santa Ana in October. We will have started into design at that time and I believe there will be significant issues that would best be resolved at this early date. I would appreciate you giving this serious consideration in light of the short schedule.

Very truly yours,

Carl Montana

Carl J. Montana
Project Manager

CJM:rg

cc: J L Ehasz
G E Rockwell
D Groner
S Goyal
V M Bolano

EBASCO SERVICES INCORPORATED EBASCO

Two World Trade Center, New York, N.Y. 10048

File Ref: USDA 3767-L0021

Via Telecopier August 13, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Additional Field Testing Requirements

Dear Mr. Paulus:

Attached find Ebasco's recommendations for the additional field testing required for design of the Apache Junction Flood Retarding Structure.

Seven field permeability tests have been assigned on the SC, SM-SC, SM-SP and caliche materials at the locations and depths noted on Table I. A typical test installation is shown on Figure 1 and includes:

1. drilling, using a 3½-inch ID hollow stem auger to the bottom of the test section;

2. placing a 2-inch diameter, Schedule 40, PVC pipe with a 5-foot slotted screen section (0.010 or 0.020 inch) and capped at the bottom;

3. placing a medium-to-coarse sand in the area between the outside of the slotted PVC pipe and the drilled hole as the augers are slowly withdrawn in order to prevent caving of the surrounding hole;

4. placing a 2-foot bentonite pellet seal above the slotted screen section;

5. backfilling the remaining hole with random material.

Prior to performing the test and collecting the required data, water should be placed inside the PVC pipe in order to saturate the zone to be tested. It is recommended that Standard Penetration Tests be conducted throughout the entire depth to be drilled in order to obtain continuous samples and classify the materials. The type of test to be conducted, either a falling head or constant head, will be dependent on the permeability of the materials.

The collapsibility potential of the foundation soils will be determined by performing seven in-situ density tests at the locations and depths shown on Table II. Representative bag samples should be collected for each soil tested and standard proctor, moisture content and liquid limit tests be performed in the laboratory. Based on the results of the field density tests and data currently available (standard proctor, water contents, and liquid limits), Ebasco will be able to determine whether undisturbed samples will be required while the drilling contractor is still in the field.

In case the materials encountered while drilling or trenching are significantly different from those noted in the tables, alternate locations must be selected for performing the tests. Similarly, it may be decided in the field to expand the scope of work if further information is deemed necessary.

As we have discussed, Victor Bolano will be in the field on Wednesday afternoon (8/21) and all day Thursday (8/22) and Friday (8/23). Please schedule the field work such that Victor can maximize the interface with your geologist, observe the testing performed and be totally acquainted with field conditions.

It is estimated that the in-situ density tests, installation of the PVC pipes and the permeability tests can be completed in a maximum of five or six days. If you have any questions or require additional information please call me at 212/839-1421 or Victor Bolano at 212/839-1483.

Very truly yours,

Carl Montana

Carl J. Montana
Project Manager

CJM/VMB:rg
attachments

cc: J L Ehasz
G E Rockwell
S N Goyal
V M Bolano

United States
Department of
Agriculture

Soil
Conservation
Service

Suite 200
201 E. Indianola Ave.
Phoenix, AZ 85012

July 30, 1985

Carl Montana
Consulting Engineer
EBASCO Services, Inc., 91st Floor
Two World Trade Center
New York, N. Y. 10048

RE: Apache Junction/Bulldog, Contract #53-9457-5-00475

Dear Mr. Montana:

As requested during the Phase I Feasibility Study Conference, I have enclosed the following:

1.) NEH-20 with the July 3, 1984 Amendment #1 and Arizona Bulletin No. 210-5-24. This is an additional copy to the one supplied April 1, 1985.

2.) Trip Report by Neville Curtis, Sedimentation Geologist dated March 7, 1983. This report gives the procedure used for estimating Sediment yield to Pass Mountain for the 100 year event.

We have reviewed our NEH-20 file on the Word Processor and have decided not to send you a copy. Approximately one-half of the specifications and material specifications still have not been reviewed for errors.

Sincerely,

Donald E Paulus

Donald E. Paulus
Government Representative

Enclosures

The Soil Conservation Service
is an agency of the
Department of Agriculture

United States Department of Agriculture

Soil Conservation Service

Suite 200
201 E. Indianola Ave.
Phoenix, AZ 85012

August 7, 1985

Carl Montana
Consulting Engineer
EBASCO Service, Inc. 91st Floor
Two World Trade Center
New York, N.Y. 10048

RE: Apache Junction/Bulldog, Contract #53-9457-5-00475,
Proposed AT&T Cable Crossing

Dear Mr. Montana:

We have enclosed for your information and review the items as listed in the attached cover letter dated July 30, 1985 from Black & Veatch.

These items are being submitted by Black & Veatch in accordance with the coordination terms and reviews that were agreed to.

Sincerely,

Donald Paulus

Donald E. Paulus
Government Representative

cc: Ralph Arrington, SCE
Bill Payne. DE

The Soil Conservation Service is an agency of the United States Department of Agriculture

50

☆ U.S. Government Printing Office: 1983—420-630/1578

BLACK & VEATCH
ENGINEERS-ARCHITECTS

TEL. (913) 967-2000
TELEX 42-6263

1500 MEADOW LAKE PARKWAY
MAILING ADDRESS: P.O. BOX NO 8405
KANSAS CITY, MISSOURI 64114

AT&T Communications
Southern Transcontinental
Lightguide System
Permits and Licenses

B&V Project 11380
B&V File M620-31.32.0200
July 30, 1985

U.S. Department of Agriculture
Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Attention: Mr. Don Paulas

Gentlemen:

Enclosed for your review are four copies of the following items.

- Design Drawings WR-52607 (Revision 1), WR-52608 (Revision 3), and WR-52932 (Revision 2), showing how the lightguide cable will be constructed under the Apache/Bulldog Flood Retension Structure.
- Soil boring logs AJ-1 and AJ-2 for the borings taken where the lightguide intersects with the dam. The boring locations are called out on Drawing WR-52608.
- Specification Sections 2E - Conduit System, 2I - Excavation and Trenching, 2J - Cast-in-Place Concrete. Note that special backfill and compaction requirements for the area under the dam are called for on Drawing WR-52932.

We understand that the Soil Conservation Service will stake the dam and culvert locations prior to lightguide construction if notified one week before construction start. By copy of this letter to Burnup and Sims, we are advising the Contractor that he is to request dam and culvert staking through Mr. Don Paulas at (602) 241-5145.

If you have any questions or comments, please call me at (913) 339-2464.

Very truly yours,

BLACK & VEATCH

H. Lee Kupfer

H. Lee Kupfer

kab
Enclosures

cc: AT&T-C
Mr. A. Lindley
Mr. K. Reinert
Mr. G. Hyatt

EBASCO SERVICES INCORPORATED
Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref. USDA 3767-L0019

August 5, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Meridian and Ironwood Road Crossings

Dear Mr. Paulus:

At the end of the Comparative Design Study Conference on July 24, 1985, the following tentative information was provided to the Flood Control District regarding floodways and road intersections:

Meridian Road Crossing

Approximate Location	STA 195 + 10 ±
Channel Width	50 feet
Depth of Water	5.1 feet
Channel Bed Elevation	1714.66 feet
Height of Wall (Min.)	6'3" Add for floating debris

Ironwood Road Crossing

Approximate Location	STA 139 + 20
Channel Width	22 feet
Depth of Water	3.76 feet
Channel Bed Elevation	1744.57 feet
Height of Wall (Min.)	4'7" Add for floating debris

On July 25, 1985 the Flood Control District requested similar information regarding the intersection of Apache Junction Floodway and Tomahawk Road.

EBASCO SERVICES
INCORPORATED

Mr. D. R. Paulus
USDA Soil Conservation Service

August 5, 1985

Since Tomahawk Road is neither located on the Apache Junction Floodway drawings, nor since the exact bearing and coordinates of the road are known, it will not be possible to furnish the channel characteristics. However, the following information regarding the channel in that area may be useful for initial planning:

From Northing 618021 to 618485

Channel Width	8.5 feet
Depth of Water	5.48 feet
Channel Bed Elevation	1806.17 to 1806.67 feet
Height of Wall	6 feet Add for floating debris

Please note that all the information is subject to change, depending upon SCS comments on the Comparative Design Study and the final designs.

Please pass this information on to the Flood Control District. If they need further information please let us know.

Very truly yours,

Carl J. Montana
Project Manager

CJM/SG:rg

cc: J L Khasz
S Goyal
G Rockwell

Suite 200
201 E. Indianola Ave.
Phoenix, AZ 85012

July 30, 1985

Carl Montana
Consulting Engineer
EBASCO Services, Inc., 91st Floor
Two World Trade Center
New York, N. Y. 10048

RE: Apache Junction/Bulldog, Contract #53-9457-5-00475

Dear Mr. Montana:

As requested during the Phase I Feasibility Study Conference, I have enclosed the following:

1.) NEH-20 with the July 3, 1984 Amendment #1 and Arizona Bulletin No. 210-5-24. This is an additional copy to the one supplied April 1, 1985.

2.) Trip Report by Neville Curtis, Sedimentation Geologist dated March 7, 1983. This report gives the procedure used for estimating Sediment yield to Pass Mountain for the 100 year event.

We have reviewed our NEH-20 file on the Word Processor and have decided not to send you a copy. Approximately one-half of the specifications and material specifications still have not been reviewed for errors.

Sincerely,

Donald E. Paulus
Government Representative

cc: Bill Payne
Ralph Arrington

Enclosures

EBASCO SERVICES INCORPORATE:

Two World Trade Center, New York, N Y 10048

EBASCO

.. Ref: USDA 3767-L0019

July 31, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Pheonix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Minutes of Comparative Design Study Conference

Dear Mr. Paulus:

Attached is a copy of the minutes of the Comparative Design Study Conference held in your office July 24, 25, 1985. Let me know if you would like any changes or additions.

As we agreed, your written comments on the Phase I Report will provide additional documentation on the meeting.

Very truly yours,

Carl Montana

Carl Montana
Project Manager

CM/lm

Attachment

cc: J. L. Ehasz w/ att.
G. Rockwell w/ att.
S. Goyal w/ att.
V. Bolano w/ att.
D. Hunter w/ att.

EBASCO SERVICES INCORPORATED

EBASCO

Two World Trade Center, New York, N.Y. 10048

File Ref: USDA 3767-L0018

July 16, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Pheonix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Meeting Agenda

Dear Mr. Paulus:

Attached is the proposed agenda for the Comparative Design Conference to be held in your office July 24, 25, 1985.

Very truly yours,

Carl Montana

Carl Montana
Project Manager

cc: S. Goyal
D. Hunter
V. Bolano

EBASCO SERVICES INCORPORATED

Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref. USDA 3767-L0017

July 16, 1985

Mr. Paul Monville
USDA Soil Conservation Service
Federal Building
511 N. W. Broadway
Room 514
Portland, Oregon 97209-3489

Subject: BULLDOG FLOODWAY AND APACHE JUNCTION
PHASE I - FEASIBILITY REPORT

Dear Paul:

Don Paulus called me today and asked that I send you two additional copies of the Phase I Report. I have included both a bound and unbound copy so you can more easily make copies if necessary.

Very truly yours,

Carl Montana

Carl Montana
Project Manager

CM:mq

ENC.

cc: D. Paulus
S. Goyal

EBASCO SERVICES INCORPORATED

Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref: USDA 3767-L0016

July 12, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: BULLDOG FLOODWAY AND APACHE JUNCTION
FLOOD CONTROL PROJECT
CONTRACT NO. 53-9457-5-00475
PHASE I - FEASIBILITY REPORT
REVISED FIGURE VI.6

Dear Mr. Paulus:

Please replace Figure VI.6 in your copies of the Phase I Feasibility Report with the attached Figure VI.6, revised 7 / 12/85.

Very truly yours,

Carl Montana

Carl Montana
Project Manager

CM:mq
Attach.
cc: G Rockwell (w/Attach.)

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York, N.Y. 10048

File Ref: USDA 3767L0015

July 11, 1985

Mr. Dan Lawrence
Arizona Department of Water Resources
99 East Virginia
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Phase I - Feasibility Study Report

Dear Mr. Lawrence:

As a follow-up to our conversation today, I have enclosed a copy of the Phase I Feasibility Study Report for the Bulldog Floodway and Apache Junction Flood Control Project, which Ebasco is designing for the USDA Soil Conservation Service.

As you know, we will be meeting with the SCS in their office on the afternoon of July 24th to review the report. Since it is at this point in time that we hope to "fix" the project features, I would appreciate your comments prior to that date.

I look forward seeing you at the meeting on the 24th.

Sincerely,

Carl Montana

Carl Montana

CM/lm
Attachment

cc: D. Paulus
J. Ehasz
M. Temchin

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York, N Y 10048

File Ref: USDA 3767-L0014

FEDERAL EXPRESS July 9, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Contract No. 53-9457-5-00475
Phase I - Feasibility Report

Dear Mr. Paulus:

Transmitted herewith are three (3) copies of the Feasibility Report for the subject contract.

We look forward to meeting with you on July 24th to review its contents. If at all possible, I would appreciate it if you could let me know prior to the meeting if there are major issues with it that will have to be resolved.

Call me if you have any questions.

Very truly yours,

Carl J. Montana
Project Manager

CJM:rg
attachments

cc: J L Ehasz - w/att.
M S Temchin
S Goyal
G Rockwell - w/att.

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York, N.Y. 10048

File Ref: USDA 3767-L0013

July 3, 1985

Mr. Donald R. Paulus
Government Representive
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Review of AT&T-C Proposal
SCS Letter Dated June 6, 1985

Dear Mr. Paulus:

The following is in response to the questions asked in your letter of June 6, 1985 regarding the AT&T-C cable along Lost Dutchmans Boulevard.

1. The culvert is sized to pass 200 cfs with a differential head of .25 feet. It will be located 350 feet (measured along the centerline of the road) from the centerline of the dam. We propose to use a box culvert 7 feet high and 10 feet wide with an invert at elevation 1785 feet.

2. The centerline locations have not been changed from those origionally provided by the SCS.

3. The maximum lake level attained during passage of the emergency spillway storm is elevation 1802.5 feet.

4. The earthfill placement requirements will be Class A compaction to at least 95 percent of the maximum density obtained from compaction tests performed by Method C, ASTM designation D698. The moisture content shall be within 2 percent of optimum. The material shall have a maximum particle size of 1 inch with a minimum of 75 percent passing the number 4 seive.

Please call me if you have any questions.

Very truly yours,

Carl Montana

Carl Montana
Project Manager

cc: Ehasz
Temchin
Goyal
Bolano
Rockwell

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York, N.Y. 10048

File Ref: USDA 3767-L0012

July 2, 1985

Mr. Donald R. Paulus
Government Representation
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: BULLDOG FLOODWAY AND APACHE JUNCTION
FLOOD CONTROL PROJECT
SCS LETTER OF JUNE 26, 1985

Dear Mr. Paulus:

Reference is made to your letter of June 26, 1985.

We have completed the routings requested in paragraphs 2.b and 3 and have determined that the effect of not including the modified channel loss factor for the emergency and freeboard hydrographs is minor and that the 100 year - 24 hour type II storm does not flow out the emergency spillway when routed through the site.

We will provide the documentation requested in paragraphs 4, 5, and 6.

I believe there is a misunderstanding regarding the work requested in paragraphs 1 and 2.a. It remains our opinion that we have correctly applied the modified channel loss factor as required by the Soil Conservation Service's National Engineering Handbook Section 4, Chapter 21 and PO-4. As you know, each of the watersheds for which we have not applied the factor has a drainage area less than 1 square mile and drains directly into the reservoir of the Apache Junction FRS. I believe the references are clear and have been applied properly with sound engineering judgement and logic.

Based on your request over the telephone today, we will perform the routing as requested in 2.a for your use. We do not agree to apply the results of this routing to our studies which, at this point, have been completed.

Very truly your,

Carl Montana

Carl Montana
Project Manager

cc: J. Ehasz
S. Goyal
D. Hunter
G. Rockwell

United States
Department of
Agriculture

Soil
Conservation
Service

201 E. Indianola
Suite 200
Phoenix, Arizona 85012

June 26, 1985

Carl Montana
Consulting Engineer
EBASCO Services, Inc., 91st Floor
Two World Trade Center
New York, N.Y. 10048

RE: Apache Junction/Bulldog, Contract #53-9457-5-00475

Dear Mr. Montana:

As agreed in our 6-26-85 phone conversation with Dave Hunter of your staff and Harry Millsaps of our staff the following work shall be added or corrected to your submitted hydrology report.

1. Calculate the modified channel loss factor for the entire Drainage Area and not each sub-basin as shown in your report. This calculated value will then be used for each sub-basin.

2. Re-run the routing program for the following conditions:

   a. To include the newly calculated channel loss factor for the principle spillway hydrograph.

   b. Not to include the channel loss factor for either the Emergency or Freeboard hydrographs.

3. Test the 100 year-24 hour type II storm to make sure we do not get flow out the emergency spillway for this rainfall event.

4. Include all input data as part of the report.

5. Document WNTC comment for using QDIRECT versus PDIRECT in establishing the runoff distribution curve.

6. Show the 100 year-6 hour rainfall amount on the Hydrologic Summary Sheet.

Sincerely,

Donald E. Paulus

Donald E. Paulus
Government Representative

EBASCO SERVICES INCORPORATED

Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref: USDA 3767-L0011

July 2, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: BULLDOG FLOODWAY AND APACHE JUNCTION
FLOOD CONTROL PROJECT
INVOICE FOR PROGRESS PAYMENT NUMBER 2
CONTRACT NO. 53-9457-5-00475
INVOICE NO. USDA-853074-5

Dear Mr. Paulus:

Attached is the original and two copies of the invoice for work completed thru June 27, 1985 on the subject contract. I have also attached a copy of the rationale behind the percent completion.

Please note that we have included the increases resulting from Modifications 1 and 2 in the price per phase.

Call me if you have any questions.

Very truly yours,

Carl Montana

Carl Montana
Project Manager

CM:mq

Attach.

cc: J L Ehasz
G Rockwell
S Goyal
C Socrates

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York N.Y 10048

File Ref: USDA 3767-L0010

June 17, 1985

Mr. Donald R. Paulus
Government Representative
USAD Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Hydrology Report

Dear Mr. Paulus:

As we agreed over the phone today, I have enclosed two copies of the "Hydrology Report" we prepared for the subject project. I would appreciate it if you could have Harry look it over and let us know if there is anything you have difficulty with. A report on the hydrology will be included as part of the "Preliminary Design Report" which will be submitted July 10th.

Thank you for your cooperation.

Very truly yours,

Carl J. Montana
Project Manager

CJM:rg
attachments

cc: J L Ehasz
M S Temchin
S N Goyal
D S Hunter

EBASCO SERVICES INCORPORATED
Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref: USDA 3767-L009

June 13, 1985

Mr. David O. Lambson
Contract Specialist
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: BULLDOG FLOODWAY AND APACHE JUNCTION
FLOOD CONTROL PROJECT
CONTRACT NO. 53-9457-5-00475
CONTRACT MODIFICATIONS 1 & 2

Dear Mr Lambson:

Enclosed are signed copies of contract modifications 1 and 2.

Very truly yours,

Carl Montana

Carl Montana
Consulting Engineer

CM:mq

ENC.

cc: J L Ehasz
G Rockwell
S Goyal

United States
Department of
Agriculture

Soil
Conservation
Service

Suite 200
201 E. Indianola
Phoenix, AZ 85012

May 30, 1985

Ebasco Services, Inc.
Two World Trade Center, 91st Floor
New York, NY 10048

Attn: Carl Montana, Consulting Engineer

RE: Design Services for Bulldog and Apache Junction FRS & Outlet
Contract No. 53-9457-5-00475

Gentlemen:

Enclosed for your review and signature are two copies each of contract modification Nos. 1 & 2 of the above referenced contract. Item amended is described in Section 14 of both modifications.

Please sign return original copies to this office. The other copies may be retained for your files.

Sincerely,

David O. Lambson
Contracting Officer

Enclosures (4)

cc: Don Paulus, Gov't Rep

EBASCO SERVICES INCORPORATED
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

EBASCO

File Ref: USDA3767-LK008

June 11, 1985

Mr. David O. Lambson
Contract Specialist
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: BULLDOG FLOODWAY AND APACHE JUNCTION
FLOOD CONTROL PROJECT
CONTRACT NO. 53-9457-5-00475
DESIGNATION OF ALTERNATE TO NEGOTIATE,
SIGN, AND ADMINISTER CONTRACT MODIFICATIONS

Dear Mr. Lambson:

In accordance with Paragraph K-9, page 55, of the subject contract, I am hereby designating Mr. Carl Montana, Project Manager, as being authorized to negotiate, sign, and administer contract modifications for the Bulldog Floodway and Apache Junction Flood Control Project.

Please call me at 713-954-4111 if you have any questions.

Very truly yours,

R.M. Morse

Robert M. Morse
Vice President

cc: J L Ehasz
H M Blum
C Montana

EBASCO SERVICES INCORPORATED
Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref: USDA 3767-L007

June 10, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: BULLDOG FLOODWAY AND APACHE JUNCTION
FLOOD CONTROL PROJECT
INVOICE FOR PROGRESS PAYMENT NUMBER 1
CONTRACT NO. 53-9457-5-00475
INVOICE NO. USDA-852462-5

Dear Mr. Paulus:

Attached is the original and two copies of the invoice for work completed thru May 26, 1985 on the subject contract. I have also attached a copy of the rationale behind the 35% completion.

Please note that we have not included the increases resulting from Modifications 1 and 2 in the price per phase at this point.

Call me if you have any questions.

Very truly yours,

Carl Montana

Carl Montana
Project Manager

CM:mq
Attach.
cc: J L Ehasz
G Rockwell
S Goyal

United States
Department of
Agriculture

Soil
Conservation
Service

201 E. Indianola Ave.
Suite 200
Phoenix, Arizona 85012

June 6, 1985

Carl Montana
Consulting Engineer
EBASCO Services, Inc. 91st Floor
Two Work Trade Center
New York, N.Y. 10048

RE: Apache Junction/Bulldog, Contract #53-9457-5-00475
Follow-up to the minutes for the May 22, 23, 1985 monthly meeting and hydrology review

Dear Mr. Montana:

Enclosed are the following:

1. WEST NTC BULLETIN NO. W210-5-12 - to be filed with NEH-20.

2. ARIZONA BULLETIN NO. 210-5-24 - to be filed with NEH-20.

3. AT&T-C letter dated May 31, 1985 with attachments.

4. Engineering Design Standards, FAR WEST STATES - as requested.

Please review the AT&T-C proposal and reply with any comments as soon as possible. In addtion, AT&T-C contractor has scheduled the concrete portions of the cable and the manholes as his first phase of work. As a result AT&T-C would appreciate the following as it is available.

1. Culvert locations along Lost Dutchmans Blvd., sizes, and invert elevations.

2. Final centerline location.

3. Final impoundment elevation for the emergency spillway frequency.

4. Requirements for placement of earthfill.

In review of the minutes dated May 29, 1985 section:

I.5. No additional criteria was followed in the design of Signal Butte Floodway side inlets.

II. Para 3.2.2. The 8 ft/sec velocity may not be suitable for the caliche in this area (i.e. Emergency Spillway investigation). Need to determine from the investigations and perhaps the overall design picture in this area. (Elevations, grades, location, etc.).

III. As discussed by phone we are interested in pursuing the shallower cutoff depth.

Also please return the HEC-14 after you have had it copied.

Sincerely,

Donald E Paulus

Donald E. Paulus
Government Representative

Enclosure

EBASCO SERVICES INCORPORATED
Two World Trade Center, New York, N.Y. 10048

EBASCO

File Ref: USDA 3767-L006

May 29, 1985

Mr. Donald R. Paulus
Government Representative
USAD Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Minutes of Monthly Meeting & Hydrology Review
May 22, 23, 1985

Dear Mr. Paulus:

Attached are copies of the minutes of the meeting held in your office last week. We found the meeting very productive. Please thank everyone who participated; Susan and Harry were especially helpful.

Very truly yours,

Carl J. Montana
Project Manager

CJM:rg
attachments

cc: J L Ehasz - w/att.
G Rockwell - "
M S Temchin- "
S Goyal - "
V M Bolano - "
D S Hunter - "

United States Department of Agriculture

Soil Conservation Service

201 E. Indianola Ave.
Suite 200
Phoenix, Arizona 85012

June 6, 1985

Carl Montana
Consulting Engineer
EBASCO Services, Inc. 91st Floor
Two Work Trade Center
New York, N.Y. 10048

RE: Apache Junction/Bulldog, Contract #53-9457-5-00475
Follow-up to the minutes for the May 22, 23, 1985 monthly meeting and hydrology review

Dear Mr. Montana:

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2. ARIZONA BULLETIN NO. 210-5-24 - to be filed with NEH-20. — Attached

3. AT&T-C letter dated May 31, 1985 with attachments.

4. Engineering Design Standards, FAR WEST STATES - as requested. — We will pass this to you when you start phase II.

Please review the AT&T-C proposal and reply with any comments as soon as possible. In addtion, AT&T-C contractor has scheduled the concrete portions of the cable and the manholes as his first phase of work. As a result AT&T-C would appreciate the following as it is available.

1. Culvert locations along Lost Dutchmans Blvd., sizes, and invert elevations.

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III. As discussed by phone we are interested in pursuing the shallower cutoff depth.

Also please return the HEC-14 after you have had it copied.

Sincerely,

Donald E. Paulus

Donald E. Paulus
Government Representative

Enclosure

United States
Department of
Agriculture

Soil
Conservation
Service

Suite 200
201 E. Indianola Ave.
Phoenix, AZ 85012

Subject: ADMIN SERV - Bulldog Floodway & Apache Junction FRS & Outlet-Design Services Contract No. 53-9457-5-00457

Date: May 20, 1985

To: Don Paulus, Government Representative
SCS, State Office

File Code:

The work commencement notice was delivered to Ebasco Service, Inc., on May 6, 1985. Accordingly, the 306 calendar days performance time commences on May 7, 1985, and ends on the close of business March 8, 1986.

David O. Lambson
Contracting Officer

cc: Ebasco Service, Inc.
Ralph Arrington, SCE
Bill Payne, SDE

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York, N.Y. 10048

File Ref: USDA 3767-L005

May 17, 1985

Mr. Donald R. Paulus
Government Representative
USAD Soil Conservation Service
Suite 200
201 East Indianola
Pheonix, Arizona

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Monthly Meeting & Hydrology Review
May 22, 23, 1985

Dear Mr. Paulus,

This letter confirms the dates of May 22, 23, 1985 for our next meeting to be held in your office. I plan to be in your office at 12:30 PM on the 22nd and can spend the morning of the 23rd with you. I have attached an agenda for the meeting; please feel free to make any additions that you feel are needed.

I have also attached a copy of the "Design Criteria" as required in Paragraph B.1, Criteria, of the Contract and some preliminary findings related to our review of the geology and soils testing reports. We will review these at the meeting.

I would like you to have the Maricopa County officials at the meeting so we can discuss our interface with them regarding the roads, bridges, and utilities.

Very Truly Yours,

Carl Montana

Carl Montana
Project Manager

Attachments

cc: Ehasz
Rockwell
Tamchin
Goyal

BUCKHORN-MESA WATERSHED

APACHE JUNCTION FLOODWAY, FRS, OUTLET AND BULLDOG FLOODWAY

AGENDA FOR MONTHLY MEETING

MAY 22, 23, 1985

USDA SCS OFFICE - PHEONIX, ARIZONA

1. STATUS OF AT&T CABLE CROSSING.

2. STATUS OF EBASCO SERVICES INCORPORATED AGREEMENTS WITH MARICOPA COUNTY FOR COORDINATION OF UTILITIES, ROAD AND BRIDGE CROSSINGS.

   A. METHOD OF CONTRACTING - PLANS AND SPECS

   B. INSPECTIONS OF ROAD AND BRIDGE CONSTRUCTION

3. REVIEW OF DESIGN NOTE 21 REQUIREMENTS

4. STATUS OF MODIFICATION FOR STUDY OF TYPE C DROP STRUCTURE

5. REFERENCE FOR DESIGN OF CURVED SIDE INLETS ON BULLDOG FLOODWAY.

6. REVIEW OF DESIGN CRITERIA (SEE ATTACHED).

7. REVIEW OF PRELIMINARY FINDINGS ON SUITABILITY OF GEOLOGICAL AND SOIL MECHANICS DATA (SEE ATTACHED).

8. REGIONAL SUBSIDENCE CONSIDERATIONS.

9. REVIEW OF PRELIMINARY FINDINGS ON HYDROLOGY REVIEW.

   A. DRAINAGE AREAS - SOME DIFFERENCES BASED ON AERIAL PHOTOS

   B. CURVE NUMBERS - GENERALLY THE SAME (WITHIN 1)

   C. TIMES OF CONCENTRATION - NEW TC'S ABOUT 30% SHORTER (METHODOLOGY USED ON BULLDOG FLOODWAY WAS UTILIZED AND SIMILAR R AND N VALUES WERE USED.

   D. PMP, 100, AND 10 YEAR RAINFALLS - SLIGHT VARIATION FROM SIGNAL BUTTE FRS HYDROLOGY FOR EXTREEM EASTERN END OF DRAINAGE AREA (LOWER THAN 1974 HYDROLOGY).

   E. INFLOW HYDROGRAPH COMPARISONS.

10. BILLING PROCEDURES

11. FREEBOARD REQUIREMENTS FOR APACHE JUNCTION FRS - SCS & STATE

12. STATUS OF LOCATION OF TRANSMISSION TOWER ON BULLDOG FLOODWAY.

13. LOCATION AND TYPE OF EMERGENCY SPILLWAY USED ON SIGNAL BUTTE DAM AS IT RELATES TO OUTLET TO BULLDOG FLOODWAY

14. APACHE JUNCTION FRS CONDUIT WILL GO DIRECTLY INTO CONRETE CHANNEL WITHOUT THE USE OF AN ENERGY DISSIPATOR

15. METHOD OF HANDLING BULLDOG FLOODWAY CENTERLINE TO ACOUNT FOR SHIFT THAT OCCURS WHERE SIDE CHANNEL INLETS JOIN CHANNEL. THIS WILL CREATE AN ALIGNMENT THAT DIFFERS FROM THE ONE SHOWN ON CURRENT SCS DRAWINGS.

16. MIMIMUM UPSTREAM SLOPE OF EMBANKMENT WILL BE 2.5 TO 1 UNLESS FLATTER SLOPES ARE REQUIRED BY STABILITY ANALYSIS.

17. BAFFLE CHUTE DESIGN CRITERIA:
    A. RECOMMENDED FLOW PER FOOT OF WITH
    B. COMPUTATION OF DEPTH OF SCOUR AT DOWNSTREAM TOE

18. USE OF HIGH DENSITY POLYETHYLENE MEMBRANE FOR CRACK CONTROL

United States Department of Agriculture

Soil Conservation Service

Suite 200
201 E. Indianola
Phoenix, AZ 85012

May 13, 1985

H. Lee Kupfer
Black & Veatch Engineers - Architects
1500 Meadow Lake Parkway
P.O. Box 8405
Kansas City, MO 64114

RE: Comments on proposal for passing AT&T cable through the Apache Junction flood control project site.

Dear Mr. Kupfer:

Per your request by letter to Mr. Al Lindley dated April 19, 1985, the Soil Conservation Service, EBASCO, and Flood Control District of Maricopa County have reviewed your proposal.

First, additional information is needed as to the suitability of the proposal. We need the following:

1. Plan of the proposed exploration to determine caliche depth.
2. Profile showing the results of the exploration.
3. Plan and profile of the proposed installation. This should include provisions for passing under the proposed culverts along Lost Dutchmans Rd.
4. Installation details including typical sections of the proposed excavations.
5. Construction specifications for the work including backfill placement.
6. Location and details of manholes.

Because of concerns about the potential for differential settlement and seepage thru the foundation area disturbed by this installation we feel the questions to backfill placement will be best answered only after the foundation and embankment design have been completed by EBASCO. Therefore, we can not comment on the range of moisture contents, densities, or method of placement at this time.

Next, if PVC conduit is to be used we would want to see the concrete encasement reinforced. An alternative to this approach would be to use a steel conduit encased with non-reinforced concrete.

The installation of a telephone cable is a Land Rights item which is ineligible for Federal cost-sharing under Public Law 83-566. The Flood Control District of Maricopa County is responsible for all Land Rights costs, including costs for design, increased construction costs, and construction inspection. We are, on behalf of the Flood Control District of Maricopa County, requesting that AT&T state their willingness to pay for the following land rights items.

Phoenix, Arizona 85012

May 8, 1985

Carl Montana
Consulting Engineer
EBASCO Services, Inc.
Two World Trade Center
New York, N.Y. 10048

RE: Apache Junction/Bulldog, Contract #53-9457-5-00475

Dear Mr. Montana:

This letter is intended to clarify some of the remaining unanswered questions left from the pre-design conference held 4/16/85 in Phoenix.

First, EBASCO asked the SCS for a clarification on the use of DN-21 (Substitution of Higher Strength Steels in Reinforced Concrete). The following summaries its intent:

1. According to design criteria, design of all reinforced concrete will be based on ρ_{shy} with 40 ksi steel.

2. Do not use moment redistribution in design if higher strength 60 ksi steels are permitted to be substituted during construction.

3. Check 0.75 $\bar{\rho}_b$ for 60 ski steel. If ρ_{shy} (40) < 0.75 $\bar{\rho}_b$ (60) the failure made remains well within the desired ductile range and substitution is okay.

4. Check all critical sections or generally pick sections that would determine the adequacy of the substitution.

5. You will <u>NOT</u> need to check the SCS standard drawings.

6. Lap splices using the 60 ksi steel shall be used when specifying 60 ksi steel.

Second, as requested, we have attached a map showing the location of the only power pole within 200 feet each side of the Bulldog centerline.

Last, SMN-1 design criteria for drain material will be in rough final form by approximately June 10, 1985 and printed final by October 1st 1985.

Sincerely,

5-31-85 – 7:30 – [illegible]

Donald E. Paulus

Donald E. Paulus
Government Representative

cc: Bill Payne
Ralph Arrington

6 – [illegible]

DEP:nn

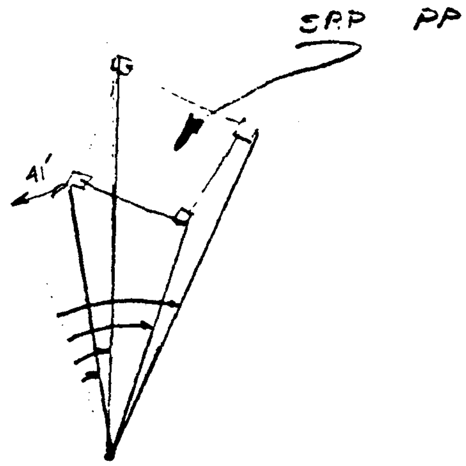
COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

cc N Hung
Nguyen

STATE AZ	PROJECT BULLDOG FLOODWAY			
BY C.P.O.	DATE 5-2-85	CHECKED BY	DATE	JOB NO.
SUBJECT LOCATION OF S.R.P. Power Pole				SHEET 1 OF 1

Fd Rebar in Conc
© & P.I.



Fd. Rebar in Conc ©
P.C. Sta 148+99.88 — [illegible]

~~Δ~~ 1	137.2'	17° 26' 10"
2	161.5'	21° 07' 00"
3	128.9'	28° 32' 40"
4	154.5'	30° 29' 20"

1. Design Costs (Estimated at $5,865)
2. Construction Costs (Not determined)
3. Construction Inspection (Not determined)

We would appreciate an early reply to these questions since we may request that EBASCO do this design work and we may have to modify our contract with EBASCO accordingly, and bill the Flood Control District of Maricopa County for the increased cost.

The Flood Control District is also responsible for any damage to the cable or disruption of service during construction. We will submit the plan & specifications for this dam to AT&T for review.

Any work that might be needed on this cable after the dam has been constructed might require that the dam be breached or other associated excavation work. This will require SCS approval of the design and specifications, which might be more than is called for in the original plans and specifications.

W. Wayne Killgore
Asst. State Conservationist (W)

cc: Dan Sagramoso, FCDMC
Carl Montana, EBASCO
Al Lindley, AT&T Communications

United States Department of Agriculture

Soil Conservation Service

Suite 200
201 E. Indianola Ave.
Phoenix, Arizona 85012

RECEIVED
MAY 7 1985
JOAQUIN J. PEREZ

April 29, 1985

Ebasco Services Incorporated
3000 W. McArthur Blvd.
Santa Ana, CA 92704

RE: DESIGN SERVICE FOR BULLDOG AND APACHE JUNCTION FRS & OUTLET CONTRACT NO. 53-9457-5-00457

Gentlemen:

You were awarded Contract No. 53-9457-5-00475 for design services on the Bulldog Floodway and Apache Junction FRS & Outlet on April 8, 1985.

You are hereby notified to commence and complete all work within 306 calendar days. Performance time begins the day following receipt of this notice.

If you have any questions regarding this contract, please contact Don Paulus, Government Representative, at 602-241-5143.

Sincerely,

David O. Lambson

David O. Lambson
Contracting Officer

cc: Don Paulus, Gov't Rep.
Ralph Arrington, SCE
Bill Payne, SDE

United States Department of Agriculture

Soil Conservation Service

201 E. Indianola Ave.
Suite 200
Phoenix, Arizona 85012

April 25, 1985

Carl Montana
Consulting Engineer
EBASCO Services Incorporated
Two Work Trade Center
New York, NY 10048

RE: Apache Junction/Bulldog Contract #53-9457-5-00475

Dear Mr. Montana:

As of this date we have not received the minutes summarizing the discussions and decisions reached during the pre-design conference which was held 4-16-85.

After the pre-design conference the following materials were supplied by the SCS:

1. Topographic map of downstream area of the Apache Dam.

2. One copy of the drawings and specifications for Signal Butte FRS and Pass Mountain Diversion and Outlet.

3. Development Guide for Apache Junction.

Enclosed are the following materials:

1. Copy of the cover of HEC-14, Hydraulic Design of Energy Dissipators for Culverts and Channels.

2. West NTC Bulletin No. 210-4-28, ENG-Construction-Computation of Performance Time for Contracts Using the Federal Acquisition Regulation, with rainfall summary tables.

3. Abstract of proposals for a.) Signal Butte Floodway and b.) RWCD, Reach-3.

4. SCS-ENG-353A, Rev. 11-71, Grain Size Distribution/Soil Classification.

5. Underground Conduit Loading worksheets (2 of 2) (use with TR-5).

6. Joint Gap computation sheet (use with TR-18).

7. Pipe Strength Computation sheet.

The Soil Conservation Service is an agency of the United States Department of Agriculture

50

U.S. Government Printing Office: 1983—420-030/1879

8. Work sheet for data on Flood Routing Hydraulics.

9. Tractive Stress, d75 > 1/4" and d75 <1/4"; and Tractive Power d75 < 1/4" work sheets.

10. Report: Cracking of Dams in Arizona, April 27, 1978. (Since this report additional studies in this subject area have been completed by the SCS. Results of these studies are presently being put into report but will not be available during this design contract. However, you may want to discuss some of the results with the members of the Crack Study Team. Some of the present conclusions may differ from those given in the 1978 report!).

11. Bulldog Floodway Design Hydrology, Revised 1985. (Both revised pages and void pages are enclosed.)

The title of the paper on strength of caliche which you were interested in is "A Classification of Ca Horizons in Soils of a Desert Region". Reprinted from Soil Science Society of America Proceedings, Volume 25, No. 1, Jan.-Feb. 1961, pages 52-61.

Under separate cover we are sending the following:

1. Mylar drawings of:

   a. Title Sheet Apache Junction Floodwater Retarding Structure

   b. Plan and Profile Apache Junction FRS, 9 sheets

   c. Plan and Profile Apache Junction Floodway, 2 sheets

   d. Plan and Profile Apache Junction FRS Outlet, 2 sheets

   e. Title Sheet Bulldog Floodway

   f. Plan and Profile Bulldog Floodway, 6 sheets

2. SCS-ENG-313C mylar sheets, 21 sheets

3. SCS-ENG-317 mylar sheets, 5 sheets

In answer to a few of the questions which came up during the pre-design conference:

1. Right of Entry permits will continually be renewed until time of construction.

2. Apache Junction Floodway will begin at station 11+00 as drawn on the plan and profile mylars, (NOTE: station 10+00 work plan equals station 11+00 present).

3. We will not study the cost of land acquisition downstream of the dam in choosing our Emergency Spillway location. Therefore, no additional downstream routings will be needed.

4. No earth test sections will be done for crack studies of Apache FRS.

We have reviewed your proposal of considering a third alternate emergency spillway structure. This would be a low Type C drop structure along the earth emergency spillway centerline. We are interested in this type of alternative and would like for you to submit to us a proposal to perform the additional work. The work shall follow the specifications set for Phase I of this contract.

Sincerely,

Donald E. Paulus

Donald E. Paulus
Government Representative

B L A C K & V E A T C H
ENGINEERS- ARCHITECTS

TEL (913) 967-2000
TELEX 42-6263

1500 MEADOW LAKE PARKWAY
MAILING ADDRESS PO BOX NO 8405
KANSAS CITY MISSOURI 64114

AT&T Communications
Southern Transcontinental
Lightguide System
Permits and Licenses

B&V Project 11380
B&V File M620-31.32.0600
April 19, 1985

AT&T Communications
221 East Indianola, Suite 216
Phoenix, Arizona 85012

Attention: Mr. Al Lindley

Gentlemen:

Enclosed for your information is the conference memorandum for our April 16, 1985, meeting with the Soil Conservation Service (SCS), the Maricopa County Flood Control District (MCFCD), and several other organizations with interest in the Apache Junction flood control project. Our purpose for attending was to coordinate cable design through the flood control project site with design of the flood control structure.

Based on this meeting and subsequent discussions with Mr. Don Paulus of the SCS, Black & Veatch (B&V) has developed the following proposed design coordination agreement terms for review by AT&T Communications (AT&T-C).

<u>AT&T-C Commitments</u>

1. AT&T-C will determine the depth of caliche material under the dam at the cable crossing and construct the cable at a depth of at least three feet below the top of the caliche material, or at least 10 feet deep, whichever is deepest. Cable construction at this depth will extend to points beyond each side of the dam core base. The cable will be placed in a four inch diameter PVC conduit, encased in concrete. The excavated caliche material will be backfilled to the top of the surrounding caliche material and compacted to 97 percent of maximum density, at -1 percent to +3 percent of optimum moisture content as determined by ASTM D698. Caliche backfill partical size will not exceed six inches. Remaining backfill will be compacted to 95 percent of maximum density at $\pm$ 5 percent optimum moisture.

2. AT&T-C will construct cable under all other portions of the flood control project right-of-way at a depth of at least four feet below existing grade. The cable will be placed in a four inch diameter PVC conduit encased in concrete. Backfill will be compacted to 95 percent of maximum density.

3. AT&T-C will place easily visable cable marker poles at 500 foot centers, and cable warning tape at one above all cable constructed within the proposed flood control project right-of-way.

4. Cable maintenance is planned to be from manholes west of the dam or east of the impoundment area. If cable excavation is required at the dam, AT&T-C will reconstruct the dam to the original design specifications.

5. AT&T-C will provide SCS/MCFCD with construction and as-built cable construction drawings.

SCS/MCFCD Commitments

1. SCS/MCFCD will finalize the dam centerline location, core base width, and maximum impoundment water elevation by September 1, 1985.

2. SCS/MCFCD will provide design and construction required to interface the dam's drain system with the cable under the dam. SCS will advise AT&T-C at least three days before excavating to the cable for this interface.

3. SCS/MCFCD will limit barrowing to outside the limits of the corridor that will be granted to AT&T-C by the Bureau of Land Management. (This corridor could adjoin a corridor excluded from barrowing for Lost Dutchman Road construction across the impoundment area)

B&V believes that these proposed terms offer a practical and fair means of sharing the work required to interface the two projects. By copy of this letter to Mr. Don Paulus of the SCS, Ms. Cora Hernandez of the MCFCD, and Mr. Carl Montana of Ebasco Services, we request that these parties provide comments to B&V through Mr. Paulus concerning the proposed coordination terms by May 10, 1985.

An addendum based on a conservative estimate of how these terms will affect the lightguide contractor's work will be discussed at a prebid meeting on April 24, 1985 and issued on April 29, 1985, pending an initial concurrance from AT&T-C.

Please provide us with AT&T-C comments at your earliest convenience.

If you have any questions, please call.

Very truly yours,

BLACK & VEATCH

H. Lee Kupfer

H. Lee Kupfer

kfb
Enclosure
cc: AT&T-C, w/encl.
Mr. Bill Simson, w/encl.
Mr. Ken Reinart, w/encl.
Mr. Clay Ricker, w/encl.
Mr. Don Paulus, w/encl.

CONFERENCE MEMORANDUM

AT&T Communications
Southern Transcontinental
Lightguide System

B&V Project 11380
B&V File M620-31.15.0200
April 19, 1985

Meeting held in Soil Conservation Service offices in Phoenix on April 16, 1985.

Attending:

Soil Conservation Service (SCS)

LTR

Maricopa County Flood Control District

LTR

Coates Field Services

K. Reinart

Ebasco Services

LTR

Salt River Project

LTR

Black & Veatch (B&V)

L. Kupfer

Background. AT&T must show that cable design across the future Apache Junction Flood control structure has been coordinated with the flood control structure design in order to obtain a grant for this area from BLM. The Soil Conservation Service has recently retained Ebasco to design the Apache Junction Flood Retaining Structure, which will cross the lightguide cable route near the intersection at Lost Dutchman and Idaho Roads. Maricopa County Flood Control District is the local project administrator for the (SCS).

Meeting. The purpose of the meeting was to address design concerns from outside the SCS, and other project pre-design items. B&V and Coates attended only the first hour of the meeting, which was devoted to AT&T's interests.

1. B&V described the cable route (40 feet north of Lost Dutchman Road), noted that cable construction must precede dam construction, and asked how cable construction could accommodate dam design.

2. Ebasco advised that the cable would not be a design consideration if constructed at least two feet below the top of the caliche soil, and backfill was adequately compacted. Preliminary soil data indicates the caliche soil is typically five feet deep along the dam site, and as deep as 12 feet at isolated areas. Specific excavation requirements for the dam will not be known until September 1, 1985. A conservative cable depth based on information known today would be 15 feet.

CONFERENCE MEMORANDUM

3. Ebasco noted that floodway area barrowing will affect cable depth across a majority of the floodway. A preliminary SCS report calls for barrowing from an area 1200 feet wide along the upstream side of the dam (1700 feet of cable route). Barrow depths will vary depending upon dam design alternatives and the soils found in the barrow area. The cable would have to be 15 feet deep under the entire barrow area to be conservative based on information known to date. Ebasco's planned soil investigations would have to be supplemented by a special investigation along the cable route to determine a practical cable depth.

4. Ebasco noted that barrowing could be limited to either side of a corridor containing the cable. The restriction would result in extra construction cost.

5. B&V asked when bids would be requested for the flood control project work. The SCS responded that bidding would not proceed until additional funding was available.

6. Coates asked if the project had obtained environmental approval. The SCS indicated there were no environmental obstacles.

7. The SCS expressed concern that cable maintenance could require excavation that would breach the dam. B&V advised that the cable would be placed in conduit encased in concrete under the dam. Cable maintenance would be performed by replacing the cable from manholes or excavations located away from the dam.

8. The SCS expressed concern that they could be exposed to liability and extra costs resulting from cable construction under the flood control project. B&V advised that the cable would be constructed such that it would not be visable to the dam structure.

9. Maricopa County Flood Control District advised that road construction alternatives may require the dam centerline location be moved to the intersection of Lost Dutchman and Idaho Roads.

10. B&V advised that they would consider alternatives for interfacing cable construction with dam design and construction.

kab

11046 (SH) 5-82

EBASCO SERVICES INCORPORATED

RECORD OF TELEPHONE CONVERSATION

~~FOR SHEARON HARRIS NUCLEAR POWER PLANT~~

INSTRUCTIONS:
White – Retain for preparer's use
Yellow & Pink – To Project Engineer ~~(yellow will then be forwarded to client)~~

FILE ______

TO FILE – TELEPHONE CONVERSATION

DATE 4.24.85

FROM S GOYAL

SUBJECT USDA-SCS-PHOENIX AZ. BULLDOG/APACHE JUNCTION FLOOD CONTROL PROJ

CHARGE DEPT NO. 550 USDA 3767.100 ~~EAR 6416.~~

DOCUMENTS REFERENCED/APPROVED (FCR'S, DCN'S, ETC.)

DISCUSSION: The layout of Idaho road and Lost Dutchman road intersection and ¢ dam were discussed with Don Paulus. Burial of AT&T cables in the reservoir area and under the dam were also discussed.

Don informed Ebasco that the layout of roads and the dam will stay as shown on the drawing. The dam width will be locally increased to account for the road intersection. The top of roads at the intersection and the top of the dam will be at the same elevation. The layout of road has however not been finalized.

Don will inform AT&T that the cables will have to be lowered under the culvert locally and also that the layout of road may change in the final design.

COMMENTS: Don informed Ebasco that County has received the Ebasco proposal for roads at this morning

cc. Carl Montana.

BY S. Goyal 550
NAME TITLE DEPT NO.

EBASCO SERVICES INCORPORATED EBASCO

Two World Trade Center, New York N.Y 10048

File Ref.: USDA.3767-L002

April 24, 1985

Mr. Donald R. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: BULLDOG FLOODWAY AND APACHE JUNCTION FLOOD CONTROL PROJECT MINUTES OF PREDESIGN MEETING

Dear Mr. Paulus:

Attached are the Minutes of the Predesign Meeting held in your office on April 16, 1985. I have identified items that we agreed would be done by each of us throughout them.

If you have any questions or comments please call me.

I would like to thank you for the time you gave us on the 15th; it was very helpful. Please thank Harry for us.

Very truly yours,

Carl Montana

Carl Montana
Project Manager

CM:mq

ATTACH.

cc: M S Temchin
G Rockwell
S N Goyal

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York, N.Y. 10048

File Ref.: USDA 3767-L001

April 22, 1985

Mr. Donald E. Paulus
Government Representative
USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Subject: Bulldog Floodway and Apache Junction
Flood Control Project
Design Note 21

Dear Mr. Paulus:

As agreed, we are evaluating the subject design note which was brought to our attention for the first time at the pre-design meeting held on April 16, 1985 in Phoenix.

A preliminary review, made without going into actual computations, indicates that Design Note 21 may not significantly affect Ebasco's design effort if we are not required to provide documentary calculations for all potential reinforcing steel substitutions. Conversely, should SCS require that an analysis be made for each reinforcing steel calculation made on the basis of Grade 40 steel, including those for the standard drawings to be provided by SCS, we believe the impacts on our cost and schedule could be significant.

I am sure you understand that we cannot adequately evaluate the effect the introduction of Design Note 21 will have on our design effort until SCS defines what will be required to satisfactorily document compliance. We would appreciate clarification on this as soon as possible.

Very truly yours,

Carl J. Montana, P.E.
Project Manager

CJM:rg

cc: J L Ehasz
M S Temchin
G Rockwell
S K Goyal

EBASCO SERVICES INCORPORATED EBASCO
Two World Trade Center, New York, N.Y. 10048

April 8, 1985

Mr. Donald E. Paulus
Government Representative
USDA Soil Conservation
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Dear Mr. Paulus:

As requested, I have attached a list of questions we would like to discuss at our April 16th meeting. We are completing the detail schedule for Phases I and II and will bring it with us to the pre-design meeting.

Very truly yours,

Carl J. Montana
Project Manager

CJM:rg
attachment

bc: S N Goyal - w/att.
M S Temchin - "
D S Hunter - "
V M Bolano - "

QUESTIONS FOR PRE-DESIGN MEETING

1. What are landrights acquisitions based on? How high can we raise top-of-dam?

2. Emergency spillway earth channel as proposed will outlet directly into the concrete outlet channel and would cause its loss should it flow. Has a pipe been considered for the Apache Junction Outlet?

3. Does the stage storage data provided contain the volume for material excavated as borrow material?

4. Can we obtain copies of the approrpiate soil surveys?

5. What purpose does running the emergency spillway storm serve?
   a) Structural spillway must be stable for the PMP
   b) The earth emergency must be checked using Oe/b for PMP.

6. Can we obtain copies of construction costs for use on cost estimates?

7. Procedures to be used for conduit design. Can manufacturer's recommendations be used? Are TR-5, TR-18, and DN-2 to be used? Obtain copies of TN-1, TN-2, and SN-5 that are listed in the list of references. How do they apply?

8. What procedure is used by SCS to design the energy dissipators at the end of the concrete channels? DN 22 COE CE EM 1110-2-1603 HYDRAULIC DESIGN

9. What procedure is used by SCS for estimating the depth of scour below the baffle chute structure? BUR REC. AND PROC. FR

10. Has consideration been given to using the excavated material from the channel construction as the earth fill in the FRS?

11. What have you used as allowable velocities in the Calachi? DO NOT USE VELOCITY USE TR-52.

12. How have you been treating the Calachi when evaluating it in accordance with TR-52 requirements? WE WILL EVALUATE

13. Explain the reference to "error" on page 6 of the Watershed Supporting Data.

14. Is there any inflow to the Apache Floodway at STA 10 + 00 from the area east of the Apache Trail? Is any inflow from the Apache Trail?

15. Will we be required to use your standard computation sheets, such as the one for conduit design?

United States Department of Agriculture

Soil Conservation Service

201 E. Indianola Ave.
Suite 200
Phoenix, Arizona 85012

April 1,1985

Carl Montana
Consulting Engineer
EBASCO Services Incorporated
Two World Trade Center
New York, NY 10048

RE: Apache Junction-Bulldog Design Contract
Phase I, Pre-design Conference

Dear Mr. Montana:

Atached is a copy of the tentative agenda for the Phase I, pre-design conference.

The design references listed in the "topics for discussion" on the attached agenda are enclosed for your review. Additional information on soil test results and utility information are also enclosed.

Please submit to us by April 10th for our review, any additional criteria or methods that you believe would be advantageous in design. In addition, please send a detailed design schedule for this phase of work.

Additional materials that are being furnished by the SCS will be available at this conference.

Donald E. Paulus

Donald E. Paulus
Government Representative

BUCKHORN-MESA

APACHE JUNCTION FLOODWAY, FRS, OUTLET AND BULLDOG FLOODWAY

MEETING: April 16, 1985 8:30 a.m. - tentative

LOCATION: Soil Conservation Service, Phoenix Office, 201 E. Indianola Avenue, Suite 200

ATTENDANCE: Soil Conservation Service (SCS)
EBASCO Services, Inc.
Flood Control District of Maricopa County (FCDMC)
City of Apache Junction
Salt River Project

SUBJECT: Phase 1, Pre-design Conference

TOPICS FOR DISCUSSION:

A. Design concerns from outside the SCS
   1. City of Apache Junction
   2. Pinal county
   3. FCDMC
   4. Salt River Project
   5. AT&T

B. Review SCS design standards and criteria. (NOTE: Design references have been generally categorized as shown below for discussion purposes.)

   1. HYDRAULICS

      a.) NEH-5
      b.) TR-39
      c.) TR-29
      d.) TR-70
      e.) TR-48

   2. STRUCTURE

      a.) TR-18
      b.) TR-46
      c.) TR-30
      d.) TR-5
      e.) TR-67
      f.) NEH-6
      g.) Eng. Monograph No. 25 (USBR)
      h.) TR-63
      i.) NEH-14
      j.) TR-50
      k.) TR-49
      l.) NEH-11

3. SOILS/LAYOUT

   a.) TR-25
   b.) ICES Lease-11
   c.) SMN-3
   d.) ENG-PO-18
   e.) SMN-1 (NOTE: Being revised. May be available by this meeting)
   f.) TR-52
   g.) TR-2

4. HYDROLOGY

   a.) TR-66
   b.) TR-16
   c.) Hydrometeorological Report No. 49
   d.) Hydrology-PO-6 (Rev. 2)
   e.) TR-20
   f.) TR-61
   g.) NEH-4
   h.) NOAA-Atlas 2
   i.) Curve Number Reduction Factors (NOTE: This material will be available at the time of this meeting)

5. OTHER

   a.) TR-60
   b.) NEH-20
   c.) NEH-2
   d.) Catalog of National Engineering Standard Drawings

C. Additional criteria or methods the A&E believes would be advantageous

D. Review the detailed design schedule for Phase 1

E. Review specification

F. Review contract requirements

G. General questions

United States Department of Agriculture

Soil Conservation Service

201 E. Indianola Ave.
Suite 200
Phoenix, Arizona 85012

February 22, 1985

Carl J. Montana
EBASCO Services Inc.
Two World Trade Center
New York, NY 10048

RE: Apache Junction - Bulldog Specifications

Dear Mr. Montana:

As a result of our meeting held 2/11/85, we have made extensive revisions to restructure and clairfy the specifications of the subject job. Enclosed you should find the revised specification and examples of the following:

1. Soils mechanics report (narative only)

2. Design reports

3. Operation and maintenance report

Under separate cover you will receive the following examples:

1. Grouted rock drop structure

2. SCS impact basin

3. SCS standard cover riser

4. Grouted rock plunge pool

Examples of a Design Hydrology Report and Hydrologic Investigation, Emergency Action Plan are being copied and will be sent by express mail when completed.

Please read the specification carefully and review the example work furnished. Submit your cost proposal following the new format of the revised specification.

If you have any questions please call me.

Sincerely,

Donald E Paulus

Donald E. Paulus
Government Representative

The Soil Conservation Service is an agency of the Department of Agriculture

SCS-AS-1A
10-79

EBASCO SERVICES INCORPORATED

EBASCO

3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4000

February 5, 1985

USDA Soil Conservation Service
Suite 200
201 East Indianola
Phoenix, Arizona 85012

Attention: David D. Lambson
Contract Specialist

Re: COST PROPOSAL FOR BULLDOG FLOODWAY AND APACHE JUNCTION FLOODWAY, FRS AND OUTLET

Attached you will find our cost proposal with supporting documentation. This cost proposal is based upon our understanding of the "Scope-of-Work" as presented in the specifications, the supporting data provided, and conversations with Don Paulus on January 31, 1985, documented in the attached Memo to File.

As you know, the scope-of-work requires a fixed price on all phases of work. Phase II calls for a fixed price while asking for comparative design studies and cost estimates on the general features of the project with no limit on the type or number of structures to be studied. Phase III requires a fixed price for final design on features that have yet to be established. We are sure you realize this makes establishing a fixed price extremely risky from our point of view. The most significant example would be the possibility of Ebasco having to design a reinforced concrete drop structure in lieu of an earth emergency spillway. We have had to base our estimates on the assumption that we would have to design the most complex structures resulting from the Phase II studies.

It is our belief that the most equitable approach for both the SCS and Ebasco would be to have Phase I redefined as a Feasibility Study including the Geology and Soil Mechanics Review together with the Hydrologic and Hydraulic Analysis of the Apache Junction FRS. It should not include slope stability analysis, drain design, seepage analysis and other detail design studies which should be in Phase II or Phase III. This would permit us to establish all features prior to effort being spent on design, quantities, cost estimates, and specifications as would be the case under the present scope of work. Phase II, Preliminary Design, could then be limited to a finite number of alternatives established upon completion of Phase I. Phase III, Final Design, would then naturally be tied to the selected alternative. The price for Phase II could be negotiated after completion of Phase I, and Phase III would be negotiated upon completion of Phase II. This arrangement would give both the SCS and Ebasco a well defined scope of work in each phase upon which to base our estimates. We would like you to consider this suggestion and would be happy to discuss this with you over the phone or at our meeting on the 19th.

The price proposal provided is based upon the scope-of-work and includes the following assumptions:

ASSUMPTIONS MADE RELATIVE TO CONTRACT IN PREPARING ESTIMATE:

1. Section C, Paragraph A.4 (Pg. 8): "Other Conferences" shall be considered out-of-scope and billed at a rate to be agreed upon. All "specified conferences" are included in the price proposal. It is also assumed that conferences for Bulldog Floodway can be held concurrently with Apache Junction conferences.

2. Section C. Paragraph B.2 (Pg. 13): It is assumed for purposes of this estimate that the geological investigation and materials testing is adequate for design.

3. Section C, Paragraph B.3.a.III.A.3 (Pg. 14): SCS will supply Ebasco with reproducible copies of the plan and plan-profile sheets which will be suitable for use in completion of Phase I.

4. Section C, Paragraph B.3.a.III.I.2 (Pg. 22): Analysis will be made utilizing TR-52. Cost proposal includes the cost of studying structural alternatives and the assumption that a structural spillway will be required based on the existing geology report and discussions with Don Paulus on January 31, 1985.

5. Section C, Paragraph C.1.b (Pg. 25): In preparing the cost proposal it was assumed, based on conversations with Don Paulus, that energy dissipators are required at the ends of both the Apache Junction Floodway and the Bulldog Floodway. It was also assumed that a structural emergency spillway will be required for the Apache Junction FRS.

6. Section C, Paragraph C.3.a (Pg. 26): No hydrology study is required for the Bulldog Floodway Project.

7. Section C, Paragraph C.3.c (Pg. 26): Topography is available on which to prepare the innundation maps.

8. Section C, Paragraph C.4.b (Pg. 26): The Ironwood and Meridian road crossings will be designed and construction plans and specifications prepared by the Flood Control District of Maricopa County. Ebasco will coordinate with the District.

9. Section C, Paragraph C.4.c (Pg. 26): Relocation and modification of utilities will be handled by the utility. Ebasco will coordinate its design with the utility.

10. Section C, Paragraph D.4 (Pg. 29): The topography provided by the SCS is adequate for Final Design and Quantities.

11. The irrigation system referred to in the EIS is not required.

12. The "model study" referred to in footnote 14 in the Supplement to the Work Plan is not a part of this contract.

If you have any questions please feel free to call me at (714) 662-4105. I look forward to our meeting on February 19, 1985.

Very truly yours,

Joaquin J. Perez

Joaquin J. Perez
Manager, Projects Development

JJP/

EBASCO

Interoffice Correspondence

DATE February 1, 1985 FILE REF

TO FILE OFFICE LOCATION

FROM C J Montana CJM OFFICE LOCATION

SUBJECT RECORD OF TELEPHONE CONVERSATION 1/31/85
USDA SOIL CONSERVATION SERVICE, PHOENIX, ARIZONA

On January 31, 1985 Myron Temchin and I spoke to Don Paulus, SCS Government Representative on the Bulldog Floodway and Apache Junction Project to resolve questions that arose while we were preparing the price proposal.

Question: As we see the project, energy dissipators may be required at the ends of both the Bulldog Floodway and Apache Junction Floodway. The plans provided do not reflect this. How do you see this and should our price proposal include the costs associated with these?

Response: SCS now believes that energy dissipators will be needed at the outlet of both dloodways and your price should include this work.

Question: Has the Oe/b requirement been met regarding the use of an earth emergency spillway as proposed in the two alternate layouts provided? Is there the possibility that we will have to design a structural emergency spillway?

Response: SCS now anticipates that a structural emergency spillway will be required. The SCS Geologist has stated that an earth spillway cannot satisfy current requirements. SCS would like an evaluation of this but Ebasco should assume a structural spillway will be needed.

Question: Are maps available for the area downstream of the dam on which we can prepare the inundation maps associated with the dam break analysis?

Response: Yes!

Question: Are we expected to complete the model study referred to in the Work Plan Supplement in footnote 14?

Response: No!

Question: Can we get reproducibles of the plan and plan-profile sheets provided so we can use them in completing Phase I?

Response: Yes!

Question: What do you propose to do with Idaho Road where it intersects the proposed centerline of the Apache Junction FRS?

Response: The road will be continued by ramping it up and over the dam.

Question: Who will be responsible for completing any design work and preparing plans and specifications for any modifications required to the utility towers both in the dam area and along Bulldog Floodway?

Response: This work will be completed by the utility company. Ebasco must coordinate with the utility.

Question: Who will be responsible for designing and preparing plans and specifications for the road crossings along Bulldog Floodway?

Response: This work will be performed by Maricopa County. Ebasco must coordinate with the County and provide them with the information needed for design such as line, grade, opening.

Question: Are you satisfied with the accuracy of the topography provided for final design purposes?

Response: Yes! The topography provided on the plan-profile sheets is 1983 topo.

Question: Do you want the flat side slope (6 to 1) on the dam as stated in the EIS for visual resource purposes and the installation of an irrigation system also called for in the EIS?

Response: Neither is required. (Don called this information back to us after clarifying it with other members of the staff in Phoenix.)

CJM:rg

cc: J L Ehasz
M L Temchin