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Study

of

Indian Bend Wash Outlet Channel

from

Arizona Canal

Flood Gates

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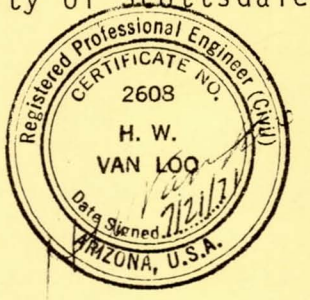

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July 1971

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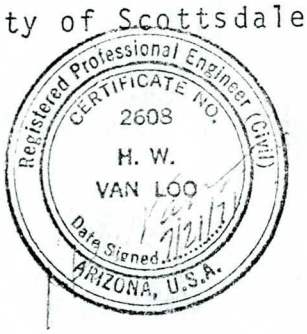

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Drawings:

General Plan-Indian Bend
Wash Outlet Channel- 5 sheets
Cross Sections-3 sheets

1. INTRODUCTION

The Indian Bend Spillway structure planned for construction in the Arizona Canal will permit discharge of additional waters down the Indian Bend Wash. This release will help reduce the possibility of failure of the South bank of the Arizona Canal.

At the intersection of the Arizona Canal and the Indian Bend Wash, there is an existing gated spillway and a weir in the South bank which is about 230 feet long. The weir which is a concreted depression in the South canal bank will allow some excess water to flow out of the canal irrespective of whether the gates are used. The amount which would flow over the weir is limited to the capacity of the existing channel which extends in a Southerly direction from the canal. If those banks fail the weir capacity would increase.

This study involves the possible use of the existing channel and the development of a plan for a channel which will permit operation of the Arizona Canal gates, both those existing and those proposed.

Because of the importance of the Channel and its complexities Water Resources Associates (John R & W.A. Erickson) were retained as consultants on these investigations.

2. SUMMARY & CONCLUSIONS

A. The existing Channel cannot be used as it does not have sufficient capacity.

B. A channel with 6,000 c.f.s. capacity can be constructed in the approximate location of the existing channel to permit release of approximately that quantity of water through the existing and proposed gates at the Arizona Canal without overtopping the spillway crest in the South bank of the Arizona Canal.

C. The cost of such a channel would be approximately $45,000 assuming the excavated materials can be utilized nearby and assuming there is no cost for right of way.

D. The precise location of the channel could be shifted in the general area without major impact.

E. Construction drawings should not be prepared until the right of way is acquired and the precise channel location known.

F. Before construction commences, all legal aspects should be explored.

G. Discharge of 6,000 c.f.s. will have adverse effects on some areas along the Indian Bend Wash well downstream from this channel.

3. SUMMARY OF DESIGN CRITERIA

(a) Capacity - 6,000 c.f.s.

(b) Alignment - follow existing channel so far as possible.

(c) Minimize discharge effects of 6,000 c.f.s. from mouth of channel.

(d) So far as possible minimize disturbance to natural conditions as related to flows greater than 6,000 c.f.s.

(e) Hold right of way requirements to a minimum.

(f) A Manning's coefficient of 0.040 is to be used. This will permit some weed and plant growth in the channel.

4. EXPLANATION OF DESIGN CRITERIA

(a) The capacity basically is the volume the existing and proposed gates will discharge with the water in the canal at spillway crest level with a two foot head differental between the upstream and downstream sides of the gates.

(b) The existing channel is somewhere near the lowest part of the overall wash area as it exists today and presumably as it was when the channel was built. Continuing the channel in this location was used because the development and use of the land follows this pattern and it was felt this location would cause the least disturbance to property owners.

(c) Any channel design must discharge the flow of 6,000 c.f.s. in a manner which will permit it to spread to the natural wash downstream without undue scouring.

(d) There is no assurance that there will not be a flow in excess of 6,000 c.f.s.. In fact, it is a certainty flow at higher than that rate will occur sometime in the future unless conditions are changed. Hence, the channel must permit the passage of flows in excess of 6,000 c.f.s. without undue interference

or diversion.

5. EXISTING CHANNEL

For the initial approach profiles and cross sections of the existing channel were taken and the information plotted and analyzed. Because of the obvious advantages, it had been hoped the existing channel could be modified to provide sufficient capacity.

The existing channel has a bottom width varying from 60 to 70 feet in width except near its beginning where it is much wider to accomodate the spillway weir and the gate structure. It's depth varies from 8 to 10 feet generally below the top of the bank.

The embankments contain a moderately heavy growth of mesquite which provides a good reinforcement against scour. The top of the embankments are fairly rough and are not at a uniform elevation. Some of this appears to have resulted from cleaning operations and it may have been so constructed. In addition, there are some areas which have been washed out.

Assuming the low areas in the banks were filled and with some cleaning of the bottom the effective cross sectional area would be about 700 s.f.. At best with construction of a proper transition at the downstream end, the capacity would not exceed 3,500 c.f.s.. The Salt River Project has estimated the capacity at about 3,000 c.f.s.

As a result of these investigations, it was con-

cluded the existing channel could not be modified to provide the desired capacity and it would be necessary to build a new channel.

6. DESIGNED CHANNEL

(a) Alignment

In following the alignment of the channel, it seemed logical to utilize as much of the existing embankment as possible. As designed, the East bank would remain except at the flare at the South end and the enlargement would be made by moving the West bank. The West bank could be the one used and the East bank moved. However, this would require acquisition of one house near the North end or considerable curvature of the channel requiring construction of both banks in part.

A very good case could also be made for moving the channel East about 20 feet which would leave embankment about 20 feet wide on the East side. Shifting the embankment Eastward substantially would tend to increase the danger to Saguaro High School.

(b) Discharge

In discharging the water from the channel, the embankments are flared at the South end. At the same time, the bottom raises so that the cross sectional area remains comparatively uniform. The combination of raising the bottom and control of the cross sectional

area regulates the discharge velocities so that within 300 feet of the end of the channel the flood waters should essentially be restored to their natural condition without scouring.

(c) Excess Flow

In the event of flow in Indian Bend Wash in an amount exceeding 6,000 c.f.s., the channel will be overtopped. The freeboard in the channel has been left low deliberately because it is believed the channel embankments should be overtopped when the flow is comparatively small rather than when it has increased materially. In addition, the dikes must be so constructed that if flood waters begin flowing outside the channel, they do not divert the waters. For this reason the flare has been kept as short and as low as possible to permit waters flowing outside the channel to overtop the bank and minimize its affects.

If for example, the channel were constructed longer and the Arizona Canal embankment broke East of the channel releasing a large quantity of water, a higher dike would hold the water East of the channel and divert it into Saguaro High School. In other words, the dike would block out the use of part of the main channel.

Once a flow exceeding 6,000 c.f.s. is reached, it is anticipated the water level in the canal will

rise rapidly. The quantity flowing through the gates and over the weir will not increase significantly until the banks of the channel are overtopped and at least partially washed out.

(d) Right of Way

To hold right of way requirements to a minimum the velocity in the channel has been allowed to be higher than desirable. The designed velocity is 5 feet per second in the 180 foot wide channel which is a scouring velocity for the silty soil in this area. To reduce the velocity to the four foot velocity which should be the maximum a wider shallower channel should be used which would materially increase the land requirement.

(e) Pilot Channel

The small channel extending from the low area in the main channel almost to McDonald Drive is to drain the pond created by the raise in the bottom. The present channel does not have a drain and as a result, there is a pool of stagnant water at the South end. This is strictly an environmental consideration. Hydraulically this channel is not needed.

7. LEGAL PROBLEMS

There are a number of possibilities which may cause a problem legally. These include:

(a) Do the flares at the end of the channel in anyway create a possible liability if they divert water in excess of channel capacity which could flow

outisde the constructed channel?

(b) Does the construction of the channel and it's presumed use to capacity create the need for right of way between the end of the channel and McDonald Drive?

(c) Even though the channel capacity is nearly doubled, would removal of the channel bank on each side of the channel near the Arizona Canal create any liability in the event the Channel capacity was exceeded and water flowed out through the area now diked? Or conversely would leaving the dike at the existing elevation near its' upstream end create any legal problems?

(d) If Saguaro High School is flooded has any liability been created?

(e) Does the existing agreement for use of the wasteway by the Salt River Project offer any means of permitting the enlargement of the existing wasteway?

8. CONSTRUCTION COST ESTIMATE

The estimated cost for the outlet channel as proposed is as follows:

Excavation	111,000 c.y.	@.30	$33,300
24 inch reinforced concrete pipe	150 l.f.	@10.00	1,800
Headwall			300
Miscellaneous irrigation facilities			2,000
Engineering			8,000
			$45,400

The earthwork quantities contemplate that the material can be disposed nearby without use of truck equipment. There is no allowance for compaction as equipment compaction without special testing is contemplated. The pipe and headwall are for reconstructing an existing section of pipe and concrete ditch near the North end of the Channel. A part of the existing pipe will have to be lowered and a part of the existing ditch will have to be piped to accomodate the new channel as shown on the drawings. The allowance of $2,000 for miscellaneous irrigation facilities is to provide minor piping across the channel at the outlet end. This is an item which will need to be worked out with the land owners.

9. ALTERNATES

As discussed, elsewhere in this report there are a great many alternates but all would have to follow roughly the existing channel. Costwise, the best channel would be very wide with little cut. This would be prohibitive with respective to land use which is really the reason the present channel was built. If the channel were made more narrow, the depth necessarily would increase raising the construction cost.

Possibly some means might be found to develope some of the existing farm lands on the West side by a combination of cutting a channel and filling the Western portion to provide land not subject to flooding similar to many similar situations further South.

Doing the same thing on the East side will be difficult because of the presence of Saguaro High School. It appears it's location and elevation will limit channeling and filling on the East side of the wash.

A possible alternate which may have serious legal problems would be the construction of the dikes and channel so that only the gated spillway would release water into the channel. Under this condition, excess flows would pass outside the channel on the East side. The difficulty here is that existing improvements on the East side would lie directly in front of the spillway crest.

To equalize the flows on each side of the channel, it would be necessary to construct another weir West of the new spillway gates which would limit access to the gates once the weirs were flowing.

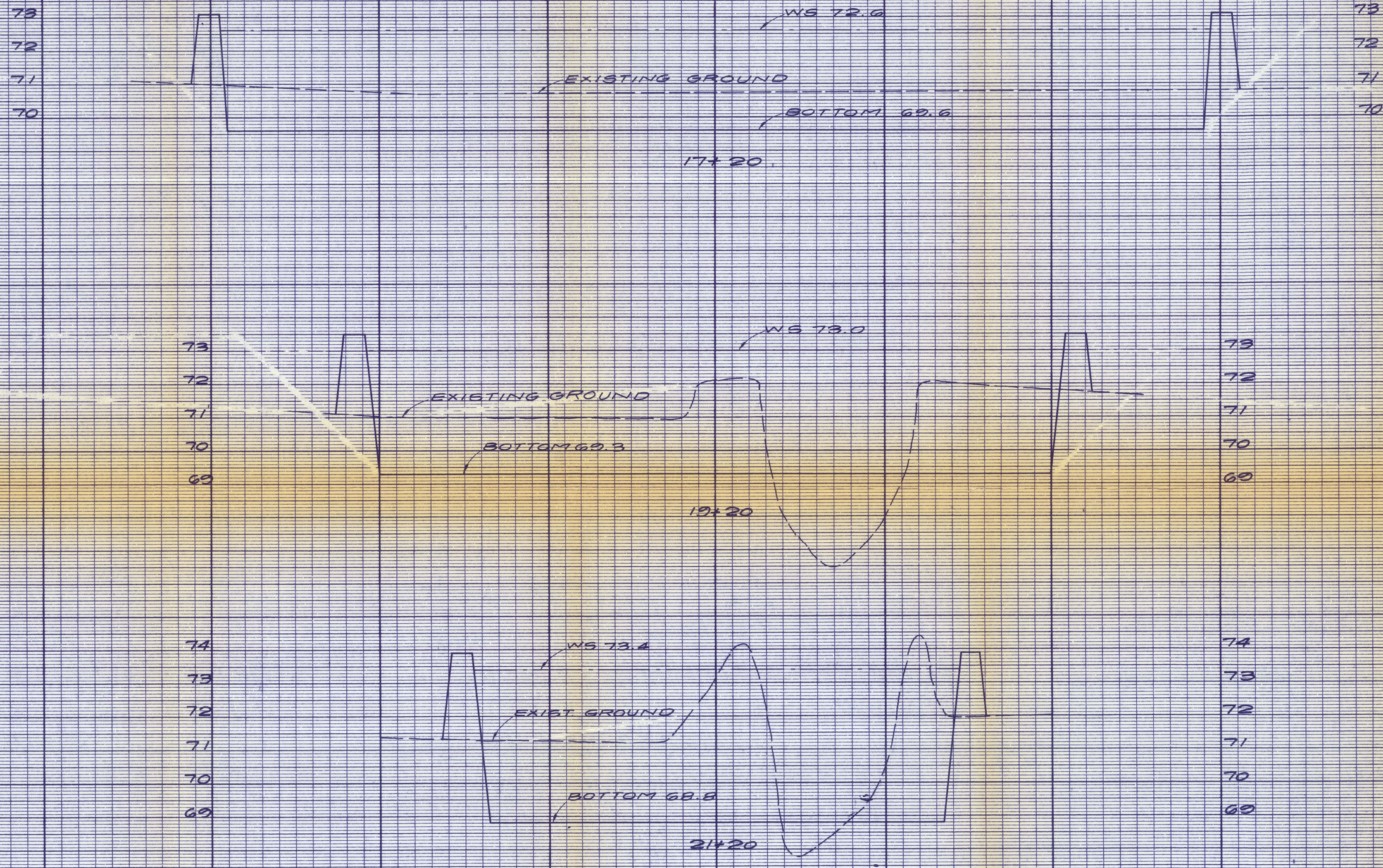
Considering the Salt River Project's Right of Way at the upper end of the existing wasteway as indicated on the drawings the channel banks could be cut nearly to prevailing grade. Such a cut would increase the capacity of the gates and overflow weir because water would overflow the channel more quickly in the event the channel capacity was exceeded. This in turn would provide more safety for the Arizona Canal and make an uncontrolled break less likely. However, somewhat the same legal problems are present for this situation as were discussed previously.

10. PROPERTY AND CONSTRUCTION SURVEYS

Before the right of way can be finalized various parcels will need to be surveyed after the parties concerned have reached general agreement and the corners established where they would be affected by the channel. The Salt River Project has established it's right of way boundary, but at this time, it is not known whether the corners are in place. The location of the property lines on the drawings should be considered as approximate only.

Although the assessment maps indicate the "Indian Bend Wasteway" as a part of the Salt River Project Right of Way, the project advises it has no right of way. It does have authority to make improvements, construct, maintain, enlarge, improve and operate the wasteway under on agreement dating back to 1922. Whether this agreement could be extended to the construction of the facility now contemplated is a matter for legal determination.

Once the channel location has been finalized, detailed cross sections will need to be taken to verify the earth quantities.



SCALE
HORIZONTAL 1"=40'
VERTICAL 1"=2'

ARIZONA CANAL
INDIAN BEND WASH OUTLET CHANNEL
CROSS SECTIONS
16 JULY 1971

CHARLES BRUNING COMPANY
PROFILE PLATE A
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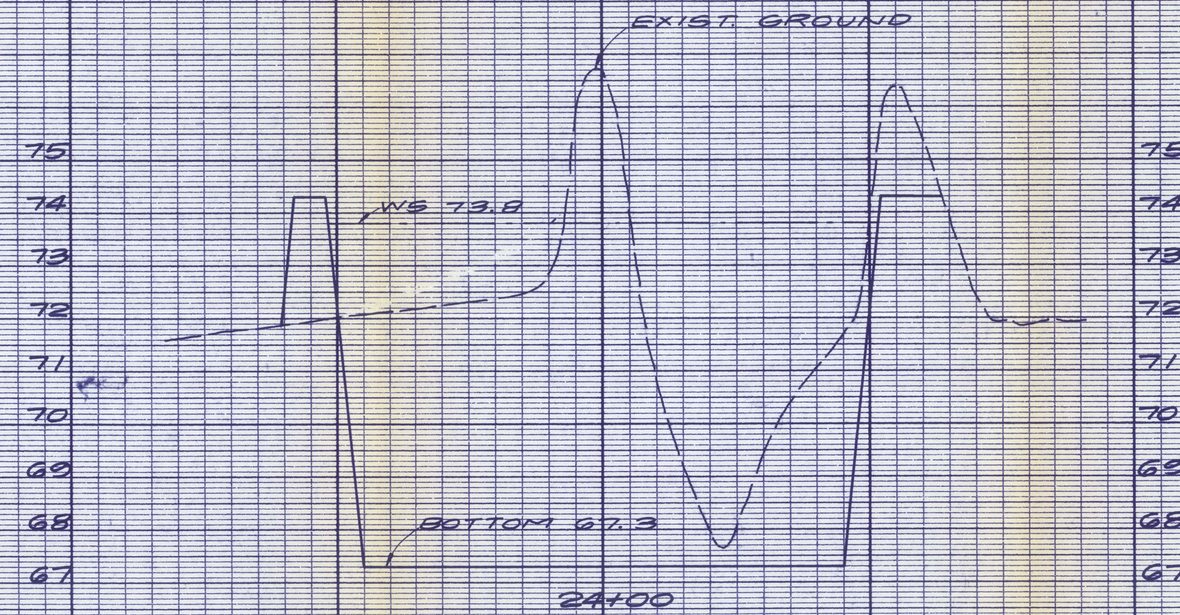

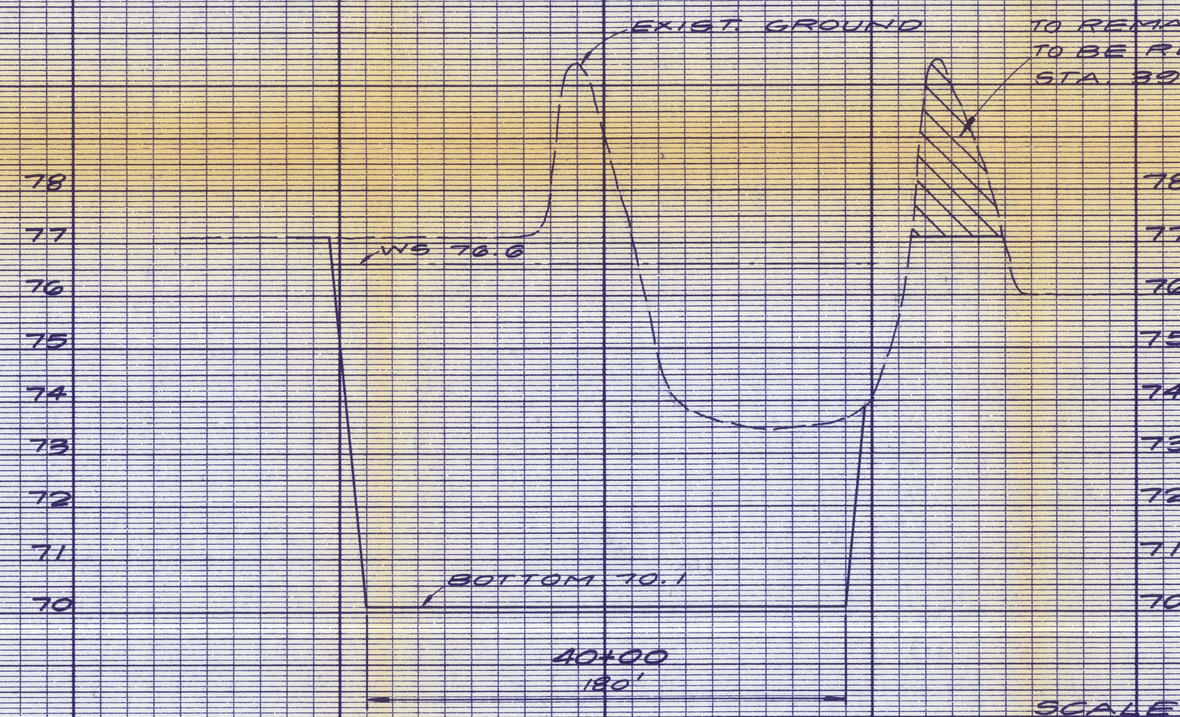

SCALE
HORIZONTAL 1" = 40'
VERTICAL 1" = 2'

ARIZONA CANAL
INDIAN BEND WASH OUTLET CHANNEL
CROSS SECTIONS
16 JULY 1971

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PROFILE PLATE A
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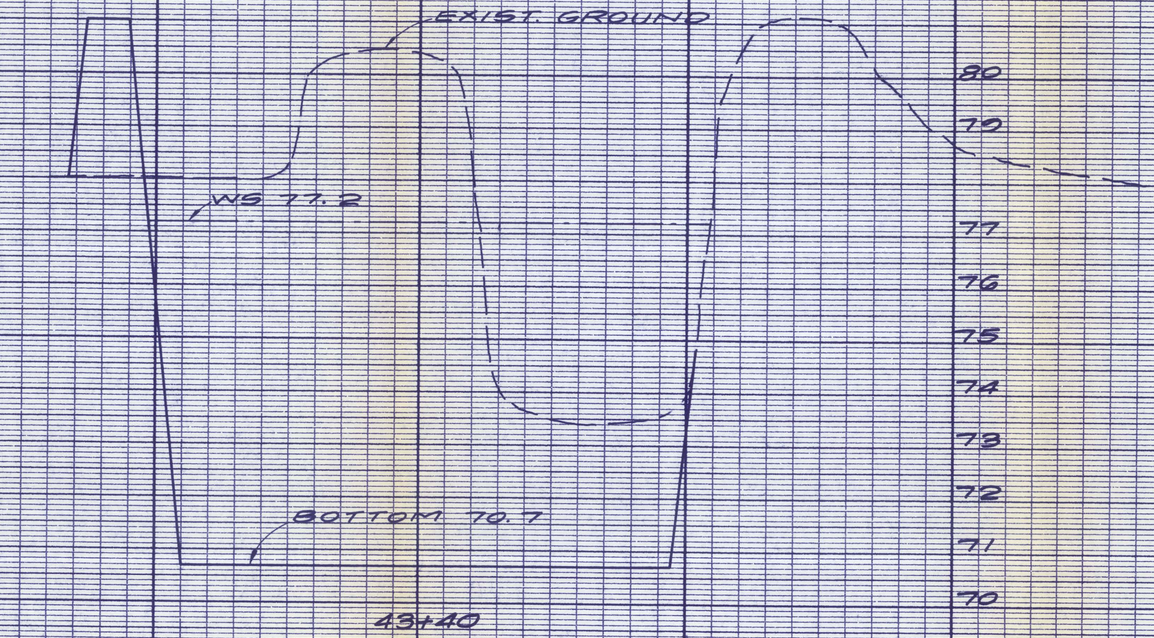

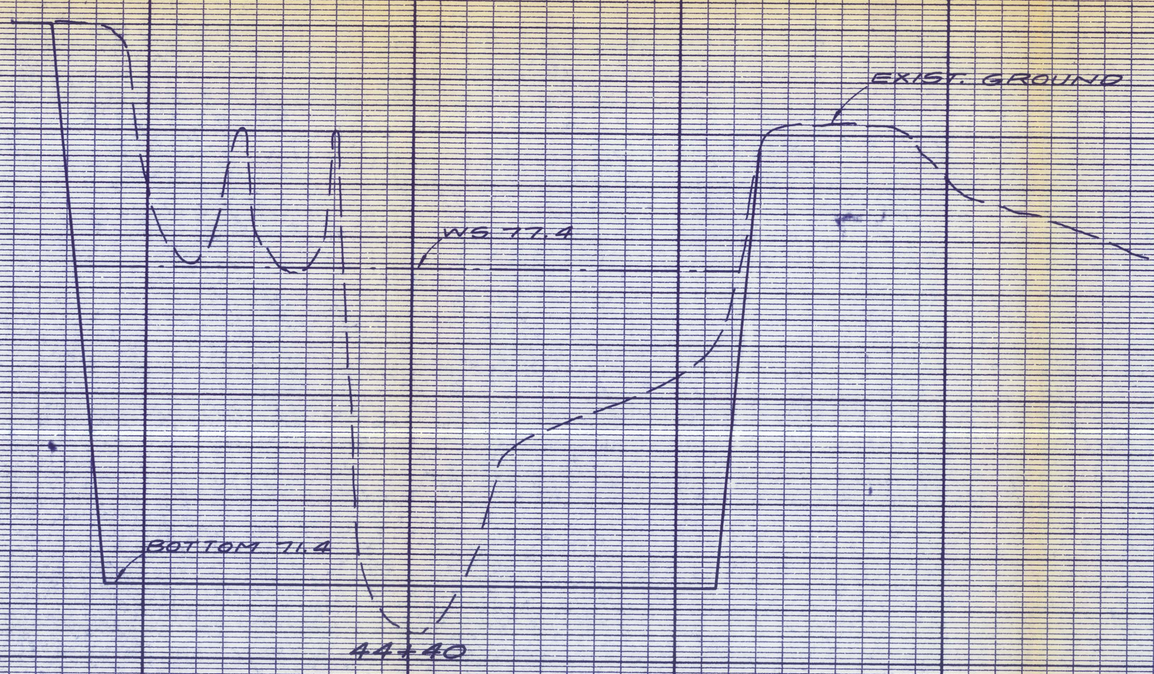

SCALE
HORIZONTAL 1"= 40'
VERTICAL 1"= 2'

ARIZONA CANAL
INDIAN BEND WASH OUTLET CHANNEL
CROSS SECTIONS

16 JULY 1971

CHARLES BRUNING COMPANY
PROFILE PLATE A
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E 2000

E 2400

E 2800

E 3200

E 3600

E 4000

STA. 14+00
TOP BANK 74.3
WS 73.8
BOTTOM 67.3

STA. 12+20
TOP BANK 73.8
WS 73.6
BOTTOM 68.6

STA. 10+20
TOP BANK 73.1
WS 72.6
BOTTOM 60.6

STA. 8+00
TOP BANK
WS
BOTTOM

600'±

GRADE FROM GROUND TO NATURAL ELEV. 60.6

STA. 14+40

FIELD CROP

PILOT CHANNEL

STA. 11+00

STA. 7+00

STA. 4+00

STA. 0+00

2:1 SLOPE — 12' — 2:1 SLOPE

SECTION A-A
NO SCALE

EXTEND PILOT CHANNEL TO DAYLIGHT AT ELEV. 67.0

NORTH
SCALE 1" = 80'

INDIAN BEND WASH OUTLET CHANNEL
ARIZONA CANAL
16 JULY 1971

McDONALD DRIVE

BLEACHERS

POOL

O PIPE

E 2000

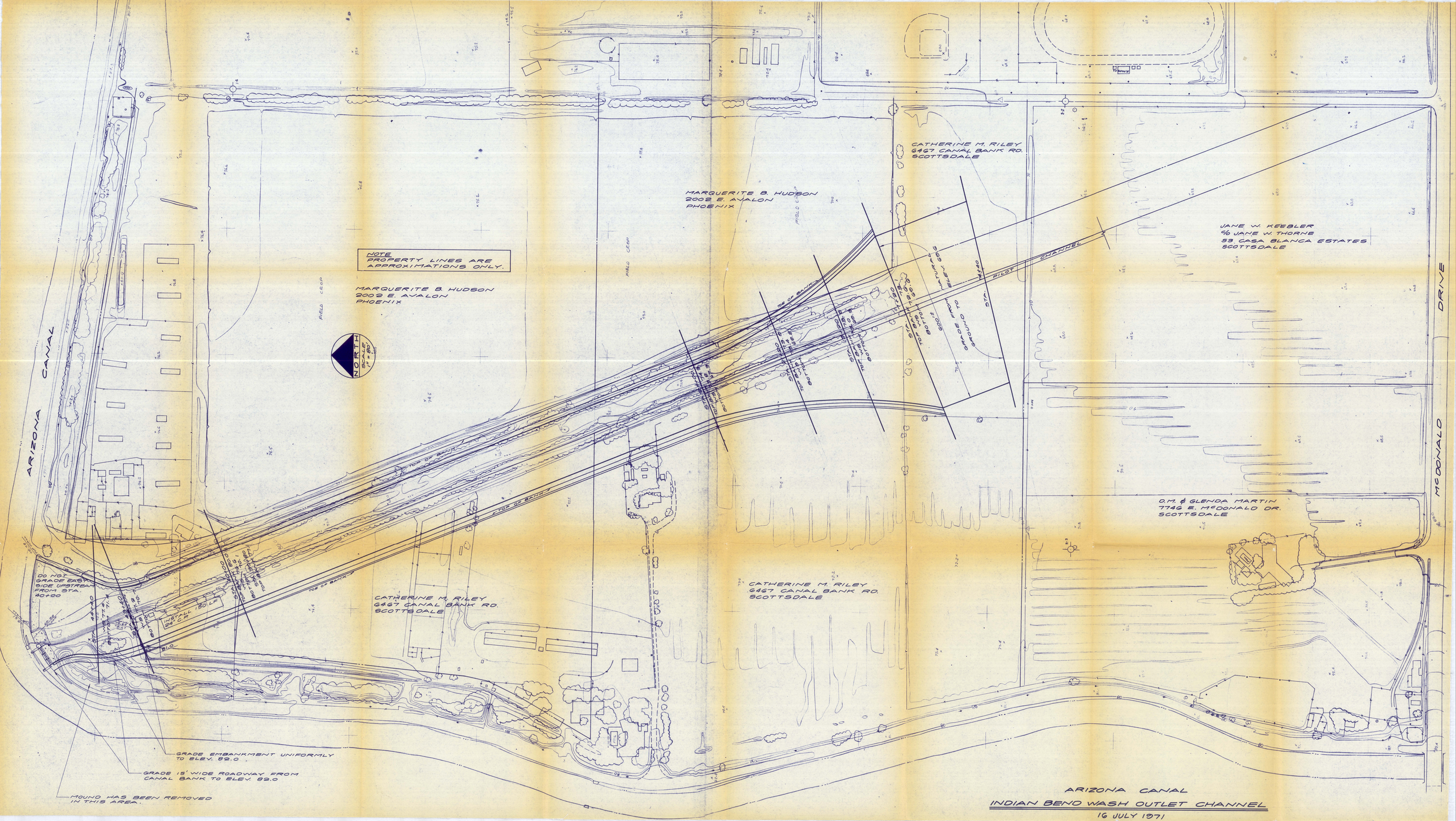
E 2400

E 2800

E 3200

E 3600

E 4000



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INDIAN BEND WASH OUTLET CHANNEL

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