RWCD – REACH 4

DESIGN REPORT
MAY 28, 1985

A121.623

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WEST NATIONAL TECHNICAL CENTER
Design Section
Portland, Oregon
May 28, 1985

DESIGN REPORT

Job : Roosevelt Water Conservation District Floodway, Reach 4
Project : Williams-Chandler W.P.P.
Location : Maricopa County, Arizona
Authority : WF-08
Phase : Final Design

Summary: The design phases of this project have been carried out by the WNTC Staff at the request of the Arizona State Conservationist (SCS-ENG-328 dated 1/19/84).

Description of Job: Major features are:

1. Channel: The primary work consists of enlarging the existing channel from Ray Road (STA 485+88.08) to Queen Creek Road (STA 745+28.47) to 100 yr. capacity. Six thousand feet of trapezoidal reinforced concrete lining will be installed from the junction with the existing Powerline Floodway downstream to Power Road. The remaining channel is excavated earth.

2. Structures:

a. Powerline Drop: This structure is a grouted rock hydraulic jump basin with an overall drop of 7 ft. It is located in the existing Powerline Floodway approximately 445 feet upstream of the junction at STA 490+50.61 of RWCD Floodway

b. Temporary Inlet: A temporary rock lined channel joins the existing floodway and the beginning of Reach 4 near Ray Road.

c. Low Drop: A drop structure (3.35 feet drop) is provided at STA 675+50. This structure is of a type developed at the USDA Sedimentation Laboratory at Oxford, Mississippi. It is a grouted rock lined hydraulic jump basin with addition of a reinforced concrete baffle. The baffle stabilizes the flow through the drop by dampening oscillations in the downstream water surface.

Design Objective: The existing Floodway is being enlarged to provide a stable channel with 100-yr flood frequency capacity.

Basis for Design:

TR 20
Williams-Chandler Watershed Supplemental Work Plan No. 2, March 1978
RWCD Floodway Hydrology Studies, November 1976
RWCD Floodway Update of Hydrology Studies, May 1977
RWCD REACH 4 Hydrology, Side Inlets, December 1984
TR 25

Far West Design Standards
NEH 6

"Stilling Basin Design For Low Drop Structures", ASAE Paper 83-2115

"Model Study of Low Drop Structures", ASCE Journal of Hydraulics Division, October 1982.

"Design and Construction of Low Drop Structures", ASCE Specialty Conference, "Applying Research to Hydraulic Practice", August 1982.

"Stream Channel Stability", USDA Sedimentation Laboratory, April 1981.

ACI 318-83

"Drilled Pier Foundations", Woodward, et al.

Location and Layout: Alignment was constrained to the Rights-of-way delineated on the Right-of-Way Survey Maps developed prior to the design phase of this project. Access along the right side of the floodway between Ray Road and Williams Field Road will be by way of the existing maintenance road within the irrigation canal right of way. The limit of work for Reach 4 was extended upstream approximately 300 feet to provide for a better temporary connection to the existing channel upstream.

Hydrology: The Floodway 100-yr. capacity is as established in the Work Plan Supplement No. 2 and supported by "RWCD Hydrology Studies" and "Update of Hydrology Studies". Side inlet capacities are as developed in "RWCD Reach 4 HYDROLOGY, SIDE INLETS". The locations have been adjusted to fit the floodway layout.

Powerline Floodway 100-yr flow is taken as 3140 cfs, as requested by the Arizona Staff, which corresponds to the value used in the original design.

Hydraulic Design: Standard energy and momentum principles were used in the analysis of the design water surface elevations in the floodway. Grades and cross sections selected follow closely those developed during planning. The Low Drop at STA 675+50 was added to improve channel stability in the portion of the channel from STA 626+00 to the downstream end of Reach 4 at Queen Creek Road at approximate STA 744+00 The channel bottom width was reduced from 200 feet to 175 feet between STA 555+00 and STA 626+00 to provide a more effective section and to improve hydraulics through bridges. Stability in the earth channel was evaluated by tractive power procedures as outlined in TR 25.

Actual tractive powers were computed for the design event. Erodibility of soils along the channel perimeter was evaluated by examining the unconfined compressive strength test results. In portions of the channel where low strengths indicate erodibility, a three foot thick compacted earth lining will be installed. In general, soils characterized as "loose sands" in the

soil investigation logs have inadequate resistance and will be replaced with the lining. In addition some areas, as revealed by the test results, with soils characterized more by low in place density also have inadequate resistance and will be replaced within the limits shown on the drawings. The anticipated extent of lining required has been indicated on the drawings. Any additional areas revealed during construction to have "loose sands" along the channel perimeter should also receive a compacted earth lining.

Test results also indicate that SM, ML, SC, or CL soils obtained from the excavation may be used to construct any of the earthfill, including the channel lining.

Momentum analysis indicates that with the pier configuration of the existing Power Road Bridge at approximate STA 551+00 flow will become supercritical under the bridge and a hydraulic jump will occur immediately downstream at design flow. No adverse effects are anticipated in the channel expansion downstream. Adequate freeboard and channel protection are provided.

Hydraulic proportioning of the Low Drop at STA 675+50 is in accordance with the criteria provided in "Model Study of the Low Drop Grade Control Structures" and the subsequent papers cited above. The entrance to the drop was proportioned to maintain flow at normal depth in the channel upstream for the design Q. The exit incorporates a standard 12.5 deg. flare in the bottom width.

The weir for the grouted rock drop in Powerline Floodway is also proportioned to maintain normal flow depth in the upstream channel at design Q. A recessed basin assures that tailwater will exceed the depth sequent to dl in the entrance chute for all flow conditions. While the jump is in the undular range, no adverse effects are anticipated in the rock riprap lined section downstream.

The geology report indicates that the amount of sediment transported to the floodway should be negligible. Some deposition requiring removal during routine maintenance should be anticipated, however.

Foundation Design: The Low Drop Baffle is supported on a slab/cast-in-place pile foundation. The piles are designed to resist the high lateral hydraulic loads on the baffle as well as the vertical dead loads. A pile foundation was selected as the most efficient approach to carry the combinations of anticipated loads. Cast in place piles have been successfully installed on the highway bridges crossing the Floodway at Rittenhouse and Higley Roads near the site under essentially identical foundation conditions.

The lateral and vertical load capacity for the proposed foundation was analyzed for worst case soil strength values. The drill logs for the adjacent bridge foundations were examined and blow counts correlated.

While the foundation is adequate to resist all anticipated loads and likely soil conditions, additional soil investigation prior to construction is strongly recommended to reveal any conditions which may affect construction. Two drill holes at STA 675+91, 20 feet left and right of centerline, extended

to Elevation 1266 or below, are suggested with continuous recording of blow counts and soil logs.

The pier footings for the existing Power Road Bridge crossing the Floodway at STA 551+00 will be exposed during construction. The top of the footings will be approximately 3 inches below the Floodway invert according to the bridge construction drawings. Additional investigation prior to construction would be advisable to confirm the actual footing locations and elevations and any needed modifications. The Maricopa County Highway Department should review the Floodway drawings to satisfy themselves that the proposed construction will not affect the structural adequacy of the bridge.

Structural Design:

The reinforced concrete channel lining is designed as a slab on grade with minimum section thickness of 6 inches and a single mat of steel bar reinforcement in accordance with NEH 6 criteria. Transverse expansion joints are provided at 100 feet intervals for control of cracking due to concrete shrinkage and thermal expansion. Resilient surface sealant is specified for the joints. The sealant is intended to prevent entry of inelastic material into the joint which may restrict free expansion and contraction. Continuous drainage is provided along the lined section to prevent buildup of excess hydraulic pressure.

The Low Drop Baffle structure was designed in accordance with TR 67 procedures for strength design. Hydraulic loads on the baffle were resolved, including a 1.8 Load Factor, into a 9.7 kip/ft line load acting at mid height of the baffle. The baffle was analyzed as a beam with fixed support at the two buttresses. Mid-span moment was increased to model a restrained rather than fixed condition at these supports.

The buttresses were treated as short cantilever beams carrying the baffle loads into the base slab. The buttress base moments are resisted by torsion and bending in the base slab.

Lateral loads are resisted by the cast in place piles and give rise to shear and bending in the pile and slab. Four structural steel "U" shaped members, placed parallel to the line of flow in the eight drilled holes, are used to resist this bending and to simplify the reinforcement in the cast in place piles. Use of structural sections in cast in place piles is recommended to avoid construction difficulties attendant to installation of reinforcement cages in boreholes (see "Drilled Pier Foundations"). ASTM A 572 grade 50 steel is specified in order to minimize the member cross section. Cover plates are provided for the horizontal member and for the upper portion of the vertical legs to increase moment capacity of the W 16x31 sections. The horizontal member is fitted with end plates for field connection to the vertical legs with a bolted and welded joint as detailed on the drawings. Variation of the borehole center to center spacing from the 10-foot length shown on the drawings is allowed within the tolerances given. If there is a variation, enlargement of the boreholes or fabrication of the horizontal member to the exact length between vertical members will be required in order to assure adequate concrete cover between the vertical member and the sides of the hole.

Working stress design methods were used for the retaining wall between STA 532+20 and STA 534+60. The design assumes that saturation of the embankment behind the retaining wall is not likely to occur during the life of the structure.

The weir crest walls used in the Low Drop and in the Powerline Drop are essentially non-structural diaphragms.

Environmental Considerations: Environmental consequences were analyzed during planning and will be addressed in the landscape plan developed separately from this design. Pollution control is provided for in the contract specifications. It is also required that no disturbance of vegetation occur beyond that required to carry out the work.

Construction Drawings: Several of the drawing sheets were developed with aid of the WNTC CAD system.

Specifications: The specifications follow closely those used for the previously constructed Floodway reaches. Special specifications have been provided for Cast in Place Piles and for Surveys.

The Cast in Place Pile Specification has been adapted from Arizona DOT specifications. No existing SCS specifications were available for this type of construction.

The Survey specification is the same used for the previous contracts.

Bid Schedule: Removal of water has been made subsidiary to the excavation and concrete items.

Concrete for the cast in place piles is covered as an item under the concrete specification subsidiary to the cast in place pile bid item. The cast in place piles are measured on a lineal foot basis.

Cost Estimate: The cost estimate developed here should be reviewed and adjusted to reflect current local costs prior to advertisement.

Operation and Maintenance: O&M will be addressed in a separate O&M Plan. Removal of sediment and debris following major flow events as well as any accumulation from successive smaller flows will be required to maintain the design capacity of the floodway. Accumulations may be expected in the vicinity of the junction with Powerline Floodway, the expansion downstream of Power Road, the Low Drop, and the vicinity of Queen Creek Road.

Periodic inspection of the joints in the reinforced concrete channel lining will be necessary to assure that thermally induced expansion and contraction may occur without damage to the lining. Any loss or deterioration of the joint sealant or filler should be noted and repairs made. Any evidence of loss of drainfill or soil through the drains, or of uplift or offset at joints should also be noted.

Access to the concrete lined section of the floodway has been facilitated by placement of a layer of drainfill material over the rock riprap lining in the

inlet and outlet transitions as shown on the drawings. This method has been successfully used on the Reach 2 Extension. Major flow events will likely require replacement of some material in these approach sections.

The earth channel perimeter should also be periodically examined for loss of material, jugging in localized deposits of dispersive material, sloughing, bank failure, or other excessive change from the design cross section. Surface rilling of the channel banks can be anticipated as a result of direct runoff from rainfall on the banks and adjacent berms.

Rock and grouted rock riprap should be replaced or extended as required should damage occur.

Construction Review: Field review of the following items will be advisable during construction:

1. The Low Drop Baffle Foundation: The State Geologist should be advised of the schedule for excavation of the drilled pile shafts so that the materials and conditions can be logged for an as built geology report. Occurrence of any unusual or unanticipated conditions requiring a modification of the design should be relayed to the State Design Engineer.

2. Compacted Earth Lining: The extent of earth lining will require some adjustment from the extent shown on the drawings. A design or soil mechanics engineer or geologist familiar with the project should be available to the project engineer to assist in determining the actual extent required.

3. Reinforced Concrete Lining: The State Design Engineer should be contacted in the event that the Power Road bridge footings are different than as depicted on the drawings and a modification of the reinforced concrete lining details is required.

WNTC staff will be made available on request for a preconstruction conference or consultation during construction.

David E. Hathaway
SUBMITTED

Leland M. Saale
CONCURRED

Donald E. Wallin
APPROVED

5-30-85
DATE

United States Department of Agriculture

Soil Conservation Service

2021 E. Indianola Ave., Suite 200
Phoenix, Arizona 85012

Subject: ENG-KWCD Floodway Reach 4- Design
Williams-Chandler Watershed, Arizona

Date: December 11, 1984

To: Jack Stevenson, Head, Engineering Staff
Portland, OR

File Code: 210

Attached are the locations and discharges for the side inlets on Reach-4 as requested in your letter of August 6, 1984.

The 100-year discharge for Powerline Floodway calculated to be 2400 cfs while the floodway was designed for a discharge of 3140 cfs. This change has been explained in the backup documentation. We would prefer the outlet structure for Powerline be designed for the original 3140 cfs.

Please have Wendell Styner review the documentation before using in the inlet design.

Ralph M. Arrington [Acting]
State Conservation Engineer

Attachment

cc: Wayne Killgore, ASTC (W)
Joe Knisley, AC, Tucson

Done -
This looks adequate -
GLE 1-3-85

United States
Department of
Agriculture

Soil
Conservation
Service

USDA - Soil Conservation Service
201 E. Indianola, Suite 200
Phoenix, Arizona 85012

Subject: ENG - RWCD Reach-4, Inlet Hydrology

Date: December 6, 1984

To: Ralph Arrington, SCE
Phoenix, AZ

For Code: 210-18

I have completed the hydrologic analysis for Inlet Structures on Reach-4 of the RWCD. This analysis is a modification of Revised Alternate No. 3, TR-20 Program, dated November 1974, used in the Design of the RWCD. The major modifications include: (1) adjusting the areal rainfall for each of the subareas in the reach, (2) redelineation of Williams Field Air Force Base (Subarea 142) into eight separate subareas and computation of peak discharges for selected inlet locations (3) modifying the curve number on irrigated lands in Subarea 150, (4) eliminating Subareas 147 and 148 from Reach-4, since flows from these subareas are diverted into the Queen Creek channel upstream of the small community of Queen Creek and (5) adding Structure Release Rates to uncontrolled drainage discharges on Powerline Floodway. All of these modifications are documented in the back-up data.

The results of the analysis are shown in the following Summary Table, with approximate inlet locations shown on the accompanying map. The 100-year and 10-year, 24-hour peak discharges are also shown on the map to indicate approximate distribution of flow. In Subarea 150, the inlet locations and distribution of flow were difficult to determine, and some modification may be needed based on field surveys at the time of construction.

Should you have any questions, please let me know.

Respectfully submitted,

Harry C Millsaps

Harry C. Millsaps
Hydraulic Engineer

Enclosures

TIME OF CONC'D DRAINAGE AREA

United States Department of Agriculture

Soil Conservation Service

Midwest National Technical Center
Soil Mechanics Laboratory
512 South 7th Street
Lincoln, NE 68508-2919

Subject: ENG - Soil Mechanics - Arizona (WF-08)
RWCD Reach No. 4

Date: October 17, 1984

To: Ralph M. Arrington
State Conservation Engineer
SCS, Phoenix, AZ

File Code: 210-22

Attached are the test results of 21 compaction tests and 43 q_u shear tests. Associated index tests are on the form SCS-ENG-354 (7 sheets).

All of the test specimens, except those tested at molding water content, were saturated by either placing the specimen in a pan of water or passing water through the specimen, using low head, in the triaxial shear test chamber.

The molded specimens were cured either 14 or 28 days at the molding water content.

Lorn P. Dunnigan

LORN P. DUNNIGAN
Head, Soil Mechanics Laboratory

Attachments:
Form SCS-ENG-354, Soil Mechanics Laboratory Data, 7 sheets
Form SCS-ENG-355A, Triaxial Shear Test Data, 43 tests, 43 sheets
Form SCS-ENG-352, Compaction and Penetration Resistance, 21 sheets

cc:
Ralph M. Arrington (Original + 3 copies)
Jack C. Stevenson, Head, Engineering Staff, WNTC, SCS, Portland, OR (ltr. only)
Clifton E. Deal, Soil Mechanics Engineer, Engineering Staff, WNTC, SCS, Portland, OR

West National Technical Center
511 N. W. Broadway, Room 514
Portland, Oregon 97209-3489

ENG - Trip Report - RWCD Floodway, Apache-Gilbert and Williams-Chandler WPP, Arizona

October 3, 1984

Verne Bathurst, State Conservationist,
SCS, Phoenix, Arizona

Purpose

The purpose of this trip was to meet with the project staff and discuss the drawings and specifications prior to the start of construction on RWCD Floodway Reach 3, and to visit the site of Reaches 4 and 5. Additionally, we were to discuss aspects of the design of these two Reaches with the Arizona and Maricopa County Flood Control Districts.

Participants

William Payne, State Design Engineer, Phoenix, Arizona
David Thackeray, Civil Engineer, WNTC, Portland, Oregon
John Harrington, Project Engineer, Chandler, Arizona

Findings and Recommendations

1. The onsite review of Reach 4 and Reach 5 south of Guadelupe Road was made on the afternoon of September 26, 1984. Photographs of bridge crossings and other features were made for reference during design.

2. A meeting with the staff at the Chandler Project Office was held from 8:30 to 11:00 a.m. on September 27 to discuss the drawings and specifications for Reach 3. Questions regarding the design, minor corrections to, and interpretation of some aspects of the drawings were discussed and resolved.

3. At the monthly coordination meeting with representatives of the Maricopa County Flood Control District, Arizona Water Resources Department, and the SCS State staff held on the arternoon of September 27, some items relating to the design of RWCD Floodway Reaches 4 and 5 were discussed.

a. The work plan indicate that some provision for diverting floodwater to the RWCD canal from the floodway is to be made in the vicinity of the junction with the powerline floodway. Some follow-up will be needed in Arizona to determine what the canal district's requirements are.

b. Construction on the Southern Pacific Railroad Bridge relocation adjacent to Rittenhouse Road is expected to begin this month (October, 1984). The FCD will ask the railroad for a more legible copy of the drawings for the relocation.

c. General progress and scheduling on the design of Reaches 4 and 5 were discussed.

4. The design staff at the WNTC had requested the Arizona FCD staffs to consider a proposed soil-cement lining as an alternate to the reinforced concrete lining recommended in the work plan for the portion of Reach 4 adjacent to Williams Field. This proposal was discussed with Ralph Arrington, State Conservation Engineer; William Payne, State Design Engineer; Nick Karan, Chief, Engineering Division, FCD; Bob Payette, Chief of Maintenance, FCD and R.W. Shobe, Project Engineer, FCD. The FCD staff had concerns over the use of soil cement in this application including:

a. The lack of precedent and experience with its use in channel linings.

b. Uncertainty of maintenance requirements.

c. Possible wear of or deterioration due to maintenance equipment operating in the floodway.

d. The small savings in cost over the R/C lining alternate.

However, it was generally agreed that with further study and experience, soil-cement may prove to be a viable alternate in similar future applications and that use of soil-cement in lieu of loose or grouted rock riprap would be acceptable in portions of this job.

Conclusion

In the interest of expediting design work on Reach 4, the soil-cement lining alternate will be dropped and R/C lining will be used.

I appreciated the opportunity to meet with the project staff prior to construction. The mutual exchange of information regarding the Reach 3 project will be beneficial in the construction of this Reach and in the design of future Reaches of the floodway. The site visit and discussions with your staff and the sponsors will be helpful in carrying out the design.

David D. Thackeray

DAVID D. THACKERAY
Civil Engineer

cc:
Donald E. Wallis, Head, Design Unit, WNTC
Jack Stevenson, Head, Engineering Staff, WNTC

SPEED MEMO

3

9/24/[illegible]

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RE: [illegible] [illegible]
WILLIAMS [illegible]
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[illegible] ARE [illegible] HYDRAULICS AND A [illegible] [illegible] [illegible] [illegible] OF A [illegible] [illegible] YOUR REQUEST.

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RETURN TO SENDER

United States
Department of
Agriculture

Soil
Conservation
Service

Room 3008 Federal Building
230 North First Avenue
Phoenix, Arizona 85025

Subject: ENG-RWCD Floodway Reach 4, Williams-Chandler Watershed, Arizona

Date: August 28, 1984

To: Jack Stevenson, Head Engineering Staff, WNTC

File Code: 210

In response to your letter of August 6, 1984 the following comments are made:

1. Hydrology - We have requested the services of our hydrologist, and the side inlet hydrology will be submitted to you on or about October 1, 1984.

2. Powerline Floodway - Under separate cover we are sending the plans and geology for Powerline. If you need more information we will try to locate specific items for you.

3. Southern Pacific Railroad Bridge - You have all there is, standard bridge drawings, small sizes. The bridge is ready to be built but due to flooding in other areas the construction has been delayed for an indeterminate time. We will let you know when construction gets underway.

4. Aerial Photo - We are sending one photo numbered 2 - 5 which should give you stereo coverage.

5. No comment at this time on the R/C lined section.

6. Plan and Profile - The Plan and Profile vinyls are being sent under separate cover. This also satisfies the last item requested in No. 1 of your letter of June 11, 1984.

We appreciate the progress you are making on this project.

Ralph M. Arrington
State Conservation Engineer

cc: Verne M. Bathurst
Wayne Killgore
Joe Knisley

United States Department of Agriculture
Soil Conservation Service
Room 3008 Federal Building
230 North First Avenue
Phoenix, Arizona 85025

Subject: ENG-RWCD Reach 4-Basic Design Data

Date: July 19, 1984

To: Jack Stevenson, Head Engineering Staff, WNTC

File Code: 210

We are transmitting the material requested in your letter of June 11, 1984, specifically Items 3 and 4.

The rest of the material in Item 1 will be sent as soon as we receive it from the surveyor. Estimate a minimum of 30 days before we can send it.

Ralph M. Arrington
State Conservation Engineer

cc: Verne Bathurst
Wayne Killgore
Joe Knisley

West National Technical Center
511 N. W. Broadway, Room 514
Portland, Oregon 97209-3489

ENG - RWCD Floodway Reach 4 - Williams-Chandler Watershed - Basic Design Data, Arizona

June 11, 1984

Ralph Arrington, State Conservation Engineer,
SCS, Phoenix, Arizona

We need additional basic data to enable us to proceed with the design of Reach 4 as follows:

1. The engineering survey data including: The alignment survey, profile and cross section data, horizontal control survey, bench mark information, contact prints of the aerial photography, plan and profile base sheets (if these were developed), copies or original survey notebooks, and copies of any survey computations.

2. A full set of the right-of-way drawings and any other pertinent right-of-way information.

3. As built drawings and any available geologic information for the following bridges crossing Reach 4:

   A. Williams Field Road at approximate station 543+27.

   B. Powers Road at approximate station 547+85.

   C. Southern Pacific RR at approximate station 596+49.

   D. Rittenhouse Road at approximate station 558+00.

   E. Higley Road at approximate station 715+53.

4. Any available drawings or information regarding: The jet fuel line, at approximate station 607+90, the water main crossing at approximate station 588+70.

We are requesting the NTC at Lincoln, Nebraska to perform additional testing on the Reach 4 samples sent to the lab earlier. We will send you a copy of this request.

Please send any of the above information you have readily available at your earliest convenience, and the remaining as it can be obtained.

JACK O. STEVENSON
Head, Engineering Staff

cc:
Verne Bathurst, State Conservationist,
SCS, Phoenix, Arizona
Donald E. Wallin, Head, Design Unit, Engineering, WNTC

DThackeray:bb

United States Department of Agriculture

Soil Conservation Service

517 Gold Avenue, S.W.
Room 3301
Albuquerque, NM 87102-3157

Subject: ENG - Design - Transfer of RWCD #4 Design Materials to WNTC

Date: March 1, 1984

To: Jack C. Stevenson
Head, Engineering Staff
West National Technical Center
USDA, SCS - Room 514
511 N.W. Broadway
Portland, OR 97209

File Code: 210-13-0

Enclosed are the materials listed below which the New Mexico State office has either obtained or developed regarding the RWCD #4 Floodway in Arizona:

1. "Report of Supplemental Geologic Investigation and Sampling of RWCD Floodway, Reach #4" by Rufus Meadows, June, 1983
2. Notebook (green) of Correspondence
3. "Report of Geologic Investigation - RWCD Floodway" by A.C. Sanders, December, 1973
4. Williams-Chandler W/S Work Plan, January 1963
5. Williams-Chandler W/S Work Plan, Supplement, March, 1978
6. Subsurface Profile of Reaches 1 thru 5 (Sanders)
7. Geologic Correlation of Reach #4 (Sanders)
8. Plot of all Geologic Sampling Reach #4 (Wood)
9. Mylar of Meadow's GI Profile for Report
10. Mylar of 1983 GI Profile
11. Plan & Profile RWCD Floodway, Sheets 14-17 of 26
12. Channel Right of Way, Sheets 1-3 of 3
13. Channel R-O-W, Sheets 2-4 & 6, 7, 9 of 9
14. Channel R-O-W, Sheets 2, 3 & 5 of 5
15. Folder of GI logs and SM Testing Program

J. Gordon Odell
State Conservation Engineer

Enclosures
cc: w/o Enclosures
Ray T. Margo, Jr., State Conservationist, NM50
Verne Bathurst, State Conservationist, Phoenix, AZ

United States Department of Agriculture

Soil Conservation Service

Room 3008 Federal Building
230 North First Avenue
Phoenix, Arizona 85025

Subject: ENG-Roosevelt Water Conservation District-Reach 4 Date: Febraury 23,1984

To: Lorn Dunnigan, Head Soil Mechanics, Lincoln,NE File Code: 210

This letter is to document our request that identification tests on soil samples from RWCD-Reach 4 be made on the undisturbed (core) samples unless the only sample of any one number is a disturbed (bag) sample.

The purpose of the core samples was for unconsolidated undisturbed tests (q_u). No shear tests or consolidation tests are anticipated at this time, though some other testing might be requested on any samples high in organic material or fine grained and very porous in appearance when removed from the packaging at the lab. This is a floodway with probable cut and fill limits of approximately eight feet, respectively.

Further tests will be requested by the designers after they receive your identification test results.

As for the duplication of sample numbers, designate the undisturbed (bag) samples with a B and the disturbed (core) samples with a C.

Sample: 2401.1B and 2401.1C

If you have any additional questions, contact me or Susanne Leckband, FTS 261-6711.

Ralph M. Arrington
State Conservation Engineer

cc: Don Wallin, WNTC, DE
Greg Cunningham, NM, SDE
Bill E. Payne, AZ, SDE
Jim Talbot, N.O., SME
Clifton Deal, WNTC, SME
Susanne Leckband, AZ, SME

SCS-ENG-328
REV. 3-74

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

REQUEST FOR SERVICES OF DESIGN SECTION

ENGINEERING AND WATERSHED PLANNING UNIT

FROM
State Conservation Engineer

DATE
January 19, 1984

STATE
Arizona

COUNTY OR SCD
Maricopa

REQUESTED DELIVERY DATE
March 1, 1985

JOB NAME
RWCD Reach 4

BUDGET DESIGNATION
WP-03

ESTIMATED CONSTRUCTION COST
$6,725,000.00

SIGNATURE Ralph M Arnold
(STATE CONSERVATION ENGINEER)

1 LIST OF MATERIAL SUBMITTED

(A) CARTOGRAPHIC REQUISITION (SCS-19) NO. To be submitted by New Mexico State Office

1. Plan and profile vinyl sheets Rec'd 1-24-84

2. Geological Investigation

3. Soil Mechanics Testing

4. Work Plan Information

DESCRIPTION OF SERVICES REQUIRED

Total design of project ready for contract.

Field and site reviews to be arranged as needed.

RETURN ORIGINAL MATERIAL TO:

SEND (NUMBER) CHECK PRINTS TO:

SEND (NUMBER) FINAL PLANS TO:

Midwest National Technical Center
Soil Mechanics Laboratory
[illegible] 7th Street
Lincoln, NE 68508

NC - Soil Mechanics - Arizona, WF-08
Williams Chandler RCCD
Reach III Floodway

Date August 16, 1982

~~Ralph M. Arlington~~
~~State Conservation Engineer~~
~~Soil Conservation Service~~
~~Phoenix, AZ~~

Job Code 210-22

The unconfined compression tests and the mechanical analyses requested for the samples from the above channel study have been completed and the test results are summarized on the attached reporting forms.

TORN P. PENNINGTON, P.E.
Soil Mechanics Laboratory

Attachments:
- SCS-SG-354, Soil Mechanics Laboratory Data, 1 sheet
- SCS-SG-355A, Triaxial Shear Test Data, 8 tests, 8 sheets

cc:
Ralph M. Arlington (Original + 3 copies)
Jack C. Stevenson, Head, Engineering Staff, MWTC, SCS, Portland, OR (1 copy)
Donald E. Gallin, Acting Soil Mechanics Engr., MWTC, SCS, Portland, OR

FINAL

WILLIAMS-CHANDLER WATERSHED

ARIZONA

SUPPLEMENTAL WATERSHED PLAN AGREEMENT NO. 2

AND

SUPPLEMENTAL WATERSHED PLAN NO. 2

MARCH 1978

STREAM CHANNEL STABILITY

APPENDIX B

MODEL STUDY OF THE LOW DROP GRADE CONTROL STRUCTURES

Project Objective 1

by

W. C. Little and J. B. Murphey

USDA Sedimentation Laboratory
Oxford, Mississippi

April 1981

Prepared for
US Army Corps of Engineers Vicksburg District
Vicksburg, Mississippi

Under
Section 32 Program Work Unit 7

Reprinted from the Proceedings of the Conference
Applying Research to Hydraulic Practice
ASCE/Jackson, Mississippi/August 17-20, 1982

Design and Construction of Low Drop Structures

W. C. Little[1/], M. ASCE and Robert C. Daniel[2/]

Abstract

Hydraulic design criteria for low drop channel grade control structures are reviewed. Guidelines and experiences in structural design, layout and construction are given. The hydraulic performance of a field structure is discussed. These low drop structures overcome the problems associated with low drop structures at high discharges where undulating waves are normally generated. A rock lined stilling basin with either a baffle pier or plate is provided to dissipate the energy through the drop.

Introduction

Streams in northwestern Mississippi are incising into flood plains which are composed of several strata of fine grained alluvium of redeposited loess. These fine materials overlie unconsolidated sands and gravels. Vertical overfalls or knickpoints form and work upstream when a reach of channel erodes or is dug through the fine grained material, exposing the sands and gravels. As the headcut moves upstream, the height of overfall increases, leaving the downstream channel at a lower gradient. These headcuts vary in height from a fraction of a meter to several meters and move sporadically upstream as large runoff events occur. As they move farther upstream and become higher, bank instability problems become acute and large volumes of bank material are lost during extreme runoff events from mass bank failures.

These vertical headcuts present a great need for in-channel gradient control structures to halt the upstream migration of the headcuts and consequent loss of cropland from widening channels.

Review of Hydraulic Design Procedures

Prior to 1980, hydraulic design procedures were not available for low drop, channel grade control structures. However, the need was so great that many action agencies designed and constructed structures which functioned as low drop structures. The authors observed the early attempts to provide bed control through low drop structures in Mississippi, Georgia, and South Carolina. The majority

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MODEL STUDY OF LOW DROP GRADE CONTROL STRUCTURES

By W. C. Little,[1] M. ASCE and J. B. Murphey[2]

ABSTRACT: A generalized model study was conducted on low drop, grade control structures. A low drop was defined from this study as an hydraulic drop with a difference in elevation between the upstream and downstream channel beds, H; a discharge, Q; and a corresponding critical depth, Y_c, such that the relative drop height, H/Y_c, is equal to or less than 1.0. Conversely a high drop is defined as one with a relative drop height, H/Y_c, greater than 1.0. Tentative design criteria, in the form of dimensionless equations, are given to proportion and hydraulically design the stilling basin for low drops with energy dissipation devices. A method is given to determine the size and placement of a baffle pier or baffle plate to achieve optimum flow conditions in the downstream channel.

INTRODUCTION

Streams and rivers incised and flowing through alluvial valleys many times have little or no natural bed material, such as rock outcrops, to serve as bed control. Such is the case with a majority of the streams located within the Yazoo basin. These streams flow west through the bluffline into the Mississippi Delta. The streams in the hills have steep channel gradients and flow through valleys that are alluvial. During the past 50 years, a majority of these streams have degraded seriously. Degradation has occurred as a result of surface erosion of the bed but most often by the upstream progression of headcuts or overfalls. Because valley deposits of the Yazoo basin are highly stratified, overfalls are created when the stream breaks through a resistant layer of dense silt or clay into a layer of unconsolidated sand or gravel. The erosive energy of the flow is concentrated at the overfall. Headcuts are prevalent throughout the upland portion of the Yazoo basin, and several headcuts may be active on a stream system simultaneously.

The channel gradient downstream from the headcut is reduced as the headcut moves upstream, thereby increasing the height of the overfall. These headcuts generally range from about 0.3 m where they originate up to 1.5 m as they move

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STILLING BASIN DESIGN FOR LOW DROP STRUCTURES

by

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For presentation at the 1983 Summer Meeting
AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

Montana State University
Bozeman, Montana
June 26-29, 1983

SUMMARY:

Rectangular shaped stilling basins for low drop grade control structures were investigated. Design criteria for the length and width of basin are given to supplement other previously established design criteria.

American Society of Agricultural Engineers

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NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

ARIZONA RWCD RH

DT 11/26/85

CHANNEL HYDRAULICS SUMMARY

DESCRIPTION	STATION	INV. EL	S	n	b (FT)	Z	Q (cfs)	d (FT) 100yr	WS EL
END TRANSITION	744+00	1299.62	0.0003	0.027	200	3	6900	8.45	1308.07
BEGIN "	742+00	1299.68	0.0006		150			8.32	1308.00
GRADE CH. (EMBED)	720+00	1301.00	0.0005					8.20	1309.20
HIGLEY RD. BR.									
	676+97.5	1303.15						8.48	1311.63
DS DROP	676+22.5	1303.19							
US DROP	675+50	1306.54	0.0005						
	675+00	1306.57						8.42	1314.99
END TRANS (EMBED)	627+00	1308.97						8.47	1317.44
BEG. TRANS: GR. CH.	626+00	1309.02	0.00025		175			8.54	1317.56
	596+00	1309.77				3 to 2	6500		
END BOX: SIDEWARP	555+20								
END TRANS: BEG WARP	555+00	1310.80			175	2		8.99	1319.79
					8:1 flare				
END	554+00	1310.83			125				
5521.50 END	553+00	1310.85			75				
GROUTED RIPRAP	552+40	1310.86	(-0.01425)		68.33				
	552+00	1310.29		12:1 N	61.67				
BEG. TRANS; END R/C	551+50	1310.34	0.0009		50			8.18	1318.52
U.S. POWER RD	550+50	1310.43		0.014				8.70	1319.13
U.S. WMS ELD RD	542+60	1311.14						8.87	1320.01
R/C	496+00	1315.33							
	495+35	1315.39							
	494+15.6	1315.50			50				
R/C TRANSITION D.S. R/C TRANS.	493+75.6	1315.53	0.00831					8.65	1324.18
U.S. R/C TRANS.	491+50.6	1317.40	0.0003		150			8.23	1325.63
U.S. JCT —	489+30	1317.47		.027		3	5900	8.83	1326.30
BEG. CHANN.	485+88.08	1317.57						8.88	1326.45
BEG. TEMP INL.	485+13.08	1320.00						—	

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = 0.0 lbs.

Retardation pressure of friction = 7,050.4 lbs.

Momentum of moving mass of water in upstream channel = 43,310.2 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 642.9 lbs.

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

SUBCRITCAL

#2

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 200.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	4,100 cfs.	6,500 cfs.	2,400 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	2.80 ft.	3.78 ft.	2.92 ft.
DEPTH =	8.94 ft.	8.65 ft.	8.94 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 419,086.0 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = -0.0 lbs.

Retardation pressure of friction = 5,441.8 lbs.

Momentum of moving mass of water in upstream channel = 20,595.3 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 10,116.0 lbs.

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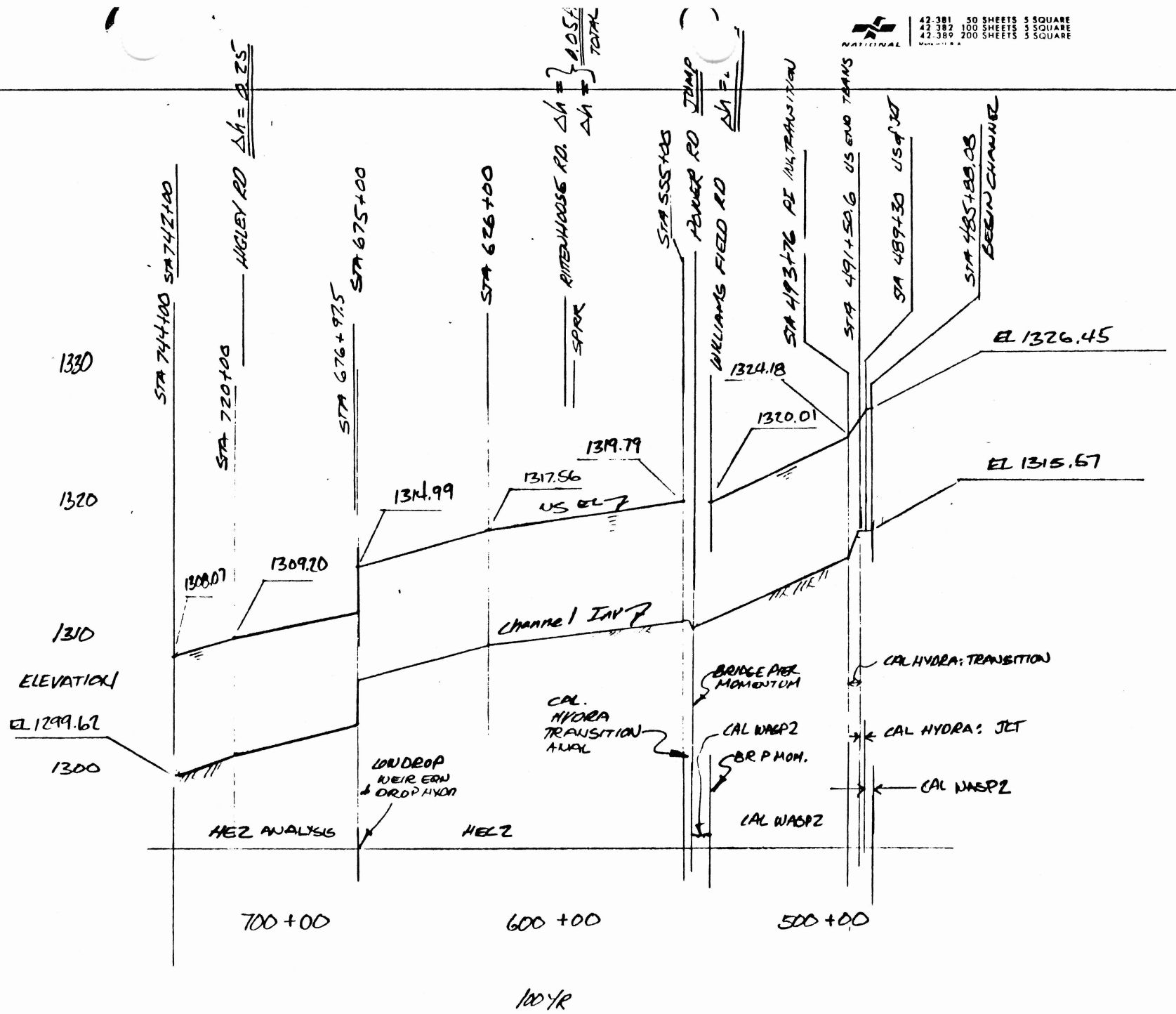
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL



ARIZONA RWCD REACH 4

DT 4/85

HYDRAULIC DESIGN SUMMARY

COMPUTATION SHEET
SCS–ENG–522 REV. 3–69

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
GPO: 1984—O-337-998

STATE ARIZ		PROJECT PIDCO RCH 4		
BY DTHACKERAY	DATE 5/14/84	CHECKED BY ✓	DATE	JOB NO.
SUBJECT				SHEET ____ OF ____

PRELIM DRWGS L. BARTON 12/74 ET. AL

STATION	n	s	b	d	a	V	Q
470+00							
501+00	0.027	0.00025	170	8.5	1661	3.6	5900
502+29	0.027	0.00124	170	8.4	1626	3.6	5900
503+49	0.037	0.00025	170	8.4	1645	4.0	6500
	ROCK TRANS						
495+90 = (506+50	CONC TR 0.014	0.0009	50	8.8	591	11.0	6500
548+55)							

CONC ch

(505+00 APACH JCT - GILBERT
494+40 WILLIAMS - CHANDLER)

548+55	ROCK TRANS						
552+05	0.027	0.000154	200	8.6	1950	3.3	6500
595+00	0.027	0.000154	200	8.1	1825	3.8	6900
635+00	EARTH TRANS						
636+13	0.027	0.00097	150	7.1	1200	5.7	6900
765+00							

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*  WATER SURFACE PROFILES                                *
*  VERSION OF NOVEMBER 1976                              *
*  UPDATED MARCH 1982                                    *
*                                                        *
*  RUN DATE   120584   TIME   122101                     *
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****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  THE HYDROLOGIC ENGINEERING CENTER   *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616             *
*  (916) 440-2105 (FTS) 448-2105       *
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12/5/84 RUN 002

744+00 TO 676+22.5

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X      X  X         X     X            X     X
X      X  X         X                        X
XXXXXXX   XXXX      X          XXXXX     XXXXX
X      X  X         X                    X
X      X  X         X     X              X
X      X  XXXXXXX   XXXXX                XXXXXXX
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  HEC2 RELEASE DATED NOV 76 UPDATED MARC 1982
  ERROR CORR -  01,02,03,04,05
  MODIFICATION -  50,51,52,53,54,55
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  ERROR CORR -  01,02,03,04,05
  MODIFICATION -  50,51,52,53,54,55
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T2      WATER SURFACE PROFILE
T3      RWCD REACH 4 MODIFIED

J1  ICHECK     INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

       0.        0.        0.        0.   .000000       .00       .2    6900.   308.070      .000

J2  NPROF      IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

    -1.000      .000      .000      .000      .000      .000      .000      .000      .000      .000


NC      .027      .027      .027      .000      .000      .000      .000      .000      .000      .000
X1  74400.000     4.000      .000   260.000      .000      .000      .000      .000      .000      .000
GR    309.620      .000   299.620    30.000   299.620   230.000   309.620   260.000      .000      .000

X1  74360.000     4.000      .000   250.000    40.000    40.000    40.000      .000      .000      .000
GR    309.630      .000   299.630    30.000   299.630   220.000   309.630   250.000      .000      .000

X1  74320.000     4.000      .000   240.000    40.000    40.000    40.000      .000      .000      .000
GR    309.640      .000   299.640    30.000   299.640   210.000   309.640   240.000      .000      .000

X1  74280.000     4.000      .000   230.000    40.000    40.000    40.000      .000      .000      .000
GR    309.660      .000   299.660    30.000   299.660   200.000   309.660   230.000      .000      .000

X1  74240.000     4.000      .000   220.000    40.000    40.000    40.000      .000      .000      .000
GR    309.670      .000   299.670    30.000   299.670   190.000   309.670   220.000      .000      .000

X1  74200.000     4.000      .000   210.000    40.000    40.000    40.000      .000      .000      .000
GR    309.680      .000   299.680    30.000   299.680   180.000   309.680   210.000      .000      .000

X1  74000.000     4.000      .000   210.000   200.000   200.000   200.000      .000      .000      .000
GR    309.800      .000   299.800    30.000   299.800   180.000   309.800   210.000      .000      .000

X1  73000.000     4.000      .000   210.000  1000.000  1000.000  1000.000      .000      .000      .000
GR    310.400      .000   300.400    30.000   300.400   180.000   310.400   210.000      .000      .000

X1  72000.000     4.000      .000   210.000  1000.000  1000.000  1000.000      .000      .000      .000
GR    311.000      .000   301.000    30.000   301.000   180.000   311.000   210.000      .000      .000
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X1	71810.000	10.000	6.000	372.000	190.000	190.000	190.000	.798	.000	.000
GR	319.230	.000	317.000	6.000	310.000	28.000	310.000	62.000	301.100	95.000
GR	301.100	283.000	310.000	316.000	310.000	350.000	317.000	372.000	319.230	378.000
SB	.900	1.600	2.800	.000	150.000	6.000	2950.000	3.000	301.140	301.100
X1	71730.000	.000	.000	.000	80.000	80.000	80.000	.798	.040	.000
X2	.000	.000	1.000	317.300	319.300	.000	.000	1.330	.798	.000
BT	7.000	.000	319.230	317.230	63.000	319.480	317.480	126.000	319.640	317.640
BT	188.000	319.690	317.690	251.000	319.640	317.640	314.000	319.480	317.480	376.000
BT	319.230	317.230	.000	.000	.000	.000	.000	.000	.000	.000
X1	71500.000	4.000	.000	210.000	230.000	230.000	230.000	.000	.000	.000
GR	311.250	.000	301.250	30.000	301.250	180.000	311.250	210.000	.000	.000
X1	71000.000	.000	.000	.000	500.000	500.000	500.000	.000	.250	.000
X1	70000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.500	.000
X1	69000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.500	.000
X1	68000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.500	.000
X1	67622.000	.000	.000	.000	377.500	377.500	377.500	.000	.190	.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

*SECNO 74400.000

74400.00	8.45	308.07	.00	308.07	308.27	.20	.00	.00	309.62
6900.	0.	6900.	0.	0.	1904.	0.	0.	0.	309.62
.00	.00	3.62	.00	.027	.027	.027	.000	299.62	4.65
.000295	0.	0.	0.	0	0	0	.00	250.70	255.35

*SECNO 74360.000

74360.00	8.43	308.06	.00	.00	308.29	.22	.01	.00	309.63
6900.	0.	6900.	0.	0.	1818.	0.	2.	0.	309.63
.00	.00	3.80	.00	.027	.027	.027	.000	299.63	4.68
.000326	40.	40.	40.	1	0	0	.00	240.65	245.32

*SECNO 74320.000

74320.00	8.41	308.05	.00	.00	308.30	.25	.01	.00	309.64
6900.	0.	6900.	0.	0.	1726.	0.	3.	0.	309.64
.01	.00	4.00	.00	.027	.027	.027	.000	299.64	4.76
.000365	40.	40.	40.	2	0	0	.00	230.47	235.24

*SECNO 74280.000

74280.00	8.38	308.04	.00	.00	308.32	.28	.02	.00	309.66
6900.	0.	6900.	0.	0.	1635.	0.	5.	1.	309.66
.01	.00	4.22	.00	.027	.027	.027	.000	299.66	4.86
.000413	40.	40.	40.	2	0	0	.00	220.27	225.14

*SECNO 74240.000

74240.00	8.35	308.02	.00	.00	308.33	.31	.02	.00	309.67
6900.	0.	6900.	0.	0.	1546.	0.	6.	1.	309.67
.01	.00	4.46	.00	.027	.027	.027	.000	299.67	4.94
.000467	40.	40.	40.	2	0	0	.00	210.12	215.06

*SECNO 74200.000

74200.00	8.32	308.00	.00	.00	308.35	.35	.02	.00	309.68
6900.	0.	6900.	0.	0.	1457.	0.	8.	1.	309.68
.01	.00	4.74	.00	.027	.027	.027	.000	299.68	5.03
.000534	40.	40.	40.	2	0	0	.00	199.95	204.97

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 74000.000									
74000.00	8.31	308.11	.00	.00	308.46	.35	.11	.00	309.80
6900.	0.	6900.	0.	0.	1455.	0.	14.	2.	309.80
.02	.00	4.74	.00	.027	.027	.027	.000	299.80	5.05
.000535	200.	200.	200.	1	0	0	.00	199.91	204.95
*SECNO 73000.000									
73000.00	8.25	308.65	.00	.00	309.00	.36	.54	.00	310.40
6900.	0.	6900.	0.	0.	1441.	0.	48.	7.	310.40
.08	.00	4.79	.00	.027	.027	.027	.000	300.40	5.26
.000551	1000.	1000.	1000.	2	0	0	.00	199.48	204.74
*SECNO 72000.000									
72000.00	8.20	309.20	.00	.00	309.56	.36	.56	.00	311.00
6900.	0.	6900.	0.	0.	1432.	0.	81.	11.	311.00
.14	.00	4.82	.00	.027	.027	.027	.000	301.00	5.40
.000563	1000.	1000.	1000.	2	0	0	.00	199.20	204.60
*SECNO 71810.000									
71810.00	8.21	309.31	.00	.00	309.67	.36	.11	.00	317.00
6900.	0.	6900.	0.	0.	1429.	0.	87.	12.	317.00
.15	.00	4.83	.00	.027	.027	.027	.000	301.10	51.55
.000564	190.	190.	190.	0	0	0	.00	198.55	250.10

SPECIAL BRIDGE

SB XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
.90	1.60	2.80	.00	150.00	6.00	2950.00	3.00	301.14	301.10

*SECNO 71730.000

3301 HV CHANGED MORE THAN HVINS

CLASS A LOW FLOW

3420 BRIDGE W.S.= 309.30 BRIDGE VELOCITY=, 5.01 CALCULATED CHANNEL AREA=, 1374.

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	309.89	.02	0.	6900.	2950.	3110.	317.30	319.30

71730.00	8.18	309.32	.00	.00	309.89	.57	.23	.00	317.04
6900.	0.	6900.	0.	0.	1138.	0.	89.	12.	317.04
.16	.00	6.07	.00	.027	.027	.027	.000	301.14	41.18
.000901	80.	80.	80.	0	0	0	.00	158.36	199.53

*SECNO 71500.000

1645 INT SEC ADDED BY RAISING SEC 71500.00, -.055FT AND MULTIPLYING BY .898

1.01	8.36	309.55	.00	.00	309.98	.43	.09	.00	311.19
6900.	0.	6900.	0.	0.	1315.	0.	92.	13.	311.19
.16	.00	5.25	.00	.027	.027	.027	.000	301.19	4.42
.000655	115.	115.	115.	2	0	0	.00	179.79	184.22

1645 INT SEC ADDED BY RAISING SEC 1.01, .055FT AND MULTIPLYING BY 1.113

71500.00	8.46	309.71	.00	.00	310.05	.34	.07	.00	311.25
6900.	0.	6900.	0.	0.	1484.	0.	96.	13.	311.25
.17	.00	4.65	.00	.027	.027	.027	.000	301.25	4.62
.000505	115.	115.	115.	2	0	0	.00	200.77	205.38

*SECNO 71000.000

71000.00	8.46	309.96	.00	.00	310.30	.34	.25	.00	311.50
6900.	0.	6900.	0.	0.	1484.	0.	113.	16.	311.50
.20	.00	4.65	.00	.027	.027	.027	.000	301.50	4.62
.000505	500.	500.	500.	0	0	0	.00	200.77	205.38

*SECNO 70000.000

70000.00	8.47	310.47	.00	.00	310.80	.34	.50	.00	312.00
6900.	0.	6900.	0.	0.	1484.	0.	147.	20.	312.00
.26	.00	4.65	.00	.027	.027	.027	.000	302.00	4.61
.000504	1000.	1000.	1000.	0	0	0	.00	200.78	205.39

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	FLMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 69000.000									
69000.00	8.47	310.97	.00	.00	311.31	.34	.50	.00	312.50
6900.	0.	6900.	0.	0.	1485.	0.	181.	25.	312.50
.32	.00	4.65	.00	.027	.027	.027	.000	302.50	4.60
.000503	1000.	1000.	1000.	0	0	0	.00	200.81	205.40
*SECNO 68000.000									
68000.00	8.48	311.48	.00	.00	311.81	.33	.50	.00	313.00
6900.	0.	6900.	0.	0.	1486.	0.	215.	29.	313.00
.38	.00	4.64	.00	.027	.027	.027	.000	303.00	4.58
.000502	1000.	1000.	1000.	0	0	0	.00	200.83	205.42
*SECNO 67622.000									
67622.00	8.48	311.67	.00	.00	312.00	.33	.19	.00	313.19
6900.	0.	6900.	0.	0.	1487.	0.	228.	31.	313.19
.40	.00	4.64	.00	.027	.027	.027	.000	303.19	4.57
.000502	378.	378.	378.	0	0	0	.00	200.85	205.43

WSEL 1303.19 OK

PROFILE FOR STREAM RWCD REACH 4 MODIFIED

PLOTTED POINTS (BY PRIORITY)-E-ENERGY,W-WATER SURFACE,I-INVERT,C-CRITICAL W.S.,L-LEFT BANK,R-RIGHT BANK,M-LOWER END STA

```
ELEVATION   298.      300.      302.      304.      306.      308.      310.      312.      314.      316.
   SECNO    CUMDIS
 74400.00      0.  C      I .       .         .         .         WE      L .       .         .         .         .
 74360.00     50.  C      I .       .         .         .         WE      L .       .         .         .         .
 74320.00    100.  C      I .       .         .         .         WE      L .       .         .         .         .
 74280.00    150.  C      I .       .         .         .         W E     L .       .         .         .         .
 74240.00    200.  C      I .       .         .         .         W E     L .       .         .         .         .
 74200.00    250.  C      I .       .         .         .         W E     L .       .         .         .         .
             300.  C       I.       .         .         .         W E       L.      .         .         .         .
             350.  C       I.       .         .         .         W E       L.      .         .         .         .
 74000.00    400.  C       I.       .         .         .         .WE       L.      .         .         .         .
             450.  C       I.       .         .         .         .WE       L.      .         .         .         .
             500.  C       I.       .         .         .         .W E      L.      .         .         .         .
             550.  C       I.       .         .         .         .W E      L.      .         .         .         .
             600.  C        I       .         .         .         .W E       L      .         .         .         .
             650.  C        I       .         .         .         .W E       L      .         .         .         .
             700.  C        I       .         .         .         .W E       L      .         .         .         .
             750.  C        I       .         .         .         . WE       L      .         .         .         .
             800.  C        I       .         .         .         . WE       L      .         .         .         .
             850.  C        I       .         .         .         . W E      L      .         .         .         .
             900.  C        I       .         .         .         . W E      L      .         .         .         .
             950.  C       .I       .         .         .         . W E      .L     .         .         .         .
            1000.  C       .I       .         .         .         . W E      .L     .         .         .         .
            1050.  C       .I       .         .         .         . W E      .L     .         .         .         .
            1100.  C       .I       .         .         .         . W E      .L     .         .         .         .
            1150.  C       .I       .         .         .         .  WE      .L     .         .         .         .
            1200.  C       .I       .         .         .         .  WE      .L     .         .         .         .
            1250.  C      . I       .         .         .         .  W E     . L    .         .         .         .
            1300.  C      . I       .         .         .         .  W E     . L    .         .         .         .
            1350.  C      . I       .         .         .         .  W E     . L    .         .         .         .
 73000.00   1400.  C      . I       .         .         .         .  W E     . L    .         .         .         .
            1450.  C      . I       .         .         .         .  W E     . L    .         .         .         .
            1500.  C      . I       .         .         .         .   WE     . L    .         .         .         .
            1550.  C      . I       .         .         .         .   WE     . L    .         .         .         .
            1600.  C      .  I      .         .         .         .   W E    .  L   .         .         .         .
            1650.  C      .  I      .         .         .         .   W E    .  L   .         .         .         .
            1700.  C      .  I      .         .         .         .   W E    .  L   .         .         .         .
            1750.  C      .  I      .         .         .         .   W E    .  L   .         .         .         .
            1800.  C      .  I      .         .         .         .   W E    .  L   .         .         .         .
            1850.  C      .  I      .         .         .         .   W E    .  L   .         .         .         .
            1900.  C      .   I     .         .         .         .    WE    .   L  .         .         .         .
            1950.  C      .   I     .         .         .         .    W E   .   L  .         .         .         .
            2000.  C      .   I     .         .         .         .    W E   .   L  .         .         .         .
            2050.  C      .   I     .         .         .         .    W E   .   L  .         .         .         .
            2100.  C      .   I     .         .         .         .    W E   .   L  .         .         .         .
            2150.  C      .   I     .         .         .         .    W E   .   L  .         .         .         .
            2200.  C      .   I     .         .         .         .    W E   .   L  .         .         .         .
            2250.  C      .    I    .         .         .         .     WE   .    L .         .         .         .
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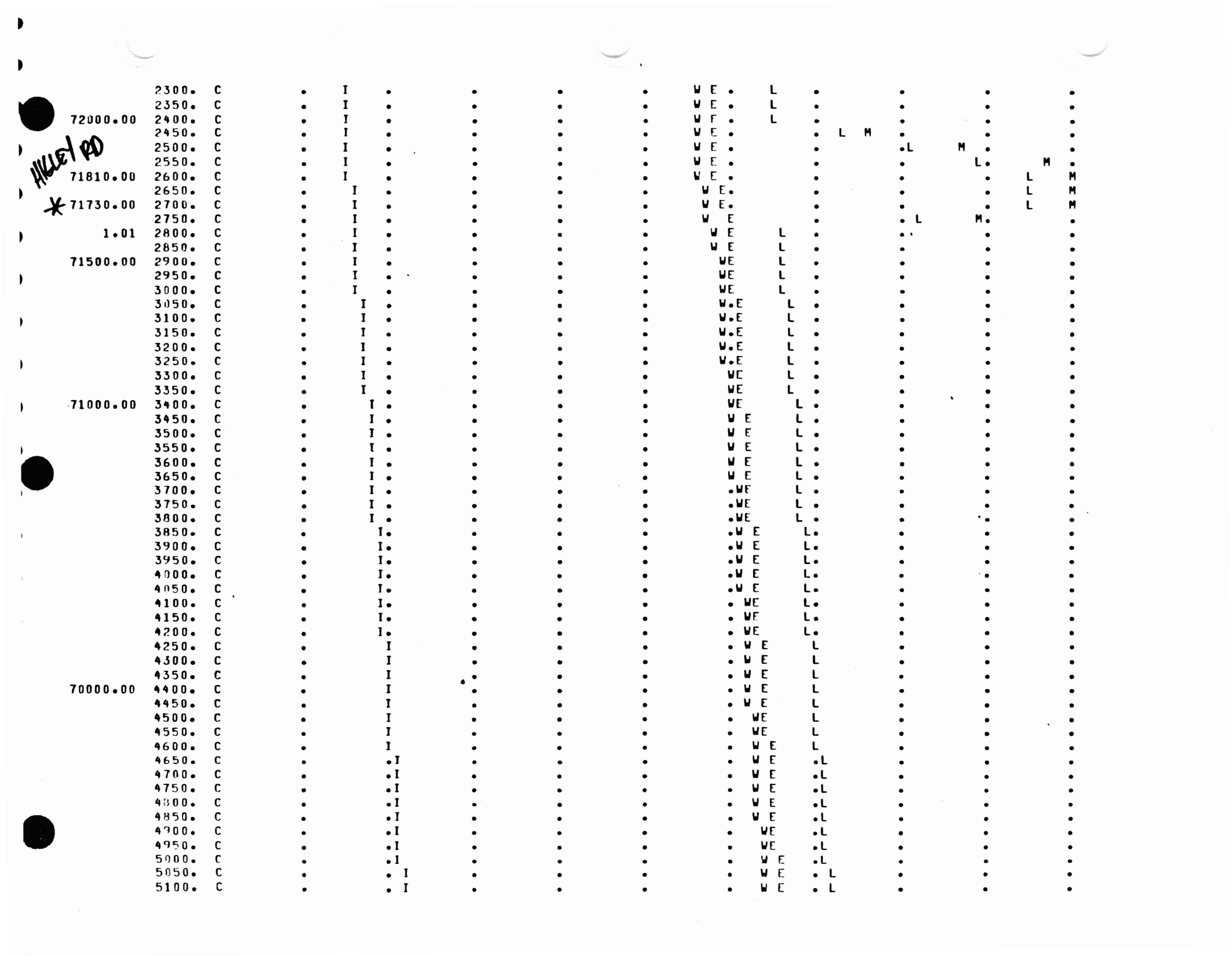
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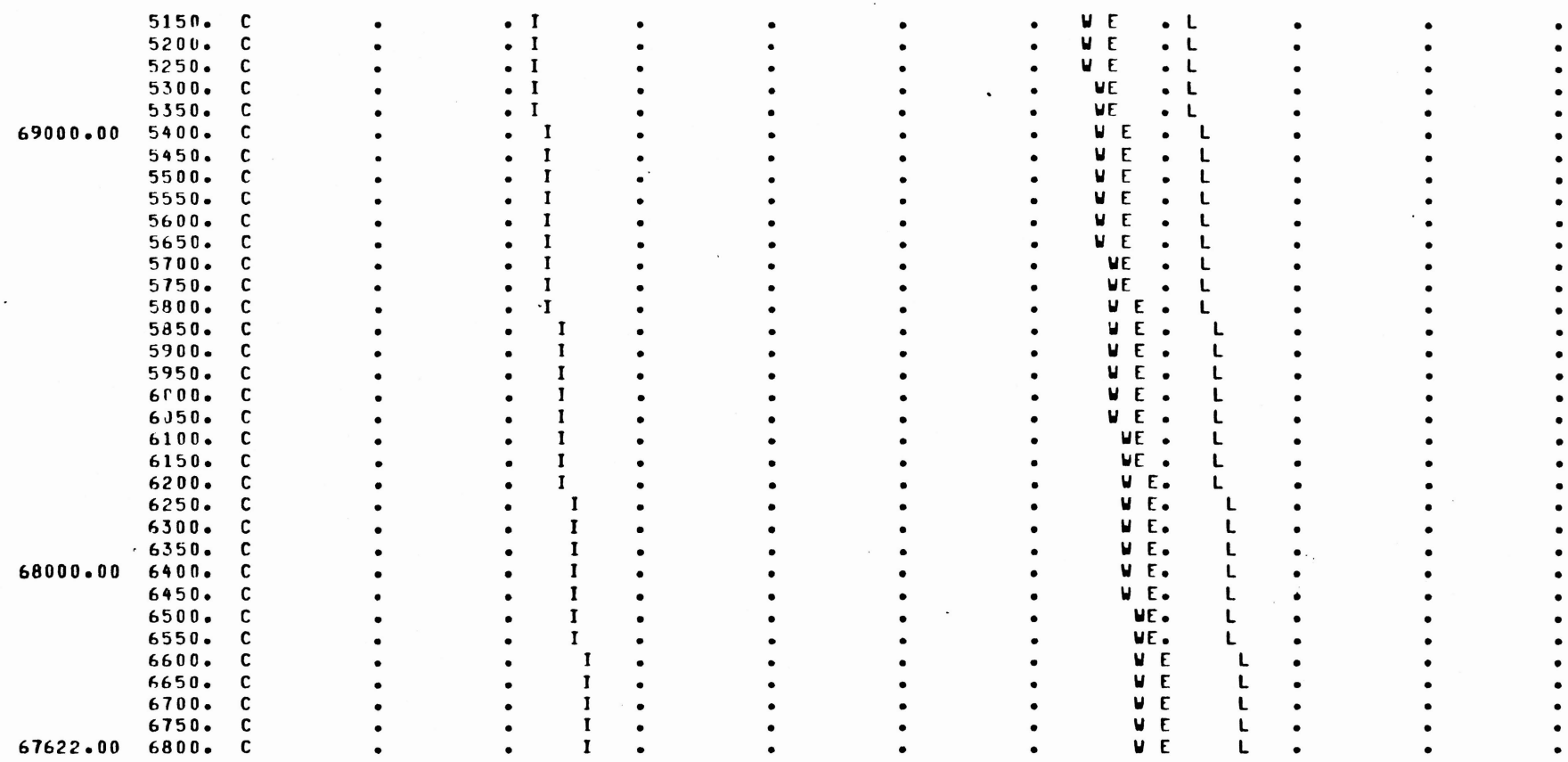
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  HEC2 RELEASE DATED NOV 76 UPDATED MARC 1982
  ERROR CORR -  01,02,03,04,05
  MODIFICATION -  50,51,52,53,54,55
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

RWCD REACH 4 MODIFIED

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
	74400.000	.00	.00	.00	299.62	6900.00	308.07	.00	308.27	2.95	3.62	1904.21	4020.58
	74360.000	40.00	.00	.00	299.63	6900.00	308.06	.00	308.29	3.26	3.80	1817.66	3822.42
	74320.000	40.00	.00	.00	299.64	6900.00	308.05	.00	308.30	3.65	4.00	1726.45	3609.55
	74280.000	40.00	.00	.00	299.66	6900.00	308.04	.00	308.32	4.13	4.22	1635.06	3396.62
	74240.000	40.00	.00	.00	299.67	6900.00	308.02	.00	308.33	4.67	4.46	1545.97	3191.47
	74200.000	40.00	.00	.00	299.68	6900.00	308.00	.00	308.35	5.34	4.74	1456.60	2985.97
	74000.000	200.00	.00	.00	299.80	6900.00	308.11	.00	308.46	5.35	4.74	1455.27	2981.86
	73000.000	1000.00	.00	.00	300.40	6900.00	308.65	.00	309.00	5.51	4.79	1441.18	2938.22
	72000.000	1000.00	.00	.00	301.00	6900.00	309.20	.00	309.56	5.63	4.82	1431.67	2908.86
	71810.000	190.00	.00	.00	301.10	6900.00	309.31	.00	309.67	5.64	4.83	1429.10	2906.07
	71730.000	80.00	319.30	317.30	301.14	6900.00	309.32	.00	309.89	9.01	6.07	1137.62	2299.19
*	71500.000	230.00	.00	.00	301.25	6900.00	309.71	.00	310.05	5.05	4.65	1483.98	3071.38
	71000.000	500.00	.00	.00	301.50	6900.00	309.96	.00	310.30	5.05	4.65	1483.96	3071.32
	70000.000	1000.00	.00	.00	302.00	6900.00	310.47	.00	310.80	5.04	4.65	1484.43	3072.79
	69000.000	1000.00	.00	.00	302.50	6900.00	310.97	.00	311.31	5.03	4.65	1485.37	3075.74
	68000.000	1000.00	.00	.00	303.00	6900.00	311.48	.00	311.81	5.02	4.64	1486.21	3078.37
	67622.000	377.50	.00	.00	303.19	6900.00	311.67	.00	312.00	5.02	4.64	1486.85	3080.39

RWCD REACH 4 MODIFIED

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	74400.000	6900.00	308.07	.00	.00	.00	250.70	.00
	74360.000	6900.00	308.06	.00	-.01	.00	240.65	40.00
	74320.000	6900.00	308.05	.00	-.01	.00	230.47	40.00
	74280.000	6900.00	308.04	.00	-.01	.00	220.27	40.00
	74240.000	6900.00	308.02	.00	-.02	.00	210.12	40.00
	74200.000	6900.00	308.00	.00	-.02	.00	199.95	40.00
	74000.000	6900.00	308.11	.00	.11	.00	199.91	200.00
	73000.000	6900.00	308.65	.00	.54	.00	199.48	1000.00
	72000.000	6900.00	309.20	.00	.55	.00	199.20	1000.00
	71810.000	6900.00	309.31	.00	.11	.00	198.55	190.00
	71730.000	6900.00	309.32	.00	.02	.00	158.36	80.00
*	71500.000	6900.00	309.71	.00	.16	.00	200.77	230.00
	71000.000	6900.00	309.96	.00	.25	.00	200.77	500.00
	70000.000	6900.00	310.47	.00	.50	.00	200.78	1000.00
	69000.000	6900.00	310.97	.00	.50	.00	200.81	1000.00
	68000.000	6900.00	311.48	.00	.50	.00	200.83	1000.00
	67622.000	6900.00	311.67	.00	.19	.00	200.85	377.50

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO=71500.000 PROFILE= 1 INTERPOLATED XSECTIONS USED

(1.62) Q100 Final 2/26/85

675400 TO 555400

THIS RUN EXECUTED 01/01/80 03:36:40

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION
**************************************************

T1 RWCD REACH4 Q=6900CFS
T2 WATER SURFACE PROFILE
T3 RWCD REACH 4 MODIFIED

J1   ICHECK     INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

       0.        0.        0.        0.    .000000       .00       .2     6900.   315.020      .000

J2   NPROF      IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     -1.000      .000      .000      .000      .000      .000      .000      .000      .000      .000


NC       .027      .027      .027      .000      .000      .000      .000      .000      .000      .000
X1  67500.000     4.000      .000   210.000      .000      .000      .000      .000      .000      .000
GR    316.600      .000   306.600    30.000   306.600   180.000   316.600   210.000      .000      .000

X1  67000.000      .000      .000      .000   500.000   500.000   500.000      .000      .250      .000

X1  66000.000      .000      .000      .000  1000.000  1000.000  1000.000      .000      .500      .000

X1  65000.000      .000      .000      .000  1000.000  1000.000  1000.000      .000      .500      .000

X1  64000.000      .000      .000      .000  1000.000  1000.000  1000.000      .000      .500      .000

X1  63000.000      .000      .000      .000  1000.000  1000.000  1000.000      .000      .500      .000

X1  62700.000      .000      .000      .000   300.000   300.000   300.000      .000      .150      .000

X1  62600.000     4.000      .000   235.000   100.000   100.000   100.000      .000      .000      .000
GR    319.050      .000   309.050    30.000   309.050   205.000   319.050   235.000      .000      .000

X1  62000.000      .000      .000      .000   600.000   600.000   600.000      .000      .150      .000

X1  61000.000      .000      .000      .000  1000.000  1000.000  1000.000      .000      .250      .000

X1  60000.000     4.000      .000   235.000  1000.000  1000.000  1000.000      .000      .000      .000
GR    319.700      .000   309.700    30.000   309.700   205.000   319.700   235.000      .000      .000

X1  59860.000     6.000     1.000   240.000   140.000   140.000   140.000      .000      .000      .000
GR    322.700      .000   319.900     1.000   309.740    32.000   309.740   207.000   319.900   240.000
GR    322.700   241.000      .000      .000      .000      .000      .000      .000      .000      .000
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SB       .900     1.600     2.800      .000   175.000     4.000  2055.000     3.000   309.750   309.740
X1  59800.000      .000      .000      .000    60.000    60.000    60.000      .000      .020      .000
X2       .000      .000     1.000     7.000     .000      .000      .000      .000      .000      .000
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SB	900	2.800	.000	175.000	4.000	2055.000	3.000	309.750	309
X1	5[illegible]000	.000	.000	60.000	[illegible].000	60.000	.000	.020	
X2	[illegible]000	1.000	319.700	322.800	.000	.000	1.330	.000	
BT	[illegible].000	75[illegible] 322.700	319.700	7810.000	322.200	319.700	.000	.000	.000
X1	59680.000	.000	235.000	120.000	120.000	120.000	.000	.000	.000
GR	319.790	309.790	30.000	309.790	205.000	319.790	235.000	.000	.000
SB	1.050	2.800	270.000	175.000	15.000	2202.000	3.000	309.800	309.790
X1	59650.000	.000	.000	30.000	30.000	30.000	.000	.010	.000
X2	.000	1.000	319.970	324.000	.000	.000	1.800	.000	.000
X1	59600.000	.000	235.000	50.000	50.000	50.000	.000	.000	.000
X2	6500.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	319.800	309.800	30.000	309.800	205.000	319.800	235.000	.000	.000
X1	59000.000	.000	.000	600.000	600.000	600.000	.000	.150	.000
X1	58000.000	.000	.000	1000.000	1000.000	1000.000	.000	.250	.000
X1	57000.000	.000	.000	1000.000	1000.000	1000.000	.000	.250	.000
X1	56000.000	.000	.000	1000.000	1000.000	1000.000	.000	.250	.000
X1	55500.000	.000	235.000	500.000	500.000	500.000	.000	.000	.000
GR	320.820	310.820	30.000	310.820	205.000	320.820	235.000	.000	.000
NC	.035	.035	.000	.000	.000	.000	.000	.000	.000
X1	55450.000	.000	209.100	50.000	50.000	50.000	.000	.000	.000
GR	320.830	310.830	28.400	310.830	180.800	320.830	209.100	.000	.000
X1	55400.000	.000	183.400	50.000	50.000	50.000	.000	.000	.000
GR	320.840	310.840	26.700	310.840	156.700	320.840	183.400	.000	.000
X1	55380.000	.000	174.000	20.000	20.000	20.000	.000	.000	.000
GR	320.850	310.850	26.000	310.850	148.000	320.850	174.000	.000	.000
X1	55340.000	.000	155.400	40.000	40.000	40.000	.000	.000	.000
GR	320.860	310.860	24.700	310.860	130.700	320.860	155.400	.000	.000
X1	55320.000	.000	146.000	20.000	20.000	20.000	.000	.000	.000
GR	320.870	310.870	24.000	310.870	122.000	320.870	146.000	.000	.000
X1	55300.000	.000	136.600	20.000	20.000	20.000	.000	.000	.000
GR	320.870	310.870	23.300	310.870	113.300	320.870	136.600	.000	.000
X1	55280.000	.000	129.400	20.000	20.000	20.000	.000	.000	.000
GR	320.880	310.880	22.700	310.880	106.700	320.880	129.400	.000	.000

1

X1	55260.000	.000	122.000	20.000	20.000	20.000	.000	.000	.000
GR	320.880	310.880	22.000	310.880	100.000	320.880	122.000	.000	.000
X1	55240.000	.000	114.600	20.000	20.000	20.000	.000	.000	.000
GR	320.880	310.880	21.300	310.880	93.300	320.880	114.600	.000	.000
X1	55220.000	.000	107.400	20.000	20.000	20.000	.000	.000	.000
GR	320.610	310.610	20.700	310.610	86.700	320.610	107.400	.000	.000
X1	55200.000	.000	100.000	20.000	20.000	20.000	.000	.000	.000
GR	320.310	310.310	20.000	310.310	80.000	320.310	100.000	.000	.000

X1	552	000	4.000	.000	129.400	20.000	[illegible].000	20.000	.000	.000	.
GR		80	.000	310.880	22.700	310.880	.700	320.880	129.400	.000	.

1

X1	55260.000	4.000	.000	122.000	20.000	20.000	20.000	.000	.000	.000
GR	320.880	.000	310.880	22.000	310.880	100.000	320.880	122.000	.000	.000
X1	55240.000	4.000	.000	114.600	20.000	20.000	20.000	.000	.000	.000
GR	320.880	.000	310.880	21.300	310.880	93.300	320.880	114.600	.000	.000
X1	55220.000	4.000	.000	107.400	20.000	20.000	20.000	.000	.000	.000
GR	320.610	.000	310.610	20.700	310.610	86.700	320.610	107.400	.000	.000
X1	55200.000	4.000	.000	100.000	20.000	20.000	20.000	.000	.000	.000
GR	320.310	.000	310.310	20.000	310.310	80.000	320.310	100.000	.000	.000
X1	55180.000	4.000	.000	98.000	20.000	20.000	20.000	.000	.000	.000
GR	320.330	.000	310.330	20.000	310.330	78.000	320.330	98.000	.000	.000
X1	55160.000	4.000	.000	96.000	20.000	20.000	20.000	.000	.000	.000
GR	320.350	.000	310.350	20.000	310.350	76.000	320.350	96.000	.000	.000
X1	55140.000	4.000	.000	126.000	20.000	20.000	20.000	.000	.000	.000
GR	328.360	.000	310.360	36.000	310.360	90.000	328.360	126.000	.000	.000
SB	1.250	1.600	2.800	120.000	54.000	1.300	1560.000	2.000	310.400	310.360
X1	55095.000	4.000	.000	122.000	45.000	45.000	45.000	.000	.000	.000
X2	.000	.000	1.000	329.300	330.500	.000	.000	2.000	.000	.000
GR	328.400	.000	310.400	36.000	310.400	86.000	328.400	122.000	.000	.000
NC	.014	.014	.014	.000	.000	.000	.000	.000	.000	.000
X1	55060.000	4.000	.000	90.000	35.000	35.000	35.000	.000	.000	.000
GR	320.440	.000	310.440	20.000	310.440	70.000	320.440	90.000	.000	.000
X1	55000.000	.000	.000	.000	60.000	60.000	60.000	.000	.050	.000
X1	54340.000	.000	.000	.000	660.000	660.000	660.000	.000	.590	.000
SB	1.250	1.500	2.900	100.000	50.000	1.300	1100.000	2.000	311.400	311.330
X1	54260.000	.000	.000	.000	80.000	80.000	80.000	.000	.070	.000
X2	.000	.000	1.000	325.900	328.900	.000	.000	1.330	.000	.000
X1	54000.000	.000	.000	.000	260.000	260.000	260.000	.000	.230	.000
X1	53000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.900	.000
X1	52000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.900	.000
X1	51000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.900	.000
X1	50000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.900	.000

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X1	49590.000	4.000	.000	90.000	410.000	410.000	410.000	.000	.000	.000
GR	325.360	.000	315.360	20.000	315.360	70.000	325.360	90.000	.000	.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

*PROF 1

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X1  49   000      4.000      .000      90.000     410.000      .000     410.000      .000      .000
GR     325.360      .000   315.360      20.000     315.360      .000     325.360    90.000      .000      .000
EJ        .000      .000      .000        .000        .000      .000        .000      .000      .000      .000
*PROF 1
1
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST


 *SECNO 67500.000
  67500.00      8.42    315.02       .00    315.02    315.36       .34       .00       .00    316.60
     6900.        0.     6900.        0.        0.     1476.        0.        0.        0.     316.60
        .00       .00      4.68       .00      .027      .027      .027      .000    306.60      4.74
   .000513        0.        0.        0.         0         0         0       .00    200.52    205.26
0
 *SECNO 67000.000
  67000.00      8.43    315.28       .00       .00    315.62       .34       .26       .00    316.85
     6900.        0.     6900.        0.        0.     1476.        0.       17.        2.     316.85
        .03       .00      4.68       .00      .027      .027      .027      .000    306.85      4.74
   .000513      500.      500.      500.         0         0         0       .00    200.52    205.26
0
 *SECNO 66000.000
  66000.00      8.44    315.79       .00       .00    316.13       .34       .51       .00    317.35
     6900.        0.     6900.        0.        0.     1478.        0.       51.        7.     317.35
        .09       .00      4.67       .00      .027      .027      .027      .000    307.35      4.70
   .000511     1000.     1000.     1000.         1         0         0       .00    200.60    205.30
0
 *SECNO 65000.000
  65000.00      8.45    316.30       .00       .00    316.64       .34       .51       .00    317.85
     6900.        0.     6900.        0.        0.     1481.        0.       85.       12.     317.85
        .15       .00      4.66       .00      .027      .027      .027      .000    307.85      4.66
   .000508     1000.     1000.     1000.         1         0         0       .00    200.67    205.34
0
 *SECNO 64000.000
  64000.00      8.46    316.81       .00       .00    317.14       .34       .51       .00    318.35
     6900.        0.     6900.        0.        0.     1482.        0.      119.       16.     318.35
        .21       .00      4.66       .00      .027      .027      .027      .000    308.35      4.65
   .000507     1000.     1000.     1000.         0         0         0       .00    200.70    205.35
0
 *SECNO 63000.000
  63000.00      8.47    317.32       .00       .00    317.65       .34       .51       .00    318.85
     6900.        0.     6900.        0.        0.     1483.        0.      153.       21.     318.85
        .27       .00      4.65       .00      .027      .027      .027      .000    308.85      4.63
   .000505     1000.     1000.     1000.         0         0         0       .00    200.75    205.37
0
1
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST


 *SECNO 62700.000
```

.000	1000.	1000.	1000.	0	0		.00	200.75	205.37

0

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 62700.000									
62700.00	8.47	317.47	.00	.00	317.80	.34	.15	.00	319.00
6900.	0.	6900.	0.	0.	1485.	0.	163.	22.	319.00
.29	.00	4.65	.00	.027	.027	.027	.000	309.00	4.60
.000504	300.	300.	300.	0	0	0	.00	200.79	205.40
0									
*SECNO 62600.000									
62600.00	8.54	317.59	.00	.00	317.85	.25	.04	.00	319.05
6900.	0.	6900.	0.	0.	1714.	0.	167.	23.	319.05
.29	.00	4.03	.00	.027	.027	.027	.000	309.05	4.37
.000365	100.	100.	100.	2	0	0	.00	226.26	230.63
0									
*SECNO 62000.000									
62000.00	8.61	317.81	.00	.00	318.06	.25	.22	.00	319.20
6900.	0.	6900.	0.	0.	1730.	0.	190.	26.	319.20
.33	.00	3.99	.00	.027	.027	.027	.000	309.20	4.16
.000355	600.	600.	600.	2	0	0	.00	226.69	230.84
0									
*SECNO 61000.000									
61000.00	8.72	318.17	.00	.00	318.41	.24	.35	.00	319.45
6900.	0.	6900.	0.	0.	1754.	0.	230.	31.	319.45
.41	.00	3.93	.00	.027	.027	.027	.000	309.45	3.84
.000341	1000.	1000.	1000.	2	0	0	.00	227.31	231.16
0									
*SECNO 60000.000									
60000.00	8.81	318.51	.00	.00	318.74	.23	.33	.00	319.70
6900.	0.	6900.	0.	0.	1774.	0.	271.	36.	319.70
.48	.00	3.89	.00	.027	.027	.027	.000	309.70	3.57
.000329	1000.	1000.	1000.	2	0	0	.00	227.85	231.43
0									
*SECNO 59860.000									
59860.00	8.82	318.56	.00	.00	318.79	.23	.05	.00	319.90
6900.	0.	6900.	0.	0.	1786.	0.	277.	37.	319.90
.49	.00	3.86	.00	.027	.027	.027	.000	309.74	5.12
.000326	140.	140.	140.	0	0	0	.00	230.49	235.61
0									

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	.90	1.60	2.80	.00	175.00	4.00	2055.00	3.00	309.75	309.74

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	.90	1.60	2.80	.00	175.00	4.00	2055.00	3.00	309.75	309.74

*SECNO 59800.000
CLASS A LOW FLOW

3420 BRIDGE W.S.= 318.55 BRIDGE VELOCITY=, 3.97 CALCULATED CHANNEL AREA=, 1738.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	318.79	.00	0.	6900.	2055.	1998.	319.70	322.80

59800.00	8.80	318.56	.00	.00	318.79	.23	.01	.00	319.92
6900.	0.	6900.	0.	0.	1784.	0.	279.	37.	319.92
.49	.00	3.87	.00	.000	.027	.000	.000	309.76	5.14
.000327	60.	60.	60.	0	0	0	.00	230.45	235.59

0
*SECNO 59680.000

59680.00	8.81	318.60	.00	.00	318.83	.24	.04	.00	319.79
6900.	0.	6900.	0.	0.	1773.	0.	284.	38.	319.79
.50	.00	3.89	.00	.027	.027	.027	.000	309.79	3.59
.000330	120.	120.	120.	0	0	0	.00	227.81	231.41

0

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.05	1.56	2.80	270.00	175.00	15.00	2202.00	3.00	309.80	309.79

*SECNO 59650.000
CLASS A LOW FLOW

3420 BRIDGE W.S.= 318.56 BRIDGE VELOCITY=, 4.22 CALCULATED CHANNEL AREA=, 1632.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	318.86	.03	0.	6900.	2202.	1937.	319.97	324.00

59650.00	8.83	318.63	.00	.00	318.86	.23	.03	.00	319.80
6900.	0.	6900.	0.	0.	1778.	0.	285.	38.	319.80
.50	.00	3.88	.00	.000	.027	.000	.000	309.80	3.52
.000327	30.	30.	30.	0	0	0	.00	227.95	231.48

0
1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV

SE(	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 59600.000									
59600.00	8.87	318.67	.00	.00	318.87	.21	.02	.00	319.80
6500.	0.	6500.	0.	0.	1788.	0.	287.	38.	319.80
.51	.00	3.64	.00	.027	.027	.027	.000	309.80	3.39
.000285	50.	50.	50.	2	0	0	.00	228.22	231.61
0									
*SECNO 59000.000									
59000.00	8.89	318.84	.00	.00	319.04	.20	.17	.00	319.95
6500.	0.	6500.	0.	0.	1793.	0.	312.	41.	319.95
.55	.00	3.63	.00	.027	.027	.027	.000	309.95	3.33
.000283	600.	600.	600.	2	0	0	.00	228.34	231.67
0									
*SECNO 58000.000									
58000.00	8.92	319.12	.00	.00	319.33	.20	.28	.00	320.20
6500.	0.	6500.	0.	0.	1800.	0.	353.	47.	320.20
.63	.00	3.61	.00	.027	.027	.027	.000	310.20	3.23
.000279	1000.	1000.	1000.	2	0	0	.00	228.54	231.77
0									
*SECNO 57000.000									
57000.00	8.95	319.40	.00	.00	319.60	.20	.28	.00	320.45
6500.	0.	6500.	0.	0.	1807.	0.	395.	52.	320.45
.71	.00	3.60	.00	.027	.027	.027	.000	310.45	3.14
.000276	1000.	1000.	1000.	2	0	0	.00	228.71	231.86
0									
*SECNO 56000.000									
56000.00	8.98	319.68	.00	.00	319.88	.20	.27	.00	320.70
6500.	0.	6500.	0.	0.	1813.	0.	436.	57.	320.70
.78	.00	3.59	.00	.027	.027	.027	.000	310.70	3.07
.000273	1000.	1000.	1000.	2	0	0	.00	228.87	231.93
0									
*SECNO 55500.000									
55500.00	8.99	319.81	.00	.00	320.01	.20	.14	.00	320.82
6500.	0.	6500.	0.	0.	1815.	0.	457.	60.	320.82
.82	.00	3.58	.00	.027	.027	.027	.000	310.82	3.04
.000272	500.	500.	500.	1	0	0	.00	228.92	231.96
0									
1									

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 55450.000									
55450.00	8.94	319.77	.00	.00	320.03	.26	.02	.00	320.83
6500.	0.	6500.	0.	0.	1590.	0.	459.	60.	320.83
.83	.00	4.09	.00	.035	.035	.035	.000	310.83	3.00
.000609	50.	50.	50.	2	0	0	.00	203.11	206.11
0									
*SECNO 55400.000									
55400.00	8.88	319.72	.00	.00	320.07	.35	.04	.00	320.84
6500.	0.	6500.	0.	0.	1364.	0.	461.	60.	320.84
.83	.00	4.76	.00	.035	.035	.035	.000	310.84	3.00
.000849	50.	50.	50.	2	0	0	.00	177.40	180.40

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      6500.        0.     6500.        0.        0.     1815.        0.      456.       57.     320.70
         .         .00      3.59       .00       .027      .027      .02       .000   310.70       3.07
    .000        1000.     1000.     1000.        2         0                  .00    228.87     231.93
0
 *SECNO      500.000
  55500.00      8.99   319.81       .00       .00    320.01       .20       .14       .00    320.82
     6500.        0.     6500.        0.        0.     1815.        0.      457.       60.     320.82
       .82        .00      3.58       .00       .027      .027      .027      .000   310.82       3.04
   .000272      500.      500.      500.        1         0         0       .00    228.92     231.96
0
1
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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS     BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST


 *SECNO 55450.000
  55450.00      8.94   319.77       .00       .00    320.03       .26       .02       .00    320.83
     6500.        0.     6500.        0.        0.     1590.        0.      459.       60.     320.83
       .83        .00      4.09       .00       .035      .035      .035      .000   310.83       3.00
   .000609       50.       50.       50.        2         0         0       .00    203.11     206.11
0
 *SECNO 55400.000
  55400.00      8.88   319.72       .00       .00    320.07       .35       .04       .00    320.84
     6500.        0.     6500.        0.        0.     1364.        0.      461.       60.     320.84
       .83        .00      4.76       .00       .035      .035      .035      .000   310.84       3.00
   .000849       50.       50.       50.        2         0         0       .00    177.40     180.40
0
 *SECNO 55380.000
  55380.00      8.84   319.69       .00       .00    320.09       .40       .02       .00    320.85
     6500.        0.     6500.        0.        0.     1281.        0.      461.       60.     320.85
       .83        .00      5.07       .00       .035      .035      .035      .000   310.85       3.02
   .000975       20.       20.       20.        2         0         0       .00    167.96     170.98
0
 *SECNO 55340.000
  55340.00      8.75   319.61       .00       .00    320.13       .53       .05       .00    320.86
     6500.        0.     6500.        0.        0.     1116.        0.      462.       60.     320.86
       .83        .00      5.82       .00       .035      .035      .035      .000   310.86       3.10
   .001326       40.       40.       40.        2         0         0       .00    149.21     152.30
0
 *SECNO 55320.000
  55320.00      8.67   319.54       .00       .00    320.16       .62       .03       .00    320.87
     6500.        0.     6500.        0.        0.     1031.        0.      463.       61.     320.87
       .83        .00      6.31       .00       .035      .035      .035      .000   310.87       3.18
   .001386       20.       20.       20.        2         0         0       .00    139.64     142.82
0
 *SECNO 55300.000
  55300.00      8.59   319.46       .00       .00    320.20       .73       .03       .00    320.87
     6500.        0.     6500.        0.        0.     945.         0.      463.       61.     320.87
       .83        .00      6.88       .00       .035      .035      .035      .000   310.87       3.28
   .001930       20.       20.       20.        2         0         0       .00    130.04     133.32
0
1
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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS     BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA     LEFT/RIGHT
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST
```

VOID

VOID

SECNO / Q / TIME / SLOPE	DEPTH / QLOB / VLOB / XLOBL	CWSEL / QCH / VCH / XLCH	CRIWS / QROB / VROB / XLOBR	WSELK / ALOB / XNL / ITRIAL	EG / ACH / XNCH / IDC	HV / AROB / XNR / ICONT	HL / VOL / WTN / CORAR	OLOSS / TWA / ELMIN / TOPWID	BANK ELEV LEFT/RIGHT / SSTA / ENDST
*SECNO 55280.000									
55280.00	8.51	319.39	.00	.00	320.24	.85	.04	.00	320.88
6500.	0.	6500.	0.	0.	879.	0.	464.	61.	320.88
.83	.00	7.39	.00	.035	.035	.035	.000	310.88	3.38
.002279	20.	20.	20.	3	0	0	.00	122.64	126.02
0									
*SECNO 55260.000									
55260.00	8.41	319.29	.00	.00	320.29	.99	.05	.00	320.88
6500.	0.	6500.	0.	0.	812.	0.	464.	61.	320.88
.83	.00	8.00	.00	.035	.035	.035	.000	310.88	3.49
.002736	20.	20.	20.	2	0	0	.00	115.02	118.51
0									
*SECNO 55240.000									
55240.00	8.28	319.16	.00	.00	320.35	1.19	.06	.00	320.88
6500.	0.	6500.	0.	0.	742.	0.	464.	61.	320.88
.84	.00	8.76	.00	.035	.035	.035	.000	310.88	3.67
.003379	20.	20.	20.	2	0	0	.00	107.26	110.93
0									
*SECNO 55220.000									
55220.00	8.52	319.13	.00	.00	320.42	1.29	.07	.00	320.61
6500.	0.	6500.	0.	0.	713.	0.	465.	61.	320.61
.84	.00	9.12	.00	.035	.035	.035	.000	310.61	3.06
.003600	20.	20.	20.	2	0	0	.00	101.27	104.34
0									
*SECNO 55200.000									
55200.00	8.76	319.07	.00	.00	320.49	1.42	.07	.00	320.31
6500.	0.	6500.	0.	0.	680.	0.	465.	61.	320.31
.84	.00	9.56	.00	.035	.035	.035	.000	310.31	2.47
.003897	20.	20.	20.	2	0	0	.00	95.07	97.53
0									
*SECNO 55180.000									
55180.00	8.73	319.06	.00	.00	320.57	1.51	.08	.00	320.33
6500.	0.	6500.	0.	0.	659.	0.	465.	61.	320.33
.84	.00	9.86	.00	.035	.035	.035	.000	310.33	2.53
.004193	20.	20.	20.	2	0	0	.00	92.94	95.47
0									

VOID

1

SECNO / Q / TIME / SLOPE	DEPTH / QLOB / VLOB / XLOBL	CWSEL / QCH / VCH / XLCH	CRIWS / QROB / VROB / XLOBR	WSELK / ALOB / XNL / ITRIAL	EG / ACH / XNCH / IDC	HV / AROB / XNR / ICONT	HL / VOL / WTN / CORAR	OLOSS / TWA / ELMIN / TOPWID	BANK ELEV LEFT/RIGHT / SSTA / ENDST
*SECNO 55160.000									
55160.00	8.70	319.05	.00	.00	320.66	1.61	.09	.00	320.35
6500.	0.	6500.	0.	0.	639.	0.	466.	61.	320.35
.84	.00	10.17	.00	.035	.035	.035	.000	310.35	2.59
.004515	20.	20.	20.	2	0	0	.00	90.82	93.41
0									
*SECNO 55140.000									
55140.00	8.70	319.06	.00	.00	320.75	1.70	.09	.00	328.36
6500.	0.	6500.	0.	0.	622.	0.	466.	61.	328.36

VOID

SEC.	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 55160.000

55160.00	8.70	319.05	.00	.00	320.66	1.61	.09	.00	320.35
6500.	0.	6500.	0.	0.	639.	0.	466.	61.	320.35
.84	.00	10.17	.00	.035	.035	.035	.000	310.35	2.59
.004515	20.	20.	20.	2	0	0	.00	90.82	93.41

0

VOID

*SECNO 55140.000

55140.00	8.70	319.06	.00	.00	320.75	1.70	.09	.00	328.36
6500.	0.	6500.	0.	0.	622.	0.	466.	61.	328.36
.84	.00	10.46	.00	.035	.035	.035	.000	310.36	18.59
.004812	20.	20.	20.	0	0	0	.00	88.82	107.41

0

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.25	1.50	2.80	120.00	54.00	1.30	1560.00	2.00	310.40	310.36

*SECNO 55095.000

CLASS A LOW FLOW

3420 BRIDGE W.S.= 318.95 BRIDGE VELOCITY=, 10.86 CALCULATED CHANNEL AREA=, 597.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	321.08	.20	0.	6500.	1560.	1710.	329.30	330.50

55095.00	8.86	319.26	.00	.00	321.08	1.82	.33	.00	328.40
6500.	0.	6500.	0.	0.	600.	0.	467.	61.	328.40
.84	.00	10.84	.00	.000	.035	.000	.000	310.40	18.28
.005164	45.	45.	45.	0	0	0	.00	85.43	103.72

0

*SECNO 55060.000

55060.00	8.90	319.34	.00	.00	321.14	1.80	.06	.00	320.44
6500.	0.	6500.	0.	0.	603.	0.	467.	61.	320.44
.84	.00	10.78	.00	.014	.014	.014	.000	310.44	2.21
.000814	35.	35.	35.	2	0	0	.00	85.58	87.79

0

VOID

*SECNO 55000.000

55000.00	8.89	319.38	.00	.00	321.19	1.80	.05	.00	320.49
6500.	0.	6500.	0.	0.	603.	0.	468.	61.	320.49
.84	.00	10.78	.00	.014	.014	.014	.000	310.49	2.21
.000814	60.	60.	60.	0	0	0	.00	85.58	87.79

0

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 54340.000

54340.00	8.80	319.88	.00	.00	321.74	1.85	.55	.00	321.08
6500.	0.	6500.	0.	0.	595.	0.	477.	63.	321.08
.86	.00	10.92	.00	.014	.014	.014	.000	311.08	2.39
.000844	660.	660.	660.	2	0	0	.00	85.22	87.61

0

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.25	1.50	2.90	100.00	50.00	1.30	1100.00	2.00	311.40	311.33

*SECNO 54260.000
CLASS A LOW FLOW

3420 BRIDGE W.S.= 319.70 BRIDGE VELOCITY=, 11.93 CALCULATED CHANNEL AREA=, 542.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	321.89	.25	0.	6500.	1100.	1127.	325.90	328.90

54260.00	8.99	320.14	.00	.00	321.89	1.76	.16	.00	321.15
6500.	0.	6500.	0.	0.	611.	0.	478.	63.	321.15
.86	.00	10.64	.00	.000	.014	.000	.000	311.15	2.03
.000784	80.	80.	80.	0	0	0	.00	85.95	87.97

0

*SECNO 54000.000

54000.00	8.94	320.32	.00	.00	322.10	1.78	.21	.00	321.38
6500.	0.	6500.	0.	0.	607.	0.	482.	63.	321.38
.87	.00	10.71	.00	.014	.014	.014	.000	311.38	2.12
.000800	260.	260.	260.	2	0	0	.00	85.75	87.88

0

*SECNO 53000.000 VOID

53000.00	8.78	321.06	.00	.00	322.93	1.86	.82	.00	322.28
6500.	0.	6500.	0.	0.	594.	0.	496.	65.	322.28
.89	.00	10.95	.00	.014	.014	.014	.000	312.28	2.43
.000851	1000.	1000.	1000.	2	0	0	.00	85.14	87.57

0

*SECNO 52000.000

52000.00	8.71	321.89	.00	.00	323.79	1.90	.87	.00	323.18
6500.	0.	6500.	0.	0.	587.	0.	509.	67.	323.18
.92	.00	11.07	.00	.014	.014	.014	.000	313.18	2.59
.000879	1000.	1000.	1000.	2	0	0	.00	84.83	87.41

0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

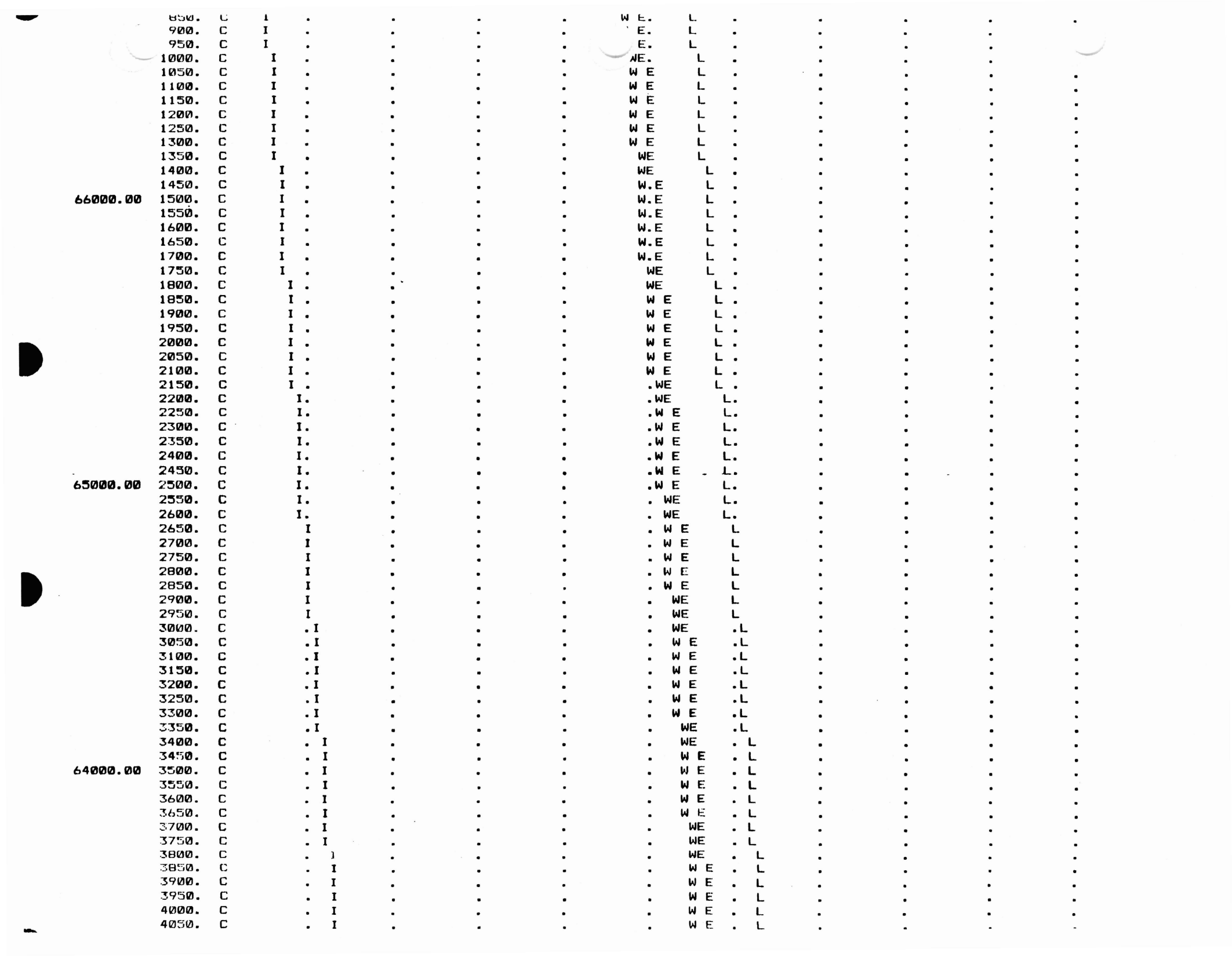
SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 51000.000									
51000.00	8.67	322.75	.00	.00	324.68	1.92	.89	.00	324.08
6500.	0.	6500.	0.	0.	584.	0.	523.	69.	324.08
.94	.00	11.13	.00	.014	.014	.014	.000	314.08	2.65
.000892	1000.	1000.	1000.	2	0	0	.00	84.69	87.35
0									
*SECNO 50000.000									
50000.00	8.66	323.64	.00	.00	325.57	1.92	.89	.00	324.98
6500.	0.	6500.	0.	0.	584.	0.	536.	71.	324.98
.97	.00	11.13	.00	.014	.014	.014	.000	314.98	2.65
.000892	1000.	1000.	1000.	0	0	0	.00	84.69	87.35
0									
*SECNO 49590.000									
49590.00	8.63	323.99	.00	.00	325.94	1.95	.37	.00	325.36
6500.	0.	6500.	0.	0.	580.	0.	541.	72.	325.36
.98	.00	11.20	.00	.014	.014	.014	.000	315.36	2.74
.000908	410.	410.	410.	2	0	0	.00	84.52	87.26
0									
1									

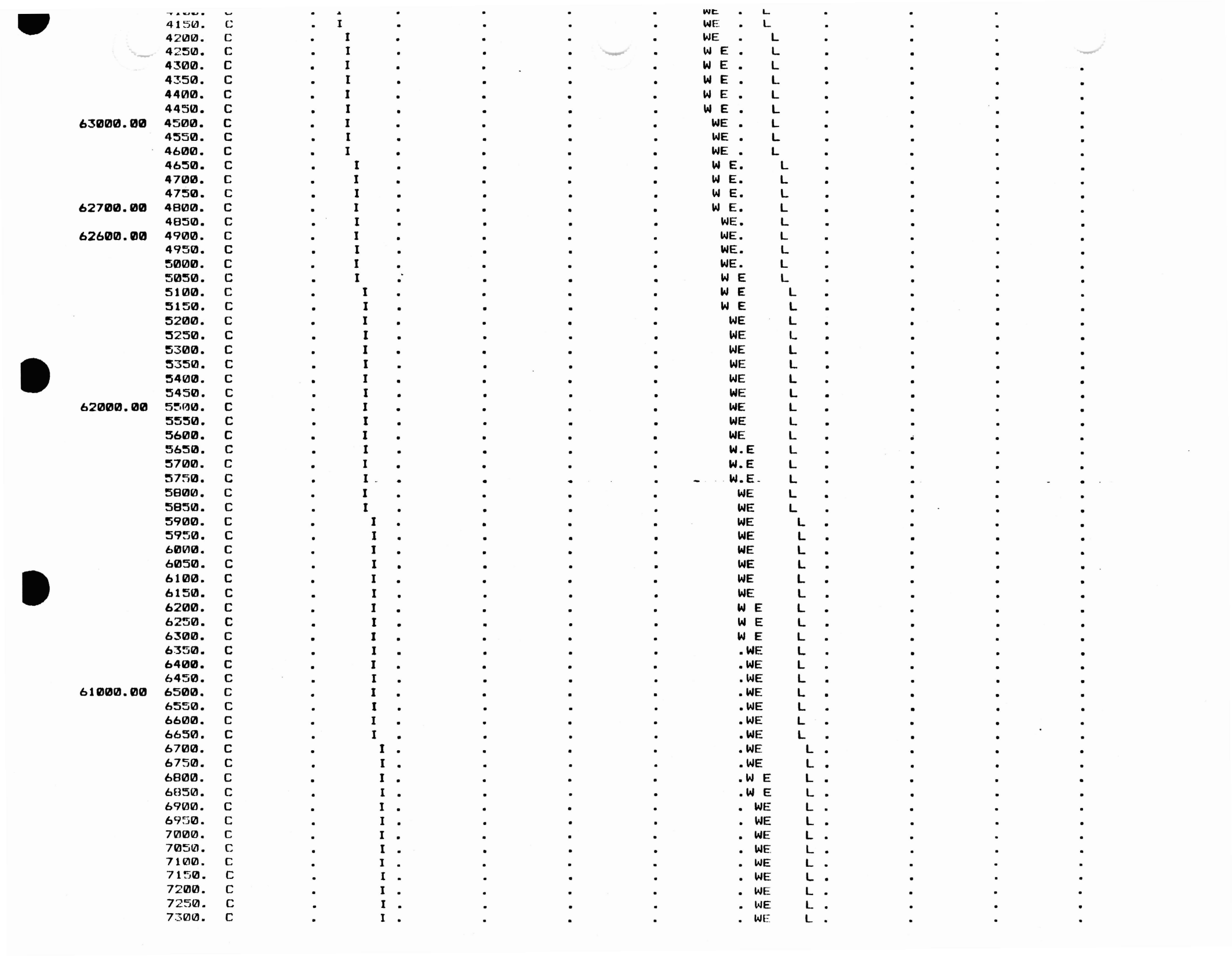
VOID

PROFILE FOR STREAM REACH 4 MODIFIED

PLOTTED POINTS (BY PRIORITY)-E-ENERGY,W-WATER SURFACE,I-INVERT,C-CRITICAL W.S.,L-LEFT BANK,R-RIGHT BANK,M-LOWER END STA

ELEVATION	306.	308.	310.	312.	314.	316.	318.	320.	322.	324.
SECNO	CUMDIS									
67500.00	0. C I	.	.	.	.	W E . L	.	.	.	.
	50. C I	.	.	.	.	W E . L	.	.	.	.
	100. C I	.	.	.	.	W E . L	.	.	.	.
	150. C I	.	.	.	.	W E . L	.	.	.	.
	200. C I	.	.	.	.	WE . L	.	.	.	.
	250. C I	.	.	.	.	WE . L	.	.	.	.
	300. C I	.	.	.	.	W E . L	.	.	.	.
	350. C I	.	.	.	.	W E . L	.	.	.	.
	400. C I	.	.	.	.	W E . L	.	.	.	.
	450. C I	.	.	.	.	W E . L	.	.	.	.
67000.00	500. C I	.	.	.	.	W E . L	.	.	.	.
	550. C I	.	.	.	.	W E . L	.	.	.	.
	600. C I	.	.	.	.	WE . L	.	.	.	.
	650. C I	.	.	.	.	WE . L	.	.	.	.
	700. C I	.	.	.	.	W E. L	.	.	.	.
	750. C I	.	.	.	.	W E. L	.	.	.	.
	800. C I	.	.	.	.	W E. L	.	.	.	.
	850. C I	.	.	.	.	W E. L	.	.	.	.
	900. C I	.	.	.	.	W E. L	.	.	.	.
	950. C I	.	.	.	.	W E. L	.	.	.	.
	1000. C I	.	.	.	.	WE. L	.	.	.	.

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4250. C . I . . . . W E . L . . .
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4350. C . I . . . . W E . L . . .
4400. C . I . . . . W E . L . . .
4450. C . I . . . . W E . L . . .
63000.00 4500. C . I . . . . WE . L . . .
4550. C . I . . . . WE . L . . .
4600. C . I . . . . WE . L . . .
4650. C . I . . . . W E. L . . .
4700. C . I . . . . W E. L . . .
4750. C . I . . . . W E. L . . .
62700.00 4800. C . I . . . . W E. L . . .
4850. C . I . . . . WE. L . . .
62600.00 4900. C . I . . . . WE. L . . .
4950. C . I . . . . WE. L . . .
5000. C . I . . . . WE. L . . .
5050. C . I . . . . W E L . . .
5100. C . I . . . . W E L . . .
5150. C . I . . . . W E L . . .
5200. C . I . . . . WE L . . .
5250. C . I . . . . WE L . . .
5300. C . I . . . . WE L . . .
5350. C . I . . . . WE L . . .
5400. C . I . . . . WE L . . .
5450. C . I . . . . WE L . . .
62000.00 5500. C . I . . . . WE L . . .
5550. C . I . . . . WE L . . .
5600. C . I . . . . WE L . . .
5650. C . I . . . . W.E L . . .
5700. C . I . . . . W.E L . . .
5750. C . I . . . . W.E L . . .
5800. C . I . . . . WE L . . .
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6000. C . I . . . . WE L . . .
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6200. C . I . . . . W E L . . .
6250. C . I . . . . W E L . . .
6300. C . I . . . . W E L . . .
6350. C . I . . . . .WE L . . .
6400. C . I . . . . .WE L . . .
6450. C . I . . . . .WE L . . .
61000.00 6500. C . I . . . . .WE L . . .
6550. C . I . . . . .WE L . . .
6600. C . I . . . . .WE L . . .
6650. C . I . . . . .WE L . . .
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6950. C . I . . . . . WE L . . .
7000. C . I . . . . . WE L . . .
7050. C . I . . . . . WE L . . .
7100. C . I . . . . . WE L . . .
7150. C . I . . . . . WE L . . .
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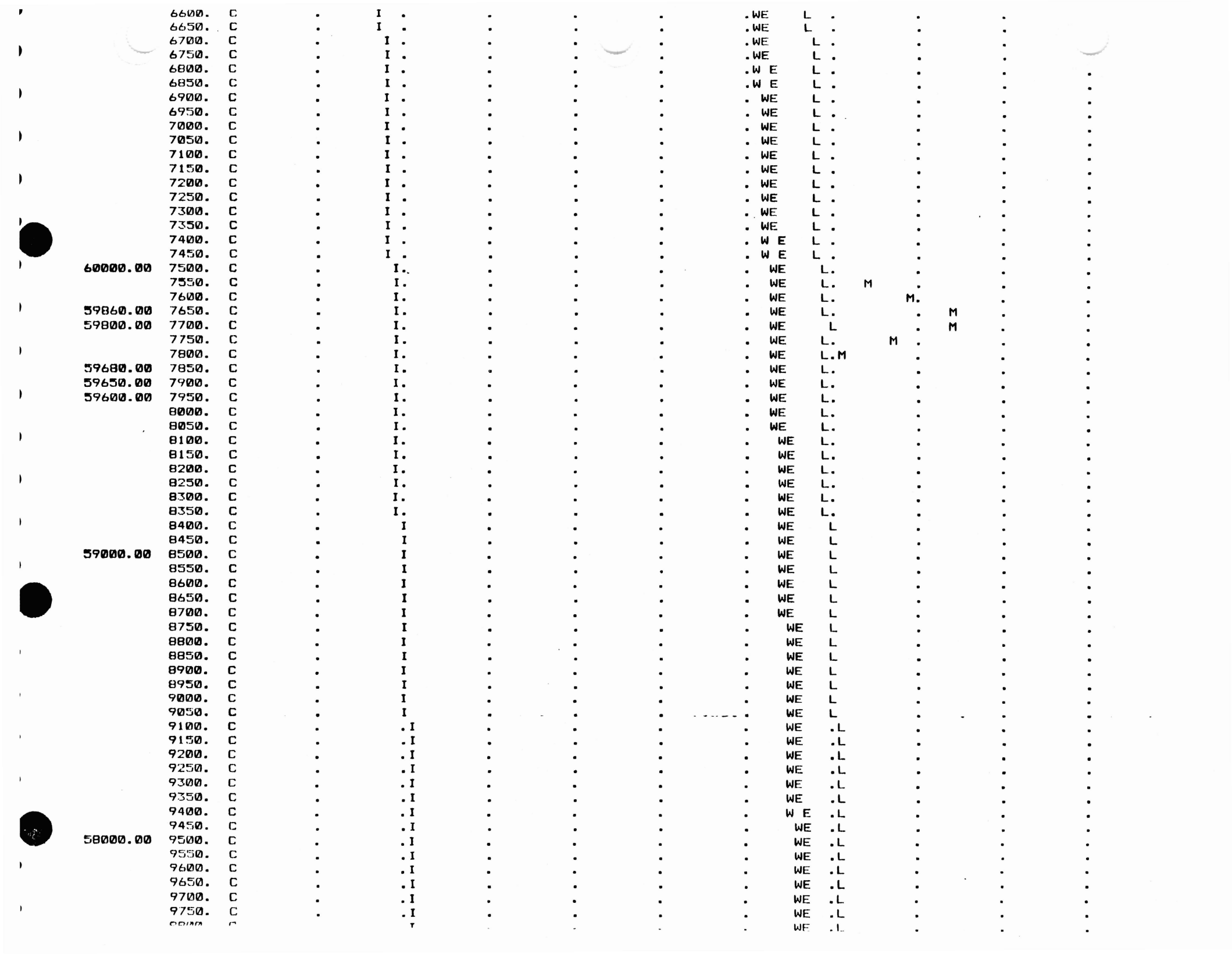

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            9250.  C  .  .I  .  .  .  .  WE  .L  .  .
            9300.  C  .  .I  .  .  .  .  WE  .L  .  .
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            9700.  C  .  .I  .  .  .  .   WE .L  .  .
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           10350.  C  .  . I .  .  .  .    WE . L  .  .
           10400.  C  .  . I .  .  .  .    WE . L  .  .
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           10600.  C  .  . I .  .  .  .    WE . L  .  .
           10650.  C  .  . I .  .  .  .    WE . L  .  .
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           10750.  C  .  .  I .  .  .  .   WE .  L  .  .
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           11450.  C  .  .  I .  .  .  .    WE.  L  .  .
56000.00   11500.  C  .  .   I .  .  .  .   WE.   L  .  .
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           11650.  C  .  .   I .  .  .  .    WE   L  .  .
           11700.  C  .  .   I .  .  .  .    WE   L  .  .
           11750.  C  .  .   I .  .  .  .    WE   L  .  .
           11800.  C  .  .   I .  .  .  .    WE   L  .  .
           11850.  C  .  .   I .  .  .  .    WE   L  .  .
           11900.  C  .  .   I .  .  .  .    WE   L  .  .
           11950.  C  .  .   I .  .  .  .    WE   L  .  .
55500.00   12000.  C  .  .   I .  .  .  .    WE   L  .  .
55450.00   12050.  C  .  .   I .  .  .  .    WE   L  .  .
55400.00   12100.  C  .  .   I .  .  .  .    WE   L  .  .
55380.00   12150.  C  .  .   I .  .  .  .   W E   L  .  .
55340.00   12200.  C  .  .   I .  .  .  .   W .E  L  .  .
55320.00   12250.  C  .  .   I .  .  .  .   W .E  L  .  .
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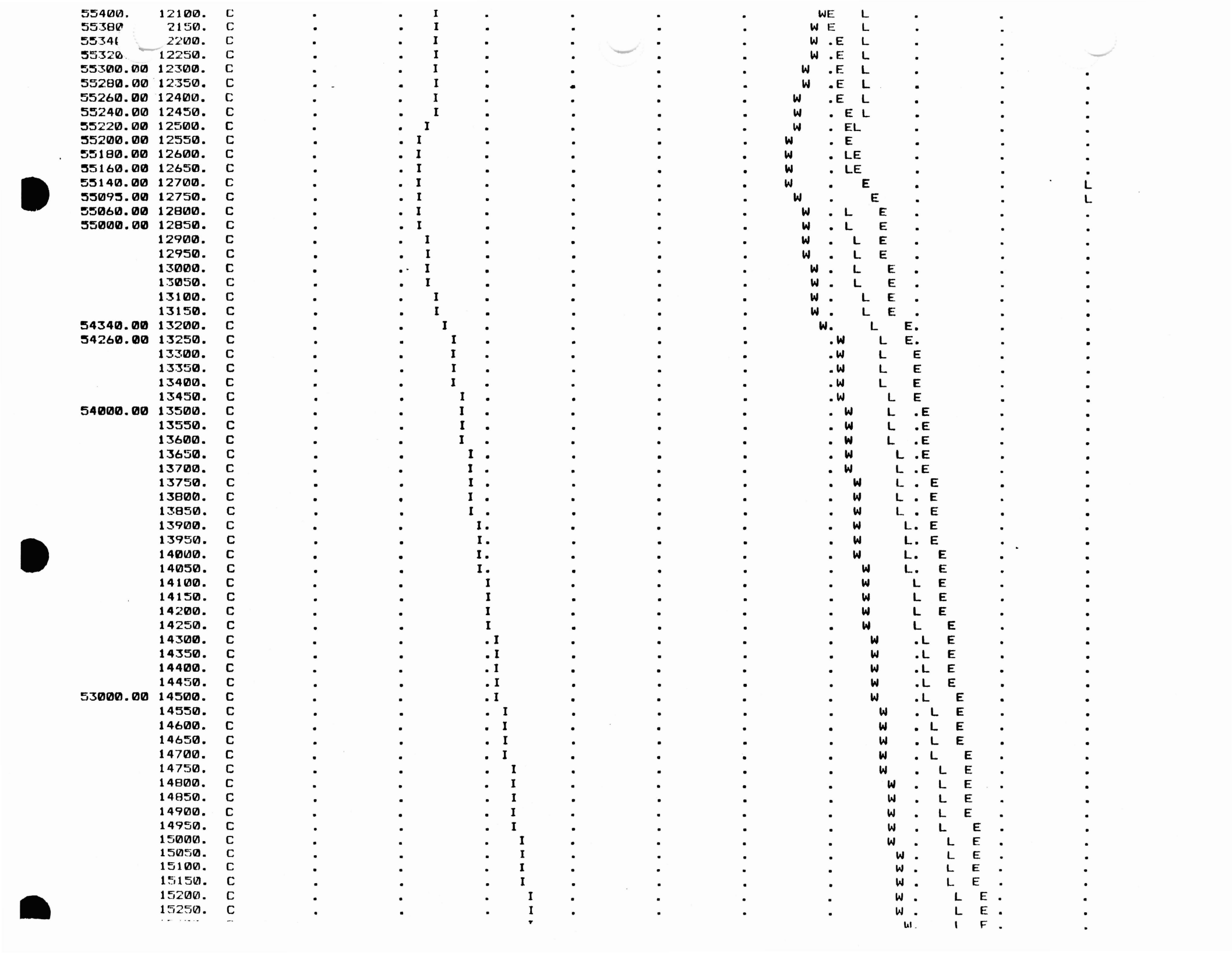

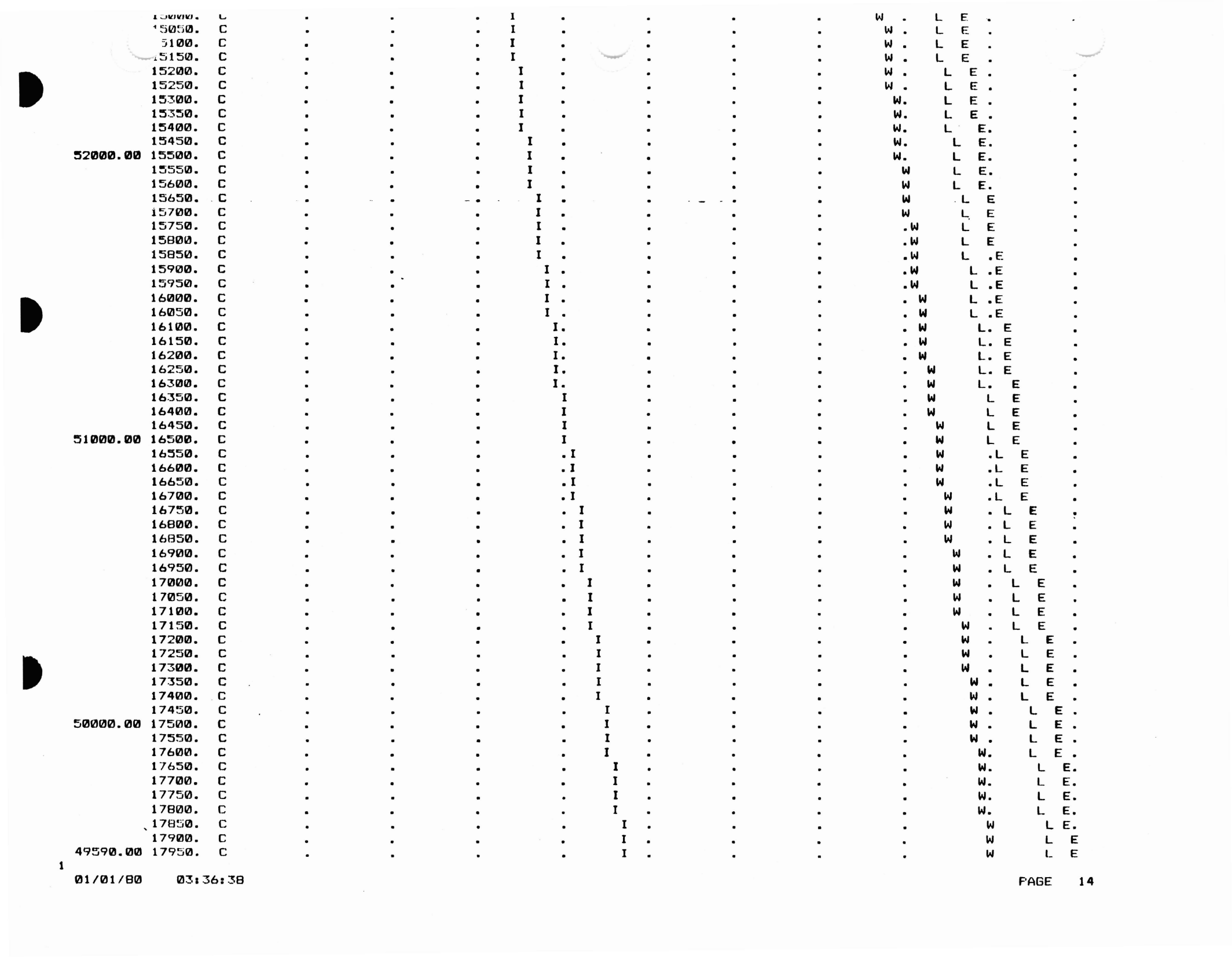
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15200. C
15250. C
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17400. C
17450. C
50000.00 17500. C
17550. C
17600. C
17650. C
17700. C
17750. C
17800. C
17850. C
17900. C
49590.00 17950. C

THIS RUN EXECUTED 01/01/80 03:39:36

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************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION
************************************************
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

REACH 4 MODIFIED

SUMMARY PRINTOUT TABLE 150

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
67500.000	.00	.00	.00	306.60	6900.00	315.02	.00	315.36	5.13	4.68	1475.69	3045.43
67000.000	500.00	.00	.00	306.85	6900.00	315.28	.00	315.62	5.13	4.68	1475.69	3045.43
66000.000	1000.00	.00	.00	307.35	6900.00	315.79	.00	316.13	5.11	4.67	1478.35	3053.76
65000.000	1000.00	.00	.00	307.85	6900.00	316.30	.00	316.64	5.08	4.66	1480.71	3061.13
64000.000	1000.00	.00	.00	308.35	6900.00	316.81	.00	317.14	5.07	4.66	1481.74	3064.37
63000.000	1000.00	.00	.00	308.85	6900.00	317.32	.00	317.65	5.05	4.65	1483.35	3069.40
62700.000	300.00	.00	.00	309.00	6900.00	317.47	.00	317.80	5.04	4.65	1484.73	3073.73
62600.000	100.00	.00	.00	309.05	6900.00	317.59	.00	317.85	3.65	4.03	1714.09	3609.72
62000.000	600.00	.00	.00	309.20	6900.00	317.81	.00	318.06	3.55	3.99	1730.12	3661.39
61000.000	1000.00	.00	.00	309.45	6900.00	318.17	.00	318.41	3.41	3.93	1753.82	3738.19
60000.000	1000.00	.00	.00	309.70	6900.00	318.51	.00	318.74	3.29	3.89	1774.35	3805.14
59860.000	140.00	.00	.00	309.74	6900.00	318.56	.00	318.79	3.26	3.86	1785.95	3819.04
59800.000	60.00	322.80	319.70	309.76	6900.00	318.56	.00	318.79	3.27	3.87	1784.48	3814.27
59680.000	120.00	.00	.00	309.79	6900.00	318.60	.00	318.83	3.30	3.89	1772.89	3800.35
59650.000	30.00	324.00	319.97	309.80	6900.00	318.63	.00	318.86	3.27	3.88	1778.10	3817.38
59600.000	50.00	.00	.00	309.80	6500.00	318.67	.00	318.87	2.85	3.64	1788.13	3850.27
59000.000	600.00	.00	.00	309.95	6500.00	318.84	.00	319.04	2.83	3.63	1793.00	3866.26

1

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
58000.000	1000.00	.00	.00	310.20	6500.00	319.12	.00	319.33	2.79	3.61	1800.45	3890.74

59[illegible]0	600.00	.00	.00	309.95	6500.0[illegible]	318.84	.00	319.04	2.83	3.63	[illegible]	3866.26

1

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EB	10K*S	VCH	AREA	.01K
58000.000	1000.00	.00	.00	310.20	6500.00	319.12	.00	319.33	2.79	3.61	1800.45	3890.74
57000.000	1000.00	.00	.00	310.45	6500.00	319.40	.00	319.60	2.76	3.60	1807.08	3912.58
56000.000	1000.00	.00	.00	310.70	6500.00	319.68	.00	319.88	2.73	3.59	1812.99	3932.09
55500.000	500.00	.00	.00	310.82	6500.00	319.81	.00	320.01	2.72	3.58	1814.90	3938.41
55450.000	50.00	.00	.00	310.83	6500.00	319.77	.00	320.03	6.09	4.09	1589.89	2634.91
55400.000	50.00	.00	.00	310.84	6500.00	319.72	.00	320.07	8.49	4.76	1364.42	2230.41
55380.000	20.00	.00	.00	310.85	6500.00	319.69	.00	320.09	9.75	5.07	1281.32	2081.32
55340.000	40.00	.00	.00	310.86	6500.00	319.61	.00	320.13	13.26	5.82	1116.04	1785.32
55320.000	20.00	.00	.00	310.87	6500.00	319.54	.00	320.16	15.86	6.31	1030.67	1632.08
55300.000	20.00	.00	.00	310.87	6500.00	319.46	.00	320.20	19.30	6.88	945.39	1479.72
55280.000	20.00	.00	.00	310.88	6500.00	319.39	.00	320.24	22.79	7.39	879.25	1361.70
55260.000	20.00	.00	.00	310.88	6500.00	319.29	.00	320.29	27.36	8.00	812.01	1242.69
55240.000	20.00	.00	.00	310.88	6500.00	319.16	.00	320.35	33.79	8.76	741.99	1118.23
55220.000	20.00	.00	.00	310.61	6500.00	319.13	.00	320.42	36.00	9.12	712.55	1083.27
55200.000	20.00	.00	.00	310.31	6500.00	319.07	.00	320.49	38.97	9.56	679.78	1041.27
55180.000	20.00	.00	.00	310.33	6500.00	319.06	.00	320.57	41.93	9.86	659.22	1003.82
55160.000	20.00	.00	.00	310.35	6500.00	319.05	.00	320.66	45.15	10.17	639.03	967.35
55140.000	20.00	.00	.00	310.36	6500.00	319.06	.00	320.75	48.12	10.46	621.61	937.01
55095.000	45.00	330.50	329.30	310.40	6500.00	319.26	.00	321.08	51.64	10.84	599.82	904.55
55060.000	35.00	.00	.00	310.44	6500.00	319.34	.00	321.14	8.14	10.78	603.06	2278.91
55000.000	60.00	.00	.00	310.49	6500.00	319.38	.00	321.19	8.14	10.78	603.07	2278.92
54340.000	660.00	.00	.00	311.08	6500.00	319.88	.00	321.74	8.44	10.92	595.27	2236.82
54260.000	80.00	328.90	325.90	311.15	6500.00	320.14	.00	321.89	7.84	10.64	610.84	2321.10
54000.000	260.00	.00	.00	311.38	6500.00	320.32	.00	322.10	8.00	10.71	606.72	2298.72
53000.000	1000.00	.00	.00	312.28	6500.00	321.06	.00	322.93	8.51	10.95	593.58	2227.70
52000.000	1000.00	.00	.00	313.18	6500.00	321.89	.00	323.79	8.79	11.07	586.93	2192.03

1

5400[illegible]00	260.00	.00	.00	311.38	6500.00	320.32	.00	322.10	8.00	10.71	60[illegible]72	2298.72
53[illegible]	1000.00	.00	.00	312.28	6500.00	[illegible]21.06	.00	322.93	8.51	10.95	[illegible]	2227.70
52000.000	1000.00	.00	.00	313.18	6500.00	321.89	.00	323.79	8.79	11.07	58[illegible].93	2192.03

1
01/01/80 03:36:38 PAGE 16

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
51000.000	1000.00	.00	.00	314.08	6500.00	322.75	.00	324.68	8.92	11.13	584.11	2176.90
50000.000	1000.00	.00	.00	314.98	6500.00	323.64	.00	325.57	8.92	11.13	584.11	2176.88
49590.000	410.00	.00	.00	315.36	6500.00	323.99	.00	325.94	9.08	11.20	580.35	2156.83

1
01/01/80 03:36:38 PAGE 17

REACH 4 MODIFIED

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
67500.000	6900.00	315.02	.00	.00	.00	200.52	.00
67000.000	6900.00	315.28	.00	.26	.00	200.52	500.00
66000.000	6900.00	315.79	.00	.51	.00	200.60	1000.00
65000.000	6900.00	316.30	.00	.51	.00	200.67	1000.00
64000.000	6900.00	316.81	.00	.51	.00	200.70	1000.00
63000.000	6900.00	317.32	.00	.51	.00	200.75	1000.00
62700.000	6900.00	317.47	.00	.15	.00	200.79	300.00
62600.000	6900.00	317.59	.00	.13	.00	226.26	100.00
62000.000	6900.00	317.81	.00	.22	.00	226.69	600.00
61000.000	6900.00	318.17	.00	.35	.00	227.31	1000.00
60000.000	6900.00	318.51	.00	.34	.00	227.85	1000.00
59860.000	6900.00	318.56	.00	.05	.00	230.49	140.00
59800.000	6900.00	318.56	.00	.00	.00	230.45	60.00
59680.000	6900.00	318.60	.00	.04	.00	227.81	120.00
59650.000	6900.00	318.63	.00	.03	.00	227.95	30.00
59600.000	6500.00	318.67	.00	.04	.00	228.22	50.00
59000.000	6500.00	318.84	.00	.17	.00	228.34	600.00
58000.000	6500.00	319.12	.00	.28	.00	228.54	1000.00

495[illegible]0	410.00	.00	.00	315.36	6500.00	323.99	.00	325.94	9.08	11.20	[illegible]5 2156.83

1

REACH 4 MODIFIED

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
67500.000	6900.00	315.02	.00	.00	.00	200.52	.00
67000.000	6900.00	315.28	.00	.26	.00	200.52	500.00
66000.000	6900.00	315.79	.00	.51	.00	200.60	1000.00
65000.000	6900.00	316.30	.00	.51	.00	200.67	1000.00
64000.000	6900.00	316.81	.00	.51	.00	200.70	1000.00
63000.000	6900.00	317.32	.00	.51	.00	200.75	1000.00
62700.000	6900.00	317.47	.00	.15	.00	200.79	300.00
62600.000	6900.00	317.59	.00	.13	.00	226.26	100.00
62000.000	6900.00	317.81	.00	.22	.00	226.69	600.00
61000.000	6900.00	318.17	.00	.35	.00	227.31	1000.00
60000.000	6900.00	318.51	.00	.34	.00	227.85	1000.00
59860.000	6900.00	318.56	.00	.05	.00	230.49	140.00
59800.000	6900.00	318.56	.00	.00	.00	230.45	60.00
59680.000	6900.00	318.60	.00	.04	.00	227.81	120.00
59650.000	6900.00	318.63	.00	.03	.00	227.95	30.00
59600.000	6500.00	318.67	.00	.04	.00	228.22	50.00
59000.000	6500.00	318.84	.00	.17	.00	228.34	600.00
58000.000	6500.00	319.12	.00	.28	.00	228.54	1000.00
57000.000	6500.00	319.40	.00	.28	.00	228.71	1000.00
56000.000	6500.00	319.68	.00	.28	.00	228.87	1000.00
55500.000	6500.00	319.81	.00	.14	.00	228.92	500.00
55450.000	6500.00	319.77	.00	-.04	.00	203.11	50.00
55400.000	6500.00	319.72	.00	-.06	.00	177.40	50.00
55380.000	6500.00	319.69	.00	-.03	.00	167.96	20.00

1

5540[illegible]00	6500.00	319.72	.00	-.06	.00	177.40	50.00
553[illegible]0	6500.00	319.69	.00	-.03	.00	67.96	20.00

1

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
55340.000	6500.00	319.61	.00	-.08	.00	149.21	40.00
55320.000	6500.00	319.54	.00	-.06	.00	139.64	20.00
55300.000	6500.00	319.46	.00	-.08	.00	130.04	20.00
55280.000	6500.00	319.39	.00	-.07	.00	122.64	20.00
55260.000	6500.00	319.29	.00	-.10	.00	115.02	20.00
55240.000	6500.00	319.16	.00	-.14	.00	107.26	20.00
55220.000	6500.00	319.13	.00	-.03	.00	101.27	20.00
55200.000	6500.00	319.07	.00	-.05	.00	95.07	20.00
55180.000	6500.00	319.06	.00	-.01	.00	92.94	20.00
55160.000	6500.00	319.05	.00	-.01	.00	90.82	20.00
55140.000	6500.00	319.06	.00	.00	.00	88.82	20.00
55095.000	6500.00	319.26	.00	.20	.00	85.43	45.00
55060.000	6500.00	319.34	.00	.08	.00	85.58	35.00
55000.000	6500.00	319.38	.00	.05	.00	85.58	60.00
54340.000	6500.00	319.88	.00	.50	.00	85.22	660.00
54260.000	6500.00	320.14	.00	.25	.00	85.95	80.00
54000.000	6500.00	320.32	.00	.18	.00	85.75	260.00
53000.000	6500.00	321.06	.00	.75	.00	85.14	1000.00
52000.000	6500.00	321.89	.00	.82	.00	84.83	1000.00
51000.000	6500.00	322.75	.00	.87	.00	84.69	1000.00
50000.000	6500.00	323.64	.00	.89	.00	84.69	1000.00
49590.000	6500.00	323.99	.00	.34	.00	84.52	410.00

1

SUMMARY OF ERRORS AND SPECIAL NOTES

1

55060.000	6500.00	319.34	.00	.08	.00	85.58	35.00
55025.000	6500.00	319.38	.00	.05	.00	85.58	60.00
54340.000	6500.00	319.88	.00	.50	.00	85.22	660.00
54260.000	6500.00	320.14	.00	.25	.00	85.95	80.00
54000.000	6500.00	320.32	.00	.18	.00	85.75	260.00
53000.000	6500.00	321.06	.00	.75	.00	85.14	1000.00
52000.000	6500.00	321.89	.00	.82	.00	84.83	1000.00
51000.000	6500.00	322.75	.00	.87	.00	84.69	1000.00
50000.000	6500.00	323.64	.00	.89	.00	84.69	1000.00
49590.000	6500.00	323.99	.00	.34	.00	84.52	410.00

SUMMARY OF ERRORS AND SPECIAL NOTES

THIS RUN EXECUTED 01/01/80 03:39:55

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION
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ARIZONA RWCD R4

DT 11/19/84 YMK 2/85

LOW DROP

1

PROBLEM: DEVELOP DIMENSIONS FOR DROP STRUCTURE USDA PUBLICATION STREAM CHANNEL STABILITY APPENDIX E "MODEL STUDY OF THE LOW DROP GRADIENT CONTROL STRUCTURES"

ANALYSIS: 1. $Q = 6900$ CFS ✓
$H = 3.35$ FT

2. CRITERIA

WIDTH $W_{SB} = 2B$

LENGTH $X_b/Y_c = 3.54 + 4.26\ (H/Y_c)$

DEPTH $Y_{SB} = 1.0\ Y_c + H$

SS 2.5:1 TO 2.0:1

BAFFLE LENGTH $L_B = B/2$

BAFFLE HEIGHT $H_B = Y_c$

HEIGHT OF BAFF ABOVE INVERT CH. $Y_c/4 \leq Y_b \leq Y_c/3$

ARIZONA RWCD R4

DT 11/19/84 YMK 2/85

LOW DROP

2

1. DETERMINE WEIR CREST LENGTH

Try crest length that will provide H = normal depth in channel upstream.

$D = 8.48$

TRAPEZOIDAL WEIR

$$Q = CLH^{3/2} + CZH^{5/2}$$

$$L = \frac{Q - CZH^{5/2}}{CH^{3/2}}$$

$$= \frac{6900 - 3.1(2.5)(8.48)^{5/2}}{3.1(8.48)^{3/2}}$$

$$= 68.94$$

TRY 70 FT WEIR

2. FIND Y_c:

$Y_c = 6.21$ ✓

Check $Q = \left(\frac{gA^3}{T}\right)^{1/2}$

$A = bd + zd^2$
$= 70(6.21) + 2.5(6.21)^2$
$= 531$

$T = b + 2zd$
$= 70 + 2(2.5)(6.21)$
$= 101.05$

$$= \left(\frac{32.16(531)^3}{101.05}\right)^{1/2}$$

$= 6902$ ✓

$$V_c = \frac{6900}{531} = 13.0 \text{ ft/s}$$

ARIZONA RWCD R4

DT 11/19/84 EMA 2/85

LOW DROP

3

3. WIDTH (1.0 to 2.0) B is OK A.F

$W_{SB} = 2B = 2(70) = 140$

4. LENGTH

$X_b = 3.54 Y_c + 4.26 H$

$= 3.54(6.21) + 4.26(3.35)$

$= 21.98 + 14.27$

$X_b = 36.25$ ✓

$L_{SB} = 2X_b = \underline{72.5 ft}$ ✓

5. DEPTH:

$W_{SB} = D = Y_c + H = 6.21 + 3.35 = \underline{9.56 ft}$ ✓

6. BAFFLE HEIGHT $H_b = Y_c = 6.21$ ✓

7. HEIGHT OF BAFFLE ABOVE WEIR CR: $Y_c/4 \leq Y_b \leq Y_c/3$

$1.55' \; Y_b \leq 2.07$ ✓

USE 2.0

8. BAFFLE LENGTH = $B/2 = 70/2 = 35 ft$ ✓

ARIZONA RWCD R4

DT 11/19/84 Lmt 2/85

LOW DROP 4

MSLD

CHECK HYDRAULICS

EQN. 11

$$\frac{Y_M}{Y_c} = 0.68\left(\frac{H}{Y_c}\right)^{-0.19}$$

$H = 3.35$

$Y_c = 6.21$

$$Y_M = 6.21(0.68)\left(\frac{3.35}{6.21}\right)^{0.19}$$

$Y_M = 4.75$ ✓

$F = V/\sqrt{gh}$

$= 17.75/\sqrt{32.16(4.75)}$

$F = 1.44$

$A = 4.75(2.5(4.75)+70)$

$= 388.14$

$V = 6900/388 = 17.75$

PER BEST FIT EQN: (7)

$$Y_2 = Y_M(-0.36 + 1.47F_M)$$

$$= 4.75(-0.36 + 1.47(1.44))$$

$= 8.32$ ft OK

ARIZONA RWCD REACH 4

DT 11/19/84 LMH 2/85

LOW DROP 5,

SUMMARY:

SS: 2.5:1
B: 70
* W_{SS}: 140
L_B: 35
L_{SS}: 72.5
X_B: 36.25
Y_C: 6.21
Y_{SS}: 9.56 USE → 9.5
Y_b: 2.00
H_L: 6.21 USE → 6.0
H: 3.35

Depth = 6.65

* W_{SS} MAY BE REDUCED TO = B WITH NO BAD EFFECT ON THE PERFORMANCE. SEE LAYOUT ✓

from "STILLING BASIN DESIGN FOR LOW DROP STRUCTURES"

by W. CAMPBELL LITTLE

ASAE PAPER 83-2115

6/83

ARIZONA
DJ 11/29/84 RWCD RCH 4 LMW 2/85
WSP US OF LOW DROP

WEIR CREST

PWEP

SUB
STA.=675+00.00
Q=6,900.00 CFS
BW=70.00 FT
Z=2.50:1
N=0.027
Scb=0.0005 F/F
a=1.000
k=0.150
CB-EL.=1,306.64 FT
WS-EL.=1,312.85 FT
EGL-EL.=1,315.47 FT
D=6.210 FT
V=12.992 F/S
DC=6.205 FT
VC=13.004 F/S
FR=0.999

1306.6

SUB
STA.=674+80.00
Q=6,900.00 CFS
BW=73.00 FT
Z=2.80:1
N=0.027
Scb=0.0005 F/F
a=1.000
k=0.150
CB-EL.=1,306.65 FT
WS-EL.=1,314.33 FT
EGL-EL.=1,315.73 FT
EGL-S=0.0031115 F/F
D=7.680 FT
V=9.506 F/S
DC=6.014 FT
VC=12.770 F/S
FR=0.670

SUB
STA.=674+90.00
Q=6,900.00 CFS
BW=70.00 FT
Z=2.70:1
N=0.027
Scb=0.0005 F/F
a=1.000
k=0.150
CB-EL.=~~1,306.65~~ FT
WS-EL.=~~1,313.90~~ FT
EGL-EL.=~~1,315.65~~ FT
EGL-S=0.0049235 F/F
D=7.257 FT
V=10.613 F/S
DC=6.169 FT
VC=12.908 F/S
FR=0.766

SUB
STA.=674+70.00
Q=6,900.00 CFS
BW=100.00 FT
Z=2.90:1
N=0.027
Scb=0.0005 F/F
a=1.000
k=0.150
CB-EL.=1,306.68 FT
WS-EL.=1,312.22 FT
EGL-EL.=1,313.37 FT
EGL-S=0.0018466 F/F
D=6.563 FT
V=6.455 F/S
DC=5.026 FT
VC=11.982 F/S
FR=0.426

AKIZONA
DT 11/29/84

RWCD R4
JMT 2/8/85

STA.=674+60.00
Q=6,900.00 CFS
BW=150.00 FT
Z=3.00:1
N=0.027
Scb=0.0005 F/F
a=1.000
k=0.150
CB-EL.=1,306.05 FT
WS-EL.=1,315.63 FT
EGL-EL.=1,315.93 FT
EGL-S=0.0007188 F/F
D=8.972 FT
V=4.347 F/S
DC=3.928 FT
VC=10.858 F/S
FR=0.275

WEIR EQN.
D = 8.42 FT
B = 70
Z = 2.5
C = 3.1
Q = 6896

ARIZONA DT

RWCD R4

11/29/04

WSP U.S. OF NEIR @ 675+00 50

$Q = 6900$

$b = 70$

$z = 2.5$

$d_c = 6.21$

	STA	b	z	d	INV EL
CL	675+00 50	70	2.5	6.21	1306.64
	674+90 40	70	2.7		
	80 30	73	2.8		
	70 20	100	2.9		
	60 10	150	3.0		

ARIZ
DT 11/26/84 RWCD R4
LOW DROP LMF 2/85

PROBLEM: THE LOW DROP CRITERIA WERE REFINED IN THE PAPER

"STILLING BASIN DESIGN FOR LOW DROP STRUCTURES. ASAE P 83-2115"

CHECK BASIN DIMENSIONS

ANALYSIS:

1. THE PAPER PROVIDES FOR A RECTANGULAR BASIN SHAPE TO SIMPLIFY CONSTRUCTION LAYOUT.

2. THE OPTIMUM BAFFLE LOCATION IS PROVIDED BY:

$$\frac{X_b}{Y_c} = 3.65 + 4.04\left(\frac{H}{Y_c}\right)$$

$$X_b = 3.65 Y_c + 4.04 H \quad \checkmark$$

(THE COEFFICIENTS ARE SLIGHTLY DIFFERENT THAN IN THE ORIGINAL PAPER)

3. PERFORMANCE OF THE STRUCTURE REMAINED THE SAME FOR BOTTOM WIDTHS FOR THE RANGE OF $W_B/B = 1.0$ TO 2.0

ARIZ RWCD R4

JT 11/26/84

LOW DROP

SOLUTION:

1. USE $W_{SB} = 70$ $(Y/B = 1.0)$

2. $X_b = 3.65 Y_c + 4.04 H$

$= 3.65(6.21) + 4.04(2.35)$

$X_b = 36.2$ FT ✓

RWCD R-4, Ag. Low Drop STA 675+50

LMS 2/85

Objective: Analyze alternative design to "low drop with baffle" based on Calif. Low Drop design.

design criteria: 1. Stable flow condition – Basic hydraulics

design procedure 1. Size weir to minimize upstream drawdown
2. Chute and basin geometry based on WSP and jump basin length per Monograph 25 (Bureau).

Weir crest:
Trapezodial $Q = CLH^{3/2} + ZCH^{5/2}$

Use $Z = 2$
$C = 3.5$ (Kings)

Upstream channel hydraulics
$d_n = 8.5$ SS = 3:1
$b = 150$ $Q = 6900$ cfs
$S = 0.0005$
$n = 0.027$

For $L = 60$
$Q = 6488$ cfs

$L = 65$
$Q = 7112$

RWCD R4
LMS 2/85

Low Drop STA 675+50

Provide transition inlet similar to design by Thackeray 11/84

Chute to diverge no ~~greater~~ faster than 12°

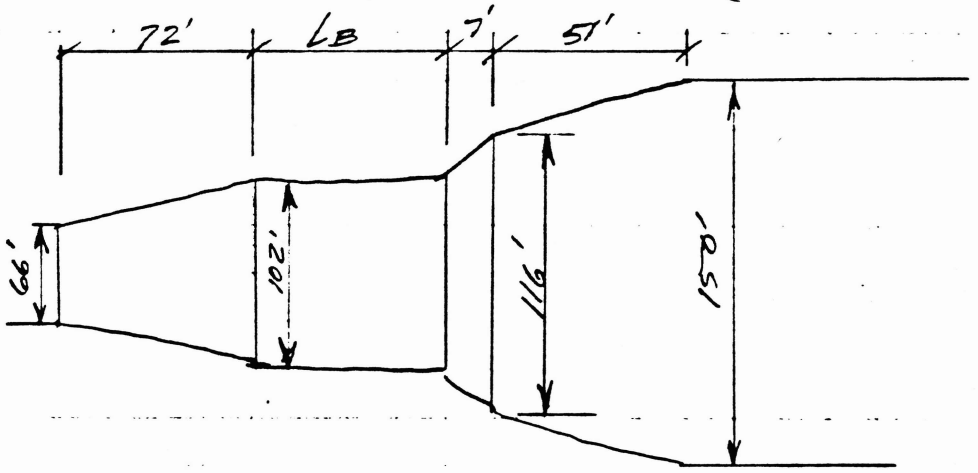
Try Weir crest L=65
Chute slope 10% ∴ Length 80'
divergence 4:1

WSP (see attached Computer Runs)

d @ 3.5 feet vert. downslope = 3.3'
∴ Total fall = 3.5 + 3.3 = 6.8
Use F = 7.0'

Length of transition = $\frac{7}{0.1}$ = 70'
4:1 divergence $\frac{70}{4}$ = 17.5'

Try length of transition = 72'
F = 7.0'
b(crest) = 66'
b(invert) = 102'



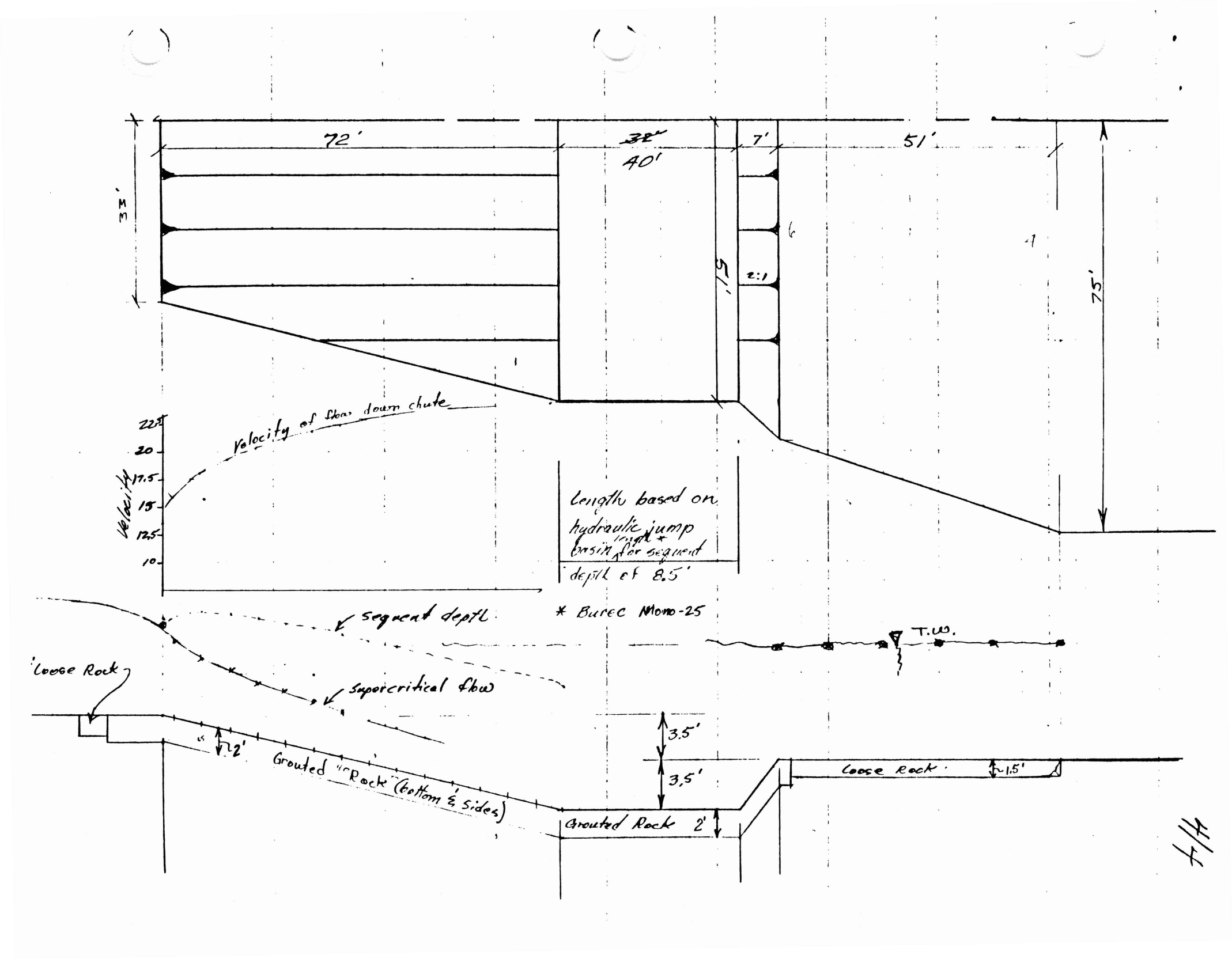
L_B = Basin length

use MONO-25 (Buried)

$F = 2.75$

$L_B = (5)(8.5) = 42.5$

Use $L_B = 40$ End Sill will shorten basin length required.


72'
32'
40'
7'
51'
33'
75'
15'
2:1
Velocity of flow down chute
Velocity
22.5
20
17.5
15
12.5
10
Length based on hydraulic jump basin for segment depth of 8.5'
* Bureau Mono-25
Segment depth
Supercritical flow
T.W.
Loose Rock
2'
Grouted "Rock" (bottom & sides)
3.5'
3.5'
Grouted Rock 2'
Loose rock
1.5'

A2 - RWCD R-4 Drop @ STA 675+50
LMS / 2/05

Cost Analysis & Comparison

"Calif. Drop" versus "Low drop with baffle"

Structure layout all similar ∴ following assumptions can be made:

1. Inlet section to crest of weir is identical
2. Outlet ds. of basin are the same
3. Chute length and basin length for Calif. drop is longer. Base cost comparison on only these sections.

Calif. Drop (use 2.5 side slopes)

Chute – Grouted Rock

A at crest = (66)(2) + (2)(27)(2) = 240 ft²
A at invert = (102)(2) + (2)(32)(2) = 332 ft²
2)572
286 ft²

$V_c = (286)(72) \div 27 = 763\ yd^3$

Basin

A = (102)(2) + (2)(32)(2) = 332

$V = (332)(40) = \frac{13280}{27} = 492\ yd^3$

TOTAL $1255\ yd^3$

Low Drop w/ Baffle

A at crest = (70)(2) + (2)(27)(2) = 248
A at invert = (86)(2) + (2)(54)(2) = 388
388/2 = 318 ft²

$V = \frac{(318)(36)}{27} = 424\ yd^3$

AZ - RWCD R-4 Low Drop @ STA 675+50 2/2
LMS 2/85

Basin

$A = 386$

$V = (386)(\frac{27}{27}) = 386\ yd^3$

TOTAL = $812\ yd^3$ grouted Rock

Baffle Wall

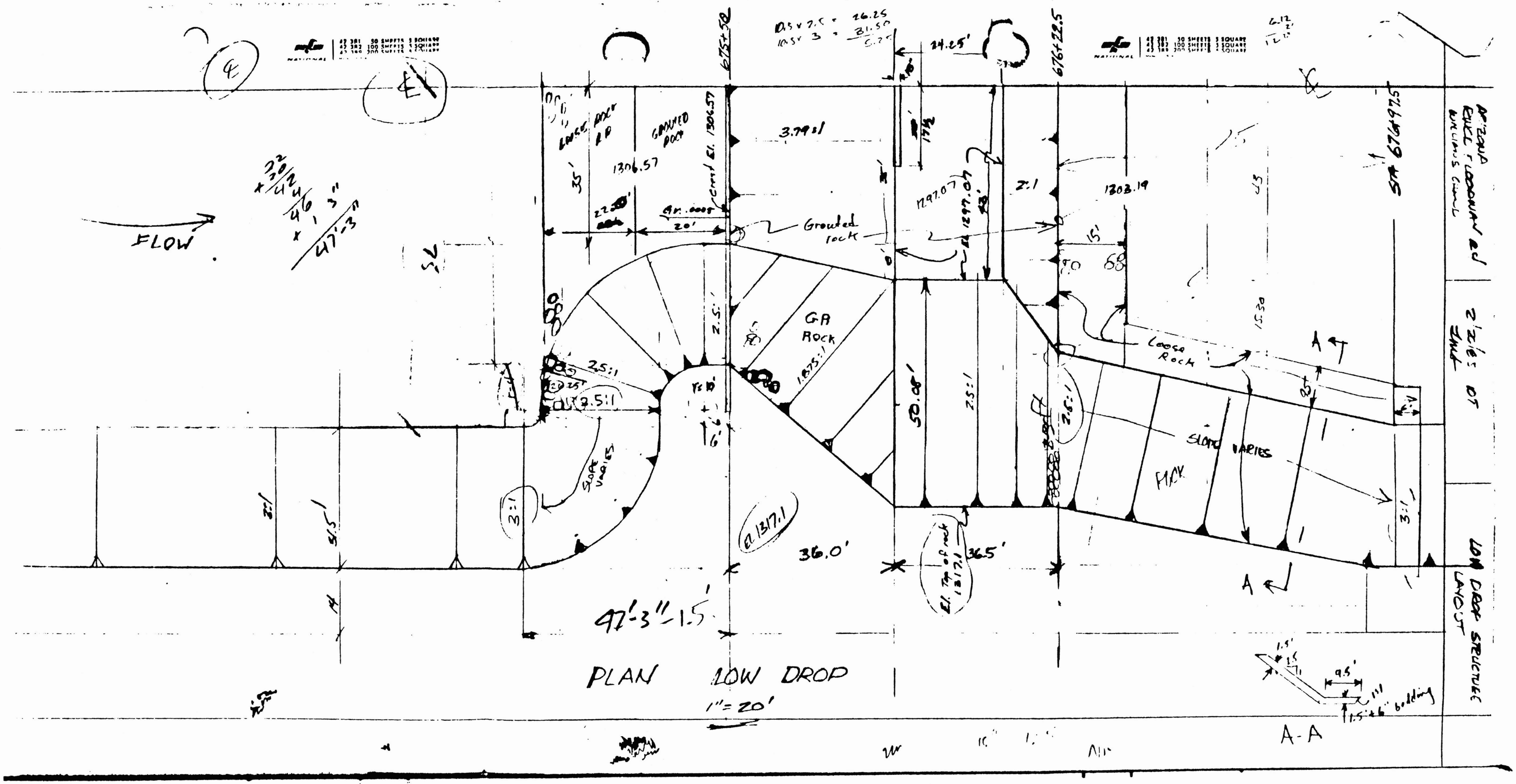
$V = (\frac{35}{27})(6.25)(\frac{15''}{12}) = \underline{10\ yd^3}$ concrete

Support Wall on Concrete Columns
Assume 20' depth below basin : L = 30'
3 required 1.5' DIA

$V = (3)(\pi\frac{(1.5)^2}{4})(\frac{30}{27}) = 5.9\ cu.yd^3$

CALIF. Drop	ITEM	Unit	Quantity	Unit Cost	~~Cost~~
	GROUTED Rock	cu yd.	1255	50 *	62,750
Loco Drop W/Baffle	Grouted Rock	cu yd	812	50 *	40,600
	R/C Concrete (Baffle - includes Steel)	Cuyd	10	350 *	3500
	R/C Concrete Columns - includes drilling	Cu yd	6	600	3600
* Reference Reach 3 bid prices				Total	47,700

⇒ Conclusion: Low Drop with Baffle will be used
1. Apparent lower cost
2. Performance backed up by hydraulic research



PLAN LOW DROP

1" = 20'

(1.2) Q10 Final 2/26/85 675+00 to 555+00

THIS RUN EXECUTED 01/01/80 03:58:51

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION
**************************************************

T1 RWCD REACH4 Q=1670CFS
T2 WATER SURFACE PROFILE
T3 RWCD REACH 4 MODIFIED 10 YEAR DISCHARGE

J1  ICHECK     INQ        NINV       IDIR       STRT       METRIC     HVINS      Q          WSEL       FQ
       0.       0.         0.         0.    .000000        .00        .2     1670.    310.270       .000

J2  NPROF      IPLOT      PRFVS      XSECV      XSECH      FN         ALLDC      IBW        CHNIM      ITRACE
     -1.000      .000       .000       .000       .000       .000       .000       .000       .000       .000

NC       .027       .027       .027       .000       .000       .000       .000       .000       .000       .000
X1  67500.000      4.000       .000    210.000       .000       .000       .000       .000       .000       .000
GR     316.600       .000    306.600     30.000    306.600    180.000    316.600    210.000       .000       .000

X1  67000.000       .000       .000       .000    500.000    500.000    500.000       .000       .250       .000

X1  66000.000       .000       .000       .000   1000.000   1000.000   1000.000       .000       .500       .000

X1  65000.000       .000       .000       .000   1000.000   1000.000   1000.000       .000       .500       .000

X1  64000.000       .000       .000       .000   1000.000   1000.000   1000.000       .000       .500       .000

X1  63000.000       .000       .000       .000   1000.000   1000.000   1000.000       .000       .500       .000

X1  62700.000       .000       .000       .000    300.000    300.000    300.000       .000       .150       .000

X1  62600.000      4.000       .000    235.000    100.000    100.000    100.000       .000       .000       .000
GR     319.050       .000    309.050     30.000    309.050    205.000    319.050    235.000       .000       .000

X1  62000.000       .000       .000       .000    600.000    600.000    600.000       .000       .150       .000

X1  61000.000       .000       .000       .000   1000.000   1000.000   1000.000       .000       .250       .000

X1  60000.000      4.000       .000    235.000   1000.000   1000.000   1000.000       .000       .000       .000
GR     319.700       .000    309.700     30.000    309.700    205.000    319.700    235.000       .000       .000

X1  59860.000      6.000      1.000    240.000    140.000    140.000    140.000       .000       .000       .000
GR     322.700       .000    319.900      1.000    309.740     32.000    309.740    207.000    319.900    240.000
GR     322.700    241.000       .000       .000       .000       .000       .000       .000       .000       .000
1
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SB       .900      1.600      2.800       .000    175.000      4.000   2055.000      3.000    309.750    309.740
X1  59800.000       .000       .000       .000     60.000     60.000     60.000       .000       .020       .000
X2       .000       .000      1.000    319.700    322.800       .000       .000      1.330       .000       .000
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SB	.900	1.600	2.800	.000	175.000	4.000	2055.000	3.000	309.750	309.
X1	59800.000	.000	.000	.000	60.000	60.000	60.000	.000	.020	.000
X2	.000	.000	1.000	319.700	322.800	.000	.000	.000	.000	.000
BT	2.000	7575.000	322.700	319.700	7810.000	322.200	319.700	.000	.000	.000
X1	59680.000	4.000	.000	235.000	120.000	120.000	120.000	.000	.000	.000
GR	319.790	.000	309.790	30.000	309.790	205.000	319.790	235.000	.000	.000
SB	1.050	1.560	2.800	270.000	175.000	15.000	2202.000	3.000	309.800	309.790
X1	59650.000	.000	.000	.000	30.000	30.000	30.000	.000	.010	.000
X2	.000	.000	1.000	319.970	324.000	.000	.000	1.800	.000	.000
X1	59600.000	4.000	.000	235.000	50.000	50.000	50.000	.000	.000	.000
X2	1620.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
GR	319.800	.000	309.800	30.000	309.800	205.000	319.800	235.000	.000	.000
X1	59000.000	.000	.000	.000	600.000	600.000	600.000	.000	.150	.000
X1	58000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.250	.000
X1	57000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.250	.000
X1	56000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.250	.000
X1	55500.000	4.000	.000	235.000	500.000	500.000	500.000	.000	.000	.000
GR	320.820	.000	310.820	30.000	310.820	205.000	320.820	235.000	.000	.000
NC	.035	.035	.035	.000	.000	.000	.000	.000	.000	.000
X1	55450.000	4.000	.000	209.100	50.000	50.000	50.000	.000	.000	.000
GR	320.830	.000	310.830	28.400	310.830	180.800	320.830	209.100	.000	.000
X1	55400.000	4.000	.000	183.400	50.000	50.000	50.000	.000	.000	.000
GR	320.840	.000	310.840	26.700	310.840	156.700	320.840	183.400	.000	.000
X1	55380.000	4.000	.000	174.000	20.000	20.000	20.000	.000	.000	.000
GR	320.850	.000	310.850	26.000	310.850	148.000	320.850	174.000	.000	.000
X1	55340.000	4.000	.000	155.400	40.000	40.000	40.000	.000	.000	.000
GR	320.860	.000	310.860	24.700	310.860	130.700	320.860	155.400	.000	.000
X1	55320.000	4.000	.000	146.000	20.000	20.000	20.000	.000	.000	.000
GR	320.870	.000	310.870	24.000	310.870	122.000	320.870	146.000	.000	.000
X1	55300.000	4.000	.000	136.600	20.000	20.000	20.000	.000	.000	.000
GR	320.870	.000	310.870	23.300	310.870	113.300	320.870	136.600	.000	.000
X1	55280.000	4.000	.000	129.400	20.000	20.000	20.000	.000	.000	.000
GR	320.880	.000	310.880	22.700	310.880	106.700	320.880	129.400	.000	.000

X1	55260.000	4.000	.000	122.000	20.000	20.000	20.000	.000	.000	.000
GR	320.880	.000	310.880	22.000	310.880	100.000	320.880	122.000	.000	.000
X1	55240.000	4.000	.000	114.600	20.000	20.000	20.000	.000	.000	.000
GR	320.880	.000	310.880	21.300	310.880	93.300	320.880	114.600	.000	.000
X1	55220.000	4.000	.000	107.400	20.000	20.000	20.000	.000	.000	.000
GR	320.610	.000	310.610	20.700	310.610	86.700	320.610	107.400	.000	.000

X1	55[illegible]000	4.000	.000	129.400	20.000	20.000	20.000	.000	.000	.000
GR	[illegible]380	.000	310.880	22.700	310.880	[illegible]6.700	320.880	129.400	.000	

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X1	55260.000	4.000	.000	122.000	20.000	20.000	20.000	.000	.000	.000
GR	320.880	.000	310.880	22.000	310.880	100.000	320.880	122.000	.000	.000
X1	55240.000	4.000	.000	114.600	20.000	20.000	20.000	.000	.000	.000
GR	320.880	.000	310.880	21.300	310.880	93.300	320.880	114.600	.000	.000
X1	55220.000	4.000	.000	107.400	20.000	20.000	20.000	.000	.000	.000
GR	320.610	.000	310.610	20.700	310.610	86.700	320.610	107.400	.000	.000
X1	55200.000	4.000	.000	100.000	20.000	20.000	20.000	.000	.000	.000
GR	320.310	.000	310.310	20.000	310.310	80.000	320.310	100.000	.000	.000
X1	55180.000	4.000	.000	98.000	20.000	20.000	20.000	.000	.000	.000
GR	320.330	.000	310.330	20.000	310.330	78.000	320.330	98.000	.000	.000
X1	55160.000	4.000	.000	96.000	20.000	20.000	20.000	.000	.000	.000
GR	320.350	.000	310.350	20.000	310.350	76.000	320.350	96.000	.000	.000
X1	55140.000	4.000	.000	126.000	20.000	20.000	20.000	.000	.000	.000
GR	328.360	.000	310.360	36.000	310.360	90.000	328.360	126.000	.000	.000
SB	1.250	1.600	2.800	120.000	54.000	1.300	1560.000	2.000	310.400	310.360
X1	55095.000	4.000	.000	122.000	45.000	45.000	45.000	.000	.000	.000
X2	.000	.000	1.000	329.300	330.500	.000	.000	2.000	.000	.000
GR	328.400	.000	310.400	36.000	310.400	86.000	328.400	122.000	.000	.000
NC	.014	.014	.014	.000	.000	.000	.000	.000	.000	.000
X1	55060.000	4.000	.000	90.000	35.000	35.000	35.000	.000	.000	.000
GR	320.440	.000	310.440	20.000	310.440	70.000	320.440	90.000	.000	.000
X1	55000.000	.000	.000	.000	60.000	60.000	60.000	.000	.050	.000
X1	54340.000	.000	.000	.000	660.000	660.000	660.000	.000	.590	.000
SB	1.250	1.500	2.900	100.000	50.000	1.300	1100.000	2.000	311.400	311.330
X1	54260.000	.000	.000	.000	80.000	80.000	80.000	.000	.070	.000
X2	.000	.000	1.000	325.900	328.900	.000	.000	1.330	.000	.000
X1	54000.000	.000	.000	.000	260.000	260.000	260.000	.000	.230	.000
X1	53000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.900	.000
X1	52000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.900	.000
X1	51000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.900	.000
X1	50000.000	.000	.000	.000	1000.000	1000.000	1000.000	.000	.900	.000

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01/01/80 03:58:50 PAGE 4

X1	49590.000	4.000	.000	90.000	410.000	410.000	410.000	.000	.000	.000
GR	325.360	.000	315.360	20.000	315.360	70.000	325.360	90.000	.000	.000
EJ	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

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01/01/80 03:58:50 PAGE 5

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 X1  5      000        .000        .000        .000     1000.000      00.000     1000.000        .000        .900
 X1  5      .000        .000        .000        .000     1000.000      00.000     1000.000        .000        .900
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  01/01/80     03:58:50                                                                                    PAGE     4


 X1  49590.000        4.000        .000       90.000      410.000      410.000      410.000        .000        .000        .000
 BR    325.360         .000      315.360       20.000      315.360       70.000      325.360      90.000        .000        .000
 EJ       .000         .000        .000         .000         .000         .000         .000        .000        .000        .000
1
  01/01/80     03:58:50                                                                                    PAGE     5

    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS    BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST


 *PROF 1

 *SECNO 67500.000
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     1670.         0.      1670.         0.         0.       591.         0.         0.         0.      316.60
       .00        .00       2.83        .00       .027       .027       .027       .000     306.60      18.99
   .000513         0.         0.         0.          0          0          0        .00     172.02     191.01
0
 *SECNO 67000.000
  67000.00       3.68     310.53        .00        .00     310.65        .12        .26        .00     316.85
     1670.         0.      1670.         0.         0.       591.         0.         7.         2.      316.85
       .05        .00       2.83        .00       .027       .027       .027       .000     306.85      18.99
   .000513       500.       500.       500.          0          0          0        .00     172.02     191.01
0
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     1670.         0.      1670.         0.         0.       593.         0.        20.         4.      317.35
       .15        .00       2.82        .00       .027       .027       .027       .000     307.35      18.95
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0
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     1670.         0.      1670.         0.         0.       594.         0.        34.        10.      317.85
       .25        .00       2.81        .00       .027       .027       .027       .000     307.85      18.94
   .000505      1000.      1000.      1000.          0          0          0        .00     172.13     191.06
0
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       .35        .00       2.81        .00       .027       .027       .027       .000     308.35      18.92
   .000502      1000.      1000.      1000.          0          0          0        .00     172.17     191.08
0
 *SECNO 63000.000
  63000.00       3.70     312.55        .00        .00     312.67        .12        .50        .00     318.85
     1670.         0.      1670.         0.         0.       596.         0.        61.        18.      318.85
       .44        .00       2.80        .00       .027       .027       .027       .000     308.85      18.90
   .000500      1000.      1000.      1000.          0          0          0        .00     172.19     191.10
0
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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS    BANK ELEV
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 62700.000									
62700.00	3.70	312.70	.00	.00	312.82	.12	.15	.00	319.00
1670.	0.	1670.	0.	0.	596.	0.	65.	19.	319.00
.47	.00	2.80	.00	.027	.027	.027	.000	309.00	18.90
.000500	300.	300.	300.	0	0	0	.00	172.20	191.10
0									
*SECNO 62600.000									
62600.00	3.72	312.77	.00	.00	312.86	.09	.04	.00	319.05
1670.	0.	1670.	0.	0.	693.	0.	67.	19.	319.05
.49	.00	2.41	.00	.027	.027	.027	.000	309.05	18.83
.000362	100.	100.	100.	2	0	0	.00	197.34	216.17
0									
*SECNO 62000.000									
62000.00	3.79	312.99	.00	.00	313.07	.09	.21	.00	319.20
1670.	0.	1670.	0.	0.	706.	0.	77.	22.	319.20
.56	.00	2.37	.00	.027	.027	.027	.000	309.20	18.64
.000341	600.	600.	600.	2	0	0	.00	197.73	216.36
0									
*SECNO 61000.000									
61000.00	3.87	313.32	.00	.00	313.40	.08	.33	.00	319.45
1670.	0.	1670.	0.	0.	722.	0.	93.	27.	319.45
.68	.00	2.31	.00	.027	.027	.027	.000	309.45	18.39
.000317	1000.	1000.	1000.	2	0	0	.00	198.22	216.61
0									
*SECNO 60000.000									
60000.00	3.93	313.63	.00	.00	313.71	.08	.31	.00	319.70
1670.	0.	1670.	0.	0.	735.	0.	110.	31.	319.70
.80	.00	2.27	.00	.027	.027	.027	.000	309.70	18.20
.000301	1000.	1000.	1000.	2	0	0	.00	198.59	216.80
0									
*SECNO 59860.000									
59860.00	3.93	313.67	.00	.00	313.75	.08	.04	.00	319.90
1670.	0.	1670.	0.	0.	737.	0.	112.	32.	319.90
.82	.00	2.27	.00	.027	.027	.027	.000	309.74	20.00
.000300	140.	140.	140.	0	0	0	.00	199.77	219.77
0									

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	.90	1.60	2.80	.00	175.00	4.00	2055.00	3.00	309.75	309.74

*SECNO 59800.000
CLASS A LOW FLOW

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SPECIAL BRIDGE

SB XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
.90	1.60	2.80	.00	175.00	4.00	2055.00	3.00	309.75	309.74

*SECNO 59800.000
CLASS A LOW FLOW

3420 BRIDGE W.S.= 313.68 BRIDGE VELOCITY=, 2.32 CALCULATED CHANNEL AREA=, 718.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	313.76	.00	0.	1670.	2055.	1998.	319.70	322.80

59800.00	3.92	313.68	.00	.00	313.76	.08	.00	.00	319.92
1670.	0.	1670.	0.	0.	734.	0.	113.	32.	319.92
.82	.00	2.28	.00	.000	.027	.000	.000	309.76	20.05
.000304	60.	60.	60.	0	0	0	.00	199.67	219.72

0
*SECNO 59680.000

59680.00	3.92	313.71	.00	.00	313.79	.08	.04	.00	319.79
1670.	0.	1670.	0.	0.	731.	0.	115.	33.	319.79
.84	.00	2.28	.00	.027	.027	.027	.000	309.79	18.25
.000305	120.	120.	120.	0	0	0	.00	198.50	216.75

0

SPECIAL BRIDGE

SB XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
1.05	1.56	2.80	270.00	175.00	15.00	2202.00	3.00	309.80	309.79

*SECNO 59650.000
CLASS A LOW FLOW

3420 BRIDGE W.S.= 313.70 BRIDGE VELOCITY=, 2.49 CALCULATED CHANNEL AREA=, 670.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	313.80	.01	0.	1670.	2202.	1937.	319.97	324.00

59650.00	3.92	313.72	.00	.00	313.80	.08	.01	.00	319.80
1670.	0.	1670.	0.	0.	732.	0.	116.	33.	319.80
.84	.00	2.28	.00	.000	.027	.000	.000	309.80	18.24
.000304	30.	30.	30.	0	0	0	.00	198.53	216.76

0
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT

.000	30.	30.	30.	0	0		.00	198.53	216.76

0

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 59600.000									
59600.00	3.94	313.74	.00	.00	313.82	.08	.01	.00	319.80
1620.	0.	1620.	0.	0.	736.	0.	116.	33.	319.80
.85	.00	2.20	.00	.027	.027	.027	.000	309.80	18.17
.000281	50.	50.	50.	2	0	0	.00	198.65	216.83
0									
*SECNO 59000.000									
59000.00	3.96	313.91	.00	.00	313.98	.07	.17	.00	319.95
1620.	0.	1620.	0.	0.	738.	0.	127.	36.	319.95
.92	.00	2.19	.00	.027	.027	.027	.000	309.95	18.15
.000279	600.	600.	600.	1	0	0	.00	198.71	216.85
0									
*SECNO 58000.000									
58000.00	3.99	314.19	.00	.00	314.26	.07	.27	.00	320.20
1620.	0.	1620.	0.	0.	745.	0.	144.	40.	320.20
1.05	.00	2.17	.00	.027	.027	.027	.000	310.20	18.04
.000270	1000.	1000.	1000.	2	0	0	.00	198.92	216.96
0									
*SECNO 57000.000									
57000.00	4.01	314.46	.00	.00	314.53	.07	.27	.00	320.45
1620.	0.	1620.	0.	0.	747.	0.	161.	45.	320.45
1.18	.00	2.17	.00	.027	.027	.027	.000	310.45	18.01
.000268	1000.	1000.	1000.	1	0	0	.00	198.98	216.99
0									
*SECNO 56000.000									
56000.00	4.02	314.72	.00	.00	314.79	.07	.27	.00	320.70
1620.	0.	1620.	0.	0.	751.	0.	178.	49.	320.70
1.31	.00	2.16	.00	.027	.027	.027	.000	310.70	17.96
.000264	1000.	1000.	1000.	1	0	0	.00	199.09	217.04
0									
*SECNO 55500.000									
55500.00	4.03	314.85	.00	.00	314.93	.07	.13	.00	320.82
1620.	0.	1620.	0.	0.	754.	0.	187.	52.	320.82
1.37	.00	2.15	.00	.027	.027	.027	.000	310.82	17.92
.000261	500.	500.	500.	1	0	0	.00	199.17	217.08
0									

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 55450.000									
55450.00	4.02	314.85	.00	.00	314.94	.09	.02	.00	320.83
1620.	0.	1620.	0.	0.	660.	0.	187.	52.	320.83
1.38	.00	2.46	.00	.035	.035	.035	.000	310.83	16.96
.000577	50.	50.	50.	1	0	0	.00	175.24	192.20
0									

1	.00	2.15	.00	.027	.027	.0	.000	310.82	17.92
.000	500.	500.	500.	1	0		.00	199.17	217.08

0

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 55450.000									
55450.00	4.02	314.85	.00	.00	314.94	.09	.02	.00	320.83
1620.	0.	1620.	0.	0.	660.	0.	187.	52.	320.83
1.38	.00	2.46	.00	.035	.035	.035	.000	310.83	16.96
.000577	50.	50.	50.	1	0	0	.00	175.24	192.20
0									
*SECNO 55400.000									
55400.00	4.01	314.85	.00	.00	314.98	.13	.03	.00	320.84
1620.	0.	1620.	0.	0.	565.	0.	188.	52.	320.84
1.38	.00	2.87	.00	.035	.035	.035	.000	310.84	15.98
.000798	50.	50.	50.	1	0	0	.00	151.44	167.42
0									
*SECNO 55380.000									
55380.00	4.00	314.85	.00	.00	315.00	.14	.02	.00	320.85
1620.	0.	1620.	0.	0.	531.	0.	188.	52.	320.85
1.39	.00	3.05	.00	.035	.035	.035	.000	310.85	15.57
.000909	20.	20.	20.	0	0	0	.00	142.86	158.43
0									
*SECNO 55340.000									
55340.00	3.99	314.85	.00	.00	315.04	.19	.04	.00	320.86
1620.	0.	1620.	0.	0.	463.	0.	189.	52.	320.86
1.39	.00	3.50	.00	.035	.035	.035	.000	310.86	14.83
.001216	40.	40.	40.	1	0	0	.00	125.73	140.57
0									
*SECNO 55320.000									
55320.00	3.97	314.84	.00	.00	315.06	.22	.03	.00	320.87
1620.	0.	1620.	0.	0.	428.	0.	189.	52.	320.87
1.39	.00	3.79	.00	.035	.035	.035	.000	310.87	14.45
.001438	20.	20.	20.	1	0	0	.00	117.10	131.55
0									
*SECNO 55300.000									
55300.00	3.96	314.83	.00	.00	315.09	.26	.03	.00	320.87
1620.	0.	1620.	0.	0.	394.	0.	189.	52.	320.87
1.39	.00	4.11	.00	.035	.035	.035	.000	310.87	14.05
.001712	20.	20.	20.	0	0	0	.00	108.50	122.55

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 55280.000									
55280.00	3.95	314.83	.00	.00	315.13	.30	.04	.00	320.88
1620.	0.	1620.	0.	0.	368.	0.	189.	53.	320.88
1.39	.00	4.40	.00	.035	.035	.035	.000	310.88	13.72
.001986	20.	20.	20.	1	0	0	.00	101.96	115.68

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0

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 55280.000									
55280.00	3.95	314.83	.00	.00	315.13	.30	.04	.00	320.88
1620.	0.	1620.	0.	0.	368.	0.	189.	53.	320.88
1.39	.00	4.40	.00	.035	.035	.035	.000	310.88	13.72
.001986	20.	20.	20.	1	0	0	.00	101.96	115.68
0									
*SECNO 55260.000									
55260.00	3.95	314.83	.00	.00	315.17	.35	.04	.00	320.88
1620.	0.	1620.	0.	0.	342.	0.	189.	53.	320.88
1.39	.00	4.73	.00	.035	.035	.035	.000	310.88	13.31
.002312	20.	20.	20.	0	0	0	.00	95.38	108.69
0									
*SECNO 55240.000									
55240.00	3.94	314.82	.00	.00	315.22	.40	.05	.00	320.88
1620.	0.	1620.	0.	0.	317.	0.	190.	53.	320.88
1.39	.00	5.10	.00	.035	.035	.035	.000	310.88	12.89
.002716	20.	20.	20.	0	0	0	.00	88.81	101.71
0									
*SECNO 55220.000									
55220.00	4.27	314.88	.00	.00	315.28	.40	.05	.00	320.61
1620.	0.	1620.	0.	0.	320.	0.	190.	53.	320.61
1.40	.00	5.06	.00	.035	.035	.035	.000	310.61	11.85
.002456	20.	20.	20.	2	0	0	.00	83.69	95.55
0									
*SECNO 55200.000									
55200.00	4.62	314.93	.00	.00	315.32	.40	.05	.00	320.31
1620.	0.	1620.	0.	0.	320.	0.	190.	53.	320.31
1.40	.00	5.06	.00	.035	.035	.035	.000	310.31	10.76
.002265	20.	20.	20.	2	0	0	.00	78.48	89.24
0									
*SECNO 55180.000									
55180.00	4.62	314.95	.00	.00	315.37	.42	.05	.00	320.33
1620.	0.	1620.	0.	0.	310.	0.	190.	53.	320.33
1.40	.00	5.22	.00	.035	.035	.035	.000	310.33	10.77
.002426	20.	20.	20.	0	0	0	.00	76.46	87.23
0									

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 55160.000									
55160.00	4.62	314.97	.00	.00	315.42	.45	.05	.00	320.35
1620.	0.	1620.	0.	0.	301.	0.	190.	53.	320.35
1.40	.00	5.38	.00	.035	.035	.035	.000	310.35	10.77
.002589	20.	20.	20.	0	0	0	.00	74.47	85.23
0									
*SECNO 55140.000									

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 55160.000

55160.00	4.62	314.97	.00	.00	315.42	.45	.05	.00	320.35
1620.	0.	1620.	0.	0.	301.	0.	190.	53.	320.35
1.40	.00	5.38	.00	.035	.035	.035	.000	310.35	10.77
.002589	20.	20.	20.	0	0	0	.00	74.47	85.23

0

VOID

*SECNO 55140.000

55140.00	4.64	315.00	.00	.00	315.47	.48	.05	.00	328.36
1620.	0.	1620.	0.	0.	293.	0.	190.	53.	328.36
1.40	.00	5.53	.00	.035	.035	.035	.000	310.36	26.74
.002748	20.	20.	20.	1	0	0	.00	72.51	99.26

0

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.25	1.60	2.80	120.00	54.00	1.30	1560.00	2.00	310.40	310.36

*SECNO 55095.000
CLASS A LOW FLOW

3420 BRIDGE W.S.= 314.99 BRIDGE VELOCITY=, 5.67 CALCULATED CHANNEL AREA=, 284.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	315.58	.04	0.	1620.	1560.	1710.	329.30	330.50

55095.00	4.64	315.04	.00	.00	315.58	.54	.10	.00	328.40
1620.	0.	1620.	0.	0.	275.	0.	191.	53.	328.40
1.40	.00	5.89	.00	.000	.035	.000	.000	310.40	26.72
.003150	45.	45.	45.	0	0	0	.00	68.56	95.28

0

VOID

*SECNO 55060.000

55060.00	4.63	315.07	.00	.00	315.61	.54	.04	.00	320.44
1620.	0.	1620.	0.	0.	275.	0.	191.	53.	320.44
1.40	.00	5.89	.00	.014	.014	.014	.000	310.44	10.72
.000504	35.	35.	35.	0	0	0	.00	68.56	79.28

0

*SECNO 55000.000

55000.00	4.61	315.10	.00	.00	315.64	.55	.03	.00	320.49
1620.	0.	1620.	0.	0.	273.	0.	191.	53.	320.49
1.41	.00	5.94	.00	.014	.014	.014	.000	310.49	10.79
.000516	60.	60.	60.	2	0	0	.00	68.43	79.21

0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 54340.000									
54340.00	4.31	315.39	.00	.00	316.03	.64	.38	.00	321.08
1620.	0.	1620.	0.	0.	253.	0.	195.	54.	321.08
1.44	.00	6.41	.00	.014	.014	.014	.000	311.08	11.38
.000649	660.	660.	660.	2	0	0	.00	67.25	78.62
0									

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.25	1.50	2.90	100.00	50.00	1.30	1100.00	2.00	311.40	311.33

*SECNO 54260.000
CLASS A LOW FLOW

3420 BRIDGE W.S.= 315.36 BRIDGE VELOCITY=, 7.15 CALCULATED CHANNEL AREA=, 224.

EGPRS	EGLWC	H3	QWEIR	QLOW	BAREA	TRAPEZOID AREA	ELLC	ELTRD
.00	316.10	.08	0.	1620.	1100.	1127.	325.90	328.90

54260.00	4.32	315.47	.00	.00	316.10	.64	.08	.00	321.15
1620.	0.	1620.	0.	0.	253.	0.	196.	54.	321.15
1.44	.00	6.40	.00	.000	.014	.000	.000	311.15	11.37
.000646	80.	80.	80.	0	0	0	.00	67.27	78.63
0									
*SECNO 54000.000									
54000.00	4.23	315.61	.00	.00	316.28	.67	.17	.00	321.38
1620.	0.	1620.	0.	0.	247.	0.	197.	55.	321.38
1.45	.00	6.55	.00	.014	.014	.014	.000	311.38	11.54
.000693	260.	260.	260.	2	0	0	.00	66.93	78.46
0									
*SECNO 53000.000									
53000.00	4.00	316.28	.00	.00	317.04	.76	.76	.00	322.28
1620.	0.	1620.	0.	0.	232.	0.	203.	56.	322.28
1.49	.00	6.98	.00	.014	.014	.014	.000	312.28	11.99
.000838	1000.	1000.	1000.	2	0	0	.00	66.02	78.01
0									
*SECNO 52000.000									
52000.00	3.93	317.11	.00	.00	317.90	.79	.86	.00	323.18
1620.	0.	1620.	0.	0.	228.	0.	208.	58.	323.18
1.53	.00	7.12	.00	.014	.014	.014	.000	313.18	12.13
.000890	1000.	1000.	1000.	2	0	0	.00	65.74	77.87
0									

VOID

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

0
*SECNO 0.000
52000 3.93 317.11 .00 .00 317.90 .7 .86 .00 323.18
16. 0. 1620. 0. 0. 228. 0 208. 58. 323.18
1.53 .00 7.12 .00 .014 .014 .014 .000 313.18 12.13
.000890 1000. 1000. 1000. 2 0 0 .00 65.74 77.87
0
1
01/01/80 03:58:50 PAGE 13

SECNO DEPTH CWSEL CRIWS WSELK EG HV HL OLOSS BANK ELEV
Q QLOB QCH QROB ALOB ACH AROB VOL TWA LEFT/RIGHT
TIME VLOB VCH VROB XNL XNCH XNR WTN ELMIN SSTA
SLOPE XLOBL XLCH XLOBR ITRIAL IDC ICONT CORAR TOPWID ENDST

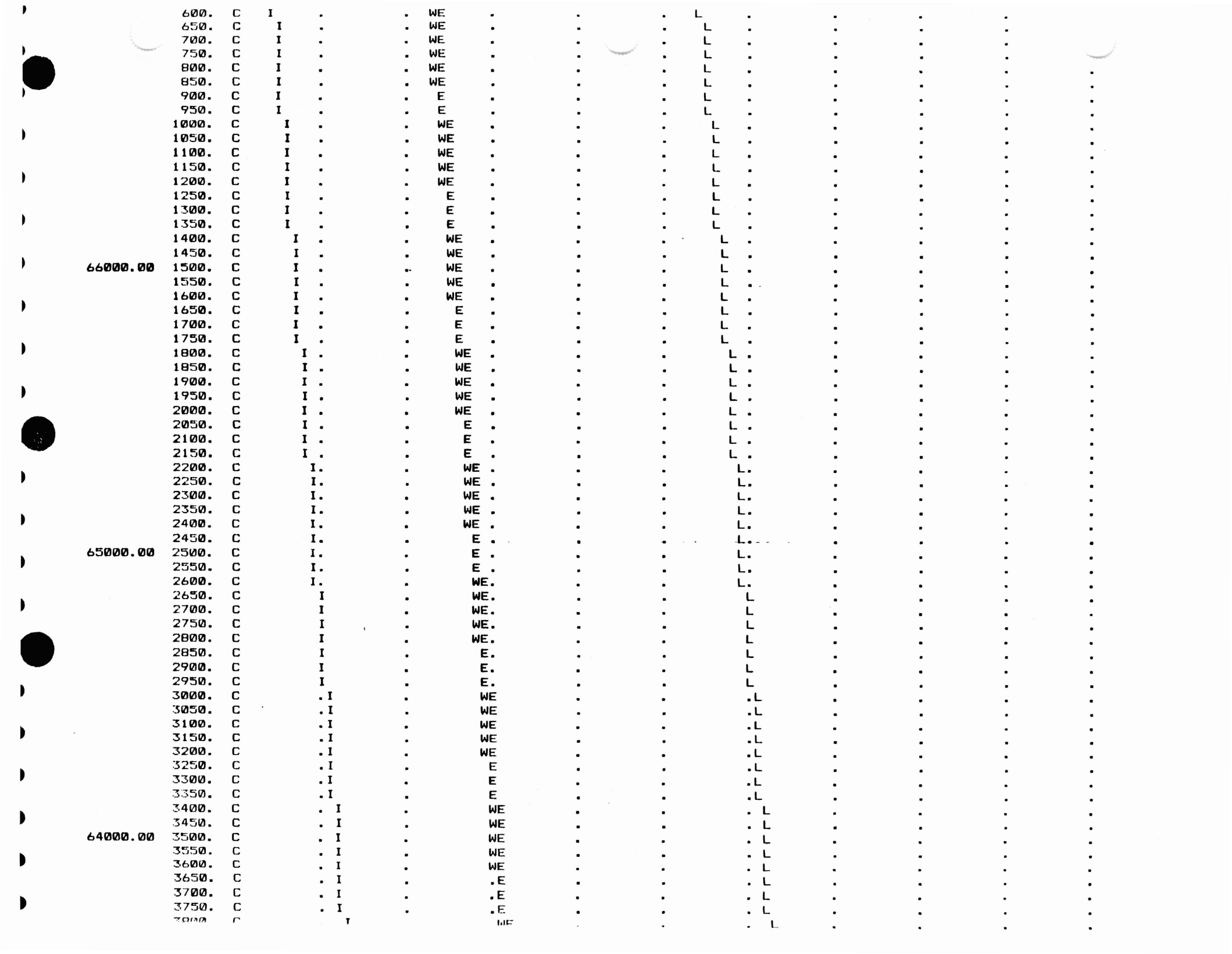
VOID

*SECNO 51000.000
51000.00 3.92 318.00 .00 .00 318.79 .79 .89 .00 324.08
1620. 0. 1620. 0. 0. 227. 0. 213. 59. 324.08
1.57 .00 7.13 .00 .014 .014 .014 .000 314.08 12.14
.000894 1000. 1000. 1000. 1 0 0 .00 65.72 77.86
0
*SECNO 50000.000
50000.00 3.92 318.90 .00 .00 319.69 .79 .90 .00 324.98
1620. 0. 1620. 0. 0. 227. 0. 218. 61. 324.98
1.61 .00 7.14 .00 .014 .014 .014 .000 314.98 12.15
.000898 1000. 1000. 1000. 0 0 0 .00 65.70 77.85
0
*SECNO 49590.000
49590.00 3.90 319.26 .00 .00 320.06 .80 .37 .00 325.36
1620. 0. 1620. 0. 0. 226. 0. 221. 61. 325.36
1.62 .00 7.16 .00 .014 .014 .014 .000 315.36 12.18
.000909 410. 410. 410. 1 0 0 .00 65.64 77.82
0
1 VOID
PROFILE FOR STREAM REACH 4 MODIFIED 10 YEAR

PLOTTED POINTS (BY PRIORITY)-E-ENERGY,W-WATER SURFACE,I-INVERT,C-CRITICAL W.S.,L-LEFT BANK,R-RIGHT BANK,M-LOWER END STA

ELEVATION 306. 308. 310. 312. 314. 316. 318. 320. 322. 324.
SECNO CUMDIS

67500.00 0. C I .WE . . . L . . . . .
50. C I .WE . . . L . . . . .
100. C I . E . . . L . . . . .
150. C I . E . . . L . . . . .
200. C I . E . . . L . . . . .
250. C I . WE . . . L . . . . .
300. C I . WE . . . L . . . . .
350. C I . WE . . . L . . . . .
400. C I . WE . . . L . . . . .
450. C I . WE . . . L . . . . .
67000.00 500. C I . E . . . L . . . . .
550. C I . E . . . L . . . . .
600. C I . WE . . . L . . . . .
650. C I . WE . . . L . . . . .
700. C I . WE . . . L . . . . .
750. C I . WE . . . L . . . . .
800. C I . WE . . . L . . . . .
850. C I . WE . . . L . . . . .
900. C I . E . . . L . . . . .


600. C I . . WE . . . L . . . .
650. C I . . WE . . . L . . . .
700. C I . . WE . . . L . . . .
750. C I . . WE . . . L . . . .
800. C I . . WE . . . L . . . .
850. C I . . WE . . . L . . . .
900. C I . . E . . . L . . . .
950. C I . . E . . . L . . . .
1000. C I . . WE . . . L . . . .
1050. C I . . WE . . . L . . . .
1100. C I . . WE . . . L . . . .
1150. C I . . WE . . . L . . . .
1200. C I . . WE . . . L . . . .
1250. C I . . E . . . L . . . .
1300. C I . . E . . . L . . . .
1350. C I . . E . . . L . . . .
1400. C I . . WE . . . L . . . .
1450. C I . . WE . . . L . . . .
66000.00 1500. C I . . WE . . . L . . . .
1550. C I . . WE . . . L . . . .
1600. C I . . WE . . . L . . . .
1650. C I . . E . . . L . . . .
1700. C I . . E . . . L . . . .
1750. C I . . E . . . L . . . .
1800. C I . . WE . . . L . . . .
1850. C I . . WE . . . L . . . .
1900. C I . . WE . . . L . . . .
1950. C I . . WE . . . L . . . .
2000. C I . . WE . . . L . . . .
2050. C I . . E . . . L . . . .
2100. C I . . E . . . L . . . .
2150. C I . . E . . . L . . . .
2200. C I. . WE . . . L. . . .
2250. C I. . WE . . . L. . . .
2300. C I. . WE . . . L. . . .
2350. C I. . WE . . . L. . . .
2400. C I. . WE . . . L. . . .
2450. C I. . E . . . L. . . .
65000.00 2500. C I. . E . . . L. . . .
2550. C I. . E . . . L. . . .
2600. C I. . WE. . . . L. . . .
2650. C I . WE. . . . L . . .
2700. C I . WE. . . . L . . .
2750. C I . WE. . . . L . . .
2800. C I . WE. . . . L . . .
2850. C I . E. . . . L . . .
2900. C I . E. . . . L . . .
2950. C I . E. . . . L . . .
3000. C .I . WE . . . .L . . .
3050. C .I . WE . . . .L . . .
3100. C .I . WE . . . .L . . .
3150. C .I . WE . . . .L . . .
3200. C .I . WE . . . .L . . .
3250. C .I . E . . . .L . . .
3300. C .I . E . . . .L . . .
3350. C .I . E . . . .L . . .
3400. C . I . WE . . . . L . . .
3450. C . I . WE . . . . L . . .
64000.00 3500. C . I . WE . . . . L . . .
3550. C . I . WE . . . . L . . .
3600. C . I . WE . . . . L . . .
3650. C . I . .E . . . . L . . .
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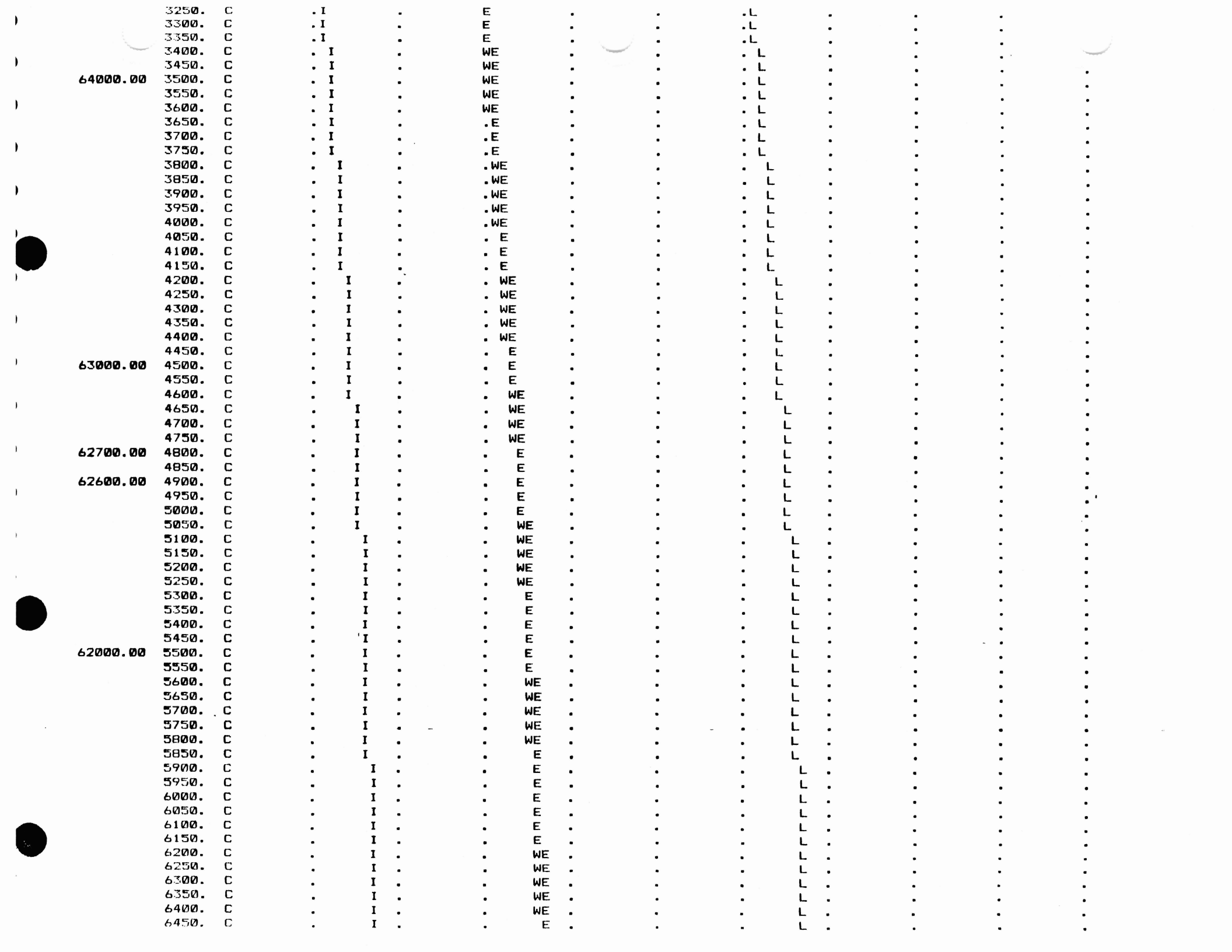
3750. C . I . .E . . . . L . . .
3800. C . I . WE . . . . L . . .


3250. C .I . E . .L . . .
3300. C .I . E . .L . . .
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3400. C . I . WE . . L . . .
3450. C . I . WE . . L . . .
64000.00 3500. C . I . WE . . L . . .
3550. C . I . WE . . L . . .
3600. C . I . WE . . L . . .
3650. C . I . .E . . L . . .
3700. C . I . .E . . L . . .
3750. C . I . .E . . L . . .
3800. C . I . .WE . . L . . .
3850. C . I . .WE . . L . . .
3900. C . I . .WE . . L . . .
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4000. C . I . .WE . . L . . .
4050. C . I . . E . . L . . .
4100. C . I . . E . . L . . .
4150. C . I . . E . . L . . .
4200. C . I . . WE . . L . . .
4250. C . I . . WE . . L . . .
4300. C . I . . WE . . L . . .
4350. C . I . . WE . . L . . .
4400. C . I . . WE . . L . . .
4450. C . I . . E . . L . . .
63000.00 4500. C . I . . E . . L . . .
4550. C . I . . E . . L . . .
4600. C . I . . WE . . L . . .
4650. C . I . . WE . . L . . .
4700. C . I . . WE . . L . . .
4750. C . I . . WE . . L . . .
62700.00 4800. C . I . . E . . L . . .
4850. C . I . . E . . L . . .
62600.00 4900. C . I . . E . . L . . .
4950. C . I . . E . . L . . .
5000. C . I . . E . . L . . .
5050. C . I . . WE . . L . . .
5100. C . I . . WE . . L . . .
5150. C . I . . WE . . L . . .
5200. C . I . . WE . . L . . .
5250. C . I . . WE . . L . . .
5300. C . I . . E . . L . . .
5350. C . I . . E . . L . . .
5400. C . I . . E . . L . . .
5450. C . I . . E . . L . . .
62000.00 5500. C . I . . E . . L . . .
5550. C . I . . E . . L . . .
5600. C . I . . WE . . L . . .
5650. C . I . . WE . . L . . .
5700. C . I . . WE . . L . . .
5750. C . I . . WE . . L . . .
5800. C . I . . WE . . L . . .
5850. C . I . . E . . L . . .
5900. C . I . . E . . L . . .
5950. C . I . . E . . L . . .
6000. C . I . . E . . L . . .
6050. C . I . . E . . L . . .
6100. C . I . . E . . L . . .
6150. C . I . . E . . L . . .
6200. C . I . . WE . . L . . .
6250. C . I . . WE . . L . . .
6300. C . I . . WE . . L . . .
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6400. C . I . . WE . . L . . .
6450. C . I . . E . . L . . .

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          6250.  C       .     I  .      .    WE  .      .      .    L   .      .      .
          6300.  C       .     I  .      .    WE  .      .      .    L   .      .      .
          6350.  C       .     I  .      .    WE  .      .      .    L   .      .      .
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          6450.  C       .     I  .      .     E  .      .      .    L   .      .      .      .
61000.00  6500.  C       .     I  .      .     E  .      .      .    L   .      .      .      .
          6550.  C       .     I  .      .     E  .      .      .    L   .      .      .      .
          6600.  C       .     I  .      .     E  .      .      .    L   .      .      .      .
          6650.  C       .     I  .      .     E  .      .      .    L   .      .      .      .
          6700.  C       .      I .      .     E  .      .      .     L  .      .      .      .
          6750.  C       .      I .      .     E  .      .      .     L  .      .      .      .
          6800.  C       .      I .      .     E  .      .      .     L  .      .      .      .
          6850.  C       .      I .      .     WE .      .      .     L  .      .      .      .
          6900.  C       .      I .      .     WE .      .      .     L  .      .      .      .
          6950.  C       .      I .      .     WE .      .      .     L  .      .      .      .
          7000.  C       .      I .      .     WE .      .      .     L  .      .      .      .
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          7100.  C       .      I .      .      E .      .      .     L  .      .      .      .
          7150.  C       .      I .      .      E .      .      .     L  .      .      .      .
          7200.  C       .      I .      .      E .      .      .     L  .      .      .      .
          7250.  C       .      I .      .      E .      .      .     L  .      .      .      .
          7300.  C       .      I .      .      E .      .      .     L  .      .      .      .
          7350.  C       .      I .      .      E .      .      .     L  .      .      .      .
          7400.  C       .      I .      .      E .      .      .     L  .      .      .      .
          7450.  C       .      I .      .      E .      .      .     L  .      .      .      .
60000.00  7500.  C       .       I.      .      WE.      .      .      L.      .      .      .
          7550.  C       .       I.      .      WE.      .      .      L.   M  .      .      .
          7600.  C       .       I.      .      WE.      .      .      L.      M.      .      .
59860.00  7650.  C       .       I.      .      WE.      .      .      L.      .   M  .      .
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59680.00  7850.  C       .       I.      .       E.      .      .      L.      .      .      .
59650.00  7900.  C       .       I.      .       E.      .      .      L.      .      .      .
59600.00  7950.  C       .       I.      .       E.      .      .      L.      .      .      .
          8000.  C       .       I.      .       E.      .      .      L.      .      .      .
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          8150.  C       .       I.      .       E.      .      .      L.      .      .      .
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          8350.  C       .       I.      .       WE      .      .      L.      .      .      .
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          8650.  C       .        I      .        E      .      .       L      .      .      .
          8700.  C       .        I      .        E      .      .       L      .      .      .
          8750.  C       .        I      .        E      .      .       L      .      .      .
          8800.  C       .        I      .        E      .      .       L      .      .      .
          8850.  C       .        I      .        E      .      .       L      .      .      .
          8900.  C       .        I      .        E      .      .       L      .      .      .
          8950.  C       .        I      .        WE     .      .       L      .      .      .
          9000.  C       .        I      .        WE     .      .       L      .      .      .
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55060.000	1620.00	315.07	.00	.04	.00	68.56	35.00
55000.000	1620.00	315.10	.00	.02	.00	68.43	60.00
54340.000	1620.00	315.39	.00	.29	.00	67.25	660.00
54260.000	1620.00	315.47	.00	.08	.00	67.27	80.00

```
                8850.  C  .  I  .  E  .  .  L  .  .
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                9350.  C  .  .I .  .E .  .  .L .  .
                9400.  C  .  .I .  .E .  .  .L .  .
                9450.  C  .  .I .  .E .  .  .L .  .
58000.00        9500.  C  .  .I .  .E .  .  .L .  .
                9550.  C  .  .I .  .E .  .  .L .  .
                9600.  C  .  .I .  .E .  .  .L .  .
                9650.  C  .  .I .  .WE .  .  .L .  .
                9700.  C  .  .I .  .WE .  .  .L .  .
                9750.  C  .  .I .  .WE .  .  .L .  .
                9800.  C  .  .I .  .WE .  .  .L .  .
                9850.  C  .  .I .  .WE .  .  .L .  .
                9900.  C  .  . I .  .WE .  .  . L .  .
                9950.  C  .  . I .  . E .  .  . L .  .
               10000.  C  .  . I .  . E .  .  . L .  .
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               10400.  C  .  . I .  . WE .  .  . L .  .
               10450.  C  .  . I .  . WE .  .  . L .  .
57000.00       10500.  C  .  . I .  . WE .  .  . L .  .
               10550.  C  .  . I .  . WE .  .  . L .  .
               10600.  C  .  . I .  . WE .  .  . L .  .
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               10900.  C  .  .  I .  .  E .  .  .  L .  .
               10950.  C  .  .  I .  .  E .  .  .  L .  .
               11000.  C  .  .  I .  .  E .  .  .  L .  .
               11050.  C  .  .  I .  .  E .  .  .  L .  .
               11100.  C  .  .  I .  .  E .  .  .  L .  .
               11150.  C  .  .  I .  .  E .  .  .  L .  .
               11200.  C  .  .  I .  .  WE .  .  .  L .  .
               11250.  C  .  .  I .  .  WE .  .  .  L .  .
               11300.  C  .  .  I .  .  WE .  .  .  L .  .
               11350.  C  .  .  I .  .  WE .  .  .  L .  .
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               11450.  C  .  .  I .  .  WE .  .  .  L .  .
56000.00       11500.  C  .  .   I .  .   E .  .  .   L .  .
               11550.  C  .  .   I .  .   E .  .  .   L .  .
               11600.  C  .  .   I .  .   E .  .  .   L .  .
               11650.  C  .  .   I .  .   E .  .  .   L .  .
               11700.  C  .  .   I .  .   E .  .  .   L .  .
               11750.  C  .  .   I .  .   E .  .  .   L .  .
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               11900.  C  .  .   I .  .   WE .  .  .   L .  .
               11950.  C  .  .   I .  .   WE .  .  .   L .  .
55500.00       12000.  C  .  .   I .  .   WE .  .  .   L .  .
55450.00       12050.  C  .  .   I .  .   WE .  .  .   L .  .
```

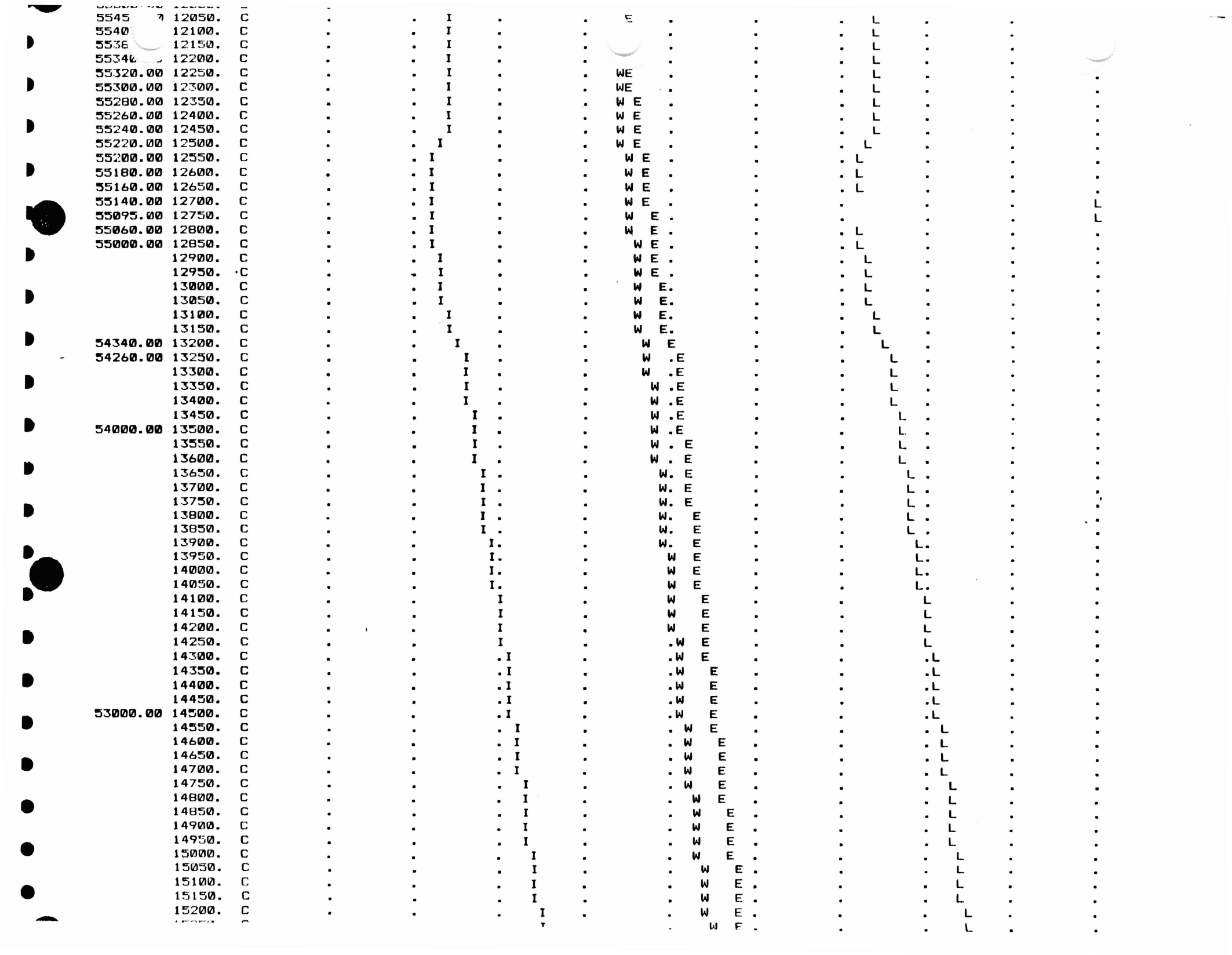

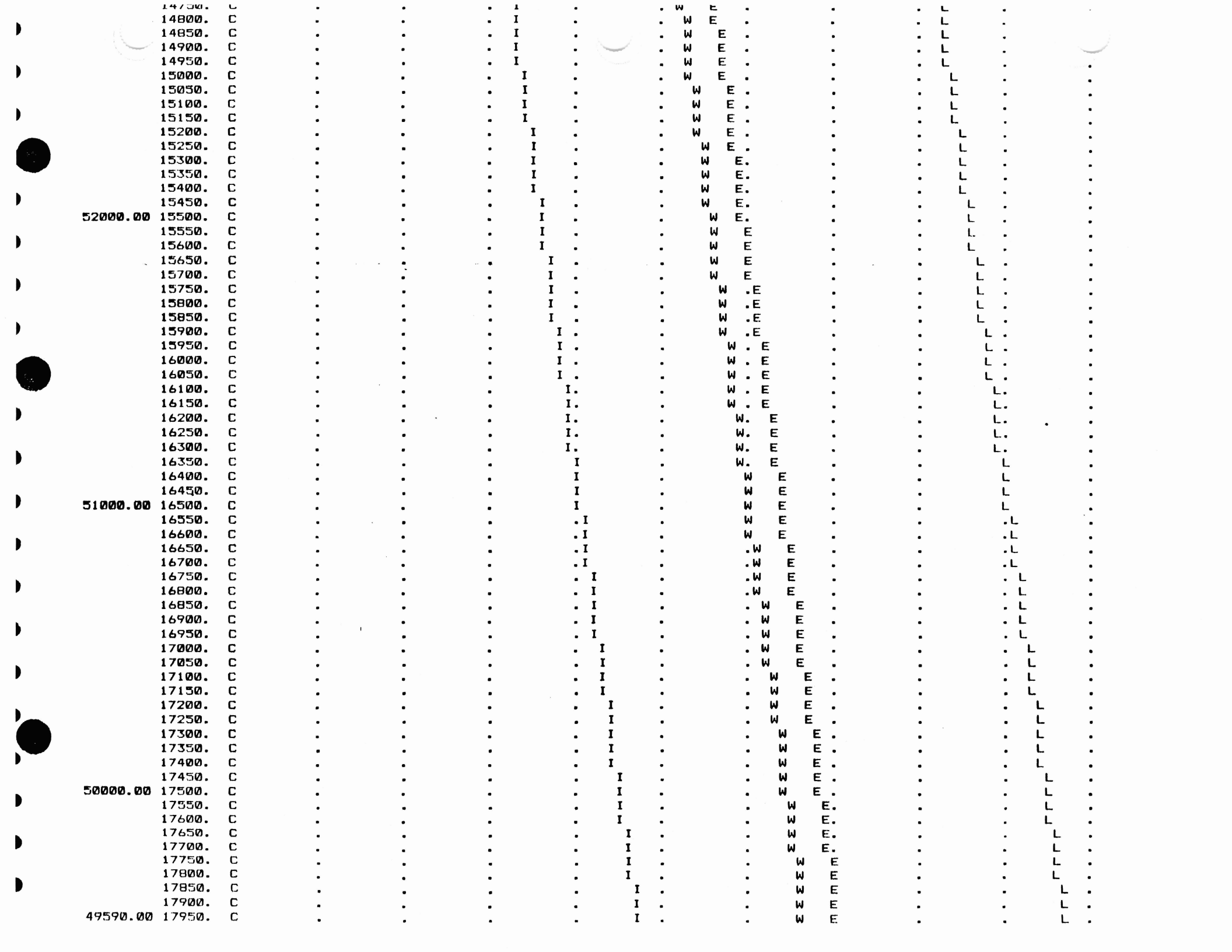

17900. C . . . . I . . W E . . L
49590 17950. C . . . . . W E . . L

1

THIS RUN EXECUTED 01/01/80 04:01:46

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION
**************************************************
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

REACH 4 MODIFIED 10 YEAR

SUMMARY PRINTOUT TABLE 150

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
67500.000	.00	.00	.00	306.60	1670.00	310.27	.00	310.39	5.13	2.83	590.90	737.03
67000.000	500.00	.00	.00	306.85	1670.00	310.53	.00	310.65	5.13	2.83	590.90	737.03
66000.000	1000.00	.00	.00	307.35	1670.00	311.04	.00	311.16	5.07	2.82	593.12	741.41
65000.000	1000.00	.00	.00	307.85	1670.00	311.54	.00	311.67	5.05	2.81	594.00	743.15
64000.000	1000.00	.00	.00	308.35	1670.00	312.05	.00	312.17	5.02	2.81	595.13	745.38
63000.000	1000.00	.00	.00	308.85	1670.00	312.55	.00	312.67	5.00	2.80	595.80	746.73
62700.000	300.00	.00	.00	309.00	1670.00	312.70	.00	312.82	5.00	2.80	596.04	747.18
62600.000	100.00	.00	.00	309.05	1670.00	312.77	.00	312.86	3.62	2.41	693.29	878.25
62000.000	600.00	.00	.00	309.20	1670.00	312.99	.00	313.07	3.41	2.37	705.92	903.85
61000.000	1000.00	.00	.00	309.45	1670.00	313.32	.00	313.40	3.17	2.31	722.33	937.49
60000.000	1000.00	.00	.00	309.70	1670.00	313.63	.00	313.71	3.01	2.27	734.57	962.85
59860.000	140.00	.00	.00	309.74	1670.00	313.67	.00	313.75	3.00	2.27	736.88	964.30
59800.000	60.00	322.80	319.70	309.76	1670.00	313.68	.00	313.76	3.04	2.28	733.71	957.75
59680.000	120.00	.00	.00	309.79	1670.00	313.71	.00	313.79	3.05	2.28	731.42	956.30
59650.000	30.00	324.00	319.97	309.80	1670.00	313.72	.00	313.80	3.04	2.28	732.41	958.37
59600.000	50.00	.00	.00	309.80	1620.00	313.74	.00	313.82	2.81	2.20	736.43	966.73
59000.000	600.00	.00	.00	309.95	1620.00	313.91	.00	313.98	2.79	2.19	738.27	970.57

1

59600	0	50.00	.00	.00	309.80	1620.00	313.74	.00	313.82	2.81	2.20	736	966.73
5900		600.00	.00	.00	309.95	1620.00	3.91	.00	313.98	2.79	2.19		970.57

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
58000.000	1000.00	.00	.00	310.20	1620.00	314.19	.00	314.26	2.70	2.17	745.18	985.05
57000.000	1000.00	.00	.00	310.45	1620.00	314.46	.00	314.53	2.68	2.17	747.22	989.32
56000.000	1000.00	.00	.00	310.70	1620.00	314.72	.00	314.79	2.64	2.16	750.84	996.94
55500.000	500.00	.00	.00	310.82	1620.00	314.85	.00	314.93	2.61	2.15	753.63	1002.82
55450.000	50.00	.00	.00	310.83	1620.00	314.85	.00	314.94	5.77	2.46	659.80	674.48
55400.000	50.00	.00	.00	310.84	1620.00	314.85	.00	314.98	7.98	2.87	565.13	573.60
55380.000	20.00	.00	.00	310.85	1620.00	314.85	.00	315.00	9.09	3.05	531.11	537.46
55340.000	40.00	.00	.00	310.86	1620.00	314.85	.00	315.04	12.16	3.50	462.77	464.57
55320.000	20.00	.00	.00	310.87	1620.00	314.84	.00	315.06	14.38	3.79	427.97	427.27
55300.000	20.00	.00	.00	310.87	1620.00	314.83	.00	315.09	17.12	4.11	394.12	391.50
55280.000	20.00	.00	.00	310.88	1620.00	314.83	.00	315.13	19.86	4.40	367.91	363.54
55260.000	20.00	.00	.00	310.88	1620.00	314.83	.00	315.17	23.12	4.73	342.47	336.94
55240.000	20.00	.00	.00	310.88	1620.00	314.82	.00	315.22	27.16	5.10	317.36	310.84
55220.000	20.00	.00	.00	310.61	1620.00	314.88	.00	315.28	24.56	5.06	319.87	326.92
55200.000	20.00	.00	.00	310.31	1620.00	314.93	.00	315.32	22.65	5.06	319.95	340.40
55180.000	20.00	.00	.00	310.33	1620.00	314.95	.00	315.37	24.26	5.22	310.27	328.94
55160.000	20.00	.00	.00	310.35	1620.00	314.97	.00	315.42	25.89	5.38	301.16	318.40
55140.000	20.00	.00	.00	310.36	1620.00	315.00	.00	315.47	27.48	5.53	292.79	309.05
55095.000	45.00	330.50	329.30	310.40	1620.00	315.04	.00	315.58	31.50	5.89	274.99	288.64
55060.000	35.00	.00	.00	310.44	1620.00	315.07	.00	315.61	5.04	5.89	274.99	721.60
55000.000	60.00	.00	.00	310.49	1620.00	315.10	.00	315.64	5.16	5.94	272.79	712.99
54340.000	660.00	.00	.00	311.08	1620.00	315.39	.00	316.03	6.49	6.41	252.76	635.84
54260.000	80.00	328.90	325.90	311.15	1620.00	315.47	.00	316.10	6.46	6.40	253.11	637.14
54000.000	260.00	.00	.00	311.38	1620.00	315.61	.00	316.28	6.93	6.55	247.38	615.55
53000.000	1000.00	.00	.00	312.28	1620.00	316.28	.00	317.04	8.38	6.98	232.25	559.63
52000.000	1000.00	.00	.00	313.18	1620.00	317.11	.00	317.90	8.90	7.12	227.67	543.03

5300	0	1000.00	.00	.00	312.28	1620.00	316.28	.00	317.04	8.38	6.98	559.63
5200	0	1000.00	.00	.00	313.18	1620.00	317.11	.00	317.90	8.90	7.12	543.03

1
01/01/80 03:58:50 PAGE 16

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10K*S	VCH	AREA	.01K
51000.000	1000.00	.00	.00	314.08	1620.00	318.00	.00	318.79	8.94	7.13	227.33	541.80
50000.000	1000.00	.00	.00	314.98	1620.00	318.90	.00	319.69	8.98	7.14	226.98	540.52
49590.000	410.00	.00	.00	315.36	1620.00	319.26	.00	320.06	9.09	7.16	226.12	537.43

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01/01/80 03:58:50 PAGE 17

REACH 4 MODIFIED 10 YEAR

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
67500.000	1670.00	310.27	.00	.00	.00	172.02	.00
67000.000	1670.00	310.53	.00	.26	.00	172.02	500.00
66000.000	1670.00	311.04	.00	.51	.00	172.10	1000.00
65000.000	1670.00	311.54	.00	.51	.00	172.13	1000.00
64000.000	1670.00	312.05	.00	.50	.00	172.17	1000.00
63000.000	1670.00	312.55	.00	.50	.00	172.19	1000.00
62700.000	1670.00	312.70	.00	.15	.00	172.20	300.00
62600.000	1670.00	312.77	.00	.07	.00	197.34	100.00
62000.000	1670.00	312.99	.00	.21	.00	197.73	600.00
61000.000	1670.00	313.32	.00	.33	.00	198.22	1000.00
60000.000	1670.00	313.63	.00	.31	.00	198.59	1000.00
59860.000	1670.00	313.67	.00	.04	.00	199.77	140.00
59800.000	1670.00	313.68	.00	.00	.00	199.67	60.00
59680.000	1670.00	313.71	.00	.04	.00	198.50	120.00
59650.000	1670.00	313.72	.00	.01	.00	198.53	30.00
59600.000	1620.00	313.74	.00	.02	.00	198.65	50.00
59000.000	1620.00	313.91	.00	.17	.00	198.71	600.00
58000.000	1620.00	314.19	.00	.28	.00	198.92	1000.00
57000.000	1620.00	314.46	.00	.27	.00	198.98	1000.00

REACH 4 MODIFIED 10 YEAR

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
67500.000	1670.00	310.27	.00	.00	.00	172.02	.00
67000.000	1670.00	310.53	.00	.26	.00	172.02	500.00
66000.000	1670.00	311.04	.00	.51	.00	172.10	1000.00
65000.000	1670.00	311.54	.00	.51	.00	172.13	1000.00
64000.000	1670.00	312.05	.00	.50	.00	172.17	1000.00
63000.000	1670.00	312.55	.00	.50	.00	172.19	1000.00
62700.000	1670.00	312.70	.00	.15	.00	172.20	300.00
62600.000	1670.00	312.77	.00	.07	.00	197.34	100.00
62000.000	1670.00	312.99	.00	.21	.00	197.73	600.00
61000.000	1670.00	313.32	.00	.33	.00	198.22	1000.00
60000.000	1670.00	313.63	.00	.31	.00	198.59	1000.00
59860.000	1670.00	313.67	.00	.04	.00	199.77	140.00
59800.000	1670.00	313.68	.00	.00	.00	199.67	60.00
59680.000	1670.00	313.71	.00	.04	.00	198.50	120.00
59650.000	1670.00	313.72	.00	.01	.00	198.53	30.00
59600.000	1620.00	313.74	.00	.02	.00	198.65	50.00
59000.000	1620.00	313.91	.00	.17	.00	198.71	600.00
58000.000	1620.00	314.19	.00	.28	.00	198.92	1000.00
57000.000	1620.00	314.46	.00	.27	.00	198.98	1000.00
56000.000	1620.00	314.72	.00	.27	.00	199.09	1000.00
55500.000	1620.00	314.85	.00	.13	.00	199.17	500.00
55450.000	1620.00	314.85	.00	.00	.00	175.24	50.00
55400.000	1620.00	314.85	.00	.00	.00	151.44	50.00
55380.000	1620.00	314.85	.00	.00	.00	142.86	20.00

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
55340.000	1620.00	314.85	.00	.00	.00	125.73	40.00
55320.000	1620.00	314.84	.00	-.01	.00	117.10	20.00
55300.000	1620.00	314.83	.00	-.01	.00	108.50	20.00
55280.000	1620.00	314.83	.00	.00	.00	101.96	20.00
55260.000	1620.00	314.83	.00	.00	.00	95.38	20.00
55240.000	1620.00	314.82	.00	-.01	.00	88.81	20.00
55220.000	1620.00	314.88	.00	.06	.00	83.69	20.00
55200.000	1620.00	314.93	.00	.05	.00	78.48	20.00
55180.000	1620.00	314.95	.00	.02	.00	76.46	20.00
55160.000	1620.00	314.97	.00	.02	.00	74.47	20.00
55140.000	1620.00	315.00	.00	.03	.00	72.51	20.00
55095.000	1620.00	315.04	.00	.04	.00	68.56	45.00
55060.000	1620.00	315.07	.00	.04	.00	68.56	35.00
55000.000	1620.00	315.10	.00	.02	.00	68.43	60.00
54340.000	1620.00	315.39	.00	.29	.00	67.25	660.00
54260.000	1620.00	315.47	.00	.08	.00	67.27	80.00
54000.000	1620.00	315.61	.00	.14	.00	66.93	260.00
53000.000	1620.00	316.28	.00	.67	.00	66.02	1000.00
52000.000	1620.00	317.11	.00	.83	.00	65.74	1000.00
51000.000	1620.00	318.00	.00	.89	.00	65.72	1000.00
50000.000	1620.00	318.90	.00	.89	.00	65.70	1000.00
49590.000	1620.00	319.26	.00	.36	.00	65.64	410.00

SUMMARY OF ERRORS AND SPECIAL NOTES

55[illegible]00	1620.00	315.10	.00	.02	.0[illegible]	68.43	60.00
543[illegible]000	1620.00	315.39	.00	.29	.00	67.25	660.00
54260.000	1620.00	315.47	.00	.08	.00	67.27	80.00
54000.000	1620.00	315.61	.00	.14	.00	66.93	260.00
53000.000	1620.00	316.28	.00	.67	.00	66.02	1000.00
52000.000	1620.00	317.11	.00	.83	.00	65.74	1000.00
51000.000	1620.00	318.00	.00	.89	.00	65.72	1000.00
50000.000	1620.00	318.90	.00	.89	.00	65.70	1000.00
49590.000	1620.00	319.26	.00	.36	.00	65.64	410.00

SUMMARY OF ERRORS AND SPECIAL NOTES

THIS RUN EXECUTED 01/01/80 04:02:05

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**************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAY  1984
  ERROR CORR -  01,02,03,04,05,06
  MODIFICATION -  50,51,52,53,54,55,56
  IBM-PC-XT VERSION
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SUBCRITCAL TRANSITION ANALYSIS CAL HYDRA: MOMENTUM ANALYSIS

OUTLET TRANSITION

COMPUTED BY: DT DATE: 3/25/05 CHECKED BY: _____ DATE: _____

n= 0.030 So= 0.000333

	STATION	Q	B	Z	Dc	DEPTH	AREA	VEL.	INV.EL.	W.S. EL.	FROUDE NUMBER	SEQUENT DEPTH	MAX C/L OFFSET
B5+00	1+ 0.00	6500.00	175.00	3.00	3.43	8.99	1815.7	3.58	1310.80	1319.79	0.000	0.000	0.000
	1+ 5.00	6500.00	172.50	2.83	3.46	8.97	1775.2	3.66	1310.80	1319.77	0.229	0.000	
	1+10.00	6500.00	170.00	2.67	3.50	8.95	1734.8	3.75	1310.80	1319.75	0.234	0.000	
	1+15.00	6500.00	167.50	2.50	3.54	8.93	1694.5	3.84	1310.81	1319.73	0.239	0.000	
	1+20.00	6500.00	165.00	2.33	3.58	8.90	1654.2	3.93	1310.81	1319.71	0.245	0.000	
	1+25.00	6500.00	162.50	2.17	3.62	8.88	1614.0	4.03	1310.81	1319.69	0.250	0.000	
54+70	1+30.00	6500.00	160.00	2.00	3.66	8.86	1573.9	4.13	1310.81	1319.67	0.256	0.000	

SUBCRITICAL TRANSITION ANALYSIS

COMPUTED BY: DT DATE: 4/05 CHECKED BY: _____ DATE: _____

n= 0.030 So= 0.000235

STATION	Q	B	Z	Dc	DEPTH	AREA	VEL.	INV.EL.	W.S. EL.	FROUDE NUMBER	SEQUENT DEPTH	MAX C/L OFFSET
4+70 1+30.00	6500.00	160.00	2.00	3.66	8.86	1574.6	4.13	1310.81	1319.67	0.000	0.000	0.000
1+50.00	6500.00	150.00	2.00	3.81	8.83	1480.5	4.39	1310.81	1319.64	0.274	0.000	
1+70.00	6500.00	140.00	2.00	3.98	8.79	1385.9	4.69	1310.82	1319.61	0.294	0.000	
4+10 1+90.00	6500.00	130.00	2.00	4.17	8.75	1290.9	5.04	1310.82	1319.58	0.317	0.000	
3+90 2+10.00	6500.00	120.00	2.00	4.39	8.70	1195.5	5.44	1310.83	1319.53	0.345	0.000	
2+30.00	6500.00	110.00	2.00	4.63	8.64	1099.5	5.91	1310.83	1319.47	0.378	0.000	
3+50 2+50.00	6500.00	100.00	2.00	4.91	8.56	1002.9	6.48	1310.84	1319.40	0.418	0.000	
2+70.00	6500.00	90.00	2.00	5.24	8.47	905.6	7.18	1310.84	1319.31	0.468	0.000	
2+90.00	6500.00	80.00	2.00	5.62	8.35	807.8	8.05	1310.85	1319.20	0.531	0.000	
3+00 3+ 0.00	6500.00	75.00	2.00	5.83	8.29	758.7	8.57	1310.85	1319.14	0.570	0.000	

SUBCRITCAL TRANSITION ANALYSIS

COMPUTED BY: DATE: CHECKED BY: _____ DATE: _____

n= 0.030 So= 0.000167

STATION	Q	B	Z	Dc	DEPTH	AREA	VEL.	INV.EL.	W.S. EL.	FROUDE NUMBER	SEQUENT DEPTH	MAX C/L OFFSET
3+ 0.00	6500.00	75.00	2.00	5.83	8.29	759.2	8.56	1310.85	1319.14	0.000	0.000	0.000
3+10.00	6500.00	[illegible]	2.00	5.88	8.28	749.0	8.68	1310.85	1319.13	0.578	0.000	
3+20.00	6500.00	[illegible]	2.00	5.93	8.27	738.7	8.80	1310.85	1319.12	0.587	0.000	
3+30.00	6500.00	[illegible]	2.00	5.99	8.26	728.4	8.92	1310.86	1319.12	0.596	0.000	
3+40.00	6500.00	[illegible]	2.00	6.04	8.25	718.1	9.05	1310.86	1319.11	0.606	0.000	
3+50.00	6500.00	[illegible]	2.00	6.09	8.24	707.7	9.18	1310.86	1319.10	0.616	0.000	
3+60.00	6500.00	[illegible]	2.00	6.15	8.22	697.2	9.32	1310.86	1319.08	0.626	0.000	

SUBCRITCAL TRANSITION ANALYSIS

65.00

COMPUTED BY: DATE: CHECKED BY: _____ DATE: _____

n= 0.030 So= -0.014250

NDRA: HOMEOUTLOW
.ITCAL TRANSITION ANALYSIS

COMPUTED BY: DT DATE: 4/85 CHECKED BY:_____ DATE:_____

n= 0.030 So= 0.000167

STATION	Q	B	Z	Dc	DEPTH	AREA	VEL.	INV.EL.	W.S. EL.	FROUDE NUMBER	SEQUENT DEPTH	MAX C/L OFFSET
00 3+ 0.00	6500.00	75.00	2.00	5.83	8.29	759.2	8.56	1310.85	1319.14	0.000	0.000	0.000
90 3+10.00	6500.00	73.33	2.00	5.91	8.26	742.1	8.76	1310.85	1319.11	0.584	0.000	
80 3+20.00	6500.00	71.67	2.00	5.99	8.23	724.8	8.97	1310.85	1319.08	0.600	0.000	
70 3+30.00	6500.00	70.00	2.00	6.07	8.19	707.3	9.19	1310.86	1319.04	0.617	0.000	
60 3+40.00	6500.00	68.33	2.00	6.15	8.15	689.5	9.43	1310.86	1319.00	0.636	0.000	
50 3+50.00	6500.00	66.67	2.00	6.24	8.10	671.5	9.68	1310.86	1318.96	0.655	0.000	
40 3+60.00	6500.00	65.00	2.00	6.33	8.05	653.1	9.95	1310.86	1318.91	0.677	0.000	

CAL HDRA: MOMENTUM

SUBCRITCAL TRANSITION ANALYSIS

COMPUTED BY: DT DATE: 4/05 CHECKED BY:_____ DATE:_____

n= 0.030 So= -0.014250

STATION	Q	B	Z	Dc	DEPTH	AREA	VEL.	INV.EL.	W.S. EL.	FROUDE NUMBER	SEQUENT DEPTH	MAX C/L OFFSET
SS2+40 3+60.00	6500.00	65.00	2.00	6.33	8.05	652.9	9.96	1310.86	1318.91	0.000	0.000	0.000
SS2+30 3+70.00	6500.00	63.33	2.00	6.42	8.25	659.0	9.86	1310.72	1318.97	0.665	0.000	
SS2+20 3+80.00	6500.00	61.67	2.00	6.51	8.45	663.9	9.79	1310.58	1319.03	0.654	0.000	
SS2+10 3+90.00	6500.00	60.00	2.00	6.61	8.64	667.8	9.73	1310.43	1319.07	0.645	0.000	
SS2+00 4+ 0.00	6500.00	58.33	2.00	6.71	8.83	670.7	9.69	1310.29	1319.12	0.638	0.000	

\L HYDRA: MOMENTUM

IBCRITCAL TRANSITION ANALYSIS

COMPUTED BY: DT DATE: 4/05 CHECKED BY: _____ DATE: _____

n= 0.030 So= 0.001000

STATION	Q	B	Z	Dc	DEPTH	AREA	VEL.	INV.EL.	W.S. EL.	FROUDE NUMBER	SEQUENT DEPTH	MAX C/L OFFSET
4+ 0.00	6500.00	58.33	2.00	6.71	8.83	671.0	9.69	1310.29	1319.12	0.000	0.000	0.000
4+10.00	6500.00	56.66	2.00	6.82	8.75	648.9	10.02	1310.30	1319.05	0.663	0.000	
4+20.00	6500.00	55.00	2.00	6.93	8.66	626.1	10.38	1310.31	1318.97	0.692	0.000	
4+30.00	6500.00	53.33	2.00	7.04	8.55	602.3	10.79	1310.32	1318.87	0.725	0.000	
4+40.00	6500.00	51.67	2.00	7.16	8.43	577.3	11.26	1310.33	1318.76	0.763	0.000	
4+50.00	6500.00	50.00	2.00	7.28	8.27	550.7	11.80	1310.34	1318.61	0.808	0.000	

''WASP2''SUBCRITICAL WATER SURFACE PROFILE

OUTLET TRANSITION

COMPUTED BY: DT DATE: 3/26/96 DATA FILE: R4MAR CHECKED BY: _____ DATE: _____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
1+00.00	6500.00	175.00	3.00	3.430	8.990	1815.7	3.58	1319.99	1310.80	1319.79	0.00	0.22	0.87
	n=0.0300		So=0.000195		Sf=0.000349	Headloss Factor=0.000		Total Headloss=0.003 ft.		Se=0.000351			
1+10.00	6500.00	170.00	2.67	3.501	8.974	1740.3	3.73	1319.99	1310.80	1319.78	10.81	0.23	0.93
	n=0.0300		So=0.000305		Sf=0.000378	Headloss Factor=0.000		Total Headloss=0.004 ft.		Se=0.000368			
1+20.00	6500.00	165.00	2.33	3.577	8.955	1664.6	3.90	1320.00	1310.81	1319.76	10.79	0.24	0.99
	n=0.0300		So=0.000195		Sf=0.000412	Headloss Factor=0.000		Total Headloss=0.004 ft.		Se=0.000414			
1+30.00	6500.00	160.00	2.00	3.657	8.934	1589.0	4.09	1320.00	1310.81	1319.74	10.77	0.25	1.07
	n=0.0300		So=0.000293		Sf=0.000445	Headloss Factor=0.000		Total Headloss=0.004 ft.		Se=0.000428			
1+40.00	6500.00	155.00	2.00	3.732	8.919	1541.5	4.22	1320.00	1310.81	1319.73	10.76	0.26	1.13
	n=0.0300		So=0.000208		Sf=0.000476	Headloss Factor=0.000		Total Headloss=0.005 ft.		Se=0.000474			
1+50.00	6500.00	150.00	2.00	3.811	8.904	1494.1	4.35	1320.01	1310.81	1319.72	10.74	0.27	1.20
	n=0.0300		So=0.000415		Sf=0.000501	Headloss Factor=0.000		Total Headloss=0.003 ft.		Se=0.000491			
1+55.00	6500.00	147.50	2.00	3.852	8.895	1470.2	4.42	1320.01	1310.81	1319.71	10.73	0.27	1.23
	n=0.0300		So=0.000195		Sf=0.000520	Headloss Factor=0.000		Total Headloss=0.003 ft.		Se=0.000491			
1+60.00	6500.00	145.00	2.00	3.895	8.886	1446.4	4.49	1320.01	1310.82	1319.70	10.73	0.28	1.27
	n=0.0300		So=0.000195		Sf=0.000549	Headloss Factor=0.000		Total Headloss=0.005 ft.		Se=0.000546			
1+70.00	6500.00	140.00	2.00	3.982	8.868	1398.8	4.65	1320.02	1310.82	1319.68	10.71	0.29	1.36
	n=0.0300		So=0.000293		Sf=0.000593	Headloss Factor=0.000		Total Headloss=0.006 ft.		Se=0.000596			
1+80.00	6500.00	135.00	2.00	4.075	8.847	1350.9	4.81	1320.03	1310.82	1319.67	10.69	0.30	1.45
	n=0.0300		So=0.000208		Sf=0.000642	Headloss Factor=0.000		Total Headloss=0.006 ft.		Se=0.000640			
1+90.00	6500.00	130.00	2.00	4.173	8.824	1302.9	4.99	1320.03	1310.82	1319.65	10.67	0.31	1.55

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300		So=0.000305		Sf=0.000697	Headloss Factor=0.000		Total Headloss=0.007 ft.		Se=0.000690			

	n=0.0300	So=0.000273	Sf=0.003071	Headloss Factor=0.000	Total Headloss=0.031 ft.	Se=0.003073						
3+40.00	00	68.33	2.00	6.150	7.970	671.6	9	1320.28	1310.86	1318.83	9.85	0.66	51
	n=0.0300	So=0.000208	Sf=0.003282	Headloss Factor=0.000	Total Headloss=0.033 ft.	Se=0.003284						
3+50.00	6500.00	66.67	2.00	6.236	7.917	653.2	9.95	1320.32	1310.86	1318.78	9.81	0.68	4.79
	n=0.0300	So=-.000208	Sf=0.003517	Headloss Factor=0.000	Total Headloss=0.035 ft.	Se=0.003509						
3+60.00	6500.00	65.00	2.00	6.325	7.865	634.9	10.24	1320.35	1310.86	1318.72	9.76	0.70	4.98
	n=0.0300	So=-.014197	Sf=0.003556	Headloss Factor=0.000	Total Headloss=0.036 ft.	Se=0.003549						
3+70.00	6500.00	63.33	2.00	6.417	8.079	642.2	10.12	1320.39	1310.72	1318.80	10.01	0.69	4.98
	n=0.0300	So=-.014294	Sf=0.003402	Headloss Factor=0.000	Total Headloss=0.034 ft.	Se=0.003397						
3+80.00	6500.00	61.67	2.00	6.512	8.285	648.2	10.03	1320.42	1310.58	1318.86	10.25	0.68	4.99
	n=0.0300	So=-.014197	Sf=0.003276	Headloss Factor=0.000	Total Headloss=0.033 ft.	Se=0.003269						
3+90.00	6500.00	60.00	2.00	6.611	8.482	652.8	9.96	1320.45	1310.43	1318.91	10.49	0.67	5.01
	n=0.0300	So=-.014319	Sf=0.003174	Headloss Factor=0.000	Total Headloss=0.032 ft.	Se=0.003166						
552+00												
4+00.00	6500.00	58.33	2.00	6.713 (137.66)	8.674	656.4	9.90	1320.49	1310.29	1318.96	10.71	0.66	5.04
	n=0.0300	So=0.000916	Sf=0.003264	Headloss Factor=0.000	Total Headloss=0.033 ft.	Se=0.003252						
551+90												
4+10.00	6500.00	56.67	2.00	6.818	8.589	634.2	10.25	1320.52	1310.30	1318.89	10.63	0.68	5.28

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.000903	Sf=0.003571	Headloss Factor=0.000	Total Headloss=0.036 ft.	Se=0.003569							
551+80													
4+20.00	6500.00	55.00	2.00	6.927	8.489	611.1	10.64	1320.55	1310.31	1318.80	10.54	0.72	5.55
	n=0.0300	So=0.000891	Sf=0.003945	Headloss Factor=0.000	Total Headloss=0.039 ft.	Se=0.003933							
551+70													
4+30.00	6500.00	53.33	2.00	7.041	8.369	586.5	11.08	1320.59	1310.32	1318.69	10.42	0.75	5.84
	n=0.0300	So=0.000903	Sf=0.004417	Headloss Factor=0.000	Total Headloss=0.044 ft.	Se=0.004415							
551+60													
4+40.00	6500.00	51.67	2.00	7.158	8.217	559.6	11.62	1320.64	1310.33	1318.54	10.28	0.80	6.18
	n=0.0140	So=0.000903	Sf=0.002182	Headloss Factor=0.000	Total Headloss=0.022 ft.	Se=0.002183							
551+50													
4+50.00	6500.00	50.00	2.00	7.280 (137.62)	7.887	518.8	12.53	1320.66	1310.34	1318.22	9.95	0.88	6.70
	n=0.0140	So=0.000891	Sf=0.001250	Headloss Factor=0.000	Total Headloss=0.013 ft.	Se=0.001243							
4+60.00	6500.00	50.00	2.00	7.280	7.902	520.0	12.50	1320.67	1310.34	1318.25	9.97	0.87	6.68
	n=0.0140	So=0.000903	Sf=0.001242	Headloss Factor=0.000	Total Headloss=0.012 ft.	Se=0.001239							
4+70.00	6500.00	50.00	2.00	7.280	7.916	521.1	12.47	1320.68	1310.35	1318.27	9.98	0.87	6.67
	n=0.0140	So=0.000903	Sf=0.001234	Headloss Factor=0.000	Total Headloss=0.012 ft.	Se=0.001231							
4+80.00	6500.00	50.00	2.00	7.280	7.930	522.3	12.45	1320.70	1310.36	1318.29	10.00	0.87	6.66

4+90.00	[illegible]0.00	50.00	2.00	7.280	7.943	523.3	[illegible]2	1320.71	1310.37	1318.31	10.01	0.87	[illegible].65

[illegible].0140 So=0.000891 Sf=0.001220 Headloss [illegible]or=0.000 Total Headloss=0.012 ft. Se=0.00121

55+00

5+00.00	6500.00	50.00	2.00	7.280	7.956	524.4	12.40	1320.72	1310.38	1318.34	10.02	0.86	6.63

1317.66

	n=0.0300	So=0.000195	Sf=0.000744	Headlo	Factor=0.000	Total Headloss=0.004 ft.	Se=0.00072					
2+05.00	20.00	122.50	2.00	4.332	8.784	1230.4	.28	1320.04	1310.83	1319.61	10.63	0.	1.72
	n=0.0300	So=0.000195	Sf=0.000778	Headloss	Factor=0.000	Total Headloss=0.004 ft.	Se=0.000763					
2+10.00	6500.00	120.00	2.00	4.388	8.769	1206.1	5.39	1320.05	1310.83	1319.60	10.61	0.34	1.78
	n=0.0300	So=0.000293	Sf=0.000833	Headloss	Factor=0.000	Total Headloss=0.008 ft.	Se=0.000819					
2+20.00	6500.00	115.00	2.00	4.506	8.736	1157.2	5.62	1320.06	1310.83	1319.57	10.58	0.36	1.92
	n=0.0300	So=0.000208	Sf=0.000918	Headloss	Factor=0.000	Total Headloss=0.009 ft.	Se=0.000908					
2+30.00	6500.00	110.00	2.00	4.632	8.699	1108.2	5.87	1320.06	1310.83	1319.53	10.55	0.37	2.07
	n=0.0300	So=0.000305	Sf=0.001017	Headloss	Factor=0.000	Total Headloss=0.010 ft.	Se=0.001003					
2+40.00	6500.00	105.00	2.00	4.767	8.654	1058.5	6.14	1320.07	1310.84	1319.49	10.50	0.39	2.25
	n=0.0300	So=0.000195	Sf=0.001133	Headloss	Factor=0.000	Total Headloss=0.011 ft.	Se=0.001131					
553+50 2+50.00	6500.00	100.00	2.00	4.912	8.604	1008.5	6.45	1320.09	1310.84	1319.44	10.45	0.41	2.44
	n=0.0300	So=0.000415	Sf=0.001235	Headloss	Factor=0.000	Total Headloss=0.006 ft.	Se=0.001226					
2+55.00	6500.00	97.50	2.00	4.988	8.575	983.1	6.61	1320.09	1310.84	1319.41	10.43	0.43	2.55
	n=0.0300	So=0.000171	Sf=0.001312	Headloss	Factor=0.000	Total Headloss=0.007 ft.	Se=0.001302					
2+60.00	6500.00	95.00	2.00	5.068	8.544	957.6	6.79	1320.10	1310.84	1319.38	10.40	0.44	2.67
	n=0.0300	So=0.000208	Sf=0.001443	Headloss	Factor=0.000	Total Headloss=0.014 ft.	Se=0.001432					
2+70.00	6500.00	90.00	2.00	5.236	8.472	906.1	7.17	1320.11	1310.84	1319.31	10.33	0.47	2.92
	n=0.0300	So=0.000305	Sf=0.001654	Headloss	Factor=0.000	Total Headloss=0.017 ft.	Se=0.001647					
2+80.00	6500.00	85.00	2.00	5.418	8.384	853.2	7.62	1320.13	1310.85	1319.23	10.24	0.50	3.22
	n=0.0300	So=0.000195	Sf=0.001922	Headloss	Factor=0.000	Total Headloss=0.019 ft.	Se=0.001907					
2+90.00	6500.00	80.00	2.00	5.615	8.274	798.8	8.14	1320.15	1310.85	1319.12	10.13	0.54	3.56

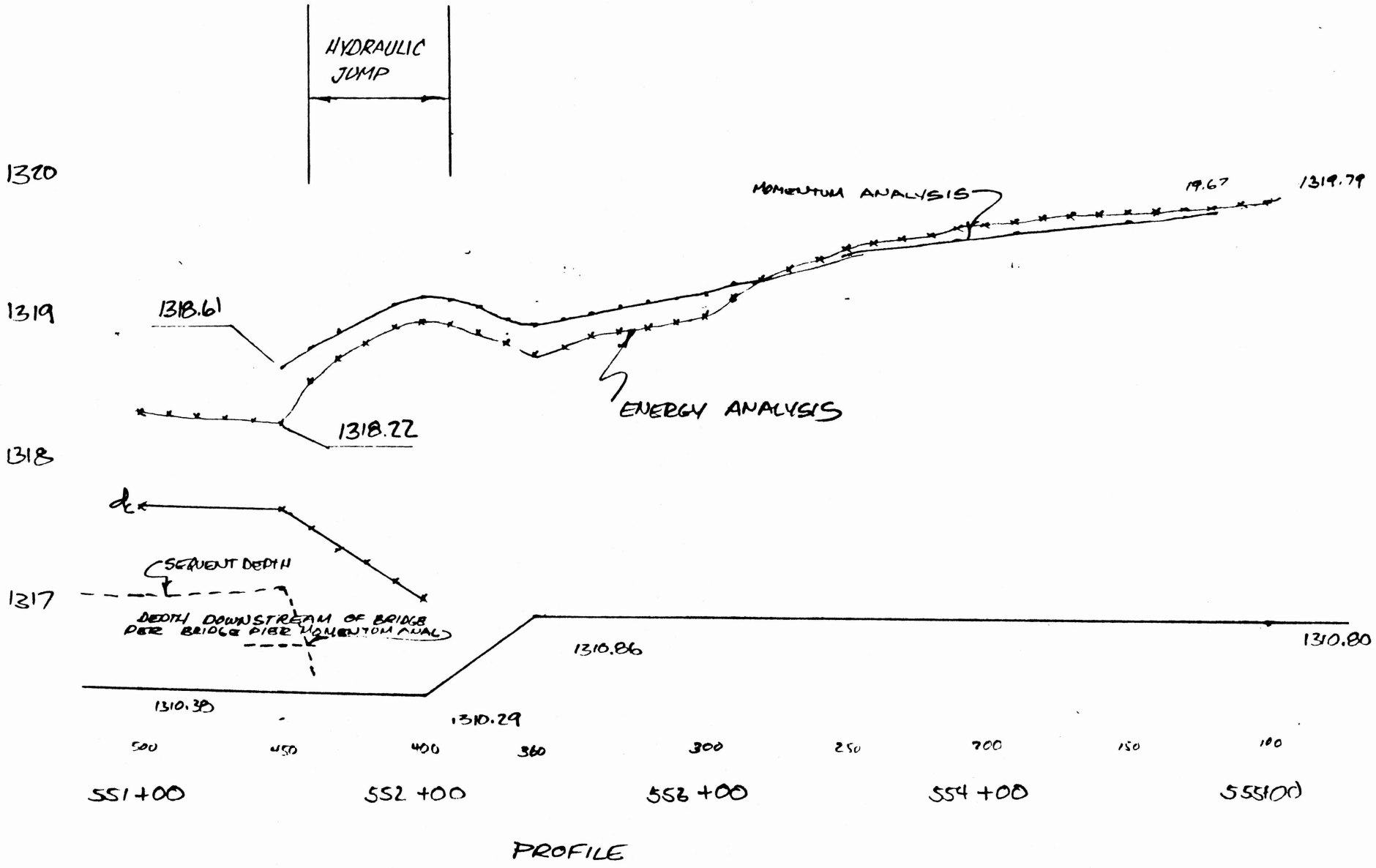
STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.000293	Sf=0.002275	Headloss	Factor=0.000	Total Headloss=0.023 ft.	Se=0.002265						
553+00 3+00.00	6500.00	75.00	2.00	5.831	8.130	742.0	8.76	1320.17	1310.85	1318.98	9.99	0.59	3.98
	n=0.0300	So=0.000208	Sf=0.002565	Headloss	Factor=0.000	Total Headloss=0.026 ft.	Se=0.002559						
3+10.00	6500.00	73.33	2.00	5.907	8.097	724.9	8.97	1320.20	1310.85	1318.95	9.97	0.60	4.12
	n=0.0300	So=0.000305	Sf=0.002716	Headloss	Factor=0.000	Total Headloss=0.027 ft.	Se=0.002705						
3+20.00	6500.00	71.67	2.00	5.985	8.058	707.4	9.19	1320.22	1310.86	1318.91	9.93	0.62	4.27
	n=0.0300	So=0.000195	Sf=0.002884	Headloss	Factor=0.000	Total Headloss=0.029 ft.	Se=0.002875						
3+30.00	6500.00	70.00	2.00	6.066	8.017	689.8	9.42	1320.25	1310.86	1318.87	9.90	0.64	4.43

NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

ARIZONA RWCD R4

DT 3/25/85

POWER RD TRANSITION



PROFILE

Bridge at STA. 550+00 (±) was assumed during design that it would be replaced. This month it was learned that the bridge would not be replaced. This affected the hydraulics because of several piers supporting the exist. bridge. The new hydraulics indicated the flow would pass through critical depth under bridge and cause a hydraulic jump downstream.

It is a weak jump (Freude number less than 2). Two options were looked at: 1. Increased channel roughness downstream to reduce energy and 2. Rock lined reach for channel protection.

Option 2. was selected as best choice

a) less problem with maintenance
b) Rock lining was needed because of high velocity for either option.

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 383 200 SHEETS 5 SQUARE
NATIONAL

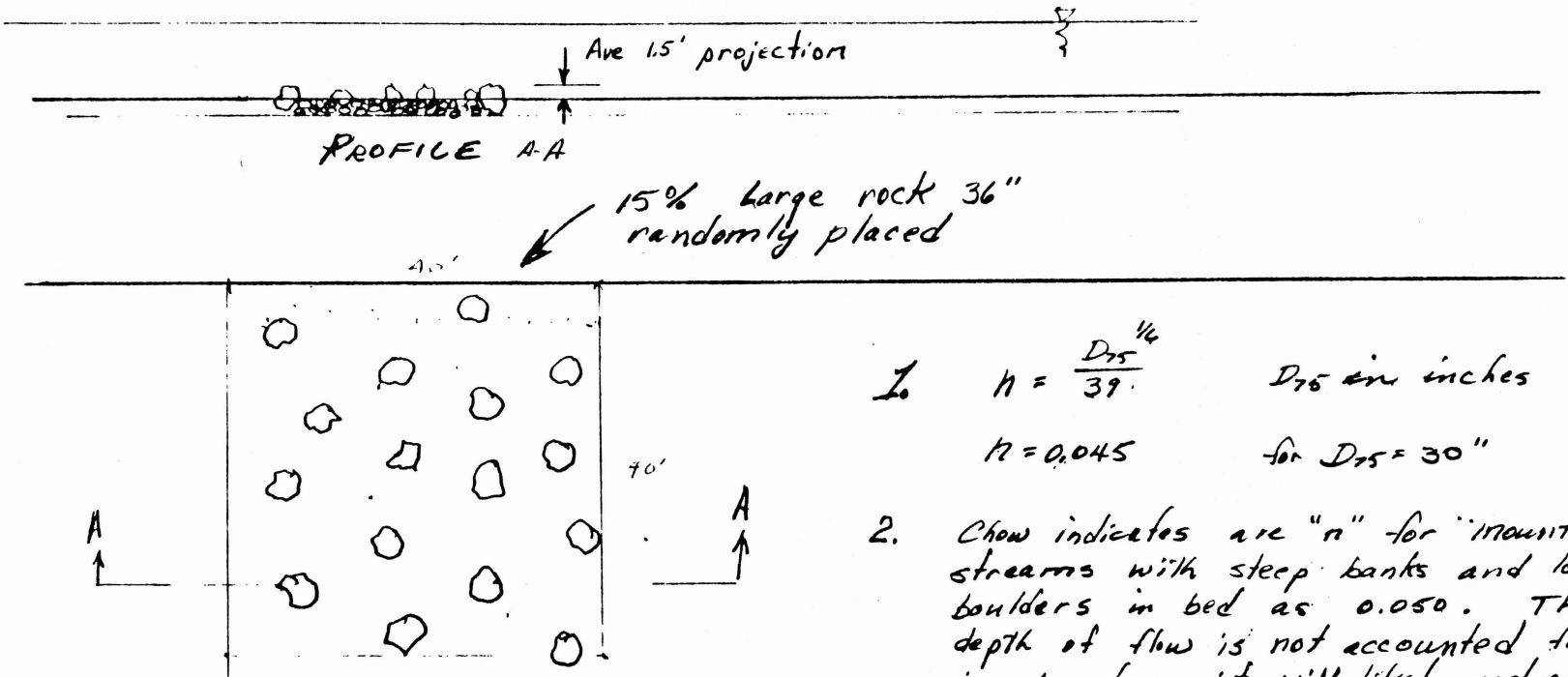
2

Channel Hydraulics

3/85

PWCD RY, AZ

WATER SURFACE PROFILE INDICATES Hydraulic Jump (weak) downstream of bridge near STA. 551+50.



PLAN

1. $n = \frac{D_{75}^{1/6}}{39}$ D_{75} in inches

$n = 0.045$ for $D_{75} = 30"$

2. Chow indicates are "n" for "mountain streams with steep banks and large boulders in bed as 0.050. The depth of flow is not accounted for in 1. above; it will likely reduce n.

Assuming n = 0.045 will provide some idea of effect of large rock in bottom.

Option 1.
Place rock boulders downstream of jump. Purpose is to help dissipate energy and surface undulations.

NATIONAL
42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

Cont.-

Option 2.
Do nothing - Hydraulic calculations indicate that a jump will occur at design flow. Froude number is low meaning a weak jump. Surface undulations can be expected to continue downstream for considerable distance. Grouted rock or rock riprap should be used to prevent erosion from turbulent flow.

Option 2. selected because of maintenance problems associated with Option 1.

Design as shown on Dwgs.
Grouted rock used from STA 551+50 to STA 552+50
Loose rock used from STA 552+00 to 556+00 ±

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

Bridge Pier Momentum Analysis.

POWER RD. (STA 551+00) EXISTING BRIDGE

$Q = 6500$ cfs bottom width = 50 ft.

Slope = 2:1 Pier width = 1.333 ft. No. Piers = 3

From Far West States:

$\bar{y} = \frac{d(T+2b)}{3(T+b)}$ where T = Top width; b = base width

and $M_1 = A_1 \bar{y}$; also $\frac{d}{d} A_0 = M_0$

$A_1 = A_3$ and $M_1 = M_3$

A = Area of trap. channel.

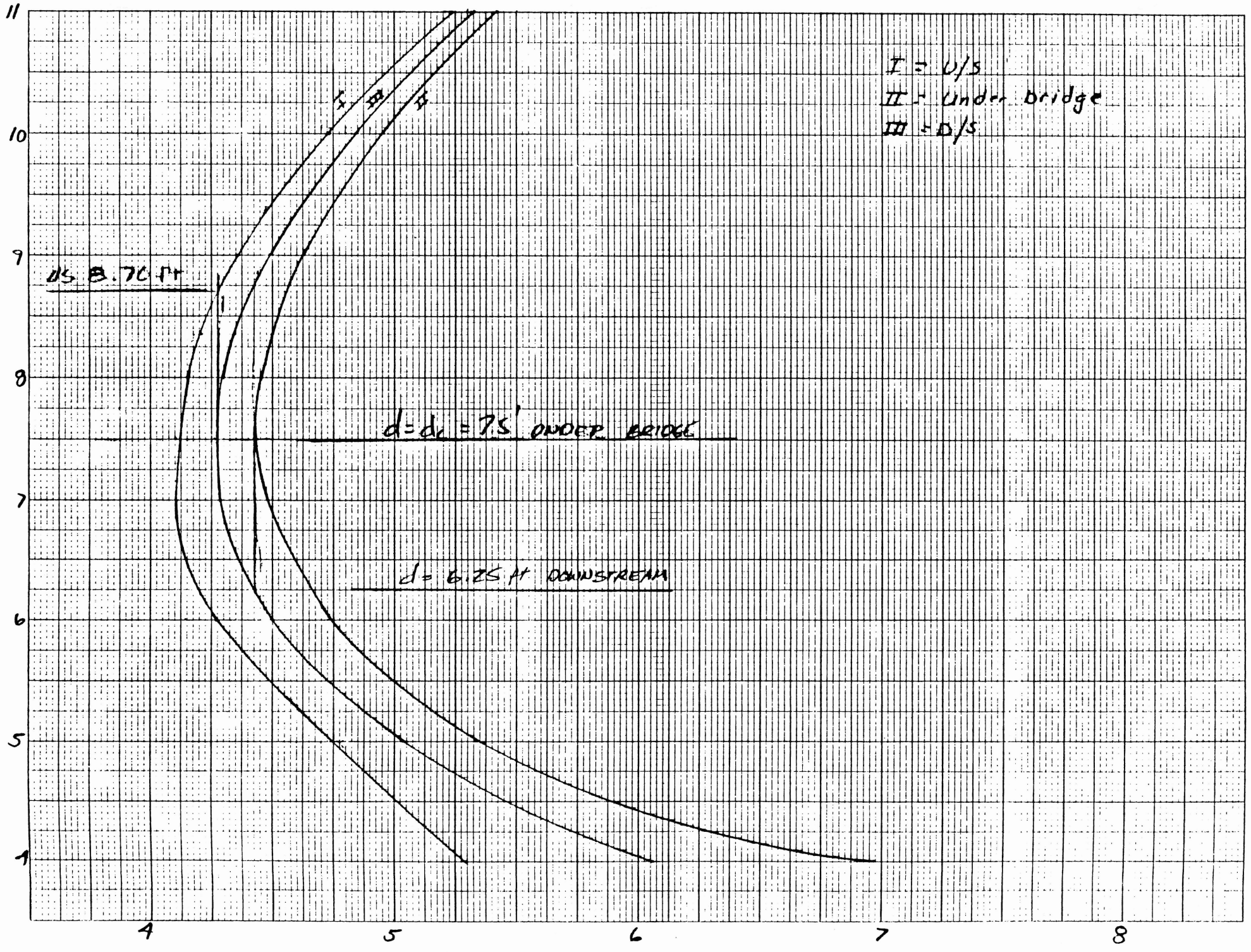
$= (b+2d)d$

d	T $(4d+b)$	$\bar{y}$
4	66	1.908
5	70	2.361
6	74	2.806
7	78	3.245
8	82	3.677
8.35	83.4	3.827
9.00	86	4.103
10.00	90	4.524
11.00	94	4.940
3	62	1.446

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

d	$A_1 = A_3$	$M_1 = M_3$	A_0	M_0	$A_1 - A_0$	$M_1 - M_0$ (1)	$\frac{Q^2}{g(A_1 - A_0)}$ (2)	$\frac{Q^2}{g A_1^2}$	$\frac{Q^2(A_1 - A_0)}{g A_1^2}$ (3)	$\frac{Q^2}{g A_3}$ (4)	I (1)+(3)	II (1)+(2)	III (1)+(4)
4	232	442.7	16	32	200	410.7	656.1	24.4	487.6	562	520.7	697.2	606.7
5	300	708.3	20	50	280	658.3	466	14.6	408.2	437.4	474.0	534.4	503.2
6	372	1043.8	24	72	348	971.8	377.0	9.5	330.0	352.7	427.2	474.2	449.9
7	448	1453.8	28	98	420	1355.8	312.4	6.5	274.6	292.9	410.2	448.0	428.5
8	528	1941.5	32	128	496	1813.5	264.5	4.7	233.4	248.5	414.8	445.9	429.9
8.35	556.9	2131.3	33.4	139.4	523.5	1991.9	250.6	4.2	221.5	235.6	420.7	449.8	434.8
9	612.0	2511.0	36	162.0	576	2349	227.8	3.5	201.8	214.4	436.7	462.7	449.3
10	700	3166.8	40	200	660	2946.8	198.8	2.7	176.7	187.4	473.4	495.5	484.1
11	792	3912.5	44	242	748	3670.5	175.4	2.1	156.5	165.7	523.6	542.5	532.8
3	168	242.9	12	18	150	224.9							

K&E 10 X 10 TO ½ INCH • 7½ X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



Bridge Pier Momentum Analysis

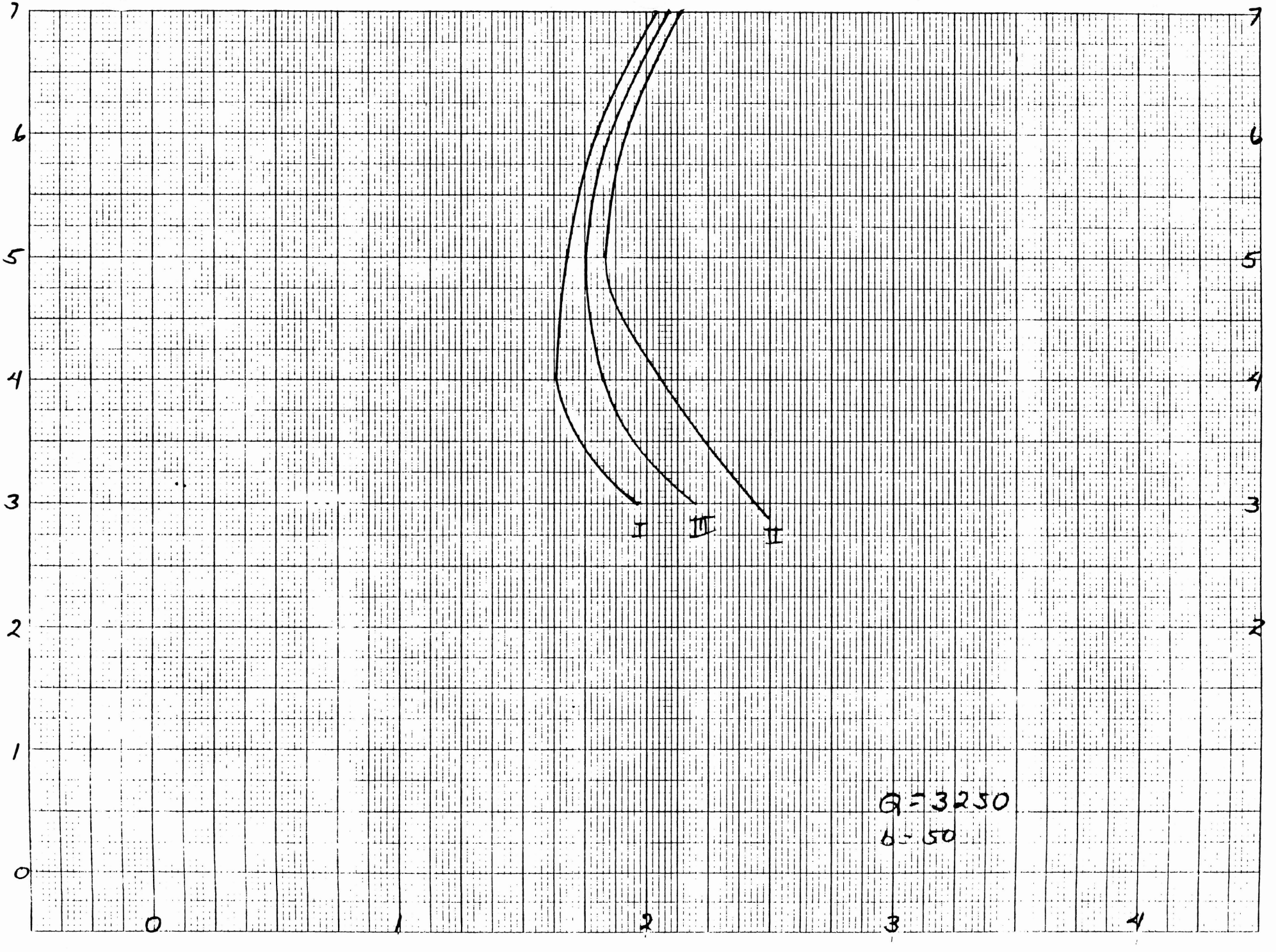
Q = 3250 bottom width = 50ft.

Slope = 2:1 Pier width = 1.333ft No piers = 3

Trial Run 2.

d	① $M_1 - M_0$	② $\frac{Q^2}{g(A_1 - A_0)}$	$\frac{Q^2}{gA_1^2}$	③ $\frac{Q^2(A_1 - A_3)}{gA_1^2}$	④ $\frac{Q^2}{gA_3}$	I ①+③	II ①+②	III ①+④
4	410.7	1640	6.09	1218.9	1413.9	1630	2051	1825
5	658.3	1172	3.64	1020.5	1093.4	1679	1830	1752
6	971.8	943	2.37	824.9	881.8	1797	1915	1854
7	1355.8	781	1.64	686.4	732.2	2042	2137	2088
8	1813.5	661	1.18	583.6	621.3	2399	2475	2435
9	2349	569	0.88	504.5	536.0	2854	2918	2885
10	2966.8	497	0.67	441.8	468.6	3409	3464	3436
11	3670.5	439	0.52	391.2	414.2	4062	4110	4085
3	242.9	2187	11.62	1743.3	1952.5	1986	2430	2195

K&E 10 X 10 TO ½ INCH • 7½ X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



Bridge Pier Momentum Analysis.

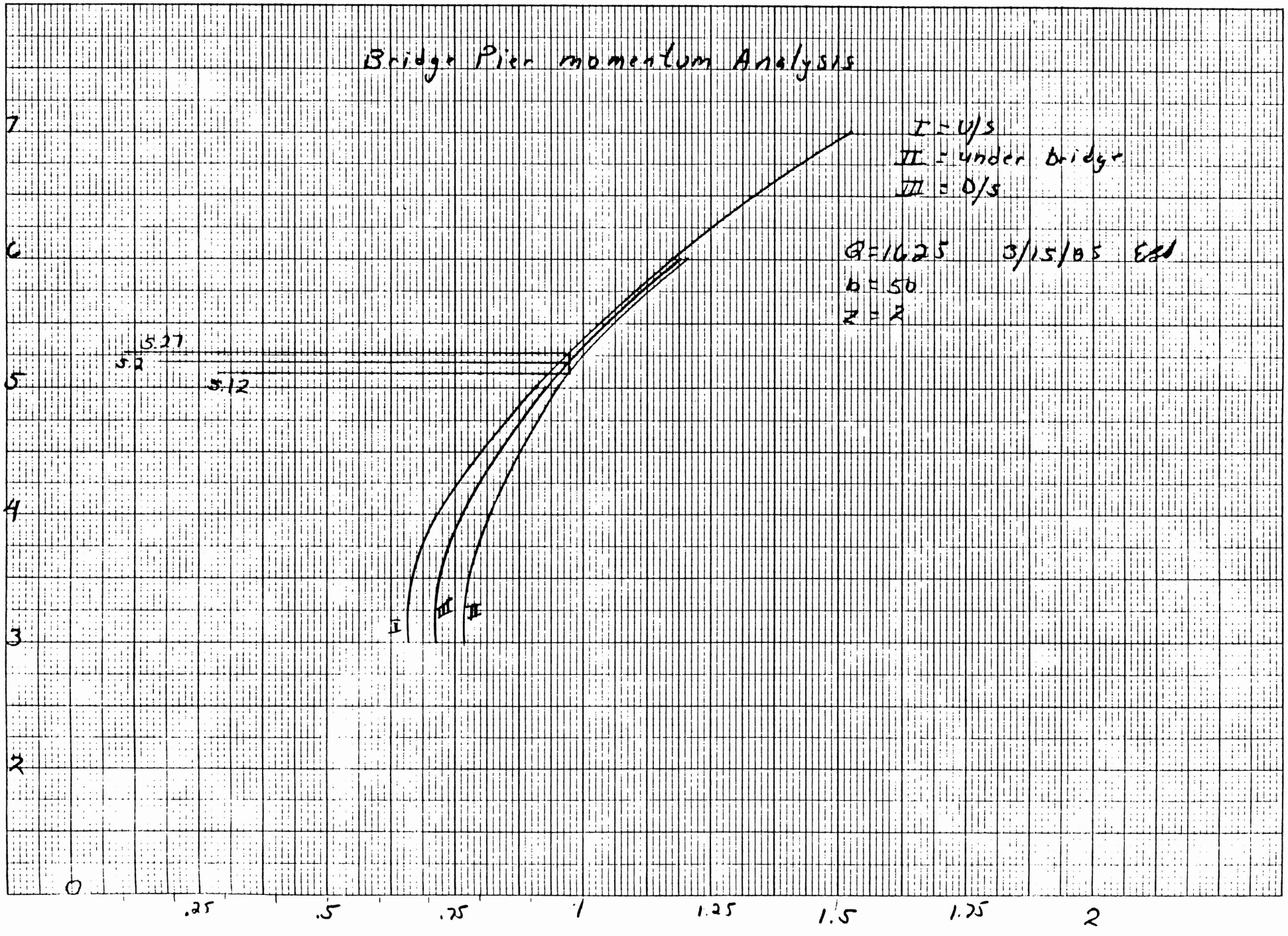
Q = 1625 bottom width = 50ft

Slope = 2.0 Pier width = 1.333 No Piers = 3

Trial Run 3

d	① $M_1 - M_0$	② $\frac{Q^2}{g(A_1 - A_0)}$	$\frac{Q^2}{gA_1^2}$	③ $\frac{Q^2(A_1 - A_0)}{gA_1^2}$	④ $\frac{Q^2}{gA_3}$	I ① + ③	II ① + ②	III ① + ④
3	225	541	2.91	436	488	661	772	713
4	411	410	1.52	305	353	716	821	764
5	658	293	0.91	255	273	913	951	931
6	972	236	0.59	206	220	1178	1208	1192
7	1356	195	0.41	172	183	1528	1551	1539

K•E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



FILE RC1.

''WASP2'' SUBCRITICAL WATER SURFACE PROFILE

WSP- POWER RD TO WMS. FIELD RD.

COMPUTED BY: DT DATE: 4/25 DATA FILE: RC1. CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
					from Momentum Analysis								
SSO 1+50.00	6500.00	50.00	2.00	7.280	8.700	586.4	11.08	1321.04	1310.43	1319.13	0.00	0.74	6.00
	n=0.0140	So=0.000903		Sf=0.000882	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000879				
2+00.00	6500.00	50.00	2.00	7.280	8.697	586.2	11.09	1321.08	1310.48	1319.17	10.82	0.74	6.00
	n=0.0140	So=0.000898		Sf=0.000883	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000884				
2+50.00	6500.00	50.00	2.00	7.280	8.696	586.0	11.09	1321.13	1310.52	1319.22	10.82	0.74	6.00
	n=0.0140	So=0.000901		Sf=0.000884	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000882				
3+00.00	6500.00	50.00	2.00	7.280	8.694	585.9	11.09	1321.17	1310.57	1319.26	10.81	0.74	6.01
	n=0.0140	So=0.000898		Sf=0.000884	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000883				
3+50.00	6500.00	50.00	2.00	7.280	8.692	585.7	11.10	1321.21	1310.61	1319.30	10.81	0.74	6.01
	n=0.0140	So=0.000901		Sf=0.000885	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000883				
4+00.00	6500.00	50.00	2.00	7.280	8.690	585.6	11.10	1321.26	1310.66	1319.35	10.81	0.74	6.01
	n=0.0140	So=0.000898		Sf=0.000886	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000885				
4+50.00	6500.00	50.00	2.00	7.280	8.689	585.4	11.10	1321.30	1310.70	1319.39	10.81	0.74	6.01
	n=0.0140	So=0.000903		Sf=0.000886	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000886				
5+00.00	6500.00	50.00	2.00	7.280	8.687	585.3	11.11	1321.35	1310.75	1319.43	10.81	0.74	6.01
	n=0.0140	So=0.000896		Sf=0.000887	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000885				
5+50.00	6500.00	50.00	2.00	7.280	8.686	585.2	11.11	1321.39	1310.79	1319.48	10.81	0.74	6.01
	n=0.0140	So=0.000903		Sf=0.000887	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000885				
6+00.00	6500.00	50.00	2.00	7.280	8.684	585.0	11.11	1321.44	1310.84	1319.52	10.80	0.75	6.01
	n=0.0140	So=0.000898		Sf=0.000888	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000888				
6+50.00	6500.00	50.00	2.00	7.280	8.683	584.9	11.11	1321.48	1310.88	1319.56	10.80	0.75	6.01

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140	So=0.000901		Sf=0.000888	Headloss Factor=0.000		Total Headloss=0.044 ft.		Se=0.000888				

	n=0.0140	So=0.000901	Sf=0.000888	Head.	Factor=0.000	Total Headloss=0.044 ft.		Se=0.0[illegible]				
7+00.[illegible]	6500.00	50.00	2.00	7.280	8.682	584.8	11.11	1321.52	1310.93	1319.61	10.80	6.02
	n=0.0140	So=0.000898	Sf=0.000889	Headloss	Factor=0.000	Total Headloss=0.044 ft.		Se=0.000887				
7+50.00	6500.00	50.00	2.00	7.280	8.680	584.7	11.12	1321.57	1310.97	1319.65	10.80	0.75	6.02
	n=0.0140	So=0.000901	Sf=0.000889	Headloss	Factor=0.000	Total Headloss=0.044 ft.		Se=0.000887				
8+00.00	6500.00	50.00	2.00	7.280	8.679	584.6	11.12	1321.61	1311.02	1319.69	10.80	0.75	6.02
	n=0.0140	So=0.000898	Sf=0.000890	Headloss	Factor=0.000	Total Headloss=0.044 ft.		Se=0.000888				
8+50.00	6500.00	50.00	2.00	7.280	8.678	584.5	11.12	1321.66	1311.06	1319.74	10.80	0.75	6.02
	n=0.0140	So=0.000903	Sf=0.000890	Headloss	Factor=0.000	Total Headloss=0.045 ft.		Se=0.000891				
9+00.00	6500.00	50.00	2.00	7.280	8.677	584.4	11.12	1321.70	1311.11	1319.78	10.80	0.75	6.02

WATER SURFACE PROFILE

- BRIDGE AT WILLIAMS FIELD ROAD
  - FOR PRELIMINARY RUN ΔH AT BRIDGE. (HEC2 VOID COMPS)
  - DEPTH @ 543+40 8.80 ft
    542+60 8.99

ΔH = 0.19 ft

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 383 200 SHEETS 5 SQUARE
NATIONAL

FILE 7

''WASP2'' SUBCRITICAL WATER SURFACE PROFILE

WSPG WILLIAMS FIELD ROAD TO RIC INLET TRANSITION

COMPUTED BY: DT DATE: 4/8 DATA FILE: RC2 CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
542+60	6500.00	50.00	2.00	7.280	8.870 (from Bridge Pier Momentum Analysis)	600.9	10.82	1321.83	1311.14	1320.01	0.00	0.72	5.87
	n=0.0140	So=0.000832		Sf=0.000822	Headloss Factor=0.000	Total Headloss=0.049 ft.		Se=0.000823					
542+00	6500.00	50.00	2.00	7.280	8.869	600.8	10.82	1321.88	1311.19	1320.06	11.01	0.72	5.87
	n=0.0140	So=0.000901		Sf=0.000825	Headloss Factor=0.000	Total Headloss=0.083 ft.		Se=0.000825					
	6500.00	50.00	2.00	7.280	8.853	599.4	10.84	1321.96	1311.28	1320.13	10.99	0.72	5.88
	n=0.0140	So=0.000900		Sf=0.000830	Headloss Factor=0.000	Total Headloss=0.083 ft.		Se=0.000830					
540 4+00.00	6500.00	50.00	2.00	7.280	8.839	598.2	10.87	1322.04	1311.37	1320.21	10.97	0.72	5.89
	n=0.0140	So=0.000900		Sf=0.000835	Headloss Factor=0.000	Total Headloss=0.084 ft.		Se=0.000834					
4+00.00	6500.00	50.00	2.00	7.280	8.825	597.0	10.89	1322.13	1311.46	1320.28	10.96	0.73	5.90
	n=0.0140	So=0.000900		Sf=0.000840	Headloss Factor=0.000	Total Headloss=0.084 ft.		Se=0.000840					
4+00.00	6500.00	50.00	2.00	7.280	8.812	595.9	10.91	1322.21	1311.55	1320.36	10.94	0.73	5.91
	n=0.0140	So=0.000901		Sf=0.000844	Headloss Factor=0.000	Total Headloss=0.084 ft.		Se=0.000843					
4+00.00	6500.00	50.00	2.00	7.280	8.800	594.9	10.93	1322.29	1311.64	1320.44	10.93	0.73	5.92
	n=0.0140	So=0.000900		Sf=0.000848	Headloss Factor=0.000	Total Headloss=0.085 ft.		Se=0.000848					
4+00.00	6500.00	50.00	2.00	7.280	8.789	594.0	10.94	1322.38	1311.73	1320.52	10.92	0.73	5.93
	n=0.0140	So=0.000900		Sf=0.000852	Headloss Factor=0.000	Total Headloss=0.085 ft.		Se=0.000851					
535 4+00.00	6500.00	50.00	2.00	7.280	8.779	593.1	10.96	1322.46	1311.82	1320.60	10.91	0.73	5.94
	n=0.0140	So=0.000900		Sf=0.000855	Headloss Factor=0.000	Total Headloss=0.086 ft.		Se=0.000855					
4+00.00	6500.00	50.00	2.00	7.280	8.770	592.3	10.97	1322.55	1311.91	1320.68	10.90	0.73	5.94
	n=0.0140	So=0.000901		Sf=0.000858	Headloss Factor=0.000	Total Headloss=0.086 ft.		Se=0.000858					
4+00.00	6500.00	50.00	2.00	7.280	8.760	591.5	10.99	1322.64	1312.00	1320.76	10.89	0.73	5.95

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140	So=0.000900		Sf=0.000862	Headloss Factor=0.000	Total Headloss=0.086 ft.		Se=0.000861					

	n=0.0140	So=0.000900	Sf=0.000864	Headl	actor=0.000	Total Headloss=0.086 ft.	Se=0.000					
+00.00	500.00	50.00	2.00	7.280	8.744	590.1	1.01	1322.81	1312.18	1320.92	10.87	0..	5.96
	n=0.0140	So=0.000901	Sf=0.000867	Headloss Factor=0.000		Total Headloss=0.087 ft.	Se=0.000866					
+00.00	6500.00	50.00	2.00	7.280	8.737	589.5	11.03	1322.89	1312.27	1321.01	10.86	0.74	5.97
	n=0.0140	So=0.000900	Sf=0.000870	Headloss Factor=0.000		Total Headloss=0.087 ft.	Se=0.000869					
+00.00	6500.00	50.00	2.00	7.280	8.730	588.9	11.04	1322.98	1312.36	1321.09	10.85	0.74	5.98
	n=0.0140	So=0.000900	Sf=0.000872	Headloss Factor=0.000		Total Headloss=0.087 ft.	Se=0.000871					
+00.00	6500.00	50.00	2.00	7.280	8.724	588.4	11.05	1323.07	1312.45	1321.17	10.85	0.74	5.98
	n=0.0140	So=0.000900	Sf=0.000874	Headloss Factor=0.000		Total Headloss=0.087 ft.	Se=0.000874					
+00.00	6500.00	50.00	2.00	7.280	8.718	587.9	11.06	1323.16	1312.54	1321.26	10.84	0.74	5.99
	n=0.0140	So=0.000901	Sf=0.000876	Headloss Factor=0.000		Total Headloss=0.088 ft.	Se=0.000876					
+00.00	6500.00	50.00	2.00	7.280	8.713	587.5	11.06	1323.24	1312.63	1321.34	10.84	0.74	5.99
	n=0.0140	So=0.000900	Sf=0.000878	Headloss Factor=0.000		Total Headloss=0.088 ft.	Se=0.000878					
+00.00	6500.00	50.00	2.00	7.280	8.708	587.1	11.07	1323.33	1312.72	1321.43	10.83	0.74	5.99
	n=0.0140	So=0.000900	Sf=0.000880	Headloss Factor=0.000		Total Headloss=0.088 ft.	Se=0.000879					
+00.00	6500.00	50.00	2.00	7.280	8.704	586.7	11.08	1323.42	1312.81	1321.51	10.83	0.74	6.00
	n=0.0140	So=0.000901	Sf=0.000881	Headloss Factor=0.000		Total Headloss=0.088 ft.	Se=0.000881					
+00.00	6500.00	50.00	2.00	7.280	8.699	586.3	11.09	1323.51	1312.90	1321.60	10.82	0.74	6.00
	n=0.0140	So=0.000900	Sf=0.000883	Headloss Factor=0.000		Total Headloss=0.088 ft.	Se=0.000882					
+00.00	6500.00	50.00	2.00	7.280	8.695	586.0	11.09	1323.60	1312.99	1321.69	10.82	0.74	6.00
	n=0.0140	So=0.000900	Sf=0.000884	Headloss Factor=0.000		Total Headloss=0.088 ft.	Se=0.000883					
+00.00	6500.00	50.00	2.00	7.280	8.692	585.7	11.10	1323.68	1313.08	1321.77	10.81	0.74	6.01

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140	So=0.000900	Sf=0.000885	Headloss Factor=0.000		Total Headloss=0.089 ft.	Se=0.000885						
+00.00	6500.00	50.00	2.00	7.280	8.689	585.4	11.10	1323.77	1313.17	1321.86	10.81	0.74	6.01
	n=0.0140	So=0.000901	Sf=0.000887	Headloss Factor=0.000		Total Headloss=0.089 ft.	Se=0.000885						
+00.00	6500.00	50.00	2.00	7.280	8.685	585.1	11.11	1323.86	1313.26	1321.95	10.81	0.74	6.01
	n=0.0140	So=0.000900	Sf=0.000888	Headloss Factor=0.000		Total Headloss=0.089 ft.	Se=0.000887						
+00.00	6500.00	50.00	2.00	7.280	8.683	584.9	11.11	1323.95	1313.35	1322.03	10.80	0.75	6.01
	n=0.0140	So=0.000900	Sf=0.000889	Headloss Factor=0.000		Total Headloss=0.089 ft.	Se=0.000888						
+00.00	6500.00	50.00	2.00	7.280	8.680	584.7	11.12	1324.04	1313.44	1322.12	10.80	0.75	6.02

	n=0.0140	So=0.000901	Sf=0.000890	Headl[illegible]	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000890						
+00.0	500.00	50.00	2.00	7.280	8.678	584.5	1.12	1324.13	1313.53	1322.21	10.80	0	6.02
	n=0.0140	So=0.000900	Sf=0.000890	Headloss	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000[illegible]						
515 +00.00	6500.00	50.00	2.00	7.280	8.675	584.3	11.12	1324.22	1313.62	1322.30	10.79	0.75	6.02
	n=0.0140	So=0.000900	Sf=0.000891	Headloss	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000891						
+00.00	6500.00	50.00	2.00	7.280	8.674	584.1	11.13	1324.31	1313.71	1322.38	10.79	0.75	6.02
	n=0.0140	So=0.000901	Sf=0.000892	Headloss	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000892						
+00.00	6500.00	50.00	2.00	7.280	8.672	584.0	11.13	1324.40	1313.80	1322.47	10.79	0.75	6.02
	n=0.0140	So=0.000900	Sf=0.000893	Headloss	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000892						
+00.00	6500.00	50.00	2.00	7.280	8.670	583.8	11.13	1324.48	1313.89	1322.56	10.79	0.75	6.02
	n=0.0140	So=0.000900	Sf=0.000893	Headloss	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000893						
+00.00	6500.00	50.00	2.00	7.280	8.669	583.7	11.14	1324.57	1313.98	1322.65	10.79	0.75	6.03
	n=0.0140	So=0.000900	Sf=0.000894	Headloss	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000893						
510 +00.00	6500.00	50.00	2.00	7.280	8.667	583.6	11.14	1324.66	1314.07	1322.74	10.79	0.75	6.03
	n=0.0140	So=0.000900	Sf=0.000894	Headloss	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000893						
+00.00	6500.00	50.00	2.00	7.280	8.666	583.5	11.14	1324.75	1314.16	1322.83	10.78	0.75	6.03

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140	So=0.000901	Sf=0.000895	Headloss	Factor=0.000	Total Headloss=0.089 ft.	Se=0.000894						
+00.00	6500.00	50.00	2.00	7.280	8.664	583.4	11.14	1324.84	1314.25	1322.91	10.78	0.75	6.03
	n=0.0140	So=0.000900	Sf=0.000895	Headloss	Factor=0.000	Total Headloss=0.090 ft.	Se=0.000894						
+00.00	6500.00	50.00	2.00	7.280	8.663	583.3	11.14	1324.93	1314.34	1323.00	10.78	0.75	6.03
	n=0.0140	So=0.000900	Sf=0.000895	Headloss	Factor=0.000	Total Headloss=0.090 ft.	Se=0.000895						
+00.00	6500.00	50.00	2.00	7.280	8.662	583.2	11.15	1325.02	1314.43	1323.09	10.78	0.75	6.03
	n=0.0140	So=0.000901	Sf=0.000896	Headloss	Factor=0.000	Total Headloss=0.090 ft.	Se=0.000896						
505 +00.00	6500.00	50.00	2.00	7.280	8.661	583.1	11.15	1325.11	1314.52	1323.18	10.78	0.75	6.03
	n=0.0140	So=0.000900	Sf=0.000896	Headloss	Factor=0.000	Total Headloss=0.090 ft.	Se=0.000896						
+00.00	6500.00	50.00	2.00	7.280	8.661	583.0	11.15	1325.20	1314.61	1323.27	10.78	0.75	6.03
	n=0.0140	So=0.000900	Sf=0.000897	Headloss	Factor=0.000	Total Headloss=0.090 ft.	Se=0.000895						
+00.00	6500.00	50.00	2.00	7.280	8.660	583.0	11.15	1325.29	1314.70	1323.36	10.78	0.75	6.03
	n=0.0140	So=0.000900	Sf=0.000897	Headloss	Factor=0.000	Total Headloss=0.090 ft.	Se=0.000896						
+00.00	6500.00	50.00	2.00	7.280	8.659	582.9	11.15	1325.38	1314.79	1323.45	10.78	0.75	6.03

+00.00	0.00	50.00	2.00	7.280	8.658	582.9	15	1325.47	1314.88	1323.54	10.78	0.75	.03
	.0140	So=0.000900		Sf=0.000897		Headlos	or=0.000		Total Headloss=0.090 ft.		Se=0.0008		
+00.00	6500.00	50.00	2.00	7.280	8.658	582.8	11.15	1325.56	1314.97	1323.63	10.78	0.75	6.03
	n=0.0140	So=0.000900		Sf=0.000898		Headloss	Factor=0.000		Total Headloss=0.090 ft.		Se=0.000897		
+00.00	6500.00	50.00	2.00	7.280	8.657	582.8	11.15	1325.65	1315.06	1323.72	10.78	0.75	6.03
	n=0.0140	So=0.000900		Sf=0.000898		Headloss	Factor=0.000		Total Headloss=0.090 ft.		Se=0.000896		
+00.00	6500.00	50.00	2.00	7.280	8.657	582.7	11.15	1325.74	1315.15	1323.81	10.77	0.75	6.04
	n=0.0140	So=0.000901		Sf=0.000898		Headloss	Factor=0.000		Total Headloss=0.090 ft.		Se=0.000898		
+00.00	6500.00	50.00	2.00	7.280	8.656	582.7	11.16	1325.83	1315.24	1323.90	10.77	0.75	6.04

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140	So=0.000900		Sf=0.000898		Headloss	Factor=0.000		Total Headloss=0.090 ft.		Se=0.000898		
+00.00	6500.00	50.00	2.00	7.280	8.656	582.6	11.16	1325.92	1315.33	1323.99	10.77	0.75	6.04
	n=0.0140	So=0.000900		Sf=0.000898		Headloss	Factor=0.000		Total Headloss=0.090 ft.		Se=0.000898		
+00.00	6500.00	50.00	2.00	7.280	8.656	582.6	11.16	1326.01	1315.42	1324.08	10.77	0.75	6.04
	n=0.0140	So=0.000901		Sf=0.000898		Headloss	Factor=0.000		Total Headloss=0.090 ft.		Se=0.000898		
+00.00	6500.00	50.00	2.00	7.280	8.655	582.8	11.16	1326.10	1315.51	1324.16	10.77	0.75	6.04

ARIZONA RWCO ed

DT 2/15/85

INLET TRANSITION HYDRAULICS

PROBLEM: DETERMINE INLET TRANSITION CONFIGURATION

ANALYSIS:

1. LAYOUT: FLARE FROM $B_W = 50$
TO $B_W = 150$ *

WITH 12½° SIDE FLARE
$L = \Delta B_W \times 2.25 = 225$ FT

2. INV AT DS END:

$S = 0.0009$
STA = 493+76
@ STA = 552+00

INV EL	1310.31
Δ EL	5.24
	1315.55

* 3. WORK PLAN SHOWS US CHANNEL $B_W = 170$

- USE 150' TO ALLOW BETTER JUNCTION CONFIGURATION. AN EXPANSION TO 170 FT MAY BE PROVIDED IN RCH 5 UPSTREAM IF SO DESIRED IN DESIGN OF REACH 5.

- WORK PLAN SHOWS $\Delta H = 2.1$ FT IN TRANSITION:

US EL =	1317.4
DS EL =	1315.3
ΔH =	2.1

- TRY USING U.S. EL = 1317.4 @ STA 491+51

	1315.55
	1.85

$S = 185/225$

ARIZONA RUCO R4

D.T. 2/15/85 LMK 3/85

R/L CHANNEL INLET TRANSITION

- UNTIL WSP RUNS ARE COMPLETED MAKE TRIAL RUNS W/ $D = D_n$ AT D.S. END OF TRANSITION:

$Q = 6500$ FT^3

$D = 50$

$Z = 2$

$n = 0.014$

$S = 0.0009$

$d_n = 8.65$

$A = 582$ FT^2

$V = 11.16$ FT/S

2/15/ DT

''WASP2'' SUBCRITICAL WATER SURFACE PROFILE

REACH 4 TRANSITION R/C CHANNEL INLET

COMPUTED BY: DATE: DATA FILE: R4TRA CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
5+00.00	6500.00	50.00	2.00	7.280	8.650	582.1	11.17	1326.14	1315.55	1324.20	0.00	0.75	6.04
	n=0.0140		So=0.008215		Sf=0.000784	Headloss Factor=0.000			Total Headloss=0.008 ft.		Se=0.000787		
5+10.00	6500.00	54.44	2.00	6.965	8.944	647.0	10.05	1326.14	1315.63	1324.58	11.05	0.66	5.27
	n=0.0140		So=0.008203		Sf=0.000621	Headloss Factor=0.000			Total Headloss=0.006 ft.		Se=0.000616		
5+20.00	6500.00	58.89	2.00	6.678	9.104	701.9	9.26	1326.15	1315.71	1324.82	11.19	0.60	4.69
	n=0.0140		So=0.008301		Sf=0.000518	Headloss Factor=0.000			Total Headloss=0.005 ft.		Se=0.000512		
5+30.00	6500.00	63.33	2.00	6.417	9.197	751.6	8.65	1326.16	1315.80	1324.99	11.27	0.56	4.22
	n=0.0140		So=0.008191		Sf=0.000445	Headloss Factor=0.000			Total Headloss=0.004 ft.		Se=0.000437		
5+40.00	6500.00	67.78	2.00	6.178	9.251	798.1	8.14	1326.16	1315.88	1325.13	11.31	0.52	3.83
	n=0.0140		So=0.008203		Sf=0.000389	Headloss Factor=0.000			Total Headloss=0.004 ft.		Se=0.000386		
5+50.00	6500.00	72.22	2.00	5.959	9.277	842.2	7.72	1326.16	1315.96	1325.24	11.32	0.49	3.50
	n=0.0140		So=0.008203		Sf=0.000346	Headloss Factor=0.000			Total Headloss=0.003 ft.		Se=0.000339		
5+60.00	6500.00	76.67	2.00	5.757	9.285	884.2	7.35	1326.17	1316.04	1325.33	11.31	0.46	3.22
	n=0.0140		So=0.008301		Sf=0.000312	Headloss Factor=0.000			Total Headloss=0.003 ft.		Se=0.000313		
5+70.00	6500.00	81.11	2.00	5.570	9.276	924.5	7.03	1326.17	1316.13	1325.40	11.29	0.44	2.98
	n=0.0140		So=0.008191		Sf=0.000283	Headloss Factor=0.000			Total Headloss=0.003 ft.		Se=0.000277		
5+80.00	6500.00	85.56	2.00	5.397	9.258	963.5	6.75	1326.17	1316.21	1325.47	11.25	0.42	2.76
	n=0.0140		So=0.008191		Sf=0.000260	Headloss Factor=0.000			Total Headloss=0.003 ft.		Se=0.000248		
5+90.00	6500.00	90.00	2.00	5.236	9.231	1001.2	6.49	1326.18	1316.29	1325.52	11.21	0.41	2.57
	n=0.0140		So=0.008215		Sf=0.000240	Headloss Factor=0.000			Total Headloss=0.002 ft.		Se=0.000234		
6+00.00	6500.00	94.44	2.00	5.086	9.196	1037.7	6.26	1326.18	1316.37	1325.57	11.16	0.39	2.41

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140		So=0.008203		Sf=0.000223	Headloss Factor=0.000			Total Headloss=0.002 ft.		Se=0.000215		

	n=0.0140	So=0.008301	Sf=0.000208	Headl	Factor=0.000	Total Headloss=0.002 ft.		Se=0.00020					
6+20.00	00.00	103.33	2.00	4.814	9.110	1107.3	.87	1326.18	1316.54	1325.65	11.04	0.	2.12
	n=0.0140	So=0.008191	Sf=0.000196	Headloss	Factor=0.000	Total Headloss=0.002 ft.		Se=0.000190					
6+30.00	6500.00	107.78	2.00	4.691	9.061	1140.8	5.70	1326.18	1316.62	1325.68	10.97	0.36	2.01
	n=0.0140	So=0.008203	Sf=0.000184	Headloss	Factor=0.000	Total Headloss=0.002 ft.		Se=0.000178					
6+40.00	6500.00	112.22	2.00	4.575	9.008	1173.2	5.54	1326.19	1316.70	1325.71	10.91	0.35	1.90
	n=0.0140	So=0.008203	Sf=0.000175	Headloss	Factor=0.000	Total Headloss=0.002 ft.		Se=0.000170					
6+50.00	6500.00	116.67	2.00	4.466	8.952	1204.7	5.40	1326.19	1316.78	1325.74	10.83	0.34	1.80
	n=0.0140	So=0.008301	Sf=0.000166	Headloss	Factor=0.000	Total Headloss=0.002 ft.		Se=0.000167					
6+60.00	6500.00	121.11	2.00	4.363	8.893	1235.3	5.26	1326.19	1316.87	1325.76	10.76	0.33	1.71
	n=0.0140	So=0.008191	Sf=0.000159	Headloss	Factor=0.000	Total Headloss=0.002 ft.		Se=0.000150					
6+70.00	6500.00	125.56	2.00	4.266	8.833	1265.1	5.14	1326.19	1316.95	1325.78	10.68	0.32	1.64
	n=0.0140	So=0.008203	Sf=0.000152	Headloss	Factor=0.000	Total Headloss=0.002 ft.		Se=0.000139					
6+80.00	6500.00	130.00	2.00	4.173	8.770	1294.0	5.02	1326.19	1317.03	1325.80	10.60	0.32	1.56
	n=0.0140	So=0.008203	Sf=0.000146	Headloss	Factor=0.000	Total Headloss=0.001 ft.		Se=0.000145					
6+90.00	6500.00	134.44	2.00	4.086	8.706	1322.1	4.92	1326.19	1317.11	1325.82	10.52	0.31	1.50
	n=0.0140	So=0.008203	Sf=0.000140	Headloss	Factor=0.000	Total Headloss=0.001 ft.		Se=0.000134					
7+00.00	6500.00	138.89	2.00	4.003	8.641	1349.4	4.82	1326.20	1317.19	1325.83	10.44	0.30	1.44
	n=0.0140	So=0.008301	Sf=0.000135	Headloss	Factor=0.000	Total Headloss=0.001 ft.		Se=0.000125					
7+10.00	6500.00	143.33	2.00	3.923	8.573	1375.7	4.72	1326.20	1317.28	1325.85	10.36	0.30	1.38
	n=0.0140	So=0.008191	Sf=0.000131	Headloss	Factor=0.000	Total Headloss=0.001 ft.		Se=0.000133					
7+20.00	6500.00	147.78	2.00	3.848	8.505	1401.5	4.64	1326.20	1317.36	1325.86	10.27	0.29	1.33

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140	So=0.008203	Sf=0.000128	Headloss	Factor=0.000	Total Headloss=0.001 ft.		Se=0.000106					
7+25.00	6500.00	150.00	2.00	3.811	8.470	1414.0	4.60	1326.20	1317.40	1325.87	10.23	0.29	1.31

BCRITCAL TRANSITION ANALYSIS

RWCD @ OVERLOOK R/C WL "HYDRA" MODEL

COMPUTED BY: DT DATE: 2/15/85 CHECKED BY: _____ DATE: _____

n= 0.014 So= 0.008222

	STATION	Q	B	Z	Dc	DEPTH	AREA	VEL.	INV.EL.	W.S. EL.	FROUDE NUMBER	SEQUENT DEPTH	MAX C/L OFFSET
D5	5+ 0.00	6500.00	50.00	2.00	7.28	8.65	582.1	11.17	1315.55	1324.20	0.000	0.000	0.000
	5+10.00	6500.00	54.44	2.00	6.96	8.94	646.8	10.05	1315.63	1324.57	0.661	0.000	
	5+20.00	6500.00	58.89	2.00	6.68	9.10	701.3	9.27	1315.71	1324.81	0.602	0.000	
	5+30.00	6500.00	63.33	2.00	6.42	9.18	750.3	8.66	1315.80	1324.98	0.558	0.000	
	5+40.00	6500.00	67.78	2.00	6.18	9.23	795.7	8.17	1315.88	1325.11	0.522	0.000	
	5+50.00	6500.00	72.22	2.00	5.96	9.24	838.5	7.75	1315.96	1325.20	0.493	0.000	
	5+60.00	6500.00	76.67	2.00	5.76	9.24	879.1	7.39	1316.04	1325.28	0.468	0.000	
	5+70.00	6500.00	81.11	2.00	5.57	9.22	917.8	7.08	1316.13	1325.35	0.447	0.000	
	5+80.00	6500.00	85.56	2.00	5.40	9.19	955.0	6.81	1316.21	1325.40	0.429	0.000	
	5+90.00	6500.00	90.00	2.00	5.24	9.15	990.8	6.56	1316.29	1325.44	0.413	0.000	
	6+ 0.00	6500.00	94.44	2.00	5.09	9.10	1025.3	6.34	1316.37	1325.47	0.399	0.000	
	6+10.00	6500.00	98.89	2.00	4.95	9.05	1058.6	6.14	1316.45	1325.50	0.387	0.000	
	6+20.00	6500.00	103.33	2.00	4.81	8.99	1090.8	5.96	1316.54	1325.53	0.375	0.000	
	6+30.00	6500.00	107.78	2.00	4.69	8.93	1121.9	5.79	1316.62	1325.55	0.365	0.000	
	6+40.00	6500.00	112.22	2.00	4.58	8.86	1151.9	5.64	1316.70	1325.57	0.356	0.000	
	6+50.00	6500.00	116.67	2.00	4.47	8.80	1181.0	5.50	1316.78	1325.58	0.348	0.000	
	6+60.00	6500.00	121.11	2.00	4.36	8.73	1209.2	5.38	1316.87	1325.59	0.340	0.000	
	6+70.00	6500.00	125.56	2.00	4.27	8.65	1236.5	5.26	1316.95	1325.60	0.333	0.000	
	6+80.00	6500.00	130.00	2.00	4.17	8.58	1262.8	5.15	1317.03	1325.61	0.327	0.000	
	6+90.00	6500.00	134.44	2.00	4.09	8.51	1288.3	5.05	1317.11	1325.62	0.322	0.000	
	7+ 0.00	6500.00	138.89	2.00	4.00	8.43	1312.9	4.95	1317.19	1325.62	0.316	0.000	
	7+10.00	6500.00	143.33	2.00	3.92	8.35	1336.6	4.86	1317.28	1325.63	0.312	0.000	
	7+20.00	6500.00	147.78	2.00	3.85	8.27	1359.6	4.78	1317.36	1325.63	0.307	0.000	
D5	7+25.00	6500.00	150.00	2.00	3.81	8.23	1370.7	4.74	1317.40	1325.63	0.305	0.000	

SUBCRITCAL TRANSITION ANALYSIS

RWCA R4 INLET TRANSITION

COMPUTED BY: DATE: CHECKED BY: _____ DATE: _____

n= 0.014 So= 0.008222

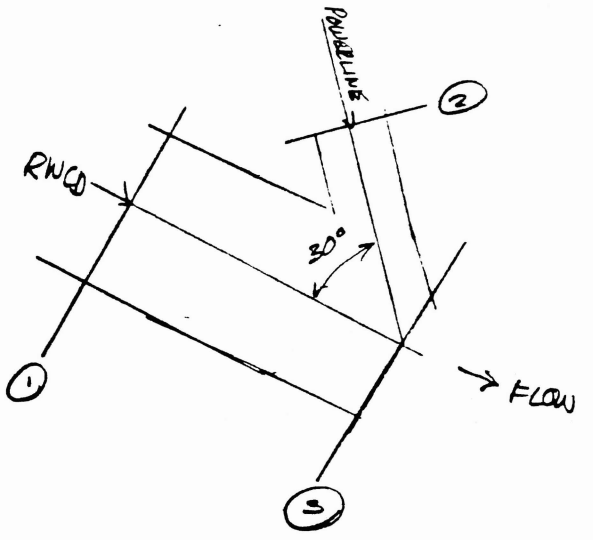
STATION	Q	B	Z	Dc	DEPTH	AREA	VEL.	INV.EL.	W.S. EL.	FROUDE NUMBER	SEQUENT DEPTH	MAX C/L OFFSET
4+93.76 5+ 0.00	3140.00	50.00	2.00	4.65	5.74	352.9	8.90	1315.55	1321.29	0.000	0.000	0.000
5+10.00	3140.00	54.44	2.00	4.43	5.89	389.9	8.05	1315.63	1321.52	0.635	0.000	
5+20.00	3140.00	58.89	2.00	4.24	5.96	421.7	7.45	1315.71	1321.67	0.581	0.000	
5+30.00	3140.00	63.33	2.00	4.06	5.98	450.5	6.97	1315.80	1321.78	0.541	0.000	
5+40.00	3140.00	67.78	2.00	3.90	5.98	477.1	6.58	1315.88	1321.86	0.508	0.000	
5+50.00	3140.00	72.22	2.00	3.75	5.97	502.0	6.25	1315.96	1321.93	0.482	0.000	
5+60.00	3140.00	76.67	2.00	3.62	5.93	525.4	5.98	1316.04	1321.98	0.460	0.000	
5+70.00	3140.00	81.11	2.00	3.49	5.89	547.6	5.73	1316.13	1322.02	0.442	0.000	
5+80.00	3140.00	85.56	2.00	3.38	5.85	568.5	5.52	1316.21	1322.05	0.426	0.000	
5+90.00	3140.00	90.00	2.00	3.27	5.79	588.4	5.34	1316.29	1322.08	0.412	0.000	
6+ 0.00	3140.00	94.44	2.00	3.18	5.73	607.2	5.17	1316.37	1322.11	0.401	0.000	
6+10.00	3140.00	98.89	2.00	3.09	5.67	625.1	5.02	1316.45	1322.13	0.390	0.000	
6+20.00	3140.00	103.33	2.00	3.00	5.61	642.1	4.89	1316.54	1322.14	0.381	0.000	
6+30.00	3140.00	107.78	2.00	2.92	5.54	658.2	4.77	1316.62	1322.16	0.374	0.000	
6+40.00	3140.00	112.22	2.00	2.85	5.47	673.4	4.66	1316.70	1322.17	0.367	0.000	
6+50.00	3140.00	116.67	2.00	2.78	5.40	687.8	4.57	1316.78	1322.18	0.361	0.000	
6+60.00	3140.00	121.11	2.00	2.71	5.32	701.3	4.48	1316.87	1322.19	0.356	0.000	
6+70.00	3140.00	125.56	2.00	2.65	5.25	714.0	4.40	1316.95	1322.20	0.351	0.000	
6+80.00	3140.00	130.00	2.00	2.59	5.17	725.9	4.33	1317.03	1322.20	0.347	0.000	
6+90.00	3140.00	134.44	2.00	2.54	5.10	737.0	4.26	1317.11	1322.21	0.344	0.000	
7+ 0.00	3140.00	138.89	2.00	2.48	5.02	747.2	4.20	1317.19	1322.21	0.342	0.000	
7+10.00	3140.00	143.33	2.00	2.43	4.94	756.7	4.15	1317.28	1322.22	0.339	0.000	
7+20.00	3140.00	147.78	2.00	2.39	4.86	765.4	4.10	1317.36	1322.22	0.338	0.000	
41+5 7+25.00	3140.00	150.00	2.00	2.36	4.82	769.5	4.08	1317.40	1322.22	0.337	0.000	

ARIZONA RWCD RCH J WILLIAMS - CHANDLER	DT 2/21/85 JLL 3/85	POWERLINE JCT

PROBLEM: FIND W.S. EL UPSTREAM OF JCT. BY MOMENTUM METHODS.

ANALYSIS:

1.



LAYOUT

2. SECTION DATA

	B	Z
①	150	3
②	80	3
③	150	3

3. CASES

CASE	Q_1	Q_2	Q_3	d_3
I	3360	3140	6500	8.65
II	4100	2400	6500	8.65
III	5900	600	6500	8.65

SOLUTION:

SUMMARY

CASE	d_3 L=100	L=200	
I	8.95	—	(≈8.96) ←
II	8.93	8.94	
III	8.81	8.83	←

Aj
CSS

RWCD Channel Rch 4

2/27/85

Junction Analysis

Situation: Channel with side inlet at 30° to main channel.

1. Main channel D/s = 150 ft
2. Main channel U/s = 150 ft
3. Side channel = 80 ft

Q D/s = 6500 cfs
Q U/s = 3360 cfs
Q side = 3140 cfs

depth D/s = 8.65 ft. ℓ = 150 ft
n = 0.027

Channel slopes = 3:1
Invert slope = 0.0

Determine:

1. Depths of flow for U/s main channel and side channel.

2. Using Momentum Analysis

	$A=(b+Zd)d$			$\frac{d_1+d_3}{2}$	$(b_a+Zd_a)d_a$	$b_a=b_1=b_3$
$d_1=d_2$	A_1	A_2	A_3	d_a	A_a	
6	1008	588	1521.97	7.33	1260.58	
7	1197	707	"	7.83	1358.31	
8	1392	832	"	8.33	1457.54	
8.92	1576.7	952.3	"	8.79	1550.16	
9	1593.0	963	"	8.83	1558.27	
10	1800	1100	"	9.33	1660.51	

	$b_a+2d_a\sqrt{Z^2+1}$	$\frac{A_a}{P_a}$		$\frac{Q_3}{A_a}$	
$d_1=d_2$	P_a	R_a	$R_a^{2/3}$	V_a	V_a^2
6	196.33	6.42	1.86	5.16	26.63
7	199.49	6.81	1.89	4.79	22.94
8	202.65	7.19	1.93	4.46	19.89
8.92	205.59	7.54	1.96	4.19	17.58
9	205.81	7.57	1.96	4.17	17.39
10	208.97	7.95	1.99	3.91	15.32

A3
ESSD 2/27/85 RWCD Channel Rch 4.

Junction Analysis 3

Downstream Pressure & Momentum:

$$\frac{Q_3^2}{gA_3} + \left(\frac{b_3}{2} + \frac{Zd_3}{3}\right)(d_3^2) = M_3 + P_3$$

$$\frac{(6500)^2}{(32.2)(1521.97)} + \left(\frac{150}{2} + \frac{(3)8.65}{3}\right)[8.65]^2 = 7121.02$$

Summary of U/S Pressure & Momentum:

$$\frac{Q_1^2}{gA_1} + \frac{Q_2^2}{gA_2}\cos\theta + \left(\frac{b_1}{2} + \frac{Zd_1}{3}\right)(d_1^2) - \frac{P_a l_n^2 V_a^2}{2.21 R_a^{4/3}}$$

d	$\frac{Q_1^2}{gA_1}$	$\frac{Q_2^2}{gA_2}\cos\theta$	$\frac{b_1 d_1^2}{2}$	$\frac{Zd_1^3}{3}$	$\frac{P_a l_n^2 V_a^2}{2.21 R_a^{4/3}}$	Total
6	347.83	450.98	2700	216.0	139.08	3575.73
7	292.91	375.07	3675	343.0	119.81	4566.17
8	251.87	318.72	4800	512.0	103.34	5779.25
8.92	222.37	278.46	5967.5	709.7	91.24	7086.79
9	220.09	275.36	6075	729.0	90.35	7209.10
10	194.78	241.07	7500	1000.0	79.60	8856.25

• WSP POWER ROAD BRIDGE TO WILLIAMS FIELD ROAD BRIDGE:

$Q = 6500$, $b = 50$, $Z = 2$, $n = 0.014$, $S = 0.0009$

RC1	STA	INV. EL	d	V
150	550+50	1310.43	8.70*	
200	550	1310.47		
300	549	1310.56		
400	548	1310.65		
500	547	1310.74		
600	546	1310.83		
700	545	1310.92		
800	544	1311.01		
860	543+40	1311.06	8.67	
RC2	USE	$\Delta h = 0.20$ FT		
140	542+60	1311.14	8.87	
200	542	1311.19		
400	540	1311.37		
900	535	1311.82		
1400	530	1312.27		
2400	520	1313.17		
~~4400~~	500	1314.97		
~~584.40~~ 584.40	494+15.60	1315.50	8.65	11.16

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

Retardation pressure of friction = 8,356.6 lbs.

Momentum of moving mass of water in upstream channel = 1[illegible].3 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 17,252.7 lbs.

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 150.00 ft. Manning's 'n' = 0.035

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	3,360 cfs.	6,500 cfs.	3,140 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	2.46 ft.	3.78 ft.	3.47 ft.
DEPTH =	8.95 ft.	8.65 ft.	8.95 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 419,494.0 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = 0.0 lbs.

Retardation pressure of friction = 6,268.6 lbs.

Momentum of moving mass of water in upstream channel = 13,824.4 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 17,306.0 lbs.

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 200.00 ft. Manning's 'n' = 0.027

FLOW =	3,360 cfs.	6,500 cfs.	3,140 cfs.
BOTTOM WI	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	2.46 ft.	3.78 ft.	3.47 ft.
DEPTH =	8.94 ft.	8.65 ft.	8.94 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 418,142.1 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = 0.0 lbs.

Retardation pressure of friction = 4,974.6 lbs.

Momentum of moving mass of water in upstream channel = 13,848.9 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 17,339.2 lbs.

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

SUBCRITCAL

#L 5

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 150.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	4,100 cfs.	6,500 cfs.	2,400 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	2.80 ft.	3.78 ft.	2.92 ft.
DEPTH =	8.93 ft.	8.65 ft.	8.93 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 417,660.2 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Axial com ent of pressure on walls = -0.0 lbs.

Retardat ressure of friction = 4,083.3 lbs.

Momentum of moving mass of water in upstream channel = 20,633.7 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 10,136.5 lbs.

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 150.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	5,900 cfs.	6,500 cfs.	2,400 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	3.55 ft.	3.78 ft.	2.92 ft.
DEPTH =	8.70 ft.	8.65 ft.	8.70 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 395,197.0 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = 0.0 lbs.

Retardation pressure of friction = 5,361.2 lbs.

Momentum of moving mass of water in upstream channel = 44,038.0 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 10,474.4 lbs.

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

SUBCRITCAL

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

#4

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 150.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	3,360 cfs.	6,500 cfs.	3,140 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	2.46 ft.	3.78 ft.	3.47 ft.
DEPTH =	8.92 ft.	8.65 ft.	8.92 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 416,834.5 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = 0.0 lbs.

Retardation pressure of friction = 3,731.4 lbs.

Momentum of moving mass of water in upstream channel = 13,872.6 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 17,371.4 lbs.

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 150.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	5,900 cfs.	6,500 cfs.	600 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	3.55 ft.	3.78 ft.	1.19 ft.
DEPTH =	8.81 ft.	8.65 ft.	8.81 ft.

#6

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 405,582.3 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = -0.0 lbs.

Retardation pressure of friction = 5,298.5 lbs.

Momentum of moving mass of water in upstream channel = 43,418.8 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 644.7 lbs.

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 200.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	5,900 cfs.	6,500 cfs.	600 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	3.55 ft.	3.78 ft.	1.19 ft.
DEPTH =	8.83 ft.	8.65 ft.	8.83 ft.

#3

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 407,444.7 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = 0.0 lbs.

Retardation pressure of friction = 7,050.4 lbs.

Momentum of moving mass of water in upstream channel = 43,310.2 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 642.9 lbs.

JUNCTION ANALYSIS

COMPUTED BY: DATE: CHECKED BY:_____ DATE:_____

#2

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 200.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	4,100 cfs.	6,500 cfs.	2,400 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	2.80 ft.	3.78 ft.	2.92 ft.
DEPTH =	8.94 ft.	8.65 ft.	8.94 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel = 419,086.0 lbs.

Hydrostatic pressure on downstream channel = 390,555.5 lbs.

Horizontal component of pressure on invert = 0.0 lbs.

Axial component of pressure on walls = -0.0 lbs.

Retardation pressure of friction = 5,441.8 lbs.

Momentum of moving mass of water in upstream channel = 20,595.3 lbs.

Momentum of moving mass of water in downstream channel = 53,796.0 lbs.

Axial component of moving mass of water in side channel = 10,116.0 lbs.

ARIZONA RWCD REACH 4	DT 4/85	HYDRAULICS SUMMARY

• WATER SURFACE PROFILE •

UPSTREAM OF JCT AT STA 489+30:

$Q = 5900$ cfs, $b = 150$, $Z = 3$, $n = 0.027$

	STA	INVERT	d (FT)	V (FT/S)
70	489+30	1317.47	8.83	3.79
100	489+00	1317.48	(	(
200	488+00	1317.51		
300	487+00	1317.54		
400	486+00	1317.57		
511.92	485+88.08	1317.57	8.88	3.76

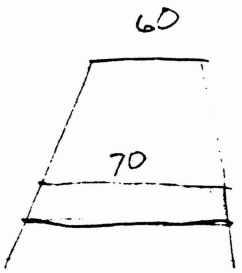
* from JCT. ANAL. WITH $Q_{DS} = 5900$
$d_{DS} = 8.83$

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	
485+88.03	5900.00	150.00	3.00	3.548	8.883	1569.2	3.76	1326.67	1317.57	1326.45	10.70	0.24
	n=0.0270		So=-.002519		Sf=0.000325							
485+00	5900.00	150.00	2.00	3.577	8.821	1478.9	3.99	1326.67	1317.60	1326.42	10.64	0.25
	n=0.0270		So=0.000298		Sf=0.000339							
484+00	5900.00	150.00	2.00	3.577	8.819	1478.5	3.99	1326.65	1317.59	1326.40	10.63	0.25
	n=0.0270		So=0.000303		Sf=0.000340							
483+00	5900.00	150.00	2.00	3.577	8.817	1478.1	3.99	1326.63	1317.57	1326.39	10.63	0.25
	n=0.0270		So=0.000298		Sf=0.000340							
482+00	5900.00	150.00	2.00	3.577	8.815	1477.7	3.99	1326.62	1317.56	1326.37	10.63	0.25
	n=0.0270		So=0.000303		Sf=0.000340							
481+00	5900.00	150.00	2.00	3.577	8.813	1477.3	3.99	1326.60	1317.54	1326.35	10.63	0.25
	n=0.0270		So=0.000298		Sf=0.000340							
480+00	5900.00	150.00	2.00	3.577	8.811	1476.9	3.99	1326.58	1317.53	1326.34	10.62	0.25
	n=0.0270		So=0.000303		Sf=0.000341							
479+00	5900.00	150.00	2.00	3.577	8.809	1476.5	4.00	1326.57	1317.51	1326.32	10.62	0.25
	n=0.0270		So=0.000298		Sf=0.000341							
478+00	5900.00	150.00	2.00	3.577	8.806	1476.1	4.00	1326.55	1317.50	1326.30	10.62	0.25
	n=0.0270		So=0.000300		Sf=0.000341							
477+00	5900.00	150.00	2.00	3.577	8.804	1475.7	4.00	1326.53	1317.48	1326.28	10.61	0.25
	n=0.0270		So=0.000298		Sf=0.000341							

Headloss Factor=0.000 Total Headloss=0.010 ft. Se=0.000340 1.03
Headloss Factor=0.000 Total Headloss=0.017 ft. Se=0.000340 1.03
Headloss Factor=0.000 Total Headloss=0.017 ft. Se=0.000339 1.03
Headloss Factor=0.000 Total Headloss=0.017 ft. Se=0.000338 1.02
Headloss Factor=0.000 Total Headloss=0.017 ft. Se=0.000339 1.02
Headloss Factor=0.000 Total Headloss=0.017 ft. Se=0.000339 1.02
Headloss Factor=0.000 Total Headloss=0.004 ft. Se=0.000326 0.98

PAGE 2

FROUDE NUMBER | SEQUENT DEPTH



JT 2/19/85
RWCO R4
POWERLINE JCT

CH. by Alignment
set attached

ANALYSES: 1. TRANSITION: NORMAL Q = 3140
6500
1625

* FOR ALTERNATE CONFIG. IF NECESSARY

2. JUNCTION:

CASE	$Q_{RWCO\,DS}$	$Q_{(M)}$	ΣQ
(1)	3360	3140	6500
(2)	5900	600	6500
(3)	4100	2400	6500
(4)			

3. JCT:

BACKWATER:

(1) Q = 3140 TO DS OF DROP

b = L = 70 = 80 z = 2 n = 0.027

SPILLWAY

(2)

L	b	z	S	AVG EL
TOP	45	2	0.11667	24.7
60	60	3		17.7
40	70	3	0.0000	
22.5	80	3	0.0003	

R4 POW

JUNCTION ANALYSIS

RWCD RCH4

COMPUTED BY: ALDERMAN DATE: 2/27/85 CHECKED BY:_____ DATE:_____

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 150.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	3,360 cfs.	6,500 cfs.	3,140 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	2.46 ft.	3.78 ft.	3.47 ft.
DEPTH =	8.54 ft.	8.23 ft.	8.54 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel	=	379,962.6 lbs.
Hydrostatic pressure on downstream channel	=	351,774.3 lbs.
Horizontal component of pressure on invert	=	0.0 lbs.
Axial component of pressure on walls	=	-0.0 lbs.
Retardation pressure of friction	=	4,186.1 lbs.
Momentum of moving mass of water in upstream channel	=	14,592.0 lbs.
Momentum of moving mass of water in downstream channel	=	56,949.2 lbs.
Axial component of moving mass of water in side channel	=	18,351.2 lbs.

JUNCTION ANALYSIS

RWCD RCH4

COMPUTED BY: ALDERMAN DATE: 2/27/85 CHECKED BY:_____ DATE:_____

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 150.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	4,100 cfs.	6,500 cfs.	2,400 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	2.80 ft.	3.78 ft.	2.92 ft.
DEPTH =	8.55 ft.	8.23 ft.	8.55 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel	=	380,890.4 lbs.
Hydrostatic pressure on downstream channel	=	351,774.3 lbs.
Horizontal component of pressure on invert	=	0.0 lbs.
Axial component of pressure on walls	=	0.0 lbs.
Retardation pressure of friction	=	4,574.3 lbs.
Momentum of moving mass of water in upstream channel	=	21,698.3 lbs.
Momentum of moving mass of water in downstream channel	=	56,949.2 lbs.
Axial component of moving mass of water in side channel	=	10,705.4 lbs.

JUNCTION ANALYSIS

RWCD RCH4

COMPUTED BY: ALDERMAN DATE: 2/27/85 CHECKED BY:_____ DATE:_____

SUBCRITCAL

JUNCTION ANGLE = 30.00 deg. JUNCTION LENGTH = 150.00 ft. Manning's 'n' = 0.027

	UPSTREAM CHANNEL	DOWNSTREAM CHANNEL	SIDE CHANNEL
FLOW =	5,900 cfs.	6,500 cfs.	600 cfs.
BOTTOM WIDTH =	150.00 ft.	150.00 ft.	80.00 ft.
SIDE SLOPE =	3.00	3.00	3.00
INVERT ELEV. =	100.00 ft.	100.00 ft.	100.00 ft.
CRITICAL DEPTH =	3.55 ft.	3.78 ft.	1.19 ft.
DEPTH =	8.41 ft.	8.23 ft.	8.41 ft.

JUNCTION ANALYSIS - PRESSURE AND MOMENTUM VALUES

Hydrostatic pressure on upstream channel	=	368,193.2 lbs.
Hydrostatic pressure on downstream channel	=	351,774.3 lbs.
Horizontal component of pressure on invert	=	0.0 lbs.
Axial component of pressure on walls	=	0.0 lbs.
Retardation pressure of friction	=	5,926.4 lbs.
Momentum of moving mass of water in upstream channel	=	45,770.3 lbs.
Momentum of moving mass of water in downstream channel	=	56,949.2 lbs.
Axial component of moving mass of water in side channel	=	682.6 lbs.

ARIZONA
RWCD REACH 4 | DT 2/26/85 ~~JMA~~ 3/85 | JCT

- VELOCITY U.S. OF JCT w/ POWERLINE

FROM MOMENTUM ANALYSIS DEPTH UPSTREAM OF JCT ≈ 8.4 ft

w/ $Q_{DS} = 5900$ cfs

$$A = 3(8.4)^2 + 150(8.4) = 1472$$

$$V = Q/A = 5900/1472 = 4.01 \text{ ft/s}$$

42 381 30 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

DT 3/85

- Construction of Reach 5 is expected to follow Reach 4 by 1 yr.
- A temporary inlet is required at the upstream end of Reach 4.
- check approx depth of flow for $Q_{10} = \frac{3000}{4}$

$Q_{10} = 1500$ c/s

- Try a ramp inlet as follows:

$b = 40$
$z = 2$
$S = 0.03$

- INITIAL DEPTH:

TRAP WEIR EQN.

$Q = CLH^{3/2} + Cz H^{3/2}$

USE FOR $C = 3.1$
$Q = 1500$

$H = 4.6$ FT

USE ROCK DEPTH = 5 FT ✓

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL

Work checked by Gary Conway — See comments by Gary dated 3/13/85 JMT

ANALYSIS:

1. THE REQUIRED UNCOMPRESSIVE STRENGTH'S ARE:

STA 565+00 TO STA 626+00: 190 PSF

STA 626+00 TO STA 744+00: 240 psf

2. OF 29 UNCONFINED COMPRESSIVE STRENGTH TESTS RUN ON UNDISTURBED SAMPLES TAKEN FOR REACH 4:

- ONLY 1 HAD q_u < 190 psf:

LAB# 84W2409 q_u = 160 psf STRATIG. UNIT (27)

- TWO ADDITIONAL SAMPLES HAD q_u < 240 psf:

LAB# 84W2422 q_u = 200 psf STRAT. UNIT (26)

LAB# 84W2412 q_u = 220 psf STRAT UNIT (27)

3. THE MEAN q_u FOR 5 SAMPLES OF SUN (27) WITH q_u < 1000

= q_{mean} = 364 psf

4. MEAN VALUES OF q_u BY SUN:

SUN	q_u MEAN	q_u MIN	q_u MAX
23	1300	–	–
26	240	200	280
27	3127	160	13600
28	250	260	240
29	972	360	1584
31	12110	660	23560
32	1475	340	2860
33	2006	860	4180

5. CONCLUSIONS:

1. BASED ON THE ABOVE, ALL IN PLACE SOILS HAVING SOME COHESION OR CEMENTATION DO NOT NEED REPLACEMENT. * EXCEPT AS BELOW

2. SOILS WITHOUT EITHER COHESION OR CEMENTATION WILL REQUIRE REPLACEMENT. * ALSO AS BELOW

3. THE EXTENT OF EARTH LINING REQUIRED CANNOT BE PRECISELY DELINEATED AND WILL REQUIRE SOME FIELD ADJUSTMENT.

4. THE EXTENT OF LINING REQUIRED CANNOT BE DETERMINED ON THE BASIS OF STRATIGRAPHIC UNITS. ~~EACH FIELD LOG WILL BE EXAMINED.~~ SOILS REQUIRING REPLACEMENT ARE GENERALLY CHARACTERIZED AS "LOOSE SANDS AND GRAVELS" ON THE LOGS.

5. ALL SOILS FOR WHICH UNCONFINED SHEAR TESTS WERE MADE HAD SUFFICIENT STRENGTH, WHEN RECOMPACTED, TO BE NON-ERODIBLE ACCORDING TO TRACTIVE POWER PROCEDURES.

ALSO, ALL MATERIALS BETWEEN STA 673+00 AND 744+00 WILL REQUIRE REPLACEMENT. THESE ARE GENERALLY LOW DENSITY ($\gamma_{d\,in\,place} / \gamma_{d\,max} \leq 85\%$) ML, CL, & SM SOILS.

DT 3/14/85

ARIZONA
D.T.
TRACTIVE FORCE
RUCO R4

for normal depth $n = 0.027$
$z = 3$

$K = V/(\tau/\rho)^{1/2}$
$\tau = (V/K)^2 \rho$
$\rho = 1.94$ lb-sec^2/ft^4
$\gamma = 1.4 \times 10^{-5}$ ft/sec

Q	Se	b	d	V	k_s d_{65} ft	$V^3/g\gamma Se$	$V/(gk_sS_e)^{1/2}$	$V/\sqrt{\tau/\rho}$	τ psf	TRAC FORCE $\tau_0 V$	τ_0 lbs/sq ft
					(0.10 mm)						
6900	0.0009	200	6.091	5.190	0.000328	3.45×10^8	1680	27.3	0.0701	0.3639	0.34
	0.0008	200	6.305	4.999	"	3.47	1720	27.3	0.0650	0.3252	0.31
	0.0007	200	6.558	4.790	"	3.49	1760	27.3	0.0597	0.2861	0.29
	0.0006	200	6.862	4.559	"	3.51	1810	27.3	0.0541	0.2467	0.26
	0.0005	200	7.239	4.299	"	3.53	1870	27.3	0.0481	0.2068	0.23
	0.0004	200	7.727	4.001	"	3.56	1950	27.4	0.0414	0.1655	0.19
					(1.0 mm)						
	0.0009	200	6.091	5.190	0.00328	3.45×10^8	533	22.3	0.1051	0.5454	
	0.0008	"	6.305	4.999	"	$3.47\times$	544	22.4	0.0966	0.4830	
	0.0007	"	6.558	4.790	"	$3.49\times$	557	22.5	0.0879	0.4212	
	0.0006	"	6.862	4.559	"	$3.51\times$	573	22.5	0.0796	0.3631	
	0.0005	"	7.239	4.299	"	$3.53\times$	592	22.8	0.0690	0.2965	
	0.0004	"	7.727	4.001	"	3.56×10^8	616	23.0	0.0587	0.2349	
					(0.10 mm)						
	0.0009	150	7.16	5.62	0.000328	4.38×10^8	1820	27.8	0.0793	0.4456	0.40
	0.0008	"	7.41	5.41	"	4.40×10^8	1860	27.8	0.0735	0.3975	0.37
	0.0007	"	7.70	5.18	"	4.41×10^8	1910	27.8	0.0674	0.3489	0.34
	0.0006	"	8.05	4.92	"	4.41×10^8	1960	27.8	0.0608	0.2990	0.30
	0.0005	"	8.48	4.64	"	4.44×10^8	2020	27.9	0.0537	0.2490	0.26
	0.0004	"	9.05	4.31	"	4.45×10^8	2100	27.9	0.0463	0.1995	0.23
					(1.0 mm)						
	0.0009	150	7.16	5.62	0.00328	4.38×10^8	577	22.5	0.1210	0.6802	
	0.0008	"	7.41	5.41	"	4.40×10^8	589	22.7	0.1102	0.5961	
	0.0007	"	7.70	5.18	"	4.41×10^8	603	22.9	0.0993	0.5142	
	0.0006	"	8.05	4.92	"	4.41×10^8	618	23.0	0.0885	0.4368	
	0.0004	"	9.05	4.31	"	4.45×10^8	664	23.1	0.0675	0.2911	

ARIZONA
O. Thackeray 11/15/64 RWCD FLOODWAY REACH 11

$n = 0.027$
$z = 3$

$d_{65} = 0.25\ mm$
$= 8.20 \times 10^{-4}\ ft$

$T = 50°F$
$\rho = 1.94$
$\nu = 1.4 \times 10^{-5}$

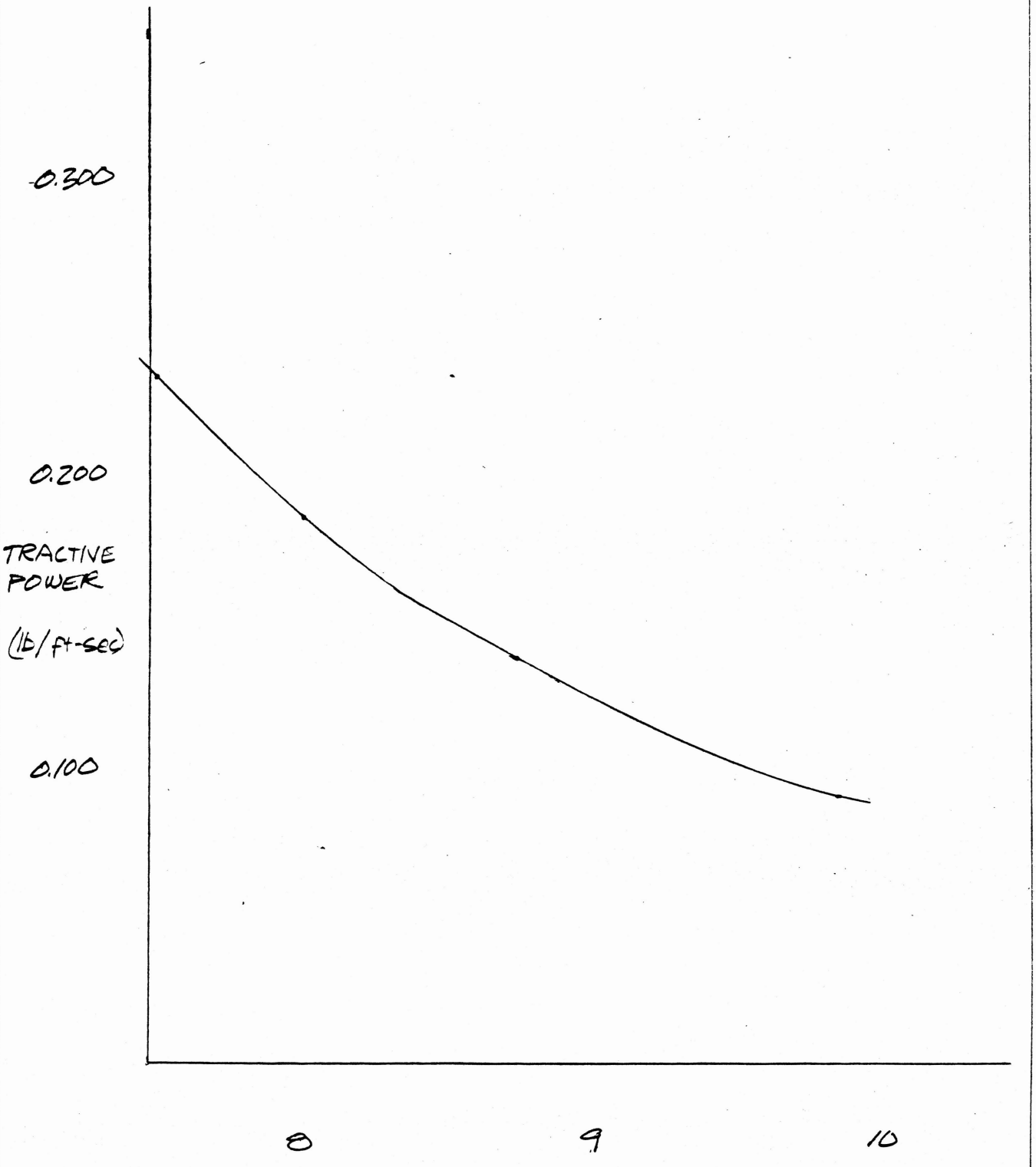
Q	Se	b	d	V	k_s	$V^3/(gR_hS_e)^{1/2}$	$V/(gR_hS_e)^{1/2}$	$V/C\sqrt{\rho}$	τ	$\tau * V$	Y/dSe
6900	0.00094	150	7.07	5.70	8.2×10^{-4}	4.38×10^8	1140	26.15	0.0972	0.525	0.415
"	0.0009	"	7.16	5.62	"	4.38	1150	26.2	0.0893	0.5017	0.402
"	8	"	7.41	5.41	"	4.40	1180	26.3	0.0821	0.4441	0.370
"	7	"	7.70	5.18	"	4.41	1210	26.4	0.0747	0.3869	0.336
"	6	"	8.05	4.92	"	4.41	1240	26.5	0.0669	0.3290	0.301
"	5	"	8.48	4.64	"	4.44	1280	26.6	0.0590	0.2739	0.265
"	4	"	9.05	4.31	"	4.45	1330	26.8	0.0502	0.2163	0.226
"	3	"	9.83	3.91	"	4.43	1390	26.95	0.0408	0.1597	0.184

ARIZONA DOT 12/3/84 RWCD R4

$n = 0.027$ $\rho = 1.94$ lb-sec^2/ft^4 $t = 50°F$
$z = 3$ $\nu = 1.4 \times 10^{-5}$ ft/s $\rho = 1.94$
$d_{65} = 0.25$ mm $\nu = 1.4 \times 10^{-5}$
$= 8.20 \times 10^{-4}$ ft

Q	Se	D	d	V	k_s	$V^3/g\nu Se$	$V/(gk_sSe)^{1/2}$	$V/\sqrt{\tau/\rho}$	τ (psf)	TRAC POW $\tau \times V$
	0.0006	↑	7.40	4.73	"	3.92×10^8	1190	26.3	0.063	0.297
6900	0.0005	175	7.80	4.46	8.2×10^{-4}	3.94×10^8	1230	26.4	0.055	0.247
	0.0004		8.32	4.15	"	3.97×10^8	1280	26.6	0.047	0.196
	0.0003		9.05	3.77	"	3.97×10^8	1340	26.8	0.038	0.145
	0.0002		10.17	3.30	"	3.99×10^8	1440	26.5	0.030	0.099
	0.00015		11.05	3.00	"	4.00×10^8	1510	26.7	0.024	0.073
	0.00010	↓	12.41	2.62	"	3.99×10^8	1610	27.4	0.018	0.046
6500	0.0005	175	7.53	4.37	8.2×10^{-4}	3.71×10^8	1200	26.4	0.053	0.232
	0.0004		8.04	4.06	"	3.72×10^8	1250	26.5	0.046	0.185
	0.0003		8.74	3.70	"	3.75×10^8	1320	26.7	0.037	0.138
	0.0002		9.83	3.23	"	3.74×10^8	1410	26.9	0.028	0.090
	0.00015		10.68	2.94	"	3.76×10^8	1480	27.0	0.023	0.068
	0.00010	↓	11.99	2.57	"	3.77×10^8	1580	27.2	0.017	0.045
	0.0006	↓	7.14	4.63	"	3.68×10^8	1160	26.2	0.061	0.281

ARIZONA RWCO R4	DT 2/28/85	CHANNEL STABILITY



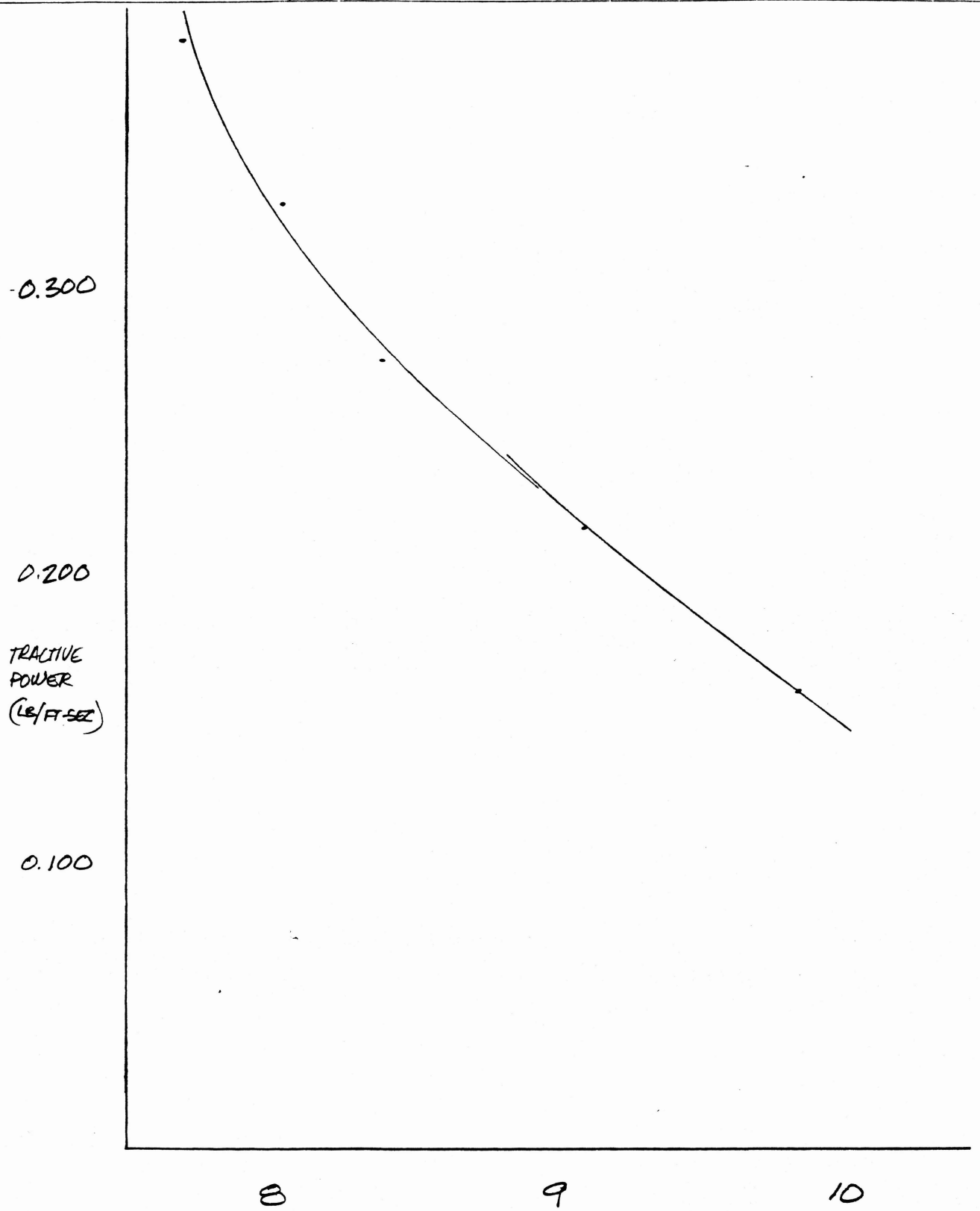
$Q = 6500$
$b = 175$
$z = 3$
$n = 0.027$

$d_{65} = 0.25$ mm
$T = 50°F$
$\rho = 1.94$
$\nu = 1.4 \times 10^{-5}$

ARIZONA
RNCD R4

DT 3/7/85

CHANNEL STABILITY

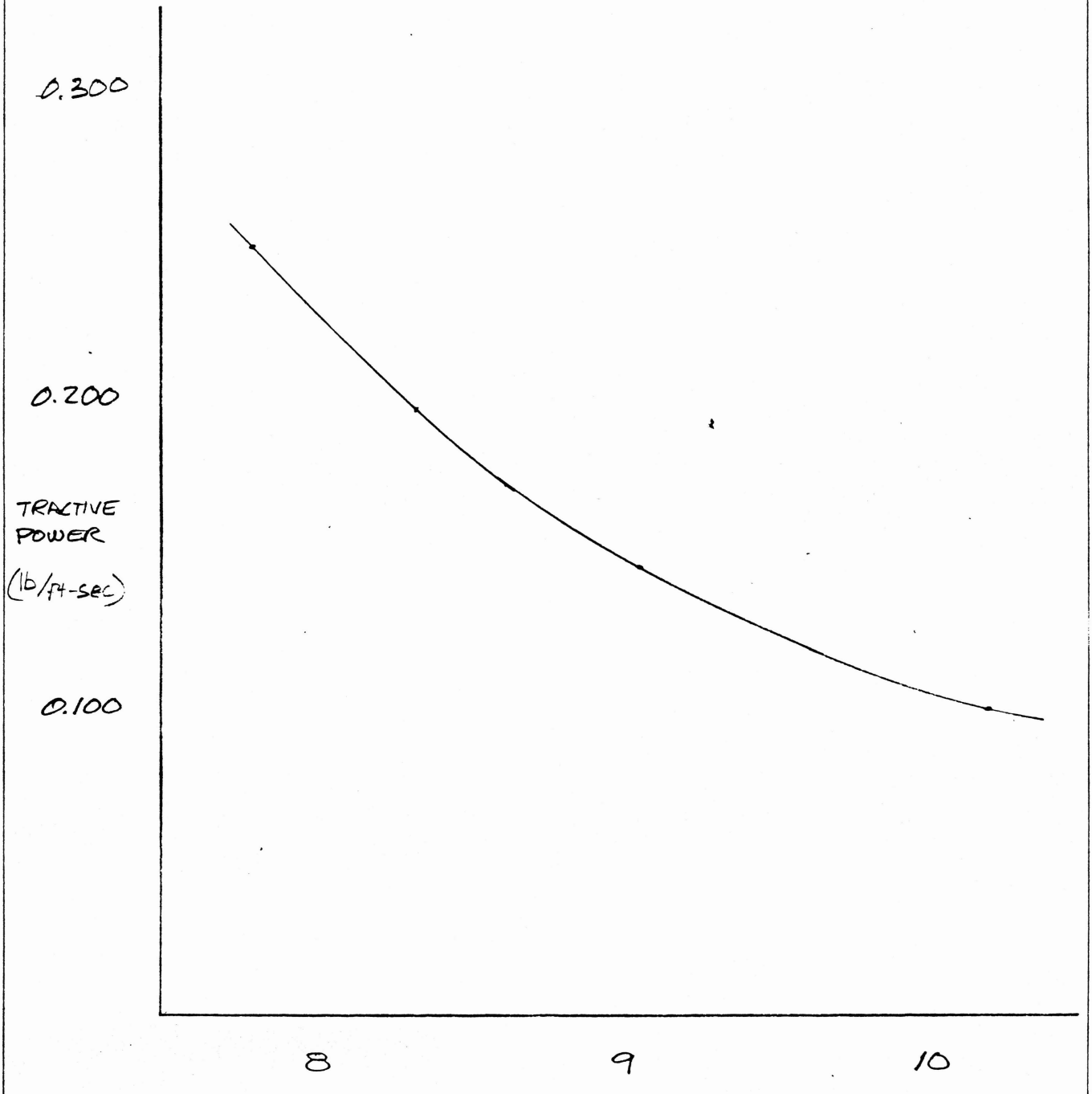


$Q = 6900$
$b = 150$
$z = 3$
$n = 0.027$

$d = 0.25\ mm$
$T = 50°F$
$\rho = 1.94$
$\nu = 1.4 \times 10^{-5}$

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

ARIZONA RWCD R4	DT 3/7/85	CHANNEL STABILITY



$Q = 6900$
$D = 175$
$Z = 3$
$n = 0.027$

$d_{65} = 0.25\,mm$
$T = 50°F$
$\rho = 1.94$
$\nu = 1.4 \times 10^{-5}$

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

	STATION	Q	b	d	TRACT STRESS	TRACTIVE POWER	TRRS F166-B P 6-32 q_{uncorr} (PSF)	Values calc. as a check
	744+00	6900	200	8.45		—		
	742+00		150	8.32		0.29	240	240
	730+00			8.25		0.295	240	245
	720+00			8.20		0.30	242	240
	718+10			8.21		0.30	242	245
HIGGINBD	715+00			8.46		0.275	235	230
	676+22			8.48		0.275	235	225
	675+00			8.42		0.278	235	230
	627+00			8.47		0.275	235	240
	626+00		175	8.81		0.159	190	190
	598+60							180
	596+00	6500		8.87		0.132	175	170
	555+00			8.99		0.125	170	165

As a check, values for V, d, Se were taken From the final HEC-2 runs for Reach 4. Using 50° water and an average K_s value for the test data, I calculated required shear strength values for each of the stations above.

For the comparison - The values check out.

Problem Areas - Shear Strength Requires greater than lab values:

Sample No.	Station	Depth	Lab C	Required C	Classif-lab	
2415.1	669+00 R15'	5-6	180	240	CL-ML	OK DT
2415.2	"	12-13	220	240	CL	OK
2416.1	678+00 R50'	9-10	80	230	ML	
2417.1	690+00	3-4	120	225	CL-ML	
2417.3	"	11-12	110	225	CL	
2419.1	715+00	5-6	140	225	CL	
2419.2	"	10-11	130	225	SC-SM	
2420.2	723+00 R25'	6-7	120	240	SM	
2424.1	743+00 R50'	8-9	100	240	SM	

G. Conway 3-13-85

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL

MAXIMUM TRACTIVE STRESS

- DETERMINE MAX. TRACTIVE STRESS PER FIGS. 6-12 AND 6-13 TR 25.

$b = 150 : \min b/d = 150/8.48 = 17.7$

- PROJECTION OF MAX. VALUES FROM LIMIT OF CHART AT $b/d = 8$ WOULD INDICATE MAX. TRACT. STRESSES TO BE LESS THAN 5% GREATER THAN BASELINE VALUES ALREADY COMPUTED.

→ - USE THE BASELINE VALUES ALREADY COMPUTED (IE NEGLECT INCREASE)

CURVED REACHES

- USE FIGS 6-5, TR-25

	PC STA	R	b	R/b	τ_c/τ_s	TREATMENT	
*	555+98.34	730.36	175	4.2	1.7	RIP-RAP	AS OF STA.
	584+71.00	1077.56	175	6.2	1.4	* NOTE	
	636+64.70	1555.02	150	10.4	1.0	NONE	
*	681+44.42	505.00	150	3.4	1.8	RIP-RAP	
	699+30.01	1472.58	150	9.8	~~1.06~~ → 1.0	NONE	
	721+58.44	1447.49	150	9.6	~~1.07~~ → 1.0	NONE	

FOR CURVE AT PC 584+71.8

TRAC P = $0.132 \times 1.4 = 0.1848$ lb/ft-sec

- q_o REQ = 200 lb/ft^2 (TR25 FIG 6-15)

* i.e. NO ADDITIONAL PROTECTION

PROBLEM: NEED TO CHECK "AS BUILT" CONDITION

ANALYSIS: 1. PER "ORSN CHANNEL" SPECIFICATION IN NHCP CHECK FOR:

$Q = Q_{100}/2$ (since $Q_{10} \approx Q_{100}/4 < Q_{100}/2$)

2. USE $n = 0.024$

3. AT STA 744+00 USE:

d = normal depth

$Q = 6900/2 = 3450$
$b = 200$
$z = 3$
$n = 0.024$
$S = 0.0003$

FIND $d = 5.22$ ft
$A = 1125$
$V = 3.06$ ft/s

4. AT LOW DROP:

$z = 2.5$ $C = 3.1$
$b = 70$

$Q = CLH^{3/2} + CzH^{5/2}$

- FIND $D = 5.6$ ft for $Q = 3450$ c/s
- NORMAL:
  $n = 0.024$
  $b = 150$
  $z = 3$

$D = 5.29$
$A = 878$
$V = 3.93$

So CHECK TRACTIVE POWER FOR THE ABOVE NORMAL DEPTH. IF IT IS LESS THAN THAT FOR FULL DESIGN FLOW, CONCLUDE THAT THE "AS BUILT" DOES NOT CONTROL.

USE $\rho = 1.94$ lb-sec/ft⁴

$\nu = 1.4 \times 10^{-5}$

$d_{65} = k_s = 0.25\,mm = 0.25\,mm \times \frac{1\,in}{25.4\,mm} \times \frac{1\,ft}{12\,in}$

$d_{65} = 0.00082\,ft$

- $V = 3.93$
- $S_e = 0.0005$
- $V^3/gVS_e = 2.70 \times 10^8$
- $V/(gk_sS_e)^{1/2} = 3.93/(32.16 \times (0.00082) \times 0.0005)^{1/2} = 1082$

TR25 FIG 6-10 p 6-23

- FIND $V/\sqrt{\tau/\rho} = 25.8 = C_1$
- $\tau = (V/C_1)^2 \rho = (3.93/25.8)^2\, 1.94 = 0.0120$

$\tau_{Q100} = 0.0502 >> 0.0120$

→ THEREFORE "AS BUILT" DOES NOT CONTROL

ARIZONA
RWCD REACH 4 | DT 3/8/85 | CHANNEL STABILITY

DETERMINE EXTENT OF LINING REQUIRED

CHECK SOILS LOGS

Rev'd DT 3/14/85 ynk 4/4/85

FLO #	STATION		LINING NO	BOT. ONLY	SIDE ONLY	BOT. & SIDE	COMMENT
2425	744+25	RT 50	✓			✓	
2424	743+00	RT 50	✓			✓	SW SI pl
2427	737+00	RT 75		✓		✓	Sand, NP, CSE
2423	732+00	RT 100				✓	
2422	"	RT 30					
2428	728+00	RT 0				✓	
2429	"	RT 100				✓	
2421	723+00	℄				✓	- "Non cohesive: non supportive"
2420	"	RT 25					- shows silt strng on IAU
2430	718+00	℄	✓			✓	
2419	715+00	℄		✓		✓	- May need sides also
2431	709+00	℄		✓		✓	- "
2432	"	RT 100		✓		✓	- "
2418	702+00	℄		✓		✓	
2433	696+00	℄		✓		✓	2434 looks ok; Part of line possible
2434	696+00	RT 100					
2417	690+00	℄	✓			✓	OR
2435	684+00	℄	✓			✓	"
2416	678+00	RT 50	✓			✓	"
2436	672+00	℄	✓				
2415	669+00	RT 75	✓				
2414	658+00	RT 50			✓		- SM on side; loose
2439	651+00	LT 100	✓				- loose on bottom & side
2437	"	℄		✓			
2438	"	RT 100				✓	
2413	643+50	℄	✓				
2440	638+00	LT 100	✓				
2441	638+00	RT 100	✓				- might need LNG on side
2412	633+00	℄	✓				
2442	633+00	RT 100	✓				
2443	628+00	LT 100	✓				- one lens SM on bank
2445	620+00	LT 100	✓				> one - 1' sand lens
2444	620+00	RT 50	✓				
2411	607+00	℄	✓				- some sand offset bk

ARIZONA
RWCD REACH 4 | DT 3/8/85 | CHANNEL STABILITY

FIELD #	STATION		NO	BOTTOM ONLY	SIDE ONLY	BOTTOM & SIDE	COMMENTS
2446	600+00	LT 100	✓				
2447	596+00	LT 100	✓				- SM UPPER BANK
2410	"	RT 50	✓				
2448	"	RT 100	✓				
2450	584+00	LT 100		✓			- 1ft SND LENS SL. CEM & INV.
2409	584+00	℄		✓			- SND BSL. INV.
2449	584+00	RT 100		✓			- 1ft. SAND LENS B. INV.
2452	574+45	LT 100	✓				
2408	"	℄	✓				
2451		100' RT	✓				- LOGGED SM/NL LAB @ 930'
2407	562+50	℄	✓				CL
2453	560+00	LT 100	✓				CL
2406	557+75	℄		✓			- 1½' LENS OF SM ON INV.

(ALSO CHECKED 1973 LOGS TO VERIFY EXTENT)

CHECK AREAS NEEDING LINING U.S. FROM GA 626+
BY TRACTIVE STRESS PROCEDURES:

- 555+00 to 559+00 & 580+00 to 588+00
  - BOTTOM LINING IS NEEDED DUE TO SM ON INVERT.
  - FOR ALL SAMPLES:

    MAX D_{65} = 3.0 mm FLO# 2409.3 ST# 584+00
    MIN D_{65} = 0.1 mm

  - USE d = 8.87, $\begin{cases} Q = 6500 \\ b = 175 \\ z = 3 \\ n = 0.027 \end{cases}$

    find S_e = 0.000285
    A = 1788 ft²
    V = 3.63 ft/s

    TRACTIVE STRESS

    - k_s = 3.0 mm /25.4/12 = 0.00984 ft
    - $V^3/g\nu_e$ = $3.63^3/32.16(1.4\times10^{-5})(0.000285)$
      = 3.73×10^8
    - $V/(gk_sS_e)^{1/2}$ = $3.63/(32.16\times0.00984\times0.000285)^{1/2}$
      = 38.2

TR 25

- FIND $V/\sqrt{\tau/\rho}$ = 20.8

  $\tau = \left(\frac{3.63}{20.8}\right)^2 \times 1.94 = 0.059$ lb/ft²

- COMPARE WITH FIG 6-14 (where d_{50} = 0.84 mm)

TR25 FIG 6-14 P 6-26:

FOR LOW CONTENT FINE SEDIMENT: (<2000ppm)

$D_{50} = 0.84$ mm $\tau_{all} = 0.059$ lb/ft^2

CLEAR WATER (< 1000ppm):

$\tau_{all} = 0.037$ lb/ft^2

CONCLUSION:

USE THE COMPACTED EARTH LINING IN THE AREAS DISCUSSED (

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL

- REVIEW OF THE PREVIOUS COMPS. AND TR 25 TRACTIVE POWER APPROACH SHOW THAT THE SOIL STRENGTH VALUE LABELED "UNCONFINED COMPRESSIVE STRENGTH" ON FIG 6-15, P 6-32.
- SHOULD APPROPRIATELY BE LABELED UNCONFINED SHEAR STRENGTH (S_u)
- THE STRENGTH VALUES (q_u) SHOULD BE HALVED FOR USE ON THIS CHART.

→ SOME SOILS THOUGHT TO HAVE ADEQUATE STRENGTH WHERE q_u IS USED DO NOT IF S_u IS USED.

→ REVISE THE EXTENT OF LINING REQUIRED. —

REVISED COMPACTED EARTH LINING SUMMARY

STATIONS FROM	TO	NO	BOTTOM ONLY	SIDE ONLY	BOTTOM & SIDE
655+00	559+00		400		
559+00	580+00	2100			
580+00	588+00		800		
588+00	655+00	6700			
655+00	662+00			700	
662+00	673+00	1100			
674+00	744+00				7000
	TOTAL	9900	1200	700	7000
		53%	6%	4%	37%

Soil logs plotted on the plan and profile sheets do not agree with the surveyed ground line indicated on dwgs. Dale Meadows (Geologic Investigation) said test pit and drill hole elevations were surveyed by SCS State staff. Gary Mason (SCS tech) was helping with survey.

In telecon with Gary today, I found that bench marks placed by County flood control district at bridges were used as datum for determining test hole elevations as follows:

General location	Reference Datum
Between Rittenhouse & Power	Rittenhouse Bridge
" Higley & Rittenhouse	Higley Bridge
" Power Rd to N. end	Williams Rd Bridge

The channel survey by A.E. uses a different datum with bridge elev. by Highway Dept. being approx. 3 feet lower than the AE RWCD Survey Elev.

→ Therefore the log elevations have been adjusted up to fit the ground elevation determined by horizontal location and the channel survey. This generally is a 3.0 foot change in elev. Notes on drawing will indicate elev. as approximate.

ARIZONA
DT 11/6/84 RWCD FLOCONAY REACH 4
LMS 3/85

	FIELD	LAB	C	2C	REM/UND	DAYS
	2401.1	84W 2380	330	660	UND	0
	2402.1	84W 2382	510	1020	UND	0
	03.1	84W 2384	650	1300	UND	0
	04.1	84W 2385	670	1340	UND	0
	04.1	84W 2385	980	1960	REM	14
	04.1	84W 2385	1340	2680	REM	28
	04.2	84W 2386	2090	4180	UND	0
	05.1	84W 2387	430	860	UND	0
	06.1	84W 2389	1220	2440	REM	14
	06.1	84W 2389	1340	2680	UND	0
	09.2	84W 2395	11780	23560	UND	0
	11.2	84W 2400	4190+	8380	UND	0
	11.2	84W 2400	760	1520	REM	0
	12.2	2402	610	1220	UND	0
*	12.2	2402	330	660	REM	0
	13.2	2404	500	1000	REM	14
	15.1	2407	180	360	UND	0
	15.1	2407	550	1100	REM	0
	15.2	2415.2	220	440	UND	0
	16.1	2409	80	160	UND	0
	16.1	2409	200	400	REM	14
	17.1	2410	120	240	UND	0
	17.1	2410	340	680	REM	14
*	17.3	2412	110	220	UND	0
	17.3	2412	380	760	REM	0
	18.3	2415	6800	13600	UND	0
	19.1	2416	140	280	UND	0
	19.1	2416	350	700	REM	0
	19.2	2417	130	260	UND	0
	19.2	2417	600	1200	REM	14
	20.2	2419	120	240	UND	
	20.2	2419	1370	2740	REM	14
	20.2	2419	2380	4760	REM	28

RWCD R4	LMS	3/15/85	soil logs

The change in elevation and its effect on the lining requirements of the floodway were reviewed. No changes will be necessary.

DNH

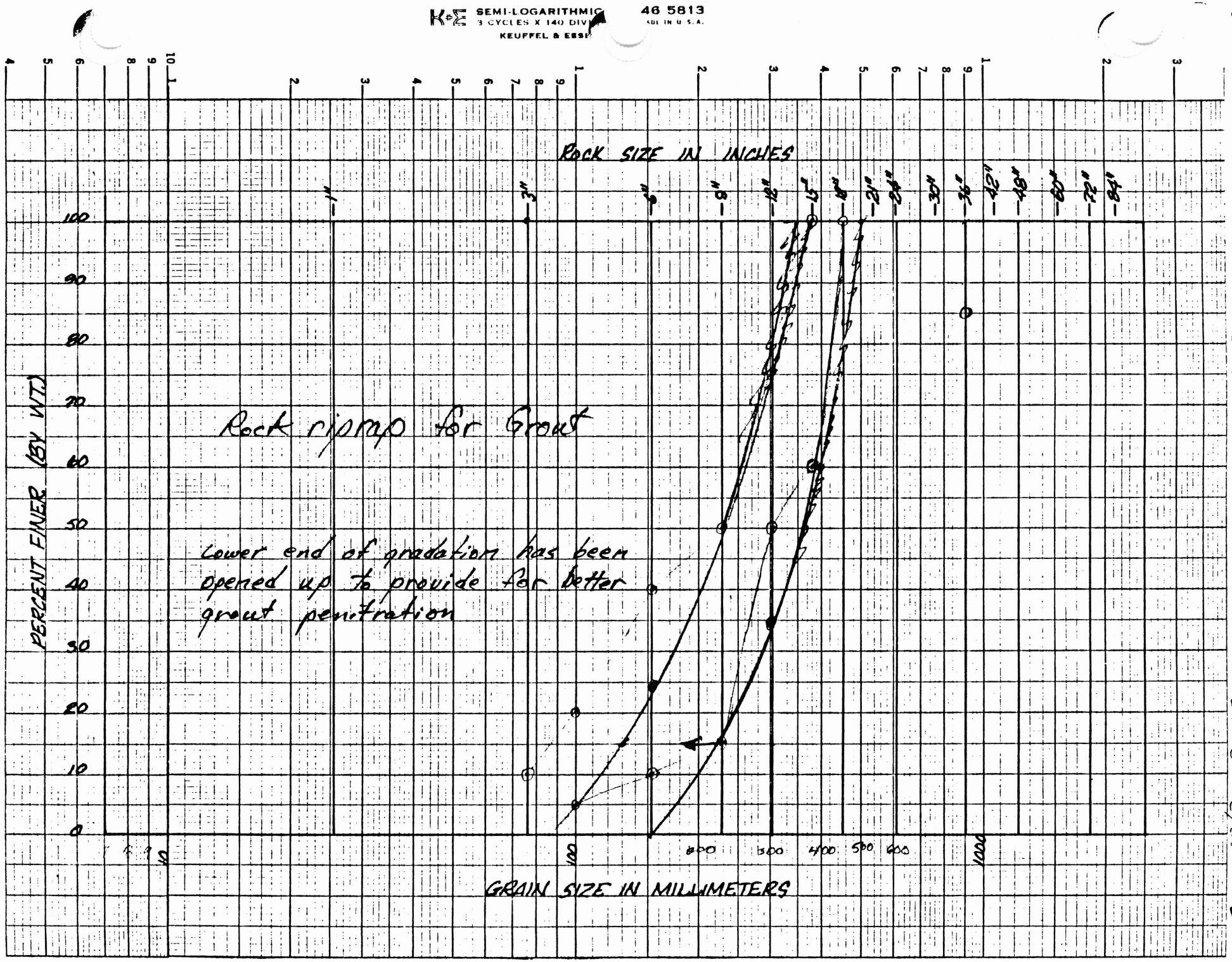
42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 380 200 SHEETS 5 SQUARE
NATIONAL

Record#		FLD	STA	D	USC	LL	PI	SUN	QU	/5	UND	REM	COMP	SAMP
1	740052	S2405.1	708+75	2-2.7	SC	34	16		1106					
2	740053	S2450A.1	708+75	2-2.7	CL-1	27	8	28	0.0					
3	740054	S2451.1	695+00	3-6	CL-1	100	29	30						
4	740055	S2451.2	695+00	7.5-9	ML	NP		30						
5	740056	2451.3	695+00	11.5-13	GM	NP								
6	740057	S2454A.1	651+00	2-3	CL-2	26	9	29		.074				
7	740058	S2456A.1	723+00	3.5-3.7	CL-1	46	21	29	1584					
8	740059	S2456.2	623+00	5-5.7	CL-2	46	21	27						
9	740060	S2457.1	609+00	5-5.2	ML	28	5	31	316					
10	740061	S2457.2	609+00	7.5-7.7	CL-1	29	11	31	260	.105				
11	740062	S2458.1	584+25	2-2.7	SM-1	29	3	27						
12	740063	S2460.1	560+25	1-2	CL-1	26	10	31						
13	740064	S2460.2	560+25	6-7	ML	NP		32						
14	740065	S2460.3	560+25	7-10	SM-1	NP		32						
15	740066	S2461.1	547+00	13-17	SP-SM	NP								
16	740067	S2462.1	534+50	5-5.7	CL-1	28	10	32						
17	740068	S2463.1	520+00	6-9	CL-2	35	17	33	1642					
18	84W2380	2401.1	493+25	4-5	CL	37	17	31			X			
19	84W2381	2401.2	493+25	7-8	SC	29	12	32						
20	84W2382	2402.1	520+40	3-4	CL	41	19	31			X			
21	84W2383	2402.2	520+40	8-9	SM	NP		32						
22	84W2384	2403.1	486+50	8-9	CL	37	17				X			
23	84W2385	2404.1	541+70	3.5-4.5	SM	NP		33			X		X	
24	84W2386	2404.2	541+70	9-10	SM	NP		33			X			
25	84W2387	2405.1	547+75	8-9	CL	29	8	33			X			
26	84W2388	2405.2	547+75	12-13	ML	36	5	33						
27	84W2389	2406.1	557+75	4-5	ML	NP		32			X			
28	84W2390	2406.2	557+75	11-12	SC	30	11	33			X			
29	84W2391	2407.1	562+50	6-7	CL	34	15	32					X	
30	84W2392	2408.1	574+45	6-7	CL	24	8	31						BAG
31	84W2393	2408.2	574+45	12-13	CL-ML	22	4	32						BAG
32	84W2394	2409.1	584+00	2.5-3.5	CL	32	11	31						
33	84W2395	2409.2	584+00	6-7	SM	NP		31			X			
34	84W2396	2409.3	584+00	8-14	SM	NP		22						BAG
35	84W2397	2410.1	596+00	1-6	ML	NP		27						BAG
36	84W2398	2410.2	596+00	1-6	CL	34	13	31						BAG
37	84W2399	2411.1	607+00	3-4	SM	NP		29					X	
38	84W2400	2411.2	607+00	8-9	CL	40	23	27			X		X	
39	84W2401	2412.1	632+00	1.5-2.5	CL-ML	27	6	29						
40	84W2402	2412.2	632+00	12-13	SC	28	14	27			X			
41	84W2403	2413.1	643+50	1-4.5	CL-ML	26	5	29					X	BAG
42	84W2404	2413.2	643+50	4.5-16	CL-ML	20	4	23						BAG
43	84W2405	2414.1	658+00	2.5-3.5	SM	NP		29						
44	84W2406	2414.2	658+00	6.5-9.0	SM	NP		23						BAG
45	84W2407	2415.1	669+00	5-6	CL-ML	28	6	29					X	
46	84W2408	2415.2	669+00	12-13	CL	36	18	27			X		X	
47	84W2409	2416.1	678+00	9-10	ML	22	2	27			X			
48	84W2410	2417.1	690+00	3-4	CL-ML	25	6	28					X	
49	84W2411	2417.2	690+00	5-6	CL	29	11	29					X	
50	84W2412	2417.3	690+00	11-12	CL	27	10	27			X		X	
51	84W2413	2418.1	702+00	3-4	CL	33	12	28						
52	84W2414	2418.2	702+00	8-9	CL	28	9	27						
53	84W2415	2418.3	702+00	10-10.9	SM	NP		27			X			
54	84W2416	2419.1	715+00	5-6	CL	23	8	26						
55	84W2417	2419.2	715+00	10-11	SC-SM	22	7	28						
56	84W2418	2420.1	723+00	3-4	CL	33	12	29						
57	84W2419	2420.2	723+00	6-7	SM	NP		27			X			
58	84W2420	2421.1	723+00	6.5-16	SM	NP		30						BAG
59	84W2421	2422.1	732+00	4.5-5.5	SM	20	2	28						
60	84W2422	2424.1	743+00	8-9	SM	NP		26			X			
61	84W2423	2425.1	744+25	7.5-8.5	SM	NP		27						

63	W2425	2437.1	651+00	10-11	SM	NP		27			BAG
64	2426	2440.1	638+00	15-16	ML	29	2	31		X	
65	2427	2451.1	574+45	5-6	ML	NP		32		X	
66	2428	2454.1	547+75	7-8	ML	NP		32		X	
67	84W2429	2461.1	498+00	7-8	SC-SM	27	7	32		X	

Record#	L	FLD	STA	D	USC	LL	PI	SUN	QU		UND	REM	COMP	SAMP	QUD NS	QURD NS	QUR1/4 NS	QUR2E NS	NS	OPTM NS	1GS-4
1	740052	S2405.1	708+75	2-2.7	SC	34	16		1108						1108						
2	740053	S2450A.1	708+75	2-2.7	CL-1	27	8	28	0.0												
3	740054	S2451.1	695+00	3-6	CL-1	100	29	30													
4	740055	S2451.2	695+00	7.5-9	ML	NP		30													
5	740056	2451.3	695+00	11.5-13	GM	NP															
6	740057	S2454A.1	651+00	2-3	CL-2	26	9	29		.074											
7	740058	S2456A.1	723+00	3.5-3.7	CL-1	46	21	29	1584						1584						
8	740059	S2456.2	623+00	5-5.7	CL-2	46	21	27													
9	740060	S2457.1	609+00	5-5.2	ML	28	5	31	316						316						
10	740061	S2457.2	609+00	7.5-7.7	CL-1	29	11	31	260	.105					260						
11	740062	S2458.1	584+25	2-2.7	SM-1	29	3	27													
12	740063	S2460.1	560+25	1-2	CL-1	26	10	31													
13	740064	S2460.2	560+25	6-7	ML	NP		32													
14	740065	S2460.3	560+25	7-10	SM-1	NP		32													
15	740066	S2461.1	547+00	13-17	SP-SM	NP															
16	740067	S2462.1	534+50	5-5.7	CL-1	28	10	32													
17	740068	S2463.1	520+00	6-9	CL-2	35	17	33	1642						1612						
18	84W2380	2401.1	493+25	4-5	CL	37	17	31			X										
19	84W2381	2401.2	493+25	7-8	SC	29	12	32													
20	84W2382	2402.1	520+40	3-4	CL	41	19	31			X										
21	84W2383	2402.2	520+40	8-9	SM	NP		32													
22	84W2384	2403.1	486+50	8-9	CL	37	17				X										
23	84W2385	2404.1	541+70	3.5-4.5	SM	NP		33			X		X								
24	84W2386	2404.2	541+70	9-10	SM	NP		33			X										
25	84W2387	2405.1	547+75	8-9	CL	29	8	33			X										
26	84W2388	2405.2	547+75	12-13	ML	36	5	33													
27	84W2389	2406.1	557+75	4-5	ML	NP		32			X										
28	84W2390	2406.2	557+75	11-12	SC	30	11	33			X										
29	84W2391	2407.1	562+50	6-7	CL	34	15	32					X								
30	84W2392	2408.1	574+45	6-7	CL	24	8	31						BAG							
31	84W2393	2408.2	574+45	12-13	CL-ML	22	4	32						BAG							
32	84W2394	2409.1	584+00	2.5-3.5	CL	32	11	31													
33	84W2395	2409.2	584+00	6-7	SM	NP		31			X										
34	84W2396	2409.3	584+00	8-14	SM	NP		22						BAG							
35	84W2397	2410.1	596+00	1-6	ML	NP		27						BAG							
36	84W2398	2410.2	596+00	1-6	CL	34	13	31						BAG							
37	84W2399	2411.1	607+00	3-4	SM	NP		29					X								
38	84W2400	2411.2	607+00	8-9	CL	40	23	27			X		X								
39	84W2401	2412.1	632+00	1.5-2.5	CL-ML	27	6	29													
40	84W2402	2412.2	632+00	12-13	SC	28	14	27			X										
41	84W2403	2413.1	643+50	1-4.5	CL-ML	26	5	29					X	BAG							
42	84W2404	2413.2	643+50	4.5-16	CL-ML	20	4	23						BAG							
43	84W2405	2414.1	658+00	2.5-3.5	SM	NP		29													
44	84W2406	2414.2	658+00	6.5-9.0	SM	NP		23						BAG							
45	84W2407	2415.1	669+00	5-6	CL-ML	28	6	29					X								
46	84W2408	2415.2	669+00	12-13	CL	36	18	27			X		X								
47	84W2409	2416.1	678+00	9-10	ML	22	2	27			X										
48	84W2410	2417.1	690+00	3-4	CL-ML	25	6	28					X								
49	84W2411	2417.2	690+00	5-6	CL	29	11	29					X								
50	84W2412	2417.3	690+00	11-12	CL	27	10	27			X		X								
51	84W2413	2418.1	702+00	3-4	CL	33	12	28													
52	84W2414	2418.2	702+00	8-9	CL	28	9	27													
53	84W2415	2418.3	702+00	10-10.9	SM	NP		27			X										
54	84W2416	2419.1	715+00	5-6	CL	23	8	26													
55	84W2417	2419.2	715+00	10-11	SC-SM	22	7	28													
56	84W2418	2420.1	723+00	3-4	CL	33	12	29													
57	84W2419	2420.2	723+00	6-7	SM	NP		27			X										
58	84W2420	2421.1	723+00	6.5-16	SM	NP		30						BAG							
59	84W2421	2422.1	732+00	4.5-5.5	SM	20	2	28													
60	84W2422	2424.1	743+00	8-9	SM	NP		26			X										
61	84W2423	2425.1	744+25	7.5-8.5	SM	NP		27													

63	[illegible]425	2437.1	851+00	10-11	SM	NP		27			BAG
64	[illegible]26	2440.1	638+00	15-16	ML	29	2	31		X	
65	[illegible]427	2451.1	574+45	5-6	ML	NP		32		X	
66	[illegible]2428	2454.1	547+75	7-8	ML	NP		32		X	
67	84W2429	2461.1	498+00	7-8	SC-SM	27	7	32		X	



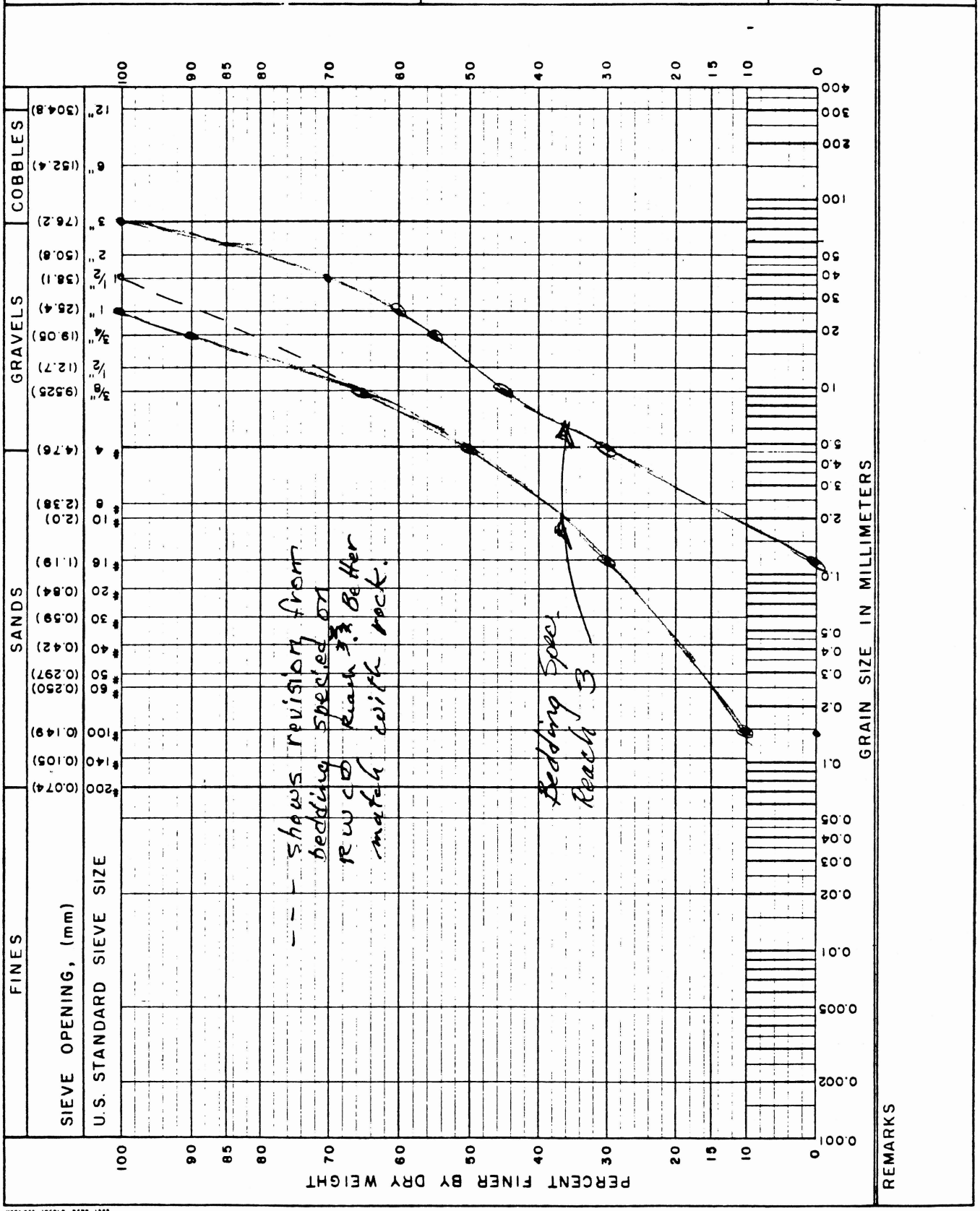
EXCD-R4, Az.
2005 3/85

Form SCS 130
5-65

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	DRAIN MATERIALS

PROJECT and STATE: RWCD - R4, AZ

DESIGNED AT: WNTC. | BY: LMS ✓ | DATE: 3/85



REMARKS

ARIZONA RWCD R4

DT 2/13/85 JMA 3/85

R/C/GR OUTLET TRANSITION

PROBLEM: IN DESIGN OF THE TRANSITION DOWNSTREAM OF POWER RD WSP CALCULATIONS SHOW THAT AN $n = 0.035$ IS REQUIRED FOR SATISFACTORY PERFORMANCE.
NEED D_{50} REQ'D TO OBTAIN VARIOUS n

ANALYSIS: 1. TR59: EQN (2) p7

$$n = C_n (D_{50})^{EXPN} \qquad EXPN = 1/6, \quad C_n = 0.0395$$

D_{50} = SIZE 50% FINER (FT)

$$D_{50} = (n/C_n)^{1/EXPN}$$

$$D_{50} = (25.32\, n)^6$$

n	D_{50} (in)
0.015	0.04
0.020	0.2
0.025	0.8
0.030	2.3
0.035	5.8
0.040	13
0.045	26
0.026	1.0
0.027	1.2
0.028	1.5
0.029	1.9
0.031	2.8
0.032	3.4
0.033	4.1
0.034	4.9

ARIZONA — RDWCD R4

DT — 11/8/84 — YMA — 3/85

FIELD	LAB	MAX YD	OPT. MOIST	G.-C.
2402.1	84W 2382 "B"	106.0	12.0	2.68
2404.1	84W 2385 B	120.5	11.0	2.64
2406.1	84W 2389 B	110.0	14.5	2.68
2407.1	84W 2391 B	104.0	19.5	2.67
2409.1	84W 2395 B	102.5	19.5	2.70
2411.1	84W 2399 B	120.5	10.0	2.70
2411.2	84W 2400 B	111.5	15.5	2.68
2412.2	84W 2402 B	117.5	12.5	2.64
2413.1	84W 2403 B	108.5	17	2.72
2413.2	84W 2404 B	120.5	11	2.67
2415.1	84W 2407 B	100.5	22	2.69
2415.2	84W 2408 B	112.5	15.5	2.67
2416.1	84W 2409 B	105.5	18	2.68
2417.1	84W 2410 B	107.0	18.5	2.69
2417.2	84W 2411 B	107.0	18	2.69
2417.3	84W 2412 B	113.0	15	2.68
2419.1	84W 2416 B	122.0	12	2.71
2419.2	84W 2417 B	119.5	13	2.69
2420.2	84W 2419 B	125.5	10.5	2.70
2454.1	84W 2425 B	112.5	14	2.65
2461.1	84W 2429 B	119.5	12.5	2.67

ARIZONA RWCD

DT 12/18/84

POWERLINE JCT - DESIGN "Q" 2

PER 12/11/84 LETTER FROM RALPH ARRINGTON

100 yr PEAK PER ACH STUDIES	2400 cfs
POWERLINE FLOODWAY DESIGN PEAK	3140
RWCD PLANNING HYDROLOGY	1600

EXISTING

HYDRAULICS - POWERLINE:

$Q = 3140$
$S = 0.00296$
~~$B = 60$~~
$Z = 2$
$n = 0.027$ $\quad n = 0.030$ $\quad n = 0.035$

$d = 5.40$	$d = 5.74$	$d = 6.27$
$A = 382$	$A = 410$	$A = 455$
$V = 8.21$	$V = 7.66$	$V = 6.90$

$d_c = 4.19$ FT

$S_c, n = 0.027 \quad S_c = 0.005598$
$n = 0.024 \quad = 0.007085$

ARIZONA RWCD R4

DT EXISTING 1/15/85
POWERLINE FLOODWAY

CHECK VEL WITH FLOW AT TOP OF RR.

$Q = 3140$
$S = 0.00296$
$B = 50$
$Z = 2$

OK

$d = 6$ FT

$A = bd + zd^2 = 50(6) + 2(6)^2 = 372$ FT^2

$V = 3140/372 = 8.44$ FT/S
$P = b + 2d\sqrt{5} = 76.83$

Backfigure n

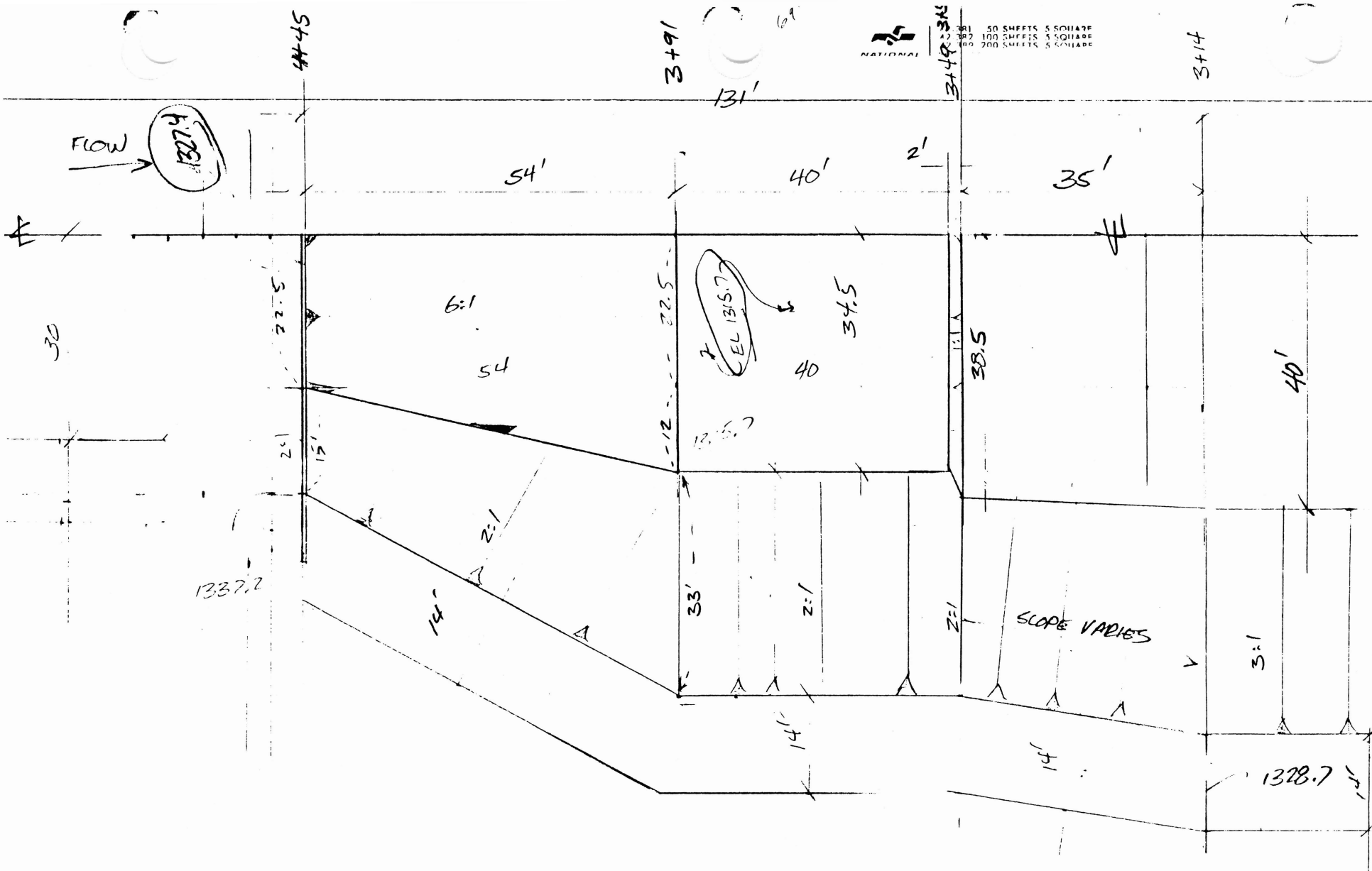
$V = \frac{1.486 R^{2/3} S^{1/2}}{n}$ OK

$n = \frac{1.486 R^{2/3} S^{1/2}}{V}$

$= \frac{1.486 (372/76.83)^{2/3} (0.00296)^{1/2}}{8.44}$

$n = 0.027$

$d_c = 4.19$ FT



POWERLINE FLDY GROUTED ROCK DROP

1in = 20ft

KVCD REACH 4
ARIZONA
WMS GRAND NP

DT 2/21/85

POWERLINE DROP

R4POWX

''WASP2''SUPERCRITICAL WATER SURFACE PROFILE

COMPUTED BY: DATE: DATA FILE: R4POWX CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
4+45.00	3140.00	45.00	2.00	4.933	4.900	268.5	11.69	1328.12	1321.10	1326.00	0.00	1.01	4.99
	n=0.0300	So=0.100006		Sf=0.012527	Headloss Factor=0.000		Total Headloss=0.050 ft.		Se=0.012489				
4+41.00	3140.00	46.78	2.00	4.829	3.811	207.3	15.15	1328.07	1320.70	1324.51	4.76	1.46	6.00
	n=0.0300	So=0.100000		Sf=0.023084	Headloss Factor=0.000		Total Headloss=0.115 ft.		Se=0.023032				
4+36.00	3140.00	49.00	2.00	4.706	3.344	186.2	16.86	1327.96	1320.20	1323.54	4.18	1.72	6.36
	n=0.0300	So=0.100000		Sf=0.031407	Headloss Factor=0.000		Total Headloss=0.157 ft.		Se=0.031393				
4+31.00	3140.00	51.22	2.00	4.590	3.034	173.8	18.06	1327.80	1319.70	1322.73	3.79	1.92	6.56
	n=0.0300	So=0.100000		Sf=0.039191	Headloss Factor=0.000		Total Headloss=0.196 ft.		Se=0.039156				
4+26.00	3140.00	53.44	2.00	4.480	2.799	165.2	19.00	1327.61	1319.20	1322.00	3.50	2.09	6.68
	n=0.0300	So=0.100000		Sf=0.046725	Headloss Factor=0.000		Total Headloss=0.234 ft.		Se=0.046703				
4+21.00	3140.00	55.67	2.00	4.376	2.610	158.9	19.76	1327.37	1318.70	1321.31	3.26	2.25	6.75
	n=0.0300	So=0.100000		Sf=0.054051	Headloss Factor=0.000		Total Headloss=0.270 ft.		Se=0.054027				
4+16.00	3140.00	57.89	2.00	4.278	2.454	154.1	20.38	1327.10	1318.20	1320.65	3.07	2.38	6.78
	n=0.0300	So=0.100000		Sf=0.061154	Headloss Factor=0.000		Total Headloss=0.306 ft.		Se=0.061118				
4+11.00	3140.00	60.11	2.00	4.185	2.322	150.3	20.89	1326.80	1317.70	1320.02	2.90	2.50	6.79
	n=0.0300	So=0.100000		Sf=0.067993	Headloss Factor=0.000		Total Headloss=0.340 ft.		Se=0.067974				
4+06.00	3140.00	62.33	2.00	4.096	2.208	147.4	21.31	1326.46	1317.20	1319.41	2.76	2.61	6.78
	n=0.0300	So=0.100000		Sf=0.074524	Headloss Factor=0.000		Total Headloss=0.373 ft.		Se=0.074508				
4+01.00	3140.00	64.56	2.00	4.012	2.109	145.1	21.64	1326.08	1316.70	1318.81	2.64	2.71	6.76
	n=0.0300	So=0.100000		Sf=0.080705	Headloss Factor=0.000		Total Headloss=0.404 ft.		Se=0.080670				
3+96.00	3140.00	66.78	2.00	3.931	2.023	143.3	21.91	1325.68	1316.20	1318.22	2.53	2.79	6.72

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.100000		Sf=0.086503	Headloss Factor=0.000		Total Headloss=0.433 ft.		Se=0.086454				

3+91.00	3140.00	69.00	2.00	3.854	1.947	141.9	22.12	1325.25	1315.70	1317.65		
	n=0.0300		So=0.000000		Sf=0.084724	Headloss Factor=0.000			Total Headloss=0.424 ft.		Se=0	
3+86.00	3140.00	69.00	2.00	3.854	2.009	146.7	21.41	1324.82	1315.70	1317.71	2.51	2.73	6.54
	n=0.0300		So=0.000000		Sf=0.076363	Headloss Factor=0.000			Total Headloss=0.382 ft.		Se=0.076333	
3+81.00	3140.00	69.00	2.00	3.854	2.071	151.5	20.73	1324.44	1315.70	1317.77	2.59	2.61	6.41
	n=0.0300		So=0.000000		Sf=0.068998	Headloss Factor=0.000			Total Headloss=0.345 ft.		Se=0.068963	
3+76.00	3140.00	69.00	2.00	3.854	2.134	156.3	20.08	1324.10	1315.70	1317.83	2.67	2.49	6.28
	n=0.0300		So=0.000000		Sf=0.062480	Headloss Factor=0.000			Total Headloss=0.312 ft.		Se=0.062446	
3+71.00	3140.00	69.00	2.00	3.854	2.197	161.2	19.47	1323.79	1315.70	1317.90	2.75	2.38	6.15
	n=0.0300		So=0.000000		Sf=0.056687	Headloss Factor=0.000			Total Headloss=0.283 ft.		Se=0.056652	
3+66.00	3140.00	69.00	2.00	3.854	2.261	166.2	18.89	1323.50	1315.70	1317.96	2.83	2.28	6.03
	n=0.0300		So=0.000000		Sf=0.051515	Headloss Factor=0.000			Total Headloss=0.258 ft.		Se=0.051495	
3+61.00	3140.00	69.00	2.00	3.854	2.325	171.3	18.33	1323.24	1315.70	1318.03	2.91	2.18	5.91
	n=0.0300		So=0.000000		Sf=0.046879	Headloss Factor=0.000			Total Headloss=0.234 ft.		Se=0.046839	
3+56.00	3140.00	69.00	2.00	3.854	2.391	176.4	17.80	1323.01	1315.70	1318.09	2.99	2.09	5.79
	n=0.0300		So=0.000000		Sf=0.042707	Headloss Factor=0.000			Total Headloss=0.214 ft.		Se=0.042693	
3+51.00	3140.00	69.00	2.00	3.854	2.458	181.7	17.29	1322.80	1315.70	1318.16	3.07	2.01	5.67

2/15/85
POWERLINE DROP
DT

493+60 13

626 +00	1309.05	1309.
555 +00	1310.82	
552 +00	1310.31	
492 +60	1315.36	

//

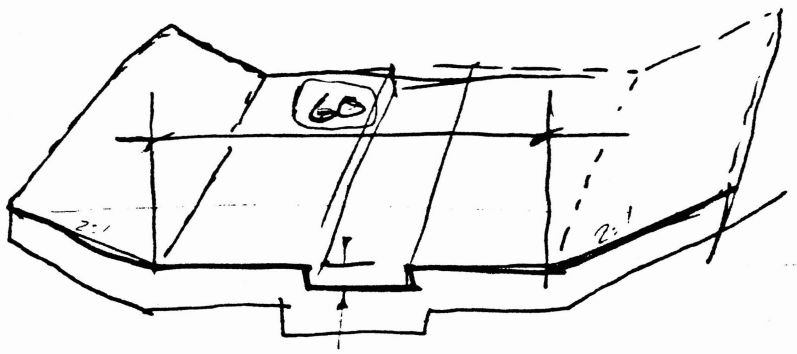
R= A= ~~(6.16(2)+50) 6.16~~
= ~~384~~

(5.91(2)+50) 5.91
= 365

P= B+ 2D$\sqrt{5}$
= 76.43
R= 4.7756
$R^{2/3}$= 2.8359

Q = $\frac{1.49}{n} A R^{2/3} S^{1/2}$
= 3.291 m^3/s

3140

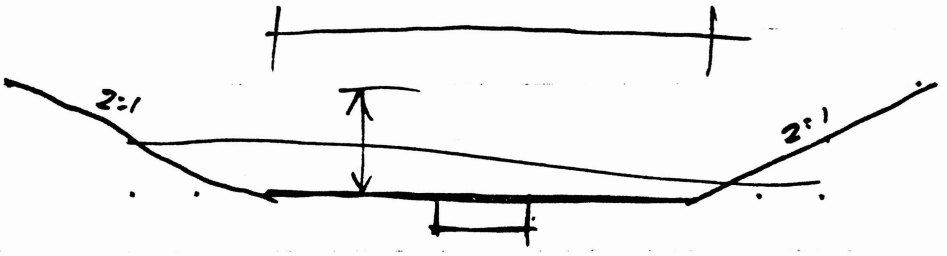


2/15
POWERLINE
DEEP
D.T.

H = 5.9

30

23.5



3140 / 51 → 62 cfs/ft

2400 / 51 → 47 cfs/ft

1600 / 51 → 31 cfs/ft

$Q_{10} \simeq \frac{600}{51}$ → 12 cfs/ft

ARIZONA
DT 2/15/85 RWD RH YMH 3/85

PROBLEM: DESIGN DROP IN POWERLINE FLOODWAY

ANALYSIS: 1. USE GROUTED ROCK DROP. ✓

2. USE TRAP R/C WEIR CREST. ✓

3. MAINTAIN CAPACITY IN POWERLINE FLY. W/O EXCESSIVE DRAWDOWN. ✓

4. PROVIDE RECESSED BASIN AT BASE OF DROP TO ASSURE HYDRAULIC JUMP OCCURS AT MINIMUM TW LEVELS. ✓

ARIZONA RWCD REACH 4

DT 2/11/85 YMH 3/85

PROBLEM: CHECK WEIR DIMENSIONS AT CREST OF DROP IN POWERLINE FNY AT RWCD FNY.

ANALYSIS:

1. check USING TRAP. WEIR EQN:

$Q = CLH^{3/2} + CzH^{5/2}$ — from where?

CHECK:

$n_{ch} = 0.027$
$s = 6.0$
$Q = 3140$ cfs — (1.11)
$V = 8.44$

$H = 6.0 + \frac{8.44^2}{64.4} = 7.11$ ft

1/15/85 COMPS.

SOLUTION:

FOR $C = 3.1$, $z = 2$, $Q = 3140$

FIND

L	H
60	5.85
50	6.39
45	6.70
40	7.05

TRY WEIR L = 45 ft ✓

H	Q
4.8	1780
5.0	1906
5.5	2239
6.0	2597
6.5	2980
7.0	3387

L=45, z=2
Q=3140
d_c = 4.93
V_o = 8.53 ft/s
$\frac{V_o^2}{2g}$ = 1.13
A = 368 ft²
H_{oc} = 6.06

ARIZONA RWCD R4

DT 2/15/85 LMS 3/85

- TRY RECESSING BASIN 2.0 FT

FROM WSP COMPS:

$b = 45$
$z = 2$
$S = 0.10$
$n = 0.035$

AT BASE OF JDHP

$F_f = 2.80$

EGL = 1325.4
INV = 1313.7

H_e = 11.7

LOSS ≈ (FIG VI-20 HEC 14) 0.22

$\Delta H_e \simeq 11.7(0.22) = 2.57$ FT

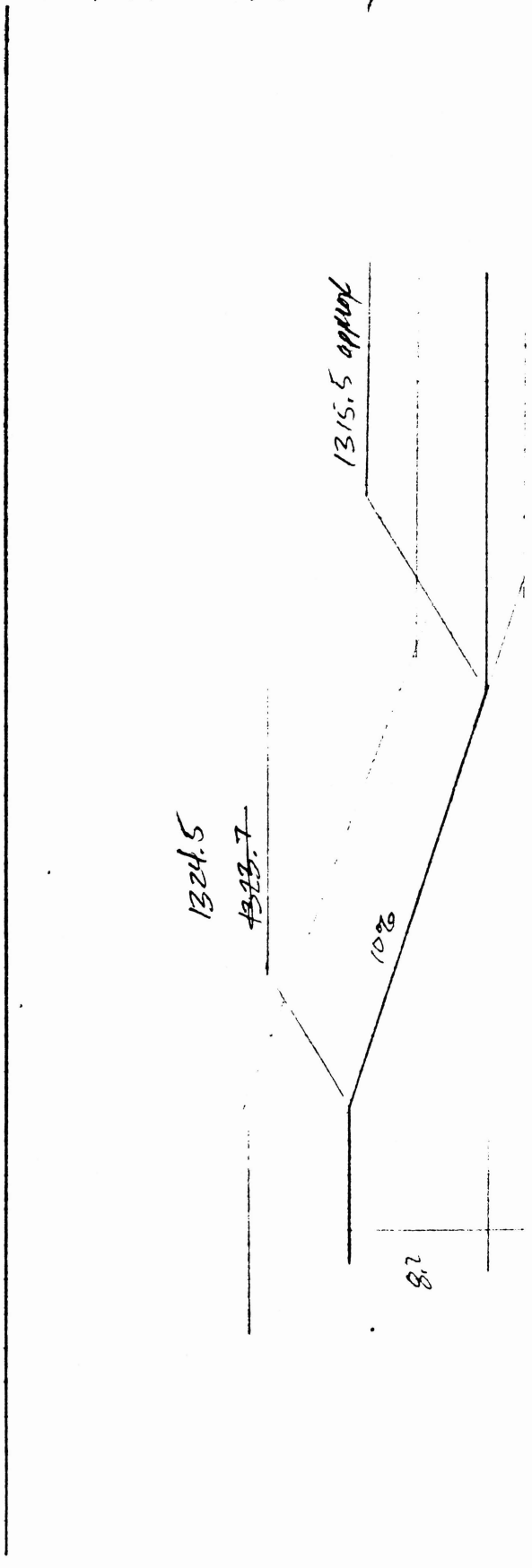
DS DEPTH ≈ 11.7 − 2.6 − 2.0 = 7.10 FT

TW ANAL ≈ 5.9

ARIZONA RWCO R4

D. Thackeray 2/13/85 ✓

JCT AT POWERLINE FLOODWAY



2/15/85
POWERLINE LOOP
DT

493+60 13

626 +00	1309.05	1300.
555 +00	1310.82	
552 +00	1310.31	
492 +60	1315.36	

$A = \frac{(6.16(2)+2)6.16}{384}$

$(5.91(2)+50)5.91$

$= 365$

$P = B + 2D\sqrt{5}$

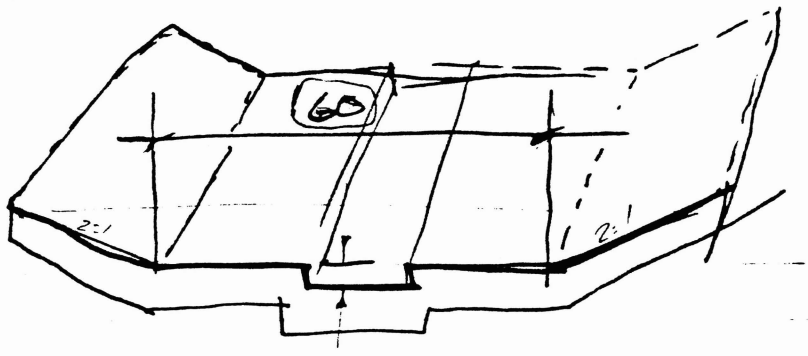
$= 76.43$

$R = 4.7756$

$R^{2/3} = 2.835$

$= 3291$

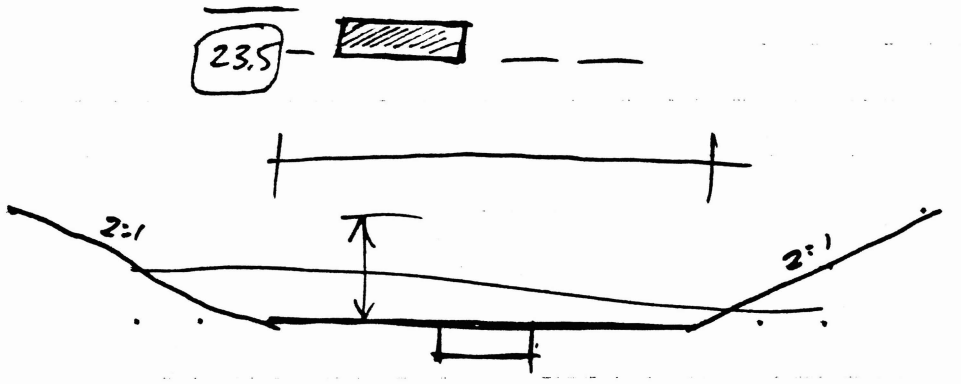
3140



2/15
POWERLINE
DEEP
D.T.

H= 5.9

~~30~~



$\frac{3140}{51}$ → 62 cfs/ft

$\frac{2400}{51}$ → 47 cfs/ft

$\frac{1600}{51}$ → 31 cfs/ft

$Q_{10} \simeq \frac{600}{51}$ → 12 cfs/ft

POWX POWERLINE DROP

''WASP2''SUPERCRITICAL WATER SURFACE PROFILE

CHUTE
n=0.035
Q = 3140

COMPUTED BY: DATE: DATA FILE: R4POWX CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
4+45.00	3140.00	45.00	2.00	4.933	4.900	268.5	11.69	1331.72	1324.70	1329.60	0.00	1.01	4.99
	n=0.0350		So=0.166667		Sf=0.021383	Headloss Factor=0.000			Total Headloss=0.192 ft.		Se=0.021379		
4+36.00	3140.00	49.00	2.00	4.706	3.099	171.1	18.36	1331.53	1323.20	1326.30	3.87	1.94	6.74
	n=0.0350		So=0.166577		Sf=0.056092	Headloss Factor=0.000			Total Headloss=0.280 ft.		Se=0.056069		
4+31.00	3140.00	51.22	2.00	4.590	2.791	158.5	19.81	1331.25	1322.37	1325.16	3.49	2.19	6.98
	n=0.0350		So=0.166602		Sf=0.071405	Headloss Factor=0.000			Total Headloss=0.357 ft.		Se=0.071379		
4+26.00	3140.00	53.44	2.00	4.480	2.562	150.1	20.92	1330.89	1321.53	1324.10	3.20	2.40	7.11
	n=0.0350		So=0.166821		Sf=0.086136	Headloss Factor=0.000			Total Headloss=0.431 ft.		Se=0.086102		
4+21.00	3140.00	55.67	2.00	4.376	2.383	144.0	21.80	1330.46	1320.70	1323.08	2.98	2.58	7.19
	n=0.0350		So=0.166577		Sf=0.100214	Headloss Factor=0.000			Total Headloss=0.501 ft.		Se=0.100186		
4+16.00	3140.00	57.89	2.00	4.278	2.238	139.6	22.49	1329.96	1319.87	1322.11	2.80	2.74	7.22
	n=0.0350		So=0.166797		Sf=0.113509	Headloss Factor=0.000			Total Headloss=0.568 ft.		Se=0.113489		
4+11.00	3140.00	60.11	2.00	4.185	2.118	136.3	23.04	1329.39	1319.03	1321.15	2.65	2.88	7.23
	n=0.0350		So=0.166626		Sf=0.125907	Headloss Factor=0.000			Total Headloss=0.630 ft.		Se=0.125867		
4+06.00	3140.00	62.33	2.00	4.096	2.016	133.8	23.46	1328.77	1318.20	1320.22	2.52	3.00	7.21
	n=0.0350		So=0.166577		Sf=0.137289	Headloss Factor=0.000			Total Headloss=0.686 ft.		Se=0.137244		
4+01.00	3140.00	64.56	2.00	4.012	1.930	132.0	23.78	1328.08	1317.37	1319.30	2.41	3.10	7.17
	n=0.0350		So=0.166797		Sf=0.147613	Headloss Factor=0.000			Total Headloss=0.738 ft.		Se=0.147577		
3+96.00	3140.00	66.78	2.00	3.931	1.855	130.8	24.01	1327.34	1316.53	1318.39	2.32	3.19	7.12
	n=0.0350		So=0.166626		Sf=0.156834	Headloss Factor=0.000			Total Headloss=0.784 ft.		Se=0.156815		
3+91.00	3140.00	69.00	2.00	3.854	1.790	129.9	24.16	1326.56	1315.70	1317.49	2.24	3.26	7.05

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0350		So=0.000000		Sf=0.156256	Headloss Factor=0.000			Total Headloss=0.313 ft.		Se=0.156180		
3+88.00	3140.00	69.00	2.00	3.854	1.824	129.5	24.24	1326.24	1315.70	1317.53	2.17	3.17	6.87

	n=0.0350	So=0.000000	Sf=0.140303	Hea[illegible]s	Factor=0.000	Total Headloss=0.702 ft.	Se=0.14[illegible]					
3+84	3140.00	69.00	2.00	3.854	1.908	138.[illegible]	22.61	1325.54	1315.70	1317.61	2.38	6.77
	n=0.0350	So=0.000000	Sf=0.115830	Headloss	Factor=0.000	Total Headloss=0.927 ft.	Se=0.115804					
3+76.00	3140.00	69.00	2.00	3.854	2.042	149.2	21.04	1324.62	1315.70	1317.74	2.55	2.67	6.47
	n=0.0350	So=0.000000	Sf=0.096653	Headloss	Factor=0.000	Total Headloss=0.483 ft.	Se=0.096636					
3+71.00	3140.00	69.00	2.00	3.854	2.127	155.8	20.15	1324.13	1315.70	1317.83	2.66	2.50	6.29
	n=0.0350	So=0.000000	Sf=0.084420	Headloss	Factor=0.000	Total Headloss=0.422 ft.	Se=0.084393					
3+66.00	3140.00	69.00	2.00	3.854	2.213	162.5	19.32	1323.71	1315.70	1317.91	2.77	2.36	6.12
	n=0.0350	So=0.000000	Sf=0.076996	Headloss	Factor=0.000	Total Headloss=0.154 ft.	Se=0.076948					
3+64.00	3140.00	69.00	2.00	3.854	2.248	165.2	19.01	1323.56	1315.70	1317.95	2.81	2.30	6.05
	n=0.0350	So=0.000000	Sf=0.070246	Headloss	Factor=0.000	Total Headloss=0.351 ft.	Se=0.070228					
3+59.00	3140.00	69.00	2.00	3.854	2.336	172.1	18.25	1323.21	1315.70	1318.04	2.92	2.17	5.89
	n=0.0350	So=0.000000	Sf=0.061804	Headloss	Factor=0.000	Total Headloss=0.309 ft.	Se=0.061756					
3+54.00	3140.00	69.00	2.00	3.854	2.425	179.1	17.53	1322.90	1315.70	1318.13	3.03	2.05	5.73

POWERLINE DROP : DRAWDOWN 4:1 RH NBIC DT 2/21/85

''WASP2''SUBCRITICAL WATER SURFACE PROFILE

COMPUTED BY: DATE: DATA FILE: POWZ CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
4+45.00	3140.00	45.00	2.00	4.933	4.950	271.8	11.55	1331.72	1324.70	1329.65	0.00	0.99	4.90
	n=0.0300		So=0.003027		Sf=0.006919	Headloss Factor=0.000		Total Headloss=0.035 ft.			Se=0.006905		
4+50.00	3140.00	46.00	2.00	4.874	5.452	310.2	10.12	1331.76	1324.72	1330.17	6.86	0.83	4.33
	n=0.0300		So=0.002979		Sf=0.005698	Headloss Factor=0.000		Total Headloss=0.028 ft.			Se=0.005679		
4+55.00	3140.00	46.00	2.00	4.874	5.495	313.1	10.03	1331.79	1324.73	1330.22	6.91	0.82	4.29
	n=0.0300		So=0.002808		Sf=0.004515	Headloss Factor=0.000		Total Headloss=0.023 ft.			Se=0.004509		
4+60.00	3140.00	50.00	2.00	4.653	5.924	366.4	8.57	1331.81	1324.74	1330.67	7.34	0.68	3.56
	n=0.0300		So=0.003003		Sf=0.002726	Headloss Factor=0.000		Total Headloss=0.014 ft.			Se=0.002725		
4+65.00	3140.00	60.00	2.00	4.189	6.343	461.1	6.81	1331.82	1324.76	1331.10	7.76	0.52	2.56
	n=0.0300		So=0.002197		Sf=0.002089	Headloss Factor=0.000		Total Headloss=0.010 ft.			Se=0.002087		
4+70.00	3140.00	60.00	2.00	4.189	6.342	461.0	6.81	1331.83	1324.77	1331.11	7.75	0.52	2.56
	n=0.0300		So=0.002961		Sf=0.002123	Headloss Factor=0.000		Total Headloss=0.106 ft.			Se=0.002124		
5+20.00	3140.00	60.00	2.00	4.189	6.285	456.1	6.88	1331.94	1324.92	1331.20	7.69	0.52	2.59
	n=0.0300		So=0.002959		Sf=0.002189	Headloss Factor=0.000		Total Headloss=0.109 ft.			Se=0.002189		
5+70.00	3140.00	60.00	2.00	4.189	6.232	451.6	6.95	1332.05	1325.07	1331.30	7.63	0.53	2.63
	n=0.0300		So=0.002961		Sf=0.002253	Headloss Factor=0.000		Total Headloss=0.113 ft.			Se=0.002253		
6+20.00	3140.00	60.00	2.00	4.189	6.182	447.4	7.02	1332.16	1325.21	1331.40	7.57	0.54	2.65
	n=0.0300		So=0.002959		Sf=0.002314	Headloss Factor=0.000		Total Headloss=0.116 ft.			Se=0.002314		
6+70.00	3140.00	60.00	2.00	4.189	6.137	443.5	7.08	1332.28	1325.36	1331.50	7.52	0.54	2.68
	n=0.0300		So=0.002966		Sf=0.002362	Headloss Factor=0.000		Total Headloss=0.071 ft.			Se=0.002357		
7+00.00	3140.00	60.00	2.00	4.189	6.111	441.3	7.12	1332.35	1325.45	1331.56	7.49	0.55	2.70

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH

OVERFLOW DROP (CHUTE)

''WASP2''SUPERCRITICAL WATER SURFACE PROFILE

R4POWX DT 2/22/85

COMPUTED BY: DATE: DATA FILE: R4POWX CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
4+45.00	3140.00	45.00	2.00	4.933	4.900	268.5	11.69	1331.72	1324.70	1329.60	0.00	1.01	4.99
	n=0.0300	So=0.166473		Sf=0.013460		Headloss Factor=0.000		Total Headloss=0.054 ft.			Se=0.013435		
4+41.00	3140.00	46.78	2.00	4.829	3.612	195.1	16.10	1331.67	1324.03	1327.65	4.52	1.59	6.27
	n=0.0300	So=0.166821		Sf=0.028693		Headloss Factor=0.000		Total Headloss=0.143 ft.			Se=0.028664		
4+36.00	3140.00	49.00	2.00	4.706	3.101	171.2	18.34	1331.53	1323.20	1326.30	3.88	1.94	6.74
	n=0.0300	So=0.166577		Sf=0.041585		Headloss Factor=0.000		Total Headloss=0.208 ft.			Se=0.041540		
4+31.00	3140.00	51.22	2.00	4.590	2.773	157.4	19.95	1331.32	1322.37	1325.14	3.47	2.21	7.01
	n=0.0300	So=0.166602		Sf=0.054129		Headloss Factor=0.000		Total Headloss=0.271 ft.			Se=0.054094		
4+26.00	3140.00	53.44	2.00	4.480	2.531	148.1	21.21	1331.05	1321.53	1324.07	3.16	2.45	7.17
	n=0.0300	So=0.166821		Sf=0.066617		Headloss Factor=0.000		Total Headloss=0.333 ft.			Se=0.066591		
4+21.00	3140.00	55.67	2.00	4.376	2.340	141.2	22.23	1330.72	1320.70	1323.04	2.93	2.66	7.28
	n=0.0300	So=0.166577		Sf=0.079006		Headloss Factor=0.000		Total Headloss=0.395 ft.			Se=0.078982		
4+16.00	3140.00	57.89	2.00	4.278	2.186	136.1	23.07	1330.32	1319.87	1322.05	2.73	2.85	7.34
	n=0.0300	So=0.166797		Sf=0.091178		Headloss Factor=0.000		Total Headloss=0.456 ft.			Se=0.091175		
4+11.00	3140.00	60.11	2.00	4.185	2.057	132.1	23.77	1329.86	1319.03	1321.09	2.57	3.01	7.37
	n=0.0300	So=0.166626		Sf=0.103010		Headloss Factor=0.000		Total Headloss=0.515 ft.			Se=0.103001		
4+06.00	3140.00	62.33	2.00	4.096	1.948	129.0	24.34	1329.35	1318.20	1320.15	2.43	3.16	7.37
	n=0.0300	So=0.166577		Sf=0.114362		Headloss Factor=0.000		Total Headloss=0.572 ft.			Se=0.114330		
4+01.00	3140.00	64.56	2.00	4.012	1.854	126.6	24.81	1328.78	1317.37	1319.22	2.32	3.30	7.35
	n=0.0300	So=0.166797		Sf=0.125138		Headloss Factor=0.000		Total Headloss=0.626 ft.			Se=0.125124		
3+96.00	3140.00	66.78	2.00	3.931	1.773	124.7	25.18	1328.15	1316.53	1318.31	2.22	3.42	7.32

STATI	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FP N	SEQUENT DEPTH
	n=0.0300		So=0.166626		Sf=0.135240	Headloss Factor=0.000		Total Headloss=0.676 ft.		Se=0.135213			
3+91.00	3140.00	69.00	2.00	3.854	1.703	123.3	25.47	1327.48	1315.70	1317.40	2.13	3.52	7.28
	n=0.0300		So=0.000000		Sf=0.131999	Headloss Factor=0.000		Total Headloss=0.660 ft.		Se=0.131987			
3+86.00	3140.00	69.00	2.00	3.854	1.764	127.9	24.54	1326.82	1315.70	1317.46	2.21	3.33	7.12
	n=0.0300		So=0.000000		Sf=0.117427	Headloss Factor=0.000		Total Headloss=0.587 ft.		Se=0.117398			
3+81.00	3140.00	69.00	2.00	3.854	1.826	132.6	23.68	1326.23	1315.70	1317.53	2.28	3.16	6.97
	n=0.0300		So=0.000000		Sf=0.104865	Headloss Factor=0.000		Total Headloss=0.524 ft.		Se=0.104839			
3+76.00	3140.00	69.00	2.00	3.854	1.887	137.3	22.86	1325.70	1315.70	1317.59	2.36	3.01	6.82
	n=0.0300		So=0.000000		Sf=0.093972	Headloss Factor=0.000		Total Headloss=0.470 ft.		Se=0.093938			
3+71.00	3140.00	69.00	2.00	3.854	1.949	142.1	22.10	1325.24	1315.70	1317.65	2.44	2.86	6.68
	n=0.0300		So=0.000000		Sf=0.084471	Headloss Factor=0.000		Total Headloss=0.422 ft.		Se=0.084456			
3+66.00	3140.00	69.00	2.00	3.854	2.011	146.8	21.39	1324.81	1315.70	1317.71	2.51	2.73	6.54
	n=0.0300		So=0.000000		Sf=0.076141	Headloss Factor=0.000		Total Headloss=0.381 ft.		Se=0.076134			
3+61.00	3140.00	69.00	2.00	3.854	2.073	151.6	20.71	1324.43	1315.70	1317.77	2.59	2.61	6.40
	n=0.0300		So=0.000000		Sf=0.068800	Headloss Factor=0.000		Total Headloss=0.344 ft.		Se=0.068780			
3+56.00	3140.00	69.00	2.00	3.854	2.136	156.5	20.07	1324.09	1315.70	1317.84	2.67	2.49	6.27
	n=0.0300		So=0.000000		Sf=0.062304	Headloss Factor=0.000		Total Headloss=0.312 ft.		Se=0.062271			
3+51.00	3140.00	69.00	2.00	3.854	2.199	161.4	19.46	1323.78	1315.70	1317.90	2.75	2.38	6.15

2/15 AT

''WASP2''SUPERCRITICAL WATER SURFACE PROFILE

POWERLINE DROP

COMPUTED BY: DATE: DATA FILE: R4POWC CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
10+00.00	3140.00	45.00	2.00	4.933	4.900	268.5	11.69	1330.72	1323.70	1328.60	0.00	1.01	4.99
	n=0.0350	So=0.100000		Sf=0.016610	Headloss Factor=0.000	Total Headloss=0.083 ft.		Se=0.016607					
9+95.00	3140.00	45.00	2.00	4.933	3.966	209.9	14.96	1330.64	1323.20	1327.17	4.96	1.42	6.03
	n=0.0350	So=0.100000		Sf=0.028072	Headloss Factor=0.000	Total Headloss=0.140 ft.		Se=0.028037					
9+90.00	3140.00	45.00	2.00	4.933	3.682	192.8	16.28	1330.50	1322.70	1326.38	4.60	1.60	6.41
	n=0.0350	So=0.100000		Sf=0.034922	Headloss Factor=0.000	Total Headloss=0.175 ft.		Se=0.034876					
9+85.00	3140.00	45.00	2.00	4.933	3.498	181.9	17.26	1330.33	1322.20	1325.70	4.37	1.73	6.68
	n=0.0350	So=0.100000		Sf=0.040841	Headloss Factor=0.000	Total Headloss=0.204 ft.		Se=0.040804					
9+80.00	3140.00	45.00	2.00	4.933	3.363	174.0	18.05	1330.12	1321.70	1325.06	4.20	1.84	6.88
	n=0.0350	So=0.100000		Sf=0.046147	Headloss Factor=0.000	Total Headloss=0.231 ft.		Se=0.046111					
9+75.00	3140.00	45.00	2.00	4.933	3.259	167.9	18.70	1329.89	1321.20	1324.46	4.07	1.94	7.05
	n=0.0350	So=0.100000		Sf=0.050965	Headloss Factor=0.000	Total Headloss=0.255 ft.		Se=0.050935					
9+70.00	3140.00	45.00	2.00	4.933	3.175	163.0	19.26	1329.64	1320.70	1323.87	3.97	2.02	7.19
	n=0.0350	So=0.100000		Sf=0.055363	Headloss Factor=0.000	Total Headloss=0.277 ft.		Se=0.055339					
9+65.00	3140.00	45.00	2.00	4.933	3.105	159.0	19.75	1329.36	1320.20	1323.31	3.88	2.09	7.30
	n=0.0350	So=0.100000		Sf=0.059385	Headloss Factor=0.000	Total Headloss=0.297 ft.		Se=0.059337					
9+60.00	3140.00	45.00	2.00	4.933	3.047	155.7	20.17	1329.06	1319.70	1322.75	3.81	2.15	7.40
	n=0.0350	So=0.100000		Sf=0.063067	Headloss Factor=0.000	Total Headloss=0.315 ft.		Se=0.063041					
9+55.00	3140.00	45.00	2.00	4.933	2.998	152.9	20.54	1328.75	1319.20	1322.20	3.75	2.21	7.49
	n=0.0350	So=0.100000		Sf=0.066433	Headloss Factor=0.000	Total Headloss=0.332 ft.		Se=0.066397					
9+50.00	3140.00	45.00	2.00	4.933	2.956	150.5	20.86	1328.42	1318.70	1321.66	3.70	2.26	7.56

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0350	So=0.100000		Sf=0.069511	Headloss Factor=0.000	Total Headloss=0.348 ft.		Se=0.069480					

	n=0.0350	So=0.100000	Sf=0.072323	Heac	Factor=0.000	Total Headloss=0.362 ft.	Se=0.07?						
9+40.	3140.00	45.00	2.00	4.933	2.888	146.7	21.41	1327.71	1317.70	1320.59	3.61		7.69
	n=0.0350	So=0.100000	Sf=0.074889	Headloss	Factor=0.000	Total Headloss=0.374 ft.	Se=0.074849						
9+35.00	3140.00	45.00	2.00	4.933	2.861	145.1	21.64	1327.33	1317.20	1320.06	3.58	2.38	7.74
	n=0.0350	So=0.100000	Sf=0.077230	Headloss	Factor=0.000	Total Headloss=0.386 ft.	Se=0.077188						
9+30.00	3140.00	45.00	2.00	4.933	2.837	143.7	21.84	1326.95	1316.70	1319.54	3.55	2.41	7.78
	n=0.0350	So=0.100000	Sf=0.079362	Headloss	Factor=0.000	Total Headloss=0.397 ft.	Se=0.079344						
9+25.00	3140.00	45.00	2.00	4.933	2.816	142.6	22.03	1326.55	1316.20	1319.02	3.52	2.44	7.82
	n=0.0350	So=0.100000	Sf=0.081302	Headloss	Factor=0.000	Total Headloss=0.407 ft.	Se=0.081269						
9+20.00	3140.00	45.00	2.00	4.933	2.797	141.5	22.19	1326.14	1315.70	1318.50	3.50	2.46	7.86
	n=0.0350	So=0.100000	Sf=0.083068	Headloss	Factor=0.000	Total Headloss=0.415 ft.	Se=0.083017						
9+15.00	3140.00	45.00	2.00	4.933	2.780	140.6	22.34	1325.73	1315.20	1317.98	3.48	2.49	7.89
	n=0.0350	So=0.100000	Sf=0.084674	Headloss	Factor=0.000	Total Headloss=0.423 ft.	Se=0.084647						
9+10.00	3140.00	45.00	2.00	4.933	2.766	139.8	22.47	1325.30	1314.70	1317.47	3.46	2.51	7.92
	n=0.0350	So=0.100000	Sf=0.086132	Headloss	Factor=0.000	Total Headloss=0.431 ft.	Se=0.086102						
9+05.00	3140.00	45.00	2.00	4.933	2.753	139.0	22.59	1324.87	1314.20	1316.95	3.44	2.53	7.95
	n=0.0350	So=0.100000	Sf=0.087454	Headloss	Factor=0.000	Total Headloss=0.437 ft.	Se=0.087435						
9+00.00	3140.00	45.00	2.00	4.933	2.741	138.4	22.69	1324.44	1313.70	1316.44	3.43	2.54	7.97
	n=0.0350	So=0.000000	Sf=0.083774	Headloss	Factor=0.000	Total Headloss=0.419 ft.	Se=0.083754						
8+95.00	3140.00	45.00	2.00	4.933	2.822	142.9	21.97	1324.02	1313.70	1316.52	3.53	2.43	7.81
	n=0.0350	So=0.000000	Sf=0.075934	Headloss	Factor=0.000	Total Headloss=0.380 ft.	Se=0.075893						
8+90.00	3140.00	45.00	2.00	4.933	2.904	147.5	21.29	1323.64	1313.70	1316.60	3.63	2.32	7.66

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0350	So=0.000000	Sf=0.068938	Headloss	Factor=0.000	Total Headloss=0.345 ft.	Se=0.068909						
8+85.00	3140.00	45.00	2.00	4.933	2.986	152.2	20.63	1323.29	1313.70	1316.69	3.73	2.22	7.51
	n=0.0350	So=0.000000	Sf=0.062669	Headloss	Factor=0.000	Total Headloss=0.313 ft.	Se=0.062640						
8+80.00	3140.00	45.00	2.00	4.933	3.070	157.0	20.00	1322.98	1313.70	1316.77	3.84	2.13	7.36
	n=0.0350	So=0.000000	Sf=0.057030	Headloss	Factor=0.000	Total Headloss=0.285 ft.	Se=0.057005						
8+75.00	3140.00	45.00	2.00	4.933	3.155	161.9	19.39	1322.70	1313.70	1316.86	3.94	2.04	7.22
	n=0.0350	So=0.000000	Sf=0.051938	Headloss	Factor=0.000	Total Headloss=0.260 ft.	Se=0.051924						
8+70.00	3140.00	45.00	2.00	4.933	3.242	166.9	18.81	1322.44	1313.70	1316.94	4.05	1.95	7.07

	n=0.0350	So=0.000000	Sf=0.043121	Headloss Factor=0.000	Total Headloss=0.216 ft.	Se=0.04[illegible]3							
8+65.	3140.00	45.00	2.00	4.933	3.332	172.1	18.24	1322.20	1313.70	1317.03	4.16		6.93
	n=0.0350	So=0.000000	Sf=0.043121	Headloss Factor=0.000	Total Headloss=0.216 ft.	Se=0.04[illegible]3							
8+60.00	3140.00	45.00	2.00	4.933	3.423	177.5	17.69	1321.98	1313.70	1317.12	4.28	1.79	6.79

2/15/E ST

''WASP2'' SUPERCRITICAL WATER SURFACE PROFILE

POWERLINE DROP

COMPUTED BY: DATE: DATA FILE: R4POWC CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
10+00.00	3140.00	45.00	2.00	4.933	4.900	268.5	11.69	1330.72	1323.70	1328.60	3.82	1.01	4.99
	n=0.0300	So=0.100000		Sf=0.012295		Headloss Factor=0.000		Total Headloss=0.061 ft.		Se=0.012286			
9+95.00	3140.00	45.00	2.00	4.933	3.945	208.6	15.05	1330.66	1323.20	1327.14	4.93	1.43	6.06
	n=0.0300	So=0.100000		Sf=0.021153		Headloss Factor=0.000		Total Headloss=0.106 ft.		Se=0.021110			
9+90.00	3140.00	45.00	2.00	4.933	3.647	190.7	16.46	1330.56	1322.70	1326.35	4.56	1.62	6.46
	n=0.0300	So=0.100000		Sf=0.026695		Headloss Factor=0.000		Total Headloss=0.133 ft.		Se=0.026650			
9+85.00	3140.00	45.00	2.00	4.933	3.451	179.1	17.53	1330.42	1322.20	1325.65	4.31	1.77	6.75
	n=0.0300	So=0.100000		Sf=0.031629		Headloss Factor=0.000		Total Headloss=0.158 ft.		Se=0.031615			
9+80.00	3140.00	45.00	2.00	4.933	3.306	170.6	18.40	1330.26	1321.70	1325.01	4.13	1.89	6.97
	n=0.0300	So=0.100000		Sf=0.036184		Headloss Factor=0.000		Total Headloss=0.181 ft.		Se=0.036142			
9+75.00	3140.00	45.00	2.00	4.933	3.192	164.0	19.15	1330.08	1321.20	1324.39	3.99	2.00	7.16
	n=0.0300	So=0.100000		Sf=0.040440		Headloss Factor=0.000		Total Headloss=0.202 ft.		Se=0.040424			
9+70.00	3140.00	45.00	2.00	4.933	3.099	158.6	19.79	1329.88	1320.70	1323.80	3.87	2.10	7.31
	n=0.0300	So=0.100000		Sf=0.044435		Headloss Factor=0.000		Total Headloss=0.222 ft.		Se=0.044405			
9+65.00	3140.00	45.00	2.00	4.933	3.021	154.2	20.36	1329.66	1320.20	1323.22	3.78	2.18	7.45
	n=0.0300	So=0.100000		Sf=0.048192		Headloss Factor=0.000		Total Headloss=0.241 ft.		Se=0.048164			
9+60.00	3140.00	45.00	2.00	4.933	2.955	150.4	20.87	1329.42	1319.70	1322.66	3.69	2.26	7.56
	n=0.0300	So=0.100000		Sf=0.051727		Headloss Factor=0.000		Total Headloss=0.259 ft.		Se=0.051697			
9+55.00	3140.00	45.00	2.00	4.933	2.899	147.2	21.33	1329.16	1319.20	1322.10	3.62	2.33	7.67
	n=0.0300	So=0.100000		Sf=0.055051		Headloss Factor=0.000		Total Headloss=0.275 ft.		Se=0.055027			
9+50.00	3140.00	45.00	2.00	4.933	2.849	144.5	21.74	1328.89	1318.70	1321.55	3.56	2.39	7.76

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.100000		Sf=0.058173		Headloss Factor=0.000		Total Headloss=0.291 ft.		Se=0.058141			

	n=0.0300	So=0.100000	Sf=0.061105	Head	Factor=0.000	Total Headloss=0.306 ft.	Se=0.06[illegible]						
9+40.[illegible]	3140.00	45.00	2.00	4.933	2.769	139.9	22.44	1328.29	1317.70	1320.47	3.46		7.91
	n=0.0300	So=0.100000	Sf=0.063855	Headloss	Factor=0.000	Total Headloss=0.319 ft.	Se=0.063818						
9+35.00	3140.00	45.00	2.00	4.933	2.735	138.0	22.75	1327.97	1317.20	1319.93	3.42	2.55	7.98
	n=0.0300	So=0.100000	Sf=0.066429	Headloss	Factor=0.000	Total Headloss=0.332 ft.	Se=0.066400						
9+30.00	3140.00	45.00	2.00	4.933	2.705	136.4	23.03	1327.64	1316.70	1319.41	3.38	2.60	8.04
	n=0.0300	So=0.100000	Sf=0.068837	Headloss	Factor=0.000	Total Headloss=0.344 ft.	Se=0.068807						
9+25.00	3140.00	45.00	2.00	4.933	2.678	134.9	23.28	1327.29	1316.20	1318.88	3.35	2.64	8.09
	n=0.0300	So=0.100000	Sf=0.071088	Headloss	Factor=0.000	Total Headloss=0.355 ft.	Se=0.071067						
9+20.00	3140.00	45.00	2.00	4.933	2.655	133.5	23.51	1326.94	1315.70	1318.35	3.32	2.67	8.14
	n=0.0300	So=0.100000	Sf=0.073190	Headloss	Factor=0.000	Total Headloss=0.366 ft.	Se=0.073169						
9+15.00	3140.00	45.00	2.00	4.933	2.633	132.4	23.72	1326.57	1315.20	1317.83	3.29	2.71	8.19
	n=0.0300	So=0.100000	Sf=0.075151	Headloss	Factor=0.000	Total Headloss=0.376 ft.	Se=0.075118						
9+10.00	3140.00	45.00	2.00	4.933	2.614	131.3	23.92	1326.20	1314.70	1317.31	3.27	2.74	8.23
	n=0.0300	So=0.100000	Sf=0.076978	Headloss	Factor=0.000	Total Headloss=0.385 ft.	Se=0.076965						
9+05.00	3140.00	45.00	2.00	4.933	2.596	130.3	24.10	1325.81	1314.20	1316.80	3.25	2.77	8.26
	n=0.0300	So=0.100000	Sf=0.078679	Headloss	Factor=0.000	Total Headloss=0.393 ft.	Se=0.078658						
9+00.00	3140.00	45.00	2.00	4.933	2.580	129.4	24.26	1325.42	1313.70	1316.28	3.23	2.80	8.30
	n=0.0300	So=0.000000	Sf=0.076502	Headloss	Factor=0.000	Total Headloss=0.383 ft.	Se=0.076493						
8+95.00	3140.00	45.00	2.00	4.933	2.639	132.7	23.67	1325.04	1313.70	1316.34	3.30	2.70	8.18
	n=0.0300	So=0.000000	Sf=0.070930	Headloss	Factor=0.000	Total Headloss=0.355 ft.	Se=0.070916						
8+90.00	3140.00	45.00	2.00	4.933	2.698	135.9	23.10	1324.68	1313.70	1316.40	3.37	2.61	8.06

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.000000	Sf=0.065845	Headloss	Factor=0.000	Total Headloss=0.329 ft.	Se=0.065819						
8+85.00	3140.00	45.00	2.00	4.933	2.757	139.2	22.55	1324.35	1313.70	1316.46	3.45	2.52	7.94
	n=0.0300	So=0.000000	Sf=0.061191	Headloss	Factor=0.000	Total Headloss=0.306 ft.	Se=0.061174						
8+80.00	3140.00	45.00	2.00	4.933	2.816	142.6	22.02	1324.05	1313.70	1316.52	3.52	2.44	7.82
	n=0.0300	So=0.000000	Sf=0.056922	Headloss	Factor=0.000	Total Headloss=0.285 ft.	Se=0.056898						
8+75.00	3140.00	45.00	2.00	4.933	2.876	146.0	21.51	1323.76	1313.70	1316.58	3.59	2.36	7.71
	n=0.0300	So=0.000000	Sf=0.053000	Headloss	Factor=0.000	Total Headloss=0.265 ft.	Se=0.052959						
8+70.00	3140.00	45.00	2.00	4.933	2.936	149.4	21.02	1323.50	1313.70	1316.64	3.67	2.28	7.60

8+65.0	3140.00	45.00	2.00	4.933	2.997	152.8	20.54	1323.25	1313.70	1316.70	3.75	7.49
	n=0.0300	So=0.000000	Sf=0.046050	Headlo	Factor=0.000	Total Headloss=0.230 ft.	Se=0.04					
8+60.00	3140.00	45.00	2.00	4.933	3.059	156.4	20.08	1323.02	1313.70	1316.76	3.82	2.14	7.38

2/15 - DT

POWERLINE DROP

'WASP2' SUPERCRITICAL WATER SURFACE PROFILE

COMPUTED BY: DATE: DATA FILE: R4POWC CHECKED BY: _____ DATE: _____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
10+00.00	2400.00	45.00	2.00	4.173	4.150	221.2	10.85	1329.68	1323.70	1327.85	3.82	1.01	4.21
	n=0.0300	So=0.100000		Sf=0.013124		Headloss Factor=0.000		Total Headloss=0.066 ft.		Se=0.013113			
9+95.00	2400.00	45.00	2.00	4.173	3.276	168.9	14.21	1329.61	1323.20	1326.48	4.09	1.47	5.21
	n=0.0300	So=0.100000		Sf=0.023585		Headloss Factor=0.000		Total Headloss=0.118 ft.		Se=0.023552			
9+90.00	2400.00	45.00	2.00	4.173	3.014	153.8	15.60	1329.49	1322.70	1325.71	3.77	1.67	5.57
	n=0.0300	So=0.100000		Sf=0.030083		Headloss Factor=0.000		Total Headloss=0.150 ft.		Se=0.030036			
9+85.00	2400.00	45.00	2.00	4.173	2.846	144.2	16.64	1329.34	1322.20	1325.05	3.56	1.83	5.83
	n=0.0300	So=0.100000		Sf=0.035836		Headloss Factor=0.000		Total Headloss=0.179 ft.		Se=0.035798			
9+80.00	2400.00	45.00	2.00	4.173	2.722	137.3	17.48	1329.17	1321.70	1324.42	3.40	1.96	6.02
	n=0.0300	So=0.100000		Sf=0.041095		Headloss Factor=0.000		Total Headloss=0.205 ft.		Se=0.041075			
9+75.00	2400.00	45.00	2.00	4.173	2.627	132.0	18.18	1328.96	1321.20	1323.83	3.28	2.08	6.19
	n=0.0300	So=0.100000		Sf=0.045949		Headloss Factor=0.000		Total Headloss=0.230 ft.		Se=0.045914			
9+70.00	2400.00	45.00	2.00	4.173	2.550	127.8	18.79	1328.73	1320.70	1323.25	3.19	2.18	6.32
	n=0.0300	So=0.100000		Sf=0.050444		Headloss Factor=0.000		Total Headloss=0.252 ft.		Se=0.050409			
9+65.00	2400.00	45.00	2.00	4.173	2.487	124.3	19.31	1328.48	1320.20	1322.69	3.11	2.26	6.43
	n=0.0300	So=0.100000		Sf=0.054607		Headloss Factor=0.000		Total Headloss=0.273 ft.		Se=0.054575			
9+60.00	2400.00	45.00	2.00	4.173	2.434	121.4	19.77	1328.21	1319.70	1322.13	3.04	2.34	6.53
	n=0.0300	So=0.100000		Sf=0.058460		Headloss Factor=0.000		Total Headloss=0.292 ft.		Se=0.058439			
9+55.00	2400.00	45.00	2.00	4.173	2.389	118.9	20.18	1327.91	1319.20	1321.59	2.99	2.41	6.62
	n=0.0300	So=0.100000		Sf=0.062021		Headloss Factor=0.000		Total Headloss=0.310 ft.		Se=0.061996			
9+50.00	2400.00	45.00	2.00	4.173	2.351	116.8	20.54	1327.60	1318.70	1321.05	2.94	2.47	6.69

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.100000		Sf=0.065309		Headloss Factor=0.000		Total Headloss=0.327 ft.		Se=0.065289			

	n=0.0300	So=0.100000	Sf=0.068339	Hea ss Factor=0.000	Total Headloss=0.342 ft.	Se=0.[illegible]9						
9+4(	2400.00	45.00	2.00	4.173	2.289	113.	21.15	1326.93	1317.70	1319.99	2.86	6.81
	n=0.0300	So=0.100000	Sf=0.071128	Headloss Factor=0.000	Total Headloss=0.356 ft.	Se=0.071086						
9+35.00	2400.00	45.00	2.00	4.173	2.264	112.1	21.41	1326.58	1317.20	1319.46	2.83	2.62	6.86
	n=0.0300	So=0.100000	Sf=0.073690	Headloss Factor=0.000	Total Headloss=0.368 ft.	Se=0.073677						
9+30.00	2400.00	45.00	2.00	4.173	2.242	110.9	21.64	1326.21	1316.70	1318.94	2.80	2.66	6.91
	n=0.0300	So=0.100000	Sf=0.076039	Headloss Factor=0.000	Total Headloss=0.380 ft.	Se=0.076029						
9+25.00	2400.00	45.00	2.00	4.173	2.222	109.9	21.84	1325.83	1316.20	1318.42	2.78	2.70	6.95
	n=0.0300	So=0.100000	Sf=0.078193	Headloss Factor=0.000	Total Headloss=0.391 ft.	Se=0.078166						
9+20.00	2400.00	45.00	2.00	4.173	2.205	108.9	22.03	1325.44	1315.70	1317.90	2.76	2.73	6.99
	n=0.0300	So=0.100000	Sf=0.080164	Headloss Factor=0.000	Total Headloss=0.401 ft.	Se=0.080154						
9+15.00	2400.00	45.00	2.00	4.173	2.190	108.1	22.20	1325.04	1315.20	1317.39	2.74	2.76	7.02
	n=0.0300	So=0.100000	Sf=0.081966	Headloss Factor=0.000	Total Headloss=0.410 ft.	Se=0.081949						
9+10.00	2400.00	45.00	2.00	4.173	2.176	107.4	22.35	1324.63	1314.70	1316.88	2.72	2.78	7.05
	n=0.0300	So=0.100000	Sf=0.083612	Headloss Factor=0.000	Total Headloss=0.418 ft.	Se=0.083590						
9+05.00	2400.00	45.00	2.00	4.173	2.164	106.8	22.48	1324.21	1314.20	1316.36	2.71	2.81	7.07
	n=0.0300	So=0.100000	Sf=0.085114	Headloss Factor=0.000	Total Headloss=0.426 ft.	Se=0.085095						
9+00.00	2400.00	45.00	2.00	4.173	2.154	106.2	22.60	1323.79	1313.70	1315.85	2.69	2.83	7.10
	n=0.0300	So=0.000000	Sf=0.081800	Headloss Factor=0.000	Total Headloss=0.409 ft.	Se=0.081782						
8+95.00	2400.00	45.00	2.00	4.173	2.215	109.5	21.92	1323.38	1313.70	1315.91	2.77	2.71	6.96
	n=0.0300	So=0.000000	Sf=0.074451	Headloss Factor=0.000	Total Headloss=0.372 ft.	Se=0.074432						
8+90.00	2400.00	45.00	2.00	4.173	2.277	112.8	21.28	1323.00	1313.70	1315.98	2.85	2.60	6.84

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.000000	Sf=0.067892	Headloss Factor=0.000	Total Headloss=0.339 ft.	Se=0.067874							
8+85.00	2400.00	45.00	2.00	4.173	2.339	116.2	20.66	1322.67	1313.70	1316.04	2.92	2.49	6.71
	n=0.0300	So=0.000000	Sf=0.062017	Headloss Factor=0.000	Total Headloss=0.310 ft.	Se=0.061976							
8+80.00	2400.00	45.00	2.00	4.173	2.401	119.6	20.07	1322.36	1313.70	1316.10	3.00	2.39	6.59
	n=0.0300	So=0.000000	Sf=0.056736	Headloss Factor=0.000	Total Headloss=0.284 ft.	Se=0.056701							
8+75.00	2400.00	45.00	2.00	4.173	2.464	123.0	19.51	1322.07	1313.70	1316.16	3.08	2.30	6.47
	n=0.0300	So=0.000000	Sf=0.051972	Headloss Factor=0.000	Total Headloss=0.260 ft.	Se=0.051952							
8+70.00	2400.00	45.00	2.00	4.173	2.528	126.6	18.96	1321.81	1313.70	1316.23	3.16	2.21	6.36

	n=0.0300	So=0.000000	Sf=0.047800	Headloss Factor=0.000	Total Headloss=0.190 ft.	Se=0.047832						
8+65.	2400.00	45.00	2.00	4.173	2.593	130.1	18.44	1321.57	1313.70	1316.29	3.24	6.24
	n=0.0300	So=0.000000	Sf=0.043743	Headloss Factor=0.000	Total Headloss=0.219 ft.	Se=0.043724						
8+60.00	2400.00	45.00	2.00	4.173	2.659	133.8	17.94	1321.36	1313.70	1316.36	3.32	2.04	6.13

185 DT

''WASP2'' SUPERCRITICAL WATER SURFACE PROFILE

POWERLINE DROP

COMPUTED BY: DATE: DATA FILE: R4POWC CHECKED BY: _____ DATE: _____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
10+00.00	600.00	45.00	2.00	1.722	1.700	82.3	7.29	1326.23	1323.70	1325.40	3.32	1.02	1.76
	n=0.0300	So=0.100000	Sf=0.019705	Headloss Factor=0.000	Total Headloss=0.099 ft.	Se=0.019693							
9+95.00	600.00	45.00	2.00	1.722	1.200	56.9	10.55	1326.13	1323.20	1324.40	1.50	1.74	2.37
	n=0.0300	So=0.100000	Sf=0.044977	Headloss Factor=0.000	Total Headloss=0.225 ft.	Se=0.044937							
9+90.00	600.00	45.00	2.00	1.722	1.090	51.4	11.66	1325.90	1322.70	1323.79	1.36	2.01	2.55
	n=0.0300	So=0.100000	Sf=0.058427	Headloss Factor=0.000	Total Headloss=0.292 ft.	Se=0.058385							
9+85.00	600.00	45.00	2.00	1.722	1.030	48.5	12.38	1325.61	1322.20	1323.23	1.29	2.20	2.66
	n=0.0300	So=0.100000	Sf=0.068624	Headloss Factor=0.000	Total Headloss=0.343 ft.	Se=0.068601							
9+80.00	600.00	45.00	2.00	1.722	0.992	46.6	12.88	1325.27	1321.70	1322.69	1.24	2.33	2.73
	n=0.0300	So=0.100000	Sf=0.076412	Headloss Factor=0.000	Total Headloss=0.382 ft.	Se=0.076397							
9+75.00	600.00	45.00	2.00	1.722	0.966	45.3	13.23	1324.89	1321.20	1322.17	1.21	2.42	2.78
	n=0.0300	So=0.100000	Sf=0.082337	Headloss Factor=0.000	Total Headloss=0.412 ft.	Se=0.082288							
9+70.00	600.00	45.00	2.00	1.722	0.948	44.5	13.49	1324.47	1320.70	1321.65	1.19	2.49	2.82
	n=0.0300	So=0.100000	Sf=0.086821	Headloss Factor=0.000	Total Headloss=0.434 ft.	Se=0.086780							
9+65.00	600.00	45.00	2.00	1.722	0.936	43.9	13.68	1324.04	1320.20	1321.14	1.17	2.54	2.85
	n=0.0300	So=0.100000	Sf=0.090195	Headloss Factor=0.000	Total Headloss=0.451 ft.	Se=0.090157							
9+60.00	600.00	45.00	2.00	1.722	0.927	43.4	13.81	1323.59	1319.70	1320.63	1.16	2.58	2.86
	n=0.0300	So=0.100000	Sf=0.092717	Headloss Factor=0.000	Total Headloss=0.464 ft.	Se=0.092709							
9+55.00	600.00	45.00	2.00	1.722	0.921	43.1	13.91	1323.13	1319.20	1320.12	1.15	2.60	2.88
	n=0.0300	So=0.100000	Sf=0.094596	Headloss Factor=0.000	Total Headloss=0.473 ft.	Se=0.094579							
9+50.00	600.00	45.00	2.00	1.722	0.916	42.9	13.98	1322.65	1318.70	1319.62	1.15	2.62	2.89

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.100000	Sf=0.095998	Headloss Factor=0.000	Total Headloss=0.480 ft.	Se=0.095966							

	n=0.0300	So=0.100000	Sf=0.097040	Head	s Factor=0.000	Total Headloss=0.485 ft.			Se=0.097				
9+40.	600.00	45.00	2.00	1.722	0.910	42.6	14.08	1321.69	1317.70	1318.61	1.14		2.90
	n=0.0300	So=0.100000	Sf=0.097811	Headloss	Factor=0.000	Total Headloss=0.489 ft.			Se=0.097795				
9+35.00	600.00	45.00	2.00	1.722	0.908	42.5	14.11	1321.20	1317.20	1318.11	1.14	2.66	2.91
	n=0.0300	So=0.100000	Sf=0.098383	Headloss	Factor=0.000	Total Headloss=0.492 ft.			Se=0.098360				
9+30.00	600.00	45.00	2.00	1.722	0.907	42.5	14.13	1320.71	1316.70	1317.61	1.13	2.66	2.91
	n=0.0300	So=0.100000	Sf=0.098809	Headloss	Factor=0.000	Total Headloss=0.494 ft.			Se=0.098770				
9+25.00	600.00	45.00	2.00	1.722	0.906	42.4	14.15	1320.21	1316.20	1317.11	1.13	2.67	2.91
	n=0.0300	So=0.100000	Sf=0.099128	Headloss	Factor=0.000	Total Headloss=0.496 ft.			Se=0.099089				
9+20.00	600.00	45.00	2.00	1.722	0.905	42.4	14.16	1319.72	1315.70	1316.61	1.13	2.67	2.91
	n=0.0300	So=0.100000	Sf=0.099363	Headloss	Factor=0.000	Total Headloss=0.497 ft.			Se=0.099337				
9+15.00	600.00	45.00	2.00	1.722	0.905	42.4	14.17	1319.22	1315.20	1316.10	1.13	2.67	2.91
	n=0.0300	So=0.100000	Sf=0.099534	Headloss	Factor=0.000	Total Headloss=0.498 ft.			Se=0.099513				
9+10.00	600.00	45.00	2.00	1.722	0.904	42.3	14.17	1318.72	1314.70	1315.60	1.13	2.68	2.91
	n=0.0300	So=0.100000	Sf=0.099660	Headloss	Factor=0.000	Total Headloss=0.498 ft.			Se=0.099627				
9+05.00	600.00	45.00	2.00	1.722	0.904	42.3	14.18	1318.23	1314.20	1315.10	1.13	2.68	2.91
	n=0.0300	So=0.100000	Sf=0.099754	Headloss	Factor=0.000	Total Headloss=0.499 ft.			Se=0.099716				
9+00.00	600.00	45.00	2.00	1.722	0.904	42.3	14.18	1317.73	1313.70	1314.60	1.13	2.68	2.92
	n=0.0300	So=0.000000	Sf=0.085969	Headloss	Factor=0.000	Total Headloss=0.430 ft.			Se=0.085950				
8+95.00	600.00	45.00	2.00	1.722	0.985	46.3	12.97	1317.30	1313.70	1314.68	1.23	2.35	2.75
	n=0.0300	So=0.000000	Sf=0.064968	Headloss	Factor=0.000	Total Headloss=0.325 ft.			Se=0.064935				
8+90.00	600.00	45.00	2.00	1.722	1.069	50.4	11.91	1316.97	1313.70	1314.77	1.34	2.08	2.59

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0300	So=0.000000	Sf=0.049646	Headloss	Factor=0.000	Total Headloss=0.248 ft.			Se=0.049615				
8+85.00	600.00	45.00	2.00	1.722	1.156	54.7	10.97	1316.72	1313.70	1314.86	1.45	1.84	2.44
	n=0.0300	So=0.000000	Sf=0.038084	Headloss	Factor=0.000	Total Headloss=0.190 ft.			Se=0.038063				
8+80.00	600.00	45.00	2.00	1.722	1.251	59.4	10.09	1316.53	1313.70	1314.95	1.56	1.63	2.29
	n=0.0300	So=0.000000	Sf=0.029029	Headloss	Factor=0.000	Total Headloss=0.145 ft.			Se=0.028984				
8+75.00	600.00	45.00	2.00	1.722	1.359	64.8	9.25	1316.39	1313.70	1315.06	1.70	1.44	2.14
	n=0.0300	So=0.000000	Sf=0.021491	Headloss	Factor=0.000	Total Headloss=0.107 ft.			Se=0.021474				
8+70.00	600.00	45.00	2.00	1.722	1.495	71.7	8.36	1316.28	1313.70	1315.19	1.87	1.24	1.97

2/15/ DT

''WASP2'' SUBCRITICAL WATER SURFACE PROFILE

REACH 4 TRANSITION RK CHANNEL INLET

COMPUTED BY: DATE: DATA FILE: R4TRA CHECKED BY: _____ DATE: _____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
5+00.00	6500.00	50.00	2.00	7.280	8.650	582.1	11.17	1326.14	1315.55	1324.20	10.23	0.75	6.04
	n=0.0140		So=0.008215		Sf=0.000772	Headloss Factor=0.100		Total Headloss=0.048 ft.			Se=0.004766		
5+10.00	6500.00	54.44	2.00	6.965	9.014	653.3	9.95	1326.18	1315.63	1324.65	11.12	0.65	5.22
	n=0.0140		So=0.008203		Sf=0.000601	Headloss Factor=0.100		Total Headloss=0.030 ft.			Se=0.002993		
5+20.00	6500.00	58.89	2.00	6.678	9.203	711.3	9.14	1326.21	1315.71	1324.92	11.30	0.59	4.63
	n=0.0140		So=0.008301		Sf=0.000497	Headloss Factor=0.100		Total Headloss=0.022 ft.			Se=0.002188		
5+30.00	6500.00	63.33	2.00	6.417	9.312	763.2	8.52	1326.24	1315.80	1325.11	11.40	0.54	4.15
	n=0.0140		So=0.008191		Sf=0.000425	Headloss Factor=0.100		Total Headloss=0.017 ft.			Se=0.001715		
5+40.00	6500.00	67.78	2.00	6.178	9.377	811.4	8.01	1326.25	1315.88	1325.26	11.45	0.51	3.76
	n=0.0140		So=0.008203		Sf=0.000371	Headloss Factor=0.100		Total Headloss=0.014 ft.			Se=0.001396		
5+50.00	6500.00	72.22	2.00	5.959	9.412	857.0	7.58	1326.27	1315.96	1325.37	11.47	0.48	3.43
	n=0.0140		So=0.008203		Sf=0.000329	Headloss Factor=0.100		Total Headloss=0.012 ft.			Se=0.001165		
5+60.00	6500.00	76.67	2.00	5.757	9.426	900.4	7.22	1326.28	1316.04	1325.47	11.47	0.45	3.15
	n=0.0140		So=0.008301		Sf=0.000295	Headloss Factor=0.100		Total Headloss=0.010 ft.			Se=0.000988		
5+70.00	6500.00	81.11	2.00	5.570	9.423	941.9	6.90	1326.29	1316.13	1325.55	11.46	0.43	2.91
	n=0.0140		So=0.008191		Sf=0.000268	Headloss Factor=0.100		Total Headloss=0.009 ft.			Se=0.000846		
5+80.00	6500.00	85.56	2.00	5.397	9.409	982.0	6.62	1326.30	1316.21	1325.62	11.43	0.41	2.69
	n=0.0140		So=0.008191		Sf=0.000245	Headloss Factor=0.100		Total Headloss=0.008 ft.			Se=0.000749		
5+90.00	6500.00	90.00	2.00	5.236	9.385	1020.8	6.37	1326.30	1316.29	1325.67	11.39	0.40	2.51
	n=0.0140		So=0.008215		Sf=0.000226	Headloss Factor=0.100		Total Headloss=0.007 ft.			Se=0.000658		
6+00.00	6500.00	94.44	2.00	5.086	9.353	1058.3	6.14	1326.31	1316.37	1325.73	11.34	0.38	2.34

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140		So=0.008203		Sf=0.000210	Headloss Factor=0.100		Total Headloss=0.006 ft.			Se=0.000590		

	n=0.0140		So=0.008301		Sf=0.000196	Head	s Factor=0.100		Total Headloss=0.005 ft.		Se=0.000		
6+20.	6500.00	103.33	2.00	4.814	9.272	1130.0	5.75	1326.32	1316.54	1325.81	11.23		2.06
	n=0.0140		So=0.008191		Sf=0.000184	Headloss	Factor=0.100		Total Headloss=0.005 ft.		Se=0.000482		
6+30.00	6500.00	107.78	2.00	4.691	9.224	1164.4	5.58	1326.33	1316.62	1325.84	11.17	0.35	1.95
	n=0.0140		So=0.008203		Sf=0.000173	Headloss	Factor=0.100		Total Headloss=0.004 ft.		Se=0.000432		
6+40.00	6500.00	112.22	2.00	4.575	9.173	1197.8	5.43	1326.33	1316.70	1325.87	11.10	0.34	1.84
	n=0.0140		So=0.008203		Sf=0.000164	Headloss	Factor=0.100		Total Headloss=0.004 ft.		Se=0.000395		
6+50.00	6500.00	116.67	2.00	4.466	9.119	1230.2	5.28	1326.34	1316.78	1325.90	11.03	0.33	1.75
	n=0.0140		So=0.008301		Sf=0.000156	Headloss	Factor=0.100		Total Headloss=0.004 ft.		Se=0.000360		
6+60.00	6500.00	121.11	2.00	4.363	9.061	1261.6	5.15	1326.34	1316.87	1325.93	10.96	0.32	1.66
	n=0.0140		So=0.008191		Sf=0.000149	Headloss	Factor=0.100		Total Headloss=0.003 ft.		Se=0.000341		
6+70.00	6500.00	125.56	2.00	4.266	9.002	1292.3	5.03	1326.34	1316.95	1325.95	10.88	0.31	1.58
	n=0.0140		So=0.008203		Sf=0.000142	Headloss	Factor=0.100		Total Headloss=0.003 ft.		Se=0.000312		
6+80.00	6500.00	130.00	2.00	4.173	8.941	1322.2	4.92	1326.35	1317.03	1325.97	10.80	0.31	1.51
	n=0.0140		So=0.008203		Sf=0.000136	Headloss	Factor=0.100		Total Headloss=0.003 ft.		Se=0.000283		
6+90.00	6500.00	134.44	2.00	4.086	8.877	1351.2	4.81	1326.35	1317.11	1325.99	10.72	0.30	1.45
	n=0.0140		So=0.008203		Sf=0.000131	Headloss	Factor=0.100		Total Headloss=0.003 ft.		Se=0.000277		
7+00.00	6500.00	138.89	2.00	4.003	8.813	1379.3	4.71	1326.35	1317.19	1326.01	10.64	0.30	1.39
	n=0.0140		So=0.008301		Sf=0.000127	Headloss	Factor=0.100		Total Headloss=0.003 ft.		Se=0.000252		
7+10.00	6500.00	143.33	2.00	3.923	8.746	1406.5	4.62	1326.35	1317.28	1326.02	10.56	0.29	1.33
	n=0.0140		So=0.008191		Sf=0.000122	Headloss	Factor=0.100		Total Headloss=0.002 ft.		Se=0.000241		
7+20.00	6500.00	147.78	2.00	3.848	8.678	1433.1	4.54	1326.36	1317.36	1326.04	10.48	0.29	1.28

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
	n=0.0140		So=0.008203		Sf=0.000120	Headloss	Factor=0.100		Total Headloss=0.001 ft.		Se=0.000236		
7+25.00	6500.00	150.00	2.00	3.811	8.644	1446.1	4.49	1326.36	1317.40	1326.04	10.44	0.28	1.26

• J ERLINE DROP
2/21/ MIN TAILWATER

''WASP2''SUBCRITICAL WATER SURFACE PROFILE

approx dept
@ RWCD
w/ Q = 3140

COMPUTED BY: DATE: DATA FILE: R4POWUS CHECKED BY:_____ DATE:_____

STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
1+74.00	3140.00	80.00	3.00	3.470	5.700	553.5	5.67	1323.60	1317.40	1323.10	10.54	0.45	1.89
	n=0.0300	So=0.001724		Sf=0.001635	Headloss Factor=0.000		Total Headloss=0.041 ft.		Se=0.001633				
1+99.00	3140.00	80.00	3.00	3.470	5.697	553.2	5.68	1323.64	1317.44	1323.14	6.94	0.45	1.89
	n=0.0300	So=0.001680		Sf=0.001638	Headloss Factor=0.000		Total Headloss=0.041 ft.		Se=0.001634				
2+24.00	3140.00	80.00	3.00	3.470	5.696	553.0	5.68	1323.68	1317.49	1323.18	6.94	0.45	1.90
	n=0.0300	So=0.001719		Sf=0.001639	Headloss Factor=0.000		Total Headloss=0.041 ft.		Se=0.001637				
2+49.00	3140.00	80.00	3.00	3.470	5.693	552.7	5.68	1323.72	1317.53	1323.22	6.93	0.45	1.90
	n=0.0300	So=0.001675		Sf=0.001641	Headloss Factor=0.000		Total Headloss=0.041 ft.		Se=0.001636				
2+74.00	3140.00	80.00	3.00	3.470	5.692	552.6	5.68	1323.76	1317.57	1323.26	6.93	0.46	1.90
	n=0.0300	So=0.001724		Sf=0.001643	Headloss Factor=0.000		Total Headloss=0.041 ft.		Se=0.001642				
2+99.00	3140.00	80.00	3.00	3.470	5.690	552.3	5.69	1323.80	1317.61	1323.30	6.93	0.46	1.90
	n=0.0300	So=0.001668		Sf=0.001645	Headloss Factor=0.000		Total Headloss=0.025 ft.		Se=0.001643				
3+14.00	3140.00	80.00	3.00	3.470	5.689	552.3	5.69	1323.83	1317.64	1323.33	6.93	0.46	1.90

Rock RR full side inlet

WERLINE DROP
2/2005 MAX TAILWATER

Depth at RWCD from JCT Analysis

''WASP2''SUBCRITICAL WATER SURFACE PROFILE

COMPUTED BY: DATE: DATA FILE: R4POWUS CHECKED BY:_____ DATE:_____

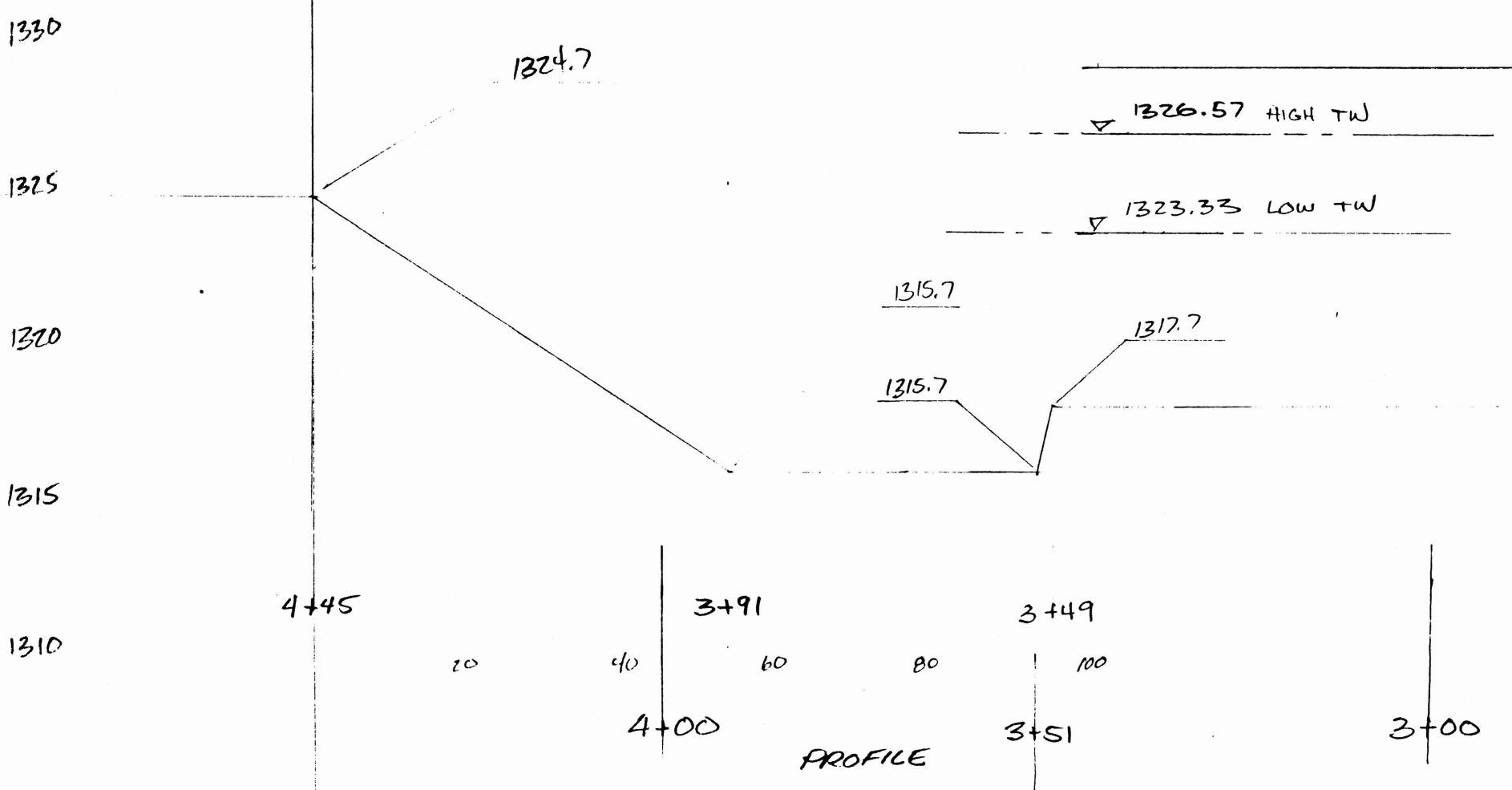
STATION	Q	B	Z	Dc	DEPTH	AREA	VELOC	E.G.L	INV EL	W.S.EL	FREE BOARD	FROUDE NUMBER	SEQUENT DEPTH
1+74.00	3140.00	80.00	3.00	3.470	8.950	956.3	3.28	1326.52	1317.40	1326.35	0.00	0.22	0.88
	n=0.0300	So=0.001724		Sf=0.000331		Headloss Factor=0.000		Total Headloss=0.008 ft.		Se=0.000328			
1+99.00	3140.00	80.00	3.00	3.470	8.913	951.4	3.30	1326.53	1317.44	1326.36	10.73	0.22	0.89
	n=0.0300	So=0.001680		Sf=0.000335		Headloss Factor=0.000		Total Headloss=0.008 ft.		Se=0.000337			
2+24.00	3140.00	80.00	3.00	3.470	8.878	946.7	3.32	1326.53	1317.49	1326.36	10.69	0.22	0.89
	n=0.0300	So=0.001719		Sf=0.000340		Headloss Factor=0.000		Total Headloss=0.009 ft.		Se=0.000338			
2+49.00	3140.00	80.00	3.00	3.470	8.842	941.9	3.33	1326.54	1317.53	1326.37	10.64	0.22	0.90
	n=0.0300	So=0.001675		Sf=0.000345		Headloss Factor=0.000		Total Headloss=0.009 ft.		Se=0.000346			
2+74.00	3140.00	80.00	3.00	3.470	8.807	937.3	3.35	1326.55	1317.57	1326.38	10.60	0.22	0.91
	n=0.0300	So=0.001724		Sf=0.000350		Headloss Factor=0.000		Total Headloss=0.009 ft.		Se=0.000351			
2+99.00	3140.00	80.00	3.00	3.470	8.771	932.5	3.37	1326.56	1317.61	1326.38	10.56	0.22	0.91
	n=0.0300	So=0.001668		Sf=0.000354		Headloss Factor=0.000		Total Headloss=0.005 ft.		Se=0.000351			
3+14.00	3140.00	80.00	3.00	3.470	8.750	929.7	3.38	1326.57	1317.64	1326.39	10.54	0.22	0.92

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

RWCD REACH 4
ARIZONA
WILLIAMS-CHANNEL.WP

DT 2/21/95

POWERLINE DROP



RWCD REACH 4	2/21/85	POWERLINE DROP

WSP US FROM CREST

STA	INV. EL	S	b	z	d	V
4445	1324.7	0.00296	45	2	4.95	11.6
50			46		5.45	10.1
55			46		5.50	10.0
60			50			8.6
65			60			6.8
70	1324.77	0.00296	60	2	6.34	6.8
700	1326.45	"	60	2	6.11	7.12

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 380 200 SHEETS 5 SQUARE
NATIONAL

ARIZONA RWCD R4 WILLIAMS CHANDLER	DT 1/21/85	POWERLINE DROP

BASIN LENGTH

FROUDE # ≈ 3.0

FROM CHOW p 398 FIG 15-4.

$\frac{L}{y_2} \approx 5.3$

$y_2 \approx 7.0$

THUS $L \approx 7.0 \times 5.3 = 37$ FT

USE $L = 40$ FT

BASIN DEPTH

- SOME DROPS HAVE PERFORMED WELL WITH BASIN RECESSED = D_1
- ALSO CHECK THAT $T_W \geq$ SEQUENT DEPTH FOR WORST CASE.

- $D_1 \approx 2.0$ FT $y_2 = 7$ FT
- MIN $T_W \approx 5.9$ FT
- USE 2.0 FT RECESS

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

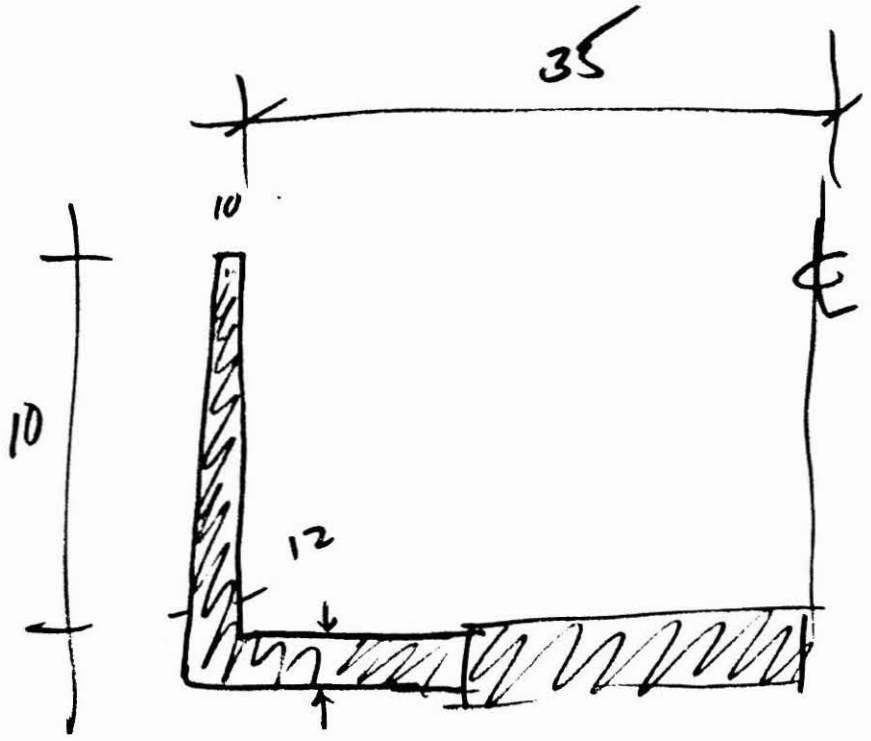
NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

AE12 RUCD R4

3/B/E5 DT

R/C LININGS: APPROX COST COMP.

3,485,000
+ 825,000



$V/ft = \frac{2(46)}{27} = 3.407$

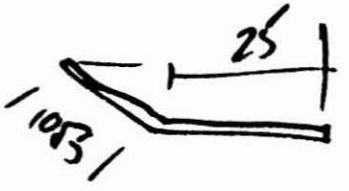
cost/yd = 200

≈ #681/ft

FOR RECTANGULAR LINING

6°57'52"

TRAP LINING

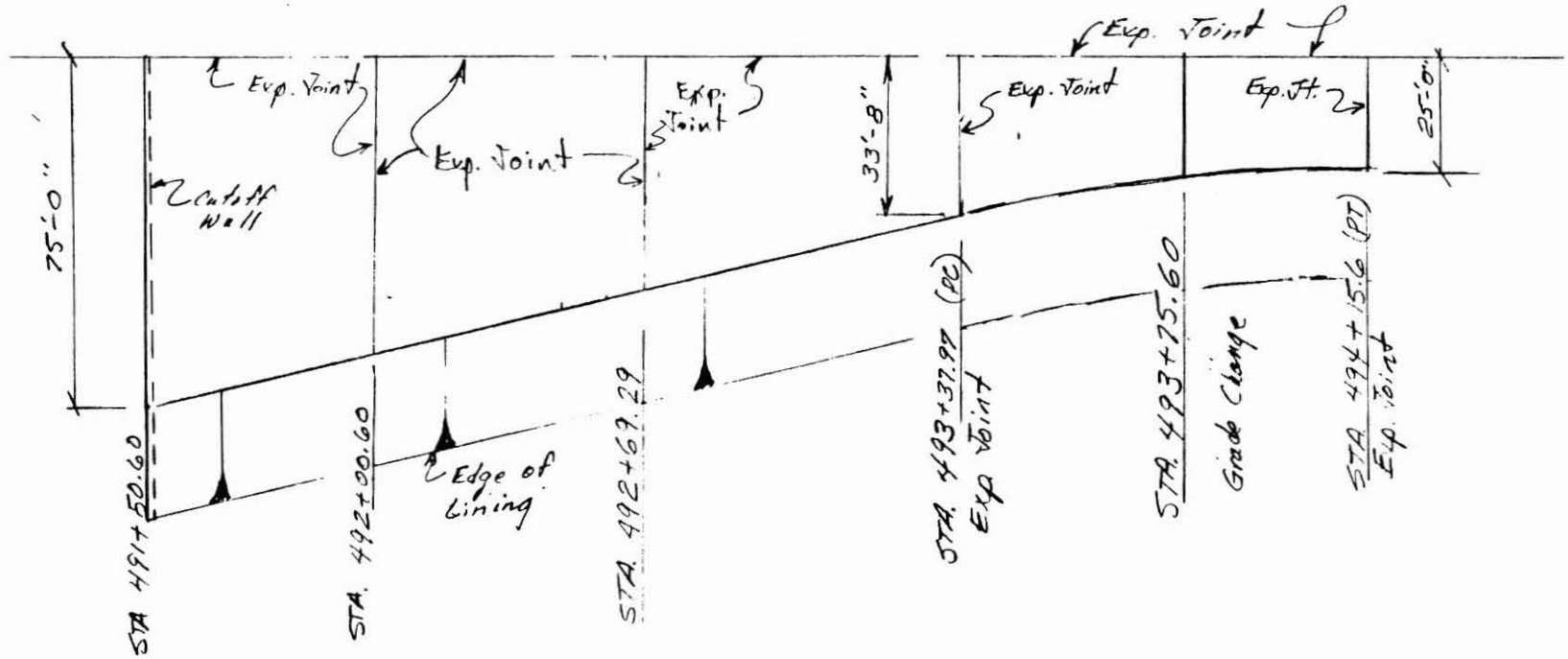


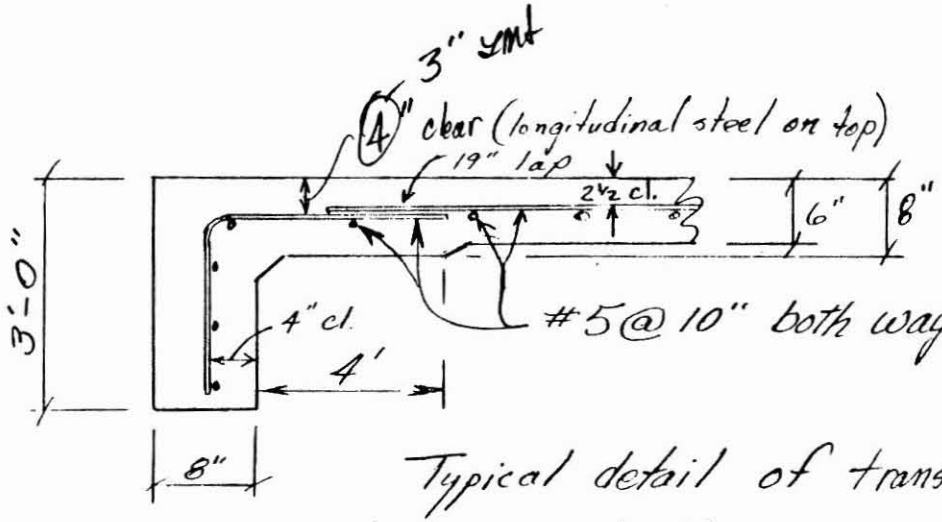
$V = \frac{2(\frac{1}{2}(105+25)}{27} = 8.02$ cy

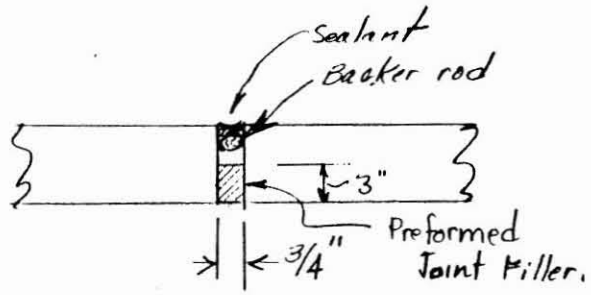
x 200

#165/ft

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL







Typical detail of transition reinforcement at Cut off —— STA. 491+50.60

SECT A-A
SEE SHT. 5

R/C Lining (cont. from design comps by D.T.)

STRUCTURAL DESIGN:

1. Minimum section thickness per FWS = 6 inches
2. Subgrade soils:

   ℄ STA. 491+00 to ℄ STA 552+00 Logs indicate CL, SC, SM & SP (mostly CL & SC).

   Conclusion: Slab on strong foundation, no significant structural loading due to found. conditions.

3. Structural loading on channel lining will be limited to effects of expansion and contraction from temperature change.
4. Evaluate design for continuous lining and for independent sections.

ACI Journal June 1972

Continuous lining

Measurements of highway pavements (continuous) with 0.6% longitudinal reinforcement showed crack widths up to 0.031 inches.

$A_s = (0.006)(6)(12) = 0.43$ "/ft for 6" Thick.

$W_c = (0.031)(25.4\ mm/in) = 0.79$ mm

Crack width is sufficient to allow deposition of sand size particles. This could lead to eventual buckling of concrete. Not recommended!

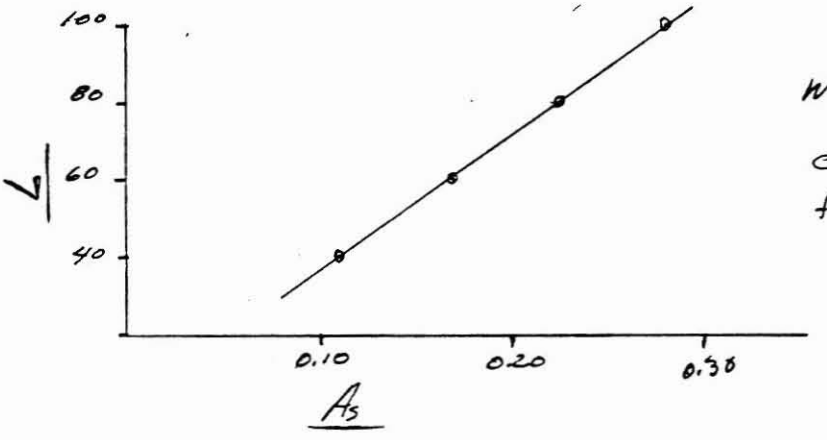
Reduced crack width will require increased concrete to steel ratio. Since 0.6% is equivalent to #6 bars at 12 inches it does not appear practical for added reinforcement and an alternate method of design should be investigated.

R/C Lining non-continuous

FWS 1. Determine reinforcement required by subgrade drag theory for temp & shrinkage

$$A_s = \frac{W\,c\,L}{2\,f_s}$$

L = effective length between joints
c = coefficient of friction slab & subgrade
W = Unit weight of concrete
f_s = Allowable steel stress



$W = (6)(12)(150) = 75$

$c = 1.5$

$f_s = 20{,}000$

Transverse length = $50 + (24.9)(2) \simeq 100'$

A_s (for transverse reinforcement) = 0.281 "

2. Determine reinforcement required by T&S criteria

T&S Single grid of reinforcement
$L > 30'$

TR-67 steel-concrete ratio $P_t = 0.005$

$A_s = (6)(12)(.005) = 0.36$ "

3. Use #5 @ 12" single grid, both directions. This will provide $A_s = 0.31$ " which exceeds area required by subgrade drag Theory.
Provide Transverse expansion joints @ 100'

There are no structural loads anticipated on the channel lining. It will be important however to minimize temp. and shrinkage cracking. This channel is in the same location as the Powerline Canal which experienced structural problems because of cracking.

The engineering investigation for Powerline concludes probable cause as fine grained soils in cracks resulting in high compressive forces during temperature expansion.

SCS criteria for T&S requires a steel to concrete ratio as follows:

TR-67 p-41

		P_t (L<30')	P_t (L>30')
Reinforcement in both faces	Exposed	0.002	0.003
	Unexposed	0.001	0.002
Single grid reinforcement		0.003	0.005

Spacing Maximum $3t = (3)(6) = 18"$

EDS-FW2 Area of reinforcement by Subgrade Drag

$$A_s f_s = w \frac{L}{2} F$$

$F = 1.5$ coefficient subgrade friction
L = length between joints
w = weight of slab (unit)

For $\underline{L = 100'}$ (both long. & transverse)

$$A_s f_s = (75)\left(\frac{100}{2}\right)(1.5) = \underline{5625} \text{ lbs/ft}$$

Check thickness of concrete needed to limit tensile stress of concrete (f_c) to 200 psi. [$f_c \leq 0.05 f_c'$]

Reference
PCA – "Circular Conc. Tanks"

$f_c = \frac{CE_s A_s + T}{A_c + nA_s}$ = concrete tensile stress

$A_c = (12)(t)$ t = thickness

T = Tension load = $A_s f_s$ from subgrade drag = 5625

$E_s = 30 \times 10^6$ $C = 0.0011$ 0% R.H.
$f_s = 20{,}000$ $C = 0.0005$ 85% R.H.
$n = 10$

$$t = \frac{C E_s + f_s - n f_c}{12 f_c f_s}(T)$$

Use $C = 0.001$ long term, dry

$$t = \left[\frac{(0.001)(30 \times 10^6) + 20{,}000 - 10(200)}{(12)(200)(20{,}000)}\right][5625]$$

$t = (0.0010)(5625) = 5.63$ inches

$5.63 < 6''$ ∴ Slab thickness OK

$A_s = \frac{5625}{20{,}000} = 0.28\ in^2$

T & S criteria $\rho = .005$ $A_s = 0.36\ in^2$

Therefore Use $A_s = \underline{0.36\ in^2}$
for $L = 100$ ft between joints

Reinforcement layout

$A_s = 0.36$ " Single grid, Both directions

Important factors to control shrinkage cracks of concrete.

1. Minimize water content (low slump)
   a) larger aggregate
   b) Keep temp down during placement
2. Steel placement close to surface
3. Provide curing compound to retard surface water loss.
4. Close spac reinforcement

Size	Spacing	A_s
#4	6"	0.39
#4	7½	0.31
#5	10	0.37
#5	12	0.31

Use ⟹ Appears that #5 @ 10" will provide the most favorable layout for ease of construction and crack control.

Placement temp – < 90°F Covered under Std. SCS spec's.

Use low water-cement ratio

Check with John Sullivan for E-3 mix.

Place longitudinal bar closest to top face (2½" clear*)

* Compromise between flexural strength and cracking control.

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 383 200 SHEETS 5 SQUARE
NATIONAL

Joint design:

Butt joints at 100 foot intervals

Check thermal expansion:

$C_t \approx 6 \times 10^{-6}$ / in/in/°F

Temp. variation

Concrete ⇒ low 25° F
high 135° F

$\Delta t = 110°$ F

$\Delta l_j = (l)(\Delta t)(C_t)$

$= (100)(12)(110)(6 \times 10^{-6})$

$\Delta l_j = 0.792$ inches / 100 foot length

Provide minimum joint opening 0.75 in

Joint seal:

Requirements

1. Must remain flexible
2. Withstand high temp. = 135° F
3. Water proof
4. Service life = 20 year(?)

Maintenance ⟹

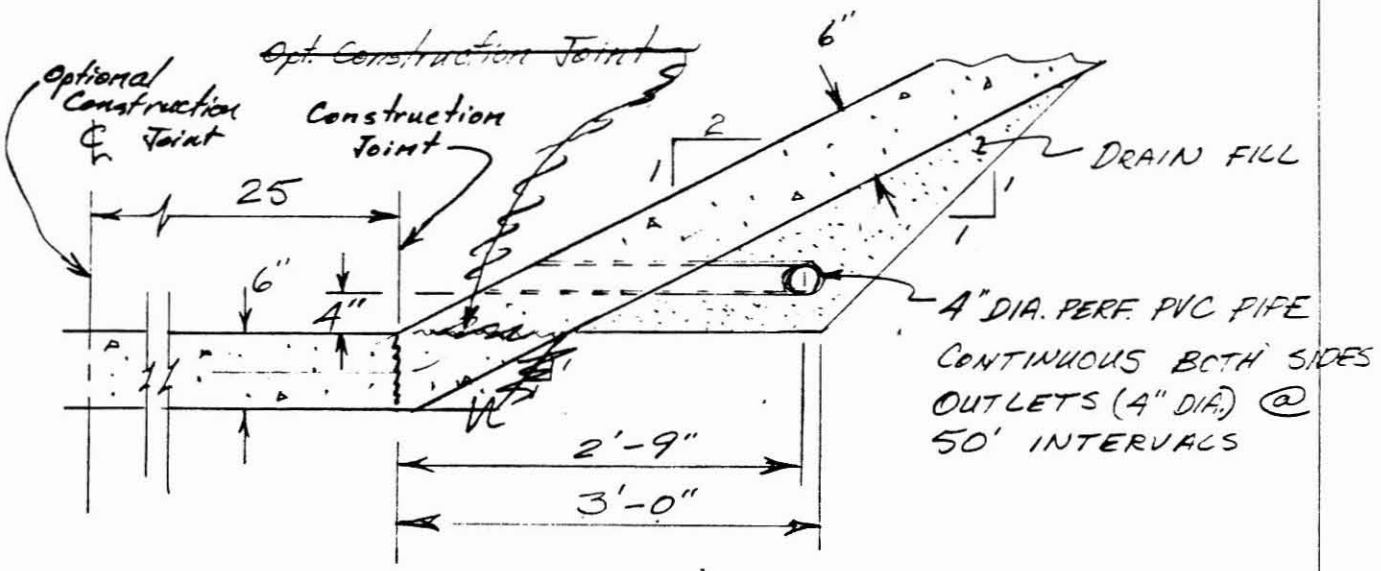
Design

1. Placement (temp. of concrete) 50° F low
90° F high

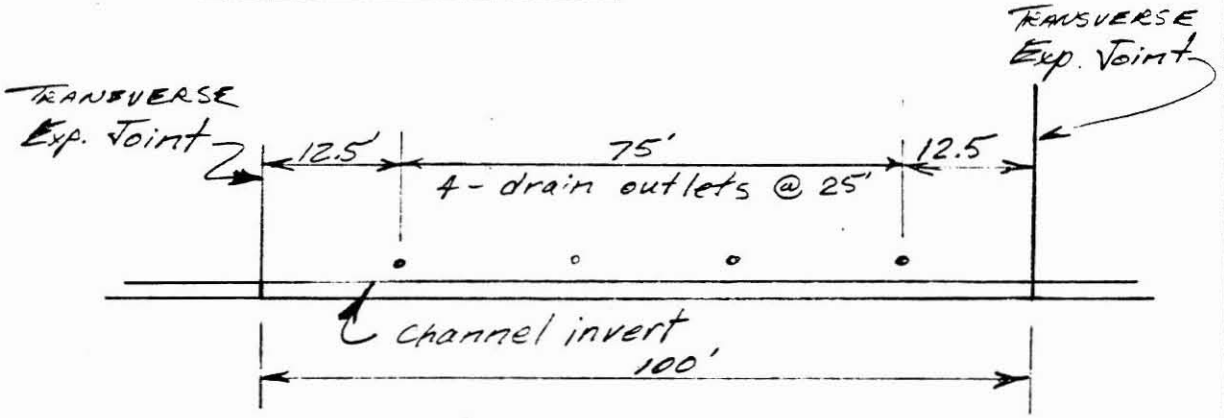
Specifications

2. Joint movement
Concrete @ 50°
$\Delta t = 135 - 50 = 85°$
$\Delta l_j = (85)(100)(12)(6 \times 10^{-6}) = 0.612$ in

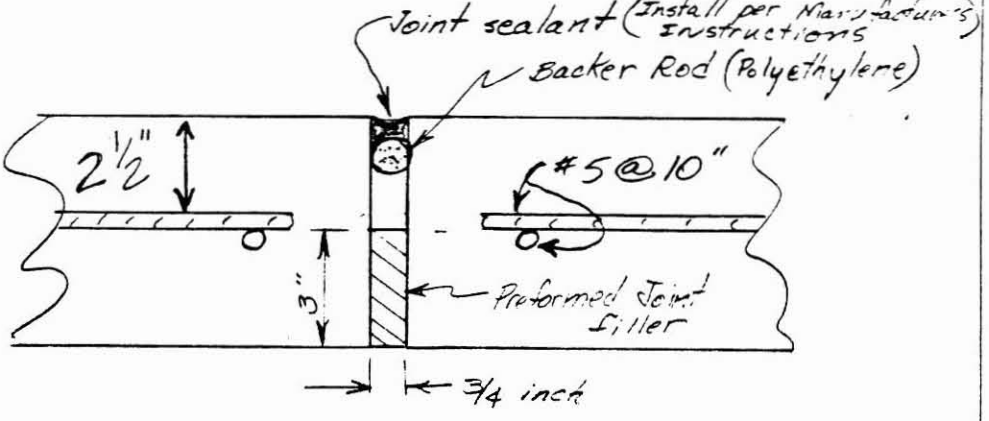
DETAIL OF R/C LINING DRAIN SYSTEM



CROSS SECTION



PROFILE (NTS)



TRANSVERSE EXPANSION - CONTRACTION JOINT

ARIZONA RWCD REACH 4 | 5/6/05 ✓ | SUMMARY: - HYDRAULIC DESIGN LINED CHANNEL

SUMMARY: DESIGN DEPTH OF R/C LINED CHANNEL.

- A DESIGN DEPTH, INCLUDING FREEBOARD, OF 11FT WAS ARRIVED AT THROUGH VARIOUS EVOLUTIONS OF THE DESIGN.
  IT WAS DESIRED TO USE A UNIFORM LINING DEPTH IF POSSIBLE. ✓

- MAX FLOW DEPTH IS 8.87 ft AT THE UPSTREAM SIDE OF WILLIAMS FIELD ROAD. ✓

- **SUPERELEVATION:**

  (A) — CURVE #4 (D.S. OF WMS FLD RD) R = 961.12, d = 8.87
  FIND SUPER PER TR25 S = 0.16 ft ✓

  (B) — CURVE #5 (D.S. OF WMS FLDRD) R = 480.53 d = 8.70
  FIND SUPER PER TR25 S = 0.34 ft ✓

  (C) — CURVE #2 D.S. OF JCT R = 488.66 d = 8.65
  SUPER S = 0.35 ✓

- FREEBOARD:

LOCATION	d (ft)	S (ft)	FBD $\left(\frac{11-(d+S)}{d+S}\right)100$	$\frac{V^2}{2g}$ (ft)	std $+\frac{V^2}{2g}$	FBD $\left(\frac{11-(d+S+\frac{V^2}{2g})}{d+S+\frac{V^2}{2g}}\right)100$
A	8.87	0.16	22%	1.91	10.94	0.5%
B	8.70	0.34	22	1.82	10.86	1.3%
C	8.65	0.35	22	1.94	10.94	0.5%

- **CONCLUSION:**

  - THE FREEBOARD PROVIDED BY THE 11FT DEEP TRAPEZOIDAL CHANNEL IS GREATER THAN 20% FOR ALL CRITICAL LOCATIONS. YMA

  - THE 11 FT DEPTH IS GREATER THAN DEPTH PLUS SUPERELEVATION PLUS VELOCITY HEAD AT ALL LOCATIONS. YMA

ARIZONA
DT 11/15/85
SUPERELEVATION

RWCD REACH 4

Summary:

Q = 6500
D = 50
z = 2

n = 0.012

R_c	Slope	TR 25	CHOW 16-13
480.53	0.0009	0.43	0.34
	0.0010	0.45	0.35
	0.0011	0.48	0.38

S = 0.0009

APPROX. DEPTH 7.94
0.46
8.42
1.20
10.10

Revised

USE 10.0'

SEE 11/24/ Comp. ALSO FOR n = 0.014

ARIZ. ROCD FLOODWAY ECH 4

DT 1/9/84 JMT 3/85

SUPERELEVATION -

SUPERELEVATION

TR25 p5-4

$$S = \frac{V^2(b+2zd)}{2(gR-2zV^2)}$$

max 1ft

$b = 50$
$z = 2$
$g = 32.16$

$A = bd + zd^2$

R = Radius of curvature
$V = Q/A$

BASIC PROGRAM

- ENTER Q, b, z
- FOR VARIOUS d
- FIND V AND S
- PRINT ALL

DTSUPER

```
10  REM ** TR 25 / SUPERELEVATION
15  G = 32.16
20  CLS
30  INPUT "ENTER Q, b, z"; Q, b, z
40  INPUT "ENTER DEPTH"
50  REM
60  A = B*D + Z*D*D


90  V = Q/A
100 S = V*V*(B + 2*Z*D)/(2*(G*R - 2*Z*V*V))

45  LPRINT TAB(5) "Q" TAB(15) "B" TAB(25) "Z" TAB(35) "d"
        TAB(45) "V" TAB(55) "S"

110 LPRINT Q, B, Z, D, V, S

120 GOTO 40
```

ARIZONA RWCD FLOODWAY REACH
DT 1/14/85
SUPERELEVATION

SUPERELEVATION

→ CHECK BY CHOW EQN 16-13

$$\Delta h = \frac{V_{max}^2}{g}\left[\frac{20}{3}\frac{r_c}{b} - 16\frac{r_c^3}{b^3} + \left(\frac{4r_c^2}{b^2}-1\right)^2 \ln\frac{2r_c+b}{2r_c-b}\right]$$

FOR TRAP. CHANNEL

use $b' = b + zd$

EXAMPLE: $B = 50 \quad D = 8.51$
$Z = 2$
$R = 480.53$
$B' = 50 + 2(8.51)$
$= 67.02$

$V = 11.397$

$$\Delta h = \frac{(11.397)^2}{32.16}\left(\frac{20}{3}\left(\frac{480.53}{67.02}\right) - 16\left(\frac{480.53}{67.02}\right)^3 + \left(4\left(\frac{480.53}{67.02}\right)^2 - 1\right)^2 \ln\left(\frac{2(480.53)+67.0}{2(480.53-67.0}\right)\right.$$

$$= 4.0389\left(47.80 - 5897.5 + (41,875)(0.1397)\right)$$

$$= 4.0389(47.80 - 5897.50 + 5849.84)$$

$$= 4.0389(0.07445)$$

$$\Delta h = 0.30068$$

ARIZ RWCD FLOODWAY REACH 4

DT 11/4/04 JMK 3/05

SUPERELEVATION

SUPERELEVATION

$$\Delta h = \frac{V_z^2 b}{g r_c}$$ (Flow 16-11)

Use $b' = 67.02$

$V_z = 11.3967$

$r_c = 480.53$

$$= \frac{(11.3967)^2 (67.02)}{32.16 (480.53)}$$

$$= 0.56$$

TRY $d = 7.16$

$V = 11.11$

$b' = 60 + 2(7.16) = 64.32$

$$\Delta h = \frac{(11.11)^2 (64.32)}{32.16 (480.53)} = 0.53'$$

ARIZ. RWCD FLOOD WAY R4

DT 1/10/05 MF

SUPERELEVATION

TR 25

EXAMPLE:

$Q = 6500$ $V = 11.40$

$B = 50$

$Z = 2$

$D = 8.51$

$R_c = 961.12$

$$S = \frac{V^2(b+2zd)}{2(gR - 2zV^2)} * = \frac{11.40^2(50+2(2)8.51)}{2(32.16(961.12) - 2(2)(11.40)^2)}$$

$= 0.180$

* TR25 & FARWEST STATES DES. STDS p6-8

* 5/6/05

$Q = 6500$, $b = 30$, $z = 2$

CURVE	R	d	V	S	$\frac{V^2}{2g}$
2	488.66	8.65	11.17	0.35	1.94
# ~~3~~	~~1645.13~~				
4	961.12	8.87	10.82	0.16	1.82
5	480.53	8.70	11.08	0.34	1.91
~~3~~	~~4980~~			NOG	NA

DRAIN FILL, floodway R/c Lining

BASE MATERIALS (See gradations sheet 2)

d_{85} ⇒ .08 mm to 8.0 mm

USCS classification

CL d_{85} ⇒ 0.08 to 0.105 mm

SM d_{85} ⇒ 0.5 mm to > 1/4"

SM material without cementation is probably more erodiable than CL's under the sudden wetting that will occur in this floodway. The F2 filter from Az. MAG. spec's appears to be a good choice for meeting general criteria for filtering of the finer CL material and providing a permeability greater than all base materials sampled.

MAG – F2

GRADATION

Sieve Size	% PASSING
3/4	100
3/8	80 – 100
No 4	60 – 85
No 8	45 – 70
No 16	30 – 55
" 30	15 – 40
" 50	5 – 20
" 100	0 – 10
" 200	0 – 5

This gradation satisfactory for perforated pipe with 1/4" holes.

Form SCS 130
5-65

MATERIALS TESTING REPORT | **U.S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**

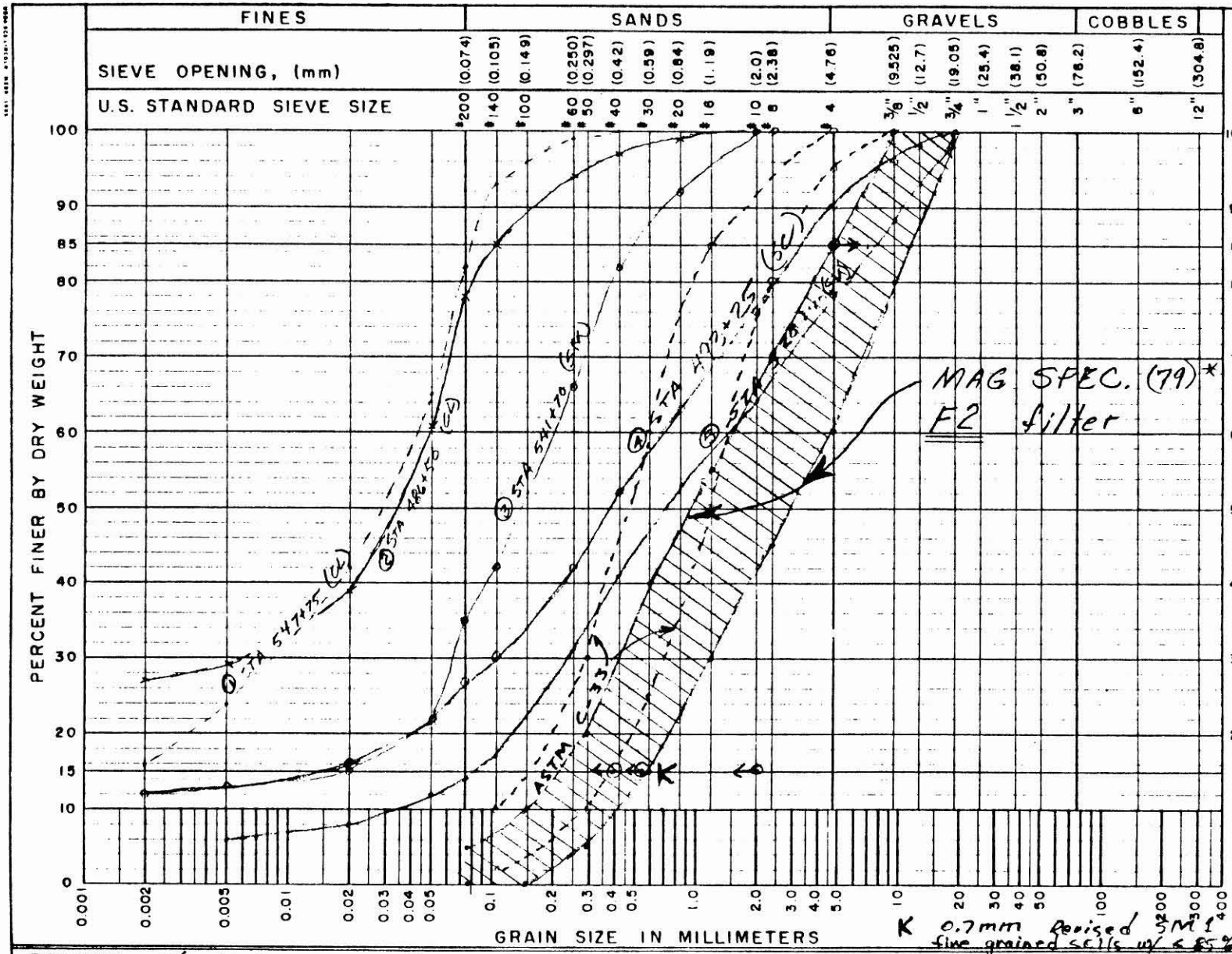
DRAIN MATERIALS

PROJECT and STATE: RUCD R-2, AZ.

DESIGNED AT: Lwls

BY: 3/20/85

DATE



K 0.7mm revised 5th ed for fine grained soils w/ ≤ 85% passing #200.

* Maricopa Association of Gov., AZ.

REMARKS R/C Lining STA. 495+00± to 550+10±

Perforated drain pipe — 1/4" dia. holes

Min. d_{85} = 0.08 mm (Sample ①.) ∴ $D_{15} = (5)(.08) = 0.4$ mm

$C_u = \frac{D_{60}}{D_{10}} = \frac{4.76}{.15} = 31$

$d_{85} = 0.11$ (sample ②) $D_{15} = (5)(.11) = 0.55$ mm

$d_{85} = 0.5$ (sample ③) $D_{15} = (4)(.5) = 2.0$ mm

Sht. 2

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

BEGIN R/C Lining Transition STA. 491+50.60
b = 150'
El = 1317.40

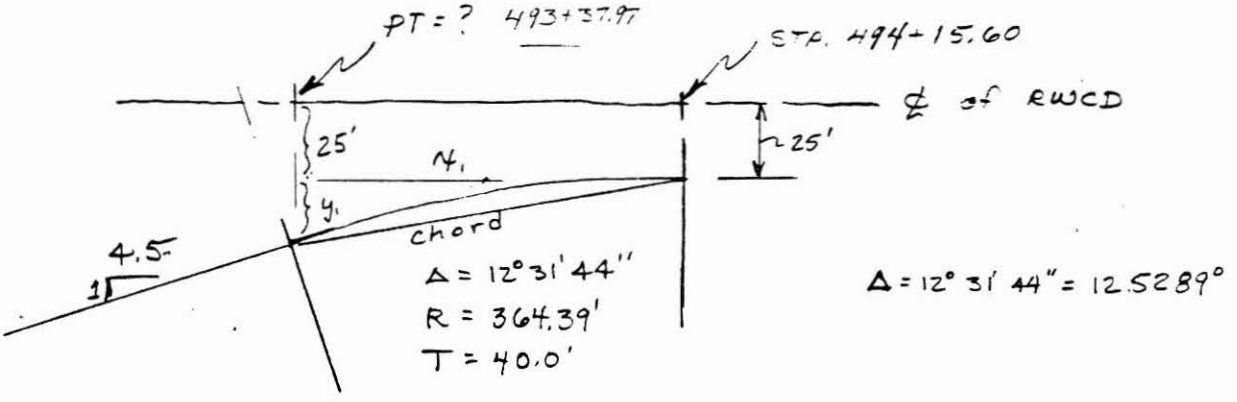
End Transition STA. 494+15.60
b = 50'
El = 1315.53

Begin transition STA. 551+00
b = 50'
El =

End R/C Lining STA 552+00
b = 60'
El =

Determine point of tangency for curve upstream of STA. 493+25.6

Length of Chord = $2r \sin\frac{\Delta}{2}$ = 79.523

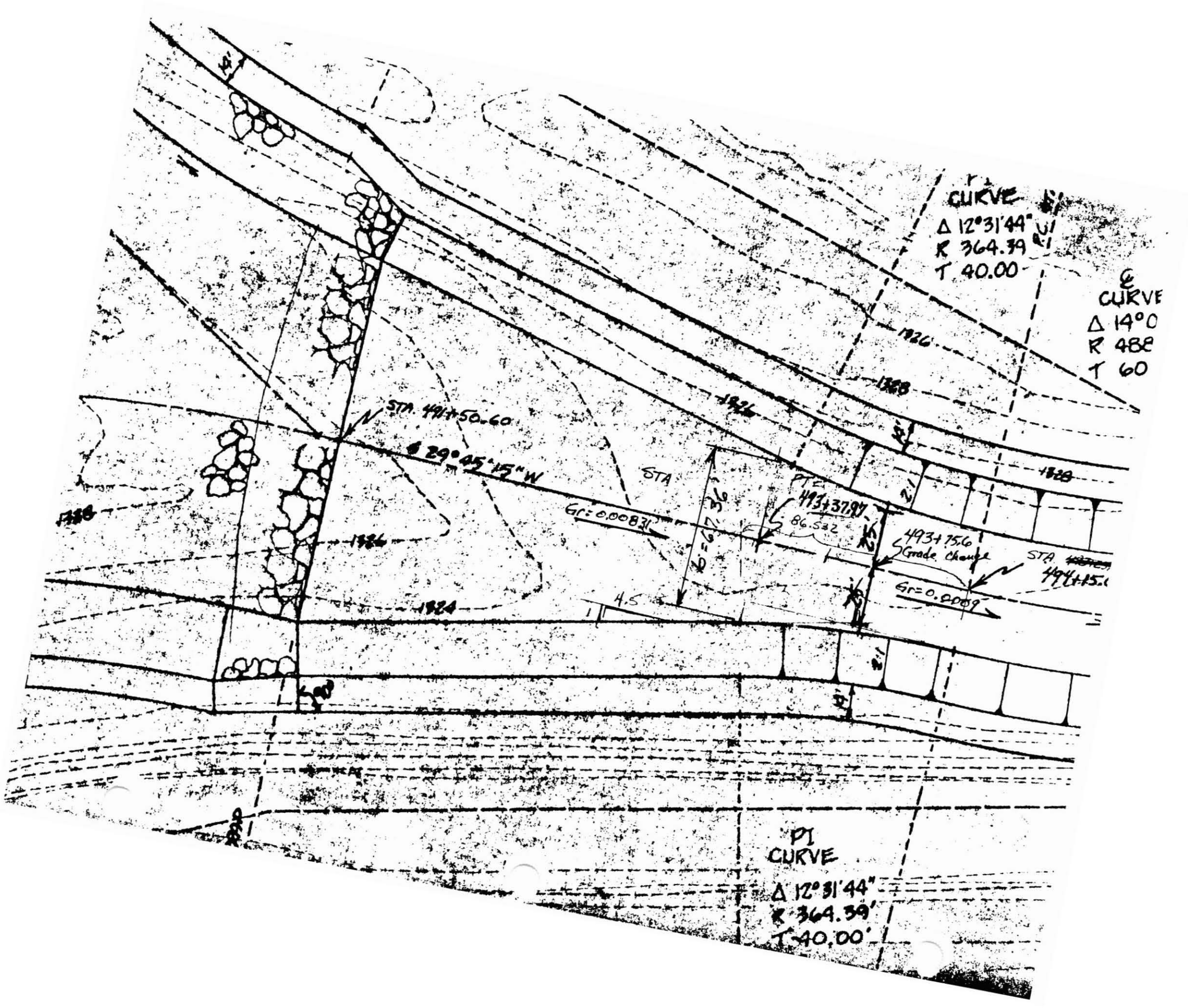


$y_1 = (\sin\frac{\Delta}{2})(\text{chord}) = 8.677'$

$x_1 = (\cos\Delta)(\text{chord}) = 77.629'$

PT = 494 L5.60 − 77.629 = <u>493+37.97</u>

$b = 2(25 + y_1) = \underline{67.355'}$


CURVE
Δ 12°31'44"
R 364.39
T 40.00
℄ CURVE
Δ 14°0
R 488
T 60
STA. 491+50.60
S 29°45'15"W
Gr=0.00831
STA
PT
493+37.97
86.532
493+75.6
Grade Change
STA
Gr=0.0089
4.5
1
PI
CURVE
Δ 12°31'44"
R 364.39'
T 40.00'

Determine joint spacing for R/c transition
STA. 491+56.60 to STA. 494+15.60

Criteria:

for ease of construction this criteria was exceeded for two reaches of channel. JMK

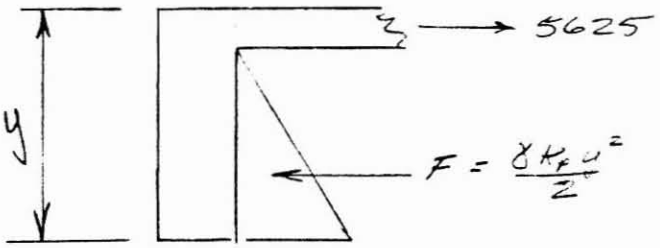
1. Distance between expansion joints shall not exceed 100 feet
2. T & S reinforcement shall be same as channel lining.
3. Section Thickness = 6"
4. Where lining is restrained (cutoff wall), distance (in restrained direction) between joints shall not exceed 50 feet.

Design cutoff wall at upstream end to provide undercutting protection.

1. Try 3.0 foot depth (equal to earth lining)
2. Design to resist movement from subgrade drag

Sht 3 of R/c lining Comps dated 2/28/85

- Subgrade drag = 5625 lbs/ft? (for 50' length) (for 100' length)



Assume $\gamma_m \simeq 120$ lbs/ft³

$K_p \simeq 3.0$

$y = 3$ $\quad F = 1620$ lbs

$M = 1620 \pm$ lbs.

RWCD R4 | LMS 3/7/85 | Inlet to R/C Lining

Provide sufficient section thickness for moment due to passive soil load on cutoff.

$M = 1620$ ft lbs

$A_s = \frac{M}{a\,d}$ $\quad a = 1.44$

$V_c = (2\phi\sqrt{f_c'}) = 126$ psi

$V = \frac{V}{\phi b} = \frac{5.625}{d(12)} = \frac{468}{d}$

$d = \frac{468}{126} = 3.7$

Use min. thickness (t) = 8"

$A_s = \frac{1620}{(1.44)(4)} = \underline{0.28}$ "

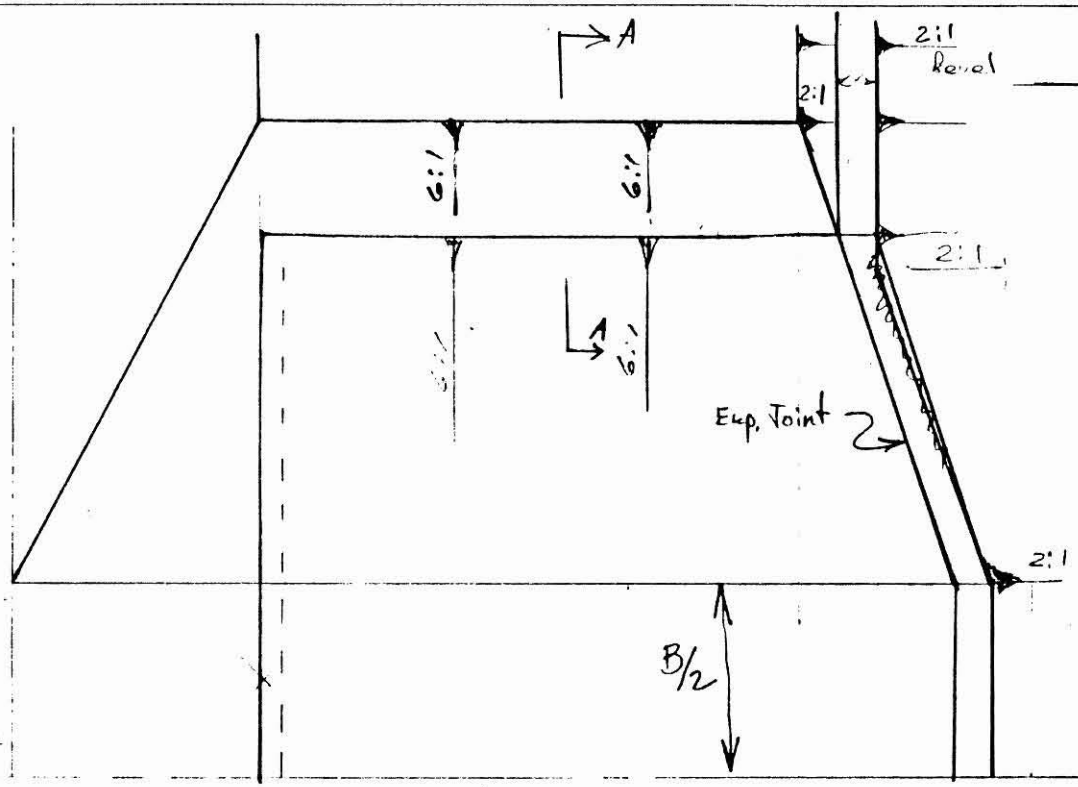
#5 @ 10" from channel lining $A_s = 0.37$ OK

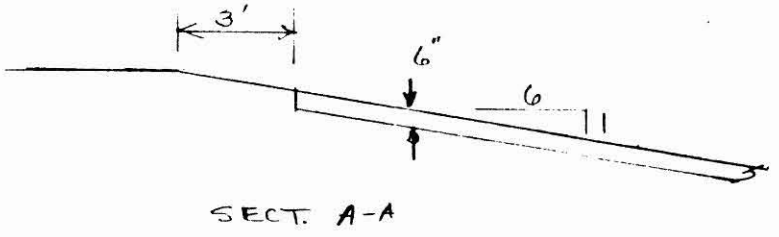
Cutoff will not be fully restrained some movement can occur. This should be OK.

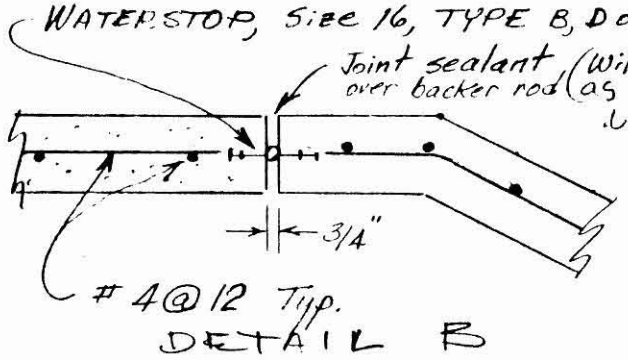
42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 383 200 SHEETS 5 SQUARE
NATIONAL

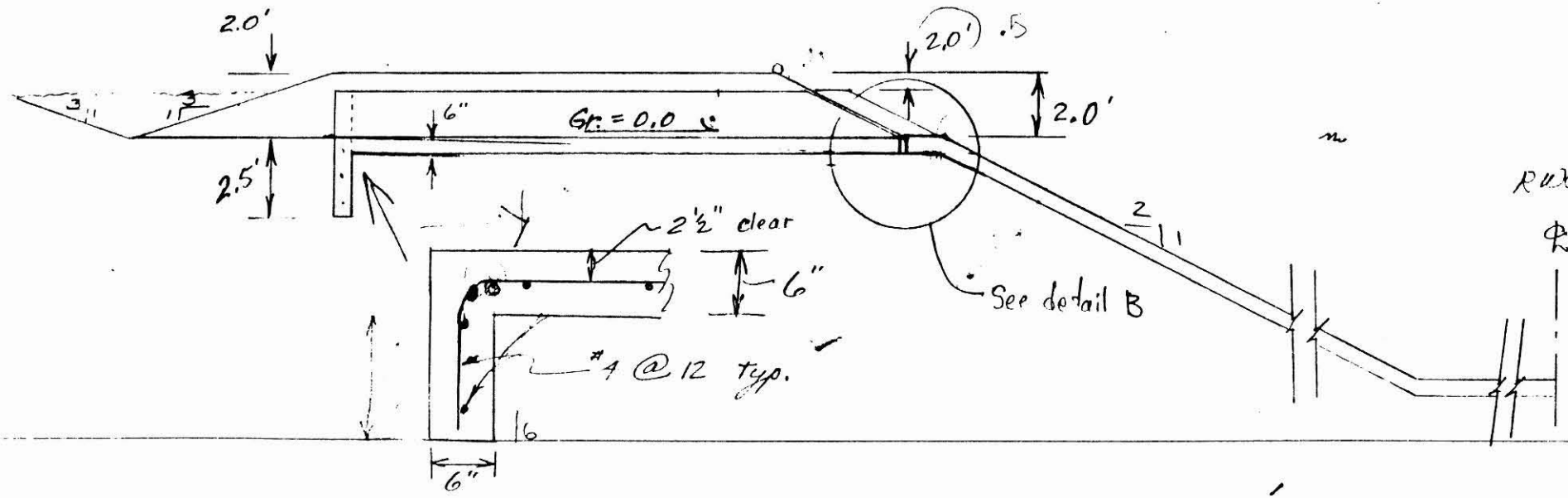
NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

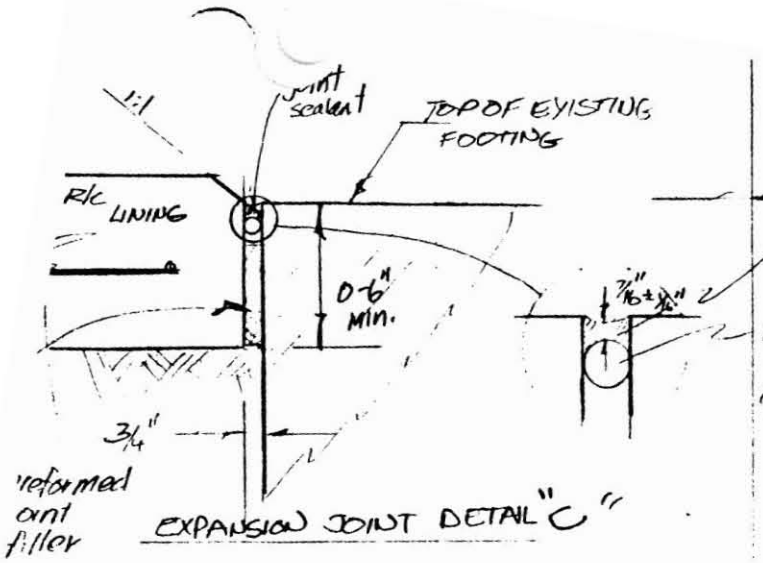
RWCD R4 Ave. LMMS 3/85 Side Inlets



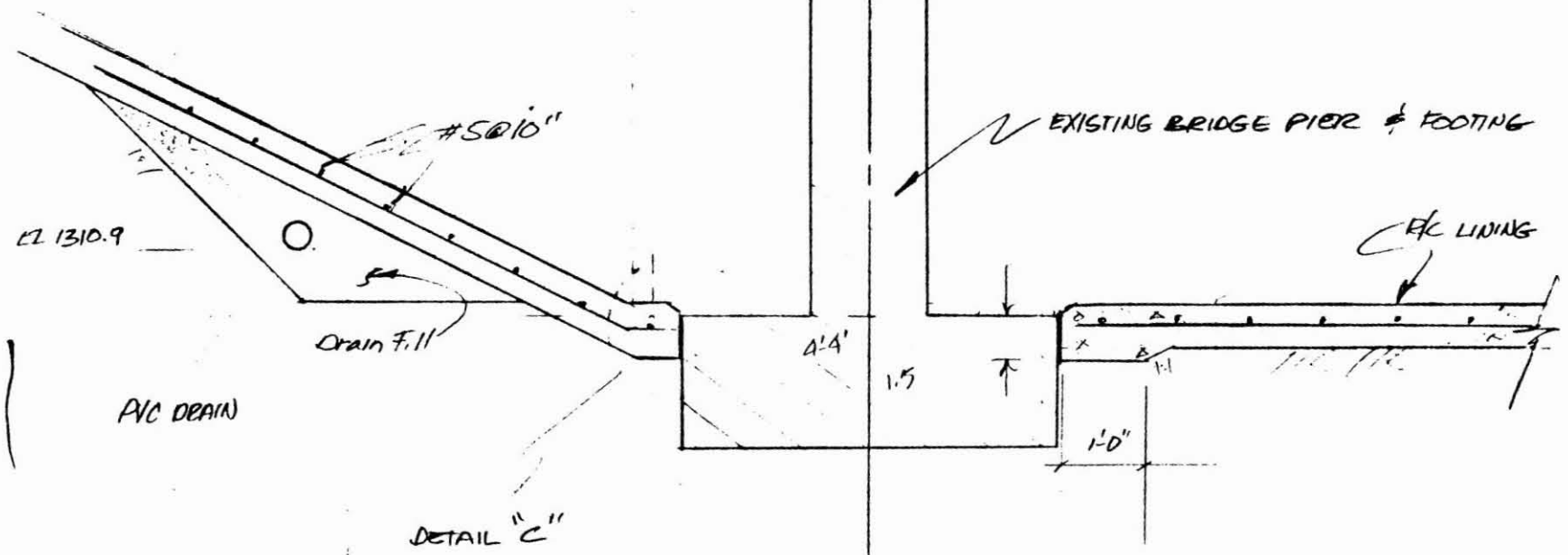




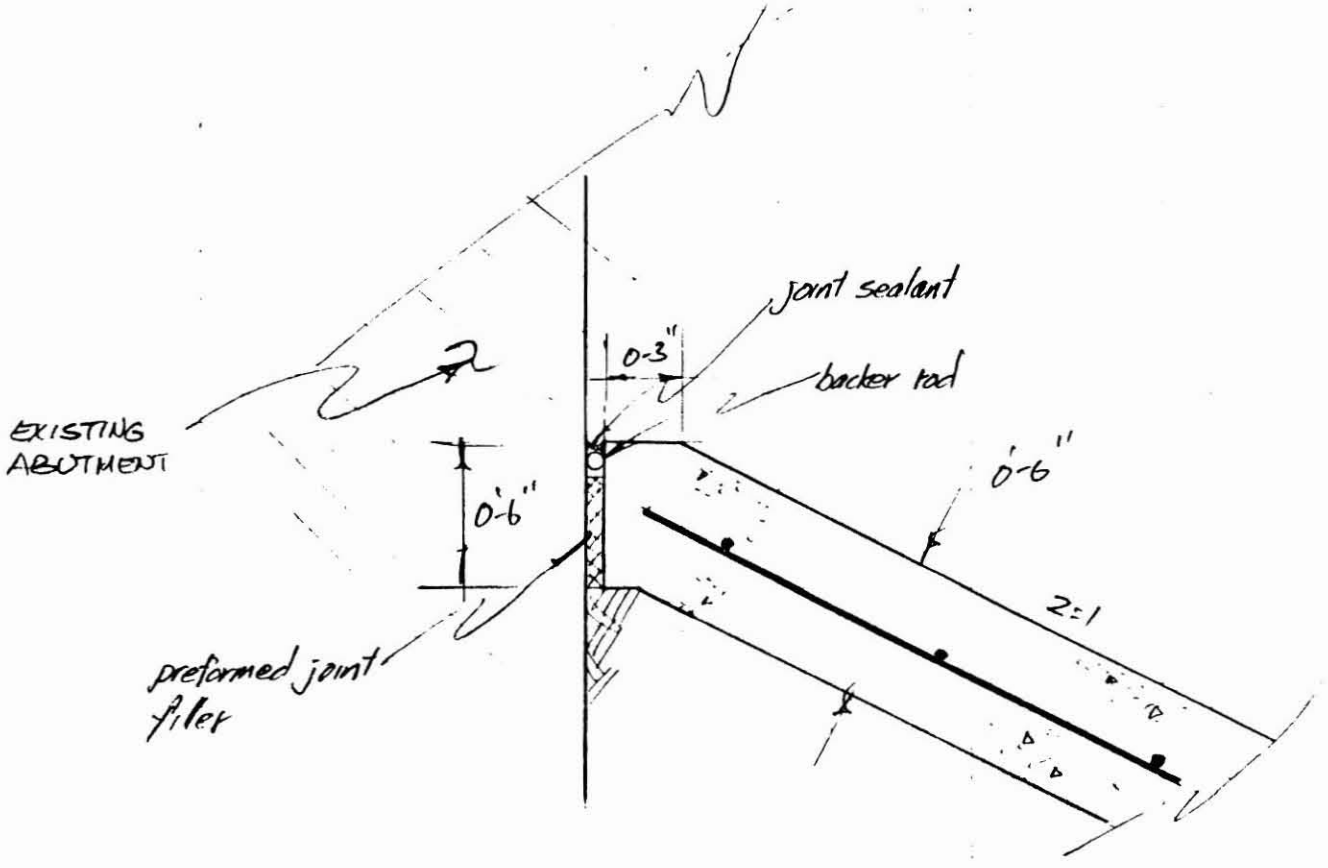




EXPANSION JOINT DETAIL "C"

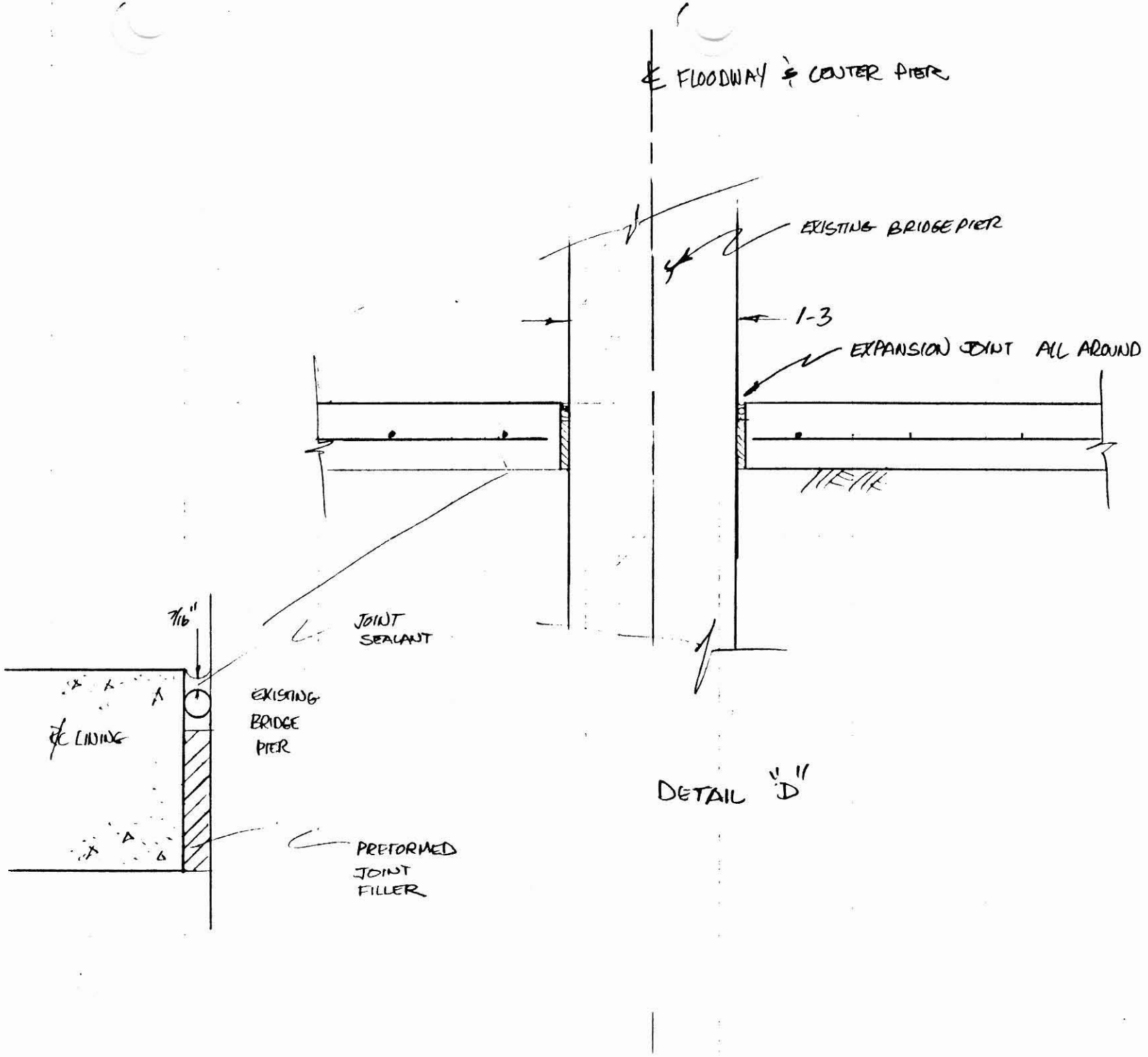


DETAIL "A"



DETAIL "B"

PWCD REV
ARIZONA
DT 3/27/85



DETAIL "D"

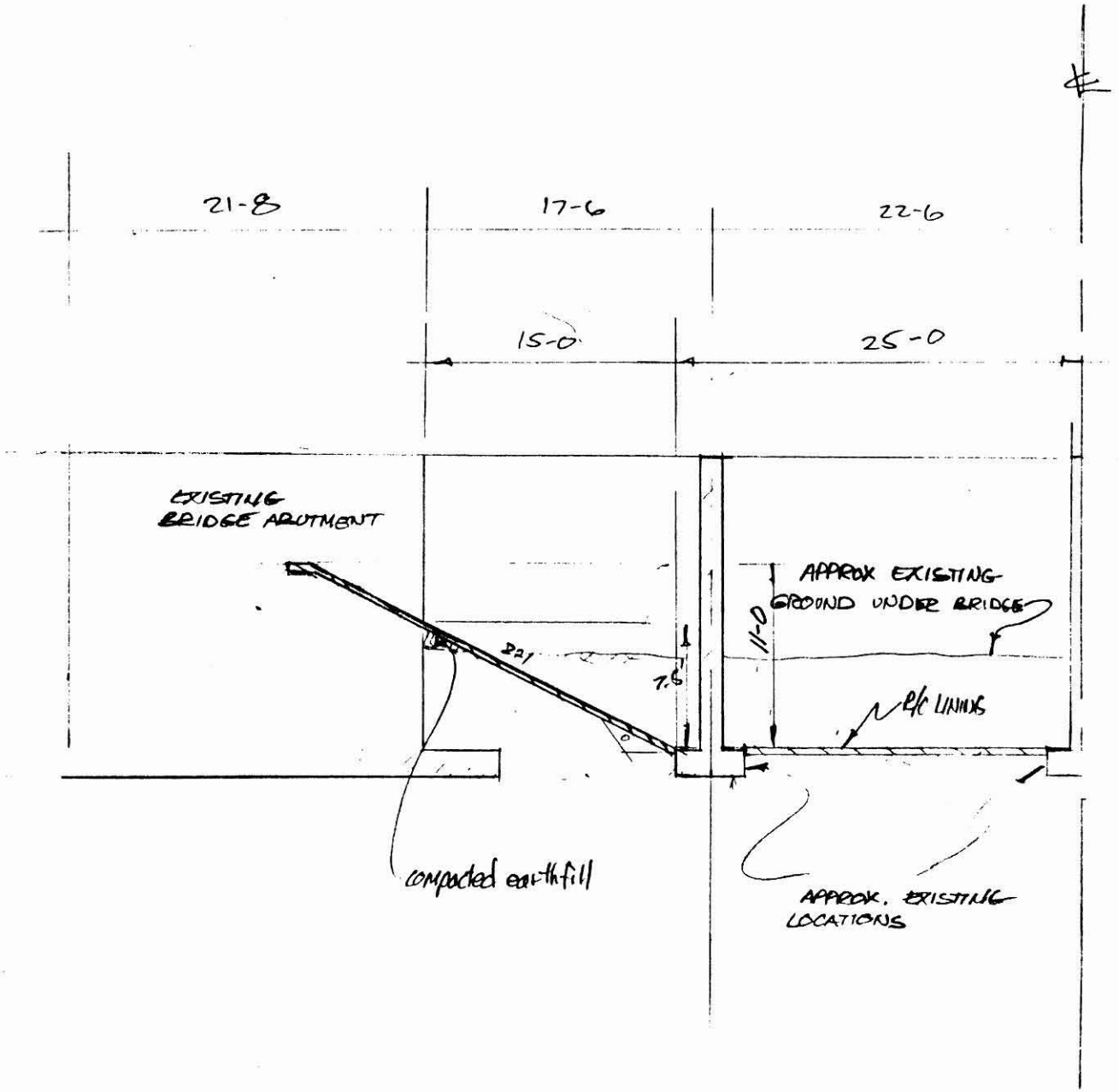
ARIZONA RANCO P.I.
OT 3/27/85
WILLIAMS FIELD ROAD BRIDGE
JHA

NATIONAL
42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

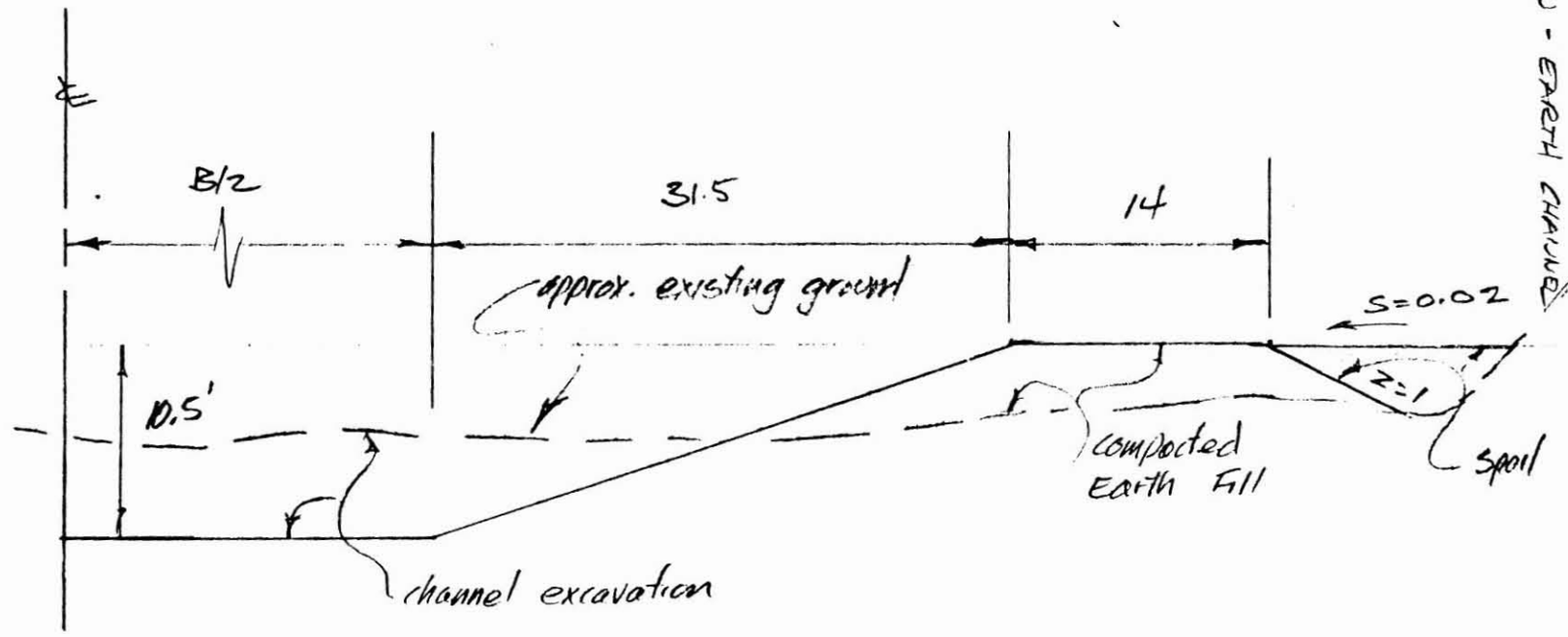
ARIZONA RWCD R4

ST 3/25/05 JML

POWER RD BRIDGE



ARIZ
DT
11/01/85
TYPICAL SECTION - EARTH CHANNEL
RNCD R4
INK



NOTE:
EARTH LINING
NOT SHOWN

TYPICAL SECTION - EARTH CHANNEL RIGHT OF ℄

STA 555+00 TO STA 745+70

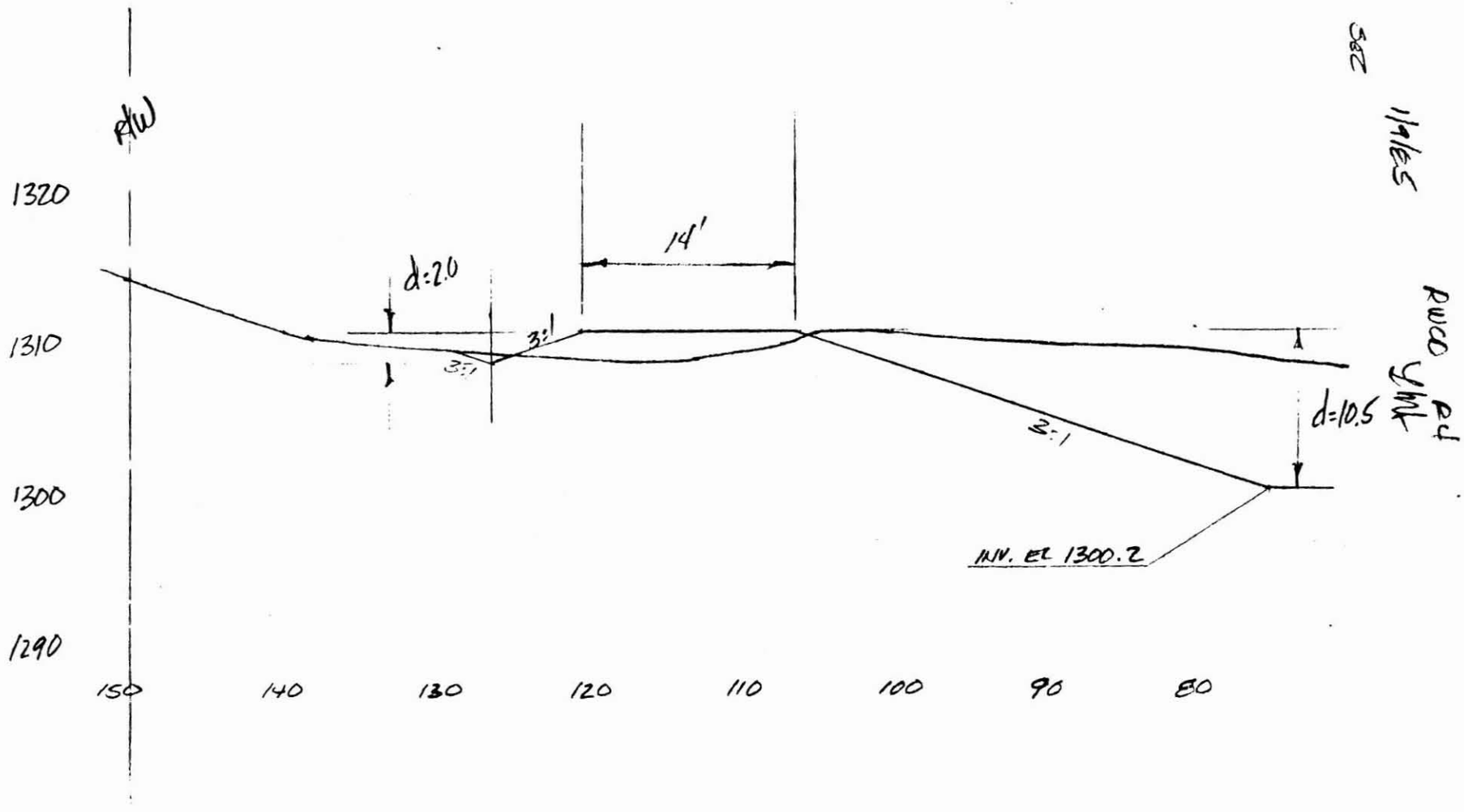
ARIZ RWCD R4
DT 11/9/85 YMK
EARTH CHANNEL - TYPICAL SECTION

EARTH CHANNEL - TYPICAL DETAIL

ARIZ.
DT
1/10/85
TYPICAL SECTIONS - EARTH CHANNEL
TENCD RD
YMK

NOTE:
EARTH LINING
NOT SHOWN

TYPICAL SECTION - EARTH CHANNEL LEFT OF ℄
STATION 555+00 TO STA 745+70
(not to scale)


RIW
1320
1310
1300
1290
150
140
130
120
110
100
90
80
d=2.0
14'
3:1
3:1
3:1
d=10.5
INV. EL 1300.2
AE12
DT
TYP. SEC
1/4 LES
RWCD
Y MK

733+00

A212.
DT
1/9/84 46
RWCO KY
GMT
1/85

STA 591+00

[redacted]

ARIZ
DT
CROSS

11/86

RWD RH
YMV

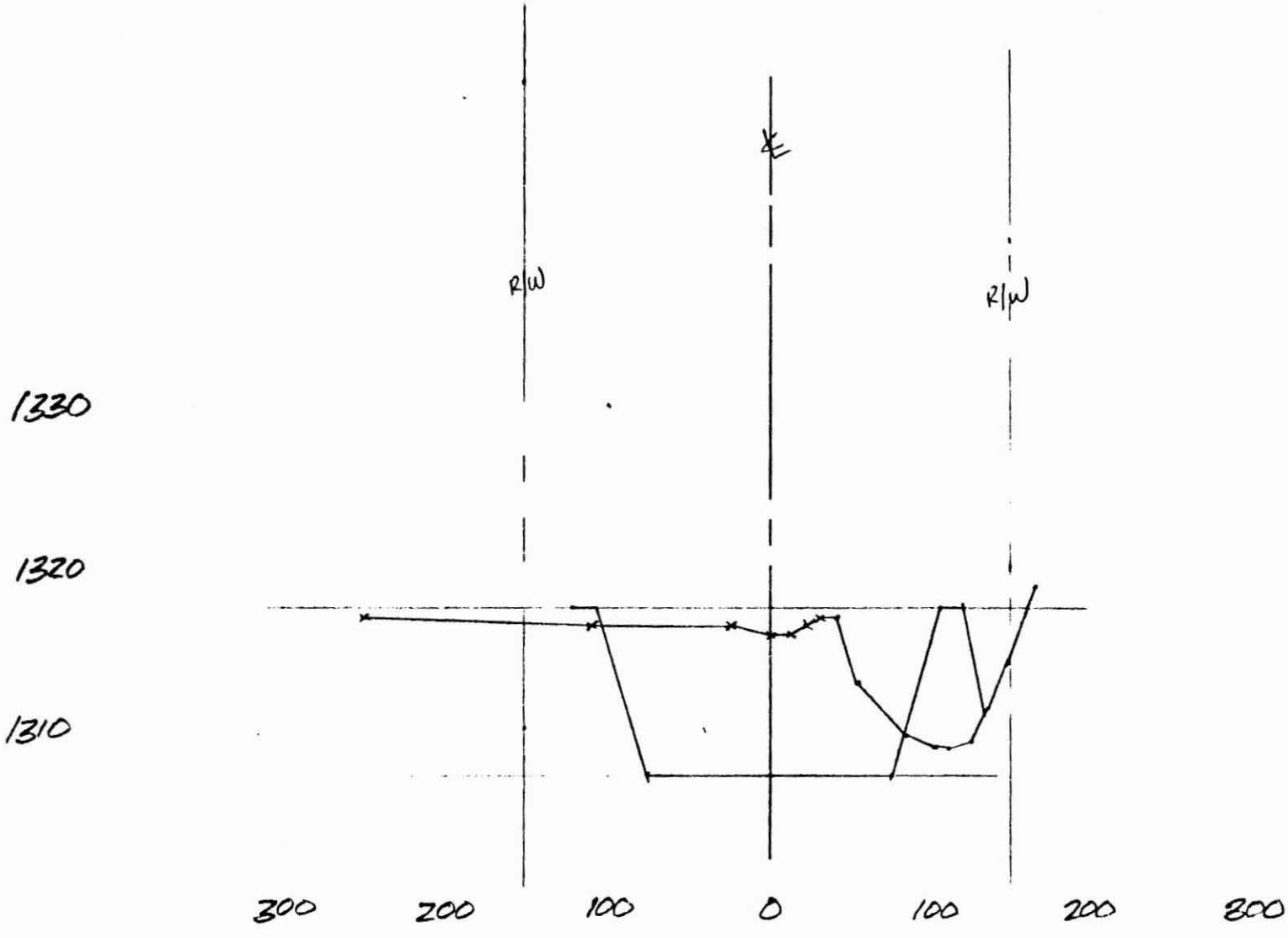
ARIZ.
DT

1/8 IES

RWCD R4
JMK

685+00

AEH.
DT 1/8/85 RWD RH



667 +00

BM = 150
INV EL = 1306.97

ARIZONA DT

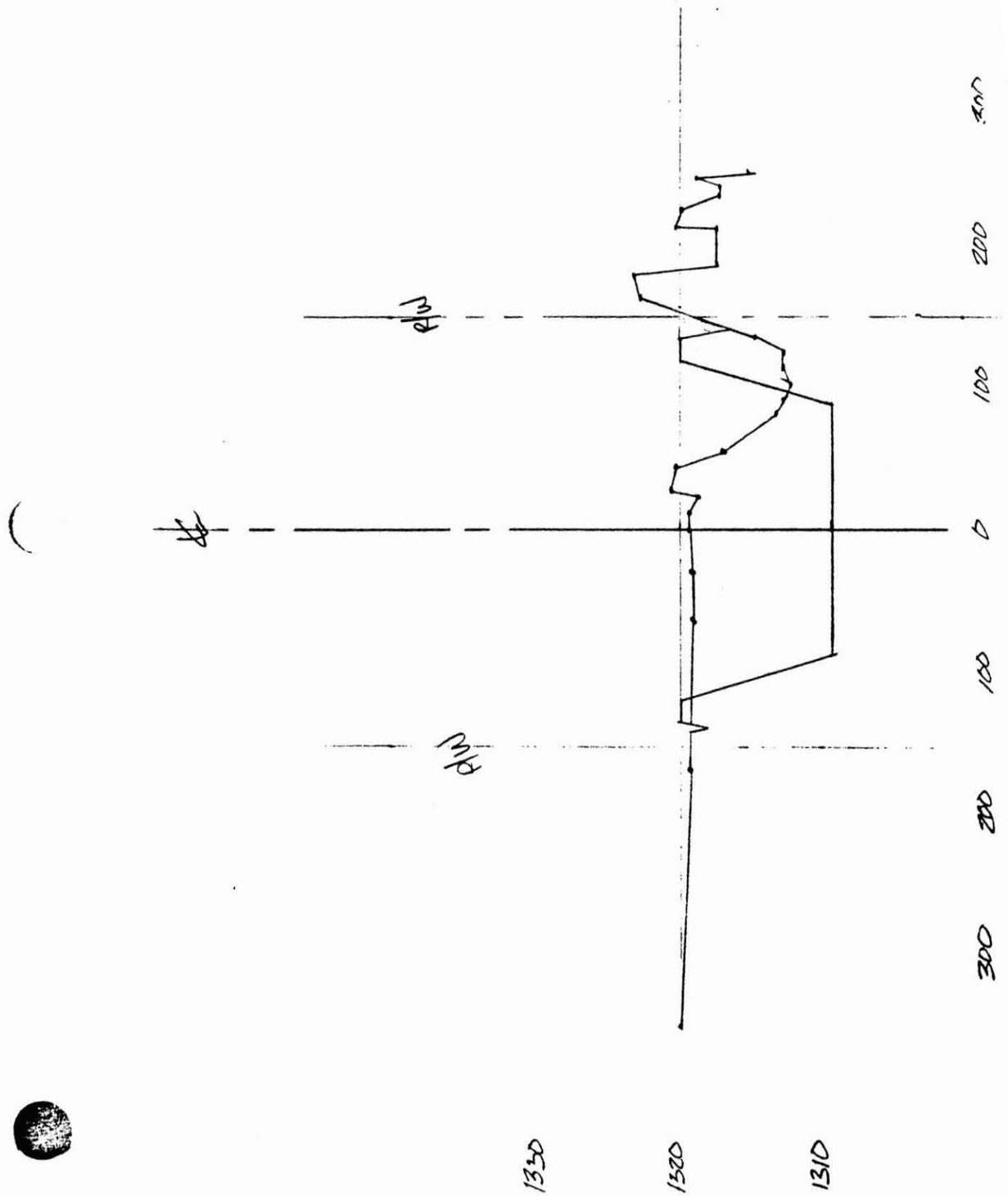
1/8/25

RWCD RJ

ARIZONA
DT

1/7/85

RWCC RC



ARIZONA

ST

11/1/65

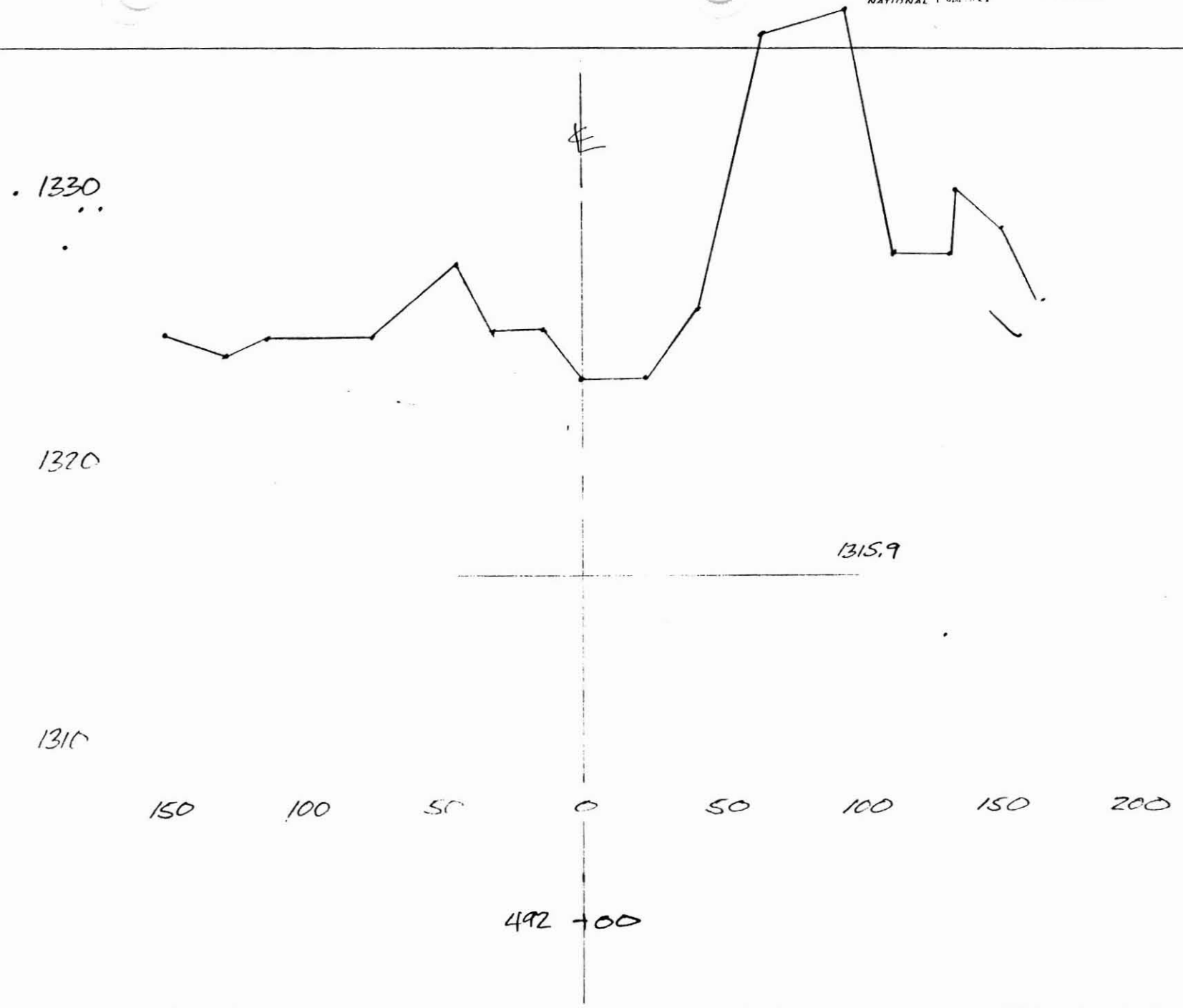
BASED R4

NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

DT 1/21/85

RWCD RU
ARIZONA

CROSS SECTIONS

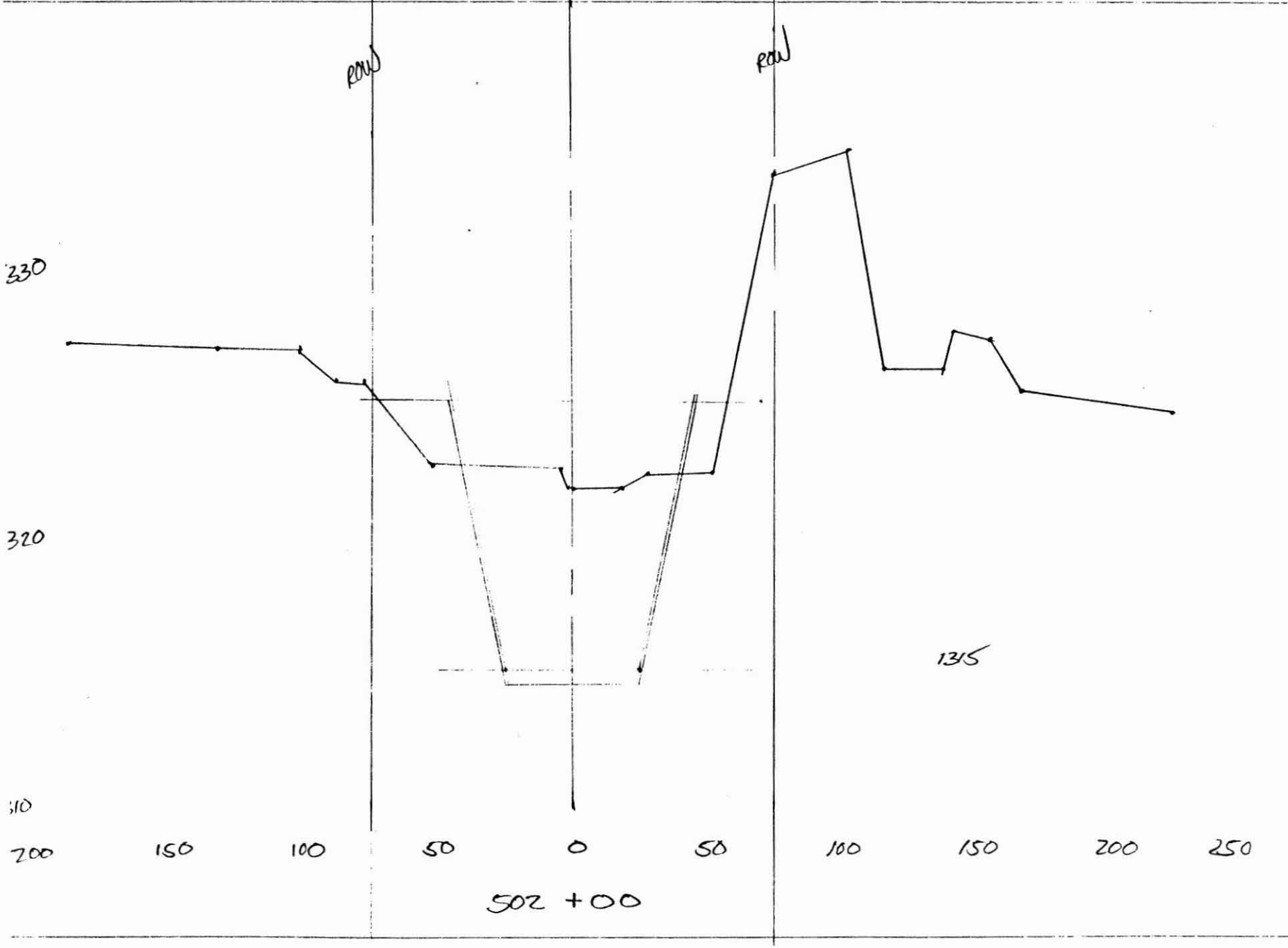


NATIONAL
42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 380 200 SHEETS 5 SQUARE

DT 1/21/85

RWCD RT
ARIZONA

CROSS SECTIONS



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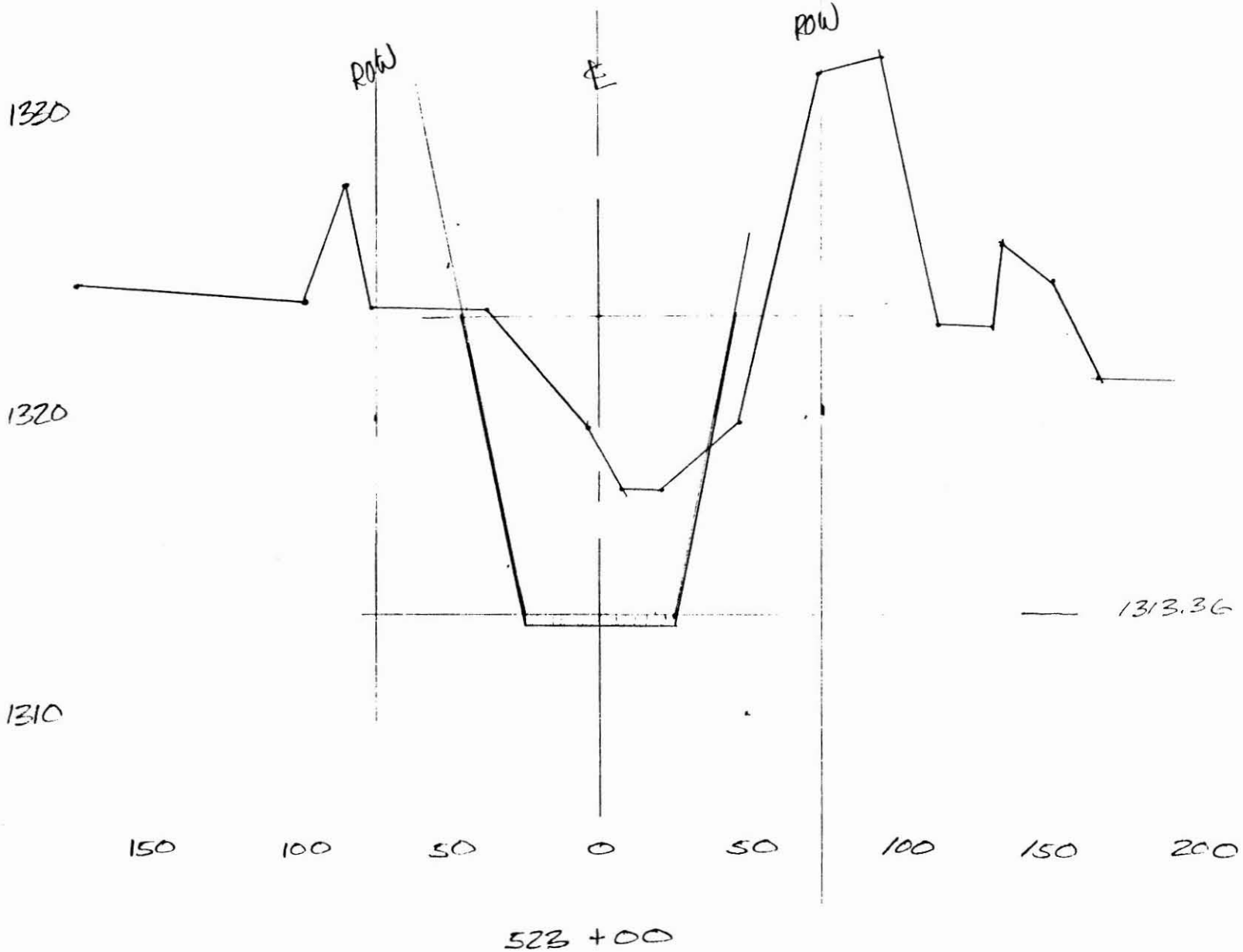
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

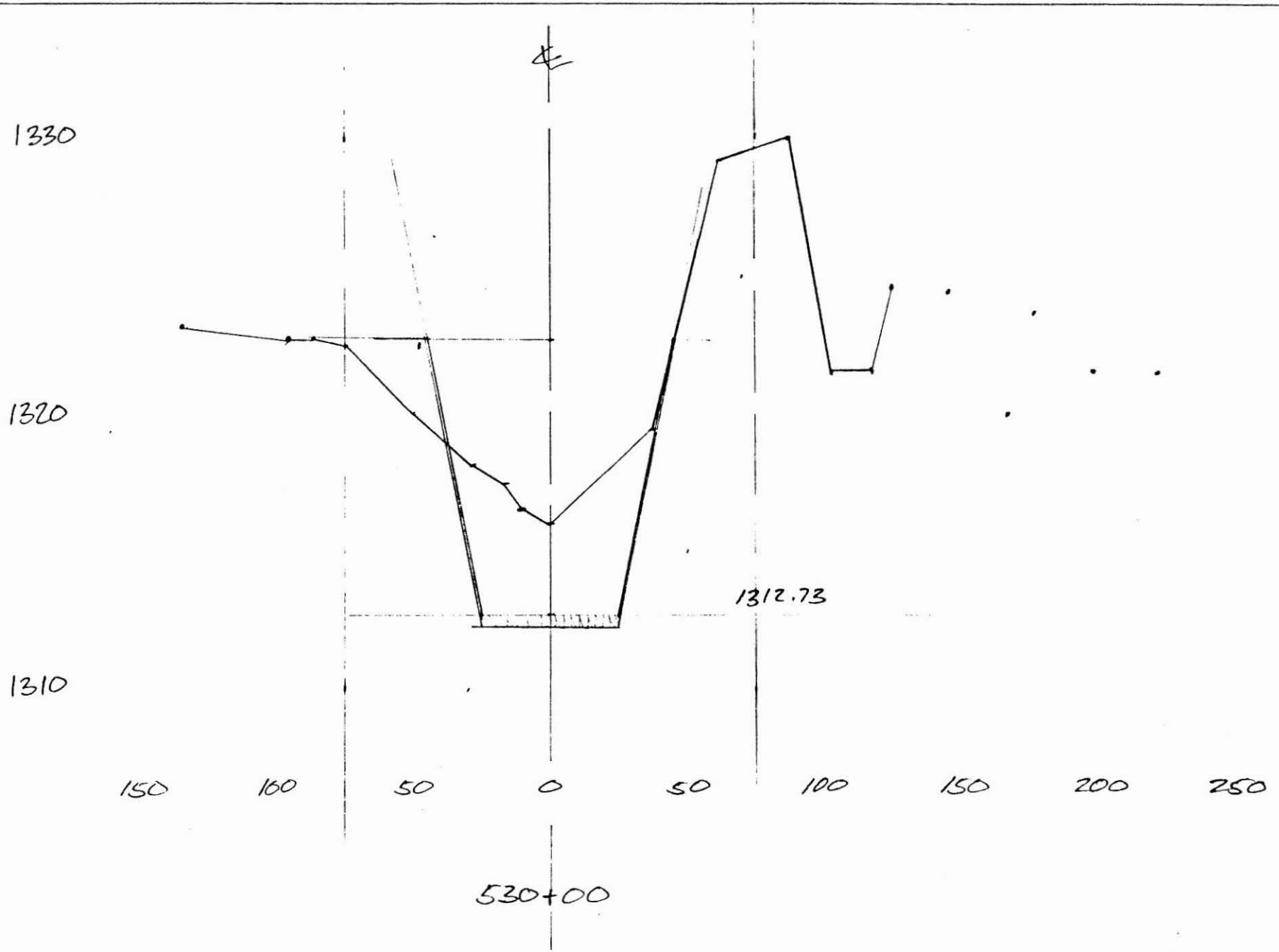


DT 11/21/85

ARIZONA

CROSS SECTIONS

NATIONAL | 42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE



DT 1/21/85

RWCD #4
ARIZONA

CROSS SECTIONS

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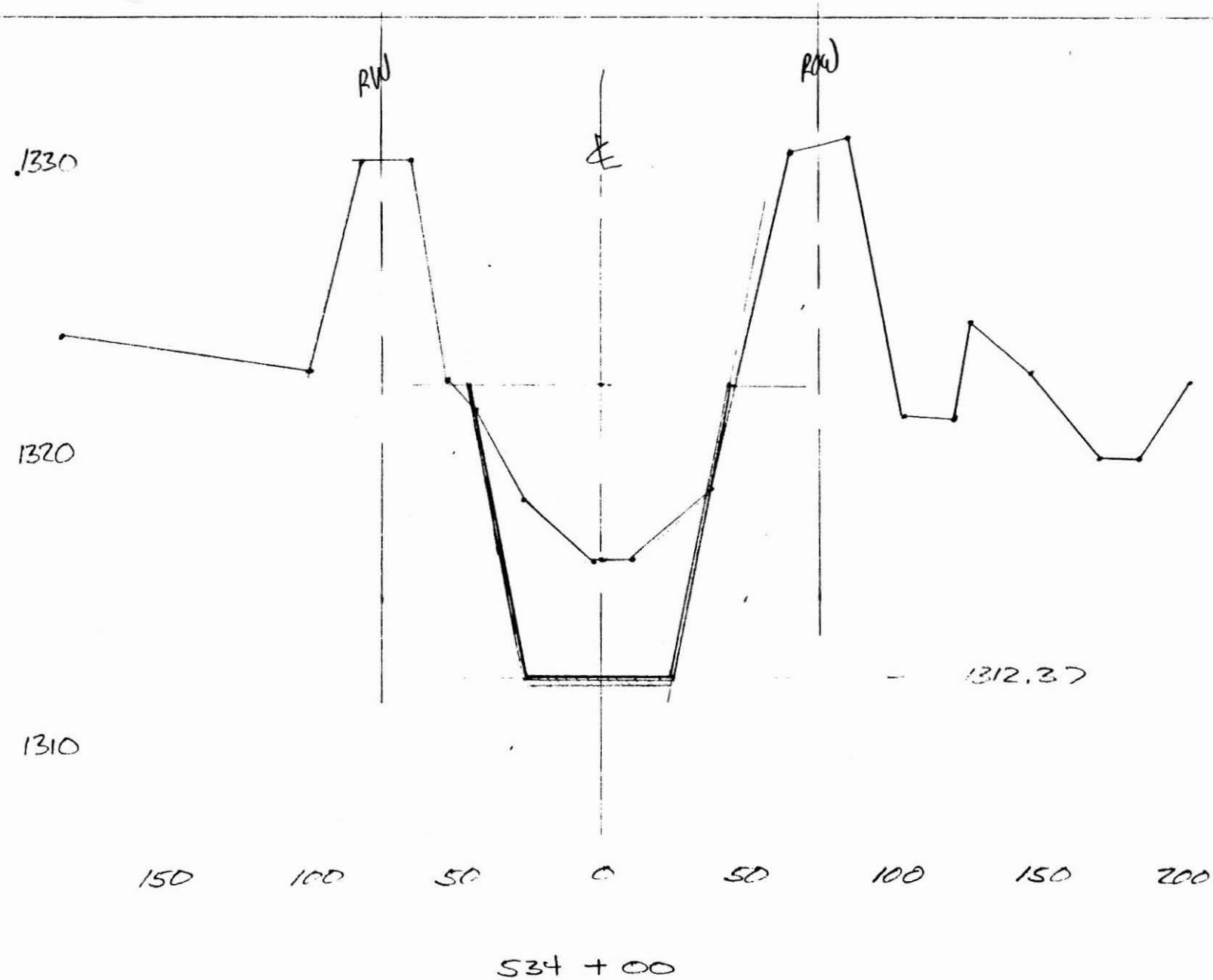
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

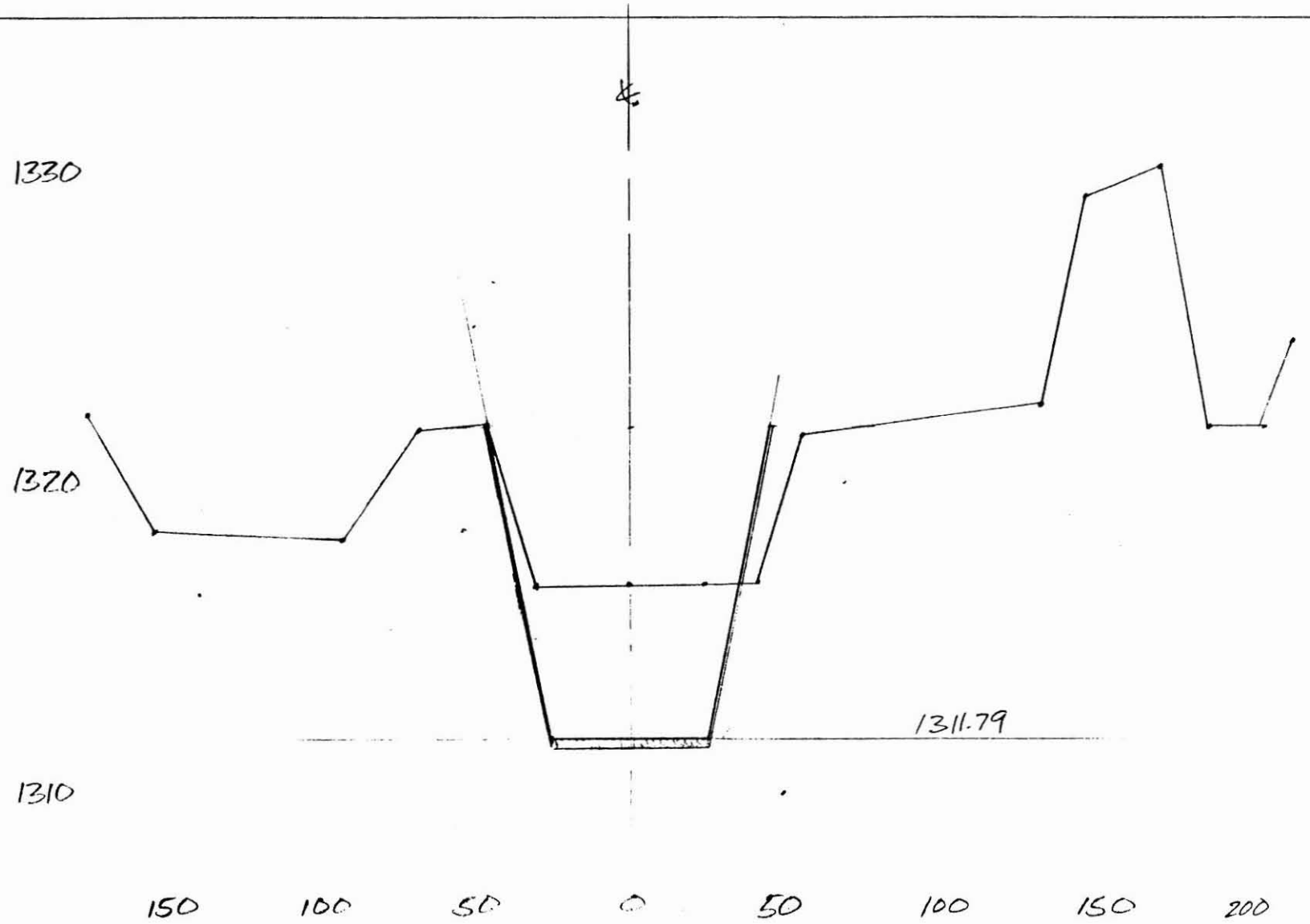


DT 11/21/85

RWCD #4
ARIZONA

CROSS SECTIONS

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE



540 + 34.25

DT 11/21/85

KWCD 84
ARIZONA

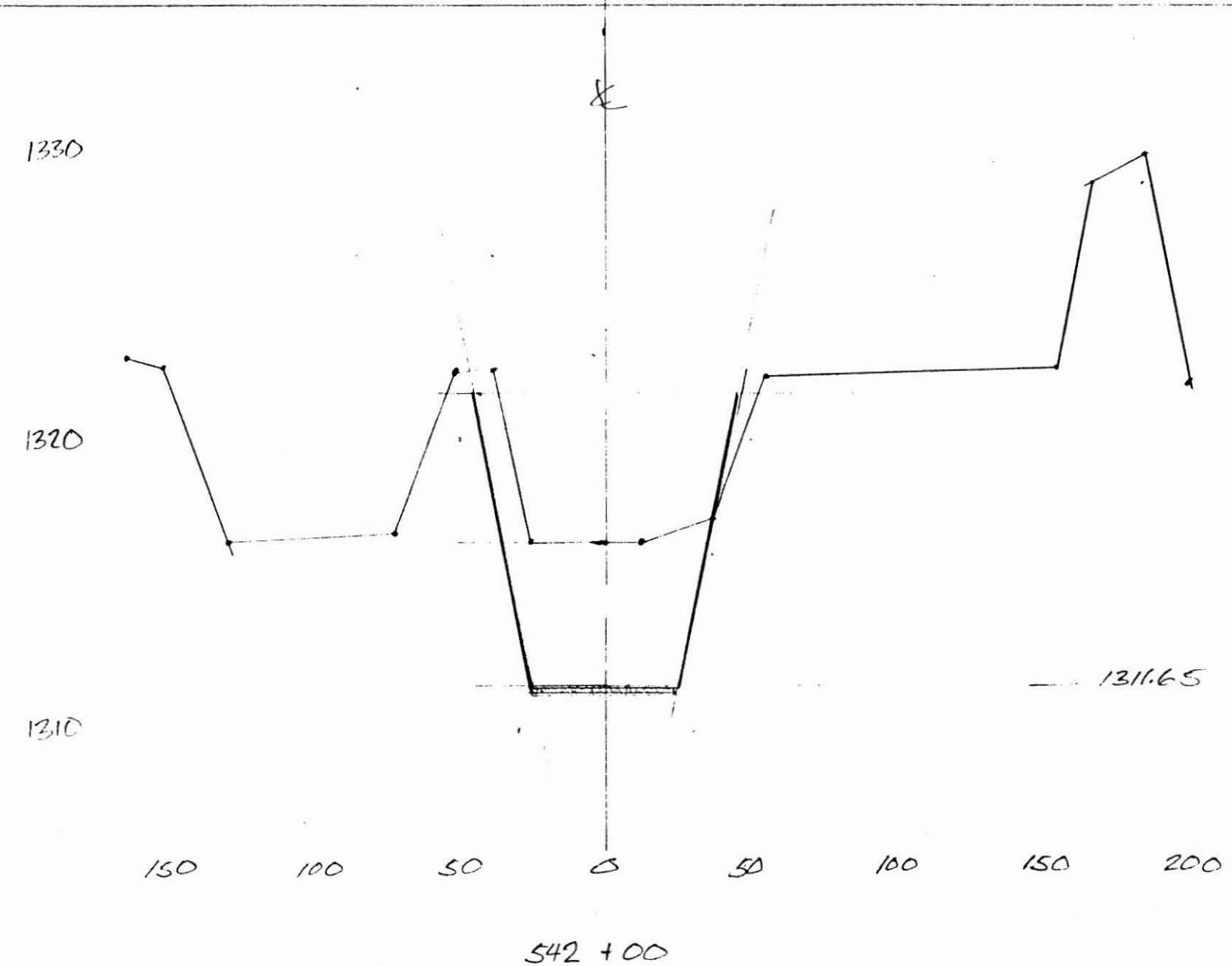
CROSS SECTIONS

NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

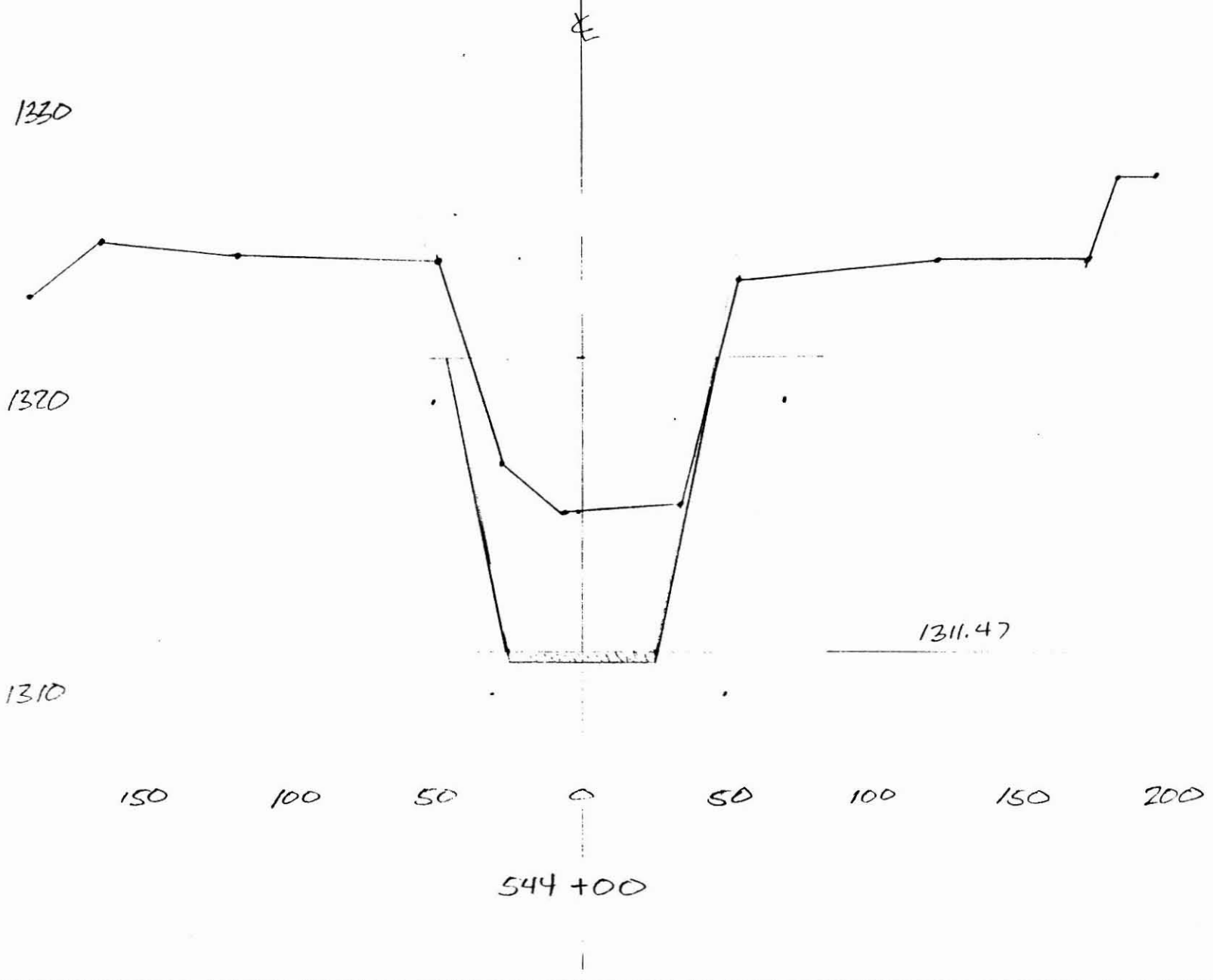
DT 1/21/85

RNCD #4 ARIZONA

CROSS SECTIONS



42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE



DT 1/21/85

KWCC FY
ARIZONA

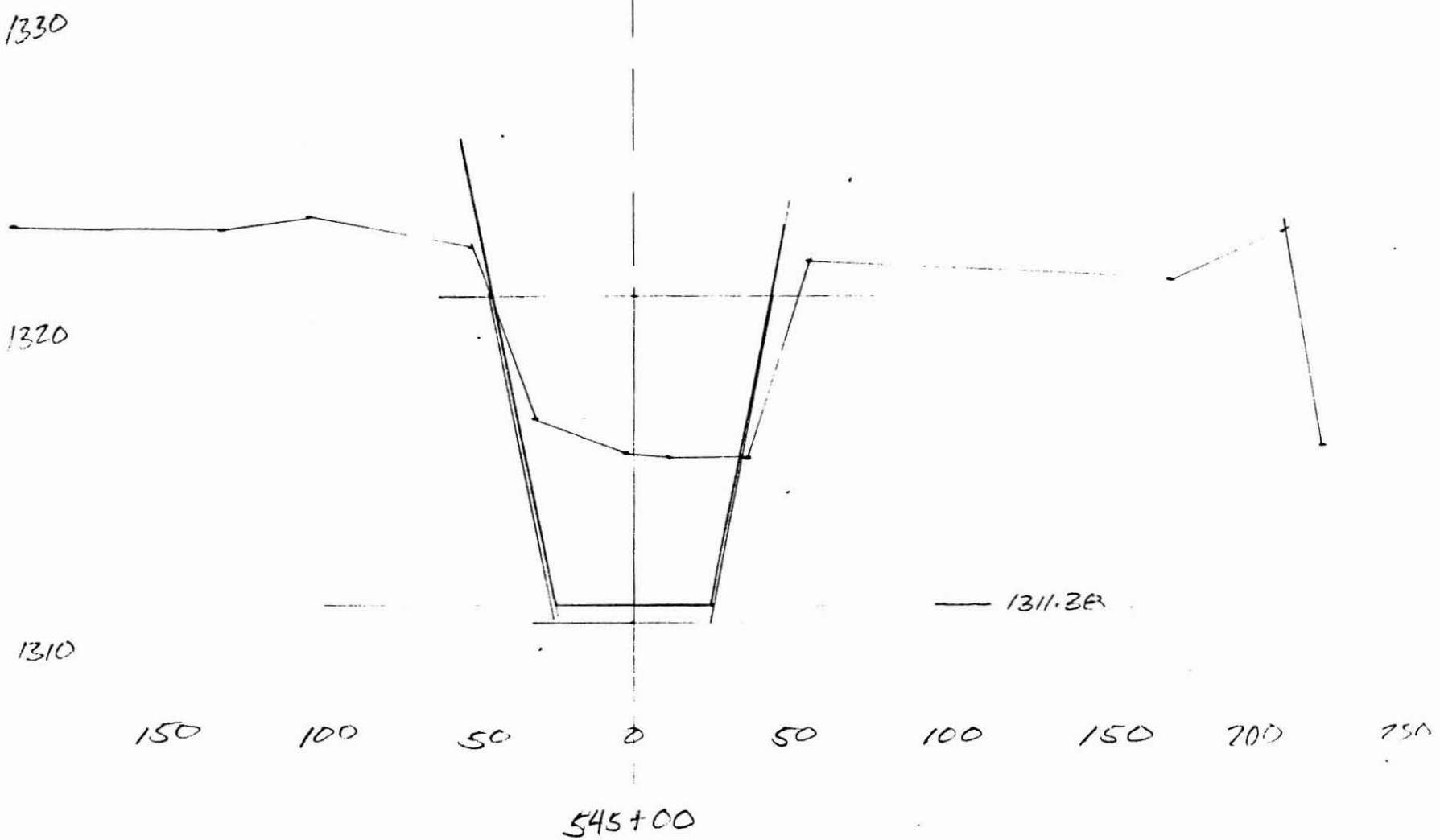
CROSS SECTIONS

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

OT 1/21/85

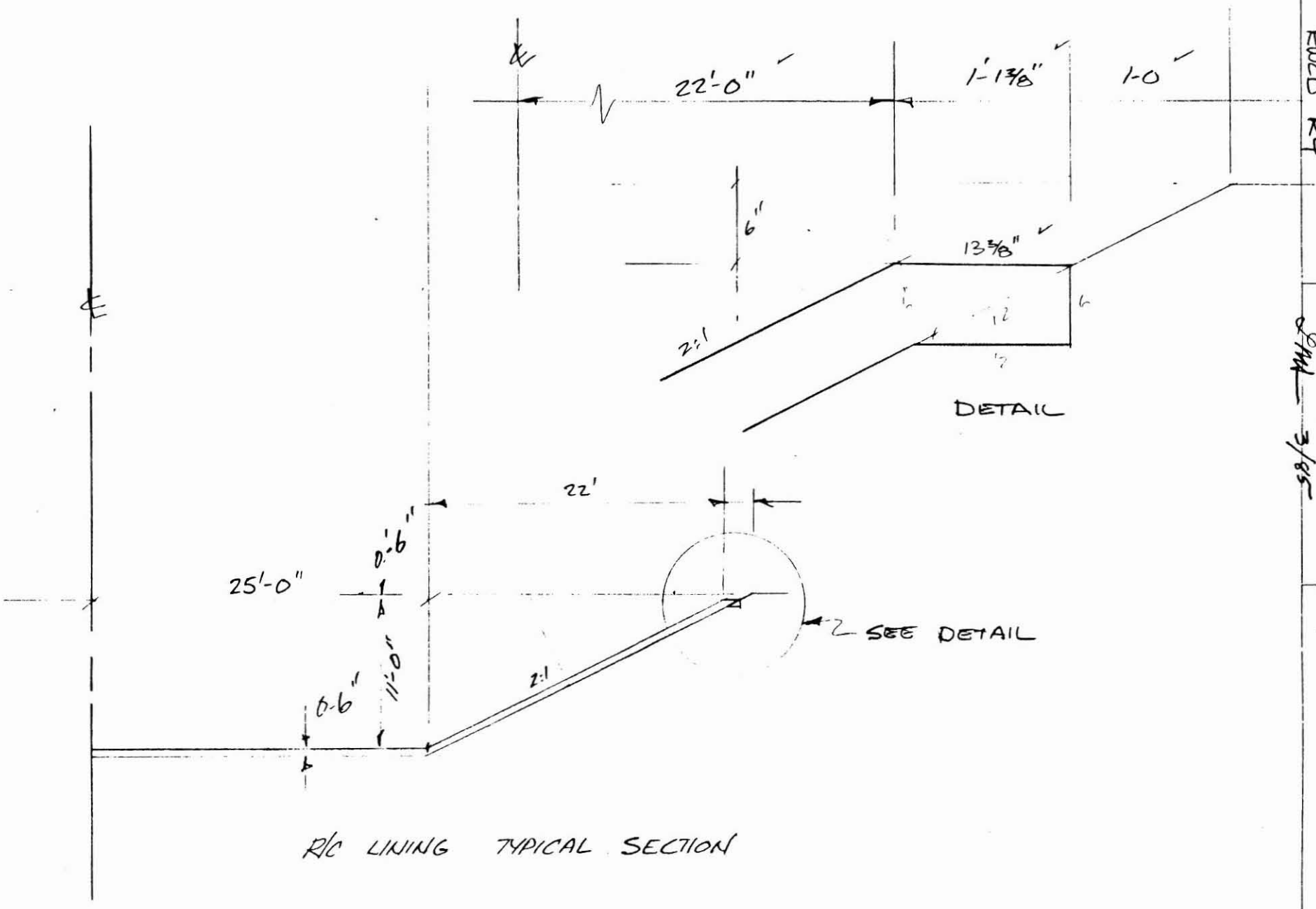
ROAD R4

CROSS SECTIONS
EYE LINE SECTION



545+00

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

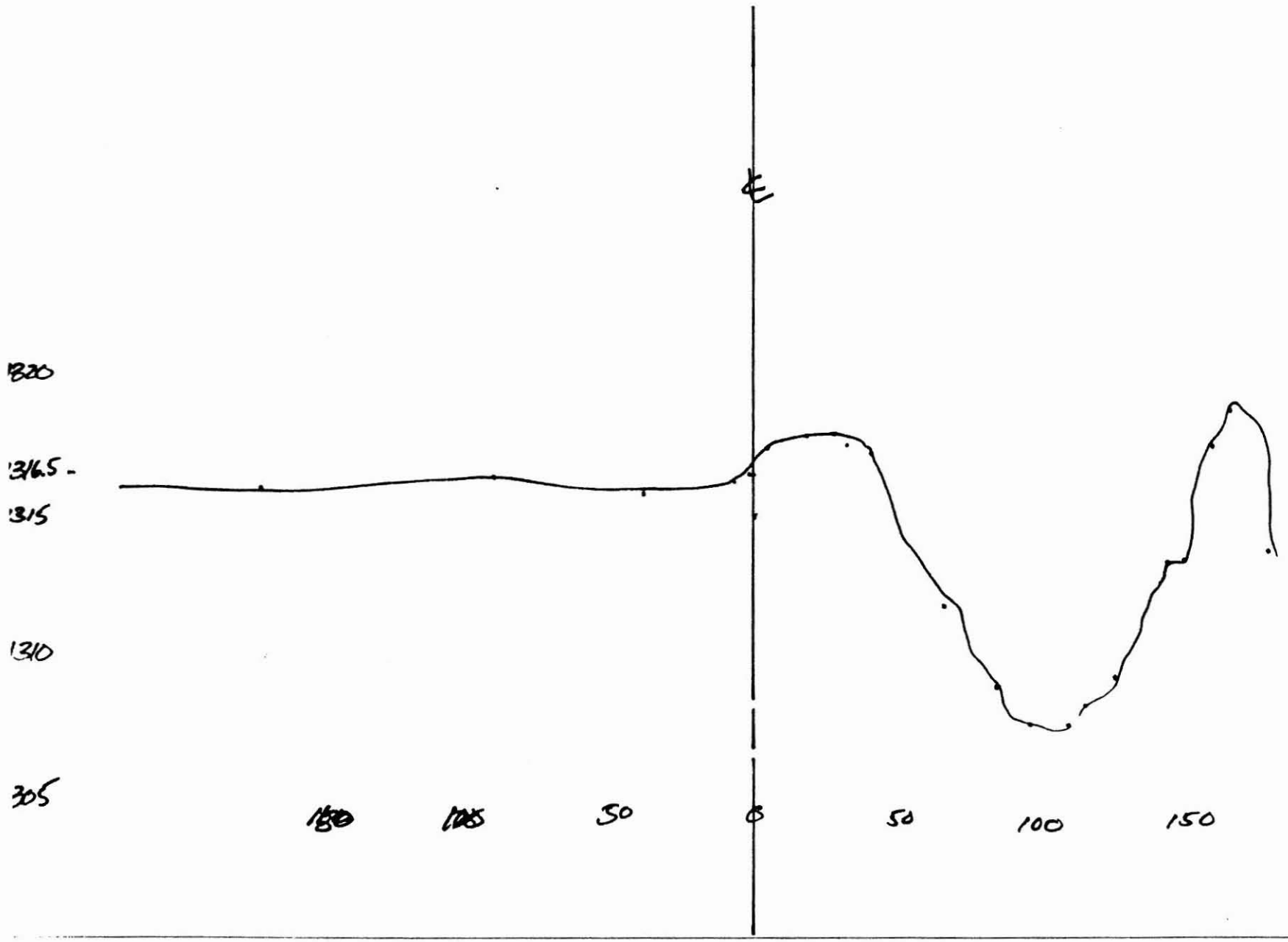


ARIZONA
RWCD R4

DT 2/26/85
3/85

R/C LINING TYP SEC.

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

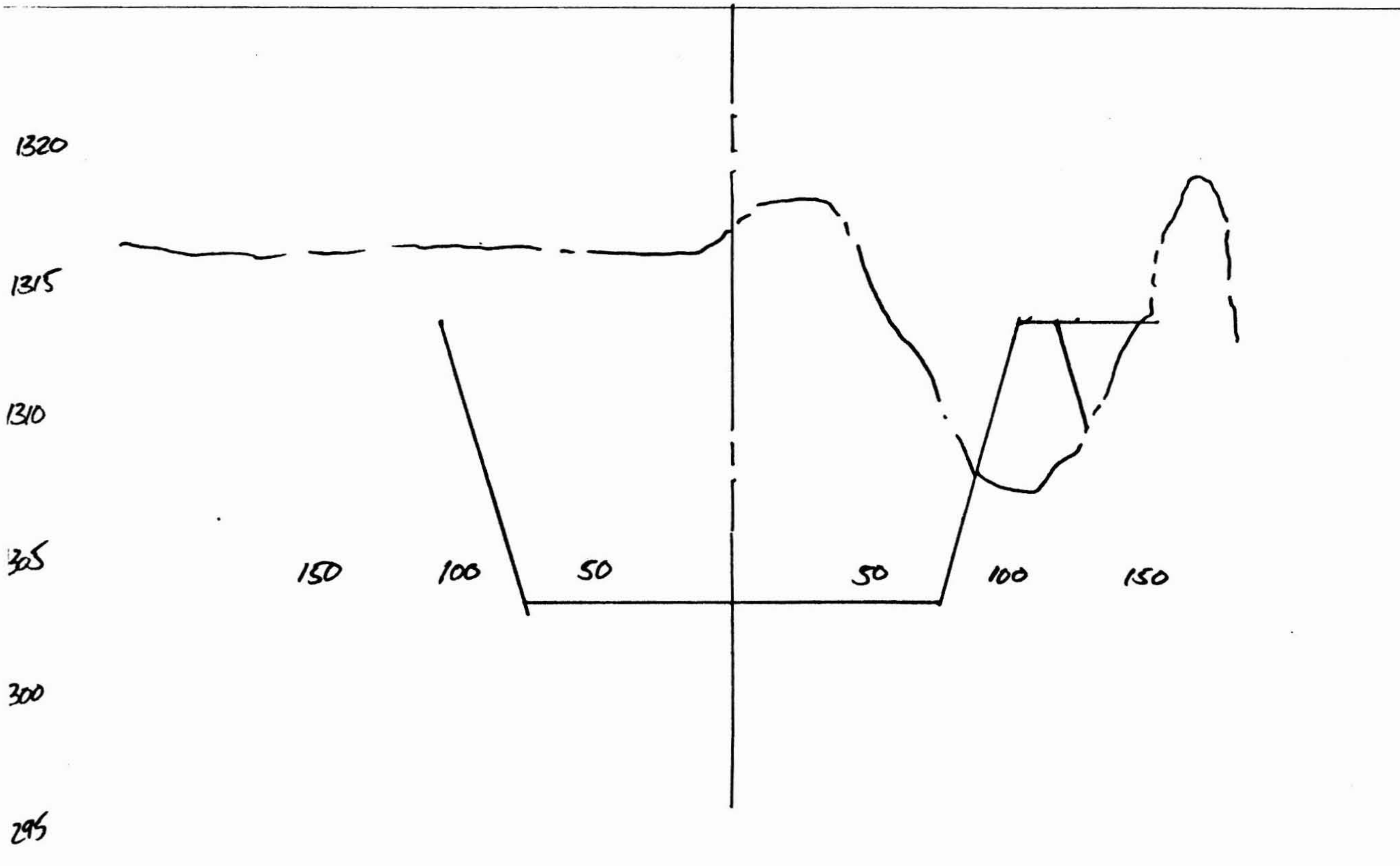


A412 RAMP RH

DT 3/65

K-SEC @ 676+00

NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE



ACIE
PUCO Rd

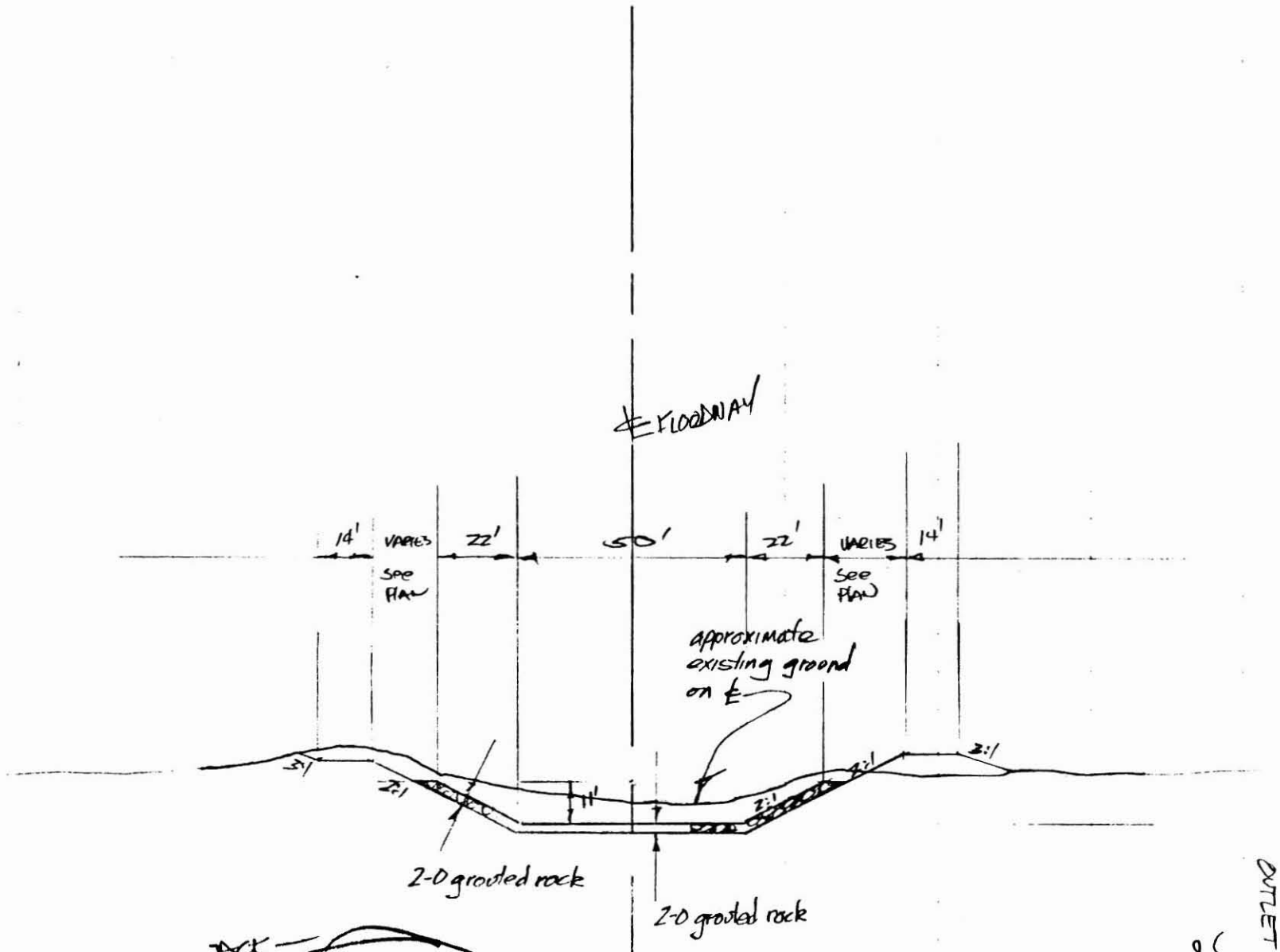
DT 3/85

X-SEC @ [redacted]

Not on Sheet

FROM STATION	TO STATION	b	z	n
485+88.05	491+20.60	150	3	11.5
(491+20.60	555+00	R/C CHANNEL AND TRANSITION)		
555+00	626+00	175	3	10.5
(626+00	627+00)	TRANSITION		
627+00	675+00	150	3	10.5
(675+00	676+97.5)	DROP STRUCTURE		
676+97.5	742+00	150	3	10.5
(742+00	744+00)	TRANSITION		
744+00	745+28.37	200	3	10.5

CHANNEL BOTTOM WIDTH SCHEDULE

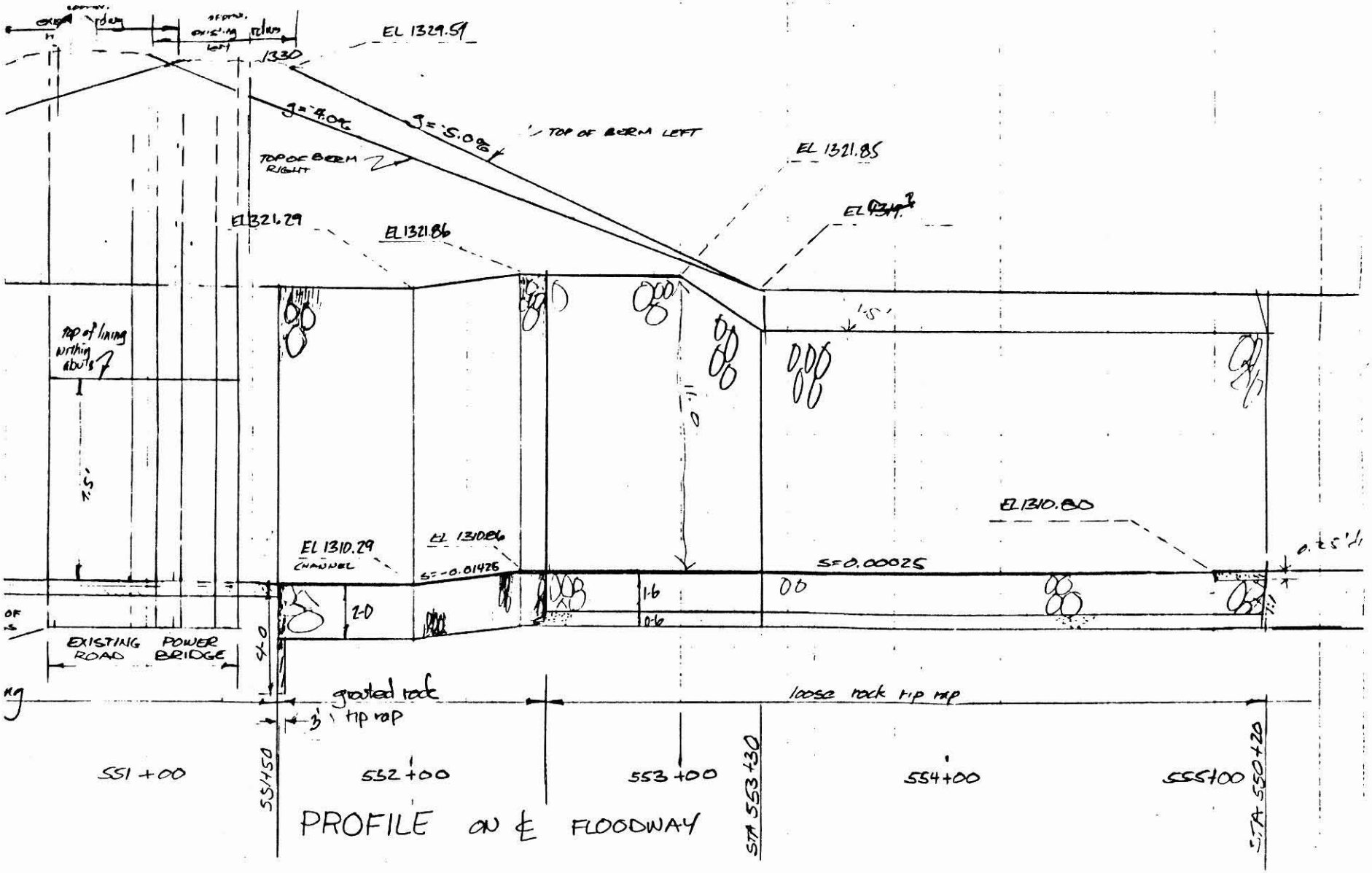


JACK
REVERSE THIS ONE

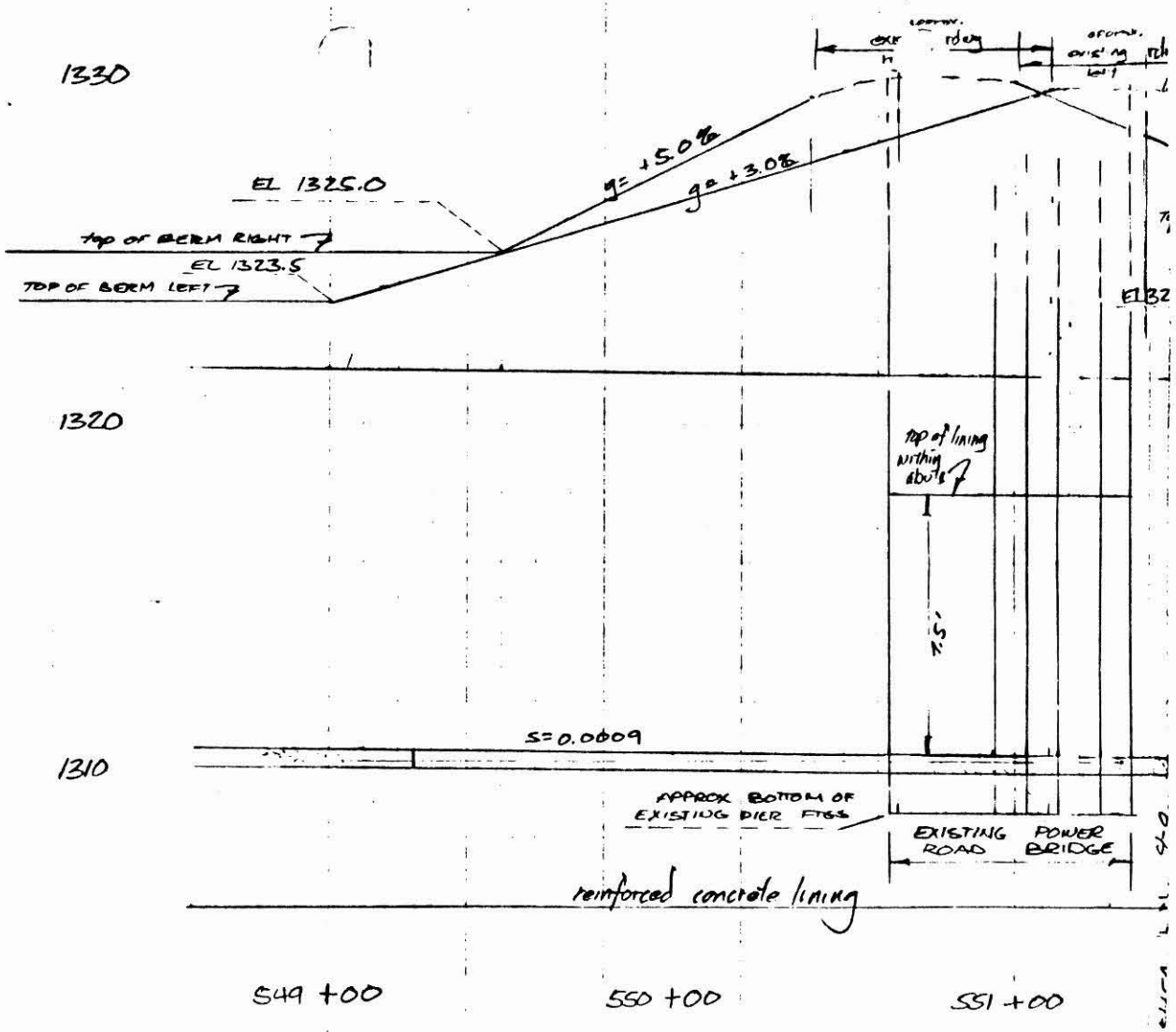
SKETCH (A) (A) LOOKING UPSTREAM

Show looking D.S.

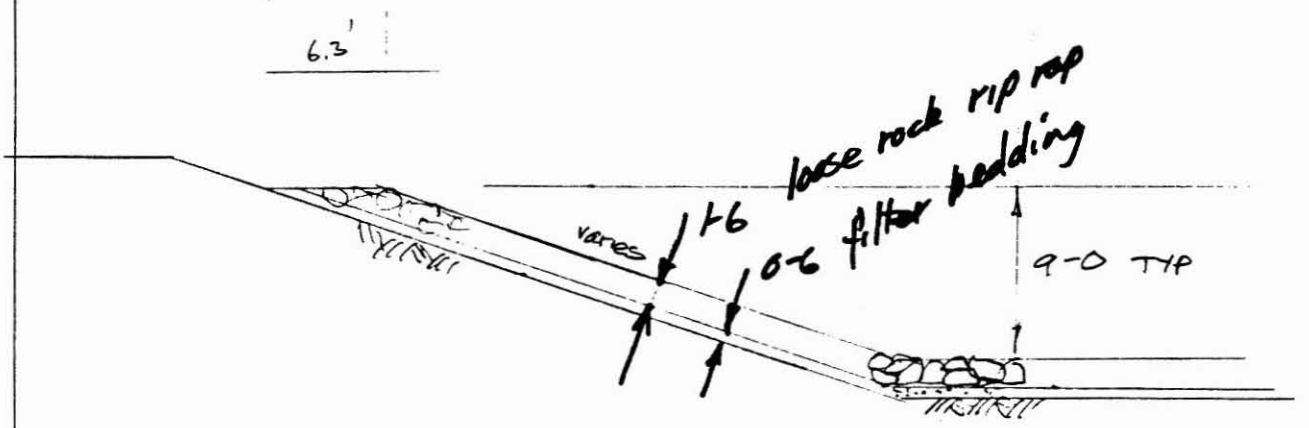
ARIZONA
BNCO #4
DT 3/26/85
OUTLET TRANS.
JMH



PROFILE ON ℄ FLOODWAY


1330
1320
1310
EL 1325.0
TOP OF BERM RIGHT
EL 1323.5
TOP OF BERM LEFT
g= +5.0%
g= +3.0%
top of lining
S=0.0009
APPROX BOTTOM OF
EXISTING PIER FTGS
EXISTING ROAD
POWER BRIDGE
reinforced concrete lining
549 +00
550 +00
551 +00

ARIZONA RUCD R4	DT 3/25/85 JMK	@ POWER RD. LAYOUT



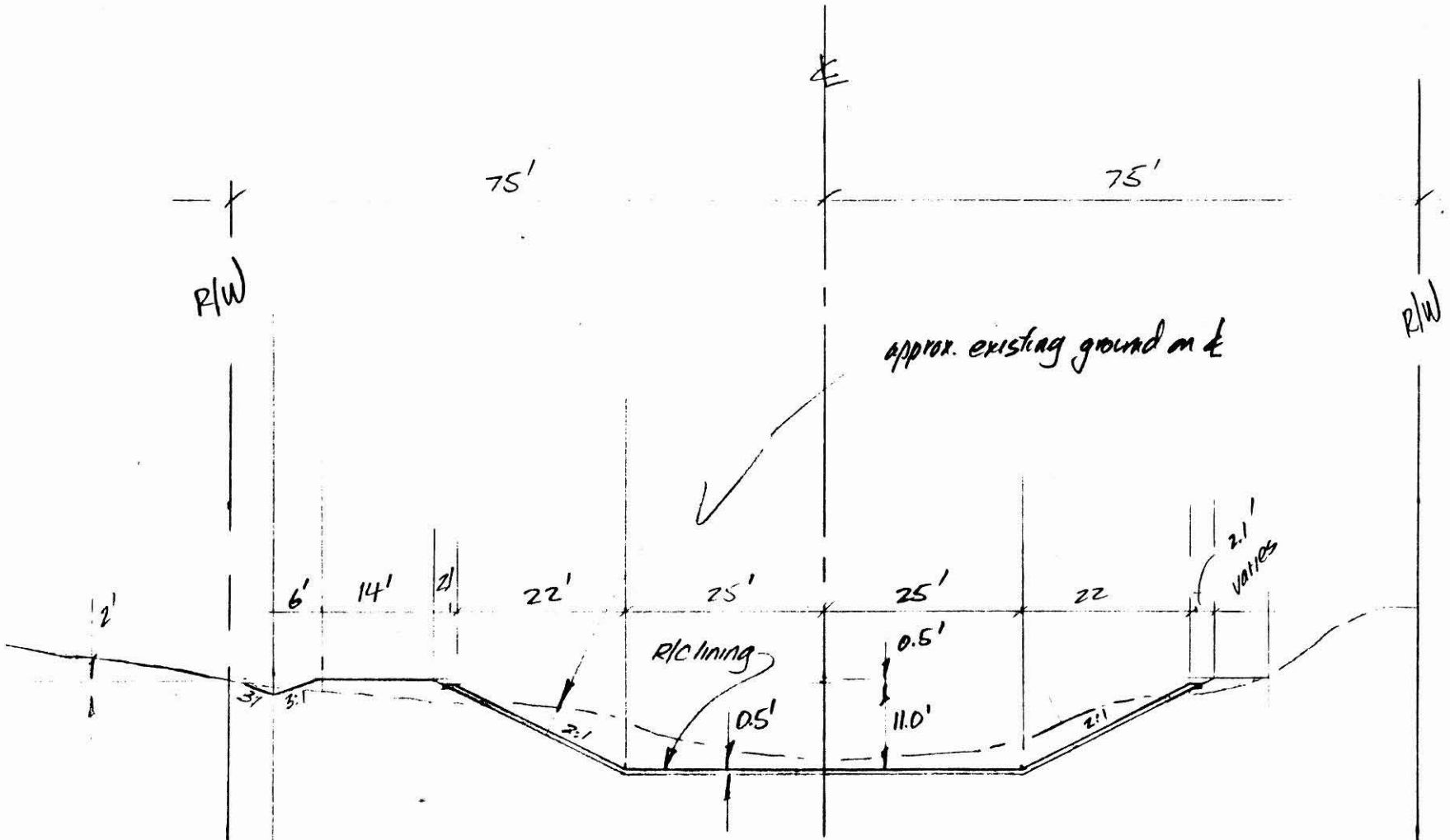
42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-383 200 SHEETS 5 SQUARE

ARIZONA
RWCD R4

DT 2/28/85 JM R/C LINING TYP SEC

1/8

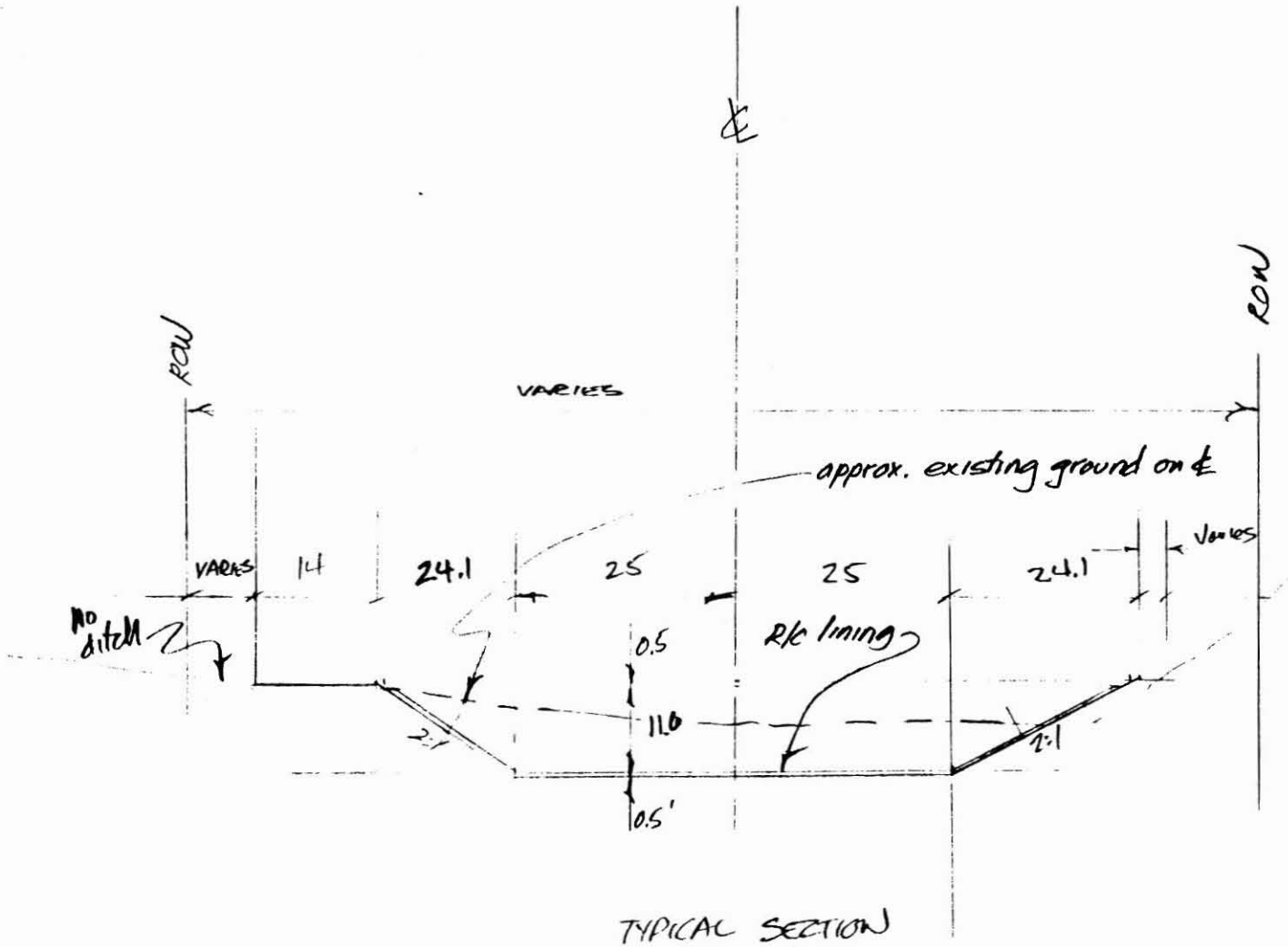


TYPICAL SECTION

STA 495+35 to 521+00

not to scale

NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE



TYPICAL SECTION

STA 521+00 TO STA 527+00

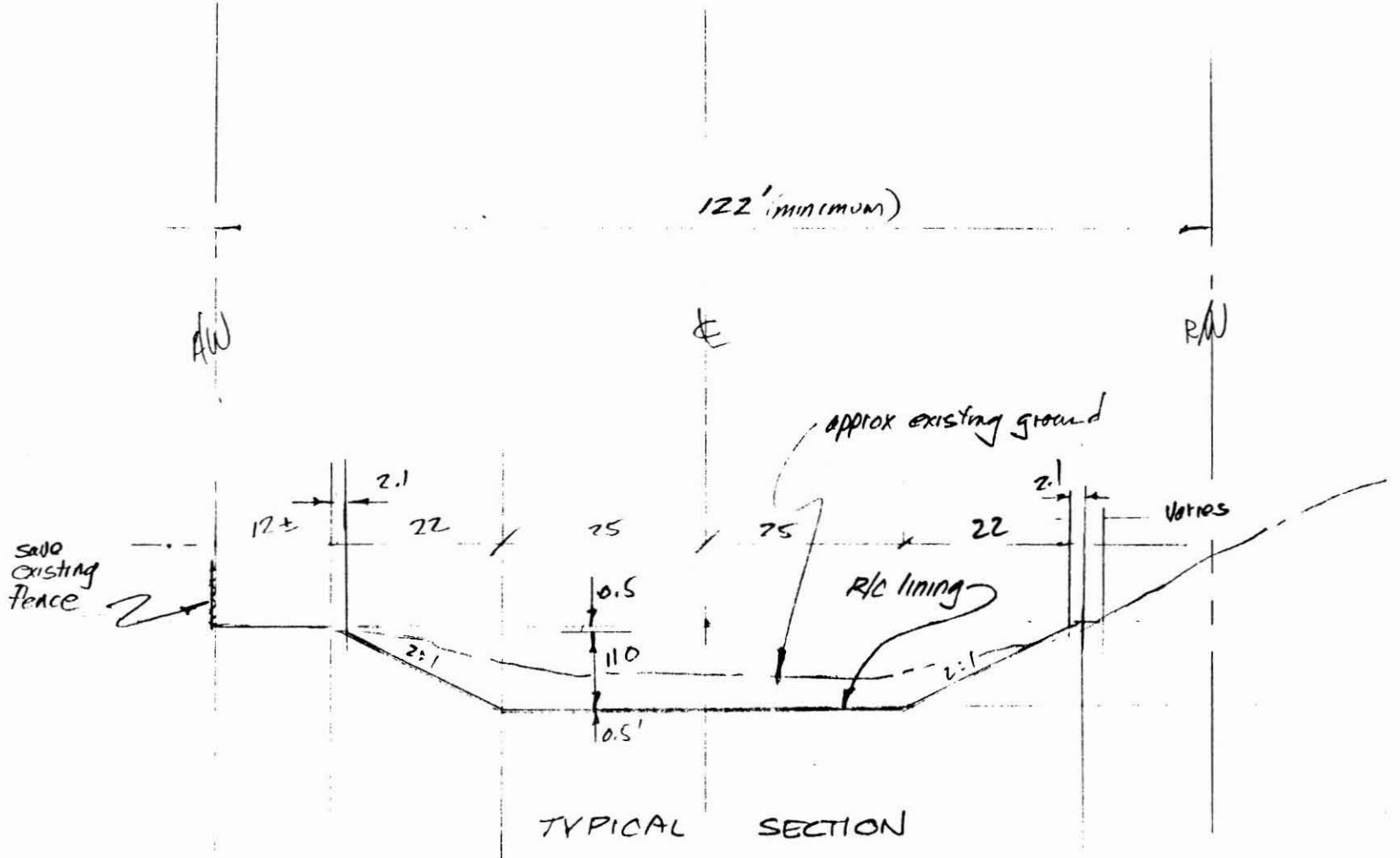
not to scale

ARIZONA RWCD REACH 4

DT 2/25

R/C LINING TYPICAL SECTIONS

2/8



TYPICAL SECTION

approx. STA 527+00 TO STA 532+40

not to scale

ARIZONA RWCD REACH 4

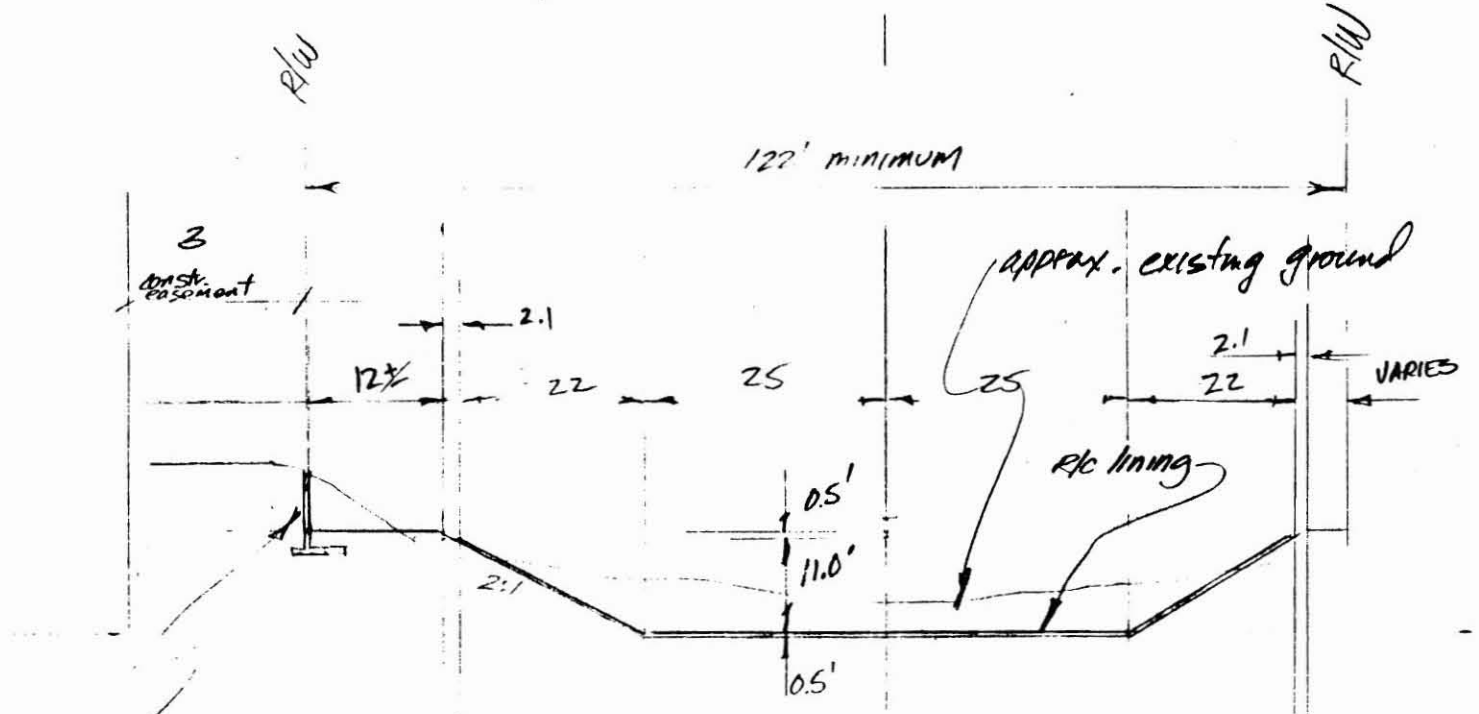
DT 2/85

JMK

R/C LINING TYPICAL SECTIONS

3/8

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 380 200 SHEETS 5 SQUARE
NATIONAL



RETAINING WALL

TYPICAL SECTION
approx. STA 532+40 TO 534+50

not to scale

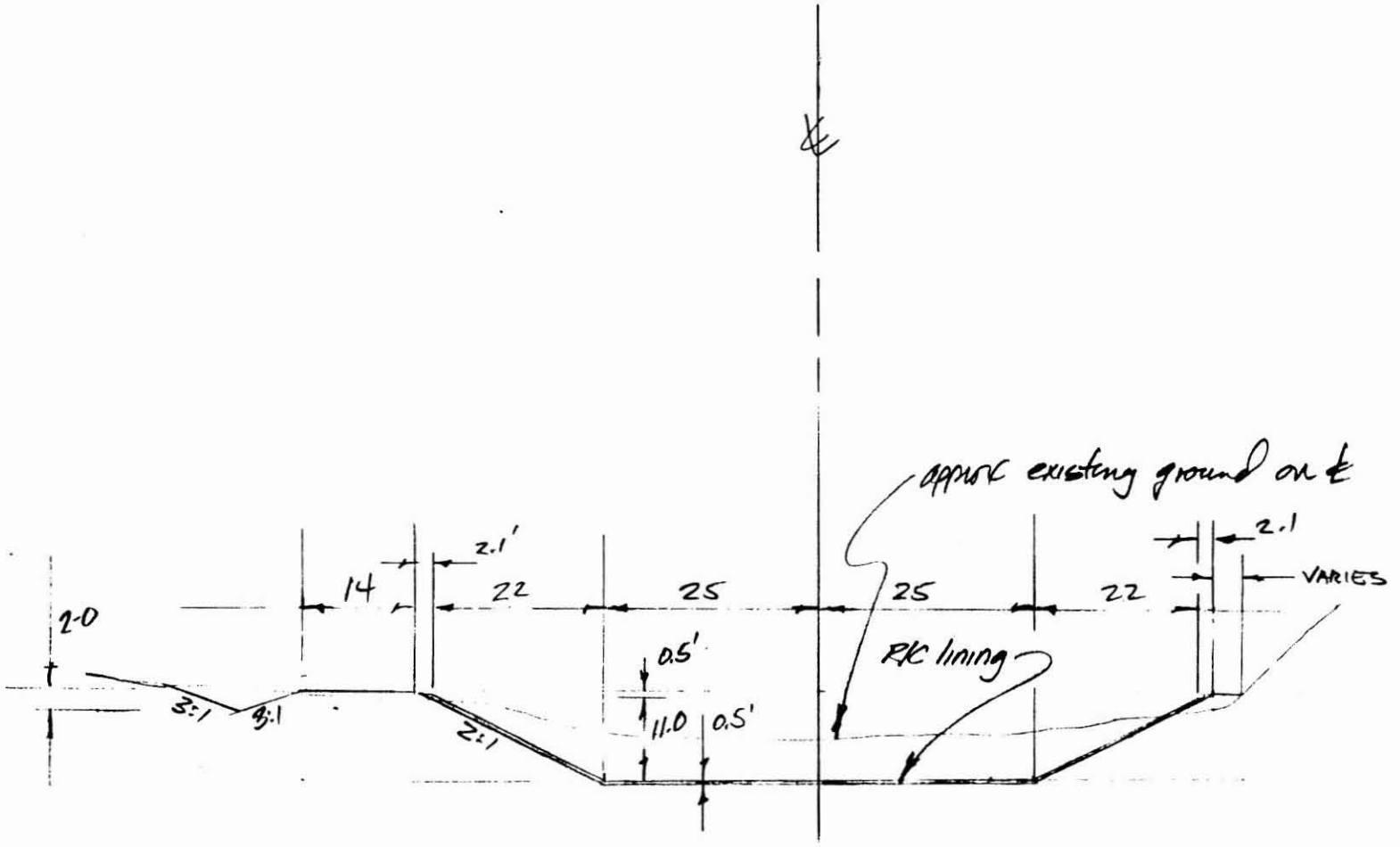
ARIZONA
RWCD REACH 4

DT 2/85 YMF

TYPICAL SECTIONS

A/B

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL



TYPICAL SECTION

STA 534+50 TO STA 538+50

not to scale

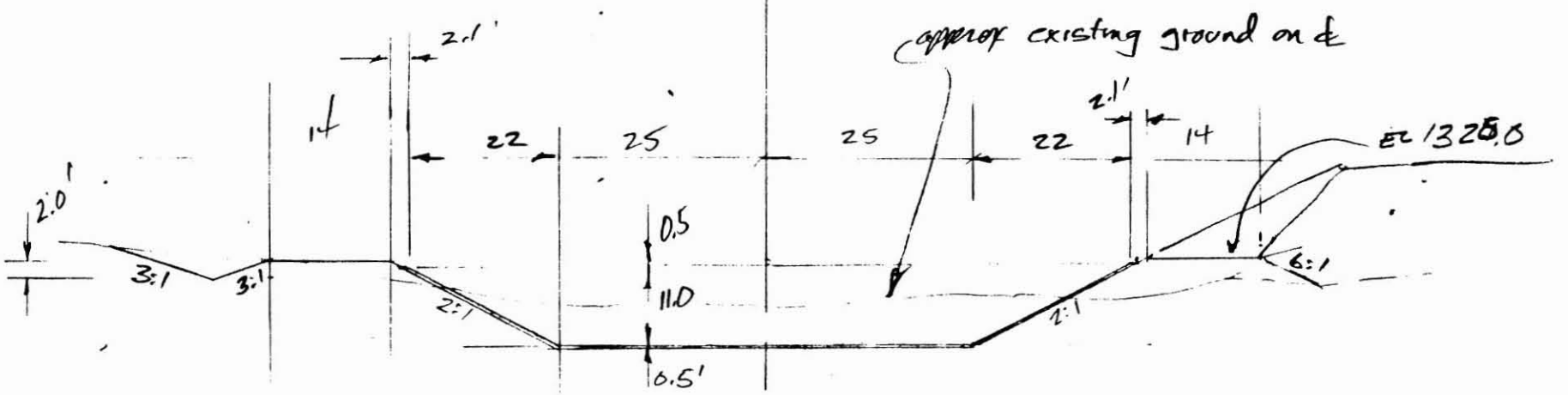
PARK REACH 1

DT 2/95

RC LINING TYPICAL SECTIONS

5/8

NATIONAL 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE



TYPICAL SECTION 5433-1
. STA 528+50 TO 541+50
not to scale

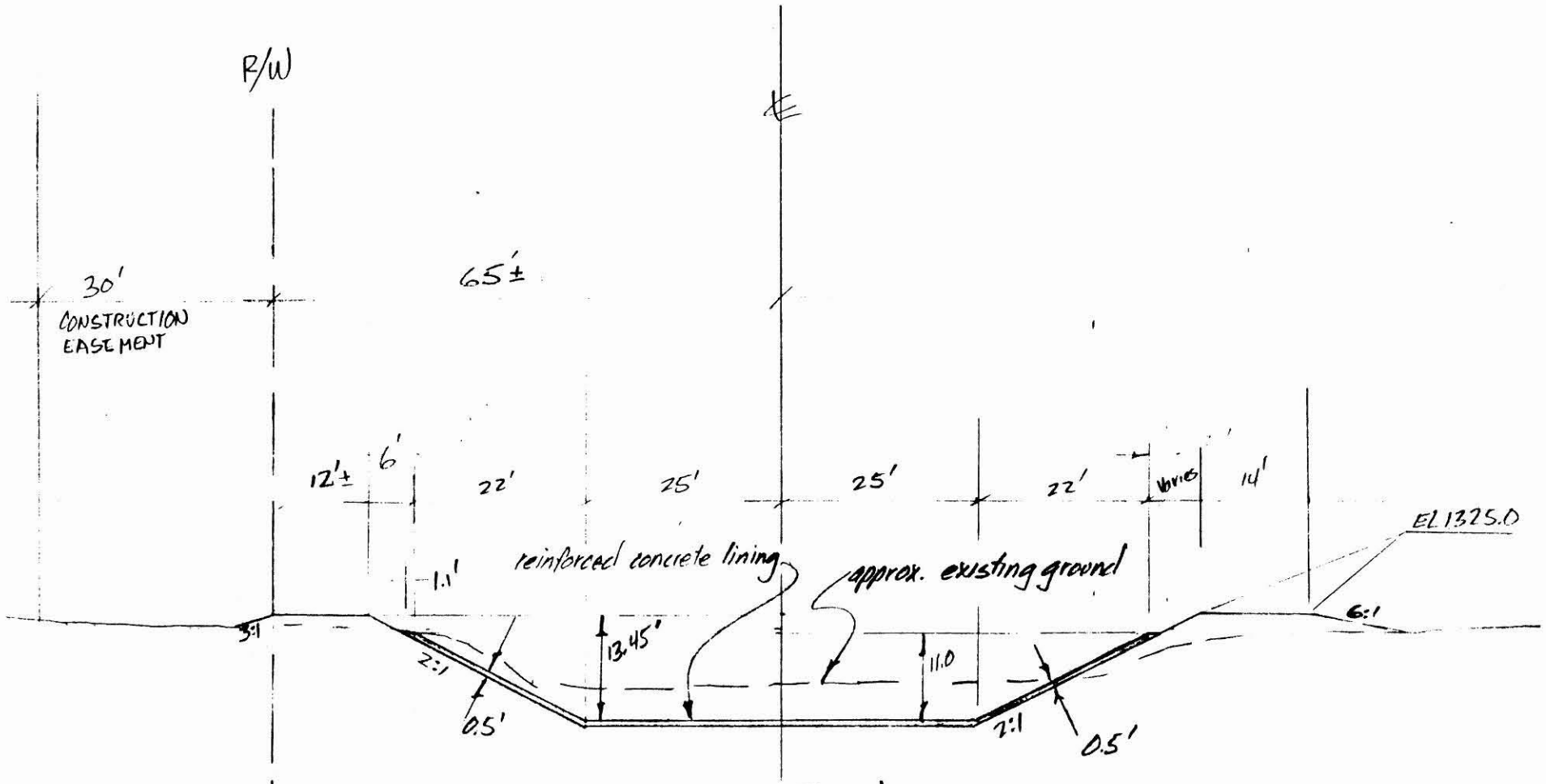
ARIZONA
RWCD REACH 4

DI 265

RIC LINING
TYPICAL SECTION

4/8

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE



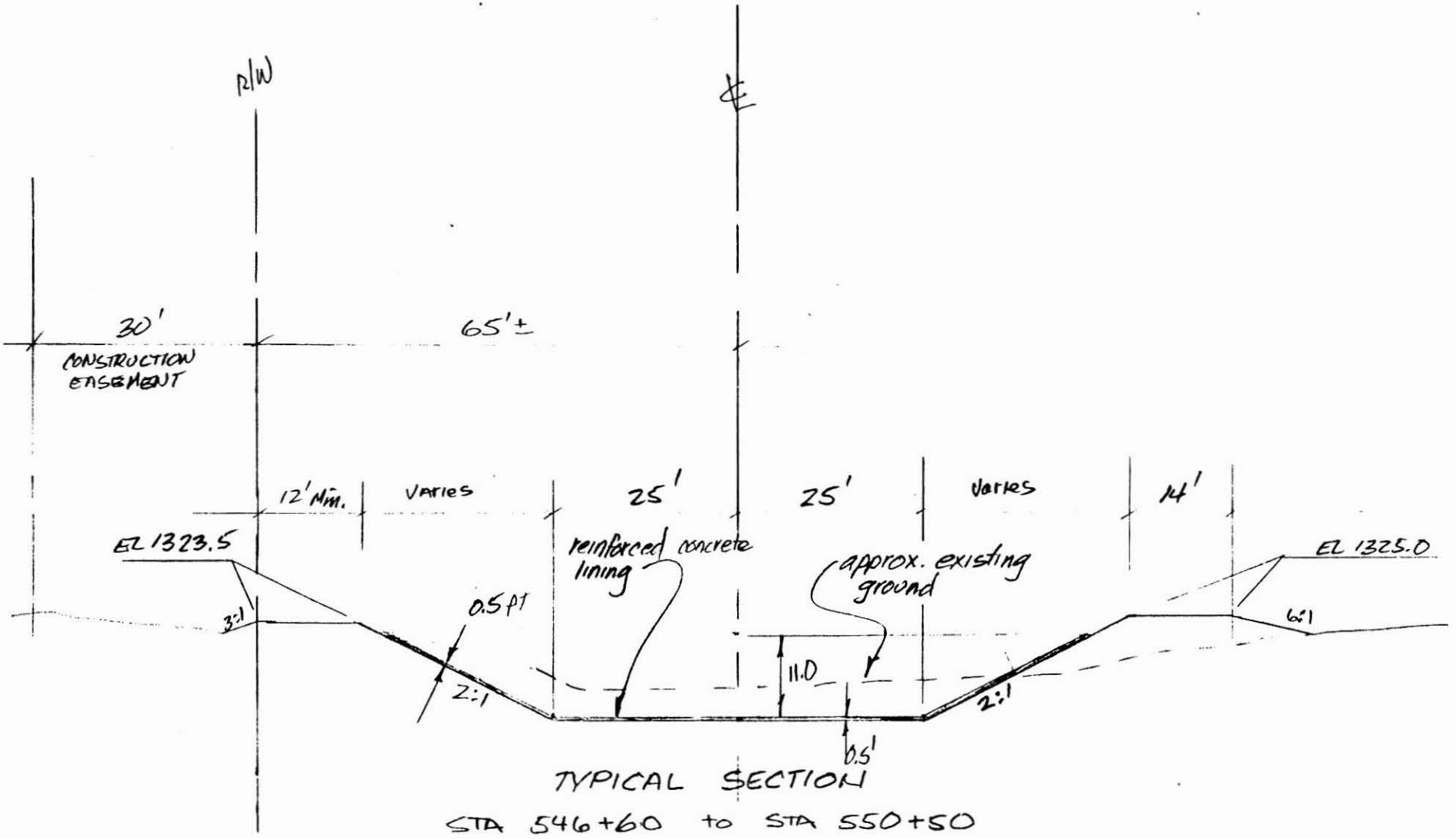
TYPICAL SECTION

STA 543+45 to STA 546+60

not to scale

ARIZONA RWCD REACH 4 DT 2/ES JMK RC LINING TYP SECTIONS 7/8

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE



TYPICAL SECTION

STA 546+60 to STA 550+50

not to scale

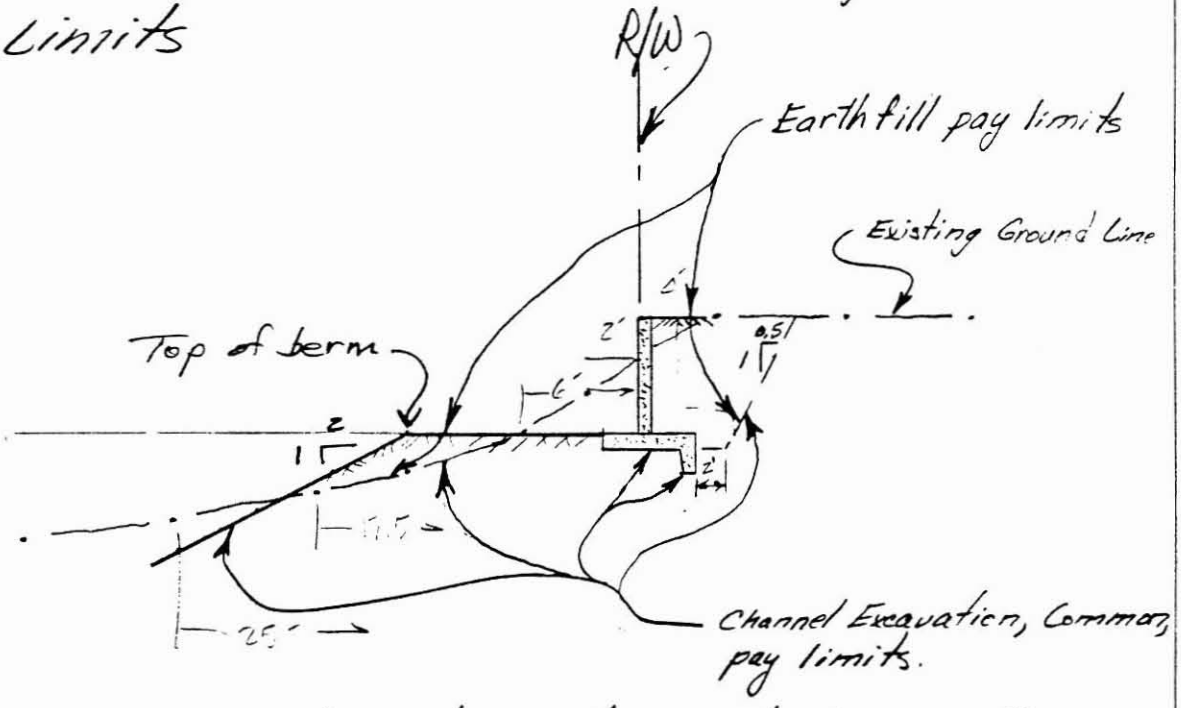
ARIZONA EWCD REACH 4

DT 2/85

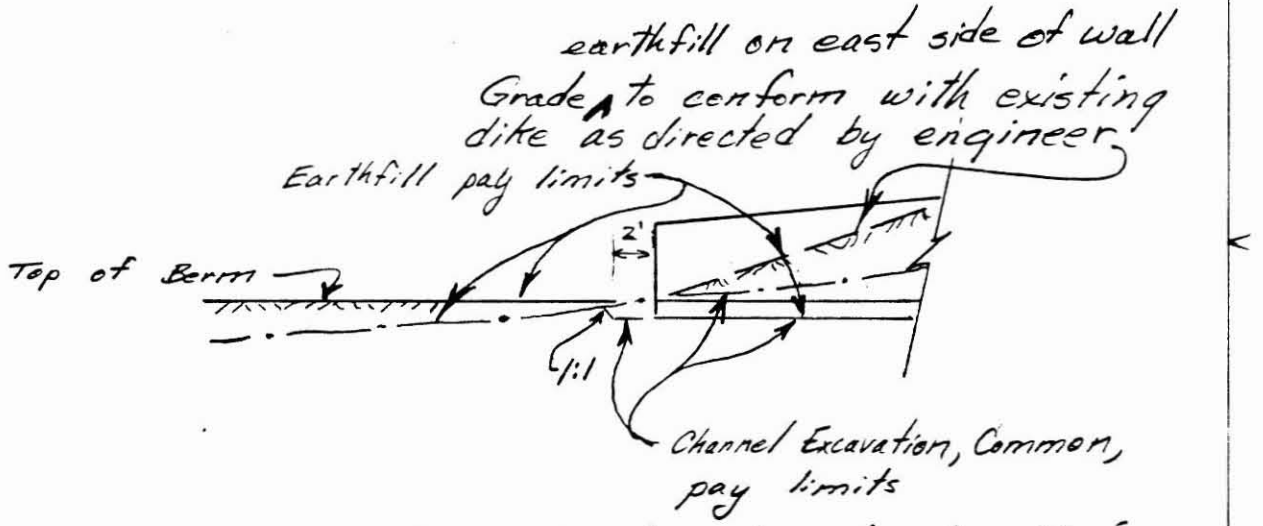
R/C LINING TYPICAL SECTION

8/8

Pay Limits



Typical section along retaining wall



Typical pay limits at end of retaining wall

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

Retaining wall to support containment berm between STA. 532+20 ± to STA. 534+70 ±

Assumed soil conditions:

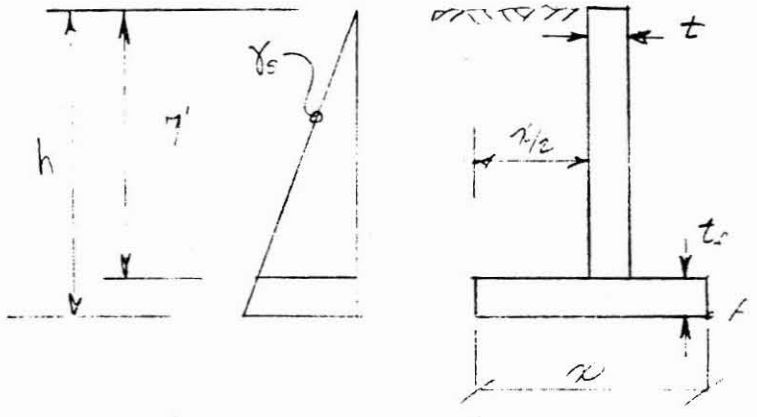
$\gamma_m = 130$ lbs/ft^3 SM, CL

$\gamma_s = 134$

$\phi_{ave} = 27°$ $K_o = 0.65$

No wall drainage

Design concrete wall for maximum height of fill, STA 533+00 ± $h = 7'$



Check Over turning about A.

Try $w = 6'$ ∴ $h = 5'$

$t = t_s = 12"$

Item		Weight [Force]	Arm	Mom
Horiz. Soil	$\frac{[(\gamma_s - 62.4)(K_o) + 62.4][h]^2}{2}$	= 3486	$\frac{h}{3} = 2.67$	9296 '#
Vert. Soil	$(\gamma_s)(7)(\frac{w}{2})$	= 2814 lbs/ft	$\frac{w}{2} + \frac{w}{4} = 4.5$	12,663 '#
Conc. (Wall)		1050	$\frac{t}{2} - \frac{t_s}{2} = 2.5$	2625 '#
(Foot)		900	$\frac{w}{2} = 3$	2700 '#
		ΣW = 4764		ΣM = 8672 ?

$R_f = \frac{\Sigma M}{\Sigma W} = 1.83 < \frac{w}{3}$ ∴ N.G.

Saturated fill is probably too conservative analysis. The dikes is well above channel flows. Most likely chance of water accumulation against wall would be Thunderstorm following a dry spell - fill dry and cracked - Pressure on wall would be mostly hydrostatic under this condition.

Moist soil condition will be used for design.

$\gamma_m = 130$ lbs/ft^3 $\quad K_o = 0.65$

⇒ Cross section data indicates a wall height of 6.75 feet above berm is adequate. see sheet 2a

Recheck overturning using following

Wall height = 6'-9"

h = 7'-9" includes footing

Try $f = 5.5'$ footing width

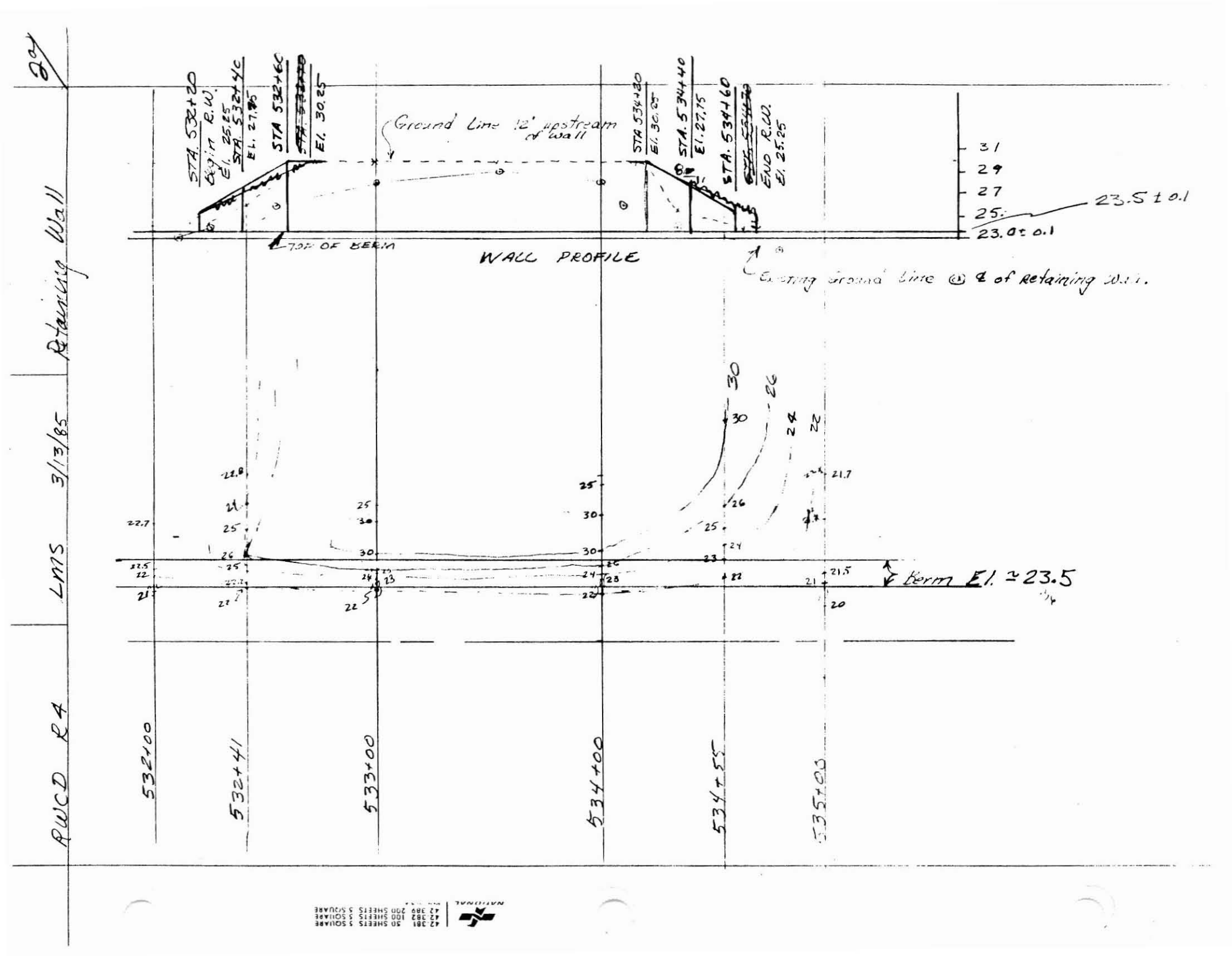
$t = 10"$

$t_f = 11"$

			Wt.	Force	Arm	Mom.
Hor	Soil	$(130)(0.65)\frac{(7.75)^2}{2} =$		2537.6	2.58	6556
Vert.	Soil	$(130)(6.75)(\frac{5.5}{2}) =$	2413		4.13	9954
Conc	Wall	$(10/12)(6.75)(150)$	844		2.33	1969
"	footing	$1/12\,(5.5)(150)$	756		2.75	2080

Σ 4013 $\qquad$ $\Sigma M = 7447$

$R_M = \frac{\Sigma M}{\Sigma wt} = \frac{7447}{4013} = 1.86 > \frac{5.5}{3}$ ∴ OK


RWCD #4 LMS 3/13/85 Retaining Wall
STA. 532+20 Begin R.W. El. 25.25
STA. 532+40 El. 27.85
STA 532+60 El. 30.25
Ground Line 12' upstream of wall
STA 534+20 El. 30.25
STA. 534+40 El. 27.75
STA. 534+60 End R.W. El. 25.25
31
29
27
25.
23.0 ± 0.1
23.5 ± 0.1
TOP OF BERM
WALL PROFILE
Existing ground line @ ℄ of Retaining W.L.
Berm El. ± 23.5
532+00
532+41
533+00
534+00
534+55
535+03

Check Sliding:

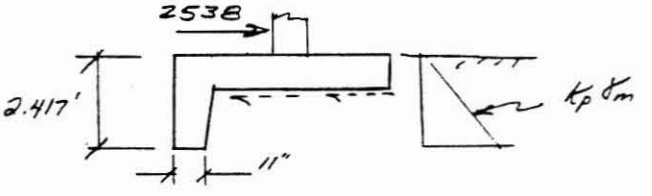
Friction: Concrete to soil $\Rightarrow f = 0.4$

$R_f = (f)(\Sigma Wt) = (0.4)(4013) = 1605$

F_s = driving force = 2538 *

$R_f < F_s$ N.G.

Try 1.5 deep cutoff
Also include cohesion $c = 200$



$k_p = 2.7$

$\Sigma Wt = 4013 + 206 = 4219$ $\quad R_f = f_s \Sigma Wt + CA$

$R_f = (0.4)(4219) + (200)(5.5) = 2788$

$R_s = (2.7)(130)\frac{(2.417)^2}{2} = 1025$

F.S. for sliding

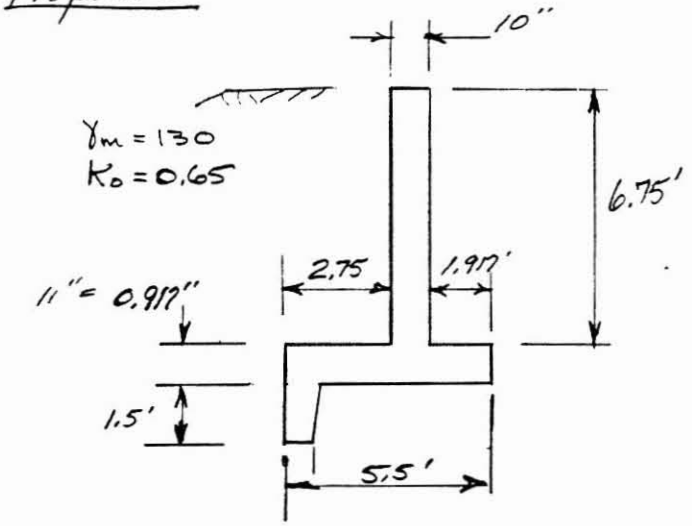
$F.S. = \frac{2788 + 1025}{2538} = 1.5$ Ok

* At rest driving force since backfill may contain CL soils that creep after initial strength is mobilized.

R/C design

Design wall at maximum section

Proposed



42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

Determine wall moments:

$M = \frac{w l^3}{6}$ $\quad w = \gamma_m K_o = 130(.65) = 84.5 \text{ lbs/ft}^3$

An EFP = 100 lbs/ft³ will be used for design. This will allow for temporary vehicle loads that may occur on the containment dike.

$\therefore w = 100 \text{ lbs/ft}^3$

$M_{@ base} = \frac{(100)(6.75)^3}{6} = 5.1^{1K}$ $\quad f'_c = 4000$

$d = \sqrt{\frac{M}{K}} = \left(\frac{5126}{272}\right)^{1/2} = 4.34 \text{ in.}$ $\therefore$ 10" Wall OK

$A_s = \frac{M^{1K}}{a d} = \frac{5.1}{(1.44)(7.5)} = 0.47 \,\square''$ ⊛

? Assumed ...

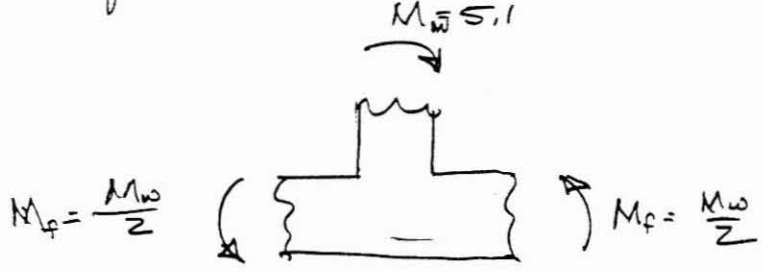
Shear OK by inspection

⊛ #6 @ 12" ⇒ $A_s = 0.44$ This will result in overstress if design loading is realized; however going to larger bar size, or closer sp...

Footing

Maximum moment in footing will be moment induced from wall.

Since this is a small structure and effective thickness of wall(10") and footing (11"-poured against earth) are the same moment distribution into the footing is assumed equal.



$$M_f = \frac{5.1}{2} = 2.55^{1k}$$

$$A_s = \frac{2.55}{(1.44)(7.5)} = 0.24^{\square''}$$

Key wall

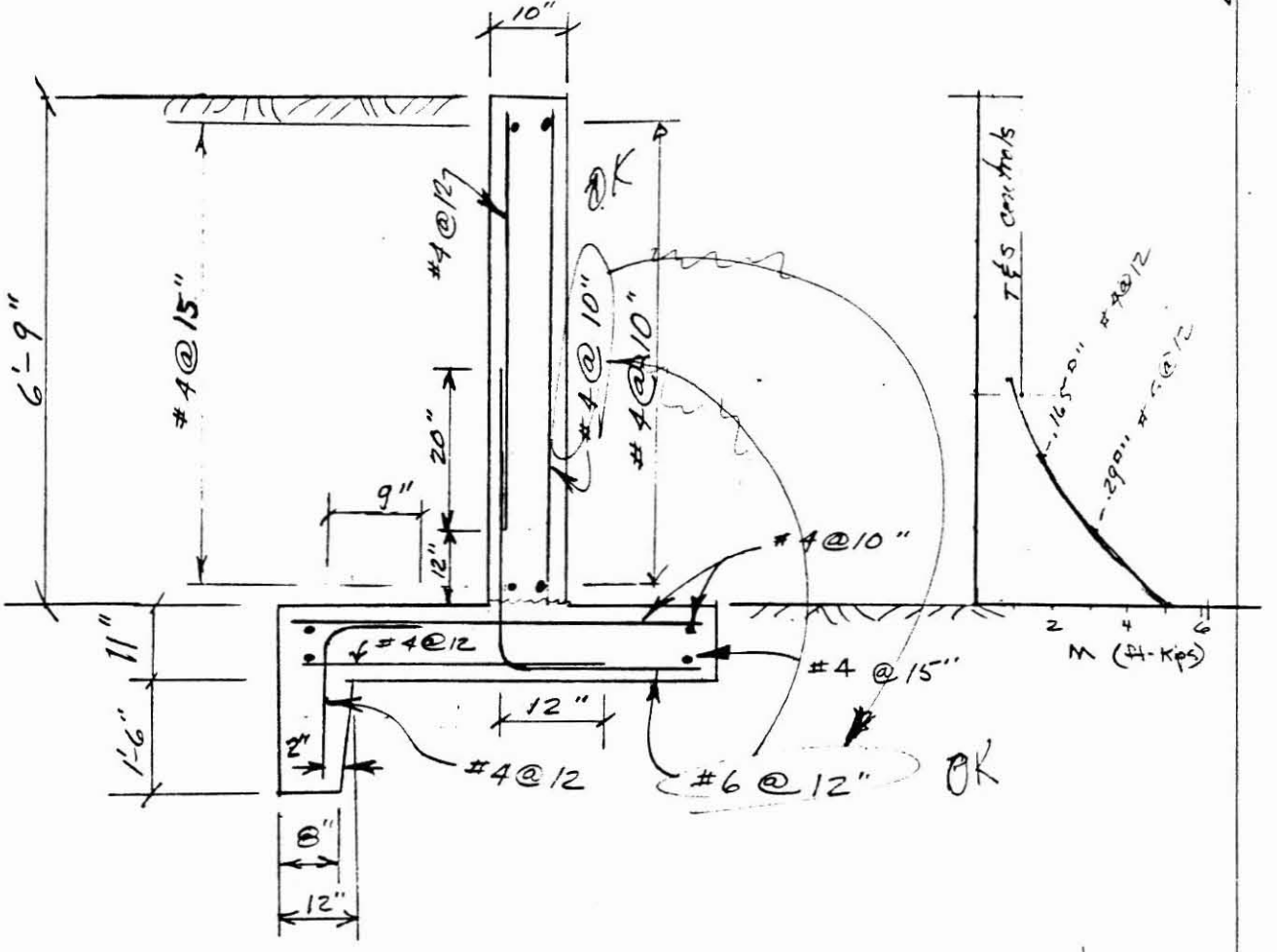
$$M_K = K_p \gamma_m \frac{t^3}{6} \qquad \text{from sheet 3}$$

$$M_K = (2.7)(130)\frac{(2.417)^3}{6} = 0.8^{1k}\ *$$

* Moment is on conservative side since I did not reduce for soil load against edge of footing.

STA. 532+60 TO STA. 534+20

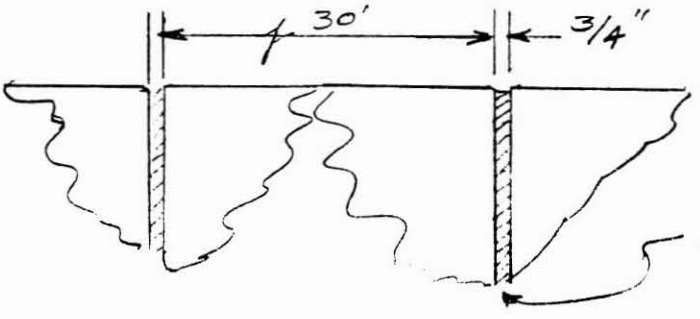
Note: Provide 2" cover except 3" bottom of footing



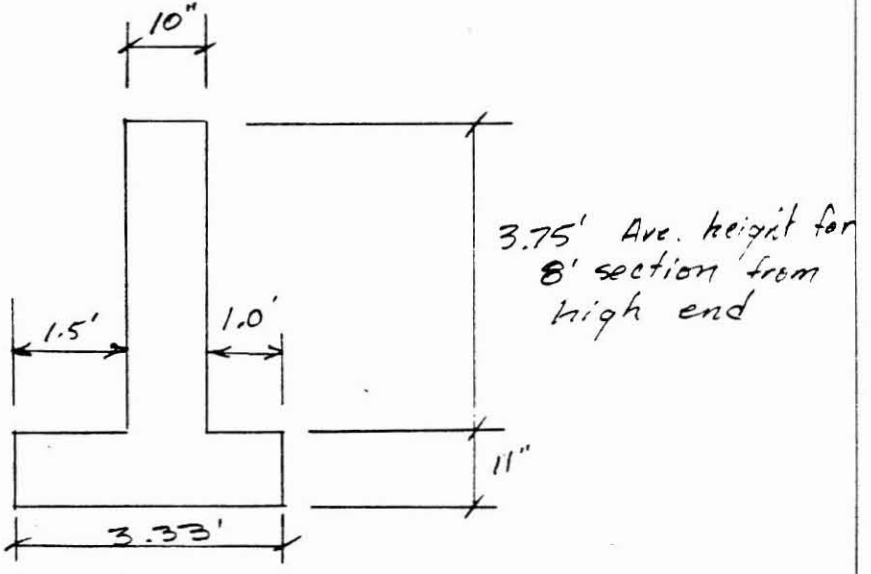
Grade 60 steel	
#4	ℓ_d = 12"
#5	ℓ_d = 15"
#6	ℓ_d = 18"

T & S	L ≤ 30'	
Exposed	ρ_t = .002	A_s = 0.24
Unexposed	ρ_t = .001	A_s = 0.12

Expansion joints at 30 foot intervals



STA. 532+20 to STA. 532+40
534+40 to STA. 534+60



Check Over turning:
$\gamma_m = 130$ $K_o = 0.65$

Soil Horiz.	$(130)(.65)\frac{(4.667)^2}{2} =$		920	$\frac{4.67}{3}$	1432 ↗
" Vert	$(130)(1.5)(3.75) =$	731		2.58	1888 ↘
Conc. Wall	$(150)\frac{10}{12}(3.75) =$	469		1.83	860 ↑
" foot	$(150)\frac{11}{12}(3.33) =$	458		$\frac{3.33}{2}$	763 ↖
		$\Sigma M_T = 1658$			$\Sigma M = 2079$

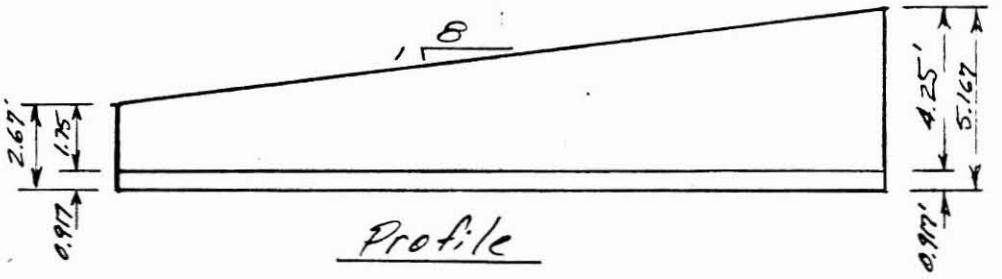
$\frac{\Sigma M}{\Sigma M_T} = 1.25 > \frac{3.33}{3}$ ∴ Ok

Check Sliding

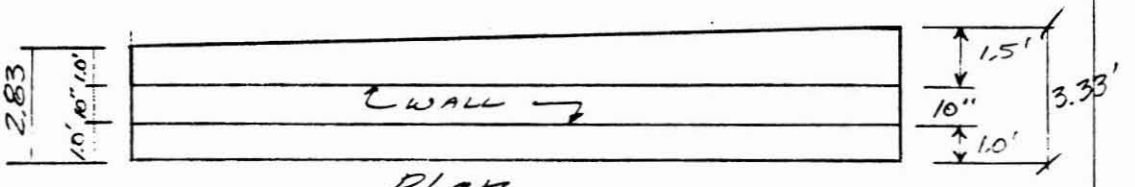
$R_F = (f)(\Sigma M_T) + CA = (0.4)(1658) + (200)(3.33) = 1329$

$F.S. = \frac{1329}{920} = 1.45 \simeq 1.5$ Ok

STA. 532+20 To STA 532+40 and
STA 534+40 To STA 534+60.

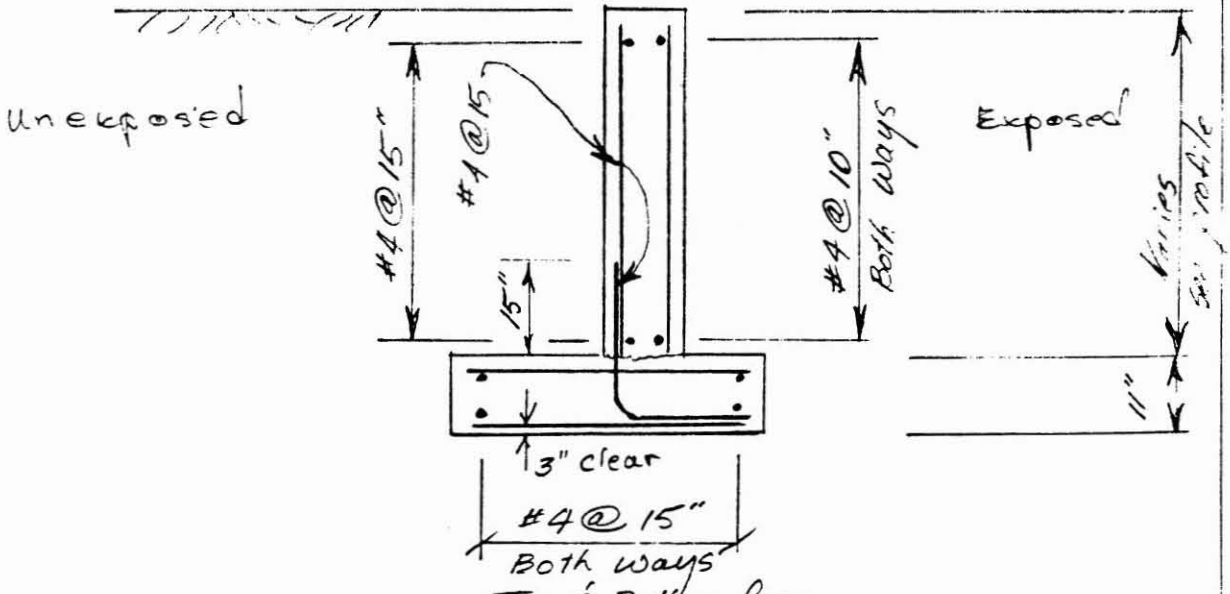


Profile



Plan

STEEL DESIGN BY INSPECTION (REFERENCE SH. 6)



STA. 532+40 to STA 532+60

STA 534+20 to STA 534+40

Reference sheets 6 & 8

Check sliding using ave. wall height over 8 foot ~~length~~ between STA. 532+52 and STA 532+60

Consider footing width tapering from 1.917' to 1.0' in 20' on channel side and 2.75' to 1.5' on emb. side.

Assume no key.

Ave Wall height above footing = 6.25'
footing thickness = 11" = 0.917'
footing width (and) channel side = 1.73
footing width (and) emb. side = 2.50

Soil Horiz	$(130)(.65)\left(\frac{7.167}{2}\right)^2$	2170	2.389	5184
" Vert	$(130)(2.5)(6.25)$	2031	3.813	7745
Conc. Wall	$(150)\left(\frac{2.5}{12}\right)(6.25)$	781	2.146	1674
Conc foot	$(150)(5.06)\left(\frac{15}{12}\right)$	696	$\frac{5.06}{2}$	1760
		ΣW 3508		ΣM 5997

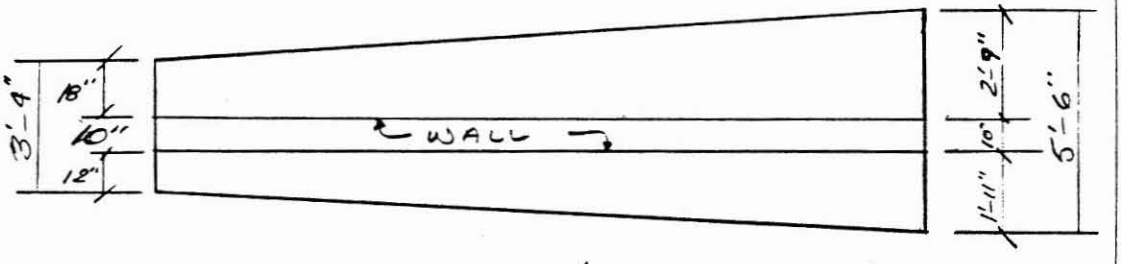
$$\frac{\Sigma M}{\Sigma W} = 1.71 > \frac{5.06}{3} \quad \therefore OK$$

$R_F = (0.4)(3508) + (200)(5.06) = 2415$

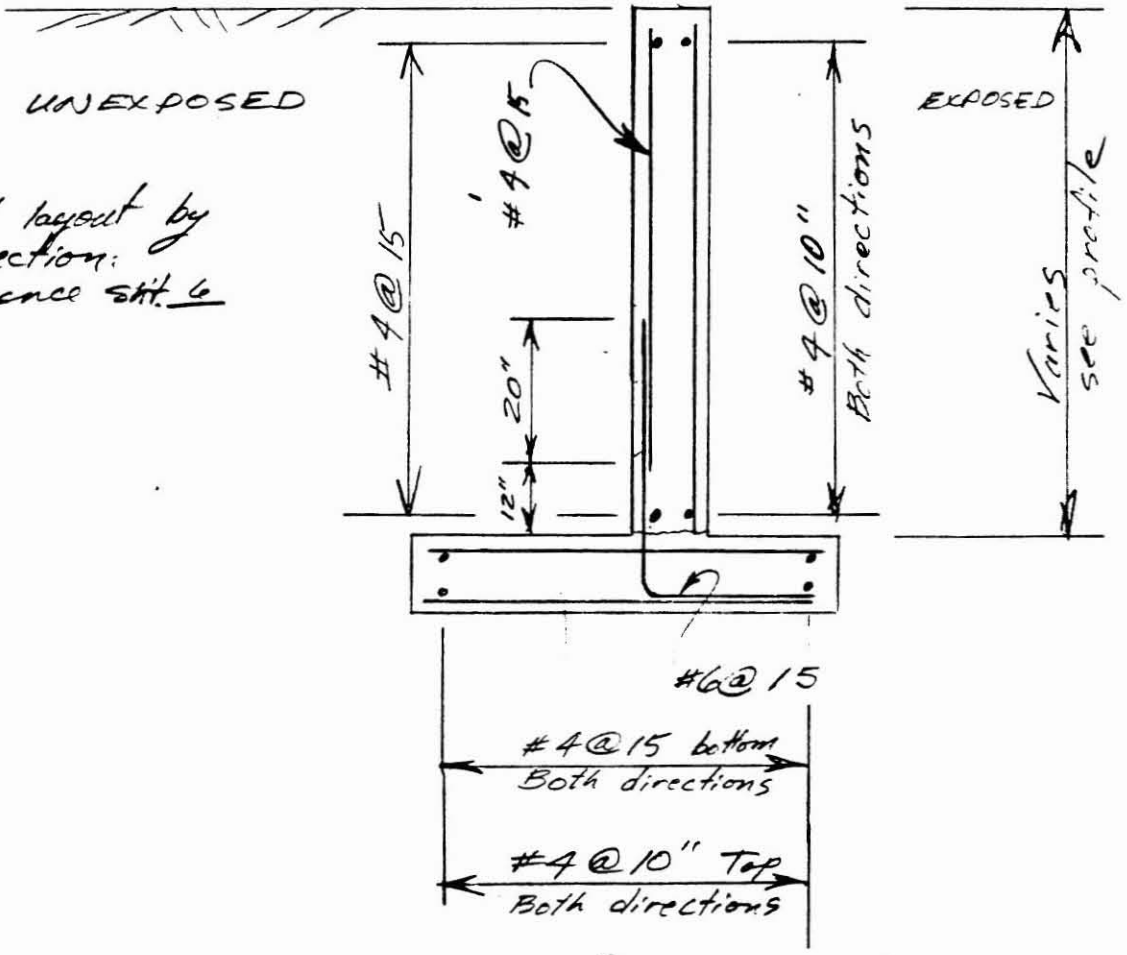
$FS = \frac{2415}{2170} = 1.11 < 1.5$ This is less than 1.5 generally recommended, however the passive restraint at d.s. end of footing is ignored as well as using at rest mobilizing forces. Therefore I believe design is acceptable. LMS

STA. 532+40 To STA. 532+60 and
STA. 534+20 to STA. 534+40

Layout



PLAN



Steel layout by Inspection: Reference Sht. 6

Typical Section

ARIZONA RWCD FLOODWAY REACH 4

D.T. 10/29/84

HIGLEY RD BR

JW

PROBLEM: COMPARE DATUMS USED:

SOLUTION:

	AS BUILT	SCS PLAN & PROF
1. TOP CENTER DECK	1319.69	1316.30
	Δ = 3.4	

LOWEST BOTTOM SIDE OF DECK APPROX. = 4.0

2. RITTENHOUSE RD. BRIDGE

ON BRIDGE DRWGS AT CANAL BRIDGE	1325.81
SCS PLAN & PROFILE " "	1322.50
Δ	3.31

IT APPEARS THAT THE MCHC DATUM IS APPROX 3.3 TO 3.4 FT HIGHER THAN THE REACH 4 DATUM.

ARIZONA
DT 1/21/85 RWCD RL

POWER RD BRIDGE

CHECK FIT AT POWER RD. BRIDGE

TOP ~ ℄ ROAD & ℄ FLOODWAY

PT 110 EL 1329.80 RWCD DRWGS

BRIDGE DRWGS 1330.50

~~Δ = 0.70~~

FROM DRWGS: SH 6/8

SH 8/8

MIDDLE TOP CENTER = 1329.55
+ DEPT "t" AT PIER 1.50
1331.05

RWCD RL 1329.80

Δ = 1.25'

ARIZONA RWCD R4
OT 1/21/05
WMS FIELD RD BR.

TOP CENTER OF DECK

EL 1327.20 RWCD DRWGS

EL 1328.86 BRIDGE DRWGS. SH 1/10

$\Delta = 1.66$ FT

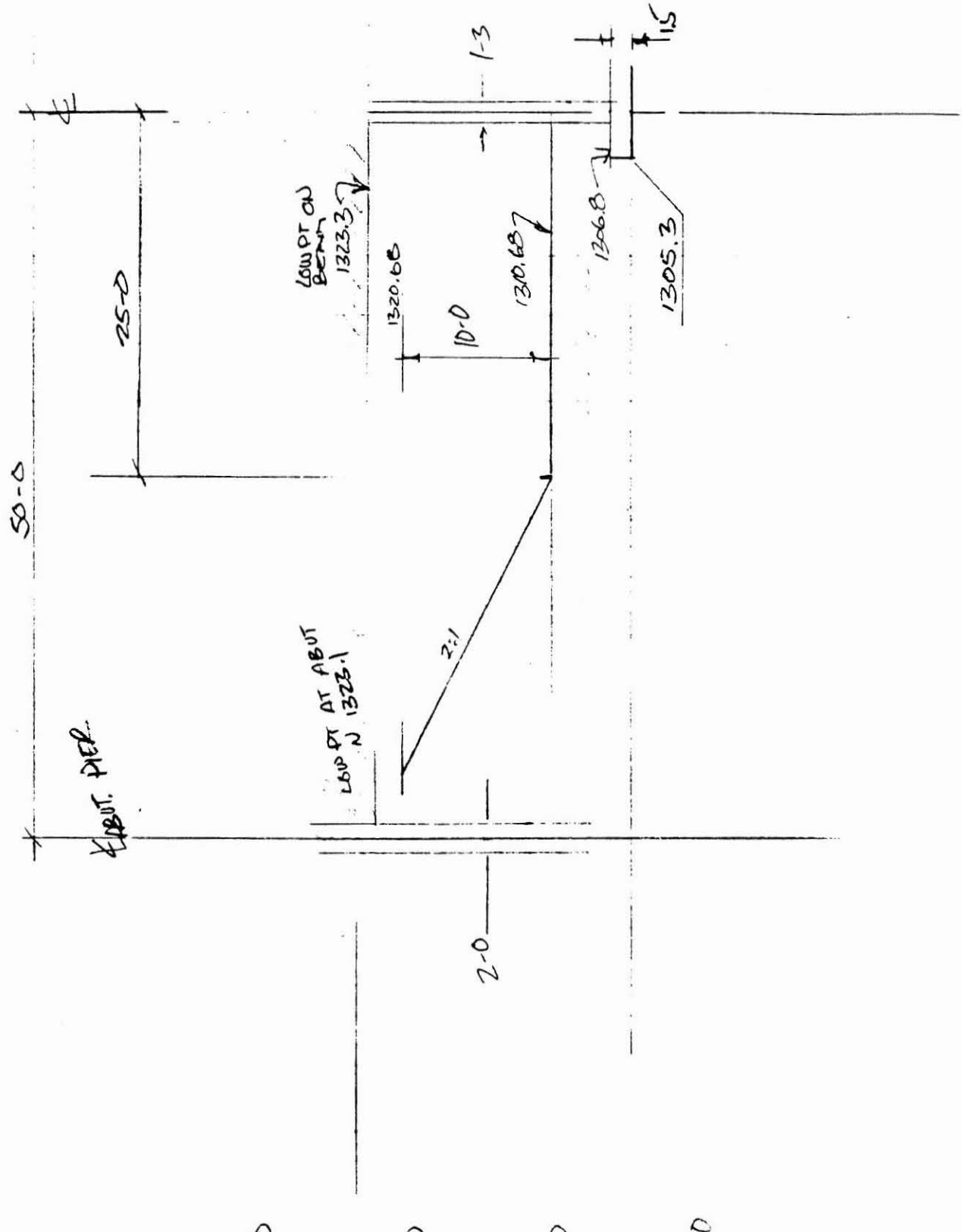
PROP BOTT CH AS SHOWN ON DRWGS 1312.1 (MCHD)
− 1.66
1310.44

(current planned 1/21/05 1310.68)

ARIZONA RWCD R4

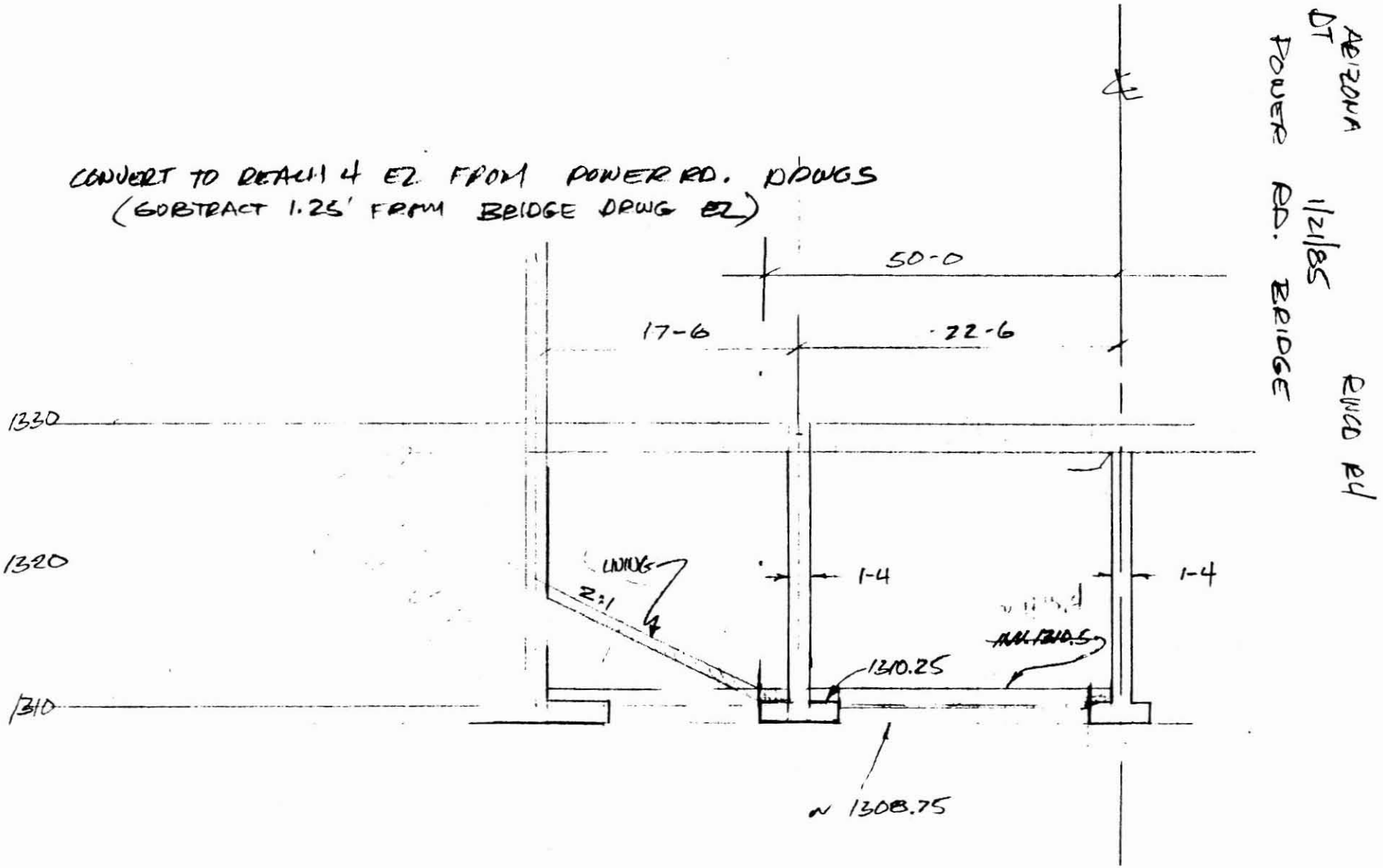
DT 1/21/85

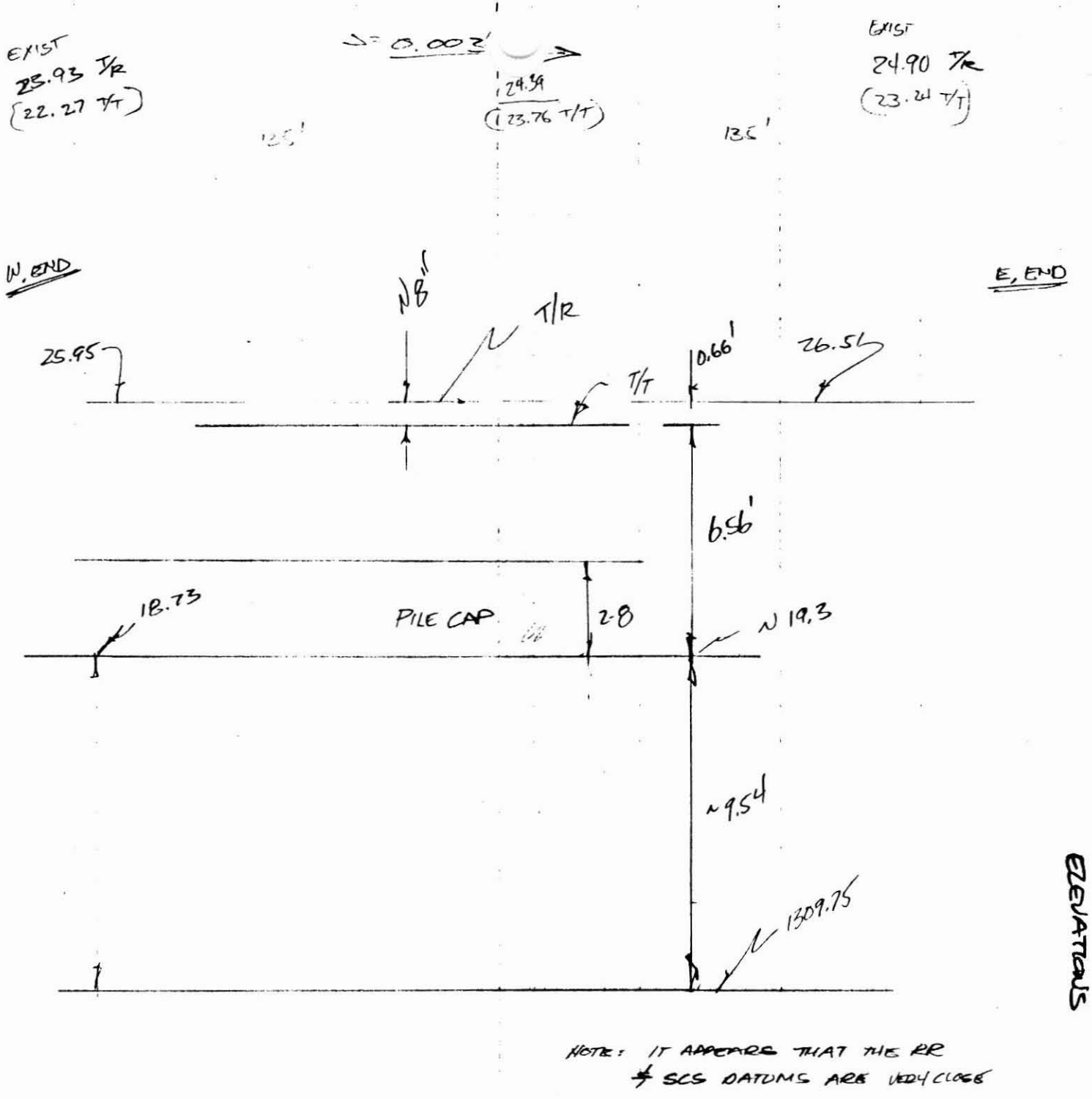
WILLIAMS FIELD RD. BRIDGE



ARIZONA DT
POWER RD. BRIDGE
1/21/85
REVISED

CONVERT TO DETAIL 4 E2 FROM POWER RD. DWGS
(SUBTRACT 1.25' FROM BRIDGE DWG E2)





NOTE: IT APPEARS THAT THE RR & SCS DATUMS ARE VERY CLOSE

ARIZONA RWCD #4
SOUTH PAC. RR & AR STA 578+00
3/85
ELEVATIONS

POWER ROAD BRIDGE

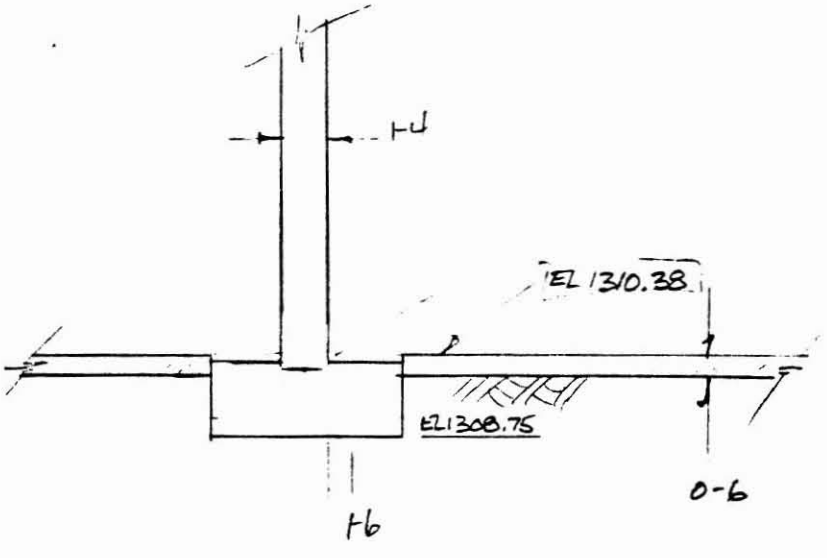
RWCD TOP CENTER OF DECK EL 1329.80

- DECK OVER PIER #2 1-0½ + 4 + 1½ = 1'-6"

(EAST) LEFT PIER 1330.10
RIGHT PIER 1329.00
MID 1329.55 + 1.50 = 1331.05

- RWCD DRAWINGS PT 110 @ 1329.80, Δ = 1.25 FT
- TOP OF FOOTINGS 1310.0 + 1.5 = 1311.5 — BRIDGE DRWG @ 1308.75 RWCD DATUM
  BRIDGE DRWG = 1310.25 RWCD DATUM − 1.50 = 1308.75

- CHANNEL INVERT STA 55+00 EL 1310.38



COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

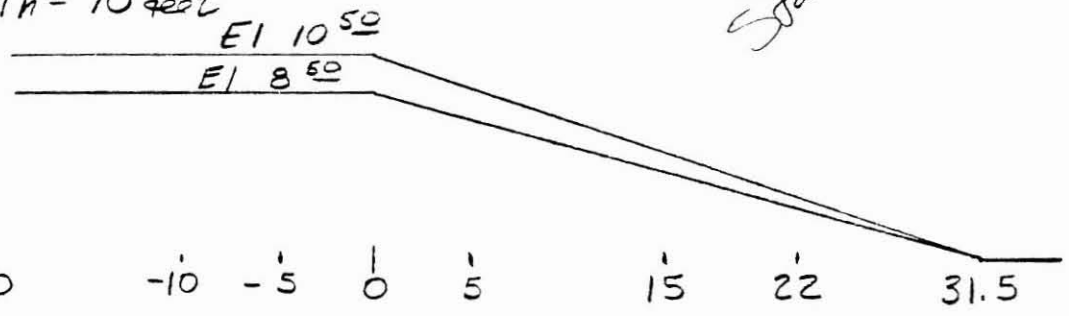
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

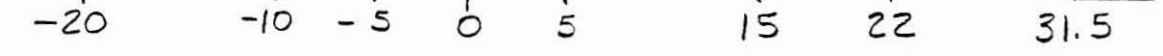
STATE ARIZONA		PROJECT RWCD - Reach 4		
BY GLC	DATE 1-11-85	CHECKED BY ✓	DATE	JOB NO.
SUBJECT Hydraulics of Side Channel Inlets				SHEET ____ OF ____

Station?

Q = 100 cfs

Bottom width = 10 feet





Stations

Used HP41 WSP Program "PWSP"

n = 0.03 in channel upstream of crest
= 0.035 grouted rock riprap downstream of crest

Water Surface Profile

Sta.	Bottom Width	Side Slope	Channel Elev.	WS Elev.	EGL Elev.	Depth	Velocity	Fe
-40	10.0	6.	8.50	10.13	10.28	1.64	3.09	.52
-30				10.08	10.25	1.58	3.24	.55
-20				10.02	10.20	1.52	3.45	.60
-10				9.93	10.15	1.43	3.78	.67
-5			8.50	9.86	10.11	1.36	4.05	.74
0	10.0		8.50	9.65	10.06	1.152	5.13	1.0
5	11.90		7.15	7.75	9.58	0.595	10.86	2.75
15	15.71		4.45	4.90	7.23	0.44	12.26	3.47
22	18.38		2.56	2.97	5.14	0.41	11.83	3.46
31.5	22.00		0.00	0.37	2.31	0.37	11.19	3.39

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE AZ		PROJECT RWCD, Reach 4		
BY GLC	DATE 1-11-85	CHECKED BY ~	DATE	JOB NO.
SUBJECT Hydraulics - Inlet @ 596+10				SHEET ___ OF ___

Water Surface Profile -

Q = 750
~~Bottom~~ width = 80 feet

Sta.	Bottom Width	Side Slope	Channel Elev.	WS Elev.	EGL Elev.	Depth	Vel.	FR
-50	80.	6.	8.50					
-40				10.40	10.69	1.90	4.32	0.59
-30				10.34	10.65	1.84	4.49	0.62
-20				10.26	10.60	1.76	4.71	0.66
-10				10.15	10.55	1.65	5.04	0.73
-5				10.08	10.52	1.58	5.32	0.78
0	80.		8.50	9.85	10.47	1.35	6.31	1.00
5	81.90		7.15	7.88	10.10	0.73	11.96	2.54
15	85.71		4.45	5.04	8.23	0.59	14.33	3.36
22	88.38		2.56	3.12	6.43	0.56	14.59	3.50
31.5	92.0.		0.0	0.54	3.83	0.54	14.55	3.54

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE AZ		PROJECT RWCD - Reach 4		
BY GLC	DATE 1-11-85	CHECKED BY ✓	DATE	JOB NO.
SUBJECT Sizing of Side Inlets - Length of Apron				SHEET ____ OF ____

Approx. length of hydraulic jump

For $Q = 100$ and btm width = 22'

for $d_1 = 0.37'$
$V_1 = 11.19$

d_2 - Eq. 5-4-28 (NEHS) for rect. section

$d_2 = 1.52$ length $\approx 8'$

For $Q = 750$ and btm width = 92'

for $d_1 = 0.54$
$V_1 = 14.55$

$d_2 = 2.41$ length $\approx 12'$

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

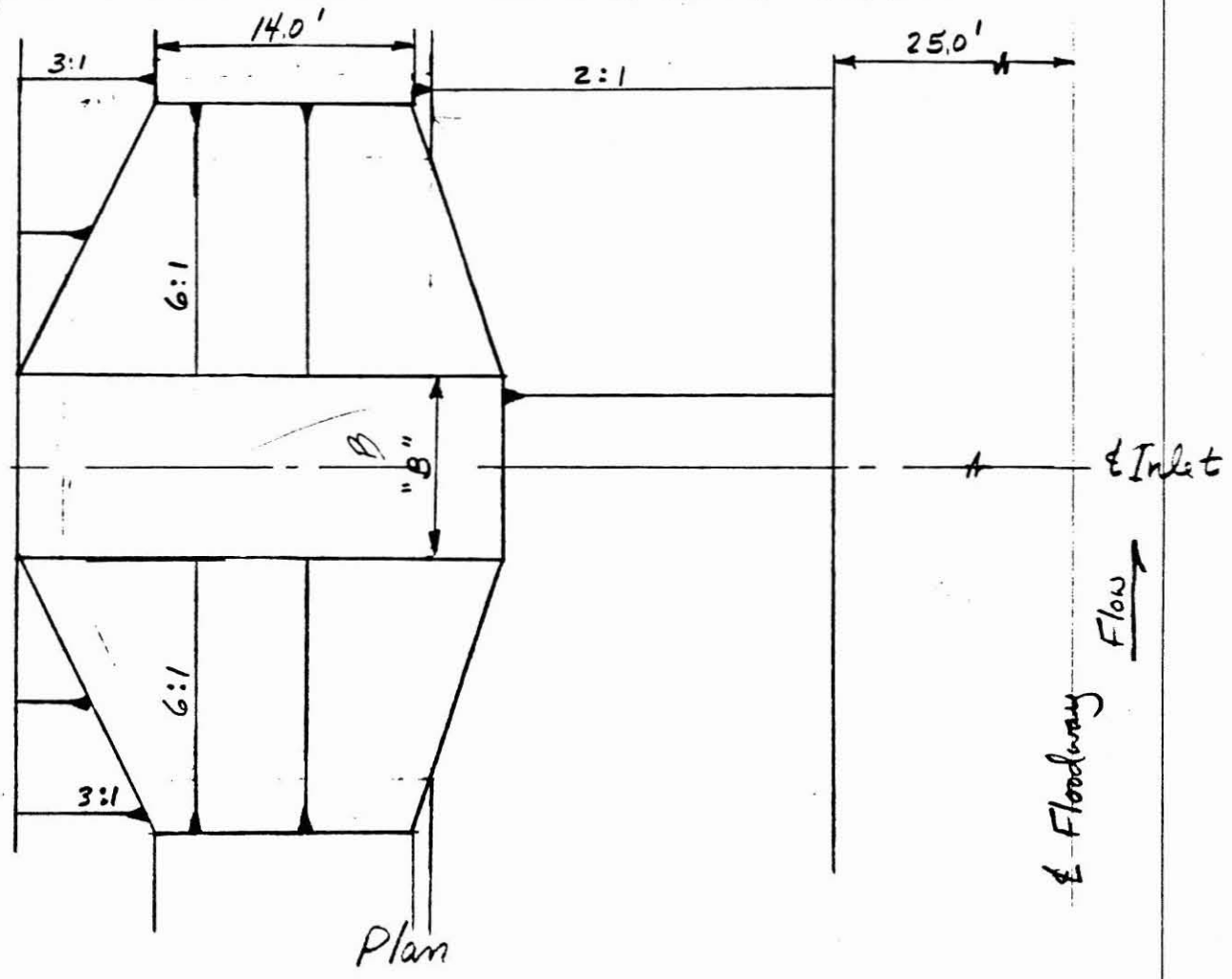
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

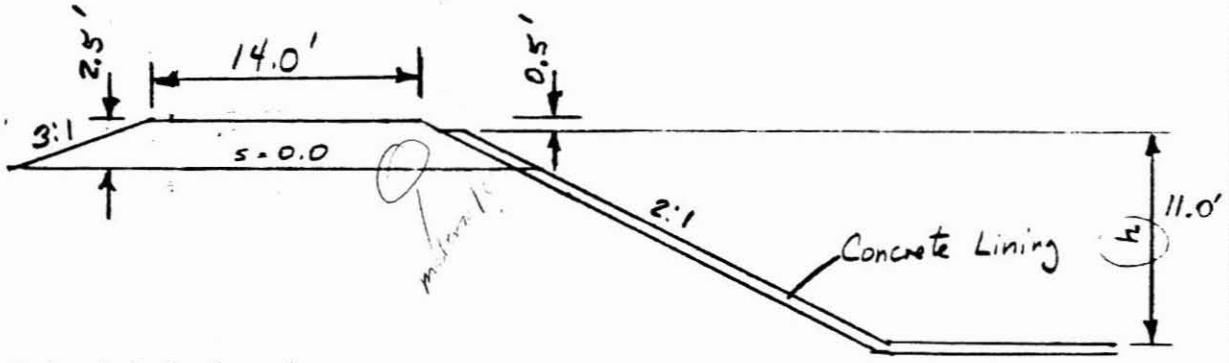
STATE		PROJECT		
BY	DATE	CHECKED BY	DATE	JOB NO.
SUBJECT Inlets - Earth Channel				SHEET ____ OF ____

No.	Approx Sta.	Q_{100}	Width	Main channel Invert	Inlet invert	Approx natural ground @ inlet
7	567+30	90	10	1310.19	1318.69	1320
8	580+00	100	10	1309.94	1318.44	1320
9	596+10	750	80	1309.62	1318.12	1319
10	597+60	100	10	1309.59	1318.09	
11	600+00	100	10	1309.54	1318.04	1320
12	626+75	100	10	1308.98	1317.48	1318
13	685+50	100	10	1302.73	1311.23	1313
14	714+00	100	10	1301.30	1309.80	1311.5
15	726+50	100	10	1300.61	1309.11	1311

KWCD Reach 4 ARIZONA	GLC 2-26-85	SIDE INLETS

Typical Side Inlet - Concrete Lined Section

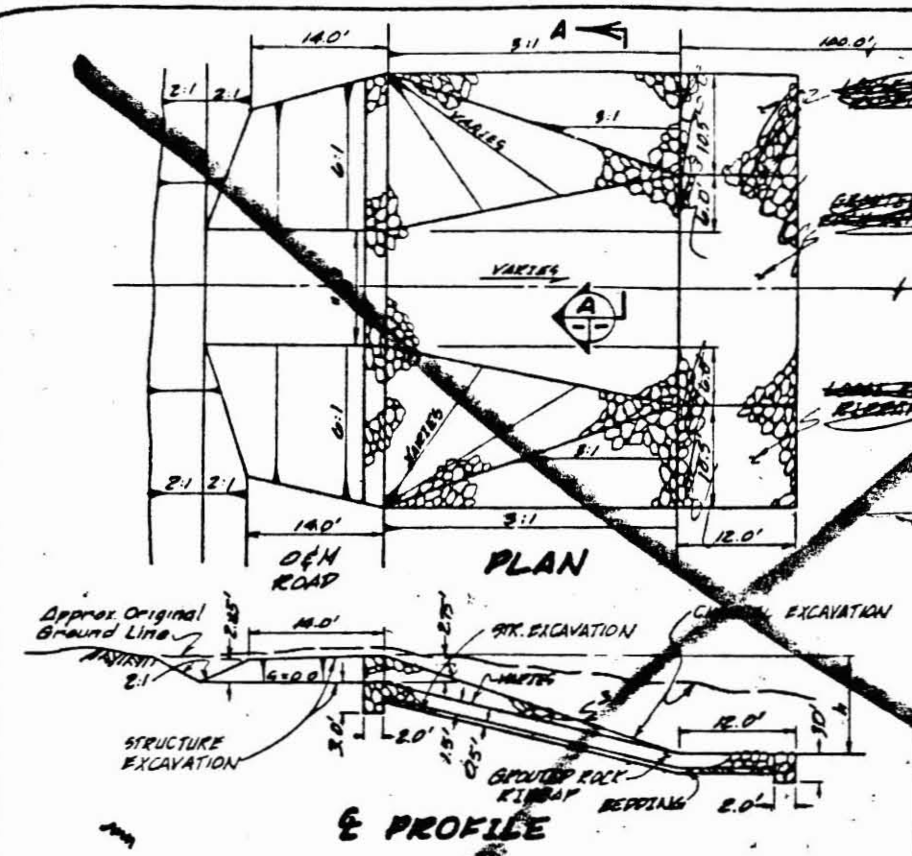




Side Inlet Location

Inlet Station	Inlet Bottom Width - "B"	h
501+60 Lt.	10.0'	11.0'
513+79.5 Lt	40.0'	11.0'
541+50 Lt.	10.0'	11.0'
~~545+60 Lt~~	40.0'	11.0'

546+60 DT 3/11/85 Typical Side Inlet Upstream of Sta. 560+00

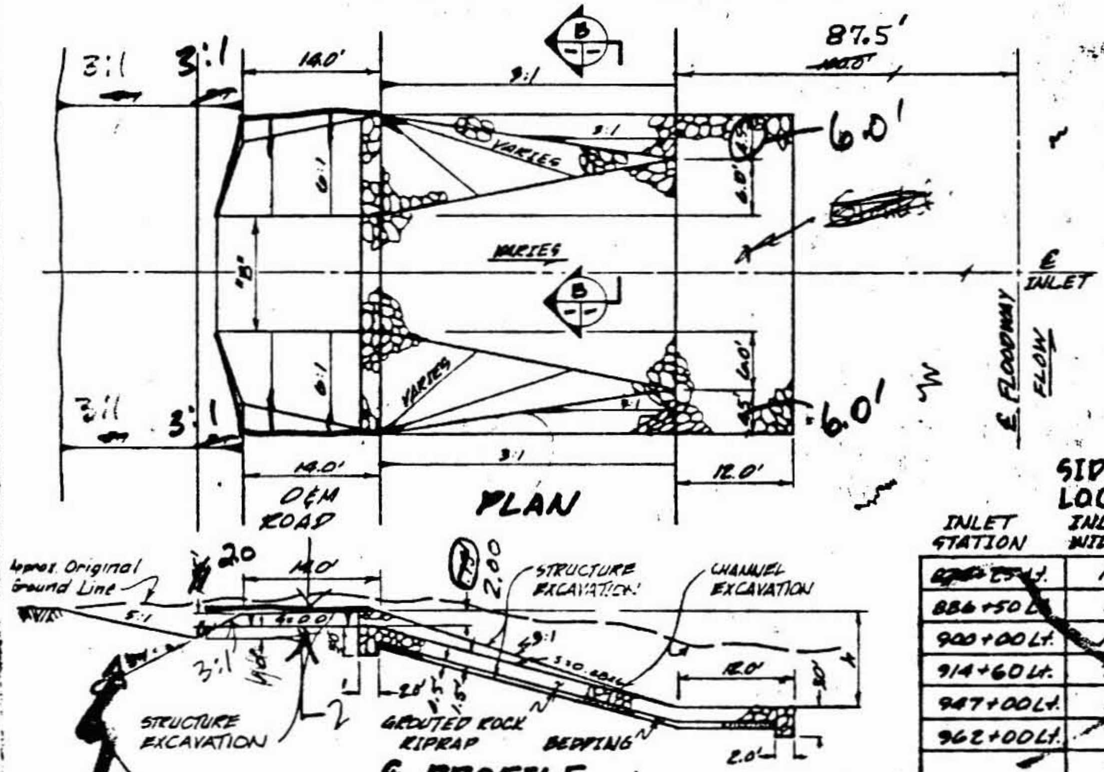


TYPICAL SIDE INLET UPSTREAM OF STA. 860+00

SIDE INLET LOCATION

INLET STATION	INLET BOTTOM WIDTH - "B"	h
752+00 Lt.	10.0'	10.5'
[illegible]+00 Lt.	10.0'	10.5'
835+00 Lt.	10.0'	10.5'
773+60 Lt.	10.0'	10.5'

Lt. = Left of Floodway Channel



TYPICAL SIDE INLET DOWNSTREAM OF STA. ~~860+00~~ 560+00

SCALE IN FEET

SIDE INLET LOCATION

INLET STATION	INLET BOTTOM WIDTH - "B"	h
[illegible] Lt.	12.0'	11.5'
886+50 Lt.	12.0'	11.5'
900+00 Lt.	12.0'	11.5'
914+60 Lt.	12.0'	11.5'
947+00 Lt.	12.0'	11.5'
962+00 Lt.	12.0'	11.5'

Lt. = Left of Floodway Channel

See next sheet

567+30 Lt. 10.0' 10.5'
580+00 Lt. 10.0
595+75 Lt. 80.0 11.0
597+60 Lt. 10 10.5
600+00 Lt. 10
626+75 Lt. 10.

685+50 Lt. 10
714+00 Lt. 10'
721+50 Lt. 10'

Inlet @ ~~596+10~~ 597+40 will not have the dam site

Side Inlet Location

Inlet Station	Inlet Bottom Width - "B"	h
567+30 Lt.	10.0'	10.5'
580+00 Lt.	10.0'	10.5'
595+75 Lt.	80.0'	11.22'
597+40 Lt.	10.0'	10.5
600+00 Lt.	10.0'	10.5
626+75 Lt.	10.0'	10.5
685+50 Lt.	10.0'	10.5
714+00 Lt.	10.0'	10.5
726+50 Lt.	10.0'	10.5

GROUTED ROCK GR
RIPRAP SIDE INLET

Side Inlets:

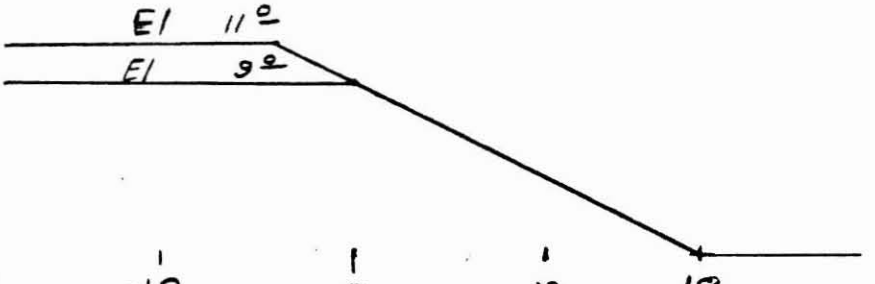
No.	Station	Q_{100}	Q_{10}	Channel Invert elev.
1	501+60	115	30	1314.83
2	513+79.5	350	110	1313.73
3	534+18.5	CMP/HEADWALL		
4	541+50	25	5	
5	545+60	350	90	1310.87
6	550+00	25	5	(Combined with 5)
7	567+30	90	20	1310.49
8	580+00	100	25	1310.17
9	595+75	750	200	1309.78
10	597+40	100	50	1309.74
11	600+00	100	20	1309.67
12	625+75	100	20	1309.98
13	685+50	100	20	1302.73
14	714+00	100	20	1301.30
15	726+50	100	20	1300.61

Hydraulics of Side Channel Inlets - Concrete Lined Section

$Q = 350$ cfs

bottom width = 40 feet

$n = .030$ upstream
$n = .015$ downstream



Sta.	Bottom Width	Side Slope	Channel Elev.	W.S. Elev	EGL Elev.	Depth	Velocity	FR
-40	40.0	6.	9.0	10.779	11.01	1.779	3.88	
-30				10.719	10.97	1.719	4.04	
-20				10.646	10.93	1.646	4.26	
-10				10.545	10.87	1.545	4.60	
-5				10.471	10.84	1.471	4.872	
0	40.0	↓		10.250		1.250	5.895	1.0

$Q = 115$ cfs

bottom width = 10 feet

-40	10.0	6:1	9.0	10.741	10.90	1.741	3.23
-30				10.687	10.86	1.687	3.39
-20				10.619	10.82	1.619	3.60
-10				10.525	10.77	1.525	3.94
-5				10.456	10.73	1.457	4.21
0				10.244	10.679	1.244	5.29
5							

ARIZONA DT — RWCD REACH 4

12/18/84

SIDE INLET DESIGN Q'S

DESIGN Q'S ARE AS OBTAINED FROM 1984 REPORT "RWCD REACH 4" HYDROLOGY SIDE INLETS.

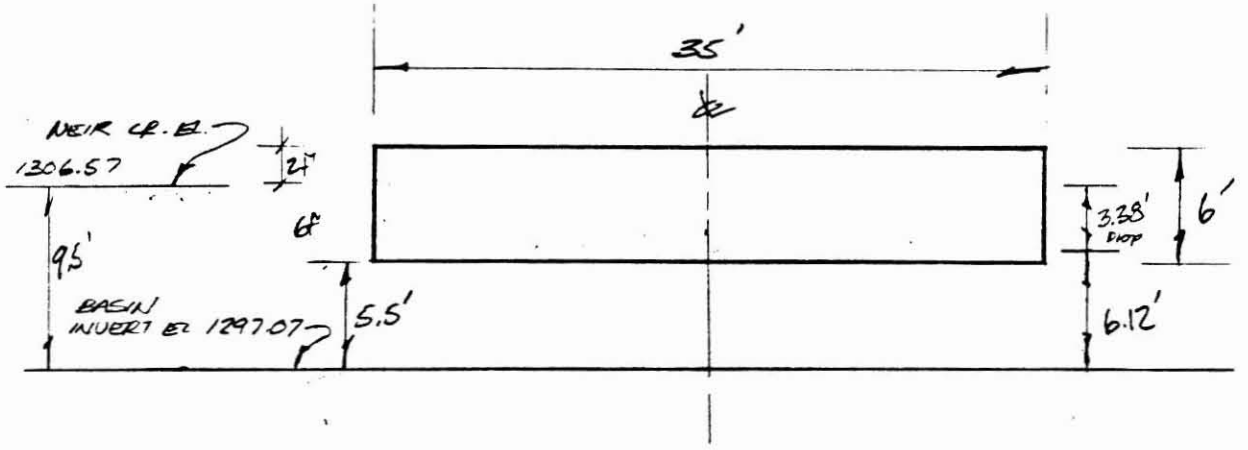
NO	APPROX. STA	Q_{100}	Q_{10}
1	498+40 at 501+60	115	30
2	513+79.50	350	110
3	534+18.5	CMP / HEADWALL	
4	540+34.25	25	5
5	546+~~60~~ 60	350	90
6	550+00	25	5
7	567+30	90	20
8	580+00	100	25
9	596+10	750	200
10	597+60	100	50
11	~~590+90~~ 600+00	100	20
12	~~626+75~~ 625+25	100	20
13	685+50	100	20
14	714+00	100	20
15	726+50	100	20

RC LINED CHANNEL

EARTH CHANNEL

PROBLEM: NEED TO DESIGN BAFFLE FOR LOW DROP

ANALYSIS: 1. DIMENSIONS FROM HYDRAULIC DESIGN:



2. • USE REINFORCED CONCRETE. FOR SUPPORTS USE 2 (1ST TRIAL) CAST IN PLACE, DRILLED PILES.

• ANALYZE BAFFLE AS A LATERALLY LOADED BEAM. CHECK VERTICAL DEAD LOAD.

• PILE ANALYSIS: DETERMINE MOMENTS VERTICAL LOAD AND SHEAR ON PILE. DETERMINE SOILS PROPERTIES BY EXAMINING RANGE OF VALUES FOUND GEOLOGIC INVESTIGATION FOR BRIDGE PIERS (QUEEN CR RD, HIGLEY RD, RITTENHOUSE RD.)

3. USE STRENGTH DESIGN - TR 67

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 383 200 SHEETS 5 SQUARE
NATIONAL

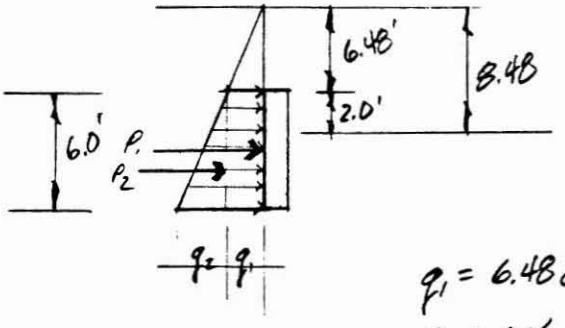
• HYDRAULIC LOADS:

USE STATIC PRESS. ON FACE + QPV

STATIC:

~~NEGLECT STATIC ON BACK F.~~

ASSUME:



$q_1 = 6.48\gamma = 404.35$ psf ✓

$q_2 = 6\gamma = 374.40$ psf ✓

$P_1 = 6q_1 = 2426$ ✓

$P_2 = 3q_2 = 1123$ ✓

$P_1 + P_2 = 3549$ lb/ft ✓

• USE DIFFERENTIAL STATIC FOR $\Delta H = 6.48$ FT OK.

THEN $P_{ST} = P_1 = 2426$ lb/ft $= 2.4$ kips/ft ✓

Conservative if d.s. H_2O at top of wall. OK YMH

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

DYNAMIC:

Determine V at base of baffle by WSP

$S = 0.264$

$b = 70$, $z = 2.5$, $n = 0.035$
$d_o = 6.2$ $\quad V = 13$
$Q = 6900$ cfs

36

USING WASP2:

B1 = 70	Z = 2.5	EL 109.5
B2 = 86	Z = 2.5	EL 100.0

- FIND $d_1 = 2.59$ ✓, $V = 28.81$. ✓

(○ IF THE 6900 CFS WAS CONCENTRATED OVER THE $6 \times 35 = 210$ FT² BAFFLE, V WOULD = 32.8 FT/S)

I probably would have used bottom width at base of baffle. How ever have accounted for some of this with the 1/3 reduction in momentum force. Looks Good! JAM

- THE BASIN BOTTOM WIDTH = 86 FT. ASSUME FLOW IS DISTRIBUTED UNIFORMLY. THEN $Q_{BAF} = \frac{35}{86}(6900) = 2808$ cfs DIRECTLY IMPINGING ON THE BAFFLE.

- ASSUME FLOW IS DEFLECTED AT 90° TO INCOMING FLOW, GIVING $\rho V_{out_x} = 0$ WHERE X = FLOW AXIS.

- REDUCING THE COMPUTED MOMENTUM FORCE BY 1/3 SINCE THE PROPORTIONAL FLOW WILL NOT ENTIRELY IMPINGE ON THE BAFFLE AND THE d_1 WILL BE SUBMERGED AT DESIGN FLOW.

THEN

$$F = \frac{\frac{2}{3}(Q)(V)(\rho)}{1000 \text{ K/LB}} = \frac{\frac{2}{3}(2808)(28.8)(1.94)}{1000} = 104.6 \text{ kips}$$ ✓

$$W = 104.6/35 = 3.0 \text{ kips/ft}$$ ✓

$W_{TOTAL} = 3.0 + 2.4 = 5.4$ kips/ft ✓ 3.0

WITH LF = 1.8, $W_u = 9.7$ K/FT

TAKE ANOTHER APPROACH:

LOADS: MAINSTREAM:

$Q = 6900$ cfs

AT BAFFLE $b = 86$; $z = 2.5$; $V = 28.3$ fps; $I = 24°$
$d_1 \simeq 2.66$ ft

AT WEIR: $b = 70$; $z = 2.5$; $d = 6.21$; $A = 531$
$V_c = 13$ ft/s

- WIDTH OF FLOW VS BAFFLE WIDTH:

$$W = b + 2zd = 86 + 2(2.5)2.66 = 99.3'$$

- $W_b = 35$

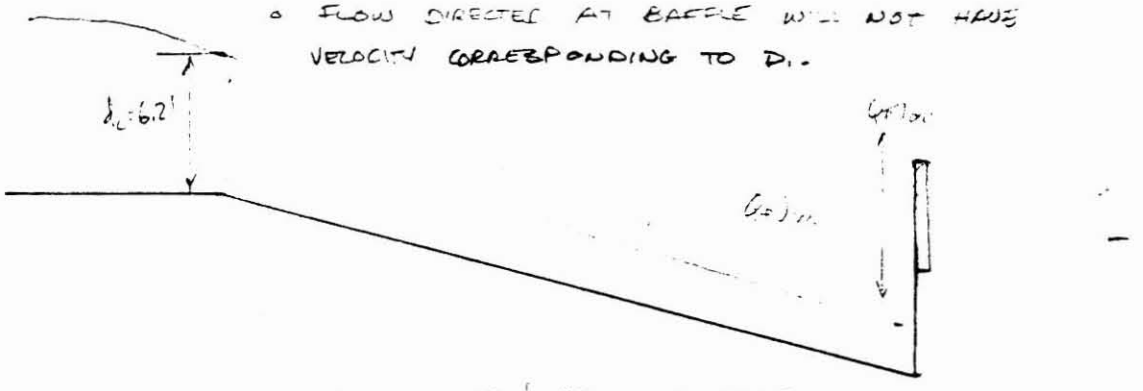
$$r = \frac{35}{99.3} = 0.35$$

- FOR DISTRIBUTION AREA OF V at BAFFLE:

$$\frac{35}{86 + 2.66 \times 2.5} = 0.38$$

- $Q_1 = 6900(0.38) = 2656$ cfs $= 75$ cfs/ft AT BAFFLE

- FLOW DIRECTED AT BAFFLE WILL NOT HAVE VELOCITY CORRESPONDING TO D_1.

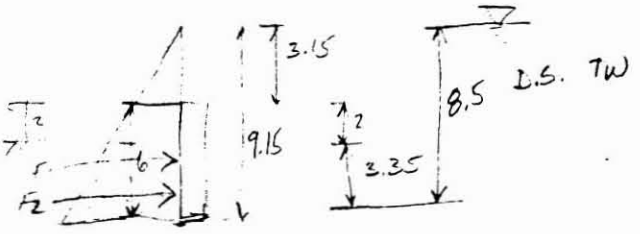


- ASSUME 75 cfs/ft IS DIRECTED AT THE BAFFLE AT $V_1 = V_c + 2/3(V_1 - V_c) = 13 + 2/3(28 - 13) = 23$ fps

- ASSUME FLOW IN IS $\perp$ TO BAFFLE AND FLOW OUT IS $\parallel$ TO BAFFLE

$$\therefore F = QpV = 75(1.94)23 = 3.35 \text{ k/ft}$$

STATIC — ASSUME NO FORWARD AND FULL FRONT AS SHOWN



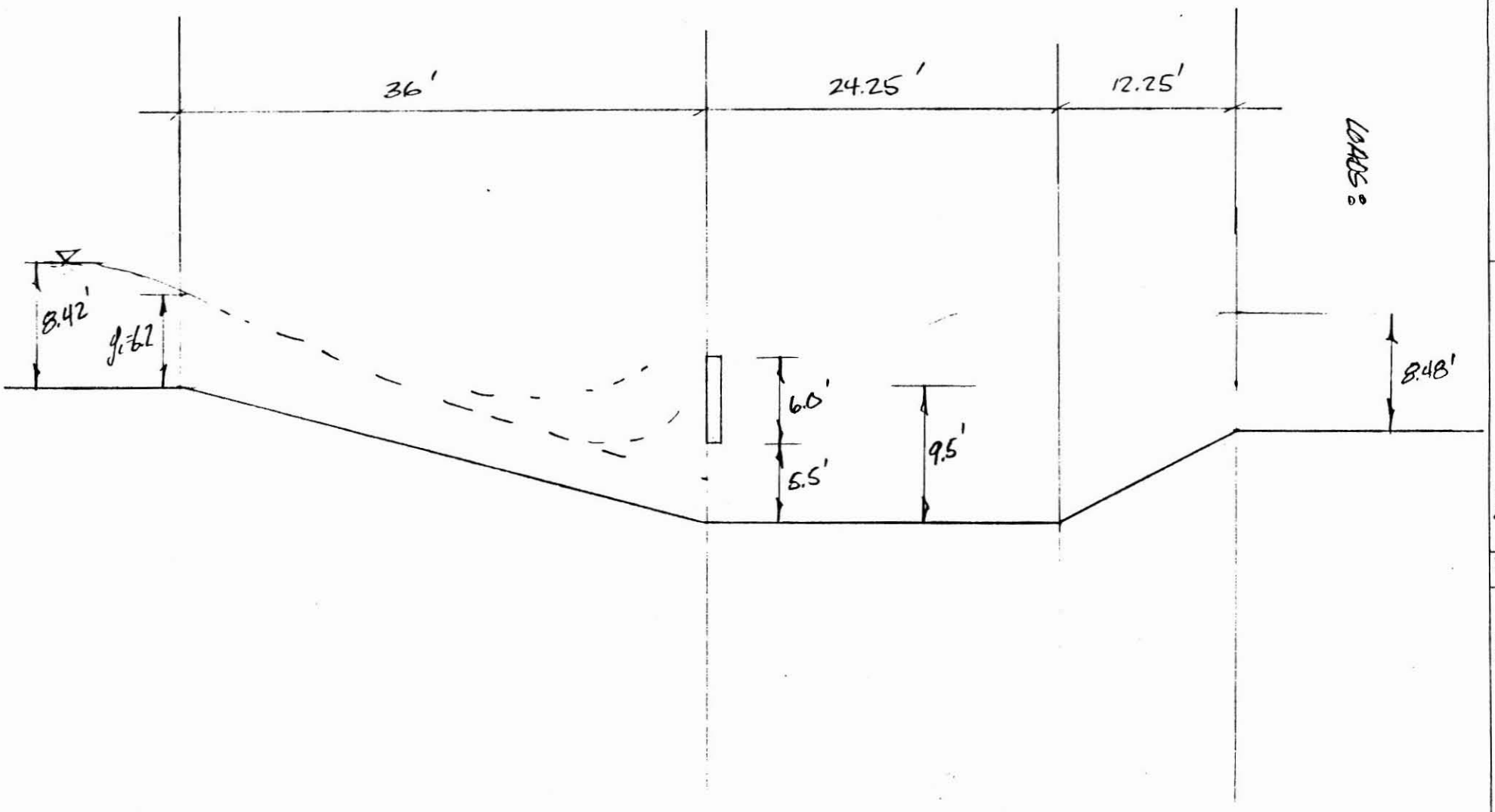
$$F_s = F_1 + F_2 = \left(6(3.15) + 6^2/2\right)62.4 = 2.30$$

$$F = \Sigma F_A + F_s = 3.35 + 2.30 = 5.65 \text{ k/f}$$

FOR CF = 1.8, $F_U = 1.8 \times 5.65 = 10.17$ k/ft

— SAME ORDER OF MAGNITUDE AS PREVIOUSLY ASSUMED, (9.7 K/FT)

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE



ARIZONA
RWCD R4

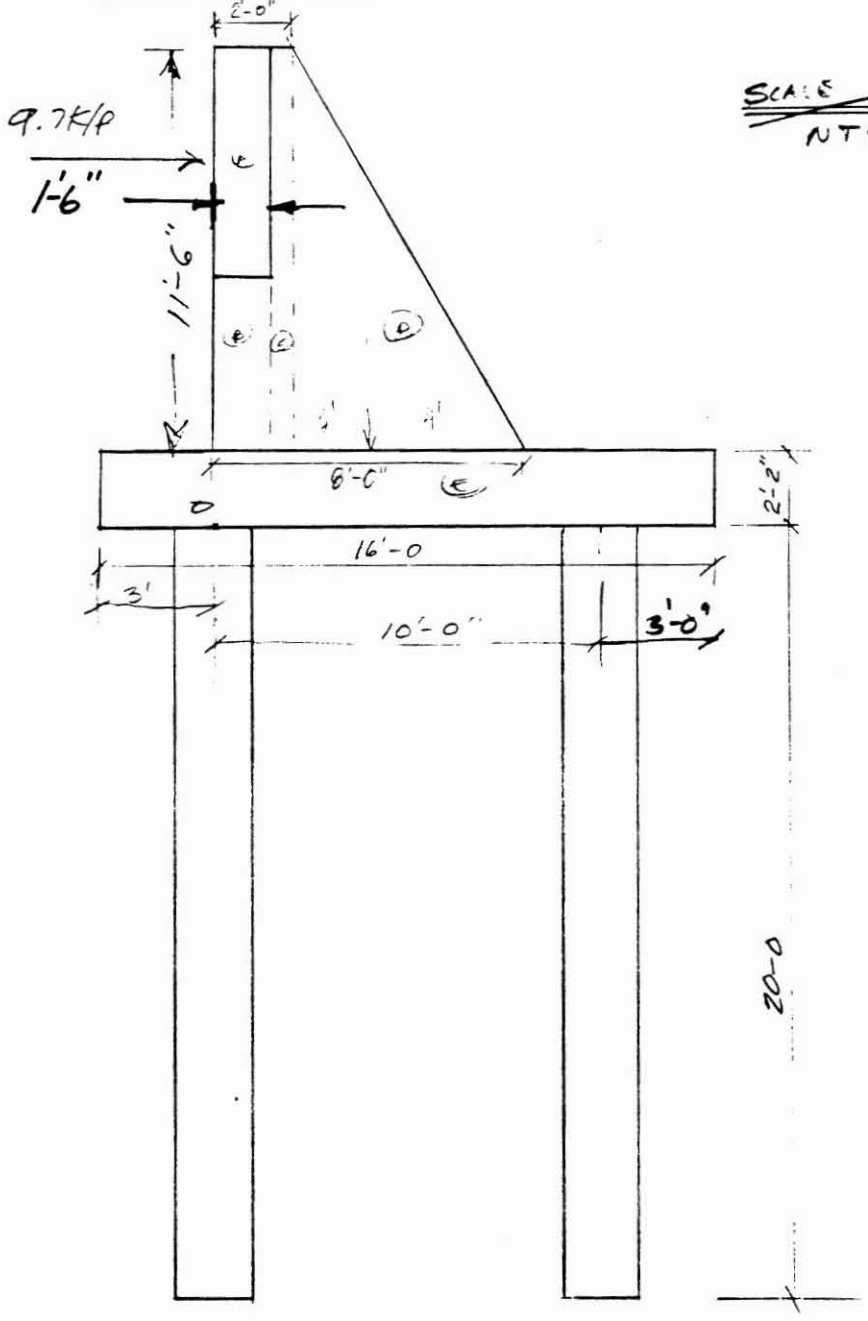
DT 3/2/85 JW 4/5

LOW DROP
BAFFLE

4/6/

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 383 200 SHEETS 5 SQUARE
NATIONAL

RETAINING WALL STATICS



SCALE 1" = 10'-0"
NTS JMA

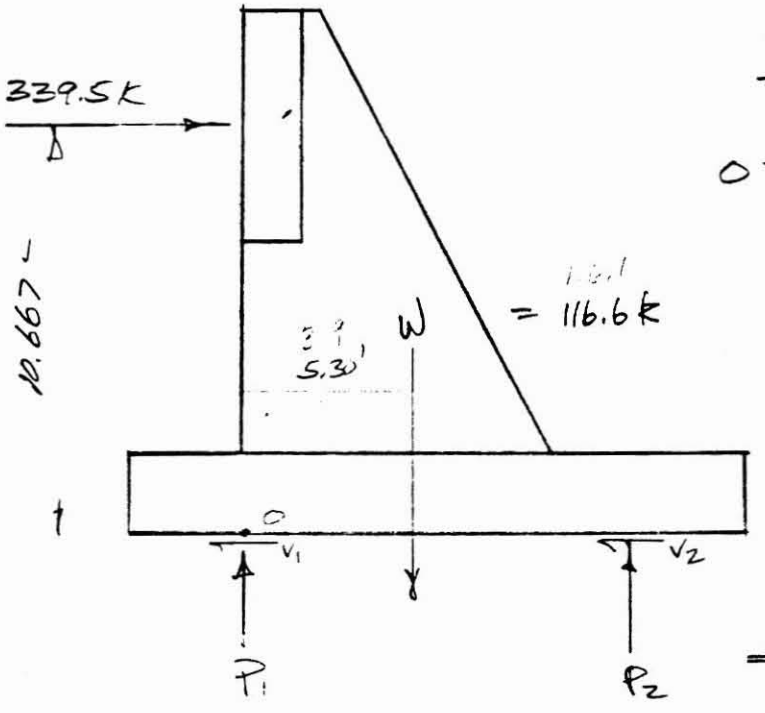
BAFFLE

use $\phi_b = 87$ psf

* ALL VALUES ULTIMATE INCLUDE LF = 1.8

	DESCRIPTION		WT (K)	ARM*	M (K-ft)*	
A	BAFFLE	$(35-3)(1.5)(6) = 288$	25.06	0.75	18.8	✓
B	BUTT	$5.5(2)(1.5)^2$ ✓ $= 24.75$	2.15	0.75	1.61	✓
C	BUTT	$2(11.5)1.5(0.5)$ ✓ $= 23$ (17.25)	1.5 / 2.00	1.75	2.63 / 3.50	
D	BUTT	$2(11.5)(6)(1.5)(0.5) = 103.5$ ✓	9.00	5 4	36.00 / 45.02	
E	BASE	$16(26)\left(\frac{26}{12}\right) = 901$	78.42	> 5	392.09 / 548.91	
			116.13		451.14	
			116.63		617.84	

$$\bar{X} = \frac{3.9}{5.30}$$



P_2 $\Sigma M_o = 0 =$

$0 = 339.5(10.67) + 116.6(5.3) - P_2(10)$

$P_2 = \frac{1}{10}(3621 + 618) = \underline{424k}$

PER PILE $P_p = 424/4 = \underline{106k}$

P_1 $\Sigma F_v = 0$

$= P_1 + P_2 - W$

PER PILE $P_1 = 116.6 - 106 = \underline{10.6k}$

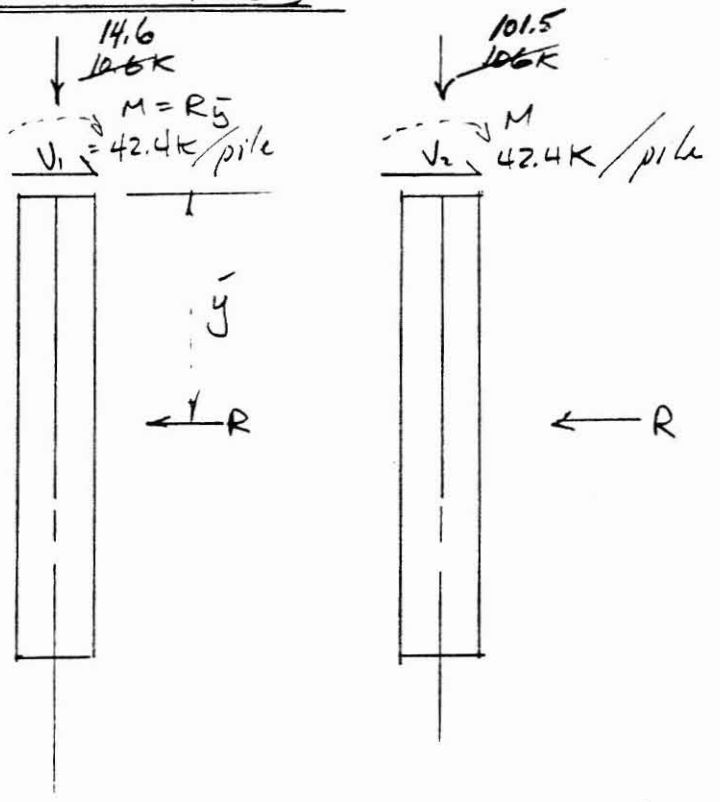
$V_1 = V_2$ $\Sigma F_H = 0$

$V_1 + V_2 = 339.5k$

$V_2 = V_1 = 169.75$ ✓

$V_{pile} = 169.75/4 = \underline{42.4k}$

STATICS ON PILES



R = RESULTANT OF LATERAL RESISTANCE

ASSUME $\bar{y} = 10'$

$M_{\bar{y}} = 420$ FT-K

- CHECK THIS ASSUMPTION

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

PILE CAPACITY

VERTICAL

- COMPARISON W/ HIGLEY RD. BRIDGE DRWGS

• MHCD
• HIGLEY RD. BR
SH 7
SH 6 DRWGS

- PILES L = 22', 24' · ABUT #1
- MATERIAL BORING B-1 = SP/SC
- $\bar{N} \approx 43$ BLOWS/FT
- ABUT #1 DES LOAD = 58 TONS = 116 KIPS
- PILE TIP EL 1306 [≈ 1302.5 RCH 4]
  BOT EL 1284 [≈ 1280.5 RCH 4]
- REACH 4 P_{MAX} WORKING = 106/1.8 = 59 KIPS

" DRILLED PIER FOUND. " WOODWARD, KLAH. 1972

- SKIN FRICTION:

$$P = \frac{A_s f_s}{F_s} = \frac{20\pi 2(0.86)}{1.8}$$

= 60 TONS SKIN FRICTION ONLY

$f_s = 0.01N < 0.5$ tsf

$= 0.01(43) = 0.43$ tsf

$= 0.86$ ksf

- BEARING: PROVIDES ADD'L FS

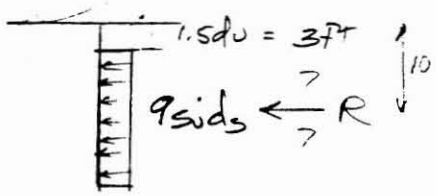
LATERAL

ABOVE PLOT

CHECK ULTIMATE LAT. RES:

- PILE IS FIXED-HEAD, SHORT

COHESIONLESS:



FIND s_u FOR

$R_{ULT} = 42.5K = q s_u (2)(14)$

$s_u = \frac{42.5}{9(2)(14)}$

$= .169$ KSF

$q_{ULT} = 337$ PSF OK

LATERAL PILE CAPACITY (CONT.)

CORREL. S_u TO BC.

NAVDOCKS DM 7.1
p 7.1-88

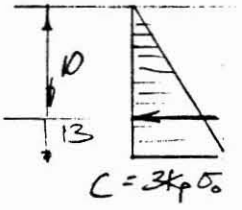
$N = 30$; $\Rightarrow q_u = 2.25\,TSF = 4.5\,KSF$

$S_u = 2.25\,KSF$

$>> 0.169\,KSF$ REQ.

COHESIONLESS

USE $\gamma_b = 45\,\#/ft^3$



$R = \frac{C_t H}{2}$

$d = 2'$

$\sigma_o = 45(13) = 0.585\,KSF$

$C = 3k_p(0.585)$
$= 1.755\,k_p$

$= 1.755\,k_p \frac{2}{2}(13)$

$R_o = 22.82\,k_p$

$k_{p_{req}} = 42.4/22.82 = 1.85$

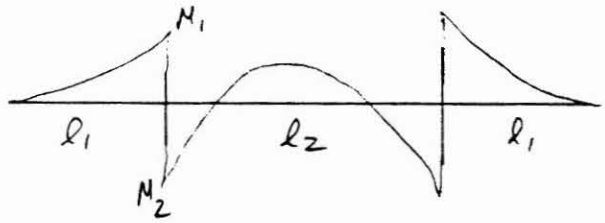
$\therefore$ ANY SOIL MAT'L IS OK.

CONCLUSION:

STRUCTURE IS STABLE; SOIL RESIST. OK.

- LOCATE PIERS

BALANCE MOMENTS:



$$M_1 = \frac{w l_1^2}{2}, \quad M_2 = \frac{w l_2^2}{12}$$

$$M_1 = M_2$$

$$\frac{w l_1^2}{2} = \frac{w l_2^2}{12} \checkmark$$

$$l_1 = \frac{l_2}{\sqrt{6}} = 0.408 l_2 \checkmark$$

$$35 = 2l_1 + l_2 = (2(0.408) + 1) l_2 = 1.816 l_2$$

$$l_2 = \frac{35}{1.816} = \underline{19.27} \checkmark$$

$$l_1 = \underline{7.86} \checkmark$$

BALANCE SHEAR:

$$l_1 = \frac{35}{4} = 8.75 \text{ ft}$$
$$l_2 = \frac{35}{2} = 17.5 \text{ ft}$$

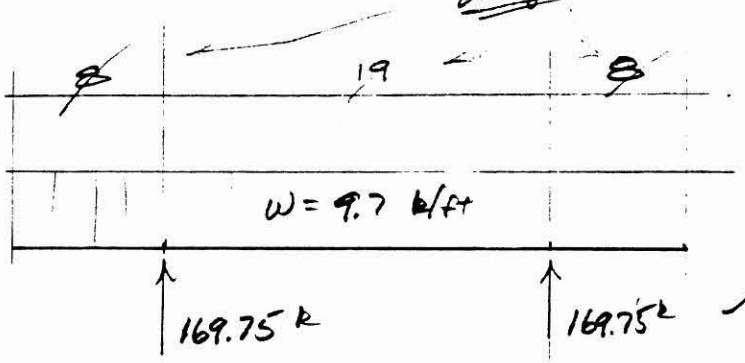
USE: $l_1 = 8$
$l_2 = 19$

Changed $l_1 = 7.5$
$l_2 = 20$ ✓ DT 3/20/ES

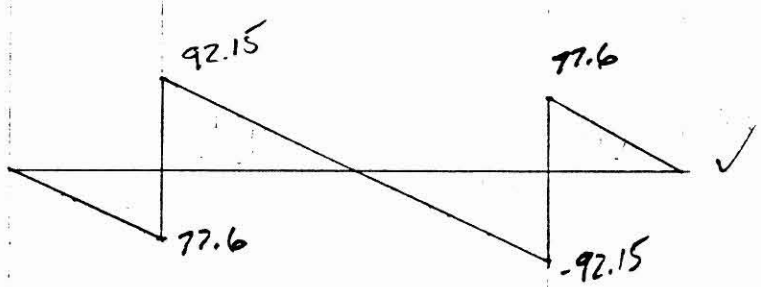
$W_u = 1.8 W_T = 1.8(5.4) = \underline{9.7\ k/ft}$

changed see note below

LOAD

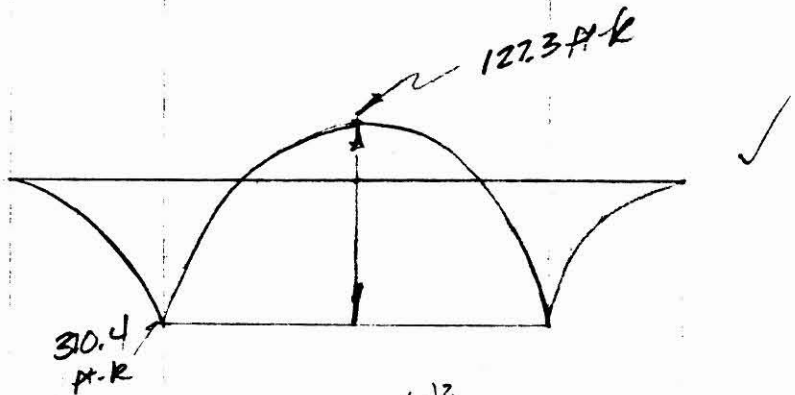


✓ ✓



✓

M



✓

$\frac{wl^2}{8} = \frac{9.7(19)^2}{8}$

$= 437.7$ ft-k

✓

check $\frac{wl^2}{12}$ @ support = $9.7(\underline{20})^2/12 = 323$ k/ft w/ $l = 20$

4½ conc slab ok

DT 3/20/85

$M/A_{sh} = 310/6 = 51.7$ k-ft/ft ✓

BEAM:

~~TRY t = 12"~~ changed t = 1'-6" DT 3/21/ES

$d = 9.5"$ ✓

TR-67
ES 220

FIND ρ $\rho = \rho_{shrg}$ $f_y = 40$ $f'_c = 4$

$M_{all} = 52$ k-ft/ft ok

NOTE: t CHANGED TO 18".

$A_s = 1.78 in^2$

• SHEAR

USE UNFACTORED SHEAR

$V = 92.15/(144)(6)1.0 = 0.059$ ksi $= 59$ psi < 70 psi ok

?

$d \simeq 15"$ for $t = 18"$

$v = \frac{92.15}{(12)(6)(18)} = 71.1$

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

CHECK STRESS DESIGN:

7 L.F.

$P = 42^{K}/_{10} = 23^{K}$

$M = P\,10'$

$M = 230$ ft-k FIND FOR $F_y = 50$ ksi use $\ell < 4'$ W16x57 is ok

W16x31 $\phi M_n = 129.75$ k-ft or W18x50

WITH PL flanges

- CONCRETE ENCASEMENT PROVIDES COLUMN TYPE SUPPORT OF FLANGES, SO ADEQUACY OF WEB NOT RELEVANT

CHECK WELD OF COVER PL

FOR ASTM A572 GR50 USE E70XX = 21 ksi = F_v

Nominal Size (in)	R_w (k/in)
1/4	3.71
5/16	4.64
3/8	5.57
7/16	6.49
1/2	7.42

$R_n = t_w (0.707) F_v$

TOP PL: DESIGN FIELD WELDED TOP PL FOR

$\frac{1}{2} F_f = 166k/2 = 83k$ Judge 20 From where?

$A_s \text{ req} = \frac{83}{\frac{2}{3} F_y} = \frac{83}{\frac{2}{3} 50} = 2.49 \text{ in}^2$ Moment Hs

TRY $w = 6''$

$t = \frac{A}{w} = \frac{2.49}{6} = 0.415$ USE $\frac{1}{2}'' \times 6'$ gr 50 PL

WELD: SEE SUMMARY

Salmon & Johnson 5.13.4 p214

$a_{max} = 1.89 \frac{F_y t_2}{F_w} - \frac{1.89 (50)(1/2)}{80} = 0.59''$

$\max = 1/2''$

For $t = 0.44''$

$L_{min} = \frac{1.89 (50)(.44)}{80} = 0.52'' - \frac{1}{2}''$ fillet

$\frac{1}{2}''$ WELD E80XX 8.48 kips/ft

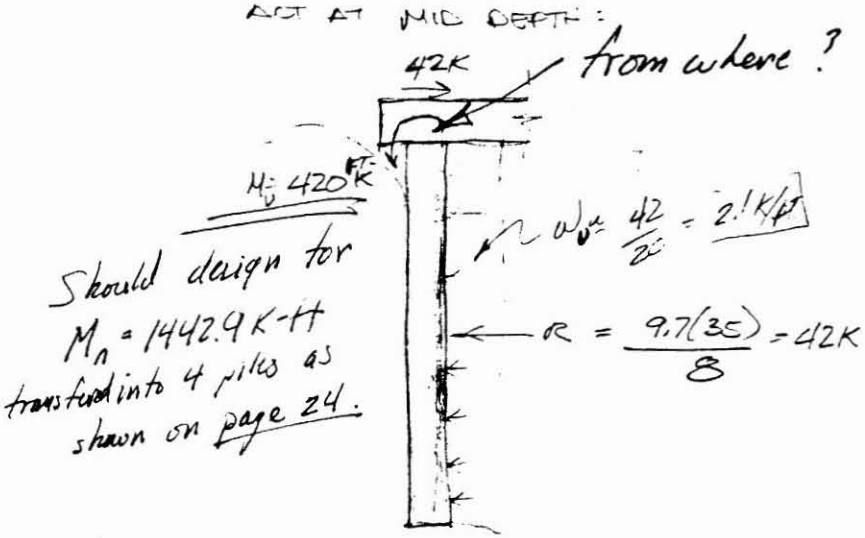
$L_W = T/R = 83/8.48 = 10 \text{ in}$

TRY $5/16''$ $R_W = 5.30$ k/ft

$L_W = 83/5.3 = 15.6 \text{ in}$

BASE:

THE 24" ⌀ PILES DEVELOP RESISTANCE TO THE LATERAL LOAD OVER THEIR LENGTH. ASSUME THE RESULTANT OF RESIST. TO ACT AT MID DEPTH:



Should design for $M_n = 1442.9$ K-FT transfer into 4 piles as shown on page 24.

- AN ULTIMATE M OF 420 FT-K ACTS AT PILE TOP. ✓
- PROVIDE A_s REQ'D BY STEEL SECTION:

USE $f_y = 50$ ksi

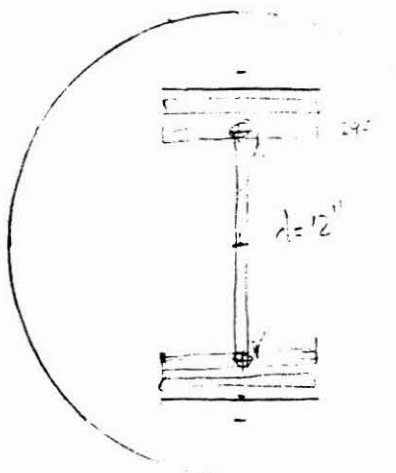
Flexure

$M_u = \phi A_s f_y \left(d - \frac{a}{2}\right)$

$A_s = \frac{M_u}{\phi f_y \left(d - \frac{a}{2}\right)} = \frac{420}{50(12)} = 8.4 in^2$

Can I use f_y → use $f_b = 0.66 F_y$ per AISC

≈ 29 #/FT



d = 14":

$A_s = 7.2 in^2$

- TRY W 16 × 50 $t_f = 5/8$ $A_f = b t_f = (7.07)(0.63) = 4.45 in^2$

$d = 16 - 5/8 = 15.375"$

$M_u = \phi A_f f_b = \frac{15.375}{12}(4.45)(50) = 237$ FT-K

- ADD # TO FLANGES

- FOR $420 - 285 = 135$ kip

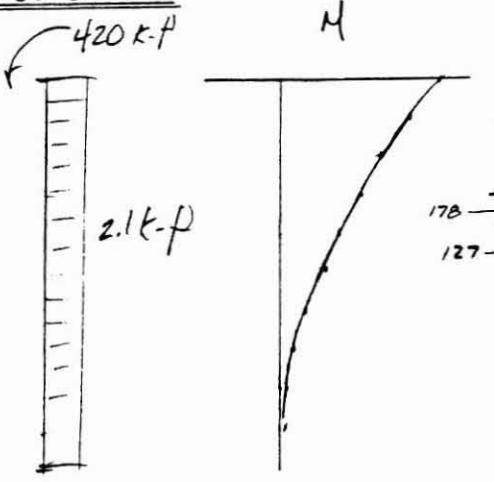
$$\Delta A_s = M_u / F_y d = \frac{135}{50}(12)(16) = 2.03 \text{ in}^2$$

what do you finally use?

FOR $w = 6''$ $\quad t = \frac{2.03}{6} = 0.338 \text{ in}^2$ ~~USE 3/8 x 6" ℄~~

$\approx \frac{M_u 12}{50(15.7)}$

CHECK CUTOFF'S



M_u	A_f	A_{f_A} *1	A_{f_A} *2
426	6.40	2.43	3.97
340	5.18	1.21	2.75
269	4.10	0.13	1.67
206 / 191	3.14		0.71
178 / 160	2.49		
151 / 139	2.30		
127 / 116	1.60		
105	1.04		
68			
38			
17			
42			

4.2'

*1 W 16x45 $\quad d = 16.13$
$t_w = 0.345$
$b_f = 7.035$
$t_f = 0.565$
$\rightarrow A_f = 3.97 \text{ in}^2$

*2 W 16x31 $\quad d = 15.88$
$t_w = 0.275$
$b_f = 5.525$
$t_f = 0.440$
$A_f = 2.43 \text{ in}^2$

$A_w = 0.275(15.88 - 2(0.440))$
$= 4.125$

USE W16 x 31
w/ COVER PL
USE 8" x ½ COVER PL

$F_y = 50$ ksi
ASTM A572

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

CONNECTION AT CORNER:

Flange force Wothering str. $P_b = \frac{(F_y A_f)}{(1.8)_7} = \frac{(50(2.43+4))}{1.8} = 179^K$

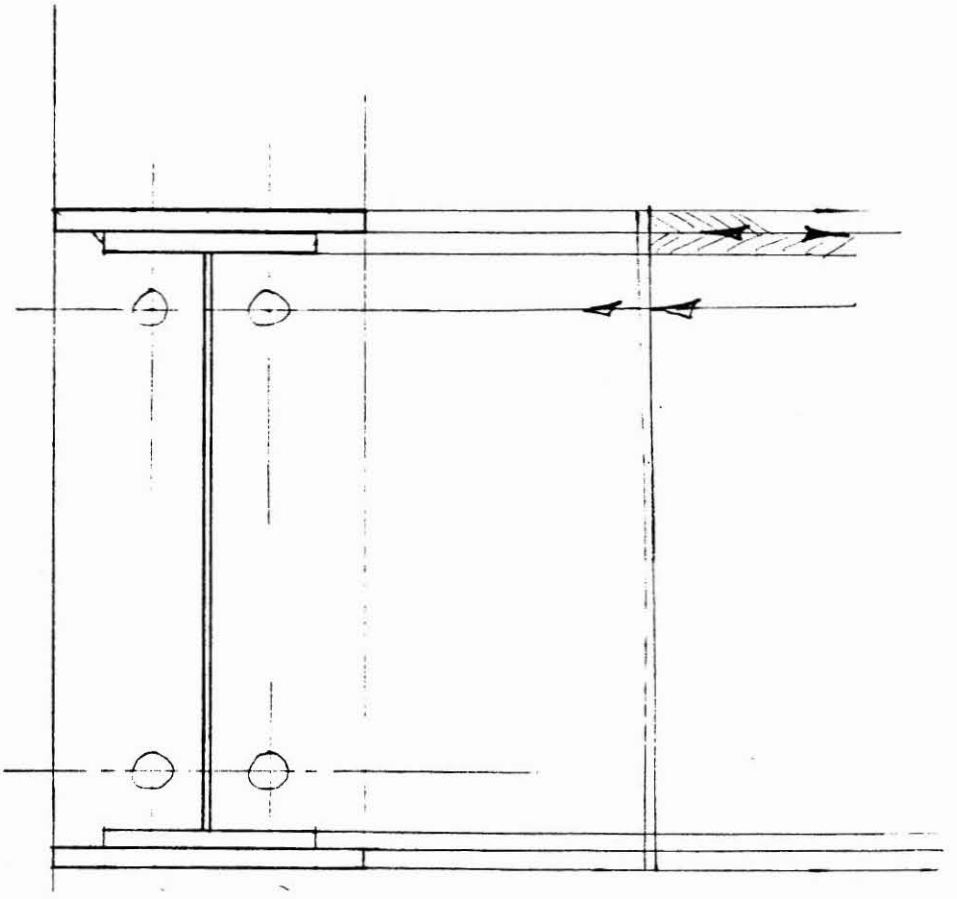
A 490 BOLTS 1" DIA MIN $t = 64^k$ (In Tension)

$n = \frac{179^K}{\frac{7}{3}64} = 4.2$

TRY FOR 4: $\frac{179}{4} = 44.75^k \times 3/2 =$

FIND

p122		54 ksi - Tension T
3/4	0.4418	23.9
7/8	0.6013	32.5
1	0.7854	42.4
1 1/8	0.9940	53.7
1 1/4	1.2272	66.3



Reference ?

END PL

ULTIMATE $M_u = 420$ K-FT

WORKING STRESS $M_{wk} = 420/1.8 = 233$ K-FT

$d = 15.88 + 2(1/2) = 16.88$ in

$$F_f = \frac{M}{(d - t_f)} = \frac{233(12)}{(16.88)} = 166 \text{ kips}$$

$A_b = F_f / 2n F_t = 166/2(2)54 = 0.769$ USE 1" BOLTS

$P_e = P_f - (d_b/4) - 0.707w$ USE $w = 1/2"$

$= 1\frac{1}{2} - (1/4) - 0.707(1/2)$ $P_f = d_b + 1/2$

$= 0.897$ in $= 1\frac{1}{2}"$

$M_e = \alpha_m F_f P_e / 4$ $\alpha_m = 6 C_b (A_f/A_w)^{1/3} (l_e/d_b)^{1/4}$

$= 1.251(166)(0.897)/4$

$= 46.6$ $C_b = b_f/b_s)^{1/2} = 1$

$C_a = 1.11$ A490 $F_y = 50$

$$t_s = \left(\frac{6 M_e}{b_s F_b}\right)^{1/2} = \frac{6(466)}{8(50)^{1/3}}$$

$\alpha_m = 1.11(6.4$

$= 1.04$

USE $t = 1"$ END PLATE $A_f = 6.4$

$(A_f/A_w)^{1/3} = (6.4/4.125)^{1/3} = 1.158$

Shear

$f_v = F_f / 2 b_s t_s$ $\alpha_m = 1(1.11)(1.158)\left(\frac{0.897}{1}\right)^{1/4}$

$= 166/2(8)(1)$ $= 1.251$

$= 10$ KSI $<< 0.4(50)$ OK

NATIONAL | 42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

WELD SUMMARY

ALL E70XX (BASE ASTM A572 Gr 50)

LOCATION		$F_{WORKING}$ KIPS	TYPE	a	R_W	L_{REQD}	
COVER PL TO W 16x31	AT CORNER	118K [1]	FILLET	5/16	4.64	25	CONTINUOUS
	OTHER						$L_{AVAIL} = 8(12)(2) = 192$ in : USE 2" WELDS @ 12" c/c
STRAP		88 [2]	"	5/16	4.64	19	CONTINUOUS
STIFFENER			"	5/16			CONTINUOUS
& TOP PL			"	5/16			"
END PL			—	FULL PENETRATION DOUBLE GROOVE			

[1] $\phi \frac{A_l F_y}{LE} = \frac{4(50)}{1.7} = 118K$

[2] $\frac{3(50)}{1.7} = 88K$

ARIZONA RUCD PL

DT 3/21/85

LOW DROP BAFFLE STEEL

21

323 K-ft (page 13)

STEEL DESIGN

BAFFLE: USE M_u = 310 K-ft AT SUPPORTS

Note: for $l = 20$, $\frac{292}{w(20)^2} = \frac{1}{13.3}$

Then $M = \frac{wl^2}{13.3}$ OK DT 3/20/85

INCREASE CENTER @ MIDSPAN TO: $\frac{wl^2}{12} = \frac{(437.7)}{15} = 292$ K-ft

(12 ? -24)

ASSUME UNIFORM DISTRIBUTION OVER HEIGHT OF BAFFLE:

INCREASE BAFFLE T to 18", ALLOW for this ∴ use $d = 18 - 2 - \frac{1}{2} - \frac{3}{4}$

$= 14.75$ in

$T\#s = 0.003 (18" \times 12") = 0.65 in^2/ft$

USE #7@6 $A_s = 1.20 in^2$

~~#8@10~~ + ~~#4@10~~ $A_s = 1.19 in^2$

Changed DT 3/22/85

#7@6" BOTH FACE

$58 k\text{-}ft \times 6 = 348$ OK

& BOTTOM

292 k-ft = 49 k-ft/ft $A_s = 1.04 in^2$

$A_s = 0.88$ ~~#3@12 095~~

$P_{bal} = 0.88 in^2$

4.4'

USE

#7@6 $3.48 in^2$

255 ft-k @ supp

310.4 K-ft

244 @ face = 41 k-ft/ft

= 43 k-ft/ft

~~#8@10~~

$A_s = P_{bal} = 0.88$

OK for $l_2 = 20'$ DT 3/21/85

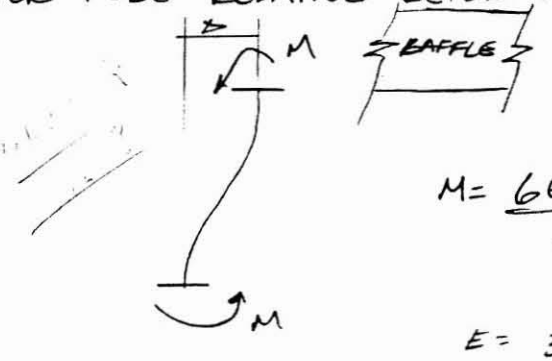
42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

CHECK THERMAL STRAIN

- USE $\Delta T = 75^\circ F$
- ℓ TO FACE $L = 8.75$ FT
- $\Delta = L \times \Delta t$
  $= 8.75(5\times10^{-6})\,75(12)$
  $= 0.04$ in"

$\alpha = 5\times10^{-6}$ in/in/°F

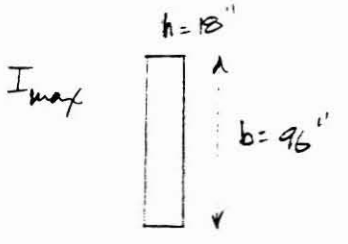
FOR PURE RELATIVE DEFORMATION:



$$M = \frac{6EI\Delta}{\ell^2}$$

$E = 300{,}000$ psi

$I = \frac{bh^3}{12} = \frac{96(18)^3}{12} = 46656$ in^4



$$M = \frac{6(300{,}000)(46656)(0.04)}{(5.5(12))^2\ 12{,}000}$$

$= 64.3$ FT-K

USE MONOLITHIC CONSTRUCTION

ARIZONA EWCO E4 DT 3/15/85 ~~AND 4/85~~ LOW DEEP BAFFLE

PIER BUTTRESS

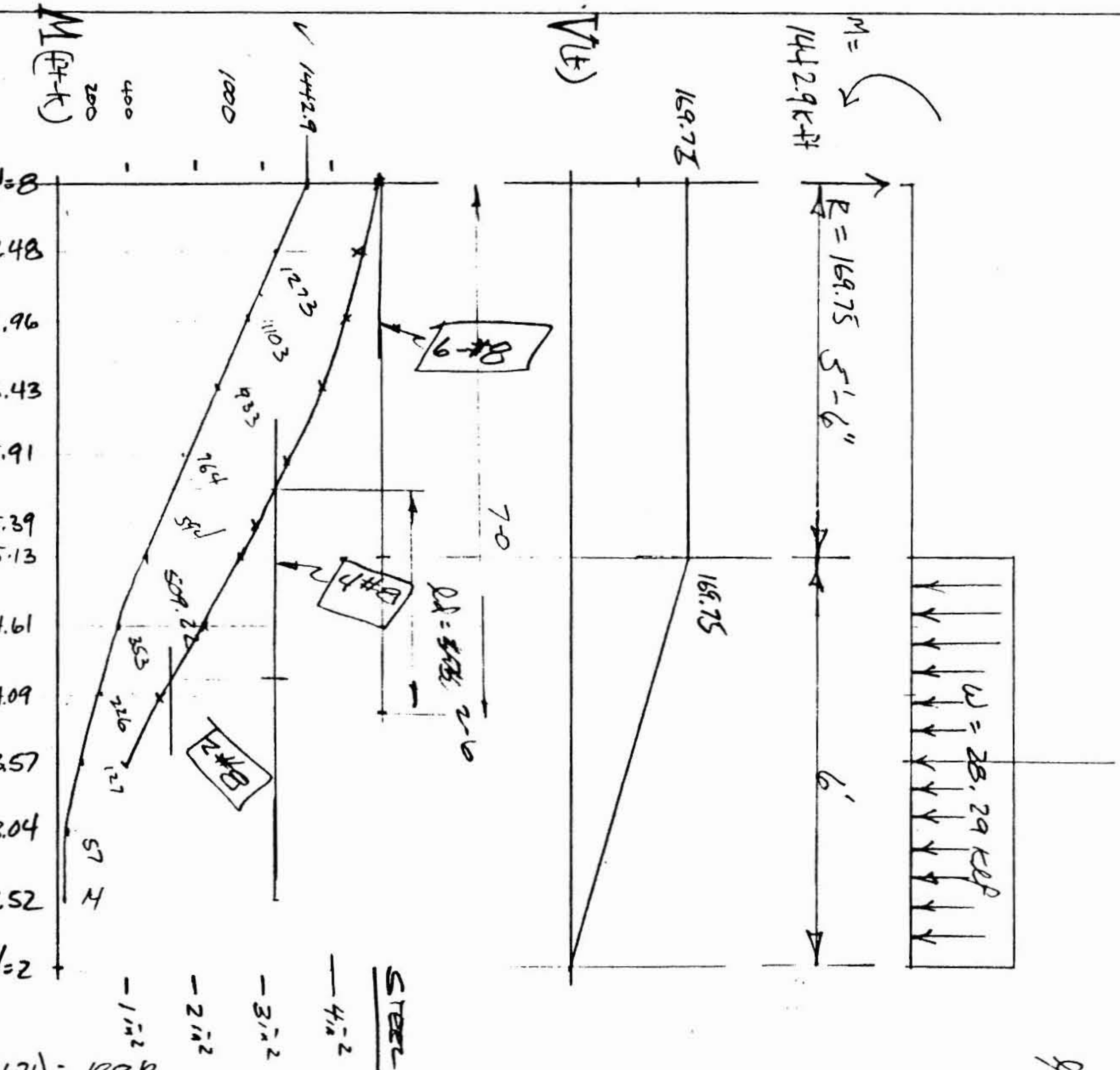
o ANALYZE AS A VERTICAL VARIABLE DEPTH BEAM:

$M \simeq (d-4) f_s A_s$

$A_s \simeq M/(d-4) f_s$

$= M/(d-4)\,40$

A_s	d
4.71	d=8
4.45	7.48
4.16	6.96
3.83	6.43
3.42	5.91
2.94	5.39
2.65	5.13
2.06	4.61
1.50	4.09
0.98	3.57
0.53	3.04
0.16	2.52
	d=2



$\ell/2 = 17.5'$

check $f_y A_{s_0} = 40(4.71) = 188k$

$h \simeq \dfrac{188}{4(18)\,0.85} = 3.08$

3.08

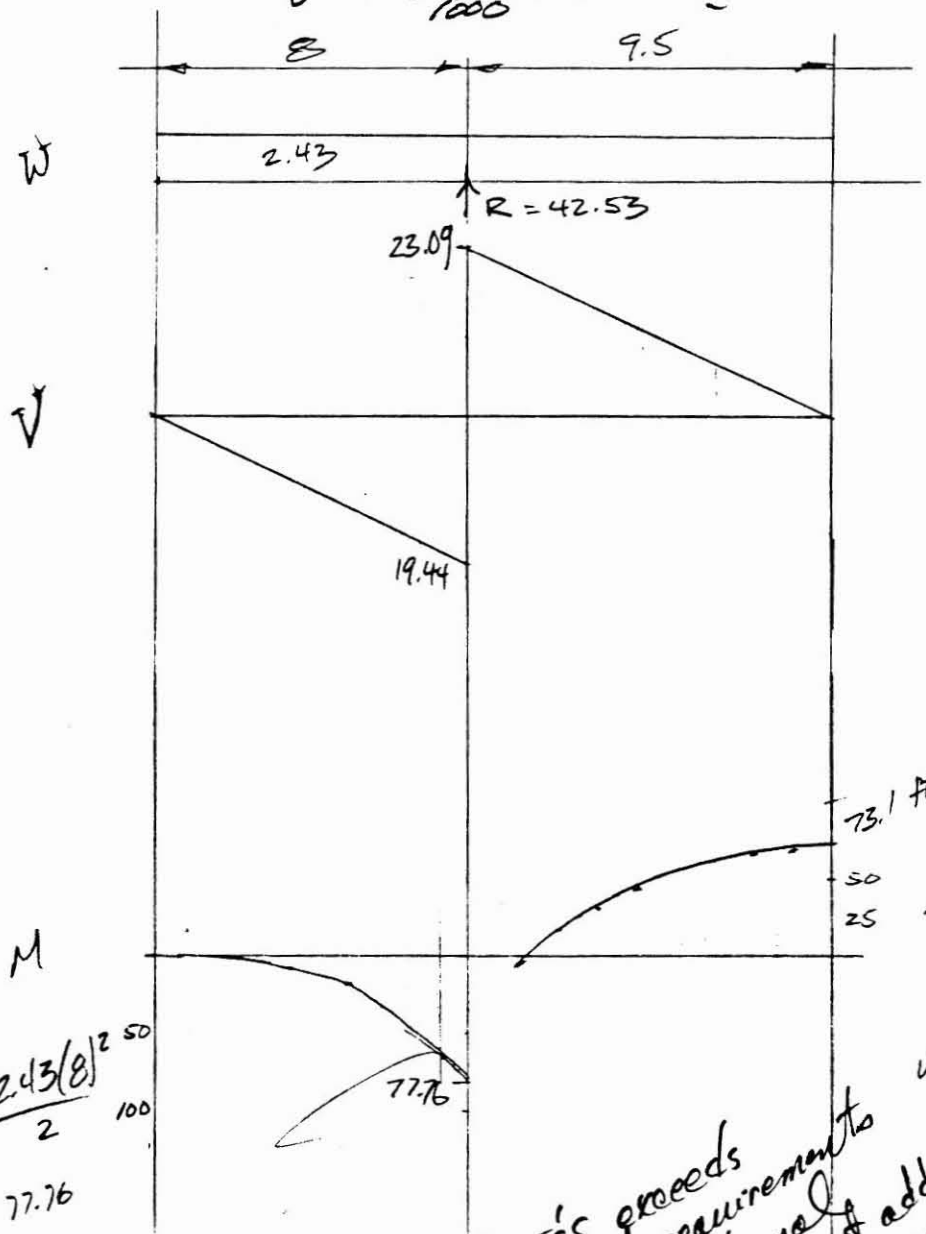
NOTE: $d \simeq t-9$; Gr 60 bars spec'd
use same A_s
DT 3/22/85

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL

BENDING DUE TO VERTICAL LOADS

USE VERTICAL LIVE LD = (2x) DEAD LOAD.

$$W_d = \frac{150(1.5)6(1.8)}{1000} = 2.43 \text{ kips/ft} \quad \text{w/ L.F.} = 1.8$$



$$\frac{wl^2}{2} = \frac{2.43(8)^2}{2} = 77.76$$

$$\frac{wl^2}{8} = \frac{2.43(19)^2}{8} = 109.65 \text{ ft-k}$$

Use $\frac{wl^2}{12}$ @ Mid

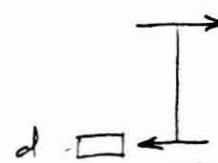
$$\frac{2.43(19)^2}{12} = 73.1 \text{ ft-k}$$

@ FACE 63.9 k-ft

Wall T's exceeds moment requirements no additional reinforcement added.

$$A_s f_y d' = M$$

$$A_s = \frac{M}{f_y d} = \frac{78}{40(5.5)} = 0.35 \text{ in}^2$$



$$d = \frac{T}{\text{CONC}} = \frac{14k}{\text{CONC}} \Rightarrow 0.23"$$

PROVIDE $\rho = 1.33 \rho_{req}$. SINCE

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

SHEAR, BUTTRESS:

AT BASE OF BAFFLE: $A = (5(12)+1)10 = 1090\ in^2$

$V_u = 169.75k$

$v = \frac{169750}{1098(1.8)} = 86 psi > 70$ working

CHECK BY STRENGTH DESIGN

$V_c = 2\sqrt{f'_c}\, b_w d = 2\sqrt{4000}\ 18"(59 - 2\tfrac{1}{2})$

$= 128.64k < 169.75k$ ← from page 24

∴ NEED SHEAR STEEL

$V_n = \frac{169.75}{0.85} = 199.7k$

$V_s = 199.7 - 128.6 = 71.1k$

10in sp

$A_v = \frac{(V_u/\phi - V_c)s}{f_y d}$

$= \frac{71.1(10)}{(40)(56.5)}$

$= 0.31\ in^2$

12in sp

$A_v = \frac{(V_u/\phi - V_c)s}{f_y d} = \frac{71.1(12)}{40(56.5)} = 0.38\ in^2$ ← the

USE #6@12 HORIZ + VERT

SEE ALSO CHECK ON V_u AT BASE

BAFFLE

changed DT 3/21/ES

SHEAR @ d from face = 9.5 − 0.75(2) = 8ft from ℄

W_u = 9.7 k/ft

V_u = 9.7(8) = 77.6k

$v_{u\,ENG} = \frac{77{,}600}{1.8\,(6)(1.5)144}$ = 33 psi << 70 psi ok

PROVIDE NOMINAL TIES = T+S = 0.002(18)(12) = 0.43 in²

#6@12 c-c A_s = 0.44 OK DT 3/21/ES

CHECK STRENGTH DESIGN

$V_c = 2\sqrt{f'_c}\, b_w d = 2\sqrt{4000}(18)(72 - 3\tfrac{1}{4})$

= 156.5 k

½(ϕ)

½(0.85)(156.5) = 66.51 k

77.6k > 66.51k ∴ min A_v needed

10" spacing

$A_v = 50 b_w s / f_y$

$= 50(18)(10)/40{,}000$

$= 0.23\ in^2$

12" inch spacing

$A_v = 50(18)(12)/40{,}000 = 0.27\ in^2$

ok A_v provide = 0.44 in² (#6)

Shear @ base of baffle:

ASSUME 18" COUNTERFORT, h ≈ 3.5'

$$V = \frac{169{,}750}{18(3.5)(12)1.0} = 125 psi > 70 \quad \therefore \text{NEED shear reinf.}$$

$V_u = 169.7/0.85 = 200k$

STRENGTH:

$$V_c = 2\sqrt{f'_c}\, b_w d = \frac{2\sqrt{4000}(42)(18)}{1000} = 95.6k$$

$$V_{s\,req'd} = 3\sqrt{f'_c} b_w d = 4V_c$$

$$V_s + V_c = 5V_c = 478 psi$$

→ CHECK #6; $A_b = 0.44 in^2/leg$; $V_s = \frac{A_v f_y d}{s} = \frac{0.44(40)(42)}{12} = 70k$ ($\frac{V_n}{166}$)

for gr 60 $\frac{0.44(60)(42)}{12} = 106$ (201) > 200k OK

APPROX. DEAD LOAD:

- TAKE ADVANTAGE OF GR 60 STEEL HERE DT 3/22/05

BAFFLE $(35-3)6(1)150 = 28{,}800\,lb$ $(= 0.9k/ft)$

$(14\,400^{\#}/ft)$

PIER: PRISMOICAL FORM

$$V = \frac{(A_1 + 4L + A_2)}{6} = \left(\frac{2(1.5)+4(1.5)4+6(1.5)}{6}\right) H.S$$

$= 43.5 ft^3$

$W = 43.5(150) = 6525^{\#}$

Σ PIER DL $= 14400 + 6525 = 20925^{\#}$ • USE EQUIVALENT $\left(\frac{150-62.4}{150}\right) = 12{,}220^{\#}$

BASE:	$8' \times 10 \times 1.5 \times (150-62.4)$	= 10512
CR ROCK:	$8 \times 10 \times 3.0\,(150-62.4)$	= 21024
SOIL:	$8 \times 10 \times 1\,(135-62.4)$	= 5808
		37344 #

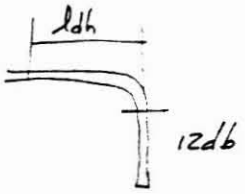
$\Sigma = 49564^{\#}$

BASIC DEVELOPMENT LENGTH FOR STD. HOOK IN TENS

ACI 318-83

12.5.2 $l_{hb} = 1200 d_b / \sqrt{f'_c}$

min $8 d_b$ or 6 in



MODIF.

12.5.3.2 0.7 for side cov > 2½" bar < #11

SO FOR $f_y = 4000$ psi

BAR	l_{hb} x	l_{hb} x 0.7
#3	7.12	4.98
4	9.49	6.64
5	11.86	8.30
6	14.23	9.96
7	16.60	11.62
8	18.97	13.28
9	21.35	14.94

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 383 200 SHEETS 5 SQUARE
NATIONAL

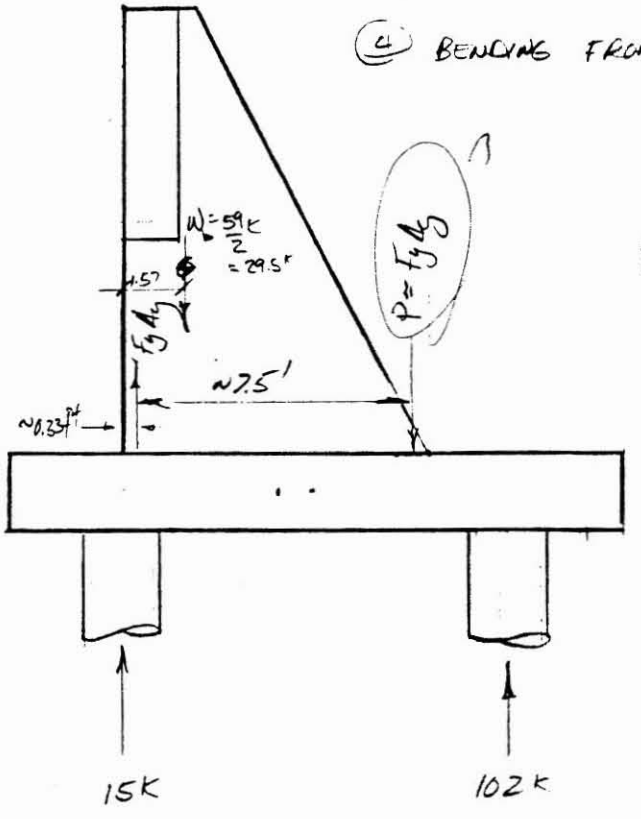
BASE

CHECK: ① TORSIONAL MOMENT IN BASE DUE TO OVERTURNING MOMENT OF BUTTRESS

② CHECK PUNCHING SHEAR AT PILE TOPS

③ BENDING M ALONG FACE OF BUTRESS DUE TO PILE REACTION

④ BENDING FROM SIDE LOAD ON BAFFLE



$F_y A_y = 40(6)(6.79) = 190K$

Assume $a = \frac{190}{0.85 f'_c (6)} = \frac{190}{0.85(4)(16)} = 3.49"$

RESULTANT OF WT. (W/O BUOY. BASE) $= \frac{59.06}{37.71} = 1.57'$

DL CONDITION

DL WT + BASE $= 116 \frac{50}{87} = 200K$

$\bar{x} = 3.88$ FT

$P_{DS} = \frac{200(3.88)}{10} = 78K = 20K/S\ e$

$P_{US} = 200 - 78 = 122K = 3'K/ft$

DOES NOT CONTROL

① check TORSIONAL STRENGTH: where?

TR67 (71) P26

$$T_c = \frac{2.4\sqrt{f'_c}\,\frac{1}{3}\,\Sigma(x^2y)}{\sqrt{1+\left(\frac{V_u}{2.5\,C_t\,T_u}\right)}}$$

$V_u = 115k \times 115{,}000\ \#$

$C_t = \frac{b_w d}{\Sigma x^2 y} = \frac{16(12)(22)}{(22)^2\,16(2)} = 0.045$

$T_u = 190(7.5) = 1425\ k\text{-}ft/4 = 356\ k\text{-}ft = 4.27\,E6\ \#\text{-}in$

$$T_c = \frac{2.4\sqrt{4000}\,\frac{1}{3}\,(22^2)(16)(12)}{\sqrt{1+\left(\frac{115{,}000}{2.5(0.045)(4.275\,E6)}\right)}} = \frac{14{,}105{,}479\ LB\text{-}IN}{1.113}$$

$= 12{,}670\ k\text{-}in$

$= 1055\ K\text{-}ft$

$T_u/\phi = \frac{356}{0.85} = 418\ k\text{-}ft << 1055\ K\text{-}ft$ OK

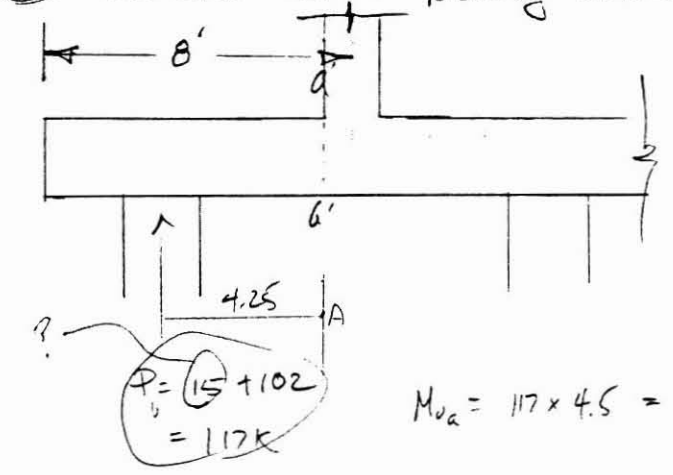
(2) PUNCHING USE $\frac{3}{4}\pi(d_{brick}+d)$ = $\frac{3}{4}\pi(24+22)22$

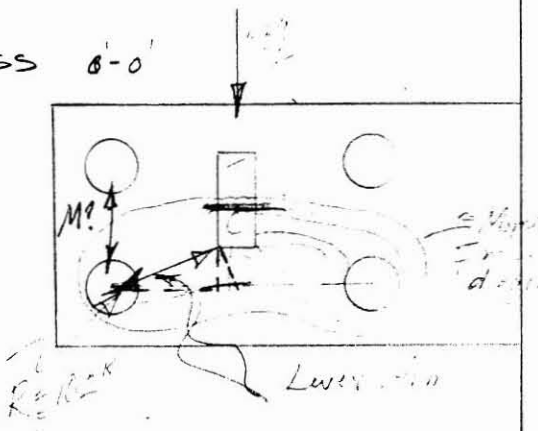
= 9,538 in^2

$V_c = 2\sqrt{f'_c}(9538) = \frac{2\sqrt{4000}(9538)}{1000} = 1206k$

$>>> \frac{102k}{0.85}$ OK

(3) BENDING ALONG face of buttress 8'-0"





$M_{u_a} = 117 \times 4.5 = 526.5$ k-ft $= \frac{526.5}{16} = 32.9$ k-ft/ft

$\rho_{req} = 0.003$; $A_s = 12(22)(0.003) = 0.79 in^2$ = #8 @ 12" c-c

M_u for 1' w/ d=22 ≃ 57 k-ft/ft OK

T & S short dir : $\rho = 0.002$; $A_s = 22(12)0.002 = 0.528$ #7 @ 12

T & S bottom dir : $\rho = 0.001$; $A_s = 22(12)0.001 = 0.26$ #5 @ 12

~ What about moment in other direction?

(1) BENDING FROM SIDE LOAD ON BAFFLE:

- check capacity of vert T+S #6@12

$d = 18 - 2 - 3/4 - 3/8 = 14\,3/8 = 14.875$

$A_s = 0.44\ in^2$

$M_u = 21\ k\text{-}ft/ft \times (8) = 168\ k\text{-}ft$

- EQUIVALENT P at $\bar{y}$ = 8.5 ABOVE BASE:

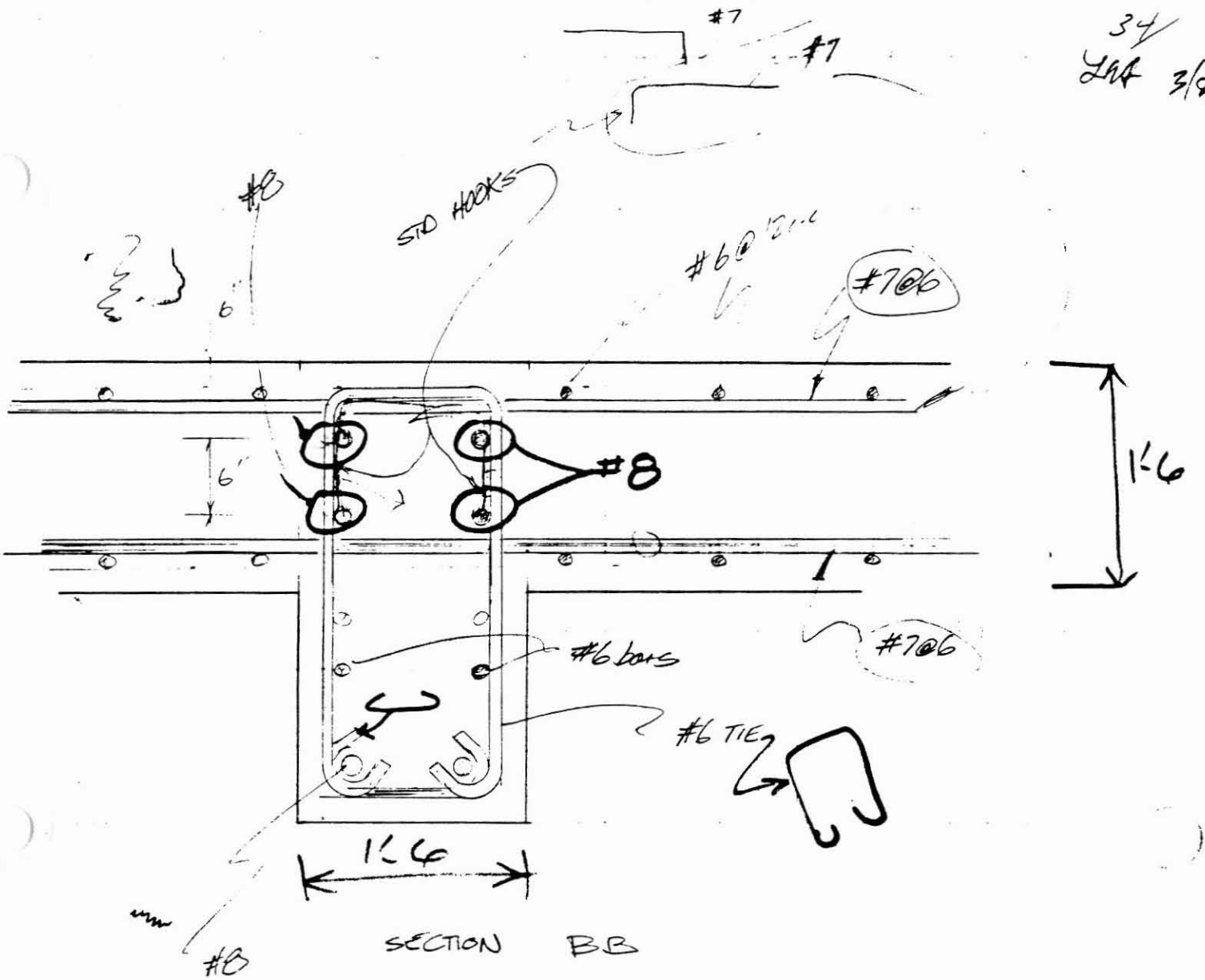
$P_{eq} = \frac{168}{8.5} = 19.8\ K$ or 40 K FOR BOTH.

OK PROVIDE ANCHORAGE

CONCLUSION: USE #8@12" c-c BOTH DIRECTIONS, BOTH FACES

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

34
LHA 3/85



GG on sh 31

MW DT 4/9

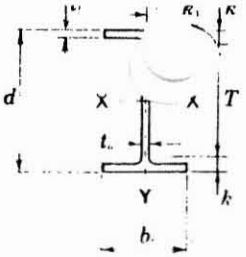
10'
-9"
7'-3"

4'-7½ TO CENTER

17'

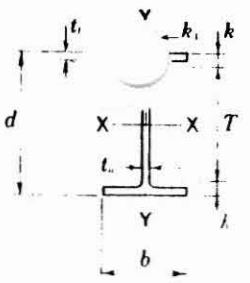
4'-7½

1'-6
1'-½



W SHAPES
Dimensions

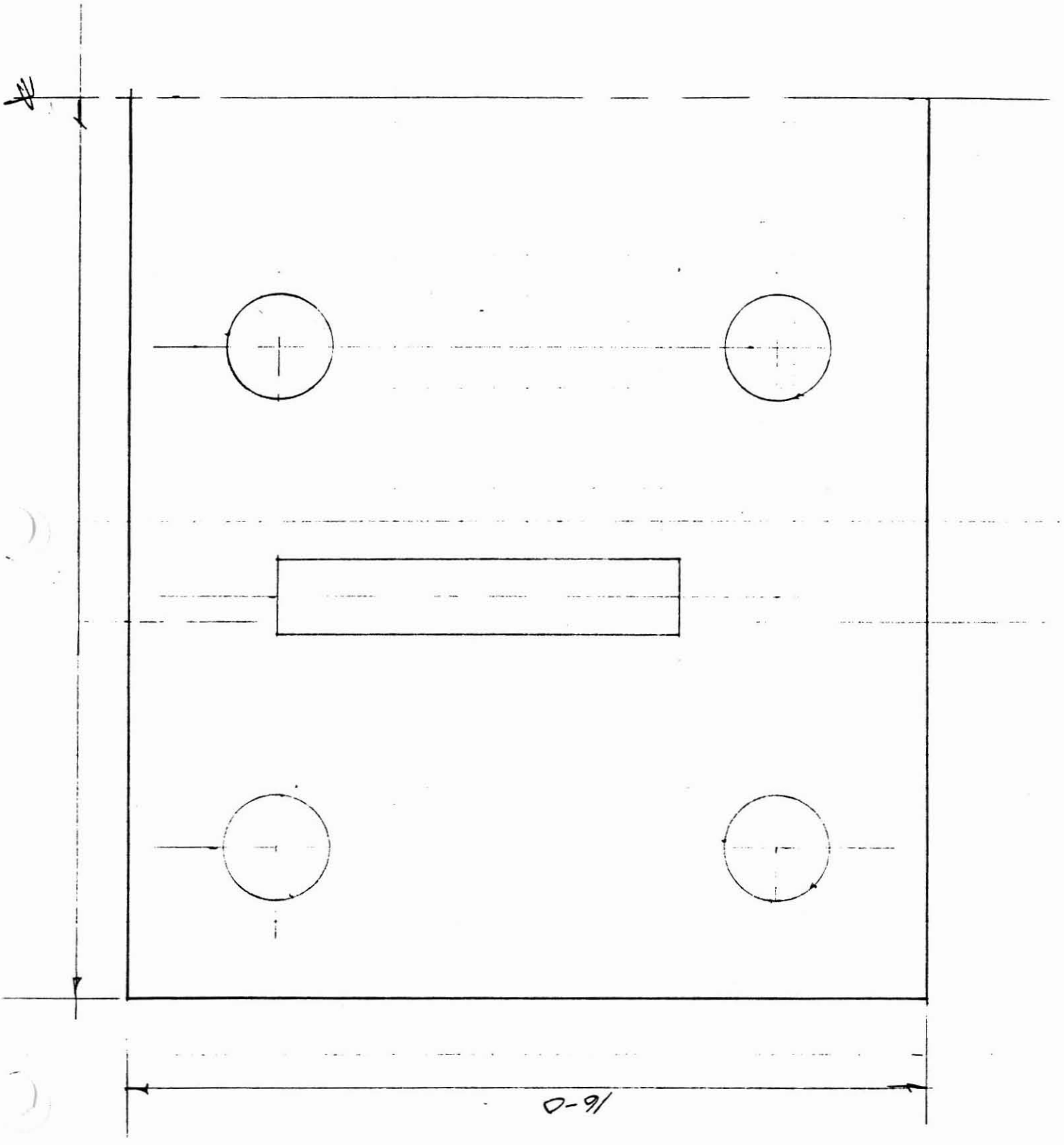
Designation	Area A	Depth d	Web Thickness t_w		$\frac{t_w}{2}$	Flange Width b_f		Flange Thickness t_f		Distance T	Distance k	Distance k_1
	In.²	In.	In.		In.	In.		In.		In.	In.	In.
W 18×119	35.1	18.97	19	0.655	5/8	5/16	11.265	11 1/4	1.060	1 1/16	15 1/2	1 3/4	15/16
×106	31.1	18.73	18 3/4	0.590	9/16	5/16	11.200	11 1/4	0.940	15/16	15 1/2	1 5/8	15/16
× 97	28.5	18.59	18 5/8	0.535	9/16	5/16	11.145	11 1/8	0.870	7/8	15 1/2	1 9/16	7/8
× 86	25.3	18.39	18 3/8	0.480	1/2	1/4	11.090	11 1/8	0.770	3/4	15 1/2	1 7/16	7/8
× 76	22.3	18.21	18 1/4	0.425	7/16	1/4	11.035	11	0.680	11/16	15 1/2	1 3/8	13/16
W 18× 71	20.8	18.47	18 1/2	0.495	1/2	1/4	7.635	7 5/8	0.810	13/16	15 1/2	1 1/2	7/8
× 65	19.1	18.35	18 3/8	0.450	7/16	1/4	7.590	7 5/8	0.750	3/4	15 1/2	1 7/16	7/8
× 60	17.6	18.24	18 1/4	0.415	7/16	1/4	7.555	7 1/2	0.695	11/16	15 1/2	1 3/8	13/16
× 55	16.2	18.11	18 1/8	0.390	3/8	3/16	7.530	7 1/2	0.630	5/8	15 1/2	1 5/16	13/16
× 50	14.7	17.99	18	0.355	3/8	3/16	7.495	7 1/2	0.570	9/16	15 1/2	1 1/4	13/16
W 18× 46	13.5	18.06	18	0.360	3/8	3/16	6.060	6	0.605	5/8	15 1/2	1 1/4	13/16
× 40	11.8	17.90	17 7/8	0.315	5/16	3/16	6.015	6	0.525	1/2	15 1/2	1 3/16	13/16
× 35	10.3	17.70	17 3/4	0.300	5/16	3/16	6.000	6	0.425	7/16	15 1/2	1 1/8	3/4
W 16×100	29.4	16.97	17	0.585	9/16	5/16	10.425	10 3/8	0.985	1	13 5/8	1 11/16	15/16
× 89	26.2	16.75	16 3/4	0.525	1/2	1/4	10.365	10 3/8	0.875	7/8	13 5/8	1 9/16	7/8
× 77	22.6	16.52	16 1/2	0.455	7/16	1/4	10.295	10 1/4	0.760	3/4	13 5/8	1 7/16	7/8
× 67	19.7	16.33	16 3/8	0.395	3/8	3/16	10.235	10 1/4	0.665	11/16	13 5/8	1 3/8	13/16
W 16× 57	16.8	16.43	16 3/8	0.430	7/16	1/4	7.120	7 1/8	0.715	11/16	13 5/8	1 3/8	7/8
× 50	14.7	16.26	16 1/4	0.380	3/8	3/16	7.070	7 1/8	0.630	5/8	13 5/8	1 5/16	13/16
× 45	13.3	16.13	16 1/8	0.345	3/8	3/16	7.035	7	0.565	9/16	13 5/8	1 1/4	13/16
× 40	11.8	16.01	16	0.305	5/16	3/16	6.995	7	0.505	1/2	13 5/8	1 3/16	13/16
× 36	10.6	15.86	15 7/8	0.295	5/16	3/16	6.985	7	0.430	7/16	13 5/8	1 1/8	3/4
W 16× 31	9.12	15.88	15 7/8	0.275	1/4	1/8	5.525	5 1/2	0.440	7/16	13 5/8	1 1/8	3/4
× 26	7.68	15.69	15 3/4	0.250	1/4	1/8	5.500	5 1/2	0.345	3/8	13 5/8	1 1/16	3/4

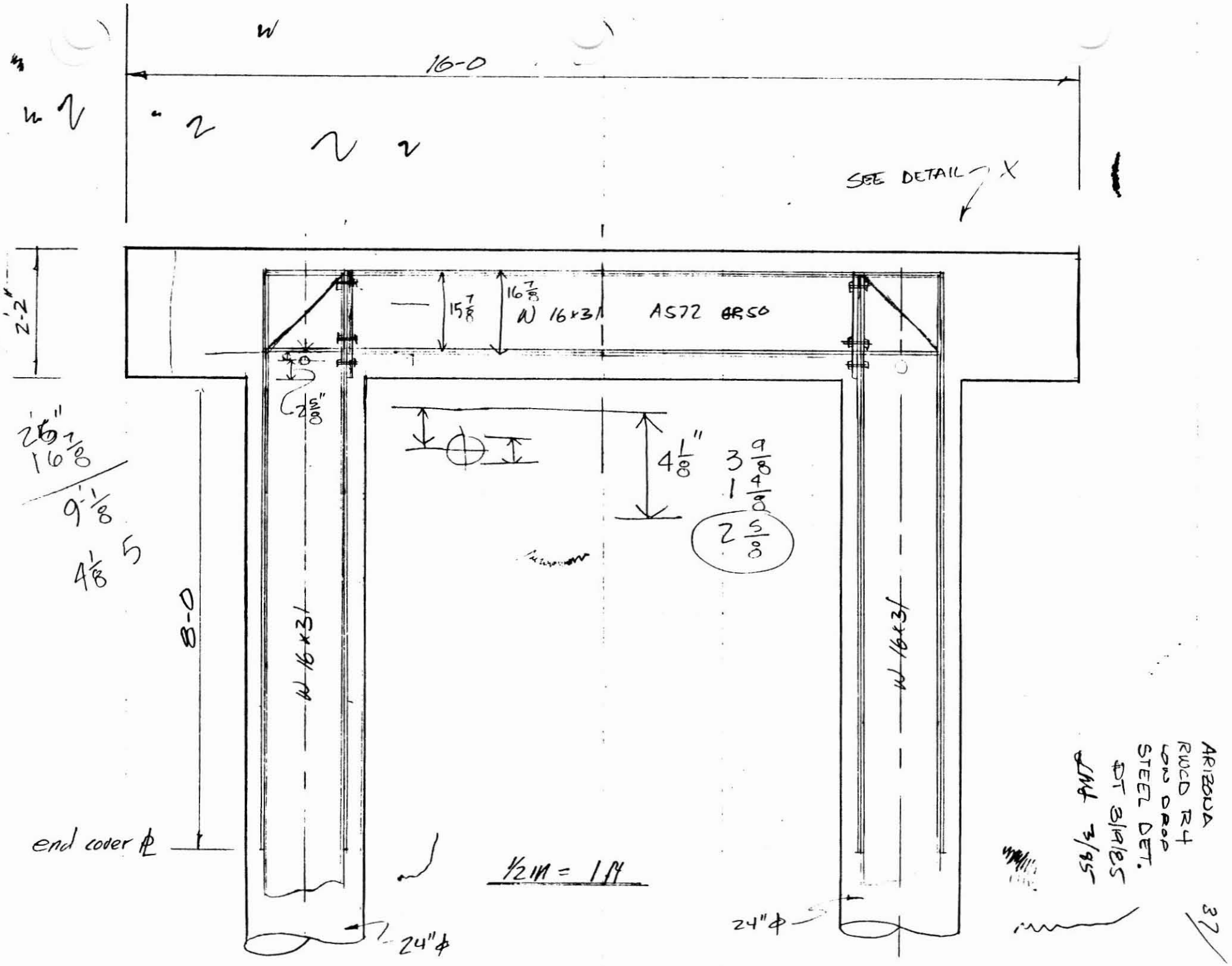


W SHAPES
Properties

Nominal Wt per Ft	Compact Section Criteria $\frac{b_f}{2t_f}$	Compact Section Criteria F_y'	Compact Section Criteria $\frac{d}{t_w}$	Compact Section Criteria F_y'''	r_T	$\frac{d}{A_f}$	Elastic Properties Axis X-X I	Axis X-X S	Axis X-X r	Axis Y-Y I	Axis Y-Y S	Axis Y-Y r	Torsional constant J	Plastic Modulus Z_x	Plastic Modulus Z_y
Lb		Ksi		Ksi	In.		In.⁴	In.³	In.	In.⁴	In.³	In.	In.⁴	In.³	In.³
119	5.3	—	29.0	—	3.02	1.59	2190	231	7.90	253	44.9	2.69	10.6	261	69.1
106	6.0	—	31.7	—	3.00	1.78	1910	204	7.84	220	39.4	2.66	7.48	230	60.5
97	6.4	—	34.7	54.7	2.99	1.92	1750	188	7.82	201	36.1	2.65	5.86	211	55.3
86	7.2	—	38.3	45.0	2.97	2.15	1530	166	7.77	175	31.6	2.62	4.10	186	48.4
76	8.1	64.2	42.8	36.0	2.95	2.43	1330	146	7.73	152	27.6	2.61	2.83	163	42.2
71	4.7	—	37.4	47.4	1.98	2.99	1170	127	7.50	60.3	15.8	1.70	3.48	145	24.7
65	5.1	—	40.8	39.7	1.97	3.22	1070	117	7.49	54.8	14.4	1.69	2.73	133	22.5
60	5.4	—	44.0	34.2	1.96	3.47	984	108	7.47	50.1	13.3	1.69	2.17	123	20.6
55	6.0	—	46.4	30.6	1.95	3.82	890	98.3	7.41	44.9	11.9	1.67	1.66	112	18.5
50	6.6	—	50.7	25.7	1.94	4.21	800	88.9	7.38	40.1	10.7	1.65	1.24	101	16.6
46	5.0	—	50.2	26.2	1.54	4.93	712	78.8	7.25	22.5	7.43	1.29	1.22	90.7	11.7
40	5.7	—	56.8	20.5	1.52	5.67	612	68.4	7.21	19.1	6.35	1.27	0.81	78.4	9.95
35	7.1	—	59.0	19.0	1.49	6.94	510	57.6	7.04	15.3	5.12	1.22	0.51	66.5	8.06
100	5.3	—	29.0	—	2.81	1.65	1490	175	7.10	186	35.7	2.51	7.73	198	54.9
89	5.9	—	31.9	64.9	2.79	1.85	1300	155	7.05	163	31.4	2.49	5.45	175	48.1
77	6.8	—	36.3	50.1	2.77	2.11	1110	134	7.00	138	26.9	2.47	3.57	150	41.1
67	7.7	—	41.3	38.6	2.75	2.40	954	117	6.96	119	23.2	2.46	2.39	130	35.5
57	5.0		38.2	45.2	1.86	3.23	758	92.2	6.72	43.1	12.1	1.60	2.22	105	18.9
50	5.6	—	42.8	36.1	1.84	3.65	659	81.0	6.68	37.2	10.5	1.59	1.52	92.0	16.3
45	6.2	—	46.8	30.2	1.83	4.06	586	72.7	6.65	32.8	9.34	1.57	1.11	82.3	14.5
40	6.9	—	52.5	24.0	1.82	4.53	518	64.7	6.63	28.9	8.25	1.57	0.79	72.9	12.7
36	8.1	64.0	53.8	22.9	1.79	5.28	448	56.5	6.51	24.5	7.00	1.52	0.54	64.0	10.8
31	6.3	—	57.7	19.8	1.39	6.53	375	47.2	6.41	12.4	4.49	1.17	0.46	54.0	7.03
26	8.0	—	62.8	16.8	1.36	8.27	301	38.4	6.26	9.59	3.49	1.12	0.26	44.2	5.48

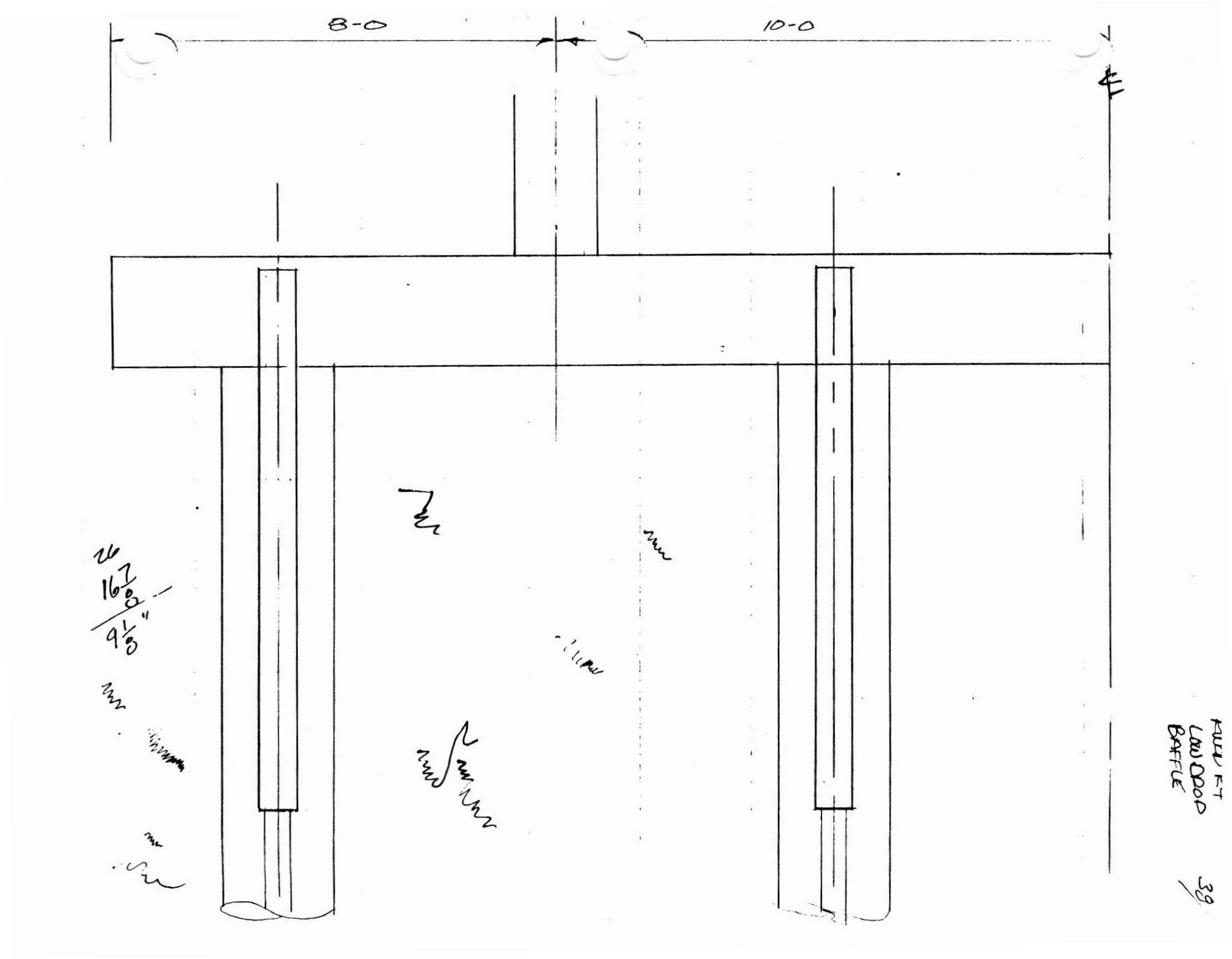
RWCO REACH 4 36/
LOW DROP
BASE
DT 1/21/85

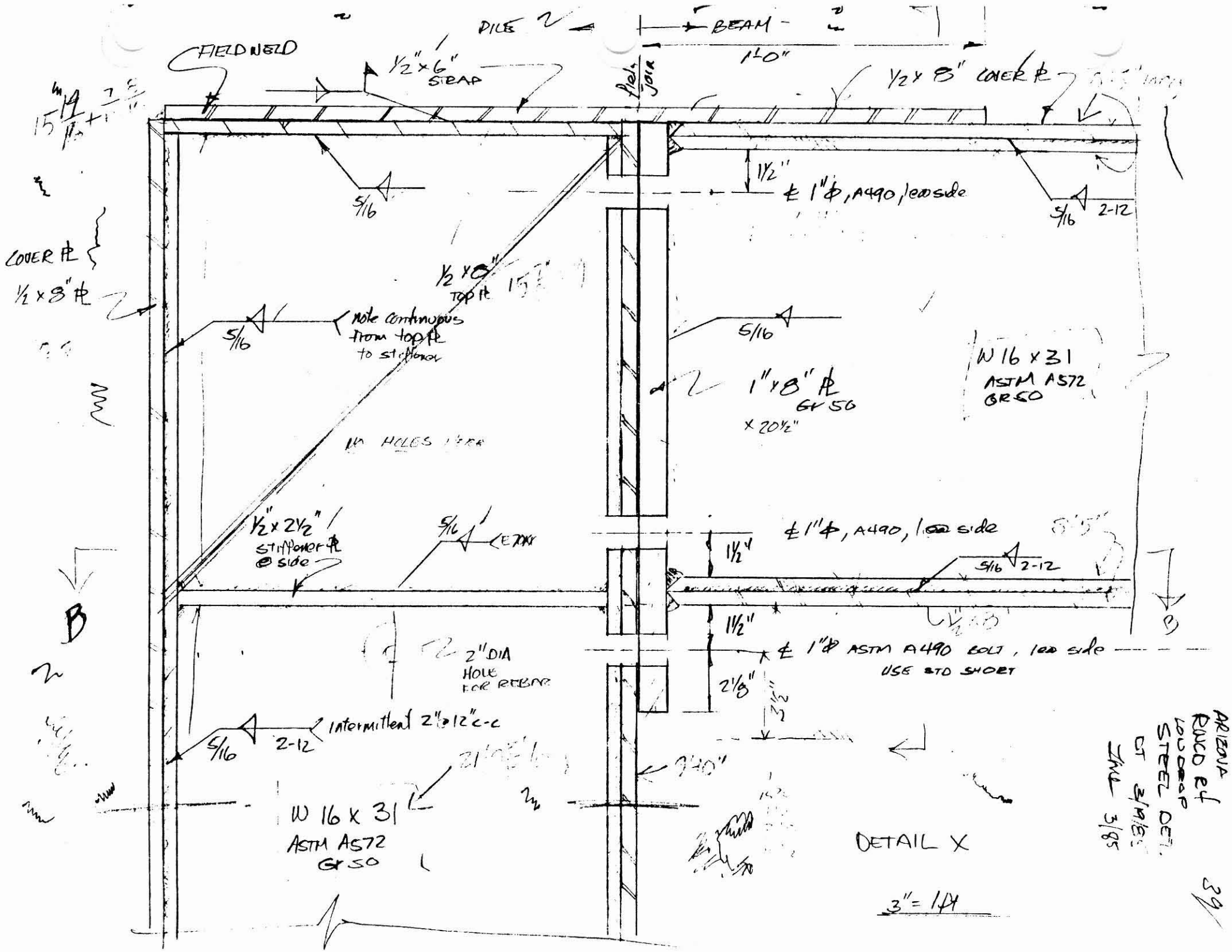




ARIZONA
RWCD R4
LOW DROP
STEEL DET.
DT 3/18/85
LWH 3/95

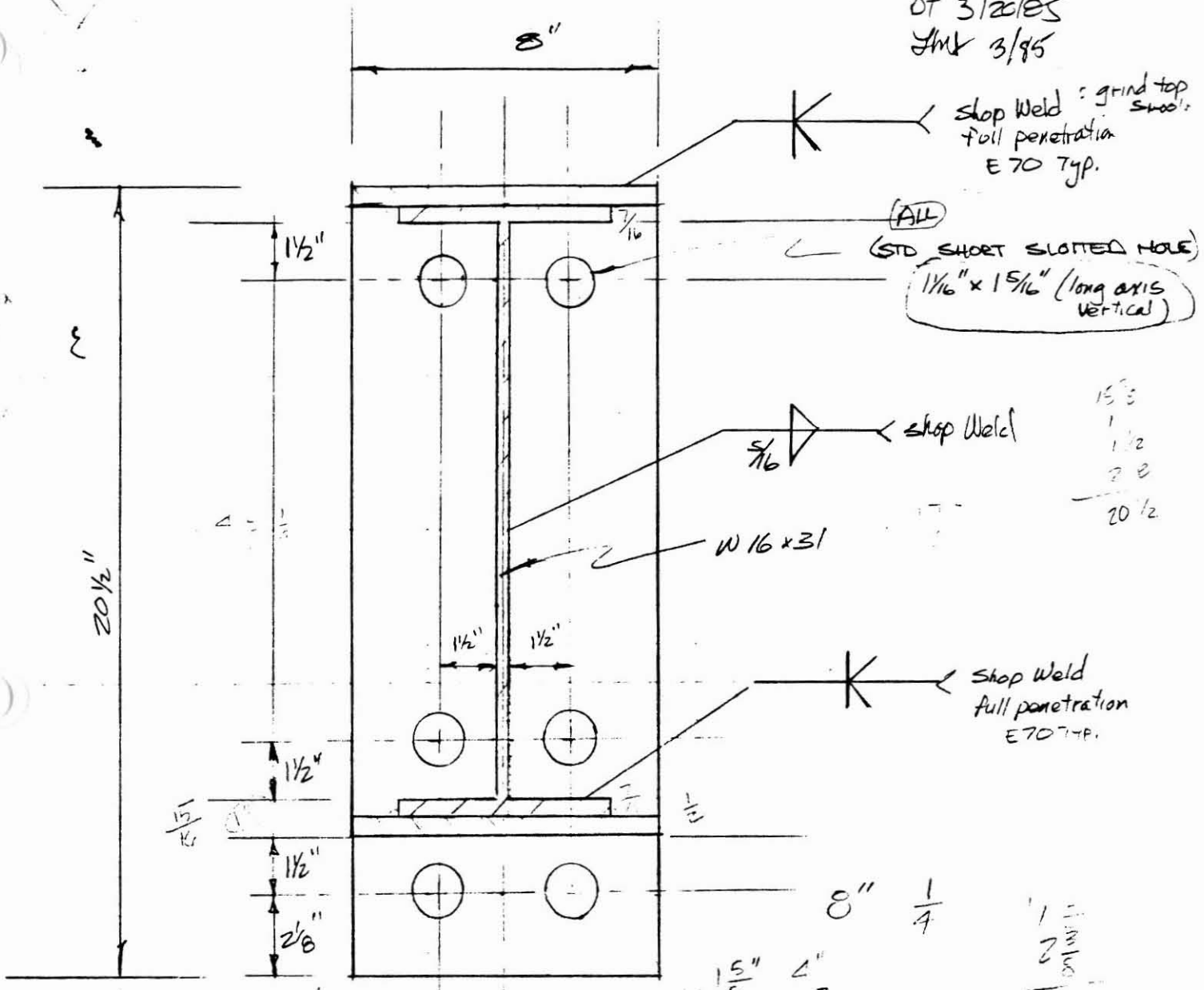
37


8-0
10-0
41
16 7/8"
9 1/8"
FULL FT
LOW DOD
BAFFLE
39


PILE
BEAM
1'-0"
FIELD WELD
½"x6" STRAP
Field Joint
½ x 8" COVER PL
1½"
℄ 1"ϕ, A490, loose side
5/16
2-12
COVER PL
½ x 8" PL
½ x 8" TOP PL
note continuous from top PL to stiffener
1" x 8" PL Gr 50 x 20½"
W 16 x 31 ASTM A572 GR 50
½" x 2½" STIFFENER PL @ SIDE
intermittent 2" @ 12" c-c
2" DIA HOLE FOR REBAR
℄ 1"ϕ ASTM A490 BOLT, loose side
USE STD SHORT
2⅛"
7'-0"
W 16 x 31
ASTM A572
Gr 50
B
DETAIL X
3" = 1'-0"
ARIZONA RANCO RD. OVERPASS STEEL DET. CT SHEET JUNE 3/85
39

RIXCO REACH 4
LOW DROP
STEEL DETAIL
OT 3/20/85
Ltr 3/85

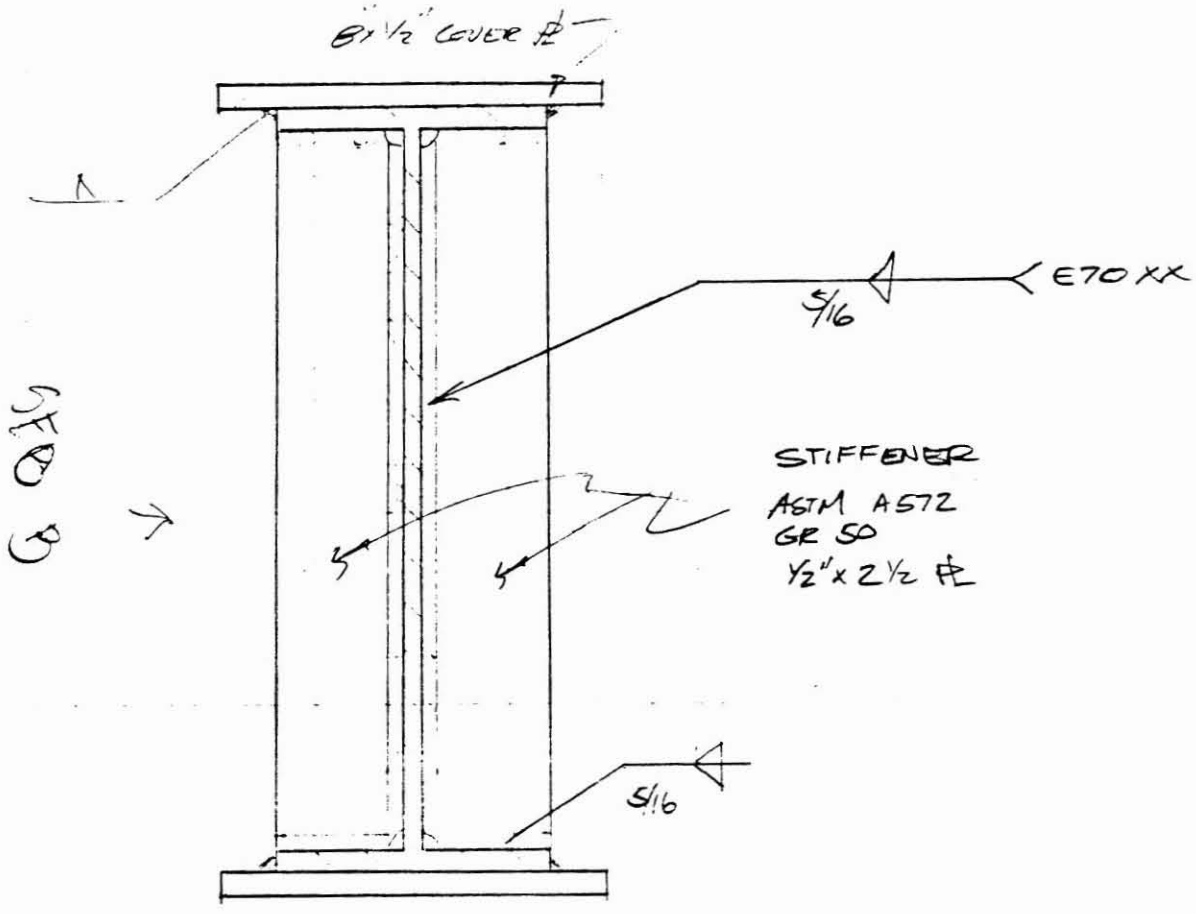
40



END PL DETAIL

ROXCO R4
LOW DROP
STEEL DETAIL
PT 8/20/85
LMA 8/85

41



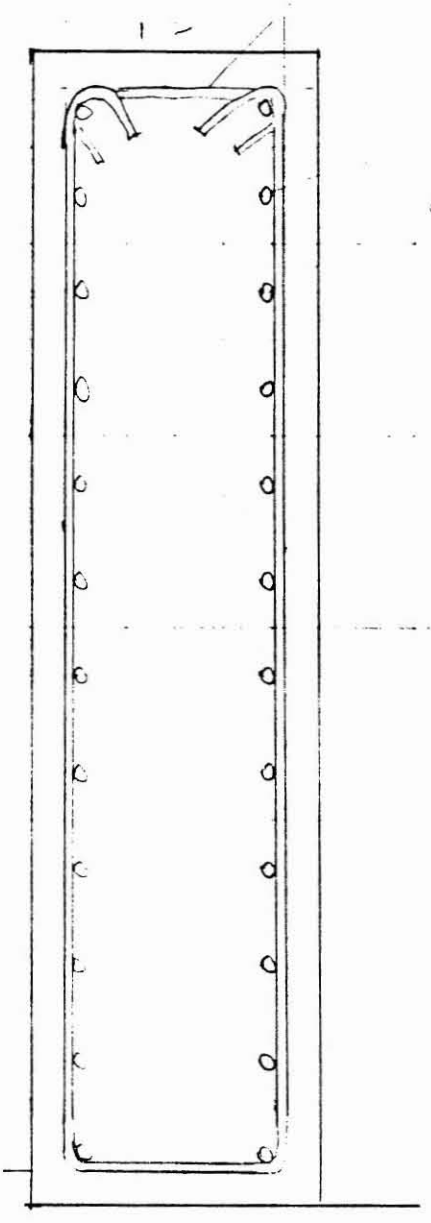
STIFFENER DETAIL 1in = 3in

SEC B

ARIZONA
RWCD #4
LOW DROP
DT 3/22/95
Lmt 3/95

1" = 1'

2 #6 CLOSED STIRRUP



#7 @ 6" c-c
BOTH FACES

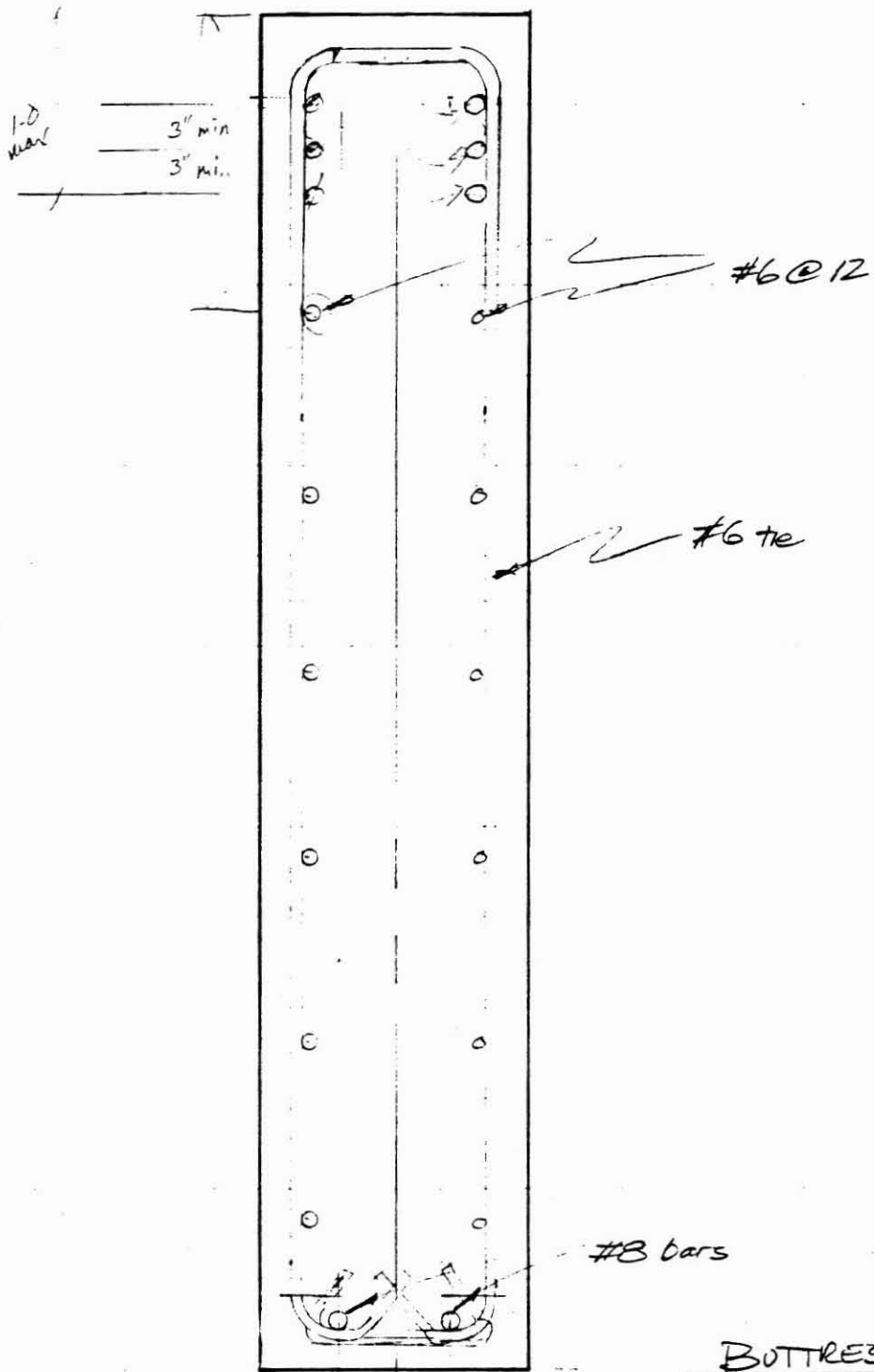
SECTION D-D

BAFFLE

ARIZONA
RUCD R4
BAFFLE
AT 3/21/85
LHH 3/85

1" = 1 ft

6 #8 bars



Typ.
Closed Stirrup
see ACI 315-80, p33

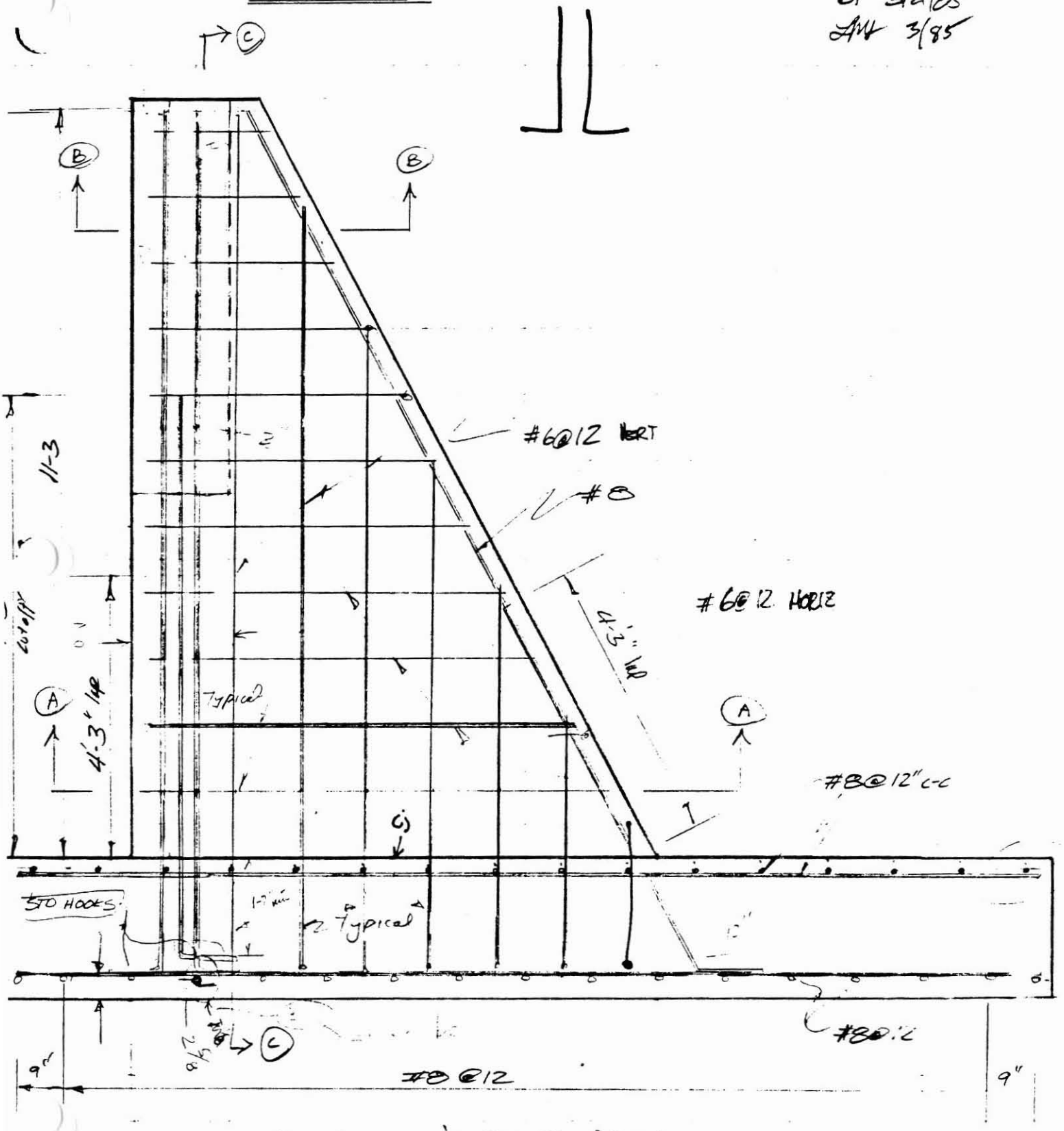
BUTTRESS DETAIL

SECTION A-A

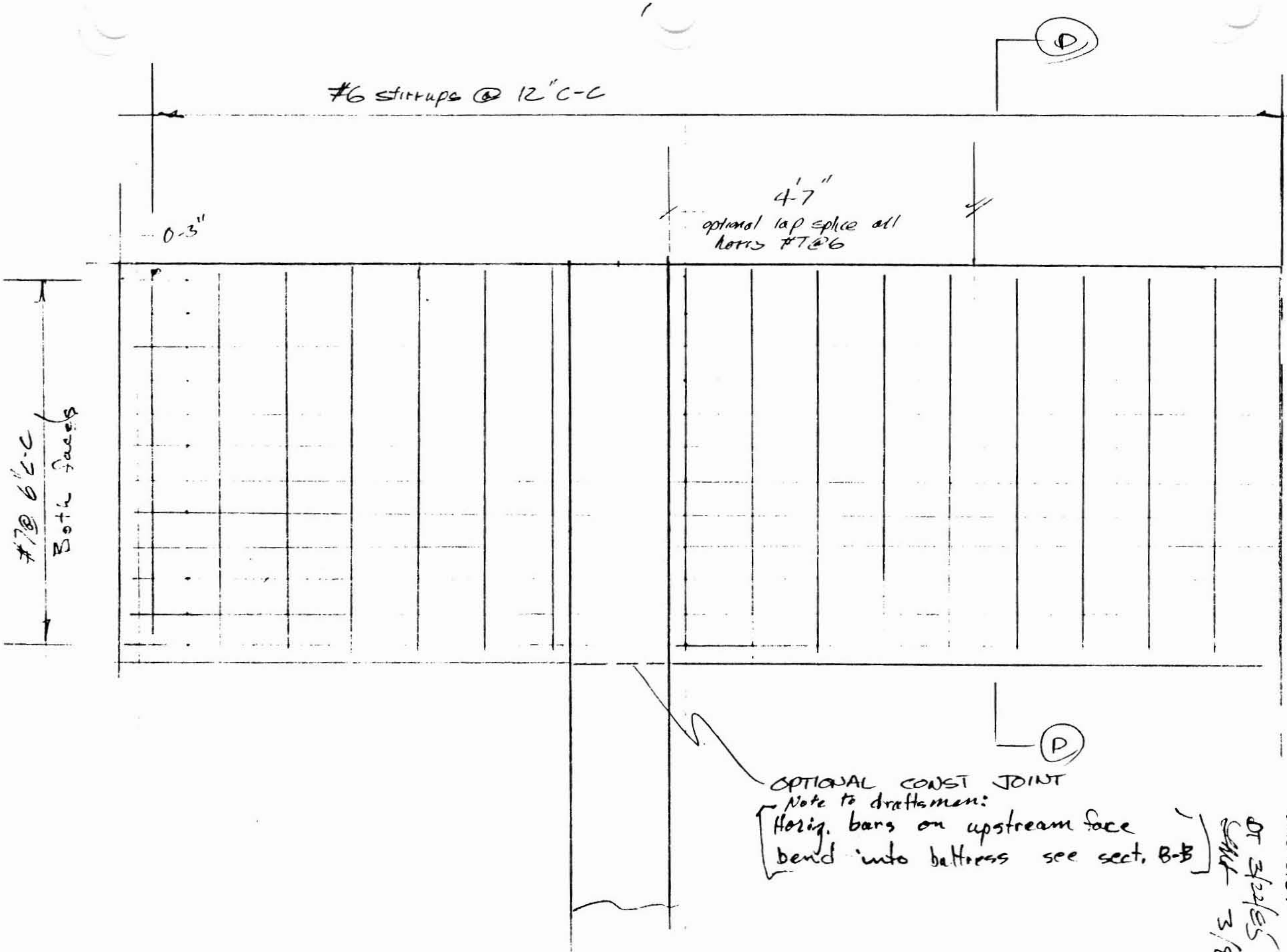
ARIZONA
RWCD RH
BAFFLE
DETAIL
DT 3/21/85
AM 3/85

44

1/2" = 1 FT.



BUTTRESS & BASE DETAIL



BAFFLE

LOOKING US

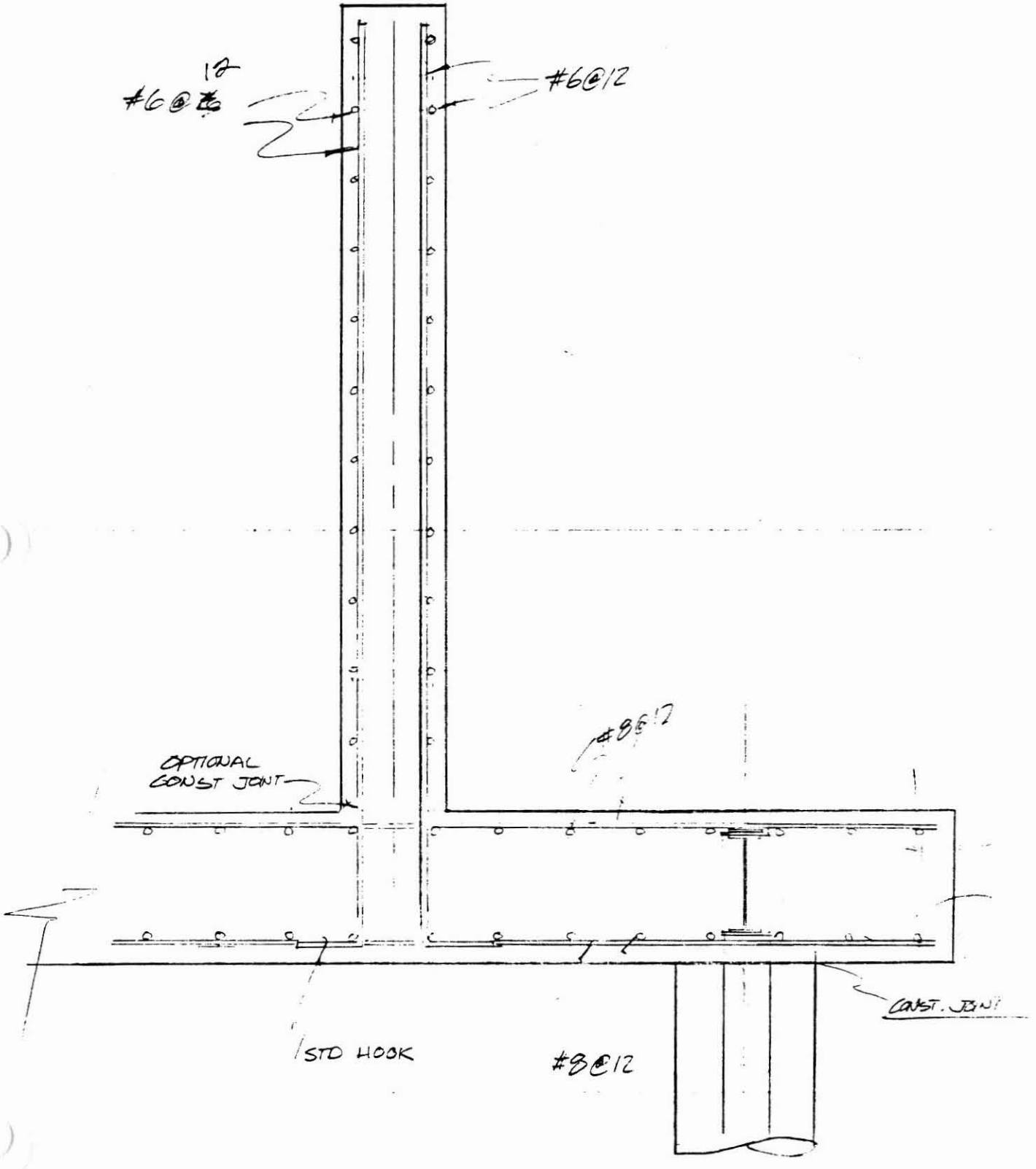
1/2" = 1 FT

4/5

ARIZONA
RWCD R4
LOW DROP
DT 3/24/05
JWH 3/8/5

46

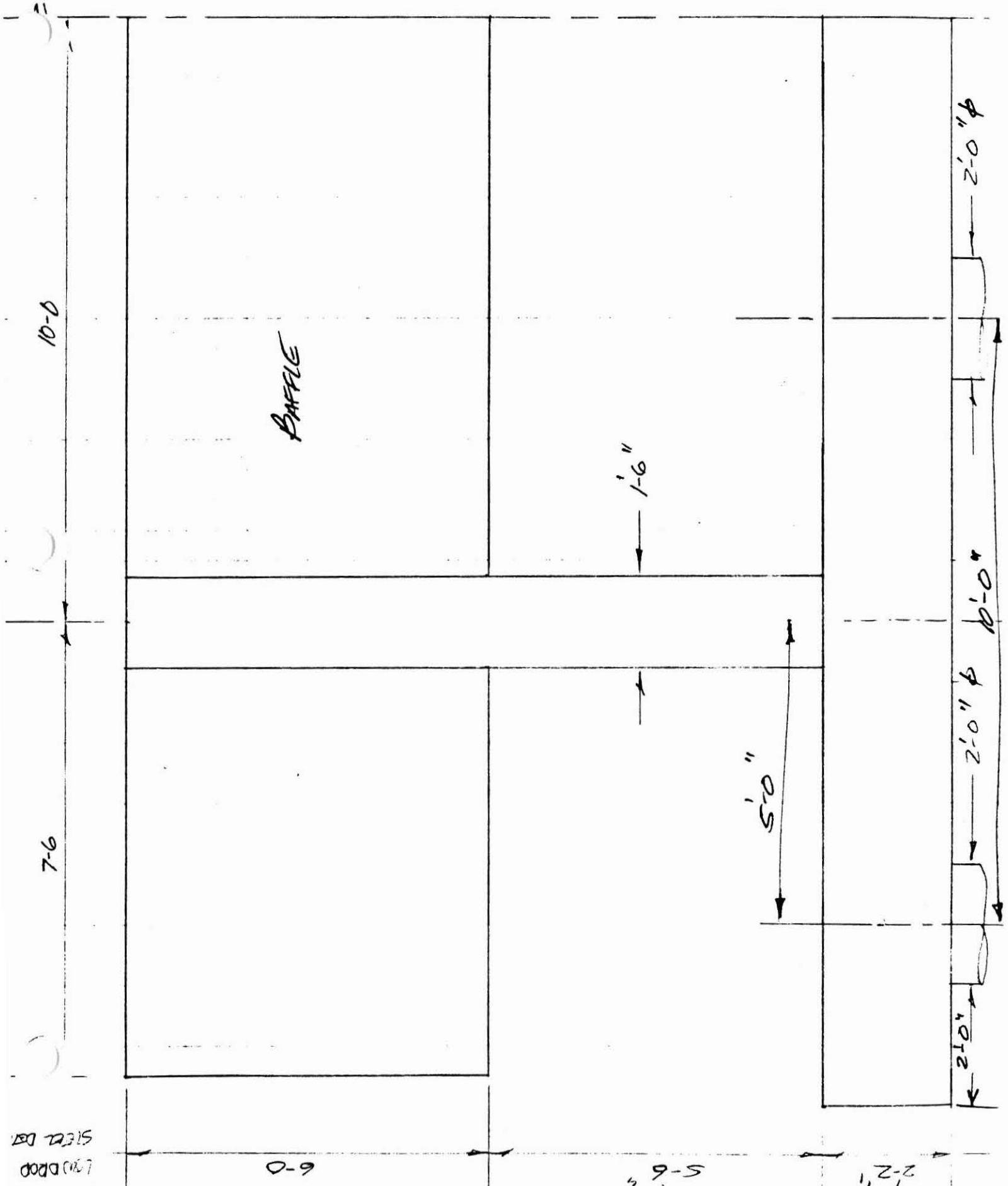
1/2" = 1 FT



SECTION C-C

ARIZONA
RWCO R4
LOW DROP
DT 2/21/85

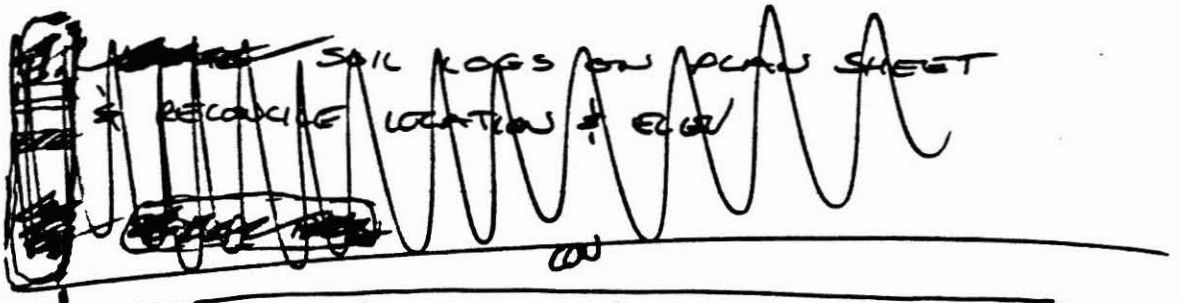
47



11/20/84 11:20 AM

— CALLED FORSYTHE NO ANSWER

[redacted]



BOBBY DANIELS → CONSTRUCTION ENGR.

→ WATERWAYS EXP. STA. WITH RECOMMENDATION
→ PATTERN OF BAFFLE

RICHARD PEASE →

— MON. AFTERNOON
— 4070 BL

-960-

talked to → WARREN BERRY
ST. DESIGN

CHOPIE MEIER
PROJ. ENGR.
GRENADA

FTS 490-4070

NORTH FORK TILLATOBA — 1978
GRADY GOULD CANAL — 1976
INDIAN CREEK — 1976

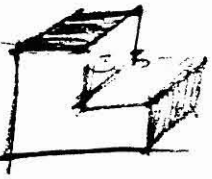
11/19/84

DR. W.C. LITTLE

$\frac{3.35}{6.21} = \frac{0.54}{}$

25

→ IN THE FIELD ←



150

DON
BOB FRONK

PETER FORSYTHE
ST. EDGE
SPECIAL STUDIES
SCS
SIE 1321 FI
JACKSON MISS
39269
490-4956

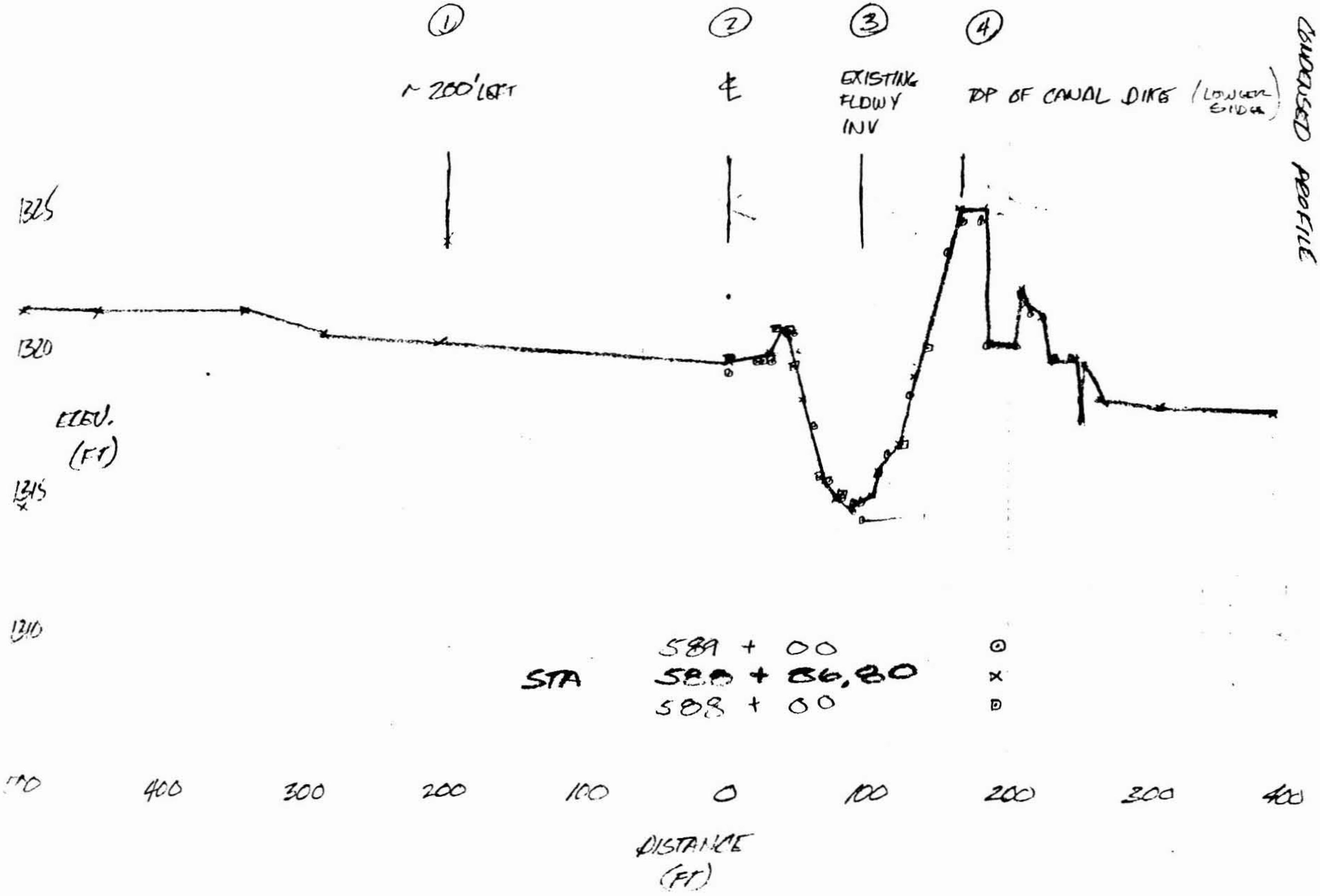
FTS

WORKED 7 OR 8 YRS
GOOD JOB
H

11:48
12:45
10:45

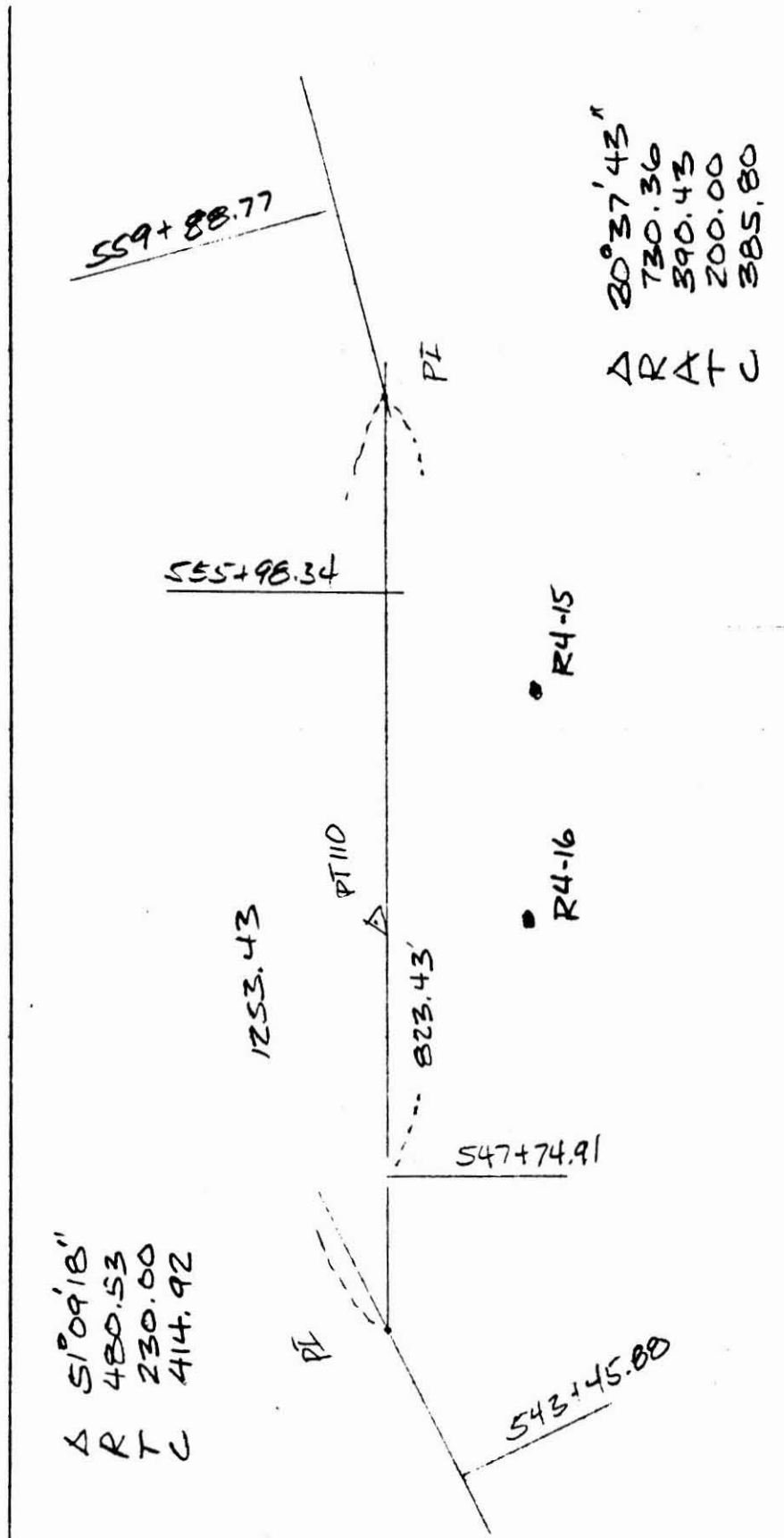
36¼
42¼
42¼'
675
676+22.5
15'
676+91.5
20'
grouted
3.79:1
15'
55'
loose
58.3'
6'
8.5'
2.5:1
26.05°
DKT
3:1
slope varies
2:1

AB12
D. THACKERAY / 7/23/84
CONDENSED PROFILE



ARIZONA RWCD REACH 4

DT 12/7/84



ARIZONA RWCD R4	DT 4/9/85	LOW CROP LAYOUT

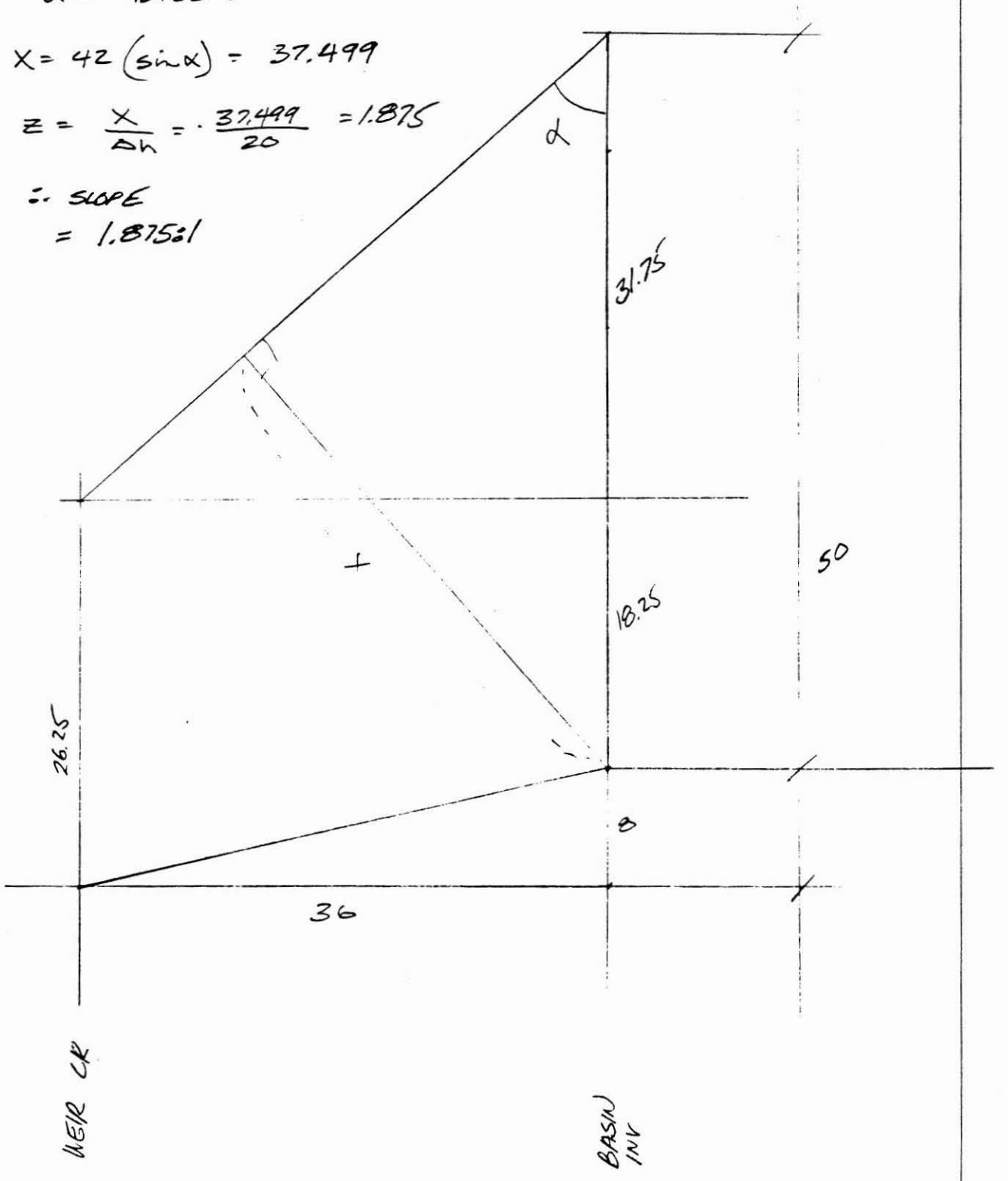
$\tan \alpha = 36/31.75$

$\alpha = 48.5895^\circ$

$X = 42 (\sin \alpha) = 37.499$

$Z = \frac{X}{\Delta h} = \frac{37.499}{20} = 1.875$

∴ SLOPE
= 1.875:1



42.381 50 SHEETS 5 SQUARE
42.382 100 SHEETS 5 SQUARE
42.389 200 SHEETS 5 SQUARE
NATIONAL

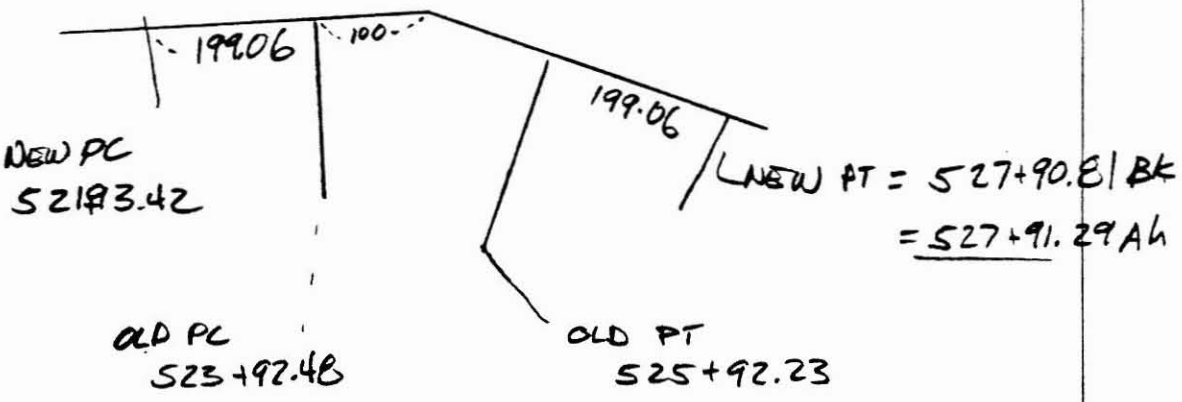
```
JOB

INVERSE/BEARINGS  22 140
     FROM     22 TO    140 S    2  41  33.000E          290.9100

320 325
     FROM    320 TO    325 S   15  17  16.760W          331.6456

300 22
     FROM    300 TO     22 N   89  43   0.043W           95.5110

LIST/COORDINATES  (1-500)
     POINT     22       N      844591.9730,  E      571585.8488
     POINT    101       N      844500.0000,  E      571500.0000
     POINT    102       N      844500.0000,  E      572000.0000
     POINT    103       N      844000.0000,  E      571500.0000
     POINT    104       N      844000.0000,  E      572000.0000
     POINT    138       N      842327.7872,  E      571042.8041
     POINT    110       N      844301.1042,  E      571599.5145
     POINT    200       N      844413.8958,  E      571709.2387
     POINT    201       N      844280.3209,  E      571671.6972
     POINT    205       N      844058.0834,  E      571608.8612
     POINT    210       N      844650.4203,  E      571770.2090
     POINT    215       N      844473.3705,  E      571835.8921
     POINT    220       N      844473.3705,  E      571835.8921
     POINT    222       N      844473.3705,  E      571835.8921
     POINT    225       N      844473.3705,  E      571835.8921
     POINT    300       N      844591.3007,  E      571681.3587
     POINT    301       N      844583.7349,  E      572768.0823
     POINT    302       N      844183.0670,  E      571912.7891
     POINT    303       N      843908.0168,  E      571643.4107
     POINT    304       N      843948.4709,  E      571500.0114
     POINT    305       N      843995.9766,  E      571513.4132
     POINT    306       N      843928.1076,  E      571572.1941
     POINT    310       N      843627.1793,  E      571409.4572
     POINT    311       N      843603.6983,  E      571557.5601
     POINT    320       N      844587.8198,  E      572181.3465
     POINT    321       N      844658.6742,  E      571774.3276
     POINT    322       N      844725.5754,  E      571962.8063
     POINT    325       N      844267.9102,  E      572093.9012
     POINT    350       N      843715.4546,  E      571580.9156

END.OF/RUN
JOB  05  1  IS COMPLETED AT 01:07:09
LAST FIGURE NUMBER USED=       3 MAXIMUM ALLOWED=     50
LAST POINT NUMBER USED=      497 MAXIMUM ALLOWED=   1000
END/OF/RUN - PROGRAM TERMINATED
```

N 844591.97
E 571589.90
22

N E
844,659.84 571,778.38
844725.74 571 966.86

PROBLEM: CHECK REVISED CURVE #3

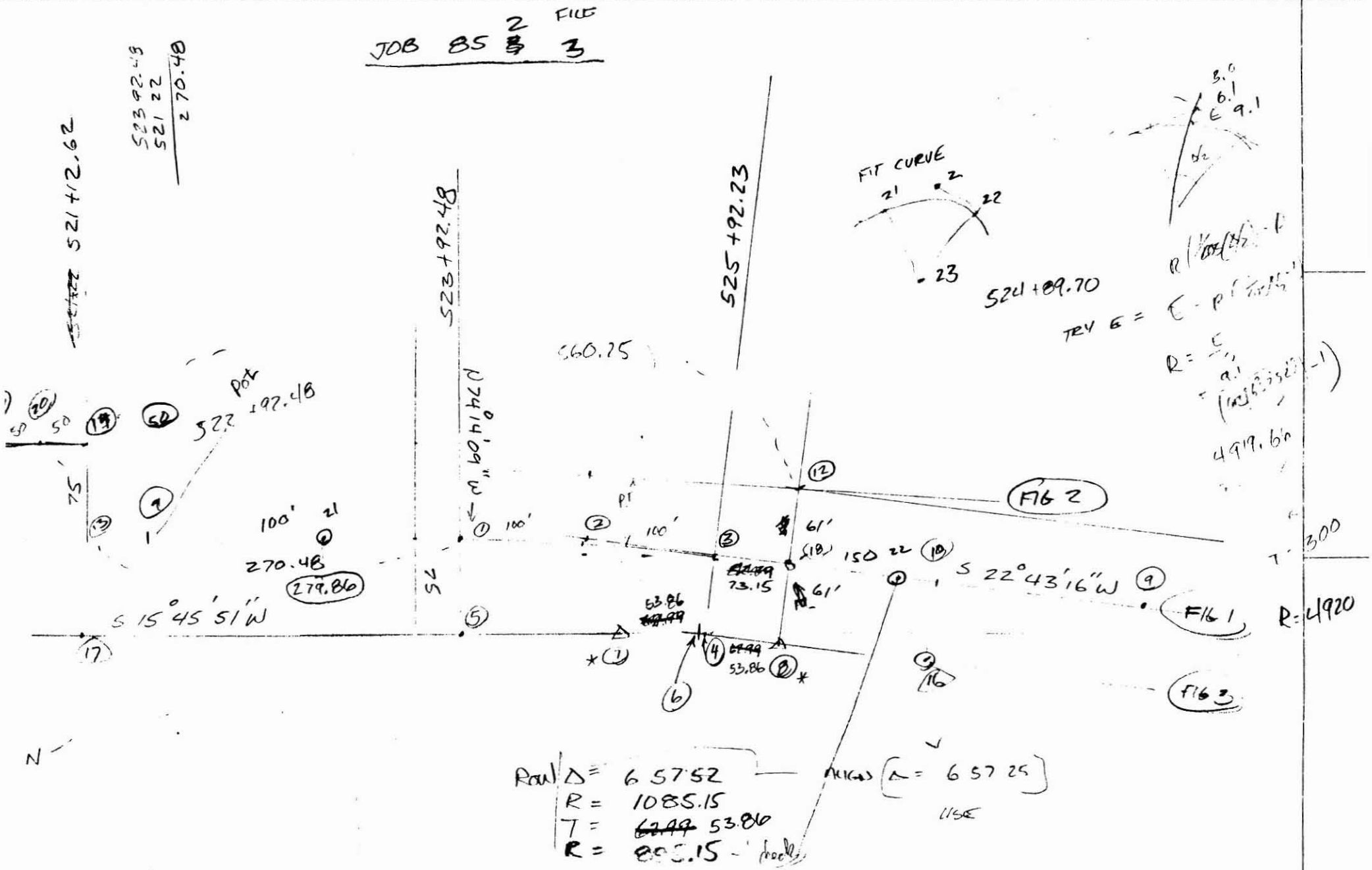
SOLUTION:



NEW	OLD
$\Delta = 6^\circ 57' 25''$	"
$L = 597.39$	
$T = 299.06$	100
$R = 4920$	

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE

JOB 85 2 3 FILE



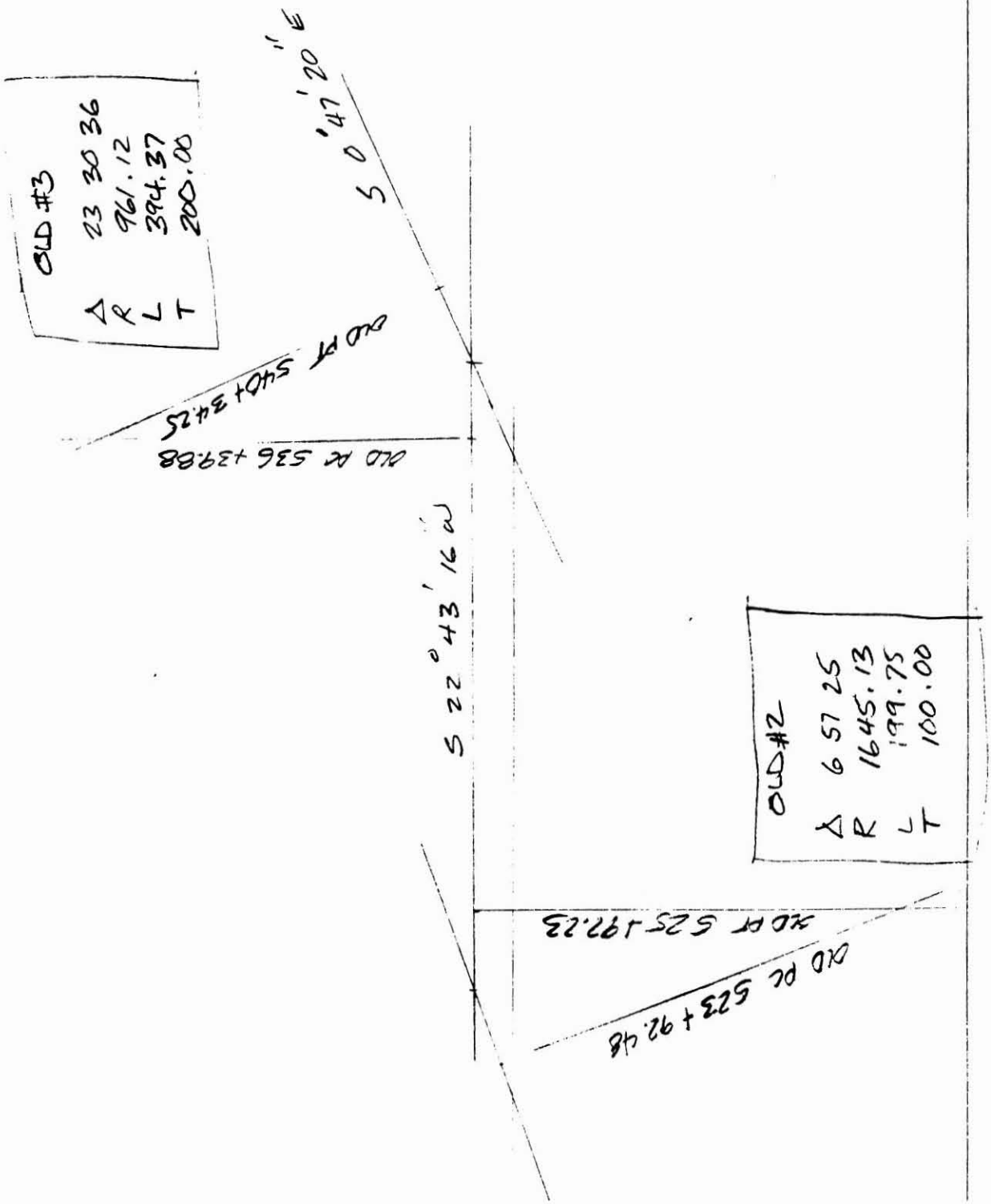
(11) CENTER 1-11-3

(15) CENTER 7-15-8

ARIZONA
RWCD R4

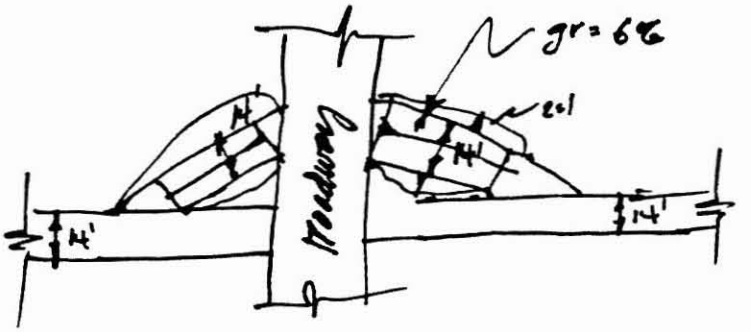
DT 1/28/85

PROBLEM: NEED TO ADJUST ALIGNMENT BETWEEN CURVE #2 AND CURVE #3



42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE

TYPICAL RAMPS AT ROAD CROSSINGS:



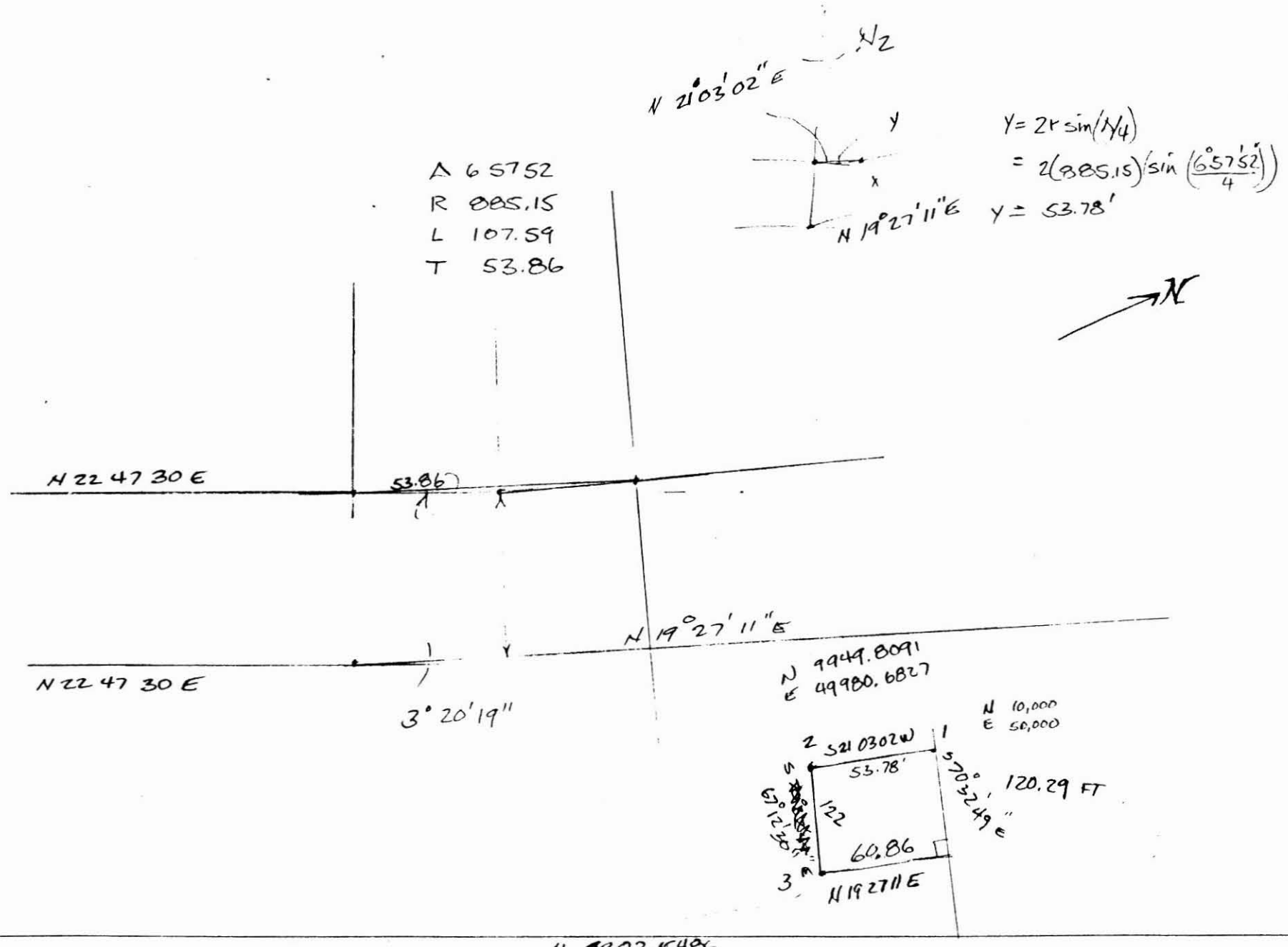
NOTE TYPICAL RAMPS AT ROADWAYS:

grade = 6%
width = 14 ft
side slopes = 2:1

42-381 50 SHEETS 5 SQUARE
42-382 100 SHEETS 5 SQUARE
42-389 200 SHEETS 5 SQUARE
NATIONAL

ARIZONA RWCD RL

QT 4/5/85



N 9902.5486
E 50093.1569

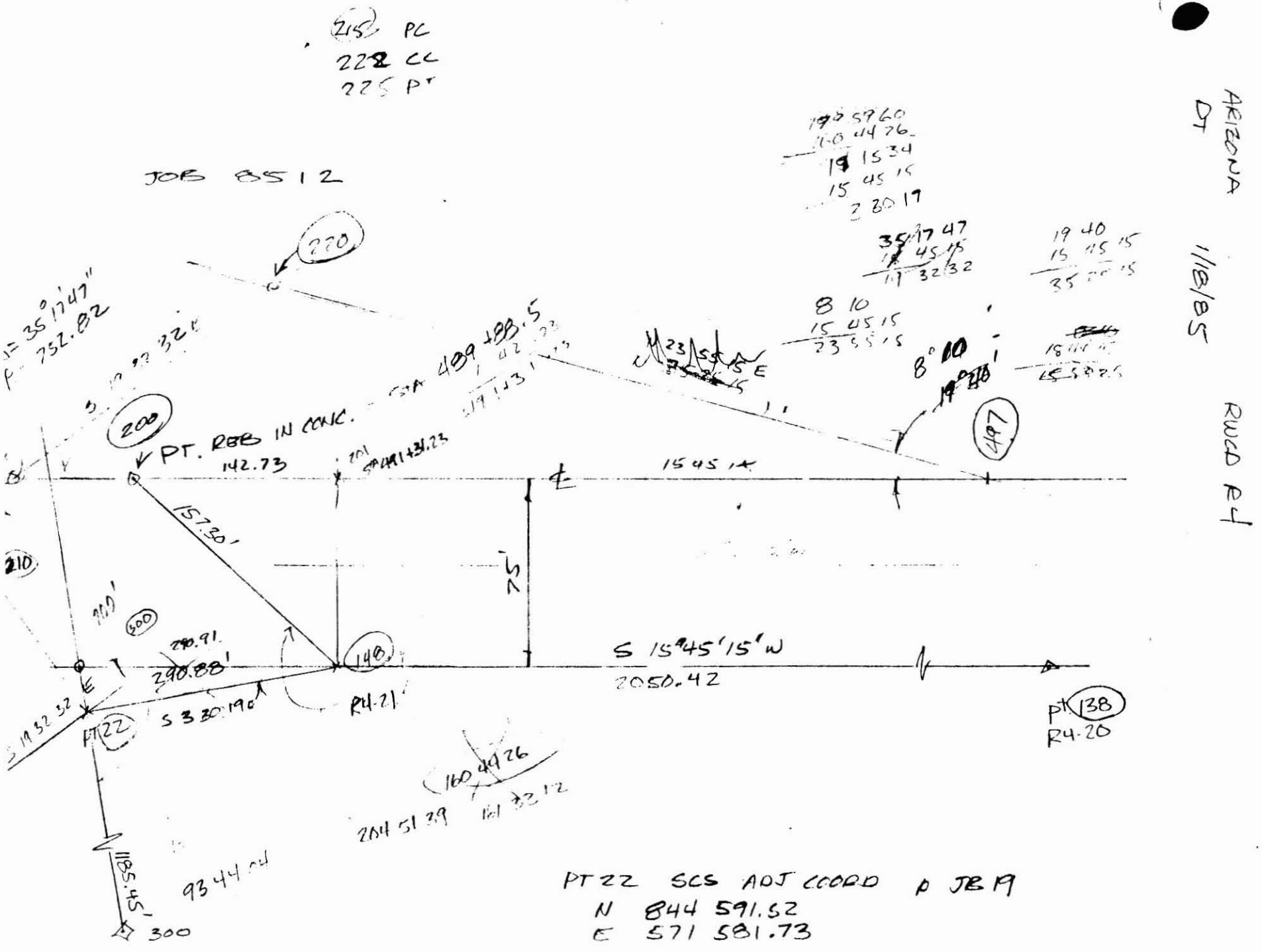
ARIZONA
DWCD R4

DT 4/16/85

CHECK CURVE DATA

CURVE NUMBER	BEARING	Δ	R	T	L	D
	S19°31'57"E					
1		✓ 49°17'48"	653.80			
	S29°45'51"W					
2		✓ 14°00'00"	488.66			
	S15°45'51"W					
3		✓ 6°57'25"	4920.00			
	S22°43'16"W					
4		✓ 23°30'36"	961.12			
	S 0°47'20"E					
5		✓ 51°09'19"	480.53	230.00	429.03	
	S50°21'59"W					
6		30°37'43"	730.36			7 50 42
	S19°44'16"W					
7		✓ 22°06'14"	1077.56			5 19 02
	S 41 50 20 W					
	S 41 48 47 W	X PT				
8		✓ 13°28'50"	1555.02			3 41 04
	S 28 19 57 W					
9		33°55'26"	921.60			6 13 01
	S 62 15 23 W					
10		36°27'36"	505.00			11 20 45
	S 25 47 47 W					
11		22°13'57"	1472.58			3 53 27
	S 48 01 44 W					
12		17°45'17"	1447.49			3 57 30
	S 30 16 27 W					

42 381 50 SHEETS 5 SQUARE
42 382 100 SHEETS 5 SQUARE
42 389 200 SHEETS 5 SQUARE
NATIONAL

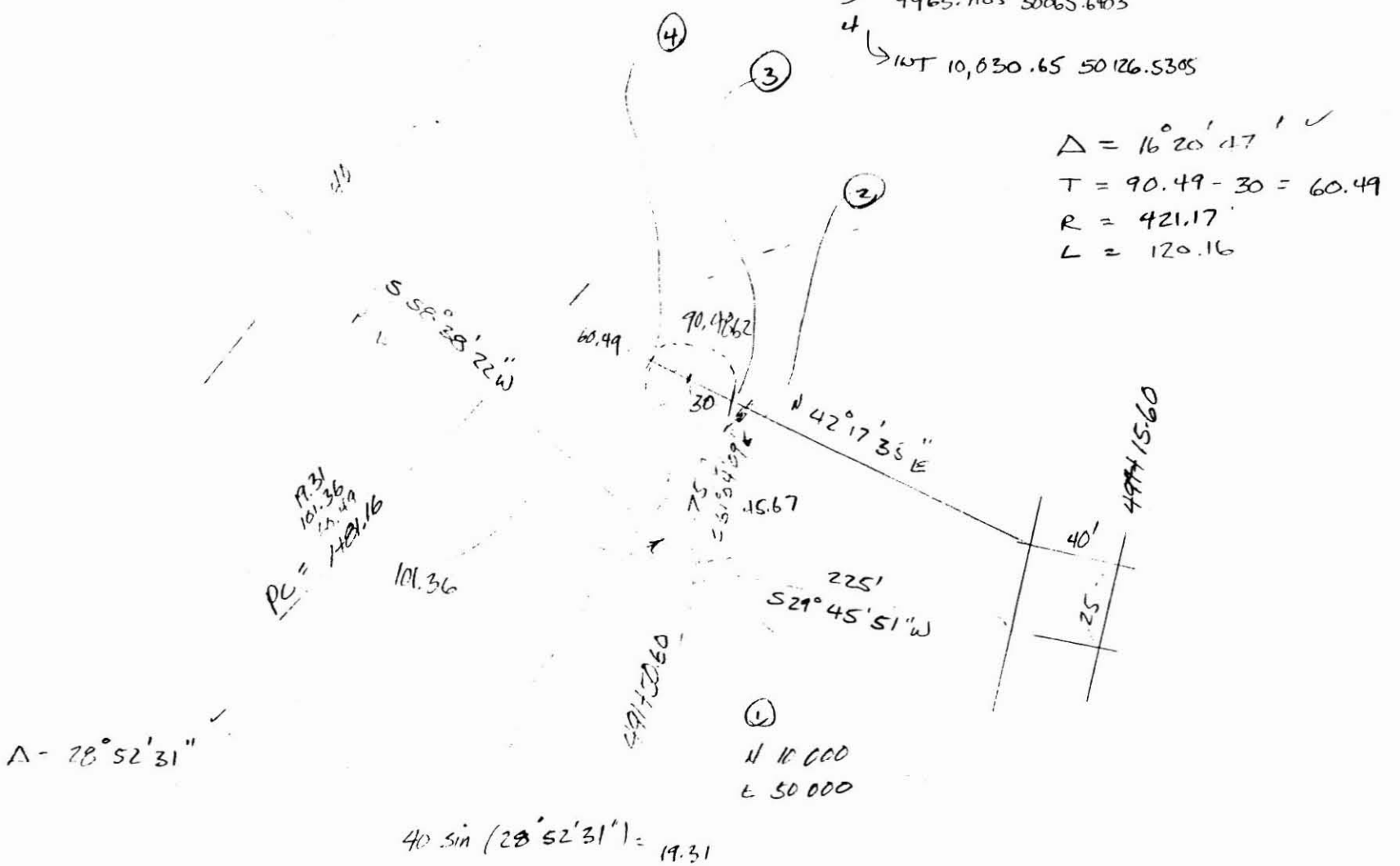


PT 22 SCS ADJ COORD & JBM
N 844 591.52
E 571 581.73

NATIONAL | 42.381 50 SHEETS 5 SQUARE
42.382 100 SHEETS 5 SQUARE
42.389 200 SHEETS 5 SQUARE

PT	N	E	BRG	D
1	10000	50000		
			S61°04'09"E	45.6792
2	9977.9025	50039.9786		
			S61°04'09"E	9.3208
3	9963.7185	50065.6403		
4				

↳ IOT 10,030.65 50126.5305



Δ = 16°20'47" ✓

T = 90.49 - 30 = 60.49

R = 421.17'

L = 120.16

Δ = 28°52'31" ✓

HALEDON RUCD #4

DT 4/4/85

LAYOUT AT RECREATIONAL FLOODWAY

```
* E *NO O   PT FOR  72
* E *NO       T FOR  73
* E *NO       T FOR  12

STATIONS/AND/OFFSETS  4 52112.62 2
   POINT      14: OFFSET =      -4.3223, STATION =  525[illegible]1.1601
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible] 20   1.586
   POINT      50: OFFSET =      -0.5017, STATION =  52[illegible].0890
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible]  4  36.283
   POINT      51: OFFSET =       3.2197, STATION =  52[illegible].9841
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible] 19   9.560
   POINT      52: OFFSET =       6.8418, STATION =  5[illegible].8460
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible] 33  41.452
   POINT      53: OFFSET =      10.3642, STATION =  52[illegible].6758
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible] 19  11.993
   POINT      54: OFFSET =      13.7968, STATION =  5[illegible].4742
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible]  2  41.218
   POINT      55: OFFSET =      17.1094, STATION =  52[illegible].2421
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible] 47   9.163
   POINT      56: OFFSET =      20.3317, STATION =  52[illegible].9802
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible] 31  35.863
   POINT      57: OFFSET =      23.4555, STATION =  52[illegible].6895
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible] 16   1.354
   POINT      58: OFFSET =      26.4719, STATION =  52[illegible].3708
                  LOCAL TANGENT :  NORTH AZIMUTH    [illegible]  0  25.672
* E *NO OFFSET FOR  59
* E *NO OFFSET FOR  60
* E *NO OFFSET FOR  61
* E *NO OFFSET FOR  62
* E *NO OFFSET FOR  63
* E *NO OFFSET FOR  64
* E *NO OFFSET FOR  65
* E *NO OFFSET FOR  66
* E *NO OFFSET FOR  67
* E *NO OFFSET FOR  68
* E *NO OFFSET FOR  69
* E *NO OFFSET FOR  70
* E *NO OFFSET FOR  71
* E *NO OFFSET FOR  72
* E *NO OFFSET FOR  73
* E *NO OFFSET FOR  12

END/OF/JOB
JOB  25  2  IS COMPLETED AT 23:00:17
LAST FIGURE NUMBER USED=       4 MAXIMUM ALLOWED=     15
LAST POINT NUMBER USED=       73 MAXIMUM ALLOWED=    [illegible]

END/OF/RUN
END/OF/RUN - PROGRAM TERMINATED
```

Δ 6 57 25

T = 299.06

R = 4920

L = 600.26

NEW PC = 523+92.48
+ 1 99.06
521+93.42
+ 6 00.26
NEW PT = 527+93.68

EQUATION 525+92.23
+ 1 99.06
527+91.29

PT EQN ~~529~~+ 92.23 BK
= 527+93.68 BK
= 527+91.29 AH

```
                    LOCAL TANGENT :  NORTH AZIMUTH   200  39  40.840
    POINT      69: OFFSET =     -54.9282, STATION =  52554.7765
                    LOCAL TANGENT :  NORTH AZIMUTH   201  24  59.21
    POINT      70: OFFSET =     -55.8684, STATION =  52576.4375
                    LOCAL TANGENT :  NORTH AZIMUTH   202  10  15.049
    POINT      71: OFFSET =     -57.0925, STATION =  52598.2733
                    LOCAL TANGENT :  NORTH AZIMUTH   202  43  16.000
    POINT      72: OFFSET =     -58.3950, STATION =  52620.6454
                    LOCAL TANGENT :  NORTH AZIMUTH   202  43  16.000
    POINT      73: OFFSET =     -59.6975, STATION =  52643.0175
                    LOCAL TANGENT :  NORTH AZIMUTH   202  43  16.000
    POINT      12: OFFSET =     -61.0000, STATION =  52665.3896
                    LOCAL TANGENT :  NORTH AZIMUTH   202  43  16.000

STATIONS/AND/OFFSETS  1 52112.62 (2)
    POINT       2: OFFSET =      -3.0365, STATION =  52492.3601
                    LOCAL TANGENT :  NORTH AZIMUTH   199  11  33.500

UNUSED/POINTS  (1-100)
  9  21  22  23  24  25  26  27  28  29  30  31
 32  33  34  35  36  37  38  39  40  41  42  43
 44  45  46  47  48  49  74  75  76  77  78  79
 80  81  82  83  84  85  86  87  88  89  90  91
 92  93  94  95  96  97  98  99  100

FIT/CURVE  14 2 18 21 23 22 4220
     POINT      21       N       10065.0565,  E       50054.7787
     POINT      23       N        7836.5530,  E       54441.1407
     POINT      22       N        9736.8830,  E       49900.9532

STORE/FIGURE  4 (13 21 C 23 R 22)
     FIGURE  4      :  13  21 C  23 R  22

STATIONS/AND/OFFSETS  4 52112.62 2
    POINT      14: OFFSET =      -4.3223, STATION =  52524.1601
                    LOCAL TANGENT :  NORTH AZIMUTH    29  20   1.586
    POINT      50: OFFSET =      -0.5017, STATION =  52500.0890
                    LOCAL TANGENT :  NORTH AZIMUTH    29   4  36.283
    POINT      51: OFFSET =       3.2197, STATION =  52479.9941
                    LOCAL TANGENT :  NORTH AZIMUTH    28  49   9.560
    POINT      52: OFFSET =       6.8418, STATION =  52457.9460
                    LOCAL TANGENT :  NORTH AZIMUTH    28  33  41.452
    POINT      53: OFFSET =      10.3642, STATION =  52435.6758
                    LOCAL TANGENT :  NORTH AZIMUTH    28  18  11.993
    POINT      54: OFFSET =      13.7868, STATION =  52413.4742
                    LOCAL TANGENT :  NORTH AZIMUTH    28   2  41.218
    POINT      55: OFFSET =      17.1094, STATION =  52391.2421
                    LOCAL TANGENT :  NORTH AZIMUTH    27  47   9.163
    POINT      56: OFFSET =      20.3317, STATION =  52369.9802
                    LOCAL TANGENT :  NORTH AZIMUTH    27  31  35.863
    POINT      57: OFFSET =      23.4535, STATION =  52346.6095
                    LOCAL TANGENT :  NORTH AZIMUTH    27  16   1.354
    POINT      58: OFFSET =      26.4748, STATION =  52324.3708
                    LOCAL TANGENT :  NORTH AZIMUTH    27   0  25.672
* E *NO OFFSET FOR  59
* E *NO OFFSET FOR  60
* E *NO OFFSET FOR  61
* E *NO OFFSET FOR  62
* E *NO OFFSET FOR  63
* E *NO OFFSET FOR  64
* E *NO OFFSET FOR  65
* E *NO OFFSET FOR  66
* E *NO OFFSET FOR  67
* E *NO OFFSET FOR  68
* E *NO OFFSET FOR  69
```

JOB:

POINT	63	N	9913.0144,	E	50044.0558
POINT	64	N	9931.8754,	E	50036.6161
POINT	65	N	9910.7364,	E	50029.1763
POINT	66	N	9889.5973,	E	50021.7366
POINT	67	N	9868.4583,	E	50014.2969
POINT	68	N	9847.3193,	E	50006.8572
POINT	69	N	9826.1802,	E	49999.4175
POINT	70	N	9805.0412,	E	49991.9777
POINT	71	N	9783.9022,	E	49984.5380
POINT	72	N	9762.7631,	E	49977.0983
POINT	73	N	9741.6241,	E	49969.6586
POINT	12	N	9720.4851,	E	49962.2189

INVERSE/BEARINGS 13 1
FROM 13 TO 1 S 15 45 51.0000W 379.9629

STATIONS/AND/OFFSETS 1 (52392.48-52772.86) 2

POINT 14: OFFSET = -75.0000, STATION = 52112.6200
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 50: OFFSET = 73.5031, STATION = 52154.9852
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 51: OFFSET = -72.1662, STATION = 52157.3503
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 52: OFFSET = -70.7124, STATION = 52179.7155
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 53: OFFSET = 69.3325, STATION = 52202.0807
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 54: OFFSET = -67.9156, STATION = 52224.4458
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 55: OFFSET = 66.4987, STATION = 52246.8110
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 56: OFFSET = -65.0818, STATION = 52269.1761
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 57: OFFSET = 63.6650, STATION = 52291.5413
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 58: OFFSET = -62.2481, STATION = 52313.9065
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 59: OFFSET = 60.8312, STATION = 52336.2716
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 60: OFFSET = 59.4143, STATION = 52358.6368
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 61: OFFSET = 57.9975, STATION = 52381.0020
LOCAL TANGENT : NORTH AZIMUTH 195 45 51.000

POINT 62: OFFSET = 56.4474, STATION = 52403.0051
LOCAL TANGENT : NORTH AZIMUTH 195 7 50.258

POINT 63: OFFSET = 55.4000, STATION = 52421.4425
LOCAL TANGENT : NORTH AZIMUTH 195 52 4.009

POINT 64: OFFSET = 54.4[illegible], STATION = 52434.5188
LOCAL TANGENT : NORTH AZIMUTH 195 38 20.[illegible]

POINT 65: OFFSET = -54.1000, STATION = 52463.0055
LOCAL TANGENT : NORTH AZIMUTH 193 23 39.953

POINT 66: OFFSET = -53.0000, STATION = 52482.7022
LOCAL TANGENT : NORTH AZIMUTH 195 9 0.365

POINT 67: OFFSET = 51.9333, STATION = 52511.4013
LOCAL TANGENT : NORTH AZIMUTH 195 54 20.976

```
>    <<<
>>> JOB:

 **> COORDINATES CHANGED <**
     POINT      64 OLD  N        9925.2105,  E      50033.4805
                NEW  N        9931.0054,  E      50036.6161
 **> COORDINATES CHANGED <**
     POINT      65 OLD  N        9902.0950,  E      50026.0017
                NEW  N        9910.7364,  E      50029.1763
 **> COORDINATES CHANGED <**
     POINT      66 OLD  N        9880.9811,  E      50018.5229
                NEW  N        9889.5935,  E      50021.7366
 **> COORDINATES CHANGED <**
     POINT      67 OLD  N        9859.0664,  E      50011.0441
                NEW  N        9868.4503,  E      50014.2969
 **> COORDINATES CHANGED <**
     POINT      68 OLD  N        9838.7517,  E      50003.5653
                NEW  N        9847.2193,  E      50006.8572
 **> COORDINATES CHANGED <**
     POINT      69 OLD  N        9817.6330,  E      49996.0865
                NEW  N        9826.1002,  E      49999.4175
 **> COORDINATES CHANGED <**
     POINT      70 OLD  N        9796.5224,  E      49988.6077
                NEW  N        9805.0412,  E      49991.9777
 **> COORDINATES CHANGED <**
     POINT      71 OLD  N        9775.4077,  E      49981.1289
                NEW  N        9783.9022,  E      49984.5380
 **> COORDINATES CHANGED <**
     POINT      72 OLD  N        9754.2950,  E      49973.6501
                NEW  N        9762.7631,  E      49977.0983
 **> COORDINATES CHANGED <**
     POINT      73 OLD  N        9733.1783,  E      49966.1713
                NEW  N        9741.6241,  E      49969.6586

LIST/COORDINATES  2
     POINT      14       N      10248.7609,  E      50148.2110
     POINT      50       N      10227.8210,  E      50140.7421
     POINT      51       N      10206.6828,  E      50133.0324
     POINT      52       N      10185.5438,  E      50125.3227
     POINT      53       N      10164.4048,  E      50117.6130
     POINT      54       N      10143.2657,  E      50111.0132
     POINT      55       N      10122.1267,  E      50103.5735
     POINT      56       N      10100.9877,  E      50096.1338
     POINT      57       N      10079.8486,  E      50088.6941
     POINT      58       N      10058.7096,  E      50081.2544
     POINT      59       N      10037.5706,  E      50073.8146
     POINT      60       N      10016.4315,  E      50066.3749
     POINT      61       N       9995.2925,  E      50058.9352
     POINT      62       N       9974.1535,  E      50051.4955
```

JOB:

INVERSE/BEARINGS 14 17
FROM 14 TO 17 N 74 14 9.000W 150.0000

DIVIDE/LINE 14 12 25 50
> COORDINATES CHANGED <
POINT 50 OLD N 10210.0162, E 5017[illegible]8.1839
NEW N 10227.[illegible], E 5017[illegible]0.7721
> COORDINATES CHANGED <
POINT 51 OLD N 10197.7015, E 5013[illegible]6.7051
NEW N 10206.4820, E 5013[illegible].3324
> COORDINATES CHANGED <
POINT 52 OLD N 10176.5068, E 5012[illegible].3263
NEW N 10184.5438, E 5012[illegible].0927
> COORDINATES CHANGED <
POINT 53 OLD N 10150.4721, E 5011[illegible].7474
NEW N 10164.4048, E 5011[illegible].4530
> COORDINATES CHANGED <
POINT 54 OLD N 10134.3574, E 5010[illegible].2686
NEW N 10147.[illegible], E 5011[illegible].0132
> COORDINATES CHANGED <
POINT 55 OLD N 10113.[illegible], E 5010[illegible].7898
NEW N 10125.1267, E 5010[illegible].5735
> COORDINATES CHANGED <
POINT 56 OLD N 10092.1200, E 5009[illegible].3110
NEW N 10100.0077, E 5009[illegible].1338
> COORDINATES CHANGED <
POINT 57 OLD N 10071.0133, E 5009[illegible].8322
NEW N 10079.0486, E 5009[illegible].6941
> COORDINATES CHANGED <
POINT 58 OLD N 10049.0986, E 5007[illegible].3534
NEW N 10058.3096, E 5008[illegible].2544
> COORDINATES CHANGED <
POINT 59 OLD N 10028.7839, E 5007[illegible].8746
NEW N 10037.[illegible]706, E 5007[illegible].8146
> COORDINATES CHANGED <
POINT 60 OLD N 10007.4693, E 5006[illegible].3958
NEW N 10017.[illegible]10, E 5006[illegible].3749
> COORDINATES CHANGED <
POINT 61 OLD N 9984.[illegible]546, E 5003[illegible].9170
NEW N [illegible]3225, E 5005[illegible].9352
> COORDINATES CHANGED <
POINT 62 OLD N 9975.[illegible]22, E 5004[illegible].4382
NEW N 9984.[illegible]535, E 5007[illegible].4955
> COORDINATES CHANGED <
POINT 63 OLD N 9944.3252, E 5004[illegible].9593
NEW N 9955.0144, E 5004[illegible].0558

```
[illegible] <<<
[illegible] POB:

     FROM      18 TO       8 N   47  16  44.900W          61.0000

INVERSE/BEARINGS  17 13
     FROM      17 TO      13 S   74  14   2.000E          75.0000

13 14
     FROM      13 TO      14 S   74  14   2.000E          75.0000

13 1
     FROM      13 TO       1 S   15  45  51.000W         270.4900

1 2
     FROM       1 TO       2 S   15  45  51.000W         100.0000

2 3
     FROM       2 TO       3 S   22  17  16.000W         100.0000

3 19
     FROM       3 TO      19 S   22  43  16.000W          73.1525

UNUSED/POINTS  (1-20)
 9  19  20

LOCATE/BEARING  19 14 (A 2 1)100
     POINT     19       N      10336.1697,  E      5017?.0305

20 14 (A 2 1) 50
     POINT     20       N      10208.0503,  E      50159.2466

ARC/LINE AZIMUTH  14 12 560.25 19 (A 1 2) 20
 *** COORDINATES CHANGED ***
     POINT     14 OLD   N      10239.0209,  E      50145.6627
               NEW   N      10248.9602,  E      50149.2110

INVERSE/BEARINGS  14 12
     FROM      14 TO      12 S   19  23  20.016W         560.2500

LOCATE/BEARING  13 14 (A 1 2 190) 75
 *** COORDINATES CHANGED ***
     POINT     13 OLD   N      10260.3062,  E      50073.1836
               NEW   N      10253.7368,  E      50076.0327

17 13 (A 14 13) 75
 *** COORDINATES CHANGED ***
     POINT     17 OLD   N      10280.4026,  E      50001.3045
               NEW   N      10273.[illegible],  E      50004.0536
```

```
>>>   <<<
>>> JOB:


*JOB 85  2 USING FILE 3  AT 22:11:37
LAST FIGURE NUMBER USED=       3 MAXIMUM ALLOWED=     15
LAST POINT NUMBER USED=       23 MAXIMUM ALLOWED=    100

START/OF/JOB  85 2 3

INVERSE/BEARINGS  2 18
     FROM      2 TO     18 S   22  43  16.000W          182.2825

3 18
     FROM      3 TO     18 S   22  43  16.000W           82.2825

2 13
     FROM      2 TO     13 N   15  45  51.000E          270.4800

LOCATE/BEARING  8 6 (A 2 3) 53.86
 **> COORDINATES CHANGED <**
     POINT      8 OLD  N        9759.1856,  E       49846.1601
                NEW  N        9762.6071,  E       49849.6866

7 6 (A 2 1) 53.86
 **> COORDINATES CHANGED <**
     POINT      7 OLD  N        9877.9091,  E       49887.6028
                NEW  N        9869.1215,  E       49885.1224

BEARING/INTERSECT  18 2 (A 2 3) 8 (A 2 3 -90)
 **> COORDINATES CHANGED <**
     POINT     18 OLD  N        9735.6246,  E       49902.4263
                NEW  N        9744.0461,  E       49905.9527

LOCATE/BEARING  12 18 (A 8 18) 61
 **> COORDINATES CHANGED <**
     POINT     12 OLD  N        9712.0636,  E       49950.6924
                NEW  N        9720.4851,  E       49962.2189

INVERSE/BEARINGS  3 18
     FROM      3 TO     18 S   22  43  16.000W           73.1525

14 12
     FROM     14 TO     12 S   19  27   2.968W          550.8862

13 1
     FROM     13 TO      1 S   15  45  51.000W          270.4800

INVERSE/BEARINGS  18 8
```

```
>>>  <<
>>> JOB:


STATIONS/AND/OFFSETS  4 52112.62 2
   POINT     14: OFFSET =     -75.0000, STATION =  52112.6200
                 LOCAL TANGENT :  NORTH AZIMUTH   195  45  51.000
   POINT     50: OFFSET =     -73.5831, STATION =  52134.9852
                 LOCAL TANGENT :  NORTH AZIMUTH   195  45  51.000
   POINT     51: OFFSET =     -72.1662, STATION =  52157.3503
                 LOCAL TANGENT :  NORTH AZIMUTH   195  45  51.000
   POINT     52: OFFSET =     -70.7494, STATION =  52179.7155
                 LOCAL TANGENT :  NORTH AZIMUTH   195  45  51.000
   POINT     53: OFFSET =     -69.3400, STATION =  52201.9603
                 LOCAL TANGENT :  NORTH AZIMUTH   195  51  49.111
   POINT     54: OFFSET =     -68.0121, STATION =  52224.0230
                 LOCAL TANGENT :  NORTH AZIMUTH   196   7  14.061
   POINT     55: OFFSET =     -66.7846, STATION =  52246.0969
                 LOCAL TANGENT :  NORTH AZIMUTH   196  22  39.485
   POINT     56: OFFSET =     -65.6575, STATION =  52268.1813
                 LOCAL TANGENT :  NORTH AZIMUTH   196  38   5.346
   POINT     57: OFFSET =     -64.6309, STATION =  52290.2753
                 LOCAL TANGENT :  NORTH AZIMUTH   196  53  31.607
   POINT     58: OFFSET =     -63.7048, STATION =  52312.3779
                 LOCAL TANGENT :  NORTH AZIMUTH   197   8  58.231
   POINT     59: OFFSET =     -62.8794, STATION =  52334.4883
                 LOCAL TANGENT :  NORTH AZIMUTH   197  24  25.181
   POINT     60: OFFSET =     -62.1546, STATION =  52356.6055
                 LOCAL TANGENT :  NORTH AZIMUTH   197  39  52.419
   POINT     61: OFFSET =     -61.5305, STATION =  52378.7288
                 LOCAL TANGENT :  NORTH AZIMUTH   197  55  19.909
   POINT     62: OFFSET =     -61.0072, STATION =  52400.8571
                 LOCAL TANGENT :  NORTH AZIMUTH   198  10  47.612
   POINT     63: OFFSET =     -60.5847, STATION =  52422.9897
                 LOCAL TANGENT :  NORTH AZIMUTH   198  26  15.491
   POINT     64: OFFSET =     -60.2630, STATION =  52445.1255
                 LOCAL TANGENT :  NORTH AZIMUTH   198  41  43.508
   POINT     65: OFFSET =     -60.0420, STATION =  52467.2638
                 LOCAL TANGENT :  NORTH AZIMUTH   198  57  11.627
   POINT     66: OFFSET =     -59.9220, STATION =  52489.4036
                 LOCAL TANGENT :  NORTH AZIMUTH   199  12  39.810
   POINT     67: OFFSET =     -59.9028, STATION =  52511.5440
                 LOCAL TANGENT :  NORTH AZIMUTH   199  28   8.018
   POINT     68: OFFSET =     -59.9844, STATION =  52533.6841
                 LOCAL TANGENT :  NORTH AZIMUTH   199  43  36.215
   POINT     69: OFFSET =     -60.1668, STATION =  52555.8231
                 LOCAL TANGENT :  NORTH AZIMUTH   199  59   4.362
   POINT     70: OFFSET =     -60.4501, STATION =  52577.9599
                 LOCAL TANGENT :  NORTH AZIMUTH   200  14  32.423
   POINT     71: OFFSET =     -60.8342, STATION =  52600.0938
                 LOCAL TANGENT :  NORTH AZIMUTH   200  30   0.360
   POINT     72: OFFSET =     -61.3191, STATION =  52622.2239
                 LOCAL TANGENT :  NORTH AZIMUTH   200  45  28.134
   POINT     73: OFFSET =     -61.9048, STATION =  52644.3492
                 LOCAL TANGENT :  NORTH AZIMUTH   201   0  55.709
   POINT     12: OFFSET =     -62.5912, STATION =  52666.4688
                 LOCAL TANGENT :  NORTH AZIMUTH   201  16  23.048

STATIONS/AND/OFFSETS  4 52112.62 3
   POINT     17: OFFSET =      75.0000, STATION =  52112.6200
                 LOCAL TANGENT :  NORTH AZIMUTH   195  45  51.000
   POINT      5: OFFSET =      70.9123, STATION =  52395.4598
```

MIN DIST NOW ℄ TO LEFT ROW = 59.90

```
   POINT      64: OFFSET =     -60.2630, STATION =  52445.1255
                  LOCAL TANGENT :  NORTH AZIMUTH   198  41  43.50
   POINT      65: OFFSET =     -60.0420, STATION =  52467.2638
                  LOCAL TANGENT :  NORTH AZIMUTH   198  57  11.62
   POINT      66: OFFSET =     -59.9220, STATION =  52489.4036
                  LOCAL TANGENT :  NORTH AZIMUTH   199  12  39.810
   POINT      67: OFFSET =     -59.9028, STATION =  52511.5440
                  LOCAL TANGENT :  NORTH AZIMUTH   199  28   8.018
   POINT      68: OFFSET =     -59.9844, STATION =  52533.6841
                  LOCAL TANGENT :  NORTH AZIMUTH   199  43  36.215
   POINT      69: OFFSET =     -60.1668, STATION =  52555.8231
                  LOCAL TANGENT :  NORTH AZIMUTH   199  59   4.362
   POINT      70: OFFSET =     -60.4501, STATION =  52577.9599
                  LOCAL TANGENT :  NORTH AZIMUTH   200  14  32.423
   POINT      71: OFFSET =     -60.8342, STATION =  52600.0938
                  LOCAL TANGENT :  NORTH AZIMUTH   200  30   0.360
   POINT      72: OFFSET =     -61.3191, STATION =  52622.2239
                  LOCAL TANGENT :  NORTH AZIMUTH   200  45  28.134
   POINT      73: OFFSET =     -61.9048, STATION =  52644.3492
                  LOCAL TANGENT :  NORTH AZIMUTH   201   0  55.709
   POINT      12: OFFSET =     -62.5912, STATION =  52666.4688
                  LOCAL TANGENT :  NORTH AZIMUTH   201  16  23.048

STATIONS/AND/OFFSETS  4 52112.62 3
   POINT      17: OFFSET =      75.0000, STATION =  52112.6200
                  LOCAL TANGENT :  NORTH AZIMUTH   195  45  51.000
   POINT       5: OFFSET =      70.9123, STATION =  52395.4508
                  LOCAL TANGENT :  NORTH AZIMUTH   198   7   0.958
   POINT       7: OFFSET =      61.9217, STATION =  52554.5132
                  LOCAL TANGENT :  NORTH AZIMUTH   198  58   9.450
   POINT       8: OFFSET =      59.3689, STATION =  52663.3482
                  LOCAL TANGENT :  NORTH AZIMUTH   201  14  12.218
   POINT      16: OFFSET =      60.7523, STATION =  52741.1336
                  LOCAL TANGENT :  NORTH AZIMUTH   202   8  33.275

DIVIDE/ARC  7 15 8 6 80
     POINT      80       N        9851.9554,  E       49879.9512
     POINT      81       N        9834.8814,  E       49874.4838
     POINT      82       N        9817.9044,  E       49868.7219
     POINT      83       N        9801.0297,  E       49862.6672
     POINT      84       N        9784.2622,  E       49856.3214

STATIONS/AND/OFFSETS  4 52112.62 (5 7 80 81 82 83 84 8 16)
   POINT       5: OFFSET =      70.9123, STATION =  52395.4508
                  LOCAL TANGENT :  NORTH AZIMUTH   198   7   0.958
   POINT       7: OFFSET =      61.9217, STATION =  52554.5132
                  LOCAL TANGENT :  NORTH AZIMUTH   198  58   9.450
   POINT      80: OFFSET =      60.8865, STATION =  52572.6376
                  LOCAL TANGENT :  NORTH AZIMUTH   200  10  49.292
   POINT      81: OFFSET =      60.0950, STATION =  52590.7712
                  LOCAL TANGENT :  NORTH AZIMUTH   200  23  29.518
   POINT      82: OFFSET =      59.5475, STATION =  52608.9115
                  LOCAL TANGENT :  NORTH AZIMUTH   200  36  10.027
   POINT      83: OFFSET =      59.2439, STATION =  52627.0560
                  LOCAL TANGENT :  NORTH AZIMUTH   200  48  50.715
   POINT      84: OFFSET =      59.1844, STATION =  52645.2024
                  LOCAL TANGENT :  NORTH AZIMUTH   201   1  31.480
   POINT       8: OFFSET =      59.3689, STATION =  52663.3482
                  LOCAL TANGENT :  NORTH AZIMUTH   201  14  12.218
   POINT      16: OFFSET =      60.7523, STATION =  52741.1336
                  LOCAL TANGENT :  NORTH AZIMUTH   202   8  33.275
```

MIN DIST NEW ℄ TO LEFT ROW = 59.90

MIN DIST NEW ℄ TO RIGHT ROW = 59.18

Queen Creek Rd. to Germain R return

WS-93A
12-12-56

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON

JOB NO._____

TRANSIT TRAVERSE COMPUTATION SHEET

TRAVERSE OF_____ SECTION _____ SHEET NO. 1 OF ____

PARTY_____ CHIEF_____ CALCULATED BY_____ DATA_____ CHECKED BY_____ DATE_____

STATION	DISTANCE	ANGLE LEFT	ANGLE RIGHT	BEARING	COSINE	SINE	LATITUDE N	LATITUDE S	DEPARTURE E	DEPARTURE W	CO-ORDINATES LATITUDE	CO-ORDINATES DEPARTURE
	2009.30			N 30°27'50"E	.861929	.507029	1731.87		1018.77		823,293.01	558,435.55
											825,~~824.88~~	559,454.32
	249.54			"	.861929	.507029	215.10		126.53		5,239.98 824,~~524.88~~	559,580.85
	249.54			N 48°13'21"E	.666222	.745954	166.26		186.11		5,406.24 824,~~693.44~~	559,766.96
	522.07			N 48°13'21"E			347.81		389.34		754.05 825,~~048.95~~	560,156.30
	1134.49			"			755.82		846.05		6,509.87 825,~~796.27~~	560,002.35
	260.39			"			173.48		194.19		6,683.35 825,~~990.25~~	561,196.54
	260.39			N 25°52'54"E	.899189	.437560	234.14		113.94		917.49 826,~~204.89~~	561,310.48
	1460.73		1	N 25°52'54"E			1313.47		639.16		8,230.96 827,~~317.86~~	561,949.64
	216.04			"			194.26		94.53		8,425.22 827,~~712.12~~	562,044.17
	216.04			N 62°27'22"E	.462428	.886657	99.90		191.55		8,525.12 827,~~812.02~~	562,235.72
	150.22			"			69.47		133.19		8,594.59 827,~~881.49~~	562,368.91

WS-93A
12-12-56

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON

JOB NO._____

TRANSIT TRAVERSE COMPUTATION SHEET

TRAVERSE OF_____ SECTION _____ SHEET NO. 2 OF ____

PARTY_____ CHIEF_____ CALCULATED BY_____ DATA_____ CHECKED BY_____ DATE_____

STATION	DISTANCE	ANGLE LEFT	ANGLE RIGHT	BEARING	COSINE	SINE	LATITUDE N	LATITUDE S	DEPARTURE E	DEPARTURE W	CO-ORDINATES LATITUDE	CO-ORDINATES DEPARTURE
											828,594.59	562,368.91
	220.98			N 89°21'44"E	.0N131	0.999938	2.46		220.97		828,597.05	562,589.88
	184.83			"			2.06		184.82		828,599.11	562,774.70
	258.00			N 89°15'50"E	.012847	.999917	3.31		257.98		828,602.42	563,032.68
	742.38			S 62°27'22"W	.462428	.886657	~~3.42~~	343.30		658.24	828,259.12	562,374.44
	117.09			"				54.15		103.82	828,204.97	562,270.62
	117.09			S 25°56'34"W	.899189	.437560		105.25		51.23	828,099.68	562,219.39
	1460.73			"				1313.47		639.16	826,786.21	561,580.23
	319.45			"				287.25		139.78	826,498.96	561,440.45
	319.45			S 48°13'26"W	0.666222	0.745754		212.82		238.23	826,286.14	561,202.22
	1401.31			"				933.58		1043.03	825,352.56	560,157.19
	255.25			"				170.05		190.35	825,182.51	559,966.84

WS-93A
12-12-56

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON

JOB NO._____

TRANSIT TRAVERSE COMPUTATION SHEET

TRAVERSE OF_____ SECTION _____ SHEET NO. 3 OF____

PARTY_____ CHIEF_____ CALCULATED BY_____ DATA_____ CHECKED BY_____ DATE_____

STATION	DISTANCE	ANGLE LEFT	ANGLE RIGHT	BEARING	COSINE	SINE	LATITUDE N	LATITUDE S	DEPARTURE E	DEPARTURE W	CO-ORDINATES LATITUDE	CO-ORDINATES DEPARTURE
	202.69			S 48°13'26"W	.666222	.745754		135.04		151.16	825,182.31	559,944.84
											825,047.47	559,815.68
	202.69			S 30°27'58"W	.861929	.507029		174.70		102.77	824,872.77	559,712.91
	1833.28			"	"	"		1580.16		929.53		
											823,292.61	558,783.38
	231.88			N89°56'09"W	.001120	.999999	0.26			231.88		
											823,292.87	558,551.50
	115.94			N89°56'09"W	"	"	0.13			115.94		
											823,293.00	558,435.56

WS-93A
12-12-56

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON

JOB NO._____

TRANSIT TRAVERSE COMPUTATION SHEET

TRAVERSE OF Traverse Germain Rd to Pecos Rd & Return SECTION _____ SHEET NO. 1 OF ____

PARTY_____ CHIEF_____ CALCULATED BY_____ DATA_____ CHECKED BY_____ DATE_____

STATION	DISTANCE	ANGLE LEFT	ANGLE RIGHT	BEARING	COSINE	SINE	LATITUDE N	LATITUDE S	DEPARTURE E	DEPARTURE W	CO-ORDINATES LATITUDE	CO-ORDINATES DEPARTURE
	820.26			N 62°27'22"E	.462428	.886657	379.31		727.29		828,594.59	562,368.91
											828,923.90	563,096.20
	235.67			"			108.98		208.96			
											829,082.88	563,305.16
	235.67			N 28°29'17"E	.878917	.476976	207.13		112.41			
											829,290.01	563,417.57
	2270.95			"			1995.98		1083.19			
											831,285.99	564,500.76
	327.34			"			287.70		156.13			
											831,573.69	564,656.89
	202.63			"			178.09		96.65			
											831,751.78	564,753.54
	202.63			N 42°02'34"E	.742645	.669685	150.48		135.70			
											831,902.26	564,889.24
	689.61			"			512.14		461.82			
											832,414.40	565,351.06
	2187.53			"			1587.43		1431.47			
											834,001.83	566,782.53
	135.57			N 89°34'24"E	.007447	.999972	1.01		135.57			
											834,002.84	566,918.10
	271.14		/	"			2.02		271.13			
											834,004.86	567,189.23

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12-12-56

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON

JOB NO._____

TRANSIT TRAVERSE COMPUTATION SHEET

TRAVERSE OF_____ SECTION_____ SHEET NO. 2 OF____

PARTY_____ CHIEF_____ CALCULATED BY_____ DATA_____ CHECKED BY_____ DATE_____

STATION	DISTANCE	ANGLE LEFT	ANGLE RIGHT	BEARING	COSINE	SINE	LATITUDE N	LATITUDE S	DEPARTURE E	DEPARTURE W	CO-ORDINATES LATITUDE	CO-ORDINATES DEPARTURE
	2736.47			S 42°02'34"W	.742645	.669685		2032.23		1832.57	834,004.86	562,189.23
											831,972.63	565,356.6
	365.27			"				271.27		244.62	831,701.36	565,112.04
	166.97			"				124.00		111.82	831,577.36	565,000.22
	166.97			S 28°29'17"W	.879917	.476976		146.75		79.64	831,430.61	564,920.58
	2441.00			"				2145.44		1164.30		563,001.26
	2578.27							2278.19		1242.32	829,285.17	563,756.28
	327.29			"				287.66		156.11	828,997.51	563,600.17
	327.29			S 62°27'22"W	.462428	.886657		151.35		290.19	828,846.16	563,309.98
	228.10			"				105.48		202.25	828,740.68	563,107.73
	258.00			S 89°15'50"W	.012847	.999917		3.31		257.98	828,737.37	562,849.75
	184.83			S 89°21'49"W	.011131	.999938		2.06		184.82	828,735.00	562,664.94
	220.98			"				2.46		220.98	828,732.16	562,443.98

Traverse Pecos R[illegible]

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12-12-56

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON

JOB NO._____

TRANSIT TRAVERSE COMPUTATION SHEET

TRAVERSE OF_____ SECTION_____ SHEET NO. 1 OF____

PARTY_____ CHIEF_____ CALCULATED BY_____ DATA_____ CHECKED BY_____ DATE_____

STATION	DISTANCE	ANGLE LEFT	ANGLE RIGHT	BEARING	COSINE	SINE	LATITUDE N	LATITUDE S	DEPARTURE E	DEPARTURE W	CO-ORDINATES LATITUDE	CO-ORDINATES DEPARTURE
											834,001.83	566,782.53
	945.71			N 42°04'25"E	.742285	.670085	701.99		633.71		834,703.82	567,416.24
	282.64			N41°54'34"E	.744201	.667955	210.34		188.79		834,914.16	567,605.03
	720.49			N 41°59'39"E	.743213	.669055	535.48		482.65		835,449.64	568,087.08
	181.35			"	"	"	134.78		121.33		835,584.42	568,208.41
	181.35			N19°52'08"E	.940473	.339869	170.55		61.64		835,754.97	568,270.05
	2685.91			"	"	"	2507.22		906.06		838,262.19	569,176.11
	173.85			"	"	"	163.50		59.09		838,425.69	569,235.20
	455.72			S 0°38'52"E	.999936	.011306	~~455.69~~	455.69	5.15		837,970.00	569,240.35
	149.51			N89°38'04"E	.006380	.999980	0.95		149.51		837,970.95	569,389.86
	1402.88			S 19°52'08"W	.940473	.339869	~~1318.87~~	1319.37		476.80	836,651.58	568,913.06
	1061.78			"	"	"		998.38		360.87	835,653.00	568,552.19
	240.01			"	"	"		225.72		81.57	835,427.28	568,470.62

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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON

JOB NO._____

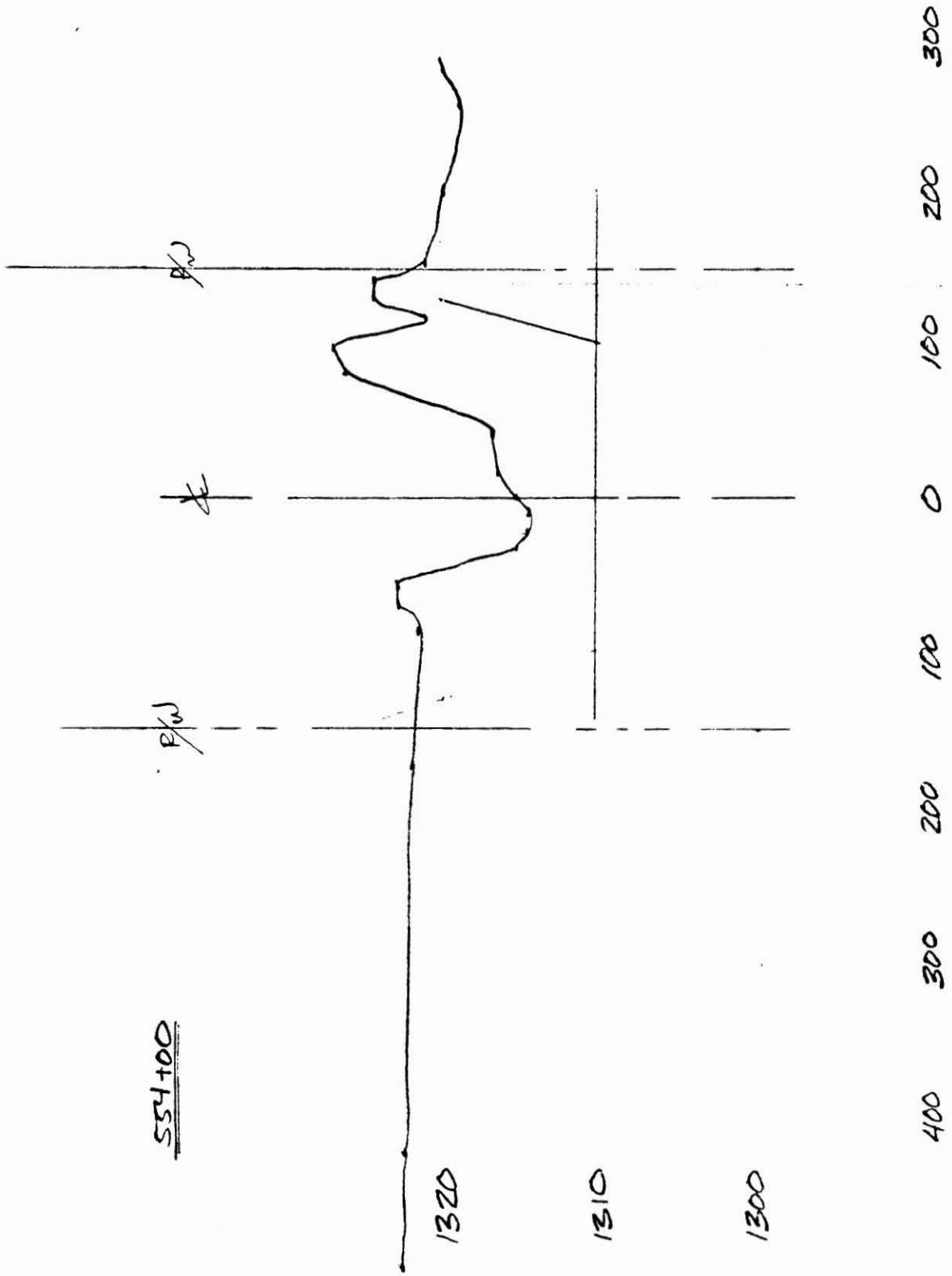
TRANSIT TRAVERSE COMPUTATION SHEET

TRAVERSE OF_____ SECTION_____ SHEET NO. 2 OF____

PARTY_____ CHIEF_____ CALCULATED BY_____ DATA_____ CHECKED BY_____ DATE_____

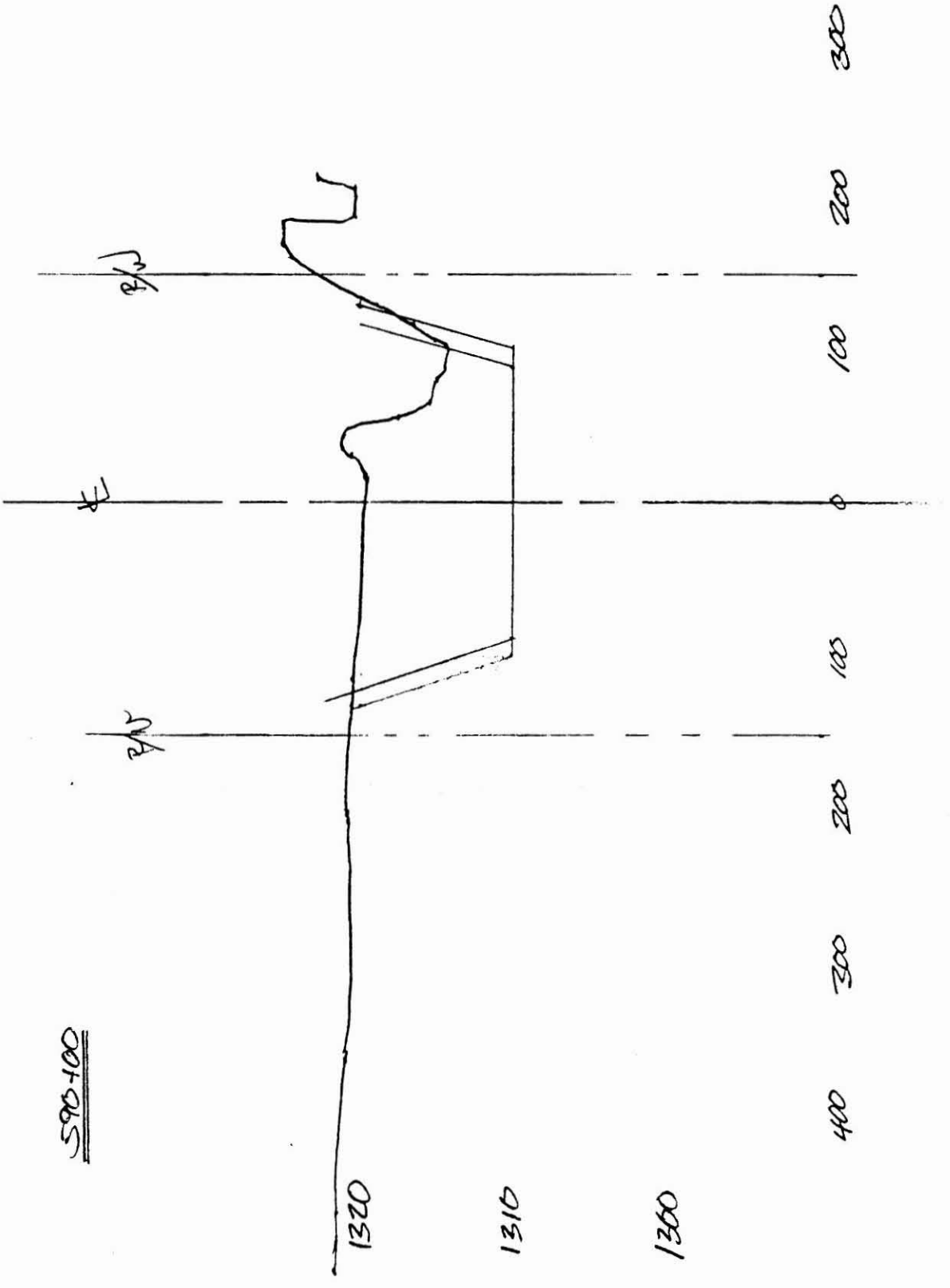
STATION	DISTANCE	ANGLE LEFT	ANGLE RIGHT	BEARING	COSINE	SINE	LATITUDE N	LATITUDE S	DEPARTURE E	DEPARTURE W	CO-ORDINATES LATITUDE	CO-ORDINATES DEPARTURE
											835,427.28	568,470.62
	240.01			S 41°59'39" W	.743213	.669055		178.38		160.58	835,248.90	568,310.04
	524.59			S 41°59'39" W	"	"		391.37		352.32	834,857.53	567,957.72
	165.53			S 42°12'05" W	.740788	.671739		122.62		111.19	834,734.91	567,846.53
	282.60			S 41°54'34" W	.744201	.667955		210.31		188.76	834,524.60	567,657.77
	699.79			S 42°04'25" W	.742285	.670085		519.44		468.92	834,005.16	567,188.85
	406.68			S 89°34'24" W	.007447	.999972		3.03		406.67	834,002.13	566,782.18

ARIZONA RWCD RETCH C/
DT 12/3/84
CROSS SECTION



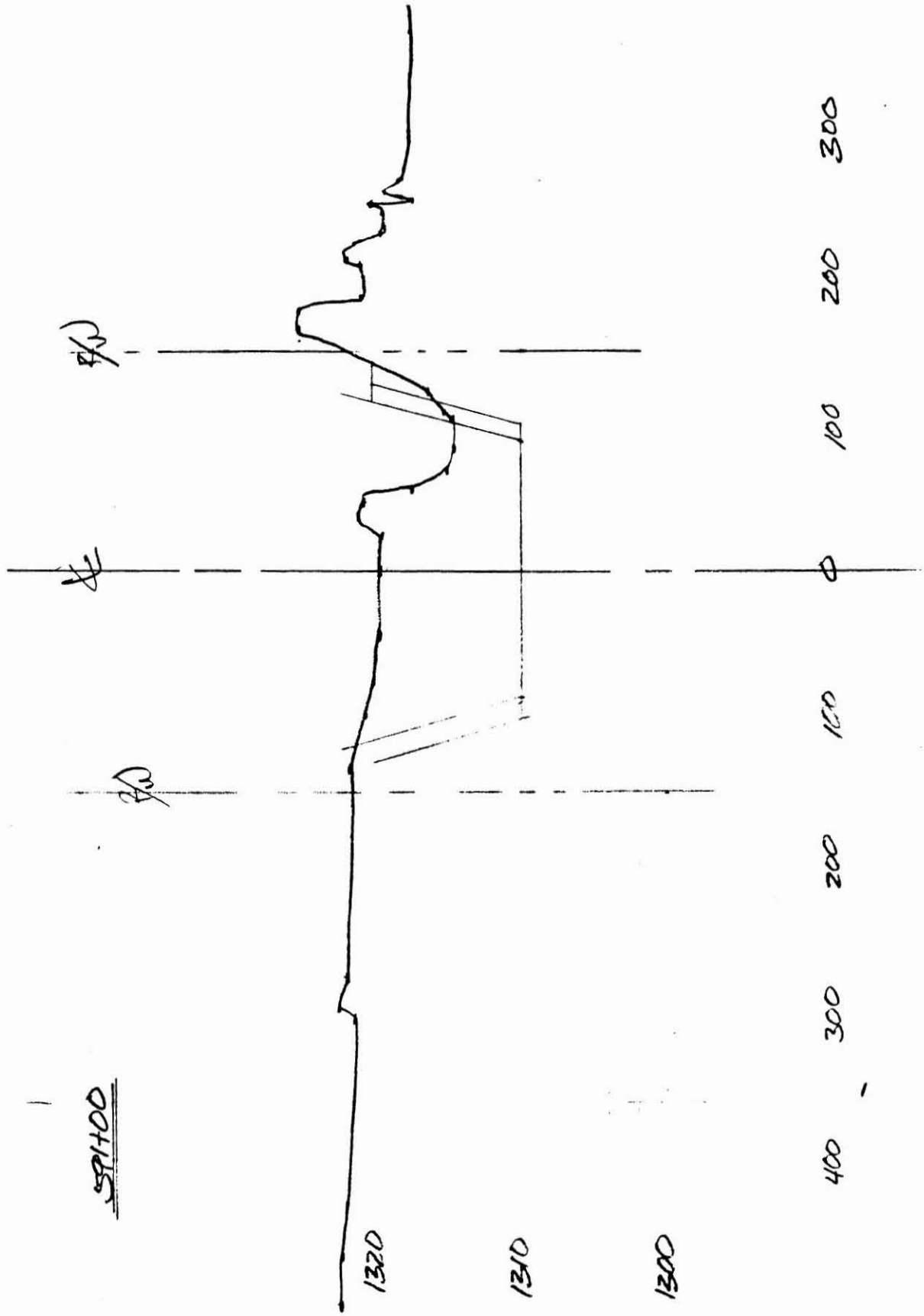
ARIZONA
DT 12/3/84
CROSS SECTION

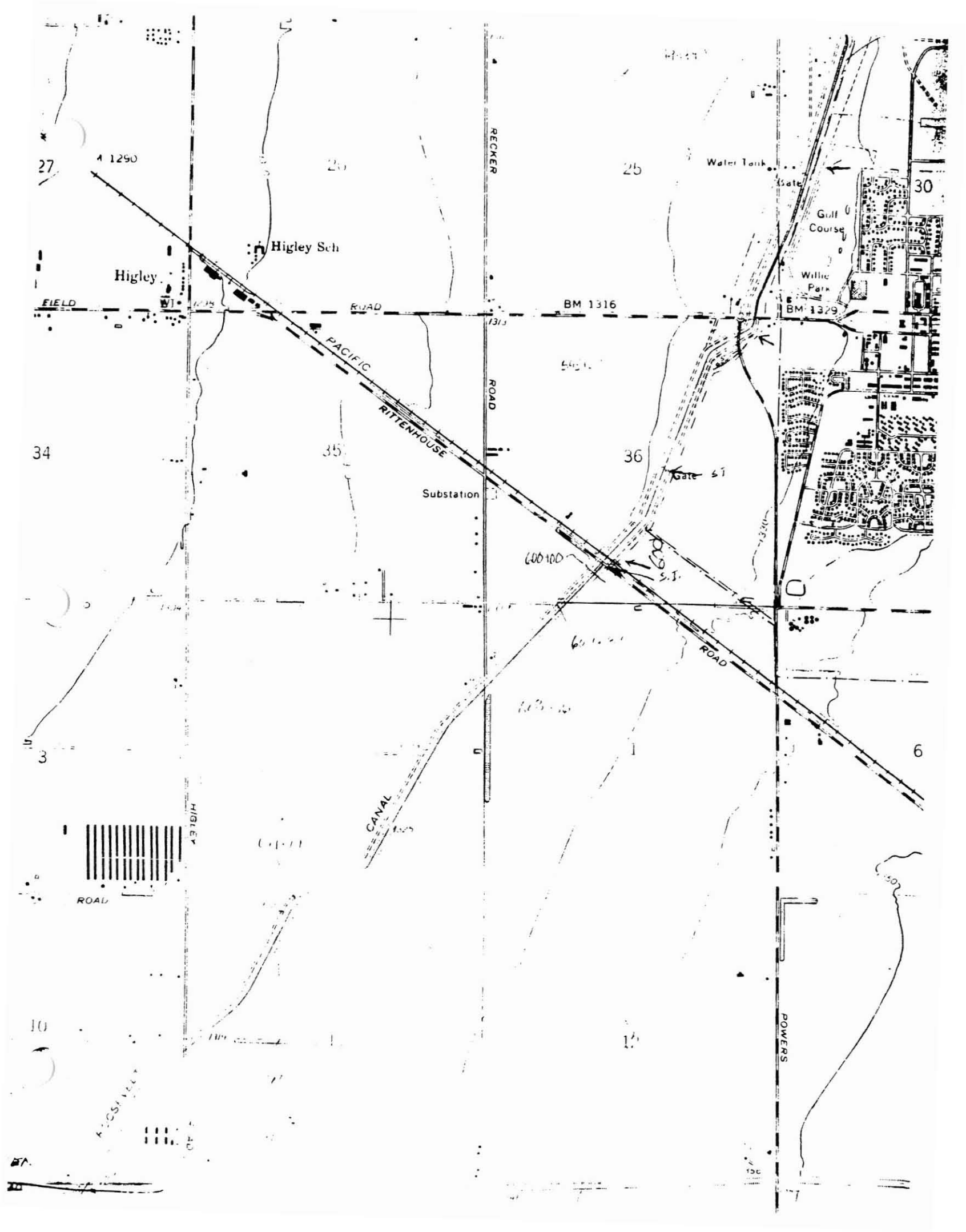
RWCD REACH 4



ARIZONA
DT 12/3/84
CROSS SECTION

RWCD R4




RECKER
ROAD
Higley Sch
Higley
FIELD
ROAD
BM 1316
BM 1329
Water Tank
Gate
Gulf Course
Willie Park
PACIFIC
RITTENHOUSE
Substation
Gate
ROAD
CANAL
HIGLEY
ROAD
POWERS
27
26
25
30
34
35
36
3
1
6
10
15

ALIG. RWCD R4

DT 1/15/85

LAYOUT POWERLINE ELEVATIONS

— CORRELATE POWERLINE AS BUILTS TO REACH 4 ALIGNMENT.

POWERLINE

EOP 467+50 EL 1323.00

AT END OF RR : 464+00

350

× 0.00296

1.036 + 1.036

EL 1324.04

RWCD DRAWS

AT 463+50

50

0.00296

0.148 + 0.148

POWERL STA 463+50 IN EL 1324.19

RWCD 1324.5

CHANNEL BOTTOM Δ = + 0.3 FT

AT 462+75

125

0.00296

037 1324.04

.37

1324.41

TOP OF DIKE = 1324.41 + 7.5 = 1331.9

RWCD 1332.5

TOP OF DIKE Δ = + 0.6

ARIZ RWCD R4

DT 1/16/85

POWERLINE ELEVATIONS 2 2

AT 461+25

225
0.00296
0.67

1324.04
1324.71
7.5
1332.21

TOP OF DIKE — POWERLINE ENCD R4 — 1333.0

$\Delta = +.8$

ELEVATIONS APPEAR TO BE APPROX 0.6-0.8 HIGHER ON THE RWCD DRAWINGS THAN ON THE POWERLINE DRAWINGS

- THE POWERLINE DRWGS USE EL 1323.5 AT THE END OF THE POWERLINE FLOODWAY (STA 467+50)
- USE EL 1323.7 AS THE POWERLINE FLOODWAY INVERT AT THE END OF THE RIP RAPPED SECTION

ARIZ RWCD R4

D.T. 11/15/85

LAYOUT POWERLINE FLOODWAY JCT 1

PROBLEM: NEED DETAIL AND LAYOUT OF JCT. AT POWERLINE FLOODWAY

ANALYSIS: 1. SUMMARIZE DESIGN Q

2. CORRELATE POWERLINE FLOODWAY AS BUILT DRAWINGS

3. DEVELOP ALTERNATE LAYOUTS

4. ~~MAKE ROUGH COST EVAL AND SELECT ALT.~~

5. DETAIL HYDRAULIC DES.

6. LAYOUT

SOLUTION:

1. NEXT PAGE

ARIZ
DT
2/14/06
RANCO RD
LAYOUT JCT @ POWERLINE
TANGENT OFFSET (℄)

- R=653.8000
- D=8.4549
- DELTA=49.1748
- T=300

L=562.5224

PT=662.5224
PI=400.0004
PC=100.0000

CO=0.0000
CD=0.0000
STA=100.0000

TO=0.4779
TD=24.9939
STA=125.0000

TO=1.9110
TD=49.9513
STA=150.0000

TO=4.2971
TD=74.8356
STA=175.0000

TO=7.6327
TD=99.6106
STA=200.0000

TO=11.9130
TD=124.2399
STA=225.0000

TO=17.1318
TD=148.6875
STA=250.0000

TO=23.2813
TD=172.9178
STA=275.0000

TO=30.3526
TD=196.8953
STA=300.0000

TO=38.3354
TD=220.5850
STA=325.0000

TO=47.2179
TD=243.9521
STA=350.0000

TO=56.9873
TD=266.9626
STA=375.0000

TO=67.6292
TD=289.5828
STA=400.0000

TO=79.1280
TD=311.7797
STA=425.0000

TO=91.4670
TD=333.5207
STA=450.0000

TO=104.6281
TD=354.7742
STA=475.0000

TO=118.5921
TD=375.5090
STA=500.0000

TO=133.3386
TD=395.6948
STA=525.0000

TO=148.8459
TD=415.3021
STA=550.0000

TO=165.0915
TD=434.3022
STA=575.0000

TO=182.0515
TD=452.6674
STA=600.0000

TO=199.7012
TD=470.3700
STA=625.0000

TO=218.0148
TD=487.3866
STA=650.0000

TO=237.4292
TD=495.6434
PT=662.5224

ARIZONA RWCO R4

D.T. 2/14/85

JCT @ POWERLINE

TANGENT OFFSET (INCIDE BOTTOM)

9.8991°D

* [illegible]

* [illegible]

DELTA=49.1748

* L=497.9932

PT=497.9932
PI=365.5862
PC=100.0000

TO=0.0000
TD=0.0000
STA=100.0000

TO=0.5398
TD=24.9922
STA=125.0000

TO=2.1583
TD=49.9378
STA=150.0000

TO=4.8524
TD=74.7903
STA=175.0000

TO=8.6171
TD=99.5032
STA=200.0000

TO=13.4454
TD=124.0306
STA=225.0000

TO=19.3282
TD=148.3266
STA=250.0000

TO=26.2547
TD=172.3459
STA=275.0000

TO=34.2118
TD=196.0437
STA=300.0000

TD=219.3758
STA=325.0000

TO=53.1568
TD=242.2988
STA=350.0000

TO=64.1094
TD=264.7697
STA=375.0000

TO=76.0220
TD=286.7468
STA=400.0000

TO=88.8725
TD=308.1890
STA=425.0000

TO=102.6368
TD=329.0564
STA=450.0000

TO=117.2894
TD=349.3099

TD=368.9118
STA=500.0000

TO=149.1482
TD=387.8257
STA=525.0000

TO=166.2950
TD=406.0160
STA=550.0000

TO=184.2112
TD=423.4491
STA=575.0000

TO=201.3399
TD=438.7862
PT=597.9932