RID OVERCHUTE PROJECT

DESIGN REPORT

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

FLOOD CONTROL DISTRICT of MARICOPA COUNTY 1959

FCD 94-07

Registered Professional Engineer (Civil)
18668
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Date Signed 6-21-97
ARIZONA, U.S.A.

July 1997

Stantech Consulting Project No. 28900014

Stantech
Consulting

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JULY 1997

Prepared for:

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
2801 West Durango Street
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SFC PROJECT NO. 28900014

SFC

ROOSEVELT IRRIGATION DISTRICT OVERCHUTE/SIPHON
CONTRACT FCD 94-07
CONSTRUCTION CONTRACT NOS. 96-09 AND 97-01

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DESIGN REPORT

1.0 PROJECT DESCRIPTION

The purpose of this project is to complete designs for construction of an overchute/siphon structure and related flood control features for drainage areas near Indian School Road Bypass and Old Litchfield Road (see figure 1). The location of the project to be constructed is at the intersection of the Roosevelt Irrigation District canal and the road alignment of Old Litchfield Road just to the south of Litchfield Park, Arizona. The RID Canal runs approximately 100 feet south of Indian School Road Bypass at this location. This site is also near the physical boundaries of the cities of Avondale and Goodyear, Arizona.

The overchute/siphon structure and related flood control features will be designed to safely pass floodwater up to the 100-year storm event from the north side of the RID Canal to the south side of the RID Canal and into an existing drainage channel

Concurrent with this design, designs to widen the Indian School Road Bypass (ISRB) west of Old Litchfield Road have been prepared by Standage and Truitt Engineering, Ltd for Suncor. The proposed Indian School Road Bypass road section west of Old Litchfield Road is being designed in conjunction with the City of Goodyear and Maricopa County Department of Transportation (MCDOT) in order to insure that the necessary roadway transition required to provide adequate easement for this project is within acceptable standards. Currently, the roadway width at this project's greatest encroachment location will occupy 85.6 feet from curb-to-curb. Current findings indicate that the area between the widened Indian School Road Bypass and this project's proposed concrete rectangular drainage channel will be adequate to construct a drainage channel capable of conveying the 100-year peak flows as computed by FCDMC (1996).

Analysis of alternatives and design which will allow conveyance of the flows from the northeast along ISRB (FCDMC (1996) CP-2711 [Q_{100}=384 cfs] and CP-255A [Q_{100}=1160 cfs]) into the overchute/siphon were completed as Phase 2 of this project scope of work.

No additional improvements are foreseen as being necessary or proposed for conveyance of flows along the RID Canal from Dysart Road (FCDMC (1996) CP-271A, Q_{100}=481 cfs) into the overchute/siphon. The existing drainage channel appears to be adequate for conveyance of flows from Dysart Road to the Plaza Circle detention basins. These flows will then combine with flows from CP-255A and CP-2711 and continue westward to the overchute/siphon.

Analysis of alternatives and design which will allow conveyance of flows from drainage from Old Litchfield Road to the north (FCDMC (1996) CP-270, Q_{100}=548 cfs) will be completed by others (Litchfield Park's consultant, Gannett-Fleming Engineering). Currently, no conclusion has been reached on how best to drain stormwater from the Old Litchfield Road and ISRB intersection into the overchute. The present ISRB roadway redesign does not include reconstruction of the existing intersection to drain to the overchute. Possible alternatives have been discussed which will convey the peak 100-year storm flowrate across the intersection through a combination of overland channelized street flow and a series of storm drains beneath ISRB. Reconstruction of the ISRB/OLR intersection to accommodate drainage from the north into the overchute is the responsibility of others as part of future ISRB improvements.

1.1 General Description

The White Tanks ADMS (WLB, 1992) has identified a drainage problem at the location of Old Litchfield Road and the Roosevelt Irrigation District Canal just to the south of Litchfield Park, Arizona. The ADMS reported that storm water travels south to the RID Canal where ponding occurs against its raised embankments. At Old Litchfield Road and the RID Canal, the ADMS determined that the 100-year flow event will overtop the canal and travel south through an area currently planned for residential development. It is the intent for this project to reduce the flood impact throughout this area north of the RID Canal and reduce the current FEMA designated flood plane zone.

The City of Litchfield Park has requested that the Flood Control District participate in the flood control improvements to the area. The District has approved development of plans and specifications to construct such facilities as needed to safely pass the 100-year flow to the south side of the RID Canal.

The drainage area is generally bounded one-quarter mile east of Dysart Road on the east, Old Litchfield Road on the west, and Camelback Road to the north. The project design must allow for conveyance of storm water that is passed through, or generated within these boundaries to a collection point at the intersection of Old Litchfield Road and the RID Canal. The flows will pass across the RID Canal and into an existing drainage channel. This channel was constructed by Suncor and was intended to accept the flows from the north side of the RID Canal. The channel travels south and eventually drains into a retention basin built by ADOT to the north of Interstate 10.

In addition to addressing the 100-year flows within the drainage area, the project design must consider the existing detention basins located on the north side of the RID Canal between Old Litchfield Road and Dysart Road. There are currently three existing detention basins that are the terminus of flows from CP-271A across Dysart Road. Construction within the basins will be completed as part of Phase 2 of this project; with an approximate total storage volume of 40 acre-feet provided in order to reduce the 100-year event peak flow and stage that may occur downstream between the detention basins and the overchute/siphon.

Additionally, this project design incorporates flows from the existing 36-inch diameter storm drain which runs along the south edge of the current Indian School Road Bypass alignment. This storm drain was designed to intercept roadway drainage flows from Indian School Road Bypass and currently drains to the west and enlarges to a 42-inch diameter storm drain west of Old Litchfield Road. It is estimated that the maximum storm drain flow is between 35 and 40 cfs.

At the intersection of Indian School Bypass Road and Litchfield Road Bypass, it is proposed by Suncor that the storm drain will outlet via a siphon to the southwest into a drainage channel. Because there is concern by Suncor that this outlet drainage channel may not have adequate capacity or an established drainage easement, this project's design reduces the peak storm drain flowrate to the west by intercepting storm drain flows east of Old Litchfield Road (approximately 20 cfs) and conveying them to the proposed concrete rectangular drainage channel. The remaining storm drain flows west of Old Litchfield Road will be designed by Suncor's consultant to continue to be collected by the storm drain and discharged west to the outlet drainage channel across Litchfield Road Bypass or be conveyed back to the east through a new storm drain to the overchute.

Because of the concern for connecting a storm drain to this project's rectangular drainage channel during high flow storm events; and the potential for reverse flow into the storm drain system; manhole elevations were checked to insure they are above the potential 100-year hydraulic grade line at the connection. It appears that the storm drain will function adequately with a 100-year storm event hydraulic grade line water surface elevation in the proposed concrete rectangular drainage channel of 1011.50. The top of manhole cover elevation of 1012.50 appears to provide sufficient elevation buffer to allow the 36-inch storm drain flows to continue discharging to the concrete rectangular drainage channel.

1.2 Purpose

The purpose of this contract is to develop finished plans and specifications for the construction of an overchute/siphon structure and related drainage facilities needed to safely pass the 100-year flow to the south side of the RID Canal. The Phase 1 design will provide an inlet transition from Old Litchfield Road, inlet concrete rectangular drainage channel, overchute structure, and outlet transition to convey flows across the RID canal, which will allow for reduction of the ponding along the north side of the RID Canal between Dysart Road and Old Litchfield Road. The design will incorporate the existing detention basins located just east of Old Litchfield Road along the north side of the RID Canal. Phase 2 of the project will analyze alternatives and prepare designs to convey flows from between the Phase 1 inlet channel and concentration points along Indian School Road Bypass and between the Phase 1 inlet channel and Dysart Road. The ultimate constructed project will channelize drainage that has historically meandered, sheet flowed, and ponded between ISRB and the RID Canal. The design will also incorporate drainage flow from the existing 36-inch storm drain that runs along Indian School Road Bypass, which will result in the reduction of flow to the storm drain west of Old Litchfield Road.

1.3 Future Recommendations

- Reconstruct Indian School Road Bypass to accommodate sheet flow and drainage to offset superelevation in roadway.
- Curb cuts, scuppers, and other storm drain inlets should be provided to convey drainage from Indian School Road Bypass and into the RID Overchute Project drainage channels.

2.0 DESIGN DATA

2.1 RID Canal Siphon

2.1.1 Siphon. The siphon is sized to convey a design discharge of 435 cfs. A concrete box culvert with two 8-foot wide by 7-foot high barrels is recommended. The energy head loss across the structure is estimated to be approximately 0.25 foot (about 3 inches) at peak canal flow. The velocity at the peak flow of 435 cfs is 2.79 feet per second.

Because the RID Canal is an existing conveyance system, the primary objective of the design was to optimize barrel size for standard design criteria, with special consideration for minimizing head loss across the structure. Canal flows less than peak capacity may result in velocities less than 2.5 feet per second, which is considered to be the minimum acceptable velocity that will discourage sedimentation. A larger box culvert was considered to reduce the head loss across the structure, but resulted in unacceptably low velocities that would encourage the accumulation of sediment. A smaller box culvert was considered to provide higher velocities at partial canal flow, but resulted in greater head losses across the structure than considered acceptable.

Although the proposed siphon design velocities at canal flows less than capacity may be considered low, sedimentation is not considered to be a serious maintenance problem. The proposed two-barrel, 8-foot wide by 7-foot high box culvert siphon is designed with a wide transition, sufficiently large to be accessed for maintenance by a small "Bobcat" front end loader or similar equipment. In addition, because the RID Canal water source is primarily from groundwater wells and effluent from the City of Phoenix 23rd Avenue Wastewater Treatment Plant, sediment load from the water is considered to be only low to moderate. Therefore, it is concluded for this design that the construction of a slightly larger box culvert than required for this project is preferred to reduce head losses; although some sedimentation is considered possible.

2.2 Rectangular Concrete Drainage Channel

A rectangular concrete drainage channel has been designed for this project for a 600-foot reach directly upstream of the proposed overchute structure in order to accommodate the reduced available easement between Indian School Road Bypass and the RID Canal through the area directly east of Old Litchfield Road. The impact of easement width reduction will become specifically important in the future as improvements are made to ISRB. Because of proposed ISRB roadway improvements, the proximity of the RID Canal through this area, and the resulting reduced available easement, the concrete rectangular drainage channel is proposed as the most suitable method for conveying flows from the east along the north side of the RID canal. Discussions among FCDMC, MCDOT, the City of Litchfield Park, and Suncor have also resulted in proposed ISRB roadway improvement plans for a reduced ISRB section to accommodate the construction of the concrete rectangular drainage channel.

It is noted for this design that the largest right-of-way encroachment distance between the north face of the north concrete rectangular drainage channel wall and the south ISRB right-of-way line is currently 10.3 feet. According to the most recent information available from Standage and Truitt Engineering, the ISRB roadway section at Old Litchfield Road will be designed with a 42.58-foot wide section between centerline of right-of-way and south face of curb. An additional one foot can be reduced from this section at the point of the largest encroachment of the concrete rectangular drainage channel, providing a 41.58-foot roadway section at this point between centerline of right-of-way and south face of curb. This results in the north face of the north concrete rectangular drainage channel wall located approximately 3 feet from the proposed ISRB back of curb.

The proposed 30-foot bottom rectangular concrete drainage channel is designed to convey the 100-year flood event flowrate of 1,317 cfs. The HEC-2 determined flow depth ranges between 5.6 feet to 6.69 feet deep, with the concrete rectangular drainage channel (retaining) wall height at approximately 8-9 feet deep. Velocities throughout the 600-foot reach average approximately 7 feet per second.

The proposed 8-9 feet high concrete retaining wall on both sides of the channel will extend above existing grade a minimum of 2.67 feet and is designed as a traffic barricade; with an additional two-foot high safety railing to meet MCDOT bicycle safety standards. The inlet transition to the concrete rectangular drainage channel will consist of a north side retaining wall wingwall that will transition to a future upstream trapezoidal channel. The south side concrete rectangular drainage channel retaining wall will end approximately 100 feet beyond the end of the channel invert. The extended length of the south retaining wall will provide the necessary transition to the upstream trapezoidal detention basin outlet channel.

2.2.1 Overchute. The overchute was originally proposed to convey a discharge of 1500 cfs. This flowrate was based upon hydrologic data results provided in the White Tanks Area Drainage Master Plan (FCDMC, 1995). The flowrate has been adjusted since the FCDMC (1995) study to 1456 cfs per FCDMC in "Hydrologic Analysis for the RID Overchute Project", May 1997. A throat width of 60 feet was recommended and designed for this project. This results in a unit discharge of 24 cfs per foot of width. The crest elevation (upstream flowline) of the overchute is currently set at elevation 1005.0. The depth across the overchute at maximum flowrate is between 6.25 feet and 6.50 feet, with the top of overchute structure wall set at elevation 1014.00. The overchute has been designed to drain to the centerline of the structure, with nuisance flows conveyed beneath O&M access roads through a gutter drain.

Access is limited across the overchute structure with a series of bollards. O&M access roads are designed with 8-inch thick concrete ramp downs on both sides of the RID Canal. The north side O&M road ramps down from the east at 18 feet road width at the top of slope to 14 feet at the middle of the overchute. The south side O&M road ramps down from the east at 20 feet road width at the top of slope to 12 feet at the middle of the overchute. The south O&M roadway is designed with a 3.5-foot deep downstream cutoff wall for protection against churning discharge flow from the overchute. Reinforced structural concrete lining is identified for placement between the replaced RID Canal lining and the concrete O&M roadway ramp downs in order to insure stability of the slope without excess widening of the O&M road.

2.3 Downstream Old Litchfield Road Drainage Channel

As of this report, the channel downstream of the overchute has an existing bank-full capacity of about 600 cfs. The existing channel capacity is less than the 100-year peak discharge of 1456 cfs. The channel will require modification as the area south of the RID Canal is developed to avoid overtopping during high flow storm events. Analysis of the downstream channel between the proposed overchute and Palm Valley Golf Course indicates that, assuming the effective flow area is vertical from the existing overbank locations, the HEC-2 hydraulic grade line at a flowrate of 1456 cfs is approximately one to two feet higher than the existing overbanks at several locations. The hydraulic grade line ranges from approximately elevation 1011.50 directly downstream of the overchute to elevation 1001.50 upstream of the Thomas Road box culvert and Palm Valley Golf Course. The overtopping appears to occur more frequently within the initial few hundred feet downstream of the overchute, rather than farther downstream. The future improvements required of the downstream channel have been discussed with Tom Hill of Suncor; and Suncor is aware of, and understands, the requirement.

The outlet transition from the proposed overchute structure previously consisted of a small elevation drop structure and dissipating transition. Because the overchute elevation has been lowered from elevation 1006.00 to 1005.00, with downstream nuisance drain gutter elevation at 1003.50, the outlet will no longer require a drop transition. The outlet transition will now consist of a grouted riprap transition that matches the proposed downstream overchute structure flowline. In addition to the 3.5-foot downstream concrete vertical cutoff wall on the overchute south O&M roadway, a 3-foot deep grouted riprap cutoff wall and 18-inch thick grouted riprap are provided in the design for additional protection and dissipation of flows.

The outlet transition is also designed to flare outward to meet potential static water levels at the O&M roadway ramps.

2.4 Traffic

2.4.1. Access During Construction. It is recommended that the Old Litchfield Road alignment between the Indian School Bypass and the RID Canal be made available to the contractor for access from the Indian School Bypass. Access to the structure site along the RID Canal maintenance roads is also recommended and should be requested. The bypass canal is designed to have a 16 foot wide O&M road along the south side only for access along the RID Canal during construction. The north side of the proposed bypass canal is designed with a five-foot wide berm only and is not proposed for vehicle access during construction.

2.4.2. Access After Construction. It is recommended that access to the drainage facilities be provided with :

1. Access to the overchute/siphon and the concrete rectangular concrete channel shall be obtained from the Indian School Road Bypass at the Old Litchfield Road alignment.

2. Access to the related upstream drainage facilities located to the east of the overchute and concrete rectangular drainage channel will be provided from ISRB via graded roads along the channels.

2.5 Right-of-Way

It is recommended that the FCDMC acquire the temporary and permanent rights-of-way as shown on the plans. Rights-of-way for the drainage facilities east of the overchute structure and concrete rectangular drainage channel were provided during the Phase 2 design period. A summary of the total required construction right-of way for Phase 1 is as follows:

PHASE 1 PERMANENT AND TEMPORARY CONSTRUCTION EASEMENT SUMMARY

DESCRIPTION	AMAR WT9-13/16 (ac)	MCDOT (ac)	RID (ac)	SUNCOR (ac)	TOT. EASEM. REQ'D. (ac)
1. Overchute Outlet Transition (PCE)	0.00	0.00	0.00	0.19	**0.19**
2. Overchute Area (PCE)	0.00	0.00	0.34	0.00	**0.34**
3. OLR Inlet Transition (PCE)	0.015/ 0.036	0.00	0.00	0.00	**0.05**
4. Concrete Rectangular Drainage Channel (PCE)	0.024/ 0.028	0.06	0.02	0.36	**0..49**
5. RID Canal Temporary Bypass (TCE)	0.00	0.00	0.97	0.85	**1.82**
6. Other MiscTemp Const Easement (TCE)	0.12/ 0.003	1.11	0.15	0.19	**1.58**
TOTAL EASEMENT	**0.23**	**1.18**	**1.47**	**1.60**	**4.47**

1. PCE from AMAR Investments Co. for the overchute inlet transition from Old Litchfield Road and the concrete rectangular drainage channel.
2. PCE from MCDOT for the encroachment segment of the concrete rectangular drainage channel.

3. PCE from RID for the concrete rectangular drainage channel. Future O&M access for FCDMC and Litchfield Park along the RID Canal has not been identified for this submittal
4. Permanent Construction Easement (PCE) from Suncor for the overchute (north and south of Rid Canal) and the concrete rectangular drainage channel.
5. Temporary Construction Easement (TCE) from RID and Suncor for the temporary canal bypass and proposed construction routes or access.
6. Easements for other miscellaneous temporary construction access areas have also been included.

2.6 Utilities

The utilities impacted by the construction of the overchute/siphon will include the relocation of existing 5-inch and 6-inch diameter natural gas pipelines, the relocation of an AT&T transcontinental fiber optics cable, the relocation of buried electrical and telephone lines, the relocation of overhead electrical lines, the relocation of an existing 12-inch and 24-inch domestic water line, the relocation of an existing 8-inch and 15-inch sanitary sewer line, the demolition, adjustment, or addition of five sanitary sewer manholes, and the connection of an existing 36-inch diameter storm drain to the project concrete rectangular drainage channel.

The following is a brief description of the proposed utility relocations for this project:

AT&T Fiber Optics Cable - AT&T maintains an existing underground fiber optics cable within the north RID Canal O&M road area that runs generally from east to west. This fiber optics cable will be lowered within the area directly north of the proposed siphon/overchute structure

APS 69kV and 12 kV - APS maintains an existing 69kV overhead transmission line and a 12kV underground transmission line located within the limits of the project. The 69kV transmission line traverses from Litchfield Road Bypass along the north side of the RID Canal and turns to the north at a location immediately west of the proposed overchute structure. The transmission line then turns east again along the north side of Indian

School Road Bypass and continues parallel to ISRB to Dysart Road.

The 69kV transmission line traverses the perimeter of the project and does not conflict with the proposed construction.

The 12 kV line is located along the Old Litchfield Road alignment and crosses the RID Canal diagonally from northwest to southeast. The 12kV line provides service to an abandoned groundwater well pump located directly south and east of the proposed overchute structure. The 12kV transmission line also has a support pole and overhead guy wires located on the north side of the RID Canal directly east of the proposed overchute structure that will require removal and/or relocation prior to construction.

One leg of the 12kV transmission line crosses ISRB and the proposed Plaza Circle Channel directly east of Indian School Road (at CP-255A). This line provides service to an existing (active) groundwater well one-quarter mile south of ISRB and directly west of Dysart Road. The transmission line has a pole and guy wires that will require relocation prior to construction of the CP-255A spillway and the related features of the Plaza Circle Channel.

US West - US West maintains two existing underground telephone lines in the area of the overchute construction, one traversing east-west across the north edge of the proposed overchute inlet transition from Old Litchfield Road and the other traversing north-south in the Old Litchfield Road alignment. The east-west telephone line will require relocation to avoid conflicts with proposed storm drain stubouts to be constructed as part of the Old Litchfield Road inlet transition. The north-south underground telephone line runs along the west side of the proposed overchute structure and will require relocation beneath the proposed overchute structure and surrounding area.

Southwest Gas Company - Southwest Gas Company maintains two existing natural gas lines running north-south through the proposed overchute area. The 6-inch diameter gas line currently crosses over the RID Canal directly east of the proposed overchute structure. The 5-inch diameter gas line is capped, but not abandoned. Both lines will require relocation outside of, or beneath the proposed overchute structure and rectangular concrete drainage channel.

Litchfield Park Service Company (LPSCO) Sanitary Sewer and Water Line - The alignment of an existing 24-inch diameter ductile iron pipe (DIP) LPSCO water line passes adjacent to the north side of the proposed rectangular concrete drainage channel between approximate stations of 8+50 and 9+50. The pipe may require shoring or encasement for any reach within two feet of the outside face of the north side concrete rectangular drainage channel retaining wall.

In addition, relocation of a reach of the 24-inch diameter water line will be required in order to construct the proposed storm drain connection for the project.

A 12-inch diameter water line crosses the Plaza Circle Channel (Sta 44+96) approximately 700 feet north and east of the detention basins. This water line will also require relocation beneath the proposed Plaza Circle Channel.

The alignment of an existing LPSCO 8-inch sanitary sewer line passes beneath the proposed rectangular concrete drainage channel beginning at approximately Sta.7+80 of the project alignment. The 8-inch sanitary sewer line intersects the proposed rectangular concrete drainage channel at approximately 45 degrees and extends to a manhole located at approximately 8+20. Between Sta 8+20 and 18+05, there are five sanitary sewer manholes which will require special consideration in order to be incorporated into the proposed rectangular drainage channel and upstream drainage facilities proposed for Phase 2 of this project. The four manholes located at Sta 8+13 (7' Lt.), Sta 12+50 (15' Rt.), Sta 15+06, and Sta 18+05 (13' Rt.) will require adjustment downward flush with the proposed channel inverts or sideslopes as shown on the plans. In addition, all four manholes will require the replacement of the existing manhole frames and covers with water tight manhole frames and covers.

The manhole located at Sta 10+00 (15' Lt.) will require the construction of a perimeter parapet wall as shown on the plans in order to protect the manhole from the drainage channel

The alignment of an existing LPSCO 15-inch sanitary sewer line passes almost perpendicular beneath the proposed West Interceptor Channel at approximately Sta 107+96. Approximately 70 linear feet of the existing VCP sanitary sewer line will require replacement with ductile iron pipe and the construction of a concrete cap for additional protection.

2.7 Construction

2.7.1 Removal of the Existing Bridge. The existing bridge will require removal prior to initiating construction of the overchute/siphon.

2.7.2 Canal Diversion During Construction. The RID Main Canal is in service except for a two-week dry-up period typically scheduled in late November. The construction of the overchute/siphon cannot be completed within this time period. Therefore, a temporary bypass canal has been designed for the project to divert canal flows around the construction site. The channel proposed for the project is a shotcrete or geomembrane-lined channel, with a 12-foot bottom width and side slopes of 1 horizontal to 1 vertical, located on the south side of the canal.

3.0 HYDROLOGIC ANALYSIS AND HYDRAULIC DESIGN

3.1 Hydrologic Analysis

3.1.1 Existing Conditions. Existing hydrologic conditions were established in the "White Tanks Area Drainage Master Plan" (WLB, 1992). The design hydrologic conditions are modified and summarized by FCDMC in "Hydrology for the RID Overchute", May 1997.

Topographic mapping at a scale of 1 inch equals 400 feet with two-foot contour intervals was developed for the White Tanks ADMS study for the watershed contributing flows to the RID Overchute/Siphon. This mapping was used to confirm runoff flow paths. Currently, flows concentrate along the embankment of the RID Canal and pond at two locations between the Litchfield Road Bypass and Dysart Road. Flows accumulate until the depth of water overtops the RID Canal embankments, at both sites, with the water flowing to the south into lands currently being developed for residential subdivisions.

Ponding occurs at the existing detention basins located along the north side of the RID Canal embankment about 1,000 feet east of the Old Litchfield Road alignment. Flows entering this site originate in the watershed located to the north and east. Ponding also occurs at the intersection of the Litchfield Road Bypass and the RID Canal. Flows entering this site originate in a watershed located to the north and between Old Litchfield Road and the Litchfield Road Bypass.

3.1.2 General Hydraulic and Hydrologic Criteria. The following listing provides general hydraulic and hydrologic design criteria for the RID Overchute Project:

1. Initial hydraulic sizing was completed using a Manning's normal depth analysis for the overchute structure cross drainage requirements, the Old Litchfield Road inlet transition and the concrete rectangular channel. However, the final hydraulic analysis

was completed using an HEC-2 backwater computation analysis. A copy of the HEC-2 analysis is included in this report.

The final hydraulic sizing for the RID siphon structure was completed using an HEC-2 backwater computation analysis of the RID Main Canal. The RID Main Canal is a concrete and gunnite lined channel with bottom widths of 10 to 12 feet, sideslopes of 2:1, and depths of 7 to 10 feet. The HEC-2 model was developed using field surveyed cross sections of the canal located at approximately 500-foot intervals. The cross sections included surveyed points at the tops of lining and edges of canal invert. Maximum canal capacities were based upon water surfaces at the top of concrete lining. Flow into the earth freeboard area and outside overbank areas was not a consideration for the analysis.

2. Freeboard was added to the overchute and concrete rectangular drainage channel based upon the *Drainage Design Manuual of Maricopa County, Volume II.*

3. Concrete channel design was based upon *ADOT's "Urban Highways, Channel Lining Design Guidelines"*, 1989.

4. The overchute siphon design was based upon the *"Drainage Design Manual of Maricopa County", Volume II* and the United States Department of the Interior, Bureau of Reclamation, *"Design of Small Canal Structures", 1974.*

5. The concrete rectangular drainage channel retaining walls have been designed to meet MCDOT traffic and bicycle safety standards.

6. Grouted riprap design was based upon *"Drainage Design Manual of Maricopa County", Volume II.*

3.1.3 Hydrologic Modeling. The Overchute/siphon and related drainage channels are sized to convey the peak discharge resulting from the estimated 100-year flood event. Hydrologic data developed for the "White Tanks Area Drainage Master Plan" (White Tanks ADMS, WLB, 1992) and the "Master Drainage Report for Litchfield Master Planned Community" were considered in establishing the design discharges. The FCDMC (1996) report was developed to establish the limits of the 100-year floodplain within the project area and has been approved by the Federal Emergency Management Agency (FEMA). Documentation to modify the floodplain delineations will need to be based upon the data previously approved by FEMA. Therefore, the FCDMC (1997) hydrologic modeling has been used to establish the design discharges for sizing the structures.

At the existing detention basins, located about 1,000 feet east of the proposed overchute/siphon site, the White Tanks ADMS (WLB, 1992) HEC-1 model indicates that a 100-year flow will overtop the canal embankment with a peak flow of 887 cfs. Recently FCDMC (1995, 1996) completed hydrologic analyses for the RID Overchute through modification of the White Tanks ADMS hydrologic model. Flows which may potentially enter this site are from three sources:

1. Flows from areas east of Dysart Road (CP-271A, 481 cfs) are conveyed to the west along the RID Canal embankment into the existing basins.

2. Flows originating north of Indian School Road concentrate at the intersection of Indian School Road and the ISRB and at the intersection of Dysart Road and ISRB. This runoff currently flows southerly from CP-7/CP-256 (approximately 493 cfs) and flows southwesterly from CP-255A (1160 cfs). The CP-7/CP-256 flows contribute to the Dysart Road flows described in no. 1 above.

3. Flows originating from the area between Old Litchfield Road, Indian School Road, and Indian School Road Bypass concentrate at an existing lake within Litchfield Park and exit at the east end of the lake flowing southerly into the existing basins (CP-2711, 384 cfs).

The recommended alternative (alternative no.1) determined in the FCDMC report (1996) to reduce the peak flow and stage at the proposed overchute structure identifies a combined flow to the detention basins from sources number 1 and 2 above only. The flows from drainage area numbers 1 and 2 above result in a combined total runoff volume of about 166 acre-feet with a peak discharge of **1,084 cfs** directly downstream of the detention basins. The final basin capacity is estimated to be approximately 40 acre-feet at elevation 1012.50, which is near the top of the RID Canal embankment near the downstream end of the basins.

The runoff flow from source number 3 above is identified to flow directly to the overchute. The flow combines upstream of the overchute with flow from sources number 1 and 2. The combined peak flow of **1317 cfs** is the flowrate used for the concrete rectangular drainage channel design. The combined flow from source numbers 1,2,and 3 continue for approximately 600 feet to the overchute structure.

At the northeast corner of the intersection of the RID Canal, Old Litchfield Road, and the Indian School Road Bypass, the FCDMC (1997) HEC-1 model indicates that a 100-year flow will overtop the canal embankment with a peak flow of 468 cfs. Flows entering this site originate from the area between the Litchfield Road Bypass, Old Litchfield Road, the RID Canal, and includes an irregular area north of Indian School Road. The runoff volume from this area is 52 acre-feet with a peak discharge of 548 cfs. These flows currently concentrate at the intersection of Old Litchfield Road and the Indian School Road Bypass and flow to the intersection of the RID Canal and the Old Litchfield Road. Water ponds at this site until the water level exceeds the top of the canal bank at an elevation of 1012.5 feet with a storage volume of 7.8 acre-feet. This flow that has historically ponded along the RID Canal **(CP-270, 548 cfs)** and overtopped is now identified to combine with source numbers 1,2,and 3 to result in a total flowrate used for design of the proposed RID overchute of **1456 cfs** (FCDMC, 1997).

As a comparison, the Master Drainage Report for the Litchfield Master Planned Community summarizes results of an HEC-1 hydrologic model prepared for the Litchfield Master Planned Community study. The model did not have the benefit of the detailed topographic mapping that was available for the FCDMC (1997). The Master Drainage Report for the Litchfield Master Planned Community model did not simulate either channel or storage routing and combined the flows at the RID Canal with a peak discharge of 1409 cfs.

3.1.4 Design Discharges. The scope of work for this project established the design capacity of the overchute/siphon at 1456 cfs, based upon the May 1997 FCDMC hydrology report. The walls on the proposed structure have been extended vertically to match existing elevations upstream and provide 2.5 to 3.0 feet of freeboard. This is approximately twice the minimum freeboard required.

The April 1996 FCDMC hydrology report was also used for the design capacity criteria for the upstream concrete rectangular drainage channel and the Old Litchfield Road inlet transition structure. The concrete rectangular channel was designed for a capacity of 1376 cfs. Because of the requirements for the vertical side retaining walls to extend above surrounding grade, the channel is designed with a lining freeboard of 2.5 to 3.0 feet, which is larger than the minimum freeboard requirement of approximately 1.9 feet.

The Old Litchfield Road inlet transition is designed as a drop inlet weir and apron at a location just south of the intersection of ISRB and Old Litchfield Road. The inlet transition is designed to receive weir flow from each of the two sides (60-foot west weir length and 15-foot east weir length) as well as the north (60-foot weir length). Current design of the drop inlet weir and apron transition will provide for inlet sheet flow of as much as 560 cfs at a weir length of 135 feet and a weir depth of 1.17 feet. Flows to be conveyed to the structure through the Litchfield Park storm drain system have not been currently finalized and will be provided by Litchfield Park's consultant, Gannet Fleming Engineering.

The "Preliminary Study of Drainage to the RID Overchute" completed for Litchfield Park by Gannet-Fleming Engineering (August 1996) has provided that the maximum flow to the overchute site (CP-270) from Litchfield Park will be approximately 501 cfs, with approximately half of this flow to be divided between sheet flow and storm drain flow. An additional 59 cfs is to be conveyed through the Ancora storm drain to a location near the overchute outlet.

The weir inlet transition has been designed to convey the full 560 cfs total as sheet flow, which will enable the full concentration point flow to be conveyed overland to the RID overchute until that time when the Litchfield Park storm drain system is completely developed.. Future storm drain stubouts were provided for this project based upon recommendations provided in the Gannet-Fleming report.

3.2 Hydraulic Design

3.2.1 RID Canal Siphon. The siphon will be designed as a reinforced concrete box culvert. The culvert is sized to convey a peak flow of 435 cfs. HEC-2 water surface profiles were developed for the RID Canal existing conditions with the existing 3 barrel 8 foot wide by 8 foot high concrete box culvert at Old Litchfield Road. The existing box culverts at the Litchfield Road Bypass and Old Litchfield Road were included in the model. Cross sections at approximately 500-foot intervals were obtained and used in the model.

The HEC-2 model was then modified by removing the existing box culvert at Old Litchfield Road and inserting the proposed siphon. The head loss across the siphon as computed by the HEC-2 program was verified using procedures established by the Bureau of Reclamation for canal siphon design (Design of Small Canal Structures, 1981). A plan of the model reach and associated profile drawing is included at the back of this report and contains the future condition hydraulic grade line profile.

3.2.2 Overchute. The overchute is hydraulically designed to convey 1456 cfs. The structure grade was adjusted during design to maintain the upstream hydraulic grade line profile elevation below the existing ground for proposed drainage facilities between the concrete rectangular drainage channel and the drainage facilities surrounding the existing detention basin. Because the primary intent of this project is to reduce the floodplain throughout this area, the intent with the proposed designs is to not only channelize runoff from drainage areas to the north that has historically ponded against the RID Canal; but also to maintain peak 100-year flow hydraulic grade line profiles below ground in order to provide unobstructed collection of localized sheet flow drainage from surrounding areas in order to eliminate any localized flooding that could potentially occur.

3.2.3 Indian School Road Bypass Storm Drain. The existing Indian School Road Bypass storm drain is a 42 inch diameter cast in place concrete pipe extending from the Litchfield Road Bypass east to Old Litchfield Road. The storm drain is a 36 inch diameter concrete pipe east of Old Litchfield Road. The invert elevation of the existing pipe is about 1001.0 at the west side of Litchfield Road Bypass, 1002.6 at the west side of Old Litchfield Road, and 1006.0 approximately 146 feet east of Old Litchfield Road. With a proposed crest elevation of 1005.0 for the overchute, it is feasible to drain the existing storm drain into the proposed concrete rectangular drainage channel. It also appears that the storm drain will also function adequately with a 100-year storm event hydraulic grade line water surface elevation in the proposed concrete rectangular drainage channel of 1011.50. The top of manhole cover elevation of 1012.50 appears to provide sufficient elevation buffer to allow the 36-inch storm drain flows to continue discharging to the concrete rectangular drainage channel. It should be noted, however, that there is some potential that the storm drain could overtop during high flow storm events.

4.0 LOCATION OF CONFLICTING UTILITIES

The construction of the overchute/siphon will require relocation of an existing 6 inch diameter natural gas pipeline, an AT&T transcontinental fiber optics cable, a buried electrical line, a buried telephone line, and partial removal of an existing capped 5-inch natural gas pipeline. Construction of the temporary canal bypass will require relocation of two existing power poles. The existing alignment of these utilities is shown on the existing utility site map. The following individuals have been identified within the last 6 months regarding potential utility relocations for the project and are designated for 90 percent review design report (DR), plans (P), specifications (S), or none (N):

John Herrera, **(P,S)**
Design Project Leader
Goodyear Service Center
Arizona Public Service Company
PO Box 53933, Mail Sta 4609
Phoenix, Arizona 85072-3933
Tel (602) 932-6758
Pager (602) 226-3396

Kurt H. Maddern **(P,S)**
Litchfield Park Service Company (LPSCO)
109 W. Honeysuckle St.
Litchfield Park, Arizona 85340
Tel (602) 935-9367
Mob (602) 390-8451

Carl McKay **(P,S)**
Utility Liaison
Cox Communications
115 N. 51st Avenue
Phoenix, Arizona 85043
Tel (602) 352-5860, Ext 155

Jim Alber (or Steve Tatrai) **(P,S)**
Assistant Engineer
Southwest Gas Corporation
9 South 43rd Avenue
P.O. Box 52075
Phoenix, Arizona 85072-2075
Tel (602) 484-5336

Howard Denniston, P.E., N.C.E. **(P,S)**
Engineer, Capacity Provisioning
U.S. West Communications
2233 West Dunlap Avenue, Suite 232
Phoenix, Arizona 85021
Tel (602) 395-2429
Pager (602) 226-1109

Al Fisher **(P,S)**
Construction Engineering
AT&T
1231 W. University, Room 1023
Mesa, Arizona 85201
Tel (602) 844-5802
Mob (602) 377-5413

5.0 REQUIREMENTS FOR PUBLIC AND PRIVATE ACCESS

5.1 Public Access

The proposed Phase 1 RID Overchute drainage facilities will not cross or disrupt existing or planned public traffic patterns. The facilities will not cross existing public streets or roadways. The Phase 2 features will cause some minor disruption to the Plaza Circle Drive.

5.2 Private Access

The only traffic which will be impacted is traffic along the maintenance roads for the RID Canal in the vicinity of the overchute/siphon site.

The overchute structure is being designed to provide access across the structure along both the north and south RID Canal O&M roads. The O&M roads will slope from their existing elevation to the overchute crest elevation with 8-inch thick concrete roadway aprons to allow access along the O&M road. Flood flows crossing the overchute will interrupt access across the structure during a flood event. The south roadway will incorporate a rectangular grated drain at the center of the proposed overchute to intercept and divert small "nuisance flows" which may occur.

5.3 Access During Construction

The canal diversion, required to maintain canal flows during construction, will include a 16 foot wide maintenance road along the south side to provide continuous access along the canal during the construction period. The canal diversion will be aligned to allow access for construction equipment to the structure site without blocking the maintenance road during construction.

Access to the site will be required for the construction contractor. The structure site can be accessed during construction from Indian School Road Bypass.

6.0 RIGHT-OF-WAY AND EASEMENT INFORMATION

The overchute/siphon will be constructed within the right-of-way of the Roosevelt Irrigation District. The required right-of-way for construction of the structure is shown on the structure site plan.

The right-of-way for the existing Indian School Road Bypass east of Old Litchfield Road is held by Maricopa County. The area along the south side of the Indian School Road Bypass required for the Old Litchfield Road inlet transition and widening the roadway is held by AMAR Investment Company and Suncor; and is in the Cities of Goodyear and Avondale.

The area between the Indian School Road Bypass and the RID Main Canal required for the concrete rectangular drainage channel is held by Suncor. Construction of the overchute structure and inlet channels will require acquisition of portions of these privately held lands. Acquisition of permanent construction easement from Roosevelt Irrigation District will also be required for access along the RID Canal.

7.0 MAINTENANCE REQUIREMENTS

It is the policy of the RID to inspect each structure along the main canal daily. The overchute/siphon will, therefore, require daily monitoring for obstructions resulting from debris floating in the canal. It is recommended that an agreement between Litchfield Park and the RID be completed to utilize Litchfield Park city staff to monitor the structure daily and remove any debris collecting on the structure.

Additionally, it is recommended that the structure be visually inspected during the annual canal dry-up.

8.0 DESIGN REVIEW AND PERMIT REQUIREMENTS - RID OVERCHUTE/SIPHON

The following individuals have been identified either recently or within the last two years regarding design review, approval or permitting for the project and are designated for 90 percent review design report (DR), plans (P), specifications (S), or none (N):

George Flanagan **(P,S)**
City Engineer for City of Litchfield Park
Gannett Fleming Engineers & Planners
3001 E. Camelback Road, Suite 130
Phoenix, AZ 85016-4498
(602) 553-8817

Robert Gasser **(N)**
Compliance Coordinator
State Historic Preservation Office
Arizona State Parks
1300 W. Washington
Phoenix, AZ 85007
(602) 542-4174

Tom Hill **(P,S)**
Suncor Development Co.
2025 N. Litchfield Road
Goodyear, AZ 85338
(602) 935-5100

Lynn Kartchner (or Larry Martinez) **(P,S)**
Public Works Director
City of Goodyear
119 N. Litchfield Road
Goodyear, AZ 85338
(602) 932-1637

Cindy Lester **(N)**
U.S. Army Corps of Engineers
3636 N. Central Avenue, Suite 760
Phoenix, AZ 85012-1936
(602) 640-5385

Stan Ashby **(P,S)**
Superintendent
Roosevelt Irrigation District
P.O. Box 95
103 W. Baseline Road
Buckeye, AZ 85326
(602) 386-2046

Jim Badowich **(P,S)**
Engineering Manager
City of Avondale Public Works
1211 S. 4th Street
Avondale, AZ 85323
(602) 918-3361
Fax (602) 932-3329

Mike Campbell **(N)**
Assistant Manager
Engineering Services
Water/Wastewater Department
Maricopa County Environmental
Health Services
2406 S. 24th Street
Phoenix, AZ 85034
(602) 506-6666

Gerald Toscano **(P,S)**
Maricopa County Department
of Transportation
(MCDOT) **(P,S)**
2901 West Durango Street
Phoenix, Arizona 85009
Tel (602) 506-8620

Kathy Willman **(P,S)**
Water Resource Specialist
Phoenix Active Management Area
Arizona Department of Water Resources
15 S. 15th Avenue
Phoenix, AZ 85007
(602) 542-1512

Robert Wilson **(N)**
Engineering and Permit Review
Water Quality Department
Arizona Department of Environmental
Quality
3033 N. Central Avenue
Phoenix, AZ 85012
(602) 207-4574

A call to the U.S. Army Corps of Engineers in September 1994 resulted in the request that we submit the plan to them and request a determination regarding whether or not a Section 404 Permit was required. Permit issuance would require one to six months. One copy of the 90 percent plans and specifications will be submitted to the Phoenix Area Office.

A representative of the Arizona Department of Water Resources requested in September 1994 that someone come in and describe the project to them so they could be informed regarding water rights. One copy of the 90 percent plans and specifications will be submitted to ADWR's Phoenix

.

Maricopa County Environmental Health Services suggested in September 1994 that they would have no input to the project.

According to the Arizona Department of Environmental Quality, a Construction Stormwater NPDES permit would be required for any project affecting more than five acres. This has been identified in the 90 percent Supplemental General Conditions.

Several calls were placed to the State Historic Preservation Office to determine if a cultural resource survey was required, but calls were not returned.

Contact Report

Time Period 9/29/94	Job. No. 1202101

OFFICE ROUTING	
To	Initials
Return To:	

☐ TELEPHONE CONVERSATION
☐ Received ☒ Initiated

☐ VISIT
Location:

Person Contacted: Robert Wilson
Telephone Number: 207-~~2305~~ 4574
Organization: Water Quality Dept.
AZ Dept. of Environmental Quality
3033 N. Central Ave.
Phoenix, AZ 85012

Subject:

Summary: Robert Wilson - Engineering + Permit review
207-4574

Construction Stormwater NPDES permit required for >5 acres of construction.

"call 207-4502 Jim Mott to touch base regarding Sec. 404 permitting, unless you have already spoken to the Corps."

9-87 on Mac Disk 10

Report By: Robert Larkin

Contact Report

Time Period 9/29/94	Job. No. 1202101

OFFICE ROUTING

To	Initials

Return To:

☐ **TELEPHONE CONVERSATION**
☐ Received ☒ Initiated

☐ **VISIT**
Location:

Person Contacted:
Telephone Number: 542-1581
Organization:
Arizona Dept. of Water Resources
15 S. 15th Ave
Phoenix, AZ 85007

Subject:

Summary: ~~Sylvia~~

~~Asked if any wells would be excavated~~

542-1512 Phoenix Active Management Area
Field Representative.

Kathy Willman — Water Resource Specialist

They may need to know details regarding how water use is reported if it is being transported between areas. Suggested having someone come in and discuss the project with them. There would probably not be a permit needed; it would be a matter of water rights.

9-87 on Mac Disk 10

Report By: Robert Larkin

Contact Report

Time Period	9/29/94	Job. No.	1202101

OFFICE ROUTING

To	Initials

Return To:

☐ **TELEPHONE CONVERSATION**

☐ Received ☐ Initiated

☐ **VISIT**

Location:

Person Contacted: Mike Campbell

Telephone Number: 506-6666

Organization: Water-Wastewater
Maricopa Co. Environmental Health
Services
2406 S. 24th St, Phx. AZ 85034

Subject:

Summary:

Mike Campbell Asst
Mgr., Engineering
Services

If it's storm runoff, they
would not need to get involved.

9-87 on Mac Disk 10

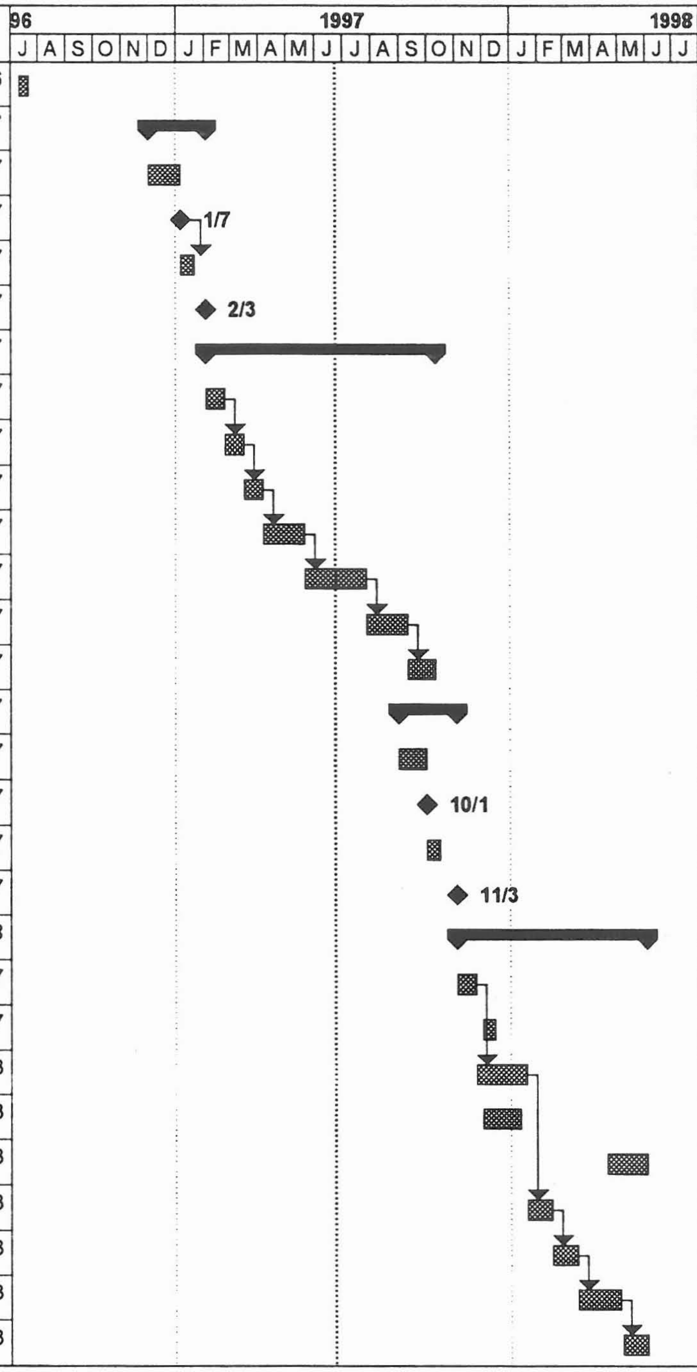
Report By: Robert Fantini

9.0 CONSTRUCTION DURATION AND SCHEDULE

It is anticipated that the construction of the overchute/siphon, Old Litchfield Road inlet transition, overchute outlet transition, and concrete rectangular drainage channel will require about 4 months to complete, allowing about 3 months for relocation of the utilities prior to construction. With the canal bypass as part of the project, construction will not impact irrigation operations or traffic flow. However, the construction schedule should be expedited as possible to alleviate future flooding at the site.

RID OVERCHUTE PROJECT
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
PHASE 1 (FCD 96-09) AND PHASE 2 (FCD 97-01) CONSTRUCTION SCHEDULE

ID	Task Name	Duration	Start	Finish
1	Construct Tie-in Ends	7d	7/12/96	7/22/96
2	**Phase 1 Prebid**	**45d**	**12/2/96**	**2/3/97**
3	Ph1 - Advertise for Bids	36ed	12/2/96	1/7/97
4	Ph1 - Bid Opening	0d	1/7/97	1/7/97
5	Ph1 - Bid Evaluation	15ed	1/7/97	1/22/97
6	Ph1 - Notice to Proceed	0d	2/3/97	2/3/97
7	**Phase 1 Construction**	**180d**	**2/3/97**	**10/11/97**
8	Construct Bypass	21ed	2/3/97	2/24/97
9	Tie-in Bypasses	21ed	2/24/97	3/17/97
10	Demolition	21ed	3/17/97	4/7/97
11	Overchute/Siphon	45ed	4/7/97	5/22/97
12	Rectangular Channel	67ed	5/22/97	7/28/97
13	OLR Inlet	45ed	7/28/97	9/11/97
14	OLR Outlet	30ed	9/11/97	10/11/97
15	**Phase 2 Prebid**	**45d**	**9/1/97**	**11/3/97**
16	Ph2 -Advertise for Bids	30ed	9/1/97	10/1/97
17	Ph 2 - Bid Opening	0d	10/1/97	10/1/97
18	Ph2 - Bid Evaluation	15ed	10/1/97	10/16/97
19	Ph2 - Not to Proceed	0d	11/3/97	11/3/97
20	**Phase 2 Construction**	**150d**	**11/3/97**	**6/1/98**
21	Remove Bypass	21ed	11/3/97	11/24/97
22	Overchute Outlet	14ed	12/1/97	12/15/97
23	Detention Basins	56ed	11/24/97	1/19/98
24	Paladin Box Culvert	42ed	12/1/97	1/12/98
25	Pal/Plaza Circ Intersect	45ed	4/17/98	6/1/98
26	West Interceptor Channe	28ed	1/19/98	2/16/98
27	Basin Outlet Channel	28ed	2/16/98	3/16/98
28	Plaza Circle Channel	47ed	3/16/98	5/2/98
29	Spillways	28ed	5/4/98	6/1/98



Project:
Date: 6/23/97

Task		Rolled Up Task	
Progress		Rolled Up Milestone	◇
Milestone	◆	Rolled Up Progress	
Summary			

10.0 SPECIAL PROJECT FEATURES

10.1 Sanitary Sewer Line

An existing 8-inch vitrified clay pipe (VCP) sanitary sewer line crosses beneath the rectangular concrete channel at a depth of one to two feet between station 8+60 and 9+80. The sanitary sewer line crosses two to two and one-half feet below the existing alignment at another location between station 10+10 and the rectangular concrete channel inlet cutoff wall at station 10+80. Protection will be required for the entire reach of sanitary sewer line between 8+60 and 10+80.

It is proposed that the existing sanitary sewer line between the existing manholes at station 8+10 and 10+00 be replaced with a new 8-inch diameter PVC sanitary sewer line by rerouting between a proposed new manhole at station 7+50 and the existing manhole at station 10+00. The rerouting would be accomplished through an opening and 8-inch diameter PVC discharge from the new manhole at station 7+50 at a 10 to 15 degree counterclockwise offset angle from the existing 8-inch diameter VCP sanitary sewer alignment; with the PVC pipe traversing from the new manhole in a tangent and radius manner to the existing manhole at station 10+00.

In addition to the reach of 8-inch VCP sanitary sewer line between the two existing manholes at station 8+10 and 10+00, the reach between 10+00 and the beginning of the grouted riprap rectangular channel at station 11+16 should also be protected. Although this reach has between two to three feet of clearance between the sanitary sewer line and the bottom of proposed channel, it is proposed that two inches minimum of styrofoam wrap be placed over the 8-inch VCP sewer line and concrete slurry encasement be provided one-foot minimum thick from the crown of the sewer line.

10.2 Water Line

An existing 24-inch diameter reinforced concrete cylinder pipe (RCCP) water line passes adjacent to the concrete rectangular channel at its closest point near station 8+40. The water line passes within 3.5 feet of the concrete rectangular channel retaining wall and 2.5 feet from the concrete rectangular channel footing. Shoring, encasement, or other special construction was potentially considered to be required at this location before the actual clearance was determined from potholing data. It is now determined that no special construction will be required in the plans for this location; although the specifications will identify the contractor's responsibility for the protection of the line within this area.

The same 24-inch diameter RCCP will be relocated between station 6+35 and 7+20 to accommodate the construction crossing of a 36-inch diameter storm drain. The rerouted water line will bend outside of its original alignment and pass below the proposed storm drain approximately two feet; and will continue past the storm drain until it reconnects to the existing water line. It was determined that welded joint restraint will be required for the RCCP a minimum distance of 12 feet either side of the proposed 45-degree compound bends at the beginning and ending of the relocation.

10.3 Storm Drain Construction

An existing 36-inch diameter reinforced concrete pipe storm drain located along the south side of the present Indian School Road Bypass alignment is proposed to be connected to the concrete rectangular channel at approximately station 6+80. The storm drain will be disconnected from the existing manhole at station 7+12, 65'Lt. a sufficient distance to the west to allow the installation of an elbow that will discharge toward the concrete rectangular channel. The storm drain will then traverse to the concrete rectangular channel, passing over the top of a relocated 24-inch diameter reinforced concrete cylinder pipe (RCCP) water line. The water line will be relocated beneath the storm drain as identified above and will be completed as part of the storm drain construction.

Bid Opening - Phase 1 - RID Overchute Project
Opinion of Probable Construction Costs
FCDMC Contract No. 96-09
January 7, 1997

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENDED AMOUNT
105	Partnering	1	LS	$4,000.00	$4,000.00
107-1	NPDES/SWPPP Permits	1	LS	$1,800.00	$1,800.00
107-2	Project Signs Allowance	1	LS	$2,000.00	$2,000.00
202	Mobilization	1	LS	$25,000.00	$25,000.00
215	Drainage Excavation	12877	CY	$3.00	$38,631.00
216-1	Temporary Bypass Canal	2311	CY	$15.00	$34,665.00
216-2	Temporary Bypass Canal Lining	2089	SY	$18.00	$37,602.00
220	Grouted Riprap	662	CY	$75.00	$49,650.00
310-1	Aggregate Base Course	432	TONS	$10.00	$4,320.00
310-2	Granular Bedding Material	1222	TONS	$10.00	$12,220.00
350-1	Remove Canal Bridge Structure	1	LS	$30,000.00	$30,000.00
350-2	Remove Irrigation Overchute Structure	1	LS	$1,000.00	$1,000.00
350-3	Miscellaneous Removals	1	LS	$1,000.00	$1,000.00
401	Traffic Control	1	LS	$5,000.00	$5,000.00
415	Guardrail	255	LF	$35.00	$8,925.00
421	Wire Fence	63	LF	$3.30	$207.90
505-1	Two Barrel 8' x 7' Box Culvert	71	LF	$600.00	$42,600.00
505-2	Box Culvert Headwalls and Wingwalls	139	CY	$325.00	$45,175.00
505-3	Drainage Channel Walls	1395	LF	$265.00	$369,675.00
505-4	Drainage Channel Slab	1351	SY	$40.00	$54,040.00
505-5	Old Litchfield Road Inlet Transition Spillway	149	SY	$40.00	$5,960.00
505-6	Overchute Slab and Access Roads	1184	SY	$40.00	$47,360.00
505-7	Concrete Lining	448	SY	$30.00	$13,440.00
515-1	Frame and Grate	33	LF	$60.00	$1,980.00
515-2	Fixed Bollards	34	EA	$300.00	$10,200.00
515-3	Removable Bollards	8	EA	$125.00	$1,000.00
515-4	Access Barriers	6	EA	$750.00	$4,500.00
520-1	22" Channel Handrail	1312	LF	$30.00	$39,360.00
520-2	42" Channel Handrail	255	LF	$30.00	$7,650.00
520-3	56" Channel Handrail	72	LF	$30.00	$2,160.00
525	Lining Repair Shotcrete	100	SY	$35.00	$3,500.00
610	Water Main Relocation	67	LF	$195.00	$13,065.00
615-1	Sanitary Sewer Line Relocation (8" PVC)	258	SY	$28.00	$7,224.00
615-2	Sanitary Sewer Line Replacement (8" DIP)	122	LF	$57.00	$6,954.00
618-1	36" RGRCP	64	LF	$100.00	$6,400.00
618-2	48" RGRCP	20	LF	$109.00	$2,180.00
618-3	51" x 31" Arch Pipe	117	LF	$145.00	$16,965.00
625	Sanitary Sewer Manhole	1	EA	$2,000.00	$2,000.00
	TOTAL CONSTRUCTION COSTS[1]				**$959,408.90**

Source: FCDMC, 1996
ADOT Construction Costs, 1995
SFC Eng Co., 1996

Phase 2 - RID Overchute Project
Opinion of Probable Construction Costs
FCDMC Contract No. 97-01
June 1997

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENDED AMOUNT
105	Partnering	1	LS	$5,000.00	$5,000.00
107-1	NPDES/SWPPP Permits	1	LS	$1,800.00	$1,800.00
107-2	Project Signs Allowance	1	LS	$2,000.00	$2,000.00
202	Mobilization	1	LS	$25,000.00	$25,000.00
215	Drainage Excavation	113,843	CY	$2.75	$313,068.25
220	Grouted Riprap	1,610	CY	$65.00	$104,650.00
310-1	Aggregate Base Course	507	TON	$15.00	$7,605.00
310-2	Granular Bedding Material	1,442	TON	$15.00	$21,630.00
336	Replace AC Pavement	273	TON	$23.00	$6,279.00
337	Signing and Striping	1	LS	$1,200.00	$1,200.00
340-1	Single Curb (MAG 220, Type "A")	549	LF	$5.50	$3,019.50
340-2	Concrete Curb Termination (MAG 222)	15	LF	$7.00	$105.00
340-3	Ribbon Curb (MAG 220, Type "B", modified)	491	LF	$7.00	$3,437.00
350	Miscellaneous Removals	1	LS	$15,000.00	$15,000.00
401	Traffic Control	1	LS	$5,000.00	$5,000.00
411	Delineators	6	EA	$50.00	$300.00
415	Guardrail	97	LF	$25.00	$2,425.00
421	Wire Fence	830	LF	$20.00	$16,600.00
432	Gravel Mulch	3,280	SY	$2.00	$6,560.00
505-1	Three Barrel 6' x 7' Box Culvert	84	LF	$775.00	$65,100.00
505-2	Wingwalls	102	LF	$235.00	$23,970.00
505-3	Concrete Barrier and Parapet Walls	179	LF	$35.00	$6,265.00
505-4	Concrete Channel Lining and Transitions	8,643	SY	$30.00	$259,290.00
505-5	Roadway Transition Aprons	181	SY	$30.00	$5,430.00
515-1	Fixed Bollards	6	EA	$300.00	$1,800.00
515-2	Removable Bollards	1	EA	$125.00	$125.00
520	22" Handrail	87	LF	$30.00	$2,610.00
610-1	12" Waterline Relocation	125	LF	$102.00	$12,750.00
610-2	1-1/2" Waterline Relocation	220	LF	$4.00	$880.00
610-3	Fire Hydrant Relocation	1	LS	$1,880.00	$1,880.00
615-1	Sanitary Sewer Replacement (15" DIP)	70	LF	$80.00	$5,600.00
615-2	Sewer Plugs, MAG Det. 427	8	EA	$480.00	$3,840.00
625	Sanitary Sewer Manhole Adjustment	3	EA	$1,875.00	$5,625.00
	TOTAL CONSTRUCTION COSTS				$935,843.75

Source: FCDMC, 1997
ADOT Construction Costs, 1995
SFC Engineering Company, 1997

13.0 REFERENCES

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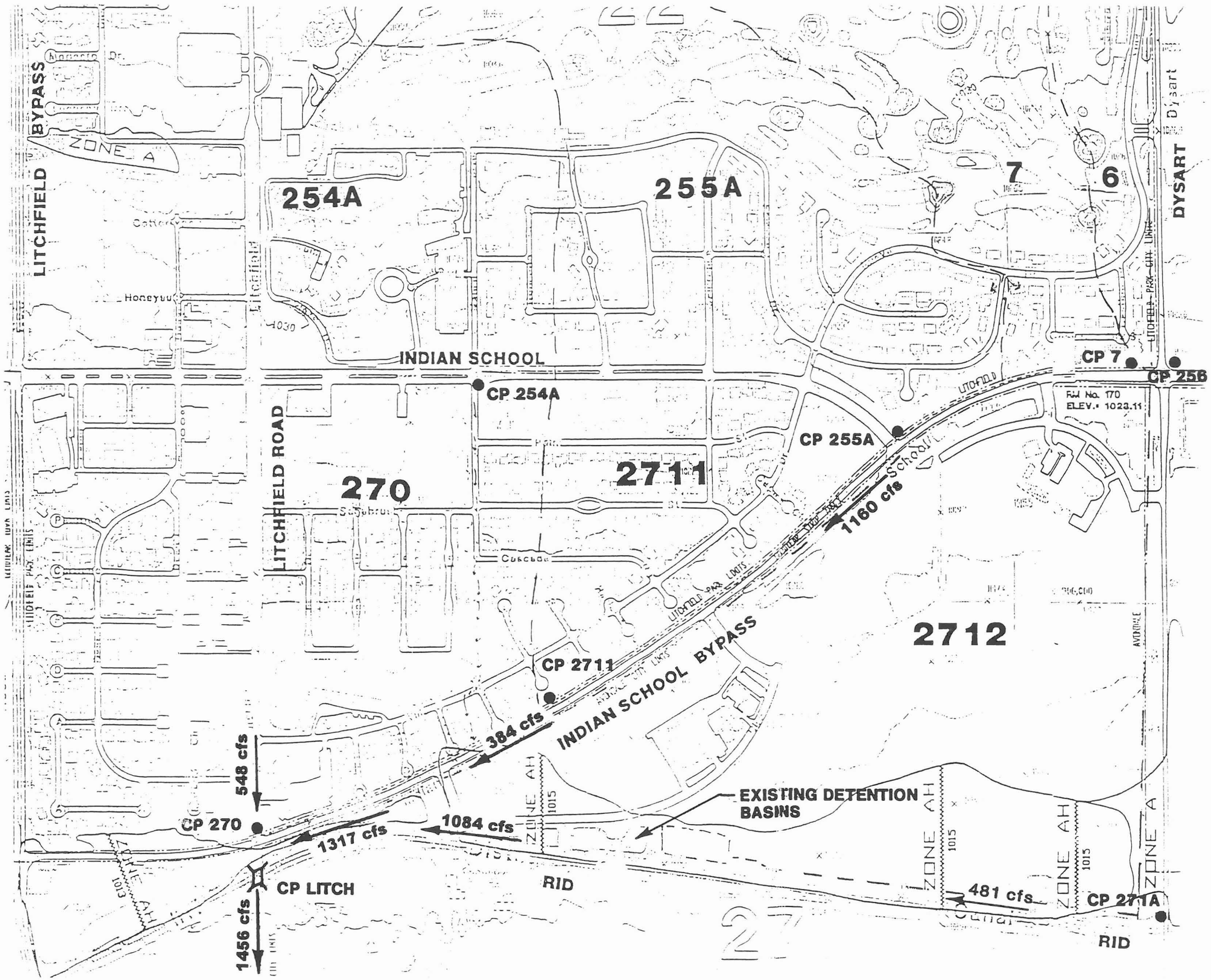

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* FLOW RATES REFLECT FINAL ITERATION OF MODELS (1997)

FIGURE 1

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

HEC-1 MODEL SUMMARY
PROPOSED CONDITIONS
100-YEAR 24-HOUR

R.I.D. OVERCHUTE PROJECT

SFC

APPENDIX A DESIGN CALCULATIONS

Attached are the following calculations and supporting documentation:

- Rectangular Channel Grouted Riprap Design Calculations
- Rectangular Channel Hydraulic Calculations
- Old Litchfield Road Inlet Transition Hydraulic Calculations
- RID Overchute Hydraulic Calculations
- RID Overchute Outlet Transition Hydraulic Calculations and Grouted Riprap Design
- RID Canal Temporary Bypass Hydraulic Calculations
- Paladin Road Box Culvert Hydraulic Calculations
- CP-2711 (West Interceptor) Spillway Hydraulic Calculations
- CP-255A Hydraulic Calculations
- Structural Design Calculations

STRUCTURAL DESIGN CALCULATIONS

DESIGN REPORT
JULY 1997

OVERCHUTE

SFC

PROJECT: INLET TRANSITION TO RECT CHANNEL

PROJECT No.: 202101 DATE: 8/27/96

PAGE: 1 OF 3 SCALE:

DESIGN CRITERIA:

THIS IS A TEMPORARY INLET TRANSITION PROVIDED UNTIL PHASE 2 BEGIN CONSTRUCTION.

1. TRANSITION LENGTH

USE 4:1 SLOPE

APPROX EXISTING GRADE = 1012.8
INVERT CHANNEL = 1005.9
} DROP = 6.9'

LENGTH = 6.9' X 4 = 27.6'

From OUTLET STRUCT (Drainage Design Manual for MC) Page 6-52 RECOMMENDED A MIN DISTANCE EQUAL THE BASIN WIDTH (W = 30')

USE L = 30'

2. STONE SIZE:

THERE ARE SOME UNKNOWN DATA TO DETERMINE STONE SIZE (EXISTING EARTH CHANNELS UPSTREAM - VELOCITY, WATER DEPTH, ETC. AT EXIST OPEN CHANNEL JUNCTION) THE USBR, TYPE 3 MINIMUM PROTECTION SHOULD BE USED WHERE VELOCITY EXCEED 5 FPS, REGARLESS OF

DESIGNED BY: HVM CHECKED BY: [signature]

RIO OVERCHUTE

PROJECT: INLET TRANS.

PROJECT No.: 1202101 DATE: 8/27/96

 SCALE:

WATER DEPTH W/ 12-IN RIPRAP? (12-IN D_{100} (MAX)

3. THICKNESS OF RIPRAP:

- IT SHOULD NOT BE LESS THAN 12" FOR PRACTICAL PLACEMENT. (MIN. = 12" THICK)
- USE 1.5 D_{100} ⇒ $T = 1.5 \times 12'' = 18''$

4. INLET CUT OFF WALL:

From ASCE PRESS Fig 3-11 Page 45
(SEE OUTLET TRANSITION RIPRAP DESIGN CALCS)

$h = 2T = 2(18'') = 36''$ or $3'-0''$
$W = 3T = 3(18'') = 54''$ or $4'-6''$

DESIGNED BY: Hun CHECKED BY: JB

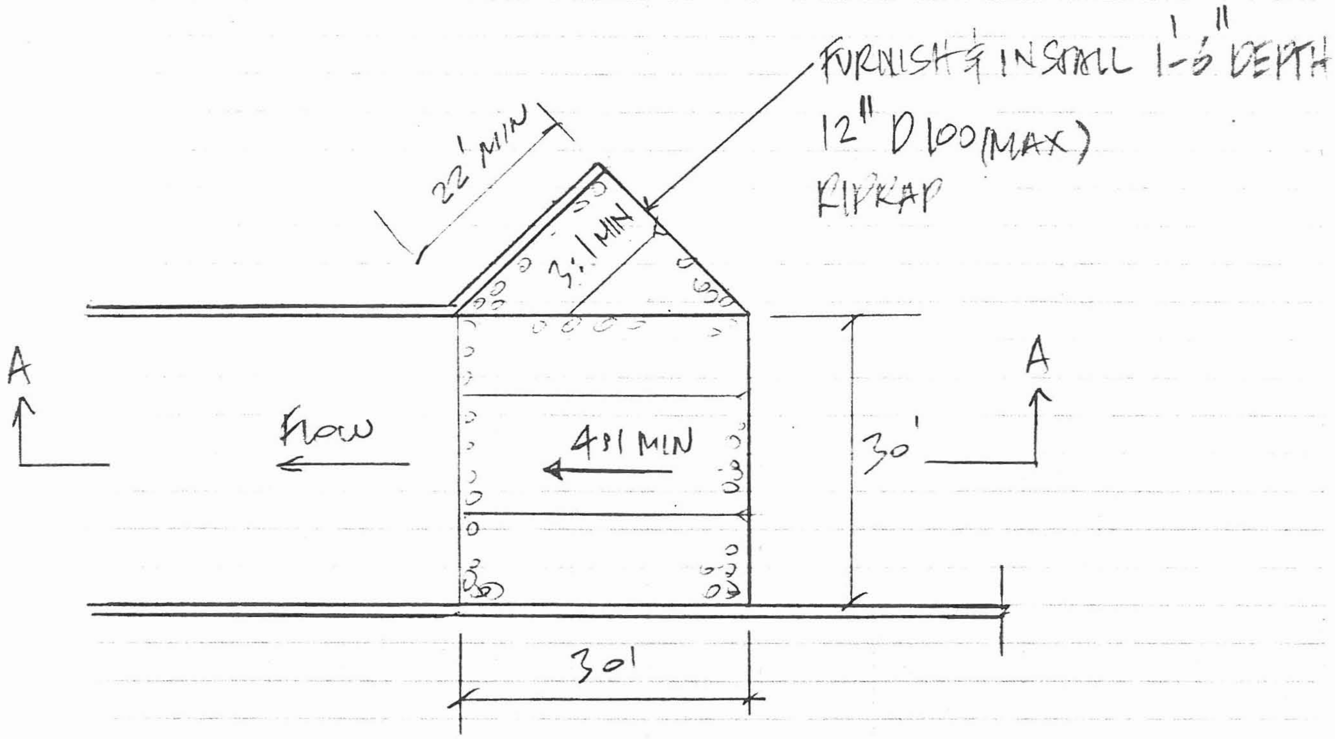
RW - OVERCHUTE

SFC

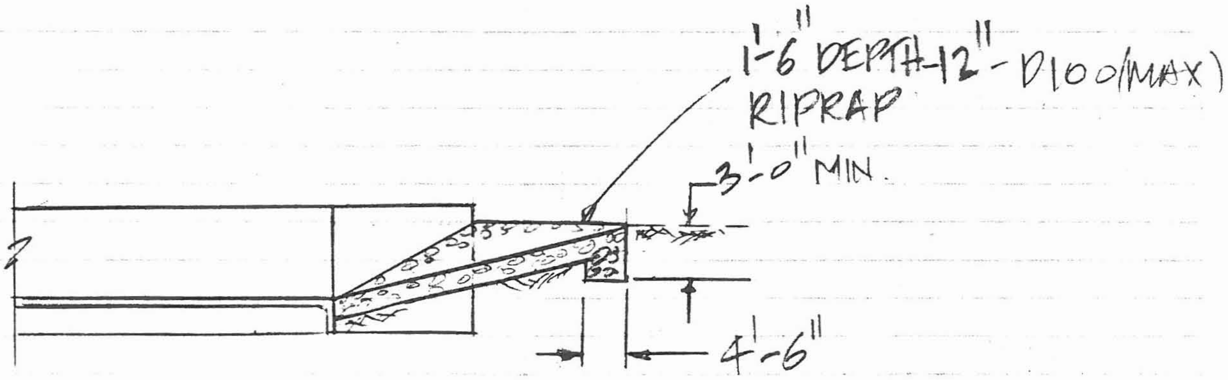
PROJECT: INLET TRANSITION

PROJECT No.: 1202101 DATE: 3/27/96

 SCALE:



PLAN - INLET



SECTION A-A
NTS

DESIGNED BY: HMM CHECKED BY:

HONG V. MAI

Design Standards No. 3

CANALS AND RELATED STRUCTURES

CHAPTER 1 CANALS AND LATERALS
2 GENERAL DESIGN INFORMATION FOR STRUCTURES
3 DIVERSION DAMS
4 DIVERSION HEADWORKS
5 CANAL STRUCTURES
6 WATER MEASUREMENT STRUCTURES
7 CROSS DRAINAGE AND PROTECTIVE STRUCTURES
8 PIPE DISTRIBUTION SYSTEMS
9 BRIDGES

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

OFFICE OF CHIEF ENGINEER
DENVER, COLORADO

HYDRAULICS--Continued

FREEBOARD (Cont'd.)

designs or by improper operation. The increased freeboard is to be extended away from the structure to a point where the least damage due to overtopping will occur, or a minimum distance of 50 feet.

PERCOLATION

.27 Where water is confined in an area above a point of relief, such as above a check structure, there is a tendency for the water to flow along the structure or through the earth to the lower point of relief. The type of structure and the nature of the soil will govern the amount and rate of the flow. The percolation factor should be at least 2.5:1 as computed by Lane's weighted creep method, and 3.5:1 on a straight path. Straight path factors of 5:1 are common. Larger factors may be required where warranted by the type of soil or importance and type of structure.

The percolation path may be increased by adding length or cutoff walls to most structures. Cutoff walls must be far enough apart to prevent a short circuit between the ends of the cutoffs. The cutoffs must be so spaced that the actual distance between the cutoffs will be at least one-half the weighted creep distance along the structure between the ends of the cutoffs. For computing weighted creep distance, the horizontal distance is considered to be one-third as effective as the vertical distance.

OVERTURNING AND SLIDING

.28 All structures must be checked for stability. Especially, small check structures often require additional length to prevent overturning or sliding for maximum upstream and minimum downstream water surface. The sliding factor, defined as the ratio of the horizontal forces to the total weight reduced by uplift, should not exceed 0.35 for most conditions. Cutoff walls may be added to increase the sliding resistance.

HYDRAULIC JUMP

.29 A treatment of hydraulic jump and critical depth and their application to design is given in Appendix A to this chapter, which is a reprint of an article by Julian Hinds entitled "The Hydraulic Jump and Critical Depth in the Design of Hydraulic Structures." See also Figures 17, 18, and 19.

RIPRAP

GENERAL

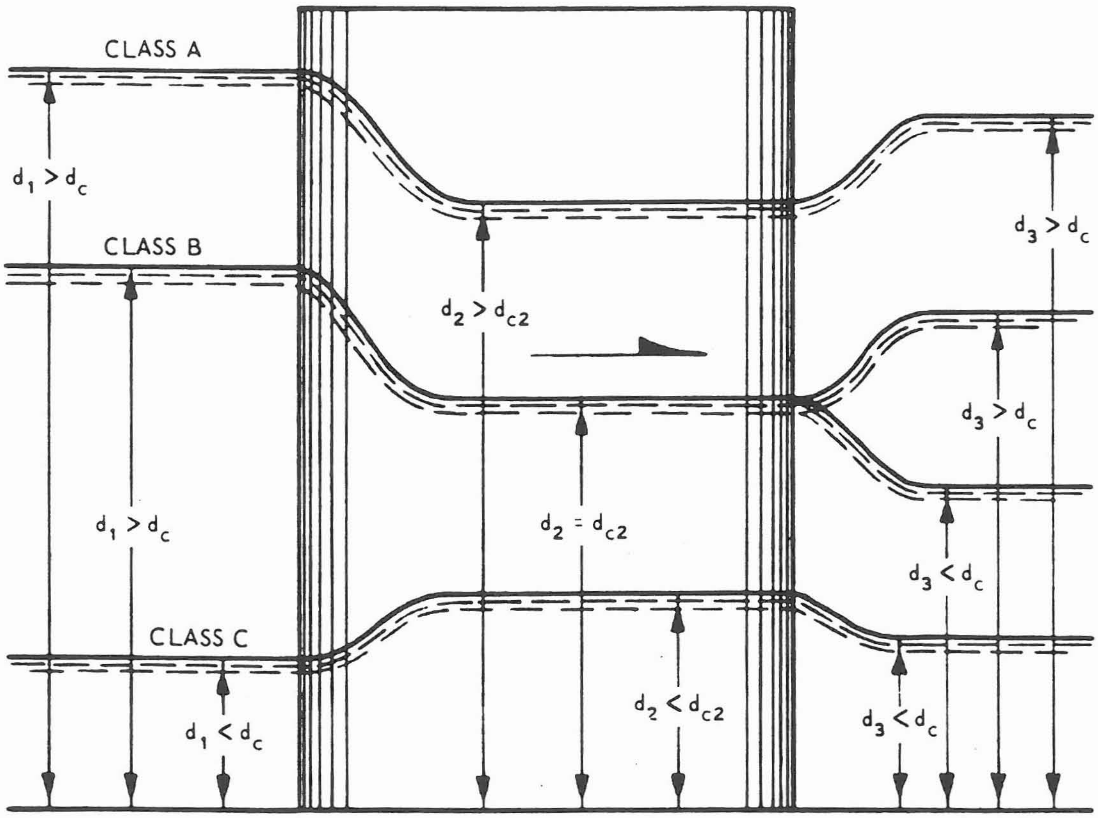
.30 Riprap protection is often used adjacent to structures and at other locations in earth-surfaced canals where erosion may occur. The local conditions must be considered in determining the type and amount of protection to be provided. These conditions include the cost of riprap, cost of gravel, danger to structures and crops or to human life should scour occur, rodent protection, type of soil, and velocity of water. In areas where riprap and gravel are scarce, consideration should also be given to stockpiling riprap under the construction contract for later use by operation and maintenance forces. The following protection requirements are to be used as a guide only. Types of protection are identified herein for convenience in discussing the protection requirements. The types shown represent minimum sizes and amounts of material to be used, and adjustments should be made to meet the local conditions mentioned above.

Type 1--6-inch coarse gravel
Type 2--12-inch coarse gravel
→Type 3--12-inch riprap and 6-inch sand and gravel bedding
Type 4--18-inch riprap and 6-inch sand and gravel bedding

Except for cross-drainage structures, Type 3 minimum protection should be used where velocities exceed 5 feet per second, regardless of depth.

TECHNICAL ENGINEERING AND DESIGN GUIDES
AS ADAPTED FROM THE
US ARMY CORPS OF ENGINEERS, NO. 10

HYDRAULIC DESIGN OF



FLOOD CONTROL CHANNELS

AMERICAN SOCIETY OF CIVIL ENGINEERS

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riprap gradation is first assumed and resistance coefficients are computed using Equation 3-2. Then the five steps described previously in (2) are conducted. If the gradation found in the preceding point 5 is equal to the assumed trial gradation, the solution is complete. If not, a new trial gradation is assumed and the procedure is repeated. The second example in Appendix H demonstrates this type of channel riprap.

(5) In braided streams and some meandering streams, flow is often directed into the bank line at sharp angles (angled flow impingement). Guidance is lacking on determining the imposed force for this condition. Until better guidance can be developed, a local velocity of 1.5 times the average velocity in the approach channel is recommended for use in riprap design.

(6) Transitions in size or shape may also require riprap protection. The procedures in this paragraph are applicable to gradual transitions where flow remains tranquil. In areas where flow changes from tranquil to rapid and then back to tranquil, riprap sizing methods applicable to hydraulic structures (HDC 712-1) should be used. In converging transitions, the procedures based on Equation 3-3 can be used unaltered. In expanding transitions, flow can concentrate on one side of the expansion and design velocities should be increased.

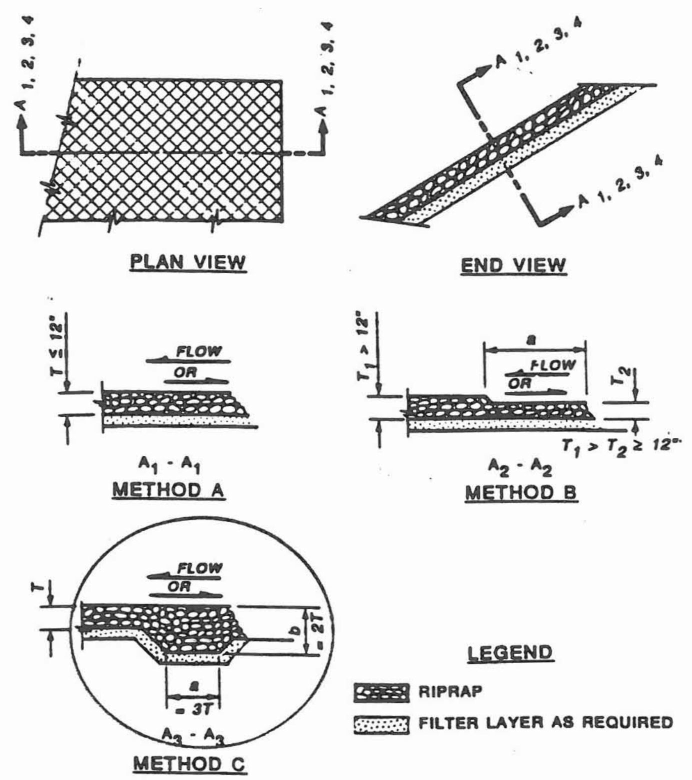


FIG. 3-11. Riprap End Protection

For installations immediately downstream of concrete channels, a vertical velocity distribution coefficient of 1.25 should be used due to the difference in velocity profile over the two surfaces.

3-8. REVETMENT TOP AND END PROTECTION.

Revetment top and end protection requirements, as with all channel protective measures, are to assure the project benefits, to perform satisfactorily throughout the project economic life, and not to exceed reasonable maintenance costs. Reference is made to ER 1110-2-1405, with emphasis on paragraph 6c.

A. Revetment Top. When the full height of a levee is to be protected, the revetment will cover the freeboard, i.e., extend to the top of the levee. This provides protection against waves, floating debris, and water-surface irregularities. Similar provisions apply to incised channel banks. A horizontal collar, at the top of the bank, is provided to protect against escaping and returning flows as necessary. The end protection methods illustrated in Figure 3-11 can be adapted for horizontal collars. Figure 3-6 provides general guidance for velocity variation over channel side slopes that can assist in evaluating the economics of reducing or omitting revetment for upper bank areas. Revetment size changes should not be made unless a sufficient quantity is involved to be cost effective. Many successful revetments have been constructed where the top of the revetment was terminated below the design flow line. See USACE (1981) for examples.

B. Revetment End Protection. The upstream and downstream ends of riprap revetment should be protected against erosion by increasing the revetment thickness *T* or extending the revetment to areas of noneroding velocities and relatively stable banks. The following guidance applies to the alternative methods of end protection illustrated in Figure 3-11.

(1) Method A. For riprap revetments 12 in. thick or less, the normal riprap layer should be extended to areas where velocities will not erode the natural channel banks.

(2) Method B. For riprap revetments exceeding 12 in. in thickness, one or more reductions in riprap thickness and stone size may be adopted for a distance a (Figure 3-11) in which velocities decrease to a noneroding natural channel velocity.

(3) Method C. For all riprap revetments that do not terminate in noneroding natural channel velocities,

RECTANGULAR CHANNEL HYDRAULIC CALCULATIONS

DRAFT DESIGN REPORT
JULY 1997

Flood Control District of Maricopa County (FCDMC)
RID Overchute Project
Rect Chann Design Criteria Summary
Stantech Project No. 28900014
July 1997

INDIAN SCHOOL ROAD BYPASS RECTANGULAR CONCRETE DRAINAGE CHANNEL DESIGN CRITERIA		
ITEM	**RESPONSE**	**COMMENTS**
Maximum Des Flowrate (Q)	1317 cfs	"Hydrologic Analysis for the RID Overchute Project", April 1996
Lining Type:	Concrete Floor	8" thick - (6" min req'd for maint traffic plus reinf per ADOT "Urban Hwys Chann Lin Des Guidelines", 1989)
	Retaining Wall Sideslope	N & S walls @ 32" above exist grade for traff barr protect plus handrail@ add'l 22" for bicycle protect for 4'-6" total.
Permissible Velocity:	15 f/s	Table 5.3, Drain Des Man
Normal Depth (Manning's) Hydraulic Properties	Q=1317	Overch to 600' E. of Overch along RID Canal - S. Wall Only last 150' for 750' total
	B=30 ft	
	S=.0015 ft/ft	
	S:S=Vertical (0)	
	H= Varies	2'-8" above surrounding grade throughout length, approx 9.5'-10' depth throughout. Also, 1'-10" handrail on top of wall throughout.
	d=4.61 ft	Normal Depth - Manning's
	n=.014	Table 5.11 Drain Des Manual
	v=9.25 f/s	
	L= approx. 750 ft.	HEC-2 water surface profiles
HEC-2 Backwater Hydraulic Properties	Flowline S=.0015 ft/ft	U/S of Overch to beg. of transition
	V=7.5 to 8 f/s	
	d=5.75 to 6.25 ft	
	Freeboard (FB)=1.80 ft **No Freeboard Req**	FB= 0.25 $(Y+V^2/2g)$, Eq'n 5.10, Mar Cnty Drain Des Man - HGL of chann not perched above exist grade, therefore freeboard req not applicable
	Freeboard Available=3.75 to 4.5 ft	

Source: Drainage Des Man of Mar Cnty, Vol II, Hydraulics, Sept 1992
Chan Lin Des Guidel, ADOT, Feb 1989
HEC-2 Wat Surf Anal Prog HEC-2 User's Man, Boss Corp, 1993
Stantech Consultants, 1997

Table
Rating Table for Rectangular Channel

Project Description	
Project File	c:\fmw\ridochut.fm2
Worksheet	ISRB Rectangular Concrete Channel
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data		
Mannings Coefficient	0.014	
Channel Slope	0.001500	ft/ft
Bottom Width	30.00	ft

Input Data	Minimum	Maximum	Increment
Depth	1.00	7.00	0.50 ft

Rating Table

Depth (ft)	Discharge (ft^3/s)
1.00	118.13
1.50	227.47
2.00	360.17
2.50	512.43
3.00	681.47
3.50	865.15
4.00	1061.76
4.50	1269.87
5.00	1488.30
5.50	1716.05
6.00	1952.24
6.50	2196.13
7.00	2447.05

[illegible]

PROJECT: [illegible]

PROJECT No.: [illegible] DATE: [illegible]

PAGE: 1 of [illegible] SCALE:

1. From Drainage Manual Design For [illegible]

Use Equation [illegible] Page F-19

$$\Delta y = \frac{V^2 T}{g r_c}$$

$V = 7.0 \pm$ FPS

$T = 30'$

$g = 32.2$ ft/sec²

$r_c = 45'$

Note: $r_c = 45' < 3T$ recommended

$(r > 3T > 90')$

$$\boxed{\Delta y = 1.01'}$$

The freeboard requirements should be added to the superelevated water surface elevation.

$FB = .25'\left(Y + \frac{V^2}{2g}\right) = 1.5'$

2. [illegible] Hydraulic Design of Flood Control Channels (ASCE, US Army Corps of Engineers [illegible])

Use Equation (2-51) Page [illegible]

$$\Delta y = C\frac{V^2 T}{gr}$$

DESIGNED BY: [illegible] CHECKED BY: [illegible]

SFC

PROJECT:

PROJECT No.:

DATE:

PAGE: 2 of 2

SCALE:

$C = .5$ (Tranquil flow $F < 1$)
$C = 1.0$ (Rapid flow $F > 1$)

USE $C = .5$

$$\Delta y = C\frac{V^2}{2g} = 0.51'$$

The freeboard recommended is 2 ft in rectangular channel.

3. Summary:

FCD & ... : $\Delta y = 1.0'$ and $FB = .5'$

ASCE : $\Delta y = .5'$ and $FB = 2.0'$

Either method is equal vertical distance measured from W.S. to the top of the channel wall.

USE $\Delta y = 1.0'$ and $FB = 1.5'$

DESIGNED BY:

CHECKED BY:

G. BRADY

Drainage Design Manual for Maricopa County, Arizona

Volume II Hydraulics

By
NBS Lowry
Engineers & Planners
and
McLaughlin Water Engineers, Ltd.

for the
Flood Control District
of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009
(602) 506-1501

Curves in a channel cause the maximum flow velocity to shift toward the outside of the bend. Along the outside of the curve, the depth of flow is at a maximum. This rise in the water surface is referred to as superelevation. The shift in the velocity may cause cross-waves to form, which will persist downstream when the flow is *supercritical.* Severe erosion, deposition and reduced channel performance result from severe curvatures in channel alignment. To minimize the effect due to channel bends, channel curvature should only be used where topographic or other conditions necessitate their use. If the flow is *supercritical*, special design criteria may need to be employed to eliminate the downstream effects.

For superelevation under subcritical conditions, the following formula is generally used:

$$\Delta y = V^2 T / g r_c \tag{5.9}$$

The freeboard requirements should be added to the superelevated water surface elevation.

For supercritical flow, the disturbance caused by a bend in the channel persists downstream. Therefore, a detailed hydraulic study must be conducted to determine the effects of the channel curvature on the freeboard requirement. This section includes a discussion of channel curvature.

— *Freeboard:*

Required freeboard is computed according to the following formula:

$$FB = 0.25\,(Y + V^2/2g) \tag{5.10}$$

The minimum freeboard value for rigid channels shall be 1 foot for subcritical and 2 feet for supercritical flows. Using a smaller freeboard in specific cases requires prior approval of the governing agency.

Additional requirements for freeboard may be called for in specific cases where aggradation is substantial during a single flow event and/or superelevation must be taken into consideration.

— *Low Flow Channels:* For channels with grass or earth bottoms, it is recommended that low flow channels (see Figure 5.1, page 5-7) be considered whenever the following condition exists:

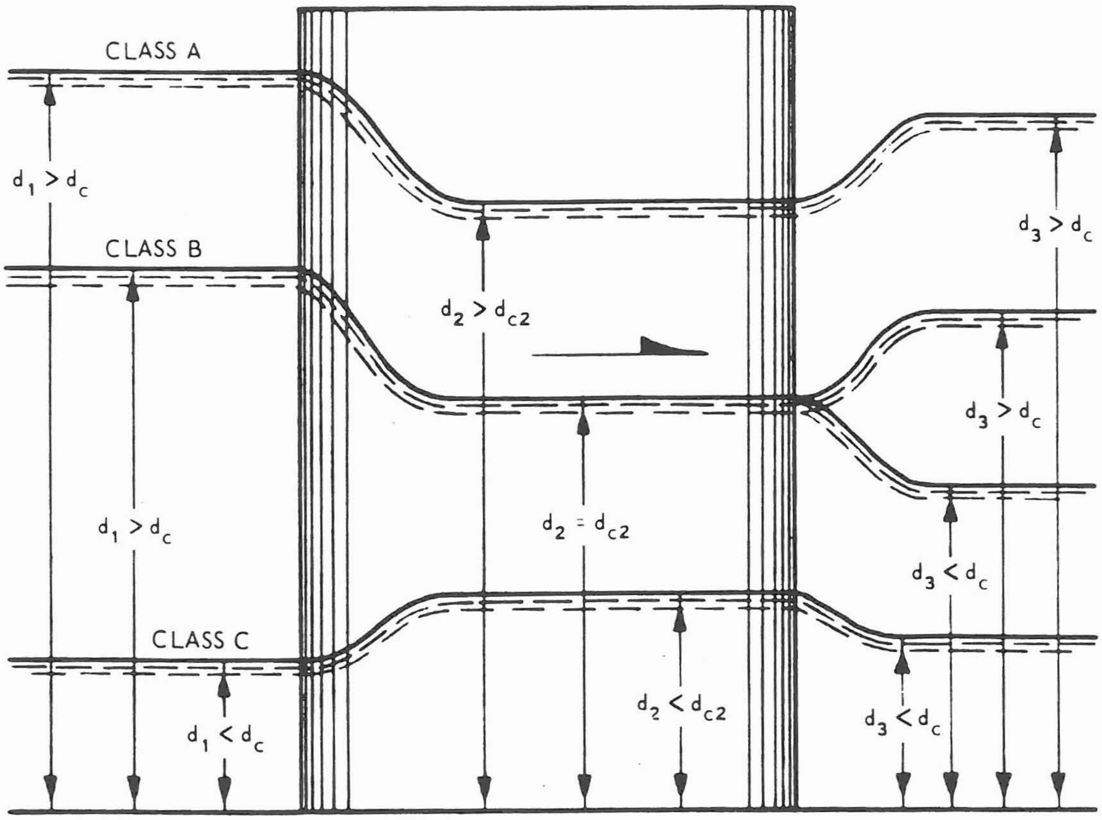
$$b/(VY) \geq 1.40 \tag{5.11}$$

where V and Y are values for the 100-year flood.

The existence of frequent grade control structures may also preclude the requirement for compound channel sections; however, where grade control structures are used in conjunction with low flow channels, the hydraulic structure should be matched to pass flows within the low flow channel.

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 10

HYDRAULIC DESIGN OF



FLOOD CONTROL CHANNELS

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the outside wall and a depression of the surface along the inside wall. This phenomenon is called superelevation. In addition, curved channels tend to create secondary flows (helicoidal motion) that may persist for many channel widths downstream. The shifting of the maximum velocity from the channel centerline may cause a disturbing influence downstream. The latter two phenomena could lead to serious local scour and deposition or poor performance of a downstream structure. There may also be a tendency toward separation near the inner wall, especially for very sharp bends. Because of the complicated nature of curvilinear flow, the amount of channel alignment curvature should be kept to a minimum consistent with other design requirements.

(2) The required amount of superelevation is usually small for the channel size and curvature commonly used in the design of tranquil-flow channels. The main problem in channels designed for rapid flow is standing waves generated in simple curves. These waves not only affect the curved flow region but exist over long distances downstream. The total rise in water surface for rapid flow has been found experimentally to be about twice that for tranquil flow.

(3) Generally, the most economical design for rapid flow in a curved channel results when wave effects are reduced as much as practical and wall heights are kept to a minimum. Channel design for rapid flow usually involves low rates of channel curvature, the use of spiral transitions with circular curves, and consideration of invert banking.

B. Superelevation. The equation for the transverse water-surface slope around a curve can be obtained by balancing outward centrifugal and gravitational forces (Woodward and Posey 1941). If concentric flow is assumed where the mean velocity occurs around the curve, the following equation is obtained:

$$\Delta y = C \frac{V^2 W}{gr} \qquad (2\text{-}31)$$

where Δy = rise in water surface between a theoretical level water surface at the centerline and outside water-surface elevation (superelevation); C = coefficient (see Table 2-4); V = mean channel velocity; W = channel width at elevation of centerline water surface; g = acceleration of gravity; and r = radius of channel centerline curvature.

Use of the coefficient C in Equation 2-31 allows computation of the total rise in water surface due to superelevation and standing waves for the conditions listed in Table 2-4. If the total rise in water surface (superelevation plus surface disturbances) is less than 0.5 ft, the normally determined channel freeboard (paragraph 2-6) should be adequate. No special treatment such as increased wall heights or invert banking and spiral transitions is required.

TABLE 2-4. Superelevation Formula Coefficients

Flow type (1)	Channel cross section (2)	Type of curve (3)	Value of C (4)
Tranquil	Rectangular	Simple circular	0.5
Tranquil	Trapezoidal	Simple circular	0.5
Rapid	Rectangular	Simple circular	1.0
Rapid	Trapezoidal	Simple circular	1.0
Rapid	Rectangular	Spiral transitions	0.5
Rapid	Trapezoidal	Spiral transitions	1.0
Rapid	Rectangular	Spiral banked	0.5

(1) Tranquil flow. The amount of superelevation in tranquil flow around curves is small for the normal channel size and curvature used in design. No special treatment of curves such as spirals or banking is usually necessary. Increasing the wall height on the outside of the curve to contain the superelevation is usually the most economical remedial measure. Wall heights should be increased by Δy over the full length of curvature. Wall heights on the inside of the channel curve should be held to the straight channel height because of wave action on the inside of curves.

(2) Rapid flow. The disturbances caused by rapid flow in simple curves not only affect the flow in the curve, but persist for many channel widths downstream. The cross waves generated at the beginning of a simple curve may be reinforced by other cross waves generated farther downstream. This could happen at the end of the curve or within another curve, provided the upstream and downstream waves are in phase. Wall heights should be increased by the amount of superelevation, not only in the simple curve, but for a considerable distance downstream. A detailed analysis of standing waves in simple curves is given in Ippen (1950). Rapid-flow conditions are improved in curves by the provision of spiral transition curves with or without a banked invert, by dividing walls to reduce the channel width, or by invert sills located in the curve. Both the dividing wall and sill treatments require structures in the flow; these structures create debris problems and, therefore, are not generally used.

a. Spiral transition curves. For channels in which surface disturbances need to be minimized, spiral transition curves should be used. The gradual increase in wall deflection angles of these curves results in minimum be reduced by unaccounted factors. These might include erratic hydrologic phenomena; future development of urban areas; unforeseen embankment settlement; the accumulation of silt, trash, and debris; aquatic or other growth in the channels; and variation of resistance or other coefficients from those assumed in design.

(2) Local regions where water-surface elevations are difficult to determine may require special consideration. Some examples are locations in or near channel curves, hydraulic jumps, bridge piers, transitions and drop structures, major junctions, and local storm inflow structures. As these regions are subject to wave-action uncertainties in water-surface computations and possible overtopping of walls, especially for rapid flow, conservative freeboard allowances should be used. The backwater effect at bridge piers may be especially critical if debris accumulation is a problem.

(3) The amount of freeboard cannot be fixed by a single, widely applicable formula. It depends in large part on the size and shape of channel, type of channel lining, consequences of damage resulting from overtopping, and velocity and depth of flow. The following approximate freeboard allowances are generally considered to be satisfactory: 2 ft in rectangular cross sections and 2.5 ft in trapezoidal sections for concrete-lined channels; 2.5 ft for riprap channels; and 3 ft for earth levees. The freeboard for riprap and earth channels may be reduced somewhat because of the reduced hazard when the top of the riprap or earth channels is below natural ground levels. It is usually economical to vary concrete wall heights by 0.5-ft increments to facilitate reuse of forms on rectangular channels and trapezoidal sections constructed by channel pavers.

(4) Freeboard allowances should be checked by computations or model tests to determine the additional discharge that could be confined within the freeboard allowance. If necessary, adjustments in freeboard should be made along either or both banks to ensure that the freeboard allowance provides the same degree of protection against overtopping along the channel.

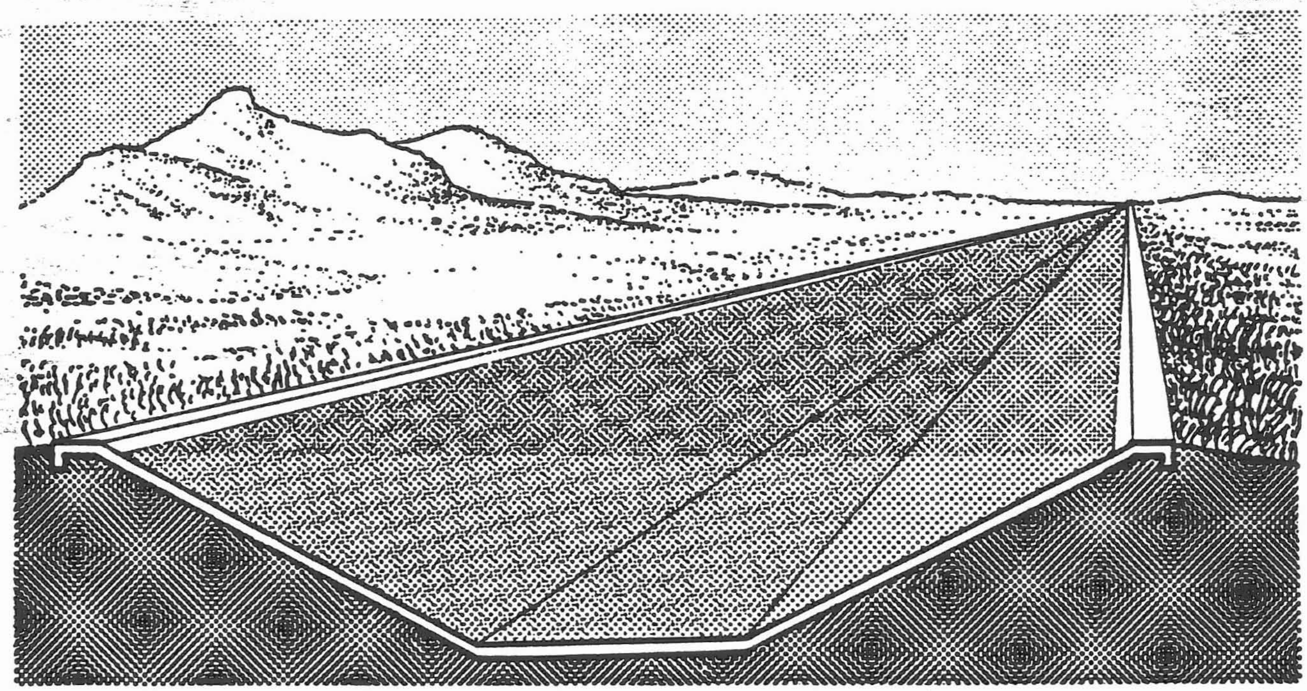
B. Sediment Transport. Flood control channels with tranquil flow usually have protected banks but unprotected inverts. In addition to reasons of economy, it is sometimes desirable to use the channel streambed to percolate water into underground aquifers (USAED, Los Angeles, 1963). The design of a channel with unprotected inverts and protected banks requires the determination of the depth of the bank protection below the invert in regions where bed scour may occur. Levee heights may depend on the amount of sediment that may deposit in the channel. The design of such channels requires estimates of sediment transport to predict channel conditions under given flow and sediment characteristics. The subject of sediment transport in alluvial channels and design of canals has been ably presented by Leliavsky (1955). Fundamental information on bed-load equations and their background with examples of use in channel design is given in Rouse (1950) (see pp. 769–857). An excellent review with an extensive bibliography is available (Chien 1956). This review includes the generally accepted Einstein approach to sediment transport. A comparative treatment of the many bed-load equations (Vanoni, Brooks, and Kennedy 1961) with field data indicates that no one formula is conclusively better than any other and that the accuracy of prediction is about ±100 percent. A recent paper by Colby (1964b) proposes a simple, direct method of empirically correlating bed-load discharge with mean channel velocity at various flow depths and median grain size diameters. This procedure is adopted herein for rough estimates of bed-load movement in flood control channels.

C. Design Curves. Figure 2-27 gives curves of bed-load discharge versus channel velocity for three depths of flow and four sediment sizes. The basic ranges of depths and velocities have been extrapolated and interpolated from the curves presented in Colby (1964a) for use in flood control channel design. Corrections for water temperature and concentration of fine sediment (Colby 1964a) are not included because of their small influence. The curves in Figure 2-27 should be applicable for estimating bed-load discharge in channels having geologic and hydraulic characteristics similar to those in the channels from which the basic data were obtained. The curves in this plate can also be used to estimate the relative effects of a change in channel characteristics on bed-load movement. For example, the effect of a series of check dams or drop structures that are provided to decrease channel slope would be reflected in the hydraulic characteristics by decreasing the channel velocity. The curves could then be used to estimate the decrease in sediment load. The curves can also be used to approximate the equilibrium sediment discharge. If the supply of sediment from upstream sources is less than the sediment discharge computed by the rating curves, the approximate amount of streambed scour can be estimated from the curves. Similarly, deposition will occur if the sediment supply is greater than the sediment discharge indicated by the rating curves. An example of this is a large sediment load from a small side channel that causes deposition in a major flood channel. If the location of sediment deposition is to be controlled, the estimated size of a sediment detention facility can be approximated using the curves. An example of the use of a sediment discharge equation in channel design is given in USAED, Los Angeles (1963).

URBAN HIGHWAYS

CHANNEL LINING DESIGN GUIDELINES

FEBRUARY, 1989



DEPARTMENT OF TRANSPORTATION
DOT
STATE OF ARIZONA

ARIZONA DEPARTMENT OF TRANSPORTATION

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URBAN HIGHWAYS
CHANNEL LINING DESIGN GUIDELINES

Introduction:

This publication is intended as an Executive Summary for channel lining designs. It was prepared to establish design criteria for concrete channel linings for the East Papago/ Hohokam Freeway project. This criteria can also be adopted for similar channel lining designs on other Arizona Department of Transportation (ADOT) projects. The study was conducted by gathering, reviewing and analyzing various published documents from Federal, State, and local agencies which are involved in the design and construction of concrete channel linings. These documents are included in a separate publication titled "Report on Concrete Lined Drainage Channels" dated February, 1989, which also contains this Executive Summary.

Design Criteria:

There are three distinct approaches to the design of channel lining reinforcement for canals and hydraulic drainage structures. Two of these approaches utilize expansion and/or contraction joints with the reinforcement varying from 0.0 to 0.5 percent depending on joint spacing. The third approach utilizes no joints with continuous reinforcing varying from 0.3 to 0.4 percent depending on climatic conditions. The design criteria of most agencies reviewed fall within one or more of these approaches and the resulting linings have performed satisfactorily for the most part.

The following items were considered in reaching the conclusion that a continuously reinforced lining without joints will provide the most cost-effective and serviceable channel lining:

- Review of lining performance relative to minimal cracking in continuously reinforced channels;
- Reported and observed maintenance problems of weeds growing in unsealed joints;
- High maintenance cost of replacing damaged joints;
- Moderate difference in construction cost between continuous versus discontinuous reinforcement;
- Potential local compressive buckling of lining due to open joints being filled with incompressible material;
- Potential infiltration of water through open expansion or contraction joints into moisture sensitive soils.

A 0.3 percent longitudinal reinforcement for a moderate climate was found reasonable for adoption to the Phoenix area, (it is performing well on the U.S. Army Corps of Engineers (Corps) Arizona Canal Diversion Channel). A minimum 0.2 percent transverse reinforcement for moderate climates is also considered reasonable for narrow to medium width channels up to 70 feet wide. For wider channels, it is considered realistic to increase the percentage based on the subgrade drag method to a maximum of 0.3 percent.

The criteria for the channel invert lining thickness follows two basic approaches and relates either to velocity or the presence of corrosive materials in the channel bed. Review of collected data indicates that the current general practice for establishing base slab thickness for channels without corrosive material follows closely the U.S. Soil Conservation Service (SCS) nomograph for thickness versus water velocity and it is concluded that bottom lining thickness should be based on this criteria. The minimum thickness, however, is dictated by two considerations--reinforcing clearance, and access for maintenance vehicles. Based on the support capacity of the stabilized moisture sensitive soils, a minimum thickness of 6 inches is required for maintenance vehicle access. A minimum 3-inch clearance for corrosion protection limits the minimum lining thickness to 6 inches for tied reinforcement and 5 inches for flat mesh.

Special consideration of thickness needs on a site specific basis will be required for unusual hydraulic and soil conditions. Energy dispators and extreme breaks in grade will require special design to ensure that lining thickness can resist potential negative pressures. Areas of collapsing or expansive soils require evaluation of thickness in conjunction with subgrade treatment to ensure a serviceable lining.

Slope paving thickness criteria (excluding SCS) generally approximates 80 percent of bottom thickness and is considered a reasonable approach. The limitations on minimum thickness for reinforcement and vehicle access applies to slope paving as well as bottom thickness. It was found that slope paving has even been placed vertically in transition areas, but it is the general consensus that a 1.5:1 maximum slope is more reasonable for maintenance of a quality product. In no circumstance should the slope exceed the soils angle of repose without being formed and designed as a retaining wall. In keeping with a continuously reinforced lining, it is concluded that transitions from trapezoidal channels to rectangular cross-sections should be accomplished without warped slope paving which the Corps is using on the ACDC (Figure 1).

A review of concrete qualities in the various standards indicates a wide range of values but with a general need for shrinkage and crack control. Concrete mix designs will be required which achieve a low drying shrinkage, while also maintaining strength requirements and constructibility.

A review of soil conditions in the Phoenix area indicates the area is well suited for construction of concrete lined channels. Most areas will require only a scarification and recompaction of surface soils without pressure relief. Minor areas of moisture sensitive collapsing or expansive soils will require partial or total removal and replacement with compacted fill based upon a site specific evaluation. Pressure relief and seepage barrier requirements in these moisture sensitive areas will also require special consideration.

The method of pressure relief on channel lining has generally been gravel pockets with weep holes. Problems with silting have been identified which create a maintenance requirement. Use of pressure relief flap valves in conjunction with geocomposite drainage strips is considered a better solution than weep holes. The need for pressure relief will require evaluation on a site specific basis not only for soil condition but for potential groundwater infiltration from heavy irrigation and special conditions such as parallel or crossing utilities.

The use of transverse cutoff walls has generally been eliminated from most design criteria (except at the start and end of a lining), and are not considered to be needed for elimination of seepage or progressive failure. A need does exist for transverse stiffening or stabilizing walls in continuously reinforced linings at movement sensitive structures and where unbalanced compressive forces may occur.

General details were reviewed to reduce construction and maintenance problems. Top of slope paving cutoff walls are a general practice and are needed to eliminate erosion and ground water seepage. A vertical wall set back from the top of slope sufficiently to allow machine trenching provides easier construction. A 2 percent cross slope to one side of the channel bottom (a minimum slope of 6 inches is recommended) provides a means to transport sediment during low flows. Access ramps should be located on the high side of the channel and slope downstream where possible to reduce hydraulic disturbance and sediment buildup. O-Gee control structures should be constructed with sufficient open area at the channel floor to allow flushing of sediment during low flows.

Recommendations:

We recommend the following "Design Guidelines for Concrete Lined Drainage Channels":

1. Channel lining shall be continuously reinforced without expansion or tooled joints except as follows. Construction joints shall be located at the end of a day's pour or when concrete placement stops for more than 45 minutes and between longitudinal paving strips. Longitudinal construction joints shall be located 1-foot up the side slope and in the bottom slab as dictated by channel width but not within the low flow section. Reinforcing steel shall be continuous through lining construction joints and through joints with box culverts and other hydraulic structures.

2. Reinforcing steel shall be Grade 60 or flat sheet welded wire fabric and have the following percentage ratios (p) of reinforcement to cross section area of concrete.

Longitudinal Reinforcement: p = 0.30%

Transverse Reinforcement:

Channel Width*	p
less than 70 feet	0.20%
70 to 90 feet	0.25%
more than 90 feet	0.30%

*Total width including side slopes

Reinforcing steel shall have a minimum 3-inch clearance to grade and a maximum size of #4 for 6 inch lining thickness.

3. Minimum lining thickness for trapezoidal channels shall be:

Bottom Slab

Mean Water Velocity (fps)	Thickness (inches)
less than 10	5*
10 to 15	6
15 to 20	7
more than 20	8

OUR VELOC IS LESS THAN 10 f/s, BUT VEH TRAFFIC REQUIRES MIN. OF 6"

Side Slopes

Mean Water Velocity (fps)	Thickness (inches)
less than 15	5*
15 to 20	5 1/2
more than 20	6

NOT APPLICABLE — RETAINING WALL DESIGN REQ'D

*Minimum slab thickness of 6 inches is required for use of tied reinforcement and in channels wide enough to accommodate maintenance vehicles.

Lining thickness and channel profile shall be investigated on a site specific basis where negative pressures might occur such as a change from a light to a steeper slope per Corps manual EM 1110-2-1602 and 1603.

Lining thickness and reinforcement shall be investigated on a site specific basis in conjunction with subsoil treatment where collapsing or expansive soils occur.

4. Side slopes on main channels should not exceed 1.5 horizontal to 1.0 vertical or the recommended maximum safe cut slope (Table 2) and preferably should not exceed 2.0 to 1.0.

   If side slopes which are steeper than the recommended safe cut slope are used for warped transitions, lining shall be designed as retaining walls for lateral earth pressures listed in Table 2.

5. Sealed vertical expansion joints shall be provided at bridge piers and abutments.

6. Transverse cutoff or stiffening walls which are rigidly attached to the paving shall be installed in the following locations:

   a. At the beginning and end of concrete lining unless terminating in a movement stable structure.

   b. Where new lining abuts an existing concrete lining that is not designed with continuous reinforcement. A transverse sealed expansion joint should be provided between new and existing linings.

   c. At the upstream or start of a transition section to widen the channel.

   d. At breaks in channel profile where the increase in slope exceeds 0.5 degree or 0.009 ft./ft.

   e. Immediately upstream and downstream of movement sensitive structures such as intersecting drainage channels. This shall be evaluated on a project specific basis.

7. Continuous 12-inch deep vertical cutoff walls with a top elevation 6-inches below natural grade shall be provided at the top of side slopes 2 foot back of the top of slope. The 2 foot horizontal section shall have a 2 percent slope toward the channel. Cutoff walls shall be increased to 24-inches deep where substantial flows occur.

8. Bottom lining shall have a cross slope to one side of 2 percent with a minimum of 6 inches of slope.

9. Access ramps shall be located upstream and downstream of box culverts and other hydraulic structures that will not allow vehicular access. Ramps should be located on the high side of the channel invert and slope in a downstream direction where possible.

10. Transitions from a trapezoidal cross section to a rectangular cross section should be made with a varying height vertical retaining wall (Figure 1) instead of warped side slopes. The retaining walls are to be designed for earth pressures listed in Table 2.

11. O-Gee control structures should be constructed with a 30 to 50 percent opening at the base slab for flushing.

12. Subgrade treatment shall be on a site specific basis in accordance with recommendations for the five typical subsurface profile cases in Table 1 and shall result in a minimum Modulus of Subgrade Reaction of 200 pci. Detailed discussions of subsurface profile cases and recommendations are found in Appendix A of the East Papago/Hohokam Freeway "Design Guidelines for Concrete Lined Drainage Channels."

13. Pressure relief of channel linings shall be accomplished with geotextile or geocomposite drainage strips and 4" diameter PVC weepholes through the lining in accordance with recommendations for the five subsurface profile cases in Table 1. Weepholes should be located 1-foot vertically above channel bottom and slope down 3" from back to face of lining. Plastic flap type relief valves should be considered if available and a workable detail can be developed.

    Project and site specific evaluation will be required based on subsurface investigations, potential future changes in ground water levels, where structural back fill occurs adjacent to channel, and at parallel or crossing utilities.

14. Concrete strengths, mix design and drying shrinkage evaluation shall be in accordance with recommendations in Table 3. Detailed recommendations for concrete design mix and shrinkage criteria are found in Appendix A of the East Papago/Hohokam Freeway "Design Guidelines for Concrete Lined Drainage Channels."

TABLE 1

RECOMMENDED SUBGRADE TREATMENT, DRAINAGE & PRESSURE RELIEF PROCEDURES FOR THE FIVE TYPICAL SUBSURFACE PROFILES IN THE GREATER PHOENIX AREA

Subsurface Profile Case	Description	Subgrade Treatment	Drainage & Pressure Relief
1	Clean sands or sands & gravels	• No special treatment required	
		• Scarification & recompaction of surface soils	• Pressure relief not required unless potential exists for groundwater to rise above canal bottom
2	Cemented desert alluvium	• No special treatment required	
		• Scarification & recompaction of surface soils	• Low risk of water accumulation: Pressure relief not required
			• High risk of water accumulation: ex: Extended flow periods adjacent water/sewer lines, heavy landscaping, potential groundwater rise
			Geocomposite drainage strips with pressure relief weepholes
3	Moisture sensitive soils over poorly drained cemented desert alluvium	• <u>Collapsing soils</u>	• Low risk of water accumulation: Pressure relief not required
		• 4-feet thick: partial over-excavation, wetting, vibratory compaction & replacement with compacted fill	• High risk of water accumulation: ex: Extended flow periods adjacent water/sewer lines, heavy landscaping, potential groundwater rise
		• Full removal & replacement with compacted fill	• Geocomposite drainage strips with pressure relief weepholes

TABLE 1 (Continued)

RECOMMENDED SUBGRADE TREATMENT, DRAINAGE & PRESSURE RELIEF PROCEDURES FOR THE FIVE TYPICAL SUBSURFACE PROFILES IN THE GREATER PHOENIX AREA

Subsurface Profile Case	Description	Subgrade Treatment	Drainage & Pressure Relief
3 (continued)		• Expansive Soils	• Low risk of water accumulation: Pressure relief not required
		• Partial or total removal & replacement with compacted fill	• High risk of water accumulation: ex: Extended flow periods adjacent water/sewer lines, heavy landscaping, potential groundwater rise
		• Geomembrane underliner as seepage barrier	• Geocomposite drainage strips with pressure relief weepholes
4	Moisture sensitive soils over free draining granular stata	• Collapsing soils	• Pressure relief not required unless potential exists for groundwater to rise above canal bottom
		• 4-feet thick: partial over-excavation, wetting, vibratory compaction & replacement with compacted fill	
		• Full removal & replacement with compacted fill	
		• Expansive soils	
		• Partial or total removal & replacement with compacted fill	
		• Geomembrane underliner as seepage barrier	

TABLE 1 (Continued)

RECOMMENDED SUBGRADE TREATMENT, DRAINAGE & PRESSURE RELIEF PROCEDURES FOR THE FIVE TYPICAL SUBSURFACE PROFILES IN THE GREATER PHOENIX AREA

Subsurface Profile Case	Description	Subgrade Treatment	Drainage & Pressure Relief
5	Expansive clays throughout profile	• Overexcavate & replace with nonexpansive compacted fill; depth of overexcavation as required to limit potential expansion to tolerable limits	• Low risk of water accumulation: Pressure relief not required
			• High risk of water accumulation: ex: Extended flow periods adjacent water/sewer lines, heavy landscaping, potential groundwater rise
		• Geomembrane underliner as seepage barrier	• Geocomposite drainage strips with pressure relief weepholes

Note: Methodology for design of geocomposite drainage systems can be found in "Designing for Flow:", R.M. Koerner, Civil Engineering, Volume 56, No. 10, October 1986, and "Designing with Geosynthetics", R.M. Koerner, Prentice Hall International, New Jersey, 1986

TABLE 2

RECOMMENDED ENGINEERING DESIGN PARAMETERS FOR SUBSURFACE CONDITIONS 1 THROUGH 5

		*Slopes		Modules of Subgrade Reaction, pcl		Lateral Earth Pressures Against Retaining Walls "Active" B, deg.				"At Rest" B, deg.			
Case	Subsurface Conditions	Cut	Fill	Dry	Wet	0	10	20	30	0	10	20	30
1	Clean sand or sand & gravel	2:1	2:1	600	600	30	31	37	56	50	52	61	93
2	Moderately to strongly cemented alluvial soils	1:1	1:1	750	600	30	31	37	56	50	52	61	93
3	Moisture sensitive (collapsing or expansive soils over cemented alluvium)	1:1	1:1	200	100	30	31	37	56	50	52	61	93
4	Moisture sensitive (collapsing or expansive) soils over granular free-draining soils	2:1	2:1	200	100	30	31	37	56	50	52	61	93
5	Medium to highly expansive clays throughout entire profile	1:1	1:1	600	400	30	31	37	56	50	52	61	93

*Notes:

1. Recommended slope ratios are horizontal to vertical. Slopes are maxiumum safe slopes. In most cases, slopes will be controlled by construction considerations and will be no steeper than 1.5:1.

2. Moduli of subgrade reaction for Cases 3, 4 and 5 for wet conditions are based on the moisture sensitive soils not being stabilized or replaced with structural fill. Values for dry conditions for these cases apply to stabilized moisture sensitive soils or structural fills.

3. "Active" case for lateral earth pressures applied to conditions in which the retaining wall is free to move at the top. The "at rest" case applies where walls are restrained from movement at the top. The angle B refers to the slope angle of the backfill from the horizontal.

TABLE 3

RECOMMENDED GUIDELINES FOR CONCRETE DESIGN MIX & EVALUATION OF DRYING SHRINKAGE

DESIGN MIX

- Design mix should meet the general specification requirements of ADOT 1006-3.

Strength

- Compressive strength should be 3,000 psi at 28 days.

Aggregates

- Aggregates should meet minimum requirements of ADOT Standard Specification 1006-3. Coarse aggregate should be size 57. Coarse aggregate should have a minimum of 75 percent crushed faces.

Mineral Filler

- Ninety (90) pounds of fly ash Class F (ASTM C618) shall be used as a mineral filler. Loss on ignition should be a maximum of 3.0 percent. Fly ash should not be considered as a replacement for cement. Fly ash should have an R factor less than 2.5. The R factor is defined as (C-5%)/F, where C is the calcium oxide content expressed as a percentage and F is the ferric oxide content expressed as a percentage. The R factor requirement may be waived if the contractor furnishes documented test results that the soil in contact with the Portland Cement concrete contains less than 0.10 percent water soluble sulfate, (as SO_4) and/or the water in contact with the Portland Cement concrete contains less than 150 milligrams per liter sulfate (as SO_4). The tests for sulfates should be performed in accordance with the requirements of California Department of Transportation Test Method No. 417. Calcium and ferric oxide content should be determined in accordance with the requirements of ASTM C311

Chemical Admixtures

- Should meet the requirements of ADOT 1006-2.04.

Water

- Should meet the requirements of ADOT 1006-2.02.

Cement

- Should be Portland Cement Type II, meeting the requirements of ASTM C150.

Slump

- Maximum 4 inches (AASHTO T119).

Air Content

- 5 plus or minus 2 percent by volume (AASHTO T-152).

TABLE 3 (Continued)

RECOMMENDED GUIDELINES FOR CONCRETE DESIGN MIX & EVALUATION OF DRYING SHRINKAGE

Curing

- Should meet the requirements of ADOT 1006-6 A.
- Subgrade shall be moistened and free of excess standing water prior to placement of concrete.

Hot Weather Concreting

- Should meet the requirements of ADOT 1006-5.02.

Minimum Cement Content

- Not applicable.

DRYING SHRINKAGE EVALUATION

Mortar Shrinkage Tests

- ASTM C157, "Length Change of Hardened Cement Mortar and Concrete," testing should be performed on the cement proposed for the project design concrete mix. If other than previously approved Type II cement is proposed, the shrinkage of the cement should be equal to or less than the value obtained in the control specimens made from previously approved cements which result in the lowest practicable shrinkage.

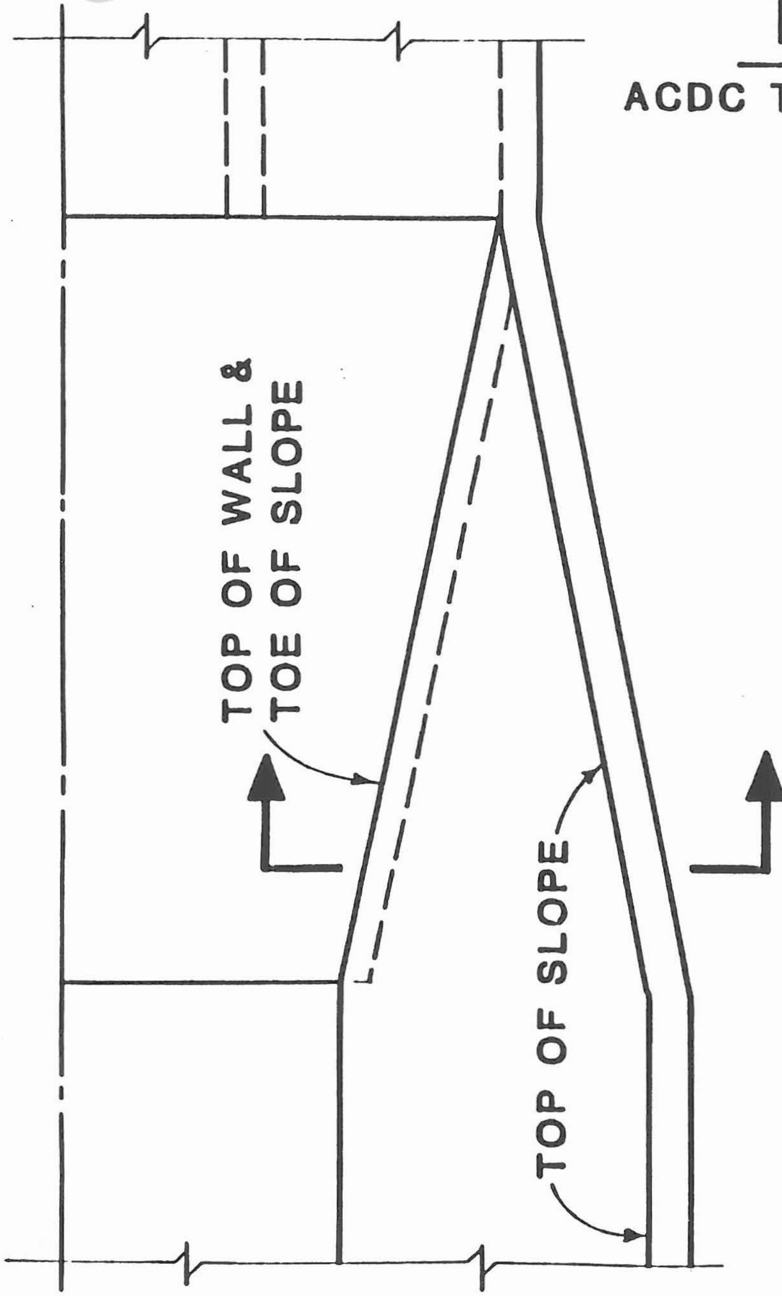
Field Shrinkage Tests

- Test panels should be prepared with the proposed concrete design mix for the purpose of evaluating drying shrinkage properties. Test panels should be made in accordance with the Kraai Method outlined in Concrete Construction, Volume 30, No. 9, September, 1985, 9 pp. 775-788. Test panels shall be 2 by 3 feet in plan dimension and 2 inches in thickness.
- The Control Test Panel should be made from an established reference mix design. Locally produced Salt River aggregate should be used. Minimum compressive strength should be 3,000 psi at 28 days. Fly ash, as a pozzolanic material, should be utilized as a mineral filler at a maximum of 90 pounds per cubic yard of concrete. A water reducing admixture should be used meeting the requirements of ADOT 1006-2.04.

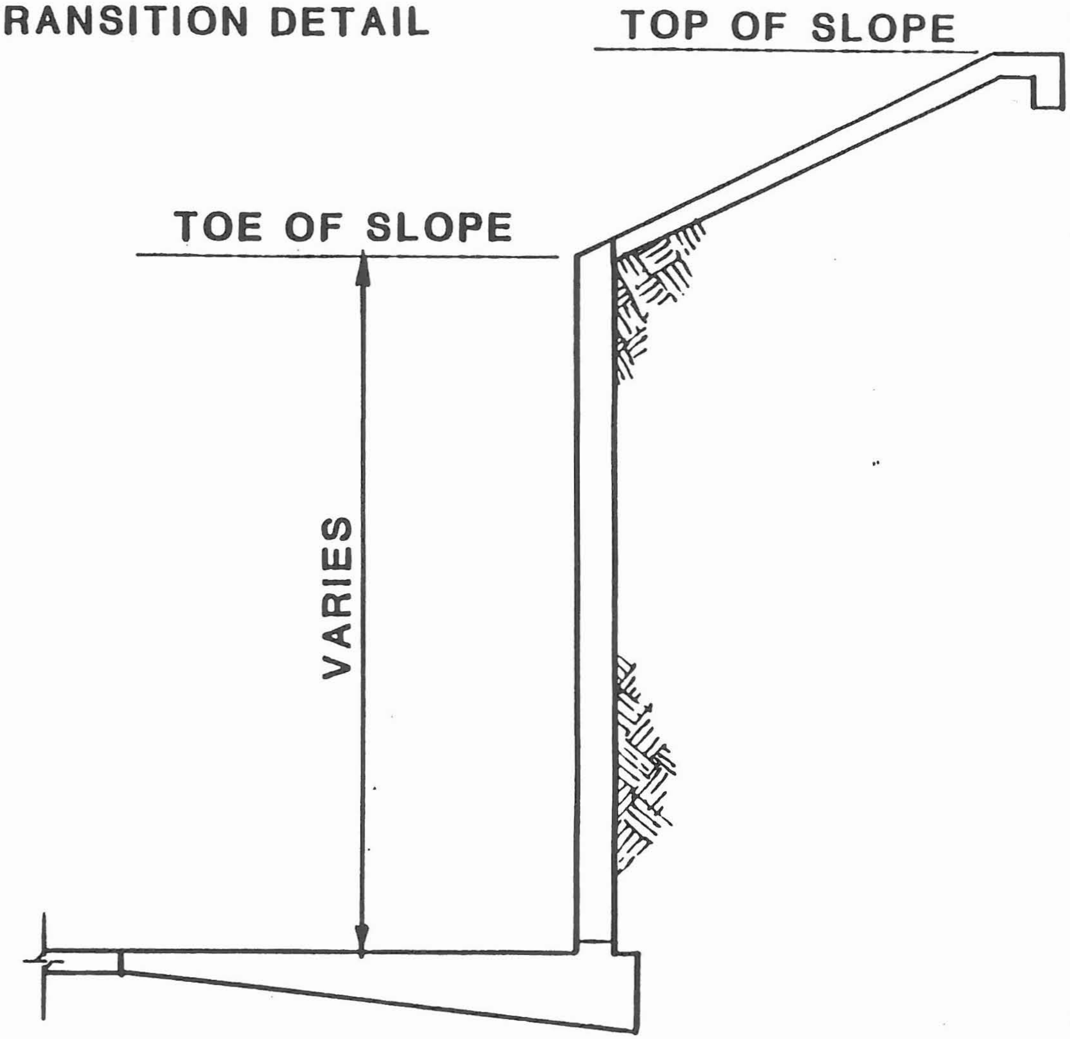
  The project design mix acceptance should have an equal or reduced number and size of shrinkage cracking as compared to the Control Mix Test Panel.

FIGURE 1

ACDC TRANSITION DETAIL



PLAN



SECTION A-A

DESIGN GUIDELINES FOR
CONCRETE LINED DRAINAGE
CHANNELS

DMJM

OLD LITCHFIELD ROAD INLET TRANSITION
HYDRAULIC CALCULATIONS

DRAFT DESIGN REPORT
JULY 1997

RIO OVERCHUTE

PROJECT: OLD LITCHFIELD RD INLET

PROJECT No.: 202101 DATE: 7/19/96

 SCALE:

DETERMINE STONE SIZE:

ASSUMED HYDRAULIC PROPERTIES:

$Q = 460$ CFS (MAX)

$d = 1.17'$ } SEE INLET HYDRAULIC CALCS.
$L = 152'$

$$\text{AVE VELOCITY} = \frac{Q}{A} = \frac{460\ \text{CFS}}{(152')(1.17')} = 2.59\ \text{FPS}$$

USE THE BASIC EQUATION FOR THE REPRESENTATIVE STONE SIZE (ASCE PRESS COPIES INCLUDED)

$$D_{30} = S_f C_s C_v C_T d \left[\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{1/2} \frac{V}{(K_1 g d)^{1/2}} \right]^{2.5}$$

ASSUMED LOCAL QUARRY HAS ROCK WEIGHING 165 PCF AND CAN PRODUCE THE 12-, 15-, 18-IN D_{100}(MAX) GRADATIONS SHOWN IN TABLE 3-1 (SEE REF. COPIES INCLUDED)

USE:

S_f = SAFETY FACTOR = 1.1

C_s = STABILITY COEFFICIENT FOR INCIPIENT FAILURE = 0.30

C_v = VERTICAL VELOCITY DISTRIBUTION COEFFICIENT = 1.25

C_T = THICKNESS COEFFICIENT = 1.0

DESIGNED BY: HM CHECKED BY: [signature]

RIP OVERCHUTE

PROJECT: OLD LITCHFIELD RD INLET

PROJECT No.: 203101 DATE: 7/19/96

PAGE: 2 OF 3 SCALE:

SFC

d = DEPTH OF FLOW $= 1.17'$

γ_w = UNIT WEIGTH OF WATER $= 62.4$ PCF

γ_s = UNIT WEIGTH OF STONE $= 165$ PCF

V = AVERAGE VELOCITY $= 2.59$ FPS

$$K_1 = \left[1 - \frac{\sin^2\theta}{\sin^2\phi}\right]^{1/2}$$

SAY MAX $\theta = 0° \Rightarrow K_1 = 1$

$g = 32.2$ ft/sec^2

$\therefore D_{30} = 0.03'$

FROM TABLE 3-1 (SEE OUTLET TRANSITION RIPRAP DESIGN CALCS), THE 12-IN D_{100} (MAX) GRADATION IS THE MINIMUM AVAILABLE GRADATION THAT HAS $D_{30}(MIN) \geq 0.03'$

(D_{30}: RIPRAP SIZE OF WHICH 30% IS FINER BY WEIGTH)

THICKNESS OF RIPRAP:

$T = 1.5(D_{100}) = 1.5(12'') = 18''$ THICKNESS.

INLET CUTOFF WALL:

From ASCE PRESS Fig 3-1 Page 45 (SEE REF COPIES INCL)

DESIGNED BY: HVM CHECKED BY: [signature]

RIP-OVERCHUTE

PROJECT: OLD LITCHFIELD INLET

PROJECT No.: 120201 DATE: 7/19/96

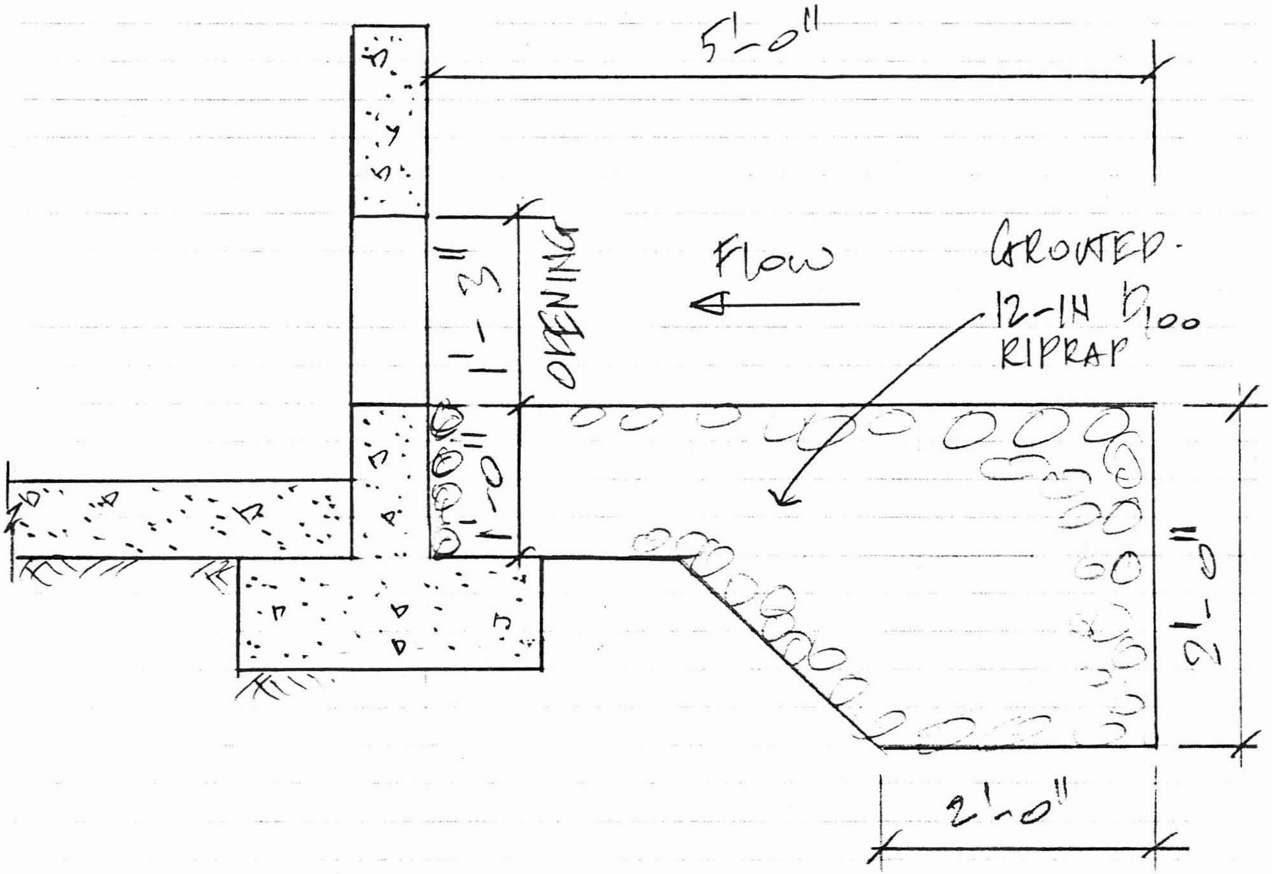
PAGE: 3 OF 3 SCALE:

$h = 2T = 2 \times 18'' = 36''$

$w = 3T = 3 \times 18'' = 54''$

SUMMARY:

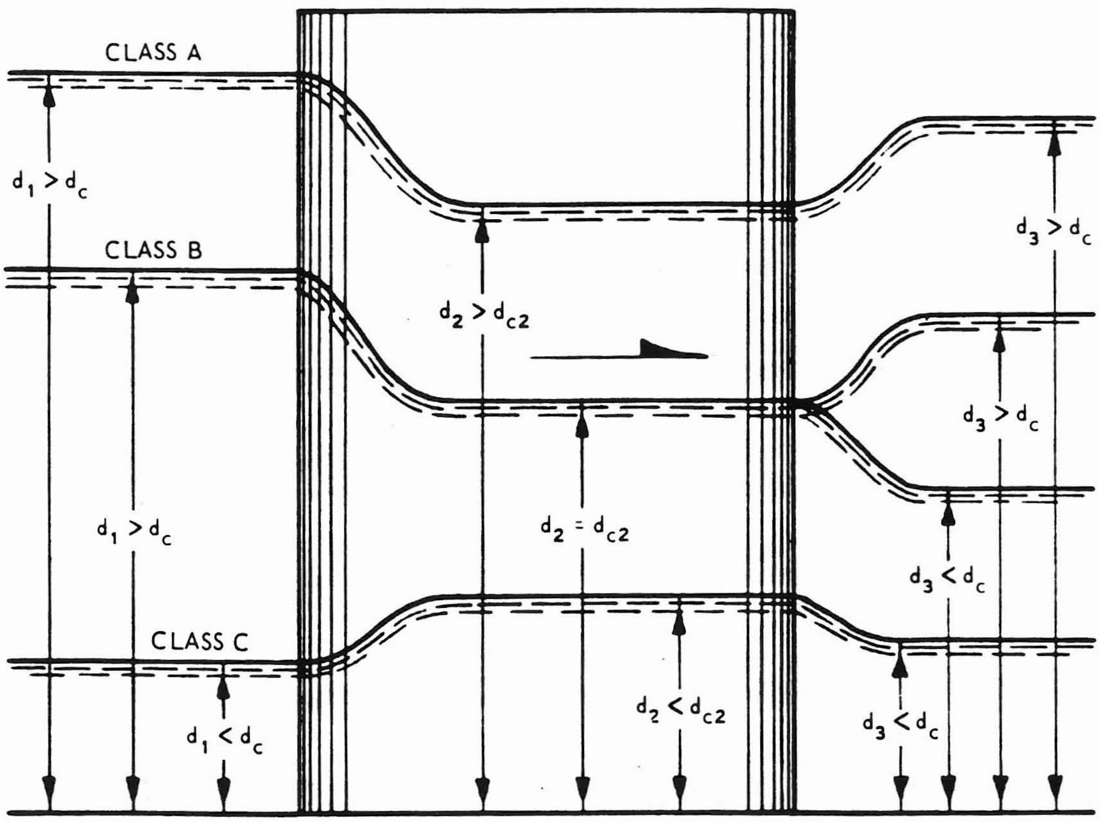
THE PROPOSED WIDTH OF RIPRAP PROTECTION APPROX 5'-0" WIDE FOR PRACTICAL RIPRAP PLACEMENT USE MINIMUM 12" THICKNESS.



DESIGNED BY: [illegible] CHECKED BY: [signature]

TECHNICAL ENGINEERING AND DESIGN GUIDES
AS ADAPTED FROM THE
US ARMY CORPS OF ENGINEERS, NO. 10

HYDRAULIC DESIGN OF



FLOOD CONTROL CHANNELS

AMERICAN SOCIETY OF CIVIL ENGINEERS

ASCE PRESS

A. Velocity Estimation. The characteristic velocity for side slopes V_{SS} is the depth-averaged local velocity over the slope at a point 20 percent of the slope length from the toe of slope. Figure 3-3 presents the ratio V_{SS}/V_{AVG} where V_{AVG} is the average channel velocity at the upstream end of the bend as a function of the channel geometry, which is described by R/W, where R is the centerline radius of bend and W is the water-surface width. For straight channels sufficiently far (>5W) from upstream bends, large values of R/W should be used, resulting in constant values of V_{SS}/V_{AVG}. Figure 3-4 describes V_{SS} and Figure 3-5 shows the location in a trapezoidal channel bend of the maximum V_{SS}. Figure 3-6 shows the variation in velocity over the side slope in a channel bend. Figures 3-5 and 3-6 are presented to illustrate concepts; the designer should consider the specific geometry. Other parameters, such as side slope angle, ratio of bed and bank roughness, and aspect ratio (channel width/depth), are probably important in defining V_{SS}/V_{AVG}, but data do not exist to define these effects. For equal cross-sectional areas, steep side slopes tend to move the maximum velocities away from the side slope whereas mild side slop allow the maximum velocities to occur over the sic slope. An alternate means of velocity estimation base on field observation is discussed in Appendix G. Th alpha method (Appendix C), or velocities resulting fror subsections of a water-surface profile computation, shoul be used only in straight reaches. When the alpha metho is used, velocity from the subsection adjacent to the ban subsection should be used as V_{SS} in design of ban riprap.

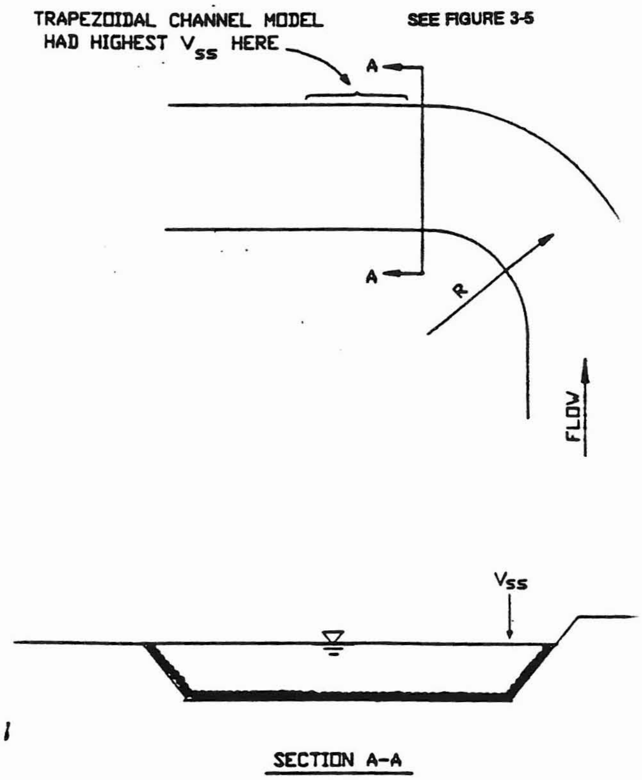
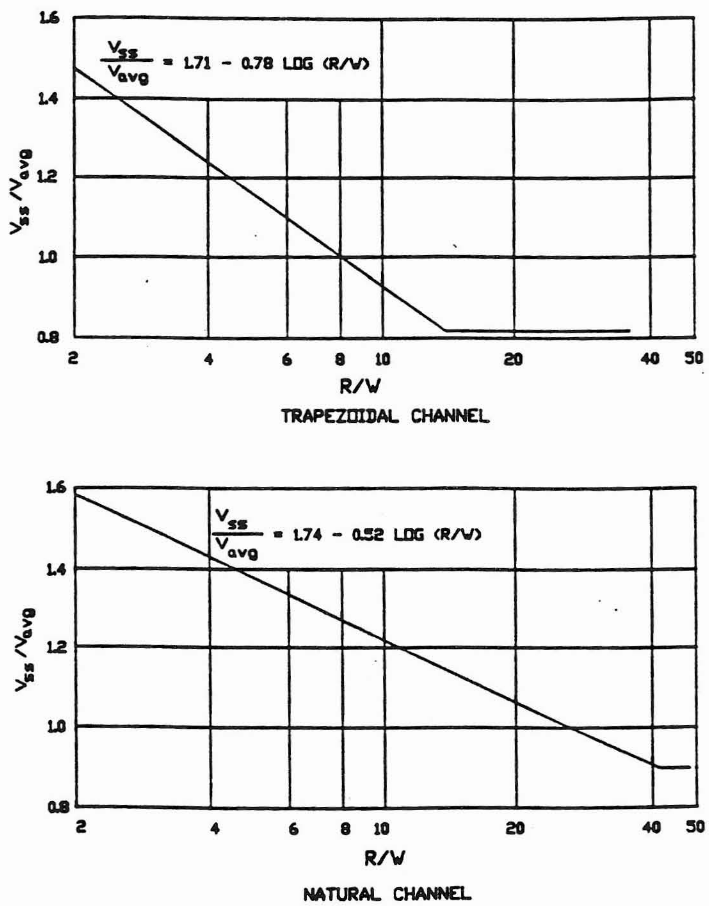


FIG. 3-4. Parameters Used in Stone Size Calculation



NOTE: V_{SS} IS DEPTH-AVERAGED VELOCITY AT 20 PERCENT OF SLOPE LENGTH UP FROM TOE

FIG. 3-3. Riprap Design Velocities

B. Stone Size Relations. The basic equc tion for the representative stone size in straight or curvec channels is:

$$D_{30} = S_f C_s C_V C_T d \left[\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{1/2} \frac{V}{\sqrt{K_1 g d}} \right]^{2.5} \qquad (3\text{-}3)$$

where D_{30} = riprap size of which 30 percent is finer by weight, length; S_f = safety factor (see c); C_s = stability coefficient for incipient failure, thickness = 1D_{100}(max) or $1.5D_{50}$(max), whichever is greater, D_{85}/D_{15} = 1.7 to 5.2 = 0.30 for angular rock = 0.36 for rounded rock; C_V = vertical velocity distribution coefficient = 1.0 for straight channels, inside of bends = 1.283 – 0.2 log (R/W), outside of bends (1 for (R/W) > 26) = 1.25, downstream of concrete channels = 1.25, ends of dikes; C_T = thickness coefficient [see D.(1)]; d = local depth of flow, length; γ_w = unit weight of water, weight/volume; V = local average velocity, usually V_{SS}, length/time; K_1 = side slope correction factor [see D.(1)]; and g = gravitational constant, length/time^2. This equation can be used with either SI (metric) or non-SI units.

C. Safety Factor. Equation 3-3 gives a rock size that should be increased to resist hydrodynamic and a variety of nonhydrodynamic imposed forces and/or uncontrollable physical conditions. The size increase can best be accomplished by including the safety factor, which will be a value greater than unity. The basic safety factor is S_f = 1.1. The basic safety factor may have to be increased in consideration for the following conditions:

(1) Imposed impact forces resulting from logs, uprooted trees, loose vessels, ice, and other types of large floating debris. Impact will produce more damage to a lighter weight riprap section than to a heavier section. For moderate debris impact, it is unlikely that an added safety factor should be used when the blanket thickness exceeds 15 in.

(2) The basic stone sizing parameters of velocity, unit weight of rock, and depth need to be determined as accurately as possible. A safety factor should be included to compensate for small inaccuracies in these parameters. If conservative estimates of these parameters are used in the analysis, the added safety factor should not be used. The safety factor should be based on the anticipated error in the values used. The following discussion shows the importance of obtaining nearly correct values rather than relying on a safety factor to correct inaccurate or assumed stone sizing parameters. The average velocity over the toe of the riprap is an estimate at best and is the parameter to which the rock size is the most sensitive. A check of the sensitivity will show that a 10 percent change in velocity will result in a nearly 100 percent change in the weight limits of the riprap gradation (based on a sphere) and about a 30 percent change in the riprap thickness. The riprap size is also quite sensitive to the unit weight of the rock to be used: a 10 percent change in the unit weight will result in a 70 percent change in the weight limits of the riprap gradation (based on a sphere) and about a 20 percent change in the riprap thickness. The natural variability of unit weight of stone from a stone source adds to the uncertainty (EM 1110-2-2302). The rock size is nearly as sensitive to the depth parameter.

(3) Vandalism and/or theft of the stones serious problem in urban areas where small riprap been placed. A W_{50}(min) of 80 lb should help pre theft and vandalism. Sometimes grouted stone is u around vandalism prone areas.

(4) The completed revetment will contain sc pockets of undersized rocks, no matter how much e is devoted to obtaining a well-mixed gradation throu out the revetment. This placement problem can be sumed to occur on any riprap job to some degree probably more frequently on jobs that require stock ing or additional handling. A larger safety factor shc be considered with stockpiling or additional haul and where placement will be difficult if quality con cannot be expected to address these problems.

(5) The safety factor should be increased wh severe freeze-thaw is anticipated. The safety factor ba on each of these considerations should be consider separately and then the largest of these values should used in Equation 3-3.

D. Applications.

(1) The outer bank of straight channels dow stream of bends should be designed using velociti computed for the bend. In projects where the cost riprap is high, a channel model to indicate locations high velocity might be justified. These coefficients a applicable to a thickness of $1D_{100}$(max). Equation 3 has been developed into Figure 3-7, which is applicab to thicknesses equal to $1D_{100}$(max), γ_s of 165 pcf, ar the basic S_f of 1.1. Figure 3-8 is used to correct f values of other than γ_s of 165 pcf (when D_{30} is dete mined from Figure 3-7). The K_1 side slope factor normally defined by the relationship of Carter, Carlso and Lane (1953):

$$K_1 = \sqrt{1 - \frac{\sin^2\theta}{\sin^2\phi}} \qquad (3\text{-}4)$$

where θ = angle of side slope with horizontal; and ϕ angle of repose of riprap material (normally 40 deg).

Results given in Maynord (1988) show Equatio 3-4 to be conservative and that the repose angle is nc a constant 40 deg but varies with several factors. The recommended relationship for K_1 as a function of θ i given in Figure 3-9 along with Equation 3-4 using ϕ = 40 deg. Also shown on Figure 3-9 is the correction fo side slope when D_{30} is determined from Figure 3-7 the ends of the revetment should be enlarged, as shown in Figure 3-11. The dimensions *a* and *b* should be 3 and 2 times the layer thickness, respectively. The decision to terminate the revetment in erosive velocities should be made with caution since severe erosion can cause the revetment to fail by progressive flanking.

C. Length. Riprap revetment is frequently carried too far upstream and not far enough downstream of a channel bend. In a trapezoidal channel, the maximum velocities along the outer bank are often located in the straight reach immediately downstream of the bend for relatively large distances downstream. In a natural channel, the limit of protection on the downstream end should depend on where the flow crosses to the opposite bank, and should consider future bar building on the opposite bank, resulting in channel constriction and increased velocities. Guidance is generally lacking in this area, but review of aerial photographs of the subject location can provide some insight on where the crossover flow occurs. Model tests in a sand bed and bank flume (USACE 1981) were conducted to determine the limits of protection required to prevent scour that would lead to destruction of the revetment. These tests were conducted in a 110-deg bend having a constant discharge. The downstream end of the revetment had to be 1.5 channel widths downstream of the end of the bend. Geomorphic studies to determine revetment ends should be considered.

SECTION IV REVETMENT TOE SCOUR ESTIMATION AND PROTECTION

3-9. GENERAL.

Toe scour is probably the most frequent cause of failure of riprap revetments. This is true not only for riprap, but also for a wide variety of protection techniques. Toe scour is the result of several factors, including these three:

A. Meandering Channels, Change in Cross Section That Occurs after a Bank Is Protected. In meandering channels the thalweg often moves toward the outer bank after the bank is protected. The amount of change in cross section that occurs after protection is added is related to the erodibility of the natural channel bed and original bank material. Channels with highly erodible bed and banks can experience significant scour along the toe of the new revetment.

B. Meandering Channels, Scour at High Flows. Bed profile measurements have shown that the bed observed at low flows is not the same bed that exists at high flows. At high flows the bed scours in chan bends and builds up in the crossings between bends. (the recession side of the flood, the process is reverse Sediment is eroded from the crossings and deposited the bends, thus obscuring the maximum scour that h occurred.

C. Braided Channels. Scour in braided ch nels can reach a maximum at intermediate discharg where flow in the channel braids attacks banks at sha angles.

Note that local scour is the mechanism bei addressed herein. When general bed degradation headcutting is expected, it must be added to the loc scour. When scour mechanisms are not considered the design of protection works, undermining and failu may result. Figure 3-12 may be used for gross depth scour estimates. Neill (1973) provides additional inf mation on scour depth estimation.

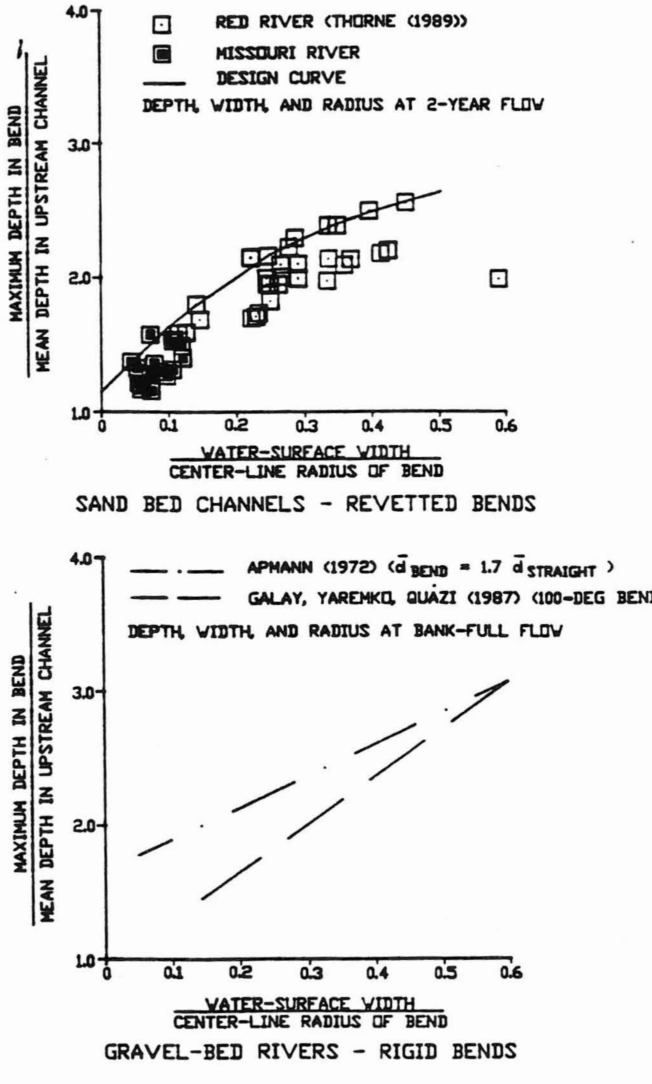


FIG. 3-12. Scour Depth in Bends

riprap gradation is first assumed and resistance coefficients are computed using Equation 3-2. Then the five steps described previously in (2) are conducted. If the gradation found in the preceding point 5 is equal to the assumed trial gradation, the solution is complete. If not, a new trial gradation is assumed and the procedure is repeated. The second example in Appendix H demonstrates this type of channel riprap.

(5) In braided streams and some meandering streams, flow is often directed into the bank line at sharp angles (angled flow impingement). Guidance is lacking on determining the imposed force for this condition. Until better guidance can be developed, a local velocity of 1.5 times the average velocity in the approach channel is recommended for use in riprap design.

(6) Transitions in size or shape may also require riprap protection. The procedures in this paragraph are applicable to gradual transitions where flow remains tranquil. In areas where flow changes from tranquil to rapid and then back to tranquil, riprap sizing methods applicable to hydraulic structures (HDC 712-1) should be used. In converging transitions, the procedures based on Equation 3-3 can be used unaltered. In expanding transitions, flow can concentrate on one side of the expansion and design velocities should be increased.

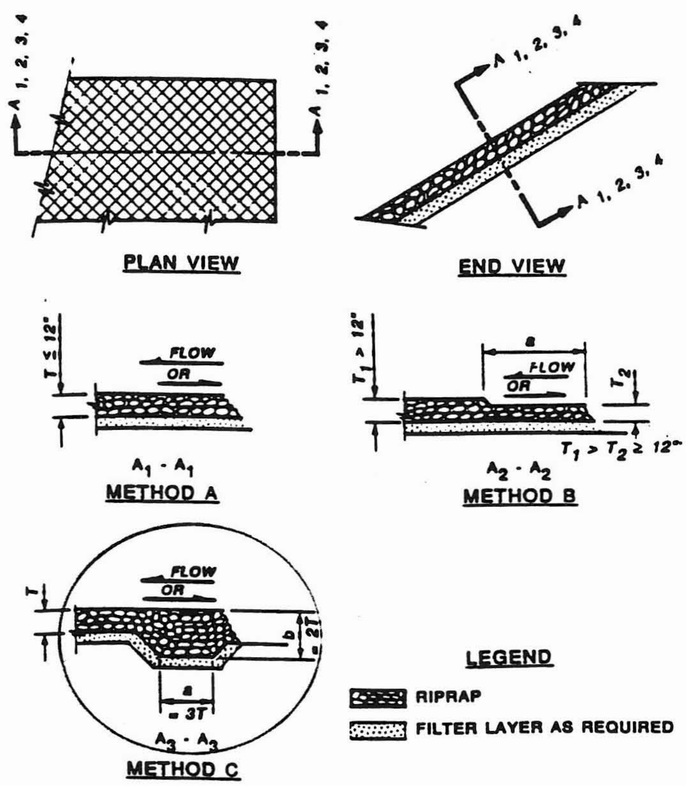


FIG. 3-11. Riprap End Protection

For installations immediately downstream of concrete channels, a vertical velocity distribution coefficient of 1.25 should be used due to the difference in velocity profile over the two surfaces.

3-8. REVETMENT TOP AND END PROTECTION.

Revetment top and end protection requirements, as with all channel protective measures, are to assure the project benefits, to perform satisfactorily throughout the project economic life, and not to exceed reasonable maintenance costs. Reference is made to ER 1110-2-1405, with emphasis on paragraph 6c.

A. Revetment Top. When the full height of a levee is to be protected, the revetment will cover the freeboard, i.e., extend to the top of the levee. This provides protection against waves, floating debris, and water-surface irregularities. Similar provisions apply to incised channel banks. A horizontal collar, at the top of the bank, is provided to protect against escaping and returning flows as necessary. The end protection methods illustrated in Figure 3-11 can be adapted for horizontal collars. Figure 3-6 provides general guidance for velocity variation over channel side slopes that can assist in evaluating the economics of reducing or omitting revetment for upper bank areas. Revetment size changes should not be made unless a sufficient quantity is involved to be cost effective. Many successful revetments have been constructed where the top of the revetment was terminated below the design flow line. See USACE (1981) for examples.

B. Revetment End Protection. The upstream and downstream ends of riprap revetment should be protected against erosion by increasing the revetment thickness *T* or extending the revetment to areas of noneroding velocities and relatively stable banks. The following guidance applies to the alternative methods of end protection illustrated in Figure 3-11.

(1) Method A. For riprap revetments 12 in. thick or less, the normal riprap layer should be extended to areas where velocities will not erode the natural channel banks.

(2) Method B. For riprap revetments exceeding 12 in. in thickness, one or more reductions in riprap thickness and stone size may be adopted for a distance a (Figure 3-11) in which velocities decrease to a noneroding natural channel velocity.

(3) Method C. For all riprap revetments that do not terminate in noneroding natural channel velocities,

TABLE 3-1. Gradations for Riprap Placement in the Dry, Low-Turbulence Zones

Limits of Stone Weight, lb[a], for Percent Lighter by Weight

D_{100} (max) (in.) (1)	100 Max (2)	100 Min (3)	50 Max[b] (4)	50 Min (5)	15 Max[b] (6)	15 Min (7)	D_{30} (min) (ft) (8)	D_{90} (min) (ft) (9)
(*a*) Specific Weight = 155 pcf								
12	81	32	24	16	12	5	0.48	0.70
15	159	63	47	32	23	10	0.61	0.88
18	274	110	81	55	41	17	0.73	1.06
21	435	174	129	87	64	27	0.85	1.23
24	649	260	192	130	96	41	0.97	1.40
27	924	370	274	185	137	58	1.10	1.59
30	1,268	507	376	254	188	79	1.22	1.77
33	1,688	675	500	338	250	105	1.34	1.94
36	2,191	877	649	438	325	137	1.46	2.11
42	3,480	1,392	1,031	696	516	217	1.70	2.47
48	5,194	2,078	1,539	1,039	769	325	1.95	2.82
54	7,396	2,958	2,191	1,479	1,096	462	2.19	3.17
(*b*) Specific Weight = 165 pcf								
12	86	35	26	17	13	5	0.48	0.70
15	169	67	50	34	25	11	0.61	0.88
18	292	117	86	58	43	18	0.73	1.06
21	463	185	137	93	69	29	0.85	1.23
24	691	276	205	138	102	43	0.97	1.40
27	984	394	292	197	146	62	1.10	1.59
30	1,350	540	400	270	200	84	1.22	1.77
33	1,797	719	532	359	266	112	1.34	1.96
36	2,331	933	691	467	346	146	1.46	2.11
42	3,704	1,482	1,098	741	549	232	1.70	2.47
48	5,529	2,212	1,638	1,106	819	346	1.95	2.82
54	7,873	3,149	2,335	1,575	1,168	492	2.19	3.17
(*c*) Specific Weight = 175 pcf								
12	92	37	27	18	14	5	0.48	0.70
15	179	72	53	36	27	11	0.61	0.88
18	309	124	92	62	46	19	0.73	1.06
21	491	196	146	98	73	31	0.85	1.23
24	733	293	217	147	109	46	0.97	1.40
27	1,044	417	309	209	155	65	1.10	1.59
30	1,432	573	424	286	212	89	1.22	1.77
33	1,906	762	565	381	282	119	1.34	1.94
36	2,474	990	733	495	367	155	1.46	2.11
42	3,929	1,571	1,164	786	582	246	1.70	2.47
48	5,864	2,346	1,738	1,173	869	367	1.95	2.82
54	8,350	3,340	2,474	1,670	1,237	522	2.19	3.17

[a] Stone weight limit data from ETL 1110-2-120 [HQUSACE, 1971 (14 May), "Additional Guidance for Riprap Channel Protection, Ch. 1," U.S. Government Printing Office, Washington, DC]. Relationship between diameter and weight is based on the shape of a sphere.

[b] The maximum limits at the W_{50} and W_{15} sizes can be increased as in the Lower Mississippi Valley Division Standardized Gradations shown in Appendix F.

G. BRADY

Drainage Design Manual for Maricopa County, Arizona

Volume II
Hydraulics

By
NBS Lowry
Engineers & Planners
and
McLaughlin Water Engineers, Ltd.

for the
Flood Control District
of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009
(602) 506-1501

Regulation	Page
Required freeboard is computed according to the following formula: $$FB = 0.25\,(Y + V^2/2g) \qquad (5.10)$$ The minimum freeboard value for rigid channels shall be 1 foot for subcritical and 2 feet for supercritical flows. Using a smaller freeboard in specific cases requires prior approval of the governing agency.	5-19
According to ARS 48-3609.A, during the course of the Master Planning process, the 100-year runoff will be used to delineate a floodplain for major channels with discharges of more than 1,000 cfs and will be processed through the local government, ADWR, and FEMA.	5-24
Encroachments into the floodplain of a natural wash are to be analyzed according to the FEMA requirements.	5-24
At no time should an encroachment adversely affect the river's stability or adversely alter flooding conditions on adjacent properties. When encroachment is proposed within the floodplain of a major watercourse, the regulating entity may, at its discretion, request that a detailed study be performed to determine if a reduction in overbank flood storage will significantly affect downstream flood peaks.	5-24
The minimum thickness for the soil cement lining shall be 12-inches (two 6-inch lifts).	5-30
All concrete channels carrying supercritical flow shall be lined with continuously reinforced concrete extending both longitudinally and laterally. There shall be no reduction in cross sectional area at bridges or culverts. Freeboard shall be adequate to provide a suitable safety margin—at least 2 feet—or an additional capacity of approximately one-third of the design flow.	5-33
Riprap linings shall have a minimum thickness of 1.5 times D_{100}. In urban areas, riprap having a D_{50} less than one foot should be buried and revegetated to protect the riprap lining from vandalism.	5-41
Due to a high failure rate and excessive maintenance costs, drop structures having loose riprap on a sloping face are not permitted.	6-8
The maximum vertical drop height from crest to basin for a vertical hard basin drop is limited to 3 feet for safety considerations.	6-28
Maximum drop depth is limited to 3 feet due to safety considerations and the practicality of obtaining large basin riprap for higher drops.	6-33

6.8. Using the relationship Q = AV, determine the flow velocity V at the pipe outlet. Assume depth $D = A^{0.5}$ and compute the Froude Number $= V/(gD)^{0.5}$.

2. The entrance pipe should be turned horizontal at least one pipe diameter equivalent length upstream from the outlet. For pipe slopes greater than 15 degrees, the horizontal length should be a minimum of two pipe diameters.

3. Do not use this type of outlet energy dissipator when exit velocities exceed 50 feet per second or Froude Numbers exceed 9.0. These conditions would be extreme and must be considered as special cases. Performance is achieved with a tailwater depth equal to half full flow level in the pipe outlet.

4. Determine the basin width (W) by entering the appropriate Froude Number and effective flow depth on Figure 6.23. The remaining dimensions are proportional to the basin width according to the legend in Figure 6.22. Note that the baffle thickness, t, is a suggested minimum. It is not a hydraulic parameter and is not a substitute for structural analysis.

   The basin width should not be increased since the basin is inherently oversized for less than design flows. Larger basins become less effective as the inflow can pass under the baffle.

5. Structure wall thickness, steel reinforcement, and anchor walls (underneath the floor) should be designed using accepted structural engineering methods. Hydraulic forces on the overhanging baffle may be approximated by determination of the jet momentum force:

$$F_m = \rho V Q = 1.94\,VQ \qquad \textbf{(6.14)}$$

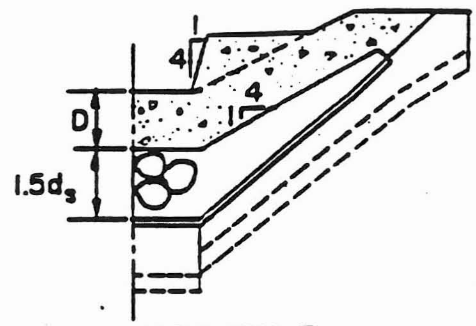
6. Riprap with a minimum D_{50} of 18 inches should be provided in the receiving channel from the end sill to a minimum distance equal to the basin width. The depth of rock should be equal to the sill height or at least 2.5 feet. Rock may be buried below finished grades and the area vegetated as desired to match the site.

7. The alternate end sill and wingwall shown in Figure 6.22 is recommended for all grass lined channels to reduce the scour potential below the sill wall.

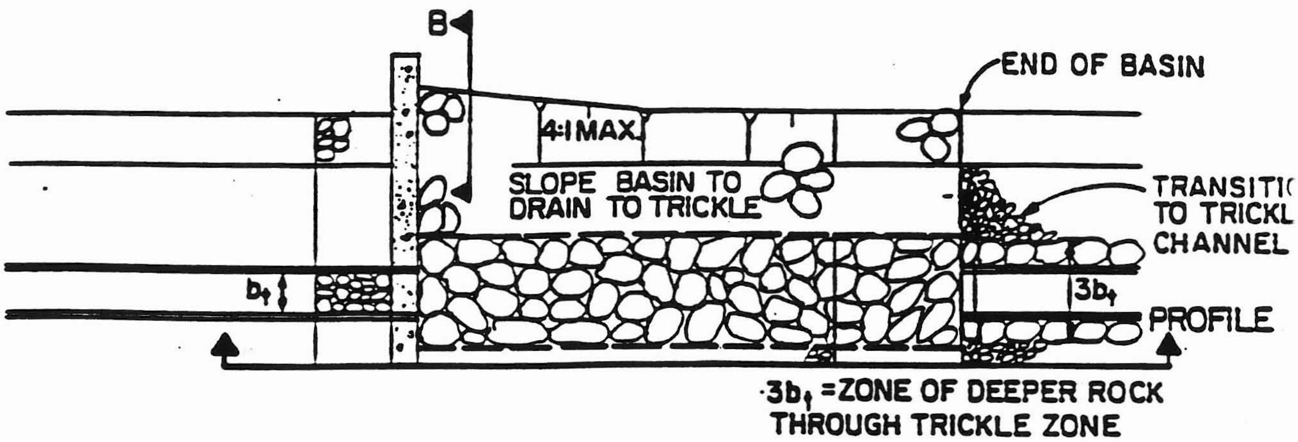
Low Flow Modifications: The standard design will retain a standing pool of water in the basin bottom which is generally undesirable from a safety and maintenance standpoint. This situation should be alleviated where practical by matching the receiving channel low flow depth to the basin depth, see Figure 6.24.

A low flow gap is extended through the basin end sill wall. The gap in the sill should be as narrow as possible to minimize effects on the sill hydraulics. This implies that a narrow and deeper (1.5 to 2-foot) low flow channel will work better than a wider gap section. The low flow width should not exceed 60 percent of the pipe diameter to prevent the jet from short-circuiting through the cleanout notches.

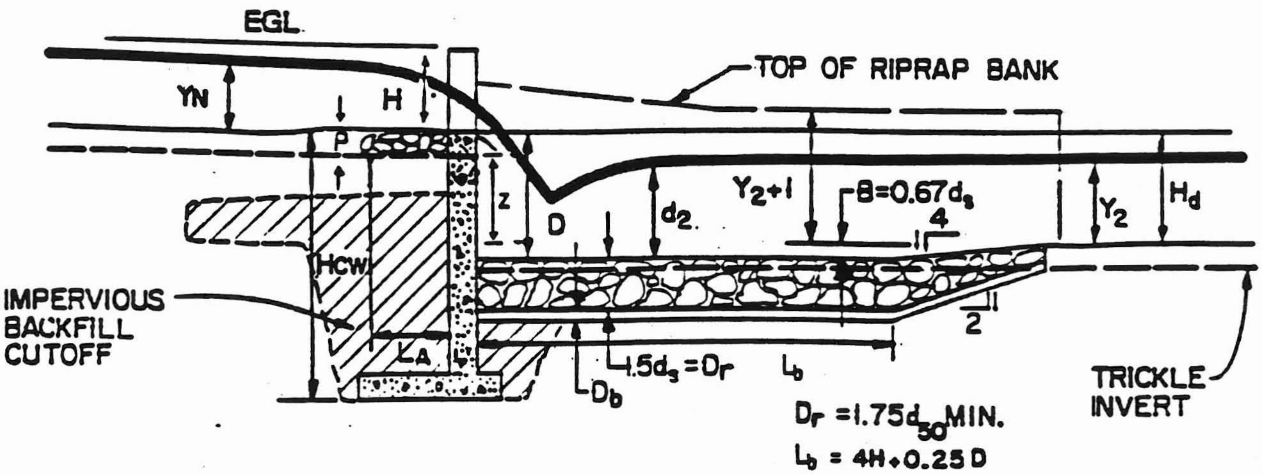
Low flow modifications have not been fully tested to date. Caution is advised to avoid compromising the overall hydraulic performance of the structure. Other ideas



SECTION B



PARTIAL PLAN



PROFILE

Figure 6.12
Vertical Riprap Basin Drop
(Stevens 1981)

SFC

PROJECT: RID - OVERCHUTE

SUPERELEVATION @ BEND U/S OF OVERCHUTE

PROJECT No.: DATE:

PAGE: 1 OF 2 SCALE:

1. From Drainage Manual Design For FCD of MC

USE Equation (5.9) Page 5-19

$$\Delta y = \frac{V^2 T}{g r_c}$$

$V = 7.0 \pm$ FPS

$T = 30'$

$g = 32.2\ ft/sec^2$

$r_c = 45'$

Note: $r_c = 45' < 3T$ recommended

$(r > 3T > 90')$

$\boxed{\Delta y = 1.01'}$

The Freeboard requirements should be added to the superelevated water surface elevation.

$FB = .25\left(Y + \frac{V^2}{2g}\right) = 1.5'$

2. From Hydraulic Design of Flood Control Channels (ASCE, US ARMY CORPS OF ENGINEERS, No. 10)

USE Equation (2-31) Page 27

$$\Delta y = C\frac{V^2 T}{g r}$$

DESIGNED BY: HM CHECKED BY:

PROJECT: RWD - OVERCHUTE

SUPERELEVATION

PROJECT No.: DATE:

 SCALE:

$C = .5$ (Tranquil Flow $F < 1$)
$C = 1.0$ (Rapid Flow $F > 1$)

USE $C = .5$

$$\Delta y = C \frac{V^2 T}{g r} = 0.51'$$

The Freeboard recommended is 2FT in rectangular channel.

3. Summary:

FCD of MC : $\Delta y = 1.0'$ and $FB = 1.5'$

ASCE : $\Delta y = .5'$ and $FB = 2.0'$

Either method is equal vertical distance measured from W.S. to the top of the channel wall.

USE $\Delta y = 1.0'$ and $FB = 1.5'$

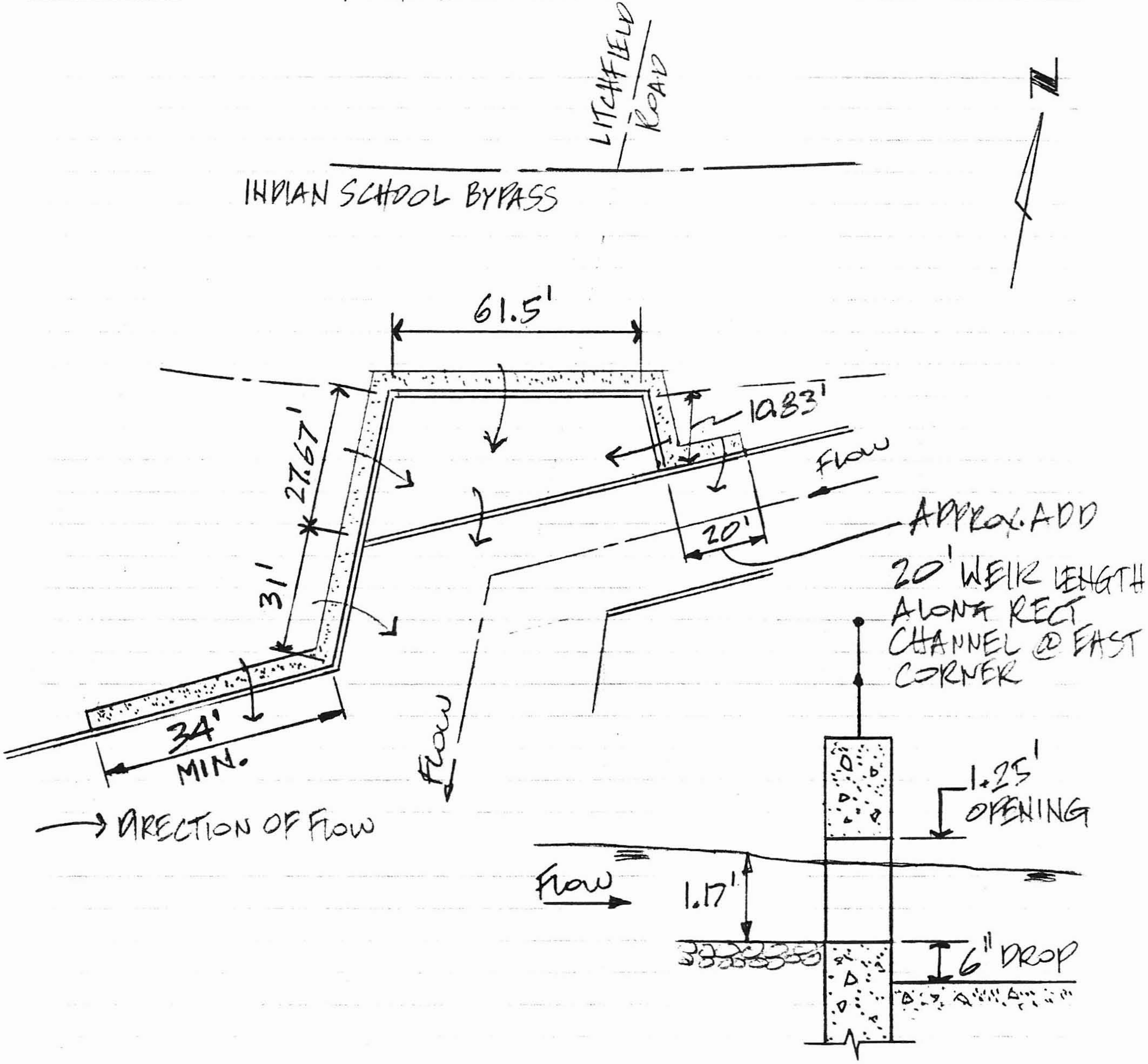
DESIGNED BY: HW CHECKED BY:

SFC

PROJECT: RID OVERCHUTE

PROJECT No.: 1202101 DATE: 7/19/96

PAGE: 1 OF 2 SCALE:



THE DEPTH AND AREA LIMITATIONS OF WATER ABOVE THE STREET BEFORE FLOWS INTO THE INLET (PONDING WATER WITH LARGE INFLOWS) DEPEND ON THE STREET INTERSECTION DESIGN. AS THIS PART OF THE INLET

DESIGNED BY: HVM CHECKED BY: [signature]

SFC

PROJECT: RID OVERCHUTE
INLET TRANSITION

PROJECT No.: 1203101 DATE: 7/19/96

PAGE: 2 OF 2 SCALE:

TRANSITION HYDRAULIC CALCULATIONS IS TO PROVIDE THE WEIR LENGTH REQUIRED FOR THE DEPTH OF WATER OPERATES AS A WEIR.

THE WEIR EQUATION IS: $Q = CLd^{1.5}$

where $C = 3.0$

$Q = 560$ CFS (MAX)

THE DEPTH LIMITATION FOR OPERATION AS A WEIR BECOMES: $d < H$

H = HEIGHT OF OPENING $= 1.25'$

ASSUMED $d = 1.17' < 1.25'$ = DEPTH OF WATER

IN ORDER TO ELIMINATE POTENTIAL FOR ORIFICE FLOW & BACKING UP OF WATER BEHIND WALL (OR GUARAIL.)

FIND L: $L = \frac{Q}{Cd^{1.5}} = \frac{560}{3.0(1.17)^{1.5}} = 147.5'$

ADD 25% SAFETY FACTOR FOR CLOGGING (0.80 REDUCTION FACTOR)

REQUIRED WEIR LENGTH $= 147.5 \times 1.25 = 185'$ (EXCLUDED PIERS)

PROVIDED LENGTH (MIN.) $= 34' + 31' + 27.67' + 61.5' + 10.83' + 20'$
$= 185'$

OK.

DESIGNED BY: [signature] CHECKED BY: [signature]

RID OVERCHUTE HYDRAULIC CALCULATIONS

DRAFT DESIGN REPORT
JULY 1997

Flood Control District of Maricopa County (FCDMC)
RID Overchute Project
Overchute/Siphon Design Criteria Summary
Stantech Project No. 28900014
July 1997

OVERCHUTE PROPERTIES		
Maximum Des Flowrate (Q)	1456 cfs	Flood Control District of Maricopa County, "Hydrologic Anal for the RID Overchute Proj", 1997
	Flowline S=.0015 ft/ft	U/S of N overch access rd to d/s of S overch access rd
	Transverse S=.005 ft/ft	Drain to center for nuisance flow
	V=3.50 f/s	Veloc moderate @ outlet transition= 7-8 f/s
	d=6.00 ft to 6.25 ft	HEC-2 water surface profiles
	Freeboard (FB)=1.75 ft	FB= 0.25 $(Y+V^2/2g)$, Eq'n 5.10, Mar Cnty Drain Des Man
	Overch W=60 ft	
	Overch H=8.5 ft minimum - **Use 9.0 ft**	Top of wall @ 1014.00 to blend with rectang. conc channel upstream.
	Overch L=100 ft	N side of N access rd to S side of S access rd
	Overch inv=1005.00	@ N side of overchute
	TOW El=1014.00 min	TOW EL=1015 along ISRB plus handrail for MCDOT traffic & bicycle safety requirements. Safety handrail also around headwall and top of lining @ transitions.
	O&M Rd Width=18'	8" conc ramps N&S sides for approx 220' length each side (75'+67.66'+75')
RID CANAL SIPHON PROPERTIES		
Minimum Velocity:	2.5 f/s	Sect 4.3.2.2, Mar Cnty Drain Des Man
Maximum Velocity	15 f/s	
Siphon BC Size	**2-8x7**	**7.79 ft top of box to invert**
Top of Box Elev	1014.00	
U/S Inv Elev.	1003.60	
U/S W.S. Elev.	1012.45	
D/S Inv Elev.	1003.50	
D/S W.S. Elev.	1012.20	0.25 ft headloss @ Max Q=435 cfs
Maximum Des Flowrate (Q)	435 cfs	
BC Veloc @ Des Q	3.88 f/s	
U/S Canal Wat Surf El	1012.45	
D/S Canal Wat Surf El	1012.20	

Source: Drain Des Man of Mar Cnty, Vol II, Hydraulics, Sept 1992
Chan Lin Des Guidel, ADOT, Feb 1989
HEC-2 Wat Surf Anal Prog HEC-2 User's Man, Boss Corp, 1993
Stantech Consultants, 1997

Flood C[illegible] District of Maricopa County (FCDMC)
RID Overchute Project
RID Canal Siphon Design
SFC Project No. 1202101
July 1996

EXISTING DATA

Site I.D.	RID Overchute Structure	
Add'l Site I.D.	OLR and RID Canal	
	Repl. exist. bridge & culvert. w/RID box culvert siphon	
Prop. Chann Width (ft)	67.67	top of slope to top of slope
Est Siph Pipe L (ft)	71.83	
Est Station Length (ft)	71.83	

ASSUMED DATA

ROW Width (ft)	N/A
New Pipe Dia (ft)	96
Canal Frict Factor	0.020

GENERAL HYDRAULICS

INLET

Extg U/S Lateral ("Sta A")			
Q	435		
B	12		
D	9.57		
S:S	1.25		
Slope (Estimated)	0.000095		
TCD Elev	1013.10	u/s @ inlet trans.	
NWS Elev		u/s @ inlet trans.	
Invert Elev	1003.60		0 u/s @ inlet trans.
TCD Elev	1013.17	Sta A @ Begin inlet trans.	
NWS Elev (Assume)	1012.45	Sta A @ Begin inlet trans.	
Invert Elev	1003.60	Sta A @ Begin inlet trans.	
Calc Flow Depth (d)	8.85	Solve for depth in Manning equation knowing Q, n, & S	
Calc Flow Area (ft^2)	204.10		8.85 d
Calc Flow Perim (ft)	37.03		204.10313 A
Calc Hyd Rad (f/f)	5.51		2.94431 R^0.666
Calc Velocity (f/s)	2.13		600.94358 A*(R^0.666)
Calc Vel Hd	0.07		599.06119 (Q*n)/1.49/(S^0.5)

PIPE

Prop Pipe Culvert		
Culvert Width (ft)	8.0	
Culvert Height (ft)	7.0	
Pipe rough coeff (n)	0.014	
Cntrln of Overch El.	1003.76	
Max inv below overchute	995.93	(overch el) - (floor slab) - (culv ht)
Calc Area (ft^2)	112.00	Width X Ht X 2 barrels
Calc Wet Perim	60.00	2 barrels X 2 X (Width+Ht)
Calc Hyd Rad (R)	1.87	Area/Wetted Perimeter
Calc Velocity f/s (V)	3.88	Q/Area
Calc Vel Hd (ft) (Hv)	0.234	(V^2)/2g
Calc frict slope	0.00058	(1/(2.2*R^1.33))*(n^2)*(V^2)

OUTLET

Existing D/S Lateral (Sta "J")			
Q	435		
B	12		
D	9.52		
S:S	1.25		
Slope (Estimated)	0.000095	Assme wrst cond-	
Invert Elev	1003.50		0 d/s @ outlet trans.
TCD Elev	1013.02	Sta D @ End outlet trans.	
NWS Elev (Assum)	1012.35	Sta D @ End outlet trans.	
Invert Elev	1003.50	Sta D @ End outlet trans.	
Calc Flow Depth (d)	8.85		
		Solve for depth in Manning equation	
Calc Flow Area (ft^2)	204.10	knowing Q, n, & S:	8.85 d
Calc Flow Perim (ft)	40.33		204.10313 A
Calc Hyd Rad (f/f)	5.06	R=A/P	2.94431 R^0.666
Calc Velocity (f/s)	2.13		600.94358 A*(R^0.666)
Calc Vel Hd	0.07		599.06119 Q*n/1.49/(S^0.5)

Source: USBR, "Design of Small Canal Structures", 1974
SFC Engineering Company, 1996

Flood C District of Maricopa County (FCDMC)
RID Overchute Project
RID Canal Siphon Design
SFC Project No. 1202101
July 1996

SIPHON DESIGN

INLET				PIPE			OUTLET		
							Sta D	231.83	Sta C + 4:1 outlet transition length
TOTAL HD LOSS AVAIL	0.10	NWS Differential (A-D)		Chann Wid tp o/s-tp o/s	67.67	@ center of exst Main Canal			
				Approx L of Culvert	71.83	Chann Wid + 2 X 2.08 (Wall t + 11")			
Calc Head Losses									
Inlet (broken-back)	0.07	0.4*(ch in vel hd)							
Pipe	0.04	Pipe L*(pipe frict slope)		Slope of 1st reach	0.0003	Min slope for drainage, no bends reqd			
Outlet (broken-back)	0.11	0.7*(ch in vel hd)		Angle of 1st reach	0.02	(degrees)			
Pipe Bends	0.00	.08*(vel hd pipe)*0 bends		Sta leng of 1st rch	71.83				
TOTAL HD LOSS	0.24	Includes 10% saf fact		Lay leng of 1st rch	71.83				
				Elev @ end 1st rch	995.96	**Sta C**			
Max Inv Elev Sta C (beg. pipe) for submergence requirement	1005.10	NWS A-(Culv Ht)-(1.5 * hvp)	Top Box Too Hig	**Sta C**	201.83	Sta B + culvert length			
Set invert Elev Sta C per overchute flowline	995.98	(1003.81 overch floor @ u/s end of overch) - 10" floor - (7' culv ht)							
Check (El B)-(El C)	7.62	prefer to be less than 3/4 D = 0.75 X 8 = 6 ft unless other criteria dictates such as keeping beneath overchute							
Min L of Inl Conc Trans	30	4:1 max, 4 * (El B - El C) - **Use 30' transition**							
Sta A	100	at u/stream edge of inlet transition							
Sta B	130	30' lining transition							
Slope B to C	0.0003	overchute flowline slope							

Source: USBR, "Design of Small Canal Structures", 1974
SFC Engineering Company, 1996

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width = 3(5411.00 – 5405.38) + 18 = 34.9 ft. The 1.5 represents a 1-1/2 to 1 side slope. If the side slope is 2 to 1 use 2 instead of 1.5 in the previous equation.

(7) Drop in pipe = length of pipe x slope of pipe = 34.9 x 0.005 = 0.17 ft

(8) El. C = El. B – drop in pipe
= 5405.38 – 0.17 = 5405.21.

(9) Length of earth transitions = 3 x dia. of pipe = 3 x 2.5 = 7.5 ft.

(10) Drop in transitions

Upstream = El. A – El. B
= 5406.52 – 5405.38
= 1.14 ft.

Downstream = El. D – El. C
= 5406.22 – 5405.21
= 1.01 ft.

(11) Assume losses in road crossing are 1.5 pipe velocity heads for inlet and outlet loss combined plus pipe friction loss, or

$$1.5\, h_{v_p} + h_f = 0.22 + 35 \times 0.00133 = 0.27 \text{ ft.}$$

where h_f = length of pipe x friction slope.

(12) *Protection.*—Use figure 7-8 to determine if protection is required. If required, select type, length, and height of protection.

For d_1 or d_2 = 1.58 ft. and for road crossings without concrete transitions:

Inlet protection = none

Outlet protection = 12-in. coarse gravel (type 2)

Length = 4d or 5 ft. min. = 4 x 1.58 ft. = 6.3 ft.

Because the transition length of 7.5 feet is not much greater than the required protection length, extend protection for full length of transition. Extend protection to 12 inches above canal water surface.

(c) *Check of Design.*—

(1) Compare computed losses with the loss provided on profile sheet. Computed losses = 0.27 foot. Loss provided, F = 0.30 foot. The excess head of 0.03 foot (0.30 – 0.27) provided on the profile sheet is inconsequential and the hydraulic design is considered adequate.

(2) *Transition slopes.*—To reduce turbulence and provide for relatively smooth transitioning of the water prism, the maximum length to drop ratio of 4 to 1 is used. The design ratio of the upstream transition is 7.5 to 1.14 or 6.6 to 1. This is flatter than 4 to 1 and therefore within the criteria limits. By inspection, the slope of the downstream transition is also satisfactory.

(3) *Cover on pipe.*—Minimum earth cover for farm road crossing is 2 feet. Approximate cover on pipe = El. F – (El. B + dia. of pipe) = 5411.00 – (5405.38 + 2.50) = 3.12 feet. As 3.12 feet is greater than the minimum required 2.0 feet the cover is satisfactory.

If concrete transitions are required for a road crossing the inlet and outlet transitions will usually be identical. Refer to subchapter VII A and design example of inverted siphons subchapter II C for procedure used in design of type 1 concrete transitions.

C. INVERTED SIPHONS

R. B. YOUNG[1]

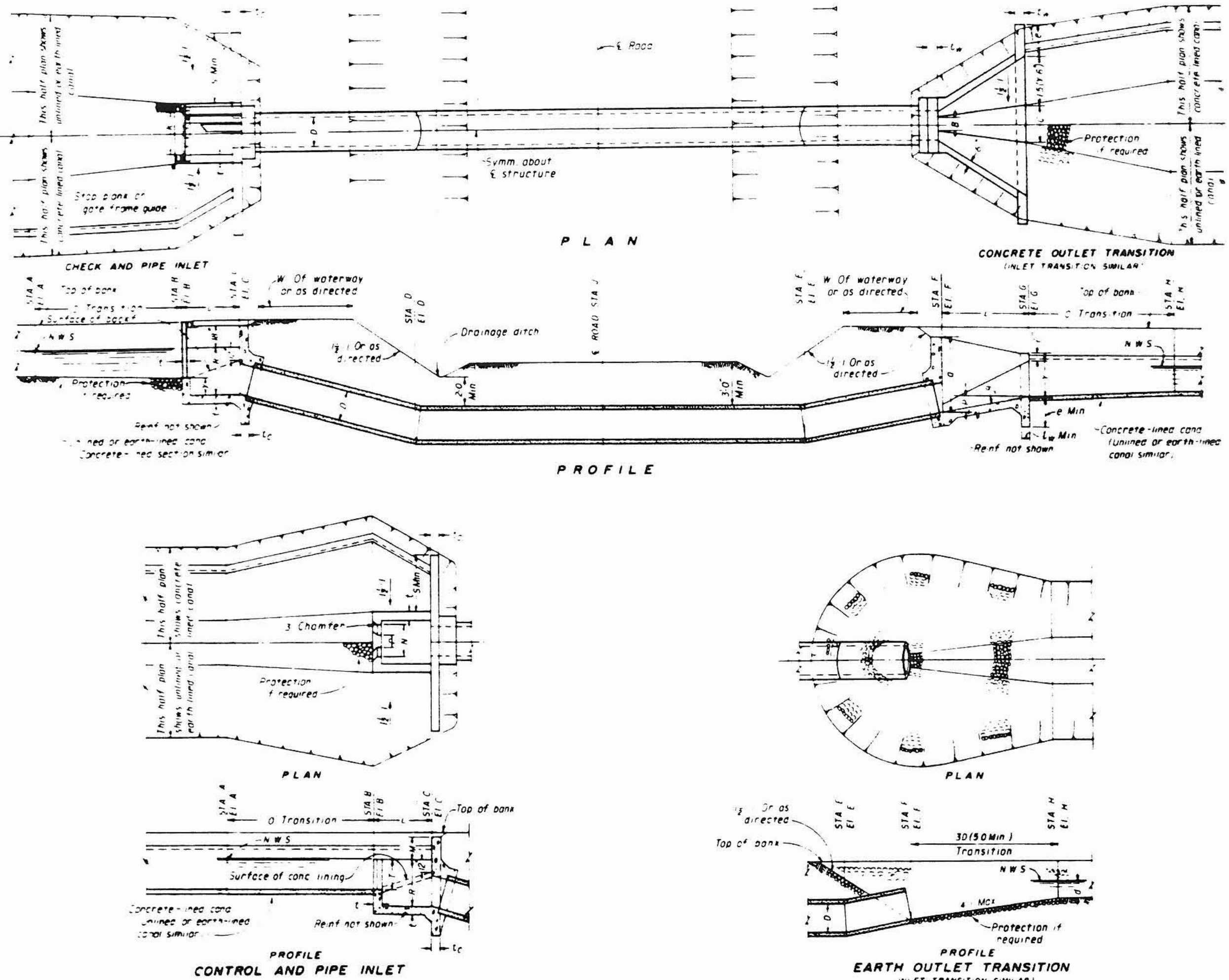
2-7. ***Purpose and Description.***—Inverted siphons figures 2-4, 2-5, and 2-6 (sometimes called sag pipes or sag lines) are used to convey canal water by gravity under roads, railroads, other structures, various types of drainage channels, and depressions. A siphon is a closed conduit designed to run full and under pressure. The structure should operate without excess head when flowing at design capacity.

Closed conduits with excess head are discussed in subchapters II E Drops and II F Chutes.

Closed conduits with straight profiles under roadways and railroads may also function as inverted siphons with internal pressure.

2-8. ***Application.***—Economics and other considerations determine the feasibility of using a siphon or another type of structure to

[1] Op. cit., p. 19.



PIPE DIAMETER SELECTION DATA							
MAX V=3.5 fps (EARTH TRANSITION)		MAX V=5.0 fps (CONC TRANSITION)		MAX V=10.0 fps (CONC TRANSITION)		PIPE	
Q (cfs)		Q (cfs)		Q (cfs)		DIA	AREA
FROM	INCLUDING	FROM	INCLUDING	FROM	INCLUDING	(INCHES)	(SQ FT)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	6	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	6	8.8	[illegible]	[illegible]	8	[illegible]
[illegible]	[illegible]	8.8	[illegible]	[illegible]	24	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	24	[illegible]	24	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	39.8	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	39.8	49	[illegible]	4.909
[illegible]	[illegible]	24.5	[illegible]	[illegible]	59.4	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	59.4	[illegible]	36	7.069
[illegible]	[illegible]	35.3	[illegible]	[illegible]	[illegible]	[illegible]	8.296
[illegible]	[illegible]	[illegible]	48	83.0	96.2	42	[illegible]
[illegible]	[illegible]	48	[illegible]			45	[illegible]
[illegible]	[illegible]	55.2	62.8			48	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
[illegible]	[illegible]	79.5	[illegible]			[illegible]	[illegible]
[illegible]	[illegible]	88.6	98.2			[illegible]	[illegible]
[illegible]	[illegible]					[illegible]	[illegible]
[illegible]	[illegible]					66	[illegible]
[illegible]	[illegible]					69	[illegible]
[illegible]	[illegible]					[illegible]	28.274

NOTES

Locations of vertical PI's at [illegible] and [illegible] are to be considered approximate only, and may be adjusted to fit actual laying length of pipe.

Stations and elevations refer to invert unless otherwise shown.

Figure 2-4. Inverted siphon plan and section. 103-D-1254.

accomplish the previous objectives. The use of an elevated flume would be an alternative to a siphon crossing a depression, drain channel or another manmade channel. The use of a bridge over a canal would be an alternative to a siphon under a road or a railroad. Generally, for capacities up to 100 cfs, it is more economical to use a siphon rather than a bridge. Bridge design is beyond the scope of this publication and consequently is not included.

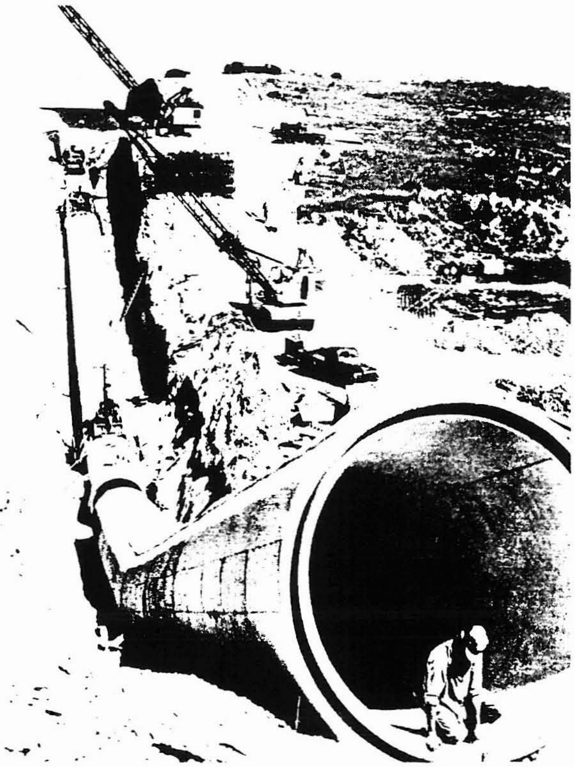


Figure 2-5. **Inverted siphon under construction. P-328-701-7259A.**

2-9. ***Advantages and Disadvantages of Inverted Siphons.***—Inverted siphons are economical, easily designed and built, and have proven a reliable means of water conveyance. Normally, canal erosion at the ends of the siphon is inconsequential if the structures in earth waterways have properly designed and constructed transitions and erosion protection.

Costs of design, construction, and maintenance are factors that may make an inverted siphon more feasible than another structure that might be used for the same purpose. There may be, however, instances where the value of the head required to operate a siphon may justify the use of another structure such as a bridge.

An inverted siphon may present a hazard to life, especially in high population density areas. See chapter IX for safety features.

2-10. ***Structure Components.***—(a) *Pipe.*—The closed conduits discussed in this publication are generally pipe. All pipe subjected to internal pressure should have watertight joints. Precast reinforced concrete pressure pipe (PCP), asbestos-cement pressure pipe (AC), or reinforced plastic mortar pressure pipe (RPM), all with rubber gasket joints, are used to insure watertightness. For heads up to 150 feet precast reinforced concrete pressure pipe is most frequently used but any of the above types may be used depending on their availability and cost considerations.

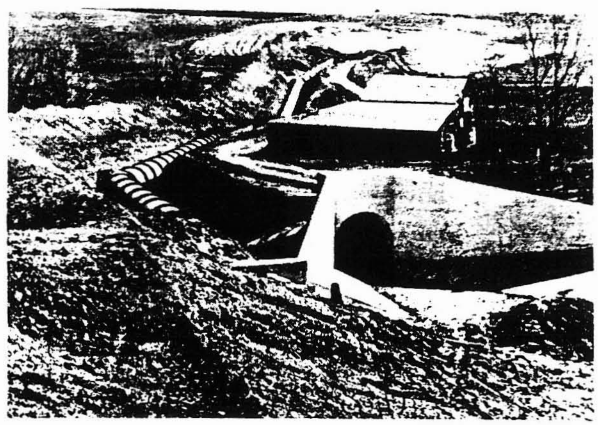


Figure 2-6. **Inverted siphon inlet transition and 60-inch-diameter precast concrete pipe. P 499-700-520.**

These pressure pipes are classed as to their capacity to withstand external loads of cover and wheel (equivalent earth cover) and internal hydrostatic head measured to the centerline of the pipe. Designations of A, B, C, and D represent 5, 10, 15, and 20 feet of cover respectively, while the associated number such as 25, 50, 75, 100, 125, and 150 represents feet of hydrostatic head. As an example, C 50 would be pressure pipe for 15-foot maximum cover and 50-foot maximum head.

Additional information regarding pipe, pipe joints, pipe bends, and other pipe appurtenances may be found in chapter VIII.

The pipe profile is determined in such a way as to satisfy certain requirements of cover, pipe slopes, bend angles, and submergence of inlet and outlet. Pipe cover requirements are:

(1) At all siphons crossing under roads other than farm roads and siphons crossing under railroads, a minimum of 3 feet of earth cover should be provided. Farm roads require only 2 feet of earth cover and are frequently ramped using 10 to 1 slopes (10 percent grade) when necessary to provide minimum cover requirements. If roadway ditches exist and are extended over the pipe, the minimum distance from the ditch to the top of the pipe should be 2 feet.

(2) At siphons crossing under cross-drainage channels, a minimum of 3 feet of earth cover should be provided unless studies indicate more cover is required because of projected future retrogressions of the channel.

(3) At siphons crossing under an earth canal, a minimum of 24 inches of earth cover should be provided.

(4) At siphons crossing under a lined canal, a minimum of 6 inches of earth cover should be provided between the canal lining and the top of pipe.

Roadway widths and side slopes at road and railroad siphon crossings should match existing roadway widths and side slopes, or as otherwise specified. Side slopes should not be steeper than 1-1/2 to 1.

Pipe slopes should not be steeper than 2 to 1 and should not be flatter than a slope of 0.005.

Changes in PCP pipe grade and alinement (bends) may be made with precast elbows, with beveled end pipe, by miter cutting pipe, or by pulling joints. Changes in AC and RPM pipe grade and alinement may be made by miter cutting pipe or by pulling joints. See chapter VIII for further information on bends.

(b) *Transitions.*—Transitions are nearly always used at the inlet and outlet of a siphon to reduce head losses and prevent canal erosion in unlined canals by causing the velocity change between the canal and pipe to be less abrupt. Concrete, earth, or a combination of concrete and earth transitions are used for this purpose.

The following siphons require either a concrete inlet transition or some type of concrete inlet control structure, and a concrete outlet transition:

All siphons crossing railroads and state highways.

All 36-inch-diameter and larger siphons crossing roads.

All siphons in unlined canals with water velocities in excess of 3.5 feet per second in the pipe.

Standardization of concrete transitions is a means of reducing costs. This is accomplished by having a single transition cover a range of canal and structure conditions. The base width and invert of standardized transitions will seldom match those of the canal. Additional transitioning is then accomplished with an earth transition where earth canals are involved and with a concrete lining transition where concrete-lined canals are involved.

For relatively short structures, such as siphons crossing roads, it is frequently more economical to omit concrete transitions even though the length of pipe will increase and size of pipe and protection may also increase. For further discussion on Transitions see chapter VII.

If there is a need for controlling the water surface elevation upstream from the siphon, a check and pipe inlet or a control and pipe inlet is used. (See discussion of Check and Pipe Inlet and Control and Pipe Inlet, subchapters III F and III G.)

(c) *Pipe Collars.*—Pipe collars are not normally required on siphons but they may be needed to reduce the velocity of the water moving along the outside of the pipe or through the surrounding earth thereby preventing removal of soil particles (piping) at the point of emergence. Pipe collars may also be necessary to discourage rodents from burrowing along the pipe. A detailed discussion for design of pipe collars and cutoffs as related to percolation may be found in chapter VIII.

(d) *Blowoff Structures.*—Blowoff structures are provided at or near the low point of relatively long inverted siphons to permit draining the pipe for inspection and maintenance or wintertime shutdown. Essentially the blowoff structure consists of a valved steel pipe tapped into the siphon barrel. Blowoffs may also be used in an emergency in conjunction with wasteways for evacuating water from canals. Short siphons are usually dewatered when necessary by pumping from either end of the siphon. If annual wintertime draining is not required, breaking into pipe smaller than 24-inch diameter for emergency draining is an economical alternative to providing a blowoff.

A manhole is often included with a blowoff on long siphons 36 inches and larger in diameter to provide an intermediate access point for inspection and maintenance.

A detailed discussion for design of blowoff structures and manholes may be found in chapter VIII.

(e) *Canal Freeboard and Erosion Protection.*—The canal bank freeboard upstream from siphons should be increased 50 percent (1.0 foot maximum) to prevent washouts at these locations due to more storm runoff being taken into the canal than anticipated or by improper operation. The increased freeboard should extend a distance from the structure such that damage caused by overtopping the canal banks would be minimal; but in any event a minimum distance of 50 feet from the structure.

Erosion protection is often used adjacent to siphons in earth canals. A discussion of Protection is presented in chapter VII.

(f) *Wasteways.*—Wasteways are often placed upstream from a siphon for the purpose of diverting the canal flow in case of emergency. For design of wasteways see the discussion on Wasteways, subchapter IV B.

(g) *Safety Features.*—Safety measures must be taken near siphons to protect persons and animals from injury and loss of life. Safety features are discussed in chapter IX.

2-11. ***Hydraulic Design Considerations.***—Available head, economy, and allowable pipe velocities determine the size of the siphon pipe. Thus, it is necessary to assume internal dimensions for the siphon and compute head losses such as entrance, pipe friction, pipe bend, and exit. The sum of all the computed losses should approximate the difference in energy grade elevation between the upstream and downstream ends of the siphon (available head).

In general, siphon velocities should range from 3.5 to 10 feet per second, depending on available head and economic considerations.

The following velocity criteria may be used in determining the diameter of the siphon:

(1) 3.5 feet per second or less for a relatively short siphon with only earth transitions provided at entrance and exit.

(2) 5 feet per second or less for a relatively short siphon with either a concrete transition or a control structure provided at the inlet and a concrete transition provided at the outlet.

(3) 10 feet per second or less for a relatively long siphon with either a concrete transition or a control structure provided at the inlet and a concrete transition provided at the outlet.

The velocity or pipe size of a long siphon is of particular importance, economically, because a slight change in pipe size can make a great change in the structure cost.

Head losses which should be considered are as follows:

(1) Convergence loss in the inlet transition.

(2) Check structure losses when a check is installed in the inlet.

(3) Control structure losses when a control is installed in the inlet.

(4) Friction and bend losses in the pipe.

(5) Divergence loss in the outlet transition.

(6) Transition friction losses are usually ignored for the size of structures in this publication.

(7) Convergence and divergence head losses in earth transitions when required between the canal and concrete transition are usually small and are usually ignored.

The total computed head loss is usually increased by 10 percent as a safety factor to insure against the possibility of the siphon causing backwater in the canal upstream from the siphon.

The hydraulic head loss in a transition is dependent on the difference of the velocity heads in the canal and the normal to centerline section of the closed conduit. Coefficients of velocity head considered adequate for determining head losses in a broken-back type of transition are 0.4 for the inlet and 0.7 for the outlet. therefore the losses would be $0.4\Delta h_v$ for inlet and $0.7\Delta h_v$ for the outlet transitions.

Coefficients of velocity head considered adequate for determining head losses in earth transitions from the canal to a pipe are 0.5 for the inlet and 1.0 for the outlet. Therefore, the losses would be $0.5\Delta h_v$ for the inlet and $1.0\Delta h_v$ for the outlet transitions.

For minimum hydraulic loss, it is desirable to provide a seal of $1.5\Delta h_v$ with 3-inch minimum at pipe inlet and no submergence at the pipe outlet. The seal is equal in height to the vertical drop from the normal canal water surface to the top of the siphon opening. If the siphon has both upstream and downstream concrete transitions it may be economically desirable to construct the downstream transition the same as the upstream transition.

If the outlet seal is greater than one-sixth the height of opening at the outlet, the head loss should be computed on the basis of a sudden enlargement and the loss for both earth and concrete outlet transitions would be $1.0\Delta h_v$.

For additional discussion on Transitions see chapter VII.

If there is a check and pipe inlet or a control and pipe inlet for the siphon see subchapters III F and III G for their hydraulic design.

. Pipe friction losses are determined by using Manning's formula as is explained in section 2-13 or by using table 8-1.

Pipe bend losses are determined by using figure 8-1 as is explained in chapter VIII.

Special hydraulic considerations must be given to the inlets on long siphons where, under certain conditions, the inlet will not become sealed. On long siphons, such conditions may result when the canal is being operated at partial flows (flows less than design flow) or at full design flow when the actual coefficient of friction is less than assumed in design. Under such conditions, a hydraulic jump occurs in the pipe and may cause blowback and very unsatisfactory operating conditions. Figure 2-7, which is self-explanatory, should be used to determine proper performance of inlets to long siphons. Pipe slope or diameter should be changed to meet the requirements noted on the figure.

Another way of solving the air problem is to place properly designed air vents at locations where air might accumulate. This procedure is ordinarily used only as a remedial measure for an existing siphon with blowback problems. See discussion on Air Vents in chapter VIII.

2-12. ***Design Procedure.***—Steps required for design of a siphon include the following:

(1) Determine what inlet and outlet structures are required, and the type and approximate size of pipe.

(2) Make a preliminary layout of the siphon profile (siphon and required inlet and outlet structures) using the existing ground line, the canal properties, and the canal stations and elevations at the siphon ends (fig. 2-8). This layout should provide pipe requirements of cover, slope, bend angles, and provide pipe submergence requirements at transitions, check and pipe inlets, or control and pipe inlets.

(3) Compute the siphon head losses in this preliminary layout. If the head losses as computed are in disagreement with the available head, it may be necessary to make some adjustment such as pipe size or even the canal profile.

If the computed losses are greater than the difference in upstream and downstream canal water surface, the siphon will probably cause backwater in the canal upstream from the siphon. If backwater exists, the pipe size should be increased or the canal profile revised to provide adequate head.

If the computed losses are appreciably less than the difference in upstream and downstream canal water surface it may be possible to decrease the size of pipe, or the canal profile may be revised so the available head is approximately the same as the head losses.

(4) On long siphons where the inlet may not be sealed there is the possibility of blowback and unsatisfactory operating conditions. The inlet should be checked for proper performance and adjustments made if necessary.

(5) Determine the pipe class. The pipe class can be determined from the amount of external load and internal head shown on the pipe profile.

2-13. *Design Example (see fig. 2-4.)*—Assume that an earth canal crosses a

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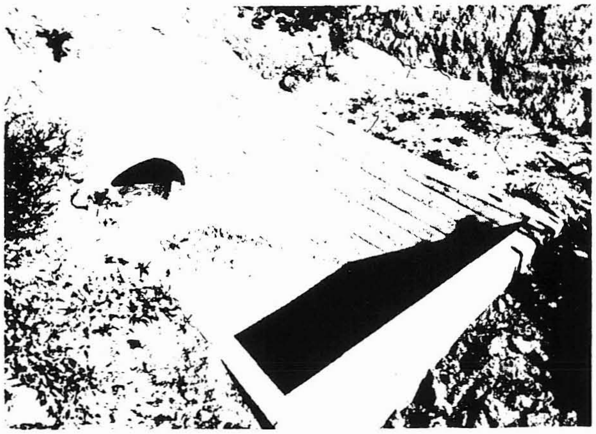


Figure 7-7. Type 4 inlet concrete transition. P-328-701-9300

(c) *Water Surface Angle.*—To obtain the most desirable hydraulic conditions, the angle between the water surface and the transition centerline should not exceed 27-1/2° for inlet transitions and 22-1/2° for outlet transitions. For some structure designs it may be economical to use an angle of 25° to allow the same concrete transition to be used for both inlet and outlet. For this angle the loss coefficients remain 0.5 for the inlet and 1.0 for the outlet.

(d) *Channel Erosion.*—To prevent undue channel erosion downstream from a structure outlet, the following criteria for pipe velocity should be observed. If the pipe velocity is equal to or less than 3.5 feet per second, an earth outlet transition is usually sufficient. If the pipe velocity is greater than 3.5 feet per second a concrete outlet transition or other outlet structure is required. If the pipe velocity is greater than 10 feet per second a baffled outlet or a stilling pool should be used.

7-4. ***Cutoffs.***—Cutoffs are provided to reduce percolation around transitions and to add stability and structural strength to transitions. Cutoffs are required at the ends of transitions in concrete-lined canals as well as in other lined or earth canals.

Cutoff walls should, in general, be a minimum of 24 inches deep for water depths up to 3 feet at the cutoff; 2 feet 6 inches deep for water depths of 3 to 6 feet; and 3 feet for water depths greater than 6 feet. For some small structures, 18-inch cutoffs may be satisfactory. The minimum concrete thickness should be 6 inches for 18- and 24-inch cutoffs and 8 inches for cutoffs deeper than 24 inches. Excavation for the structure may disclose soils that are unusually susceptible to piping, in which case the cutoff should be extended vertically or horizontally, or both, beyond these minimums to provide adequate protection against percolation. Nonreinforced concrete may be used for the extension.

7-5. *Standardization.*—Concrete transitions may be standardized as a means of reducing cost by designing them to fit a range of conditions thereby rendering them applicable for a number of transition installations. If concrete transitions are standardized for inline canal structures it will probably be necessary to supplement the concrete transitions with earth or concrete lining transitions to complete the transitioning to the canal section. Transition losses for these supplemental transitions are usually neglected.

7-6. ***Type 1 Transitions (Broken-back).***—Figure 7-2 shows a typical type 1 transition. The type 1 transition is generally used with inline structures because of its applicability to a well-defined channel cross section.

A transition length L equal to three times the pipe diameter has given satisfactory performance in providing the necessary distance for smoothly changing the water velocity.

Dimension B is chosen so that the 1-1/2 to 1 sloping walls are approximately tangent to the opening at the headwall, and may be determined using the relationship, B = 0.303 times the pipe diameter. The computed value is rounded to the nearest greater inch.

The base width C at the cutoff walls is dependent on the design refinement of the water surface angle. If y – 6 inches is assumed to be approximately the same as the depth d in the canal at the cutoff, an acceptable C value can be determined by using the following water surface angles, equations, and relationships for pipe diameter D to depth d:

For a water surface angle of 22-1/2°:

$C = 0.5D$ when $D = d$,
$C = 1.1D$ when $D = 1.25d$,
$C = 1.5D$ when $D = 1.5d$, and
$C = 2D$ when $D = 2d$

RID OVERCHUTE OUTLET TRANSITION HYDRAULIC CALCULATIONS AND GROUTED RIPRAP DESIGN

DRAFT DESIGN REPORT
JULY 1997

PROJECT:	RVC - OVERCHUTE OUTLET TRANSITION		
PROJECT No.:	1303101	DATE:	3/12/96
PAGE:	1 OF 4	SCALE:	

SFC

DETERMINE STONE SIZE:

USE THE BASIC EQUATION FOR THE REPRESENTATIVE STONE SIZE (HYDRAULIC DESIGN OF FLOOD CONTROL CHANNELS - RIPRAP PROTECTION ASCE)

$$D_{30} = S_f C_s C_v C_T d \left[\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{1/2} \frac{V}{(K_1 g d)^{1/2}} \right]^{2.5}$$

ASSUMED LOCAL QUARRY HAS ROCK WEIGHING 165 PCF AND CAN PRODUCE THE 12-, 15-, 18-IN D_{100} (MAX) GRADATION (SEE TABLE 3-1 INCLUDED)

ASSUMED DOWNSTREAM EARTH CHANNEL DATA:

B = 8
Z = 4:1
n = 0.025
S = .0050
Q = ~~1513~~

⟹ d = ~~5.07'~~ From HEC 2 - SEC 115
V = ~~3.93 FPS~~ d = 6.48'
F = .88 V = 8.47 FPS

AVERAGE WATER DEPTH AT CHUTE = 6.5'

WIDTH = 60'

AVE. VELOCITY = 1440 ~~1513~~ CFS / (60' X 6.5') = ~~3.88~~ 3.69 FPS

USE:

S_f = SAFETY FACTOR = 1.1

C_s = STABILITY COEFFICIENT FOR INCIPIENT FAILURE = .30

DESIGNED BY: HM CHECKED BY: GB

KID_OVERCHUTE

PROJECT: OUTLET TRANSITION

PROJECT No.: 120101 DATE: 3/27/96

PAGE: 2 OF 4 SCALE:

C_V = VERTICAL VELOCITY DISTRIBUTION COEFF = 1.25
(D/S OF CONC CHANNEL)

C_T = THICKNESS COEFFICIENT = 1.0

d = DEPTH OF FLOW

γ_w = UNIT WEIGTH OF WATER = 62.4 PCF

γ_s = UNIT WEIGTH OF STONE = 165 PCF

V = AVERAGE VELOCITY

$$K_1 = \left[1 - \frac{\sin^2\theta}{\sin^2\phi}\right]^{.5}$$

$\theta = 14°$ (4:1 SIDESLOPE)

$\phi = 40°$ RECOMMENDED

$\cot\theta = \frac{X}{Y} = 4$

$K_1 = .93$

$\sin^2\phi = (1 - \cos 2\phi)\frac{1}{2}$

$g = 32.2\ ft/sec^2$

∴ d = ~~5.57'~~ 6.48', V = ~~8.93~~ 8.47 FPS ⇒ D_{30} = ~~.50~~ .41'

d = 6.5', V = ~~3.83~~ 3.69 FPS ⇒ D_{30} = ~~.06~~ .05'

USE D_{30} = ~~.50~~ .41'

FROM TABLE 3-1, THE ~~15~~ 12-IN D_{100} (MAX) GRADATION IS THE MIN AVAIABLE GRADATION THAT HAS D_{30}(MIN) ≥ ~~.50~~ .41'

(D_{30}: RIPRAP SIZE OF WHICH 30% IS FINER BY WEIGHT)

DESIGNED BY: K/M CHECKED BY: [signature]

RIO- OVERCHUTE

PROJECT: OUTLET TRANSITION

PROJECT No.: 20101 DATE: 3/ /96

 SCALE:

THICKNESS $1.5 D_{100} < T < 2.0 D_{100}$

$1.5 D_{100} = 1.5 \times 12'' = 18''$
$2.0 D_{100} = 2.0 \times 12'' = 24''$ } USE 18" THICKNESS (MIN)

LENGTH OF RIPRAP:

a) FROM HYDRAULIC DESIGN OF FLOOD CONTROL CHANNELS (ASCE PRESS) $L = 1.5 \times$ CHANNEL WIDTH (OVERCHUTE $W = 60'$)

$L = 1.5 \times 60' = \underline{90'}$

b) FROM DRAINAGE DESIGN MANUAL FOR MARICOPA COUNTY

+ CHANNEL DROP STRUCT (Page 6-34)

$L = 4H + 0.25D$

ASSUMED H = HEAD OF WATER

$H = d + \frac{v^2}{2g} = 6.5' + \frac{(3.69)^2}{64.4} = 6.71'$

$D = 0'$

$\therefore L = 4H = 4(6.71') = \underline{27'}$

+ OUTLET STRUCTURES (Page 6-52): RIPRAP W/A MIN. D_{50} OF 13-IN - 2.5' DEPTH SHOULD BE PROVIDED TO A MIN DISTANCE EQUAL THE BASIN WIDTH

$L = W = \underline{60'}$

DESIGNED BY: HM CHECKED BY: [signature]

RUT OVERCHUTE

SFC

PROJECT: OUTLET TRANS.

PROJECT No.: | DATE: 3/12/96

PAGE: 4 OF 4 | SCALE:

RECOMMENDED:

- STONE SIZE: USE AS SAME SIZE OF INLET TRANS.
  12-IN D_{100} (MAX)
- THICKNESS : T = 18"
- LENGTH : 60' (ADEQUATELY)

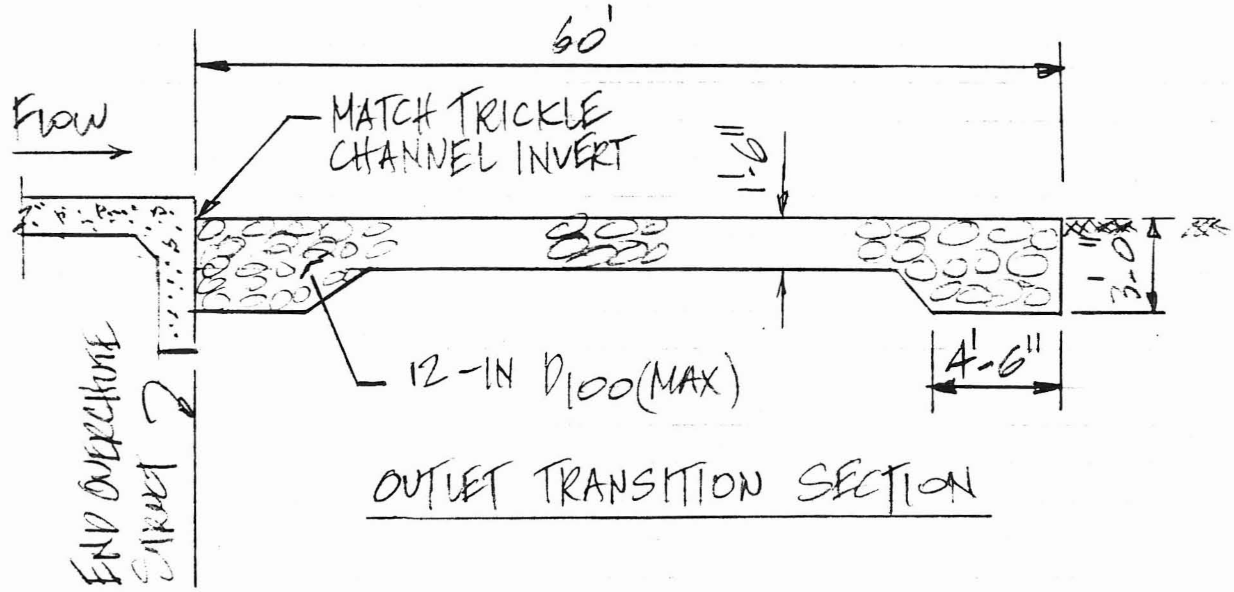
CUTOFF WALL AT D/S END

a/ FROM ASCE PRESS RIPRAP END PROTECTION

h = 2T = 2(18") = 36" or 3'-0"

w = 3T = 3(18") = 54" or 4'-6"

SUMMARY:

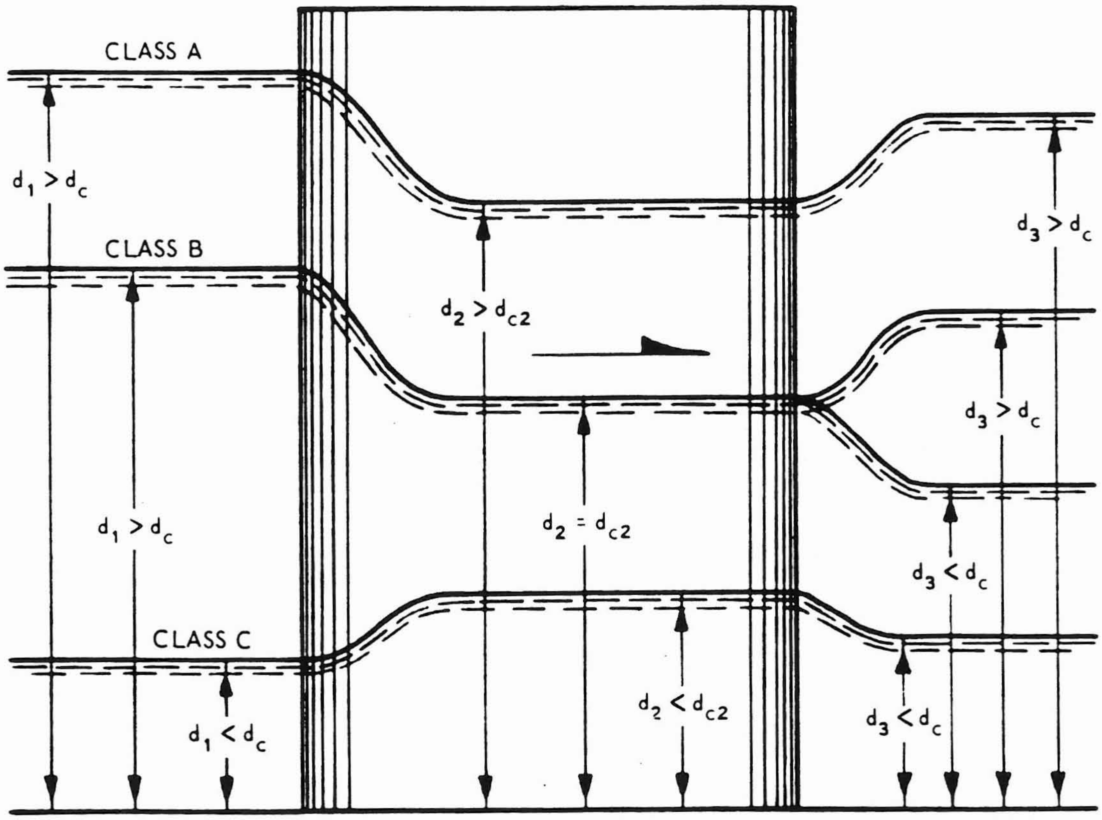


OUTLET TRANSITION SECTION

DESIGNED BY: | CHECKED BY:

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 10

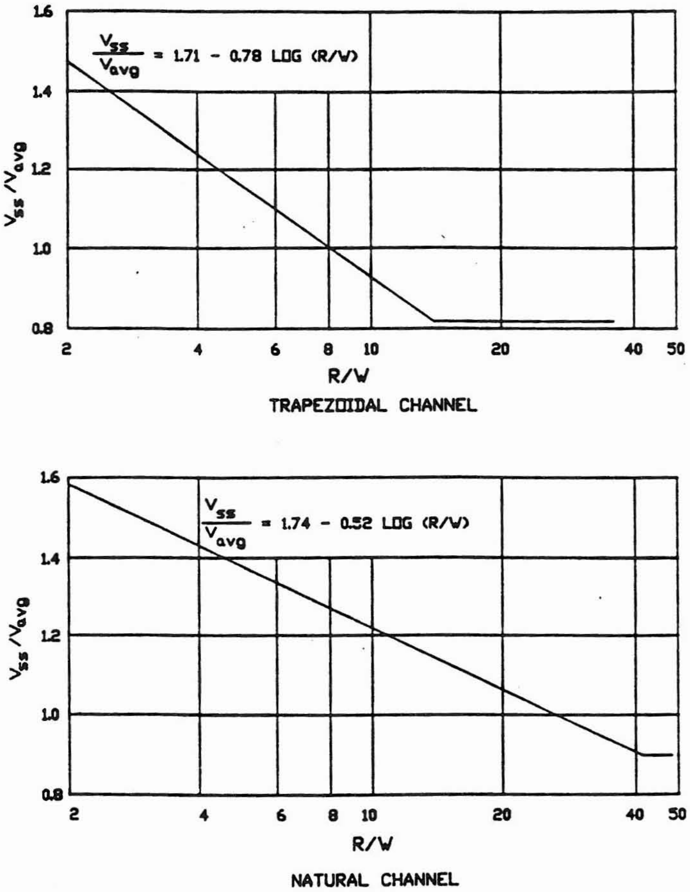
HYDRAULIC DESIGN OF



FLOOD CONTROL CHANNELS

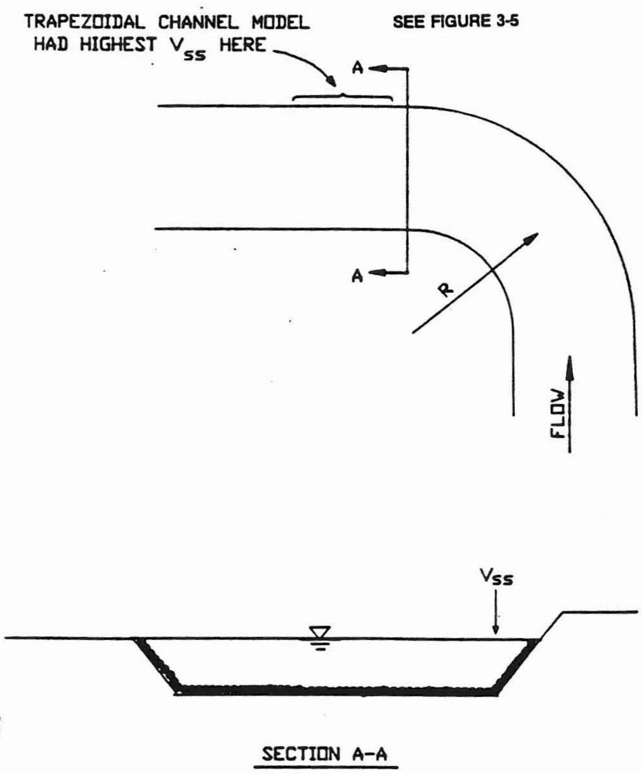
AMERICAN SOCIETY OF CIVIL ENGINEERS

A. Velocity Estimation. The characteristic velocity for side slopes V_{SS} is the depth-averaged local velocity over the slope at a point 20 percent of the slope length from the toe of slope. Figure 3-3 presents the ratio V_{SS}/V_{AVG} where V_{AVG} is the average channel velocity at the upstream end of the bend as a function of the channel geometry, which is described by R/W, where R is the centerline radius of bend and W is the water-surface width. For straight channels sufficiently far (>5W) from upstream bends, large values of R/W should be used, resulting in constant values of V_{SS}/V_{AVG}. Figure 3-4 describes V_{SS} and Figure 3-5 shows the location in a trapezoidal channel bend of the maximum V_{SS}. Figure 3-6 shows the variation in velocity over the side slope in a channel bend. Figures 3-5 and 3-6 are presented to illustrate concepts; the designer should consider the specific geometry. Other parameters, such as side slope angle, ratio of bed and bank roughness, and aspect ratio (channel width/depth), are probably important in defining V_{SS}/V_{AVG}, but data do not exist to define these effects. For equal cross-sectional areas, steep side slopes tend to move the maximum velocities away from the side slope whereas mild side slopes allow the maximum velocities to occur over the side slope. An alternate means of velocity estimation based on field observation is discussed in Appendix G. The alpha method (Appendix C), or velocities resulting from subsections of a water-surface profile computation, should be used only in straight reaches. When the alpha method is used, velocity from the subsection adjacent to the bank subsection should be used as V_{SS} in design of bank riprap.



NOTE: V_{SS} IS DEPTH-AVERAGED VELOCITY AT 20 PERCENT OF SLOPE LENGTH UP FROM TOE

FIG. 3-3. Riprap Design Velocities



R = CENTER-LINE RADIUS

V_{SS} = DEPTH-AVERAGED VELOCITY IN THE VERTICAL OVER SLOPE AT 20 PERCENT OF SLOPE LENGTH UP FROM TOE.

FIG. 3-4. Parameters Used in Stone Size Calculation

B. Stone Size Relations. The basic equation for the representative stone size in straight or curved channels is:

$$D_{30} = S_f C_s C_V C_T d \left[\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{1/2} \frac{V}{\sqrt{K_1 g d}} \right]^{2.5} \qquad (3\text{-}3)$$

where D_{30} = riprap size of which 30 percent is finer by weight, length; S_f = safety factor (see c); C_s = stability coefficient for incipient failure, thickness = $1D_{100}$(max) or $1.5D_{50}$(max), whichever is greater, D_{85}/D_{15} = 1.7 to 5.2 = 0.30 for angular rock = 0.36 for rounded rock; C_V = vertical velocity distribution coefficient = 1.0 for straight channels, inside of bends = 1.283 − 0.2 log (R/W), outside of bends (1 for $(R/W) > 26$) = 1.25, downstream of concrete channels = 1.25, ends of dikes; C_T = thickness coefficient [see D.(1)]; d = local depth of flow, length; γ_w = unit weight of water, weight/volume; V = local average velocity, usually V_{SS}, length/time; K_1 = side slope correction factor [see D.(1)]; and g = gravitational constant, length/time^2. This equation can be used with either SI (metric) or non-SI units.

C. Safety Factor. Equation 3-3 gives a rock size that should be increased to resist hydrodynamic and a variety of nonhydrodynamic imposed forces and/or uncontrollable physical conditions. The size increase can best be accomplished by including the safety factor, which will be a value greater than unity. The basic safety factor is S_f = 1.1. The basic safety factor may have to be increased in consideration for the following conditions:

(1) Imposed impact forces resulting from logs, uprooted trees, loose vessels, ice, and other types of large floating debris. Impact will produce more damage to a lighter weight riprap section than to a heavier section. For moderate debris impact, it is unlikely that an added safety factor should be used when the blanket thickness exceeds 15 in.

(2) The basic stone sizing parameters of velocity, unit weight of rock, and depth need to be determined as accurately as possible. A safety factor should be included to compensate for small inaccuracies in these parameters. If conservative estimates of these parameters are used in the analysis, the added safety factor should not be used. The safety factor should be based on the anticipated error in the values used. The following discussion shows the importance of obtaining nearly correct values rather than relying on a safety factor to correct inaccurate or assumed stone sizing parameters. The average velocity over the toe of the riprap is an estimate at best and is the parameter to which the rock size is the most sensitive. A check of the sensitivity will show that a 10 percent change in velocity will result in a nearly 100 percent change in the weight limits of the riprap gradation (based on a sphere) and about a 30 percent change in the riprap thickness. The riprap size is also quite sensitive to the unit weight of the rock to be used: a 10 percent change in the unit weight will result in a 70 percent change in the weight limits of the riprap gradation (based on a sphere) and about a 20 percent change in the riprap thickness. The natural variability of unit weight of stone from a stone source adds to the uncertainty (EM 1110-2-2302). The rock size is n nearly as sensitive to the depth parameter.

(3) Vandalism and/or theft of the stones is serious problem in urban areas where small riprap hc been placed. A W_{50}(min) of 80 lb should help preve theft and vandalism. Sometimes grouted stone is use around vandalism prone areas.

(4) The completed revetment will contain som pockets of undersized rocks, no matter how much effo is devoted to obtaining a well-mixed gradation througl out the revetment. This placement problem can be a: sumed to occur on any riprap job to some degree bu probably more frequently on jobs that require stockpi ing or additional handling. A larger safety factor shoul be considered with stockpiling or additional haulin and where placement will be difficult if quality contrc cannot be expected to address these problems.

(5) The safety factor should be increased where severe freeze-thaw is anticipated. The safety factor basec on each of these considerations should be considerec separately and then the largest of these values should be used in Equation 3-3.

D. Applications.

(1) The outer bank of straight channels downstream of bends should be designed using velocities computed for the bend. In projects where the cost of riprap is high, a channel model to indicate locations of high velocity might be justified. These coefficients are applicable to a thickness of $1D_{100}$(max). Equation 3-3 has been developed into Figure 3-7, which is applicable to thicknesses equal to $1D_{100}$(max), γ_s of 165 pcf, and the basic S_f of 1.1. Figure 3-8 is used to correct for values of other than γ_s of 165 pcf (when D_{30} is determined from Figure 3-7). The K_1 side slope factor is normally defined by the relationship of Carter, Carlson, and Lane (1953):

$$K_1 = \sqrt{1 - \frac{\sin^2\theta}{\sin^2\phi}} \qquad (3\text{-}4)$$

where θ = angle of side slope with horizontal; and ϕ = angle of repose of riprap material (normally 40 deg).

Results given in Maynord (1988) show Equation 3-4 to be conservative and that the repose angle is not a constant 40 deg but varies with several factors. The recommended relationship for K_1 as a function of θ is given in Figure 3-9 along with Equation 3-4 using ϕ = 40 deg. Also shown on Figure 3-9 is the correction for side slope when D_{30} is determined from Figure 3-7.

the ends of the revetment should be enlarged, as shown in Figure 3-11. The dimensions *a* and *b* should be 3 and 2 times the layer thickness, respectively. The decision to terminate the revetment in erosive velocities should be made with caution since severe erosion can cause the revetment to fail by progressive flanking.

C. Length. Riprap revetment is frequently carried too far upstream and not far enough downstream of a channel bend. In a trapezoidal channel, the maximum velocities along the outer bank are often located in the straight reach immediately downstream of the bend for relatively large distances downstream. In a natural channel, the limit of protection on the downstream end should depend on where the flow crosses to the opposite bank, and should consider future bar building on the opposite bank, resulting in channel constriction and increased velocities. Guidance is generally lacking in this area, but review of aerial photographs of the subject location can provide some insight on where the crossover flow occurs. Model tests in a sand bed and bank flume (USACE 1981) were conducted to determine the limits of protection required to prevent scour that would lead to destruction of the revetment. These tests were conducted in a 110-deg bend having a constant discharge. The downstream end of the revetment had to be 1.5 channel widths downstream of the end of the bend. Geomorphic studies to determine revetment ends should be considered.

SECTION IV
REVETMENT TOE SCOUR ESTIMATION AND PROTECTION

3-9. GENERAL.

Toe scour is probably the most frequent cause of failure of riprap revetments. This is true not only for riprap, but also for a wide variety of protection techniques. Toe scour is the result of several factors, including these three:

A. Meandering Channels, Change in Cross Section That Occurs after a Bank Is Protected. In meandering channels the thalweg often moves toward the outer bank after the bank is protected. The amount of change in cross section that occurs after protection is added is related to the erodibility of the natural channel bed and original bank material. Channels with highly erodible bed and banks can experience significant scour along the toe of the new revetment.

B. Meandering Channels, Scour at High Flows. Bed profile measurements have shown that the bed observed at low flows is not the same bed that exists at high flows. At high flows the bed scours in channel bends and builds up in the crossings between bends. On the recession side of the flood, the process is reversed. Sediment is eroded from the crossings and deposited in the bends, thus obscuring the maximum scour that had occurred.

C. Braided Channels. Scour in braided channels can reach a maximum at intermediate discharges where flow in the channel braids attacks banks at sharp angles.

Note that local scour is the mechanism being addressed herein. When general bed degradation or headcutting is expected, it must be added to the local scour. When scour mechanisms are not considered in the design of protection works, undermining and failure may result. Figure 3-12 may be used for gross depth of scour estimates. Neill (1973) provides additional information on scour depth estimation.

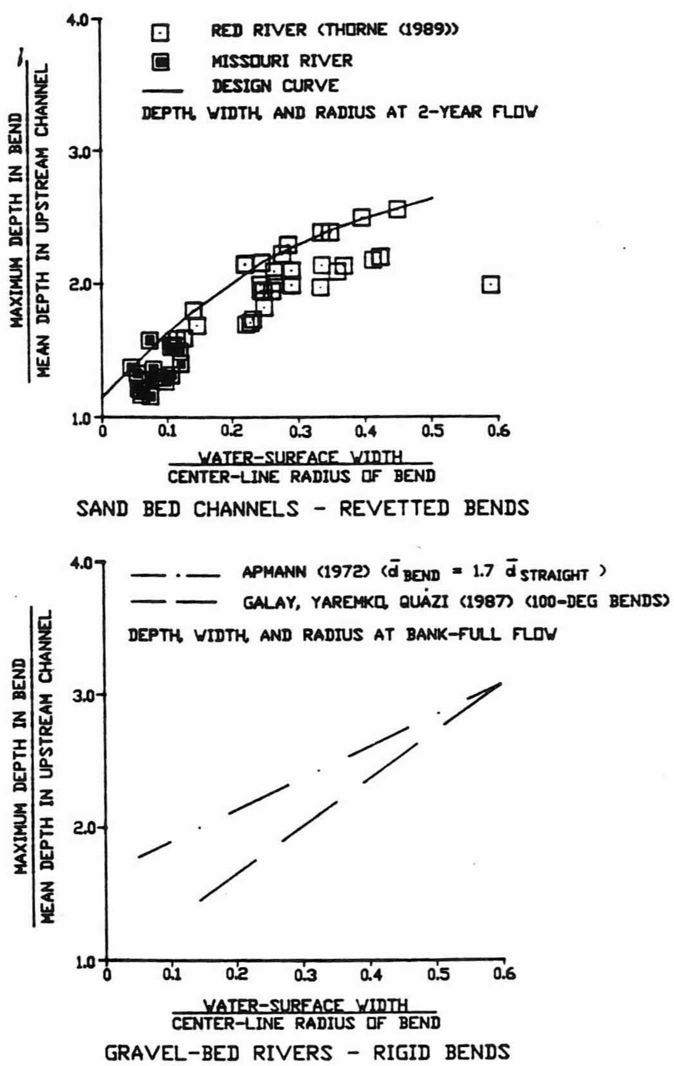


FIG. 3-12. Scour Depth in Bends

riprap gradation is first assumed and resistance coefficients are computed using Equation 3-2. Then the five steps described previously in (2) are conducted. If the gradation found in the preceding point 5 is equal to the assumed trial gradation, the solution is complete. If not, a new trial gradation is assumed and the procedure is repeated. The second example in Appendix H demonstrates this type of channel riprap.

(5) In braided streams and some meandering streams, flow is often directed into the bank line at sharp angles (angled flow impingement). Guidance is lacking on determining the imposed force for this condition. Until better guidance can be developed, a local velocity of 1.5 times the average velocity in the approach channel is recommended for use in riprap design.

(6) Transitions in size or shape may also require riprap protection. The procedures in this paragraph are applicable to gradual transitions where flow remains tranquil. In areas where flow changes from tranquil to rapid and then back to tranquil, riprap sizing methods applicable to hydraulic structures (HDC 712-1) should be used. In converging transitions, the procedures based on Equation 3-3 can be used unaltered. In expanding transitions, flow can concentrate on one side of the expansion and design velocities should be increased.

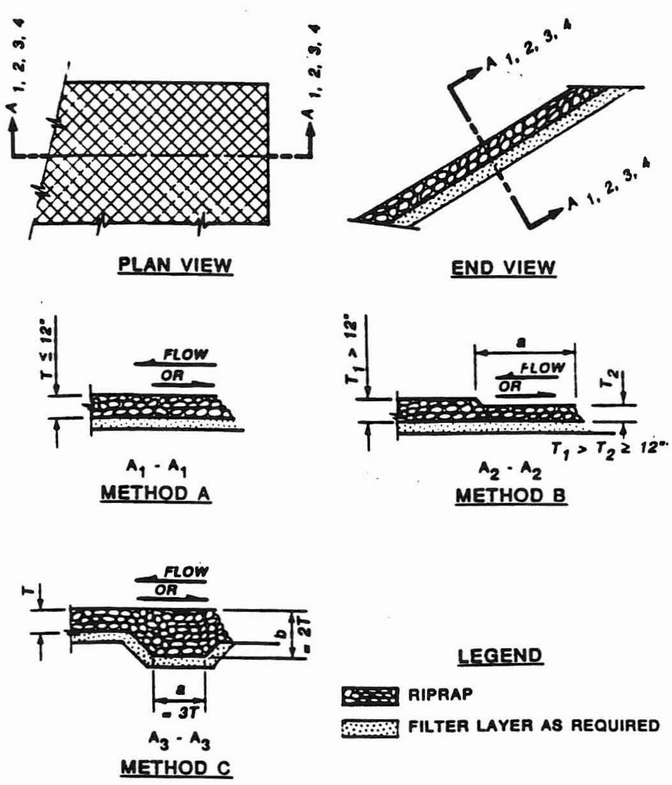


FIG. 3-11. Riprap End Protection

For installations immediately downstream of concrete channels, a vertical velocity distribution coefficient of 1.25 should be used due to the difference in velocity profile over the two surfaces.

3-8. REVETMENT TOP AND END PROTECTION.

Revetment top and end protection requirements, as with all channel protective measures, are to assure the project benefits, to perform satisfactorily throughout the project economic life, and not to exceed reasonable maintenance costs. Reference is made to ER 1110-2-1405, with emphasis on paragraph 6c.

A. Revetment Top. When the full height of a levee is to be protected, the revetment will cover the freeboard, i.e., extend to the top of the levee. This provides protection against waves, floating debris, and water-surface irregularities. Similar provisions apply to incised channel banks. A horizontal collar, at the top of the bank, is provided to protect against escaping and returning flows as necessary. The end protection methods illustrated in Figure 3-11 can be adapted for horizontal collars. Figure 3-6 provides general guidance for velocity variation over channel side slopes that can assist in evaluating the economics of reducing or omitting revetment for upper bank areas. Revetment size changes should not be made unless a sufficient quantity is involved to be cost effective. Many successful revetments have been constructed where the top of the revetment was terminated below the design flow line. See USACE (1981) for examples.

B. Revetment End Protection. The upstream and downstream ends of riprap revetment should be protected against erosion by increasing the revetment thickness T or extending the revetment to areas of noneroding velocities and relatively stable banks. The following guidance applies to the alternative methods of end protection illustrated in Figure 3-11.

(1) Method A. For riprap revetments 12 in. thick or less, the normal riprap layer should be extended to areas where velocities will not erode the natural channel banks.

(2) Method B. For riprap revetments exceeding 12 in. in thickness, one or more reductions in riprap thickness and stone size may be adopted for a distance a (Figure 3-11) in which velocities decrease to a noneroding natural channel velocity.

(3) Method C. For all riprap revetments that do not terminate in noneroding natural channel velocities,

TABLE 3-1. Gradations for Riprap Placement in the Dry, Low-Turbulence Zones

Limits of Stone Weight, lb[a], for Percent Lighter by Weight

D_{100} (max) (in.) (1)	100 Max (2)	100 Min (3)	50 Max[b] (4)	50 Min (5)	15 Max[b] (6)	15 Min (7)	D_{30} (min) (ft) (8)	D_{90} (min) (ft) (9)
(a) Specific Weight = 155 pcf								
12	81	32	24	16	12	5	0.48	0.70
15	159	63	47	32	23	10	0.61	0.88
18	274	110	81	55	41	17	0.73	1.06
21	435	174	129	87	64	27	0.85	1.23
24	649	260	192	130	96	41	0.97	1.40
27	924	370	274	185	137	58	1.10	1.59
30	1,268	507	376	254	188	79	1.22	1.77
33	1,688	675	500	338	250	105	1.34	1.94
36	2,191	877	649	438	325	137	1.46	2.11
42	3,480	1,392	1,031	696	516	217	1.70	2.47
48	5,194	2,078	1,539	1,039	769	325	1.95	2.82
54	7,396	2,958	2,191	1,479	1,096	462	2.19	3.17
(b) Specific Weight = 165 pcf								
12	86	35	26	17	13	5	0.48	0.70
15	169	67	50	34	25	11	0.61	0.88
18	292	117	86	58	43	18	0.73	1.06
21	463	185	137	93	69	29	0.85	1.23
24	691	276	205	138	102	43	0.97	1.40
27	984	394	292	197	146	62	1.10	1.59
30	1,350	540	400	270	200	84	1.22	1.77
33	1,797	719	532	359	266	112	1.34	1.96
36	2,331	933	691	467	346	146	1.46	2.11
42	3,704	1,482	1,098	741	549	232	1.70	2.47
48	5,529	2,212	1,638	1,106	819	346	1.95	2.82
54	7,873	3,149	2,335	1,575	1,168	492	2.19	3.17
(c) Specific Weight = 175 pcf								
12	92	37	27	18	14	5	0.48	0.70
15	179	72	53	36	27	11	0.61	0.88
18	309	124	92	62	46	19	0.73	1.06
21	491	196	146	98	73	31	0.85	1.23
24	733	293	217	147	109	46	0.97	1.40
27	1,044	417	309	209	155	65	1.10	1.59
30	1,432	573	424	286	212	89	1.22	1.77
33	1,906	762	565	381	282	119	1.34	1.94
36	2,474	990	733	495	367	155	1.46	2.11
42	3,929	1,571	1,164	786	582	246	1.70	2.47
48	5,864	2,346	1,738	1,173	869	367	1.95	2.82
54	8,350	3,340	2,474	1,670	1,237	522	2.19	3.17

[a] Stone weight limit data from ETL 1110-2-120 [HQUSACE, 1971 (14 May), "Additional Guidance for Riprap Channel Protection, Ch. 1," U.S. Government Printing Office, Washington, DC]. Relationship between diameter and weight is based on the shape of a sphere.

[b] The maximum limits at the W_{50} and W_{15} sizes can be increased as in the Lower Mississippi Valley Division Standardized Gradations shown in Appendix F.

G. BRADY

Drainage Design Manual for Maricopa County, Arizona

Volume II Hydraulics

By
NBS Lowry
Engineers & Planners
and
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for the
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of Maricopa County
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Regulation	Page
Required freeboard is computed according to the following formula: $$FB = 0.25\,(Y + V^2/2g) \qquad (5.10)$$ The minimum freeboard value for rigid channels shall be 1 foot for subcritical and 2 feet for supercritical flows. Using a smaller freeboard in specific cases requires prior approval of the governing agency.	5-19
According to ARS 48-3609.A, during the course of the Master Planning process, the 100-year runoff will be used to delineate a floodplain for major channels with discharges of more than 1,000 cfs and will be processed through the local government, ADWR, and FEMA.	5-24
Encroachments into the floodplain of a natural wash are to be analyzed according to the FEMA requirements.	5-24
At no time should an encroachment adversely affect the river's stability or adversely alter flooding conditions on adjacent properties. When encroachment is proposed within the floodplain of a major watercourse, the regulating entity may, at its discretion, request that a detailed study be performed to determine if a reduction in overbank flood storage will significantly affect downstream flood peaks.	5-24
The minimum thickness for the soil cement lining shall be 12-inches (two 6-inch lifts).	5-30
All concrete channels carrying supercritical flow shall be lined with continuously reinforced concrete extending both longitudinally and laterally. There shall be no reduction in cross sectional area at bridges or culverts. Freeboard shall be adequate to provide a suitable safety margin—at least 2 feet—or an additional capacity of approximately one-third of the design flow.	5-33
Riprap linings shall have a minimum thickness of 1.5 times D_{100}. In urban areas, riprap having a D_{50} less than one foot should be buried and revegetated to protect the riprap lining from vandalism.	5-41
Due to a high failure rate and excessive maintenance costs, drop structures having loose riprap on a sloping face are not permitted.	6-8
The maximum vertical drop height from crest to basin for a vertical hard basin drop is limited to 3 feet for safety considerations.	6-28
Maximum drop depth is limited to 3 feet due to safety considerations and the practicality of obtaining large basin riprap for higher drops.	6-33

6.8. Using the relationship Q = AV, determine the flow velocity V at the pipe outlet. Assume depth $D = A^{0.5}$ and compute the Froude Number = $V/(gD)^{0.5}$.

2. The entrance pipe should be turned horizontal at least one pipe diameter equivalent length upstream from the outlet. For pipe slopes greater than 15 degrees, the horizontal length should be a minimum of two pipe diameters.

3. Do not use this type of outlet energy dissipator when exit velocities exceed 50 feet per second or Froude Numbers exceed 9.0. These conditions would be extreme and must be considered as special cases. Performance is achieved with a tailwater depth equal to half full flow level in the pipe outlet.

4. Determine the basin width (W) by entering the appropriate Froude Number and effective flow depth on Figure 6.23. The remaining dimensions are proportional to the basin width according to the legend in Figure 6.22. Note that the baffle thickness, t, is a suggested minimum. It is not a hydraulic parameter and is not a substitute for structural analysis.

   The basin width should not be increased since the basin is inherently oversized for less than design flows. Larger basins become less effective as the inflow can pass under the baffle.

5. Structure wall thickness, steel reinforcement, and anchor walls (underneath the floor) should be designed using accepted structural engineering methods. Hydraulic forces on the overhanging baffle may be approximated by determination of the jet momentum force:

$$F_m = \rho V Q = 1.94\, VQ \qquad (6.14)$$

6. Riprap with a minimum D_{50} of 18 inches should be provided in the receiving channel from the end sill to a minimum distance equal to the basin width. The depth of rock should be equal to the sill height or at least 2.5 feet. Rock may be buried below finished grades and the area vegetated as desired to match the site.

7. The alternate end sill and wingwall shown in Figure 6.22 is recommended for all grass lined channels to reduce the scour potential below the sill wall.

Low Flow Modifications: The standard design will retain a standing pool of water in the basin bottom which is generally undesirable from a safety and maintenance standpoint. This situation should be alleviated where practical by matching the receiving channel low flow depth to the basin depth, see Figure 6.24.

A low flow gap is extended through the basin end sill wall. The gap in the sill should be as narrow as possible to minimize effects on the sill hydraulics. This implies that a narrow and deeper (1.5 to 2-foot) low flow channel will work better than a wider gap section. The low flow width should not exceed 60 percent of the pipe diameter to prevent the jet from short-circuiting through the cleanout notches.

Low flow modifications have not been fully tested to date. Caution is advised to avoid compromising the overall hydraulic performance of the structure. Other ideas

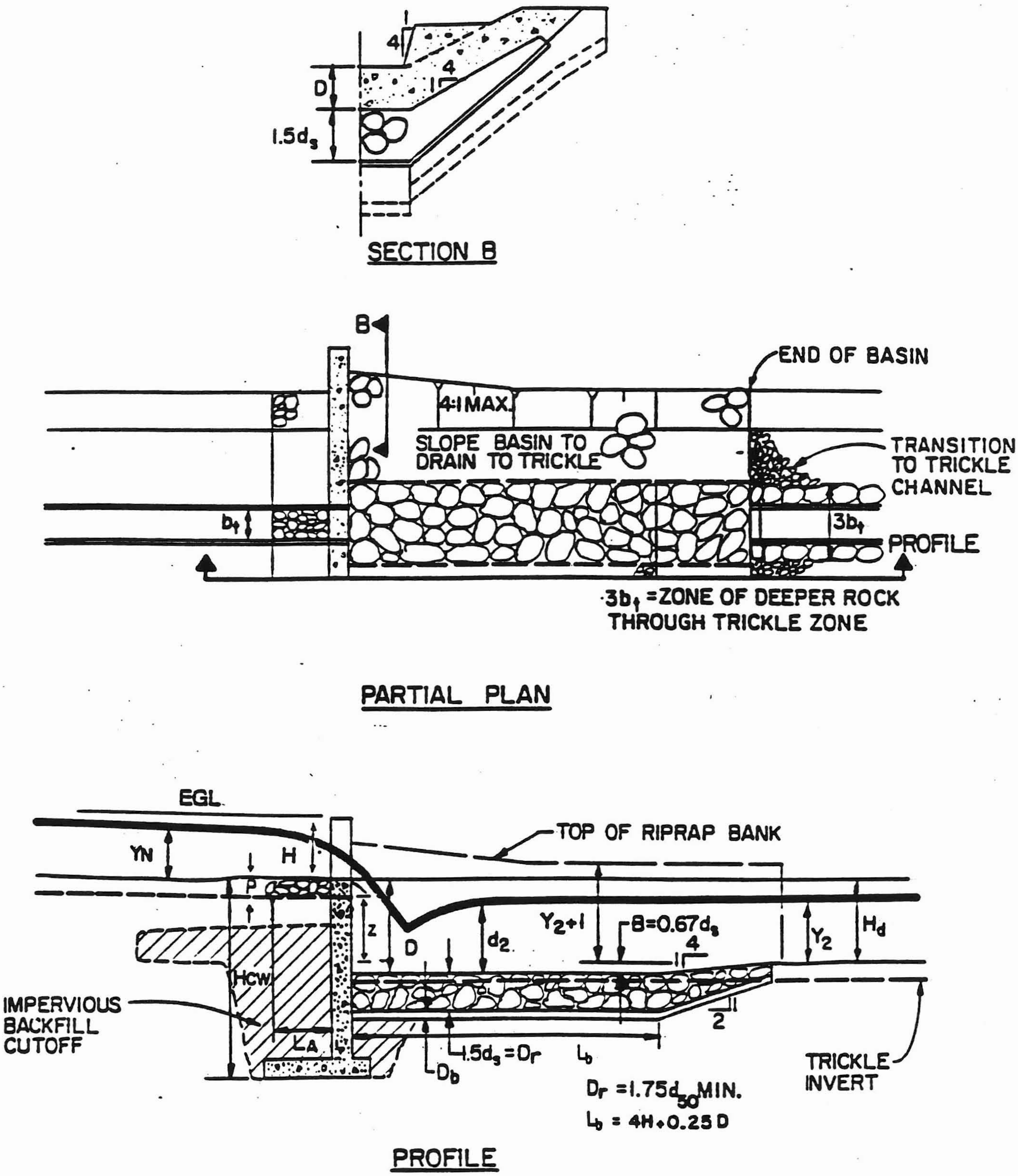


Figure 6.12
Vertical Riprap Basin Drop
(Stevens 1981)

RID CANAL TEMPORARY BYPASS HYDRAULIC CALCULATIONS

DRAFT DESIGN REPORT
JULY 1997

Flood Control District of Maricopa County (FCDMC)
RID Overchute Project
Temp Bypass Canal Des Criteria Summ
Stantech Project No. 28900014
July 1997

RID CANAL TEMPORARY BYPASS CHANNEL		
Lining Type:	Temporary earth chann. w/geomembrane liner	
Max Permissible Velocity	Not Available	Water flow protection may be req when velocity exceeds 3 ft/s
Normal Depth (Manning's) Hydraulic Properties	Q=435 (max)	Overch to 750' E. of Overch along RID Canal - S. Wall Only last 150'
	B=12 ft	
	S=.00013 ft/ft	HEC-2 water surface profiles
	S:S=1:1	Geomembrane liner literature (Siplast Inc., Teranap Geomembrane Div.)
	d=7.00 ft	Normal Depth - Manning's
	n=.012	Geomembrane iner literature (Siplast Inc., Teranap Geomembrane Div.)
	v=3.67 f/s	
	L= approx. 600 ft.	Estimated from prelim layout dwgs.
Beginning U/S Elev	1003.60	
Ending D/S Elev	1003.50	
Radius of Curvature @ Bends	5 X (Top Width)	USBR Design Standards No. 3, "Canals and Related Structures", 1967

Source: Drainage Des Man of Mar Cnty, Vol II, Hydraulics, Sept 1992
Chan Lin Des Guidel, ADOT, Feb 1989
HEC-2 Wat Surf Anal Prog HEC-2 User's Man, Boss Corp, 1993
Stantech Consultants, 1997

Table
Rating Table for Trapezoidal Channel

Project Description	
Project File	c:\fmw\ridochut.fm2
Worksheet	RID Canal Temporary Bypass Channel
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data		
Channel Slope	0.000130	ft/ft
Left Side Slope	1.00	H : V
Right Side Slope	1.00	H : V
Bottom Width	12.00	ft

Input Data	Minimum	Maximum	Increment
Mannings Coefficient	0.012	0.016	0.001
Depth	1.00	9.00	1.00 ft

Rating Table

Depth (ft)	Mannings Coefficient	Discharge (ft^3/s)
1.00	0.012	16.81
1.00	0.013	15.52
1.00	0.014	14.41
1.00	0.015	13.45
1.00	0.016	12.61
2.00	0.012	53.76
2.00	0.013	49.62
2.00	0.014	46.08
2.00	0.015	43.01
2.00	0.016	40.32
3.00	0.012	107.36
3.00	0.013	99.10
3.00	0.014	92.02
3.00	0.015	85.89
3.00	0.016	80.52
4.00	0.012	177.15
4.00	0.013	163.52
4.00	0.014	151.84
4.00	0.015	141.72
4.00	0.016	132.86
5.00	0.012	263.38
5.00	0.013	243.12

Table
Rating Table for Trapezoidal Channel

Rating Table

Depth (ft)	Mannings Coefficient	Discharge (ft^3/s)
5.00	0.014	225.76
5.00	0.015	210.71
5.00	0.016	197.54
6.00	0.012	366.60
6.00	0.013	338.40
6.00	0.014	314.22
6.00	0.015	293.28
6.00	0.016	274.95
7.00	0.012	487.45
7.00	0.013	449.95
7.00	0.014	417.81
7.00	0.015	389.96
7.00	0.016	365.59
8.00	0.012	626.67
8.00	0.013	578.46
8.00	0.014	537.15
8.00	0.015	501.34
8.00	0.016	470.00
9.00	0.012	785.01
9.00	0.013	724.63
9.00	0.014	672.87
9.00	0.015	628.01
9.00	0.016	588.76

Q_{MAX} = 435 cfs

Design Standards No. 3

CANALS AND RELATED STRUCTURES

CHAPTER 1. CANALS AND LATERALS
2. GENERAL DESIGN INFORMATION FOR STRUCTURES
3. DIVERSION DAMS
4. DIVERSION HEADWORKS
5. CANAL STRUCTURES
6. WATER MEASUREMENT STRUCTURES
7. CROSS DRAINAGE AND PROTECTIVE STRUCTURES
8. PIPE DISTRIBUTION SYSTEMS
9. BRIDGES

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

OFFICE OF CHIEF ENGINEER
DENVER, COLORADO

siplast

Fax Transmission
Cover Sheet

Fax No. 214/506-6249

Date: 3-1-96 Time:

Person To: GARY BRADY

Company To:

Fax No. Transmitted To:

Person From: JOHN THOMAS

Number of Pages (Including This Page): 5

Message Content Description:

$.85/ft² LINER

$1.15/ft² Installation

222 West Las Colinas Boulevard • Suite 1600 • Irving, Texas 75039 • 214/869-0070

CONSTRUCTION SPECIFICATION

REINFORCED ELASTOMERIC BITUMEN LINING

1. SCOPE

The work shall consist of furnishing all materials, equipment, and labor necessary for the installation of the Reinforced Elastomeric Bitumen Liner (REBL).

2. MATERIALS

The REBL shall be Teranap 431 manufactured by Siplast or an approved equal. Salient features include:

a. Two asphalt layers separated by a layer of polyester reinforcement.

b. Minimum thickness of the composite geomembrane shall be 158 mils, in accordance with ASTM D5147.

c. The geomembrane shall be lightly sanded on one side and covered with a polyester film on the other.

d. The materials properties shall equal or exceed the following:

Test Description	Requirements	Test Method
Puncture Resistance	110 lbs	FTMS 101C Method 2065
Low Temperature Brittleness	-15°F	ASTM D 5147
Seam Strength	240 lbs.	ASTM D 751
Seam Peel	30 lbs	ASTM D 413
Specific Gravity	1.25	ASTM D 792
Tensile Strength	90 lbs/in	ASTM D 5147
Elongation Maximum Load (yield)	70%	ASTM D 5147
Tear Resistance	96 lbs	ASTM D 5147

3. SUBGRADE PREPARATION

A. GENERAL

All vegetation and traces of organic vegetable substances must be removed in order to prevent direct contact of large roots with the REBL.

The subgrade upon which the REBL is to be placed shall be prepared to produce a firm surface, reasonably even and smooth and free of abrupt breaks, protruding materials, and sharp rocks on the surface exceeding 1 inch in diameter. Where the existing ground surface is below the lining grade, approved excavated materials shall be placed as compacted fill to the elevation of the underside of the lining as shown on the drawings or as directed. Frozen materials shall not be used. In hard or unsuitable foundation material, the subgrade shall be over excavated and backfilled, as directed by the Engineer.

B. FINAL PREPARATION

The subgrade on which the REBL will be placed shall be raked to remove all large clods, roots, brush, sod, or rocks that might endanger the lining material. Rolling the subgrade is recommended to provide an extra measure of safety against punctures.

4. STORAGE

The REBL rolls shall be stored horizontally, without stacking, and/or as otherwise recommended by the manufacturer. The material shall be stored by supporting the projecting metal cores to keep the rolls off the ground.

5. PLACEMENT

A. GENERAL

The REBL shall be placed with the polyester film side facing the subgrade as per manufacturers recommendations. The lining shall be anchored along each side of the canal section and at each end of the lining as shown on the drawings. Anchor trench excavation shall be completed before the lining installation begins. The leading edge of the lining shall be secured at all times by means of ballast, such as sand bags or other approved methods. The lining shall not be placed on a frozen or snow covered subgrade. The lining shall not be placed when the air temperature is below 32 degrees F., unless approved by the Engineer and special application procedures furnished by the manufacture are followed. Only that material that can be anchored and seamed together that same day shall be placed in position. No vehicle traffic shall be allowed on the liner after the liner is in place.

B. SEAMING

The REBL shall be positioned in a manner to provide a minimum of 6 inches of overlap at the sides and on the ends of each roll of lining material. The seams shall be laid in a shingle fashion downstream. Laps shall be increased by 2 inches when covering a irregular substrata. Horizontal seaming on side slopes will not be permitted unless approved by the Engineer. Prior to seaming, the seam area must be free of dirt, debris, moisture, dust or any foreign material. Excessive undulations (waves) along the seams during seaming will not be allowed. Seaming shall not be allowed during rain or snow.

Laps shall be bonded as recommended by manufacturer. Upon completion of the REBL installation, the contractor shall inspect all seamed areas for obvious defects. The seams shall be tested with an air lance mechanical probe or other approved method. Any suspect areas shall be further tested and repaired as necessary.

Repairs to the REBL shall be made with the parent material and bonded according to manufacturers recommendations. The patch shall extend a minimum of 6 inches in each direction beyond the damaged area. The area to be patched shall be clean and free of moisture. Upon bonding the patch shall be smooth and free of wrinkles to assure a tight, smooth seal.

C. ATTACHMENT TO CONCRETE

Where the reinforced elastomeric bitumen liner is to be attached by thermal bonding to concrete, the concrete shall be primed with an asphalt based primer (ASTM D412). The area to be thermally bonded shall be 6 inches in width. The liner shall then be anchored to the concrete according to the details shown on the drawings. After the liner is anchored to the concrete, a bead of caulk shall be placed around the entire anchorage perimeter to prevent water from seeping under the anchorage. The caulk may be Sonoplastic NP 1 supplied by Sonneborn Building Products, Minneapolis, MN., or an approved equal.

6. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of REBL placed within the specified limits will be determined to the nearest square foot by computing the area covered. The length shall be measured along the centerline of the lined canal including the anchor trenches at each end. The width shall be the computed perimeter shown on the drawings plus the anchor dimensions at the sides. The computed quantity does not include the material required to make the lapped seams.

Payment for the REBL, including subgrade preparation, will be made at the contract unit price. Such payment will be considered full compensation for all labor, materials, equipment, and other incidental items necessary for the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

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

A. BID ITEM 3 - REINFORCED ELASTOMERIC BITUMEN LINER

(1) This item includes subgrade preparation and furnishing and installing the 158 mil REBL as shown on the drawings and as described herein.

(2) MEASUREMENT AND PAYMENT, Section 6, will apply. The material required to make the lapped seams specified is subsidiary to this bid item. Such payment will constitute partial compensation for Subsidiary Item Metal Fabrication and Installation.

MAR-01-96 FRI 03:45 PM SIPLAST 2145066249 P.05

IV. TERANAP INSTALLATION

4.1 GENERAL

Teranap Geomembranes are installed with the polyester film side facing the subgrade. The Teranap Geomembrane shall be placed over the prepared subgrade in such a manner as to assure minimum handling. Anchor trench excavation should be completed before the lining installation begins. The rolls shall be of maximum design size and shall be placed in such a manner as to minimize seaming. Only those rolls of material which can be anchored and seamed together that same day shall be unrolled and placed in position.

In areas where wind is prevalent, lining installation should be started at the upwind side of the project and proceed downwind. The leading edge of the membrane shall be secured at all times by means of ballast (i.e. sandbags) spaced every 3 feet to hold it down during high winds.

Teranap rolls shall be closely fitted and sealed around inlets, outlets and other projections through the liner.

4.2 SEAMING

Horizontal seaming on side slopes is not recommended.

If the geomembrane is not ballasted with cover material and is subject to flowing water, i.e. canals, seams must be laid in a shingle fashion downstream.

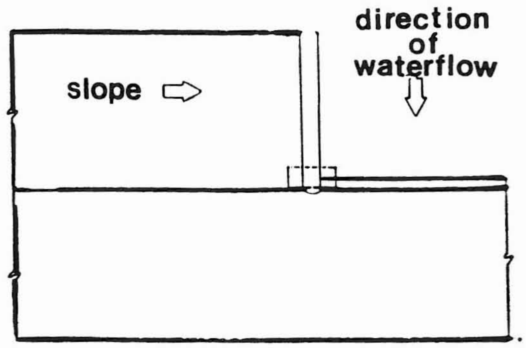
Laps must be increased by 2 inches when covering an irregular substrate.

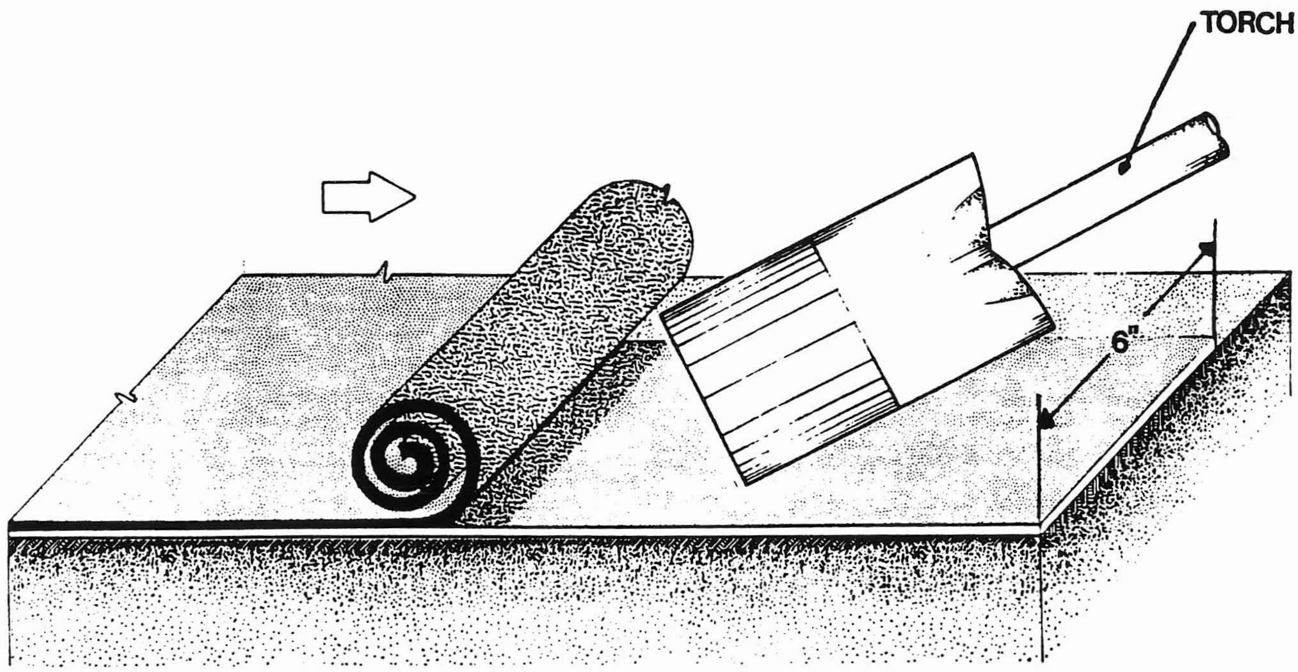
4.3 SEAMING TERANAP 2 METER ROLLS

Each roll should be positioned to effect a 6 inch seam over lap at the side and ends of the roll. Prior to seaming, the seam area must be free of dirt, debris, moisture, dust or any foreign material. Excessive undulations (waves) along the seams during seaming should be avoided. Seaming is not allowed during rain or snow. Special application precautions may be necessary during cold weather. (Contact SIPLAST Technical Department for cold weather application procedures.)

Laps should be thermally bonded by torch or hot air methods. Torch/hot air sealing shall begin as work advances by rolling the upper sheet onto the adjacent lower sheet while continually holding a flow of molten bitumen in contact with the over lap area.

The sheet shall be pressed in per the sketch below:





If the above method cannot be achieved then Teranap should be unrolled, lapped 8 inches and the lap shall be torched or hot air-seamed in place. The over lap should then be pressed down with a wet rag or sponge following the torching to accomplish total bonding.

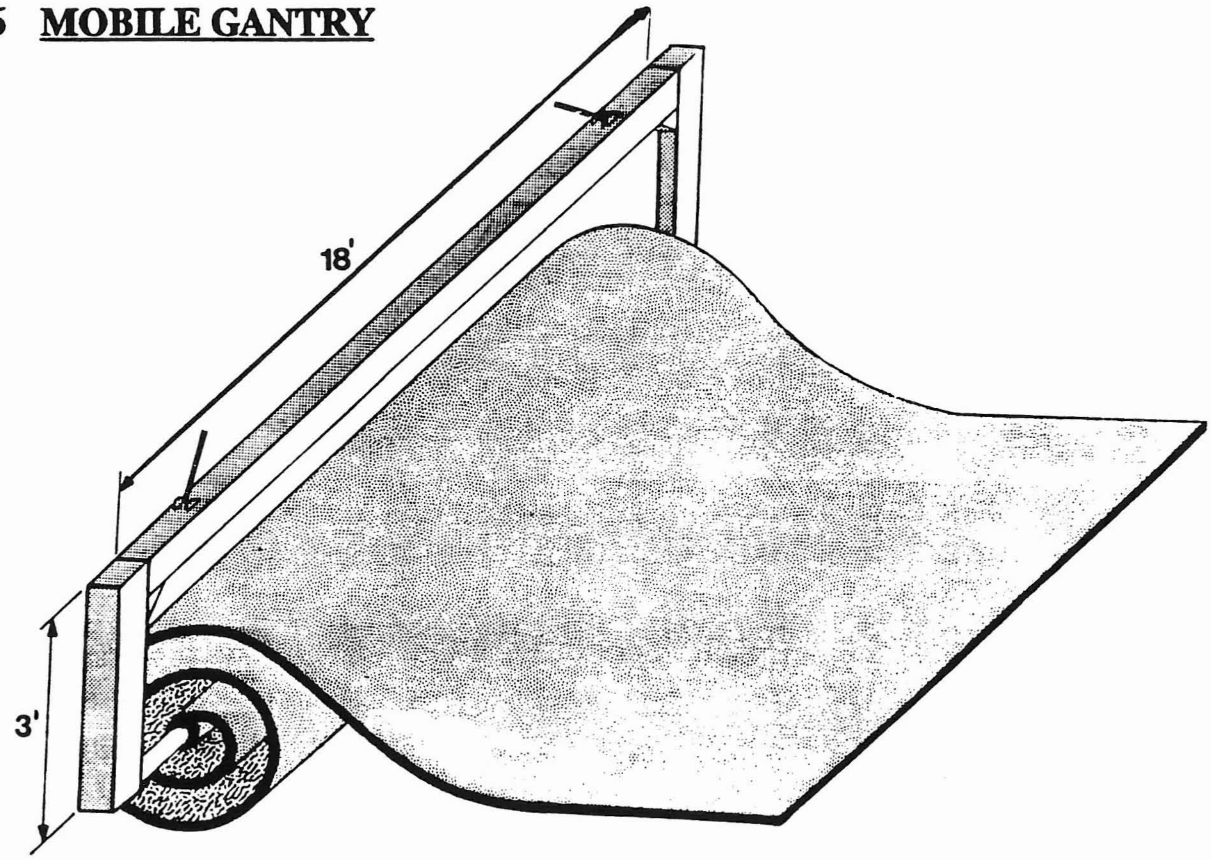
4.4 UNROLLING 4 METER WIDE ROLLS

Four meter wide Teranap 431 is packaged with the polyester film facing inside (instead of being outside as in Teranap 331 and 431 in 2 meter wide rolls) so that it is facing the subgrade when unrolled from a mobile gantry, crane or backhoe.

4.5 HANDLING

Special mechanical equipmient is necessary to handle Teranap 431 in 4 meter widths as show in the figure below.

4.6 MOBILE GANTRY



4.7 PLACEMENT OF 4 METER WIDE ROLLS

Due to the weight and length of the 4 meter wide rolls, mechanical placement of the rolls is necessary by one of the following methods; a crane, back hoe, or mobile gantry suspended from a dump truck.

The only case when a mobile gantry is not required is when the roll length does not exceed 80 feet. The use of a light crane or back hoe is still necessary for handling the shorter rolls.

Unrolling devices can be designed by the contractor for specific application requirements.

4.8 SEAMING TERANAP 431 4 METER ROLLS

Teranap 431-4m cannot be thermally bonded at the overlaps while unrolling the roll. The material should be unrolled and lapped 8 inches. The selvage paper on the membrane must then be removed and the overlap surfaces shall be fully torched or hot air softened and pressed together with a wet cloth, sponge, or roller to accomplish total bonding.

4.9 SEAM INSPECTION/TESTING

Upon completion of the Teranap installation, the installation contractor shall visually inspect all seamed areas for obvious defects. The seams shall be tested with an air lance mechanical probe or other approved method. Any suspect areas shall be further tested and repaired as necessary.

4.10 PATCHING/REPAIRING

Repairs to Teranap shall be made with the parent material and a propane torch. Clean and heat prime the surface to be patched. The patch shall extend a minimum of 6 inches in each direction beyond the damaged area. Completely heat bond the patch material to the prepared surface, smoothing out any wrinkles. Mechanically smooth the edges of the patch (i.e. with a small metal trowel) to assure a tight, smooth seal.

V. ANCHORING

5.1 TOP OF SLOPE

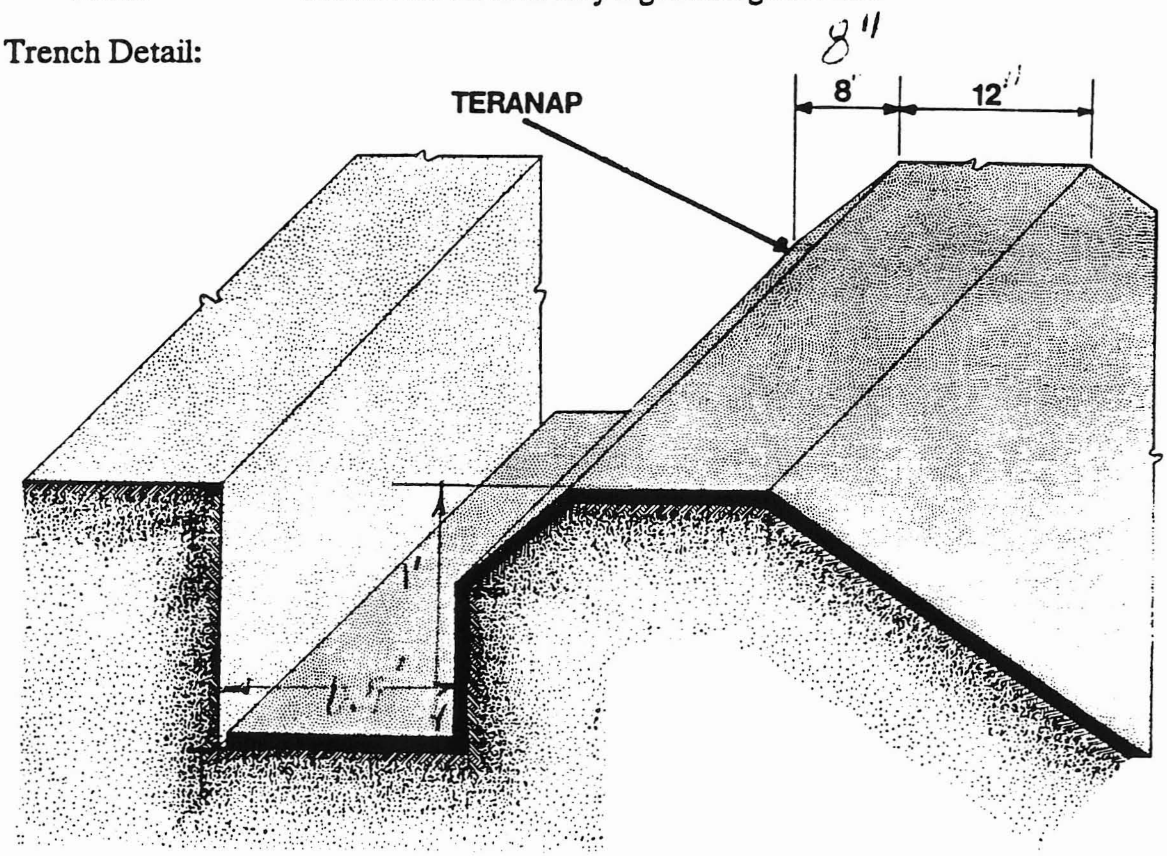
Teranap shall be anchored at the top of the slope to prevent the geomembrane from slipping down the embankment and to allow the geomembrane to resist wind uplift. During installation the membrane must be temporarily held in place at the top of the side slope before anchoring. Temporary ballasting in trenches can be accomplished with sand bags or soil.

As a general guideline the width and depth of the trench to be excavated at the top of the slope is indicated in the table below in relation to the length of the slope

Length of Slope ft.	Trench Area Cross Section Square footage Light Wind Exposure	Strong wind Exposure
0-15	.5	1
16	1	2
32	2	3
50 and over	3	4

Note: The above table is only a general guideline.

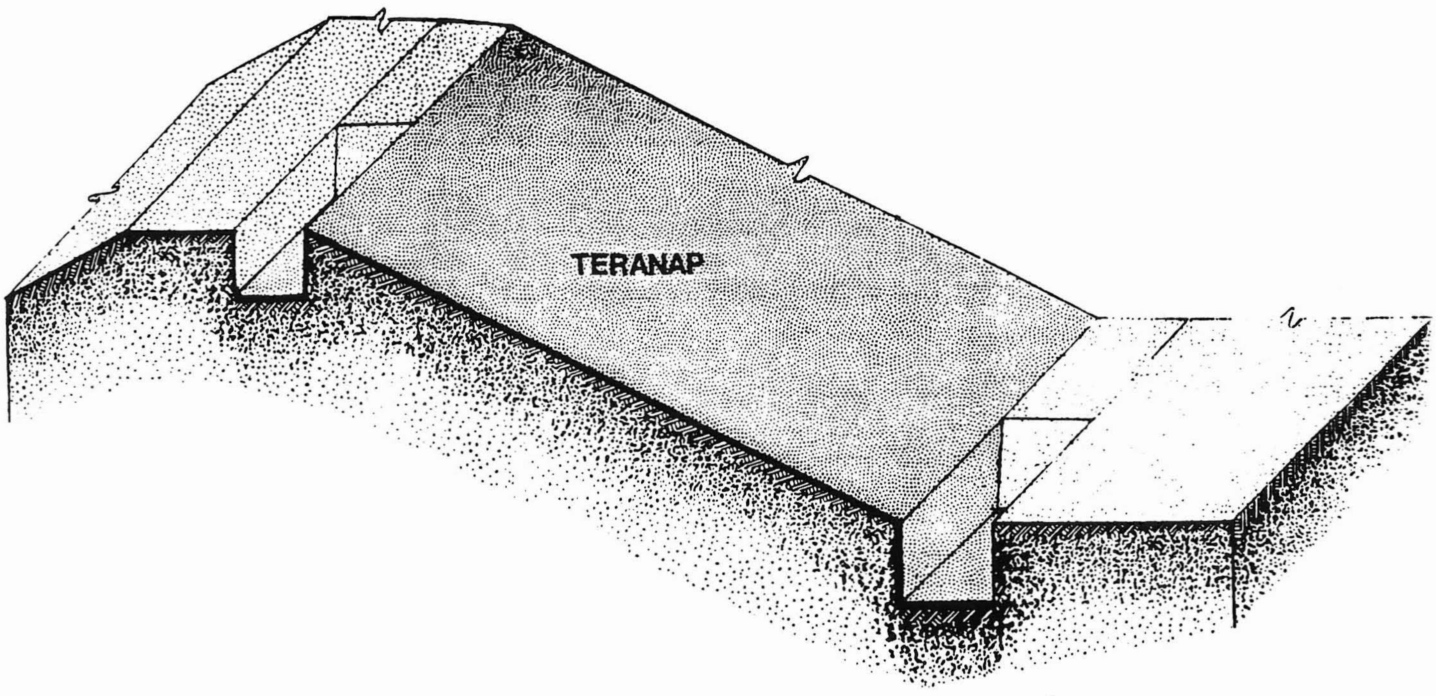
Trench Detail:



5.2 BOTTOM OF SLOPE (DAM APPLICATIONS)

Teranap shall be anchored at the bottom of the slope to ensure the stability of the geomembrane under wind suction effect and to ensure the continuity of the waterproofing between the geomembrane and the substrate.

The suggested method of anchoring to be used is illustrated in the following detail:

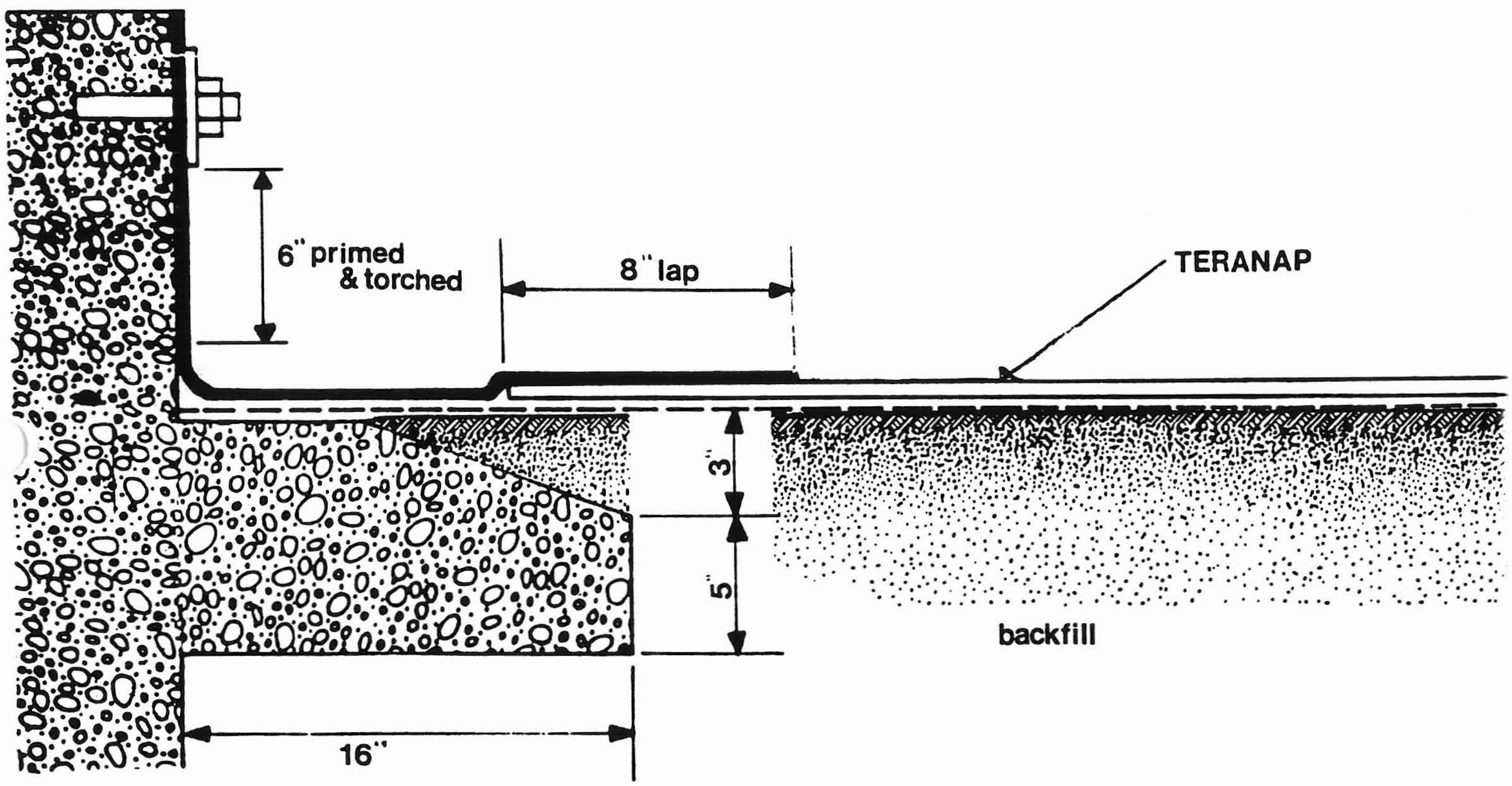


5.3 BALLASTING

Basins that do not have permanently stored liquids in them may require ballasting to resist wind uplift pressures. (Contact the Siplast Technical Department for specific ballasting requirements based on expected wind forces.)

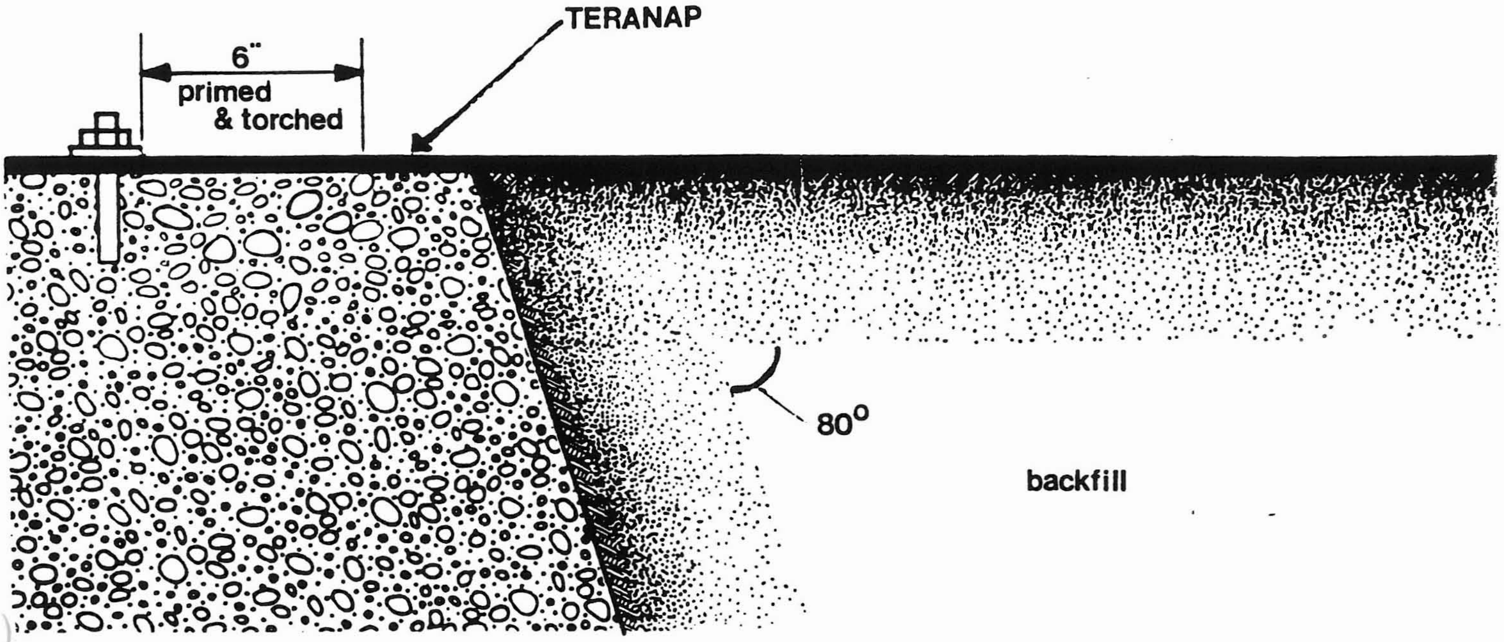
5.4 ATTACHMENT TO CONCRETE (VERTICAL WALLS)

Where Teranap is to be attached by thermal bonding to concrete, the concrete shall be primed with an asphalt based primer (ASTM D-412). The area to be thermally bonded shall be 6 inches in width unless noted otherwise and fastened according to the detail below.

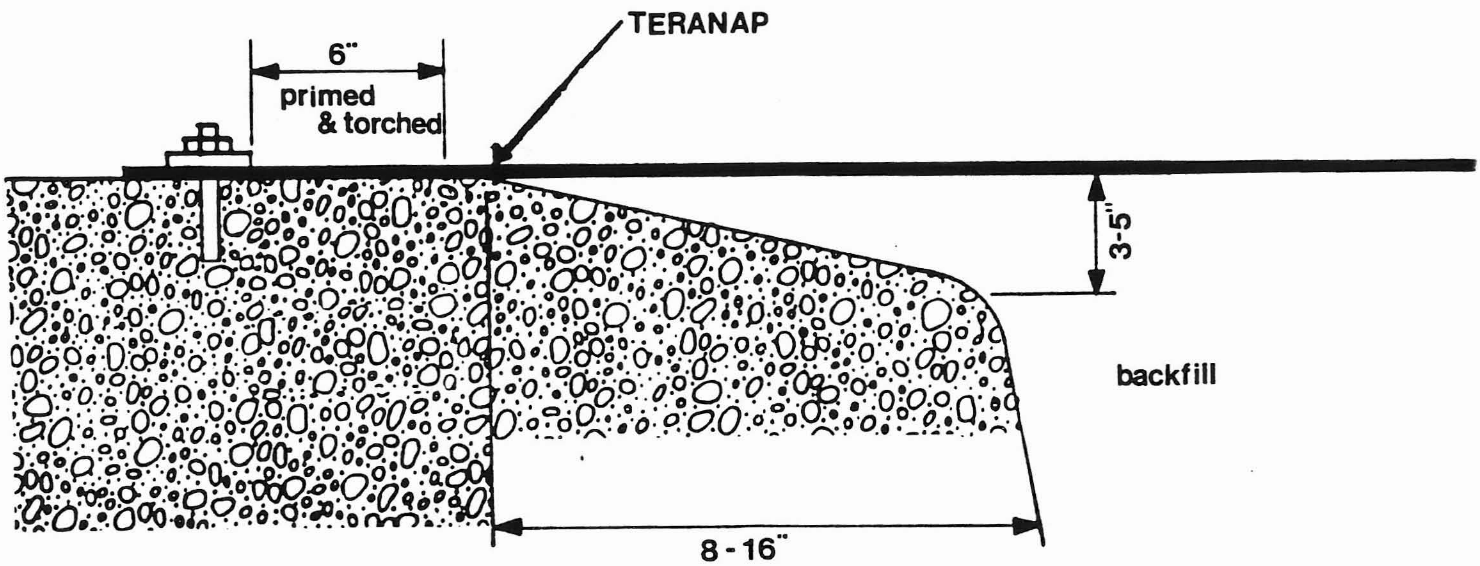


5.5 ATTACHMENT TO CONCRETE (HORIZONTAL)

Proper Attachment:

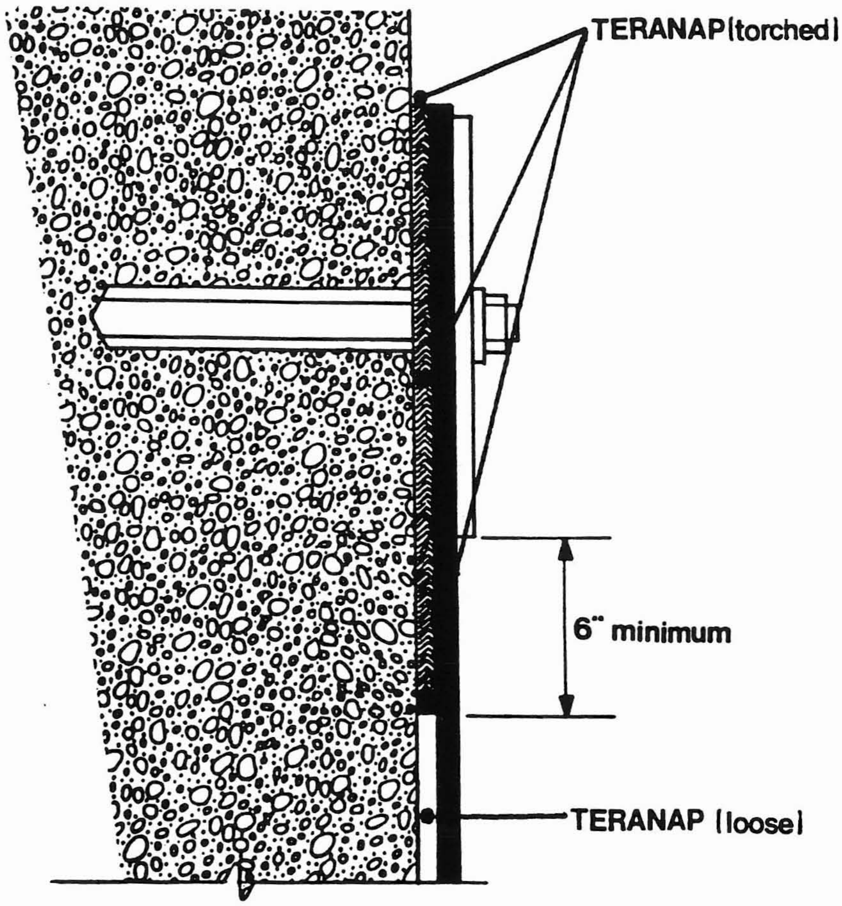


Other Acceptable Detail:

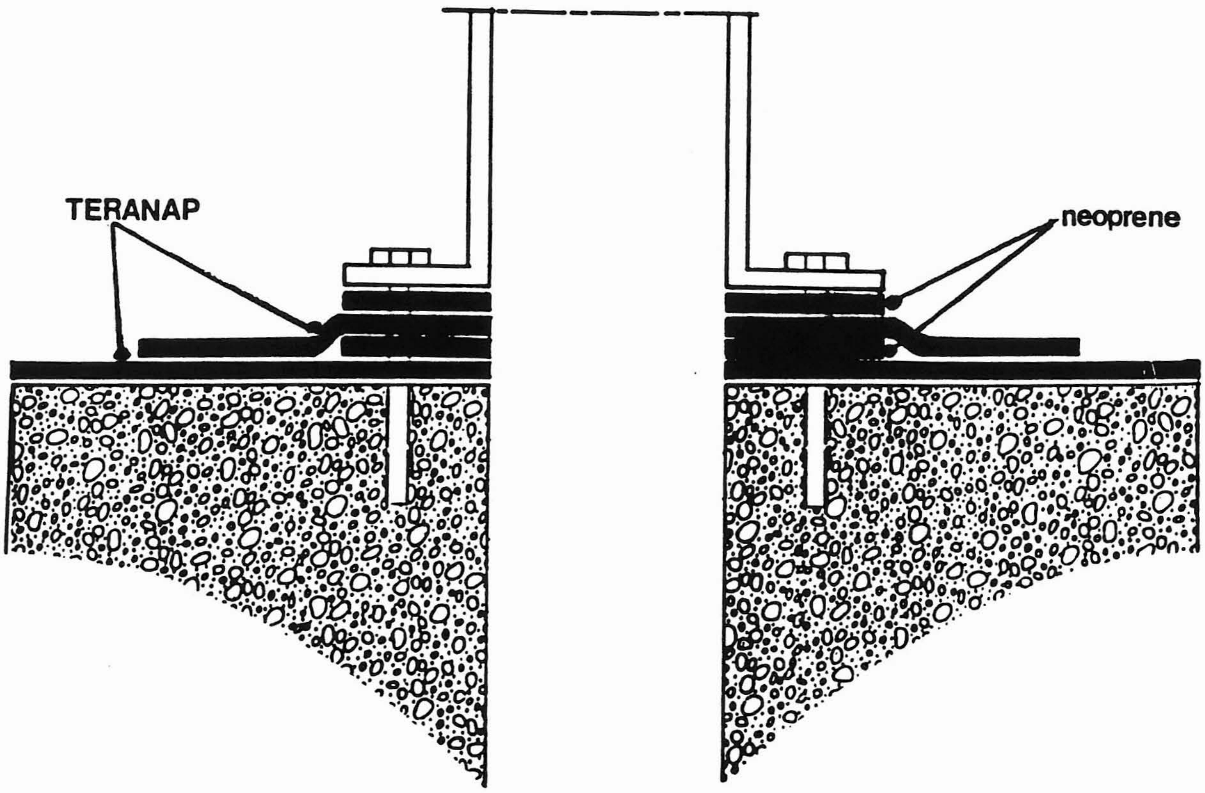


5.6 Other Typical Details:

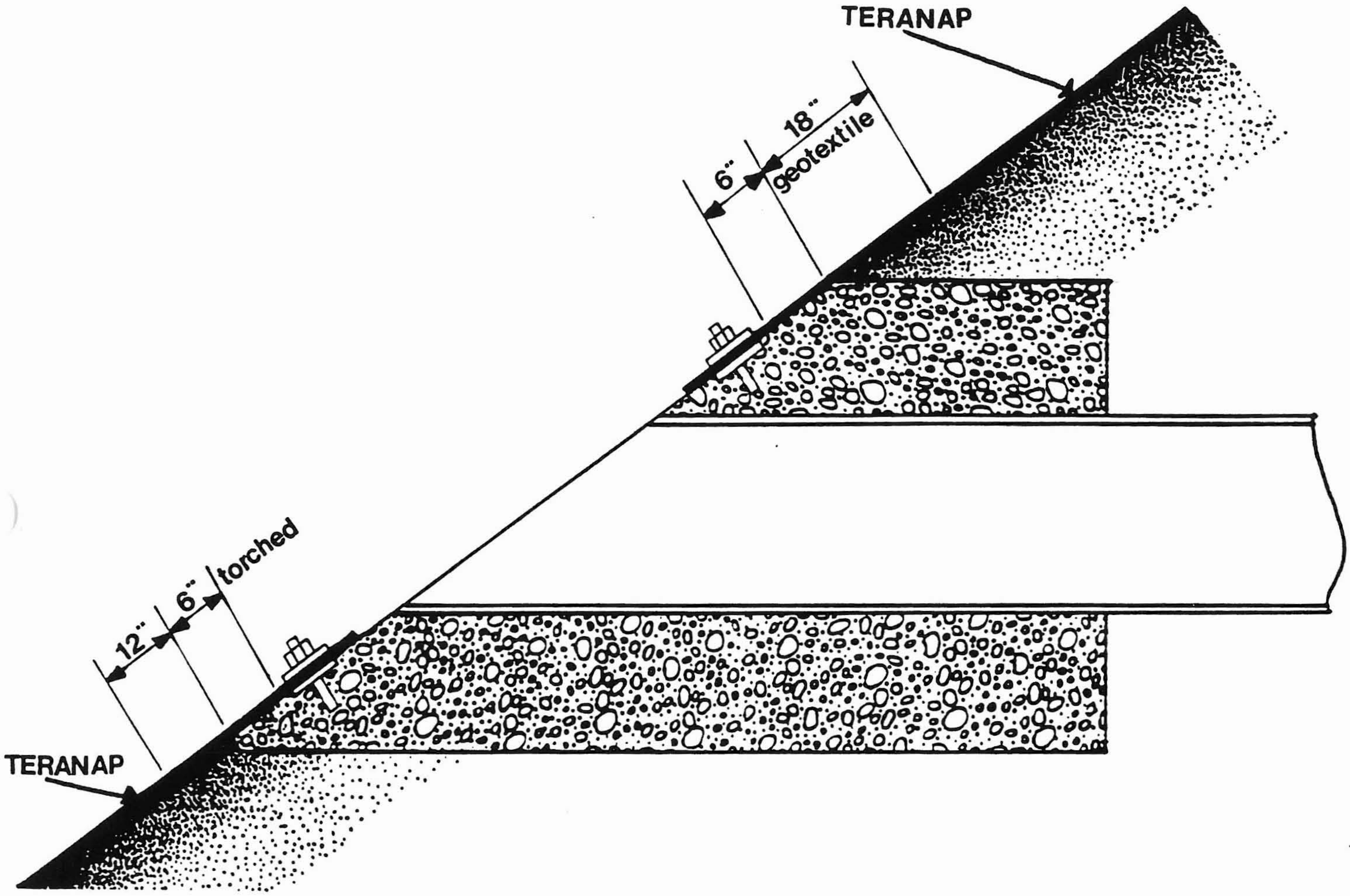
5.6.1 MECHANICAL ATTACHMENT



5.6.2 PIPE



5.6.3 PIPE CONNECTION ON AN EMBANKMENT



PALADIN BOX CULVERT HYDRAULIC CALCULATIONS

DRAFT DESIGN REPORT
JULY 1997

Flood Control District of Maricopa County (FCDMC)
RID Overchute Project
ISRB West Interceptor Channel Design Criteria Summary
Stantech Project No. 28900014
July 1997

WEST INTERCEPTOR CHANNEL DESIGN CRITERIA		
ITEM	**RESPONSE**	**COMMENTS**
Maximum Des Flowrate (Q)	384 cfs	"Hydrologic Analysis for the RID Overchute Project", 1997
Lining Type:	Earth	Alternative A
	Grass	Alternative B
	Grass W/ Low Flow Grouted Riprap Channel	Alternative C
Permissible Velocity:	2.5 to 3.0 f/s	Altern A, Table 5.1, Drain Des Man, Sandy to silt loam
	4.5 f/s	Altern B, Table 5.2, Drain Des Man, Slope 0 to 5 percent
	9.0 f/s	Altern. C, Table 5.3, Drain Des Man, Grouted Rock, Riprap, or Gabions
Normal Depth (Manning's) Hydraulic Properties	Q=384	Rect Channel Transition to 600' E. of Paladin Circle
	B=10 ft	
	S=.00187 ft/ft	
	S:S=4:1	
	d=2.75 ft	Normal Depth - Manning's
	n=.035	Table 5.11 Drain Des Manual - Assumed grass lined
	v=5 f/s	
	L= approx. 1,200 ft.	profile Sta 101+00 to Sta 112+85
HEC-2 Backwater Hydraulic Properties		
	Flowline S=.00187 ft/ft	Sta 101+00 to 112+85 (d/s Box Culv # 1)
	V=2.5	
	d=4.68 to 5.68 ft	

Source: Drainage Des Man of Mar Cnty, Vol II, Hydraulics, Sept 1992
Chan Lin Des Guidel, ADOT, Feb1989
HEC-2 Wat Surf Anal Prog HEC-2 User's Man, Boss Corp, 1993
Stantech Consultants, 1997

	Req Freeboard (FB)=1.30 ft per eq'n - **Freeboard N/A, HGL Below Grade**	FB= 0.25 $(Y+V^2/2g)$, Eq'n 5.10, Mar Cnty Drain Des Man - HGL not perched above surrounding grade, freeboard not applicable
BOX CULVERT PROPERTIES		
Maximum Des Flowrate (Q)	384 cfs	"Hydrologic Analysis for the RID Overchute Project", 1997
Minimum Velocity:	2.5 f/s	Sect 4.3.2.2, Mar Cnty Drain Des Man
Maximum Velocity	15 f/s	
Paladin Road BC Size	**3-6x7**	**7.47 ft top of box to invert**
Top of Box Elev	1014.47	
D/S Inv Elev.	1007.00	
U/S Inv Elev.	1007.05	
BC Veloc @ Des Q	2.68 to 2.82 f/s	HEC-2 culvert analysis results @ u/s inlet to d/s outlet @ design Q=384 cfs
Inlet/Outlet Protection	Concrete Apron - Allowable veloc up to 9 f/s	Table 5.3, Mar Cnty Drain Des Man

Source: Drainage Des Man of Mar Cnty, Vol II, Hydraulics, Sept 1992
Chan Lin Des Guidel, ADOT, Feb1989
HEC-2 Wat Surf Anal Prog HEC-2 User's Man, Boss Corp, 1993
Stantech Consultants, 1997

Flood Control District of Maricopa County (FCDMC)
RID Overchute Project
Basin Outlet Channel Design Criteria Summary
Stantech Project No. 28900014
July 1997

BASIN OUTLET CHANNEL DESIGN CRITERIA		
ITEM	**RESPONSE**	**COMMENTS**
Maximum Des Flowrate (Q)	1084 cfs	"Hydrologic Analysis for the RID Overchute Project", 1997
Lining Type:	Concrete Floor	8" thick - (6" min req'd for maint traffic plus reinf per ADOT "Urban Hwys Chann Lin Des Guidelines",
Permissible Velocity:	15 f/s	Table 5.3, Drain Des Man
Normal Depth (Manning's) Hydraulic Properties	Q=1084	Rect Channel Transition to 600' E. of Paladin Circle
	B=20 ft	
	S=.0023 ft/ft	
	S:S=3:1	
	d=3.63 ft	Normal Depth - Manning's
	n=.014	Table 5.11 Drain Des Manual
	v=6.69 f/s	
	L= approx. 820 ft.	Water surface profile Sta 10+79.77 to Sta 19+00
HEC-2 Backwater Hydraulic Properties		
	Flowline S=.0023 ft/ft	Sta 101+00 to 112+85 (d/s Box Culv # 1)
	V=2.5	
	d=4.68 to 5.68 ft	
	Req Freeboard (FB)=1.30 ft per eq'n - **Freeboard N/A, HGL Below Grade**	FB= 0.25 $(Y+V^2/2g)$, Eq'n 5.10, Mar Cnty Drain Des Man - HGL not perched above surrounding grade, freeboard not applicable

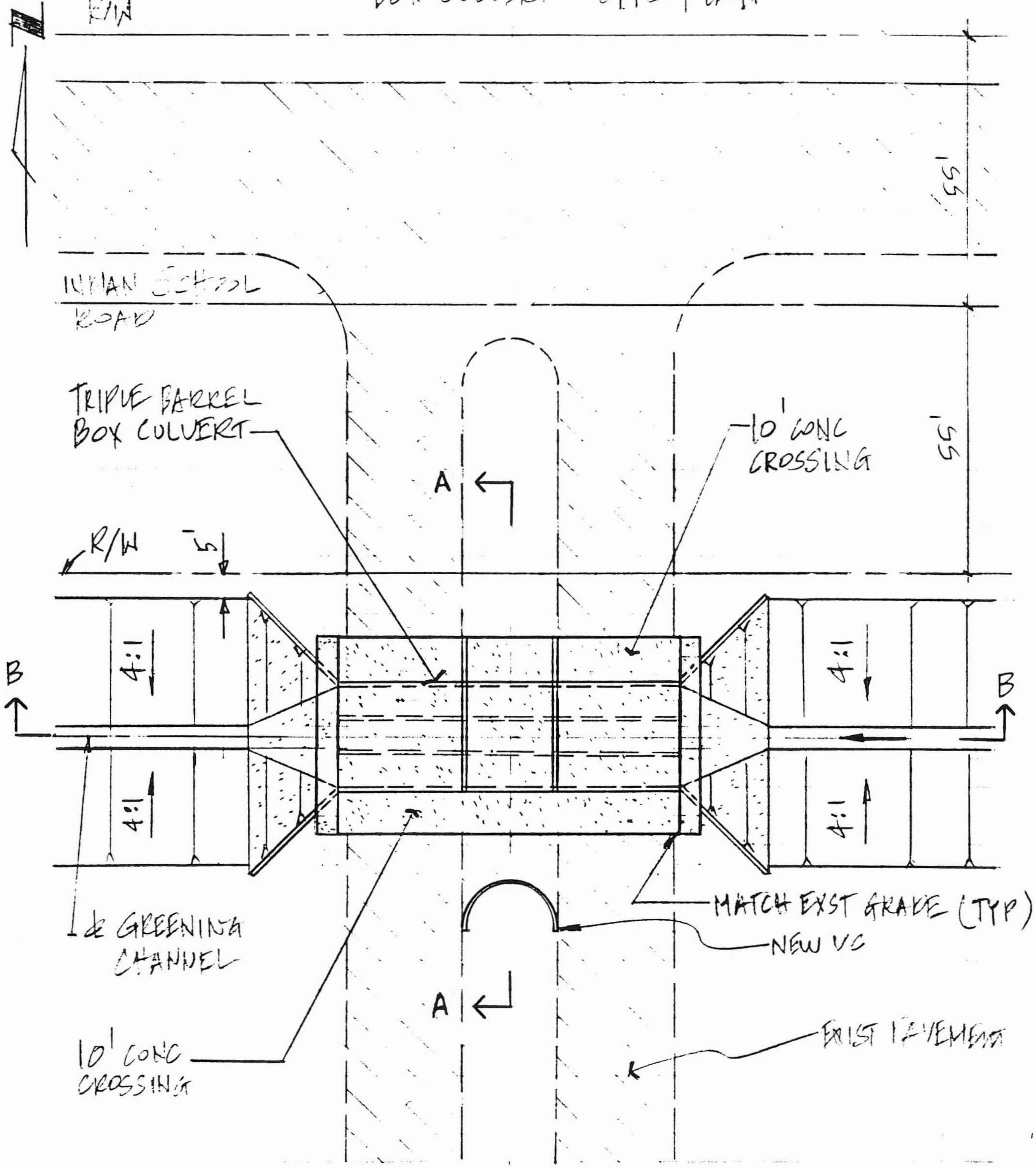
Source: Drainage Des Man of Mar Cnty, Vol II, Hydraulics, Sept 1992
Chan Lin Des Guidel, ADOT, Feb1989
HEC-2 Wat Surf Anal Prog HEC-2 User's Man, Boss Corp, 1993
SFC Engineering Company, 1996

WEST INTERCEPTOR
RID- GREENING CHANNEL

PROJECT:

PROJECT No.: 120210 | DATE: 10/14/96
PAGE: 1 of 3 | SCALE:

BOX CULVERT - SITE PLAN



DESIGNED BY: HM | CHECKED BY:

PROJECT:

PROJECT No.:

DATE:

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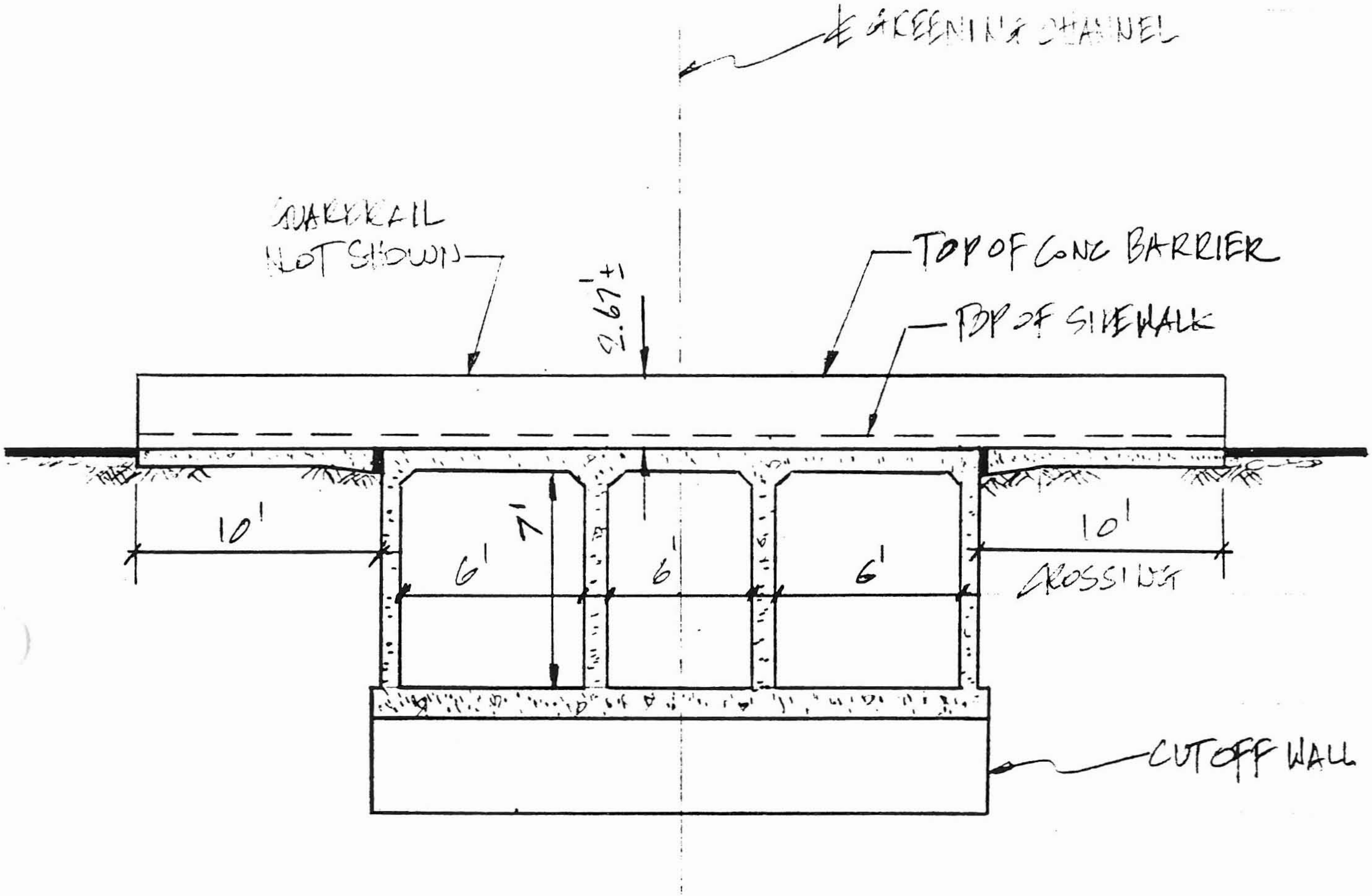
SCALE:



SECTION A-A

DESIGNED BY: HAA

CHECKED BY:

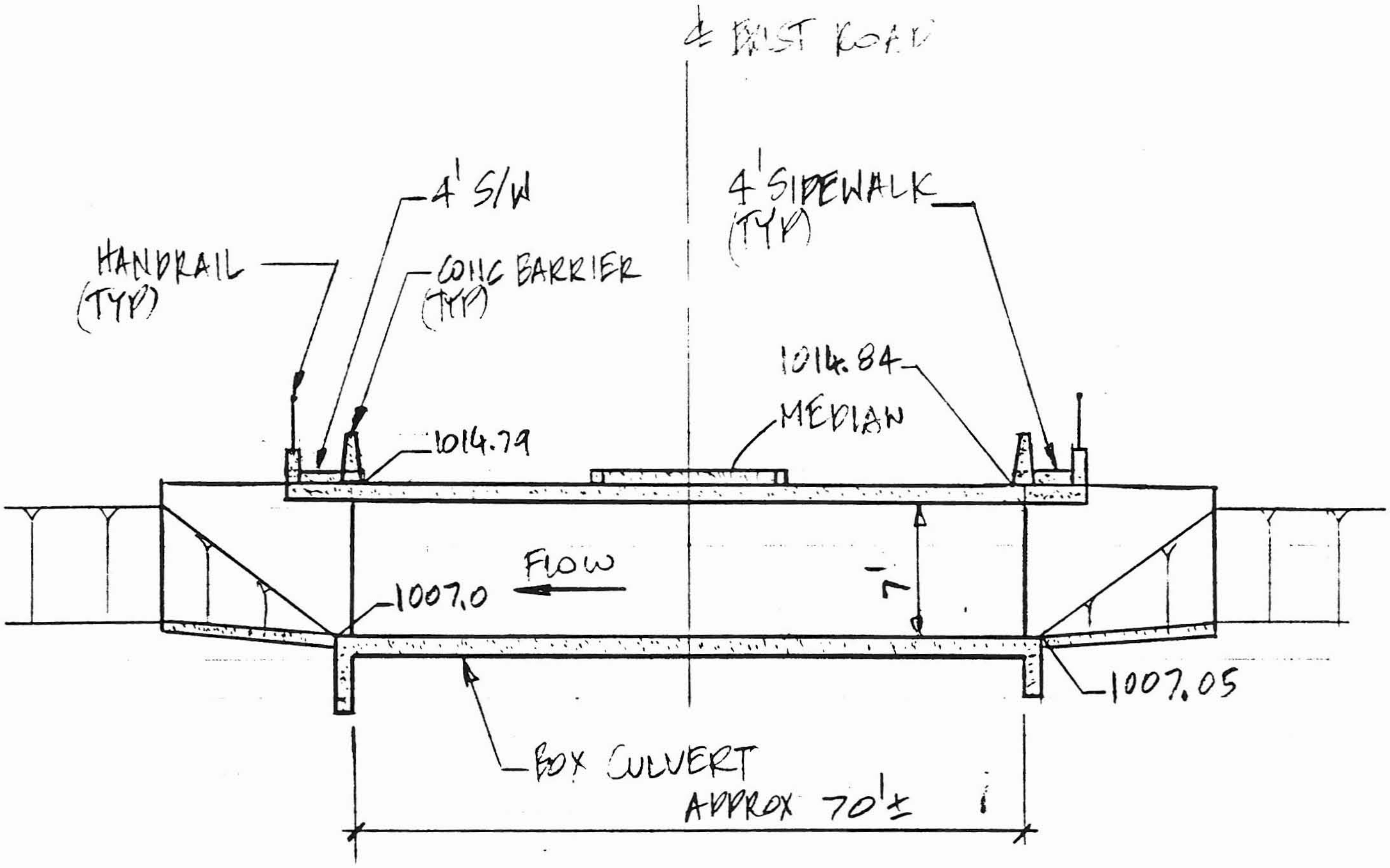
PROJECT: KIL FREENING CHANNEL

PROJECT No.:

DATE:

PAGE: 3 OF 3

SCALE:



SECTION B-B

DESIGNED BY: HVM

CHECKED BY:

CURRENT DATE: 09-17-1996 FILE DATE: 08-06-1996
CURRENT TIME: 11:29:53 FILE NAME: EWCULV

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1007.05	1007.00	100.00	3 RCB	6.00	7.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: EWCULV DATE: 08-06-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1012.50	0	0	0	0	0	0	0	0	0
1012.51	40	40	0	0	0	0	0	0	0
1012.52	80	80	0	0	0	0	0	0	0
1012.53	120	120	0	0	0	0	0	0	0
1012.56	160	160	0	0	0	0	0	0	0
1012.60	200	200	0	0	0	0	0	0	0
1012.63	239	239	0	0	0	0	0	0	0
1012.68	279	279	0	0	0	0	0	0	0
1012.72	319	319	0	0	0	0	0	0	0
1012.78	359	359	0	0	0	0	0	0	0
1012.85	399	399	0	0	0	0	0	0	0
0.00	0	0	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: EWCULV DATE: 08-06-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1012.50	0.00	0	0	0.00
1012.51	0.00	40	0	0.00
1012.52	0.00	80	0	0.00
1012.53	0.00	120	0	0.00
1012.56	0.00	160	0	0.00
1012.60	0.00	200	0	0.00
1012.63	0.00	239	0	0.00
1012.68	0.00	279	0	0.00
1012.72	0.00	319	0	0.00
1012.78	0.00	359	0	0.00
1012.85	0.00	399	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 09-17-1996 FILE DATE: 08-06-1996
'RENT TIME: 11:29:53 FILE NAME: EWCULV

PERFORMANCE CURVE FOR CULVERT # 1 - 3 (6 BY 7) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1012.50	0.00	5.45	0-NF	0.00	0.00	0.00	0.00	0.00	5.50
40	1012.51	0.81	5.46	3-M1t	0.95	0.54	0.40	5.50	0.00	5.50
80	1012.52	1.27	5.47	3-M1t	1.56	0.85	0.81	5.50	0.00	5.50
120	1012.53	1.66	5.48	3-M1t	2.09	1.11	1.21	5.50	0.00	5.50
160	1012.56	2.01	5.51	3-M1t	2.57	1.35	1.61	5.50	0.00	5.50
200	1012.60	2.33	5.55	3-M1t	3.03	1.57	2.02	5.50	0.00	5.50
239	1012.63	2.64	5.58	3-M1t	3.49	1.77	2.42	5.50	0.00	5.50
279	1012.68	2.92	5.63	3-M1t	3.92	1.96	2.82	5.50	0.00	5.50
319	1012.72	3.19	5.67	3-M1t	4.36	2.14	3.22	5.50	0.00	5.50
359	1012.78	3.45	5.73	3-M1t	4.78	2.32	3.63	5.50	0.00	5.50
399	1012.85	3.72	5.80	3-M1t	5.20	2.49	4.03	5.50	0.00	5.50

El. inlet face invert 1007.05 ft El. outlet invert 1007.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	12950.00
INLET ELEVATION (FT)	1007.05
OUTLET STATION (FT)	12850.00
OUTLET ELEVATION (FT)	1007.00
NUMBER OF BARRELS	3
SLOPE (V-FT/H-FT)	0.0005
CULVERT LENGTH ALONG SLOPE (FT)	100.00

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	6.00 FT
BARREL RISE	7.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	1:1 BEVEL (45 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 09-17-1996 FILE DATE: 08-06-1996
RENT TIME: 11:29:53 FILE NAME: EWCULV

ááá
ááááááááááááááááááááááá TAILWATER ááááááááááááááááááááááá
ááá
ááá

CONSTANT WATER SURFACE ELEVATION
1012.50

ááá
ááááááááááááááááááááááá ROADWAY OVERTOPPING DATA ááááááááááááááááááááááá
ááá

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	80.00
CREST LENGTH (FT)	60.00
OVERTOPPING CREST ELEVATION (FT)	1014.80

ááá

SECNO	XNL	XNCH	XNR	DEPTH	CWSEL	CRIWS	WSELK
SLOPE	XLOBL	XLCH	XLOBR	EG	HV	HL	OLOSS
VOL	ALOB	ACH	AROB	CORAR	LTBNK	RTBNK	ITRIAL
Q	QLOB	QCH	QROB	TOPWD	SSTA	ENDST	IDC
TIME	VLOB	VCH	VROB	WTN	TWA	ELMIN	ICONT
526.2	0.035	0.035	0.035	5.71	1012.59	0	0
0.000604	15	15	15	1012.64	0.05	0.01	0
1.68	76	165	11	0	1012	1012	0
399	55	335	8	210	0	209.97	0
0.05	0.73	2.02	0.72	0	1.1	1006.88	0

STA TUS: Anal zing cross -section r each 527. 0

□
BOSS HE 2 for Auto CAD versi on 2.0 PAGE 8
PROJECT TITLE : RID-OVE UTE
PROJECT NUMBER 1202101 9/18/96

CHANNE MPROVE :

Cha nnel Cent rline Stat ion (ft, C LSTA)	56
Cha nnel Inver t Elevatio n (ft MSL, CELCH)	1007
Cha nnel Botto m Width (f t, BW)	20
Lef t Bank Sta tion (ft, STCHL)	25
Rig ht Bank St ation (ft, STCHR)	87

5'

EXCAVAT N DATA :

Exc avation Ar ea (sq ft, AEX)	189
Rea ch Excava ion Volum (1000 cyd , VEXR)	0.51
Cum ulative Ex cavation V olume (10 0 cyd, VE T)	2.5

WAR NING: (33 2) Convey nce chang is outsid e of accep table rang e.
Upst ream to D wnstream onveyance Ratio (KR TIO) 2.35

SECNO	XNL	XNCH	XNR	DEPTH	CWSEL	CRIWS	WSELK
SLOPE	XLOBL	XLCH	XLOBR	EG	HV	HL	OLOSS
VOL	ALOB	ACH	AROB	CORAR	LTBNK	RTBNK	ITRIAL
Q	QLOB	QCH	QROB	TOPWD	SSTA	ENDST	IDC
TIME	VLOB	VCH	VROB	WTN	TWA	ELMIN	ICONT
527	0	0.014	0	5.58	1012.58	0	0
0.000109	86	86	86	1012.71	0.12	0.02	0.05
2.07	0	142	0	0	1014	1014	2
399	0	399	0	31.2	40.42	71.58	0
0.06	0	2.79	0	0	1.4	1007	0

FC. ELV. } OUTLET

STA TUS: Spe al culvert analysis being perf ormed.

□
BOSS HE 2 for Auto CAD versi on 2.0 PAGE 9
PROJECT TITLE : RID-OVE UTE
PROJECT NUMBER 1202101 9/18/96

CULVERT ESCRIPTI :

Number of Identi cal Culver ts (CUNO)	3
Culver t Manning n (CUNV)	0.012
Culver t Entrance Loss Coef ficient (E NTLC)	0.4
Box Cu lvert Heig ht (ft, RI SE)	7
Box Cu lvert Open ing Width (ft, SPAN)	6
Culver t Length (ft, CULVL)	100
Culver t Opening Upstream nvert (ft MSL, ELC)	1007.05
Culver t Opening Downstrea Invert (f t MSL, EL HD)	1007
Roadwa y Length (ft, RDLEN)	60
Roadwa y Weir Flo w Dischar e Coeffici ent (COFQ)	2.5

Chart # 8 - box culvert wi th flared wingwalls, no inlet top edge b evel

Scale # 1 - wing walls flar ed 30 to 7 5 degrees

STA TUS: Anal zing cross -section r each 528. 0

CHANNE MPROVE :

Cha nnel Cent rline Stat ion (ft, C LSTA)	49
Cha nnel Inver t Elevatio n (ft MSL, CELCH)	1007.05
Cha nnel Botto m Width (f t, BW)	~~20~~ 5'
Lef t Bank Sta tion (ft, STCHL)	19
Rig ht Bank St ation (ft, STCHR)	79

EXCAVAT N DATA :

Exc avation Ar ea (sq ft, AEX)	187.3
Rea ch Excava ion Volum (1000 cyd , VEXR)	0.72
Cum ulative Ex cavation V olume (10 0 cyd, VE T)	3.2

SPECIAL ULVERT LET CON L RESUL :

Energy Grade Lin e Elevatio n for Inle t Control (ft MSL, E GIC)	1010.99
Energy Grade Lin e Elevatio n for Outl et Control (ft MSL, EGOC)	1012.97
Previo us Compu d Water S rface Elev ation (ft MSL, PC)	1012.58

Top of Roadway levation (ft MSL, EL TRD) 1014.8

CULVERT NALYSIS SULTS :

Inlet Control En ergy Grad Line Elev ation (ft MSL, EGIC) 1010.99

Outlet Control E nergy Gra e Line Ele vation (ft MSL, EG) 1012.97

Water Surface D op Throug Culvert (ft, H4) 0.26

Total Weir Flow (cfs, QWE R) 0

Total Culvert Fl ow (cfs, Q CULV) 399

Mean C hannel Vel ocity (fps , VCH) 2.66

Culver t Opening Area (sq f t, ACULV) 126

Top of Roadway levation (ft MSL, EL TRD) 1014.8

Roadwa y Weir Le gth (ft, W EIRLN) 0

□

BOSS HE 2 for Auto CAD versi on 2.0 PAGE 11
PROJECT TITLE : RID-OVE UTE
PROJECT NUMBER 1202101 9/18/96

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
528	0	0.014	0	5.81	1012.86	0	0
0.000095	103	103	103	1012.97	0.11	0.26	0
2.42	0	149	0	0	1014	1014	2
399	0	399	0	31.6	33.19	64.81	0
0.07	0	2.66	0	0	1.4	1007.05	0

} INLET

Contra ction Coef ficient (C CHV) 0.1

Expans ion Coeffi cient (CE V) 0.3

STA TUS: Anal zing cross -section r each 528. 0

CHANNE MPROVE :

Cha nnel Cent rline Stat ion (ft, C LSTA) 197

Cha nnel Inver t Elevatio n (ft MSL, CELCH) 1007.11

Cha nnel Botto m Width (f t, BW) 5

Lef t Bank Sta tion (ft, STCHL) 166.94

Rig ht Bank St ation (ft, STCHR) 227.04

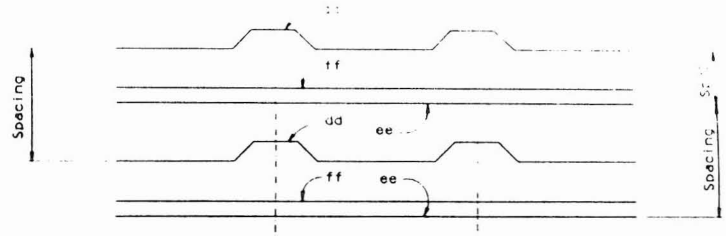
EXCAVAT N DATA :

Exc avation Ar ea (sq ft, AEX) 224.34

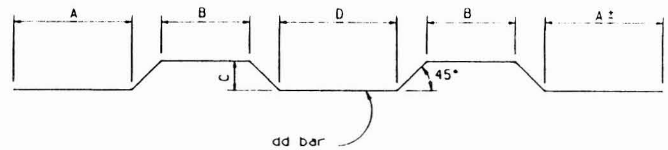
TABLE NO. 1
0'-10' FILL

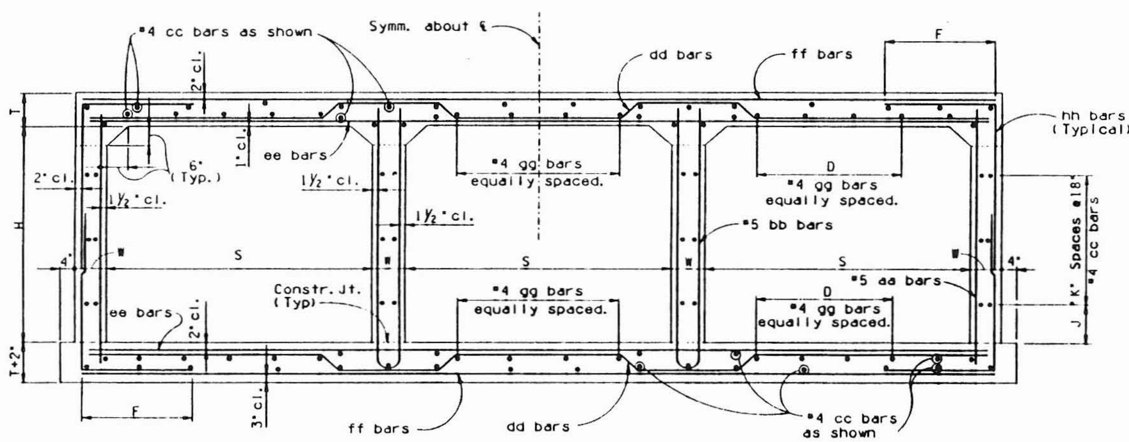
Span 'S'	Height 'H'	Top Slab 'T'	Walls 'W'	aa Spacing	aa Length	bb Spacing	bb Length	cc Number ◆	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	dd D	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number ◆	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	9½"	8"	12"	4'-4	12"	8'-9	68	5	14"	20'-2	4'-7	2'-7	6½"	3'-1	5	14"	20'-3	5	14"	20'-3	30	4	7"	5'-1	2'-5
	4'	9½"	8"	12"	5'-4	12"	10'-9	76	5	14"	20'-2	4'-7	2'-7	6½"	3'-1	5	14"	20'-3	5	14"	20'-3	30	4	7"	5'-7	2'-5
	5'	9½"	8"	12"	6'-4	12"	12'-9	76	5	14"	20'-2	4'-7	2'-7	6½"	3'-1	5	14"	20'-3	5	14"	20'-3	30	4	7"	6'-1	2'-5
	6'	9½"	8"	12"	7'-4	12"	14'-9	84	5	14"	20'-2	4'-7	2'-7	6½"	3'-1	5	14"	20'-3	5	14"	20'-3	30	4	7"	6'-7	2'-5
	7'	9½"	8"	12"	8'-4	12"	16'-9	92	5	13"	20'-2	4'-7	2'-7	6½"	3'-1	5	13"	20'-3	5	13"	20'-3	30	4	6½"	7'-1	2'-5
8'	3'	9½"	9"	12"	4'-4	12"	8'-9	68	6	14"	26'-4	6'-1	3'-8	6½"	4'-2	6	14"	26'-7	6	14"	26'-7	36	6	7"	5'-6	2'-6
	4'	9½"	9"	12"	5'-4	12"	10'-9	76	6	14"	26'-4	6'-1	3'-8	6½"	4'-2	6	14"	26'-7	6	14"	26'-7	36	6	7"	6'-0	2'-6
	5'	9½"	9"	12"	6'-4	12"	12'-9	76	6	14"	26'-4	6'-1	3'-8	6½"	4'-2	6	14"	26'-7	6	14"	26'-7	36	6	7"	6'-6	2'-6
	6'	9½"	9"	12"	7'-4	12"	14'-9	84	6	14"	26'-4	6'-1	3'-8	6½"	4'-2	6	14"	26'-7	6	14"	26'-7	36	6	7"	7'-0	2'-6
	7'	9½"	9"	12"	8'-4	12"	16'-9	92	6	13"	26'-4	6'-1	3'-8	6½"	4'-2	6	13"	26'-7	6	13"	26'-7	36	5	6½"	7'-5	2'-6
	8'	9½"	9"	12"	9'-4	12"	18'-9	92	6	13"	26'-4	6'-1	3'-8	6½"	4'-2	6	13"	26'-7	6	13"	26'-7	36	6	6½"	8'-0	2'-6
10'	3'	10½"	11"	12"	4'-6	12"	9'-2	68	7	17"	32'-9	7'-7	4'-8	7½"	5'-2	6	17"	33'-3	7	17"	33'-3	66	6	8½"	6'-1	3'-0
	4'	10½"	11"	12"	5'-6	12"	11'-2	76	7	17"	32'-9	7'-7	4'-8	7½"	5'-2	6	17"	33'-3	7	17"	33'-3	66	6	8½"	6'-7	3'-0
	5'	10½"	11"	12"	6'-6	12"	13'-2	76	6	12"	32'-9	7'-7	4'-8	7½"	5'-2	5	12"	33'-3	6	12"	33'-3	66	5	6"	6'-8	2'-8
	6'	10½"	11"	12"	7'-6	12"	15'-2	84	6	12"	32'-9	7'-7	4'-8	7½"	5'-2	5	12"	33'-3	6	12"	33'-3	66	5	6"	7'-2	2'-8
	7'	10½"	11"	12"	8'-6	12"	17'-2	92	7	15"	32'-9	7'-7	4'-8	7½"	5'-2	5	15"	33'-3	7	15"	33'-3	66	6	7½"	7'-9	2'-8
	8'	10½"	11"	12"	9'-6	12"	19'-2	92	7	15"	32'-9	7'-7	4'-8	7½"	5'-2	5	15"	33'-3	7	15"	33'-3	66	6	7½"	8'-3	2'-8
	9'	10½"	11"	12"	10'-6	12"	21'-2	100	7	15"	32'-9	7'-7	4'-8	7½"	5'-2	6	15"	33'-3	7	15"	33'-3	66	6	7½"	8'-9	2'-8
	10'	10½"	11"	12"	11'-6	12"	23'-2	108	7	14"	32'-9	7'-7	4'-8	7½"	5'-2	5	14"	33'-3	7	14"	33'-3	66	6	7"	9'-3	2'-8
12'	8'	12½"	13"	12"	9'-10	12"	20'-0	92	7	13"	39'-4	9'-1	5'-6	9½"	6'-2	5	13"	39'-11	7	13"	39'-11	78	6	6½"	8'-7	2'-10
	9'	12½"	13"	12"	10'-10	12"	22'-0	100	8	16"	39'-4	9'-1	5'-6	9½"	6'-2	5	16"	39'-11	8	16"	39'-11	78	6	8"	9'-1	2'-10
	10'	12½"	13"	12"	11'-10	12"	24'-0	108	8	16"	39'-4	9'-1	5'-6	9½"	6'-2	5	16"	39'-11	8	16"	39'-11	78	6	8"	9'-7	2'-10
	11'	12½"	13"	12"	12'-10	12"	26'-0	108	7	12"	39'-4	9'-1	5'-6	9½"	6'-2	4	12"	39'-11	7	12"	39'-11	78	6	6"	10'-1	2'-10
	12'	12½"	13"	12"	13'-10	12"	28'-0	116	7	12"	39'-4	9'-1	5'-6	9½"	6'-2	5	12"	39'-11	7	12"	39'-11	78	6	6"	10'-8	2'-10

◆ Total number of bars in the cross-section.



REINFORCING BAR PLACING DIAGRAM



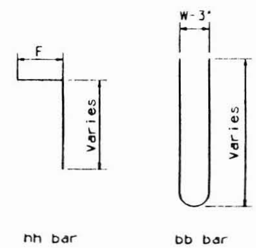


TYPICAL SECTION

NOTE:

Reinforcing shown is for placement location only.
Use the appropriate table to determine the reinforcing requirements.

Height 'H'	'J' Dia.	'K' Spaces
3'	9"	1
4'	3"	2
5'	12"	2
6'	9"	3
7'	3"	4
8'	12"	4
9'	9"	5
10'	3"	6
11'	12"	6
12'	9"	7



BENDS

NOTE:

See B-02.35 for Tables II thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.70 for Quantities.

DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION 4-92
APPROVED FOR DISTRIBUTION	TRIPLE BARREL BOX CULVERT	STANDARD NO. B-02.30

CP-2711 SPILLWAY HYDRAULIC CALCULATIONS

DRAFT DESIGN REPORT
JULY 1997

WEST INTERCEPTOR

RID - GREENING CHANNEL

SFC

PROJECT: CP 2711

PROJECT No.: 1202101 DATE: 10/23/96

 SCALE:

DETERMINE THE SPILLWAY WIDTH TO ACCEPT THE FLOW FROM CP 2711 (OVERTOPPING).

THE DEPTH AND AREA LIMITATIONS OF WATER ABOVE THE STREET BEFORE FLOWS INTO THE SPILLWAY DEPEND ON THE FUTURE STREET DESIGN.

- ASSUMED THE CREST OF THE SPILLWAY WILL BE SET AS ABOUT THE FUTURE SOUTH GUTTER ELEVATION OF AN IMPROVED ISRB.
- ASSUMED THE DEPTH OF WATER AT SPILLWAY CREST OPERATES AS A WEIR.
- ASSUMED GUARDRAIL (ADOT STD) WILL BE INSTALLED ALONG THE CREST OF SPILLWAY.
- ASSUMED MAX DEPTH OF WATER = 1.17' UNDER STEEL W BEAM FOR OPERATION AS A WEIR AND NOT BACKING UP OF WATER BEHIND THE GUARDRAIL.

FIND THE WEIR LENGTH.

THE WEIR EQUATION IS: $Q = CLH^{1.5}$

where:

$C = 3.0$

$H = 1.17'$

$Q = 399$ CFS

DESIGNED BY: HVM CHECKED BY:

SFC

PROJECT: RID-GREENING CHANNEL
CP 2711

PROJECT No.: 1202101 DATE: 10/23/96

PAGE: 2 OF 2 SCALE:

$$L = \frac{Q}{CH^{1.5}} = \frac{399}{(3.0)(1.17)^{1.5}} = 105.09'$$

SPACING OF GUARDRAIL POST ≅ 6.25' ℄ - ℄

$$\text{No. OF SPACINGS} = \frac{105.09'}{6.25'} = 17 \text{ EA}$$

WOOD POST = 8"X 8"

TOTAL POSTS LENGTH = 8"/EA X 17 EA = 136" or 11.33'

TOTAL WEIR LENGTH REQUIRED = 105.09' + 11.33'
= 116.42'

PROVIDED WIER LENGTH = 120' OK

DESIGNED BY: HVM CHECKED BY:

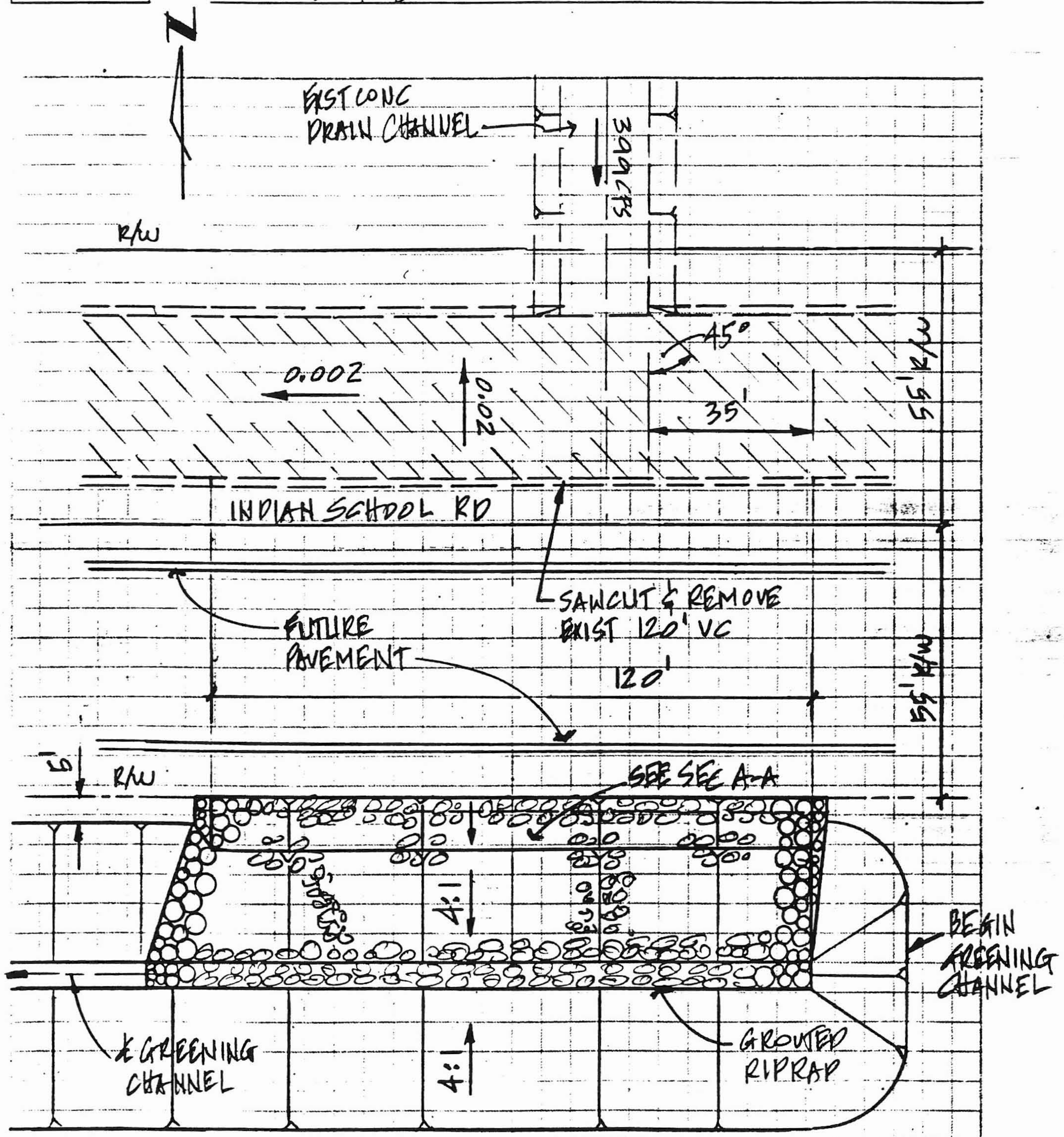
RIP - GREENING CHANNEL

SFC

PROJECT:

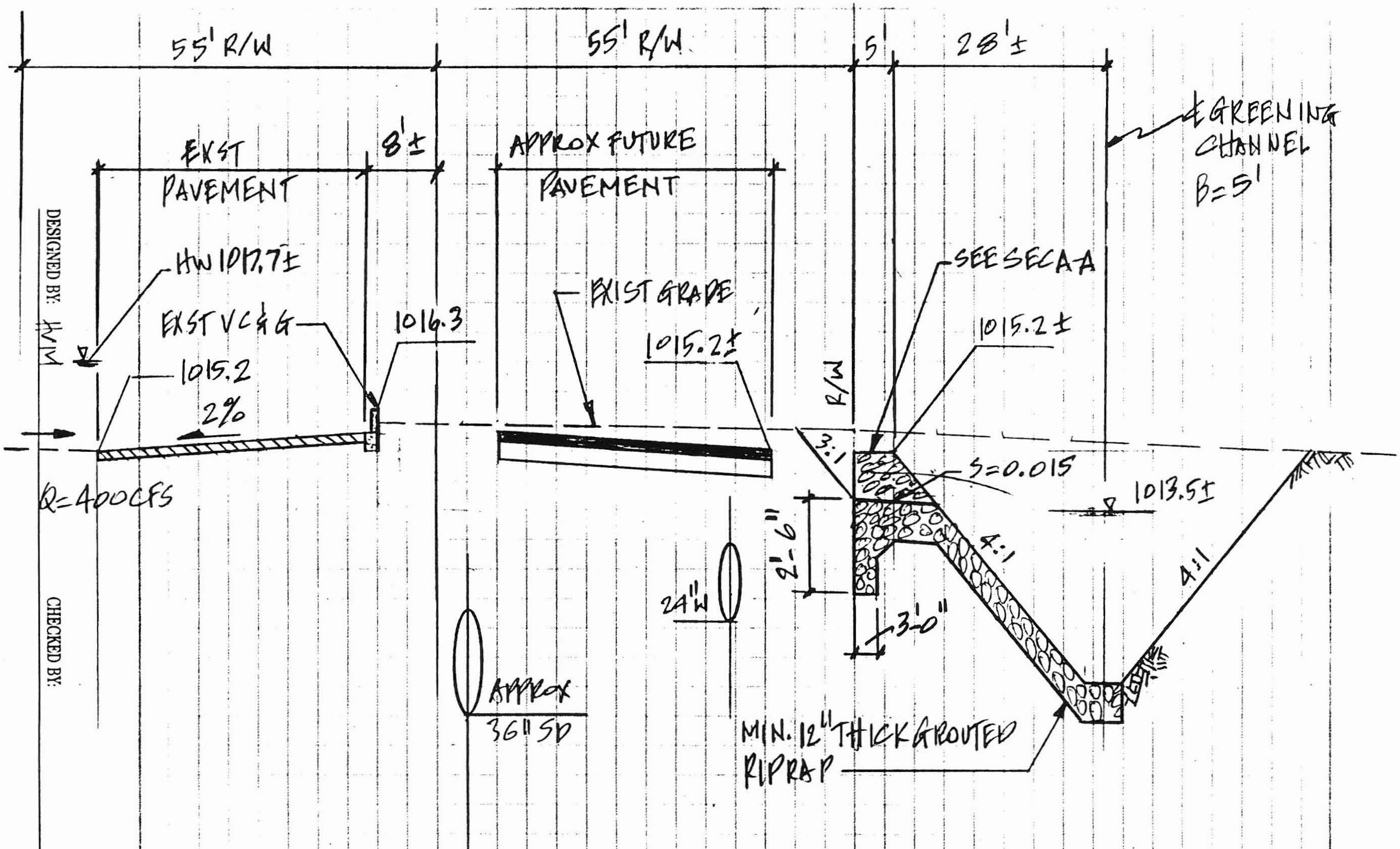
PROJECT No.: 120210 | DATE: 10/11/96

PAGE: 1 OF 3 | SCALE:



CP2211 SPILLWAY - PLAN

DESIGNED BY: HM | CHECKED BY:



CP 2711 SPILLWAY - SECTION

SFC

PROJECT: RIO-GREENING CHANNEL SPILLWAY

PROJECT No: 120210

DATE: 10/10/96

PAGE: 2 OF 3

SCALE:

DESIGNED BY: HJM

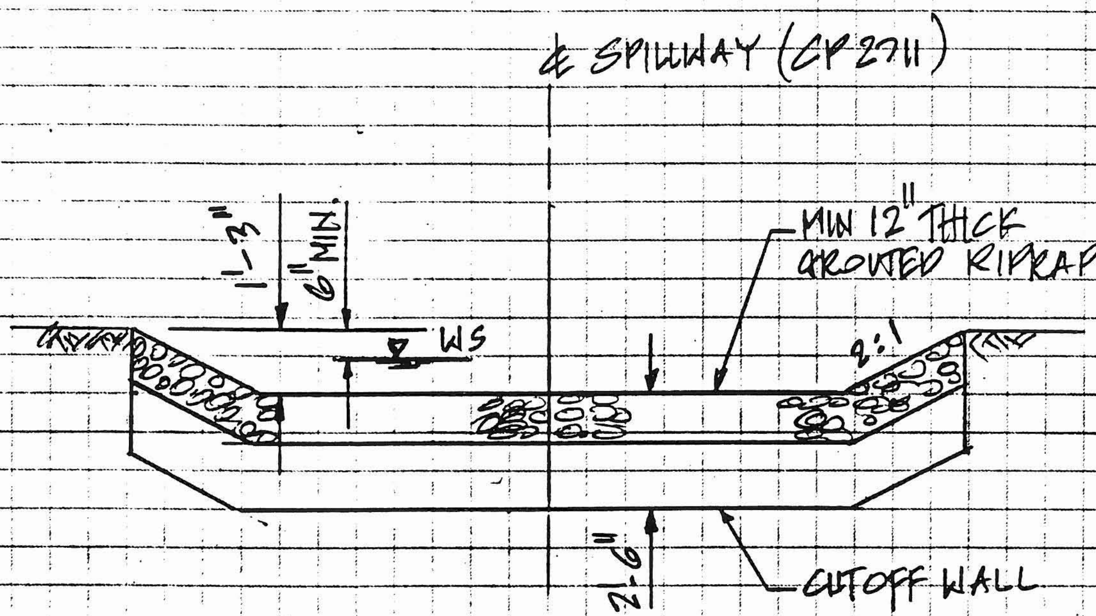
CHECKED BY:

SFC

PROJECT: RID-

PROJECT No.: 120210l DATE: 10/10/96

PAGE: 3 OF 3 SCALE:



SPILLWAY - SECTION A-A

DESIGNED BY: HVM CHECKED BY:

R/W - GREENING CHANNEL

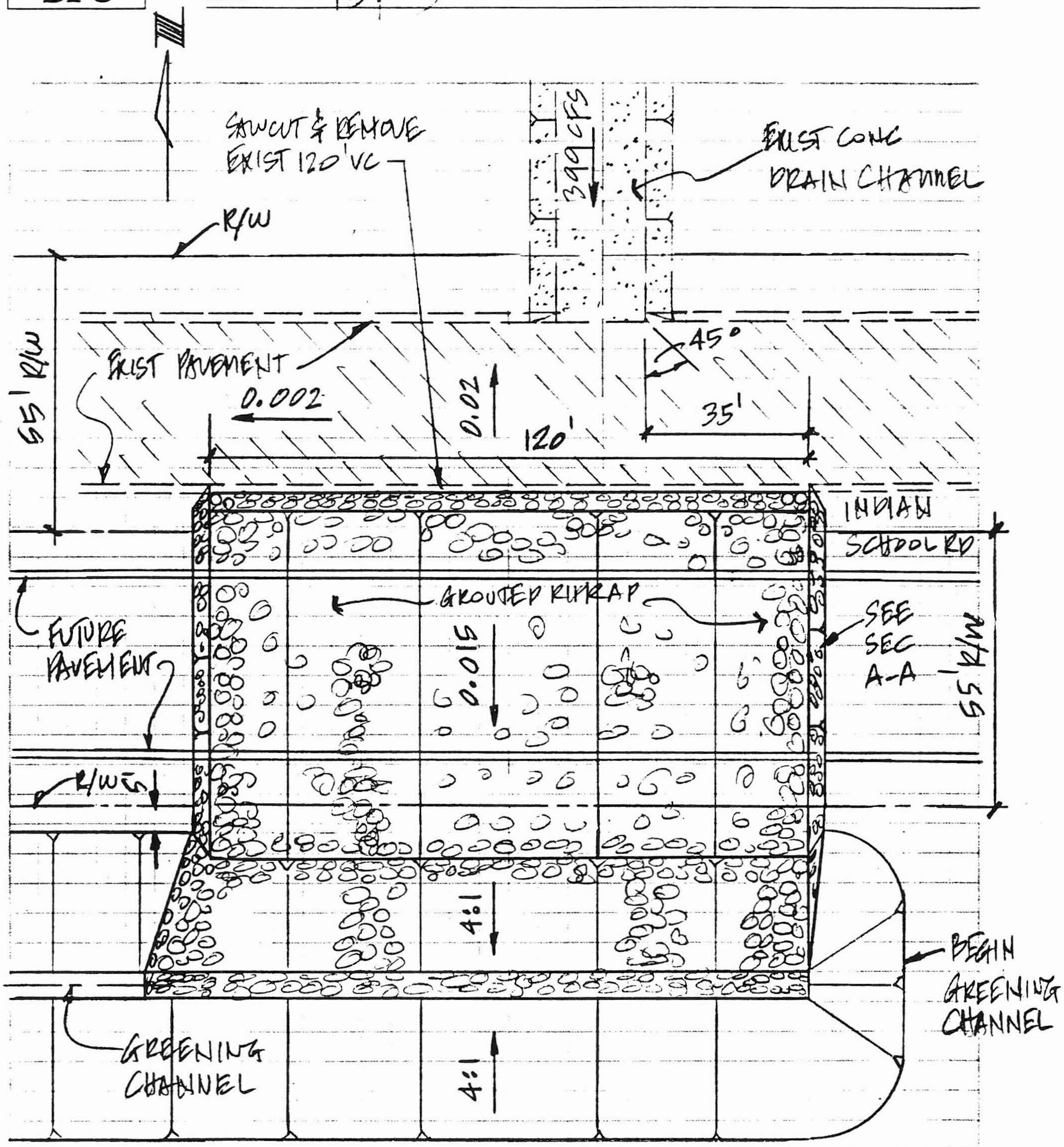
PROJECT: SPILLWAY - ALTERNATIVE

PROJECT No.: 120210

DATE: 6/11/96

PAGE: 1 OF 3

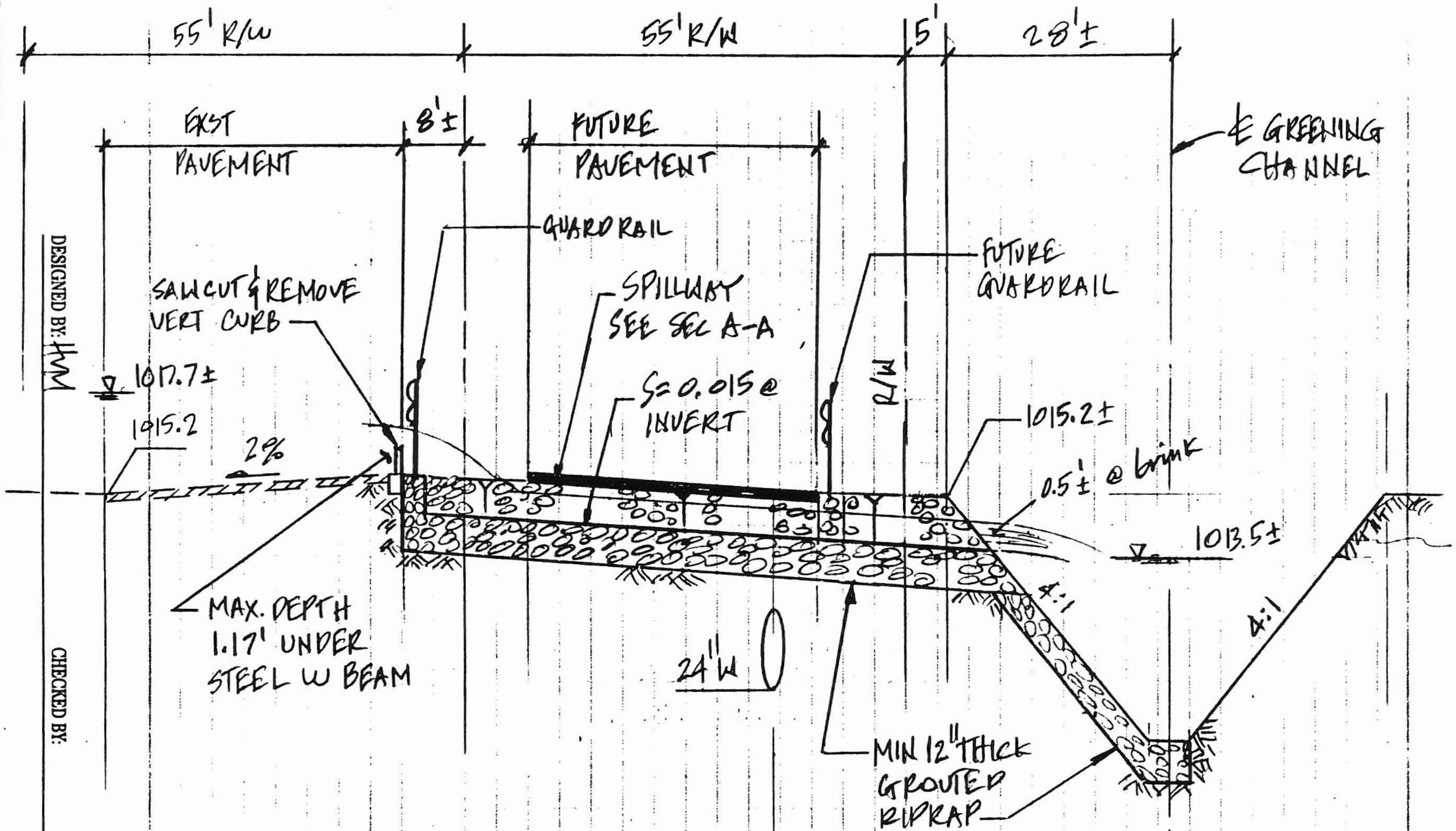
SCALE:



SPILLWAY PLAN - ALTERNATIVE

DESIGNED BY: H/M

CHECKED BY:



ALTERNATIVE SPILLWAY SECTION – TIE TO EXIST PAVEMENT

DESIGNED BY: HM

CHECKED BY:

SFC

PROJECT: RIO GREENING CHANNEL

PROJECT No.: SPILLWAY – ALTERNATIVE @ CP 2711

DATE: 10/10/96

PAGE: 2 of 3

SCALE:

SFC

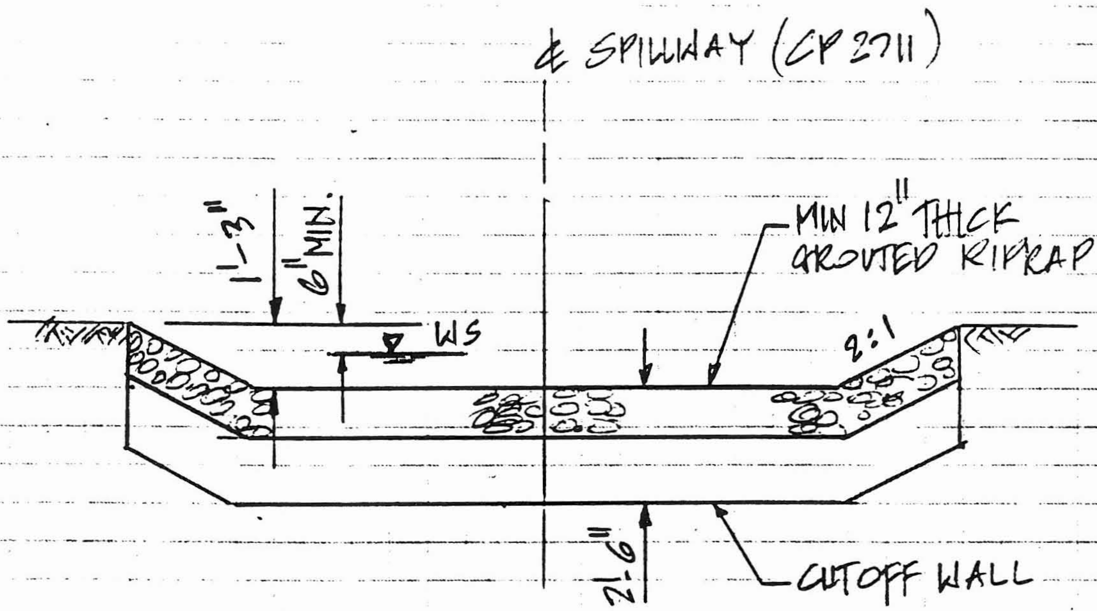
PROJECT: RID-

PROJECT No.: 120210l

DATE: 10/10/96

PAGE: 3 OF 3

SCALE:



SPILLWAY - SECTION A-A

DESIGNED BY: HVM

CHECKED BY:

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: SPILLWAY AT CP 2711

Comment:

Solve For Depth

Given Input Data:

Bottom Width.....	120.00 ft
Left Side Slope..	2.00:1 (H:V)
Right Side Slope.	2.00:1 (H:V)
Manning's n......	0.030
Channel Slope....	0.0150 ft/ft
Discharge........	399.00 cfs

Computed Results:

Depth............	0.70 ft
Velocity.........	4.72 fps
Flow Area........	84.52 sf
Flow Top Width...	122.78 ft
Wetted Perimeter.	123.11 ft
Critical Depth...	0.70 ft
Critical Slope...	0.0149 ft/ft
Froude Number....	1.00 (flow is Critical)

NOTE: THE WATER DEPTH AT THE OVERFALL APPROX ABOUT .7 dc
=.7x.7 = .49'

Open Channel Flow Module, Version 3.2 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: RID-ISRB

Comment: EXIST CHANNEL AT CP 2711

Solve For Depth

Given Input Data:

Bottom Width.....	18.00 ft
Left Side Slope..	2.00:1 (H:V)
Right Side Slope.	2.00:1 (H:V)
Manning's n......	0.015
Channel Slope....	0.0015 ft/ft
Discharge........	400.00 cfs

Computed Results:

Depth............	2.71 ft
Velocity.........	6.31 fps
Flow Area........	63.44 sf
Flow Top Width...	28.84 ft
Wetted Perimeter.	30.12 ft
Critical Depth...	2.27 ft
Critical Slope...	0.0028 ft/ft
Froude Number....	0.75 (flow is Subcritical)

Open Channel Flow Module, Version 3.2 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: RID-ISRB

Comment: EAST/WEST EARTH LINED TRAPEZOIDAL CHANNEL (GREENING CHAN)

Solve For Discharge

Given Input Data:

Bottom Width.....	5.00 ft
Left Side Slope..	4.00:1 (H:V)
Right Side Slope.	4.00:1 (H:V)
Manning's n......	0.035
Channel Slope....	0.0015 ft/ft
Depth............	5.00 ft

Computed Results:

Discharge........	398.92 cfs
Velocity.........	3.19 fps
Flow Area........	125.00 sf
Flow Top Width...	45.00 ft
Wetted Perimeter.	46.23 ft
Critical Depth...	3.05 ft
Critical Slope...	0.0152 ft/ft
Froude Number....	0.34 (flow is Subcritical)

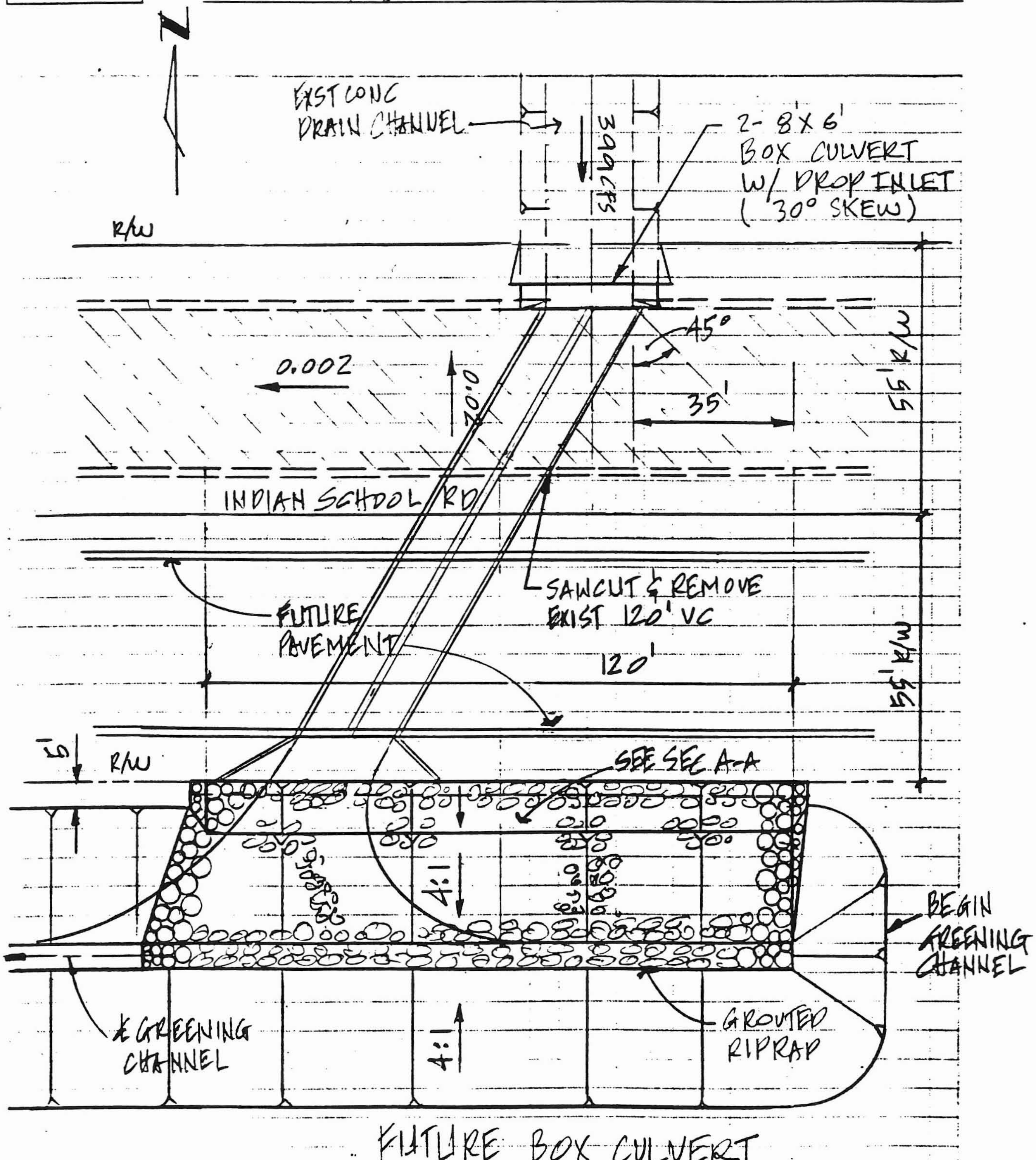
WEST INTERCEPTOR
RIP - GREENING CHANNEL

SFC

PROJECT:

PROJECT No.: 1202101 DATE: 10/11/96

PAGE: 1 OF 3 SCALE:



FUTURE BOX CULVERT
CP2211 ~~SPILLWAY PLAN~~

DESIGNED BY: HM CHECKED BY:

PRELIMINARY

CURRENT DATE: 10-28-1996 FILE DATE: 10-18-1996
CURRENT TIME: 12:48:02 FILE NAME: ISRB2711

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV	SITE DATA INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1007.45	1007.40	100.00	2 RCB	8.00	6.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: ISRB2711 DATE: 10-18-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1013.27	0	0	0	0	0	0	0	0	0
1013.28	40	40	0	0	0	0	0	0	0
1013.30	80	80	0	0	0	0	0	0	0
1013.31	120	120	0	0	0	0	0	0	0
1013.34	160	160	0	0	0	0	0	0	0
1013.39	200	200	0	0	0	0	0	0	0
1013.43	239	239	0	0	0	0	0	0	0
1013.48	279	279	0	0	0	0	0	0	0
1013.55	319	319	0	0	0	0	0	0	0
1013.62	359	359	0	0	0	0	0	0	0
1013.70	399	399	0	0	0	0	0	0	0
0.00	0	0	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: ISRB2711 DATE: 10-18-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1013.27	0.00	0	0	0.00
1013.28	0.00	40	0	0.00
1013.30	0.00	80	0	0.00
1013.31	0.00	120	0	0.00
1013.34	0.00	160	0	0.00
1013.39	0.00	200	0	0.00
1013.43	0.00	239	0	0.00
1013.48	0.00	279	0	0.00
1013.55	0.00	319	0	0.00
1013.62	0.00	359	0	0.00
1013.70	0.00	399	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 10-28-1996 FILE DATE: 10-18-1996
RENT TIME: 12:48:02 FILE NAME: ISRB2711

PERFORMANCE CURVE FOR CULVERT # 1 - 2 (8 BY 6) RCB

DIS- CHARGE FLOW (cfs)	HEAD- WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1013.27	0.00	5.82	0-NF	0.00	0.00	0.00	0.00	0.00	5.87
40	1013.28	0.89	5.83	3-M1t	1.01	0.58	0.42	5.87	0.00	5.87
80	1013.30	1.41	5.85	3-M1t	1.62	0.92	0.85	5.87	0.00	5.87
120	1013.31	1.85	5.86	3-M1t	2.15	1.20	1.27	5.87	0.00	5.87
160	1013.34	2.24	5.89	3-M1t	2.63	1.46	1.70	5.87	0.00	5.87
200	1013.39	2.60	5.94	3-M1t	3.10	1.69	2.12	5.87	0.00	5.87
239	1013.43	2.93	5.98	3-M1t	3.54	1.91	2.55	5.87	0.00	5.87
279	1013.48	3.26	6.03	3-M1t	3.97	2.12	2.97	5.87	0.00	5.87
319	1013.55	3.57	6.10	3-M1t	4.39	2.32	3.40	5.87	0.00	5.87
359	1013.62	3.86	6.17	3-M1t	4.81	2.51	3.82	5.87	0.00	5.87
399	1013.70	4.15	6.25	3-M1t	5.21	2.69	4.25	5.87	0.00	5.87

El. inlet face invert 1007.45 ft El. outlet invert 1007.40 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

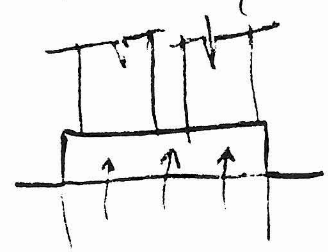
***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	53400.00
INLET ELEVATION (FT)	1007.45
OUTLET STATION (FT)	53300.00
OUTLET ELEVATION (FT)	1007.40
NUMBER OF BARRELS	2
SLOPE (V-FT/H-FT)	0.0005
CULVERT LENGTH ALONG SLOPE (FT)	100.00

Vmax = 9 FPS for grouted riprap
Vmax = 5.0 FPS (earth)

***** CULVERT DATA SUMMARY ************************

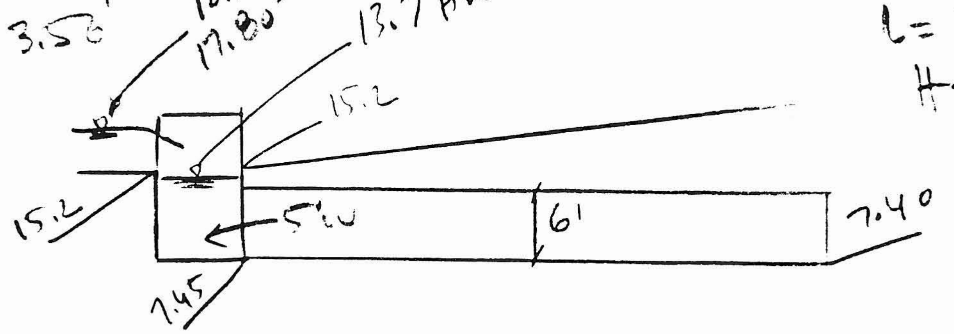
BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	6.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE



Say: 30' WEIR
$H = \left[\frac{Q}{CL}\right]^{.67} = 3.56'$

not adequately - increasing L

L = 32
H = 2.60'
HWS = 15.2 + 2.6
= 17.80
OK



C RRENT DATE: 10-28-1996 FILE DATE: 10-18-1996
RENT TIME: 12:48:02 FILE NAME: ISRB2711

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ááááááááááááááááááááááááááá TAILWATER ááááááááááááááááááááááááááá
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CONSTANT WATER SURFACE ELEVATION
1013.27

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ááááááááááááááááááááááááááá ROADWAY OVERTOPPING DATA ááááááááááááááááááááááááááá
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ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	0.00
CREST LENGTH (FT)	200.00
OVERTOPPING CREST ELEVATION (FT)	1015.20

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CP-255A SPILLWAY HYDRAULIC CALCULATIONS

DRAFT DESIGN REPORT
JULY 1997

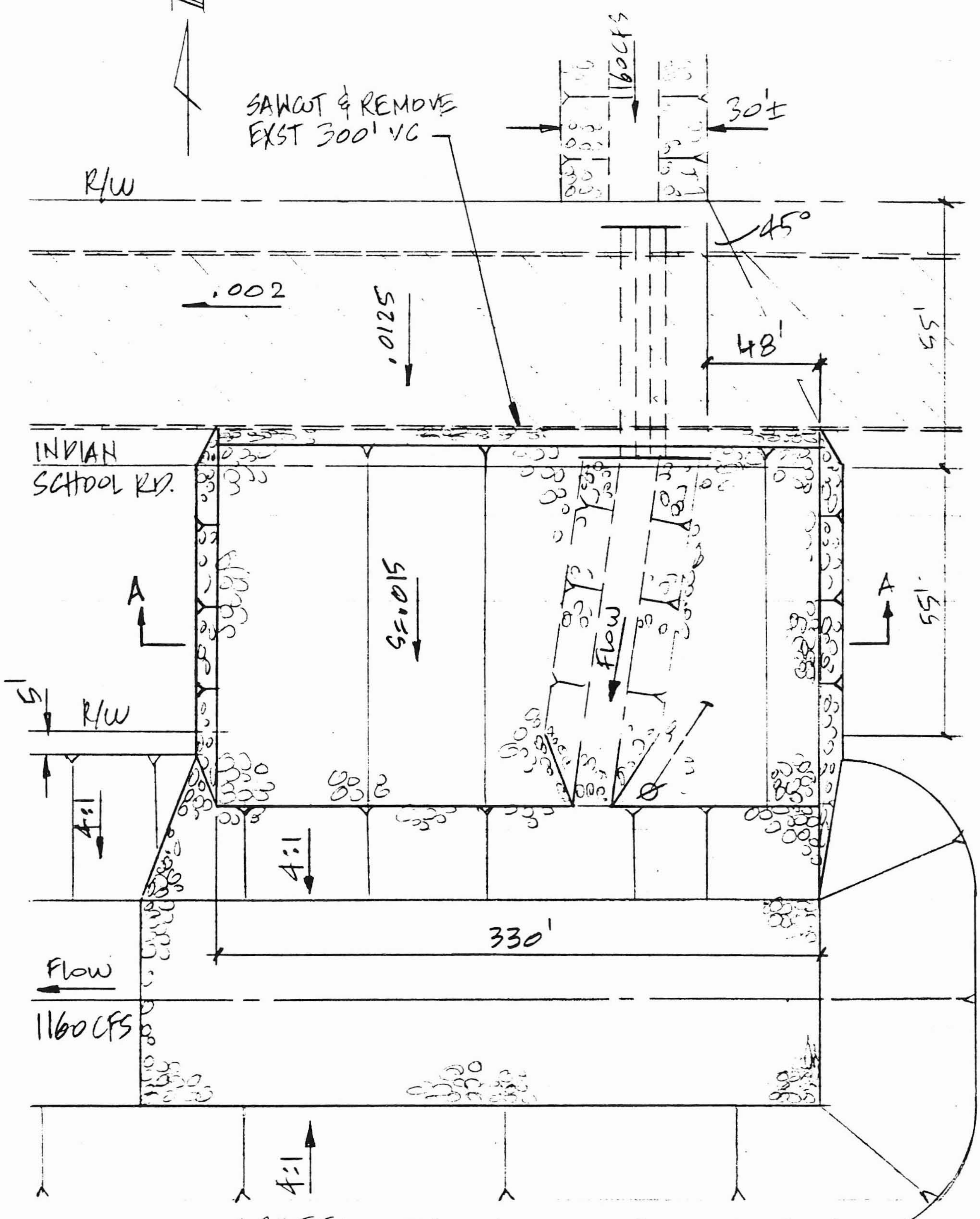
REV- PLAZA CIRCLE CHANNEL

SFC

PROJECT: CP 255A – SPILLWAY (ALTERNATIVE)

PROJECT No.: 1202101 DATE: 10/22/96

PAGE: SCALE:



CP255A SPILLWAY – ALTERNATIVE PLAN

DESIGNED BY: HVM CHECKED BY:

PLAZA CIRCLE CHANNEL

KID-ISRB

PROJECT: SPILLWAY @ CP255A

PROJECT No.: 202101 DATE: 10/24/96

PAGE: SCALE:

DETERMINE THE FLOW THRU. THE PIPES (4-18" RCP) AND OVERTOPPING @ CP 255A.

USE THE HY-8 CULVERT ANALYSIS.

From the Survey: Conc Driveway el = 22.8 ±

Headwater = 22.15 OK

Flow thru pipes = 40 CFS

Flow overtopping = 1160 CFS - 40 CFS = 1120 CFS

DESIGNED BY: Hun CHECKED BY:

CURRENT DATE: 10-23-1996 FILE DATE: 10-22-1996
CURRENT TIME: 13:49:33 FILE NAME: CP255A

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV	SITE DATA INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1017.46	1017.20	50.00	4 RCP	1.50	1.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: CP255A DATE: 10-22-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1021.07	0	0	0	0	0	0	0	0	1
1021.24	116	15	0	0	0	0	0	100	6
1021.38	232	21	0	0	0	0	0	210	5
1021.51	348	25	0	0	0	0	0	321	4
1021.62	464	28	0	0	0	0	0	435	4
1021.72	580	30	0	0	0	0	0	544	3
1021.82	696	32	0	0	0	0	0	658	3
1021.91	812	34	0	0	0	0	0	773	3
1022.00	928	36	0	0	0	0	0	888	3
1022.08	1044	38	0	0	0	0	0	1003	3
1022.16	1160	39	0	0	0	0	0	1118	3
1021.00	27	0	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CP255A DATE: 10-22-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1021.07	0.00	0	0	0.00
1021.24	-0.00	116	1	0.61
1021.38	-0.00	232	1	0.42
1021.51	-0.01	348	2	0.61
1021.62	-0.00	464	2	0.34
1021.72	-0.00	580	6	0.95
1021.82	-0.00	696	5	0.78
1021.91	-0.00	812	5	0.58
1022.00	-0.00	928	4	0.44
1022.08	-0.00	1044	4	0.34
1022.16	-0.00	1160	3	0.27

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 10-23-1996 FILE DATE: 10-22-1996
CURRENT TIME: 13:49:33 FILE NAME: CP255A

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PERFORMANCE CURVE FOR CULVERT # 1 - 4 (1.5 BY 1.5) RCP

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DIS- CHARGE FLOW (cfs)	HEAD- WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1021.07	0.00	3.61	0-NF	0.00	0.00	0.00	0.00	0.00	3.87
15	1021.23	1.08	3.77	4-FFt	0.71	0.74	2.11	1.50	0.00	3.87
21	1021.38	1.33	3.92	4-FFt	0.87	0.88	2.94	1.50	0.00	3.87
25	1021.50	1.49	4.04	4-FFt	0.97	0.95	3.48	1.50	0.00	3.87
28	1021.61	1.62	4.15	4-FFt	1.05	1.01	3.91	1.50	0.00	3.87
30	1021.71	1.73	4.25	4-FFt	1.13	1.06	4.26	1.50	0.00	3.87
32	1021.81	1.84	4.35	4-FFt	1.21	1.10	4.57	1.50	0.00	3.87
34	1021.90	1.94	4.44	4-FFt	1.31	1.13	4.85	1.50	0.00	3.87
36	1021.99	2.04	4.53	4-FFt	1.50	1.16	5.11	1.50	0.00	3.87
38	1022.07	2.12	4.61	4-FFt	1.50	1.18	5.32	1.50	0.00	3.87
39	1022.15	2.22	4.69	4-FFt	1.50	1.21	5.54	1.50	0.00	3.87

ááá

El. inlet face invert 1017.46 ft El. outlet invert 1017.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

ááá

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	1017.46
OUTLET STATION (FT)	150.00
OUTLET ELEVATION (FT)	1017.20
NUMBER OF BARRELS	4
SLOPE (V-FT/H-FT)	0.0052
CULVERT LENGTH ALONG SLOPE (FT)	50.00

Conc D/W = 22.8
HW = 22.15
↓
USE MAX Q pipes = 40 ft.
Q over bypass = 112

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	1.50 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

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CURRENT DATE: 10-23-1996 FILE DATE: 10-22-1996
RENT TIME: 13:49:33 FILE NAME: CP255A

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áááááááááááááááááááááááááá TAILWATER áááááááááááááááááááááááááá
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CONSTANT WATER SURFACE ELEVATION
1021.07

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áááááááááááááááááááááááááá ROADWAY OVERTOPPING DATA áááááááááááááááááááááááááá
áá

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	100.00
CREST LENGTH (FT)	295.00
OVERTOPPING CREST ELEVATION (FT)	1021.00

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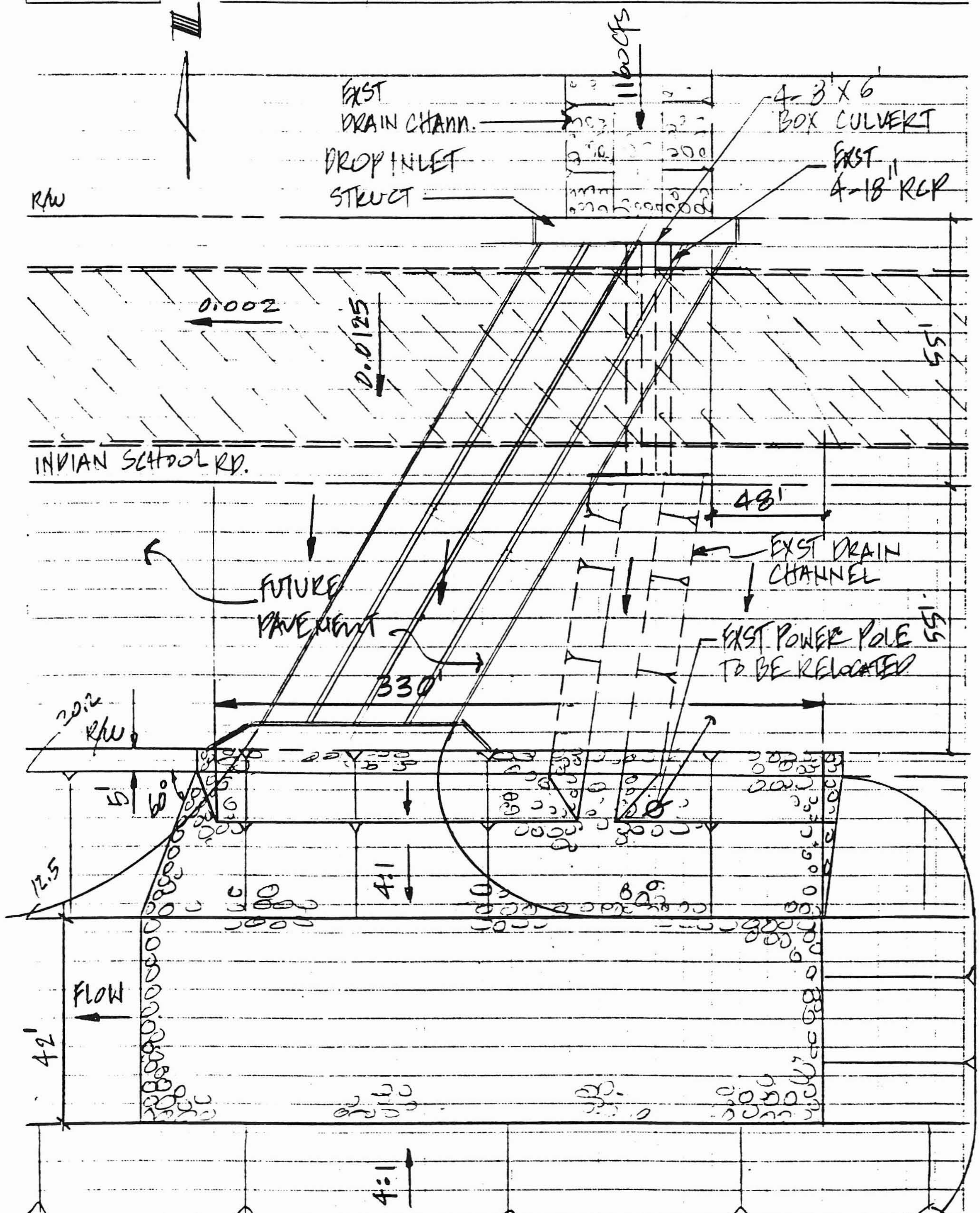
RIO- ~~[illegible]~~ NEW CHANNEL @ CP255A

PROJECT: CP 255A - ~~SPILLWAY~~

PROJECT No.: 1202101 **DATE:** 10/22/96

PAGE: 1 OF 3 **SCALE:**



CP255A - ~~SPILLWAY PLAN~~ FUTURE BOX CULVERT

DESIGNED BY: HVM **CHECKED BY:**

SIZE FOR 50yr STORM or 100yr ? PRELIMINARY

Q_{100} = 1160 CFS

CURRENT DATE: 10-29-1996
CURRENT TIME: 08:52:12

FILE DATE: 10-16-1996
FILE NAME: ISRB255A

FHWA CULVERT ANALYSIS
HY-8, VERSION 4.3

CULV	SITE DATA: INLET ELEV. (FT)	OUTLET ELEV. (FT)	CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	1012.43	1012.38	100.00	4 RCB	8.00	6.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (CFS) FILE: ISRB255A DATE: 10-16-1996

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1017.38	0	0	0	0	0	0	0	0	0
1017.40	116	116	0	0	0	0	0	0	0
1017.43	232	232	0	0	0	0	0	0	0
1017.50	348	348	0	0	0	0	0	0	0
1017.58	464	464	0	0	0	0	0	0	0
1017.70	580	580	0	0	0	0	0	0	0
1017.84	696	696	0	0	0	0	0	0	0
1018.00	812	812	0	0	0	0	0	0	0
1018.96	928	928	0	0	0	0	0	0	0
1019.12	1044	1044	0	0	0	0	0	0	0
1019.29	1160	1160	0	0	0	0	0	0	0
0.00	0	0	0	0	0	0	0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: ISRB255A DATE: 10-16-1996

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
1017.38	0.00	0	0	0.00
1017.40	0.00	116	0	0.00
1017.43	0.00	232	0	0.00
1017.50	0.00	348	0	0.00
1017.58	0.00	464	0	0.00
1017.70	0.00	580	0	0.00
1017.84	0.00	696	0	0.00
1018.00	0.00	812	0	0.00
1018.96	0.00	928	0	0.00
1019.12	0.00	1044	0	0.00
1019.29	0.00	1160	0	0.00

<1> TOLERANCE (FT) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 10-29-1996 FILE DATE: 10-16-1996
CURRENT TIME: 08:52:12 FILE NAME: ISRB255A

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PERFORMANCE CURVE FOR CULVERT # 1 - 4 (8 BY 6) RCB

ááá

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	1017.38	0.00	4.95	0-NF	0.00	0.00	0.00	0.00	0.00	5.00
116	1017.40	1.14	4.97	3-M1t	1.31	0.74	0.73	5.00	0.00	5.00
232	1017.43	1.81	5.00	3-M1t	2.10	1.18	1.45	5.00	0.00	5.00
348	1017.50	2.37	5.07	3-M1t	2.80	1.55	2.17	5.00	0.00	5.00
464	1017.58	2.87	5.15	3-M1t	3.46	1.87	2.90	5.00	0.00	5.00
580	1017.70	3.34	5.27	3-M1t	4.08	2.17	3.63	5.00	0.00	5.00
696	1017.84	3.78	5.41	3-M1t	4.69	2.45	4.35	5.00	0.00	5.00
812	1018.00	4.19	5.57	3-M2t	5.28	2.72	5.07	5.00	0.00	5.00
928	1018.96	4.59	6.53	6-FFn	6.00	2.97	4.83	6.00	0.00	5.00
1044	1019.12	4.96	6.69	6-FFn	6.00	3.22	5.44	6.00	0.00	5.00
1160	1019.29	5.34	6.86	6-FFn	6.00	3.45	6.04	6.00	0.00	5.00

ááá

El. inlet face invert 1012.43 ft El. outlet invert 1012.38 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

ááá

OK w/ grouted riprap outlet Vmax = 9 FPS.

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION (FT)	46700.00
INLET ELEVATION (FT)	1012.43
OUTLET STATION (FT)	46600.00
OUTLET ELEVATION (FT)	1012.38
NUMBER OF BARRELS	4
SLOPE (V-FT/H-FT)	0.0005
CULVERT LENGTH ALONG SLOPE (FT)	100.00

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	8.00 FT
BARREL RISE	6.00 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

ááá

CURRENT DATE: 10-29-1996 FILE DATE: 10-16-1996
CURRENT TIME: 08:52:12 FILE NAME: ISRB255A

áá
áááááááááááááááááááááááááá TAILWATER áááááááááááááááááááááááááá
áá
áá

CONSTANT WATER SURFACE ELEVATION
1017.38

áá
áááááááááááááááááááááááááá ROADWAY OVERTOPPING DATA áááááááááááááááááááááááááá
áá

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH (FT)	100.00
CREST LENGTH (FT)	300.00
OVERTOPPING CREST ELEVATION (FT)	1020.20

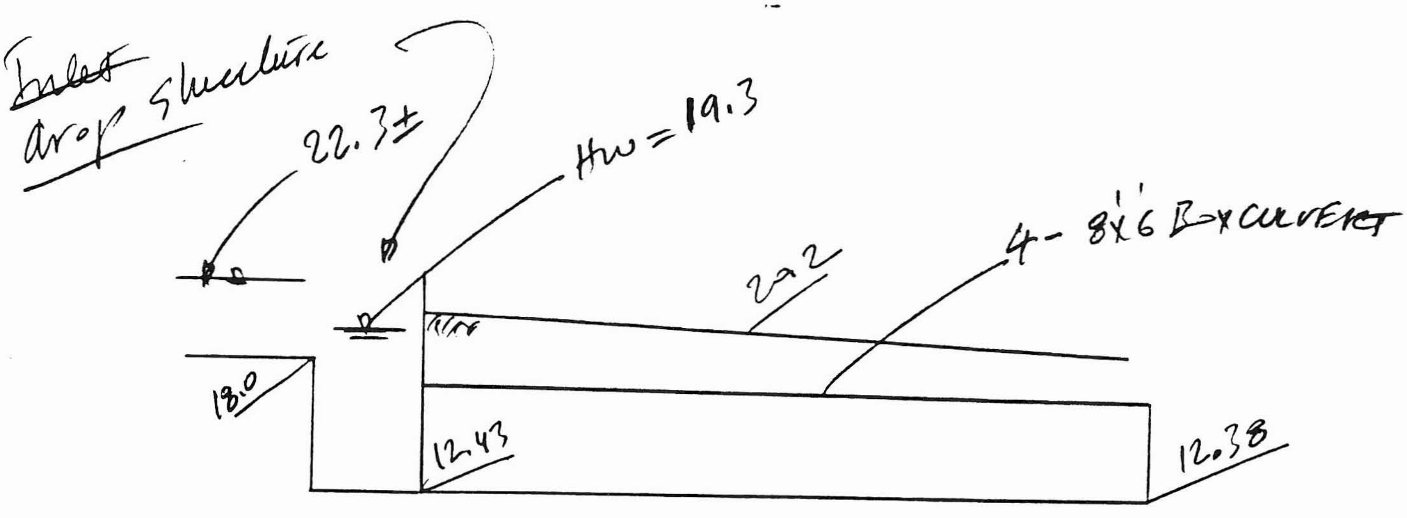
áá

Max 30' weir length.

$$H = \left[\frac{Q}{CL}\right]^{.67} = \left[\frac{1160}{3 \times 30}\right]^{.67} = 5.54'$$

↑ NOT ADEQUATE

Cone O/W = 22.8 max



Revise crest el when final design hydraulic calc.

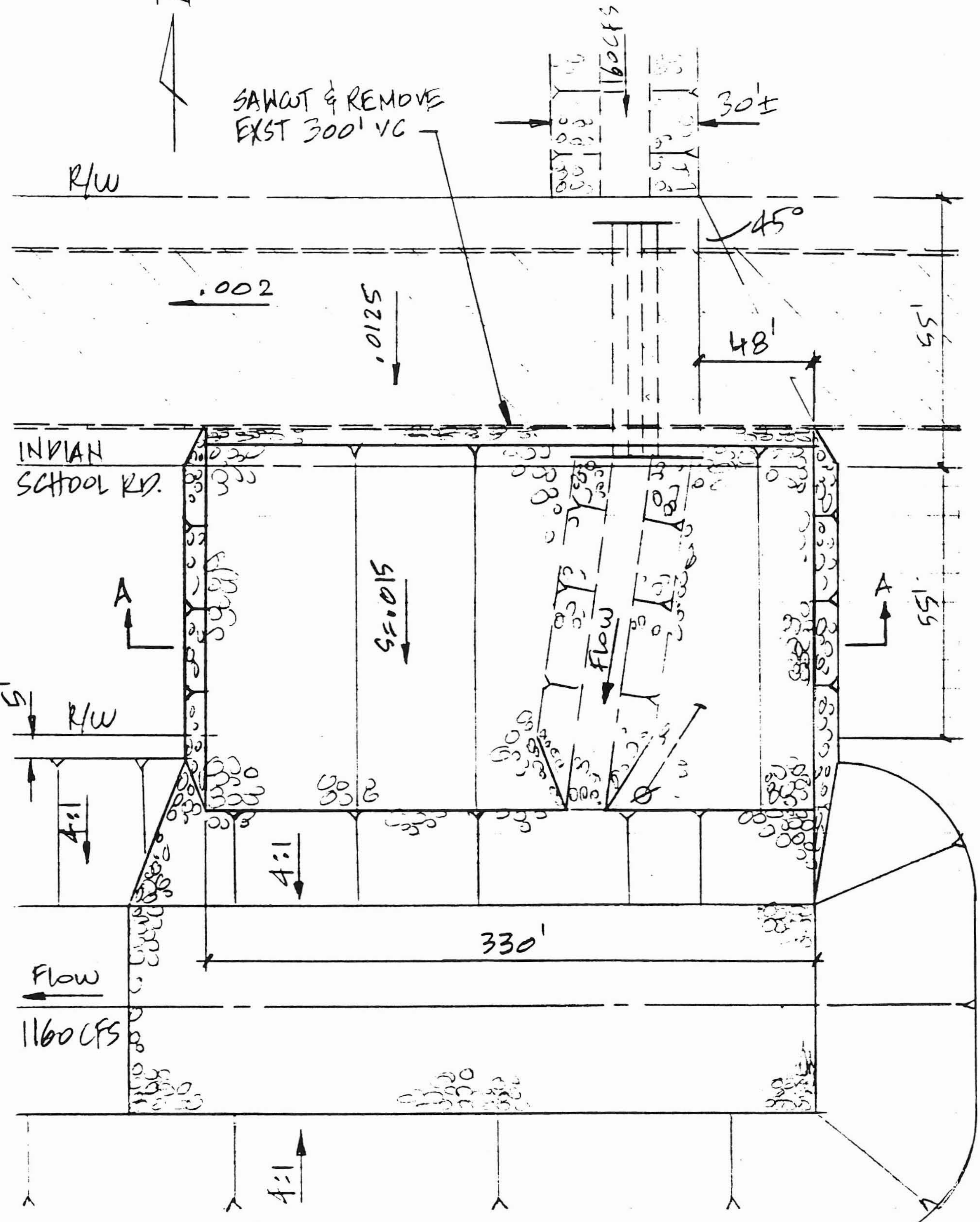
SFC

PROJECT: PLAZA CIRCLE CHANNEL

CP 255A – SPILLWAY (ALTERNATIVE)

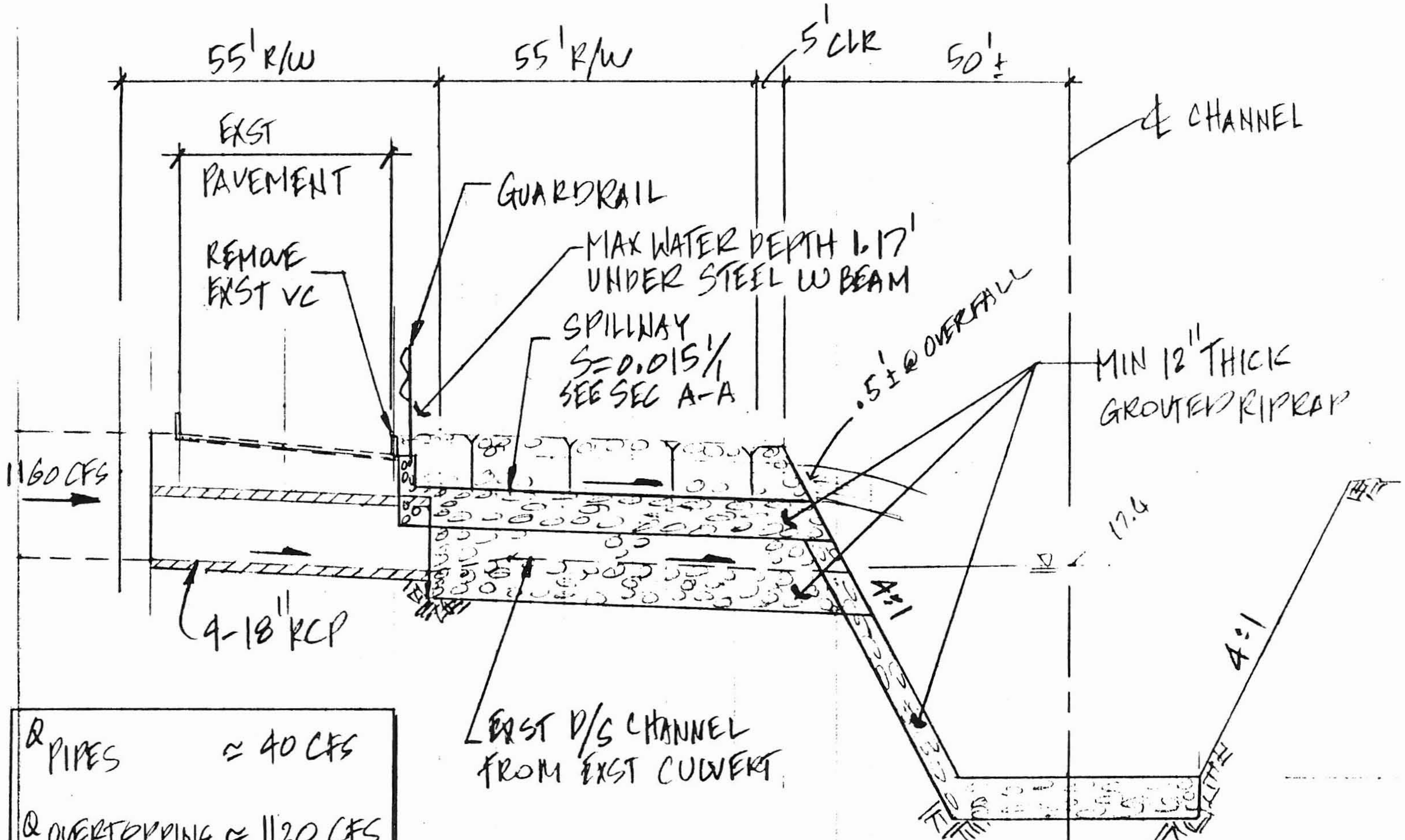
PROJECT No.:　　DATE:

PAGE:　　SCALE:



CP255A SPILLWAY – ALTERNATIVE PLAN

DESIGNED BY: HVM　　CHECKED BY:



Q_{PIPES}	≃ 40 CFS
$Q_{OVERTOPPING}$	≃ 1120 CFS
ΣQ	= 1160 CFS

CP255A - ALTERNATIVE SPILLWAY SECTION - TIE TO EXST PAVEMENT

DESIGNED BY:

CHECKED BY:

SFC

PROJECT: CP 255A SPILLWAY - ALTERNATIVE

PROJECT No.:

PAGE: 2 OF 3

DATE:

SCALE:

PROJECT: RID- CP 255A SPILLWAY - ALTERNATIVE

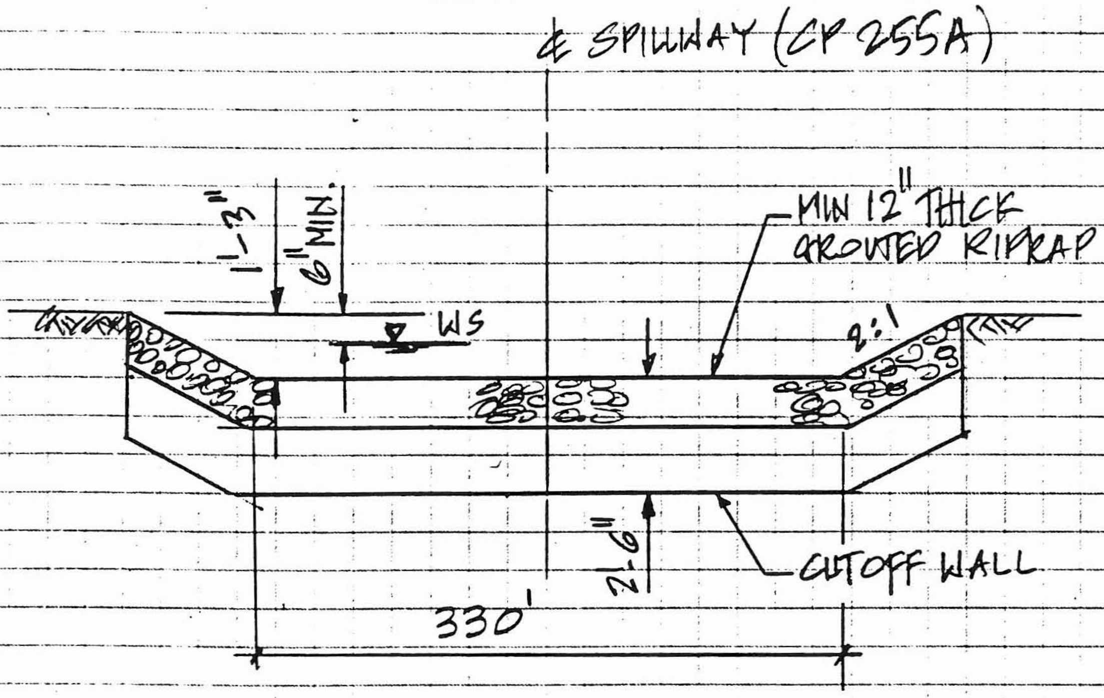
SFC

PROJECT No.: 120210

DATE: 10/10/96

PAGE: 3 OF 3

SCALE:



SPILLWAY - SECTION A-A

NOTE: EXIST CHANNEL FROM OUTLET OF EXIST CULVERT NOT SHOWN.

DESIGNED BY: HVM

CHECKED BY:

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: RID-ISRB

Comment: SPILLWAY AT CP255A

Solve For Depth

Given Input Data:

Bottom Width.....	330.00 ft
Left Side Slope..	2.00:1 (H:V)
Right Side Slope.	2.00:1 (H:V)
Manning's n......	0.030
Channel Slope....	0.0150 ft/ft
Discharge........	1120.00 cfs

Computed Results:

Depth............	0.71 ft
Velocity.........	4.79 fps
Flow Area........	233.79 sf
Flow Top Width...	332.82 ft
Wetted Perimeter.	333.15 ft
Critical Depth...	0.71 ft
Critical Slope...	0.0148 ft/ft
Froude Number....	1.01 (flow is Supercritical)

Note: THE WATER DEPTH AT THE OVERFALL APPROX .7 dc = .7 X .71 = .50'
(brink)

Open Channel Flow Module, Version 3.2 (c) 1990
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: RID-ISRB

Comment: EXIST CHANNEL AT CP 255A

Solve For Depth

Given Input Data:

Bottom Width.....	10.00 ft
Left Side Slope..	2.00:1 (H:V)
Right Side Slope.	2.00:1 (H:V)
Manning's n......	0.030
Channel Slope....	0.0281 ft/ft
Discharge........	1160.00 cfs

Computed Results:

Depth............	4.06 ft
Velocity.........	15.76 fps
Flow Area........	73.62 sf
Flow Top Width...	26.25 ft
Wetted Perimeter.	28.17 ft
Critical Depth...	5.30 ft
Critical Slope...	0.0096 ft/ft
Froude Number....	1.66 (flow is Supercritical)

RIO

PROJECT: SPILLWAY AT CP255A

PROJECT No.: 1202101 DATE: 10/05/03

 SCALE:

DETERMINE THE SPILLWAY WIDTH TO ACCEPT THE FLOW FROM CP 255A

Q (OVERTOPPING) = 1120 CFS.

Q (PIPES) = 40 CFS

THE DEPTH AND AREA LIMITATIONS OF WATER ABOVE THE STREET BEFORE FLOWS INTO THE SPILLWAY DEPEND ON THE FUTURE STREET DESIGN.

ASSUMED THE DEPTH OF WATER AT SPILLWAY CREST OPERATES AS A WEIR.

ASSUMED GUARDRAIL (ADOT STD) WILL BE INSTALLED ALONG THE CREST OF THE SPILLWAY.

ASSUMED MAX DEPTH OF WATER = 1.17' UNDER STEEL W BEAM FOR OPERATION AS A WEIR AND NOT BACKING UP OF WATER BEHIND THE GUARDRAIL.

FIND THE WEIR LENGTH

USE EQUATION $Q = CLH^{1.5}$

Where: $Q = 1120$ CFS

$C = 3.0$

$H = 1.17'$

DESIGNED BY: HVM CHECKED BY:

KID

SFC

PROJECT: SPILLWAY AT SP 355 A

PROJECT No.: 120210 | DATE: 10/23/96

 | SCALE:

$$L = \frac{Q}{CH^{1.5}} = \frac{1120}{(3.0)(1.17)^{1.5}} = 295'$$

ASSUMED SPACING OF POST = 6.25' @ ℄ - ℄

No OF SPACINGS $= \frac{295'}{6.25'} = 48$ EA

Say WOOD POST = 3" X 8"

TOTAL POST LENGTH = 48 EA X 8"/EA = 384" or 32'

TOTAL WEIR LENGTH REQUIRED = 295' + 32' = 327'

PROVIDED WEIR LENGTH = 330' OK

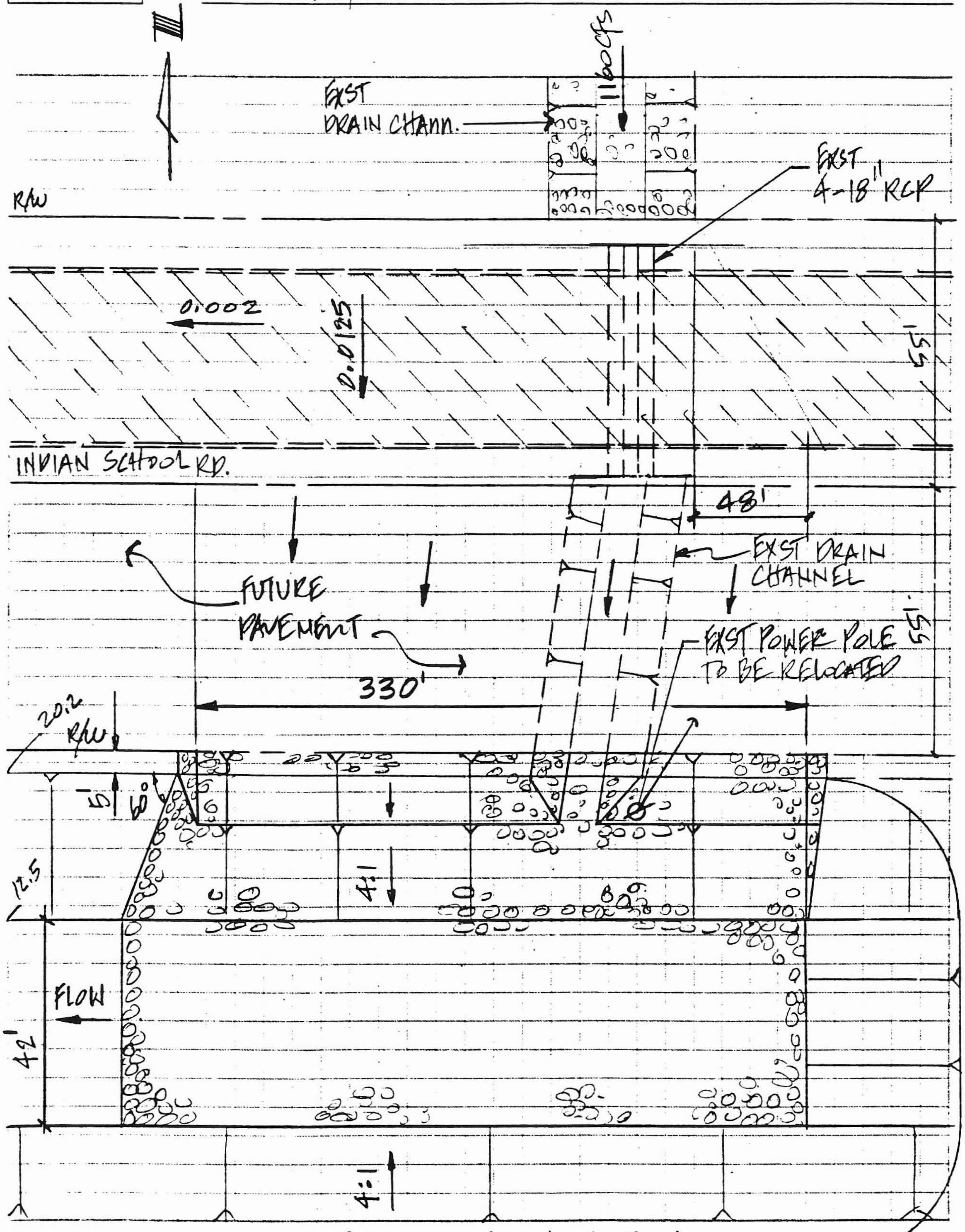
DESIGNED BY: LH/MA | CHECKED BY:

RID- NEW CHANNEL @ CP255A

PROJECT: CP 255A - SPILLWAY

PROJECT No.: 1202101 DATE: 10/22/96

PAGE: 1 OF 3 SCALE:



CP255A - SPILLWAY PLAN

DESIGNED BY: HVM CHECKED BY:

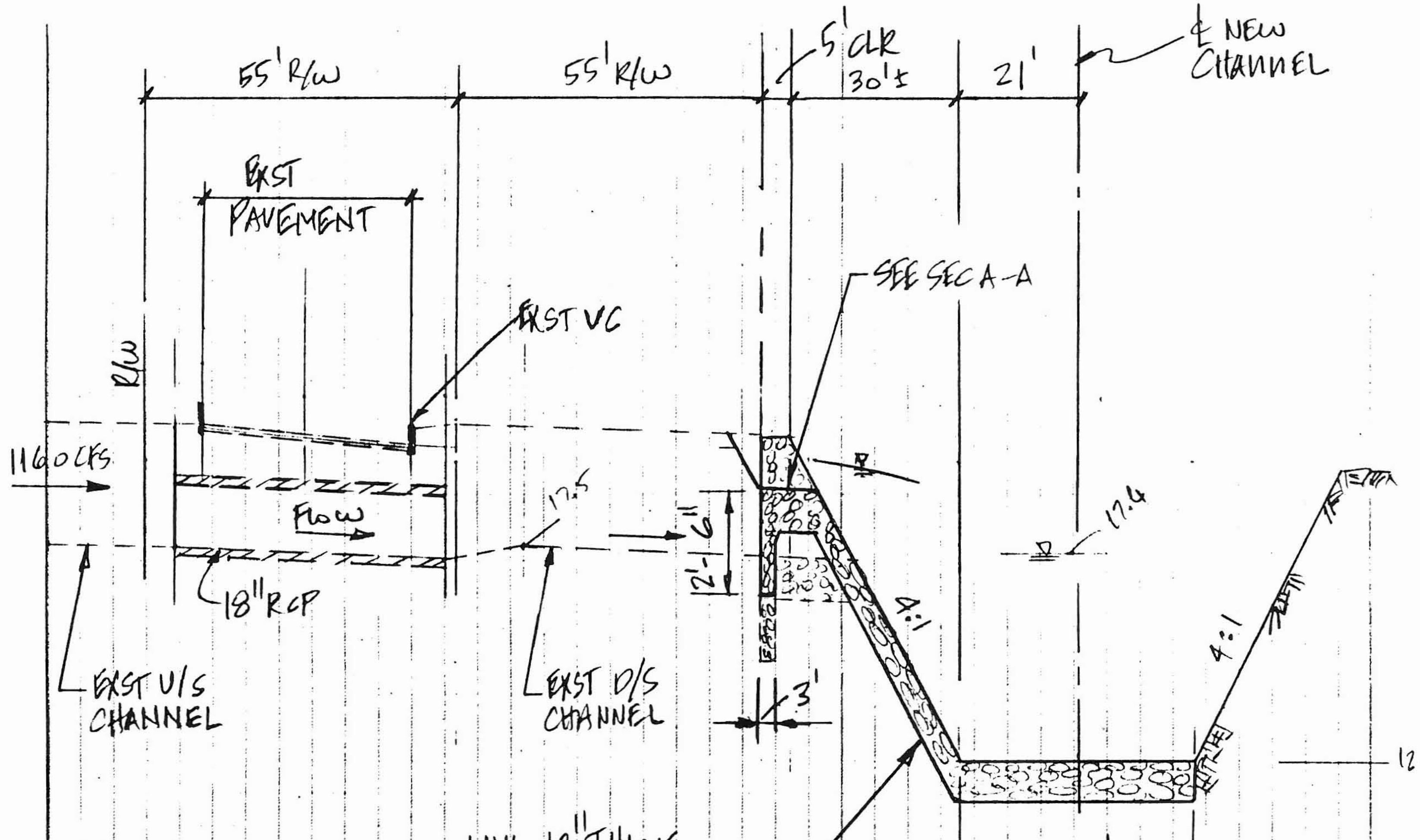
PROJECT: RIO - CP255A SPILLWAY

PROJECT No.: 120101

DATE: 10/22/06

PAGE: 2 OF 3

SCALE:



Q_{PIPES}	≃ 40 CFS
$Q_{OVERTOPPING}$	≃ 1120 CFS
ΣQ	≃ 1160 CFS

CP255A - SECTION

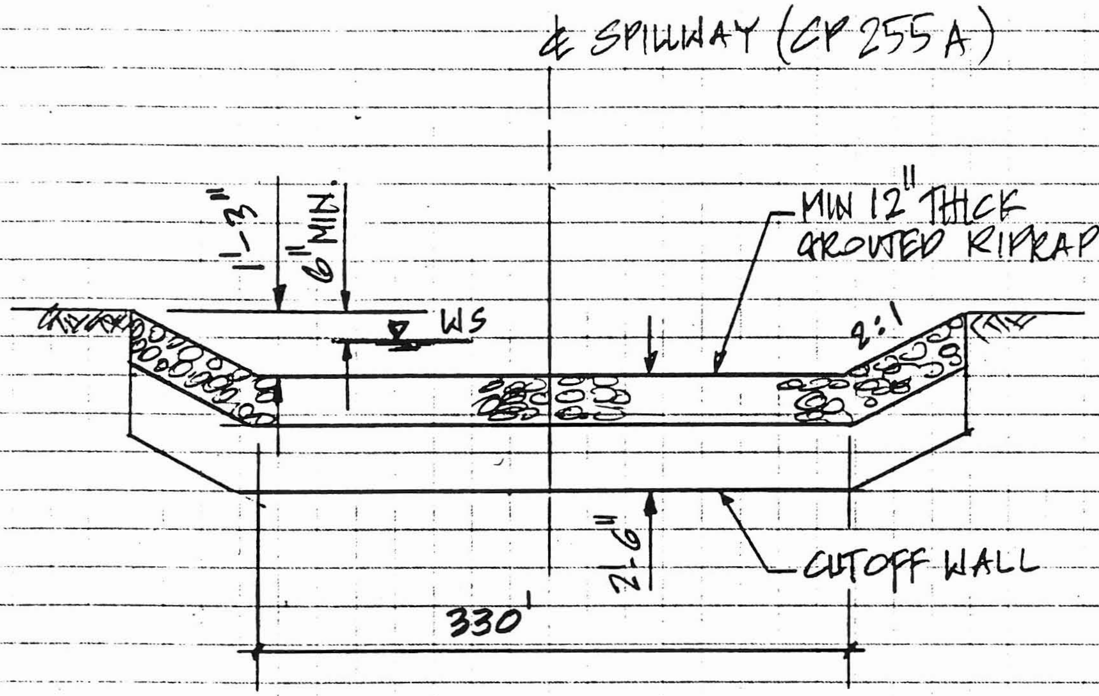
DESIGNED BY:

CHECKED BY:

PROJECT: RIO- CP 255A SPILLWAY

PROJECT No.: 120210 | DATE: 10/10/96

PAGE: 3 OF 3 | SCALE:



SPILLWAY - SECTION A-A

DESIGNED BY: HVM

CHECKED BY:

PROJECT: RID- CP 255A

PROJECT No.: 1202101 DATE: 3/25/97

PAGE: 1 OF SCALE:

1. DETERMINE Q_1 @ ISR

Say 200' SPILLWAY.

$Q = CLH^{1.5}$ ($C = 3.0$, $L = 200'$, $H = 1.17'$)

$Q = (3.0)(200')(1.17)^{1.5}$

$Q = 760$ CFS

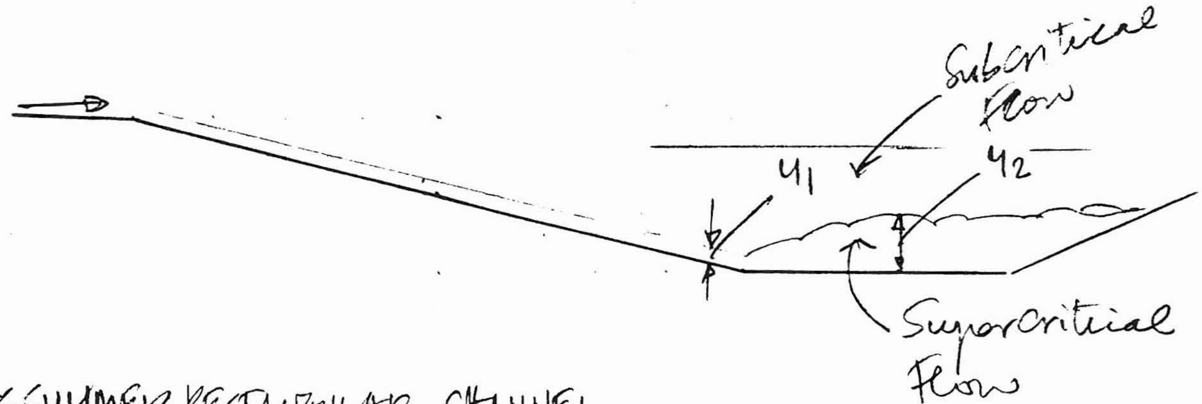
2. DETERMIN Q_2 THRU. CULVERTS AND OVERTOP ROAD

$Q_2 = Q - Q_1$

$Q_2 = 1160$ CFS $- 760$ CFS

$Q_2 = 400$ CFS

3. DETERMIN HYDRAULIC JUMP y_1, y_2



ASSUMMED RECTANGULAR CHANNEL

$Q = 400$ CFS $n = 0.03$ (Riprap)

$B = 120'$ $S = .25$ (4:1)

DESIGNED BY: CHECKED BY:

$y_1 = 0.30'$

$V = 11.08$

$F = 3.56$

$d_c = 0.70'$

$S_c = 0.0150$

a- Find y_2 (USE eq $\frac{y_2}{y_1} = \frac{1}{2}\left[\sqrt{1+8F^2} - 1\right]$

$y_2 = \left[\frac{1}{2}\left(\sqrt{1+8 \times 3.56^2} - 1\right)\right] 0.30'$ (USE $y_1 = .30'$ ≅ depth)

$= 1.37'$

b- LENGTH OF JUMP - (has been found to vary between $4.0\,y_2$ to $6.2\,y_2$

Say $L = 5.6\,y_2$

$= 5.6(1.37') = 7.66'$

c. USE the theoretical velocity defined by the Bureau is $V = \sqrt{2g(Z - 0.5H}$ FLOW AT THE TOE OF OVERFLOW SPILLWAY.

PROJECT:

PROJECT No.: DATE:

PAGE: 3 SCALE:

ASSUMED SPILLWAY IS RECTANGULAR CHANNEL @ SLOPE = 0.015 –

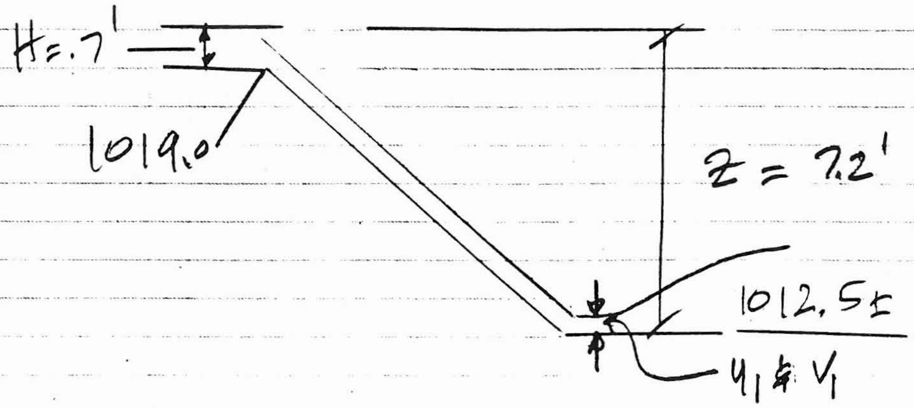
H = 0.70'

V = 4.75 FPS.

dc = 0.7'

Sc = .015

F = 1.0 –



$V_1 = \sqrt{2g(Z - .5H)}$

$= \sqrt{64.4(7.2 - .5(.7)}$

$V_1 =$ 21.0 FPS.

L = 120'

FLOW AREA $= \frac{Q}{V} = \frac{400 \text{ CFS}}{21.0 \text{ FPS}} = 19.05 \text{ FT}^2$

$y_1 = A/L = \frac{19.05 \text{ FT}^2}{120 \text{ FT}} = 0.16'$

DESIGNED BY: CHECKED BY:

SFC

PROJECT:

PROJECT No.: DATE:

PAGE: 4 SCALE:

$$F = \frac{V_1}{\sqrt{g y_1}} = \frac{21.0}{\sqrt{32.2(.16)}} = 9.25$$

$$y_2 = \frac{1}{2}\left(\sqrt{1+8F^2} - 1\right) y_1$$

$$= \left[\frac{1}{2}\left(\sqrt{1+8(9.25^2)} - 1\right)\right] .16$$

$$y_2 = 2.01'$$

d. LENGTH OF JUMP

$$L = 6.1\, y_2$$

$$= 6.1 \times 2.01 = 12.29'$$

MIN. BOTTOM CHANNEL = 12.0'

∴ RIPRAP PROTECTION 2.5' HIGH UP THE SOUTH SIDE SLOPE OF CHANNEL WHERE B = 12.0' —

USE AS SAME AS CP-2211 —

DESIGNED BY: HVM CHECKED BY:

channel for irrigation or other water-distribution purposes; (3) to increase weight on an apron and thus reduce uplift pressure under a masonry structure by raising the water depth on the apron; (4) to increase the discharge of a sluice by holding back tailwater, since the effective head will be reduced if the tailwater is allowed to drown the jump;[1] (5) to indicate

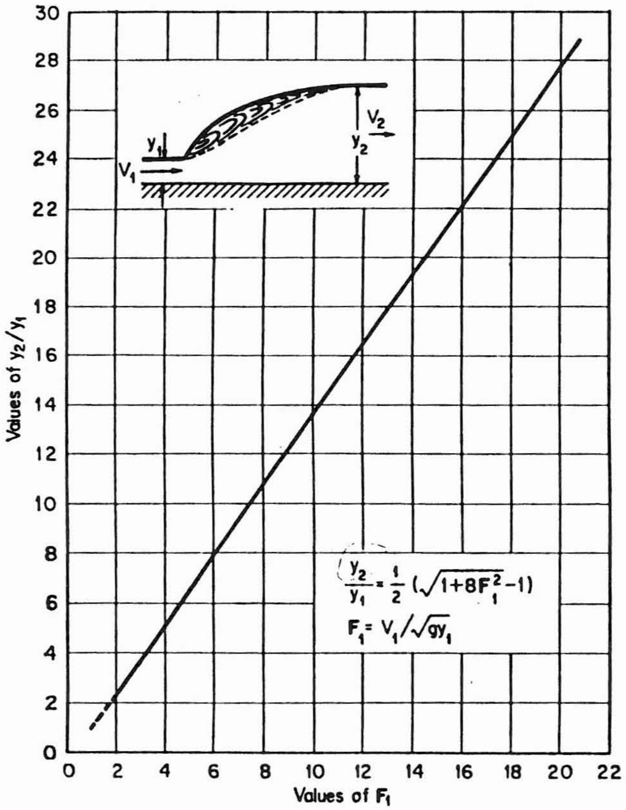


Fig. 15-1. Relation between $\mathbf{F}_1$ and y_2/y_1 for a hydraulic jump in a horizontal rectangular channel.

special flow conditions, such as the existence of supercritical flow or the presence of a control section so that a gaging station may be located; (6) to mix chemicals used for water purification, and so forth [28]; (7) to aerate water for city water supplies; and (8) to remove air pockets from water-supply lines and thus prevent air locking [29].

[1] This principle has been applied by Saugey [27] to an interesting device known as *fall increaser*. The device is intended to increase the effective head in a water-power plant during periods of flood by holding back tailwater from the outlet of the draft tube by a [illegible]ulic jump.

15-2. Jump in Horizontal Rectangular Channels.[1] For supercritical flow in a horizontal rectangular channel, the energy of flow is dissipated through frictional resistance along the channel, resulting in a decrease in velocity and an increase in depth in the direction of flow. A hydraulic jump will form in the channel if the Froude number $\mathbf{F}_1$ of the flow, the flow depth y_1, and a downstream depth y_2 satisfy the equation

$$\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1 + 8\mathbf{F}_1^2} - 1\right) \qquad (3\text{-}21)$$

This equation may be represented by the curve in Fig. 15-1. This curve has been verified satisfactorily with many experimental data and will be found very useful in the analysis and design for hydraulic jumps.

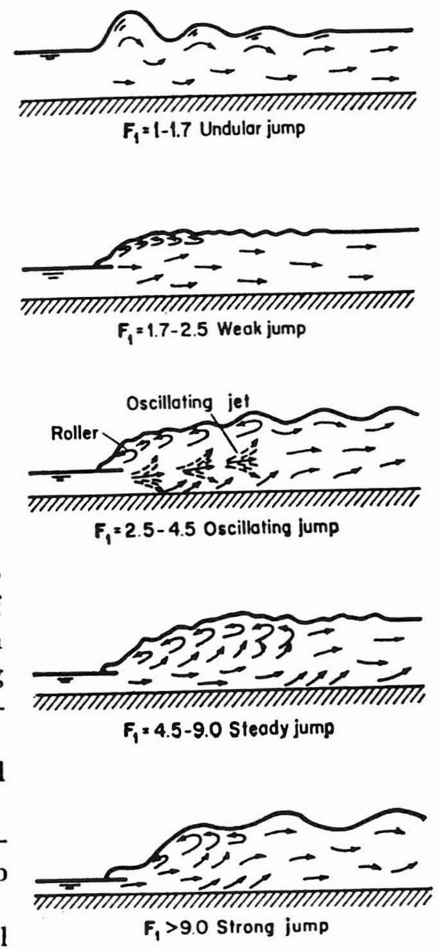


Fig. 15-2. Various types of hydraulic jump.

15-3. Types of Jump. Hydraulic jumps on horizontal floor are of several distinct types. According to the studies of the U.S. Bureau of Reclamation [34,35], these types can be conveniently classified according to the Froude number $\mathbf{F}_1$ of the incoming flow (Fig. 15-2), as follows:

For $\mathbf{F}_1 = 1$, the flow is critical, and hence no jump can form.

For $\mathbf{F}_1 = 1$ to 1.7, the water surface shows undulations, and the jump is called an *undular jump*.

For $\mathbf{F}_1 = 1.7$ to 2.5, a series of small rollers develop on the surface of the jump, but the downstream water surface remains smooth. The velocity throughout is fairly uniform, and the energy loss is low. This jump may be called a *weak jump*.

For $\mathbf{F}_1 = 2.5$ to 4.5, there is an oscillating jet entering the jump bottom to surface and back again with no periodicity. Each oscillation produces

[1] For hydraulic jumps in trapezoidal channels, see [30] and [31]. For jumps in closed conduits, see [29] and [32]. For a general treatment of nonre[illegible]ngular channels, see [33].

zontal rectangular channels. For horizontal nonrectangular channels, similar curves may also be prepared.

The theoretical curves for y_2/E_1 and h_j/E_1 have been verified experimentally by Bakhmeteff and Matzke [17], who found that these curves give values of y_2/E_1 and h_j/E_1 about 3 to 4% greater than the experimental values.[1] The characteristic curves were also checked with U.S.

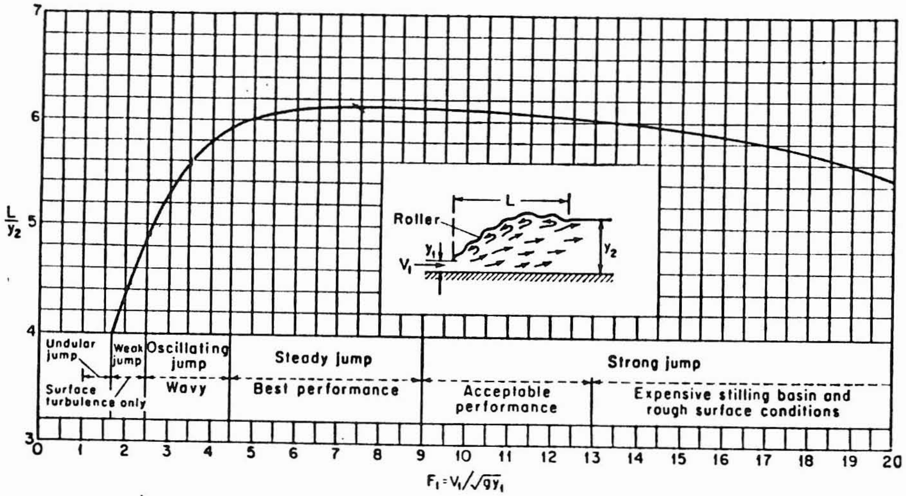


Fig. 15-4. Length in terms of sequent depth y_2 of jumps in horizontal channels. (*Based on data and recommendations of U.S. Bureau of Reclamation* [34].)

Bureau of Reclamation data [34,35] obtained from six test flumes. Perfect agreement was found between the y_1/E_1 curve and the data. The agreement between the E_2/E_1 or $\Delta E/E_1$ curve and the data was fairly good except for $\mathbf{F}_1 < 2$. The experimental curve for $\Delta E/E_1$ recommended by the Bureau is shown by the dashed line (Fig. 15-3). The agreement between the y_2/E_1 and h_j/E_1 curves and the data was good for high $\mathbf{F}_1$ values, but the scattered data failed to define the curves accurately for $\mathbf{F}_1 < 3$.

15-5. Length of Jump. The *length of a jump* may be defined as the distance measured from the front face of the jump to a point on the surface immediately downstream from the roller. This length cannot be determined easily by theory, but it has been investigated experimentally by many hydraulicians.[2]

[1] It is possible that at least part of this discrepancy is due to the scale effect of the testing model (see next article).

[2] Among them Safranez at the Technical University of Berlin [36,37], Wóycicki at the Federal Institute of Technology in Zürich, Switzerland [38], Aravin in Russia [39], Bakhmeteff and Matzke at Columbia University [17], Moore at the California Institute of Technology [40], and the engineers of the U.S. Bureau of Reclamation [34,...

The experimental data on length of jump can be plotted convenient with the Froude number $\mathbf{F}_1$ against a dimensionless ratio $L/(y_2 - y$ L/y_1, or L/y_2. The plot of $\mathbf{F}_1$ vs. L/y_1 is probably the best, for the resu ing curve can be best defined by the data. For practical purposes, ho ever, the plot of $\mathbf{F}_1$ vs. L/y_2 is desirable, because the resulting curve sho regularity or a fairly flat portion for the range of well-established jum A curve of $\mathbf{F}_1$ vs. L/y_2 (Fig. 15-4) based on the experimental data of s test flumes has been prepared by the Bureau of Reclamation. In co paring this curve with the well-known Bakhmeteff-Matzke curve [17], pr nounced disagreement was found. Investigation of the matter has l to the belief that this disagreement is due to the scale effect involved Bakhmeteff and Matzke's experimental data. This scale effect mea that the prototype action was not faithfully reproduced in the mod The curve shown in Fig. 15-4 was developed primarily for jumps occu ring in rectangular channels. In the absence of adequate data, th curve may also be applied approximately to jumps formed in trapezoid channels.

15-6. The Surface Profile. Knowledge of the surface profile of jump is desirable in designing the freeboard for the retaining walls of t stilling basin where the jump takes place. It is important also for dete mining the pressure for use in structural design, because experiments ha shown that the vertical pressure on the horizontal floor under a hydrau jump is practically the same as would be indicated by the water-surfa profile.

On the basis of their experimental data, Bakhmeteff and Matzke [1 have found that the surface profile of a hydraulic jump can be repr sented by dimensionless curves for various $\mathbf{F}_1$ values, as shown in F 15-5. Moore [40] has developed similar curves for jumps below a fr overfall. The profiles shown by Moore rise more rapidly at the beginni than do Bakhmeteff and Matzke's profiles. It is believed that this because the nonhydrostatic-pressure distribution in the jump was n registered properly by the piezometric measurements for Bakhmeteff a Matzke's data. Furthermore, Moore's length of jump was about 20 longer than that shown by the Bakhmeteff-Matzke curves. Since t jump in the latter case was formed downstream from a regulating slui lack of agreement may be caused by a difference in the velocity profile the shooting flow entering the jump.

15-7. Location of Jump. Hydraulic jump occurs in a supercritic flow when the depth changes abruptly to its sequent depth. The retically speaking, the jump will occur in a horizontal rectangular chann if the initial and sequent depths and the approaching Froude numb satisfy Eq. (3-21). This theoretical condition is generally used to loca the position of a jump. For a closer estimate of the jump position, ho

Since the drum gate acts as a weir, the discharge through the gate may be expressed as

$$Q = CLH_e^{1.5} \qquad (14\text{-}16)$$

where C is the coefficient of discharge, L is the length of the gate, and H_e is the total head. Laboratory investigations have shown that the flow over this type of gate can be completely defined by H_e, θ, C, the radius r of the gate, and the depth of approach. The depth of approach, however, has very little influence on the flow behavior when the approach depth, measured below the highest point of the gate, is equal to or greater than twice the head on the gate. This condition is well satisfied by most drum-gate installations, especially when the gate is in a raised position. Therefore, the coefficient C may be considered to be a function of H_e, θ, and r.

Bradley [27] has made a comprehensive study of the drum gate, using data obtained from 40 hydraulic models of existing drum-gate structures of various sizes and scales. The results of this study are shown by a family of curves (Fig. 14-14) where C is plotted against θ with the ratio H_e/r as a parameter. When $H_e/r = 0$, the gate becomes a straight inclined weir, and the corresponding dashed line in the family of curves is based on Bazin's data [12]. The curves extend downward to $\theta = -15°$. The discharge coefficients in the region between $\theta = -15°$ and the gate completely down can be obtained by graphical interpolation of the rating curves of the gate. The computation of the rating curve when the gate is completely down is the same as that for a spillway with an ungated crest (Art. 14-5).

14-10. Flow at the Toe of Overflow Spillways. The theoretical velocity of flow at the toe of an overflow spillway (Fig. 14-15) may be computed by

$$V_1 = \sqrt{2g(Z + H_a - y_1)} \qquad (14\text{-}19)$$

where Z is the fall, or vertical distance in ft from the upstream reservoir level to the floor at the toe; H_a is the upstream approach velocity head; and y_1 is the depth of flow at the toe. Owing to the energy loss involved in the flow over the spillway, the actual velocity is always less than the theoretical value. The magnitude of the actual velocity depends mainly on the head on the spillway crest, the fall, the slope of the spillway surface, and the spillway-surface roughness.[1] By reasoning and experiments it is shown that the deviation of the actual velocity from its theoretical value becomes larger when the head is smaller and the fall is greater.

On the basis of experience, theoretical analysis, and a limited amount of experimental information obtained from prototype tests on Shasta and Grand Coulee dams, the U.S. Bureau of Reclamation [29] has studied the

[1] See [28] for further information.

relationship between the actual velocity and a theoretical value.[1] From the results of this study, a chart (Fig. 14-15) was prepared to show the actual velocity at the toe of spillways under various heads, falls, slopes from 1 on 0.6 to 1 on 0.8, and the condition of average surface roughness. It is felt that this chart is sufficiently accurate for preliminary-design

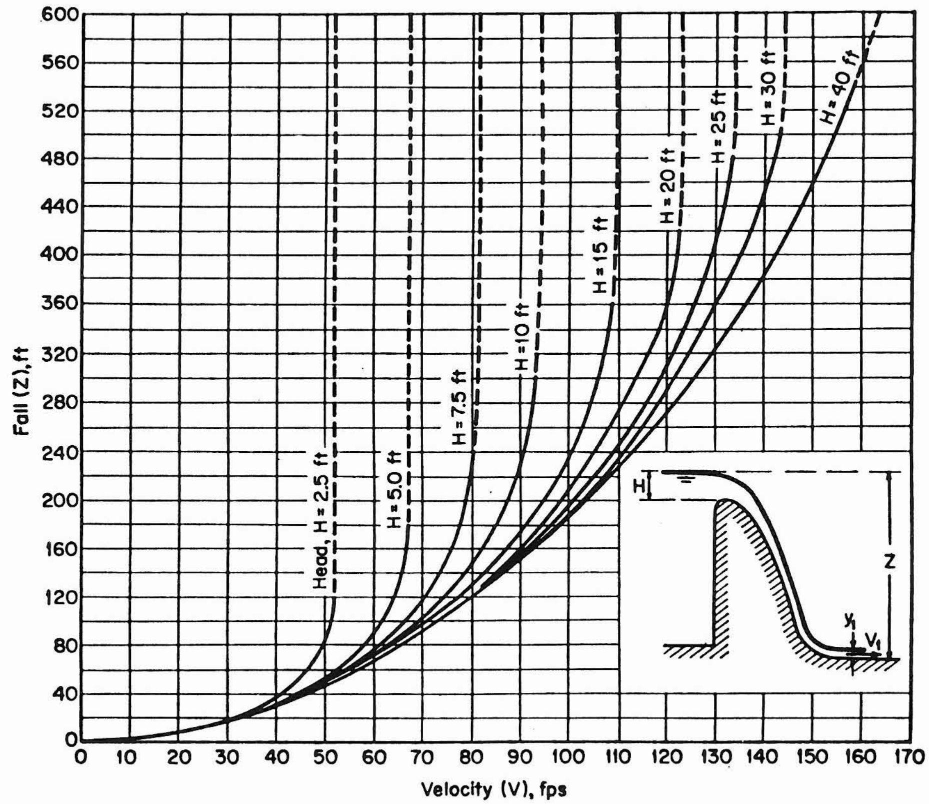


FIG. 14-15. Curves for determination of velocity at the toe of spillways with slopes 1 on 0.6 to 0.8.

purposes, although it can be refined by additional experimental information which may become available in the future.

Experiments by Bauer [30] indicate that friction losses in accelerating the flow down the face of a spillway may be considerably less than the normal friction loss in flow with well-developed turbulence. Therefore, the friction loss is not significant on steep slopes, but it would become important if the slope were small. For this reason, the chart in Fig.

[1] The theoretical velocity defined by the Bureau is $V_1 = \sqrt{2g(Z - 0.5H)}$.

HEC-2 WATER SURFACE PROFILES UPSTREAM OF OVERCHUTE TO DETENTION BASINS

AND

DOWNSTREAM OF OVERCHUTE TO PALM VALLEY GOLF COURSE

DRAFT DESIGN REPORT
JULY 1997

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1******** ******** ******** ******** ***                                        ******** *****
* HEC-2  TER SUR  E PROFILES          *                                        * U.S. AR *
*                                     *                                        * HYDR   *
* Version  4.6.2;       May-91        *                                        * 609 SE  *
*                                     *                                        * DAVIS,  *
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X   X   X      X                X
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X   X   XXXXXX XXXXX            XXXXXXX
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7-May-97 11:58 :21 PAGE 1

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******** ******** ******** ******
HEC-2 W  R SURFA  PROFILES

Version  4.6.2; Ma y 1991
******** ******** ******** ******
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T1 120 1202
T2 RID LITCHFIE D ROAD RCHUTE JECT
T3 ME AJOB 2 - UNCOR C N, RID O RCH, RE CONC C , & BAS O TLET CHAN
T4 THI S REACH G @ THE RID OVE BASINS, XTENDS T THRU C LINED
T4 BA IN OUTL CHANN; SSES RID VERCH S CT, & CO INUES S H TO
T4 PA M VALLE OLF COU . CONDI ONS ARE AL. W/ A =1492 cfs FROM THE
T4 OV RCH D/S, 319 cfs FR OM MER OINT OF CT CONC ANN (600' OF
T4 OV RCH) TO ERCHUT ND 1071 c s FROM ENTION INS TO R T CHANN.

J1 ICHEC	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
-10	2						1456	1000.35	

J2 NPRO	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
1		-1						-6	

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

*PROF 1
0

CCHV= 100 CEH 0.3
*SECNO 0

3470 ENC	CHMENT	TIONS=	57.3	84.6 T	YPE=	1 TARGE	27	290	
ELENCL=	1001.00 E	LENCR=	1						
200	7.23	1000.35	0	1000.35	1001.2	0.85	0	0	1000.12
1456	0	1456	0	0	197.1	0	0	0	1001
0	0.03	7.39	0	0.035	0.035	0	0	993.12	57.26
0.003789	0	0	0	0	0	0	0	27.29	84.55

CCHV= 100 CEH 0.3
*SECNO 0

3495 OVE	NK AREA	SUMED	EFFECTI	ELLEA=	1001.16	ELREA=	1001.16		
201	8.61	1000.77	0	0	1001.37	0.6	0.15	0.03	1001.16
1456	0	1456	0	0	235.1	0	0.2	0	1001.1
0	0	6.19	0	0	0.035	0	0	992.16	13.01
0.002312	50	50	50	2	0	0	0	27.31	40.32

SPECIAL VERT

SC CUN	CUNV	ENTLC	COFQ	RDLEN	RISE	SPAN	CULVLN	CHRT	SCL	ELCHU	ELCHD
3	0.013	0.4	2.9	53.49	7	8	45	8	1	993.62	993.12

CHART 8 BOX CUL T WITH F RED WIN LLS; NO I LET TOP GE BEVEL
SCALE 1 WINGWA FLARED TO 75 DE EES

*SECNO 0

SPECIAL VERT OU T CONTR #NAME? W EG = 2.16
SPECIAL VERT

EGIC	EGOC	H4	QWEIR	QCULV	VCH	ACULV	ELTRD	WEIRLN
1001.46	1002.52	0.79	161	1296	6.221	168	1001.13	53

3470 ENC	CHMENT	TIONS=	57.3	84.6 T	YPE=	1 TARGE	27	290	
ELENCL=	1001.13 E	LENCR=	1.13						
202	8.44	1001.56	0	0	1002.16	0.59	0.79	0	1000.12
1456	12.4	1433.3	10.3	10.8	230.4	9	0.5	0.1	1001.13
0	1.15	6.22	1.14	0.035	0.035	0.035	0	993.12	32.13
0.002241	45	45	45	2	0	0	0	74.1	106.24

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

CCHV= 500 CEH 0.7
*SECNO 0

3302 WA G: CONV ANCE CH E OUTSI OF ACCE BLE RAN KRATIO 2.14

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1004 ELREA= 1004

203	9.3	1002.3	0	0	1002.44	0.14	0.06	0.22	1004
1456	0	1456	0	0	480.1	0	1	0.2	1004
0.01	0	3.03	0	0	0.035	0	0	993	27.81
0.00049	78	64	48	2	0	0	0	79.27	107.07

*SECNO 0

3302 WA G: CONV ANCE CH E OUTSI OF ACCE BLE RAN KRATIO 0.6

3470 ENC CHMENT TIONS= 23.5 105.1 T YPE= 1 TARGE -23 450

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1002 ELREA= 1004

204	8.28	1002.28	0	0	1002.57	0.29	0.03	0.1	1002
1456	0	1456	0	0	336.5	0	1.4	0.3	1004
0.01	0	4.33	0	0	0.035	0	0	994	23.45
0.001358	51	34	14	2	0	0	0	70.76	94.21

*SECNO 0
3280 CRO SECTION 205.00 EX TENDED .46 FEE T

3470 ENC CHMENT TIONS= 73.5 135.6 T YPE= 1 TARGE -73 540

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1002 ELREA= 100000

205	7.46	1002.46	0	0	1002.92	0.46	0.23	0.12	1002
1456	0	1456	0	0	266.2	0	2.2	0.5	100000
0.02	0	5.47	0	0	0.035	0	0	995	73.54
0.002515	136	129	122	2	0	0	0	62.06	135.6

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

*SECNO 0
3280 CRO SECTION 206.00 EX TENDED .51 FEE T

206	6.51	1003.51	0	0	1004.08	0.56	1.09	0.07	1003
1456	0	1456	0	0	241.7	0	4.5	1	1003
0.04	0	6.02	0	0	0.035	0	0	997	0

0.003184	383	385	387	2	0	0	0	58.04	58.04

*SECNO 0
3280 CRO SECTION 207.00 EX TENDED .13 FEE T

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1005 ELREA= 1004

207	7.13	1004.13	0	0	1004.73	0.6	0.63	0.03	1005
1456	0	1456	0	0	233.5	0	5.5	1.2	1004
0.04	0	6.24	0	0	0.035	0	0	997	5.67
0.003815	178	180	180	2	0	0	0	61.88	67.55

*SECNO 0
3280 CRO SECTION 208.00 EX TENDED .34 FEE T

208	6.35	1004.35	0	0	1004.96	0.61	0.22	0	1004
1456	0	1456	0	0	233.2	0	5.8	1.3	1004
0.05	0	6.24	0	0	0.035	0	0	998	0
0.003493	56	61	69	0	0	0	0	57.1	57.1

*SECNO 0
3280 CRO SECTION 209.00 EX TENDED .56 FEE T

209	6.56	1004.56	0	0	1005.51	0.95	0.32	0.24	1004
1456	0	1456	0	0	186.1	0	6.2	1.4	1004
0.05	0	7.83	0	0	0.035	0	0	998	0
0.005535	58	73	90	2	0	0	0	44.55	44.55

*SECNO 0
3280 CRO SECTION 210.00 EX TENDED 1.40 FEE T

210	7.4	1005.4	0	0	1006.06	0.66	0.4	0.15	1004
1456	0	1456	0	0	223.6	0	6.6	1.5	1004
0.05	0	6.51	0	0	0.035	0	0	998	0
0.003084	99	99	98	3	0	0	0	43.81	43.81

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

*SECNO 0
3280 CRO SECTION 211.00 EX TENDED 1.03 FEE T

3470 ENC CHMENT TIONS= 14.8 59.7 T YPE= 1 TARGE 44 870
ELENCL= 1006.50 E LENCR= 6.5

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1004 ELREA= 1006.5

211	8.02	1006.02	0	0	1006.63	0.6	0.54	0.03	1004
1456	0	1456	0	0	233.7	0	7.6	1.7	1006.5
0.06	0	6.23	0	0	0.035	0	0	998	14.81
0.00261	191	191	190	2	0	0	0	44.87	59.68

*SECNO 0
3280 CRO SECTION 212.00 EX TENDED 2.04 FEE T

3470 ENC CHMENT TIONS= 26.6 69.6 T YPE= 1 TARGE 43 10
ELENCL= 1007.50 E LENCR= 7.5

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1005 ELREA= 1007.5

212	7.04	1007.04	0	0	1007.7	0.66	1.03	0.04	1005
1456	0	1456	0	0	222.6	0	9.6	2.1	1007.5
0.08	0	6.54	0	0	0.035	0	0	1000	26.59
0.002947	372	372	373	2	0	0	0	43.01	69.6

*SECNO 0
3280 CRO SECTION 213.00 EX TENDED 1.34 FEE T

3470 ENC CHMENT TIONS= 0 41.5 T YPE= 1 TARGE 41 549

213	7.34	1008.34	0	0	1009.01	0.67	1.3	0	1006
1456	0	1456	0	0	222.2	0	11.8	2.5	1009
0.1	0	6.55	0	0	0.035	0	0	1001	0
0.003062	434	434	433	2	0	0	0	41.55	41.55

*SECNO 0
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3280 CRO SECTION 214.00 EX TENDED 1.51 FEE T

3470 ENC CHMENT TIONS= 29.1 68.1 T YPE= 1 TARGE 38 980
ELENCL= 1010.50 E LENCR= 10.5

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1007 ELREA= 1010.5

214	7.51	1009.51	0	0	1010.26	0.75	1.2	0.06	1007
1456	0	1456	0	0	209.8	0	13.7	2.8	1010.5
0.11	0	6.94	0	0	0.035	0	0	1002	29.13
0.003224	381	382	382	2	0	0	0	38.98	68.11

CCHV= 100 CEH 0.3
*SECNO 0

3470 ENC CHMENT TIONS= 33.2 73.7 T YPE= 1 TARGE 40 510

ELENCL= 1011.50 E LENCR= 11.5

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1009 ELREA= 1011.5

215	6.51	1010.51	0	0	1011.63	1.12	1.26	0.11	1009
1456	0	1456	0	0	171.5	0	14.9	3.1	1011.5
0.12	0	8.49	0	0	0.035	0	0	1004	33.17
0.006394	286	286	286	2	0	0	0	40.51	73.68

*SECNO 0

3301 HV NGED M THAN HVINS

3302 WA G: CONV ANCE CH E OUTSI OF ACCE BLE RAN KRATIO 7.88

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1013 ELREA= 1013

216	7.07	1011.57	0	0	1011.76	0.18	0.03	0.09	1013
1456	0	1456	0	0	423	0	15.6	3.2	1013
0.13	0	3.44	0	0	0.014	0	0	1004.5	26
0.000103	97	95	96	2	0	0	0	60.02	86.03

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

*SECNO 0

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1013 ELREA= 1013

217	6.59	1011.59	0	0	1011.77	0.17	0.01	0	1013
1323	0	1323	0	0	395.8	0	16.2	3.3	1013
0.14	0	3.34	0	0	0.014	0	0	1005	0.02
0.000104	71	71	71	2	0	0	0	60.09	60.11

*SECNO 0
CHIMP C 32 50 CELC 1005.05 BW= 30.00 STC L= 5 .00 STCH 60 0
EXCAVA DATA
AEX= 2 9.5SQ-FT VEXR= .0K* CU-YD VEXT= .0K*CU #NAME?

3301 HV NGED M THAN HVINS

3302 WA G: CONV ANCE CH E OUTSI OF ACCE BLE RAN KRATIO 0.4

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1013.5 ELREA= 1013.5

218	6.1	1011.15	0	0	1011.96	0.81	0.01	0.19	1013.5

1323	0	1323	0	0	183.2	0	16.4	3.3	1013.5
0.14	0	7.22	0	0	0.014	0	0	1005.05	17.5
0.000653	19	31	43	2	0	0	0	30	47.5

*SECNO 0
CHIMP C 25 00 CELC 1005.11 BW= 30.00 STC L= 10 .00 STCH 40 0
EXCAVA DATA
AEX= 2 6.6SQ-FT VEXR= .4K* CU-YD VEXT= .4K*CU #NAME?

219	6.06	1011.17	0	0	1011.99	0.82	0.03	0	1014
1323	0	1323	0	0	181.8	0	16.6	3.4	1013
0.14	0	7.28	0	0	0.014	0	0	1005.11	10
0.000669	30	41	54	0	0	0	0	30	40

*SECNO 0
CHIMP C 20 00 CELC 1005.18 BW= 30.00 STC L= 5 .00 STCH 35 0
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

EXCAVA DATA
AEX= 2 4.7SQ-FT VEXR= .5K* CU-YD VEXT= .8K*CU #NAME?

220	6.02	1011.2	0	0	1012.03	0.83	0.03	0	1014
1323	0	1323	0	0	180.7	0	16.8	3.4	1013
0.14	0	7.32	0	0	0.014	0	0	1005.18	5
0.000681	49	49	50	0	0	0	0	30	35

*SECNO 0
CHIMP C 30 00 CELC 1005.3 BW= 30.00 STC L= 15 .00 STCH 45 0
EXCAVA DATA
AEX= 2 6.0SQ-FT VEXR= .7K* CU-YD VEXT= 1.5K*CU #NAME?

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1013 ELREA= 1013

221	5.94	1011.24	0	0	1012.09	0.85	0.06	0.01	1013
1323	0	1323	0	0	178.4	0	17.2	3.5	1013
0.14	0	7.42	0	0	0.014	0	0	1005.3	15
0.000707	82	82	82	1	0	0	0	30	45

*SECNO 0
CHIMP C 15 50 CELC 1005.87 BW= 30.00 STC L= .00 STCH 30.5 0
EXCAVA DATA
AEX= 2 6.2SQ-FT VEXR= 3.0K* CU-YD VEXT= 4.5K*CU #NAME?

222	5.58	1011.45	0	0	1012.42	0.97	0.29	0.03	1013
1323	0	1323	0	0	167.5	0	18.7	3.7	1012.5
0.16	0	7.9	0	0	0.014	0	0	1005.87	0.5
0.000853	375	379	383	2	0	0	0	30	30.5

*SECNO 0
CHIMP C 51 50 CELC 1006.22 BW= 20.00 STC L= 20 .00 STCH 80.3 4
EXCAVA DATA
AEX= 2 7.3SQ-FT VEXR= 1.2K* CU-YD VEXT= 5.7K*CU #NAME?

3301 HV NGED M THAN HVINS

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

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1013.18 ELREA= 1012.5

223	5.99	1012.21	0	0	1012.56	0.35	0.08	0.06	1013.18
1084	0	1084	0	0	227.5	0	19.4	3.9	1012.5
0.17	0	4.77	0	0	0.014	0	0	1006.22	23.53
0.000325	155	154	151	3	0	0	0	55.94	79.47

*SECNO 0
CHIMP C 46 08 CELC 1006.59 BW= 20.00 STC L= 16 .58 STCH 75.5 8
EXCAVA DATA
AEX= 2 0.1SQ-FT VEXR= 1.4K* CU-YD VEXT= 7.1K*CU #NAME?

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1013 ELREA= 1012.4

224	5.63	1012.22	0	0	1012.64	0.42	0.06	0.02	1013
1084	0	1084	0	0	207.7	0	20.2	4.1	1012.4
0.17	0	5.22	0	0	0.014	0	0	1006.59	19.19
0.000417	158	161	163	2	0	0	0	53.79	72.97

*SECNO 0
CHIMP C 45 50 CELC 1007.18 BW= 20.00 STC L= 16 .00 STCH 75 0
EXCAVA DATA
AEX= 2 8.0SQ-FT VEXR= 2.2K* CU-YD VEXT= 9.3K*CU #NAME?

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1013 ELREA= 1013

225	5.07	1012.25	0	0	1012.82	0.57	0.13	0.05	1013
1084	0	1084	0	0	178.4	0	21.3	4.4	1013
0.19	0	6.08	0	0	0.014	0	0	1007.18	20.3
0.000634	257	260	260	2	0	0	0	50.41	70.7

*SECNO 0
CHIMP C 51 83 CELC 1007.75 BW= 20.00 STC L= 15 .28 STCH 88.3 9
EXCAVA DATA
AEX= 1.1SQ-FT VEXR= 1.0K* CU-YD VEXT= 10.3K*CU #NAME?

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

3495 OVE NK AREA SUMED EFFECTI ELLEA= 1013.05 ELREA= 1013

226	4.54	1012.29	0	0	1013.07	0.78	0.19	0.06	1013.05
1084	0	1084	0	0	152.8	0	22.3	4.7	1013
0.2	0	7.09	0	0	0.014	0	0	1007.75	28.2
0.000973	248	246	245	2	0	0	0	47.26	75.47

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THIS RU N EXECUTED 07MAY97 11:58:22

******** ******** ******** ******
HEC-2 W R SURFA PROFILES

Version 4.6.2; Ma y 1991
******** ******** ******** ******

NOTE- A ISK (*) A LEFT OF ROSS-SE ON NUM INDICAT MESSAG SUMMAR F ERROR IST

METAJO SUNCOR ANN

SUMMAR NTOUT T E 150

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	01K
200 0	.0 0	.0 0	.0 0	993.1 2	1456.0 0	1000.3 5	.0 0	1001.2 0	37.89	6.54
201 0	50.0 0	.0 0	.0 0	992.1 6	1456.0 0	1000.7 7	.0 0	1001.3 7	23.12	2.82
202 0	45.0 0	1001.1 3	.0 0	993.1 2	1456.0 0	1001.5 6	.0 0	1002.1 6	22.41	7.57
* 203.00 0	63.9 9	.0 0	.0 0	993.0 0	1456.0 0	1002.3 0	.0 0	1002.4 4	4.90	7.89
* 204.00 0	34.1 0	.0 0	.0 0	994.0 0	1456.0 0	1002.2 8	.0 0	1002.5 7	13.58	5.13
205 0	129.1 1	.0 0	.0 0	995.0 0	1456.0 0	1002.4 6	.0 0	1002.9 2	25.15	0.32
206 0	384.8 5	.0 0	.0 0	997.0 0	1456.0 0	1003.5 1	.0 0	1004.0 8	31.84	8.02
207 0	179.7 8	.0 0	.0 0	997.0 0	1456.0 0	1004.1 3	.0 0	1004.7 3	38.15	5.72
208 0	61.0 7	.0 0	.0 0	998.0 0	1456.0 0	1004.3 5	.0 0	1004.9 6	34.93	6.37

	209	0	72.8	4	.0	0	.0	0	998.0	0	1456.0	0	1004.5	6	.0	0	1005.5 1	55.35 5.71
	210	0	98.8	8	.0	0	.0	0	998.0	0	1456.0	0	1005.4	0	.0	0	1006.0 6	30.84 2.2
	211	0	190.5	1	.0	0	.0	0	998.0	0	1456.0	0	1006.0	2	.0	0	1006.6 3	26.10 5.02
	212	0	372.2	5	.0	0	.0	0	1000.0	0	1456.0	0	1007.0	4	.0	0	1007.7 0	29.47 8.2
	213	0	433.8	3	.0	0	.0	0	1001.0	0	1456.0	0	1008.3	4	.0	0	1009.0 1	30.62 3.14
	214	0	381.8	3	.0	0	.0	0	1002.0	0	1456.0	0	1009.5	1	.0	0	1010.2 6	32.24 6.44
	215	0	285.6	1	.0	0	.0	0	1004.0	0	1456.0	0	1010.5	1	.0	0	1011.6 3	63.94 2.08
*	216.00	0	95.1	6	.0	0	.0	0	1004.5	0	1456.0	0	1011.5	7	.0	0	1011.7 6	1.03 3.99

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SECNO XLCH ELTRD ELLC ELMIN Q CWSEL CRIWS EG 10*KS 01K

	217	0	71.3	1	.0	0	.0	0	1005.0	0	1323.0	0	1011.5	9	.0	0	1011.7 7	1.04 4.69
*	218.00	0	31.0	2	.0	0	.0	0	1005.0	5	1323.0	0	1011.1	5	.0	0	1011.9 6	6.53 7.53
	219	0	41.4	6	.0	0	.0	0	1005.1	1	1323.0	0	1011.1	7	.0	0	1011.9 9	6.69 1.48
	220	0	49.4	2	.0	0	.0	0	1005.1	8	1323.0	0	1011.2	0	.0	0	1012.0 3	6.81 7.13
	221	0	81.9	1	.0	0	.0	0	1005.3	0	1323.0	0	1011.2	4	.0	0	1012.0 9	7.07 7.6
	222	0	379.0	6	.0	0	.0	0	1005.8	7	1323.0	0	1011.4	5	.0	0	1012.4 2	8.53 3.11
	223	0	153.5	2	.0	0	.0	0	1006.2	2	1084.0	0	1012.2	1	.0	0	1012.5 6	3.25 1.2
	224	0	161.4	1	.0	0	.0	0	1006.5	9	1084.0	0	1012.2	2	.0	0	1012.6 4	4.17 0.89
	225	0	260.2	1	.0	0	.0	0	1007.1	8	1084.0	0	1012.2	5	.0	0	1012.8 2	6.34 0.52
	226	0	246.1	7	.0	0	.0	0	1007.7	5	1084.0	0	1012.2	9	.0	0	1013.0 7	9.73 7.52

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METAJO SUNCOR ANN

SUMMAR NTOUT T E 150

SECNO Q CWSEL DIFWSP DIFWSX DIFKWS TOPWID XLCH

	200	0	1456.0	0	1000.3	5	.0	0	.0	0	.0	0	27.2	9	.0	0
	201	0	1456.0	0	1000.7	7	.0	0	.4	2	.0	0	27.3	1	50.0	0
	202	0	1456.0	0	1001.5	6	.0	0	.7	9	.0	0	74.1	0	45.0	0
*	203.00	0	1456.0	0	1002.3	0	.0	0	.7	3	.0	0	79.2	7	63.9	9

*	204.00	0	1456.0	0	1002.2	8	.0	0	-.0	2	.0	0	70.7	6	34.1	0
	205	0	1456.0	0	1002.4	6	.0	0	.1	8	.0	0	62.0	6	129.1	1
	206	0	1456.0	0	1003.5	1	.0	0	1.0	6	.0	0	58.0	4	384.8	5
	207	0	1456.0	0	1004.1	3	.0	0	.6	1	.0	0	61.8	8	179.7	8
	208	0	1456.0	0	1004.3	5	.0	0	.2	2	.0	0	57.1	0	61.0	7
	209	0	1456.0	0	1004.5	6	.0	0	.2	1	.0	0	44.5	5	72.8	4
	210	0	1456.0	0	1005.4	0	.0	0	.8	4	.0	0	43.8	1	98.8	8
	211	0	1456.0	0	1006.0	2	.0	0	.6	2	.0	0	44.8	7	190.5	1
	212	0	1456.0	0	1007.0	4	.0	0	1.0	1	.0	0	43.0	1	372.2	5
	213	0	1456.0	0	1008.3	4	.0	0	1.3	0	.0	0	41.5	5	433.8	3
	214	0	1456.0	0	1009.5	1	.0	0	1.1	8	.0	0	38.9	8	381.8	3
	215	0	1456.0	0	1010.5	1	.0	0	1.0	0	.0	0	40.5	1	285.6	1
*	216.00	0	1456.0	0	1011.5	7	.0	0	1.0	6	.0	0	60.0	2	95.1	6
	217	0	1323.0	0	1011.5	9	.0	0	.0	2	.0	0	60.0	9	71.3	1
*	218.00	0	1323.0	0	1011.1	5	.0	0	-.4	4	.0	0	30.0	0	31.0	2
	219	0	1323.0	0	1011.1	7	.0	0	.0	2	.0	0	30.0	0	41.4	6
	220	0	1323.0	0	1011.2	0	.0	0	.0	3	.0	0	30.0	0	49.4	2
	221	0	1323.0	0	1011.2	4	.0	0	.0	4	.0	0	30.0	0	81.9	1
	222	0	1323.0	0	1011.4	5	.0	0	.2	1	.0	0	30.0	0	379.0	6
	223	0	1084.0	0	1012.2	1	.0	0	.7	6	.0	0	55.9	4	153.5	2

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SECNO	Q		CWSEL	DIFWSP		DIFWSX		DIFKWS		TOPWID		XLCH		
224 0	1084.0	0	1012.2	2	.0	0	.0	1	.0	0	53.7	9	161.4	1
225 0	1084.0	0	1012.2	5	.0	0	.0	3	.0	0	50.4	1	260.2	1
226 0	1084.0	0	1012.2	9	.0	0	.0	5	.0	0	47.2	6	246.1	7

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SUMMAR ERRORS D SPECIA NOTES

WARNIN NO= 20 .000 PRO ILE= 1 C ONVEYA CHANGE SIDE AC TABLE R E

WARNIN NO= 20 .000 PRO ILE= 1 C ONVEYA CHANGE SIDE AC TABLE R E

WARNIN NO= 21 .000 PRO ILE= 1 C ONVEYA CHANGE SIDE AC TABLE R E

WARNIN NO= 21 .000 PRO ILE= 1 C ONVEYA CHANGE SIDE AC TABLE R E

HEC-2 WATER SURFACE PROFILES FOR PLAZA CIRCLE CHANNEL

DRAFT DESIGN REPORT
JULY 1997

```
1*********************************************
 ***************************************
 *  HEC-2 WATER SURFACE PROFILES            *
  *
 *                                          *
  *
 *  Version   4.6.2;  May 1991              *
  *
 *                                          *
  *
 *  RUN DATE    04JUN97    TIME   16:00:34  *
  *
 *********************************************
***************************************
```

```
*  U.S. ARMY CORPS OF ENGINEERS
*  HYDROLOGIC ENGINEERING CENTER
*  609 SECOND STREET, SUITE D
*  DAVIS, CALIFORNIA 95616-4687
*          (916) 756-1104
```

```
X      X  XXXXXXX   XXXXX            XXXXX
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
```



```
                                              THIS RUN EXECUTED 04JUN97    16:00:34

 ************************************
  HEC-2 WATER SURFACE PROFILES

  Version   4.6.2;  May 1991
 ************************************


 T1       1202101
 T2       RID OVERCHUTE PROJECT
 T3       METAJOB NO. 4 - PLAZA CIRCLE CHANNEL FROM CP-255
 T4       THIS UNLINED EXCAVATED CHANNEL EXTENDS FROM CP-255 WEST ALONG INDIAN
 T4       SCHOOL ROAD BYPASS, AROUND PLAZA CIRCLE TO INLET OF THE DETENTION BASINS

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q        WSEL      FQ

        0         2                                                      1071   1012.34

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW      CHNIM     ITRACE

       -1                  -1                                              -6


 J3  VARIABLE CODES FOR SUMMARY PRINTOUT

      120        150

 NC   0.035      0.035     0.035       0.1       0.3
 QT       1       1120
 X1     444          9        68       167     90.97     86.86     87.66
 CI     118    1009.26                   4         4       -42       .01
 GR  1016.3          0   1016.41        68   1016.45     89.47   1016.46     95.28    1016.3    132.23
 GR  1016.2        167   1016.09    175.97   1016.05    200.44   1016.02    224.18

 X1     445          9        80       177     98.55     94.59     97.11
 CI     130    1009.41                   4         4       -42       .01
 X3      10
 GR  1016.5          0   1016.61        80   1016.62     94.47    1016.5     101.5   1016.21    142.72
 GR    1016        177   1015.83    188.11   1016.22    211.52   1016.35    235.66

 X1     446         10     67.23    150.03    101.64    101.64    102.02
 CI      -1    1009.56                   4         4       -42       .01
 GR  1016.8          0   1017.02     67.23   1017.06     87.04   1017.08     96.71   1016.86    130.15
 GR  1016.7     150.03   1016.58    174.26   1016.52    197.89   1016.21    221.66   1016.76    232.47

 X1     447         12     65.76    147.76     89.74     74.56     80.23
 CI      -1    1009.68                   4         4       -42       .01
 GR  1017.1          0   1017.28     65.76   1017.31     82.07   1017.29      86.1   1017.03     127.6
 GR  1016.9     147.76   1016.78       168   1016.34    168.57   1016.69     193.2   1016.41    215.14
 GR  1016.4     215.42   1016.96    215.94
```



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 X1     448          8     76.88    159.46     98.03     98.38     98.77
 CI      -1    1009.83                   4         4       -42       .01
 GR  1017.3          0   1017.58     76.88   1017.63     91.02   1017.64     96.91   1017.68    139.77
 GR  1017.7     159.46   1017.73    189.37   1017.77    276.06
```

X1	449	8	103.91	191.36	106.69	105.73	107.06			
CI	-1	1009.99		4	4	-42	.01			
GR	1017.6	0	1017.93	61.86	1018	103.91	1018.03	124.19	1018.07	161.44
GR	1018	171.35	1018.07	191.36	1018.07	254.59				
X1	450	8	115.77	200.37	105.4	106.8	105			
CI	-1	1010.15		4	4	-42	.01			
GR	1018.2	0	1018.57	85.08	1018.53	115.77	1018.49	136.24	1018.44	179.45
GR	1018.4	183.85	1018.4	200.37	1018.4	246				
X1	451	8	142.5	226.14	96.3	96.62	96			
CI	-1	1010.29		4	4	-42	.01			
GR	1017.6	0	1018.49	77.59	1018.77	142.5	1018.85	162.8	1018.9	175.67
GR	1019	205.8	1019.14	226.14	1019.29	264.11				
X1	452	10	116.06	198.38	84.9	74.14	80.18			
CI	-1	1010.41		4	4	-42	.01			
GR	1018	0	1019.31	65.77	1019.34	116.06	1019.35	136.46	1019.36	158.91
GR	1019.3	178.46	1019.3	198.38	1019.52	234.3	1019.67	254.01	1019.87	281.71
X1	453	10	145	227	83.76	122.98	103.98			
CI	-1	1010.57		4	4	-42	.01			
GR	1017.7	0	1019.12	114.82	1019.43	145	1019.45	165	1019.64	205.14
GR	1019.6	207	1019.1	227	1019.08	229.87	1019	240.29	1019.97	302.79
QT	1	1141								
X1	454	11	112.58	194.8	89.25	104.87	96.71			
CI	-1	1010.71		4	4	-42	.01			
GR	1019.2	0	1019.34	101.77	1019.41	112.58	1019.55	132.73	1019.71	157.11
GR	1018.3	174.72	1017.93	181.7	1017.98	194.8	1017.99	206.99	1018	209.62
GR	1018.2	270.61								
X1	455	11	173.65	255.61	103.62	113.18	107.98			
CI	-1	1010.87		4	4	-42	.01			
GR	1017.8	0	1018.29	103.54	1018.28	173.65	1018.27	194.08	1018.26	202.37
GR	1018.3	236.03	1018.29	240.05	1018.97	255.61	1019.51	267.78	1020	274.13
GR	1020.4	329.3								
X1	456	17	183.7	265.54	105.45	107.35	106.08			
CI	-1	1011.03		4	4	-42	.01			
GR	1017.9	0	1018.35	97.02	1018.5	183.7	1018.7	187.49	1018.7	187.49
GR	1018.4	187.49	1018	203.71	1017.69	245.75	1017.68	247.81	1017.67	247.81
GR	1017.6	247.81	1017.68	247.81	1017.68	247.81	1018.19	265.54	1018.39	276.08
GR	1020	363.28	1020.63	375.36						

X1	457	12	153.85	235.85	102.24	101.32	102.31			
CI	-1	1011.19		4	4	-42	.01			
GR	1018	0	1018.28	74.59	1018.47	153.85	1018.62	170.82	1018.8	173.85
GR	1018.8	215.85	1018.81	218.73	1018.8	235.85	1019.34	242.84	1020	296.51
GR	1019.7	298.61	1020.86	310.44						
QT	1	1160								
X1	458	12	158.32	240.32	103.9	103.37	103.9			
CI	-1	1011.34		4	4	-42	.01			
GR	1018.2	0	1018.44	97.24	1018.71	158.32	1018.79	176.67	1018.74	178.32
GR	1018	220.32	1017.89	222.85	1018.65	240.32	1019.56	248.7	1020	301.34
GR	1020	313.51	1020.91	316.54						
X1	459	14	114.35	196.35	114.01	107.54	110.77			
CI	-1	1011.51		4	4	-42	.01			
GR	1018.4	0	1018.78	77.72	1018.8	114.35	1018.81	134.35	1018.88	150.88
GR	1019	155.07	1017.96	165.05	1018.11	176.35	1018.17	180.52	1019.08	196.35
GR	1019.5	204.85	1020	258.97	1019.91	269.68	1020.6	276.77		
X1	460	14	131.13	213.13	94.98	95.76	94.02			
CI	-1	1011.65		4	4	-42	.01			
GR	1018.5	0	1018.91	96.52	1019.12	131.13	1019.22	151.13	1019.36	166.01
GR	1017.4	184.74	1017.48	193.13	1017.51	195.39	1018.84	212.24	1018.84	213.13
GR	1019.7	288.5	1020	295.43	1020.17	300.12	1020	300.2		
X1	461	12	188.21	270.21	84.97	94.29	90.78			
CI	-1	1011.77		4	4	-42	.01			
GR	1018.8	0	1018.82	64.35	1018.9	147.98	1018.82	188.21	1018.8	208.21
GR	1018.8	227.55	1017.15	245.47	1017.07	250.21	1016.93	258.28	1017.28	270.21
GR	1017.6	281.75	1019.96	364.79						
X1	462	10	63.36	145.36	128.25	124.25	124.75			
CI	-1	1011.97		4	4	-42	.01			
GR	1019.1	0	1019.25	63.36	1019.4	83.36	1019.53	105.23	1017.1	125.36
GR	1017	126.83	1017.02	139.04	1017.1	145.36	1019.59	159.84	1020.26	246.95
X1	463	14	117.03	199.03	61.62	65.37	63.34			
CI	-1	1012.07		4	4	-42	.01			
GR	1021.8	0	1019.82	94.56	1018.7	100.42	1018.81	117.03	1018.87	122.62
GR	1018.9	137.03	1018.96	146.99	1019.39	162.12	1017.25	179.03	1017.16	182.55
GR	1017.4	191.82	1017.4	199.03	1019.33	207.54	1020.31	303.85		
X1	464	16	125	207.57	105.99	116.52	110.7			

```
CI      -1     1012.23                     4           4         -42         .01
GR   1019.4          0    1019.26     105.79      1018.8       107.1        1019        125      1019.1     132.31
GR   1018.9     144.69    1018.76      153.6     1019.26      154.18     1019.27      166.5      1017.3     183.48
GR   1017.3     187.34    1017.33     200.59     1018.11      207.57     1019.08     216.31     1020.67     264.22
GR   1020.6     311.09
```



```
QT       1         400
X1     465          10     121.81     184.03      103.85      105.91      104.13
CI     155     1012.39                     4           4         -12         .01
GR  1019.4           0    1018.96      97.21     1019.29      121.81     1019.44     142.03     1019.44      144.6
GR  1019.3      154.86       1018     168.62     1018.12      184.03     1020.53     275.38      1020.9     304.38

X1     466          15     139.16     201.65       97.87      101.59       98.32
CI     172     1012.54                     4           4          -1         .01
GR  1018.5           0    1019.56     102.56     1019.51      127.49      1019.3     139.16      1019.1     150.19
GR  1019.7      159.65    1018.22     170.11     1018.28      201.65     1018.31     215.21     1018.99     221.65
GR  1020.2       232.3    1020.39     273.96        1021      285.69        1021      316.2     1021.18     316.24
```



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


*PROF 1
0

CCHV=      .100 CEHV=      .300
*SECNO 444.000
CHIMP CLSTA=      118.00 CELCH=     1009.26 BW=      42.00 STCHL=      68.00 STCHR=     167.00
EXCAVATION DATA
AEX=     498.8SQ-FT      VEXR=         .0K*CU-YD      VEXT=        .0K*CU-YD

  444.000      3.08   1012.34        .00   1012.34   1013.04       .70        .00        .00   1016.41
   1120.0        .0    1120.0         .0        .0     167.3        .0         .0         .0   1016.20
      .00       .00      6.69        .00      .000      .035      .000       .000    1009.26      84.68
  .007396       91.       88.        87.         0         0         0        .00      66.64     151.32


*SECNO 445.000
CHIMP CLSTA=      130.00 CELCH=     1009.41 BW=      42.00 STCHL=      80.00 STCHR=     177.34
EXCAVATION DATA
AEX=     480.7SQ-FT      VEXR=        1.8K*CU-YD      VEXT=       1.8K*CU-YD

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.40


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1016.61 ELREA=      1015.99

  445.000      3.71   1013.12        .00       .00   1013.56       .44        .50        .03   1016.61
   1120.0        .0    1120.0         .0        .0     211.1        .0         .4         .2   1015.99
      .01       .00      5.31        .00      .000      .035      .000       .000    1009.41      94.15
  .003765       99.       97.        95.         2         0         0        .00      71.70     165.85


*SECNO 446.000
CHIMP CLSTA=      108.63 CELCH=     1009.56 BW=      42.00 STCHL=      57.91 STCHR=     158.03
EXCAVATION DATA
AEX=     527.2SQ-FT      VEXR=        1.9K*CU-YD      VEXT=       3.7K*CU-YD

  446.000      3.98   1013.54        .00       .00   1013.90       .37        .34        .01   1016.99
   1120.0        .0    1120.0         .0        .0     230.4        .0         .9         .3   1016.66
      .01       .00      4.86        .00      .000      .035      .000       .000    1009.56      71.72
  .002926      102.      102.       102.         2         0         0        .00      73.82     145.54
```



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


*SECNO 447.000
CHIMP CLSTA=      106.76 CELCH=     1009.68 BW=      42.00 STCHL=      55.47 STCHR=     156.43
EXCAVATION DATA
AEX=     535.2SQ-FT      VEXR=        1.6K*CU-YD      VEXT=       5.2K*CU-YD

  447.000      4.11   1013.79        .00       .00   1014.13       .34        .22        .00   1017.25
```

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   1120.0        .0    1120.0        .0        .0     241.0        .0       1.4        .5   1016.85
      .02       .00      4.65       .00      .000      .035      .000      .000   1009.68     69.27
  .002569       90.       80.       75.         1         0         0       .00     74.97    144.25


*SECNO 448.000
CHIMP CLSTA=     118.17 CELCH=    1009.83 BW=      42.00 STCHL=      66.32 STCHR=     170.69
EXCAVATION DATA
AEX=     573.2SQ-FT     VEXR=       2.0K*CU-YD     VEXT=        7.3K*CU-YD

  448.000      4.23   1014.06       .00       .00   1014.37       .31       .24       .00   1017.54
   1120.0        .0    1120.0        .0        .0     249.4        .0       1.9        .6   1017.71
      .02       .00      4.49       .00      .000      .035      .000      .000   1009.83     80.24
  .002330       98.       99.       98.         0         0         0       .00     75.86    156.10


*SECNO 449.000
CHIMP CLSTA=     147.64 CELCH=    1009.99 BW=      42.00 STCHL=      94.66 STCHR=     200.96
EXCAVATION DATA
AEX=     596.9SQ-FT     VEXR=       2.3K*CU-YD     VEXT=        9.6K*CU-YD

  449.000      4.33   1014.32       .00       .00   1014.61       .30       .24       .00   1017.98
   1120.0        .0    1120.0        .0        .0     256.7        .0       2.6        .8   1018.07
      .03       .00      4.36       .00      .000      .035      .000      .000   1009.99    109.32
  .002145      107.      107.      106.         0         0         0       .00     76.63    185.95


*SECNO 450.000
CHIMP CLSTA=     158.07 CELCH=    1010.15 BW=      42.00 STCHL=     103.49 STCHR=     212.07
EXCAVATION DATA
AEX=     625.6SQ-FT     VEXR=       2.4K*CU-YD     VEXT=       12.0K*CU-YD

  450.000      4.40   1014.55       .00       .00   1014.83       .28       .22       .00   1018.55
   1120.0        .0    1120.0        .0        .0     262.5        .0       3.2       1.0   1018.40
      .04       .00      4.27       .00      .000      .035      .000      .000   1010.15    119.46
  .002014      105.      105.      107.         0         0         0       .00     77.22    196.68
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   SECNO      DEPTH     CWSEL     CRIWS     WSELK      EG        HV        HL        OLOSS     L-BANK ELEV
   Q          QLOB      QCH       QROB      ALOB       ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME       VLOB      VCH       VROB      XNL        XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE      XLOBL     XLCH      XLOBR     ITRIAL     IDC       ICONT     CORAR     TOPWID    ENDST


*SECNO 451.000
CHIMP CLSTA=     184.32 CELCH=    1010.29 BW=      42.00 STCHL=     129.62 STCHR=     240.95
EXCAVATION DATA
AEX=     662.7SQ-FT     VEXR=       2.3K*CU-YD     VEXT=       14.3K*CU-YD

  451.000      4.46   1014.75       .00       .00   1015.02       .27       .19       .00   1018.71
   1120.0        .0    1120.0        .0        .0     266.8        .0       3.8       1.2   1019.20
      .04       .00      4.20       .00      .000      .035      .000      .000   1010.29    145.49
  .001922       96.       96.       97.         0         0         0       .00     77.67    223.15


*SECNO 452.000
CHIMP CLSTA=     157.22 CELCH=    1010.41 BW=      42.00 STCHL=     100.54 STCHR=     214.17
EXCAVATION DATA
AEX=     693.5SQ-FT     VEXR=       2.0K*CU-YD     VEXT=       16.3K*CU-YD

  452.000      4.50   1014.91       .00       .00   1015.17       .27       .15       .00   1019.33
   1120.0        .0    1120.0        .0        .0     269.6        .0       4.3       1.3   1019.40
      .05       .00      4.15       .00      .000      .035      .000      .000   1010.41    118.24
  .001866       85.       80.       74.         0         0         0       .00     77.95    196.20


*SECNO 453.000
CHIMP CLSTA=     186.00 CELCH=    1010.57 BW=      42.00 STCHL=     130.17 STCHR=     240.75
EXCAVATION DATA
AEX=     682.9SQ-FT     VEXR=       2.7K*CU-YD     VEXT=       18.9K*CU-YD

  453.000      4.53   1015.10       .00       .00   1015.37       .26       .19       .00   1019.28
   1120.0        .0    1120.0        .0        .0     272.5        .0       4.9       1.5   1019.01
      .05       .00      4.11       .00      .000      .035      .000      .000   1010.57    146.87
  .001810       84.      104.      123.         0         0         0       .00     78.25    225.13


*SECNO 454.000
CHIMP CLSTA=     153.69 CELCH=    1010.71 BW=      42.00 STCHL=      98.19 STCHR=     203.80
EXCAVATION DATA
AEX=     622.2SQ-FT     VEXR=       2.3K*CU-YD     VEXT=       21.3K*CU-YD

  454.000      4.57   1015.28       .00       .00   1015.54       .27       .18       .00   1019.34
   1141.0        .0    1141.0        .0        .0     275.5        .0       5.5       1.7   1017.99
      .06       .00      4.14       .00      .000      .035      .000      .000   1010.71    114.41
  .001819       89.       97.      105.         0         0         0       .00     78.57    192.97
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     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST


*SECNO 455.000
CHIMP CLSTA=     214.63 CELCH=     1010.87 BW=       42.00 STCHL=      163.98 STCHR=      271.27
EXCAVATION DATA
AEX=       548.1SQ-FT       VEXR=        2.3K*CU-YD       VEXT=       23.6K*CU-YD

   455.000       4.60    1015.47        .00        .00    1015.74        .26        .19        .00    1018.28
    1141.0         .0     1141.0         .0         .0      278.0         .0        6.2        1.9    1019.78
       .07        .00       4.10        .00       .000       .035       .000       .000    1010.87     175.22
   .001774       104.       108.       113.          0          0          0        .00      78.82     254.04


*SECNO 456.000
CHIMP CLSTA=     224.62 CELCH=     1011.03 BW=       42.00 STCHL=      173.81 STCHR=      274.98
EXCAVATION DATA
AEX=       491.0SQ-FT       VEXR=        2.0K*CU-YD       VEXT=       25.6K*CU-YD

   456.000       4.64    1015.67        .00        .00    1015.92        .26        .19        .00    1018.48
    1141.0         .0     1141.0         .0         .0      280.6         .0        6.9        2.1    1018.37
       .08        .00       4.07        .00       .000       .035       .000       .000    1011.03     185.08
   .001727       105.       106.       107.          0          0          0        .00      79.08     264.16


*SECNO 457.000
CHIMP CLSTA=     194.85 CELCH=     1011.19 BW=       42.00 STCHL=      144.82 STCHR=      248.74
EXCAVATION DATA
AEX=       548.0SQ-FT       VEXR=        2.0K*CU-YD       VEXT=       27.6K*CU-YD

   457.000       4.65    1015.84        .00        .00    1016.10        .25        .18        .00    1018.45
    1141.0         .0     1141.0         .0         .0      282.1         .0        7.5        2.3    1019.41
       .08        .00       4.04        .00       .000       .035       .000       .000    1011.19     155.23
   .001701       102.       102.       101.          0          0          0        .00      79.23     234.47


*SECNO 458.000
CHIMP CLSTA=     199.32 CELCH=     1011.34 BW=       42.00 STCHL=      149.00 STCHR=      253.36
EXCAVATION DATA
AEX=       509.3SQ-FT       VEXR=        2.0K*CU-YD       VEXT=       29.6K*CU-YD

   458.000       4.68    1016.02        .00        .00    1016.28        .26        .18        .00    1018.67
    1160.0         .0     1160.0         .0         .0      284.3         .0        8.2        2.4    1019.60
       .09        .00       4.08        .00       .000       .035       .000       .000    1011.34     159.59
   .001720       104.       104.       103.          0          0          0        .00      79.45     239.05
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     SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

*SECNO 459.000
CHIMP CLSTA=     155.35 CELCH=     1011.51 BW=       42.00 STCHL=      105.21 STCHR=      208.44
EXCAVATION DATA
AEX=       508.5SQ-FT       VEXR=        2.1K*CU-YD       VEXT=       31.7K*CU-YD

   459.000       4.70    1016.21        .00        .00    1016.47        .26        .19        .00    1018.79
    1160.0         .0     1160.0         .0         .0      285.6         .0        8.9        2.6    1019.53
       .10        .00       4.06        .00       .000       .035       .000       .000    1011.51     115.56
   .001698       114.       111.       108.          0          0          0        .00      79.58     195.14


*SECNO 460.000
CHIMP CLSTA=     172.13 CELCH=     1011.65 BW=       42.00 STCHL=      121.48 STCHR=      222.31
EXCAVATION DATA
AEX=       490.2SQ-FT       VEXR=        1.7K*CU-YD       VEXT=       33.5K*CU-YD

   460.000       4.72    1016.37        .00        .00    1016.63        .25        .16        .00    1019.06
    1160.0         .0     1160.0         .0         .0      287.6         .0        9.6        2.8    1018.94
       .10        .00       4.03        .00       .000       .035       .000       .000    1011.65     132.24
   .001665        95.        94.        96.          0          0          0        .00      79.78     212.02


*SECNO 461.000
CHIMP CLSTA=     229.21 CELCH=     1011.77 BW=       42.00 STCHL=      179.94 STCHR=      272.50
EXCAVATION DATA
AEX=       428.2SQ-FT       VEXR=        1.5K*CU-YD       VEXT=       35.0K*CU-YD

   461.000       4.76    1016.53        .00        .00    1016.77        .25        .15        .00    1018.84
    1160.0         .0     1160.0         .0         .0      290.0         .0       10.2        3.0    1017.34
       .11        .00       4.00        .00       .000       .035       .000       .000    1011.77     189.20
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   .001625       85.        91.        94.          0          0          0        .00      80.03    269.22


 *SECNO 462.000
 CHIMP CLSTA=     104.36 CELCH=    1011.97 BW=      42.00 STCHL=      54.33 STCHR=     147.03
 EXCAVATION DATA
 AEX=     450.3SQ-FT     VEXR=       2.0K*CU-YD     VEXT=       37.0K*CU-YD

   462.000       4.76   1016.73        .00        .00   1016.98        .25        .20        .00   1019.23
    1160.0         .0    1160.0         .0         .0     290.8         .0       11.0        3.2   1017.39
       .12        .00      3.99        .00       .000       .035       .000       .000    1011.97     64.31
   .001613       128.       125.       124.          0          0          0        .00      80.11    144.41
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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST


 *SECNO 463.000
 CHIMP CLSTA=     158.03 CELCH=    1012.07 BW=      42.00 STCHL=     110.25 STCHR=     208.09
 EXCAVATION DATA
 AEX=     430.3SQ-FT     VEXR=       1.0K*CU-YD     VEXT=       38.1K*CU-YD

   463.000       4.76   1016.83        .00        .00   1017.08        .25        .10        .00   1018.77
    1160.0         .0    1160.0         .0         .0     290.8         .0       11.4        3.3   1019.34
       .12        .00      3.99        .00       .000       .035       .000       .000    1012.07    117.98
   .001614        62.        63.        65.          0          0          0        .00      80.10    198.08


 *SECNO 464.000
 CHIMP CLSTA=     166.29 CELCH=    1012.23 BW=      42.00 STCHL=     118.50 STCHR=     213.39
 EXCAVATION DATA
 AEX=     416.2SQ-FT     VEXR=       1.7K*CU-YD     VEXT=       39.8K*CU-YD

   464.000       4.78   1017.01        .00        .00   1017.26        .24        .18        .00   1018.93
    1160.0         .0    1160.0         .0         .0     292.2         .0       12.2        3.5   1018.76
       .13        .00      3.97        .00       .000       .035       .000       .000    1012.23    126.16
   .001590       106.       111.       117.          0          0          0        .00      80.25    206.41


 *SECNO 465.000
 CHIMP CLSTA=     155.00 CELCH=    1012.39 BW=      12.00 STCHL=     121.42 STCHR=     184.03
 EXCAVATION DATA
 AEX=     245.6SQ-FT     VEXR=       1.3K*CU-YD     VEXT=       41.1K*CU-YD


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .47

   465.000       4.92   1017.31        .00        .00   1017.41        .10        .14        .01   1019.28
     400.0         .0     400.0         .0         .0     155.7         .0       12.7        3.7   1018.12
       .14        .00      2.57        .00       .000       .035       .000       .000    1012.39    129.33
   .000860       104.       104.       106.          2          0          0        .00      51.34    180.67


 *SECNO 466.000
 CHIMP CLSTA=     172.00 CELCH=    1012.54 BW=       1.00 STCHL=     139.16 STCHR=     201.65
 EXCAVATION DATA
 AEX=     157.2SQ-FT     VEXR=        .7K*CU-YD     VEXT=       41.8K*CU-YD
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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .54

   466.000       4.80   1017.34        .00        .00   1017.60        .26        .14        .05   1019.30
     400.0         .0     400.0         .0         .0      96.8         .0       13.0        3.8   1018.28
       .15        .00      4.13        .00       .000       .035       .000       .000    1012.54    152.31
   .002966        98.        98.       102.          2          0          0        .00      39.37    191.69
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                                                                       THIS RUN EXECUTED 04JUN97    16:00:34
 *************************************
  HEC-2 WATER SURFACE PROFILES
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Version 4.6.2; May 1991
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

METAJOB NO. 4 - PLAZA CI

SUMMARY PRINTOUT TABLE 120

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	444.000	1012.34	1013.04	6.69	73.96	3.08	66.64	118.00	42.00	68.00	1016.41	167.00	1016.20
*	445.000	1013.12	1013.56	5.31	37.65	3.71	71.70	130.00	42.00	80.00	1016.61	177.34	1015.99
	446.000	1013.54	1013.90	4.86	29.26	3.98	73.82	108.63	42.00	57.91	1016.99	158.03	1016.66
	447.000	1013.79	1014.13	4.65	25.69	4.11	74.97	106.76	42.00	55.47	1017.25	156.43	1016.85
	448.000	1014.06	1014.37	4.49	23.30	4.23	75.86	118.17	42.00	66.32	1017.54	170.69	1017.71
	449.000	1014.32	1014.61	4.36	21.45	4.33	76.63	147.64	42.00	94.66	1017.98	200.96	1018.07
	450.000	1014.55	1014.83	4.27	20.14	4.40	77.22	158.07	42.00	103.49	1018.55	212.07	1018.40
	451.000	1014.75	1015.02	4.20	19.22	4.46	77.67	184.32	42.00	129.62	1018.71	240.95	1019.20
	452.000	1014.91	1015.17	4.15	18.66	4.50	77.95	157.22	42.00	100.54	1019.33	214.17	1019.40
	453.000	1015.10	1015.37	4.11	18.10	4.53	78.25	186.00	42.00	130.17	1019.28	240.75	1019.01
	454.000	1015.28	1015.54	4.14	18.19	4.57	78.57	153.69	42.00	98.19	1019.34	203.80	1017.99
	455.000	1015.47	1015.74	4.10	17.74	4.60	78.82	214.63	42.00	163.98	1018.28	271.27	1019.78
	456.000	1015.67	1015.92	4.07	17.27	4.64	79.08	224.62	42.00	173.81	1018.48	274.98	1018.37
	457.000	1015.84	1016.10	4.04	17.01	4.65	79.23	194.85	42.00	144.82	1018.45	248.74	1019.41
	458.000	1016.02	1016.28	4.08	17.20	4.68	79.45	199.32	42.00	149.00	1018.67	253.36	1019.60
	459.000	1016.21	1016.47	4.06	16.98	4.70	79.58	155.35	42.00	105.21	1018.79	208.44	1019.53
	460.000	1016.37	1016.63	4.03	16.65	4.72	79.78	172.13	42.00	121.48	1019.06	222.31	1018.94

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	461.000	1016.53	1016.77	4.00	16.25	4.76	80.03	229.21	42.00	179.94	1018.84	272.50	1017.34
	462.000	1016.73	1016.98	3.99	16.13	4.76	80.11	104.36	42.00	54.33	1019.23	147.03	1017.39
	463.000	1016.83	1017.08	3.99	16.14	4.76	80.10	158.03	42.00	110.25	1018.77	208.09	1019.34
	464.000	1017.01	1017.26	3.97	15.90	4.78	80.25	166.29	42.00	118.50	1018.93	213.39	1018.76
*	465.000	1017.31	1017.41	2.57	8.60	4.92	51.34	155.00	12.00	121.42	1019.28	184.03	1018.12
*	466.000	1017.34	1017.60	4.13	29.66	4.80	39.37	172.00	1.00	139.16	1019.30	201.65	1018.28

METAJOB NO. 4 - PLAZA CI

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	444.000	.00	.00	.00	1009.26	1120.00	1012.34	.00	1013.04	73.96	6.69	167.31	130.23
*	445.000	97.11	.00	.00	1009.41	1120.00	1013.12	.00	1013.56	37.65	5.31	211.07	182.53
	446.000	102.02	.00	.00	1009.56	1120.00	1013.54	.00	1013.90	29.26	4.86	230.38	207.05
	447.000	80.23	.00	.00	1009.68	1120.00	1013.79	.00	1014.13	25.69	4.65	241.04	220.95
	448.000	98.77	.00	.00	1009.83	1120.00	1014.06	.00	1014.37	23.30	4.49	249.39	232.00
	449.000	107.06	.00	.00	1009.99	1120.00	1014.32	.00	1014.61	21.45	4.36	256.75	241.85
	450.000	105.00	.00	.00	1010.15	1120.00	1014.55	.00	1014.83	20.14	4.27	262.47	249.59
	451.000	96.00	.00	.00	1010.29	1120.00	1014.75	.00	1015.02	19.22	4.20	266.79	255.47
	452.000	80.18	.00	.00	1010.41	1120.00	1014.91	.00	1015.17	18.66	4.15	269.56	259.27
	453.000	103.98	.00	.00	1010.57	1120.00	1015.10	.00	1015.37	18.10	4.11	272.47	263.26
	454.000	96.71	.00	.00	1010.71	1141.00	1015.28	.00	1015.54	18.19	4.14	275.55	267.52
	455.000	107.98	.00	.00	1010.87	1141.00	1015.47	.00	1015.74	17.74	4.10	277.99	270.90
	456.000	106.08	.00	.00	1011.03	1141.00	1015.67	.00	1015.92	17.27	4.07	280.64	274.59
	457.000	102.31	.00	.00	1011.19	1141.00	1015.84	.00	1016.10	17.01	4.04	282.12	276.65
	458.000	103.90	.00	.00	1011.34	1160.00	1016.02	.00	1016.28	17.20	4.08	284.30	279.70
	459.000	110.77	.00	.00	1011.51	1160.00	1016.21	.00	1016.47	16.98	4.06	285.60	281.52

	460.000	94.02	.00	.00	1011.65	1160.00	1016.37	.00	1016.63	16.65	4.03	287.56	284.26
	461.000	90.78	.00	.00	1011.77	1160.00	1016.53	.00	1016.77	16.25	4.00	290.04	287.77
	462.000	124.75	.00	.00	1011.97	1160.00	1016.73	.00	1016.98	16.13	3.99	290.82	288.85
	463.000	63.34	.00	.00	1012.07	1160.00	1016.83	.00	1017.08	16.14	3.99	290.75	288.76
	464.000	110.70	.00	.00	1012.23	1160.00	1017.01	.00	1017.26	15.90	3.97	292.24	290.87
*	465.000	104.13	.00	.00	1012.39	400.00	1017.31	.00	1017.41	8.60	2.57	155.75	136.44
*	466.000	98.32	.00	.00	1012.54	400.00	1017.34	.00	1017.60	29.66	4.13	96.83	73.44

METAJOB NO. 4 - PLAZA CI

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	444.000	1120.00	1012.34	.00	.00	.00	66.64	.00
*	445.000	1120.00	1013.12	.00	.78	.00	71.70	97.11
	446.000	1120.00	1013.54	.00	.41	.00	73.82	102.02
	447.000	1120.00	1013.79	.00	.25	.00	74.97	80.23
	448.000	1120.00	1014.06	.00	.27	.00	75.86	98.77
	449.000	1120.00	1014.32	.00	.26	.00	76.63	107.06
	450.000	1120.00	1014.55	.00	.23	.00	77.22	105.00
	451.000	1120.00	1014.75	.00	.20	.00	77.67	96.00
	452.000	1120.00	1014.91	.00	.16	.00	77.95	80.18
	453.000	1120.00	1015.10	.00	.20	.00	78.25	103.98
	454.000	1141.00	1015.28	.00	.17	.00	78.57	96.71
	455.000	1141.00	1015.47	.00	.20	.00	78.82	107.98
	456.000	1141.00	1015.67	.00	.19	.00	79.08	106.08
	457.000	1141.00	1015.84	.00	.18	.00	79.23	102.31
	458.000	1160.00	1016.02	.00	.17	.00	79.45	103.90
	459.000	1160.00	1016.21	.00	.19	.00	79.58	110.77
	460.000	1160.00	1016.37	.00	.16	.00	79.78	94.02
	461.000	1160.00	1016.53	.00	.15	.00	80.03	90.78
	462.000	1160.00	1016.73	.00	.20	.00	80.11	124.75
	463.000	1160.00	1016.83	.00	.10	.00	80.10	63.34
	464.000	1160.00	1017.01	.00	.18	.00	80.25	110.70
*	465.000	400.00	1017.31	.00	.30	.00	51.34	104.13
*	466.000	400.00	1017.34	.00	.03	.00	39.37	98.32

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 445.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 465.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 466.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

HEC-2 WATER SURFACE PROFILES FOR WEST INTERCEPTOR CHANNEL

DRAFT DESIGN REPORT
JULY 1997

```
1*********************************************
 *************************************
 *  HEC-2 WATER SURFACE PROFILES            *                                                  *  U.S. ARMY CORPS OF ENGINEERS
  *
 *                                          *                                                  *  HYDROLOGIC ENGINEERING CENTER
  *
 *  Version   4.6.2;  May 1991              *                                                  *  609 SECOND STREET, SUITE D
  *
 *                                          *                                                  *  DAVIS, CALIFORNIA 95616-4687
  *
 *  RUN DATE    04JUN97    TIME   15:59:27  *                                                  *          (916) 756-1104
  *
 *********************************************
*************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
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
```



```
                                                                                   THIS RUN EXECUTED 04JUN97    15:59:27
 *************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
 *************************************


T1       1202101
T2       RID-OVERCHUTE
T3       METAJOB 5-WEST INTERCEPTOR CHANNEL FROM CP-2711
T4       THIS UNLINED EXCAVATED DRAINAGE CHANNEL MODELS THE WEST INTERCEPTOR
T4       CHANNEL TO BE CONSTRUCTED AS PART OF PHASE 2 OF THE RID OVERCHUTE
T4       PROJECT.  THE CHANNEL IS APPROXIMATELY 1/4 MILE LONG, PARALLELS ISRB,
T4       AND CROSSES PALADIN ROAD WITH A BOX CULVERT.  THE INLET TO THE CHANNEL
T4       IS CP-2711

J1   ICHECK     INQ       NINV      IDIR      STRT      METRIC     HVINS      Q         WSEL       FQ

        0         2                                                         384    1011.55

J2   NPROF     IPLOT     PRFVS     XSECV     XSECH       FN       ALLDC      IBW       CHNIM      ITRACE

       -1                   -1                                               -6


J3   VARIABLE CODES FOR SUMMARY PRINTOUT

      120        150

NC     0.035      0.035      0.014        0.1        0.3
X1       522         10          7      37.02
CI        22    1005.87      0.014          0          0         30       0.01
X3        10
GR    1015.6          0     1015.6          7     1015.6       7.01     1015.6      22.01    1005.87      22.02
GR    1015.6      22.03     1015.6      37.01     1015.6      37.02     1012.5     118.47     1012.5     120.49

NC     0.035      0.035      0.035        0.1        0.3
X1       523          7       8.02      68.82          1          1          1
CI        -1     1006.4      0.035          4          4         30       0.01
X3        10
  x5    1 1012.28
GR      1013          0       1013       8.02       1012      50.43       1012      52.84     1012.5      68.82
GR    1012.5     103.02       1013     118.06

X1       524          7         80      139.6     150.06     150.06     150.06
CI        -1    1006.55                     4          4         15       0.01
X3        10
GR      1013          0       1013      20.37     1012.5         80       1012       83.7       1012     100.13
GR    1012.5      139.6     1012.5      179.2
```



```
X1       525          5         66      124.4     103.32     103.32     103.32
CI        -1     1006.7      0.035          4          4         12       0.01
X3        10
GR      1012          0       1012      22.09     1012.5         66     1012.5      124.4     1012.5     143.53
```

```
X1      526        6        127       185      90.55      90.55      90.55
CI       -1  1006.85      0.035         4          4         12       0.01
X3       10
GR     1012        0       1012     37.61       1012      45.31     1012.6        127     1012.6        185
GR   1012.6    207.7

NC                                    0.4        0.7
X1    526.2        6        130    187.76      15.29      15.29      15.29
CI       -1  1006.88      0.035         4          4         12       0.01
X3       10
GR     1012        0       1012     29.77       1012       37.2     1012.6        130     1012.6     187.76
GR   1012.6   209.97

X1      527        7         39        73      86.25      86.25      86.25
CI       -1     1007      0.014         1          1         20       0.01
X3       10
GR     1014        0       1014        39       1014      53.55       1014      67.68       1014         73
GR     1014    94.97       1014    115.95

SC    3.012      0.4        2.5        60          7          6        100        8.1    1007.05       1007
X1      528        4      32.05     65.95     103.52     103.52     103.52
CI       -1  1007.05      0.014         1          1         20       0.01
X2                            2               1014.8
X3       10
GR     1013        0       1014     32.05       1014      65.95       1014     120.45

NC                                    0.1        0.3
X1    528.4        5        160    227.12      40.91      40.91      40.91
CI       -1  1007.11      0.035         4          4         12       0.01
X3       10                           160       1018     227.12       1018
GR     1012        0       1014       160       1014     227.12       1014     235.15       1014     276.47

X1      529        4          1      66.4      58.18      58.18      58.18
CI       -1   1007.2                    4          4         12       0.01
X3       10
GR     1013        0       1014         1       1014       66.4       1014     113.69

X1      530        4         34      99.2     102.64     102.64     102.64
CI       -1  1007.35                    4          4         12       0.01
X3       10
GR     1013        0       1014        34       1014       99.2       1014     141.95

X1      531        4         55       119      98.79      98.79      98.79
CI       -1   1007.5      0.035         4          4         12       0.01
X3       10
GR     1013        0       1014        55       1014        119       1014     164.38
```



```
X1      532        4      103.2       166      99.01      99.01      99.01
CI       -1  1007.65      0.035         4          4         12       0.01
X3       10
GR     1013        0       1014     103.2       1014        166       1014     179.79

X1      533        4      124.3     193.9      95.98      95.98      95.98
CI       -1   1007.8      0.035         4          4         12       0.01
X3       10
GR   1013.7        0       1015     124.3       1015      193.9       1015     207.54
```



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

*PROF 1
0

CCHV=     .100 CEHV=     .300
*SECNO 522.000
CHIMP CLSTA=     22.00 CELCH=    1005.87 BW=     30.00 STCHL=      7.00 STCHR=     37.02
EXCAVATION DATA
AEX=     291.8SQ-FT     VEXR=         .0K*CU-YD     VEXT=          .0K*CU-YD

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=     1015.60 ELREA=     1015.60

   522.000      5.68   1011.55       .00   1011.55   1011.63       .08       .00       .00   1015.60
     384.0        .0     384.0        .0        .0     170.4        .0        .0        .0   1015.60
       .00       .00      2.25       .00      .000      .014      .000      .000   1005.87      7.00
   .000068        0.        0.        0.         0         0         0       .00     30.00     37.00

CCHV=     .100 CEHV=     .300
```

```
*SECNO 523.000
CHIMP CLSTA=      38.42 CELCH=    1006.40 BW=      30.00 STCHL=        .00 STCHR=      77.82
EXCAVATION DATA
AEX=     330.5SQ-FT     VEXR=         .0K*CU-YD     VEXT=         .0K*CU-YD


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .57


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=     1012.26 ELREA=     1012.50

   523.000      5.20   1011.60       .00       .00   1011.63       .03       .00       .00   1012.26
     384.0        .0     384.0        .0        .0     264.2        .0        .0        .0   1012.50
       .00       .00      1.45       .00      .000      .035      .000      .000   1006.40      2.62
   .000210        1.        1.        1.         2         0         0       .00     71.61     74.22


*SECNO 524.000
CHIMP CLSTA=     109.80 CELCH=    1006.55 BW=      15.00 STCHL=      78.45 STCHR=     141.10
EXCAVATION DATA
AEX=     211.9SQ-FT     VEXR=        1.5K*CU-YD     VEXT=        1.5K*CU-YD
```



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


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .62


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=     1012.51 ELREA=     1012.50

   524.000      5.07   1011.62       .00       .00   1011.69       .07       .05       .01   1012.51
     384.0        .0     384.0        .0        .0     179.0        .0        .8        .2   1012.50
       .02       .00      2.15       .00      .000      .035      .000      .000   1006.55     82.01
   .000553      150.      150.      150.         0         0         0       .00     55.57    137.59


*SECNO 525.000
CHIMP CLSTA=      95.20 CELCH=    1006.70 BW=      12.00 STCHL=      66.00 STCHR=     124.40
EXCAVATION DATA
AEX=     204.2SQ-FT     VEXR=         .8K*CU-YD     VEXT=        2.3K*CU-YD


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=     1012.50 ELREA=     1012.50

   525.000      4.97   1011.67       .00       .00   1011.77       .09       .07       .01   1012.50
     384.0        .0     384.0        .0        .0     158.3        .0       1.2        .3   1012.50
       .03       .00      2.43       .00      .000      .035      .000      .000   1006.70     69.33
   .000758      103.      103.      103.         1         0         0       .00     51.74    121.07


*SECNO 526.000
CHIMP CLSTA=     156.00 CELCH=    1006.85 BW=      12.00 STCHL=     127.00 STCHR=     185.00
EXCAVATION DATA
AEX=     201.2SQ-FT     VEXR=         .7K*CU-YD     VEXT=        3.0K*CU-YD


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=     1012.60 ELREA=     1012.60

   526.000      4.89   1011.74       .00       .00   1011.84       .10       .07       .00   1012.60
     384.0        .0     384.0        .0        .0     154.0        .0       1.5        .5   1012.60
       .04       .00      2.49       .00      .000      .035      .000      .000   1006.85    130.46
   .000816       91.       91.       91.         0         0         0       .00     51.07    181.54


CCHV=      .400 CEHV=      .700
*SECNO 526.200
CHIMP CLSTA=     158.88 CELCH=    1006.88 BW=      12.00 STCHL=     130.00 STCHR=     187.76
```



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


EXCAVATION DATA
AEX=     199.5SQ-FT     VEXR=         .1K*CU-YD     VEXT=        3.1K*CU-YD


3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=     1012.60 ELREA=     1012.60

   526.200      4.87   1011.75       .00       .00   1011.85       .10       .01       .00   1012.60
     384.0        .0     384.0        .0        .0     153.5        .0       1.5        .5   1012.60
```

```
      .04        .00       2.50        .00       .000       .035       .000       .000    1006.88     133.38
   .000823        15.        15.        15.          0          0          0        .00      50.99     184.38


 *SECNO 527.000
 CHIMP CLSTA=       56.00 CELCH=     1007.00 BW=       20.00 STCHL=       39.00 STCHR=       73.00
 EXCAVATION DATA
 AEX=     189.0SQ-FT      VEXR=          .6K*CU-YD      VEXT=         3.7K*CU-YD


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.17


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1014.00 ELREA=      1014.00

   527.000       4.76    1011.76        .00        .00    1011.93        .16        .03        .05    1014.00
     384.0         .0      384.0         .0         .0      117.9         .0        1.8         .6    1014.00
       .05        .00       3.26        .00       .000       .014       .000       .000    1007.00      41.24
   .000175        86.        86.        86.          2          0          0        .00      29.53      70.76


 SPECIAL CULVERT

 SC  CUNO        CUNV      ENTLC       COFQ      RDLEN       RISE       SPAN     CULVLN       CHRT        SCL       ELCHU       ELCHD
       3         .012        .40       2.50      60.00       7.00       6.00     100.00 [struck out; handwritten: 32.0]    8    1    1007.05     1007.00

 CHART  8 - BOX CULVERT WITH FLARED WINGWALLS; NO INLET TOP EDGE BEVEL
 SCALE  1 - WINGWALLS FLARED 30 TO 75 DEGREES

 *SECNO 528.000
 CHIMP CLSTA=       49.00 CELCH=     1007.05 BW=       20.00 STCHL=       32.05 STCHR=       65.95
 EXCAVATION DATA
 AEX=     187.3SQ-FT      VEXR=          .7K*CU-YD      VEXT=         4.4K*CU-YD
```



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


 SPECIAL CULVERT OUTLET CONTROL
 EGIC =   1010.885  EGOC =    1012.256  PCWSE=    1011.763  ELTRD=    1014.800

 SPECIAL CULVERT

      EGIC       EGOC         H4      QWEIR      QCULV        VCH      ACULV      ELTRD     WEIRLN
   1010.88    1012.26        .33         0.       384.      3.025      126.0    1014.80         0.


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1014.00 ELREA=      1014.00

   528.000       5.06    1012.11        .00        .00    1012.26        .14        .33        .00    1014.00
     384.0         .0      384.0         .0         .0      126.9         .0        2.1         .6    1014.00
       .06        .00       3.03        .00       .000       .014       .000       .000    1007.05      33.94
   .000142       104.       104.       104.          2          0          0        .00      30.13      64.06
   [104. struck out in XLOBL, XLCH, XLOBR; handwritten: 83.0  83.0  83.0]

 CCHV=      .100 CEHV=       .300
 *SECNO 528.400
 CHIMP CLSTA=      193.56 CELCH=     1007.11 BW=       12.00 STCHL=      160.00 STCHR=      227.12
 EXCAVATION DATA
 AEX=     272.6SQ-FT      VEXR=          .3K*CU-YD      VEXT=         4.8K*CU-YD


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .45


 3470 ENCROACHMENT STATIONS=       160.0       227.1   TYPE=       1  TARGET=        67.120
  ELENCL=   1018.00  ELENCR=   1018.00

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1014.00 ELREA=      1018.00

   528.400       5.08    1012.19        .00        .00    1012.27        .09        .01        .01    1014.00
     384.0         .0      384.0         .0         .0      164.1         .0        2.2         .7    1018.00
       .06        .00       2.34        .00       .000       .035       .000       .000    1007.11     167.25
   .000688        41.        41.        41.          2          0          0        .00      52.62     219.87


 *SECNO 529.000
 CHIMP CLSTA=       33.70 CELCH=     1007.20 BW=       12.00 STCHL=         .90 STCHR=       66.90
```



```
     SECNO      DEPTH      CWSEL      CRIWS      WSELK         EG         HV         HL      OLOSS   L-BANK ELEV
     Q          QLOB       QCH        QROB       ALOB         ACH       AROB        VOL        TWA   R-BANK ELEV
```

```
     TIME        VLOB        VCH         VROB        XNL         XNCH        XNR         WTN         ELMIN       SSTA
     SLOPE       XLOBL       XLCH        XLOBR       ITRIAL      IDC         ICONT       CORAR       TOPWID      ENDST

 EXCAVATION DATA
 AEX=     266.5SQ-FT     VEXR=          .6K*CU-YD     VEXT=          5.4K*CU-YD

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1013.90 ELREA=      1014.00

    529.000       5.03   1012.23       .00       .00   1012.32       .09       .04       .00   1013.90
      384.0         .0     384.0        .0        .0     161.0        .0       2.5        .7   1014.00
        .07        .00      2.39       .00      .000      .035      .000      .000   1007.20      7.62
    .000724        58.       58.       58.         1         0         0       .00     52.15     59.78

 *SECNO 530.000
 CHIMP CLSTA=      66.60 CELCH=     1007.35 BW=       12.00 STCHL=      34.00 STCHR=      99.20
 EXCAVATION DATA
 AEX=     256.7SQ-FT     VEXR=         1.0K*CU-YD     VEXT=          6.4K*CU-YD

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1014.00 ELREA=      1014.00

    530.000       4.95   1012.30       .00       .00   1012.39       .09       .08       .00   1014.00
      384.0         .0     384.0        .0        .0     157.4        .0       2.8        .9   1014.00
        .08        .00      2.44       .00      .000      .035      .000      .000   1007.35     40.80
    .000770       103.      103.      103.         0         0         0       .00     51.59     92.40

 *SECNO 531.000
 CHIMP CLSTA=      87.00 CELCH=     1007.50 BW=       12.00 STCHL=      55.00 STCHR=     119.00
 EXCAVATION DATA
 AEX=     247.0SQ-FT     VEXR=          .9K*CU-YD     VEXT=          7.3K*CU-YD

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1014.00 ELREA=      1014.00

    531.000       4.88   1012.38       .00       .00   1012.47       .10       .08       .00   1014.00
      384.0         .0     384.0        .0        .0     153.5        .0       3.2       1.0   1014.00
        .09        .00      2.50       .00      .000      .035      .000      .000   1007.50     61.50
    .000823        99.       99.       99.         0         0         0       .00     50.99    112.50

 *SECNO 532.000
 CHIMP CLSTA=     134.60 CELCH=     1007.65 BW=       12.00 STCHL=     103.20 STCHR=     166.00
```



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

 EXCAVATION DATA
 AEX=     237.5SQ-FT     VEXR=          .9K*CU-YD     VEXT=          8.2K*CU-YD

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1014.00 ELREA=      1014.00

    532.000       4.81   1012.46       .00       .00   1012.56       .10       .08       .00   1014.00
      384.0         .0     384.0        .0        .0     150.0        .0       3.5       1.1   1014.00
        .11        .00      2.56       .00      .000      .035      .000      .000   1007.65    109.38
    .000877        99.       99.       99.         0         0         0       .00     50.44    159.82

 *SECNO 533.000
 CHIMP CLSTA=     159.10 CELCH=     1007.80 BW=       12.00 STCHL=     124.30 STCHR=     193.90
 EXCAVATION DATA
 AEX=     293.8SQ-FT     VEXR=          .9K*CU-YD     VEXT=          9.1K*CU-YD

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1015.00 ELREA=      1015.00

    533.000       4.74   1012.54       .00       .00   1012.65       .11       .09       .00   1015.00
      384.0         .0     384.0        .0        .0     146.7        .0       3.9       1.2   1015.00
        .12        .00      2.62       .00      .000      .035      .000      .000   1007.80    134.15
    .000932        96.       96.       96.         0         0         0       .00     49.91    184.05
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                                                                              THIS RUN EXECUTED 04JUN97     15:59:27
 ************************************
  HEC-2 WATER SURFACE PROFILES

  Version   4.6.2;  May 1991
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

METAJOB 5-WEST INTERCEPT

SUMMARY PRINTOUT TABLE 120

	SECNO	CWSEL	EG	VCH	10*KS	DEPTH	TOPWID	CLSTA	BW	STCHL	XLBEL	STCHR	RBEL
	522.000	1011.55	1011.63	2.25	.68	5.68	30.00	22.00	30.00	7.00	1015.60	37.02	1015.60
*	523.000	1011.60	1011.63	1.45	2.10	5.20	71.61	38.42	30.00	.00	1012.26	77.82	1012.50
*	524.000	1011.62	1011.69	2.15	5.53	5.07	55.57	109.80	15.00	78.45	1012.51	141.10	1012.50
	525.000	1011.67	1011.77	2.43	7.58	4.97	51.74	95.20	12.00	66.00	1012.50	124.40	1012.50
	526.000	1011.74	1011.84	2.49	8.16	4.89	51.07	156.00	12.00	127.00	1012.60	185.00	1012.60
	526.200	1011.75	1011.85	2.50	8.23	4.87	50.99	158.88	12.00	130.00	1012.60	187.76	1012.60
*	527.000	1011.76	1011.93	3.26	1.75	4.76	29.53	56.00	20.00	39.00	1014.00	73.00	1014.00
	528.000	1012.11	1012.26	3.03	1.42	5.06	30.13	49.00	20.00	32.05	1014.00	65.95	1014.00
*	528.400	1012.19	1012.27	2.34	6.88	5.08	52.62	193.56	12.00	160.00	1014.00	227.12	1018.00
	529.000	1012.23	1012.32	2.39	7.24	5.03	52.15	33.70	12.00	.90	1013.90	66.90	1014.00
	530.000	1012.30	1012.39	2.44	7.70	4.95	51.59	66.60	12.00	34.00	1014.00	99.20	1014.00
	531.000	1012.38	1012.47	2.50	8.23	4.88	50.99	87.00	12.00	55.00	1014.00	119.00	1014.00
	532.000	1012.46	1012.56	2.56	8.77	4.81	50.44	134.60	12.00	103.20	1014.00	166.00	1014.00
	533.000	1012.54	1012.65	2.62	9.32	4.74	49.91	159.10	12.00	124.30	1015.00	193.90	1015.00

METAJOB 5-WEST INTERCEPT

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	522.000	.00	.00	.00	1005.87	384.00	1011.55	.00	1011.63	.68	2.25	170.40	464.84
*	523.000	1.00	.00	.00	1006.40	384.00	1011.60	.00	1011.63	2.10	1.45	264.21	264.73
*	524.000	150.06	.00	.00	1006.55	384.00	1011.62	.00	1011.69	5.53	2.15	178.96	163.27
	525.000	103.32	.00	.00	1006.70	384.00	1011.67	.00	1011.77	7.58	2.43	158.34	139.51
	526.000	90.55	.00	.00	1006.85	384.00	1011.74	.00	1011.84	8.16	2.49	154.02	134.40
	526.200	15.29	.00	.00	1006.88	384.00	1011.75	.00	1011.85	8.23	2.50	153.52	133.82
*	527.000	86.25	.00	.00	1007.00	384.00	1011.76	.00	1011.93	1.75	3.26	117.93	289.87
	528.000	103.52	1014.80	.00	1007.05	384.00	1012.11	.00	1012.26	1.42	3.03	126.93	322.21
*	528.400	40.91	.00	.00	1007.11	384.00	1012.19	.00	1012.27	6.88	2.34	164.07	146.37
	529.000	58.18	.00	.00	1007.20	384.00	1012.23	.00	1012.32	7.24	2.39	161.00	142.69
	530.000	102.64	.00	.00	1007.35	384.00	1012.30	.00	1012.39	7.70	2.44	157.37	138.36
	531.000	98.79	.00	.00	1007.50	384.00	1012.38	.00	1012.47	8.23	2.50	153.52	133.82
	532.000	99.01	.00	.00	1007.65	384.00	1012.46	.00	1012.56	8.77	2.56	150.00	129.68
	533.000	95.98	.00	.00	1007.80	384.00	1012.54	.00	1012.65	9.32	2.62	146.67	125.81

METAJOB 5-WEST INTERCEPT

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	522.000	384.00	1011.55	.00	.00	.00	30.00	.00
*	523.000	384.00	1011.60	.00	.05	.00	71.61	1.00
*	524.000	384.00	1011.62	.00	.02	.00	55.57	150.06
	525.000	384.00	1011.67	.00	.05	.00	51.74	103.32
	526.000	384.00	1011.74	.00	.07	.00	51.07	90.55
	526.200	384.00	1011.75	.00	.01	.00	50.99	15.29
*	527.000	384.00	1011.76	.00	.01	.00	29.53	86.25
	528.000	384.00	1012.11	.00	.35	.00	30.13	103.52

*	528.400	384.00	1012.19	.00	.07	.00	52.62	40.91
	529.000	384.00	1012.23	.00	.04	.00	52.15	58.18
	530.000	384.00	1012.30	.00	.07	.00	51.59	102.64
	531.000	384.00	1012.38	.00	.08	.00	50.99	98.79
	532.000	384.00	1012.46	.00	.08	.00	50.44	99.01
	533.000	384.00	1012.54	.00	.08	.00	49.91	95.98

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 523.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 524.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 527.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 528.400 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

HEC-2 WATER SURFACE PROFILES FOR RID MAIN CANAL EXISTING CONDITIONS

DRAFT DESIGN REPORT
JULY 1997

================================
BOSS HEC-2 for AutoCAD (tm)
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Version : 3.0
Serial Number : 23191

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PROGRAM ORIGIN :

BOSS HEC-2 for AutoCAD is an enhanced version of the U.S. Army Corps of Engineers Hydrologic Engineering Center HEC-2 program for water-surface profile computations. Program based upon the September 1990 version, updated on August 1991.

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PROJECT DESCRIPTION :

PROJECT TITLE : RID OVERCHUTE PROJECT
PROJECT NUMBER : 1202101
DESCRIPTION : METAJOB NO. 1 - RID CANAL
ENGINEER : GARY BRADY
DATE OF RUN : 6/13/1997
TIME OF RUN : 3:38 pm

T1 1202101
T2 RID OVERCHUTE PROJECT
T3 METAJOB NO. 1 - RID CANAL
T4 THIS LINED RID CANAL REACH EXTENDS FROM DYSART ROAD TO LITCHFIELD ROAD
T4 BYPASS. THE HEC-2 ANALYSIS WAS USED TO DETERMINE THE AFFECTS OF THE
T4 PROPOSED RID OVERCHUTE STRUCTURE ON THE RID CANAL HYDRAULICS.

JOB PARAMETERS :

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q
	-10	2						435
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW
	-1		-1					-6

STATUS: Analyzing profile 1.

Contraction Coefficient (CCHV) .100

Expansion Coefficient (CEHV) .300

STATUS: Analyzing cross-section reach 1.000.

STATUS: (3280) For cross-section 1.00, ends have been extended vertically 2.66 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1012.00
Right Overbank Elevation (ft, RBEL) 1012.00

Cross Section Number SECNO	Left Overbank Manning XNL	Channel Manning n XNCH	Right Overbank Manning XNR	Flow Depth DEPTH (ft)	Water Surface Elevation CWSEL (ft MSL)	Critical W. S. Elevation CRIWS (ft MSL)	Known W. S. Elevation WSELK (ft MSL)
Energy Gradient SLOPE (ft/ft)	Left Overbank Length XLOBL (ft)	Channel Length XLCH (ft)	Right Overbank Length XLOBR (ft)	Energy Gradient Elevation EG (ft MSL)	Weighted Velocity Head HV (ft)	Friction Energy Loss HL (ft)	Other Energy Loss OLOSS (ft)
Cummul-ative Volume VOL (acre-ft)	Left Overbank Area ALOB (sq ft)	Channel Area ACH (sq ft)	Right Overbank Area AROB (sq ft)	Bridge Deck Area CORAR (sq ft)	Left Bank Elevation LTBNK (ft MSL)	Right Bank Elevation RTBNK (ft MSL)	Number of Balance Trials ITRIAL
Total Flow Q (cfs)	Left Overbank Flow QLOB (cfs)	Channel Flow QCH (cfs)	Right Overbank Flow QROB (cfs)	Computed W. S. Top Width TOPWD (ft)	Left W. S. Station SSTA (ft)	Right W. S. Station ENDST (ft)	Number of Crit Dpth Trials IDC
Flow Travel Time TIME (hrs)	Left Overbank Velocity VLOB (ft/s)	Channel Mean Velocity VCH (ft/s)	Right Overbank Velocity VROB (ft/s)	Length Weighted Manning n WTN	Cummul. Surface Area TWA (acres)	Minimum C. S. Elevation ELMIN (ft MSL)	Number of Other Trials ICONT

1.000	.000	.020	.000	9.66	1011.66	.00	1011.66
.000063	0	0	0	1011.71	.05	.00	.00
.00	0	233	0	.00	1012.00	1012.00	0
435	0	435	0	33.3	65.82	99.08	0
.00	.00	1.86	.00	.000	.0	1002.00	0

STATUS: Analyzing cross-section reach 2.000.

STATUS: (3280) For cross-section 2.00, ends have been extended vertically 1.69 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1012.00
Right Overbank Elevation (ft, RBEL) 1012.00

2.000	.000	.020	.000	9.69	1011.69	.00	.00
.000053	401	401	402	1011.74	.05	.02	.00
2.23	0	249	0	.00	1012.00	1012.00	0
435	0	435	0	33.5	55.85	89.39	0
.06	.00	1.74	.00	.000	.3	1002.00	0

STATUS: (3280) For cross-section 3.00, ends have been extended vertically .71 feet in order to calculate the hydraulic cross-section properties.

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
3.000	.000	.020	.035	8.70	1011.70	.00	.00
.000080	395	394	394	1011.77	.06	.03	.01
4.34	0	214	0	.00	1013.00	1013.00	0
435	0	434	0	34.0	13.56	90.10	0
.12	.00	2.03	.15	.000	.6	1003.00	0

Contraction Coefficient (CCHV) .300

Expansion Coefficient (CEHV) .500

STATUS: Analyzing cross-section reach 4.000.

STATUS: (3265) Divided flow.

STATUS: (3280) For cross-section 4.00, ends have been extended vertically .72 feet in order to calculate the hydraulic cross-section properties.

4.000	.000	.020	.035	7.72	1011.72	.00	.00
.000139	290	290	292	1011.81	.10	.03	.02
5.65	0	175	2	.00	1013.00	1013.00	0
435	0	434	0	37.4	74.99	142.38	0
.15	.00	2.48	.24	.000	.9	1004.00	0

STATUS: Analyzing cross-section reach 5.000.

STATUS: (3470) Encroachment computation information follows:

Left Encroachment Station (ft, STENCL)	10.55
Right Encroachment Station (ft, STENCR)	37.85
Encroachment Method (TYPE)	1
Width or Percent Target	27.300
Left Encroachment Elevation (ft, ELENCL)	1013.13
Right Encroachment Elevation (ft, ELENCR)	1013.13

5.000	.000	.020	.000	7.66	1011.76	.00	.00
.000095	58	60	63	1011.83	.07	.01	.01
5.92	0	208	0	.00	1013.13	1013.13	2
435	0	435	0	27.2	10.60	37.80	0
.16	.00	2.09	.00	.000	.9	1004.10	0

STATUS: Special culvert analysis being performed.

CULVERT DESCRIPTION :

Number of Identical Culverts (CUNO)	3
Culvert Mannings n (CUNV)	.012
Culvert Entrance Loss Coefficient (ENTLC)	.400
Box Culvert Height (ft, RISE)	5.00
Box Culvert Opening Width (ft, SPAN)	8.00
Culvert Length (ft, CULVLN)	20.00
Culvert Opening Upstream Invert (ft MSL, ELCHU)	1004.13
Culvert Opening Downstream Invert (ft MSL, ELCHD)	1004.13
Roadway Length (ft, RDLEN)	47.51
Roadway Weir Flow Discharge Coefficient (COFQ)	2.90

Chart # 8 - box culvert with flared wingwalls, no inlet top edge bevel

Scale # 1 - wingwalls flared 30 to 75 degrees

STATUS: Analyzing cross-section reach 6.000.

SPECIAL CULVERT OUTLET CONTROL RESULTS :

Energy Grade Line Elevation for Inlet Control (ft MSL, EGIC)	1007.59
Energy Grade Line Elevation for Outlet Control (ft MSL, EGOC)	1012.06
Previous Computed Water Surface Elevation (ft MSL, PCWSE)	1011.76
Top of Roadway Elevation (ft MSL, ELTRD)	1013.13

CULVERT ANALYSIS RESULTS :

Inlet Control Energy Grade Line Elevation (ft MSL, EGIC)	1007.59
Outlet Control Energy Grade Line Elevation (ft MSL, EGOC)	1012.06
Water Surface Drop Through Culvert (ft, H4)	.23
Total Weir Flow (cfs, QWEIR)	0.
Total Culvert Flow (cfs, QCULV)	435.
Mean Channel Velocity (fps, VCH)	2.11
Culvert Opening Area (sq ft, ACULV)	120.0
Top of Roadway Elevation (ft MSL, ELTRD)	1013.13
Roadway Weir Length (ft, WEIRLN)	.0

STATUS: (3470) Encroachment computation information follows:

Left Encroachment Station (ft, STENCL)	.00
Right Encroachment Station (ft, STENCR)	26.28
Encroachment Method (TYPE)	1
Width or Percent Target	26.279
Left Encroachment Elevation (ft, ELENCL)	1013.13
Right Encroachment Elevation (ft, ELENCR)	1013.13

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
6.000	.000	.020	.000	7.86	1011.99	.00	.00
.000097	20	20	20	1012.06	.07	.23	.00
6.01	0	206	0	.00	1013.10	1013.13	2
435	0	435	0	26.3	.01	26.28	0
.16	.00	2.11	.00	.000	.9	1004.13	0

STATUS: Analyzing cross-section reach 7.000.

STATUS: (3470) Encroachment computation information follows:

Left Encroachment Station (ft, STENCL)	24.41
Right Encroachment Station (ft, STENCR)	51.69
Encroachment Method (TYPE)	1
Width or Percent Target	27.280
Left Encroachment Elevation (ft, ELENCL)	1017.00
Right Encroachment Elevation (ft, ELENCR)	1017.00

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
7.000	.000	.020	.000	7.09	1011.99	.00	.00
.000119	35	35	35	1012.06	.08	.00	.01
6.18	0	192	0	.00	1012.94	1017.00	0
435	0	435	0	27.2	24.45	51.69	0
.17	.00	2.26	.00	.000	.9	1004.90	0

STATUS: Special culvert analysis being performed.

CULVERT DESCRIPTION :

Number of Identical Culverts (CUNO)	3
Culvert Mannings n (CUNV)	.012
Culvert Entrance Loss Coefficient (ENTLC)	.400
Box Culvert Height (ft, RISE)	8.00
Box Culvert Opening Width (ft, SPAN)	8.00
Culvert Length (ft, CULVLN)	100.00
Culvert Opening Upstream Invert (ft MSL, ELCHU)	1004.94
Culvert Opening Downstream Invert (ft MSL, ELCHD)	1004.94
Roadway Length (ft, RDLEN)	72.21
Roadway Weir Flow Discharge Coefficient (COFQ)	2.90

Chart # 8 - box culvert with flared wingwalls, no inlet top edge bevel

Scale # 1 - wingwalls flared 30 to 75 degrees

STATUS: Analyzing cross-section reach 8.000.

SPECIAL CULVERT OUTLET CONTROL RESULTS :

Energy Grade Line Elevation for Inlet Control (ft MSL, EGIC)	1008.36
Energy Grade Line Elevation for Outlet Control (ft MSL, EGOC)	1012.14
Previous Computed Water Surface Elevation (ft MSL, PCWSE)	1011.99
Top of Roadway Elevation (ft MSL, ELTRD)	1017.00

CULVERT ANALYSIS RESULTS :

Inlet Control Energy Grade Line Elevation (ft MSL, EGIC)	1008.36
Outlet Control Energy Grade Line Elevation (ft MSL, EGOC)	1012.14
Water Surface Drop Through Culvert (ft, H4)	.08
Total Weir Flow (cfs, QWEIR)	0.
Total Culvert Flow (cfs, QCULV)	435.
Mean Channel Velocity (fps, VCH)	2.21
Culvert Opening Area (sq ft, ACULV)	192.0
Top of Roadway Elevation (ft MSL, ELTRD)	1017.00
Roadway Weir Length (ft, WEIRLN)	.0

STATUS: (3470) Encroachment computation information follows:

Left Encroachment Station (ft, STENCL)	19.70
Right Encroachment Station (ft, STENCR)	47.27
Encroachment Method (TYPE)	1
Width or Percent Target	27.570
Left Encroachment Elevation (ft, ELENCL)	1017.00
Right Encroachment Elevation (ft, ELENCR)	1017.00

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
8.000	.000	.020	.000	7.17	1012.07	.00	.00
.000112	102	102	102	1012.14	.08	.08	.00
6.63	0	196	0	.00	1014.00	1017.00	2
435	0	435	0	27.6	19.71	47.27	0
.18	.00	2.21	.00	.000	1.0	1004.90	0

Contraction Coefficient (CCHV)	.100
Expansion Coefficient (CEHV)	.300

STATUS: Analyzing cross-section reach 9.000.

9.000	.000	.020	.000	7.06	1012.06	.00	.00
.000130	19	22	26	1012.15	.09	.00	.00
6.73	0	183	0	.00	1013.00	1013.00	0
435	0	435	0	34.0	28.49	62.45	0
.18	.00	2.37	.00	.000	1.0	1005.00	0

STATUS: (3280) For cross-section 10.00, ends have been extended vertically 2.11 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1013.00
Right Overbank Elevation (ft, RBEL) 1013.00

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
10.000	.000	.020	.000	8.11	1012.11	.00	.00
.000093	329	328	329	1012.18	.07	.04	.00
8.19	0	204	0	.00	1013.00	1013.00	1
435	0	435	0	33.3	27.56	60.90	0
.22	.00	2.13	.00	.000	1.3	1004.00	0

STATUS: Analyzing cross-section reach 11.000.

STATUS: (3280) For cross-section 11.00, ends have been extended vertically 2.15 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1013.00
Right Overbank Elevation (ft, RBEL) 1013.00

11.000	.000	.020	.000	9.15	1012.15	.00	.00
.000068	295	295	295	1012.21	.06	.02	.00
9.65	0	226	0	.00	1013.00	1013.00	0
435	0	435	0	33.1	28.36	61.47	0
.27	.00	1.92	.00	.000	1.5	1003.00	0

STATUS: Analyzing cross-section reach 12.000.

STATUS: (3280) For cross-section 12.00, ends have been extended vertically 2.17 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1013.00
Right Overbank Elevation (ft, RBEL) 1013.00

12.000	.000	.020	.000	8.16	1012.16	.00	.00
.000116	283	284	285	1012.24	.08	.02	.01
11.01	0	188	0	.00	1013.00	1013.00	1
435	0	435	0	32.4	33.85	66.25	0

STATUS: (3280) For cross-section 13.00, ends have been extended vertically 1.18 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL)	1013.00
Right Overbank Elevation (ft, RBEL)	1013.00

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
13.000	.000	.020	.000	8.18	1012.18	.00	.00
.000122	224	222	222	1012.27	.09	.03	.00
11.96	0	184	0	.00	1013.00	1013.00	0
435	0	435	0	31.4	54.60	86.02	0
.33	.00	2.35	.00	.000	1.9	1004.00	0

Contraction Coefficient (CCHV)	.500
Expansion Coefficient (CEHV)	.700

STATUS: Analyzing cross-section reach 14.000.

STATUS: (3265) Divided flow.

STATUS: (3280) For cross-section 14.00, ends have been extended vertically .20 feet in order to calculate the hydraulic cross-section properties.

14.000	.035	.020	.000	8.21	1012.21	.00	.00
.000106	116	116	115	1012.29	.08	.01	.00
12.47	0	193	0	.00	1013.00	1013.00	1
435	0	434	0	35.0	.00	56.85	0
.34	.09	2.25	.00	.000	2.0	1004.00	0

STATUS: Analyzing cross-section reach 15.000.

STATUS: (3470) Encroachment computation information follows:

Left Encroachment Station (ft, STENCL)	12.90
Right Encroachment Station (ft, STENCR)	30.48
Encroachment Method (TYPE)	1
Width or Percent Target	17.580
Left Encroachment Elevation (ft, ELENCL)	1014.00
Right Encroachment Elevation (ft, ELENCR)	1014.00

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL)	1014.00

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
15.000	.000	.020	.000	8.70	1012.20	.00	.00
.000204	55	60	65	1012.33	.13	.01	.03
12.71	0	153	0	.00	1014.00	1014.00	1
435	0	435	0	17.6	12.89	30.48	0
.35	.00	2.84	.00	.000	2.0	1003.50	0

STATUS: Special culvert analysis being performed.

CULVERT DESCRIPTION :

Number of Identical Culverts (CUNO)	2
Culvert Mannings n (CUNV)	.014
Culvert Entrance Loss Coefficient (ENTLC)	.400
Box Culvert Height (ft, RISE)	7.00
Box Culvert Opening Width (ft, SPAN)	8.00
Culvert Length (ft, CULVLN)	65.00
Culvert Opening Upstream Invert (ft MSL, ELCHU)	1003.60
Culvert Opening Downstream Invert (ft MSL, ELCHD)	1003.50
Roadway Length (ft, RDLEN)	43.33
Roadway Weir Flow Discharge Coefficient (COFQ)	2.90

Chart # 8 - box culvert with flared wingwalls, no inlet top edge bevel

Scale # 1 - wingwalls flared 30 to 75 degrees

STATUS: Analyzing cross-section reach 16.000.

SPECIAL CULVERT OUTLET CONTROL RESULTS :

Energy Grade Line Elevation for Inlet Control (ft MSL, EGIC)	1008.12
Energy Grade Line Elevation for Outlet Control (ft MSL, EGOC)	1012.57
Previous Computed Water Surface Elevation (ft MSL, PCWSE)	1012.20
Top of Roadway Elevation (ft MSL, ELTRD)	1014.00

STATUS: (3280) For cross-section 16.00, ends have been extended vertically .21 feet in order to calculate the hydraulic cross-section properties.

CULVERT ANALYSIS RESULTS :

Inlet Control Energy Grade Line Elevation (ft MSL, EGIC)	1008.12
Outlet Control Energy Grade Line Elevation (ft MSL, EGOC)	1012.57
Water Surface Drop Through Culvert (ft, H4)	.24
Total Weir Flow (cfs, QWEIR)	0.
Total Culvert Flow (cfs, QCULV)	435.
Mean Channel Velocity (fps, VCH)	2.79
Culvert Opening Area (sq ft, ACULV)	112.0
Top of Roadway Elevation (ft MSL, ELTRD)	1014.00
Roadway Weir Length (ft, WEIRLN)	.0

STATUS: (3470) Encroachment computation information follows:

Left Encroachment Station (ft, STENCL)	8.01
Right Encroachment Station (ft, STENCR)	39.01
Encroachment Method (TYPE)	1
Width or Percent Target	31.000
Left Encroachment Elevation (ft, ELENCL)	1012.24
Right Encroachment Elevation (ft, ELENCR)	1012.24

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
16.000	.000	.020	.000	8.85	1012.45	.00	.00
.000194	62	62	62	1012.57	.12	.24	.00
12.93	0	155	0	.00	1014.00	1014.00	2
435	0	435	0	17.7	14.71	45.01	0
.35	.00	2.79	.00	.000	2.0	1003.60	0

Contraction Coefficient (CCHV)	.100
Expansion Coefficient (CEHV)	.300

STATUS: Analyzing cross-section reach 17.000.

WARNING: (3302) Conveyance change is outside of acceptable range.

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
17.000	.000	.020	.000	8.51	1012.51	.00	.00
.000095	41	36	30	1012.58	.07	.00	.00
13.08	0	201	0	.00	1013.00	1013.00	2
435	0	435	0	32.0	22.62	54.60	0
.36	.00	2.16	.00	.000	2.0	1004.00	0

STATUS: Analyzing cross-section reach 18.000.

STATUS: (3265) Divided flow.

STATUS: (3280) For cross-section 18.00, ends have been extended vertically .52 feet in order to calculate the hydraulic cross-section properties.

18.000	.035	.020	.000	7.51	1012.51	.00	.00
.000135	131	133	135	1012.60	.09	.02	.00
13.67	2	181	0	.00	1013.00	1013.00	1
435	0	434	0	44.6	.00	63.30	0
.37	.19	2.39	.00	.000	2.2	1005.00	0

STATUS: Analyzing cross-section reach 19.000.

STATUS: (3265) Divided flow.

STATUS: (3280) For cross-section 19.00, ends have been extended vertically .53 feet in order to calculate the hydraulic cross-section properties.

19.000	.035	.020	.000	7.53	1012.53	.00	.00
.000113	110	112	114	1012.61	.08	.01	.00
14.16	2	191	0	.00	1014.00	1014.00	1
435	0	434	0	43.8	.00	64.60	0
.39	.18	2.27	.00	.000	2.3	1005.00	0

STATUS: Analyzing cross-section reach 20.000.

STATUS: (3280) For cross-section 20.00, ends have been extended vertically 1.58 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1014.00
Right Overbank Elevation (ft, RBEL) 1014.00

20.000	.000	.020	.000	7.57	1012.57	.00	.00
.000109	344	347	349	1012.65	.08	.04	.00

STATUS: (3280) For cross-section 21.00, ends have been extended vertically 1.58 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1014.00
Right Overbank Elevation (ft, RBEL) 1014.00

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
21.000	.000	.020	.000	7.58	1012.58	.00	.00
.000125	66	72	77	1012.66	.08	.01	.00
16.02	0	185	0	.00	1014.00	1014.00	0
435	0	435	0	32.3	56.20	88.47	0
.44	.00	2.34	.00	.000	2.6	1005.00	0

STATUS: Analyzing cross-section reach 22.000.

STATUS: (3280) For cross-section 22.00, ends have been extended vertically 1.58 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1014.00
Right Overbank Elevation (ft, RBEL) 1014.00

22.000	.000	.020	.000	7.58	1012.58	.00	.00
.000125	63	64	65	1012.67	.09	.01	.00
16.29	0	185	0	.00	1014.00	1014.00	0
435	0	435	0	33.1	55.36	88.47	0
.45	.00	2.35	.00	.000	2.7	1005.00	0

STATUS: Analyzing cross-section reach 23.000.

STATUS: (3280) For cross-section 23.00, ends have been extended vertically 1.62 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1014.00
Right Overbank Elevation (ft, RBEL) 1014.00

23.000	.000	.020	.000	7.61	1012.61	.00	.00
.000175	288	289	289	1012.72	.11	.04	.01
17.45	0	164	0	.00	1014.00	1014.00	0
435	0	435	0	32.9	55.44	88.35	0

STATUS: (3280) For cross-section 24.00, ends have been extended vertically 3.69 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1014.00
Right Overbank Elevation (ft, RBEL) 1014.00

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
24.000	.000	.020	.000	8.69	1012.69	.00	.00
.000123	383	384	383	1012.78	.09	.06	.00
18.99	0	184	0	.00	1014.00	1014.00	2
435	0	435	0	32.2	21.62	53.82	0
.52	.00	2.36	.00	.000	3.2	1004.00	0

STATUS: Analyzing cross-section reach 25.000.

STATUS: (3280) For cross-section 25.00, ends have been extended vertically 1.75 feet in order to calculate the hydraulic cross-section properties.

STATUS: (3495) Overbank area assumed noneffective.

Left Overbank Elevation (ft, XLBEL) 1014.00
Right Overbank Elevation (ft, RBEL) 1014.00

25.000	.000	.020	.000	8.74	1012.74	.00	.00
.000109	397	396	396	1012.82	.08	.05	.00
20.71	0	192	0	.00	1014.00	1014.00	0
435	0	435	0	32.3	31.87	64.12	0
.57	.00	2.26	.00	.000	3.5	1004.00	0

STATUS: Analyzing cross-section reach 26.000.

26.000	.000	.020	.000	7.79	1012.79	.00	.00
.000122	395	395	395	1012.87	.08	.05	.00
22.42	0	186	0	.00	1015.00	1015.00	0
435	0	435	0	33.1	26.78	59.88	0
.62	.00	2.33	.00	.000	3.8	1005.00	0

STATUS: Analyzing cross-section reach 27.000.

27.000	.000	.020	.000	8.84	1012.84	.00	.00
.000096	407	407	407	1012.92	.07	.04	.00
24.24	0	202	0	.00	1015.00	1014.00	1
435	0	435	0	34.0	60.22	94.19	0
.67	.00	2.15	.00	.000	4.1	1004.00	0

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

28.000	.035	.020	.000	7.88	1012.88	.00	.00
.000108	390	391	391	1012.96	.08	.04	.00
26.06	8	194	0	.00	1015.00	1015.00	0
435	3	431	0	44.0	.41	94.94	0
.72	.39	2.22	.00	.000	4.4	1005.00	0

STATUS: Analyzing cross-section reach 29.000.

29.000	.000	.020	.000	7.93	1012.93	.00	.00
.000099	402	402	401	1013.00	.07	.04	.00
27.92	0	200	0	.00	1015.00	1016.00	0
435	0	435	0	33.8	52.01	85.78	0
.77	.00	2.17	.00	.000	4.8	1005.00	0

STATUS: Analyzing cross-section reach 30.000.

STATUS: (3265) Divided flow.

30.000	.035	.020	.000	7.97	1012.97	.00	.00
.000092	392	392	393	1013.04	.07	.04	.00
29.76	2	205	0	.00	1015.00	1015.00	0
435	0	434	0	37.6	3.87	92.80	0
.82	.29	2.11	.00	.000	5.1	1005.00	0

STATUS: Analyzing cross-section reach 31.000.

STATUS: (3265) Divided flow.

STATUS: (3280) For cross-section 31.00, ends have been extended vertically .00 feet in order to calculate the hydraulic cross-section properties.

31.000	.035	.020	.000	9.01	1013.01	.00	.00
.000072	378	378	379	1013.07	.06	.03	.00
31.65	1	224	0	.00	1015.00	1015.00	0
435	0	434	0	37.6	.00	156.00	0
.88	.22	1.94	.00	.000	5.4	1004.00	0

STATUS: Analyzing cross-section reach 32.000.

STATUS: (3265) Divided flow.

32.000	.035	.020	.000	9.04	1013.04	.00	.00
.000080	432	431	430	1013.10	.06	.03	.00
33.84	0	215	0	.00	1016.00	1016.00	0
435	0	435	0	35.8	4.48	92.24	0
.94	.00	2.02	.00	.000	5.8	1004.00	0

SECNO SLOPE VOL Q TIME	XNL XLOBL ALOB QLOB VLOB	XNCH XLCH ACH QCH VCH	XNR XLOBR AROB QROB VROB	DEPTH EG CORAR TOPWD WTN	CWSEL HV LTBNK SSTA TWA	CRIWS HL RTBNK ENDST ELMIN	WSELK OLOSS ITRIAL IDC ICONT
33.000	.000	.020	.000	8.07	1013.07	.00	.00
.000111	394	394	394	1013.15	.08	.04	.01
35.68	0	191	0	.00	1019.00	1018.00	0
435	0	435	0	32.8	45.30	78.15	0
.99	.00	2.27	.00	.000	6.1	1005.00	0

STATUS: Analyzing cross-section reach 34.000.

34.000	.000	.020	.000	8.08	1013.08	.00	.00
.000130	154	155	155	1013.17	.09	.02	.00
36.35	0	181	0	.00	1019.00	1018.00	0
435	0	435	0	32.8	53.79	86.61	0
1.00	.00	2.39	.00	.000	6.2	1005.00	0

SPECIAL NOTE :

An asterisk (*) to the left of the cross-section number indicates a special note is present in the SUMMARY OF WARNING AND STATUS MESSAGES section.

SUMMARY PRINTOUT TABLE 150 : RID OVERCHUTE PROJECT
METAJOB NO. 1 - RID CANAL
1202101

Cross-Section Number SECNO	Channel Reach Length (ft) XLCH	Top of Roadway Elevation (ft MSL) ELTRD	Max. Low Chord Elevation (ft MSL) ELLC	Minimum C. S. Elevation (ft MSL) ELMIN	Discharge Flow (cfs) Q	Computed W. S. Elevation (ft MSL) CWSEL	Critical W. S. Elevatio (ft MSL) CRIWS
1.000	.00	.00	.00	1002.00	435.00	1011.66	.0
2.000	401.99	.00	.00	1002.00	435.00	1011.69	.0
3.000	394.64	.00	.00	1003.00	435.00	1011.70	.0
4.000	290.35	.00	.00	1004.00	435.00	1011.72	.0
5.000	60.92	.00	.00	1004.10	435.00	1011.76	.0
6.000	20.00	1013.13	.00	1004.13	435.00	1011.99	.0
7.000	35.14	.00	.00	1004.90	435.00	1011.99	.0
8.000	102.08	1017.00	.00	1004.90	435.00	1012.07	.0

	Cross-Section Number SECNO	Channel Reach Length (ft) XLCH	Top of Roadway Elevation (ft MSL) ELTRD	Max. Low Chord Elevation (ft MSL) ELLC	Minimum C. S. Elevation (ft MSL) ELMIN	Discharge Flow (cfs) Q	Computed W. S. Elevation (ft MSL) CWSEL	Critical W. S. Elevatio (ft MSL) CRIWS
	10.000	328.96	.00	.00	1004.00	435.00	1012.11	.0
	11.000	295.28	.00	.00	1003.00	435.00	1012.15	.0
	12.000	284.42	.00	.00	1004.00	435.00	1012.16	.0
	13.000	222.64	.00	.00	1004.00	435.00	1012.18	.0
	14.000	116.34	.00	.00	1004.00	435.00	1012.21	.0
	15.000	60.02	.00	.00	1003.50	435.00	1012.20	.0
	16.000	62.00	1014.00	.00	1003.60	435.00	1012.45	.0
*	17.000	36.09	.00	.00	1004.00	435.00	1012.51	.0
	18.000	133.81	.00	.00	1005.00	435.00	1012.51	.0
	19.000	112.92	.00	.00	1005.00	435.00	1012.53	.0
	20.000	347.20	.00	.00	1005.00	435.00	1012.57	.0
	21.000	72.27	.00	.00	1005.00	435.00	1012.58	.0
	22.000	64.19	.00	.00	1005.00	435.00	1012.58	.0
	23.000	289.02	.00	.00	1005.00	435.00	1012.61	.0
	24.000	384.00	.00	.00	1004.00	435.00	1012.69	.0
	25.000	396.28	.00	.00	1004.00	435.00	1012.74	.0
	26.000	395.29	.00	.00	1005.00	435.00	1012.79	.0
	27.000	407.59	.00	.00	1004.00	435.00	1012.84	.0
	28.000	391.09	.00	.00	1005.00	435.00	1012.88	.0
	29.000	402.07	.00	.00	1005.00	435.00	1012.93	.0
	30.000	392.79	.00	.00	1005.00	435.00	1012.97	.0
	31.000	378.66	.00	.00	1004.00	435.00	1013.01	.0
	32.000	431.30	.00	.00	1004.00	435.00	1013.04	.0
	33.000	394.32	.00	.00	1005.00	435.00	1013.07	.0

SUMMARY PRINTOUT TABLE 150 : RID OVERCHUTE PROJECT
METAJOB NO. 1 - RID CANAL
1202101

	Cross-Section Number SECNO	Discharge Flow (cfs) Q	Computed W. S. Elevation (ft MSL) CWSEL	W.S. Elev Diff per Profile (ft) DIFWSP	W.S. Elev Diff per Section (ft) DIFWSX	W.S. Elev Diff per Know/Comp (ft) DIFKWS	Water Surface Top Width (ft) TOPWID	Channel Reach Length (ft) XLCH
	1.000	435.00	1011.66	.00	.00	.00	33.26	.0
	2.000	435.00	1011.69	.00	.03	.00	33.54	401.9
	3.000	435.00	1011.70	.00	.01	.00	34.03	394.6
	4.000	435.00	1011.72	.00	.01	.00	37.44	290.3
	5.000	435.00	1011.76	.00	.04	.00	27.20	60.9
	6.000	435.00	1011.99	.00	.23	.00	26.27	20.0
	7.000	435.00	1011.99	.00	.00	.00	27.24	35.1
	8.000	435.00	1012.07	.00	.08	.00	27.55	102.0
	9.000	435.00	1012.06	.00	-.01	.00	33.96	22.2
	10.000	435.00	1012.11	.00	.05	.00	33.34	328.9
	11.000	435.00	1012.15	.00	.04	.00	33.11	295.2
	12.000	435.00	1012.16	.00	.01	.00	32.40	284.4
	13.000	435.00	1012.18	.00	.02	.00	31.43	222.6
	14.000	435.00	1012.21	.00	.02	.00	34.97	116.3
	15.000	435.00	1012.20	.00	-.01	.00	17.59	60.0
	16.000	435.00	1012.45	.00	.24	.00	17.67	62.0
*	17.000	435.00	1012.51	.00	.06	.00	31.98	36.0
	18.000	435.00	1012.51	.00	.00	.00	44.57	133.8
	19.000	435.00	1012.53	.00	.02	.00	43.79	112.9
	20.000	435.00	1012.57	.00	.04	.00	29.16	347.2
	21.000	435.00	1012.58	.00	.00	.00	32.27	72.2

Cross-Section Number SECNO	Discharge Flow (cfs) Q	Computed W. S. Elevation (ft MSL) CWSEL	W.S. Elev Diff per Profile (ft) DIFWSP	W.S. Elev Diff per Section (ft) DIFWSX	W.S. Elev Diff per Know/Comp (ft) DIFKWS	Water Surface Top Width (ft) TOPWID	Channel Reach Length (ft) XLCH
24.000	435.00	1012.69	.00	.08	.00	32.20	384.0
25.000	435.00	1012.74	.00	.05	.00	32.25	396.2
26.000	435.00	1012.79	.00	.04	.00	33.10	395.2
27.000	435.00	1012.84	.00	.06	.00	33.98	407.5
28.000	435.00	1012.88	.00	.04	.00	43.99	391.0
29.000	435.00	1012.93	.00	.05	.00	33.78	402.0
30.000	435.00	1012.97	.00	.04	.00	37.63	392.7
31.000	435.00	1013.01	.00	.04	.00	37.59	378.6
32.000	435.00	1013.04	.00	.03	.00	35.78	431.3
33.000	435.00	1013.07	.00	.03	.00	32.85	394.3
34.000	435.00	1013.08	.00	.01	.00	32.82	155.1

SUMMARY OF WARNING AND STATUS MESSAGES :

Section 17, profile 1, conveyance change outside acceptable range.

1 Warning and status message(s) generated

END OF OUTPUT

STRUCTURAL DESIGN CALCULATIONS

DESIGN REPORT
JULY 1997

BKS
Engineers, Inc.
CONSULTING ENGINEERS

PRELIMINARY - NOT FOR CONSTRUCTION

STRUCTURAL CALCULATIONS

FOR

THE ROOSEVELT IRRIGATION DISTRICT OVERCHUTE PROJECT

STRUCTURAL ENGINEERING FOR:

- TRANSPORTATION
- WATER/WASTEWATER
- ARCHITECTURE

Registered Professional Engineer (Structural)
CERTIFICATE NO.
12991
RAYMOND D.
TROYER
Date Signed 9/10/96
ARIZONA, U.S.A.

4120 North 20th Street, Phoenix, Arizona 85016-6022, (602) 955-9301, FAX (602) 955-8949

BKS Engineers, Inc. | CONSULTING ENGINEERS

GENERAL COMPUTATION SHEET

CALC SET NO.	REV	COMP. BY	CHK'D BY
SHEET 1 OF		DATE	DATE
JOB NO. 94808		DATE	DATE

PROJECT OVERCHUTE PROJECT

CLIENT FCDMC / SFC

SUBJECT STRUCTURAL CALCULATIONS

INDEX

Registered Professional Engineer (Structural)
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ARIZONA, U.S.A.

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		SHEET OF	0	DATE	DATE
		JOB NO. 94 808		DATE	DATE

PROJECT Litchfield Park [illegible]

CLIENT FCDMC / SFC

SUBJECT Design Criteria

[illegible]

[illegible] By [illegible] 9/26/94

γ_s = [illegible]5 pcf

p_a = 34 psf/ft

p_{ar} = 32 psf/ft

p_p = 309 psf/ft

q_a = 2000 psf

α = 33°

f_s = 0.55

[illegible]

f'_c = 3,000 psi (Per ADOT [illegible])

f_c = (0.4)(3,000) = 1200 psi (AASHTO)

f_s = 24,000 psi

Design Standards

AASHTO Standard Specification for Highway Bridges

MAG

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		SHEET 1 OF	0	4/96 DATE	DATE
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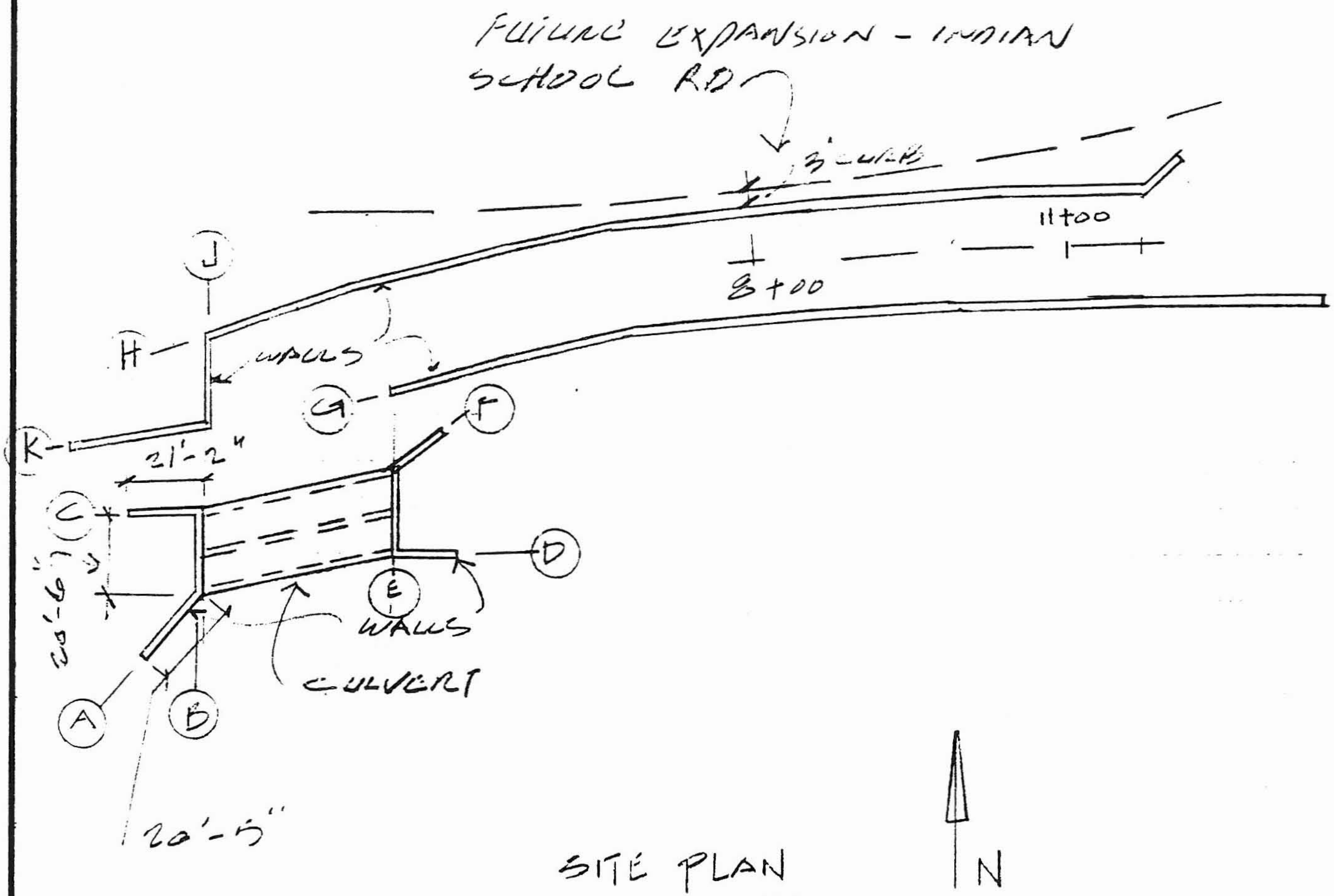
PROJECT Flood Cont. Dist. Maric. Cty (FCDMC)

CLIENT FCD

SUBJECT



SITE PLAN

CULVERT WILL BE AN 8'X7' DBL BARREL BOX CULVERT PER ADOT STD. B-02.20

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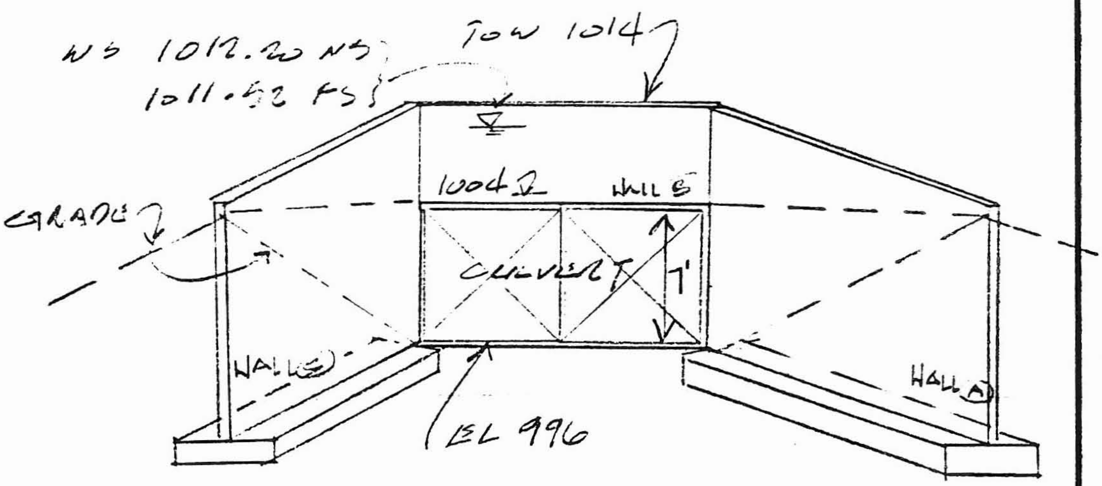
PROJECT: [illegible]

CLIENT: SFC

SUBJECT:

WALLS A, B & C (D, E & F SIM.)



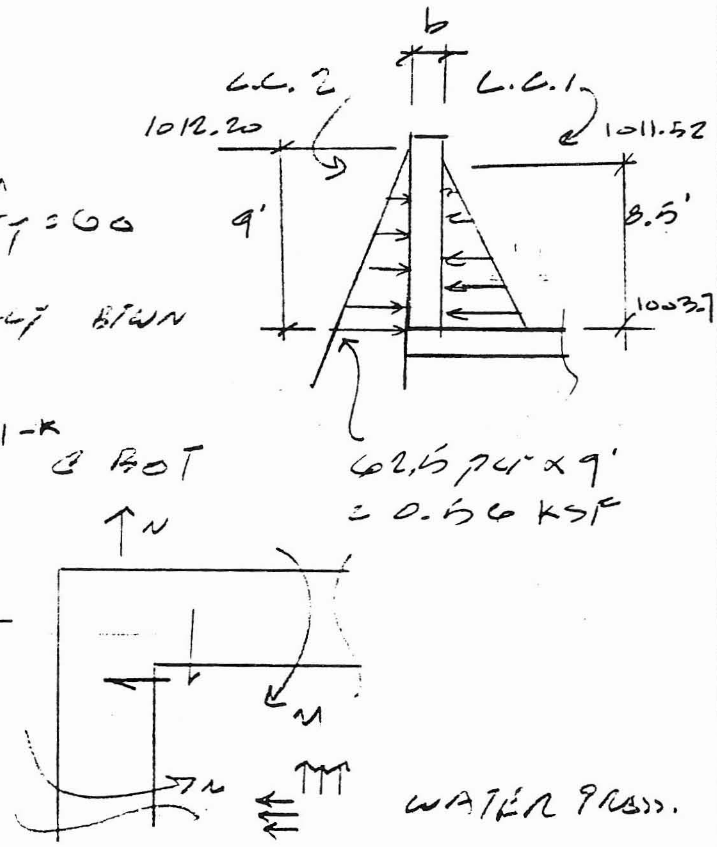
WALL B)

b = TRY 16" $f'_c = 3$ $f_y = 60$

SPAN WALL HORIZONTALLY BTWN WALLS A & C

$M_{MAX} = 0.56 \times 20^2/10 = 23^{1-K}$ @ BOT

WATER AXIAL LOAD
$N = 0.56 \times \frac{20'}{2} = 5.6^{K}$



BKS Engineers, Inc. | CONSULTING ENGINEERS | GENERAL COMPUTATION SHEET

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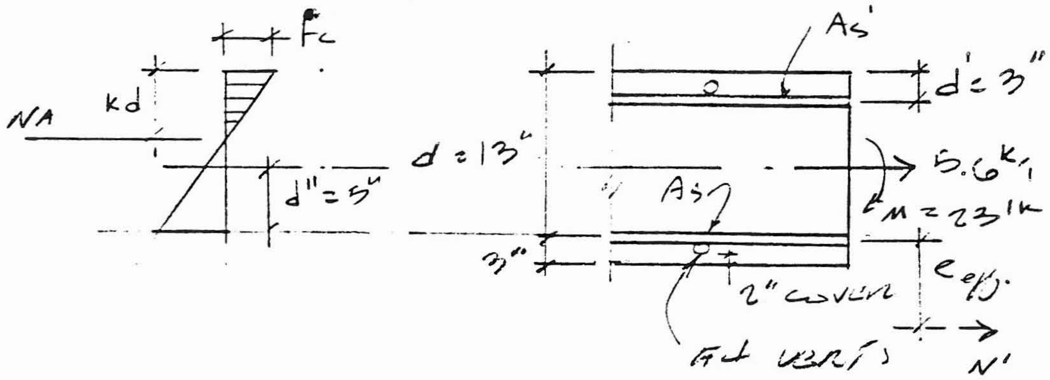
PROJECT FCDMC

CLIENT SFO

SUBJECT

BY ACI SP-3 METHOD,



$$e = \frac{M}{N} + d'' = \frac{23'^{k} \times 12}{-5.6} + 5" = 44.3"$$

(−5.6: Tension)

$$e/d = 44.3/13 = -3.4$$

$$i = \frac{1}{1 - \frac{jd}{e}} = \frac{1}{1 - .9\left(-\frac{1}{3.4}\right)} = .8$$

(Assumes j)

$$m = \frac{n A_s i}{bd} + \frac{(2n-1)A_s'}{bd} = \frac{9.2 \times 1.2 \times .8}{12" \times 13"} + \frac{(18.4-1)1.2}{12 \times 13}$$

$$= .06 + .13 = 0.19$$

$$n = \frac{E_s}{E_c} = \frac{29000}{57\sqrt{3000}} = 9.2$$

$$A_s = A_s' = (\text{Try \#7 HORIZ. @6"}) = 1.2\ in^2.$$

$$g = \frac{n A_s i}{bd} + \frac{(2n-1)A_s'}{bd} \times \frac{d'}{d} = .06 + .13\left(\frac{3}{13}\right) = .09$$

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PROJECT FCDMC

CLIENT SFC

SUBJECT

TABLE 11; for $m = .19$, $q = .09 \rightarrow K = .275$

$$\frac{1}{k} \times \frac{(2n-1)A_s'}{bd} = \frac{1}{.275}\left(\frac{(18.4-1)1.2}{12 \times 13}\right) = .49$$

$$\frac{1}{k}\left(\frac{d'}{d}\right) = .49\left(\frac{3}{13}\right) = .11$$

TABLE 12; $Z = 0.23$

TABLE 13; for $Z = .23$, $k = .275 \rightarrow j = .94$

$$i = \frac{1}{1 - \frac{jd}{e}} = \frac{1}{1 - .94\left(-\frac{1}{3.4}\right)} = .78$$

$$f_s = \frac{1000\,N}{jA_s\,i} \times \frac{e}{d} = \frac{-5.600}{.94 \times 1.2 \times .78} \times -3.4 = 21.7^{ksi}$$

< 24

$$f_s' = 2 f_s \times \frac{k - \frac{d'}{d}}{1-k} = 2 \times 21.7 \times \frac{0.044}{.73} = 2.6^{ksi}$$

$$f_c = \frac{f_s}{n} \times \frac{k}{1-k} = \frac{21.7}{9.2} \times \frac{.275}{1-.275} = .9^{ksi}$$

$f_{c\,allow} = .4 f_c' = .4 \times 3 = 1.2 > .9$

ok

$$l_d \text{ req'd for \#7 Hook} = \frac{1200 \times .875}{\sqrt{3000}} \times .7 \times \frac{[illegible]}{24}$$

$= 12''$

∴ USE 16" THK WALL w/ #7 @6" HORIZ EF

BKS Engineers, Inc. | CONSULTING ENGINEERS

GENERAL COMPUTATION SHEET

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PROJECT FCDMC

CLIENT SFC

SUBJECT

VERT REINF: (TEMP) = .0012 X 14" X 12" = .2 in^2/1

USE #4 VERTS @ 12" E.F.

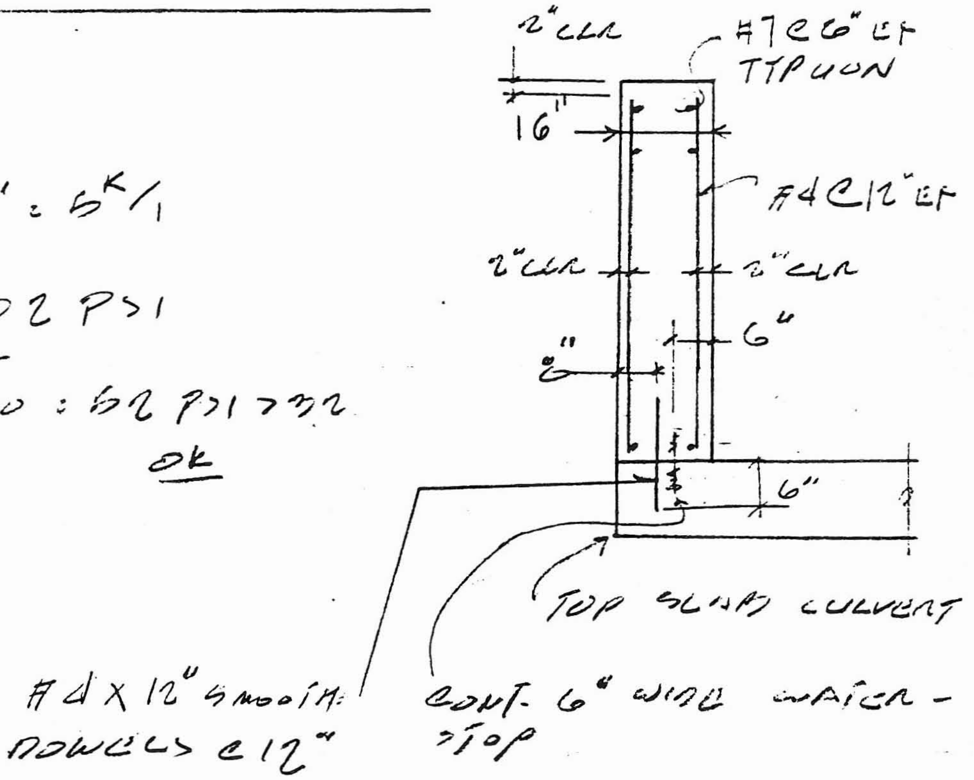
SHR)

$V_{MAX} = 0.56 \times 9' = 5^K/1$

$v = \frac{5}{12 \times 13} = 32$ PSI

$V_c = .95\sqrt{3000} = 52$ PSI > 32

OK



NOTE: SHORE CULVERT TOP SLAB WHILE CASTING WALL ABOVE

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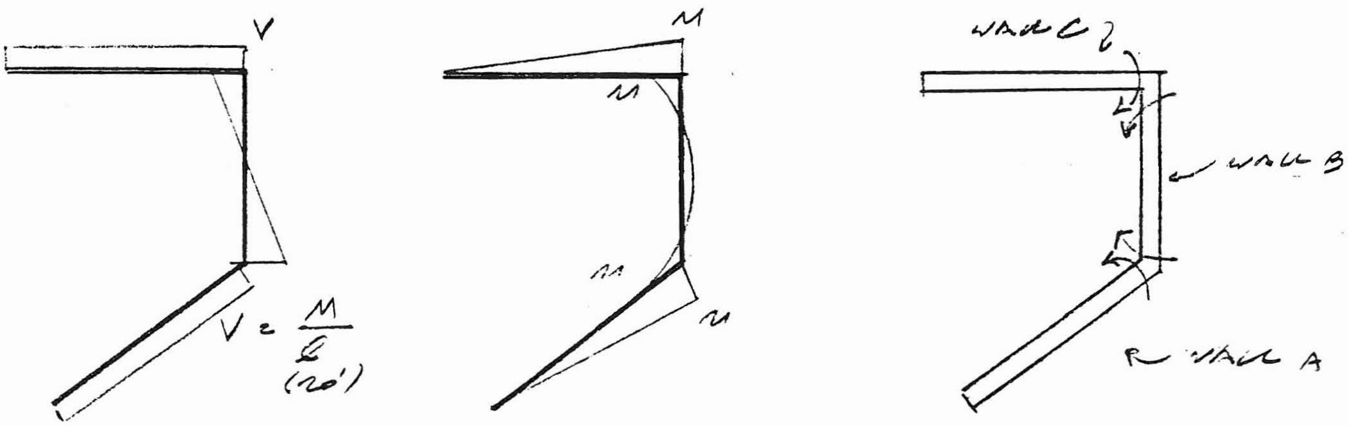
PROJECT EDMC

CLIENT SFC

SUBJECT

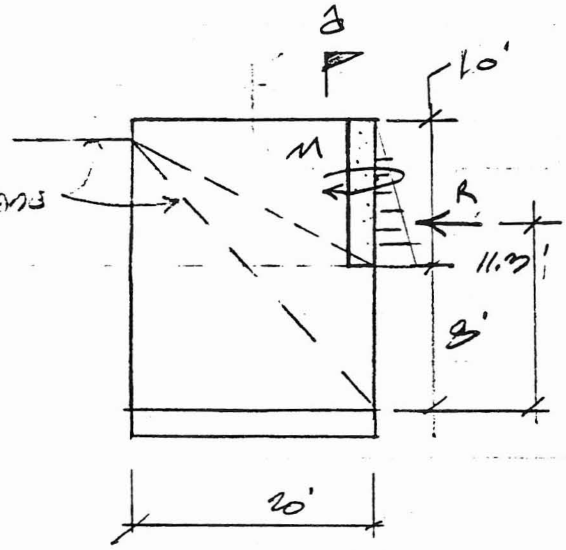
WALLS A & C)



V-DIAG. DUE TO WALL B

M-DIAG. DUE TO WALL B

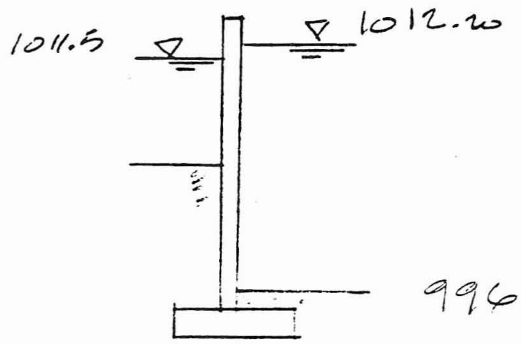
R (FROM WALL B)
= 0.56 × 9'/2 × 10' = 25^K



WALL A OR C

L.C. 2)

L.C. 1B



SECT. A

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CLIENT SFC				DATE	DATE
SUBJECT					

ΣM ON WALL HORIZ. $= 23^{k} \times 9'/2 = 104^{'k}$

$V = 104/20' = 5^{k}$

$5/9' = 0.6^{k/'}$

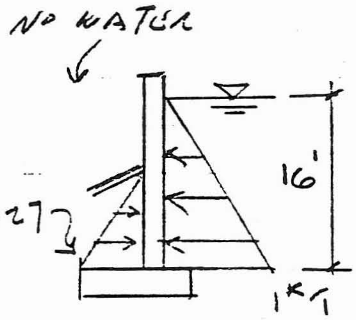
$M_{IN\text{-}PLANE}$ DUE TO R $= 25^{K} \times 13' = 325^{'-k}$

<u>M OUT OF PLANE</u>

MAX @ SECT. 2)

1) L.C. 1

SOIL ACTIVE PRESS = 34 × 8' = .27



$M_{WATER} = 1^{k/'} \times \frac{16'}{2} \times \frac{16'}{3} = 43^{'-k/'}$

$M_{SOIL\ RESIST} = .27 \times 8^2/6 = -3^{'-k/'}$

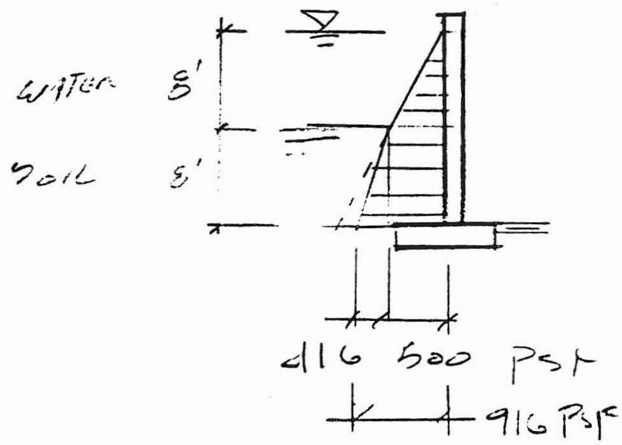
$\Sigma M = 40^{'-k/'}$

1) L.C. 2

62.4 × 8' = 500 PSF

52 PCF × 8' = 416 AT REST

M = SAT $40^{'-k/'}$



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PROJECT FCDMC

CLIENT SFC

SUBJECT

WALL DESIGN)

) M INPLANE = 325 $^{l-k}$

COUPLE = 325 / 10' x .5 = 20^{K}

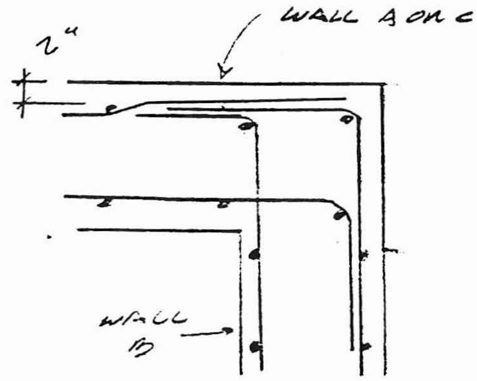
A_s = 20/24 = 0.85 IN^2 EA. END OF WALL

) M HORIZ. @ TOP DUE TO WALL B = $\frac{23^{l-k}}{2}$ = 11.5^{l-k}

14" THK WALL

USE SAME STEEL AS OTHER WALL

USE #7 @ 6" HORIZ. EF



PLAN

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GENERAL COMPUTATION SHEET

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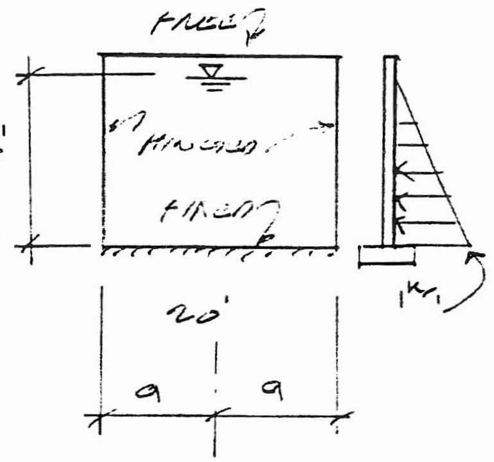
PROJECT FCDMC

CLIENT DFC

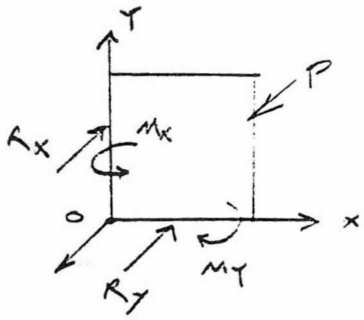
SUBJECT

WALL DESIGN

DESIGN OF WALL BASED ON PLATE ANALYSIS



a/b = 10'/16' = 0.625

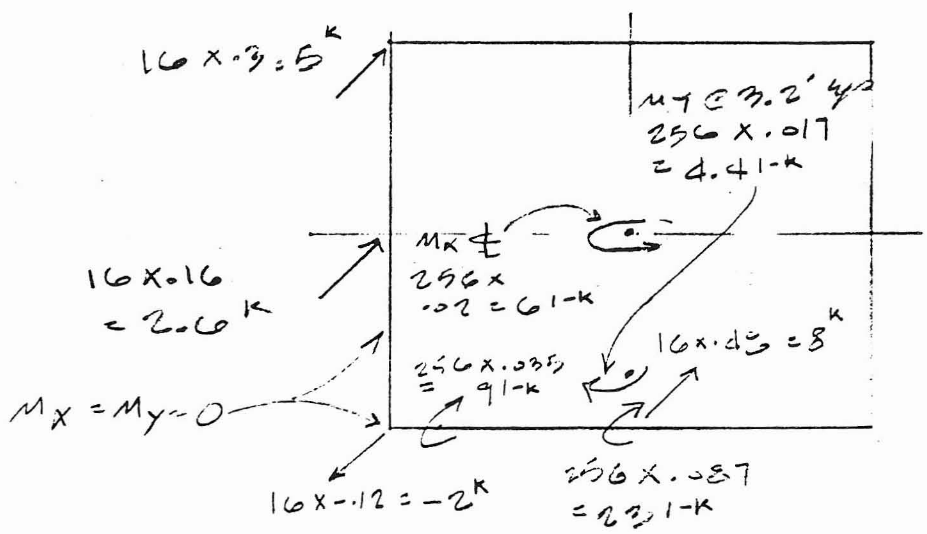


POSITIVE SIGN CONVN.

KSF, ft

$M = \alpha (Pb^2) = \alpha (1^{ksf} \times 16^2) = 256\alpha^{\,1\text{-}k}$

$R = \alpha (Pb) = \alpha (1^{ksf} \times 16') = 16\alpha^{k}$



$A_s = \frac{M}{1.76\,d}$

d { VERT REINF = 11.5"
HORIZ " = 10.5"

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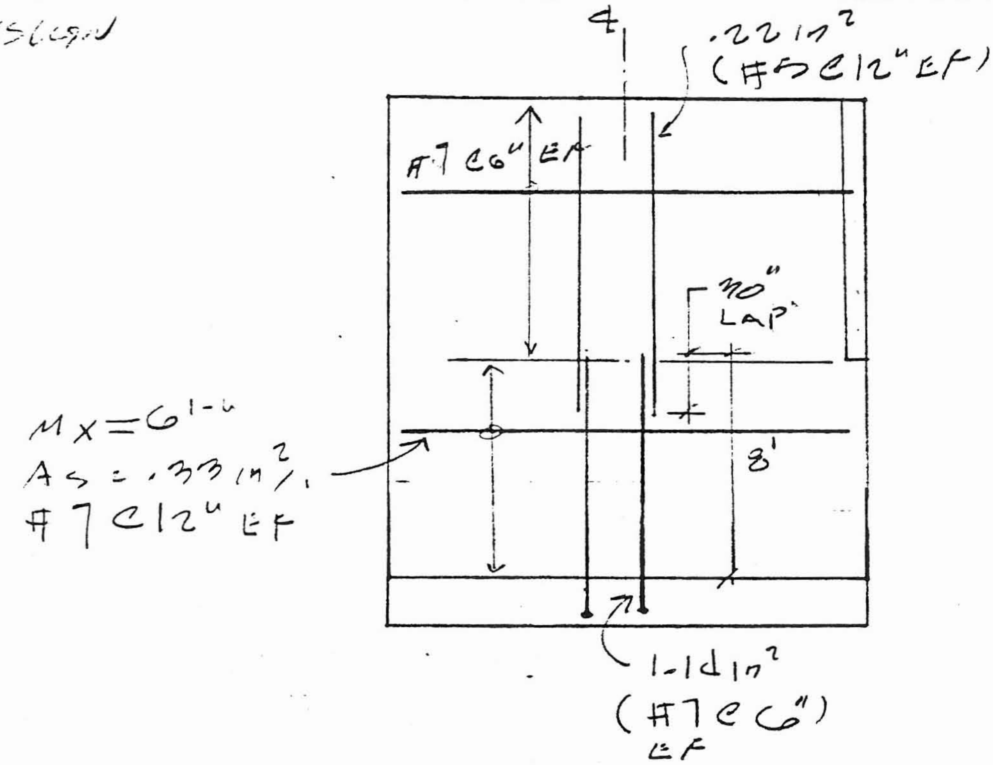
PROJECT FCDMC

CLIENT SFC

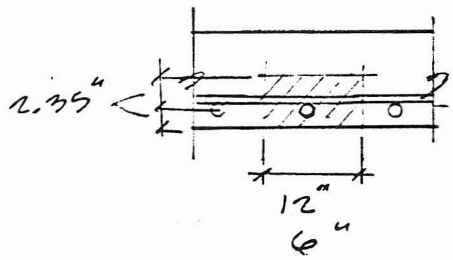
SUBJECT

WALL DESIGN



AS LAYOUT

) CRACK CONTROL



$Z = f_s \sqrt[3]{2.35(56)} = 87 < 115$ OK

12" SPA

$f_s = \frac{.22}{.31} \times 24^{ksi} = 17^{ksi}$

$Z = 24 \sqrt[3]{2.5(5" \times 6")} = 101 < 115$ OK

6" SPA

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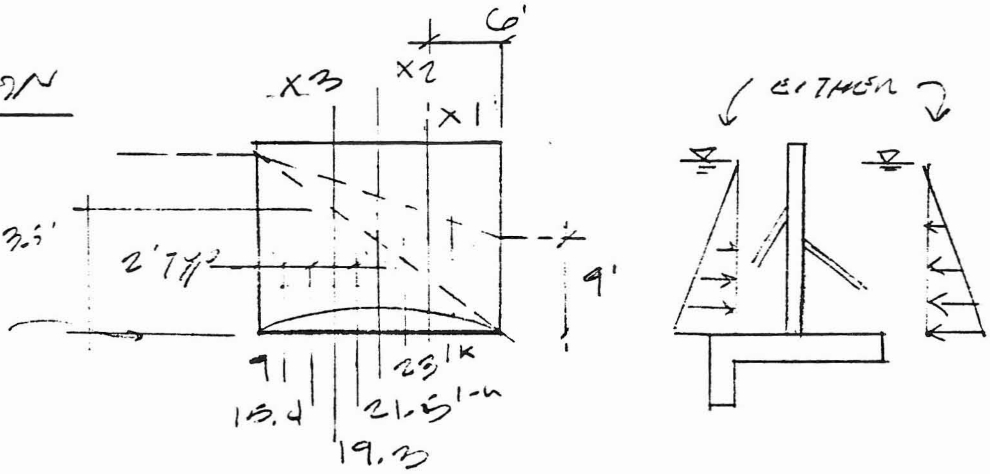
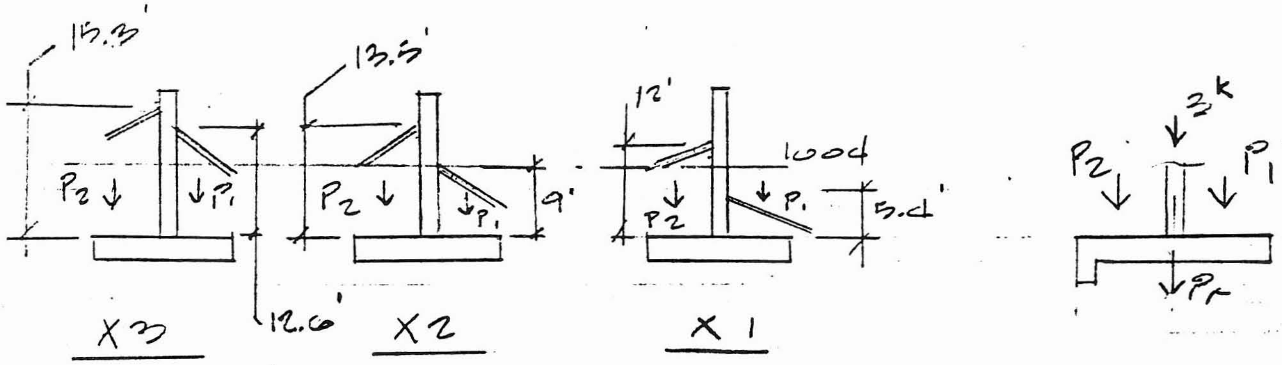
PROJECT FCDMC

CLIENT

SUBJECT

FTG. DESIGN

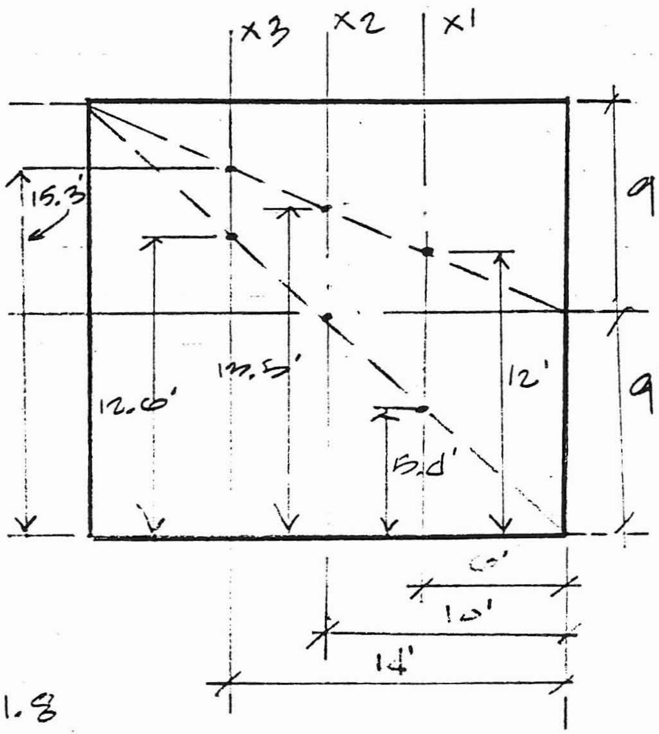




AT X1)

P_1 { SOIL = 5.4' × 115 PCF = .6 k/'
WATER = (16'-5.4') 62.5 = .7 k/'
1.3

P_2 { SOIL = 1.4 k/'
WATER = .3 k/'
1.7 k/'



AT X2)

P_1 { SOIL = 1 k/'
WATER = .4
1.4

P_2 { SOIL = 1.6 k/'
WATER = .2
1.8

AT X3)

P_1 { SOIL = 1.4 k/'
WATER = .2
1.6

P_2 { SOIL = 1.8
WATER = 0
1.8

BKS Engineers, Inc. CONSULTING ENGINEERS — GENERAL COMPUTATION SHEET

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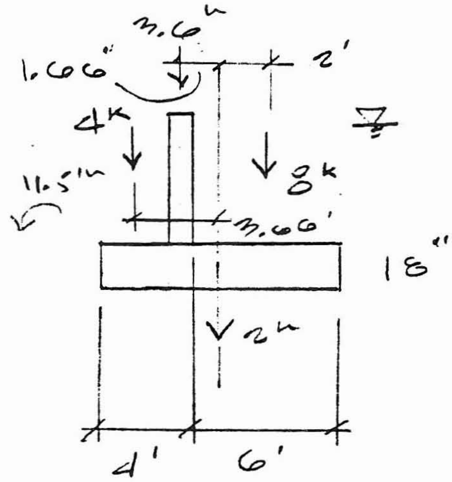
PROJECT FCDMC

CLIENT SF

SUBJECT

$M_{avg.} = say \frac{23^{1k}}{2} = 11.5^{1k}$

$q_{soil\ allow} = 2^{ksf}$ NET



AT X1) a) WATER ON RIGHT

$M_{\mathcal{C}} = 11.5^{1k} + 4^k \times 3.66' + 3.6^k \times 1.66' - 8^k \times 2' = 16^{1k}$

$e_{\mathcal{C}} = \frac{16^{1k}}{18^k} = .9'$

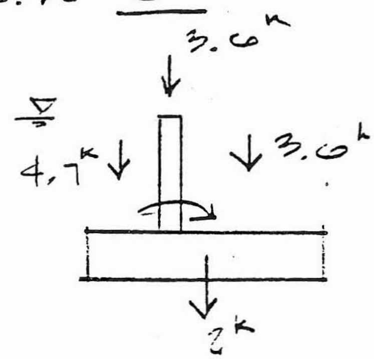
$q_{max} = \frac{18}{10'} \left(1 + \frac{6 \times .9}{10'}\right) = 2.76^{ksf}$

$q_{min} = .8^{ksf}$ ← q_{NET} ← 16' of natural soil

$q_{allow} = 2^{ksf} + 16' (0.13) = 4^{ksf} > 2.76$ ok

q_{max}

b) WATER ON LEFT



$M_{\mathcal{C}} = 11.5^{1k} + 3.6^k \times 2' - 3.6^k \times 1.66' - 4.7 \times 3.6' = 4.5^{1k}$

$e_{\mathcal{C}} = \frac{4.5}{14^k} = .32'$

$q_{max} = \frac{14^k}{10'} \left(1 + \frac{6 \times .36}{10'}\right) = 1.67 KSF < 4$ ok

$q_{min} = 1^{ksf}$

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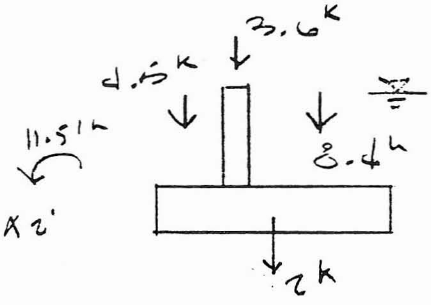
PROJECT FCDMC

CLIENT

SUBJECT

AT X2)

a) WATER ON RIGHT

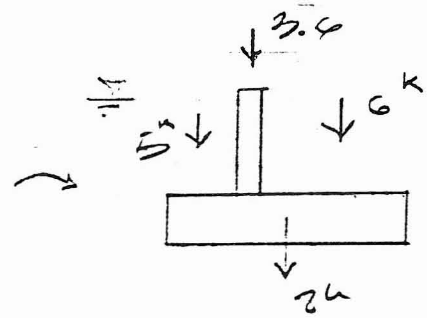


$M_{\text{¢}} = 11.5 + 4.5^k \times 3.6' + 3 \times 1.66' - 8.4 \times 2'$
$= 16'^k$

$e_{\text{¢}} = 16'^k / 18.5^k = 0.87'$

$q_{MAX} = \frac{18.5}{10'} \left(1 + \frac{6 \times .87'}{10'}\right) = 2.8^{KSF} < 4$ OK

b) WATER ON LEFT



$M_{\text{¢}} = 11.5 + 6^k \times 2' - 3.6^k \times 1.66'$
$- 5^k \times 3.6' = -0.8'^k$

$e_{\text{¢}} = .8 / 16.6^k = 0.1'$

$q_{MAX} = \frac{16}{10'} \left(1 + \frac{6 \times .1}{10'}\right) = 1.65^{KSF} < 4$ OK

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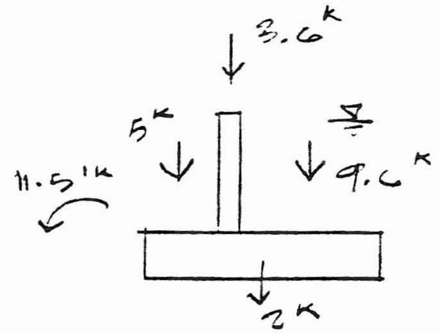
PROJECT: RDMC

CLIENT: ME

SUBJECT:

AT X8)

a) WATER ON THE RIGHT



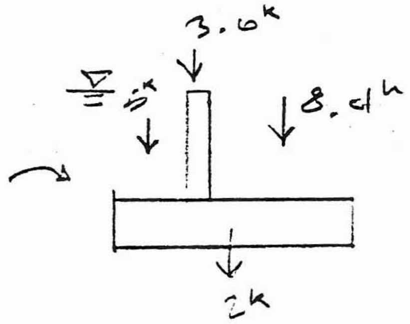
$M_{CL} = 11.5^{'k} + 5 \times 3.6' + 3.6^k \times 1.66' - 9.6^k \times 2' = 16.6^{'k}$

$e_{CL} = \frac{16.6}{20^k} = 0.82'$

$q_{max} = \frac{20^k}{10'} \left(1 + \frac{6 \times .82'}{10'}\right) = 3.0 \text{ ksf} < 4$ ok

$q_{min} = .1$

b) WATER ON LEFT



$M_{CL} = 11.5^{'k} + 8.4^k \times 2' - 3.6^k \times 1.66' - 5^k \times 3.6' = 4.4^{'k}$

$e_{CL} = 4.4 / 19^k = .23$

$q_{max} = \frac{19^k}{10'} \left(1 + \frac{6 \times .23'}{10'}\right) = 2.16 \text{ ksf} < 4$ ok

BKS Engineers, Inc. | CONSULTING ENGINEERS | GENERAL COMPUTATION SHEET

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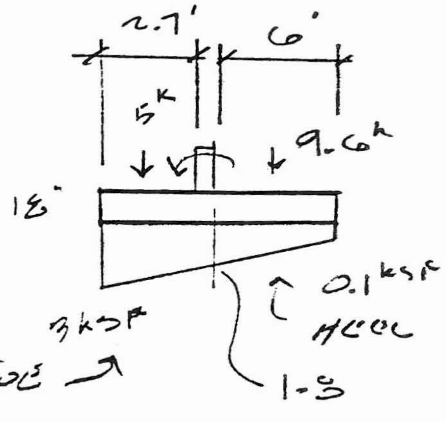
PROJECT YCDMC

CLIENT SFC

SUBJECT

FTG DESIGN)

a) WATER ON RIGHT



@ X3

TOE :

$M = 3 \times 2.7^2/2 - 5^k \times \frac{2.7}{2} = 4^{k/1}$

$V = 3 \times 2 = 6^{k/1}$

$A_s = 4/1.76 \times 14.5 = \underline{0.16\ in^2/1}$

$v = 6/12 \times 14.5 = 34\ psi$

$v_c = .95\sqrt{4000} = 52 > 34$ ok

HEEL :

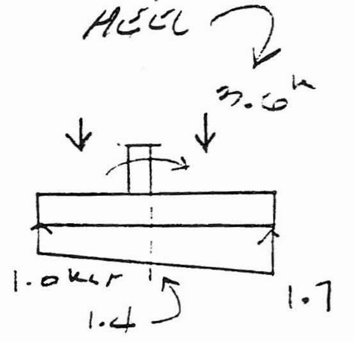
$M = 9.6 \times 3' - 1.8 \times \frac{6'}{2} \times \frac{6'}{3} = 18^{k/1}$

$V = 1.8 \times \frac{6'}{2} - 9.6 = 4^k$ ok

$A_s = 18/1.76 \times 14.5 = .7\ in^2/1$

Use #8 @ 12" @ Top

b) WATER ON LEFT



@ X1

HEEL)

M : SAY $\frac{1.7+1.4}{2} \times \frac{6^2}{2} - 3.6 \times 3' = 17^{1k}$

$V = \frac{1.7+1.4}{2} \times 5' - 3.6 = 2.4^k$

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GENERAL COMPUTATION SHEET

CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET 16 OF	0	NW 4, 96 DATE	DATE
JOB NO. 94-800		DATE	DATE

PROJECT FCDMC

CLIENT SFC

SUBJECT

USE #8 @12" @ PROT.

SLIDING)

$V_{AVA} = \frac{8^k}{2} = 4^{k/1}$

Res. = SAY $15^k \times .55 = 8^k$

S.F. $8/4 = 2$

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CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET 17 OF	0	4.96 DATE	DATE
JOB NO. 9d-305		DATE	DATE

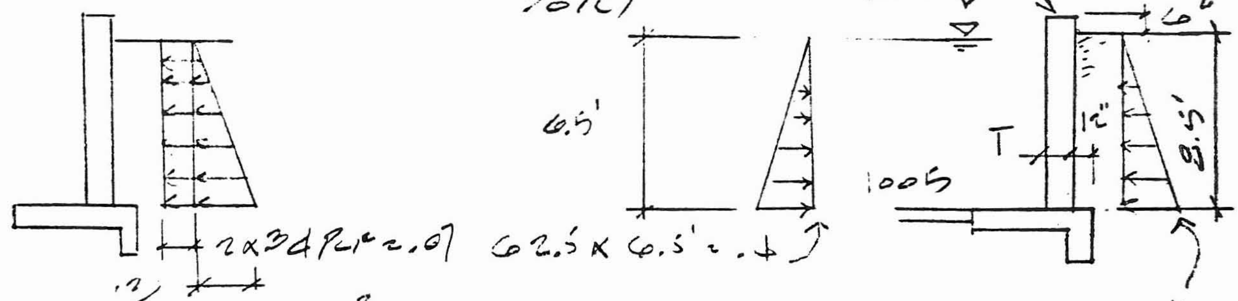
PROJECT FCDMC

CLIENT SFC

SUBJECT

NORTH WALLS

WALL W/ SURCHARGE (EQUIV. 2' SOIL)



$M_{WATER} = .4 \times \frac{6.5^2}{6} = 2.8^{1\text{-}k/'}$

$M_{SOIL} = .3 \times 8.5^2/6 = 3.6^{1\text{-}k/'}$

$M_{SOIL+SURCH.} = 3.6 + .07 \times 8.5^2/2 = 6^{1k/'}$

L.C. 1) $M_{W+S} = 2.8 - 3.6 = -.81^{k/'}$

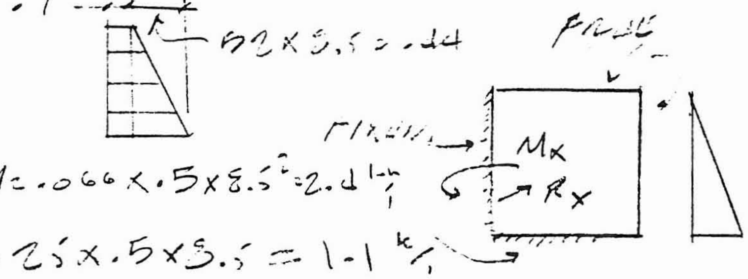
L.C. 2) $M_{S+SUR} = \underline{\underline{6^{1k}}}$ NO WATER

TRY 12" THK WALL W/ 2 LAYERS OF REINF

$d = 9.5"$

$A_s = \frac{6}{1.76 \times 9.5} = .35 \text{ in}^2/'$

USE #6 VERTS @ 12" EF
#5 HORIZ @ 12" EF



AT WALL CORNERS
BY PLATE COEFF.

$\alpha_{M\,max} = .066 \rightarrow M = .066 \times .5 \times 8.5^2 = 2.4^{1\text{-}k/'}$

$\alpha_{R\,max} = .25 \rightarrow R_x = .25 \times .5 \times 8.5 = 1.1^{k/'}$

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GENERAL COMPUTATION SHEET

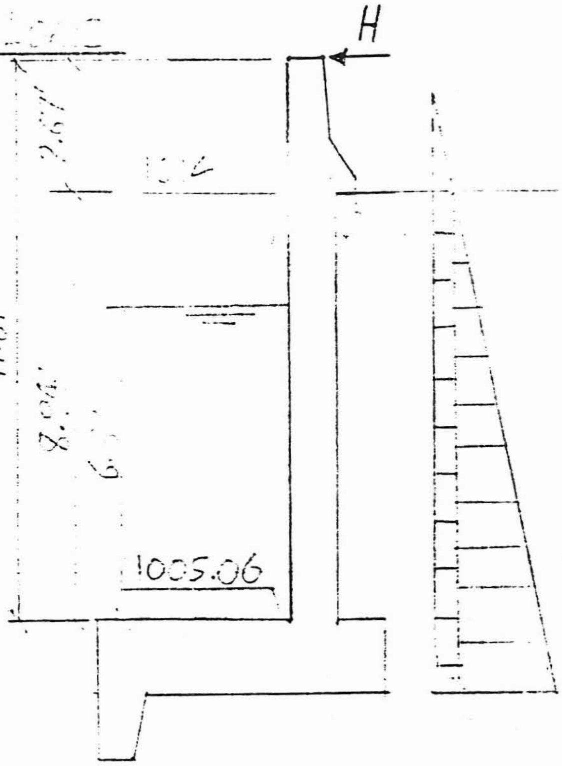
CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET [illegible] OF [illegible]	0	DATE	DATE
JOB NO. [illegible]		DATE	DATE

PROJECT [illegible]

CLIENT [illegible]

SUBJECT [illegible]

[illegible] FOR EP + BARRIER LOAD



SURCHARGE = 2' SOIL
= (2)(.034) = .068 KSF

ACTIVE = 34 pcf = .034 KCF

H = 10^K (DISTRIBUTE OVER 5')

10/5 = 2^KLF

WALL

M = (10)(2.67+8.94)/(2×8.94+5) + ...
+ (.068)(8.94)^2/2 + (.034)(8.94)^3/6

= 11.84^K-FT/FT   d = 9.5"   b = 12"

As = 11.84/(1.76)(9.5) = 0.75 in²/ft   - USE #8 @ 12"

[illegible]

M = (.0624)([illegible])^3/6 = 2.93^K-FT/FT ⇒ As = 0.22 in²/ft
USE #5 @ 12"

[illegible] #5 @ [illegible]

= [illegible] = [illegible]^K-FT/FT   [illegible]

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GENERAL COMPUTATION SHEET

CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET 76 OF	0	DATE	DATE
JOB NO. 94808		DATE	DATE

PROJECT [illegible]

CLIENT [illegible]

SUBJECT [illegible]

[illegible] FOOTING

[illegible] 0(2.67 + 10.44)[illegible] + (.062)(10.44)²/2 + ...

.034)(10.44)³/6 = 15.22 K-FT/FT

[illegible]

BARRIER	(2.49 [illegible])	= [illegible]	@ 4.5′	=	1.68 K-FT
[illegible]	(.894)(1.0)(0.15)	= 1.34 K	@ 4.5′	=	6.03
FOOTING	(6.0)(1.5)(0.15)	= 1.35 K	@ 3′	=	4.05
KEY 1	(.67)(1.33)(0.15)	= 0.13	@ .33′	=	.04
KEY 2	(.33)(1.33)(0.15)/2	= 0.033	@ .78′	=	.03
		3.23 K			11.83 K-FT
[illegible]	(2)(.115)	= .23	@ 5.5′		1.27
SOIL/[illegible]	(8.94)(.115)	= 1.03	@ 5.5′		5.65
		4.49 K			18.76 K-FT

[illegible] = [illegible] (OUT [illegible])

[illegible]

T: [illegible] FOOTING

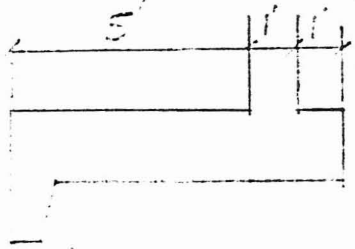
BKS Engineers, Inc. CONSULTING ENGINEERS	GENERAL COMPUTATION SHEET	CALC. SET NO.	REV.	COMP. BY	CHK'D BY
		SHEET [illegible] OF	0	DATE	DATE
		JOB NO. 94202		DATE	DATE

PROJECT [illegible]

CLIENT [illegible]

SUBJECT [illegible]

[illegible]



	[illegible]	ARM	M_R
[illegible]	.374	5.5	2.06
[illegible]	1.34	5.5	7.37
[illegible]	1.58	3.5	5.51
[illegible]	0.133	.33	.04
[illegible]	0.033	.78	.03
[illegible]	.230	6.5	1.50
[illegible]	1.03	6.5	6.70
	4.72^K	$M_R =$	$23.20^{K\text{-}FT}$

R = (23.20 − 15.22)/4.72 = 1.69 (OUTSIDE KERN)

[illegible] = (23.20/15.22) = 1.52 ✓ (>1.5)

[illegible] − 2' = (3)(1.69) = 5.07

q = 2(4.72^K)/5.07 = 1.86 KSF (< 2.0 KSF ✓)

[illegible]

d = 4.5" b = 12"

[illegible] = 0.50 [illegible] = 0.58 USE #[illegible]

BKS Engineers, Inc. | CONSULTING ENGINEERS | GENERAL COMPUTATION SHEET

CALC. SET NO.

SHEET 13 OF

JOB NO.

REV. 0 | COMP. BY NW | 4.96 DATE | CHK'D BY | DATE

PROJECT PCDMC

CLIENT

SUBJECT

HORIZ. WALL CORNER REINF. $= \frac{2.4}{1.76 \times 9} = 0.15 \text{ in}^2/'$

USE #5@12" EF

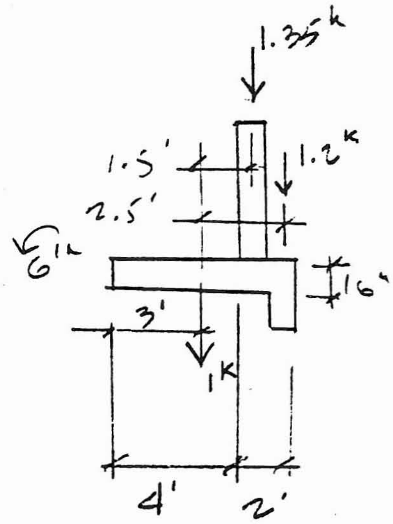
WALL FTG.)

$M_{\text{℄}} = 6^k - 1.2^k \times 2.5' - 1.35^k \times 1.5 = -1^{k'}$

$e_{\text{℄}} = 1/3.6^k = 0.28'$

$q = \frac{3.6}{6'}\left(1 + \frac{6 \times .28}{6'}\right) = 0.77^{ksf}$

< 2.0 ok



$M_{FTG} = 0.8 \times 4^2/2 = 6.4^{k'}$

$A_s = 6.4^{k'}/1.76 \times 12.5" = 0.3 \text{ in}^2/'$

USE #6 @12" BOT
#5 @12" TOP

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GENERAL COMPUTATION SHEET

CALC. SET NO.	REV.	COMP. BY NW	CHK'D BY
SHEET 19 OF	0	4,96 DATE	DATE
JOB NO. 94-808		DATE	DATE

PROJECT FEDMC

CLIENT SFC

SUBJECT

$Z = \frac{.3}{.44} \times 2d \sqrt[3]{3.7 (90)} = 113 < 115$ ok

S.F. / OT : $M_{OT} = 6^{1k}$

$M_{RESIST} = 1.2^k \times 5.5' + 1.35^k \times 4.5' + 1^k \times 3' = 15^{1k}$

S.F. = 2.6 ok

Sliding

$\Sigma V = 0.3^{k/1} \times \frac{8.5'}{2} + 0.07 \times 8.5' = 1.9^{k/1}$

Resist. Friction $= 3.6^k \times .55 = 2.0^{k/1}$

Passive, 2'-6" key

$P = .309 \times 2.5' \times \frac{2.5'}{2} = .96^{k/1}$

$\Sigma R = 2 + 0.96 = 2.96$

S.F. = 2.96/1.9 = 1.56 ok

Use A 2'-6 key

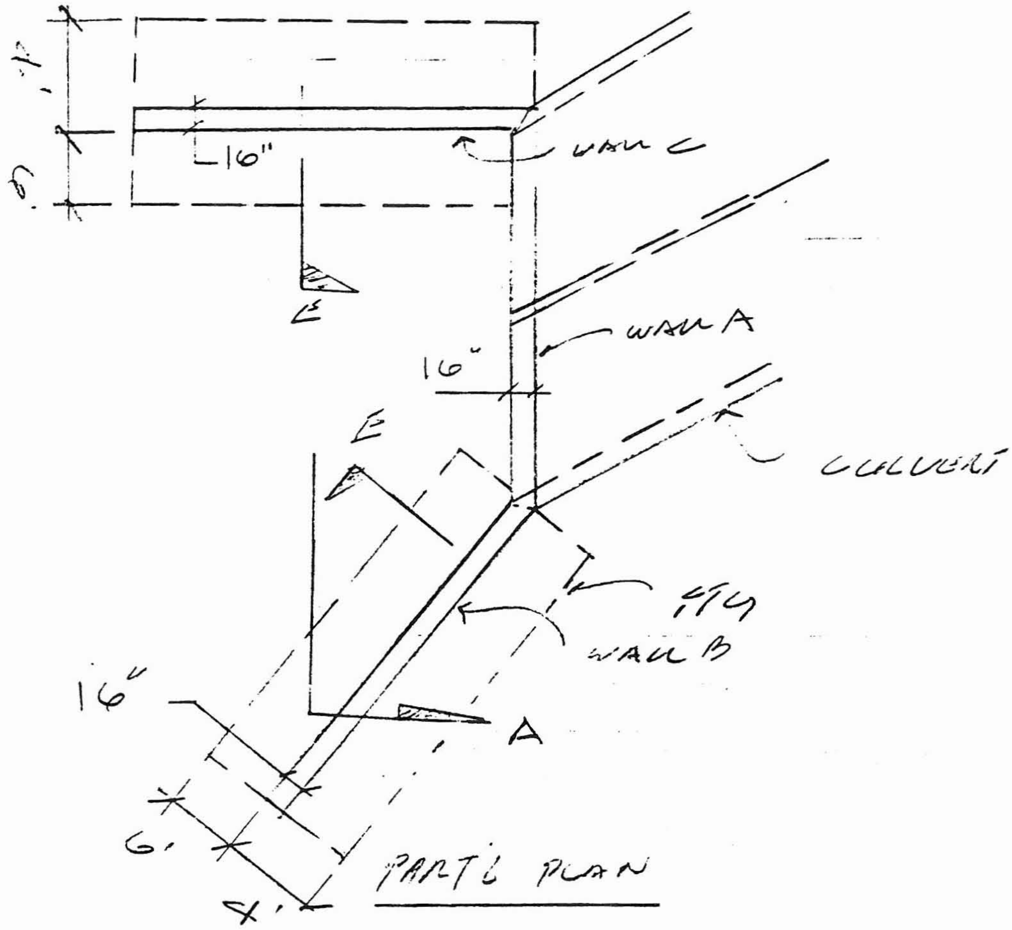
Design of wall line 'B' same as above

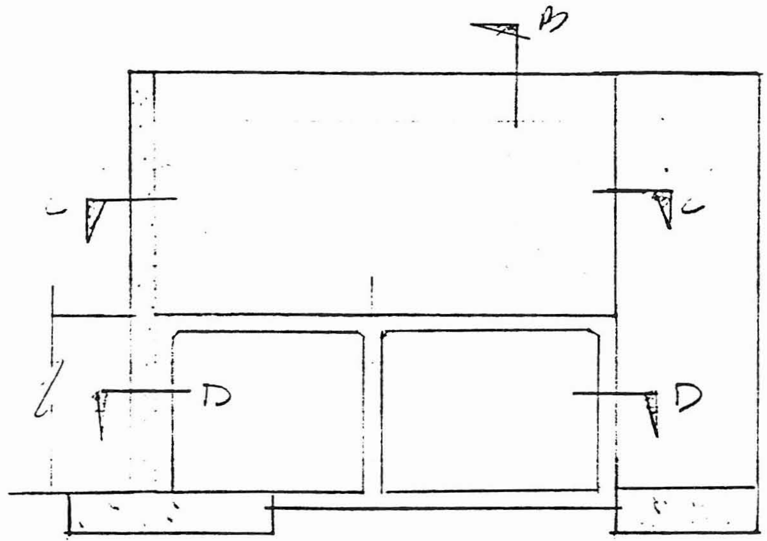
BKS Engineers, Inc. CONSULTING ENGINEERS	GENERAL COMPUTATION SHEET	CALC. SET NO.	REV.	COMP. BY NW	CHK'D BY
		SHEET 20 OF	0	4.96 DATE	DATE
		JOB NO. 94-808		DATE	DATE

PROJECT FCDMC

CLIENT -FC

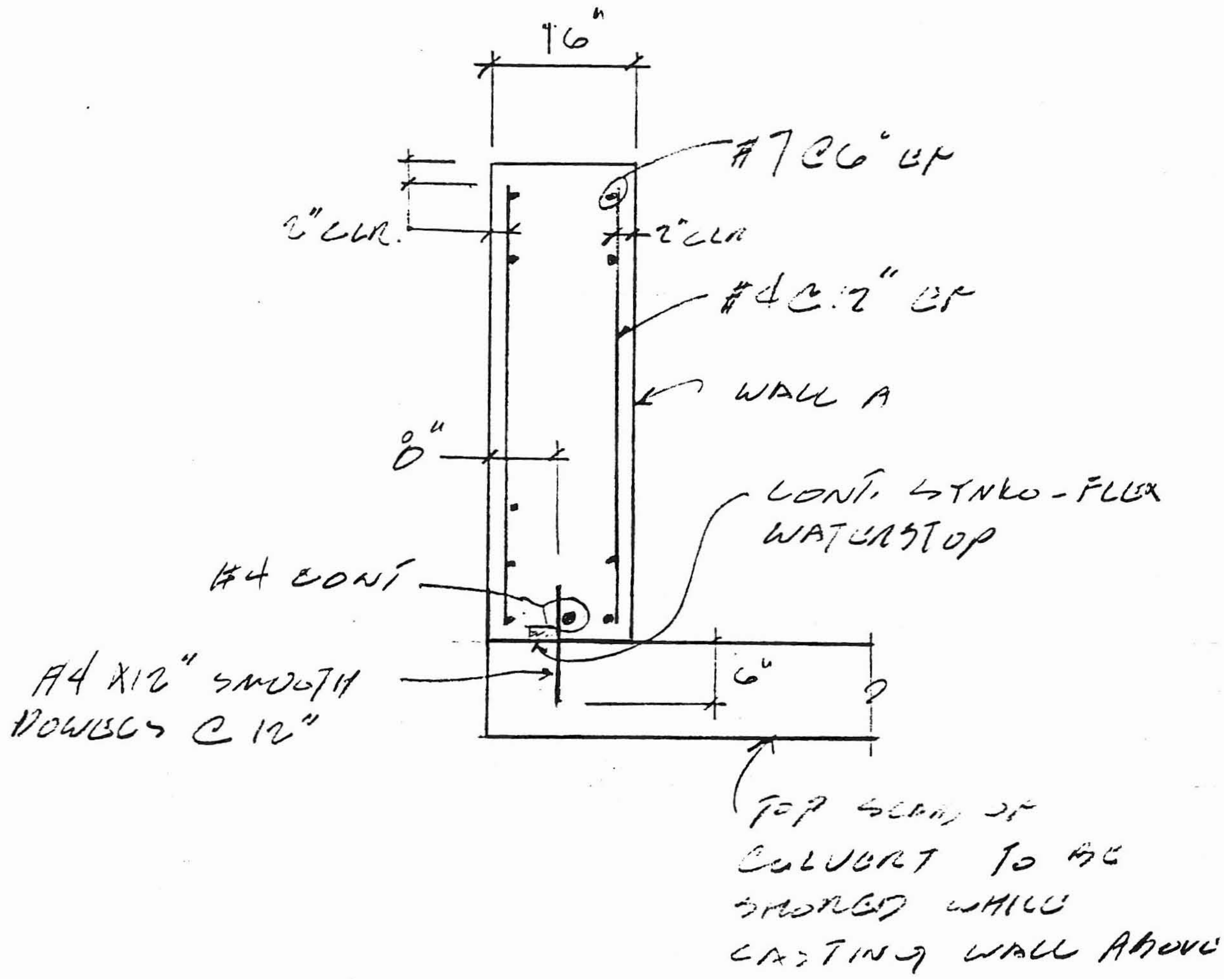
SUBJECT





A

BKS Engineers, Inc. — CONSULTING ENGINEERS	GENERAL COMPUTATION SHEET	CALC. SET NO.	REV.	COMP. BY	CHK'D BY
		SHEET 21 OF	0	DATE	DATE
PROJECT		JOB NO.			
CLIENT				DATE	DATE
SUBJECT					



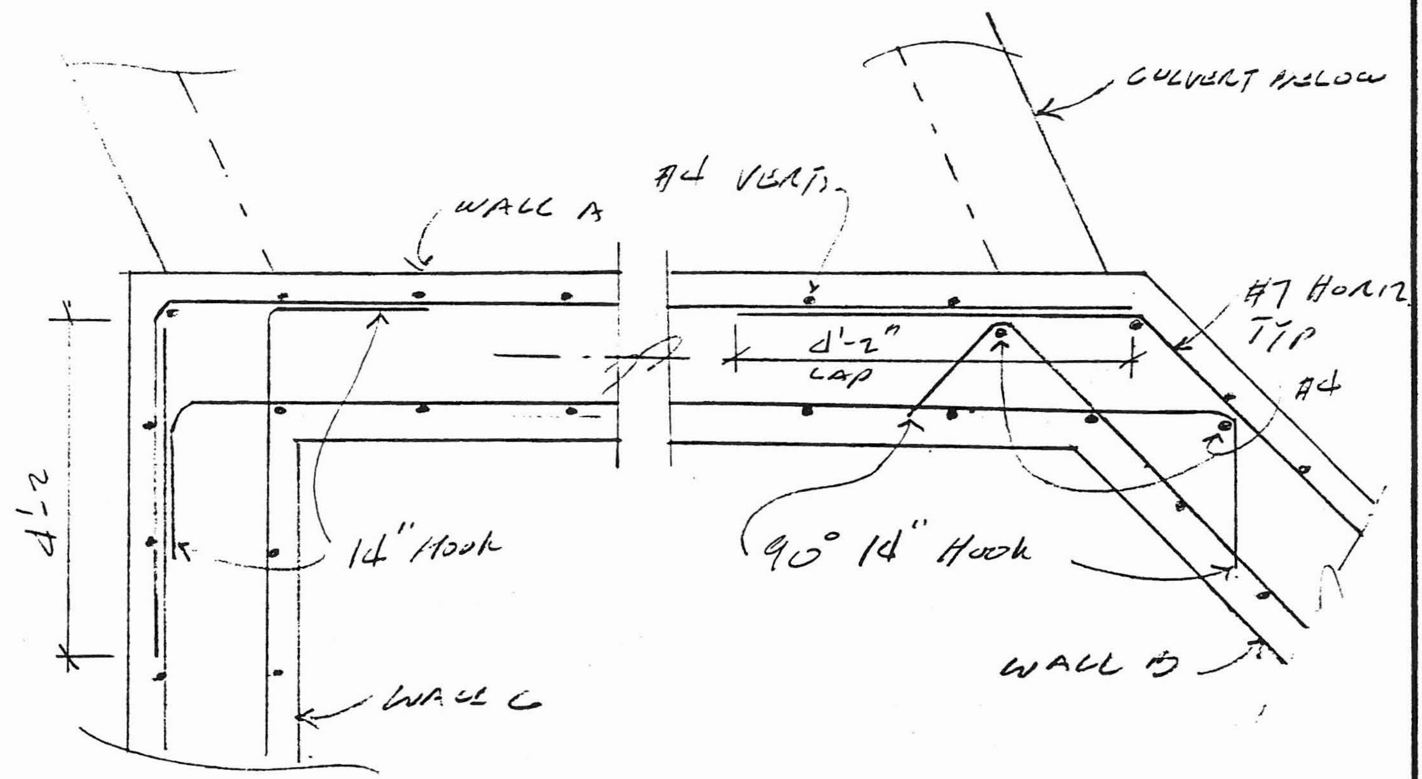
B

BKS Engineers, Inc. — CONSULTING ENGINEERS	GENERAL COMPUTATION SHEET	CALC. SET NO.	REV.	COMP. BY	CHK'D BY
		SHEET OF	0	DATE	DATE
		JOB NO.		DATE	DATE

PROJECT

CLIENT

SUBJECT



C-C / PLAN

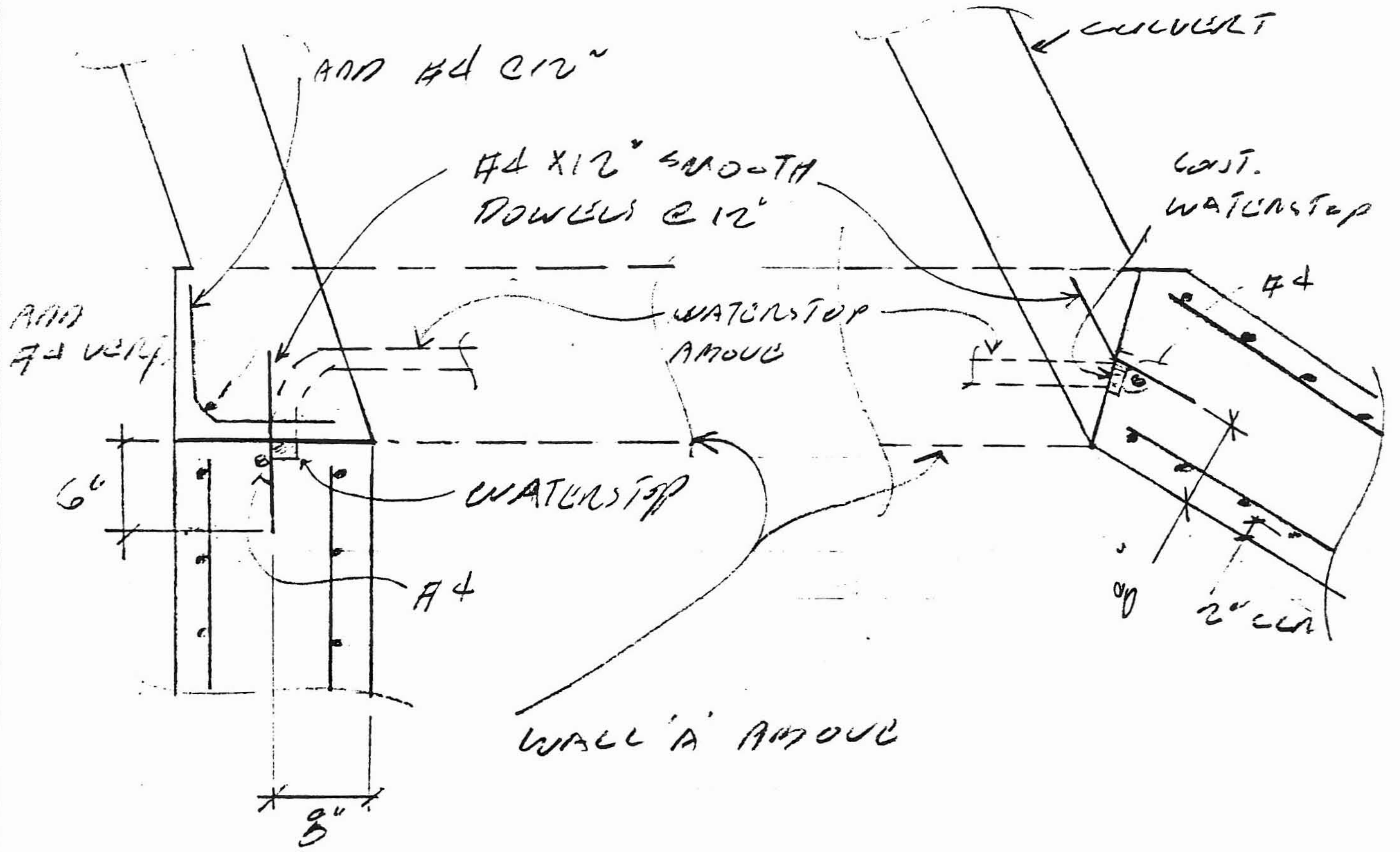
BKS Engineers, Inc. | CONSULTING ENGINEERS | GENERAL COMPUTATION SHEET

CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET 23 OF	0	DATE	DATE
JOB NO.		DATE	DATE

PROJECT

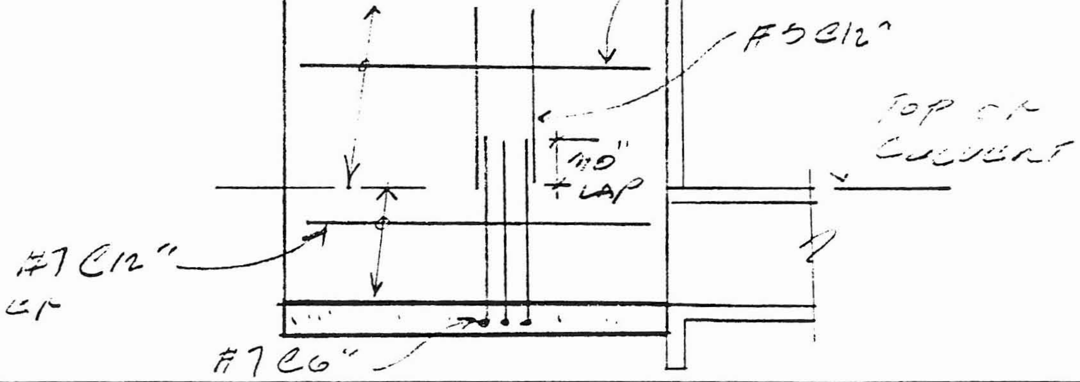
CLIENT

SUBJECT



D-D / PLAN

FOR REINF. IN WALLS B & C SEE BELOW



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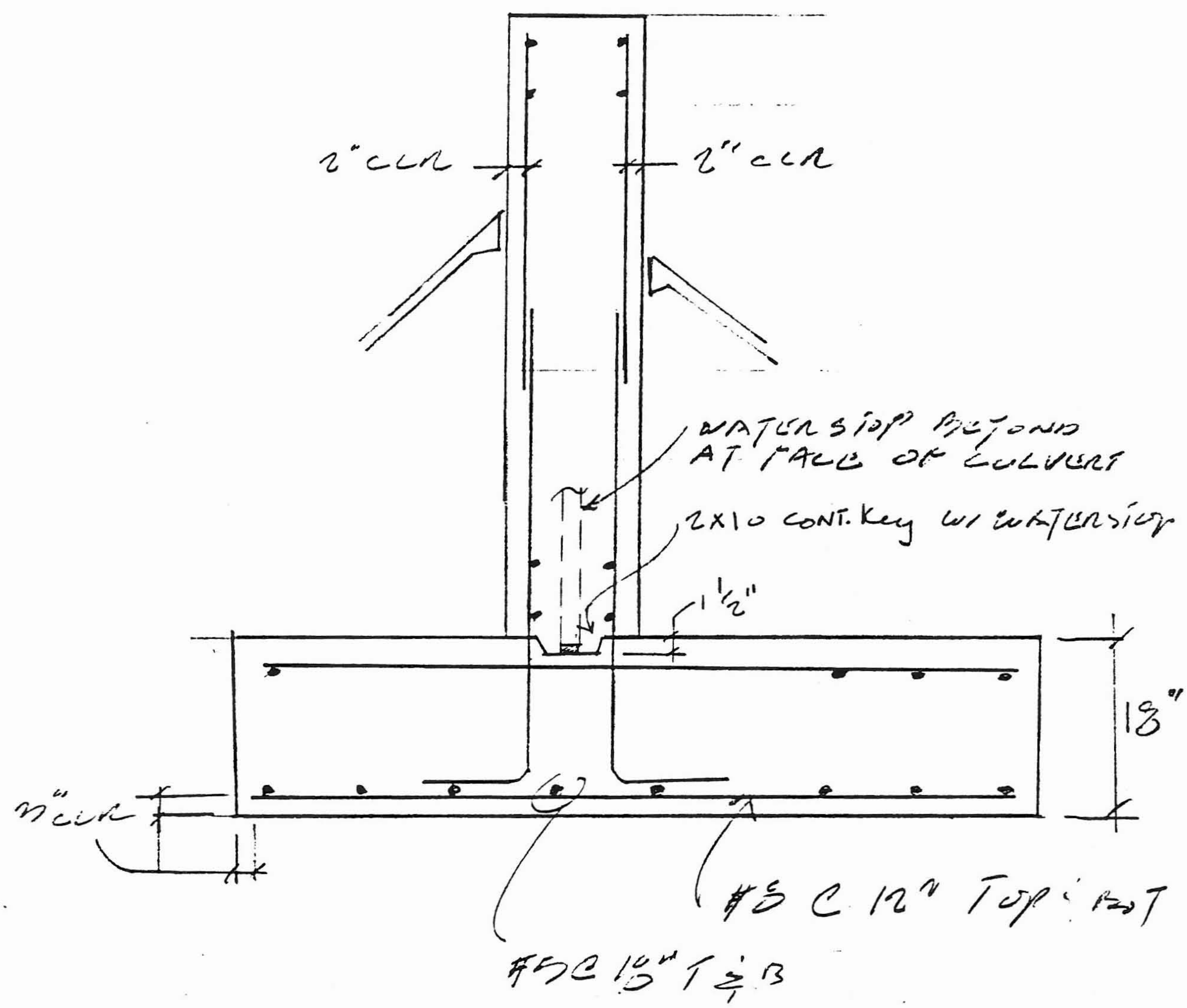
GENERAL COMPUTATION SHEET

CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET 22 OF	0	DATE	DATE
JOB NO.		DATE	DATE

PROJECT

CLIENT

SUBJECT



E

BKS Engineers, Inc. | CONSULTING ENGINEERS

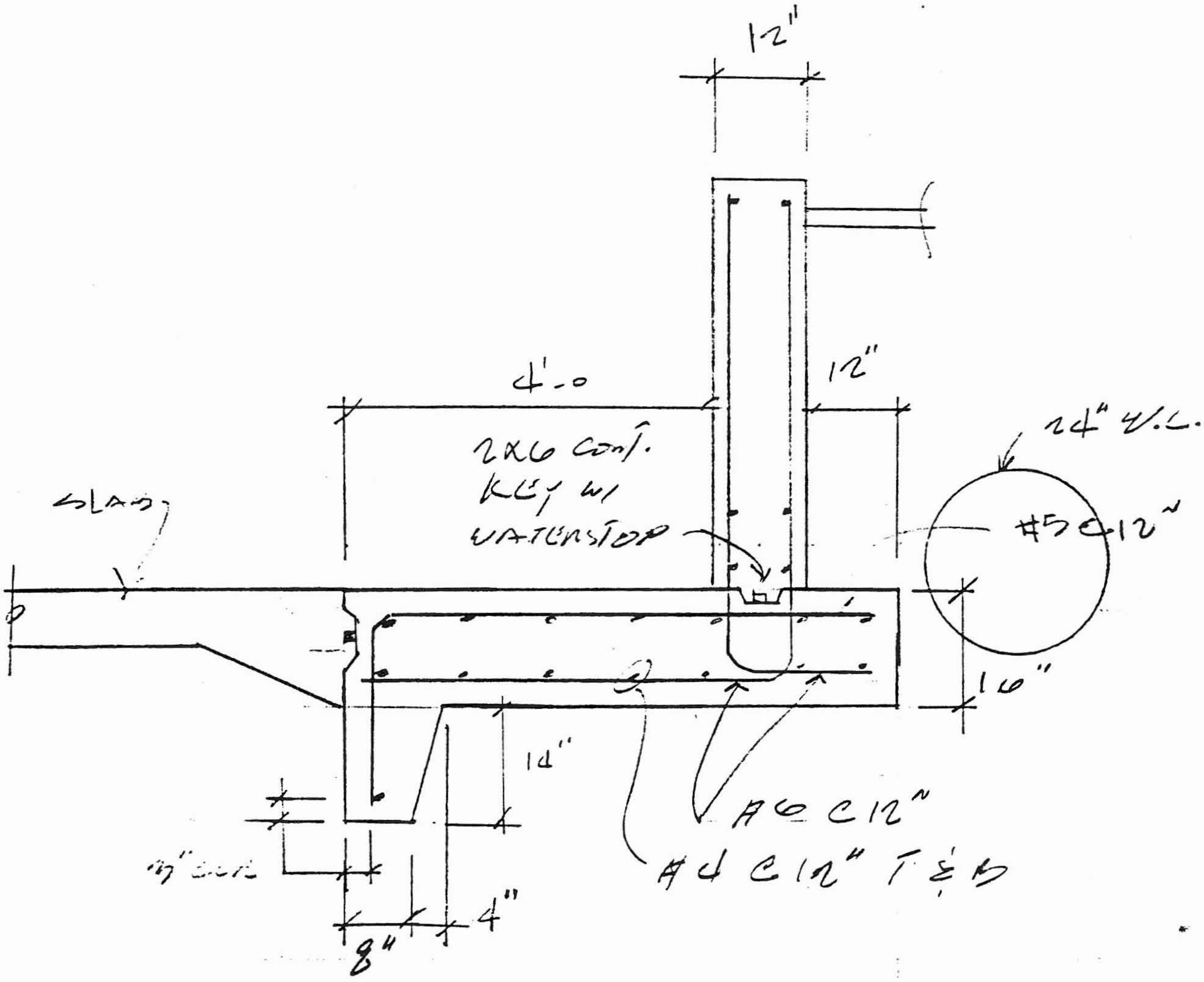
GENERAL COMPUTATION SHEET

CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET 25 OF	0	DATE	DATE
JOB NO.		DATE	DATE

PROJECT

CLIENT

SUBJECT



NORTH WALL SECTION LINES G, H, J & K

NOTE

CONTRACTOR SHALL VERIFY THAT THE EXIST'G 24" W.C. DOES NOT INTERFERE W/ WALL FTG. IN CASE OF SUCH INTERFERENCE NOTIFY ENGINEER

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GENERAL COMPUTATION SHEET

CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET 26 OF	0	RDG DATE	DATE
JOB NO. 94-502		DATE	DATE

PROJECT: OVERROUTE [illegible]

CLIENT: [illegible]

SUBJECT: BIKE RAIL / INVERTED WEB

DESIGN INVERTED WEB & RAIL FOR AASHTO

BIKE RAIL (2.7.2.2)

W = 50 plf (ALL SIMULTANEOUSLY)

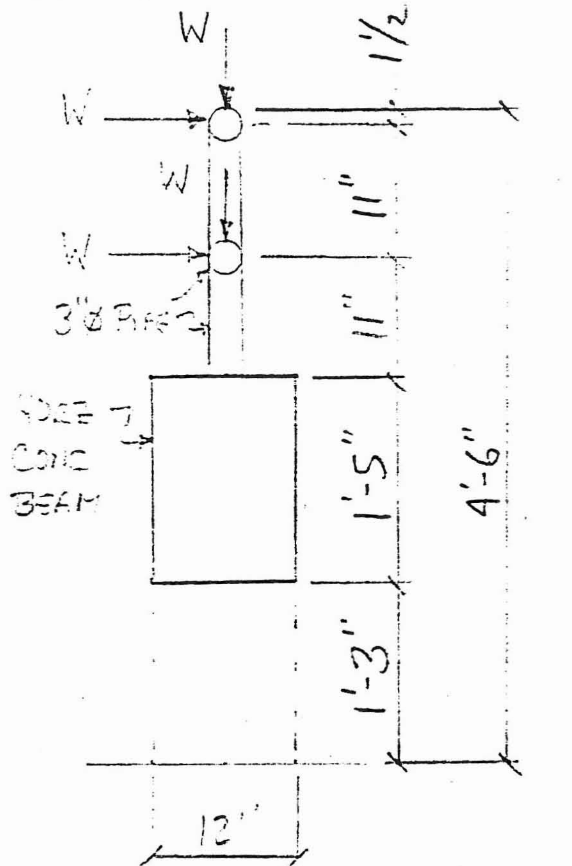
$W_{DL} = (1.0)(1.42')(.15) = .213$ KLF

RAIL = (2)(7.58 plf) = .015

.23 KLF

VERT LL = (2)(50) = .10

.33 KLF



MAX BEAM SPACING = 16.5'

$M_U = (.33)(16.5)^2/8 = 11.23$ K-FT

$d_1 = 17 - 2 - .375 - .75/2 = 14.25"$

b = 12"

A_s = [illegible] (14.25) = 0.43 in²

× 1⅓

0.57 in²

$V/I = \frac{(.33)(16.5)}{(14.25)(12)}$ = .32 psi ✓

M = [illegible] $(16.5)^2/8$ = 3.40 K-FT

d = 12 − 2 − .375 − .75/2 = 9.25" b = 17"

A_s = 3.40 [illegible] = 0.20 in²

× 1⅓

0.27 in²

A_s BAR REQ = .57/2 + .27/2 = 0.42 in² USE (2) #6 T&B

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GENERAL COMPUTATION SHEET

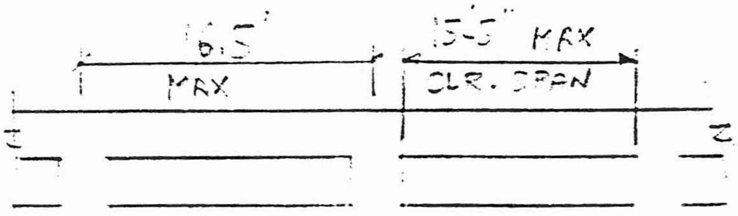
CALC. SET NO.	REV.	COMP. BY	CHK'D BY
SHEET 27 OF	0	[illegible] DATE	DATE
JOB NO. 94808		DATE	DATE

PROJECT: OVERCROUTE

CLIENT: [illegible]

SUBJECT: BIKE RAIL [illegible]

POSTS



[illegible] 2.7.2.2.5

M = [illegible](5.5) = 4.54 K-FT

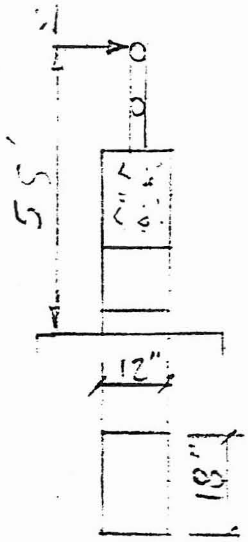
d = 12 - 2 - .375 - .75/2 = 9.25"

b = 15"

A_s = 4.54/(1.83)(9.25) = 0.27 in²

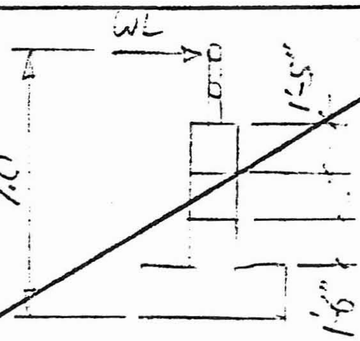
× 1 1/3

0.36 in²



USE (4) #6 & #3 TIES @ 12"

FOOTINGS (CONTINUOUS)



M = [illegible](1.0)(7.0) = 0.35 K-FT/FT

DL = [illegible](.42)(1.5)[illegible] = 0.32 KLF

(1.5)(1.0)(1.25)(.15)/15.5 = 0.02

(3.0)(1.0)(.15) = 0.45

0.79 KLF

[illegible](3.0/2) = 1.18 K-FT/FT [illegible] 1.18/0.35 = 3.37 (> 1.5 ✓)

[illegible] - 0.35/0.79 = 1.05 (FULL BEARING)

[illegible] = 0.79/(3.0) ± (6)(.79)(1.5-1.05)/(1)(3)² = 0.02 KSF, 0.50 KSF (< 2.0 ✓)

USE 3' WIDE FTS.

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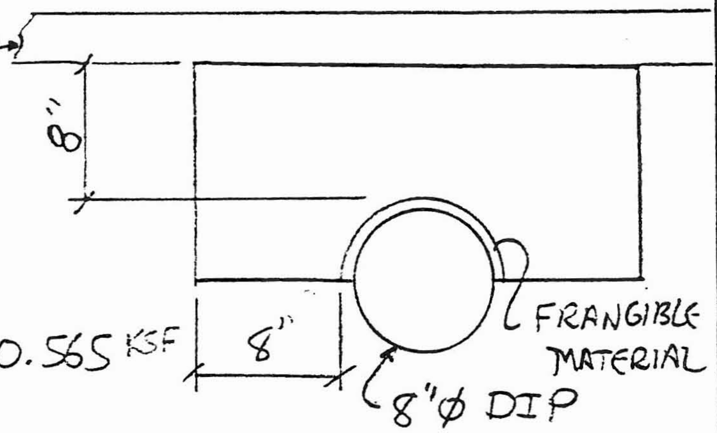
GENERAL COMPUTATION SHEET

CALC. SET NO.		REV.	COMP. BY	CHK'D BY
SHEET 28 OF		0	RGJ DATE	DATE
JOB NO. 94808			DATE	DATE

PROJECT OVERCHUTE

CLIENT FCDMC / SFC

SUBJECT SEWER CAP



LOADING

H20 OR 6'-3" HYDROSTATIC

$(6.25)(.0624) + (1.17)(0.15) = 0.565$ KSF

WORSE CASE 8" SIMPLE SPAN

WHEEL FOOTPRINT: $(.4)(40)/(100\text{psi})(144) = 1.11\ ft^2\ (>8")$, 14.4 KSF (> .565)

$M = (14.4)(8/12)^2/8 = 0.80$ K-FT/FT

$d = 8/2 = 4"$ $A_s = .8/(4)(1.76) = 0.11\ in^2/ft$

USE # 4@12"

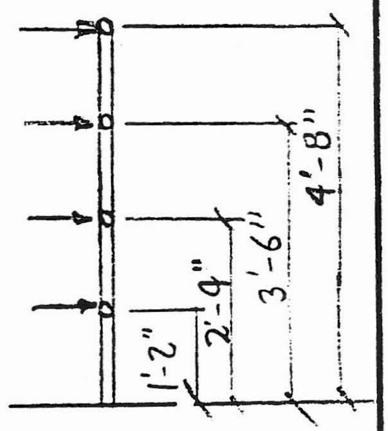
BKS Engineers, Inc. CONSULTING ENGINEERS	GENERAL COMPUTATION SHEET	CALC. SET NO.	REV.	COMP. BY	CHK'D BY
		SHEET 29 OF	0	RDT DATE	DATE
		JOB NO. 9480E		DATE	DATE

PROJECT OVERCHUTE

CLIENT FCDMC / SFC

SUBJECT PEDESTRIAN GUARDRAIL

GUARDRAIL @ SPILLWAY [AASHTO 2.7.2]



RAIL SPACING = 5'-7"

CHECK HORZ RAILS ASSUME PIPE STD 1 1/2

VERT LOAD = 2.72 p/f + 50 = 52.72

HORZ = 50 p/f

$M_V = (.05272)(5.58)^2/12 = 0.14^{K\text{-}FT}$ $f_b = 5.04^{KSI}$

$M_H = (.050)(5.58)^2/12 = 0.13^{K\text{-}FT}$ $f_b = 4.78^{KSI}$

$\frac{5.04}{20} + \frac{4.78}{20}$ 0.49

USE PIPE STD 1 1/2

CHECK POSTS ASSUME PIPE STD 2 1/2

$M = (.050)(5.58)(4.50) = 1.26^{K\text{-}FT}$

$f_b = (1.26)(12)/1.06 = 14.26^{KSI}$ (< 20 ✓)

USE 2 1/2" VERTS

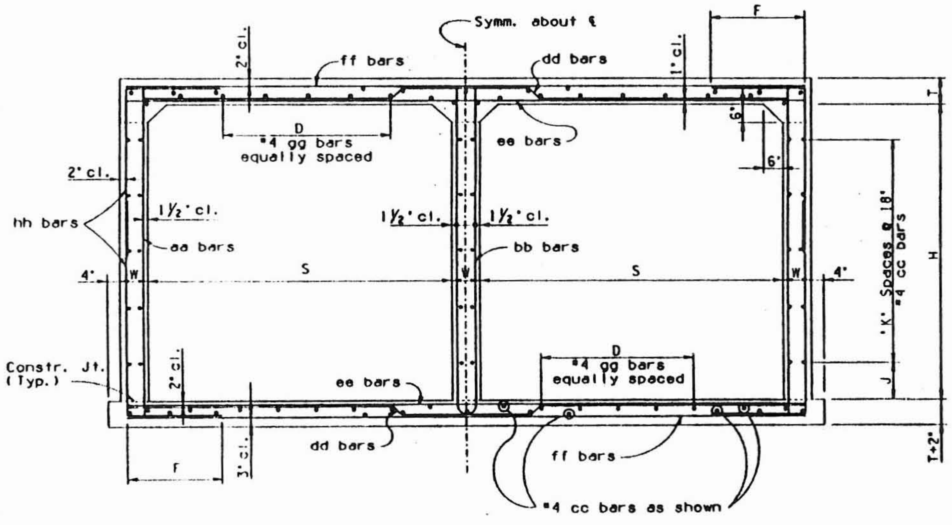
TABLE I
0'-10' FILL

Span 'S'	Height 'H'	Top Slab 'T'	Walls 'W'	aa Bar Size	aa Spacing	aa Length	bb Bar Size	bb Spacing	bb Length	cc Number ♦	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number ♦	gg D	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	9½"	8"	5	12"	4'-4	5	12"	8'-9	48	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	5'-1	2'-5
	4'	9½"	8"	5	12"	5'-4	5	12"	10'-9	54	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	5'-7	2'-5
	5'	9½"	8"	5	12"	6'-4	5	12"	12'-9	54	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	6'-1	2'-5
	6'	9½"	8"	5	12"	7'-4	5	12"	14'-9	60	5	14"	13'-2	4'-7	2'-7	6½"	5	14"	13'-7	5	14"	13'-7	20	3'-0	4	7"	6'-7	2'-5
	7'	9½"	8"	5	12"	8'-4	5	12"	16'-9	66	5	13"	13'-2	4'-7	2'-7	6½"	5	13"	13'-7	5	13"	13'-7	20	3'-0	4	6½"	7'-1	2'-5
8'	3'	9½"	9"	5	12"	4'-4	5	12"	8'-9	48	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	5'-6	2'-6
	4'	9½"	9"	5	12"	5'-4	5	12"	10'-9	54	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	6'-0	2'-6
	5'	9½"	9"	5	12"	6'-4	5	12"	12'-9	54	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	6'-6	2'-6
	6'	9½"	9"	5	12"	7'-4	5	12"	14'-9	60	6	14"	17'-2	6'-1	3'-8	6½"	6	14"	17'-10	6	14"	17'-10	28	4'-0	6	7"	7'-0	2'-6
	7'	9½"	9"	5	12"	8'-4	5	12"	16'-9	66	6	13"	17'-2	6'-1	3'-8	6½"	6	13"	17'-10	6	13"	17'-10	28	4'-0	5	6½"	7'-5	2'-6
	8'	9½"	9"	5	12"	9'-4	5	12"	18'-9	66	6	13"	17'-2	6'-1	3'-8	6½"	6	13"	17'-10	6	13"	17'-10	28	4'-0	6	6½"	8'-0	2'-6
10'	3'	10½"	11"	5	12"	4'-6	5	12"	9'-2	48	7	17"	21'-5	7'-7	4'-8	7½"	6	17"	22'-4	7	17"	22'-4	32	5'-0	6	8½"	6'-0	3'-0
	4'	10½"	11"	5	12"	5'-6	5	12"	11'-2	54	7	17"	21'-5	7'-7	4'-8	7½"	6	17"	22'-4	7	17"	22'-4	32	5'-0	6	8½"	6'-7	3'-0
	5'	10½"	11"	5	12"	6'-6	5	12"	13'-2	54	6	12"	21'-5	7'-7	4'-8	7½"	5	12"	22'-4	6	12"	22'-4	32	5'-0	5	6"	6'-8	2'-8
	6'	10½"	11"	5	12"	7'-6	5	12"	15'-2	60	6	12"	21'-5	7'-7	4'-8	7½"	5	12"	22'-4	6	12"	22'-4	32	5'-0	5	6"	7'-2	2'-8
	7'	10½"	11"	5	12"	8'-6	5	12"	17'-2	66	7	15"	21'-5	7'-7	4'-8	7½"	5	15"	22'-4	7	15"	22'-4	32	5'-0	6	7½"	7'-9	2'-8
	8'	10½"	11"	5	12"	9'-6	5	12"	19'-2	66	7	15"	21'-5	7'-7	4'-8	7½"	5	15"	22'-4	7	15"	22'-4	32	5'-0	6	7½"	8'-3	2'-8
	9'	10½"	11"	5	12"	10'-6	5	12"	21'-2	72	7	15"	21'-5	7'-7	4'-8	7½"	6	15"	22'-4	7	15"	22'-4	32	5'-0	6	7½"	8'-9	2'-8
	10'	10½"	11"	5	12"	11'-6	5	12"	23'-2	78	7	14"	21'-5	7'-7	4'-8	7½"	5	14"	22'-4	7	14"	22'-4	32	5'-0	6	7"	9'-3	2'-8
12'	8'	12½"	13"	5	12"	9'-10	5	12"	20'-0	66	7	13"	25'-8	9'-1	5'-6	9½"	5	13"	26'-10	7	13"	26'-10	40	6'-0	6	6½"	8'-6	2'-10
	9'	12½"	13"	5	12"	10'-10	5	12"	22'-0	72	8	16"	25'-8	9'-1	5'-6	9½"	5	16"	26'-10	8	16"	26'-10	40	6'-0	6	8"	9'-0	2'-10
	10'	12½"	13"	5	12"	11'-10	5	12"	24'-0	78	8	16"	25'-8	9'-1	5'-6	9½"	5	16"	26'-10	8	16"	26'-10	40	6'-0	6	8"	9'-6	2'-10
	11'	12½"	13"	5	12"	12'-10	5	12"	26'-0	78	7	12"	25'-8	9'-1	5'-6	9½"	4	12"	26'-10	7	12"	26'-10	40	6'-0	6	6"	10'-0	2'-10
	12'	12½"	13"	5	12"	13'-10	5	12"	28'-0	84	7	12"	25'-8	9'-1	5'-6	9½"	5	12"	26'-10	7	12"	26'-10	40	6'-0	6	6"	10'-6	2'-10

TABLE NO. II
10'-15' FILL

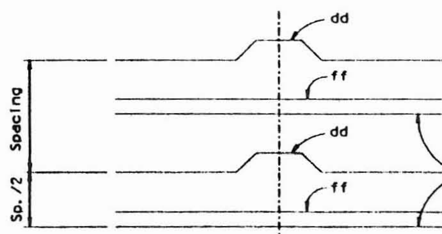
Span 'S'	Height 'H'	Top Slab 'T'	Walls 'W'	aa Bar Size	aa Spacing	aa Length	bb Bar Size	bb Spacing	bb Length	cc Number ♦	dd Bar Size	dd Spacing	dd Length	dd A	dd B	dd C	ee Bar Size	ee Spacing	ee Length	ff Bar Size	ff Spacing	ff Length	gg Number ♦	gg D	hh Bar Size	hh Spacing	hh Length	hh F
6'	3'	8"	8"	5	12"	4'-1	5	12"	8'-3	48	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	5'-0	2'-5
	4'	8"	8"	5	12"	5'-1	5	12"	10'-3	54	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	5'-6	2'-5
	5'	8"	8"	5	12"	6'-1	5	12"	12'-3	54	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	6'-0	2'-5
	6'	8"	8"	5	12"	7'-1	5	12"	14'-3	60	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	6'-6	2'-5
	7'	8"	8"	5	12"	8'-1	5	12"	16'-3	66	5	14"	13'-0	4'-7	2'-10	5"	5	14"	13'-7	5	14"	13'-7	16	3'-0	4	7"	7'-0	2'-5
8'	3'	10½"	9"	5	12"	4'-6	5	12"	9'-2	48	6	13"	17'-3	6'-1	3'-6	7½"	5	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	5'-3	2'-6
	4'	10½"	9"	5	12"	5'-6	5	12"	11'-2	54	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	5'-9	2'-6
	5'	10½"	9"	5	12"	6'-6	5	12"	13'-2	54	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	6'-3	2'-6
	6'	10½"	9"	5	12"	7'-6	5	12"	15'-2	60	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	6'-9	2'-6
	7'	10½"	9"	5	12"	8'-6	5	12"	17'-2	66	6	13"	17'-3	6'-1	3'-6	7½"	4	13"	17'-10	6	13"	17'-10	20	4'-0	4	6½"	7'-3	2'-6
	8'	10½"	9"	5	12"	9'-6	5	12"	19'-2	66	6	12"	17'-3	6'-1	3'-6	7½"	4	12"	17'-10	6	12"	17'-10	20	4'-0	4	6"	7'-9	2'-6
10'	3'	12½"	11"	5	12"	4'-10	5	12"	9'-10	48	7	14"	21'-6	7'-7	4'-4	9½"	4	14"	22'-4	7	14"	22'-4	24	5'-0	5	7"	5'-10	2'-8
	4'	12½"	11"	5	12"	5'-10	5	12"	11'-10	54	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	4	6½"	6'-4	2'-8
	5'	12½"	11"	5	12"	6'-10	5	12"	13'-10	54	7	14"	21'-6	7'-7	4'-4	9½"	4	14"	22'-4	7	14"	22'-4	24	5'-0	5	7"	6'-10	2'-8
	6'	12½"	11"	5	12"	7'-10	5	12"	15'-10	60	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	7'-4	2'-8
	7'	12½"	11"	5	12"	8'-10	5	12"	17'-10	66	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	7'-10	2'-8
	8'	12½"	11"	5	12"	9'-10	5	12"	19'-10	66	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	8'-4	2'-8
	9'	12½"	11"	5	12"	10'-10	5	12"	21'-10	72	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	8'-10	2'-8
	10'	12½"	11"	5	12"	11'-10	5	12"	23'-10	78	7	13"	21'-6	7'-7	4'-4	9½"	4	13"	22'-4	7	13"	22'-4	24	5'-0	5	6½"	9'-4	2'-8
12'	8'	15"	13"	5	12"	10'-3	5	12"	20'-9	66	8	15"	25'-7	9'-1	5'-1	12"	4	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	8'-9	2'-11
	9'	15"	13"	5	12"	11'-3	5	12"	22'-9	72	8	15"	25'-7	9'-1	5'-1	12"	4	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	9'-3	2'-11
	10'	15"	13"	5	12"	12'-3	5	12"	24'-9	78	8	15"	25'-7	9'-1	5'-1	12"	5	15"	26'-10	8	15"	26'-10	28	6'-0	6	7½"	9'-9	2'-11
	11'	15"	13"	5	12"	13'-3	5	12"	26'-9	78	8	14"	25'-7	9'-1	5'-1	12"	4	14"	26'-10	8	14"	26'-10	28	6'-0	5	7"	10'-9	3'-5
	12'	15"	13"	5	12"	14'-3	5	12"	28'-9	84	8	14"	25'-7	9'-1	5'-1	12"	5	14"	26'-10	8	14"	26'-10	28	6'-0	6	7"	11'-3	3'-5

♦ Total number of bars in the cross-section.

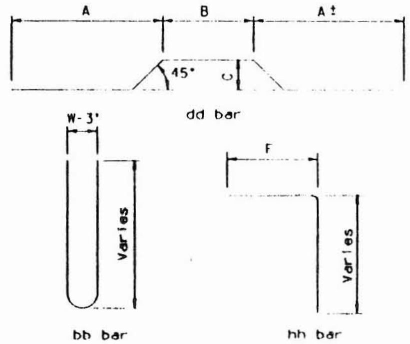


TYPICAL SECTION

Height 'H'	'J' Dim.	'K' Spaces
3'	9"	1
4'	3"	2
5'	12"	2
6'	9"	3
7'	3"	4
8'	12"	4
9'	9"	5
10'	3"	6
11'	12"	6
12'	9"	7



REINFORCING BAR PLACING DIAGRAM



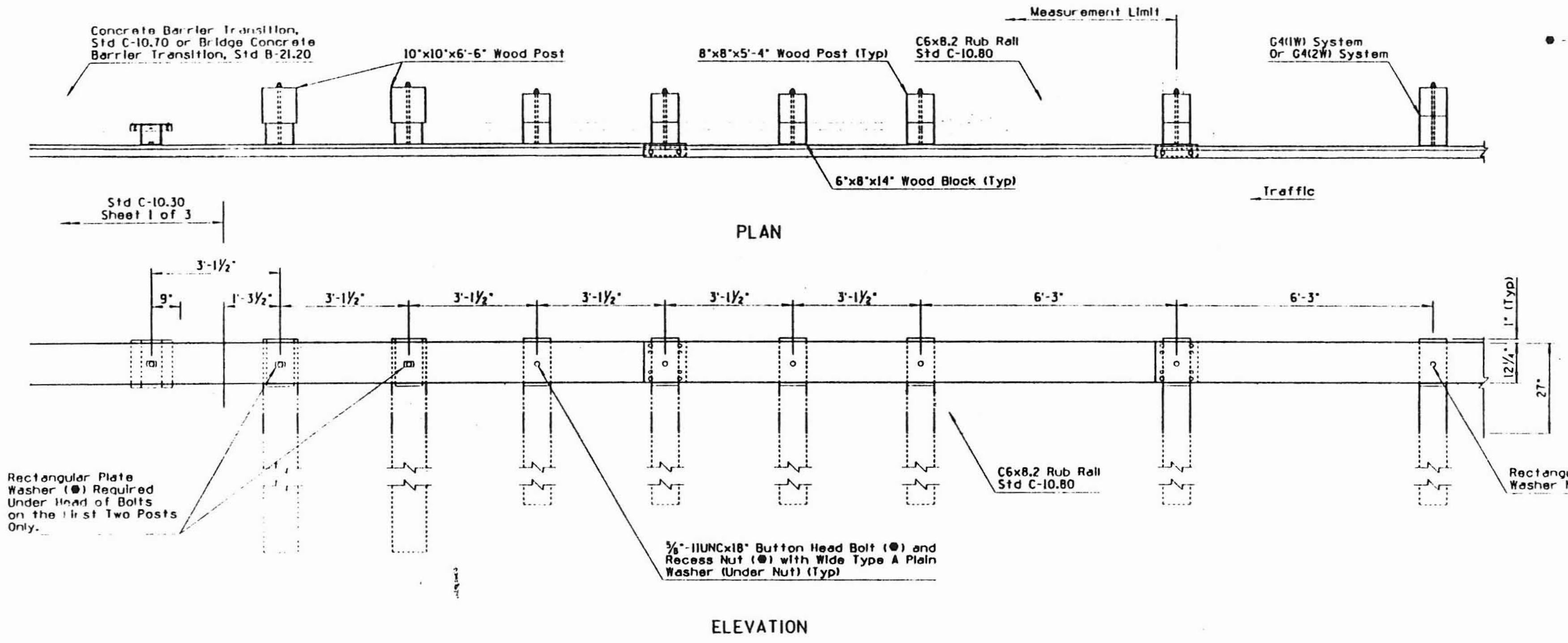
BENDS

NOTE:
See B-02.25 for Tables III thru V.
See B-01.10 for General Notes and Miscellaneous Details.
See B-02.70 for Quantities.

DESIGN APPROVED	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STANDARD DRAWINGS	REVISION 7-88
APPROVED FOR DISTRIBUTION	DOUBLE BARREL BOX CULVERT	STANDARD No. B-02.2[illegible]

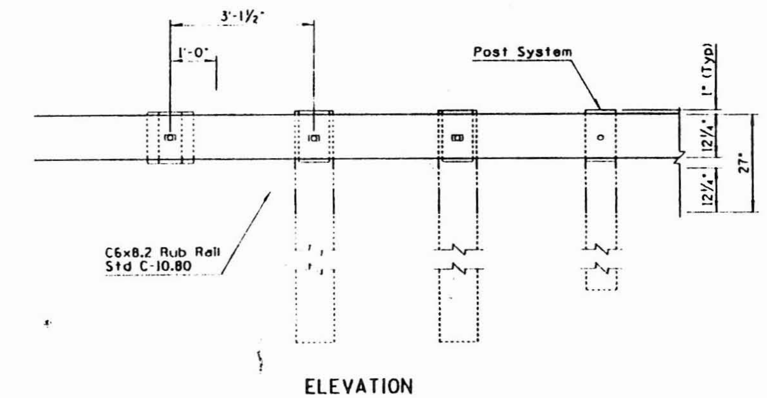
GENERAL NOTES

● - Indicates ARTBA designation



Guard Rail Transition (Timber Post)

Note:
For Notes and Dimensions Not Shown, See Guard Rail Transition Above.

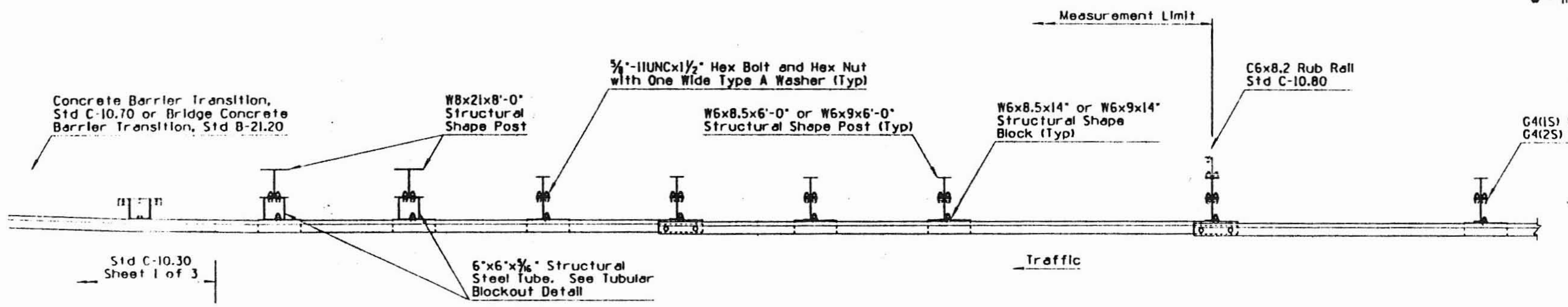


Guard Rail Transition To Existing Concrete Barrier Transition

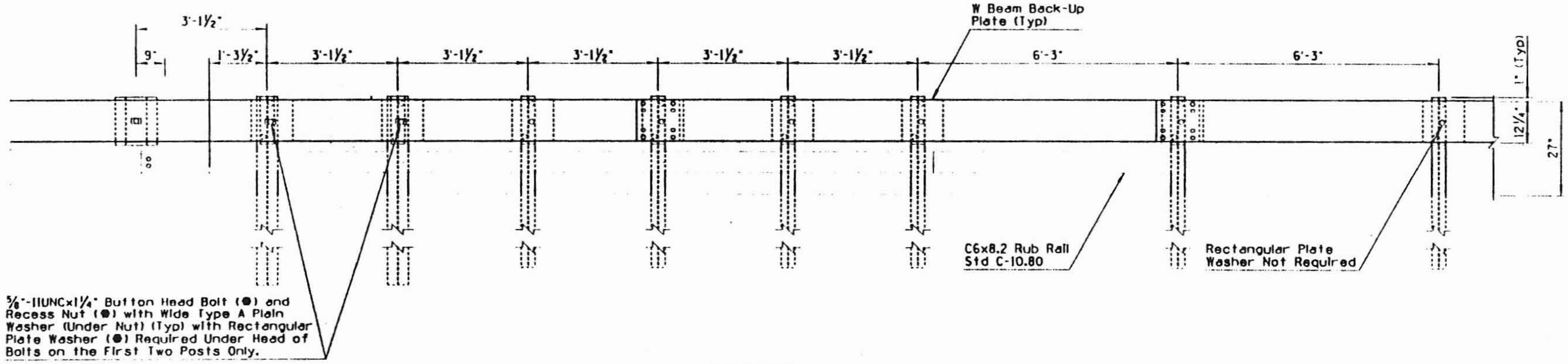
DESIGN APPROVED	STATE OF ARIZONA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS STANDARD DRAWINGS	3/94
APPROVED FOR DISTRIBUTION	GUARD RAIL TRANSITION W BEAM TO CONCRETE HALF BARRIER (APPROACH)	DRAWING NO C-10.30 Sheet 2 of 3

GENERAL NOTES

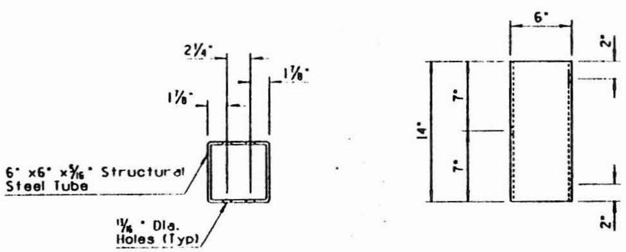
● - Indicates ARTBA designation



PLAN



ELEVATION



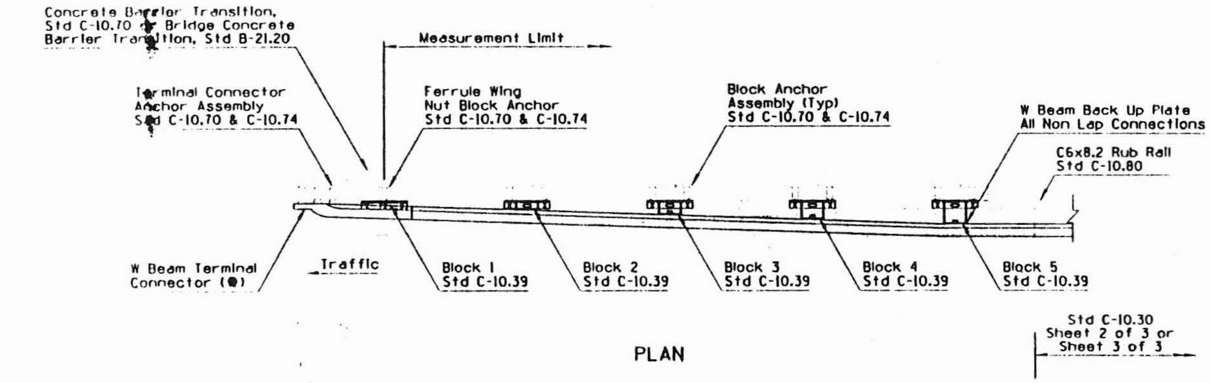
TUBULAR BLOCKOUT DETAIL

Guard Rail Transition
(Steel Post)

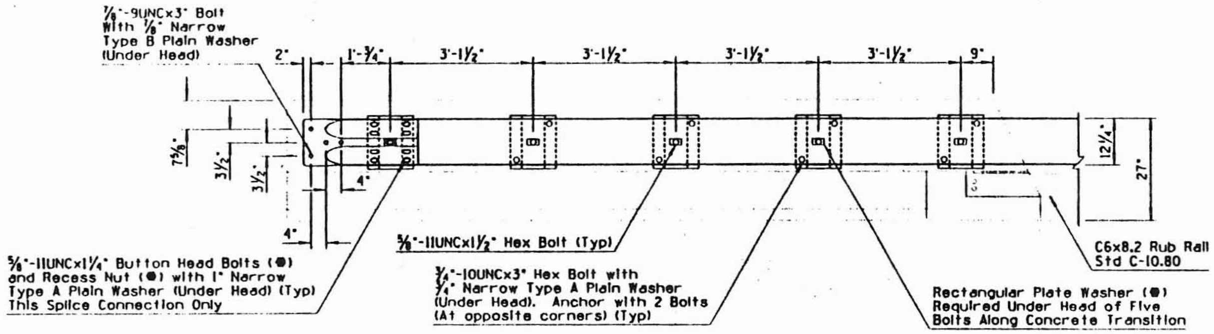
DESIGN APPROVED	STATE OF ARIZONA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS STANDARD DRAWINGS	3/94
APPROVED FOR DISTRIBUTION	GUARD RAIL TRANSITION, W BEAM TO CONCRETE HALF BARRIER (APPROACH)	DRAWING NO. C-10.30 Sheet 3 of 3

GENERAL NOTES

● - Indicates ARTBA designation



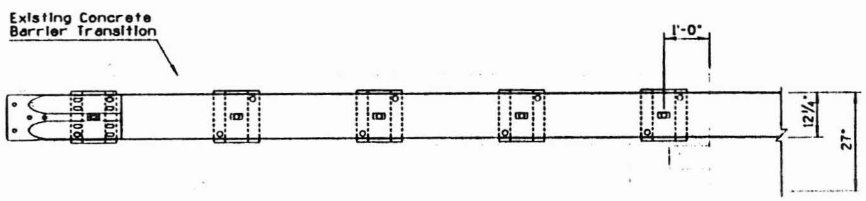
PLAN



ELEVATION

Guard Rail Transition

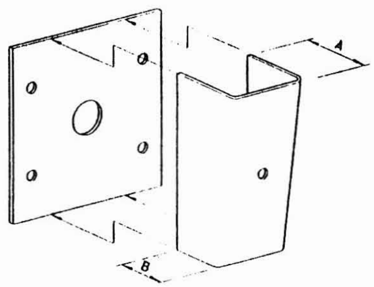
Note:
For Notes and Dimensions Not Shown, See Guard Rail Transition Above



ELEVATION

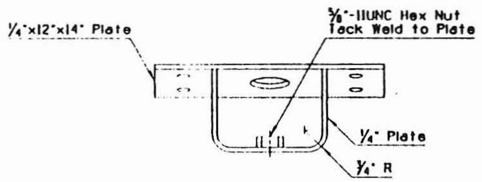
Guard Rail Transition To Existing Concrete Barrier Transition

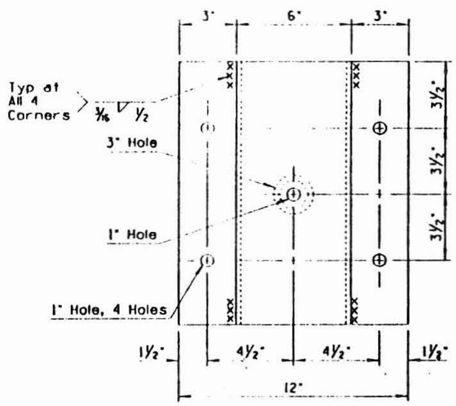
DESIGN APPROVED / APPROVED FOR DISTRIBUTION	STATE OF ARIZONA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS STANDARD DRAWINGS	3/94
	GUARD RAIL TRANSITION W BEAM TO CONCRETE HALF BARRIER (APPROACH)	DRAWING NO. C-10.30 Sheet 1 of 3

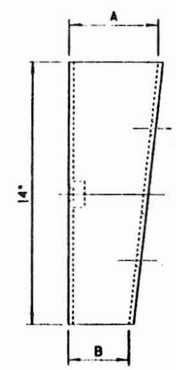


BLOCK	DIMENSION A	DIMENSION B
2	1¼"	⅞"
3	2½"	1¾"
4	3¹¹⁄₁₆"	2⅝"
5	4¹⁵⁄₁₆"	3⁷⁄₁₆"

Note:
Block 1 is a ¼"x12"x14" Plate

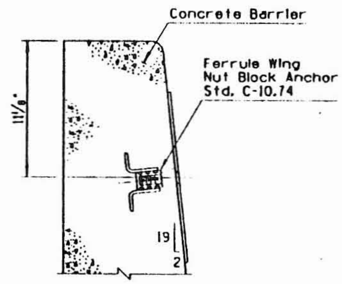




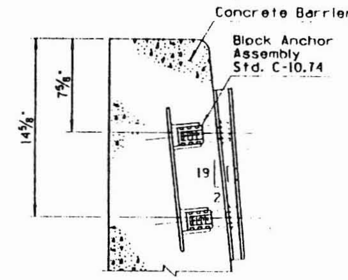


Blocks 2,3,4 and 5

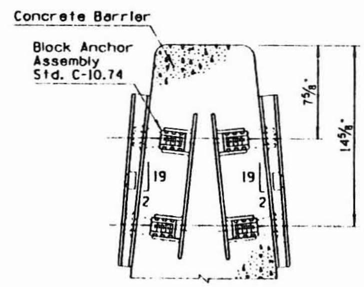
BLOCK DETAILS



HALF BARRIER
(BLOCK 1 SHOWN)



HALF BARRIER
(BLOCK 2 SHOWN)



MEDIAN BARRIER
(BLOCK 2 SHOWN)

BLOCK AND ANCHORAGE DETAILS

DESIGN APPROVED	STATE OF ARIZONA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS STANDARD DRAWINGS	3/94
APPROVED FOR DISTRIBUTION	HARDWARE FOR W BEAM TRANSITION TO CONCRETE BARRIER	DRAWING NO. C-10.39

GENERAL NOTES:

Construction - Arizona Department of Transportation Standar[d] Specifications for Road and Bridge Construction, Editi[on] of 1982, revised to date.

Design - AASHTO Standard Specification for Highway Bridges 1983, revised to date.

Loading - Class HS20-44

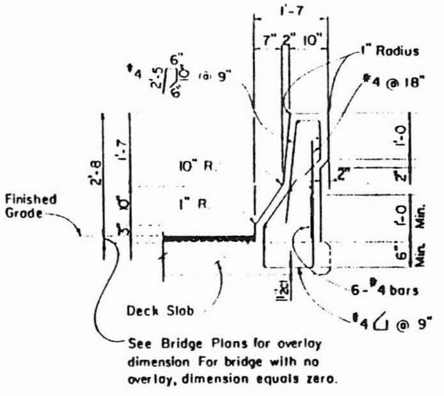
All concrete shall be Class "S" f'_c = 3000 psi.

Reinforcing steel shall conform to ASTM Specification A6[15]. Bar sizes are designed as Grade 40 and furnished as Grade 40 or Grade 60. f_s = 20,000 psi

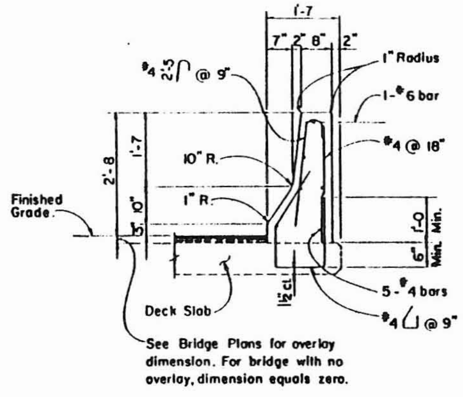
All dimensions for reinforcing steel shall be to center of b[ar] unless noted otherwise.

All reinforcing steel shall have 2" clear cover unless note[d] otherwise.

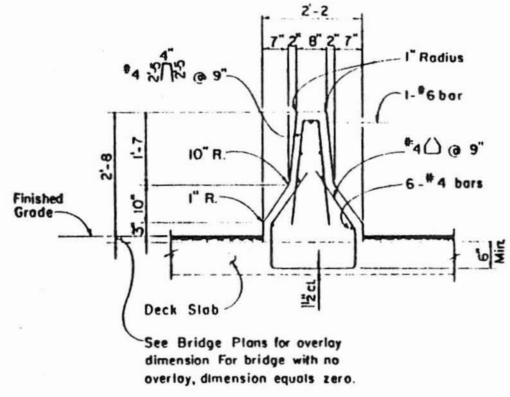
Dimensions shall not be scaled from drawing.



TYPE A



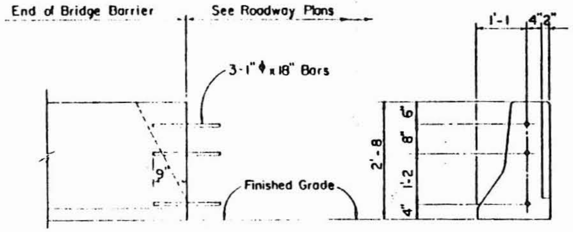
TYPE B



TYPE C

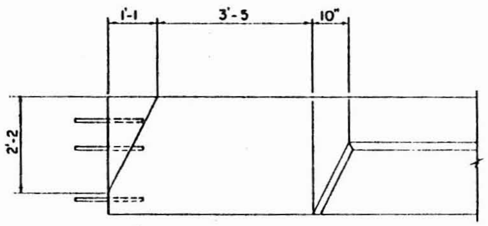
APPROXIMATE QUANTITIES		
Barrier Type	Class "S" Conc. f'_c = 3000 psi C.Y.	Reinf Steel Lbs
A	0.0985	8.995
B	0.0918	8.758
C	0.1178	10.312

NOTE:
Quantities are per lineal foot with no overlay. Reinforcing bars embedded in deck slab are not included in Reinforcing Steel Quantity.



ROADWAY ELEVATION

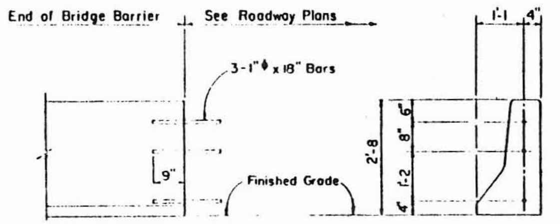
END VIEW



FASCIA ELEVATION

NOTE:
Details A, B and C show end treatment of concrete barriers and are to be used unless other end treatment is called for on plans.

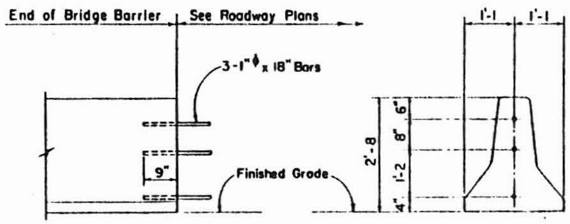
DETAIL A
(Use with Barrier Detail Type A)



ELEVATION

END VIEW

DETAIL B
(Use with Barrier Detail Type B)



ELEVATION

END VIEW

DETAIL C
(Use with Barrier Detail Type C)

DESIGN APPROVED

APPROVED FOR DISTRIBUTION

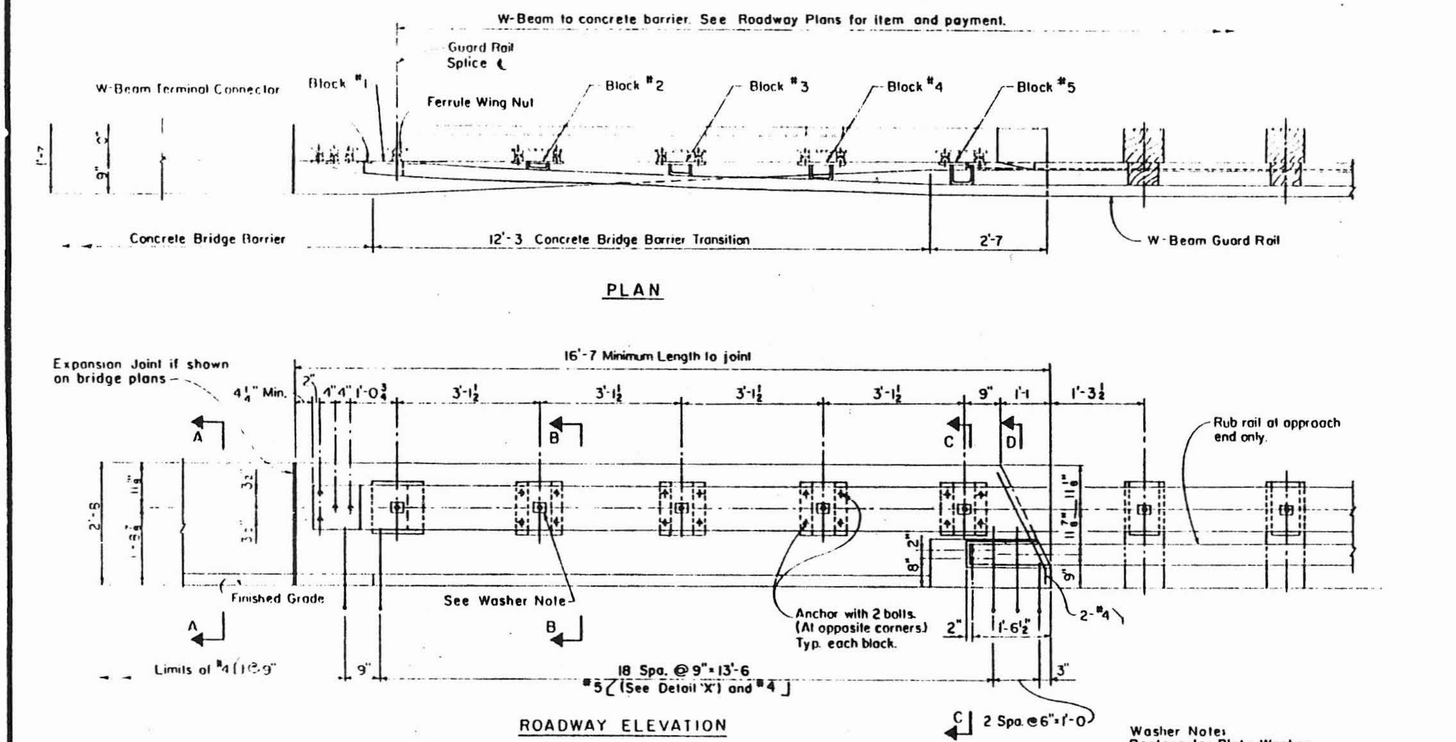
ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

BRIDGE CONCRETE BARRIER DETAILS

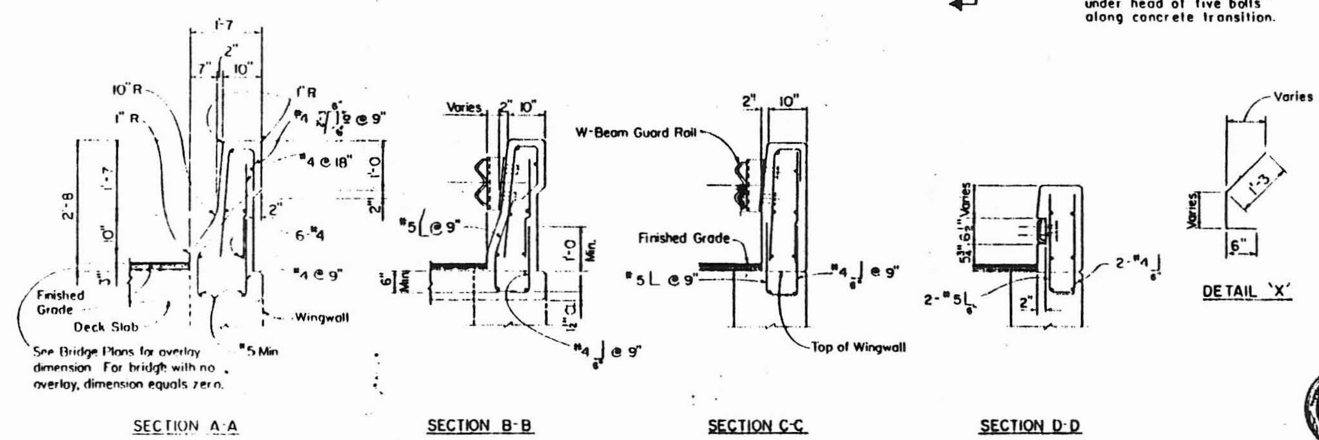
B-21.

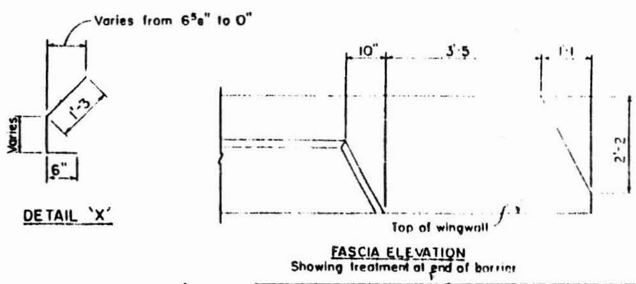
DESIGN | DRAWN | CHECKED

DESCRIPTION OF REVISIONS | MADE BY | DATE



Washer Note: Rectangular Plate Washer (ARTBA designation) required under head of five bolts along concrete transition.





GENERAL NOTES

Construction - Arizona Department of Transportation Standard Specifications for Road and Bridge Construction.

Design - AASHTO Standard Specifications for Highway Bridges, 1983, revised to date.

All concrete shall be Class S, f'_c = 3000 psi.

Reinforcing Steel shall conform to ASTM Specification A 615. Bar size #5 and smaller are designed as grade 40 and furnished as Grade 40 or Grade 60, fs = 20,000 psi.

All dimensions for reinforcing steel shall be to center of bars unless noted otherwise.

All reinforcing steel shall have 2" clear cover unless noted otherwise.

Structural Steel shall conform to ASTM Specification A36 unless noted otherwise.

The terminal connectors and blocks shall be galvanized after fabrication in accordance with ASTM Spec. A123.

Bolts and washers shall be galvanized or, at the contractors option, stainless steel bolts and washers may be used as an alternate for the ⅞" ø x 2¾" galvanized bolts and washers. They shall conform to or exceed the mechanical requirements of ASTM A 307.

Terminal connectors, blocks and hardware shall be furnished and installed with roadway approach guard rail.

Insert assemblies shall be placed in new construction.

Ferrules shall be made from steel meeting the requirements of ASTM A108, grade 12 L 14.

Wire struts shown in the insert assembly shall have a minimum tensile strength of 100,000 psi.

The insert assembly shall be assembled in the shop. Bolt threads may be re-cut as necessary to insure fit.

The Bridge Quantities include all concrete and reinforcing steel for barrier transition.

The cost of the insert assembly will consist of the insert assembly, bolts and washers complete in place and shall be included in the unit price bid for barrier concrete.

See Std. B-21.21 for Terminal Connector Assembly, Ferrule Wing Nut and Block Details.

Dimensions shall not be scaled from drawings.

APPROXIMATE QUANTITIES	
Class 'S' Concrete	1.516 CY
Reinforcing Steel	141 lbs.

Note: Quantities are for one transition 16'-7 in length with no overlay. Reinf. bars embedded in deck slab or wingwall are not included in Reinf. Steel Quantity.

NO.	DESCRIPTION OF REVISIONS	MADE BY	DATE
1	Add Block #1, Washer, etc.	JEM	10-86
2	Add Detail X	JEM	3-88

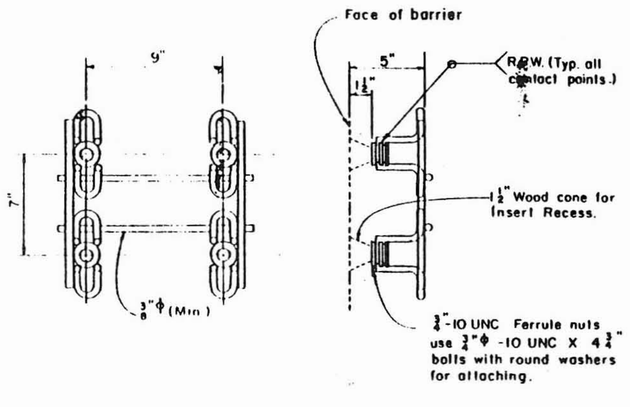
DESIGN JEM 3-85
DRAWN JEM 3-85
CHECKED KW 3-85

DESIGN APPROVED
APPROVED FOR DISTRIBUTION

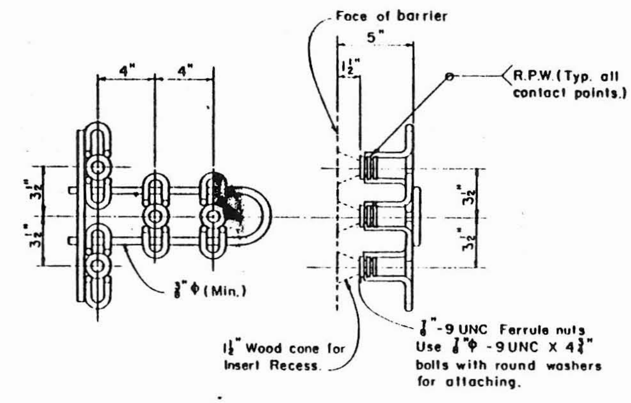
ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

BRIDGE
CONCRETE BARRIER TRANSITION

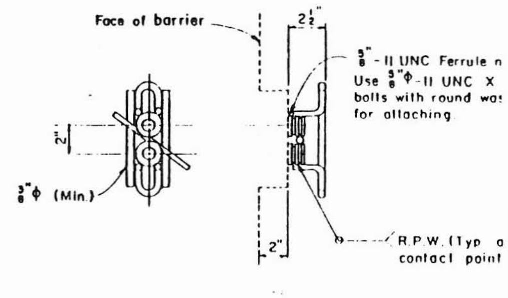
B-



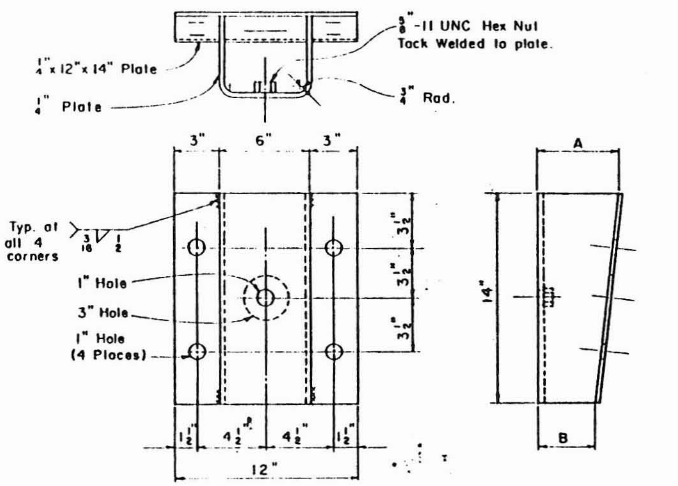
BLOCK ANCHOR ASSEMBLY



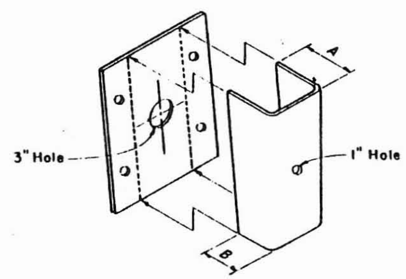
TERMINAL CONNECTOR ANCHOR ASSEMBLY



RUB RAIL
TERMINAL ANCHOR

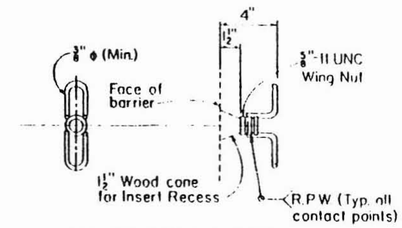


BLOCK DETAILS



DIMENSIONS		
Block #	A	B
2	1¼"	⅞"
3	2½"	1¾"
4	3 11/16"	2⅝"
5	4 15/16"	3 7/16"

Note: Block #1 is a ℄ 12" x ¼" x 14"



FERRULE WING NUT DETAIL

NO.	DESCRIPTION OF REVISIONS	MADE BY	DATE
1	Changed Bl. Dim. & add Wing Nut Det.	JEM	2-85
2	Revised Block Dimensions	JEM	10-86
3			

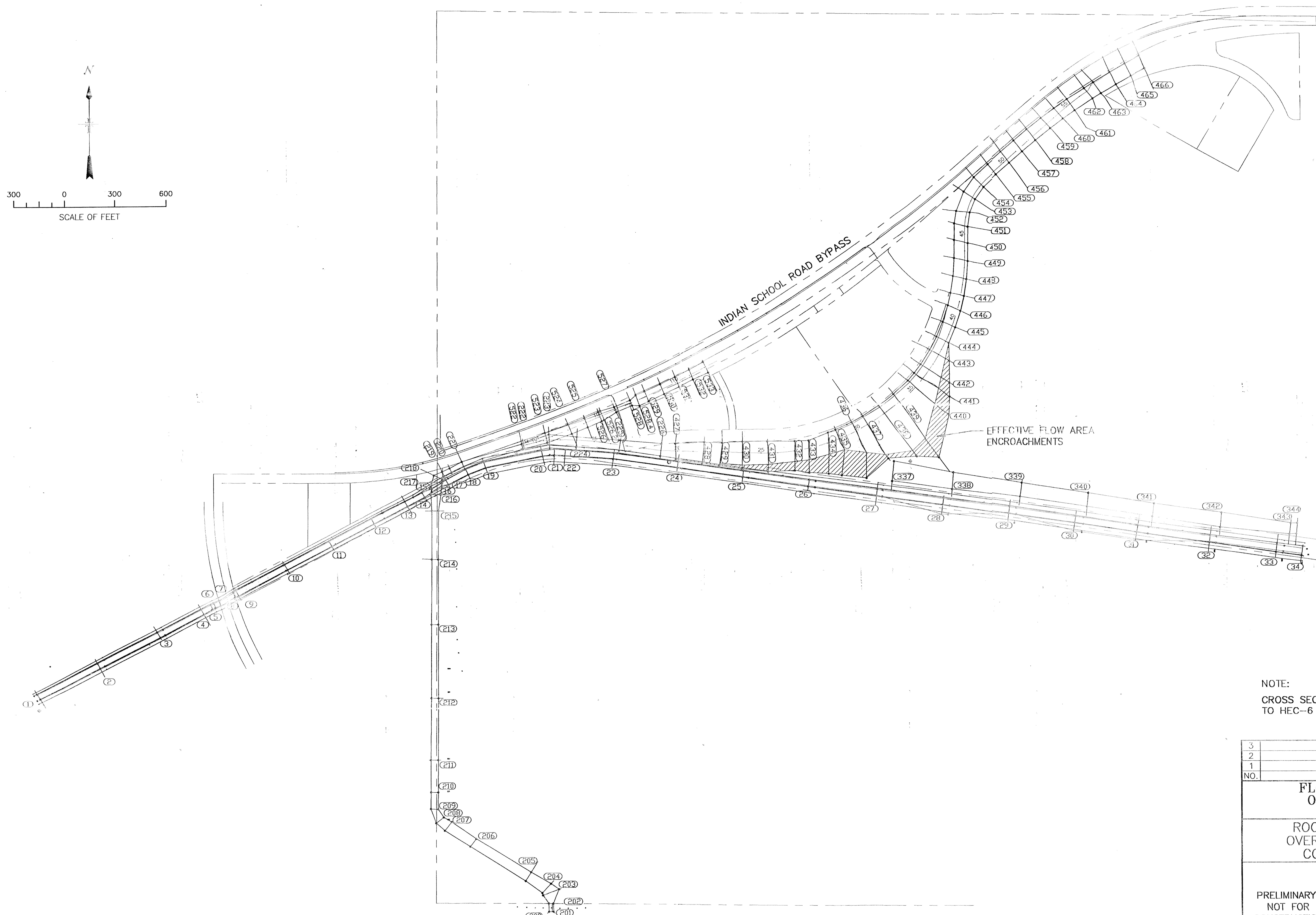
DESIGN WEB 12-82
DRAWN
CHECKED

DESIGN APPROVED
APPROVED FOR DISTRIBUTION

ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
STANDARD DRAWINGS

BLOCK AND TERMINAL CONNECTOR ASSEMBLY DETAILS

B-2



NOTE:

CROSS SECTION NUMBERS 428 – 443 APPLY TO HEC-6 ANALYSIS ONLY

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

ROOSEVELT IRRIGATION DISTRICT
OVERCHUTE PROJECT – PHASE 2
CONTRACT NO. FCD-94-07

		BY	DATE
PRELIMINARY NOT FOR CONSTRUCTION	DESIGNED	G. BRADY	5/13/97
	DRAWN	D. SENUM	5/13/97
	CHECKED	T. KOENEKAMP	5/13/97

SFC Engineering Company
7776 Pointe Parkway W, Suite 290
Phoenix, Arizona 85044
Phone: (602) 438-2200
Fax: (602) 431-9562

HEC-2 HYDROLOGIC ANALYSIS
SECTION LOCATIONS

SHEET 1 OF 1

FILE NAME: ROOCH12.DWG

Hydrologic Analysis

for

Roosevelt Irrigation District (RID) Canal Overchute

at Litchfield Road

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

May, 1997

Table of Contents

1. Introduction

Hydrologic analysis is conducted for Roosvelt Irrigation District (RID) overchute study by using HEC-1 modeling. The HEC-1 model is developed by modifying previous HEC-1 models which were developed by FCDMC (1995, 1996). The drainage map can be seen in Figure 1. The project site can be seen in Figure 2. The results are shown in Table 1.

2. Previous Hydrologic Analyses

2.1 White Tanks/Agua Fria ADMS HEC-1 Model (WLB, 1992)

The drainage area for White Tanks/Agua Fria ADMS is approximately 220 square miles with approximately 2/3 of the watershed draining to the Gila River and 1/3 of the watershed draining to the Agua Fria River (WLB, 1992). Figure 2 shows the drainage area for White Tanks/Agua Fria ADMS. The hydrologic methodology was based on "Hydrologic Design Manual for Maricopa County, Arizona" dated April, 1990. The following are a summary of important hydrologic parameters for the White Tanks/Agua Fria ADMS HEC-1 model:

- Storm frequency and duration: 100-year, 24 hour;
- Rainfall amount: 4.03 inches
- Rainfall distribution pattern: SCS Type II
- Unit hydrograph: The Phoenix valley S-graph
- Rainfall loss model: Green-Ampt
- Channel routing procedure: Modified Puls

2.2 1995 RID HEC-1 Model (FCDMC, 1995)

FCDMC (1995) developed a RID HEC-1 model by modifying the HEC-1 model for the White Tanks/Agua Fria Area Drainage Master Study (ADMS) (WLB, 1992). The sub-basin boundaries can be seen in Figure 1. The modifications include (FCDMC, 1995):

- drainage channel along Dysart Road from Camelback to RID (MCDOT, 1993);
- drainage channel/detention along RID from Dysart Road east for 2500 feet (MCDOT, 1993);
- detention basin with 30 inch outlet at the end of the above channel;
- proposed Indian School Bypass (I.S.B.) Channel from Indian School Road to the proposed overchute at Litchfield Road alignment;
- proposed channel from the existing detention basin to the proposed overchute;
- proposed channel from Litchfield Road to the proposed overchute;
- existing wall along the I.S.B. from Litchfield Road to the Litchfield Road Bypass.

Sub-basin 255 in the HEC-1 model for White Tanks/Agua Fria ADMS was divided into three new subbasins 255A, 6 and 7, and subbasin 271 was divided into subbasins 2711 and 2712 along the proposed I.S.B. channel. The subdivision for sub-basin 255 was based on MCDOT (1993). In addition, CP-270 was moved from Litchfield Road Bypass to Litchfield Road (FCDMC, 1995). It was assumed that 50% of Sub-basin 7 goes to CP256, and the rest goes to CP255 (MCDOT, 1993).

All detention basins were lumped together and modeled as one detention basin system for developing the stage-storage relationship for the reservoir routing. The stage-discharge relationship was developed by applying the Manning's equation to the outlet channel. Design drawings and the topographic maps were used to estimate routing parameters for the channels and detention basins. The computed peak discharge at the RID Overchute for the 100-yr, 24-hr storm is 1516 cfs. The computed peak stage for the detention basin system is about 1012.59 ft.

2.3 1996 RID HEC-1 Models (FCDMC, 1996)

FCDMC (1996) conducted another hydrologic analysis in which three alternatives were proposed. The sub-basin boundaries can be seen in Figure 1. The alternatives are required to satisfy the criterion that the peak discharge at the RID Overchute and the peak stage at the detention basin system are, respectively, not larger than the peak discharge (1516 cfs) and peak stage (1012.59 ft) in the 1995 RID HEC-1 model. The HEC-1 models for these alternatives were developed by modifying the 1995 RID HEC-1 model.

Alternative One can be seen on Figure 3. Alternative One has the following new characteristics:

- the flow along Indian School Bypass is routed south of the Plaza Circle Drive into the detention basin system;
- another detention basin is added to the existing detention basin system (the existing basin system could be enlarged rather than adding a separate basin);
- channels R255, R2711, and R271 have been modified;
- channels R2712 and R271_1 have been added.

Alternative Two (Figure 4) is obtained by modifying Alternative One. Alternative Two has the following new characteristics:

- the concrete channel (R2711) along Indian School Bypass is removed from Alternative One;
- flow from CP2711 is routed as sheet-flow (R2711) into the detention basin system;
- the detention basin system is enlarged;
- the width of the basin outlet channel (R271) has been increased.

Alternative Three (Figure 5) is obtained by modifying Alternative Two. Alternative Three has the following new characteristics:

- flow from CP2711 is routed into the detention basin system through a concrete channel.

3. Design Hydrologic Analysis

The HEC-1 model for the new hydrologic analysis is developed by modifying the HEC-1 model for Alternative One in the 1996 RID study (FCDMC, 1996). Figure 1 shows the drainage map. The following are new characteristics in the new HEC-1 model compared to Alternative One in the 1996 HEC-1 model:

- the drainage area for sub-basins 254A and 270 are reduced based on WLB (1996). (Unit hydrographs are re-developed for these two sub-basins.)
- a new stage-storage relationship for the detention basin is used. (The new stage-storage relationship is obtained by modifying a recently developed stage-storage relationship (SFC, 1997) by adding more storage to the relationship from a portion of the MCDOT channel. The berms between detention basins are removed. Therefore, there is only one detention basin. See "**5. Appendix**" for the stage-storage relationship calculations)

The final peak discharges are obtained by running the HEC-1 model and an HEC-2 model with several iterations until the peak discharges converge. The HEC-2 model is for the area starting from the outlet of the detention basin to the golf course at Thomas Road. The HEC-2 model is used to compute the stage-discharge relationship at the outlet of the detention basin, which is then input into the HEC-1 model as the rating curve for the detention basin routing. The final HEC-1 and HEC-2 models can be found in a pocket at the end of this report. The following

HEC-2 models can be found in a pocket at the end of this report. The following explains more details about the iterations for running HEC-1 and HEC-2.

The initial stage-discharge at the outlet of the detention basin system is obtained from using Manning's equation. HEC-1 model is run to obtain the peak discharges at the overchute, merging point for channels R2711 and R271, and the outlet of the detention basin system. Then, the peak discharges are input into the HEC-2 model (using 100%, 80%, 60%, 40%, 20% of the discharges). HEC-2 model is run to obtain the stage-discharge relationship at the outlet of the detention basin system which is the most upstream cross-section in the HEC-2 model. Then the computed stage-discharge is input into the HEC-1 model for the detention basin system storage routing. Then, the HEC-1 model is run to obtain the peak discharges at the overchute, merging point for channels R2711 and R271, and the outlet of the detention basin system. This iterative process is performed until the peak discharges converge in the sense that the peak discharge between the current and previous iterations is about the same. Table 1 lists the final peak discharges at the locations of interest.

6. References

Flood Control District of Maricopa County, 1995, "Roosevelt Irrigation District Canal, Proposed Overchute at Litchfield Road."

Flood Control District of Maricopa County, 1996, "Hydrologic Analysis for the RID Overchute Project"

Maricopa County Department of Transportation, 1993, "Dysart Road, Final Drainage Calculations," Work Order No. 68644.

SFC, 1997, "Stage-Storage Relationship for Detention Basin," a 3-page fax to Don Rerick of FCDMC from Gary Brady of SFC (May 6, 1997).

WLB, 1992, "White Tanks/Agua Fria Area Drainage Master Study." Prepared for Flood Control District of Maricopa County.

WLB, 1996, "Concept Drainage Plan for the Roosevelt Canal Watershed."

Table 1. Peak Discharges at Selected Locations for a 100-yr and 24-hr Storm (see the HEC-1 Output for the Detailed Results).

	Alternative One	This Study
Sub-basin 254A	443 cfs	403 cfs
Sub-basin 270	560 cfs	548 cfs
Sub-basin 257	217 cfs	217 cfs
Diversion from 257 to 256	119 cfs	119 cfs
Sub-basin 6	188 cfs	188 cfs
Sub-basin 7	429 cfs	429 cfs
Outflow from 7	214 cfs	214 cfs
Diversion from 7 to 255A	214 cfs	214 cfs
Sub-basin 256	326 cfs	326 cfs
CP-256 (6+outflow from 7 + 256 + R257)	493 cfs	493 cfs
CP-271A	481 cfs	481 cfs
CP-255A (255A + D7out)	1160 cfs	1160 cfs
CP-271 (inflow to the detention basin)	1724 cfs (R271A +R2712+2712)	1746 cfs (R271A +R2712+2712)
SR-271	1102 cfs	1084 cfs
CP-2711	399 cfs	384 cfs
R271_1	1364 cfs	1317 cfs
Overchute	1440 cfs	1456 cfs

Drainage Map for Roosevelt Irrigation District (RID) Canal Overchute Project

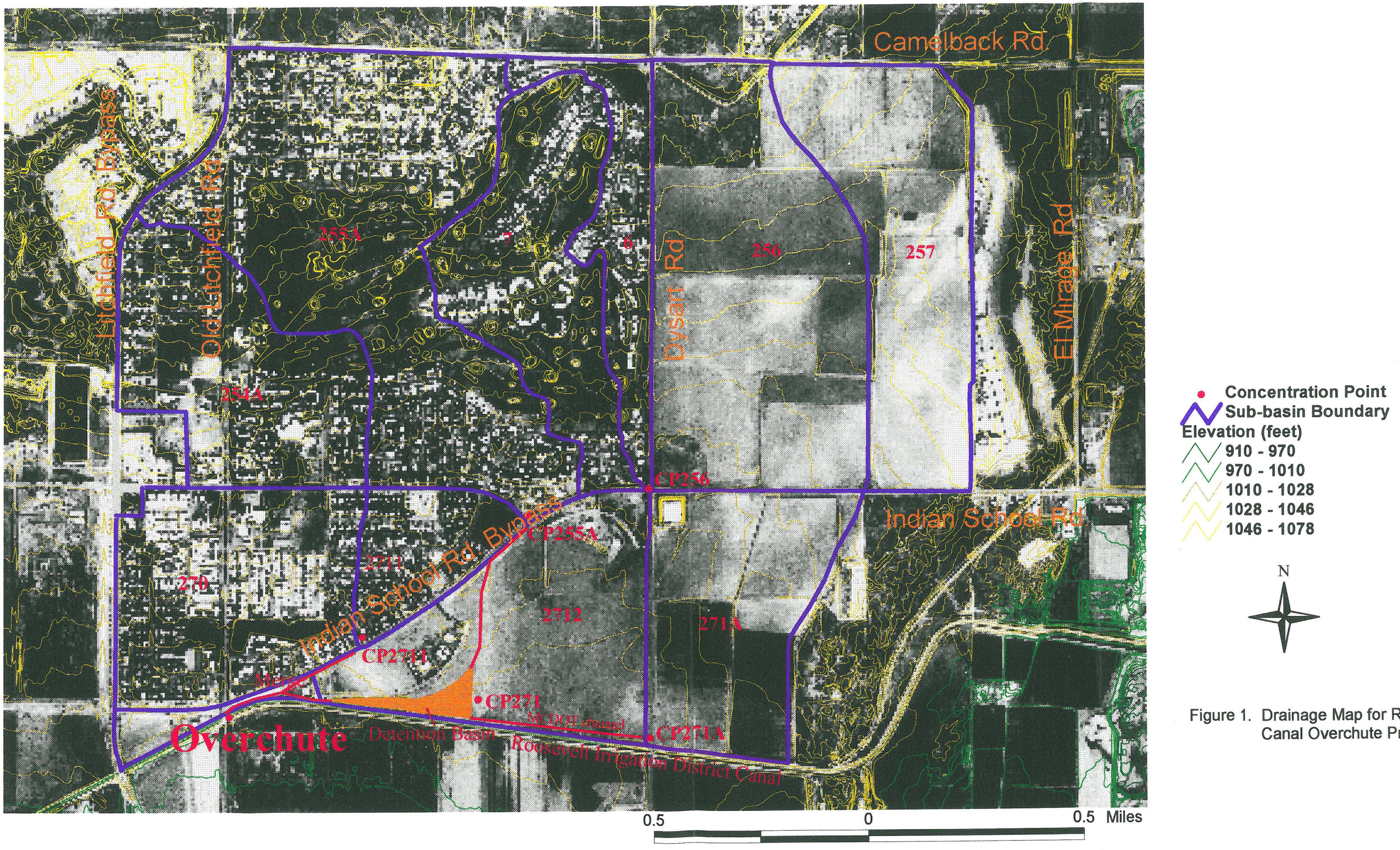
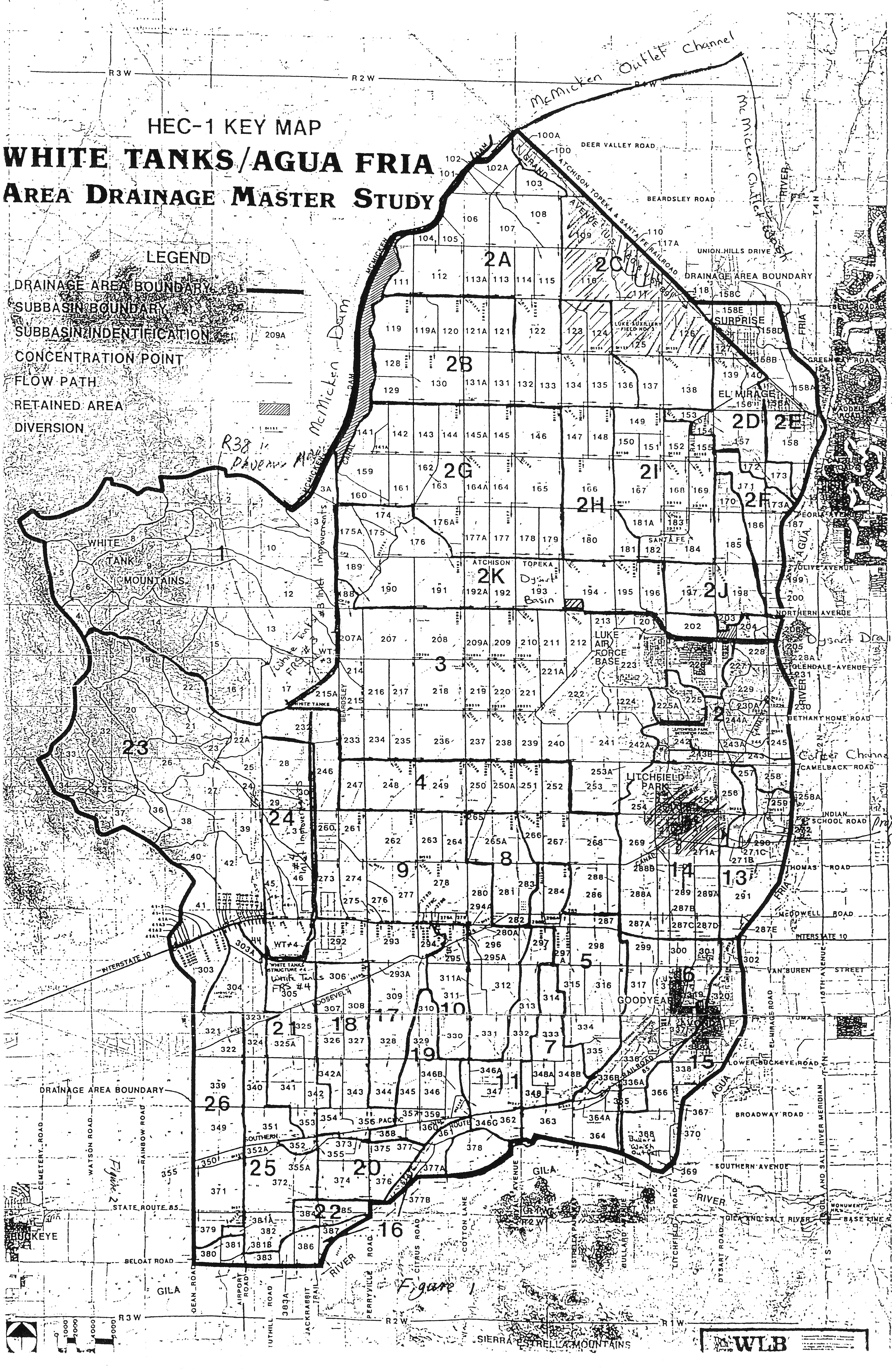


Figure 1. Drainage Map for RID Canal Overchute Project

Existing FCD 1.17.95



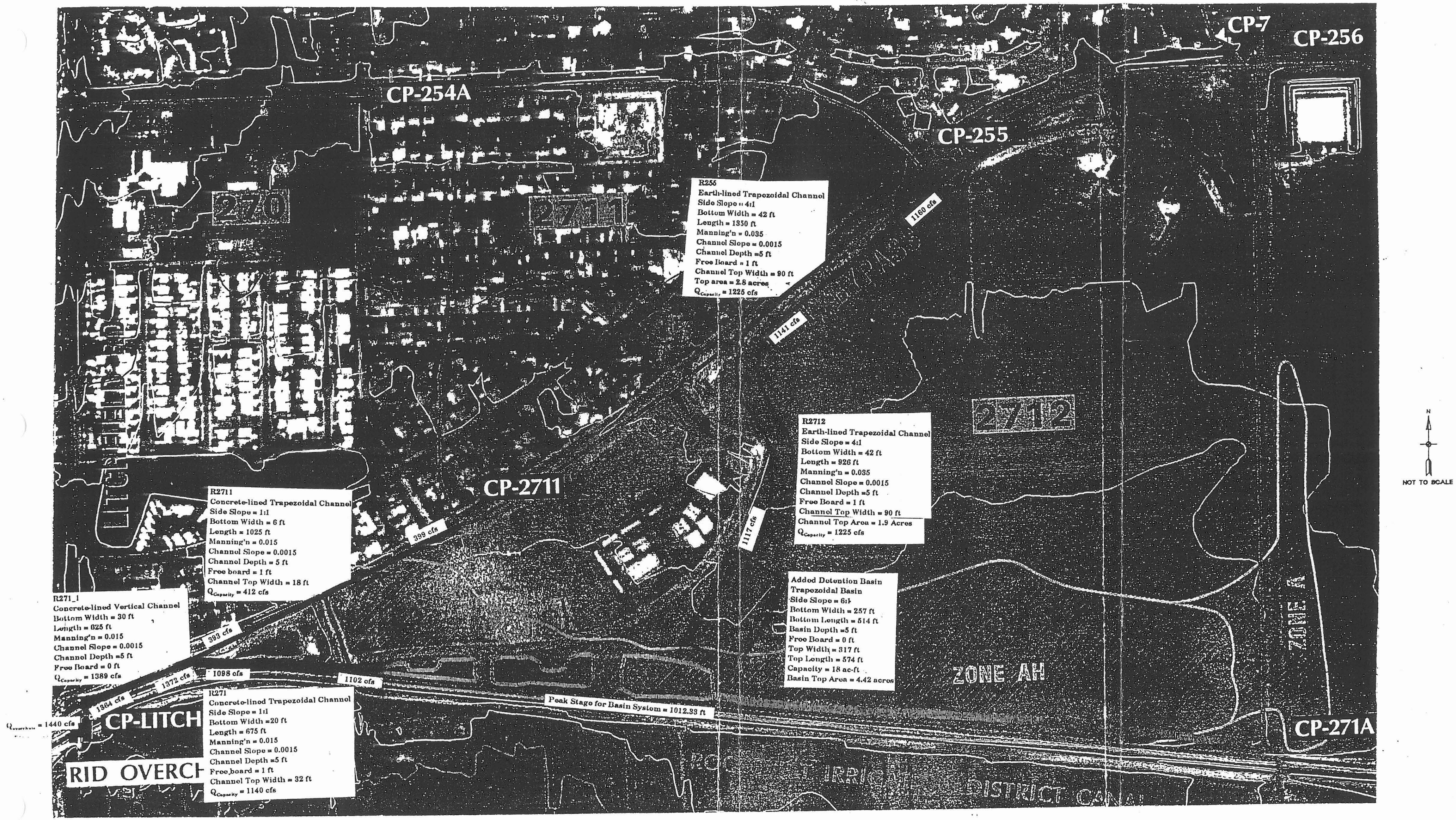


Figure 1. **Alternative One for Channel and Basin Sizing** (Note: the values shown on the Figure are only based on hydrologic analysis; hydraulic analysis is needed for final design)

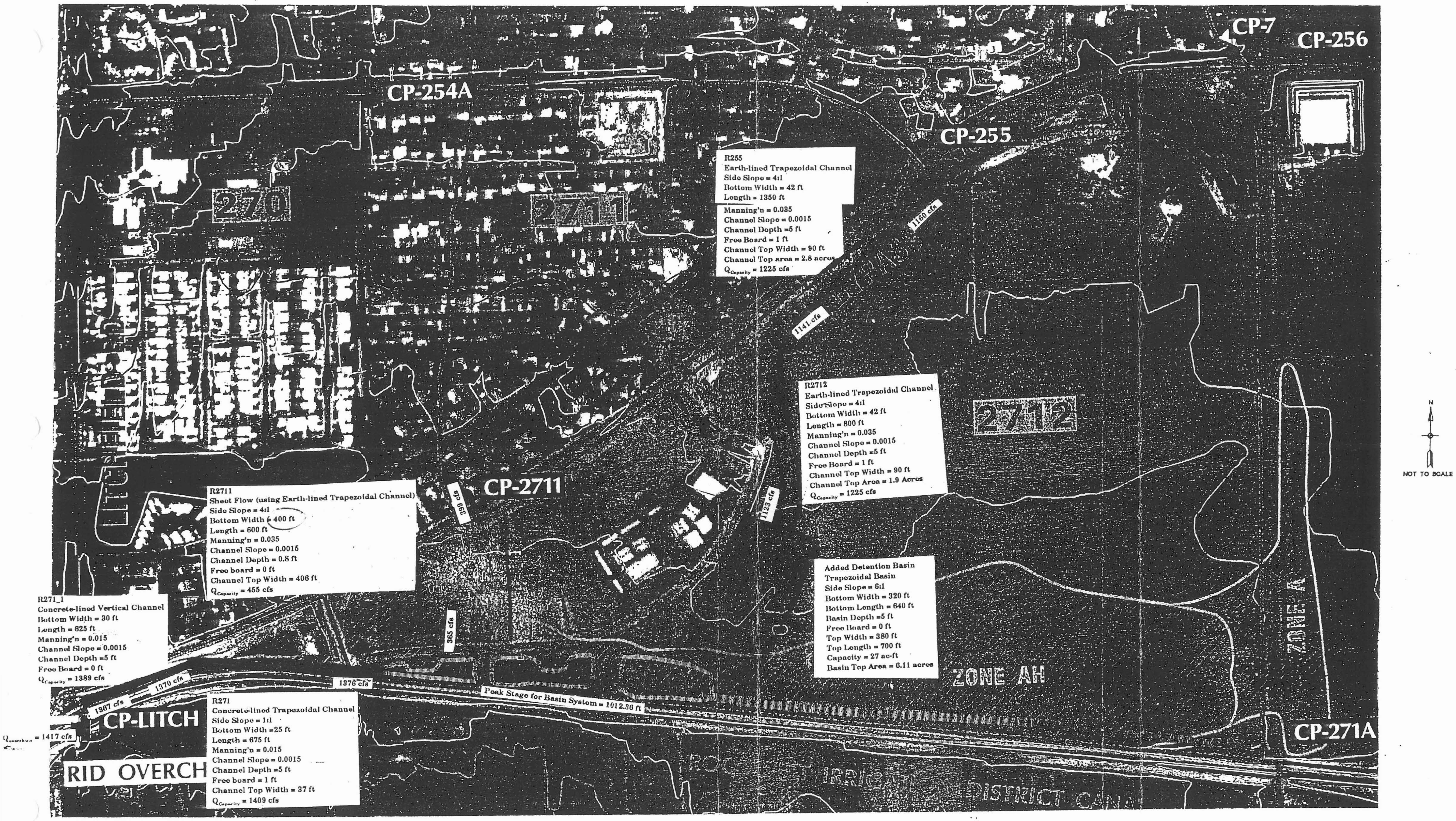


Figure 24 **Alternative Two for Channel and Basin Sizing** (Note: the values shown on the Figure are only based on hydrologic analysis; hydraulic analysis is needed for final design)

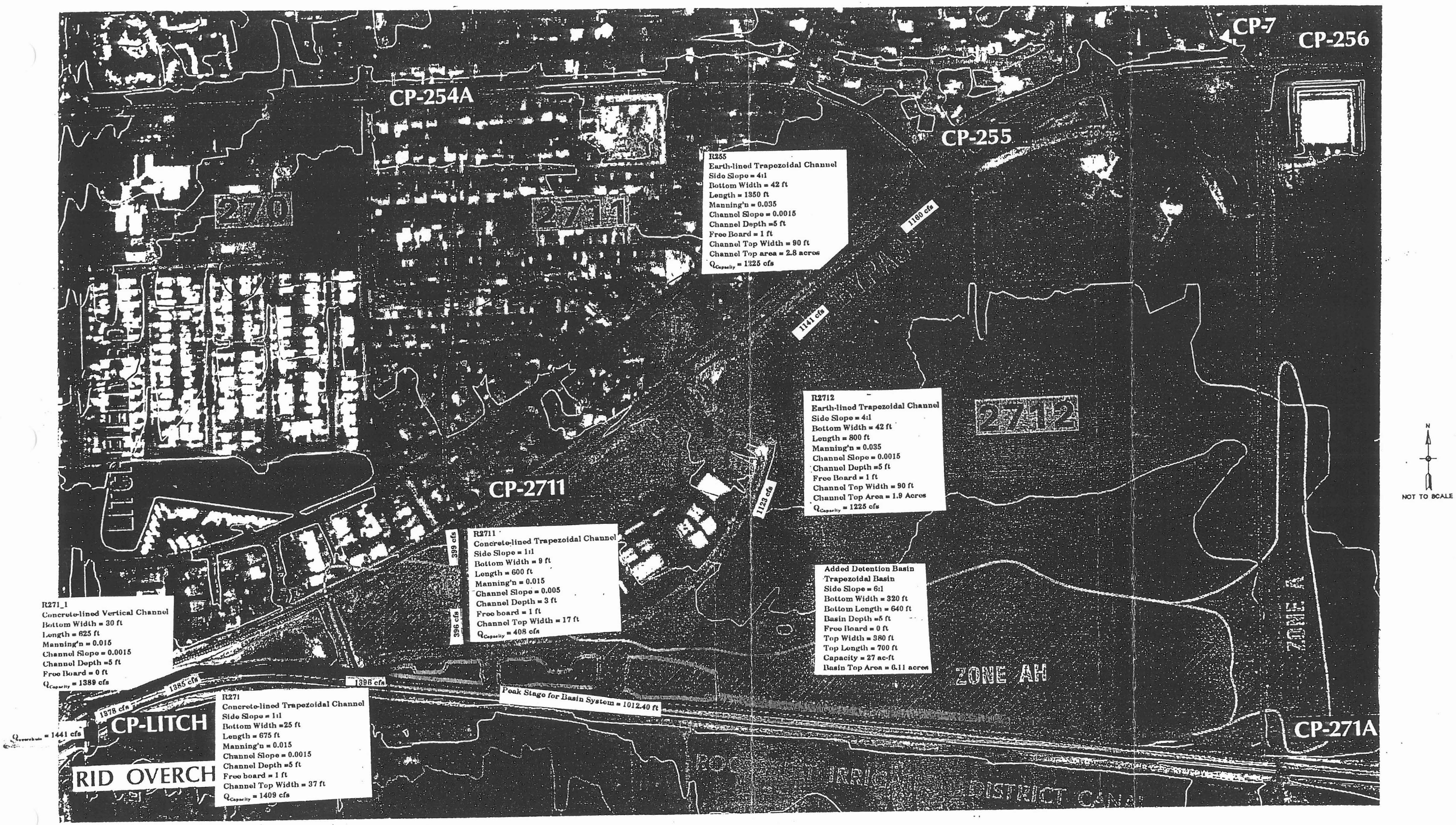


Figure 3. **Alternative Three for Channel and Basin Sizing** (Note: the values shown on the Figure are only based on hydrologic analysis; hydraulic analysis is needed for final design)

Flood Control District of Maricopa County (FCDMC)
RID Overchute Project
Basin Stage-Storage Relationship Summary
Stantech Project No. 28900014
July 1997

ELEVATION	BASIN NO. 1 VOLUME	BASIN NO. 2 VOLUME	BASIN NO. 3 VOLUME	BASIN NO. 4 VOLUME	MCDOT CHANNEL VOLUME	TOTAL BASIN VOLUME	TOTAL CUMULATIVE VOLUME
	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
1009.00	0.34	0.37	1.00	3.66	0.33	5.70	**5.70**
1010.00	0.57	1.21	1.19	5.48	0.44	8.89	**14.59**
1011.00	0.72	1.40	1.36	5.61	0.55	9.64	**24.23**
1012.00	0.88	1.59	1.55	5.73	0.66	10.41	**34.64**
1012.50	0.51	0.89	0.87	2.95	0.38	5.60	**40.24**
TOTAL BASIN VOLUME	**3.02**	**5.46**	**5.97**	**23.43**	**2.36**	**40.24**	

Source: Stantech Consultants, 1997

May 6, 97

SFC

FAX TRANSMITTAL

To:	FCDMC	Fax No.	(602) 506-4601
Attention:	Don Rerick (602) 506-4878	Date:	5 May 1997
Reference:	**PHASE 2 - RID OVERCHUTE PROJECT** **FILE: 28900014**		3 ~~2~~ page(s) total including cover sheet. Original will NOT follow by mail.
Sender:	Gary Brady		

MESSAGE:

Don:

Attached is Hong's latest volume calculations for the four basins. The bottom grades of basin no. 4 have not varied significantly from the grades Hong used initially; thus the volumes have changed very little. The only significant change to the basin volumes is the addition of the MCDOT channel sideslope volume within Basin 4 (approximately 2.63 acre-foot total) that Hong overlooked before.

Gary Brady

Attachment

gb/c:\data\ridochut\faxrerick5-5-97.doc

RID - PHASE 2

SFC

PROJECT: VOL BETWEEN INTERFACE AREA BS 3 & BS 4

PROJECT No.: 2890001 4 DATE: 5/5/97

PAGE: SCALE:

DISTANCE ALONG INTERFACE AREA BS 3 & BS 4 APPROX 750'

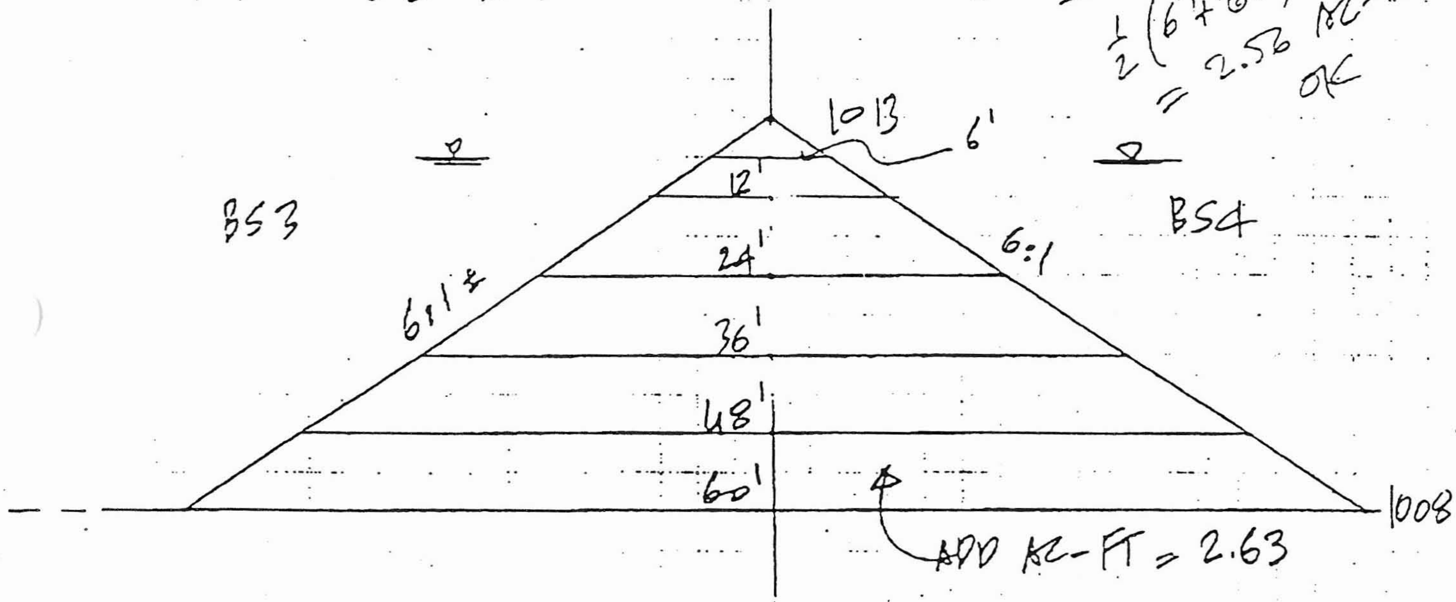
Say SIDESLOPE 6:1

BOTTOM EL 1008

TOP EL 1013

Check

$\frac{1}{2}(6' + 60')\,4.5' \times 750'$ AC-FT = 2.56 AC-FT OK



$V_{08-09} = \frac{1}{2}[48' + 60']\,750' = 40,500$ CF $= 0.93$ AC-FT

$V_{09-10} = \frac{1}{2}[36' + 48']\,750' = 31,500$ CF $= 0.72$ AC-FT

$V_{10-11} = \frac{1}{2}[24' + 36']\,750' = 22,500$ CF $= 0.52$ AC-FT

$V_{11-12} = \frac{1}{2}[12' + 24']\,750' = 13,500$ CF $= 0.31$ AC-FT.

$V_{12-12.5} = \frac{1}{2}[6' + 12']\,750' = 6,750$ CF $= 0.15$ AC-FT.

$\Sigma = 2.63$ AC-FT

SK

RIO OVERCHUTE

PROJECT: STAGE STORAGE DISCHARGE

SFC

PROJECT No.: 120210 DATE: 1/06/97

PAGE: 1 OF 5 SCALE:

REVISED 5/5/97

ELEV	BASIN 1 VOL AC-FT	BASIN 2 VOL AC-FT	BASIN 3 VOL AC-FT	BASIN 4 VOL AC-FT	TOTAL AC-FT	
1009	0.34	0.37	1.00	2.73+.93 =3.66	5.37	5.37
1010	0.57	1.21	1.19	4.76+.72 =5.48	8.45	13.82
1011	0.72	1.40	1.36	5.09+.52 =5.61	9.09	22.91
1012	0.88	1.59	1.55	5.42+.31 =5.73	9.75	32.66
1012.5	0.51	0.89	0.87	2.8+.15 =2.95	5.22	37.88
TOTAL AC-FT	3.02	5.46	5.97	20.8+2.63 23.43	37.88	

ELEV	BS1 AC-FT	BS2 AC-FT	BS3 AC-FT	BS4 AC-FT	TOTAL
1012	2.51	4.57	5.10	18.0+2.48 20.48	32.66
1012.5	3.02	5.46	5.97	20.8+2.63 23.43	37.88

DESIGNED BY: HMM CHECKED BY: [signature]

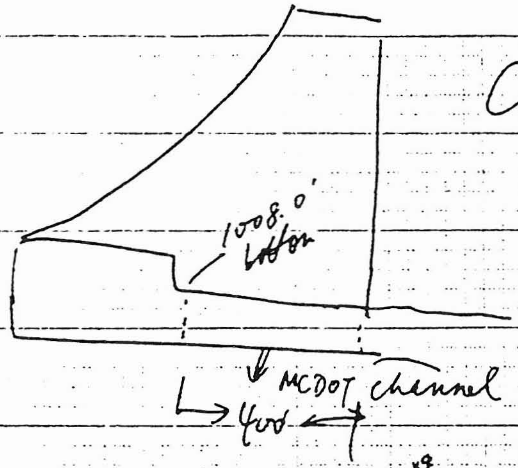
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT ______ PAGE ____ OF ____

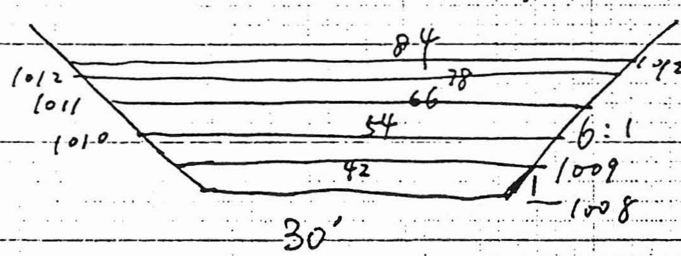
DETAIL ______ COMPUTED *PL* DATE ____

______ CHECKED BY ______ DATE ____



Compute the stage-storage for McDOT 400' part

1012.5
1008
4.5



36

$2 \times 6 \times 4.5 = 6 \times 9 = 54$

30

write a matlab program for computing the storage-stage

stage	storage (ft³)
1008	0
1009	$1 \times \frac{1}{2} \times 400 \times (30+30+2\times6) = 200 \times 72\ ft^3 = 0.33$ Ac-ft
1010	$\frac{1}{2} \times 1 \times 400(42+30+2\times6\times2) = 200(42+54) = 200 \times 96 \therefore 200\times96 + 200\times72 = 0.7713$ Ac-ft
1011	$\frac{1}{2} \times 1 \times 400(54+66) = 200 \times 120 \therefore 200 \times 120 / 43560 + 0.7713 = 1.3223$ Ac-ft
1012	$\frac{1}{2} \times 1 \times 400(66+78) / 43560 + 1.3223 = 1.9835$
1012.5	$\frac{1}{2} \times 0.5 \times 400(78+84) / 43560 + 1.9835 = 2.3554$ Ac-ft.

∴

stage (ft)	storage (ac-ft)
1008	0
1009	0.33
1010	0.77
1011	1.32
1012	1.98
1012.5	2.36

∴ Need to add the storage to the SFC stage-storage relationship.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PROJECT ______________________ PAGE ____ OF ____

DETAIL ______________________ COMPUTED PZ DATE ____

______________________ CHECKED BY ______ DATE ____

Stage (ft)	Storage (Ac-ft)
1008	0
1009	5.37+0.33=5.7
1010	13.82+0.77=14.59
1011	22.91+1.32=24.23
1012	32.66+1.98=34.64
1012.5	37.88+2.36=40.24

5.37 + 0.33

13.82 + 0.77 = 14.59

22.91 + 1.32 = 24.23

32.66 + 1.98 = 34.64

37.88 + 2.36 = 40.24

6. Appendix --- *HEC-1 Input File and Selected Results*

```
ID      FILENAME: ridhydro.dat (final HEC-1 for RID)
ID      FCDMC, May, 1997
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IO     5
IN    15
JD  4.03      .001
PC  .000      .002      .005      .008      .011      .014      .017      .020      .023      .026
PC  .029      .032      .035      .038      .041      .044      .048      .052      .056      .060
PC  .064      .068      .072      .076      .080      .085      .090      .095      .100      .105
PC  .110      .115      .120      .126      .133      .140      .147      .155      .163      .172
PC  .181      .191      .203      .218      .236      .257      .283      .387      .663      .707
PC  .735      .758      .776      .791      .804      .815      .825      .834      .842      .849
PC  .856      .863      .869      .875      .881      .887      .893      .898      .903      .908
PC  .913      .918      .922      .926      .930      .934      .938      .942      .946      .950
PC  .953      .956      .959      .962      .965      .968      .971      .974      .977      .980
PC  .983      .986      .989      .992      .995      .998      1.00     1.000     1.000     1.000
JD  3.99        10
JD  3.83        50
JD  3.76       100
JD  3.70       200
KK   257
KM      RUNOFF HYDROGRAPH FROM SUB-BASIN 257
BA   .34
LG   .50       .00      5.82       .24       .00
UI   12.       12.       12.       12.       27.       40.       46.       55.       59.       65.
UI   69.       74.       80.       88.       93.      106.      127.      144.      156.      136.
UI  122.      111.      102.       96.       89.       81.       74.       69.       62.       57.
UI   53.       45.       34.       27.       21.       21.       20.       20.       17.       12.
UI   12.       12.       12.        5.        4.        4.        4.        4.        4.        4.
UI    4.        4.        4.        4.        4.        4.        4.        0.        0.        0.
UI    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
KK  D257
KM      DIVERT FROM CP257 TO CP256
DT DI256
DI     0        56      1308
DQ     0         0       922
KK  2711
KM  NEW SUBBASIN, PART OF THE PREVIOUS 271 NORTH OF INDIAN SCHOOL BYPASS
BA  0.11
LG   0.2      0.25      4.3      0.39       20
UI    93       288       306       118       33        11         0         0         0         0
UI     0         0         0         0         0         0         0         0         0         0
KK  254A
KM      RUNOFF HYDROGRAPH FROM SUB-BASIN 254A
* BA   .22
* Among 0.22 mi^2, 0.02 mi^2 goes to the west of Litchfield Road
BA   .20
LG   .12       .19      5.82       .21     20.00
* UI   79.      248.      444.      456.      271.      115.       56.       15.       14.
* UI    0.        0.        0.        0.        0.        0.        0.        0.        0.
* UI    0.        0.        0.        0.        0.        0.        0.        0.        0.
* the following is new unit hydrograph by running MCUHP2 because the
* area is changed.
UI   72.      225.      404.      415.      246.      104.       51.       14.       13.        0.
UI    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
UI    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
KKR254A1
KM      ROUTE FLOW FROM CP254A TO CP270A
KM      FROM CP254A TO THE PROPOSED INDIAN SCHOOL BYPASS
RS     2                  -1
RC  0.05      0.05      0.05      2100   0.0025
RX  1000      1001      1002      1180      1310      1398      1399      1400
RY  1050      1017      1017      1016      1016      1017      1017      1050
KKCP2711
* 2/21/96, change "HC     3" to "HC     2". Flow from CP255A will not be
* combined here.
HC     2
* The following was modified on 2/21/1996 at FCD.
KK R2711   REVISED CHANNEL
KM      ROUTE FLOW FROM CP2711 TO MERGING POINT
RS     1     FLOW       -1
* RC 0.014    0.014    0.014     1650  0.0008
RC 0.015    0.015    0.015     1025  0.0015
```

```
* B=6
RX     0       5      15      20      26      31      41      46
RY    10      10      10       5       5      10      10      10
* *************************************************************
KK  D257
KM      RETURN DIVERT AT CP257
DR DI256
KK  R257
KM      ROUTE DIVERT FROM CP257 TO CP256
RS    12              -1       0
RC  .035    .035    .075    2680   .0018
RX  1000    1001    1002    1010    1540    1858    1859    1860
RY1025.5    1025    1025    1024    1024    1025    1025  1025.5
KK   256
KM      RUNOFF HYDROGRAPH FROM SUB-BASIN 256
BA   .43
LG   .50     .00    5.84     .30     .00
UI   20.     20.     20.     47.     71.     86.     98.    108.    119.    132.
UI  147.    165.    205.    244.    244.    206.    182.    165.    150.    133.
UI  120.    107.     96.     83.     64.     47.     35.     34.     32.     27.
UI   20.     20.     19.      6.      6.      6.      6.      6.      6.      6.
UI    6.      6.      6.      6.      0.      0.      0.      0.      0.      0.
UI    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
KK  SUB6
KM  THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
KM  L=      1.1  Lca=       .6   S=    19.0  Kn= .030  LAG=  20.0
KM  PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
BA   .10
LG   .17     .20    6.00     .16   20.00
UI   21.     75.    114.    189.    162.    109.     65.     30.     17.      5.
UI    5.      0.      0.      0.      0.      0.      0.      0.      0.      0.
UI    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
KK  SUB7
KM BASIN SUB7
KM  THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
KM  L=      1.0  Lca=       .5   S=    21.0  Kn= .030  LAG=  19.0
KM  PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
BA   .24
LG   .19     .19    6.80     .20    3.00
UI   55.    192.    294.    483.    362.    238.    117.     60.     28.     13.
UI   13.      0.      0.      0.      0.      0.      0.      0.      0.      0.
UI    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
KK    D7
KM DIVERT D7 TO CP255A
DT D7OUT
DI     0     250
DQ     0     125
KK CP256
KM      ADD HYDROGRAPHS AT CP256
HC     4
KK  R256
* KO      1
KM      ROUTE FLOW FROM CP256 TO CP271A  ** REVISED CHANNEL
KM      ASSUMED CHANNEL UNLINED, D= 5FT, V=3.5 FT/SEC
KM      3100 FEET, SLOPE 0.0014, 30FT BOTTOM WIDTH, 2:1 SIDE SLOPES
RS     3    FLOW      -1
RC 0.035   0.035   0.035    3100  0.0014
RX     0       5      10      20      50      60      65      70
RY    11      11      10       5       5      10      11      11
KK 271A
KM      RUNOFF HYDROGRAPH FROM SUB-BASIN 271A
BA   .16
LG   .50     .00    4.93     .39     .00
UI    6.      6.      6.      6.     16.     21.     24.     28.     30.     33.
UI   35.     38.     42.     45.     50.     59.     70.     78.     68.     60.
UI   55.     50.     47.     43.     39.     36.     33.     30.     28.     24.
UI   19.     16.     10.     10.     10.     10.      9.      6.      6.      6.
UI    6.      2.      2.      2.      2.      2.      2.      2.      2.      2.
UI    2.      2.      2.      2.      0.      0.      0.      0.      0.      0.
UI    0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
KKCP271A
KM      ADD HYDROGRAPHS AT CP271A
HC     2
KKSR271A
* KO      1
KM      STORAGE ROUTE FLOW AT CP271A
RS     1    STOR
SV     0     .06    0.97    1.51
```

```
SE017.99     1018  1018.3  1018.4
SQ              7     247     460     604
SE017.99     1018  1018.3  1018.4  1018.5
KK R271A
KO      1
KM       ROUTE FLOW FROM CP271A TO DETENTION BASIN AT CP271 **REVISED BY FCD
KM       REMEASURED LENGTH AT 3400 (FROM PREVIOUS 2000)
KM       EXISTING CHANNEL, 2750 FT LONG, SLOPE=0.001; 6:1 SIDE SLOPES
RS      3    FLOW      -1
* RC 0.035    0.035    0.035     2750    0.001
* the length = 2750-400 =2350 ft because part of MCDOT channel becomes
* part of detention basin 4
RC 0.035    0.035    0.035     2350    0.001
RX      0       10       20       45       75      100      110      120
RY     11       10       10        6        6       10       10       11
KK  255A
KM       RUNOFF HYDROGRAPH FROM SUB-BASIN 255A (NEW BY FCD)
BA .5968
LG   .20      .22     3.88      .29    12.00
UI   91.     359.     542.     814.    1029.     707.     492.     268.     147.      86.
UI   28.      28.      28.       0.       0.       0.       0.       0.       0.       0.
UI    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
KK D7OUT
KM       RETURN DIVERT TO 255A
DR D7OUT
KK CP255A
KM       ADD HYDROGRAPHS AT CP255A
HC      2
* *******************************************************
KK  R255
* KO      1
KM       ROUTE FLOW ALONG INDIAN SCHOOL BYPASS AND A PATH SOUTHEAST TO
KM       2712 (around the circle)
KM      ASSUME CHANNEL UNLINED, D= 5FT , V<3.93 FT/SEC
KM       B=40', 4:1 side slope
KM      The length is 1350 ft, which is the half of 2700 ft from
KM      previous study (2/21/96, FCD)
RS      2    FLOW      -1
RC 0.035   0.035    0.035     1350  0.0015
* B=42, T=82 ft after running flowmaster using computer Q=1200
RX     18       19       20       40       82      102      103      104
RY     10       10       10        5        5       10       10       10
* Above water will go to 2712
* ********************************
* 2/21/1996, FCD
KK R2712
KO      1                                  21                          0.5
KM       ROUTE FLOW INTO 2712
KM      ASSUME CHANNEL UNLINED, D=5 FT, V<3.93 FT/SEC
KM      40FT BOTTOM WIDTH, 4:1 SIDE SLOPES, LENGTH = 1500 FT
* the length is reduced, so use NSTPS=1
RS      1    FLOW      -1
* the length is reduced because the new basin of 18 AC-FT is put at the
* end of the reach. The length of the channel is 868 ft based on SFC's plan.
* the total length of R2712 and R255 is 2218 ft.  Since R255 is 1350 ft,
* R2712 = 2218-1350 = 868 ft
RC 0.035   0.035    0.035      868  0.0015
* B=42, T=82 ft after running flowmaster using computer Q=1200
RX     18       19       20       40       82      102      103      104
RY     10       10       10        5        5       10       10       10
* ************
KK  2712
* KO      1
KM       RUNOFF HYDROGRAPH FROM SUB-BASIN 2712
BA   .46
LG   .35      .25     4.30      .39        2
UI  117      397      618      973      667      425      181      102       34       26
UI    0        0        0        0        0        0        0        0        0        0
KK CP271
* KO      1      1
KM COMBINE THREE FLOWS
HC      3
KK SR271
KO      1
* KO      2      2 (2/14/96)
KM       STORAGE ROUTE CP271 BEHIND ROOSEVELT CANAL
KM       THIS INCLUDES THE TWO EXISTING STORAGE BASINS, THE ADDITIONAL STORAGE
KM       OF 14.7 CUFT OF THE PROPOSED BASIN AND FLOODPLAIN PONDING
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KM      STAGE/STORAGE BASED ON 1014'
RS     1     STOR        0
* add a portion of MCDOT channel to the new rating curve
* obtained from SFC (May, 6, 1997) by fax
SV      0      5.7    14.59    24.23    34.64    40.24
SE  1008     1009     1010     1011     1012   1012.5
* B=20' (the newest HEC-2 results from ridjob2i.dat by FCD)
SQ      0      217      433      650      866     1083
SE1008.3 1009.24 1009.95 1010.68 1011.48 1012.29
KK  R271
* KO      1
KM  ROUTE CP271 TO THE MERGING POINT OF TWO CHANNELS
* RS      1     FLOW      -1
* use Mukingum-Cunge, since outflow is greater than the inflow
RD
RC 0.015   0.015   0.015      675  0.0015
* The new depth = 5ft, new bottom width = 20 ft, new side slope = 1:1
RX     10       11       12   17.00     37.0       42       43       44
RY     10       10       10     5.0      5.0       10       10       10
KKMERGE
* KO      1
KM      COMBINED Q ALONG INDIAN SCH.RD. INTO OVERCHUTE
HC      2
KKR271_1
KO      1
KM  ROUTE THE MERGING POINT OF TWO CHANNELS TO LITCH, 3/8/96, FCD
RD
RC 0.015   0.015   0.015      625  0.0015
RX     10       11       12       12       42       42       43       44
RY     10       10       10      5.0      5.0       10       10       10
KK   270
KM BASIN 270
KM  THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN** REVISED BY FCD
KM  L=       .7  Lca=        .3    S=    10.5  Kn= .030   LAG=  16.0
KM  PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
* BA   .30
* 0.0064 mi^2 of 0.3 mi^2 contributes to the west of Litchfield Road
BA .2936
LG    .16      .22     3.58      .38    18.00
* UI  103.     326.     570.     635.     379.     174.      80.      26.      19.
* UI    0.       0.       0.       0.       0.       0.       0.       0.       0.
* UI    0.       0.       0.       0.       0.       0.       0.       0.       0.
* the following is new unit hydrograph by running MCUHP2 because the
* area is changed.
UI  100.     319.     558.     621.     371.     170.      78.      26.      19.       0.
UI    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
UI    0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
KK LITCH
* KO      1
HC      2
* ZW  A=RID INFLOW2 B=FCD C=FLOW E=5MIN F=LITCH
ZZ
```

```
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    23        257
               .
               .
    36         .-------->   DI256
    34       D257
               .
               .
    39         .         2711
               .           .
               .           .
    45         .           .          254A
               .           .             V
               .           .             V
    52         .           .        R254A1
```

```
              .           .           .
              .           .           .
 59           .      CP2711............
              .           V
              .           V
 61           .       R2711
              .           .
              .           .
 69           .           .           .<-------   DI256
 67           .           .        D257
              .           .           V
              .           .           V
 70           .           .        R257
              .           .           .
              .           .           .
 76           .           .           .         256
              .           .           .           .
              .           .           .           .
 86           .           .           .           .        SUB6
              .           .           .           .           .
              .           .           .           .           .
 95           .           .           .           .           .        SUB7
              .           .           .           .           .           .
              .           .           .           .           .           .
107           .           .           .           .           .           .--------   D7OUT
105           .           .           .           .           .          D7
              .           .           .           .           .           .
              .           .           .           .           .           .
110           .           .       CP256....................................
              .           .           V
              .           .           V
113           .           .        R256
              .           .           .
              .           .           .
121           .           .           .        271A
              .           .           .           .
              .           .           .           .
132           .           .      CP271A............
              .           .           V
              .           .           V
135           .           .      SR271A
              .           .           V
              .           .           V
142           .           .       R271A
              .           .           .
              .           .           .
151           .           .           .        255A
              .           .           .           .
              .           .           .           .
160           .           .           .           .           .<-------   D7OUT
158           .           .           .           .       D7OUT
              .           .           .           .           .
              .           .           .           .           .
161           .           .           .      CP255A............
              .           .           .           V
              .           .           .           V
164           .           .           .        R255
              .           .           .           V
              .           .           .           V
175           .           .           .       R2712
              .           .           .           .
              .           .           .           .
184           .           .           .           .        2712
              .           .           .           .           .
              .           .           .           .           .
190           .           .       CP271........................
              .           .           V
              .           .           V
193           .           .       SR271
              .           .           V
              .           .           V
204           .           .        R271
              .           .           .
              .           .           .
210           .      MERGE ............
              .           V
              .           V
213           .      R271_1
```

```
220          .          .          270
             .          .            .
             .          .            .
230          .       LITCH............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+ HYDROGRAPH AT	257	217.	13.42	62.	16.	15.	.34		
+ DIVERSION TO	DI256	119.	13.42	23.	6.	6.	.34		
+ HYDROGRAPH AT	D257	99.	13.42	39.	10.	9.	.34		
+ HYDROGRAPH AT	2711	234.	12.00	18.	5.	5.	.11		
+ HYDROGRAPH AT	254A	403.	12.08	36.	10.	10.	.20		
+ ROUTED TO	R254A1	281.	12.33	36.	10.	10.	.20		
+ 2 COMBINED AT	CP2711	384.	12.08	54.	15.	15.	.31		
+ ROUTED TO	R2711	374.	12.17	54.	15.	15.	.31		
+ HYDROGRAPH AT	D257	119.	13.42	23.	6.	6.	.34		
+ ROUTED TO	R257	104.	14.08	23.	6.	6.	.34		
+ HYDROGRAPH AT	256	326.	13.00	72.	18.	17.	.43		
+ HYDROGRAPH AT	SUB6	188.	12.17	20.	6.	5.	.10		
+ HYDROGRAPH AT	SUB7	429.	12.17	37.	9.	9.	.24		
+ DIVERSION TO	D7OUT	214.	12.17	18.	5.	5.	.24		
+ HYDROGRAPH AT	D7	214.	12.17	18.	5.	5.	.24		

+ .77	4 COMBINED AT	CP256	493.	12.25	133.	34.	33.
+ .77	ROUTED TO	R256	445.	12.42	132.	34.	33.
+ .16	HYDROGRAPH AT	271A	95.	13.33	25.	6.	6.
+ .93	2 COMBINED AT	CP271A	481.	12.42	157.	40.	39.
+ .93	ROUTED TO	SR271A	475.	12.42	157.	40.	39.
+ .93	ROUTED TO	R271A	435.	12.67	156.	40.	39.
+ .60	HYDROGRAPH AT	255A	957.	12.25	96.	26.	25.
+ .24	HYDROGRAPH AT	D7OUT	214.	12.17	18.	5.	5.
+ .60	2 COMBINED AT	CP255A	1160.	12.17	114.	31.	30.
+ .60	ROUTED TO	R255	1141.	12.25	114.	31.	30.
+ .60	ROUTED TO	R2712	1120.	12.33	114.	31.	30.
+ .46	HYDROGRAPH AT	2712	739.	12.17	56.	14.	14.
+ 1.99	3 COMBINED AT	CP271	1746.	12.25	325.	85.	82.
+ 1.99	ROUTED TO	SR271	1084.	12.58	324.	84.	81.
+ 1.99	ROUTED TO	R271	1081.	12.58	324.	84.	81.
+ 2.30	2 COMBINED AT	MERGE	1323.	12.50	377.	100.	96.
+ 2.30	ROUTED TO	R271_1	1317.	12.50	377.	100.	96.
+ .29	HYDROGRAPH AT	270	548.	12.08	48.	14.	13.
+ 2.59	2 COMBINED AT	LITCH	1456.	12.25	423.	113.	109.

1

7. Appendix --- *HEC-2 Input and Output Files for Channel from Detention Basin Outlet to Golf Course at Thomas Road*

```
T1      1201202
T2      RID LITCHFIELD ROAD OVERCHUTE PROJECT
J1   -10       2                                            1456 1000.35
J2     1                -1                                      -6
NC 0.035   0.035   0.035     0.1     0.3
X1   200       8   57.28   84.59
X3     0                   57.26    1001   84.55    1001
GR  1001       0    1001    33.3 1000.12   57.28  993.12   57.29  993.12   84.58
GR1000.1   84.59    1001  104.07    1001  136.28
NC 0.035   0.035   0.035     0.1     0.3
X1   201       7   13.01   40.32      50      50      50
X3    10                                                 1001.16 1001.16
GR1001.1       0 1001.16    3.15 1001.16   13.01  992.16   13.02  992.16   40.31
GR1001.1   40.32 1001.16   53.49
SC 3.013     0.4     2.9   53.49       7       8      45     8.1  993.62  993.12
X1   202      22   57.28   84.59      45      45      45
X2                     2         1001.13
X3     0                   57.26 1001.13   84.55 1001.13
GR  1003       0    1003    0.02    1004    3.52    1005    5.61    1006    7.76
GR  1007    9.93    1007   13.25    1006   15.71    1005   18.61    1004   21.62
GR  1003   27.05    1002   30.99    1001    33.3 1000.12   57.28  993.12   57.29
GR993.12   84.58 1000.12   84.59    1001  104.07    1002  108.36    1003  112.19
GR  1004  114.82    1005  136.28
NC                           0.5     0.7
X1   203      28    13.2  114.96   77.83   47.74   63.99
X3    10
GR  1006       0    1006    4.78    1005    8.99    1004    13.2    1003   17.42
GR  1002   32.16    1001   34.92    1000   36.93     999   38.93     998   40.94
GR   997   42.94     996   44.94     995   47.76     994   50.36     993   54.44
GR   993   81.68     994   84.24     995   86.81     996   89.37     997   91.94
GR   998    94.5     999   97.07    1000   99.37    1001  101.62    1002  105.63
GR  1003  110.52    1004  114.96    1005  119.36
X1   204      22   23.45   99.23   51.14   14.17    34.1
X3    10                   23.45
GR  1003       0    1002   23.45    1001   27.45    1000   31.45     999   35.44
GR   998   39.44     997   43.44     996   47.44     995   51.43     994   55.43
GR   994   64.84     995   68.39     996   71.95     997   75.51     998   79.06
GR   999   82.62    1000   86.18    1001   89.74    1002   93.29    1003    96.6
GR  1004   99.23    1005   105.1
X1   205      17   73.54   135.6  136.08  122.08  129.11
X3    10                   73.54
GR  1003       0    1002   73.54    1001   77.48    1000   81.43     999   85.37
GR   998    89.3     997   93.23     996   97.22     995  101.19     995  106.01
GR   996  111.32     997  115.33     998  119.34     999  123.35    1000  127.44
GR  1001  131.57    1002   135.6
X1   206      14       0   58.04  382.73  386.94  384.85
X3    10
GR  1003       0    1002    3.86    1001    7.72    1000   11.58     999   15.44
GR   998    19.3     997   23.15     997   35.98     998   39.48     999   43.11
GR  1000   46.86    1001   50.61    1002   54.36    1003   58.04
X1   207      18    1.69   67.55  177.74  180.03  179.78
X3    10
GR  1005       0    1005    1.69    1004    6.25    1003   10.56    1002   14.86
GR  1001   19.17    1000   23.47     999   27.78     998   32.08     997   36.28
GR   997   37.51     998   44.15     999   47.97    1000    51.8    1001   55.62
GR  1002   59.45    1003   63.28    1004   67.55
X1   208      14       0    57.1   55.55   69.26   61.07
X3    10
GR  1004       0    1003    3.26    1002    6.53    1001    9.79    1000   13.06
GR   999   16.33     998    19.6     998   31.65     999   36.69    1000   41.72
GR  1001   45.71    1002   50.16    1003   53.64    1004    57.1
X1   209      14       0   44.55   58.35   89.73   72.84
X3    10
GR  1004       0    1003    2.59    1002    5.19    1001    7.78    1000   10.38
GR   999   12.97     998   15.57     998   25.57     999    28.5    1000   31.43
GR  1001   34.36    1002   37.37    1003      41    1004   44.55
X1   210      14       0   43.81   99.35   98.29   98.88
X3    10
GR  1004       0    1003    2.84    1002    5.68    1001    8.52    1000   11.36
GR   999   14.21     998   17.05     998   27.31     999   30.06    1000   32.81
GR  1001   35.56    1002   38.31    1003   41.06    1004   43.81
X1   211      17   14.81   59.68  191.04  190.14  190.51
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X3    10                     14.81  1006.5   59.68  1006.5
GR  1005       0    1004     14.81    1003   17.84    1002   20.87    1001    23.9
GR  1000   26.93     999     29.96     998      33     998   39.19     999   42.11
GR  1000   45.03    1001     47.95    1002   50.88    1003    53.8    1004   56.74
GR  1005   59.68    1005     70.95
X1   212      13   26.59      69.6  371.95  372.72  372.25
X3    10                     26.59  1007.5    69.6  1007.5
GR  1006       0    1005     26.59    1004   29.76    1003      33    1002   36.24
GR  1001   39.47    1000     42.71    1000   53.65    1001   56.84    1002   60.03
GR  1003   63.22    1004     66.41    1005    69.6
X1   213      13       0     41.55  434.21  433.34  433.83
X3     0                                     41.55    1009
GR  1006       0    1005      3.22    1004    6.44    1003    9.61    1002   12.73
GR  1001   15.86    1001     24.38    1002   27.87    1003   31.29    1004   34.71
GR  1005   38.13    1006     41.55    1007   44.96
X1   214      16   29.13     68.11   381.2  382.42  381.83
X3    10                     29.13  1010.5   68.11  1010.5
GR  1008       0    1007     29.13    1006   32.52    1005   35.95    1004   39.17
GR  1003   42.29    1002     45.56    1002    51.5    1003   54.85    1004   58.17
GR  1005   61.49    1006      64.8    1007   68.11    1008   71.46    1008   77.42
GR  1008  127.14
NC 0.035   0.035   0.035       0.1     0.3
X1   215      15   33.17     73.68  285.61  285.61  285.61
X3    10                     33.17  1011.5   73.68  1011.5
GR  1009       0    1009     33.17    1008   36.84    1007   40.52    1006    44.2
GR  1005   47.87    1004     51.34    1004   55.69    1005   58.68    1006   62.37
GR  1007   66.17    1008     69.97    1009   73.68    1010    79.8    1011  114.07
NC 0.035   0.035   0.014
X1   216       8      26     86.03   96.55   95.82   95.16
X3    10
GR  1013       0    1013        26 1004.53   26.01 1004.53   46.61 1004.53    71.5
GR1004.5   86.01    1013     86.03    1013   93.93
NC 0.035   0.035   0.014
QT     1    1323
X1   217       5       0     60.11   71.31   71.31   71.31
X3    10
GR  1013       0    1005       0.1    1005    60.1    1013   60.11    1013  136.52
X1   218       7       5        60   19.45   43.36   31.02
CI    -1 1005.05   0.014         0       0     -30    0.01
X3    10
GR1013.5       0  1013.5         5    1013   16.04    1013   17.07  1013.5      60
GR1013.5  120.05  1013.5       150
X1   219       5      10        40   29.84   53.94   41.46
CI    25 1005.11   0.014         0       0     -30    0.01
GR  1014       0    1014        10    1013   29.79    1013      40    1013   98.02
X1   220       5       5        35   48.79   49.78   49.42
CI    20 1005.18                 0       0     -30    0.01
GR  1014       0    1014         5  1013.5   30.19    1013      35    1013   60.38
X1   221       8      15        45   81.55   82.36   81.91
CI    30  1005.3                 0       0     -30    0.01
X3    10
GR  1013       0    1013     11.78    1013      15    1012      26    1013      45
GR  1013   66.78    1013     74.44    1013     130
X1   222       3       0     30.28  374.97  382.79  379.06
CI  15.5 1005.87                 0       0     -30    0.01
GR  1013       0  1012.5     30.28    1012   60.56
NC 0.035   0.035   0.014
QT     1    1084
X1   223       8      20        79  154.62  150.66  153.52
CI  51.5 1006.22   0.014         3       3     -20    0.01
X3    10
GR1013.7       0 1013.18      16.2 1013.18      20    1013   25.74  1011.5      41
GR1012.5   71.23  1012.5        79  1012.5     125
X1   224       7   16.58     75.58  158.25  163.45  161.41
CI 46.08 1006.59                 3       3     -20    0.01
X3    10
GR  1013       0    1013     16.58    1013   39.27  1012.4   71.58  1012.4   75.58
GR1012.3   95.92  1012.3       125
X1   225      10      16        75  257.13  260.45  260.21
CI  45.5 1007.18                 3       3     -20    0.01
X3    10
GR1013.1       0    1013     13.37    1013      16 1012.97   17.42    1013   19.39
GR  1013    59.6    1013     68.37    1013      75  1012.4   99.31  1012.4   104.9
X1   226      18   15.28     88.39   247.8   245.4  246.17
CI    -1 1007.75   0.014         3       3     -20    0.01
X3    10
GR  1013       0    1013      5.88 1013.05   15.28    1013   17.89    1013   18.13
GR  1012   24.11    1011      29.7    1010   36.48    1009   43.28 1008.25   46.62
```

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GR1008.8    60.76     1009    63.16     1010    69.05     1011    74.86     1012    79.69
GR  1013    88.39     1013    92.26     1013     150
EJ
ER

 *  HEC-2 WATER SURFACE PROFILES            *                                                    *
U.S. ARMY CORPS OF ENGINEERS         *
 *                                          *                                                    *
HYDROLOGIC ENGINEERING CENTER        *
 *  Version    4.6.2;  May 1991             *                                                    *
609 SECOND STREET, SUITE D           *
 *                                          *                                                    *
DAVIS, CALIFORNIA 95616-4687         *
 *  RUN DATE    07MAY97    TIME   11:58:21  *                                                    *
      (916) 756-1104                *
 ********************************************
****************************************


                                                             X     X  XXXXXXX   XXXXX           XXXXX
                                                             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
1
    07MAY97       11:58:21
                PAGE     1



                                                                                      THIS RUN
EXECUTED 07MAY97     11:58:21
 *************************************
  HEC-2 WATER SURFACE PROFILES

  Version    4.6.2;  May 1991
 *************************************


 T1       1201202
 T2       RID LITCHFIELD ROAD OVERCHUTE PROJECT
 T3       METAJOB 2 - SUNCOR CHANN, RID OVERCH, RECT CONC CHANN, & BAS OUTLET CHAN
 T4       THIS REACH BEG @ THE 4 RID OVERCH BASINS, EXTENDS WEST THRU CONC LINED
 T4       BASIN OUTLET CHANN; CROSSES RID OVERCH STRUCT, & CONTINUES SOUTH TO
 T4       PALM VALLEY GOLF COURSE.  CONDITIONS ARE ANAL. W/ A Q=1492 cfs FROM THE
 T4       OVERCH D/S, 1319 cfs FROM MERGE POINT OF RECT CONC CHANN (600'E OF
 T4       OVERCH) TO OVERCHUTE; AND 1071 cfs FROM DETENTION BASINS TO RECT CHANN.

 J1   ICHECK     INQ        NINV       IDIR       STRT       METRIC     HVINS      Q          WSEL       FQ

      -10          2                                                              1456    1000.35


 J2  NPROF      IPLOT      PRFVS      XSECV      XSECH      FN        ALLDC      IBW        CHNIM
ITRACE

        1                    -1                                                    -6

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    07MAY97       11:58:21
                PAGE     2


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

```
ENDST

 *PROF 1
0

 CCHV=      .100 CEHV=      .300
 *SECNO 200.000

 3470 ENCROACHMENT STATIONS=        57.3       84.6  TYPE=       1  TARGET=        27.290
  ELENCL=   1001.00  ELENCR=   1001.00
    200.000       7.23   1000.35       .00   1000.35   1001.20       .85       .00       .00
1000.12
     1456.0        .0    1456.0        .0        .0     197.1        .0        .0        .0
1001.00
        .00       .03      7.39       .00      .035      .035      .000      .000    993.12
57.26
    .003789        0.        0.        0.         0         0         0       .00     27.29
84.55


 CCHV=      .100 CEHV=      .300
 *SECNO 201.000

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1001.16 ELREA=      1001.16

    201.000       8.61   1000.77       .00       .00   1001.37       .60       .15       .03
1001.16
     1456.0        .0    1456.0        .0        .0     235.1        .0        .2        .0
1001.10
        .00       .00      6.19       .00      .000      .035      .000      .000    992.16
13.01
    .002312       50.       50.       50.         2         0         0       .00     27.31
40.32


 SPECIAL CULVERT

 SC  CUNO      CUNV      ENTLC      COFQ      RDLEN      RISE      SPAN      CULVLN    CHRT
SCL        ELCHU      ELCHD
     3         .013       .40       2.90      53.49      7.00      8.00      45.00      8          1
    993.62    993.12

 CHART  8 - BOX CULVERT WITH FLARED WINGWALLS; NO INLET TOP EDGE BEVEL
 SCALE  1 - WINGWALLS FLARED 30 TO 75 DEGREES

 *SECNO 202.000

 SPECIAL CULVERT OUTLET CONTROL + WEIR FLOW EG =   1002.16
 SPECIAL CULVERT

      EGIC      EGOC        H4     QWEIR     QCULV       VCH     ACULV     ELTRD    WEIRLN
   1001.46   1002.52       .79      161.     1296.     6.221     168.0   1001.13       53.


 3470 ENCROACHMENT STATIONS=        57.3       84.6  TYPE=       1  TARGET=        27.290
  ELENCL=   1001.13  ELENCR=   1001.13
    202.000       8.44   1001.56       .00       .00   1002.16       .59       .79       .00
1000.12
     1456.0      12.4    1433.3      10.3      10.8     230.4       9.0        .5        .1
1001.13
        .00      1.15      6.22      1.14      .035      .035      .035      .000    993.12
32.13
    .002241       45.       45.       45.         2         0         0       .00     74.10
106.24


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                 PAGE    3


     SECNO     DEPTH     CWSEL     CRIWS     WSELK       EG       HV       HL      OLOSS
L-BANK ELEV
       Q       QLOB       QCH      QROB      ALOB      ACH      AROB      VOL      TWA
R-BANK ELEV
```

```
     TIME        VLOB        VCH         VROB        XNL         XNCH        XNR         WTN         ELMIN
SSTA
     SLOPE       XLOBL       XLCH        XLOBR       ITRIAL      IDC         ICONT       CORAR       TOPWID
ENDST


 CCHV=      .500 CEHV=      .700
 *SECNO 203.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  2.14


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1004.00 ELREA=      1004.00

    203.000      9.30   1002.30        .00         .00   1002.44        .14         .06         .22
1004.00
     1456.0        .0    1456.0         .0          .0     480.1         .0         1.0          .2
1004.00
        .01       .00      3.03        .00        .000      .035       .000        .000      993.00
27.81
    .000490       78.       64.        48.          2          0          0         .00       79.27
107.07


 *SECNO 204.000

 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .60


 3470 ENCROACHMENT STATIONS=        23.5      105.1  TYPE=       1  TARGET=       -23.450

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1002.00 ELREA=      1004.00

    204.000      8.28   1002.28        .00         .00   1002.57        .29         .03         .10
1002.00
     1456.0        .0    1456.0         .0          .0     336.5         .0         1.4          .3
1004.00
        .01       .00      4.33        .00        .000      .035       .000        .000      994.00
23.45
    .001358       51.       34.        14.          2          0          0         .00       70.76
94.21


 *SECNO 205.000
 3280 CROSS SECTION    205.00 EXTENDED       .46 FEET


 3470 ENCROACHMENT STATIONS=        73.5      135.6  TYPE=       1  TARGET=       -73.540

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1002.00 ELREA=    100000.00

    205.000      7.46   1002.46        .00         .00   1002.92        .46         .23         .12
1002.00
     1456.0        .0    1456.0         .0          .0     266.2         .0         2.2          .5
100000.00
        .02       .00      5.47        .00        .000      .035       .000        .000      995.00
73.54
    .002515      136.      129.       122.          2          0          0         .00       62.06
135.60


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                  PAGE    4


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


 *SECNO 206.000
 3280 CROSS SECTION    206.00 EXTENDED       .51 FEET
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    206.000       6.51   1003.51       .00       .00   1004.08       .56      1.09       .07
1003.00
     1456.0         .0    1456.0        .0        .0     241.7        .0       4.5       1.0
1003.00
        .04        .00      6.02       .00      .000      .035      .000      .000    997.00
.00
    .003184       383.      385.      387.         2         0         0       .00     58.04
58.04


 *SECNO 207.000
 3280 CROSS SECTION    207.00 EXTENDED       .13 FEET


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1005.00 ELREA=      1004.00

    207.000       7.13   1004.13       .00       .00   1004.73       .60       .63       .03
1005.00
     1456.0         .0    1456.0        .0        .0     233.5        .0       5.5       1.2
1004.00
        .04        .00      6.24       .00      .000      .035      .000      .000    997.00
5.67
    .003815       178.      180.      180.         2         0         0       .00     61.88
67.55


 *SECNO 208.000
 3280 CROSS SECTION    208.00 EXTENDED       .34 FEET

    208.000       6.35   1004.35       .00       .00   1004.96       .61       .22       .00
1004.00
     1456.0         .0    1456.0        .0        .0     233.2        .0       5.8       1.3
1004.00
        .05        .00      6.24       .00      .000      .035      .000      .000    998.00
.00
    .003493        56.       61.       69.         0         0         0       .00     57.10
57.10


 *SECNO 209.000
 3280 CROSS SECTION    209.00 EXTENDED       .56 FEET

    209.000       6.56   1004.56       .00       .00   1005.51       .95       .32       .24
1004.00
     1456.0         .0    1456.0        .0        .0     186.1        .0       6.2       1.4
1004.00
        .05        .00      7.83       .00      .000      .035      .000      .000    998.00
.00
    .005535        58.       73.       90.         2         0         0       .00     44.55
44.55


 *SECNO 210.000
 3280 CROSS SECTION    210.00 EXTENDED      1.40 FEET

    210.000       7.40   1005.40       .00       .00   1006.06       .66       .40       .15
1004.00
     1456.0         .0    1456.0        .0        .0     223.6        .0       6.6       1.5
1004.00
        .05        .00      6.51       .00      .000      .035      .000      .000    998.00
.00
    .003084        99.       99.       98.         3         0         0       .00     43.81
43.81


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

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 *SECNO 211.000
 3280 CROSS SECTION    211.00 EXTENDED      1.03 FEET


 3470 ENCROACHMENT STATIONS=       14.8       59.7  TYPE=       1   TARGET=       44.870
  ELENCL=   1006.50  ELENCR=   1006.50

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1004.00 ELREA=      1006.50

    211.000       8.02   1006.02        .00        .00   1006.63        .60        .54        .03
1004.00
     1456.0         .0    1456.0         .0         .0     233.7         .0        7.6        1.7
1006.50
        .06        .00      6.23        .00       .000      .035       .000       .000     998.00
14.81
    .002610       191.      191.       190.          2         0          0        .00      44.87
59.68


 *SECNO 212.000
 3280 CROSS SECTION    212.00 EXTENDED      2.04 FEET


 3470 ENCROACHMENT STATIONS=       26.6       69.6  TYPE=       1   TARGET=       43.010
  ELENCL=   1007.50  ELENCR=   1007.50

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1005.00 ELREA=      1007.50

    212.000       7.04   1007.04        .00        .00   1007.70        .66       1.03        .04
1005.00
     1456.0         .0    1456.0         .0         .0     222.6         .0        9.6        2.1
1007.50
        .08        .00      6.54        .00       .000      .035       .000       .000    1000.00
26.59
    .002947       372.      372.       373.          2         0          0        .00      43.01
69.60


 *SECNO 213.000
 3280 CROSS SECTION    213.00 EXTENDED      1.34 FEET


 3470 ENCROACHMENT STATIONS=         .0       41.5  TYPE=       1   TARGET=       41.549
    213.000       7.34   1008.34        .00        .00   1009.01        .67       1.30        .00
1006.00
     1456.0         .0    1456.0         .0         .0     222.2         .0       11.8        2.5
1009.00
        .10        .00      6.55        .00       .000      .035       .000       .000    1001.00
.00
    .003062       434.      434.       433.          2         0          0        .00      41.55
41.55


 *SECNO 214.000
1
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      SECNO      DEPTH      CWSEL      CRIWS      WSELK       EG         HV         HL         OLOSS
L-BANK ELEV
        Q        QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA
R-BANK ELEV
      TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN
SSTA
      SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID
ENDST


 3280 CROSS SECTION    214.00 EXTENDED      1.51 FEET


 3470 ENCROACHMENT STATIONS=       29.1       68.1  TYPE=       1   TARGET=       38.980
  ELENCL=   1010.50  ELENCR=   1010.50

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1007.00 ELREA=      1010.50
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   214.000       7.51   1009.51        .00        .00   1010.26        .75       1.20        .06
1007.00
    1456.0         .0    1456.0         .0         .0     209.8         .0       13.7        2.8
1010.50
       .11        .00      6.94        .00       .000      .035       .000       .000    1002.00
29.13
   .003224       381.      382.       382.          2         0          0        .00      38.98
68.11


 CCHV=      .100 CEHV=      .300
 *SECNO 215.000

 3470 ENCROACHMENT STATIONS=        33.2        73.7  TYPE=       1  TARGET=        40.510
  ELENCL=   1011.50  ELENCR=   1011.50

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=       1009.00 ELREA=      1011.50

   215.000       6.51   1010.51        .00        .00   1011.63       1.12       1.26        .11
1009.00
    1456.0         .0    1456.0         .0         .0     171.5         .0       14.9        3.1
1011.50
       .12        .00      8.49        .00       .000      .035       .000       .000    1004.00
33.17
   .006394       286.      286.       286.          2         0          0        .00      40.51
73.68


 *SECNO 216.000

 3301 HV CHANGED MORE THAN HVINS


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  7.88


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=       1013.00 ELREA=      1013.00

   216.000       7.07   1011.57        .00        .00   1011.76        .18        .03        .09
1013.00
    1456.0         .0    1456.0         .0         .0     423.0         .0       15.6        3.2
1013.00
       .13        .00      3.44        .00       .000      .014       .000       .000    1004.50
26.00
   .000103        97.        95.        96.          2         0          0        .00      60.02
86.03


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                 PAGE     7


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


 *SECNO 217.000

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=       1013.00 ELREA=      1013.00

   217.000       6.59   1011.59        .00        .00   1011.77        .17        .01        .00
1013.00
    1323.0         .0    1323.0         .0         .0     395.8         .0       16.2        3.3
1013.00
       .14        .00      3.34        .00       .000      .014       .000       .000    1005.00
.02
   .000104        71.        71.        71.          2         0          0        .00      60.09
60.11


 *SECNO 218.000
```

```
 CHIMP CLSTA=      32.50 CELCH=     1005.05 BW=      30.00 STCHL=       5.00 STCHR=      60.00
 EXCAVATION DATA
 AEX=     239.5SQ-FT      VEXR=          .0K*CU-YD     VEXT=          .0K*CU-YD


 3301 HV CHANGED MORE THAN HVINS


 3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .40


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1013.50 ELREA=      1013.50

    218.000      6.10   1011.15       .00       .00   1011.96       .81       .01       .19
1013.50
     1323.0        .0    1323.0        .0        .0     183.2        .0      16.4       3.3
1013.50
        .14       .00      7.22       .00      .000      .014      .000      .000   1005.05
17.50
    .000653       19.       31.       43.         2         0         0       .00     30.00
47.50


 *SECNO 219.000
 CHIMP CLSTA=      25.00 CELCH=     1005.11 BW=      30.00 STCHL=      10.00 STCHR=      40.00
 EXCAVATION DATA
 AEX=     246.6SQ-FT      VEXR=          .4K*CU-YD     VEXT=          .4K*CU-YD

    219.000      6.06   1011.17       .00       .00   1011.99       .82       .03       .00
1014.00
     1323.0        .0    1323.0        .0        .0     181.8        .0      16.6       3.4
1013.00
        .14       .00      7.28       .00      .000      .014      .000      .000   1005.11
10.00
    .000669       30.       41.       54.         0         0         0       .00     30.00
40.00


 *SECNO 220.000
 CHIMP CLSTA=      20.00 CELCH=     1005.18 BW=      30.00 STCHL=       5.00 STCHR=      35.00
1
    07MAY97       11:58:21
               PAGE     8


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


 EXCAVATION DATA
 AEX=     254.7SQ-FT      VEXR=          .5K*CU-YD     VEXT=          .8K*CU-YD

    220.000      6.02   1011.20       .00       .00   1012.03       .83       .03       .00
1014.00
     1323.0        .0    1323.0        .0        .0     180.7        .0      16.8       3.4
1013.00
        .14       .00      7.32       .00      .000      .014      .000      .000   1005.18
5.00
    .000681       49.       49.       50.         0         0         0       .00     30.00
35.00


 *SECNO 221.000
 CHIMP CLSTA=      30.00 CELCH=     1005.30 BW=      30.00 STCHL=      15.00 STCHR=      45.00
 EXCAVATION DATA
 AEX=     216.0SQ-FT      VEXR=          .7K*CU-YD     VEXT=         1.5K*CU-YD


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1013.00 ELREA=      1013.00

    221.000      5.94   1011.24       .00       .00   1012.09       .85       .06       .01
1013.00
```

```
     1323.0          .0      1323.0          .0          .0       178.4          .0        17.2         3.5
1013.00
        .14         .00        7.42         .00        .000        .014        .000        .000     1005.30
15.00
    .000707         82.         82.         82.           1           0           0         .00       30.00
45.00


 *SECNO 222.000
 CHIMP CLSTA=       15.50 CELCH=    1005.87 BW=       30.00 STCHL=         .00 STCHR=       30.50
 EXCAVATION DATA
 AEX=      206.2SQ-FT      VEXR=        3.0K*CU-YD     VEXT=          4.5K*CU-YD

    222.000        5.58     1011.45         .00         .00     1012.42         .97         .29         .03
1013.00
     1323.0          .0      1323.0          .0          .0       167.5          .0        18.7         3.7
1012.50
        .16         .00        7.90         .00        .000        .014        .000        .000     1005.87
.50
    .000853        375.        379.        383.           2           0           0         .00       30.00
30.50


 *SECNO 223.000
 CHIMP CLSTA=       51.50 CELCH=    1006.22 BW=       20.00 STCHL=       20.00 STCHR=       80.34
 EXCAVATION DATA
 AEX=      227.3SQ-FT      VEXR=        1.2K*CU-YD     VEXT=          5.7K*CU-YD


 3301 HV CHANGED MORE THAN HVINS

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



 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1013.18 ELREA=       1012.50

    223.000        5.99     1012.21         .00         .00     1012.56         .35         .08         .06
1013.18
     1084.0          .0      1084.0          .0          .0       227.5          .0        19.4         3.9
1012.50
        .17         .00        4.77         .00        .000        .014        .000        .000     1006.22
23.53
    .000325        155.        154.        151.           3           0           0         .00       55.94
79.47


 *SECNO 224.000
 CHIMP CLSTA=       46.08 CELCH=    1006.59 BW=       20.00 STCHL=       16.58 STCHR=       75.58
 EXCAVATION DATA
 AEX=      240.1SQ-FT      VEXR=        1.4K*CU-YD     VEXT=          7.1K*CU-YD


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=      1013.00 ELREA=       1012.40

    224.000        5.63     1012.22         .00         .00     1012.64         .42         .06         .02
1013.00
     1084.0          .0      1084.0          .0          .0       207.7          .0        20.2         4.1
1012.40
        .17         .00        5.22         .00        .000        .014        .000        .000     1006.59
19.19
    .000417        158.        161.        163.           2           0           0         .00       53.79
72.97


 *SECNO 225.000
```

```
 CHIMP CLSTA=       45.50 CELCH=      1007.18 BW=       20.00 STCHL=       16.00 STCHR=       75.00
 EXCAVATION DATA
 AEX=      218.0SQ-FT      VEXR=         2.2K*CU-YD      VEXT=          9.3K*CU-YD

 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=       1013.00 ELREA=      1013.00

    225.000       5.07    1012.25        .00        .00    1012.82        .57        .13        .05
1013.00
      1084.0        .0     1084.0         .0         .0      178.4         .0       21.3        4.4
1013.00
         .19        .00       6.08        .00       .000       .014       .000       .000    1007.18
20.30
     .000634       257.       260.       260.          2          0          0        .00      50.41
70.70


 *SECNO 226.000
 CHIMP CLSTA=       51.83 CELCH=      1007.75 BW=       20.00 STCHL=       15.28 STCHR=       88.39
 EXCAVATION DATA
 AEX=         1.1SQ-FT      VEXR=         1.0K*CU-YD      VEXT=         10.3K*CU-YD

1
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                  PAGE   10


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


 3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA=       1013.05 ELREA=      1013.00

    226.000       4.54    1012.29        .00        .00    1013.07        .78        .19        .06
1013.05
      1084.0        .0     1084.0         .0         .0      152.8         .0       22.3        4.7
1013.00
         .20        .00       7.09        .00       .000       .014       .000       .000    1007.75
28.20
     .000973       248.       246.       245.          2          0          0        .00      47.26
75.47


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                  PAGE   11



                                                                                       THIS RUN
EXECUTED 07MAY97     11:58:22
 **************************************
  HEC-2 WATER SURFACE PROFILES

  Version    4.6.2;  May 1991
 **************************************


 NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST


 METAJOB 2 - SUNCOR CHANN

 SUMMARY PRINTOUT TABLE  150


       SECNO       XLCH      ELTRD       ELLC      ELMIN          Q      CWSEL      CRIWS         EG
10*KS       VCH       AREA      .01K

      200.000        .00        .00        .00     993.12    1456.00    1000.35        .00    1001.20
```

```
37.89       7.39    197.13    236.54

         201.000     50.00       .00       .00    992.16   1456.00   1000.77       .00   1001.37
23.12       6.19    235.15    302.82

         202.000     45.00   1001.13       .00    993.12   1456.00   1001.56       .00   1002.16
22.41       6.22    250.23    307.57

 *       203.000     63.99       .00       .00    993.00   1456.00   1002.30       .00   1002.44
4.90        3.03    480.11    657.89

 *       204.000     34.10       .00       .00    994.00   1456.00   1002.28       .00   1002.57
13.58       4.33    336.50    395.13

         205.000    129.11       .00       .00    995.00   1456.00   1002.46       .00   1002.92
25.15       5.47    266.21    290.32

         206.000    384.85       .00       .00    997.00   1456.00   1003.51       .00   1004.08
31.84       6.02    241.71    258.02

         207.000    179.78       .00       .00    997.00   1456.00   1004.13       .00   1004.73
38.15       6.24    233.46    235.72

         208.000     61.07       .00       .00    998.00   1456.00   1004.35       .00   1004.96
34.93       6.24    233.17    246.37

         209.000     72.84       .00       .00    998.00   1456.00   1004.56       .00   1005.51
55.35       7.83    186.07    195.71

         210.000     98.88       .00       .00    998.00   1456.00   1005.40       .00   1006.06
30.84       6.51    223.55    262.20

         211.000    190.51       .00       .00    998.00   1456.00   1006.02       .00   1006.63
26.10       6.23    233.73    285.02

         212.000    372.25       .00       .00   1000.00   1456.00   1007.04       .00   1007.70
29.47       6.54    222.60    268.20

         213.000    433.83       .00       .00   1001.00   1456.00   1008.34       .00   1009.01
30.62       6.55    222.22    263.14

         214.000    381.83       .00       .00   1002.00   1456.00   1009.51       .00   1010.26
32.24       6.94    209.84    256.44

         215.000    285.61       .00       .00   1004.00   1456.00   1010.51       .00   1011.63
63.94       8.49    171.52    182.08

 *       216.000     95.16       .00       .00   1004.50   1456.00   1011.57       .00   1011.76
1.03        3.44    423.01   1433.99

1
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                    PAGE   12

           SECNO      XLCH     ELTRD      ELLC     ELMIN         Q     CWSEL     CRIWS        EG
10*KS        VCH      AREA      .01K

         217.000     71.31       .00       .00   1005.00   1323.00   1011.59       .00   1011.77
1.04        3.34    395.84   1294.69

 *       218.000     31.02       .00       .00   1005.05   1323.00   1011.15       .00   1011.96
6.53        7.22    183.23    517.53

         219.000     41.46       .00       .00   1005.11   1323.00   1011.17       .00   1011.99
6.69        7.28    181.78    511.48

         220.000     49.42       .00       .00   1005.18   1323.00   1011.20       .00   1012.03
6.81        7.32    180.73    507.13

         221.000     81.91       .00       .00   1005.30   1323.00   1011.24       .00   1012.09
7.07        7.42    178.42    497.60

         222.000    379.06       .00       .00   1005.87   1323.00   1011.45       .00   1012.42
8.53        7.90    167.49    453.11

         223.000    153.52       .00       .00   1006.22   1084.00   1012.21       .00   1012.56
3.25        4.77    227.45    601.20
```

	224.000	161.41	.00	.00	1006.59	1084.00	1012.22	.00	1012.64
4.17	5.22	207.74	530.89						
	225.000	260.21	.00	.00	1007.18	1084.00	1012.25	.00	1012.82
6.34	6.08	178.41	430.52						
	226.000	246.17	.00	.00	1007.75	1084.00	1012.29	.00	1013.07
9.73	7.09	152.82	347.52						

METAJOB 2 - SUNCOR CHANN

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	200.000	1456.00	1000.35	.00	.00	.00	27.29	.00
	201.000	1456.00	1000.77	.00	.42	.00	27.31	50.00
	202.000	1456.00	1001.56	.00	.79	.00	74.10	45.00
*	203.000	1456.00	1002.30	.00	.73	.00	79.27	63.99
*	204.000	1456.00	1002.28	.00	-.02	.00	70.76	34.10
	205.000	1456.00	1002.46	.00	.18	.00	62.06	129.11
	206.000	1456.00	1003.51	.00	1.06	.00	58.04	384.85
	207.000	1456.00	1004.13	.00	.61	.00	61.88	179.78
	208.000	1456.00	1004.35	.00	.22	.00	57.10	61.07
	209.000	1456.00	1004.56	.00	.21	.00	44.55	72.84
	210.000	1456.00	1005.40	.00	.84	.00	43.81	98.88
	211.000	1456.00	1006.02	.00	.62	.00	44.87	190.51
	212.000	1456.00	1007.04	.00	1.01	.00	43.01	372.25
	213.000	1456.00	1008.34	.00	1.30	.00	41.55	433.83
	214.000	1456.00	1009.51	.00	1.18	.00	38.98	381.83
	215.000	1456.00	1010.51	.00	1.00	.00	40.51	285.61
*	216.000	1456.00	1011.57	.00	1.06	.00	60.02	95.16
	217.000	1323.00	1011.59	.00	.02	.00	60.09	71.31
*	218.000	1323.00	1011.15	.00	-.44	.00	30.00	31.02
	219.000	1323.00	1011.17	.00	.02	.00	30.00	41.46
	220.000	1323.00	1011.20	.00	.03	.00	30.00	49.42
	221.000	1323.00	1011.24	.00	.04	.00	30.00	81.91
	222.000	1323.00	1011.45	.00	.21	.00	30.00	379.06
	223.000	1084.00	1012.21	.00	.76	.00	55.94	153.52

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
224.000	1084.00	1012.22	.00	.01	.00	53.79	161.41

```
        225.000     1084.00     1012.25        .00         .03         .00      50.41      260.21

        226.000     1084.00     1012.29        .00         .05         .00      47.26      246.17
1
    07MAY97        11:58:21
                  PAGE   15
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  SUMMARY OF ERRORS AND SPECIAL NOTES

 WARNING SECNO=     203.000   PROFILE=  1   CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=     204.000   PROFILE=  1   CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=     216.000   PROFILE=  1   CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=     218.000   PROFILE=  1   CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
```

8. Appendix --- *HEC-2 Input Files Used for last Iteration with HEC-1 (for channel from detention basin outlet to golf course at Thomas Road)*

```
T1      1201202
T2      RID LITCHFIELD ROAD OVERCHUTE PROJECT
J1   -10       2                                                      1000.35
J2     1              -1                                          -6
QT     5    1455    1164     873     582     291
NC 0.035   0.035   0.035     0.1     0.3
X1   200       8   57.28   84.59
X3     0                   57.26    1001   84.55    1001
GR  1001       0    1001    33.3 1000.12   57.28  993.12   57.29  993.12   84.58
GR1000.1   84.59    1001  104.07    1001  136.28
NC 0.035   0.035   0.035     0.1     0.3
X1   201       7   13.01   40.32      50      50      50
X3    10                                                 1001.16 1001.16
GR1001.1       0 1001.16    3.15 1001.16   13.01  992.16   13.02  992.16   40.31
GR1001.1   40.32 1001.16   53.49
SC 3.013     0.4     2.9   53.49       7       8      45     8.1  993.62  993.12
X1   202      22   57.28   84.59      45      45      45
X2                     2         1001.13
X3     0                   57.26 1001.13   84.55 1001.13
GR  1003       0    1003    0.02    1004    3.52    1005    5.61    1006    7.76
GR  1007    9.93    1007   13.25    1006   15.71    1005   18.61    1004   21.62
GR  1003   27.05    1002   30.99    1001    33.3 1000.12   57.28  993.12   57.29
GR993.12   84.58 1000.12   84.59    1001  104.07    1002  108.36    1003  112.19
GR  1004  114.82    1005  136.28
NC                           0.5     0.7
X1   203      28    13.2  114.96   77.83   47.74   63.99
X3    10
GR  1006       0    1006    4.78    1005    8.99    1004    13.2    1003   17.42
GR  1002   32.16    1001   34.92    1000   36.93     999   38.93     998   40.94
GR   997   42.94     996   44.94     995   47.76     994   50.36     993   54.44
GR   993   81.68     994   84.24     995   86.81     996   89.37     997   91.94
GR   998    94.5     999   97.07    1000   99.37    1001  101.62    1002  105.63
GR  1003  110.52    1004  114.96    1005  119.36
X1   204      22   23.45   99.23   51.14   14.17    34.1
X3    10                   23.45
GR  1003       0    1002   23.45    1001   27.45    1000   31.45     999   35.44
GR   998   39.44     997   43.44     996   47.44     995   51.43     994   55.43
GR   994   64.84     995   68.39     996   71.95     997   75.51     998   79.06
GR   999   82.62    1000   86.18    1001   89.74    1002   93.29    1003    96.6
GR  1004   99.23    1005   105.1
X1   205      17   73.54   135.6  136.08  122.08  129.11
X3    10                   73.54
GR  1003       0    1002   73.54    1001   77.48    1000   81.43     999   85.37
GR   998    89.3     997   93.23     996   97.22     995  101.19     995  106.01
GR   996  111.32     997  115.33     998  119.34     999  123.35    1000  127.44
GR  1001  131.57    1002   135.6
X1   206      14       0   58.04  382.73  386.94  384.85
X3    10
GR  1003       0    1002    3.86    1001    7.72    1000   11.58     999   15.44
```

GR	998	19.3	997	23.15	997	35.98	998	39.48	999	43.11
GR	1000	46.86	1001	50.61	1002	54.36	1003	58.04		
X1	207	18	1.69	67.55	177.74	180.03	179.78			
X3	10									
GR	1005	0	1005	1.69	1004	6.25	1003	10.56	1002	14.86
GR	1001	19.17	1000	23.47	999	27.78	998	32.08	997	36.28
GR	997	37.51	998	44.15	999	47.97	1000	51.8	1001	55.62
GR	1002	59.45	1003	63.28	1004	67.55				
X1	208	14	0	57.1	55.55	69.26	61.07			
X3	10									
GR	1004	0	1003	3.26	1002	6.53	1001	9.79	1000	13.06
GR	999	16.33	998	19.6	998	31.65	999	36.69	1000	41.72
GR	1001	45.71	1002	50.16	1003	53.64	1004	57.1		
X1	209	14	0	44.55	58.35	89.73	72.84			
X3	10									
GR	1004	0	1003	2.59	1002	5.19	1001	7.78	1000	10.38
GR	999	12.97	998	15.57	998	25.57	999	28.5	1000	31.43
GR	1001	34.36	1002	37.37	1003	41	1004	44.55		
X1	210	14	0	43.81	99.35	98.29	98.88			
X3	10									
GR	1004	0	1003	2.84	1002	5.68	1001	8.52	1000	11.36
GR	999	14.21	998	17.05	998	27.31	999	30.06	1000	32.81
GR	1001	35.56	1002	38.31	1003	41.06	1004	43.81		
X1	211	17	14.81	59.68	191.04	190.14	190.51			
X3	10			14.81	1006.5	59.68	1006.5			
GR	1005	0	1004	14.81	1003	17.84	1002	20.87	1001	23.9
GR	1000	26.93	999	29.96	998	33	998	39.19	999	42.11
GR	1000	45.03	1001	47.95	1002	50.88	1003	53.8	1004	56.74
GR	1005	59.68	1005	70.95						
X1	212	13	26.59	69.6	371.95	372.72	372.25			
X3	10			26.59	1007.5	69.6	1007.5			
GR	1006	0	1005	26.59	1004	29.76	1003	33	1002	36.24
GR	1001	39.47	1000	42.71	1000	53.65	1001	56.84	1002	60.03
GR	1003	63.22	1004	66.41	1005	69.6				
X1	213	13	0	41.55	434.21	433.34	433.83			
X3	0					41.55	1009			
GR	1006	0	1005	3.22	1004	6.44	1003	9.61	1002	12.73
GR	1001	15.86	1001	24.38	1002	27.87	1003	31.29	1004	34.71
GR	1005	38.13	1006	41.55	1007	44.96				
X1	214	16	29.13	68.11	381.2	382.42	381.83			
X3	10			29.13	1010.5	68.11	1010.5			
GR	1008	0	1007	29.13	1006	32.52	1005	35.95	1004	39.17
GR	1003	42.29	1002	45.56	1002	51.5	1003	54.85	1004	58.17
GR	1005	61.49	1006	64.8	1007	68.11	1008	71.46	1008	77.42
GR	1008	127.14								
NC	0.035	0.035	0.035	0.1	0.3					
X1	215	15	33.17	73.68	285.61	285.61	285.61			
X3	10			33.17	1011.5	73.68	1011.5			
GR	1009	0	1009	33.17	1008	36.84	1007	40.52	1006	44.2
GR	1005	47.87	1004	51.34	1004	55.69	1005	58.68	1006	62.37
GR	1007	66.17	1008	69.97	1009	73.68	1010	79.8	1011	114.07
NC	0.035	0.035	0.014							
X1	216	8	26	86.03	96.55	95.82	95.16			
X3	10									
GR	1013	0	1013	26	1004.53	26.01	1004.53	46.61	1004.53	71.5
GR	1004.5	86.01	1013	86.03	1013	93.93				
NC	0.035	0.035	0.014							
QT	5	1322	1058	793	529	264				
X1	217	5	0	60.11	71.31	71.31	71.31			
X3	10									
GR	1013	0	1005	0.1	1005	60.1	1013	60.11	1013	136.52
X1	218	7	5	60	19.45	43.36	31.02			
CI	-1	1005.05	0.014	0	0	-30	0.01			
X3	10									
GR	1013.5	0	1013.5	5	1013	16.04	1013	17.07	1013.5	60
GR	1013.5	120.05	1013.5	150						
X1	219	5	10	40	29.84	53.94	41.46			
CI	25	1005.11	0.014	0	0	-30	0.01			
GR	1014	0	1014	10	1013	29.79	1013	40	1013	98.02
X1	220	5	5	35	48.79	49.78	49.42			
CI	20	1005.18		0	0	-30	0.01			
GR	1014	0	1014	5	1013.5	30.19	1013	35	1013	60.38
X1	221	8	15	45	81.55	82.36	81.91			
CI	30	1005.3		0	0	-30	0.01			
X3	10									
GR	1013	0	1013	11.78	1013	15	1012	26	1013	45
GR	1013	66.78	1013	74.44	1013	130				
X1	222	3	0	30.28	374.97	382.79	379.06			

```
CI   15.5 1005.87               0       0     -30    0.01
GR   1013       0  1012.5   30.28    1012   60.56
NC 0.035   0.035   0.014
QT      5    1083     866     650     433     217
X1    223       8      20      79  154.62  150.66  153.52
CI   51.5 1006.22   0.014       3       3     -20    0.01
X3     10
GR1013.7        0 1013.18    16.2 1013.18      20    1013   25.74  1011.5      41
GR1012.5    71.23  1012.5      79  1012.5     125
X1    224       7   16.58   75.58  158.25  163.45  161.41
CI 46.08  1006.59               3       3     -20    0.01
X3     10
GR   1013       0    1013   16.58    1013   39.27  1012.4   71.58  1012.4   75.58
GR1012.3    95.92  1012.3     125
X1    225      10      16      75  257.13  260.45  260.21
CI   45.5 1007.18               3       3     -20    0.01
X3     10
GR1013.1        0    1013   13.37    1013      16 1012.97   17.42    1013   19.39
GR   1013    59.6    1013   68.37    1013      75  1012.4   99.31  1012.4   104.9
X1    226      18   15.28   88.39   247.8   245.4  246.17
CI     -1 1007.75   0.014       3       3     -20    0.01
X3     10
GR   1013       0    1013    5.88 1013.05   15.28    1013   17.89    1013   18.13
GR   1012   24.11    1011    29.7    1010   36.48    1009   43.28 1008.25   46.62
GR1008.8    60.76    1009   63.16    1010   69.05    1011   74.86    1012   79.69
GR   1013   88.39    1013   92.26    1013     150
EJ
T1       second profile
J1    -10       3                                                 1000.35
J2      2
T1       third profile
J1    -10       4                                                 1000.35
J2      3
T1       fourth profile
J1    -10       5                                                 1000.35
J2      4
T1       fifth profile
J1    -10       6                                                 1000.35
J2      5
ER
```

Sedimentation Engineering

Introduction

Sedimentation tasks involve the estimation of sediment yield into the detention basin and the sediment routing through the unlined channels (West interceptor and Plaza Circle channels). The sediment yield results will be used to size the basin to have adequate capacity to contain the 100 year flood volume as well as sediment deposited during this flood event. Also, it will be used to estimate the level of sediment removal required for maintenance budgeting. The sediment routing through the channels is to determine the level of aggradation and degradation and account for these in the channel sizing.

1.0 Sediment Yield Analysis

The sub-basins contributing sediment to the detention basins are 256, 257, 271A and 2712. These subbasins are agricultural lands that will generate sediment. The other subbasins are all fully developed residential areas and will therefore not generate significant sediment. The total area of these contributing sub-basins is only 1.39 square miles.

Two approaches were used in this analysis. The first method are gross volume methods that compute average annual sediment yield. The second is event based method that determines sediment yield for storms of different frequencies.

1.1 Method 1.

Two methods were used. They were Renard and Dendy-Bolton methods. These are empirical relationships for sediment yield and basin drainage areas. The methods are summarized below in the form of spreadsheet.

RID Overchute Phase II
Sediment Yield Analysis

Gross Estimation Methods (Total Annual Yield)

Annual Rain	7.76							
Sub-basin	Area (mi^2)	Area (acres)	Renard (ac-ft/ac/yr)	Renard (ac-ft/yr)	Dendy/B Q	Dendy-Bolton (ton/sqmi/yr)	Dendy-B (ac-ft/mi^2/yr)	Dendy-Bolton (ac-ft/yr)
256	0.43	275.2	0.0009476	0.261	0.50865	1093.10	0.5283	0.227
257	0.34	217.6	0.0009744	0.212	0.52626	1129.65	0.5460	0.186
271A	0.16	102.4	0.0010656	0.109	0.58700	1253.01	0.6056	0.097
2712	0.46	294.4	0.0009401	0.277	0.50370	1082.77	0.5233	0.241
Totals	1.39	889.6		**0.859**				**0.750**

1). Renard Method $Y = 0.001846 * A^{(-0.1187)}$ where

Y = Annual Yield in ac-ft / ac/ yr
A = Drainage Area in acres

2) Dendy-Bolton Method

S = 1280 * Q^0.46 *(1.43-0.26*LOG A) where

S= Sediment Yield (tons/sq.mi./yr)
Q = Annual Runoff (in)
A = Watershed Area (sq. mi.)
Walnut Gulch relates annual prec. to annual runoff as:

Qw = 0.4501*A^(-0.1449) based on Precipitation of 14 inches per year.
Use the ratio of (Annual Precp/14 inches)* Qw in place of Q

To convert (tons/sq. mi./year) to (ac-ft/sq.mi./year) divide S by 2069.1

The results showed annual sediment yield into the basins will be about 1.0 acre feet. This will be the annual volume that will accumulate, on the average.

1.2 Method 2.

For the event based sediment yield, the Modified Universal Soil Loss Equation (MUSLE) method was used. This method estimates sediment yield based on basin parameters such as soil, ground cover, basin slope (topography), and erosion control practice. This approach is more reliable as uses more information for the analysis. The explanation of the method parameters and the computations, as applied to the 100 year discharge are listed below. The full spreadsheet showing the computation for all the other events are listed in the appendix.

RID Overchute Project Phase II;

Sediment Yield Analysis for All Contributing Sub-Basins Using Modified Universal Soil Loss Equation.

100 Year Event

Sub-basin (Conc. Pt)	Basin Length LCH (miles)	Basin Slope (feet/mile)	Basin Slope (percent)	Basin Area (sq. mi)	Overland Lgth (L)	Univ . LS Factor(LS)	Peak Disch (cfs)
256	1.06	17.90	0.34	0.43	1070.94	0.18	326.00
257	1.21	11.60	0.22	0.34	741.82	0.15	217.00
271A	1.00	10.00	0.19	0.16	422.40	0.13	95.00
2712	0.95	16.80	0.32	0.46	1278.32	0.19	739.00

Sub-basin (Conc. Pt)	Runoff Vol. (ac-ft)	Pract. Factor P	Cover Factor C	%Area of Mr	%Area of Lb	Soil Erodibility Factor (K)	Sed. Yield (tons)	Sed Yield (ac-ft)
256	18.00	1.00	0.35	0.70	0.30	0.53	412.55	0.20
257	16.00	1.00	0.35	0.75	0.25	0.53	257.26	0.12
271A	6.00	1.00	0.35	0.30	0.70	0.50	72.88	0.04
2712	14.00	1.00	0.35	0.70	0.30	0.53	590.04	0.29
Total							**1332.73**	**0.64**

Notes:

Modified Universal Soil Loss Equation (MUSLE) " , Ys = Rw * K * LS * C * P "

"1. Rw, Storm Energy Runoff Factor " Rw = a (V*q)^b

where a = 95 and b=0.56

V = Runoff Vol in ac-ft

q = Runoff Peak in cfs

"2. K, Soil Erodibility Factor"

Soil Map Unit	Soil Series	Textural Class	XKSAT (in/hr)	Perm. Rating	Soil Struc. Rating
Mr	Mohall	Clay Loam	0.05	Very Slow	Very Fine Granular
Lb	Laveen	Loam	0.25	Moderate	Fine Granular

% Silt & VFS 70.00 % Sand 15.00 % Orgn & M 1.00

Soil Map Unit	K Value
Mr	0.55
Lb	0.48

"3. C, Cover and Management Factor" Cover Type..... Agricultural Tilled/Irrigated

Canopy Factor....	1.0 (0% veg cover)
Mulch Factor....	0.8 (10% mulc cover)
Root Factor....	"0.45 (0% root, weeds)"
Composite C....	0.36 (1.0*0.8*0.45)

"4. P, Erosion Control Practice Factor" No Practice P = 1

"5. LS, Topographic Factor" LS = (L/72.6)^n *(.065 + .0454*S + .0065*S^2)

L = Basin Slope Length as given above for each sub-basin
"S = Basin Slope in percent, as given above for each sub-basin"
"n = index,0.3 since basin slopes are less than 3%"

6. Sediment Density 95 lbs per ft ^3

The results gave 0.64 acre feet of sediment deposition for the 100 year event. The results for the other frequency events are listed in the table below.

Event (Recurrence Interval, Years)	Sediment Yield (Acre-feet)
100	0.64
50	0.55
25	0.41
10	0.30
5	0.20
2	0.14

Annual Sediment Yield by MUSLE method is sum of the values of each event multiplied by its probability of excedence. Therefore

Annual Sediment Yield (ac-ft) = 0.01*0.64+0.02*0.55+0.04*0.41+0.1*0.3+0.2*0.2+0.5*0.14
= 0.17 ac-ft

Values obtained by the other gross methods are higher, hence the design will adopt a value of 1.0 acre feet of annual sediment yield and 0.65 acre feet for the 100 year event. The basin will be sized to include an additional volume of 1.0 acre foot to accommodate the annual volume of sediment yield.

2.0. Sediment Routing for Channels

The next level of analysis is to determine the capacity for the unlined channels, Plaza Circle and West Interceptor channels. The objective of the Sediment Transport Analysis is to estimate the sediment quantities flowing into the channel and the resulting channel response in terms of aggradation and degradation. The extent of aggradation and degradation would be used in determining the stability of the proposed channels and consequently the validity of the flood control measures. The results would also give an indication of sediment volume that would be involved in the channel maintenance. "HEC-6 Scour and Deposition in Rivers and Reservoirs" computer program was used for this analysis. The data required for this modeling effort are explained below.

2.1 Hydrologic Data.

The hydrologic data in the form of hydrographs were obtained from the White Tanks Area Drainage Master Study for each of the channels. These were used for the channel design but only the peaks were used in the HEC-2 models. The hydrographs were discretized into time steps as required by the modeling procedure.

2.2 Sediment Data: Channel Bed Material Size Distribution

Sediment data is another important set of data required. Representative bed material data for each stream segment is required. This data is generated from sieve analysis of samples in the form of particle size and the percentage of the bed material sample that is finer by weight than this particle size. Soil samples were taken throughout the project area by ATL, Inc. and the data closest to the sediment contributing area (Boring Site #4 shown on Plate 4 of the Geotechnical Report by ATL) was used. The bed material was found to be mostly fine material of sandy silty clay.

2.3 Sediment Data: Inflowing Sediment Load

The other sediment data required is inflowing sediment load that enter the channel from the most upstream boundary, the tributary and the local inflow points. This stream system has no storage reservoirs or lakes, therefore zero inflow sediment load assumption cannot apply. Therefore, either historical sample data has be used or this data has to be generated by an appropriate method. In this location, no historical data exist. Dust et al., (1986) outlined how to generate inflowing sediment load. The basis for this process is that given any hydraulic condition at any time, the channel reach has to be in equilibrium with respect to sediment transport capacity. If the sediment load entering he reach exceeds the transport capacity for the given hydraulic condition, the excess sediment material will be deposited. If the flow is deficient in sediment load below the equilibrium quantity, sediment pickup would occur from the channel bed and banks. The former is termed aggradation while the latter is degradation. If sediment routing is started slightly upstream of the inflow boundary, equilibrium conditions can be attained at the point of interest. This assumption is used to generate inflowing sediment load. The final sediment loads used are listed in the HEC-6 model under the LF record.

2.4 Results of the Sediment Transport Models

The above model formulation was run using HEC-6 software and the table below is a summary of bed elevation changes for the two earthen channels. In the case of Plaza Circle channel, additional cross sections were added within the detention basin (Cross Sections 436.0 to 443.0) to the HEC - 2 model developed for the channel design.

Table 2.1. Results of HEC-6 Model (Bed Elevation Changes) for West Interceptor Channel

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 1	Time Step # 2	Time Step # 3	Time Step # 4	Time Step # 5	Time Step # 6	Time Step # 7	Time Step # 8
533.000	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	-0.03
532.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
531.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
530.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
529.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
528.400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
528.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
527.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
526.200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
526.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
525.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
524.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
523.000	-0.06	-0.06	-0.07	-0.07	-0.08	-0.08	-0.08	-0.10

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 9	Time Step # 10	Time Step #11	Time Step # 12	Time Step # 13	Time Step # 14	Time Step # 15	Time Step # 16
533.000	-0.03	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
532.000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

531.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
530.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
529.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
528.400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
528.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
527.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
526.200	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
526.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
525.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
524.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
523.000	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10

Table 2.2. Results of HEC-6 Model (Bed Elevation Changes) for Plaza Circle Channel

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 1	Time Step # 2	Time Step # 3	Time Step # 4	Time Step # 5	Time Step # 6	Time Step # 7	Time Step # 8
466.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
465.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
464.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
463.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
462.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
461.400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
460.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
459.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
458.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
457.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
456.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
453.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
452.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

451.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 1	Time Step # 2	Time Step # 3	Time Step # 4	Time Step # 5	Time Step # 6	Time Step # 7	Time Step # 8
449.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
448.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
447.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
446.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
445.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
444.400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
443.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
442.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
441.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
440.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
439.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
438.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
437.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
436.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 2.2. Results of HEC-6 Model (Bed Elevation Changes) for Plaza Circle Channel

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 9	Time Step # 10	Time Step # 11	Time Step # 12	Time Step # 13	Time Step # 14	Time Step # 15	Time Step # 16
466.000	0.00	0.00	0.00	0.00	-0.01	0.00	0.01	0.01
465.000	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.03
464.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
463.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
462.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
461.400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
460.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
459.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
458.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

457.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
456.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
453.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
452.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
451.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 9	Time Step # 10	Time Step # 11	Time Step # 12	Time Step # 13	Time Step # 14	Time Step # 15	Time Step # 16
449.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
448.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
447.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
446.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
445.000	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
444.400	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
443.000	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
442.000	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01
441.000	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
440.000	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
439.000	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02
438.000	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
437.000	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
436.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 2.2. Results of HEC-6 Model (Bed Elevation Changes) for Plaza Circle Channel (Contd.)

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 17	Time Step # 18	Time Step # 19	Time Step # 20	Time Step # 21	Time Step # 22	Time Step # 23	Time Step #24
466.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
465.000	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
464.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

463.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
462.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
461.400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
460.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
459.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
458.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
457.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
456.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
453.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
452.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
451.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
450.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 2.2. Results of HEC-6 Model (Bed Elevation Changes) for Plaza Circle Channel (Contd).

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 17	Time Step # 18	Time Step # 19	Time Step # 20	Time Step # 21	Time Step # 22	Time Step # 23	Time Step # 24
449.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
448.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
447.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
446.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
445.000	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
444.400	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
443.000	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
442.000	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
441.000	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
440.000	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.02
439.000	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
438.000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
437.000	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
436.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 2.2. Results of HEC-6 Model (Bed Elevation Changes) for Plaza Circle Channel (Contd)

	Bed Elevation Change (ft)							
Cross Section #	Time Step # 25	Time Step # 26	Time Step # 27	Time Step # 28	Time Step # 29			
466.000	0.00	0.00	0.00	0.00	0.00			
465.000	0.03	0.03	0.03	0.03	0.03			
464.000	0.00	0.00	0.00	0.00	0.00			
463.000	0.00	0.00	0.00	0.00	0.00			
462.000	0.00	0.00	0.00	0.00	0.00			
461.400	0.00	0.00	0.00	0.00	0.00			
460.000	0.00	0.00	0.00	0.00	0.00			
459.000	0.00	0.00	0.00	0.00	0.00			
458.000	0.00	0.00	0.00	0.00	0.00			
457.000	0.00	0.00	0.00	0.00	0.00			
456.000	0.00	0.00	0.00	0.00	0.00			
455.000	0.00	0.00	0.00	0.00	0.00			
454.000	0.00	0.00	0.00	0.00	0.00			
453.000	0.00	0.00	0.00	0.00	0.00			
452.000	0.00	0.00	0.00	0.00	0.00			
451.000	0.00	0.00	0.00	0.00	0.00			
450.000	0.00	0.00	0.00	0.00	0.00			
	Bed Elevation Change (ft)							
Cross Section #	Time Step # 25	Time Step # 26	Time Step # 27	Time Step # 28	Time Step # 29			
449.000	0.00	0.00	0.00	0.00	0.00			
448.000	0.00	0.00	0.00	0.00	0.00			
447.000	0.00	0.00	0.00	0.00	0.00			
446.000	0.00	0.00	0.00	0.00	0.00			
445.000	-0.01	-0.01	-0.01	-0.01	-0.01			
444.400	-0.01	-0.01	-0.01	-0.01	-0.01			
443.000	-0.01	-0.01	-0.01	-0.01	-0.01			
442.000	-0.01	-0.01	-0.01	-0.01	-0.01			

441.000	-0.01	-0.01	-0.01	-0.01	-0.01			
440.000	0.02	0.02	0.02	0.02	0.02			
439.000	0.02	0.02	0.02	0.02	0.02			
438.000	0.01	0.01	0.01	0.01	0.01			
437.000	0.01	0.01	0.01	0.01	0.01			
436.000	0.00	0.00	0.00	0.00	0.00			

The tables above indicate that the channels are stable with regard to sediment transport. The bed elevation changes within the channels were very minor. This is mainly due to the fact that the channels were designed based on permissible velocity to minimize channel degradation. In the case of channel aggradation, there is little sediment flowing into the channels since most of the watershed is fully developed.

Flood Control District of Maricopa County
RID Overchute Project Phase II;
Sediment Yield Analysis for All Contributing Sub-Basins Using Modified Universal Soil Loss Equation.

Sub-basin (Conc. Pt)	Basin Length LCH (miles)	Basin Slope (feet/mile)	Basin Slope (percent)	Basin Area (sq. mi)	Overland Lgth (L)	Univ . LS Factor(LS)	Peak Disch (cfs)	Runoff Vol. (ac-ft)
100 Year Event								
256	1.06	17.90	0.34	0.43	1070.94	0.18	326.00	18.00
257	1.21	11.60	0.22	0.34	741.82	0.15	217.00	16.00
271A	1.00	10.00	0.19	0.16	422.40	0.13	95.00	6.00
2712	0.95	16.80	0.32	0.46	1278.32	0.19	739.00	14.00
				1.39				
50 Year Event								
256	1.06	17.90	0.34	0.43	1070.94	0.18	288.00	16.00
257	1.21	11.60	0.22	0.34	741.82	0.15	193.00	14.00
271A	1.00	10.00	0.19	0.16	422.40	0.12	84.00	5.00
2712	0.95	16.80	0.32	0.46	1278.32	0.19	641.00	12.00
25 Year Event								
256	1.06	17.90	0.34	0.43	1070.94	0.18	227.00	12.00
257	1.21	11.60	0.22	0.34	741.82	0.15	152.00	11.00
271A	1.00	10.00	0.19	0.16	422.40	0.12	67.00	4.00
2712	0.95	16.80	0.32	0.46	1278.32	0.19	477.00	9.00
10 Year Event								
256	1.06	17.90	0.34	0.43	1070.94	0.18	185.00	10.00
257	1.21	11.60	0.22	0.34	741.82	0.15	124.00	8.00
271A	1.00	10.00	0.19	0.16	422.40	0.12	54.00	3.00
2712	0.95	16.80	0.32	0.46	1278.32	0.19	355.00	6.00
5 Year Event								
256	1.06	17.90	0.34	0.43	1070.94	0.18	138.00	7.00
257	1.21	11.60	0.22	0.34	741.82	0.15	92.00	6.00
271A	1.00	10.00	0.19	0.16	422.40	0.12	39.00	2.00
2712	0.95	16.80	0.32	0.46	1278.32	0.19	210.00	4.00

2 Year Event

256	1.06	17.90	0.34	0.43	1070.94	0.18	79.00	4.00
257	1.21	11.60	0.22	0.34	741.82	0.15	53.00	3.00
271A	1.00	10.00	0.19	0.16	422.40	0.12	23.00	1.00
2712	0.95	16.80	0.32	0.46	1278.32	0.19	41.00	1.00

Notes:

Modified Universal Soil Loss Equation (MUSLE) , **Ys = Rw * K * LS * C * P**

1. **Rw,** Storm Energy Runoff Factor

Rw = a (V*q)^b
where a = 95 and b=0.56
V = Runoff Vol in ac-ft
q = Runoff Peak in cfs

2. **K**, Soil Erodibility Factor

Soil Map Unit	Soil Series	Textural Class	XKSAT (in/hr)	Perm. Rating	Soil Struc. Rating
Mr	Mohall	Clay Loam	0.05	Very Slow	Very Fine Granular
Lb	Laveen	Loam	0.25	Moderate	Fine Granular
% Silt & VFS	70.00	% Sand	15.00	% Orgn & M	1.00

Soil Map Unit	K Value
Mr	0.55
Lb	0.48

3. **C,** Cover and Management Factor

Cover Type.....	Agricultural Tilled/Irrigated
Canopy Factor....	1.0 (0% veg cover)
Mulch Factor....	0.8 (10% mulc cover)
Root Factor....	0.45 (0% root, weeds)
Composite C....	0.36 (1.0*0.8*0.45)

4. **P**, Erosion Control Practice Factor   No Practice   P = 1

5. **LS**, Topographic Factor

LS = (L/72.6)^n *(.065 + .0454*S + .0065*S^2)
L = Basin Slope Length as given above for each sub-basin
S = Basin Slope in percent, as given above for each sub-basin
n = index,0.3 since basin slopes are less than 3%

6. Sediment Density   95 lbs per ft ^3

Pract. Factor P	Cover Factor C	%Area of Mr	%Area of Lb	Soil Erodibility Factor (K)	Sed. Yield (tons)	Sed Yield (ac-ft)	Sub-basin
1.00	0.35	0.70	0.30	0.53	412.55	0.20	256
1.00	0.35	0.75	0.25	0.53	257.26	0.12	257
1.00	0.35	0.30	0.70	0.50	72.88	0.04	271A
1.00	0.35	0.70	0.30	0.53	590.04	0.29	2712
					1332.73	**0.64**	***0.006***
1.00	0.35	0.70	0.30	0.53	358.84	0.17	256.00
1.00	0.35	0.75	0.25	0.53	222.66	0.11	257.00
1.00	0.35	0.30	0.70	0.50	61.18	0.03	271A
1.00	0.35	0.70	0.30	0.53	497.75	0.24	2712.00
					1140.42	**0.55**	***0.011***
1.00	0.35	0.70	0.30	0.53	267.33	0.13	256
1.00	0.35	0.75	0.25	0.53	170.18	0.08	257
1.00	0.35	0.30	0.70	0.50	47.57	0.02	271A
1.00	0.35	0.70	0.30	0.53	359.06	0.17	2712
					844.14	**0.41**	***0.016***
1.00	0.35	0.70	0.30	0.53	215.25	0.10	256
1.00	0.35	0.75	0.25	0.53	127.04	0.06	257
1.00	0.35	0.30	0.70	0.50	35.88	0.02	271A
1.00	0.35	0.70	0.30	0.53	242.50	0.12	2712
					620.68	**0.30**	***0.030***
1.00	0.35	0.70	0.30	0.53	149.60	0.07	256
1.00	0.35	0.75	0.25	0.53	91.49	0.04	257
1.00	0.35	0.30	0.70	0.50	23.83	0.01	271A
1.00	0.35	0.70	0.30	0.53	144.02	0.07	2712
					408.94	**0.20**	***0.04***

1.00	0.35	0.70	0.30	0.53	80.01	0.04	256
1.00	0.35	0.75	0.25	0.53	45.57	0.02	257
1.00	0.35	0.30	0.70	0.50	12.03	0.01	271A
1.00	0.35	0.70	0.30	0.53	26.55	0.01	2712
					164.15	**0.08**	0.04
							0.143

```
***************************************************     **********************************
*  SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS  *     *  U.S. ARMY CORPS OF ENGINEERS  *
*       Version: 4.1.07 -  OCT93+FIXS95           *     *  HYDROLOGIC ENGINEERING CENTER *
*  INPUT FILE:  WESTSED.DAT                       *     *  609 SECOND STREET             *
*  OUTPUT FILE: WESTSED.OUT                       *     *  DAVIS, CALIFORNIA 95616-4687  *
*  RUN DATE: 11 FEB 97    RUN TIME: 15:59:09      *     *  (916) 756-1104                *
***************************************************     **********************************

                       X     X  XXXXXXX   XXXXX          XXXXX
                       X     X  X        X     X        X     X
                       X     X  X        X              X
                       XXXXXXX  XXXX     X       XXXXX  XXXXXX
                       X     X  X        X              X     X
                       X     X  X        X     X        X     X
                       X     X  XXXXXXX   XXXXX          XXXXX

          ********************************************************************
          *  MAXIMUM LIMITS FOR THIS VERSION ARE:                            *
          *       10  Stream Segments (Main Stem + Tributaries)              *
          *      150  Cross Sections                                         *
          *      100  Elevation/Station Points per Cross Section             *
          *       20  Grain Sizes                                            *
          *       10  Control Points                                         *
          ********************************************************************

T1      RID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
T2      SFC ENGINEERING
T3      SEDIMENT TRANSPORT MODEL  TOFALETTI/MEYER PETER & MULLER

N values...  Left    Channel   Right    Contraction    Expansion
           0.0350   0.0350   0.0350       1.1000     0.7000

SECTION NO.   523.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   524.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   525.000
...Ineffective Flow Area - Method 1 - Left Overbank  Right Overbank
          Natural Levees at Station          66.000          124.400
              Ineffective Elevation        1012.500         1012.500
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   526.000
...Ineffective Flow Area - Method 1 - Left Overbank  Right Overbank
          Natural Levees at Station         127.000          185.000
              Ineffective Elevation        1012.600         1012.600
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0350   0.0350   0.0350       1.4000     0.3000

SECTION NO.   526.200
...Ineffective Flow Area - Method 1 - Left Overbank  Right Overbank
          Natural Levees at Station         130.000          187.800
              Ineffective Elevation        1012.600         1012.600
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   527.000
...Ineffective Flow Area - Method 1 - Left Overbank  Right Overbank
          Natural Levees at Station          39.000           73.000
              Ineffective Elevation        1014.000         1014.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

SECTION NO.   528.000
...Ineffective Flow Area - Method 1 - Left Overbank  Right Overbank
          Natural Levees at Station          32.000           65.900
              Ineffective Elevation        1014.000         1014.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

N values...  Left    Channel   Right    Contraction    Expansion
           0.0350   0.0350   0.0350       1.1000     0.7000

SECTION NO.   528.400
...Ineffective Flow Area - Method 1 - Left Overbank  Right Overbank
          Natural Levees at Station         160.000          227.100
              Ineffective Elevation        1014.000         1014.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   529.000
```

```
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   530.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   531.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   532.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   533.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 13
NO. OF INPUT DATA MESSAGES =    0

TOTAL NO. OF CROSS SECTIONS IN THE NETWORK =  13
TOTAL NO. OF STREAM SEGMENTS IN THE NETWORK=   1
END OF GEOMETRIC DATA

==========================================================================================================

T4      Tatum Wash Sediment Sampling Data
T5      Load curve based on Zeller-Fullerton reach-average results
T6      Sediment gradation from Law Crandall seive analysis
T7
T8

        ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
        FC ENGINEERING
        EDIMENT TRANSPORT MODEL  TOFALETTI/MEYER PETER & MULLER

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
SEDIMENT PROPERITES AND PARAMETERS

       SPI     IBG    MNQ      SPGF      ACGR     NFALL    IBSHER
I1     50.       0      1     0.997    32.174        2         1
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
CLAY IS PRESENT.

       MTCL    SPGC      PUCD      UWCL      CCCD
I2       1     2.650    78.000    30.000    16.000


  DEPOSITION COEFFICIENTS BY LAYER
                          DEPOSITION
                          THRESHOLD
                            SHEAR
              LAYER        STRESS
               NO.        lb/sq.ft

  ACTIVE LAYER  1         0.0200
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
SILT IS PRESENT

       MTCL    IASL   LASL     SGSL     PUSDLB    UWSDLB    CCSDLB
I3       1       4      4      2.650    82.000    65.000     5.700

  DEPOSITION COEFFICIENTS BY LAYER
                          DEPOSITION
                          THRESHOLD
                            SHEAR
              LAYER        STRESS
               NO.        lb/sq.ft

  ACTIVE LAYER  1         0.0200
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 SANDS - BOULDERS ARE PRESENT

       MTC      IASA    LASA     SPGS       GSF       BSAE       PSI      UWDLB
I4     12         1      10     2.650     0.667     0.500    30.000    93.000

USING TRANSPORT CAPACITY RELATIONSHIP # 12, TOFFALETI-MPM
GRAIN SIZES UTILIZED (mean diameter - mm)
----------------------------------------------------------------------
    CLAY.............    0.003  |  VERY COARSE SAND..    1.414
    COARSE SILT......    0.045  |  VERY FINE GRAVEL..    2.828
    VERY FINE SAND...    0.088  |  FINE GRAVEL.......    5.657
    FINE SAND........    0.177  |  MEDIUM GRAVEL.....   11.314
    MEDIUM SAND......    0.354  |  COARSE GRAVEL.....   22.627
```

COARSE SAND....... 0.707 | VERY COARSE GRAVEL 45.255

COEFFICIENTS FOR COMPUTATION SCHEME WERE SPECIFIED

	DBI	DBN	XID	XIN	XIU	UBI	UBN	JSL
I5	0.500	0.500	0.250	0.250	0.250	0.000	1.000	1

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 1
LOAD BY GRAIN SIZE CLASS (tons/day)

LQ		0.000000	100.000	200.000
LF	CLAY	0.100000E-19	0.100000E-19	0.100000E-19
LF	SILT	0.100000E-19	0.100000E-19	0.100000E-19
LF	VFS	0.100000E-19	16.0000	19.9800
LF	FS	0.100000E-19	17.0000	19.0080
LF	MS	0.100000E-19	13.0000	9.99000
LF	CS	0.100000E-19	9.00000	3.99600
LF	VCS	0.100000E-19	3.00000	0.972000
LF	VFG	0.100000E-19	0.100000E-19	0.100000E-19
LF	FG	0.100000E-19	0.100000E-19	0.100000E-19
LF	MG	0.100000E-19	0.100000E-19	0.100000E-19
LF	CG	0.100000E-19	0.100000E-19	0.100000E-19
LF	VCG	0.100000E-19	0.100000E-19	0.100000E-19
	TOTAL	0.120000E-18	58.0000	53.9460

REACH GEOMETRY FOR STREAM SEGMENT 1

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL BED-ELEVATIONS LEFT SIDE (ft)	THALWEG (ft)	RIGHT SIDE (ft)	ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM (ft)	(miles)
	0.000						
523.000		118.100	1012.300	1006.400	1013.000	0.000	0.000
	150.100						
524.000		179.200	1013.000	1006.550	1012.500	150.100	0.028
	103.300						
525.000		143.500	1012.000	1006.700	1012.500	253.400	0.048
	90.600						
526.000		207.700	1012.000	1006.800	1012.600	344.000	0.065
	15.300						
526.200		210.000	1012.000	1006.880	1012.600	359.300	0.068
	86.300						
527.000		115.900	1014.000	1007.000	1014.000	445.600	0.084
	103.500						
528.000		120.400	1013.000	1007.050	1014.000	549.100	0.104
	40.900						
528.400		276.500	1012.000	1007.110	1014.000	590.000	0.112
	58.200						
529.000		113.700	1013.000	1007.200	1014.000	648.200	0.123
	102.600						
530.000		141.900	1013.000	1007.350	1014.000	750.800	0.142
	98.800						
531.000		164.400	1013.000	1007.500	1014.000	849.600	0.161
	99.000						
532.000		179.800	1013.000	1007.650	1014.000	948.600	0.180
	96.000						
533.000		207.500	1013.700	1007.800	1015.000	1044.600	0.198

BED MATERIAL GRADATION

SECNO	SAE	DMAX (ft)	DXPI (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size					
523.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
524.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
525.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002

526.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
526.200	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
527.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
528.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
528.400	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
529.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
530.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
531.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
532.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
533.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 1: ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	V O L U M E (cu.ft)	(cu.yd)
523.000	75.050	138.467	10.000	103919.	3848.86
524.000	126.700	162.285	10.000	205615.	7615.37
525.000	96.950	159.839	10.000	154964.	5739.40
526.000	52.950	189.503	10.000	100342.	3716.36
526.200	50.800	183.241	10.000	93086.6	3447.65
527.000	94.900	130.980	0.000	0.000000	0.000000
528.000	72.200	134.063	10.000	96793.4	3584.94
528.400	49.550	223.155	10.000	110573.	4095.31
529.000	80.400	139.339	10.000	112029.	4149.21
530.000	100.700	140.791	10.000	141776.	5250.97
531.000	98.900	163.223	10.000	161428.	5978.80
532.000	97.500	181.739	10.000	177196.	6562.81
533.000	48.000	198.267	10.000	95168.0	3524.74

NO. OF INPUT DATA MESSAGES= 0
END OF SEDIMENT DATA

==

$HYD
BEGIN COMPUTATIONS.

$RATING

```
Downstream Boundary Condition - Rating Curve
  Elevation        Stage     Discharge |  Elevation       Stage     Discharge
 --------------------------------------|-------------------------------------
   1006.400     1006.400        0.000  |   1011.500     1011.500      300.000
   1008.000     1008.000      100.000  |   1012.300     1012.300      400.000
   1010.000     1010.000      200.000  |

==========================================================================================
TIME STEP #       1
*    B   100-YEAR HYDROGRAPH INCREMENT 1

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
       ACCUMULATED TIME (yrs)....       0.000
       FLOW DURATION (days)......       0.042

UPSTREAM BOUNDARY CONDITIONS
----------------------------------------------------------------------
Stream Segment # 1      |   DISCHARGE    | SEDIMENT LOAD | TEMPERATURE
Section No.    533.000  |     (cfs)      |  (tons/day)   |   (deg F)
----------------------------------------------------------------------
                INFLOW  |          1.80  |          0.00 |        83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT #  1
            ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
            ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

*********************************************************************************************************
******
     TIME        ENTRY *            CLAY             *            SILT             *           SAND
    *
     DAYS        POINT *    INFLOW    OUTFLOW  TRAP EFF *    INFLOW    OUTFLOW  TRAP EFF *    INFLOW    OUTFLOW
TRAP EFF *
     0.04      533.000 *      0.00                   *      0.00                   *      0.00
    *
    TOTAL=     523.000 *      0.00      0.00      0.28 *      0.00      0.00      1.00 *      0.00
0.00********** *

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TABLE SB-1:  SEDIMENT LOAD PASSING THE  BOUNDARIES OF STREAM SEGMENT #  1
-------------------------------------------------------------------------------
  SEDIMENT INFLOW at the Upstream Boundary:
      GRAIN SIZE      LOAD (tons/day) |    GRAIN SIZE      LOAD (tons/day)
  ---------------------------------------------------------------------------
    CLAY.............          0.00  |  VERY COARSE SAND..          0.00
    COARSE SILT.......         0.00  |  VERY FINE GRAVEL..          0.00
    VERY FINE SAND....         0.00  |  FINE GRAVEL.......          0.00
    FINE SAND.........         0.00  |  MEDIUM GRAVEL.....          0.00
    MEDIUM SAND.......         0.00  |  COARSE GRAVEL.....          0.00
    COARSE SAND.......         0.00  |  VERY COARSE GRAVEL          0.00
                       -------------                        -------------
                                               TOTAL =              0.00
  SEDIMENT OUTFLOW from the Downstream Boundary
      GRAIN SIZE      LOAD (tons/day) |    GRAIN SIZE      LOAD (tons/day)
  ---------------------------------------------------------------------------
    CLAY.............          0.00  |  VERY COARSE SAND..         18.75
    COARSE SILT.......         0.00  |  VERY FINE GRAVEL..          7.14
    VERY FINE SAND....        47.22  |  FINE GRAVEL.......          7.11
    FINE SAND.........        52.40  |  MEDIUM GRAVEL.....          1.75
    MEDIUM SAND.......        46.38  |  COARSE GRAVEL.....          4.06
    COARSE SAND.......        36.58  |  VERY COARSE GRAVEL          0.51
                       -------------                        -------------
                                               TOTAL =            221.90

TABLE SB-2:  STATUS OF THE BED PROFILE AT TIME =      0.042 DAYS
-------------------------------------------------------------------------------
  SECTION   BED CHANGE   WS ELEV   THALWEG         Q       TRANSPORT RATE (tons/day)
  NUMBER       (ft)        (ft)      (ft)        (cfs)       CLAY         SILT         SAND
    533.000      0.00   1008.06   1007.80          2.          0.           0.           0.
    532.000      0.00   1007.89   1007.65          2.          0.           0.           0.
    531.000      0.00   1007.75   1007.50          2.          0.           0.           0.
    530.000      0.00   1007.63   1007.35          2.          0.           0.           0.
    529.000      0.00   1007.57   1007.20          2.          0.           0.           0.
    528.400      0.00   1007.56   1007.11          2.          0.           0.           0.
    528.000      0.00   1007.55   1007.05          2.          0.           0.           0.
    527.000      0.00   1007.55   1007.00          2.          0.           0.           0.
    526.200      0.00   1007.55   1006.88          2.          0.           0.           0.
    526.000      0.00   1007.55   1006.80          2.          0.           0.           0.
    525.000      0.00   1007.54   1006.70          2.          0.           0.           0.
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524.000	0.00	1007.54	1006.55	2.	0.	0.	16.
523.000	-0.06	1006.45	1006.34	2.	0.	0.	222.

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TIME STEP # 2
* B

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ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.000
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	1.90	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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*****************************************************************************************************
******
    TIME       ENTRY *              CLAY             *              SILT            *            SAND
   *
    DAYS       POINT *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW  OUTFLOW  TRAP EFF *    INFLOW  OUTFLOW
TRAP EFF *
    0.08     533.000 *     0.00                      *     0.00                      *     0.00
   *
   TOTAL=    523.000 *     0.00      0.00      0.26 *     0.00      0.00      1.00 *     0.00
0.00********** *

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.15
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	8.54	FINE GRAVEL.......	0.00
FINE SAND.........	5.54	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	3.04	COARSE GRAVEL.....	0.00
COARSE SAND.......	1.43	VERY COARSE GRAVEL	0.00
		TOTAL =	18.70

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.084 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	0.00	1008.02	1007.80	2.	0.	0.	0.
532.000	0.00	1007.86	1007.65	2.	0.	0.	0.
531.000	0.00	1007.72	1007.50	2.	0.	0.	0.
530.000	0.00	1007.61	1007.35	2.	0.	0.	0.
529.000	0.00	1007.44	1007.20	2.	0.	0.	0.
528.400	0.00	1007.30	1007.11	2.	0.	0.	0.
528.000	0.00	1007.27	1007.05	2.	0.	0.	0.
527.000	0.00	1007.21	1007.00	2.	0.	0.	0.
526.200	0.00	1007.08	1006.88	2.	0.	0.	0.
526.000	0.00	1007.04	1006.80	2.	0.	0.	0.
525.000	0.00	1006.92	1006.70	2.	0.	0.	0.
524.000	0.00	1006.81	1006.55	2.	0.	0.	0.
523.000	-0.06	1006.43	1006.34	2.	0.	0.	19.

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TIME STEP # 3
* B

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.000
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	1.93	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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*******************************************************************************************************************
******
    TIME       ENTRY *             CLAY                 *             SILT                 *             SAND
   *
    DAYS       POINT *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW
TRAP EFF *
    0.13     533.000 *     0.00                     *     0.00                     *     0.00
   *
   TOTAL=    523.000 *     0.00      0.00      0.27 *     0.00      0.00      1.00 *     0.00
0.01********** *

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.01
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	2.99	FINE GRAVEL.......	0.00
FINE SAND.........	1.52	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.34	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.05	VERY COARSE GRAVEL	0.00
		TOTAL =	4.90

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.126 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	0.00	1008.06	1007.80	2.	0.	0.	0.
532.000	0.00	1007.90	1007.65	2.	0.	0.	0.
531.000	0.00	1007.73	1007.50	2.	0.	0.	0.
530.000	0.00	1007.61	1007.35	2.	0.	0.	0.
529.000	0.00	1007.47	1007.20	2.	0.	0.	0.
528.400	0.00	1007.34	1007.11	2.	0.	0.	0.
528.000	0.00	1007.30	1007.05	2.	0.	0.	0.
527.000	0.00	1007.24	1007.00	2.	0.	0.	0.
526.200	0.00	1007.08	1006.88	2.	0.	0.	0.
526.000	0.00	1007.05	1006.80	2.	0.	0.	0.
525.000	0.00	1006.92	1006.70	2.	0.	0.	0.
524.000	0.00	1006.77	1006.55	2.	0.	0.	0.
523.000	-0.07	1006.43	1006.33	2.	0.	0.	5.

TIME STEP # 4
* B

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.000
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.10	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.17	533.000	0.00			0.00			0.00		
TOTAL=	523.000	0.00	0.00	0.26	0.00	0.00	1.00	0.00	0.01	**********

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.01
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	3.72	FINE GRAVEL.......	0.00
FINE SAND.........	2.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.50	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.07	VERY COARSE GRAVEL	0.00
		TOTAL =	6.31

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.168 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	0.00	1008.09	1007.80	2.	0.	0.	0.
532.000	0.00	1007.94	1007.65	2.	0.	0.	0.
531.000	0.00	1007.76	1007.50	2.	0.	0.	0.
530.000	0.00	1007.58	1007.35	2.	0.	0.	0.
529.000	0.00	1007.44	1007.20	2.	0.	0.	0.
528.400	0.00	1007.34	1007.11	2.	0.	0.	0.
528.000	0.00	1007.30	1007.05	2.	0.	0.	0.
527.000	0.00	1007.23	1007.00	2.	0.	0.	0.
526.200	0.00	1007.09	1006.88	2.	0.	0.	0.
526.000	0.00	1007.06	1006.80	2.	0.	0.	0.
525.000	0.00	1006.91	1006.70	2.	0.	0.	0.
524.000	0.00	1006.76	1006.55	2.	0.	0.	0.
523.000	-0.07	1006.43	1006.33	2.	0.	0.	6.

TIME STEP # 5
* B

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.60	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.21	533.000	0.00			0.00			0.00		
TOTAL=	523.000	0.00	0.00	0.23	0.00	0.00	1.00	0.00		0.01**********

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.04
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	4.24	FINE GRAVEL.......	0.00
FINE SAND.........	4.54	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	1.38	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.20	VERY COARSE GRAVEL	0.00
		TOTAL =	10.39

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.210 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	0.00	1008.13	1007.80	3.	0.	0.	0.
532.000	0.00	1007.98	1007.65	3.	0.	0.	0.
531.000	0.00	1007.80	1007.50	3.	0.	0.	0.
530.000	0.00	1007.61	1007.35	3.	0.	0.	0.
529.000	0.00	1007.49	1007.20	3.	0.	0.	0.
528.400	0.00	1007.39	1007.11	3.	0.	0.	0.
528.000	0.00	1007.33	1007.05	3.	0.	0.	0.
527.000	0.00	1007.25	1007.00	3.	0.	0.	0.
526.200	0.00	1007.13	1006.88	3.	0.	0.	0.
526.000	0.00	1007.10	1006.80	3.	0.	0.	0.
525.000	0.00	1006.93	1006.70	3.	0.	0.	0.
524.000	0.00	1006.78	1006.55	3.	0.	0.	0.
523.000	-0.07	1006.44	1006.33	3.	0.	0.	10.

TIME STEP # 6
* B

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)

```
 --------------------------------------------------------------------
              INFLOW |          5.50 |          0.00 |       83.00

 TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT #  1
             ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
             ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

*****************************************************************************************************************
******
    TIME       ENTRY *            CLAY              *             SILT              *            SAND
   *
    DAYS       POINT *   INFLOW   OUTFLOW  TRAP EFF *   INFLOW   OUTFLOW  TRAP EFF *   INFLOW   OUTFLOW
TRAP EFF *
    0.25     533.000 *     0.00                     *     0.00                     *     0.00
   *
   TOTAL=    523.000 *     0.00      0.00      0.19 *     0.00      0.00      1.00 *     0.00
0.01********** *

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

 TABLE SB-1:  SEDIMENT LOAD PASSING THE  BOUNDARIES OF STREAM SEGMENT #  1
 ---------------------------------------------------------------------------------
   SEDIMENT INFLOW at the Upstream Boundary:
       GRAIN SIZE      LOAD (tons/day) |    GRAIN SIZE      LOAD (tons/day)
   ------------------------------------------------------------------------------
     CLAY..............          0.00  |  VERY COARSE SAND..          0.00
     COARSE SILT.......          0.00  |  VERY FINE GRAVEL..          0.00
     VERY FINE SAND....          0.00  |  FINE GRAVEL.......          0.00
     FINE SAND.........          0.00  |  MEDIUM GRAVEL.....          0.00
     MEDIUM SAND.......          0.00  |  COARSE GRAVEL.....          0.00
     COARSE SAND.......          0.00  |  VERY COARSE GRAVEL          0.00
                        -------------                       -------------
                                                TOTAL =           0.00
   SEDIMENT OUTFLOW from the Downstream Boundary
       GRAIN SIZE      LOAD (tons/day) |    GRAIN SIZE      LOAD (tons/day)
   ------------------------------------------------------------------------------
     CLAY..............          0.00  |  VERY COARSE SAND..          0.11
     COARSE SILT.......          0.00  |  VERY FINE GRAVEL..          0.03
     VERY FINE SAND....          0.81  |  FINE GRAVEL.......          0.00
     FINE SAND.........          9.11  |  MEDIUM GRAVEL.....          0.00
     MEDIUM SAND.......          5.54  |  COARSE GRAVEL.....          0.00
     COARSE SAND.......          1.44  |  VERY COARSE GRAVEL          0.00
                        -------------                       -------------
                                                TOTAL =          17.04

 TABLE SB-2:  STATUS OF THE BED PROFILE AT TIME =      0.252 DAYS
 ---------------------------------------------------------------------------------
   SECTION  BED CHANGE   WS ELEV   THALWEG       Q       TRANSPORT RATE (tons/day)
   NUMBER      (ft)        (ft)      (ft)      (cfs)        CLAY        SILT        SAND
     533.000      0.00   1008.24   1007.80        6.          0.          0.          2.
     532.000      0.00   1008.09   1007.65        6.          0.          0.          0.
     531.000      0.00   1007.93   1007.50        6.          0.          0.          0.
     530.000      0.00   1007.78   1007.35        6.          0.          0.          0.
     529.000      0.00   1007.63   1007.20        6.          0.          0.          0.
     528.400      0.00   1007.51   1007.11        6.          0.          0.          0.
     528.000      0.00   1007.47   1007.05        6.          0.          0.          0.
     527.000      0.00   1007.41   1007.00        6.          0.          0.          0.
     526.200      0.00   1007.28   1006.88        6.          0.          0.          0.
     526.000      0.00   1007.25   1006.80        6.          0.          0.          1.
     525.000      0.00   1007.10   1006.70        6.          0.          0.          0.
     524.000      0.00   1006.94   1006.55        6.          0.          0.          1.
     523.000     -0.08   1006.49   1006.32        6.          0.          0.         17.

=========================================================================================
 TIME STEP #       7
 *    B

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
        ACCUMULATED TIME (yrs)....       0.001
        FLOW DURATION (days)......       0.042

 UPSTREAM BOUNDARY CONDITIONS
 --------------------------------------------------------------------
 Stream Segment # 1        |   DISCHARGE   | SEDIMENT LOAD | TEMPERATURE
 Section No.    533.000    |     (cfs)     |  (tons/day)   |   (deg F)
 --------------------------------------------------------------------
              INFLOW |          9.35 |          0.00 |       83.00

 TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT #  1
```

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

****

TIME DAYS	ENTRY POINT *	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF *	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF *	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF *
0.29	533.000 *	0.00		*	0.00		*	0.00		*
TOTAL=	523.000 *	0.00	0.00	0.17 *	0.00	0.00	0.86 *	0.00		0.01********** *

****

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.40
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.03
VERY FINE SAND....	2.89	FINE GRAVEL.......	0.00
FINE SAND.........	1.27	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	8.90	COARSE GRAVEL.....	0.00
COARSE SAND.......	3.34	VERY COARSE GRAVEL	0.00
		TOTAL =	16.82

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.294 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	0.00	1008.39	1007.80	9.	0.	0.	3.
532.000	0.00	1008.25	1007.65	9.	0.	0.	1.
531.000	0.00	1008.10	1007.50	9.	0.	0.	1.
530.000	0.00	1007.95	1007.35	9.	0.	0.	1.
529.000	0.00	1007.79	1007.20	9.	0.	0.	1.
528.400	0.00	1007.68	1007.11	9.	0.	0.	1.
528.000	0.00	1007.63	1007.05	9.	0.	0.	0.
527.000	0.00	1007.56	1007.00	9.	0.	0.	0.
526.200	0.00	1007.44	1006.88	9.	0.	0.	1.
526.000	0.00	1007.41	1006.80	9.	0.	0.	2.
525.000	0.00	1007.23	1006.70	9.	0.	0.	1.
524.000	0.00	1007.04	1006.55	9.	0.	0.	5.
523.000	-0.08	1006.55	1006.32	9.	0.	0.	17.

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TIME STEP # 8
* B PEAK DISCHARGE
** Q ABOVE TABLE **
INLOAD
WATER DISCHARGE, WATER-SEDIMENT LOAD TABLE ENDPOINT 334.40 200.00 0.000000

- -

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	334.40	53.95	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC

ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

****
******
TIME ENTRY * CLAY * SILT * SAND
*
DAYS POINT * INFLOW OUTFLOW TRAP EFF * INFLOW OUTFLOW TRAP EFF * INFLOW OUTFLOW
TRAP EFF *
0.34 533.000 * 0.00 * 0.00 * 0.00
*
TOTAL= 523.000 * 0.00 0.00 0.15 * 0.00 0.00 0.75 * 0.00 0.01
-4.97 *

****
******

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.97
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	19.98	FINE GRAVEL.......	0.00
FINE SAND.........	19.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	9.99	COARSE GRAVEL.....	0.00
COARSE SAND.......	4.00	VERY COARSE GRAVEL	0.00
		TOTAL =	53.95

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.11
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.02
VERY FINE SAND....	18.96	FINE GRAVEL.......	0.01
FINE SAND.........	4.26	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	2.08	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.80	VERY COARSE GRAVEL	0.00
		TOTAL =	26.24

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.336 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	-0.02	1012.37	1007.78	334.	0.	0.	88.
532.000	0.00	1012.29	1007.65	334.	0.	0.	85.
531.000	0.00	1012.22	1007.50	334.	0.	0.	86.
530.000	0.00	1012.16	1007.35	334.	0.	0.	82.
529.000	0.00	1012.10	1007.20	334.	0.	0.	78.
528.400	0.00	1012.06	1007.11	334.	0.	0.	82.
528.000	0.00	1011.99	1007.05	334.	0.	0.	90.
527.000	0.00	1011.92	1007.00	334.	0.	0.	88.
526.200	0.00	1011.87	1006.88	334.	0.	0.	88.
526.000	0.00	1011.87	1006.80	334.	0.	0.	76.
525.000	0.01	1011.82	1006.71	334.	0.	0.	57.
524.000	0.00	1011.79	1006.55	334.	0.	0.	24.
523.000	-0.08	1011.78	1006.32	334.	0.	0.	26.

==
TIME STEP # 9
* B

- -
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	49.60	0.04	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

****
*****

TIME *	ENTRY *	CLAY			*	SILT			*	SAND		
DAYS	POINT *	INFLOW	OUTFLOW	TRAP EFF	*	INFLOW	OUTFLOW	TRAP EFF	*	INFLOW	OUTFLOW	TRAP EFF *
0.38 *	533.000 *	0.00			*	0.00			*	0.00		
TOTAL=	523.000 *	0.00	0.00	0.13	*	0.00	0.00	0.67	*	0.00	0.01	-7.15 *

****

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.01	FINE GRAVEL.......	0.00
FINE SAND.........	0.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.01	VERY COARSE GRAVEL	0.00
		TOTAL =	0.04

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	3.79
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.30
VERY FINE SAND....	52.86	FINE GRAVEL.......	0.04
FINE SAND.........	37.00	MEDIUM GRAVEL.....	0.01
MEDIUM SAND.......	13.47	COARSE GRAVEL.....	0.00
COARSE SAND.......	10.04	VERY COARSE GRAVEL	0.00
		TOTAL =	117.51

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.378 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	-0.03	1009.35	1007.77	50.	0.	0.	19.
532.000	0.00	1009.20	1007.65	50.	0.	0.	12.
531.000	0.00	1009.03	1007.50	50.	0.	0.	14.
530.000	0.00	1008.86	1007.35	50.	0.	0.	15.
529.000	0.00	1008.67	1007.20	50.	0.	0.	16.
528.400	0.00	1008.57	1007.11	50.	0.	0.	14.
528.000	0.00	1008.53	1007.05	50.	0.	0.	11.
527.000	0.00	1008.41	1007.00	50.	0.	0.	11.
526.200	0.00	1008.24	1006.88	50.	0.	0.	18.
526.000	0.00	1008.21	1006.80	50.	0.	0.	26.
525.000	0.00	1007.95	1006.70	50.	0.	0.	39.
524.000	0.00	1007.59	1006.55	50.	0.	0.	51.
523.000	-0.10	1007.19	1006.30	50.	0.	0.	118.

==

TIME STEP # 10

* B

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC

ACCUMULATED TIME (yrs).... 0.001

FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	7.80	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC

ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

****

TIME *	ENTRY *	CLAY			*	SILT			*	SAND		
DAYS	POINT *	INFLOW	OUTFLOW	TRAP EFF	*	INFLOW	OUTFLOW	TRAP EFF	*	INFLOW	OUTFLOW	TRAP EFF *

```
    0.42      533.000 *       0.00                        *       0.00                        *       0.00
   *
   TOTAL=     523.000 *       0.00       0.00      0.12 *       0.00       0.00      0.60 *       0.00       0.01
-7.35 *

************************************************************************************************************
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TABLE SB-1:  SEDIMENT LOAD PASSING THE  BOUNDARIES OF STREAM SEGMENT #  1
--------------------------------------------------------------------------------
  SEDIMENT INFLOW at the Upstream Boundary:
      GRAIN SIZE      LOAD (tons/day) |    GRAIN SIZE      LOAD (tons/day)
  ----------------------------------------------------------------------------
    CLAY.............          0.00   | VERY COARSE SAND..         0.00
    COARSE SILT.......         0.00   | VERY FINE GRAVEL..         0.00
    VERY FINE SAND....         0.00   | FINE GRAVEL.......         0.00
    FINE SAND.........         0.00   | MEDIUM GRAVEL.....         0.00
    MEDIUM SAND.......         0.00   | COARSE GRAVEL.....         0.00
    COARSE SAND.......         0.00   | VERY COARSE GRAVEL         0.00
                        -------------                        ------------
                                                TOTAL =            0.00
  SEDIMENT OUTFLOW from the Downstream Boundary
      GRAIN SIZE      LOAD (tons/day) |    GRAIN SIZE      LOAD (tons/day)
  ----------------------------------------------------------------------------
    CLAY.............          0.00   | VERY COARSE SAND..         0.18
    COARSE SILT.......         0.00   | VERY FINE GRAVEL..         0.03
    VERY FINE SAND....         1.58   | FINE GRAVEL.......         0.00
    FINE SAND.........         0.69   | MEDIUM GRAVEL.....         0.00
    MEDIUM SAND.......         6.01   | COARSE GRAVEL.....         0.00
    COARSE SAND.......         2.33   | VERY COARSE GRAVEL         0.00
                        -------------                        ------------
                                                TOTAL =           10.82

TABLE SB-2:  STATUS OF THE BED PROFILE AT TIME =      0.420 DAYS
--------------------------------------------------------------------------------
  SECTION   BED CHANGE   WS ELEV   THALWEG        Q      TRANSPORT RATE (tons/day)
  NUMBER      (ft)        (ft)      (ft)        (cfs)       CLAY        SILT        SAND
    533.000      -0.03   1008.37   1007.77         8.          0.          0.         11.
    532.000       0.01   1008.23   1007.66         8.          0.          0.          0.
    531.000       0.00   1008.08   1007.50         8.          0.          0.          1.
    530.000       0.00   1007.93   1007.35         8.          0.          0.          1.
    529.000       0.00   1007.75   1007.20         8.          0.          0.          1.
    528.400       0.00   1007.64   1007.11         8.          0.          0.          1.
    528.000       0.00   1007.60   1007.05         8.          0.          0.          0.
    527.000       0.00   1007.52   1007.00         8.          0.          0.          0.
    526.200       0.00   1007.39   1006.88         8.          0.          0.          1.
    526.000       0.00   1007.36   1006.80         8.          0.          0.          1.
    525.000       0.00   1007.19   1006.70         8.          0.          0.          1.
    524.000       0.00   1006.99   1006.55         8.          0.          0.          2.
    523.000      -0.10   1006.52   1006.30         8.          0.          0.         11.

=========================================================================================
TIME STEP #      11
*    B

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
       ACCUMULATED TIME (yrs)....      0.001
       FLOW DURATION (days)......      0.042

UPSTREAM BOUNDARY CONDITIONS
-----------------------------------------------------------------------
Stream Segment # 1        |   DISCHARGE    | SEDIMENT LOAD | TEMPERATURE
Section No.    533.000    |     (cfs)      |  (tons/day)   |   (deg F)
-----------------------------------------------------------------------
                INFLOW |            4.90 |           0.00 |        83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT #  1
            ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
            ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

************************************************************************************************************
******
    TIME       ENTRY *              CLAY              *              SILT              *              SAND
   *
    DAYS       POINT *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW
TRAP EFF *
    0.46      533.000 *       0.00                        *       0.00                        *       0.00
   *
   TOTAL=     523.000 *       0.00       0.00      0.11 *       0.00       0.00      0.64 *       0.00       0.01
-7.43 *
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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.07
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.03
VERY FINE SAND....	0.60	FINE GRAVEL.......	0.00
FINE SAND.........	0.27	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	2.63	COARSE GRAVEL.....	0.00
COARSE SAND.......	1.07	VERY COARSE GRAVEL	0.00
		TOTAL =	4.66

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.462 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	-0.04	1008.23	1007.76	5.	0.	0.	6.
532.000	0.01	1008.10	1007.66	5.	0.	0.	0.
531.000	0.00	1007.95	1007.50	5.	0.	0.	0.
530.000	0.00	1007.79	1007.35	5.	0.	0.	0.
529.000	0.00	1007.60	1007.20	5.	0.	0.	0.
528.400	0.00	1007.50	1007.11	5.	0.	0.	0.
528.000	0.00	1007.46	1007.05	5.	0.	0.	0.
527.000	0.00	1007.39	1007.00	5.	0.	0.	0.
526.200	0.00	1007.28	1006.88	5.	0.	0.	0.
526.000	0.00	1007.26	1006.80	5.	0.	0.	0.
525.000	0.00	1007.10	1006.70	5.	0.	0.	0.
524.000	0.00	1006.90	1006.55	5.	0.	0.	1.
523.000	-0.10	1006.48	1006.30	5.	0.	0.	5.

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TIME STEP # 12
* B

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ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.40	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME DAYS	ENTRY POINT	*	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	*	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	*	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF	*
0.50	533.000	*	0.00			*	0.00			*	0.00			*
TOTAL=	523.000	*	0.00	0.00	0.12	*	0.00	0.00	0.67	*	0.00	0.01	-7.45	*

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.03
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.12	FINE GRAVEL.......	0.00
FINE SAND.........	0.03	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.53	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.08	VERY COARSE GRAVEL	0.00
		TOTAL =	0.79

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.504 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	-0.04	1008.04	1007.76	2.	0.	0.	3.
532.000	0.01	1007.91	1007.66	2.	0.	0.	0.
531.000	0.00	1007.76	1007.50	2.	0.	0.	0.
530.000	0.00	1007.63	1007.35	2.	0.	0.	0.
529.000	0.00	1007.47	1007.20	2.	0.	0.	0.
528.400	0.00	1007.37	1007.11	2.	0.	0.	0.
528.000	0.00	1007.34	1007.05	2.	0.	0.	0.
527.000	0.00	1007.25	1007.00	2.	0.	0.	0.
526.200	-0.01	1007.15	1006.87	2.	0.	0.	0.
526.000	0.00	1007.12	1006.80	2.	0.	0.	0.
525.000	0.00	1006.96	1006.70	2.	0.	0.	0.
524.000	0.00	1006.79	1006.55	2.	0.	0.	0.
523.000	-0.10	1006.44	1006.30	2.	0.	0.	1.

TIME STEP # 13
* B

ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	1.94	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.55	533.000	0.00			0.00			0.00		
TOTAL=	523.000	0.00	0.00	0.13	0.00	0.00	0.69	0.00	0.01	-7.46

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE LOAD (tons/day) | GRAIN SIZE LOAD (tons/day)

CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.02
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.08	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.29	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.06	VERY COARSE GRAVEL	0.00
		TOTAL =	0.47

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.546 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	-0.04	1008.03	1007.76	2.	0.	0.	1.
532.000	0.01	1007.93	1007.66	2.	0.	0.	0.
531.000	0.00	1007.74	1007.50	2.	0.	0.	0.
530.000	0.00	1007.58	1007.35	2.	0.	0.	0.
529.000	0.00	1007.43	1007.20	2.	0.	0.	0.
528.400	0.00	1007.34	1007.11	2.	0.	0.	0.
528.000	0.00	1007.31	1007.05	2.	0.	0.	0.
527.000	0.00	1007.22	1007.00	2.	0.	0.	0.
526.200	-0.01	1007.11	1006.87	2.	0.	0.	0.
526.000	0.00	1007.08	1006.80	2.	0.	0.	0.
525.000	0.00	1006.95	1006.70	2.	0.	0.	0.
524.000	0.00	1006.76	1006.55	2.	0.	0.	0.
523.000	-0.10	1006.43	1006.30	2.	0.	0.	0.

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TIME STEP # 14
* B

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ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.002
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	1.93	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.59	533.000	0.00			0.00			0.00		
TOTAL=	523.000	0.00	0.00	0.15	0.00	0.00	0.71	0.00	0.01	-7.47

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00

FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.02
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.09	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.27	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.05	VERY COARSE GRAVEL	0.00
		TOTAL =	0.46

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.588 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	-0.04	1008.06	1007.76	2.	0.	0.	2.
532.000	0.01	1007.90	1007.66	2.	0.	0.	0.
531.000	0.00	1007.75	1007.50	2.	0.	0.	0.
530.000	0.00	1007.62	1007.35	2.	0.	0.	0.
529.000	0.00	1007.43	1007.20	2.	0.	0.	0.
528.400	0.00	1007.32	1007.11	2.	0.	0.	0.
528.000	0.00	1007.29	1007.05	2.	0.	0.	0.
527.000	0.00	1007.22	1007.00	2.	0.	0.	0.
526.200	-0.01	1007.11	1006.87	2.	0.	0.	0.
526.000	0.00	1007.08	1006.80	2.	0.	0.	0.
525.000	0.00	1006.96	1006.70	2.	0.	0.	0.
524.000	0.00	1006.76	1006.55	2.	0.	0.	0.
523.000	-0.10	1006.43	1006.30	2.	0.	0.	0.

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TIME STEP # 15
* B

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ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED TIME (yrs).... 0.002
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	1.93	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.63	533.000	0.00			0.00			0.00		
TOTAL=	523.000	0.00	0.00	0.15	0.00	0.00	0.73	0.00	0.01	-7.47

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00

TOTAL = 0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.02
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.08	FINE GRAVEL.......	0.00
FINE SAND.........	0.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.27	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.06	VERY COARSE GRAVEL	0.00

TOTAL = 0.44

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.630 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	-0.04	1008.05	1007.76	2.	0.	0.	1.
532.000	0.01	1007.94	1007.66	2.	0.	0.	0.
531.000	0.00	1007.79	1007.50	2.	0.	0.	0.
530.000	0.00	1007.61	1007.35	2.	0.	0.	0.
529.000	0.00	1007.41	1007.20	2.	0.	0.	0.
528.400	0.00	1007.30	1007.11	2.	0.	0.	0.
528.000	0.00	1007.26	1007.05	2.	0.	0.	0.
527.000	0.00	1007.19	1007.00	2.	0.	0.	0.
526.200	-0.01	1007.08	1006.87	2.	0.	0.	0.
526.000	0.00	1007.05	1006.80	2.	0.	0.	0.
525.000	0.00	1006.94	1006.70	2.	0.	0.	0.
524.000	0.00	1006.75	1006.55	2.	0.	0.	0.
523.000	-0.10	1006.43	1006.30	2.	0.	0.	0.

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TIME STEP # 16

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ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC

ACCUMULATED TIME (yrs).... 0.002

FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 533.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	1.72	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.67	533.000	0.00			0.00			0.00		
TOTAL=	523.000	0.00	0.00	0.17	0.00	0.00	0.75	0.00	0.01	-7.48

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00

TOTAL = 0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)

CLAY..............	0.00	VERY COARSE SAND..	0.02
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.07	FINE GRAVEL.......	0.00
FINE SAND.........	0.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.18	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.04	VERY COARSE GRAVEL	0.00
		TOTAL =	0.31

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.672 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
533.000	-0.04	1008.02	1007.76	2.	0.	0.	1.
532.000	0.01	1007.90	1007.66	2.	0.	0.	0.
531.000	0.00	1007.74	1007.50	2.	0.	0.	0.
530.000	0.00	1007.59	1007.35	2.	0.	0.	0.
529.000	0.00	1007.46	1007.20	2.	0.	0.	0.
528.400	0.00	1007.32	1007.11	2.	0.	0.	0.
528.000	0.00	1007.26	1007.05	2.	0.	0.	0.
527.000	0.00	1007.20	1007.00	2.	0.	0.	0.
526.200	-0.01	1007.10	1006.87	2.	0.	0.	0.
526.000	0.00	1007.07	1006.80	2.	0.	0.	0.
525.000	0.00	1006.95	1006.70	2.	0.	0.	0.
524.000	0.00	1006.74	1006.55	2.	0.	0.	0.
523.000	-0.10	1006.43	1006.30	2.	0.	0.	0.

$VOL

STREAM SEGMENT # 1: ID OVERCHUTE PROJECT PHASE II - FLOOD CONTROL DISTRICT OF MC

SUMMARY TABLE: MASS AND VOLUME OF SEDIMENT

SECTION	SEDIMENT THROUGH SECTION (tons) TOTAL	SAND	SILT	CLAY	SEDIMENT DEPOSITED IN REACH in cu. yds TOTAL	CUMULATIVE	SAND	SILT	CLAY
INFLOW	2.	2.	0.	0.	2.				
533.000	6.	6.	0.	0.	-3.	-3.	-3.	0.	0.
532.000	4.	4.	0.	0.	1.	-2.	1.	0.	0.
531.000	4.	4.	0.	0.	0.	-2.	0.	0.	0.
530.000	4.	4.	0.	0.	0.	-2.	0.	0.	0.
529.000	4.	4.	0.	0.	0.	-1.	0.	0.	0.
528.400	4.	4.	0.	0.	0.	-2.	0.	0.	0.
528.000	4.	4.	0.	0.	0.	-2.	0.	0.	0.
527.000	4.	4.	0.	0.	0.	-2.	0.	0.	0.
526.200	5.	5.	0.	0.	0.	-2.	0.	0.	0.
526.000	5.	5.	0.	0.	0.	-2.	0.	0.	0.
525.000	4.	4.	0.	0.	0.	-2.	0.	0.	0.
524.000	4.	4.	0.	0.	0.	-2.	0.	0.	0.
523.000	19.	19.	0.	0.	-12.	-14.	-12.	0.	0.

$$END

0 DATA ERRORS DETECTED.

TOTAL NO. OF TIME STEPS READ = 16
TOTAL NO. OF WS PROFILES = 16
ITERATIONS IN EXNER EQ = 10400

COMPUTATIONS COMPLETED
RUN TIME = 0 HOURS, 0 MINUTES & 5.00 SECONDS

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*****************************************************     ***********************************
* SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS   *     * U.S. ARMY CORPS OF ENGINEERERS  *
*      Version: 4.1.07 -  OCT93+FIXS95             *     * HYDROLOGIC ENGINEERING CENTER   *
* INPUT FILE:  PLZCSED.DAT                          *     * 609 SECOND STREET               *
* OUTPUT FILE: PLZCSED.OUT                          *     * DAVIS, CALIFORNIA 95616-4687    *
* RUN DATE: 19 FEB 97    RUN TIME: 16:06:44         *     * (916) 756-1104                  *
*****************************************************     ***********************************

                    X     X  XXXXXXX   XXXXX          XXXXX
                    X     X  X        X     X        X     X
                    X     X  X        X              X
                    XXXXXXX  XXXX     X       XXXXX  XXXXXX
                    X     X  X        X              X     X
                    X     X  X        X     X        X     X
                    X     X  XXXXXXX   XXXXX          XXXXX

          *******************************************************************
          * MAXIMUM LIMITS FOR THIS VERSION ARE:                            *
          *       10  Stream Segments (Main Stem + Tributaries)             *
          *      150  Cross Sections                                        *
          *      100  Elevation/Station Points per Cross Section            *
          *       20  Grain Sizes                                           *
          *       10  Control Points                                        *
          *******************************************************************
```

T1 DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
T2 RID CANAL OVERCHUTE PROJ. PHASE II EARTH LINED CHAN THRU DET
T3 SEDIMENT TRANSPORT MODEL - TOFALETTI/MEYER PETER & MULLER

N values...	Left	Channel	Right	Contraction	Expansion
	0.0350	0.0350	0.0350	1.1000	0.7000

SECTION NO. 436.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 437.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 438.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 439.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 440.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 441.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 442.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 443.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 444.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 445.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 446.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 447.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 448.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 449.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 450.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 451.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 452.000

```
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   453.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

LOCAL INFLOW POINT  1 occurs upstream from Section No.     453.000

SECTION NO.   454.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   455.000
...DEPTH of the Bed Sediment Control Volume =    0.00 ft.

SECTION NO.   456.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   457.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

LOCAL INFLOW POINT  2 occurs upstream from Section No.     457.000

SECTION NO.   458.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   459.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   460.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   461.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   462.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   463.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   464.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   465.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

SECTION NO.   466.000
...DEPTH of the Bed Sediment Control Volume =   10.00 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 31
NO. OF INPUT DATA MESSAGES =    0

TOTAL NO. OF CROSS SECTIONS IN THE NETWORK =  31
TOTAL NO. OF STREAM SEGMENTS IN THE NETWORK=   1
END OF GEOMETRIC DATA

=================================================================================================

T4      RID OVERCHUTE PROJECT PHASE 2 - PLAZA CIRCLE CHANNEL & BASIN
T5      Load curve based on Zeller-Fullerton reach-average results
T6      Sediment gradation from ATL Geotech Report (Job # 194031)
T7
T8

        DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
        RID CANAL OVERCHUTE PROJ. PHASE II  EARTH LINED CHAN THRU DET
        SEDIMENT TRANSPORT MODEL - TOFALETTI/MEYER PETER & MULLER

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
SEDIMENT PROPERITES AND PARAMETERS

       SPI      IBG    MNQ      SPGF      ACGR     NFALL     IBSHER
I1     50.        0      1      0.997    32.174        2          1
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
CLAY IS PRESENT.

       MTCL    SPGC       PUCD      UWCL      CCCD
I2      1     2.650    78.000    30.000    16.000


  DEPOSITION COEFFICIENTS BY LAYER
                      DEPOSITION
```

LAYER NO.	THRESHOLD SHEAR STRESS lb/sq.ft
ACTIVE LAYER 1	0.0200

SILT IS PRESENT

	MTCL	IASL	LASL	SGSL	PUSDLB	UWSDLB	CCSDLB
I3	1	4	4	2.650	82.000	65.000	5.700

DEPOSITION COEFFICIENTS BY LAYER

LAYER NO.	DEPOSITION THRESHOLD SHEAR STRESS lb/sq.ft
ACTIVE LAYER 1	0.0200

SANDS - BOULDERS ARE PRESENT

	MTC	IASA	LASA	SPGS	GSF	BSAE	PSI	UWDLB
I4	12	1	10	2.650	0.667	0.500	30.000	93.000

USING TRANSPORT CAPACITY RELATIONSHIP # 12, TOFFALETI-MPM
GRAIN SIZES UTILIZED (mean diameter - mm)

CLAY.............	0.003	VERY COARSE SAND..	1.414
COARSE SILT.......	0.045	VERY FINE GRAVEL..	2.828
VERY FINE SAND....	0.088	FINE GRAVEL.......	5.657
FINE SAND.........	0.177	MEDIUM GRAVEL.....	11.314
MEDIUM SAND.......	0.354	COARSE GRAVEL.....	22.627
COARSE SAND.......	0.707	VERY COARSE GRAVEL	45.255

COEFFICIENTS FOR COMPUTATION SCHEME WERE SPECIFIED

	DBI	DBN	XID	XIN	XIU	UBI	UBN	JSL
I5	0.500	0.500	0.250	0.250	0.250	0.000	1.000	1

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 1
LOAD BY GRAIN SIZE CLASS (tons/day)

LQ		0.000000	100.000	200.000	400.000	800.000
LF	CLAY	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LF	SILT	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LF	VFS	0.100000E-19	16.0000	19.9800	23.0020	285.995
LF	FS	0.100000E-19	17.0000	19.0080	23.4360	317.028
LF	MS	0.100000E-19	13.0000	9.99000	10.9740	276.016
LF	CS	0.100000E-19	9.00000	3.99600	3.00080	207.012
LF	VCS	0.100000E-19	3.00000	0.972000	0.100000E-19	84.9466
LF	VFG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	27.0174
LF	FG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	18.0116
LF	MG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.973600
LF	CG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LF	VCG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
TOTAL		0.120000E-18	58.0000	53.9460	60.4128	1217.00

REACH GEOMETRY FOR STREAM SEGMENT 1

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL BED-ELEVATIONS LEFT SIDE (ft)	THALWEG (ft)	RIGHT SIDE (ft)	ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM (ft)	(miles)
	116.900						
436.000		504.400	1014.000	1008.200	1014.000	0.000	0.000
	96.700						
437.000		365.000	1013.000	1008.250	1014.370	96.700	0.018
	129.500						
438.000		331.300	1013.800	1008.400	1014.980	226.200	0.043
	113.300						
439.000		410.000	1013.800	1008.590	1015.200	339.500	0.064
	126.500						
440.000		395.700	1014.300	1008.780	1015.400	466.000	0.088
	58.500						
441.000		409.400	1014.800	1008.870	1015.100	524.500	0.099
	70.000						

442.000		302.400	1015.400	1008.970	1015.680	594.500	0.113
	104.100						
443.000		281.300	1015.800	1009.100	1015.890	698.600	0.132
	87.700						
444.000		224.200	1016.300	1009.260	1016.020	786.300	0.149
	97.100						
445.000		235.700	1016.500	1009.400	1016.350	883.400	0.167
	102.000						
446.000		232.500	1016.800	1009.560	1016.760	985.400	0.187
	80.200						
447.000		215.900	1017.100	1009.680	1017.000	1065.600	0.202
	98.800						
448.000		276.100	1017.300	1009.800	1017.770	1164.400	0.221
	107.100						
449.000		254.600	1017.600	1009.990	1018.070	1271.500	0.241
	105.000						
450.000		246.000	1018.200	1010.150	1018.400	1376.500	0.261
	96.000						
451.000		264.100	1017.600	1010.290	1019.290	1472.500	0.279
	80.200						
452.000		281.700	1018.000	1010.400	1019.870	1552.700	0.294
	104.000						
453.000		302.800	1017.700	1010.570	1019.970	1656.700	0.314
	96.700						
454.000		270.600	1019.200	1010.700	1018.200	1753.400	0.332
	108.000						
455.000		329.300	1017.800	1010.870	1020.400	1861.400	0.353
	106.100						
456.000		375.400	1017.900	1011.000	1020.630	1967.500	0.373
	102.300						
457.000		310.400	1018.000	1011.190	1020.860	2069.800	0.392
	103.900						
458.000		316.500	1018.200	1011.300	1020.910	2173.700	0.412
	110.800						
459.000		276.800	1018.400	1011.500	1020.600	2284.500	0.433
	94.000						
460.000		300.200	1018.500	1011.650	1020.000	2378.500	0.450
	90.800						
461.000		364.800	1018.800	1011.770	1019.960	2469.300	0.468
	124.800						
462.000		246.900	1019.100	1011.970	1020.260	2594.100	0.491
	63.300						
463.000		303.900	1021.800	1012.070	1020.300	2657.400	0.503
	110.700						
464.000		311.100	1019.400	1012.200	1020.600	2768.100	0.524
	104.100						
465.000		304.400	1019.400	1012.390	1020.900	2872.200	0.544
	98.300						
466.000		316.200	1018.500	1012.540	1021.180	2970.500	0.563

BED MATERIAL GRADATION

SECNO	SAE	DMAX (ft)	DXPI (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size					
436.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
437.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
438.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
439.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
440.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
441.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013

						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
442.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
443.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
444.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
445.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
446.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
447.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
448.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
449.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
450.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
451.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
452.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
453.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
454.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
455.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
456.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
457.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003

						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
458.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
459.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
460.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
461.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
462.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
463.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
464.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
465.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002
466.000	0.000	0.123	0.123	1.000	1.000	CLAY	0.482	M SAND	0.083	F GRVL	0.013
						C SILT	0.125	C SAND	0.066	M GRVL	0.003
						VF SAND	0.078	VC SAND	0.035	C GRVL	0.008
						F SAND	0.091	VF GRVL	0.013	VC GRVL	0.002

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 1: DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	VOLUME (cu.ft)	(cu.yd)
436.000	48.350	457.933	10.000	221411.	8200.40
437.000	113.100	378.433	10.000	428008.	15852.2
438.000	121.400	349.533	10.000	424333.	15716.0
439.000	119.900	395.091	10.000	473714.	17545.0
440.000	92.500	400.403	10.000	370373.	13717.5
441.000	64.250	387.892	10.000	249220.	9230.39
442.000	87.050	312.535	10.000	272062.	10076.4
443.000	95.900	276.414	10.000	265081.	9817.83
444.000	92.400	235.247	10.000	217368.	8050.67
445.000	99.550	233.284	10.000	232234.	8601.27
446.000	91.100	230.662	10.000	210133.	7782.69
447.000	89.500	229.455	10.000	205362.	7606.01
448.000	102.950	262.743	10.000	270494.	10018.3
449.000	106.050	256.800	10.000	272336.	10086.5
450.000	100.500	250.379	10.000	251631.	9319.67
451.000	88.100	263.483	10.000	232129.	8597.36
452.000	92.100	283.117	10.000	260751.	9657.43
453.000	100.350	293.984	0.000	0.000000	0.000000
454.000	102.350	285.994	10.000	292715.	10841.3
455.000	107.050	327.045	0.000	0.000000	0.000000
456.000	104.200	356.941	10.000	371932.	13775.3
457.000	103.100	322.174	10.000	332161.	12302.3
458.000	107.350	308.687	10.000	331375.	12273.2
459.000	102.400	287.540	10.000	294440.	10905.2
460.000	92.400	306.813	10.000	283495.	10499.8
461.000	107.800	332.982	10.000	358955.	13294.6

462.000	94.050	279.369	10.000	262746.	9731.34
463.000	87.000	298.515	10.000	259708.	9618.81
464.000	107.400	308.781	10.000	331631.	12282.6
465.000	101.200	307.459	10.000	311148.	11524.0
466.000	49.150	312.267	10.000	153479.	5684.41

NO. OF INPUT DATA MESSAGES= 0
END OF SEDIMENT DATA

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$HYD
BEGIN COMPUTATIONS.

$RATING

Downstream Boundary Condition - Rating Curve

Elevation	Stage	Discharge	Elevation	Stage	Discharge
1008.210	1008.210	0.000	1011.890	1011.890	700.000
1009.310	1009.310	100.000	1012.140	1012.140	800.000
1009.840	1009.840	200.000	1012.500	1012.500	900.000
1010.590	1010.590	300.000	1012.730	1012.730	1000.000
1010.970	1010.970	400.000	1012.950	1012.950	1100.000
1011.310	1011.310	500.000	1012.980	1012.980	1200.000
1011.580	1011.580	600.000			

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TIME STEP # 1
* B 100-YEAR HYDROGRAPH INCREMENT 1

- -

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.000
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	1.31	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	1.31	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	1.31	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	1.31	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	1.31	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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*****************************************************************************************************
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    TIME      ENTRY *            CLAY              *            SILT              *            SAND
   *
    DAYS      POINT *   INFLOW   OUTFLOW  TRAP EFF *   INFLOW   OUTFLOW  TRAP EFF *   INFLOW   OUTFLOW
TRAP EFF *
    0.04    466.000 *    0.00                      *    0.00                      *    0.00
   *
            457.000 *    0.00                      *    0.00                      *    0.00
   *
            453.000 *    0.00                      *    0.00                      *    0.00
   *
   TOTAL=   436.000 *    0.00     0.00      0.99 *    0.00     0.00      1.00 *    0.00
.00********** *
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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.01	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.01

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.042 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.63	1012.54	1.	0.	0.	0.
465.000	0.00	1012.49	1012.39	1.	0.	0.	0.
464.000	0.00	1012.32	1012.20	1.	0.	0.	0.
463.000	0.00	1012.13	1012.07	1.	0.	0.	0.
462.000	0.00	1012.06	1011.97	1.	0.	0.	0.
461.000	0.00	1011.92	1011.77	1.	0.	0.	0.
460.000	0.00	1011.73	1011.65	1.	0.	0.	0.
459.000	0.00	1011.60	1011.50	1.	0.	0.	0.
458.000	0.00	1011.42	1011.30	1.	0.	0.	0.
457.000	0.00	1011.33	1011.19	1.	0.	0.	0.
456.000	0.00	1011.17	1011.00	1.	0.	0.	0.
455.000	0.00	1010.93	1010.87	1.	0.	0.	0.
454.000	0.00	1010.80	1010.70	1.	0.	0.	0.
453.000	0.00	1010.71	1010.57	1.	0.	0.	0.
452.000	0.00	1010.51	1010.40	1.	0.	0.	0.
451.000	0.00	1010.39	1010.29	1.	0.	0.	0.
450.000	0.00	1010.25	1010.15	1.	0.	0.	0.
449.000	0.00	1010.06	1009.99	1.	0.	0.	0.
448.000	0.00	1009.87	1009.80	1.	0.	0.	0.
447.000	0.00	1009.76	1009.68	1.	0.	0.	0.
446.000	0.00	1009.67	1009.56	1.	0.	0.	0.
445.000	0.00	1009.51	1009.40	1.	0.	0.	0.
444.000	0.00	1009.36	1009.26	1.	0.	0.	0.
443.000	0.00	1009.21	1009.10	1.	0.	0.	0.
442.000	0.00	1009.04	1008.97	1.	0.	0.	0.
441.000	0.00	1008.93	1008.87	1.	0.	0.	0.
440.000	0.00	1008.87	1008.78	1.	0.	0.	0.
439.000	0.00	1008.68	1008.59	1.	0.	0.	0.
438.000	0.00	1008.50	1008.40	1.	0.	0.	0.
437.000	0.00	1008.30	1008.25	1.	0.	0.	0.
436.000	0.00	1008.22	1008.20	1.	0.	0.	0.

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TIME STEP # 2
* B

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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.000
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.19	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.19	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.19	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.19	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.19	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.08	466.000	0.00			0.00			0.00		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.96	0.00	0.00	1.00	0.00	0.00	**********

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.07	FINE GRAVEL.......	0.00
FINE SAND.........	0.03	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.38	VERY COARSE GRAVEL	0.00
		TOTAL =	0.48

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.084 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.67	1012.54	2.	0.	0.	0.
465.000	0.00	1012.51	1012.39	2.	0.	0.	0.
464.000	0.00	1012.36	1012.20	2.	0.	0.	0.
463.000	0.00	1012.16	1012.07	2.	0.	0.	0.
462.000	0.00	1012.09	1011.97	2.	0.	0.	0.
461.000	0.00	1011.95	1011.77	2.	0.	0.	0.
460.000	0.00	1011.79	1011.65	2.	0.	0.	0.
459.000	0.00	1011.59	1011.50	2.	0.	0.	0.
458.000	0.00	1011.44	1011.30	2.	0.	0.	0.
457.000	0.00	1011.31	1011.19	2.	0.	0.	0.
456.000	0.00	1011.19	1011.00	2.	0.	0.	0.
455.000	0.00	1011.03	1010.87	2.	0.	0.	0.
454.000	0.00	1010.82	1010.70	2.	0.	0.	0.

453.000	0.00	1010.71	1010.57	2.	0.	0.	0.
452.000	0.00	1010.55	1010.40	2.	0.	0.	0.
451.000	0.00	1010.42	1010.29	2.	0.	0.	0.
450.000	0.00	1010.28	1010.15	2.	0.	0.	0.
449.000	0.00	1010.12	1009.99	2.	0.	0.	0.
448.000	0.00	1009.94	1009.80	2.	0.	0.	0.
447.000	0.00	1009.80	1009.68	2.	0.	0.	0.
446.000	0.00	1009.72	1009.56	2.	0.	0.	0.
445.000	0.00	1009.51	1009.40	2.	0.	0.	0.
444.000	0.00	1009.36	1009.26	2.	0.	0.	0.
443.000	0.00	1009.23	1009.10	2.	0.	0.	0.
442.000	0.00	1009.07	1008.97	2.	0.	0.	0.
441.000	0.00	1008.99	1008.87	2.	0.	0.	0.
440.000	0.00	1008.89	1008.78	2.	0.	0.	0.
439.000	0.00	1008.73	1008.59	2.	0.	0.	0.
438.000	0.00	1008.48	1008.40	2.	0.	0.	0.
437.000	0.00	1008.32	1008.25	2.	0.	0.	0.
436.000	0.00	1008.23	1008.20	2.	0.	0.	0.

TIME STEP # 3
* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.000
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.33	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.33	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.33	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.33	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.33	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.13	466.000	0.00			0.00			0.00		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.95	0.00	0.00	1.00	0.00	0.00**********	

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00

COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.06	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.02	VERY COARSE GRAVEL	0.00
		TOTAL =	0.11

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.126 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.68	1012.54	2.	0.	0.	0.
465.000	0.00	1012.47	1012.39	2.	0.	0.	0.
464.000	0.00	1012.36	1012.20	2.	0.	0.	0.
463.000	0.00	1012.20	1012.07	2.	0.	0.	0.
462.000	0.00	1012.11	1011.97	2.	0.	0.	0.
461.000	0.00	1011.93	1011.77	2.	0.	0.	0.
460.000	0.00	1011.80	1011.65	2.	0.	0.	0.
459.000	0.00	1011.63	1011.50	2.	0.	0.	0.
458.000	0.00	1011.46	1011.30	2.	0.	0.	0.
457.000	0.00	1011.36	1011.19	2.	0.	0.	0.
456.000	0.00	1011.18	1011.00	2.	0.	0.	0.
455.000	0.00	1010.99	1010.87	2.	0.	0.	0.
454.000	0.00	1010.83	1010.70	2.	0.	0.	0.
453.000	0.00	1010.68	1010.57	2.	0.	0.	0.
452.000	0.00	1010.54	1010.40	2.	0.	0.	0.
451.000	0.00	1010.44	1010.29	2.	0.	0.	0.
450.000	0.00	1010.31	1010.15	2.	0.	0.	0.
449.000	0.00	1010.15	1009.99	2.	0.	0.	0.
448.000	0.00	1009.96	1009.80	2.	0.	0.	0.
447.000	0.00	1009.83	1009.68	2.	0.	0.	0.
446.000	0.00	1009.75	1009.56	2.	0.	0.	0.
445.000	0.00	1009.56	1009.40	2.	0.	0.	0.
444.000	0.00	1009.37	1009.26	2.	0.	0.	0.
443.000	0.00	1009.22	1009.10	2.	0.	0.	0.
442.000	0.00	1009.11	1008.97	2.	0.	0.	0.
441.000	0.00	1009.03	1008.87	2.	0.	0.	0.
440.000	0.00	1008.88	1008.78	2.	0.	0.	0.
439.000	0.00	1008.68	1008.59	2.	0.	0.	0.
438.000	0.00	1008.44	1008.40	2.	0.	0.	0.
437.000	0.00	1008.32	1008.25	2.	0.	0.	0.
436.000	0.00	1008.24	1008.20	2.	0.	0.	0.

TIME STEP # 4
* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.000
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.46	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.46	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.46	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.46	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.46	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.17	466.000	0.00			0.00			0.00		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.95	0.00	0.00	1.00	0.00	0.00	**********

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.05	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.08

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.168 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.69	1012.54	2.	0.	0.	0.
465.000	0.00	1012.55	1012.39	2.	0.	0.	0.
464.000	0.00	1012.39	1012.20	2.	0.	0.	0.
463.000	0.00	1012.23	1012.07	2.	0.	0.	0.
462.000	0.00	1012.12	1011.97	2.	0.	0.	0.
461.000	0.00	1011.95	1011.77	2.	0.	0.	0.
460.000	0.00	1011.83	1011.65	2.	0.	0.	0.
459.000	0.00	1011.66	1011.50	2.	0.	0.	0.
458.000	0.00	1011.49	1011.30	2.	0.	0.	0.
457.000	0.00	1011.35	1011.19	2.	0.	0.	0.
456.000	0.00	1011.14	1011.00	2.	0.	0.	0.
455.000	0.00	1010.99	1010.87	2.	0.	0.	0.
454.000	0.00	1010.85	1010.70	2.	0.	0.	0.
453.000	0.00	1010.69	1010.57	2.	0.	0.	0.
452.000	0.00	1010.56	1010.40	2.	0.	0.	0.
451.000	0.00	1010.45	1010.29	2.	0.	0.	0.
450.000	0.00	1010.32	1010.15	2.	0.	0.	0.
449.000	0.00	1010.11	1009.99	2.	0.	0.	0.
448.000	0.00	1009.99	1009.80	2.	0.	0.	0.
447.000	0.00	1009.86	1009.68	2.	0.	0.	0.
446.000	0.00	1009.75	1009.56	2.	0.	0.	0.
445.000	0.00	1009.51	1009.40	2.	0.	0.	0.

444.000	0.00	1009.38	1009.26	2.	0.	0.	0.
443.000	0.00	1009.24	1009.10	2.	0.	0.	0.
442.000	0.00	1009.13	1008.97	2.	0.	0.	0.
441.000	0.00	1009.02	1008.87	2.	0.	0.	0.
440.000	0.00	1008.90	1008.78	2.	0.	0.	0.
439.000	0.00	1008.70	1008.59	2.	0.	0.	0.
438.000	0.00	1008.51	1008.40	2.	0.	0.	0.
437.000	0.00	1008.30	1008.25	2.	0.	0.	0.
436.000	0.00	1008.24	1008.20	2.	0.	0.	0.

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TIME STEP # 5
* B

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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.93	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.93	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.93	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.93	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.93	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.21	466.000	0.00			0.00			0.00		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.94	0.00	0.00	1.00	0.00		0.00

****

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)

CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.06	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.01	VERY COARSE GRAVEL	0.00
		TOTAL =	0.09

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.210 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.65	1012.54	3.	0.	0.	0.
465.000	0.00	1012.53	1012.39	3.	0.	0.	0.
464.000	0.00	1012.36	1012.20	3.	0.	0.	0.
463.000	0.00	1012.18	1012.07	3.	0.	0.	0.
462.000	0.00	1012.08	1011.97	3.	0.	0.	0.
461.000	0.00	1011.93	1011.77	3.	0.	0.	0.
460.000	0.00	1011.80	1011.65	3.	0.	0.	0.
459.000	0.00	1011.65	1011.50	3.	0.	0.	0.
458.000	0.00	1011.45	1011.30	3.	0.	0.	0.
457.000	0.00	1011.31	1011.19	3.	0.	0.	0.
456.000	0.00	1011.15	1011.00	3.	0.	0.	0.
455.000	0.00	1011.00	1010.87	3.	0.	0.	0.
454.000	0.00	1010.84	1010.70	3.	0.	0.	0.
453.000	0.00	1010.71	1010.57	3.	0.	0.	0.
452.000	0.00	1010.59	1010.40	3.	0.	0.	0.
451.000	0.00	1010.48	1010.29	3.	0.	0.	0.
450.000	0.00	1010.31	1010.15	3.	0.	0.	0.
449.000	0.00	1010.11	1009.99	3.	0.	0.	0.
448.000	0.00	1009.95	1009.80	3.	0.	0.	0.
447.000	0.00	1009.83	1009.68	3.	0.	0.	0.
446.000	0.00	1009.71	1009.56	3.	0.	0.	0.
445.000	0.00	1009.54	1009.40	3.	0.	0.	0.
444.000	0.00	1009.43	1009.26	3.	0.	0.	0.
443.000	0.00	1009.28	1009.10	3.	0.	0.	0.
442.000	0.00	1009.09	1008.97	3.	0.	0.	0.
441.000	0.00	1008.99	1008.87	3.	0.	0.	0.
440.000	0.00	1008.90	1008.78	3.	0.	0.	0.
439.000	0.00	1008.72	1008.59	3.	0.	0.	0.
438.000	0.00	1008.51	1008.40	3.	0.	0.	0.
437.000	0.00	1008.37	1008.25	3.	0.	0.	0.
436.000	0.00	1008.24	1008.20	3.	0.	0.	0.

TIME STEP # 6
* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	3.15	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	3.15	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	3.15	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	3.15	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	3.15	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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*********************************************************************************************************
******
     TIME        ENTRY *               CLAY               *            SILT               *           SAND
    *
     DAYS        POINT *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW
TRAP EFF *
     0.25      466.000 *      0.00                     *      0.00                     *      0.00
    *
               457.000 *      0.00                     *      0.00                     *      0.00
    *
               453.000 *      0.00                     *      0.00                     *      0.00
    *
    TOTAL=     436.000 *      0.00      0.00      0.93 *      0.00      0.00      1.00 *      0.00
0.00********* *

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.04	FINE GRAVEL.......	0.00
FINE SAND.........	0.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.06

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.252 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.67	1012.54	3.	0.	0.	0.
465.000	0.00	1012.54	1012.39	3.	0.	0.	0.
464.000	0.00	1012.39	1012.20	3.	0.	0.	0.
463.000	0.00	1012.21	1012.07	3.	0.	0.	0.
462.000	0.00	1012.11	1011.97	3.	0.	0.	0.
461.000	0.00	1011.96	1011.77	3.	0.	0.	0.
460.000	0.00	1011.85	1011.65	3.	0.	0.	0.
459.000	0.00	1011.64	1011.50	3.	0.	0.	0.
458.000	0.00	1011.48	1011.30	3.	0.	0.	0.
457.000	0.00	1011.36	1011.19	3.	0.	0.	0.
456.000	0.00	1011.18	1011.00	3.	0.	0.	0.
455.000	0.00	1011.00	1010.87	3.	0.	0.	0.
454.000	0.00	1010.87	1010.70	3.	0.	0.	0.
453.000	0.00	1010.74	1010.57	3.	0.	0.	0.
452.000	0.00	1010.58	1010.40	3.	0.	0.	0.
451.000	0.00	1010.47	1010.29	3.	0.	0.	0.
450.000	0.00	1010.34	1010.15	3.	0.	0.	0.
449.000	0.00	1010.16	1009.99	3.	0.	0.	0.
448.000	0.00	1009.97	1009.80	3.	0.	0.	0.
447.000	0.00	1009.83	1009.68	3.	0.	0.	0.
446.000	0.00	1009.72	1009.56	3.	0.	0.	0.
445.000	0.00	1009.57	1009.40	3.	0.	0.	0.
444.000	0.00	1009.39	1009.26	3.	0.	0.	0.
443.000	0.00	1009.27	1009.10	3.	0.	0.	0.
442.000	0.00	1009.16	1008.97	3.	0.	0.	0.
441.000	0.00	1009.03	1008.87	3.	0.	0.	0.
440.000	0.00	1008.93	1008.78	3.	0.	0.	0.
439.000	0.00	1008.76	1008.59	3.	0.	0.	0.
438.000	0.00	1008.46	1008.40	3.	0.	0.	0.
437.000	0.00	1008.35	1008.25	3.	0.	0.	0.
436.000	0.00	1008.24	1008.20	3.	0.	0.	0.

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================================================================================
TIME STEP #       8
*    B

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
       ACCUMULATED TIME (yrs)....      0.001
       FLOW DURATION (days)......      0.042

UPSTREAM BOUNDARY CONDITIONS
---------------------------------------------------------------------
Stream Segment # 1      |   DISCHARGE    | SEDIMENT LOAD | TEMPERATURE
Section No.    466.000  |     (cfs)      |  (tons/day)   |   (deg F)
---------------------------------------------------------------------
                 INFLOW |           3.92 |          0.00 |      83.00

Upstream of SECTION NO.    457.000 is...
LOCAL INFLOW POINT # 2  |  DISCHARGE     | SEDIMENT LOAD | TEMPERATURE
                        |    (cfs)       |  (tons/day)   |   (deg F)
---------------------------------------------------------------------
      MAINSTEM  INFLOW  |           3.92 |          0.00 |      83.00
      LOCAL     INFLOW  |           0.00 |          0.00 |       0.00
---------------------------------------------------------------------
                 TOTAL  |           3.92 |          0.00 |      83.00

Upstream of SECTION NO.    453.000 is...
LOCAL INFLOW POINT # 1  |  DISCHARGE     | SEDIMENT LOAD | TEMPERATURE
                        |    (cfs)       |  (tons/day)   |   (deg F)
---------------------------------------------------------------------
      MAINSTEM  INFLOW  |           3.92 |          0.00 |      83.00
      LOCAL     INFLOW  |           0.00 |          0.00 |       0.00
---------------------------------------------------------------------
                 TOTAL  |           3.92 |          0.00 |      83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT #  1
            DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
            ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

****************************************************************************************************************
******
    TIME       ENTRY *            CLAY              *             SILT             *            SAND
   *
    DAYS       POINT *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW
TRAP EFF *
    0.34     466.000 *      0.00                    *      0.00                    *      0.00
   *
             457.000 *      0.00                    *      0.00                    *      0.00
   *
             453.000 *      0.00                    *      0.00                    *      0.00
   *
   TOTAL=    436.000 *      0.00      0.00     0.90 *      0.00      0.00     1.00 *      0.00
0.00********** *

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TABLE SB-1:  SEDIMENT LOAD PASSING THE  BOUNDARIES OF STREAM SEGMENT #  1
--------------------------------------------------------------------------------
  SEDIMENT INFLOW at the Upstream Boundary:
      GRAIN SIZE      LOAD (tons/day) |    GRAIN SIZE       LOAD (tons/day)
  ---------------------------------------------------------------------------
    CLAY.............         0.00  |  VERY COARSE SAND..          0.00
    COARSE SILT.......        0.00  |  VERY FINE GRAVEL..          0.00
    VERY FINE SAND....        0.00  |  FINE GRAVEL.......          0.00
    FINE SAND.........        0.00  |  MEDIUM GRAVEL.....          0.00
    MEDIUM SAND.......        0.00  |  COARSE GRAVEL.....          0.00
    COARSE SAND.......        0.00  |  VERY COARSE GRAVEL          0.00
                      ------------                         ------------
                                              TOTAL =          0.00
  SEDIMENT OUTFLOW from the Downstream Boundary
      GRAIN SIZE      LOAD (tons/day) |    GRAIN SIZE       LOAD (tons/day)
  ---------------------------------------------------------------------------
    CLAY.............         0.00  |  VERY COARSE SAND..          0.00
    COARSE SILT.......        0.00  |  VERY FINE GRAVEL..          0.00
    VERY FINE SAND....        0.03  |  FINE GRAVEL.......          0.00
    FINE SAND.........        0.01  |  MEDIUM GRAVEL.....          0.00
    MEDIUM SAND.......        0.00  |  COARSE GRAVEL.....          0.00
    COARSE SAND.......        0.00  |  VERY COARSE GRAVEL          0.00
                      ------------                         ------------
                                              TOTAL =          0.04
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TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.336 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.73	1012.54	4.	0.	0.	0.
465.000	0.00	1012.59	1012.39	4.	0.	0.	0.
464.000	0.00	1012.43	1012.20	4.	0.	0.	0.
463.000	0.00	1012.29	1012.07	4.	0.	0.	0.
462.000	0.00	1012.17	1011.97	4.	0.	0.	0.
461.000	0.00	1011.93	1011.77	4.	0.	0.	0.
460.000	0.00	1011.83	1011.65	4.	0.	0.	0.
459.000	0.00	1011.70	1011.50	4.	0.	0.	0.
458.000	0.00	1011.49	1011.30	4.	0.	0.	0.
457.000	0.00	1011.33	1011.19	4.	0.	0.	0.
456.000	0.00	1011.20	1011.00	4.	0.	0.	0.
455.000	0.00	1011.02	1010.87	4.	0.	0.	0.
454.000	0.00	1010.89	1010.70	4.	0.	0.	0.
453.000	0.00	1010.79	1010.57	4.	0.	0.	0.
452.000	0.00	1010.60	1010.40	4.	0.	0.	0.
451.000	0.00	1010.47	1010.29	4.	0.	0.	0.
450.000	0.00	1010.36	1010.15	4.	0.	0.	0.
449.000	0.00	1010.17	1009.99	4.	0.	0.	0.
448.000	0.00	1009.98	1009.80	4.	0.	0.	0.
447.000	0.00	1009.87	1009.68	4.	0.	0.	0.
446.000	0.00	1009.74	1009.56	4.	0.	0.	0.
445.000	0.00	1009.57	1009.40	4.	0.	0.	0.
444.000	0.00	1009.44	1009.26	4.	0.	0.	0.
443.000	0.00	1009.31	1009.10	4.	0.	0.	0.
442.000	0.00	1009.13	1008.97	4.	0.	0.	0.
441.000	0.00	1009.05	1008.87	4.	0.	0.	0.
440.000	0.00	1008.96	1008.78	4.	0.	0.	0.
439.000	0.00	1008.74	1008.59	4.	0.	0.	0.
438.000	0.00	1008.54	1008.40	4.	0.	0.	0.
437.000	0.00	1008.35	1008.25	4.	0.	0.	0.
436.000	0.00	1008.25	1008.20	4.	0.	0.	0.

TIME STEP # 9
* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	4.78	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	4.78	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	4.78	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	4.78	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	4.78	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME ENTRY * CLAY * SILT * SAND
*
DAYS POINT * INFLOW OUTFLOW TRAP EFF * INFLOW OUTFLOW TRAP EFF * INFLOW OUTFLOW
RAP EFF *
0.38 466.000 * 0.00 * 0.00 * 0.00

*									
	457.000 *	0.00		*	0.00		*	0.00	
*									
	453.000 *	0.00		*	0.00		*	0.00	
*									
TOTAL=	436.000 *	0.00	0.00	0.89 *	0.00	0.00	1.00 *	0.00	

0.00********** *

****
******

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.02	FINE GRAVEL.......	0.00
FINE SAND.........	0.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.03

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.378 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.73	1012.54	5.	0.	0.	1.
465.000	0.00	1012.57	1012.39	5.	0.	0.	0.
464.000	0.00	1012.43	1012.20	5.	0.	0.	0.
463.000	0.00	1012.29	1012.07	5.	0.	0.	0.
462.000	0.00	1012.16	1011.97	5.	0.	0.	0.
461.000	0.00	1011.99	1011.77	5.	0.	0.	0.
460.000	0.00	1011.88	1011.65	5.	0.	0.	0.
459.000	0.00	1011.67	1011.50	5.	0.	0.	0.
458.000	0.00	1011.55	1011.30	5.	0.	0.	0.
457.000	0.00	1011.44	1011.19	5.	0.	0.	0.
456.000	0.00	1011.24	1011.00	5.	0.	0.	0.
455.000	0.00	1011.06	1010.87	5.	0.	0.	0.
454.000	0.00	1010.91	1010.70	5.	0.	0.	0.
453.000	0.00	1010.75	1010.57	5.	0.	0.	0.
452.000	0.00	1010.59	1010.40	5.	0.	0.	0.
451.000	0.00	1010.49	1010.29	5.	0.	0.	0.
450.000	0.00	1010.41	1010.15	5.	0.	0.	0.
449.000	0.00	1010.19	1009.99	5.	0.	0.	0.
448.000	0.00	1010.02	1009.80	5.	0.	0.	0.
447.000	0.00	1009.87	1009.68	5.	0.	0.	0.
446.000	0.00	1009.74	1009.56	5.	0.	0.	0.
445.000	0.00	1009.61	1009.40	5.	0.	0.	0.
444.000	0.00	1009.47	1009.26	5.	0.	0.	0.
443.000	0.00	1009.33	1009.10	5.	0.	0.	0.
442.000	0.00	1009.16	1008.97	5.	0.	0.	0.
441.000	0.00	1009.08	1008.87	5.	0.	0.	0.
440.000	0.00	1009.00	1008.78	5.	0.	0.	0.
439.000	0.00	1008.76	1008.59	5.	0.	0.	0.
438.000	0.00	1008.50	1008.40	5.	0.	0.	0.
437.000	0.00	1008.36	1008.25	5.	0.	0.	0.
436.000	0.00	1008.26	1008.20	5.	0.	0.	0.

TIME STEP # 10
* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL

ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	6.10	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	6.10	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	6.10	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	6.10	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	6.10	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.42	466.000	0.00			0.00			0.00		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.87	0.00	0.00	1.00	0.00	0.00	**********

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.02	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.02

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.420 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.74	1012.54	6.	0.	0.	1.
465.000	0.00	1012.62	1012.39	6.	0.	0.	0.
464.000	0.00	1012.46	1012.20	6.	0.	0.	0.
463.000	0.00	1012.31	1012.07	6.	0.	0.	0.
462.000	0.00	1012.21	1011.97	6.	0.	0.	0.

461.000	0.00	1012.00	1011.77	6.	0.	0.	0.
460.000	0.00	1011.87	1011.65	6.	0.	0.	0.
459.000	0.00	1011.73	1011.50	6.	0.	0.	0.
458.000	0.00	1011.59	1011.30	6.	0.	0.	0.
457.000	0.00	1011.40	1011.19	6.	0.	0.	0.
456.000	0.00	1011.24	1011.00	6.	0.	0.	0.
455.000	0.00	1011.10	1010.87	6.	0.	0.	0.
454.000	0.00	1010.95	1010.70	6.	0.	0.	0.
453.000	0.00	1010.78	1010.57	6.	0.	0.	0.
452.000	0.00	1010.63	1010.40	6.	0.	0.	0.
451.000	0.00	1010.55	1010.29	6.	0.	0.	0.
450.000	0.00	1010.43	1010.15	6.	0.	0.	0.
449.000	0.00	1010.21	1009.99	6.	0.	0.	0.
448.000	0.00	1010.04	1009.80	6.	0.	0.	0.
447.000	0.00	1009.92	1009.68	6.	0.	0.	0.
446.000	0.00	1009.78	1009.56	6.	0.	0.	0.
445.000	0.00	1009.62	1009.40	6.	0.	0.	0.
444.000	0.00	1009.51	1009.26	6.	0.	0.	0.
443.000	0.00	1009.37	1009.10	6.	0.	0.	0.
442.000	0.00	1009.21	1008.97	6.	0.	0.	0.
441.000	0.00	1009.10	1008.87	6.	0.	0.	0.
440.000	0.00	1008.98	1008.78	6.	0.	0.	0.
439.000	0.00	1008.77	1008.59	6.	0.	0.	0.
438.000	0.00	1008.53	1008.40	6.	0.	0.	0.
437.000	0.00	1008.38	1008.25	6.	0.	0.	0.
436.000	0.00	1008.28	1008.20	6.	0.	0.	0.

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==========================================================================================
TIME STEP #      11
*    B

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
       ACCUMULATED TIME (yrs)....      0.001
       FLOW DURATION (days)......      0.042
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UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	17.20	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	17.20	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	17.20	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	17.20	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	17.20	0.00	83.00

```
TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT #  1
            DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
            ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

*****************************************************************************************************************
******
    TIME       ENTRY *             CLAY               *             SILT               *             SAND
  *
    DAYS       POINT *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW  TRAP EFF *    INFLOW   OUTFLOW
TRAP EFF *
    0.46     466.000 *     0.00                       *     0.00                       *     0.00
  *
             457.000 *     0.00                       *     0.00                       *     0.00
  *
             453.000 *     0.00                       *     0.00                       *     0.00
  *
   TOTAL=    436.000 *     0.00      0.00      0.80 *     0.00      0.00      1.00 *     0.00
0.00********** *

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.462 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.94	1012.54	17.	0.	0.	5.
465.000	0.00	1012.80	1012.39	17.	0.	0.	1.
464.000	0.00	1012.66	1012.20	17.	0.	0.	1.
463.000	0.00	1012.47	1012.07	17.	0.	0.	1.
462.000	0.00	1012.36	1011.97	17.	0.	0.	1.
461.000	0.00	1012.19	1011.77	17.	0.	0.	1.
460.000	0.00	1012.05	1011.65	17.	0.	0.	1.
459.000	0.00	1011.90	1011.50	17.	0.	0.	1.
458.000	0.00	1011.74	1011.30	17.	0.	0.	1.
457.000	0.00	1011.59	1011.19	17.	0.	0.	1.
456.000	0.00	1011.44	1011.00	17.	0.	0.	1.
455.000	0.00	1011.31	1010.87	17.	0.	0.	0.
454.000	0.00	1011.17	1010.70	17.	0.	0.	1.
453.000	0.00	1011.00	1010.57	17.	0.	0.	1.
452.000	0.00	1010.82	1010.40	17.	0.	0.	1.
451.000	0.00	1010.71	1010.29	17.	0.	0.	1.
450.000	0.00	1010.56	1010.15	17.	0.	0.	1.
449.000	0.00	1010.40	1009.99	17.	0.	0.	1.
448.000	0.00	1010.25	1009.80	17.	0.	0.	1.
447.000	0.00	1010.14	1009.68	17.	0.	0.	1.
446.000	0.00	1010.03	1009.56	17.	0.	0.	1.
445.000	0.00	1009.85	1009.40	17.	0.	0.	2.
444.000	0.00	1009.67	1009.26	17.	0.	0.	1.
443.000	0.00	1009.54	1009.10	17.	0.	0.	1.
442.000	0.00	1009.40	1008.97	17.	0.	0.	1.
441.000	0.00	1009.29	1008.87	17.	0.	0.	1.
440.000	0.00	1009.20	1008.78	17.	0.	0.	2.
439.000	0.00	1008.97	1008.59	17.	0.	0.	5.
438.000	0.00	1008.61	1008.40	17.	0.	0.	3.
437.000	0.00	1008.44	1008.25	17.	0.	0.	0.
436.000	0.00	1008.40	1008.20	17.	0.	0.	0.

TIME STEP # 12

* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL

ACCUMULATED TIME (yrs).... 0.001

FLOW DURATION (days)...... 0.007

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	299.30	57.09	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE	SEDIMENT LOAD	TEMPERATURE

	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	299.30	57.09	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	299.30	57.09	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	299.30	57.09	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	299.30	57.09	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.47	466.000	0.00			0.00			0.00		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.78	0.00	0.00	0.99	0.00	0.00	0.90

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	21.69	FINE GRAVEL.......	0.00
FINE SAND.........	21.47	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	10.55	COARSE GRAVEL.....	0.00
COARSE SAND.......	3.38	VERY COARSE GRAVEL	0.00
		TOTAL =	57.09

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.01	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.01

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.469 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	-0.01	1014.82	1012.53	299.	0.	0.	285.
465.000	0.00	1014.67	1012.39	299.	0.	0.	181.
464.000	0.00	1014.51	1012.20	299.	0.	0.	180.
463.000	0.00	1014.34	1012.07	299.	0.	0.	177.
462.000	0.00	1014.24	1011.97	299.	0.	0.	178.
461.000	0.00	1014.06	1011.77	299.	0.	0.	176.
460.000	0.00	1013.92	1011.65	299.	0.	0.	175.
459.000	0.00	1013.78	1011.50	299.	0.	0.	176.
458.000	0.00	1013.62	1011.30	299.	0.	0.	175.
457.000	0.00	1013.46	1011.19	299.	0.	0.	175.
456.000	0.00	1013.31	1011.00	299.	0.	0.	176.
455.000	0.00	1013.15	1010.87	299.	0.	0.	159.
454.000	0.00	1012.99	1010.70	299.	0.	0.	177.
453.000	0.00	1012.84	1010.57	299.	0.	0.	160.

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    452.000        0.00   1012.69   1010.40        299.          0.          0.        177.
    451.000        0.00   1012.56   1010.29        299.          0.          0.        179.
    450.000        0.00   1012.41   1010.15        299.          0.          0.        178.
    449.000        0.00   1012.24   1009.99        299.          0.          0.        177.
    448.000        0.00   1012.08   1009.80        299.          0.          0.        181.
    447.000        0.00   1011.93   1009.68        299.          0.          0.        181.
    446.000        0.00   1011.79   1009.56        299.          0.          0.        179.
    445.000        0.00   1011.62   1009.40        299.          0.          0.        181.
    444.000        0.00   1011.46   1009.26        299.          0.          0.        184.
    443.000        0.00   1011.31   1009.10        299.          0.          0.        184.
    442.000        0.00   1011.12   1008.97        299.          0.          0.        185.
    441.000        0.00   1010.99   1008.87        299.          0.          0.        185.
    440.000        0.00   1010.88   1008.78        299.          0.          0.        181.
    439.000        0.00   1010.64   1008.59        299.          0.          0.        143.
    438.000        0.00   1010.58   1008.40        299.          0.          0.         44.
    437.000        0.00   1010.59   1008.25        299.          0.          0.          1.
    436.000        0.00   1010.58   1008.20        299.          0.          0.          0.

 ==========================================================================================
 TIME STEP #      13
 *    B
 ** Q ABOVE TABLE **
**INLOAD**
 **WATER DISCHARGE, WATER-SEDIMENT LOAD TABLE ENDPOINT**        851.50        800.00       0.000000

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 DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
        ACCUMULATED TIME (yrs)....     0.001
        FLOW DURATION (days)......     0.007

 UPSTREAM BOUNDARY CONDITIONS
 ----------------------------------------------------------------------
 Stream Segment # 1     |   DISCHARGE    | SEDIMENT LOAD | TEMPERATURE
 Section No.   466.000  |     (cfs)      |  (tons/day)   |   (deg F)
 ----------------------------------------------------------------------
                 INFLOW |        851.50  |      1217.00  |      83.00

 Upstream of SECTION NO.   457.000 is...
 LOCAL INFLOW POINT # 2 |   DISCHARGE    | SEDIMENT LOAD | TEMPERATURE
                        |     (cfs)      |  (tons/day)   |   (deg F)
 ----------------------------------------------------------------------
       MAINSTEM  INFLOW |        851.50  |      1217.00  |      83.00
       LOCAL     INFLOW |          0.00  |         0.00  |       0.00
 ----------------------------------------------------------------------
                  TOTAL |        851.50  |      1217.00  |      83.00

 Upstream of SECTION NO.   453.000 is...
 LOCAL INFLOW POINT # 1 |   DISCHARGE    | SEDIMENT LOAD | TEMPERATURE
                        |     (cfs)      |  (tons/day)   |   (deg F)
 ----------------------------------------------------------------------
       MAINSTEM  INFLOW |        851.50  |      1217.00  |      83.00
       LOCAL     INFLOW |          0.00  |         0.00  |       0.00
 ----------------------------------------------------------------------
                  TOTAL |        851.50  |      1217.00  |      83.00

 TABLE SA-1.  TRAP EFFICIENCY ON STREAM SEGMENT #  1
              DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
              ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

************************************************************************************************************************
******
     TIME      ENTRY *            CLAY              *             SILT              *            SAND
   *
     DAYS      POINT *   INFLOW   OUTFLOW  TRAP EFF *   INFLOW   OUTFLOW  TRAP EFF *   INFLOW   OUTFLOW
TRAP EFF *
     0.48    466.000 *     0.00                     *     0.00                     *     0.00
   *
             457.000 *     0.00                     *     0.00                     *     0.00
   *
             453.000 *     0.00                     *     0.00                     *     0.00
   *
    TOTAL=   436.000 *     0.00      0.00      0.77 *     0.00      0.00      0.98 *     0.00      0.00
0.99 *

************************************************************************************************************************
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 TABLE SB-1:  SEDIMENT LOAD PASSING THE  BOUNDARIES OF STREAM SEGMENT #  1
 ------------------------------------------------------------------------------
   SEDIMENT INFLOW at the Upstream Boundary:
       GRAIN SIZE      LOAD (tons/day) |     GRAIN SIZE      LOAD (tons/day)
```

CLAY..............	0.00	VERY COARSE SAND..	84.95
COARSE SILT.......	0.00	VERY FINE GRAVEL..	27.02
VERY FINE SAND....	285.99	FINE GRAVEL.......	18.01
FINE SAND.........	317.03	MEDIUM GRAVEL.....	0.97
MEDIUM SAND.......	276.02	COARSE GRAVEL.....	0.00
COARSE SAND.......	207.01	VERY COARSE GRAVEL	0.00
		TOTAL =	1217.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	3.37	FINE GRAVEL.......	0.00
FINE SAND.........	0.03	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.01	VERY COARSE GRAVEL	0.00
		TOTAL =	3.42

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.476 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	-0.01	1016.64	1012.53	852.	0.	0.	1040.
465.000	0.01	1016.49	1012.40	852.	0.	0.	629.
464.000	0.00	1016.34	1012.20	852.	0.	0.	622.
463.000	0.00	1016.17	1012.07	852.	0.	0.	627.
462.000	0.00	1016.07	1011.97	852.	0.	0.	629.
461.000	0.00	1015.88	1011.77	852.	0.	0.	633.
460.000	0.00	1015.74	1011.65	852.	0.	0.	634.
459.000	0.00	1015.60	1011.50	852.	0.	0.	633.
458.000	0.00	1015.43	1011.30	852.	0.	0.	632.
457.000	0.00	1015.27	1011.19	852.	0.	0.	632.
456.000	0.00	1015.11	1011.00	852.	0.	0.	637.
455.000	0.00	1014.95	1010.87	852.	0.	0.	627.
454.000	0.00	1014.78	1010.70	852.	0.	0.	644.
453.000	0.00	1014.63	1010.57	852.	0.	0.	636.
452.000	0.00	1014.47	1010.40	852.	0.	0.	657.
451.000	0.00	1014.34	1010.29	852.	0.	0.	665.
450.000	0.00	1014.18	1010.15	852.	0.	0.	671.
449.000	0.00	1014.01	1009.99	852.	0.	0.	682.
448.000	0.00	1013.84	1009.80	852.	0.	0.	704.
447.000	0.00	1013.67	1009.68	852.	0.	0.	753.
446.000	0.00	1013.53	1009.56	852.	0.	0.	816.
445.000	0.00	1013.35	1009.40	852.	0.	0.	900.
444.000	0.00	1013.17	1009.26	852.	0.	0.	975.
443.000	0.00	1013.01	1009.10	852.	0.	0.	1098.
442.000	0.00	1012.80	1008.97	852.	0.	0.	1248.
441.000	0.00	1012.65	1008.87	852.	0.	0.	1368.
440.000	0.00	1012.54	1008.78	852.	0.	0.	1388.
439.000	0.01	1012.30	1008.60	852.	0.	0.	926.
438.000	0.01	1012.31	1008.41	852.	0.	0.	500.
437.000	0.00	1012.33	1008.25	852.	0.	0.	7.
436.000	0.00	1012.33	1008.20	852.	0.	0.	3.

TIME STEP # 14
* B
** Q ABOVE TABLE **
INLOAD
WATER DISCHARGE, WATER-SEDIMENT LOAD TABLE ENDPOINT 1130.10 800.00 0.000000

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.007

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	1130.10	1217.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	1130.10	1217.00	83.00

	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	1130.10	1217.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	1130.10	1217.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	1130.10	1217.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

****

TIME DAYS	ENTRY POINT *	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF *	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF *	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF *
0.48	466.000 *	0.00		*	0.00		*	0.01		*
	457.000 *	0.00		*	0.00		*	0.00		*
	453.000 *	0.00		*	0.00		*	0.00		*
TOTAL=	436.000 *	0.00	0.00	0.76 *	0.00	0.00	0.97 *	0.01	0.00	0.96 *

****

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	84.95
COARSE SILT.......	0.00	VERY FINE GRAVEL..	27.02
VERY FINE SAND....	285.99	FINE GRAVEL.......	18.01
FINE SAND.........	317.03	MEDIUM GRAVEL.....	0.97
MEDIUM SAND.......	276.02	COARSE GRAVEL.....	0.00
COARSE SAND.......	207.01	VERY COARSE GRAVEL	0.00
		TOTAL =	1217.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	93.68	FINE GRAVEL.......	0.00
FINE SAND.........	0.70	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.03	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.02	VERY COARSE GRAVEL	0.00
		TOTAL =	94.44

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.483 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1017.32	1012.54	1130.	0.	0.	1132.
465.000	0.02	1017.17	1012.41	1130.	0.	0.	919.
464.000	0.00	1017.02	1012.20	1130.	0.	0.	1068.
463.000	0.00	1016.85	1012.07	1130.	0.	0.	1146.
462.000	0.00	1016.75	1011.97	1130.	0.	0.	1189.
461.000	0.00	1016.56	1011.77	1130.	0.	0.	1220.
460.000	0.00	1016.42	1011.65	1130.	0.	0.	1239.
459.000	0.00	1016.27	1011.50	1130.	0.	0.	1248.
458.000	0.00	1016.11	1011.30	1130.	0.	0.	1250.
457.000	0.00	1015.94	1011.19	1130.	0.	0.	1265.
456.000	0.00	1015.79	1011.00	1130.	0.	0.	1293.
455.000	0.00	1015.62	1010.87	1130.	0.	0.	1290.
454.000	0.00	1015.45	1010.70	1130.	0.	0.	1353.
453.000	0.00	1015.29	1010.57	1130.	0.	0.	1351.
452.000	0.00	1015.13	1010.40	1130.	0.	0.	1438.
451.000	0.00	1015.00	1010.29	1130.	0.	0.	1498.
450.000	0.00	1014.84	1010.15	1130.	0.	0.	1566.

449.000	0.00	1014.66	1009.99	1130.	0.	0.	1631.
448.000	0.00	1014.49	1009.80	1130.	0.	0.	1711.
447.000	0.00	1014.31	1009.68	1130.	0.	0.	1759.
446.000	0.00	1014.17	1009.56	1130.	0.	0.	1805.
445.000	0.00	1013.98	1009.40	1130.	0.	0.	1859.
444.000	0.00	1013.80	1009.26	1130.	0.	0.	1913.
443.000	0.00	1013.63	1009.10	1130.	0.	0.	1978.
442.000	-0.01	1013.42	1008.96	1130.	0.	0.	2034.
441.000	0.00	1013.27	1008.87	1130.	0.	0.	2034.
440.000	0.00	1013.15	1008.78	1130.	0.	0.	2136.
439.000	0.02	1012.91	1008.61	1130.	0.	0.	1488.
438.000	0.01	1012.93	1008.41	1130.	0.	0.	898.
437.000	0.01	1012.96	1008.26	1130.	0.	0.	138.
436.000	0.00	1012.96	1008.20	1130.	0.	0.	94.

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TIME STEP # 15
* B

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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.007

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	797.80	1180.32	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	797.80	1180.32	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	797.80	1180.32	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	797.80	1180.32	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	797.80	1180.32	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.49	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.75	0.00	0.00	0.96	0.01	0.00	0.97

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	69.51
COARSE SILT.......	0.00	VERY FINE GRAVEL..	22.21
VERY FINE SAND....	283.15	FINE GRAVEL.......	14.83
FINE SAND.........	313.76	MEDIUM GRAVEL.....	0.81
MEDIUM SAND.......	272.50	COARSE GRAVEL.....	0.00

COARSE SAND.......	203.56	VERY COARSE GRAVEL	0.00
		TOTAL =	1180.32

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	3.98	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.01	VERY COARSE GRAVEL	0.00
		TOTAL =	4.03

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.490 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.01	1016.49	1012.55	798.	0.	0.	929.
465.000	0.03	1016.34	1012.42	798.	0.	0.	531.
464.000	0.00	1016.19	1012.20	798.	0.	0.	491.
463.000	0.00	1016.02	1012.07	798.	0.	0.	519.
462.000	0.00	1015.92	1011.97	798.	0.	0.	544.
461.000	0.00	1015.73	1011.77	798.	0.	0.	564.
460.000	0.00	1015.59	1011.65	798.	0.	0.	573.
459.000	0.00	1015.45	1011.50	798.	0.	0.	578.
458.000	0.00	1015.28	1011.30	798.	0.	0.	581.
457.000	0.00	1015.12	1011.19	798.	0.	0.	581.
456.000	0.00	1014.96	1011.00	798.	0.	0.	582.
455.000	0.00	1014.80	1010.87	798.	0.	0.	584.
454.000	0.00	1014.63	1010.70	798.	0.	0.	583.
453.000	0.00	1014.48	1010.57	798.	0.	0.	583.
452.000	0.00	1014.32	1010.40	798.	0.	0.	583.
451.000	0.00	1014.19	1010.29	798.	0.	0.	586.
450.000	0.00	1014.03	1010.15	798.	0.	0.	593.
449.000	0.00	1013.86	1009.99	798.	0.	0.	598.
448.000	0.00	1013.68	1009.80	798.	0.	0.	616.
447.000	0.00	1013.51	1009.68	798.	0.	0.	663.
446.000	0.00	1013.37	1009.56	798.	0.	0.	726.
445.000	-0.01	1013.19	1009.39	798.	0.	0.	810.
444.000	-0.01	1013.01	1009.25	798.	0.	0.	886.
443.000	-0.01	1012.85	1009.09	798.	0.	0.	958.
442.000	-0.01	1012.64	1008.96	798.	0.	0.	982.
441.000	-0.01	1012.49	1008.86	798.	0.	0.	1039.
440.000	0.00	1012.37	1008.78	798.	0.	0.	1103.
439.000	0.02	1012.12	1008.61	798.	0.	0.	862.
438.000	0.01	1012.12	1008.41	798.	0.	0.	494.
437.000	0.01	1012.14	1008.26	798.	0.	0.	8.
436.000	0.00	1012.13	1008.20	798.	0.	0.	4.

TIME STEP # 18
* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.001
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	40.70	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	40.70	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	40.70	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	40.70	0.00	83.00

LOCAL	INFLOW	0.00	0.00	0.00
	TOTAL	40.70	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
0.55	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.68	0.00	0.00	0.95	0.01	0.00	0.97

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.546 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1013.29	1012.54	41.	0.	0.	7.
465.000	0.03	1013.13	1012.42	41.	0.	0.	4.
464.000	0.00	1012.97	1012.20	41.	0.	0.	5.
463.000	0.00	1012.81	1012.07	41.	0.	0.	5.
462.000	0.00	1012.71	1011.97	41.	0.	0.	5.
461.000	0.00	1012.53	1011.77	41.	0.	0.	5.
460.000	0.00	1012.39	1011.65	41.	0.	0.	6.
459.000	0.00	1012.24	1011.50	41.	0.	0.	5.
458.000	0.00	1012.08	1011.30	41.	0.	0.	5.
457.000	0.00	1011.93	1011.19	41.	0.	0.	5.
456.000	0.00	1011.77	1011.00	41.	0.	0.	5.
455.000	0.00	1011.62	1010.87	41.	0.	0.	5.
454.000	0.00	1011.46	1010.70	41.	0.	0.	5.
453.000	0.00	1011.31	1010.57	41.	0.	0.	5.
452.000	0.00	1011.16	1010.40	41.	0.	0.	5.
451.000	0.00	1011.04	1010.29	41.	0.	0.	5.
450.000	0.00	1010.89	1010.15	41.	0.	0.	6.
449.000	0.00	1010.72	1009.99	41.	0.	0.	6.
448.000	0.00	1010.57	1009.80	41.	0.	0.	5.
447.000	0.00	1010.43	1009.68	41.	0.	0.	6.
446.000	0.00	1010.30	1009.56	41.	0.	0.	6.
445.000	-0.01	1010.14	1009.39	41.	0.	0.	7.
444.000	-0.01	1009.99	1009.25	41.	0.	0.	7.
443.000	-0.01	1009.85	1009.09	41.	0.	0.	7.
442.000	-0.01	1009.69	1008.96	41.	0.	0.	8.
441.000	-0.01	1009.56	1008.86	41.	0.	0.	11.

```
    440.000      -0.01   1009.46   1008.77          41.          0.          0.          12.
    439.000       0.02   1009.21   1008.61          41.          0.          0.          21.
    438.000       0.02   1008.78   1008.42          41.          0.          0.          13.
    437.000       0.01   1008.68   1008.26          41.          0.          0.           2.
    436.000       0.00   1008.66   1008.20          41.          0.          0.           0.

 ===============================================================================
 TIME STEP #      19
 *    B

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 DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
        ACCUMULATED TIME (yrs)....      0.002
        FLOW DURATION (days)......      0.042

 UPSTREAM BOUNDARY CONDITIONS
 ---------------------------------------------------------------
 Stream Segment # 1      |  DISCHARGE   | SEDIMENT LOAD | TEMPERATURE
 Section No.   466.000   |    (cfs)     |  (tons/day)   |   (deg F)
 ---------------------------------------------------------------
                 INFLOW  |         9.67 |          0.00 |       83.00

 Upstream of SECTION NO.   457.000 is...
 LOCAL INFLOW POINT # 2  |  DISCHARGE   | SEDIMENT LOAD | TEMPERATURE
                         |    (cfs)     |  (tons/day)   |   (deg F)
 ---------------------------------------------------------------
       MAINSTEM  INFLOW  |         9.67 |          0.00 |       83.00
       LOCAL     INFLOW  |         0.00 |          0.00 |        0.00
 ---------------------------------------------------------------
                  TOTAL  |         9.67 |          0.00 |       83.00

 Upstream of SECTION NO.   453.000 is...
 LOCAL INFLOW POINT # 1  |  DISCHARGE   | SEDIMENT LOAD | TEMPERATURE
                         |    (cfs)     |  (tons/day)   |   (deg F)
 ---------------------------------------------------------------
       MAINSTEM  INFLOW  |         9.67 |          0.00 |       83.00
       LOCAL     INFLOW  |         0.00 |          0.00 |        0.00
 ---------------------------------------------------------------
                  TOTAL  |         9.67 |          0.00 |       83.00

 TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT #  1
             DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
             ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

**************************************************************************************************
******
     TIME       ENTRY *            CLAY              *             SILT              *            SAND
   *
     DAYS       POINT *   INFLOW   OUTFLOW  TRAP EFF *   INFLOW   OUTFLOW  TRAP EFF *   INFLOW   OUTFLOW
TRAP EFF *
     0.59     466.000 *    0.00                      *    0.00                      *    0.01
   *
              457.000 *    0.00                      *    0.00                      *    0.00
   *
              453.000 *    0.00                      *    0.00                      *    0.00
   *
    TOTAL=    436.000 *    0.00      0.00      0.65 *    0.00      0.00      0.96 *    0.01      0.00
0.97 *

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 TABLE SB-1:  SEDIMENT LOAD PASSING THE  BOUNDARIES OF STREAM SEGMENT #  1
 -------------------------------------------------------------------------------
   SEDIMENT INFLOW at the Upstream Boundary:
       GRAIN SIZE      LOAD (tons/day) |   GRAIN SIZE      LOAD (tons/day)
   ---------------------------------------------------------------------------
     CLAY..............           0.00 | VERY COARSE SAND..           0.00
     COARSE SILT.......           0.00 | VERY FINE GRAVEL..           0.00
     VERY FINE SAND....           0.00 | FINE GRAVEL.......           0.00
     FINE SAND.........           0.00 | MEDIUM GRAVEL.....           0.00
     MEDIUM SAND.......           0.00 | COARSE GRAVEL.....           0.00
     COARSE SAND.......           0.00 | VERY COARSE GRAVEL           0.00
                          -------------                      -------------
                                                 TOTAL =            0.00
   SEDIMENT OUTFLOW from the Downstream Boundary
       GRAIN SIZE      LOAD (tons/day) |   GRAIN SIZE      LOAD (tons/day)
   ---------------------------------------------------------------------------
     CLAY..............           0.00 | VERY COARSE SAND..           0.00
     COARSE SILT.......           0.00 | VERY FINE GRAVEL..           0.00
     VERY FINE SAND....           0.01 | FINE GRAVEL.......           0.00
```

FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.01

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.588 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.85	1012.54	10.	0.	0.	1.
465.000	0.03	1012.68	1012.42	10.	0.	0.	0.
464.000	0.00	1012.51	1012.20	10.	0.	0.	0.
463.000	0.00	1012.38	1012.07	10.	0.	0.	0.
462.000	0.00	1012.28	1011.97	10.	0.	0.	0.
461.000	0.00	1012.11	1011.77	10.	0.	0.	0.
460.000	0.00	1011.98	1011.65	10.	0.	0.	0.
459.000	0.00	1011.81	1011.50	10.	0.	0.	0.
458.000	0.00	1011.66	1011.30	10.	0.	0.	0.
457.000	0.00	1011.51	1011.19	10.	0.	0.	0.
456.000	0.00	1011.34	1011.00	10.	0.	0.	0.
455.000	0.00	1011.19	1010.87	10.	0.	0.	0.
454.000	0.00	1011.06	1010.70	10.	0.	0.	1.
453.000	0.00	1010.88	1010.57	10.	0.	0.	0.
452.000	0.00	1010.70	1010.40	10.	0.	0.	1.
451.000	0.00	1010.59	1010.29	10.	0.	0.	0.
450.000	0.00	1010.47	1010.15	10.	0.	0.	0.
449.000	0.00	1010.30	1009.99	10.	0.	0.	1.
448.000	0.00	1010.12	1009.80	10.	0.	0.	0.
447.000	0.00	1009.99	1009.68	10.	0.	0.	0.
446.000	0.00	1009.88	1009.56	10.	0.	0.	0.
445.000	-0.01	1009.74	1009.39	10.	0.	0.	0.
444.000	-0.01	1009.59	1009.25	10.	0.	0.	1.
443.000	-0.01	1009.41	1009.09	10.	0.	0.	1.
442.000	-0.01	1009.24	1008.96	10.	0.	0.	0.
441.000	-0.01	1009.16	1008.86	10.	0.	0.	0.
440.000	-0.01	1009.09	1008.77	10.	0.	0.	0.
439.000	0.02	1008.89	1008.61	10.	0.	0.	1.
438.000	0.02	1008.59	1008.42	10.	0.	0.	1.
437.000	0.01	1008.40	1008.26	10.	0.	0.	0.
436.000	0.00	1008.32	1008.20	10.	0.	0.	0.

TIME STEP # 20
* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.002
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	6.76	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	6.76	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	6.76	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	6.76	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	6.76	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME * DAYS	ENTRY * POINT *	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF *	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF *	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF *
0.63	466.000 *	0.00		*	0.00		*	0.01		*
	457.000 *	0.00		*	0.00		*	0.00		*
	453.000 *	0.00		*	0.00		*	0.00		*
TOTAL=	436.000 *	0.00	0.00	0.65 *	0.00	0.00	0.96 *	0.01	0.00	0.97 *

****

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.06	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.06

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.630 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.80	1012.54	7.	0.	0.	1.
465.000	0.03	1012.64	1012.42	7.	0.	0.	0.
464.000	0.00	1012.50	1012.20	7.	0.	0.	0.
463.000	0.00	1012.32	1012.07	7.	0.	0.	0.
462.000	0.00	1012.24	1011.97	7.	0.	0.	0.
461.000	0.00	1012.05	1011.77	7.	0.	0.	0.
460.000	0.00	1011.89	1011.65	7.	0.	0.	0.
459.000	0.00	1011.73	1011.50	7.	0.	0.	0.
458.000	0.00	1011.57	1011.30	7.	0.	0.	0.
457.000	0.00	1011.42	1011.19	7.	0.	0.	0.
456.000	0.00	1011.27	1011.00	7.	0.	0.	0.
455.000	0.00	1011.10	1010.87	7.	0.	0.	0.
454.000	0.00	1010.95	1010.70	7.	0.	0.	0.
453.000	0.00	1010.80	1010.57	7.	0.	0.	0.
452.000	0.00	1010.66	1010.40	7.	0.	0.	0.
451.000	0.00	1010.56	1010.29	7.	0.	0.	0.
450.000	0.00	1010.40	1010.15	7.	0.	0.	0.
449.000	0.00	1010.24	1009.99	7.	0.	0.	0.
448.000	0.00	1010.06	1009.80	7.	0.	0.	0.
447.000	0.00	1009.95	1009.68	7.	0.	0.	0.
446.000	0.00	1009.86	1009.56	7.	0.	0.	0.
445.000	-0.01	1009.67	1009.39	7.	0.	0.	0.
444.000	-0.01	1009.53	1009.25	7.	0.	0.	0.
443.000	-0.01	1009.37	1009.09	7.	0.	0.	0.
442.000	-0.01	1009.21	1008.96	7.	0.	0.	0.
441.000	-0.01	1009.10	1008.86	7.	0.	0.	0.
440.000	-0.01	1009.02	1008.77	7.	0.	0.	0.
439.000	0.02	1008.82	1008.61	7.	0.	0.	0.
438.000	0.02	1008.57	1008.42	7.	0.	0.	0.
437.000	0.01	1008.36	1008.26	7.	0.	0.	0.
436.000	0.00	1008.28	1008.20	7.	0.	0.	0.

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TIME STEP # 21

* B

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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.002
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	5.36	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	5.36	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	5.36	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	5.36	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	5.36	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.67	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.65	0.00	0.00	0.96	0.01	0.00	0.97

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.03	FINE GRAVEL.......	0.00
FINE SAND.........	0.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.04

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.672 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND

466.000	0.00	1012.79	1012.54	5.	0.	0.	0.
465.000	0.03	1012.63	1012.42	5.	0.	0.	0.
464.000	0.00	1012.45	1012.20	5.	0.	0.	0.
463.000	0.00	1012.29	1012.07	5.	0.	0.	0.
462.000	0.00	1012.17	1011.97	5.	0.	0.	0.
461.000	0.00	1012.00	1011.77	5.	0.	0.	0.
460.000	0.00	1011.85	1011.65	5.	0.	0.	0.
459.000	0.00	1011.69	1011.50	5.	0.	0.	0.
458.000	0.00	1011.52	1011.30	5.	0.	0.	0.
457.000	0.00	1011.38	1011.19	5.	0.	0.	0.
456.000	0.00	1011.22	1011.00	5.	0.	0.	0.
455.000	0.00	1011.07	1010.87	5.	0.	0.	0.
454.000	0.00	1010.95	1010.70	5.	0.	0.	0.
453.000	0.00	1010.79	1010.57	5.	0.	0.	0.
452.000	0.00	1010.62	1010.40	5.	0.	0.	0.
451.000	0.00	1010.53	1010.29	5.	0.	0.	0.
450.000	0.00	1010.39	1010.15	5.	0.	0.	0.
449.000	0.00	1010.22	1009.99	5.	0.	0.	0.
448.000	0.00	1010.07	1009.80	5.	0.	0.	0.
447.000	0.00	1009.92	1009.68	5.	0.	0.	0.
446.000	0.00	1009.76	1009.56	5.	0.	0.	0.
445.000	-0.01	1009.62	1009.39	5.	0.	0.	0.
444.000	-0.01	1009.46	1009.25	5.	0.	0.	0.
443.000	-0.01	1009.31	1009.09	5.	0.	0.	0.
442.000	-0.01	1009.17	1008.96	5.	0.	0.	0.
441.000	-0.01	1009.07	1008.86	5.	0.	0.	0.
440.000	-0.01	1008.98	1008.77	5.	0.	0.	0.
439.000	0.02	1008.81	1008.61	5.	0.	0.	0.
438.000	0.02	1008.55	1008.42	5.	0.	0.	0.
437.000	0.01	1008.39	1008.26	5.	0.	0.	0.
436.000	0.00	1008.27	1008.20	5.	0.	0.	0.

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TIME STEP # 22
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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.002
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	4.57	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	4.57	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	4.57	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	4.57	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	4.57	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME	ENTRY *	CLAY			SILT			SAND		
DAYS	POINT *	INFLOW	OUTFLOW	TRAP EFF *	INFLOW	OUTFLOW	TRAP EFF *	INFLOW	OUTFLOW	TRAP EFF *
0.71	466.000 *	0.00		*	0.00		*	0.01		
*	457.000 *	0.00		*	0.00		*	0.00		
*	453.000 *	0.00		*	0.00		*	0.00		

*
TOTAL= 436.000 * 0.00 0.00 0.66 * 0.00 0.00 0.96 * 0.01 0.00
.97 *

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.03	FINE GRAVEL.......	0.00
FINE SAND.........	0.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.04

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.714 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.74	1012.54	5.	0.	0.	0.
465.000	0.03	1012.59	1012.42	5.	0.	0.	0.
464.000	0.00	1012.39	1012.20	5.	0.	0.	0.
463.000	0.00	1012.24	1012.07	5.	0.	0.	0.
462.000	0.00	1012.15	1011.97	5.	0.	0.	0.
461.000	0.00	1011.97	1011.77	5.	0.	0.	0.
460.000	0.00	1011.87	1011.65	5.	0.	0.	0.
459.000	0.00	1011.72	1011.50	5.	0.	0.	0.
458.000	0.00	1011.54	1011.30	5.	0.	0.	0.
457.000	0.00	1011.38	1011.19	5.	0.	0.	0.
456.000	0.00	1011.21	1011.00	5.	0.	0.	0.
455.000	0.00	1011.05	1010.87	5.	0.	0.	0.
454.000	0.00	1010.91	1010.70	5.	0.	0.	0.
453.000	0.00	1010.74	1010.57	5.	0.	0.	0.
452.000	0.00	1010.58	1010.40	5.	0.	0.	0.
451.000	0.00	1010.49	1010.29	5.	0.	0.	0.
450.000	0.00	1010.34	1010.15	5.	0.	0.	0.
449.000	0.00	1010.19	1009.99	5.	0.	0.	0.
448.000	0.00	1010.04	1009.80	5.	0.	0.	0.
447.000	0.00	1009.88	1009.68	5.	0.	0.	0.
446.000	0.00	1009.73	1009.56	5.	0.	0.	0.
445.000	-0.01	1009.57	1009.39	5.	0.	0.	0.
444.000	-0.01	1009.44	1009.25	5.	0.	0.	0.
443.000	-0.01	1009.31	1009.09	5.	0.	0.	0.
442.000	-0.01	1009.17	1008.96	5.	0.	0.	0.
441.000	-0.01	1009.08	1008.86	5.	0.	0.	0.
440.000	-0.01	1009.01	1008.77	5.	0.	0.	0.
439.000	0.02	1008.81	1008.61	5.	0.	0.	0.
438.000	0.02	1008.51	1008.42	5.	0.	0.	0.
437.000	0.01	1008.37	1008.26	5.	0.	0.	0.
436.000	0.00	1008.26	1008.20	5.	0.	0.	0.

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TIME STEP # 23
* B

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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.002
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)

	INFLOW	3.93	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	3.93	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	3.93	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	3.93	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	3.93	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.76	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.67	0.00	0.00	0.97	0.01	0.00	0.97

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.03	FINE GRAVEL.......	0.00
FINE SAND.........	0.01	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.04

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.756 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.72	1012.54	4.	0.	0.	0.
465.000	0.03	1012.60	1012.42	4.	0.	0.	0.
464.000	0.00	1012.43	1012.20	4.	0.	0.	0.
463.000	0.00	1012.24	1012.07	4.	0.	0.	0.
462.000	0.00	1012.13	1011.97	4.	0.	0.	0.
461.000	0.00	1011.96	1011.77	4.	0.	0.	0.
460.000	0.00	1011.83	1011.65	4.	0.	0.	0.
459.000	0.00	1011.66	1011.50	4.	0.	0.	0.
458.000	0.00	1011.49	1011.30	4.	0.	0.	0.

457.000	0.00	1011.36	1011.19	4.	0.	0.	0.
456.000	0.00	1011.22	1011.00	4.	0.	0.	0.
455.000	0.00	1011.07	1010.87	4.	0.	0.	0.
454.000	0.00	1010.93	1010.70	4.	0.	0.	0.
453.000	0.00	1010.79	1010.57	4.	0.	0.	0.
452.000	0.00	1010.59	1010.40	4.	0.	0.	0.
451.000	0.00	1010.49	1010.29	4.	0.	0.	0.
450.000	0.00	1010.36	1010.15	4.	0.	0.	0.
449.000	0.00	1010.15	1009.99	4.	0.	0.	0.
448.000	0.00	1010.00	1009.80	4.	0.	0.	0.
447.000	0.00	1009.83	1009.68	4.	0.	0.	0.
446.000	0.00	1009.70	1009.56	4.	0.	0.	0.
445.000	-0.01	1009.59	1009.39	4.	0.	0.	0.
444.000	-0.01	1009.44	1009.25	4.	0.	0.	0.
443.000	-0.01	1009.26	1009.09	4.	0.	0.	0.
442.000	-0.01	1009.16	1008.96	4.	0.	0.	0.
441.000	-0.01	1009.05	1008.86	4.	0.	0.	0.
440.000	-0.01	1008.93	1008.77	4.	0.	0.	0.
439.000	0.02	1008.79	1008.61	4.	0.	0.	0.
438.000	0.02	1008.50	1008.42	4.	0.	0.	0.
437.000	0.01	1008.34	1008.26	4.	0.	0.	0.
436.000	0.00	1008.25	1008.20	4.	0.	0.	0.

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TIME STEP # 25

* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL

ACCUMULATED TIME (yrs).... 0.002

FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	3.04	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	3.04	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	3.04	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	3.04	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	3.04	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.84	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.69	0.00	0.00	0.97	0.01	0.00	0.97

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.06	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.08

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.840 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.70	1012.54	3.	0.	0.	0.
465.000	0.03	1012.54	1012.42	3.	0.	0.	0.
464.000	0.00	1012.34	1012.20	3.	0.	0.	0.
463.000	0.00	1012.23	1012.07	3.	0.	0.	0.
462.000	0.00	1012.13	1011.97	3.	0.	0.	0.
461.000	0.00	1011.98	1011.77	3.	0.	0.	0.
460.000	0.00	1011.84	1011.65	3.	0.	0.	0.
459.000	0.00	1011.64	1011.50	3.	0.	0.	0.
458.000	0.00	1011.49	1011.30	3.	0.	0.	0.
457.000	0.00	1011.33	1011.19	3.	0.	0.	0.
456.000	0.00	1011.17	1011.00	3.	0.	0.	0.
455.000	0.00	1011.01	1010.87	3.	0.	0.	0.
454.000	0.00	1010.91	1010.70	3.	0.	0.	0.
453.000	0.00	1010.71	1010.57	3.	0.	0.	0.
452.000	0.00	1010.54	1010.40	3.	0.	0.	0.
451.000	0.00	1010.46	1010.29	3.	0.	0.	0.
450.000	0.00	1010.30	1010.15	3.	0.	0.	0.
449.000	0.00	1010.16	1009.99	3.	0.	0.	0.
448.000	0.00	1009.99	1009.80	3.	0.	0.	0.
447.000	0.00	1009.85	1009.68	3.	0.	0.	0.
446.000	0.00	1009.73	1009.56	3.	0.	0.	0.
445.000	-0.01	1009.55	1009.39	3.	0.	0.	0.
444.000	-0.01	1009.39	1009.25	3.	0.	0.	0.
443.000	-0.01	1009.26	1009.09	3.	0.	0.	0.
442.000	-0.01	1009.11	1008.96	3.	0.	0.	0.
441.000	-0.01	1009.00	1008.86	3.	0.	0.	0.
440.000	-0.01	1008.90	1008.77	3.	0.	0.	0.
439.000	0.02	1008.77	1008.61	3.	0.	0.	0.
438.000	0.02	1008.48	1008.42	3.	0.	0.	0.
437.000	0.01	1008.35	1008.26	3.	0.	0.	0.
436.000	0.00	1008.24	1008.20	3.	0.	0.	0.

TIME STEP # 26
* B

DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.002
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.55	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.55	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00

TOTAL	2.55	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.55	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.55	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.88	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.70	0.00	0.00	0.97	0.01	0.00	0.97

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.06	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.10

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.882 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.71	1012.54	3.	0.	0.	0.
465.000	0.03	1012.56	1012.42	3.	0.	0.	0.
464.000	0.00	1012.33	1012.20	3.	0.	0.	0.
463.000	0.00	1012.19	1012.07	3.	0.	0.	0.
462.000	0.00	1012.10	1011.97	3.	0.	0.	0.
461.000	0.00	1011.92	1011.77	3.	0.	0.	0.
460.000	0.00	1011.79	1011.65	3.	0.	0.	0.
459.000	0.00	1011.61	1011.50	3.	0.	0.	0.
458.000	0.00	1011.46	1011.30	3.	0.	0.	0.
457.000	0.00	1011.34	1011.19	3.	0.	0.	0.
456.000	0.00	1011.13	1011.00	3.	0.	0.	0.
455.000	0.00	1010.97	1010.87	3.	0.	0.	0.
454.000	0.00	1010.84	1010.70	3.	0.	0.	0.
453.000	0.00	1010.70	1010.57	3.	0.	0.	0.
452.000	0.00	1010.53	1010.40	3.	0.	0.	0.
451.000	0.00	1010.44	1010.29	3.	0.	0.	0.
450.000	0.00	1010.32	1010.15	3.	0.	0.	0.
449.000	0.00	1010.10	1009.99	3.	0.	0.	0.

448.000	0.00	1009.97	1009.80	3.	0.	0.	0.
447.000	0.00	1009.84	1009.68	3.	0.	0.	0.
446.000	0.00	1009.71	1009.56	3.	0.	0.	0.
445.000	-0.01	1009.50	1009.39	3.	0.	0.	0.
444.000	-0.01	1009.38	1009.25	3.	0.	0.	0.
443.000	-0.01	1009.22	1009.09	3.	0.	0.	0.
442.000	-0.01	1009.08	1008.96	3.	0.	0.	0.
441.000	-0.01	1008.99	1008.86	3.	0.	0.	0.
440.000	-0.01	1008.90	1008.77	3.	0.	0.	0.
439.000	0.02	1008.76	1008.61	3.	0.	0.	0.
438.000	0.02	1008.46	1008.42	3.	0.	0.	0.
437.000	0.01	1008.32	1008.26	3.	0.	0.	0.
436.000	0.00	1008.24	1008.20	3.	0.	0.	0.

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TIME STEP # 27
* B

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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.003
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.37	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.37	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.37	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.37	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.37	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.92	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.71	0.00	0.00	0.97	0.01	0.00	0.97

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00

TOTAL = 0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.12	FINE GRAVEL.......	0.00
FINE SAND.........	0.04	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00

TOTAL = 0.17

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.924 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.70	1012.54	2.	0.	0.	0.
465.000	0.03	1012.53	1012.42	2.	0.	0.	0.
464.000	0.00	1012.35	1012.20	2.	0.	0.	0.
463.000	0.00	1012.22	1012.07	2.	0.	0.	0.
462.000	0.00	1012.09	1011.97	2.	0.	0.	0.
461.000	0.00	1011.91	1011.77	2.	0.	0.	0.
460.000	0.00	1011.84	1011.65	2.	0.	0.	0.
459.000	0.00	1011.62	1011.50	2.	0.	0.	0.
458.000	0.00	1011.50	1011.30	2.	0.	0.	0.
457.000	0.00	1011.32	1011.19	2.	0.	0.	0.
456.000	0.00	1011.12	1011.00	2.	0.	0.	0.
455.000	0.00	1010.97	1010.87	2.	0.	0.	0.
454.000	0.00	1010.82	1010.70	2.	0.	0.	0.
453.000	0.00	1010.71	1010.57	2.	0.	0.	0.
452.000	0.00	1010.57	1010.40	2.	0.	0.	0.
451.000	0.00	1010.47	1010.29	2.	0.	0.	0.
450.000	0.00	1010.30	1010.15	2.	0.	0.	0.
449.000	0.00	1010.09	1009.99	2.	0.	0.	0.
448.000	0.00	1009.93	1009.80	2.	0.	0.	0.
447.000	0.00	1009.81	1009.68	2.	0.	0.	0.
446.000	0.00	1009.67	1009.56	2.	0.	0.	0.
445.000	-0.01	1009.53	1009.39	2.	0.	0.	0.
444.000	-0.01	1009.40	1009.25	2.	0.	0.	0.
443.000	-0.01	1009.23	1009.09	2.	0.	0.	0.
442.000	-0.01	1009.10	1008.96	2.	0.	0.	0.
441.000	-0.01	1008.99	1008.86	2.	0.	0.	0.
440.000	-0.01	1008.92	1008.77	2.	0.	0.	0.
439.000	0.02	1008.75	1008.61	2.	0.	0.	0.
438.000	0.02	1008.53	1008.42	2.	0.	0.	0.
437.000	0.01	1008.33	1008.26	2.	0.	0.	0.
436.000	0.00	1008.24	1008.20	2.	0.	0.	0.

TIME STEP # 28

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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL

ACCUMULATED TIME (yrs).... 0.003

FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.35	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.35	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.35	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.35	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00

	TOTAL	2.35	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	CLAY			SILT			SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF	INFLOW	OUTFLOW	TRAP EFF
0.97	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.72	0.00	0.00	0.97	0.01	0.00	0.97

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.05	FINE GRAVEL.......	0.00
FINE SAND.........	0.02	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.08

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 0.966 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.67	1012.54	2.	0.	0.	0.
465.000	0.03	1012.54	1012.42	2.	0.	0.	0.
464.000	0.00	1012.32	1012.20	2.	0.	0.	0.
463.000	0.00	1012.19	1012.07	2.	0.	0.	0.
462.000	0.00	1012.14	1011.97	2.	0.	0.	0.
461.000	0.00	1011.93	1011.77	2.	0.	0.	0.
460.000	0.00	1011.81	1011.65	2.	0.	0.	0.
459.000	0.00	1011.64	1011.50	2.	0.	0.	0.
458.000	0.00	1011.45	1011.30	2.	0.	0.	0.
457.000	0.00	1011.29	1011.19	2.	0.	0.	0.
456.000	0.00	1011.15	1011.00	2.	0.	0.	0.
455.000	0.00	1010.99	1010.87	2.	0.	0.	0.
454.000	0.00	1010.86	1010.70	2.	0.	0.	0.
453.000	0.00	1010.68	1010.57	2.	0.	0.	0.
452.000	0.00	1010.53	1010.40	2.	0.	0.	0.
451.000	0.00	1010.42	1010.29	2.	0.	0.	0.
450.000	0.00	1010.32	1010.15	2.	0.	0.	0.
449.000	0.00	1010.13	1009.99	2.	0.	0.	0.
448.000	0.00	1009.93	1009.80	2.	0.	0.	0.
447.000	0.00	1009.79	1009.68	2.	0.	0.	0.
446.000	0.00	1009.67	1009.56	2.	0.	0.	0.
445.000	-0.01	1009.53	1009.39	2.	0.	0.	0.
444.000	-0.01	1009.38	1009.25	2.	0.	0.	0.
443.000	-0.01	1009.23	1009.09	2.	0.	0.	0.
442.000	-0.01	1009.05	1008.96	2.	0.	0.	0.
441.000	-0.01	1008.99	1008.86	2.	0.	0.	0.
440.000	-0.01	1008.92	1008.77	2.	0.	0.	0.

439.000	0.02	1008.78	1008.61	2.	0.	0.	0.
438.000	0.02	1008.44	1008.42	2.	0.	0.	0.
437.000	0.01	1008.38	1008.26	2.	0.	0.	0.
436.000	0.00	1008.24	1008.20	2.	0.	0.	0.

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TIME STEP # 29
* B

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DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED TIME (yrs).... 0.003
FLOW DURATION (days)...... 0.042

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No. 466.000	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	2.15	0.00	83.00

Upstream of SECTION NO. 457.000 is...

LOCAL INFLOW POINT # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.15	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.15	0.00	83.00

Upstream of SECTION NO. 453.000 is...

LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAINSTEM INFLOW	2.15	0.00	83.00
LOCAL INFLOW	0.00	0.00	0.00
TOTAL	2.15	0.00	83.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1
DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

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TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	CLAY TRAP EFF	SILT INFLOW	SILT OUTFLOW	SILT TRAP EFF	SAND INFLOW	SAND OUTFLOW	SAND TRAP EFF
1.01	466.000	0.00			0.00			0.01		
	457.000	0.00			0.00			0.00		
	453.000	0.00			0.00			0.00		
TOTAL=	436.000	0.00	0.00	0.73	0.00	0.00	0.97	0.01	0.00	0.97

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TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.00	FINE GRAVEL.......	0.00
FINE SAND.........	0.00	MEDIUM GRAVEL.....	0.00
MEDIUM SAND.......	0.00	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.00

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY..............	0.00	VERY COARSE SAND..	0.00
COARSE SILT.......	0.00	VERY FINE GRAVEL..	0.00
VERY FINE SAND....	0.11	FINE GRAVEL.......	0.00
FINE SAND.........	0.04	MEDIUM GRAVEL.....	0.00

MEDIUM SAND.......	0.01	COARSE GRAVEL.....	0.00
COARSE SAND.......	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	0.16

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 1.008 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) CLAY	SILT	SAND
466.000	0.00	1012.66	1012.54	2.	0.	0.	0.
465.000	0.03	1012.52	1012.42	2.	0.	0.	0.
464.000	0.00	1012.33	1012.20	2.	0.	0.	0.
463.000	0.00	1012.21	1012.07	2.	0.	0.	0.
462.000	0.00	1012.12	1011.97	2.	0.	0.	0.
461.000	0.00	1011.93	1011.77	2.	0.	0.	0.
460.000	0.00	1011.81	1011.65	2.	0.	0.	0.
459.000	0.00	1011.64	1011.50	2.	0.	0.	0.
458.000	0.00	1011.41	1011.30	2.	0.	0.	0.
457.000	0.00	1011.30	1011.19	2.	0.	0.	0.
456.000	0.00	1011.19	1011.00	2.	0.	0.	0.
455.000	0.00	1010.99	1010.87	2.	0.	0.	0.
454.000	0.00	1010.87	1010.70	2.	0.	0.	0.
453.000	0.00	1010.73	1010.57	2.	0.	0.	0.
452.000	0.00	1010.50	1010.40	2.	0.	0.	0.
451.000	0.00	1010.38	1010.29	2.	0.	0.	0.
450.000	0.00	1010.27	1010.15	2.	0.	0.	0.
449.000	0.00	1010.09	1009.99	2.	0.	0.	0.
448.000	0.00	1009.93	1009.80	2.	0.	0.	0.
447.000	0.00	1009.83	1009.68	2.	0.	0.	0.
446.000	0.00	1009.70	1009.56	2.	0.	0.	0.
445.000	-0.01	1009.54	1009.39	2.	0.	0.	0.
444.000	-0.01	1009.41	1009.25	2.	0.	0.	0.
443.000	-0.01	1009.22	1009.09	2.	0.	0.	0.
442.000	-0.01	1009.09	1008.96	2.	0.	0.	0.
441.000	-0.01	1009.01	1008.86	2.	0.	0.	0.
440.000	-0.01	1008.91	1008.77	2.	0.	0.	0.
439.000	0.02	1008.70	1008.61	2.	0.	0.	0.
438.000	0.02	1008.52	1008.42	2.	0.	0.	0.
437.000	0.01	1008.35	1008.26	2.	0.	0.	0.
436.000	0.00	1008.23	1008.20	2.	0.	0.	0.

$VOL

STREAM SEGMENT # 1: DATA GENERATED USING CHIMP ROUTINE FOR PLAZA CIRC. MODEL

SUMMARY TABLE: MASS AND VOLUME OF SEDIMENT

SECTION	SEDIMENT THROUGH SECTION (tons) TOTAL	SAND	SILT	CLAY	SEDIMENT DEPOSITED IN REACH in cu. yds TOTAL	CUMULATIVE	SAND	SILT	CLAY
INFLOW	27.	27.	0.	0.	21.				
466.000	26.	26.	0.	0.	0.	0.	0.	0.	0.
465.000	18.	18.	0.	0.	7.	7.	7.	0.	0.
464.000	19.	19.	0.	0.	-1.	6.	-1.	0.	0.
463.000	20.	20.	0.	0.	-1.	6.	-1.	0.	0.
462.000	20.	20.	0.	0.	-1.	5.	-1.	0.	0.
461.000	21.	21.	0.	0.	0.	5.	0.	0.	0.
460.000	21.	21.	0.	0.	0.	4.	0.	0.	0.
459.000	21.	21.	0.	0.	0.	4.	0.	0.	0.
458.000	21.	21.	0.	0.	0.	4.	0.	0.	0.
LOCAL	0.	0.	0.	0.	0.				
457.000	21.	21.	0.	0.	0.	4.	0.	0.	0.
456.000	21.	21.	0.	0.	0.	4.	0.	0.	0.
455.000	21.	21.	0.	0.	0.	4.	0.	0.	0.
454.000	22.	22.	0.	0.	-1.	4.	-1.	0.	0.
LOCAL	0.	0.	0.	0.	0.				
453.000	22.	22.	0.	0.	0.	4.	0.	0.	0.
452.000	23.	23.	0.	0.	-1.	3.	-1.	0.	0.
451.000	23.	23.	0.	0.	0.	3.	0.	0.	0.
450.000	24.	24.	0.	0.	0.	2.	0.	0.	0.
449.000	24.	24.	0.	0.	0.	2.	0.	0.	0.
448.000	25.	25.	0.	0.	-1.	1.	-1.	0.	0.
447.000	26.	26.	0.	0.	-1.	1.	-1.	0.	0.
446.000	27.	27.	0.	0.	-1.	0.	-1.	0.	0.
445.000	29.	29.	0.	0.	-1.	-2.	-1.	0.	0.

444.000	30.	30.	0.	0.	-1.	-3.	-1.	0.	0.
443.000	32.	32.	0.	0.	-1.	-4.	-1.	0.	0.
442.000	34.	34.	0.	0.	-1.	-6.	-1.	0.	0.
441.000	35.	35.	0.	0.	-1.	-7.	-1.	0.	0.
440.000	37.	37.	0.	0.	-1.	-8.	-1.	0.	0.
439.000	29.	29.	0.	0.	6.	-2.	6.	0.	0.
438.000	16.	16.	0.	0.	10.	9.	10.	0.	0.
437.000	1.	1.	0.	0.	11.	20.	11.	0.	0.
436.000	1.	1.	0.	0.	0.	20.	0.	0.	0.

$$END

0 DATA ERRORS DETECTED.

TOTAL NO. OF TIME STEPS READ = 29
TOTAL NO. OF WS PROFILES = 29
ITERATIONS IN EXNER EQ = 44950

COMPUTATIONS COMPLETED
RUN TIME = 0 HOURS, 0 MINUTES & 16.00 SECONDS