ARIZONA
DEPARTMENT OF TRANSPORTATION

Draft Final Drainage Report I-10 (Papago) Widening Verrado Way to Sarival Avenue

ECS Contract No. 08-01
TRACS No. H7211 01C

PREPARED BY:

URS
7720 North 16th Street, Suite 100
Phoenix, Arizona 85020
602-371-1100

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1.0 INTRODUCTION

1.1 BACKGROUND AND SCOPE

The purpose of this Draft Final Drainage Report is to document the engineering analyses utilized for the Stage III design of the drainage facilities for the I-10 (Papago) Widening from Verrado Way to Sarival Avenue. The project location is shown on Figure 1.1, Project Location Map. The project is located within the Town of Buckeye from Verrado Way to Perryville Road and within the City of Goodyear for the remainder of the project. The project begins at Milepost (MP) 120.21 and extends east to MP 126.03, approximately 5.82 miles, as shown on Figure 1.2, Project Vicinity Map.

The purpose of the project is to improve the safety and operational characteristics of I-10 by providing an additional general purpose lane to extend a 3-lane section (in each direction) west to Verrado Way. The I-10 west corridor is above ground for the entire project. Grade separation bridge structures occur at Jackrabbit Trail, Perryville Road, Citrus Road, Cotton Lane, Roosevelt Irrigation District Canal (RID Canal) and Sarival Avenue.

Interstate 10 (Papago Freeway) is a major element of the Maricopa Association of Governments (MAG) adopted Regional Freeway System in the central portion of Maricopa County. Rapid development within this area is increasing congestion along the I-10 west corridor. Traffic projections indicate future traffic volumes will further congest the facility. The I-10 Widening project will add one general purpose lane (in each direction) from Verrado Way to Sarival Avenue. The proposed improvements will provide a continuous three-lane section in each direction from Verrado Way to 1,700 feet east of Sarival Avenue, the beginning of the two earlier I-10 improvement projects (Median Widening and Outside Widening). The Median Widening project is currently under construction and the Outside Widening project is currently in the Stage IV design stage.

From Verrado Way east to Citrus Road, the section of the I-10 roadway median pavement widening will extend to the median. This design approach replaces the initial design concept of widening into the median while retaining a smaller open median. From approximately 2,230 feet east of Citrus Road to 1,700 feet east of Sarival Avenue, the roadway improvements are considered interim because this section of I-10 is schedule to be removed and replaced with a new roadway realigned slightly to the north as part of the I-10/SR 303L System Traffic Interchange (TI). The future TI project would most likely result in the replacement of the three bridges at Cotton lane, Roosevelt Irrigation District Canal, and Sarival Avenue. Therefore, these

bridges will not be widened with this current project. Instead, the traffic lanes will be shifted to fit the three general purpose lanes on the existing structures. Roadway widening will occur off the bridges on the outside and in the median to provide wider shoulders.

The hydrologic and hydraulic analyses use procedures and methodologies presented in the Arizona Department of Transportation (ADOT) *Highway Drainage Design Manual – Hydrology* (HDDM), Highway Drainage Design Manual-Hydraulics, and the ADOT *Roadway Design Guidelines* (RDG).

The I-10 west corridor is shown as a Class 1 roadway on the ADOT Operation Drainage Frequency Classes map. The ADOT pavement drainage design criterion is the 10-year storm event.

1.2 DESIGN CONSTRAINTS AND OPPORTUNITIES

The I-10 widening project will increase the freeway capacity by adding one general purpose lane and shoulder to the median of the existing travel lanes from Verrado Way to east of the Cotton Lane TI Overpass. For the west segment of the project, Verrado Way to east of Citrus Road, the reconstructed roadways will consist of widening the existing roadways to the center of the median with new pavement and the remaining existing roadway pavement will be replaced or overlaid as necessary. The roadways will consist of three general purpose lanes with extra wide shoulders for future widening(s). For the east segment of the project, east of Citrus Road to Sarival Avenue, the reconstructed roadways will consist of widening the existing roadways to both sides. The pavement area along the mainline will increase while the median ditch area will decrease. The roadway profiles will remain unchanged.

The existing freeway includes outside curbs associated with guard rails along the upward and downward segments of the freeway at each traffic interchange (TI) overpass. With the increase in runoff from widening the roadways into the median, the spacing of the existing drainage structures (downdrains) will be evaluated to determine compliance with surface spread and depth criteria. Additional drainage structures (downdrains) will be implemented should one of the two design conditions not be met. The increase in roadway runoff may also require placement of riprap spillways at the end of the existing outside curbs to accommodate bypass flow and minimize embankment erosion. Riprap spillways were selected because of their minimal construction cost and the anticipated short time period between this project and the future outside widening of I-10.

The addition of the general purpose lanes will narrow the open median, shift the location of the median drainage ditch and raise its flowline elevation from Citrus Avenue east to Sarival Avenue. The existing C-15.80 median catch basins will be adjusted vertically to match the new ditch flowline while the existing C-15.90 median catch basins will be replaced and realigned with the new median ditch. Median catch basin outlet pipes and extensions will not be required unless the new outside embankment extends beyond the toe of the existing embankment.

The three horizontal curves at Verrado Way underpass and east and west of Perryville Road overpass will transition the roadway from normal cross slope to superelevation slopes through the curves. The side of the freeway with cross slope toward the median will require a drainage system to capture the pavement runoff. This drainage system will consist of modified ADOT C-15.92 catch basins with slotted drains installed along the median barrier. New catch basin outlet pipes will either connect to the off-road cross culverts or extend south or north under the roadway to ADOT right-of-way (or to interchange infield areas). ADOT has made the decision to replace the existing outlet pipes along the section of I-10 from Verrado Way to Citrus Road where the roadway pavement is being replaced. This decision was based on the poor structural condition of existing corrugated metal pipes removed from other ongoing projects in this area.

The I-10 Jackrabbit Trail, Perryville Road and Citrus Road Overpasses will be widened into the median. The three structures will be sized to accommodate a future lane in the median (bridges will extend across the entire median). However, the deck drainage structures for these three bridge will not be designed for ultimate roadway conditions. In the future, these bridges may also be widened to the outside. These bridges will be analyzed for roadway spread criteria based on the presently proposed large bridge deck surface areas and existing roadway profiles.

The allowable pavement spread width on the existing I-10 Cotton Lane, RID Canal, and Sarival Avenue Overpasses will be approximately 9 feet due to a narrow shoulder of approximately 3 feet. The shoulders will be narrowed to 2'-10.5" to accommodate three lanes of traffic. Also, the tapering of the outside shoulders from these bridges will result in the allowable runoff spread width varying along the tapers. These bridges will be analyzed for pavement spread criteria based on these changed conditions.

The increase in roadway runoff volume onto ADOT right-of-way will require both enlargement of the existing on-site storage areas and the installation of several new small retention basins. Furthermore, the increase in concentrated flows will require new roadside ditches to carry the runoff to existing and proposed retention areas. The absence of viable outfalls along the east segment of the I-10 project necessitates the installation new retention basins.

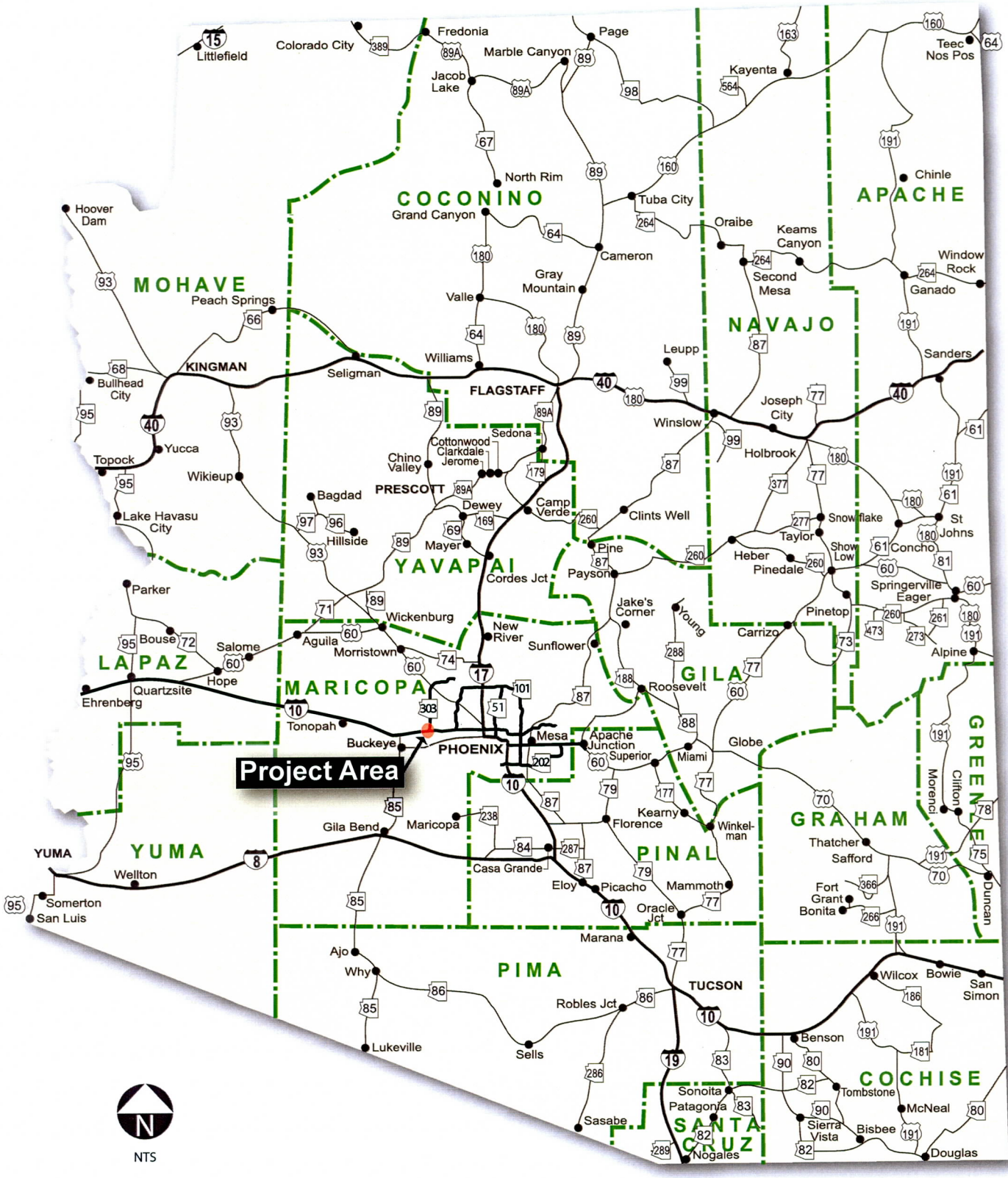

Figure 1

Project Location Map

Figure 2
Project Vicinity Map

1.3 PREVIOUS STUDIES

A Preliminary (30%) Drainage Report was published for this project in May 2007. Reports pertinent to this drainage report are:

- Loop 303 Corridor/White Tanks Area Drainage Master Plan Update, February 2005 by URS
- Draft Design Concept Report for SR 303L, I-10 to US 60, February 2006 by URS
- I-10 (Papago) Median Widening, SR 85 to Citrus Road Initial Drainage Report, May 2006 by Aztec
- I-10 (Papago) Outside Widening, Sarival Avenue to SR 101L Preliminary Drainage Report, May 2006 by HDR
- I-10 (Papago) Outside Widening, Sarival Avenue to Dysart Road Preliminary Drainage Report, May 2007 by HDR
- Final Drainage Report for Interstate 10 Median Widening, Sarival Avenue to SR 101L, March 2007 by URS
- Outer Loop/I-10 Interchange at 99th Avenue Drainage Report (June 1991, April 2002 and June 2005), by HDR
- Durango Area Drainage Master Plan, September 2005, Dibble and Associates
- Buckeye Flood Retarding Structure No. 1 Rehabilitation Project
- Sun Valley Area Drainage Master Plan (ADMP)

As-Built plans pertinent to this project are:

- I-10-2 (31) Grading, Pavement, Drainage & Structures, Cemetery Road to Perryville Road, October 26, 1977
- I-10-2 (34) Grading, Pavement, Drainage & Bridges, Perryville Road to Bullard Wash, September 19, 1985
- I-10-2 (75) Grading and Drainage, Agua Fria to 115th Avenue, March 28, 1984
- I-10-2 (70) Grading Drainage & Bridges, 115th Avenue to 95th Avenue, June 18, 1986

Portions of these plans that relate to onsite and off-site drainage are included in Appendix L.

2.0 SITE DESCRIPTION

2.1 TOPOGRAPHY

The general topography to the north of I-10 slopes from northwest to southeast within the limits of the project. South of I-10, the topography maintains the same general orientation, with a gradual slope towards the Gila River.

Major washes that approach I-10 from the north are Tuthill Wash, Jackrabbit Trail Wash and 191 Avenue Wash. All three washes cross I-10 to the south through multi-barrel box culverts. Smaller drainage crossings are accomplished with 36" to 42" pipe culverts as single barrel or multi-barrel structures.

The elevated I-10 forms a barrier prohibiting overland flow from crossing the freeway except at major cross-road locations, major washes or at other hydraulic structures.

2.2 FIELD INVESTIGATIONS

Several field investigations were conducted in the fall 2007 and spring of 2008 to verify topographic features, hydrologic parameters and existing drainage structures.

2.3 LAND USE, VEGETATION AND SOIL TYPES

The existing right-of-way is owned by ADOT and reserved for transportation. Adjacent land is a combination undeveloped, single and multi-family residential, commercial, agricultural and industrial. The majority of adjacent properties is currently in agricultural use and is planned for future residential, commercial and industrial development.

Native subsurface soils underlying the roadway embankment within this segment of the I-10 corridor is basin-filled deposits comprised of interbedded granular and fine-grained alluvial soils. These predominantly fine-grained soils consist of mixtures of sand, clay and silt with variable gravel content. Where non-cohesive sandy soils are encountered silt contents will vary and these soils can be expected to be typically uncemented, and dense to very dense with depth. Gravel content and frequency of cobbles with the native soils are likely to increase with depth.

Depth to groundwater is expected to be approximately 230 feet below native grade. Groundwater was not encountered in any of the borings during the Stage II geotechnical investigation.

2.4 EXISTING UTILITIES

Existing utilities for this segment of I-10 includes a sanitary sewer line for the City of Goodyear, water lines for Arizona Water Company and City of Goodyear, natural gas line of Southwest Gas, irrigation pipe and box culverts for both private and Roosevelt Irrigation District, overhead and underground power lines for Arizona Public Service, overhead and underground cable TV/fiber optics for Cox Communication, and overhead and underground communications cable/fiber optics for AT&T, MCI and Qwest.

A utility inventory was developed for the Design Concept Report (DCR) using information collected from field investigation, Blue Stake ticket requests, ADOT permits, as-built plans, and quarter-section maps. The following table summarizes the existing utilities presented in the DCR for this segment of the I-10.

Table 2.1 Summary of Existing Utilities[1]

Location Along I-10	Existing Utility Types
Verrado Way to Tuthill Road	Cox Communication – fiber optic TV line on bridge, unknown fiber optic TV line in bridge, Qwest underground fiber optic line
Tuthill Road to Jackrabbit Trail	Arizona Water Co. 20" Steel Sleeve at approximately Sta. 6393+12
Jackrabbit Trail to Perryville Road	Southwest Gas 2" and 4" Gas Lines, Arizona Water Co. 6" water line, Qwest underground fiber optics line, two Arizona Water Co. 12" steel Sleeves and one 20" sleeve, three APS 12 kV O.H. power lines, Qwest O.H. fiber optic line underbuild, Qwest underground telephone line, MCI fiber optic line
Perryville Road to Citrus Road	Arizona Water Co. 20" Sleeve, Qwest Underground fiber optic line, private 12" CMP sleeve, Arizona Water Co. two 6" water lines in 12" CMP sleeves
Citrus Road to Cotton Lane	Southwest Gas 2" gas line, APS 12 kV O.H. power line, four private 24" CMP irrigation and one 30" CMP, Arizona Water Co. 10" water in 24" CMP sleeve, and unknown buried lines
Cotton Lane to Sarival Avenue	APS 69 kV O.H. power line, two AT&T buried conduits, RID canal, City of Goodyear 24" sewer, two private 30" RCP irrigation lines, and unknown buried lines
Sarival Avenue	City of Goodyear 12", 24", and 36" water lines; APS 12kV O.H. power line; Private 30" and 36" RCP irrigation lines and RID 4'x4' CBC

[1] Summarized from Table 2, Utility Report, I-10 (Papago) Widening, Verrado Way to Sarival Avenue in Maricopa County, August 2007.

2.5 FLOODPLAIN LOCATIONS

A review of the Federal Emergency Management Agency Flood Insurance Rate Maps for the project area indicates 100-year floodplains along the north side of I-10 for almost the entire length of the project. Flood hazard zones along the project are identified on the September 30, 2005 FIRM as follows:

- From Verrado Way to Tuthill Wash, adjacent to existing north right-of-way – Zone X.
- From Tuthill Wash to West of Jackrabbit Trail, adjacent to existing north right-of-way – Zone AE, floodway present.
- From Jackrabbit Trail to approximately 1,000 feet west of the RID Canal Overpass – Zone A.
- From approximately 1,000 feet west of the RID Canal west to the west bank of the RID canal – Zone A.
- From approximately 1,500 feet east of the RID Canal to approximately 600 feet east of Sarival Avenue – Zone AH.
- From approximately 600 feet east of Sarival Avenue to the end of the project – Zone A.

Copes of the floodplain Area Map 04013C, Panels 20055G and 2060G are included in Appendix D.

The new outside embankment slopes will be maintained within the existing ADOT right-of-way. The fill into the floodplains is considered insignificant and will not impact the floodplains located to the north of I-10 and east of Citrus Road (Zones A and AH).

2.6 EXISTING DRAINAGE SYSTEMS

2.6.1 Off-Site Drainage

The general topography north of I-10 from Verrado Way to Sarival Avenue slopes towards the southeast. South of I-10, the topography has a gradual southern slope toward the Gila River. The interstate embankment forms a barrier prohibiting cross flows except at cross culverts, overpasses and major wash crossings as discussed below.

Table 2.2 summarizes the major existing drainage structures carrying off-site flow.

Table 2.2 Existing Major Cross Conveyances and Estimated Offsite Flows[1]

Location	100-year, 24-hour Peak Flow at I-10 to the South	Reference
I-10/Section Line 5 and 6 crossing (Sta. 6367+00)	Unknown/Four 10'x8' RCBC	ADOT As-Built Plans/Sun Valley ADMP
Jackrabbit Trail TI	Unknown/Five 10'x4' RCBC	ADOT As-Built Plans/Sun Valley ADMP
I-10/189th Avenue (Sta. 6453+00)	Unknown/Five 10'x3' RCBC	ADOT As-Built Plans/Sun Valley ADMP
I-10/184th Avenue (Sta. 6486+00)	Unknown/Four 36" CMP	ADOT As-Built Plans/Sun Valley ADMP
Citrus Road	444 cfs/TI Bridge	Loop 303/White Tanks ADMP Update
I-10 at Sta. 6538+00 (West of Cotton Lane TI)	60 cfs/four 36" CMP	Loop 303/White Tanks ADMP Update
I-10 at Sta. 6562+00 (west of Cotton Lane TI)	36cfs/Four 36" CMP	Loop 303/White Tanks ADMP Update
Cotton Lane	635 cfs/TI Bridge	Loop 303/White Tanks ADMP Update
RID Canal Crossing	646 cfs/ RID Bridge	Loop 303/White Tanks ADMP Update
Sarival Avenue	532 cfs/TI Bridge	Loop 303/White Tanks ADMP Update

[1]Taken from Table 7, Initial Drainage Report (Stage II), "I-10 (Papago) Widening, Verrado Way to Sarival Avenue in Maricopa County, Arizona," May 2006.

2.6.2 Existing Onsite Drainage

The roadway alignment from west of Verrado Road east to Cotton Lane has three super elevated horizontal curves. The straight sections of the roadway are crowned at the median edge with a 2% transverse slope. Onsite drainage along the roadway straight sections sheet flows outside to ADOT right-of-way or is collected in embankment curb downdrains with conveyance to the infield areas or ADOT right-of-way. Runoff from the super elevated roadway sections sloping toward the median is collected by median catch basins with discharge to ADOT right-of-way. Runoff collected in the right-of-way is either carried overland to cross culverts or to downstream historical washes leaving ADOT right-of-way.

The roadway alignment from west of Cotton Lane east to the end of the project is straight and the roadway is crowned at the median edge of pavement with a 2% transverse slope. Onsite drainage either sheet flows off the edge of the roadway to the outside or is collected in downdrain catch basins and conveyed by lateral pipes into existing off-site drainage systems. The median is drained by catch basins created in sump conditions. Curb along the I-10 mainline occurs only on short segments over each overpass. These outside embankment curbs are associated with guardrail.

The following table identifies the existing drainage structures and runoff flow patterns for the existing I-10 mainline within the limits of the project.

Table 2.3 Existing Drainage Structures and Roadway Runoff Flow Patterns[1]

Begin Approach	End Approach	Northern Runoff (I-10 WB lanes)	Southern Runoff (I-10 EB Lanes)	Existing Drainage Structure
Sta. 6547+53.4	West of Cotton Lane	- Sheet flow to the outside, except where embankment curb is present. - Infield area is drained to the north by catch basins and culverts under Ramp A. - Flows are retained in low areas that are part of the floodplain and extend outside of the right-of-way. - Floodplain area drains south under the freeway through 5-29"x42" elliptical culverts.	- Sheet flow to the outside, except where embankment curb is present. - Median area is drained to the south. - Infield area is drained to the south by catch basins and culverts under Ramp B. - Some flows are retained in shallow longitudinal retention basins within the right-of-way and drain to the south.	- Embankment curb on upward ramp, downdrains. - Median catch basins and culverts.
East of Cotton Lane	West of RID Canal	- Confined pavement flow, embankment curb is present. - Infield area is drained to the north by catch basins and culverts under Ramp C. - Flows are retained in low areas that are part of the floodplain and extend outside of the right-of-way.	- Confined pavement flow, embankment curb is present. - Median area is drained to the south. - Infield area is drained to the south by catch basins and culverts under Ramp D. - Flows are retained in low areas that are part of the floodplain and extend outside of the right-of-way.	- Embankment curb and downdrains. - Median catch basins and culverts.
East of RID Canal	West of Sarival Avenue	- Confined pavement flow, embankment curb is present. - Some portion of the median area is drained to the North. - Flows are retained in low areas that are part of the floodplain and extend outside of the right-of-way.	- Confined pavement flow, embankment curb is present. - Some portion of the median are drained to the South. - Flows are retained in a large retention outside of the right-of-way and within a residential subdivision.	- Embankment curb and downdrains. - Median catch basins and culverts.
East of Sarival Avenue	Sta. 6648+00	- Sheet flow to the outside, except where embankment curb is present. - Some portion of the median area is drained to the North. - Some Flows are conveyed within the right-of-way along the roadway embankment to Dysart Road where it is retained in a small longitudinal basin. - Some flows are retained in low areas that are part of the floodplain and extend outside of the right-of-way.	- Sheet flow to the outside, except where embankment curb is present. - Some portion of the median area is drained to the South. - Some flows are conveyed within the right-of-way along the roadway embankment to Dysart Road where it is retained in a small longitudinal basin. - Some flows are retained in longitudinal retention basins within the right-of-way.	- Embankment curb and downdrains. - Median catch basins and culverts.

[1] Taken from Table 1, Preliminary Drainage Report (Stage II), "I-10 (Papago) Widening, Verrado Way to Sarival Avenue in Maricopa County, Arizona," August 2007.

2.7 PROPOSED DRAINAGE SYSTEM

The intent of the proposed I-10 drainage system is to continue to maintain the existing drainage patterns throughout the project.

The proposed drainage system improvements include barrier type catch basins and outlet pipes, new and rebuilt median catch basins, reconstructed and new downdrains and the extension of several existing outlet pipes.

The existing ADOT C-15.80 and C-15.90 median catch basins for the section of the I-10 from Citrus Road to Sarival Avenue will be reconstructed or replaced, respectively. These catch basins will collect both onsite median runoff and roadway inside shoulder runoff that sheet flows to the median. To utilize the existing cross culverts, several of the new median catch basins will be located at or near the same location as the existing median catch basins that they replace. ADOT C-15.92 catch basins (modified), C-13.60 slotted drains and outlet pipes will be provided for the segment of I-10 with the open median removed.

Many of the existing embankment curb downdrains will be reconstructed along those segments of the freeway widened to the outside. Additional downdrains will be provided to accommodate the increase in runoff from the inside and outside widening. Double downdrains will be utilized to improve interception as warranted. Even with the additional downdrains, the increased bypass flows at the end of the embankment curb sections of the guardrail requires installing riprap spillways.

Runoff collected in the median will be conveyed to ADOT's outside right-of-way. New cross culverts to handle the increase in runoff are not required.

The on and off service ramps at the interchanges are not affected by the proposed mainline widening. Infield areas at Cotton Lane Ramps C and D and Sarival Avenue Ramps A and B will be re-graded because of mainline outside widening. Impact to the existing drainage system is minimal and changes to the system are not required.

2.7.1 Proposed Bridge Deck Drainage

There are six I-10 bridges within the limits of the project: Jackrabbit Trail Traffic Interchange Overpass, Perryville Road Overpass, Citrus Road Overpass, Cotton Lane Traffic Interchange Overpass, RID Canal Overpass, and Sarival Avenue Overpass. Because of the future realignment of I-10 with the proposed I-10/SR 303L System Traffic Interchange project, Cotton Lane, RID Canal, and Sarival Avenue bridges will not be modified with this project.

Based on bridge drainage analyses, all six bridges meet pavement spread criteria and additional drainage structures, such as deck drains, are not required. Supporting computations are contained in Appendix I.

2.7.2 Design Issues

- Onsite drainage design for I-10 from Verrado Way east to Citrus Road should be performed for this project assuming ultimate widening condition where appropriate. To minimize future throwaway, the onsite drainage facilities will be designed to be compatible with the ultimate widening condition.
- Widening of pavement along the segment of I-10 from Citrus Road to Sarival Avenue will impact the existing drainage structures in the median. Reconstruction of the existing drainage structures or replacement is required.
- Median drainage swales will be realigned as part of the inside widening of I-10 from Citrus Road east to Sarival Avenue. Median ditches will be evaluated to ensure the hydraulic grade line for the 10-year event is at or below the lower of the subgrade elevations for the east and westbound lanes at any given location. In addition, the median ditches will be checked to ensure the hydraulic grade line for the 50-year event is 3 inches or more below the top of the pavement.
- Roadside ditches will be designed to carry runoff from the new drainage systems to the existing off-site cross culverts, to downstream historical washes leaving ADOT right-of-way and to existing and new retention facilities.
- The impact of a minimal increase in onsite runoff and flows on the floodplain areas to the north of I-10 will be evaluated. Retention basins will be installed if required.
- Available onsite storage capacity within ADOT right-of-way will be evaluated, in particular to the south of freeway, to ensure any increase in flow rates leaving ADOT right-of-way does not exceed existing conditions.
- Existing storm drain system not being used will be either removed or abandoned in-place and filled with cement slurry.
- Three new onsite retention basins will be required to handle the increased roadway runoff: one in the southwest quadrant of I-10 and Citrus Road interchange, one within ADOT south right-of-way between the RID Canal and Sarival Avenue, and one in the southeast quadrant of I-10 and Sarival Avenue interchange. These will be evaluated for percolation into the underlying soil within 36 hours after a storm event.

2.8 OFF-SITE DRAINAGE DESIGN

The proposed widening will contribute additional flow to the existing off-site infrastructure from an increase in paving area. As discussed earlier, the roadway improvements will require onsite roadside ditches, enlargement of existing onsite retention facilities and several new onsite retention basins. The existing off-site infrastructure cross culverts will remain unchanged, with historic flows maintained. Off-site drainage is conveyed under I-10 through existing hydraulic structures into farm fields, desert areas, and downstream drainage improvements. The one exception is the off-site drainage within the I-10/SR 303L system interchange, where future improvements will include several detention basins sized to detain the 100-year, 24-hour regional runoff event.

As mentioned earlier, a regional drainage system is planned for the area west of SR 303L. This system will follow the SR 303L alignment and include a series of detention basins, channels and storm drains that eventually discharge into the Gila River to the south.

Two regional detention basins are proposed for the realigned section of I-10 at the interchange. The basins will be located to the northwest of the I-10/SR 303L interchange. The outfall will be a double box culvert and connected to the regional channel system. However, a temporary basin will be necessary to the south of I-10 for the interim until the Flood Control District of Maricopa County (FCDMC) regional channel is constructed.

Maintenance of the two regional detention basins was discussed with FCDMC in Stage II. The northernmost basin is adjacent to the Perryville Prison and officials have indicated the prison would be willing to accept maintenance of the basin provided certain conditions are met. FCDMC has agreed in principle to maintain the southernmost basin if the basin is not equipped with park-like amenities. The remaining basins associated with the SR 303L IDCR are not needed at this time for the functioning of the mainline system and are not included with this project. These facilities include a basin in the southeast quadrant of the interchange and two basins adjacent to Sarival Avenue. The basins will become necessary once the ramps and frontage roads are built.

The existing RID Canal overpass crosses a 105-foot wide drainage channel located west of the RID canal. When the bridge was constructed in 1975, the 50-year off-site flow was listed at 2,380 cfs from a drainage area of 8.54 square miles. Current hydrology models for this area have a 100-year flow of 656 cfs at this location. The reduction in flow allows a future installation of a double 10'x6' RCBC in lieu of a wide channel and a new bridge structure. However, the future

proposed box culvert would have to be extended to the south and connected to the regional I-10/SR 303L System TI drainage infrastructure.

3.0 HYDROLOGY

Hydrologic models were not developed for the offsite watershed. Offsite hydrology for major structure crossings is available in several recent Flood Control District of Maricopa County studies.

3.1 OFFSITE HYDROLOGY FROM PREVIOUS STUDIES

Offsite hydrology for major structures is documented in Table 2.2. The estimated flows are based on the following two studies:

- The Loop 303 Corridor/White Tanks Area Drainage Master Plan Update prepared in 2004 for FCDMC by URS updated an existing regional HEC-1 model. The ADMP covers the area west of the Aqua Fria to the White Tanks Mountain. The HEC-1 estimated flows are presented in Table 2.2.
- The Sun Valley Area Drainage Master Plan (ADMP) was developed by the FCDMC. The ADMP is divided into two areas, Areas 3 and 1. Area 3 is upstream and adjacent to this segment of I-10. Area 4 is west of the westerly limits of this project. Area 3 runoff outfalls into the existing Buckeye Flood Retarding Structures (FRS). An estimate of offsite flows that may impact the study area is being developed in this study. This plan may also identify improvements to the Jackrabbit Trail channel.

In accordance with ADOT policy, the 500-year peak discharge will be estimated at 1.7 times the 100-year peak discharges.

3.2 DRAINAGE BASIN DELINEATION AND TOPOGRAPHY

Drainage delineations for onsite pavement runoff are shown on the Drainage Area Sheets in Appendix K. New catch basins and outlet pipe drainage areas are designated as 96 through 134. Reconstructed and new downdrains are designated as 200 through 296. Prefixes 'E' and 'N' are added to the numbers to represent reconstructed and new downdrains, respectively.

3.3 PRECIPITATION

Rainfall data for the project were determined using the Precipitation Frequency Data Server program based on the "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4. Rainfall depths were calculated for the 2, 5, 10, 25, 50, 100, and 500-year storm events. The precipitation calculations and maps are located in Appendix C.

3.4 RATIONAL EQUATION

The rational runoff method calculates the peak discharge using the algebraic formula:

$$Q=CiA$$

Where, Q = peak discharge (cfs)

C = the runoff coefficient

i = average rainfall intensity (inches/hour)

A = the contributing drainage area (acres)

A summary of the rational equation calculations for the project is located in Appendix E for roadway catch basins, Appendix F for median catch basins, and Appendix G for downdrains and riprap spillways. Each of the rational equation components is discussed below.

3.4.1 Rational Runoff Coefficient: C

The value of the 'C' coefficient is a function of the one-hour precipitation depth, vegetation cover, percent of effective impervious area and the hydrologic soil group (HSG).

The "C" coefficients for each soil map number can be determined using Figure 2.5 in the ADOT HDDM. Composite coefficients would then be determined for each sub-basin. Only onsite peak runoffs were determined for this project.

3.4.2 Rational Rainfall Intensity: i

The intensity (i) in the Rational Runoff equation is the average rainfall intensity for a selected return period with a rainfall duration that is equal to the time of concentration. The time of concentration is the travel time, during the corresponding period of most intense rainfall excess, for a flood wave to travel from the hydraulically most distant point in the watershed to the point of interest.

Rainfall data utilized for the project can be found in Appendix C.

For the rational runoff method, the rainfall depths were converted to rainfall intensities. An iterative process is utilized to determine the relationship between the rainfall intensity and the time of concentration of the basin. Appendix C contains the Intensity-Duration-Frequency

(I-D-F) curves for 0 to 60 minutes that were utilized for this project. The minimum T_c used for the project was 10 minutes, as per ADOT criterion.

The time of concentration was developed from the following iterative equation (HDDM, 2-2):

$$\mathbf{T_c = 11.4\ L^{0.5}\ K_b^{0.52}\ S^{-0.31}\ I^{-0.38}}$$

Where, T_c = Time of concentration (hours)

L = Length of the longest flow path (miles)

K_b = Watershed resistance coefficient

S = Slope of the longest flow path (ft/mile)

I = Average rainfall intensity (in./hr)

The resistance coefficient (K_b = 0.10) was determined from Table 2-1 in the ADOT HDDM.

4.0 HYDRAULIC ANALYSIS

4.1 PROCEDURE

Procedures and methodologies outlined in the two ADOT publications entitled *Roadway Design Guidelines* (RDG) and *Highway Drainage Design Manual-Hydraulics*, and the Federal Highway Administration *Hydraulic Design Series 5, Hydraulic Design of Highway Culverts*, were utilized for design of the cross drainage systems. The hydraulic calculations were done using the Haestad Method's Culvertmaster and/or HY-8. The hydraulic calculations for the onsite drainage systems were performed using the Haestad Method's 'Flowmaster' and 'StormCad' proprietary programs.

4.2 ROADSIDE AND MEDIAN DITCHES

Roadside drainage ditches will be constructed to collect and carry onsite runoff to either onsite retention basins or existing cross culverts.

The hydraulic grade line for the ditches should be no higher than the sub-grade for the 10-year event and not higher than 3 inches below top of pavement edge for the 50-year event. The cut median ditches should be designed to convey a 10-year storm event. In addition, ditches draining to sag points should be checked for the 50-year storm event.

Where existing drainage ditches are filled by roadway embankment, they will be realigned along the toe of slope where appropriate. Dumped riprap will be provided, if necessary, to avoid erosion of the roadway embankment slope. A minimum one-foot of freeboard should be provided.

The ditches were analyzed by using the computer program Haestad Method's *Flowmaster Open Channel Flow Module*. The ditch design computations, along with the plans and typical sections, will be included in Appendix H of the Stage IV submittal.

The drainage areas are outlined on the Drainage Area maps included in Appendix K.

The ditches are designed as follows:

- The 10- and 50-year events were used to size the roadside and median ditches in accordance with ADOT Design Criteria.

- The roadside ditches will consist of a 4-foot wide bottom with a 2% minimum cross slope and side-slopes of 4H:1V along I-10 and 3H:1V away from the roadway. The 2% cross slope will facilitate positive drainage during low flow events.
- The longitudinal channel gradient was maintained at approximately 0.005 ft/foot.
- The channel hydraulics was performed with a Manning Roughness coefficient value of 0.035, which is representative of a natural vegetated earth surface.

4.3 PAVEMENT DRAINAGE

4.3.1 Discussion

The onsite pavement drainage system shown on the roadway plans contained in Appendix B will drain the pavement runoff to appropriate drainage facilities. This system is comprised of pavement catch basins, downdrains and riprap spillways that will maintain storm water encroachment on the roadway below acceptable limits. The catch basins and connector pipes and downdrains were designed to meet the ADOT criteria for the 10-year and 50-year storm events.

4.3.2 Facility Selection

Storm water interception of pavement runoff will be accomplished with roadway grate catch basins, embankment downdrains and riprap spillways. The selected facilities are:

- ADOT Catch Basin Flush, Drawing C-15.80.
- ADOT Catch Basin with Concrete Half Barrier 32-inch Type 'F', Drawing C-15.92 (Modified)
- ADOT Slotted Drain Details, Drawing C-13.40
- ADOT Downdrain, Embankment Single and Double Inlets, Drawing C-4.20

4.3.3 Pavement and Embankment Drainage (Hydrology)

The Rational Method was employed to determine the peak runoffs from pavement and landscape areas. Parameters used were:

Design storm	–	10 and 50 years
Time of concentration	–	10 minutes
Rainfall intensity (10 yr.)	–	3.80 inches/hour Max.
Rainfall intensity (50 yr.)	–	5.32 inches/hour Max.
Runoff Coefficients	–	Paved areas = 0.95, Unpaved area (Moderate Urban, 40% Impervious) = 0.70

Section 3.0 contains a discussion on the Rational Method.

4.3.4 Inlet/Catch Basin Spacing Design

Catch basin spacing and pavement spread calculations were determined by employing the Hydraulic Engineering Circular No. 22, *Drainage of Highway Pavements,* FHWA, November 1996. The actual calculations were completed by a Haestad's "Flowmaster" computer program. This program is a registered trademark of Haestad Methods, Inc., 37 Brookside Road, Waterbury, Connecticut 06708.

The combination catch basin and slotted drain structures were designed with the slotted drains sized to provide 100% runoff interception. Existing and new downdrains were analyzed and designed as though functioning as curb opening inlets without the clogging factor.

The open median catch basins were designed as operating in sump conditions because of the median dikes.

Allowable Ponding Depth

Allowable ponding depth should not exceed the height of the curb for the 10-year runoff. The catch basins ponding limits are evaluated for the appropriate design storm and checked for the other storm to insure spread compliance with both design storms.

The allowable spread from the ramp gore shall match the design spread criteria presented in Figure 603.2A, Roadway Design Guidelines Draft, December 2, 2005.

The allowable spread for the 10-year runoff event is:

- For multi-lane roadway (and one-way frontage road), one-half of the travel lane (or auxiliary lane) plus shoulder, turn lane, parking lane, and/or distress lane. For one-directional crowned roadways, the one-half lane spread shall be included only on one side.

- For two-way roadway (and frontage road), shoulder, turn lane, parking lane, and/or distress lane.

For a depressed roadway condition, the assumed allowable spread for the 50-year runoff event is:

- For multi-lane roadway (and one-way frontage road), one full travel lane (or auxiliary lane) plus shoulder, turn lane, parking lane, and/or distress lane. For one directional crowned roadways, the full lane spread shall be included only on one side.

- For two-way roadway (and frontage road), shoulder, turn lane, parking land, and/or distress lane.

A depressed roadway is defined as any roadway whose ultimate ponded depth (assuming no outflow at the sag) is 30 inches or more.

Catch Basin Capture Ratios

Type	Inlet Capture Ratio	
	Sump	On-Grade
Curb-opening	80	80
Grate inlets	50	50
Slotted drain	50	67
Slotted drain/Grate inlets	50/50	67/50
Downdrains	NA	NA
Riprap spillways	NA	NA

Grates

The selected locations for the new catch basins were based on roadway profiles, catch basin spacing required to maintain water spread on the pavement below maximum allowable, near

superelevation crossover points to minimize sheet flow across the pavement, and at the low point in sag areas.

The drainage areas, peak discharges (10- and 50-year events) and time of concentration for the onsite drainage are included in Appendices E, F, and G. Calculations for spacing and sizing the catch basins are also included in Appendices E, F, and G.

4.3.5 Storm Sewer Design

Storm sewer pipe sizes and the hydraulic grade line were determined with a computer program. STORMCAD is a computer program that designs and analyzes any new and existing storm sewer system for non-uniform flow, and the hydraulic grade line (HGL). STORMCAD is a registered trademark of Haestad Methods, Inc., 37 Brookside Road, Waterbury, Connecticut, 06708. The storm sewer design was based on criteria contained in ADOT's Roadway Design Guidelines Manual dated Draft December 2005. These are:

Minimum Pipe Size

- Trunk Lines – 24 inches, except 18-inch pipes may be used where conflicts occur with utilities or other highway appurtenances.
- Laterals – 18 inches

Storm Drain Length between Manholes

- Pipes under 33 inches in diameter: 330 feet
- Pipes 36 and 39 inches in diameter: 440 feet
- Pipes from 42 to 69 inches in diameter: 660 feet
- Pipes 72 inches in diameter and larger: 1,200 feet

Pipe Material and Roughness

Pipe material was selected based on the requirements of ADOT's Pipe Selection Guidelines and Procedures, February 1, 1996. Manning's "n" values used for the selected pipe materials are:

Pipe Material	Manning's "n"
Concrete Pipe	0.012
Plastic pipe, smooth	0.012
Corrugated metal pipe	0.024

Approved pipe types include reinforced concrete pipe (RCP), corrugated metal pipe (CMP), and corrugate high-density polyethylene plastic pipe (CHDPEPP) Class S (sizes less than or equal to 42 inches in diameter under fills less than 10 feet in height).

Pipe Size Design

Pipe size selection was based on full flow with the 10-year storm event for non-depressed roadways. The hydraulic grade line was set a minimum 6 inches below the top of grate for the selected design storm event.

Desirable "Self Cleaning" velocity is 3 feet per sec flowing full. The minimum velocity flowing full is 2 fps. Some exceptions occur due to catch basins requirements at transitions and end of barriers and short pipe connections of flanking catch basins.

The storm sewer calculations for pipe sizes and hydraulic grade lines will be contained in Appendix H of the Stage IV submittal. Proposed storm drain profiles are depicted on the details included in Appendix B.

4.4 RETENTION AREAS/BASINS

The storage requirements for the enlargement of the existing retention areas and the construction of new onsite retention basins will be based on the difference in contributing runoff volume between post development and predevelopment conditions. This approach results in not increasing the offsite flow beyond its predevelopment condition.

The storage volumes will be based on the 100-year, 2-hour storm event.

4.5 EROSION PROTECTION

Erosion protection was provided where recommended in the *Roadway Design Guidelines.* Dumped riprap aprons were used to reduce erosion at the outlets. Dumped riprap and filter fabric will be used to line ditches, where warranted. The type of erosion protection required is determined in accordance with Section 612.2 of the *Roadway Design Guidelines.*

4.6 FLOODPLAINS

The floodplains adjacent to the freeway occur because of the off-site runoff generated from large watersheds to the north of I-10. Copes of the floodplain Area Map 04013C, Panels 20055G and 2060G are included in Appendix D.

The drainage area north of I-10 between Verrado Way and Jackrabbit Trail has been delineated as the floodway of a Zone AE floodplain, with west to east flow direction. The floodplain has two outfalls that cross I-10 at Tuthill Road (Tuthill Dike Wash) and Jackrabbit Trail (Jackrabbit Trail Wash). Both outfalls drain south approximately 1 mile into the White Tanks Structure No. 4. The impact will be a slight increase in the onsite runoff along this segment of I-10 and an insignificant increase in runoff volume stored at the White Tanks Structure No. 4.

The off-site drainage area north of I-10 between Jackrabbit Trail and 191st Avenue Wash has been delineated as a Zone A floodplain, with discharge south through the 191st Avenue Wash crossing. The impact will be an insignificant increase in onsite runoff along this segment of I-10.

The drainage area north of I-10 between 191st Avenue Wash and Perryville Road is delineated as Zone A floodplain. Because the majority of this segment of I-10 is superelevated, the westbound I-10 runoff combines with the median runoff and drains to the north.

The off-site area north of I-10 between Perryville Road and Citrus Road is delineated as Zone A floodplain. A hydraulic structure approximately mid distance between the crossroads drains the west side of the floodplain. The east half of the floodplain does not have a drainage outfall.

The off-site area north of I-10 between Citrus Road and Cotton Lane is classified as a Zone A floodplain. The floodplain extends the entire segment of I-10. Approximately one quarter of the west side drains south under I-10 through a pipe cross culvert. The central and eastern area or approximately two-thirds of the remaining floodplain drains to a second pipe cross culvert. The outfall invert appear to be higher than the existing ground, indicating the runoff below the outlet will remain north of I-10 and have to infiltrate.

Approximately three-quarters of the off-site area north of I-10 between Cotton Lane and RID Canal are classified as Zone A, while the remaining eastern floodplain ponds against I-10 and the RID Canal levee. This floodplain is classified as Zone AH and extends south of I-10 under the RID Canal overpass and is confined by the freeway to the north, Cotton Lane to the west and RID Canal to the southeast. Approximately two-thirds of Zone A floodplain to the north of I-10 is connected to the Zone AH floodplain.

The floodplain north of I-10 between the RID Canal and Sarival Avenue is Zone AH. The floodplain extends a short distance to the east of Sarival Avenue. The outfall is Sarival Avenue, a paved two-lane normal-crown half-street.

The last 600 feet of the freeway north of I–10 from Sarival Avenue to the end of the project is a Zone A floodplain. The outfall is located to the east of the project and is a series of 5-29"x45" HERCP culverts.

5.0 REFERENCES

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2. Arizona Department of Transportation, *Highway Drainage Design Manual, Hydrology*, Report Number: FHWA-AZ93-281, March 1993.

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4. Arizona Highway Department, Bridge Division, *Hydrologic Design for Highway Drainage in Arizona*, revised March 1969.

5. Arizona Highway Department, Structures Section, Hydraulics Division, *Hydrologic and Hydraulic Training Session Manual*, October 16-18, 1972, revised December 1973.

6. Arizona Department of Transportation, Highways Division, *Construction Standard Drawings*, April 2006.

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8. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology*, November 2003 (Draft).

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10. U.S. Department of Transportation, Federal Highway Administration, *Hydraulic Design of Highway Culverts*, Hydraulic Design Series No. 5, September 1982.

11. U.S. Department of Transportation, Federal Highway Administration, *Drainage of Highway Pavements*, Hydraulic Engineering Circular No. 12, March 1984.

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20. U.S. Department of the Army Corps of Engineers, Hydrologic Engineering Center, *Computer Program, HEC-1, Flood Hydrograph Package, Version 4.1*, January 2001.

21. Arizona Department of Transportation, Preliminary Drainage Report (Stage II (30%) Plans, I-10 (Papago) Outside Widening, Sarival Avenue to Dysart Road in Maricopa County, Arizona, May 2007.

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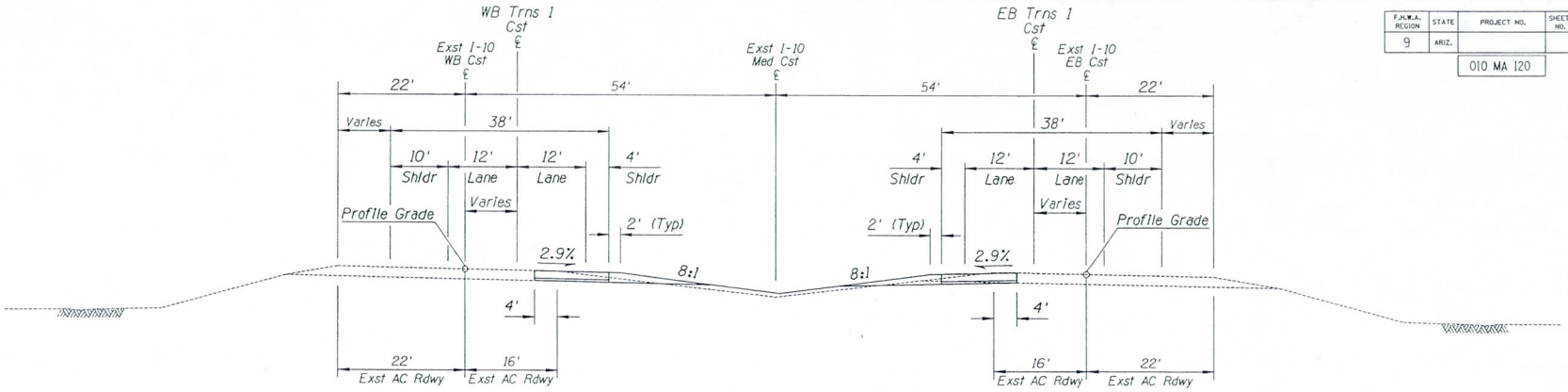
APPENDIX A

ROADWAY TYPICAL SECTIONS (STAGE III)

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



TYPICAL SECTION

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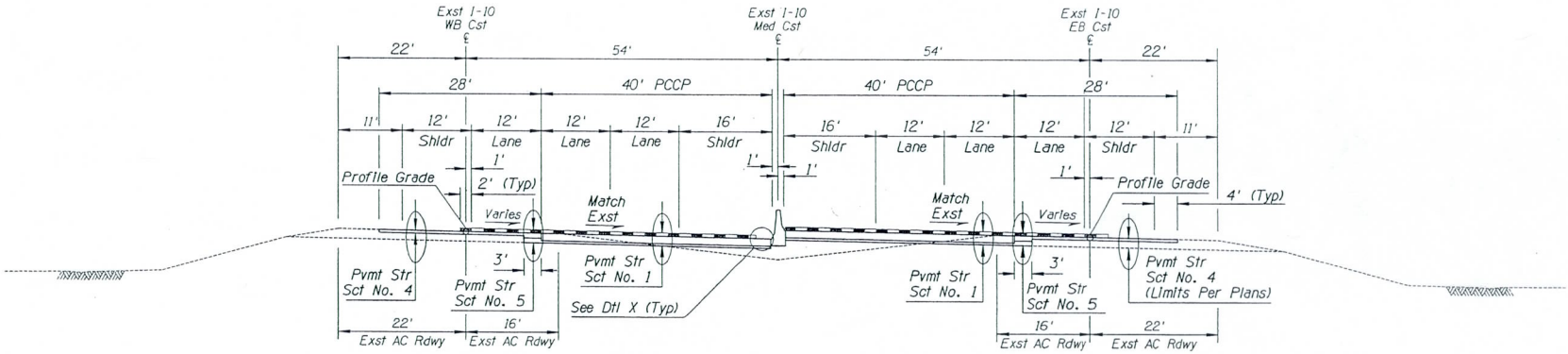

TYPICAL SECTION

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Exst I-10 EB Cst ℄ Sta 6340+44.90 to 6344+36.75

	NAME	DATE
DESIGN	R. HOOKEY	04/08
DRAWN	M. WILLIAMS	04/08
CHECKED	A. SCHMERER	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DESIGN SHEET
TYPICAL SECTIONS

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO G-03.01

___ OF ___

DATE: LOCATION: REVISIONS: FINISHED PLANS: SURVEY NO. DATE: LOCATION: REVISIONS: FINISHED PLANS: SURVEY NO.

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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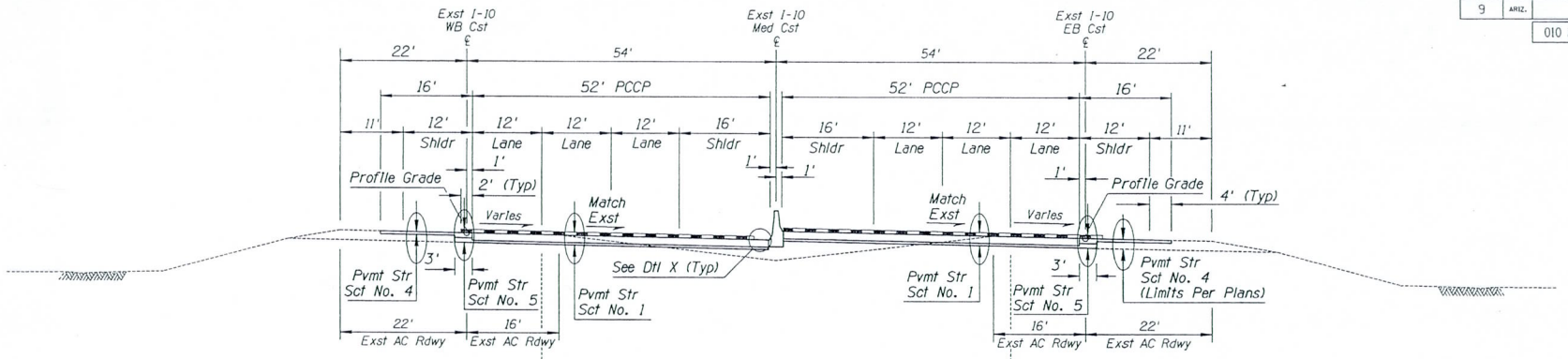
		010 MA 120			



TYPICAL SECTION

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Exst I-10 WB Cst ℄ Sta 6371+86.10 (Ahd) to 6374+22.10

Exst I-10 EB Cst ℄ Sta 6339+95.14 to 6354+35.00
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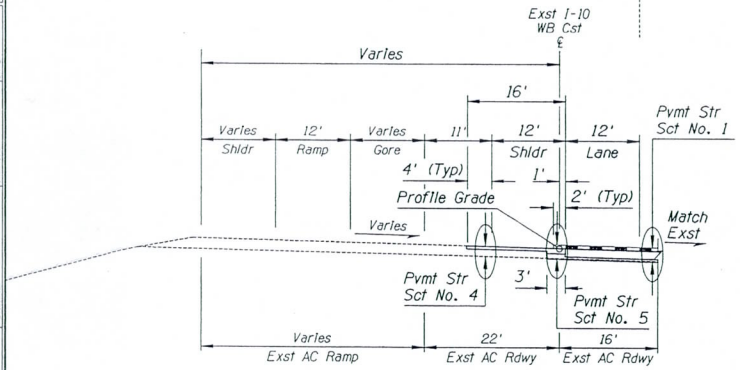

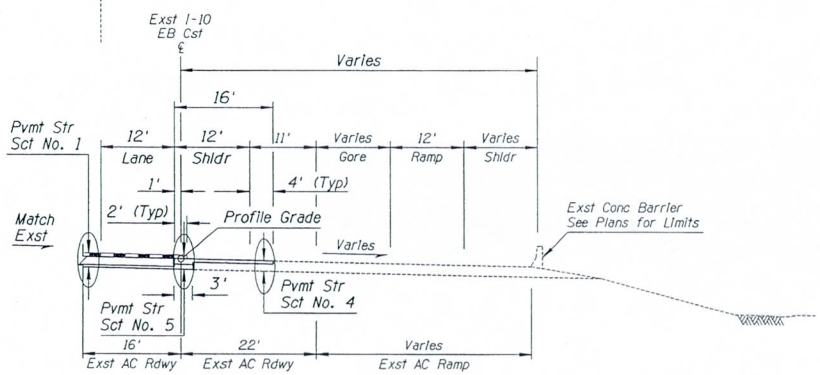

TYPICAL SECTION

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Exst I-10 EB Cst ℄ Sta 6354+35.00 to 6368+33.00

	NAME	DATE
DESIGN	R. HOOKEY	04/08
DRAWN	M. WILLIAMS	04/08
CHECKED	A. SCHMERER	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DESIGN SHEET
TYPICAL SECTIONS

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

DWG NO G-03.02

TRACS NO. H7211 01C

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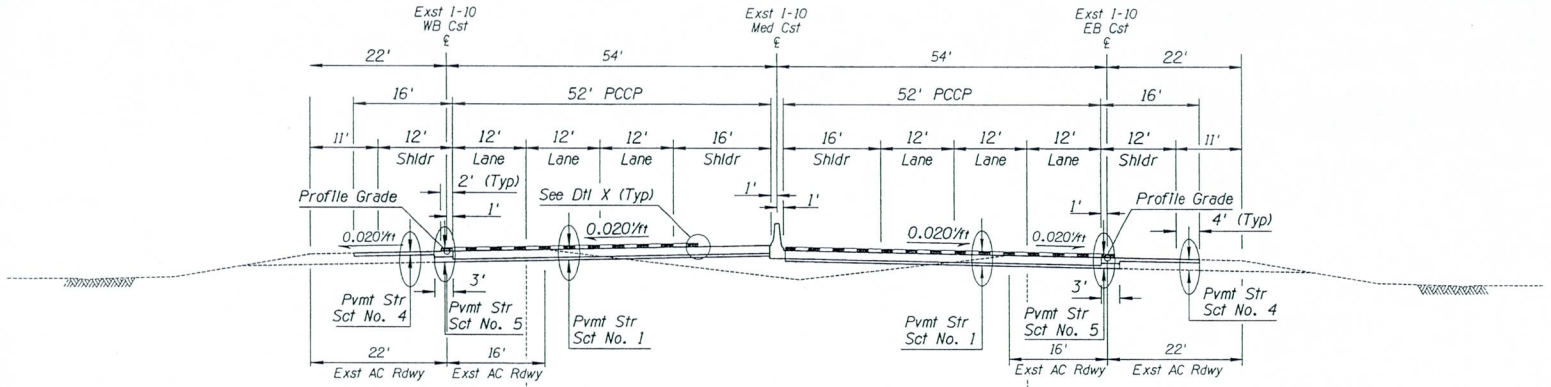
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



TYPICAL SECTION

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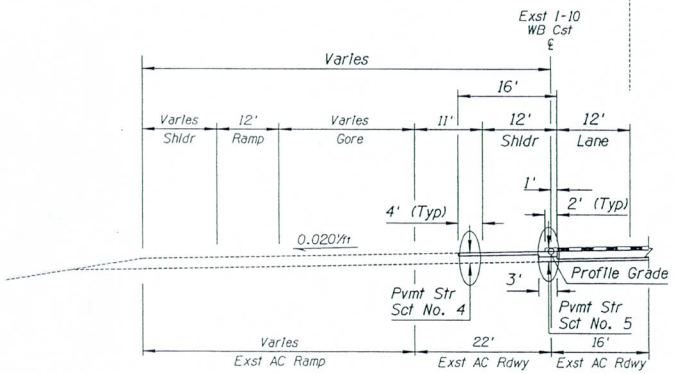
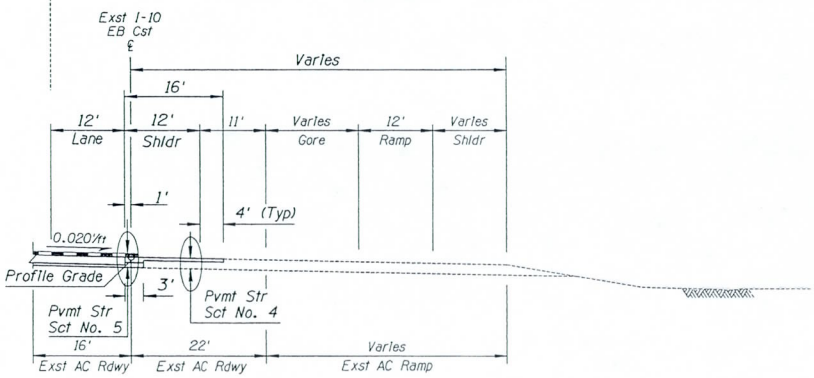
Exst I-10 WB Cst ℄ Sta 6441+00.00 to 6454+00.00
Exst I-10 WB Cst ℄ Sta 6488+54.90 to 6547+43.40

Exst I-10 EB Cst ℄ Sta 6374+22.10 to 6400+00.00
Exst I-10 EB Cst ℄ Sta 6406+33.00 to 6432+49.00
Exst I-10 EB Cst ℄ Sta 6452+65.00 to 6454+00.00
Exst I-10 EB Cst ℄ Sta 6488+54.90 to 6547+43.40





TYPICAL SECTION

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Exst I-10 WB Cst ℄ Sta 6434+50.00 to 6441+00.00

Exst I-10 EB Cst ℄ Sta 6400+00.00 to 6406+33.00
Exst I-10 EB Cst ℄ Sta 6432+49.00 to 6452+65.00

	NAME	DATE
DESIGN	R. HOOKEY	04/08
DRAWN	M. WILLIAMS	04/08
CHECKED	A. SCHMERER	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DESIGN SHEET
TYPICAL SECTIONS

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO G-03.03

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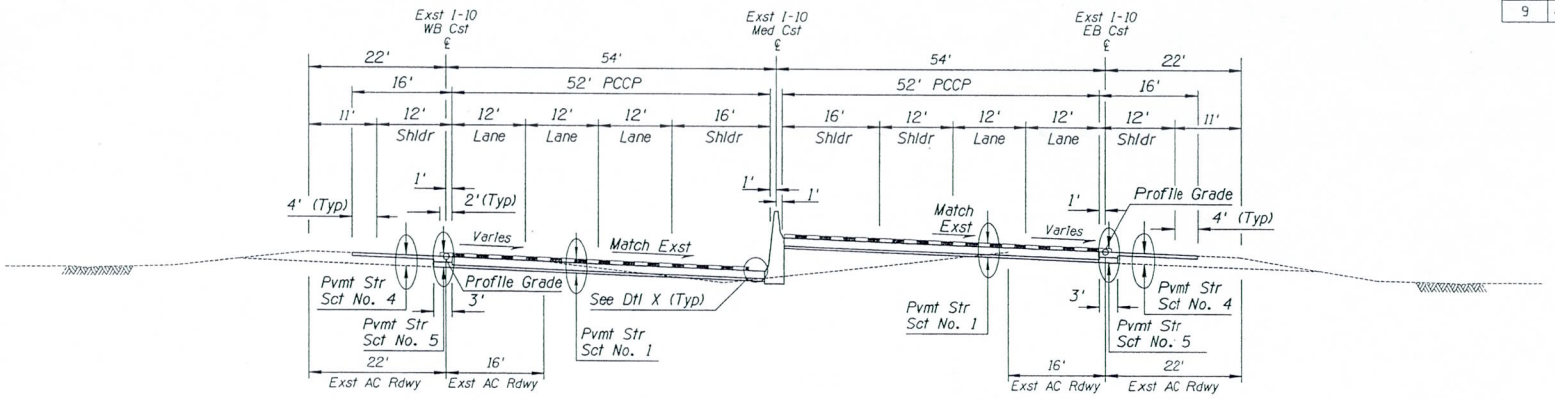
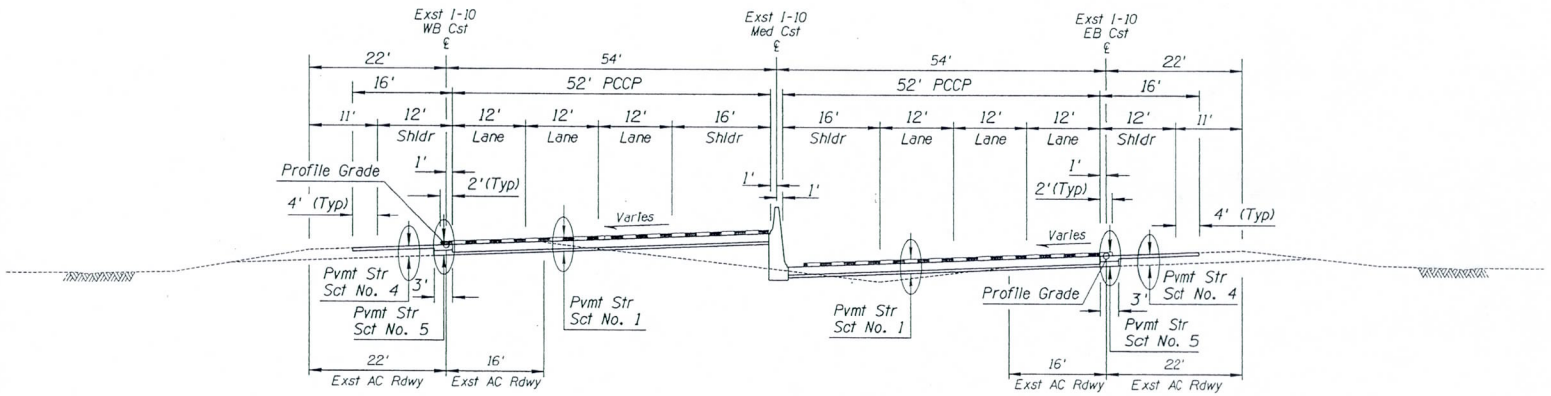
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				
		010 MA 120			



TYPICAL SECTION

Exst I-10 WB Cst ℄ Sta 6454+00.00 to 6469+18.61 (Bk)
Exst I-10 WB Cst ℄ Sta 6469+04.97 (Ahd) to 6470+79.93

Exst I-10 EB Cst ℄ Sta 6454+00.00 to 6468+99.76 (Bk)
Exst I-10 EB Cst ℄ Sta 6469+04.97 (Ahd) to 6470+86.45



TYPICAL SECTION

Exst I-10 WB Cst ℄ Sta 6473+32.50 to 6486+67.21 (Bk)
Exst I-10 WB Cst ℄ Sta 6486+75.85 (Ahd) to 6488+54.90

Exst I-10 EB Cst ℄ Sta 6473+41.44 to 6486+86.39 (Bk)
Exst I-10 EB Cst ℄ Sta 6486+75.85 (Ahd) to 6488+54.90

	NAME	DATE
DESIGN	R. HOOKEY	04/08
DRAWN	M. WILLIAMS	04/08
CHECKED	A. SCHMERER	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DESIGN SHEET
TYPICAL SECTIONS

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO G-03.04

___ OF ___

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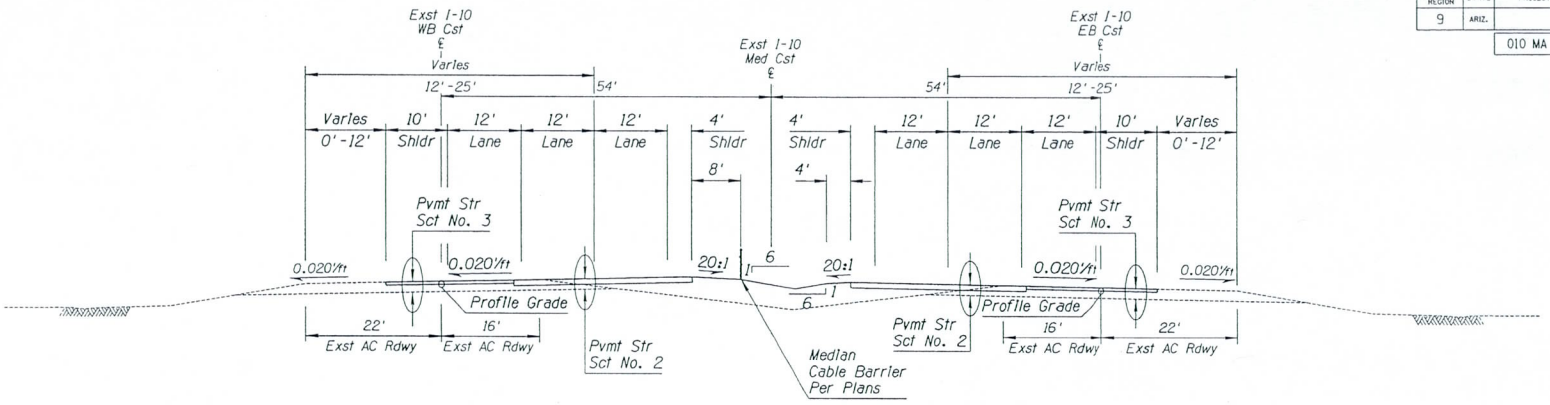
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

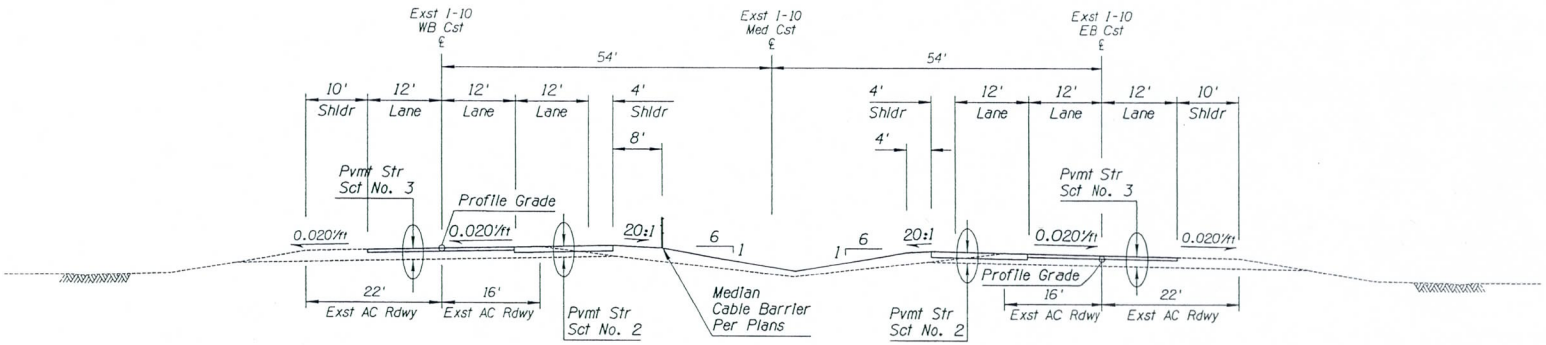
010 MA 120



TYPICAL SECTION
Tangent

Exst I-10 WB Cst ℄ Sta 6526+39.23 to 6536+39.12

Exst I-10 EB Cst ℄ Sta 6526+39.38 to 6536+39.27



TYPICAL SECTION
Tangent

Exst I-10 WB Cst ℄ Sta 6536+39.12 to 6547+00.00

Exst I-10 EB Cst ℄ Sta 6526+39.38 to 6547+00.00

	NAME	DATE
DESIGN	R. HOOKEY	04/08
DRAWN	M. WILLIAMS	04/08
CHECKED	A. SCHMERER	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DESIGN SHEET
TYPICAL SECTIONS

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO G-03.05

___ OF ___

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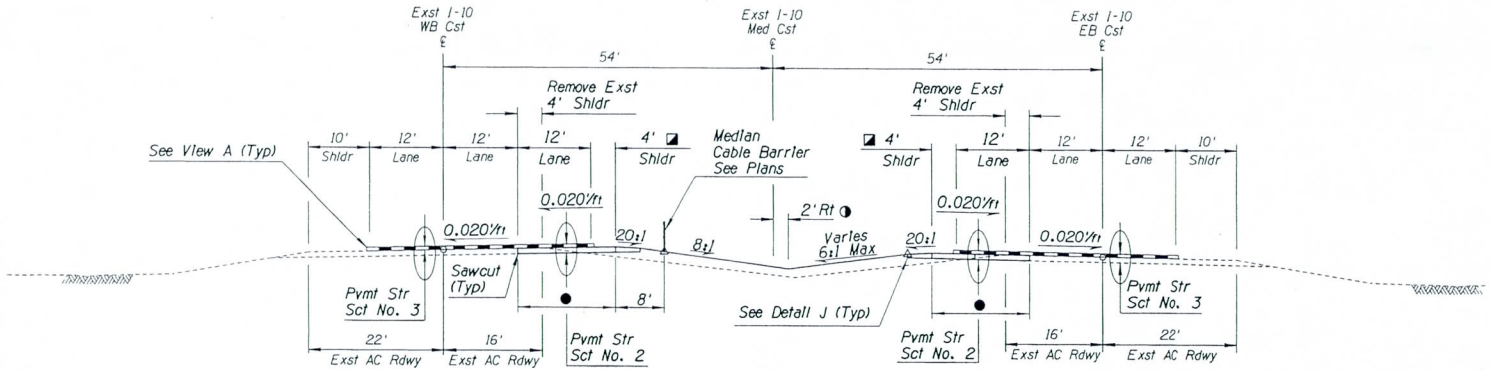
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.		9	349	

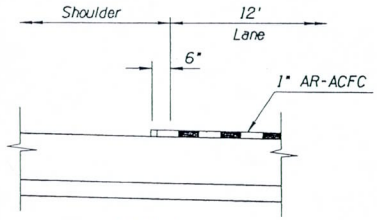
010 MA 120



TYPICAL SECTION
Interim Construction Area

Exst I-10 WB Cst ℄ Sta 6547+00.00 to 6577+17.00

Exst I-10 EB Cst ℄ Sta 6547+00.00 to 6577+17.00



VIEW A

FILL SLOPE EXCEPTION TABLE		
Station	Side	Slope Control
WB Sta 6586+00 to 6587+50	Lt	Trans 2:1 to 6:1
WB Sta 6587+50 to 6589+75	Lt	6:1
EB Sta 6584+00 to 6585+25	Rt	Trans 2:1 to 6:1
EB Sta 6585+25 to 6587+50	Rt	6:1

● Widening Varies with Traffic Lane Shift See paving & Striping Plans

◪ See Paving Plans for Shoulder Taper Locations.

◆ See Fill Slope Exception Table

	NAME	DATE
DESIGN	SRL	04-08
DRAWN	RM	04-08
CHECKED	TJC	04-08

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

Stanley Consultants inc.
1661 East Camelback Road, Suite 400
Phoenix, Arizona 85016
Phone: (602) 333-2200

DESIGN SHEET
TYPICAL SECTIONS

PRELIMINARY
STAGE III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

DWG NO. G-3.06

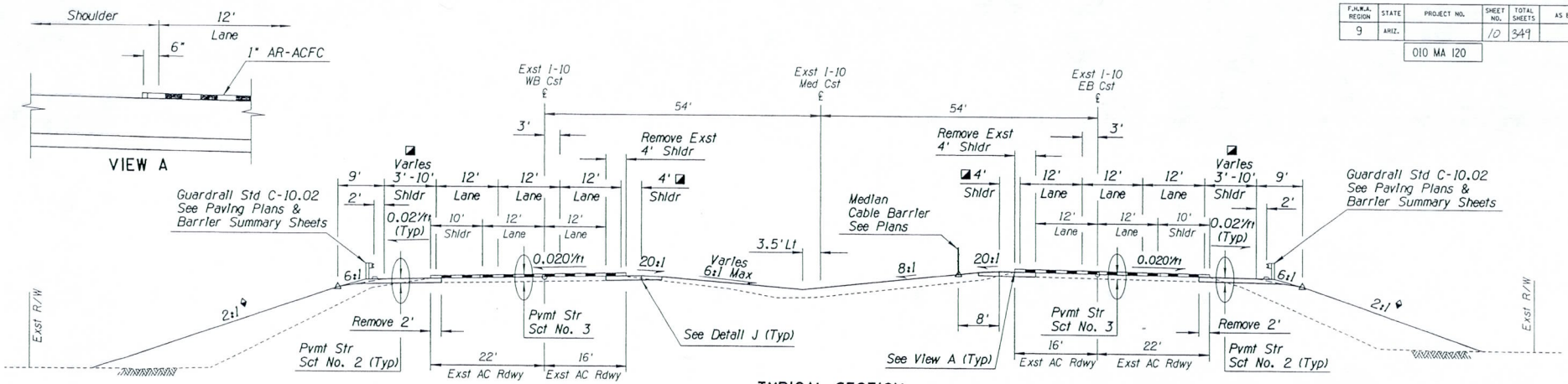
TRACS NO. H7211 01C

___ OF ___

NO.	DESCRIPTION OF REVISION	MADE BY	DATE
NO.1			
NO.2			

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.		10	349	

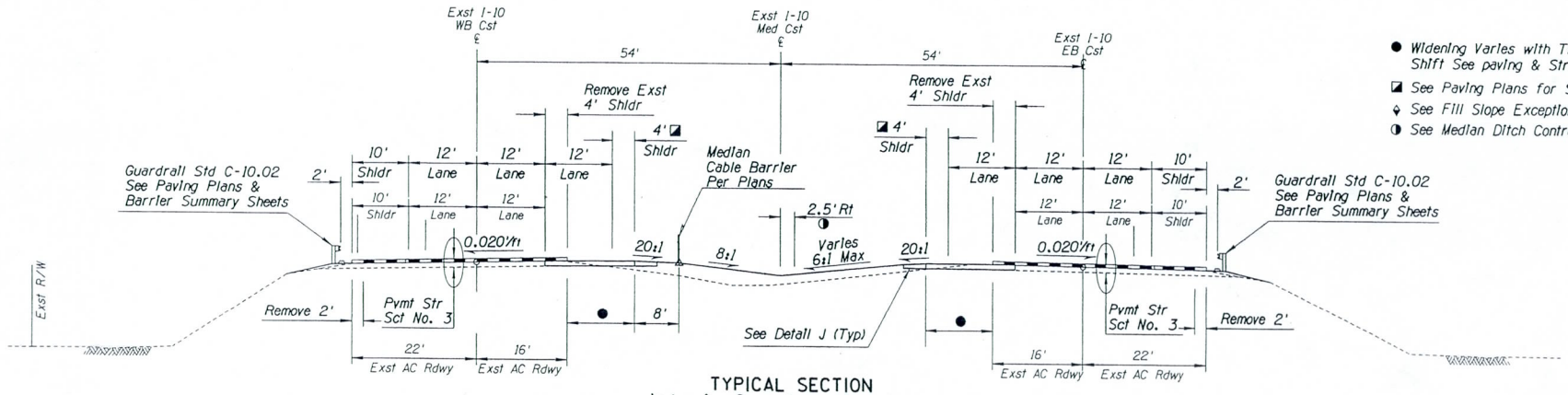
010 MA 120



TYPICAL SECTION
Interim Construction Area

Exst I-10 WB Cst ℄ Sta 6578+99.00 to 6558+28.16 (Bk)
Exst I-10 WB Cst ℄ Sta 6558+30.03 (Ahd) to 6631+62.75

Exst I-10 EB Cst ℄ Sta 6578+99.00 to 6558+27.38 (Bk)
Exst I-10 EB Cst ℄ Sta 6558+30.03 (Ahd) to 6631+62.75



- ● Widening Varies with Traffic Lane Shift See paving & Striping Plans
- ◪ See Paving Plans for Shoulder Taper Locations.
- ♦ See Fill Slope Exception Table
- ◑ See Median Ditch Control Table, Dwg G-01.01.

TYPICAL SECTION
Interim Construction Area

Exst I-10 WB Cst ℄ Sta 6631+62.75 to 636+15.00 (Bk)

Exst I-10 EB Cst ℄ Sta 6631+62.75 to 6640+40.00 (Bk)

	NAME	DATE
DESIGN	SRL	04-08
DRAWN	RM	04-08
CHECKED	TJC	04-08

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

Stanley Consultants inc.
1661 East Camelback Road, Suite 400
Phoenix, Arizona 85016
Phone (602) 333-2200

DESIGN SHEET
TYPICAL SECTIONS

PRELIMINARY
STAGE III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

DWG NO. G-3.07

TRACS NO. H7211 01C

___ OF ___

NO.	DESCRIPTION OF REVISION	MADE BY	DATE
NO.1			
NO.2			

APPENDIX B

ROADWAY DRAINAGE SYSTEM PLANS & PROFILES

(STAGE III)

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

Station	Plan Ref No.	◒ Controlling Fill Height Range	DESCRIPTION: Size, Corrugated (In.)	Size, Smooth (In.)	Length (0) (Ft.)	Skew (0) (Degree)	CSP: ◪ Corrugation	Wall Thickness (0.00)	Coating: Zinc	Bit. Coated Zinc	Aluminum	Bit. Coated Aluminum	CAP: ◪ Corrugation	Wall Thickness (0.00)	Uncoated	Bit. Coated	RCP: Class - Non Trench	Class - Trench	Class	Min Wall Thickness (0) (In.)	NRCP: AASHTO M-294 Type C	AASHTO M-294 Type S	NRCIPCP: C-13.20 & C-13.25	CHDPEPP: Detail - Size, (in) Manhole	END TREATMENT: End Sec (Each) Standard or Detail	Ea: S-Single / D-Double	Location	Catch basin, Manhole, Headwall & Junction Structure: H (0.0) (Ft.)	L wing (0.0) (Ft.)	L 18" Slotted Drn (0) (Ft.)	L 24" Slotted Drn (0) (Ft.)	Type	Elev. (0.00) (Ft.)	Grate: Depth (Ft.)	Grate: L (0.0) (Ft.)	Inlet Depression (In.)	QUANTITIES: Pipe Exc (0) (Cubic Yard)	Pipe Bkfl (0) (Cubic Yard)	Drn Exc (0) (Cubic Yard)	Berm/Dike Emb (0) (Cubic Yard)	REMARKS
I-10 Med Sta 6334+86.12 0.43' Lt	96		28 x 20	28 x 20	6																			C-15.90															CB96 to Existing Pipe
to Sta 6335+12.37 0.43' Lt																																							See Detail D7
I-10 Med Sta 6335+55.28 0.32 Rt	98		28 x 20	28 x 20	6																			C-15.90															CB98 to Existing Pipe
to Sta 6335+71.53 0.32' Rt																																							See Detail D7
I-10 WB Sta 6342+26 50.5' Rt	100		24	24	116																			1	D1			4.0	15			1009.48	1	2.5					CBI 00 to Outlet
to Sta 6342+93.21' Rt																																							
I-10 WB Sta 6346+00 50.5' Rt	102		24	24	23																				D1			5.0	15			1099.61	1	2.5					CB102 to Existing 36" CMP
to Sta 6345+74+33 52.49' Rt																																							Culvert
I-10 WB Sta 6349+00 50.5' Rt	104		24	24	23																				D1			5.0	15			1099.75	1	2.5					CB104 to Existing 36" Culvert
to Sta 6349+56.71 59.60' Rt																																							
I-10 WB Sta 6353+12 50.5' Rt	106		24	24	95																				D1			4.0	15			1099.86	1	2.5					CB106 Connects to Existing
to Sta 6353+12 149' Rt																																							24" Pipe
I-10 WB Sta 6357+35 50.5' Rt	108		24	24	17																				D1			5.0	10			1100.03	1	2.5					CB108 to Existing 36" Culvert
to Sta 6357+16.32 52.43' Rt																																							
I-10 WB Sta 6360+17 50.5' Rt	110		24	24	131																			1	D1			5.0	15			1101.27	1	2.5					CB110 to Outlet
to Sta 6360+17 184.5' Rt																																							
I-10 WB Sta 6363+15 50.5' Rt	112		24	24	120																			1	D1			5.0	15			1100.22	1	2.5					CB112 to Outlet
to Sta 6363+15 173.1' Rt																																							
Sheet Total																								3					100										

FILL HEIGHT RANGE TABLE (Ft.)												
RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL	>	1	3	5	8	11	15	20	25	30	40	55	70
HEIGHT (Ft.)	≤	3	5	8	11	15	20	25	30	40	55	70	90

◒ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

◪ PIPE CORRUGATION				
A	2⅔x½	D	6x2	
B	3x1	E	3x1 or 9x2½	
C	9x2½			

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	M. WILLIAMS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY SHEET

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

DWG NO G-05.01

___ OF ___

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NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	010 MA 120			

	DESCRIPTION						CSP			CAP		RCP		NRCP	NRCIPCP	CHDPEPP	END TREATMENT														QUANTITIES	
				In.	In.	Ft.	Degree	In.	Coating		In.					In.		Each	Catch basin, Manhole, Headwall & Junction Structure													Cubic Yard	
																		End Sec	Ea			Ft.			Grate	Ft.						
Station	Plan Ref No.	Controlling Fill Height Range	Size, Corrugated	Size, Smooth	Length (0)	Skew (0)	Corrugation	Wall Thickness (0.00)	Zinc	Bit. Coated Zinc	Aluminum	Bit. Coated Aluminum	Corrugation	Wall Thickness (0.00)	Uncoated	Bit. Coated	Class - Non Trench	Class - Trench	Class	Min Wall Thickness (0)	AASHTO M-294 Type C	AASHTO M-294 Type S	C-13.20 & C-13.25	Detail -	Size, (in) Manhole	Standard or Detail	S-Single / D-Double	Location	H (0.0)	L Wing (0.0)	L 18" Slotted Drn (0)	L 24" Slotted Drn (0)	Type	Elev. (0.00)	Depth	Inlet Depression L (0.0)	Pipe Exc (0)	Pipe Bkfl (0)	Drn Exc (0)	Berm/Dike Emb (0)	REMARKS
I-10 WB Sta 6371+85 50.5' Rt	114		24	24	122													1			DI					5.0	15				1099.87	1	2.5					CB114 to Outlet
to Sta 6371+85 85' 174.7' Rt																																							
I-10 WB Sta 6456+34.84 50.5' Rt	116		24	24	102													1			DI					4.0	10 (W)				1058.79	1	2.5					CB116 to Outlet
to Sta 5456+34.84 50.5' Lt																													20 (E)										
I-10 WB Sta 6459+54.45 50.5' Rt	118		24	24	123													1			DI					4.0	30				1059.76	1	2.5					CB118 to Outlet
to Sta 6459+54.45 71.7' Lt																																							
I-10 WB Sta 6463+31.3 50.5' Rt	120		24	24	121													1			DI					4.0	35				1063.17	1	2.5					CB120 to Outlet
to Sta 6463+31.3 68.9' Lt																																							
I-10 WB Sta 6467+15 50.5' Rt	122		24	24	129													1			DI					4.0	30				1066.7	1	2.5					CB122 to Outlet
to Sta 6467+15 74.5' Lt																																							
I-10 EB Sta 6477+77.67 50.5' Lt	124		24	24	133													1			DI					4.0	30				1062.57	1	2.5					CB124 to Outlet
to Sta 6477+77.67 79.9' Rt																																							
I-10 EB Sta 6481+83 50.5' Lt	126		24	24	134													1			DI					4.0	40				1056.82	1	2.5					CB126 to Outlet
to Sta 6481+83 74.90' Rt																																							
I-10 EB Sta 6487+14 50.5' Lt	128		24	24	109													1			DI					4.0	50				1047.44	1	2.5					CB128 to Outlet
to Sta 6487+14 58.5' Rt																																							
I-10 Med Sta 6545+71.32 2.5' Rt	130		28 x 20	28 x 20	6																C-15.90											1021.59							CB130 to Existing Pipe
to Sta 6545+86.88 0.30' Lt																																							See Detail D7
Sheet Total																								8					260										

FILL HEIGHT RANGE TABLE (Ft.)												
RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL HEIGHT (Ft.)	>	1	3	5	8	11	15	20	25	30	40	55	70
	≤	3	5	8	11	15	20	25	30	40	55	70	90

◒ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

◪ PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	M. WILLIAMS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

NEW PIPE SUMMARY SHEET

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

DWG NO G-05.02

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NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS ARE THE RECOMMENDED PRECISION OF THE VALUE TO BE ENTERED IN THE COLUMN.

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWING C-13.15

NOTE:
PIPE OPTIONS SELECTED ARE THOSE REQUIRED TO MEET MINIMUM SERVICE LIFE.
SHADED PIPE OPTION FIELDS ARE NOT ALLOWABLE ALTERNATES.

CSP - CORRUGATED STEEL PIPE
CAP - CORRUGATED ALUMINUM PIPE
RCP - REINFORCED CONCRETE PIPE
NRCP - NON-REINFORCED CONCRETE PIPE
NRCIPCP - NON-REINFORCED CAST-IN-PLACE CONCRETE PIPE
CHDPEPP - CORRUGATED HIGH DENSTIY POLYETHYLENE PLASTIC PIPE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				
		010 MA 120			

DESCRIPTION						CSP		CAP		RCP	NRCP	NRCIPCP	CHDPEPP	END TREATMENT														QUANTITIES	
			In.	In.	Ft.	Degree	In.	Coating	In.				In.	Each	Ea	Catch basin, Manhole, Headwall & Junction Structure			Ft.		Grate	Ft.					Cubic Yard	
Station	Plan Ref No.	Controlling Fill Height Range	Size, Corrugated	Size, Smooth	Length (0)	Skew (0)	Corrugation / Wall Thickness (0.00)	Zinc / Bit. Coated Zinc	Aluminum / Bit. Coated Aluminum	Corrugation / Wall Thickness (0.00)	Uncoated / Bit. Coated	Class - Non Trench	Class - Trench	Class / Min Wall Thickness (0)	AASHTO M-294 Type C / AASHTO M-294 Type S	C-13.20 & C-13.25 / Detail -	Size, (In) Manhole	End Sec / Standard or Detail	S-Single / D-Double	Location	H (0.0)	L Wing (0.0)	L 18" Slotted Drn (0)	L 24" Slotted Drn (0)	Type	Elev. (0.00)	Inlet Depression Depth	Inlet Depression L (0.0)	Pipe Exc (0)	Pipe Bkfl (0)	Drn Exc (0)	Berm/Dike Emb (0)	REMARKS
I-10 Med Sta 6557+66.79 2.5' Rt	132		28 x 20	28 x 20	6												C-15.90								1019.78							CBI32 to Existing Pipe
to Sta 6657+82.65 0.34' Rt																																See Detail D7
I-10 Med Sta 6558+25.33 2.5'Rt	134		28 x 20	28 x 20	6												C-15.90								1019.76							CBI34 to Existing Pipe
to Sta 6588+09.50 0.30' Rt																																See Detail D7
Sheet Total																																

FILL HEIGHT RANGE TABLE (Ft.)													
RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL HEIGHT (Ft.)	>	1	3	5	8	11	15	20	25	30	40	55	70
	≤	3	5	8	11	15	20	25	30	40	55	70	90

◒ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

	NAME	DATE
DESIGN	D. JERMELANO	04/08
DRAWN	M. WILLIAMS	04/08
CHECKED	D. SCHAUB	04/08

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

URS

NEW PIPE SUMMARY SHEET

PRELIMINARY
Stage III Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

DWG NO G-05.03

TRACS NO. H7211 01C

___ OF ___

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ccccSYSTIMEcccccccccDGNcSPECIFICATIONccccc

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

CSP - CORRUGATED STEEL PIPE

DESCRIPTION										CSP						END TREATMENT															QUANTITIES				
Station	Plan Reference Number	◒ Controlling Fill Height Range	Size	Length In Place (0.0)	Skew (0)	Remove & Salvage End Section	Remove Headwall	Left (0.0)	Right (0.0)	Left (0.0)	Right (0.0)	Corrugation	Wall Thickness (0.000)	Zinc	Aluminum	Bituminous	Reset Salvaged End Section	New	Detail	Size, (in.) Manhole	Detail C-4.20	S-Single / D-Double	Location	H (0.0)	L Wing (0.0)	L 18" Slotted Drn (0)	L 24" Slotted Drn (0)	Type	Elevation (0.00)	Depth	L (0.0)	Pipe Excavation (0)	Pipe Backfill (0) C-13.15	Drainage Excavation (0)	Berm Embankment (0)	Dike Embankment (0)	REMARKS
			In.	Ft.	Degree	Each	Ft.			Ft.			In.							Each						Ft.		Grate	Ft.		Inlet Depression C-13.70						
							Remove Existing Pipe			Extend										End Section C-13.25	Catch Basin, Manhole, Headwall & Junction Structure																
																															In.	Ft.				
6611+73.60 Med	100		24		0°						A	0.079	X				X																			
6618+67.97 WB	102		12		0°						A	0.079	X							X															Extension of Exst Downdrain
6621+10.13 WB	104		12		0°						A	0.079	X							X															Extension of Exst Downdrain
6621+23.74 Med	106		24		0°						A	0.079	X				X																		
Sheet Total																	2																		

FILL HEIGHT RANGE TABLE (Ft.)												
RANGE NO.		1	2	3	4	5	6	7	8	9	10	11	12
FILL HEIGHT (Ft.)	>	1	3	5	8	11	15	20	25	30	40	55	70
	≤	3	5	8	11	15	20	25	30	40	55	70	90

◒ SHOULD FIELD CONDITIONS VARY FROM THE RANGE INDICATED, CONTACT DESIGN FOR RE-EVALUATION OF PIPE DESIGN REQUIREMENTS.

◪ PIPE CORRUGATION			
A	2⅔x½	D	6x2
B	3x1	E	3x1 or 9x2½
C	9x2½		

NOTE:
FOR PIPE CULVERT PLACEMENT SEE STANDARD DRAWINGS C-13.10 AND C-13.15

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.000) IN THE HEADING OF SOME OF THE COLUMNS IS THE PRECISION OF THE DIMENSION FOR THAT COLUMN.

DESCRIPTION													END TREATMENT				LENGTH OF BARREL & BARREL EXTENSIONS										APPROXIMATE QUANTITIES							
Plan Ref No.	Structure Number	New	Extend	Number of Barrels	Barrel Span (0.0)	Barrel Height (0.0)	Culvert Length (0.0)	Skew (Degree) (0)	B-01.10 Miscellaneous Details	B-01.11 Extension Details	◪ Standard or Detail	▼ Location	WINGS		APRONS		MISCELLANEOUS										Lbs.	Ea.	Cubic Yards						
													Inlet Wings	Outlet Wings	◪ Standard or Detail	Apron	◪ Standard or Detail	Scour/Bank Protection	◪ Standard or Detail	Energy Dissipaters	Detail						◑ Reinforcing Steel (0)	◑ Place Dowels	◑ Class S Concrete f'c=3,000 PSI	◑ Remove Str Concrete (0)	◑ Structural Excavation (0)	◑ Structure Backfill (0)	Berm Embankment (0)	Dike Embankment (0)	Drainage Excavation (0)	REMARKS
Station:												Left																							
Existing:												Right																							
Station:												Left																							
Existing:												Right																							
Station:												Left																							
Existing:												Right																							

Construction ℄ / Existing & Construction ℄ / Extension Length

I II III IV V | V IV III II I

Barrel Length / Barrel Length

Linear Feet (0.0)

▲ Left of ℄ / ▲ Right of ℄

I II III IV V V IV III II I

Box Culvert Total

Box Culvert Total

Box Culvert Total

Sheet Total

NOTE:
FOR STRUCTURAL EXCAVATION, STRUCTURE BACKFILL PLACEMENT AND MEASUREMENT, SEE STANDARD DRAWING B-19.50

NOTE:
THE ZEROS IN PARENTHESIS (0, 0.0 & 0.00) IN THE HEADING OF SOME OF THE COLUMNS IS THE PRECISION OF THE DIMENSION FOR THAT COLUMN.

▲ Construction ℄ Looking Ahead

◑ TOTALS SHOWN FOR THE BOX CULVERT INCLUDE THE QUANTITIES FOR HEADWALLS, WINGS, APRONS, CURBS, CUT-OFF WALLS AND LAPS AT CONSTRUCTION JOINTS.

◪ STRUCTURES SECTION STANDARD DRAWINGS JUNE, 1992 (PUBLICATION NO. 31-002) (ENGLISH EDITION)

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

CSP PIPE EXT SUMMARY SHEET & RCB CULVERT SUMMARY SHEET

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

DWG NO G-05.04

___ OF ___

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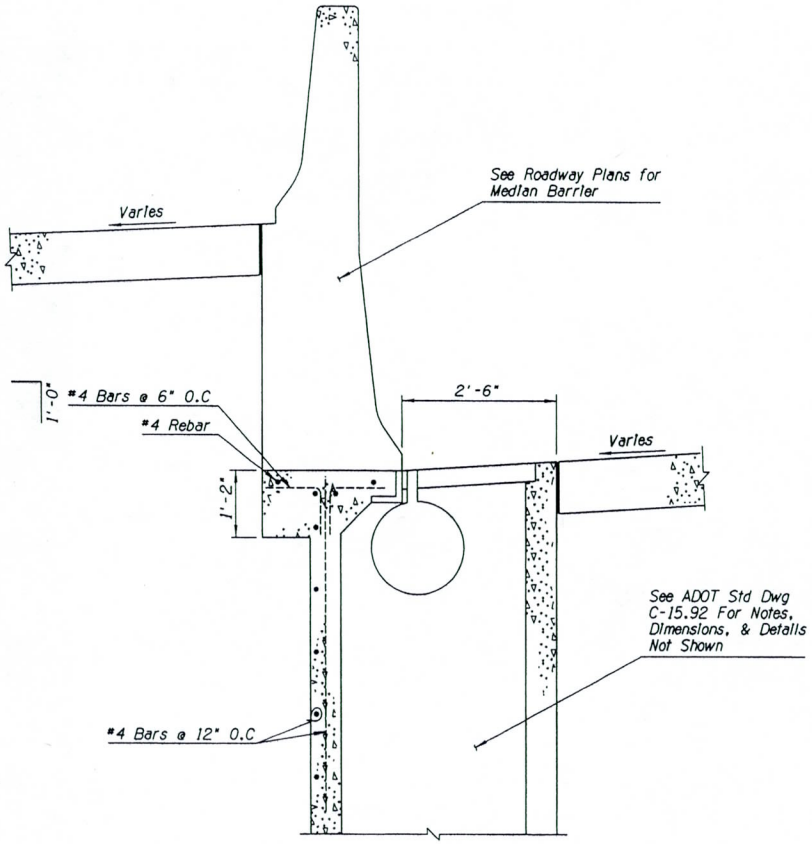
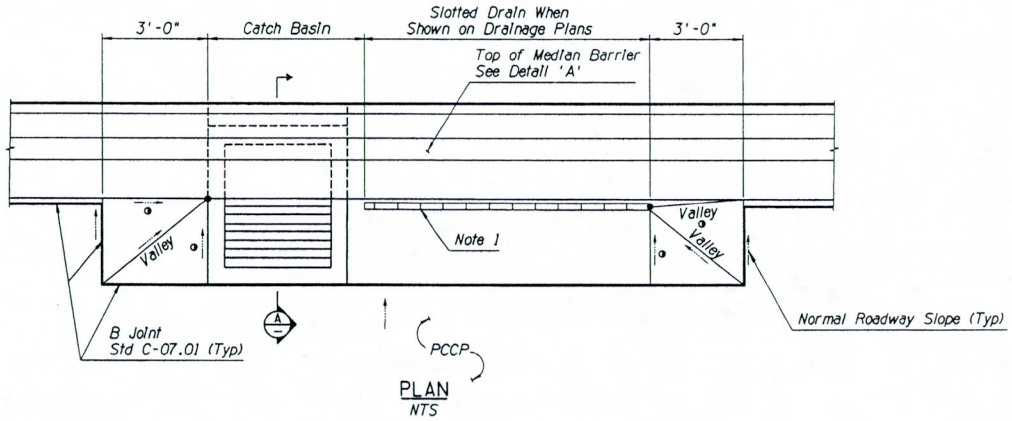
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



SECTION A-A
MODIFIED STD C-15.92 CATCH BASIN
NTS



PLAN
NTS

NOTE:

1. See ADOT Std. Dwgs C-13.60 & C-15.92 for Slotted Drain Details.

● See "Inlet Depression" New Pipe Summary.

◑ Match Inlet Depression.

DETAIL D1

CATCH BASIN
MODIFIED C-15.92

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	R SRIPADA	04/08
CHECKED	R STUART	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAIL D1

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

DWG NO D-01.01

TRACS NO. H7211 01C

___ OF ___

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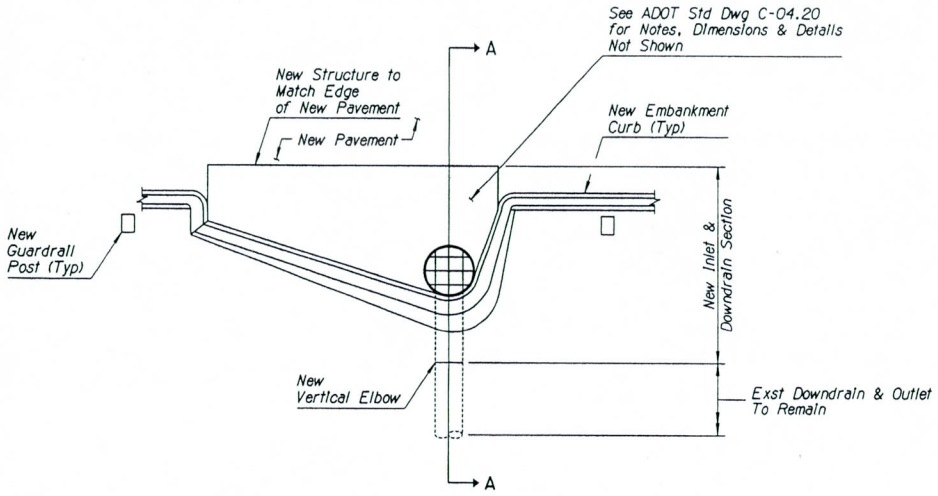
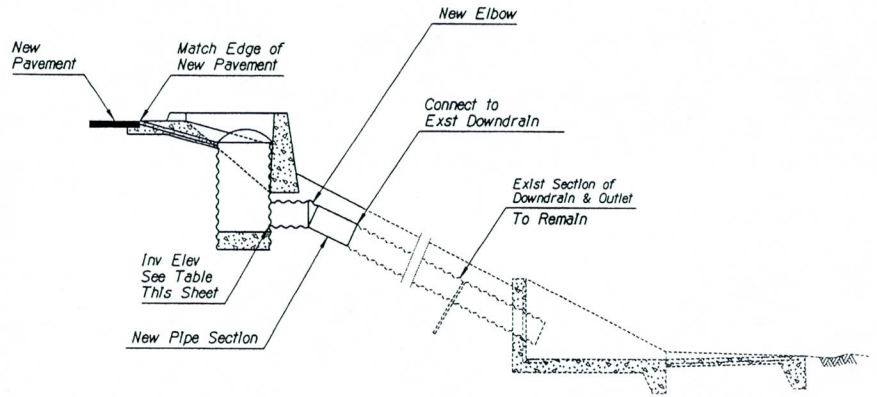
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



PLAN VIEW
NTS

DOWNDRAIN SCHEDULE		
Location (Station)	Grate Elev (Ft)	Inv Elev (Ft)
6580+52.62 I-10 EB		
6582+83.32 I-10 WB		
6613+69.60 I-10 EB		
6613+69.64 I-10 WB		
6618+69.83 I-10 WB		
6618+69.94 I-10 EB		
6624+32.88 I-10 EB		



SECTION A-A
NTS

DETAIL D2

DOWNDRAIN RECONSTRUCTION

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAIL D2

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-01.02

___ OF ___

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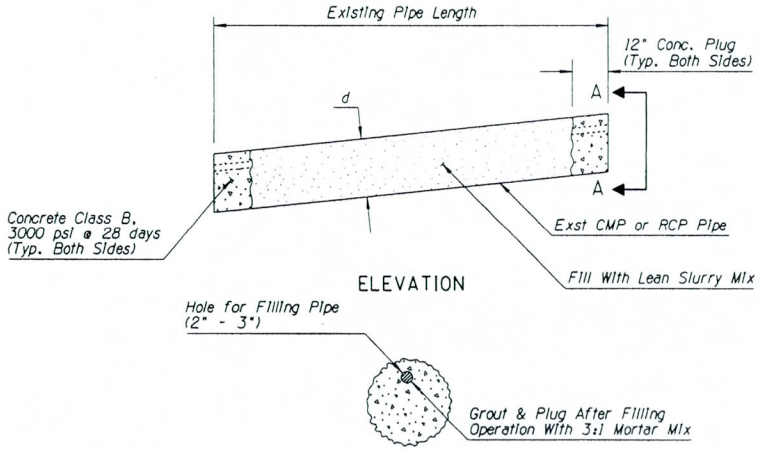
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				
		010 MA 120			

PIPE SLEEVE FILLING SCHEDULE			
I-10 Med Cst ℄ Station[1]	d (Inches)	Pipe Length (feet)	Pipe Type
6378+00	24	73	CMP
6387+00	24	71	CMP
6407+00	24	113	CMP
6444+00	24	43	CMP
6453+00	24	58	CMP
6456+50	24	63	CMP
6497+84	24	55	CMP
6508+20	24	67	CMP
6515+25	24	76	CMP

[1]Refer to Utility & Removal Plans.



DETAIL D3

PIPE PLUGGING DETAIL

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D JERMELAND	04/08

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

URS

DETAIL SHEET
DETAIL D3

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-01.03

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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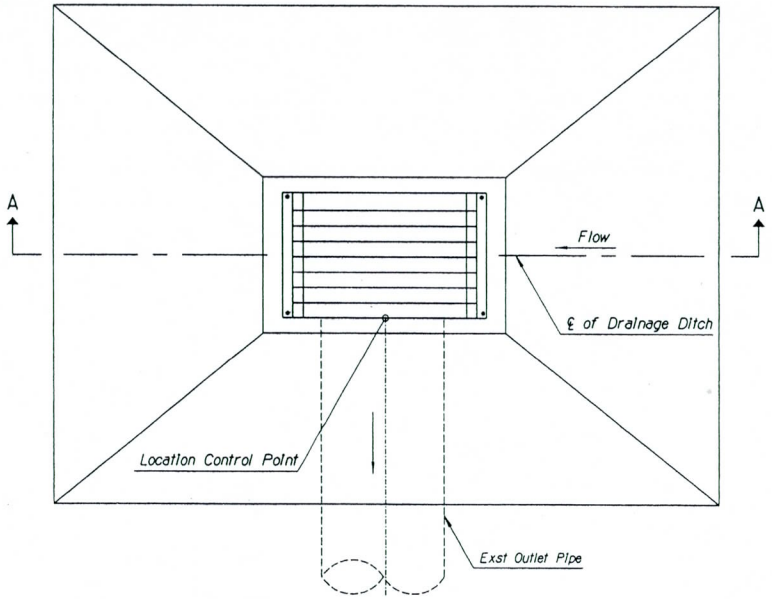
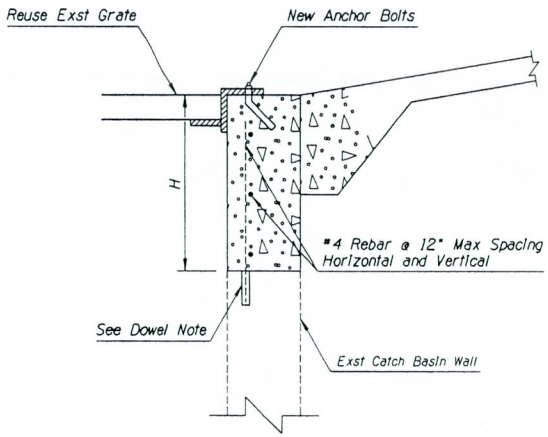
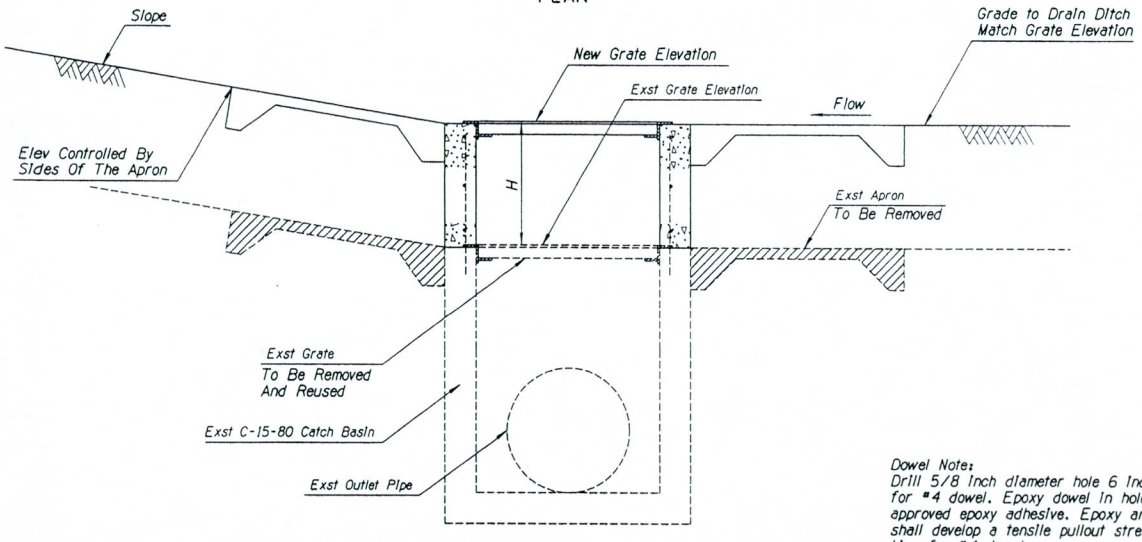
FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



PLAN





SECTION A-A

I-10 MED STATION	EXST GRATE ELEV (FT)	NEW GRATE ELEV (FT)	"H" (FT)
6537+86.83	1026.57	1029.60	3.03
6562+49.31	1019.90	1022.11	2.21
6570+23.86	1029.41	1032.13	2.72
6583.78.30	1029.78	1030.49	0.71
6592+99.56	1019.75	1020.90	1.15
6611+73.83	1023.96	1024.68	0.72
6621+23.79	1015.81	1017.02	1.21

Dowel Note:
Drill 5/8 Inch diameter hole 6 Inches deep for #4 dowel. Epoxy dowel in hole with an approved epoxy adhesive. Epoxy anchorage shall develop a tensile pullout strength of 6 kips for #4 dowels.

DETAIL D4

CATCH BASIN
RECONSTRUCTED C-15.80

	NAME	DATE
DESIGN	R STUART	04/08
DRAWN	K THOMAS	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAIL D4

PRELIMINARY
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

DWG NO D-01.04

___ OF ___

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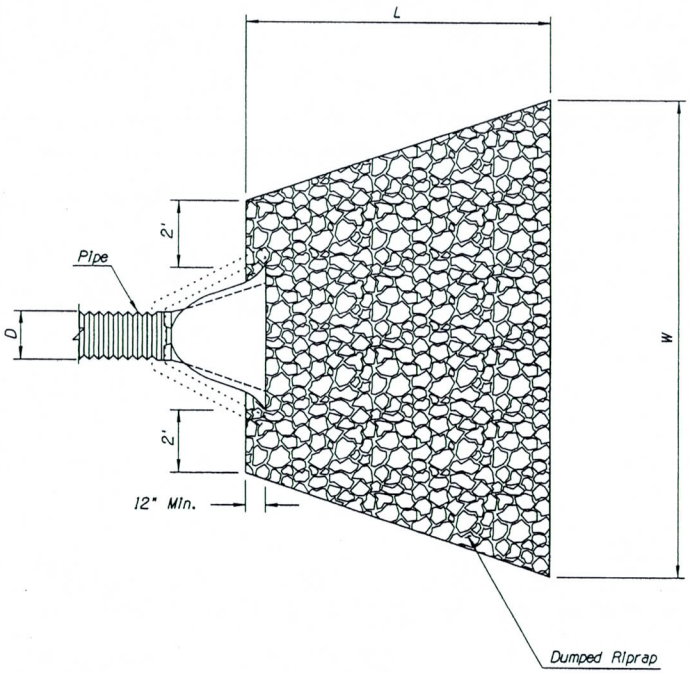
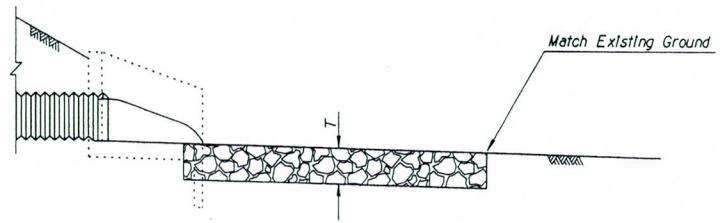
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120





RIPRAP APRON LOCATION

Pipe Station or Location	D (IN)	L (FT)	W (FT)	T (IN)	D_{50}=6" 9130051 (CY)	D_{50}=9" 9130052 (CY)	Remarks
6342+93.21 I-10 WB	24	10	13	12	4		
6360+17.00 I-10 WB	24	10	13	12	4		
6363+15.00 I-10 WB	24	10	13	12	4		
6371+85.00 I-10 WB	24	10	13	12	4		
6456+34.83 I-10 WB	24	10	13	12	4		
6459+54.45 I-10 WB	24	10	13	12	4		
6463+31.30 I-10 WB	24	10	13	12	4		
6467+15.00 I-10 WB	24	10	13	12	4		
6477+77.67 I-10 EB	24	10	13	12	4		
6481+83.00 I-10 EB	24	10	13	12	4		
6487+14.00 I-10 EB	24	10	13	12	4		

NOTES

The geometric shape of the apron may vary to match the existing site conditions as directed by the Engineer.

DETAIL D5

RIPRAP APRON

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN		04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAIL D5

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

DWG NO D-01.05

TRACS NO. H7211 01C

___ OF ___

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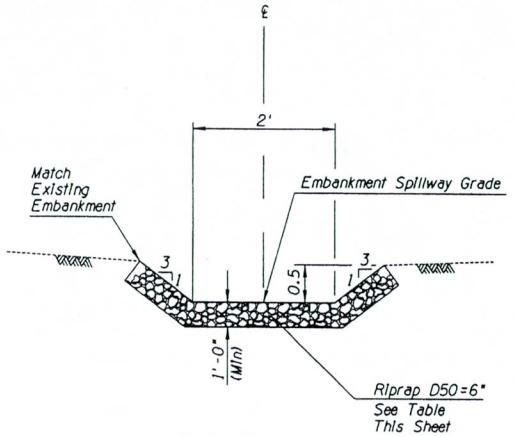
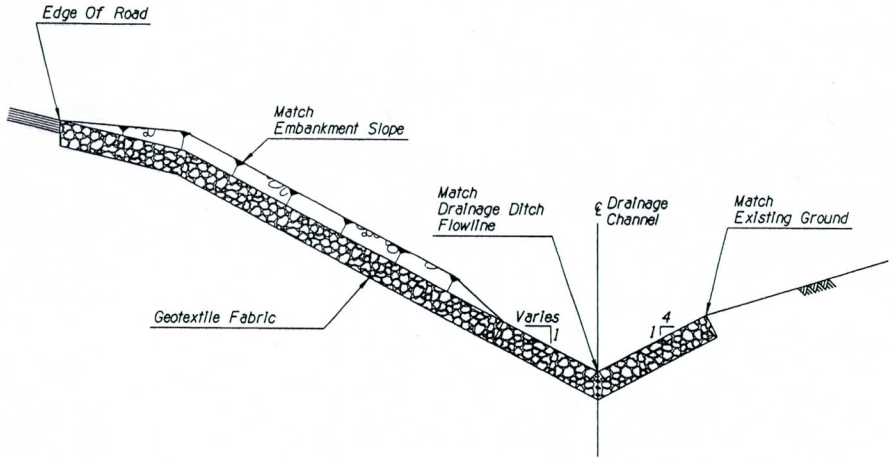
F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

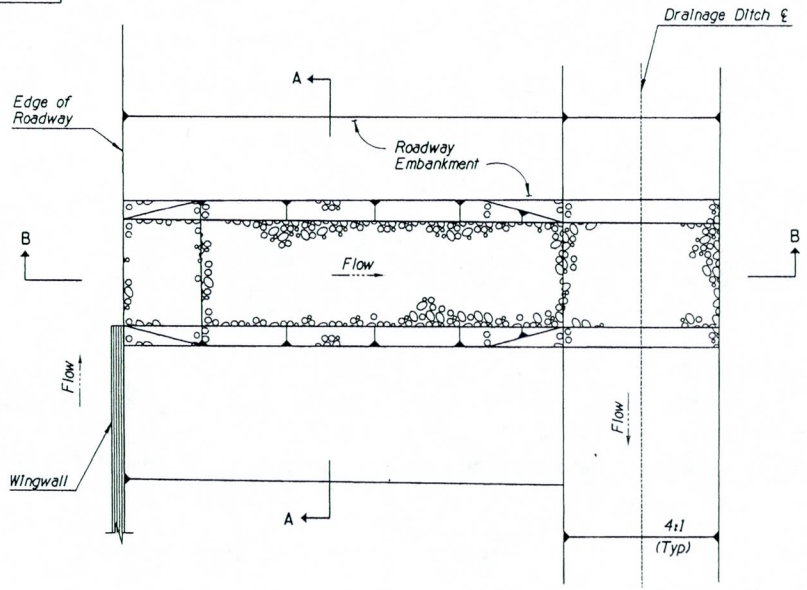
Dumped Riprap Gradation	
D_{50}= 6"	
Size of Rocks	% Passing
12"	90-100
9"	70-85
6"	30-50
4"	5-15
2"	0-5



SECTION A-A
TYPICAL SECTION



SECTION B-B
RIPRAP EMBANKMENT SPILLWAY PROFILE



DETAIL D6

RIPRAP EMBANKMENT SPILLWAY

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN		04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAIL D6

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION	DWG NO
I-10	VERRADO WAY TO SARIVAL AVE	D-01.06

TRACS NO. H7211 01C

___ OF ___

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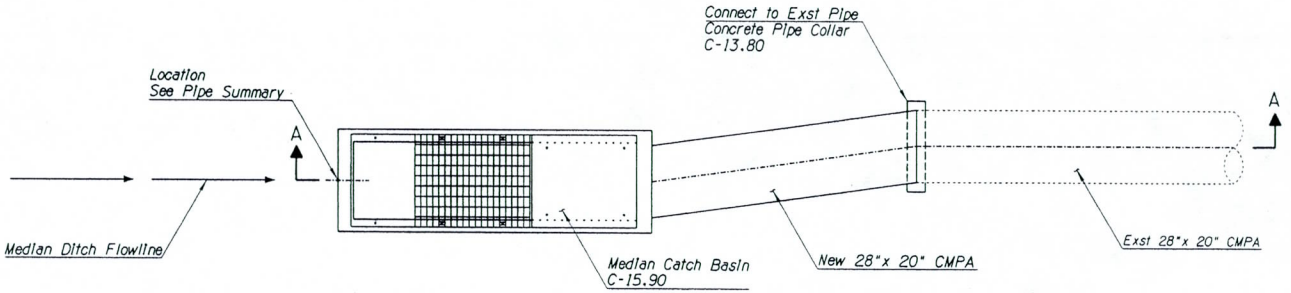
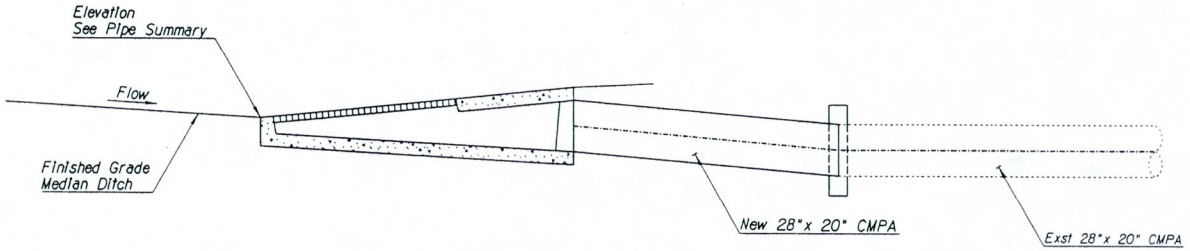
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



PLAN



SECTION A-A

DETAIL D7

RELOCATION OF MEDIAN CATCH BASINS

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAIL D7

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION	DWG NO
I-10	VERRADO WAY TO SARIVAL AVE	D-01.07

TRACS NO. H7211 01C

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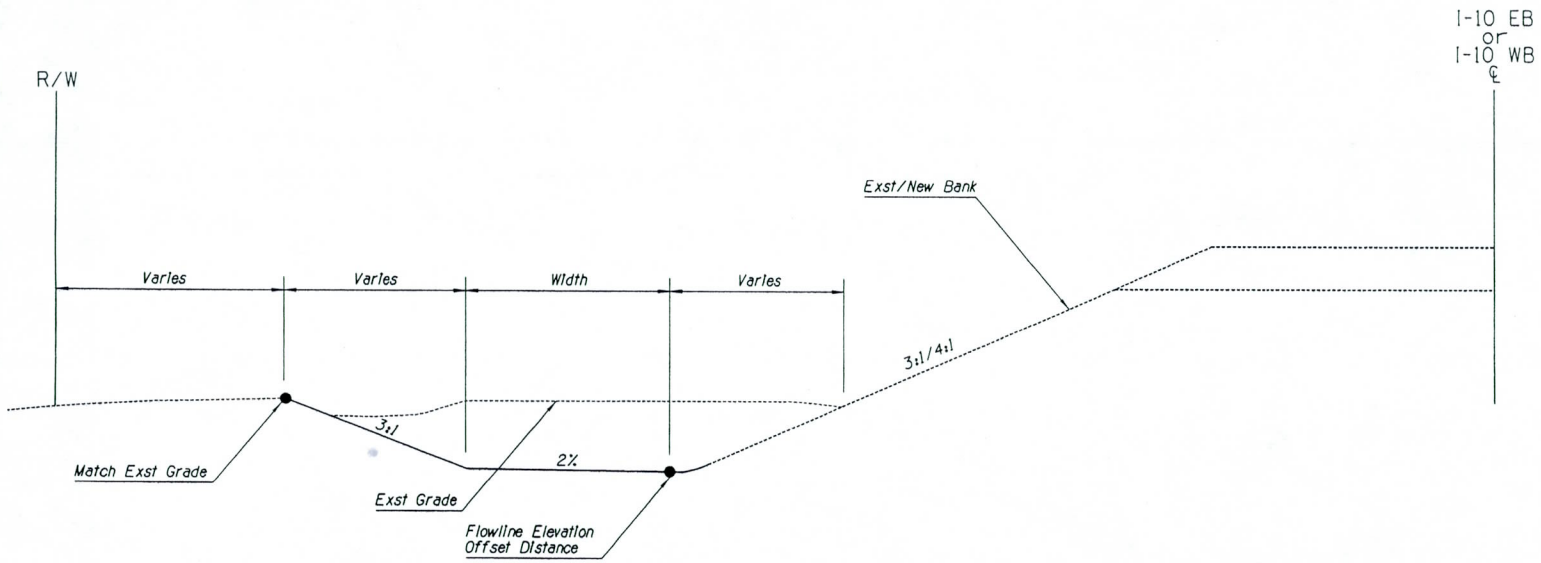
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



DRAINAGE DITCH 'A'

GEOMETRICS			
STATION	I-10 EB OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'B'

GEOMETRICS			
STATION	I-10 WB OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'C'

GEOMETRICS			
STATION	OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'D'

GEOMETRICS			
STATION	OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'E'

GEOMETRICS			
STATION	OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DETAIL D8

Sheet 1 of 2

DRAINAGE DITCH

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAIL D8

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-01.08

___ OF ___

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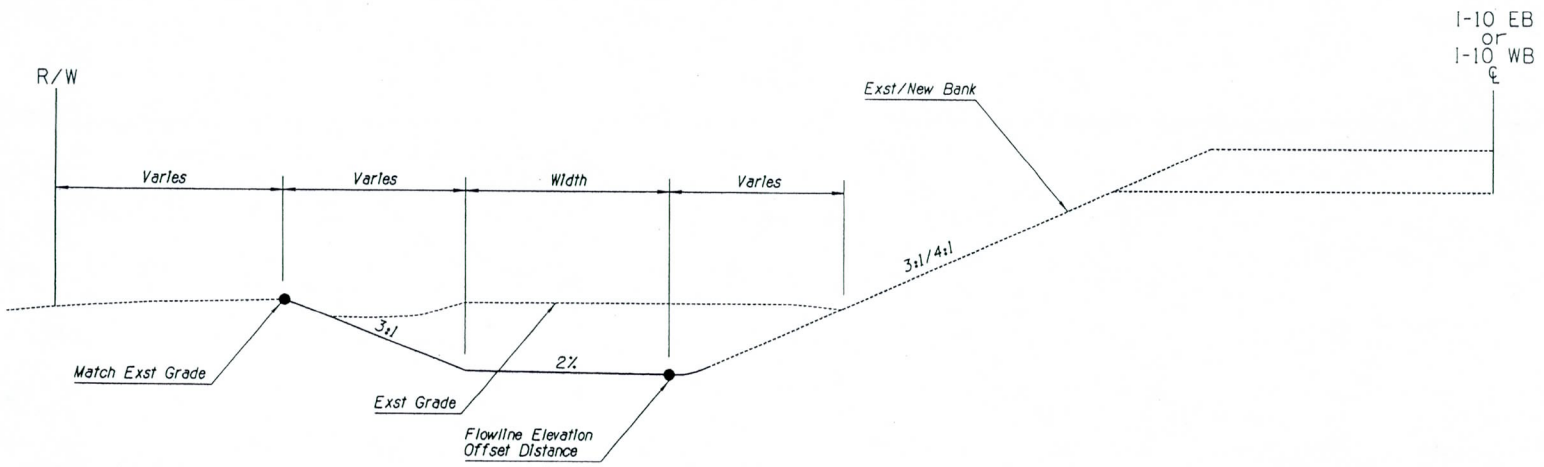
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



DRAINAGE DITCH 'F'

GEOMETRICS			
STATION	I-10 EB OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'G'

GEOMETRICS			
STATION	I-10 WB OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'H'

GEOMETRICS			
STATION	OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'I'

GEOMETRICS			
STATION	OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'J'

GEOMETRICS			
STATION	OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DRAINAGE DITCH 'K'

GEOMETRICS			
STATION	OFFSET	WIDTH	FLOWLINE ELEVATION
.	.	.	.

DETAIL D8

Sheet 2 of 2

DRAINAGE DITCH

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

DETAIL SHEET
DETAIL D8

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-01.08

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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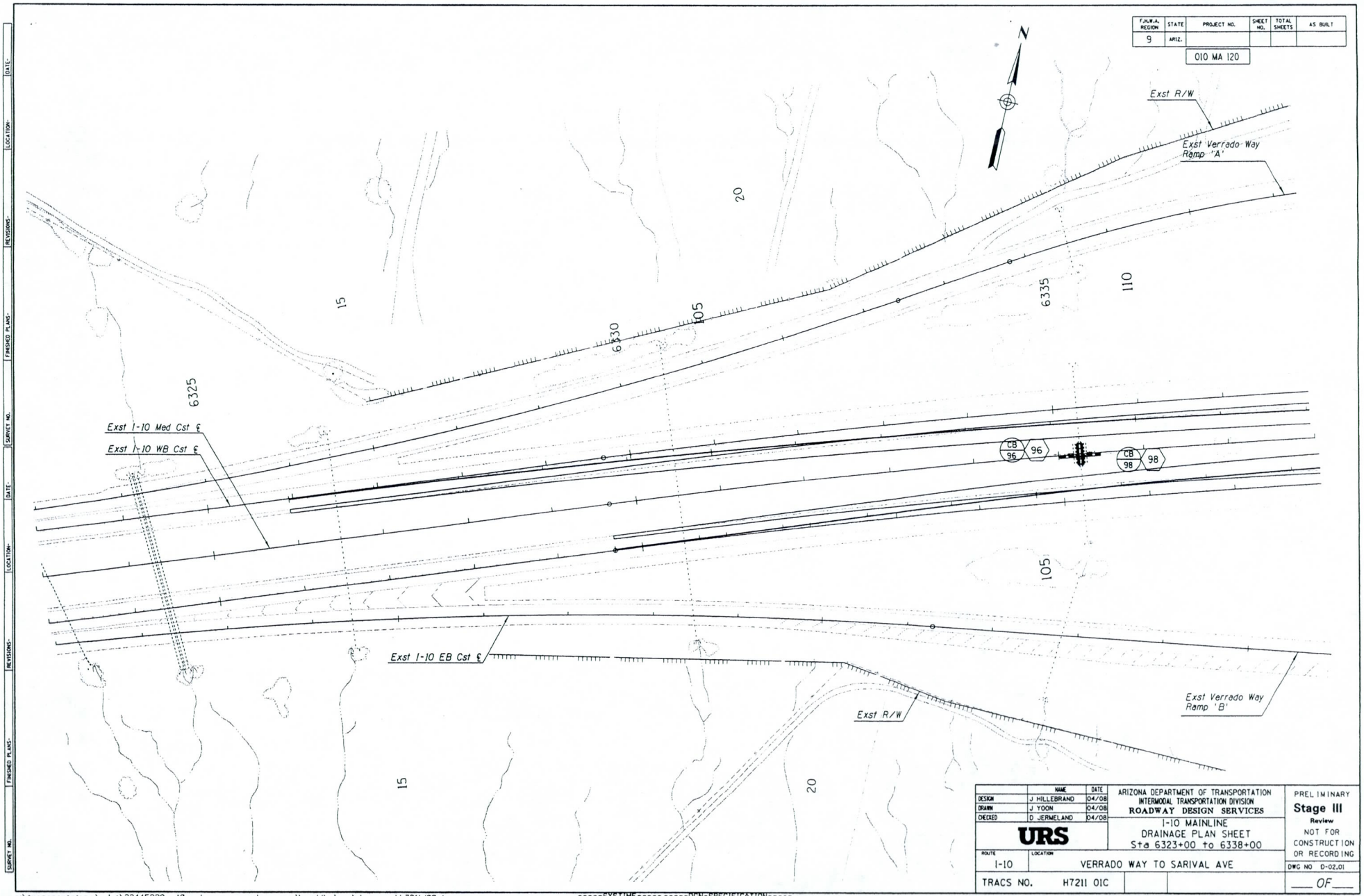

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6323+00 to 6338+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.01

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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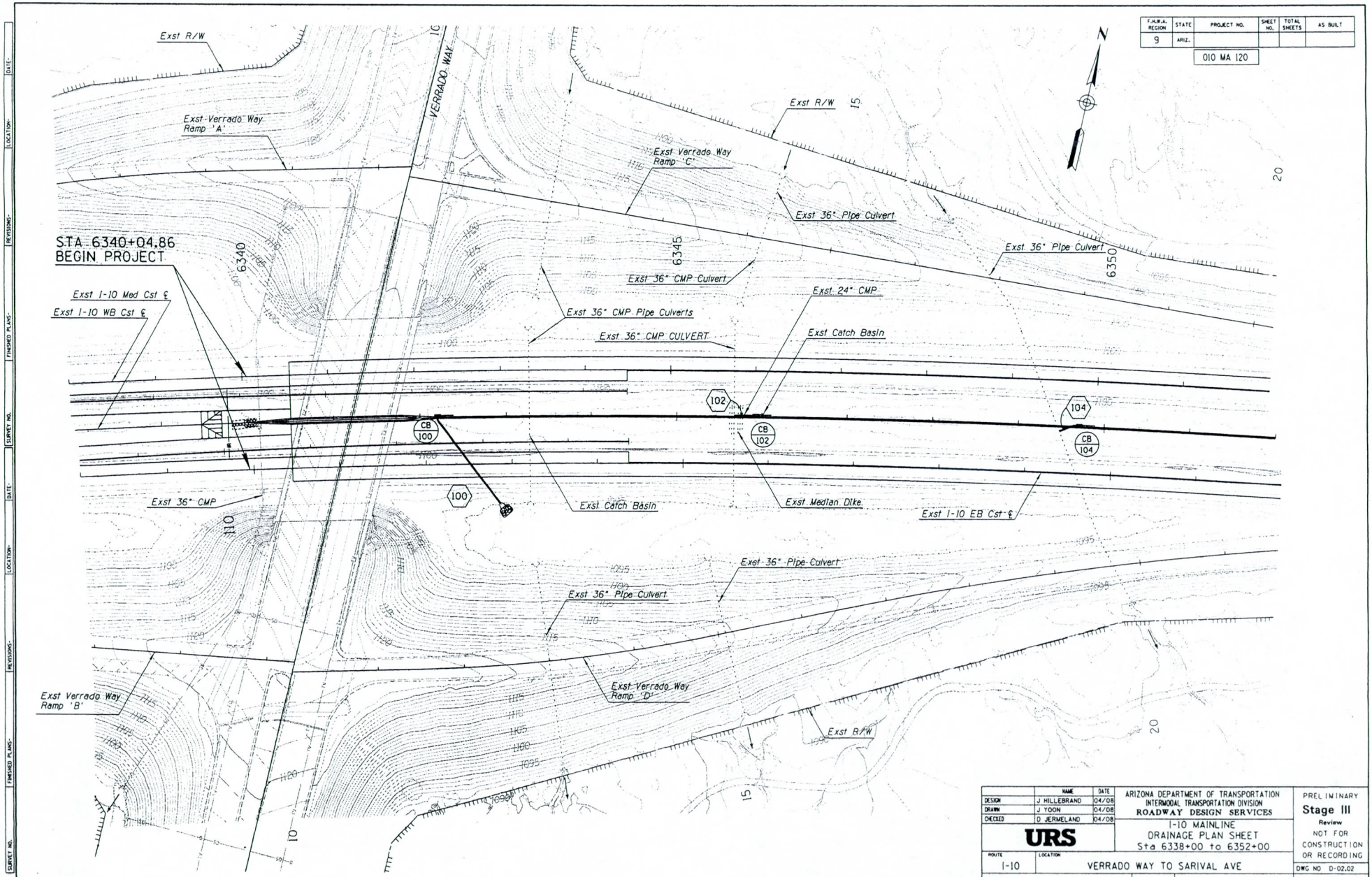

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6338+00 to 6352+00

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

DWG NO D-02.02

TRACS NO. H7211 01C

___ OF ___

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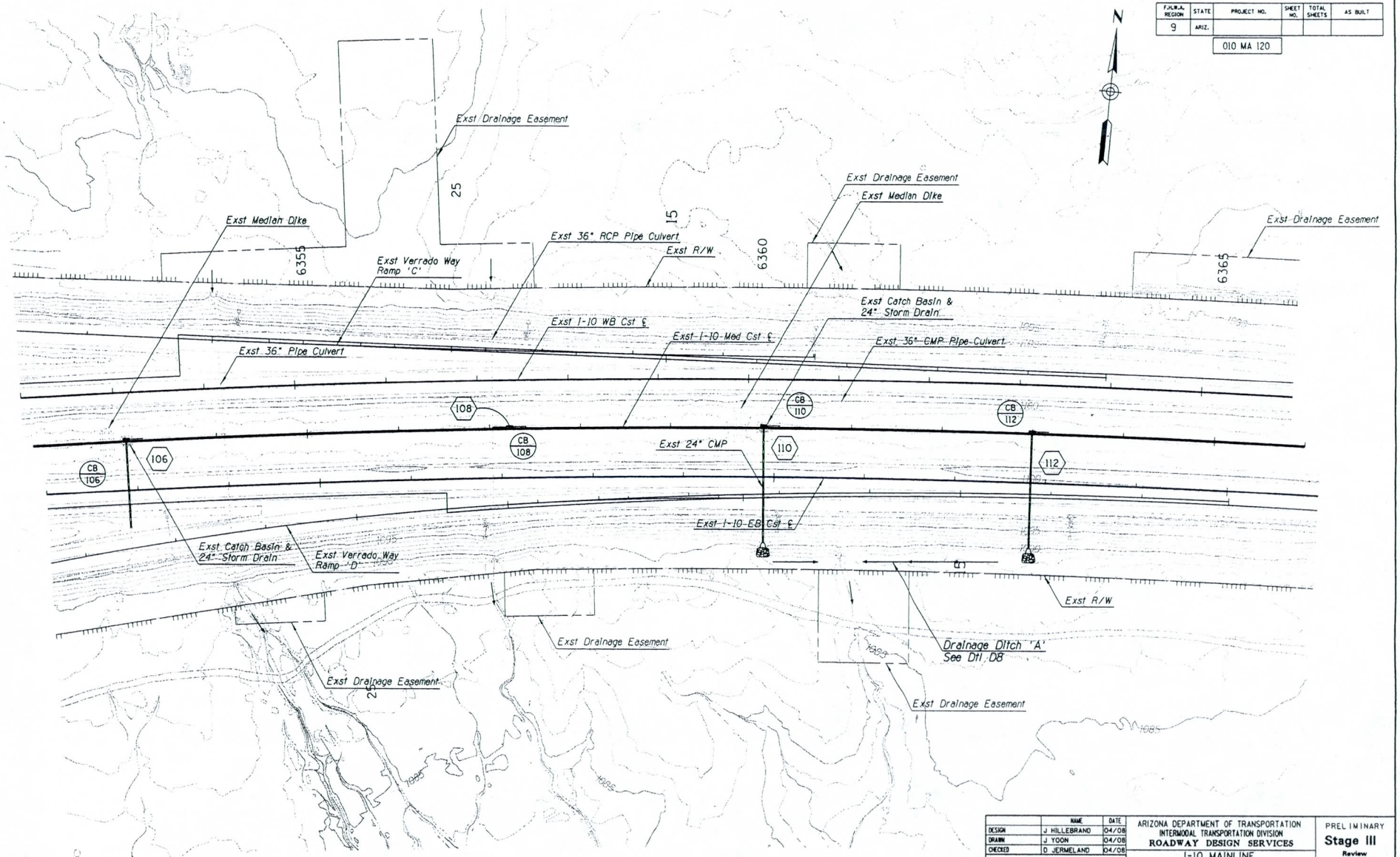

FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6352+00 to 6366+00

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.03

___ OF ___

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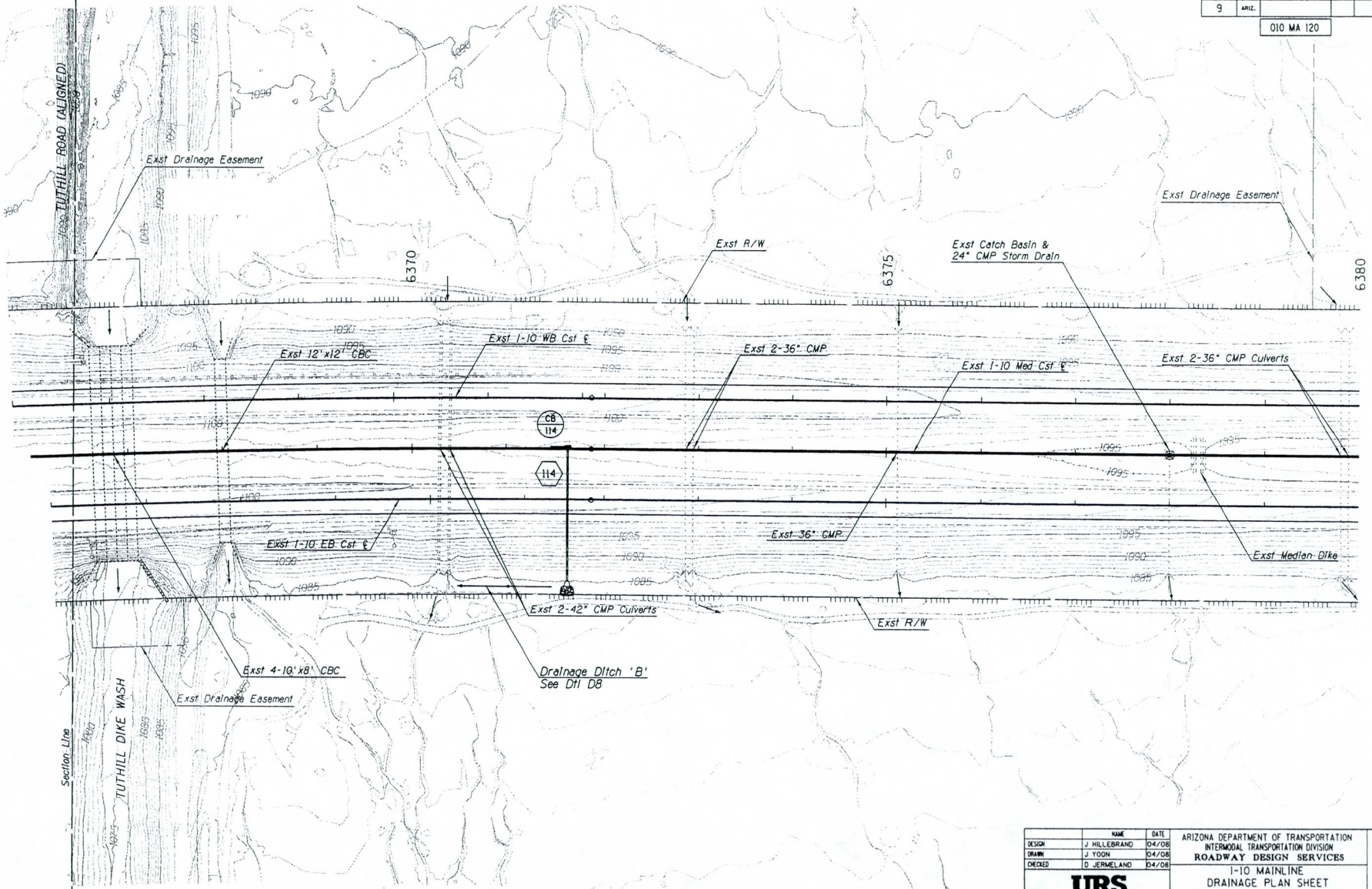

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6366+00 to 6380+00

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.04

___ OF ___

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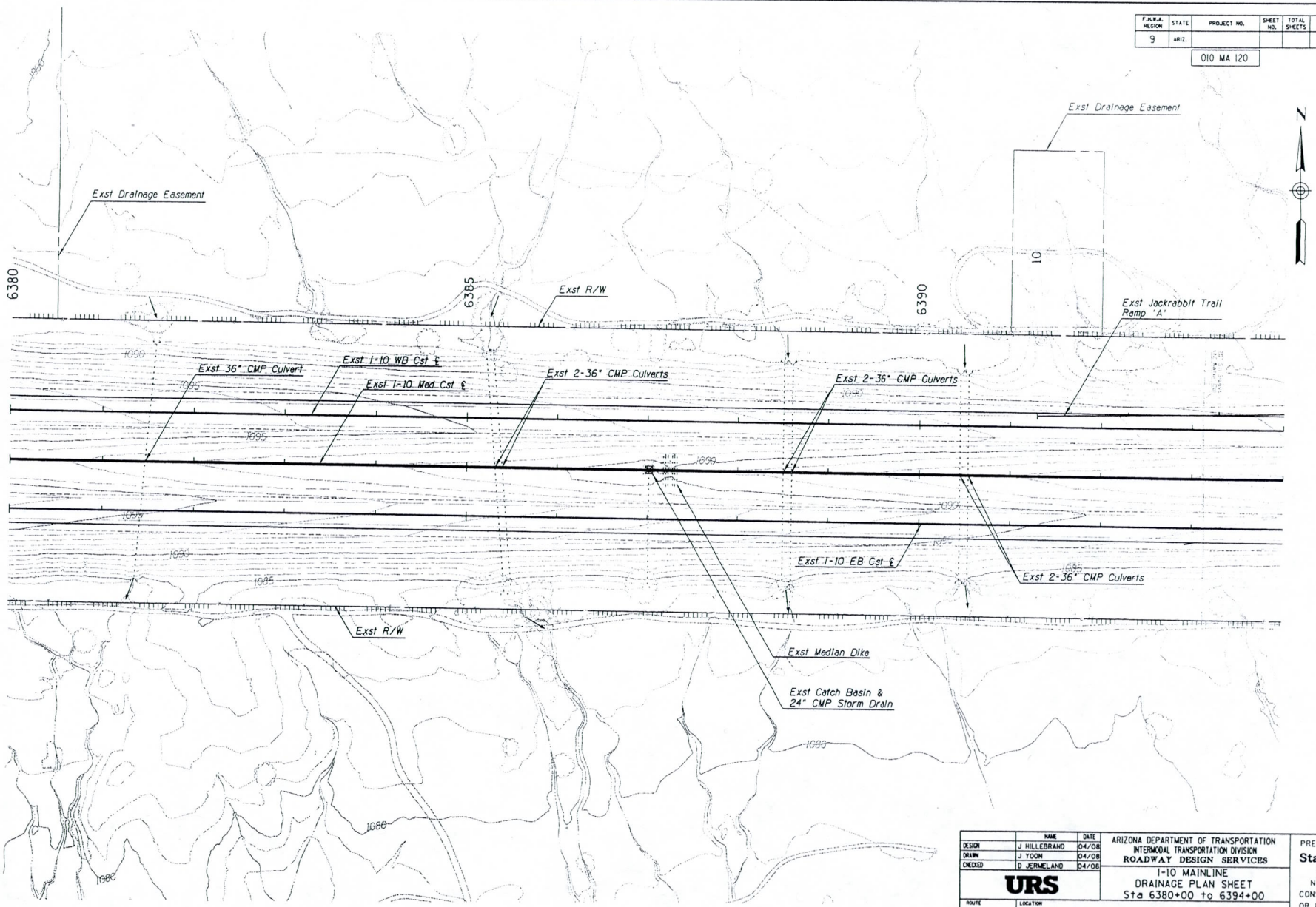

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6380+00 to 6394+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.05

___ OF ___

SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE- | SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE-

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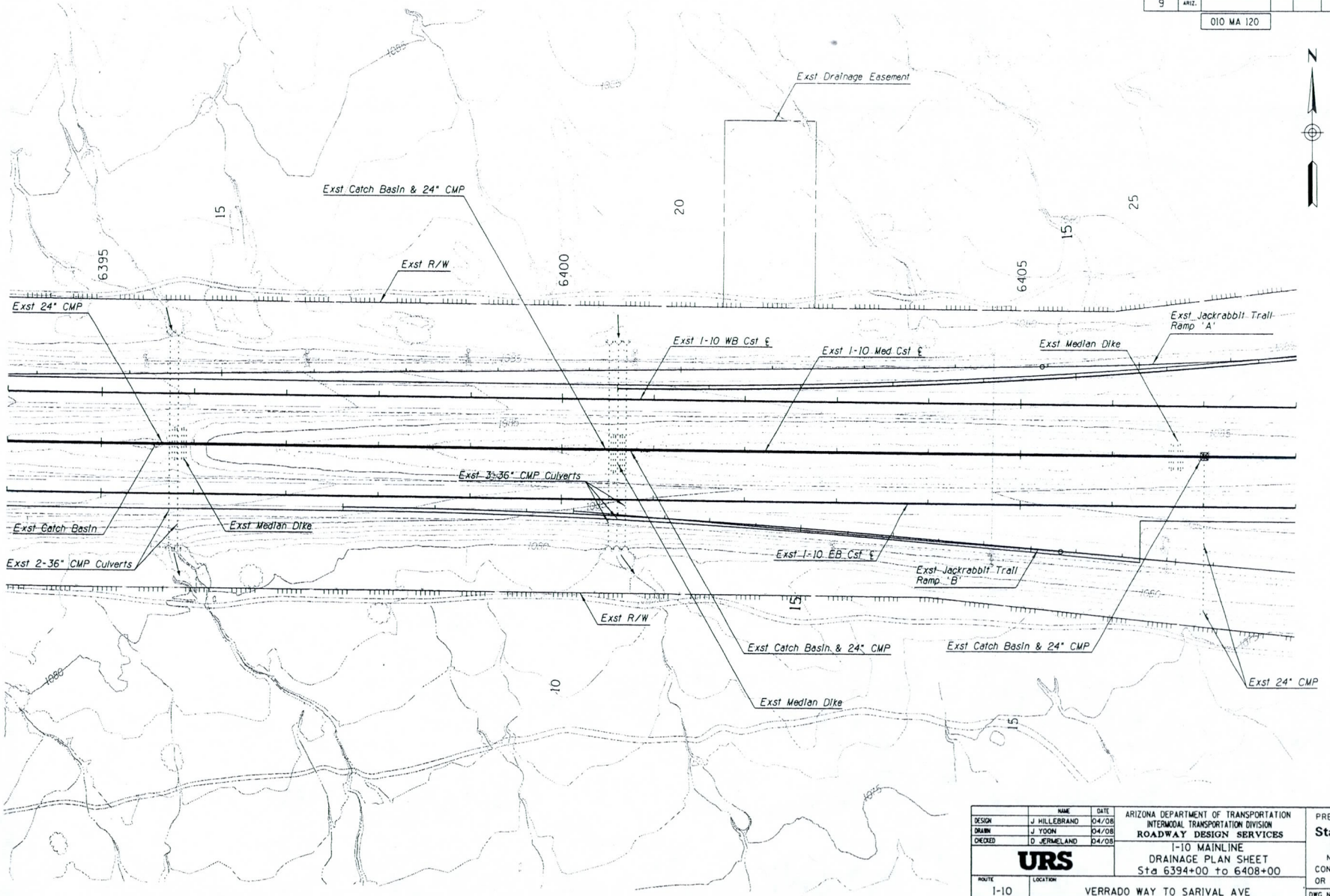
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6394+00 to 6408+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.06

___ OF ___

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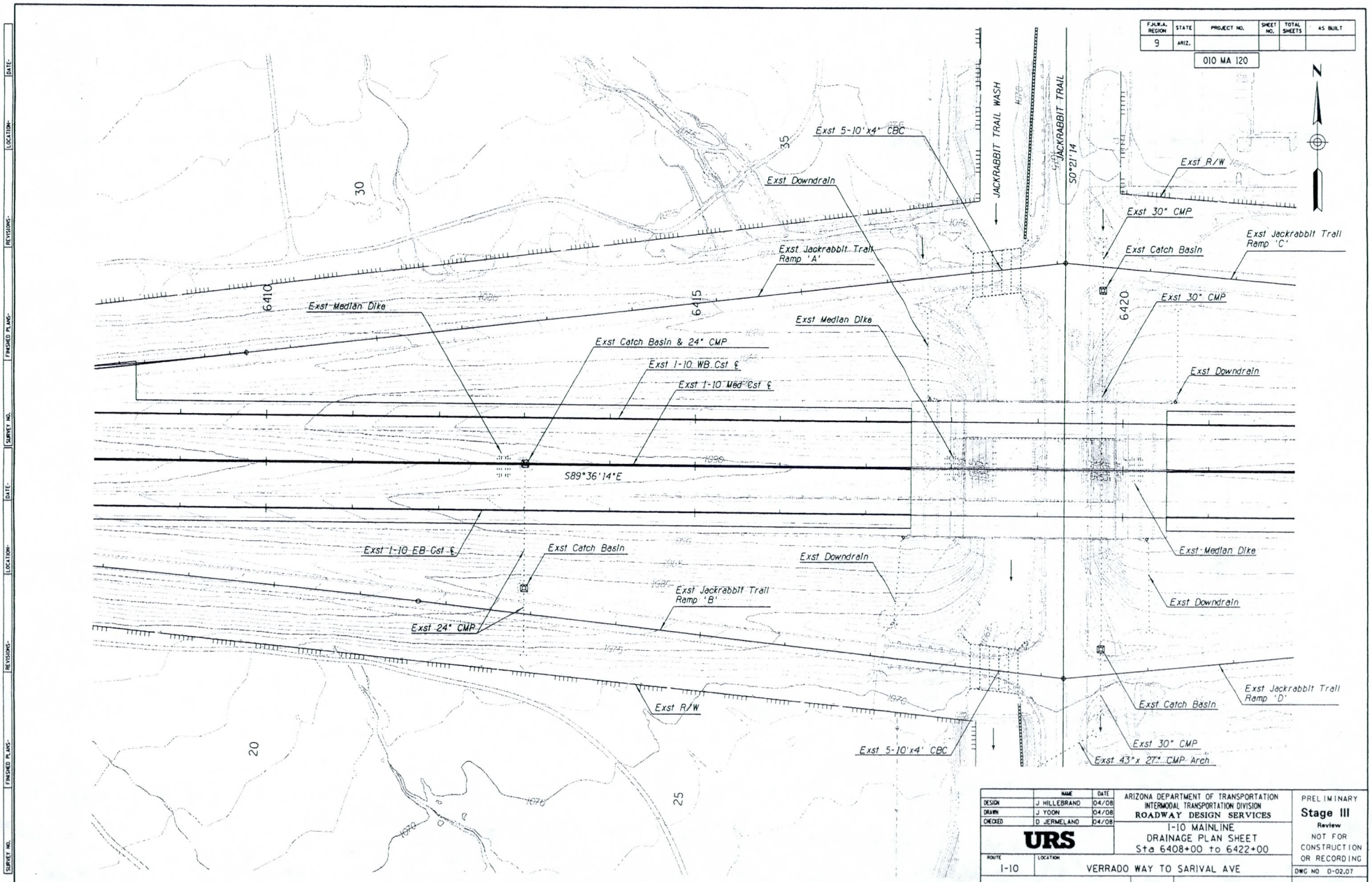

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

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	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6408+00 to 6422+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.07

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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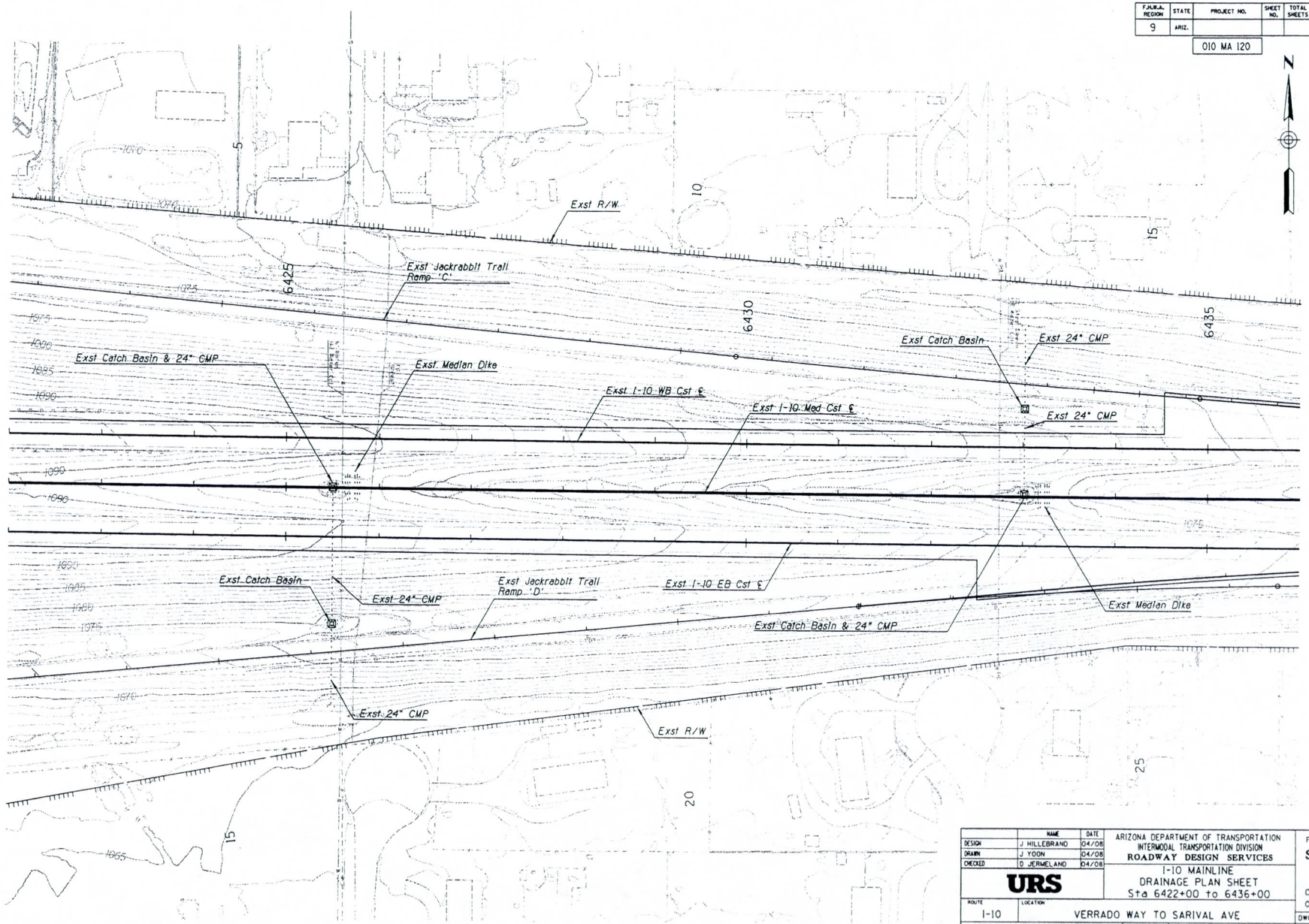
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	010 MA 120			



	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6422+00 to 6436+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.08

___ OF ___

SURVEY NO. | FINISHED PLANS: | REVISIONS: | LOCATION: | DATE: | SURVEY NO. | FINISHED PLANS: | REVISIONS: | LOCATION: | DATE:

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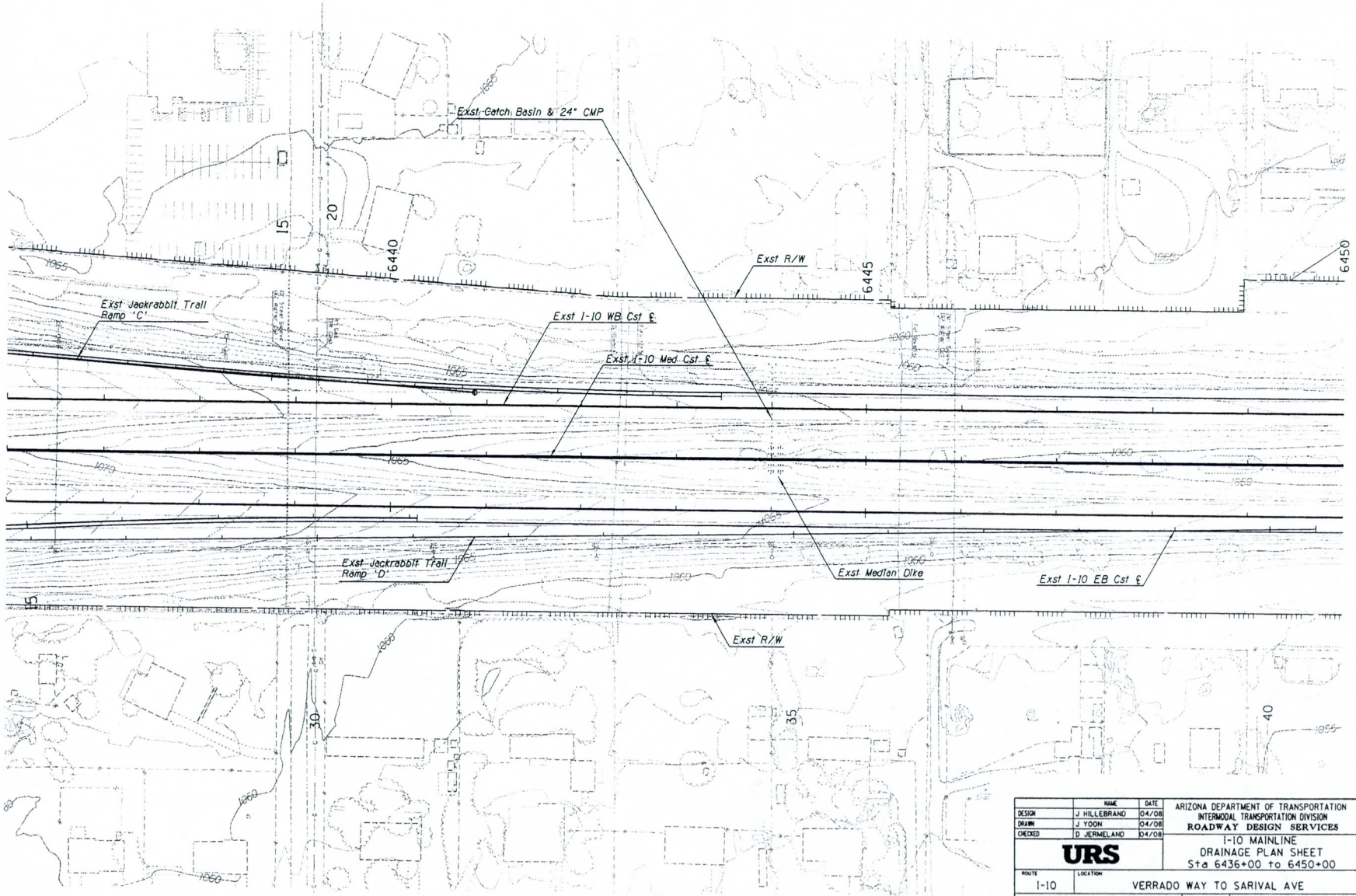
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6436+00 to 6450+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.09

___ OF ___

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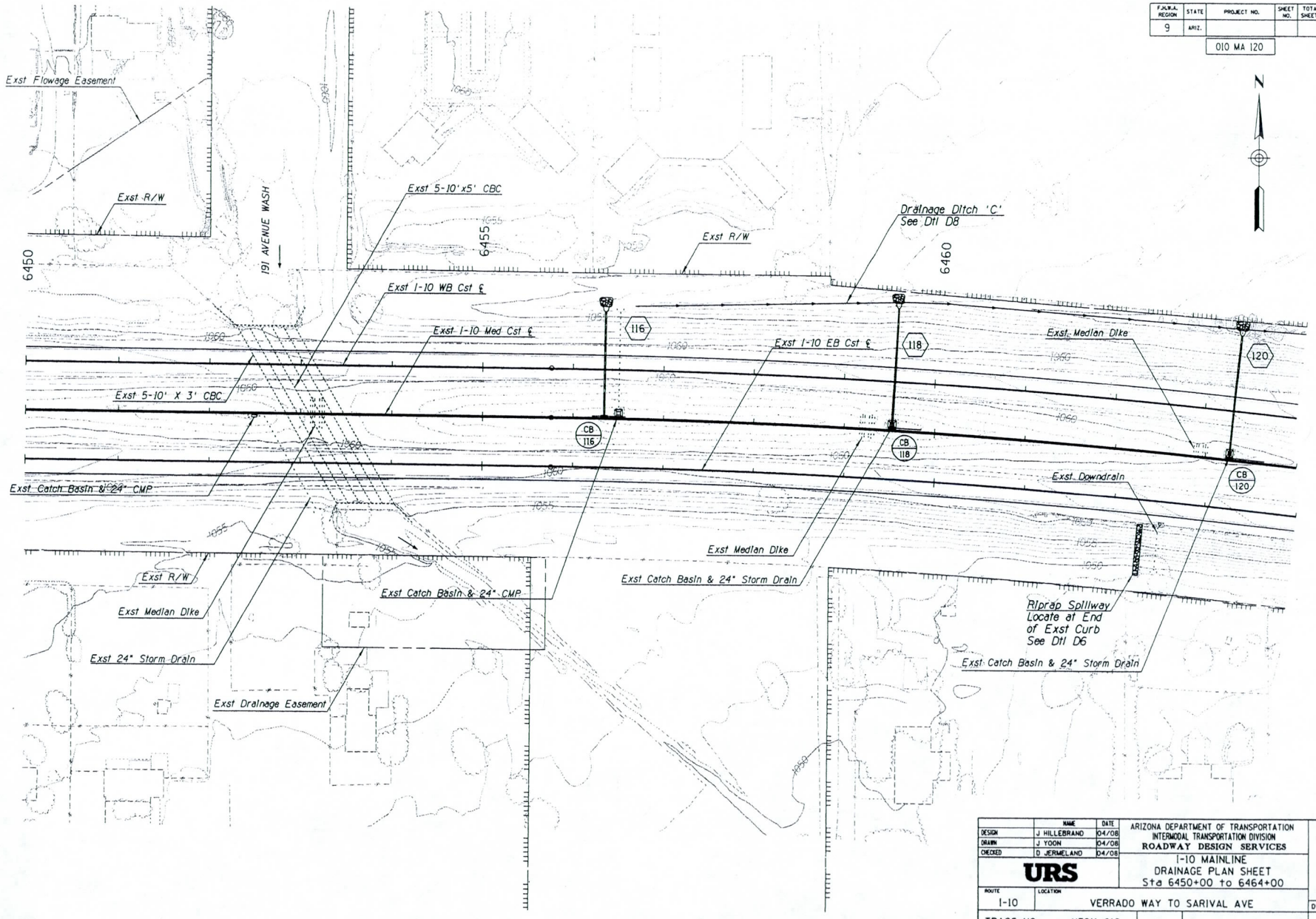

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6450+00 to 6464+00

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.10

___ OF ___

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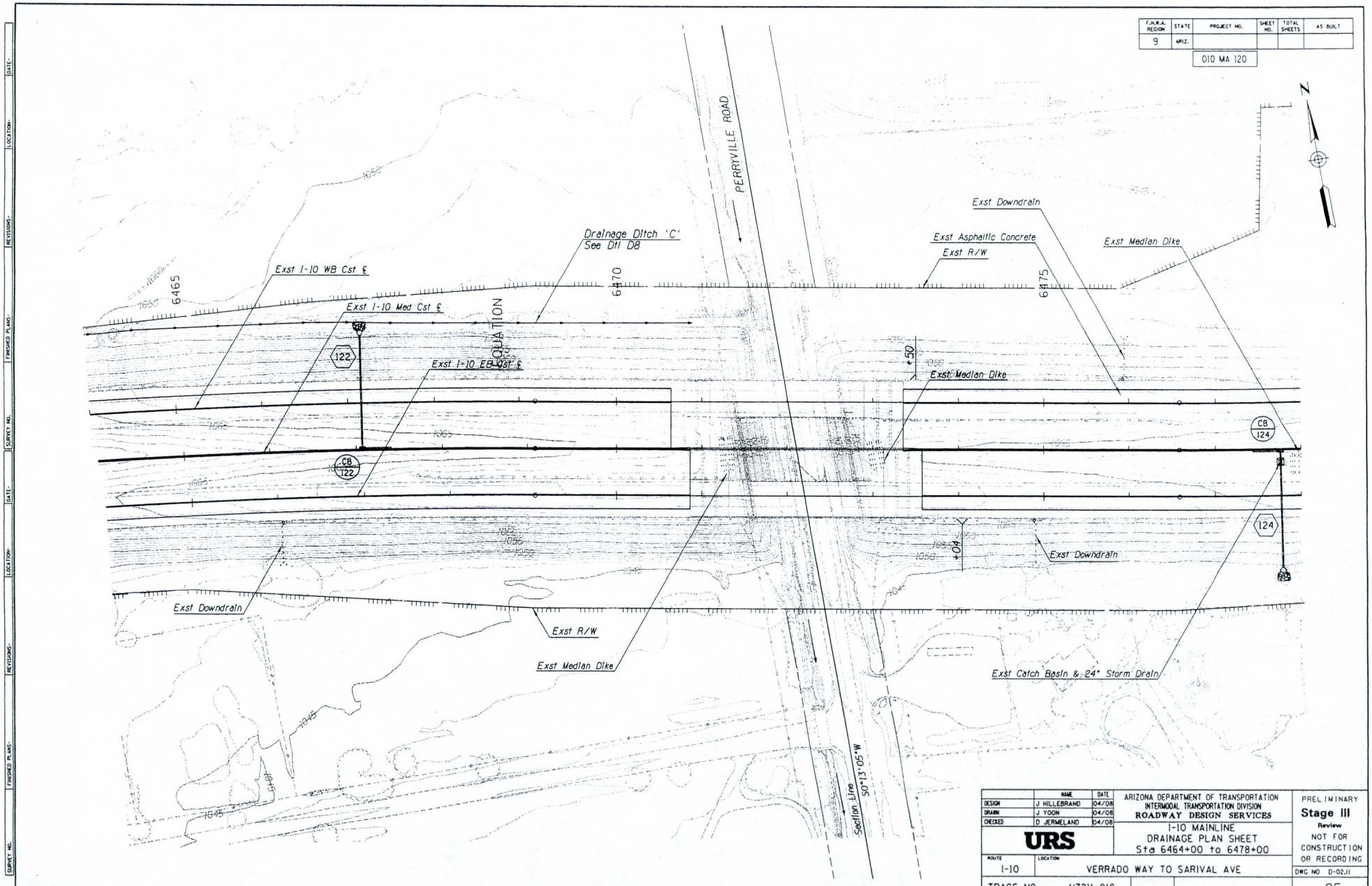

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6464+00 to 6478+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.11

___ OF ___

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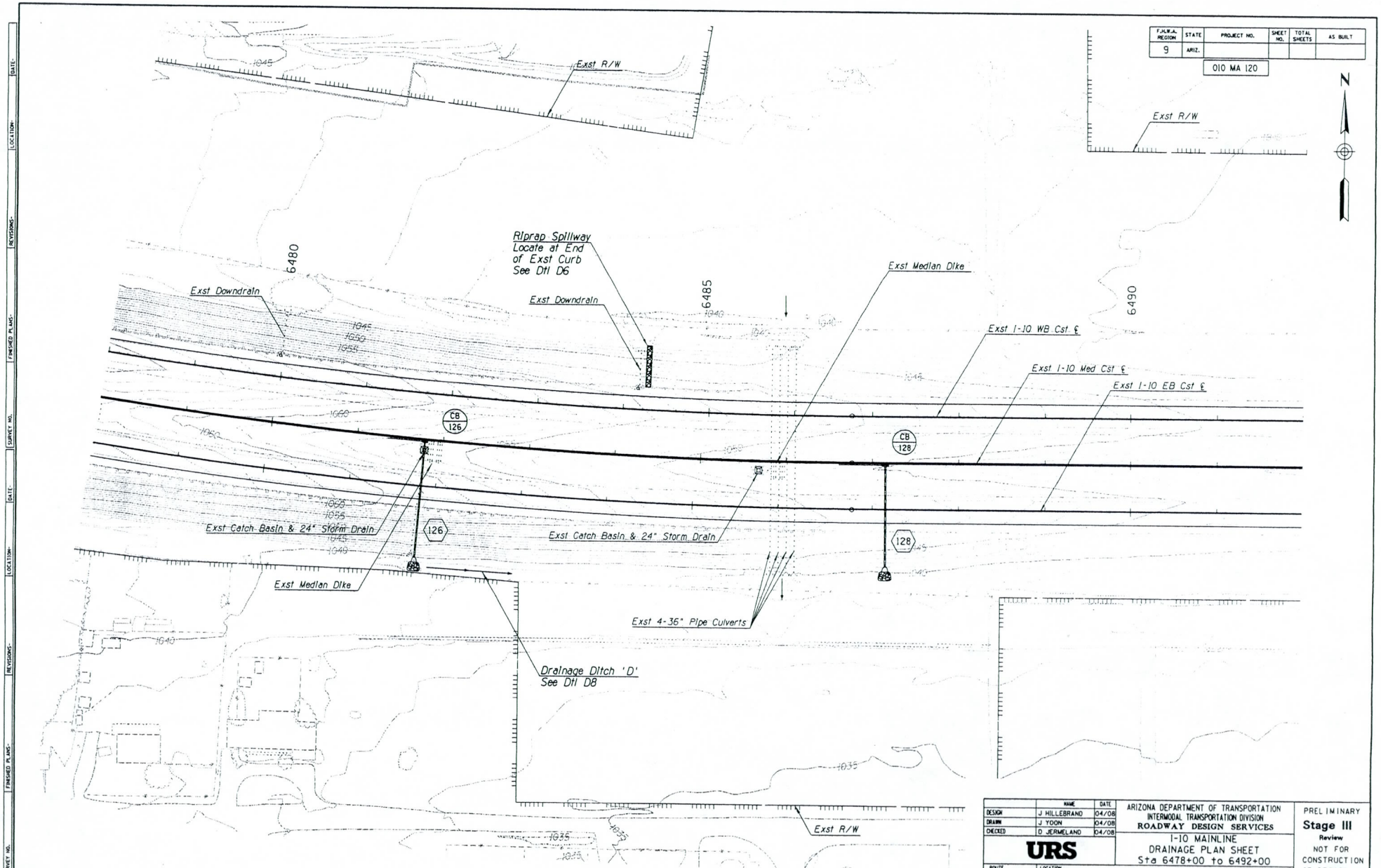

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6478+00 to 6492+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.12

___ OF ___

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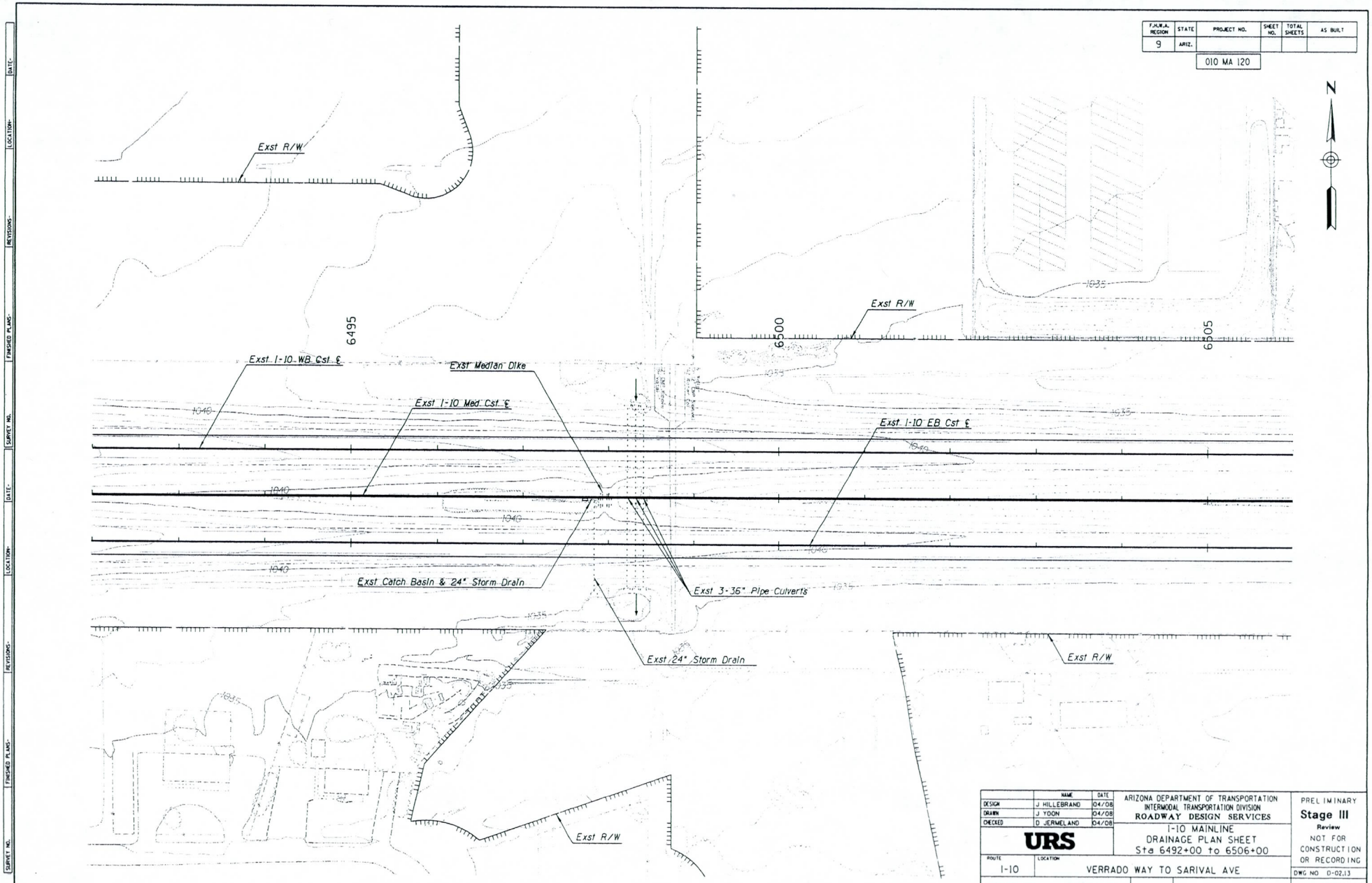

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6492+00 to 6506+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.13

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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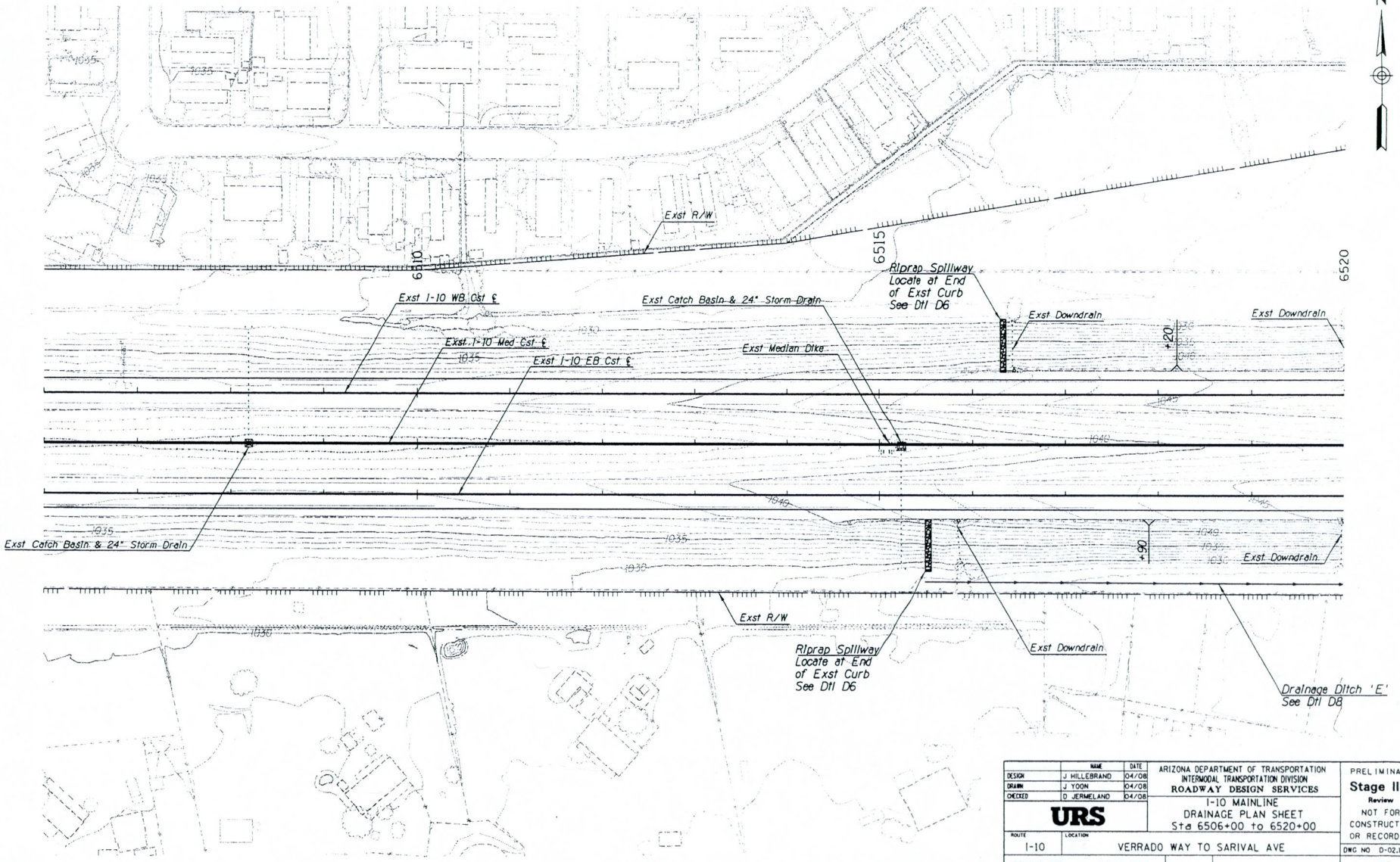
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6506+00 to 6520+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.14

___ OF ___

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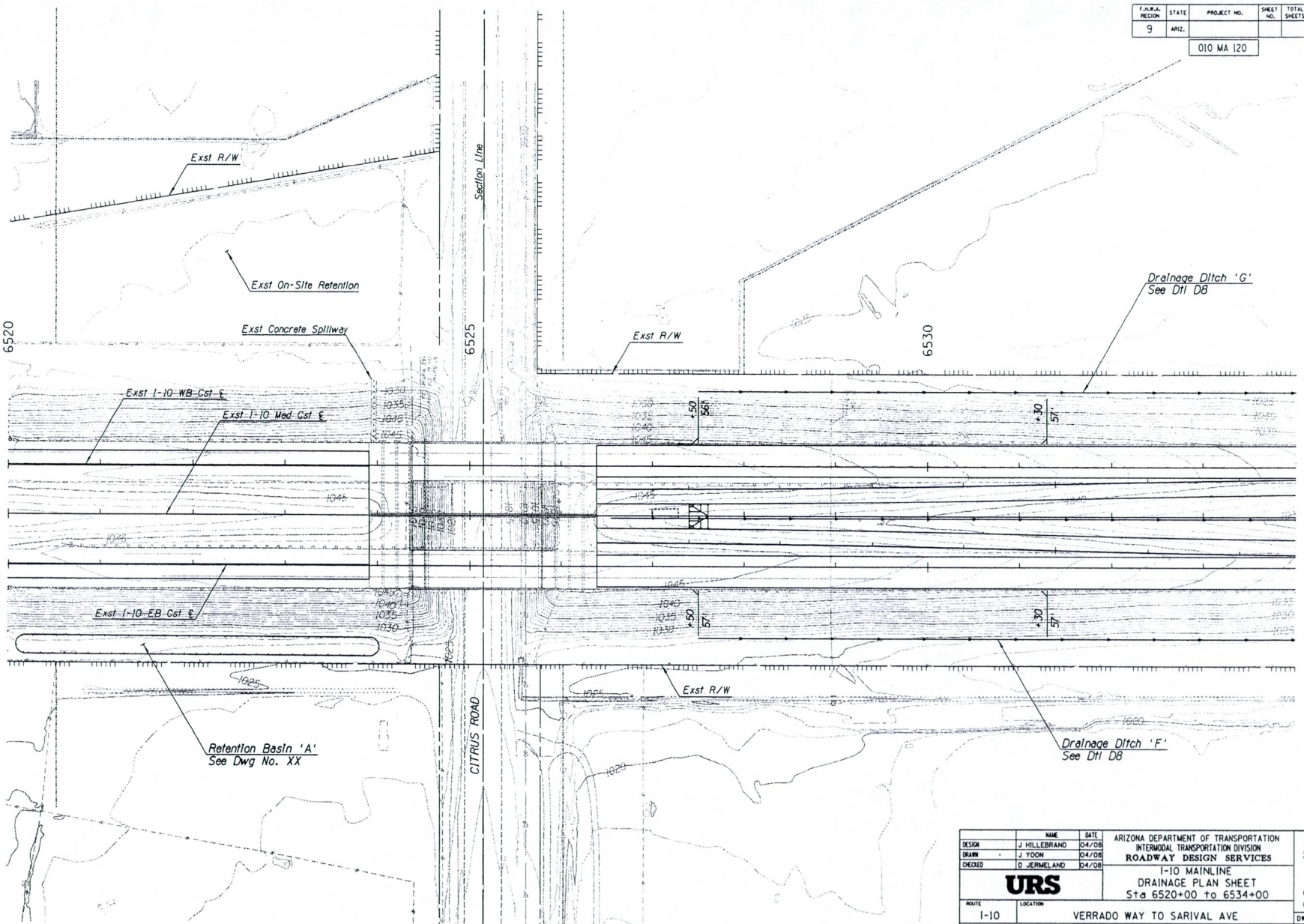

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6520+00 to 6534+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.15

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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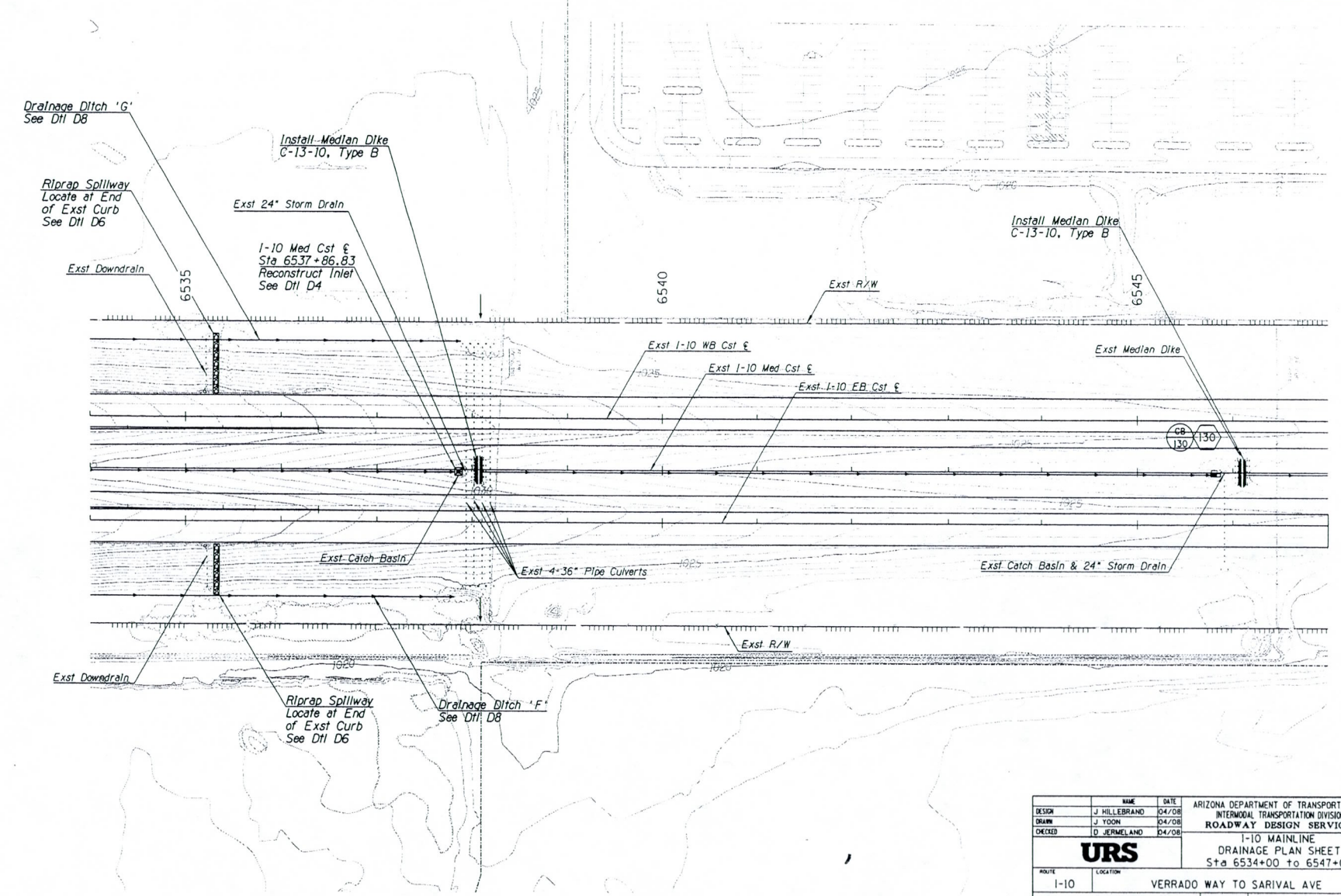
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6534+00 to 6547+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.16

___ OF ___

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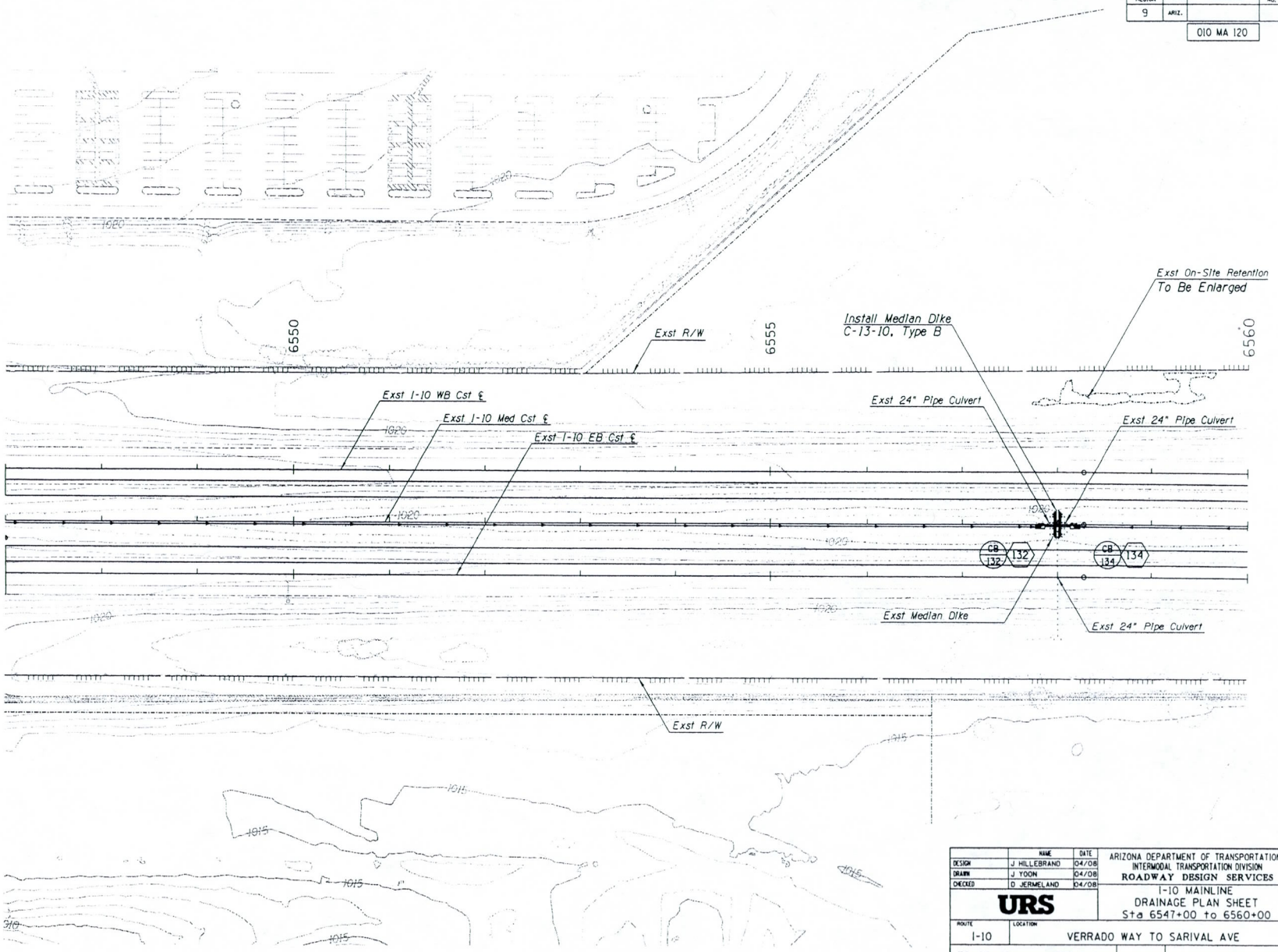
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6547+00 to 6560+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO. D-02.17

___ OF ___

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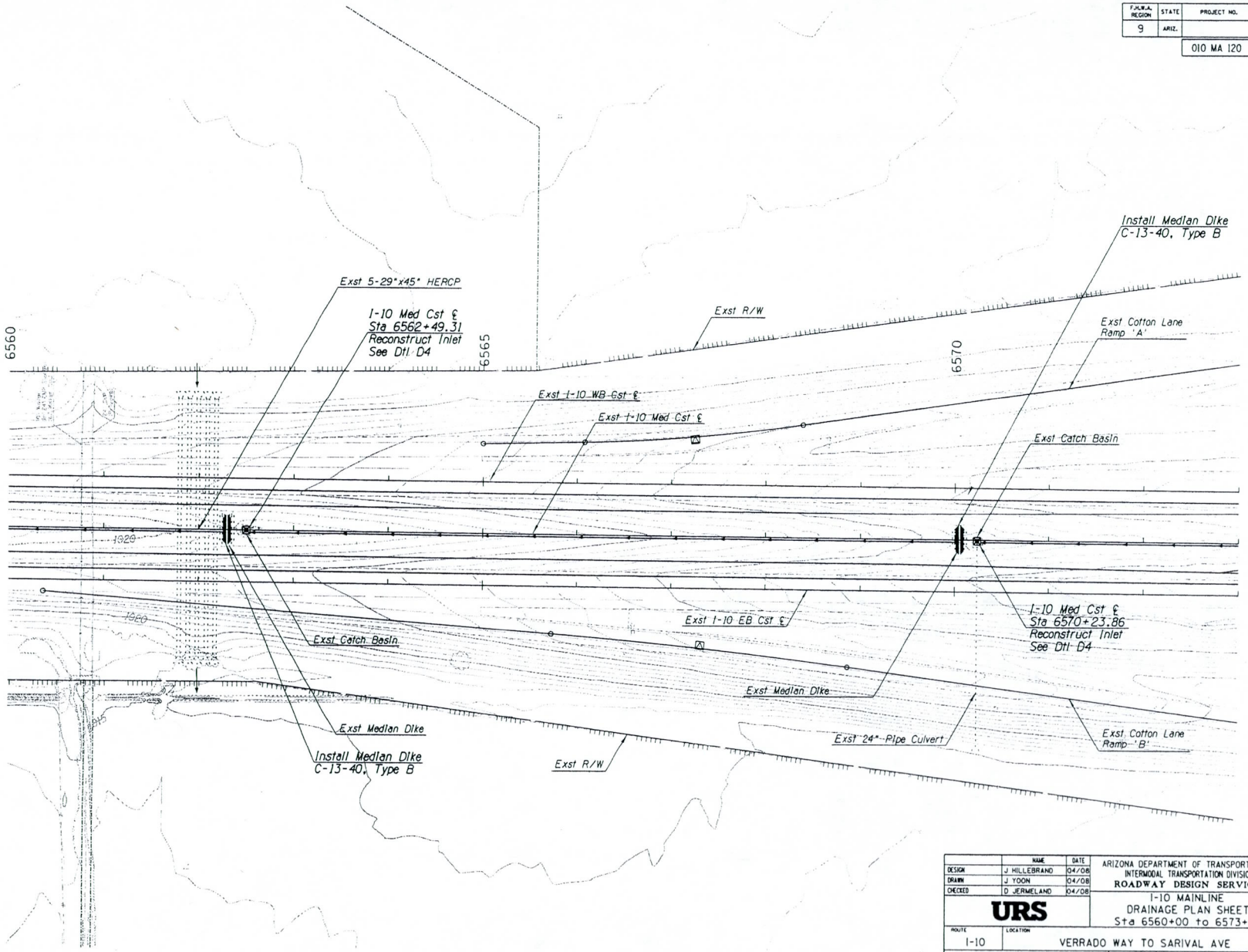
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	J. HILLEBRAND	04/08
DRAWN	J. YOON	04/08
CHECKED	D. JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6560+00 to 6573+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.18

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SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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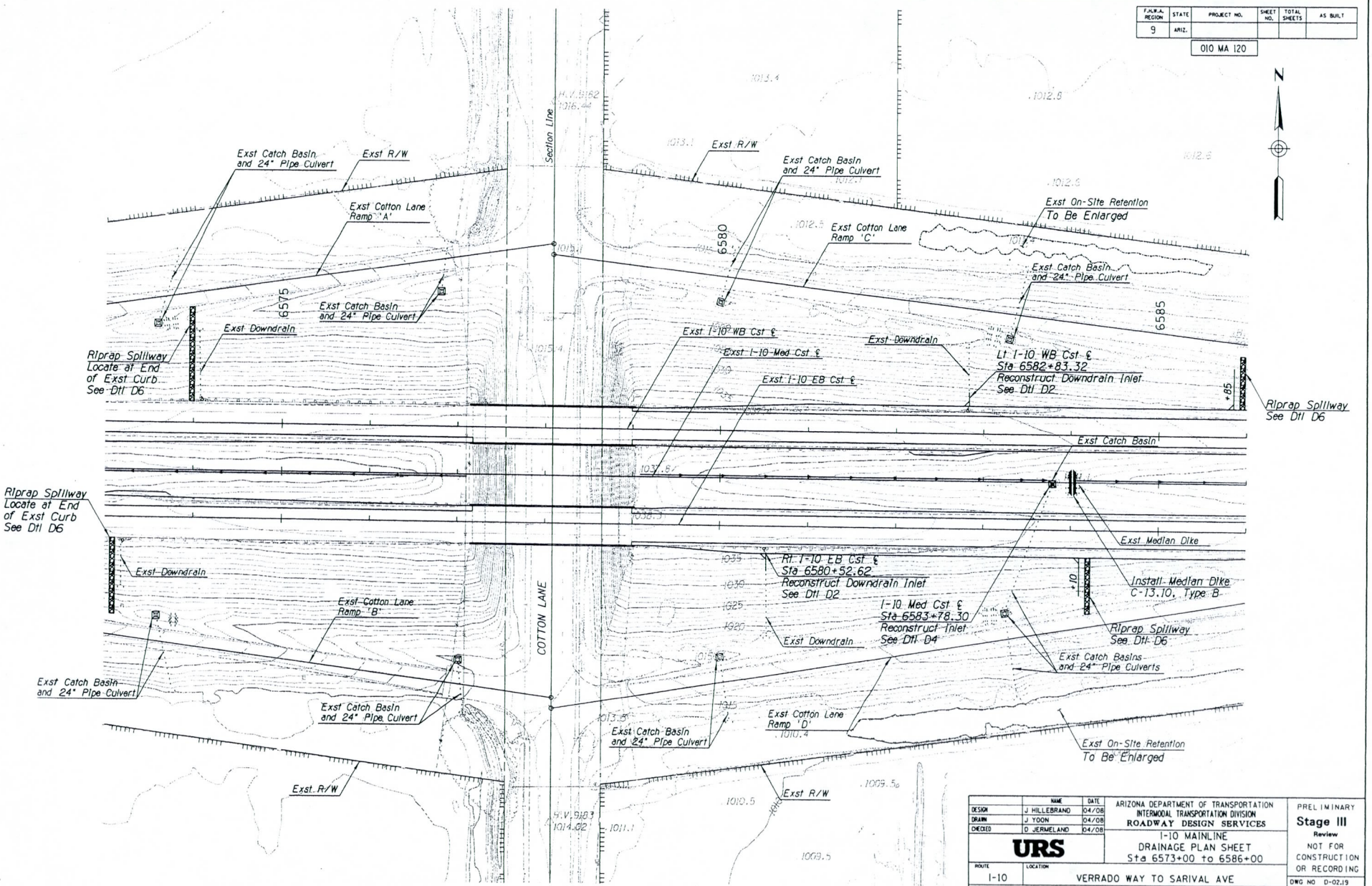

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6573+00 to 6586+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.19

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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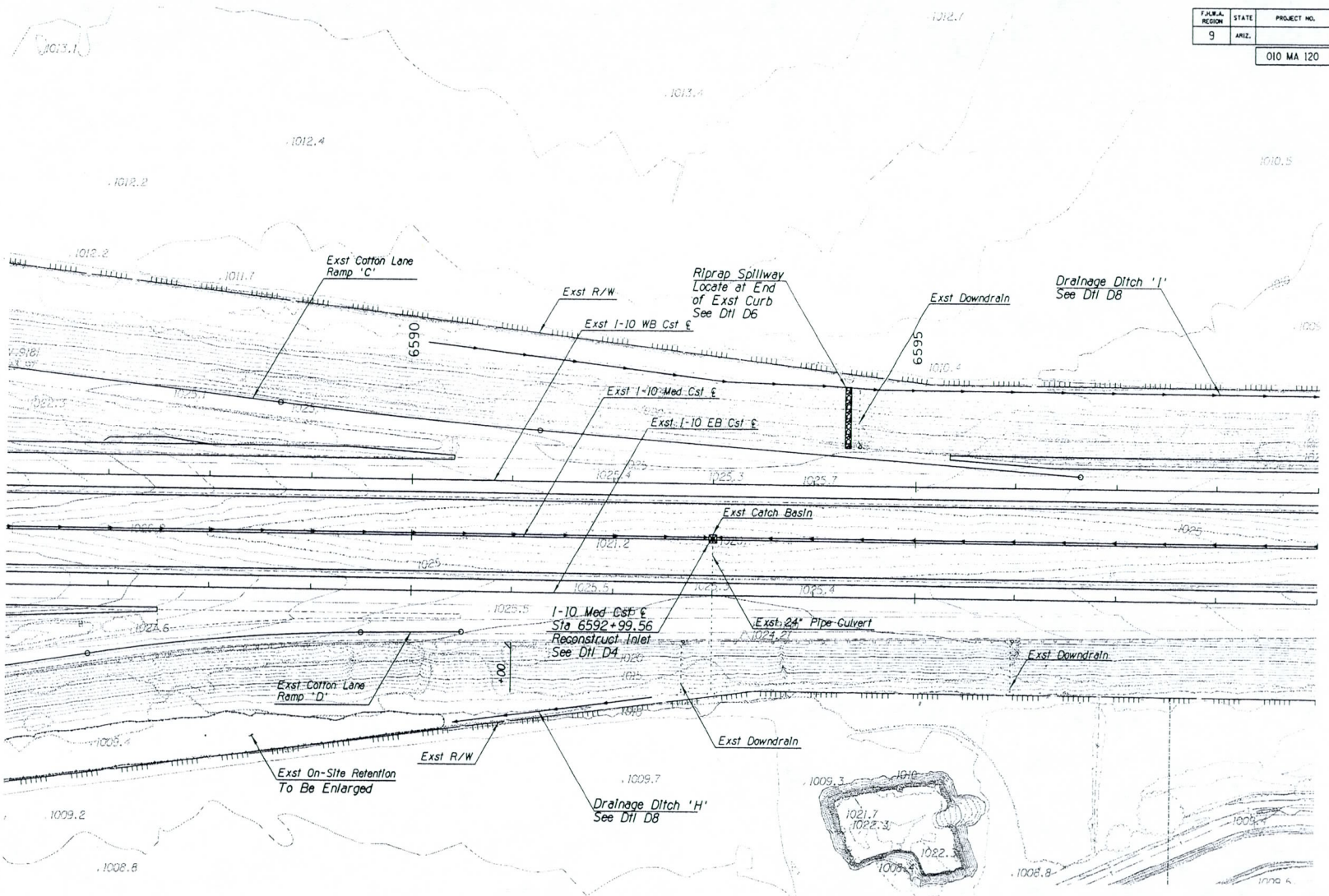
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



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DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6586+00 to 6599+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.20

___ OF ___

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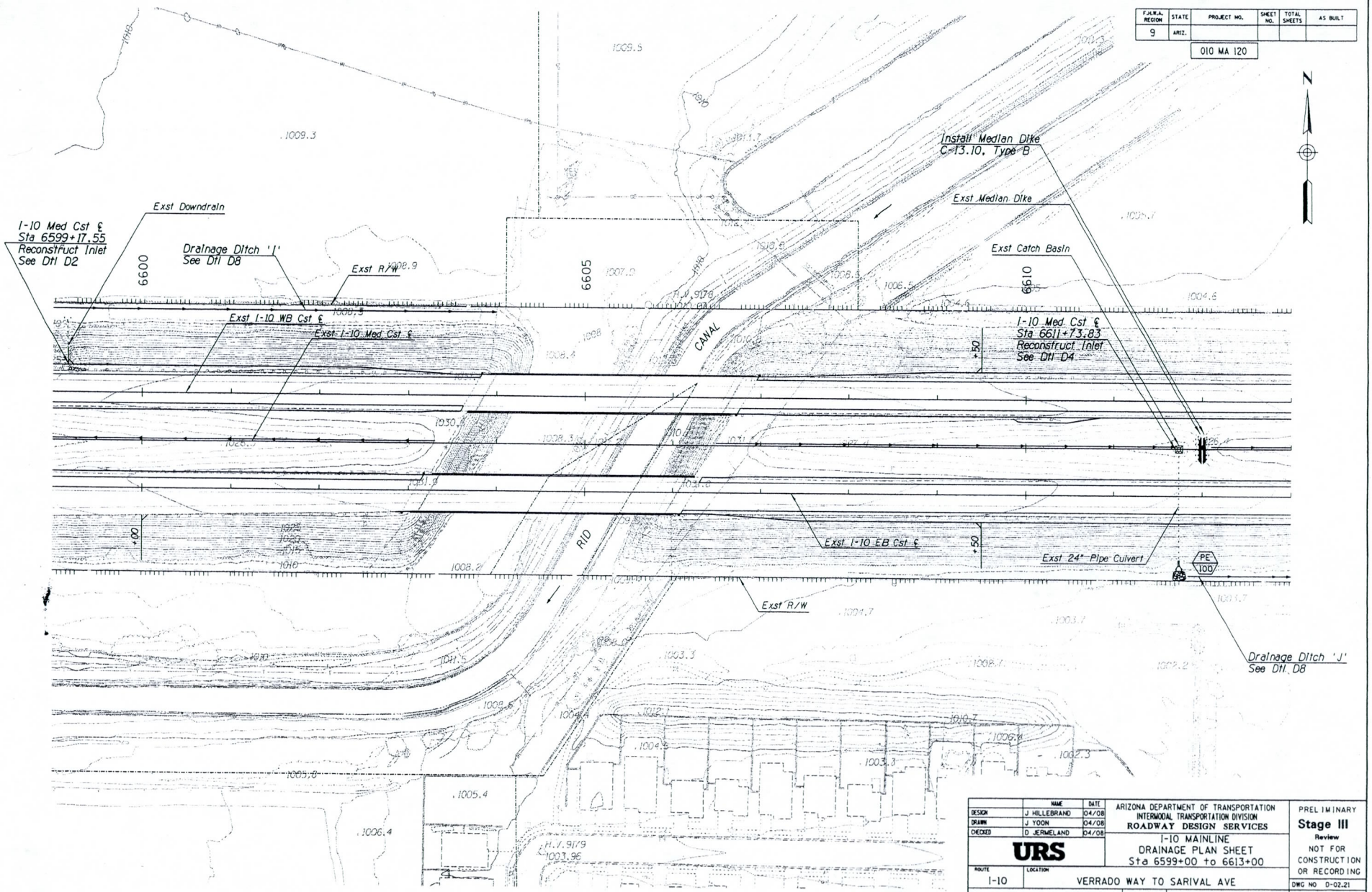

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6599+00 to 6613+00

ROUTE: I-10 | LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.21

___ OF ___

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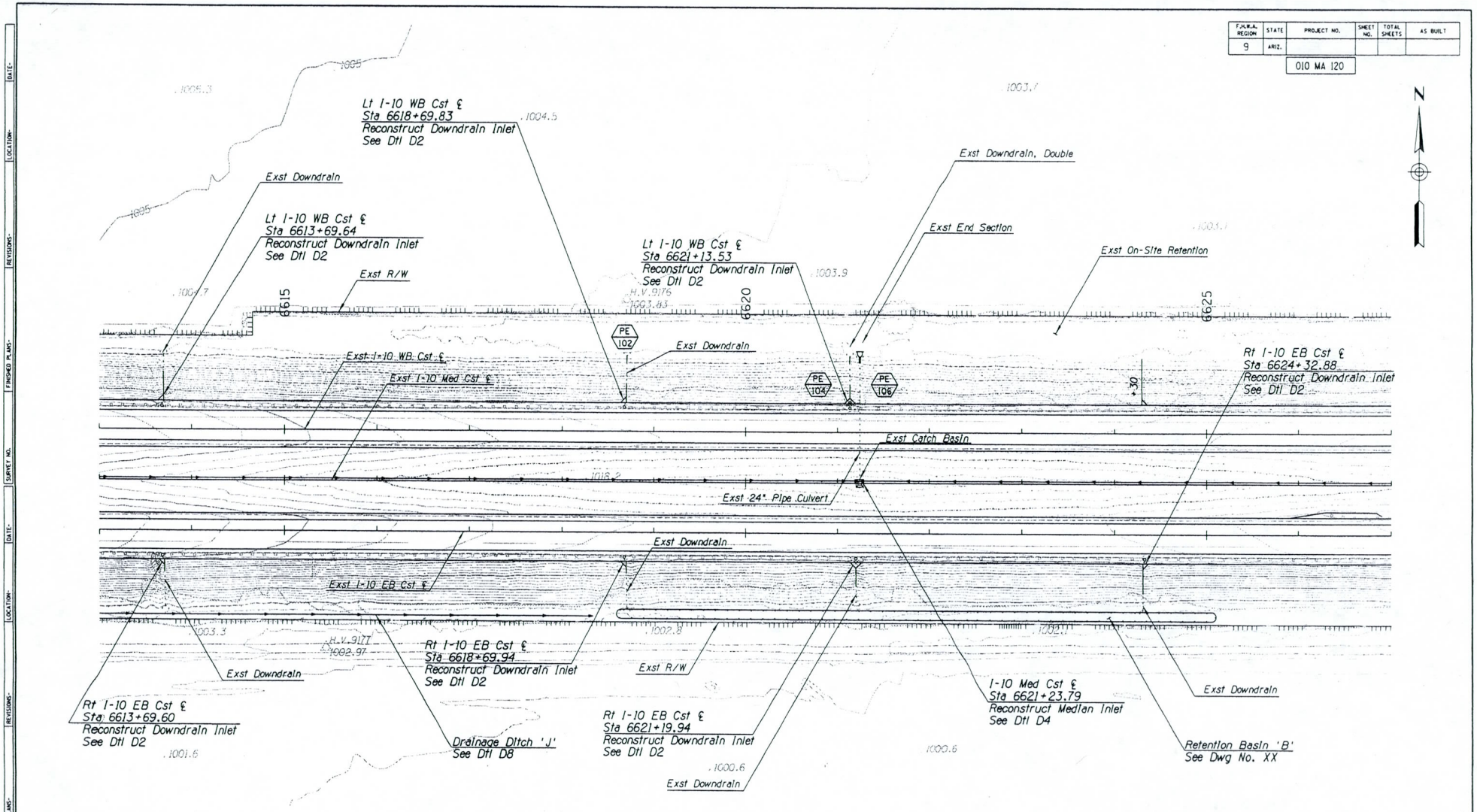

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				
		010 MA 120			

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6613+00 to 6627+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.22

___ OF ___

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE

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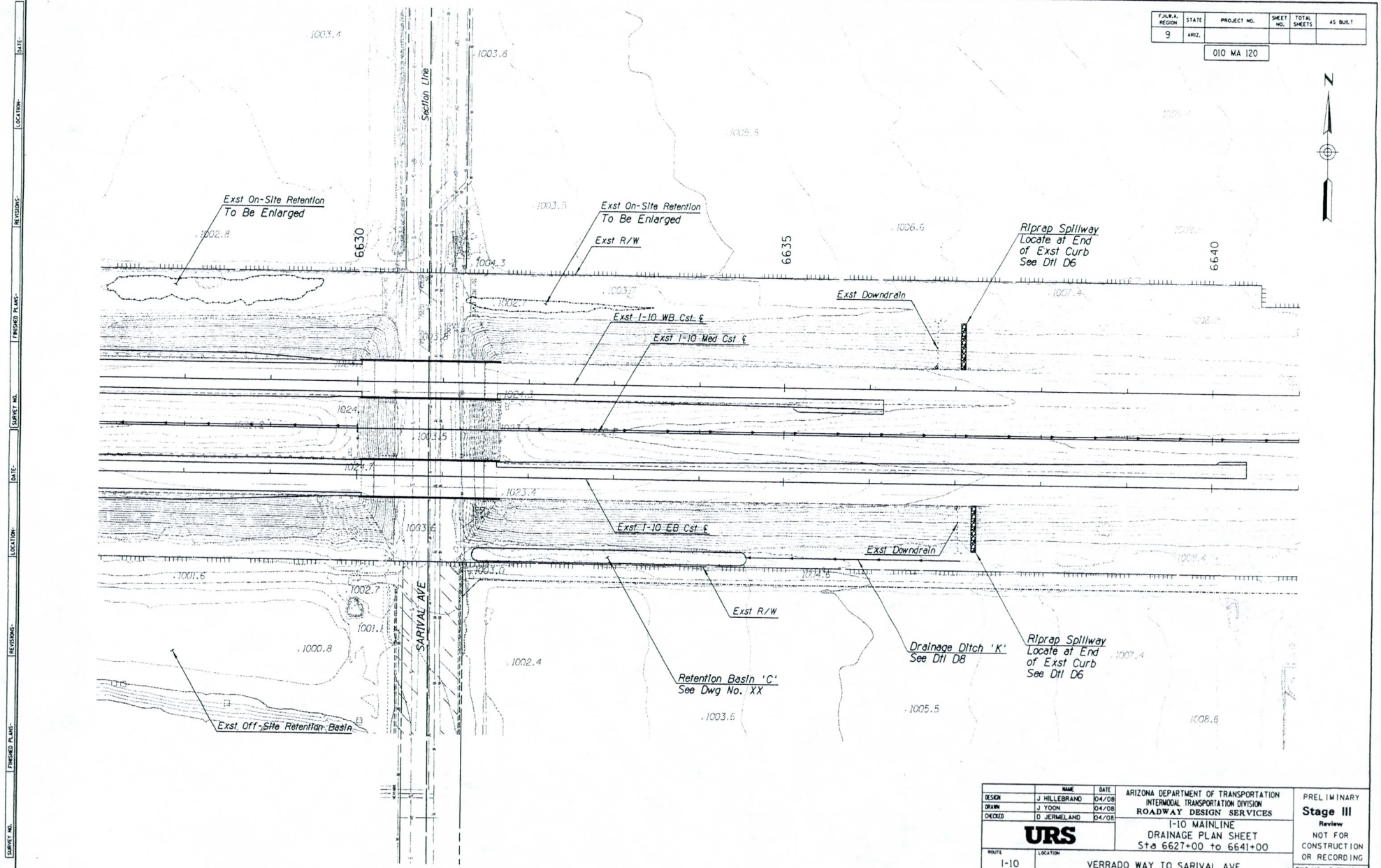

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6627+00 to 6641+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.23

___ OF ___

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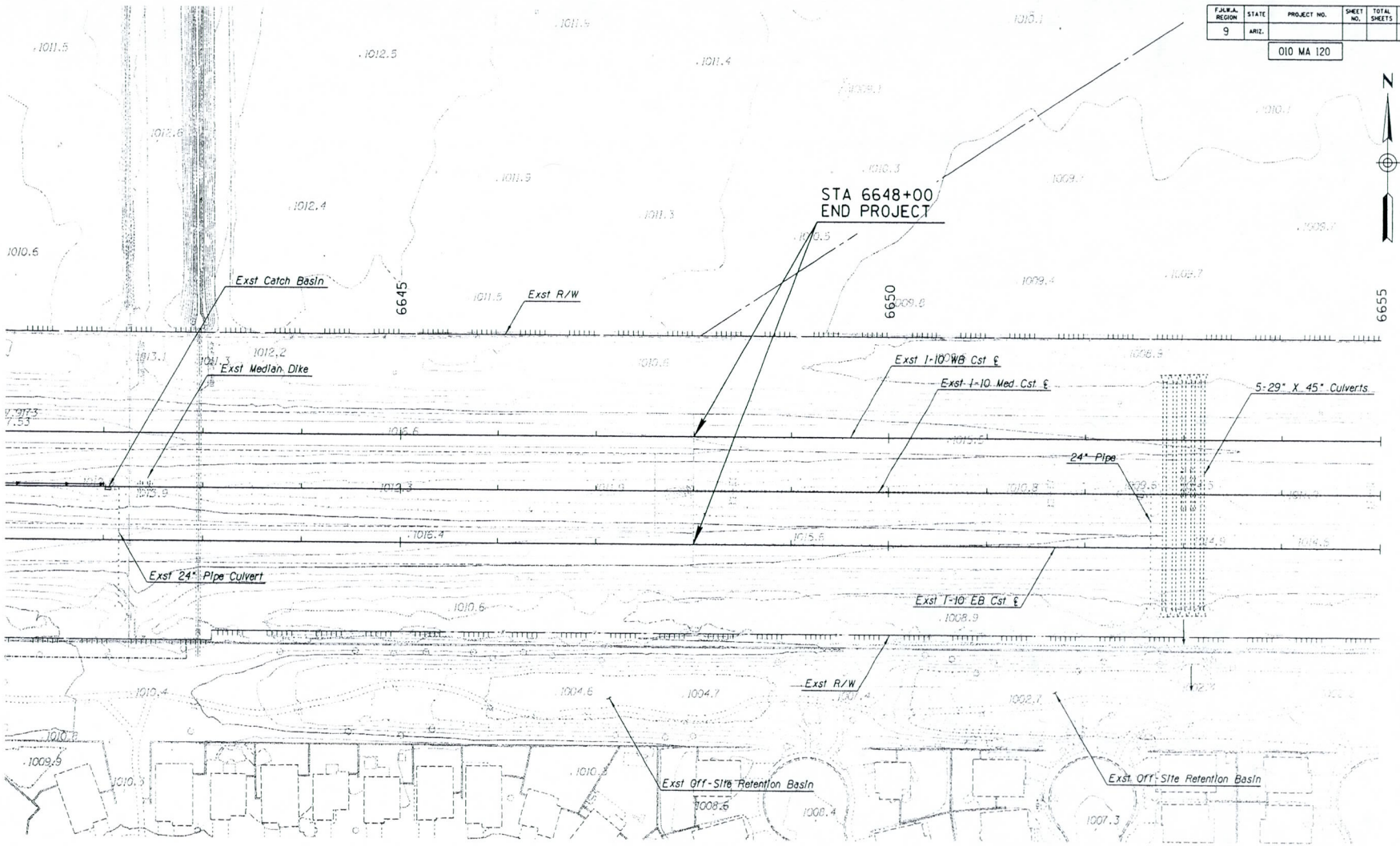
SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	J HILLEBRAND	04/08
DRAWN	J YOON	04/08
CHECKED	D JERMELAND	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE PLAN SHEET
Sta 6641+00 to 6655+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.24

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APPENDIX C

RAINFALL INTENSITY CALCULATIONS

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Arizona 33.45 N 112.37 W 990 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Thu Feb 28 2008

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | D

Precipitation Intensity Estimates (in/hr)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	2.35	1.79	1.48	1.00	0.62	0.35	0.24	0.14	0.08	0.05	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00
2	3.06	2.33	1.93	1.30	0.80	0.45	0.31	0.18	0.10	0.06	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00
5	4.16	3.17	2.62	1.76	1.09	0.60	0.41	0.23	0.12	0.08	0.04	0.02	0.02	0.01	0.01	0.01	0.00	0.00
10	5.00	3.80	3.14	2.12	1.31	0.72	0.49	0.27	0.15	0.09	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00
25	6.13	4.66	3.86	2.60	1.61	0.88	0.60	0.33	0.17	0.11	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.00
50	7.00	5.32	4.40	2.96	1.83	1.00	0.69	0.37	0.20	0.13	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01
100	7.88	6.00	4.96	3.34	2.07	1.12	0.78	0.42	0.22	0.15	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01
200	8.80	6.69	5.53	3.72	2.30	1.25	0.88	0.47	0.24	0.16	0.09	0.05	0.03	0.03	0.01	0.01	0.01	0.01
500	9.98	7.60	6.28	4.23	2.62	1.43	1.01	0.53	0.27	0.19	0.10	0.06	0.04	0.03	0.02	0.01	0.01	0.01
1000	10.91	8.30	6.86	4.62	2.86	1.56	1.12	0.59	0.30	0.20	0.12	0.07	0.04	0.03	0.02	0.01	0.01	0.01

Text version of table

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Intensity Estimates (in/hr)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	2.90	2.21	1.82	1.23	0.76	0.42	0.30	0.17	0.09	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00
2	3.78	2.88	2.38	1.60	0.99	0.54	0.38	0.21	0.11	0.07	0.04	0.02	0.01	0.01	0.01	0.00	0.00	0.00
5	5.11	3.89	3.22	2.17	1.34	0.72	0.50	0.27	0.15	0.09	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00
10	6.12	4.66	3.85	2.59	1.60	0.86	0.59	0.32	0.17	0.10	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.00
25	7.48	5.69	4.70	3.17	1.96	1.05	0.72	0.39	0.20	0.13	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01
50	8.50	6.47	5.34	3.60	2.23	1.19	0.82	0.44	0.23	0.14	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01
100	9.56	7.27	6.01	4.05	2.50	1.34	0.93	0.49	0.25	0.16	0.09	0.05	0.03	0.03	0.01	0.01	0.01	0.01
200	10.66	8.11	6.70	4.52	2.79	1.49	1.05	0.55	0.28	0.18	0.10	0.06	0.04	0.03	0.02	0.01	0.01	0.01
500	12.13	9.23	7.63	5.14	3.18	1.70	1.21	0.63	0.32	0.21	0.12	0.07	0.04	0.03	0.02	0.01	0.01	0.01
1000	13.27	10.10	8.34	5.62	3.48	1.87	1.34	0.70	0.35	0.23	0.13	0.08	0.05	0.04	0.02	0.01	0.01	0.01

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

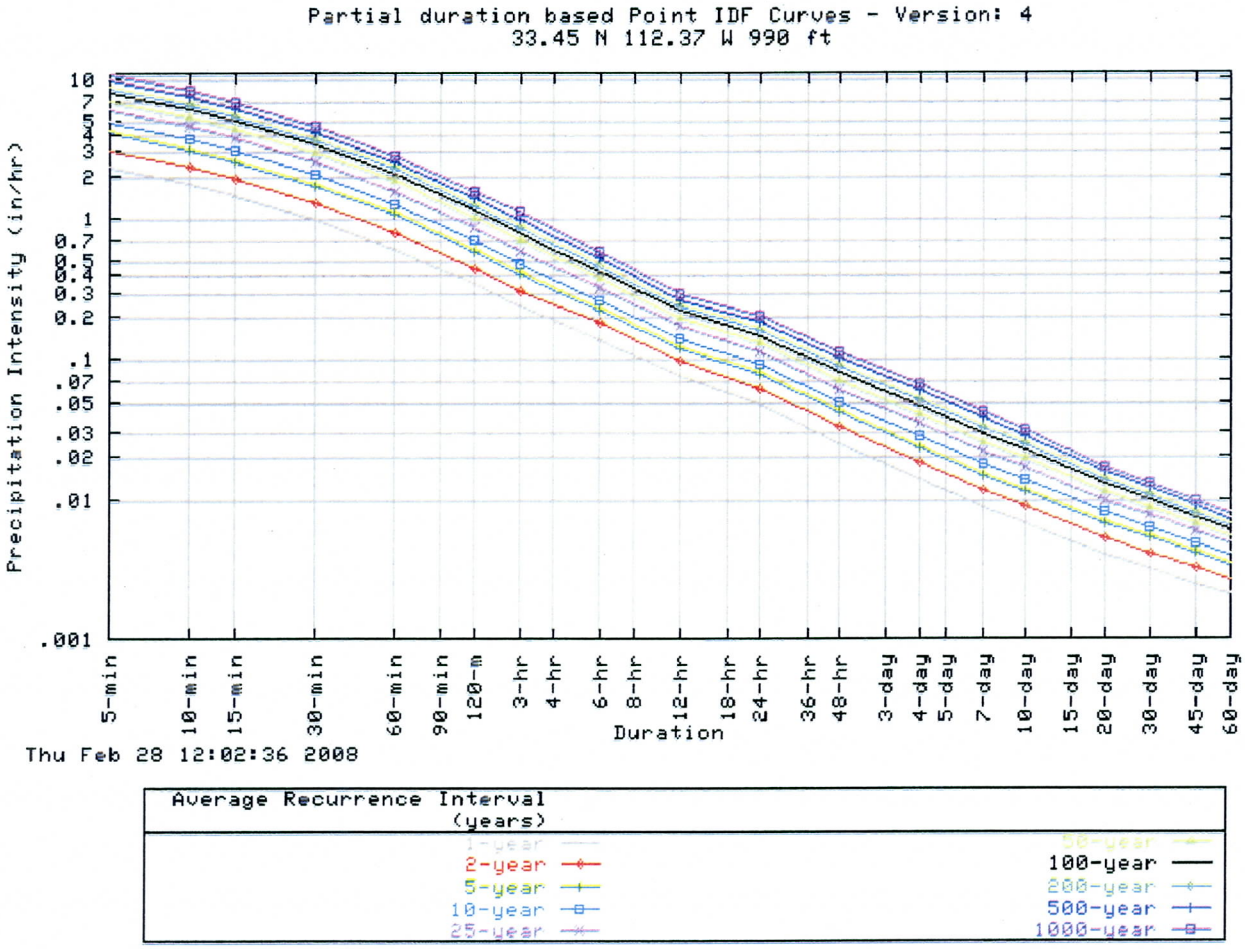
* Lower bound of the 90% confidence interval Precipitation Intensity Estimates (in/hr)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day

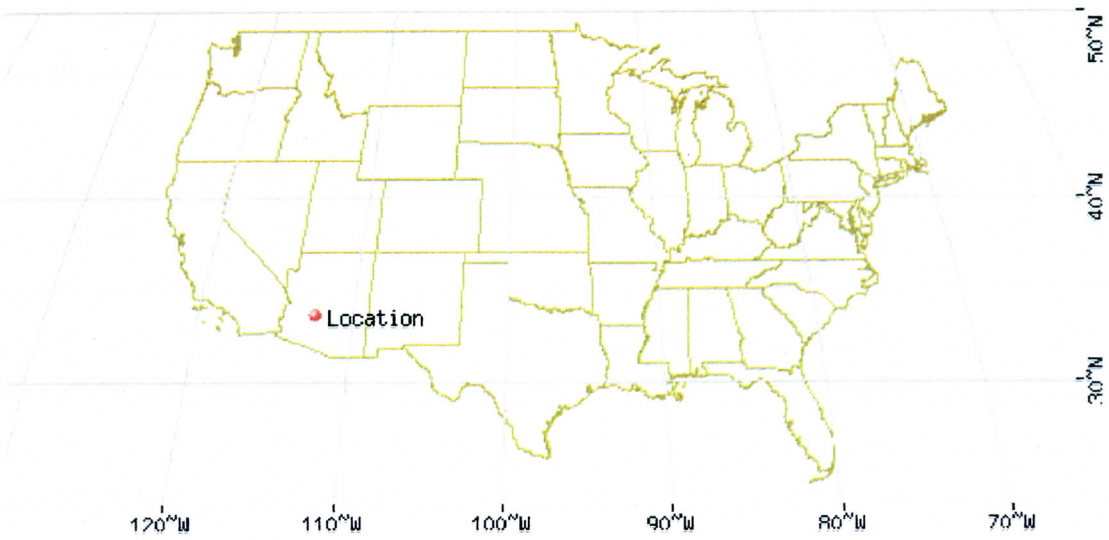
1	1.93	1.47	1.22	0.82	0.51	0.29	0.20	0.12	0.07	0.04	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
2	2.53	1.93	1.59	1.07	0.66	0.38	0.26	0.15	0.09	0.06	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00
5	3.42	2.60	2.15	1.45	0.90	0.50	0.34	0.20	0.11	0.07	0.04	0.02	0.01	0.01	0.01	0.00	0.00	0.00
10	4.08	3.11	2.57	1.73	1.07	0.59	0.41	0.23	0.13	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00
25	4.94	3.76	3.11	2.09	1.29	0.71	0.49	0.27	0.15	0.10	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.00
50	5.57	4.24	3.50	2.36	1.46	0.80	0.56	0.31	0.16	0.11	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.00
100	6.16	4.69	3.87	2.61	1.61	0.89	0.62	0.34	0.18	0.13	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01
200	6.76	5.14	4.25	2.86	1.77	0.98	0.68	0.37	0.20	0.14	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01
500	7.48	5.69	4.70	3.17	1.96	1.09	0.76	0.41	0.22	0.16	0.09	0.05	0.03	0.03	0.01	0.01	0.01	0.01
1000	8.00	6.09	5.03	3.39	2.10	1.16	0.83	0.44	0.23	0.17	0.10	0.06	0.04	0.03	0.02	0.01	0.01	0.01

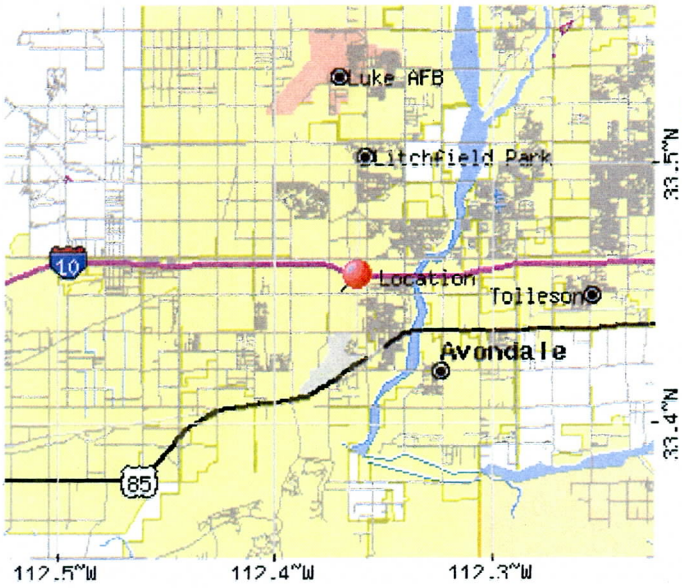
* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.
** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.

Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.



Maps -





These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.

LEGEND

State
County
Indian Resv
Lake/Pond/Ocean
Street
Expressway
Highway
Connector
Stream
Military Area
National Park
Other Park
City
County

Scale 1:228583
*average--true scale depends on monitor resolution

0 2 4 6 8 mi
0 2 4 6 8 10 km

Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; **USGS Aerial Photograph** may also be available
from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information
about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study,

please refer to our documentation.

Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (33.45/-112.37). Digital ASCII data can be obtained directly from **NCDC**.

Find Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry) stations by visiting the **Western Regional Climate Center's state-specific SNOTEL station maps**.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910

(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX D

FLOODPLAIN MAPS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

(central Arizona). The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

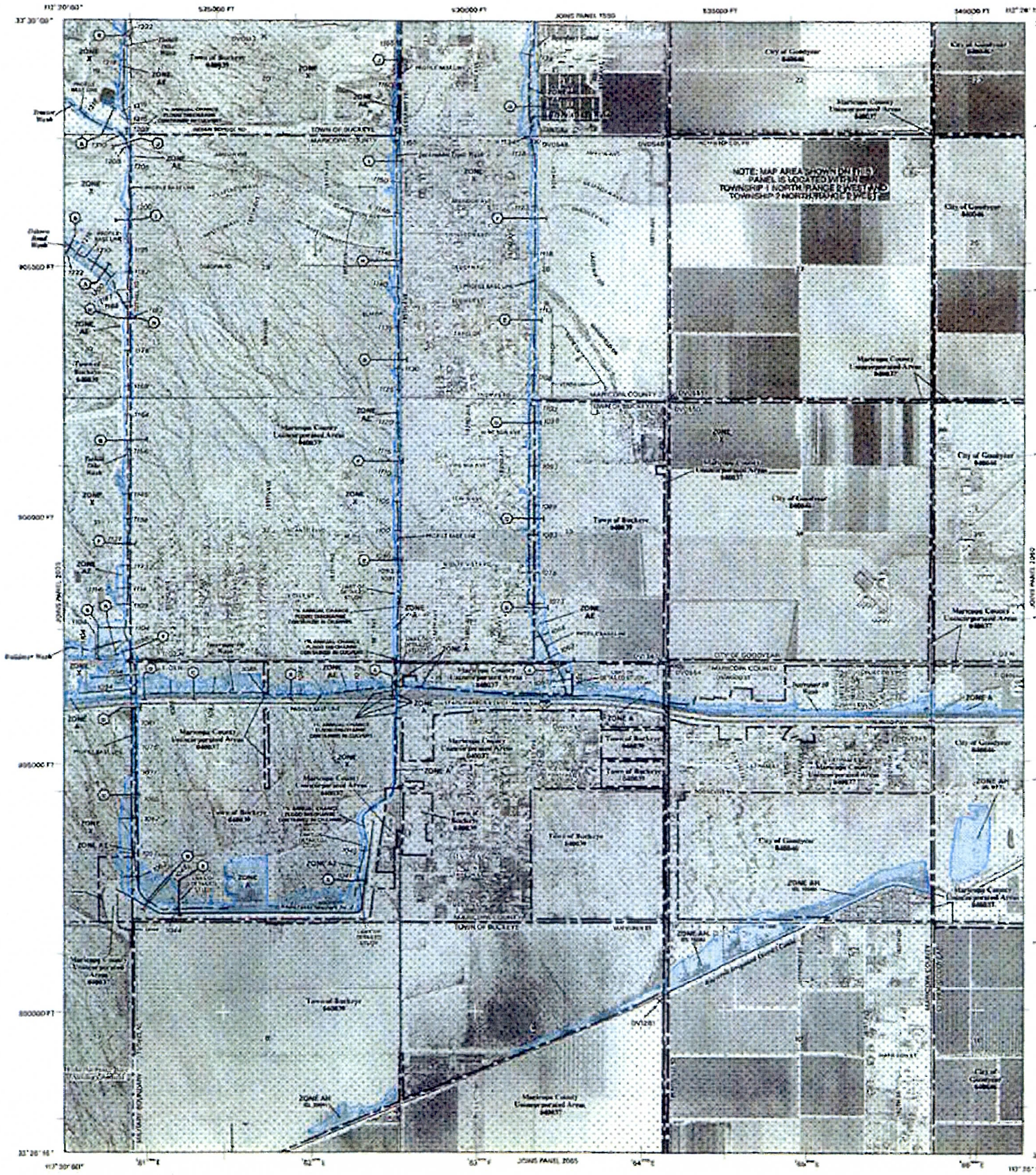
This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)—(A)	Cross section line
(2)—(2)	Transect line
112°07'00", 33°26'41"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
76 E	1000-meter Universal Transverse Mercator grid line values, zone 12
875000 FT	5000-foot grid ticks: Arizona State Plane coordinate system, central zone (FIPSZONE 0202), NAD83 (Transverse Mercator)
X DV2313	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 30, 1995; July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2055G

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2055 OF 4350

MAP NUMBER
04013C2055G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

[illegible] Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management [illegible]

[illegible] cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

[illegible] **flood control structures.** [illegible] Flood Insurance Study [illegible]

The projection used in the preparation of this map was Arizona State Plane Zone 0202 (central Arizona). The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

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Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:4000 using HARN for control. Aerial photography is dated December 2000 to [illegible]

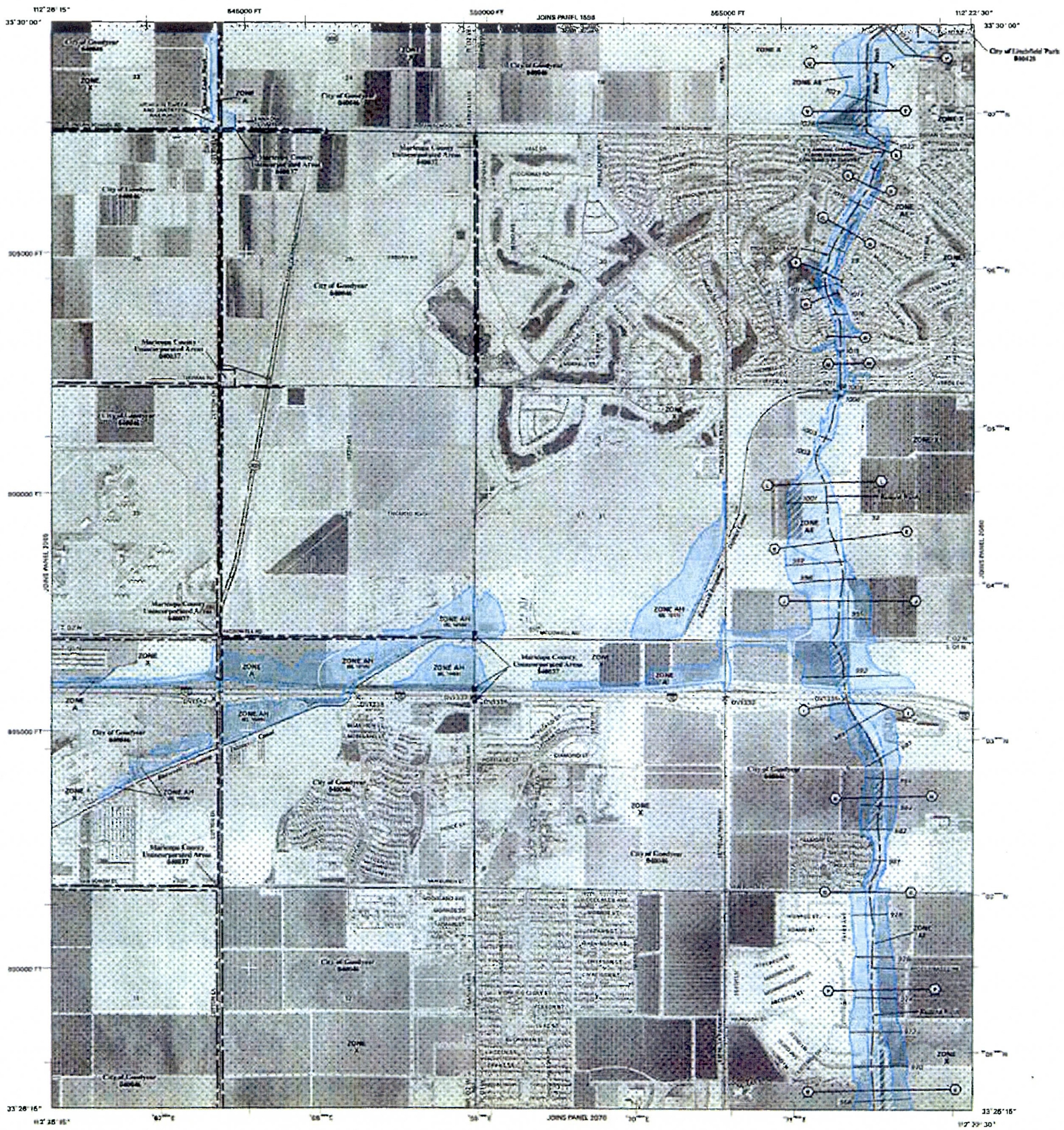
[illegible] shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov.

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
[illegible]

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2060G

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2060 OF 4350

MAP NUMBER
04013C2060G

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

APPENDIX E

ROADWAY HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Time of Concentration
&
Rational Method Computations

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB100	Date:	3/6/08
Station:	Sta 6342+26 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.85	0.95	0.8
			0.0
			0.0
	0.85		0.8

Weighted C-Coefficient: **0.95**

Time of Concentration:

$$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1100.62	Upstream elevation, feet
	1099.56	Downstream elevation, feet
L =	465	feet
L =	0.0881	miles
S =	12.036	feet/mile
K_b =	0.0405	

where:

A =	0.85	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	10.66	
15	3.74	10.73	
30	3.72	10.75	***Use 10 minutes**

Rational Method:

$$Q = CiA$$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **3.06** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **3.06** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB102	Date:	3/6/08
Station:	Sta 6346+00 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.89	0.95	0.8
			0.0
			0.0
	0.89		0.8

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1102.76	Upstream elevation, feet
	1099.61	Downstream elevation, feet
L =	481	feet
L =	0.0911	miles
S =	34.578	feet/mile
K_b =	0.0403	

where:

A =	0.89	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	7.81	
15	3.74	7.85	
30	3.72	7.87	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.20**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.20**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB104	Date:	3/6/08
Station:	Sta 6349+80 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.76	0.95	0.7
			0.0
			0.0
	0.76		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1102.87	Upstream elevation, feet
	1099.83	Downstream elevation, feet
L =	433	feet
L =	0.0820	miles
S =	37.070	feet/mile
K_b =	0.0407	

where:

A =	0.76	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	7.29
15	3.74	7.33
30	3.72	7.34

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.75**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.75**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB106	Date:	3/6/08
Station:	Sta 6353+12 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	1.13	0.95	1.1
			0.0
			0.0
	1.13		1.1

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1103.04	Upstream elevation, feet
	1099.94	Downstream elevation, feet
L =	524	feet
L =	0.0992	miles
S =	31.237	feet/mile
K_b =	0.0397	

where:

A =	1.13	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	8.34	
15	3.74	8.39	
30	3.72	8.40	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**4.07**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**4.07**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB108	Date:	3/6/08
Station:	Sta 6357+35 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.66	0.95	0.6
			0.0
			0.0
	0.66		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1103.12	Upstream elevation, feet
	1100.19	Downstream elevation, feet
L =	383	feet
L =	0.0725	miles
S =	40.393	feet/mile
K_b =	0.0411	

where:

A =	0.66	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.70	
15	3.74	6.75	
30	3.72	6.76	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.39**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.39**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB110	Date:	3/6/08
Station:	Sta 6360+17 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.69	0.95	0.7
			0.0
			0.0
	0.69		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1103.23	Upstream elevation, feet
	1100.14	Downstream elevation, feet
L =	399	feet
L =	0.0756	miles
S =	40.890	feet/mile
K_b =	0.0410	

where:

A =	0.69	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	6.81
15	3.74	6.85
30	3.72	6.86

***Use 10 minutes**

Rational Method:

Q = CiA *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **2.51** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **2.51** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB112	Date:	3/4/08
Station:	6363+15 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	1.09	0.95	1.0
			0.0
			0.0
	1.09		1.0

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1103.43	Upstream elevation, feet
	1100.3	Downstream elevation, feet
L =	564.4	feet
L =	0.1069	miles
S =	29.281	feet/mile
K_b =	0.0398	

where:

A =	1.09	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	8.84	
15	3.74	8.89	
30	3.72	8.91	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.92**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.92**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB114	Date:	3/4/08
Station:	6371+85 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.95	0.95	0.9
			0.0
			0.0
	0.95		0.9

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1103.43	Upstream elevation, feet
	1009.83	Downstream elevation, feet
L =	510.6	feet
L =	0.0967	miles
S =	967.897	feet/mile
K_b =	0.0401	

where:

A =	0.95	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	2.86
15	3.74	2.87
30	3.72	2.88

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **3.42** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **3.42** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB116 West	Date:	3/4/08
Station:	6456+34.83 I-10 WB - West		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.49	0.95	0.5
			0.0
			0.0
	0.49		0.5

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1060.36	Upstream elevation, feet
	1058.87	Downstream elevation, feet
L =	293.8	feet
L =	0.0556	miles
S =	26.777	feet/mile
K_b =	0.0420	

where:

A =	0.49	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.74	
15	3.74	6.78	
30	3.72	6.79	***Use 10 minutes**

Rational Method:

Q = CiA *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.76**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**1.76**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB116 East	Date:	3/4/08
Station:	6456+34.83 I-10 WB - East		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	1.04	0.95	1.0
			0.0
			0.0
	1.04		1.0

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1063.36	Upstream elevation, feet
	1058.87	Downstream elevation, feet
L =	472.8	feet
L =	0.0895	miles
S =	50.142	feet/mile
K_b =	0.0399	

where:

A =	1.04	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	6.86
15	3.74	6.90
30	3.72	6.91

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	3.77	**cfs**
Q_B =	0.00	**cfs (upstream bypass flow)**
Q_T =	3.77	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB118	Date:	3/4/08
Station:	6459+54.45 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	1.01	0.95	1.0
			0.0
			0.0
	1.01		1.0

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1065.92	Upstream elevation, feet
	1059.84	Downstream elevation, feet
L =	492.7	feet
L =	0.0933	miles
S =	65.156	feet/mile
K_b =	0.0400	

where:

A =	1.01	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.46	
15	3.74	6.50	
30	3.72	6.51	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.64**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.64**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB120	Date:	3/4/08
Station:	6463+31.3 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	1.00	0.95	1.0
			0.0
			0.0
	1.00		1.0

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1069.58	Upstream elevation, feet
	1063.25	Downstream elevation, feet
L =	505.5	feet
L =	0.0957	miles
S =	66.118	feet/mile
K_b =	0.0400	

where:

A =	1.00	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.52	
15	3.74	6.56	
30	3.72	6.57	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.62**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.62**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB122	Date:	3/4/08
Station:	6467+15 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	1.03	0.95	1.0
			0.0
			0.0
	1.03		1.0

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1078.2	Upstream elevation, feet
	1066.78	Downstream elevation, feet
L =	506	feet
L =	0.0958	miles
S =	119.165	feet/mile
K_b =	0.0399	

where:

A =	1.03	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	5.43
15	3.74	5.46
30	3.72	5.47

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	3.71	**cfs**
Q_B =	0.00	**cfs (upstream bypass flow)**
Q_T =	3.71	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB124	Date:	3/12/08
Station:	6477+77.67 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.98	0.95	0.9
			0.0
			0.0
	0.98		0.9

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1066.01	Upstream elevation, feet
	1062.65	Downstream elevation, feet
L =	415	feet
L =	0.0786	miles
S =	42.749	feet/mile
K_b =	0.0400	

where:

A =	0.98	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	6.76
15	3.74	6.81
30	3.72	6.82

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.55**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.55**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB126	Date:	3/12/08
Station:	6481+83 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	1.11	0.95	1.1
			0.0
			0.0
	1.11		1.1

Weighted C-Coefficient: **0.95**

Time of Concentration:

$$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1066.04	Upstream elevation, feet
	1056.9	Downstream elevation, feet
L =	518.3	feet
L =	0.0982	miles
S =	93.111	feet/mile
K_b =	0.0397	

where:

A =	1.11	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	5.91
15	3.74	5.95
30	3.72	5.96

***Use 10 minutes**

Rational Method:

$$Q = CiA$$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**4.01**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**4.01**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Median Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB128	Date:	3/12/08
Station:	6487+14 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	1.44	0.95	1.4
			0.0
			0.0
	1.44		1.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1060.29	Upstream elevation, feet
	1047.52	Downstream elevation, feet
L =	644	feet
L =	0.1220	miles
S =	104.698	feet/mile
K_b =	0.0390	

where:

A =	1.44	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.30	
15	3.74	6.33	
30	3.72	6.35	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**5.20**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**5.20**	**cfs (inflow)**

Catch Basin Analyses

Worksheet for Slotted Drain Inlet On Grade - CB128 Sta 6487+14 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	5.20	ft³/s
Slope	0.01516	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Slot Length	33.50	ft ← 50' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	5.20	ft³/s
Bypass Flow	0.00	ft³/s
Spread	11.77	ft
Depth	0.24	ft
Flow Area	1.38	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.75	ft/s
Equivalent Cross Slope	0.03570	ft/ft
Length Factor	1.03	
Total Interception Length	32.64	ft

Worksheet for Slotted Drain Inlet On Grade - CB100 Sta 6342+26 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.06	ft³/s
Slope	0.00035	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	10.05	ft ← 15' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	3.06	ft³/s
Bypass Flow	0.00	ft³/s
Spread	15.50	ft
Depth	0.45	ft
Flow Area	3.48	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	0.88	ft/s
Equivalent Cross Slope	0.04148	ft/ft
Length Factor	1.30	
Total Interception Length	7.71	ft

Worksheet for Slotted Drain Inlet On Grade - CB102 Sta 6346+00 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.20	ft³/s
Slope	0.00035	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	10.05	ft ← 15' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	3.20	ft³/s
Bypass Flow	0.00	ft³/s
Spread	15.76	ft
Depth	0.46	ft
Flow Area	3.60	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	0.89	ft/s
Equivalent Cross Slope	0.04130	ft/ft
Length Factor	1.28	
Total Interception Length	7.88	ft

Worksheet for Slotted Drain Inlet On Grade - CB104 Sta 6349+80 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.75	ft³/s
Slope	0.00035	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	10.05	ft ← 15' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	2.75	ft³/s
Bypass Flow	0.00	ft³/s
Spread	14.89	ft
Depth	0.43	ft
Flow Area	3.22	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	0.86	ft/s
Equivalent Cross Slope	0.04191	ft/ft
Length Factor	1.37	
Total Interception Length	7.32	ft

Worksheet for Slotted Drain Inlet On Grade - CB106 Sta 6353+12 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	4.07	ft^3/s
Slope	0.00035	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	10.05	ft ← 15' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	4.07	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	17.25	ft
Depth	0.50	ft
Flow Area	4.32	ft^2
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	0.94	ft/s
Equivalent Cross Slope	0.04038	ft/ft
Length Factor	1.14	
Total Interception Length	8.83	ft

Worksheet for Slotted Drain Inlet On Grade - CB108 Sta 6357+35 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.39	ft³/s
Slope	0.00035	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	6.70	ft ← 10' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	99.90	%
Intercepted Flow	2.39	ft³/s
Bypass Flow	0.00	ft³/s
Spread	14.13	ft
Depth	0.41	ft
Flow Area	2.89	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	0.83	ft/s
Equivalent Cross Slope	0.04250	ft/ft
Length Factor	0.98	
Total Interception Length	6.85	ft

Worksheet for Slotted Drain Inlet On Grade - CB110 Sta 6360+17 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.51	ft³/s
Slope	0.00035	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	10.05	ft ← 15' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	2.51	ft³/s
Bypass Flow	0.00	ft³/s
Spread	14.39	ft
Depth	0.42	ft
Flow Area	3.00	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	0.84	ft/s
Equivalent Cross Slope	0.04229	ft/ft
Length Factor	1.43	
Total Interception Length	7.01	ft

Worksheet for Slotted Drain Inlet On Grade - CB112 Sta 6363+15 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.92	ft³/s
Slope	0.00035	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	10.05	ft ← 15' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	3.92	ft³/s
Bypass Flow	0.00	ft³/s
Spread	17.01	ft
Depth	0.49	ft
Flow Area	4.20	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	0.93	ft/s
Equivalent Cross Slope	0.04052	ft/ft
Length Factor	1.16	
Total Interception Length	8.68	ft

Worksheet for Slotted Drain Inlet On Grade - CB114 Sta 6371+85 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.42	ft³/s
Slope	0.00027	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	10.05	ft ← 15' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	3.42	ft³/s
Bypass Flow	0.00	ft³/s
Spread	16.97	ft
Depth	0.49	ft
Flow Area	4.17	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	0.82	ft/s
Equivalent Cross Slope	0.04054	ft/ft
Length Factor	1.33	
Total Interception Length	7.58	ft

Worksheet for Slotted Drain Inlet In Sag - CB116 Sta 6456+34.83 I-10 WB (EAST)

Project Description

Solve For	Spread

Input Data

Discharge	3.77	ft³/s
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Slot Width	0.15	ft
Slot Length	10.00	ft ← 20' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Spread	8.76	ft
Depth	0.20	ft
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Open Slot Area	1.45	ft²

Worksheet for Slotted Drain Inlet In Sag - CB116 Sta 6456+34.83 I-10 WB (WEST)

Project Description

Solve For	Spread

Input Data

Discharge	1.77	ft³/s
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Slot Width	0.15	ft
Slot Length	5.00	ft ← 10' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Spread	8.25	ft
Depth	0.19	ft
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Open Slot Area	0.73	ft²

Worksheet for Slotted Drain Inlet On Grade - CB118 Sta 6459+54.45 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.64	ft³/s
Slope	0.00600	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Slot Length	20.10	ft ← 30' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	3.64	ft³/s
Bypass Flow	0.00	ft³/s
Spread	11.22	ft
Depth	0.26	ft
Flow Area	1.45	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.51	ft/s
Equivalent Cross Slope	0.03931	ft/ft
Length Factor	1.00	
Total Interception Length	20.09	ft

Worksheet for Slotted Drain Inlet On Grade - CB120 Sta 6463+31.30 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.62	ft³/s
Slope	0.01040	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Slot Length	23.45	ft ← 35' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	3.62	ft³/s
Bypass Flow	0.00	ft³/s
Spread	10.10	ft
Depth	0.23	ft
Flow Area	1.17	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.08	ft/s
Equivalent Cross Slope	0.04071	ft/ft
Length Factor	1.01	
Total Interception Length	23.14	ft

Worksheet for Slotted Drain Inlet On Grade - CB122 Sta 6467+15 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.71	ft³/s
Slope	0.00649	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Slot Length	20.10	ft ← 30' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	99.83	%
Intercepted Flow	3.70	ft³/s
Bypass Flow	0.01	ft³/s
Spread	11.14	ft
Depth	0.26	ft
Flow Area	1.43	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	2.60	ft/s
Equivalent Cross Slope	0.03941	ft/ft
Length Factor	0.97	
Total Interception Length	20.70	ft

Worksheet for Slotted Drain Inlet On Grade - CB124 Sta 6477+77.67 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.55	ft³/s
Slope	0.01100	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	20.10	ft ← 30' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	99.90	%
Intercepted Flow	3.55	ft³/s
Bypass Flow	0.00	ft³/s
Spread	8.41	ft
Depth	0.25	ft
Flow Area	1.06	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	3.35	ft/s
Equivalent Cross Slope	0.05033	ft/ft
Length Factor	0.98	
Total Interception Length	20.55	ft

Worksheet for Slotted Drain Inlet On Grade - CB126 Sta 6481+83 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	4.01	ft³/s
Slope	0.01740	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Slot Length	26.80	ft ← 40' SLOTTED DRAIN
Local Depression	1.00	in
Local Depression Width	2.50	ft

Results

Efficiency	100.00	%
Intercepted Flow	4.01	ft³/s
Bypass Flow	0.00	ft³/s
Spread	8.07	ft
Depth	0.24	ft
Flow Area	0.98	ft²
Gutter Depression	0.00	ft
Total Depression	0.08	ft
Velocity	4.10	ft/s
Equivalent Cross Slope	0.05092	ft/ft
Length Factor	1.09	
Total Interception Length	24.65	ft

APPENDIX F

MEDIAN CATCH BASINS AND DITCH HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Time of Concentration
&
Rational Method Computations

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Median Catch Basin Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Existing Catch Basin No.:	E244	Date:	3/24/08
Station:	I-10 MED Sta 6537+86.83		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.32	0.95	0.3
Median	1.14	0.7	0.8
			0.0
	1.46		1.1

Weighted C-Coefficient: **0.76**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1046.44	Upstream elevation, feet
	1029.6	Downstream elevation, feet
L =	1160	feet
L =	0.2197	miles
S =	76.651	feet/mile
K_b =	0.0390	

where:

A =	1.46	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	9.30	
15	3.14	10.00	
30	2.12	11.61	***Use 17 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 4.19 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 4.19 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB130	Date:	3/24/08
Station:	I-10 MED Sta 6545+86.88		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.22	0.95	0.2
Median	1.03	0.7	0.7
			0.0
	1.25		0.9

Weighted C-Coefficient: **0.74**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1029.6	Upstream elevation, feet
	1021.59	Downstream elevation, feet
L =	800	feet
L =	0.1515	miles
S =	52.866	feet/mile
K_b =	0.0394	

where:

A =	1.25	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	8.72	
15	3.14	9.37	
30	2.12	10.88	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.53**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.53**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB132	Date:	3/20/08
Station:	I-10 MED Sta 6557+66.79		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.22	0.95	0.2
Median	0.98	0.7	0.7
			0.0
	1.20		0.9

Weighted C-Coefficient: **0.75**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1032.3	Upstream elevation, feet
	1019.78	Downstream elevation, feet
L =	1190	feet
L =	0.2254	miles
S =	55.551	feet/mile
K_b =	0.0395	

where:

A =	1.20	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	10.49	
11	3.67	10.62	
12	3.54	10.77	***Use 11 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.29**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.29**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	CB134	Date:	3/20/08
Station:	I-10 MED Sta 6558+25.33		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.08	0.95	0.1
Median	0.36	0.7	0.3
			0.0
	0.44		0.3

Weighted C-Coefficient: **0.75**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1024.69	Upstream elevation, feet
	1019.76	Downstream elevation, feet
L =	462	feet
L =	0.0875	miles
S =	56.343	feet/mile
K_b =	0.0422	

where:

A =	0.44	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.73	
15	3.14	7.24	
30	2.12	8.40	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.26**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**1.26**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Existing Catch Basin No.:	E246	Date:	3/20/08
Station:	I-10 MED Sta 6562+49.31		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.14	0.95	0.1
Median	0.63	0.7	0.4
			0.0
	0.77		0.6

Weighted C-Coefficient: **0.75**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1035.09	Upstream elevation, feet
	1021.69	Downstream elevation, feet
L =	788	feet
L =	0.1492	miles
S =	89.787	feet/mile
K_b =	0.0407	

where:

A =	0.77	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	7.47	
15	3.14	8.03	
30	2.12	9.32	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.19**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.19**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	E248	Date:	3/20/08
Station:	I-10 MED Sta 6570+23.86		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.13	0.95	0.1
Median	0.79	0.7	0.6
			0.0
	0.92		0.7

Weighted C-Coefficient: **0.74**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1039.4	Upstream elevation, feet
	1032.13	Downstream elevation, feet
L =	742	feet
L =	0.1405	miles
S =	51.733	feet/mile
K_b =	0.0402	

where:

A =	0.92	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	8.54	
15	3.14	9.19	
30	2.12	10.67	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.58**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.58**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	E258	Date:	3/20/08
Station:	I-10 MED Sta 6583+78.30		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.09	0.95	0.1
Median	0.65	0.7	0.5
			0.0
	0.74		0.5

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1038.85	Upstream elevation, feet
	1030.49	Downstream elevation, feet
L =	532	feet
L =	0.1008	miles
S =	82.971	feet/mile
K_b =	0.0408	

where:

A =	0.74	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.30	
15	3.14	6.77	
30	2.12	7.86	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.06**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.06**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	E264	Date:	3/21/08
Station:	I-10 MED Sta 6592+99.56		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.36	0.95	0.3
Median	2.49	0.7	1.7
			0.0
	2.85		2.1

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1031.76	Upstream elevation, feet
	1020.9	Downstream elevation, feet
L =	1085	feet
L =	0.2055	miles
S =	52.849	feet/mile
K_b =	0.0372	

where:

A =	2.85	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	9.85	
15	3.14	10.59	
30	2.12	12.29	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 7.92 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 7.92 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	E278	Date:	3/21/08
Station:	I-10 MED Sta 6611+73.83		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.10	0.95	0.1
Median	0.71	0.7	0.5
			0.0
	0.81		0.6

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1031.89	Upstream elevation, feet
	1024.68	Downstream elevation, feet
L =	581	feet
L =	0.1100	miles
S =	65.523	feet/mile
K_b =	0.0406	

where: A = 0.81 acres
m = -0.00625 (Table 5.1)
b = 0.04 (Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	7.06	
15	3.14	7.59	
30	2.12	8.81	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **2.26** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **2.26** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	E279	Date:	3/21/08
Station:	I-10 MED Sta 6621+23.79		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.33	0.95	0.3
Median	2.28	0.7	1.6
			0.0
	2.61		1.9

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

1028.77		Upstream elevation, feet
1017.02		Downstream elevation, feet
L = 958		feet
L = 0.1814		miles
S = 64.760		feet/mile
K_b = 0.0374		

where: A = 2.61 acres
m = -0.00625 (Table 5.1)
b = 0.04 (Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	8.72	
15	3.14	9.37	
30	2.12	10.88	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **7.26** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **7.26** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	E279 East	Date:	3/20/08
Station:	I-10 Med Sta 6621+23.79		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.16	0.95	0.2
Median	1.10	0.7	0.8
			0.0
	1.26		0.9

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

1028.77		Upstream elevation, feet
1017.02		Downstream elevation, feet
L =	958	feet
L =	0.1814	miles
S =	64.760	feet/mile
K_b =	0.0394	

where: A = 1.26 acres
m = -0.00625 (Table 5.1)
b = 0.04 (Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	5.32	7.88
15	4.40	8.47
30	2.93	9.89

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **4.91** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **4.91** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	E279 (West)	Date:	3/21/08
Station:	I-10 MED Sta 6621+23.79		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.17	0.95	0.2
Median	1.18	0.7	0.8
			0.0
	1.35		1.0

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

1024.56		Upstream elevation, feet
1017.02		Downstream elevation, feet
L = 911		feet
L = 0.1725		miles
S = 43.701		feet/mile
K_b = 0.0392		

where: A = 1.35 acres
m = -0.00625 (Table 5.1)
b = 0.04 (Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	9.84	
15	3.14	10.58	
30	2.12	12.28	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 3.75 **cfs**
Q_B = 0.00 **cfs (upstream bypass flow)**
Q_T = 3.75 **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Existing Catch Basin No.:	E244	Date:	3/24/08
Station:	I-10 Med Sta 6537+86.83		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.32	0.95	0.3
Median	1.14	0.7	0.8
			0.0
	1.46		1.1

Weighted C-Coefficient: **0.76**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1026.96	Upstream elevation, feet
	1021.59	Downstream elevation, feet
L =	800	feet
L =	0.1515	miles
S =	35.442	feet/mile
K_b =	0.0390	

where:

A =	1.46	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	8.63	
15	4.40	9.28	
30	2.96	10.79	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**5.87**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**5.87**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Existing Catch Basin No.:	CB130	Date:	3/24/08
Station:	I-10 Med Sta 6545+86.88		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.22	0.95	0.2
Median	1.03	0.7	0.7
			0.0
	1.25		0.9

Weighted C-Coefficient: **0.74**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1046.44	Upstream elevation, feet
	1026.9	Downstream elevation, feet
L =	1160	feet
L =	0.2197	miles
S =	88.941	feet/mile
K_b =	0.0394	

where:

A =	1.25	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	7.86	
15	4.40	8.45	
30	2.96	9.83	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**4.93**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**4.93**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	CB132	Date:	3/20/08
Station:	I-10 Med Sta 6557+66.79		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.22	0.95	0.2
Median	0.98	0.7	0.7
			0.0
	1.20		0.9

Weighted C-Coefficient: **0.75**

Time of Concentration:

$$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1032.3	Upstream elevation, feet
	1019.78	Downstream elevation, feet
L =	1190	feet
L =	0.2254	miles
S =	55.551	feet/mile
K_b =	0.0395	

where:

A =	1.20	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	5.32	9.23
15	4.40	9.92
30	2.96	11.53

***Use 10 minutes**

Rational Method:

$$Q = CiA$$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**4.77**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**4.77**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	CB134	Date:	3/20/08
Station:	I-10 Med Sta 6558+25.33		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.08	0.95	0.1
Median	0.36	0.7	0.3
			0.0
	0.44		0.3

Weighted C-Coefficient: **0.75**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1024.69	Upstream elevation, feet
	1019.76	Downstream elevation, feet
L =	462	feet
L =	0.0875	miles
S =	56.343	feet/mile
K_b =	0.0422	

where:

A =	0.44	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
14.4	5.32	5.92	
14.5	4.40	6.37	
15	2.96	7.40	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **1.76** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **1.76** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	E246	Date:	3/20/08
Station:	I-10 Med Sta 6562+49.31		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.14	0.95	0.1
Median	0.63	0.7	0.4
			0.0
	0.77		0.6

Weighted C-Coefficient: **0.75**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1035.09	Upstream elevation, feet
	1021.69	Downstream elevation, feet
L =	788	feet
L =	0.1492	miles
S =	89.787	feet/mile
K_b =	0.0407	

where:

A =	0.77	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	6.57	
15	4.40	7.06	
30	2.96	8.21	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.07**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.07**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	E248	Date:	3/20/08
Station:	I-10 Med Sta 6570+23.86		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.13	0.95	0.1.
Median	0.79	0.7	0.6
			0.0
	0.92		0.7

Weighted C-Coefficient: **0.74**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1039.4	Upstream elevation, feet
	1032.13	Downstream elevation, feet
L =	742	feet
L =	0.1405	miles
S =	51.733	feet/mile
K_b =	0.0402	

where:

A =	0.92	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	7.52	
15	4.40	8.08	
30	2.96	9.40	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.61**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.61**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	E258	Date:	3/20/08
Station:	I-10 Med Sta 6583+78.30		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.09	0.95	0.1
Median	0.65	0.7	0.5
			0.0
	0.74		0.5

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1038.85	Upstream elevation, feet
	1030.49	Downstream elevation, feet
L =	532	feet
L =	0.1008	miles
S =	82.971	feet/mile
K_b =	0.0408	

where:

A =	0.74	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	5.54	
15	4.40	5.96	
30	2.96	6.92	***Use 10 minutes**

Rational Method:

Q = CiA *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.88**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.88**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	E264	Date:	3/20/08
Station:	I-10 Med Sta 6592+99.56		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.36	0.95	0.3
Median	2.49	0.7	1.7
			0.0
	2.85		2.1

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1031.76	Upstream elevation, feet
	1020.9	Downstream elevation, feet
L =	1085	feet
L =	0.2055	miles
S =	52.849	feet/mile
K_b =	0.0372	

where:

A =	2.85	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	8.67	
15	4.40	9.32	
30	2.96	10.83	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **11.09** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **11.09** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	E278	Date:	3/20/08
Station:	I-10 Med Sta 6611+73.83		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.10	0.95	0.1
Median	0.71	0.7	0.5
			0.0
	0.81		0.6

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1031.89	Upstream elevation, feet
	1024.68	Downstream elevation, feet
L =	581	feet
L =	0.1100	miles
S =	65.523	feet/mile
K_b =	0.0406	

where:

A =	0.81	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	6.21	
15	4.40	6.67	
30	2.96	7.76	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.17**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.17**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	E279	Date:	3/20/08
Station:	I-10 Med Sta 6621+23.79		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.33	0.95	0.3
Median	2.28	0.7	1.6
			0.0
	2.61		1.9

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1028.77	Upstream elevation, feet
	1017	Downstream elevation, feet
L =	958	feet
L =	0.1814	miles
S =	64.870	feet/mile
K_b =	0.0374	

where:

A =	2.61	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	7.67	
15	4.40	8.24	
30	2.93	9.62	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**10.17**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**10.17**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	E279 (East)	Date:	3/21/08
Station:	I-10 MED Sta 6621+23.79		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.16	0.95	0.2
Median	1.10	0.7	0.8
			0.0
	1.26		0.9

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1028.77	Upstream elevation, feet
	1017.02	Downstream elevation, feet
L =	958	feet
L =	0.1814	miles
S =	64.760	feet/mile
K_b =	0.0394	

where:

A =	1.26	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	8.96
15	3.14	9.63
30	2.12	11.18

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **3.50** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **3.50** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	50 years	Check:	
Catch Basin No.:	E279 West	Date:	3/20/08
Station:	I-10 Med Sta 6621+23.79		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.17	0.95	0.2
Median	1.18	0.7	0.8
			0.0
	1.35		1.0

Weighted C-Coefficient: **0.73**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1024.56	Upstream elevation, feet
	1017.02	Downstream elevation, feet
L =	911	feet
L =	0.1725	miles
S =	43.701	feet/mile
K_b =	0.0392	

where:

A =	1.35	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	5.32	8.66	
15	4.40	9.31	
30	2.93	10.86	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**5.25**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**5.25**	**cfs (inflow)**

Median Catch Basin Analyses

Worksheet for Median Inlet In Sag E244 Sta 6537+86.83 I-10 Med -10-ye

Project Description

Solve For	Spread

Input Data

Discharge		4.19	ft³/s
Left Side Slope		6.00	ft/ft (H:V)
Right Side Slope		4.00	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.13	ft
Depth	0.31	ft
Wetted Perimeter	2.64	ft
Top Width	2.13	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag CB130 Sta 6545+86.88 I-10 Med-10-yr

Project Description

Solve For	Spread

Input Data

Discharge		3.53	ft^3/s
Left Side Slope		6.00	ft/ft (H:V)
Right Side Slope		8.30	ft/ft (H:V)
Bottom Width		2.50	ft
Grate Width		2.50	ft
Grate Length		6.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.55	ft
Depth	0.19	ft
Wetted Perimeter	2.88	ft
Top Width	2.55	ft
Open Grate Area	6.75	ft^2
Active Grate Weir Length	14.50	ft

Worksheet for Median Inlet In Sag CB132 Sta 6557+66.79 I-10 Med -10-yr

Project Description

Solve For	Spread

Input Data

Discharge		4.77	ft^3/s
Left Side Slope		8.01	ft/ft (H:V)
Right Side Slope		6.44	ft/ft (H:V)
Bottom Width		2.50	ft
Grate Width		2.50	ft
Grate Length		6.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.56	ft
Depth	0.23	ft
Wetted Perimeter	2.96	ft
Top Width	2.56	ft
Open Grate Area	6.75	ft^2
Active Grate Weir Length	14.50	ft

Worksheet for Median Inlet In Sag CB134 Sta 6558+25.33 I-10 Med -10-JR

Project Description

Solve For	Spread

Input Data

Discharge		1.26	ft³/s
Left Side Slope		7.98	ft/ft (H:V)
Right Side Slope		6.33	ft/ft (H:V)
Bottom Width		2.50	ft
Grate Width		2.50	ft
Grate Length		6.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.53	ft
Depth	0.09	ft
Wetted Perimeter	2.69	ft
Top Width	2.53	ft
Open Grate Area	6.75	ft²
Active Grate Weir Length	14.50	ft

Worksheet for Median Inlet In Sag E246 Sta 6562+49.31 I-10 Med – 10-yr

Project Description

Solve For	Spread

Input Data

Discharge		2.19	ft^3/s
Left Side Slope		8.01	ft/ft (H:V)
Right Side Slope		6.44	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.06	ft
Depth	0.20	ft
Wetted Perimeter	2.41	ft
Top Width	2.06	ft
Open Grate Area	2.70	ft^2
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E248 Sta 6570+23.86 I-10 Med -10-gc

Project Description

Solve For	Spread

Input Data

Discharge		2.58	ft³/s
Left Side Slope		8.00	ft/ft (H:V)
Right Side Slope		6.95	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.06	ft
Depth	0.23	ft
Wetted Perimeter	2.46	ft
Top Width	2.06	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E258 Sta 6583+78.30 I-10 Med - 10-yr

Project Description

Solve For	Spread

Input Data

Discharge	2.06	ft^3/s
Left Side Slope	6.04	ft/ft (H:V)
Right Side Slope	8.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.00	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Results

Spread	2.06	ft
Depth	0.19	ft
Wetted Perimeter	2.39	ft
Top Width	2.06	ft
Open Grate Area	2.70	ft^2
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E264 Sta 6592+99.56 I-10 Med - 10-yr

Project Description

Solve For	Spread

Input Data

Discharge		7.92	ft^3/s
Left Side Slope		6.10	ft/ft (H:V)
Right Side Slope		7.99	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.14	ft
Depth	0.48	ft
Wetted Perimeter	2.97	ft
Top Width	2.14	ft
Open Grate Area	2.70	ft^2
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E278 Sta 6611+73.83 I-10 Med - 10 -JR

Project Description

Solve For	Spread

Input Data

Discharge		2.26	ft³/s
Left Side Slope		5.58	ft/ft (H:V)
Right Side Slope		6.98	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.07	ft
Depth	0.21	ft
Wetted Perimeter	2.42	ft
Top Width	2.07	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In SagE279 Sta 6621+23.79 I-10 Med - 10-yr

Project Description

Solve For	Spread

Input Data

Discharge		7.26	ft^3/s
Left Side Slope		6.22	ft/ft (H:V)
Right Side Slope		8.00	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.13	ft
Depth	0.45	ft
Wetted Perimeter	2.91	ft
Top Width	2.13	ft
Open Grate Area	2.70	ft^2
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E244 Sta 6637+86.83 I-10 Med - So-ye

Project Description

Solve For	Spread

Input Data

Discharge		5.87	ft^3/s
Left Side Slope		6.00	ft/ft (H:V)
Right Side Slope		4.00	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.16	ft
Depth	0.39	ft
Wetted Perimeter	2.80	ft
Top Width	2.16	ft
Open Grate Area	2.70	ft^2
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag CB130 Sta 6545+86.88 I-10 Med*-50-yr

Project Description

Solve For	Spread

Input Data

Discharge		5.87	ft^3/s
Left Side Slope		6.00	ft/ft (H:V)
Right Side Slope		8.30	ft/ft (H:V)
Bottom Width		2.50	ft
Grate Width		2.50	ft
Grate Length		6.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.58	ft
Depth	0.26	ft
Wetted Perimeter	3.03	ft
Top Width	2.58	ft
Open Grate Area	6.75	ft^2
Active Grate Weir Length	14.50	ft

Worksheet for Median Inlet In Sag CB132 Sta 6557+66.79 I-10 Med - 50-ye

Project Description

Solve For	Spread

Input Data

Discharge		3.29	ft³/s
Left Side Slope		8.01	ft/ft (H:V)
Right Side Slope		6.44	ft/ft (H:V)
Bottom Width		2.50	ft
Grate Width		2.50	ft
Grate Length		6.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.55	ft
Depth	0.18	ft
Wetted Perimeter	2.86	ft
Top Width	2.55	ft
Open Grate Area	6.75	ft²
Active Grate Weir Length	14.50	ft

Worksheet for Median Inlet In Sag CB134 Sta 6558+25.33 I-10 Med – 50-yr

Project Description

Solve For	Spread

Input Data

Discharge		1.76	ft³/s
Left Side Slope		7.98	ft/ft (H:V)
Right Side Slope		6.33	ft/ft (H:V)
Bottom Width		2.50	ft
Grate Width		2.50	ft
Grate Length		6.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.53	ft
Depth	0.12	ft
Wetted Perimeter	2.74	ft
Top Width	2.53	ft
Open Grate Area	6.75	ft²
Active Grate Weir Length	14.50	ft

Worksheet for Median Inlet In Sag E246 Sta 6562+49.31 I-10 Med - 50-yr

Project Description

Solve For	Spread

Input Data

Discharge		3.07	ft³/s
Left Side Slope		8.01	ft/ft (H:V)
Right Side Slope		6.44	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.07	ft
Depth	0.25	ft
Wetted Perimeter	2.51	ft
Top Width	2.07	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag CB245 Sta 6570+23.86 I-10 Med - 50-yr

Project Description

Solve For	Spread

Input Data

Discharge		3.61	ft³/s
Left Side Slope		8.00	ft/ft (H:V)
Right Side Slope		6.95	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.08	ft
Depth	0.28	ft
Wetted Perimeter	2.57	ft
Top Width	2.08	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E258 Sta 6583+78.30 I-10 Med - So-ge

Project Description

Solve For	Spread

Input Data

Discharge		2.88	ft³/s
Left Side Slope		6.04	ft/ft (H:V)
Right Side Slope		8.00	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.07	ft
Depth	0.24	ft
Wetted Perimeter	2.49	ft
Top Width	2.07	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E264 Sta 6592+99.56 I-10 Med - 50-yr

Project Description

Solve For	Spread

Input Data

Discharge		11.09	ft³/s
Left Side Slope		6.10	ft/ft (H:V)
Right Side Slope		7.99	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.17	ft
Depth	0.60	ft
Wetted Perimeter	3.21	ft
Top Width	2.17	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E278 Sta 6611+73.83 I-10 Med* - 50-yc

Project Description

Solve For	Spread

Input Data

Discharge		3.17	ft³/s
Left Side Slope		5.58	ft/ft (H:V)
Right Side Slope		6.98	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.08	ft
Depth	0.26	ft
Wetted Perimeter	2.53	ft
Top Width	2.08	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Worksheet for Median Inlet In Sag E279 Sta 6621+23.79 I-10 Med - 50-yr

Project Description

Solve For	Spread

Input Data

Discharge		10.17	ft³/s
Left Side Slope		6.22	ft/ft (H:V)
Right Side Slope		8.00	ft/ft (H:V)
Bottom Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	2.16	ft
Depth	0.56	ft
Wetted Perimeter	3.14	ft
Top Width	2.16	ft
Open Grate Area	2.70	ft²
Active Grate Weir Length	8.00	ft

Median Ditch Design

Worksheet for Triangular Median Ditch - E244 Sta 6537+86.82 — 10-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.01710	ft/ft
Left Side Slope	6.00	ft/ft (H:V)
Right Side Slope	9.00	ft/ft (H:V)
Discharge	4.19	ft^3/s

Results

Normal Depth	0.44	ft
Flow Area	1.48	ft^2
Wetted Perimeter	6.72	ft
Top Width	6.66	ft
Critical Depth	0.45	ft
Critical Slope	0.01511	ft/ft
Velocity	2.83	ft/s
Velocity Head	0.12	ft
Specific Energy	0.57	ft
Froude Number	1.06	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.44	ft
Critical Depth	0.45	ft
Channel Slope	0.01710	ft/ft
Critical Slope	0.01511	ft/ft

Worksheet for Triangular Median Ditch - CB130 Sta 6545+86.88 - 10-ye

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00208	ft/ft
Left Side Slope	6.00	ft/ft (H:V)
Right Side Slope	8.30	ft/ft (H:V)
Discharge	3.53	ft^3/s

Results

Normal Depth	0.63	ft
Flow Area	2.83	ft^2
Wetted Perimeter	9.09	ft
Top Width	9.00	ft
Critical Depth	0.43	ft
Critical Slope	0.01537	ft/ft
Velocity	1.25	ft/s
Velocity Head	0.02	ft
Specific Energy	0.65	ft
Froude Number	0.39	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.63	ft
Critical Depth	0.43	ft
Channel Slope	0.00208	ft/ft
Critical Slope	0.01537	ft/ft

Worksheet for Triangular Median Ditch - CB132 Sta 6557+66.79 — 10-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00208	ft/ft
Left Side Slope	8.01	ft/ft (H:V)
Right Side Slope	6.44	ft/ft (H:V)
Discharge	3.29	ft^3/s

Results

Normal Depth	0.61	ft
Flow Area	2.69	ft^2
Wetted Perimeter	8.91	ft
Top Width	8.82	ft
Critical Depth	0.42	ft
Critical Slope	0.01553	ft/ft
Velocity	1.22	ft/s
Velocity Head	0.02	ft
Specific Energy	0.63	ft
Froude Number	0.39	
Flow Type	Subcritical	

STA. 6557+00
EDGE OF PAVT = 1022.91
PAVT THICKNESS = - 1.33'
(16")
SUBGRADE: 1021.58
FLOW ELEV = 1019.78
+0.61
OKAY - 1020.39

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.42	ft
Channel Slope	0.00208	ft/ft
Critical Slope	0.01553	ft/ft

Worksheet for Triangular Median Ditch - CB134 Sta 6558+25.33 – 10-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00168	ft/ft
Left Side Slope	7.98	ft/ft (H:V)
Right Side Slope	6.33	ft/ft (H:V)
Discharge	1.26	ft^3/s

Results

Normal Depth	0.45	ft
Flow Area	1.42	ft^2
Wetted Perimeter	6.43	ft
Top Width	6.37	ft
Critical Depth	0.29	ft
Critical Slope	0.01764	ft/ft
Velocity	0.89	ft/s
Velocity Head	0.01	ft
Specific Energy	0.46	ft
Froude Number	0.33	
Flow Type	Subcritical	

STA 6559+00
EDGE OF PAV'T = 1022.85
PAV'T THICKNESS = 1.33
SUBGRADE 1021.52
FLOW ELEV = 1019.78
DEPTH = 0.45
OKAY - 1020.23

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.29	ft
Channel Slope	0.00168	ft/ft
Critical Slope	0.01764	ft/ft

Worksheet for Triangular Median Ditch - E246 Sta 6562+49.31 - 10-ye

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00903	ft/ft
Left Side Slope	8.01	ft/ft (H:V)
Right Side Slope	6.44	ft/ft (H:V)
Discharge	2.19	ft^3/s

Results

Normal Depth	0.40	ft
Flow Area	1.14	ft^2
Wetted Perimeter	5.80	ft
Top Width	5.75	ft
Critical Depth	0.36	ft
Critical Slope	0.01640	ft/ft
Velocity	1.92	ft/s
Velocity Head	0.06	ft
Specific Energy	0.45	ft
Froude Number	0.76	
Flow Type	Subcritical	

STA. 6563+00

EDGE OF PAV'T = 1025.11

PAV'T THICKNESS = -1.33

SUBGRADE 1023.78

FLOW ELEV 1022.08

+040

1022.49 OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.40	ft
Critical Depth	0.36	ft
Channel Slope	0.00903	ft/ft
Critical Slope	0.01640	ft/ft

Worksheet for Triangular Median Ditch - E248 Sta 6570+23.86 -10-yc

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00812	ft/ft
Left Side Slope	8.00	ft/ft (H:V)
Right Side Slope	6.95	ft/ft (H:V)
Discharge	2.58	ft³/s

Results

Normal Depth	0.43	ft
Flow Area	1.36	ft²
Wetted Perimeter	6.43	ft
Top Width	6.37	ft
Critical Depth	0.37	ft
Critical Slope	0.01610	ft/ft
Velocity	1.90	ft/s
Velocity Head	0.06	ft
Specific Energy	0.48	ft
Froude Number	0.73	
Flow Type	Subcritical	

STA. 6571+00

EDGE OF PAV'T: 1035.99
PAV'T THICKNESS 1.33
SUBGRADE 1034.56

FLOW ELEV: 1032.78
+ 0.43
1033.21 - OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.37	ft
Channel Slope	0.00812	ft/ft
Critical Slope	0.01610	ft/ft

Worksheet for Triangular Median Ditch - E258 Sta 6583+78.30 -10-ge

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00976	ft/ft
Left Side Slope	6.04	ft/ft (H:V)
Right Side Slope	8.00	ft/ft (H:V)
Discharge	2.06	ft³/s

Results

Normal Depth	0.39	ft
Flow Area	1.05	ft²
Wetted Perimeter	5.50	ft
Top Width	5.44	ft
Critical Depth	0.35	ft
Critical Slope	0.01648	ft/ft
Velocity	1.95	ft/s
Velocity Head	0.06	ft
Specific Energy	0.45	ft
Froude Number	0.78	
Flow Type	Subcritical	

STA. 6583+00

EDGE OF PAV'T = 1035.64
PAV'T THICKNESS -1.33
SUBGRADE 1034.31

FLOW ELEV = 1030.49
+0.39
1030.88 OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.35	ft
Channel Slope	0.00976	ft/ft
Critical Slope	0.01648	ft/ft

Worksheet for Triangular Median Ditch - E264 Sta 6592+99.56 -10-4e

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00274	ft/ft
Left Side Slope	6.10	ft/ft (H:V)
Right Side Slope	7.99	ft/ft (H:V)
Discharge	7.92	ft³/s

Results

Normal Depth	0.81	ft
Flow Area	4.67	ft²
Wetted Perimeter	11.59	ft
Top Width	11.47	ft
Critical Depth	0.60	ft
Critical Slope	0.01378	ft/ft
Velocity	1.70	ft/s
Velocity Head	0.04	ft
Specific Energy	0.86	ft
Froude Number	0.47	
Flow Type	Subcritical	

STA. 6593+00

EDGE OF PAV'T = 1025.22

PAV'T THICKNESS 1.33

SUBGRADE 1023.89

FLOW ELEV = 1020.90
0.91
1021.71

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.81	ft
Critical Depth	0.60	ft
Channel Slope	0.00274	ft/ft
Critical Slope	0.01378	ft/ft

Worksheet for Triangular Median Ditch - E278 Sta 6611+73.83 – 10ye

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00771	ft/ft
Left Side Slope	5.58	ft/ft (H:V)
Right Side Slope	6.98	ft/ft (H:V)
Discharge	2.26	ft³/s

Results

Normal Depth	0.44	ft
Flow Area	1.20	ft²
Wetted Perimeter	5.57	ft
Top Width	5.50	ft
Critical Depth	0.38	ft
Critical Slope	0.01609	ft/ft
Velocity	1.88	ft/s
Velocity Head	0.05	ft
Specific Energy	0.49	ft
Froude Number	0.71	
Flow Type	Subcritical	

STA. 6611+00

EDGE OF PAV'T = 1029.61
PAV'T THICKNESS -1.33
SUBGRADE 1028.28

FLOW ELEV = 1024.68
+0.44
1025.12 OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.44	ft
Critical Depth	0.38	ft
Channel Slope	0.00771	ft/ft
Critical Slope	0.01609	ft/ft

Worksheet for Triangular Median Ditch - E279 Sta 6621+23.79 East

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00267	ft/ft
Left Side Slope	6.22	ft/ft (H:V)
Right Side Slope	8.00	ft/ft (H:V)
Discharge	4.91	ft³/s

Results

Normal Depth	0.68	ft
Flow Area	3.30	ft²
Wetted Perimeter	9.78	ft
Top Width	9.69	ft
Critical Depth	0.49	ft
Critical Slope	0.01470	ft/ft
Velocity	1.49	ft/s
Velocity Head	0.03	ft
Specific Energy	0.72	ft
Froude Number	0.45	
Flow Type	Subcritical	

STA. 6621+06

EDGE OF PAV'T = 1020.92

PAV'T THICKNESS 1.33

SUBGRADE 1019.59

FLOW ELEV. 1017.00
+0.68
1017.68 OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.68	ft
Critical Depth	0.49	ft
Channel Slope	0.00267	ft/ft
Critical Slope	0.01470	ft/ft

Worksheet for Triangular Median Ditch - E279 Sta 6621+23.79 West -10-4c

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00267	ft/ft
Left Side Slope	6.22	ft/ft (H:V)
Right Side Slope	8.00	ft/ft (H:V)
Discharge	3.75	ft^3/s

Results

Normal Depth	0.62	ft
Flow Area	2.70	ft^2
Wetted Perimeter	8.84	ft
Top Width	8.76	ft
Critical Depth	0.44	ft
Critical Slope	0.01524	ft/ft
Velocity	1.39	ft/s
Velocity Head	0.03	ft
Specific Energy	0.65	ft
Froude Number	0.44	
Flow Type	Subcritical	

STA 6621+00

EDGE OF PAN'T = 1020.92

PAN'T THICKNESS 1.33

SUBGRADE 1019.59

FLOW ELEV = 1017.00 + 0.62

1017.62 OK.

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.62	ft
Critical Depth	0.44	ft
Channel Slope	0.00267	ft/ft
Critical Slope	0.01524	ft/ft

Worksheet for Triangular Median Ditch - E244 Sta 6537+86.83 — 50-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.01710	ft/ft
Left Side Slope	6.00	ft/ft (H:V)
Right Side Slope	9.00	ft/ft (H:V)
Discharge	5.87	ft^3/s

Results

Normal Depth	0.50	ft
Flow Area	1.91	ft^2
Wetted Perimeter	7.63	ft
Top Width	7.56	ft
Critical Depth	0.52	ft
Critical Slope	0.01444	ft/ft
Velocity	3.08	ft/s
Velocity Head	0.15	ft
Specific Energy	0.65	ft
Froude Number	1.08	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	0.52	ft
Channel Slope	0.01710	ft/ft
Critical Slope	0.01444	ft/ft

Worksheet for Triangular Median Ditch - CB130 Sta 6545+86.88 -50-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00208	ft/ft
Left Side Slope	6.00	ft/ft (H:V)
Right Side Slope	8.30	ft/ft (H:V)
Discharge	4.93	ft^3/s

Results

Normal Depth	0.71	ft
Flow Area	3.64	ft^2
Wetted Perimeter	10.30	ft
Top Width	10.20	ft
Critical Depth	0.49	ft
Critical Slope	0.01470	ft/ft
Velocity	1.35	ft/s
Velocity Head	0.03	ft
Specific Energy	0.74	ft
Froude Number	0.40	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.71	ft
Critical Depth	0.49	ft
Channel Slope	0.00208	ft/ft
Critical Slope	0.01470	ft/ft

Worksheet for Triangular Median Ditch -CB132 Sta 6557+66.79*-50-YR

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00208	ft/ft
Left Side Slope	8.01	ft/ft (H:V)
Right Side Slope	6.44	ft/ft (H:V)
Discharge	4.77	ft^3/s

Results

Normal Depth	0.70	ft
Flow Area	3.56	ft^2
Wetted Perimeter	10.24	ft
Top Width	10.14	ft
Critical Depth	0.49	ft
Critical Slope	0.01478	ft/ft
Velocity	1.34	ft/s
Velocity Head	0.03	ft
Specific Energy	0.73	ft
Froude Number	0.40	
Flow Type	Subcritical	

STA. 6557+06

EDGE OF PAV'T = 1022.91

PAV'T THICKNESS = - 1.33

SUBGRADE = 1021.58

FLOW ELEV = 1019.78

0.70

OKAY 1020.48

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.70	ft
Critical Depth	0.49	ft
Channel Slope	0.00208	ft/ft
Critical Slope	0.01478	ft/ft

Worksheet for Triangular Median Ditch -CB134 Sta 6558+25.33 - 50-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00168	ft/ft
Left Side Slope	7.98	ft/ft (H:V)
Right Side Slope	6.33	ft/ft (H:V)
Discharge	1.76	ft³/s

Results

Normal Depth	0.50	ft
Flow Area	1.82	ft²
Wetted Perimeter	7.29	ft
Top Width	7.22	ft
Critical Depth	0.33	ft
Critical Slope	0.01687	ft/ft
Velocity	0.97	ft/s
Velocity Head	0.01	ft
Specific Energy	0.52	ft
Froude Number	0.34	
Flow Type	Subcritical	

STA. 6559+00
EDGE OF PAV'T = 1022.85
PAV'T THICKNESS -1.33
SUBGRADE 1021.52

FLOW ELEV = 1019.78
0.50
1020.28 OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	0.33	ft
Channel Slope	0.00168	ft/ft
Critical Slope	0.01687	ft/ft

Worksheet for Triangular Median Ditch - E246 Sta 6562+49.31 - 50-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00903	ft/ft
Left Side Slope	8.01	ft/ft (H:V)
Right Side Slope	6.44	ft/ft (H:V)
Discharge	3.07	ft^3/s

Results

Normal Depth	0.45	ft
Flow Area	1.47	ft^2
Wetted Perimeter	6.59	ft
Top Width	6.53	ft
Critical Depth	0.41	ft
Critical Slope	0.01568	ft/ft
Velocity	2.08	ft/s
Velocity Head	0.07	ft
Specific Energy	0.52	ft
Froude Number	0.77	
Flow Type	Subcritical	

STA. 6563+00
EDGE OF PAV'T = 1025.11
PAV'T THICKNESS 1.33
SUBGRADE 1023.78

FLOW ELEV = 1022.08
+ 0.45
1022.53 OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.41	ft
Channel Slope	0.00903	ft/ft
Critical Slope	0.01568	ft/ft

Worksheet for Triangular Median Ditch - E248 Sta 6570+23.86 50-YR

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00812	ft/ft
Left Side Slope	8.00	ft/ft (H:V)
Right Side Slope	6.95	ft/ft (H:V)
Discharge	3.61	ft³/s

Results

Normal Depth	0.48	ft
Flow Area	1.75	ft²
Wetted Perimeter	7.29	ft
Top Width	7.23	ft
Critical Depth	0.43	ft
Critical Slope	0.01540	ft/ft
Velocity	2.07	ft/s
Velocity Head	0.07	ft
Specific Energy	0.55	ft
Froude Number	0.74	
Flow Type	Subcritical	

STA. 6571+00

EDGE OF PAV'T = 1035.89
PAV'T THICKNESS 1.33
SUBGRADE 1034.56

FLOW ELEV: 1032.78
+0.48
1033.26 - OK!

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.48	ft
Critical Depth	0.43	ft
Channel Slope	0.00812	ft/ft
Critical Slope	0.01540	ft/ft

Worksheet for Triangular Median Ditch - E258 Sta 6583+78.30

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00976	ft/ft
Left Side Slope	6.04	ft/ft (H:V)
Right Side Slope	8.00	ft/ft (H:V)
Discharge	2.88	ft³/s

Results

Normal Depth	0.44	ft
Flow Area	1.36	ft²
Wetted Perimeter	6.23	ft
Top Width	6.17	ft
Critical Depth	0.40	ft
Critical Slope	0.01576	ft/ft
Velocity	2.12	ft/s
Velocity Head	0.07	ft
Specific Energy	0.51	ft
Froude Number	0.80	
Flow Type	Subcritical	

STA 6553+00

EDGE OF PAV'T = 1035.64
PAV'T THICKNESS -1.33
SUBGRADE 1034.31

FLOW ELEV: 1030.49
+0.44
1030.93 - OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.44	ft
Critical Depth	0.40	ft
Channel Slope	0.00976	ft/ft
Critical Slope	0.01576	ft/ft

Worksheet for Triangular Median Ditch - Sta 6592+99.56 - 50-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00276	ft/ft
Left Side Slope	6.10	ft/ft (H:V)
Right Side Slope	7.99	ft/ft (H:V)
Discharge	11.09	ft³/s

Results

Normal Depth	0.92	ft
Flow Area	5.99	ft²
Wetted Perimeter	13.13	ft
Top Width	12.99	ft
Critical Depth	0.69	ft
Critical Slope	0.01318	ft/ft
Velocity	1.85	ft/s
Velocity Head	0.05	ft
Specific Energy	0.98	ft
Froude Number	0.48	
Flow Type	Subcritical	

STA. 6593+00

EDGE OF PAV'T = 1025.22
PAV'T THICKNESS -1.33
SUBGRADE 1023.89

FLOW ELEV. 1020.90
+ 0.92
1021.82 - OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.92	ft
Critical Depth	0.69	ft
Channel Slope	0.00276	ft/ft
Critical Slope	0.01318	ft/ft

Worksheet for Triangular Median Ditch - Sta 6611+73.83 -50-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00771	ft/ft
Left Side Slope	5.58	ft/ft (H:V)
Right Side Slope	6.98	ft/ft (H:V)
Discharge	3.15	ft³/s

Results

Normal Depth	0.50	ft
Flow Area	1.54	ft²
Wetted Perimeter	6.31	ft
Top Width	6.23	ft
Critical Depth	0.44	ft
Critical Slope	0.01540	ft/ft
Velocity	2.04	ft/s
Velocity Head	0.06	ft
Specific Energy	0.56	ft
Froude Number	0.72	
Flow Type	Subcritical	

STA 6611+00

EDGE OF PAV'T. 1029.61
PAV'T THICKNESS -1.33
SUBGRADE 1028.28

FLOW ELEV. 1024.68
+0.50
1025.18 - OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	0.44	ft
Channel Slope	0.00771	ft/ft
Critical Slope	0.01540	ft/ft

Worksheet for Triangular Median Ditch - E279 Sta 6621+23.79 East -10-4C

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00267	ft/ft
Left Side Slope	6.22	ft/ft (H:V)
Right Side Slope	8.00	ft/ft (H:V)
Discharge	3.50	ft^3/s

Results

Normal Depth	0.60	ft
Flow Area	2.56	ft^2
Wetted Perimeter	8.62	ft
Top Width	8.53	ft
Critical Depth	0.43	ft
Critical Slope	0.01538	ft/ft
Velocity	1.37	ft/s
Velocity Head	0.03	ft
Specific Energy	0.63	ft
Froude Number	0.44	
Flow Type	Subcritical	

STA. 6622+00

EDGE OF PAVT = 1021.46
PAV'T THICKNESS 1.33
SUBGRADE 1020.13
FLOW ELEV. 1017.15
0.60
1017.75 OKAY

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.60	ft
Critical Depth	0.43	ft
Channel Slope	0.00267	ft/ft
Critical Slope	0.01538	ft/ft

Worksheet for Triangular Median Ditch - E279 Sta 6621+23.79 West -50-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00145	ft/ft
Left Side Slope	6.22	ft/ft (H:V)
Right Side Slope	8.00	ft/ft (H:V)
Discharge	5.25	ft^3/s

Results

Normal Depth	0.78	ft
Flow Area	4.36	ft^2
Wetted Perimeter	11.25	ft
Top Width	11.14	ft
Critical Depth	0.51	ft
Critical Slope	0.01457	ft/ft
Velocity	1.20	ft/s
Velocity Head	0.02	ft
Specific Energy	0.81	ft
Froude Number	0.34	
Flow Type	Subcritical	

STA 6622+00

EDGE OF PAV'T = 1021.46

PAV'T THICKNESS - 1.33

SUBGRADE 1020.13

FLOW ELEV. 1017.15

+ 0.78

1017.93 - OK!

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.78	ft
Critical Depth	0.51	ft
Channel Slope	0.00145	ft/ft
Critical Slope	0.01457	ft/ft

APPENDIX G

DOWNDRAINS HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Time of Concentration
&
Rational Method Computations

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E200		
Station:	6417+43.17 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.17	0.95	0.2
			0.0
			0.0
	0.17		0.2

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1094.56	Upstream elevation, feet
	1092.84	Downstream elevation, feet
L =	172	feet
L =	0.0326	miles
S =	52.800	feet/mile
K_b =	0.0447	

where: A = 0.17 acres
m = -0.00625 (Table 5.1)
b = 0.04 (Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	4.32
15	3.14	4.65
30	2.12	5.39

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **0.63** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **0.63** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E202		
Station:	6417+72.65 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.06	0.95	0.1
			0.0
			0.0
	0.06		0.1

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1095.83	Upstream elevation, feet
	1094.26	Downstream elevation, feet
L =	107	feet
L =	0.0203	miles
S =	77.473	feet/mile
K_b =	0.0476	

where:

A =	0.06	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	3.13	
15	3.14	3.36	
30	2.12	3.90	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**0.22**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**0.22**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E204		
Station:	6420+29.35 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.35	0.95	0.3
			0.0
			0.0
	0.35		0.3

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1094.56	Upstream elevation, feet
	1092.52	Downstream elevation, feet
L =	272	feet
L =	0.0515	miles
S =	39.600	feet/mile
K_b =	0.0428	

where:

A =	0.35	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	5.81
15	3.14	6.24
30	2.12	7.25

***Use 10 minutes**

Rational Method:

Q = CiA *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.27**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**1.27**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E206		
Station:	6420+62.84 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.46	0.95	0.4
			0.0
			0.0
	0.46		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1095.83	Upstream elevation, feet
	1093.79	Downstream elevation, feet
L =	339	feet
L =	0.0642	miles
S =	31.773	feet/mile
K_b =	0.0421	

where:

A =	0.46	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	6.88
15	3.14	7.40
30	2.12	8.59

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 1.66 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 1.66 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E208		
Station:	6466+48 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.63	0.95	0.6
			0.0
			0.0
	0.63		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1067.57	Upstream elevation, feet
	1061.85	Downstream elevation, feet
L =	553	feet
L =	0.1047	miles
S =	54.614	feet/mile
K_b =	0.0413	

where:

A =	0.63	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	7.35	
15	3.14	7.90	
30	2.12	9.17	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	2.27	cfs
Q_B =	1.53	cfs (upstream bypass flow)
Q_T =	3.80	cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E210		
Station:	6466+05.55 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.84	0.95	0.8
			0.0
			0.0
	0.84		0.8

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1069.32	Upstream elevation, feet
	1065.38	Downstream elevation, feet
L =	553	feet
L =	0.1047	miles
S =	37.619	feet/mile
K_b =	0.0405	

where:

A =	0.84	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	8.17	
15	3.14	8.78	
30	2.12	10.19	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.04**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.04**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N212		
Station:	6473+50 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.46	0.95	0.4
			0.0
			0.0
	0.46		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1068.84	Upstream elevation, feet
	1068.31	Downstream elevation, feet
L =	331	feet
L =	0.0627	miles
S =	8.454	feet/mile
K_b =	0.0421	

where:

A =	0.46	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	10.25	
15	3.14	11.02	
30	2.12	12.80	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 1.65 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 1.65 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N214		
Station:	6474+04 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.58	0.95	0.5
			0.0
			0.0
	0.58		0.5

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1069.32	Upstream elevation, feet
	1066.7	Downstream elevation, feet
L =	400	feet
L =	0.0758	miles
S =	34.584	feet/mile
K_b =	0.0415	

where:

A =	0.58	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	7.22
15	3.14	7.77
30	2.12	9.02

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.08**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.08**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E216		
Station:	6474+88.16 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.15	0.95	0.1
			0.0
			0.0
	0.15		0.1

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1068.3	Upstream elevation, feet
	1066.51	Downstream elevation, feet
L =	490	feet
L =	0.0928	miles
S =	19.288	feet/mile
K_b =	0.0452	

where:

A =	0.15	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	10.02	
15	3.14	10.77	
30	2.12	12.51	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 0.53 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 0.53 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E218		
Station:	6475+95 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.46	0.95	0.4
			0.0
			0.0
	0.46		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1070.03	Upstream elevation, feet
	1066.84	Downstream elevation, feet
L =	331	feet
L =	0.0627	miles
S =	50.886	feet/mile
K_b =	0.0421	

where:

A =	0.46	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	5.88	
15	3.14	6.32	
30	2.12	7.33	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.65**	**cfs**
Q_B =	**0.24**	**cfs (upstream bypass flow)**
Q_T =	**1.89**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E220		
Station:	6479+99 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.76	0.95	0.7
			0.0
			0.0
	0.76		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1068.28	Upstream elevation, feet
	1061.75	Downstream elevation, feet
L =	182	feet
L =	0.0345	miles
S =	189.442	feet/mile
K_b =	0.0408	

where:

A =	0.76	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	2.85	
15	3.14	3.06	
30	2.12	3.56	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.74**	**cfs**
Q_B =	**0.70**	**cfs (upstream bypass flow)**
Q_T =	**3.44**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E222		
Station:	6484+18 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.73	0.95	0.7
			0.0
			0.0
	0.73		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1064.15	Upstream elevation, feet
	1053.87	Downstream elevation, feet
L =	497	feet
L =	0.0941	miles
S =	109.212	feet/mile
K_b =	0.0408	

where:

A =	0.73	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	5.59
15	3.14	6.01
30	2.12	6.98

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.65**	**cfs**
Q_B =	**1.49**	**cfs (upstream bypass flow)**
Q_T =	**4.14**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E224		
Station:	6515+82.45 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.38	0.95	0.4
			0.0
			0.0
	0.38		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1045.31	Upstream elevation, feet
	1041.54	Downstream elevation, feet
L =	286	feet
L =	0.0542	miles
S =	69.600	feet/mile
K_b =	0.0426	

where:

A =	0.38	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	4.99	
15	3.14	5.36	
30	2.12	6.23	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **1.36** **cfs**
Q_B = **0.20** **cfs (upstream bypass flow)**
Q_T = **1.56** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E226		
Station:	6516+44.91 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.32	0.95	0.3
			0.0
			0.0
	0.32		0.3

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1046.07	Upstream elevation, feet
	1042.78	Downstream elevation, feet
L =	253	feet
L =	0.0479	miles
S =	68.661	feet/mile
K_b =	0.0431	

where:

A =	0.32	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	4.73	
15	3.14	5.09	
30	2.12	5.91	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	1.17	**cfs**
Q_B =	0.24	**cfs (upstream bypass flow)**
Q_T =	1.41	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N228		
Station:	6517+90 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.40	0.95	0.4
			0.0
			0.0
	0.40		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1040.73	Upstream elevation, feet
	1043.76	Downstream elevation, feet
L =	283	feet
L =	0.0536	miles
S =	-56.531	feet/mile
K_b =	0.0425	

where:

A =	0.40	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	#NUM!
15	3.14	#NUM!
30	2.12	#NUM!

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.44**	**cfs**
Q_B =	**0.79**	**cfs (upstream bypass flow)**
Q_T =	**2.23**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N230		
Station:	6518+20 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.34	0.95	0.3
			0.0
			0.0
	0.34		0.3

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1046.73	Upstream elevation, feet
	1044.53	Downstream elevation, feet
L =	259	feet
L =	0.0491	miles
S =	44.849	feet/mile
K_b =	0.0430	

where:

A =	0.34	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	5.46	
15	3.14	5.87	
30	2.12	6.82	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **1.21** **cfs**
Q_B = **0.80** **cfs (upstream bypass flow)**
Q_T = **2.01** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E229		
Station:	6519+95.09 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.69	0.95	0.7
			0.0
			0.0
	0.69		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1047.66	Upstream elevation, feet
	1045.18	Downstream elevation, feet
L =	453	feet
L =	0.0858	miles
S =	28.906	feet/mile
K_b =	0.0410	

where:

A =	0.69	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	8.08	
15	3.14	8.69	
30	2.12	10.08	***Use 10 minutes**

Rational Method:

Q = CiA *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 2.48 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 2.48 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E231		
Station:	6520+01.19 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.65	0.95	0.6
			0.0
			0.0
	0.65		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1048.33	Upstream elevation, feet
	1045.85	Downstream elevation, feet
L =	443	feet
L =	0.0839	miles
S =	29.558	feet/mile
K_b =	0.0412	

where:

A =	0.65	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	7.95	
15	3.14	8.55	
30	2.12	9.92	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 2.34 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 2.34 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N232		
Station:	6527+50 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.63	0.95	0.6
			0.0
			0.0
	0.63		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1047.66	Upstream elevation, feet
	1011.79	Downstream elevation, feet
L =	459	feet
L =	0.0869	miles
S =	412.622	feet/mile
K_b =	0.0413	

where:

A =	0.63	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	3.58	
15	3.14	3.85	
30	2.12	4.47	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.27**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.27**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N234		
Station:	6527+50 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.70	0.95	0.7
			0.0
			0.0
	0.70		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1047.66	Upstream elevation, feet
	1045.59	Downstream elevation, feet
L =	461	feet
L =	0.0873	miles
S =	23.708	feet/mile
K_b =	0.0410	

where:

A =	0.70	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	8.66
15	3.14	9.31
30	2.12	10.81

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.53**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.53**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N236		
Station:	6531+30 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.46	0.95	0.4
			0.0
			0.0
	0.46		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1045.92	Upstream elevation, feet
	1041.58	Downstream elevation, feet
L =	432	feet
L =	0.0818	miles
S =	53.044	feet/mile
K_b =	0.0421	

where:

A =	0.46	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	6.62
15	3.14	7.12
30	2.12	8.27

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.67**	**cfs**
Q_B =	**0.71**	**cfs (upstream bypass flow)**
Q_T =	**2.38**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N238		
Station:	6531+30 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.47	0.95	0.4
			0.0
			0.0
	0.47		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1046.63	Upstream elevation, feet
	1042.45	Downstream elevation, feet
L =	432	feet
L =	0.0818	miles
S =	51.089	feet/mile
K_b =	0.0420	

where:

A =	0.47	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.70	
15	3.14	7.20	
30	2.12	8.36	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.70**	**cfs**
Q_B =	**0.59**	**cfs (upstream bypass flow)**
Q_T =	**2.29**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E240		
Station:	6531+30 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.47	0.95	0.4
			0.0
			0.0
	0.47		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1041.58	Upstream elevation, feet
	1036.12	Downstream elevation, feet
L =	443	feet
L =	0.0839	miles
S =	65.076	feet/mile
K_b =	0.0421	

where:

A =	0.47	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.29	
15	3.14	6.77	
30	2.12	7.86	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.68**	**cfs**
Q_B =	**1.01**	**cfs (upstream bypass flow)**
Q_T =	**2.69**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E242		
Station:	6535+21.8 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.48	0.95	0.5
			0.0
			0.0
	0.48		0.5

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1043.5	Upstream elevation, feet
	1036.66	Downstream elevation, feet
L =	444	feet
L =	0.0841	miles
S =	81.341	feet/mile
K_b =	0.0420	

where:

A =	0.48	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	5.87
15	3.14	6.31
30	2.12	7.33

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 1.75 cfs
Q_B = 0.97 cfs (upstream bypass flow)
Q_T = 2.72 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening		Design:	DNJ
Design Storm:	10	years	Check:	
Catch Basin No.:	Existing Downdrain		Date:	3/15/08
Drainage Area:	E250			
Station:	6573+20.53 I-10 EB			

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.44	0.95	0.4
			0.0
			0.0
	0.44		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1039.02	Upstream elevation, feet
	1036.81	Downstream elevation, feet
L =	440	feet
L =	0.0833	miles
S =	26.520	feet/mile
K_b =	0.0422	

where:

A =	0.44	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	8.30	
15	3.14	8.92	
30	2.12	10.36	***Use 10 minutes**

Rational Method:

Q = CiA *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.59**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**1.59**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E252		
Station:	6574+08.17 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.32	0.95	0.3
			0.0
			0.0
	0.32		0.3

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1039.4	Upstream elevation, feet
	1037.78	Downstream elevation, feet
L =	355	feet
L =	0.0672	miles
S =	24.095	feet/mile
K_b =	0.0431	

where:

A =	0.32	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	7.76	
15	3.14	8.34	
30	2.12	9.69	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.17**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**1.17**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E254		
Station:	6580+52.62 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.36	0.95	0.3
			0.0
			0.0
	0.36		0.3

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1039.02	Upstream elevation, feet
	1036.95	Downstream elevation, feet
L =	385	feet
L =	0.0729	miles
S =	28.389	feet/mile
K_b =	0.0428	

where:

A =	0.36	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	7.65
15	3.14	8.23
30	2.12	9.55

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.31**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**1.31**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E256		
Station:	6582+83.32 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.71	0.95	0.7
			0.0
			0.0
	0.71		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1039.4	Upstream elevation, feet
	1035.45	Downstream elevation, feet
L =	620	feet
L =	0.1174	miles
S =	33.639	feet/mile
K_b =	0.0409	

where:

A =	0.71	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	9.01
15	3.14	9.69
30	2.12	11.25

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 2.55 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 2.55 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N260		
Station:	6584+10 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.48	0.95	0.5
			0.0
			0.0
	0.48		0.5

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1037.59	Upstream elevation, feet
	1033.67	Downstream elevation, feet
L =	420	feet
L =	0.0795	miles
S =	49.280	feet/mile
K_b =	0.0420	

where:

A =	0.48	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.67	
15	3.14	7.18	
30	2.12	8.33	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.73**	**cfs**
Q_B =	**0.26**	**cfs (upstream bypass flow)**
Q_T =	**1.99**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N262		
Station:	6585+85 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.41	0.95	0.4
			0.0
			0.0
	0.41		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1035.64	Upstream elevation, feet
	1031.73	Downstream elevation, feet
L =	360	feet
L =	0.0682	miles
S =	57.347	feet/mile
K_b =	0.0424	

where:

A =	0.41	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	5.93	
15	3.14	6.37	
30	2.12	7.40	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **1.48** **cfs**
Q_B = **1.13** **cfs (upstream bypass flow)**
Q_T = **2.61** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N266		
Station:	6591+00 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.54	0.95	0.5
			0.0
			0.0
	0.54		0.5

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1028.96	Upstream elevation, feet
	1024.55	Downstream elevation, feet
L =	395	feet
L =	0.0748	miles
S =	58.949	feet/mile
K_b =	0.0417	

where:

A =	0.54	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	6.10	
15	3.14	6.55	
30	2.12	7.61	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 1.96 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 1.96 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E268		
Station:	6592+70.01 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.72	0.95	0.7
			0.0
			0.0
	0.72		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1026.16	Upstream elevation, feet
	1025.18	Downstream elevation, feet
L =	390	feet
L =	0.0739	miles
S =	13.268	feet/mile
K_b =	0.0409	

where:

A =	0.72	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	9.53	
15	3.14	10.24	
30	2.12	11.89	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 2.60 cfs
Q_B = 1.32 cfs (upstream bypass flow)
Q_T = 3.92 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E270		
Station:	6594+42.99 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.58	0.95	0.6
			0.0
			0.0
	0.58		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1029.76	Upstream elevation, feet
	1024.75	Downstream elevation, feet
L =	530	feet
L =	0.1004	miles
S =	49.911	feet/mile
K_b =	0.0415	

where:

A =	0.58	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	7.42	
15	3.14	7.98	
30	2.12	9.26	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 2.09 cfs
Q_B = 1.09 cfs (upstream bypass flow)
Q_T = 3.18 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E272		
Station:	6595+95.37 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.55	0.95	0.5
			0.0
			0.0
	0.55		0.5

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1030.24	Upstream elevation, feet
	1025.18	Downstream elevation, feet
L =	452	feet
L =	0.0856	miles
S =	59.108	feet/mile
K_b =	0.0416	

where:

A =	0.55	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	6.51
15	3.14	7.00
30	2.12	8.13

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.99**	**cfs**
Q_B =	**0.89**	**cfs (upstream bypass flow)**
Q_T =	**2.88**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening		Design:	DNJ
Design Storm:	10	years	Check:	
Catch Basin No.:	Existing Downdrain		Date:	3/15/08
Drainage Area:	E274			
Station:	6599+17.55 I-10 WB			

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.73	0.95	0.7
			0.0
			0.0
	0.73		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1032	Upstream elevation, feet
	1028.93	Downstream elevation, feet
L =	730	feet
L =	0.1383	miles
S =	22.205	feet/mile
K_b =	0.0409	

where:

A =	0.73	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	11.11	
15	3.14	11.94	
30	2.12	13.86	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.62**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**2.62**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N276		
Station:	6600+00 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.69	0.95	0.7
			0.0
			0.0
	0.69		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1032	Upstream elevation, feet
	1029.51	Downstream elevation, feet
L =	640	feet
L =	0.1212	miles
S =	20.543	feet/mile
K_b =	0.0410	

where:

A =	0.69	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	10.67	
11	3.67	10.81	
12	3.54	10.96	***Use 11 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **2.41** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **2.41** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	E279		
Station:	6609+50 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.41	0.95	0.4
			0.0
			0.0
	0.41		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1032	Upstream elevation, feet
	1030.08	Downstream elevation, feet
L =	395	feet
L =	0.0748	miles
S =	25.665	feet/mile
K_b =	0.0424	

where:

A =	0.41	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	7.96
15	3.14	8.56
30	2.12	9.94

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	1.22	**cfs**
Q_B =	0.00	**cfs (upstream bypass flow)**
Q_T =	1.22	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E280		
Station:	6613+39.60 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.56	0.95	0.5
			0.0
			0.0
	0.56		0.5

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1032	Upstream elevation, feet
	1026.53	Downstream elevation, feet
L =	475	feet
L =	0.0900	miles
S =	60.803	feet/mile
K_b =	0.0416	

where:

A =	0.56	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	6.62
15	3.14	7.11
30	2.12	8.26

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **2.00** **cfs**
Q_B = **0.21** **cfs (upstream bypass flow)**
Q_T = **2.21** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	New Downdrain	Date:	3/15/08
Drainage Area:	N281		
Station:	6609+50 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.40	0.95	0.4
			0.0
			0.0
	0.40		0.4

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1032	Upstream elevation, feet
	1030.21	Downstream elevation, feet
L =	395	feet
L =	0.0748	miles
S =	23.927	feet/mile
K_b =	0.0425	

where:

A =	0.40	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	8.15
15	3.14	8.76
30	2.12	10.17

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **1.18** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **1.18** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E282		
Station:	6613+39.64 I-10 WB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.51	0.95	0.5
			0.0
			0.0
	0.51		0.5

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1030.91	Upstream elevation, feet
	1026.63	Downstream elevation, feet
L =	475	feet
L =	0.0900	miles
S =	47.576	feet/mile
K_b =	0.0419	

where:

A =	0.51	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	7.16
11	3.67	7.26
12	3.54	7.36

***Use 10 minutes**

Rational Method:

Q = CiA *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**1.82**	**cfs**
Q_B =	**0.25**	**cfs (upstream bypass flow)**
Q_T =	**2.07**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E284		
Station:	6618+69.94 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.64	0.95	0.6
			0.0
			0.0
	0.64		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1027.25	Upstream elevation, feet
	1021.49	Downstream elevation, feet
L =	558	feet
L =	0.1057	miles
S =	54.503	feet/mile
K_b =	0.0412	

where:

A =	0.64	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	7.38
15	3.14	7.94
30	2.12	9.22

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **2.30** **cfs**
Q_B = **0.94** **cfs (upstream bypass flow)**
Q_T = **3.24** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E288		
Station:	6621+19.94 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.75	0.95	0.7
			0.0
			0.0
	0.75		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1022.69	Upstream elevation, feet
	1019.64	Downstream elevation, feet
L =	288	feet
L =	0.0545	miles
S =	55.917	feet/mile
K_b =	0.0408	

where:

A =	0.75	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	5.23
15	3.14	5.63
30	2.12	6.53

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **2.72** **cfs**
Q_B = **2.01** **cfs (upstream bypass flow)**
Q_T = **4.73** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening		Design:	DNJ
Design Storm:	10	years	Check:	
Catch Basin No.:	Existing Downdrain		Date:	3/15/08
Drainage Area:	E286			
Station:	6618+69.83 I-10 WB			

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.58	0.95	0.6
			0.0
			0.0
	0.58		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1027.36	Upstream elevation, feet
	1021.57	Downstream elevation, feet
L =	548	feet
L =	0.1038	miles
S =	55.787	feet/mile
K_b =	0.0415	

where:

A =	0.58	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	7.29
15	3.14	7.84
30	2.12	9.10

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:

Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **2.09** **cfs**
Q_B = **0.71** **cfs (upstream bypass flow)**
Q_T = **2.80** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E289		
Station:	6621+13.53 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.73	0.95	0.7
			0.0
			0.0
	0.73		0.7

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1022.69	Upstream elevation, feet
	1020.92	Downstream elevation, feet
L =	364	feet
L =	0.0689	miles
S =	25.675	feet/mile
K_b =	0.0409	

where:

A =	0.73	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	7.50
15	3.14	8.06
30	2.12	9.36

***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**2.64**	**cfs**
Q_B =	**1.88**	**cfs (upstream bypass flow)**
Q_T =	**4.52**	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E290		
Station:	6624+32.88 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.68	0.95	0.6
			0.0
			0.0
	0.68		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1024.8	Upstream elevation, feet
	1021.93	Downstream elevation, feet
L =	562	feet
L =	0.1064	miles
S =	26.964	feet/mile
K_b =	0.0411	

where:

A =	0.68	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	9.20	
15	3.14	9.89	
30	2.12	11.48	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = **2.44** **cfs**
Q_B = **0.00** **cfs (upstream bypass flow)**
Q_T = **2.44** **cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening		Design:	DNJ
Design Storm:	10	years	Check:	
Catch Basin No.:	New Downdrain		Date:	3/15/08
Drainage Area:	N292			
Station:	6624+30 I-10 WB			

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.65	0.95	0.6
			0.0
			0.0
	0.65		0.6

Weighted C-Coefficient: **0.95**

Time of Concentration:

$$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1024.89	Upstream elevation, feet
	1021.99	Downstream elevation, feet
L =	575	feet
L =	0.1089	miles
S =	26.630	feet/mile
K_b =	0.0412	

where:

A =	0.65	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	9.35
15	3.14	10.06
30	2.12	11.68

***Use 13 minutes**

Rational Method:

$$Q = CiA$$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	2.35	**cfs**
Q_B =	0.00	**cfs (upstream bypass flow)**
Q_T =	2.35	**cfs (inflow)**

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening	Design:	DNJ
Design Storm:	10 years	Check:	
Catch Basin No.:	Existing Downdrain	Date:	3/15/08
Drainage Area:	E294		
Station:	6637+03.06 I-10 EB		

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.85	0.95	0.8
			0.0
			0.0
	0.85		0.8

Weighted C-Coefficient: **0.95**

Time of Concentration:

$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1024.8	Upstream elevation, feet
	1019.58	Downstream elevation, feet
L =	809	feet
L =	0.1532	miles
S =	34.069	feet/mile
K_b =	0.0405	

where:

A =	0.85	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c	
10	3.80	10.19	
15	3.14	10.95	
30	2.12	12.71	***Use 10 minutes**

Rational Method:

$Q = CiA$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R = 3.06 cfs
Q_B = 0.00 cfs (upstream bypass flow)
Q_T = 3.06 cfs (inflow)

I-10 (Papago) Widening, Verrado Way to Sarival Avenue
Rational Method

Project Information:

Project Name:	I-10 Widening		Design:	DNJ
Design Storm:	10	years	Check:	
Catch Basin No.:	Existing Downdrain		Date:	3/15/08
Drainage Area:	E296			
Station:	6636+78.30 I-10 WB			

Computations in accordance with the Flood Control District of Maricopa County, Drainage Design Manual, Volume I, Hydrology, 1991.

Weighted C-Coefficient:

Land Use	Area (acres)	C	Area x C
Pavement	0.84	0.95	0.8
			0.0
			0.0
	0.84		0.8

Weighted C-Coefficient: **0.95**

Time of Concentration:

$$Tc = 11.4L^{0.50} K_b^{0.52} S^{-0.31} i^{-0.38}$$ *(equation 5.5)*

where:

T_c = the time of concentration, hours
L = Length of the flow path, miles
K_b = Representative watershed resistance coefficient
m log A + b
S = Watercourse slope, ft/mile
I = the average rainfall intensity, inches/hour

input:

	1024.89	Upstream elevation, feet
	1020.03	Downstream elevation, feet
L =	771	feet
L =	0.1460	miles
S =	33.282	feet/mile
K_b =	0.0405	

where:

A =	0.84	acres
m =	-0.00625	(Table 5.1)
b =	0.04	(Table 5.1)

Computations:

2-year:

Selected T_c	I	Computed T_c
10	3.80	10.02
15	3.14	10.77
30	2.12	12.50

***Use 10 minutes**

Rational Method:

$$Q = CiA$$ *(equation 3.1)*

Where:
Q = Peak flow, cfs
C = weighted 'C' coefficient
I = rainfall intensity
A = area, acres

Q_R =	**3.04**	**cfs**
Q_B =	**0.00**	**cfs (upstream bypass flow)**
Q_T =	**3.04**	**cfs (inflow)**

Downdrain Analyses

Worksheet for Exist Downdrain Grade - E200 Sta 6417+43.17 I-10 EB

Project Description

Solve For	Efficiency

JACKRABBIT TRAIL BRIDGE

Input Data

Discharge	0.63	ft³/s
Slope	0.00028	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	0.63	ft³/s
Bypass Flow	0.00	ft³/s
Spread	11.27	ft
Depth	0.23	ft
Flow Area	1.27	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	0.50	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	2.00	
Total Interception Length	5.75	ft

Worksheet for Exist Downdrain Grade - E202 Sta 6417+72.65 I-10 WB

Project Description

Solve For	Efficiency

JACKRABBIT TRAIL BRIDGE

Input Data

Discharge	0.22	ft³/s
Slope	0.00680	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	0.22	ft³/s
Bypass Flow	0.00	ft³/s
Spread	4.18	ft
Depth	0.08	ft
Flow Area	0.17	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.26	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	1.19	
Total Interception Length	9.63	ft

Worksheet for Exist Downdrain Grade - E204 Sta 6420+29.35 I-10 EB

Project Description

JACKRABBIT TRAIL BRIDGE

Solve For	Efficiency

Input Data

Discharge	1.27	ft³/s
Slope	0.00400	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	86.47	%
Intercepted Flow	1.10	ft³/s
Bypass Flow	0.17	ft³/s
Spread	8.90	ft
Depth	0.18	ft
Flow Area	0.79	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.60	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.67	
Total Interception Length	17.14	ft

Worksheet for Exist Downdrain Grade - E206 Sta 6420+62.84 I-10 WB

Project Description

JACKRABBIT TRAIL BRIDGE

Solve For	Efficiency

Input Data

Discharge	1.66	ft³/s
Slope	0.00870	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	68.63	%
Intercepted Flow	1.14	ft³/s
Bypass Flow	0.52	ft³/s
Spread	8.51	ft
Depth	0.17	ft
Flow Area	0.72	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.29	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.47	
Total Interception Length	24.22	ft

Worksheet for Exist Downdrain Grade - E208 Sta 6462+48 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.80	ft³/s
Slope	0.01060	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	53.14	%
Intercepted Flow	2.02	ft³/s
Bypass Flow	1.78	ft³/s ← TO NEW RIRAP SPILLWAY
Spread	10.25	ft
Depth	0.24	ft
Flow Area	1.21	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.14	ft/s
Equivalent Cross Slope	0.02300	ft/ft
Length Factor	0.34	
Total Interception Length	33.46	ft

Worksheet for Exist Downdrain Grade - E210 Sta 6466+05.55 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.04	ft³/s
Slope	0.01910	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	49.57	%
Intercepted Flow	1.51	ft³/s
Bypass Flow	1.53	ft³/s
Spread	8.44	ft
Depth	0.19	ft
Flow Area	0.82	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.71	ft/s
Equivalent Cross Slope	0.02300	ft/ft
Length Factor	0.32	
Total Interception Length	36.35	ft

Worksheet for New Downdrain Grade - N 212 Sta 6473+50 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.65	ft³/s
Slope	0.00300	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	85.29	%
Intercepted Flow	1.41	ft³/s
Bypass Flow	0.24	ft³/s
Spread	10.37	ft
Depth	0.21	ft
Flow Area	1.07	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.54	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.66	
Total Interception Length	17.55	ft

Worksheet for New Downdrain Grade - N214 Sta 6474+04 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.08	ft^3/s
Slope	0.00280	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	19.00	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	100.00	%
Intercepted Flow	2.08	ft^3/s
Bypass Flow	0.00	ft^3/s
Spread	11.46	ft
Depth	0.23	ft
Flow Area	1.31	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.59	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	1.00	
Total Interception Length	18.95	ft

Worksheet for Exist Downdrain Grade - E216 Sta 6474+88.16 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	0.53	ft³/s
Slope	0.00330	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.01	ft/ft
Road Cross Slope	0.01	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	10.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	61.04	%
Intercepted Flow	0.32	ft³/s
Bypass Flow	0.21	ft³/s ← CROSSOVER FLOW - OKAY
Spread	15.82	ft
Depth	0.08	ft
Flow Area	0.63	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	0.85	ft/s
Equivalent Cross Slope	0.00500	ft/ft
Length Factor	0.41	
Total Interception Length	25.75	ft

Worksheet for Exist Downdrain Grade - E218 Sta 6475+95 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.89	ft^3/s
Slope	0.00790	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	10.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	62.79	%
Intercepted Flow	1.19	ft^3/s
Bypass Flow	0.70	ft^3/s
Spread	9.10	ft
Depth	0.18	ft
Flow Area	0.83	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.28	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.42	
Total Interception Length	24.85	ft

Worksheet for Exist Downdrain Grade - E220 Sta 6479+99 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.44	ft³/s
Slope	0.01600	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	56.65	%
Intercepted Flow	1.95	ft³/s
Bypass Flow	1.49	ft³/s
Spread	7.74	ft
Depth	0.23	ft
Flow Area	0.90	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.82	ft/s
Equivalent Cross Slope	0.03000	ft/ft
Length Factor	0.37	
Total Interception Length	30.96	ft

Worksheet for Exist Downdrain Grade - E222 Sta 6484+18 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	4.14	ft^3/s
Slope	0.02400	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.03	ft/ft
Road Cross Slope	0.03	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	47.96	%
Intercepted Flow	1.99	ft^3/s
Bypass Flow	2.15	ft^3/s
Spread	7.69	ft
Depth	0.23	ft
Flow Area	0.89	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	4.66	ft/s
Equivalent Cross Slope	0.03000	ft/ft
Length Factor	0.30	
Total Interception Length	37.79	ft

Worksheet for Exist Downdrain Grade - E224 Sta 6515+82.45 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.56	ft³/s
Slope	0.01260	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	10.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	59.91	%
Intercepted Flow	0.93	ft³/s
Bypass Flow	0.63	ft³/s ← TO NEW RIPRAP SPILLWAY
Spread	7.76	ft
Depth	0.16	ft
Flow Area	0.60	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.59	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.40	
Total Interception Length	26.37	ft

Worksheet for Exist Downdrain Grade - E226 Sta 6516+44.91 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.41	ft³/s
Slope	0.01150	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	67.86	%
Intercepted Flow	0.96	ft³/s
Bypass Flow	0.45	ft³/s ← TO NEW RIPRAP SPILLWAY
Spread	7.60	ft
Depth	0.15	ft
Flow Area	0.58	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.44	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.47	
Total Interception Length	24.59	ft

Worksheet for New Downdrain Grade - N228 Sta 6517+90 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.23	ft³/s
Slope	0.00700	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	19.00	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	91.13	%
Intercepted Flow	2.03	ft³/s
Bypass Flow	0.20	ft³/s
Spread	9.90	ft
Depth	0.20	ft
Flow Area	0.98	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.27	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.74	
Total Interception Length	25.68	ft

Worksheet for Exist Downdrain Grade - E229 Sta 6519+95.09 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.48	ft³/s
Slope	0.00510	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	68.20	%
Intercepted Flow	1.69	ft³/s
Bypass Flow	0.79	ft³/s
Spread	10.94	ft
Depth	0.22	ft
Flow Area	1.20	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.07	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.47	
Total Interception Length	24.42	ft

Worksheet for New Downdrain Grade - N230 Sta 6518+20 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.01	ft³/s
Slope	0.00990	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	19.00	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	88.30	%
Intercepted Flow	1.77	ft³/s
Bypass Flow	0.24	ft³/s
Spread	8.92	ft
Depth	0.18	ft
Flow Area	0.80	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.52	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.70	
Total Interception Length	27.28	ft

Worksheet for Exist Downdrain Grade - E231 Sta 6520+01.09 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.34	ft³/s
Slope	0.00640	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	65.99	%
Intercepted Flow	1.54	ft³/s
Bypass Flow	0.80	ft³/s
Spread	10.25	ft
Depth	0.21	ft
Flow Area	1.05	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.23	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.45	
Total Interception Length	25.51	ft

Worksheet for New Downdrain Grade - N232 Sta 6527+50 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.27	ft³/s
Slope	0.00560	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	68.67	%
Intercepted Flow	1.56	ft³/s
Bypass Flow	0.71	ft³/s
Spread	10.39	ft
Depth	0.21	ft
Flow Area	1.08	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.10	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.48	
Total Interception Length	24.20	ft

Worksheet for New Downdrain Grade - N234 Sta 6527+50 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.53	ft³/s
Slope	0.00290	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	76.54	%
Intercepted Flow	1.94	ft³/s
Bypass Flow	0.59	ft³/s
Spread	12.25	ft
Depth	0.24	ft
Flow Area	1.50	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.69	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.55	
Total Interception Length	20.79	ft

Worksheet for New Downdrain Grade - N236Sta 6531+30 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.38	ft³/s
Slope	0.01130	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	57.38	%
Intercepted Flow	1.37	ft³/s
Bypass Flow	1.01	ft³/s
Spread	9.28	ft
Depth	0.19	ft
Flow Area	0.86	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.77	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.38	
Total Interception Length	30.47	ft

Worksheet for New Downdrain Grade - N238 Sta 6531+30 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.29	ft³/s
Slope	0.01160	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	57.77	%
Intercepted Flow	1.32	ft³/s
Bypass Flow	0.97	ft³/s
Spread	9.10	ft
Depth	0.18	ft
Flow Area	0.83	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.77	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.38	
Total Interception Length	30.22	ft

Worksheet for Exist Downdrain Grade - E240 Sta 6535+22.13 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.69	ft³/s
Slope	0.01710	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	49.60	%
Intercepted Flow	1.33	ft³/s
Bypass Flow	1.36	ft³/s
Spread	8.99	ft
Depth	0.18	ft
Flow Area	0.81	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.33	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.32	
Total Interception Length	36.33	ft

Worksheet for Exist Downdrain Grade - E242 Sta 6535+21.8 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.72	ft³/s
Slope	0.01750	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	49.11	%
Intercepted Flow	1.34	ft³/s
Bypass Flow	1.38	ft³/s
Spread	8.98	ft
Depth	0.18	ft
Flow Area	0.81	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.37	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.31	
Total Interception Length	36.75	ft

Worksheet for Exist Downdrain Grade - E250 Sta 6573+20.53 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.59	ft^3/s
Slope	0.00610	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	75.08	%
Intercepted Flow	1.19	ft^3/s
Bypass Flow	0.40	ft^3/s
Spread	8.95	ft
Depth	0.18	ft
Flow Area	0.80	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.98	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.54	
Total Interception Length	21.38	ft

Worksheet for Exist Downdrain Grade - E252 Sta 6574+08.17 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.17	ft³/s
Slope	0.01470	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	68.10	%
Intercepted Flow	0.80	ft³/s
Bypass Flow	0.37	ft³/s
Spread	6.77	ft
Depth	0.14	ft
Flow Area	0.46	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.56	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.47	
Total Interception Length	24.47	ft

Worksheet for Exist Downdrain Grade - E254 Sta 6580+52.62 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.31	ft³/s
Slope	0.00584	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	80.01	%
Intercepted Flow	1.05	ft³/s
Bypass Flow	0.26	ft³/s
Spread	8.39	ft
Depth	0.17	ft
Flow Area	0.70	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.86	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.59	
Total Interception Length	19.46	ft

Worksheet for Exist Downdrain Grade - E256 Sta 6582+83.32 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.55	ft³/s
Slope	0.01165	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	55.62	%
Intercepted Flow	1.42	ft³/s
Bypass Flow	1.13	ft³/s
Spread	9.46	ft
Depth	0.19	ft
Flow Area	0.90	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.85	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.36	
Total Interception Length	31.66	ft

Worksheet for New Downdrain Grade - N260 Sta 6584+10 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.99	ft³/s
Slope	0.01120	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	61.07	%
Intercepted Flow	1.22	ft³/s
Bypass Flow	0.77	ft³/s
Spread	8.69	ft
Depth	0.17	ft
Flow Area	0.75	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.64	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.41	
Total Interception Length	28.19	ft

Worksheet for New Downdrain Grade - N262 Sta 6585+85 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.61	ft³/s
Slope	0.01366	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	53.04	%
Intercepted Flow	1.38	ft³/s
Bypass Flow	1.23	ft³/s
Spread	9.27	ft
Depth	0.19	ft
Flow Area	0.86	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.04	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.34	
Total Interception Length	33.53	ft

Worksheet for New Downdrain Grade - N266 Sta 6591+00 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.96	ft³/s
Slope	0.00198	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	87.88	%
Intercepted Flow	1.72	ft³/s
Bypass Flow	0.24	ft³/s
Spread	11.96	ft
Depth	0.24	ft
Flow Area	1.43	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.37	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.69	
Total Interception Length	16.66	ft

Worksheet for Existing Downdrain In Sag - E268 Sta 6592+70.01 I-10

Project Description

Solve For	Spread

Input Data

Discharge		3.92	ft^3/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		19.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	8.39	ft
Depth	0.17	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft

Worksheet for Exist Downdrain Grade - E270 Sta 6594+42.99 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.18	ft³/s
Slope	0.00806	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	56.44	%
Intercepted Flow	1.79	ft³/s
Bypass Flow	1.39	ft³/s
Spread	11.02	ft
Depth	0.22	ft
Flow Area	1.21	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.62	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.37	
Total Interception Length	31.10	ft

Worksheet for Existing Downdrain Grade - E272 Sta 6595+95.37 I-10

Project Description

Solve For	Efficiency

Input Data

Discharge	2.88	ft³/s
Slope	0.00608	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	62.43	%
Intercepted Flow	1.80	ft³/s
Bypass Flow	1.08	ft³/s
Spread	11.19	ft
Depth	0.22	ft
Flow Area	1.25	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.30	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.42	
Total Interception Length	27.41	ft

Worksheet for Exist Downdrain Grade - E274 Sta 6599+17.55 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.62	ft³/s
Slope	0.00923	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	58.33	%
Intercepted Flow	1.53	ft³/s
Bypass Flow	1.09	ft³/s
Spread	9.99	ft
Depth	0.20	ft
Flow Area	1.00	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.63	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.39	
Total Interception Length	29.86	ft

Worksheet for New Downdrain Grade - N276 Sta 6600+00 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.41	ft³/s
Slope	0.00756	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	62.90	%
Intercepted Flow	1.52	ft³/s
Bypass Flow	0.89	ft³/s
Spread	10.05	ft
Depth	0.20	ft
Flow Area	1.01	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.39	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.42	
Total Interception Length	27.15	ft

Worksheet for New Downdrain Grade - E279 Sta 6609+50 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.22	ft³/s
Slope	0.00530	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	83.06	%
Intercepted Flow	1.01	ft³/s
Bypass Flow	0.21	ft³/s
Spread	8.32	ft
Depth	0.17	ft
Flow Area	0.69	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.76	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.63	
Total Interception Length	18.34	ft

Worksheet for Exist Downdrain Grade - E280 Sta 6613+69.60 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.21	ft³/s
Slope	0.01260	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	57.31	%
Intercepted Flow	1.27	ft³/s
Bypass Flow	0.94	ft³/s
Spread	8.84	ft
Depth	0.18	ft
Flow Area	0.78	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.83	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.38	
Total Interception Length	30.52	ft

Worksheet for New Downdrain Grade - N281 Sta 6609+50 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	1.18	ft³/s
Slope	0.00720	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	79.02	%
Intercepted Flow	0.93	ft³/s
Bypass Flow	0.25	ft³/s
Spread	7.76	ft
Depth	0.16	ft
Flow Area	0.60	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.96	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.58	
Total Interception Length	19.83	ft

Worksheet for Exist Downdrain Grade - E282 Sta 6613+69.64 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.07	ft³/s
Slope	0.00770	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	65.79	%
Intercepted Flow	1.36	ft³/s
Bypass Flow	0.71	ft³/s
Spread	9.46	ft
Depth	0.19	ft
Flow Area	0.89	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.31	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.45	
Total Interception Length	25.62	ft

Worksheet for ExistDowndrain Grade - E284 Sta 6618+69.94 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.24	ft³/s
Slope	0.00450	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	64.44	%
Intercepted Flow	2.09	ft³/s
Bypass Flow	1.15	ft³/s
Spread	12.38	ft
Depth	0.25	ft
Flow Area	1.53	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.12	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.44	
Total Interception Length	26.32	ft

Worksheet for Exist Downdrain Grade - E286 Sta 6618+69.83 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.80	ft³/s
Slope	0.00610	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	62.96	%
Intercepted Flow	1.76	ft³/s
Bypass Flow	1.04	ft³/s
Spread	11.07	ft
Depth	0.22	ft
Flow Area	1.22	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.29	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.42	
Total Interception Length	27.12	ft

Worksheet for Exist Downdrain In Sag - E288 Sta 6621+19.94 I-10 EB

Project Description

Solve For	Spread

Input Data

Discharge		4.73	ft^3/s
Gutter Width		2.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		19.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	9.51	ft
Depth	0.19	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft

Worksheet for Exist Downdrain In Sag - E289 Sta 6621+13+53 I-10 WB

Project Description

Solve For	Spread

Input Data

Discharge		4.52	ft^3/s
Gutter Width		2.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		19.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	9.23	ft
Depth	0.18	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft

Worksheet for Exist Downdrain Grade - E290 Sta 6624+32.88 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.44	ft³/s
Slope	0.00660	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	64.65	%
Intercepted Flow	1.58	ft³/s
Bypass Flow	0.86	ft³/s
Spread	10.36	ft
Depth	0.21	ft
Flow Area	1.07	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.28	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.44	
Total Interception Length	26.21	ft

Worksheet for New Downdrain Grade - N292 Sta 6624+30 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	2.35	ft^3/s
Slope	0.00710	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	64.34	%
Intercepted Flow	1.51	ft^3/s
Bypass Flow	0.84	ft^3/s
Spread	10.07	ft
Depth	0.20	ft
Flow Area	1.01	ft^2
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.32	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.44	
Total Interception Length	26.37	ft

Worksheet for Exist Downdrain Grade - E294 Sta 6637+03.06 I-10 EB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.06	ft³/s
Slope	0.00720	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	58.77	%
Intercepted Flow	1.80	ft³/s
Bypass Flow	1.26	ft³/s
Spread	11.09	ft
Depth	0.22	ft
Flow Area	1.23	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.49	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.39	
Total Interception Length	29.58	ft

Worksheet for Exist Downdrain Grade - E296 Sta 6636+78.30 I-10 WB

Project Description

Solve For	Efficiency

Input Data

Discharge	3.04	ft³/s
Slope	0.00690	ft/ft
Gutter Width	2.50	ft
Gutter Cross Slope	0.02	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.014	
Curb Opening Length	11.50	ft
Local Depression	0.00	in
Local Depression Width	0.00	ft

Results

Efficiency	59.50	%
Intercepted Flow	1.81	ft³/s
Bypass Flow	1.23	ft³/s
Spread	11.15	ft
Depth	0.22	ft
Flow Area	1.24	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	2.44	ft/s
Equivalent Cross Slope	0.02000	ft/ft
Length Factor	0.39	
Total Interception Length	29.13	ft

APPENDIX H

ROADSIDE DITCH DESIGN

(RESERVED FOR FINAL DRAINAGE REPORT)

APPENDIX I

BRIDGE DECK DRAINAGE

Pavement Spread Calculations
for
Westbound I-10 Bridge over Jackrabbit Trail
(Flow Off West End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 WB bridge over Jackrabbit Trail is located on a crest vertical curve with a high point on the west end of the bridge at Station 6418+30.49. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at new embankment downdrains at the end of approach slabs (Station 6417+69 Lt and Station 6420+37 Lt. Compute the spread as the runoff exits the bridge at the west end and at the end of the approach slab, Station 6417+69 Lt.

1. **Calculate the proposed Q that flows off the west end of the bridge:**

   Flow from Station 6418+30.49 to Station 6418+14.00

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 79.25 ft length = 16.49 ft
   A = 0.030001 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.108 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.108	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.015	ft/ft
S_L (Longitudinal Slope) =	0.000275	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	7.39	ft
$d = T(S_x)$ =	0.11	ft
$V = Q/((0.5)(T)(d))$ =	0.26	fps

5. **Conclusion**

Actual Spread of	**7.39**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.11**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at west bridge end. Deck Drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Jackrabbit Trail
(Flow off West End of Bridge Approach Slab)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 WB bridge over Jackrabbit Trail is located on a crest vertical curve with a high point on the west end of the bridge at Station 6418+30.49. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at new embankment downdrains at the end of approach slabs (Station 6417+69 Lt and Station 6420+37 Lt). Compute the spread as the runoff exits the bridge at the west end and at the end of the approach slab, Station 6417+69 Lt.

1. **Calculate the proposed Q that flows off the west end of the bridge:**

   Flow from Station 6418+30.49 to Station 6417+69.00

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 79.25 ft length = 61.49 ft
   A = 0.111871 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.404 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.404	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.015	ft/ft
S_L (Longitudinal Slope) =	0.001025	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	9.46	ft
$d = T(S_x)$ =	0.14	ft
V = Q/((0.5)(T)(d)) =	0.60	fps

5. **Conclusion**

Actual Spread of	**9.46**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.14**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at end of approach slab & new embankment downdrain.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Jackrabbit Trail
(Flow off East End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 WB bridge over Jackrabbit Trail is located on a crest vertical curve with a high point on the west end of the bridge at Station 6418+30.49. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at new embankment downdrains at the end of approach slabs (Station 6417+69 Lt and Station 6420+37 Lt). Compute the spread as the runoff exits the bridge at the west end and at the end of the approach slab, Station 6420+37 Lt.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6418+30.49 to Station 6419+92.00

   Q = CiA

   C = 0.95 for pavement

   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 161.51 ft

   A = 0.29384 acres

   Q = CiA = (0.95)(3.80)(.045627) = 1.061 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	1.061	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.015	ft/ft
S_L (Longitudinal Slope) =	0.002691	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	11.34	ft
$d = T(S_x)$ =	0.17	ft
$V = Q/((0.5)(T)(d))$ =	1.10	fps

5. **Conclusion**

Actual Spread of	**11.34**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.17**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at east bridge end. Deck Drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Jackrabbit Trail
(Flow off East End of Bridge Approach Slab)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 WB bridge over Jackrabbit Trail is located on a crest vertical curve with a high point on the west end of the bridge at Station 6418+30.49. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at new embankment downdrains at the end of approach slabs (Station 6417+69 Lt and Station 6420+37 Lt). Compute the spread as the runoff exits the bridge at the west end and at the end of the approach slab, Station 6420+37 Lt.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6418+30.49 to Station 6419+92.00

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 79.25 ft length = 161.51 ft
   A = 0.29384 acres

   Q = CiA = (0.95)(3.80)(.045627) = 1.061 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	1.061	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.015	ft/ft
S_L (Longitudinal Slope) =	0.003442	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	10.83	ft
$d = T(S_x)$ =	0.16	ft
V = Q/((0.5)(T)(d)) =	1.21	fps

5. **Conclusion**

Actual Spread of	**10.83**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.16**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at end of approach slab & new embankment downdrain.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Jackrabbit Trail
(Flow off West End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Jackrabbit Trail is located on a crest vertical curve with a high point on the west end of the bridge at Station 6418+58.78. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at new embankment downdrains at the end of approach slabs (Station 6417+69.08 Lt and Station 6420+37.08 Lt). Compute the spread as the runoff exits the bridge at the west end and at the end of the approach slab, Station 6417+69.08 Lt.

1. **Calculate the proposed Q that flows off the west end of the bridge:**

   Flow from Station 6418+58.78 to Station 6418+14.08

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 44.70 ft
   A = 0.081324 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.294 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.5"/12 = 0.402 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.294	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.015	ft/ft
S_L (Longitudinal Slope) =	0.000694	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	9.03	ft
$d = T(S_x)$ =	0.14	ft
V = Q/((0.5)(T)(d)) =	0.48	fps

5. **Conclusion**

Actual Spread of	**9.03**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.14**	**ft**	**<**	**0.402**	**ft**	**Okay**

Spread criterion met at onflow to east end of bridge.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Jackrabbit Trail
(Flow off West End of Bridge Approach Slab)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Jackrabbit Trail is located on a crest vertical curve with a high point on the west end of the bridge at Station 6418+58.78. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at new embankment downdrains at the end of approach slabs (Station 6417+69.08 Lt and Station 6420+37.08 Lt). Compute the spread as the runoff exits the bridge at the west end and at the end of the approach slab, Station 6417+69.08 Lt.

1. **Calculate the proposed Q that flows off the west end of the bridge:**

   Flow from Station 6418+58.78 to Station 6417+69.08

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 79.25 ft length = 89.70 ft
   A = 0.163194 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.589 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.589	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.015	ft/ft
S_L (Longitudinal Slope) =	0.001393	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	10.29	ft
$d = T(S_x)$ =	0.15	ft
$V = Q/((0.5)(T)(d))$ =	0.74	fps

5. **Conclusion**

Actual Spread of	**10.29**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.15**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at end of approach slab & new embankment downdrain.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Jackrabbit Trail
(Flow off East End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Jackrabbit Trail is located on a crest vertical curve with a high point on the west end of the bridge at Station 6418+58.78. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at new embankment downdrains at the end of approach slabs (Station 6417+69.08 Lt and Station 6420+37.08 Lt). Compute the spread as the runoff exits the bridge at the west end and at the end of the approach slab, Station 6420+37.08 Lt.

(Flow off East End of Bridge)

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6418+58.78 to Station 6419+92.08

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 133.30 ft
   A = 0.242517 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.875 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.875	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.015	ft/ft
S_L (Longitudinal Slope) =	0.00207	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	11.09	ft
$d = T(S_x)$ =	0.17	ft
$V = Q/((0.5)(T)(d))$ =	0.95	fps

5. **Conclusion**

Actual Spread of	**11.09**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.17**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met. Deck Drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Jackrabbit Trail
(Flow off East End of Bridge Approach Slab)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Jackrabbit Trail is located on a crest vertical curve with a high point on the west end of the bridge at Station 6418+58.78. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at new embankment downdrains at the end of approach slabs (Station 6417+69.08 Lt and Station 6420+37.08 Lt). Compute the spread as the runoff exits the bridge at the west end and at the end of the approach slab, Station 6420+37.08 Lt.

(Flow off East End of Bridge)

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6418+58.78 to Station 6420+37.08

   Q = CiA

   C = 0.95 for pavement

   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 178.30 ft

   A = 0.324386 acres

   Q = CiA = (0.95)(3.80)(.045627) = 1.171 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	1.171	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.015	ft/ft
S_L (Longitudinal Slope) =	0.002776	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	11.70	ft
$d = T(S_x)$ =	0.18	ft
V = Q/((0.5)(T)(d)) =	1.14	fps

5. **Conclusion**

Actual Spread of	**11.70**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.18**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at end of approach slab & new embankment downdrain.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Perryville Road
(Flow onto West End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Perryville Road is located on a crest vertical curve with a high point just west of the bridge at Station 6470+95.61. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at a new embankment downdrain 339 feet east of the bridge, Station 6476+00 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows onto the west end of the bridge:**

   Flow from Station 6470+95.61 to Station 6471+32.02

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 36.41 ft
   A = 0.066242 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.239 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.239	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.000599	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	7.18	ft
$d = T(S_x)$ =	0.14	ft
V = Q/((0.5)(T)(d)) =	0.46	fps

5. **Conclusion**

Actual Spread of	**7.18**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.14**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at onflow to east end of bridge.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Perryville Road
(Flow off East End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Perryville Road is located on a crest vertical curve with a high point just west of the bridge at Station 6470+95.61. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at a new embankment downdrain 339 feet east of the bridge, Station 6476+00 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6470+95.61 to Station 6472+61.06

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 165.45 ft
   A = 0.301008 acres

   Q = CiA = (0.95)(3.80)(.045627) = 1.087 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.0)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	1.087	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.002723	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	9.54	ft
$d = T(S_x)$ =	0.19	ft
$V = Q/((0.5)(T)(d))$ =	1.19	fps

5. **Conclusion**

Actual Spread of	**9.54**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.19**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met. Deck Drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Perryville Road
(Flow onto West End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Perryville Road is located on a crest vertical curve with a high point just west of the bridge at Station 6470+67.87. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at a new embankment downdrain 114.5 feet east of the bridge, Station 6474+04. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows onto the west end of the bridge:**

   Flow from Station 6470+67.87 to Station 6471+60.46

   Q = CiA

   C = 0.95 for pavement

   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 92.59 ft

   A = 0.168452 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.608 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.608	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.001467	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	8.61	ft
$d = T(S_x)$ =	0.17	ft
V = Q/((0.5)(T)(d)) =	0.82	fps

5. **Conclusion**

Actual Spread of	**8.61**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.17**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at onflow to east end of bridge.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Perryville Road
(Flow off East End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Perryville Road is located on a crest vertical curve with a high point just west of the bridge at Station 6470+67.87. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at a new embankment downdrain 114.5 feet east of the bridge, Station 6474+04. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6470+67.87 to Station 6472+89.50

   Q = CiA

   C = 0.95 for pavement

   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 221.63 ft

   A = 0.403218 acres

   Q = CiA = (0.95)(3.80)(.045627) = 1.456 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	1.456	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.003511	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	10.15	ft
$d = T(S_x)$ =	0.20	ft
$V = Q/((0.5)(T)(d))$ =	1.41	fps

5. **Conclusion**

Actual Spread of	**10.15**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.20**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met. Deck Drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Citrus Road
Flow onto West End of Bridge

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Citrus Road is located on a crest vertical curve with a high point just west of the bridge at Station 6523+48.34. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at a new embankment downdrain 299.4 feet east of the bridge, Station 6527+50 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows onto the west end of the bridge:**

   Flow from Station 6523+48.34 to Station 6524+50.60

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 79.25 ft length = 102.26 ft
   A = 0.186045 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.672 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.672	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.00153	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	8.87	ft
$d = T(S_x)$ =	0.18	ft
V = Q/((0.5)(T)(d)) =	0.85	fps

5. **Conclusion**

Actual Spread of	**8.87**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.18**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at onflow to east end of bridge.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Citrus Road
Flow off East End of Bridge

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Citrus Road is located on a crest vertical curve with a high point just west of the bridge at Station 6523+48.34. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at a new embankment downdrain 299.4 feet east of the bridge, Station 6527+50 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6523+48.34 to Station 6525+79.60

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 231.26 ft
   A = 0.420738 acres

   Q = CiA = (0.95)(3.80)(.045627) = 1.519 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	1.519	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.00346	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	10.34	ft
$d = T(S_x)$ =	0.21	ft
$V = Q/((0.5)(T)(d))$ =	1.42	fps

5. **Conclusion**

Actual Spread of	**10.34**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.21**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met. Deck Drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Citrus Road
Flow onto West End of Bridge

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Citrus Road is located on a crest vertical curve with a high point just west of the bridge at Station 6523+82.30. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at a new embankment downdrain 299.25 feet east of the bridge, Station 6527+50 Rt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows onto the west end of the bridge:**

   Flow from Station 6523+82.30 to Station 6524+50.75

   Q = CiA

   C = 0.95 for pavement

   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 79.25 ft length = 68.45 ft

   A = 0.124533 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.450 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.450	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.000995	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	8.27	ft
$d = T(S_x)$ =	0.17	ft
V = Q/((0.5)(T)(d)) =	0.66	fps

5. **Conclusion**

Actual Spread of	**8.27**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.17**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met at onflow to east end of bridge.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Citrus Road
Flow off East End of Bridge

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will be widened from 42.00 to 76.27 feet. The I-10 EB bridge over Citrus Road is located on a crest vertical curve with a high point just west of the bridge at Station 6523+82.30. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at a new embankment downdrain 299.25 feet east of the bridge, Station 6527+50 Rt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6523+82.30 to Station 6525+79.75

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 79.25 ft length = 197.45 ft
   A = 0.359227 acres

   Q = CiA = (0.95)(3.80)(.045627) = 1.297 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 12' + (0.5)(12') = 18 feet

3. **Calculate the maximum allowable depth based on spread of 18 feet.**

   Max Depth = (18')(0.02ft/ft) + 0.0"/12 = 0.360 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	1.297	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.002871	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	10.09	ft
$d = T(S_x)$ =	0.20	ft
V = Q/((0.5)(T)(d)) =	1.27	fps

5. **Conclusion**

Actual Spread of	**10.09**	**ft**	**<**	**18**	**ft**	**Okay**
Actual depth of	**0.20**	**ft**	**<**	**0.360**	**ft**	**Okay**

Spread criterion met. Deck Drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Cotton Lane
(Flow onto West End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3. The I-10 WB bridge over Cotton Lane is located on a crest vertical curve with a high point just west of the bridge at Station 6577+11.88. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at an existing embankment downdrain 399 feet east of the bridge, Station 6582+83.32 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows onto the west end of the bridge:**

   Flow from Station 6577+11.88 to Station 6577+31.56

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 41.75 ft length = 19.68 ft
   A = 0.018862 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.068 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.068	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.000356	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	4.94	ft
$d = T(S_x)$ =	0.10	ft
V = Q/((0.5)(T)(d)) =	0.28	fps

5. **Conclusion**

Actual Spread of	**4.94**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.10**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Cotton Lane
(Flow off East End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3. The I-10 WB bridge over Cotton Lane is located on a crest vertical curve with a high point just west of the bridge at Station 6577+11.88. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at an existing embankment downdrain 399 feet east of the bridge, Station 6582+83.32 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6577+11.88 to Station 6578+84.56

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 172.68 ft
   A = 0.165505 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.597 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.597	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.003022	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	7.47	ft
$d = T(S_x)$ =	0.15	ft
V = Q/((0.5)(T)(d)) =	1.07	fps

5. **Conclusion**

Actual Spread of	**7.47**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.15**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Cotton Lane
(Flow onto West End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3. The I-10 EB bridge over Cotton Lane is located on a crest vertical curve with a high point just west of the bridge at Station 6577+07.77. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at an existing embankment downdrain 168 feet east of the bridge, Station 6580+52.62 Rt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows onto the west end of the bridge:**

   Flow from Station 6577+07.77 to Station 6577+32.10

   Q = CiA

   C = 0.95 for pavement

   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 24.33 ft

   A = 0.023319 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.084 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.084	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.000418	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	5.19	ft
$d = T(S_x)$ =	0.10	ft
V = Q/((0.5)(T)(d)) =	0.31	fps

5. **Conclusion**

Actual Spread of	**5.19**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.10**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Cotton Lane
(Flow off East End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3. The I-10 EB bridge over Cotton Lane is located on a crest vertical curve with a high point just west of the bridge at Station 6577+07.77. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at an existing embankment downdrain 168 feet east of the bridge, Station 6580+52.62 Rt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6577+07.77 to Station 6578+85.10

   Q = CiA

   C = 0.95 for pavement

   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 177.33 ft

   A = 0.169962 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.614 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.614	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.003043	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	7.54	ft
$d = T(S_x)$ =	0.15	ft
$V = Q/((0.5)(T)(d))$ =	1.08	fps

5. **Conclusion**

Actual Spread of	**7.54**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.15**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over RID Canal
(Flow off West End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3. The I-10 WB bridge over RID Canal is located on a crest vertical curve with a high point on the east end of the bridge at Station 6605+17.69. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at embankment downdrains beyond the bridge ends (Station 6599+17.55 Lt and Station 6609+50 Lt). Compute the spread as the runoff exits the bridge at the west end.

1. **Calculate the proposed Q that flows off the west end of the bridge:**

   Flow from Station 6605+17.69 to Station 6603+99.11

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 118.58 ft
   A = 0.113653 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.410 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.410	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.001604	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	7.31	ft
$d = T(S_x)$ =	0.15	ft
V = Q/((0.5)(T)(d)) =	0.77	fps

5. **Conclusion**

Actual Spread of	**7.31**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.15**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over RID Canal
(Flow off East End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3. The I-10 WB bridge over RID Canal is located on a crest vertical curve with a high point on the east end of the bridge at Station 6605+17.69. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at embankment downdrains beyond the bridge ends (Station 6599+17.55 Lt and Station 6609+50 Lt). Compute the spread as the runoff exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6605+17.69 to Station 6606+81.07

   Q = CiA

   C = 0.95 for pavement

   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 163.38 ft

   A = 0.156591 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.565 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.565	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.002205	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	7.77	ft
$d = T(S_x)$ =	0.16	ft
V = Q/((0.5)(T)(d)) =	0.94	fps

5. **Conclusion**

Actual Spread of	**7.77**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.16**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over RID Canal
(Flow off West End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3. The I-10 EB bridge over RID Canal is located on a crest vertical curve with a high point on the east end of the bridge at Station 6605+23.75. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at embankment downdrains beyond the bridge ends (Station 6599+17.55 Lt and Station 6609+50 Lt). Compute the spread as the runoff exits the bridge at the west end.

1. **Calculate the proposed Q that flows off the west end of the bridge:**

   Flow from Station 6605+23.75 to Station 6603+10.23

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 213.52 ft
   A = 0.204648 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.739 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.739	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.002905	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	8.15	ft
$d = T(S_x)$ =	0.16	ft
$V = Q/((0.5)(T)(d))$ =	1.11	fps

5. **Conclusion**

Actual Spread of	**8.15**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.16**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over RID Canal
(Flow off East End of Bridge)

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3. The I-10 EB bridge over RID Canal is located on a crest vertical curve with a high point on the east end of the bridge at Station 6605+23.75. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east and west to the bridge ends, and discharged at embankment downdrains beyond the bridge ends (Station 6599+17.55 Lt and Station 6609+50 Lt). Compute the spread as the runoff exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6605+23.75 to Station 6605+92.19

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 68.44 ft
   A = 0.065596 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.237 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.237	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.000931	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	6.59	ft
$d = T(S_x)$ =	0.13	ft
V = Q/((0.5)(T)(d)) =	0.55	fps

5. **Conclusion**

Actual Spread of	**6.59**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.13**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Sarival Avenue
Flow onto West End of Bridge

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3.The I-10 WB bridge over Sarival Avenue located on a crest vertical curve with a high point just west of the bridge at Station 6529+56.08. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at an existing embankment downdrain 531.7 feet east of the bridge, Station 6636+80 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows onto the west end of the bridge:**

   Flow from Station 6629+56.08 to Station 6630+19.27

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 41.75 ft length = 63.19 ft
   A = 0.060564 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.219 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.219	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.001092	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	6.20	ft
$d = T(S_x)$ =	0.12	ft
V = Q/((0.5)(T)(d)) =	0.57	fps

5. **Conclusion**

Actual Spread of	**6.20**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.12**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Westbound I-10 Bridge over Sarival Avenue
Flow off East End of Bridge

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3.The I-10 WB bridge over Sarival Avenue located on a crest vertical curve with a high point just west of the bridge at Station 6529+56.08. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at an existing embankment downdrain 531.7 feet east of the bridge, Station 6636+80 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6629+56.08 to Station 6631+48.27

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 192.19 ft
   A = 0.184204 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.665 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.665	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.003383	ft/ft
$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	7.62	ft
$d = T(S_x)$ =	0.15	ft
V = Q/((0.5)(T)(d)) =	1.15	fps

5. **Conclusion**

Actual Spread of	**7.62**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.15**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Sarival Avenue
Flow onto West End of Bridge

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3.The I-10 EB bridge over Sarival Avenue located on a crest vertical curve with a high point just west of the bridge at Station 6629+44.44. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at an existing embankment downdrain 551.4 feet east of the bridge, Station 6637+00 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows onto the west end of the bridge:**

   Flow from Station 6629+44.44 to Station 6630+19.64

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations

   width = 41.75 ft length = 75.20 ft
   A = 0.072075 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.260 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.260	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.001384	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	6.33	ft
$d = T(S_x)$ =	0.13	ft
V = Q/((0.5)(T)(d)) =	0.65	fps

5. **Conclusion**

Actual Spread of	**6.33**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.13**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

Pavement Spread Calculations
for
Eastbound I-10 Bridge over Sarival Avenue
Flow off East End of Bridge

Problem Statement: Evaluate pavement spread for the 10-year runoff event on the I-10 bridges. Clear roadway width will remain at approximately 42.00, but the number of travel lanes will be increased from 2 to 3.The I-10 EB bridge over Sarival Avenue located on a crest vertical curve with a high point just west of the bridge at Station 6629+44.44. Guard rail with curb located along the outside edge of the roadway approaches will not be disturbed with this project. Pavement runoff will be collected by the curb beginning at the crest, conveyed east across the bridge, and discharged at an existing embankment downdrain 551.4 feet east of the bridge, Station 6637+00 Lt. Compute the spread as the runoff enters the bridge at the west end and as it exits the bridge at the east end.

1. **Calculate the proposed Q that flows off the east end of the bridge:**

   Flow from Station 6629+44.44 to Station 6631+48.64

   Q = CiA C = 0.95 for pavement
   i = 3.8 inches/hour for 10-year storm event

   Area Calculations
   width = 41.75 ft length = 204.20 ft
   A = 0.195715 acres

   Q = CiA = (0.95)(3.80)(.045627) = 0.707 cfs

2. **Calculate the maximum spread in accordance with ADOT criterion.**

   Max Spread = Gutter + Shoulder + 0.5 Travel Lane

   Max Spread = 2.88' + (0.5)(12') = 8.88 feet

3. **Calculate the maximum allowable depth based on spread of 8.88 feet.**

   Max Depth = (8.88')(0.02ft/ft) + 0.0"/12 = 0.178 feet

4. **Calculate the actual spread and depth of flow based on actual runoff. Use the conventional gutter on uniform slope equation.**

   $T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$

Q (Runoff) =	0.707	sf
n (Manning's Coefficient) =	0.016	
S_x (Pavement Cross Slope) =	0.02	ft/ft
S_L (Longitudinal Slope) =	0.003706	ft/ft

$T = ((Q)(n)/(0.56(S_x)^{1.67}(S_L)^{0.5}))^{0.375}$ =	7.66	ft
$d = T(S_x)$ =	0.15	ft
V = Q/((0.5)(T)(d)) =	1.20	fps

5. **Conclusion**

Actual Spread of	**7.66**	**ft**	**<**	**8.88**	**ft**	**Okay**
Actual depth of	**0.15**	**ft**	**<**	**0.178**	**ft**	**Okay**

Spread criterion is met. Deck drains not required.

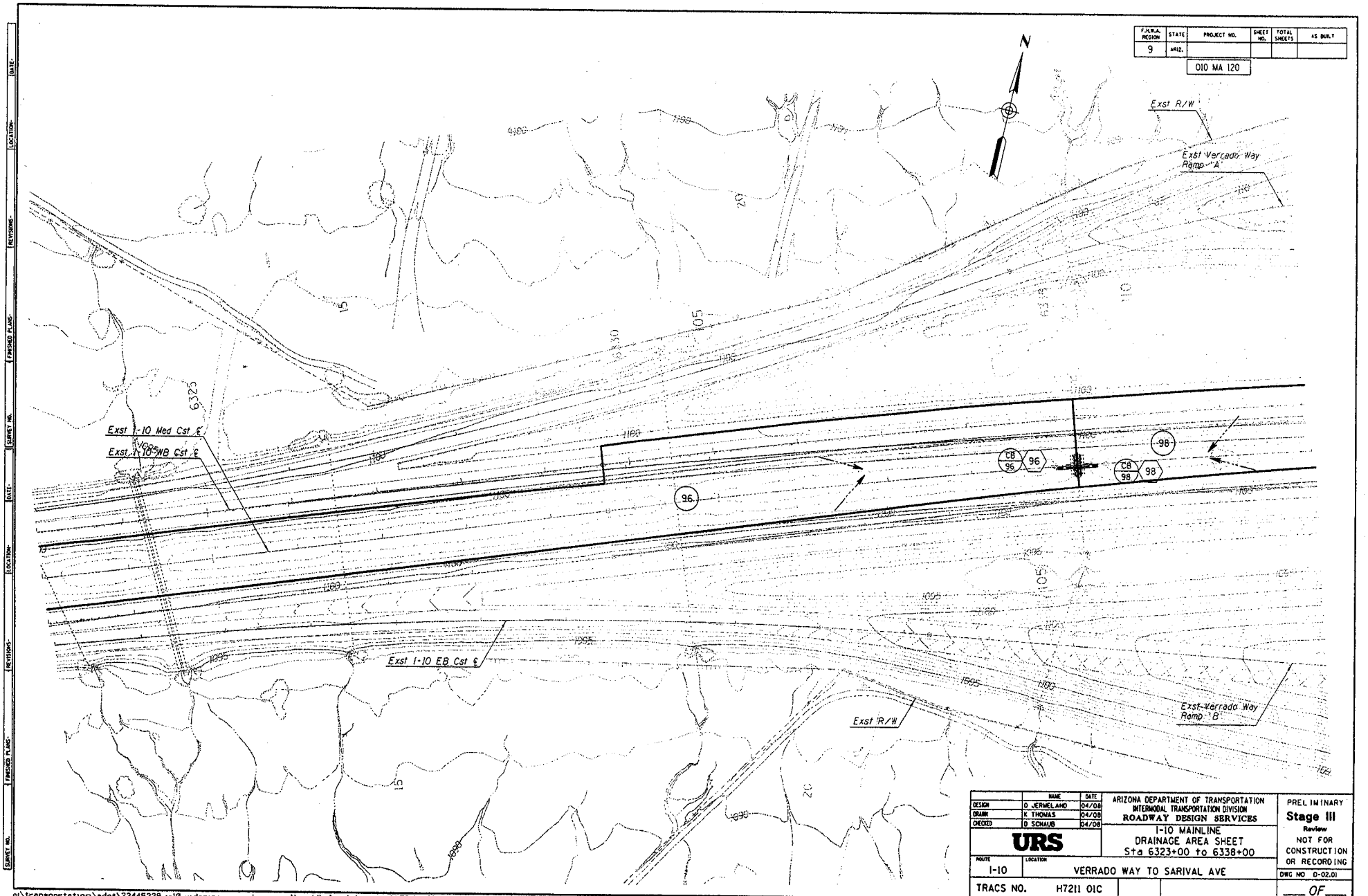
APPENDIX J

RETENTION BASIN DESIGN

(RESERVED FOR FINAL DRAINAGE REPORT)

APPENDIX K

ONSITE DRAINAGE AREAS



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6323+00 to 6338+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.01

___ OF ___

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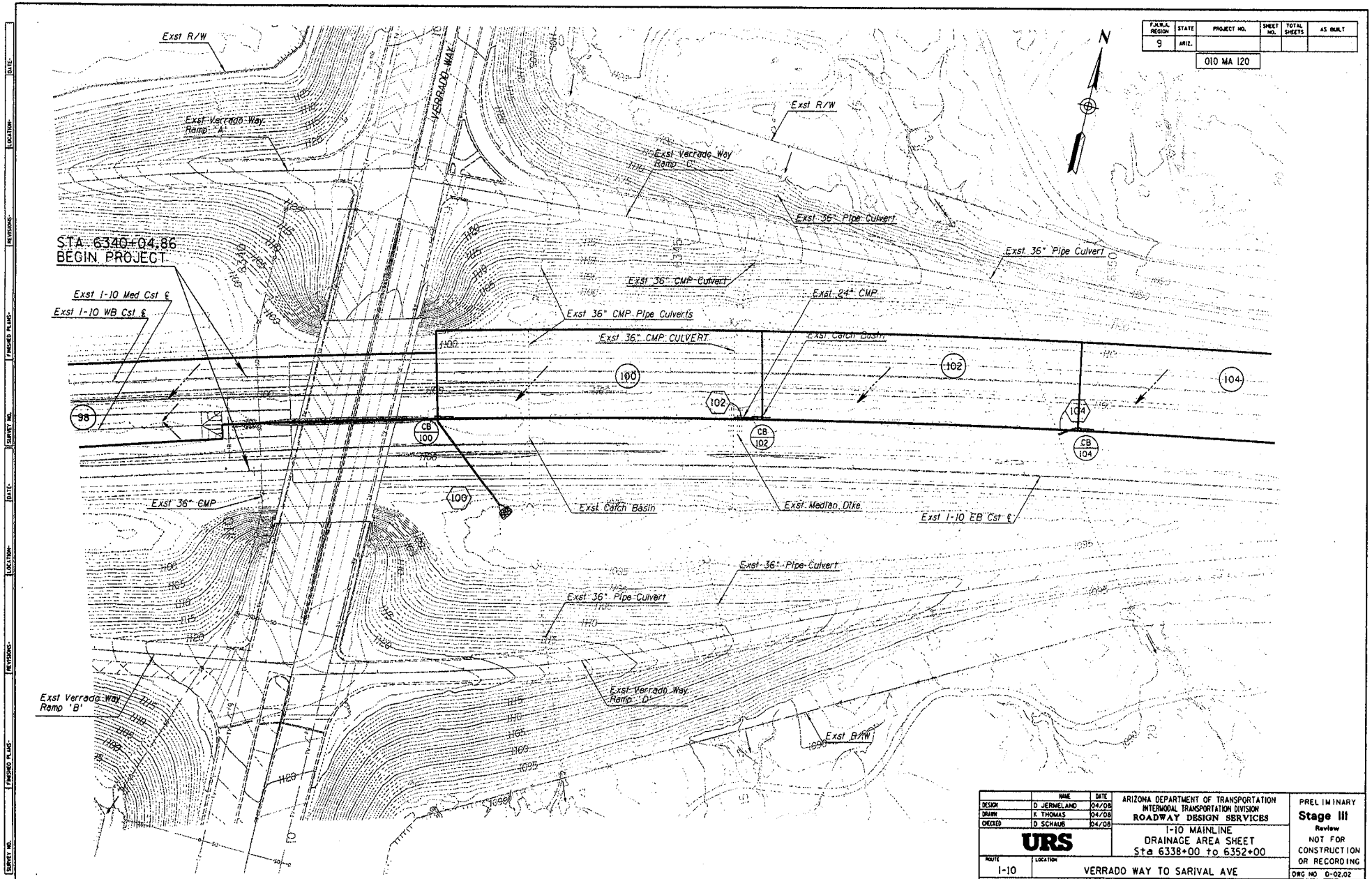

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6338+00 to 6352+00

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE

DWG NO D-02.02

TRACS NO. H7211 01C

___ OF ___

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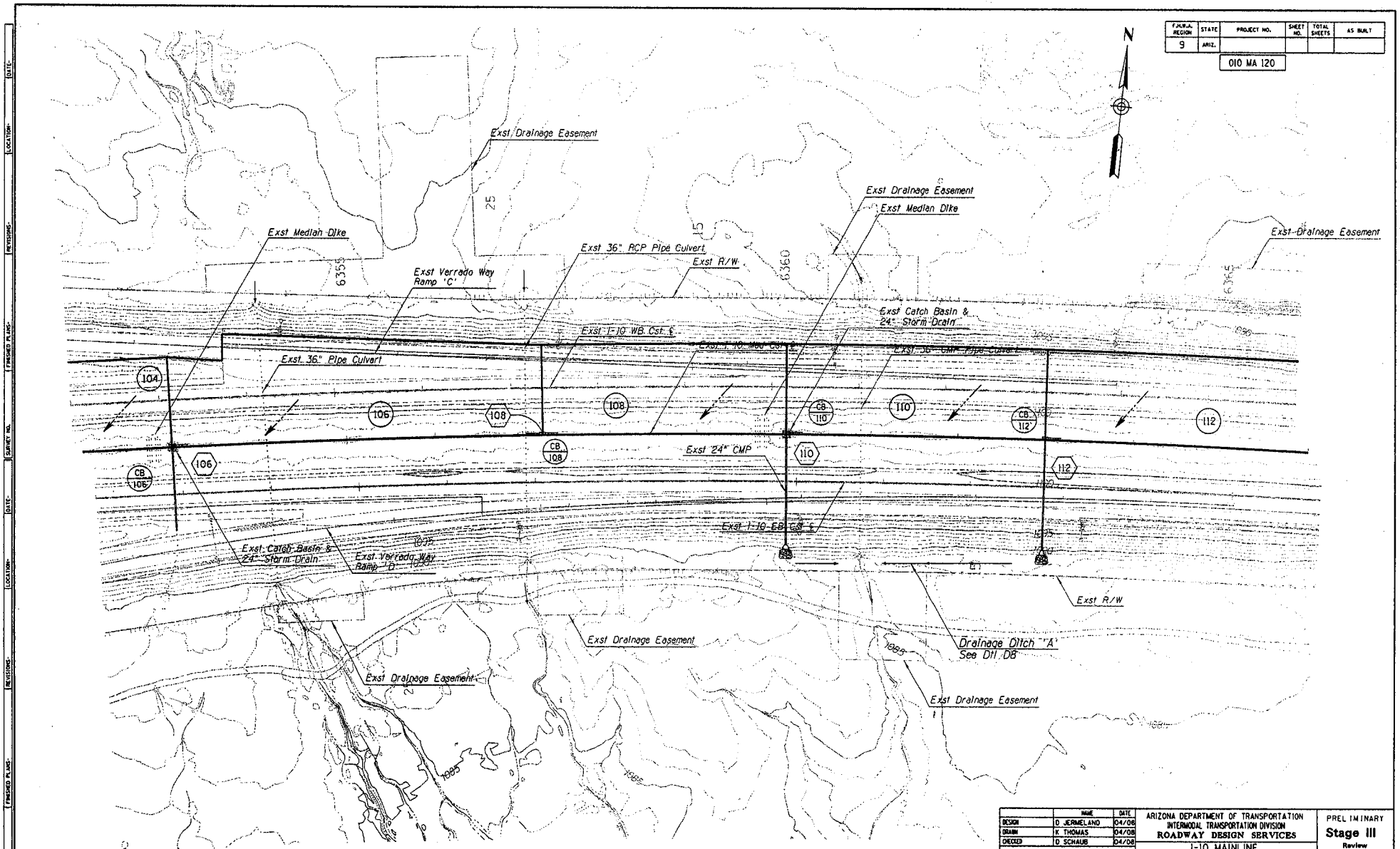

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6352+00 to 6366+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO 0-02.03

___ OF ___

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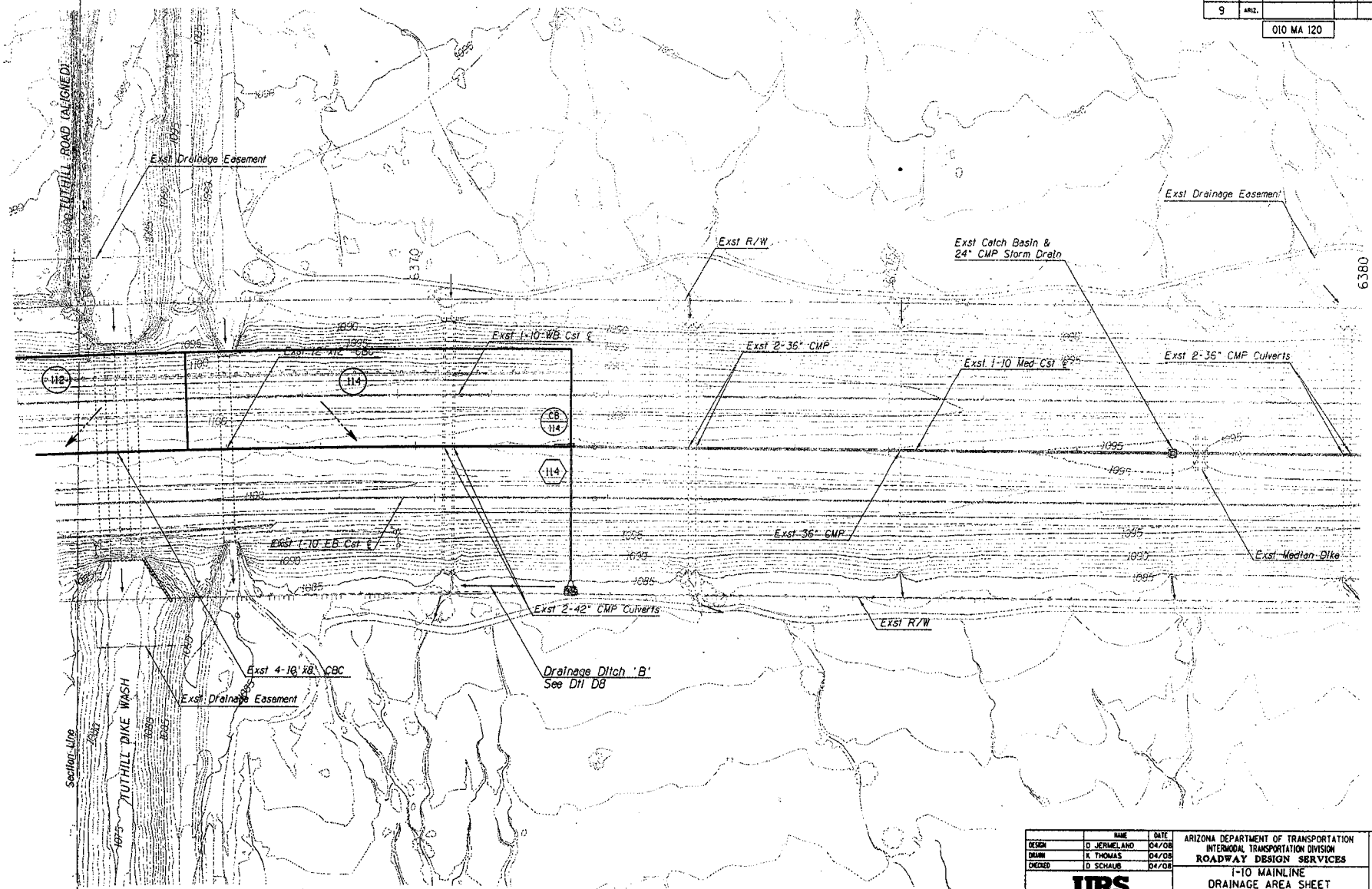

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6366+00 to 6380+00

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.04

___ OF ___

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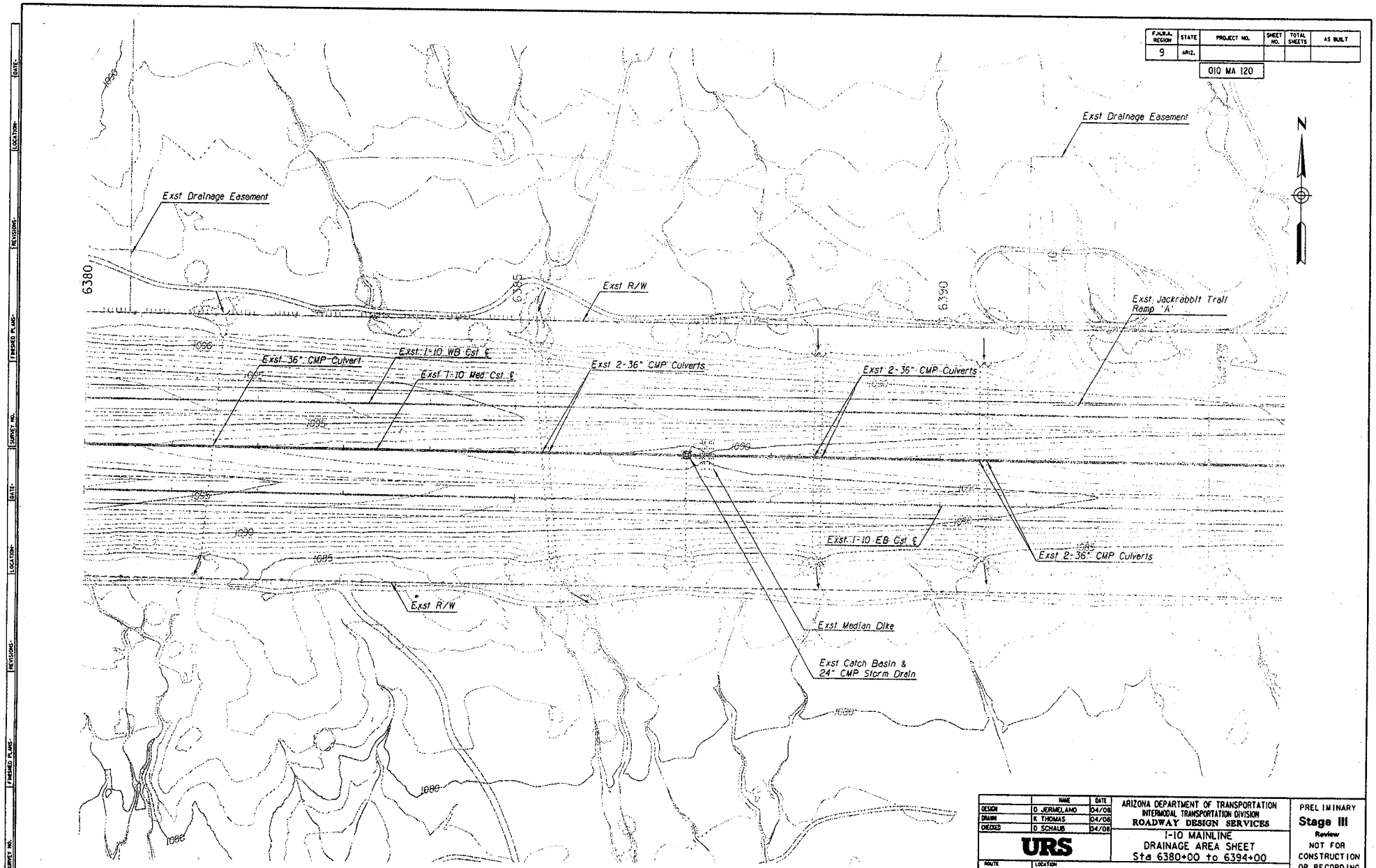

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6380+00 to 6394+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.05

___ OF ___

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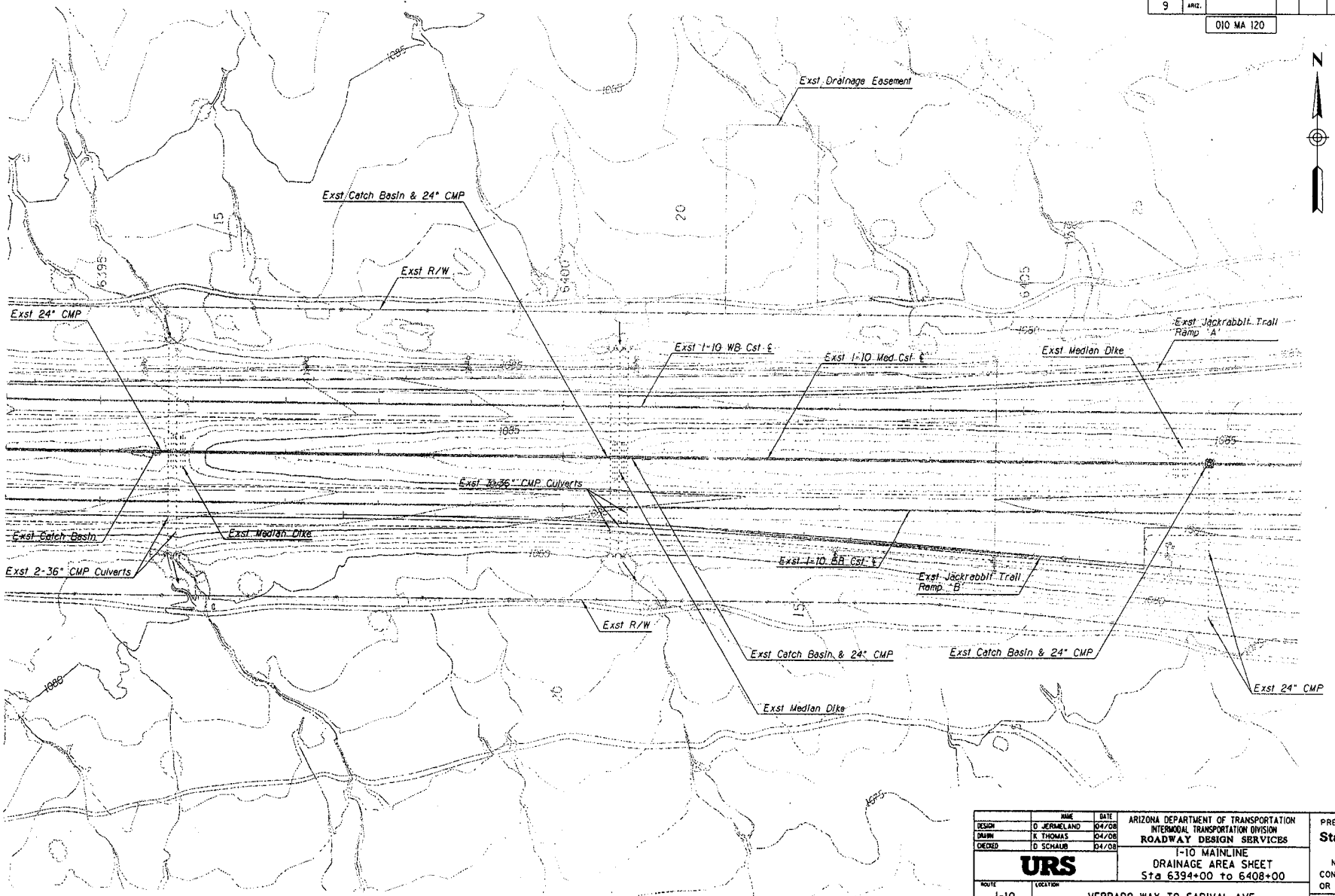
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6394+00 to 6408+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.06

___ OF ___

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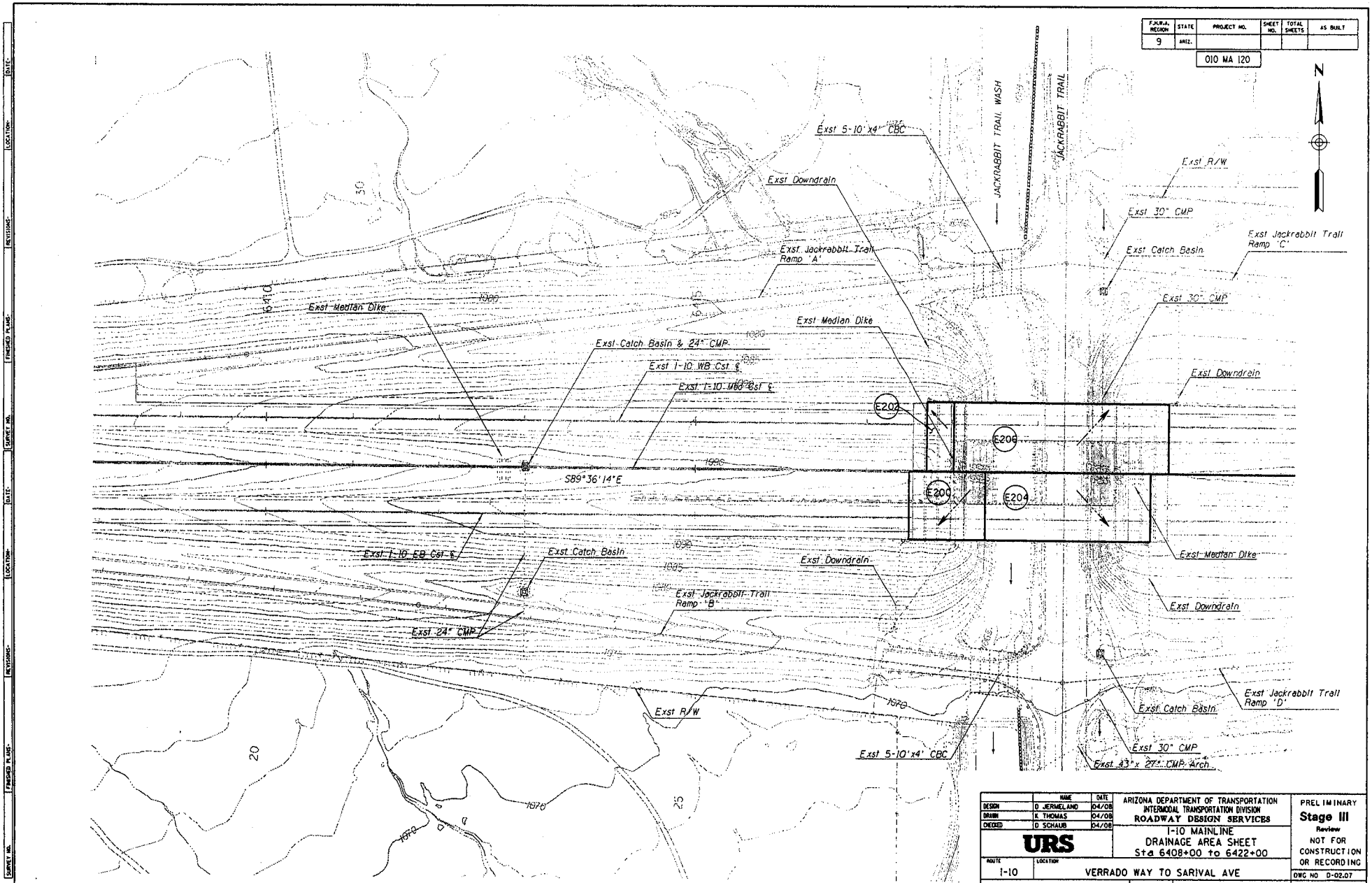

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6408+00 to 6422+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.07

___ OF ___

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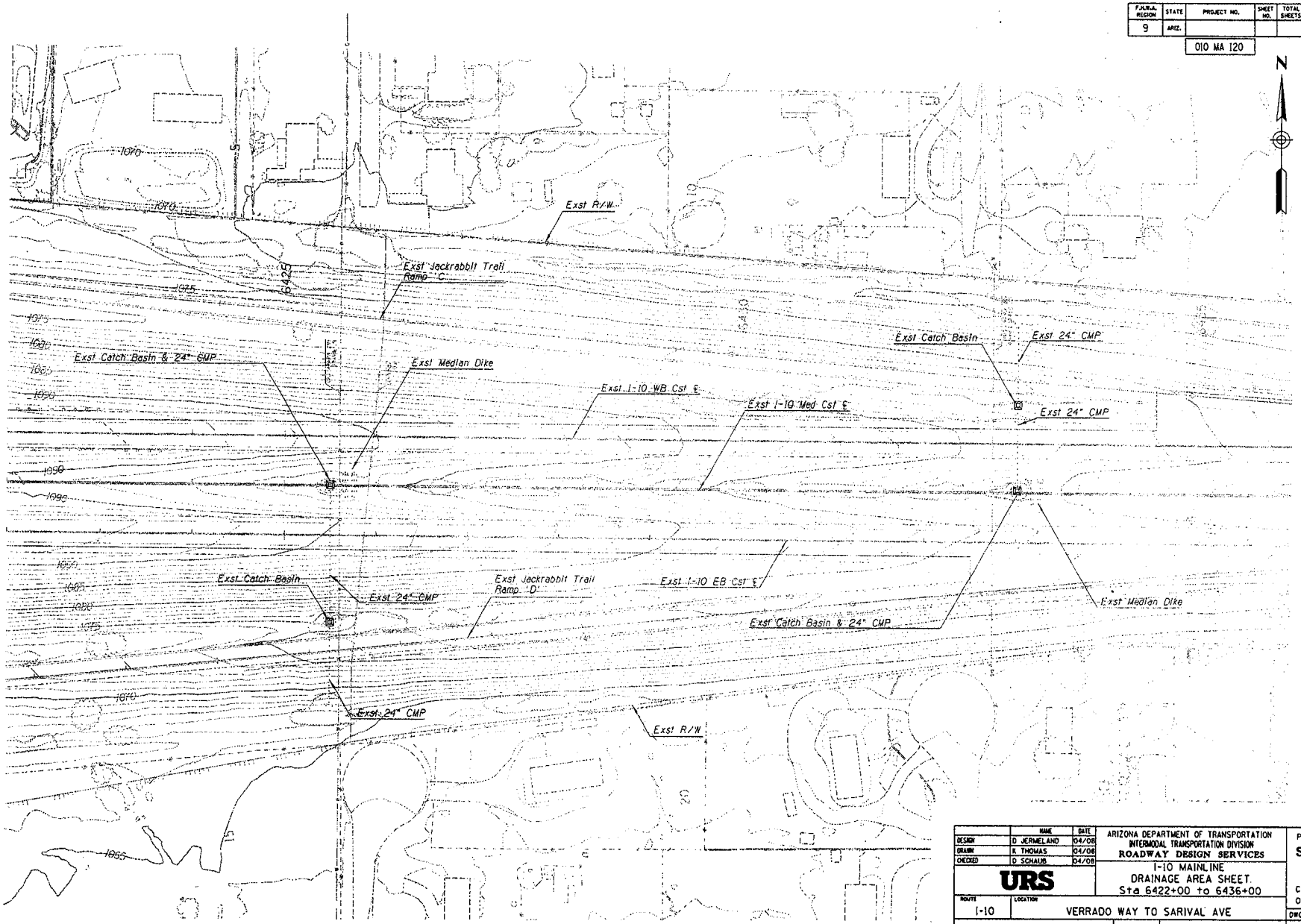

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	R THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6422+00 to 6436+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.08

___ OF ___

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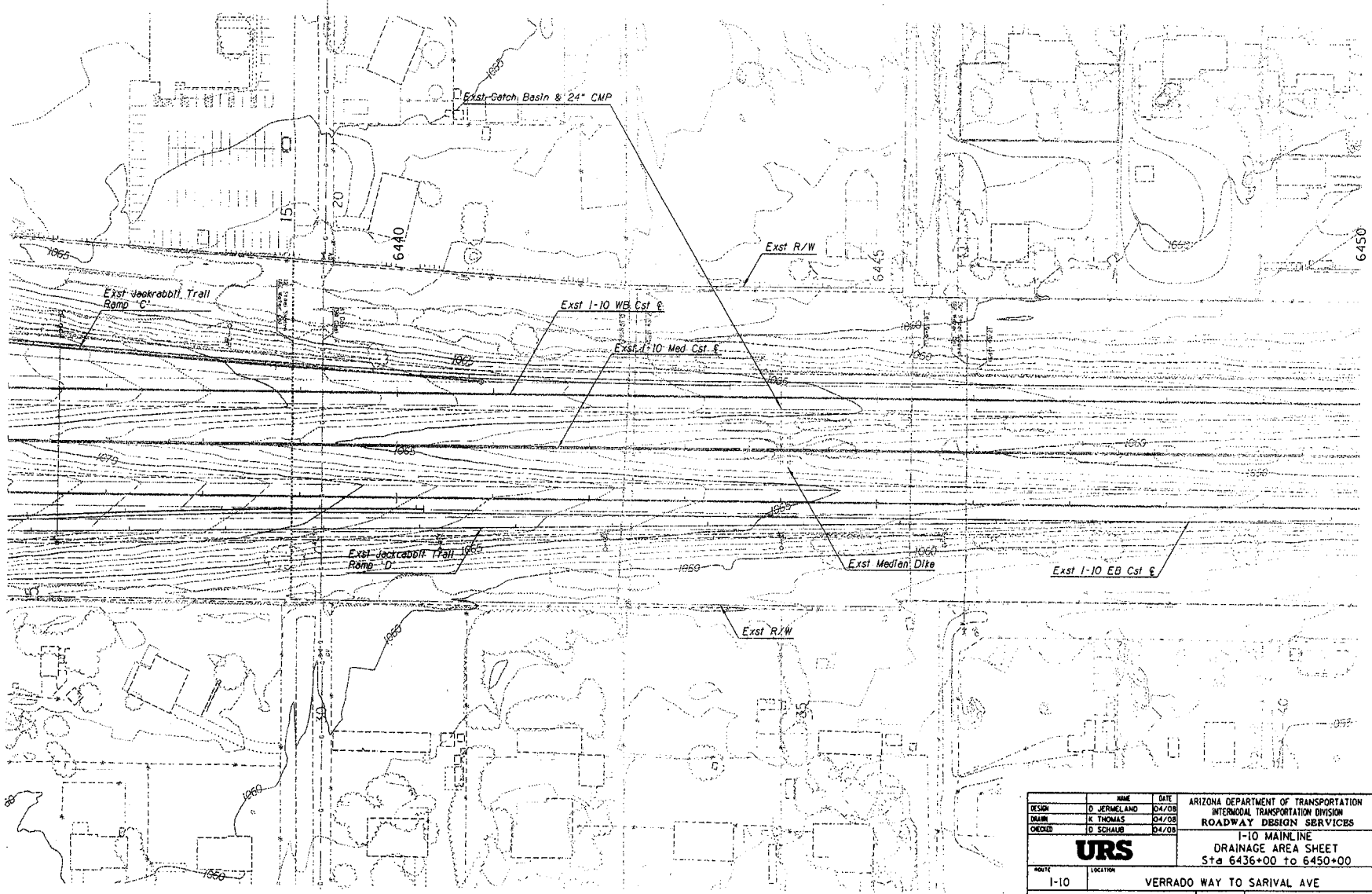
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6436+00 to 6450+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.09

___ OF ___

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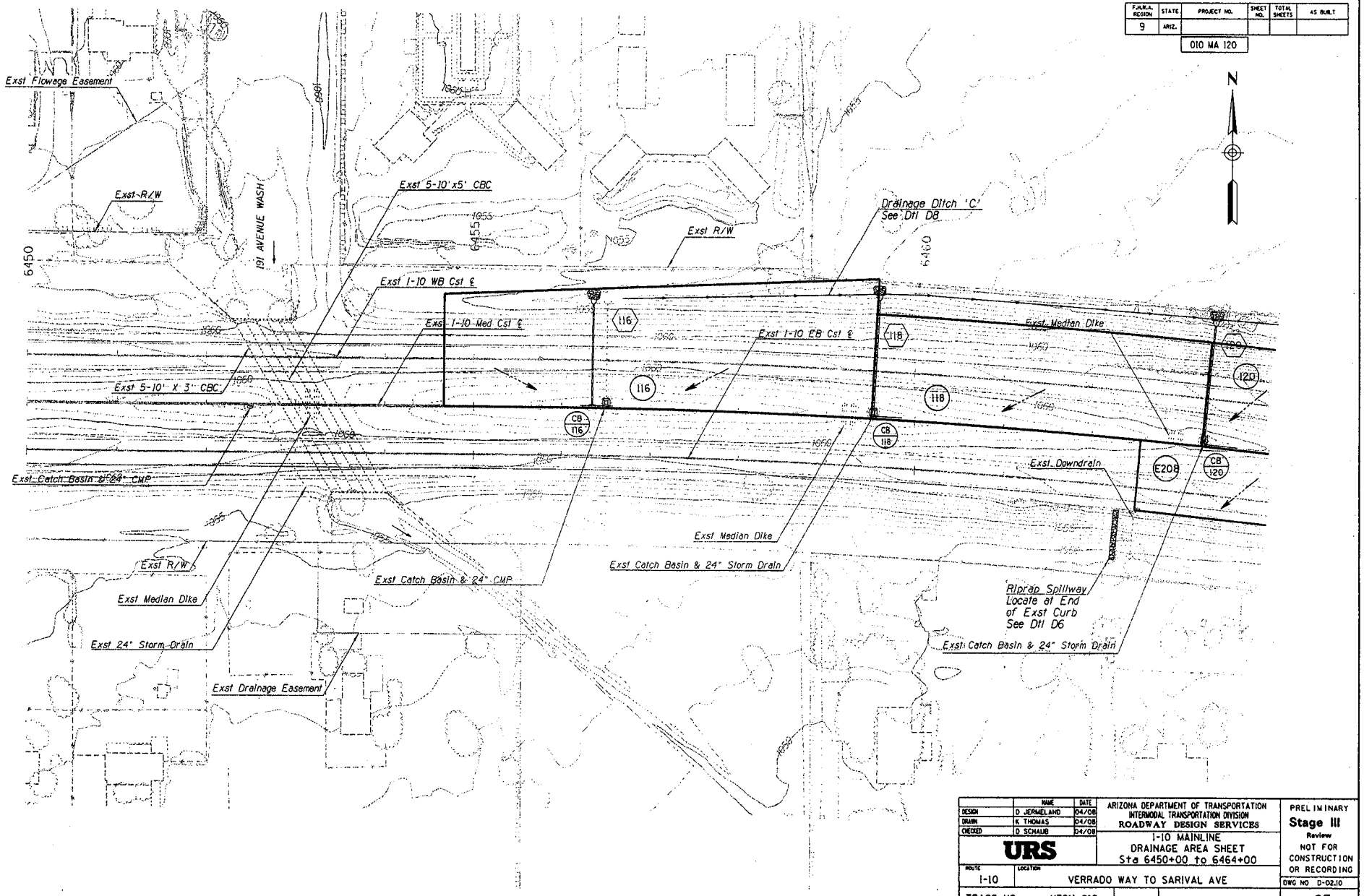

F.A.H.R.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6450+00 to 6464+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.10

___ OF ___

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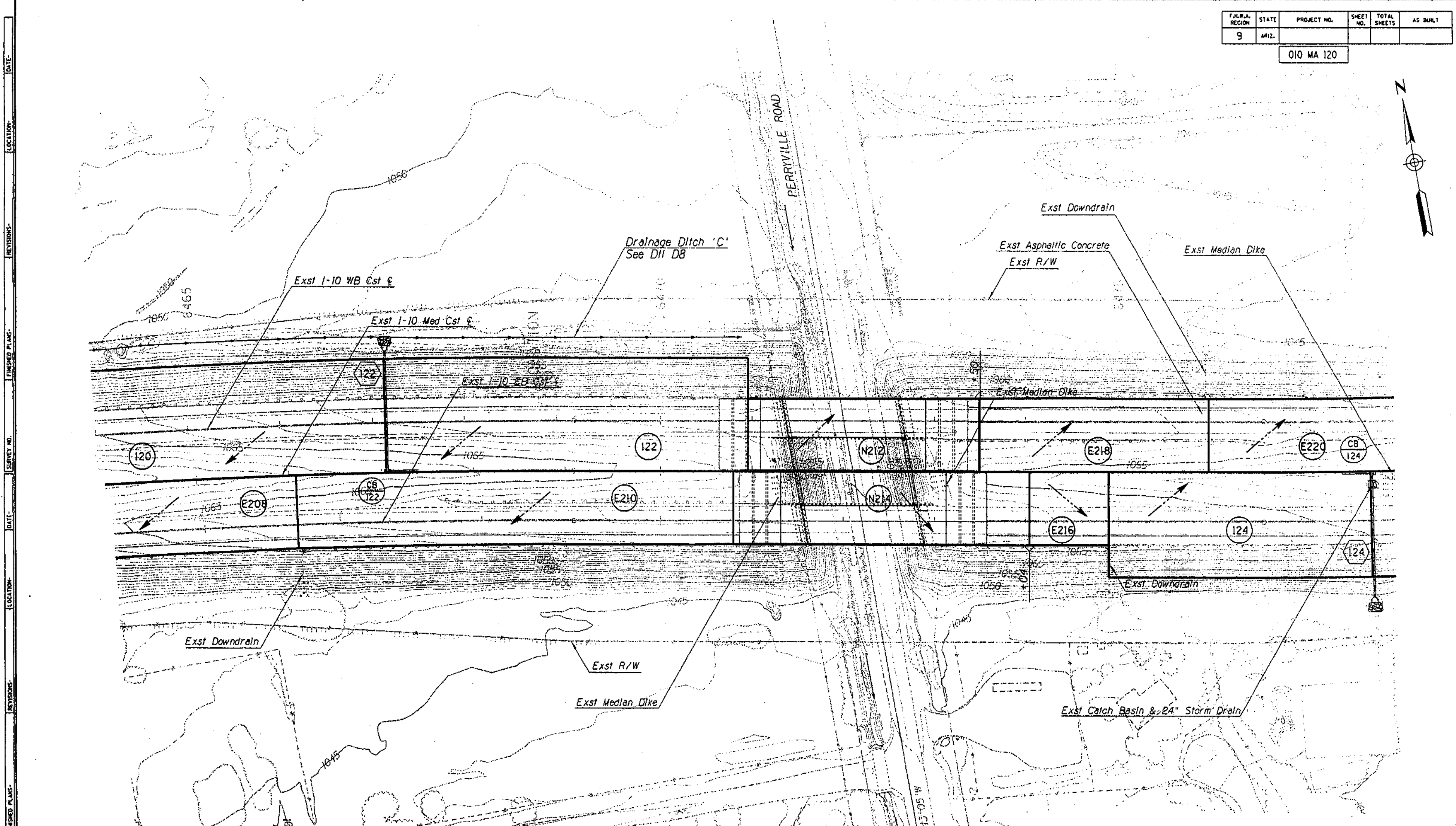
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6464+00 to 6478+00

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE
DWG NO D-02.11
TRACS NO. H7211 01C
___ OF ___

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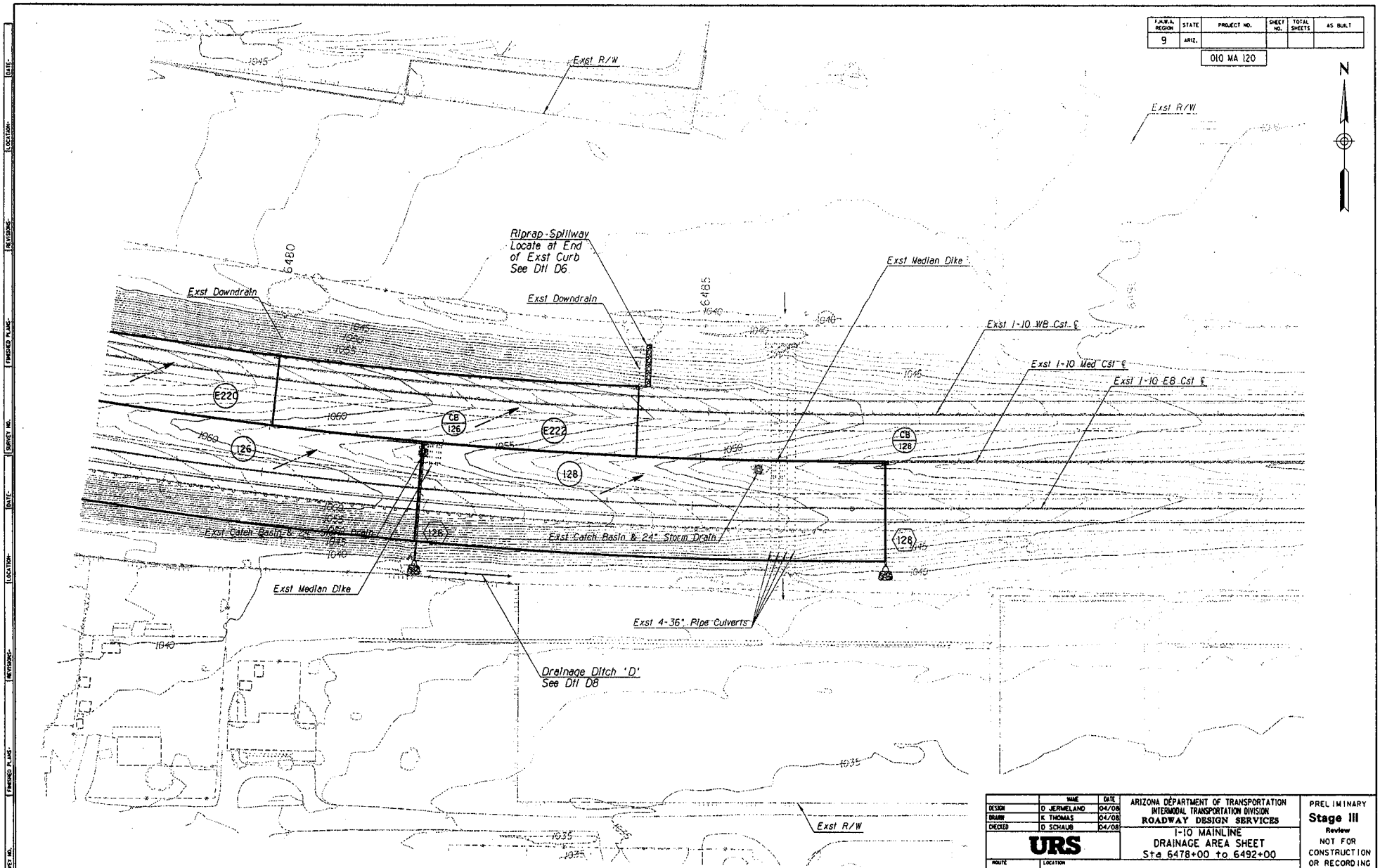

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6478+00 to 6492+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.12

___ OF ___

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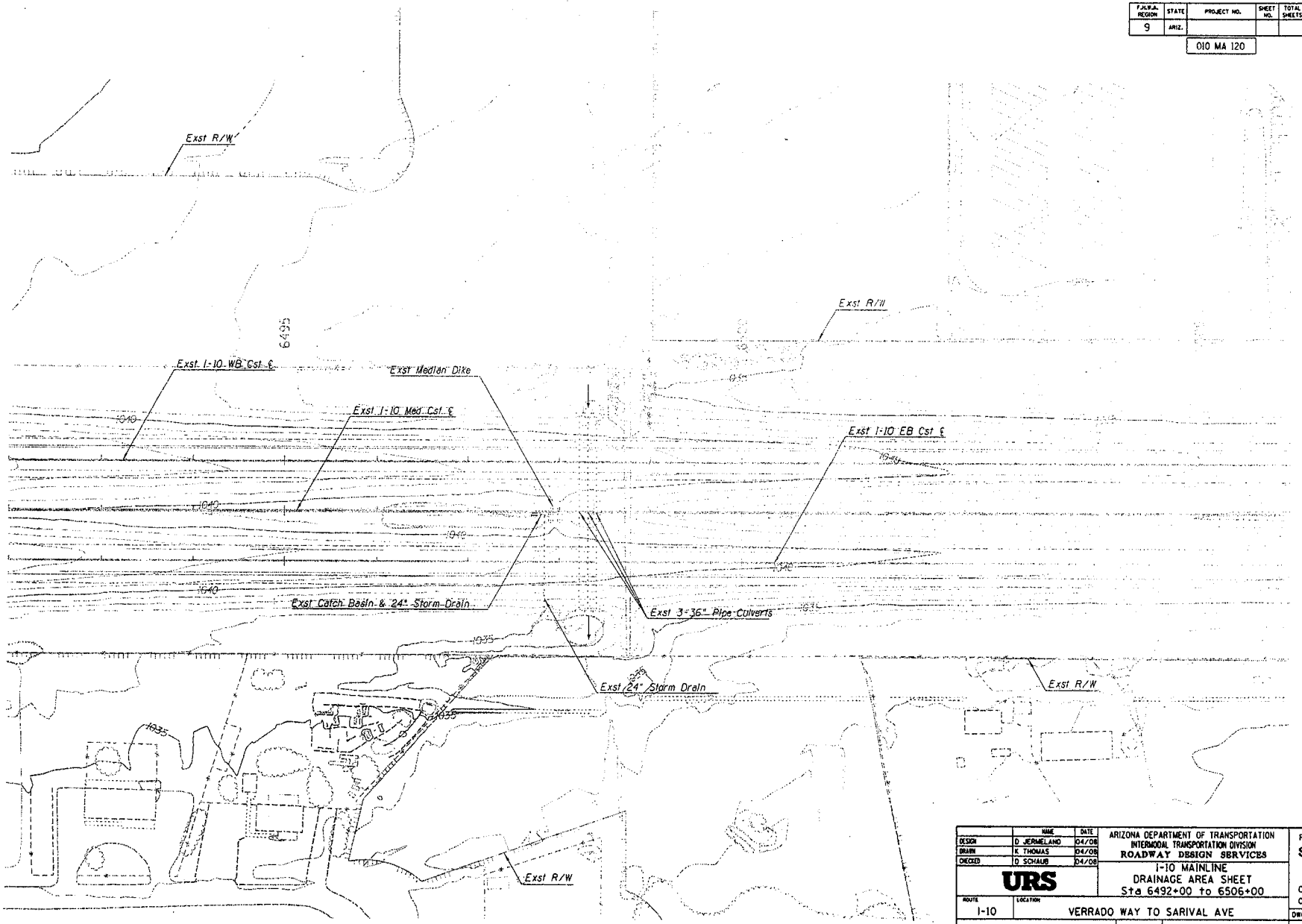

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

N

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6492+00 to 6506+00

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO 0-02.13

___ OF ___

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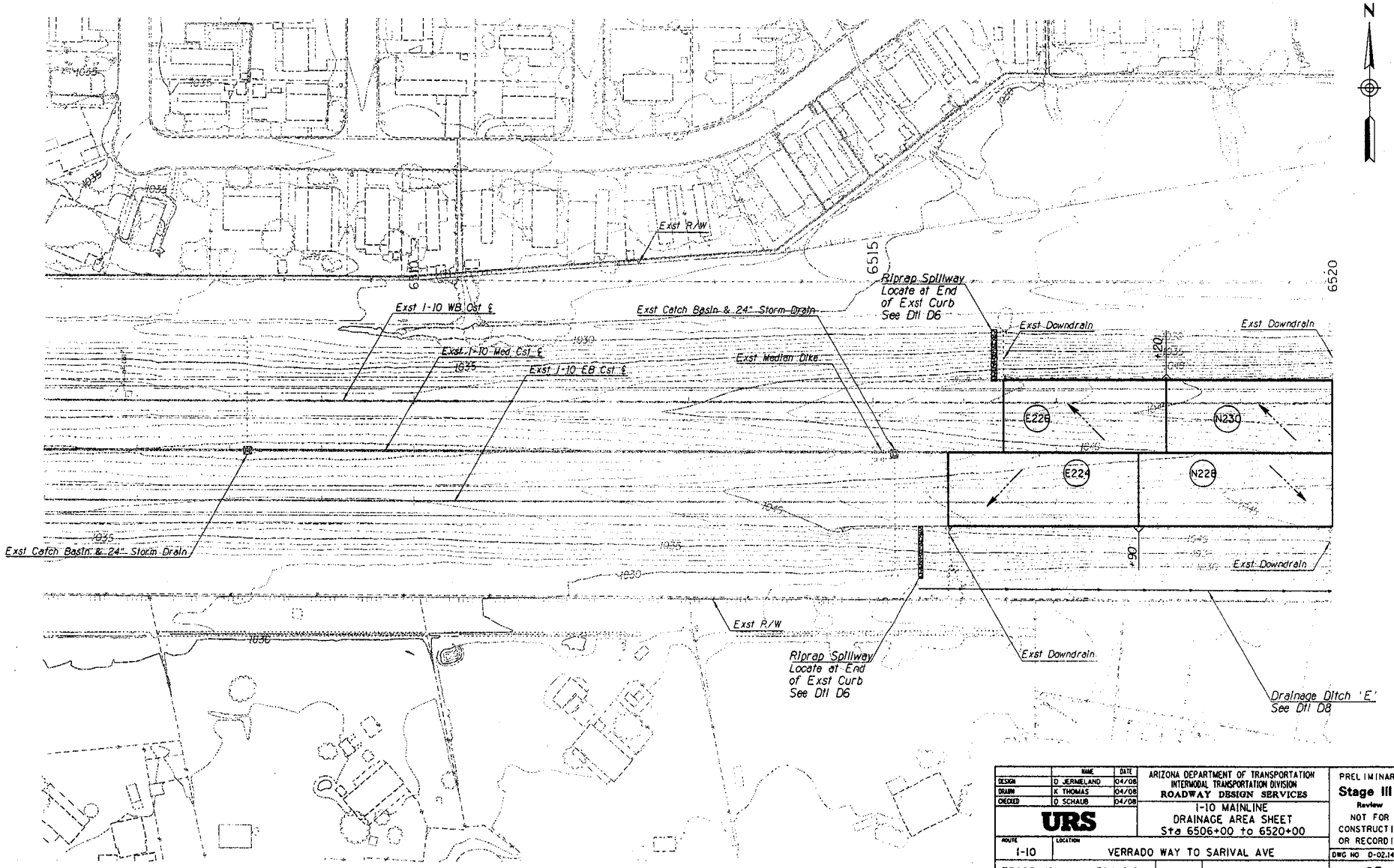
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6506+00 to 6520+00

ROUTE: I-10 | LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.14

___ OF ___

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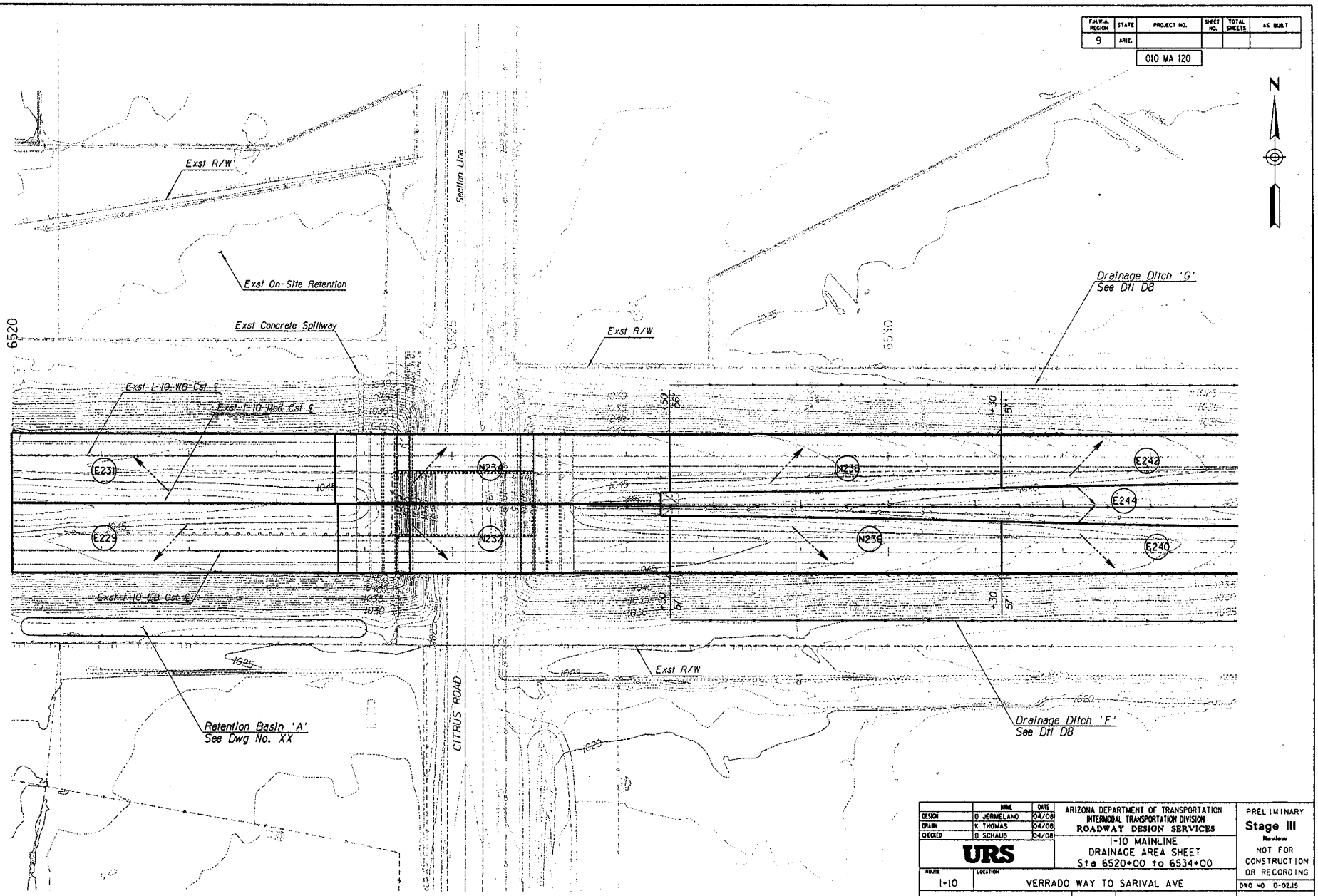

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6520+00 to 6534+00

ROUTE: I-10 | LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.15

___ OF ___

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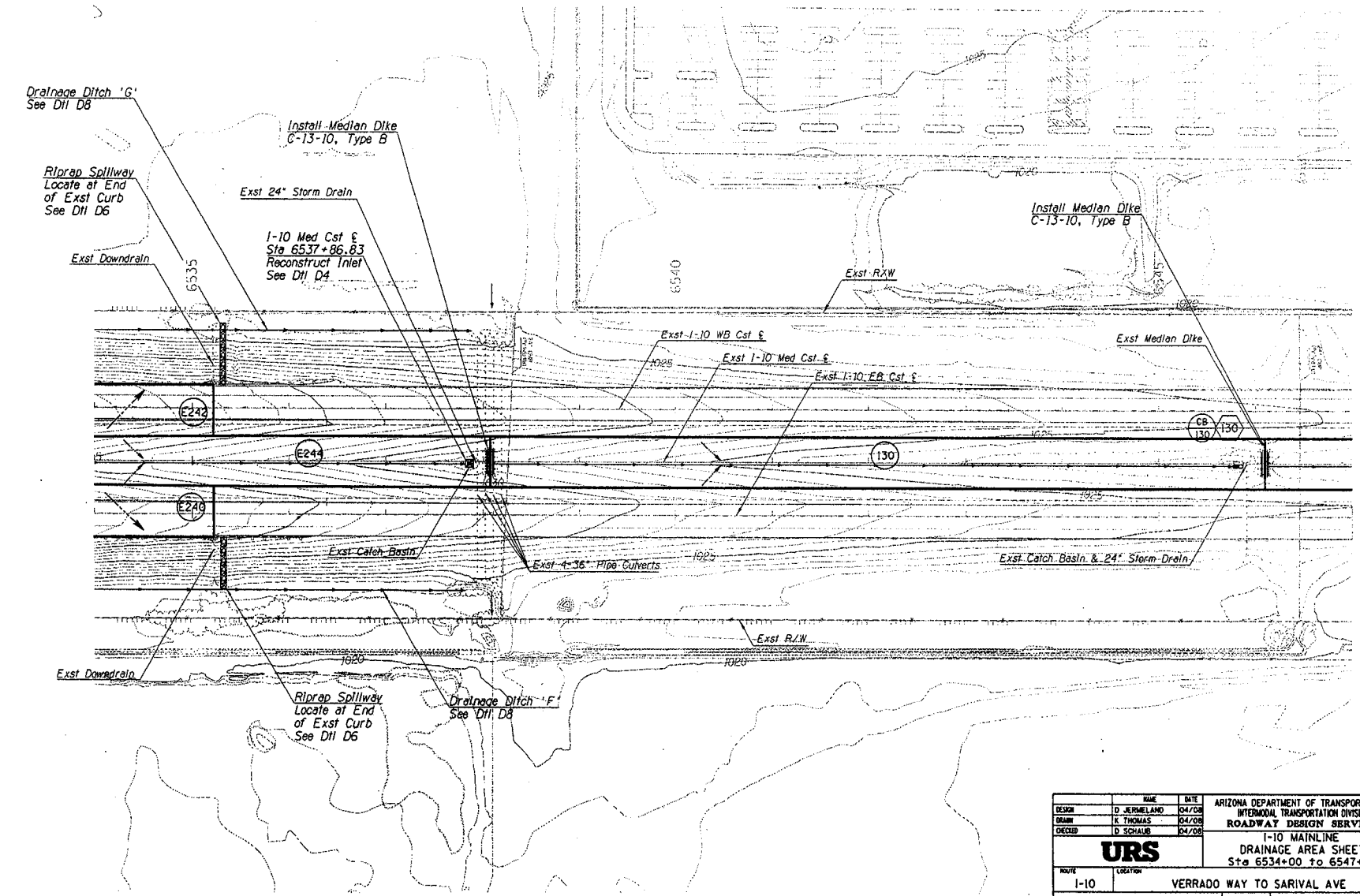
F.A.H.R.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6534+00 to 6547+00

ROUTE: I-10 | LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.16

___ OF ___

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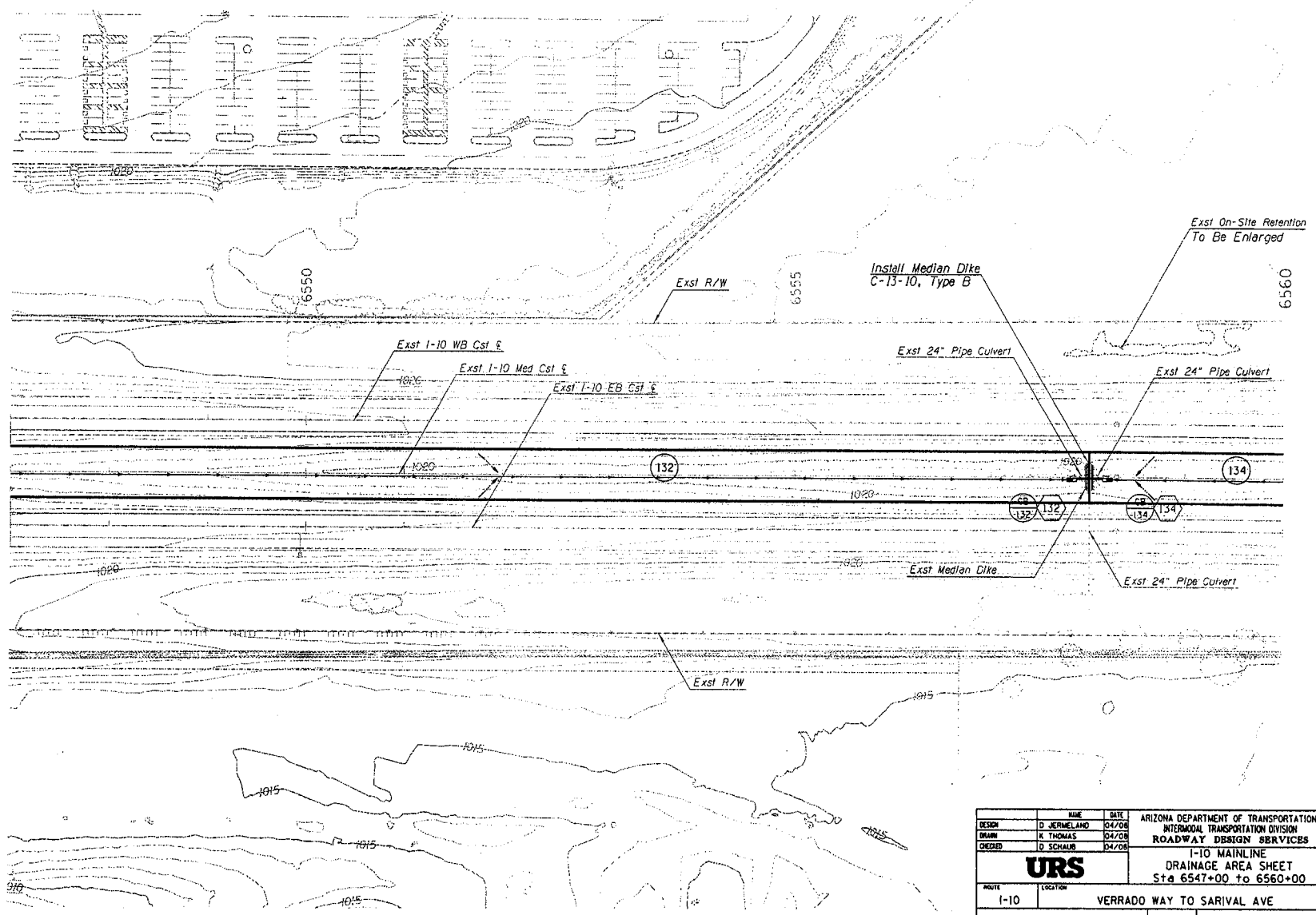
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6547+00 to 6560+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.17

___ OF ___

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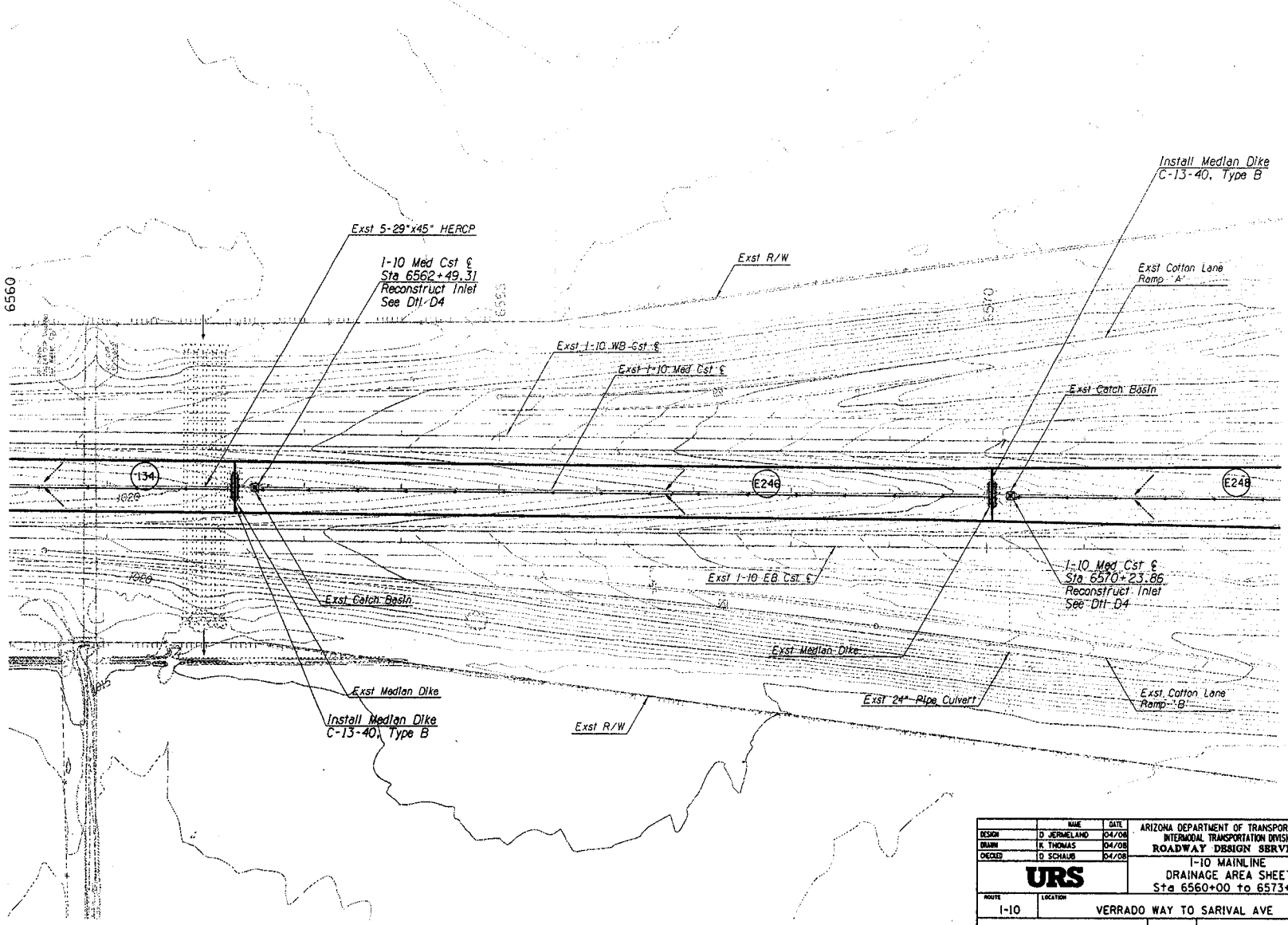
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120



	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6560+00 to 6573+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.16

___ OF ___

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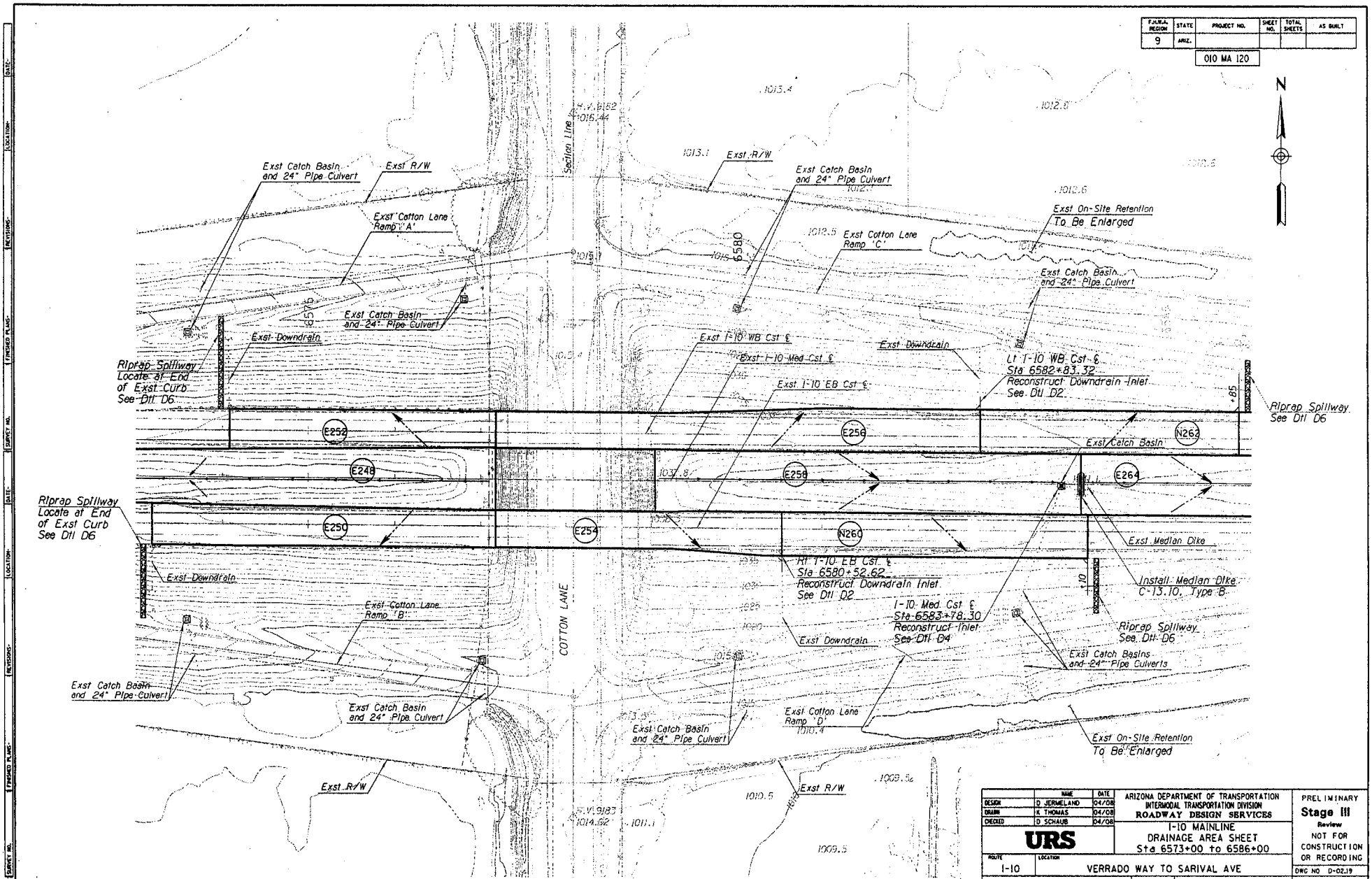

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6573+00 to 6586+00

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

DWG NO D-02.19

TRACS NO. H7211 01C

___ OF ___

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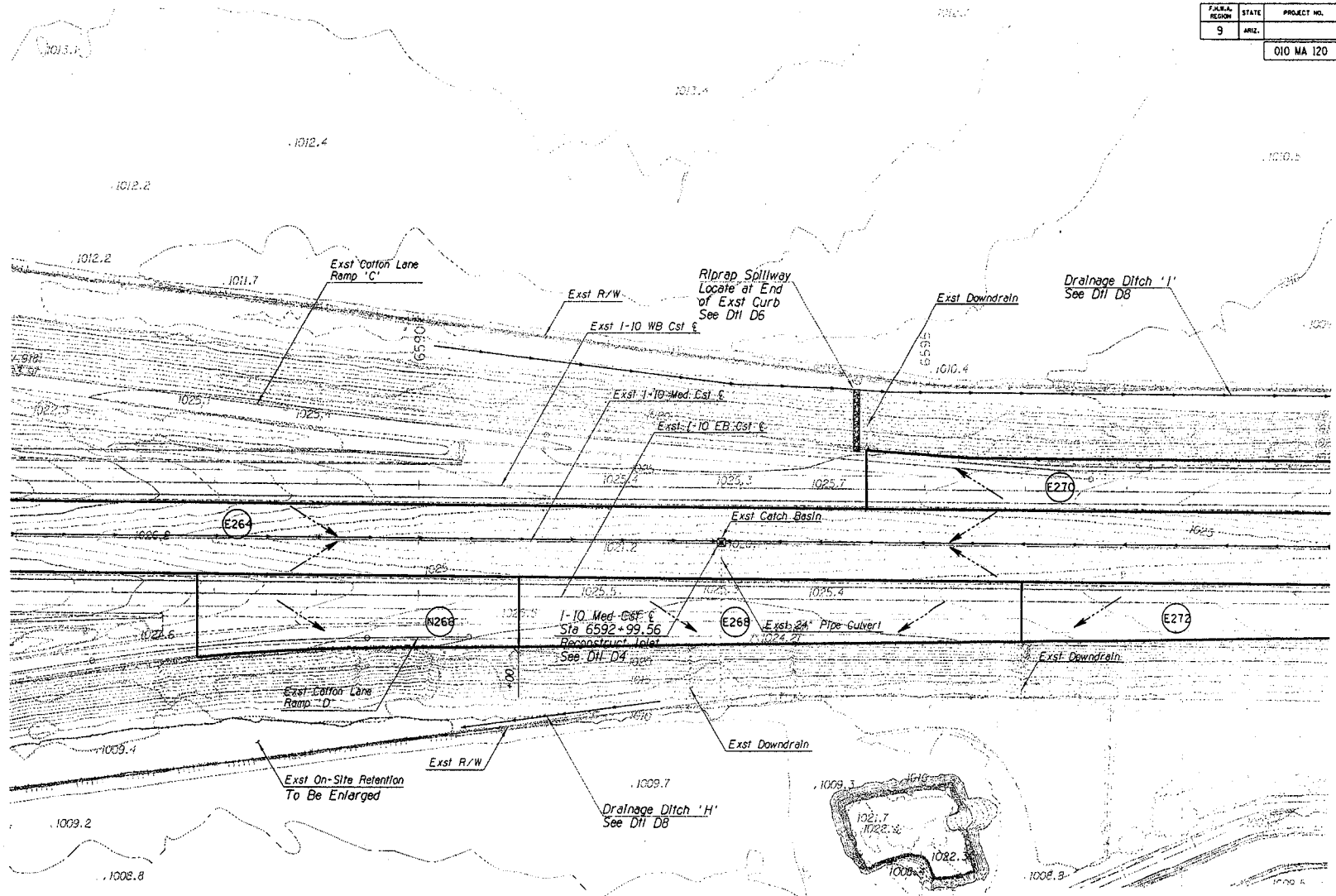

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				
		010 MA 120			

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6586+00 to 6599+00

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION	DWG NO
I-10	VERRADO WAY TO SARIVAL AVE	D-02.20

TRACS NO. H7211 01C

___ OF ___

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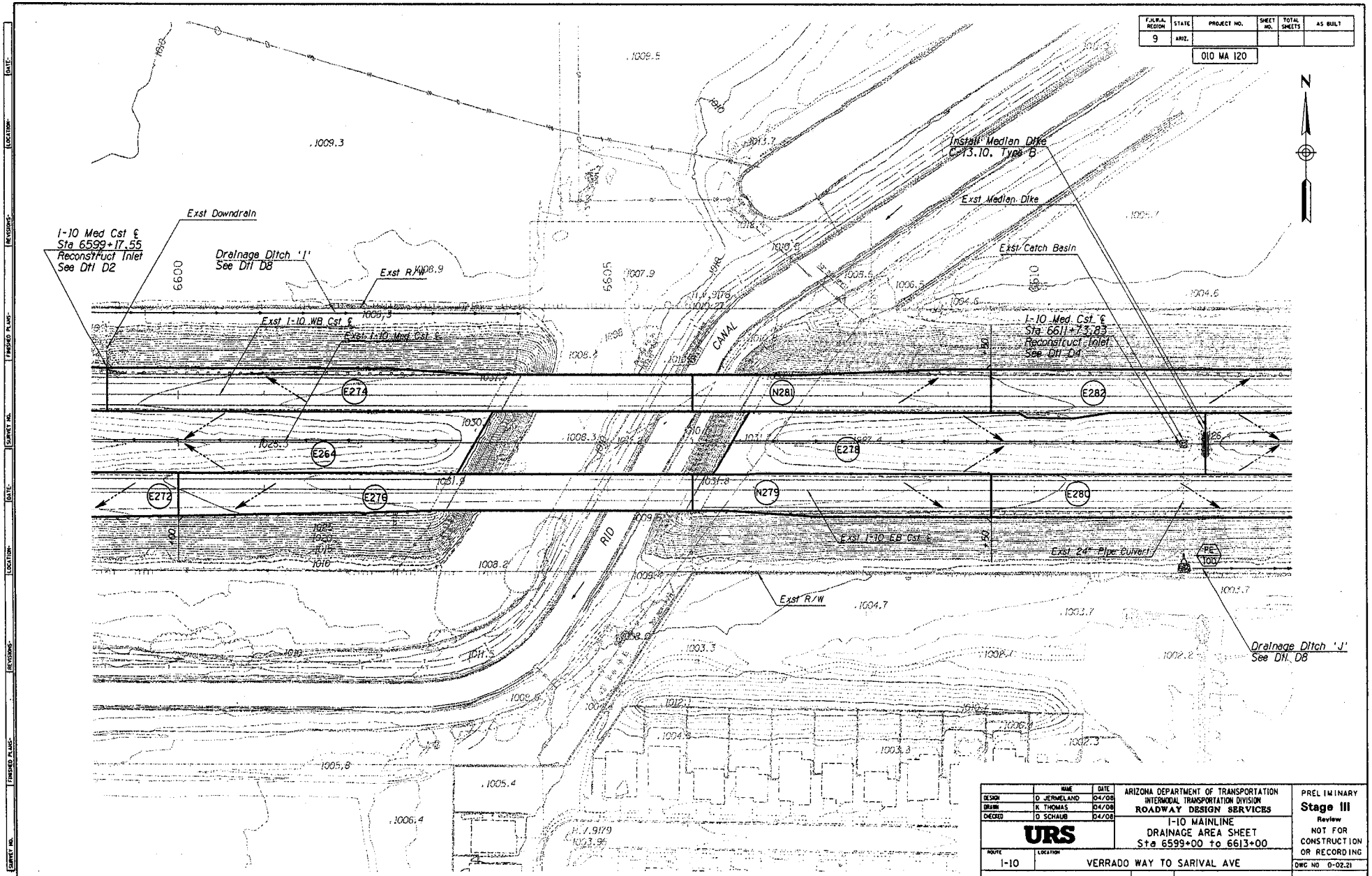

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6599+00 to 6613+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO 0-02.21

___ OF ___

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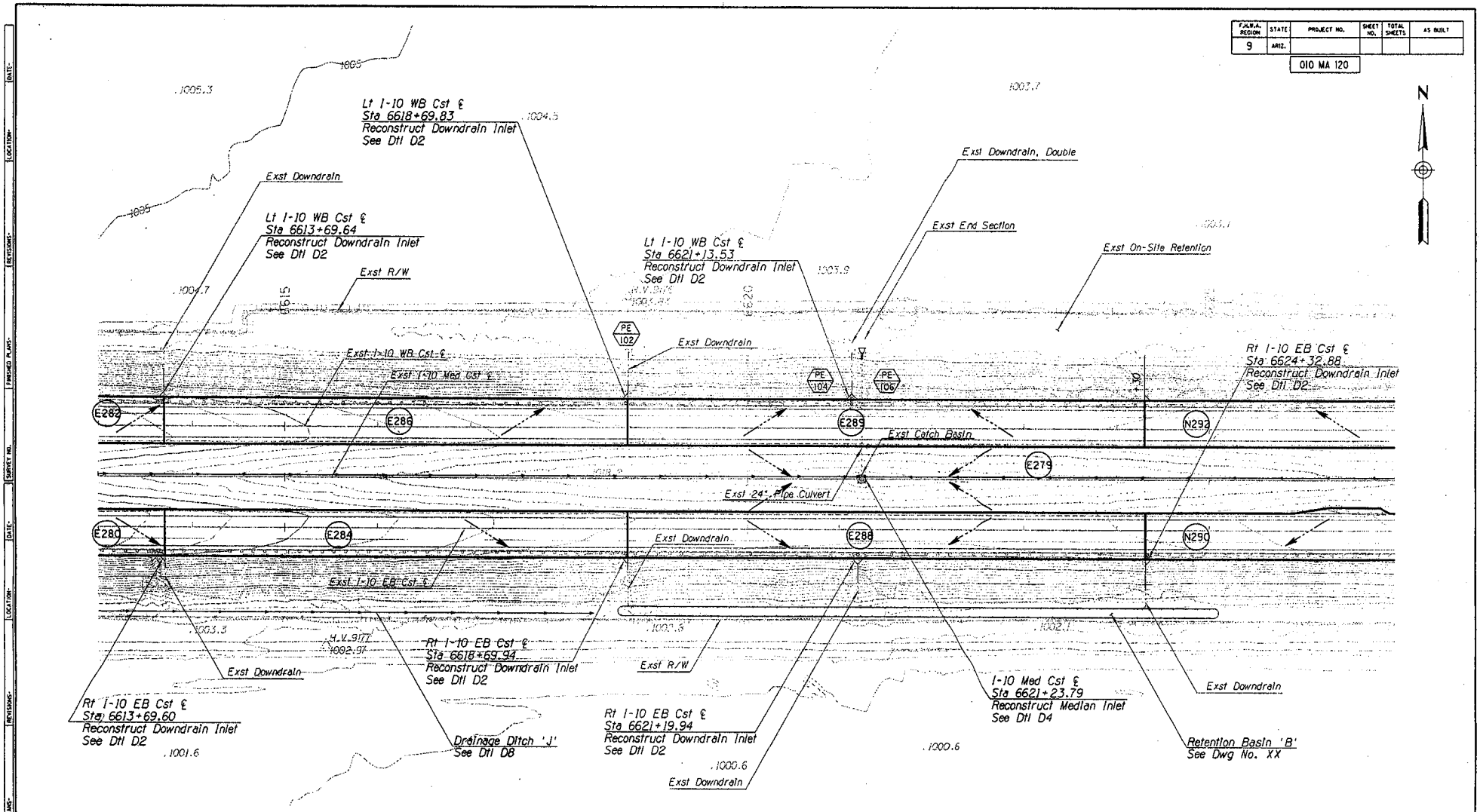

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D. JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D. SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6613+00 to 6627+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.22

___ OF ___

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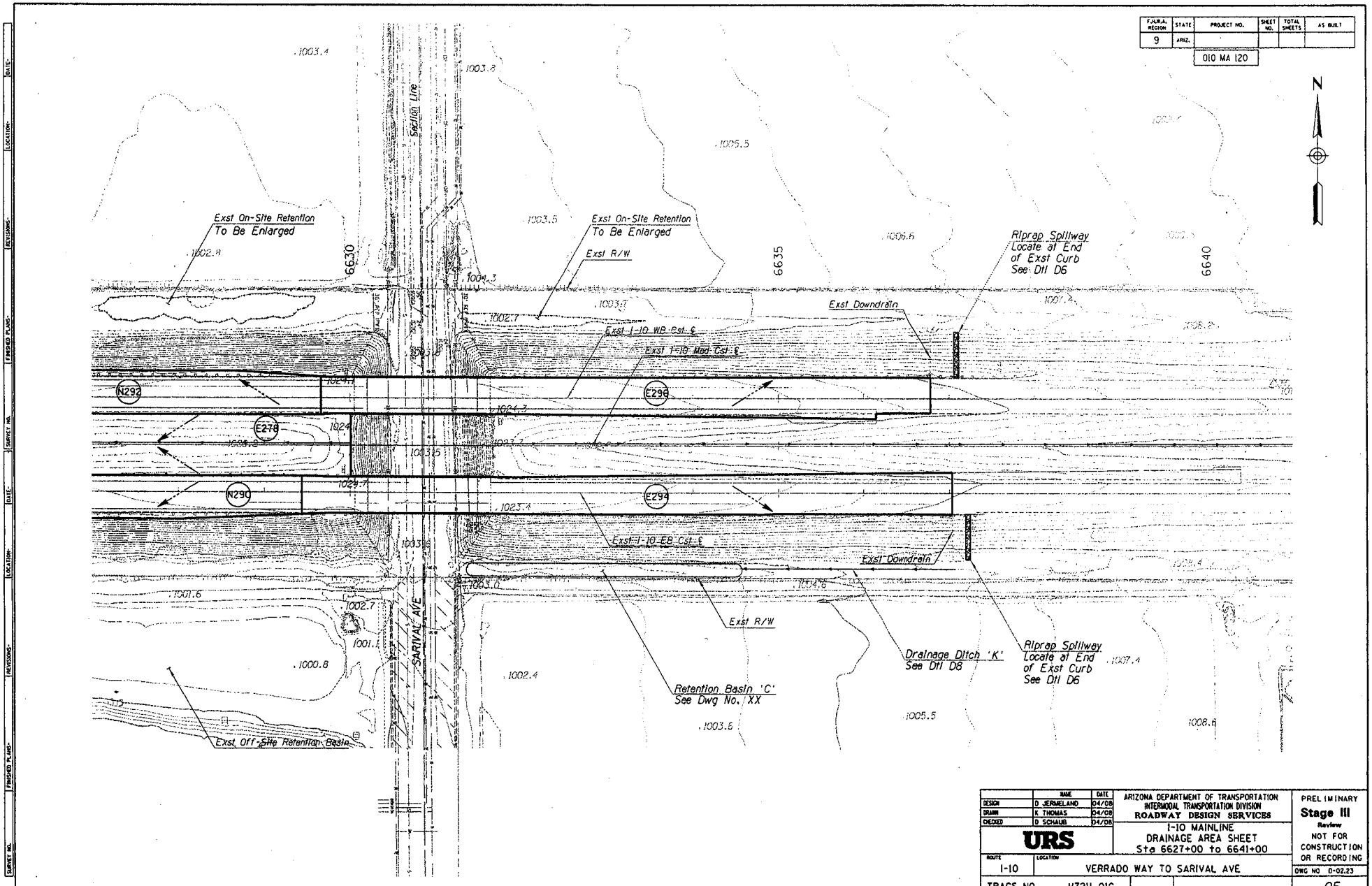

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6627+00 to 6641+00

ROUTE	LOCATION
I-10	VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.23

___ OF ___

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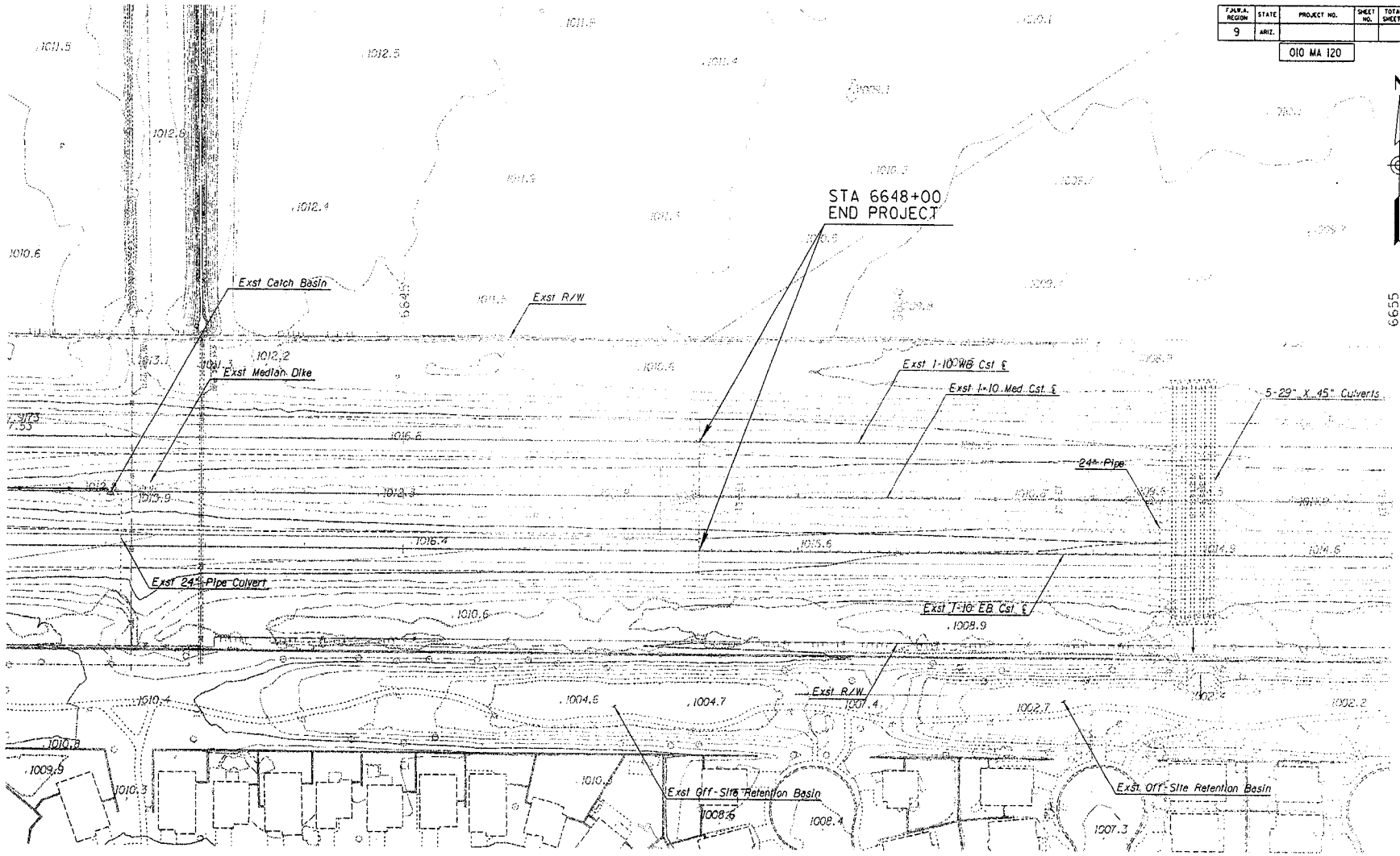

F.A.H.P.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

010 MA 120

	NAME	DATE
DESIGN	D JERMELAND	04/08
DRAWN	K. THOMAS	04/08
CHECKED	D SCHAUB	04/08

URS

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
ROADWAY DESIGN SERVICES

I-10 MAINLINE
DRAINAGE AREA SHEET
Sta 6641+00 to 6655+00

ROUTE: I-10
LOCATION: VERRADO WAY TO SARIVAL AVE

TRACS NO. H7211 01C

PRELIMINARY
Stage III
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG NO D-02.24

___ OF ___

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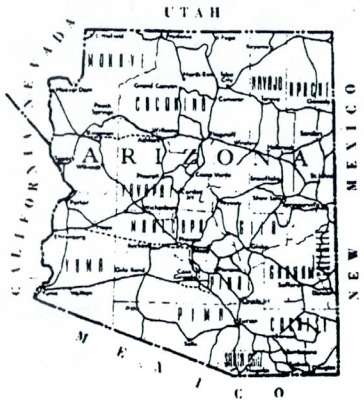
APPENDIX L

AS-BUILT/FUTURE DESIGN PLANS

122



STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PLAN AND PROFILE OF PROPOSED

STATE HIGHWAY

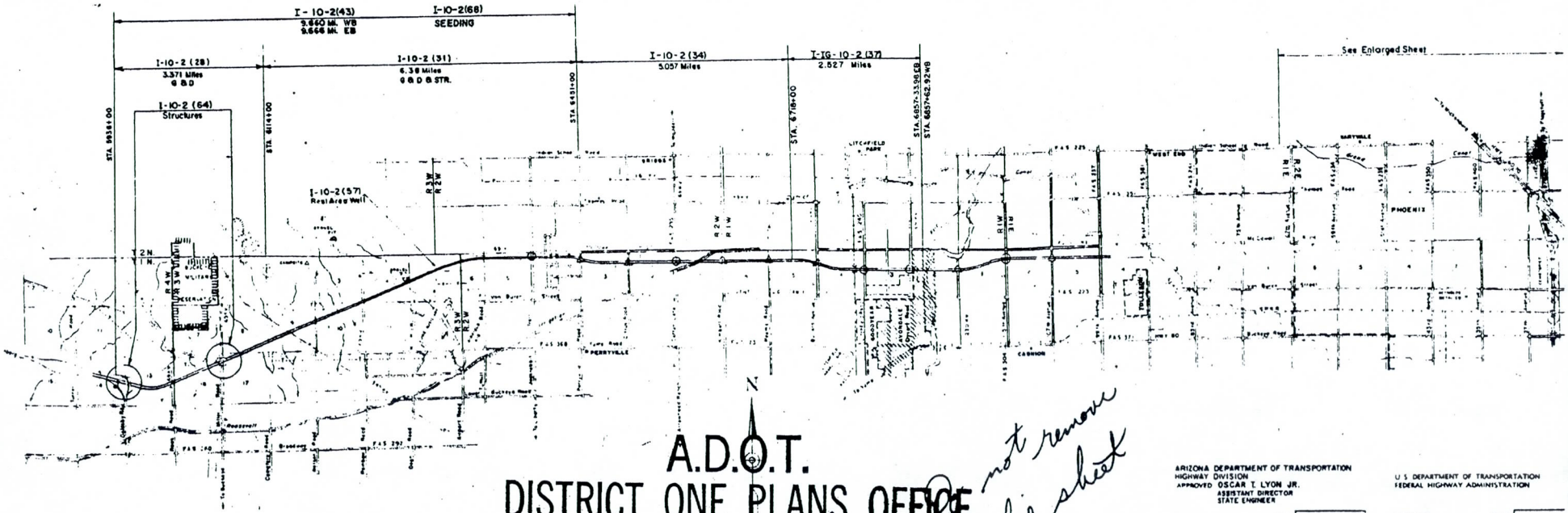
MP 127

EHRENBERG — PHOENIX

MARICOPA COUNTY

I-10-2(34)

AS BUILT
DATE 9-19-85 MH



A.D.O.T.
DISTRICT ONE PLANS OFFICE
FILE COPY
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ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
APPROVED OSCAR T. LYON JR.
ASSISTANT DIRECTOR
STATE ENGINEER

APPROVED DATE
CHIEF DEPUTY STATE ENGINEER

APPROVED DATE
DEPUTY STATE ENGINEER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED DATE
DIVISION ENGINEER

EHRENBERG — PHOENIX HIGHWAY
PERRYVILLE RD.— BULLARD RD. SECTION
MARICOPA COUNTY

NEW PIPE CULVERTS

I-10-2(34) 3 164

DESCRIPTION				C.M.P. GAUGE				R.C.P	END TREATMENT						QUANTITIES					REMARKS
				2 2/3 x 1/2		3x1			End Sect	Catch Basin			Headwall		Str Excav Cu Yds	Special Backfill Cu Yds	Class "A" Concrete Cu Yds	Reinf Steel Lbs		
	Size	Length	Skew	Uncoated	Bit. Coated	Uncoated	Bit. Coated	Placement	Class	C-1305	Type	H	Grate	R.C.C.R Apron Sq. Yds	Type					
52.27																				
E.B. G485+25	24"	122'	30° Lt.	14	14	-	-	Type 1	II	Rt.	C-15.10.1					19	199	105			See Detail 'L'
W.B. G456+50	24"	110'		14	14	-	-	Type 2	II		C-15.09	2'-6"	105303	10.9		0	30	30	0.8	G0	CO "S
W.B. G459+50	24"	120'		14	14	-	-	Type 1	II		C-15.09	3'	105382	10.9		0	110	34	0.8	G5	CO "S
W.B. G463+25	24"	132'		14	14	-	-	Type 1	III		C-15.09	3'	105682	10.9		0	140	36	0.8	G5	End Section Deleted by Engineer
Med. & G485+75	24"	10'		14	14	-	-	Type 1	II		C-15.09	3'	104480	10.9		-	15	4	0.8	G5	Connect to 36" pipe. See Detail 'P'
Med. & G486+00	4-36"	256'		14	14	14	14	Type 1	III	4Lt.+4Rt.						150	1100	1428			Bell End Lt. Bituminous lined C.M.P. (Smooth bore)
E.B. G497+82	24"	185'		14	14	-	-	Type 1	II	Rt.	C-15.10.1					0	69	29			See Detail 'L'
Med. & G498+35	3-36"	286'		14	14	14	14	Type 1	II	3Lt.+3Rt.						157	85	857			Bell End Lt. Bituminous lined C.M.P. (Smooth bore)
W.B. G508+25	24"	118'		-	14	-	-	Type 2	II		C-15.09	3'	103258	10.9		0	35	33	0.8	G5	CO "S
E.B. G515+25	24"	120'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	103461	10.9		0	5	35	0.8	G5	
Med. & G537+80	24"	0'		-	14	-	-	Type 1	II		C-15.09	3'	102537	10.9		0	-	0	0.8	G5	Connect to 36" pipe. See Detail 'P' (Special Backfill included in Str. "12)
Med. & G538+10	4-36"	246'		-	14	-	14	Type 1	II	4Lt.+4Rt.						241	1500	4936			Bell End Lt. Bituminous lined C.M.P. (Smooth bore)
E.B. G548+00	24"	101'		-	14	-	-	Type 1	II	Rt.	C-15.10.1					0	80	20			C-15.10.1 Outlet Invert Elev. 1017.33 See Detail 'L'
E.B. G558+00	24"	116'		-	14	-	-	Type 1	II	Rt.	2-C-15.10.1					0	80	53			See Detail 'M'
Med. & G562+50	24"	30'		-	14	-	-	Type 1	II		C-15.09	3'	101886	10.9		0	5	8	0.8	G5	Connect to 45"x29" Pipe Culv. See Detail 'P'
E.B. G570+25	24"	212'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	102920	10.9		0	5	60	0.8	G5	
Med. & G577+15	2-36"	530'		-	14	-	14	Type 1	III	2Lt.+2Rt.						671	1755	960			Bell End Lt. Bituminous lined C.M.P. (Smooth bore) Rubber Gasket
E.B. G583+61	24"	153'	15° Rt.	-	14	-	-	Type 1	II		C-15.09	3'	102129	10.9		0	5	42	0.8	G5	Connect to C-15.09 Lt. & Rt.
E.B. G599+00	24"	140'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	101882	10.9		0	5	40	0.8	G5	
E.B. GG42+08	24"	116'		-	14	-	-	Type 1	II	Rt.	C-15.10.1					0	75	31			See Detail 'L'
E.B. GG52+60	24"	110'		-	14	-	-	Type 1	II	Rt.	C-15.10.1					0	80	30			See Detail 'L'
W.B. GGG4+00	24"	173'		-	14	-	-	Type 2	II		2-C-15.10.1					0	40	70			See Detail 'M' CO "S
Med. & GG	30"	458'		-	-	-	-	Type 2	II									507	1.6	150	Includes: Elbows, See Detail 'S' & 'E' CO "S Special Head Lt. - See Detail "C"
E.B. GG72+00	24"	128'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	101171	10.9	Detail 'C'	0	10	35	0.8	G5	
E.B. GG94+75	24"	102'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	100884	10.9		0	5	41	0.8	G5	
E.B. G703+00	24"	130'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	99398	10.9		0	15	36	0.8	G5	
E.B. G710+50	24"	130'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	99367	10.9		0	5	36	0.8	G5	
E.B. G717+50	24"	138'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	99494	10.9		0	5	38	0.8	G5	
Ramp 'A' 8+90	24"	81'	25° Rt.	-	14	-	-	Type 1	II	Lt.	C-15.09	3'	1019.62	10.9		0	5	32	0.8	G5	
Ramp 'A' 11+95	24"	51'	15° Rt.	-	14	-	-	Type 1	II	Lt.	C-15.09	3'	1013.27	10.9		0	15	15	0.8	G5	
Ramp 'B' 2+00	24"	62'	8° Rt.	-	14	-	-	Type 1	II	Lt.	C-15.09	2'-6"	103.02	10.9		0	5	21	0.8	G0	
Ramp 'B' 5+25	24"	80'	8° Rt.	-	14	-	-	Type 1	II	Lt.	C-15.09	3'	1018.76	10.9		0	5	23	0.8	G5	
Ramp 'C' 2+00	24"	65'		-	14	-	-	Type 1	II	Rt.	C-15.09	2'-6"	1012.56	10.9		0	10	19	0.8	G0	
Ramp 'C' 5+25	24"	36'		-	14	-	-	Type 1	II	Rt.	C-15.09	3'	1018.16	10.9		0	5	27	0.8	G5	
Ramp 'D' 13+50	24"	84'	20° Lt.	-	14	-	-	Type 1	II	Rt.	C-15.09	3'	1018.36	10.9		0	5	25	0.8	G5	
Ramp 'D' 16+50	24"	51'	10° Lt.	-	14	-	-	Type 1	II	Rt.	C-15.09	3'	1011.79	10.9		0	20	15	0.8	G5	

EHRENBERG-PHOENIX HWY.
PERRYVILLE RD.-BULLARD RD. SECT.
MARICOPA COUNTY

NEW PIPE CULVERTS

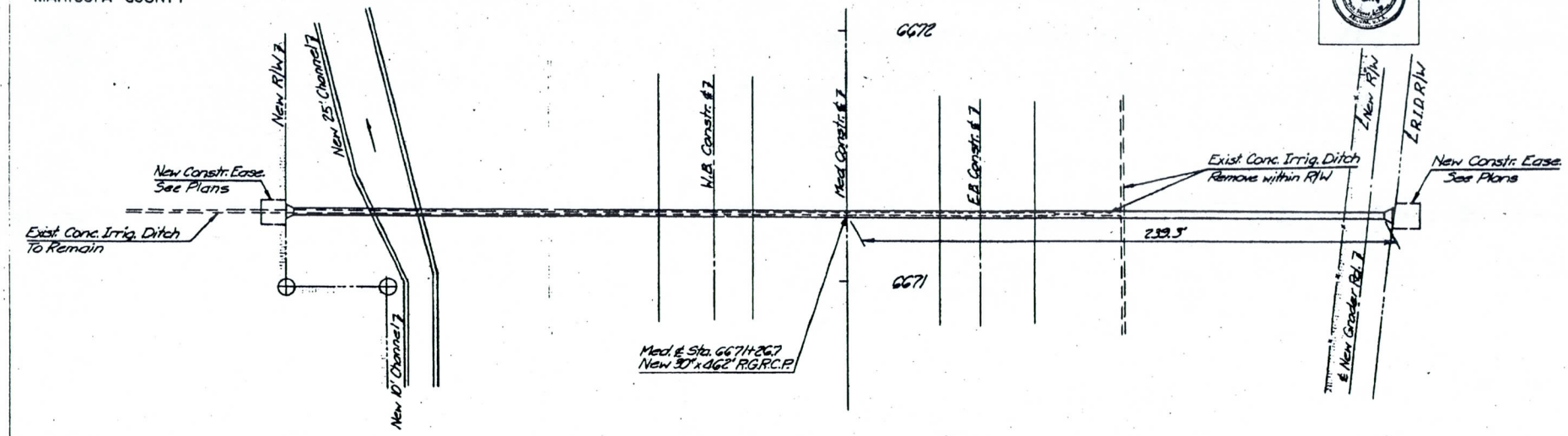
FHWA REGION	STATE	PROJECT NO	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(34)	4	164	9-10-85

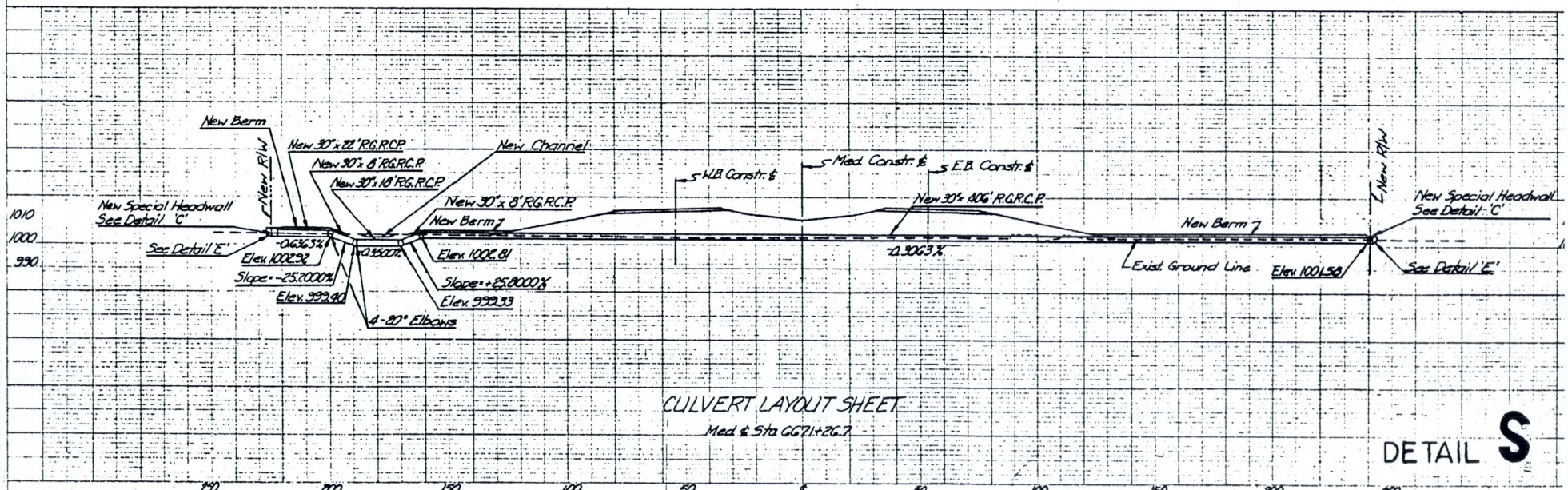
DESCRIPTION				C.M.P. GAUGE				R.C.P.		END TREATMENT						QUANTITIES					REMARKS
				2 2/3 x 1/2		3 x 1				End Sect.	Catch Basin				Headwall	Str. Excav.	Special Backfill	Drain. Excav.	Class "A" Concrete	Reinf. Steel	
Station	Size	Length	~~Skew~~	Uncoated	Bit. Coated	Uncoated	Bit. Coated	Placement	Class	C-13.05	Type	H	Grate Elev.	Apron Type	Type	Cu. Yds.	Cu. Yds.	Cu. Yds.	Cu. Yds.	Lbs.	
						C.M.P.															
E.B. 6477+80	24"	~~116'~~	122'	14	14	–	–	–	–		C-15.09	3'			Detail 'D'	0 ~~5~~	~~130~~	21	0.8	65	
E.B. 6481+82	24"	~~116'~~	120'	14	14	–	–	–	–		C-15.09	3'			Detail 'D'	0 ~~5~~	~~130~~	22	0.8	65	
Med. ℄ 6560+80	24"	~~350'~~	325'	–	14	Includes Str 40 & 40A										181 ~~95~~	~~955~~	119			Nestable C.M.P. See Detail 'R' CO #16
E.B. 6611+25	24"	~~[illegible]~~	130'	–	14	–	–	–	–		C-15.09	3'			Detail 'D'	0 ~~5~~	~~149~~	25	0.8	65	
W.B. 6621+25	24"	~~[illegible]~~	130'	–	14	–	–	–	–		C-15.09	3'			Detail 'D'	0 ~~5~~	~~145~~	25	0.8	65	
~~W.B.~~ 6689+75 E.B.	24"	~~[illegible]~~	126'	–	14	–	–	–	–		C-15.09	3'			Detail 'D'	0 ~~5~~	~~140~~	24	0.8	65	
R.I.D. 5+80	24"	34'		–	14	–	–	–	–							24	~~90~~	9			New Armco Model 101 C Turnout Gate or Equal, See Detail 'Y'
Med. ℄ 6498+80E	12"	308'		14	–	Includes Str 45 & 45A		–	–							104 ~~35~~	~~315~~	54			Nestable C.M.P. See Detail 'R'
Med. ℄ 6498+~~58~~72	12"	308'		14	–	Includes Str 46 & 46A		–	–							114 ~~35~~	~~315~~	54			Nestable C.M.P. See Detail 'R'
Med. ℄ 6524+20	12"	~~350'~~	343'	–	14	Includes Str 47 & 47A		–	–							118 ~~40~~	~~360~~	62			Nestable C.M.P. See Detail 'R'
						R.G.R.C.P.															
Med. ℄ 6562+00	5:29'45	~~[illegible]~~	269'	–	Includes Str 48 & 48A		–	Type 2	II	~~[illegible]~~						546 ~~190~~	~~5,000~~	1,703			CO #20 - N. Slope Paved for Erosion Control 42 sq/yds
Med. ℄ 6653+00	5:29'45	~~[illegible]~~	228'	–	Includes Str 49 & 49A		–	Type 1	II	~~[illegible]~~						326 165	1,780	~~45~~	1,504		CO #20 - N. Slope Paved for Erosion Control 42 sq/yds
Med. ℄ 6525+60.59	30"	~~[illegible]~~	692'	–	–	–	–	Type 2	II						Detail 'C'	124 ~~98~~	~~1,095~~	761	1.6	150	Bell End Lt., Rubber Gasket, See Detail 'E' Hdwls Lt. & Rt.
Med. ℄ 6664+91	30"	~~[illegible]~~	303'	–	–	–	–	Type 2	II						Detail 'C'	117 ~~95~~	~~330~~	315	1.6	150	Bell End Lt. Rubber Gasket, See Detail 'E' Hdwls. Lt. ~~& Rt.~~
Med. ℄ 66~~[illegible]~~ 84+04	30"	~~[illegible]~~	661'	–	–	–	–	Type 2	II						Detail 'C'	151 ~~[illegible]~~	~~750~~	1,075	1.6	150	Bell End Lt. Rubber Gasket, See Detail 'E' Hdwls. Lt. ~~& Rt.~~ CO #5 & 6
Med. ℄ 6606+93	30"	~~[illegible]~~	442'	–	–	–	–	Type 2	II							317 ~~505~~	~~590~~	184			Stand Pipe Lt. & Rt. Std. C-16.02, Bell End Rt., Rubber Gasket
Lt. Med. ℄ 6606+93	30"	188'		–	–	–	–	Type 2	II							269 ~~[illegible]~~	~~[illegible]~~	78			Bell End to N.W., Rubber Gasket
Rt. Med. ℄ 6606+93	24"	~~180~~	179'	–	–	–	–	Type 2	V							106 ~~56~~	~~[illegible]~~	60			Bell End to N.E., Rubber Gasket
Rt. Med. ℄ 6606+93	24"	~~6'~~	7'	–	–	–	–	Type 2	II							0 ~~5~~	~~5~~	0			Bell End to N.W., Rubber Gasket
Lt. Med. ℄ 6606+93	24"	20'		–	–	–	–	Type 2	II							4 ~~15~~	~~80~~	23			Bell End to West, Rubber Gasket
Med. ℄ 6630+44	36"	~~372'~~	373'	-	-	-	-	Type 2	II						C-14.[illegible]	301 ~~330~~	~~490~~	215	2.9	235	Rubber Gasket Bell End Lt - See Details 'C', 'O', & 'Z', Headwall Lt & Rt
Med. ℄ 6631+22	30"	372'		-	-	-	-	Type 2	II						C-14.[illegible]	256 ~~455~~	~~618~~	155	2.3	187	Rubber Gasket, Bell End Lt - See Details 'C', 'Z' Headwall Lt & Rt
Med. ℄ 6642+26	36"	352'		-	-	-	-	Type 2	II						C-14.[illegible]	189 ~~180~~	~~485~~	276	2.9	235	Rubber Gasket, Bell End Lt. - See Details 'C', 'Z' & 'A-1', Headwall Lt & Rt
[illegible] Med. ℄ 6642+26	24"	8'		-	-	-	-	Type 2	II							4 ~~5~~	~~5~~	3			Rubber Gasket, Bell End West - See Detail 'A-1' - Standpipe C-16.02 w/8' stubout
Med. ℄ 6529+00	24"	315'		14												132	86				CO #6
Med. ℄ 6538+28	24"	314'			14											36	344				CO #6
Med. ℄ 6546+50	24"	314'			14											58	296				CO #6
Med. ℄ 6560+90	24"	322'			14											92	285				CO #6
Med. ℄ 6656+10	24"	300'			14											53	237				CO #6
Med. ℄ 6650+50	24"	308'			14											43	321				CO #6
Med. ℄ 6707+00	24"	40'			14						C-15.09	3'	991.92	PCCP 10.9 sq/yds		29	13				CO #17
Med. ℄ 6578+50	24"	213'						Type 2	IV							94	56				CO #12 Rubber Gasket
Med. ℄ 6683+00	24"	69'			14'			Type 2	III						C-14.09	9	33				CO #23 Rubber Gasket Drainage Str

SURVEY NOS. | FINISHED PLANS | REVISIONS | LOCATION | DATE

EHRENBERG — PHOENIX HWY
PERRYVILLE RD — BULLARD RD SECTION
MARICOPA COUNTY

STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
ARIZ.	F-10-2(34)	12	164





CULVERT LAYOUT SHEET
Med. ℄ Sta. GG71+26.7

DETAIL S

7	I-10-2(34)	1209

EHRENBERG - PHOENIX HWY.
PERRYVILLE RD. - BULLARD AVE.
MARICOPA COUNTY

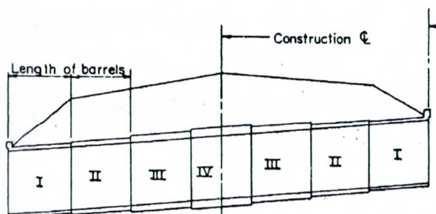
9	ARIZ.	I-10-2 (34)	17	169	9-18-75

REINFORCED CONCRETE BOX CULVERTS

SPAN	STATION	DESCRIPTION	DRAWINGS REQUIRED: Special Sheet No.	DRAWINGS REQUIRED: STANDARDS	LENGTH OF BARRELS Left of ℄ ** I	II	III	IV	V	Right of ℄ ** V	IV	III	II	I	APPROXIMATE QUANTITIES: Struct. Excav. Cu. Yds.	Class A Concrete Cu. Yds.	Reinforcing Steel Lbs.	Special Backfill Cu. Yds.	Remove Ditch Lin. Lin. Ft.		Drainage Excav. Cu. Yds.	STANDARDS: List	Revision Date
20' CLEAR SPAN* OR LESS	Sta. 664[illegible] + 95.88 to + 35.73	New 4'x4'x 356.4' Conc. Box Culvert with inlet & outlet Transitions.		Special	154	→								176	215	169.14	16,636	422	350			CM-1, CB-1	
	Sta. 6665 + ~~37.09~~ to + 26.86	New 6'x4'x 559'-0" Conc. Box Culvert with inlet & outlet Transitions.		CB-1 Special	184	→								175	356	230.10	39,282	390	334			CB-5, CWA-1	
	Sta. 6683 + 25.0[illegible]	New 5'x4'x 273'-[illegible]" Conc. Box Culvert with inlet & outlet Transitions.		Special	135	→								138	233	135.28	21,037	326	298			CWQ-1, CW6-5	
																						BM-1	
																						H-2-1	
OVER 20' CLEAR SPAN*	Sta. 6452 + 84 to Sta. 6453 + 47.51	New 5-10'x3'x223'-0" with inlet wings and outlet wings and apron.		CM-1, CB-5, CWQ-1, CWA-1, CW6-5	111'-6"	→								111'-6"	~~1140~~ 1,063	~~970~~ 967.70	~~174,100~~ 172,113	~~275~~ 275					

BRIDGES AND MISCELLANEOUS STRUCTURES ***

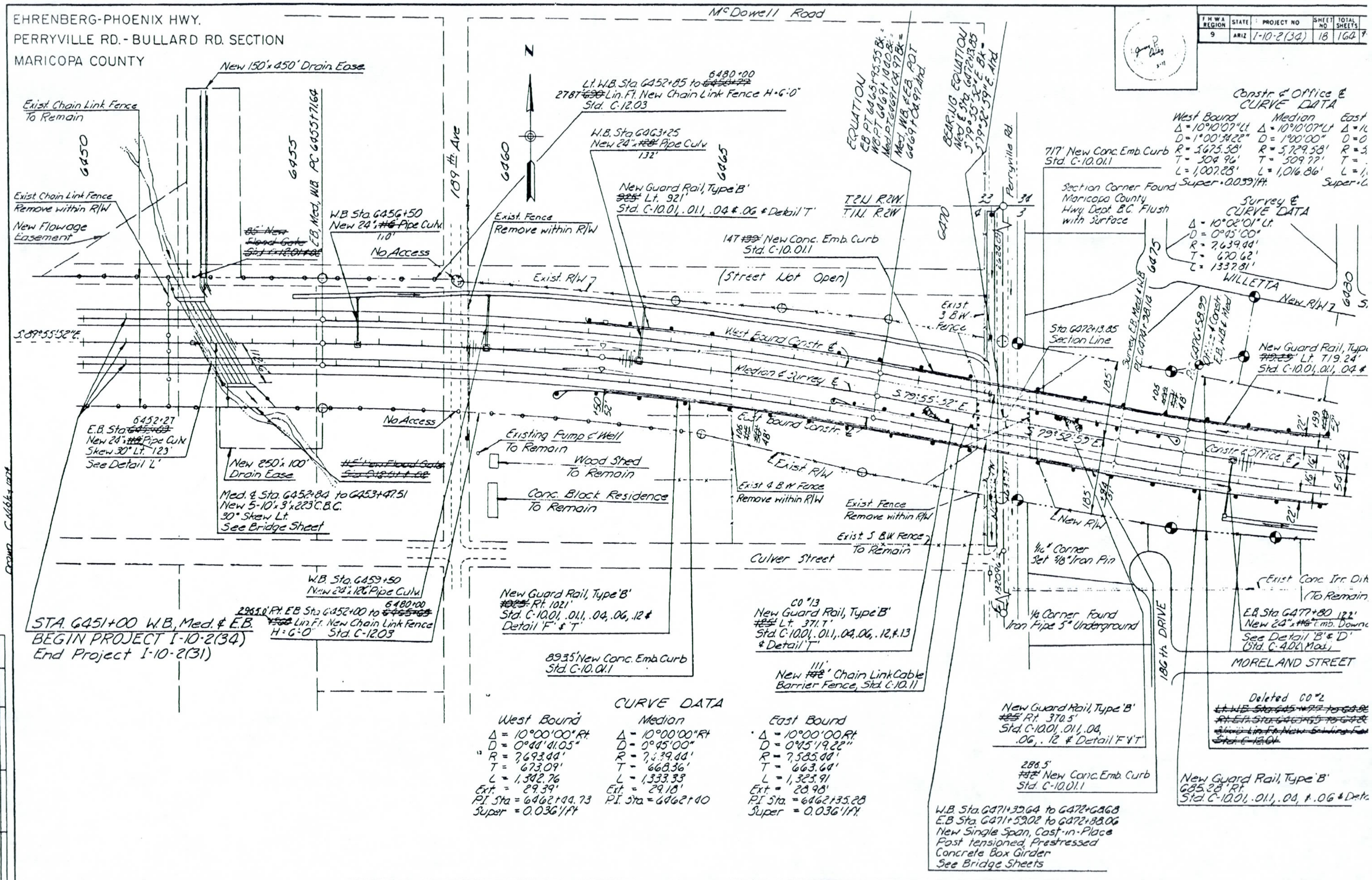
STATION BEGINNING & ENDING ON ℄	ROUTE	COUNTY	STRUCTURE NO.	DESCRIPTION	SPECIAL SHEET NUMBERS	STANDARDS
E.B. 6471 + 59.02 to 6472 + 28.06	I-10	Maricopa	1705	2 - New Single Span Cast-in-Place Post-tensioned Prestressed		BM-1, H-2-1
W.B. 6471 + 39.64 to 6472 + 69.68	»	»	1706	Concrete Box Girder Overpasses.		» »
E.B. 6524 + 54.09 to 6525 + 83.09	»	»	1707	» »		» »
W.B. 6524 + 54.09 to 6525 + 83.09	»	»	1708			» »
E.B. 6577 + 33.80 to 6578 + 85.80	»	»	1709	» »		» »
W.B. 6577 + 32.80 to 6578 + 85.80	»	»	1710			» »
E.B. 6603 + [illegible] to 6606 + 05.5[illegible]	»	»	1711	2 New 4 Span Precast Prestressed Concrete Girder Bridges -		» »
W.B. 6603 + 33.27 to 6606 + 68.33	»	»	1712	AASHTO Type III.		» »
E.B. 6630 + 19.71 to 6631 + 43.71	»	»	1713	2 - New Single Span Cast-in-Place Post-tensioned Prestressed		» »
W.B. 6630 + 1[illegible].71 to 6631 + 43.71	»	»	1714	Concrete Box Girder Overpasses.		» »
E.B. 6682 + 06.21 to 6683 + 59.21	»	»	1715	» »		» »
W.B. 6682 + 06.21 to 6683 + 59.21	»	»	1716			» »
E.B. 6707 + 12.70 to 6709 + 14.80	»	»	1849	2 New 7 Span Continuous Cast in Place Concrete		» »
W.B. 6706 + 83.65 to 6708 + 85.75	»	»	1850	Slab Bridges.		» »

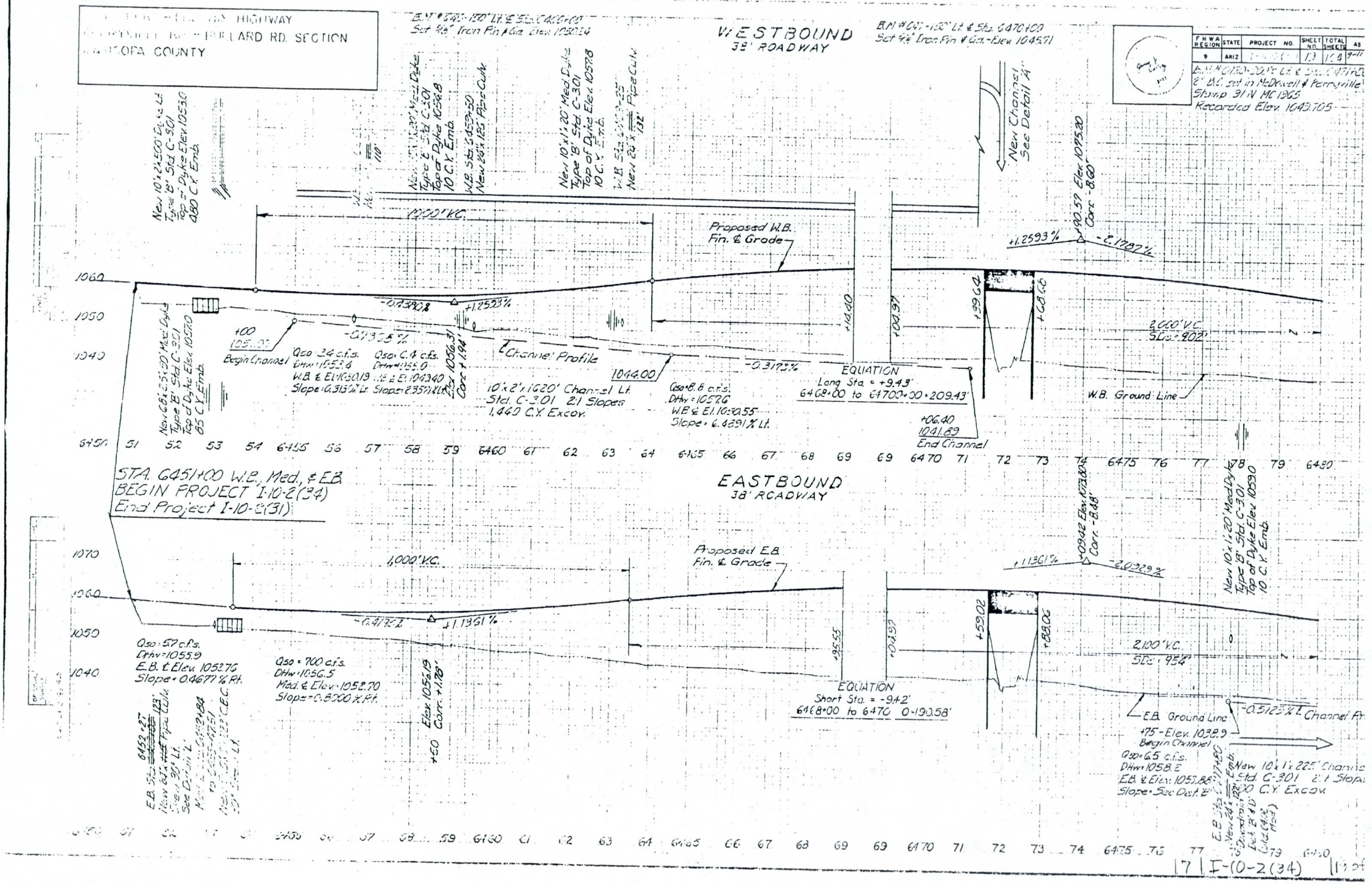


℄ Median if culverts are connected through median

* Clear span denotes distance along ℄ of roadway between inside face of exterior walls.
** Construction ℄ (Looking Ahead).
*** See Structure Plans for quantities.

		DATE	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION STRUCTURES SECTION
LAYOUT			
DESIGN			
DESIGN CK'D			STRUCTURE SUMMARY SHEET
DRAWN	SEA	1-75	
DWG. CK'D			
APPROVED			
SHEET NO. 1 OF 1	I-10 ROUTE	Maricopa COUNTY	STRUCTURE NO. / I-10-2 (34) PROJECT NUMBER / BRIDGE ENGINEER

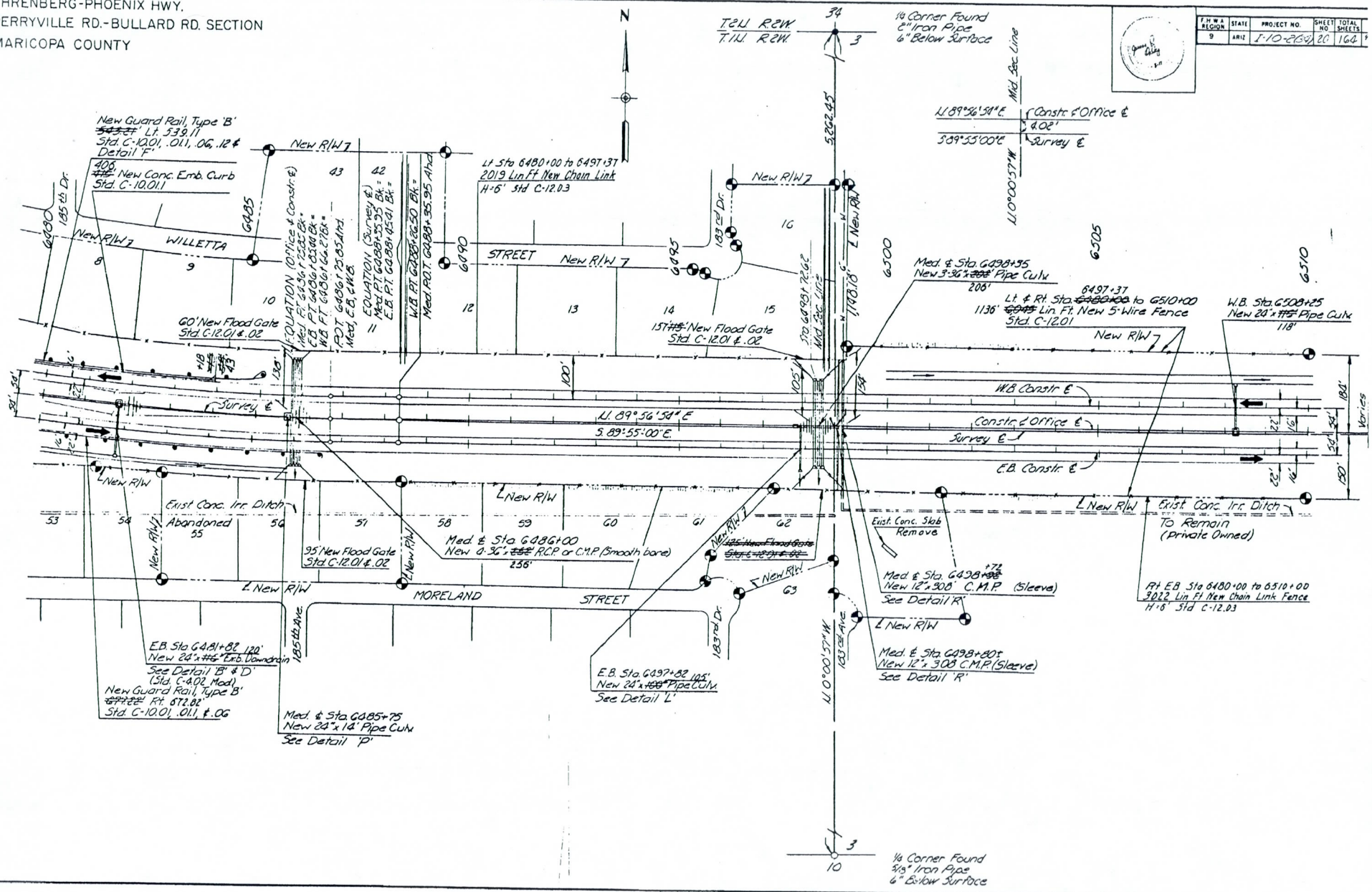

EHRENBERG-PHOENIX HWY.
PERRYVILLE RD. - BULLARD RD. SECTION
MARICOPA COUNTY
F H W A REGION 9 | STATE ARIZ | PROJECT NO I-10-2(34) | SHEET NO 18 | TOTAL SHEETS 164
McDowell Road
New 150'x 450' Drain Ease.
Exist. Chain Link Fence To Remain
Lt. W.B. Sta. 6452+85 to 6480+00
2787 Lin. Ft. New Chain Link Fence H=6'-0"
Std. C-12.03
W.B. Sta. 6463+25
New 24" Pipe Culv.
132'
EQUATION
EB PT 6465+95.55 Bk. =
WB PT 6469+10.00 Bk. =
Med PT 6469+04.97 Bk. =
Med. W.B. & E.B. POT
6469+04.97 Ahd.
BEARING EQUATION
Med. & Sta. 6472+13.85
S 79°55'52" E Bk. =
S 79°52'59" E Ahd.
Perryville Rd.
Constr. & Office &
CURVE DATA
West Bound
Δ = 10°10'07" Lt
D = 1°00'34.22"
R = 5,675.58'
T = 504.96'
L = 1,007.28'
Super = 0.039'/ft
Median
Δ = 10°10'07" Lt
D = 1°00'00"
R = 5,729.58'
T = 509.77'
L = 1,016.86'
Exist. Chain Link Fence Remove within R/W
New Flowage Easement
EB, Med, WB PC 6455+71.64
W.B. Sta. 6456+50
New 24" Pipe Culv.
110'
No Access
189th Ave
Exist. Fence Remove within R/W
New Guard Rail, Type 'B'
Lt. 921'
Std. C-10.01, .01.1, .04 & .06 & Detail 'T'
T2N R2W
T1N R2W
147 New Conc. Emb. Curb Std. C-10.01.1
717' New Conc. Emb. Curb Std. C-10.01.1
Section Corner Found Maricopa County Hwy. Dept. B.C. Flush with Surface
Surrey & CURVE DATA
Δ = 10°02'01" Lt.
D = 0°45'00"
R = 7,639.44'
T = 670.62'
L = 1337.81'
WILLETTA
New R/W
Exist. R/W
(Street Not Open)
Exist 3 B.W. Fence
West Bound Constr. &
Median & Surrey &
S 79°55'52" E.
S 89°55'52" E.
Sta. 6472+13.85 Section Line
Survey E.B. Med & W.B. PC 6474+38.14
New Guard Rail, Type
Lt. 719.24'
Std. C-10.01, .01.1, .04 &
6452+27
E.B. Sta.
New 24" Pipe Culv.
Skew 30° Lt. 123'
See Detail 'L'
No Access
Existing Pump & Well To Remain
Wood Shed To Remain
Conc. Block Residence To Remain
East Bound Constr. &
S 79°52'59" E.
Exist. R/W
Exist 4 B.W. Fence Remove within R/W
Exist. Fence Remove within R/W
Exist. 5 B.W. Fence To Remain
New R/W
Constr. & Office &
New 850' x 100' Drain Ease.
Med. & Sta. 6452+84 to 6453+47.51
New 5-10'x 3'x 223' C.B.C.
30° Skew Lt.
See Bridge Sheet
Culver Street
1/16" Corner Set 5/8" Iron Pin
Exist. Conc. Irr. Ditch (To Remain)
W.B. Sta. 6459+50
New 24" Pipe Culv.
2965.0' Rt. E.B. Sta. 6452+00 to 6480+00
Lin. Ft. New Chain Link Fence
H=6'-0" Std. C-12.03
STA. 6451+00 W.B., Med. & E.B.
BEGIN PROJECT I-10-2(34)
End Project I-10-2(31)
New Guard Rail, Type 'B'
Rt. 1021'
Std. C-10.01, .01.1, .04, .06, .12 &
Detail 'F' & 'T'
CO #13
New Guard Rail, Type 'B'
Lt. 371.7'
Std. C-10.01, .01.1, .04, .06, .12, & .13
& Detail 'T'
1/4 Corner Found Iron Pipe 5" Underground
186th DRIVE
E.B. Sta. 6477+80
New 24" ... Emb. Down...
See Detail 'B' & 'D'
Std. C-4.01 Mod.
MORELAND STREET
8935' New Conc. Emb. Curb Std. C-10.01.1
111'
New Chain Link Cable Barrier Fence, Std. C-10.11
CURVE DATA
West Bound
Δ = 10°00'00" Rt
D = 0°44'41.05"
R = 7,693.44'
T = 673.09'
L = 1,342.76
Ext. = 29.39'
P.I. Sta = 6462+44.73
Super = 0.036'/ft
Median
Δ = 10°00'00" Rt
D = 0°45'00"
R = 7,639.44'
T = 668.36'
L = 1,333.33
Ext. = 29.18'
P.I. Sta = 6462+40
East Bound
Δ = 10°00'00" Rt
D = 0°45'19.22"
R = 7,585.44'
T = 663.64'
L = 1,323.91
Ext. = 28.98'
P.I. Sta. = 6462+35.28
Super = 0.036'/ft
New Guard Rail, Type 'B'
Rt. 370.5'
Std. C-10.01, .01.1, .04, .06, .12 & Detail 'F' & 'T'
286.5'
New Conc. Emb. Curb Std. C-10.01.1
Deleted CO #2
New Guard Rail, Type 'B'
685.28' Rt.
Std. C-10.01, .01.1, .04, & .06 & Detail
W.B. Sta. 6471+39.64 to 6472+68.68
E.B. Sta. 6471+59.02 to 6472+88.06
New Single Span, Cast-in-Place
Post tensioned, Prestressed
Concrete Box Girder
See Bridge Sheets
SURVEY NOS.
AS BUILT PLANS
REVISIONS
LOCATION
DATE



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS
9	ARIZ	[illegible]	17	114	9-11

17 | F-10-2(34) | 17

EHRENBERG-PHOENIX HWY.
PERRYVILLE RD.-BULLARD RD. SECTION
MARICOPA COUNTY



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	ARIZ	I-10-2(34)	20	164

NO.	REVISIONS	DATE

Drawn C. Sibley 4-74

EHRENBERG - PHOENIX HIGHWAY
PERRYVILLE RD. - BULLARD RD. SECTION
MARICOPA COUNTY

FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-2(3.4)	7		9-11-85

D.A. Lt. = 0.064 Sq. Mi.
B.M. #C49-208' Rt. & Sta. C490+00
5/8" I.P. # Gd. — Elev. 1035.43

WESTBOUND
38' ROADWAY

D.A. Lt. = 0.044 Sq. Mi.
B.M. #C50-132' Rt. & Sta. C500+00
5/8" I.P. # Gd. Elev. 1034.75

B.M. #C48-260' Rt. & Sta. C480+00
5/8" Iron Pin # Gd. — Elev. 1037.94

New 10'x2'x490' Dyke Lt.
Top of Dyke Elev. 1041.0
See Detail 'A'
215 C.Y. Emb.

1000' V.C.

2000' K.C.
SDs. = 943'

Qso = 118 c.f.s.
DHw = 1040.2
E Elev. = 1036.77
Slope = 0.6746% Lt.

New 10'x1.5'x30' Med. Dyke
Type 'B' Std. C-301
Top of Dyke Elev. 1033.45
20 C.Y. Emb.

New 10'x1.83'
Median Dyke
Type 'B' Std. C-301
Top of Dyke Elev. 1040.55
70 C.Y. Emb.

New 10'x2'x467' Dyke Lt.
Type 'A' Std. C-301
Top of Dyke Elev. 1037.07
450 C.Y. Emb.

20'x2'x1000' Channel Lt.
1775 C.Y. Excav.
See Detail 'R'

W.B. Sta. 6505+75
New 24" ϕ R.C.P.
118' Long

Proposed W.B.
Fin. E. Grade

-0.3582%

EQUATION
Short Sta. = 9.55'
Sta. 6486 to 6487 = 90.45'

+1035.65 Elev. 04452
Corr. +2.25'

Qso = 78 c.f.s.
DHw = 1034.35
Med. E El. 1032.45
Slope = 0.2900% Rt.

W.B. Ground Line

-0.3056

Qso = 97 c.f.s.
DHw = 1033.4
W.B. E El. 1029.30
Slope = 2.0948% Lt.

100
1030.50
Begin Channel

EASTBOUND
38' ROADWAY

New 10'x1.5'x30' Med. Dyke
Type 'B' Std. C-301
Top of Dyke Elev. 1036.75
10 C.Y. Emb.

Mark & Sta. 6498+80
New 12" 30° C.M.P.
See Detail 'P'

Med. E Sta. 6499+35
New 12" 30° C.M.P.
See Detail 'R'

1000' V.C.

Proposed E.B.
Fin. E. Grade

+2.0937%

-0.3183%

2100' V.C.

-0.2000%

Channel Prof.

El. 1036.72

Elev. 1037.0
End Channel

Qso = 5.3 c.f.s.
DHw = 1052.5
E.E. E Elev. 1048.25
Slope = See Detail 'B'

E.B. E Sta. 6497+32
New 24" ϕ R.C.P. Emb. Construction
See Detail 'B' & 'D'
(Std. C-403 Mod.)

New 10'x1'x580' Channel Rt.
Std. C-301 2:1 Slopes
215 C.Y. Excav.

Mark E Sta. 6495+75
New 24" ϕ R.C.P.
See Detail 'P'

EQUATION
Long Sta. = 19.69'
Sta. 6486 to 6487 = 109.69'

+1038.85 Elev. 04451
Corr. +2.23'

Qso = 5.3 c.f.s.
DHw = 1045.3
Elev. = See Detail 'P'
Slope =

E.B. E Sta. 6495+80
New 24" ϕ R.C.P.
See Detail 'P'

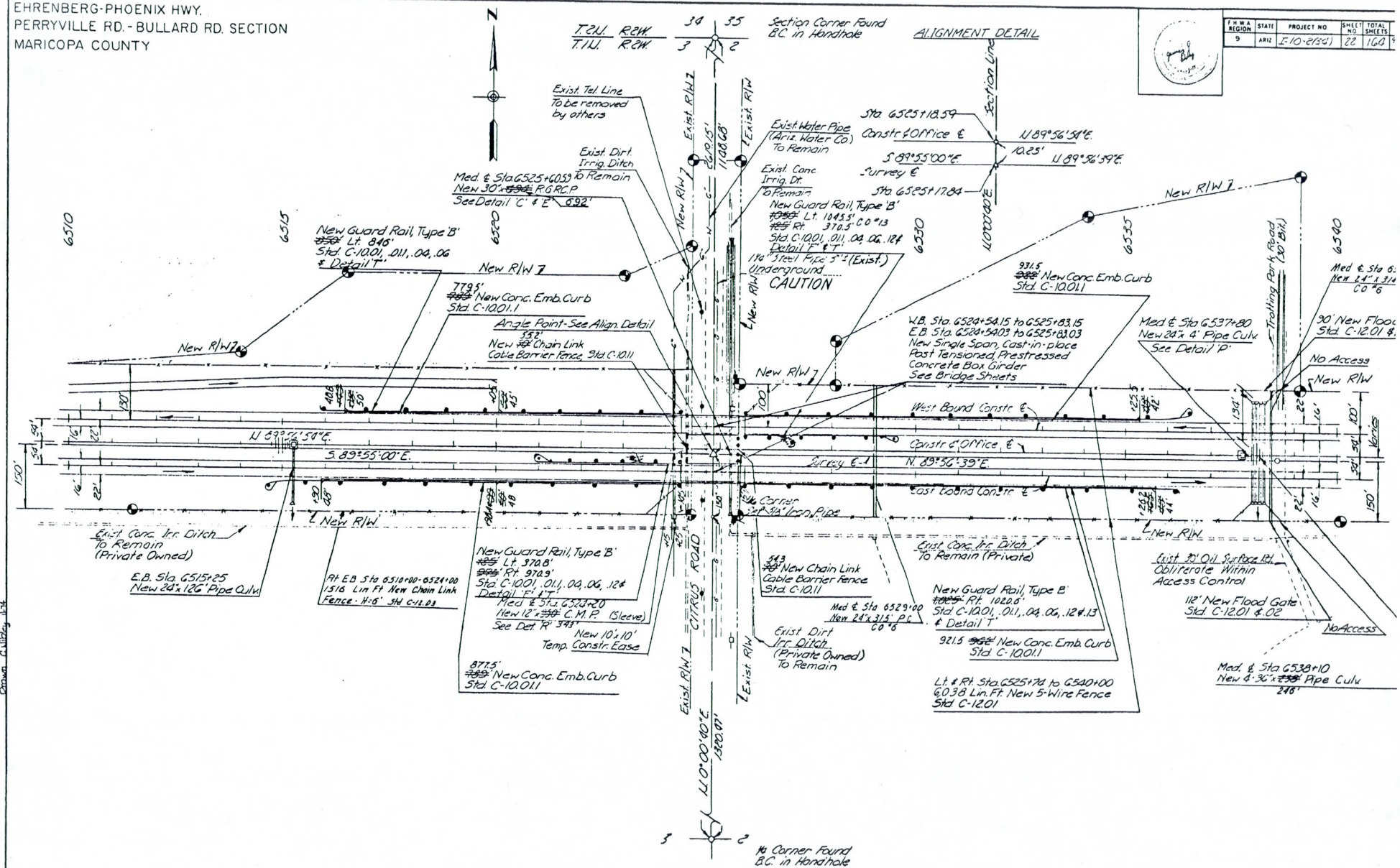
E.B. Ground Line

Qso = 9 c.f.s.
DHw = 1036.5
E.B. E Elev. 1032.96
Slope = 0.7736% Rt.

PLATE 3—CROSS SECTION

7	I-10-2(3.4)	210954

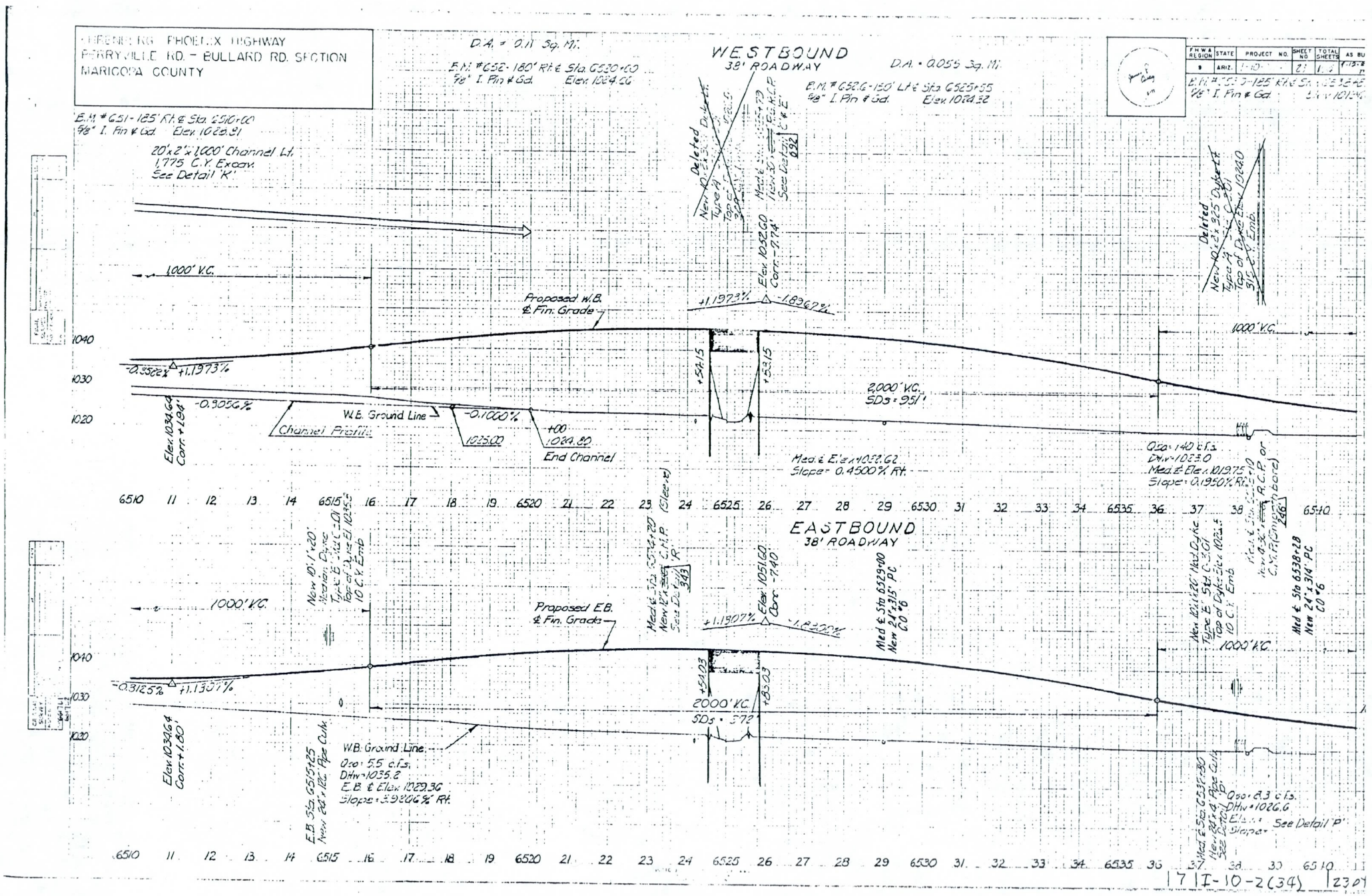
EHRENBERG-PHOENIX HWY.
PERRYVILLE RD.-BULLARD RD. SECTION
MARICOPA COUNTY



F.H.W.A. REGION	STATE	PROJECT NO	SHEET NO.	TOTAL SHEETS
9	ARIZ	I-10-2(34)	22	160

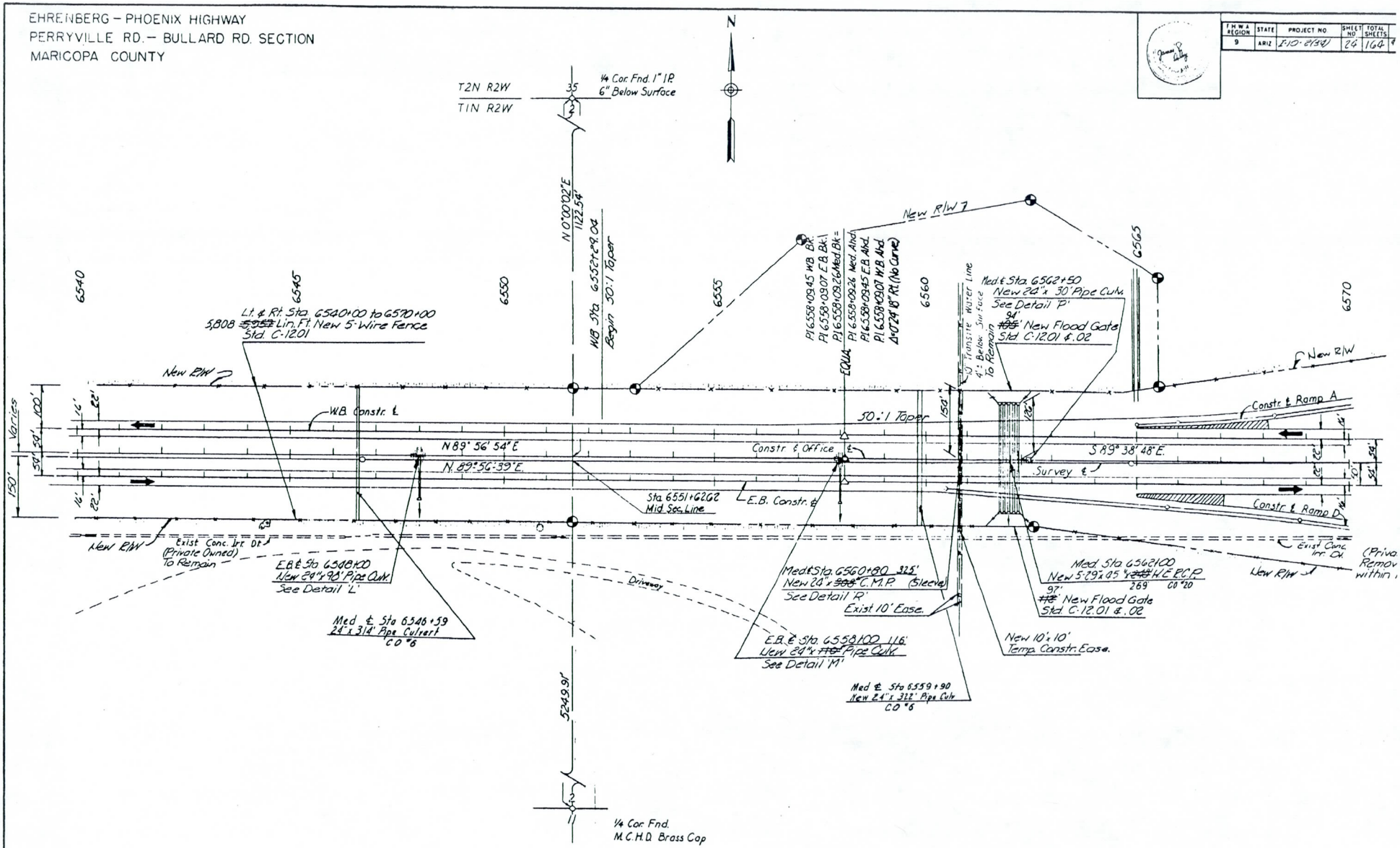
SURVEY HOLT	"D" PLANS	REVISIONS	LOCATION	DATE
CALS 347				

Drawn C. Hilty 4-74


FREEWAY PHOENIX HIGHWAY
PERRYVILLE RD. - BULLARD RD. SECTION
MARICOPA COUNTY
D.A. = 0.11 Sq. Mi.
E.M. #G52-180' Rt. & Sta. G530+00
98" I. Pin & Cd. Elev. 1024.26
WESTBOUND
38' ROADWAY
D.A. = 0.055 Sq. Mi.
E.M. #G52.6-150' Lt. & Sta. G525+55
98" I. Pin & Cd. Elev. 1024.32
E.M. #G51-185' Rt. & Sta. G510+00
98" I. Pin & Cd. Elev. 1028.31
20'x2'x1000' Channel Lt.
1,775 C.Y. Excav.
See Detail 'K'
1000' V.C.
Proposed W.B. & Fin. Grade
-0.3562%
+1.1973%
-0.3056%
Elev. 1034.64
Corr. +1.91'
W.E. Ground Line
Channel Profile
-0.1000%
1025.00
+00
1024.80
End Channel
+1.1973%
-1.8362%
Elev. 1032.60
Corr. -2.74'
+54.15
+53.15
2000' V.C.
SDs = 951'
Med. & Elev. 1032.62
Slope = 0.4500% Rt.
Q25 = 140 c.f.s.
DHw = 1033.0
Med. & Elev. 1019.75
Slope = 0.1950% Rt.
Deleted
New 10'x3' x 25' Culvert
Type 'A' - 3:1 C.M.P.
Top of Dyke Elev. 1028.0
5% C.Y. Emb.
Deleted
New 10'x3' x 25' Culvert
Type 'A' - 3:1 C.M.P.
Top of Dyke Elev. 1028.0
5% C.Y. Emb.
1000' V.C.
6510 11 12 13 14 6515 16 17 18 19 6520 21 22 23 24 6525 26 27 28 29 6530 31 32 33 34 6535 36 37 38 6540
EASTBOUND
38' ROADWAY
Proposed E.B. & Fin. Grade
-0.3125%
+1.1307%
Elev. 1034.64
Corn +1.80'
E.B. Sta. G515+25
New 84"x 102" Pipe Culv.
W.B. Ground Line
Q50 = 5.5 c.f.s.
DHw = 1035.2
E.B. & Elev. 1029.36
Slope = 3.9206% Rt.
New 10'x20' Median Dyke Type 'B' - 4:1 C.M.P. Top of Dyke El. 1035.5 10 C.Y. Emb
Med. & Sta. G514+20 (Elev. ±)
New 12" x 36" C.M.P. See Detail 'R'
+1.1307%
-1.8200%
Elev. 1031.60
Corr. -7.40
+54.03
+85.03
2000' V.C.
SDs = 572'
Med. & Sta. G529+00
New 24"x315° PC
C.M.P. Culvert
Med. & Sta. G538+28
New 24"x314° PC
C.M.P. Culvert
New 10'x20' Median Dyke Type 'B' - 4:1 C.M.P. Top of Dyke Elev. 1032.5 10 C.Y. Emb
1000' V.C.
Med. & Sta. G535+80
New 84"x 4 Pipe Culv.
See Detail 'P'
Q50 = 9.3 c.f.s.
DHw = 1026.6
E.L. = See Detail 'P'
Slope =
6510 11 12 13 14 6515 16 17 18 19 6520 21 22 23 24 6525 26 27 28 29 6530 31 32 33 34 6535 36 37 38 6540
17 I-10-2(34) 230

EHRENBERG – PHOENIX HIGHWAY
PERRYVILLE RD. – BULLARD RD. SECTION
MARICOPA COUNTY

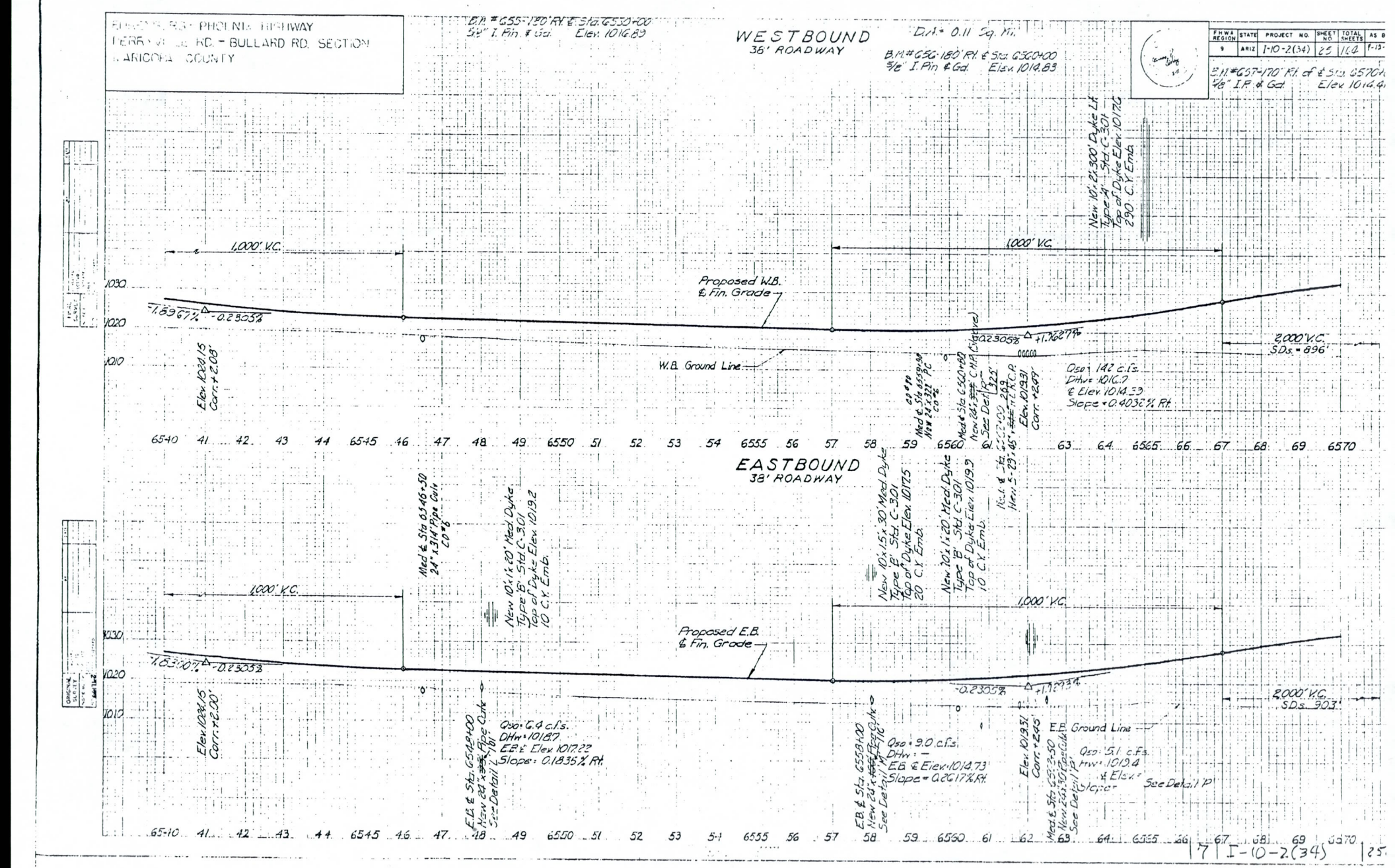
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	ARIZ.	I-10-2(34)	26	164



SURVEY MONUMENTS TO PLACE | REVISIONS | LOCATION | DATE

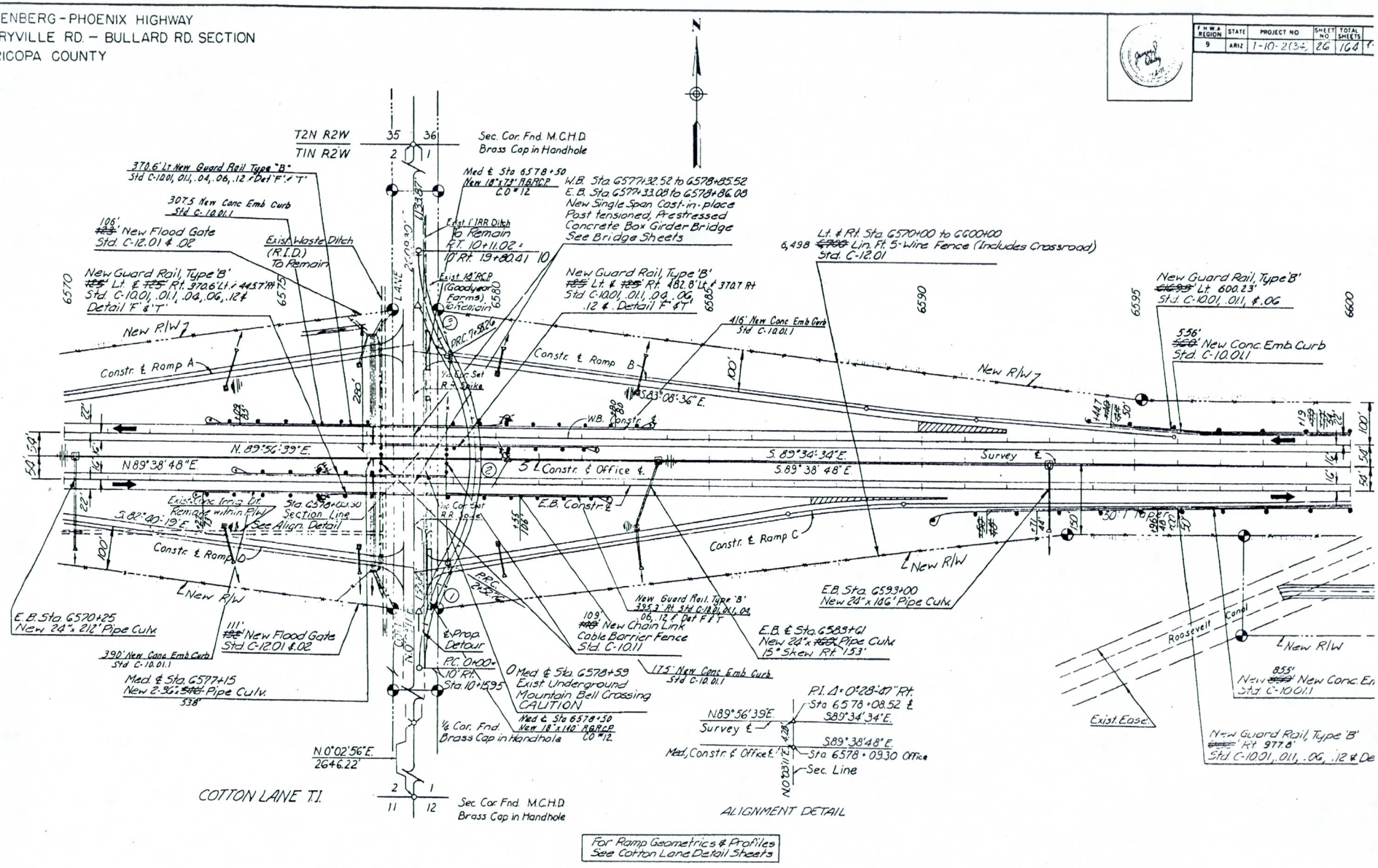
SUPERSTITION FREEWAY
PERRYVILLE RD. - BULLARD RD. SECTION
MARICOPA COUNTY

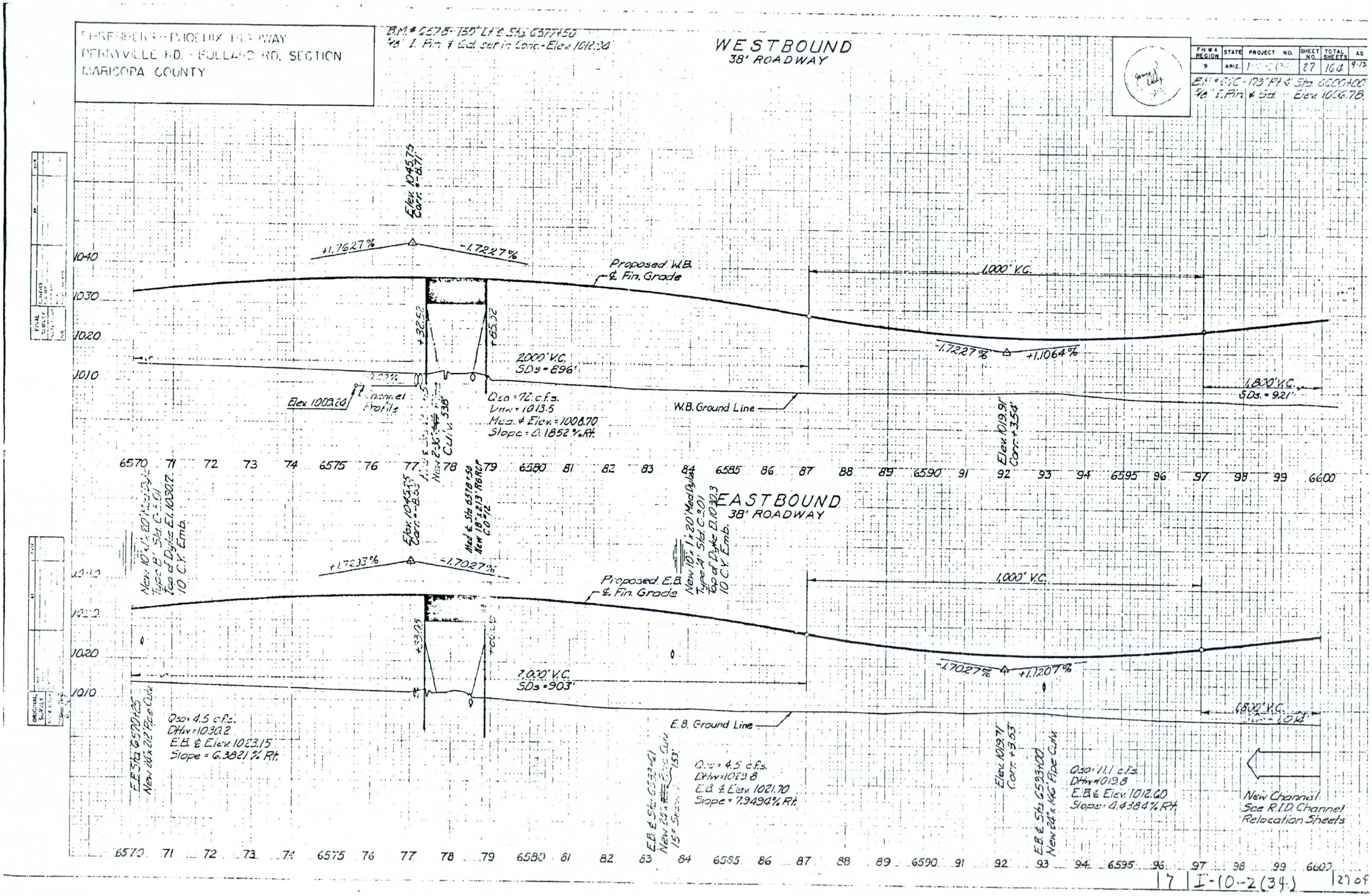
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS B
9	ARIZ	I-10-2(34)	25	164	I-13-



EHRENBERG - PHOENIX HIGHWAY
PERRYVILLE RD. – BULLARD RD. SECTION
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO	SHEET NO	TOTAL SHEETS
9	ARIZ	I-10-2(34)	26	164

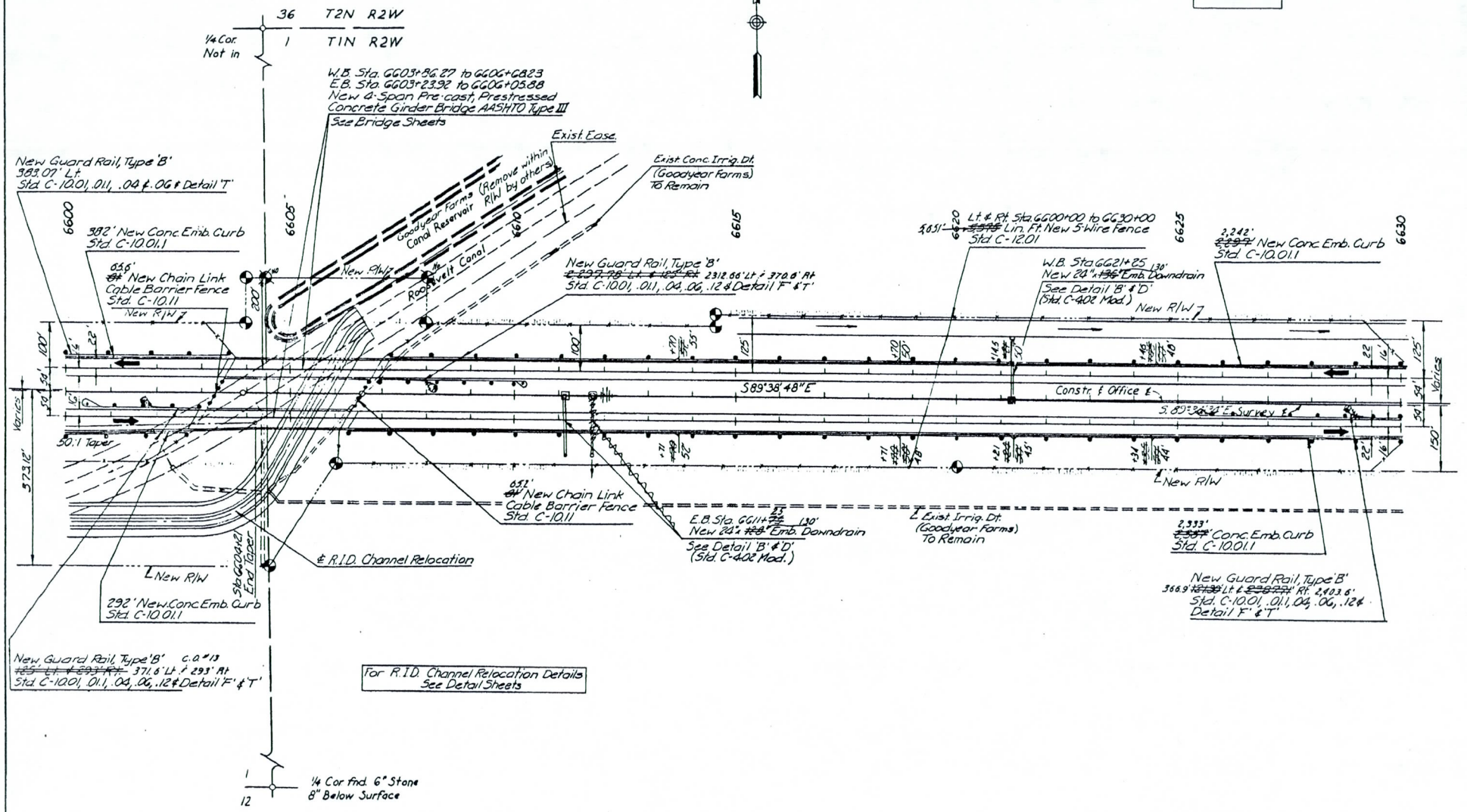




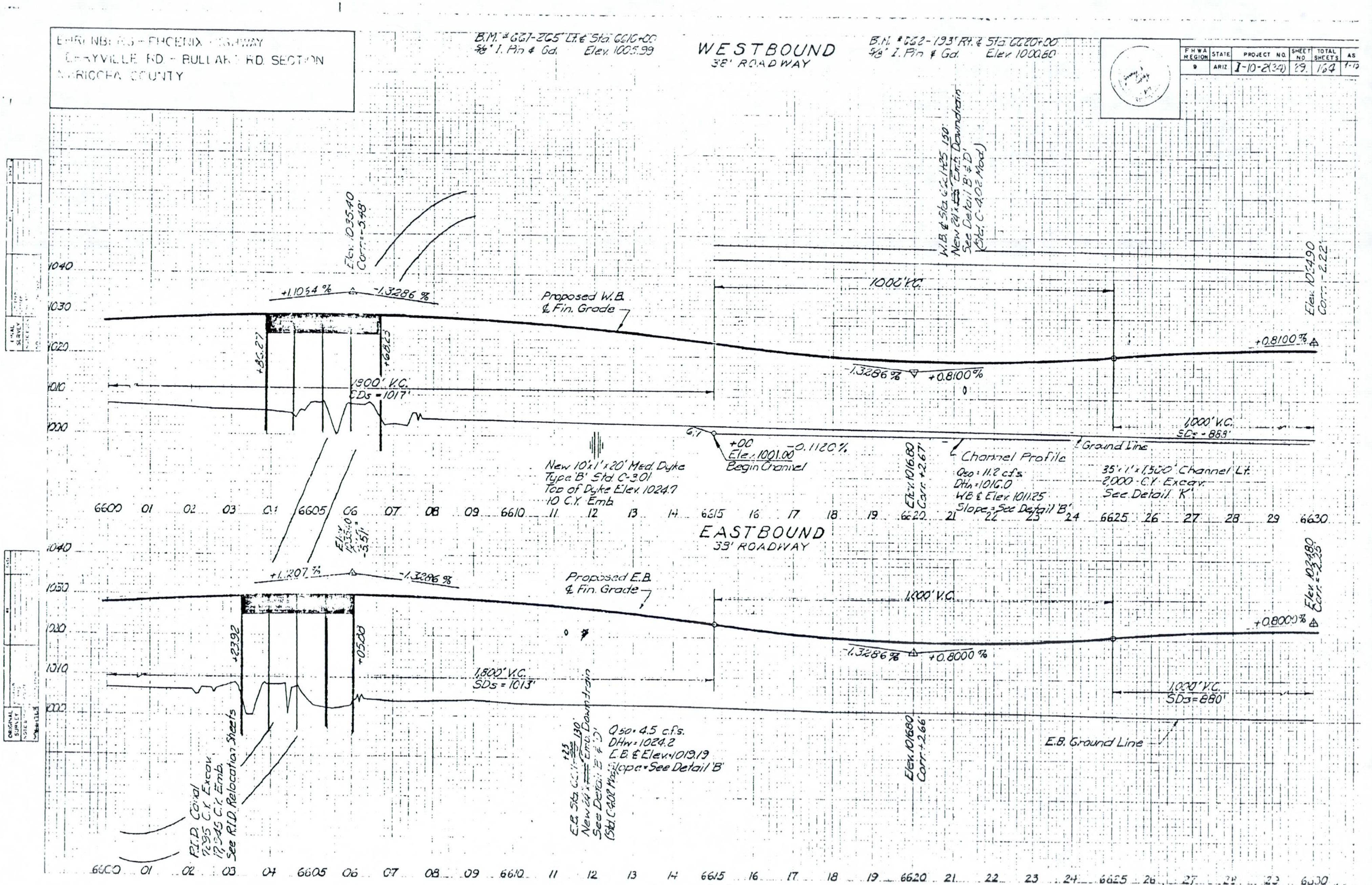
PERRYVILLE RD. - BULLARD RD. SECTION
MARICOPA COUNTY
B.M.# 6578-150' Lt. ¢ Sta. 6577+50
Elev. 1012.34
WESTBOUND
38' ROADWAY
FHWA REGION
STATE
PROJECT NO.
SHEET NO.
TOTAL SHEETS
9
ARIZ.
27
164
+1.7627%
-1.7227%
Proposed W.B. ¢ Fin. Grade
1,000' V.C.
2,000' V.C.
SDs = 896'
-1.7227%
+1.1064%
1,800' V.C.
SDs = 921'
Elev. 1009.24
Channel Profile
Q50 = 72 c.f.s.
DHw = 1013.5
Med. ¢ Elev. = 1008.70
Slope = 0.1852% Rt.
W.B. Ground Line
Elev. 1019.91
Corr. +3.54
6570 71 72 73 74 6575 76 77 78 79 6580 81 82 83 84 6585 86 87 88 89 6590 91 92 93 94 6595 96 97 98 99 6600
EASTBOUND
38' ROADWAY
+1.7233%
-1.7027%
Proposed E.B. ¢ Fin. Grade
1,000' V.C.
2,000' V.C.
SDs = 903'
-1.7027%
+1.1207%
1,800' V.C.
E.B. Ground Line
Q50 = 4.5 c.f.s.
DHw = 1030.2
E.B. ¢ Elev. 1023.15
Slope = 6.3821% Rt.
Q50 = 4.5 c.f.s.
DHw = 1029.8
E.B. ¢ Elev. 1021.70
Slope = 7.9494% Rt.
Q50 = 11.1 c.f.s.
DHw = 1019.8
E.B. ¢ Elev. 1012.60
Slope = 0.4384% Rt.
Elev. 1019.71
Corr. +3.53
New Channel
See R.I.D. Channel Relocation Sheets
6570 71 72 73 74 6575 76 77 78 79 6580 81 82 83 84 6585 86 87 88 89 6590 91 92 93 94 6595 96 97 98 99 6600
17 I-10-2(34)

EHRENBURG - PHOENIX HIGHWAY
PERRYVILLE RD - BULLARD RD SECTION
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	ARIZ	I-10-2(34)	28	164

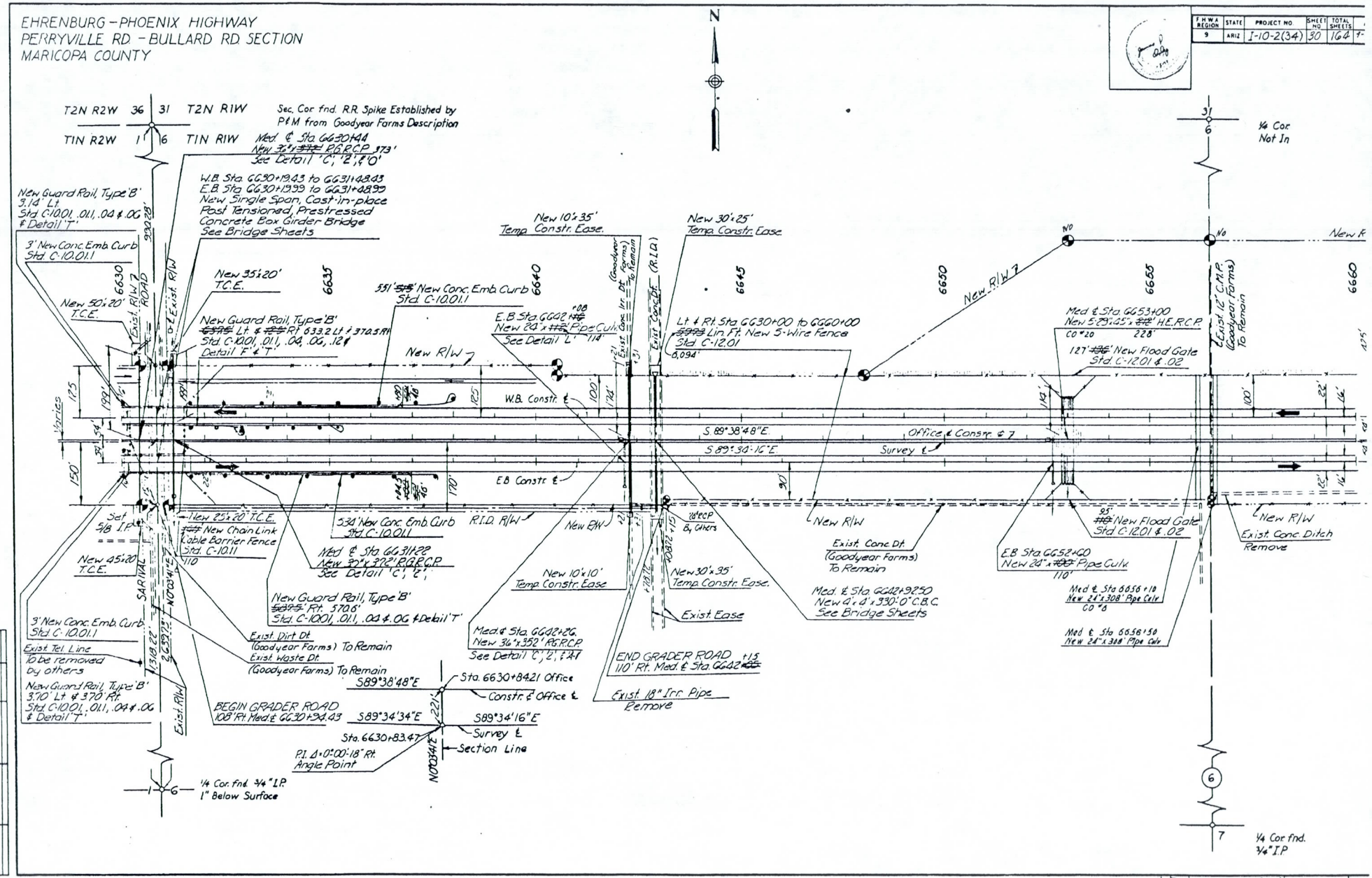


SURVEY NOTE	PLANS	REVISIONS	LOCATION	DATE
4-11-71				

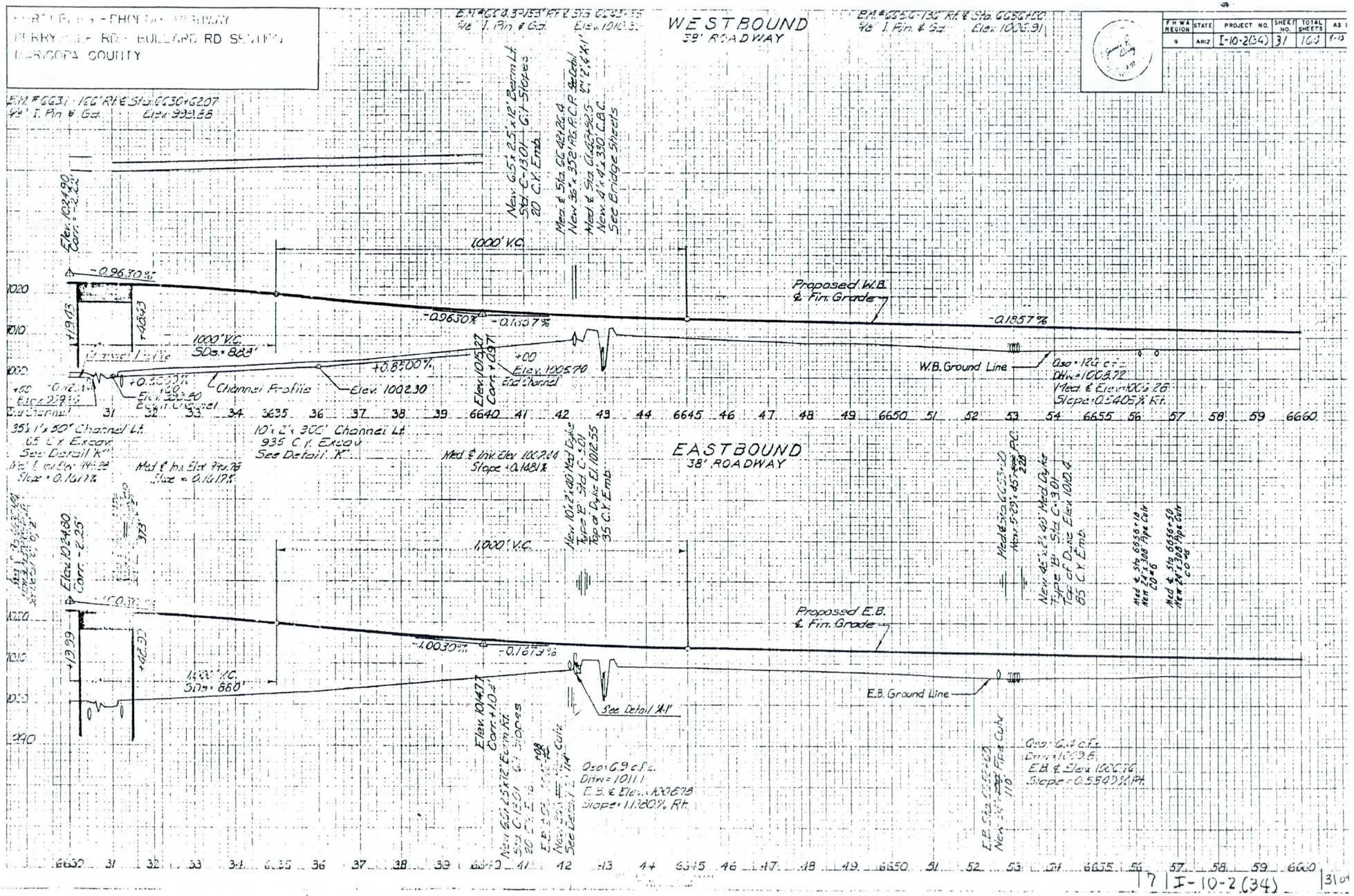

EHRENBERG - PHOENIX HIGHWAY
PERRYVILLE RD. - BULLARD RD. SECTION
MARICOPA COUNTY
B.M. # 661-265' Lt. ℄ Sta. 6610+00
5/8" I. Pin & Gd. Elev. 1005.99
WESTBOUND
38' ROADWAY
B.M. # 662-193' Rt. ℄ Sta. 6620+00
5/8" I. Pin & Gd. Elev. 1000.60
FHWA REGION 9 | STATE ARIZ. | PROJECT NO. I-10-2(34) | SHEET NO. 29 | TOTAL SHEETS 164
Elev. 1035.40
Corr. -5.48'
+1.1034 %
-1.3286 %
Proposed W.B. ℄ Fin. Grade
+85.27
+68.23
1,800' V.C.
SDs = 1017'
W.B. ℄ Sta. 6621+85 130'
New 24" x ___ Emb. Downdrain
See Detail 'B' & 'D'
(Std. C-4.02 Mod.)
1,000' V.C.
Elev. 1024.90
Corr. -2.22'
+0.8100 %
-1.3286 %
+0.8100 %
1,000' V.C.
SDs = 888'
Ground Line
+00
Elev. 1001.00
Begin Channel
-0.1120 %
New 10' x 1' x 20' Med. Dyke
Type 'B' Std. C-3.01
Top of Dyke Elev. 1024.7
10 C.Y. Emb.
Elev. 1016.80
Corr. +2.67'
Channel Profile
Q50 = 11.2 c.f.s.
DHw = 1016.0
WB ℄ Elev. 1011.25
Slope = See Detail 'B'
35' x 1' x 1,500' Channel Lt.
2,000 C.Y. Excav.
See Detail 'K'
6600 01 02 03 04 6605 06 07 08 09 6610 11 12 13 14 6615 16 17 18 19 6620 21 22 23 24 6625 26 27 28 29 6630
EASTBOUND
38' ROADWAY
Elev. 1033.10
Corr. -3.51'
+1.1207 %
-1.3286 %
Proposed E.B. ℄ Fin. Grade
1,000' V.C.
Elev. 1024.80
Corr. +2.35'
+0.8000 %
+23.92
+05.28
-1.3286 %
+0.8000 %
1,800' V.C.
SDs = 1013'
1,000' V.C.
SDs = 880'
E.B. Ground Line
R.I.D. Canal
1,295 C.Y. Excav.
17,545 C.Y. Emb.
See R.I.D. Relocation Sheets
E.B. Sta. 6611+25 130'
New 24" x ___ Emb. Downdrain
See Detail 'B' & 'D'
(Std. C-4.02 Mod.)
Q50 = 4.5 c.f.s.
DHw = 1024.2
E.B. ℄ Elev. 1019.19
Slope = See Detail 'B'
Elev. 1016.80
Corr. +2.66'
6600 01 02 03 04 6605 06 07 08 09 6610 11 12 13 14 6615 16 17 18 19 6620 21 22 23 24 6625 26 27 28 29 6630
1040
1030
1020
1010
1000

EHRENBURG - PHOENIX HIGHWAY
PERRYVILLE RD - BULLARD RD. SECTION
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	ARIZ	I-10-2(34)	30	164



7	I-10-2(34)	30



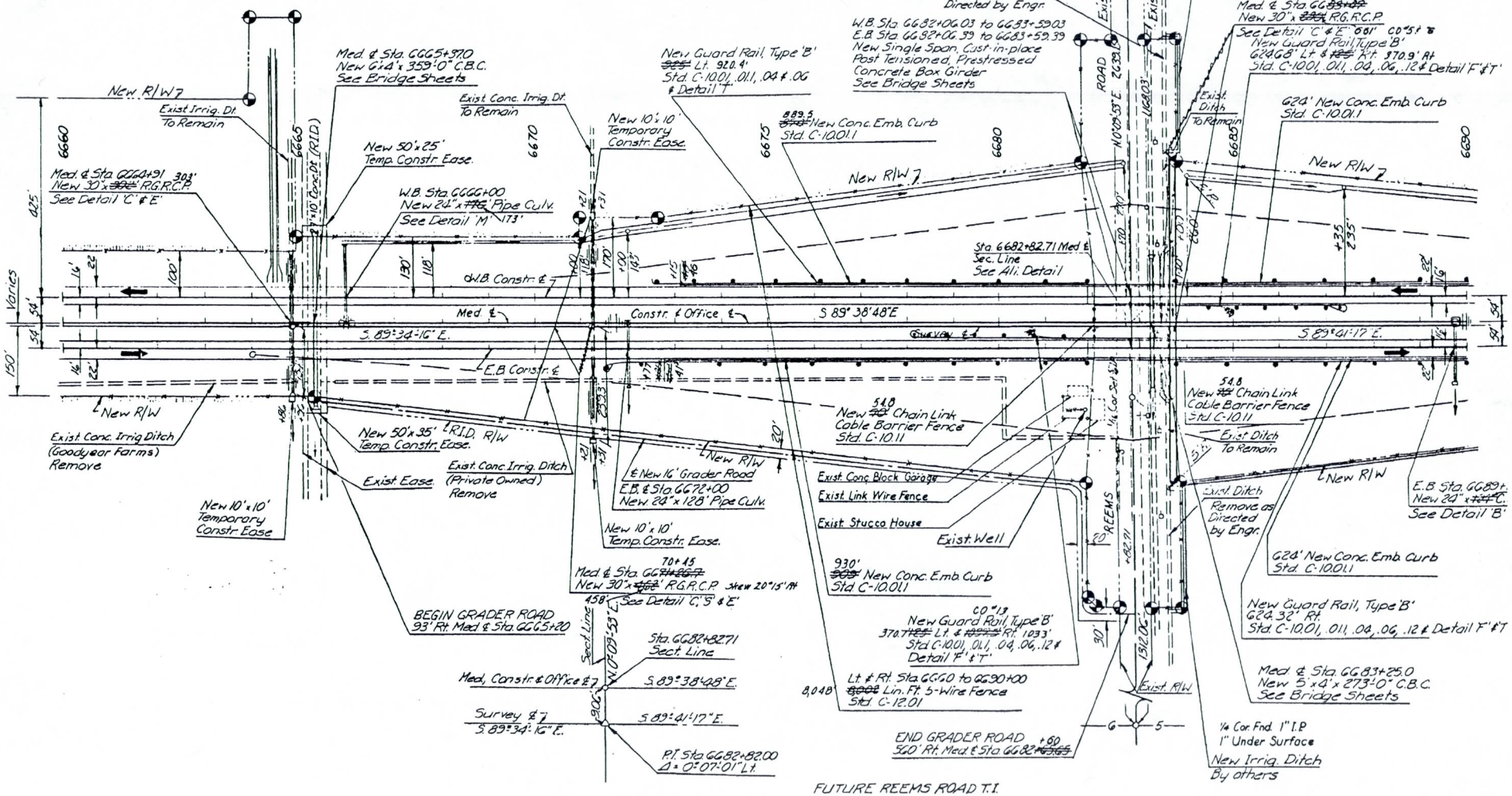
F H W A REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS I
9	ARIZ	I-10-2(34)	31	162	1-13

17 | I-10-2(34) | 31 04

EHRENBERG-PHOENIX HIGHWAY
PERRYVILLE RD. - BULLARD RD. SECTION
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO	SHEET NO	TOTAL SHEETS
9	ARIZ	I-10-2(34)	32	160

T2N R1W 31 32
T1N R1W 6 5



ALIGNMENT DETAIL

SHEET NOS	MED. RUNS	REVISIONS	LOCATION	DATE
7				
8				
9				
10				
11				

EHRENBERG – PHOENIX HWY.
PERRYVILLE RD – BULLARD RD SECTION
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS B
9	ARIZ.	I-10-2(33)&	33	142	I-13-

B.M. 95 W-1277 (4 Mod. E Sta. 6663+
CY&C Scribe in Conc. Hdwl. 0.5' E. of Re
C.S. 50' S. of McDowell ... W. of Ry
Stamped A110 1965 95W Records
Elev. 1003.51 Elev. 1003.51

B.M. #6666-116' Rt. Mod. E Sta. 6665+69
5/8" Iron Pipe & Guard Elev. 1000.53

B.M. #6676-100' Rt. Mod. E Sta. 6674+00
5/8" Iron Pipe & Guard Elev. 1003.66

B.M. #6653-150' Ct. Mod. E Sta. 6651+52
5/8" Iron Pipe & Guard Elev. 1001.92

WESTBOUND
38' ROADWAY

EASTBOUND
38' ROADWAY

1000' V.C.

-0.1857%

+1.4547%

-0.1357%

30' Trans.

-0.3923%

-0.1285%

Channel Profile

Ground Line

Elev. 1004.40

Elev. 1000.07
Corr. +2.00'

+60
Elev. 1002.20
End 16' Channel
Begin 25' Channel

+80
Elev. 1000.80
End Channel
2400' V.C.
SDs = 996'

+06.03

+59.03

35' Transition

+35
Begin 15' Channel

+00
Elev. 998.71
Begin 25' Channel

-0.5435%

-2.0696%

Elev. 1004.80
Corr. -1057'

New 1x1.5x.23 Channel Lt.
5 C.Y. Excav.
See Detail 'X'

New 1x1.5x.23 Channel Lt.
See Detail 'E'
5 C.Y. Excav.

New 10'x1.5'x.30' Med. Dyke
Type 'E' Std. C-3.01
Top of Dyke Elev. 1008.80
20 C.Y. Emb.

New 10'x1.5'x.30' Med. Dyke
Type 'B' Std. C-3.01
Top of Dyke Elev. 1008.03
20 C.Y. Emb.

New 6.5'x1.5' x 35' Berm Lt.
Std. C-1.30 | 6:1 Slopes
20 C.Y. Emb.

New 6.5'x1.5' x 24' Berm Lt.
Std. C-1.30 | 6:1 Slopes
10 C.Y. Emb.

New 10'x1.5'x.30' Med. Dyke
Type 'B' Std. C-3.01
Top of Dyke Elev. 1010.27
10 C.Y. Emb.

New 10'x1.5'x.30' Med. Dyke
Type 'B' Std. C-3.01
Top of Dyke Elev. 1010.16
10 C.Y. Emb.

New 15'x1.5'x.30' Channel Lt.
715 C.Y. Excav.
Std. C-3.01 2:1 Slopes

New 25'x1.5'x.30' Channel Lt.
975' C.Y. Excav.
Std. C-3.01 2:1 Slopes

New 15'x1.5'x.252 Channel
715 C.Y. Excav.
Std. C-3.01 2:1 Slopes

New 1.5'x1.5'x120' Channel Lt.
1745 C.Y. Excav.
Std. C-3.01 2:1 Slopes

Med. & Sta. 6666+45
New 24"x 0.5' Pipe Culv. (See Detail 'D')

Med. & Sta. 6668+03
New 30"x 0.5' RCP
See Detail 'E'

Med. & Sta. 6669+45
New 30" x 0.5' RCP
See Detail 'E'

Med. & Sta. 6671+87
New 30" x 0.5' RCP
See Detail 'E'

Med. & Sta. 6673+50
New 30" x 0.5' RCP
See Detail 'E'

Med. & Sta. 6675+90
New 30" x 0.5' RCP
See Detail 'E'

Med. & Sta. 6623+25.0
New 51"x81"x33" C.G.C.
See Bridge Sheets

Med. & Sta. 6621+84.0
New 30" x 0.5' RCP
See Detail 'E'
Elev. 1003.90
Corr. -10.41

Osp. =
Hw. =
Med. & Elev. 999.22
Slope = 0.2000% Rt.

Med. & Sta. 6666+37
New 24"x 0.5' Pipe Culv.
See Detail 'D'

Med. & Sta. 6668+70
New 30" x 0.5' RCP
See Detail 'E'

Med. & Sta. 6670+70
New 30" x 0.5' RCP
See Detail 'E'

Med. & Sta. 6672+70
New 30" x 0.5' RCP
See Detail 'E'

Med. & Sta. 6674+70
New 30" x 0.5' RCP
See Detail 'E'

Med. & Sta. 6676+70
New 30" x 0.5' RCP
See Detail 'E'

Med. & Elev. 1002.30
Slope = 0.1026% Rt.

Med. & Sta. 6667+70
New 24" x 36'-0" C.M.P.
See Bridge Sheets

Elev. 1010.07
Corr. +2.00'

Med. & Sta. 6669+70
New 24" x 36'-0" C.M.P.
See Bridge Sheets

New 6.5'x1.5' x 105' Berm Rt.
Std. C-1.30 | 6:1 Slopes
50 C.Y. Emb.

E.B. & Sta. 6672+00
New 66" x 128' Pipe Culv.

Osp. = 7.2 c.f.s.
DHw = 1012.4
E.B. & Elev. = 1005.46
Slope = 4.565% Rt.

-0.1673%

+1.4312%

-2.0396%

+06.39

+59.39

2400' V.C.

SDs = 983'

Ground Line

New 1x1.5x.25 Channel Rt.
5 C.Y. Excav.
See Detail 'X'

New 1x1.5x.25 Channel Rt.
See Detail 'E'
5 C.Y. Excav.

Osp. = 4.5 c.f.s.
DHw = 1017.1
E.B. & El. = 1012.21
Slope See Detail 'E'

New 24" x 36'-0" C.M.P.
See Detail 'B' & 'D'

6660 61 62 63 64 6665 66 67 68 69 6670 71 72 73 74 6675 76 77 78 79 6680 81 82 83 84 6685 86 87 88 89 6690

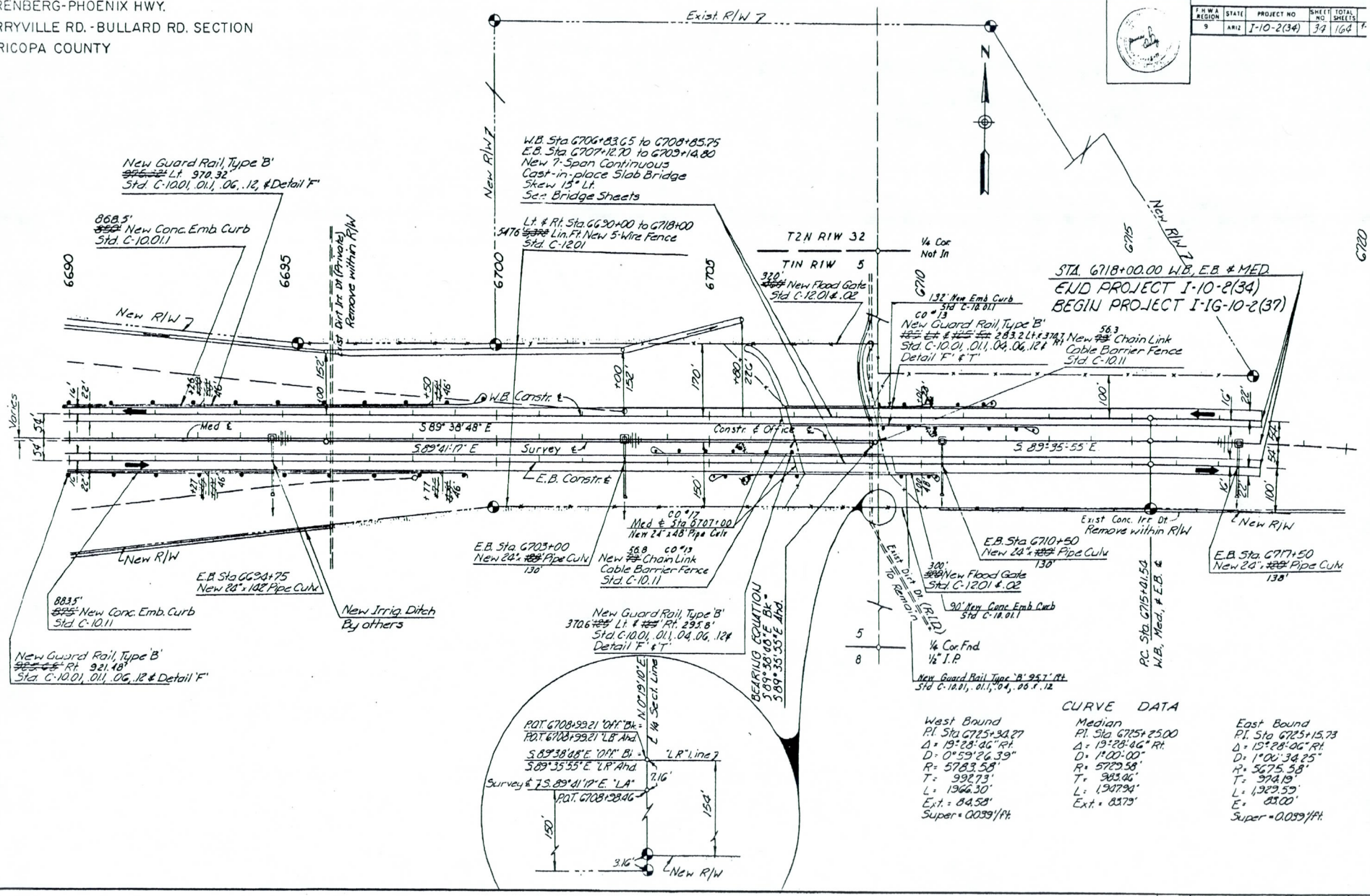
1010

1000

7 | I-10-2(34) | 33 of

EHRENBERG-PHOENIX HWY.
PERRYVILLE RD. - BULLARD RD. SECTION
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO	SHEET NO	TOTAL SHEETS
9	ARIZ	I-10-2(34)	34	164



CURVE DATA

West Bound	Median	East Bound
P.I. Sta. 6725+34.27	P.I. Sta. 6725+25.00	P.I. Sta. 6725+15.73
Δ = 19°28'06" Rt.	Δ = 19°28'06" Rt.	Δ = 19°28'06" Rt.
D = 0°59'26.39"	D = 1°00'00"	D = 1°00'34.25"
R = 5783.58'	R = 5729.58'	R = 5675.58'
T = 992.73'	T = 983.06'	T = 974.19'
L = 1966.30'	L = 1,947.90'	L = 1,929.59'
Ext. = 84.58'	Ext. = 83.79'	E = 83.00'
Super = 0.039'/ft.		Super = 0.039'/ft.

SURVEY NOS.	FWC	"CO" PLANS	REVISIONS	LOCATION	DATE
2-27-77					

Eng Records

STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PLAN AND PROFILE OF PROPOSED

STATE HIGHWAY

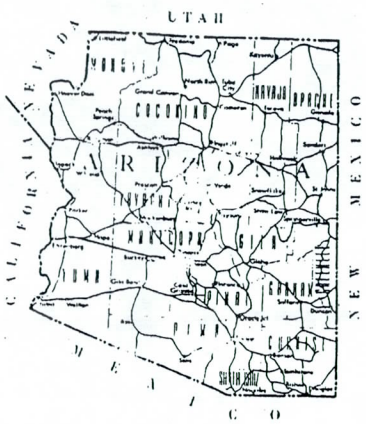
EHRENBERG — PHOENIX

MARICOPA COUNTY

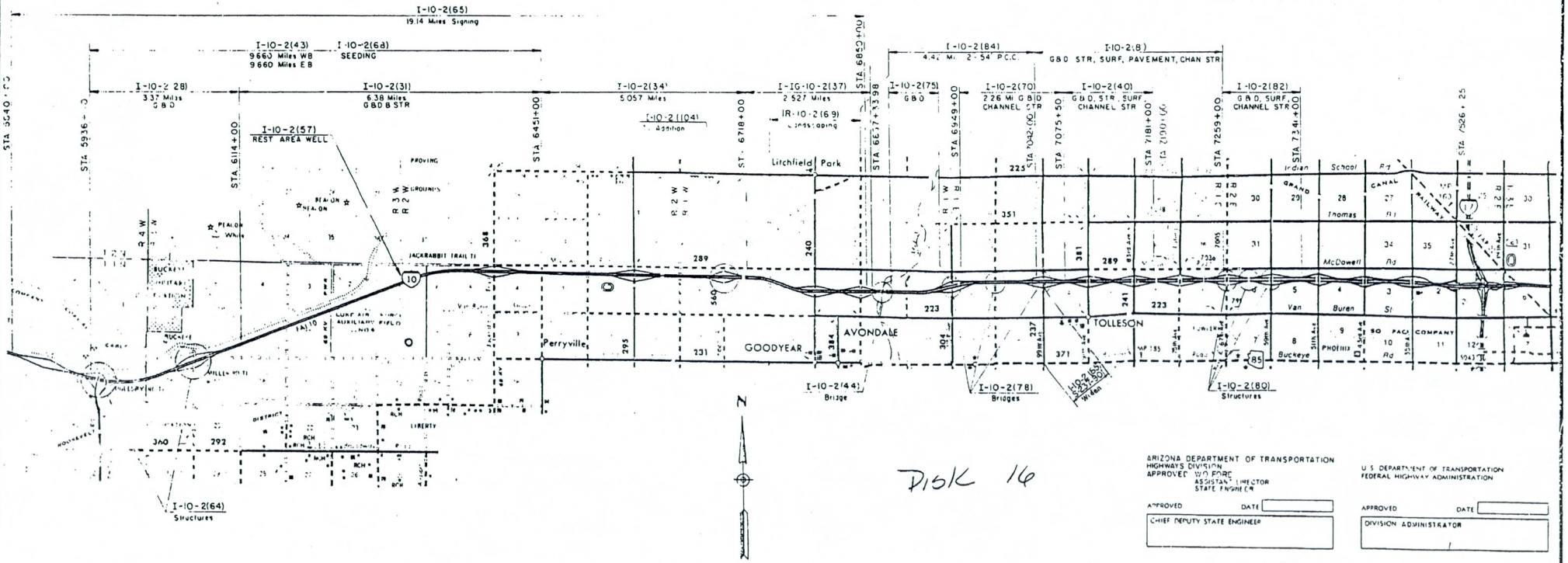
I-10-2(104)

AS BUILT
DATE 6-1-87
ROBERT COOPER

DEPARTMENT OF TRANSPORTATION DOT STATE OF ARIZONA



I-10-2 (113)
5.37 Miles Signing STA 7190+00 to STA 7526+25
5.21 Miles Pavement Markings STA 7251+10 to 7526+25
3.53 Miles Lighting & Signals STA 7340 to 7526+25



N

Disk 16

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
APPROVED W.O. FORE
ASSISTANT DIRECTOR
STATE ENGINEER

APPROVED DATE
CHIEF DEPUTY STATE ENGINEER

APPROVED DATE
DEPUTY STATE ENGINEER

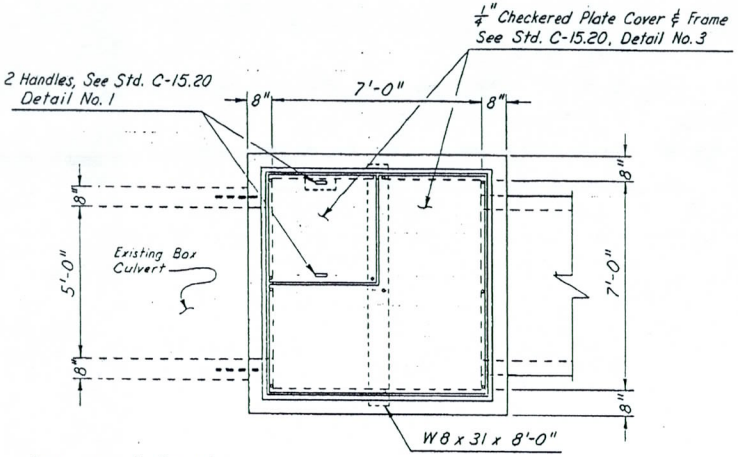
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED DATE
DIVISION ADMINISTRATOR

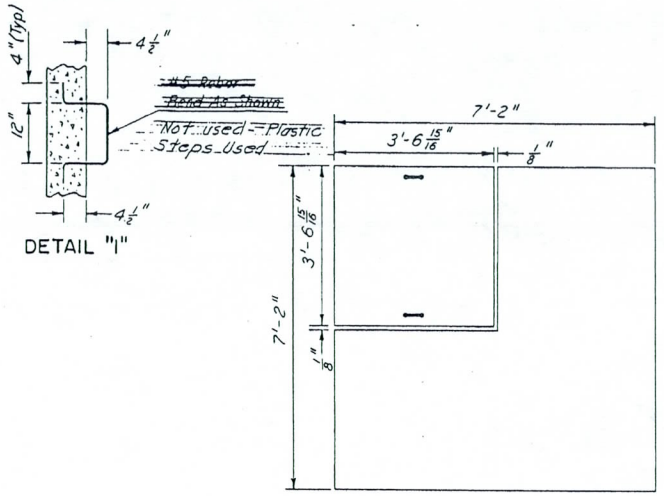
EHRENBERG - PHOENIX HIGHWAY
REEMS ROAD T. I.
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(104)	4	37	

Robert Staver's Squad
Drawn by C. Haiye 8-15-84

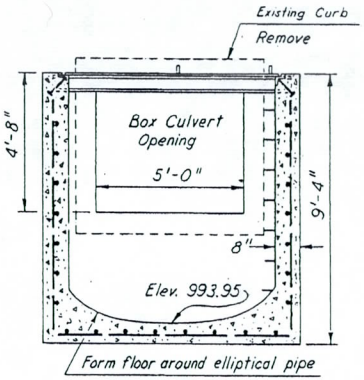


PLAN

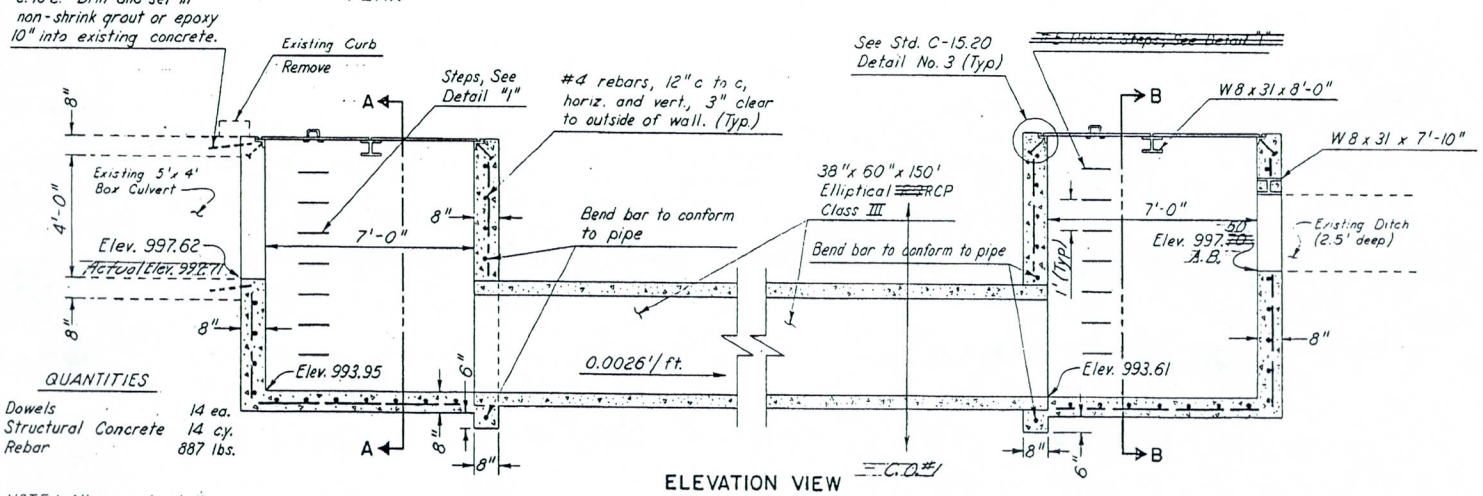


DETAIL "I"

CHECKERED PLATE COVER



SECTION A-A

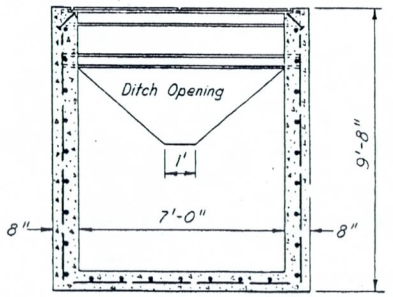


ELEVATION VIEW

QUANTITIES

Dowels	14 ea.
Structural Concrete	14 cy.
Rebar	887 lbs.

NOTE : All concrete shall be Class B



SECTION B-B

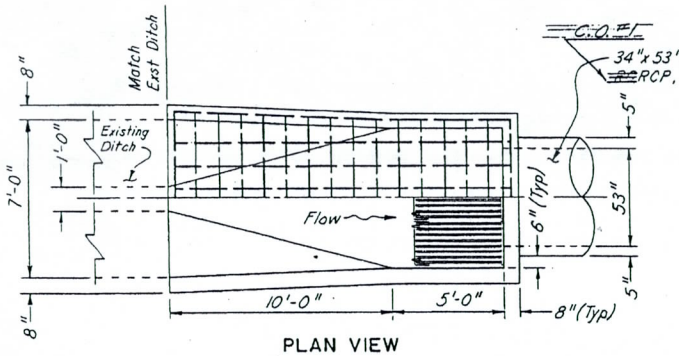
DETAIL A

EHRENBERG - PHOENIX HIGHWAY
REEMS ROAD T. I.
MARICOPA COUNTY

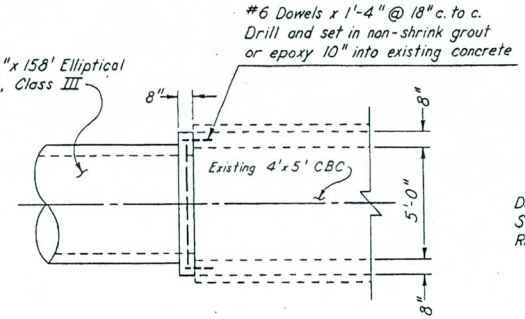
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(104)	5	37	Comp. 6-87

Robert Staver's Squad

Drawn By C. Hinze 11-03-91



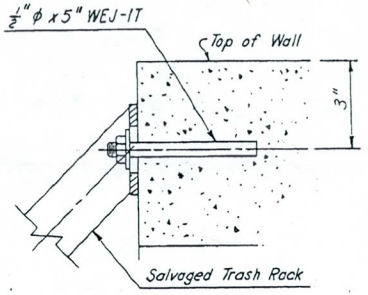
PLAN VIEW



PLAN VIEW

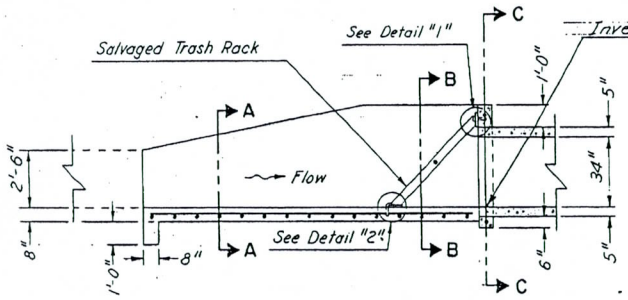
QUANTITIES

Dowels	13 Each
Structural Concrete	6 C.Y.
Rebar	308 Lbs.

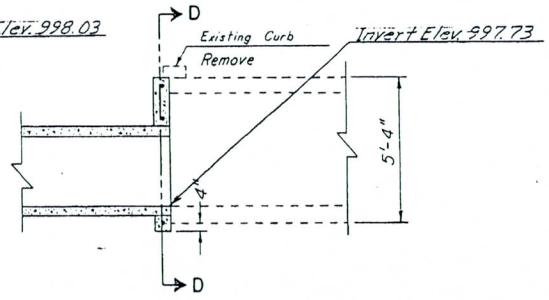


DETAIL "1"

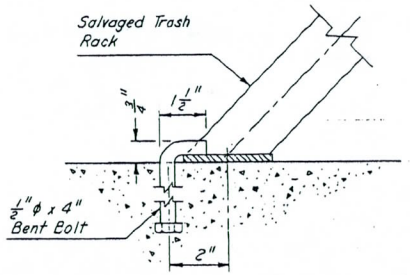
NOTE : All concrete shall be Class B



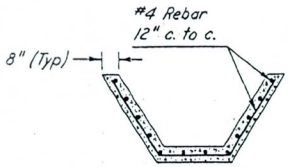
ELEVATION VIEW
INLET



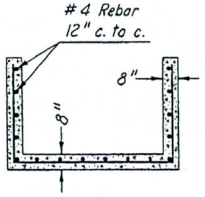
ELEVATION VIEW
OUTLET



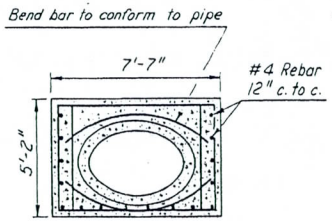
DETAIL "2"



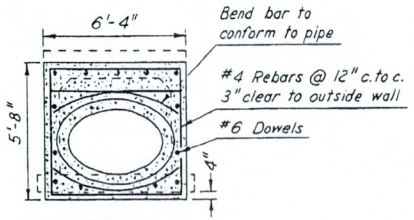
SECTION A-A



SECTION B-B



SECTION C-C



SECTION D-D

DETAIL B

EHRENBERG - PHOENIX HIGHWAY
REEMS ROAD T. I.
MARICOPA COUNTY

RAMP "A"

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(104)	11	37	

Robert Staver's Signature

Drawn By C. Hoyle 11-7-34

CURVE DATA

P.I. Sta = 4+42.51
Δ = 7°20'24"
D = 1°00'00"
R = 5729.58'
T = 367.50'
L = 734.00'
Super = 0.032'/ft.

N

T. 1 N — R. 1 W

Sct 6

93.503' Lt Med ℄ Sta 6668+50.00 = Sta 0+00 Ramp "A"

P.C. 0+75.01

Existing Drainage Channel To Remain

Existing Downdrain
Remove Outlet, Extend 12" CMP 52' Lt.
(2⅔" x ½" corrugations, 0.064" thick)

Sta 12+00 - 3.5 A.B.
New 24" x 68' CMP
(2⅔" x ½" corrugations, 0.064" thick), New End Sets, Std C-13.25

Existing R/W

P.T. 8+09.01

300' Taper 8' to 14'

50:1

N. 81°52'03" E.

Sta 14+42.06 Ramp "A" = Sta 53+61.86 Reems Road

+56.54

75' R

15' R

+02.50

Sta 12+50 End Sgl Curb Lt ℄ R1

Painted Cattle Guard C.O. #5

Reems Road Cst ℄

50:1 Taper

N. 89°12'27" E.

Saw Cut Line

386.7'

418.2 Sq. Yd.

3.5'

20.4'

Ramp "A" Cst ℄

Existing Guardrail To Remain

S. 89°38'48" E.

Existing W.B. ℄

New Paved Gore Area
Std C-8.20
423 S.Y.

Existing 30" x 484' RCP To Remain

◆ Note: Radii are to face of curb

BM No. 666.5, 184.3' Lt Med Sta 6665+00
3" Al. Cap, Elev 1008.26

BM No. 668.2, 334' Lt Med Sta 6681+75
3" Al. Cap, Elev 1002.95

Ramp Profile Grade Controlled By Existing W.B. Grade

VPI Sta 6+90
Elev = 1016.71
Corr. = -2.88'

+0.7165 %

Finished ℄ Grade

-1.9923 %

Existing 30" RCP To Remain

Existing Ground Line @ ℄ Grade

Match Edge of Pavement

Q_{10} = 8.8 cfs
Design H.W. 1004.62
Invert Elev 1002.67
Slope = 0.2%
H. Invert Elev 1002.54

850' V.C.
SD_5 = 662'

A.B. 5

1015
1010
1005
1000
995

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

6670 6675 6680

7	I-10-2(104)	11 of 37

Robert Staver's Squad

Drawn By C. Hoye 8-3-84

EHRENBERG-PHOENIX HIGHWAY
REEMS ROAD T. I.
MARICOPA COUNTY

RAMP "B"

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(104)	12	37	

◆ Note: Radii are to face of curb

Sta 0+00 Ramp "B" = Sta 53+49.86 Reems Road
Pipe Encasement C.O. #3

Existing Drainage Channel To Remain

Added 14' L.F. F.A. #2

Existing 30" x 689.2 RCP To Remain

Exist R/W

75' R

+86.56

14'

+00

300' Taper 14' to 8'

50:1

8'

Existing Downdrain
Remove Outlet
Extend 12" CMP 68' Lt.
(2⅔" x ½" corrugations, 0.064" thick)

S.84°06'42"E.

Reems Road Cst ℄

+38.08

15' R

Sta 1+30 End Sgl Curb Lt. & Rt.

Painted Cattle Guard C.O. #5

Sta 1+70 ~~82.5 AB~~
New 24" x ~~36~~ CMP
(2⅔" x ½" corrugations, 0.064" thick)
New End Scts, Std C-13.25

Ramp "B" Cst ℄

P.C. 11+27.06

1600' Existing G.R. & BCT Lt.
Remove & Salvage 500'
Reconstruct 25' G.R.
Reconstruct BCT
Std C-10.02, 10.04, 10.19, 10.20

P.T. 14+34.06

Existing Downdrain Remove

S.85°38'43"E.

Exist W.B. ℄

S.89°38'48"E.

Saw Cut Line 760.2'

+24.74

+84.74

258.1 Sq. Yds. New Paved Gore Area, Std C-8.10 251.6 S.Y.

Existing Embankment Curb Remove 510'

6685 6690 6695

CURVE DATA

P.I. Sta. = 12+80.57
Δ = 1°32'06" Lt.
D = 0°30'00"
R = 11459.16'
T = 153.51'
L = 307.00'
Super = N.C.

N
T. 1 N — R. 1 W
Sct 5

BM No. 668.2, 334.0' Lt Med Sta 6681+75
3" Al. Cap, Elev 1002.95

BM No. 670.0, 224.0' Lt Med Sta 6700+00
3" Al. Cap, Elev 991.73

VPI Sta 10+10
Elev = 1011.09
Corr = -4.33'

Ramp Profile Grade Controlled By Existing W.B. Grade

Finished ℄ Grade

-1.94165 %

1000' VC
SDs = 636'

+1.5182 %

Match Edge of Pavement

Q_{50} = 8.7 cfs
Design H.W. 1002.50
S= Invert Elev 1000.41 A.B.
Slope = 0.09 %
N-Invert Elev 1000.62

Existing 30" RGRCP To Remain

Existing Ground Line @ ℄ Grade

See Reems Road Sheet 6 Detail "B"

1015 1010 1005 1000 995

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SURVEY NOS.	FINISHED PLANS	REVISIONS	LOCATION	DATE

BRUNING 45-187

EHRENBERG - PHOENIX HIGHWAY
REEMS ROAD T. I.
MARICOPA COUNTY

RAMP "C"

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(104)	13	37	

Robert Staver's Squad

Drawn By : C. Hanye 8-8-83

Painted Cattle Guard
C.O. #5
Reems Road C&L ℄

Existing 30"x 689.2' RCP
To Remain

Existing 24" CMP
Extend 64' Rt
(2⅔" x ½" corrugations, 0.064" thick)
New End Sct, Std C-13.25

Sta 6690+10.0
New 106' CMP Downdrain, Single
1 Inlet, 1 Outlet
Std C-04.20

New Guard Rail Anchor
See Detail "D"

New Paved Gore Area
Std. C-8.20
325.42 S.Y.

Existing Guard Rail Rt
Remove & Salvage 925'

Existing Embankment Curb Rt
Remove 910'

Exist E.B. ℄ S.89°33'43"E.

Saw Cut Line

N.89°12'27"E.

50:1 Taper

Sta 1+70
New 24"x 84' CMP (2⅔" x ½" corrugations, 0.064" thick), New End Scts, Std C-13.25

Sta 1+30
End Sgl Curb Lt. & Rt.

Ramp 'C' C&L ℄

N. 80° 16' 14" E.

317.5'
334.6 Sq. Yd.
Existing Downdrain
Remove

Existing 24" CMP
Extend 23' Rt.
(2⅔" x ½" corrugations, 0.064" thick)
New End Sct.
Std C-13.25

Existing Downdrain
Remove

CURVE DATA
P.I. Sta = 8+59.76
Δ = 8°56'13" Rt.
D = 2°00'00"
R = 2861.79'
T = 223.88'
L = 446.84'
Super = 0.056'/ft.

P.C. 6+35.88
P.T. 10+82.73

Sta 0+00 Ramp "C" =
Sta 48+61.86 Reems Road

Exist R/W

Sta 3+50
New 54' CMP Downdrain, Single
1 Inlet, 1 Outlet
Std C-04.20

Sta 6+75
New 54' CMP Downdrain, Single
1 Inlet, 1 Outlet
Std C-04.20

New 2020' Embankment Curb
Std C-05.10

New Guard Rail
See Geometrics Sheet

◆ Note : Radii are to face of curb

Pipe Encasement
C.O. #3

T. 1 N ⊕ R. 1 W
Sct 5

BM No. 668.2, 334.0' Rt. Med. Sta 668+75
3" Al. Cap, Elev 1000.90

BM No. 670.0, 157.85' Rt. Med. Sta 699+90
3" Al. Cap, Elev 992.05

VPI Sta 3+64
Elev = 1015.24
Corr = -1.62'

VPI Sta 8+55
Elev = 1013.04
Corr = -1.80'

+0.72% Finished ℄ Grade -1.4475%

Ramp Profile Grade Controlled By Existing E.B. Grade

200' V.C.

Q_{50} = 5.2 cfs
Design HW 1001.28
Invert Elev. 999.71
Slope = 0.1 %

Match Edge of Pavement

+2.00%

5.2 cfs

Existing Ground Line @ ℄ Grade

Existing 30" RGRCP
To Remain

See Reems Road Sheet & Detail "B"

VPI Sta 1+20
Elev = 1002.44
Corr = +0.81'

288' V.C.
SDs = 300'

Existing 24" CMP
Extend 64' Rt.

650' V.C.
SDs = 640'

Existing 24" CMP
Extend 28' Rt.

1020 1015 1010 1005 1000 995 990

0 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SURVEY NOS.	FINISHED PLANS	REVISIONS	LOCATION	DATE
2331-11				

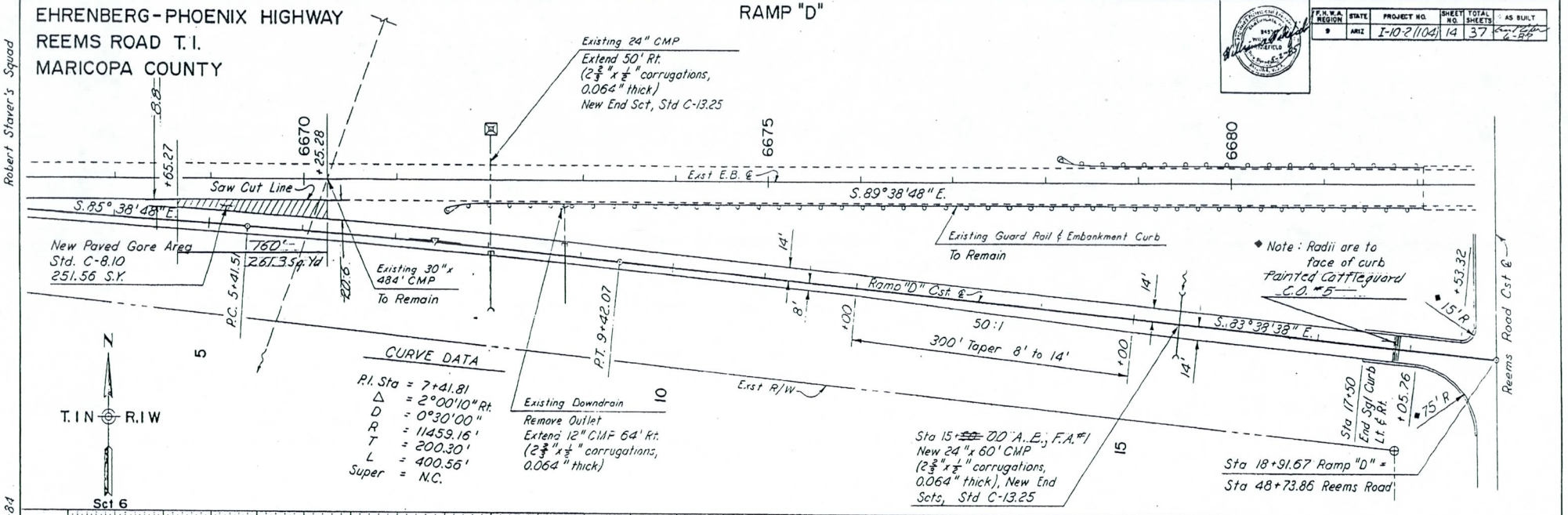
EHRENBERG - PHOENIX HIGHWAY
REEMS ROAD T.I.
MARICOPA COUNTY

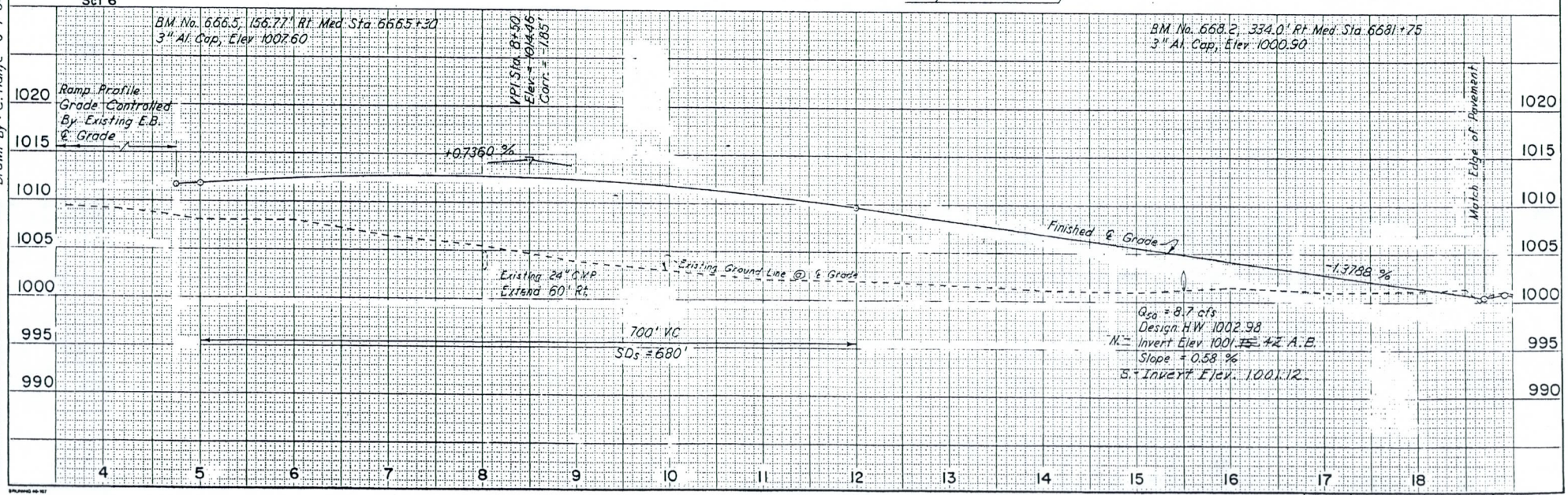
RAMP "D"

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(104)	14	37	

Robert Staver's Squad

Drawn By : C. Hanye 8-7-84

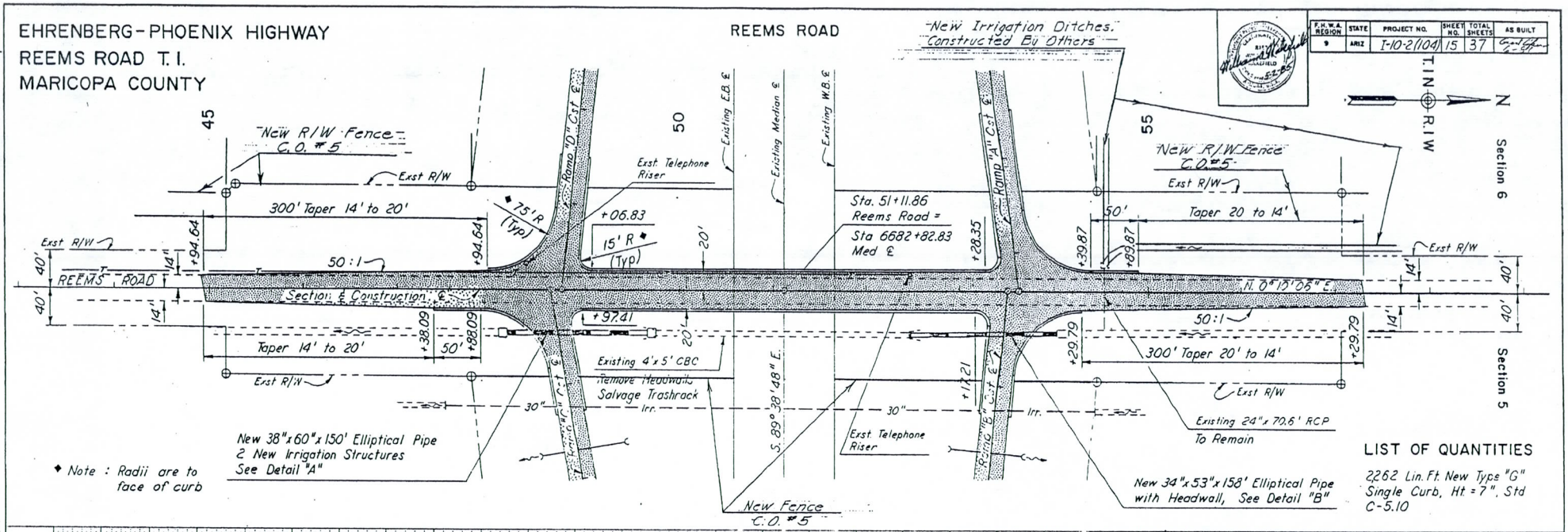




EHRENBERG - PHOENIX HIGHWAY
REEMS ROAD T. I.
MARICOPA COUNTY

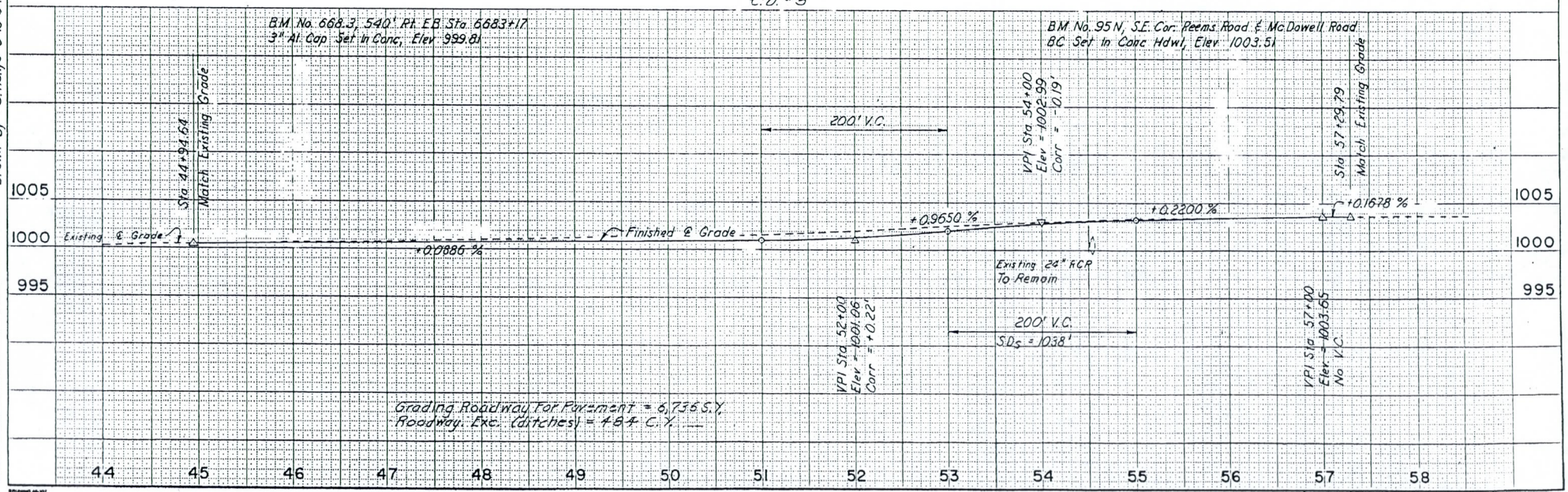
REEMS ROAD

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(104)	15	37	



LIST OF QUANTITIES

2262 Lin. Ft. New Type "G" Single Curb, Ht = 7", Std C-5.10



Robert Staver's Squad
Drawn By : C. Hanye 8-13-84

SURVEY NOS.	FINISHED PLANS	REVISIONS	LOCATION	DATE
2-23-11				

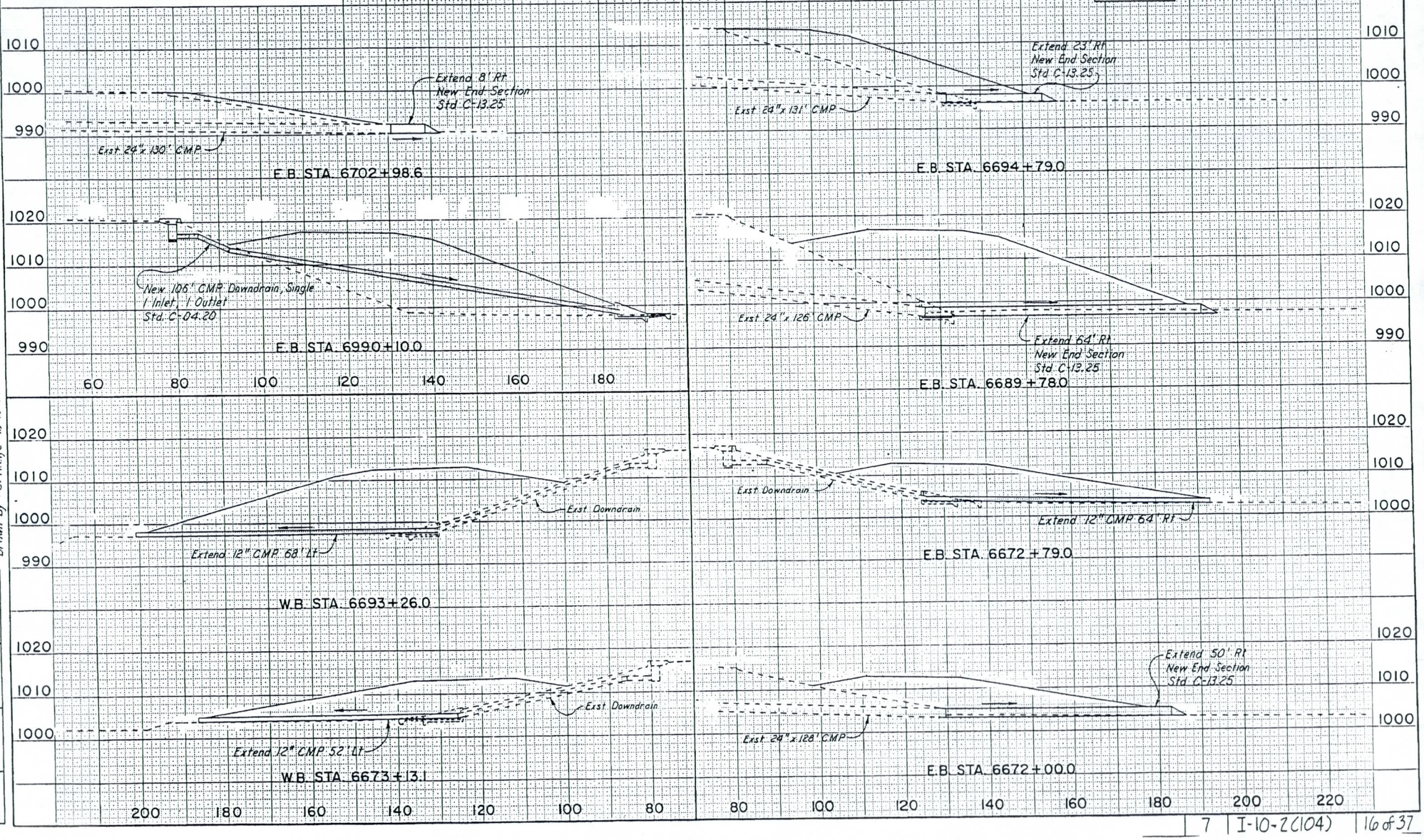
EHRENBERG - PHOENIX HIGHWAY
REEMS ROAD T. I.
MARICOPA COUNTY

PIPE EXTENSIONS

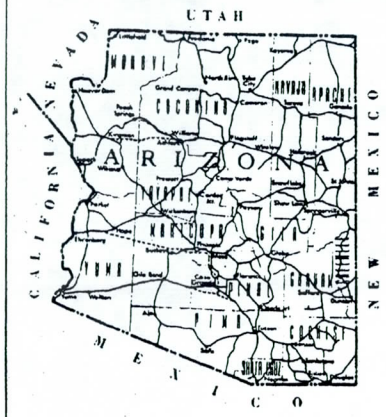
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(104)	16	37	

Robert Shaver's Squad

Drawn By: C. Hinze 10-15-91



SURVEY NOS.	FINISHED PLANS	REVISIONS	LOCATION	DATE



STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PLAN AND PROFILE OF PROPOSED

STATE HIGHWAY

EHRENBERG — PHOENIX

MARICOPA COUNTY

I-10-2 (31)

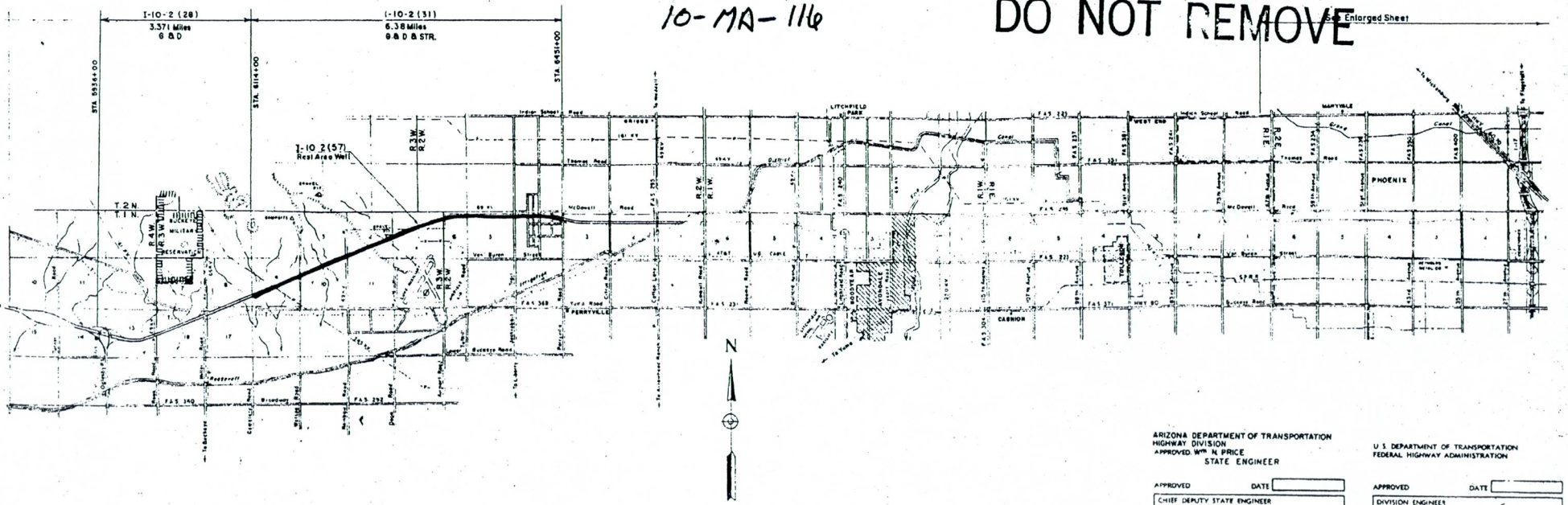
AS BUILT

10-MA-116

10-71

MP 116.00 - 121.80

A.D.O.T.
DISTRICT ONE PLANS OFFICE
FILE COPY
DO NOT REMOVE



ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
APPROVED: Wm. N. PRICE
STATE ENGINEER

APPROVED DATE
CHIEF DEPUTY STATE ENGINEER

APPROVED DATE
DEPUTY STATE ENGINEER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED DATE
DIVISION ENGINEER

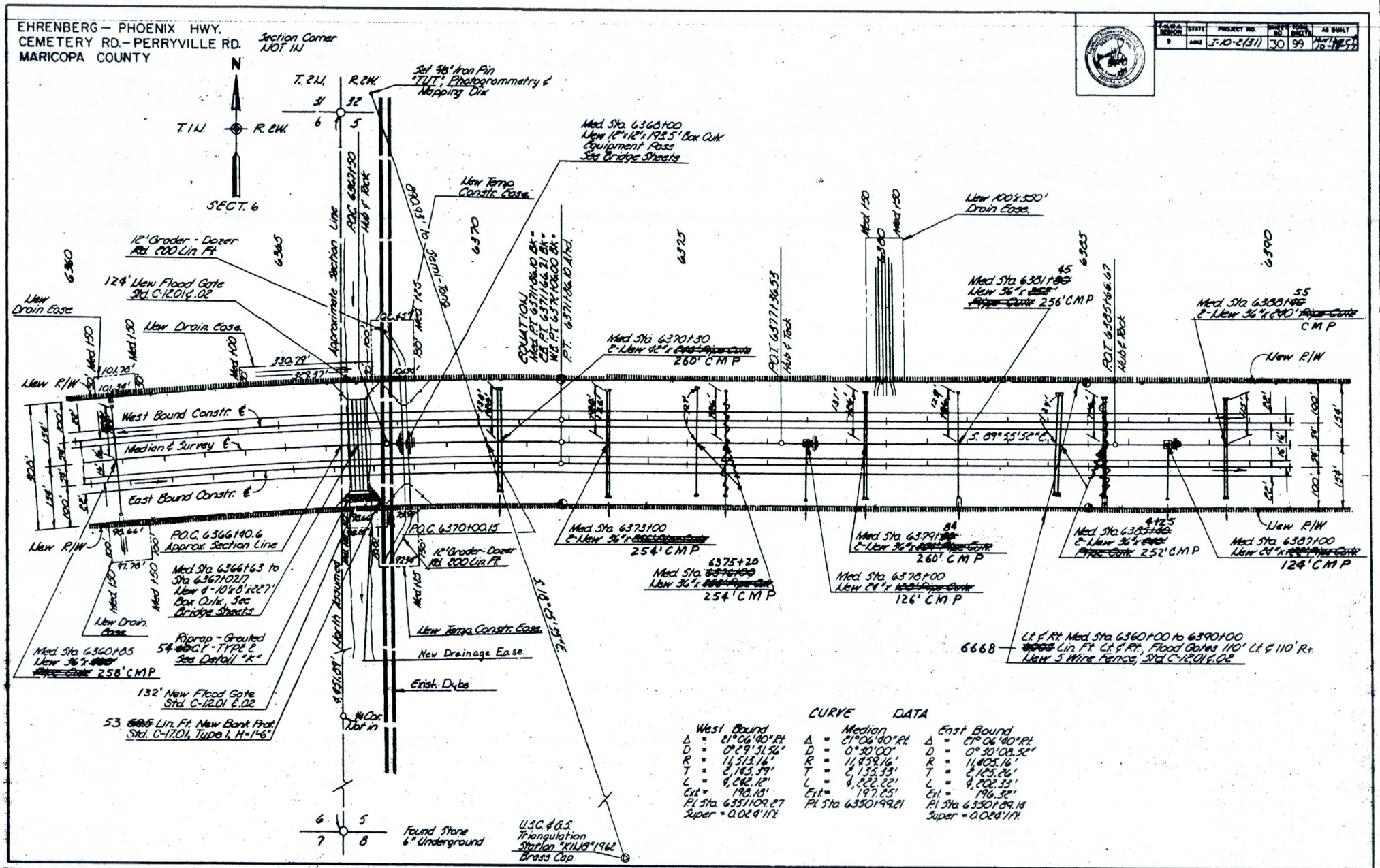
EHRENBERG - PHOENIX HWY
CEMETERY RD - PERRYVILLE RD
MARICOPA COUNTY

FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(31)	5	99	Hurlburt 10-13-77

PIPE CULVERT & MINOR STRUCTURE SUMMARY SHEET

STATION	SIZE	LENGTH	NEW PIPE CULVERTS: C.M.P. - GAUGE 2 2/3" x 1/2" UNCOATED	2 2/3" x 1/2" BIT. COATED	UNCOATED	BIT. COATED	PLACEMENT	CLASS	EARTHWORK QUANTITIES: STR. EXCAV. C.Y.	DRAIN EXCAV. C.Y.	SPECIAL BACKFILL C.Y.	END SECT. STD. C-13.04 & C-13.05	HEADWALLS: TYPE	CLASS 'A' CONC. C.Y.	REINF. STEEL LBS.	CATCH BASINS: TYPE	H	CLASS 'A' CONC. C.Y.	REINF. STEEL LBS.	APRON SQ YDS.	RIPRAP C.Y.	REMARKS
63 (15+00)	2-36"		224'-	14	-	16	Type I	II	96	731		2Lt&2Rt				C-15.10						Skew ~~29°~~ Lt 28° See Detail "F"
6319+32	40"		234'-	14	-	16	Type I	II	54	650		Lt&Rt				C-15.10						Skew 26°Lt See Detail "F"
6321+33	40"		214'	14	-	16	Type I	II	75	529		Lt&Rt										Skew 5°Lt
6323+05	40"		218'-	14	-	16	Type I	II	69	582		Lt&Rt										Skew ~~..°~~Lt 18°
6324+32	2-40"		212'-	14	-	16	Type I	II	169	955		2Lt&2Rt										Skew ~~5°~~Lt 7°30'
6326+40	36"		208'-	14	-	16	Type I	II	36		404	Lt&Rt										
6330+50	36"		208'-	14	-	16	Type I	II	38		400	Lt&Rt										
6335+25	36"	204'	-	14	-	16	Type I	III	69		316	Lt&Rt				2 C-15.10						See Detail "F"
6340+10	36"		198'-	14	-	16	Type I	III	83		274	Lt&Rt										
6343+25	36"	~~204'~~	200'-	14	-	16	Type I	III	47		358	Lt&Rt										
6345+65	36"		210'-	14	-	16	Type I	II	74		321	Lt&Rt				C-15.10						See Detail "F"
6349+45	36"	280'	-	14	-	16	Type I	II	149		341	Lt&Rt										Skew ~~30°~~Lt 23°
6353+00	24"	120'	—	14	—	—	Type I	II	13		170	Rt				C-15.09	3	0.82	62.46	10.9		
6354+00	36"	254'	-	14	-	16	Type I	II	86		392	Lt&Rt										
6357+00	36"	266'	-	14	-	16	Type I	II	110		369	Lt&Rt										
6360+00	24"		126'-	14	-	-	Type I	II	14		161	Rt				C-15.09	3	0.82	62.46	10.9		
6360+85	36"		258'-	14	-	16	Type I	II	155		283	Lt&Rt										
6370+30	2-42"		260'-	14	-	16	Type I	III	194		979	2Lt&2Rt										
6373+00	2-36"		254'-	14	-	16	Type I	III	163		775	2Lt&2Rt										
63 (75+20)	36"		254'	14	-	16	Type I	II	53		468	Lt&Rt										
6378+00	24"		126'-	14	-	-	Type I	II	14		162	Rt				C-15.09	3	0.82	62.46	10.9		
6379+84	2-36"		260'-	14	-	16	Type I	II	196		766	2Lt&2Rt										
6381+45	36"		256'-	14	-	16	Type I	II	59		457	Lt&Rt										Skew 5° Rt
638 (87+25)	2-36"		252'-	10	-	16	Type I	II	167		764	2Lt&2Rt										
6387+00	24"		124'-	14	-	-	Type I	II	13		161	Rt				C-15.09	3	0.82	62.46	10.9		
6388+55	2-36"	200'	-	14	-	16	Type I	II	164		723	2Lt&2Rt										
6390+50	2-36"		224'-	14	-	16	Type I	II	109		718	2Lt&2Rt										
6395+75	2-36"		226'-	14	-	16	Type I	II	252	602		2Lt&2Rt				C-15.10						See Detail "F"
6400+60	3-36"		217'-	14	-	16	Type I	II	257		929	3Lt&3Rt				2 C-15.10						See Detail "F"
6407+00	24"	166'	-	14	-	-	Type I	II	19		211	Rt				C-15.09		0.82	62.46	10.9		
6413+00	24"	~~214'~~	216'-	14	-	-	Type I	II	0		341	Rt				2 C-15.09	3', 4'	1.80	140.29	21.8		See Detail "I"
Ramp A 0+45	30"	58'	-	14	-	-	Type I	III	40		41	Lt.										
6419+75	30"	412'	-	14	-	-	Type I	II	290		279					Lt & Rt 2-C-15.09	3', 3'	1.40	116.90	21.8		
Ramp B 0+46	30"	72'	-	14	-	-	Type I	II	57		48	Rt										
6425+50	24"		234'-	14	-	-	Type I	II	0		369	Rt.				2 C-15.09	3', 4'	1.80	140.29	21.8		See Detail "J"
6433+00	24"	182'	-	14	-	-	Type I	II	0		286	Lt.				2 C-15.09	3', 4'	1.80	140.29	21.8		See Detail "J"
6444+00	24"	96'	-	14	-	-	Type I	II	31		89	Lt.				C-15.10						See Detail "G"
Watson Rd.																						
0+15	24"	116'	-	14	-	-	Type I	II	28		117	Lt & Rt										Skew 43° Lt
28' Lt Sta. 16+25	36"x22"	66'	-	14	-	-	C.M.P. ARCH ONLY		18		69	Lt & Rt										
80' Lt Sta. 16+25	36"	30'	-	14	-	16	Type I	II	19		32											
Jack Rabbit Rd.																						
Sta. 11+25	43"x27"	92'	-	14	-	-	C.M.P. ARCH ONLY		83		64	Lt.										Skew 30° Lt. See Detail "E"

EHRENBERG – PHOENIX HWY.
CEMETERY RD. – PERRYVILLE RD.
MARICOPA COUNTY



CURVE DATA

West Bound		Median		East Bound	
Δ =	21°06'40" Rt.	Δ =	21°06'40" Rt.	Δ =	21°06'40" Rt.
D =	0°29'31.56"	D =	0°30'00"	D =	0°30'08.52"
R =	1,515.16'	R =	1,859.16'	R =	1,405.16'
T =	2,143.39'	T =	2,135.39'	T =	2,125.26'
L =	4,082.12'	L =	4,222.22'	L =	4,202.33'
Ext =	190.13'	Ext =	197.25'	Ext =	196.32'
P.I. Sta.	6351+09.27	P.I. Sta.	6350+99.21	P.I. Sta.	6350+89.14
Super =	0.02 9'11"			Super =	0.02 8'11"

7	I-10-2(31)	30 of 56			

EHRENBERG - PHOENIX HIGHWAY
CEMETERY RD - PERRYVILLE RD.
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS-BUILT
9	ARIZ.	I-10-2(31)	31	99	10-18-77

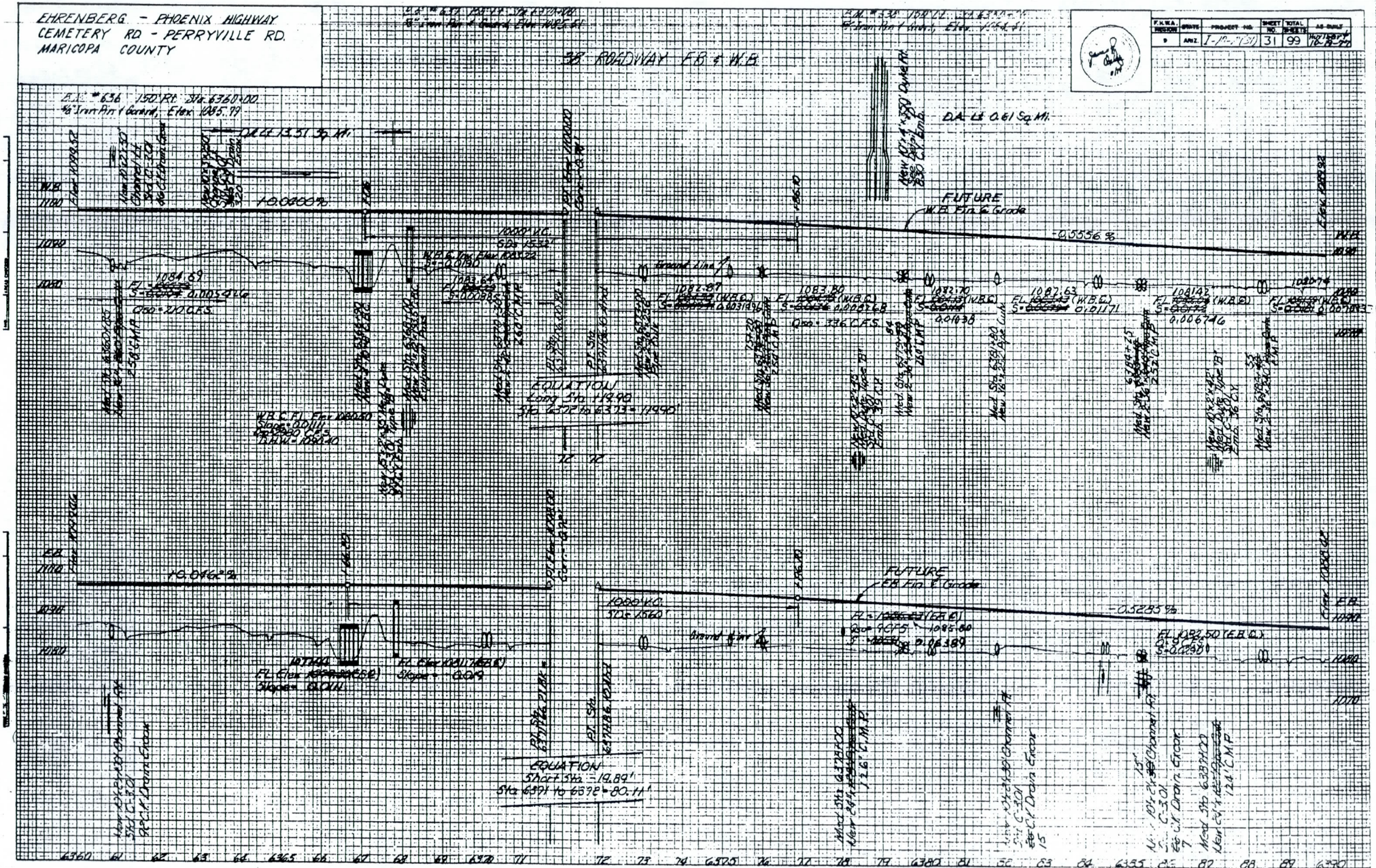
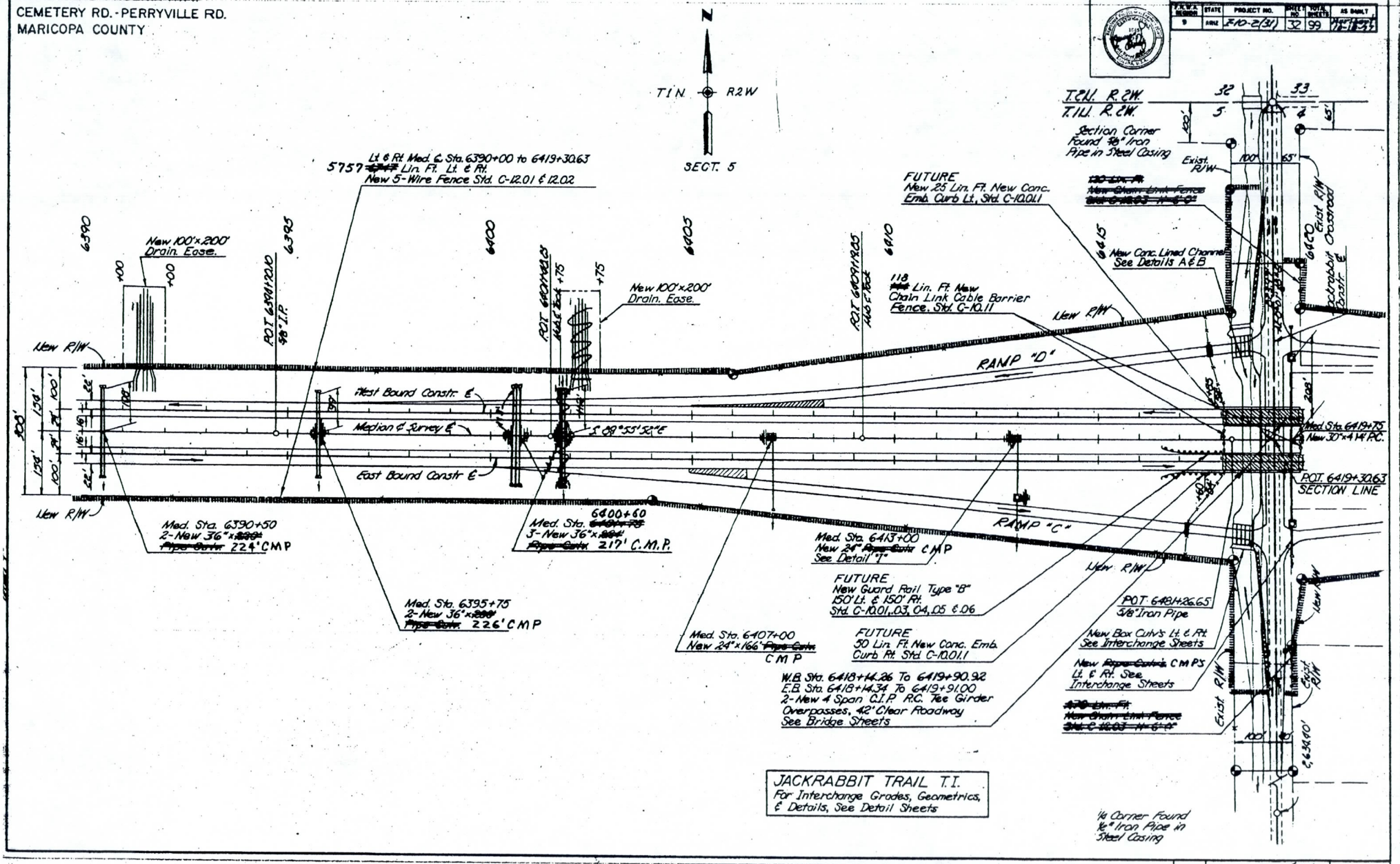


PLATE 3- CROSS SECTION OF FRAME

7	I-10-2(31)	31 or 56	

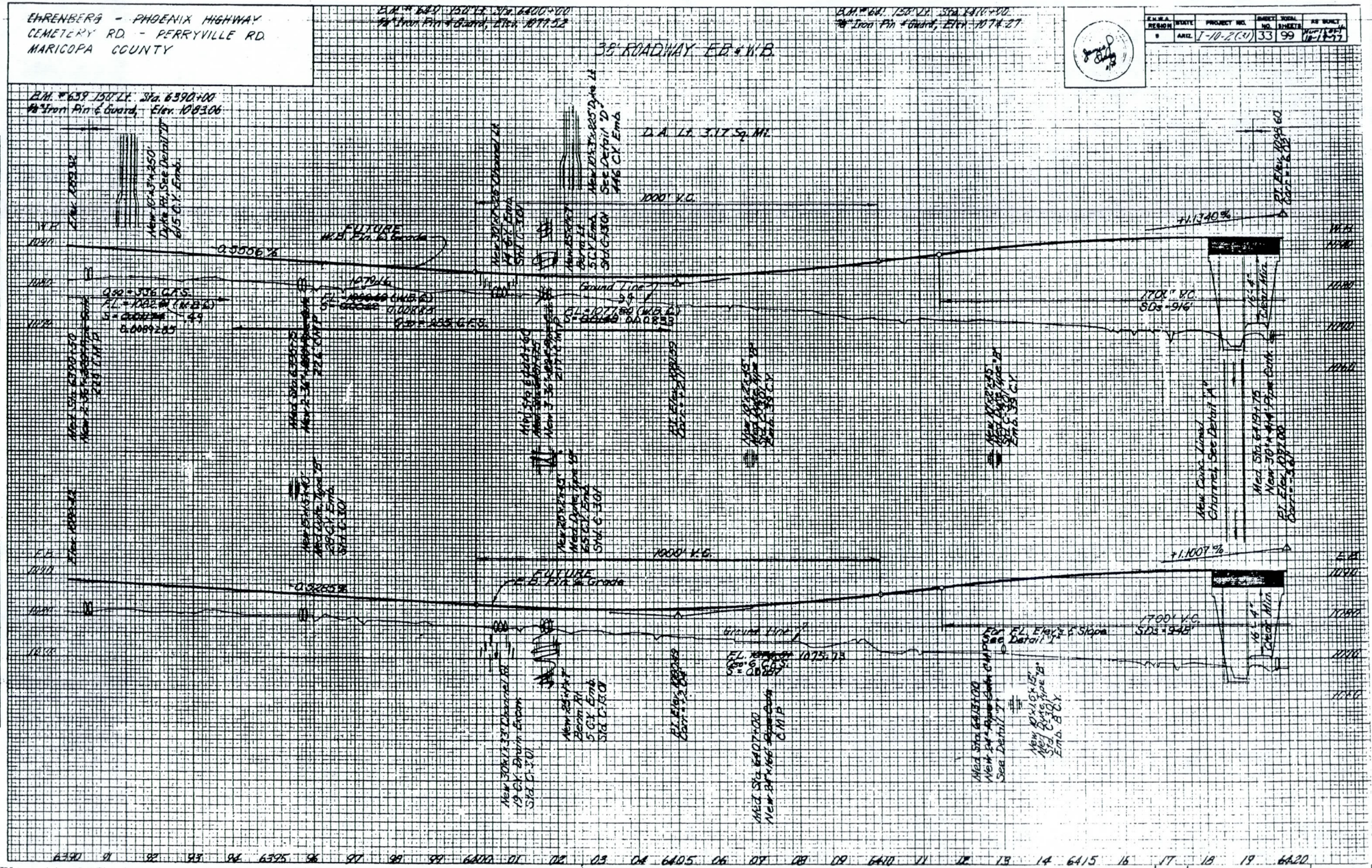
EHRENBERG - PHOENIX HWY.
CEMETERY RD. - PERRYVILLE RD.
MARICOPA COUNTY

F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(31)	32	99	



EHRENBERG - PHOENIX HIGHWAY
CEMETERY RD. - PERRYVILLE RD.
MARICOPA COUNTY

F.A.P.M. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-2(31)	33	99	



~~EHRENBERG - PHOENIX HWY.~~
CEMETERY RD. - PERRYVILLE RD.
MARICOPA COUNTY.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ	I-10-2(31)	34	99	

32 | 33
5 | 4

Mc DOWELL ROAD

T.2N R.2W
T.1N R.2W

33 1/4 Cor.:-Found Brass Cap set in conc. Stamped P.E.M. 90 N-A, Maricopa Co. Survey
4

194th AVE. | 193rd AVE. | 192nd AVE. | 191st AVE.

6420 | 6425 | 6430 | 6435 | 6440 | 6445 | 6450

FUTURE
30 Lin. Ft. New Conc. Emb. Curb Ct., Std. C-10.01.1

FUTURE
New Guard Rail Type "B" 150' Lt. & 150' Rt. Std. C-10.01, 03, 05 & 06

New R/W

Ramp "A"

Ramp "B"

New R/W

P.O.T. 6425+32.78
Hub & Tack

Exist. Conc. Block Residences To be removed.

Exist. 48" Chain Link Fence To Be Removed

No Access

No Access

No Access

P.O.T. 6432+81.12
Hub & Tack

Med. Sta. 6433+00
New 24" CMP
See Detail "J"

Exist. Conc. Block Church To be removed.

P.O.T. 6439+83.18
1/2" Iron Pipe

Med. Sta. 6444+00
New 24"x96' Pipe Culv.

No Access

Exist. 48" Mesh Fence
Remove 1,295 Lin. Ft.
Within R/W

P.O.T. 6445+18.41
Hub & Tack

Horse Corral

No Access

No Access

New R/W

West Bound Constr. ℄

Median ℄ Survey ℄
S 89°55'52"E

East Bound Constr. ℄

Horse Corral

New R/W

No Access

Med. Sta. 6425+50
New 24" Pipe Culv.
See Detail "I"

No Access

Lt. & Rt. Med. Sta. 6420+00 to 6450+00, ~~6330~~ 6496 Lin. Ft. New Chain Link Fence, H=6'-0". Std. C-12.03

No Access

Horse Corral

Exist. 4-Wire Fence
Remove 162 Lin. Ft.
Within R/W

Exist. 48" Mesh Fence
Remove 300 Lin. Ft.
Within R/W

Med. Sta. 6438+86.23
Exist. 2" Water Line
CAUTION

No Access

CAUTION
Med. Sta. 6445+28
Exist. Buried Tel. Cable

Med. Sta. 6439+23.20
Exist. 3" Gas Line CAUTION

Exist. Conc. Block Residence To Remain.

Exist. Conc. Block Residence To Remain

Med. Sta. 6425+70.81
Exist. 2" Water Line
CAUTION

Med. Sta. 6425+73.97
Exist. 1½" Gas Line
CAUTION

Approx. Med. Sta. 6432+73
Exist. 6" Water Line
CAUTION

FUTURE
25 Lin. Ft. New Conc. Emb. Curb Rt., Std. C-10.01.1

CULVER STREET

Med. Sta. 6445+88
Exist. 6" Water Line
CAUTION

JACKRABBIT TRAIL T.I.
For Interchange Grades, Geometrics & Details, See Detail Sheets.

NOTE: Obliterate & Remove all Cross Streets as shown within R/W

EHRENBERG - PHOENIX HIGHWAY
CEMETERY RD. - PERRYVILLE RD.
MARICOPA COUNTY

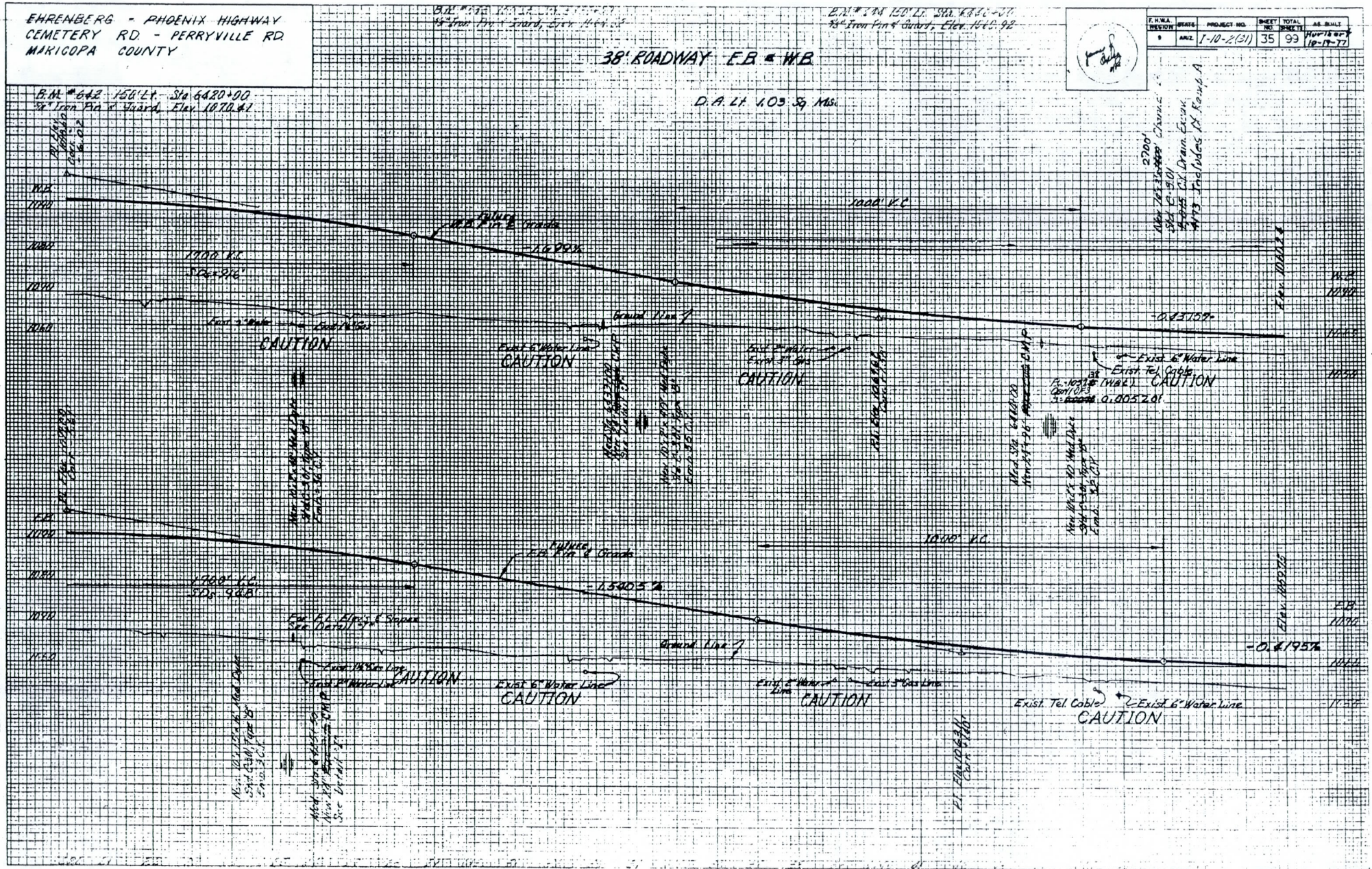
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	I-10-2(31)	35	99	Mar 15 of 16-17-77

B.M. #642 156' Lt. Sta 6420+90
24" Iron Pin & Guard, Elev 1070.41

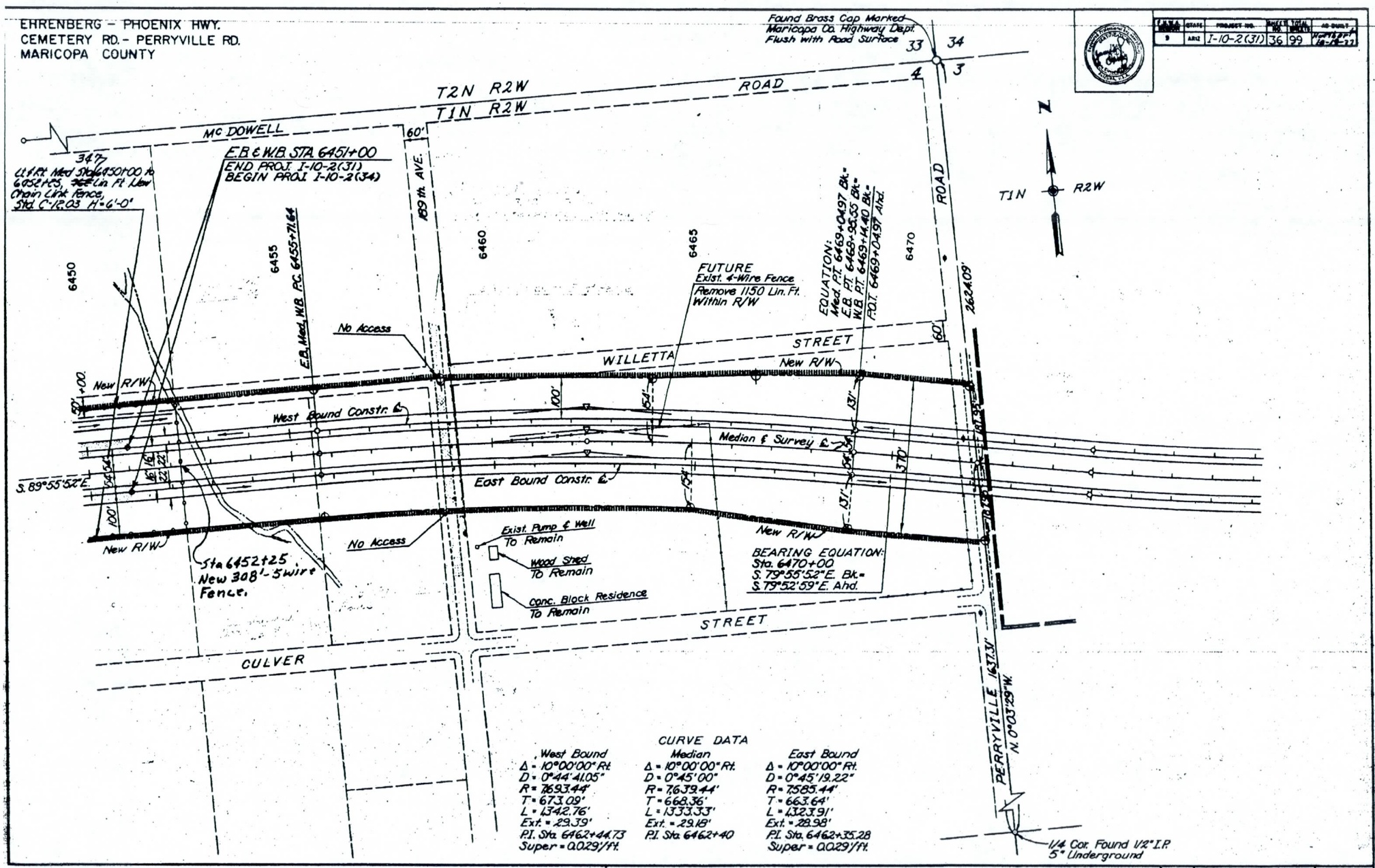
B.M. #643 150' Lt. Sta 6836+70
24" Iron Pin & Guard, Elev 1066.92

38' ROADWAY E.B. & W.B.

D.A. Lt. 1.03 Sq. Mis.

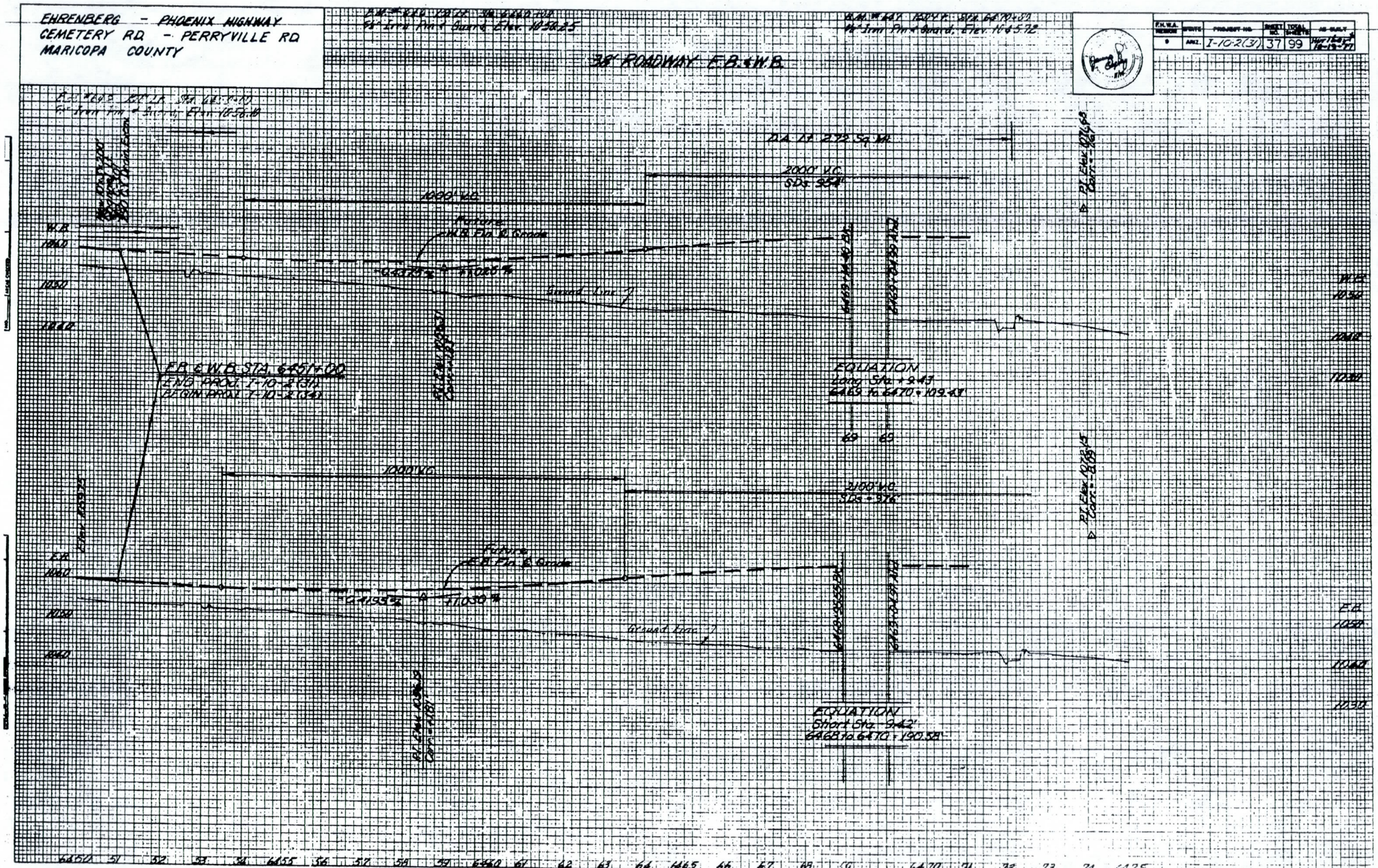


EHRENBERG - PHOENIX HWY.
CEMETERY RD. - PERRYVILLE RD.
MARICOPA COUNTY



F.A.P. No.	State	Project No.	Sheet No.	Total Sheets	No. Sheet
9	Ariz.	I-10-2(31)	36	99	

EHRENBERG - PHOENIX HIGHWAY
CEMETERY RD. - PERRYVILLE RD.
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	NO. SHEET
9	ARIZ.	I-10-2(31)	37	99	

38' ROADWAY E.B. & W.B.