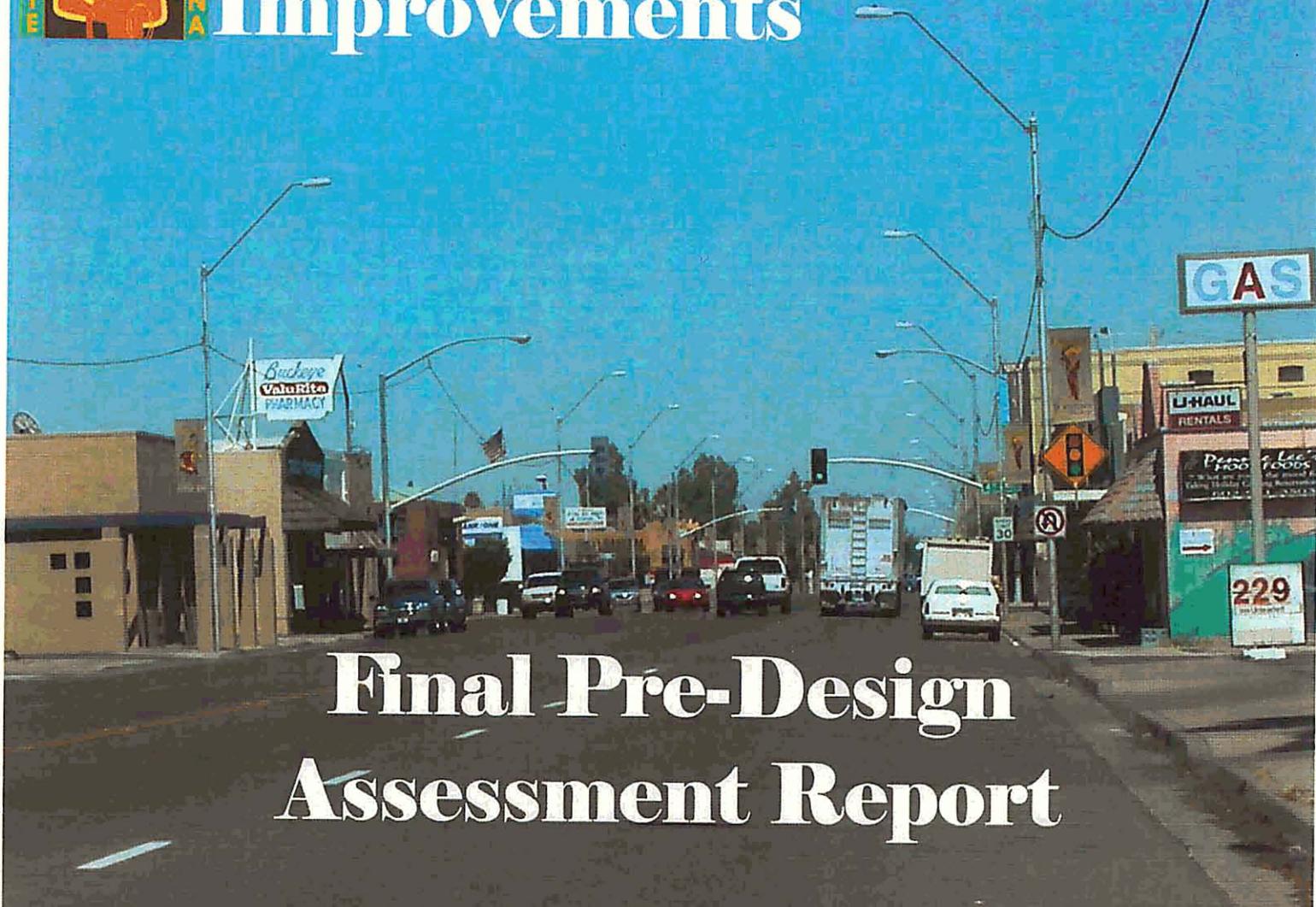




Town of Buckeye Drainage Improvements



Final Pre-Design Assessment Report



Flood Control District of Maricopa County



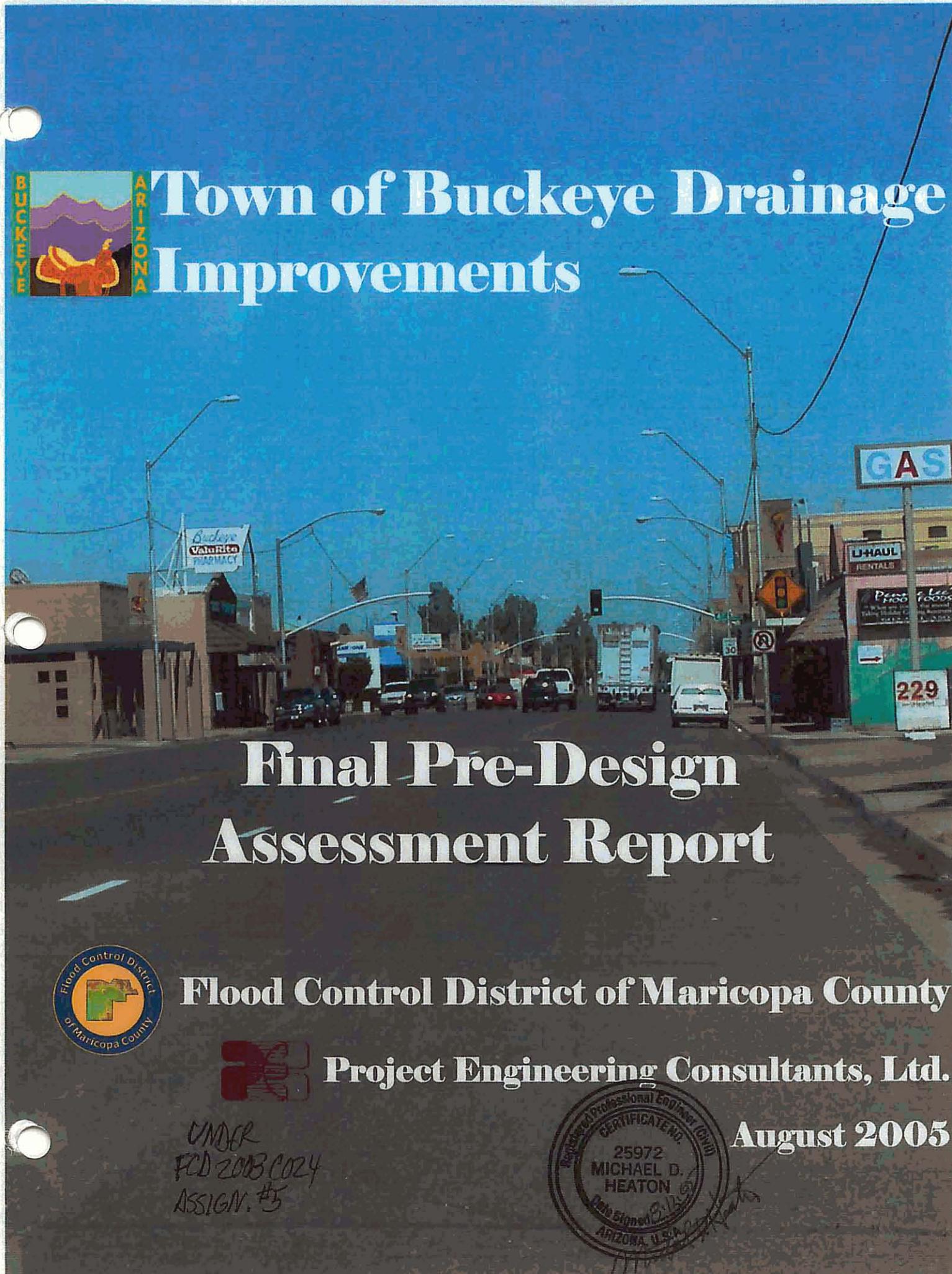
Project Engineering Consultants, Ltd.



August 2005



Town of Buckeye Drainage Improvements



Final Pre-Design Assessment Report



Flood Control District of Maricopa County



Project Engineering Consultants, Ltd.

UNDER
FCD 2003 CO24
ASSIGN. #5



August 2005

Project Engineering Consultants, Ltd.

The Downtown Buckeye Drainage Improvements Pre-Design Assessment Report was prepared for the Flood Control District of Maricopa County (FCDMC). Its purpose was to further develop the recommended alternative for the Buckeye Basin CAR (2004). The study investigated increasing the volume of the proposed basins to contain the 100-year storm runoff, examines the outfall configuration including the permits and agreements, and identifying possible utility conflicts. The utility information will be critical to for the design of the proposed storm drain facilities.

Project Engineering Consultants, Ltd. (PEC) met with the Town staff, made several site visits, and reviewed the provided utility documentation during the course of this study. PEC Engineers also met with management of the Buckeye Irrigation District and the Arlington Canal Company to determine the feasibility of using their facilities as a discharge location. PEC also attended a public meeting held in the Buckeye Community Center with the FCDMC. PEC surveyed a portion of the area to obtain additional data.

Conclusions from the Buckeye Pre-Design Assessment Report include:

- It is reasonable to construct a basin to contain the 100-year storm water runoff with a 10-year collection system.
- Groundwater does not appear to be a problem, but a soils report with borings should be done during the pre-design phase (30% plans) of the project. At least one of the borings at basin sites should attempt to determine the depth to water.
- The outfall corridor could be a multi-use public facility to make a connection to the future Buckeye Town Lake and El Rio master plan.
- The Buckeye Irrigation District drain ditch and the Arlington Canal have sufficient capacity to accept this storm water flow.
- No permits will be required to discharge into the existing irrigation facilities.
- A dedicated outfall to the Gila River could be constructed on existing ROW along the Miller Road alignment.
- A dedicated outfall to the Gila River would require a 404 permit.
- The utility provided information was not adequate to determine utility facility depths, but the corridor is relatively clear of major utilities.

The Town of Buckeye Drainage Improvement Project is a project that will benefit the residents of the Town of Buckeye and will reduce the occurrence of flooding problems. This area was developed during a time when open irrigation ditches and farm fields provided protection from excess runoff. With those fields gone and the irrigation ditches covered, flooding has become a problem in the historic downtown area.

PEC recommends the development of a major storm drain system along Monroe Avenue, a multi-use detention basin near the Buckeye Town Hall, and an outfall corridor to

discharge the storm water into existing irrigation district facilities. As the town continues to grow and develop this proposed drainage system in the downtown area will become increasingly important in minimizing the impact of future storm events in the Town of Buckeye.

Michael D. Heaton

Project Engineering Consultants, Ltd.
Michael D. Heaton, PE



Michael D. Heaton

Downtown Buckeye Drainage Improvements
Pre-Design Assessment Report
Flood Control District of Maricopa County, Arizona...

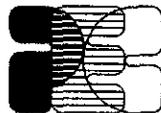


Downtown Buckeye Drainage Improvements Final Pre-Design Assessment Report Buckeye, Arizona

Prepared for:

Flood Control District of Maricopa County

Prepared by:



Project Engineering Consultants, Ltd.
2310 W. Mission Lane, Suite 4
Phoenix, Arizona 85021

August 2005



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1.0 INTRODUCTION AND PROJECT BACKGROUND

1.1 Location of Project Limits

The Buckeye Pre-Design Assessment Report is a follow on report to the Buckeye Basin Candidate Assessment Report (CAR) completed in 2004. The CAR recommended a new storm drain and detention basin storm water plan for the downtown Buckeye area.

Buckeye is located in west central Maricopa County approximately 30 miles west of Phoenix and four miles south of Interstate 10. The improvement project includes

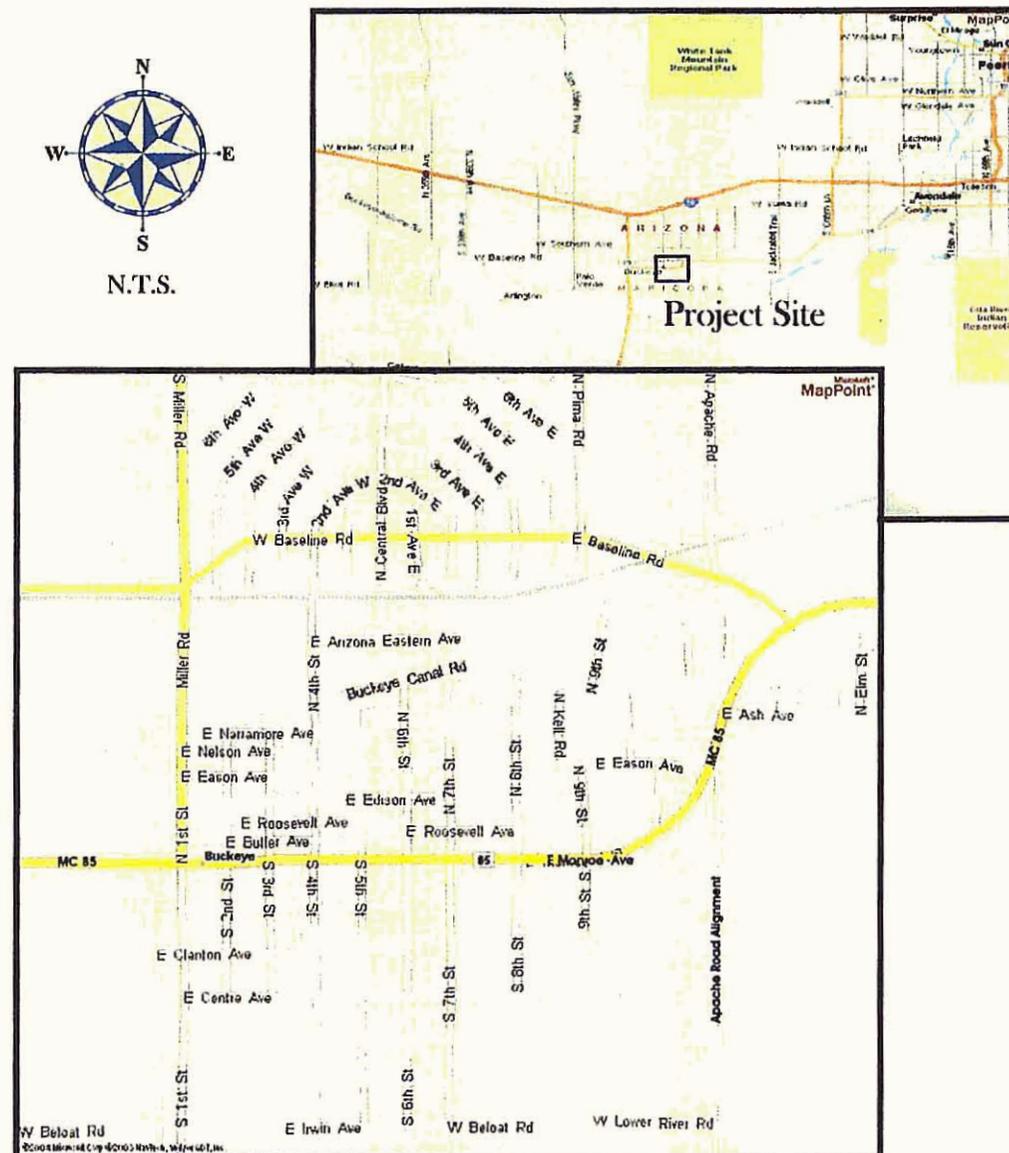


Figure 1 – Vicinity Map

Downtown Buckeye Drainage Improvements Pre-Design Assessment Report

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a proposed storm drain in Monroe Avenue (AKA MC 85) from Miller Road to Apache Road and from Baseline Road to the divide of Monroe Avenue and MC 85 east of 9th Street. The storm drains connect at this point. Also included is a proposed detention basin to be located in the vicinity of Apache Road and Monroe Avenue and a basin outfall along Apache Road alignment to Beloat Road. In addition the outfall investigation included the area south to the Gila River. The area includes portions of Sections 4, 5, 8 and 9 of Township 1 South, Range 3 West of the Gila and Salt River Base and Meridian.

1.2 Background

The Town of Buckeye submitted this project to the Flood Control District of Maricopa County (FCDMC) for evaluation as part of their Capital Improvement Projects (CIP) prioritization procedure. FCDMC asked Project Engineering Consultants, Ltd. (PEC) to evaluate the Buckeye submittal as part of FCDMC's Candidate Assessment Report (CAR) program. Additionally, PEC was contracted to determine if there were acceptable alternatives to reduce the Town of Buckeye's drainage problems. The CAR developed several alternatives and recommended one as the preferred alternative. Alternative six recommended a 10-year storm drain in Monroe Avenue from Miller Road to Baseline Avenue, two 10-year detention basins, and various local improvements around the historic town area (Ref: *Buckeye Candidate Assessment Report, June 2004*). Currently the downtown Buckeye area has a small storm drain in Monroe Avenue. The existing Storm drain is an 18" pipe and has limited conveyance for storm water.

1.3 Scope and Purpose of Study

The purpose of this study is to refine the recommended alternative concept plan developed in the Buckeye CAR study. The refinements include:

- Increasing the concept basin sizes to contain the 100-year runoff,
- to review the outfall concept to include a dedicated outfall to the Gila River and assessing the practicality of discharging the basin outflows to existing irrigation drain ditches,
- review the utility impacts of the project, and
- prepare exhibits and attend a public meeting.

A report, the color exhibits, and all data and information collected will be delivered to the District following this study.

Downtown Buckeye Drainage Improvements
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2.0 100-Year Basin Investigation

2.1 Background

The recommended alternative included a 10-year capacity basin near city Hall with a potential second basin south of Beloit Road and west of 7th Street. The city hall basin would store storm water collected by the new 10-year storm drain in Monroe Avenue and discharge a reduced peak flow into the Buckeye Irrigation District (BID) drain near Beloit Road. The second Basin, south of Beloit would store storm water flows from an area north of Beloit and also attenuate a discharge into the BID.



The vicinity of the proposed City Hall Basin

2.2 City Hall Basin

The CAR identified a 30 acre-feet basin near city hall. The feasibility design proposed a basin with a 4-acre footprint and a 10-foot depth. This study investigated a basin with a 100-Year capacity for this location. The 100-year storage volume at this location is 53 acre-feet. Table 1 presents the results of the 100-year city hall basin investigation.

Table 1

City Hall Basin – Near Monroe Avenue and Apache Road	
Basin Depth	10 Feet
Freeboard	1 Foot
Side Slopes	5 to 1
Peak Storage Volume	56 Acre Feet
Approx. Footprint	8 Acres
Natural Ground Elevation (@ Basin)	862
Natural Ground Elevation (@ Monroe Avenue & 2 nd)	872
Estimated Outlet Invert Elev. (@ Basin)	852
Estimated Outlet Invert Elev. (@ BID Drain)	842



2.3 Beloat Basin

The CAR identified an 18 acre-foot basin in the vicinity of Beloat Road and 7th Street. Since this basin is not a required facility for downtown improvements it was only proposed as an option in the CAR. However, a conceptual level design for this basin would be a 4-acre basin and a 5-foot depth. This study investigated a basin with a 100-Year capacity for this location. The 100-year volume at this location from the CAR identified a 33 acre-foot basin. Table 2 presents the results of the 100-year Beloat Basin investigation.

Table 2 *Beloat*
~~City Hall~~ Basin – Near Monroe Avenue and Apache Road

Basin Depth	5 Feet
Freeboard	1 Foot
Side Slopes	5 to 1
Peak Storage Volume	34 Acre Feet
Approx. Footprint	10 Acres
Natural Ground Elevation (@ Basin)	847
Estimated Outlet Invert Elev. (@ Basin)	843
Estimated Outlet Invert Elev. (@ Drain Ditch)	842

2.4 Ground Water

Ground water is a historic problem in this area. The depth of these basins will be dependant on the depth to groundwater. Figure 2 is a map developed from groundwater data obtained from the Arizona Department of Water Resources (ADWR). The map was developed using the newest information available for each of the wells. It is possible that the data on one well is several years older than another. However since groundwater levels do not change rapidly a disparity of this type will not produce a significant error.

The contours on Figure 2 show the depth to groundwater at various locations throughout the vicinity



BID Drain near Beloat Road

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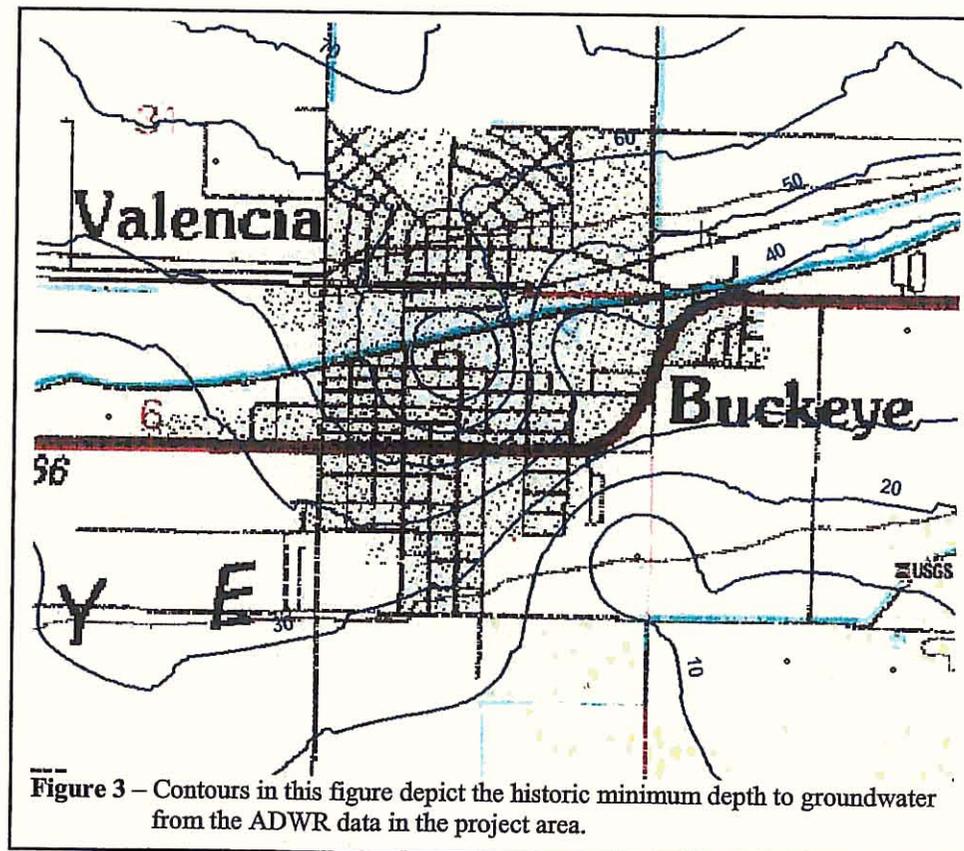
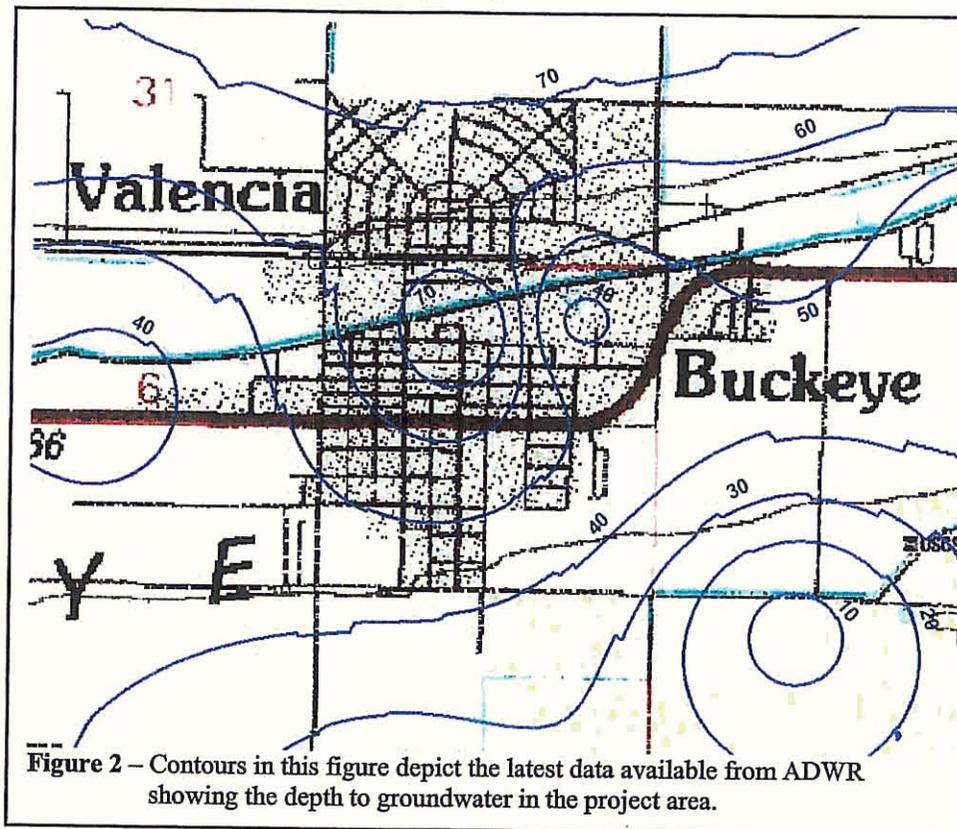
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of the Town of Buckeye. The depth to groundwater near the site of the City Hall Basin is approximately 44 feet. At the Beloat Basin site, northwest of the wastewater treatment plant, is around 40 feet. There is, however an incident that happened during the installation of a sewer pipeline in Beloat Road between 7th and Miller Road. It was reported that during this construction the pipeline floated out of the ground due to high groundwater. For this reason, the Beloat Basin is proposed to be only 5 feet in depth. Figure 2 depicts the historic minimum depth to groundwater as determined from the ADWR data.

The ADWR data shows that the basins as currently proposed should not be hindered by groundwater. However, it is recommended that during the pre-design phase of the project, soil borings be undertaken in areas where basins are proposed. These borings should be at least 45' deep (the depth of groundwater predicted by the DWR data) or to the depth of groundwater when soil profiles determined.

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3.0 Outfall Investigation

3.1 Existing Outfalls

There are two main concentration points for the study area. The first is at 7th Street and Beloit Road. Runoff generated northwest of 7th Street and MC 85 and all runoff generated south of MC 85 and west of 7th Street concentrates at this location. The concentrated flow ponds here until eventually draining into a BID surface drain via several small pipe culverts under Beloit Road. The drain discharges into the Arlington Canal about a mile to the southwest. Arlington Canal runs east to west, and crosses Miller Road approximately



Arlington Canal near Miller Road

one mile south of Beloit road. The BID surface drain along 7th Street south of Beloit Road is an auxiliary drain to the main drain that runs east to west.

The second concentration point is located at Beloit Road and the Apache Road alignment. Runoff from the remainder of the watershed concentrates and drains into the main BID surface drain at this location. This flow is then routed to the Arlington Canal. The main BID surface drain has a base flow due to the discharge of groundwater wells used by the BID to lower the water table. This enables crop production in areas with excessively high groundwater.

In general, all runoff from the town eventually enters the BID drain ditch and the Arlington Canal. The Downtown Buckeye Drainage Improvement project proposes formalizing these discharge locations and will help to reduce the impact of these storm water flows.

3.2 Dedicated Outfall

A dedicated outfall to the Gila River would be the optimum arrangement for a storm water outfall from the downtown collection facilities. Two options were investigated as dedicated outfall alignments. The locations included an



Confluence of Arlington Canal and BID Drain near Miller Road



alignment along Apache Road from the detention basin to the River (approximately 1.5 Miles) and another alignment is from the basin to Beloat Road, then west to Miller Road and then south on Miller Road to the river (about 3 Miles). Both of these alignments would require some channel work at the outfall to discharge the flow to the actual Gila Rive bed. The dedicated out fall would require a Section 404 Permit and would probably fall under the Nationwide Permit No. 7 (Outfall Structures and Maintenance). This permit requires compliance with the standards for the NPDES or AZPDES. This compliance is discussed in Section 3.5.

3.3 Outfall to Irrigation District Facilities

The Buckeye Basin CAR recommended an outfall for each of the basins that discharge into the BID Drain and Arlington Canal (ACC). Discussions with the BID and the ACC management clarified the possibility of these outfall locations. Memos for each of these meetings are in Appendix B at the end of this report.

The following bullets summarize these discussions:

- Neither BID nor ACC had a problem with receiving the storm water into their system and they realized that during major events, it entered their systems anyway.
- BID and ACC are concerned that the amount of storm water discharged to their ditches may exceed their capacity. The ACC suggested that a diversion structure could be used to divert excess flow to the river.
- The BID would want agreements with the Town for the discharge to ensure proper maintenance. The BID would do the maintenance with help funding from the town.
- The BID wants the ditch to be studied to determine if any damage would occur on their ditch and precautions should be taken to mitigate the damage. Perhaps lining in areas of bends etc.
- The BID will not allow a discharge to their tail water ditch along Apache Road between Monroe Avenue and Beloat.
- The BID drain ditch is used to convey a discharge location from the groundwater pumps which are used to lower the groundwater table. Tail water and a small existing Town of Buckeye storm drain also discharge to the BID ditch.
- The ACC Canal accepts the flow conveyed in the BID ditch.
- The ACC believes that they are under some agreement or obligation to accept the BID flows.
- Neither the BID nor ACC have agreements with the Town of Buckeye to accept runoff.

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- The ACC canal begins just east of Miller Road and south of Sunrise Road at a gravel pit that is filled with groundwater.
- Both the BID and the ACC said that if any permits were required the town would have to obtain and maintain them.

During the discussions with both districts, it was explained that the capacity of their facilities would be analyzed to ensure available conveyance capacity, that the discharges would be limited by design, that any damage expected would be mitigated, and that any water quality permits required will be obtained by the town. The possibility of a diversion structure was discussed with the ACC, but this is an option only if ACC capacity is insufficient to convey the anticipated flow.

3.4 Outfall Design

The Buckeye Basin CAR assumed the outfall from retention basins would be a pipeline from the basin to the BID drain ditch. There are several advantages to this configuration:

- Less Right-of-Way is required for pipelines
- Less hazard to the public
- Little or no maintenance

A typical pipeline outfall configuration for the Town Hall Basin is shown in Appendix C.

Another option for the outfall conveyance would be an open channel. The channel would be as deep as the basin and would become a barrier to traffic and access to property. Open channels require more maintenance and can become an "attractive nuisance". The District "kinder and gentler" (K&G) multi-use philosophy looks at this type of channel as a public thoroughfare, or place of recreation as well as a flood control facility. The Town of Buckeye has suggested that it would use the basins as multi-use facilities. The Town has also a long term plan to develop a lake park south of town near the Gila River as another recreation facility. The District is also involved in the El Rio Watercourse Master Plan though this area. With these facilities in the planning stages, an open channel K&G outfall from the basin to the south could become a major link corridor between the Downtown areas to the riverside recreation areas. A typical channel configuration for the Town Hall Basin outfall is shown in Appendix C. To determine the feasibility of such a plan, several stakeholders would need to be involved. These include the Town of Buckeye, the FCDMC, and the BID.

3.5 Permitting

The Arizona Department of Environmental Quality (ADEQ) is the state agency that regulates and permits storm water quality in the State of Arizona. Arizona's implementation of the National Pollutant Discharge Elimination System (NPDES) is known as the Arizona Pollutant Discharge Elimination System or AZPDES. During discussions with ADEQ the concept

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recommended by the Buckeye CAR was explained and information requested about permit requirements.

Regulations requiring AZDPES permits are based on the "activities" that can cause a significant loss of water quality in any waters designated as Waters of the U.S. (WOUS). There are two types of permits one is a permit for construction activities and the other is a permit for municipal and industrial activities.

Water in canals used to irrigate farmland has in the past been designated as WOUS. While it is not known if the BID drain and the ACC have been designated as WOUS, it is prudent to assume that they are such and regard the discharges as point source pollutant sources. This requires that the construction and operation of the Downtown Buckeye Drainage Improvement project should be considered under the two "activities" as previously discussed.

The first activity is construction of the drainage improvement project. It would require adherence to the AZDPES requirements during the construction. A "Notice of Intent" or NOI is required to explain what Best Management Practices or BMPs will be implemented during construction to prevent the discharge of pollutants into WOUS. The NOI and BMPs along with policies are discussed in the FCDMC's Erosion Control Manual. This manual should be used during the design and construction of the project.

The second activity is the operation of the drainage facilities. This "activity" requires that a permit be issued to communities with populations above a designated threshold to discharge their storm drain into WOUS. According to the ADEQ Buckeye does not currently qualify to be regulated based on their population. However since Buckeye is currently experiencing rapid growth, it may soon reach threshold population requirements. Additionally, the Gila River in this area has been designated as "Impaired and Threatened Waters" under Section 303(d) of the Clean Water Act. When the receiving waters carry this designation it requires additional consideration for storm water discharges. The ADEQ recommended that discharges from the drainage improvement project be treated as if they were regulated and require a permit. An email summary of the AZDEQ findings is found in Appendix D

It is recommended that the design of the Downtown Buckeye Drainage Improvement project be done in accordance with the requirements for the AZDPES permit. Storm Water Pollution Prevention Plans should be incorporated in the plans with BMPs required to prevent sediment from entering the system. Basins should be designed to retain the "first flush" storm water runoff from the drainage system. As currently configured, the basins should retain the following amounts as "first flush":

Table 3

Basin	"First Flush" Volume BMP
City Hall Basin	8.3 Acre-Feet
Beloat Basin	5 Acre-Feet

Calculation sheets showing how these amounts were determined are included in Appendix D.



4.0 Utility Investigation

4.1 Monroe Avenue – Miller Road (1st Street) to 4th Street

The following underground utilities may present conflicts in roads where propose storm drains will be located:

- Underground Telephone crossing Monroe Avenue just east of 1st Street.
- 2-inch steel gas line crosses Monroe Avenue in the east half of 1st Street. The gas line tees to the east on the north half of Monroe Avenue.
- Just west of Miller Road is concrete box culvert. This appears to be irrigation, but it also appears that a roadside catch basin is connected to this system. Also at the intersection of Miller Road and Monroe Avenue an 18" RCP crosses the intersection on the north half of Monroe Avenue and then crosses to the south side and turns east under the sidewalk continuing east. About 150' east of the intersection the pipe reduces to 15". This irrigation line turns south about 100' west of 3rd Street.
- On the west side of 2nd Street and the north side of Monroe Avenue catch basin begins a storm drain that continues to 3rd Street. At the intersection of Monroe Avenue and 3rd Street a 15" concrete storm drain connector pipe crosses the intersection from the northwest to the southeast. The pipeline apparently turns south at 3rd Street (east side).
- An 18" storm drain crosses Monroe Avenue just east of 4th Street connecting catch basins to a storm drain that begins this point.
- A two-inch waterline runs east and west just north of the curb on the south side of Monroe.
- A 12" Waterline crossed Monroe Avenue on the East half of Miller Road.
- There is a 6" VCP sanitary sewer pipe that crosses Monroe Avenue just east of the centerline of 3rd Street.



Monroe Avenue in downtown Buckeye

4.2 Monroe Avenue – 4th Street to 6th Street

The following underground utilities may present conflicts in roads where propose storm drains will be located:



- 3 underground telephone lines crossing Monroe Avenue on the west half of 6th Street (Main).
- 2-inch steel gas line crosses Monroe Avenue in the west half of 6th Street.
- An 18" storm drain crosses Monroe Avenue just east of 4th Street connecting catch basins to a storm drain that begins this point. The storm drain continues under the sidewalk on the south side of Monroe.
- Two 4" waterlines cross Monroe Avenue on each half of 4th Street. One of the lines turns east and follows Monroe Avenue on the south half of the road. The other 4" continues south on 4th Street. A two-inch water line from west of 4th Street changes to a 4" inch and continues on the south side of Monroe.

4.3 Monroe Avenue – 6th Street to 9th Street

The following underground utilities may present conflicts in roads where propose storm drains will be located:

- 4-inch steel gas line enters Monroe Avenue from the north on the west half of 6th Street turning west on the south side of Monroe Avenue. This line tees to the south on the east half of 7th Street and continues on the south side of Monroe Avenue to Apache Road. The gas line includes many service connections along Monroe Avenue from 7th to Apache Road. The line also includes a tee north and south at 8th Street, north at 9th Street and south into the mobile home park east of 9th Street. The line turns north on Apache Road.
- Three sanitary sewer lines cross Monroe Avenue at 7th Street. These include a 10" VCP and two 8" VCP pipelines.
- 8" Sewer on the north side of Monroe Avenue beginning halfway between 8th and 9th Streets.
- Two 4" waterlines continue on Monroe Avenue on the south side of road. There are 4" tees to the south at 7th, 8th, and 9th Streets.
- A 24" concrete irrigation pipeline crosses Monroe Avenue just east of 7th Street. This pipe connects to a manhole on the southeast corner. The irrigation line continues south from this point. A 24" or 18" irrigation pipeline extends east out of this same box
- An 18" storm drain crosses Monroe Avenue just east and west of 5th Street connecting catch basins to the storm drain. The storm drain continues under the sidewalk on the south side of Monroe.

Downtown Buckeye Drainage Improvements
Pre-Design Assessment Report

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- An 18" storm drain crosses 6th Street east to west just north of Monroe Avenue and then crosses Monroe Avenue just east of 6th Street connecting catch basins to the storm drain. The storm drain continues under the sidewalk on the south side of Monroe
- An 18" storm drain crosses Monroe Avenue just east and west of 7th Street connecting catch basins to the storm drain. The storm drain continues under the sidewalk on the south side of Monroe.

4.4 Monroe Avenue – 9th Street to Apache Road

The following underground utilities may present conflicts in roads where propose storm drains will be located:

- 3 underground telephone lines, at least one abandoned, enter Monroe Avenue on the east half of 9th Street and turn to the east on the south side of Monroe Avenue and extending several hundred feet then turning south off of Monroe. This facility includes a manhole in Monroe. Two lines extend across Monroe Avenue near the split with MC 85. One line continues on MC 85 to Baseline Road while the other stays on the north side of Monroe Avenue to Apache Road (Cemetery Road). There is a manhole near the intersection of Monroe Avenue and Apache Road on the north side of the road.
- 4-inch steel gas line enters Monroe Avenue from the north on the west half of 7th Street turning west on the south side of Monroe Avenue. This line tees to the south on the east half of 7th Street and continues on the south side of Monroe Avenue to Apache Road. The gas line includes many service connections along Monroe Avenue from 7th to Apache Road. The line also includes a tee north and south at 8th Street, north at 9th Street and south into the mobile home park east of 9th Street. The line turns north on Apache Road.
- 8" sewer crosses Monroe Avenue at 9th Street. The sewer is on the west side of 9th north of Monroe, and moves to the east side south of Monroe. The sewer tees on the south side of Monroe Avenue and continues to nearly Apache Road. The line also tees to the north from Monroe Avenue extending across MC 85 on the east edge of the park.
- An 8" line crosses Monroe Avenue on the west side of 9th Street. The line continues on the south side of Monroe Avenue from 9th Street to



Monroe Avenue east of 10th Street

Downtown Buckeye Drainage Improvements
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Apache Road where it turns to the north and extends to the lines crossing MC 85 north of Narramore Avenue. Another waterline parallels this line from 9th Street and turning north on Apache Road. This line is 4" at 9th and drops to 3" before it reaches Apache Road and is 2" as it turns north on Apache Road .

4.5 MC 85 - 9th Street to Baseline Avenue

The following underground utilities may present conflicts in roads where propose storm drains will be located:

- A single underground telephone line follows the MC 85 from the split with Monroe Avenue and extends to Baseline Road. It is on the south side of the road.
- A 2-inch Steel gas line crosses MC 85 at Narramore Avenue. The 4-inch steel line from the south in Apache Road enters MC 85 at Ash There is valving and several other piping arrangements at this location and a 4-inch line continues north on the east half of MC 85 to Baseline Road. A 2-inch line crosses MC 85 between Date Street and Ironwood Drive and another 2-inch line crosses at Elm Street.
- An 8" sewer line crosses MC 85 at Apache Road. The line continues north and south on Apache Road.
- 8" and 4" water lines cross MC 85 just north of Narramore Avenue. They connect to a 12" line on the west side of MC 85 from Narramore Avenue to Apache Road.

4.6 Apache Road – Monroe Avenue to Beloit Road

The following underground utilities may present conflicts in roads where propose^d storm drains will be located:

- Underground Telephone crossing Apache Road on the north side of Beloit Road.
- An 8" sewer on Apache Road extends from Monroe Avenue to Centre Street.



5.0 PUBLIC INVOLVEMENT

5.1 Public Meeting

A public meeting was held in Buckeye Arizona at the Community Center on July 20, 2005. Project stakeholders from the Town of Buckeye, the Flood Control District of Maricopa County, Project Engineering Consultants, Ltd, and members of the public were in attendance. The District has sign-in sheets and comment sheets that were filled out by those in attendance. Exhibits used for display at the meeting are in Appendix E.



APPENDIX A

Study Area Photos
(Photos attached in electronic format)

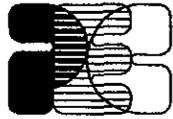


APPENDIX B

Data Collection / Meeting Notes



Memorandum



**PROJECT ENGINEERING
CONSULTANTS, LTD.**
ENGINEERS • PLANNERS • SURVEYORS

Project Name: Buckeye Basin Pre-design Assessment

Date: 5-24-05

From: Mike Heaton

To: File

Regarding: Meeting with Jacki Meck GM for the BID and Larry Owens
Superintendent for the District

Agreements between the Town of Buckeye, BID, Arlington Canal Company

The BID has no agreements with the Town of Buckeye or the Arlington Canal Company for delivery of, or quantity or quality of water. ACC does not even have to take water from this ditch, they can discharge flows to the river.

Capacity:

There is not a capacity issue with the ditch, unless you look at the 100-year runoff that reaches the ditch at Beloit Road. Jackie was quite concerned about this amount of flow reaching this location (CP Drain). I told him that the upcoming Buckeye ADMP would take up these larger issues. At this time, only the basin and storm drain was in our project. He reiterated that they would want pipes from both basins (Apache Road /Monroe Avenue & 7th/Beloat Basins) that discharge to the larger drain ditch. This was pretty clear on the Apache Road Basin, but was not shown as such for the 7th Street Basin.

Delivery Requirements:

The ditches we are proposing to use for this project are drain ditches or the BID and there are no delivery requirements. They do discharge to the ACC which does deliver to Ag fields down stream.

Water Quality:

Jacki was concerned about water quality and if there was a need for permitting (NPDES etc.) the town of FCD would have to do it, they did not want to mess with it. I told him that the basin outlet would likely be above the basin floor for water quality purposes. This would keep the "first flush" contaminants in the basin. He also mentioned that the ACC might be more concerned with the quality issue since they use the flows from the BID drains as delivery water. Jackie told the ACC contacts are Greg Gable (Pres. of Board) and Carter Gable (Father).

1 of 2

Downtown Buckeye Drainage Improvements
Pre-Design Assessment Report
Flood Control District of Maricopa County, Arizona...



Right-of-Way:

We would not be able to use the BID ROW for the pipelines, need to get new easements or ROWs.

Maintenance:

BID would maintain the canal but would probably ask the Town for remuneration for some of the maintenance. They would also be concerned if the bends of the ditches began to erode. They may require the bends be stabilized to prevent potential problems.

Miscellaneous:

Jackie mentioned that there was an issue between the BID and the ACC currently due to the movement of the ACC headwaters to the west about a mile. The discharges in the Gila this winter got behind the dikes and caused some flooding on a few of the BID farms. They would like them to move the head of the ditch back to the original location just east of the Apache Road alignment.

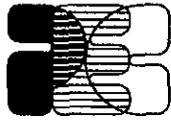
Jackie suggested that the Buckeye Lake planned for the Allenville area could use the runoff for the lake.

Jackie and Larry suggested that the water table in the area of the basin on Apache Road was only about 10 to 12 feet deep. Any basin may have to be fairly shallow to accommodate the storm water we are proposing to put there. I told him I believe we did consider that in the CAR. He said that the sanitary sewer ~~the~~ installed a few years ago in Beloit between 7th and 1st actually floated twice during construction.

Jackie was very concerned about the 100-year storm shown on our exhibit that all of the storm water from the area reaches the bend near the treatment plant. Since all of the ditches will be taking on water from storms, what will happen in this case? I told him that the basins would actually help since they will attenuate the flows and make it better ~~that~~ ^{than} it is currently if a large storm were to hit.



Memorandum



**PROJECT ENGINEERING
CONSULTANTS, LTD.**
ENGINEERS • PLANNERS • SURVEYORS

Project Name: Buckeye Basin Pre-design Assessment

Date: 6-27-05

From: Mike Heaton

To: File

Regarding: Meeting with Carter Gable VP for the Arlington Canal Company

Agreements between the Town of Buckeye, BID, Arlington Canal Company

Carter Carter thought that they had an agreement or something to take the water from the BID drain ditch. He was not sure.

Capacity:

There is not a capacity issue with the canal. The discharge is at the upper end of the canal and the only flow in the canal at Miller Road is the plant effluent from a ≈ 8 " pipe and the BID drain ditch amount.

Delivery Requirements:

The Arlington canal company delivers irrigation water to agricultural fields in Arlington Arizona, about 10 miles to the west of Buckeye along the Gila River.

Water Quality:

Carter did not have much to say about quality, just that if permits were required, the city or county should take care of getting and maintaining the permits.

Right-of-Way:

We would not be able to use the ACC ROW for the pipelines, need to get new easements or ROWs.

Maintenance:

ACC would maintain the canal and wants assurance that flows would not impact the canals operation ,

Downtown Buckeye Drainage Improvements
Pre-Design Assessment Report

Flood Control District of Maricopa County, Arizona...



Miscellaneous:

I met with Carter on Monday the 27th of June to discuss the Buckeye Storm drain project. I explained how the project would work and how it would affect his canal. He understood and wanted to take me to the canal and show me a few things.

We drove to Miller Road and the Arlington Canal crossing. We turned and went down the canal bank to the east. There was a Gradall working to clean the canal bank. He said the canal has a large capacity but requires regular cleaning. We drove about ¼ mile to a pond/gravel mine. The Arlington Canal essentially begins at this pond. It used to begin further to the east, but the pit cut it off. At times they pump the water from the pit into the canal. Currently the canal at this point is dry. The first flows in the canal are from a pipeline approximately 600' west of Miller Road. This pipeline conveys effluent from the Buckeye Wastewater Treatment Plant discharging it to the canal.

We drove back to Miller Road. Carter was concerned about quantity of water that would enter the canal. I said that the system would be designed to limit the flow into the BID ditch and the Arlington Canal. I also suggested that a diversion structure could be built to divert excess flows to the river.



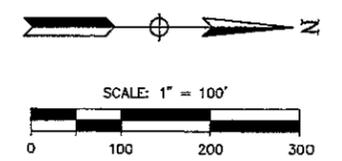
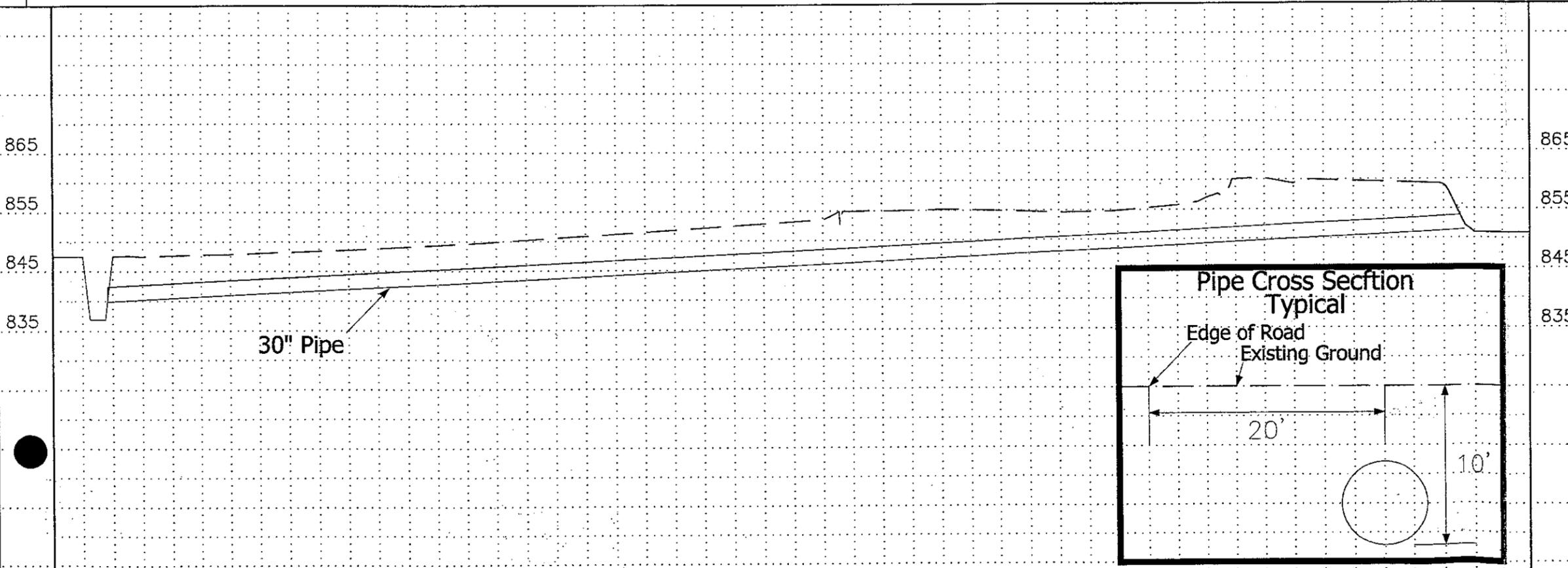
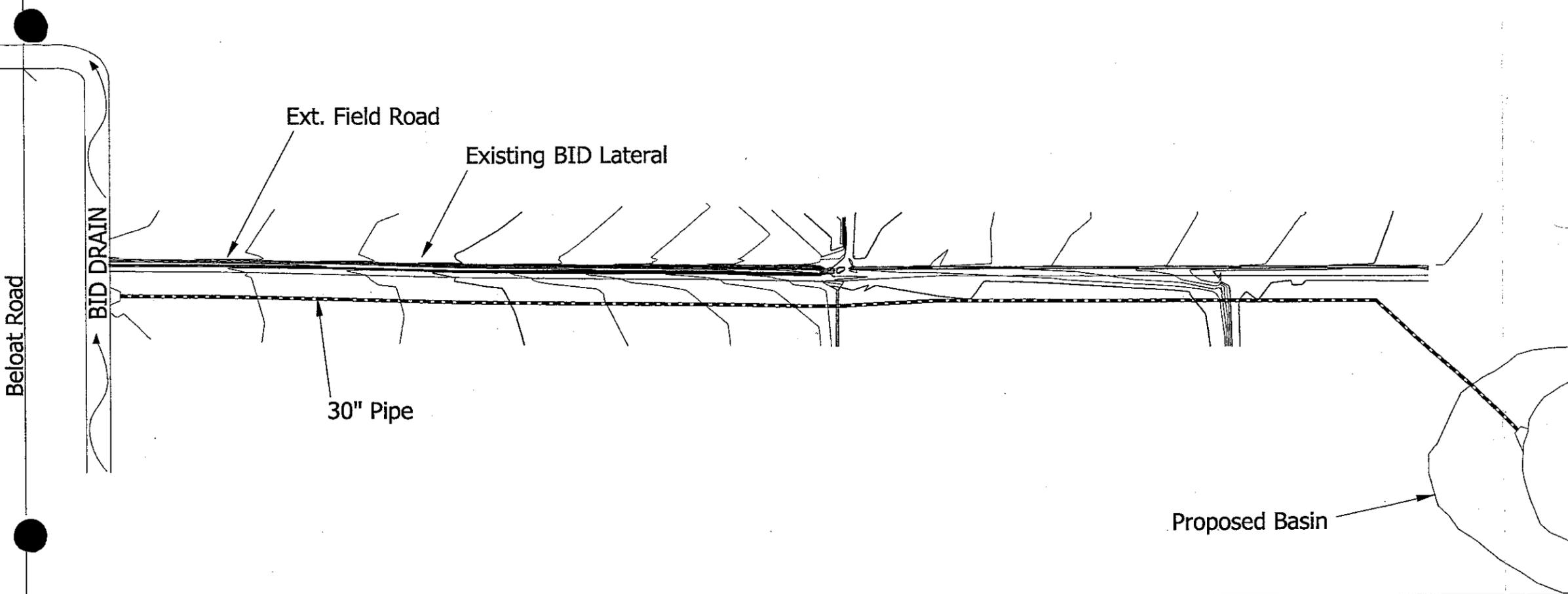
APPENDIX C

Outfall Plan and Profile Exhibits

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY



Pipe
Alternative



DATE	REVISION	BY

PROJECT ENGINEERING CONSULTANTS, LTD.
2310 W. MISSION LANE, STE. 4
PHOENIX, ARIZONA 85201

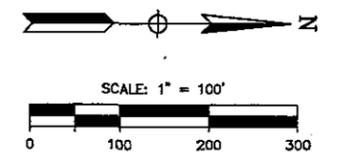
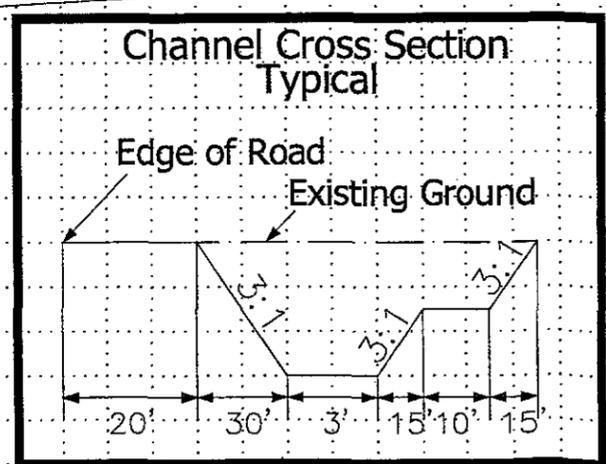
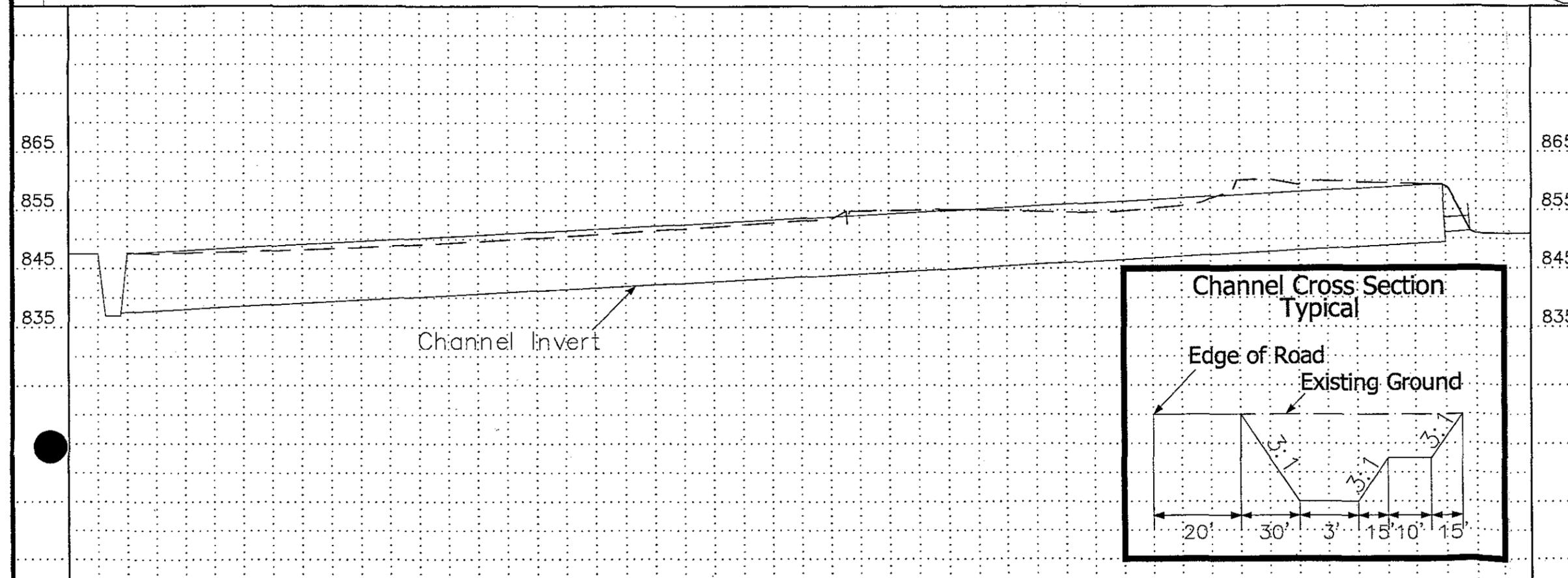
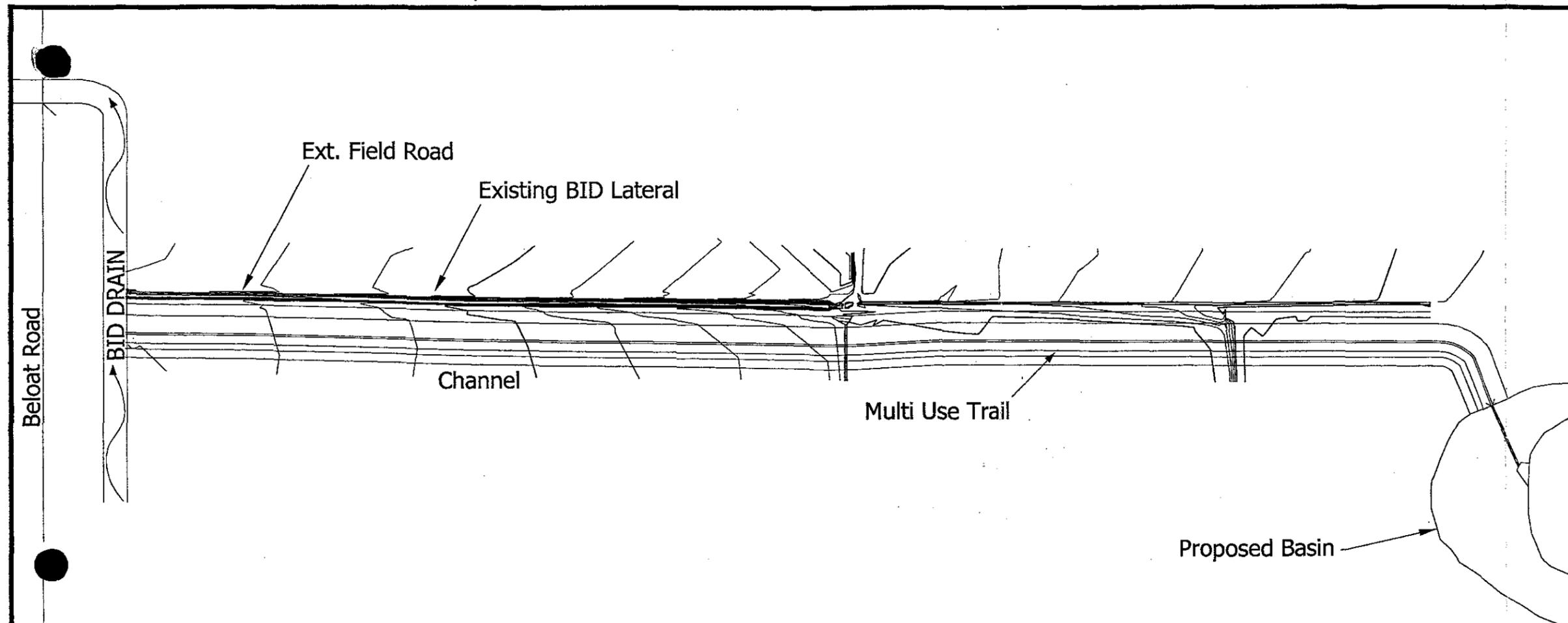
DOWNTOWN BUCKEYE
DRAINAGE IMPROVEMENTS

DESIGN	BY GSB	DATE 5/04	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	MDH	5/04	
PLANS	GSB	5/04	RECOMMENDED BY: _____ DATE: _____
PLANS CHK.	MDH	5/04	APPROVED BY: _____ DATE: _____
SUBMITTED BY:	DATE: _____		CHIEF ENGINEER AND GENERAL MANAGER
			SHEET _____ OF _____

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY



Channel Alternative



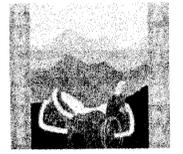
DATE	REVISION	BY

PROJECT ENGINEERING CONSULTANTS, LTD.
2310 W. MISSION LANE, STE. 4
PHOENIX, ARIZONA 85201

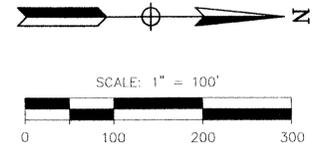
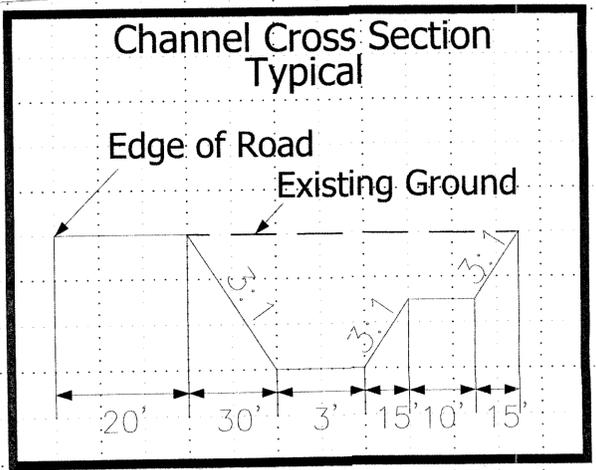
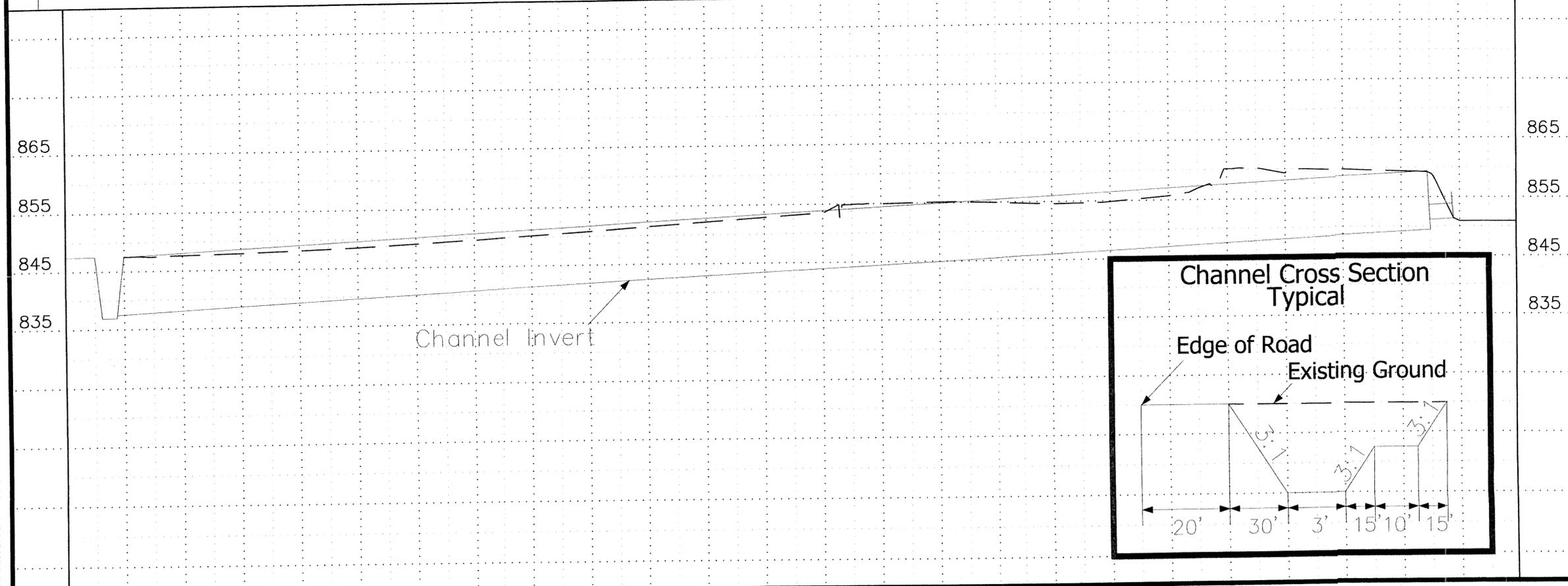
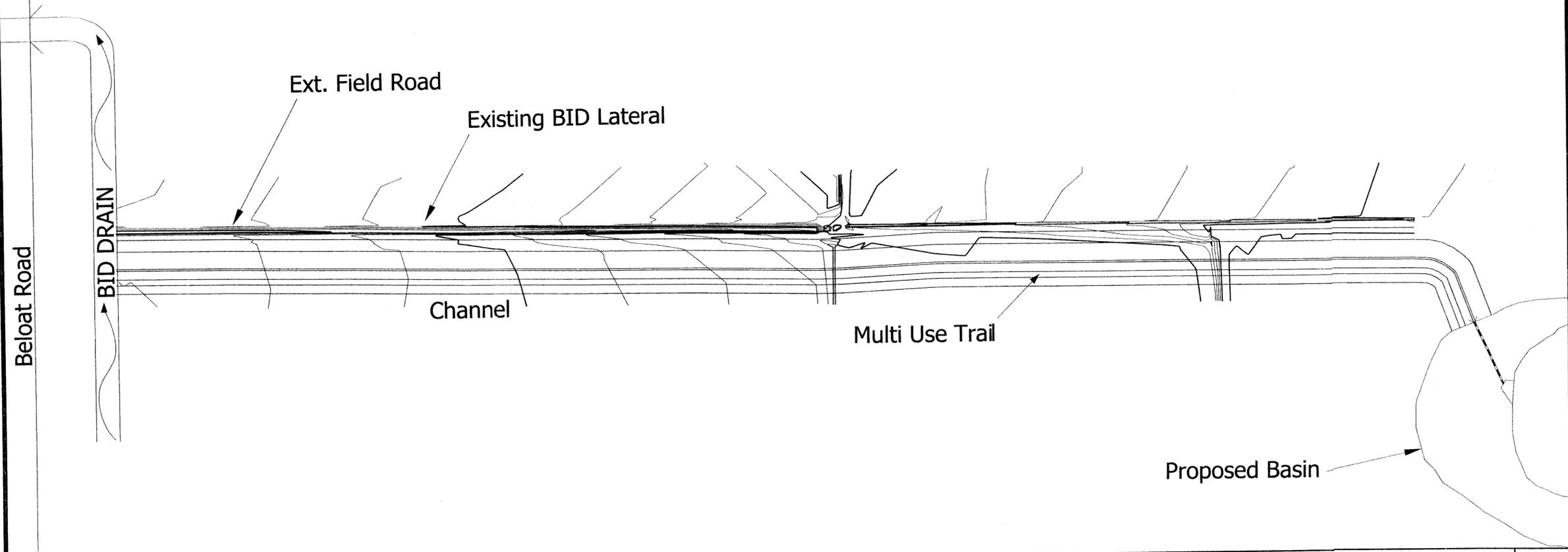
DOWNTOWN BUCKEYE DRAINAGE IMPROVEMENTS

DESIGN	BY GSB	DATE 5/04	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	MDH	5/04	
PLANS	GSB	5/04	RECOMMENDED BY: _____ DATE _____
PLANS CHK.	MDH	5/04	APPROVED BY: _____ DATE _____
SUBMITTED BY:	DATE: _____		CHIEF ENGINEER AND GENERAL MANAGER SHEET _____ OF _____

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY



Channel Alternative



DATE	REVISION	BY

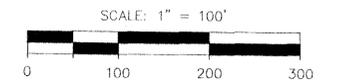
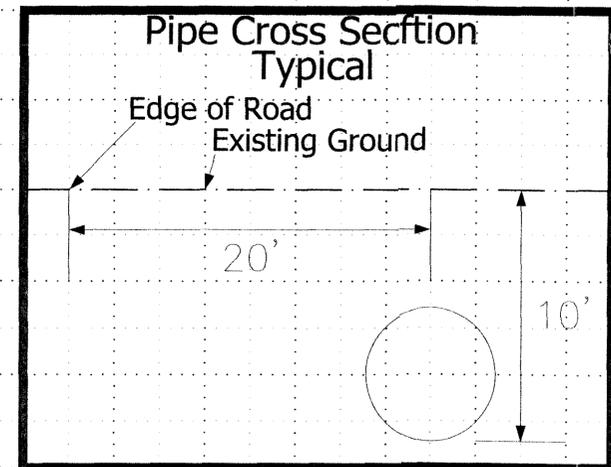
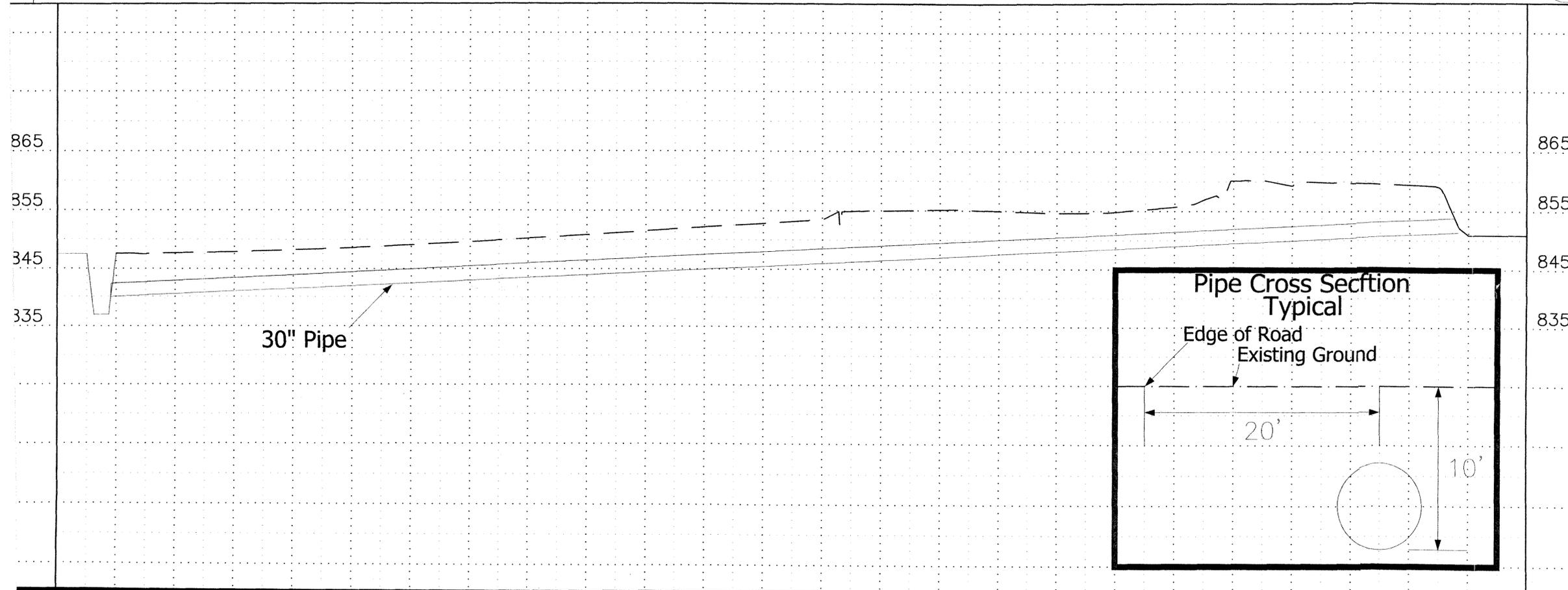
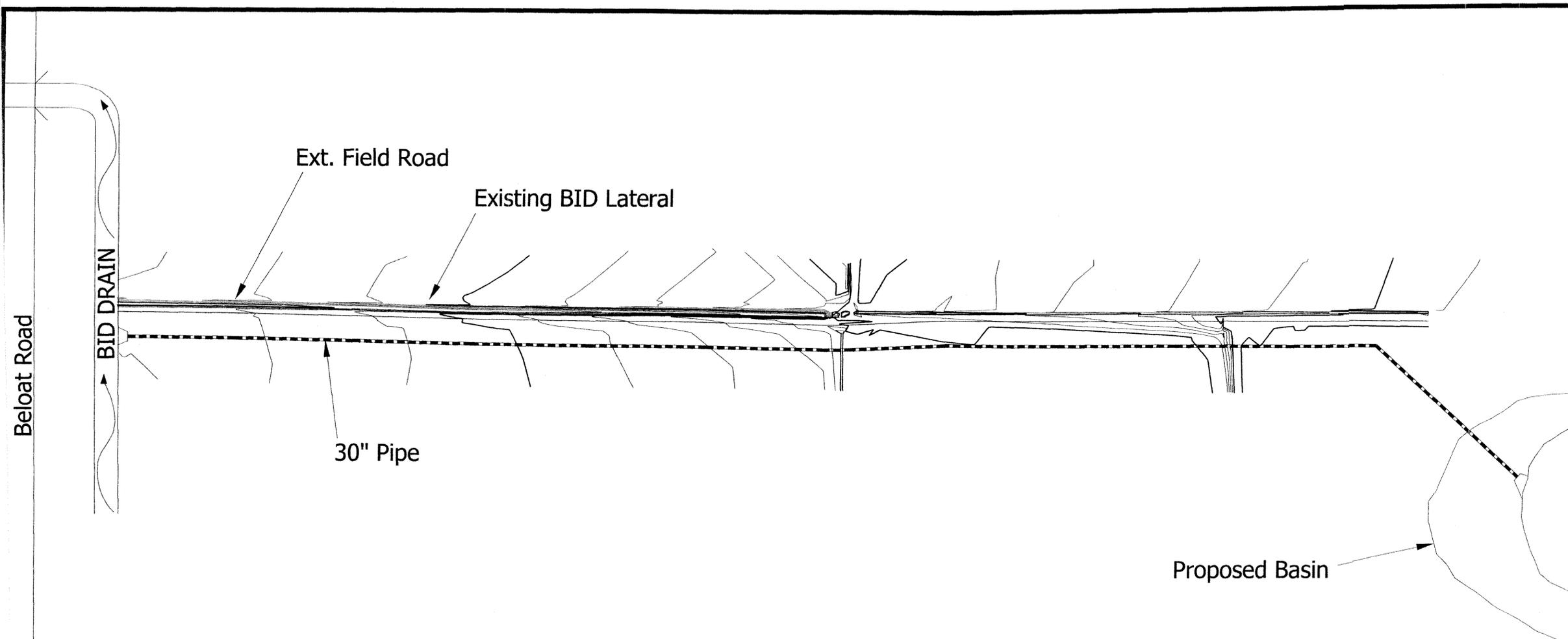
PROJECT ENGINEERING CONSULTANTS, LTD.
2310 W. MISSION LANE, STE. 4
PHOENIX, ARIZONA 85201

DOWNTOWN BUCKEYE DRAINAGE IMPROVEMENTS

DESIGN	BY GSB	DATE 5/04	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	MDH	5/04	RECOMMENDED BY: _____ DATE _____
PLANS	GSB	5/04	APPROVED BY: _____ DATE _____
PLANS CHK.	MDH	5/04	CHIEF ENGINEER AND GENERAL MANAGER
SUBMITTED BY:	DATE:		SHEET _____ OF _____



Pipe Alternative



DATE	REVISION	BY

**PROJECT ENGINEERING
CONSULTANTS, LTD.**
2310 W. MISSION LANE, STE. 4
PHOENIX, ARIZONA 85201

DOWNTOWN BUCKEYE DRAINAGE IMPROVEMENTS

DESIGN	BY GSB	DATE 5/04	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	MDH	5/04	
PLANS	GSB	5/04	RECOMMENDED BY: _____ DATE: _____
PLANS CHK.	MDH	5/04	APPROVED BY: _____ DATE: _____
SUBMITTED BY:	DATE: _____		CHIEF ENGINEER AND GENERAL MANAGER
SHEET _____ OF _____			



APPENDIX D

AZDPES Information

Downtown Buckeye Drainage Improvements
Pre-Design Assessment Report
Flood Control District of Maricopa County, Arizona...



-----Original Message-----

From: Kim Lincoln [mailto:Lincoln.Kim@azdeq.gov]
Sent: Wednesday, July 20, 2005 5:04 PM
To: mike@pecaz.com
Cc: Kim Lincoln; Chris Varga
Subject: Town of Buckeye Stormwater Permits

Mike,

This is a follow up to our telephone conversation today about stormwater permit requirements for the installation and operation of the storm drain and retention basin project located within the Town of Buckeye. As I understand this project, Maricopa County Flood Control District will build the storm drain and retention basin and the Town of Buckeye will assume responsibility for the operation and maintenance of these structures following construction. The retention basin will be used to contain stormwater runoff from residential and commercial areas within the Town. The basin will receive stormwater only. The basin will overflow to the Buckeye drain, which is owned by the Buckeye Irrigation District, and continue to flow to the Arlington Canal, operated by the Arlington Irrigation Canal Co. The water from these canals is used for irrigation or otherwise flows to the Gila River. No dewatering operations are associated with this project.

Based on this information, I have briefly summarized our discussion today as follows:

1. The Town of Buckeye is not a regulated Small MS4 so the municipal stormwater permit requirements do not apply at this time.
2. The stormwater permit for construction activity (i.e. Construction General Permit) is required for the installation/construction of these structures.
3. No stormwater permit is required to operate the retention basin or to discharge overflows to the irrigation canals, provided the basin receives and discharges stormwater only.
4. It is illegal to discharge pollutants to 'waters of the U.S.' without a permit. Therefore, the town may want to take the necessary precautions or implement pollution controls to prevent stormwater pollution during the operational life of the basin. Otherwise, the town may be required to obtain a stormwater permit if it is determined that pollutants are being discharged in stormwater.
5. If applicable, dewatering operations are subject to ADEQ's Deminimus General Permit.

Thank you for your inquiry.

Kim Lincoln
AZPDES Stormwater Permits
Arizona Department of Environmental Quality
(602) 771-4376
lincoln.kim@azdeq.gov

Downtown Buckeye Drainage Improvements
Pre-Design Assessment Report
Flood Control District of Maricopa County, Arizona...



APPENDIX E

Public Meeting Exhibits & Information



Downtown Buckeye Drainage Improvements



The Flood Control District of Maricopa County in partnership with the Town of Buckeye is working to provide drainage alternatives in the downtown Buckeye area.

Drainage improvements will include:

- A stormdrain collection system along Monroe Avenue
- A retention basin near Buckeye Town Hall
- Local drainage improvements

These improvements will reduce flooding hazards in Historic Downtown Buckeye by providing conveyance and storage for stormwater.



Downtown Buckeye Drainage Improvements Project Timeline and Costs



	<u>ACTIVITY</u>	<u>ESTIMATED COSTS</u>
Phase 1	Pre-design of the entire system	\$200,000
Phase 2	Land Acquisition and Local Improvements	\$634,000
Phase 3	Design and Construction of the Detention Basin and Outfall Pipeline	\$690,000
Phase 4	Design and Construction of Storm Drain from Baseline Road to 9th Street & Outfall to Basin	\$705,000
Phase 5	Design and Construction of Storm Drain from 9th Street to Miller Road	\$1,700,000



**Downtown Buckeye Drainage Improvements
Pre-Design Assessment Report**
Flood Control District of Maricopa County, Arizona...

Supervisor:
District 4, Max Wilson

**Downtown Buckeye
Drainage Improvements**



**Open
House**
Announcement



7801 West Durango Street
Phoenix, Arizona 85009
602.506.1501

Flood Control District of Maricopa County
60058 Avenida Durango Street
2801 West 10th Street
Phoenix, Arizona 85009

Downtown Buckeye Drainage Improvements Pre-Design Assessment Report

Flood Control District of Maricopa County, Arizona...



Open House

Downtown Buckeye Drainage Improvements

The Flood Control District of Maricopa County (District) in partnership with the Town of Buckeye invite those interested to attend a public open house presenting a proposed alternative to alleviate current drainage problems. The project team is moving forward from the data collection phase to a pre-design phase where the project will be further developed.

The purpose of the project is to provide drainage alternatives in the downtown Buckeye area. Flooding currently occurs in several locations. The current storm drain in Monroe Avenue is undersized, providing little to no protection even from shallow flooding. A larger drainage system in Monroe Avenue will reduce flooding in the downtown area and in various other locations south of this roadway.

The project area is Monroe Avenue in downtown Buckeye, and an area on the east end of the downtown area currently agricultural fields. Proposed improvements include a storm drain collection system along Monroe Avenue from 2nd Street to Baseline Avenue, and a detention basin near the intersection of Monroe Avenue and Apache Road.

Representatives from the District, the Town of Buckeye and the contracted engineering-consulting firm will be present at the open house to discuss the study and answer questions.

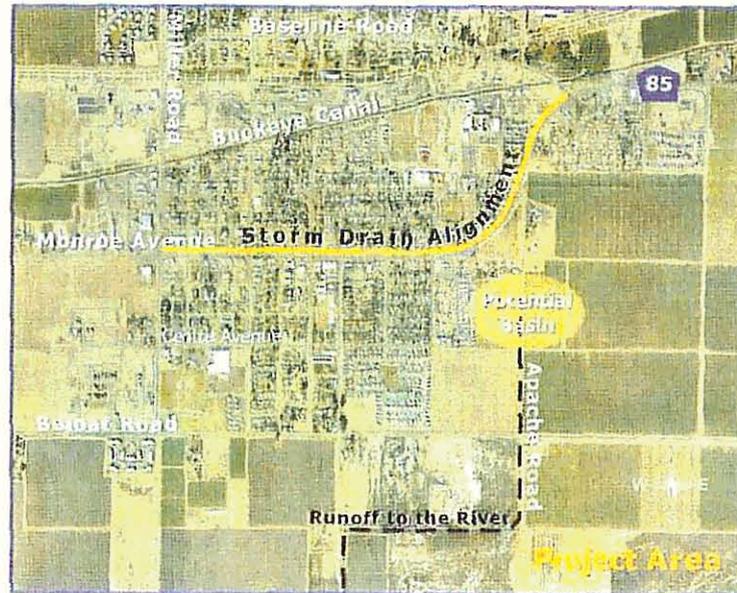
Meeting Date and Location

Wednesday, July 20, 2005

6:00 - 8:00PM

Buckeye Community Center

201 E Centre Avenue
Buckeye, AZ 85326



Project Timeline and Costs

There are five phases of the Downtown Buckeye Drainage Improvements. It will take approximately one year to design and construct each phase of the project. Budgeted costs are listed below:

Phase 1	Pre-design of the entire system	\$200,000
Phase 2	Land Acquisition and Local Improvements	\$534,000
Phase 3	Design and Construction of the Detention Basin and Outfall Pipeline	\$500,000
Phase 4	Design and Construction of Storm Drain from Baseline Avenue to 9th Street & Outfall to Basin	\$705,000
Phase 5	Design and Construction of Storm Drain from 9th Street to Miller Road	\$1,000,000

For more information, contact

Valerie Swick, Project Manager
(602) 506-2929
vas@mail.maricopa.gov

2801 West Durango Street, Phoenix, Arizona 85009

www.fcd.maricopa.gov



PUBLIC MEETING

Downtown Buckeye Drainage Improvements Comment Sheet July 20, 2005

Name: June Christy
Address: 6319 W Redfield Rd Glendale AZ 85306
Phone Number: 623 846 0329 Email: offic@4550@aol.com

1. Please provide any comments on the Downtown Buckeye Drainage Improvements.

- ① Please e-mail me w/ a real maps. Thanks.
- ② It seems to be that ^{that} open channel would be not only unattractive, but also costly for city to maintain. Please consider health hazard (mosquito etc) plus liability issues (children may fall in)
- ③ Any update on this project - please email. Thanks
- ④ How about flood happens in this area in last 20 years?

2. How did you hear about tonight's meeting?

Newspaper Brochure in the Mail Friend/Neighbor Other

3. How would you rate the overall knowledge and helpfulness of the staff members?

Very Good Good Fair Poor Very Poor

4. Was the project information presented in an understandable manner?

Yes No

THANK YOU FOR COMING TONIGHT



PUBLIC MEETING

Downtown Buckeye Drainage Improvements Comment Sheet July 20, 2005

Name: Dale Parker
Address: 12100 S. Dorn Rd. Buckeye, AZ 85326
Phone Number: 623 586 2316 Email: pale.parker@CDTds.net

1. Please provide any comments on the Downtown Buckeye Drainage Improvements.

Pleased to see this project is in the offing.
Hope it will improve drainage at Apache Rd
North of MC 85 (Mesa...)

2. How did you hear about tonight's meeting?

Newspaper Brochure in the Mail Friend/Neighbor Other

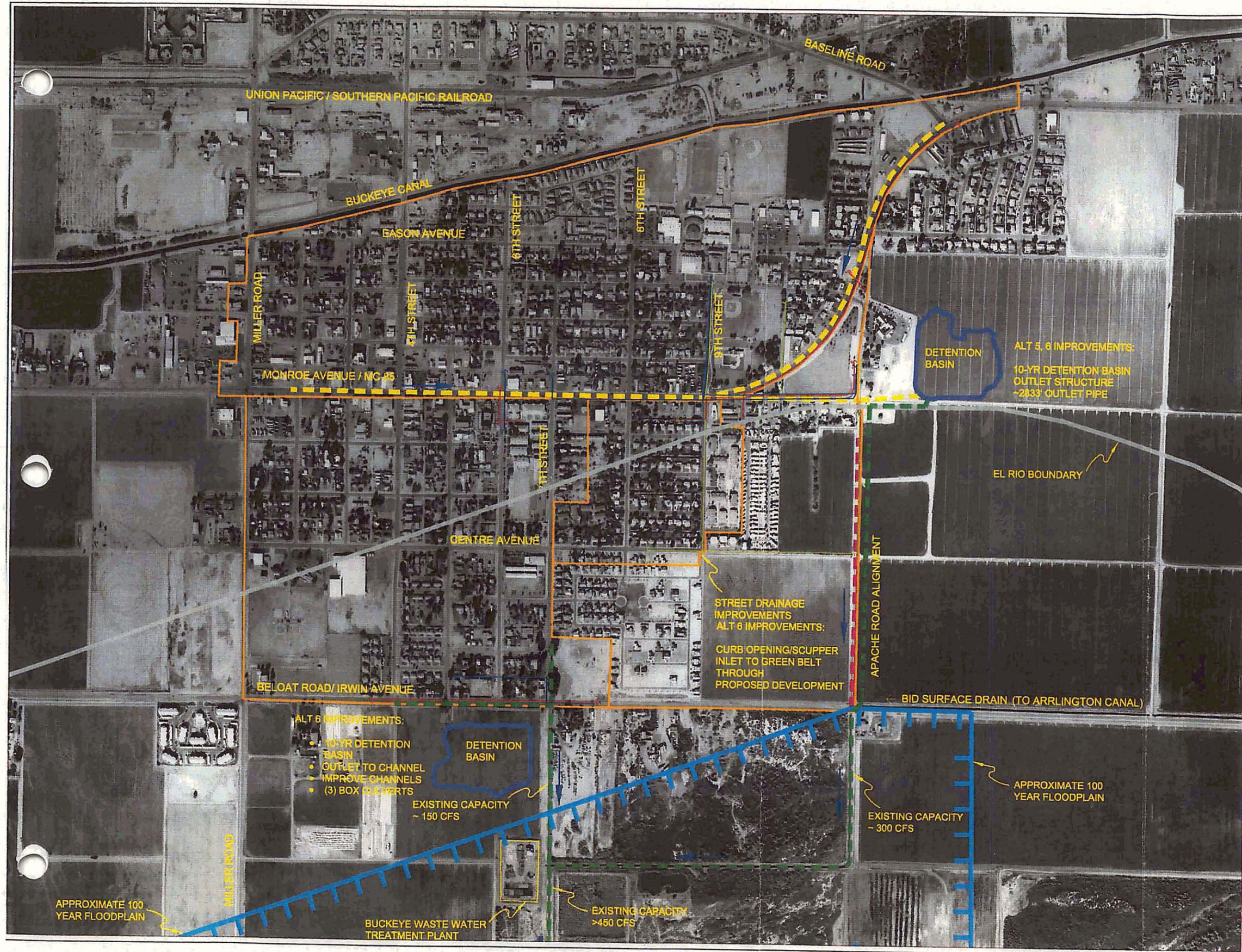
3. How would you rate the overall knowledge and helpfulness of the staff members?

Very Good Good Fair Poor Very Poor

4. Was the project information presented in an understandable manner?

Yes No

THANK YOU FOR COMING TONIGHT



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY



LEGEND

- AREA OF PROPOSED
- EL RIO PLANNING AREA BOUNDARY
- APPROXIMATE 100-YEAR FLOODPLAIN
- POTENTIAL OPEN CHANNEL OUTFALLS
- POTENTIAL PIPE OUTFALL ALIGNMENTS
- POTENTIAL STORM DRAIN ALIGNMENTS
- EXISTING PIPE
- FLOW DIRECTION
- CONTRIBUTING AREA BOUNDARIES
- TOWN OF BUCKEYE WATER
- TOWN OF BUCKEYE SEWER
- SOUTHWEST GAS UNDERGROUND UTILITY
- QWEST COMMUNICATIONS UNDERGROUND UTILITY



SCALE 1"=400'
0 200 400 800

DATE	REVISION	BY



PROJECT ENGINEERING CONSULTANTS, LTD.
2310 W. MISSION LANE, STE. 4
PHOENIX, ARIZONA 85201

DOWNTOWN BUCKEYE DRAINAGE IMPROVEMENTS

DESIGN	BY GSB	DATE 5/04	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	MDH	5/04	
PLANS	GSB	5/04	
PLANS CHK.	MDH	5/04	
SUBMITTED BY:			RECOMMENDED BY: DATE
			APPROVED BY: DATE
			CHEF ENGINEER AND GENERAL MANAGER
			SHEET 1 OF 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY



LEGEND

- AREA OF PROPOSED
- EL RIO PLANNING AREA BOUNDARY
- APPROXIMATE 100-YEAR FLOODPLAIN
- POTENTIAL OPEN CHANNEL OUTFALLS
- POTENTIAL PIPE OUTFALL ALIGNMENTS
- POTENTIAL STORM DRAIN ALIGNMENTS
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- TOWN OF BUCKEYE WATER
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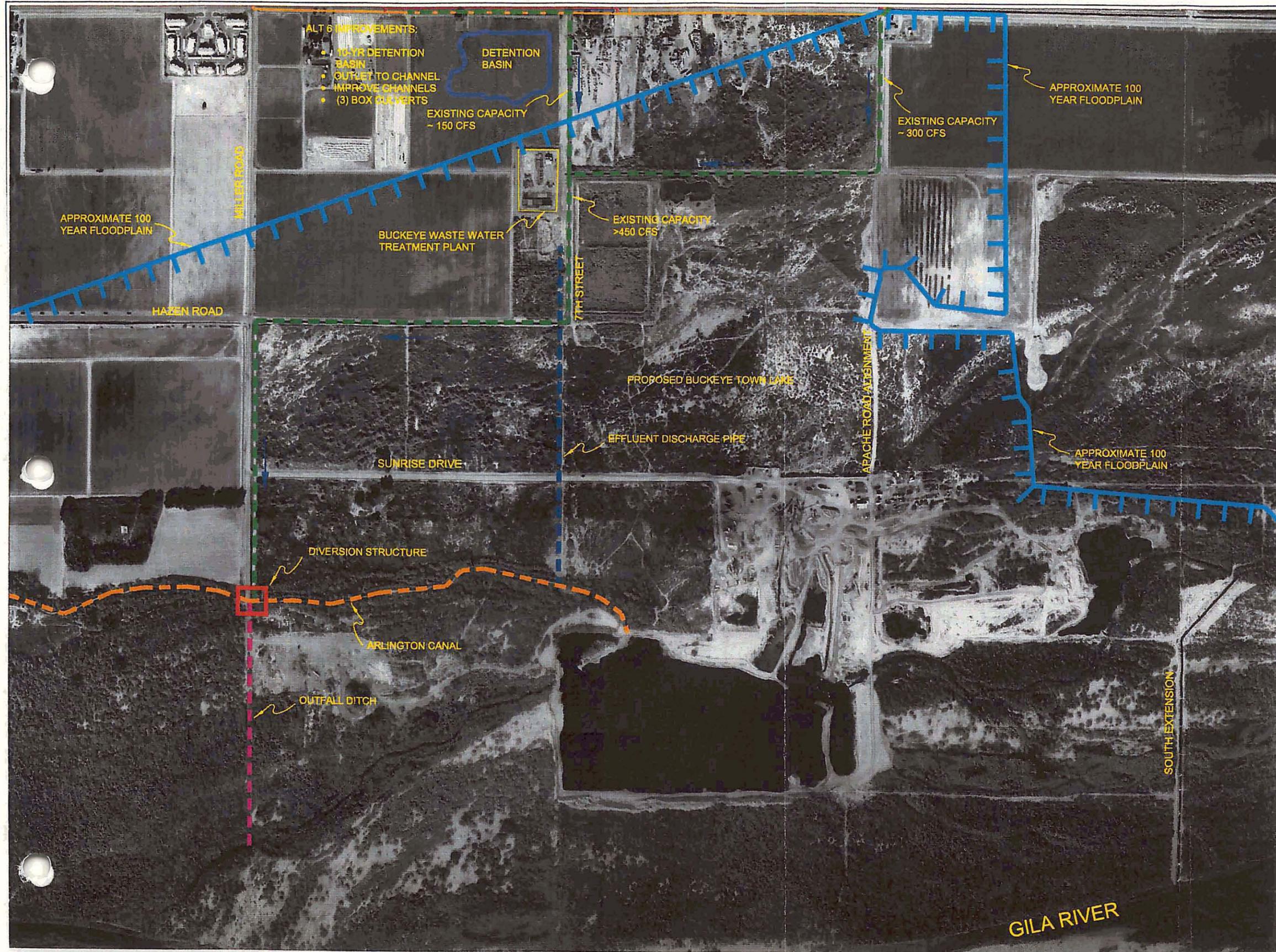
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DATE	REVISION	BY

PROJECT ENGINEERING CONSULTANTS, LTD.
2310 W. MISSION LANE, STE. 4
PHOENIX, ARIZONA 85201

DOWNTOWN BUCKEYE DRAINAGE IMPROVEMENTS

DESIGN	BY	DATE	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN	GSE	5/04	
DESIGN CHK.	MDH	5/04	RECOMMENDED BY: DATE
PLANS	GSE	5/04	APPROVED BY: DATE
PLANS CHK.	MDH	5/04	CHEF ENGINEER AND GENERAL MANAGER
SUBMITTED BY:	DATE:	SHEET	2 OF 2

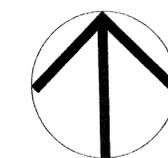


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY



LEGEND

- AREA OF PROPOSED
- EL RIO PLANNING AREA BOUNDARY
- APPROXIMATE 100-YEAR FLOODPLAIN
- POTENTIAL OPEN CHANNEL OUTFALLS
- POTENTIAL PIPE OUTFALL ALIGNMENTS
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- TOWN OF BUCKEYE WATER
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- SOUTHWEST GAS UNDERGROUND UTILITY
- QWEST COMMUNICATIONS UNDERGROUND UTILITY



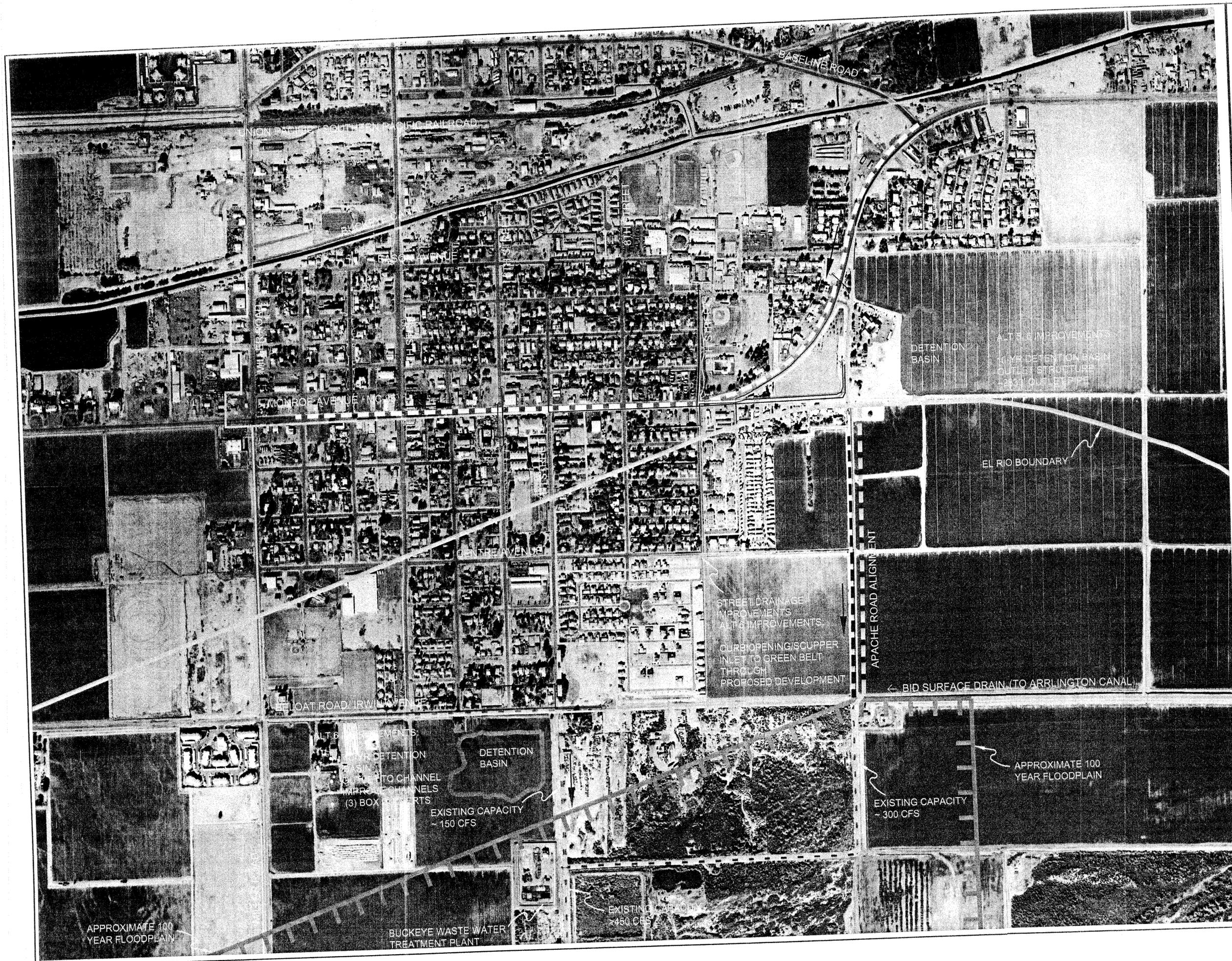
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DATE	REVISION	BY

PROJECT ENGINEERING CONSULTANTS, LTD.
2310 W. MISSION LANE, STE. 4
PHOENIX, ARIZONA 85201

DOWNTOWN BUCKEYE DRAINAGE IMPROVEMENTS

DESIGN	BY	DATE	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN	CSB	5/04	
DESIGN CHK.	MDH	5/04	
PLANS	CSB	5/04	
PLANS CHK.	MDH	5/04	
SUBMITTED BY:	DATE:		RECOMMENDED BY: _____ DATE _____
			APPROVED BY: _____ DATE _____
			CHIEF ENGINEER AND GENERAL MANAGER
			SHEET 1 OF 2

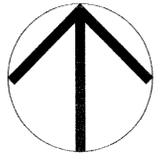


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY



LEGEND

- AREA OF PROPOSED EL RIO PLANNING AREA BOUNDARY
- APPROXIMATE 100-YEAR FLOODPLAIN
- POTENTIAL OPEN CHANNEL OUTFALLS
- POTENTIAL PIPE OUTFALL ALIGNMENTS
- POTENTIAL STORM DRAIN ALIGNMENTS
- EXISTING PIPE
- FLOW DIRECTION
- CONTRIBUTING AREA BOUNDARIES
- TOWN OF BUCKEYE WATER
- TOWN OF BUCKEYE SEWER
- SOUTHWEST GAS UNDERGROUND UTILITY
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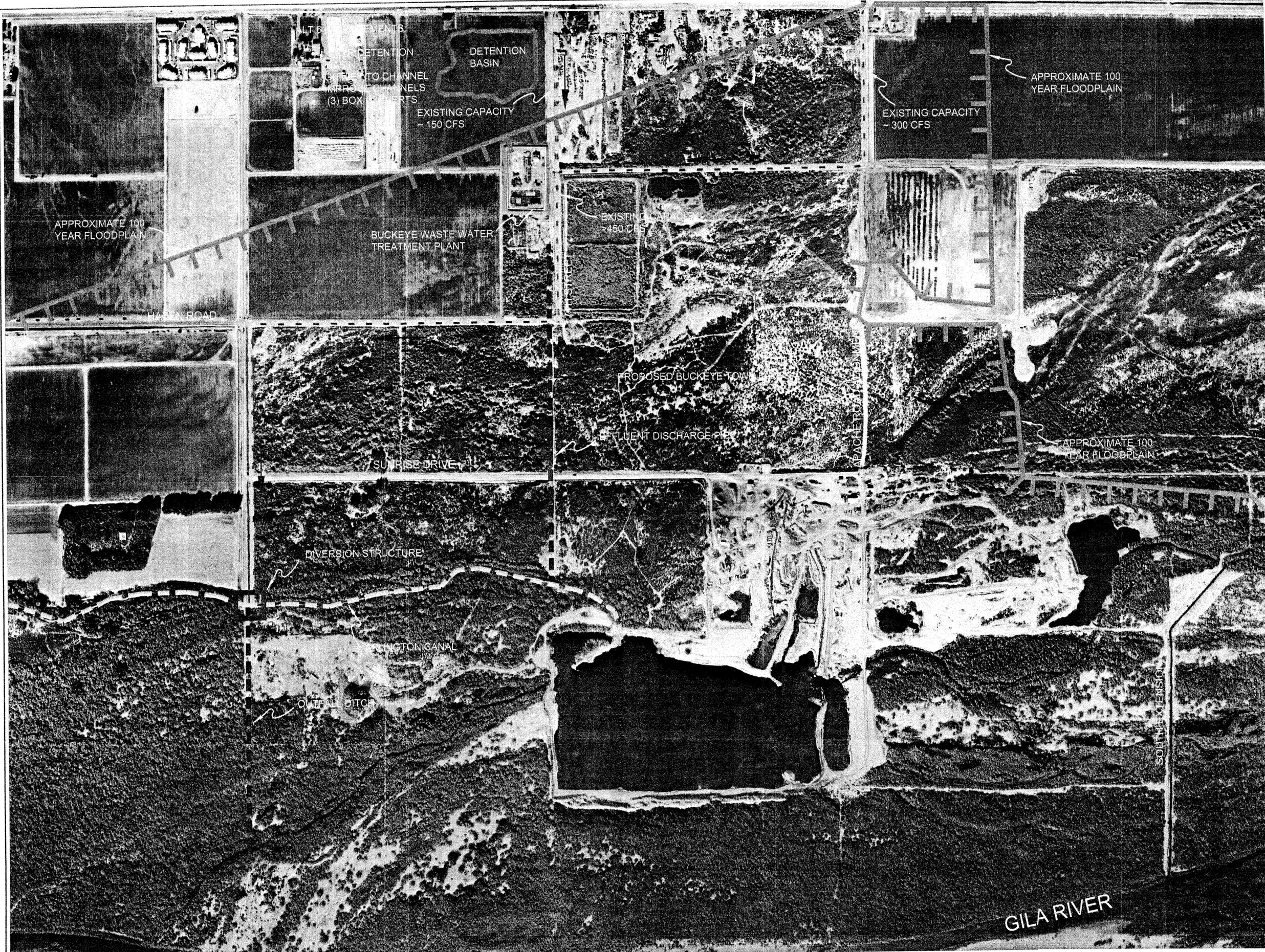
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DATE	REVISION	BY

PROJECT ENGINEERING CONSULTANTS, LTD
2510 W. MISSION LANE, STE. 4
PHOENIX, ARIZONA 85201

DOWNTOWN BUCKEYE DRAINAGE IMPROVEMENTS

DESIGN	BY GSB	DATE 5/04	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
DESIGN CHK.	MDH	5/04	RECOMMENDED BY: DATE
PLANS	GSB	5/04	APPROVED BY: DATE
PLANS CHK.	MDH	5/04	CHIEF ENGINEER AND GENERAL MANAGER
SUBMITTED BY:	DATE:	SHEET 2	OF 2





Downtown Buckeye Drainage Improvements



The Flood Control District of Maricopa County in partnership with the Town of Buckeye is working to provide drainage alternatives in the downtown Buckeye area.

Drainage improvements will include:

- A stormdrain collection system along Monroe Avenue
- A retention basin near Buckeye Town Hall
- Local drainage improvements

These improvements will reduce flooding hazards in Historic Downtown Buckeye by providing conveyance and storage for stormwater.



Downtown Buckeye Drainage Improvements Project Timeline and Costs



	<u>ACTIVITY</u>	<u>ESTIMATED COSTS</u>
Phase 1	Pre-design of the entire system	\$200,000
Phase 2	Land Acquisition and Local Improvements	\$634,000
Phase 3	Design and Construction of the Detention Basin and Outfall Pipeline	\$690,000
Phase 4	Design and Construction of Storm Drain from Baseline Road to 9th Street & Outfall to Basin	\$705,000
Phase 5	Design and Construction of Storm Drain from 9th Street to Miller Road	\$1,700,000



APPENDIX F

Responses to Comments Regarding the Buckeye CAR
(The CAR preceded this report)

Note: Revisions are attached as part of the electronic media included with the Buckeye Pre-design Assessment Report.

Downtown Buckeye Drainage Improvements
Pre-Design Assessment Report

Flood Control District of Maricopa County, Arizona...



Flood Control District

of Maricopa County

INTEROFFICE MEMORANDUM

Date: June 3, 2005
To: Valerie Swick, Project Manager, PPM Division
From: Julie Cox, Senior Hydrologist, Engineering Division
Subject: Review comments for Buckeye Candidate Assessment Report (June 2004)

I have completed a hydrology review as requested and my comments are listed below.

The first major assumption is that the Sun Valley ADMP will handle regional drainage issues. Therefore, the base models for the Buckeye CAR alternatives do not include the Buckeye Irrigation District canal overflows identified in the Buckeye Area FDS, MKE 1992 and the Buckeye/Sun Valley ADMS, PBS&J 2005.

1. HEC-1 models (Alternatives 4, 5, and 6). At the four diversion locations along Monroe, why is the entire 100-yr flow routed to the 10-yr capacity storm drain?

Hydrology models were developed to assess the flows required to be conveyed by storm drain systems for various storm events. The hydrology models were developed first, and then the storm drain pipes were sized for the resulting peak flows. This is how it was determined that a 100-year storm drain system would likely be unfeasible.

2. HEC-1 models (Alternatives 5 and 6). Flow along Monroe flows south in a 100-yr event. This is not modeled. Therefore, at CP 7th-S, actual flows will be higher than shown. At CP DRAIN, actual flows will be lower than shown.

This is true if the Town and District decide to proceed with a 10-year storm drain design along Monroe. The existing conditions models show peak flows and volumes at CP 7th-S and CP DRAIN in the present configuration. The 10-year storm drain design was not modeled with the 100-year HEC-1 hydrology model.

3. HEC-1 models (Alternative 4). Some of the flow along Monroe will flow south in a 100-yr event and some will flow east from CP 6th. Therefore, at CP 7th-S, actual flows will be lower than shown. At CP DRAIN, actual flows will be higher than shown.

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See comments above. For this report, the affects of a 10-year storm drain on flooding associated with a 100-year event were not evaluated.

4. HEC-1 models (Alternatives 4, 5, and 6). The 10-yr detention basins are not modeled. These basins must be modeled to consider impacts from the 100-yr event.

Models were structured to determine volumes necessary at proposed detention basin locations. Since the detention basins are located at the downstream outlets of the project area, they were not modeled as part of the hydrology.

5. HEC-1 models (Alternatives 1 and 3). At CP 9th, explain why 100% of the flow is diverted south when the report (Page 7) states that there is a 50/50% split based on field visits.

The flow split referred to in the report is at Centre and 9th. Monroe and 9th (the location of CP 9th) is a sag point along MC 85/Monroe.

6. Exhibit A should read SCALE 1" = 600'.

The scale of Exhibit A is 1"=300'.

7. Exhibit G. In the legend, change the symbol for potential storm drain alignments to a yellow dashed line.

OK.

8. Exhibit G. The storm drain location conflicts with the StormCad alternative. Please revise as necessary to ensure consistency.

OK.

9. Report (Table 2, Page 6). Change 4TH7TH to 4S7S.

The reach name in the HEC-1 models is 4TH7TH.

10. Report (Table 3, Page 8). For CP BELOAT, change the 100-yr peak flow in the last column to 403 cfs.

OK.

11. HEC-1 models. For the KK block DET, change the KM record to state that the CP is north of Monroe.

OK.

Note: Revisions are attached as part of the electronic media included with the Buckeye Pre-design Assessment Report.

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APPENDIX G

Hydraulic & Miscellaneous Calculations

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100-yr 6-hr Rainfall, P	3.28	in
Runoff Volume (from HEC-1), V	54.7	AF
Drainage Area, A	0.41	Sqmi
* C = $V/(D/12*A*640)*C =$	0.76	(FCDMC Drainage Manual, Hydraulics)
Runoff Volume for 0.5-in Rainfall		
V _{0.5} = $0.5/12*A*640*C =$	8.3	AF
Total Basin Depth	10	ft
Freeboard	1	ft
Designed Basin Depth	9	ft
Side slope	5	:1
Basin Top Area, A _t	7.5	Acre
Basin Top Width, W _t	572	ft
Basin Bottom Area, A _b	5.1	Acre
Basin Bottom Width, W _b	472	ft
Total Basin Volume, V _t	62.6	AF
Designed Basin Volume, V _d	55.3	AF
Outflow Invert Above Basin Bottom, h	1.58	ft

* C is calibrated from the HEC-1 data, i.e. the rainfall depth, runoff volume and drainage area.

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Basin #2 - 7th Street and Beloat Rd

100-yr 6-hr Rainfall, P	3.28	in
Runoff Volume (from HEC-1), V	32.8	AF
Drainage Area, A	0.27	Sqmi
* C = $V/(D/12*A*640)$ =	0.69	(FCDMC Drainage Manual, Hydraulics)
Runoff Volume for 0.5-in Rainfall		
V _{0.5} = $0.5/12*A*640*C$ =	5.0	AF
Total Basin Depth		
Freeboard	1	ft
Designed Basin Depth	4	ft
Side slope	5	:1
Basin Top Area, A _t	9.5	Acre
Basin Top Width, W _t	643	ft
Basin Bottom Area, A _b	8.1	Acre
Basin Bottom Width, W _b	593	ft
Total Basin Volume, V _t	43.9	AF
Designed Basin Volume, V _d	34.6	AF
Outflow Invert Above Basin Bottom, h		
	0.61	ft

* C is calibrated from the HEC-1 data, i.e. the rainfall depth, runoff volume and drainage area.

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Time to Drain the Basin Calculation (Monroe Ave and Apache Rd)

Layer	Surface Elev ft	Surface Area ac	Volume af	Q cfs	Time hr
1	860.0	7.5			
2	859.5	7.4	3.7	29.5	1.5
3	859.0	7.3	3.7	29.0	1.5
4	858.5	7.1	3.6	28.3	1.5
5	858.0	7.0	3.5	28.0	1.5
6	857.5	6.9	3.5	27.4	1.5
7	857.0	6.8	3.4	27.0	1.5
8	856.5	6.7	3.4	26.5	1.5
9	856.0	6.5	3.3	26.0	1.5
10	855.5	6.4	3.2	25.5	1.5
11	855.0	6.3	3.2	25.0	1.5
12	854.5	6.2	3.1	24.5	1.5
13	854.0	6.1	3.1	23.0	1.6
14	853.5	5.9	3.0	16.5	2.2
15	853.0	5.8	2.9	10.5	3.4
16	852.5	5.7	2.9	5.5	6.3
Total			49.5		30.4

This calculation is based on 30" RCP outfall with invert 851.58 ft and length 3200 ft. Tailwater elevation is fixed 842.5 ft. (See CulvertMaster calculation)

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CulvertMaster Calculation for the 30" RCP Outfall Pipe

Analysis Component

Storm Event	Design	Discharge	30.00	cfs
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Peak Discharge Method:
 User-Specified

Design Discharge	30.00	cfs	Check Discharge	30.00	cfs
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Tailwater Conditions:
 Constant Tailwater

Tailwater Elevation	842.50	ft
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Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-30 inch Circular	30.00 cfs	860.49 ft	6.11 ft/s
Weir	Not Considered	N/A	N/A	N/A

Component: Culvert-1

Culvert Summary

Computed Headwater Elevation	860.49	ft	Discharge	30.00	cfs
Inlet Control HW Elev.	854.74	ft	Tailwater Elevation	842.50	ft
Outlet Control HW Elev.	860.49	ft	Control Type	Outlet Control	
Headwater Depth/Height	3.56				

Grades

Upstream Invert	851.58	ft	Downstream Invert	840.00	ft
Length	3,200.00	ft	Constructed Slope	0.003619	ft/ft

Hydraulic Profile

Profile	Pressure Profile	Depth, Downstream	2.50	ft	
Slope Type	N/A	Normal Depth	N/A	ft	
Flow Regime	N/A	Critical Depth	1.87	ft	
Velocity Downstream	6.11	ft/s	Critical Slope	0.006494	ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013	
Section Material	Concrete	Span	2.50	ft
Section Size	30 inch	Rise	2.50	ft
Number Sections	1			

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Outlet Control Properties					
Outlet Control HW Elev.	860.49	ft	Upstream Velocity Head	0.58	ft
Ke	0.50		Entrance Loss	0.29	ft

Inlet Control Properties					
Inlet Control HW Elev.	854.74	ft	Flow Control	N/A	
Inlet Type	Square edge w/headwal		Area Full	4.9	ft ²
	1				
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Range Data:

Discharge	Minimum	Maximum	Increment	
	0.00	30.00	1.00	cfs
Discharge (cfs)	HW Elev. (ft)			
0.00	851.58			
1.00	852.06			
2.00	852.27			
3.00	852.44			
4.00	852.58			
5.00	852.71			
6.00	852.82			
7.00	852.93			
8.00	853.03			
9.00	853.12			
10.00	853.22			
11.00	853.31			
12.00	853.39			
13.00	853.47			
14.00	853.56			
15.00	853.63			
16.00	853.71			
17.00	853.79			
18.00	853.87			
19.00	853.94			
20.00	854.02			
21.00	854.09			
22.00	854.17			
23.00	854.25			
24.00	854.33			
25.00	854.99			
26.00	856.01			
27.00	857.07			
28.00	858.17			
29.00	859.31			
30.00	860.49			

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Culvert Master Calculation for the Short 30" RCP Outfall Pipe Connecting the Outfall Channel



Analysis Component				
Storm Event	Design	Discharge	65.00	cfs

Peak Discharge Method:
User-Specified

Design Discharge	65.00	cfs	Check Discharge	65.00	cfs
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Tailwater Conditions:
Constant Tailwater

Tailwater Elevation	853.00	ft
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Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-30 inch Circular	65.00 cfs	860.22 ft	13.24 ft/s
Weir	Not Considered	N/A	N/A	N/A

Component: Culvert-1

Culvert Summary

Computed Headwater Elevation	860.22	ft	Discharge	65.00	cfs
Inlet Control HW Elev.	860.22	ft	Tailwater Elevation	853.00	ft
Outlet Control HW Elev.	859.60	ft	Control Type	Inlet Control	
Headwater Depth/Height	3.46				

Grades

Upstream Invert	851.58	ft	Downstream Invert	850.50	ft
Length	100.00	ft	Constructed Slope	0.010800	ft/ft

Hydraulic Profile

Profile	Pressure Profile	Depth, Downstream	2.50	ft	
Slope Type	N/A	Normal Depth	N/A	ft	
Flow Regime	N/A	Critical Depth	2.42	ft	
Velocity Downstream	13.24	ft/s	Critical Slope	0.022064	ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013	
Section Material	Concrete	Span	2.50	ft
Section Size	30 inch	Rise	2.50	ft
Number Sections	1			

Outlet Control Properties

Outlet Control HW Elev.	859.60	ft	Upstream Velocity Head	2.72	ft
Ke	0.50		Entrance Loss	1.36	ft

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Section

Inlet Control Properties

Inlet Control HW Elev.	860.22	ft	Flow Control	N/A
Inlet Type	Square edge w/headwal		Area Full	4.9 ft ²
	1			
K	0.00980		HDS 5 Chart	1
M	2.00000		HDS 5 Scale	1
C	0.03980		Equation Form	1
Y	0.67000			

Range Data:

Discharge	Minimum	Maximum	Increment	
	0.00	65.00	2.00	cfs
Discharge (cfs)	HW Elev. (ft)			
0.00	853.00			
2.00	853.01			
4.00	853.04			
6.00	853.09			
8.00	853.16			
10.00	853.25			
12.00	853.38			
14.00	853.58			
16.00	853.75			
18.00	853.90			
20.00	854.06			
22.00	854.21			
24.00	854.36			
26.00	854.51			
28.00	854.65			
30.00	854.80			
32.00	854.96			
34.00	855.15			
36.00	855.38			
38.00	855.63			
40.00	855.88			
42.00	856.16			
44.00	856.44			
46.00	856.74			
48.00	857.05			
50.00	857.37			
52.00	857.71			
54.00	858.06			
56.00	858.42			
58.00	858.80			
60.00	859.19			
62.00	859.59			
64.00	860.01			
65.00	860.22			

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FlowMaster Calculation for the Outfall Channel



Project Description

Worksheet	Outfall Channel
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Channel Slope	0.0035	ft/ft
Discharge	65.00	cfs

Options

Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results

Mannings Coefficient	0.035	
Water Surface Elevation	847.25	ft
Elevation Range	845.00 to 855.00	
Flow Area	22.0	ft ²
Wetted Perimeter	17.26	ft
Top Width	16.53	ft
Actual Depth	2.25	ft
Critical Elevation	846.54	ft
Critical Slope	0.019115	ft/ft
Velocity	2.95	ft/s
Velocity Head	0.14	ft
Specific Energy	847.39	ft
Froude Number	0.45	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+41	0.050
0+41	0+62	0.035
0+62	0+93	0.050

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Natural Channel Points

Station (ft)	Elevation (ft)
0+00	855.00
0+20	855.00
0+41	848.00
0+50	845.00
0+53	845.00
0+62	848.00
0+68	850.00
0+78	850.00
0+93	855.00