

SIPHON DRAW DRAINAGE IMPROVEMENTS CONCEPT LETTER REPORT

CONTRACT FCD 2005 C021
ASSIGNMENT NO.2

May 2006
WP #062665.02

Prepared for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
Phone: (602) 506-1501
Fax: (602) 506-4601

Prepared by:

Wood, Patel & Associates, Inc.
2051 West Northern Avenue
Suite 100
Phoenix, Arizona 85021
Phone: (602) 335-8500
Fax: (602) 335-8580
Website: www.woodpatel.com



TABLE OF CONTENTS

1.0 Siphon Draw Wash Drainage Improvements1
2.0 Drainage Stipulations7

TABLES

Table 1 Summary Table
Table 2 Regional Detention Basins & Channel System within Pinal County & Storm
Drain within Maricopa County
Table 3 Estimate of Probable Costs

PLATES

Plate 1 Watershed Map
Plate 2 Regional Detention Basins

W:\2006Projects\062665.02_AS LD Basins\UCD_3_29_06\Assignment #5 - 5_18_06\062665.02 Siphon Draw Drainage Assignment 4 Report_6-06.doc

1.0 Siphon Draw Wash Drainage Improvements

Wood/Patel was requested by the Flood Control District of Maricopa County (FCDMC) to provide engineering services to support the Arizona State Land Department (ASLD) Basin Feasibility Study. The scope of this work effort was limited to estimating the land requirement for the ASLD Basin and Meridian Road Channel. To support the ASLD Basin Facility, the following tasks were performed.

Data Collection

All data from Wood/Patel's previous study in conjunction with the pre-design efforts as well as a land-use map from ASLD and detention/retention requirements from Apache Junction was collected. The project schedule dictated that only readily available data be collected. The FCDMC provided the Drainage Design Management System (DDMS) files for a portion of the watershed for Siphon Draw Wash.

Hydrology

The previous Wood/Patel hydrologic (HEC-1) model for the existing condition (100-year, 24-hour) work was updated so that the entire watershed east of Meridian Road drains to a point at the intersection of Meridian Road and Siphon Draw Wash. For this task it was assumed that there is a channel constructed along Meridian Road from Siphon Draw Wash to approximately 1.5 miles north of Siphon Draw Wash.

The hydrologic (HEC-1) model was also modified to reflect the land-use changes as proposed by ASLD to reflect a future condition. An exhibit depicting the medium density residential area was provided by the District for that purpose. This exhibit was used for the purpose of the model update.

It was assumed for this assessment that any future land development located north of the Meridian Basin will have all discharges conveyed to the Meridian Road Channel and not directly into the detention basin.

Hydraulics

The channel size along the Meridian Road was conceptually evaluated with the results of the future condition hydrology. This information was utilized to estimate the land requirements along Meridian Road.

Utilities

We have been informed by the City of Mesa that a large (48" or 60") waterline is being considered to be installed within Elliot Road, west of the intersection of Elliot Road and Meridian Road. Before the construction drawings are prepared for this waterline, coordination should occur relative to the design of the storm drain proposed within Elliot Road. Currently, the Elliot Road storm drain is proposed immediately north of the centerline of Elliot Road. From our preliminary review of the existing utilities within Elliot Road, there is also an existing waterline located approximately 30' to the south of the centerline of Elliot Road, an existing gas line approximately 40' south of the centerline of Elliot Road, an underground electric line located approximately 40' north of the centerline of Elliot Road, and an additional gas line approximately 65' north of the centerline of Elliot Road. If the new waterline is to be installed within Elliot Road it appears that the line should probably be located to the south of the currently proposed storm drain.

Elliot Detention Basin

We have conceptually aligned the Siphon Draw Basin along the Siphon Draw Wash and determined the feasibility of this scenario's future condition (Elliot Basin). The layout accounts for a 30' buffer along the basin perimeter. Due to the ASLD limitations, the basin does not account for the kinder and gentler appearance which would result in approximately 30% more area.

Conceptual Estimate of Probable Costs

We prepared a rough cost estimate for the following items:

1. Basin Construction
 - a. Meridian Basin
 - b. Elliot Basin (along Siphon Draw Wash)

2. Channel Construction for channel along Meridian Road
 - a. From basin to SRP corridor (mid-section line, Section 12)
 - b. From SRP corridor to about ½ mile north of SRP corridor (north section line, Section 12 – south boundary, Industrial Subdivision, ASLD land)
 - c. From east Meridian Road Guadalupe alignment to mid-section line (north boundary, Industrial Subdivision)
3. Storm drain construction along Elliot Road from Meridian Road to 104th Street

SUMMARY

We have prepared this summary documenting the results of our conceptual study. It includes hydrology, basin area limits and channel area limits. We have provided a summary of land requirements for the basin and channel. The scope excluded any activity related to detailed design, line and grade profiles, or any other task not listed above.

Available Data:

- HEC-1 Model used was S60EMAP1.DAT.
- Existing Condition model updated for future condition with medium density residential.
- FCDMC's 2 ft. topographic map (partial coverage).
- ASLD's medium density residential land use map.

Meridian Road Concrete Channel

- Average flow depth is 3.1'
- Channel design depth is 5.1'
- Minor horizontal meandering and color concrete may be used to enhance the aesthetics.
- 35' buffer along west side of channel & 5' buffer along east side – between subdivision.
- 2:1 side slopes with 0.46% longitudinal slope.

Meridian Basin

- Average Ponding depth = 7' for Meridian Basin.
- Maximum Berm Height = 5.5' at the southwest corner of basin.
- 3' of freeboard provided between top of berm and 100-year flooding depth.
- Basin side slopes = 6:1.

- Diversion structures to divert flow into basins.
- 30' buffer along perimeter – this will include land for a 16' maintenance road.
- Drain time = 36 hours.
- 24" bleed-off pipes are used to drain basins within 36 hours.
- Reduced channel size after diversion of flow into Meridian Basin.
- The size of the contributing upstream drainage area for the Meridian Basin was determined to be approximately 963 acres (local area) as depicted in green color on Plate 1.

Elliot Basin

- Average Ponding depth = 8' for Elliot Basin along Siphon Draw Wash.
- Maximum Berm Height = 5.5' at the south west corner of basin.
- 3' of freeboard provided between top of berm and 100-year flooding depth.
- Basin side slopes = 6:1.
- Diversion structures to divert flow into basins.
- 30' buffer along perimeter – this will include land for a 16' maintenance road.
- Drain time = 36 hours.
- The size of the contributing upstream drainage area for the Elliot Basin was determined to be approximately 838 acres (local area) as depicted in red color on Plate 1.

Uncontrolled Areas

- A portion of ASLD parcel, which is located south of Meridian and Elliot Basins, directly drains to Siphon Draw Wash culverts on Meridian Road. Since this area does not drain into the proposed basins, considerations will be required for on-site retention during the planning and design stage.
- The size of the upstream drainage area not entering either basin located south of the regional detention basins has been determined to be 81 acres as depicted in yellow color on Plates 1 and 2.

Outfall Considerations

- The peak 100-Year flows should match the design flow condition of the existing drainage facilities of Elliot Road & 104th Street.

General Goals by FCDMC & ASLD

- Reduce basin area as much as possible but still meet the drainage design considerations & constraints described above.

Construction Phasing

- Siphon Draw Wash Drainage Improvements consist of various drainage elements including basins, channels and storm drains. These elements are located within public right-of-way, private land and State land. These elements construction will be implemented through the partnership between FCDMC, City of Mesa, and private entities. It is very likely that construction of these elements may occur in different phases.
- The Meridian Channel is intended to handle the post-development flows from the ASLD parcel. This consideration should be implemented during the final design of Meridian Channel.

Analyses Results

- Q100 for Meridian Basin was determined to be 2324 cfs and for Elliot Basin was 1068 cfs.
- Bypass Q100 for Meridian Basin was 380 cfs and for Elliot Basin was 25 cfs.
- Required storage volume for Meridian Basin was 180 acre-feet.
- Required storage volume for Elliot Basin was 110 acre-feet.
- Apache Junction retention requirement for upstream medium density residential development for the ASLD parcel was determined to be 84.3 acre-feet.
- Maximum ponding depth for Apache Junction retention basins are 3'. With a 10' buffer around the perimeter, 6:1 side slopes and a natural ground slope of 0.75% the retention basin will require approximately 40 acres of land to obtain the required storage volume.
- It was determined that upstream *online* retention basins (i.e. neighborhood parks) were not efficient to decrease the regional downstream offline detention basin volume for the basins proposed on Plates 1 and 2.
- Upstream *offline* retention basins may be used to provide an efficient method of reducing regional downstream offline detention basin volume for the basins proposed on Plates 1 and 2.

low about industrial?

- Maricopa County retention requirement for upstream medium density residential development was determined to be 295 acre-feet.

2.0 Drainage Stipulations

To support the ASLD Basin Feasibility Study, we are providing a summary that addresses the drainage stipulations of each jurisdiction.

Apache Junction

- Requires the retention volume to be determined by using the 10-year, 24-hour storm precipitation value.
- The upstream development retention volume requirements have been accommodated within the regional detention basins and therefore future upstream developments within the ASLD Parcel west of the CAP canal will not be required to provide storage.
- The detention basins have been designed at a regional level with flood depths in excess of 3'.

Pinal County

- The pre- vs. post-development discharges and storage requirements have been accommodated within the regional detention basins.

City of Mesa & Maricopa County

- The regional detention basins were designed to meet the regional flood control planning conditions as dictated by the East Mesa Area Drainage Master Plan (1998).
- The regional flood control planning conditions have been consistent with those at the 104th Street & Elliot Drainage System designed and built by FCDMC.

Arizona State Land Department

- The planned drainage facilities require that the future developments upstream of the facilities will be required to have design restrictions within the development constraints.
- These constraints will assure that the future developments intercept and convey flow to the proposed regional detention basins.

U.S. Army Corp 404 Jurisdictional Waters

- The Maricopa County Flood Control District has delineated Section 404 Jurisdictional Waters for a portion of the study area and future developers must coordinate and mitigate any disturbance within these areas.

TABLE 1

Summary Table

TABLE 1 – SUMMARY OF LAND & IMPROVEMENT COSTS

PINAL COUNTY

ELEMENT #1

MERIDIAN CHANNEL NORTH OF SRP CORRIDOR COLLECTION (ASLD):

Meridian Channel = 7.4 acres
Sub-Total Land Requirement = 7.4 acres
Total Cost of Collection Elements = \$2,665,359

MERIDIAN CHANNEL SOUTH OF SRP CORRIDOR COLLECTION (ASLD):

Bi-Pass Meridian Channel along Meridian Basin = 3.0 acres
Sub-Total Land Requirement = 3.0 acres
Total Cost of Collection Elements = \$978,047

ELEMENT #1 – SUMMARY:

Total Land Requirement = 10.4 acres
Total Cost of Collection Elements = \$3,643,406

ELEMENT #2 – MERIDIAN CHANNEL COLLECTION (through Industrial Subdivision):

Industrial Subdivision Meridian Channel = 6.4 acres
Sub-Total Land Requirement = 6.4 acres
Total Cost of Collection Elements = \$1,983,481

ELEMENT #3 – MERIDIAN REGIONAL DETENTION BASIN COLLECTION (ASLD):

Meridian Basin = 35.7 acres
Basin Outlet Pipe Easements = 0.6 acres
Sub-Total Land Requirement = 36.3 acres
Total Cost of Collection Elements = \$7,004,981

ELEMENT #4 – ELLIOT REGIONAL DETENTION BASIN COLLECTION (ASLD):

Elliot Basin = 20.5 acres
Diversion Basins = 0.5 acres
Sub-Total Land Requirement = 21 acres
Total Cost of Collection Elements = \$3,810,822

SUMMARY

Total Pinal County Land Requirement = 74.1 acres
Total Pinal County Cost of Collection Elements = \$16,442,690

MARICOPA COUNTY

ELEMENT #5 – MAJOR STORM DRAIN OUTFALL:

Total Cost of Collection Elements = \$3,410,938

325

TABLE 2

**Regional Detention Basins
&
Channel System within Pinal County
&
Storm Drain within Maricopa County**

Siphon Draw Basin Options (ASLD)

June 9, 2006

Flood Control District of Maricopa County

W/P # 062665.02

FCD 2005 C021, Assignment #2

TABLE 2 SUMMARY

(Estimate of Probable Cost Based on Concept Analysis,
Certain Common Items to All Options Are Excluded from This Estimate)

ELEMENT	PINAL COUNTY		MARICOPA COUNTY	
	ELEMENTS COST (a)	LAND REQUIREMENT	ELEMENTS COST (a)	LAND REQUIREMENT
1	\$3,643,406	10.4 acres		
2	\$1,983,481	6.4 acres		
3	\$7,004,981	36.3 acres		
4	\$3,810,822	21.0 acres		
5			\$3,410,938	0 acres
TOTAL	\$16,442,690	74.1	\$3,410,938	0 acres

(a) These costs are updated for the year 2006 dollars;

TABLE 3.

Siphon Draw Wash Drainage Improvements

Estimate of Probable Costs

TABLE 3 - SIPHON DRAW WASH DRAINAGE IMPROVEMENTS - ESTIMATE OF PROBABLE COSTS

Regional Detention Basin & Channel System for Pinal County

ELEMENT #1 - MERIDIAN CHANNEL COLLECTION (ASLD):

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
A2	Concrete Channel "Meridian"	\$310	CY	4,701	\$1,457,310
A2	Channel "Meridian" Excavation	\$6.00	CY	41,420	\$248,520
A3	Bi-Pass Concrete Channel "Meridian"	\$310	CY	1,725	\$534,750
A3	Bi-Pass "Meridian" Excavation	\$6.00	CY	15,200	\$91,200
SUBTOTAL COLLECTION ELEMENTS					\$2,331,780
<u>CONTINGENCIES:</u>					
Construction				25%	\$582,945
Design & Field Engineering				18%	\$524,651
Change Orders				7%	\$204,031
TOTAL COLLECTION ELEMENTS					\$3,643,406

ELEMENT #2 - MERIDIAN CHANNEL COLLECTION (through Industrial Subdivision):

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
A1	Concrete Channel "Meridian"	\$310	CY	3,542	\$1,098,020
A1	Channel "Meridian" Excavation	\$6.00	CY	28,568	\$171,408
SUBTOTAL COLLECTION ELEMENTS					\$1,269,428
<u>CONTINGENCIES:</u>					
Construction				25%	\$317,357
Design & Field Engineering				18%	\$285,621
Change Orders				7%	\$111,075
TOTAL COLLECTION ELEMENTS					\$1,983,481

ELEMENT #3 - MERIDIAN REGIONAL DETENTION BASIN COLLECTION (ASLD):

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
B	Basin Excavation-Meridian	\$6.00	CY	581,607	\$3,489,642
B	Basin Landscaping-Meridian	\$0.50	SF	1,555,092	\$777,546
G	Diversion Structure - Meridian	\$100,000	EA	1	\$100,000?
D	24" Pipe Outlet for Meridian Basin	\$80	LF	1,350	\$108,000
D	24" Pipe Manholes for Outlet Pipe	\$2,000	1	4	\$8,000
SUBTOTAL COLLECTION ELEMENTS					\$4,483,188
<u>CONTINGENCIES:</u>					
Construction				25%	\$1,120,797
Design & Field Engineering				18%	\$1,008,717
Change Orders				7%	\$392,279
TOTAL COLLECTION ELEMENTS					\$7,004,981

ELEMENT #4 - ELLIOT REGIONAL DETENTION BASIN COLLECTION (ASLD):

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
C	Basin Excavation-Elliot Basin	\$6.00	CY	312,986	\$1,877,916
C	Basin Landscaping-Elliot Basin	\$0.50	SF	892,980	\$446,490
F	Two Diversion Structures-Elliot Basin	\$50,000	EA	2	\$100,000
H	Diversion Basin Excavation-Elliot Basin	\$6.00	CY	2,420	\$14,520
SUBTOTAL COLLECTION ELEMENTS					\$2,438,926

CONTINGENCIES:

Construction	25%	\$609,732
Design & Field Engineering	18%	\$548,758
Change Orders	7%	\$213,406
TOTAL COLLECTION ELEMENTS		\$3,810,822

MARICOPA COUNTYELEMENT #5 - MAJOR STORM DRAIN OUTFALL:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	42" RCRCP Pipe "G"	\$260	LF	8,050	\$2,093,000
2	Manholes	\$6,000	EA	15	\$90,000
SUBTOTAL MAJOR OUTFALL ELEMENTS					\$2,183,000

CONTINGENCIES:

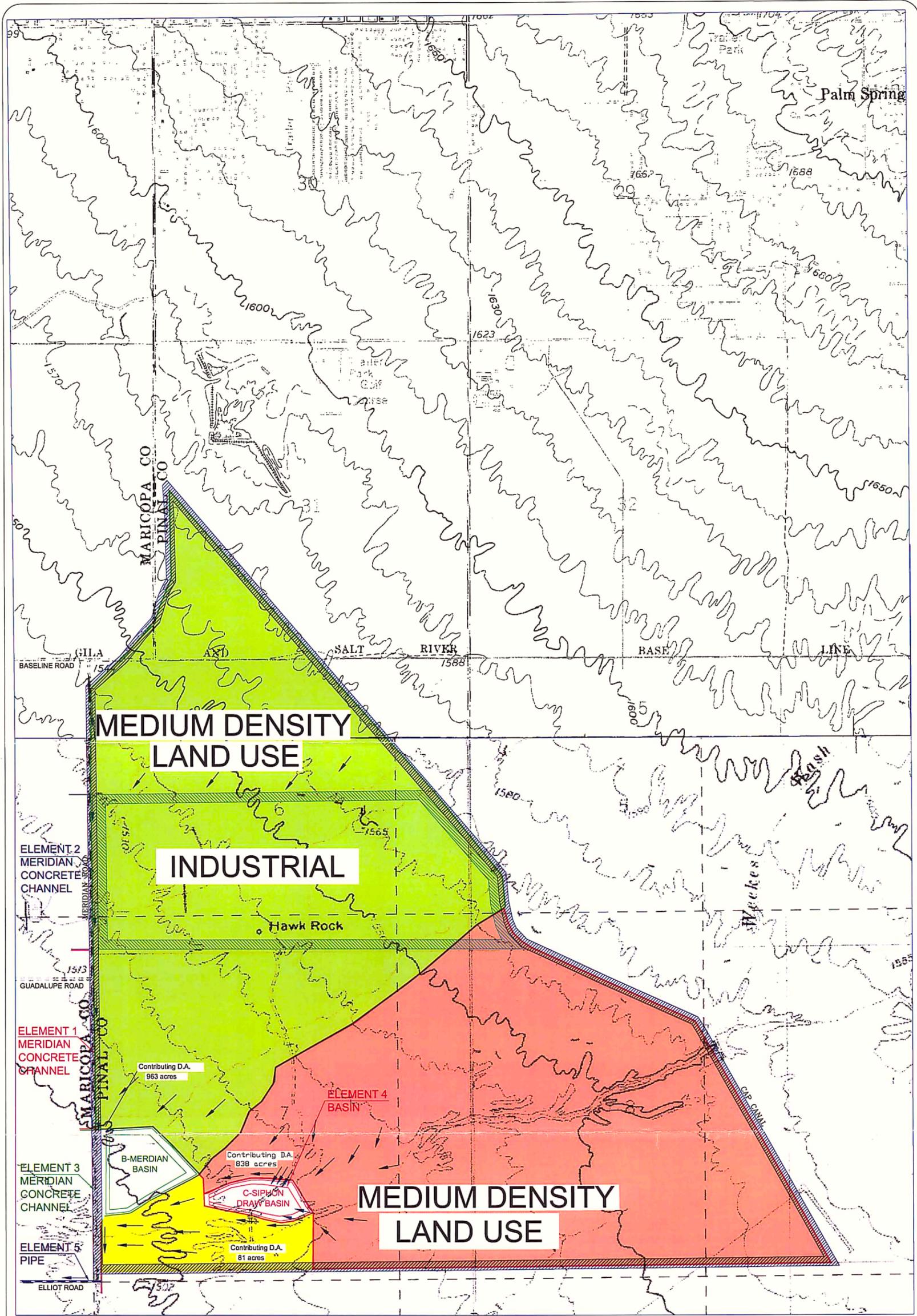
Construction	25%	\$545,750
Design & Field Engineering	18%	\$491,175
Change Orders	7%	\$191,013
TOTAL MAJOR OUTFALL ELEMENTS		\$3,410,938

1. Construction Contingencies @ 25% of the Total Construction Cost
2. Design and Field Engineering Costs @ 18% of the sum of Total Construction Cost and Construction Contingencies
3. Change Orders @ 7% of the sum of Total Construction Cost and Construction Contingencies
4. Land for channel H is assumed to be an easement at no cost to this project.
5. Siphon Draw Wash alignment will continue to get flood water from storm events between 100-year, 24-hour and 100-year, 2-hour.

PLATE 1

Siphon Draw Wash

Watershed Map



NOTE: Upstream Watersheds Extend East of the CAP Canal
However, Flow Crosses the CAP Canal at Existing Drainage Crossings



1500 0 750 1500



1 inch = 1500 ft.

SIPHON DRAW WASH
WATERSHED MAP

Wood, Patel & Associates, Inc.
2051 West Northern, Suite 100
Phoenix, Arizona 85021 (602) 335-8500

DRAWN BY: JCD DATE: 4-12-06

JOB NO: 062665.02

PLATE 1

PLATE 2

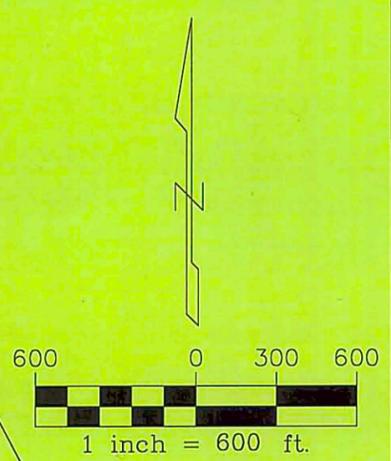
Siphon Draw Wash

Regional Detention Basins

ELEMENT #2
A1-Meridian
Concrete Channel
 110' Drainage Easement
 Q100=2365cfs
 BW=45'; Depth=5.5'
 Vel=15.0fps;SS=2:1
 Channel Slope=0.46%
 Channel Area=6.4acres

Mid Section Line

INDUSTRIAL
 SUBDIVISION



GUADALUPE ROAD

MARICOPA
 COUNTY

Meridan Road
 65' Future R.O.W.

MERIDIAN ROAD

PINAL
 COUNTY

ELEMENT #1
A2-Meridian
Concrete Channel
 110' Drainage Easement
 Q100=2365cfs
 BW=45'; Depth=5.5'
 Vel=15.0fps;SS=2:1
 Channel Slope=0.46%
 Channel Area=8.3acres

ELEMENT #3
B-Meridian Basin
 182.0 acre-feet
 26.0 acres x 7.0'
 Bottom Elev.=1488.5
 Basin Area = 35.7
 Ponding Depth=7'
 Ponding Elev=1495.5'

ELEMENT #6
C-Siphon Draw Basin
 112.0 acre-feet
 14.0 acres x 8.0'
 Bottom Elev.=1500
 Basin Area = 20.5
 Ponding Depth=8
 Ponding Elev=1508

G-Diversion
 Structure

SRP Easement

ELEMENT #3
A3-Meridian
Concrete Channel
 75' Drainage Easement
 Q100=380cfs
 BW=10'; Depth=2.4'
 Vel=10.9fps;SS=2:1
 Channel Slope=0.46%
 Channel Area=2.1acres

Berm Height=5.5'
 Berm Elev=1498.5

D-24" Drainage Pipe
 20' Easement
 0.55acres

ELEMENT #5
Pipe G-42" PGRCP
Storm Drain Outfall

ELLIOT ROAD

Contributing D.A.
 993 acres

Contributing D.A.
 838 acres

Contributing D.A.
 81 acres

30' Access

F-Diversion
 Structure

30' Access

Berm Height=5.5'
 Berm Height=1511

SIPHON DRAW WASH
 REGIONAL DETENTION BASINS

Wood, Patel & Associates, Inc.
 2051 West Northern, Suite 100
 Phoenix, Arizona 85021 (602) 335-8500

DRAWN BY: JCD DATE: 7-8-06

PLATE 2

JOB NO: 062665.02

Work Sheets for Meridian Trapezoidal Channel

Worksheet for Meridian Trapezoidal Channel - 1

Project Description

Flow Element: Trapezoidal Channel
 Friction Method: Manning Formula
 Solve For: Normal Depth

Input Data

Roughness Coefficient: 0.015
 Channel Slope: 0.00460 ft/ft
 Left Side Slope: 2.00 ft/ft (H:V)
 Right Side Slope: 2.00 ft/ft (H:V)
 Bottom Width: 45.00 ft
 Discharge: 2365.00 ft³/s

Results

Normal Depth: 3.35 ft
 Flow Area: 173.46 ft²
 Wetted Perimeter: 60.00 ft
 Top Width: 58.42 ft
 Critical Depth: 4.14 ft
 Critical Slope: 0.00223 ft/ft
 Velocity: 13.63 ft/s
 Velocity Head: 2.89 ft
 Specific Energy: 6.24 ft
 Froude Number: 1.39
 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:
 Headloss: 0.00 ft
 Downstream Velocity: Infinity ft/s
 Upstream Velocity: Infinity ft/s
 Normal Depth: 3.35 ft
 Critical Depth: 4.14 ft
 Channel Slope: 0.00460 ft/ft

Worksheet for Meridian Trapezoidal Channel - 2

Project Description

Flow Element: Trapezoidal Channel
Friction Method: Manning Formula
Solve For: Normal Depth

Input Data

Roughness Coefficient: 0.015
Channel Slope: 0.00460 ft/ft
Left Side Slope: 2.00 ft/ft (H:V)
Right Side Slope: 2.00 ft/ft (H:V)
Bottom Width: 45.00 ft
Discharge: 2365.00 ft³/s

Results

Normal Depth: 3.35 ft
Flow Area: 173.46 ft²
Wetted Perimeter: 60.00 ft
Top Width: 58.42 ft
Critical Depth: 4.14 ft
Critical Slope: 0.00223 ft/ft
Velocity: 13.63 ft/s
Velocity Head: 2.89 ft
Specific Energy: 6.24 ft
Froude Number: 1.39
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:
Headloss: 0.00 ft
Downstream Velocity: Infinity ft/s
Upstream Velocity: Infinity ft/s
Normal Depth: 3.35 ft
Critical Depth: 4.14 ft
Channel Slope: 0.00460 ft/ft