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SECTION 1. GENERAL PROJECT INFORMATION

1.1 Description and Purpose of Project

The Doña Ana County Flood Commission (DACFC) authorized Smith Engineering Company (Smith) to prepare a drainage master plan for the community of Chamberino. The purpose is to analyze existing drainage conditions in the watershed of Chamberino, determine deficiencies and propose improvements. **Figure A** below shows the Chamberino vicinity map.

Figure A: Chamberino Vicinity Map

1.2 Field Observation

Smith conducted field observations in August, 2015. The annotated photographs are presented in **Appendix 1**.

SECTION 2. EXISTING HYDROLOGIC AND HYDRAULIC ANALYSIS

2.1 Existing Flood Control Structures

Chamberino has several existing dams within the watershed. Ownership of the dams could not be determined based on GIS data provided by EBID and DACFC. All dams within the study area are breached and do not appear to be engineered.

The dams and their condition are listed on the drainage basin map, **Figure 1**. At the top of the watersheds south western quadrant there are five abandoned treatment ponds that still act as full retention basins.

Due to the enormous storage volume of these retention ponds, the basins contributing to the ponds were modeled as closed basins. For the purposes of this drainage master plan, the dams in the major arroyos were not modeled under existing conditions.

2.2 Drainage Basin Description and Basin Delineation

Drainage Basin Description

The Chamberino watershed is predominantly undeveloped range land with mild to steep topography. The community of Chamberino is located at the bottom of the watershed. The Chamberino community could be classified as a medium density, residential development. The roads within the community are a mix of paved and unpaved with no curb and gutter. The rest of the watershed east of Chamberino is comprised of straight row crops on agricultural fields that are interlaced with irrigation channels.

FEMA Floodplains

DACFC supplied Smith with various GIS shape files for the area that included the Preliminary Flood Zones for 2014. Based on this data, parts of the Chamberino watershed floodplains are classified as FEMA Zone A (approximate). **Figure 4** shows the limits of these floodplains. **Figure 4** is included in **Appendix 2**.

Drainage Basin Delineation

Drainage basins were delineated from the digital elevation models (DEM) provided by DACFC. The DEM’s resolution was at a 2-ft interval. The basins and basin characteristics were determined using the Geo-HMS extension with Arc Hydro using Arc Map 10.1. Once the parameters are computed digitally, the data is exported out to create a HEC-HMS model. The HEC-HMS model created has all hydrologic elements automatically generated and connected in correct hydrologic order along with most of the pertinent hydrologic data. The user then has the flexibility to add, reconnect or delete elements as necessary. **Figure 1** shows the subbasins delineated for the Chamberino Watershed. This process eliminates the need to manually delineate subbasins, flow paths and compute parameters such as areas, lengths and slopes.

The flow chart on the following page illustrates the process involved to generate a HEC-HMS model using the Geo-HMS extension within Arc-Hydro.

Arc Hydro Process

Terrain Pre Processing to Generate Basins, T_c Flowpaths and routing reaches

- DEM Reconditioning
- Flow Direction
- Flow Accumlation
- Stream Definition
- Stream Segementation
- Catchment Grid Delienation
- Catchment Polygon Processing
- Drainage Line Processing
- Watershed Aggregation

HEC HMS Project Set Up

- Setting Target Location to save digital data
- Defining Outlet of project
- Basin Generation and Editing
- Stream and Subbasin characteristics
- Hydrologic Parameter Estimation
- Basin and River Autoname
- TR-55 Flow Segments

Exporting Project from Arc-HYDRO to HMS

- Determine Map Units
- Data Check
- Generate HMS Legend
- Add coordinates
- Exporting background Shapefiles

2.3 Drainage and Analysis Criteria

The "Storm Drainage Criteria "per DACFC requires that the hydrologic analysis be based on the 5-year, 10-year, and 100-year return period storms of 24-hour duration.

Hydrologic Computer Program

The US Army Corps of Engineers "Hydrologic Modeling System" program or commonly called "HEC-HMS" (Version 4.0) program was selected for simulation of basin storm rainfall – runoff for existing and proposed options in conjunction with its GIS based extension called Geo-HMS.

2.4 Rainfall Data

Rainfall Distribution

The study basin is located within the USDA Natural Resources Conservation Service (NRCS) (previously the Soil Conservation Service (SCS)) Type II rainfall distribution area as defined by the SCS. Please refer to **Appendix 4** for Type II boundaries.

However, the DACFC dictated that the 25% Frequency Storm Distribution be adopted. That distribution is available in the HEC-HMS program. It places most of the rainfall in a short period at 25% of the storm duration, or at 6 hours for a 24-hour storm.

Areal Reduction Factors

No areal reduction factors were necessary due to the small watershed.

Point Rainfall Data

Point rainfall data for the 5-yr, 10-yr, and 100-yr return period storms for various durations were obtained from NOAA Atlas 14 website. **Appendix 4** contains the printouts from the NOAA Atlas 14 point rainfall data results. **Table 1** (**Appendix 3**) contains the point rainfall depth data.

2.5 Soils Data and Runoff Curve Numbers (CNs)

Soils data used to determine Runoff Curve Numbers (CNs) were provided by the DACFC. The data was checked against available data from the Natural Resources Conservation Service (NRCS) internet site Web Soil Surveys as follows:

http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Appendix 4 contains a soils map generated from the data provided by the DACFC. Also included is the comparison data from the NRCS. The Hydrologic Soil Group distribution was predominantly uniform across the watershed. Therefore, no CN weightings were necessary. Refer to **Figure 3** in **Appendix 4**.

The following assumptions were applied in order to approximate initial abstractions using CNs:

1. Antecedent Runoff Condition II (AMR II) is defined as the soil Average runoff condition (moisture condition) by the NRCS. AMR III is defined as saturated runoff conditions. To be conservative with runoff rates and volumes for basins classified as semi arid rangelands, an average curve number between AMR II and AMR III was used.

2. Hydrologic Soil Group (A, B, C, or D) was determined by the soils data provided by DACFC and compared with NRCS Web Soil Survey. The Chamberino soils were largely Hydrologic Soil Group A in 85% of the watershed, and Hydrologic Soil Group B in the agricultural fields.

3. Land Use Type is either – semi-arid rangeland (most subbasins), urban (within developed Chamberino area) or cultivated agricultural land. The orthophotgraphy as presented on the Drainage Basin Map (map pocket) was used to make the land use type determinations. The CN tables are obtained from "Urban Hydrology for Small Watersheds, US Dept of Agricultural Soil Conservation Service, Technical Release 55 (TR-55), June 1986. *

4. The TR-55 CN tables are listed here:
   Table 2-2a Runoff Curve Numbers for Urban Areas*
   Table 2-2b Runoff Curve Numbers for Cultivated Agricultural Land *
   Table 2-2c Runoff Curve Numbers for Other Agricultural Lands *
   Table 2-2d Runoff Curve Numbers for Arid and Semiarid Rangelands*
   Copies included in **Appendix 4*

5. Cover Type, Hydrologic Condition and Percent Imperviousness

   Semi-Arid Rangeland - Desert Shrub, etc., poor hydrologic condition. Curve number of 72 was applied for all undeveloped subbasins. (Table 2-2d applies)

   Urban – Due to the mixture of medium to low density development, an Average curve number of 85 was applied to account for unpaved right of way, paved roads and impervious roofs and ¼ acre lots. Curve Number of 94 was applied to the commercial processing plant in subbasin W1110 at the west end of San Francisco De Assisi Rd. (Table 2-2a applies)

   Cultivated Agricultural Land – Assumed straight row crops with good hydrologic conditions. Curve number of 78 was applied. (Table 2-2b applies).

6. CN selections were based on the previous data, assumptions and NRCS soils data / and guidelines in the TR-55 Urban Hydrology for Small Watershed Handbook.

2.6 Split hydrographs for Subbasins

Purpose

When subbasins are mostly homogeneous in terms of land use type and runoff curve numbers, an areal weighted CN approach may be acceptable. When non-homogeneous land use types occur and a greater range of CN's occur between those land used types, the subbasin runoff is more accurately simulated with spilt hydrographs as described here. This method was applied to Subbasin W1110.

Hydrograph 1 will simulate the pervious or undeveloped subbasin area and will have a subbasin name such as W1110- P ("P" for pervious). Hydrograph 2 will simulate the impervious or developed subbasin area and will have a subbasin name such as W1110 - I ("I" for impervious). The pervious and impervious hydrographs are then computed and added together at a junction before being routed downstream. This is particularly important when the impervious part of the subbasin is close to the outlet of the subbasin as in the case of subbasin W1110 as the impervious area will respond to rainfall much faster than the pervious portion.

Impervious Area Assumptions and Computations for Subbasin W1110

1. Measure the impervious area including the approximate graded limits
2. Because the impervious area is small relative to the overall basin, assume a minimum time of concentration of 12 minutes
3. Assume CN of 94 as prescribed by Table 2-2a for a commercial site that is 85% impervious
4. The pervious part of the subbasin is assigned the computed T_c and assigned a curve number of 72 per Table 2-2d
5. Within HEC-HMS two separate hydrographs are computed based on the above parameters and then added at a junction

2.7 Travel Time (T_t), Time of Concentration (T_c), Unit Hydrograph Lag Time (T_L) Computations and Unit Hydrograph

A water course may have up to three sub-reaches that comprise the longest flow path. These are an upper overland flow reach, then a shallow concentrated flow reach, followed by a channel reach. Geo-HMS uses the NRCS TR-55 to compute T_t and T_c for each water course. The time of concentration (T_c) for the watercourse equals the summation of travel times (T_t) from each sub-reach. **Appendix 4** contains the TR-55 description and procedures. The various reaches and their physical characteristics are computed by the program directly from the DEM and an Excel table is generated and stored within the Geo-HMS geo-database. **Table 4** was saved separately to document the parameters generated by Geo-HMS in **Appendix 3**. By default, Geo-HMS allocates the first 100 ft. for sheet flow. This was appropriate for the Chamberino watershed because the upper basin slopes are very steep with slopes on the order of 15-25 %. Engineering judgment had to be exercised when determining the T_c parameters through the lower Chamberino watershed. This is because the lack of curb and gutter on the streets and the lack of any storm drain infrastructure means that runoff still largely follows the topography. The T_c flow paths generated by Arc Hydro through the agricultural fields are extremely subjective. In the absence of better topographic data, the flow paths interpolated by Arc Hydro over the DEM were adopted.

Subbasins consisting of agricultural fields were not allowed to have any channel flow because the physical characteristics of the subbasins would prevent that from occurring. As a result, T_c computations were only limited to sheet flow and shallow concentrated flow.

NRCS Unit Hydrograph Lag Time Method (T_L) was applied to the Tc to compute the unit hydrograph Time to Peak (T_p). Note that Lag Time = 0.6 Tc. **Appendix 4** contains the reference pages from the National Engineering Handbook, May 2015. Chapter 15 describes the lag time concept and method.

Manning's Roughness Coefficients "n" assumptions were obtained from TR-55, by experience and by review of "n" value tables by Chow, 1959 (copies include in Appendix 4).

Tables 4 (**Appendix 3**) summarizes the travel time, time of concentration, and lag time data and results. **Table 2** also presents the lag time results that were used as input in HEC-HMS.

2.8 Channel Routing

The Muskingum-Cunge channel routing method was applied to route hydrographs. **Figure 2 in Appendix 3** illustrates the routing reaches. Manning's "n" values were assumed based on field observation, experience, and the Manning's "n" values from Chow, 1959. Bottom width assumptions were determined as the typical channel width from the drainage basin maps. **Table 3** (Appendix 3) presents the Muskingum-Cunge channel routing input data summary.

Note that runoff losses to channel bed infiltration and percolation were assumed to be small and were therefore not simulated.

2.9 Sediment Bulking

The HEC-HMS models simulate clear water hydrographs unless a "Flow Ratio" is applied to simulate sediment volume within hydrographs. This is also called sediment bulking. Note that a sediment bulking value of about 17% is considered the limit before mud flow would occur. Due to lack of site specific data, a sediment bulking factor of 1.10 or 10% was assumed for all undeveloped subbasin hydrographs while the urban subbasins were allocated a factor of 1.05 or 5 %. That assumption is based on review of information presented in the Sediment and Erosion Design Guide, Nov. 2008; Mussetter Engineering, Inc. **Appendix 4** contains a copy of relevant pages from that document.

2.10 Computation Time Increment for HEC-HMS Models

The computation increment assumed within a HEC-HMS model may make a large difference in model peak discharge results particularly for large drainage basins. Guidance on computation intervals was found in a Digital Engineering Library (McGraw-Hill, a copy included in **Appendix 4**) and summarized here. The computation time increment is typically based on Time of Concentration (Tc) and the following equation:

$T_c / 5 \ <= \ \text{computation time increment} <= T_c / 3$

Due to the small lag time observed for the smaller urban basins, the computation time increment was set to 1 minute.

2.11 Modeling Results

The results for the 5yr, 10yr, and 100yr–24 Hour Storms are presented in **Appendix 5**. The unit peak discharges for the 100 year – 24 hour event for undeveloped basins ranged from 1.1 - 1.5 cfs per acre while the more urban subbasins were in the range of 3.5 cfs per acre.

These numbers are well within the acceptable unit peak discharges observed in other similar studies.

SECTION 3. OPTIONS HYDROLOGIC AND HYDRAULIC ANALYSES

3.1 Proposed Options Hydrologic and Hydraulic Data

Two options were simulated within HEC-HMS to improve drainage conditions in Chamberino. The idea behind the two options was to divert off-site flows around town and to redirect flows within town where possible. The redirection of flows in town was handled with extreme caution. The only streets that were considered were those that had low/no risk of downstream damage. Since many of the houses are below street grade, concentrating flows in location could prove to be hazardous in large events where the street flow capacity is exceeded and water could drain into yards and houses through the driveway.

Several detention and retention ponds were simulated within HEC-HMS. Pond routings were performed based on conceptual level grading plans and elevation-storage-discharge curves derived from topographic data. Typical side slopes for ponds were assumed to 1V:3H and where applicable, principal spillways were simulated as a 24 inch CMP pipe. Hydraulic capacity calculations for the diversion channel and street flow were performed with the Flowmaster software and culvert calculations were performed with Culvertmaster.

3.2 Overview of Option 1

Sheet Opt1.1 provides an overview for all the flood control elements proposed in Option 1. These consist of the following:

Pond 1: Pond 1 is a rehabilitation of Dam **D4**, as labeled on **Figure 1** (map Pocket). This dam is located east of the Chamberino Mutual Domestic water facility at the outlet of basin W1160. Refer to **Sheet OPT1.2** for grading plan and pond routing summary. The existing structure is of unknown ownership based on EBID and Doña Ana Flood Commission GIS records. The current structure is currently breached. However this structure can be rehabilitated as follows: the existing embankment can be to be lowered to elevation 3901. This would provide a total storage volume of 23.7 ac-ft. The spillway will have to be designed to handle the 100 Yr-24 Hr flows.

Based on the routing results, this dam will control the 100 Yr- 24Hr storm without activating the emergency spillway.

Pond 1 would be a non-jurisdictional dam due to its embankment height being less than 6 ft from top of dam (Elev-3901) to the lowest downstream toe elevation (Elev-3896). The detailed routing summary is provided below and detailed rating curve data is provided in **Appendix 6.** The cost of demolishing the existing embankment and building Pond 1 is approximately **$1,160,236**. A detailed cost estimate table is presented with **Sheet OPT1.2**.

Table 1

Proposed Ponds Detention Pond Routing Summary Option 1
Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	**Return Period / year**	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	**Free board to Emergency Spillway Elevation**	**Free board to top of Pond Embankment**
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	**ft**	**ft**
a	b		c	c	c	c	d	c	c	d	d	d		d	f	e
Pond 1	24	100 / 24	256	30	23.7	23.7	23.1	11.3	3898.10	3900.00	3894.00	7	4.1	3901.00	**1.9**	**2.9**
	24	10/24	72	7	8.6	8.6	23.1	3.8	3896.00	3900.00	3894.00	7	2.0	3901.00	**4.0**	**5.0**
	24	5/24	37	4	5.4	5.4	23.1	2.2	3895.20	3900.00	3894.00	7	1.2	3901.00	**4.8**	**5.8**

Diversion Channel: The diversion channel would be located on the west side of the community. Refer to **Sheet OPT 1.3**. This channel would run south to north at a slope of 1.5%. The channel would be trapezoidal in shape with a bottom width of 15 ft. with 1V:3H side slopes and a total length of approximately 3450 ft. Based on preliminary hydraulic calculations, the channel capacity would be 110 cfs at a normal depth of 1 ft. The diversion channel will divert offsite runoff that currently flows into the Chamberino community. In some locations, the channel does not entirely divert a 100 % of a subbasin. In that case, a flow divide element was used in HEC-HMS to split hydrographs. Visual inspection was used to determine what percent of the subbasin was diverted by the channel. The maximum diversion flow rate was based on multiplying the 100 Yr-24Hr flow rate by the diversion percent. In HEC-HMS, the diversion is sent to the channel and a main branch is added to the downstream element. **Table D** in **Appendix 6** summarizes the percentages of basins diverted and the maximum flow values.

Culverts are required to convey the flow under the private road that leads to the Chamberino Mutual Domestic water facility and a construction easement will be required.

The flow at this location (HEC-HMS junction element J.CHNL6) for the 10Yr-24Hr storm is 29 cfs while the 100 Yr-24Hr flow is 69 cfs. Preliminary culvert calculations show the need for two 30 inch diameter CMPS that would pass 67 cfs. Alternatively, smoother materials such as corrugated HDPE will increase capacity to 83 cfs. **Appendix 6** has the output for the channel and culvert calculations. The diversion channel will outfall into the proposed Pond 2. The cost of building the diversion channel is approximately **$264,494.** A detailed cost estimate table is presented with **Sheet OPT1.3**.

Pond 2: Pond 2 acts as the outfall to the diversion channel. This pond is located at the very north end of Chamberino. Refer to **Sheet OPT1.4** for grading. Pond 2 would serve as a sediment control and detention facility. Pond 2 has a design volume of 5 ac-ft. This would be a non-jurisdictional facility. The detailed pond routing summary is provided below.

The routing results show that Pond 2 will fully control the 10Yr-24Hr storm while the emergency spillway will be activated during the 100 Yr-24 Hr storm.

Table 2

Proposed Ponds Detention Pond Routing Summary Option 1
Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	**Return Period / year**	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	**Free board to Emergency Spillway Elevation**	**Free board to top of Pond Embankment**
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	**ft**	**ft**
a	b		c	c	c	c	d	c	c	d	d	d		d	**f**	**e**
Pond 2	24	100 / 24	175	117	39.9	39.9	5.0	3.6	3820.30	3820.00	3814.00	8	6.3	3822.00	**-0.3**	**1.7**
	24	10/24	54	25	15.3	15.3	5.0	1.6	3817.60	3820.00	3814.00	8	3.6	3822.00	**2.4**	**4.4**
	24	5/24	31	14	9.8	9.8	5.0	1.0	3816.70	3820.00	3814.00	8	2.7	3822.00	**3.3**	**5.3**

Footnotes for Detention Pond Routing Summary Table
a - Option 1
b - Conceptual DesignOutfall Pipe
c - Results summarized from the HEC-HMS model
d - See elev-area-capacity-discharge data table and sources in Appendix 6
e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights
f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)

The cost of building Pond 2 is approximately **$173,657**. A detailed cost estimate table is presented with **Sheet OPT1.4**.

Pond 3: Pond 3 would act as the outfall for Subbasin W720 well as a sediment control and detention facility. Pond 3 will be a non-jurisdictional pond. **Sheet OPT1.5** shows the conceptual layout for the pond. Pond 3 will fully control the 10Yr-24 Hr storm. The emergency spillway will be activated during the 100Yr-24 Hr storm. Routing results are provided below.

Table 3

Proposed Ponds Detention Pond Routing Summary Option 1
Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	**Return Period / year**	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	**Free board to Emergency Spillway Elevation**	**Free board to top of Pond Embankment**
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	**ft**	**ft**
a	b		c	c	c	c	d	c	c	d	d	d		d	**f**	**e**
Pond 3	24	100 / 24	91	50	48.7	48.7	8.4	7.7	3816.10	3816.00	3810.00	7	6.1	3816.50	**-0.1**	**0.4**
	24	10/24	29	17	19.2	19.2	8.4	2.7	3813.00	3816.00	3810.00	7	3.0	3816.50	**3.0**	**3.5**
	24	5/24	20	10	12.6	12.6	8.4	1.9	3812.30	3816.00	3810.00	7	2.3	3816.50	**3.7**	**4.2**

Footnotes for Detention Pond Routing Summary Table
a - Option 1
b - Conceptual DesignOutfall Pipe
c - Results summarized from the HEC-HMS model
d - See elev-area-capacity-discharge data table and sources in Appendix 6
e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights
f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)

The cost of building Pond 3 is approximately **$308,662**. A detailed cost estimate table is presented with **Sheet OPT1.5**.

Roadway Improvements on Padre Pio Ave.: Roadway improvements are recommended with an inverted crown section and curb and gutter along Padre Pio Ave. This will help convey runoff from subbasin W720 to Pond 3 on the east side of N Sauceda Ave. Street conveyance capacity with the proposed section was computed to be 109 cfs. **Sheet OPT1.6** shows the typical roadway section and limits of proposed improvement and general assumptions made for hydraulic calculations. The subbasin runoff is 62 cfs for the 100 Yr-24 Hr storm.

The runoff from Subbasin W720 would outfall into Pond 3. Hydraulic calculations from FlowMaster are summarized in **Appendix 6.** The cost of roadway improvements is approximately **$480,217**. A detailed cost estimate table is presented with **Sheet OPT1.6**.

Pond 4: Pond 4 is located on the east side of the processing factory. The impervious area from the site generates a considerable amount of runoff as evidenced by the severe gullying at the east property boundary. Pond 4 would act as a detention facility that would control the discharge from the site.

Sheet OPT1.7 shows the conceptual layout for Pond 4. Pond 4 will fully control the 100 Yr-24 Hr storm and will be a non-jurisdictional facility. Pond routing summary is shown below.

Table 4

Proposed Ponds Detention Pond Routing Summary Option 1
Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	**Return Period / year**	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	**Free board to Emergency Spillway Elevation**	**Free board to top of Pond Embankment**
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	**ft**	**ft**
a	b		c	c	c	c	d	c	c	d	d	d		d	**f**	**e**
Pond 4	24	100 / 24	120	32	8.1	8.1	4.7	2.9	3902.50	3904.00	3898.00	7	4.5	3904.50	**1.5**	**2.0**
	24	10/24	42	11	3.3	3.3	4.7	1.2	3900.40	3904.00	3898.00	7	2.4	3904.50	**3.6**	**4.1**
	24	5/24	26	6	2.3	2.3	4.7	1.0	3899.90	3904.00	3898.00	7	1.9	3904.50	**4.1**	**4.6**

Footnotes for Detention Pond Routing Summary Table

a - Option 1
b - Conceptual DesignOutfall Pipe
c - Results summarized from the HEC-HMS model
d - See elev-area-capacity-discharge data table and sources in Appendix 6
e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights
f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)

The cost of building Pond 4 is approximately **$281,523**. A detailed cost estimate table is presented with **Sheet OPT1.7**.

The cost estimate tables for all the proposed facilities are provided in **Appendix 7**.

3.3 Overview of Option 2

Option 2 attempts to address drainage issues in the southern part of Chamberino primarily south San Jacinto Rd. This part of town is much more complicated because houses are built at the flow line of the historic arroyos. With the majority of houses lacking hard boundaries such as brick walls, any considerable rainfall will result in flooding. Due to the density of development and the nature of development, redirecting and concentrating flows through streets was not considered for the risk of flooding a property.

Option 2 assumes that Option 1 has been built therefore it attempts to deal with the local drainage in south Chamberino. **Sheet OPT 2** shows the overall improvements being proposed along with a detailed layout of the various drainage improvements.

Berm Construction: Part of San Luis Ave. south of San Jacinto Rd. has an earth berm that has been constructed and runs north to south on east side of San Luis Ave. The berm stops one lot north of the intersection of Convent Rd. and San Luis Ave. This lot is the low point for subbasins south of Jan Jacinto Rd. to Monte Alto St. which would see most of the runoff pass through the lot and house. On the south west corner of Convent Rd. and Lopez Rd., there is an enclosed facility that is owned by the Board County Commission that would be compromised in a big event. Extending the existing berm south along San Luis Rd. and east along Convent Rd. would keep surface runoff within the limits of the street.

Discussion on Ponds 5 through 6-3: In prior meetings with the DACFC, several sites for ponds along Lopez Rd. from Convent Rd. to San Bernardo St were discussed.

Pond 5 south of Convent Rd. and Lopez Rd. was examined first. While this pond can provide the necessary storage, it would be a retention pond because there is no way to drain this pond by gravity. A pump station/forcemain system would be required to drain the pond. At four feet deep, the pond would store the entire 10 Yr-24Hr volume while the 100 Yr-24 Hr events would over top the pond. However, there would be a 4 ft. deep standing body of water that would drain over a prolonged period of time.

At two feet deep, the pond would have insufficient volume to contain both the 10Yr and the 100 yr volumes.

Either way, both scenarios would create a standing body of water that would not drain without a pump.

The same scenario is true for **Pond 6-2.** The pond would have to be very large and deep to store the 8.7 ac-ft of water for the 10 Yr – 24Hr storm. Without a pump station, there would be no way of draining the pond. As a result, any storms of significance would leave a body of standing water that would create a breeding ground for mosquitoes or a drowning hazard if not fenced off given both ponds proximity to houses.

Pond 6-1 and **6-3** were also examined, however no results are reported due the inefficiency of the ponds.

From a flood control stand point, Pond 6-3 would make the most sense as it would detain the most area.

However, that would require DACFC to acquire the property. Both ponds 6-1 and 6-2 are high enough to where they could be drained completely by gravity.

The other issue for these proposed ponds is cost-benefit. Ponds 5 and 6-1 through 6-3 are basically at the outfall of the Chamberino watershed.

The construction of these ponds does not provide a great downstream flood control benefit other than keeping the sediment out the agricultural fields on the east side of Lopez Rd.

Only Pond 6-3 was simulated in the Option 2 HEC-HMS model. The routing summary is provided below.

Table 5

Proposed Ponds Detention Pond Routing Summary Option 2
Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	**Return Period / year**	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	**Free board to Emergency Spillway Elevation**	**Free board to top of Pond Embankment**
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	**ft**	**ft**
a	b		c	c	c	c	d	c	c	d	d	d		d	**f**	**e**
Pond 6-3	24	100 / 24	187	112	20.4	19.6	5.0	4.9	3810.30	3810.00	3804.00	7	6.3	3810.50	**-0.3**	**0.2**
	24	10/24	65	21	8.7	7.9	5.0	2.6	3808.00	3810.00	3804.00	7	4.0	3810.50	**2.0**	**2.5**
	24	5/24	41	12	6.1	5.3	5.0	1.8	3807.00	3810.00	3804.00	7	3.0	3810.50	**3.0**	**3.5**

Footnotes for Detention Pond Routing Summary Table
a - Option 1
b - Conceptual DesignOutfall Pipe
c - Results summarized from the HEC-HMS model
d - See elev-area-capacity-discharge data table and sources in Appendix 6
e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights
f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)

Channel Improvements: It is quite clear from field work and aerial imagery that there used to be a drainage facility in between Pond 6-1 and 6-3 (**Sheet Opt2**). In fact there is still evidence of an emergency spillway and remnants of a channel on the west side of Lopez Rd. The subbasins draining south east from San Francisco de Asis Ave. to San Bernado Rd. drain to this point. The old channel is currently full of trash and debris. The construction of a rectangular open channel section with vertical walls to contain the water would help drainage issues that would arise at this point. See the conceptual channel section on **Sheet OPT2**.

DACFC determined that facilities proposed in Option 2 provided insufficient benefit for Chamberino therefore were not considered any further.

3.3 Conclusion

The facilities proposed in Option 1 will improve drainage conditions in Chamberino. Figure B summarizes the reduction in bypass flows after the implementation of Option 1 facilities. However the facilities will have to be phased out in order of most effective to least effective in terms of flood mitigation.

Smith recommends phasing the Option 1 proposed facilities in the following order:

Pond 1: Smith recommends the demolition of the existing embankment and construction of Pond 1 for two reasons.

1 - With Pond 1 in place, the risk to the proposed downstream facilities (Pond 2 and the Diversion Channel) will be lower.

2 - The existing dam embankment does not appear to be engineered. Based on field observation, there appears to be no compaction of the embankment. This poses as a significant risk to the north part of Chamberino should the dam fail catastrophically in a large storm event.

Pond 2: Pond 2 needs to be constructed to act as the outfall for the diversion channel.

Diversion Channel: The diversion channel will divert most of the offsite runoff to Pond 2.

Pond 4: Pond 4 controls the impervious discharge that is generated from the bean processing factory at the west end of San Francisco De Asis Rd.

Pond 3: Pond 3 would act as the outfall for the runoff captured and concentrated by the roadway improvements on Padre Pio Ave.

Roadway Improvements on Padre Pio Ave: Proposed improvements to keep runoff within ROW. Flows will discharge into Pond 3.

Table 6 below summarizes the facility costs recommended for Chamberino.

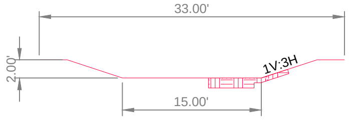
Table 6

Option 1 Facility Name In Order of Importance	Cost
Pond 1	$1,160,236
Pond 2	$264,494
Diversion Channel	$173,657
Pond 4	$281,523
Pond 3	$308,662
Roadway Improvements	$480,217
Total Cost of Facilities	**$2,668,789**

FIGURES / OPTION MAPS:

PROPOSED DIVERSION CHANNEL TO BE DESIGNED AT 1.5 % SLOPE
CHANNEL LENGTH = ~3450 FT
ASSUMED NORMAL DEPTH TO BE 1FT
MANNING'S N VALUE ASSUMED TO BE 0.025
DESIGN CAPACITY = 110 CFS
SEE APPENDIX 6 FOR PRELIMINARY FLOWMASTER CALCULATIONS

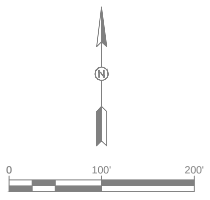
TYPICAL CHANNEL SECTION

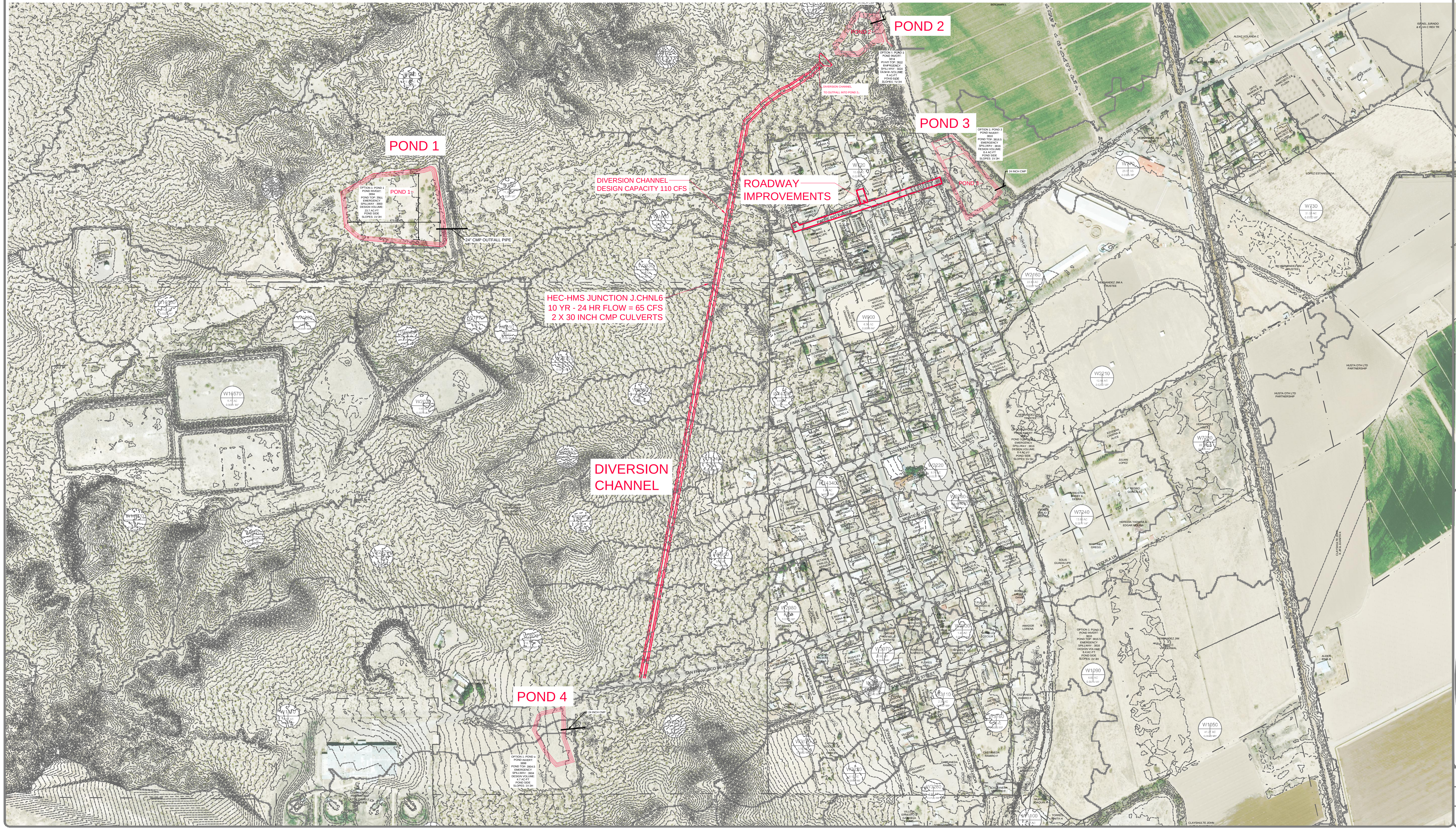


LEGEND

- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- W#### XX AC. XX MI² — SUB-BASIN NUMBER / SUB-BASIN AREA (AC./MI²)
- PRINCIPAL PIPE OUTLET FROM DAM
- EXISTING PROPERTY LINE
- PROPOSED IMPROVEMENTS

NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.





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CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN

OPTION 1 OVERVIEW

SOLUTIONS FOR TODAY... VISION FOR TOMORROW
201 N. Church Street, Suite 310
Las Cruces, NM 88001
Phone: (575) 523-2395
Fax: (575) 523-2396
SMITH ENGINEERING COMPANY
NEW MEXICO
TEXAS

JOB NO: 815105

DATE: MARCH, 2016

SHEET NO: OPT1.1

Proposed Ponds Detention Pond Routing Summary Option 1
Chamberino Drainage Master Plan

Detention Pond Name	Principal SpillwayPipe Diameter	**Return Period / year**	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	**Free board to Emergency Spillway Elevation**	**Free board to top of Pond Embankment**
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	**ft**	**ft**
a	b		c	c	c	c	d	c	c	d	d	d		d	**f**	**e**
Pond 1	24	100 / 24	256	30	23.7	23.7	23.1	11.3	3898.10	3900.00	3894.00	7	4.1	3901.00	**1.9**	**2.9**
	24	10/24	72	7	8.6	8.6	23.1	3.8	3896.00	3900.00	3894.00	7	2.0	3901.00	**4.0**	**5.0**
	24	5/24	37	4	5.4	5.4	23.1	2.2	3895.20	3900.00	3894.00	7	1.2	3901.00	**4.8**	**5.8**

Footnotes for Detention Pond Routing Summary Table

a - Option 1

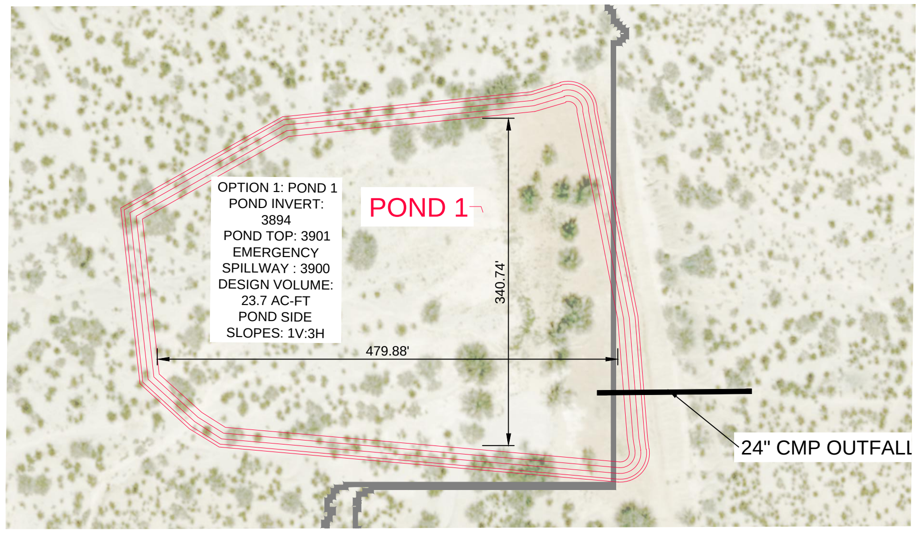
b - Conceptual DesignOutfall Pipe

c - Results summarized from the HEC-HMS model

d - See elev-area-capacity-discharge data table and sources in Appendix 6

e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights

f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)



0 100' 200'

LEGEND

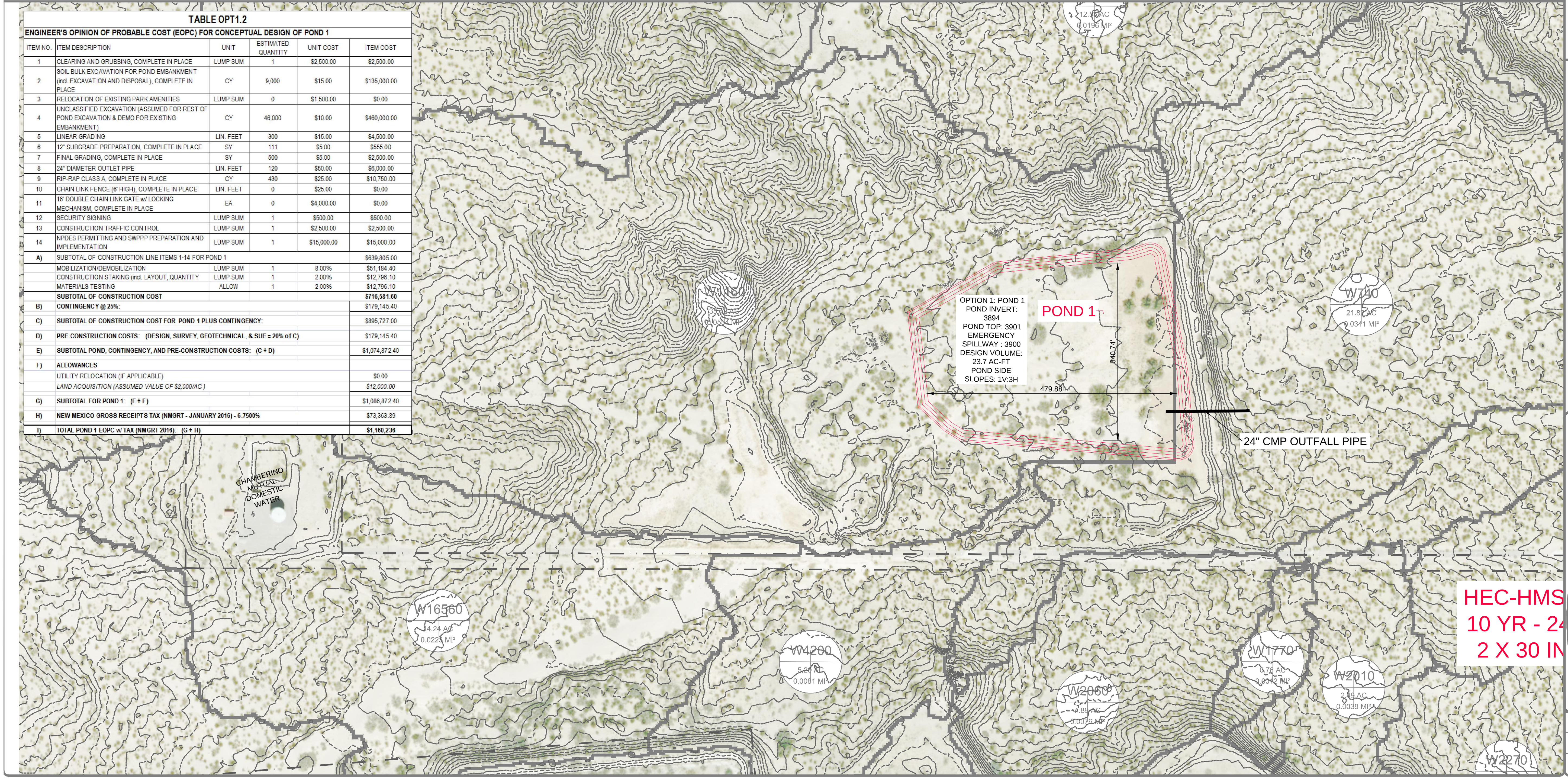
- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- W#### XX AC. XX MI² — SUB-BASIN NUMBER, SUB-BASIN AREA (AC./MI²)
- PRINCIPAL PIPE OUTLET FROM DAM
- EXISTING PROPERTY LINE
- PROPOSED IMPROVEMENTS

NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.

TABLE OPT1.2

ENGINEER'S OPINION OF PROBABLE COST (EOPC) FOR CONCEPTUAL DESIGN OF POND 1

ITEM NO.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST
1	CLEARING AND GRUBBING, COMPLETE IN PLACE	LUMP SUM	1	$2,500.00	$2,500.00
2	SOIL BULK EXCAVATION FOR POND EMBANKMENT (incl. EXCAVATION AND DISPOSAL), COMPLETE IN PLACE	CY	9,000	$15.00	$135,000.00
3	RELOCATION OF EXISTING PARK AMENITIES	LUMP SUM	0	$1,500.00	$0.00
4	UNCLASSIFIED EXCAVATION (ASSUMED FOR REST OF POND EXCAVATION & DEMO FOR EXISTING EMBANKMENT)	CY	46,000	$10.00	$460,000.00
5	LINEAR GRADING	LIN. FEET	300	$15.00	$4,500.00
6	12" SUBGRADE PREPARATION, COMPLETE IN PLACE	SY	111	$5.00	$555.00
7	FINAL GRADING, COMPLETE IN PLACE	SY	500	$5.00	$2,500.00
8	24" DIAMETER OUTLET PIPE	LIN. FEET	120	$50.00	$6,000.00
9	RIP-RAP CLASS A, COMPLETE IN PLACE	CY	430	$25.00	$10,750.00
10	CHAIN LINK FENCE (6' HIGH), COMPLETE IN PLACE	LIN. FEET	0	$25.00	$0.00
11	16' DOUBLE CHAIN LINK GATE w/ LOCKING MECHANISM, COMPLETE IN PLACE	EA	0	$4,000.00	$0.00
12	SECURITY SIGNING	LUMP SUM	1	$500.00	$500.00
13	CONSTRUCTION TRAFFIC CONTROL	LUMP SUM	1	$2,500.00	$2,500.00
14	NPDES PERMITTING AND SWPPP PREPARATION AND IMPLEMENTATION	LUMP SUM	1	$15,000.00	$15,000.00
A)	SUBTOTAL OF CONSTRUCTION LINE ITEMS 1-14 FOR POND 1				$639,805.00
	MOBILIZATION/DEMOBILIZATION	LUMP SUM	1	8.00%	$51,184.40
	CONSTRUCTION STAKING (incl. LAYOUT, QUANTITY	LUMP SUM	1	2.00%	$12,796.10
	MATERIALS TESTING	ALLOW	1	2.00%	$12,796.10
	SUBTOTAL OF CONSTRUCTION COST				**$716,581.60**
B)	**CONTINGENCY @ 25%:**				$179,145.40
C)	**SUBTOTAL OF CONSTRUCTION COST FOR POND 1 PLUS CONTINGENCY:**				$895,727.00
D)	**PRE-CONSTRUCTION COSTS: (DESIGN, SURVEY, GEOTECHNICAL, & SUE = 20% of C)**				$179,145.40
E)	**SUBTOTAL POND, CONTINGENCY, AND PRE-CONSTRUCTION COSTS: (C + D)**				$1,074,872.40
F)	**ALLOWANCES**				
	UTILITY RELOCATION (IF APPLICABLE)				$0.00
	LAND ACQUISITION (ASSUMED VALUE OF $2,000/AC)				*$12,000.00*
G)	**SUBTOTAL FOR POND 1: (E + F)**				$1,086,872.40
H)	**NEW MEXICO GROSS RECEIPTS TAX (NMGRT - JANUARY 2016) - 6.7500%**				$73,363.89
I)	**TOTAL POND 1 EOPC w/ TAX (NMGRT 2016): (G + H)**				**$1,160,236**



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CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

NO	REVISION DESCRIPTION	DATE	BY
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DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN

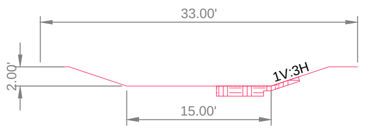
OPTION 1 POND 1

SOLUTIONS FOR TODAY... VISION FOR TOMORROW
201 N. Church Street, Suite 310
Las Cruces, NM 88001
Phone: (575) 523-2395
Fax: (575) 523-2396
SMITH ENGINEERING COMPANY
NEW MEXICO TEXAS

JOB NO: 815105
DATE: JUNE, 2016
SHEET NO: OPT1.2

PROPOSED DIVERSION CHANNEL TO BE DESIGNED AT 1.5 % SLOPE
CHANNEL LENGTH = ~3450 FT
ASSUMED NORMAL DEPTH TO BE 1FT
MANNING'S N VALUE ASSUMED TO BE 0.025
DESIGN CAPACITY = 110 CFS
SEE APPENDIX 6 FOR PRELIMINARY FLOWMASTER CALCULATIONS

TYPICAL CHANNEL SECTION



LEGEND

- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- W#### XX AC. XX MI² — SUB-BASIN NUMBER / SUB-BASIN AREA (AC./MI²)
- PRINCIPAL PIPE OUTLET FROM DAM
- EXISTING PROPERTY LINE
- PROPOSED IMPROVEMENTS

NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.

FOR PLANNING PURPOSES ONLY AND SHALL NOT BE USED FOR CONSTRUCTION, BIDDING, OR PERMITTING PURPOSES

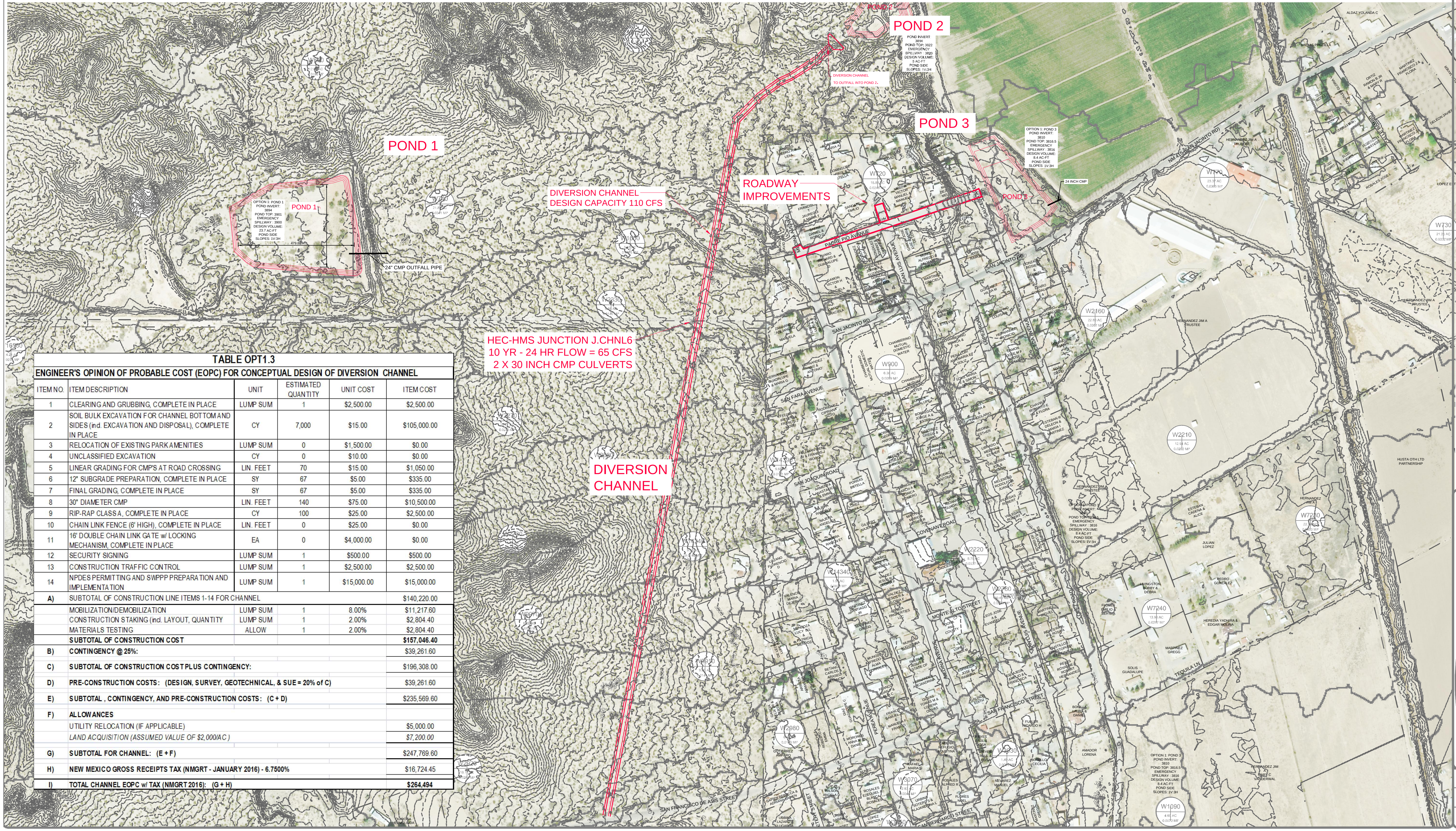


TABLE OPT1.3

ENGINEER'S OPINION OF PROBABLE COST (EOPC) FOR CONCEPTUAL DESIGN OF DIVERSION CHANNEL

ITEM NO.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST
1	CLEARING AND GRUBBING, COMPLETE IN PLACE	LUMP SUM	1	$2,500.00	$2,500.00
2	SOIL BULK EXCAVATION FOR CHANNEL BOTTOM AND SIDES (incl. EXCAVATION AND DISPOSAL), COMPLETE IN PLACE	CY	7,000	$15.00	$105,000.00
3	RELOCATION OF EXISTING PARK AMENITIES	LUMP SUM	0	$1,500.00	$0.00
4	UNCLASSIFIED EXCAVATION	CY	0	$10.00	$0.00
5	LINEAR GRADING FOR CMP'S AT ROAD CROSSING	LIN. FEET	70	$15.00	$1,050.00
6	12" SUBGRADE PREPARATION, COMPLETE IN PLACE	SY	67	$5.00	$335.00
7	FINAL GRADING, COMPLETE IN PLACE	SY	67	$5.00	$335.00
8	30" DIAMETER CMP	LIN. FEET	140	$75.00	$10,500.00
9	RIP-RAP CLASS A, COMPLETE IN PLACE	CY	100	$25.00	$2,500.00
10	CHAIN LINK FENCE (6' HIGH), COMPLETE IN PLACE	LIN. FEET	0	$25.00	$0.00
11	16' DOUBLE CHAIN LINK GATE w/ LOCKING MECHANISM, COMPLETE IN PLACE	EA	0	$4,000.00	$0.00
12	SECURITY SIGNING	LUMP SUM	1	$500.00	$500.00
13	CONSTRUCTION TRAFFIC CONTROL	LUMP SUM	1	$2,500.00	$2,500.00
14	NPDES PERMITTING AND SWPPP PREPARATION AND IMPLEMENTATION	LUMP SUM	1	$15,000.00	$15,000.00
A)	SUBTOTAL OF CONSTRUCTION LINE ITEMS 1-14 FOR CHANNEL				$140,220.00
	MOBILIZATION/DEMOBILIZATION	LUMP SUM	1	8.00%	$11,217.60
	CONSTRUCTION STAKING (incl. LAYOUT, QUANTITY	LUMP SUM	1	2.00%	$2,804.40
	MATERIALS TESTING	ALLOW	1	2.00%	$2,804.40
	SUBTOTAL OF CONSTRUCTION COST				**$157,046.40**
B)	**CONTINGENCY @ 25%:**				$39,261.60
C)	**SUBTOTAL OF CONSTRUCTION COST PLUS CONTINGENCY:**				$196,308.00
D)	**PRE-CONSTRUCTION COSTS: (DESIGN, SURVEY, GEOTECHNICAL, & SUE = 20% of C)**				$39,261.60
E)	**SUBTOTAL , CONTINGENCY, AND PRE-CONSTRUCTION COSTS: (C + D)**				$235,569.60
F)	**ALLOWANCES**				
	UTILITY RELOCATION (IF APPLICABLE)				$5,000.00
	LAND ACQUISITION (ASSUMED VALUE OF $2,000/AC)				*$7,200.00*
G)	**SUBTOTAL FOR CHANNEL: (E + F)**				$247,769.60
H)	**NEW MEXICO GROSS RECEIPTS TAX (NMGRT - JANUARY 2016) - 6.7500%**				$16,724.45
I)	**TOTAL CHANNEL EOPC w/ TAX (NMGRT 2016): (G + H)**				**$264,494**

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CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN

OPTION 1 DIVERSION CHANNEL

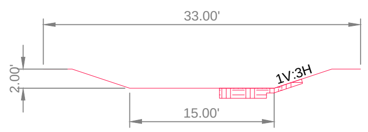
SMITH ENGINEERING COMPANY
SOLUTIONS FOR TODAY... VISION FOR TOMORROW
201 N. Church Street, Suite 310
Las Cruces, NM 88001
Phone: (575) 523-2395
Fax: (575) 523-2396
TEXAS
NEW MEXICO

JOB NO: 815105
DATE: JUNE, 2016
SHEET NO: OPT1.3

Q:\SEC---PROJECTS\815105 Chamberino DMP\CADD\Proposed Chamberino Options_1.dwg Jun 16, 2016 - 10:44am Saved By: chrisn

PROPOSED DIVERSION CHANNEL TO BE DESIGNED AT 1.5 % SLOPE
CHANNEL LENGTH = ~3450 FT
ASSUMED NORMAL DEPTH TO BE 1FT
MANNING'S N VALUE ASSUMED TO BE 0.025
DESIGN CAPACITY = 110 CFS
SEE APPENDIX 6 FOR PRELIMINARY FLOWMASTER CALCULATIONS

TYPICAL CHANNEL SECTION



Proposed Ponds Detention Pond Routing Summary Option 1

Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	Return Period / year	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	Free board to Emergency Spillway Elevation	Free board to top of Pond Embankment
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	ft	ft
a	b		c	c	c	c	d	c	c	d	d	d		d	f	e
Pond 2	24	100 / 24	175	117	39.9	39.9	5.0	3.6	3820.30	3820.00	3814.00	8	6.3	3822.00	-0.3	1.7
	24	10/24	54	25	15.3	15.3	5.0	1.6	3817.60	3820.00	3814.00	8	3.6	3822.00	2.4	4.4
	24	5/24	31	14	9.8	9.8	5.0	1.0	3816.70	3820.00	3814.00	8	2.7	3822.00	3.3	5.3

Footnotes for Detention Pond Routing Summary Table

a - Option 1
b - Conceptual DesignOutfall Pipe
c - Results summarized from the HEC-HMS model
d - See elev-area-capacity-discharge data table and sources in Appendix 6
e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights
f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)

LEGEND

MAJOR BASIN BOUNDARY
SUB-BASIN BOUNDARY
W####
XX AC.
XX MI²
SUB-BASIN NUMBER
SUB-BASIN AREA (AC./MI²)
PRINCIPAL PIPE OUTLET FROM DAM
EXISTING PROPERTY LINE
PROPOSED IMPROVEMENTS

NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.

N
0 40' 80'

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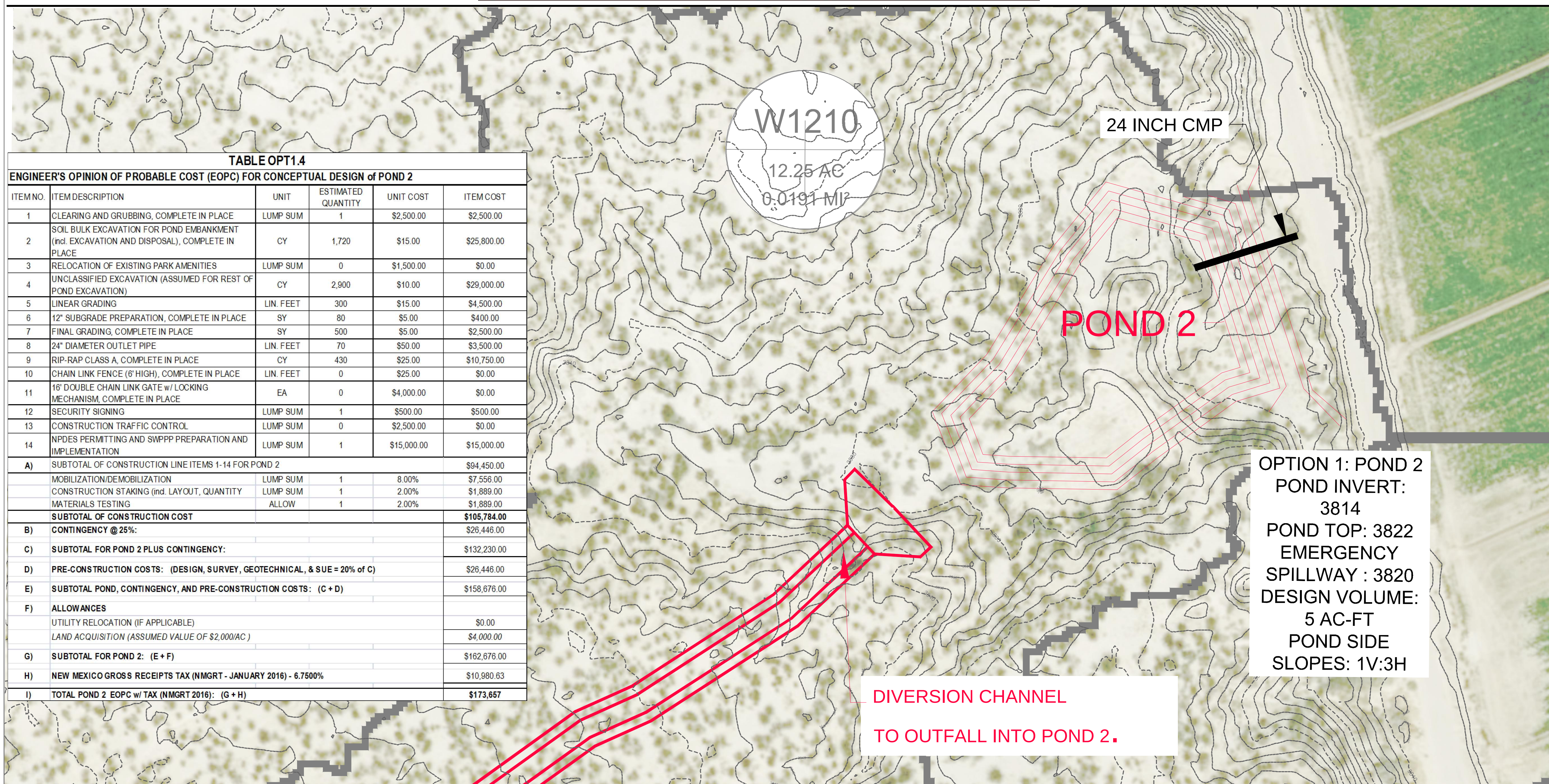

TABLE OPT1.4

ENGINEER'S OPINION OF PROBABLE COST (EOPC) FOR CONCEPTUAL DESIGN of POND 2

ITEM NO.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST
1	CLEARING AND GRUBBING, COMPLETE IN PLACE	LUMP SUM	1	$2,500.00	$2,500.00
2	SOIL BULK EXCAVATION FOR POND EMBANKMENT (incl. EXCAVATION AND DISPOSAL), COMPLETE IN PLACE	CY	1,720	$15.00	$25,800.00
3	RELOCATION OF EXISTING PARK AMENITIES	LUMP SUM	0	$1,500.00	$0.00
4	UNCLASSIFIED EXCAVATION (ASSUMED FOR REST OF POND EXCAVATION)	CY	2,900	$10.00	$29,000.00
5	LINEAR GRADING	LIN. FEET	300	$15.00	$4,500.00
6	12" SUBGRADE PREPARATION, COMPLETE IN PLACE	SY	80	$5.00	$400.00
7	FINAL GRADING, COMPLETE IN PLACE	SY	500	$5.00	$2,500.00
8	24" DIAMETER OUTLET PIPE	LIN. FEET	70	$50.00	$3,500.00
9	RIP-RAP CLASS A, COMPLETE IN PLACE	CY	430	$25.00	$10,750.00
10	CHAIN LINK FENCE (6' HIGH), COMPLETE IN PLACE	LIN. FEET	0	$25.00	$0.00
11	16' DOUBLE CHAIN LINK GATE w/ LOCKING MECHANISM, COMPLETE IN PLACE	EA	0	$4,000.00	$0.00
12	SECURITY SIGNING	LUMP SUM	1	$500.00	$500.00
13	CONSTRUCTION TRAFFIC CONTROL	LUMP SUM	0	$2,500.00	$0.00
14	NPDES PERMITTING AND SWPPP PREPARATION AND IMPLEMENTATION	LUMP SUM	1	$15,000.00	$15,000.00
A)	SUBTOTAL OF CONSTRUCTION LINE ITEMS 1-14 FOR POND 2				$94,450.00
	MOBILIZATION/DEMOBILIZATION	LUMP SUM	1	8.00%	$7,556.00
	CONSTRUCTION STAKING (incl. LAYOUT, QUANTITY	LUMP SUM	1	2.00%	$1,889.00
	MATERIALS TESTING	ALLOW	1	2.00%	$1,889.00
	SUBTOTAL OF CONSTRUCTION COST				**$105,784.00**
B)	**CONTINGENCY @ 25%:**				$26,446.00
C)	**SUBTOTAL FOR POND 2 PLUS CONTINGENCY:**				$132,230.00
D)	**PRE-CONSTRUCTION COSTS: (DESIGN, SURVEY, GEOTECHNICAL, & SUE = 20% of C)**				$26,446.00
E)	**SUBTOTAL POND, CONTINGENCY, AND PRE-CONSTRUCTION COSTS: (C + D)**				$158,676.00
F)	**ALLOWANCES**				
	UTILITY RELOCATION (IF APPLICABLE)				$0.00
	LAND ACQUISITION (ASSUMED VALUE OF $2,000/AC)				*$4,000.00*
G)	**SUBTOTAL FOR POND 2: (E + F)**				$162,676.00
H)	**NEW MEXICO GROSS RECEIPTS TAX (NMGRT - JANUARY 2016) - 6.7500%**				$10,980.63
I)	**TOTAL POND 2 EOPC w/ TAX (NMGRT 2016): (G + H)**				**$173,657**

NO.	REVISION DESCRIPTION	DATE	BY
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CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN

OPTION 1 POND 2

SOLUTIONS FOR TODAY...
VISION FOR TOMORROW
201 N. Church Street,
Suite 310
Las Cruces, NM 88001
Phone: (575) 523-2395
Fax: (575) 523-2396
SMITH ENGINEERING COMPANY
NEW MEXICO
TEXAS

JOB NO: 815105
DATE: JUNE, 2016
SHEET NO: OPT1.4

Proposed Ponds Detention Pond Routing Summary Option 1
Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	Return Period / year	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	Free board to Emergency Spillway Elevation	Free board to top of Pond Embankment
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	ft	ft
a	b		c	c	c	c	d	c	c	d	d	d		d	f	e
Pond 3	24	100 / 24	91	50	48.7	48.7	8.4	7.7	3816.10	3816.00	3810.00	7	6.1	3816.50	-0.1	0.4
	24	10/24	29	17	19.2	19.2	8.4	2.7	3813.00	3816.00	3810.00	7	3.0	3816.50	3.0	3.5
	24	5/24	20	10	12.6	12.6	8.4	1.9	3812.30	3816.00	3810.00	7	2.3	3816.50	3.7	4.2

Footnotes for Detention Pond Routing Summary Table

a - Option 1

b - Conceptual Design Outfall Pipe

c - Results summarized from the HEC-HMS model

d - See elev-area-capacity-discharge data table and sources in Appendix 6

e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights

f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)

LEGEND

MAJOR BASIN BOUNDARY

SUB-BASIN BOUNDARY

W####
XX AC
XX MI²

SUB-BASIN NUMBER
SUB-BASIN AREA (AC./MI²)

PRINCIPAL PIPE OUTLET FROM DAM

EXISTING PROPERTY LINE

PROPOSED IMPROVEMENTS

NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.

N

0 40' 80'

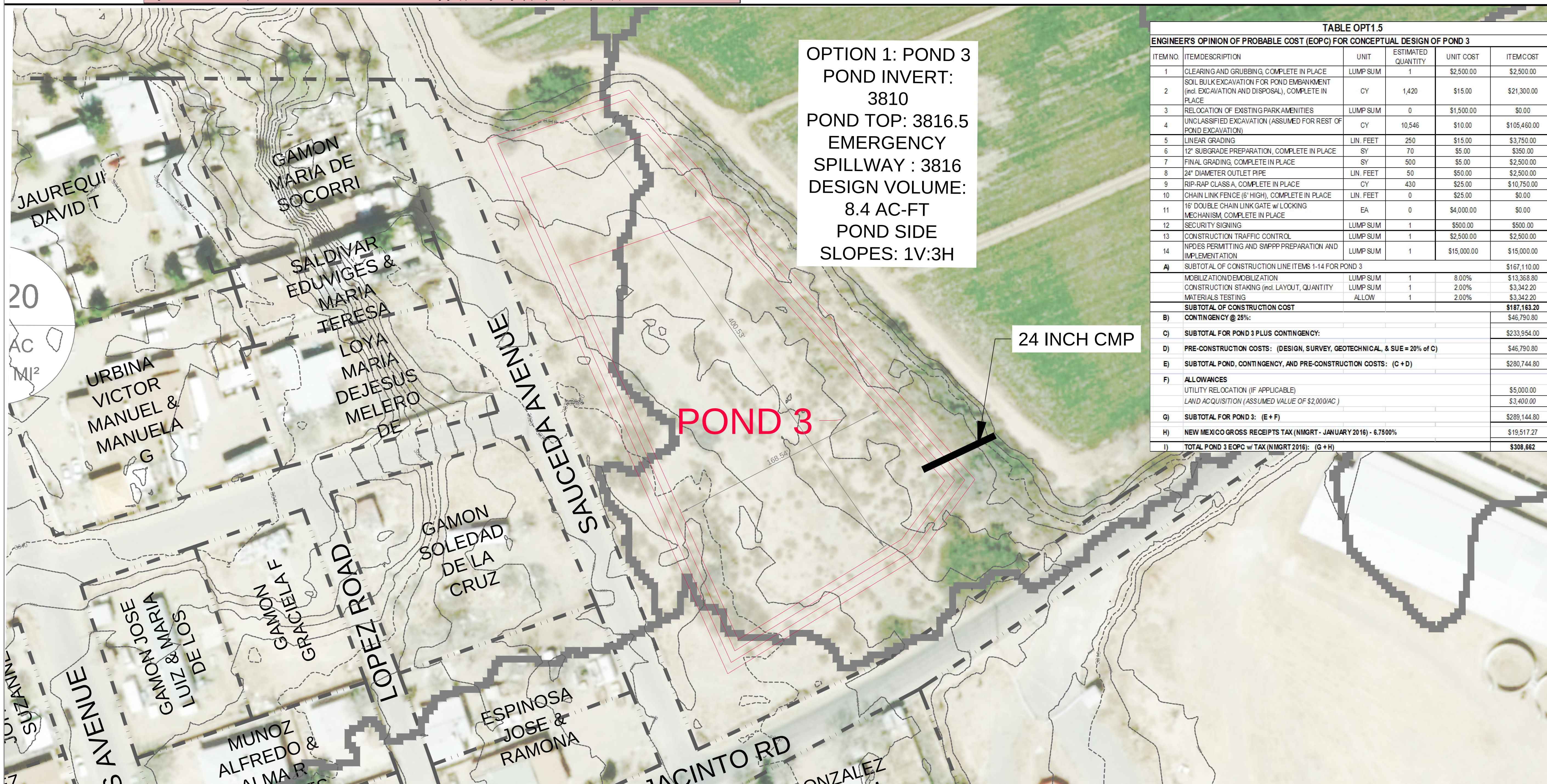

TABLE OPT1.5

ENGINEER'S OPINION OF PROBABLE COST (EOPC) FOR CONCEPTUAL DESIGN OF POND 3

ITEM NO.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST
1	CLEARING AND GRUBBING, COMPLETE IN PLACE	LUMP SUM	1	$2,500.00	$2,500.00
2	SOIL BULK EXCAVATION FOR POND EMBANKMENT (incl. EXCAVATION AND DISPOSAL), COMPLETE IN PLACE	CY	1,420	$15.00	$21,300.00
3	RELOCATION OF EXISTING PARK AMENITIES	LUMP SUM	0	$1,500.00	$0.00
4	UNCLASSIFIED EXCAVATION (ASSUMED FOR REST OF POND EXCAVATION)	CY	10,546	$10.00	$105,460.00
5	LINEAR GRADING	LIN. FEET	250	$15.00	$3,750.00
6	12" SUBGRADE PREPARATION, COMPLETE IN PLACE	SY	70	$5.00	$350.00
7	FINAL GRADING, COMPLETE IN PLACE	SY	500	$5.00	$2,500.00
8	24" DIAMETER OUTLET PIPE	LIN. FEET	50	$50.00	$2,500.00
9	RIP-RAP CLASS A, COMPLETE IN PLACE	CY	430	$25.00	$10,750.00
10	CHAIN LINK FENCE (6' HIGH), COMPLETE IN PLACE	LIN. FEET	0	$25.00	$0.00
11	16' DOUBLE CHAIN LINK GATE w/ LOCKING MECHANISM, COMPLETE IN PLACE	EA	0	$4,000.00	$0.00
12	SECURITY SIGNING	LUMP SUM	1	$500.00	$500.00
13	CONSTRUCTION TRAFFIC CONTROL	LUMP SUM	1	$2,500.00	$2,500.00
14	NPDES PERMITTING AND SWPPP PREPARATION AND IMPLEMENTATION	LUMP SUM	1	$15,000.00	$15,000.00
A)	SUBTOTAL OF CONSTRUCTION LINE ITEMS 1-14 FOR POND 3				$167,110.00
	MOBILIZATION/DEMOBILIZATION	LUMP SUM	1	8.00%	$13,368.80
	CONSTRUCTION STAKING (incl. LAYOUT, QUANTITY	LUMP SUM	1	2.00%	$3,342.20
	MATERIALS TESTING	ALLOW	1	2.00%	$3,342.20
	SUBTOTAL OF CONSTRUCTION COST				**$187,163.20**
B)	**CONTINGENCY @ 25%:**				$46,790.80
C)	**SUBTOTAL FOR POND 3 PLUS CONTINGENCY:**				$233,954.00
D)	**PRE-CONSTRUCTION COSTS: (DESIGN, SURVEY, GEOTECHNICAL, & SUE = 20% of C)**				$46,790.80
E)	**SUBTOTAL POND, CONTINGENCY, AND PRE-CONSTRUCTION COSTS: (C + D)**				$280,744.80
F)	**ALLOWANCES**				
	UTILITY RELOCATION (IF APPLICABLE)				$5,000.00
	LAND ACQUISITION (ASSUMED VALUE OF $2,000/AC)				*$3,400.00*
G)	**SUBTOTAL FOR POND 3: (E + F)**				$289,144.80
H)	**NEW MEXICO GROSS RECEIPTS TAX (NMGRT - JANUARY 2016) - 6.7500%**				$19,517.27
I)	**TOTAL POND 3 EOPC w/ TAX (NMGRT 2016): (G + H)**				**$308,662**

FOR PLANNING PURPOSES ONLY AND SHALL NOT BE USED FOR CONSTRUCTION, BIDDING, OR PERMITTING PURPOSES

NO.	REVISION DESCRIPTION	DATE	BY
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CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN

OPTION 1 POND 3

SOLUTIONS FOR TODAY...
VISION FOR TOMORROW
201 N. Church Street,
Suite 310
Las Cruces, NM 88001
Phone: (575) 523-2395
Fax: (575) 523-2396
SMITH ENGINEERING COMPANY
NEW MEXICO
TEXAS

JOB NO: 815105

DATE: JUNE, 2016

SHEET NO: OPT1.5

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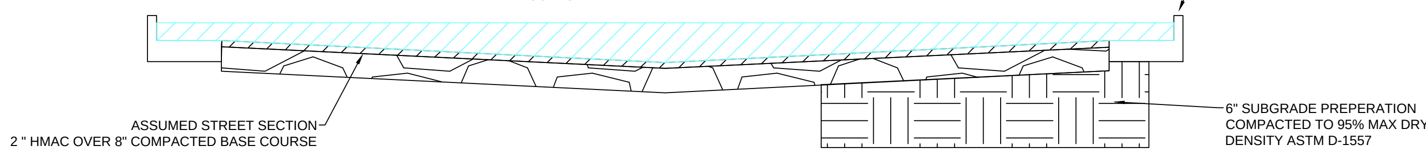


LEGEND

- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- W#### XX AC XX MI² — SUB-BASIN NUMBER / SUB-BASIN AREA (AC./MI²)
- PRINCIPAL PIPE OUTLET FROM DAM
- EXISTING PROPERTY LINE
- PROPOSED IMPROVEMENTS

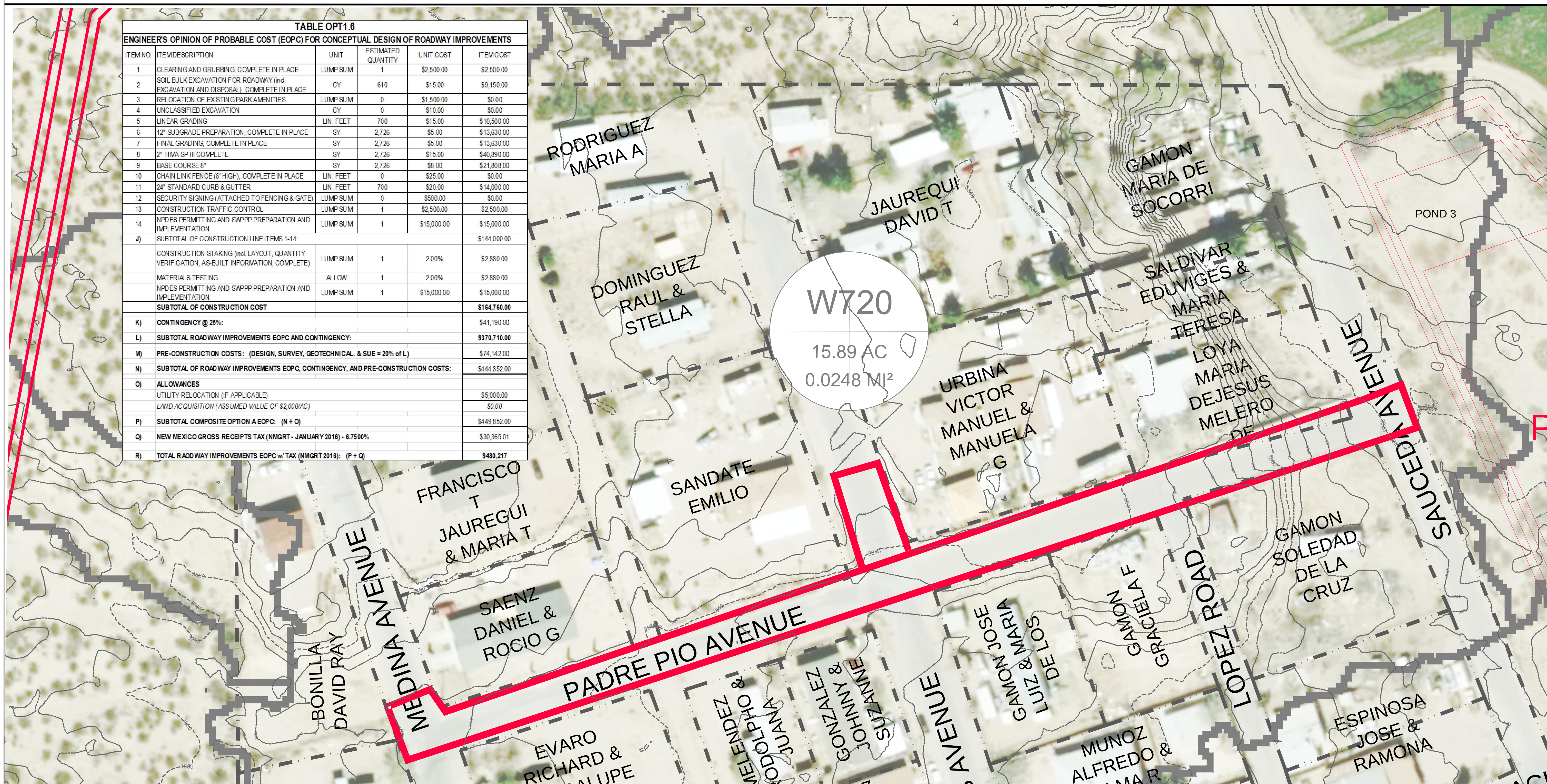
NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.

N
0 40' 80'

TABLE OPT1.6

ENGINEER'S OPINION OF PROBABLE COST (EOPC) FOR CONCEPTUAL DESIGN OF ROADWAY IMPROVEMENTS

ITEM NO.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST
1	CLEARING AND GRUBBING, COMPLETE IN PLACE	LUMP SUM	1	$2,500.00	$2,500.00
2	SOIL BULK EXCAVATION FOR ROADWAY (incl. EXCAVATION AND DISPOSAL), COMPLETE IN PLACE	CY	610	$15.00	$9,150.00
3	RELOCATION OF EXISTING PARK AMENITIES	LUMP SUM	0	$1,500.00	$0.00
4	UNCLASSIFIED EXCAVATION	CY	0	$10.00	$0.00
5	LINEAR GRADING	LIN. FEET	700	$15.00	$10,500.00
6	12" SUBGRADE PREPARATION, COMPLETE IN PLACE	SY	2,726	$5.00	$13,630.00
7	FINAL GRADING, COMPLETE IN PLACE	SY	2,726	$5.00	$13,630.00
8	2" HMA SP III COMPLETE	SY	2,726	$15.00	$40,890.00
9	BASE COURSE 8"	SY	2,726	$8.00	$21,808.00
10	CHAIN LINK FENCE (6' HIGH), COMPLETE IN PLACE	LIN. FEET	0	$25.00	$0.00
11	24" STANDARD CURB & GUTTER	LIN. FEET	700	$20.00	$14,000.00
12	SECURITY SIGNING (ATTACHED TO FENCING & GATE)	LUMP SUM	0	$500.00	$0.00
13	CONSTRUCTION TRAFFIC CONTROL	LUMP SUM	1	$2,500.00	$2,500.00
14	NPDES PERMITTING AND SWPPP PREPARATION AND IMPLEMENTATION	LUMP SUM	1	$15,000.00	$15,000.00
J)	SUBTOTAL OF CONSTRUCTION LINE ITEMS 1-14:				$144,000.00
	CONSTRUCTION STAKING (incl. LAYOUT, QUANTITY VERIFICATION, AS-BUILT INFORMATION, COMPLETE)	LUMP SUM	1	2.00%	$2,880.00
	MATERIALS TESTING	ALLOW	1	2.00%	$2,880.00
	NPDES PERMITTING AND SWPPP PREPARATION AND IMPLEMENTATION	LUMP SUM	1	$15,000.00	$15,000.00
	SUBTOTAL OF CONSTRUCTION COST				**$164,760.00**
K)	**CONTINGENCY @ 25%:**				$41,190.00
L)	**SUBTOTAL ROADWAY IMPROVEMENTS EOPC AND CONTINGENCY:**				**$370,710.00**
M)	**PRE-CONSTRUCTION COSTS: (DESIGN, SURVEY, GEOTECHNICAL, & SUE = 20% of L)**				$74,142.00
N)	**SUBTOTAL OF ROADWAY IMPROVEMENTS EOPC, CONTINGENCY, AND PRE-CONSTRUCTION COSTS:**				$444,852.00
O)	**ALLOWANCES**				
	UTILITY RELOCATION (IF APPLICABLE)				$5,000.00
	LAND ACQUISITION (ASSUMED VALUE OF $2,000/AC)				*$0.00*
P)	**SUBTOTAL COMPOSITE OPTION A EOPC: (N + O)**				$449,852.00
Q)	**NEW MEXICO GROSS RECEIPTS TAX (NMGRT - JANUARY 2016) - 6.7500%**				$30,365.01
R)	**TOTAL RAODWAY IMPROVEMENTS EOPC w/ TAX (NMGRT 2016): (P + Q)**				**$480,217**



FOR PLANNING PURPOSES ONLY AND SHALL NOT BE USED FOR CONSTRUCTION, BIDDING, OR PERMITTING PURPOSES

NO.	REVISION DESCRIPTION	DATE	BY
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CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN

OPTION 1 ROADWAY IMPROVEMENTS
PADRE PIO AVE

SOLUTIONS FOR TODAY... VISION FOR TOMORROW
201 N. Church Street, Suite 310
Las Cruces, NM 88001
Phone: (575) 523-2395
Fax: (575) 523-2396
SMITH ENGINEERING COMPANY
NEW MEXICO TEXAS

JOB NO: 815105
DATE: JUNE, 2016
SHEET NO: OPT1.6

Proposed Ponds Detention Pond Routing Summary Option 1
Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	**Return Period / year**	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	**Free board to Emergency Spillway Elevation**	**Free board to top of Pond Embankment**
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	**ft**	**ft**
a	b		c	c	c	c	d	c	c	d	d	d		d	**f**	e
Pond 4	24	100 / 24	120	32	8.1	8.1	4.7	2.9	3902.50	3904.00	3898.00	7	4.5	3904.50	**1.5**	**2.0**
	24	10/24	42	11	3.3	3.3	4.7	1.2	3900.40	3904.00	3898.00	7	2.4	3904.50	**3.6**	**4.1**
	24	5/24	26	6	2.3	2.3	4.7	1.0	3899.90	3904.00	3898.00	7	1.9	3904.50	**4.1**	**4.6**

Footnotes for Detention Pond Routing Summary Table

a - Option 1

b - Conceptual DesignOutfall Pipe

c - Results summarized from the HEC-HMS model

d - See elev-area-capacity-discharge data table and sources in Appendix 6

e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights

f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)

LEGEND

MAJOR BASIN BOUNDARY

SUB-BASIN BOUNDARY

W#### XX AC. XX MI² — SUB-BASIN NUMBER / SUB-BASIN AREA (AC./MI²)

PRINCIPAL PIPE OUTLET FROM DAM

EXISTING PROPERTY LINE

PROPOSED IMPROVEMENTS

NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.

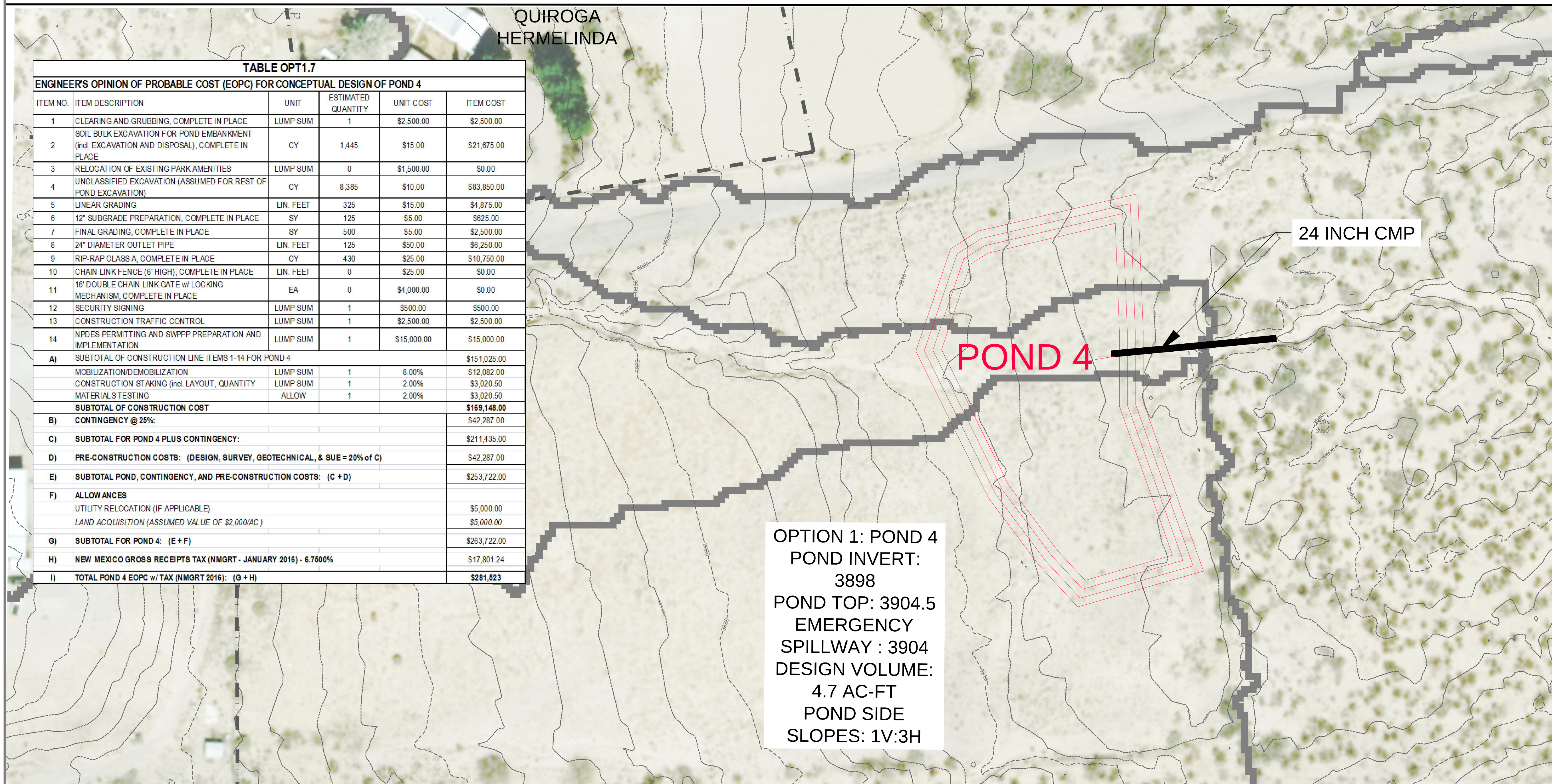
0 40' 80'

FOR PLANNING PURPOSES ONLY AND SHALL NOT BE USED FOR CONSTRUCTION, BIDDING, OR PERMITTING PURPOSES

TABLE OPT1.7

ENGINEER'S OPINION OF PROBABLE COST (EOPC) FOR CONCEPTUAL DESIGN OF POND 4

ITEM NO.	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	ITEM COST
1	CLEARING AND GRUBBING, COMPLETE IN PLACE	LUMP SUM	1	$2,500.00	$2,500.00
2	SOIL BULK EXCAVATION FOR POND EMBANKMENT (incl. EXCAVATION AND DISPOSAL), COMPLETE IN PLACE	CY	1,445	$15.00	$21,675.00
3	RELOCATION OF EXISTING PARK AMENITIES	LUMP SUM	0	$1,500.00	$0.00
4	UNCLASSIFIED EXCAVATION (ASSUMED FOR REST OF POND EXCAVATION)	CY	8,385	$10.00	$83,850.00
5	LINEAR GRADING	LIN. FEET	325	$15.00	$4,875.00
6	12" SUBGRADE PREPARATION, COMPLETE IN PLACE	SY	125	$5.00	$625.00
7	FINAL GRADING, COMPLETE IN PLACE	SY	500	$5.00	$2,500.00
8	24" DIAMETER OUTLET PIPE	LIN. FEET	125	$50.00	$6,250.00
9	RIP-RAP CLASS A, COMPLETE IN PLACE	CY	430	$25.00	$10,750.00
10	CHAIN LINK FENCE (6' HIGH), COMPLETE IN PLACE	LIN. FEET	0	$25.00	$0.00
11	16' DOUBLE CHAIN LINK GATE w/ LOCKING MECHANISM, COMPLETE IN PLACE	EA	0	$4,000.00	$0.00
12	SECURITY SIGNING	LUMP SUM	1	$500.00	$500.00
13	CONSTRUCTION TRAFFIC CONTROL	LUMP SUM	1	$2,500.00	$2,500.00
14	NPDES PERMITTING AND SWPPP PREPARATION AND IMPLEMENTATION	LUMP SUM	1	$15,000.00	$15,000.00
A)	SUBTOTAL OF CONSTRUCTION LINE ITEMS 1-14 FOR POND 4				$151,025.00
	MOBILIZATION/DEMOBILIZATION	LUMP SUM	1	8.00%	$12,082.00
	CONSTRUCTION STAKING (incl. LAYOUT, QUANTITY	LUMP SUM	1	2.00%	$3,020.50
	MATERIALS TESTING	ALLOW	1	2.00%	$3,020.50
	SUBTOTAL OF CONSTRUCTION COST				**$169,148.00**
B)	**CONTINGENCY @ 25%:**				$42,287.00
C)	**SUBTOTAL FOR POND 4 PLUS CONTINGENCY:**				$211,435.00
D)	**PRE-CONSTRUCTION COSTS: (DESIGN, SURVEY, GEOTECHNICAL, & SUE = 20% of C)**				$42,287.00
E)	**SUBTOTAL POND, CONTINGENCY, AND PRE-CONSTRUCTION COSTS: (C + D)**				$253,722.00
F)	**ALLOWANCES**				
	UTILITY RELOCATION (IF APPLICABLE)				$5,000.00
	LAND ACQUISITION (ASSUMED VALUE OF $2,000/AC)				*$5,000.00*
G)	**SUBTOTAL FOR POND 4: (E + F)**				$263,722.00
H)	**NEW MEXICO GROSS RECEIPTS TAX (NMGRT - JANUARY 2016) - 6.7500%**				$17,801.24
I)	**TOTAL POND 4 EOPC w/ TAX (NMGRT 2016): (G + H)**				**$281,523**



CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

NO	REVISION DESCRIPTION	DATE	BY
1			
2			
3			
4			
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DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN
OPTION 1 POND 4

SOLUTIONS FOR TODAY... VISION FOR TOMORROW
201 N. Church Street, Suite 310
Las Cruces, NM 88001
Phone: (575) 523-2395
Fax: (575) 523-2396
SMITH ENGINEERING COMPANY
NEW MEXICO TEXAS

JOB NO: 815105

DATE: JUNE, 2016

SHEET NO. OPT1.7

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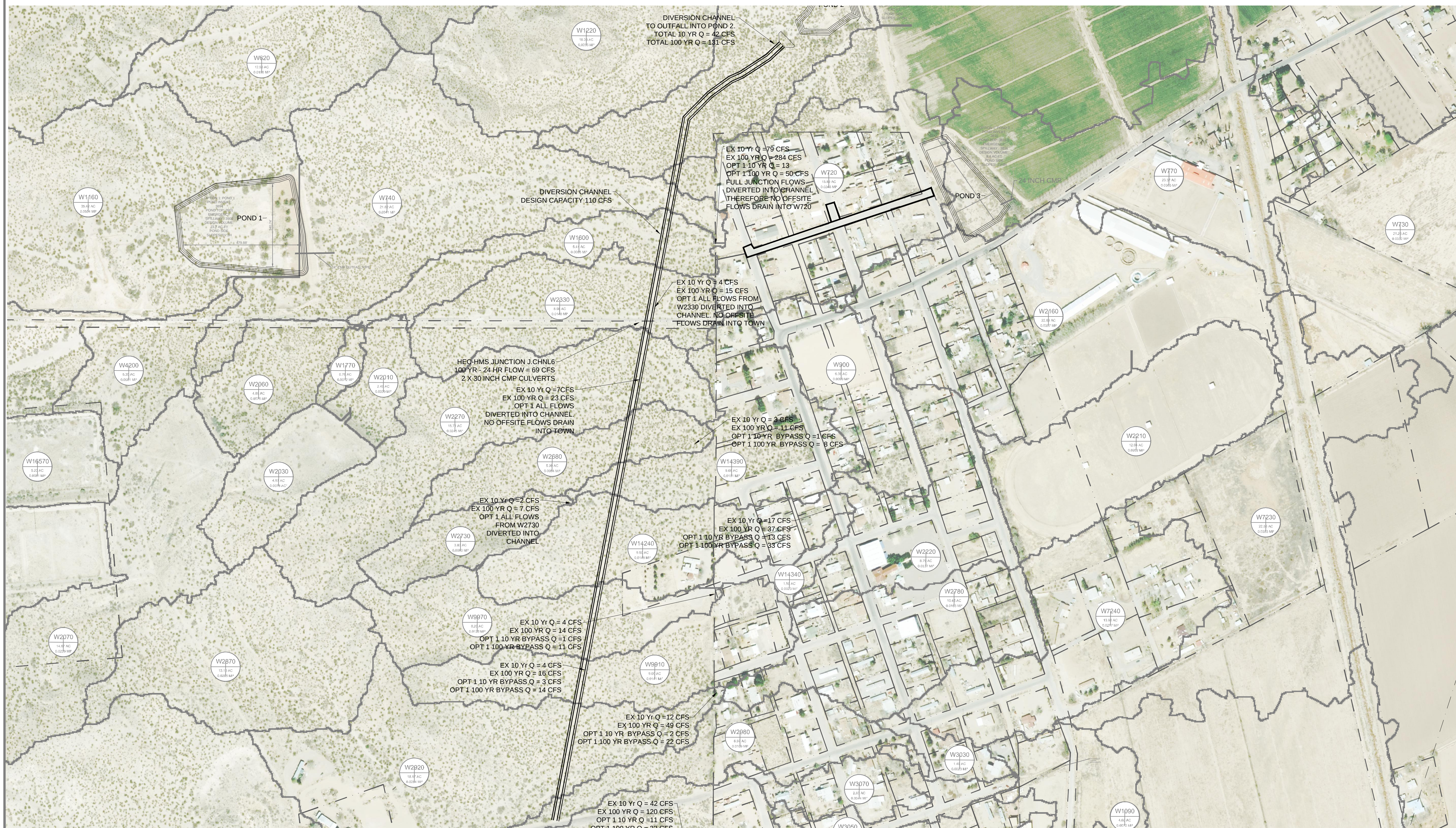
LEGEND

- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- W#### XX AC. XX MI² — SUB-BASIN NUMBER / SUB-BASIN AREA (AC./MI²)
- PRINCIPAL PIPE OUTLET FROM DAM
- EXISTING PROPERTY LINE
- PROPOSED IMPROVEMENTS

NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.

0 250' 500'



FOR PLANNING PURPOSES ONLY AND SHALL NOT BE USED FOR CONSTRUCTION, BIDDING, OR PERMITTING PURPOSES

NO	REVISION DESCRIPTION	DATE	BY
1			
2			
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4			
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CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN

OPTION 1 OVERVIEW RESULTS SUMMARY

SOLUTIONS FOR TODAY... VISION FOR TOMORROW
201 N. Church Street, Suite 310
Las Cruces, NM 88001
Phone: (575) 523-2395
Fax: (575) 523-2396
SMITH ENGINEERING COMPANY
NEW MEXICO TEXAS

JOB NO: 815105
DATE: JUNE, 2016
SHEET NO. FIGURE B

Proposed Ponds Detention Pond Routing Summary Option 2
Chamberino Drainage Master Plan

Detention Pond Name	Principal Spillway Pipe Diameter	**Return Period / year**	Peak Inflow	Peak Outflow	Inflow Runoff Volume	Outflow Runoff Volume	Maximum Design Storage Volume (top of embank	Peak Storage Volume During Design Storm	Peak Water Surface Elevation	Emergency Spillway Elevation	Pond Invert Elevation	Max Pond Depth	Peak Water Depth	Top of Pond Embankment Elevation	**Free board to Emergency Spillway Elevation**	**Free board to top of Pond Embankment**
	inches		cfs	cfs	ac-ft	ac-ft	ac-ft	ac-ft	ft	ft	ft	ft	ft	ft	**ft**	**ft**
a	b		c	c	c	c	d	c	c	d	d	d		d	**f**	**e**
Pond 6-3	24	100 / 24	187	112	20.4	19.6	5.0	4.9	3810.30	3810.00	3804.00	7	6.3	3810.50	-0.3	**0.2**
	24	10/24	65	21	8.7	7.9	5.0	2.6	3808.00	3810.00	3804.00	7	4.0	3810.50	**2.0**	**2.5**
	24	5/24	41	12	6.1	5.3	5.0	1.8	3807.00	3810.00	3804.00	7	3.0	3810.50	**3.0**	**3.5**

Footnotes for Detention Pond Routing Summary Table

a - Option 1

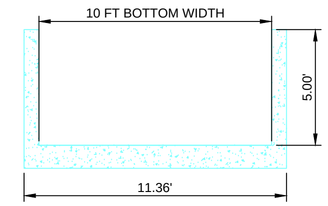
b - Conceptual DesignOutfall Pipe

c - Results summarized from the HEC-HMS model

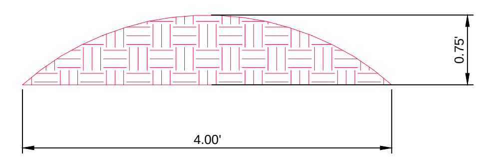
d - See elev-area-capacity-discharge data table and sources in Appendix 6

e- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights

f- Negative number indicates the flow depth exceeds referenced elevation - no freeboard available therefore cell highlights (Spills through emergency spillway or top of dam by this depth)



CHANNEL REHABILITATION AT POND 6-1/6-3



SAN LUIS AVE IMPROVEMENTS: TYPICAL BERM SECTION

LEGEND

- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- W#### XX AC. XX MI² — SUB-BASIN NUMBER, SUB-BASIN AREA (AC./MI²)
- PRINCIPAL PIPE OUTLET FROM DAM
- EXISTING PROPERTY LINE
- PROPOSED IMPROVEMENTS

NOTE: DIGITAL ORTHOPHOTOGRAPHY AND LIDAR COMPLETED IN 2010 BY DOÑA ANA COUNTY. THE CONTOUR INTERVAL FOR OPT1 IS 2-FOOT.

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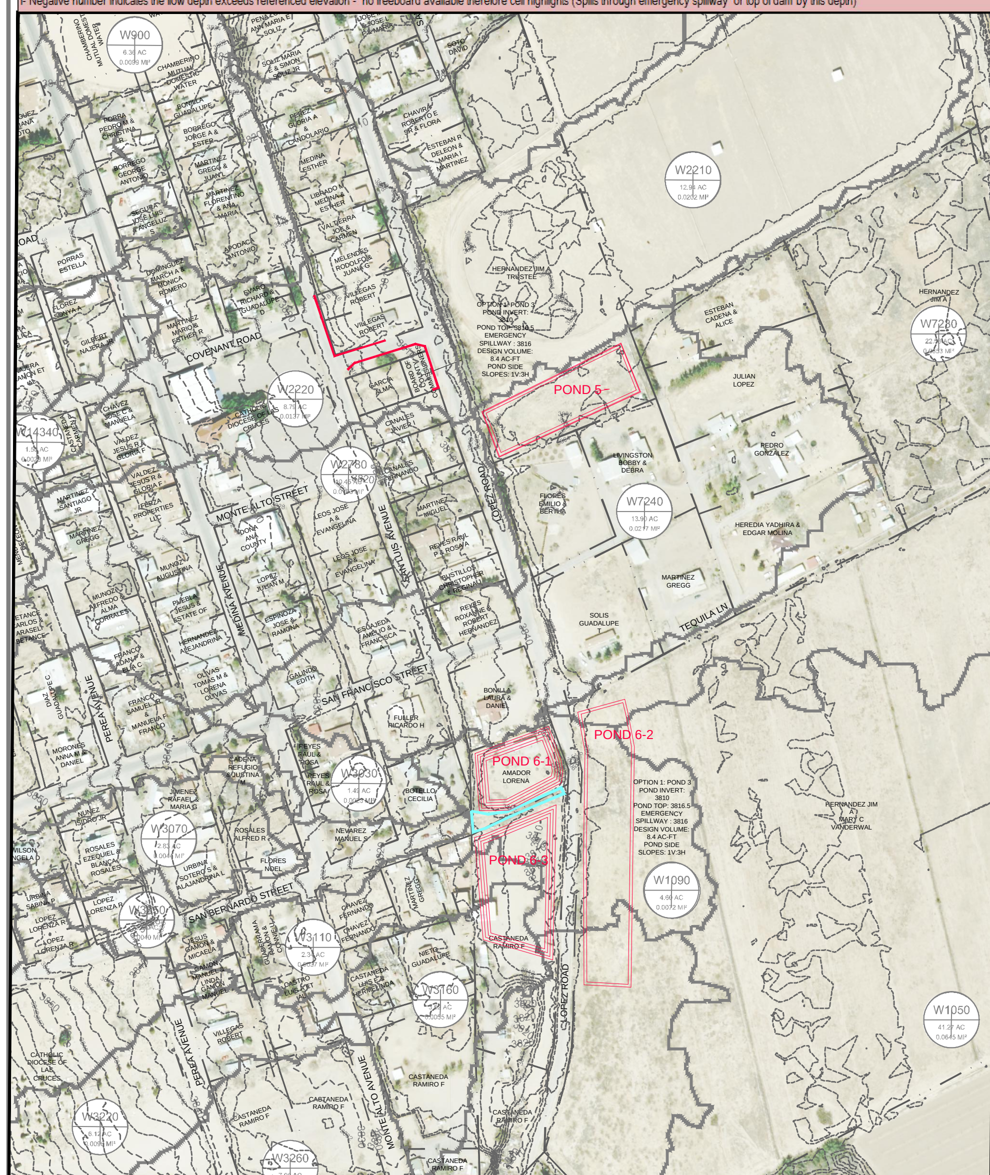
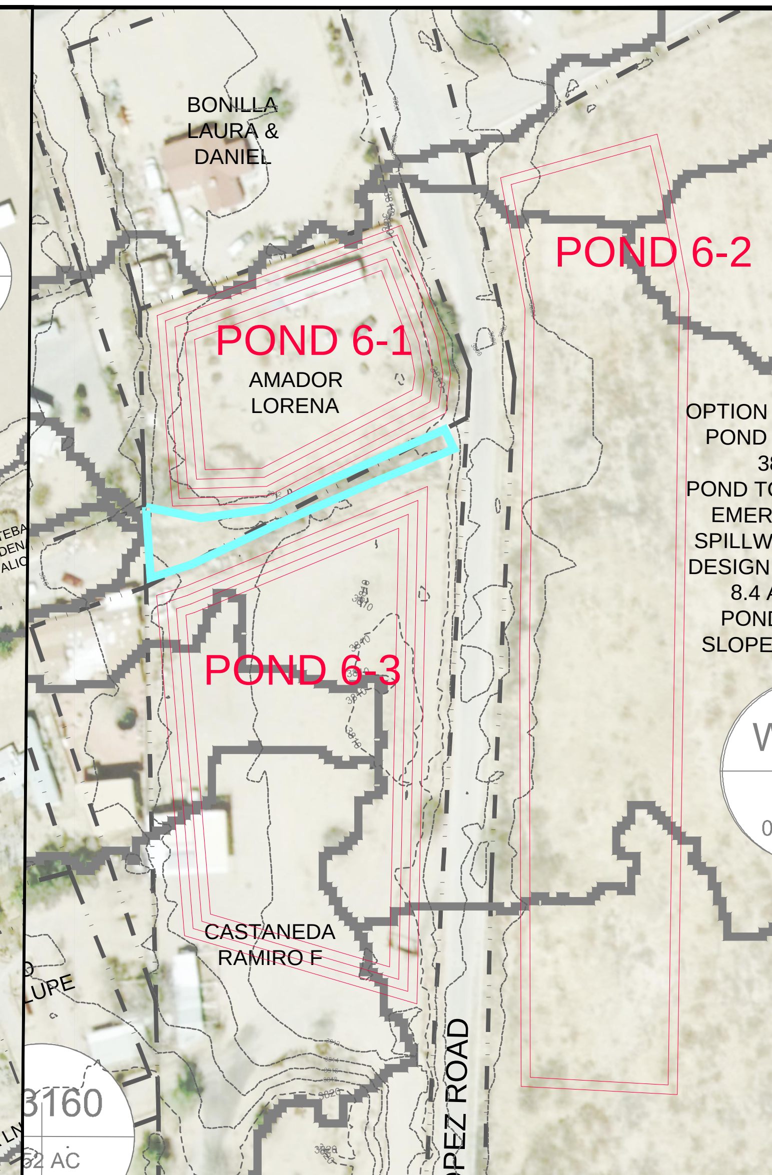


OPTION 2 OVERVIEW

POND 5 AND SAN LUIS AVE IMPROVENTS



PONDS 6-1 - 6-3 AND CHANNEL IMPROVEMENT

CHAMBERINO
DONA ANA COUNTY, NEW MEXICO

NO	REVISION DESCRIPTION	DATE	BY
1			
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DONA ANA COUNTY
CHAMBERINO DRAINAGE MASTER PLAN
OPTION 2

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NEW MEXICO

JOB NO: 815105
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SHEET NO: OPT2