February 2014

4th STREET ANTHONY PONDS DRAINAGE REPORT

WILSON &COMPANY
ENGINEERS & ARCHITECTS

City of Anthony, New Mexico
July 1, 2010
"Anthony, NM on the historic route of the Camino Real."

4TH STREET ANTHONY PONDS

DRAINAGE REPORT

FEBRUARY 2014

I, Mario Juarez-Infante, do hereby certify that this report was prepared by me or under my direction and that I am a duly registered Professional Engineer under the laws of the State of New Mexico.

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Mario Juarez-Infante, P.E.
State of New Mexico P.E. No.15340

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Date

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1. INTRODUCTION

This Drainage Report presents the hydrologic and hydraulic analysis for the watershed draining towards and into the two proposed ponds in Anthony, New Mexico. The report uses data from the hydrologic and hydraulic analysis by the U.S. Army Corps of Engineers (USACE) as presented in the “Flood Threat Identification Study and Drainage Management Plan” (DMP).

1.1 Authorization

Wilson & Company, Inc., Engineers & Architects (Wilson & Company) was contracted by the City of Anthony to provide planning and design of the two 4th Street Ponds located along the east side of 4th Street in Anthony, NM. Engineering Services include topographic survey, boundary surveys, hydrologic/hydraulic modeling and report, preliminary and final design, and construction drawings. An agreement for engineering services was finalized on June 20th, 2013.

1.2 Study Area Location

The City of Anthony, located in southeastern New Mexico, is situated on the New Mexico-Texas state line in the Upper Mesilla Valley. The ponds are described as 1) Pond 1 (Acosta Pond), located at the northeast corner of 4th Street/Acosta Road, and 2) Pond 2 (O’Hara Park Pond), located at the northeast corner of 4th Street/Livesay Street. See Figure 1-1.

1.3 Background

The report, “Flood Threat Identification Study and Drainage Management Plan”, dated June 2012, was completed by the USACE with the assistance of Wolf Engineering. A complete existing hydrologic and hydraulic analysis was performed for the watershed draining towards and through Anthony, New Mexico. The report also includes a Drainage Master Plan, which provides recommendations to address existing flood-prone areas and alleviate future flooding. The Drainage Master Plan includes both structural and non-structural recommendations to mitigate flooding impacts on the area. Recommendation #6 will be addressed in this Drainage Report. That recommendation discussed integrating storm water drainage facilities into street reconstruction projects. Most streets currently lack curb and gutter to direct runoff. The USACE suggested that 4th Street between Landers Street and the Texas state line use curb and gutter in order to help prevent erosion of street shoulders and also to direct surface runoff towards constructed inlets to either underground conveyance pipes or retention or detention basins. The athletic fields at the school located in the northeast quadrant of 4th and Church Streets and the baseball field located in the northeast quadrant of 4th Street and Livesay Street provide some areas that could be used to detain storm water and allow for a controlled release into the Anthony Arroyo.

The “4th Street Reconstruction Synopsis Report from O’Hara Road to Texas State Line”, dated September 2012, was prepared by Wilson & Company. This Synopsis Report provided a preliminary design for the 4th Street storm drain recommended by the USACE. The report was used by Wilson & Company for the “City of Anthony Construction Plans for the 4th Street Reconstruction from Landers Road to Acosta Road”, dated October 2013.

1.4 Purpose and Goals

The purpose of this Drainage Report is to provide the results of the hydrologic modeling of the Acosta Pond and O’Hara Park Pond, as well as hydraulic modeling for the Acosta Pond. Using these results, the Acosta Pond will be designed to accommodate the 100-year storm in compliance with the Doña Ana County Floodplain Ordinance & Design Criteria. The Acosta Pond will be designed as a detention pond, which will tie into the 4th Street storm drain.

The proposed O’Hara Park Pond will require additional detailed study and design to accommodate the 100-year storm. The City of Anthony is interested in pursuing a Memorandum of Understanding (MOU) for a joint use facility. The O’Hara Park Pond may be designed as a multi-use detention facility which will tie into the Clark Avenue storm drain.

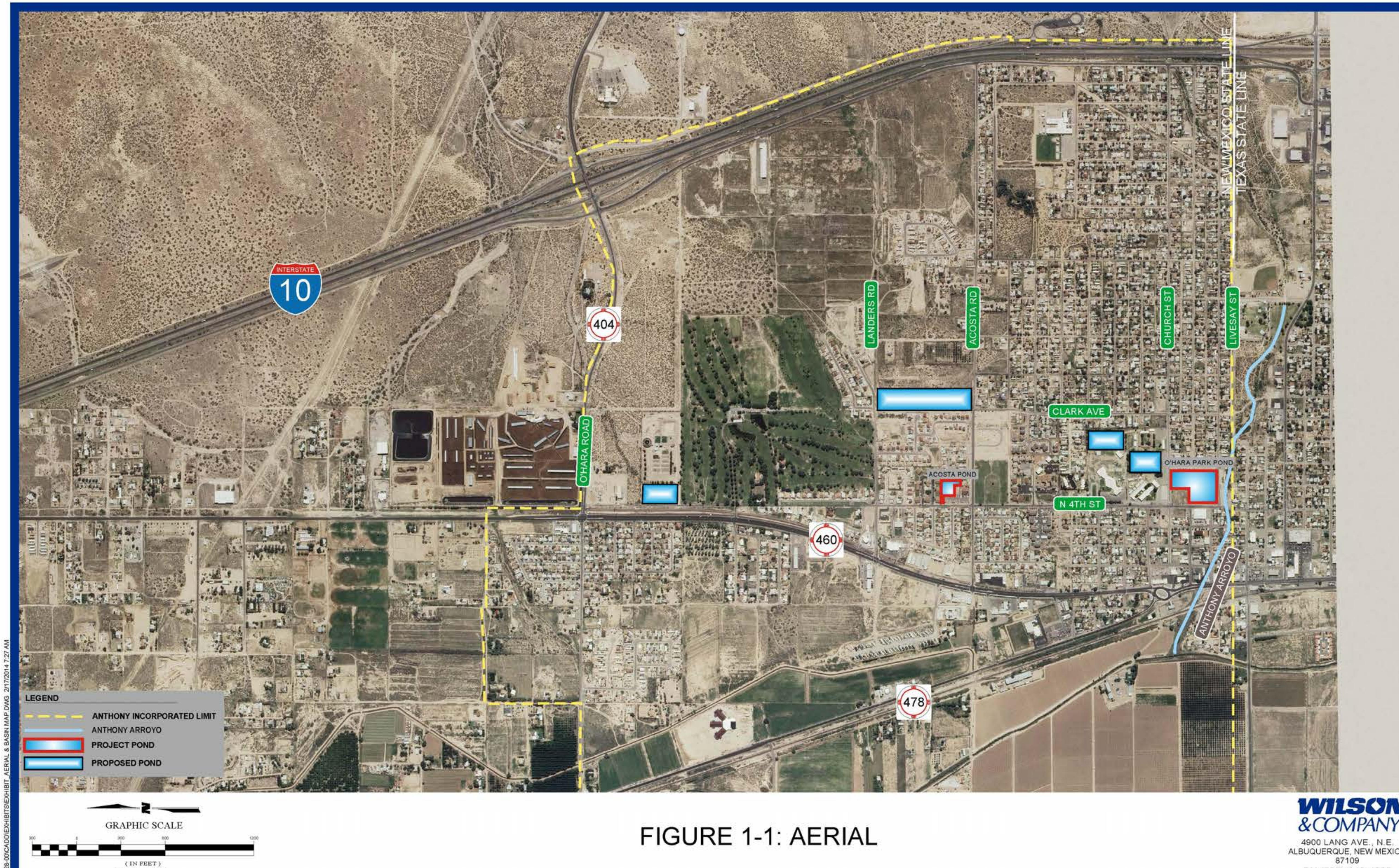

FIGURE 1-1: AERIAL

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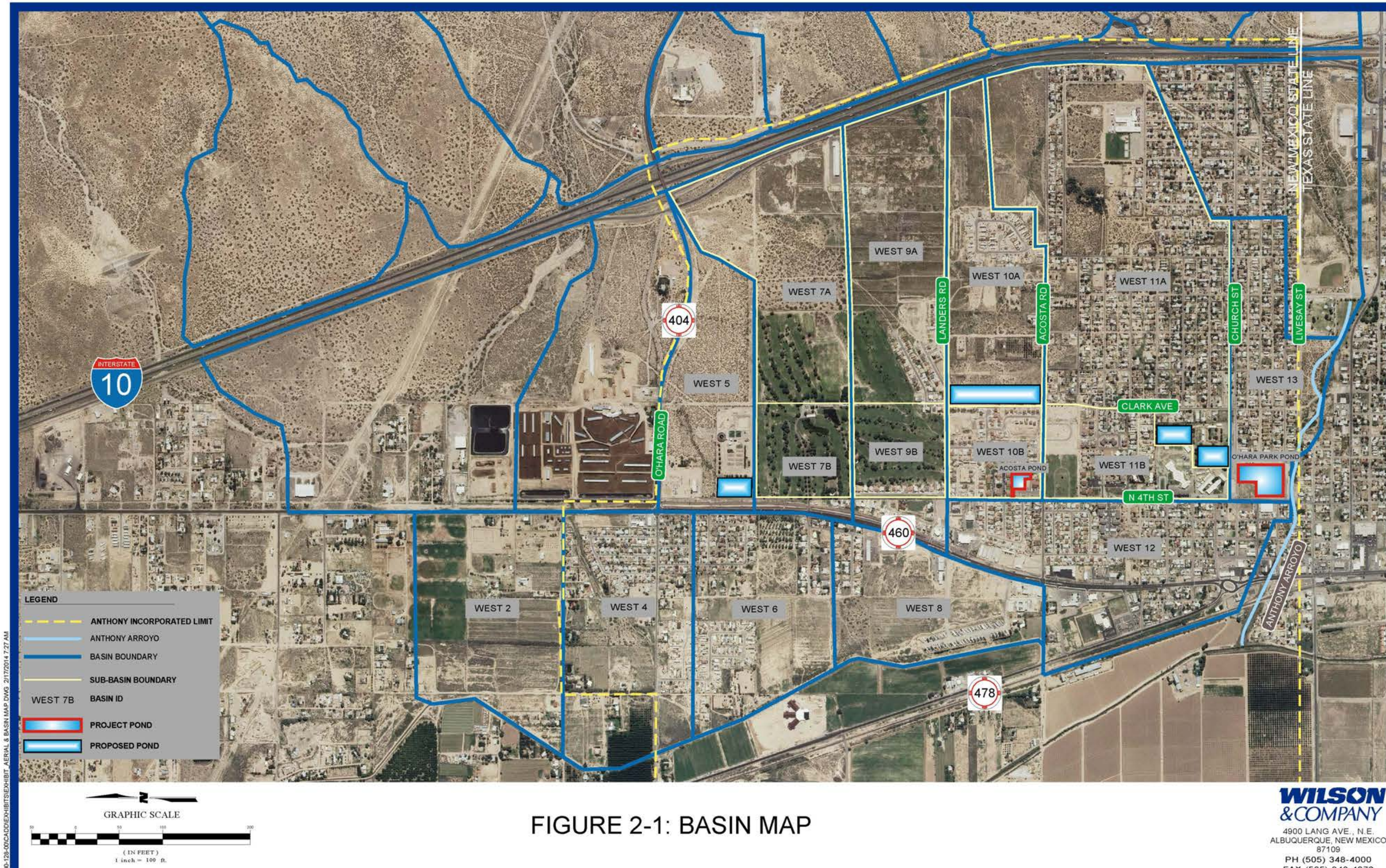

FIGURE 2-1: BASIN MAP

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2. HYDROLOGIC ANALYSIS

2.1 Review of U.S. Army Corps of Engineers Hydrologic Modeling

The watershed model was developed using the USACE Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) Version 3.5. The model was used for computing peak discharge and volumes associated with the design storm event. The storm scenario of interest is the one percent chance with a 24-hour duration period (100-year, 24-hour storm event).

2.2 Methodology-Design Storms

2.2.1 Drainage Basin Delineation

The basins delineated by the USACE were modified slightly by dividing Basins 7, 9, 10, and 11. These basins were divided because Basins 7A, 9A, 10A, and 11A will convey runoff into the proposed future Clark Avenue storm drain. Basins 7B, 9B, 10B, and 11B will convey runoff into the 4th Street storm drain. The USACE model was modified to also include the Acosta Pond (Figure 2-1).

2.2.2 Methods

In order to be consistent with the USACE "Flood Threat Identification Study and Drainage Management Plan", this report used their methodology for calculating infiltration losses for the modified basins. In addition, the chosen method complies with the Doña Ana County Design Storm Drain Criteria Guidelines for Commercial and Residential Sites, which requires drainage plans to be based on the SCS Method.

In the HEC-HMS model, the actual infiltration calculations are performed by a loss method contained within each sub-basin. The initial constant loss method was used. The actual surface runoff calculations are performed by a transform method contained within the sub-basin.

There were two methods used in the USACE DMP: the kinematic wave method and the Snyder unit hydrograph method. Unit hydrographs for the undeveloped basins, in general those east of the Interstate 10, are computed using Snyder's method. For many of the urbanized basins west of the Interstate 10, the Kinematic Wave Transform (KWT) method was used.

In this study, the KWT method was not used. Instead, the SCS Unit Hydrograph method was used for all urbanized basins. The only basin in which the Snyder's method was used was West Basin 5, since the basin retained all the same assumptions as in the USACE DMP.

A time interval of five minutes was chosen for the computation time step. Routing the hydrographs was computed using the Kinematic Wave and Muskingum-Cunge method.

2.2.3 Initial and Constant Loss Method

The storm rainfall lost to soil infiltration is estimated using the block loss method in the HEC-HMS model. The block loss method uses an initial loss and a constant loss rate that continues through the duration of the storm event. This is a simplified rainfall loss estimation method. It is assumed that all rainfall is lost to runoff until the accumulated rainfall is equal to the initial loss. Then, once the initial loss is satisfied, a portion of all future rainfall is lost at a constant rate.

In the "Flood Threat Identification Study and Drainage Management Plan", the initial loss values for the five storms were selected using the United States Geologic Survey (USGS) Fact Sheet 055-00 published in October 2000. In the DMP, the resultant computed peak discharge from the Upper Anthony Arroyo and Upper Lauson Arroyo basins in the HEC-HMS model approximated the peak discharges computed using the current USGS flood-peak discharge regression equations for the Southwest Desert. The DMP stated that the two sub-basins were selected for calibration due to their similarity to the drainage basins used in the Regional Study. The initial losses from the DMP are summarized in Table 2-1.

Table 2-1: Initial Loss (in)				
50% Chance	10% Chance	4% Chance	1% Chance	0.2% Chance
0.75	1.20	1.45	1.60	1.60

Constant loss rates for the watershed have been developed using available soils data from the Natural Resources Conservation Service (NRCS), parcel data for Doña Ana County, and land cover from using the aerial photography. The spatial data sets used in the analysis are referenced and projected to NAD 1983 Universal Transverse Mercator (UTM) New Mexico State Planes, Central Zone, US Foot coordinates. ESRI's ArcGIS version 9.3 software was used to perform the data manipulation and quantify the results.

In the "Flood Threat Identification Study and Drainage Management Plan", the land use/land cover designations were categorized into three general groups, reflecting anticipated infiltration potential. The categories are defined as high, medium, and low and are shown in Table 2-2.

Table 2-2: Land Use/Land Cover Infiltration Potential	
Land Use/Land Cover	Loss Class
CC-1 Community Commercial: Neighborhood Commercial	M
CI-1 Community Industrial: Light-Intensity	M
CR-1 Community Residential: Single-Family Residential	M
CR-1M Community Residential, Single-Family, Mobile Homes	M
CR-2 Community Residential: Medium-Intensity	M
CR-3 Community Residential: Apartments and High-Intensity	M
Rangeland Shrub and Brush	H
Urban or Built-up Land Transportation	L
VR-2 Village Residential: Multiple-Family	M

The incremental constant loss rates were taken from those used in the "Flood Threat Identification Study and Drainage Management Plan" and are shown in Table 2-3. According to the DMP, these rates were selected based on recommendations found in the Flood Hydrology Manual (Cudworth, 1989).

Table 2-3: Incremental Constant Loss Rates (inches per hour)				
Land Cover Designation	Hydrologic Soil Group			
	A	B	C	D
Low	0.300	0.150	0.050	0.000
Medium	0.400	0.225	0.100	0.025
High	0.500	0.300	0.150	0.050

An area-weighted average loss rate was determined for each modified basin (Basin 7A, 7B, 9A, 9B, 10A, 10B, 11A, and 11B). The loss rates were based on the high, medium, low land cover infiltration potential designation and the NRCS hydrologic soil group (HSG) rating (A, B, C, D). The values computed range from 0.209 inches per hour in the West 10B to 0.401 inches per hour for West 7A.

Table 2-4: Weighted Basin Loss Rate (inches per hour)		
Basin ID	Area (sq miles)	Loss Rate (in/hr)
West 5	0.14602	0.318
West 7A	0.21155	0.401
West 7B	0.06353	0.227
West 9A	0.19913	0.348
West 9B	0.06183	0.218
West 10A	0.16450	0.348
West 10B	0.06086	0.209
West 11A	0.45728	0.349
West 11B	0.09378	0.221

2.2.4 Snyder Unit Hydrograph Method

In the "Flood Threat Identification Study and Drainage Management Plan", the unit hydrographs for the undeveloped sub-basins in the HEC-HMS model are computed using Snyder's method. Therefore, the method was used in this report for Basin West 5. In addition to the basin lag time, the Snyder's method requires a peaking coefficient (Cp) to define hydrograph shape. The peaking coefficient used in this study was based on the value used in the DMP. The DMP selected the value based on a previous study completed by the USACE (General Design Memorandum 14 South East El Paso, May 1987). The value selected is 0.70.

The standard Bureau of Reclamation/Corps of Engineers lag time equation was used:

$$Lag\ (hrs) = C \times \frac{L \times L_{ca}}{\sqrt{(s)}} \times 0.33$$

where,
C = a runoff efficiency coefficient, regionally based
L = length of the longest watercourse (miles) within the basin
L_{ca} = length to the centroid of the basin (miles)
S = slope along the longest watercourse (feet/mile)

The C value used in the computations is 0.61 for basin West 5. According to the DMP, these values were selected based on data presented in Cudworth, 1989. Refer to Appendix C for the lag time computations.

Table 2-5: Snyder Method Lag Time Calculations

Basin ID	Stream Length (miles)	Slope (ft/ft)	L*Lca/sqrt(slope)	Lag time (hrs)
West 5	0.68	0.0111	0.0273	0.19

2.2.5 SCS Unit Hydrograph Method

The unit hydrographs for the developed sub-basins in the HEC-HMS model are computed using the SCS method. These basins included West Basins 7A, 7B, 9A, 9B, 10A, 10B, 11A, and 11B. Using the NMDOT Drainage Manual Volume 1, the Time of Concentration method used is the Upland Method because the sub-basins were assumed to exhibit un-gullied watershed condition. The Upland Method is used to estimate travel times for overland flow and shallow concentrated flow. At the very top of the watershed, sheet (overland) flow is the predominant flow regime. Shallow concentrated flow is assumed to occur from the end of overland flow to the bottom of a watershed where there is little or no gullying.

Figure 3-10, Flow Velocities for Overland and Shallow Concentrated Flows, located in the NMDOT Drainage Manual was used to determine the flow velocities. The graph determines the velocity based on the slope. For Basins 7A, 7B, 9A, and 9B, the flow velocity plot for paved areas was used for overland flow and alluvial fans in Western Mountain regions were used for shallow concentrated flow. For Basins 10A, 10B, 11A, and 11B, the flow velocity plot for paved area was used for overland flow and small upland gullies were used for shallow concentrated flow. Using the basic equation for time of concentration, the T_c was calculated for both the sheet flow and shallow concentrated flow.

$$T_c = \left(\frac{L_1}{V_1} + \frac{L_2}{V_2} + \cdots \frac{L_n}{V_n}\right) * \frac{1}{60}$$

where,
L = length of reach (ft)
V = average flow velocity (ft/s)

$$T_c = t_{sheet} + t_{shallow} + t_{channel}$$

where,
t_{sheet} = the sum of travel in sheet flow segments over the watershed land surface
$t_{shallow}$ = the sum of travel time in shallow flow segments
$t_{channel}$ = the sum of travel time in channel flow segments

Table 2-6: SCS Method Lag Time Calculations

Basin ID	Overland Flow Length (ft)	Velocity (ft/s)	Slope (ft/ft)	Shallow Concentrated Flow Length (ft)	Velocity (ft/s)	Slope (ft/ft)	Channel Flow Length (ft)	Velocity (ft/s)	Slope (ft/ft)
West 7A	100	4.2	0.043	4673	1.5	0.019			
West 7B	100	3.2	0.030	2066	1.0	0.010			
West 9A	100	4.2	0.043	4514	3.0	0.084			
West 9B	100	5.0	0.060	1894	1.0	0.009			
West 10A	100	3.1	0.030	6166	2.1	0.013	979	7.3	0.013
West 10B	100	3.1	0.030	1100	1.1	0.003	2222	2.3	0.001
West 11A	100	4.2	0.043	2565	2.4	0.015	3840	8.4	0.018
West 11B	100	2.6	0.018	221	2.4	0.014	2540	2.5	0.002

The lag time was then calculated for each sub-basin. Lag time is the difference between the centroid of the excess rainfall and the peak of the runoff hydrograph. The lag time is estimated as 60 percent of the time of concentration.

$$T_L = 0.6\, T_c$$

Table 2-7: Lag Time (min)		
Basin ID	Time of Concentration (min)	Lag Time (min)
West 7A	52	31
West 7B	35	21
West 9A	25	15
West 9B	34	20
West 10A	52	31
West 10B	33	20
West 11A	26	16
West 11B	19	12

2.2.6 Routing

Hydrographs computed in the HEC-HMS model are routed through Anthony using the Kinematic Wave routing method. The principle parameters of the routing cross section are specified, along with roughness, energy slope, and length.

Table 2-8: Kinematic Wave Method Routing					
Reach ID	Length (ft)	Slope (ft/ft)	Manning's n	Shape	Diameter (ft)
Reach-1	1870	0.007	0.013	Circle	2
Reach-16	1300	0.0074	0.013	Circle	4.5
Reach-17A	1100	0.005	0.013	Circle	4
Reach-17	500	0.005	0.013	Circle	4.5
Reach-18	1200	0.005	0.013	Circle	4.5
Reach-19	2200	0.005	0.013	Circle	6
Reach-20	1303	0.005	0.013	Circle	5
Reach-21	50	0.005	0.013	Circle	4
Reach-22	1520	0.005	0.013	Circle	5
Reach-23A	113	0.005	0.013	Circle	5
Reach-23B	113	0.005	0.013	Circle	5
Reach-24	1310	0.005	0.013	Circle	5

2.3 Hydrologic Characteristics

2.3.1 Precipitation

The National Oceanographic and Atmospheric Administration's (NOAA) Precipitation Frequency Data Server (PFDS) was used to obtain precipitation depths for various storm frequencies over the study area. Precipitation depths are based from NOAA Atlas 14. The PFDS requires a location to be entered. Google Earth was used to obtain the site location in latitude and longitude. The location entered into the PFDS is latitude 32.0067° N and longitude 106.6026° W. Precipitation depths (inches) for various durations were found for the 2-, 5-, 10-, 25-, 50-, and 100-year average recurrence intervals. Table 2-9 lists the precipitation depths used to determine the rainfall distribution.

Table 2-9: NOAA Precipitation Depths					
Duration	2-yr	10-yr	25-yr	100-yr	500-yr
5-min	0.28	0.46	0.56	0.73	0.94
15-min	0.53	0.86	1.05	1.37	1.77
1-hr	0.89	1.44	1.76	2.29	2.95
2-hr	1.03	1.68	2.07	2.71	3.53
3-hr	1.08	1.73	2.12	2.77	3.61
6-hr	1.21	1.88	2.29	2.93	3.73
12-hr	1.32	2.02	2.43	3.06	3.82
24-hr	1.53	2.37	2.87	3.66	4.67

2.3.2 Hydrologic Soil Groups

Soil characteristics, composition, and structure influence runoff potential by affecting the rate at which precipitation is able to infiltrate the soil. The infiltration rate is the key factor in determining the amount of rainfall that will be held in the soil and how much contributes to surface runoff. Soils with a high infiltration rate generally have low runoff potential, while soils with a low infiltration rate typically have a high runoff potential.

Soil data, including hydrologic soil group and soil type, was downloaded from the U.S. Department of Agriculture (USDA) NRCS Soil Data Mart through the Internet (Web Soil Survey). The drainage basins delineated in this study contain various soil classes. The hydrologic soil group associated with each particular soil class as defined by the NRCS was used as a component for calculating the constant loss rate for each basin. The NRCS separates hydrologic soil groups based on the rate of water infiltration with Group "A" soils having high infiltration rates and low runoff potential and with Group "D" soils having low infiltration rates and high runoff potential.

Table 2-10: Hydrologic Soil Group

Soil ID	Soil Name	Hydrologic Soil Group Rating
Ad	Adelino sandy clay loam	B
Ae	Adelino clay loam	B
Pa	Pajarito fine sandy loan	B
Bm	Bluepoint loamy sand, 1 to 5 percent slopes	A
Bn	Bluepoint loamy sand, 5 to 15 percent slopes	A

Study area soils, especially those west of Interstate 10, exhibit high hydraulic conductivity with large portions of the study area being classified in Hydrologic Group "A" and "B" indicative of high infiltration capacity. Refer to Figure 2-2 for an illustration of the hydrologic soil group coverage for the study area.

Table 2-11: Basin Hydrologic Soil Group Rating

Basin ID	Hydrologic Soil Group Rating	Percentage (%)
5	A	35.98
	B	64.02
7A	A	72.08
	B	27.92
7B	A	1.55
	B	98.45
9A	A	73.18
	B	26.82
9B	A	0.00
	B	100.00
10A	A	73.18
	B	26.82
10B	A	0.00
	B	100.00
11A	A	75.23
	B	24.77
11B	A	0.00
	B	100.00

2.3.3 Land Use/Cover

The Doña Ana County parcel data classifies the land use based upon the following land use designations:

- CC-1 Community Commercial: Neighborhood Commercial
- CI-1 Community Industrial: Light-Intensity
- CR-1 Community Residential: Single-Family Residential
- CR-1M Community Residential, Single-Family, Mobile Homes
- CR-2 Community Residential: Medium-Intensity
- CR-3 Community Residential: Apartments and High-Intensity
- Rangeland Shrub and Brush
- Urban or Built-up Land Transportation
- VR-2 Village Residential: Multiple-Family

The land cover designations were based on aerial photography. The two types of land cover used in the study are:

- Rangeland: Shrub and Brush
- Urban or Built-up Land: Transportation

Refer to Figure 2-3 for an illustration of the land use/land cover coverage for the study area.

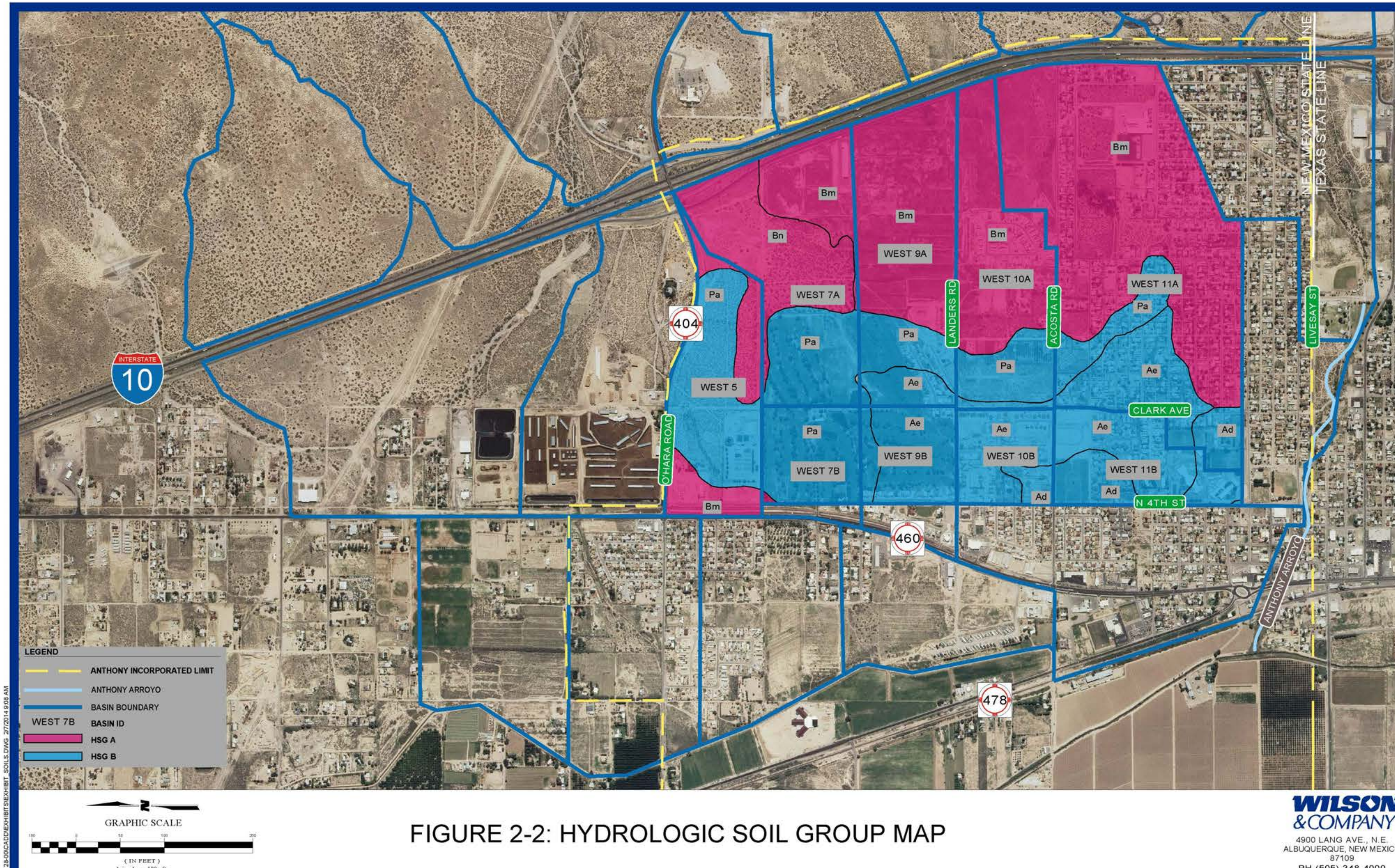

FIGURE 2-2: HYDROLOGIC SOIL GROUP MAP

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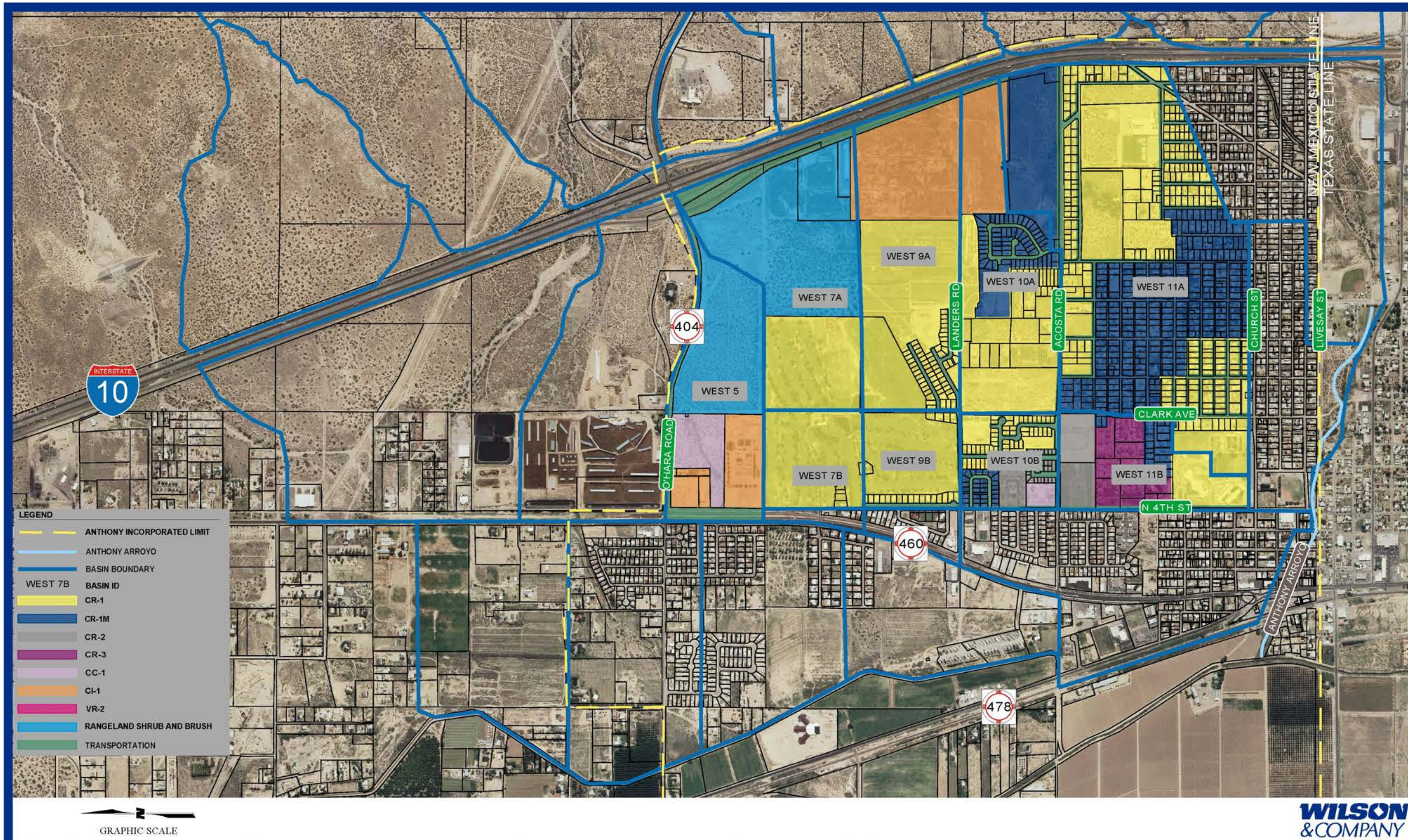

FIGURE 2-3: LAND USE/LAND COVER MAP

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2.4 Hydrologic Modeling Results

The HEC-HMS model output, including peak flow rates, runoff volume, contributing watershed areas, and modeled time to peak has been summarized in Table 2-12.

Table 2-12: HEC-HMS Results (100-Year, 24-Hour Storm Event)

Hydrologic Element	Drainage Area (ac)	Peak Discharge (cfs)	Time to Peak (hr)	Volume (acre-feet)
Acosta Div.	38.95	49.2	06:20	2.910
Acosta Pond	173.68	66.7	07:00	12.928
CP-16	134.11	63.1	06:35	9.097
CP-16A	135.39	147.6	06:40	10.157
CP-17	173.68	120.4	06:35	12.576
CP-17A	262.84	314.4	06:25	20.190
CP-18	212.63	90.6	06:50	15.835
CP-18A	368.12	54.0	07:30	24.731
CP-19	272.65	172.5	06:20	21.173
CP-19A	660.77	512.7	06:25	47.716
CP-20	660.77	122.8	07:00	45.282
CP-Lincoln	272.65	162.5	06:25	21.135
O'Hara Park Pond	660.77	122.8	07:00	45.282
Reach-1	93.45	5.2	07:15	5.538
Reach-16	134.11	62.1	06:35	9.086
Reach-17	173.68	66.5	07:00	12.925
Reach-17A	173.68	118.4	06:35	12.568
Reach-18	212.63	90.2	06:55	15.823
Reach-19	272.65	162.5	06:25	21.135
Reach-2	368.12	54.0	07:30	24.731
Reach-20	660.77	507.5	06:25	47.745
Reach-21	660.77	122.8	07:00	45.282
Reach-22	368.12	54.0	07:30	24.703
Reach-23	262.84	313.4	06:25	20.196
Reach-24	135.39	146.1	06:40	10.159
Reach-7B	40.66	58.6	06:35	3.559
Reach-9B	39.57	58.4	06:35	3.490
West 10A	105.28	117.7	06:40	8.286
West 10B	38.95	62.3	06:30	3.510
West 10 Pond	368.12	54.0	07:30	24.733
West 11A	93.45	508.4	06:25	23.013
West 11B	135.39	128.9	06:20	5.350
West 5	40.66	206.8	06:20	7.602
West 5 Pond	127.44	5.2	07:10	5.559
West 7A	39.57	147.6	06:40	10.157
West 7B	38.95	62.8	06:30	3.605
West 9A	173.68	227.4	06:20	10.031
West 9B	134.11	63.1	06:30	3.537

Refer to Figure 2-4 for the HEC-HMS Basin model. Reach 7B and Reach 9B are used to reduce the runoff from basins West 7B and West 9B. The reaches were routed through the Muskingum-Cunge method, which diffuses the flood wave through a relatively flat channel for a certain distance to mimic small retention ponds. Acosta Div. also represents a series of small retention ponds within basin West 10B.

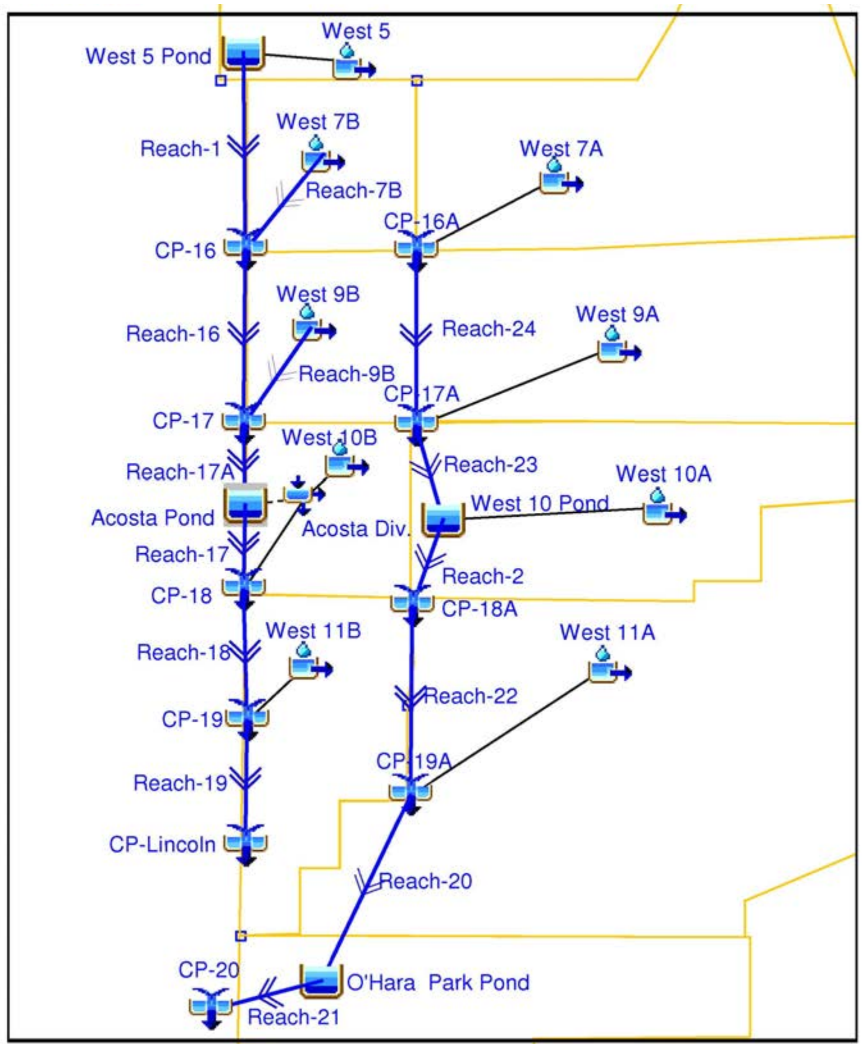

Figure 2-4: HEC-HMS Basin Model

3. HYDRAULIC ANALYSIS

3.1 Methodology

Hydraulic calculations have been performed to obtain capacities for the storm drain along 4th Street. Also, the storm drain being constructed on 4th Street between Landers Road and Acosta Road was modeled. StormCAD by Bentley was used to analyze the existing and proposed storm sewer piping.

The pipe network was modeled based on a 100-year, 24-hour storm using the results from the HEC-HMS model. A roughness number n=0.013 was used for concrete pipes.

3.2 Existing Infrastructure and Capacities

The existing StormCAD model was modified and can be found in Appendix C. Further site specific calculations need to be performed for the upstream system from Acosta Pond.

See Figure 3-1, illustrating the proposed 4th Street storm drain as well as the proposed inlet and outlet from Acosta Pond. Refer to Table 3-1 for storm drain pipe capacities.

Table 3-1: Pipe Capacities

Structure	Flow (cfs)	Capacity (cfs)
Pipe – (01)	153.05	133.39
Pipe – (02)	153.05	221.06
Pipe – (29)	75.02	72.88
Pipe – (30)	69.10	72.15
Pipe – (31)	69.10	85.68

The engineering profile showing the HGL from the StormCAD model is shown in Figures 3-2 and 3-3 for the inlet and outlet from Acosta Pond.

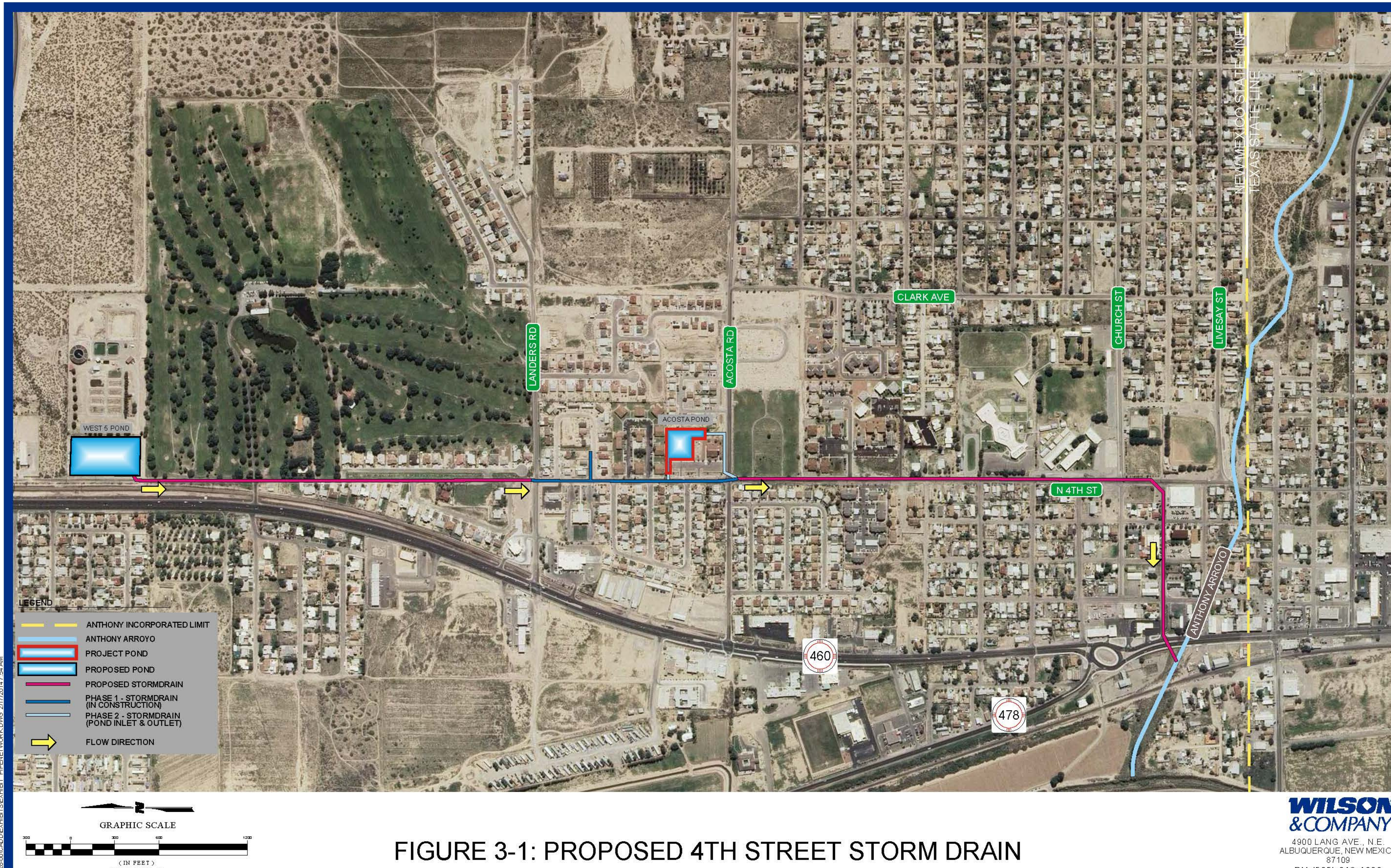

FIGURE 3-1: PROPOSED 4TH STREET STORM DRAIN

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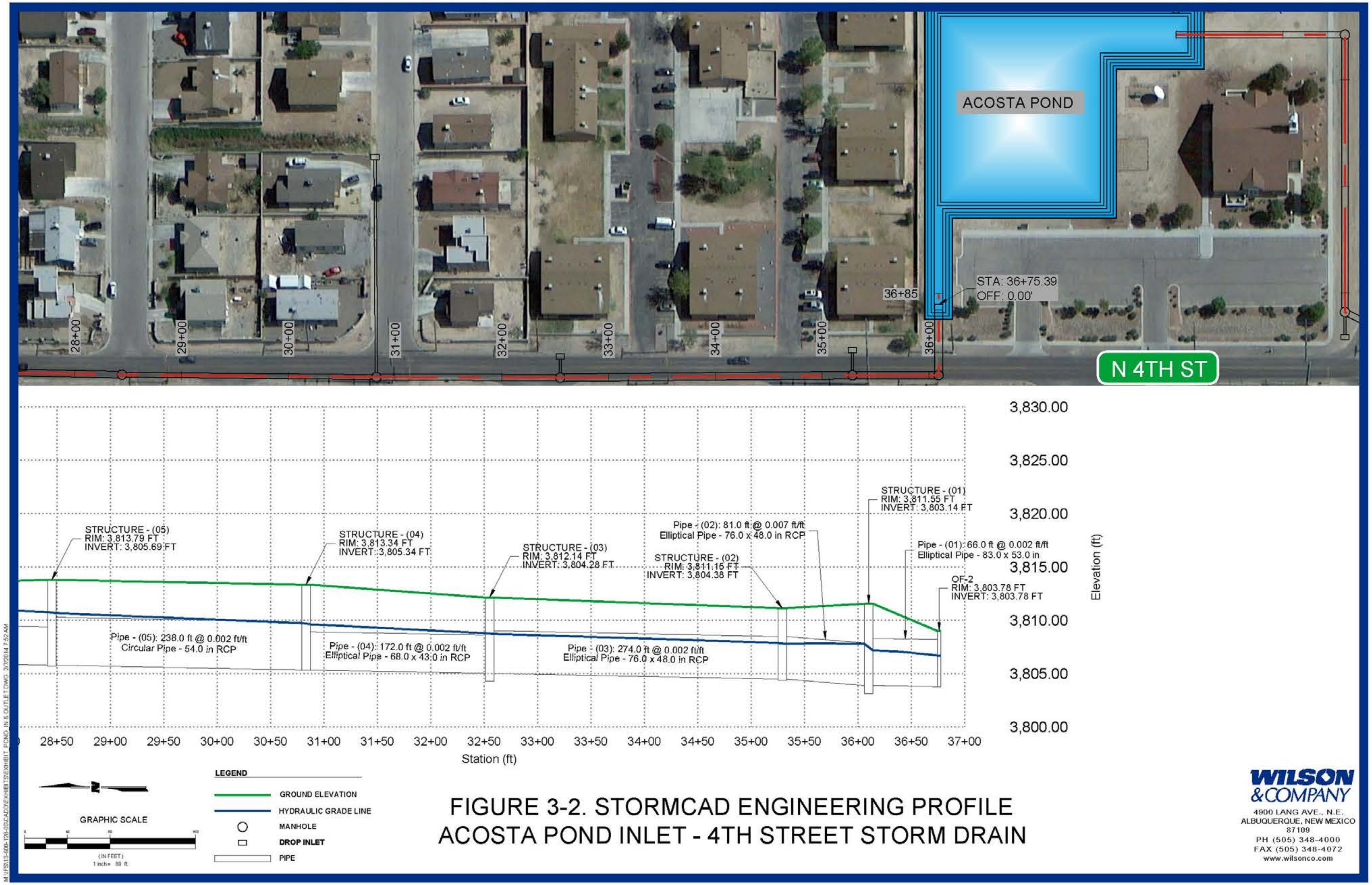


FIGURE 3-2. STORMCAD ENGINEERING PROFILE
ACOSTA POND INLET - 4TH STREET STORM DRAIN

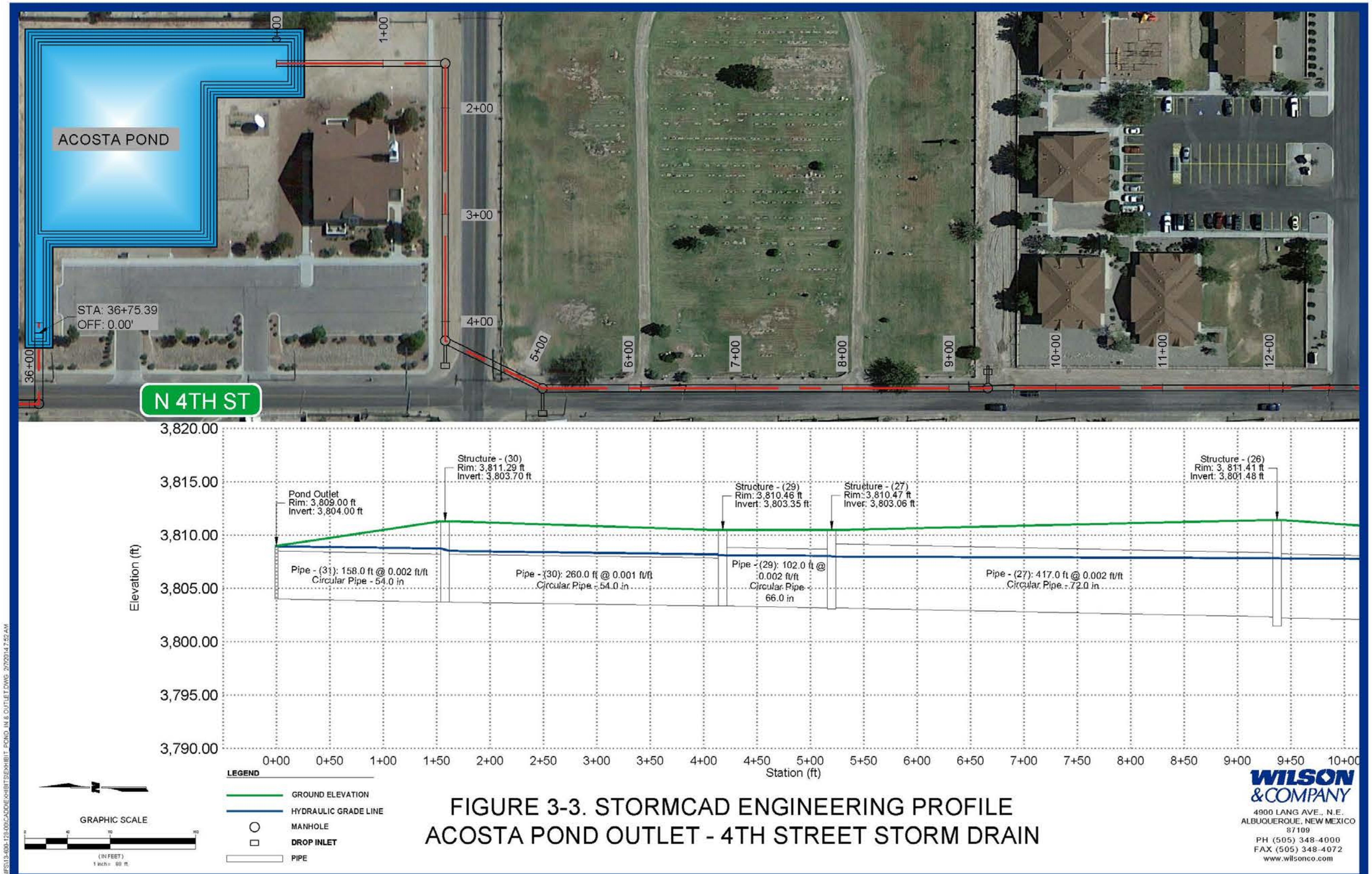


FIGURE 3-3. STORMCAD ENGINEERING PROFILE
ACOSTA POND OUTLET - 4TH STREET STORM DRAIN

4. DESIGN CONCEPTS

4.1 Design Concepts – Proposed Anthony Pond

4.1.1 Acosta Pond

The Acosta Pond has been designed to accommodate the 100-year, 24-hour event. Please see Table 4-1 below for data and results.

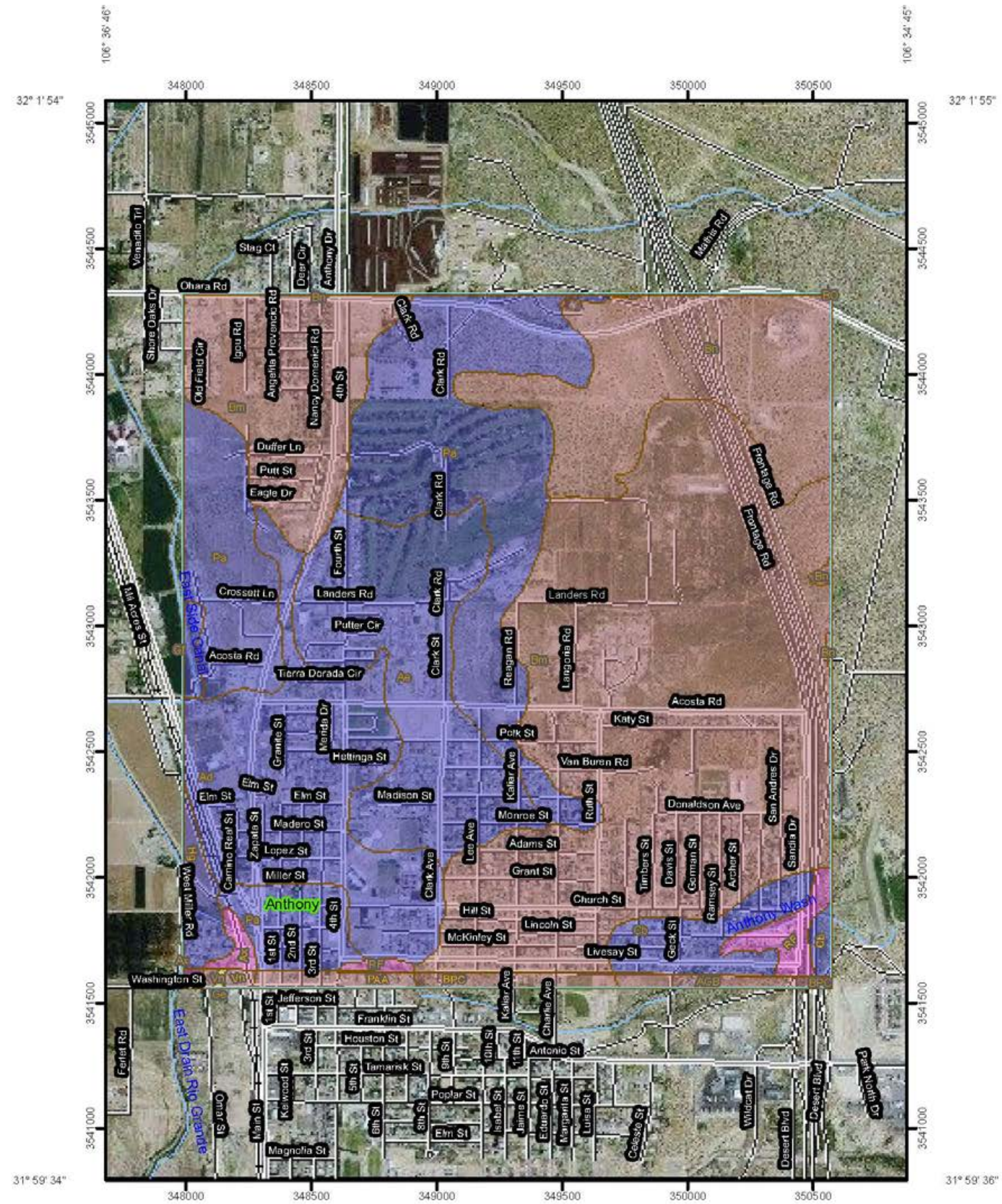
Table 4-1: Acosta Pond, 100-yr 24-hr Storm Event

Data/Result Description	Unit	Dam/Reservoir
Dam/Reservoir HEC-HMS		Acosta Pond
Return Period/Duration	Yr/Hr	100/24, no area reduction
Total Drainage Area	Mi^2	0.27
Inflow Time to Peak	Hrs	6.30
Peak Inflow	Ft^3/s	142.0
Inflow Total Runoff Volume	Ac-ft	13.168
Outflow Time to Peak	Hrs	7.0
Outflow Peak Discharge	Ft^3/s	66.7
Outflow Maximum Storage Volume at Peak	Ac-ft	12.928
Reservoir Invert Elevation	Ft	3804
Top of Embankment Elevation	Ft	3809
Maximum Water Depth	Ft	3808.7

Appendix A

Soil Report

Hydrologic Soil Group—Dona Ana County Area, New Mexico, and El Paso County, Texas (Main Part)



Map Scale: 1:20,500 if printed on A size (8.5" x 11") sheet.

N

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1,000, 2,000, 3,000

USDA Natural Resources Conservation Service | Web Soil Survey National Cooperative Soil Survey | 8/29/2012 Page 1 of 4

Hydrologic Soil Group–Dona Ana County Area, New Mexico, and El Paso County, Texas (Main Part)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:20,500 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at scales ranging from 1:24,000 to 1:31,680.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Dona Ana County Area, New Mexico
Survey Area Data: Version 10, Sep 24, 2009

Soil Survey Area: El Paso County, Texas (Main Part)
Survey Area Data: Version 7, Oct 28, 2009

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Dona Ana County Area, New Mexico (NM690)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Ad	Adelino sandy clay loam	B	195.8	11.1%
Ae	Adelino clay loam	B	184.9	10.5%
Ax	Armijo clay	D	5.7	0.3%
Bm	Bluepoint loamy sand, 1 to 5 percent slopes	A	718.3	40.7%
Bn	Bluepoint loamy sand, 5 to 15 percent slopes	A	181.2	10.3%
BO	Bluepoint loamy sand, 1 to 15 percent slopes	A	0.0	0.0%
Cb	Canutio and Arizo gravelly sandy loams	B	47.9	2.7%
Gf	Glendale clay loam	B	6.6	0.4%
Hg	Harkey loam	B	19.1	1.1%
Pa	Pajarito fine sandy loam	B	343.5	19.5%
RF	Riverwash-Arizo complex	D	19.1	1.1%
Subtotals for Soil Survey Area			**1,722.2**	**97.7%**
Totals for Area of Interest			**1,763.1**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — El Paso County, Texas (Main Part) (TX624)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AGB	Agustin association, undulating	A	10.6	0.6%
BPC	Bluepoint association, rolling	A	13.7	0.8%
Ge	Glendale silty clay loam	C	0.7	0.0%
PAA	Pajarito association, level	A	11.3	0.6%
Tg	Tigua silty clay	D	1.5	0.1%
Vn	Vinton fine sandy loam	A	3.2	0.2%
Subtotals for Soil Survey Area			**40.9**	**2.3%**
Totals for Area of Interest			**1,763.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix B

Hydrologic Calculations

Stage-Storage-Discharge Table

Acosta Detention Pond						
Elevation	Depth	Area		ΔVolume	Total Volume	54" RCP
(ft)	(ft)	(sq ft)	(ac)	(ac-ft)	(ac-ft)	Discharge (cfs)
3804	0	28878.32	0.66	0.000	0.000	0.0
3805	1	31348.05	0.72	0.691	0.691	6.7
3806	2	34625.37	0.79	0.757	1.449	20.1
3807	3	37807.33	0.87	0.831	2.280	34.7
3808	4	41061.30	0.94	0.905	3.185	46.2
3809	5	44387.27	1.02	0.981	4.166	77.6

Stage-Storage-Discharge Table

O'Hara Park Detention Pond						
Elevation	Depth	Area		ΔVolume	Total Volume	48" RCP
(ft)	(ft)	(sq ft)	(ac)	(ac-ft)	(ac-ft)	Discharge (cfs)
3812	0	157115	3.607	0	0.000	0.0
3813	1	168336	3.864	3.736	3.736	9.5
3814	2	179844	4.129	3.997	7.732	35.3
3815	3	191640	4.399	4.264	11.996	72.6
3816	4	203724	4.677	4.538	16.534	114.7
3817	5	216096	4.961	4.819	21.353	149.5

Stage-Storage-Discharge Table

West 5 Pond Detention Pond						
Elevation	Depth	Area		ΔVolume	Total Volume	12" RCP
(ft)	(ft)	(sq ft)	(ac)	(ac-ft)	(ac-ft)	Discharge (cfs)
4000	0	80458.3	1.847	0	0.000	0.0
4001	1	90397	2.075	1.961	1.961	2.0
4002	2	100848	2.315	2.195	4.156	4.0
4003	3	111811	2.567	2.441	6.597	5.0
4004	4	123286	2.830	2.699	9.296	6.0
4005	5	135274	3.105	2.968	12.264	7.0

Stage-Storage-Discharge Table

West 10 Detention Pond						
Elevation	Depth	Area		ΔVolume	Total Volume	42" RCP
(ft)	(ft)	(sq ft)	(ac)	(ac-ft)	(ac-ft)	Discharge (cfs)
3802	0	313776	7.203	0	0.000	0.0
3803	1	322732	7.409	7.306	7.306	7.7
3804	2	331760	7.616	7.513	14.819	27.4
3805	3	340860	7.825	7.721	22.539	51.8
3806	4	350031	8.036	7.930	30.470	69.5
3807	5	359275	8.248	8.142	38.611	83.5
3808	6	368591	8.462	8.355	46.966	95.49
3809	7	377979	8.677	8.569	55.536	106.13

Weighted Basin Loss Rate (inches per hour)

Layer / Sub-Area	SOIL_DESCR	Hydrologic Code	Ksat (micrometers/sec)	Land Use	Loss Class	Loss Rate (in/hr)	AREA (sq miles)	Area * Loss Rate		
Basin 5	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CC-1 Community Commercial: Neighborhood Commercial	M	0.400	0.0029	0.0011		
Basin 5	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0040	0.0016		
Basin 5	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0087	0.0035		
Basin 5	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0105	0.0032		
Basin 5	Bluepoint loamy sand 5 to 15 % slopes	A	91.7400	Rangeland Shrub and Brush	H	0.500	0.0240	0.0120		
Basin 5	Bluepoint loamy sand 5 to 15 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0024	0.0007		
Basin 5	Pajarito fine sandy loam	B	91.7400	CC-1 Community Commercial: Neighborhood Commercial	M	0.225	0.0198	0.0044		
Basin 5	Pajarito fine sandy loam	B	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.225	0.0196	0.0044		
Basin 5	Pajarito fine sandy loam	B	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.225	0.0014	0.0003		
Basin 5	Pajarito fine sandy loam	B	91.7400	Rangeland Shrub and Brush	H	0.300	0.0484	0.0145		
Basin 5	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0043	0.0006		
						Sums:	0.14602	0.0465	Area Weighted =	0.318
Basin 7A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0002	0.0001		
Basin 7A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0037	0.0015		
Basin 7A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0000	0.0000		
Basin 7A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0002	0.0001		
Basin 7A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Rangeland Shrub and Brush	H	0.500	0.0436	0.0218		
Basin 7A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Rangeland Shrub and Brush	H	0.500	0.0000	0.0000		
Basin 7A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0074	0.0022		
Basin 7A	Bluepoint loamy sand 5 to 15 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0029	0.0012		
Basin 7A	Bluepoint loamy sand 5 to 15 % slopes	A	91.7400	Rangeland Shrub and Brush	H	0.500	0.0814	0.0407		
Basin 7A	Bluepoint loamy sand 5 to 15 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0133	0.0040		
Basin 7A	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0567	0.0128		
Basin 7A	Pajarito fine sandy loam	B	91.7400	Rangeland Shrub and Brush	H	0.300	0.0021	0.0006		
						Sums:	0.21155	0.0849	Area Weighted =	0.401
Basin 7B	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0000	0.0000		
Basin 7B	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0008	0.0003		
Basin 7B	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0002	0.0001		
Basin 7B	Pajarito fine sandy loam	B	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.225	0.0000	0.0000		
Basin 7B	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0622	0.0140		
Basin 7B	Pajarito fine sandy loam	B	91.7400	Rangeland Shrub and Brush	H	0.300	0.0000	0.0000		
Basin 7B	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 7B	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0003	0.0000		
						Sums:	0.06353	0.0144	Area Weighted =	0.227
Basin 9A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0184	0.0041		
Basin 9A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0015	0.0002		
Basin 9A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0714	0.0286		
Basin 9A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0000	0.0000		
Basin 9A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0680	0.0272		
Basin 9A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Rangeland Shrub and Brush	H	0.500	0.0002	0.0001		
Basin 9A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Rangeland Shrub and Brush	H	0.500	0.0000	0.0000		
Basin 9A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0008	0.0002		
Basin 9A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0053	0.0016		
Basin 9A	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0306	0.0069		
Basin 9A	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0029	0.0004		
						Sums:	0.19913	0.0694	Area Weighted =	0.348
Basin 9B	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0467	0.0105		
Basin 9B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0038	0.0006		
Basin 9B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0015	0.0002		
Basin 9B	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0094	0.0021		
Basin 9B	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0004	0.0001		
						Sums:	0.06183	0.0135	Area Weighted =	0.218
Basin 10A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0050	0.0011		
Basin 10A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 10A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0002	0.0000		
Basin 10A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0349	0.0139		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0447	0.0179		

Weighted Basin Loss Rate (inches per hour)

Layer / Sub-Area	SOIL_DESCR	Hydrologic Code	Ksat (micrometers/sec)	Land Use	Loss Class	Loss Rate (in/hr)	AREA (sq miles)	Area * Loss Rate		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.400	0.0066	0.0027		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.400	0.0265	0.0106		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0011	0.0003		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0028	0.0008		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0023	0.0007		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0013	0.0004		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 10A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 10A	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0377	0.0085		
Basin 10A	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 10A	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0012	0.0002		
Basin 10A	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
						Sums:	0.16450	0.0572	Area Weighted =	0.348
Basin 10B	Adelino sandy clay loam	B	9.1700	CC-1 Community Commercial: Neighborhood Commercial	M	0.225	0.0047	0.0011		
Basin 10B	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 10B	Adelino sandy clay loam	B	9.1700	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0015	0.0003		
Basin 10B	Adelino sandy clay loam	B	9.1700	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0000	0.0000		
Basin 10B	Adelino sandy clay loam	B	9.1700	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0012	0.0003		
Basin 10B	Adelino sandy clay loam	B	9.1700	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0000	0.0000		
Basin 10B	Adelino sandy clay loam	B	9.1700	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0000	0.0000		
Basin 10B	Adelino sandy clay loam	B	9.1700	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0000	0.0000		
Basin 10B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 10B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0007	0.0001		
Basin 10B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0006	0.0001		
Basin 10B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0007	0.0001		
Basin 10B	Adelino clay loam	B	28.2300	CC-1 Community Commercial: Neighborhood Commercial	M	0.225	0.0001	0.0000		
Basin 10B	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0114	0.0026		
Basin 10B	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0136	0.0031		
Basin 10B	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 10B	Adelino clay loam	B	28.2300	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.225	0.0028	0.0006		
Basin 10B	Adelino clay loam	B	28.2300	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.225	0.0045	0.0010		
Basin 10B	Adelino clay loam	B	28.2300	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0051	0.0012		
Basin 10B	Adelino clay loam	B	28.2300	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0005	0.0001		
Basin 10B	Adelino clay loam	B	28.2300	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0017	0.0004		
Basin 10B	Adelino clay loam	B	28.2300	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0009	0.0002		
Basin 10B	Adelino clay loam	B	28.2300	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0000	0.0000		
Basin 10B	Adelino clay loam	B	28.2300	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0000	0.0000		
Basin 10B	Adelino clay loam	B	28.2300	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0000	0.0000		
Basin 10B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0003	0.0000		
Basin 10B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0012	0.0002		
Basin 10B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0018	0.0003		
Basin 10B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0013	0.0002		
Basin 10B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0063	0.0009		
						Sums:	0.06086	0.0127	Area Weighted =	0.209
Basin 11A	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 11A	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0003	0.0001		
Basin 11A	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0036	0.0008		
Basin 11A	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0131	0.0030		
Basin 11A	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0008	0.0001		
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0027	0.0006		
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0004	0.0001		
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0026	0.0006		

Weighted Basin Loss Rate (inches per hour)

Layer / Sub-Area	SOIL_DESCR	Hydrologic Code	Ksat (micrometers/sec)	Land Use	Loss Class	Loss Rate (in/hr)	AREA (sq miles)	Area * Loss Rate
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0025	0.0006
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0008	0.0002
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0002	0.0000
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0020	0.0005
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0041	0.0009
Basin 11A	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000
Basin 11A	Adelino clay loam	B	28.2300	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.225	0.0461	0.0104
Basin 11A	Adelino clay loam	B	28.2300	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.225	0.0000	0.0000
Basin 11A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000
Basin 11A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0007	0.0001
Basin 11A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0020	0.0003
Basin 11A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0004	0.0001
Basin 11A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0002	0.0000
Basin 11A	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CI-1 Community Industrial: Light-Intensity	M	0.400	0.0035	0.0014
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0022	0.0009
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0027	0.0011
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0026	0.0010
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0026	0.0010
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0020	0.0008
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0001	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0018	0.0007
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0024	0.0010
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0046	0.0018
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0005	0.0002
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0071	0.0029
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0069	0.0028
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0008	0.0003
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0032	0.0013
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0023	0.0009
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0041	0.0017
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0059	0.0024
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0080	0.0032
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0128	0.0051
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0947	0.0379
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0113	0.0045
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0004	0.0001
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0024	0.0010
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.400	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.400	0.0478	0.0191
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.400	0.0815	0.0326
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0042	0.0013
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0012	0.0003
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0046	0.0014
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0014	0.0004

Weighted Basin Loss Rate (inches per hour)

Layer / Sub-Area	SOIL_DESCR	Hydrologic Code	Ksat (micrometers/sec)	Land Use	Loss Class	Loss Rate (in/hr)	AREA (sq miles)	Area * Loss Rate		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0040	0.0012		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0076	0.0023		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0063	0.0019		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0003	0.0001		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Bluepoint loamy sand 1 to 5 % slopes	A	91.7400	Urban or Built-up Land Transportation	L	0.300	0.0000	0.0000		
Basin 11A	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 11A	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0065	0.0015		
Basin 11A	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0001	0.0000		
Basin 11A	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0001	0.0000		
Basin 11A	Pajarito fine sandy loam	B	91.7400	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.225	0.0223	0.0050		
Basin 11A	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 11A	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0002	0.0000		
Basin 11A	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0014	0.0002		
						Sums:	0.45728	0.1597	Area Weighted =	0.349
Basin 11B	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0119	0.0027		
Basin 11B	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0103	0.0023		
Basin 11B	Adelino sandy clay loam	B	9.1700	CR-3 Community Residential: Apartments and High-Intensity	M	0.225	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	CR-3 Community Residential: Apartments and High-Intensity	M	0.225	0.0131	0.0029		
Basin 11B	Adelino sandy clay loam	B	9.1700	CR-3 Community Residential: Apartments and High-Intensity	M	0.225	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0038	0.0006		
Basin 11B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0004	0.0001		
Basin 11B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	VR-2 Village Residential: Multiple-Family	M	0.225	0.0001	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	VR-2 Village Residential: Multiple-Family	M	0.225	0.0003	0.0001		
Basin 11B	Adelino sandy clay loam	B	9.1700	VR-2 Village Residential: Multiple-Family	M	0.225	0.0001	0.0000		
Basin 11B	Adelino sandy clay loam	B	9.1700	VR-2 Village Residential: Multiple-Family	M	0.225	0.0000	0.0000		
Basin 11B	Adelino clay loam	B	28.2300	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0092	0.0021		
Basin 11B	Adelino clay loam	B	28.2300	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.225	0.0120	0.0027		
Basin 11B	Adelino clay loam	B	28.2300	CR-1M Community Residential, Single-Family, Mobile Homes	M	0.225	0.0000	0.0000		
Basin 11B	Adelino clay loam	B	28.2300	CR-2 Community Residential: Medium-Intensity	M	0.225	0.0113	0.0025		
Basin 11B	Adelino clay loam	B	28.2300	CR-3 Community Residential: Apartments and High-Intensity	M	0.225	0.0204	0.0046		
Basin 11B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0003	0.0000		
Basin 11B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0002	0.0000		
Basin 11B	Adelino clay loam	B	28.2300	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
Basin 11B	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 11B	Pajarito fine sandy loam	B	91.7400	CR-1 Community Residential: Single-Family Residential	M	0.225	0.0000	0.0000		
Basin 11B	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0003	0.0000		
Basin 11B	Pajarito fine sandy loam	B	91.7400	Urban or Built-up Land Transportation	L	0.150	0.0000	0.0000		
						Sums:	0.09378	0.0207	Area Weighted =	0.221

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SCS Unit Hydrograph Method

Hydrologic Calculations

(Per NMDOT Drainage Manual, Vol. 1 Hydrology)

TIME OF CONCENTRATION

	Simplified Peak Flow Method												Channel Flow								Total Time of Concentration		Lag time	
Basin	Overland Flow Length (ft)	MAX EL (FT)	MIN EL (FT)	Slope (ft/ft)	Velocity (ft/s)	Time of Conc. (min)	Shallow Conc. Flow Length (ft)	MAX EL (FT)	MIN EL (FT)	Slope (ft/ft)	Velocity (ft/s)	Time of Conc. (min)	Flow Length (ft)	Manning's n	Max El. (ft)	Min El. (ft)	Slope (ft/ft)	Vel (ft/s)	Time of Conc. (min)	Total (min)	Minimum (min)	Lag Time (min)	Synopsis Lag time
West 5*	100	3926	3924	0.025	3.2	0.5	4508	3924	3832	0.020	1.5	50.1								50.6	51	30	19.6
West 7A*	100	3927	3922	0.043	4.2	0.4	4673	3922	3833	0.019	1.5	51.9								52.3	52	31	
West 7B*	100	3848	3845	0.030	3.2	0.5	2066	3845	3824	0.010	1.0	34.4								35.0	35	21	18.3
West 9A*	100	3908	3904	0.043	4.2	0.4	4514	3904	3524	0.084	3.0	25.1								25.5	25	15	
West 9B*	100	3840	3834	0.060	5.0	0.3	1894	3834	3816	0.009	1.0	33.2								33.6	34	20	23
West 10A**	100	3907	3904	0.030	3.1	0.5	6166	3904	3822	0.013	2.1	48.9	979.3	0.015	3870	3857	0.013	7.3	2.2	51.7	52	31	
West 10B**	100	3822	3819	0.030	3.1	0.5	1100	3819	3816	0.003	1.1	16.7	2222.4	0.015	3825	3822	0.001	2.3	16.1	33.3	33	20	18.9
West 11A**	100	3933	3929	0.043	4.2	0.4	2565	3929	3891	0.015	2.4	17.8	3840.0	0.015	3891	3822	0.018	8.4	7.6	25.8	26	16	
West 11B**	100	3825	3823	0.018	2.6	0.6	221	3823	3820	0.014	2.4	1.5	2540.4	0.015	3820	3816	0.002	2.5	17.1	19.2	19	12	12.1

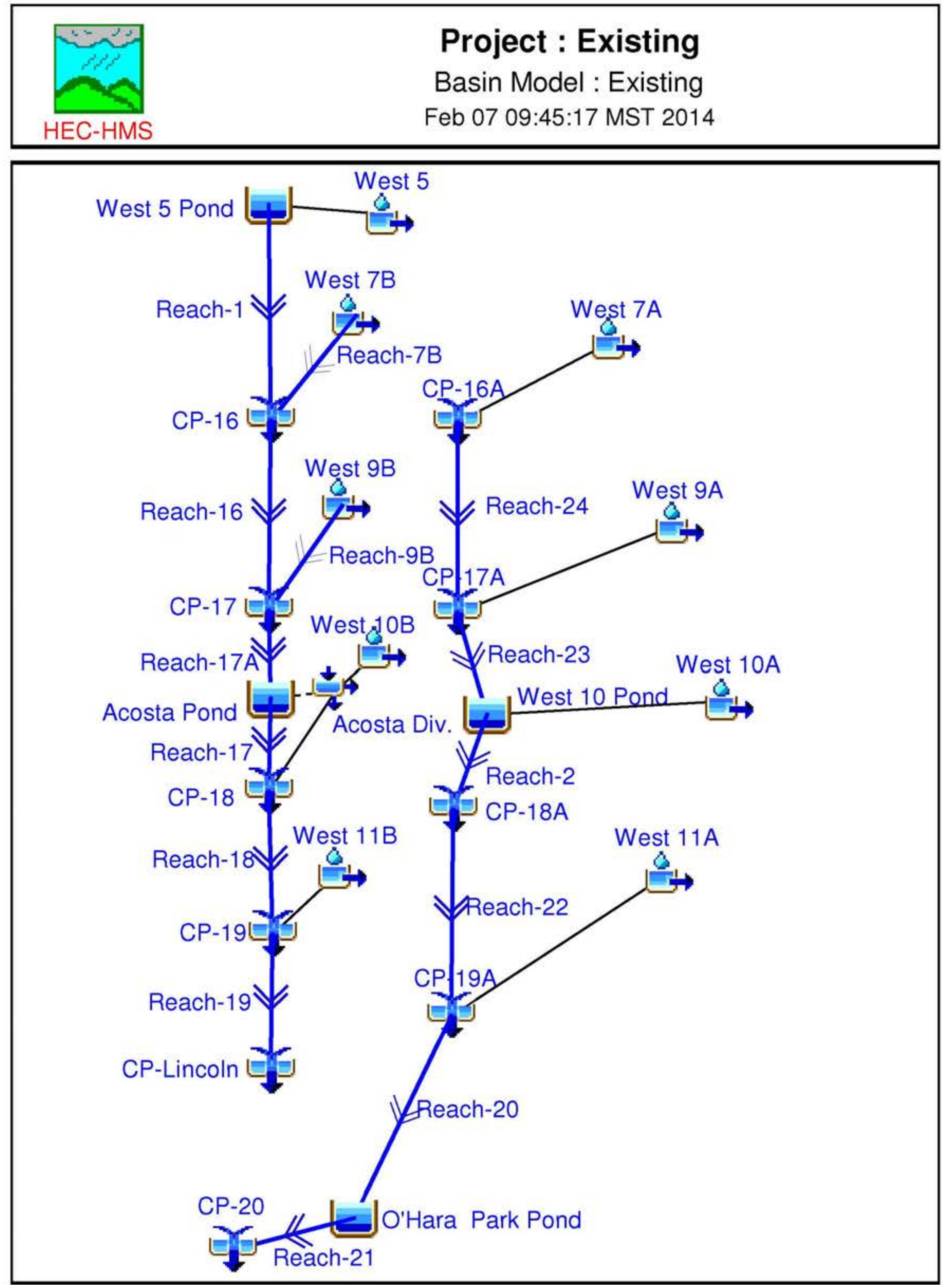
* Figure 3-10 Flow Velocities for Overland and Shallow Concentrated Flows was used from the NMDOT Drainage Manual, Volume 1. Hydrology. The Flow Velocity plot for the Paved Areas (Overland Flow), then the Alluvial Fans in Western Mountain Regions (Shallow Concentrated Flow) was used.

** Figure 3-10 Flow Velocities for Overland and Shallow Concentrated Flows was used from the NMDOT Drainage Manual, Volume 1. Hydrology. The Flow Velocity plot for the Paved Areas (Overland Flow), then the Small Upland Gullies (Shallow Concentrated Flow) was used.

Snyder Unit Hydrograph Method

Snyder Unit Hydrograph Method ("Flood Threat Identification Study and Drainage Management Plan", 2012)

Basin Number	Name	Area (square miles)	Stream Length L (feet)	Stream Length L (miles)	Length to Centroid (feet)	Length to Centroid (miles)	Elev at 15% L (ft)	Elev at 85% L (ft)	Basin Slope (ft/foot)	Basin Slope (%)	L*Lca/sqrt(slope)	lag (hours)	unit duration (hrs)
16	West 5	0.14	3590	0.68	1628	0.31	3836	3864	0.0111	1.11	0.0273	0.19	0.03


HEC-HMS
Project : Existing
Basin Model : Existing
Feb 07 09:45:17 MST 2014
West 5 Pond
West 5
Reach-1
West 7B
West 7A
Reach-7B
CP-16A
CP-16
West 9B
Reach-16
Reach-24
West 9A
Reach-9B
CP-17A
CP-17
West 10B
Reach-17A
Reach-23
West 10A
West 10 Pond
Acosta Pond
Acosta Div.
Reach-17
Reach-2
CP-18
CP-18A
West 11B
West 11A
Reach-18
Reach-22
CP-19
CP-19A
Reach-19
CP-Lincoln
Reach-20
CP-20
O'Hara Park Pond
Reach-21

Project: Existing Simulation Run: 100 Year, 24 Hour

Start of Run: 01Oct2013, 00:00 Basin Model: Existing
End of Run: 02Oct2013, 00:00 Meteorologic Model: 100 year, 24 hour
Compute Time: 22Jan2014, 11:39:09 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Acosta Div.	0.06086	49.2	01Oct2013, 06:20	2.9
Acosta Pond	0.27138	66.7	01Oct2013, 07:00	12.9
CP-16	0.20955	63.1	01Oct2013, 06:35	9.1
CP-16A	0.21155	147.6	01Oct2013, 06:40	10.2
CP-17	0.27138	120.4	01Oct2013, 06:35	12.6
CP-17A	0.41068	314.4	01Oct2013, 06:25	20.2
CP-18	0.33224	90.6	01Oct2013, 06:50	15.8
CP-18A	0.57518	54.0	01Oct2013, 07:30	24.7
CP-19	0.42602	172.5	01Oct2013, 06:20	21.2
CP-19A	1.03246	512.7	01Oct2013, 06:25	47.7
CP-20	1.03246	122.8	01Oct2013, 07:00	45.3
CP-Lincoln	0.42602	162.5	01Oct2013, 06:25	21.1
O'Hara Park Pond	1.03246	122.8	01Oct2013, 07:00	45.3
Reach-1	0.14602	5.2	01Oct2013, 07:15	5.5
Reach-16	0.20955	62.1	01Oct2013, 06:35	9.1
Reach-17	0.27138	66.5	01Oct2013, 07:00	12.9
Reach-17A	0.27138	118.4	01Oct2013, 06:35	12.6
Reach-18	0.33224	90.2	01Oct2013, 06:55	15.8
Reach-19	0.42602	162.5	01Oct2013, 06:25	21.1
Reach-2	0.57518	54.0	01Oct2013, 07:30	24.7
Reach-20	1.03246	507.5	01Oct2013, 06:25	47.7
Reach-21	1.03246	122.8	01Oct2013, 07:00	45.3
Reach-22	0.57518	54.0	01Oct2013, 07:30	24.7
Reach-23	0.41068	313.4	01Oct2013, 06:25	20.2
Reach-24	0.21155	146.1	01Oct2013, 06:40	10.2
Reach-7B	0.06353	58.6	01Oct2013, 06:35	3.6

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Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Reach-9B	0.06183	58.4	01Oct2013, 06:35	3.5
West 10A	0.16450	117.7	01Oct2013, 06:40	8.3
West 10B	0.06086	62.3	01Oct2013, 06:30	3.5
West 10 Pond	0.57518	54.0	01Oct2013, 07:30	24.7
West 11A	0.45728	508.4	01Oct2013, 06:25	23.0
West 11B	0.09378	128.9	01Oct2013, 06:20	5.4
West 5	0.14602	206.8	01Oct2013, 06:20	7.6
West 5 Pond	0.14602	5.2	01Oct2013, 07:10	5.6
West 7A	0.21155	147.6	01Oct2013, 06:40	10.2
West 7B	0.06353	62.8	01Oct2013, 06:30	3.6
West 9A	0.19913	227.4	01Oct2013, 06:20	10.0
West 9B	0.06183	63.1	01Oct2013, 06:30	3.5

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Project: Existing Simulation Run: 100 Year, 6 Hour

Start of Run: 01Oct2013, 00:00 Basin Model: Existing
End of Run: 01Oct2013, 06:00 Meteorologic Model: 100 year, 6 hour
Compute Time: 22Jan2014, 11:40:20 Control Specifications: Control 2

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Acosta Div.	0.06086	49.9	01Oct2013, 01:55	3.0
Acosta Pond	0.27138	47.9	01Oct2013, 02:35	7.1
CP-16	0.20955	53.9	01Oct2013, 02:05	4.6
CP-16A	0.21155	124.0	01Oct2013, 02:10	8.6
CP-17	0.27138	102.3	01Oct2013, 02:05	7.7
CP-17A	0.41068	260.6	01Oct2013, 02:00	17.2
CP-18	0.33224	71.4	01Oct2013, 02:15	10.1
CP-18A	0.57518	44.4	01Oct2013, 03:00	11.1
CP-19	0.42602	145.0	01Oct2013, 01:55	14.7
CP-19A	1.03246	430.0	01Oct2013, 01:55	30.6
CP-20	1.03246	102.1	01Oct2013, 02:35	22.6
CP-Lincoln	0.42602	143.1	01Oct2013, 01:55	14.7
O'Hara Park Pond	1.03246	102.1	01Oct2013, 02:35	22.6
Reach-1	0.14602	4.8	01Oct2013, 02:45	1.5
Reach-16	0.20955	53.1	01Oct2013, 02:10	4.6
Reach-17	0.27138	47.8	01Oct2013, 02:40	7.1
Reach-17A	0.27138	101.1	01Oct2013, 02:10	7.6
Reach-18	0.33224	71.3	01Oct2013, 02:15	10.1
Reach-19	0.42602	143.1	01Oct2013, 01:55	14.7
Reach-2	0.57518	44.4	01Oct2013, 03:00	11.1
Reach-20	1.03246	420.0	01Oct2013, 01:55	30.5
Reach-21	1.03246	102.1	01Oct2013, 02:35	22.6
Reach-22	0.57518	44.4	01Oct2013, 03:05	10.9
Reach-23	0.41068	260.6	01Oct2013, 02:00	17.2
Reach-24	0.21155	122.8	01Oct2013, 02:15	8.6
Reach-7B	0.06353	49.9	01Oct2013, 02:05	3.1

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Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Reach-9B	0.06183	50.0	01Oct2013, 02:05	3.0
West 10A	0.16450	99.3	01Oct2013, 02:10	7.1
West 10B	0.06086	53.1	01Oct2013, 02:00	3.1
West 10 Pond	0.57518	44.4	01Oct2013, 03:00	11.1
West 11A	0.45728	426.8	01Oct2013, 01:55	19.6
West 11B	0.09378	107.9	01Oct2013, 01:50	4.6
West 5	0.14602	174.0	01Oct2013, 01:50	6.5
West 5 Pond	0.14602	4.8	01Oct2013, 02:40	1.6
West 7A	0.21155	124.0	01Oct2013, 02:10	8.6
West 7B	0.06353	53.2	01Oct2013, 02:00	3.1
West 9A	0.19913	191.5	01Oct2013, 01:55	8.6
West 9B	0.06183	53.7	01Oct2013, 02:00	3.1

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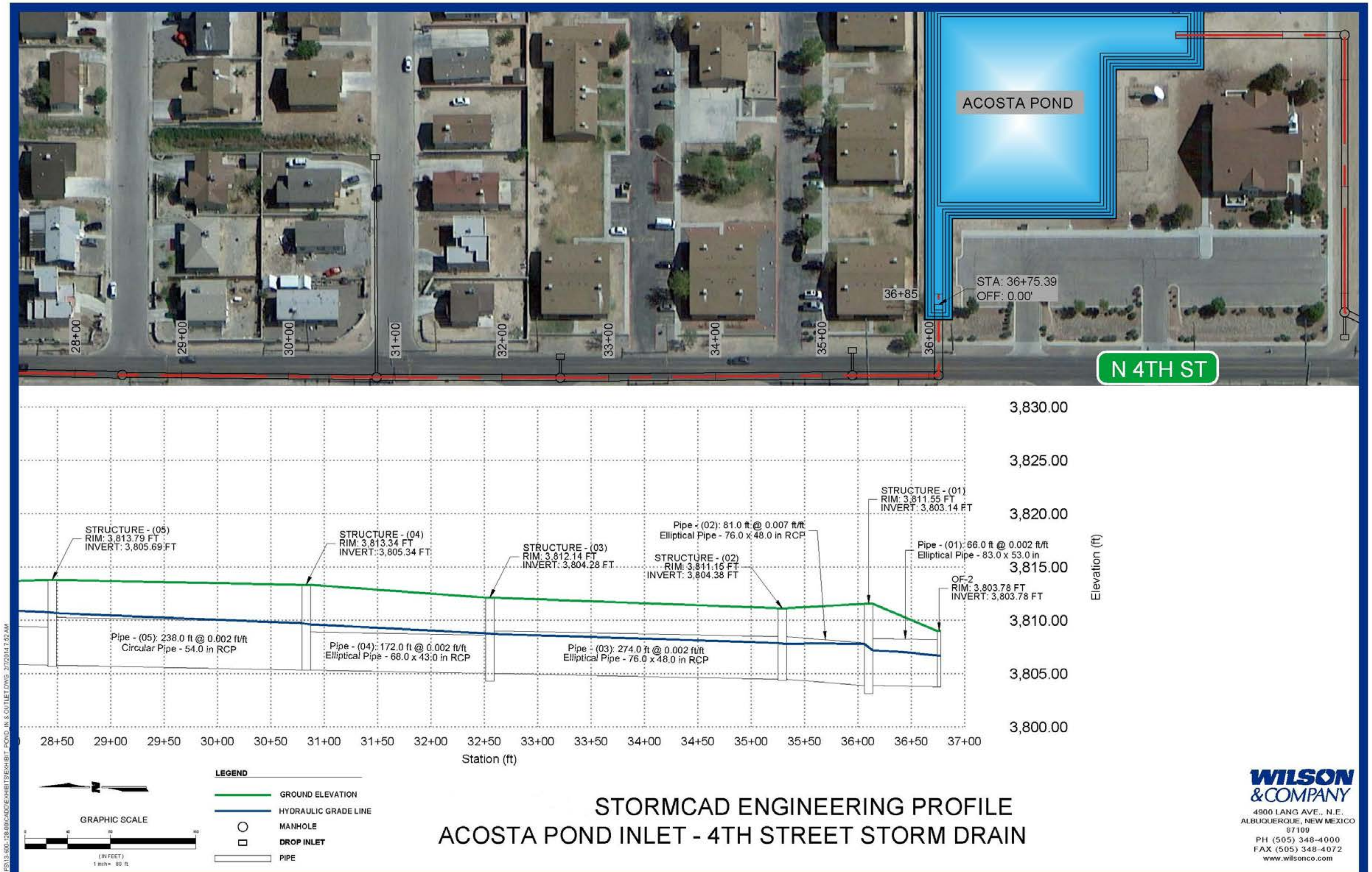
Appendix C

Hydraulic Calculations


ACOSTA POND
STA: 36+75.39
OFF: 0.00'
36+85
28+00
29+00
30+00
31+00
32+00
33+00
34+00
35+00
36+00
N 4TH ST
3,830.00
3,825.00
3,820.00
3,815.00
3,810.00
3,805.00
3,800.00
Elevation (ft)
STRUCTURE - (05) RIM: 3,813.79 FT INVERT: 3,805.69 FT
STRUCTURE - (04) RIM: 3,813.34 FT INVERT: 3,805.34 FT
STRUCTURE - (03) RIM: 3,812.14 FT INVERT: 3,804.28 FT
STRUCTURE - (02) RIM: 3,811.15 FT INVERT: 3,804.38 FT
STRUCTURE - (01) RIM: 3,811.55 FT INVERT: 3,803.14 FT
OF-2 RIM: 3,803.78 FT INVERT: 3,803.78 FT
Pipe - (05): 238.0 ft @ 0.002 ft/ft Circular Pipe - 54.0 in RCP
Pipe - (04): 172.0 ft @ 0.002 ft/ft Elliptical Pipe - 68.0 x 43.0 in RCP
Pipe - (03): 274.0 ft @ 0.002 ft/ft Elliptical Pipe - 76.0 x 48.0 in RCP
Pipe - (02): 81.0 ft @ 0.007 ft/ft Elliptical Pipe - 76.0 x 48.0 in RCP
Pipe - (01): 66.0 ft @ 0.002 ft/ft Elliptical Pipe - 83.0 x 53.0 in
28+50
29+00
29+50
30+00
30+50
31+00
31+50
32+00
32+50
33+00
33+50
34+00
34+50
35+00
35+50
36+00
36+50
37+00
Station (ft)
GRAPHIC SCALE
(IN FEET)
1 inch = 80 ft
LEGEND
GROUND ELEVATION
HYDRAULIC GRADE LINE
MANHOLE
DROP INLET
PIPE
STORMCAD ENGINEERING PROFILE
ACOSTA POND INLET - 4TH STREET STORM DRAIN
WILSON & COMPANY
4900 LANG AVE., N.E.
ALBUQUERQUE, NEW MEXICO
87109
PH (505) 348-4000
FAX (505) 348-4072
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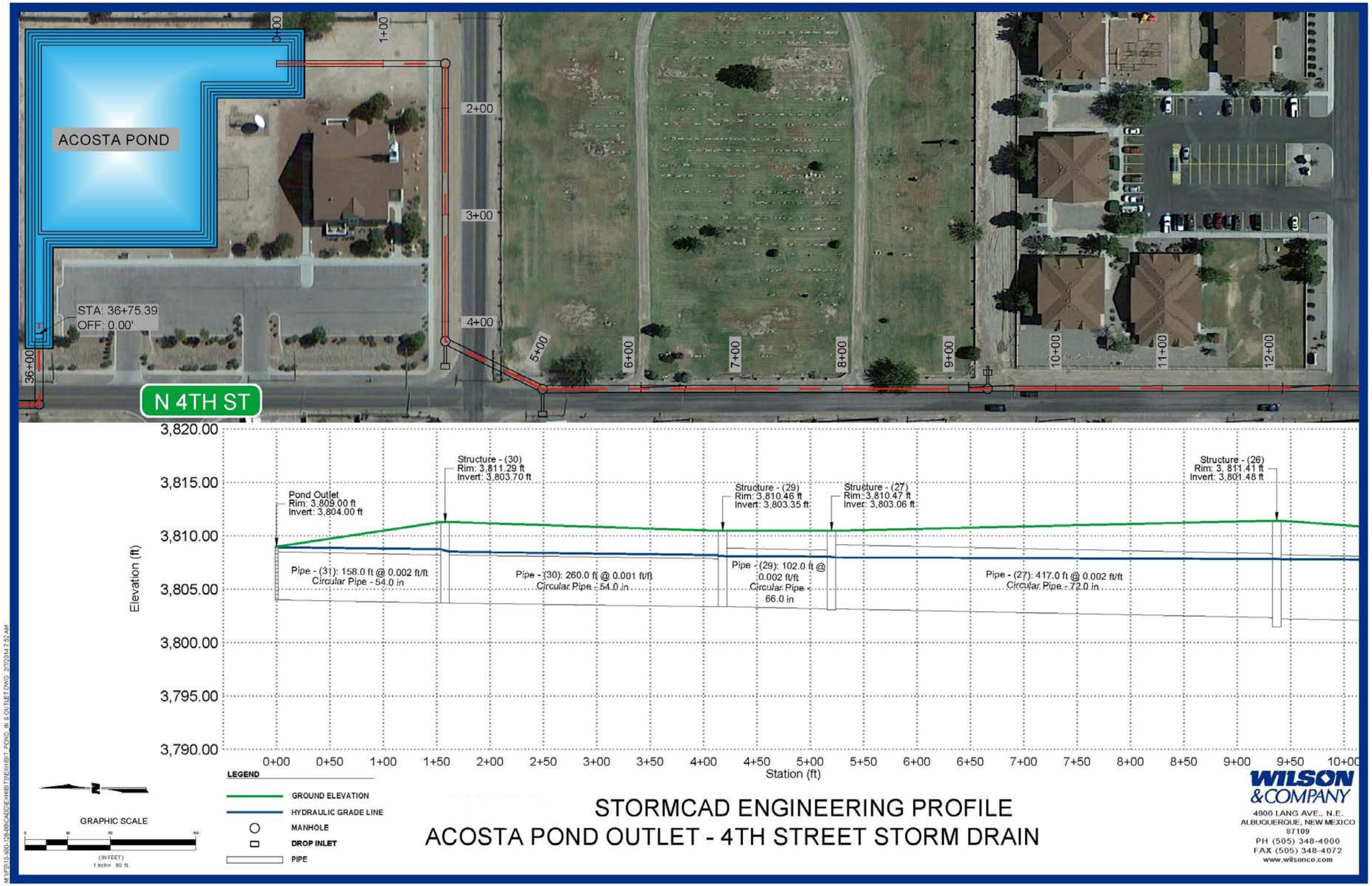
ACOSTA POND
STA: 36+75.39
OFF: 0.00'
N 4TH ST
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
36+00
Pond Outlet
Rim: 3,809.00 ft
Invert: 3,804.00 ft
Structure - (30)
Rim: 3,811.29 ft
Invert: 3,803.70 ft
Structure - (29)
Rim: 3,810.46 ft
Invert: 3,803.35 ft
Structure - (27)
Rim: 3,810.47 ft
Inver: 3,803.06 ft
Structure - (26)
Rim: 3, 811.41 ft
Invert: 3,801.48 ft
Pipe - (31): 158.0 ft @ 0.002 ft/ft
Circular Pipe - 54.0 in
Pipe - (30): 260.0 ft @ 0.001 ft/ft
Circular Pipe - 54.0 in
Pipe - (29): 102.0 ft @ 0.002 ft/ft
Circular Pipe - 66.0 in
Pipe - (27): 417.0 ft @ 0.002 ft/ft
Circular Pipe - 72.0 in
Elevation (ft)
3,820.00
3,815.00
3,810.00
3,805.00
3,800.00
3,795.00
3,790.00
0+00 0+50 1+00 1+50 2+00 2+50 3+00 3+50 4+00 4+50 5+00 5+50 6+00 6+50 7+00 7+50 8+00 8+50 9+00 9+50 10+00
Station (ft)
LEGEND
GROUND ELEVATION
HYDRAULIC GRADE LINE
MANHOLE
DROP INLET
PIPE
GRAPHIC SCALE
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Label	Start Node	Stop Node	Branch ID	Branch Element ID	Length (Unified) (ft)	Total Flow (ft^3/s)	Rise (Unified) (in)	Capacity (Full Flow) (ft^3/s)	Velocity (Average) (ft/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Slope (ft/ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Pipe - (101)	Structure - (101)	Structure - (03)	23	1	17	9.75	18	14.92	5.52	3807.64	3807.3	0.02	3809.49	3809.34
Pipe - (102)	Structure - (102)	Structure - (04)	22	1	204	9.75	18	10.5	5.52	3808.01	3805.98	0.01	3812.31	3810.56
Pipe - (107)	Structure - (107)	Structure - (09)	21	1	17	14.6	18	14.92	8.26	3810.72	3810.38	0.02	3814.59	3814.27
Pipe - (108)	Structure - (108)	Structure - (10)	20	1	17	11.72	18	14.92	6.63	3811.93	3811.59	0.02	3814.3	3814.09
Pipe - (109)	Structure - (109)	Structure - (11)	19	1	17	11.72	18	9.46	6.63	3814.94	3814.8	0.008	3820.45	3820.24
Pipe - (15)	Structure - (15)	Structure - (14)	18	1	280	6.2	24	18.89	5.39	3823.3	3821.34	0.007	3825.16	3824.96
Pipe - (112)	Structure - (112)	Structure - (14)	17	1	17	11.72	18	14.9	9.34	3825.08	3824.74	0.02	3826.38	3825.84
Pipe - (14)	Structure - (14)	Structure - (13)	17	2	277	17.92	24	18.91	5.7	3821.26	3819.33	0.007	3824.89	3823.15
Pipe - (111)	Structure - (111)	Structure - (13)	16	1	17	11.72	18	14.92	6.63	3821.17	3820.82	0.02	3823.85	3823.63
Pipe - (13)	Structure - (13)	Structure - (12)	16	2	288	29.64	30	34.42	6.04	3819.32	3817.29	0.007	3823.09	3821.58
Pipe - (110)	Structure - (110)	Structure - (12)	15	1	17	11.72	18	15.07	6.63	3817.74	3817.39	0.021	3821.87	3821.66
Pipe - (12)	Structure - (12)	Structure - (11)	15	2	257	41.36	30	34.29	8.43	3817.2	3815.4	0.007	3821.41	3818.8
Pipe - (11)	Structure - (11)	Structure - (10)	15	3	266	53.08	30	49.98	10.81	3815.3	3811.35	0.015	3818.54	3814.09
Pipe - (10)	Structure - (10)	Structure - (09)	15	4	347	64.8	54	169.29	9.94	3811.25	3808.68	0.007	3814.05	3813.98
Pipe - (09)	Structure - (09)	Structure - (08)	15	5	347	79.4	54	115.15	4.99	3808.58	3807.39	0.003	3813.95	3813.39
Pipe - (106)	Structure - (106)	Structure - (08)	14	1	17	14.6	18	14.92	8.26	3806.74	3806.4	0.02	3813.9	3813.57
Pipe - (08)	Structure - (08)	Structure - (07)	14	2	345	94	54	87.94	5.91	3807.39	3806.7	0.002	3813.34	3812.55
Pipe - (105)	Structure - (105)	Structure - (07)	13	1	17	14.6	18	14.92	8.26	3809.05	3808.7	0.02	3813.52	3813.19
Pipe - (07)	Structure - (07)	Structure - (06)	13	2	258	108.6	43	85.42	6.29	3806.7	3806.19	0.002	3812.49	3811.66
Pipe - (104)	Structure - (104)	Structure - (06)	12	1	7	7.6	18	15.27	4.3	3807.8	3807.66	0.021	3812.48	3812.44
Pipe - (103)	Structure - (103)	Structure - (06)	11	1	17	7.6	18	14.92	4.3	3808.44	3808.09	0.02	3812.53	3812.44
Pipe - (06)	Structure - (06)	Structure - (05)	11	2	180	123.8	43	90.93	7.17	3806.19	3805.79	0.002	3811.54	3810.78
Pipe - (05)	Structure - (05)	Structure - (04)	11	3	238	123.8	54	85.5	7.78	3805.79	3805.34	0.002	3810.68	3809.74
Pipe - (04)	Structure - (04)	Structure - (03)	11	4	172	133.55	43	81.89	7.74	3805.34	3805.03	0.002	3809.63	3808.79
Pipe - (03)	Structure - (03)	Structure - (02)	11	5	274	143.3	48	115.73	6.65	3805.03	3804.48	0.002	3808.72	3807.88
Pipe - (100)	Structure - (100)	Structure - (02)	10	1	21	9.75	18	14.87	5.52	3805.82	3805.4	0.02	3808.76	3808.58
Pipe - (02)	Structure - (02)	Structure - (01)	10	2	81	153.05	48	221.06	12.23	3804.48	3803.89	0.007	3807.8	3807.79
Pipe - (01)	Structure - (01)	OF-2	10	3	66	153.05	53	133.39	5.89	3803.89	3803.78	0.002	3807.18	3806.7
Pipe - (116)	Structure - (116)	Structure - (24)	9	1	17	18.41	18	14.92	10.42	3802.25	3801.9	0.02	3808.79	3808.27
Pipe - (31)	Pond Outlet	Structure - (30)	8	1	158	69.1	54	85.68	4.34	3804	3803.7	0.002	3811.03	3810.84
Pipe - (30)	Structure - (30)	Structure - (29)	8	2	260	69.1	54	72.15	4.34	3803.7	3803.35	0.001	3810.55	3810.23
Pipe - (120)	Structure - (120)	Structure - (29)	7	1	21	5.92	18	8.88	3.35	3803.5	3803.35	0.007	3810.03	3809.97
Pipe - (29)	Structure - (29)	Structure - (28)	7	2	91	75.02	54	72.88	4.72	3803.35	3803.23	0.001	3809.95	3809.81
Pipe - (28)	Structure - (28)	Structure - (27)	7	3	45	75.02	54	74.73	4.72	3803.23	3803.16	0.001	3809.49	3809.43
Pipe - (119)	Structure - (119)	Structure - (27)	6	1	21	18.41	18	14.84	10.42	3804.27	3803.85	0.02	3810.07	3809.43
Pipe - (27)	Structure - (27)	Structure - (26)	6	2	417	93.43	66	149.81	3.93	3803.16	3802.33	0.002	3809.24	3808.92
Pipe - (118)	Structure - (118)	Structure - (26)	5	1	21	18.41	18	14.85	10.42	3806.8	3806.38	0.02	3809.82	3809.17
Pipe - (26)	Structure - (26)	Structure - (25)	5	2	426	111.85	66	149.99	4.71	3802.23	3801.38	0.002	3808.89	3808.41
Pipe - (117)	Structure - (117)	Structure - (25)	4	1	21	18.41	18	14.85	10.42	3805.09	3804.67	0.02	3809.06	3808.41
Pipe - (25)	Structure - (25)	Structure - (24)	4	2	433	130.26	66	150.52	5.48	3801.38	3800.51	0.002	3808.44	3807.79
Pipe - (24)	Structure - (24)	Structure - (23)	4	3	360	148.68	66	150.17	6.26	3800.51	3799.79	0.002	3807.74	3807.03
Pipe - (115)	Structure - (115)	Structure - (23)	3	1	21	18.41	18	14.85	10.42	3806.27	3805.85	0.02	3808.28	3807.63
Pipe - (23)	Structure - (23)	Structure - (22)	3	2	398	167.09	66	150.55	7.03	3799.79	3798.99	0.002	3806.96	3805.98
Pipe - (114)	Structure - (114)	Structure - (22)	2	1	21	18.41	18	14.85	10.42	3805.53	3805.11	0.02	3807.24	3806.57
Pipe - (22)	Structure - (22)	Structure - (21)	2	2	296	185.5	72	191.34	6.56	3798.99	3798.39	0.002	3805.93	3805.36

Page 1 of 2

Label	Start Node	Stop Node	Branch ID	Branch Element ID	Length (Unified) (ft)	Total Flow (ft^3/s)	Rise (Unified) (in)	Capacity (Full Flow) (ft^3/s)	Velocity (Average) (ft/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Slope (ft/ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Pipe - (113)	Structure - (113)	Structure - (21)	1	1	21	18.41	18	14.85	10.42	3805.81	3805.39	0.02	3807.52	3806.84
Pipe - (21)	Structure - (21)	Structure - (20)	1	2	303	203.92	72	189.23	7.21	3798.39	3797.78	0.002	3805.3	3804.6
Pipe - (20)	Structure - (20)	Structure - (19)	1	3	169	203.92	72	187.5	7.21	3797.78	3797.45	0.002	3804.54	3804.15
Pipe - (19)	Structure - (19)	Structure - (18)	1	4	119	203.92	72	190.18	7.21	3797.45	3797.21	0.002	3803.7	3803.43
Pipe - (18)	Structure - (18)	Structure - (17)	1	5	500	203.92	72	190.33	7.53	3797.21	3796.2	0.002	3802.99	3801.98
Pipe - (17)	Structure - (17)	Structure - (16)	1	6	467	203.92	53	148.54	7.85	3796.2	3795.27	0.002	3801.89	3800.1
Pipe - (16)	Structure - (16)	OF-1	1	7	184	203.92	53	149.26	7.85	3795.27	3794.9	0.002	3799.69	3799.32

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