Infrastructure Assessment Study

ASLD 8500

#053-120190-00-100

November 18, 2019

Prepared For:

Brookfield Residential (Arizona) LLC
14646 N. Kierland Blvd., Suite 165,
Scottsdale, AZ 85254

and

Arizona State Land Department
1616 W. Adams St.
Phoenix, AZ 85007

Prepared By:

Kimley»Horn

1001 W. Southern Avenue, Suite 131

Mesa, Arizona 85212

Table of Contents

Project Overview

Purpose and Intent

This study intends to assess conceptual infrastructure improvements to serve the subject property known as ASLD 8500 and support a pending land sale under Application No. 053-120190-00-100 with the Arizona State Land Department (the "ASLD"). The applicant, Brookfield Residential (Arizona) LLC, has applied to purchase approximately 2,800 acres of land within the planning boundary of the City of Apache Junction, Pinal County, Arizona (the "Auction Parcel"). The Auction Parcel is located within an approximate 8,200-acre area (the "Planning Parcel"). This study assesses anticipated infrastructure associated with wastewater, water, roadway, and drainage improvements to serve the Auction Parcel and conceptual land plan proposed for the Planning Parcel. The study is conceptual, and while it includes some sizing and conceptual detail of improvements, it is not intended to be used as a final design document. If the purchase of the Auction Parcel occurs, it is the responsibility of the awarded bidder to determine final improvement and project requirements to entitle and develop the property.

Site location and Description

The ASLD 8500 Planning Parcel is located east of Meridian Road, west of the CAP Canal, north of the proposed SR 24 corridor, and south of Baseline Road in Pinal County, Arizona. Portions of the Planning Parcel are located within the Incorporated City Limits of Apache Junction (the "City"), with the remaining project area south of Elliot Road located within the planning area for the City and currently unincorporated property.

The Auction Parcel is located central to the Planning Parcel between the Ray Road and Elliot Road alignments from Meridian Road to the CAP Canal. The Auction Parcel is comprised of sections 17, 19, 20, a majority of section 18, and small portion of section 30 (T1S, R8E), approximately 2800 acres in total. Refer to Figure 1: Vicinity Map for site location and depiction of the Planning Parcel and Auction Parcel.

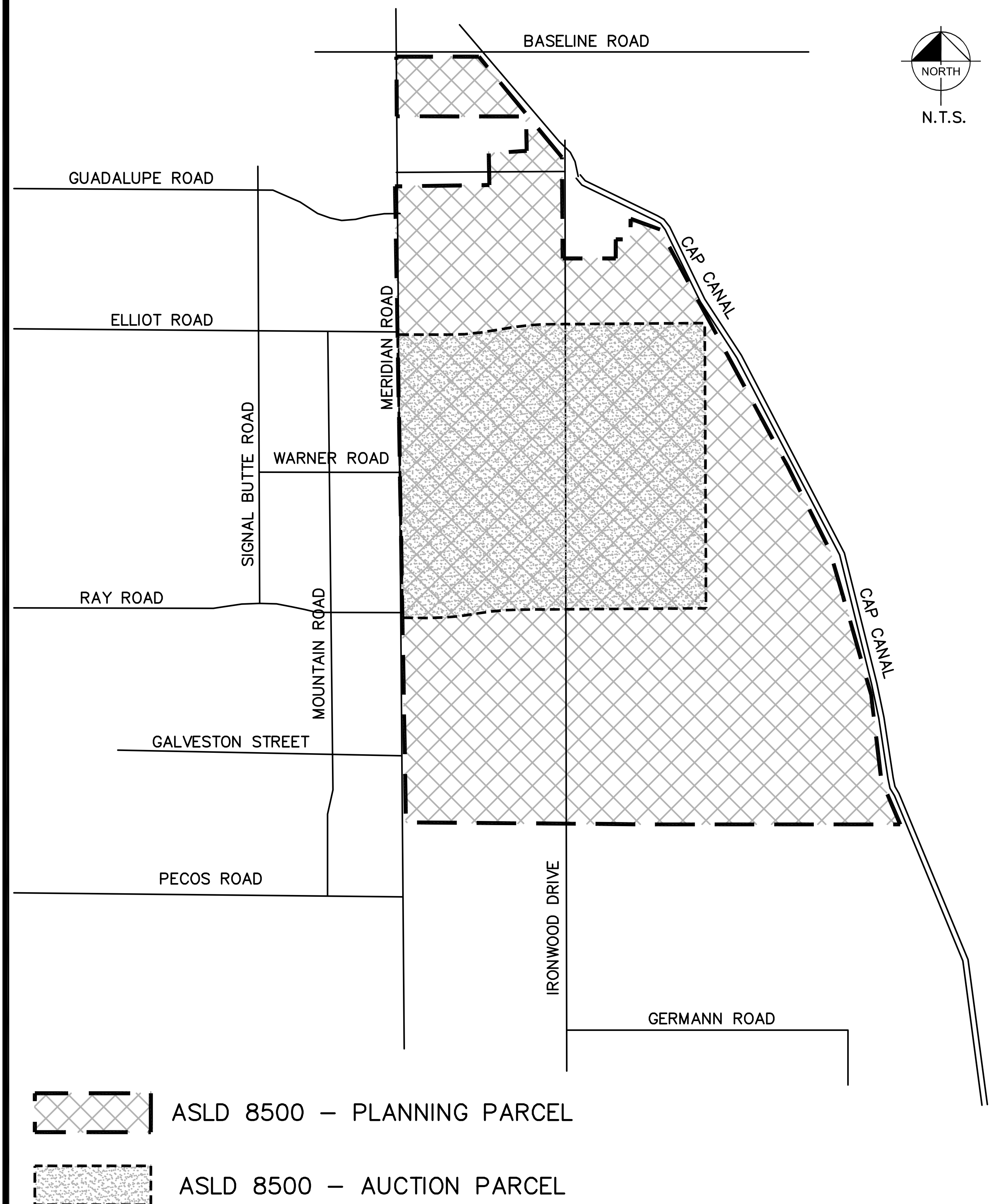
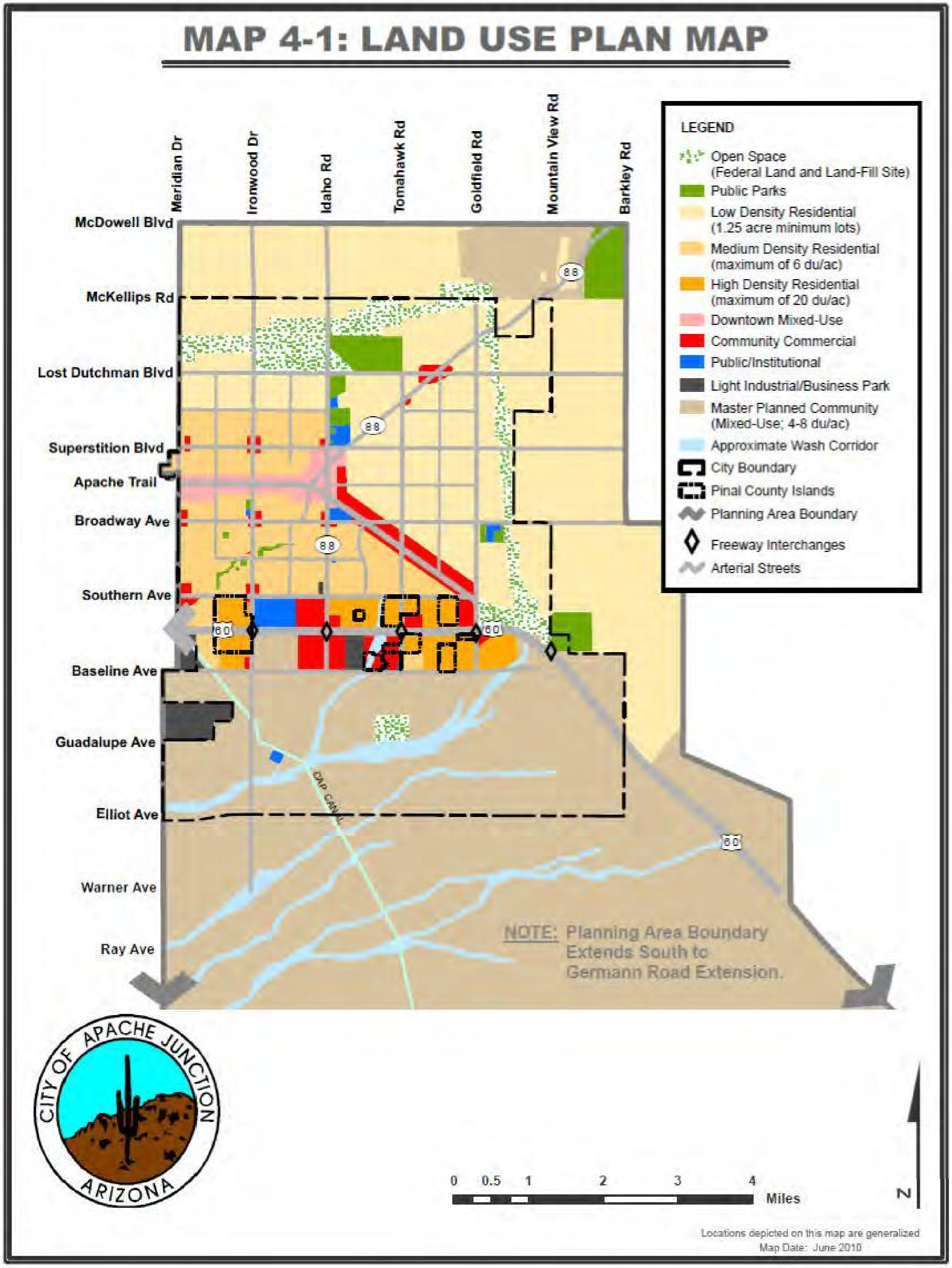


FIGURE 1 – VICINITY MAP
ASLD 8500

Kimley»Horn

Existing Land Use and Zoning

The ASLD 8500 Planning Parcel is primarily vacant with various special use permits and leases active with the ASLD in the parcel. The Planning Parcel is identified in the 2010 Apache Junction General Plan Land Use Map as a Master Planned Community (MPC) land use category. MPC permits mixed use development from 4-8 dwelling units per acre (du/acre). Refer to Figure 2: 2010 Land Use Plan Map.



MAP 4-1: LAND USE PLAN MAP
Meridian Dr
Ironwood Dr
Idaho Rd
Tomahawk Rd
Goldfield Rd
Mountain View Rd
Barkley Rd
McDowell Blvd
McKellips Rd
Lost Dutchman Blvd
Superstition Blvd
Apache Trail
Broadway Ave
Southern Ave
Baseline Ave
Guadalupe Ave
Elliot Ave
Warner Ave
Ray Ave
LEGEND
Open Space (Federal Land and Land-Fill Site)
Public Parks
Low Density Residential (1.25 acre minimum lots)
Medium Density Residential (maximum of 6 du/ac)
High Density Residential (maximum of 20 du/ac)
Downtown Mixed-Use
Community Commercial
Public/Institutional
Light Industrial/Business Park
Master Planned Community (Mixed-Use; 4-8 du/ac)
Approximate Wash Corridor
City Boundary
Pinal County Islands
Planning Area Boundary
Freeway Interchanges
Arterial Streets
NOTE: Planning Area Boundary Extends South to Germann Road Extension.
CITY OF APACHE JUNCTION ARIZONA
0 0.5 1 2 3 4 Miles
N
Locations depicted on this map are generalized
Map Date: June 2010

FIGURE 2

Existing Site Conditions

ALTA Survey

An ALTA/NSPS Land Title Survey was prepared by Hubbard Engineering, dated 10/10/19. The survey identifies the Auction Parcel boundary and schedule "B" items on and adjacent to the subject property. Refer to Appendix A for the ALTA/NSPS Land Title Survey and Title Report.

Existing Conditions

Existing perpetual right-of-way for Pinal County exists along the Ray Road and Ironwood Road alignments through the ASLD 8500 Planning Parcel. Along Meridian Road, right-of-way exists west of the section line in the City of Mesa, however, right-of-way dedications have not yet been established along the east side of Meridian Road on Arizona State Land property. Along Elliot Road, a City of Mesa waterline easement was dedicated which routes from the intersection of Elliot Road and Meridian Road to the CAP canal, located on the east side of the property. Within Section 18, the waterline alignment realigns from the Elliot Road section line within the City of Mesa back to follow the north line of Section 18 prior to Ironwood Road.

A concrete irrigation ditch known as the Powerline Floodway Channel bisects the Auction Parcel through Sections 17,18, and 19. This channel and perpetual right-of-way for the Flood Control District of Maricopa County (FCDMC) is the principal outlet for the Powerline flood retarding structure (FRS) and Vineyard FRS and will be required to remain protected in place on the property. An existing electric transmission line and perpetual right-of-way bisects the southwest corner of the Auction Parcel and will also be required to remain protected in place on the property.

Multiple leases, special uses, and right-of-way dedications exist on the property with various expiration dates and lease durations. Please refer to Appendix A for the ALTA/NSPS Land Title Survey for the Auction Parcel.

Phase 1 ESA

A Phase 1 Environmental Site Assessment (ESA) has been conducted by GeoTek, LLC for the Auction Parcel and is being provided to the Arizona State Land Department as a separate report.

Cultural Resources

A Class III Archaeological Study has been conducted by EPG, LLC for the Auction Parcel and is being provided to the Arizona State Land Department as a separate report.

Conceptual Land Plan

Key Considerations and Approach

A series of key considerations have helped to inform the land planning approach and associated decisions as to how the community framework has been organized. The extent of property and its context within the adjacent region provides the basis for decisions made. The regional transportation network (existing and planned) is a major factor for considering the overall connectivity of the road system in and around the property. Several existing conditions also result in impacts to the plan. These impacts and constraints include; washes, existing land uses, power corridor easement, the flood retardant structures, future State Route 24 alignment, parcel exclusions, and the CAP canal.

Planning Parcel Land Use Plan

Current and future growth scenarios/ projections in and around this portion of the East Valley provide a basis for considering the range and mix of land uses identified. The following summary descriptions for each land use is provided for context:

District Core - This land use area is envisioned as a more urban and higher intensity zone. It has been strategically located along the south end of the property, adjacent to key intersections and key interchanges associated with the future State Route 24. Office, commercial, retail and other business-related uses are anticipated.

Mixed-Use Commercial - This land use area is planned between Ironwood Drive and Meridian Road along the future State Route 24 corridor. The area is envisioned as a mix of semi-urban uses that complement the adjacent urban cores.

Mixed-Use Residential - This land use designation anticipates a predominately higher density residential use with some small scale vertically integrated (likely at the ground floor) retail and office use. The mixed-use residential area is located along the future State Route 24 corridor directly east of the district core at Ironwood Drive.

Neighborhood Commercial - Smaller scale neighborhood oriented commercial centers have been strategically located throughout the overall development. These more modest commercial centers are envisioned for convenient oriented uses and may include; a grocery store, restaurants, service-oriented businesses and other related components.

Medium Residential - Certain areas of the plan have been designated for medium density residential development. These envisioned residential components will range from single-family detached homes to higher density attached scenarios such as duplexes, triplexes and town homes. Small apartment complexes may also be feasible closer the future State Route 24 corridor.

Residential - The majority of land area has been designated for residential development. The plan suggests a thoughtful hierarchy of community development that is based on neighborhoods, districts and villages. All integrated within a parks and open space plan that provides easy access. The residential development assumes a variety of conventional single-family home scenarios as well as creative home scenarios such as drive courts and green courts. This land use may also include a small degree of duplexes, triplexes and townhomes.

Parks and Open Space - The plan contemplates an overarching park and open space system that allows for connectivity throughout the development. Parks will range in size to accommodate the neighborhood, district and village scale. It is also anticipated that drainage corridors and street systems will be designed with safe and attractive paths and trails that provide easy access to open space.

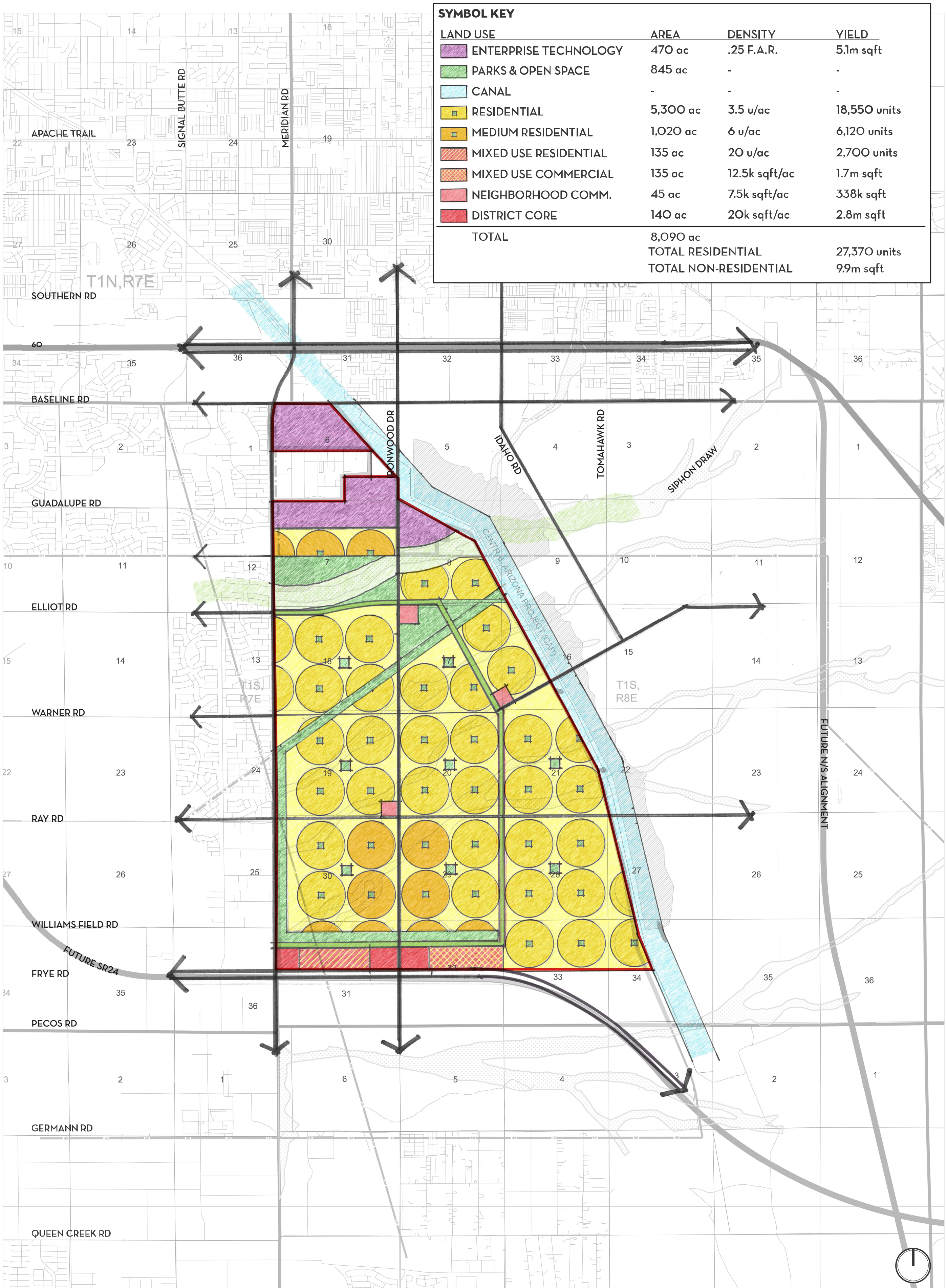
Enterprise Technology - The plan highlights several parcels along the northern boundary that have been designated for light industrial/ distribution and office related uses.

Please refer to Figure 3 for the Conceptual Land Use Plan for the Planning Parcel. For a full-size version of the plan, please refer to Appendix T.

Auction Parcel Land Use

The Auction Parcel Land Use has been illustrated on the accompanying exhibit and can be generally described as an area of land bounded by Meridian Road on the west, Elliot Road on the north, Ray Road on the south and the Idaho Road alignment to the east. These contiguous sections of land make up approximately 2,783 acres situated near the center of the overall Planning Parcel. The land use organization allows for a seamless transition and integration of future/ adjacent development and community design. The plan includes the following land use designations; residential, neighborhood commercial, and parks & open space.

Please refer to Figure 4 for the Conceptual Land Use Plan for the Auction Parcel. For a full-size version of the plan, please refer to Appendix T.



SYMBOL KEY

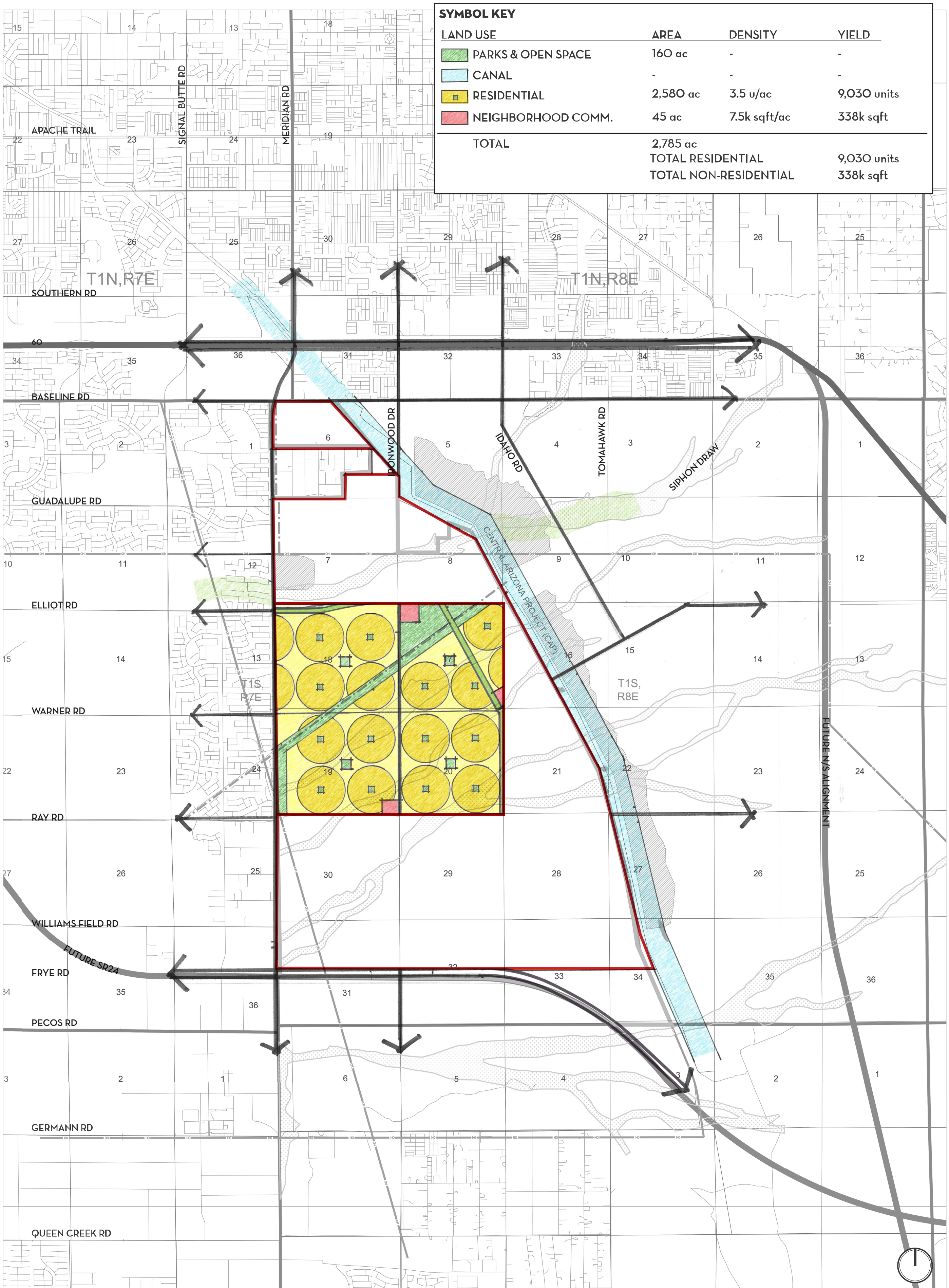
LAND USE	AREA	DENSITY	YIELD
ENTERPRISE TECHNOLOGY	470 ac	.25 F.A.R.	5.1m sqft
PARKS & OPEN SPACE	845 ac	-	-
CANAL	-	-	-
RESIDENTIAL	5,300 ac	3.5 u/ac	18,550 units
MEDIUM RESIDENTIAL	1,020 ac	6 u/ac	6,120 units
MIXED USE RESIDENTIAL	135 ac	20 u/ac	2,700 units
MIXED USE COMMERCIAL	135 ac	12.5k sqft/ac	1.7m sqft
NEIGHBORHOOD COMM.	45 ac	7.5k sqft/ac	338k sqft
DISTRICT CORE	140 ac	20k sqft/ac	2.8m sqft
TOTAL	8,090 ac		
	TOTAL RESIDENTIAL		27,370 units
	TOTAL NON-RESIDENTIAL		9.9m sqft

FIGURE 3

ASLD 8500

MAP SHOWING MASTER PROPERTY CONCEPTUAL LAND USE PLAN

10.17.19



SYMBOL KEY

LAND USE	AREA	DENSITY	YIELD
PARKS & OPEN SPACE	160 ac	-	-
CANAL	-	-	-
RESIDENTIAL	2,580 ac	3.5 u/ac	9,030 units
NEIGHBORHOOD COMM.	45 ac	7.5k sqft/ac	338k sqft
TOTAL	2,785 ac		
	TOTAL RESIDENTIAL		9,030 units
	TOTAL NON-RESIDENTIAL		338k sqft

FIGURE 4

ASLD 8500

LAND USE PLAN FOR AUCTION PROPERTY
CONCEPTUAL LAND USE PLAN

0' 1000' 2000' 4000' 6000'
scale: 1" = 2,000'

10.17.19

Entitlement Process Post-Auction

The Auction Parcel is currently located within the Master Planned Community (MPC) designation in Apache Junction. It is the responsibility of the awarded bidder to work with the City and identify the entitlement process and requirements for the project. Additionally, the Participation and Infrastructure agreement associated with the ASLD 8500 Auction Parcel requires the awarded bidder to successfully obtain all required entitlements in accordance with the plan approved by the Commissioner no later than 540 days following the Effective Date of the Agreement for the Auction Parcel and no later than 730 days following the Effective Date of the Agreement for the Retained Property. Below is the anticipated process that will likely be required post-auction for ASLD 8500:

Step 1 – Pre-Application Meeting – No later than 90 days following the Effective Date of the Participation and Infrastructure Agreement, a pre-application meeting with the City should be scheduled.

Step 2 – Prepare Application and Annexation Materials – In addition to the zoning and annexation materials, negotiations for a development agreement and a community facilities district should commence.

Step 3 – File Blank Annexation Petition and Zoning Application – No later than 365 days following the Effective Date of the Participation and Infrastructure Agreement, the applicant will be required to file a blank annexation petition and zoning application with the City of Apache Junction.

Step 4 – Planning and Zoning Commission New Business Review – Following a determination by the City's planning staff that the application is complete, the case will be scheduled for discussion at the Planning and Zoning Commission's regular meeting as a new business item.

Step 5 – Planning and Zoning Public Hearing – Following the applicable public notice period, a public hearing will be held. The applicant will be requested to attend the hearing. The Planning and Zoning Commission will make a recommendation on the application to the City Council.

Step 6 – City Council Hearing – Following the public hearing at the Planning and Zoning Commission, the City Council will hold a public hearing and vote on the application. If sufficient petitions are filed against the case, then the rezoning must receive a minimum of ¾ favorable vote from the Council to pass. If approved, the zoning becomes final after a 30-day referendum period, assuming no referendum petitions are filed challenging the case.

Wastewater Infrastructure Assessment

Existing Infrastructure and Service Area

The Superstition Mountains Community Facilities District No. 1 (SMCFD) provides regional wastewater collection and treatment for the City. SMCFD was formed in 1992 and operates as an independent governmental entity within City limits. A Central Arizona Governments (CAG) Areawide Water Quality Management Plan 208 Amendment occurred in 2010, expanding the SMCFD service area south to the Elliot Road alignment and congruent with the current southern boundary of the City of Apache Junction. SMCFD intends to expand their service area further south to ultimately cover the planning limits for the City through another CAG 208 amendment. The Planning and Auction Parcel currently falls within both SMCFD's existing service area and future service area. Refer to Appendix B for SMCFD's existing and future service areas.

SMCFD maintains and operates the existing 2.1 Million Gallons Per Day (MGD) Wastewater Treatment Facility (WWTF) to serve the City, located southeast of Ironwood Road and Guadalupe Road. The current average daily flow generated and treated at the WWTF is roughly 1.5MGD. The City and SMCFD prepared a Wastewater Master Plan in 2006, evaluating the existing infrastructure serving the City as well as a plan to serve the expansion of the City's service area to the south. The Master Plan indicated the existing WWTF can expand up to a 16 MGD facility based on the 60-acre footprint that existed in 2006, however, SMCFD has since acquired additional acreage for the WWTF. Currently, the WWTF is approximately 95 acres to increase potential to support future expansion and capacities greater than 16 MGD. Refer to Appendix B for The City's Wastewater Master Plan, prepared by Stantec Consulting, Inc., 2006.

The WWTF currently serves an area north of Baseline Road from Meridian Road to Goldfield Road. The sewer collection system consists of gravity pipe sizes ranging from 8-inch to 36-inch in diameter and routes to an existing lift station and pumped west over the CAP Canal to the existing WWTF for treatment. The Wastewater Master Plan indicates an estimated 9.9 MGD total flow at full-buildout of the existing service area north of Baseline Road.

A sewer collection system to serve the future service area and the ASLD 8500 Planning Parcel is not currently in place. Due to the location of the existing WWTF and the terrain for growth areas south of Baseline Road, a possible solution to construct a second WWTF near Meridian Road and the SR 24 alignment was evaluated in the 2006 Wastewater Master Plan. This solution was evaluated prior to a Land Plan for the growth areas and a projection for population growth and flow generation was estimated at the time.

Key Assumptions and Basis of Analysis

Darron Anglin, the district manager for SMCFD, indicated the City and SMCFD are in the process of updating the Wastewater Master Plan for the City. The Master Plan update will evaluate additional solutions to serve the Planning Parcel and project flow generation based on the Conceptual Land Use Plan presented as part of this Infrastructure Assessment Study (Figure 3). It is our understanding that an alternative to serve the Lost Dutchman Planning Parcel by expanding their existing WWTF and ultimately serve future growth areas west of the CAP canal without the need for a second WWTF is SMCFD's preference at this time. Based on discussions with Darron Anglin, this study conceptually analyzes a wastewater collection system to serve the ASLD 8500 Planning Parcel by way of a lift station located at the southwest corner of the service area. The proposed lift station will capture and pump sewer flow back to the existing WWTF, approximately 100 feet higher in elevation.

The following assumptions have been made in preparation of the analysis presented below:

- SMCFD prefers to treat wastewater flows generated from the ASLD 8500 Planning Parcel and property west of the CAP canal at the existing WWTF, located at the southeast corner of Guadalupe Road and Ironwood Road. This approach will defer/alleviate the need for a second WWTF to serve development south of Baseline Road and so near to the existing facility location.
- Due to the elevation and existing terrain of the Planning Parcel, a sewer lift station will be required at the southwest corner of the service area, pumping wastewater flows back to the existing WWTF, approximately 100 feet above the lift station location.
- SMCFD is in the process of updated the Wastewater Master Plan for the City. The updates will evaluate full build-out solutions to serve the City's wastewater needs. This study analyzes a conceptual sewer collection system and lift station improvements in advance of the updated and approved Wastewater Master Plan for the area. It will be the responsibility of the selected bidder for the Auction Parcel to finalize the sewer collection concept and infrastructure improvement requirements with SMCFD and the City.

- This study analyzes the Planning Parcel demands and conceptual wastewater infrastructure improvements within arterial roadways anticipated. Collector Road sewer improvements are assumed to be 8-inch PVC gravity sewer pipes.
- Phased improvements are unknown at this time and are not evaluated as part of this study.
- The Conceptual Land Use Plan for the Planning Parcel (Figure 3) was used as the basis for proposed uses and development densities.
- The following densities have been assumed for each land use category indicated on the Conceptual Land Plan for the Planning Parcel:
    - o Enterprise Technology – 0.25 Floor Area Ratio (FAR)
    - o Residential – 3.5 Dwelling Units per Acre (DU/AC)
    - o Medium Residential – 6.0 DU/AC
    - o Mixed Use Residential – 20 DU/AC
    - o Mixed Use Commercial – 12,500 Square Feet per Acre (SQ.FT/AC)
    - o Neighborhood Commercial – 7,500 SQ.FT/AC
    - o District Core – 20,000 SQ.FT/AC
- This study analyzes flow and population demands based on criteria outlined in the 2006 Wastewater Master Plan. Design criteria and project demands utilized as part of this study are discussed in further detail below.

Design Criteria and Project Demands

The design criteria utilized as part of this study is based on the approved in the City's 2006 Wastewater Master Plan. Design flow is based on the AAC R18-9, Table 1 Unit Daily Design Flows. Residential flow is estimated at 100 gallons per capita per day. Population density for residential (3-5 DU/acre) and medium residential (5-8 DU/acre) is 3.2 persons per dwelling unit. Higher density residential (8+ DU/Acre) is estimated at 2.0 persons per dwelling unit. Flow for non-residential commercial and district core uses are estimated at 1,500 gallons/acre. Flow for the Enterprise Technology uses are estimated at 1,000 gallons/acre. See Table 1 below for a summary of the sewer demand criteria used for residential and non-residential flow generation.

Table 1: Sewer Demand Criteria [(1)]

Residential Demand Criteria		
Land Use	Population	
Residential (3-5 DU/acre)	3.2	persons/DU
Medium Residential (5-8 DU/acre)	3.2	persons/DU
High Density Residential (8+ DU/acre)	2.0	persons/DU
Residential Demand	100	gpcpd

Non-Residential Demand Criteria		
Business/Industrial	1,000	gpd/acre
Retail/Employment	1,500	gpd/acre
Public/Institutional	1,500	gpd/acre

(1) Per SMCFD Masterplan - Appendix B - Table 1

Peaking factors were determined based on equivalent population and AAC R18-9-E301. Gravity sewer and lift station sizing is based on peak flow demands. Minimum sewer pipe slopes were determined based on minimum full flow velocities of 2.0 feet per second (ft/s) using a Manning's n value of 0.013. See Table 2 for peaking factors based on upstream population and Table 3 for sewer pipe design criteria.

Table 2: Peaking Factors (1)

Upstream Population	Peaking Factor
100	3.62
200	3.14
300	2.9
400	2.74
500	2.64
600	2.56
700	2.5
800	2.46
900	2.42
1001	2.38
1001 to 10,000	$PF = (6.330 \times P^{-0.231}) + 1.094$
10,001 to 100,000	$PF = (6.117 \times P^{-0.233}) + 1.128$
More than 100,000	$PF = (4.500 \times P^{-0.174}) + 0.945$

(1) Per SMCFD Masterplan - Table 2.1

Table 3: Pipe Design Criteria (1)

Pipe Diameter (in)	Min. Slope (ft/ft)	Full Flow Capacity (MGD)
8	0.0033	0.45
10	0.0024	0.70
12	0.0019	1.01
15	0.0014	1.57
18	0.0011	2.26
21	0.0010	3.25
24	0.0010	4.64
30	0.0010	8.41
36	0.0010	13.67
42	0.0010	20.62
48	0.0010	29.44

(1) Per SMCFD Masterplan - Table 2.2

Proposed Conceptual Infrastructure

ASLD 8500 Planning Parcel

The ASLD 8500 Planning Parcel Land Plan (Figure 3) conceptually identifies the arterial roadway network along section lines from Meridian Road to the CAP canal west to east and Baseline Road to the future SR 24 alignment north to south. Although the infrastructure requirements to serve the entire Planning Parcel is beyond the scope of this study, it is important to estimate the full build-out demands and sewer line sizes. The proposed sewer collection system routes gravity trunk lines along the arterial street network to serve the area. Fall occurs in the southwesterly direction across the site at an average slope of approximately 0.5%. Greater fall occurs east to west across the property and the proposed sewer network generally flows from east to west along the arterial roadway network to Meridian Road. Pipe sizes range from 8 inches to 30 inches along the east-west arterial roadway network. Meridian Road increases in size from 8 inches to 42 inches as additional sewer flows contribute to the Meridian Road trunk line. Near the southwest corner of the Planning Parcel (near Meridian Road and the SR 24 alignment), a proposed lift station will pump flow back to the WWTF. Multiple force mains are anticipated to convey flow back to the WWTF. The total contributing flow for the Planning Parcel is approximately 14.5 MGD peak flow.

Please refer to Appendix C for the Planning Parcel Wastewater Infrastructure Exhibit, conceptually identifying gravity sewer line sizes for the arterial street network.

ASLD 8500 Auction Parcel

The ASLD 8500 Auction Parcel is centrally located in the overall Planning Parcel area, consisting of Sections 17, 18, 19, and 20. A portion of the northwest corner of Section 30 is also proposed in the Auction Parcel to re-align Ray Road at the intersection of Meridian Road back to the south line of Sections 19 and 20 within the ASLD 8500 Planning Parcel.

The proposed sewer infrastructure for the arterial street network adjacent to the Auction Parcel includes pipe sizes ranging from 8 inches to 30 inches. It is anticipated that the collector street network will include 12-inch sewer lines and local roadways will include 8-inch sewer lines. The trunk sewer line along Meridian Road to the conceptual lift station located in the southeast portion of the Planning Parcel is required to serve the Auction Parcel, ranging from 30 inches to 42 inches. The Auction Parcel demands are estimated at approximately 3 MGD with approximately 5 MGD in peak flow. Conceptually, a dual 12-inch force main trench from the lift station back to the existing WWTF is anticipated to convey the peak demands for the Auction Parcel.

Expansion to the existing WWTF will be required to serve the demands of the Auction Parcel. Based on discussions with Darron Anglin at the SMCFD and per the 2006 Wastewater Master Plan, expansion to the treatment plant can be accomplished to serve the Auction Parcel.

Please refer to Appendix D for the Auction Parcel Wastewater Infrastructure Exhibit, conceptually identifying gravity sewer line sizes, lift station, and force main sizes for the arterial street network. Refer to Appendix E for demand criteria, Planning Parcel and Auction Parcel demand calculations, and sewer pipe sizing analysis.

Conceptual-Level Opinion of Probable Cost

A Conceptual-Level Opinion of Probable Cost for the wastewater infrastructure improvements to serve the Auction Parcel has been provided in Appendix F. Arterial street sewer improvements vary greatly in size and have been identified separately from the roadway improvement costs as part of the conceptual sewer infrastructure OPC presented in Appendix F.

It is our understanding that the SMCFD will be responsible for any wastewater treatment improvements and expansion to the existing WWTF to serve the project. All other improvements will be the responsibility of the successful bidder to construct the necessary infrastructure improvements to serve the Auction Parcel. Opportunities for reimbursement from SMCFD or payback for improvements made may be possible and should be assessed further with the City and SMCFD post-auction.

The conceptual-level OPC for sewer infrastructure within arterial roadways and facility improvements anticipated to serve the Auction Parcel is estimated at $97,544,536 and broken out into further detail in Appendix F.

Water Infrastructure Assessment

Existing Infrastructure and Service Area

Currently, the City of Apache Junction is served by two companies, the Apache Junction Water District (AJWD and previously known as the Apache Junction Water Company) and the Arizona Water Company (AWC). The AWC's current service area south of Baseline Road is isolated to west of Ironwood Road and north of Elliot Road within the ASLD 8500 Planning Parcel boundary. AJWD's current service area includes the remainder of the Planning Parcel area and was extended south to be consistent with the City's planned growth areas per Resolution No. 2014-012. See Appendix G for Resolution No. 2014-012 and AJWD's and AWC's current service areas.

A Water Master Plan for Apache Junction was prepared by Narasimhan Consulting Services, Inc. in 2010 to support AJWD in implementing a water plan that reliably will source and supply the existing and future growth areas through final build-out of the service area. Multiple options were analyzed in the report in order to provide a long-term, sustainable water use plan for the City. AJWD recently completed infrastructure improvements to transition from a groundwater dependent system to one that will optimize renewable water resources. Through a blend of sources, AJWD's 2018 assets include CAP allocation, groundwater capacity, long term storage credits, the Gila River Indian Community 100-year lease, and pending Non-Indian Agricultural reallocation, the total portfolio is estimated by AJWD at 7,386 acre-feet per year. According to AJWD, 1,657 acre-feet per year was delivered to the existing service area in 2018. See Appendix G for the Apache Junction Water Master Plan and AJWD's 2018 Water Resource Breakdown.

AJWD currently maintains and operates a surface treatment facility north of the Central Arizona Project (CAP) canal on the east side of Ironwood Road. The existing facility is capable of treating up to 2 MGD of CAP source water. This is achieved by "hanging" pumps off of the old bridge crossing over the CAP canal. Per discussions with Frank Blanco and Mike Loggins with AJWD, the facility can be updated to treat up to 10 MGD of CAP source water as demand increases within the AJWD service area. Additionally, AJWD operates three wells within the City limits and receives water from the City of Mesa via an interconnect pump station at Signal Butte and Baseline Road. An existing distribution and storage facility is located on Baseline Road between Idaho Road and Tomahawk Road.

A water distribution system to serve the ASLD 8500 Planning Parcel is not currently in place. Per discussions with Frank Blanco and Mike Loggins with AJWD, expansion to the existing CAP surface treatment facility on Ironwood Road is possible to serve up to 6MGD allocated to serve the ASLD 8500 Auction Parcel (10MGD total capable at the existing facility). AJWD indicated that any additional supply requirements to serve demands beyond the 6MGD from the existing facility would require a second surface treatment facility located along the CAP canal.

Key Assumptions and Basis of Analysis

Frank Blanco and Mike Loggins have indicated the AJWD's long-term goal to transition from a groundwater dependent system to one that will optimize renewable water resources. The AJWD has improved their existing waster system and aims to invest in renewable water supply supplemented with groundwater during drought or periods when surface water is limited. Per the 2010 Water Master Plan and discussions with Frank Blanco and Mike Loggins, the following assumptions have been made in preparation of the analysis presented below:

- This study has been prepared in advance of an approved water master plan to serve the ASLD 8500 Auction Parcel. It will be the responsibility of the selected bidder for the Auction Parcel to finalize the water system concept and infrastructure improvement requirements with AJWD and the City.
- This study focuses on the conceptual infrastructure improvements within the AJWD service area that will serve the ASLD 8500 Auction Parcel.
- AJWD has allocated up to 6 MGD capacity from the existing CAP surface treatment facility at Ironwood Road north of the CAP canal. 2 MGD pump expansions can occur up to 6 MGD (3 pumps total) to serve the initial Auction Parcel.
- The ASLD 8500 Auction Parcel falls within a single pressure zone and all within the AJWD service area. A transmission line from the existing CAP surface treatment facility to a new storage and booster facility site will be required.
- For redundancy and to supplement renewable water, a 20% ratio of recovery well supply is assumed (80% surface treated water, 20% groundwater recovery). In advance of hydrogeology and well testing for the area, a single groundwater recovery well is assumed to produce 1000 gallons per minute (1.4 MGD).
- This study analyzes the Planning Parcel demands and conceptual water infrastructure improvements within arterial roadways anticipated. Collector Road water improvements are assumed to be 12-inch ductile iron (D.I.P.) pipes.
- Phased improvements are unknown at this time and are not evaluated as part of this study.
- The Conceptual Land Use Plan for the Planning Parcel (Figure 3) was used as the basis for proposed uses and development densities.
- The following densities have been assumed for each land use category indicated on the Conceptual Land Plan for the Planning Parcel:
    - Enterprise Technology – 0.25 Floor Area Ratio (FAR)
    - Residential – 3.5 Dwelling Units per Acre (DU/AC)
    - Medium Residential – 6.0 DU/AC
    - Mixed Use Residential – 20 DU/AC
    - Mixed Use Commercial – 12,500 Square Feet per Acre (SQ.FT/AC)
    - Neighborhood Commercial – 7,500 SQ.FT/AC
    - District Core – 20,000 SQ.FT/AC
- Mike Loggins indicated the AJWD will require a second source and supply to serve the Planning Parcel beyond the 6MGD available from the existing treatment facility. It is assumed that a second treatment facility, booster and storage facility will be required for project demands beyond the initial Auction Parcel demands and 6MGD allocated to the project.
- This study analyzes flow and population demands based on the City of Apache Junction's Engineering Design Guidelines and Polices Manual for Water. These guidelines were also utilized for minimum design criteria of water infrastructure improvement requirements. Design criteria and project demands utilized as part of this study are discussed in further detail below.

Design Criteria and Project Demands

The design criteria utilized as part of this study is based on the City's published Engineering Design Guidelines and Policies Manual (AJED). Residential maximum day for all residential uses anticipated with the ASLD 8500 Planning Parcel is estimated at 440 gallons per day per dwelling unit (GPD/DU). Per the AJED, commercial and retail uses are estimated at 1.5 gallons per day per square foot (GPD/SQ.FT). Industrial uses are not specifically stated in the AJED and also not anticipated within the AJWD service area, however, the City of Phoenix industrial demand of 3000 gallons per acre was used for the enterprise technology uses shown with the AWC service area. See Table 3 below for a summary of the water demand criteria used for residential and non-residential land uses.

Table 3: Apache Junction Water Demand Criteria

Land Use	Density	Population Density	Maximum Day Demand (1)	
Residential	(0-8 du/acre)	3.2	440	gpd/du
High Density Residential	(8+ du/acre)	2	440	gpd/du
Commercial			1.5	gpd/sf
Industrial			3,000	gpd/acre (2)
Retail			1.5	gpd/sf
General			220	gpcpd

(1) Per Apache Junction Engineering Design Guidelines and Policies: Table 10-5.1

(2) Industrial demand per City of Phoenix Used

Peaking factor for pipe and booster facility sizing is 1.7 times the Maximum Day demands. System pressures should maintain 60-100 psi. Storage requirements are estimated to meet the Maximum Day demand with provisions for fire flow and emergency capacity for a 2-hour rating. Velocities of peak flow should maintain less than 5 feet per second with less than 10 feet per 1,000 feet of head loss per AJED. See Table 4 below for a summary of the water design criteria.

Table 4: Water Design Criteria

Peak Hour Factor	1.7 x Maximum Day
System Pressure	60-100 PSI in Maximum Day
Water Main Design	Maximum Day Plus Fire Flow
Appurtenances (Boosters, Reservoirs, etc.)	Max Day with provision for fire flow an emergency flows
Velocity	Less than 5 fps
Head loss	Less than 10 ft per 1,000 ft

Per the AJED, minimum pipe sizes are 8 inches for local streets, 12 inches for Collector roadways, and 16 inches or larger for Arterial roadways. Fire flow requirements for the project can be seen in Table 5 below.

Table 5: Fire Flow Criteria (4)

Land Use	Max Building Size (SF)(5)	Fire Flow (Gallons per minute)
Residential	>3,600	1,500
Medium Density Residential	3,600	1,000
Retail & Commercial	100,000	4,000
Industrial	250,000	4,000

(4) Per 2006 International Fire Code Section B105 & Table B105.1

(5) Based on type V-B Construction (lowest fire rating)

Proposed Conceptual Infrastructure

ASLD 8500 Planning Parcel

The ASLD 8500 Planning Parcel Land Plan (Figure 3) conceptually identifies the arterial roadway network along section lines from Meridian Road to the CAP canal west to east and Baseline Road to the future SR 24 alignment north to south. Although the infrastructure requirements to serve the entire Planning Parcel is beyond the scope of this study, it is important to estimate the Planning Parcel demands and water line sizes to determine roadway water infrastructure that can serve the ASLD 8500 Planning Parcel in the future. The proposed water distribution system includes water lines along the arterial street network to serve the area. A 24-inch transmission main to deliver treated supply from the existing CAP surface facility to a central distribution booster and storage facility is anticipated (Facility #1). Facility #1 to initially serve the Auction Parcel demands is conceptually estimated to have a peak hour capacity of approximately 7.4 MGD with 4MGD of storage. Facility #1 at full build-out is anticipated to require approximately 10 MGD peak hour capacity with 6 million gallons of available storage. To provide redundancy and to supplement the renewable water source to serve the area, 3 groundwater recover well sites are anticipated.

For the Planning Parcel, a secondary surface treatment facility, booster and storage facility (Facility #2) will be required. Conceptually, Facility #2 is located off the Warner Road alignment near the CAP canal. For Facility #2 to serve the full build-out demands of the Planning Parcel, it is estimated that a booster facility will require 20 MGD peak hour capacity and an additional 12 million gallons of storage. Pipe sizes range from 16 inches to 36 inches along the arterial roadway network. 24-inch water pipes are estimated central to the ASLD 8500 plan and originating from the booster facility locations to the outer arterial roadways where 16-inch pipes are proposed. Facility #2 does propose a larger 36-inch pipe to deliver the bulk of the Planning Parcel demands back to the Idaho Road alignment where 24-inch pipes extend out from the intersection of Warner Road and Idaho Road. Collector roadways are anticipated to include 12-inch water pipes and local roadways are assumed to include 8-inch water pipes.

Please refer to Appendix H for the Planning Parcel Water Infrastructure Exhibit, conceptually identifying water distribution and transmission lines for the arterial street network. Conceptual facility locations and sizes are also shown for the full build-out condition of ASLD 8500.

ASLD 8500 Auction Parcel

The ASLD 8500 Auction Parcel is centrally located in the overall Planning Parcel area, consisting of Sections 17, 18, 19, and 20. A portion of the northwest corner of Section 30 is also proposed in the Auction Parcel to re-align Ray Road at the intersection of Meridian Road back to the south line of Sections 19 and 20 within the ASLD 8500 Planning Parcel.

The proposed water infrastructure for the arterial street network adjacent to the Auction Parcel includes pipe sizes ranging from 16 inches to 24 inches. The Auction Parcel proposes the construction of the 24" transmission main from the existing CAP surface treatment facility to Facility #1. A booster facility capable of roughly 7.4 GPD peak hour demand is estimated to serve the Auction Parcel. A roughly 4-million-gallon storage tank is also estimated to serve the Auction Parcel demands. To supplement the surface water supply, a recover well site is proposed, conceptually located at Facility #1 near Warner Road and Ironwood Road. The distribution system consists of pipe sizes ranging from 16 to 24 inches along the arterial network with the larger 24-inch mains originating from the booster facility location. Additionally, an 8-inch water line to the proposed lift station facility south of the Auction Parcel is assumed. Based on the Auction demands, it is estimated that three – 2 MGD pump expansions will be required at the existing CAP surface treatment facility. It is our understanding that a building expansion at the existing facility will also be required with the second 2 MGD pump addition.

Please refer to Appendix I for the Auction Parcel Water Infrastructure Exhibit, conceptually identifying water infrastructure sizes for the arterial roadway network and anticipated facility sizes and locations. Refer to Appendix J for demand criteria, Planning Parcel, and Auction Parcel demand calculations.

Design Methodology

The WaterCAD CONNECT Edition {Update 2} hydraulic water system modeling software distributed by Haestad Methods, Inc. was used to model the conceptual water network for the ASLD 8500 Planning Parcel. The system is modeled as a series of nodes interconnected with pipes. The nodes are set at major intersections with pipes along the arterial roadways. System demands are applied to each node based on calculated demands of adjacent parcels. Reservoirs are used to provide the water supply into the system and represent the future water facilities.

Two scenarios are evaluated in the water model, Maximum Day Demand and Peak Hour Demand. The system is evaluated under these two scenarios to determine a conceptual pipe network and pipe sizes required to meet the established Design Criteria. Based on the existing grade of the site, elevations range from approximately 1450 to 1560 ft. The requirement to provide an operating pressure of 60-100 psi in the Maximum Day scenario, and system elevation head (HGL) of 1720 feet was selected for the purpose of this conceptual analysis. It is the responsibility of the successful bidder, in association with the City and AJWD to determine the final operating HGL and water master plan to serve the area. The two reservoirs utilize in the water modeling represent the proposed water storage and booster stations. It is beyond the scope of the report to design the specifics of the booster stations. The reservoirs provide water supply to the water model at a consistent HGL. Reservoir #1 represents the Facility #1 located at the intersection of Warner Road and Ironwood Road. Reservoir #2 represents Facility #2 located at Warner Road and the CAP. The available supply for each facility varies. To account for this, the set HGL of Reservoir #1 was adjusted until the output matched the available supply. For both scenarios the HGL of Reservoir #2 was set at 1720 ft, matching the conceptual HGL of the system. Reservoir #1 was set at an HGL of 1713.80 ft and 1703.25 ft for the Max Day and Peak Hour scenarios respectively.

Refer to Appendix K for WaterCAD model results.

Conceptual-Level Opinion of Probable Cost

A Conceptual-Level Opinion of Probable Cost for the water infrastructure improvements to serve the Auction Parcel has been provided in Appendix L. Arterial street water improvements vary in size and have been identified separately from the roadway improvement costs as part of the conceptual water infrastructure OPC presented in Appendix L.

Per discussions with Mike Loggins, AJWD's position is that all water infrastructure improvements, including facility improvements and the existing CAP surface water treatment plant expansion, will be the responsibility of the successful bidder. It is our understanding that any improvements to serve the Auction Parcel will be paid for by the successful bidder. Opportunities for reimbursement from AJWD or payback for improvements made may be possible and should be assessed further with the City and AJWD post-auction.

The conceptual-level OPC for water infrastructure within arterial roadways and facility improvements anticipated to serve the Auction Parcel is estimated at $60,337,444 and broken out into further detail in Appendix L.

Roadway Infrastructure Assessment

Existing Roadway Improvements

Existing roadway corridors within the ASLD 8500 Planning area are generally limited to the Ironwood Road section line improvements, which extend from south of the SR-24 alignment north past the northern boundary of the planning area. Portions of the Meridian Road section line improvements between Ray Road and Guadalupe Road, on the west side of the section line within Maricopa County, have also been constructed. Partial improvements to Baseline Road and Guadalupe Road have been constructed in the northern portion of the planning area.

Key Assumptions and Basis of Analysis

Future east/west section line arterial streets extending east, from the western edge of the planning area, are expected to conform to the same alignments and number of lanes west of Meridian Road as depicted in the City of Mesa 2040 Circulation plan. North/South arterial streets extending through the project, are expected to generally follow to the section lines except along segments where physical constraints dictate a departure from the section lines. An east/west regional, limited access corridor (SR 24) is planned along the southern boundary of the planning area and is expected to be implemented in phases with the initial interim improvements providing at-grade connections at the Ironwood Road alignment north of Pecos Road, with a proposed future extension to the east.

Cross Section Criteria

Cross sections for the six-lane, four-lane, and collector roadways identified as “LDH” in the current Apache Junction Active Transportation Plan were utilized in quantifying the roadway infrastructure improvements for the Planning Parcel, a copy of which is provided in Appendix M. These cross sections are conceptual and subject to change based on final entitlement approvals. Roadway cross sections were identified based upon the expected typical roadway improvements required in each section of the proposed development. The east/west section line arterial street cross sections are expected to conform to the same general alignments and number of lanes west of Meridian Road as depicted in the City of Mesa 2040 Circulation plan. The Mesa plan generally provides alternating six lane and four lane east/west section line arterial streets adjacent to the planning area between Baseline Road and the SR 24 alignment. A similar arrangement of alternating six lane and four lane north/south section line arterial streets is anticipated between Meridian Road and the CAP canal.

Proposed Conceptual Infrastructure

The transportation infrastructure planning is based upon the expected typical roadway improvements described in the cross section criteria, broken down into the required improvements in a prototypical section of the development. The prototypical improvement requirements are applied to each section of land within the overall Planning Parcel and Auction Parcel areas to establish the transportation infrastructure anticipated to serve the future transportation needs. The prototypical improvements anticipate the dedication of right of way around the perimeter of each section to accommodate the potential development of an ultimate six-lane facility. In order to provide flexibility in the development of final land use densities, the arterial street typical median sections will provide for phased improvements. The determination the ultimate number of lanes on the arterial streets will be based on regional transportation modeling utilizing the expected overall transportation system and the final development densities in each section. Additional collector street systems will also be planned within each section, based upon the final development land used and densities. A conceptual roadway infrastructure exhibit based on the prototypical transportation improvements expected in each section is shown in Appendix N.

Conceptual-Level Opinion of Probable Cost

A conceptual-level OPC for the prototypical half-street improvements for six-lane, four-lane and collector street sections was prepared and estimated based on the cross section criteria outlined above. The cross sections were applied to the section line lengths on the various sections within the Auction Parcel. Typical per linear foot costs for each roadway classification (six-lane, four-lane, and collector) have been established to estimate roadway infrastructure costs. A half-street six-lane section, half-street four-lane section, and full street collector section per linear foot costs (L.F) are estimated at $625/L.F., $600/L.F., and $850/L.F., respectively. The cost for construction of three traffic signals within each section was included in the totals. Adjustments to the anticipated improvements were made in sections adjacent to Ironwood Road where portions of the roadway already exist. Ironwood Road half-street widening improvements are estimated at $400/L.F. Arterial Roadway estimated costs exclude water and sewer infrastructure costs as they have been provided separately. Collector roadway costs include 8-inch sewer and 12-inch water line construction as part of the estimated per linear foot costs.

The conceptual-level OPC for roadway infrastructure for six-lane, 4-lane, and collector roadway improvements to serve the Auction Parcel is estimated at $88,598,400 and broken out into further detail in Appendix O.

Drainage Infrastructure Assessment

Existing Infrastructure and Site Conditions

The ASLD 8500 Planning area is located within Pinal County, entirely downstream of the CAP canal and the Powerline, Vineyard, and Rittenhouse Flood Retarding Structures (FRSs) maintained by the Flood Control District of Maricopa County (FCDMC). The principal outlet for the Powerline and Vineyard FRS systems is the Powerline Floodway Channel, bisecting the property in a southwesterly direction through sections 17,18, and 19. The existing perpetual lease covering the Powerline Floodway Channel is 266 feet wide per the ALTA and must be protected in place as part of the land plan.

At the northeast corner of Meridian Road and Elliot Road, a detention basin known as the siphon draw basin exists. The existing siphon draw wash routes to the basin currently. Additionally, an interceptor channel along Meridian Road north of Elliot Road conveys upstream flow to the basin where it ultimately discharges downstream through a large box culvert crossing Meridian Road north of the Auction Parcel. Half Street improvements along the west side of Meridian Road within the City of Mesa have been constructed along the Auction Parcel frontage. Ironwood Road includes multiple existing pipe and box culvert crossings within the Auction Parcel area and appear to have been constructed wide enough to allow for widening of Ironwood Road without relocation of the upstream or downstream headwalls.

As outlined in the Existing Conditions Summary Report (PVR Flood Retarding Structures Rehabilitation or Replacement Project Work Assignment No. 3), dated December 2010, and the PVR Existing and Future Conditions Hydrology and Hydraulics Update Technical Report, dated November 2010, prepared by FCDMC, the FRS system protects the ASLD 8500 Planning Parcel up to the 500-year, 24-hour storm without overtopping. Per FEMA Flood Insurance Rate Map (FIRM) 04021C0200E, dated December 4, 2007, Zone A floodplains exist within the Planning Parcel downstream of the FRS system. Multiple existing washes meander the property in a southwesterly direction. Various stock ponds for cattle appear to be located throughout the Planning Parcel.

Refer to Appendix P for FIRM Maps.

Key Assumptions and Basis of Analysis

The Planning Parcel area and FRS system have been previously modeled for existing flows within the project area. The following assumptions and previous studies have been utilized in preparation of the analysis presented below:

- The East Mesa Area Drainage Master Plan Update, August 2011, prepared by FCDMC modeled existing conditions and flows within the Planning Parcel and is the basis for stormwater flow information utilized for culvert and channel sizing for the Auction Parcel.
- The FRS system protects the Planning Parcel up to the 500-year, 24-hour storm event.
- Various existing washes exist throughout the Planning Parcel. Upstream existing washes that impact the Auction Parcel will route stormwater flow back to historic exit conditions at Meridian Road via culvert crossings and conveyance channels, generally following the arterial roadway network. It is the responsibility of the successful bidder to work with Pinal County and FEMA in order to re-route and/or re-map any existing Zone A floodplains impacting the Auction Parcel.
- It is assumed that the extent of Ironwood Road drainage infrastructure will accommodate roadway widening and will not require additional culvert improvements.
- Meridian Road will require extension and widening of the existing culverts crossing the City of Mesa half street improvements in place.
- The ASLD 8500 Auction Parcel will be subject to the City of Apache Junction Engineering Design Guidelines and Policies Manual.

Refer to Appendix Q for the East Mesa Area Drainage Master Plan Update and existing flows utilized as part of this study.

Proposed Conceptual Infrastructure

The ASLD 8500 Planning Parcel incorporates the existing siphon draw detention basin and Powerline Floodway Channel by way of open space corridors and park areas in the land plan. As development occurs for ASLD 8500, existing drainage impacting the property will be routed through the community, in general to follow the arterial roadway network. It is anticipated that onsite retention will be subject to 100-year, 2-hour retention requirements as outlined in the AJED.

The Auction Parcel is located south of the Elliot Road alignment and does not impact the Siphon Draw wash or Detention basin located at the northeast corner of Elliot Road and Meridian Road. The Powerline Floodway Channel will remain in place and bisect the property in the southwesterly direction. Multiple pipe and box culverts have been conceptually sized and located along the arterial roadway network where larger flow and wash crossings exist. Culverts are estimated at various sizes throughout the Auction Parcel, ranging from double barrel 36-inch pipe culvert crossings to larger double barrel 8x4 foot box culvert crossings.

Conveyance channels are anticipated to route upstream flow around or through the developed areas, in general to follow the arterial street network. Channels are anticipated to be trapezoidal with 5:1 average side slopes and have 0.1% longitudinal slope. 5:1 average slope is based on the assumption that 6:1 slopes will be adjacent to right-of-way areas and slopes not adjacent to right-of-way will be 4:1. It is anticipated that channel improvements will include 60% landscape rock, 30% turf, and 10% will be rip-rap material for erosion protection and longitudinal drop structures as grading requires. Based on the contributing flow per the East Mesa Drainage

Master Plan Update, three channel bottom widths are contemplated. A 10-foot, 15-foot, and 20-foot bottom width trapezoidal channels are anticipated as part of the Auction Parcel infrastructure requirements.

Refer to Appendix R for the Auction Parcel Drainage Infrastructure Exhibit.

Conceptual-Level Opinion of Probable Cost

A conceptual-level OPC for culvert and channel improvements to support development of the Auction Parcel. Seventeen (17) arterial culvert crossings have been estimated to route the larger flow and existing washes that impact the Auction Parcel. Seven (7) conveyance channel locations have also been estimated to route flow through the proposed development and discharge at the south and west ends of the property to meet historic drainage conditions.

The conceptual-level OPC for culvert and channel improvements to serve the Auction Parcel is estimated at $6,165,201 and broken out into further detail in Appendix S.

Section 404 and Floodplain

Floodplain

Per Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Number 04021C0200E, dated December 04, 2007, the vast majority of the site is located in Flood Zone "X":

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

A portion of the site, however, is located in Special Flood Hazard Area Zone "A":

> Areas subject to flooding by the 1% annual chance flood. No Base Flood Elevations determined.

It is the responsibility of the successful bidder to work with Pinal County and FEMA in order to re-route and/or re-map any existing Zone A floodplains impacting the Auction Parcel.

Refer to Appendix P for the FEMA FIRM.

Jurisdictional Washes/Section 404 Impact

Kimley-Horn submitted a Freedom of Information Action (FOIA) request for the Auction Parcel area in September 2019. The Corps responded stating the following files were found below. Two projects overlapped the current project limits:

- SPL-2008-00674-SD Lost Dutchman Heights determined Siphon Draw was not a water of the U.S. (WOUS).
- SPL-2012-00406-MWL Powerline, Vineyard Road and Rittenhouse FRS determined that Powerline Floodway was not a WOUS.
- No other delineations/permits were found on file.

It is the responsibility of the successful bidder to work with the Corps to determine if waters of the U.S. (WOUS) impact the property.

Dry Utilities

The following utility providers own and operate systems in the existing service area of Apache Junction and are in the vicinity of the ASLD 8500 Planning Parcel:

Electric: SRP
Gas: Southwest Gas
Communications: Cox Communications, AT&T, CenturyLink

Two high voltage overhead transmission lines run through the Planning Parcel. The first runs east-west along the midsection line alignment approximately 2600' north of the Elliot Road alignment. The line does not fall within the Auction Parcel boundary. The second transmission line clips the corner of section 19, crossing through the Auction Parcel in the northwesterly direction, in an approximate 125' wide easement.

The successful bidder will be responsible to coordinate with the dry utility companies and determine improvements and/or future extensions to serve the Auction Parcel demands.

Appendix List

Appendix A

ALTA/NSPS Survey
Title Report

Appendix B

SMCFD Service Area
SMCFD Wastewater Master Plan

Appendix C

ASLD 8500 Conceptual Wastewater Infrastructure Exhibit – Planning Parcel

Appendix D

ASLD 8500 Conceptual Wastewater Infrastructure Exhibit – Auction Parcel

Appendix E

Wastewater Design Criteria and Analysis

Appendix F

Auction Parcel Conceptual Opinion of Probable Cost – Wastewater

Appendix G

AJWD Water Resource Breakdown
AJWD Water Master Plan Final Report

Appendix H

ASLD 8500 Conceptual Wastewater Infrastructure Exhibit – Planning Parcel

Appendix I

ASLD 8500 Conceptual Wastewater Infrastructure Exhibit – Auction Parcel

Appendix J

Water Design Criteria and Analysis

Appendix K

WaterCAD Output – Water Model

Appendix L

Auction Parcel Conceptual Opinion of Probable Cost – Water

Appendix M

Apache Junction Active Transportation Plan Cross Sections

Appendix N

ASLD 8500 Conceptual Roadway Infrastructure Exhibit – Auction Parcel

Appendix O

Auction Parcel Conceptual Opinion of Probable Cost – Roadway

Appendix P

FIRM Map

Appendix Q

East Mesa Area Drainage Master Plan Update

Appendix R

ASLD 8500 Conceptual Drainage Infrastructure Exhibit – Auction Parcel

Appendix S

Auction Parcel Conceptual Opinion of Probable Cost – Drainage

Appendix T

Conceptual Land Plan – Planning Parcel
Conceptual Land Plan – Auction Parcel

APPENDIX A

ALTA / NSPS LAND TITLE SURVEY

A PORTION OF SECTIONS 18 & 30 AND ALL OF SECTIONS 17. 19. 20, TOWNSHIP 1 SOUTH, RANGE 8 EAST OF THE GILA AND SALT RIVER MERIDIAN, MARICOPA COUNTY, ARIZONA

LEGAL DESCRIPTION PER TITLE COMMITMENT NO. NCS-973893-PHX1

THOSE PORTIONS OF SECTIONS 17, 18, 19, 20 & 30 TOWNSHIP 1 SOUTH, RANGE 8 EAST OF THE GILA AND SALT RIVER MERIDIAN, PINAL COUNTY, ARIZONA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEAST CORNER OF SECTION 24, TOWNSHIP 1 SOUTH, RANGE 7 EAST, BEING MARKED BY A 1/2 INCH REBAR WITH NO MARKINGS, FROM WHICH THE NORTHWEST CORNER OF SAID SECTION 30, BEING MARKED BY U.S. GENERAL LAND OFFICE (GLO) BRASS CAP, BEARS NORTH 00 DEGREES 38 MINUTES 44 SECONDS WEST, 371.05 FEET;

THENCE ALONG THE RANGE LINE BETWEEN RANGE 7 AND RANGE 8, NORTH 00 DEGREES 38 MINUTES 20 SECONDS WEST, 2635.63 FEET TO THE EAST QUARTER CORNER OF SAID SECTION 24 TOWNSHIP 1 SOUTH RANGE 7 EAST, BEING MARKED BY A U.S. GLO BRASS CAP 1911, FROM WHICH THE WEST QUARTER CORNER OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 8 EAST, BEING MARKED BY A 1/2 INCH REBAR WITH NO MARKINGS, BEARS NORTH 00 DEGREES 36 MINUTES 56 SECONDS WEST, 377.08 FEET;

THENCE CONTINUING ALONG SAID RANGE LINE, NORTH 00 DEGREES 39 MINUTES 07 SECONDS WEST, 2633.06 FEET TO THE SOUTHEAST CORNER OF SECTION 13, TOWNSHIP 1 SOUTH, RANGE 7 EAST, FROM WHICH THE NORTHWEST CORNER OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 8 EAST, BEING MARKED BY A U.S. GLO BRASS CAP 1911, BEARS NORTH 00 DEGREES 32 MINUTES 24 SECONDS WEST, 384.90 FEET;

THENCE CONTINUING ALONG SAID RANGE LINE, NORTH 00 DEGREES 38 MINUTES 27 SECONDS WEST, 2637.95 FEET TO THE EAST QUARTER CORNER OF SAID SECTION 13, BEING MARKED BY A CITY OF MESA BRASS CAP IN HANDHOLE;

THENCE CONTINUING ALONG SAID RANGE LINE, NORTH 00 DEGREES 37 MINUTES 35 SECONDS WEST, 2637.63 FEET TO THE SOUTHEAST CORNER OF SECTION 12, TOWNSHIP 1 SOUTH, RANGE 7 EAST, BEING MARKED BY A CITY OF MESA BRASS CAP IN A HAND HOLE, FROM WHICH THE SOUTHWEST CORNER OF SECTION 7, TOWNSHIP 1 SOUTH, RANGE 8 EAST, BEARS NORTH 00 DEGREES 39 MINUTES 10 SECONDS WEST, 389.32 FEET, BEING MARKED BY A PK NAIL WITH TAG LS #28237;

THENCE CONTINUING ALONG SAID RANGE LINE, NORTH 00 DEGREES 39 MINUTES 10 SECONDS WEST, 75.01 FEET;

THENCE DEPARTING SAID RANGE LINE, SOUTH 89 DEGREES 37 MINUTES 16 SECONDS EAST, 1403.26 FEET TO THE BEGINNING OF A NON–TANGENT CURVE, CONCAVE EASTERLY, FROM WHICH THE CENTER BEARS SOUTH 87 DEGREES 35 MINUTES 22 SECONDS EAST, 1057.78 FEET;

THENCE ALONG SAID CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 04 DEGREES 03 MINUTES 48 SECONDS, AN ARC LENGTH OF 75.02 FEET TO THE BEGINNING OF A NON–TANGENT CURVE, CONCAVE NORTHWESTERLY, FROM WHICH THE CENTER BEARS NORTH 00 DEGREES 22 MINUTES 44 SECONDS EAST, 10,000 FEET;

THENCE ALONG SAID CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 12 DEGREES 10 MINUTES 01 SECONDS, AN ARC LENGTH OF 2123.54 FEET TO REVERSE CURVE, CONCAVE SOUTHEASTERLY, HAVING A RADIUS OF 10,000 FEET;

THENCE ALONG SAID CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 11 DEGREES 33 MINUTES 00 SECONDS, AN ARC LENGTH OF 2015.84 FEET TO THE NORTH LINE OF SAID SECTION 18;

THENCE NORTH 89 DEGREES 45 MINUTES 42 SECONDS EAST, ALONG SAID NORTH LINE, 703.03 FEET TO THE NORTHWEST CORNER OF SAID SECTION 17, BEING MARKED BY A BRASS CAP IN HAND HOLE;

THENCE NORTH 89 DEGREES 45 MINUTES 01 SECONDS EAST, ALONG THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 17, 2642.26 FEET TO THE NORTH QUARTER CORNER OF SAID SECTION 17, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE NORTH 89 DEGREES 47 MINUTES 05 SECONDS EAST, ALONG THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 17, 2643.87 FEET TO THE NORTHEAST CORNER OF SAID SECTION 17, BEING MARKED BY A BRASS CAP STAMPED "S8/S9/S17/S16 LS #35306";

THENCE SOUTH 00 DEGREES 17 MINUTES 14 SECONDS EAST, ALONG THE EAST LINE OF SAID NORTHEAST QUARTER, 2641.27 FEET TO THE EAST QUARTER CORNER OF SAID SECTION 17;

THENCE SOUTH 00 DEGREES 17 MINUTES 40 SECONDS EAST, ALONG THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 17, 2641.37 FEET TO THE SOUTHEAST CORNER OF SAID SECTION 17, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE SOUTH 00 DEGREES 16 MINUTES 27 SECONDS EAST, ALONG THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20, 2640.94 FEET TO THE EAST QUARTER CORNER OF SAID SECTION 20, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE SOUTH 00 DEGREE 15 MINUTES 27 SECONDS EAST, ALONG THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 20, 2641.55 FEET TO THE SOUTHEAST CORNER OF SAID SECTION 20, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE SOUTH 89 DEGREES 46 MINUTES 57 SECONDS WEST, ALONG THE SOUTH LINE OF SAID SOUTHEAST QUARTER, 2643.35 FEET TO THE SOUTH QUARTER CORNER OF SAID SECTION 20, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE SOUTH 89 DEGREES 48 MINUTES 18 SECONDS WEST, ALONG THE SOUTH LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 20, 2643.70 FEET TO THE SOUTHEAST CORNER OF SAID SECTION 19, BEING MARKED BY A BRASS CAP IN HAND HOLE;

THENCE SOUTH 89 DEGREES 45 MINUTES 57 SECONDS WEST, ALONG THE SOUTH LINE OF SAID SECTION 19, 702.14 FEET TO THE BEGINNING OF TANGENT CURVE, CONCAVE SOUTHEASTERLY, HAVING A RADIUS OF 10,000 FEET;

THENCE ALONG SAID CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 11 DEGREES 17 MINUTES 44 SECONDS, AN ARC LENGTH OF 1971.47 FEET TO A REVERSE CURVE, CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 10,000 FEET;

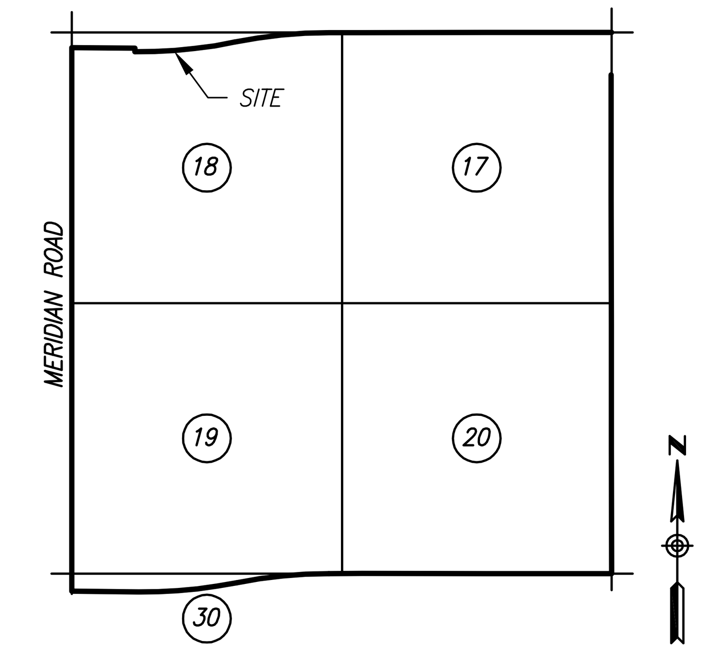
THENCE ALONG SAID CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 11 DEGREES 55 MINUTES 54 SECONDS, AN ARC LENGTH OF 2082.47 FEET;

THENCE NORTH 89 DEGREES 35 MINUTES 53 SECONDS WEST, 1419.06 FEET TO THE POINT OF BEGINNING.

SURVEYOR'S NOTES

1. THIS SURVEY IS BASED ON A COMMITMENT FOR TITLE INSURANCE ISSUED BY FIRST AMERICAN TITLE INSURANCE COMPANY, COMMITMENT NO. NCS–973893–PHX1, EFFECTIVE DATE SEPTEMBER 24, 2019, AT 8:00 AM AS TO THE RECORDS OF THE PINAL COUNTY RECORDER AND AUGUST 30, 2019 AT 7:30 AM AS TO THE RECORDS OF THE ARIZONA STATE LAND DEPARTMENT.
2. IF A DISCREPANCY IS DISCOVERED IN THE TOPOGRAPHY OF THIS MAP, THE SURVEYOR MUST BE CONTACTED TO RESOLVE ANY ISSUES PRIOR TO ANY DESIGN OR CONSTRUCTION.
3. THE LOCATION OF UNDERGROUND UTILITIES AS DEPICTED HEREON IS BASED ON RECOVERABLE FIELD LOCATED SURFACE FEATURES OF THOSE UTILITIES AND SHOULD BE CONSIDERED APPROXIMATE AND POSSIBLY INCOMPLETE. NO EXCAVATIONS WERE MADE TO LOCATE BURIED UTILITIES DURING THE PROGRESS OF OR FOR THE PURPOSE OF THIS SURVEY.
4. THE WORD "CERTIFY" OR "CERTIFICATE" IS AN EXPRESSION OF PROFESSIONAL OPINION REGARDING THE FACTS OF THE SURVEY AND DOES NOT CONSTITUTE A GUARANTEE, EXPRESSED, OR IMPLIED. THE WORD "ENCROACHMENT" IS ALSO AN EXPRESSION OF PROFESSIONAL OPINION REGARDING THE FACTS OF THE SURVEY AND DOES NOT CONSTITUTE A GUARANTEE, EXPRESSED, OR IMPLIED. THE SURVEYOR DOES NOT HAVE PROPER AUTHORITY TO DETERMINE WHETHER OR NOT AN OBJECT IS OR IS NOT AN ENCROACHMENT AND CAN ONLY ATTEST TO THE LOCATION OF SAID OBJECT.
5. UNLESS SHOWN AND LABELED ON SHEET(S) 4–7, THIS SURVEYOR'S ANALYSIS HAS NOT IDENTIFIED ANY APPARENT ENCROACHMENTS.
6. THIS SURVEY DEPICTS THE SAME PARCEL DESCRIBED IN THE LEGAL DESCRIPTION PROVIDED IN THE ABOVE REFERENCED TITLE REPORT.
7. SCHEDULE B ITEMS THAT ARE BLANKET IN NATURE OVER AN ENTIRE SECTION HAVE BEEN NOTED ON SHEETS 4–7 WITH A BOX AROUND THE SCHEDULE B ITEM NUMBER AND PLACED UNDERNEATH THE SECTION CALL–OUT ON SAID SHEETS.
8. THE ORIGINAL RIGHT–OF–WAY FOR IRONWOOD ROAD AS REFERENCED IN INSTRUMENT NO. 2008–76344, P.C.R. IS SHOWN ON SHEETS 4–5. ADDITIONAL RIGHT–OF–WAY FOR IMPROVEMENTS ARE INCLUDED IN 2016–76684, P.C.R., 2016–75097, P.C.R., 2017–18728, P.C.R. & 2017–22458, P.C.R. BUT DO NOT HAVE SUFFICIENT INFORMATION TO BE PLOTTED AND SHOWN HEREON.
9. DRAINAGE CHANNEL NOTE: SCHEDULE B ITEM 42 – RW FILE 09–3681 PROVIDES A BLANKET RIGHT OF WAY FOR DRAINAGE TO MARICOPA COUNTY FLOOD CONTROL DISTRICT. IN 2011 A QUIT CLAIM DEED, 2011–62136, WAS RECORDED WHICH RELINQUISHED THE FLOOD CONTROL DISTRICT'S RIGHTS TO MUCH OF THE LAND PREVIOUSLY INCLUDED IN THE RW FILE. IN THIS AREA, THE QUIT CLAIM DEED MAKES REFERENCE TO THE POWERLINE FLOODWAY CHANNEL, BEING 266 FEET WIDE; HOWEVER, NO INFORMATION HAS BEEN PROVIDED SHOWING THE EXTENTS OF SAID POWERLINE FLOODWAY CHANNEL. THE LOCATION OF THE RIGHTS SHOWN ON SHEETS 4–7 OF THIS SURVEY ARE BASED ON THE PHYSICAL EVIDENCE OF A CHANNEL, WHICH COINCIDES WITH THE RECORD LOCATION OF SCHEDULE B ITEM #15 (DOCKET 472, PAGE 314) IN SECTION 17. THE NORTH LINE OF SCHEDULE B ITEM #15 HAS BEEN EXTENDED THROUGH SECTION 18 AND 19 AND OFFSET 266 FEET TO THE SOUTHEAST.
10. TABLE A ITEM #11. THIS IS AN ABOVE GROUND SURVEY. FIELD LOCATED VISIBLE SURFACE FEATURES OF EXISTING UTILITIES ARE SHOWN. UNDERGROUND UTILITIES HAVE NOT BEEN LOCATED.

SHEET INDEX



VICINITY MAP

T1S, R8E, SEC 17, 18, 19, 20 & 30

OWNERS

STATE OF ARIZONA

SURVEYOR

HUBBARD ENGINEERING
1201 S. ALMA SCHOOL RD. SUITE #12000
MESA, AZ 85210
PHONE: (480) 892–3313
FAX: (480) 892–7051
CONTACT: ADRIAN BURCHAM, PLS

PARCEL AREA

GROSS AREA: 121,232,960 SQ. FT. OR 2,783.13 AC. ±
IRONWOOD RW: 1,561,909 SQ. FT. OR 35.86 AC. ±
MERIDIAN RW: 779,570 SQ. FT. OR 17.90 AC. ±
RAY RW: 859,683 SQ. FT. OR 19.74 AC. ±
ELLIOT RW: 969,927 SQ. FT. OR 22.27 AC. ±
NET AREA: 117,061,871 SQ. FT. OR 2,687.37 AC. ±

BASIS OF BEARINGS

THE NORTH LINE OF SECTION 18, TOWNSHIP 1 SOUTH, RANGE 8 EAST OF THE GILA AND SALT RIVER MERIDIAN, MARICOPA COUNTY, ARIZONA.
MEASURED BEARING=S89°45'42"W

SURVEYOR'S CERTIFICATION

THE UNDERSIGNED HEREBY CERTIFIES TO THE STATE OF ARIZONA; AND FIRST AMERICAN TITLE INSURANCE COMPANY, THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1, 2, 4, 11 & 13 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON 09/20/19.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
41282
ADRIAN M.
BURCHAM
Date Signed 10/07/19
ARIZONA U.S.A.

SIGNATURE

ADRIAN M. BURCHAM
PRINTED NAME
REGISTRATION/LICENSE NO. 41282

DATE: 10/07/19

1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313

HUBBARD
ENGINEERING
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

Date 10/07/19	Project Eng.
Project No. 19123	Project Manager ADRIAN BURCHAM

P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 08, 2019 – 11:08am RMontiel

SCHEDULE "B" ITEMS PER TITLE COMMITMENT NO. NCS-973893-PHX1

8. TAXES FOR THE FULL YEAR OF 2019.
(THE FIRST HALF IS DUE OCTOBER 1, 2019 AND IS DELINQUENT NOVEMBER 1, 2019. THE SECOND HALF IS DUE MARCH 1, 2020 AND IS DELINQUENT MAY 1, 2020.)

9. ANY ADDITIONAL TAXES WHICH MAY BECOME A LIEN BY REASON OF THE COUNTY ASSESSOR REASSESSING THE WITHIN DESCRIBED PREMISES FOR THE YEAR(S) 2019.

10. RESERVATIONS OR EXCEPTIONS IN PATENTS, OR IN ACTS AUTHORIZING THE ISSUANCE THEREOF.

11. RIGHT-OF-WAY NO. 65-000034 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO UNITED STATES OF AMERICA FOR ELECTRIC TRANSMISSION LINE AND HAVING A TERM OF PERPETUAL DURATION.
THEREAFTER CONTRACT AND GRANT OF EASEMENT RECORDED AUGUST 30, 1950 IN DOCKET 31, PAGE 436.
AFFECTS SECTIONS 19, 30 AND OTHER PROPERTY

12. RESOLUTION ESTABLISHING COUNTY ROAD RECORDED MARCH 27, 1956 IN DOCKET 148, PAGE 513.
SECTIONS 17 THROUGH 20, 30 AND OTHER PROPERTY

13. RIGHT-OF-WAY NO. 09-2341 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO PINAL COUNTY BOARD OF SUPERVISORS FOR HIGHWAY AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF WHICH RECORDED IN DOCKET 256, PAGE 16.
THEREAFTER AMENDMENT DATED FEBRUARY 26, 2008, A COPY OF WHICH IS ATTACHED TO PINAL COUNTY RESOLUTION 070908-SLD RECORDED JULY 11, 2008 AS 2008-65670 OF OFFICIAL RECORDS.
THEREAFTER AMENDMENT DATED JULY 21, 2014, A COPY OF WHICH IS ATTACHED TO RESOLUTION 08-2014_RD 14-014 OF PINAL COUNTY RECORDED AUGUST 26, 2014 AS 2014-49304 OF OFFICIAL RECORDS.
SECTION 30 AND OTHER PROPERTY

14. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PERMANENT EASEMENT" RECORDED JUNE 1, 1966 IN DOCKET 451, PAGE 64 AND RE-RECORDED DECEMBER 19, 1966 IN DOCKET 479, PAGE 415.
SECTION 17, 18

15. EASEMENTS FOR FLOOD CONTROL AND RIGHTS INCIDENT THERETO AS DISCLOSED BY RESOLUTION OF THE PINAL COUNTY BOARD OF SUPERVISORS, NOVEMBER 7, 1966, IN BOOK 472, PAGE 314.
SECTION 17

16. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PERMANENT EASEMENT" RECORDED NOVEMBER 7, 1966 IN DOCKET 472, PAGE 319.
SECTION 19

17. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "AGREEMENT" RECORDED DECEMBER 8, 1966 IN DOCKET 478, PAGE 94. BY AND BETWEEN THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION AND FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
SECTION 19

18. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

19. AN EASEMENT FOR GAS LINES AND INCIDENTAL PURPOSES IN THE DOCUMENT RECORDED IN DOCKET 524, PAGE 51.
AFFECTS SECTION 19

20. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PERMANENT EASEMENT" RECORDED JUNE 7, 1097 IN DOCKET 825, PAGE 288.
AFFECTS SECTION 19

21. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PERMANENT EASEMENT" RECORDED JUNE 7, 1976 IN DOCKET 825, PAGE 292.
SECTION 19

22. RIGHT-OF-WAY NO. 05-000026 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO JP CATTLE CO LLC FOR GRAZING AND HAVING A TERM WHICH EXPIRES DECEMBER 30, 2024.
AFFECTS SECTIONS 19, 30 AND OTHER PROPERTY

23. RIGHT-OF-WAY NO. 05-349-00 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO KEITH M. FLAKE, A MARRIED PERSON FOR GRAZING AND HAVING A TERM WHICH EXPIRES DECEMBER 30, 2027.
AFFECTS SECTIONS 16, 17, 20 AND OTHER PROPERTY

24. RIGHT-OF-WAY NO. 09-001371 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO PINAL COUNTY FOR HIGHWAY AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF WHICH RECORDED NOVEMBER 25, 1991, IN DOCKET 1091, PAGE 394.
(AFFECTS ALL PARCELS)

25. RIGHT-OF-WAY NO. 09-002458 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO PINAL COUNTY BOARD OF SUPERVISORS FOR HIGHWAY AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF WHICH RECORDED IN DOCKET 265, PAGE 179.
AFFECTS SECTION 19, 30

26. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

27. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

28. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

29. SPECIAL LAND USE PERMIT NO. 23-106799 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO ET MOTORSPORTS LLC FOR MOTORCROSS TRACK AND FACILITIES AND HAVING A TERM WHICH EXPIRES APRIL 3, 2019.
AMENDMENT DATED AUGUST 3, 2010.
SAID DOCUMENT IS STILL SHOWING AS ACTIVE. A COPY OF ANY EXTENSION IS NOT YET AVAILABLE.
ALSO AS SET FORTH IN PINAL COUNTY ARIZONA SPECIAL USE PERMIT CASE NO. SUP-021-01 RECORDED JANUARY 14, 2002 AS 2002-001694 OF OFFICIAL RECORDS AND RECORDED FEBRUARY 14, 2002 AS 2002-7538 OF OFFICIAL RECORDS AND CASE NO SUP-002-10 RECORDED DECEMBER 8, 2010 AS 2010-113585 OF OFFICIAL RECORDS.
AFFECTS SECTION 30

30. RIGHT-OF-WAY NO. 18-107826 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO ET MOTORSPORTS, L.L.C., FOR WATER DISTRIBUTION LINE AND HAVING A TERM WHICH EXPIRES ON APRIL 3, 2019.
SAID DOCUMENT IS STILL SHOWING AS ACTIVE. A COPY OF ANY EXTENSION IS NOT YET AVAILABLE.
AFFECTS SECTION 30

31. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

32. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "DESERT WELLS MULTI-USE AREA MANAGEMENT & PARTNERSHIP TEAM, AS DISCLOSED BY MEMORANDUM OF UNDERSTANDING 56-109245 BY AND BETWEEN THE ARIZONA STATE LAND DEPARTMENT AND DESERT WELLS MULTI-USE AREA MANAGEMENT & PARTNERSHIP TEAM, AS DISCLOSED BY A SEARCH OF THE RECORDS OF THE ARIZONA STATE LAND DEPARTMENT.

SCHEDULE "B" ITEMS PER TITLE COMMITMENT NO. NCS-973893-PHX1

33. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

34. RIGHT OF WAY FOR IRONWOOD/GANTZEL ROAD AS DISCLOSED BY RESOLUTION RECORDED NOVEMBER 16, 2004 AS 2004-93152 OF OFFICIAL RECORDS.
AFFECTS SECTIONS 17 THROUGH 20, 30 AND OTHER PROPERTY

35. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

36. RIGHT-OF-WAY NO. 14-110140 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO SALT RIVER PROJECT AND AGRICULTURAL IMPROVEMENT AND POWER DISTRICT FOR OVERHEAD DOUBLE CIRCUIT 500KV /120KV TRANSMISSION LINES AND HAVING A TERM WHICH EXPIRES OCTOBER 12, 2056.
A COPY OF WHICH RECORDED APRIL 19, 2007 AS 2007-46938 OF OFFICIAL RECORDS.
AFFECTS SECTION 17 AND OTHER PROPERTY

37. RIGHT-OF-WAY NO. 16-111118 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO DESERT COMMUNITIES, INC., A NEVADA CORPORATION FOR FLOOD WATER COLLECTION AND DETENTION FACILITIES AND HAVING A TERM OF PERPETUAL DURATION.
THEREAFTER ASSIGNED TO FLOOD CONTROL DISTRICT OF MARICOPA COUNTY DATED FEBRUARY 20, 2007.
THEREAFTER AMENDMENT DATED AUGUST 23, 2011 AND ANOTHER AMENDMENT DATED AUGUST 23, 2011.
AFFECTS SECTION 18 AND OTHER PROPERTY

38. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

39. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

40. RIGHT-OF-WAY NO. 18-108362 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO MEDIACOM ARIZONA, LLC, A DELAWARE LIMITED LIABILITY COMPANY FOR FIBER OPTICS AND HAVING A TERM WHICH EXPIRED ON APRIL 26, 2016.
SAID DOCUMENT IS STILL SHOWING AS ACTIVE. A COPY OF ANY EXTENSION IS NOT YET AVAILABLE.
AFFECTS SECTIONS 17, 20 AND OTHER PROPERTY

41. RIGHT-OF-WAY NO. 18-110900 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO WATER UTILITIES COMMUNITY FACILITIES DISTRICT DBA APACHE JUNCTION WATER COMPANY FOR WATER LINE AND HAVING A TERM WHICH EXPIRES JANUARY 13, 2016.
SAID DOCUMENT IS STILL SHOWING AS ACTIVE. A COPY OF ANY EXTENSION IS NOT YET AVAILABLE.
AFFECTS SECTIONS 17, 20, AND 30 AND OTHER PROPERTY

42. RIGHT-OF-WAY NO. 09-3681 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO FLOOD CONTROL DISTRICT OF MARICOPA COUNTY FOR FLOOD CONTROL FACILITIES AND HAVING A TERM OF PERPETUAL DURATION.
THEREAFTER AMENDMENT TO RIGHT OF WAY DATED OCTOBER 11, 2011.
DEED REFERENCED THEREIN IS RECORDED AS 2011-62136 OF OFFICIAL RECORDS.
AFFECTS SECTIONS 17, 18, 19 AND OTHER PROPERTY

43. SPECIAL LAND USE PERMIT NO. 23-101045-26 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO EAST VALLEY AVIATORS, INC FOR RADIO-CONTROLLED AIRCRAFT PARK AND HAVING A TERM WHICH EXPIRES OCTOBER 11, 2022.
AFFECTS SECTION 20

44. RIGHT-OF-WAY NO. 16-105661 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO MARICOPA COUNTY FOR STORM DRAIN PIPES AND HEAD WALLS AND HAVING A TERM OF PERPETUAL DURATION.
AFFECTS SECTION 18

45. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PINAL COUNTY ORDINANCE NO. 121207-AQ1" RECORDED JANUARY 8, 2008, AS 2008-1862 OF OFFICIAL RECORDS.
(AFFECTS ALL PARCELS)

46. RIGHT-OF-WAY NO. 16-110965 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO CITY OF MESA FOR UNDERGROUND WATER TRANSMISSION LINES AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF WHICH RECORDED JANUARY 28, 2008 AS 2008-7616 OF OFFICIAL RECORDS.
AMENDMENT DATED JANUARY 19, 2012 RECORDED MARCH 23, 2012 AS 2012-23559 OF OFFICIAL RECORDS.
AFFECTS SECTIONS 17 & 18 AND OTHER PROPERTY

47. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

48. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

49. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

50. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

51. RIGHT-OF-WAY NO. 16-110357 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO PINAL COUNTY FOR PUBLIC ROADWAY AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF SAID RIGHT OF WAY IS ATTACHED TO PINAL COUNTY RESOLUTION ACCEPTING A RIGHT OF WAY RECORDED AUGUST 12, 2008 AS 2008-76344 OF OFFICIAL RECORDS.
ASSIGNED TO CITY OF APACHE JUNCTION BY ASSIGNMENT DATED MARCH 5, 2012.
AMENDMENT DATED NOVEMBER 1, 2016 RECORDED NOVEMBER 14, 2016 AS 2016-76684 OF OFFICIAL RECORDS AND A COPY OF WHICH IS ATTACHED TO PINAL COUNTY RESOLUTION RECORDED NOVEMBER 7, 2016 AS 2016-75097 OF OFFICIAL RECORDS.
AMENDMENT DATED MARCH 8, 2017 RECORDED MARCH 20, 2017 AS 2017-18728 OF OFFICIAL RECORDS AND A COPY OF WHICH IS ATTACHED TO PINAL COUNTY RESOLUTION RECORDED MARCH 31, 2017 AS 2017-22458 OF OFFICIAL RECORDS.
AMENDMENT DATED JUNE 6, 2018 RECORDED JUNE 19, 2018 AS 2018-45911 OF OFFICIAL RECORDS.
AFFECTS SECTIONS 17, 18, 19, 20, 30 AND OTHER PROPERTY

52. RIGHT-OF-WAY NO. 18-118098 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO MARICOPA COUNTY FOR DRAINAGE FACILITIES AND HAVING A TERM WHICH EXPIRES JANUARY 6, 2026.
AFFECTS SECTION 19

53. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

54. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

55. ALL MATTERS AS SET FORTH IN RECORD OF SURVEY, RECORDED JUNE 30, 2010 AS RECORD OF SURVEY NO. 2010-61925 OF OFFICIAL RECORDS.
(AFFECTS ALL PARCELS)

56. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

57. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

58. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

SCHEDULE "B" ITEMS PER TITLE COMMITMENT NO. NCS-973893-PHX1

59. RIGHT-OF-WAY NO. 18-104730 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO CHI CONSTRUCTION COMPANY FOR DRAINAGE DITCH, WING DIKES, AND BOX CULVERTS AND HAVING A TERM WHICH EXPIRES OCTOBER 7, 2019.
AFFECTS SECTION 18 AND OTHER PROPERTY

60. ALL MATTERS AS SET FORTH IN PINAL COUNTY RESOLUTION NO PZ-PA-006-11-B, RECORDED FEBRUARY 13, 2012 AS 2012-11130 OF OFFICIAL RECORDS.
AFFECTS ALL PARCELS

61. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

62. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

63. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

64. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "CENTRAL ARIZONA WATER CONSERVATION DISTRICT CENTRAL ARIZONA PROJECT LAND USE LICENSE" RECORDED JUNE 1, 2015 AS 2015-35563 OF OFFICIAL RECORDS.
(AFFECTS ALL PARCELS)

65. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

66. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

67. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

68. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

69. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

70. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PRE-ANNEXATION DEVELOPMENT AGREEMENT" RECORDED MAY 30, 2019 AS 2019-42122 OF OFFICIAL RECORDS.
(AFFECTS ALL PARCELS)

71. ANY CLAIM THAT THE TITLE IS SUBJECT TO A TRUST OR LIEN CREATED UNDER THE PERISHABLE AGRICULTURAL COMMODITIES ACT, 1930 (7 U.S.C. §§499A, ET SEQ.) OR THE PACKERS AND STOCKYARDS ACT (7 U.S.C. §§181 ET SEQ.) OR UNDER SIMILAR STATE LAWS.

72. ANY FACTS, RIGHTS, INTERESTS OR CLAIMS WHICH WOULD BE DISCLOSED BY A CORRECT ALTA/NSPS SURVEY.

73. THE RIGHTS OF PARTIES IN POSSESSION BY REASON OF ANY UNRECORDED LEASE OR LEASES OR MONTH TO MONTH TENANCIES AFFECTING ANY PORTION OF THE WITHIN DESCRIBED PROPERTY.
NOTE: THIS MATTER WILL BE MORE FULLY SET FORTH OR DELETED UPON COMPLIANCE WITH THE APPLICABLE REQUIREMENT(S) SET FORTH HEREIN.

74. WATER RIGHTS, CLAIMS OR TITLE TO WATER, WHETHER OR NOT SHOWN BY THE PUBLIC RECORDS.
(AFFECTS ALL PARCELS)

75. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

76. NO LIABILITY IS ASSUMED FOR THE ACCURACY OR COMPLETENESS OF ANY MAP OR LEGAL DESCRIPTION PROVIDED IN RELATION TO ANY STATE LAND RIGHT OF WAY, PERMIT OR LEASE SET FORTH IN SCHEDULE B HEREIN. ANY COPIES FURNISHED ARE AS A COURTESY ONLY.

= INDICATES SCHEDULE B ITEMS SHOWN ON SHEETS 4-7.
= INDICATES SCHEDULE B ITEM "NOT PLOTTABLE" - BUT AFFECTS THE PROPERTY
= INDICATES SCHEDULE B ITEM "BLANKET EASEMENT" - BUT AFFECTS THE PROPERTY

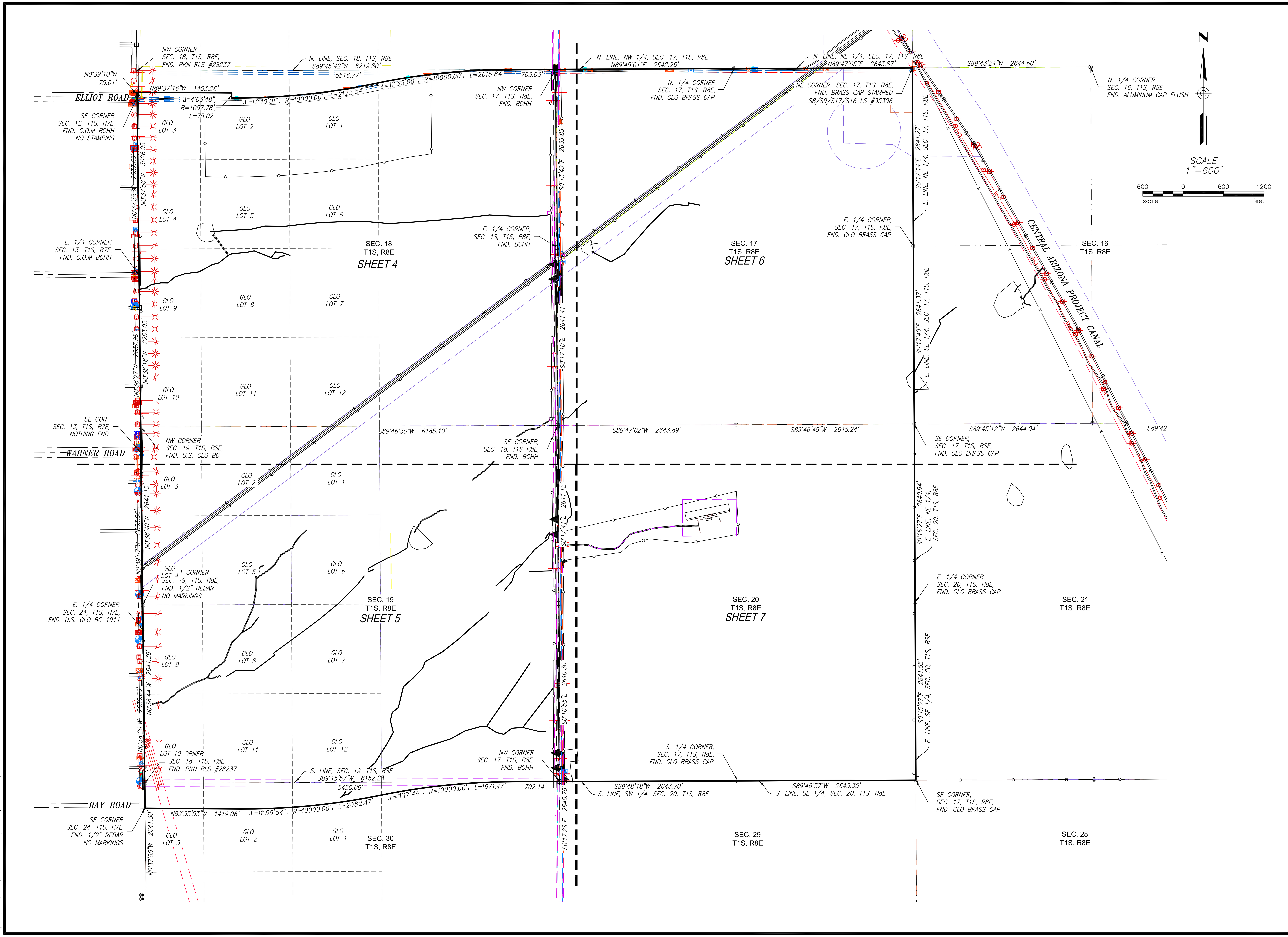
1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313
HUBBARD ENGINEERING
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR
CERTIFICATE NO. 41282
ADRIAN M. BURCHAM
Date Signed 10/07/19
ARIZONA U.S.A.

Project No. 19123	Date 10/07/19
Project Manager ADRIAN BURCHAM	Project Eng.

P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 08, 2019 - 11:08am RMontiel



HUBBARD ENGINEERING

1201 S. Alma School Rd. Suite 12000 Mesa, AZ 85210 Ph: 480.892.3313

www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

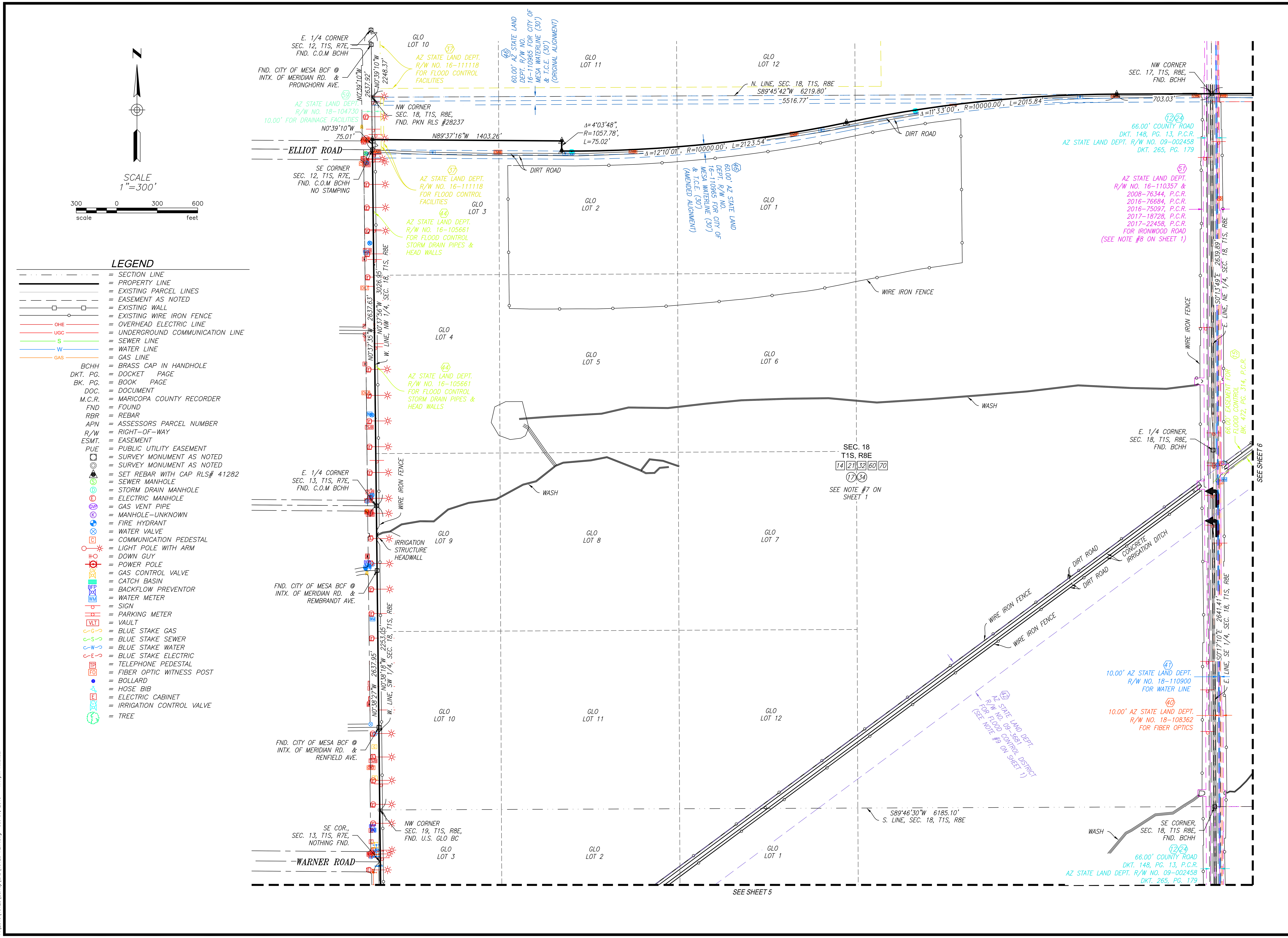
Date 10/07/19

Project Eng.

Project No. 19123

Project Manager ADRIAN BURCHAM

Sht: 3 of 7



P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 07, 2019 – 1:47pm RMontiel

1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313
HUBBARD ENGINEERING
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR 41282 ADRIAN M. BURCHAM ARIZONA U.S.A.

Date 10/07/19	Project Eng.
Project No. 19123	Project Manager ADRIAN BURCHAM

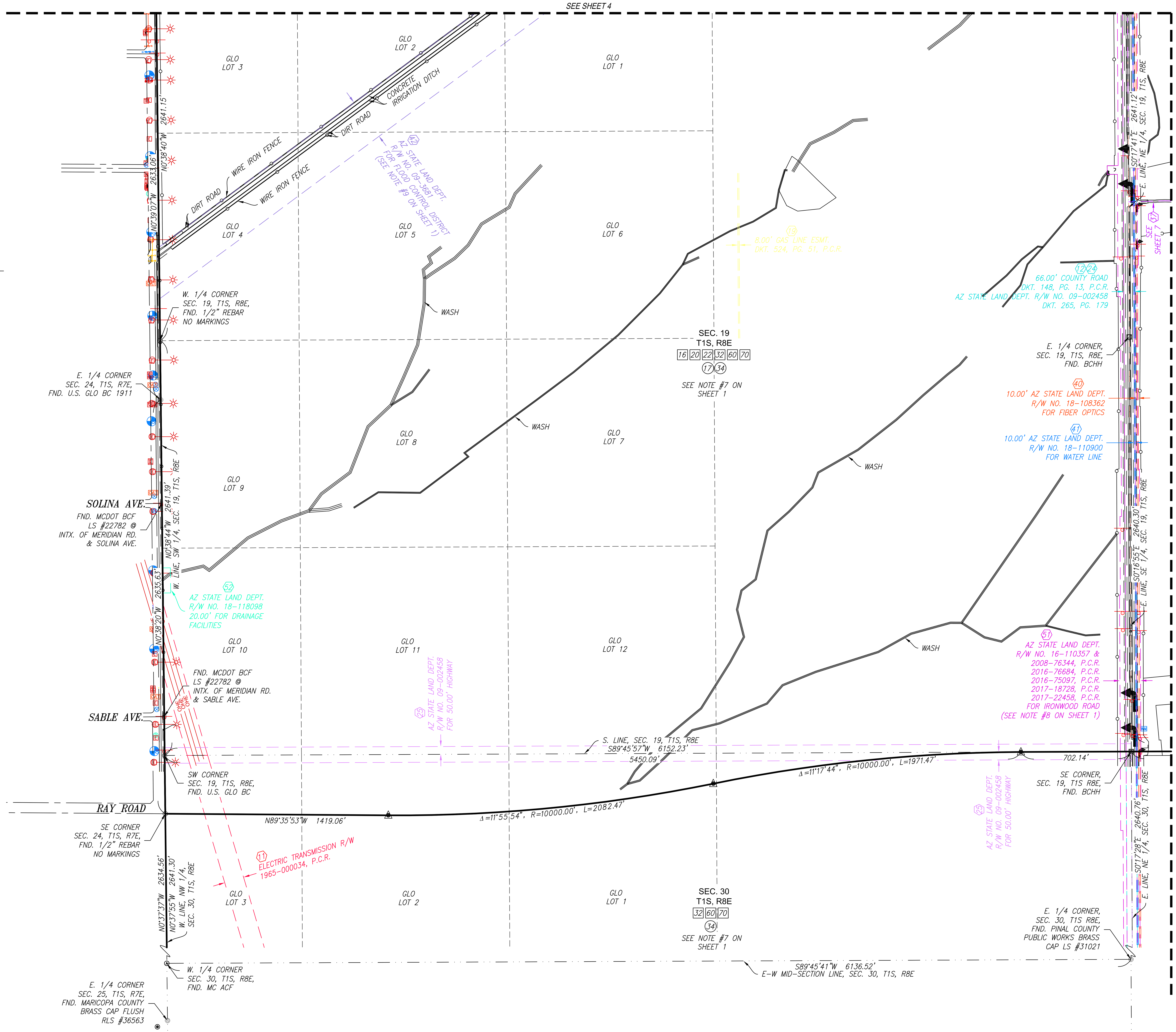
N

SCALE
1"=300'

300 0 300
scale feet

LEGEND

- SECTION LINE
- PROPERTY LINE
- EXISTING PARCEL LINES
- EASEMENT AS NOTED
- EXISTING WALL
- EXISTING WROUGHT IRON FENCE
- OHE = OVERHEAD ELECTRIC LINE
- UGC = UNDERGROUND COMMUNICATION LINE
- S = SEWER LINE
- W = WATER LINE
- GAS = GAS LINE
- BCHH = BRASS CAP IN HANDHOLE
- DKT. PG. = DOCKET PAGE
- BK. PG. = BOOK PAGE
- DOC. = DOCUMENT
- M.C.R. = MARICOPA COUNTY RECORDER
- FND = FOUND
- RBR = REBAR
- APN = ASSESSORS PARCEL NUMBER
- R/W = RIGHT-OF-WAY
- ESMT. = EASEMENT
- PUE = PUBLIC UTILITY EASEMENT
- = SURVEY MONUMENT AS NOTED
- = SURVEY MONUMENT AS NOTED
- = SET REBAR WITH CAP RLS# 41282
- = SEWER MANHOLE
- = STORM DRAIN MANHOLE
- = ELECTRIC MANHOLE
- = GAS VENT PIPE
- = MANHOLE-UNKNOWN
- = FIRE HYDRANT
- = WATER VALVE
- = COMMUNICATION PEDESTAL
- = LIGHT POLE WITH ARM
- = DOWN GUY
- = POWER POLE
- = GAS CONTROL VALVE
- = CATCH BASIN
- BFP = BACKFLOW PREVENTOR
- WM = WATER METER
- = SIGN
- = PARKING METER
- VLT = VAULT
- = BLUE STAKE GAS
- = BLUE STAKE SEWER
- = BLUE STAKE WATER
- = BLUE STAKE ELECTRIC
- TP = TELEPHONE PEDESTAL
- FO = FIBER OPTIC WITNESS POST
- = BOLLARD
- = HOSE BIB
- E = ELECTRIC CABINET
- = IRRIGATION CONTROL VALVE
- = TREE



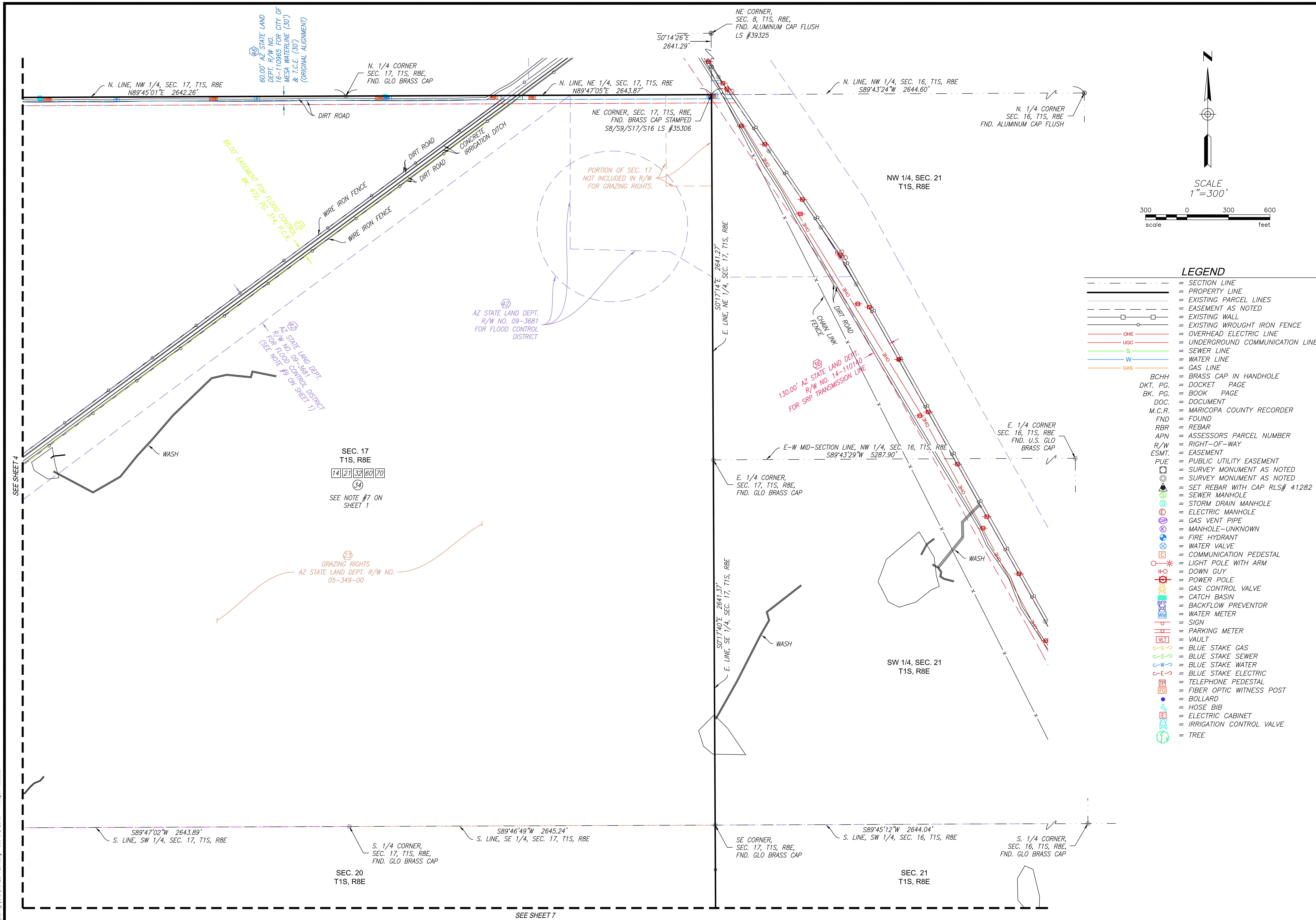
HUBBARD ENGINEERING
1201 S. Alma School Rd. Suite 12000 Mesa, AZ 85210 Ph: 480.892.3313
www.hubbardengineering.com

LOST DUTCHMAN ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR 41282 ADRIAN M. BURCHAM ARIZONA U.S.A.

Date 10/07/19
Project Eng.
Project No. 19123
Project Manager ADRIAN BURCHAM

P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 07, 2019 - 1:47pm RMontiel



LEGEND

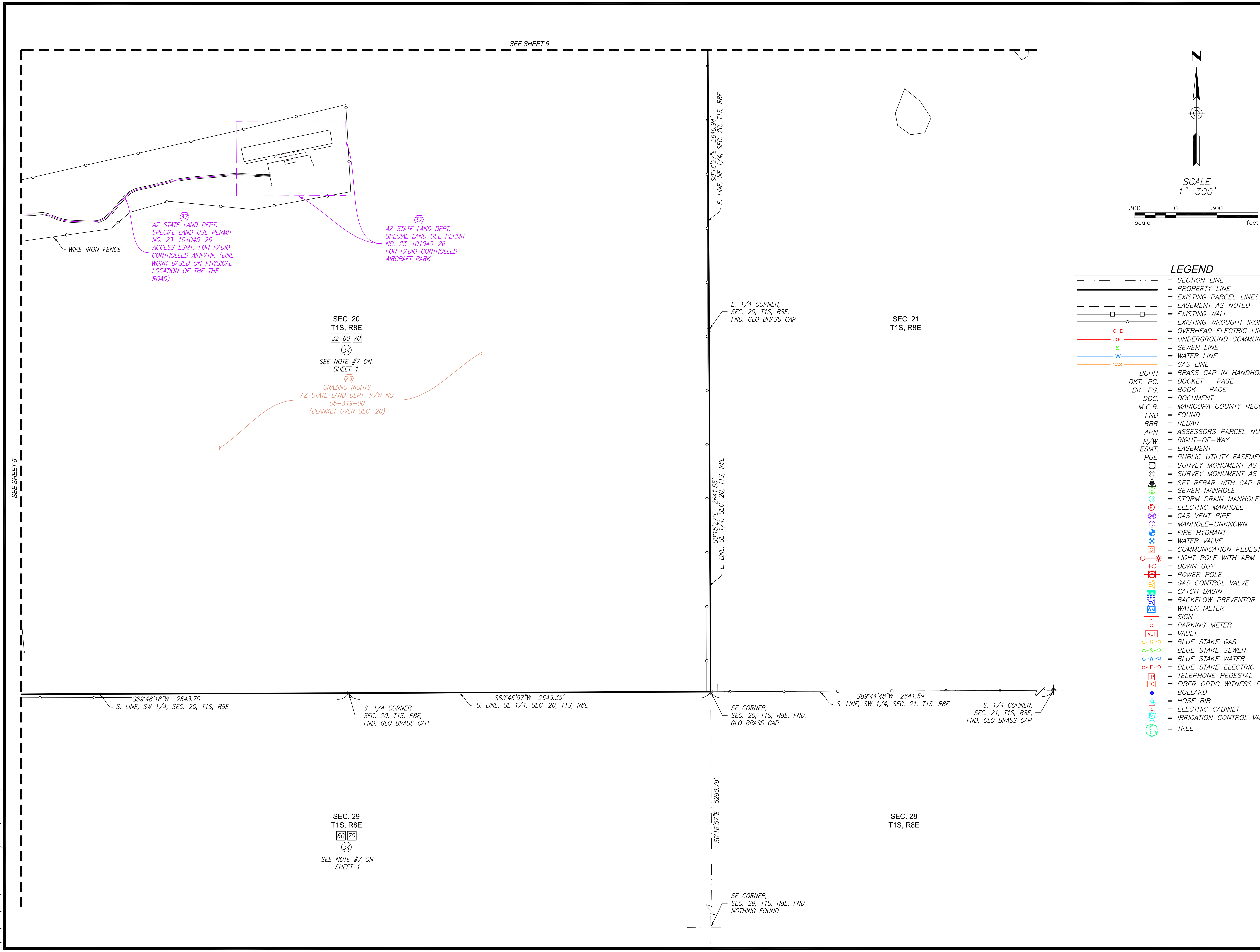
- = SECTION LINE
- = PROPERTY LINE
- = EXISTING PARCEL LINES
- = EASEMENT AS NOTED
- = EXISTING WALL
- = EXISTING WROUGHT IRON FENCE
- OHE = OVERHEAD ELECTRIC LINE
- UGC = UNDERGROUND COMMUNICATION LINE
- S = SEWER LINE
- W = WATER LINE
- GAS = GAS LINE
- BCHH = BRASS CAP IN HANDHOLE
- DKT. PG. = DOCKET PAGE
- BK. PG. = BOOK PAGE
- DOC. = DOCUMENT
- M.C.R. = MARICOPA COUNTY RECORDER
- FND = FOUND
- RBR = REBAR
- APN = ASSESSORS PARCEL NUMBER
- R/W = RIGHT-OF-WAY
- ESMT. = EASEMENT
- PUE = PUBLIC UTILITY EASEMENT
- = SURVEY MONUMENT AS NOTED
- = SURVEY MONUMENT AS NOTED
- = SET REBAR WITH CAP RLS# 41282
- = SEWER MANHOLE
- = STORM DRAIN MANHOLE
- = ELECTRIC MANHOLE
- = GAS VENT PIPE
- = MANHOLE-UNKNOWN
- = FIRE HYDRANT
- = WATER VALVE
- = COMMUNICATION PEDESTAL
- = LIGHT POLE WITH ARM
- = DOWN GUY
- = POWER POLE
- = GAS CONTROL VALVE
- = CATCH BASIN
- = BACKFLOW PREVENTOR
- WM = WATER METER
- = SIGN
- = PARKING METER
- VLT = VAULT
- G = BLUE STAKE GAS
- S = BLUE STAKE SEWER
- W = BLUE STAKE WATER
- E = BLUE STAKE ELECTRIC
- TP = TELEPHONE PEDESTAL
- FO = FIBER OPTIC WITNESS POST
- = BOLLARD
- = HOSE BIB
- E = ELECTRIC CABINET
- = IRRIGATION CONTROL VALVE
- = TREE

HUBBARD ENGINEERING
1201 S. Alma School Rd. Suite 12000 Mesa, AZ 85210 Ph: 480.892.3313
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR 41282 ADRIAN M. BURCHAM ARIZONA U.S.A.

Date 10/07/19	Project Eng.
Project No. 19123	Project Manager ADRIAN BURCHAM



LEGEND

- = SECTION LINE
- = PROPERTY LINE
- = EXISTING PARCEL LINES
- = EASEMENT AS NOTED
- = EXISTING WALL
- = EXISTING WROUGHT IRON FENCE
- OHE = OVERHEAD ELECTRIC LINE
- UGC = UNDERGROUND COMMUNICATION LINE
- S = SEWER LINE
- W = WATER LINE
- GAS = GAS LINE
- BCHH = BRASS CAP IN HANDHOLE
- DKT. PG. = DOCKET PAGE
- BK. PG. = BOOK PAGE
- DOC. = DOCUMENT
- M.C.R. = MARICOPA COUNTY RECORDER
- FND = FOUND
- RBR = REBAR
- APN = ASSESSORS PARCEL NUMBER
- R/W = RIGHT-OF-WAY
- ESMT. = EASEMENT
- PUE = PUBLIC UTILITY EASEMENT
- = SURVEY MONUMENT AS NOTED
- = SURVEY MONUMENT AS NOTED
- = SET REBAR WITH CAP RLS# 41282
- = SEWER MANHOLE
- = STORM DRAIN MANHOLE
- = ELECTRIC MANHOLE
- = GAS VENT PIPE
- = MANHOLE-UNKNOWN
- = FIRE HYDRANT
- = WATER VALVE
- = COMMUNICATION PEDESTAL
- = LIGHT POLE WITH ARM
- = DOWN GUY
- = POWER POLE
- = GAS CONTROL VALVE
- = CATCH BASIN
- = BACKFLOW PREVENTOR
- = WATER METER
- = SIGN
- = PARKING METER
- VLT = VAULT
- = BLUE STAKE GAS
- = BLUE STAKE SEWER
- = BLUE STAKE WATER
- = BLUE STAKE ELECTRIC
- TP = TELEPHONE PEDESTAL
- FO = FIBER OPTIC WITNESS POST
- = BOLLARD
- = HOSE BIB
- E = ELECTRIC CABINET
- = IRRIGATION CONTROL VALVE
- = TREE

REGISTERED LAND SURVEYOR 41282 ADRIAN M. BURCHAM ARIZONA U.S.A.

HUBBARD ENGINEERING

1201 S. Alma School Rd. Suite 12000 Mesa, AZ 85210 Ph: 480.892.3313
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

Date 10/07/19	Project Eng.
Project No. 19123	Project Manager ADRIAN BURCHAM

ALTA / NSPS LAND TITLE SURVEY

A PORTION OF SECTIONS 18 & 30 AND ALL OF SECTIONS 17. 19. 20, TOWNSHIP 1 SOUTH, RANGE 8 EAST OF THE GILA AND SALT RIVER MERIDIAN, MARICOPA COUNTY, ARIZONA

LEGAL DESCRIPTION PER TITLE COMMITMENT NO. NCS-973893-PHX1

THOSE PORTIONS OF SECTIONS 17, 18, 19, 20 & 30 TOWNSHIP 1 SOUTH, RANGE 8 EAST OF THE GILA AND SALT RIVER MERIDIAN, PINAL COUNTY, ARIZONA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEAST CORNER OF SECTION 24, TOWNSHIP 1 SOUTH, RANGE 7 EAST, BEING MARKED BY A 1/2 INCH REBAR WITH NO MARKINGS, FROM WHICH THE NORTHWEST CORNER OF SAID SECTION 30, BEING MARKED BY U.S. GENERAL LAND OFFICE (GLO) BRASS CAP, BEARS NORTH 00 DEGREES 38 MINUTES 44 SECONDS WEST, 371.05 FEET;

THENCE ALONG THE RANGE LINE BETWEEN RANGE 7 AND RANGE 8, NORTH 00 DEGREES 38 MINUTES 20 SECONDS WEST, 2635.63 FEET TO THE EAST QUARTER CORNER OF SAID SECTION 24 TOWNSHIP 1 SOUTH RANGE 7 EAST, BEING MARKED BY A U.S. GLO BRASS CAP 1911, FROM WHICH THE WEST QUARTER CORNER OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 8 EAST, BEING MARKED BY A 1/2 INCH REBAR WITH NO MARKINGS, BEARS NORTH 00 DEGREES 36 MINUTES 56 SECONDS WEST, 377.08 FEET;

THENCE CONTINUING ALONG SAID RANGE LINE, NORTH 00 DEGREES 39 MINUTES 07 SECONDS WEST, 2633.06 FEET TO THE SOUTHEAST CORNER OF SECTION 13, TOWNSHIP 1 SOUTH, RANGE 7 EAST, FROM WHICH THE NORTHWEST CORNER OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 8 EAST, BEING MARKED BY A U.S. GLO BRASS CAP 1911, BEARS NORTH 00 DEGREES 32 MINUTES 24 SECONDS WEST, 384.90 FEET;

THENCE CONTINUING ALONG SAID RANGE LINE, NORTH 00 DEGREES 38 MINUTES 27 SECONDS WEST, 2637.95 FEET TO THE EAST QUARTER CORNER OF SAID SECTION 13, BEING MARKED BY A CITY OF MESA BRASS CAP IN HANDHOLE;

THENCE CONTINUING ALONG SAID RANGE LINE, NORTH 00 DEGREES 37 MINUTES 35 SECONDS WEST, 2637.63 FEET TO THE SOUTHEAST CORNER OF SECTION 12, TOWNSHIP 1 SOUTH, RANGE 7 EAST, BEING MARKED BY A CITY OF MESA BRASS CAP IN A HAND HOLE, FROM WHICH THE SOUTHWEST CORNER OF SECTION 7, TOWNSHIP 1 SOUTH, RANGE 8 EAST, BEARS NORTH 00 DEGREES 39 MINUTES 10 SECONDS WEST, 389.32 FEET, BEING MARKED BY A PK NAIL WITH TAG LS #28237;

THENCE CONTINUING ALONG SAID RANGE LINE, NORTH 00 DEGREES 39 MINUTES 10 SECONDS WEST, 75.01 FEET;

THENCE DEPARTING SAID RANGE LINE, SOUTH 89 DEGREES 37 MINUTES 16 SECONDS EAST, 1403.26 FEET TO THE BEGINNING OF A NON-TANGENT CURVE, CONCAVE EASTERLY, FROM WHICH THE CENTER BEARS SOUTH 87 DEGREES 35 MINUTES 22 SECONDS EAST, 1057.78 FEET;

THENCE ALONG SAID CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 04 DEGREES 03 MINUTES 48 SECONDS, AN ARC LENGTH OF 75.02 FEET TO THE BEGINNING OF A NON-TANGENT CURVE, CONCAVE NORTHWESTERLY, FROM WHICH THE CENTER BEARS NORTH 00 DEGREES 22 MINUTES 44 SECONDS EAST, 10,000 FEET;

THENCE ALONG SAID CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 12 DEGREES 10 MINUTES 01 SECONDS, AN ARC LENGTH OF 2123.54 FEET TO REVERSE CURVE, CONCAVE SOUTHEASTERLY, HAVING A RADIUS OF 10,000 FEET;

THENCE ALONG SAID CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 11 DEGREES 33 MINUTES 00 SECONDS, AN ARC LENGTH OF 2015.84 FEET TO THE NORTH LINE OF SAID SECTION 18;

THENCE NORTH 89 DEGREES 45 MINUTES 42 SECONDS EAST, ALONG SAID NORTH LINE, 703.03 FEET TO THE NORTHWEST CORNER OF SAID SECTION 17, BEING MARKED BY A BRASS CAP IN HAND HOLE;

THENCE NORTH 89 DEGREES 45 MINUTES 01 SECONDS EAST, ALONG THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 17, 2642.26 FEET TO THE NORTH QUARTER CORNER OF SAID SECTION 17, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE NORTH 89 DEGREES 47 MINUTES 05 SECONDS EAST, ALONG THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 17, 2643.87 FEET TO THE NORTHEAST CORNER OF SAID SECTION 17, BEING MARKED BY A BRASS CAP STAMPED "S8/S9/S17/S16 LS #35306";

THENCE SOUTH 00 DEGREES 17 MINUTES 14 SECONDS EAST, ALONG THE EAST LINE OF SAID NORTHEAST QUARTER, 2641.27 FEET TO THE EAST QUARTER CORNER OF SAID SECTION 17;

THENCE SOUTH 00 DEGREES 17 MINUTES 40 SECONDS EAST, ALONG THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 17, 2641.37 FEET TO THE SOUTHEAST CORNER OF SAID SECTION 17, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE SOUTH 00 DEGREES 16 MINUTES 27 SECONDS EAST, ALONG THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20, 2640.94 FEET TO THE EAST QUARTER CORNER OF SAID SECTION 20, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE SOUTH 00 DEGREE 15 MINUTES 27 SECONDS EAST, ALONG THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 20, 2641.55 FEET TO THE SOUTHEAST CORNER OF SAID SECTION 20, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE SOUTH 89 DEGREES 46 MINUTES 57 SECONDS WEST, ALONG THE SOUTH LINE OF SAID SOUTHEAST QUARTER, 2643.35 FEET TO THE SOUTH QUARTER CORNER OF SAID SECTION 20, BEING MARKED BY A U.S. GLO BRASS CAP;

THENCE SOUTH 89 DEGREES 48 MINUTES 18 SECONDS WEST, ALONG THE SOUTH LINE OF THE SOUTHWEST QUARTER OF SAID SECTION 20, 2643.70 FEET TO THE SOUTHEAST CORNER OF SAID SECTION 19, BEING MARKED BY A BRASS CAP IN HAND HOLE;

THENCE SOUTH 89 DEGREES 45 MINUTES 57 SECONDS WEST, ALONG THE SOUTH LINE OF SAID SECTION 19, 702.14 FEET TO THE BEGINNING OF TANGENT CURVE, CONCAVE SOUTHEASTERLY, HAVING A RADIUS OF 10,000 FEET;

THENCE ALONG SAID CURVE TO THE LEFT, THROUGH A CENTRAL ANGLE OF 11 DEGREES 17 MINUTES 44 SECONDS, AN ARC LENGTH OF 1971.47 FEET TO A REVERSE CURVE, CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 10,000 FEET;

THENCE ALONG SAID CURVE TO THE RIGHT, THROUGH A CENTRAL ANGLE OF 11 DEGREES 55 MINUTES 54 SECONDS, AN ARC LENGTH OF 2082.47 FEET;

THENCE NORTH 89 DEGREES 35 MINUTES 53 SECONDS WEST, 1419.06 FEET TO THE POINT OF BEGINNING.

SURVEYOR'S NOTES

1. THIS SURVEY IS BASED ON A COMMITMENT FOR TITLE INSURANCE ISSUED BY FIRST AMERICAN TITLE INSURANCE COMPANY, COMMITMENT NO. NCS-973893-PHX1, EFFECTIVE DATE SEPTEMBER 24, 2019, AT 8:00 AM AS TO THE RECORDS OF THE PINAL COUNTY RECORDER AND AUGUST 30, 2019 AT 7:30 AM AS TO THE RECORDS OF THE ARIZONA STATE LAND DEPARTMENT.
2. IF A DISCREPANCY IS DISCOVERED IN THE TOPOGRAPHY OF THIS MAP, THE SURVEYOR MUST BE CONTACTED TO RESOLVE ANY ISSUES PRIOR TO ANY DESIGN OR CONSTRUCTION.
3. THE LOCATION OF UNDERGROUND UTILITIES AS DEPICTED HEREON IS BASED ON RECOVERABLE FIELD LOCATED SURFACE FEATURES OF THOSE UTILITIES AND SHOULD BE CONSIDERED APPROXIMATE AND POSSIBLY INCOMPLETE. NO EXCAVATIONS WERE MADE TO LOCATE BURIED UTILITIES DURING THE PROGRESS OF OR FOR THE PURPOSE OF THIS SURVEY.
4. THE WORD "CERTIFY" OR "CERTIFICATE" IS AN EXPRESSION OF PROFESSIONAL OPINION REGARDING THE FACTS OF THE SURVEY AND DOES NOT CONSTITUTE A GUARANTEE, EXPRESSED, OR IMPLIED. THE WORD "ENCROACHMENT" IS ALSO AN EXPRESSION OF PROFESSIONAL OPINION REGARDING THE FACTS OF THE SURVEY AND DOES NOT CONSTITUTE A GUARANTEE, EXPRESSED, OR IMPLIED. THE SURVEYOR DOES NOT HAVE PROPER AUTHORITY TO DETERMINE WHETHER OR NOT AN OBJECT IS OR IS NOT AN ENCROACHMENT AND CAN ONLY ATTEST TO THE LOCATION OF SAID OBJECT.
5. UNLESS SHOWN AND LABELED ON SHEET(S) 4-7, THIS SURVEYOR'S ANALYSIS HAS NOT IDENTIFIED ANY APPARENT ENCROACHMENTS.
6. THIS SURVEY DEPICTS THE SAME PARCEL DESCRIBED IN THE LEGAL DESCRIPTION PROVIDED IN THE ABOVE REFERENCED TITLE REPORT.
7. SCHEDULE B ITEMS THAT ARE BLANKET IN NATURE OVER AN ENTIRE SECTION HAVE BEEN NOTED ON SHEETS 4-7 WITH A BOX AROUND THE SCHEDULE B ITEM NUMBER AND PLACED UNDERNEATH THE SECTION CALL-OUT ON SAID SHEETS.
8. THE ORIGINAL RIGHT-OF-WAY FOR IRONWOOD ROAD AS REFERENCED IN INSTRUMENT NO. 2008-76344, P.C.R. IS SHOWN ON SHEETS 4-5. ADDITIONAL RIGHT-OF-WAY FOR IMPROVEMENTS ARE INCLUDED IN 2016-76684, P.C.R., 2016-75097, P.C.R., 2017-18728, P.C.R. & 2017-22458, P.C.R. BUT DO NOT HAVE SUFFICIENT INFORMATION TO BE PLOTTED AND SHOWN HEREON.
9. DRAINAGE CHANNEL NOTE: SCHEDULE B ITEM 42 – RW FILE 09-3681 PROVIDES A BLANKET RIGHT OF WAY FOR DRAINAGE TO MARICOPA COUNTY FLOOD CONTROL DISTRICT. IN 2011 A QUIT CLAIM DEED, 2011-62136, WAS RECORDED WHICH RELINQUISHED THE FLOOD CONTROL DISTRICT'S RIGHTS TO MUCH OF THE LAND PREVIOUSLY INCLUDED IN THE RW FILE. IN THIS AREA, THE QUIT CLAIM DEED MAKES REFERENCE TO THE POWERLINE FLOODWAY CHANNEL, BEING 266 FEET WIDE; HOWEVER, NO INFORMATION HAS BEEN PROVIDED SHOWING THE EXTENTS OF SAID POWERLINE FLOODWAY CHANNEL. THE LOCATION OF THE RIGHTS SHOWN ON SHEETS 4-7 OF THIS SURVEY ARE BASED ON THE PHYSICAL EVIDENCE OF A CHANNEL, WHICH COINCIDES WITH THE RECORD LOCATION OF SCHEDULE B ITEM #15 (DOCKET 472, PAGE 314) IN SECTION 17. THE NORTH LINE OF SCHEDULE B ITEM #15 HAS BEEN EXTENDED THROUGH SECTION 18 AND 19 AND OFFSET 266 FEET TO THE SOUTHEAST.
10. TABLE A ITEM #11. THIS IS AN ABOVE GROUND SURVEY. FIELD LOCATED VISIBLE SURFACE FEATURES OF EXISTING UTILITIES ARE SHOWN. UNDERGROUND UTILITIES HAVE NOT BEEN LOCATED.

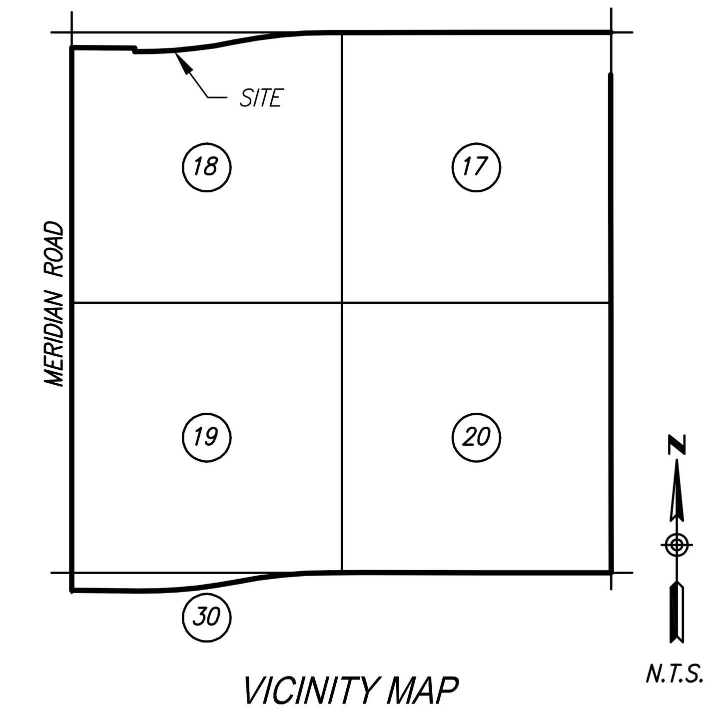
SHEET INDEX

OWNERS

STATE OF ARIZONA

SURVEYOR

HUBBARD ENGINEERING
1201 S. ALMA SCHOOL RD. SUITE #12000
MESA, AZ 85210
PHONE: (480) 892-3313
FAX: (480) 892-7051
CONTACT: ADRIAN BURCHAM, PLS



VICINITY MAP

T1S, R8E, SEC 17, 18, 19, 20 & 30

PARCEL AREA

GROSS AREA: 121,232,960 SQ. FT. OR 2,783.13 AC. ±
IRONWOOD RW: 1,561,909 SQ. FT. OR 35.86 AC. ±
MERIDIAN RW: 779,570 SQ. FT. OR 17.90 AC. ±
RAY RW: 859,683 SQ. FT. OR 19.74 AC. ±
ELLIOT RW: 969,927 SQ. FT. OR 22.27 AC. ±
NET AREA: 117,061,871 SQ. FT. OR 2,687.37 AC. ±

BASIS OF BEARINGS

THE NORTH LINE OF SECTION 18, TOWNSHIP 1 SOUTH, RANGE 8 EAST OF THE GILA AND SALT RIVER MERIDIAN, MARICOPA COUNTY, ARIZONA.
MEASURED BEARING=S89°45'42"W

SURVEYOR'S CERTIFICATION

THE UNDERSIGNED HEREBY CERTIFIES TO THE STATE OF ARIZONA; AND FIRST AMERICAN TITLE INSURANCE COMPANY, THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1, 2, 4, 11 & 13 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON 09/20/19.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
41282
ADRIAN M.
BURCHAM
Date Signed 10/07/19
ARIZONA U.S.A.

SIGNATURE

ADRIAN M. BURCHAM
PRINTED NAME
REGISTRATION/LICENSE NO. 41282

DATE: 10/07/19

1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313

HUBBARD
ENGINEERING
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

Date 10/07/19	Project Eng.
Project No. 19123	Project Manager ADRIAN BURCHAM

P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 08, 2019 - 11:09am RMontiel

SCHEDULE "B" ITEMS PER TITLE COMMITMENT NO. NCS-973893-PHX1

8. TAXES FOR THE FULL YEAR OF 2019.
(THE FIRST HALF IS DUE OCTOBER 1, 2019 AND IS DELINQUENT NOVEMBER 1, 2019. THE SECOND HALF IS DUE MARCH 1, 2020 AND IS DELINQUENT MAY 1, 2020.)

9. ANY ADDITIONAL TAXES WHICH MAY BECOME A LIEN BY REASON OF THE COUNTY ASSESSOR REASSESSING THE WITHIN DESCRIBED PREMISES FOR THE YEAR(S) 2019.

10. RESERVATIONS OR EXCEPTIONS IN PATENTS, OR IN ACTS AUTHORIZING THE ISSUANCE THEREOF.

11. RIGHT-OF-WAY NO. 65-000034 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO UNITED STATES OF AMERICA FOR ELECTRIC TRANSMISSION LINE AND HAVING A TERM OF PERPETUAL DURATION.
THEREAFTER CONTRACT AND GRANT OF EASEMENT RECORDED AUGUST 30, 1950 IN DOCKET 31, PAGE 436.
AFFECTS SECTIONS 19, 30 AND OTHER PROPERTY

12. RESOLUTION ESTABLISHING COUNTY ROAD RECORDED MARCH 27, 1956 IN DOCKET 148, PAGE 513.
SECTIONS 17 THROUGH 20, 30 AND OTHER PROPERTY

13. RIGHT-OF-WAY NO. 09-2341 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO PINAL COUNTY BOARD OF SUPERVISORS FOR HIGHWAY AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF WHICH RECORDED IN DOCKET 256, PAGE 16.
THEREAFTER AMENDMENT DATED FEBRUARY 26, 2008, A COPY OF WHICH IS ATTACHED TO PINAL COUNTY RESOLUTION 070908-SLD RECORDED JULY 11, 2008 AS 2008-65670 OF OFFICIAL RECORDS.
THEREAFTER AMENDMENT DATED JULY 21, 2014, A COPY OF WHICH IS ATTACHED TO RESOLUTION 08-2014_RD 14-014 OF PINAL COUNTY RECORDED AUGUST 26, 2014 AS 2014-49304 OF OFFICIAL RECORDS.
SECTION 30 AND OTHER PROPERTY

14. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PERMANENT EASEMENT" RECORDED JUNE 1, 1966 IN DOCKET 451, PAGE 64 AND RE-RECORDED DECEMBER 19, 1966 IN DOCKET 479, PAGE 415.
SECTION 17, 18

15. EASEMENTS FOR FLOOD CONTROL AND RIGHTS INCIDENT THERETO AS DISCLOSED BY RESOLUTION OF THE PINAL COUNTY BOARD OF SUPERVISORS, NOVEMBER 7, 1066, IN BOOK 472, PAGE 314.
SECTION 17

16. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PERMANENT EASEMENT" RECORDED NOVEMBER 7, 1966 IN DOCKET 472, PAGE 319.
SECTION 19

17. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "AGREEMENT" RECORDED DECEMBER 8, 1966 IN DOCKET 478, PAGE 94. BY AND BETWEEN THE MOUNTAIN STATES TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION AND FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
SECTION 19

18. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

19. AN EASEMENT FOR GAS LINES AND INCIDENTAL PURPOSES IN THE DOCUMENT RECORDED IN DOCKET 524, PAGE 51.
AFFECTS SECTION 19

20. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PERMANENT EASEMENT" RECORDED JUNE 7, 1097 IN DOCKET 825, PAGE 288.
AFFECTS SECTION 19

21. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PERMANENT EASEMENT" RECORDED JUNE 7, 1976 IN DOCKET 825, PAGE 292.
SECTION 19

22. RIGHT-OF-WAY NO. 05-000026 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO JP CATTLE CO LLC FOR GRAZING AND HAVING A TERM WHICH EXPIRES DECEMBER 30, 2024.
AFFECTS SECTIONS 19, 30 AND OTHER PROPERTY

23. RIGHT-OF-WAY NO. 05-349-00 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO KEITH M. FLAKE, A MARRIED PERSON FOR GRAZING AND HAVING A TERM WHICH EXPIRES DECEMBER 30, 2027.
AFFECTS SECTIONS 16, 17, 20 AND OTHER PROPERTY

24. RIGHT-OF-WAY NO. 09-001371 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO PINAL COUNTY FOR HIGHWAY AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF WHICH RECORDED NOVEMBER 25, 1991, IN DOCKET 1091, PAGE 394.
(AFFECTS ALL PARCELS)

25. RIGHT-OF-WAY NO. 09-002458 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO PINAL COUNTY BOARD OF SUPERVISORS FOR HIGHWAY AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF WHICH RECORDED IN DOCKET 265, PAGE 179.
AFFECTS SECTION 19, 30

26. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

27. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

28. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

29. SPECIAL LAND USE PERMIT NO. 23-106799 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO ET MOTORSPORTS LLC FOR MOTORCROSS TRACK AND FACILITIES AND HAVING A TERM WHICH EXPIRES APRIL 3, 2019.
AMENDMENT DATED AUGUST 3, 2010.
SAID DOCUMENT IS STILL SHOWING AS ACTIVE. A COPY OF ANY EXTENSION IS NOT YET AVAILABLE.
ALSO AS SET FORTH IN PINAL COUNTY ARIZONA SPECIAL USE PERMIT CASE NO. SUP-021-01 RECORDED JANUARY 14, 2002 AS 2002-001694 OF OFFICIAL RECORDS AND RECORDED FEBRUARY 14, 2002 AS 2002-7538 OF OFFICIAL RECORDS AND CASE NO SUP-002-10 RECORDED DECEMBER 8, 2010 AS 2010-113585 OF OFFICIAL RECORDS.
AFFECTS SECTION 30

30. RIGHT-OF-WAY NO. 18-107826 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO ET MOTORSPORTS, L.L.C., FOR WATER DISTRIBUTION LINE AND HAVING A TERM WHICH EXPIRES ON APRIL 3, 2019.
SAID DOCUMENT IS STILL SHOWING AS ACTIVE. A COPY OF ANY EXTENSION IS NOT YET AVAILABLE.
AFFECTS SECTION 30

31. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

32. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "DESERT WELLS MULTI-USE AREA MANAGEMENT & PARTNERSHIP TEAM, AS DISCLOSED BY MEMORANDUM OF UNDERSTANDING 56-109245 BY AND BETWEEN THE ARIZONA STATE LAND DEPARTMENT AND DESERT WELLS MULTI-USE AREA MANAGEMENT & PARTNERSHIP TEAM, AS DISCLOSED BY A SEARCH OF THE RECORDS OF THE ARIZONA STATE LAND DEPARTMENT.

SCHEDULE "B" ITEMS PER TITLE COMMITMENT NO. NCS-973893-PHX1

33. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

34. RIGHT OF WAY FOR IRONWOOD/GANTZEL ROAD AS DISCLOSED BY RESOLUTION RECORDED NOVEMBER 16, 2004 AS 2004-93152 OF OFFICIAL RECORDS.
AFFECTS SECTIONS 17 THROUGH 20, 30 AND OTHER PROPERTY

35. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

36. RIGHT-OF-WAY NO. 14-110140 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO SALT RIVER PROJECT AND AGRICULTURAL IMPROVEMENT AND POWER DISTRICT FOR OVERHEAD DOUBLE CIRCUIT 500KV /120KV TRANSMISSION LINES AND HAVING A TERM WHICH EXPIRES OCTOBER 12, 2056.
A COPY OF WHICH RECORDED APRIL 19, 2007 AS 2007-46938 OF OFFICIAL RECORDS.
AFFECTS SECTION 17 AND OTHER PROPERTY

37. RIGHT-OF-WAY NO. 16-111118 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO DESERT COMMUNITIES, INC., A NEVADA CORPORATION FOR FLOOD WATER COLLECTION AND DETENTION FACILITIES AND HAVING A TERM OF PERPETUAL DURATION.
THEREAFTER ASSIGNED TO FLOOD CONTROL DISTRICT OF MARICOPA COUNTY DATED FEBRUARY 20, 2007.
THEREAFTER AMENDMENT DATED AUGUST 23, 2011 AND ANOTHER AMENDMENT DATED AUGUST 23, 2011.
AFFECTS SECTION 18 AND OTHER PROPERTY

38. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

39. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

40. RIGHT-OF-WAY NO. 18-108362 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO MEDIACOM ARIZONA, LLC, A DELAWARE LIMITED LIABILITY COMPANY FOR FIBER OPTICS AND HAVING A TERM WHICH EXPIRED ON APRIL 26, 2016.
SAID DOCUMENT IS STILL SHOWING AS ACTIVE. A COPY OF ANY EXTENSION IS NOT YET AVAILABLE.
AFFECTS SECTIONS 17, 20 AND OTHER PROPERTY

41. RIGHT-OF-WAY NO. 18-110900 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO WATER UTILITIES COMMUNITY FACILITIES DISTRICT DBA APACHE JUNCTION WATER COMPANY FOR WATER LINE AND HAVING A TERM WHICH EXPIRES JANUARY 13, 2016.
SAID DOCUMENT IS STILL SHOWING AS ACTIVE. A COPY OF ANY EXTENSION IS NOT YET AVAILABLE.
AFFECTS SECTIONS 17, 20, AND 30 AND OTHER PROPERTY

42. RIGHT-OF-WAY NO. 09-3681 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO FLOOD CONTROL DISTRICT OF MARICOPA COUNTY FOR FLOOD CONTROL FACILITIES AND HAVING A TERM OF PERPETUAL DURATION.
THEREAFTER AMENDMENT TO RIGHT OF WAY DATED OCTOBER 11, 2011.
DEED REFERENCED THEREIN IS RECORDED AS 2011-62136 OF OFFICIAL RECORDS.
AFFECTS SECTIONS 17, 18, 19 AND OTHER PROPERTY

43. SPECIAL LAND USE PERMIT NO. 23-101045-26 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO EAST VALLEY AVIATORS, INC FOR RADIO-CONTROLLED AIRCRAFT PARK AND HAVING A TERM WHICH EXPIRES OCTOBER 11, 2022.
AFFECTS SECTION 20

44. RIGHT-OF-WAY NO. 16-105661 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO MARICOPA COUNTY FOR STORM DRAIN PIPES AND HEAD WALLS AND HAVING A TERM OF PERPETUAL DURATION.
AFFECTS SECTION 18

45. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PINAL COUNTY ORDINANCE NO. 121207-AQ1" RECORDED JANUARY 8, 2008, AS 2008-1862 OF OFFICIAL RECORDS.
(AFFECTS ALL PARCELS)

46. RIGHT-OF-WAY NO. 16-110965 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO CITY OF MESA FOR UNDERGROUND WATER TRANSMISSION LINES AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF WHICH RECORDED JANUARY 28, 2008 AS 2008-7616 OF OFFICIAL RECORDS.
AMENDMENT DATED JANUARY 19, 2012 RECORDED MARCH 23, 2012 AS 2012-23559 OF OFFICIAL RECORDS.
AFFECTS SECTIONS 17 & 18 AND OTHER PROPERTY

47. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

48. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

49. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

50. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

51. RIGHT-OF-WAY NO. 16-110357 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO PINAL COUNTY FOR PUBLIC ROADWAY AND HAVING A TERM OF PERPETUAL DURATION.
A COPY OF SAID RIGHT OF WAY IS ATTACHED TO PINAL COUNTY RESOLUTION ACCEPTING A RIGHT OF WAY RECORDED AUGUST 12, 2008 AS 2008-76344 OF OFFICIAL RECORDS.
ASSIGNED TO CITY OF APACHE JUNCTION BY ASSIGNMENT DATED MARCH 5, 2012.
AMENDMENT DATED NOVEMBER 1, 2016 RECORDED NOVEMBER 14, 2016 AS 2016-76684 OF OFFICIAL RECORDS AND A COPY OF WHICH IS ATTACHED TO PINAL COUNTY RESOLUTION RECORDED NOVEMBER 7, 2016 AS 2016-75097 OF OFFICIAL RECORDS.
AMENDMENT DATED MARCH 8, 2017 RECORDED MARCH 20, 2017 AS 2017-18728 OF OFFICIAL RECORDS AND A COPY OF WHICH IS ATTACHED TO PINAL COUNTY RESOLUTION RECORDED MARCH 31, 2017 AS 2017-22458 OF OFFICIAL RECORDS.
AMENDMENT DATED JUNE 6, 2018 RECORDED JUNE 19, 2018 AS 2018-45911 OF OFFICIAL RECORDS.
AFFECTS SECTIONS 17, 18, 19, 20, 30 AND OTHER PROPERTY

52. RIGHT-OF-WAY NO. 18-118098 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO MARICOPA COUNTY FOR DRAINAGE FACILITIES AND HAVING A TERM WHICH EXPIRES JANUARY 6, 2026.
AFFECTS SECTION 19

53. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

54. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

55. ALL MATTERS AS SET FORTH IN RECORD OF SURVEY, RECORDED JUNE 30, 2010 AS RECORD OF SURVEY NO. 2010-61925 OF OFFICIAL RECORDS.
(AFFECTS ALL PARCELS)

56. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

57. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

58. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

SCHEDULE "B" ITEMS PER TITLE COMMITMENT NO. NCS-973893-PHX1

59. RIGHT-OF-WAY NO. 18-104730 GRANTED BY THE ARIZONA STATE LAND DEPARTMENT TO CHI CONSTRUCTION COMPANY FOR DRAINAGE DITCH, WING DIKES, AND BOX CULVERTS AND HAVING A TERM WHICH EXPIRES OCTOBER 7, 2019.
AFFECTS SECTION 18 AND OTHER PROPERTY

60. ALL MATTERS AS SET FORTH IN PINAL COUNTY RESOLUTION NO PZ-PA-006-11-B, RECORDED FEBRUARY 13, 2012 AS 2012-11130 OF OFFICIAL RECORDS.
AFFECTS ALL PARCELS

61. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

62. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

63. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

64. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "CENTRAL ARIZONA WATER CONSERVATION DISTRICT CENTRAL ARIZONA PROJECT LAND USE LICENSE" RECORDED JUNE 1, 2015 AS 2015-35563 OF OFFICIAL RECORDS.
(AFFECTS ALL PARCELS)

65. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

66. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

67 THIS ITEM HAS BEEN INTENTIONALLY DELETED.

68. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

69. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

70. THE TERMS AND PROVISIONS CONTAINED IN THE DOCUMENT ENTITLED "PRE-ANNEXATION DEVELOPMENT AGREEMENT" RECORDED MAY 30, 2019 AS 2019-42122 OF OFFICIAL RECORDS.
(AFFECTS ALL PARCELS)

71. ANY CLAIM THAT THE TITLE IS SUBJECT TO A TRUST OR LIEN CREATED UNDER THE PERISHABLE AGRICULTURAL COMMODITIES ACT, 1930 (7 U.S.C. §§499A, ET SEQ.) OR THE PACKERS AND STOCKYARDS ACT (7 U.S.C. §§181 ET SEQ.) OR UNDER SIMILAR STATE LAWS.

72. ANY FACTS, RIGHTS, INTERESTS OR CLAIMS WHICH WOULD BE DISCLOSED BY A CORRECT ALTA/NSPS SURVEY.

73. THE RIGHTS OF PARTIES IN POSSESSION BY REASON OF ANY UNRECORDED LEASE OR LEASES OR MONTH TO MONTH TENANCIES AFFECTING ANY PORTION OF THE WITHIN DESCRIBED PROPERTY.
NOTE: THIS MATTER WILL BE MORE FULLY SET FORTH OR DELETED UPON COMPLIANCE WITH THE APPLICABLE REQUIREMENT(S) SET FORTH HEREIN.

74. WATER RIGHTS, CLAIMS OR TITLE TO WATER, WHETHER OR NOT SHOWN BY THE PUBLIC RECORDS.
(AFFECTS ALL PARCELS)

75. THIS ITEM HAS BEEN INTENTIONALLY DELETED.

76. NO LIABILITY IS ASSUMED FOR THE ACCURACY OR COMPLETENESS OF ANY MAP OR LEGAL DESCRIPTION PROVIDED IN RELATION TO ANY STATE LAND RIGHT OF WAY, PERMIT OR LEASE SET FORTH IN SCHEDULE B HEREIN. ANY COPIES FURNISHED ARE AS A COURTESY ONLY.

⬡ = INDICATES SCHEDULE B ITEMS SHOWN ON SHEETS 4-7.
◯ = INDICATES SCHEDULE B ITEM "NOT PLOTTABLE" - BUT AFFECTS THE PROPERTY
□ = INDICATES SCHEDULE B ITEM "BLANKET EASEMENT" - BUT AFFECTS THE PROPERTY

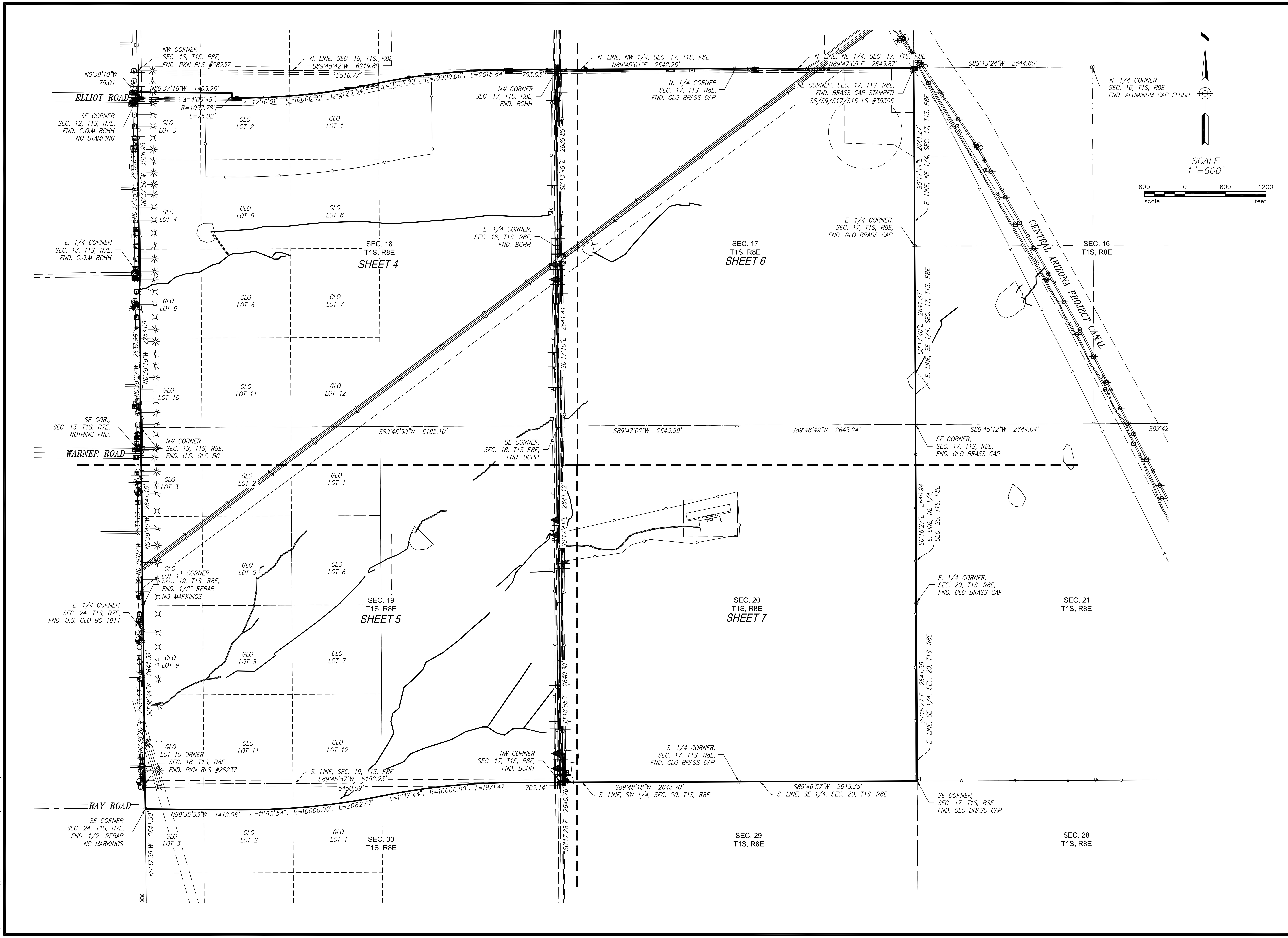
1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313

HUBBARD
ENGINEERING
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR
41282
ADRIAN M.
BURCHAM
ARIZONA U.S.A.

Date 10/07/19
Project Eng.
Project No. 19123
Project Manager ADRIAN BURCHAM



P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 07, 2019 - 1:48pm RMontiel

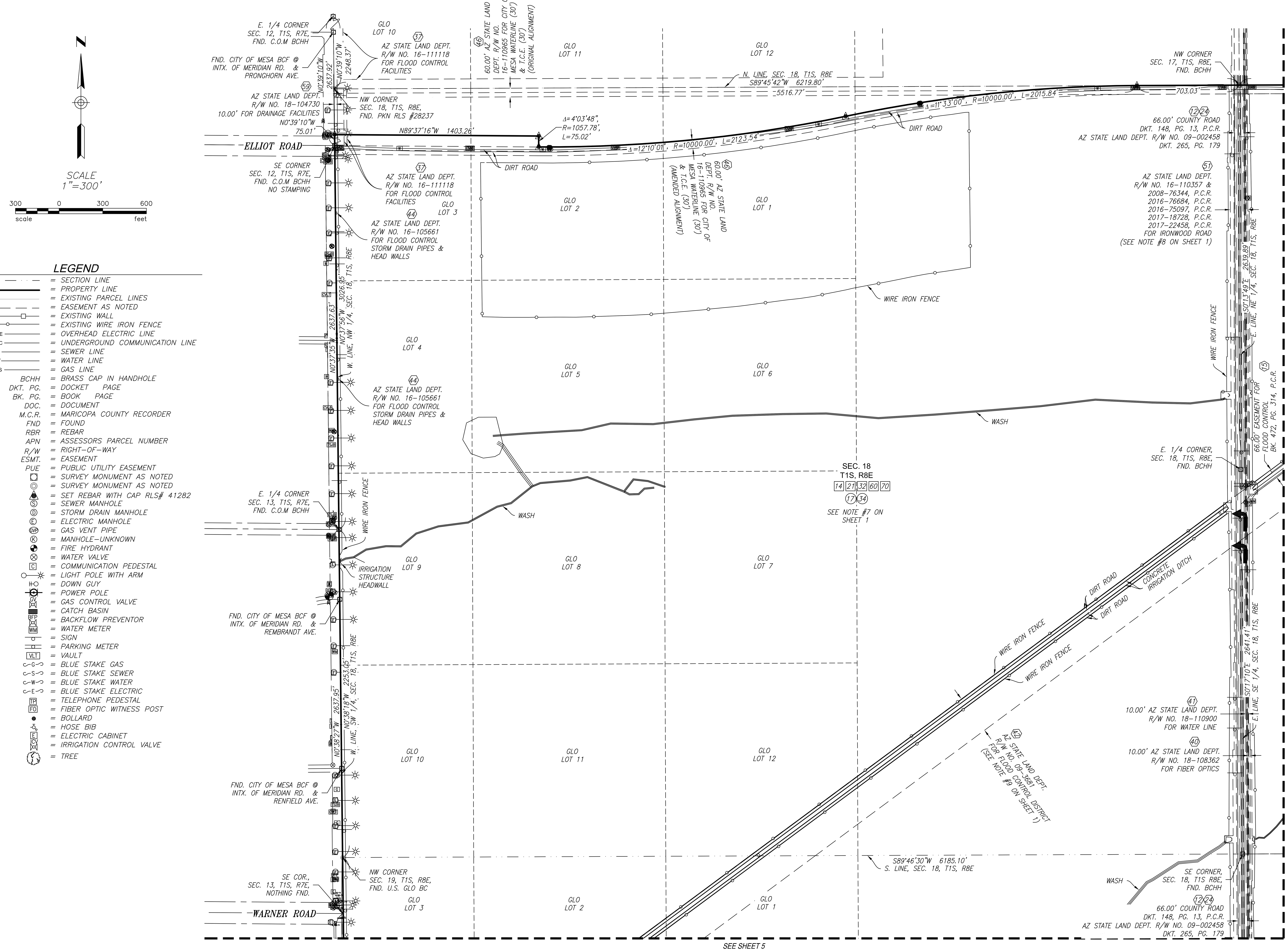
HUBBARD
ENGINEERING
1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR
41282
ADRIAN M.
BURCHAM
ARIZONA U.S.A.

Date 10/07/19
Project Eng.
Project No. 19123
Project Manager ADRIAN BURCHAM

Sht: 3 of 7



LEGEND

- = SECTION LINE
- = PROPERTY LINE
- = EXISTING PARCEL LINES
- = EASEMENT AS NOTED
- = EXISTING WALL
- = EXISTING WIRE IRON FENCE
- OHE = OVERHEAD ELECTRIC LINE
- UGC = UNDERGROUND COMMUNICATION LINE
- S = SEWER LINE
- W = WATER LINE
- GAS = GAS LINE
- BCHH = BRASS CAP IN HANDHOLE
- DKT. PG. = DOCKET PAGE
- BK. PG. = BOOK PAGE
- DOC. = DOCUMENT
- M.C.R. = MARICOPA COUNTY RECORDER
- FND = FOUND
- RBR = REBAR
- APN = ASSESSORS PARCEL NUMBER
- R/W = RIGHT-OF-WAY
- ESMT. = EASEMENT
- PUE = PUBLIC UTILITY EASEMENT
- = SURVEY MONUMENT AS NOTED
- = SURVEY MONUMENT AS NOTED
- = SET REBAR WITH CAP RLS# 41282
- = SEWER MANHOLE
- = STORM DRAIN MANHOLE
- = ELECTRIC MANHOLE
- = GAS VENT PIPE
- = MANHOLE-UNKNOWN
- = FIRE HYDRANT
- = WATER VALVE
- = COMMUNICATION PEDESTAL
- = LIGHT POLE WITH ARM
- = DOWN GUY
- = POWER POLE
- = GAS CONTROL VALVE
- = CATCH BASIN
- = BACKFLOW PREVENTOR
- = WATER METER
- = SIGN
- = PARKING METER
- VLT = VAULT
- = BLUE STAKE GAS
- = BLUE STAKE SEWER
- = BLUE STAKE WATER
- = BLUE STAKE ELECTRIC
- TP = TELEPHONE PEDESTAL
- FO = FIBER OPTIC WITNESS POST
- = BOLLARD
- = HOSE BIB
- E = ELECTRIC CABINET
- = IRRIGATION CONTROL VALVE
- = TREE

HUBBARD ENGINEERING

1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313

www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR
41282
ADRIAN M. BURCHAM
ARIZONA U.S.A.

Date 10/07/19	Project Eng.
Project No. 19123	Project Manager ADRIAN BURCHAM

Sht: 4 of 7

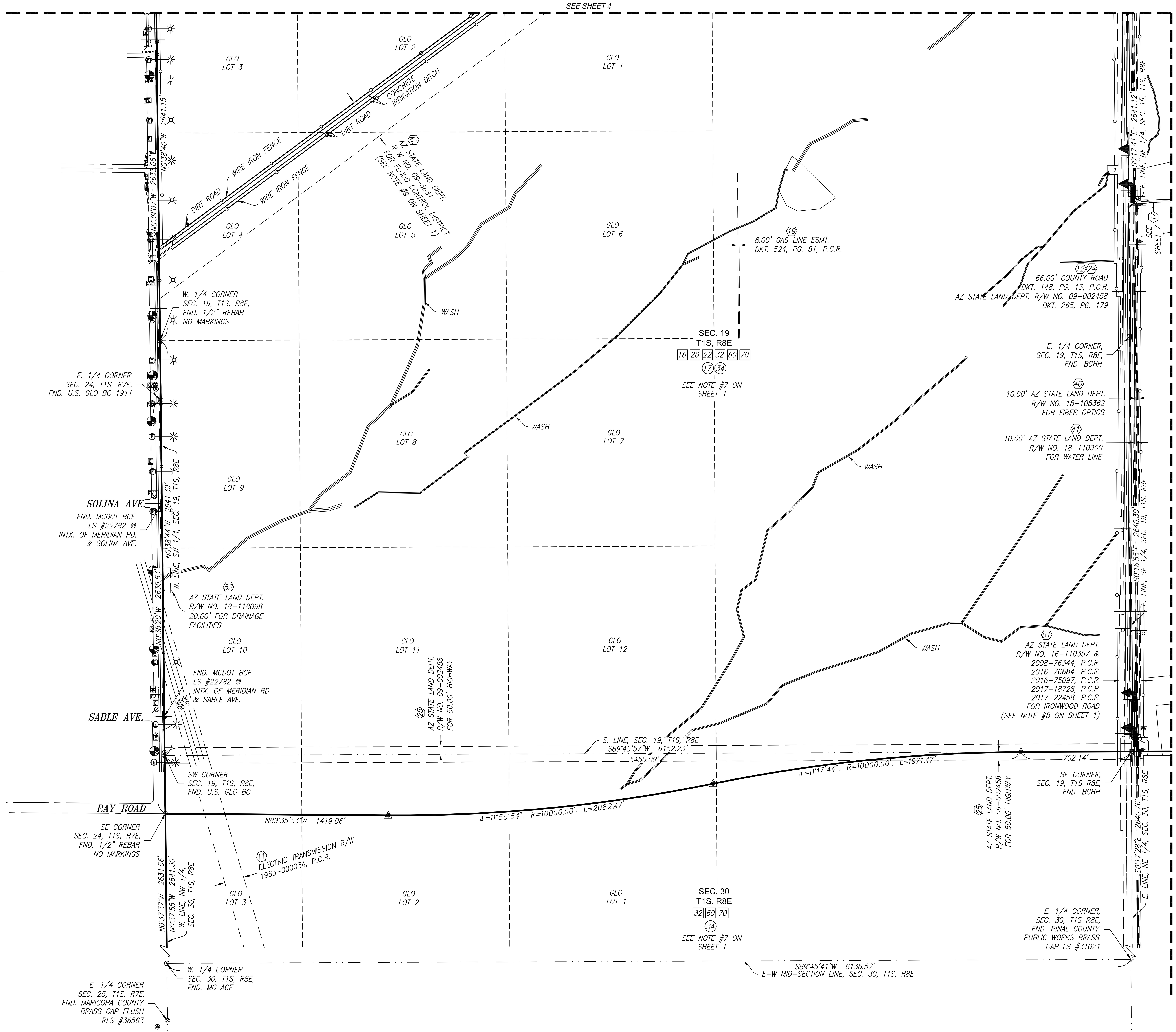
P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 07, 2019 - 1:49pm RMontiel

SCALE
1"=300'

300 0 300
scale feet

LEGEND

	= SECTION LINE
	= PROPERTY LINE
	= EXISTING PARCEL LINES
	= EASEMENT AS NOTED
	= EXISTING WALL
	= EXISTING WROUGHT IRON FENCE
OHE	= OVERHEAD ELECTRIC LINE
UGC	= UNDERGROUND COMMUNICATION LINE
S	= SEWER LINE
W	= WATER LINE
GAS	= GAS LINE
BCHH	= BRASS CAP IN HANDHOLE
DKT. PG.	= DOCKET PAGE
BK. PG.	= BOOK PAGE
DOC.	= DOCUMENT
M.C.R.	= MARICOPA COUNTY RECORDER
FND	= FOUND
RBR	= REBAR
APN	= ASSESSORS PARCEL NUMBER
R/W	= RIGHT-OF-WAY
ESMT.	= EASEMENT
PUE	= PUBLIC UTILITY EASEMENT
	= SURVEY MONUMENT AS NOTED
	= SURVEY MONUMENT AS NOTED
	= SET REBAR WITH CAP RLS# 41282
S	= SEWER MANHOLE
D	= STORM DRAIN MANHOLE
E	= ELECTRIC MANHOLE
GVP	= GAS VENT PIPE
K	= MANHOLE-UNKNOWN
	= FIRE HYDRANT
	= WATER VALVE
C	= COMMUNICATION PEDESTAL
	= LIGHT POLE WITH ARM
	= DOWN GUY
	= POWER POLE
	= GAS CONTROL VALVE
	= CATCH BASIN
BFP	= BACKFLOW PREVENTOR
WM	= WATER METER
	= SIGN
	= PARKING METER
VLT	= VAULT
G	= BLUE STAKE GAS
S	= BLUE STAKE SEWER
W	= BLUE STAKE WATER
E	= BLUE STAKE ELECTRIC
TP	= TELEPHONE PEDESTAL
FO	= FIBER OPTIC WITNESS POST
	= BOLLARD
	= HOSE BIB
E	= ELECTRIC CABINET
	= IRRIGATION CONTROL VALVE
	= TREE



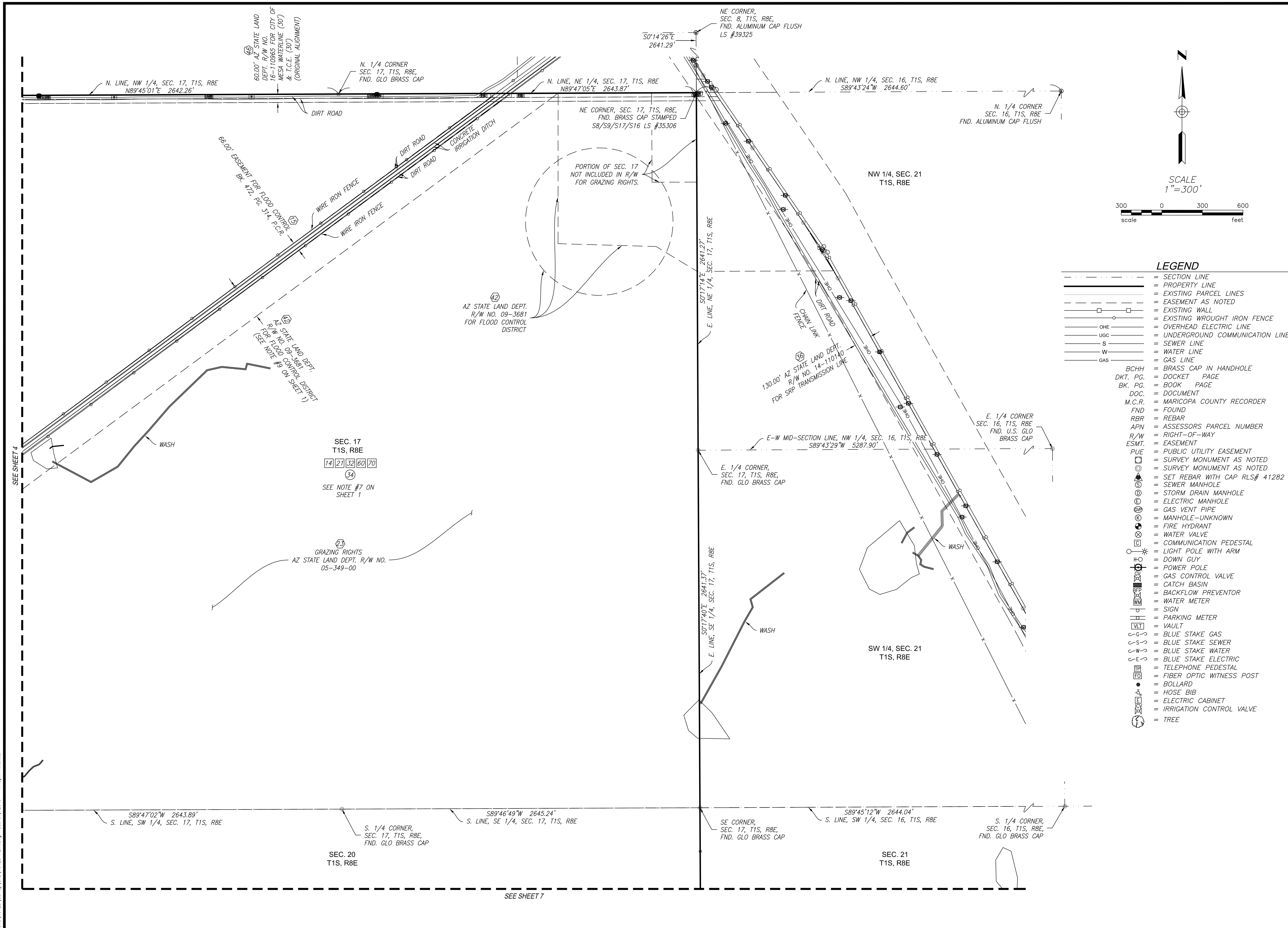
P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 07, 2019 - 1:49pm RMontiel

HUBBARD ENGINEERING
1201 S. Alma School Rd. Suite 12000 Mesa, AZ 85210 Ph: 480.892.3313
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR 41282 ADRIAN M. BURCHAM ARIZONA, U.S.A.

Project No. 19123	Date 10/07/19
Project Manager ADRIAN BURCHAM	Project Eng.



P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 07, 2019 – 1:49pm RMontiel

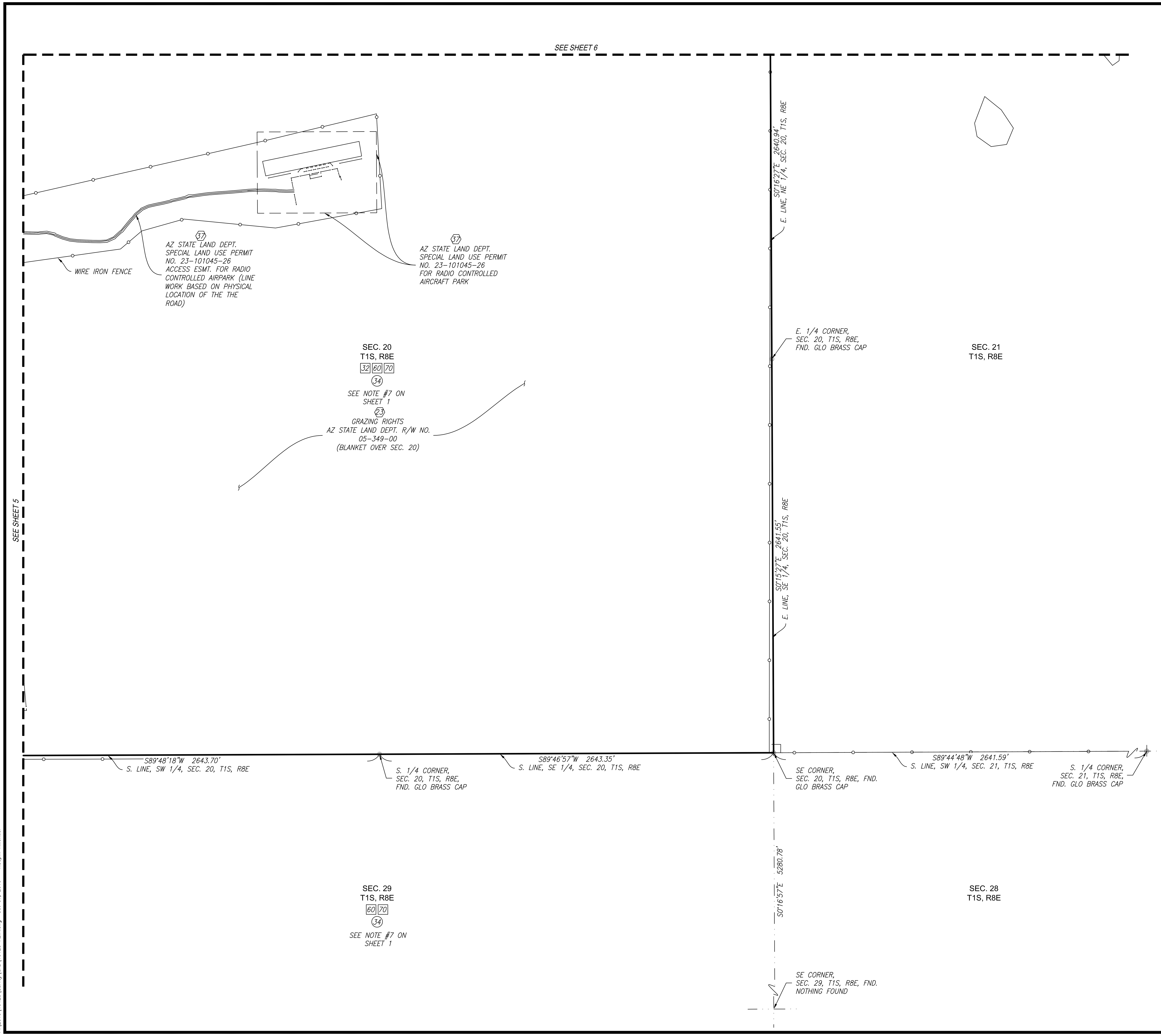
1201 S. Alma School Rd. Suite 12000 Mesa, AZ 85210 Ph: 480.892.3313

HUBBARD ENGINEERING
www.hubbardengineering.com

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR 41282 ADRIAN M. BURCHAM ARIZONA, U.S.A.

Date 10/07/19
Project Eng.
Project No. 19123
Project Manager ADRIAN BURCHAM



N

SCALE
1"=300'

300 0 300
scale feet

LEGEND

= SECTION LINE
= PROPERTY LINE
= EXISTING PARCEL LINES
= EASEMENT AS NOTED
= EXISTING WALL
= EXISTING WROUGHT IRON FENCE
OHE = OVERHEAD ELECTRIC LINE
UGC = UNDERGROUND COMMUNICATION LINE
S = SEWER LINE
W = WATER LINE
GAS = GAS LINE
BCHH = BRASS CAP IN HANDHOLE
DKT. PG. = DOCKET PAGE
BK. PG. = BOOK PAGE
DOC. = DOCUMENT
M.C.R. = MARICOPA COUNTY RECORDER
FND = FOUND
RBR = REBAR
APN = ASSESSORS PARCEL NUMBER
R/W = RIGHT-OF-WAY
ESMT. = EASEMENT
PUE = PUBLIC UTILITY EASEMENT
= SURVEY MONUMENT AS NOTED
= SURVEY MONUMENT AS NOTED
= SET REBAR WITH CAP RLS# 41282
= SEWER MANHOLE
= STORM DRAIN MANHOLE
= ELECTRIC MANHOLE
= GAS VENT PIPE
= MANHOLE-UNKNOWN
= FIRE HYDRANT
= WATER VALVE
= COMMUNICATION PEDESTAL
= LIGHT POLE WITH ARM
= DOWN GUY
= POWER POLE
= GAS CONTROL VALVE
= CATCH BASIN
= BACKFLOW PREVENTOR
WM = WATER METER
= SIGN
= PARKING METER
VLT = VAULT
G = BLUE STAKE GAS
S = BLUE STAKE SEWER
W = BLUE STAKE WATER
E = BLUE STAKE ELECTRIC
TP = TELEPHONE PEDESTAL
FO = FIBER OPTIC WITNESS POST
= BOLLARD
= HOSE BIB
E = ELECTRIC CABINET
= IRRIGATION CONTROL VALVE
= TREE

HUBBARD
ENGINEERING
www.hubbardengineering.com

1201 S. Alma School Rd.
Suite 12000
Mesa, AZ 85210
Ph: 480.892.3313

LOST DUTCHMAN
ALTA/NSPS LAND TITLE SURVEY
Pinal County, Arizona

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
41282
ADRIAN M.
BURCHAM
ARIZONA U.S.A.

Date
10/07/19

Project Eng.

Project No.
19123

Project Manager
ADRIAN BURCHAM

Sht: 7 of 7

P:\2019\19123\Survey\CAD\19123-ALTA.dwg Oct 07, 2019 - 1:50pm RMontiel

First American **Commitment**	ALTA Commitment for Title Insurance ISSUED BY **First American Title Insurance Company** File No: NCS-973893-PHX1

COMMITMENT FOR TITLE INSURANCE

Issued By

FIRST AMERICAN TITLE INSURANCE COMPANY

NOTICE

IMPORTANT-READ CAREFULLY: THIS COMMITMENT IS AN OFFER TO ISSUE ONE OR MORE TITLE INSURANCE POLICIES. ALL CLAIMS OR REMEDIES SOUGHT AGAINST THE COMPANY INVOLVING THE CONTENT OF THIS COMMITMENT OR THE POLICY MUST BE BASED SOLELY IN CONTRACT.

THIS COMMITMENT IS NOT AN ABSTRACT OF TITLE, REPORT OF THE CONDITION OF TITLE, LEGAL OPINION, OPINION OF TITLE, OR OTHER REPRESENTATION OF THE STATUS OF TITLE. THE PROCEDURES USED BY THE COMPANY TO DETERMINE INSURABILITY OF THE TITLE, INCLUDING ANY SEARCH AND EXAMINATION, ARE PROPRIETARY TO THE COMPANY, WERE PERFORMED SOLELY FOR THE BENEFIT OF THE COMPANY, AND CREATE NO EXTRACONTRACTUAL LIABILITY TO ANY PERSON, INCLUDING A PROPOSED INSURED.

THE COMPANY'S OBLIGATION UNDER THIS COMMITMENT IS TO ISSUE A POLICY TO A PROPOSED INSURED IDENTIFIED IN SCHEDULE A IN ACCORDANCE WITH THE TERMS AND PROVISIONS OF THIS COMMITMENT. THE COMPANY HAS NO LIABILITY OR OBLIGATION INVOLVING THE CONTENT OF THIS COMMITMENT TO ANY OTHER PERSON.

COMMITMENT TO ISSUE POLICY

Subject to the Notice; Schedule B, Part I-Requirements; Schedule B, Part II-Exceptions; and the Commitment Conditions, ***First American Title Insurance Company***, a Nebraska Corporation (the "Company"), commits to issue the Policy according to the terms and provisions of this Commitment. This Commitment is effective as of the Commitment Date shown in Schedule A for each Policy described in Schedule A, only when the Company has entered in Schedule A both the specified dollar amount as the Proposed Policy Amount and the name of the Proposed Insured.

If all of the Schedule B, Part I-Requirements have not been met within six months after the Commitment Date, this Commitment terminates and the Company's liability and obligation end.

First American Title Insurance Company

Dennis J. Gilmore
President

Jeffrey S. Robinson
Secretary

If this jacket was created electronically, it constitutes an original document.

This page is only a part of a 2016 ALTA® Commitment for Title Insurance issued by First American Title Insurance Company. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I-Requirements; Schedule B, Part II-Exceptions.

COMMITMENT CONDITIONS

1. DEFINITIONS

(a) "Knowledge" or "Known": Actual or imputed knowledge, but not constructive notice imparted by the Public Records.
(b) "Land": The land described in Schedule A and affixed improvements that by law constitute real property. The term "Land" does not include any property beyond the lines of the area described in Schedule A, nor any right, title, interest, estate, or easement in abutting streets, roads, avenues, alleys, lanes, ways, or waterways, but this does not modify or limit the extent that a right of access to and from the Land is to be insured by the Policy.
(c) "Mortgage": A mortgage, deed of trust, or other security instrument, including one evidenced by electronic means authorized by law.
(d) "Policy": Each contract of title insurance, in a form adopted by the American Land Title Association, issued or to be issued by the Company pursuant to this Commitment.
(e) "Proposed Insured": Each person identified in Schedule A as the Proposed Insured of each Policy to be issued pursuant to this Commitment.
(f) "Proposed Policy Amount": Each dollar amount specified in Schedule A as the Proposed Policy Amount of each Policy to be issued pursuant to this Commitment.
(g) "Public Records": Records established under state statutes at the Commitment Date for the purpose of imparting constructive notice of matters relating to real property to purchasers for value and without Knowledge.
(h) "Title": The estate or interest described in Schedule A.

2. If all of the Schedule B, Part I—Requirements have not been met within the time period specified in the Commitment to Issue Policy, this Commitment terminates and the Company's liability and obligation end.

3. The Company's liability and obligation is limited by and this Commitment is not valid without:

(a) the Notice;
(b) the Commitment to Issue Policy;
(c) the Commitment Conditions;
(d) Schedule A;
(e) Schedule B, Part I—Requirements; and
(f) Schedule B, Part II—Exceptions.

4. COMPANY'S RIGHT TO AMEND

The Company may amend this Commitment at any time. If the Company amends this Commitment to add a defect, lien, encumbrance, adverse claim, or other matter recorded in the Public Records prior to the Commitment Date, any liability of the Company is limited by Commitment Condition 5. The Company shall not be liable for any other amendment to this Commitment.

5. LIMITATIONS OF LIABILITY

(a) The Company's liability under Commitment Condition 4 is limited to the Proposed Insured's actual expense incurred in the interval between the Company's delivery to the Proposed Insured of the Commitment and the delivery of the amended Commitment, resulting from the Proposed Insured's good faith reliance to:
  (i) comply with the Schedule B, Part I—Requirements;
  (ii) eliminate, with the Company's written consent, any Schedule B, Part II—Exceptions; or
  (iii) acquire the Title or create the Mortgage covered by this Commitment.
(b) The Company shall not be liable under Commitment Condition 5(a) if the Proposed Insured requested the amendment or had Knowledge of the matter and did not notify the Company about it in writing.
(c) The Company will only have liability under Commitment Condition 4 if the Proposed Insured would not have incurred the expense had the Commitment included the added matter when the Commitment was first delivered to the Proposed Insured.
(d) The Company's liability shall not exceed the lesser of the Proposed Insured's actual expense incurred in good faith and described in Commitment Conditions 5(a)(i) through 5(a)(iii) or the Proposed Policy Amount.
(e) The Company shall not be liable for the content of the Transaction Identification Data, if any.
(f) In no event shall the Company be obligated to issue the Policy referred to in this Commitment unless all of the Schedule B, Part I—Requirements have been met to the satisfaction of the Company.
(g) In any event, the Company's liability is limited by the terms and provisions of the Policy.

6. LIABILITY OF THE COMPANY MUST BE BASED ON THIS COMMITMENT

(a) Only a Proposed Insured identified in Schedule A, and no other person, may make a claim under this Commitment.
(b) Any claim must be based in contract and must be restricted solely to the terms and provisions of this Commitment.
(c) Until the Policy is issued, this Commitment, as last revised, is the exclusive and entire agreement between the parties with respect to the subject matter of this Commitment and supersedes all prior commitment negotiations, representations, and proposals of any kind, whether written or oral, express or implied, relating to the subject matter of this Commitment.
(d) The deletion or modification of any Schedule B, Part II—Exception does not constitute an agreement or obligation to provide coverage beyond the terms and provisions of this Commitment or the Policy.
(e) Any amendment or endorsement to this Commitment must be in writing and authenticated by a person authorized by the Company.
(f) When the Policy is issued, all liability and obligation under this Commitment will end and the Company's only liability will be under the Policy.

7. IF THIS COMMITMENT HAS BEEN ISSUED BY AN ISSUING AGENT

The issuing agent is the Company's agent only for the limited purpose of issuing title insurance commitments and policies. The issuing agent is not the Company's agent for the purpose of providing closing or settlement services.

8. PRO-FORMA POLICY

The Company may provide, at the request of a Proposed Insured, a pro-forma policy illustrating the coverage that the Company may provide. A pro-forma policy neither reflects the status of Title at the time that the pro-forma policy is delivered to a Proposed Insured, nor is it a commitment to insure.

9. ARBITRATION

The Policy contains an arbitration clause. All arbitrable matters when the Proposed Policy Amount is $2,000,000 or less shall be arbitrated at the option of either the Company or the Proposed Insured as the exclusive remedy of the parties. A Proposed Insured may review a copy of the arbitration rules at http://www.alta.org/arbitration.

Transaction Identification Data for reference only:

Issuing Agent: First American Title Insurance Company National Commercial Services
Commitment No.: NCS-973893-PHX1
Property Address: , , AZ
Revision No.: 1

Issuing Office: 2425 E. Camelback Road, Suite 300, Phoenix, AZ 85016
Issuing Office File No.: NCS-973893-PHX1
Escrow Officer: Name:
Email:
Phone: (602)567-8100
Title Officer: Name: Ron B. Robertson
Email:
Phone: (602)567-8100

SCHEDULE A

1. Commitment Date: August 20, 2019, at 8:00 AM as to the records of the Pinal County Recorder and August 30, 2019 at 7:30 am as to the records of the Arizona State Land Department.

2. Policy to be issued:

   (a) ☒ ALTA® 2006 Extended Owner's Policy
   Proposed Insured: To Be Determined
   Proposed Policy Amount: $0.00

   (b) ☐ ALTA® Policy
   Proposed Insured:
   Proposed Policy Amount: $

   (c) ☐ ALTA® Policy
   Proposed Insured:
   Proposed Policy Amount: $

3. The estate or interest in the Land described or referred to in this Commitment is

   Fee Simple

4. Title to the Fee Simple estate or interest in the Land is at the Commitment Date vested in:

   State of Arizona

5. The Land is described as follows:

   See Exhibit "A" attached hereto and made a part hereof

Commitment No.: NCS-973893-PHX1

SCHEDULE B, PART I

Requirements

All of the following Requirements must be met:

1. The Proposed Insured must notify the Company in writing of the name of any party not referred to in this Commitment who will obtain an interest in the Land or who will make a loan on the Land. The Company may then make additional Requirements or Exceptions.

2. Pay the agreed amount for the estate or interest to be insured.

3. Pay the premiums, fees, and charges for the Policy to the Company.

4. Documents satisfactory to the Company that convey the Title or create the Mortgage to be insured, or both, must be properly authorized, executed, delivered, and recorded in the Public Records.

5. Compliance with A.R.S. 11-480 relative to all documents to be recorded in connection herewith. See note at end of this section for details

   NOTE: In connection with Arizona Revised Statutes 11-480, as of January 1, 1991, the County Recorder may not accept documents for recording that do not comply with the following:

   a. Print must be ten-point type or larger.
   b. A margin of two inches at the top of the first page for recording and return address information and margins of one-half inch along other borders of every page.
   c. Each instrument shall be no larger than 8-1/2 inches in width and 14 inches in length.

   NOTE: In the event any Affidavit required pursuant to A.R.S. 33-422 relating to unsubdivided land in an unincorporated area of a country has been, or will be, recorded pertaining to the Land, such as Affidavit is not reflected in this Commitment nor will it be shown in any policy to be issued in connection with this Commitment.

6. The real property is not assessed for taxes for the year 2018.

7. Approval by all parties to this transaction of the description used herein.

   The provided description has been modified herein to reference the documents creating boundaries instead of survey recording information.

8. First American Title reserves the right to make additional exceptions and/or requirements pursuant to a review of the legal description and the terms of the Patent to be issued as contemplated by this transaction.

9. Furnish an update of the search of the records of the Arizona State Land Department and disposition of matters disclosed thereby.

10. Furnish the names of parties to be insured herein and disposition of any matters disclosed thereby.

11. Furnish Plat of Survey of the subject property by a Registered Land Surveyor in accordance with the "Minimum Standard Detail Requirements for ALTA/NSPS Land Title Surveys" which became effective February 23, 2016. Said Plat of survey shall include the required certification and, at a minimum, also have shown thereon Items 1, 8, 11, 16, 17, and 19 from Table A thereof. If zoning assurances are requested, Items 7(a), 7(b), 7(c) and 9 from Table A and information regarding the usage of the property must be included.

    NOTE: If a Zoning Endorsement is requested, Items 7(a), 7(b) and 7(c) of Table A will also be required. If "parking" is to be added to the endorsement, the number and type of parking spaces must be shown on the survey. Property use information must also be provided to First American Title Insurance Company.

12. Furnish copies of any existing leases affecting the within described property and insertion of said leases in Schedule B of the Policy of Title Insurance.

13. Record Patent from the State of Arizona to buyer.

14. Such further requirements as may be necessary after completion of the above.

15. Return to title department for final recheck before recording.

Commitment No.: NCS-973893-PHX1

SCHEDULE B, PART II

Exceptions

THIS COMMITMENT DOES NOT REPUBLISH ANY COVENANT, CONDITION, RESTRICTION, OR LIMITATION CONTAINED IN ANY DOCUMENT REFERRED TO IN THIS COMMITMENT TO THE EXTENT THAT THE SPECIFIC COVENANT, CONDITION, RESTRICTION, OR LIMITATION VIOLATES STATE OR FEDERAL LAW BASED ON RACE, COLOR, RELIGION, SEX, SEXUAL ORIENTATION, GENDER IDENTITY, HANDICAP, FAMILIAL STATUS, OR NATIONAL ORIGIN.

The Policy will not insure against loss or damage resulting from the terms and provisions of any lease or easement identified in Schedule A, and will include the following Exceptions unless cleared to the satisfaction of the Company:

1. Any defect, lien, encumbrance, adverse claim, or other matter that appears for the first time in the Public Records or is created, attaches, or is disclosed between the Commitment Date and the date on which all of the Schedule B, Part I-Requirements are met.

2. (a) Taxes or assessments that are not shown as existing liens by the records of any taxing authority that levies taxes or assessments on real property or by the Public Records; (b) proceedings by a public agency that may result in taxes or assessments, or notices of such proceedings, whether or not shown by the records of such agency or by the Public Records.

3. Any facts, rights, interests, or claims that are not shown by the Public Records but that could be ascertained by an inspection of the Land or that may be asserted by persons in possession thereof.

4. Easements, liens or encumbrances, or claims thereof, not shown by the Public Records.

5. Discrepancies, conflicts in boundary lines, shortage in area, encroachments, or any other facts which a correct survey would disclose, and which are not shown by the Public Records.

6. (a) Unpatented mining claims; (b) reservations or exceptions in patents or in Acts authorizing the issuance thereof; (c) water rights, claims or title to water, whether or not the matters excepted under (a), (b), or (c) are shown by the Public Records.

7. Any lien or right to a lien for services, labor or material not shown by the Public Records.

Exceptions above will be eliminated from any A.L.T.A. Extended Coverage Policy, A.L.T.A. Homeowner's Policy, A.L.T.A. Expanded Coverage Residential Loan Policy and any short form versions thereof. However, the same or similar exception may be made in Schedule B of those policies in conformity with Schedule B, Part Two of this Commitment.

8. Taxes for the full year of 2019.
(The first half is due October 1, 2019 and is delinquent November 1, 2019. The second half is due March 1, 2020 and is delinquent May 1, 2020.)

9. Any additional taxes which may become a lien by reason of the county assessor reassessing the within described premises for the year(s) 2019.

10. Reservations or Exceptions in Patents, or in Acts authorizing the issuance thereof.

11. Right-of-Way No. 65-000034 granted by the Arizona State Land Department to United States of America for electric transmission line and having a term of perpetual duration.

Thereafter Contract and Grant of Easement recorded August 30, 1950 in Docket 31, Page 436.

Affects Sections 19, 30 and 31

12. Resolution establishing county road recorded March 27, 1956 in Docket 148, Page 513.

Sections 6, 7, 8, 17 through 20, 29 through 32

13. Right-of-Way No. 09-2341 granted by the Arizona State Land Department to Pinal County Board of Supervisors for highway and having a term of perpetual duration.

A copy of which recorded in Docket 256, Page 16.

Thereafter Amendment dated February 26, 2008, a copy of which is attached to Pinal County Resolution 070908-SLD recorded July 11, 2008 as 2008-65670 of Official Records.

Thereafter Amendment dated July 21, 2014, a copy of which is attached to Resolution 08-2014_RD 14-014 of Pinal County recorded August 26, 2014 as 2014-49304 of Official Records.

Sections 30 and 31

14. The terms and provisions contained in the document entitled "Permanent Easement" recorded June 1, 1966 in Docket 451, Page 64 and re-recorded December 19, 1966 in Docket 479, Page 415.

15. Easements for flood control and rights incident thereto as disclosed by Resolution of the Pinal County Board of Supervisors, November 7, 1066, in Book 472, Page 314.

Section 17

16. The terms and provisions contained in the document entitled "Permanent Easement" recorded November 7, 1966 in Docket 472, Page 319.

Section 19

17. The terms and provisions contained in the document entitled "Agreement" recorded December 8, 1966 in Docket 478, Page 94. By and between The Mountain States Telephone and Telegraph Company, a corporation and Flood Control District of Maricopa County

Section 19

18. The terms and provisions contained in the document entitled "Agreement" recorded June 9, 1967 in Docket 508, Page 171.

    Affects Section 34

19. An easement for gas lines and incidental purposes in the document recorded in Docket 524, Page 51.

    Affects Section 19

20. The terms and provisions contained in the document entitled "Permanent Easement" recorded June 7, 1097 in Docket 825, Page 288.

    Affects Section 19

21. The terms and provisions contained in the document entitled "Permanent Easement" recorded June 7, 1976 in Docket 825, Page 292.

22. Right-of-Way No. 05-000026 granted by the Arizona State Land Department to JP Cattle Co LLC for grazing and having a term which expires December 30, 2024.

    Affects Section 19, 30, 31

23. Right-of-Way No. 05-349-00 granted by the Arizona State Land Department to Keith M. Flake, a married person for grazing and having a term which expires December 30, 2027.

    Affects Sections 16, 17, 20, 21, 28, 29, 32, 33, 34

24. Right-of-Way No. 09-001371 granted by the Arizona State Land Department to Pinal County for highway and having a term of perpetual duration.

    A copy of which recorded November 25, 1991, in Docket 1091, Page 394.

    (Affects all parcels)

25. Right-of-Way No. 09-002458 granted by the Arizona State Land Department to Pinal County Board of Supervisors for highway and having a term of perpetual duration.

    A copy of which recorded in Docket 265, Page 179.

    Affects Section 19, 30

26. Right-of-Way No. 16-85304 granted by the Arizona State Land Department to County of Pinal for future bridge approach and having a term of indefinite duration.

    A copy of which recorded June 2, 1983 in Docket 1168, Page 584.

    Affects Sections 27 and 34

27. Right-of-Way No. 16-72453 granted by the Arizona State Land Department to Salt River Project Agricultural Improvement & Power District for overhead electric line and having a term of indefinite duration.

Affects Section 6

28. Right-of-Way No. 14-100070 granted by the Arizona State Land Department to Superstition Mountains Community Facilities for sanitary sewer, water line, electric line and non-exclusive access road and having a term of indefinite duration.

Affects Sections 6, 7 and 8

29. Special Land Use Permit No. 23-106799 granted by the Arizona State Land Department to ET Motorsports LLC for motorcross track and facilities and having a term which expires April 3, 2019.

Amendment dated August 3, 2010.

Said document is still showing as active. A copy of any extension is not yet available.

Also as set forth in Pinal County Arizona Special Use Permit Case No. SUP-021-01 recorded January 14, 2002 as 2002-001694 of Official Records and recorded February 14, 2002 as 2002-7538 of Official Records and Case No SUP-002-10 recorded December 8, 2010 as 2010-113585 of Official Records.

Affects Section 30

30. Right-of-Way No. 18-107826 granted by the Arizona State Land Department to ET Motorsports, L.L.C., for water distribution line and having a term which expires on April 3, 2019.

Said document is still showing as active. A copy of any extension is not yet available.

Affects Section 30

31. Right of Way for Houston Avenue as disclosed by Resolution recorded August 19, 2002 as 2002-44660 of Official Records.

Affects Section 6

32. The terms and provisions contained in the document entitled "Desert Wells Multi-Use Area Management & Partnership Team, as disclosed by Memorandum of Understanding 56-109245 by and between The Arizona State Land Department and Desert Wells Multi-Use Area Management & Partnership Team, as disclosed by a search of the records of the Arizona State Land Department.

33. All matters as set forth in Record of Survey Minor Land Division, recorded October 14, 2004 in Book 11 of Record of Surveys, Page 218.

Affects Section 8

34. Right of way for Ironwood/Gantzel Road as disclosed by Resolution recorded November 16, 2004 as 2004-93152 of Official Records.

Affects Sections 5, 6, 7, 8, 17 through 20, and 29 through 32

35. The terms and provisions contained in the document entitled "Land Use License as disclosed by Resolution No. 120606-LUL" recorded December 27, 2006 as 2006-175896 of Official Records.

    Affects Section 8

36. Right-of-Way No. 14-110140 granted by the Arizona State Land Department to Salt River Project and Agricultural Improvement and Power District for overhead double circuit 500kV /120kv transmission lines and having a term which expires October 12, 2056.

    A copy of which recorded April 19, 2007 as 2007-46938 of Official Records.

    Affects Sections 7, 8, 16, 17, 21, 28, 34

37. Right-of-Way No. 16-111118 granted by the Arizona State Land Department to Desert Communities, Inc., a Nevada corporation for flood water collection and detention facilities and having a term of perpetual duration.

    Thereafter Assigned to Flood Control District of Maricopa County dated February 20, 2007.

    Thereafter Amendment dated August 23, 2011 and another Amendment dated August 23, 2011.

    Affects Sections 7 and 18

38. Right-of-Way No. 16-111128 granted by the Arizona State Land Department to Desert Communities, Inc., a Nevada corporation for service road, and having a term of perpetual duration.

    Thereafter Assigned to Flood Control District of Maricopa County dated February 20, 2007.

    Affects Sections 32, 33 and 34

39. Special Land Use Permit No. 23-111460-05 granted by the Arizona State Land Department to Keith M. Flake, a married person, for livestock grazing and having a term which expires July 25, 2019.

    Renewed to new expiration date July 25, 2024. A copy of renewal is not yet available.

    Affects Section 8

40. Right-of-Way No. 18-108362 granted by the Arizona State Land Department to MediaCom Arizona, LLC, a Delaware limited liability company for fiber optics and having a term which expired on April 26, 2016.

    Said document is still showing as active. A copy of any extension is not yet available.

    Affects Sections 8, 17, 20, 29, 32

41. Right-of-Way No. 18-110900 granted by the Arizona State Land Department to Water Utilities Community Facilities District dba Apache Junction Water Company for water line and having a term which expires January 13, 2016.

Said document is still showing as active. A copy of any extension is not yet available.

Affects Sections 8, 17, 20, 29 and 30

42. Right-of-Way No. 09-3681 granted by the Arizona State Land Department to Flood Control District of Maricopa County for flood control facilities and having a term of perpetual duration.

    Thereafter Amendment to Right of Way dated October 11, 2011.

    Deed referenced therein is recorded as 2011-62136 of Official Records.

    Affects Sections 8, 16, 17, 18, 19, 21, 34

43. Special Land Use Permit No. 23-101045-26 granted by the Arizona State Land Department to East Valley Aviators, Inc for radio-controlled aircraft park and having a term which expires October 11, 2022.

    Affects Section 20

44. Right-of-Way No. 16-105661 granted by the Arizona State Land Department to Maricopa County for storm drain pipes and head walls and having a term of perpetual duration.

    Affects Section 18

45. The terms and provisions contained in the document entitled "Pinal County Ordinance No. 121207-AQ1" recorded January 8, 2008, as 2008-1862 of Official Records.

    (Affects all parcels)

46. Right-of-Way No. 16-110965 granted by the Arizona State Land Department to City of Mesa for underground water transmission lines and having a term of perpetual duration.

    A copy of which recorded January 28, 2008 as 2008-7616 of Official Records.

    Amendment dated January 19, 2012 recorded March 23, 2012 as 2012-23559 of Official Records.

    Affects Sections 16, 17, 18

47. The terms and provisions contained in the document entitled "Land Use License for Fiber Optic Cable" recorded February 25, 2008 as 2008-17210 of Official Records.

    Affects Section 8

48. Right of way for Guadalupe Road as disclosed by Resolution recorded April 14, 2008 as 2008-34605 of Official Records.

    Affects Sections 6 and 7

49. Right of way for Delaware Drive as disclosed by Resolution recorded April 14, 2008 as 2008-34606 of Official Records.

Affects Section 6

50. Right-of-Way No. 16-111760 granted by the Arizona State Land Department to Pinal County for public roadway and having a term of perpetual duration.

A copy of said right of way is attached to Pinal County Resolution Accepting a right of way recorded August 12, 2008 as 2008-76343 of Official Records.

Affects Sections 6 and 7

51. Right-of-Way No. 16-110357 granted by the Arizona State Land Department to Pinal County for public roadway and having a term of perpetual duration.

A copy of said right of way is attached to Pinal County Resolution Accepting a right of way recorded August 12, 2008 as 2008-76344 of Official Records.

Assigned to City of Apache Junction by assignment dated March 5, 2012.

Amendment dated November 1, 2016 recorded November 14, 2016 as 2016-76684 of Official Records and a copy of which is attached to Pinal County Resolution recorded November 7, 2016 as 2016-75097 of Official Records.

Amendment dated March 8, 2017 recorded March 20, 2017 as 2017-18728 of Official Records and a copy of which is attached to Pinal County Resolution recorded March 31, 2017 as 2017-22458 of Official Records.

Amendment dated June 6, 2018 recorded June 19, 2018 as 2018-45911 of Official Records.

52. Right-of-Way No. 18-118098 granted by the Arizona State Land Department to Maricopa County for drainage facilities and having a term which expires January 6, 2026.

Affects Section 19

53. Right-of-Way No. 23-118652-01 granted by the Arizona State Land Department to Rango Inc for apiary site and having a term which expires January 14, 2029.

Affects Sections 16 and 22

54. All matters as set forth in Record of Survey, recorded October 14, 2008 in Book 23 of Surveys, Page 95.

Affects Section 8

55. All matters as set forth in Record of Survey, recorded June 30, 2010 as Record of Survey No. 2010-61925 of Official Records.

(Affects all parcels)

56. This item has been intentionally deleted.

57. Right-of-Way No. 16-119167 granted by the Arizona State Land Department to City of Apache Junction for public roadway and having a term of perpetual duration.

Affects Sections 6, 7, and 8

58. Right-of-Way No. 16-42304 granted by the Arizona State Land Department to Salt River Project Agricultural Improvement and Power District for transmission lines, steel towers and having a term of perpetual duration.

Thereafter Amendments to Right of Way dated December 19, 1989 and dated June 8, 1994.

Affects Sections 7 and 8

59. Right-of-Way No. 18-104730 granted by the Arizona State Land Department to CHI Construction Company for drainage ditch, wing dikes, and box culverts and having a term which expires October 7, 2019.

Affects Sections 7 and 18

60. All matters as set forth in Pinal County Resolution NO PZ-PA-006-11-B, recorded February 13, 2012 as 2012-11130 of Official Records.

61. Right-of-Way No. 18-106158 granted by the Arizona State Land Department to Salt River Project Agricultural Improvement and Power District for underground 12kV electric distribution line with aboveground appurtenances and having a term which expires February 7, 2021.

A copy of which recorded June 20, 2013, as 2013-51353 of Official Records.

Affects Section 6

62. Right-of-Way No. 14-108816 granted by the Arizona State Land Department to Arizona Water Company for water transmission line and having a term which expires February 9, 2056.

Affects Section 6

63. All matters as set forth in Record of Survey, recorded July 28, 2014 as Record of Survey 2014-43357 of Official Records.

Affects Section 6

64. The terms and provisions contained in the document entitled "Central Arizona Water Conservation District Central Arizona Project Land Use License" recorded June 1, 2015 as 2015-35563 of Official Records.

(Affects all parcels)

65. Right-of-Way No. 18-112028-00 granted by the Arizona State Land Department to Salt River Project for an underground 12kV electric distribution line and having a term which expires August 8, 2027.

A copy of which recorded August 29, 2017 as 2017-62380 of Official Records.

Affects Sections 6 and 8

66. The effect of resolutions adopting State Route Plan for the Gateway Freeway and any Amendments thereto for the purpose of controlling access and acquiring lands in advance for rights-of-way, recorded as 2018-7536 of Official Records.

    And recorded March 25, 2019 as 2019-20550 of Official Records.

    And recorded July 24, 2019 as 2019-59645 of Official Records.

67. All matters as set forth in Apache Junction Lot Combination Record of Survey Map LCM-3-18,, recorded November 7, 2018 as Record of Survey No. 2018-83654 of Official Records

    Affects Section 8

68. All matters as set forth in Pinal County Resolution for the Acquisition and Operation of Pinal Drive, recorded January 9, 2019 as 2019-1856 of Official Records.

    Affects Section 6

69. All matters as set forth in Record of Survey for the Central Arizona Project, recorded May 22, 2019 as Record of Survey No. 2019-39708 of Official Records.

70. The terms and provisions contained in the document entitled "Pre-Annexation Development Agreement" recorded May 30, 2019 as 2019-42122 of Official Records.

    (Affects all parcels)

71. Any claim that the Title is subject to a trust or lien created under The Perishable Agricultural Commodities Act, 1930 (7 U.S.C. §§499a, et seq.) or the Packers and Stockyards Act (7 U.S.C. §§181 et seq.) or under similar state laws.

72. Any facts, rights, interests or claims which would be disclosed by a correct ALTA/NSPS survey.

73. The rights of parties in possession by reason of any unrecorded lease or leases or month to month tenancies affecting any portion of the within described property.

    NOTE: This matter will be more fully set forth or deleted upon compliance with the applicable requirement(s) set forth herein.

74. Water rights, claims or title to water, whether or not shown by the public records.

    (Affects all parcels)

75. Right-of-Way No. 09-2432 granted by the Arizona State Land Department to Pinal County for highway and having a term of perpetual duration.

    Affects Section 6

76. No liability is assumed for the accuracy or completeness of any map or legal description provided in relation to any State Land Right of Way, Permit or Lease set forth in Schedule B herein. Any copies furnished are as a courtesy only.

File No.: NCS-973893-PHX1

The Land referred to herein below is situated in the County of Pinal, State of Arizona, and is described as follows:

THOSE PORTIONS OF SECTIONS 6, 7, 8, 16, 17, 18, 19, 20, 21, 27, 28, 29, 30, 31, 32, 33 & 34 TOWNSHIP 1 SOUTH, RANGE 8 EAST OF THE GILA AND SALT RIVER MERIDIAN, PINAL COUNTY, ARIZONA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

SECTION 6:

THAT PORTION OF GLO LOTS 2 & 3 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL, AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

GLO LOTS 4, 5, 6, 7 & 8;

AND

THAT PORTION OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION 6 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

AND

THAT PORTION OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION 6 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

AND

THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION 6;

SECTION 7:

ALL OF SECTION 7;

SECTION 8:

THAT PORTION OF THE NORTHWEST QUARTER OF SAID SECTION 8 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

AND

THE SOUTHWEST QUARTER OF SAID SECTION 8;

AND

THAT PORTION OF THE NORTHEAST QUARTER OF SAID SECTION 8 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

AND

THE SOUTHEAST QUARTER OF SAID SECTION 8 FALLING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

EXCEPT FROM ALL OF SECTION 8 THOSE PORTIONS LYING WITHIN PATENT RECORDED IN DOCKET 2078, PAGE 268 AND IN PATENT ATTACHED TO RESOLUTION RECORDED IN 2010-97947 OF OFFICIAL RECORDS, AND IN PATENT RECORDED IN 2013-13844 OF OFFICIAL RECORDS AS CORRECTED BY AFFIDAVIT OF CORRECTION RECORDED IN 2018-80740 OF OFFICIAL RECORDS;

SECTION 16:

THAT PORTION OF THE WEST HALF OF SECTION 16 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

AND

THAT PORTION OF THE EAST HALF OF SECTION 16 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

SECTION 17:

ALL OF SECTION 17;

SECTION 18:

ALL OF SECTION 18;

SECTION 19:

ALL OF SECTION 19;

SECTION 20:

ALL OF SECTION 20;

SECTION 21:

THE WEST HALF OF 21;

AND

THAT PORTION OF THE EAST HALF OF SECTION 21 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123;

SECTION 28:

ALL OF SECTION 28;

SECTION 29:

ALL OF SECTION 29;

SECTION 30:

ALL OF SECTION 30;

SECTION 31:

GLO LOTS 1, 2, 5 & 6 OF SECTION 31;

AND

THE NORTHEAST QUARTER OF SAID SECTION 31;

SECTION 32:

THE NORTH HALF OF SECTION 32;

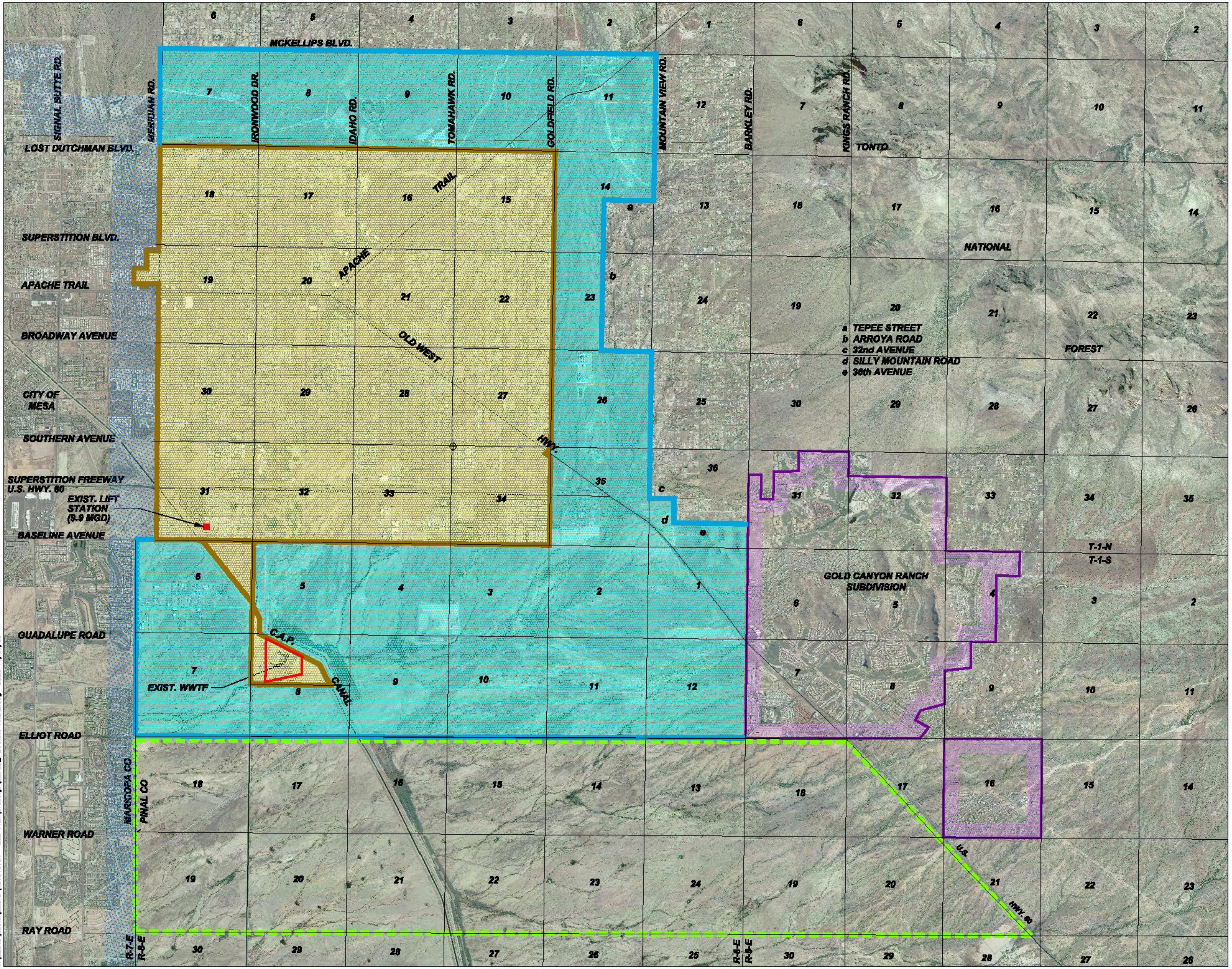
SECTION 33:

THE NORTH HALF OF SECTION 33;

SECTION 34:

THAT PORTION OF THE WEST HALF OF SAID SECTION 34 LYING SOUTH AND WEST OF THE WEST RIGHT OF WAY LINE OF THE CAP CANAL AS SET FORTH IN DEED OF RELINQUISHMENT RECORDED IN DOCKET 1175, PAGE 123.

APPENDIX B



Stantec Consulting Inc.
8211 S. 48th Street
Phoenix AZ USA
85044–5355
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

LEGEND:

EXISTING SERVICE AREA BOUNDARY

EXPANDED SERVICE AREA

FUTURE PLANNING AREA

SMCFD

Client/Project

SUPERSTITION MOUNTAINS CFD NO. 1
SERVICE AREA MODIFICATION
CAAG 208 AREAWIDE WATER QUALITY MANAGEMENT PLAN

Apache Junction, Arizona

Title

FIGURE 2
PROPOSED SERVICE AND
PLANNING AREAS

Project No.	Scale
181310701	AS SHOWN

V:\5281\active\SMCFD\181310701 – 208 Plan\Drawings\SMCFD_PLANNING AREAS.dwg Date: 11/04/09

WASTEWATER MASTER PLAN

SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1

JANUARY 2006

Stantec Project No. 181310403

Prepared in Partnership with:

CITY OF APACHE JUNCTION
300 E. Superstition Blvd.
Apache Junction, AZ 85219
(480) 474-5075

Prepared for:

SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1
879 N. Plaza Dr.
Suite C-101
Apache Junction, AZ 85220
(480) 983-2212

Prepared by:

STANTEC CONSULTING, INC.

8211 S. 48th Street
Phoenix, AZ 85044

602-438-2200

TABLE OF CONTENTS

Page No.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
29813
MARIA J.
BRADY
Date Signed 2/14/06
ARIZONA U.S.A.

APPENDICES

A. Figures
B. Tables
C. Wastewater Flow Data

LIST OF TABLES

LIST OF APPENDIX B TABLES

LIST OF FIGURES
(All figures can be found in Appendix A)

CHAPTER 1
GENERAL INFORMATION

The City of Apache Junction prepared a General Plan in 1999 that documented proposed planning for the City and surrounding area for future growth. In 2004, the City contracted with Stantec Consulting, Inc. to add a planning element for water to their General Plan. In conjunction with that planning effort, the Superstition Mountains Community Facilities District No. 1 (the District), which provides sanitary sewer collection and treatment for the City of Apache Junction, partnered with the City to produce a wastewater master plan to be used for the basis of wastewater planning element in the City of Apache Junction General Plan. The District is funding the Master Plan separately from the water element, but the water and wastewater elements are being partnered to ensure that utility systems are planned, coordinated and in place to meet the land use recommendations in the City's General Plan and that the planning efforts are based on the same basic expectations for growth of the City. The following report documents the wastewater plan.

The water element of the General Plan was completed in late 2004 and the draft Master Plan was completed in January 2005. During the summer of 2005, the State of Arizona accelerated their land sale program for the area south of Baseline Avenue, north of Ray Avenue. Several Development Plan alternatives are currently under review by the State and the City of Apache Junction. The State recommended proceeding with Master Planned Community designation for the City's Development Plan. City staff estimated that 70% of the land would be developed residential, 20% would be developed as Business Retail or Light Industrial and 10% would be developed as Public or Institutional functions. In addition, several freeway corridors were proposed and open areas along washes. Alternative 3 is typical of the wash open areas and freeway corridor (see Appendix A). Alternative 3 was also used in this Master Plan to determine the potential effect on the wastewater system using the revised increased densities that the State is proposing.

1.1 Introduction

In July 1992, the Apache Junction City Council formed the Superstition Mountains Community Facilities District No. 1 (the District). The District Service Area was initially wholly located in the City of Apache Junction and to this day is almost completely located within Apache Junction administration boundaries or it's planning boundaries. (see figure 1) The District was formed to develop, operate, and maintain a system for the collection, transport, and treatment of sewage from the commercial, residential, industrial, and institutional properties existing within the boundaries of the District.

The District was established upon the petition of the owners of more than 640 acres of land located within the City. The City had the choice of appointing an independent Board of Directors for the District or of having the City Council constitute the District Board. The City chose to appoint an independent Board of five local citizens to serve six-year terms.

Since its formation, the District has been a separate governmental entity from the City. The District is not a department of the City, but a separate entity generally vested with all the rights and powers of special taxing districts under the Arizona Constitution. The District and City finances and staff are separate and the City is not liable for the debts of the District or vice versa. The District has its own elections, with its electors consisting of a different group of persons than can vote in City elections.

Generally, the owners of property in the District (regardless of whether they reside in the District or even the City) and persons who reside on resident's property located within the District Service Area, and who are registered to vote, are electors of the District. The City, by statute, retains certain specific rights with respect to the District: (i) the City Council can appoint board members; and (ii) the City must approve any contracts for sewer service between the District and customers located outside the boundaries of the District.

The District currently consists of approximately 17 square miles, some vacant and some developed land. Not all occupied properties are connected to the collection system. When the District was formed, hook-up to the sewer system was optional, and still is today. Many residents resisted the idea of connecting to a sanitary sewer system, paying capital costs of connection and monthly service fees when they had functioning septic systems. The City Council chose to allow the residents to decide when to make connection and proceeded with the formation of the District; therefore, the resulting connection area was and is non-contiguous. In addition, the initial number of connections was so low that operation of the wastewater treatment facility was difficult in the early years.

Existing facilities and residential units, not currently connected to the collection system, are connected when their existing systems fail or when they are deemed too small per Pinal County Health Department review. Existing facilities and residential units also make connection to the collection system under various incentive programs provided by the District. These incentive programs reduce or eliminate the cost of connection. New developments in the area are required to make connection unless septic systems can be constructed that meet current Arizona Department of Environmental Quality (ADEQ) requirements for septic systems. It is anticipated that most properties within the boundaries will eventually be connected to the collection system.

The District has also expanded its boundaries in a few areas to include property owners from nearby areas that have requested sewer service and that the City has approved for inclusion. Properties outside the District are and will be served subject to Main Extension Agreements and such service will be subject to available capacity and approval of the Apache Junction City Council. The existing service area is shown on Figure 1.

The District owns and operates approximately 106 miles of sewer collection lines, a 3.3 MGD lift station and a 2.1 MGD Biolac Wastewater Treatment Facility. Initial flows to the facility were as low as 200,000 GPD, which caused significant hardship on the operations to meet discharge standards. The facility is now treating approximately 1.2 MGD. The facility was designed to expand to 3.2 MGD on the current footprint. Part of the analysis of this report will be to determine the appropriate expansion recommendations for both the collection system and the wastewater treatment facility and the potential treatment changes that will accommodate future growth of the City at the wastewater treatment facility.

1.2 Previous Work and Studies

The District provided the following reports and documents for review:

- Apache Junction General Plan, November 1999
- 208 Wastewater Management Plan Amendment for Superstition Mountains Community Facilities District No. 1; July 1994
- Final Design Report For Treatment Plant No. 1; August 1994
- Housing Growth Forecast Superstition Mountain Community Facilities District No. 1; April 2000
- Senior Cottages of America Sewer Systems CAAG 208 Water Quality Plan Amendment No. 2 for Superstition Mountains Community Facilities District No. 1; July 1998
- AutoCAD Layout and Elevation Data of the Sanitary Sewer Collection System
- Superstition Mountain Community Facilities District No. 1, Treatment Plant No. 1 Record Drawings; August 1994

These reports and documents provided the basis for understanding the District's system as it stands today. Information regarding initial design criteria for the collection system was not available and the impact of that will be discussed later as the existing collection system is modeled using the design criteria in this report.

1.3 Scope of Work

The District has retained the services of Stantec Consulting, Inc. to provide a Wastewater Master Plan. The scope of work has been divided into the following tasks:

- Task 1—Preliminary Draft Master Plan
- Task 2—Draft for Comment
- Task 3—Review and Comment
- Task 4—Final Master Plan

Elements of the Wastewater Master Plan include:

- Prepare mapping depicting current service area boundaries, land use boundaries and projected service area boundaries
- Prepare sewer collection system model that will provide pipe sizing and slopes for current land use area criteria
- Evaluate existing collection system to verify pipe sizing and slopes to meet current land use area criteria
- Evaluate wastewater treatment facility expansion options to meet current land use criteria and future expansion south to Germann Road
- Provide opinions of probable construction cost where feasible
- Provide estimated schedule of implementation where feasible

1.4 Planning Area—Service

The District currently encompasses 17-square-miles and proposes to expand the existing service area south to Germann Avenue and east to Barkley Road (see Figure 1). Apache Junction has transitioned from a community of scattered development, dominated by manufactured homes and recreational vehicle parks to one with a broader, more integrated variety of uses. The 2000 Census data reported a population for Apache Junction of 31,840 people. A more recent estimate in 2003, by the Department of Commerce, reports a population of approximately 41,000 people. However, this projection appears to be somewhat overstated. Additional population information and additional discussion about the service area are presented in Chapter 3.

1.5 Utilities

The following utility companies own and operate systems in the existing and proposed expansion service area:

• Water:	Apache Junction Water Company Arizona Water Company Superstition Mountain, LLC Sierra Del Saguaro
• Irrigation:	Central Arizona Water Conservation District (CAWCD) Salt River Project (SRP)
• Storm Water:	Arizona Department of Transportation (ADOT)
• Sewer:	Superstition Mountains CFD No. 1
• Telephone:	QWest
• Electricity:	SRP Arizona Power Service (APS)
• Roads & Streetlights:	ADOT City of Apache Junction
• Gas:	Southwest Gas Corporation Sierra Del Saguaro
• Propane:	ADOT
• Fiber Optic Lines:	AT&T Cox Communications
• Cable Television:	Cox Communications Media COM TV Max Communications

CHAPTER 2
DESIGN CRITERIA

2.1 Sanitary Sewer System Design Criteria

The following design criterion has been established for the District's Wastewater Master Plan. Sewer line design capacities are based on the projected sewage flow rate for the sewer line life (over 50 years for PVC pipe). The minimum requirements for sizing of sewage collection systems are contained in Chapter 4 of the Arizona Department of Environmental Quality (ADEQ) Engineering Bulletin No. 11 and as listed in recent modifications to the Arizona Administrative Code (AAC) R18-9, Part E. Type 4 General Permits. ADEQ recommends a minimum velocity of 2.0 feet per second (fps) when flowing full. No infiltration is included in the total flow, as water tables are quite deep and rainfall is minimal. Basic design criterion utilized is as follows:

1. Design Flow will be based on the AAC R18-9, Table 1 Unit Daily Design Flows (AAC nomenclature) and zoning for land areas under the Apache Junction General Plan.

2. Due to the changing conditions for land use south of Baseline Avenue and north of Ray Avenue, flow generation is based on both the 1999 Apache Junction General Plan and Alternative 3 of the November 2005 State land sale alternatives (see land use figures in Appendix A).

3. Housing densities are 2 dwelling units per acre for low density, 3.5 dwelling units per acre for medium density, 12 dwelling units per acre for high density and 7 dwelling units per acre for state designated master planned community. In addition, 70% of the state designated master planned community is assumed residential, 20% industrial/retail and 10% public institutional; excluding open areas and freeway corridors.

4. Flow for very low, low and medium density residential is 3.2 people per dwelling unit. Flow for high density residential (more than 5 dwelling units/acre) is 2 people per dwelling unit. Average daily flow is estimated to be 100 gallons per capita per day. Population density based on City of Phoenix Development Guidelines (the only guideline available).

5. Flow for industrial/business is estimated to be 1000 gallons per acre per day. Flow for retail/employment is estimated to be 1500 gallons per acre per day. These flows are designated as Employment - Type A and Employment - Type B in Figure 3.1, in the City of Phoenix Development Guidelines.

6. Flows for public and institutional are estimated to be 1500 gallons per acre per day.

7. Equivalent populations were calculated to determine peaking factors for gravity sewer and pump station sizing (see Table 2.1). The equivalent population was determined by taking the average flow rate (residential and commercial) and dividing by 100 gallons per capita per day. Gravity sewer lines and pump stations will be designed based upon all equivalent

populations upstream of that point or as tabulated by the following criteria (AAC R18-9-E301):

Table 2.1 - Peaking Factors

Upstream Population	Peaking Factor
100	3.62
200	3.14
300	2.90
400	2.74
500	2.64
600	2.56
700	2.50
800	2.46
900	2.42
1000	2.38
1001 to 10,000	$PF = (6.330 \times p^{-0.231}) + 1.094$
10,001 to 100,000	$PF = (6.117 \times p^{-0.233}) + 1.128$
More than 100,000	$PF = (4.500 \times p^{-0.174}) + 0.945$

PF = Peaking Factor   p = Upstream Population

8. The construction design shall be based on the "Uniform Standard Specifications for Public Works Construction," published by the Maricopa Association of Governments, revisions through 2000, as adopted by the City.

9. Sewer Lines shall be straight where possible or have a maximum radius of curve not less than 200 feet.

10. Minimum cover shall be eight feet or sufficient depth to serve the service area.

11. Sewer lines crossing floodways shall be placed at least two feet below the 100-year storm scour depth, shall extend at least 10 feet beyond the boundary of the 100-year storm scour and shall be constructed of ductile iron pipe or provide pipe protection.

12. Sewer lines shall be at least eight inches in diameter.

13. Mile street interceptor minimum flow velocity shall be 2.0 fps and maximum flow velocity shall be 10.0 fps for pipes flowing full. Interior connecting collector minimum flow velocity shall be 2.125 fps and maximum flow velocity shall be 10.0 fps for pipes flowing full.

14. Mile street interceptor flow velocities and pipe capacities shall be calculated by Manning's Formula using n=0.013 and minimum velocity of 2.0 ft/s. Interior connecting collector flow velocities and pipe capacities shall be calculated by Manning's Formula using n=0.13 and minimum velocity of 2.125 ft/s.

Table 2.2 - Mile Street Interceptor Gravity Sewer Pipe Sizing

Pipe Diameter (in)	Minimum Slope (ft/ft)	Full Flow Capacity (cfs)
8	0.0033	0.696
10	0.0024	1.076
12	0.0019	1.557
15	0.0014	2.424
18	0.0011	3.493
21	0.0010	5.024
24	0.0010	7.173
30	0.0010	13.006
36	0.0010	21.149
42	0.0010	31.901
48	0.0010	45.546

15. Manhole spacing per AAC R18-9-E301 shall not exceed the following:

Table 2.3 - Manhole Spacing

Sewer Pipe Diameter (inches)	Maximum Manhole Spacing (feet)
4 to less than 8	300
8 to less than 18	500
18 to less than 36	600
36 to less than 60	800
60 or greater	1300

2.2 Wastewater Treatment Design Criteria

The wastewater treatment facility would need to be designed for the volume of flow that it will receive and treat the effluent to the quality that is necessary for the type of disposal that will be implemented. The treatment facility should be designed in such a way that it will allow for expansion as the area grows in population and have the flexibility of treating the flow from summer to winter conditions. Wastewater treatment facilities should be designed to treat the average daily flow with a capability to handle peak flows hydraulically. If financially feasible, the main trunk collection system entering the wastewater treatment facility should be designed for the ultimate flows. The wastewater treatment facility should be planned for the 20-year growth period per Arizona Administrative Code and EPA recommendations.

Projecting the growth rate is a difficult task and especially in high growth rate communities like Apache Junction and the surrounding valley undergoing the transition from rural to municipal community.

Effluent disposal can be grouped into two major categories: reuse and discharge. The most common uses for effluent are irrigation and impoundments. The only neighboring major receptors in or near the proposed Service Area is Siphon Draw and Queen Creek Wash. Recharge is a viable option and should be highly considered. More discussion on these effluent disposal options is provided below.

2.2.1 Reuse Standards

Reclaimed water quality is regulated by the Arizona Administrative Code (AAC) R18-9 Article 7, Direct Reuse of Reclaimed Water; and R18-11-3, *Reclaimed Water Quality Standards.* R18-11-3, Table A, *Minimum Reclaimed Water Quality Requirements for Direct Reuse* of R18-11-3, provides a list of types of direct reuse and minimum class of reclaimed water required. Based on the quantity of effluent available, it is assumed that the following types of direct reuse and associated water quality will be considered.

Table 2.4 Effluent Reuse Quality Classifications

Type of Direct Reuse	Minimum Class Required
Pasture for non-dairy animals	C
Livestock watering	C
Pasture for milking animals	B
Surface irrigation for orchard or vineyard	B
School ground landscape irrigation	A
Open access landscape irrigation	A

Class 'A' reclaimed water is defined under AAC RI8-11-304 as wastewater that has undergone secondary treatment, filtration and disinfection. A chemical feed system is required to add coagulants or polymers to enhance filtration to meet the regulatory requirements.

Class 'B+' reclaimed water is wastewater that has undergone secondary treatment, nitrogen removal treatment, and disinfection. Denitrification is required to meet the + standard. (Matching crop consumptive use to application rate is not required to prevent overland flow or deep percolation of the effluent.)

Class ‘B’ reclaimed water is defined under R18-11-306 as wastewater that has undergone secondary treatment and disinfection. Filtration is not required. (Crop consumptive use must match the application rate of the effluent to prevent overland flow or deep percolation of the effluent.)

Class ‘C’ reclaimed water is wastewater that has undergone secondary treatment in a series of wastewater stabilization ponds, including aeration, with or without disinfection. Aerated lagoons can produce Class C effluent, but it is difficult and requires good operation and management.

The District has implemented a policy to design future expansions of the wastewater treatment facility to meet A+ effluent standard to provide maximum flexibility for effluent disposal.

2.2.2 Discharge Standards

The requirements for surface disposal are established by the Arizona Pollution Discharge Elimination System (AZDES). Discharges to the waters of the State are governed by AAC R18-11-1 water quality standards for surface water with designated uses listed in Appendix B of the AAC. The existing wastewater treatment facility is located below the confluence of Weeks Wash and Siphon Draw and is immediately upstream of Power Line Floodway which discharges into Maricopa Floodway and eventually the Gila River. The only other Wash or Floodway in the are that could be a discharge point would be Queen Creek Wash, also a tributary of the Gila River. The designated uses for both of these discharge points are as follows:

A&We: Aquatic & Wildlife, Ephemeral

PBC: Partial Body Contact

2.2.3 Recharge Standards

The Arizona Aquifer Protection Permit (APP) establishes the requirements for subsurface disposal and the requirements are published in AAC 18-9-1 and AAC 18-11-4. The effluent quality requirements are site specific and focus on the protection of the underlying aquifers for future uses, which usually includes drinking water. The permit carries several significant requirements that in general must be documented and demonstrated including Best Available Demonstrated Control Technology (BADCT) and the Aquifer Standards for recharge listed in AAC 18-11-4. Generally, the facility must meet A+ Reuse standards for organics and specific standards for certain inorganics.

2.2.4 Recommended Wastewater Treatment Standard

The first step to select wastewater treatment options is to determine the effluent use and the associated effluent standards. The best treatment options can then be determined and evaluated based on the standards that must be met for the effluent quality. Treatment requirements, treatment methods and affordability of treatment are all balanced to determine the best treatment method for the particular application. Numeric water quality criteria for the listed designated uses are provided in Appendix A of AAC R18-11 and are summarized below:

Table 2.5. Effluent Quality Standards

Parameter	Class A+	Class B+	Class B	Class C	Minimum Discharge Standard	Aquifer Protection Permit
BOD, 30-day average	30	30	30	30	30	30
BOD, Single Sample	45	45	45	45	45	45
TSS, 30-day average	30	30	30	30	30	30
TSS, Single Sample	45	45	45	45	45	45
Turbidity (ntu)	2	NNS	NNS	NNS	NNS	2
Turbidity, max (ntu)	5	NNS	NNS	NNS	NNS	5
Fecal Coliform, 4 out of last 7 days (cfu/100ml)	ND	200	200	1000	126 *	ND
Fecal Coliform, Single Sample (cfu/100ml)*	23	800	800	4000	235 *	23
Nitrate (mg/l)	NNS	NNS	NNS	NNS	NNS	10
Nitrite (mg/l)	NNS	NNS	NNS	NNS	140	1
Total Nitrogen as N (mg/l)	10.0	10.0	NNS	NNS	NNS	10
pH	6.5-9	6.5-9	6.5-9	6.5-9	6.5-9	6.5-9

ND = Non detection, NNS = No numerical standard
* = Discharge Standard is for e-coli rather than fecal coliform

The APP must always be met for effluent disposal in the State of Arizona. In general, the two standards that must be met are the numeric standards listed above and the BADCT for the disposal method that will be selected by a facility. Also in general, discharge and reuse numeric standards are less stringent than APP numeric standards. Often the APP will allow the lower numeric standards as long as a facility demonstrates the BADCT for that effluent disposal method. However, a facility must be careful when choosing the standard to achieve that there will not be compelling reasons in the near future to strive for a higher standard. It is often much more costly to add components at a later date to achieve the higher standards than to spend a few more capital dollars in original construction. There is no requirement to meet the higher standard just because the facility has included a component not required for the disposal technique.

The following summarizes the treatment requirements to achieve each of the standards listed above.

Table 2.6. Treatment Requirements for Effluent Standards

Parameter	Class A+	Class B+	Class B	Class C	Minimum Discharge Standard	Aquifer Protection Permit
Secondary Disinfection	X	X	X	X	X	X
Disinfection	X	X	X	X	X	X
100% Consumptive Use Match			X			
Denitrification	X	X				X
Filtration	X					X

If reuse is an option that a facility wants to consider, then it is recommended that denitrification be included in the treatment process to eliminate the need to exactly match the consumptive use of the receiving crop/plants in both summer and winter conditions. Class B does not require denitrification, but reuse must exactly match the consumptive use requirements in both winter and summer. It is further recommended that the option to add filtration at a later date should be included to allow a process to meet the Class A+ standard. Filtration is not required initially, but the facility should have a plan for where and how to easily add it to keep upgrade costs less in the future.

The WWTF discharge is currently limited to 2.1 MGD by permit, the design flow rate of the plant. When the plant is expanded, the permit will need to be modified and new limits will need to be set. The District wants to recycle all of the effluent if possible. The District has completed the permitting process with ADEQ (Aquifer Protection Permit) and ADWR to recharge its effluent and receive recharge credits. Both permits are structured to match the plant capacity of 2.1 MGD.

There are three existing recharge basins with three vadose zone wells and the District is in the process of constructing four additional wells. The District applies effluent to two of the basins at a time and allows the third to "dry out". The District has an agreement with the Apache Water Company to purchase the recharged water.

There is a limitation to the recharge opportunities at the WWTF because of the perched water table below the plant. Future expansion will need to address the potential of recharge, reuse and discharge to make sure there are viable options that maximize the potential reuse of the effluent.

The District plans to reuse effluent when potential users are identified and a distribution system can be constructed. Effluent reuse is an option that the District wants and needs to keep in mind for future expansion; especially in light of the limited discharge sites available. The District has elected to meet A+ standards in all future designs and upgrades.

CHAPTER 3
EXISTING AND FUTURE CONDITIONS

3.1 Land Use Plan, Existing Service Area and Proposed Service Area

Apache Junction has transitioned from a rural community of scattered development, dominated by mobile home parks, manufactured homes and recreational vehicle parks to one with a broader, more integrated community with a variety of uses. Diversification has been accomplished over the last two decades, accelerated by the completion of U.S. 60 freeway. The City is now experiencing an unprecedented scope of development that includes new uses previously absent from the Apache Junction area. Growth has increased the City's scale, expanding the local market to include specialty retail and hospitality uses, an improved array of commercial services and a greater variety of housing types. Survey results reported in the 1999 General Plan indicates that two-thirds of the incorporated land within Apache Junction is undeveloped, but that is rapidly changing (see Table 3.1 below).

Table 3.1 - Existing Land Use

Land Use	Existing Area (square miles)
Residential	10.5
Retail, Office, Industrial	0.7
Public	0.5
Open Space – developed	0.3
Vacant	22.8

The most current Land Use Plan for the Apache Junction service area was published in the November 1999 *Apache Junction General Plan* (a copy of the Land Use Plan is included in Appendix A). The boundary of the existing Apache Junction Land Use Plan and the existing service area for the District are shown on Figure 1. The existing Apache Junction land use boundary covers both the incorporated land of the City and adjacent lands that are expected to be annexed within the next few years. Land south of Baseline Road is still owned by the State of Arizona. The City is working to plan the type of development and the utility requirements within the state-owned area to both streamline and expedite sale procedures and also to assure development of the land in a manner that will complement the current and future goals of Apache Junction. The City wants to avoid uncontrolled growth that often occurs with unplanned development.

During the summer of 2005, the State of Arizona accelerated their land sale program for the area south of Baseline Avenue, north of Ray Avenue. Several Development Plan alternatives are currently under review by the State and the City of Apache Junction. The State recommended proceeding with Master Planned Community designation for the City's Development Plan. City staff estimated that 70% of the land would be developed residential, 20% would be developed as Business Retail or Light Industrial and 10% would be developed as Public or Institutional functions. In addition, several freeway corridors were proposed and open areas along washes. Alternative 3 (see Appendix A) was used as an example of the open areas and to modify this Master Plan to determine the potential effect on the wastewater system using the revised increased densities.

The District proposes to expand their planning area and service area boundary south to Germann Road and east to Barkley Road. The proposed planning area is larger than the currently published Apache Junction Land Use Plan, but the next publication of the Land Use Plan will match the proposed district planning area. Flow models presented in this plan include only those areas that have land use recommendations from the City of Apache Junction General Plan and from Alternative 3 of the currently proposed modifications.

3.2 Population and Water Usage Data

An assessment of population data was just completed for the Apache Junction Water Element that is being added to the General Plan. This assessment was based on 2000 Census data, Department of Commerce data, water usage data, the water system Master Plans and City staff input. A summary of the information is provided here. Note: the data presented in this section is based on the land use boundary (which is bounded on the south by Warner Road approximately) and not the District proposed boundary (which is bounded on the south by Pecos Road).

The 2000 Census reported 31,840 people. A more recent estimate in 2003, by the Department of Commerce reports population a population of approximately 41,000 people. As there have not been sufficient housing starts between 2000 and 2003 to support a population growth of almost 10,000 people, population estimates for the Water Element were based on the Hydrogeologic Study prepared by Southwest Ground-water Consultants for the Apache Junction Water Company in June 2004 (water data and typical per capita usage). The water districts are currently updating their 100-year water assured plans with the State and much of the data presented here came from studies prepared for this update. The following population and water usage projections are from the Water Element added to the General Plan:

Table 3.2 - Estimated Future Population and Water Usage

Year	Estimated Population	Average Estimated Water Usage (MGD)
2004	36,000	4.83
2009	40,600	5.44
2014	45,500	6.10
2019	51,800	6.94
2024	58,600	7.86
2029	67,000	8.98

Population and water data were not used to determine sewage flow rates for this study. However, population projections and the water data were used to cross-reference with the resultant sewage flow rates to verify that the sewage analysis was not over or under estimating the flow rates based on the projections of water usage. In addition, the time frames for expectation of development were cross-referenced with this population data to determine recommended time frames for expansion of the wastewater treatment facility. Collection systems are typically expanded based on the building permits and actual development of certain areas along the half and full section lines.

Sewage generation estimates are presented in Section 3.3. The water data presented here implies less total water use than sewage generated. There are several reasons that the total sewage numbers are higher than the 2029 water data presented above. First, the comparison between water use and sewer generation must be made based on the boundary served by each system (approximately Warner Road). Second, and most significant, the water data above does not calculate flows at full build-out. The sewer analysis is based on population numbers derived from the land use plan. The comparison of water usage in 2029 and the sewer at full build-out are not comparable comparisons. Water data and growth rates presented above were based on previous water usage and projected rate of growth without change in the per capita consumption. The studies that determined rate of growth were prepared a year to eighteen months ago and are based on a relatively slow release of State land south of Baseline for sale. In recent months, there has been significant growth and huge increases in land purchases in neighboring County communities southeast of Apache Junction.

The City has been pushing the State to release the land south of Baseline on a much faster rate than was anticipated by the Water Master Plans. The sewer analysis is based on full build-out and does not estimate when that will occur. The analysis does at least identify the long-term requirement for total flow from the area. Based on neighboring communities, it is certainly possible for a Valley City to grow faster than shown in the water study.

Third, the sewer analysis is based on ADEQ criteria for sewer flow per resident. The water plan is based on previous water usage per person. Actual water usage is much less at this time than ADEQ standards because the community has traditionally been composed of mobile home parks and very transitory residents. There are no large commercial centers, no malls, limited industry and limited numbers of traditional, metropolitan residential neighborhoods.

Actual water usage for a community like Apache Junction is typically lower than ADEQ criteria. However, as the City continues to develop, it is expected that with the higher standard of housing and addition of higher end commercial and industrial users that the water use per person will increase as well.

Even if the per capita water usage does not go up, when the current average water usage is applied to the population numbers generated by the land use plan then the total water requirement is higher than the sewer generation and the relationship between these two is reasonable. Average water use now is 134 gallons per person per day. Average sewer generation in this study is 100 gallons per person per day. The ratio between these two is 75 percent of water would be converted to sewage. Typical relationships between sewage generation and water usage are 60 to 90 per cent with the ratio being higher for desert communities like Apache Junction and lower for municipal communities like the City of Phoenix.

The relatively slow proposed rate of growth in the water studies must be considered when determining the rate of development of the District, but the total numbers for sewage generation are accurate and reasonable based on both the conservative ADEQ numbers and the current water usage numbers.

3.3 Projected Sewer and Wastewater Flows

The Land Use Plan and the criteria presented in Chapter 2 were used to determine the amount of wastewater flow generated at full build-out for the proposed service area. Average daily flows are presented per section on Figure 2 (Appendix A) and on Table 1 (Appendix B) for the 1999 Apache Junction Land Use Plan. The low-density residential areas were assumed to be developed with septic systems and are expected to always remain on septic; therefore, flow from these areas was not included in the sewage flow estimates. The following is a summary of the data from Table 1 and a comparison to current flows and WWTF sizing:

Table 3.3 - Summary of Sewage Flow Data
Based on 1999 Apache junction General Plan

	Sewage Flow (MGD)
Existing Flow	1.5
Existing WWTF Capacity	2.1
Existing WWTF Expansion	3.2
Existing Collection System at Full Build-out	7.8
Sewage Generation at Full Build-out (north of Baseline)	9.9
Sewage Generation at Full Build-out (south of Baseline, north of Warner)	12.9
Sewage Generation at Full Build-out (South of Warner, north of Germann)	13.5
Sewage Generation at Full Build-out (entire proposed service area)	36.3

Flow data was generated using the current Land Use Plan for the existing sewer collection system. Original design criteria were not available to determine whether land use planning had been modified from when the collection system was first designed. It was assumed that the Development Plan may have changed and it was therefore appropriate to check the existing collection system sizing against the new projected flows at full build-out. Construction of parallel sewer lines in areas that maybe undersized, will not be necessary unless the capacity of the existing sewer lines is actually exceeded.

Except for Sections 21 and 22 of T1S, R8E, there are no land use recommendations available for the land south of Warner Road in the current Land Use Plan; therefore wastewater flows were evaluated for several scenarios to try to get a feel for total sewage generation. Table 1 (Appendix B) and Figure 2 present the worst-case scenario of medium density residential development for all the land. Other evaluations included average density in the current land use plan and one dwelling unit (du) per ½ to one acre (0.75 du/acre). Table 3.3 gives the relationship between these analyses:

Table 3.4 - Sewage Generation Projections for Un-zoned Land

Land Use Criteria	Average Flow for Section (MGD/Section)	Total Flow for Service Area South of Warner Road (MGD)
Medium Density Residential (3.5 du/acres, 3.2 people/du)	0.72	14.74
Average Density (3.2 du/acres, 3.2 people/du)	0.66	13.51
Lowest Expectation (1 du/0.75 acres)	0.27	5.53

The average flow data presented above is used to determine size of wastewater treatment facilities. Peaking factors (presented in Chapter 2) are used along with average daily flow to size the collection system and to size the lift stations. Lift stations are presented in average daily flow when using MGD criteria, but the pumps and wet well volumes are sized to meet the peak flow rates anticipated.

During review of this Master Plan, the State of Arizona accelerated its plans for sale of land between Baseline and Ray Avenues. Various alternatives are currently under review and the State is recommending that the land designations be removed for these areas and changed to "Master Planned Community" designation. This designation would allow various developers purchasing the land to "master plan" a layout that would alter the current plan for densities and location of open space, recreational, industrial, business, retail, public, and institutional areas. Concern about increased flow generation led to the need to evaluate the 1999 designations for land and the proposed "Master Plan Designation". Table 1-A (see Appendix B) was created to compare these flow generations. The following is a summary of that data:

Table 3.5 - Summary of Sewage Flow Data

Based on Alternative 3 land use plan

	1999 Land Use Plan Sewage Flow (MGD)	Alternative 3 Land Use Plan Sewage Flow (MGD)
Existing Flow	1.5	1.5
Existing WWTF Capacity	2.1	2.1
Existing WWTF Expansion	3.2	3.2
Existing Collection System at Full Build-out	7.8	7.8
Sewage Generation at Full Build-out (north of Baseline)	9.9	9.9
Sewage Generation at Full Build-out (south of Baseline, north of Warner)	12.9	14.8
Sewage Generation at Full Build-out (South of Warner, north of Germann)	13.5	16.8
Sewage Generation at Full Build-out (entire proposed service area)	36.3	41.5

The flow generation could go up slightly if development proceeds as "Master Planned Community;" however, the difference is negligible at this level of planning for full build-out given the conservative approach taken for calculating flows. Full build-out is not expected for 10 to 20 years; much can happen between now and then. Water supply planning has not assumed these higher densities and limited water supply may limit densities when actual construction occurs. Flows are calculated at 100 GPD per person. Many communities, including the City of Mesa, use 80 GPD per person for their flow calculation planning. This Master Plan has taken a more conservative approach; 80 versus 100 gpcd represents a 20% difference in the flows.

The remaining master plan and collection system sizing is based on the 1999 Apache Junction Land Use Plan.

3.4 Existing and Proposed Sewer Collection System

A sanitary sewer collection system flow model has been prepared for this study and the results are presented in Chapter 4. The system layout used in the flow model is presented on Figures 3 and 4. Figure 3 shows the system layout against a United States Geological Survey (USGS) background map. Figure 4 shows the system layout against an aerial photograph.

3.4.1 Existing Sewer System

The existing Apache Junction sewer collection system services developments east of Meridian Road to Goldfield Road and south of Lost Dutchman Road to Baseline Road (see Figures 3 and 4). The sewer collection system consists of pipe sizes ranging from 8-inch to 36-inch diameter. All of the existing collection system is located on the east side of the CAP canal that crosses the service area in a northwesterly to southeasterly direction. The CAP is a physical barrier to the collection system and dictates that a lift station was required for the existing collection system and future lift stations will be required at certain locations for expansion of the service area because the most efficient method of crossing the CAP is to pump the sewage through a force main. A gravity line going under the CAP would be extremely deep and siphoning sewage is not a good idea because of the solids and the potential for plugging.

All flow is collected in an existing 3.3 MGD lift station and pumped to Wastewater Treatment Facility No. I located west of the CAP Canal (see figure 1). This lift station is adequately sited to meet the existing WWTF capacity but will not meet full build-out for the area it services.

The existing sewer collection system was included in the flow model. The District had recently completed an As-Built survey of the collection system that provided, in AutoCAD format, manhole locations and invert data for the system. Pipeline sizing data between manholes was collected from an analysis of the record and design drawings for the sewer collection system.

There are approximately 106 miles of sewer collection system in the existing service area, but only the main collection system was used in the model. There is one lift station and force main in the existing system. The lift station is located just north of Baseline Road at the half-mile point between Meridian Road and Ironwood Road. The force main from this pump station follows the CAP Canal alignment and crosses the CAP Canal to the WWTF. This existing gravity collection system, lift station and force main are shown on Figures 1, 3 and 4.

3.4.2 Proposed Sewer System Layout

The collection system model was generated for only the land included in the current Land Use Plan. A proposed collection system has been laid out for the proposed service area north of Warner Road and south of the existing collection system. Additional study to determine flow data for the area south of Warner Road and north of Germann Road was prepared to provide recommendations on wastewater treatment facility sizing and siting only. This is discussed further in Section 3.5 and Chapter 5.

In general, the ground surface in Apache Junction falls from the northeast to the southwest. For this reason, most of the proposed gravity sewer lines are laid out to convey wastewater in a general southwesterly direction. Most of the sewer alignments follow the right of way of the major streets or the section lines and flow either south or west by gravity. This section of sewer flows to the northwest for only 350 feet where the surface grade is slightly uphill.

Three lift stations are proposed for the collection system south of Baseline. These lift stations are required because of topographic constraints and to cross the CAP canal in the most efficient manner.

A proposed sewer collection system has not been laid out for the proposed sewer service area between Warner Road and Germann Road because there are no published Land Use criteria for this area. The analysis of expansion of the service area onto this land has been included in this Master Plan to allow long-range planning of wastewater treatment facility requirements. The Master Plan will address whether expansion of the existing Superstition Mountains WWTF or a second WWTF should be planned. Land purchases or set-asides can then be made early enough to prevent conflicts with future development.

3.5 Wastewater Treatment Facility Analysis

The existing wastewater treatment facility is located just south of Guadalupe Road and Ironwood Drive. The facility is located on a 60-acre site. The facility was constructed in 1994/95 and is sized for 2.1 MGD. The facility was designed for expansion to 3.2 MGD by adding another aeration basin, a sludge lagoon and a holding pond (both the sludge lagoon and the holding pond have already been constructed). The WWTF is designed for full reuse but also has a discharge permit in the event all the effluent cannot be used.

The facility has recently been re-permitted to recharge the effluent in three recharge beds as discussed in Section 2.2.4 above. There are plans available to construct additional Vadose Zone wells if the infiltration rate is not as high as expected.

When the facility was first brought on line, only 0.2 MGD of sewage was treated. Average daily flows are up to 1.5 MGD or 60 percent of capacity. ADEQ requires facilities to start the planning process when facilities reach 70 percent of capacity. If the service area is not fully connected, then the Master Plan should include expansion recommendations and schedule for implementation. Typical minimum time frames for expansion are two to three years for planning, design, funding acquisition, construction and start-up. If growth is more rapid then facilities need to implement expansion plans in a timely manner to prevent overloading of the system.

The average rate of increase over the last 10 years has been 110,000 GPD per year. At that rate of increase, the facility will reach capacity in eight years. However, the rate of growth is expected to increase as Apache Junction undeveloped space is converted to residential, commercial and industrial use; state land south of Baseline is released for sale and developed; and as properties within the District connect to sewer. Actual wastewater flow data is presented in Appendix C.

As can be seen from the existing water data, existing sewer generation is only 27 percent of water usage. Typically, sewer generation is 70 to 90 percent of water usage depending on the type of community. There are two reasons that the existing sewer to water ratio is so low: 1) the water service area boundaries are larger than the current sewer service area boundaries and 2) many existing septic systems both residential and commercial still exist within the sewer service boundary. New development will typically be added to the sewer collection system rather than use septic systems; therefore the rate of increase of sewage generation is expected to accelerate as Apache Junction develops.

CHAPTER 4
COLLECTION SYSTEM MASTER PLAN

4.1 Master Plan Model Description

H20MAP Sewer by MWH Soft, Inc. was used to model the existing and proposed District sewer collection system. Flow and population data that were entered into the computer model are presented on Table 2 (Flow Data) in Appendix B. Results of the computer model evaluation are presented on Table 3 (Pipe Data) in Appendix B and shown graphically on Figures 3 and 4.

The most recent Land Use Plan (Appendix A) along with the design criteria described in Chapter 2 was used to determine the wastewater flow contribution from each section in the existing and proposed service area boundary. The existing sewer collection system was surveyed and grade elevations were entered into a topographic data file; this data was used in the model. Record drawings and design plans of existing sewer lines were used to determine pipe sizes; this data was entered into the model manually. The existing system was then evaluated using the model to determine the capacity of the existing system to handle full build-out flows.

A pipe run was defined in this model as a length of pipe between the intersection of two other pipes or endpoints (nodes). The computer model was set to compute the peak flow for each pipe. The slope of the pipe was determined by the surveyed invert information. The peak flow was determined by entering the equivalent population of the coverage area for each pipe into a modified version of the peaking factor equations presented in Chapter 2 (from AAC R18-9-E 301). A steady-state analysis was performed to incorporate the peaking factor equations.

Equivalent populations were used to determine peaking factors for both residential and commercial areas. The equivalent population is equal to the average flow of the service area divided by 100 gallons per capita per day. A modified version of the peaking factor equations presented in Chapter 2 was used due to the computer program's inability to use the equations set forth by the AAC. The modified equation produces a result that is equal to or greater than results presented in Chapter 3 for equivalent populations above 300. The results are no greater than 0.14 for populations between 300 and 1,000,000 as illustrated in Figure 6.

Table 2, Flow Data, presents the peaking factors and peak flows using the AAC equations, and is equal to or slightly lower than the computer model results presented in Table 3 and Figures 3 and 4. Pipe sizing and slopes were not affected by using the modified equation. The modified equation used by *H2OMAP Sewer* is the following:

PF = 2/(0.6 + (P/1000)^0.4) + 1.263

Where:
PF = Peaking Factor
P = Equivalent Population

H2OMAP Sewer uses Manning's equation to determine gravity flow pipe capacities. Manning's equation is defined as the following:

Q = (1.49 * A * R^2/3 * S^1/2)/n

Where:

Q = Peak Flow (cfs)
A = Cross Sectional Area of Flow (ft^2)
R = Hydraulic Radius (ft) (cross sectional area divided by wetted perimeter)
S = Slope of Hydraulic Gradient (ft/ft)

For a pipe flowing full:

D = Pipe Diameter (ft)
A = (pi * D^2)/4
R = A/(pi * D) = D/4

And:

Q = (1.49 * ((pi * D^2)/4) * ((D/4)^2/3) * (S^1/2))/n

Table 4 (see appendix B) presents the flow data for the three proposed new lift stations.

4.2 Model Results

Figures 3 and 4 present graphically the model results for the existing and proposed collection system. The table on these figures lists the pipe number, the peak flow, the diameter and the slope for each pipeline in the model. The flow represents the pipeline capacity for the existing system and the peak flow for the proposed system. The diameter and slope represent known information for the existing system and the recommended design for the proposed system.

4.2.1 Existing Collection System

Using the design criteria in this report and the existing land use plan, the existing collection system is adequately sized in all but a few of areas of the existing collection system. The dashed green lines on Figures 3 and 4 show the three locations that may require future parallel collection sewer lines as Apache Junction develops and all residential and commercial properties connect. Two pipe numbers have been given for each of these reaches to model the existing pipeline and the proposed potential additional pipeline.

4.2.2 Proposed Collection System

The proposed system is shown as blue solid lines on Figures 3 and 4. Pipelines vary in size from 10 to 36 inches in diameter. Three lift stations are proposed for this area and are shown on the figures with their full build-out capacity. These lift stations could be constructed with lower capacity initially and the pumps changed out or parallel lift stations added depending on the anticipated rate of growth for the area as design progresses for each area.

4.2.3 Existing Lift Station

The existing lift station is located on Baseline Avenue near the CAP and Ironwood Drive. The lift station is a dual pump station facility that operates with one primary pump and a second alternating pump. Little design information is available for the lift station. However, each pump can produce approximately 3,500 gpm. The estimated capacity for this lift station is approximately 3.3 MGD. The lift station is designed with the option to add a second pump in future and would bring the capacity to approximately 6.6 MGD.

Estimated capacity of the existing collection system at full build-out is 7.8 MGD and the estimated sewage generation for all land north of Baseline as shown on Figure 2 would be 9.9 MGD. If the City of Apache Junction continues to develop as per the Land Use Plan, then it may be necessary to build a second lift station in the area. However, additional lift stations are proposed just south of Baseline that could take overflow capacity and would be a better option. This is discussed in greater detail in the following section.

4.2.4 Proposed Lift Stations for Service Area

As discussed previously, detailed collection system and lift station options are not presented for the proposed Phase II Service Area Expansion because this land is all State-owned land and not scheduled for release and sale in the near future. In addition, land use projections for this area are not detailed and it would be premature to provide detailed planning for the area.

Several lift stations are proposed for the Phase I Service Area expansion. Location and size of these lift stations have been approximated for this plan, but are subject to modification based on better topographic data that would be collected in the predesign and based on the specific sales and release of State land for development. In addition, location and sizing of wastewater treatment facilities will partially dictate location and size of lift stations. It is recommended in Chapter 5 that the District plan to construct two wastewater treatment facilities rather than expanding the existing facility. The current site is adequately sized for up to 16 MGD using oxidation ditches and similar open tank type processes. Additional land or a process change will be required to expand the existing wastewater treatment facility beyond about 16 MGD.

As listed in Section 4.2.3, approximately 9.9 MGD could be generated in full build-out north of Baseline Avenue. Approximately 8.5 MGD of flow is generated north of the CAP canal and south of Baseline Avenue in the Phase I proposed Service Area Expansion (see Figure 2). Approximately 4.4 MGD of flow is generated south of the CAP canal in the Phase I proposed Service Area Expansion. With the full build-out of the City of Apache Junction north of Baseline and all the flow between Baseline and Warner Road, the wastewater treatment facility will need to treat approximately 22.8 MGD. As discussed in Chapter 5, the existing site may not be adequate for this much flow depending on process selection.

As laid out on Figure 3 and 4 and listed on Table 4, flow is collected at the corner of Elliot Avenue and Idaho Road (Lift Station 2), the corner of Guadalupe Avenue and Ironwood Drive (Lift Station 3), and the corner of Warner Avenue and Meridian Road (Lift Station 4). The lift stations are sized for collection of flow from specific areas also shown on Figures 3 and 4. However, the flow collected at Lift Stations 2 and 3 could be balanced between the two depending on specific location of the lift stations. In addition, overflow from the existing lift station at full build-out could be accommodated in Lift Station 3. Detailed flow sizing should be determined when specific layouts and land developments are known.

In addition, Lift Stations 2 and 3 are shown east of the CAP and it is assumed that the force mains will be jack and bored under both a flood protection dam that parallels the CAP and under the CAP itself. However, depending on the flood design changes during development of the land, it may be more cost effective to jack and bore the gravity collectors under the CAP and the protection dam and locate the lift stations to the west of the CAP. Again, this decision can be made when detailed land use maps are complete and better topographic data is available.

In conclusion, specific sizing and location of the lift stations will depend on timing of sale of the state land, final land use plans and better topographic information. At minimum, the following is recommended:

Table 4.1 - Lift Station Sizing

	Collection System Requirement (MGD)	**Balanced Flow Recommendation (MGD)**
Existing Lift Station	9.9	6.6
Lift Station #2	7.9	Balance 11.8
Lift Station #3	0.6	Between these two
Lift Station #4	4.4	4.4
Total Potential Flow to Existing WWTF	22.8	22.8

CHAPTER 5

WASTEWATER TREATMENT FACILITY (IES) MASTER PLAN

5.1 Wastewater Treatment Facility Treatment Location and Sizing Evaluation

5.1.1 Long-Term Recommendations for Wastewater Treatment

In order to satisfy the expanded service area requirements, it is recommended that two wastewater treatment facilities be constructed for the proposed service area (see figures 3 and 4) rather than expanding the existing facility. There are a number of reasons for these recommendations: 1) existing amount of District-owned land, 2) topographic location of existing treatment facility, 3) the physical constraint of the CAP crossing the planning area, 4) the quantity of wastewater projected at full build-out, 5) the projected time frame for full build-out and 6) the limited options for discharge of effluent south of the existing wastewater treatment facility.

All of the reasons listed for constructing two facilities rather than one are inter-related to each other. Figure 2 shows quantities of flow generated for each section of the proposed service area and shows totals for areas east and west of the CAP for the short-term expansion area and the long-term expansion area. The short-term expansion area (Phase 1 on Figure 2) is all land not currently connected to the wastewater treatment facility north of Warner Road. The long-term expansion area (Phase II on Figure 2) is all land south of Warner Road and north of Germann Road. These flows indicate that the total expected flow for the Planning Area would be about 36.3 MGD based on conventional residential development and year round residents.

A wastewater treatment facility to handle 36.3 MGD would need approximately 35 to 40 acres of land, using a rough rule of thumb of 5 acres per 5 MGD of treated sewage for a mechanical plant. Too much land is required to expand the current Biolac lagoon-type treatment system to meet the full build-out flow rates. It is assumed that a 36.3 MGD facility would be an advanced facility and would have full odor and noise control in order to meet current setback limits. Setbacks for a facility of this size would be 350 feet with full odor, noise and aesthetics control and 1000 feet without odor control, noise and aesthetics control. The total approximate land size required at full build-out would be 65 acres (with 350-foot setbacks). Additional land would be required for recharge ponds and reuse storage.

The existing facility is located on a 60-acre piece of land, but most of that land is now occupied by the Biolac treatment facility. Appropriate expansion would have to be planned to convert the plant to a mechanical plant in order to site the full-size facility on the existing land.

The existing treatment facility is located upstream of one third of the short-term expansion area and all of the long-term expansion area. All flow would have to be pumped to the existing site from these areas. However, the CAP crossing the service area dictates that about half of the flow will have to be pumped in any event. Locating a second treatment facility in the southwest corner of the proposed service area will realize cost savings of not pumping all of the sewage in the District. These cost savings can be significant.

Time projections for when expansion of the existing facility and/or construction of a second facility also play a part in which option would be better. It is anticipated that development of the existing Apache Junction old town area will proceed at the same or an increasing pace for the next five to ten years. Current flow of 1.5 MGD is expected to approach the full build-out flow of 3.2 MGD in five to ten years depending on the schedule of sale of State land. It is also anticipated that the land between Baseline and Warner will be sold by the State in the near future (one to five years) and development will proceed toward build-out at or above the pace of the existing service area. Developers prefer undeveloped land over infill projects in many cases. However, sale and development of the state land between Warner and Germann Roads is expected to not fall into this same time frame. Apache Junction is working with the state to sell this land, but reasonable development of this land would be more like 10 to 20 years.

The last issue entails deciding where the effluent will be discharged or reused. Figure 1 shows the neighboring boundaries for sanitary sewer collection and treatment. The only discharge location in the existing service area is the very small wash at the existing wastewater treatment facility. The next closest location is Queen Creek Wash in the Queen Creek or Johnson Ranch District areas. Town of Queen Creek, City of Mesa and Town of Gilbert have intergovernmental agreements for construction of a regional facility in Gilbert along the Queen Creek Wash.

The current wastewater treatment facility was constructed with the intent to reuse all the effluent. Due to a lack of reuse users in the area at this time, the existing ADEQ permit was converted to a recharge permit. However, to recharge 36 MGD of effluent would take a fairly substantial recharge area and system and the existing wastewater treatment facility site will not be suitable for this quantity of effluent recharge.

It is anticipated that as Apache Junction grows, reuse will become more viable. Communities in the Valley are already instigating ordinances that require public facilities be plumbed for dual water sources: potable and gray water. Reuse water is almost always pressurized; therefore, booster pump stations will need to be constructed to route the reuse to the users. Locating the a second wastewater treatment facility at the downstream end of a gravity sewer collection system is the most cost effective location for the treatment facility and has little or no effect on the reuse system since it is to be pressurized for distribution and use anyway.

In conclusion, two wastewater treatment facilities are recommended for the District rather than purchase of additional land at the existing facility and expansion at the existing site. It is further recommended that the District proceed with updating the Central Arizona Association of Governments (CAAG) 208 plan to expand the SMCFD planning area to cover the land studied in this Master Plan.

5.1.2 Existing Facility Expansion Recommendations

Originally, this Master Plan recommended expansion to the planned 3.2 MGD capacity with plans to expand to a 10 MGD advanced treatment facility in ten years with expansion capability to 15 MGD. Rate of development was based on the expectation that State land sales, although highly desired by the City of Apache Junction, were still off in the long-distant future. However, in the year between the draft and finalization of this Master Plan, it became apparent that State land sales may be much more immanent.

The District contracted with Rothberg, Tamburini, Winsor, Inc. (RTW) to prepare a wastewater treatment facility evaluation and master plan. This plan identifies a number of shortcomings in the original plant designs and current functionality of the plant and provides recommendations for improvement and modification. In addition, the WWTF Master Plan calls for construction of an oxidation ditch that will allow expansion of the plant from the approximate 2.0 MGD today to 4.0 MGD in Phase I. Additional phases call for construction of additional oxidation ditches, in 4-MGD quantities to a total of 16 MGD. Costs and details of this expansion can be found in the RTW Master Plan.

Total flow at full build-out that could come to the WWTF based on layouts presented on Figures 3 and 4 of this plan is 22.8 MGD. As discussed in Chapter 4 and the RTW Master Plan, the existing 60-acre WWTF site is inadequate for open tank processes beyond 16 MGD. In addition, the WWTF will require either a 350-setback with full odor, noise and aesthetics control or a 1,000-foot setback without odor, noise or aesthetics control or waivers. The District currently holds a waiver from the State and it is assumed that this waiver will be transferred with land sales. However, the District has been working with the State to purchase additional buffer land or to maintain an institutional zoning around the facility. It is anticipated that even if the District has waivers, residential users of land adjacent to the WWTF will complain.

Several options are available to address expansion of the WWTF to the full build-out size of 22.8 MGD including additional land purchase at the existing site, process change, and re-routing some of the flow to the proposed second WWTF. The rate and location of the sale of State land will have a major impact on phasing and the determination of full size build-out for the existing site and for a second WWTF. It is feasible that part of the flow currently shown on Figures 2 and 3 could be routed to the proposed second facility. Another option is to convert to another treatment process that is less land intensive. Many Arizona facilities are constructing additional phases of their WWTF as membrane plants because of the reduced land requirement and because these odor, noise and aesthetic controls are intrinsic to the design. In addition, the full build-out of the existing service area may not occur. The existing service area was originally expected to generate about 6.6 MGD of sewage at full build-out. Recent land use plans and expansion of the service area north of Baseline now estimate up to 9.9 MGD of sewage at full build-out. However, there are a number of existing facilities that have not connected and may never connect to the WWTF. The additional 3.3 MGD capacity may not be required.

5.2 Facility No. 2 Siting Evaluation

It is recommended that a second wastewater treatment facility could be constructed along the western boundary of the service area (along the Meridian Road alignment). Based on the USGS topographic data, the facility could be located anywhere along the Meridian Road alignment between Germann and Pecos Road. An evaluation of the City of Mesa land use plan would be in order to verify a specific site. It would be important to keep the facility in industrial or public zoned areas if possible. A minimum 60-acre site is recommended for this second facility.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The intent of this Wastewater Master Plan is to provide guidance for an orderly expansion of the wastewater service system and identify the need for system improvements. In summary, the conclusions of this plan are as follows:

General

- The Superstition Mountains Community Facilities District No. 1 proposes to expand its service and planning areas and this Master Plan has been prepared to give recommendations for collection system and treatment facilities.
- The District currently consists of approximately 17 square miles and proposes to expand to 72 square miles.
- There are approximately 106 miles of existing main sewer collection line and the treatment facility is currently sized for 2.1 MGD with expansion capability to 3.2 MGD.

Design Criteria

- Design criteria are based upon current Arizona Department of Environmental Quality (ADEQ) and Arizona Administrative Code (AAC) requirements.
- Population density and land use criteria are based on land use recommendations in the *City of Apache Junction General Plan*.
- Average daily flow is based upon recommended land use recommendations in the *City of Apache Junction General Plan* ADEQ flow recommendations and City of Phoenix Guidelines for commercial and industrial land uses.
- In general, the flow direction of the gravity wastewater system follows the ground surface that falls from the northeast to the southwest.
- Reuse, discharge and recharge standards are all presented for the planning area.

- It has been a goal of the District to reuse or recharge all of the effluent produced. This goal is reinforced in the analysis of this Master Plan due to the limitations for discharge and the beneficial need for effluent reuse and recharge.

- The District has elected to meet A+ effluent water quality standards in all future WWTF designs and upgrades.

Existing Sewer Collection System

- The existing wastewater collection system service area is roughly 17 square miles.

- Population and water use information prepared and used in the *City of Apache Junction General Plan* was used to compare to sewage generation based on land use and ADEQ design criteria.

- Sewage generation was evaluated for both the 1999 Land Use Plan published in the *City of Apache Junction General Plan* and recently land use modifications proposed by the State of Arizona as land south of Baseline Avenue, north of Warner Road is proposed for sale.

- An assessment of population projections and water usage projections published in other documents point out the difficulty in projecting quantities of flow generated at full build-out and when full build-out will occur. Planning must balance the short- and long-term expectations for a service area.

- Projected wastewater flows were prepared for full build-out of the existing collection and expanded service area (9.9 MGD), the Phase I expansion area (12.2 MGD) and the Phase II expansion area (14.7 MGD) based on the 1999 City of Apache Junction Land Use Plan.

- Projected wastewater flows were prepared for full build-out of the existing collection and expanded service area (9.9 MGD), the Phase I expansion area (14.8 MGD) and the Phase II expansion area (16.8 MGD) based on Alternative 3 Land Use Option.

- The Master Plan collection system, lift station and wastewater treatment facility planning are based on the City of Apache Junction Land Use Plan, but detailed design will be based on the actual land use in effect at the time of design.

- Existing sewer system is composed of 8-inch to 36-inch diameter pipelines, a 3.3 MGD lift station and a 2.1 MGD treatment facility with expansion to 3.2 MGD.

- The proposed sewer collection system is a gravity system that, in general, follows the mile road alignments and flow is from the northeast to the southwest.

- Several lift stations will be required to transfer sewage across the CAP that diagonally splits the Phase I and Phase II expansion areas from the northwest to southeast.

- Current average daily flow to the wastewater treatment facility is 1.5 MGD or 70% of the facility capacity.

- Additional sewer connections are made each year in the service area. The rate of growth based on past increase suggests 110,000 GPD is added annually.

<u>Collection System Master Plan</u>

- *H20MAP Sewer* by MWH Soft, Inc. was used to model the existing and proposed District sewer collection system.

- The existing system was evaluated to determine if it could handle the future flows from the updated Land Use Plan. Three lines were found to potentially require parallel lines in future if full build-out proceeds per the land use plan.

- The proposed system is shown as blue solid lines on Figures 3 and 4. Pipelines vary in size from 10 to 36 inches in diameter.

- Three lift stations are proposed for this area and are shown on the figures with their full build-out capacity.

- Expansion of the existing lift station and specific siting and sizing of the three proposed lift stations will be based on detailed topographic data and land use as the State land is sold.

<u>Wastewater Treatment Facility(ies) Master Plan</u>

- Two wastewater treatment facilities are recommended for the existing service area and the proposed expansion of the service area.

- It is recommended that the District proceed with the documentation and research to modify the existing CAAG 208 plan and expand their planning area.

- RTW has prepared a wastewater treatment facility evaluation and master plan recommending upgrades and improvements to the existing facility and expansion to a 4.0 MGD facility using oxidation ditches.

- RTW has identified that the existing WWTF facility can be expanded to approximately 16.0 MGD on the existing site.

- Expansion of the existing WWTF to the potential 22.8 MGD capacity can be addressed by additional land purchase, process conversion or diverting a portion of the flow to the proposed second wastewater treatment facility.

- A second facility in the southwest corner of the Phase II expansion area is recommended for the Phase II expansion area.

- It is recommended that the District either purchase additional land surrounding the existing wastewater treatment facility for a buffer or encourage compatible institution or industrial land uses around the facility.

- It is recommended that a minimum of 60 acres of land be set aside and purchased in the Phase II area for a 15 MGD to 20 MGD advanced wastewater treatment facility.

6.2 Recommendations

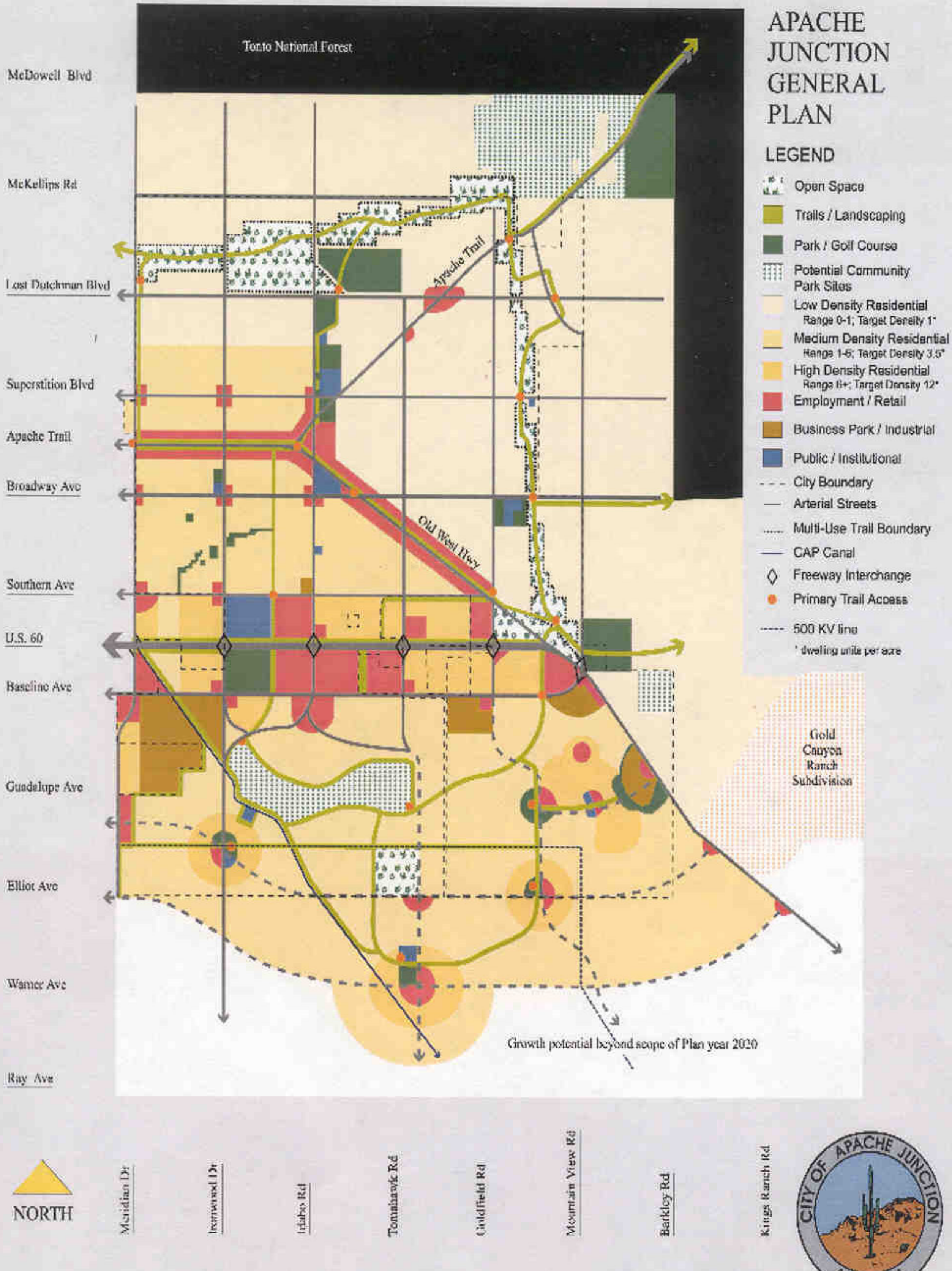
This Wastewater Master Plan should be used as a guideline for the wastewater system decision process. In addition, the District should evaluate anticipated growth and plan future funding needs and construction phasing before the existing system reaches its peak capacity.

The extended land use area is mostly state land. When this study was started in 2004, it was estimated the state would not sell this land for up to ten years. However, it appears that the City of Apache Junction is pushing forward with plans and recommendations for the release of this land in a much shorter period of time and the State is now providing recommendations on land use that are slightly different that the Apache Junction 1999 Land Use Plan. From a planning perspective, the current sizes suggested for the collection system, lift station and the WWTFs should be adequate. However, attention should be paid at each stage of design and when more information is available. Master Plans should be modified and updated to reflect the current information when the plans are out of sync by about 20% of the expectation. Sale of the state land and actual development plans will determine the rate of development and sizing required for the sanitary sewer and treatment systems.

The District should move forward with the modification of the CAAG 208 Plan for area to set in motion the planning for the Phase I and II expansion areas and to establish these areas to be added to the District Service Area in the future. In addition, the District should proceed with plans and begin the search for funding to expand the existing treatment facility per the RTW Wastewater Master Plan.

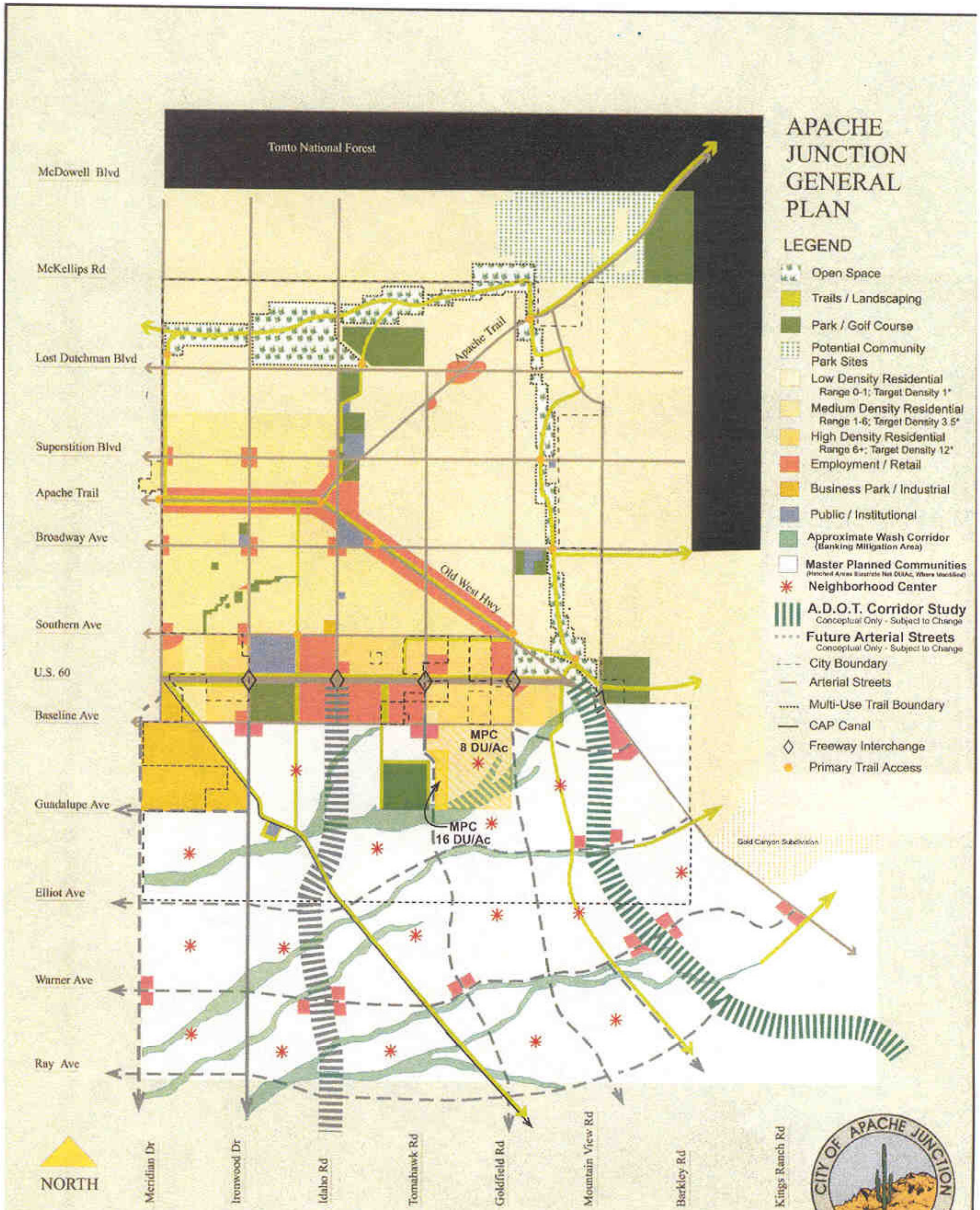
APPENDIX A

FIGURES



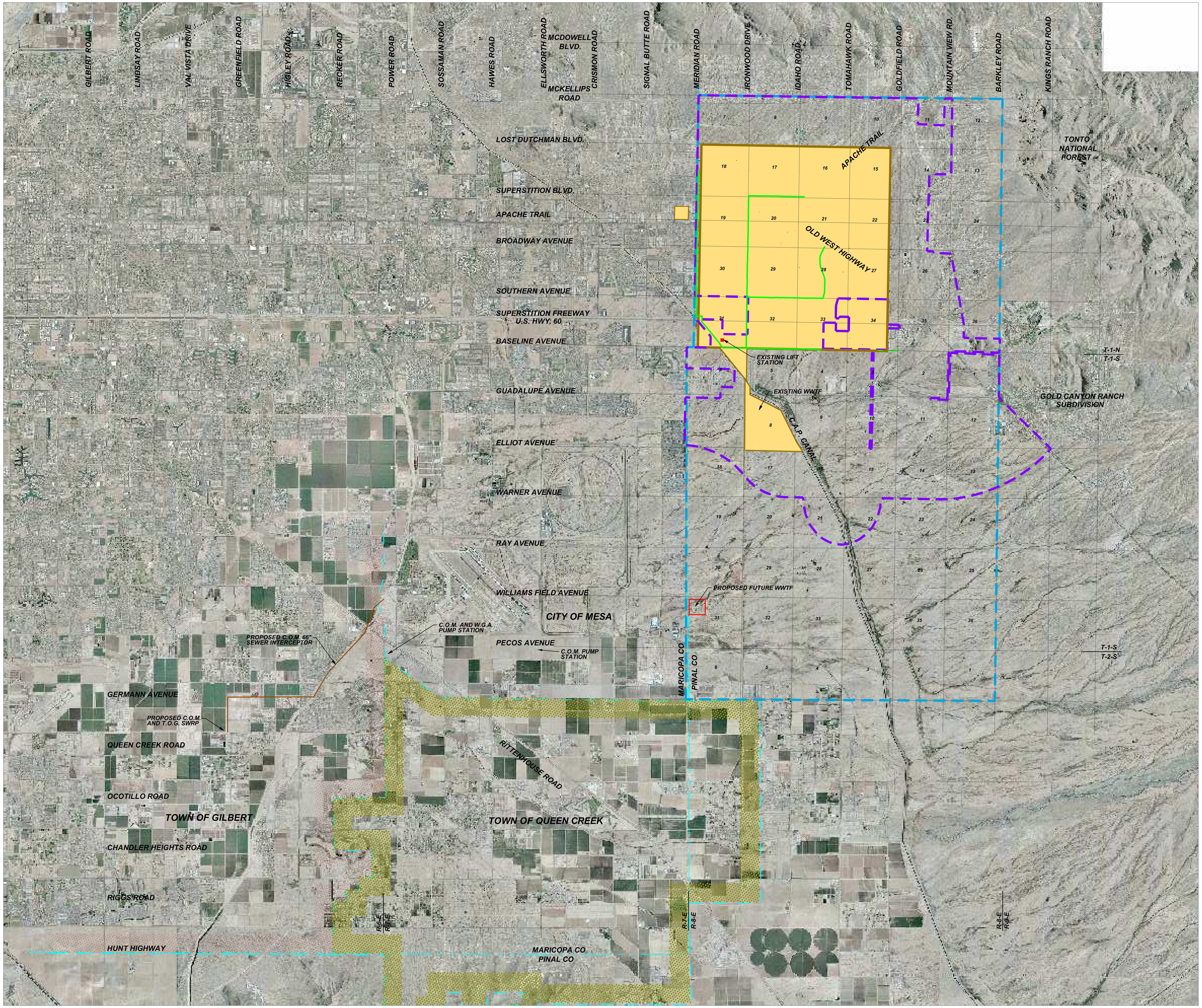
DEVELOPMENT PLAN

Alternative #1: No Changes



DEVELOPMENT PLAN

Alternative #3



V:\52813\active\Apache Junction\181310403--Sewer Planning\Drawings\AJSEWERMASTERPHOTO.dwg

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix AZ USA
85044-5355
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Stantec

LEGEND:

- SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1 SERVICE AREA BOUNDARY
- CITY OF APACHE JUNCTION LAND USE BOUNDARY
- SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1 PROPOSED SERVICE AREA BOUNDARY
- EXISTING SEWER COLLECTION SYSTEM

N

5000 2500 0 5000 10000

Scale in feet

Client/Project

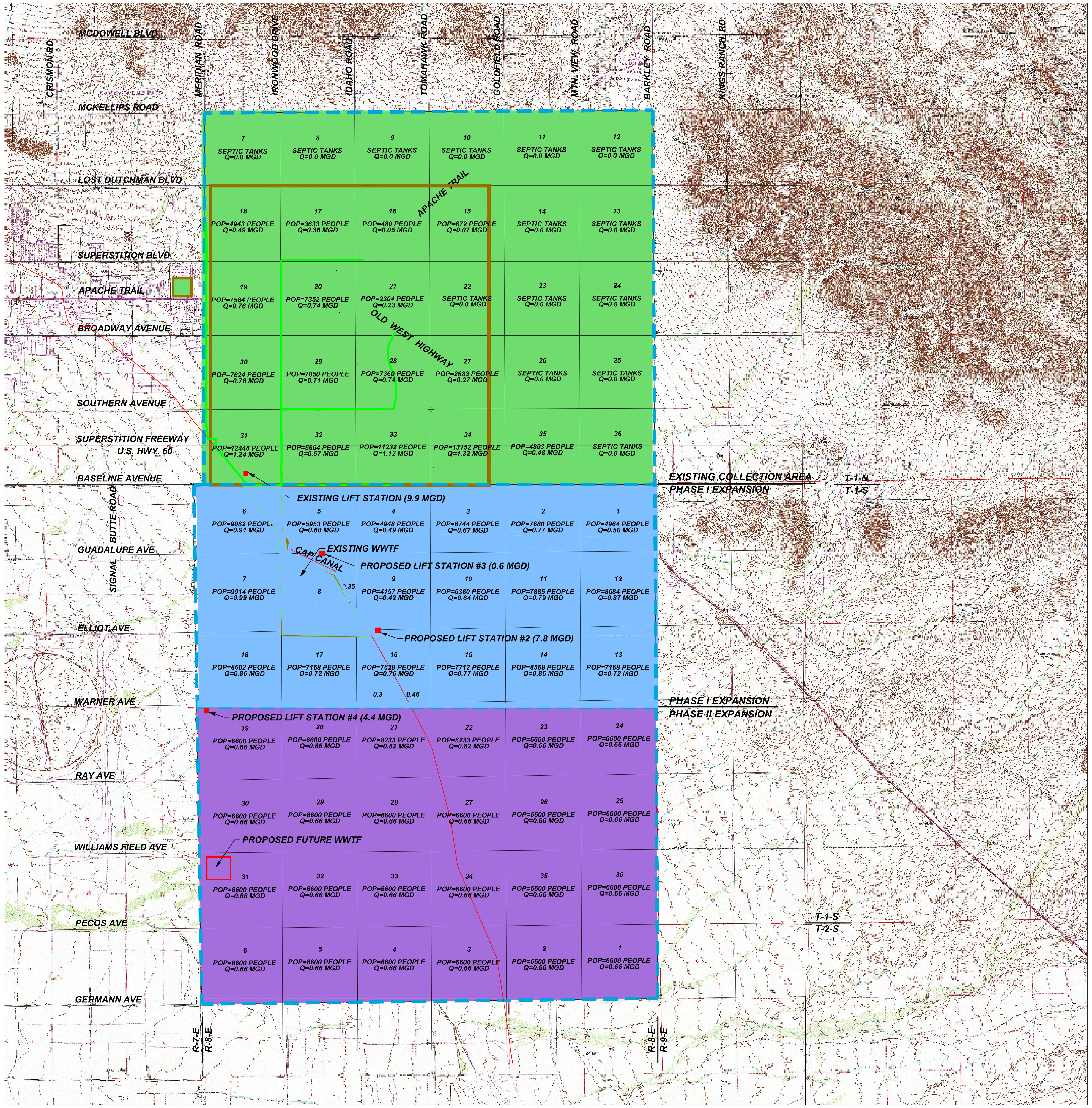
SUPERSTITION MOUNTAINS CFD NO. 1
WASTEWATER MASTER PLAN

Apache Junction, Arizona

Title

FIGURE 1
PLANNING AREAS

Project No.	Scale
181310403	1"=5000'



V:\5281\active\Apache Junction\181310403--Sewer Planning\Drawings\AJSEWEREXHIBIT3.dwg

	Sewage Flow (MGD)
Existing Flow	1.5
Existing WWTF Capacity	2.1
Existing WWTF Expansion Capacity	3.2
Existing Collection System at Full Build-out	7.8
Sewage Generation at Full Build-out (North of Baseline)	9.9
Sewage Generation at Full Build-out (South of Baseline, North of Warner)	12.9
Sewage Generation at Full Build-out (South of Warner, north of Germann)	13.5
Sewage Generation at Full Build-out (entire proposed service area)	36.3

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix AZ USA
85044-5355
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Stantec

LEGEND:

- EXISTING & EXPANDED COLLECTION SYSTEM AREA
- PHASE I EXPANSION AREA
- PHASE II EXPANSION AREA
- SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1 PROPOSED SERVICE AREA BOUNDARY
- EXISTING SEWER COLLECTION SYSTEM
- LIFT STATION
- 23 SECTION NUMBER
- POP POPULATION BASED ON LAND USE PLAN
- Q= AVERAGE DAILY FLOW IN MILLION GALLONS PER DAY

N

4000 2000 0 4000 8000

Scale in feet

SMCFD

Client/Project

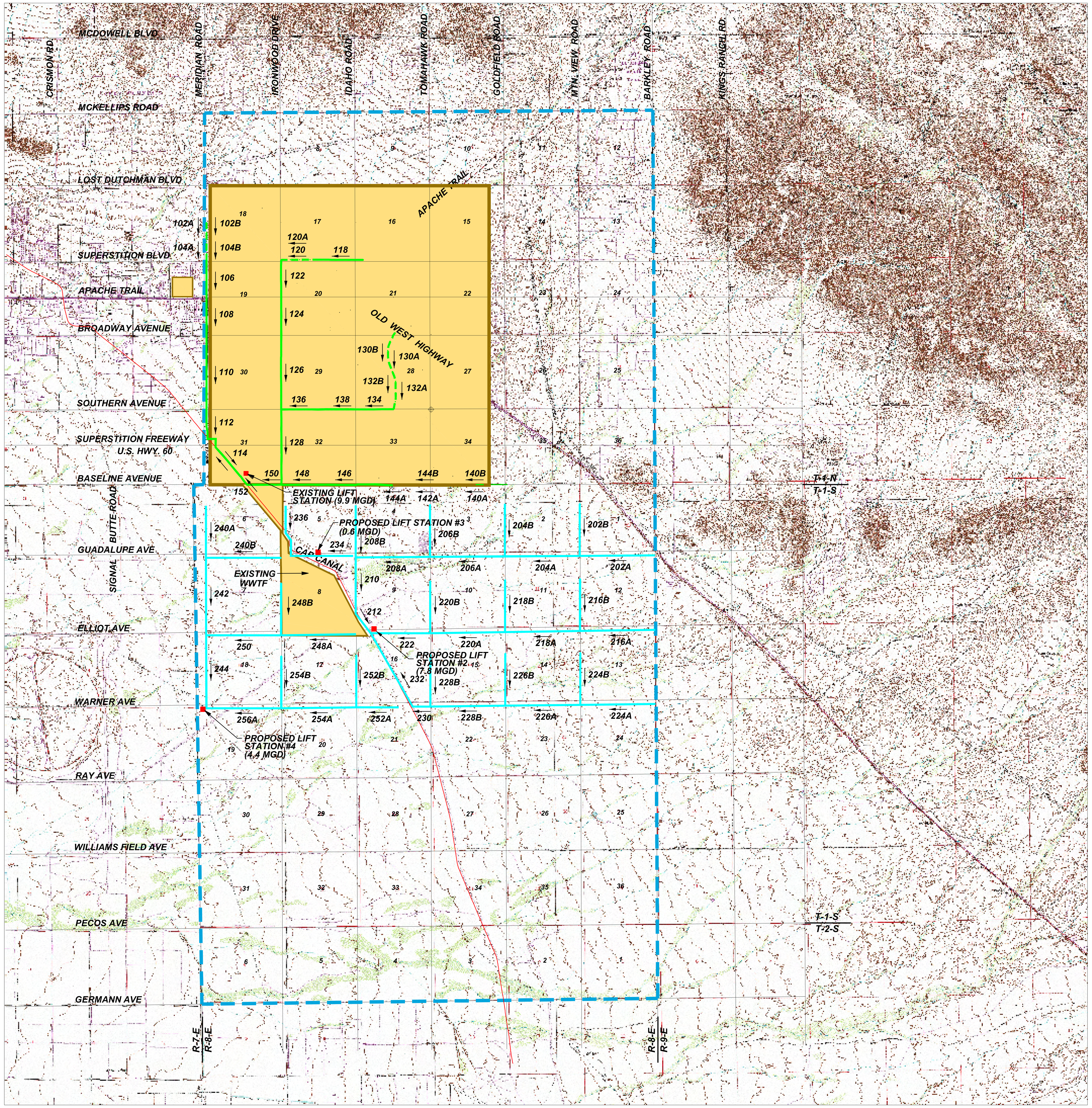
SUPERSTITION MOUNTAINS CFD NO. 1
WASTEWATER MASTER PLAN

Apache Junction, Arizona

Title

FIGURE 2
AVERAGE DAILY SEWAGE FLOWS

Project No.	Scale
181310403	1"=4000'



PIPE	Q	DIAMETER	SLOPE
ID	cfs	In	%
102A	0.49	8	0.771
102B	0.83	10	0.771
104A	0.87	10	0.712
104B	0.83	10	0.712
106	2.09	15	0.749
108	3.59	18	0.769
110	5.51	21	0.597
112	6.02	27	0.326
114	7.03	36	0.215
116	23.69	36	0.500
118	0.48	8	0.902
118A	0.55	8	0.902
120A	1.04	10	0.954
120B	0.55	8	0.954
120C	0.55	10	0.800
122	2.88	15	0.621
124	3.45	18	0.873
126	4.26	21	0.606
128	8.83	27	0.794
130A	0.53	8	0.787
130B	0.93	10	0.787
132A	0.81	10	1.334
132B	1.20	10	1.334
134	2.59	15	0.534
136	4.45	18	0.516
138	4.53	21	0.716
140A	0.47	10	0.350
140B	3.43	15	0.350
142A	1.14	12	0.576
144A	1.31	15	0.410
144B	3.99	18	0.437
146	4.98	18	0.381
148	8.47	27	0.757
150	16.81	30	0.823
152	17.76	36	0.146
202A	1.01	15	0.950
202B	0.72	10	0.500
204A	3.17	15	0.950
204B	0.65	10	0.500
206A	4.90	18	0.650
206B	0.63	10	0.750
208A	6.14	24	0.500
208B	0.63	10	0.800
210	6.56	24	0.250
212	6.56	30	0.196
214	19.16	36	0.500
216A	1.65	15	1.100
216B	1.26	15	0.450
218A	4.17	15	0.800
218B	0.65	12	0.250
220A	5.77	18	0.800
220B	0.65	12	0.350
222	7.22	24	0.600
224A	1.70	12	0.950
224B	0.65	12	0.500
226A	3.71	15	0.750
226B	0.97	12	0.300
228A	5.75	18	0.750
228B	0.83	12	0.450
230	7.18	24	1.000
232	7.18	24	0.200
234	0.67	10	0.606
236	1.33	15	0.500
238	1.86	15	1.000
240A	1.90	15	0.600
240B	1.03	12	0.800
242	3.63	15	0.400
244	7.93	24	0.300
246	11.37	24	1.000
248A	1.43	15	0.600
248B	0.55	10	0.400
250	3.56	15	0.700
252A	0.99	12	0.550
252B	0.36	10	0.300
254A	2.73	15	0.550
254B	0.65	10	0.400
256A	4.12	15	0.550

Stantec

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix AZ USA
85044-5355
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

LEGEND:

- SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1 SERVICE AREA BOUNDARY
- SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1 PROPOSED SERVICE AREA BOUNDARY
- EXISTING SEWER COLLECTION SYSTEM
- UNDERSIZED EXISTING SEWER COLLECTION SYSTEM
- PROPOSED SEWER COLLECTION SYSTEM
- LIFT STATION

4000 2000 0 4000 8000

Scale in feet

SMCFD

Client/Project

SUPERSTITION MOUNTAINS CFD NO. 1
WASTEWATER MASTER PLAN

Apache Junction, Arizona

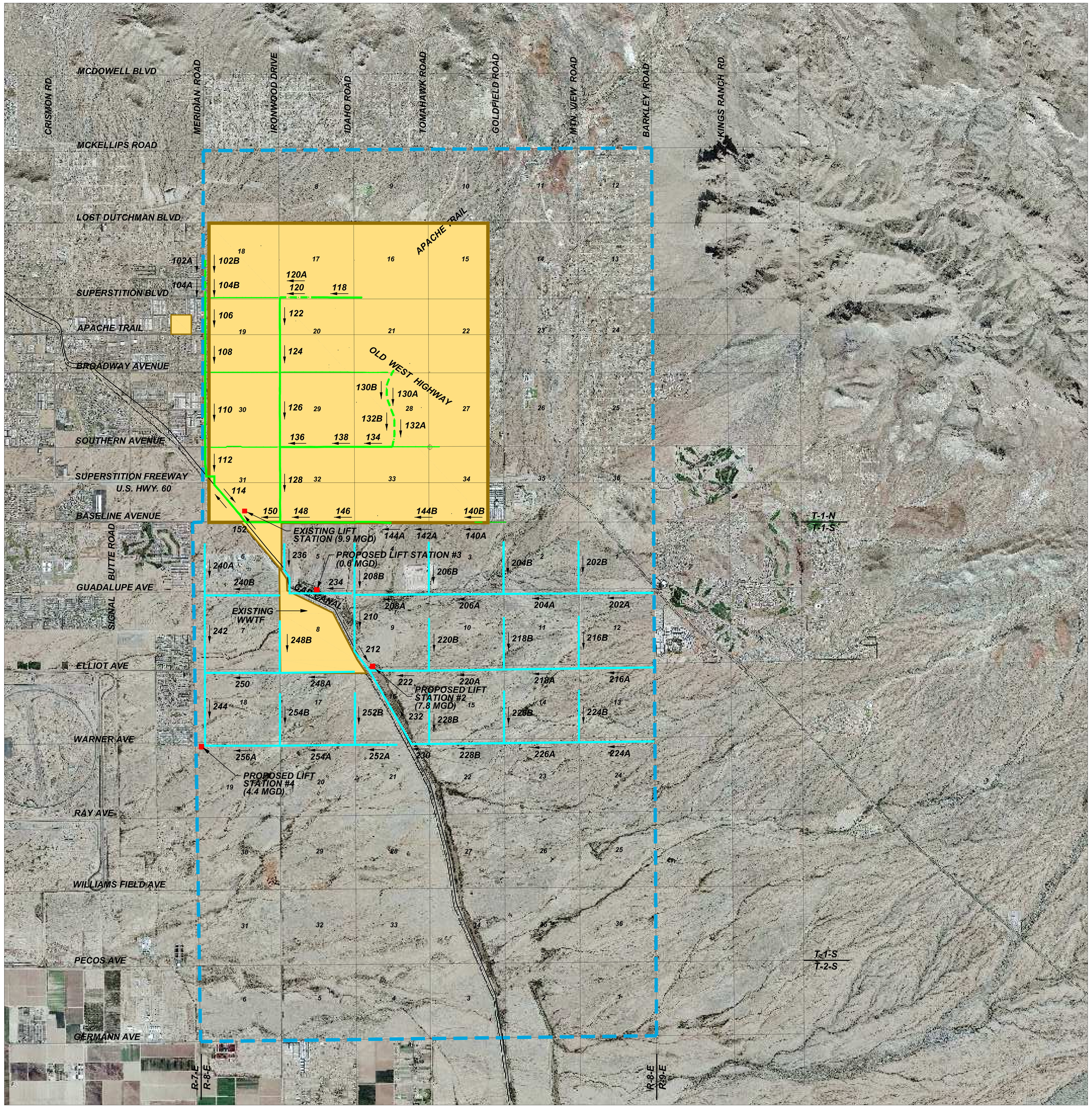
Title

FIGURE 3
SEWER SYSTEM LAYOUT

Project No. 181310403

Scale 1"=4000'

V:\52813\active\Apache Junction\181310403--Sewer Planning\Drawings\AJSEWEREXHIBIT2.dwg



PIPE	Q	DIAMETER	SLOPE
ID	cfs	In	%
102A	0.49	8	0.771
102B	0.83	10	0.771
104A	0.87	10	0.712
104B	0.83	10	0.712
106	2.09	15	0.749
108	3.59	18	0.769
110	5.51	21	0.597
112	6.02	27	0.326
114	7.03	36	0.215
116	23.69	36	0.500
118	0.48	8	0.902
118A	0.55	8	0.902
120A	1.04	10	0.954
120B	0.55	8	0.954
120C	0.55	10	0.800
122	2.88	15	0.621
124	3.45	18	0.873
126	4.26	21	0.606
128	8.83	27	0.794
130A	0.53	8	0.787
130B	0.93	10	0.787
132A	0.81	10	1.334
132B	1.20	10	1.334
134	2.59	15	0.534
136	4.45	18	0.516
138	4.53	21	0.716
140A	0.47	10	0.350
140B	3.43	15	0.350
142A	1.14	12	0.576
144A	1.31	15	0.410
144B	3.99	18	0.437
146	4.98	18	0.381
148	8.47	27	0.757
150	16.81	30	0.823
152	17.76	36	0.146
202A	1.01	15	0.950
202B	0.72	10	0.500
204A	3.17	15	0.950
204B	0.65	10	0.500
206A	4.90	18	0.650
206B	0.63	10	0.750
208A	6.14	24	0.500
208B	0.63	10	0.800
210	6.56	24	0.250
212	6.56	30	0.196
214	19.16	36	0.500
216A	1.65	15	1.100
216B	1.26	15	0.450
218A	4.17	15	0.800
218B	0.65	12	0.250
220A	5.77	18	0.800
220B	0.65	12	0.350
222	7.22	24	0.600
224A	1.70	12	0.950
224B	0.65	12	0.500
226A	3.71	15	0.750
226B	0.97	12	0.300
228A	5.75	18	0.750
228B	0.83	12	0.450
230	7.18	24	1.000
232	7.18	24	0.200
234	0.67	10	0.606
236	1.33	15	0.500
238	1.86	15	1.000
240A	1.90	15	0.600
240B	1.03	12	0.800
242	3.63	15	0.400
244	7.93	24	0.300
246	11.37	24	1.000
248A	1.43	15	0.600
248B	0.55	10	0.400
250	3.56	15	0.700
252A	0.99	12	0.550
252B	0.36	10	0.300
254A	2.73	15	0.550
254B	0.65	10	0.400
256A	4.12	15	0.550

Stantec

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix AZ USA
85044-5355
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

LEGEND:

- SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1 SERVICE AREA BOUNDARY
- SUPERSTITION MOUNTAINS COMMUNITY FACILITIES DISTRICT NO. 1 PROPOSED SERVICE AREA BOUNDARY
- EXISTING SEWER COLLECTION SYSTEM
- UNDERSIZED EXISTING SEWER COLLECTION SYSTEM
- PROPOSED SEWER COLLECTION SYSTEM
- LIFT STATION

N

4000 2000 0 4000 8000
Scale in feet

SMCFD

Client/Project
SUPERSTITION MOUNTAINS CFD NO. 1
WASTEWATER MASTER PLAN

Apache Junction, Arizona

Title
FIGURE 4
SEWER SYSTEM LAYOUT

Project No. 181310403
Scale 1"=4000'

V:\52813\active\Apache Junction\181310403--Sewer Planning\Drawings\AJSEWEREXHIBIT.dwg

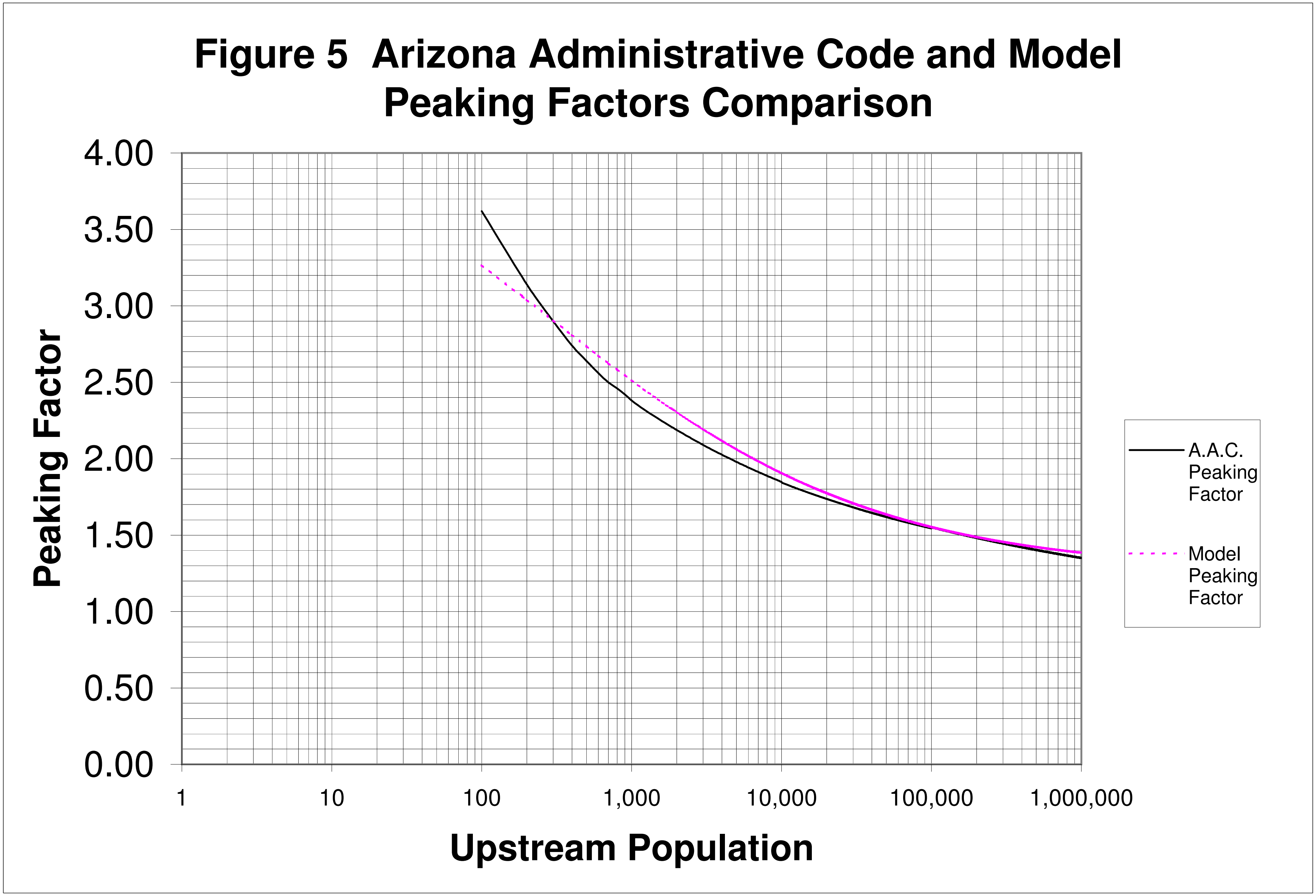


Figure 5 Arizona Administrative Code and Model Peaking Factors Comparison
Peaking Factor
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1
10
100
1,000
10,000
100,000
1,000,000
Upstream Population
A.A.C. Peaking Factor
Model Peaking Factor

APPENDIX B

TABLES

Table 1
Average Daily Flows Per Section Based on 1999 General Plan
Superstition Mountain CFD No. 1

* 100 gallons per capita per day

* low density - 2 dwelling unit per acre
* medium density - 3.5 dwelling unit per acre
* high density - 12 dwelling unit per acre

* low density - 3.2 persons per dwelling unit
* medium density - 3.2 persons per dwelling unit
* high density - 2 persons per dwelling unit
* average existing density (from zoning map)

* 3.2 people per acre
* 11.2 people per acre
* 24 people per acre
* 9.25 people per acre

* Business/Industrial - 1000 gallons per acre per day
* Retail/Employment - 1500 gallons per acre per day
* Public/Institutional - 1500 gallons per acre per day

* open space neglible flow
* trails/landscaping neglible flow
* park sites neglible flow
* golf courses neglible flow
* Areas of Septic Tank use neglible flow

Will be reffered to as open space

T	R	S	Open Space	Open Space	Business Industrial	Business Industrial	Retail Employ.	Retail Employ.	Public Inst.	Public Inst.	Low Density	Low Density	Medium Density	Medium Density	High Density	High Density	Total Area	Population	Total Flow
			sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq.mi	people	gallons
1N	8E	7	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	8	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	9	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	10	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	11	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	12	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	13	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	14	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	15	0.93	595.20	0.00	0.00	0.07	44.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	672	67,200
1N	8E	16	0.95	608.00	0.00	0.00	0.00	0.00	0.05	32.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	480	48,000
1N	8E	17	0.50	320.00	0.00	0.00	0.02	12.80	0.00	0.00	0.00	0.00	0.48	307.20	0.00	0.00	1.00	3,633	363,264
1N	8E	18	0.00	0.00	0.00	0.00	0.02	12.80	0.00	0.00	0.50	320.00	0.52	332.80	0.00	0.00	1.04	4,943	494,336
1N	8E	19	0.10	64.00	0.00	0.00	0.22	140.80	0.01	6.40	0.00	0.00	0.75	480.00	0.00	0.00	1.08	7,584	758,400
1N	8E	20	0.11	70.40	0.00	0.00	0.40	256.00	0.00	0.00	0.00	0.00	0.49	313.60	0.00	0.00	1.00	7,352	735,232
1N	8E	21	0.76	486.40	0.00	0.00	0.17	108.80	0.07	44.80	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2,304	230,400
1N	8E	22	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	23	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	24	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	25	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	26	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	27	0.68	435.20	0.00	0.00	0.16	102.40	0.00	0.00	0.00	0.00	0.16	102.40	0.00	0.00	1.00	2,683	268,288
1N	8E	28	0.00	0.00	0.00	0.00	0.09	57.60	0.01	6.40	0.01	6.40	0.89	569.60	0.00	0.00	1.00	7,360	736,000
1N	8E	29	0.02	12.80	0.03	19.20	0.02	12.80	0.00	0.00	0.00	0.00	0.93	595.20	0.00	0.00	1.00	7,050	705,024
1N	8E	30	0.03	19.20	0.00	0.00	0.04	25.60	0.00	0.00	0.00	0.00	1.01	646.40	0.00	0.00	1.08	7,624	762,368
1N	8E	31	0.00	0.00	0.00	0.00	0.15	96.00	0.00	0.00	0.00	0.00	0.25	160.00	0.60	384.00	1.00	12,448	1,244,800
1N	8E	32	0.41	262.40	0.00	0.00	0.36	230.40	0.23	147.20	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5,664	566,400
1N	8E	33	0.10	64.00	0.00	0.00	0.45	288.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	288.00	1.00	11,232	1,123,200
1N	8E	34	0.05	32.00	0.00	0.00	0.25	160.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	448.00	1.00	13,152	1,315,200
1N	8E	35	0.54	345.60	0.00	0.00	0.00	0.00	0.00	0.00	0.09	57.60	0.13	83.20	0.24	153.60	1.00	4,803	480,256
1N	8E	36	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
Sub-Total			**19.18**	**12,275.20**	**0.03**	**19.20**	**2.42**	**1,548.80**	**0.37**	**236.80**	**0.60**	**384.00**	**5.61**	**3,590.40**	**1.99**	**1,273.60**	**30.20**	**98,984**	**9,898,368**

Note: '*' Indicates area is not part of the existing sewer system, and is currently using septic tanks for disposal

Sub-Total:		
	Total Area:	**30.2 Sq.Mi**
	Existing Service Area:	**16.2 Sq.Mi**
	Population:	**98,984 People**
	Flow Generated:	**9.90 MGD**

Average Flow Per Section: **0.61 MGD**

Table 1
Average Daily Flows Per Section Based on 1999 General Plan
Superstition Mountain CFD No. 1

T	R	S	Open Space	Open Space	Business Industrial	Business Industrial	Retail Employ.	Retail Employ.	Public Inst.	Public Inst.	Low Density	Low Density	Medium Density	Medium Density	High Density	High Density	Total Area	Population	Total Flow
			sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq.mi	people	gallons
1S	8E	1	0.16	102.40	0.09	57.60	0.04	25.60	0.00	0.00	0.42	268.80	0.16	102.40	0.13	83.20	1.00	4,964	496,384
1S	8E	2	0.12	76.80	0.09	57.60	0.02	12.80	0.00	0.00	0.00	0.00	0.60	384.00	0.17	108.80	1.00	7,680	768,000
1S	8E	3	0.05	32.00	0.18	115.20	0.03	19.20	0.00	0.00	0.00	0.00	0.74	473.60	0.00	0.00	1.00	6,744	674,432
1S	8E	4	0.33	211.20	0.00	0.00	0.06	38.40	0.00	0.00	0.00	0.00	0.61	390.40	0.00	0.00	1.00	4,948	494,848
1S	8E	5	0.36	230.40	0.00	0.00	0.09	57.60	0.00	0.00	0.00	0.00	0.41	262.40	0.14	89.60	1.00	5,953	595,328
1S	8E	6	0.04	25.60	0.76	486.40	0.05	32.00	0.00	0.00	0.00	0.00	0.20	128.00	0.15	96.00	1.20	9,082	908,160
1S	8E	7	0.03	19.20	0.00	0.00	0.19	121.60	0.00	0.00	0.00	0.00	0.85	544.00	0.13	83.20	1.20	9,914	991,360
1S	8E	8	0.34	217.60	0.00	0.00	0.00	0.00	0.03	19.20	0.00	0.00	0.50	320.00	0.13	83.20	1.00	5,869	586,880
1S	8E	9	0.42	268.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	371.20	0.00	0.00	1.00	4,157	415,744
1S	8E	10	0.11	70.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	569.60	0.00	0.00	1.00	6,380	637,952
1S	8E	11	0.19	121.60	0.00	0.00	0.08	51.20	0.00	0.00	0.00	0.00	0.50	320.00	0.23	147.20	1.00	7,885	788,480
1S	8E	12	0.04	25.60	0.02	12.80	0.02	12.80	0.02	12.80	0.00	0.00	0.69	441.60	0.21	134.40	1.00	8,684	868,352
1S	8E	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	640.00	0.00	0.00	1.00	7,168	716,800
1S	8E	14	0.04	25.60	0.00	0.00	0.02	12.80	0.00	0.00	0.00	0.00	0.74	473.60	0.20	128.00	1.00	8,568	856,832
1S	8E	15	0.06	38.40	0.00	0.00	0.00	0.00	0.03	19.20	0.00	0.00	0.80	512.00	0.11	70.40	1.00	7,712	771,200
1S	8E	16	0.05	32.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	544.00	0.10	64.00	1.00	7,629	762,880
1S	8E	17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	640.00	0.00	0.00	1.00	7,168	716,800
1S	8E	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	768.00	0.00	0.00	1.20	8,602	860,160
Sub-Total			**2.34**	**1,497.60**	**1.14**	**729.60**	**0.60**	**384.00**	**0.08**	**51.20**	**0.42**	**268.80**	**12.32**	**7,884.80**	**1.70**	**1,088.00**	**18.60**	**129,106**	**12,910,592**

Sub-Total:	**Area:**	**18.6 Sq.Mi**			
	Population:	**129,106 People**			
	Flow Generated:	**12.91 MGD**		**Average Flow Per Section:**	**0.69 MGD**
Total:	**Area:**	**34.80 Sq.Mi**	(Area does not include septic tank sections)		
	Population:	**228,090 People**			
	Flow Generated:	**22.81 MGD**		**Total Average Flow Per Section:**	**0.66 MGD**

Table 1
Average Daily Flows Per Section Based on 1999 General Plan
Superstition Mountain CFD No. 1

T	R	S	Open Space	Open Space	Business Industrial	Business Industrial	Retail Employ.	Retail Employ.	Public Inst.	Public Inst.	Low Density	Low Density	Medium Density	Medium Density	High Density	High Density	Total Area	Population	Total Flow
			sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq.mi	people	gallons
1S	8E	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87	556.80	0.13	83.20	1.00	8,233	823,296
1S	8E	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87	556.80	0.13	83.20	1.00	8,233	823,296
Sub-Total			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.74**	**1,113.60**	**0.26**	**166.40**	**2.00**	**16,466**	**1,646,592**

T	R	S	Total Area	Average Flow	Population
			sq.mi	MGD	people
1S	8E	**19	1.00	0.66	6,600
1S	8E	**20	1.00	0.66	6,600
1S	8E	**23	1.00	0.66	6,600
1S	8E	**24	1.00	0.66	6,600
1S	8E	**25	1.00	0.66	6,600
1S	8E	**26	1.00	0.66	6,600
1S	8E	**27	1.00	0.66	6,600
1S	8E	**28	1.00	0.66	6,600
1S	8E	**29	1.00	0.66	6,600
1S	8E	**30	1.00	0.66	6,600
1S	8E	**31	1.00	0.66	6,600
1S	8E	**32	1.00	0.66	6,600
1S	8E	**33	1.00	0.66	6,600
1S	8E	**34	1.00	0.66	6,600
1S	8E	**35	1.00	0.66	6,600
1S	8E	**36	1.00	0.66	6,600
2S	8E	**1	1.00	0.66	6,600
2S	8E	**2	1.00	0.66	6,600
2S	8E	**3	1.00	0.66	6,600
2S	8E	**4	1.00	0.66	6,600
2S	8E	**5	1.00	0.66	6,600
2S	8E	**6	1.00	0.66	6,600
Sub-Total			**22.00**	**11.88**	**118,800**

Note: '**' Indicates sections that were not zoned in the General Plan. The City's calculated average flow was used for these sections.

Sub-Total:	**Area:**	**24.00**	**Sq.Mi**
	Population:	**135,266**	**People**
	Flow Generated:	**13.53**	**MGD**

Average Flow Per Section: **0.56 MGD**

Table 1-A
Average Daily Flows Per Section Based on 2005 Alternative 3 Land Use Plan
Superstition Mountain CFD No. 1

* 100 gallons per capita per day

* low density - 2 dwelling unit per acre
* medium density - 3.5 dwelling unit per acre
* high density - 12 dwelling unit per acre
* state designated - 7 dwelling unit per acre

* low density - 3.2 persons per dwelling unit
* medium density - 3.2 persons per dwelling unit
* high density - 2 persons per dwelling unit
* high density - 2 persons per dwelling unit
* average existing density (from zoning map)

* 3.2 people per acre
* 11.2 people per acre
* 24 people per acre
* 14.0 people per acre
* 9.25 people per acre

* Business/Industrial - 1000 gallons per acre per day
* Retail/Employment - 1500 gallons per acre per day
* Public/Institutional - 1500 gallons per acre per day

* open space neglible flow
* trails/landscaping neglible flow
* park sites neglible flow
* golf courses neglible flow
* freeway neglible flow
* Areas of Septic Tank use neglible flow

Will be reffered to as open space

T	R	S	Open Space sq. miles	Open Space acre	Business Industrial sq. miles	Business Industrial acre	Retail Employ. sq. miles	Retail Employ. acre	Public Inst. sq. miles	Public Inst. acre	Low Density sq. miles	Low Density acre	Medium Density sq. miles	Medium Density acre	High Density sq. miles	High Density acre	Total Area sq.mi	Population people	Total Flow gallons
1N	8E	7	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	8	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	9	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	10	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	11	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	12	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	13	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	14	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	15	0.93	595.20	0.00	0.00	0.07	44.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	672	67,200
1N	8E	16	0.95	608.00	0.00	0.00	0.00	0.00	0.05	32.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	480	48,000
1N	8E	17	0.50	320.00	0.00	0.00	0.02	12.80	0.00	0.00	0.00	0.00	0.48	307.20	0.00	0.00	1.00	3,633	363,264
1N	8E	18	0.00	0.00	0.00	0.00	0.02	12.80	0.00	0.00	0.50	320.00	0.52	332.80	0.00	0.00	1.04	4,943	494,336
1N	8E	19	0.10	64.00	0.00	0.00	0.22	140.80	0.01	6.40	0.00	0.00	0.75	480.00	0.00	0.00	1.08	7,584	758,400
1N	8E	20	0.11	70.40	0.00	0.00	0.40	256.00	0.00	0.00	0.00	0.00	0.49	313.60	0.00	0.00	1.00	7,352	735,232
1N	8E	21	0.76	486.40	0.00	0.00	0.17	108.80	0.07	44.80	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2,304	230,400
1N	8E	22	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	23	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	24	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	25	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	26	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
1N	8E	27	0.68	435.20	0.00	0.00	0.16	102.40	0.00	0.00	0.00	0.00	0.16	102.40	0.00	0.00	1.00	2,683	268,288
1N	8E	28	0.00	0.00	0.00	0.00	0.09	57.60	0.01	6.40	0.01	6.40	0.89	569.60	0.00	0.00	1.00	7,360	736,000
1N	8E	29	0.02	12.80	0.03	19.20	0.02	12.80	0.00	0.00	0.00	0.00	0.93	595.20	0.00	0.00	1.00	7,050	705,024
1N	8E	30	0.03	19.20	0.00	0.00	0.04	25.60	0.00	0.00	0.00	0.00	1.01	646.40	0.00	0.00	1.08	7,624	762,368
1N	8E	31	0.00	0.00	0.00	0.00	0.15	96.00	0.00	0.00	0.00	0.00	0.25	160.00	0.60	384.00	1.00	12,448	1,244,800
1N	8E	32	0.41	262.40	0.00	0.00	0.36	230.40	0.23	147.20	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5,664	566,400
1N	8E	33	0.10	64.00	0.00	0.00	0.45	288.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	288.00	1.00	11,232	1,123,200
1N	8E	34	0.05	32.00	0.00	0.00	0.25	160.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	448.00	1.00	13,152	1,315,200
1N	8E	35	0.54	345.60	0.00	0.00	0.00	0.00	0.00	0.00	0.09	57.60	0.13	83.20	0.24	153.60	1.00	4,803	480,256
1N	8E	36	* 1.00	640.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0	0
Sub-Total			**19.18**	**12,275.20**	**0.03**	**19.20**	**2.42**	**1,548.80**	**0.37**	**236.80**	**0.60**	**384.00**	**5.61**	**3,590.40**	**1.99**	**1,273.60**	**30.20**	**98,984**	**9,898,368**

Note: '*' Indicates area is not part of the existing sewer system, and is currently using septic tanks for disposal

Sub-Total:			
	Total Area:	**30.20**	**Sq.Mi**
	Existing Service Area:	**16.20**	**Sq.Mi**
	Population:	**98,984**	**People**
	Flow Generated:	**9.90**	**MGD**

Average Flow Per Section: **0.61** **MGD**

Table 1-A
Average Daily Flows Per Section Based on 2005 Alternative 3 Land Use Plan
Superstition Mountain CFD No. 1

T	R	S	Open Space(wash)	Open Space(wash	Freeway Space	Freeway Space	Retail Industrial	Retail Industrial	Public Inst.	Public Inst.	State Des Res	State Des Res	Total Area	Population	Total Flow
			sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq. miles	acre	sq.mi	people	gallons
1S	8E	1	0.00	0.00	0.03	17.84	0.19	124.43	0.10	62.22	0.68	435.51	1.00	8,897	889,683
1S	8E	2	0.11	72.89	0.03	17.84	0.17	109.85	0.09	54.93	0.60	384.48	1.00	7,854	785,445
1S	8E	3	0.14	90.12	0.00	0.00	0.17	109.98	0.09	54.99	0.60	384.91	1.00	7,863	786,323
1S	8E	4	0.28	180.91	0.03	17.84	0.14	88.25	0.07	44.12	0.48	308.87	1.00	6,310	630,976
1S	8E	5	0.00	0.00	0.03	17.84	0.19	124.43	0.10	62.22	0.68	435.51	1.00	8,897	889,683
1S	8E	6	0.00	0.00	0.00	0.00	0.77	492.80	0.03	18.56	0.20	128.00	1.00	9,462	946,240
1S	8E	7	0.16	102.24	0.00	0.00	0.17	107.55	0.08	53.78	0.59	376.43	1.00	7,690	768,997
1S	8E	8	0.16	99.74	0.04	26.77	0.16	102.70	0.08	51.35	0.56	359.45	1.00	7,343	734,303
1S	8E	9	0.20	125.45	0.02	10.14	0.16	100.88	0.08	50.44	0.55	353.09	1.00	7,213	721,305
1S	8E	10	0.12	75.85	0.00	0.00	0.18	112.83	0.09	56.41	0.62	394.90	1.00	8,067	806,733
1S	8E	11	0.06	35.80	0.02	10.14	0.19	118.81	0.09	59.41	0.65	415.84	1.00	8,495	849,503
1S	8E	12	0.00	0.00	0.04	26.77	0.19	122.65	0.10	61.32	0.67	429.26	1.00	8,769	876,925
1S	8E	13	0.00	0.00	0.07	42.28	0.19	119.54	0.09	59.77	0.65	418.41	1.00	8,547	854,743
1S	8E	14	0.04	23.87	0.00	0.00	0.19	123.23	0.10	61.61	0.67	431.29	1.00	8,811	881,062
1S	8E	15	0.00	0.00	0.00	0.00	0.20	128.00	0.10	64.00	0.70	448.00	1.00	9,152	915,200
1S	8E	16	0.14	92.09	0.00	0.00	0.17	109.58	0.09	54.79	0.60	383.54	1.00	7,835	783,512
1S	8E	17	0.11	72.80	0.06	35.69	0.17	106.30	0.08	53.15	0.58	372.06	1.00	7,601	760,061
1S	8E	18	0.00	1.32	0.00	0.00	0.20	127.74	0.10	63.87	0.70	447.08	1.00	9,133	913,316
Sub-Total			**1.52**	**973.10**	**0.35**	**223.15**	**3.80**	**2,429.55**	**1.54**	**986.94**	**10.79**	**6,906.63**	**18.00**	**147,940**	**14,794,009**

Sub-Total:	**Area:**	**17.65 Sq.Mi**			
	Population:	**147,940 People**			
	Flow Generated:	**14.79 MGD**		**Average Flow Per Section:**	**0.84 MGD**
Total:	**Area:**	**33.85 Sq.Mi**	(Area does not include septic tank sections)		
	Population:	**246,924 People**			
	Flow Generated:	**24.69 MGD**		**Total Average Flow Per Section:**	**0.73 MGD**

Table 1-A
Average Daily Flows Per Section Based on 2005 Alternative 3 Land Use Plan
Superstition Mountain CFD No. 1

T	R	S	Open Space sq. miles	Open Space acre	Freeway Space sq. miles	Freeway Space acre	Retail Industrial sq. miles	Retail Industrial acre	Public Inst. sq. miles	Public Inst. acre	State Des Res sq. miles	State Des Res acre	Total Area sq.mi	Population people	Total Flow gallons
1S	8E	1	0.00	0.00	0.07	42.28	0.19	119.54	0.09	59.77	0.65	418.41	1.00	8,547	854,743
1S	8E	2	0.12	77.58	0.06	35.69	0.16	105.35	0.08	52.67	0.58	368.72	1.00	7,532	753,234
1S	8E	3	0.08	51.31	0.03	21.08	0.18	113.52	0.09	56.76	0.62	397.33	1.00	8,117	811,683
1S	8E	4	0.19	118.67	0.00	0.00	0.16	104.27	0.08	52.13	0.57	364.93	1.00	7,455	745,507
1S	8E	5	0.10	65.88	0.00	0.00	0.18	114.82	0.09	57.41	0.63	401.89	1.00	8,210	820,998
1S	8E	6	0.02	11.26	0.00	0.00	0.20	125.75	0.10	62.87	0.69	440.12	1.00	8,991	899,099
Sub-Total			**0.51**	**324.69**	**0.15**	**99.04**	**1.07**	**683.25**	**0.53**	**341.63**	**3.74**	**2,391.39**	**6.00**	**48,853**	**4,885,264**

T	R	S	Total Area sq.mi	Average Flow MGD	Population people
1S	8E	**25	1.00	0.66	6,600
1S	8E	**26	1.00	0.66	6,600
1S	8E	**27	1.00	0.66	6,600
1S	8E	**28	1.00	0.66	6,600
1S	8E	**29	1.00	0.66	6,600
1S	8E	**30	1.00	0.66	6,600
1S	8E	**31	1.00	0.66	6,600
1S	8E	**32	1.00	0.66	6,600
1S	8E	**33	1.00	0.66	6,600
1S	8E	**34	1.00	0.66	6,600
1S	8E	**35	1.00	0.66	6,600
1S	8E	**36	1.00	0.66	6,600
2S	8E	**1	1.00	0.66	6,600
2S	8E	**2	1.00	0.66	6,600
2S	8E	**3	1.00	0.66	6,600
2S	8E	**4	1.00	0.66	6,600
2S	8E	**5	1.00	0.66	6,600
2S	8E	**6	1.00	0.66	6,600
Sub-Total			**18.00**	**11.88**	**118,800**

Note: '**' Indicates sections that were not zoned in the General Plan. The City's calculated average flow was used for these sections.

Sub-Total:	**Area:**	**24.00 Sq.Mi**
	Population:	**167,653 People**
	Flow Generated:	**16.77 MGD**

Average Flow Per Section: **0.70 MGD**

Table 2
Proposed Flow Data
Superstition Mountain CFD No. 1 Master Plan

MH	Flow Average (gpd)	Flow Average (cfs)	Equivalent Population	Peak Factor	Peak Flow (gpd)	Peak Flow (gpm)	Peak Flow (cfs)
101A	130,088	0.20	1,301	2.30	299,444	208	0.46
101B	240,663	0.37	2,407	2.14	515,463	358	0.80
103A	123,584	0.19	1,236	2.32	286,252	199	0.44
103B	0	0.00	0	3.62	0	0	0.00
105	189,600	0.29	1,896	2.20	417,346	290	0.65
107	568,800	0.88	5,688	1.95	1,110,883	771	1.72
109	762,368	1.18	7,624	1.90	1,446,083	1,004	2.24
111	208,504	0.32	2,085	2.18	453,944	315	0.70
113	413,896	0.64	4,139	2.02	835,445	580	1.29
115	0	0.00	0	3.62	0	0	0.00
117	148,416	0.23	1,484	2.27	336,256	234	0.52
117A	148,416	0.23	1,484	2.27	336,256	234	0.52
119A	181,632	0.28	1,816	2.21	401,811	279	0.62
119B	0	0.00	0	3.62	0	0	0.00
121A	514,662	0.80	5,147	1.97	1,015,484	705	1.57
121B	0	0.00	0	3.62	0	0	0.00
123	220,570	0.34	2,206	2.16	477,129	331	0.74
125	317,261	0.49	3,173	2.08	658,968	458	1.02
127	254,880	0.39	2,549	2.13	542,397	377	0.84
129A	145,000	0.22	1,450	2.27	329,433	229	0.51
129B	269,400	0.42	2,694	2.11	569,753	396	0.88
131A	92,000	0.14	920	2.38	218,960	152	0.34
131B	92,000	0.14	920	2.38	218,960	152	0.34
133	268,288	0.42	2,683	2.12	567,663	394	0.88
135	720,512	1.11	7,205	1.91	1,374,284	954	2.13
137	35,251	0.05	353	2.74	96,588	67	0.15
139A	120,065	0.19	1,201	2.32	279,083	194	0.43
139B	1,182,192	1.83	11,822	1.82	2,146,886	1,491	3.32
141A	222,600	0.34	2,226	2.16	481,017	334	0.74
141B	222,600	0.34	2,226	2.16	481,017	334	0.74
143	56,160	0.09	562	2.56	143,770	100	0.22
145	1,398,240	2.16	13,982	1.79	2,502,338	1,738	3.87
147	28,320	0.04	283	2.90	82,128	57	0.13
149	208,504	0.32	2,085	2.18	453,944	315	0.70
151	413,896	0.64	4,139	2.02	835,445	580	1.29
Sub-Total	**9,898,368**	**15.32**	**98,984**	**1.55**	**19,914,430**	**13,829**	**30.81**

Table 2
Proposed Flow Data
Superstition Mountain CFD No. 1 Master Plan

MH	Flow Average (gpd)	Flow Average (cfs)	Equivalent Population	Peak Factor	Peak Flow (gpd)	Peak Flow (gpm)	Peak Flow (cfs)
201	297,184	0.46	2,972	2.09	621,712	432	0.96
203A	588,800	0.91	5,888	1.95	1,145,922	796	1.77
203B	199,200	0.31	1,992	2.19	435,975	303	0.67
205A	497,621	0.77	4,976	1.98	985,276	684	1.52
205B	179,200	0.28	1,792	2.22	397,056	276	0.61
207A	322,560	0.50	3,226	2.07	668,763	464	1.03
207B	176,811	0.27	1,768	2.22	392,379	272	0.61
209A	0	0.00	0	3.62	0	0	0.00
209B	172,288	0.27	1,723	2.23	383,505	266	0.59
211	0	0.00	0	3.62	0	0	0.00
215	484,352	0.75	4,844	1.99	961,691	668	1.49
217A	609,280	0.94	6,093	1.94	1,181,695	821	1.83
217B	384,000	0.59	3,840	2.03	781,302	543	1.21
219A	458,752	0.71	4,588	2.00	916,024	636	1.42
219B	179,200	0.28	1,792	2.22	397,056	276	0.61
221A	415,744	0.64	4,157	2.02	838,779	582	1.30
221B	179,200	0.28	1,792	2.22	397,056	276	0.61
213	0	0.00	0	3.62	0	0	0.00
223	537,600	0.83	5,376	1.96	1,056,006	733	1.63
225A	575,232	0.89	5,752	1.95	1,122,163	779	1.74
225B	179,200	0.28	1,792	2.22	397,056	276	0.61
227A	532,000	0.82	5,320	1.97	1,046,127	726	1.62
227B	281,600	0.44	2,816	2.10	592,629	412	0.92
229A	381,440	0.59	3,814	2.04	776,648	539	1.20
229B	239,200	0.37	2,392	2.14	512,683	356	0.79
231	0	0.00	0	3.62	0	0	0.00
233	186,560	0.29	1,866	2.21	411,427	286	0.64
235	0	0.00	0	3.62	0	0	0.00
237	408,768	0.63	4,088	2.02	826,184	574	1.28
239	605,440	0.94	6,054	1.94	1,174,996	816	1.82
241A	346,880	0.54	3,469	2.06	713,529	496	1.10
241B	302,720	0.47	3,027	2.09	632,008	439	0.98
243	501,760	0.78	5,018	1.98	992,621	689	1.54
245	0	0.00	0	3.62	0	0	0.00
247	436,800	0.68	4,368	2.01	876,683	609	1.36
249A	644,480	1.00	6,445	1.93	1,242,942	863	1.92
249B	150,080	0.23	1,501	2.26	339,574	236	0.53
251	291,840	0.45	2,918	2.10	611,756	425	0.95
253A	537,600	0.83	5,376	1.96	1,056,006	733	1.63
253B	89,600	0.14	896	2.42	216,832	151	0.34
255A	358,400	0.55	3,584	2.05	734,631	510	1.14
255B	179,200	0.28	1,792	2.22	397,056	276	0.61
Sub-Total	**12,910,592**	**19.98**	**129,106**	**1.53**	**26,233,749**	**18,218**	**40.59**
Total	**22,808,960**	**35.29**	**228,090**	**1.47**	**46,148,178**	**32,047**	**71.41**

Table 3
Proposed Pipe Data
Superstition Mountain CFD No. 1 Master Plan

Pipe ID	From MH ID	To MH ID	Diameter in	Length ft	Slope %	Full Flow cfs	Design Flow cfs	Analysis Flow cfs	Pipe Flow cfs	Full Excess cfs	Design Excess cfs	Analysis Excess cfs	Water Depth ft	Critical Depth ft	Velocity ft/s	Design d/D	Analysis d/D	Actual d/D
102A	101A	103A	8	1970	0.771	1.06	0.53	0.53	0.49	0.58	0.05	0.05	0.32	0.33	2.98	0.50	0.50	0.48
102B	101B	103B	10	1970	0.771	1.93	0.96	0.96	0.83	1.10	0.13	0.13	0.38	0.40	3.41	0.50	0.50	0.46
104A	103A	105	10	690	0.712	1.85	0.93	0.93	0.87	0.98	0.05	0.05	0.40	0.41	3.35	0.50	0.50	0.48
104B	103B	105	10	690	0.712	1.85	0.93	0.93	0.83	1.02	0.09	0.09	0.39	0.40	3.31	0.50	0.50	0.47
106	105	107	15	2208	0.749	5.60	5.11	5.11	2.09	3.52	3.02	3.02	0.53	0.58	4.23	0.75	0.75	0.42
108	107	109	18	2926	0.769	9.23	8.42	8.42	3.59	5.64	4.83	4.83	0.65	0.72	4.90	0.75	0.75	0.43
110	109	111	21	5882	0.597	12.28	13.20	13.20	5.51	6.77	7.69	7.69	0.82	0.86	4.97	0.93	0.93	0.47
112	111	113	27	1473	0.326	17.73	19.06	19.06	6.02	11.70	13.04	13.04	0.90	0.84	4.03	0.93	0.93	0.40
114	113	115	36	3351	0.215	31.00	33.33	33.33	7.03	23.97	26.30	26.30	0.97	0.83	3.55	0.93	0.93	0.32
116	115	WW1	36	1000	0.500	47.29	50.85	50.85	23.69	23.60	27.15	27.15	1.50	1.57	6.69	0.93	0.93	0.50
118	117	119A	8	3150	0.902	1.15	0.58	0.58	0.48	0.67	0.10	0.10	0.30	0.32	3.15	0.50	0.50	0.45
118A	117A	119B	8	3150	0.902	1.15	0.58	0.58	0.55	0.60	0.03	0.03	0.33	0.35	3.26	0.50	0.50	0.49
120A	119A	121A	10	2639	0.954	2.15	1.07	1.07	1.04	1.11	0.03	0.03	0.41	0.45	3.90	0.50	0.50	0.49
120B	119B	121B	8	2639	0.954	1.18	0.59	0.59	0.55	0.63	0.04	0.04	0.32	0.35	3.33	0.50	0.50	0.48
120C	121B	121A	10	10	0.800	1.97	0.98	0.98	0.55	1.42	0.43	0.43	0.30	0.33	3.09	0.50	0.50	0.36
122	121A	123	15	3539	0.621	5.10	4.65	4.65	2.88	2.22	1.77	1.77	0.67	0.68	4.28	0.75	0.75	0.54
124	123	125	18	1805	0.873	9.84	8.97	8.97	3.45	6.39	5.52	5.52	0.61	0.71	5.08	0.75	0.75	0.41
126	125	127	21	5350	0.606	12.37	13.30	13.30	4.26	8.11	9.04	9.04	0.71	0.76	4.67	0.93	0.93	0.41
128	127	149	27	5306	0.794	27.68	29.76	29.76	8.83	18.85	20.93	20.93	0.87	1.02	6.19	0.93	0.93	0.39
130A	129A	131A	8	4030	0.787	1.08	0.54	0.54	0.53	0.55	0.01	0.01	0.33	0.34	3.07	0.50	0.50	0.50
130B	129B	131B	10	4030	0.787	1.95	0.97	0.97	0.93	1.02	0.04	0.04	0.41	0.43	3.53	0.50	0.50	0.49
132A	131A	133	10	1570	1.334	2.54	1.27	1.27	0.81	1.73	0.46	0.46	0.32	0.40	4.14	0.50	0.50	0.39
132B	131B	133	10	1570	1.334	2.54	1.27	1.27	1.20	1.34	0.07	0.07	0.40	0.49	4.59	0.50	0.50	0.48
134	133	135	15	356	0.534	4.73	4.32	4.32	2.59	2.14	1.72	1.72	0.66	0.65	3.94	0.75	0.75	0.53
136	135	137	18	5749	0.516	7.57	6.90	6.90	4.45	3.12	2.45	2.45	0.83	0.81	4.45	0.75	0.75	0.55
138	137	127	21	2092	0.716	13.44	14.45	14.45	4.53	8.91	9.92	9.92	0.70	0.78	5.04	0.93	0.93	0.40
140A	139A	141A	10	4120	0.350	1.30	0.65	0.65	0.47	0.83	0.18	0.18	0.35	0.30	2.19	0.50	0.50	0.41
140B	139B	141B	15	4120	0.350	3.83	3.49	3.49	3.43	0.41	0.07	0.07	0.92	0.75	3.53	0.75	0.75	0.74
142A	141A	143	12	3690	0.576	2.71	1.36	1.36	1.14	1.57	0.21	0.21	0.45	0.45	3.31	0.50	0.50	0.45
144A	143	145	15	346	0.410	4.15	3.78	3.78	1.31	2.84	2.47	2.47	0.48	0.45	3.00	0.75	0.75	0.39
144B	141B	147	18	10560	0.437	6.96	6.35	6.35	3.99	2.98	2.36	2.36	0.81	0.76	4.07	0.75	0.75	0.54
146	145	147	18	6386	0.381	6.50	5.93	5.93	4.98	1.52	0.94	0.94	0.98	0.86	4.06	0.75	0.75	0.66
148	147	149	27	1151	0.757	27.01	29.05	29.05	8.47	18.55	20.58	20.58	0.87	1.00	6.01	0.93	0.93	0.38
150	149	151	30	2410	0.823	37.32	40.12	40.12	16.81	20.50	23.31	23.31	1.18	1.39	7.40	0.93	0.93	0.47
152	151	115	36	350	0.146	25.53	27.45	27.45	17.76	7.77	9.69	9.69	1.84	1.35	3.90	0.93	0.93	0.61

Table 3
Proposed Pipe Data
Superstition Mountain CFD No. 1 Master Plan

Pipe ID	From MH ID	To MH ID	Diameter in	Length ft	Slope %	Full Flow cfs	Design Flow cfs	Analysis Flow cfs	Pipe Flow cfs	Full Excess cfs	Design Excess cfs	Analysis Excess cfs	Water Depth ft	Critical Depth ft	Velocity ft/s	Design d/D	Analysis d/D	Actual d/D
202A	201	203A	15	5280	0.950	6.31	5.76	5.76	1.01	5.30	4.75	4.75	0.34	0.40	3.77	0.75	0.75	0.27
202B	203B	203A	10	3675	0.500	1.55	0.78	0.78	0.72	0.84	0.06	0.06	0.40	0.37	2.79	0.50	0.50	0.48
204A	203A	205A	15	5280	0.950	6.31	5.76	5.76	3.17	3.14	2.58	2.58	0.63	0.72	5.15	0.75	0.75	0.50
204B	205B	205A	10	3675	0.500	1.55	0.78	0.78	0.65	0.90	0.12	0.12	0.38	0.36	2.73	0.50	0.50	0.45
206A	205A	207A	18	5280	0.650	8.49	7.74	7.74	4.90	3.59	2.84	2.84	0.82	0.85	4.98	0.75	0.75	0.55
206B	207B	207A	10	3675	0.750	1.90	0.95	0.95	0.63	1.27	0.32	0.32	0.33	0.35	3.14	0.50	0.50	0.40
208A	207A	209A	24	5280	0.500	16.04	17.25	17.25	6.14	9.90	11.11	11.11	0.86	0.88	4.77	0.93	0.93	0.43
208B	209B	209A	10	3675	0.800	1.97	0.98	0.98	0.63	1.33	0.35	0.35	0.33	0.35	3.21	0.50	0.50	0.39
210	209A	211	24	3975	0.250	11.33	12.18	12.18	6.56	4.77	5.62	5.62	1.09	0.91	3.74	0.93	0.93	0.55
212	211	213	30	1800	0.196	18.19	19.56	19.56	6.56	11.62	12.99	12.99	1.04	0.85	3.41	0.93	0.93	0.42
214	213	WW3	36	740	0.500	47.29	50.85	50.85	19.16	28.13	31.68	31.68	1.33	1.40	6.34	0.93	0.93	0.44
216A	215	217A	15	5280	1.100	6.79	6.19	6.19	1.55	5.24	4.64	4.64	0.41	0.49	4.49	0.75	0.75	0.33
216B	217B	217A	15	3675	0.450	4.35	3.96	3.96	1.26	3.09	2.71	2.71	0.46	0.44	3.06	0.75	0.75	0.37
218A	217A	219A	15	5280	0.800	5.79	5.28	5.28	4.17	1.62	1.11	1.11	0.79	0.83	5.14	0.75	0.75	0.63
218B	219B	219A	12	3675	0.250	1.79	0.89	0.89	0.65	1.13	0.24	0.24	0.42	0.34	2.10	0.50	0.50	0.42
220A	219A	221A	18	5280	0.800	9.42	8.59	8.59	5.77	3.65	2.82	2.82	0.85	0.93	5.60	0.75	0.75	0.57
220B	221B	221A	12	3675	0.350	2.11	1.06	1.06	0.65	1.46	0.40	0.40	0.38	0.34	2.37	0.50	0.50	0.38
222	221A	213	24	4200	0.600	17.57	18.89	18.89	7.22	10.35	11.67	11.67	0.89	0.95	5.32	0.93	0.93	0.45
224A	223	225A	12	5280	0.950	3.48	1.74	1.74	1.70	1.79	0.04	0.04	0.49	0.55	4.41	0.50	0.50	0.49
224B	225B	225A	12	3675	0.500	2.53	1.26	1.26	0.65	1.87	0.61	0.61	0.35	0.34	2.70	0.50	0.50	0.35
226A	225A	227A	15	5280	0.750	5.61	5.12	5.12	3.71	1.90	1.41	1.41	0.74	0.78	4.88	0.75	0.75	0.59
226B	227B	227A	12	3675	0.300	1.96	0.98	0.98	0.97	0.99	0.01	0.01	0.50	0.41	2.49	0.50	0.50	0.50
228A	227A	229A	18	5280	0.750	9.12	8.32	8.32	5.75	3.37	2.56	2.56	0.86	0.93	5.46	0.75	0.75	0.58
228B	229B	229A	12	3675	0.450	2.40	1.20	1.20	0.83	1.56	0.36	0.36	0.41	0.38	2.78	0.50	0.50	0.41
230	229A	231	24	1250	1.000	22.68	24.39	24.39	7.18	15.50	17.21	17.21	0.77	0.95	6.41	0.93	0.93	0.39
232	231	213	24	6150	0.200	10.14	10.91	10.91	7.18	2.96	3.72	3.72	1.24	0.95	3.50	0.93	0.93	0.62
234	233	235	10	3300	0.606	1.71	0.86	0.86	0.67	1.04	0.18	0.18	0.36	0.36	2.95	0.50	0.50	0.44
236	237	235	15	4200	0.500	4.58	4.18	4.18	1.33	3.25	2.85	2.85	0.46	0.46	3.23	0.75	0.75	0.37
238	235	WW2	15	100	1.000	6.48	5.91	5.91	1.86	4.62	4.05	4.05	0.46	0.54	4.56	0.75	0.75	0.37
240A	239	241A	15	3675	0.600	5.02	4.58	4.58	1.90	3.12	2.68	2.68	0.53	0.55	3.80	0.75	0.75	0.43
240B	241B	241A	12	5280	0.800	3.20	1.60	1.60	1.03	2.17	0.57	0.57	0.39	0.43	3.63	0.50	0.50	0.39
242	241A	243	15	5280	0.400	4.10	3.74	3.74	3.63	0.47	0.11	0.11	0.92	0.77	3.77	0.75	0.75	0.73
244	243	245	24	5280	0.300	12.42	13.36	13.36	7.93	4.50	5.43	5.43	1.16	1.00	4.19	0.93	0.93	0.58
246	245	WW4	24	100	1.000	22.68	24.39	24.39	11.37	11.31	13.02	13.02	1.00	1.21	7.23	0.93	0.93	0.50
248A	247	249A	15	5280	0.600	5.02	4.58	4.58	1.43	3.59	3.15	3.15	0.46	0.47	3.52	0.75	0.75	0.37
248B	249B	249A	10	3675	0.400	1.39	0.70	0.70	0.55	0.84	0.15	0.15	0.36	0.33	2.40	0.50	0.50	0.44
250	249A	243	15	5280	0.700	5.42	4.94	4.94	3.56	1.86	1.38	1.38	0.74	0.76	4.71	0.75	0.75	0.59
252A	251	253A	12	3000	0.550	2.65	1.33	1.33	0.99	1.66	0.34	0.34	0.42	0.42	3.13	0.50	0.50	0.42
252B	253B	253A	10	3675	0.300	1.20	0.60	0.60	0.36	0.85	0.25	0.25	0.31	0.26	1.92	0.50	0.50	0.37
254A	253A	255A	15	5280	0.550	4.80	4.38	4.38	2.73	2.07	1.65	1.65	0.68	0.66	4.04	0.75	0.75	0.54
254B	255B	255A	10	3675	0.400	1.39	0.70	0.70	0.65	0.74	0.04	0.04	0.40	0.36	2.51	0.50	0.50	0.48
256A	255A	245	15	5280	0.550	4.80	4.38	4.38	4.12	0.68	0.26	0.26	0.89	0.82	4.40	0.75	0.75	0.71

Table 4
Lift Station Flows
Superstition Mountain CFD No. 1

Lift Station	Flow Average	Flow Average	Equivalent Population	Peak Factor	Peak Flow	Peak Flow	Peak Flow
	gpd	cfs	people		gpd	gpm	cfs
1	9,898,368	15.32	98,984	1.55	19,914,430	13,829	30.81
2	7,870,464	12.18	78,705	1.57	12,359,418	8,583	19.12
3	595,328	0.92	5,953	2.02	1,203,250	836	1.86
4	4,444,800	6.88	44,448	1.63	7,259,897	5,042	11.23

APPENDIX C

WASTEWATER FLOW DATA

Wastewater Flow Analysis
Superstition Mountains CFD

		Average Daily Flow over previous 12 months	Increase over Previous Year	Capacity of 2.2 MGD Plant	Capacity of 3.2 MGD Plant
Actual Data					
	June '97	0.424		19.3%	
1	June '98	0.585	0.161	26.6%	
2	June '99	0.712	0.127	32.4%	
3	June '00	0.869	0.157	39.5%	
4	June '01	0.959	0.090	43.6%	
5	June '02	1.032	0.073	46.9%	
6	June '03	1.141	0.109	51.9%	
7	June '04	1.300	0.159	59.1%	
Projected Data					
8	June '05	1.460	0.160	66.4%	
9	June '06	1.620	0.160	73.6%	
10	June '07	1.780	0.160	80.9%	
11	June '08	1.940	0.160	88.2%	60.6%
12	June '09	2.100	0.160		65.6%
13	June '10	2.260	0.160		70.6%
14	June '11	2.420	0.160		75.6%
15	June '12	2.580	0.160		80.6%
16	June '13	2.740	0.160		85.6%
17	June '14	2.900	0.160		90.6%
18	June '15	3.060	0.160		95.6%
19	June '16	3.220	0.160		
20	June '17	3.380	0.160		

SMCFD No. 1
Wastewater Flows

	Influent				Septage				Combined				Annual Avg	Annual Septage
Date	Total	Daily Avg	Max Day	Min Day	Total	Daily Avg	Max Day	Min Day	Total	Daily Avg	12 mo inc	12 mo avg	Daily Flow	Daily Flow
Jan-96	4.263	0.138	0.640	0.525	0.000	0.000	0.000	0.000	4.263	0.138				
Feb-96	6.132	0.211	0.688	0.536	0.000	0.000	0.000	0.000	6.132	0.211				
Mar-96	7.329	0.236	0.284	0.195	0.101	0.003	0.011	0.000	7.430	0.240				
Apr-96	7.140	0.238	0.323	0.218	0.097	0.003	0.010	0.000	7.237	0.241				
May-96	6.979	0.225	0.251	0.175	0.000	0.000	0.000	0.000	6.979	0.225				
Jun-96	7.060	0.235	0.259	0.216	0.000	0.000	0.000	0.000	7.060	0.235				
Jul-96	7.905	0.255	0.294	0.255	0.065	0.002	0.010	0.000	7.970	0.257				
Aug-96	8.404	0.271	0.439	0.233	0.157	0.005	0.010	0.000	8.561	0.276				
Sep-96	8.679	0.289	0.411	0.230	0.220	0.007	0.015	0.000	8.899	0.297				
Oct-96	9.799	0.316	0.392	0.263	0.422	0.014	0.049	0.000	10.221	0.330				
Nov-96	12.363	0.412	0.503	0.330	0.545	0.018	0.086	0.000	12.908	0.430				
Dec-96	13.299	0.429	0.490	0.351	0.580	0.019	0.054	0.000	13.879	0.448		0.278	0.272	0.0060
Jan-97	17.889	0.577	0.640	0.525	0.534	0.017	0.040	0.001	18.423	0.594	332%	0.317	0.310	0.0075
Feb-97	15.836	0.566	0.688	0.536	0.569	0.020	0.042	0.013	16.405	0.586	168%	0.345	0.336	0.0090
Mar-97	18.166	0.586	0.640	0.551	0.522	0.017	0.036	0.010	18.688	0.603	152%	0.376	0.366	0.0102
Apr-97	14.163	0.472	0.587	0.394	0.577	0.019	0.045	0.004	14.740	0.491	104%	0.397	0.385	0.0115
May-97	11.910	0.384	0.425	0.371	0.483	0.016	0.043	0.004	12.393	0.400	78%	0.411	0.399	0.0128
Jun-97	11.235	0.375	0.398	0.349	0.433	0.014	0.042	0.000	11.668	0.389	65%	0.424	0.410	0.0140
Jul-97	11.764	0.379	0.405	0.346	0.350	0.011	0.030	0.000	12.114	0.391	52%	0.435	0.421	0.0148
Aug-97	13.688	0.442	0.490	0.387	0.382	0.012	0.035	0.000	14.070	0.454	64%	0.450	0.435	0.0154
Sep-97	14.409	0.480	0.521	0.436	0.401	0.013	0.037	0.000	14.810	0.494	66%	0.467	0.451	0.0159
Oct-97	16.909	0.545	0.607	0.494	0.445	0.014	0.037	0.000	17.354	0.560	70%	0.486	0.470	0.0159
Nov-97	17.953	0.598	0.668	0.566	0.482	0.016	0.037	0.000	18.435	0.615	43%	0.501	0.486	0.0158
Dec-97	20.026	0.646	0.696	0.602	0.672	0.022	0.043	0.006	20.698	0.668	49%	0.520	0.504	0.0160
Jan-98	21.692	0.700	0.798	0.653	0.706	0.023	0.040	0.012	22.398	0.723	22%	0.531	0.514	0.0165
Feb-98	21.172	0.756	0.921	0.677	0.823	0.029	0.061	0.015	21.995	0.786	34%	0.546	0.529	0.0172
Mar-98	22.483	0.725	0.835	0.669	0.399	0.013	0.035	0.007	22.882	0.738	22%	0.558	0.541	0.0169
Apr-98	17.561	0.585	0.688	0.507	0.556	0.019	0.032	0.014	18.117	0.604	23%	0.567	0.550	0.0168
May-98	15.297	0.493	0.527	0.442	0.469	0.015	0.026	0.000	15.766	0.509	27%	0.576	0.559	0.0168
Jun-98	14.353	0.478	0.515	0.431	0.393	0.013	0.026	0.000	14.746	0.492	26%	0.585	0.568	0.0167
Jul-98	15.837	0.511	0.537	0.472	0.369	0.012	0.027	0.000	16.206	0.523	34%	0.596	0.579	0.0167
Aug-98	17.105	0.552	0.602	0.494	0.283	0.009	0.024	0.008	17.388	0.561	24%	0.605	0.588	0.0164
Sep-98	17.376	0.579	0.638	0.539	0.433	0.014	0.039	0.009	17.809	0.594	20%	0.613	0.597	0.0165
Oct-98	18.809	0.607	0.701	0.500	0.315	0.011	0.027	0.012	19.124	0.617	10%	0.618	0.602	0.0162
Nov-98	21.043	0.701	0.745	0.654	0.388	0.013	0.035	0.000	21.431	0.714	16%	0.626	0.610	0.0159
Dec-98	24.035	0.775	0.882	0.486	0.470	0.015	0.051	0.010	24.505	0.790	18%	0.637	0.621	0.0154
Jan-99	26.632	0.859	1.080	0.742	0.412	0.013	0.037	0.010	27.044	0.872	21%	0.649	0.635	0.0145
Feb-99	25.814	0.922	1.051	0.869	0.494	0.018	0.045	0.005	26.308	0.940	20%	0.661	0.648	0.0136
Mar-99	27.137	0.875	0.935	0.795	0.528	0.017	0.038	0.010	27.665	0.892	21%	0.674	0.660	0.0140
Apr-99	22.212	0.740	1.045	0.633	0.425	0.014	0.046	0.091	22.637	0.755	25%	0.687	0.673	0.0136
May-99	19.785	0.638	0.683	0.587	0.427	0.014	0.046	0.005	20.212	0.652	28%	0.699	0.685	0.0135
Jun-99	19.290	0.643	0.685	0.602	0.430	0.014	0.034	0.009	19.720	0.657	34%	0.712	0.699	0.0136
Jul-99	20.591	0.664	0.787	0.601	0.391	0.013	0.032	0.002	20.982	0.677	29%	0.726	0.712	0.0137
Aug-99	20.821	0.672	0.744	0.672	0.336	0.011	0.025	0.001	21.157	0.682	22%	0.736	0.722	0.0138
Sep-99	21.632	0.721	0.774	0.683	0.380	0.012	0.035	0.008	22.012	0.734	24%	0.747	0.734	0.0137
Oct-99	24.540	0.792	0.847	0.665	0.395	0.013	0.032	0.003	24.935	0.804	30%	0.763	0.749	0.0139
Nov-99	27.116	0.904	0.960	0.808	0.530	0.018	0.035	0.007	27.646	0.922	29%	0.780	0.766	0.0143
Dec-99	28.933	0.933	1.067	0.882	0.672	0.022	0.038	0.012	29.605	0.955	21%	0.794	0.779	0.0148
Jan-00	30.949	0.998	1.119	0.949	0.413	0.013	0.037	0.011	31.362	1.012	16%	0.806	0.791	0.0148
Feb-00	30.365	1.084	1.107	1.004	0.519	0.019	0.033	0.003	30.884	1.103	17%	0.819	0.804	0.0149
Mar-00	32.515	1.049	1.563	0.895	0.615	0.020	0.037	0.009	33.130	1.069	20%	0.834	0.818	0.0152
Apr-00	26.376	0.879	0.973	0.805	0.366	0.012	0.043	0.005	26.741	0.891	18%	0.845	0.830	0.0150
May-00	24.944	0.805	0.855	0.762	0.400	0.013	0.035	0.002	25.344	0.818	25%	0.859	0.844	0.0149
Jun-00	23.041	0.768	0.837	0.720	0.305	0.010	0.027	0.000	23.346	0.778	18%	0.869	0.854	0.0146
Jul-00	24.643	0.795	0.851	0.723	0.258	0.008	0.027	0.000	24.901	0.803	19%	0.880	0.865	0.0142
Aug-00	24.992	0.806	0.862	0.727	0.365	0.012	0.028	0.005	25.357	0.818	20%	0.891	0.877	0.0143
Sep-00	23.992	0.800	0.883	0.738	0.302	0.010	0.054	0.005	24.294	0.810	10%	0.897	0.883	0.0141
Oct-00	28.193	0.909	1.507	0.751	0.306	0.010	0.028	0.004	28.499	0.919	14%	0.907	0.893	0.0138
Nov-00	29.241	0.975	1.277	0.887	0.458	0.015	0.041	0.003	29.699	0.990	7%	0.913	0.899	0.0136
Dec-00	30.818	0.994	1.158	0.810	0.478	0.015	0.037	0.005	31.296	1.010	6%	0.917	0.904	0.0131
Jan-01	34.240	1.105	1.370	0.960	0.597	0.019	0.037	0.008	34.837	1.124	11%	0.927	0.913	0.0136
Feb-01	31.410	1.122	1.230	1.010	0.515	0.018	0.038	0.003	31.925	1.140	3%	0.930	0.916	0.0136
Mar-01	35.790	1.155	1.250	0.980	0.554	0.018	0.039	0.013	36.344	1.172	10%	0.939	0.925	0.0134
Apr-01	29.820	0.994	1.130	0.830	0.570	0.019	0.045	0.011	30.390	1.013	14%	0.949	0.935	0.0140

SMCFD No. 1
Wastewater Flows

	Influent				Septage				Combined				Annual Avg	Annual Septage
Date	Total	Daily Avg	Max Day	Min Day	Total	Daily Avg	Max Day	Min Day	Total	Daily Avg	12 mo inc	12 mo avg	Daily Flow	Daily Flow
May-01	26.690	0.861	0.970	0.780	0.508	0.016	0.043	0.009	27.198	0.877	7%	0.954	0.939	0.0143
Jun-01	24.972	0.832	0.900	0.770	0.379	0.013	0.035	0.006	25.351	0.845	9%	0.959	0.945	0.0145
Jul-01	25.806	0.832	1.040	0.750	0.305	0.010	0.025	0.007	26.111	0.842	5%	0.962	0.948	0.0146
Aug-01	26.180	0.845	0.930	0.770	0.293	0.009	0.025	0.001	26.473	0.854	4%	0.966	0.951	0.0144
Sep-01	26.030	0.868	1.000	0.790	0.264	0.009	0.028	0.000	26.294	0.876	8%	0.971	0.957	0.0143
Oct-01	28.500	0.919	1.089	0.820	0.347	0.011	0.026	0.000	28.847	0.931	1%	0.972	0.958	0.0144
Nov-01	31.320	1.044	1.160	0.930	0.258	0.009	0.026	0.000	31.578	1.053	6%	0.977	0.963	0.0139
Dec-01	34.140	1.101	1.220	1.000	0.341	0.011	0.031	0.002	34.481	1.112	10%	0.986	0.972	0.0135
Jan-02	36.000	1.161	1.300	1.050	0.576	0.019	0.048	0.011	36.576	1.180	5%	0.991	0.977	0.0135
Feb-02	34.200	1.221	1.370	1.090	0.554	0.020	0.043	0.014	34.754	1.241	9%	0.998	0.985	0.0136
Mar-02	38.020	1.226	1.380	1.140	0.523	0.017	0.055	0.016	38.543	1.243	6%	1.004	0.991	0.0135
Apr-02	32.430	1.081	1.290	0.900	0.549	0.018	0.044	0.007	32.979	1.099	9%	1.011	0.998	0.0134
May-02	30.880	0.996	1.110	0.920	0.531	0.017	0.038	0.008	31.411	1.047	15%	1.023	1.010	0.0135
Jun-02	28.450	0.948	1.040	0.880	0.340	0.011	0.031	0.007	28.790	0.960	14%	1.032	1.019	0.0134
Jul-02	29.570	0.954	1.050	0.860	0.319	0.010	0.031	0.005	29.889	0.996	14%	1.043	1.029	0.0134
Aug-02	31.040	1.001	1.070	0.950	0.307	0.010	0.024	0.002	31.347	1.011	18%	1.056	1.043	0.0134
Sep-02	30.450	1.015	1.190	0.940	0.394	0.013	0.033	0.002	30.844	1.028	17%	1.069	1.056	0.0138
Oct-02	33.020	1.065	1.210	0.980	0.456	0.015	0.360	0.001	33.476	1.080	16%	1.081	1.067	0.0141
Nov-02	35.090	1.170	1.270	1.070	0.392	0.013	0.034	0.008	35.482	1.183	12%	1.092	1.078	0.0145
Dec-02	36.890	1.190	1.310	1.100	0.478	0.015	0.044	0.005	37.368	1.205	8%	1.100	1.085	0.0148
Jan-03	39.110	1.262	1.430	1.150	0.648	0.021	0.039	0.003	39.758	1.283	9%	1.109	1.094	0.0150
Feb-03	37.340	1.334	1.570	1.210	0.548	0.020	0.042	0.014	37.888	1.353	9%	1.117	1.102	0.0150
Mar-03	40.680	1.312	1.420	1.190	0.554	0.018	0.043	0.010	41.234	1.330	7%	1.125	1.109	0.0151
Apr-03	34.010	1.134	1.290	1.040	0.443	0.015	0.034	0.007	34.453	1.148	4%	1.129	1.114	0.0148
May-03	32.810	1.058	1.140	0.970	0.480	0.015	0.039	0.004	33.290	1.110	6%	1.134	1.119	0.0147
Jun-03	30.820	1.027	1.140	0.950	0.579	0.019	0.048	0.008	31.399	1.047	9%	1.141	1.126	0.0153
Jul-03	31.850	1.027	1.120	0.960	0.467	0.015	0.046	0.010	32.317	1.042	8%	1.148	1.132	0.0157
Aug-03	32.410	1.045	1.130	0.880	0.417	0.013	0.033	0.008	32.827	1.059	5%	1.152	1.136	0.0160
Sep-03	32.150	1.072	1.220	1.000	0.399	0.013	0.039	0.006	32.549	1.085	6%	1.156	1.140	0.0161
Oct-03	34.370	1.109	1.240	1.020	0.517	0.017	0.035	0.006	34.887	1.125	4%	1.160	1.144	0.0162
Nov-03	36.461	1.215	1.340	1.140	0.484	0.016	0.037	0.011	36.945	1.232	4%	1.164	1.148	0.0165
Dec-03	37.780	1.219	1.320	1.090	0.647	0.022	0.052	0.013	38.427	1.240	3%	1.167	1.150	0.0169
Jan-04	41.300	1.332	1.440	1.210	0.650	0.021	0.060	0.007	41.950	1.353	6%	1.173	1.156	0.0169
Feb-04	40.310	1.440	1.570	1.310	0.622	0.021	0.051	0.010	40.932	1.462	8%	1.181	1.164	0.0171
Mar-04	43.300	1.397	2.150	1.240	0.726	0.023	0.055	0.011	44.026	1.420	7%	1.189	1.171	0.0176
Apr-04	37.030	1.234	2.010	1.090	0.593	0.020	0.042	0.013	37.623	1.254	9%	1.198	1.180	0.0180
May-04	34.810	1.123	1.220	1.030	0.493	0.016	0.031	0.017	35.303	1.177	6%	1.203	1.185	0.0181

APPENDIX C


EXISTING LIFT STATION
BASELINE ROAD
EX. FORCEMAIN
SUNLAND SPRINGS VILLAGE
NOT A PART
GUADALUPE ROAD
EXISTING WWTF
ELLIOT ROAD
MERIDIAN ROAD
WARNER ROAD
PROP. FORCE MAINS
SIGNAL BUTTE ROAD
RAY ROAD
IRONWOOD ROAD
WILLIAMS FIELD ROAD
PROP. LIFT STATION
PECOS ROAD
CENTRAL ARIZONA PROJECT (CAP)
GOLDFIELD ROAD
MOUNTAIN VIEW ROAD
BARKLEY ROAD
US-60
NORTH
GRAPHIC SCALE IN FEET
0 750 1500 3000
LEGEND
OVERALL PLANNING AREA (8,090± ACRES)
SECTION
SEWER ANALYSIS AREA ID
EX. LIFT STATION
PROP. LIFT STATION (PEAK DEMAND=15 MGD)
EX. WWTF (2MGD CAPACITY, UPGRADEABLE TO 16MGD)
EX. FORCE MAIN
PROP. FORCE MAINS
SEWER ANALYSIS
ANALYSIS NODE & ID
PARCEL INFLOW INDICATOR (FLOW INTO NODE)
PROP. SEWER PIPE
8–INCH
10–INCH
12–INCH
15–INCH
18–INCH
21–INCH
24–INCH
30–INCH
36–INCH
42–INCH
NOTE:
EXHIBIT IS FOR CONCEPTUAL PURPOSES ONLY AND IS DEPENDENT ON DETAILED SITE PLANNING, ENGINEERING, ALTA SURVEY AND CITY REVIEWS/APPROVALS.
Kimley-Horn
© 2019 KIMLEY-HORN AND ASSOCIATES, INC.
1001 WEST SOUTHERN AVENUE, SUITE 131
MESA, ARIZONA 85202 (480) 207-2666
KHA PROJECT
DATE OCT. 2019
SCALE AS SHOWN
DESIGNED BY ZJH
DRAWN BY TAF
CHECKED BY JMB
CONCEPTUAL
NOT FOR CONSTRUCTION
SUBJECT TO
ENGINEERING AND CITY
REVIEW AND APPROVAL
CONCEPTUAL WASTEWATER
INFRASTRUCTURE EXHIBIT
ASLD 8500 PLANNING PARCEL
PINAL COUNTY ARIZONA
SHEET NUMBER
No. REVISIONS DATE BY

APPENDIX D


EXISTING LIFT STATION
BASELINE ROAD
EX. FORCEMAIN
GUADALUPE ROAD
ELLIOT ROAD
WARNER ROAD
RAY ROAD
WILLIAMS FIELD ROAD
PECOS ROAD
SIGNAL BUTTE ROAD
MERIDIAN ROAD
IRONWOOD ROAD
MOUNTAIN VIEW ROAD
BARKLEY ROAD
US-60
CENTRAL ARIZONA PROJECT (CAP)
SUNLAND SPRINGS VILLAGE
NOT A PART
EXISTING WWTF
PROP. 2x12-INCH FORCE MAIN
PROP. LIFT STATION
GRAPHIC SCALE IN FEET
0 750 1500 3000
LEGEND
OVERALL PLANNING AREA (8,090± ACRES)
AUCTION PARCEL (2,783± ACRES)
SECTION
SEWER ANALYSIS AREA ID
EX. LIFT STATION
PROP. LIFT STATION (DEMAND=5 MGD)
EX. WWTF (2MGD CAPACITY, UPGRADEABLE TO 16MGD)
EX. FORCEMAIN
PROP. FORCE MAIN (2X12-INCH)
PROP. SEWER PIPE
8-INCH
10-INCH
12-INCH
15-INCH
18-INCH
21-INCH
24-INCH
30-INCH
36-INCH
42-INCH
NOTE: EXHIBIT IS FOR CONCEPTUAL PURPOSES ONLY AND IS DEPENDENT ON DETAILED SITE PLANNING, ENGINEERING, ALTA SURVEY AND CITY REVIEWS/APPROVALS.
Kimley»Horn
© 2019 KIMLEY-HORN AND ASSOCIATES, INC.
1001 WEST SOUTHERN AVENUE, SUITE 131
MESA, ARIZONA 85202 (480) 207-2666
KHA PROJECT
DATE OCT. 2019
SCALE AS SHOWN
DESIGNED BY ZJH
DRAWN BY TAF
CHECKED BY JMB
CONCEPTUAL
NOT FOR CONSTRUCTION
SUBJECT TO ENGINEERING AND CITY REVIEW AND APPROVAL
CONCEPTUAL WASTEWATER INFRASTRUCTURE EXHIBIT
ASLD 8500 AUCTION PARCEL
PINAL COUNTY ARIZONA
SHEET NUMBER

APPENDIX E

ASLD 8500 - Wastewater Infrastructure Analysis

Sewer Demand Criteria [1]

Residential Demand Criteria		
Land Use	Population	
Residential (3-5 DU/acre)	3.2	Persons/DU
Medium Residential (5-8 DU/acre)	3.2	Persons/DU
High Density Residential (8+ DU/acre)	2.0	Persons/DU
Residential Demand	100	gpcpd

Non-Residential Demand Criteria		
Business/Industrial	1,000	gpd/acre
Retail/Employment	1,500	gpd/acre
Public/Institutional	1,500	gpd/acre

(1) Per SMCFD Masterplan - Appendix B - Table 1

(2) Per SMCFD Masterplan - Figure 2 Average Daily Sewage Flows

Peaking Factors [3]

Upstream Population	Peaking Factor
100	3.62
200	3.14
300	2.9
400	2.74
500	2.64
600	2.56
700	2.5
800	2.46
900	2.42
1001	2.38
1001 to 10,000	$PF = (6.330 \times P^{-0.231}) + 1.094$
10,001 to 100,000	$PF = (6.117 \times P^{-0.233}) + 1.128$
More than 100,000	$PF = (4.500 \times P^{-0.174}) + 0.945$

(3) Per SMCFD Masterplan - Table 2.1

Pipe Design Criteria [4]

Pipe Diameter (in)	Min. Slope (ft/ft)	Full Flow Capacity (MGD)
8	0.0042	0.45
10	0.0024	0.70
12	0.0019	1.01
15	0.0014	1.57
18	0.0011	2.26
21	0.0010	3.25
24	0.0010	4.64
30	0.0010	8.41
36	0.0010	13.67
42	0.0010	20.62
48	0.0010	29.44

(4) Per SMCFD Masterplan - Table 2.2

ASLD 8500 - Wastewater Infrastructure Analysis

Overall Project Demand

Land Use	Area (Acres)	Density		Yield		Population Density	Population	Unit Demand		Demand MGD
Enterprise Technology	470	0.25	F.A.R.	5,118,300	sq.-ft	-	-	1,000	gpd/acre	0.47
Parks and Open Space	845	0		0		-	-	0		
Residential	5,300	3.5	du/ac	18,550	units	3.2	59,360	100	gpcpd	5.94
Medium Residential	1,020	6.0	du/ac	6,120	units	3.2	19,584	100	gpcpd	1.96
Mixed Use Residential	135	20	du/ac	2,700	units	2	5,400	100	gpcpd	0.54
Mixed Use Commercial	135	12,500	sqft/ac	1,687,500	sq.-ft	-		1,500	gpd/acre	0.20
Neighborhood Commercial	45	7,500	sqft/ac	337,500	sq.-ft	-		1,500	gpd/acre	0.07
District Core	140	20,000	sqft/ac	2,800,000	sq.-ft	-		1,500	gpd/acre	0.21
Total	8,090						84,344			9.38

ASLD 8500 - Wastewater Infrastructure Analysis

Parcel Project Demand

Section	Land Use	Area (sq-ft)	Area (Acres)	Density		Yield		Population Density	Population	Unit Demand		Demand (MGD)
6A	Enterprise Technology	8,712,000	200.0	0.25	F.A.R.	2,178,000	sq.-ft	-		1,000	gpd/acre	0.20
6B	Enterprise Technology	3,049,200	70.0	0.25	F.A.R.	762,300	sq.-ft	-		1,000	gpd/acre	0.07
7A	Enterprise Technology	8,712,000	200.0	0.25	F.A.R.	2,178,000	sq.-ft	-		1,000	gpd/acre	0.20
7B	Medium Residential	8,712,000	200.0	6.00	du/ac	1,200	units	3.20	3,840	100	gpcpd	0.38
7C	Parks and Open Space	23,740,200	545.0									
8A	Parks and Open Space	6,534,000	150.0									
8B	Residential	10,018,800	230.0	3.50	du/ac	805	units	3.20	2,576	100	gpcpd	0.26
16A	Residential	7,840,800	180.0	3.50	du/ac	630	units	3.20	2,016	100	gpcpd	0.20
16B	Neighborhood Commercial	653,400	15.0	7,500.00	sqft/ac	112,500	sq.-ft	-		1,500	gpd/acre	0.02
17A	Neighborhood Commercial	653,400	15.0	7,500.00	sqft/ac	112,500	sq.-ft	-		1,500	gpd/acre	0.02
17B	Parks and Open Space	6,534,000	150.0	0.00	0.00							0.00
17C	Residential	6,534,000	150.0	3.50	du/ac	525	units	3.20	1,680	100	gpcpd	0.17
17D	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	3.20	3,920	100	gpcpd	0.39
18A	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	3.20	3,920	100	gpcpd	0.39
18B	Residential	12,196,800	280.0	3.50	du/ac	980	units	3.20	3,136	100	gpcpd	0.31
18C	Residential	4,573,800	105.0	3.50	du/ac	368	units	3.20	1,176	100	gpcpd	0.12
19A	Residential	1,960,200	45.0	3.50	du/ac	158	units	3.20	504	100	gpcpd	0.05
19B	Residential	17,206,200	395.0	3.50	du/ac	1,383	units	3.20	4,424	100	gpcpd	0.44
19C	Residential	11,979,000	275.0	3.50	du/ac	963	units	3.20	3,080	100	gpcpd	0.31
19D	Neighborhood Commercial	653,400	15.0	7,500.00	sqft/ac	112,500	sq.-ft	-		1,500	gpd/acre	0.02
20A	Residential	13,068,000	300.0	3.50	du/ac	1,050	units	3.20	3,360	100	gpcpd	0.34
20B	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	3.20	3,920	100	gpcpd	0.39
21A	Residential	13,939,200	320.0	3.50	du/ac	1,120	units	3.20	3,584	100	gpcpd	0.36
21B	Residential	8,712,000	200.0	3.50	du/ac	700	units	3.20	2,240	100	gpcpd	0.22
27A	Residential	4,356,000	100.0	3.50	du/ac	350	units	3.20	1,120	100	gpcpd	0.11
28A	Residential	13,068,000	300.0	3.50	du/ac	1,050	units	3.20	3,360	100	gpcpd	0.34
28B	Residential	13,939,200	320.0	3.50	du/ac	1,120	units	3.20	3,584	100	gpcpd	0.36
29A	Medium Residential	11,979,000	275.0	6.00	du/ac	1,650	units	3.20	5,280	100	gpcpd	0.53
29B	Residential	13,939,200	320.0	3.50	du/ac	1,120	units	3.20	3,584	100	gpcpd	0.36
30A	Residential	13,068,000	300.0	3.50	du/ac	1,050	units	3.20	3,360	100	gpcpd	0.34
30B	Medium Residential	11,979,000	275.0	6.00	du/ac	1,650	units	3.20	5,280	100	gpcpd	0.53
31A	Medium Residential	6,316,200	145.0	6.00	du/ac	870	units	3.20	2,784	100	gpcpd	0.28
31B	District Core	2,178,000	50.0	20,000.00	sqft/ac	1,000,000	sq.-ft	-		1,500	gpd/acre	0.08
31C	Mixed Use Commercial	5,880,600	135.0	12,500.00	sqft/ac	1,687,500	sq.-ft	-		1,500	gpd/acre	0.20
31D	District Core	2,178,000	50.0	20,000.00	sqft/ac	1,000,000	sq.-ft	-		1,500	gpd/acre	0.08
32A	Medium Residential	5,445,000	125.0	6.00	du/ac	750	units	3.20	2,400	100	gpcpd	0.24
32B	District Core	1,742,400	40.0	20,000.00	sqft/ac	800,000	sq.-ft	-		1,500	gpd/acre	0.06
32C	Mixed Use Residential	5,880,600	135.0	20.00	du/ac	2,700	units	2.00	5,400	100	gpcpd	0.54
33A	Residential	13,939,200	320.0	3.50	du/ac	1,120	units	3.20	3,584	100	gpcpd	0.36
34A	Residential	4,791,600	110.0	3.50	du/ac	385	units	3.20	1,232	100	gpcpd	0.12
Total			8090.0						84344.0			9.38

ASLD 8500 - Wastewater Infrastructure Analysis

Auction Parcel Demands

Section	Land Use	Area (sq-ft)	Area (Acres)	Density		Yield		Population Density	Population	Unit Demand		Demand (MGD)	Equivalent Population	Peaking Factor	Peaking Demand (MGD)
17A	Neighborhood Commercial	653,400	15	7,500.00	sqft/ac	112,500	sq.-ft	-		1,500	gpd/acre	0.02	225	2.91	0.07
17B	Parks and Open Space	6,534,000	150	0.00	0.00							0.00	0		
17C	Residential	6,534,000	150	3.50	du/ac	525	units	3.20	1,680	100	gpcpd	0.17	1,680	2.23	0.38
17D	Residential	15,246,000	350	3.50	du/ac	1,225	units	3.20	3,920	100	gpcpd	0.39	3,920	2.03	0.80
18A	Residential	15,246,000	350	3.50	du/ac	1,225	units	3.20	3,920	100	gpcpd	0.39	3,920	2.03	0.80
18B	Residential	12,196,800	280	3.50	du/ac	980	units	3.20	3,136	100	gpcpd	0.31	3,136	2.08	0.65
18C	Residential	4,573,800	105	3.50	du/ac	368	units	3.20	1,176	100	gpcpd	0.12	1,176	2.33	0.27
19A	Residential	1,960,200	45	3.50	du/ac	158	units	3.20	504	100	gpcpd	0.05	504	2.60	0.13
19B	Residential	17,206,200	395	3.50	du/ac	1,383	units	3.20	4,424	100	gpcpd	0.44	4,424	2.00	0.89
19C	Residential	11,979,000	275	3.50	du/ac	963	units	3.20	3,080	100	gpcpd	0.31	3,080	2.08	0.64
19D	Neighborhood Commercial	653,400	15	7,500.00	sqft/ac	112,500	sq.-ft	-		1,500	gpd/acre	0.02	225	2.91	0.07
20A	Residential	13,068,000	300	3.50	du/ac	1,050	units	3.20	3,360	100	gpcpd	0.34	3,360	2.06	0.69
20B	Residential	15,246,000	350	3.50	du/ac	1,225	units	3.20	3,920	100	gpcpd	0.39	3,920	2.03	0.80
	Total		2,780									2.96	29,570	1.68	4.98

ASLD 8500 - Wastewater Infrastructure Analysis

Pipe Capacity Calculation

Start Node	End Node	Contributing Parcels	Diameter (in)	Min. Design Slope (ft/ft)	Pipe Capacity (MGD)	Contributing ADF (MGD)	Cumulative ADF (MGD)	Equivalent Population [(1)]	Peaking Factor	Cumulative Peak Flow (MGD)	Percent of Full Pipe Capacity	Excess Capacity (MGD)
1	2	6A	10	0.0024	0.70	0.20	0.20	2,000	2.19	0.44	63%	0.26
3	2	6B	8	0.0042	0.45	0.07	0.07	700	2.49	0.17	39%	0.28
2	4	0	10	0.0024	0.70	0.00	0.27	2,700	2.11	0.57	82%	0.12
4	5	7A	15	0.0014	1.57	0.20	0.47	4,700	1.99	0.94	60%	0.63
5	6	7B	18	0.0011	2.26	0.38	0.85	8,540	1.88	1.60	71%	0.66
9	8	17C	8	0.0042	0.45	0.17	0.17	1,680	2.23	0.38	83%	0.07
8	7		8	0.0042	0.45	0.00	0.17	1,680	2.23	0.38	83%	0.07
7	6	8B 17A	12	0.0019	1.01	0.26 0.02	0.45	4,481	2.00	0.90	89%	0.11
6	10	0	21	0.001	3.25	0.00	1.30	13,021	1.80	2.34	72%	0.90
10	11	18A	21	0.001	3.25	0.39	1.69	16,941	1.76	2.98	92%	0.26
12	13	0	8	0.0042	0.45	0.00	0.00	0				
13	14	16A 16B	10	0.0024	0.70	0.20 0.02	0.22	2,241	2.16	0.48	70%	0.21
14	15	17D	15	0.0014	1.57	0.39	0.62	6,161	1.94	1.19	76%	0.37
15	11	18C	18	0.0011	2.26	0.12	0.73	7,337	1.90	1.40	62%	0.86
16	17	0	8	0.0042	0.45	0.00	0.00	0				
17	18	21B	10	0.0024	0.70	0.22	0.22	2,240	2.16	0.48	70%	0.21
18	19	21A	15	0.0014	1.57	0.36	0.58	5,824	1.95	1.13	72%	0.43
19	20	20B	18	0.0011	2.26	0.39	0.97	9,744	1.85	1.81	80%	0.45
20	21	20A 19D	21	0.001	3.25	0.34 0.02	1.33	13,329	1.80	2.40	74%	0.85
21	22	19C	21	0.001	3.25	0.31	1.64	16,409	1.77	2.90	89%	0.35
11	22	18B 19A	30	0.001	8.41	0.31 0.05	2.79	27,918	1.69	4.72	56%	3.68
22	24	19B	30	0.001	8.41	0.44	4.88	48,751	1.62	7.91	94%	0.50
24	25	30B 30A	36	0.001	13.67	0.53 0.34	5.74	57,391	1.60	9.21	67%	4.46
26	27	27A	8	0.0042	0.45	0.11	0.11	1,120	2.34	0.26	58%	0.19
27	28	28B	12	0.0019	1.01	0.36	0.47	4,704	1.99	0.94	93%	0.07
30	31	34A 33A	15	0.0014	1.57	0.12 0.36	0.48	4,816	1.99	0.96	61%	0.61
31	28	0	15	0.0014	1.57	0.00	0.48	4,816	1.99	0.96	61%	0.61
28	34	28A	21	0.001	3.25	0.34	1.29	12,880	1.80	2.32	71%	0.93
34	35	29B	21	0.001	3.25	0.36	1.65	16,464	1.76	2.91	89%	0.34
33	35	32A 32C 32B 31D	18	0.0011	2.26	0.24 0.54 0.06 0.08	0.92	9,150	1.86	1.71	76%	0.55
35	36	29A	30	0.001	8.41	0.53	3.09	30,894	1.68	5.18	62%	3.22
36	25	31A 31C	30	0.001	8.41	0.28 0.20	3.57	35,703	1.66	5.93	70%	2.48
25	LS	31B	42	0.001	20.62	0.08	9.38	93,844	1.55	14.57	71%	6.05

(1) Equivilent Population = Average Daily Flow divided by 100 gpcpd

APPENDIX F

LD 8500 - Auction Parcel
Conceptual Opinion of Probable Cost

Sewer Unit Cost Assumptions

Sewer Pipe Size (Inches)	Unit Costs Per L.F. Pipe	Manhole[1]
8	$ 30	$ 4,000
10	$ 40	$ 4,000
12	$ 50	$ 4,000
15	$ 70	$ 4,000
18	$ 90	$ 4,000
21	$ 110	$ 4,000
24	$ 140	$ 5,000
30	$ 190	$ 5,000
36	$ 230	$ 5,000
42	$ 270	$ 5,000

LD 8500 - Auction Parcel

Arterial Roadway Sewer Infrastructure Conceptual OPC

Item	Unit	Quantity	Sewer Pipe Size (Inches)	Unit Price	Total
8" PVC Sewer Pipe	LF	24,300	8	$ 30	$ 729,000
10" PVC Sewer Pipe	LF	5,300	10	$ 40	$ 212,000
12" PVC Sewer Pipe	LF	6,200	12	$ 50	$ 310,000
15" PVC Sewer Pipe	LF	5,280	15	$ 70	$ 369,600
18" PVC Sewer Pipe	LF	5,280	18	$ 90	$ 475,200
21" PVC Sewer Pipe	LF	11,500	21	$ 110	$ 1,265,000
30" PVC Sewer Pipe	LF	7,900	30	$ 190	$ 1,501,000
36" PVC Sewer Pipe	LF	2,700	36	$ 230	$ 621,000
42" PVC Sewer Pipe	LF	3,700	42	$ 270	$ 999,000
5' Diameter Manhole, Large Base (1)	EA	30		$ 5,000	$ 150,000
5' Diameter Manhole (1)	EA	130		$ 4,000	$ 520,000
				Subtotal	$ 7,151,800
			Contingency	15.0%	$ 1,072,770
				Arterial Sewer Infrastructure Total	$ 8,224,570
Infrastructure Construction, Development, Permit Fee				% of Infrastructure Costs	
Construction Surveying				2%	$164,491
Mobilization / De - Mobilization				1%	$82,246
Post Design Services				1%	$82,246
Preliminary Design				3%	$246,737
Final Design				6%	$493,474
Plan Review				2%	$164,491
Agency Permit				2%	$164,491
Tax Rate (65% of 9.6%)				6.2%	$513,213
				Subtotal	$ 1,911,390
				Total	$ 10,135,960

Facilities					
Item	Unit	Quantity		Unit Price	Total
Ex. WWTF Improvements (2)(4)	LS	3		$15,000,000	$45,000,000
Option B Lift Station (5 MGD Auction) (3)	LS	1		$4,300,000	$4,300,000
Parallel 12" D.I.P Forcemains (5)	LF	60000		$140	$8,400,000
				Facility Subtotal	$ 57,700,000
			Contingency	20.0%	$ 11,540,000
				Facility Total	$ 69,240,000
Facility Construction, Development, Permit Fee				% of Infrastructure Costs	
Mobilization / De - Mobilization				1%	$692,400
Construction Management/Post Design Services				6%	$4,154,400
Preliminary Design				3%	$2,077,200
Final Design				6%	$4,154,400
Plan Review				2%	$1,384,800
Agency Permit				2%	$1,384,800
Tax Rate (65% of 9.6%)				6.2%	$4,320,576
				Subtotal	$ 18,168,576
				Total	$ 87,408,576
				Auction Sewer Infrastructure/Facility Total	$ 97,544,536

The Conceptual Opinion of Probable Cost above was prepared based on limited information available and the ENGINEER's understanding of the project. Since the ENGINEER has no control over labor, materials, equipment or services furnished by others or over the Contractor(s)' method of determining prices, or over the competitive bidding or market conditions; the opinions of probable costs provided herein are made on the basis of experience and qualifications. The opinions of probable costs represents the best judgment as an engineer, familiar with the construction industry; but the ENGINEER cannot and does not guarantee that proposals, bids or actual project or construction cost will not vary from the opinion of probable cost.

Notes/Assumptions:

(1) 500' manhole spacing per Superstition Mountains Community Facility District (SMCFD) Master Plan.

(2) Estimated $15/treated gallon for improvements to the existing treatment facility. Existing Facility not evaluated for specific improvement requirements. It is assumed that all WWTF improvements will be the responsibility of the SMCFD but shown for reference.

(3) Lift Station estimated ~5MGD for Auction Parcel Demand. Lift Station Site and Structure sized to allow for expansion to Planning Parcel Demands in the future.

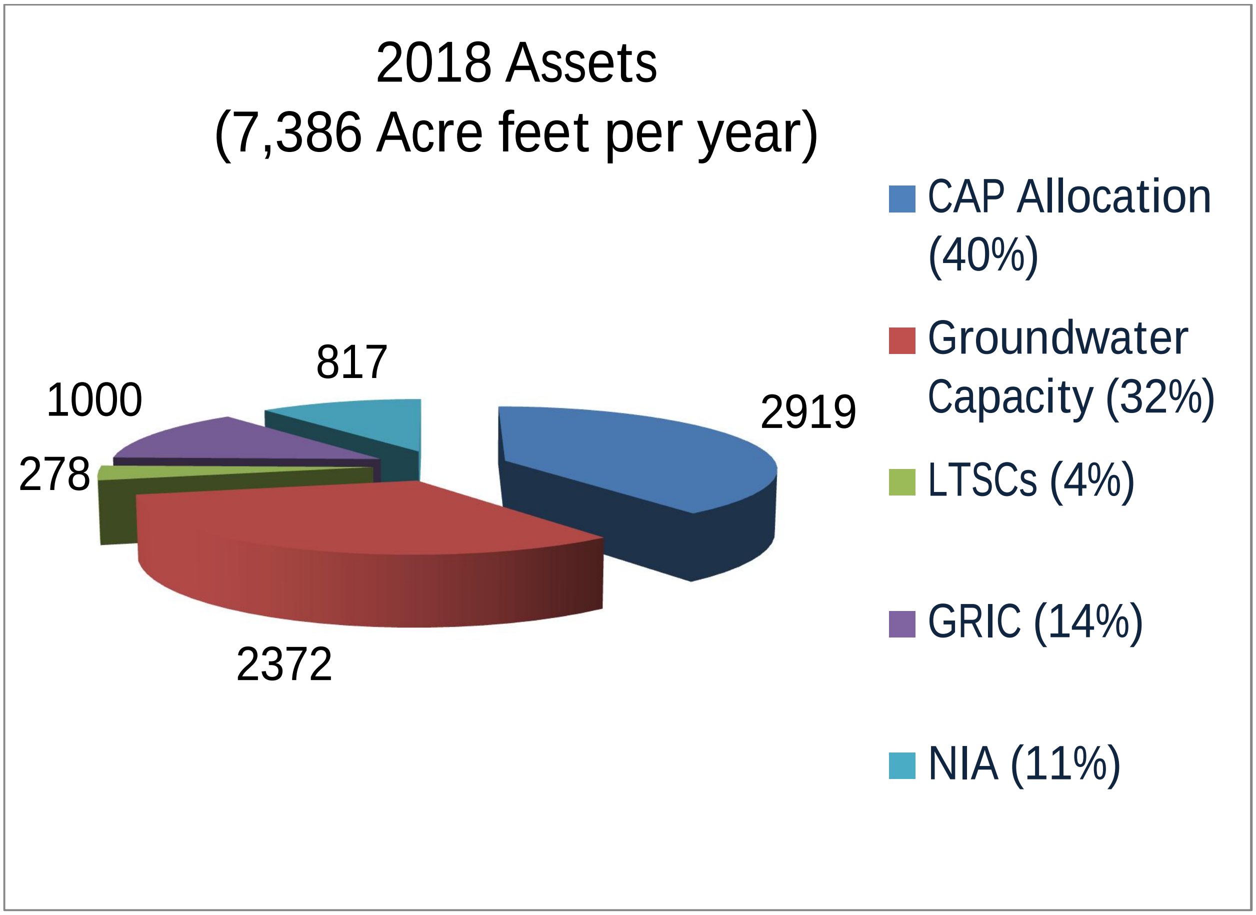
(4)3MGD WWTF expansion of existing WWTF. Odor control, injection well, and effluent recharge excluded. Assumes no improvements to administration building or O&M building necessary for expansion.

(5) Parallel forcemains anticipated for Auction demand, Protecto Lined DIP.

(6) Collector Roadway improvements assume 8 inch gravity sewer pipe. Collector Roadway sewer infrastructure costs estimated as part of the Roadway Infrastructure Conceptual OPC.

APPENDIX G

Appendix H – AJWD Water Resource Breakdown



Notes:

The groundwater amount is based on the 2010 Designation of Assured Water Supply. Prior to 2009, groundwater was the primary source of water. During 2009, recovered Long Term Storage Credits (CAP water and effluent recharge) replaced groundwater withdrawals. Moving forward, construction of an Interconnect Pump Station enabled the District to begin delivering CAP water treated by the City of Mesa. An AJWD CAP water treatment plant was constructed and became operational in the spring of 2016.

Long Term Storage Credit amount is based on latest available credit balance.

GRIC = Gila River Indian Community 100-year lease for 1000 annual acre feet of CAP.

The NIA CAP water reallocation process for 817 annual acre feet is in progress. Date of availability yet to be determined.

Apache Junction
Water Company

APACHE JUNCTION WATER COMPANY

APACHE JUNCTION MASTER PLAN
FINAL REPORT

SEPTEMBER 2010

Registered Professional Engineer (Civil)
CERTIFICATE NO.
28112
RAMESH
NARASIMHAN
Date Signed 9/2/10
ARIZONA, U.S.A.
exp 9/30/2012

Narasimhan
Consulting Services, Inc.

3660 N. Third Street
Phoenix, Arizona 85012
(602) 629-0206

APACHE JUNCTION MASTER PLAN
FINAL REPORT

TABLE OF CONTENTS

APACHE JUNCTION MASTER PLAN
FINAL REPORT

TABLE OF CONTENTS (Cont)

APACHE JUNCTION MASTER PLAN
FINAL REPORT

TABLE OF CONTENTS (Cont)

APACHE JUNCTION MASTER PLAN
FINAL REPORT

TABLE OF CONTENTS (Cont)

LIST OF APPENDICES

LIST OF FIGURES

LIST OF FIGURES (Cont)

APACHE JUNCTION MASTER PLAN
FINAL REPORT

LIST OF FIGURES (Cont)

APACHE JUNCTION MASTER PLAN
FINAL REPORT

LIST OF TABLES

EXECUTIVE SUMMARY

BACKGROUND

The City of Apache Junction, Arizona is located in Pinal County approximately 30 miles east of Phoenix. The Apache Junction Water Company (AJWC) is responsible for the administration, design, operations, and maintenance of the water system for a portion of the City. Currently (2009), AJWC supplies water to a population of approximately 12,700 along with its commercial customers. Within the next five years, modest growth is expected within the established AJWC service area. In addition, a Master Planned community (Portalis), is expected to be developed and increase water demands.

Narasimhan Consulting Services, Inc. (NCS) was tasked with developing a Master Plan for the Apache Junction Water Company (AJWC) to address issues related to water resources, water distribution, water quality and system improvements from current conditions through build-out. Concurrently, a water distribution model for the system was also developed by NCS. This model provided the capability to analyze changes to the distribution system and their impacts on water quality, operations and operational costs. This model was used to develop the Master Plan to provide guidance for the orderly expansion of the water service system, including both production and distribution system facilities, and identified the need for system improvements.

The purpose of this Master Plan is to provide a comprehensive roadmap by which AJWC can plan and implement a reliable and high quality water supply from now through build-out of the service area.

APPROACH

The overall approach used in developing this Master Plan was to consider the available and pursuable water resource options, water production alternatives and infrastructure needs. In considering the various alternatives, the potential water resources were balanced based on minimizing costs and maintaining sustainable resources. Scheduling of necessary infrastructure and source procurement needs are triggered by growth milestones, providing separation from a strict timeline in the event future growth proceeds at a slower than predicted pace.

Two types of future growth are expected for AJWC: (1) Growth within the existing AJWC service area, and (2) Growth associated with the proposed master planned Portalis community. In this Master Plan, water resources and distribution infrastructure are planned separately for both communities, but their interaction and ability to share resources and costs are considered.

Historical water use and anticipated growth rates were used to estimate future demands. Build-out for the established community was defined in the General Plan (based on land use) as 5,404 AFY (acre-feet per year), not including the Portalis development. For Portalis, the developer will be responsible for providing wells and any required treatment to meet demands and comply with SDWA rules. Average day demand at build-out for the Portalis community has been defined as 10.9 MGD (Wood, Patel & Associates, 2009). It is anticipated that the initial demand for this community will be 1.0 MGD, starting in 2012.

A future demand scenario was developed based on observed growth patterns in similar communities, and on best professional judgement. For the existing service area, the projections were based on the continuation of current growth at 0.5% until the end of 2012, followed by a consistent 2.5% growth until build-out. The Portalis development is expected to grow at 5.8% per year from initiation in 2012 to build-out.

A water distribution model for the system was developed and used to provide the capability to analyze changes to the distribution system and their impacts on water quality, operations, and operational costs. This model provided the basis in guiding the orderly expansion of the water service system, including both production and distribution system facilities, and identified the need for system improvements.

RESOURCES OVERVIEW

AJWC's current water resources include groundwater supply using three production wells, and surface water supply using their Central Arizona Project (CAP) allotment. The options for future groundwater sources include developing new wells for the established AJWC service area and new well development for the Portalis community. Wastewater recharge credits are purchased and accumulated in a recharge credit bank, which can be applied to future overdrafts of groundwater. Surface water resource options include usage through the Arizona Water Company or City of Mesa interconnections, or recharge of CAP water. The portion of the annual CAP allotment not used for potable supply is available for recharge and recharge credit. For drinking water treatment, AJWC can chose to take delivery of CAP water treated by the City of Mesa through an existing agreement, or alternatively build its own treatment plant in the future. AJWC desires to balance the various sources to obtain a sustainable, economically feasible arrangement through a blend of groundwater wells, surface water treatment and wastewater recharge.

CONJUNCTIVE USE PROGRAM

The optimal blend of groundwater and surface water resources is one which is cost-effective and considers the balance between utilizing groundwater resources without depleting the reserve of recharge credits. In the long run, the desired goal is an 80% surface water, 20% groundwater split. In working toward that goal, the feasibility of implementing either a 50% surface water, 50% groundwater blend or a 75% surface water, 25% groundwater split are considered here.

AJWC currently has 30,000 acre-feet (ac-ft) in accumulated recharge credits, and is purchasing wastewater recharge credits at a rate of 1,200 ac-ft per year (AFY). In addition, AJWC has a Central Arizona Project (CAP) allocation of 2,919 AFY, and can receive recharge credit for the potion of this surface water allocation not used and recharged. This balance of storage credits can be applied to future overdrafts of groundwater use, if needed, to meet future demands as expansion occurs.

Groundwater resources are not subject to peaking limits, seasonal dry-ups and drought, notwithstanding capacity limitations. Given that Arizona is a junior rights holder with respect to Colorado River resources (and CAP water rights), a reliable groundwater source is critical in securing future water reserves. A healthy reserve of groundwater credits is desired when drought conditions threaten surface water sources, therefore, it is important to maintain this reserve. Banked groundwater credits should be maintained at a minimum of 10,000 ac-ft (3,260 MG).

The target of maintaining 10,000 ac-ft of banked recharge credits in the long term provides AJWC with sufficient capacity to meet the average day demand at build-out for five years using only groundwater sources, provided wastewater is recharged continuously for aquifer sustainability.

In order for the Portalis system to meet the same reserve capacity criteria (i.e., meet the average day demand at build-out for five years using only groundwater sources), long term banked recharge credits needs to be maintained at 24,000 ac-ft. Thus, in the long term, a total of 34,000 ac-ft would be needed to protect both communities from a 5-year extreme drought condition.

AJWC also has an agreement with the City of Mesa, to receive treated CAP water through an interconnection to the Mesa water system. Based on actual usage and billings, the unit cost of water to AJWC under this agreement is $1.00 per 1,000 gallons. For planning purposes, this cost is assumed to increase by 10% for future unknowns, contingencies and changes in the agreement. Also, in future years, a 2% per year increase was considered for the CPI.

Water Treatment Plant Expansion Schedule

To facilitate planning, demand milestones have been identified to trigger CIP planning actions five years in advance. This will allow sufficient time to secure funds and complete design and construction of needed infrastructure. Demand triggers have been identified five years prior to when true capacity equals the projected maximum monthly average day demand.

Initially a 1.1 MGD surface water treatment plant is planned to come on-line by 2015. Prior to 2015, surface water will be obtained through the Mesa interconnect. Surface water will make up 50% of the average day demands until 2030. As of 2019, the additional water required to meet 50% of the demand in excess of the WTP capacity will be supplied through the Mesa interconnect.

The transition to 80% surface water and 20% groundwater will occur in 2030 when a 2.0 MGD surface water treatment expansion is recommended, providing a total surface water treatment capacity of 3 MGD. The trigger to begin CIP planning actions for this expansion is at an average day demand of 2.25 MGD, expected to occur in 2025.

AJWCD SVC. AREA

The next expansion trigger is expected in 2040 (or when average day demand reaches 3.2 MGD), when a 1.0 MGD expansion will need to be initiated to come on-line by 2045. This will provide a total capacity of 4.0 MGD, sufficient to maintain the 80% surface water, 20% groundwater split until build-out and beyond.

For Portalis, a 3 MGD total surface water treatment plant is recommended to come on-line by 2030 in order to maintain the balance between groundwater use and recharge credit reserves to meet drought conditions.

Groundwater Expansion Schedule

A wellfield expansion schedule has been developed to provide groundwater only supply in severe drought conditions. Under this scenario, such as a Stage 4 Drought Condition, compulsory conservation and mandated shutoff rules will necessitate a 50% reduction in maximum month average day demand. Well capacity will be needed to meet this demand, without surface water supplementation. The demand trigger is identified as the point when maximum month average day demand reaches 3.48 MGD (or when 50% of the maximum month average day demand reached 1.75 MGD). When this demand is realized, a 1.0-MGD expansion should be initiated to provide severe drought protection through build-out.

SHORT TERM CAPITAL IMPROVEMENT PROGRAM

Three scenarios were considered for analyzing the status of the recharge credit bank:

(1) Baseline surface water usage (1.0 MGD consistent with the current baseline condition water use strategy)
(2) Meeting 75% of demand with surface water, and 25% of demand with groundwater
(3) Meeting 50% of demand with surface water, and 50% of demand with groundwater

In Scenario 1, at the predicted rate of future demand, current source water usage, and current rate of recharge credit accumulation, the bank of recharge credit will be exhausted by 2045.

In Scenario 2, increasing the portion of future demand served by 75% surface water, and 25% groundwater will enable recharge credits to increase and stabilize over the planning period to build-out. This scenario, as in Scenario 1, assumes that the current rate of credit accumulation, without excess CAP credit purchase, is maintained.

In Scenario 3, increasing the portions of future demand to be supplied equally by surface and groundwater provides a balance in resources and maintains a desired target of long-term reserve capacity (10,000 ac-ft) until build-out.

Assuming an 80% and 20% surface water to groundwater ratio for the AJWC service area and a total of 6.3 MGD surface water treatment plant requirement, Portalis will require a new treatment plant (or expansion of an AJWC treatment plant) to 3 MGD.

TOTAL DEMANDS PORTALIS & AJWC

Build out average day demand for AJWC is 4.8 MGD, while that of Portalis is 10.9 MGD. The total demands imposed by both developments together is approximately 15.7 MGD. From the historical records, it is observed that the total recharge to demand ratio is approximately 0.6. This means that approximately 60% of 15.7 MGD of consumed water would be recharged leaving about 15% water for reuse purposes (while 25% is consumptive use). Therefore, to maintain a usage rate that does not either build up a bank or draw a bank down, groundwater can only be used as much as it can be recharged. The total groundwater use would be approximately 9.4 MGD. Approximately 6.3 MGD of surface water would be required for build-out. This corresponds to CAP credits of 7,033 ac-ft/yr. AJWC has a CAP allotment of 2,919 ac-ft/yr. An additional 4,114 ac-ft/yr would be required in the long term under this sustainable scenario.

To take delivery of surface water under each of these options, the CAP supply can be treated by Mesa and delivered to AJWC using the Mesa Interconnect (under the agreement); or AJWC can take direct delivery of CAP and treat it its own new water treatment plant.

A comparison of the two water delivery methods (separate WTP versus Mesa interconnect) for the three water resource scenarios is presented below:

Scenario 1 - 1 MGD Surface Water Usage With Mesa Interconnect

Separate AJWC Treatment Plant (1.0 MGD): $4,874,000 PW (Annualized Cost $425,000)
Mesa Agreement (1.0 MGD): $5,158,000 PW (Annualized Cost $449,000)

Scenario 2 - 75% Surface Water, 25% Groundwater

Separate AJWC Treatment Plant (1.6 MGD): $6,445,000 (Annualized Cost $562,000)
Mesa Agreement: $7,496,000 (Annualized Cost $654,000)

Scenario 3 - 50% Surface Water, 50% Groundwater

Separate AJWC Treatment Plant (1 MGD): $5,145,000 (Annualized Cost $449,000)
Mesa Agreement: $5,674,000 (Annualized Cost $495,000)

Based on the above analysis, it is cost-effective for AJWC to develop the surface WTP than to have continued reliance on the Mesa interconnect. Also, based on balancing costs and long term water resource goals, water resource Scenario 3 (50% surface water and 50% groundwater) is recommended for the short term. This will provide a long term sustainable groundwater supply that is available for surface water drought conditions while balancing the overall costs to AJWC. As the WTP is expanded, the AJWC main service area will move towards meeting the 80% surface water, 20% groundwater goal. Further, the cost-effectiveness of providing surface water through a new jointly-owned WTP with the City of Mesa should also be evaluated in a separate study.

If the Portalis master planned community develops, it should provide a 3 MGD treatment plant to AJWC to maintain recharge credit bank and sustainable operations.

Short Term Water Distribution System Infrastructure Upgrades

Based on the hydraulic modeling runs, upgrades were identified for booster stations to meet maximum day fire flow and peak hour demand conditions. The required pumping upgrades were identified to meet redundancy and firm capacity requirements. Storage tank upgrades were also identified to meet diurnal demand variation. Pipeline upgrades were identified to correct deficiencies in pressures, velocities and flows and to meet fire flow requirements. The costs presented below do not include engineering fees or contingencies.

Two booster station upgrade projects are recommended at a total cost of $ 1,242,000 ($900,000 plus 20% contingency and 15% engineering). Three storage tank projects are recommended (one new tank at booster site 2, one new clearwell at the WTP site, and a rehabilitation of the existing tank at booster site 2). The cost of these improvements is estimated at $2,967,000 ($2,150,000 plus 20% contingency and 15% engineering).

The total cost of the 5-year CIP for the AJWC is estimated at $9,555,000 for the projects described above. This includes construction and engineering costs but does not include any land acquisition costs. However to adequately plan and budget for future conditions an additional 15% contingency is recommended to plan for unforeseen conditions in the market place and miscellaneous projects that may be identified in the future. Therefore the total amount recommended to be funded in the 5-year CIP is $ 10,988,000 ($9,555,000 plus 15% general contingency)

INTERMEDIATE TERM CAPITAL IMPROVEMENT PROGRAM

When the average daily demand reaches 2.24 MGD, CIP planning for intermediate growth should be initiated. This will allow system improvements to be completed for the intermediate growth.

CIP and funding initiation should be started for the first expansion of this plant when the demand reaches 2.24 MGD. The expansion of the plant will be 1.9 MGD. Additionally, the strategy of surface water use will increase to 80% surface water to 20% groundwater ratio.

Additional well expansion of 1 MGD would be required to allow supplying up to 50% of the demands using groundwater for the existing AJWC service area. This would allow drought mitigation to a great extent.

Intermediate Term Water Distribution System Infrastructure Upgrades

For the intermediate growth CIP additional pumping capacity would be required to meet the peak hour demands. A total of two (1.3 MGD, Booster Station #1 and 1.7 MGD, Booster Station #2) pumps would be required to reach to a total demand capacity of 10.1 MGD.

Booster Station #1 will require a tank upgrade by 2 MG. This upgrade will allow meeting the fire flow, emergency and diurnal usage requirement. This additional storage can also be provided at the WTP if required.

Based on the water distribution system hydraulic analyses conducted for Peak Hour and Maximum Day Fire Flow Conditions the following improvements are recommended. A list of the pipes required for upgrade in this growth scenario has been identified.

A pressure zone split should be considered by allowing Portalis to grow as a separate zone. Further more, the line on the south east side of the City should be placed into this new zone. A new PRV will be required on the 8 inch line.

Future Master Planning efforts should re-evaluate time frame and triggers for new Storage Tank and Booster Station Upgrades.

LONG TERM CAPITAL IMPROVEMENT PROGRAM

CIP and funding initiation should be started for the build out conditions when the average day demand reaches 3.2 MGD with a reference year of 2040. This would be the last expansion of 1 MGD. No additional well field expansion will be required for this scenario.

Long Term Water Distribution System Infrastructure Upgrades

For the build out CIP additional pumping capacity would be required to meet the peak hour demands. Multiple pumps would be required to reach to a total demand capacity of 17.3 MGD. Because hydraulically the capacity at Booster Station #2 is maximized, the new pumps would be required at Booster Station #1.

The Booster Station #1/WTP will require a total tank upgrade by 4.7 MG. This upgrade will allow meeting the fire flow, emergency and diurnal usage requirement. This additional storage can also be provided at the WTP if required.

Based on the water distribution system hydraulic analyses conducted for Peak Hour and Maximum Day Fire Flow Conditions the following improvements are recommended. A list of the pipes required for upgrade in this growth scenario has been identified.

Future Master Planning efforts should re-evaluate time frame and triggers for new Storage Tank and Booster Station Upgrades. The schedule of implementing upgrades for the build-out scenario should be re-evaluated during future master plans to narrow the reference years and update the impact of demand changes.

SUMMARY OF RECOMMENDATIONS

In considering the various scenarios, the potential water resources were balanced based on minimizing costs and maintaining sustainable resources. Scheduling of necessary infrastructure and source procurement needs have been identified and are triggered by growth milestones and a reference timeline. The major recommendations include obtaining Council approval and obtaining funding for the short term (5-year) Capital Improvement Program that includes a new 1.1 MGD surface water treatment plant, distribution system piping upgrades, booster station upgrades, and storage tank rehabilitation and new clearwell. The planning and implementation of a new Water Treatment Plant to treat CAP surface water should be commenced immediately.

AJWC should continue to pursue additional CAP rights. A 50% surface water, 50% groundwater supply strategy should be adopted, working toward a 80% surface water, 20% groundwater strategy by 2030. A water quality modeling study should be conducted when considering migrating to surface water use. If the Portalis master planned community develops, it should provide a 3 MGD treatment plant to AJWC to maintain recharge credit bank and sustainable operations.

A non revenue water study should be initiated to determine the feasibility of recovering lost revenue potential. In addition, the feasibility of a joint WTP with the City of Mesa should be studied.

In the next 10 years, planning for the intermediate phase as demand triggers appear should begin. Finally, the Master Plan should be revisited and upgraded (if necessary) by 2020.

SECTION 1
INTRODUCTION

1.1 BACKGROUND

The City of Apache Junction, Arizona, is located in Pinal County approximately 30 miles east of Phoenix. The Apache Junction Water Company (AJWC) is responsible for the administration, design, operations and maintenance of the water system for a portion of the City. As of 2009, AJWC supplies water to a population of approximately 12,750, along with its commercial customers. AJWC operates three wells (Wells 5, 6 and 8), and as a supplemental source, obtains water from the Arizona Water Company (AWC) and the City of Mesa via interconnections. Water from these interconnections is blended with groundwater in storage tanks. Wells 5 and 6 have capacities of 600 and 500 gallons per minute (gpm), respectively. Well 8 has a production capacity of approximately 250 gpm. Water from the wells is conveyed to four system storage tanks located at two booster stations, with a combined capacity of 3 million gallons (MG). Figure 1.1 shows the current system facilities. Figure 1.2 shows a schematic elevation profile of the existing system operations.

Narasimhan Consulting Services, Inc. (NCS) was tasked with developing this Master Plan. It addresses issues related to water resources, water distribution, water quality and system improvements for AJWC from current conditions through build-out. Concurrently, a water distribution model for the system has also been developed by NCS. This model provided the capability to analyze changes to the distribution system and their impacts on water quality, operations and operational costs. This model was used to develop the Master Plan to provide guidance for the orderly expansion of the water service system, including both production and distribution system facilities, and identified the need for system improvements.

1.2 PURPOSE

The purpose of this Master Plan is to provide a comprehensive roadmap by which AJWC can plan and implement a reliable and high quality water supply from now through build-out of the service area. Key goals and issues addressed within this Master Plan include:

- Provide updated water demand projections through build-out based on previous planning documentation and analysis of existing data.
- Plan the efficient utilization of existing and future surface and groundwater resources, and the optimal balance between viable options.
- Using an accurate and calibrated model of the distribution system, determine the required storage, booster and distribution elements.
- Optimize water production and storage strategies to meet water quality regulations and minimize water age and degradation.
- Provide guidance on integrating the Portalis master planned community into the AJWC system with similar water resources and operational characteristics.
- Provide a long term, sustainable water use plan.
- Evaluate options for efficient delivery of surface water (Mesa Interconnect versus separate AJWC water plant).

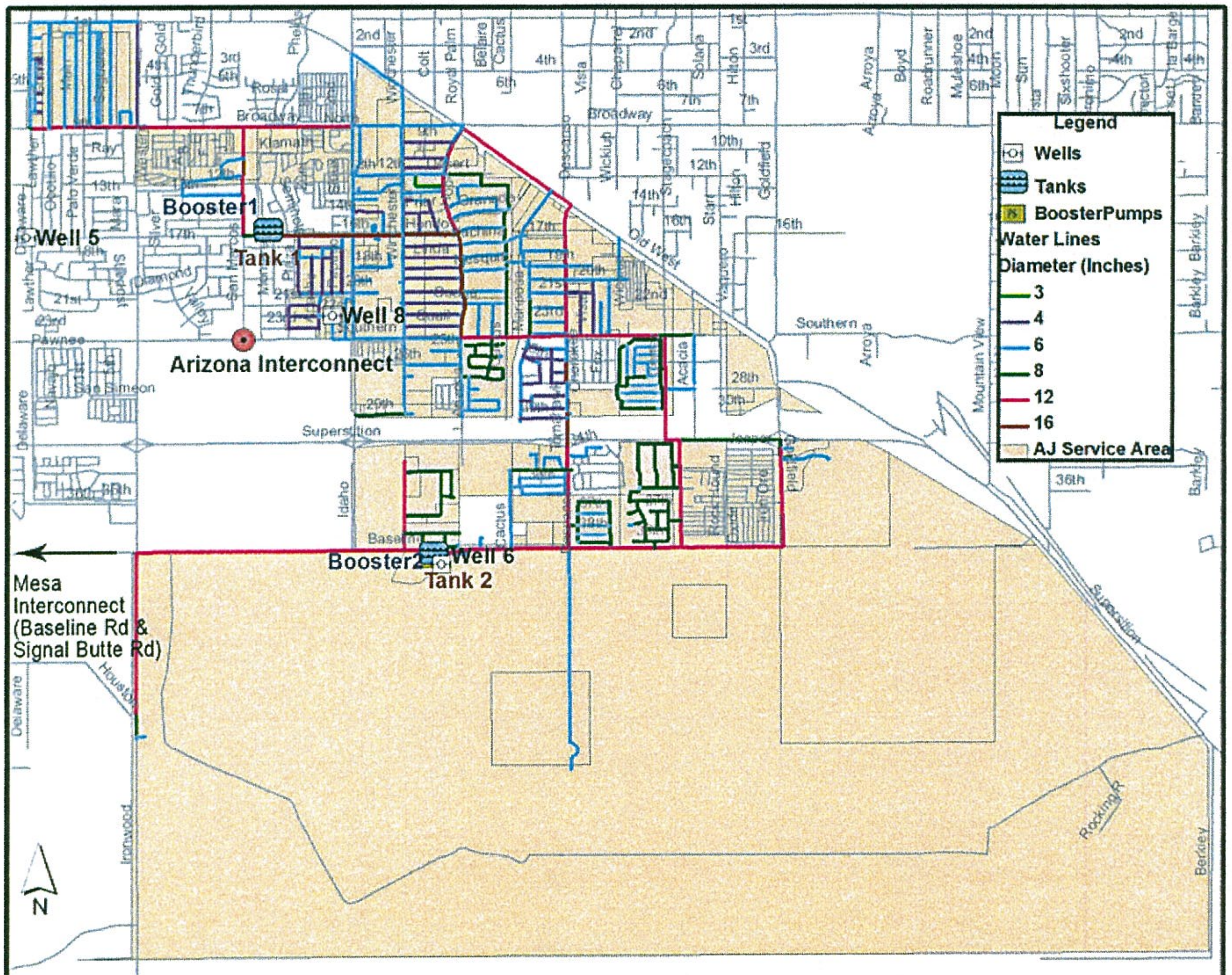


Figure 1.1: Layout of the Apache Junction Water Company Distribution System and Service Area

Apache Junction Water Company
Narasimhan Consulting Services, Inc.

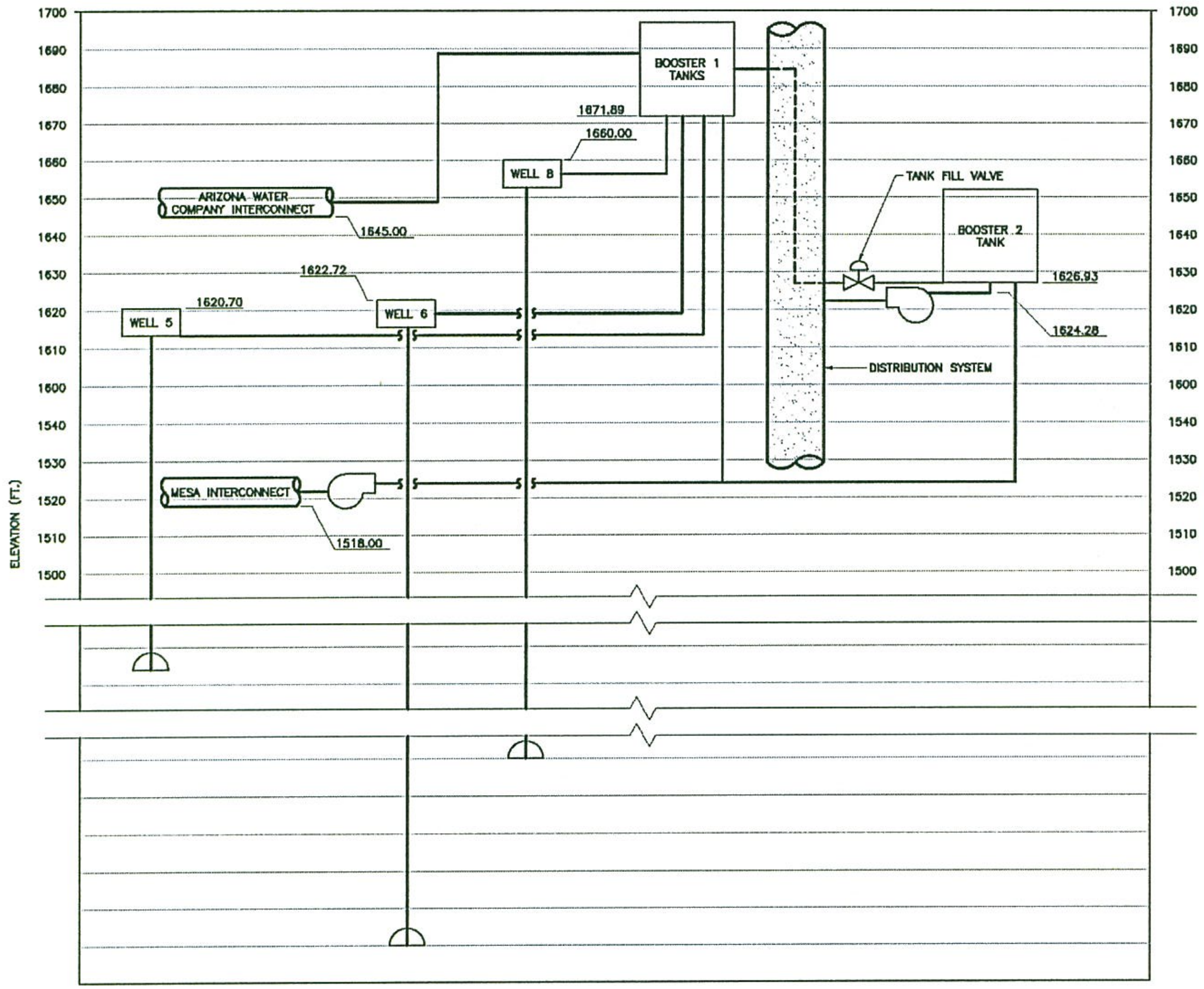


Figure 1.2: Schematic Elevation Profile of Existing System Operations

- Plan for drought mitigation.
- Provide both a time-phased and demand-triggered Capital Improvement Program (CIP) plan for water production, distribution infrastructure and storage facilities through build-out. Demand triggers allow AJWC to adapt its CIP on actual demand milestones rather than relying on temporal triggers alone.

1.3 APPROACH

The overall approach used in developing this Master Plan was to consider the available and pursuable water resource options, water production alternatives and infrastructure needs. In considering the various alternatives, the potential water resources were balanced based on minimizing costs and maintaining sustainable resources. Scheduling of necessary infrastructure and source procurement needs are triggered by growth milestones, providing separation from a strict timeline in the event future growth proceeds at a slower (or faster) than predicted pace. For this reason, a realistic customer growth rate has been adopted to provide reasonable facility costs for planning future needs. The optimal course of action, including a recommended Capital Improvement Program, is summarized in Section 9.

1.4 REFERENCE DOCUMENTS

- *City of Apache Junction 1999 General Plan.* City of Apache Junction.
- *Apache Junction Water Master Plan*, June 2001, ARCADIS Geraghty & Miller, Inc.
- *Water Master Plan for Lost Dutchman Heights*, April 09, 2009. Wood, Patel & Associates, Inc.
- OnBoard LLC population data from website accessed Feb 24, 2010: http://homes.point2.com/Neighborhood/US/Arizona/Maricopa-County

1.5 ABBREVIATIONS

AFY	acre-feet per year
AJWC	Apache Junction Water Company
AWC	Arizona Water Company
CIP	Capital Improvement Program
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
MCL	maximum contaminant level
MG	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
NCS	Narasimhan Consulting Services, Inc.
SDWA	Safe Drinking Water Act

1.6 REPORT ORGANIZATION

This Master Plan is divided into major sections as follows:

- Section 1 (Introduction) outlines the background, purpose, approach, reference material and abbreviations.
- Section 2 presents a discussion of water quality and regulations.
- Section 3 describes current and future water demands in the AJWC service area, and the methods future projections were derived.
- Section 4 presents the various source water options.
- Section 5 describes the current and future production facility needs.
- Section 6 presents the existing and future water distribution infrastructure.
- Section 7 summarizes the modeling conducted to identify system requirements.
- Section 8 presents present value capital and operating costs for the various alternatives.
- Section 9 presents the short term, mid term and long term CIP initiatives recommended through build-out.

SECTION 2
WATER QUALITY AND REGULATORY ISSUES

2.1 REGULATIONS

In 1974, Congress passed the Safe Drinking Water Act (SDWA), which requires the United States Environmental Protection Agency (EPA) to establish regulations on limiting contaminants that may be present in public water supplies and represent potential health risks. The SDWA was amended by Congress in 1986 and again in 1996. The EPA sets legal limits for contaminants based on public health protection and the ability of utilities to meet the standards using the best available technology. In addition, EPA rules dictate water testing schedules and procedures, and list acceptable technologies for treating contaminated water. The SDWA allows states to set and enforce their own regulations, providing they are at least as stringent as those set by the EPA.

The 1986 Amendments replaced the original National Interim Drinking Water Regulations with the National Primary Drinking Water Regulations (NPDWRs), and required implementation of Best Available Technologies (BATs) for regulated contaminants. For each contaminant, the EPA sets a public health goal, which is quantified as a Maximum Contaminant Level Goal (MCLG). At this level, a person could drink two liters of water containing the contaminant every day for 70 years without incurring any unacceptable health effects due to the regulated contaminant. While public water systems are not legally obliged to meet MCLGs, they are obliged to meet the MCLs, which are set as close to MCLGs as is practical based on technical and financial challenges.

Secondary Maximum Contaminant Levels (SMCLs) were enacted to provide guidelines for contaminants that may affect the appearance or taste/odor of water, but do not have adverse health effects (e.g., total dissolved solids). SMCLs are non-enforceable under Federal guidelines. The EPA recommends that monitoring for secondary contaminants be performed at intervals no less frequent than those for inorganic chemicals applicable to community public water systems (e.g., three years for ground water systems and annually for the surface water systems).

2.1.1 Groundwater

Systems using groundwater sources must comply with specific rules. These include:

- Groundwater Rule
- Radionuclides Rule

All future groundwater wells used as drinking water sources for AJWC must be assessed and, if necessary, provide mitigation to comply with these rules. Based on water quality data and current disinfection practices, the AJWC's facilities appear to comply with these rules. It may be desirable for AJWC to submit to Arizona Department of Environmental Quality (ADEQ) the 4-log virus inactivation credit.

2.1.2 Surface Water

Surface waters are subject to rules specific to this type of source and to the treatments used in the production of safe drinking water. These rules include:

- Surface Water Treatment Rule
- Interim Enhanced Surface Water Treatment Rule
- Long Term 2 Enhanced Surface Water Treatment Rule
- Filter Backwash Recycle Rule

Any future surface water sources (e.g., CAP) used by AJWC will have to be treated to comply with these rules. Such costs are included in the surface water treatment alternatives discussed in this Master Plan.

2.1.3 Rules Affecting Both Surface Water and Groundwater Sources

In addition to the rules mentioned above, several others apply to all community water systems. These include:

- Primary MCLs
- Total Coliform Rule
- Lead and Copper Rule
- Unregulated Contaminant Monitoring Rule
- Arsenic Rule
- Disinfectants/Disinfection By-Products Rule
- Contaminant Candidate List

Based on a review of water quality data, the AJWC appears to comply with these rules.

2.2 WATER QUALITY

A review of the historical records indicates that the water distributed by AJWC meets the current EPA maximum contaminant levels (MCLs), and the rules discussed above. Although all regulated organic and inorganic compounds are tested regularly for water systems, the following parameters are most commonly critical in Arizona water systems in this area. The current MCLs for these parameters are presented below:

- Nitrate (NO_3): 10.0 milligrams per liter (mg/L)
- Arsenic (As): 0.010 mg/L
- pH acceptable range: 6.5 - 8.5 standard units (SU)

The existing AJWC well sources are compliant with these MCLs, as treatment and blending are used for arsenic compliance.

Another parameter of potential concern is total dissolved solids (TDS). TDS is not regulated for drinking water use, and primarily impacts the taste and appearance of the water. The standards for nitrate and arsenic are primary drinking water standards and enforceable by the Arizona Department of Environmental Quality (ADEQ).

2.2.1 Groundwater

The groundwater quality in the Apache Junction area tends to be elevated in arsenic, pH and slightly elevated in TDS. Arsenic is a naturally occurring element in the soil, relatively common in Arizona. AJWC currently blends water to meet these MCLs. Nitrate levels are also a potential concern, but so far have not exceeded MCLs. It is anticipated that future compliance for arsenic can be met with treatment. For planning purposes, a typical arsenic groundwater treatment train is assumed. For the local water quality profile and anticipated capacities, the most appropriate technique is a wellhead partial stream adsorption treatment system.

2.2.2 Surface Water

AJWC currently has rights to an annual allocation of surface water through the Central Arizona Project (CAP) canal system. The primary concern with CAP source water is the potential for disinfection by-products (DBPs) formation. Typically, CAP source water quality has low turbidity (around 4 NTU), moderate total organic carbon (TOC [4 mg/L]), low specific ultraviolet absorbance (SUVA [2 L/mg-m]), moderate pH (8.3) and alkalinity (140 mg/L as $CaCO_3$), low bromide (0.1 mg/L) and relatively high TDS (700 mg/L). Based on the SUVA data, the source water is not amenable to TOC removal, an important parameter in DBP occurrence. Existing water treatment plants on CAP source water have utilized direct filtration or dissolved air flotation treatment processes because of low source water turbidity levels.

For planning purposes, a typical surface water treatment train is assumed and cost estimated in Section 5. The treatment processes include lined raw water storage, chlorine dioxide pre-oxidation, package water treatment system (Trident or similar) using coagulation, high rate clarification and dual media filtration and chlorine for secondary disinfection. This process was selected based on discussions with AJWC personnel, ability of the process to comply with drinking water regulations and cost comparisons from other similar WTP projects for CAP water.

2.3 CONCLUSIONS

Future water sources will need to be evaluated for drinking water compliance and suitability for treatment. A specific concern for groundwater resources is arsenic. Surface water sources are particularly susceptible to DBP formation. The cost of surface water and groundwater treatment must be considered in context of these regulations for planning updates.

SECTION 3
WATER DEMANDS

3.1 INTRODUCTION

3.1.1 Service Area

Historical water use, current growth trends, and anticipated growth rates were used to estimate future demands. For planning purposes, future growth was considered using two different components: (1) Growth within the existing AJWC service area, and (2) Growth associated with the proposed master planned Portalis community. Future demands were projected for each of these areas separately. In this manner, water resources and distribution infrastructure can be planned separately for both communities, however their interaction and ability to share resources and costs were considered.

3.1.1.1 Existing Developed Community

The AJWC service area is shown in Figure 3.1. Build-out for the established community was defined in the General Plan (based on land use) as 5,404 AFY (acre-feet per year), not including the Portalis development.

3.1.1.2 Portalis

The proposed Portalis development is shown in Figure 3.2. The developer will be responsible for providing wells, surface water facilities and any required treatment to meet demands and comply with SDWA rules. Average day demand at build-out for the Portalis community has been defined as 10.9 MGD (Wood, Patel & Associates, 2009). It is anticipated that the initial demand for this community will be 1.0 MGD, starting in 2012.

3.1.2 Methodology

Water demands can vary temporally (i.e., with time) or geospatially (i.e., with location). Temporal variations of demands can be short-term usage variations, such as diurnal water use variations or long-term trending variations (i.e., variations due to increase in customers, etc).

Master planning includes analysis for water resources as well as the water distribution system. For water resources estimation, long-term demand variations are more critical then short term. For water distribution modeling analysis, short term variables, such as diurnal patterns, are more critical.

Long-term variations for demands include trending changes as well as geospatial relative demand changes. Changes in geospatial relative demand occur, for example, when several new customers move into a sparsely populated area, changing the trending demand and at the same time changing the density and the dynamics of the system as increased supply is needed to the area.

Demand estimation was carried out for current as well as future conditions. Demand estimation for current conditions include:

1. Estimating geospatial variation of demands:

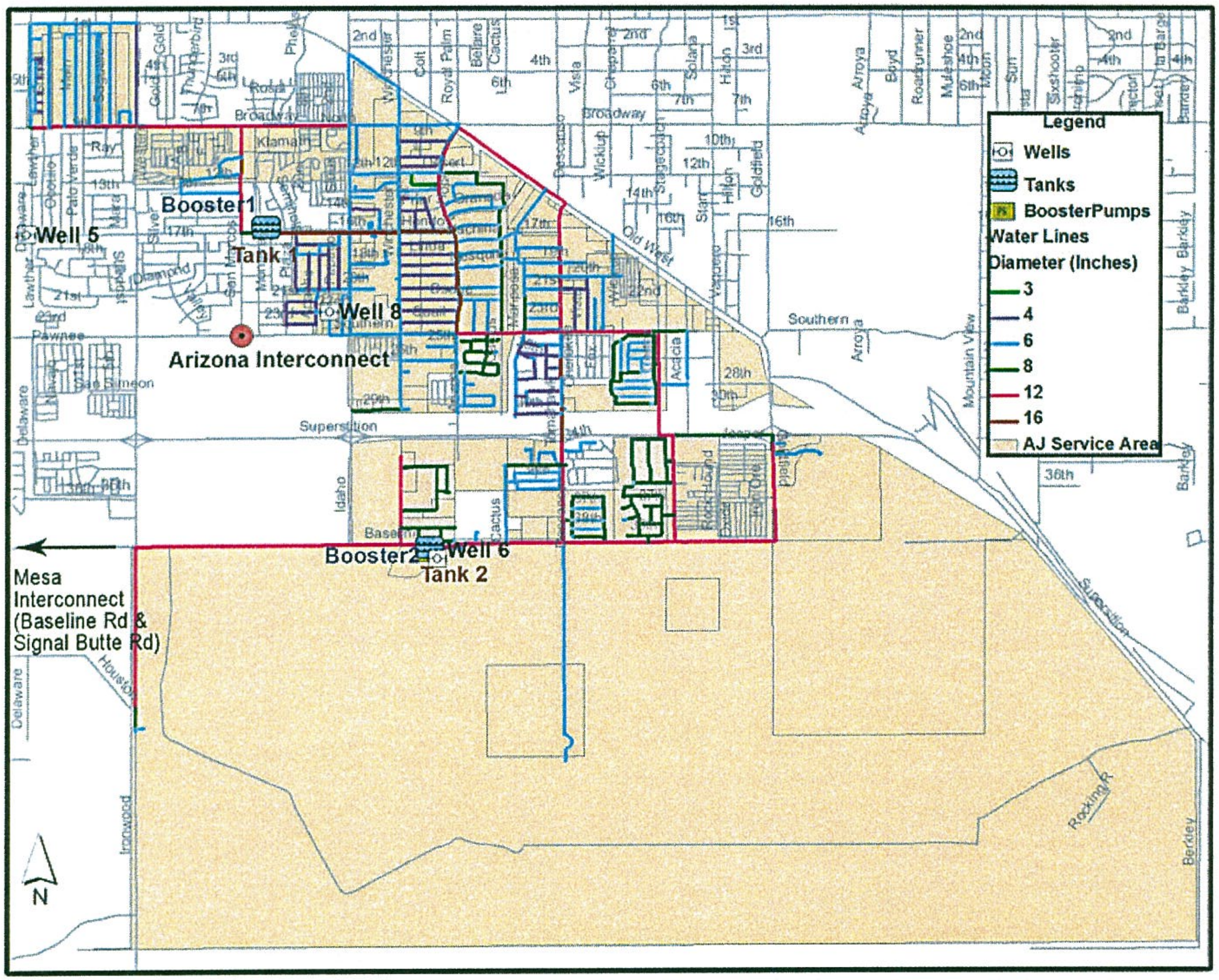


Figure 3.1: Layout of the Apache Junction Water Company Distribution System and Service Area

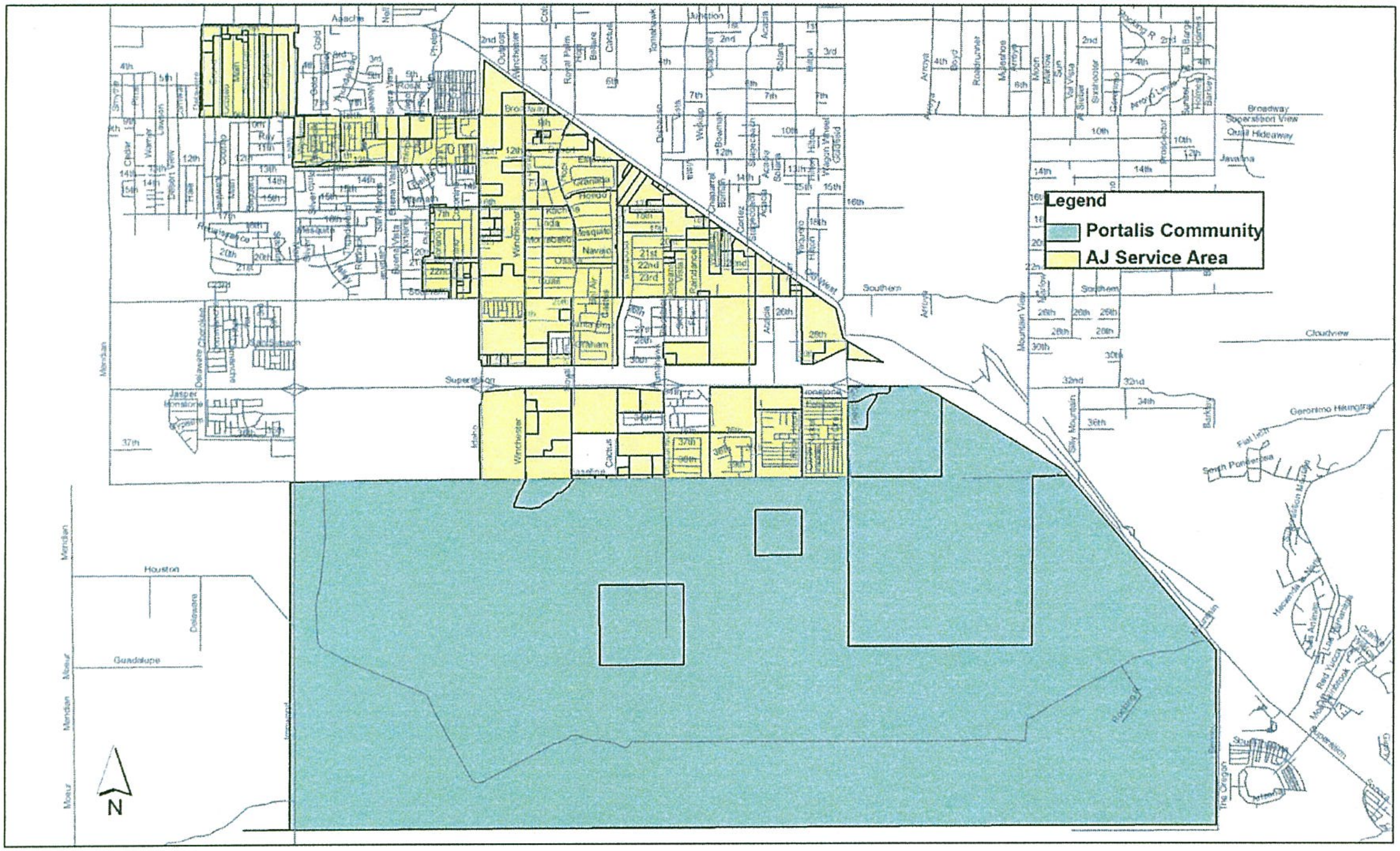


Figure 3.2: Proposed Portalis Master Planned Community Development

This can be done using billing data. Billing data records how much each meter consumed in which month. However, this is not useful for developing demand calculations for periods shorter than a month. At the same time, meters are read at different times each month and thus that difference factor also has to be accounted for.

2. Diurnal variation of demands:

   This data can be obtained from flow meters at pump discharge facilities. However, care has to be taken to ensure that the mass balance accurately reflects customer use demands and not the demands imposed by a tank.

3. Monthly Demand Trending:

   Demands depend on several additional factors, such as weather, temperature, water use, etc. Some of these factors change daily, therefore each month will have a different consumption compared to other months. These monthly demand variations can be used to help the utility prepare for both low and high demand situations. A monthly demand trend factor is used to identify low and high demand months.

Demand estimation for future conditions include:

1. Estimating geospatial variation of demands:

   This can be done in several ways. The most common approach is to use Maricopa County's population quarter section geospatial population data (if available). However, with the recent downturn in the economy, these projections are not realistic. Thus, an alternate technique was used. This technique included using land use projections and identifying per acre usage from the current use patterns, and applying that to develop geospatial projections. This technique was used and escalated to the General Plan demand of 4.85 MGD as a total demand in the existing system.

2. Diurnal variations of demands:

   Diurnal variations developed for current conditions can be used for future predictions. The largest use of diurnal demand variation is to develop a peaking factor.

3. Demand Trending:

   Demand trending can be carried out in several ways. Historical data can be analyzed and extrapolated to predict the future growth rate. Other parameters, such as population increase, can be used to estimate growth rates. In this Master Plan, several data sources as well as current growth rates were used to identify various possible demand trends. In consultation with the City staff, a demand trend that was most appropriate for AJWC was adopted, as discussed below.

Demand estimates were developed for both the existing AJWC service area as well as the Portalis master planned community.

3.2 MONTHLY DEMAND TREND FACTORS

Figure 3.3 shows the monthly water production for the years 2004 through 2009. The average monthly production over this time period is also shown.

Figure 3.4 shows the monthly demand trend factor developed from the data provided by AJWC over several years. The figure shows yearly variation in the demand trend factors and averaged demand variations.

General variation in demands range between 0.9 to 1.1 times the average day demand. This is an unusually flat demand condition throughout the year. From these graphs, a yearly maximum month average day to average day ratio of 1.1 was developed and used.

From previous studies (e.g., the General Plan and other similar communities in the area), a maximum day to average day ratio of 1.8 was also adopted.

3.3 GEOSPATIAL VARIATION OF DEMANDS

Demands vary geospatially each day. The resolution of adapting geospatial variation was to ensure that peak month geospatial variations are addressed. It was ensured that the billing data from the peak month was used to create a geospatial allocation of demands. Please refer to Appendix A for more information.

Allocating future geospatial demands was conducted by using land use classification developed in the City's General Plan. Figure 3.5 summarizes land use zoning for the AJWC service area. Build-out for the established community was defined in the General Plan (based on land use) as 5,404 AFY (acre-feet per year). This was super-imposed with current usage and current meter information to obtain a per acre land usage. This was then converted to total demands for build-out.

3.4 DIURNAL VARIATION OF DEMANDS

AJWC does not have fixed flow meters on the pump discharge headers. There are cumulative gauges that give daily totals for the flow, but do not provide flow or cumulative volume for each hour (or lower time increment). Therefore, additional flow meters were rented to define diurnal flow for a period of five days from August 12, 2009 to August 17, 2009.

Figure 3.6 shows the diurnal flows for these days, and average diurnal demand factors for weekend and weekdays.

The demand factor variation defines the need for storage for equalization purposes.

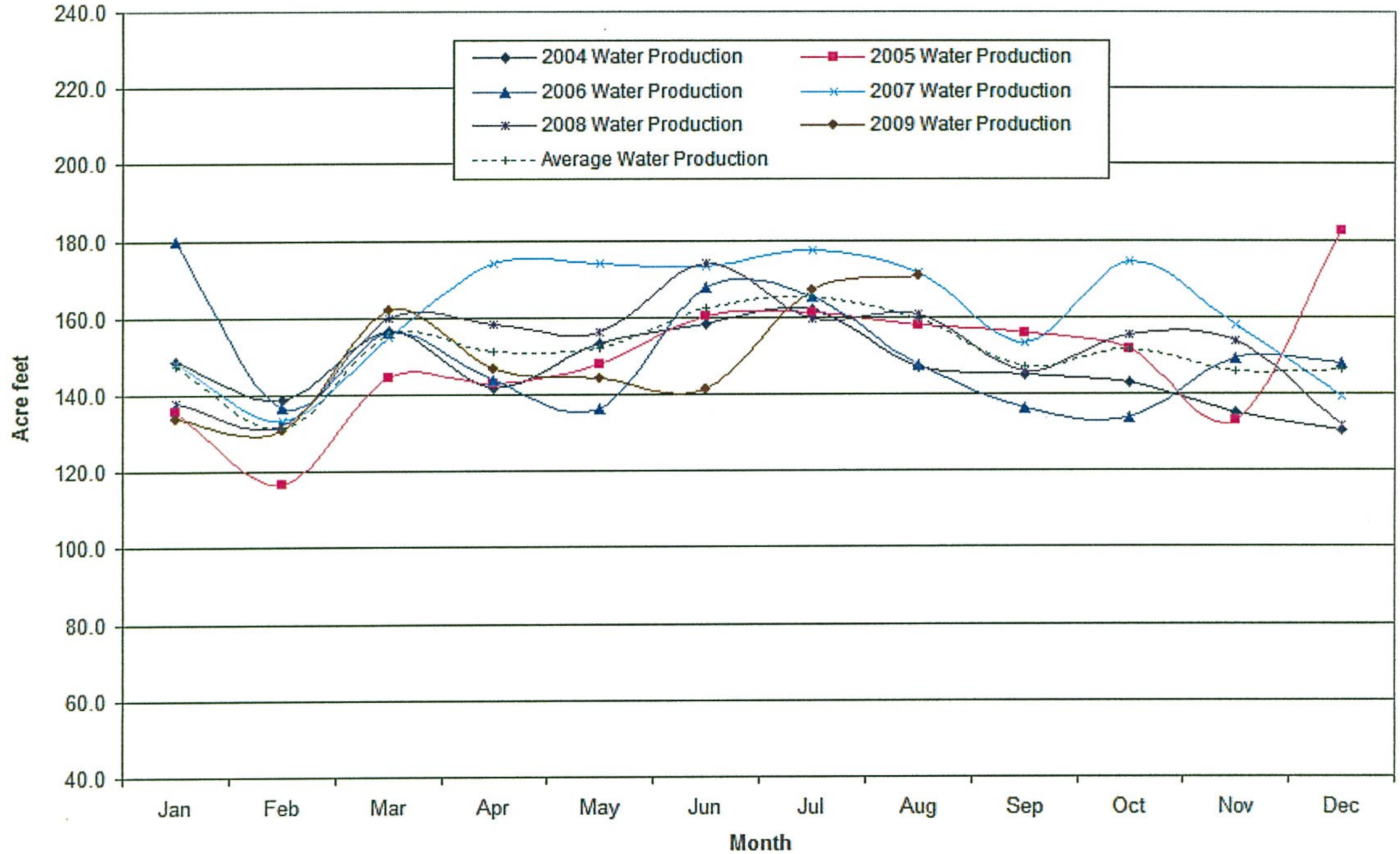
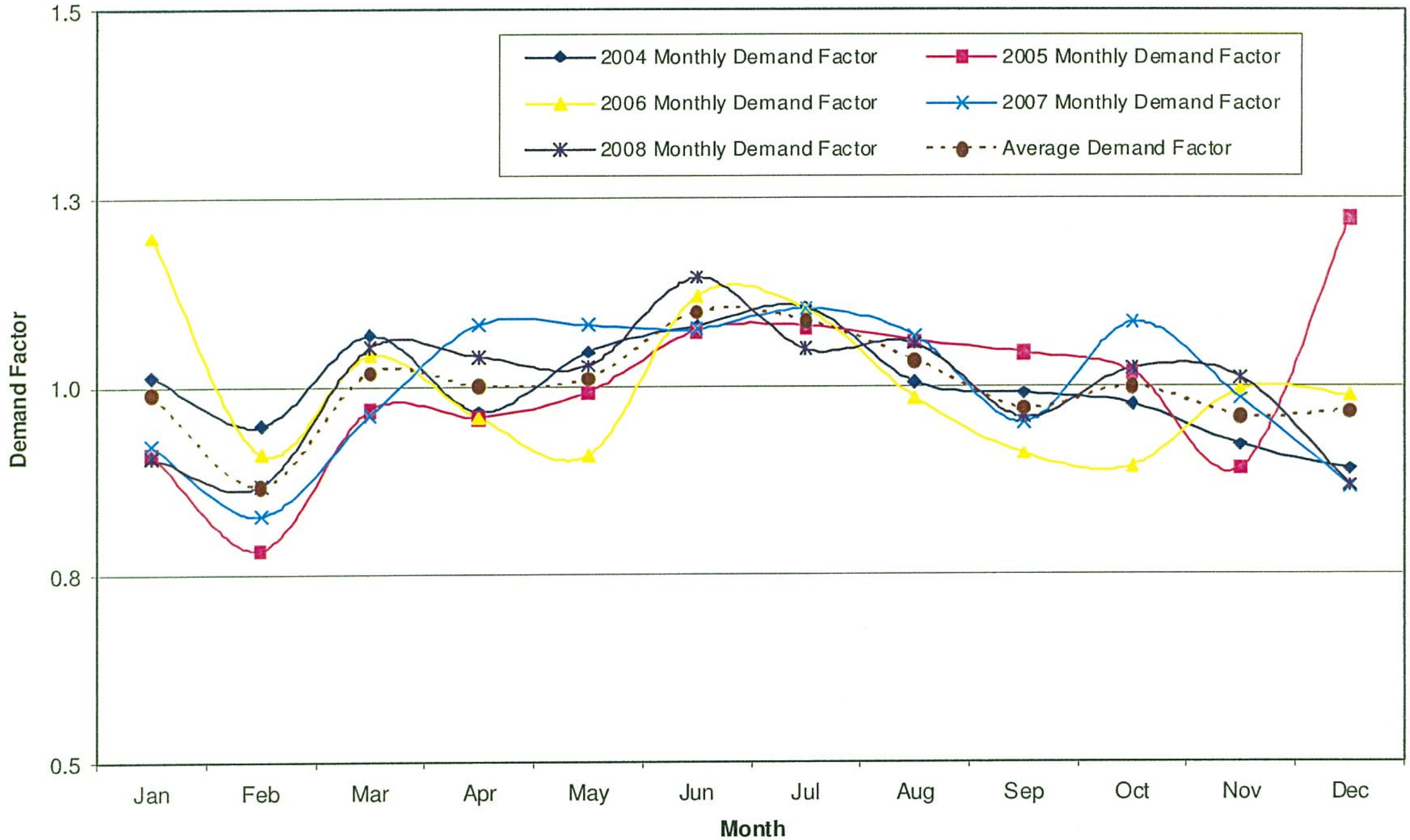
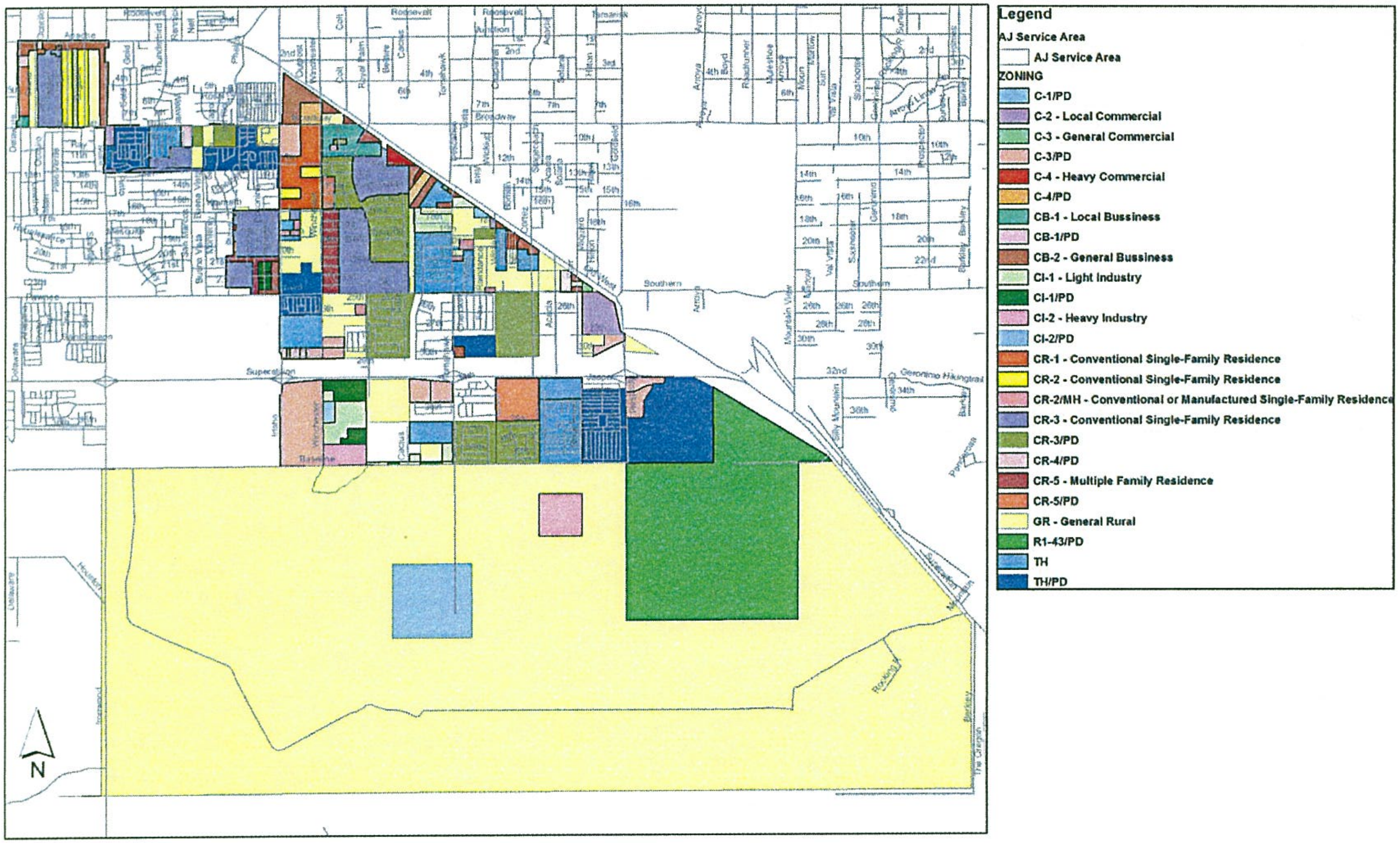


Figure 3.3: AJWC Monthly Water Production for 2004 Through 2009


1.5
1.3
1.0
0.8
0.5
Demand Factor
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
2004 Monthly Demand Factor
2005 Monthly Demand Factor
2006 Monthly Demand Factor
2007 Monthly Demand Factor
2008 Monthly Demand Factor
Average Demand Factor


Legend
AJ Service Area
AJ Service Area
ZONING
C-1/PD
C-2 - Local Commercial
C-3 - General Commercial
C-3/PD
C-4 - Heavy Commercial
C-4/PD
CB-1 - Local Bussiness
CB-1/PD
CB-2 - General Bussiness
CI-1 - Light Industry
CI-1/PD
CI-2 - Heavy Industry
CI-2/PD
CR-1 - Conventional Single-Family Residence
CR-2 - Conventional Single-Family Residence
CR-2/MH - Conventional or Manufactured Single-Family Residence
CR-3 - Conventional Single-Family Residence
CR-3/PD
CR-4/PD
CR-5 - Multiple Family Residence
CR-5/PD
GR - General Rural
R1-43/PD
TH
TH/PD
N

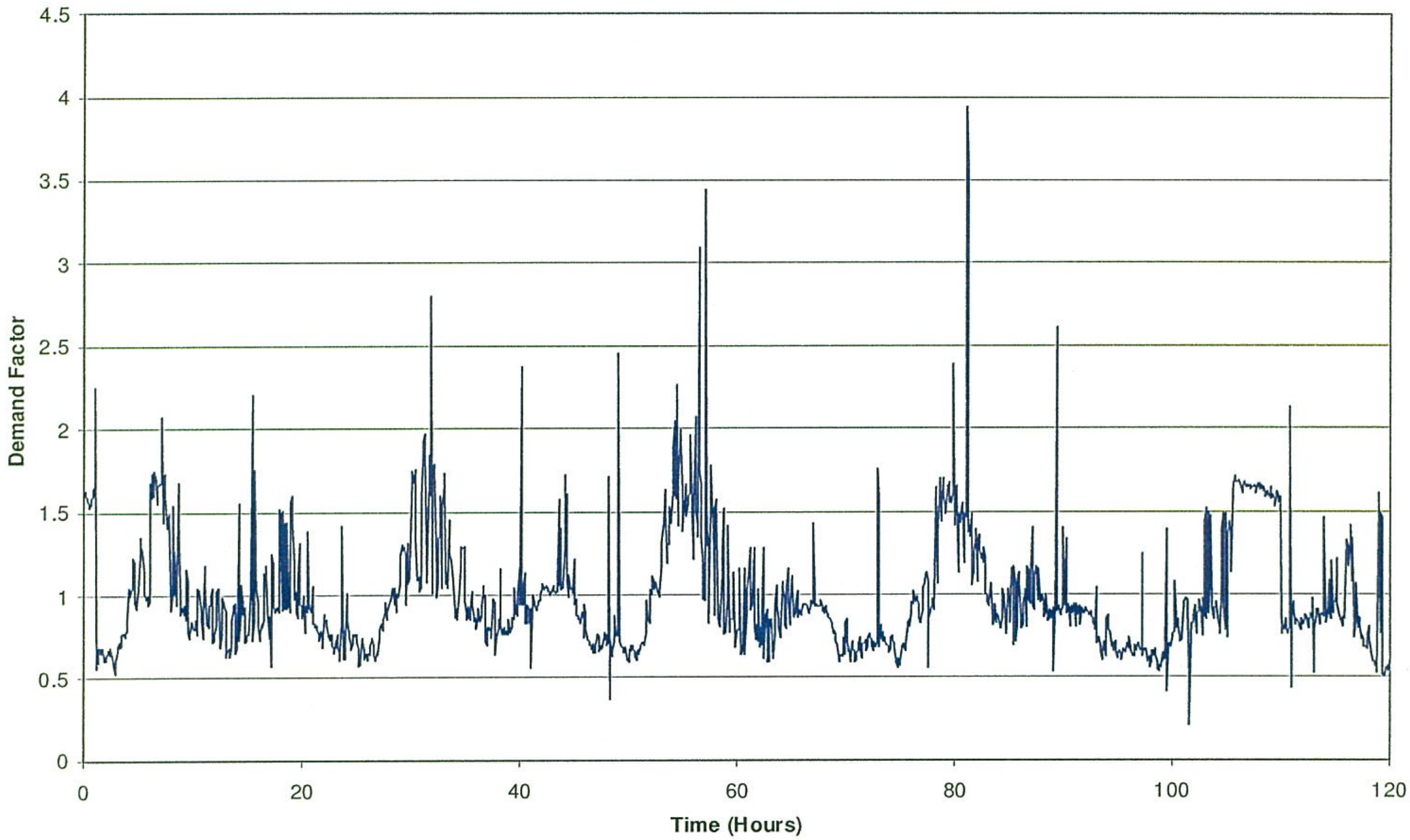


Figure 3.6: Demand Pattern Curve

3.5 DEMAND TRENDING

3.5.1 AJWC Service Area

Future average day water demands were forecast to build-out starting with 2009 as the base year. Historical average day water consumption based on available actual records from 2003 through 2009 were plotted to evaluate recent growth rates. Previous projections from the 2001 Water Master Plan (ARCADIS, 2001) and the General Plan were also plotted (average day demands). These were compared to a "best-fit" extrapolation of the historical data, and to generic growth rates of 0.5%, 4.0% and 5.0%. A future demand scenario was developed based on observed growth patterns in similar communities, on best professional judgement and discussions with AJWC. Figure 3.7 summarizes predicted growth rates in average day water demands from several sources and methods: (1) Projections from the 2001 Master Plan, (2) Projections from the Apache Junction General Plan, and (3) An extrapolation of historical data dating back to 2004. Superimposed on this figure are generic 0.5%, 4.0%, 4.5% and 5.0% growth curves.

Given the recent economic downturn since 2007, predictions that seemed reasonable a few years ago are no longer realistic. The 2001 Master Plan forecast is no longer valid. The projections from the General Plan, shadowing a 5% rate of growth, are considered too aggressive given recent trends. The "best fit" extrapolation of the available historic data approximate the 0.5% growth rate, which for planning purposes, is probably appropriate for current economic conditions.

The projections were based on the continuation of current growth at 0.5% until the end of 2012, followed by a consistent 2.5% growth until build-out. This value is consistent with other similar communities in the Phoenix area. Available data from the City of Litchfield Park, a similarly sized community located a similar distance from the Phoenix city center, was analyzed as the basis for this future growth rate. Between 2000 and 2008, Litchfield Park's population grew 34.5% (US Census Bureau). Allowing for relatively accelerated growth (rate of 5%) between 2004 and 2007, Litchfield Park averages a 2.5% annual growth rate during a period of economically sustainable growth (i.e., neither boom nor recessed) between 2000 and 2004. By comparison, the Ahwatukee Foothills community in Phoenix showed a 3.0% average annual growth rate between 2000 and 2007 (OnBoard LLC, 2007).

Figure 3.8 illustrates the predicted growth in maximum monthly average day demands for the existing community. At the projected growth rates of 0.5% per year until 2012 and 2.5% thereafter, build-out is expected to occur in 2056. Figure 3.9 shows these projections for the existing community for maximum monthly average daily, the maximum day and the peak hour (on maximum day) demands.

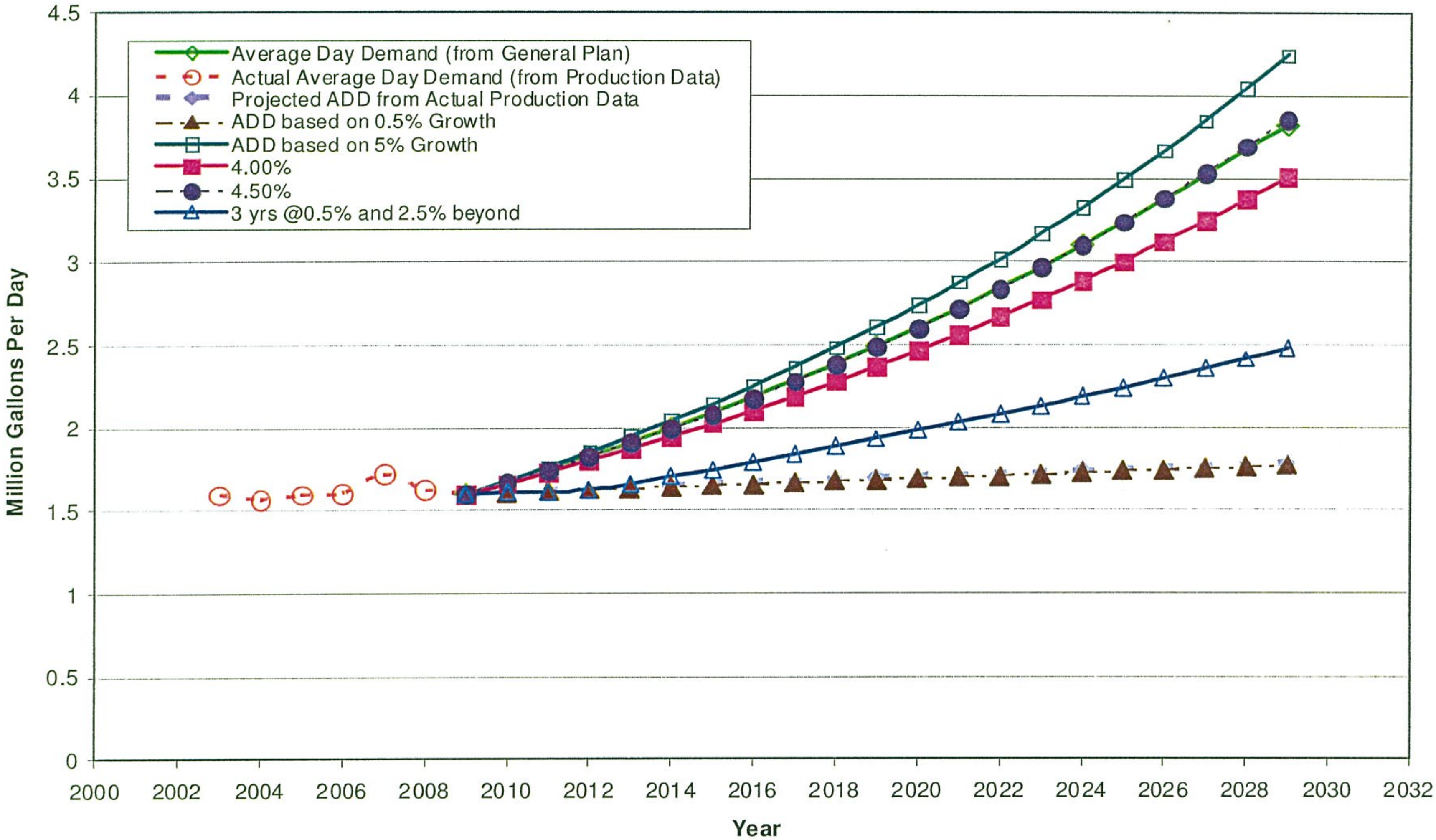


Figure 3.7: Projected Growth Rates in Average Day Water Demands

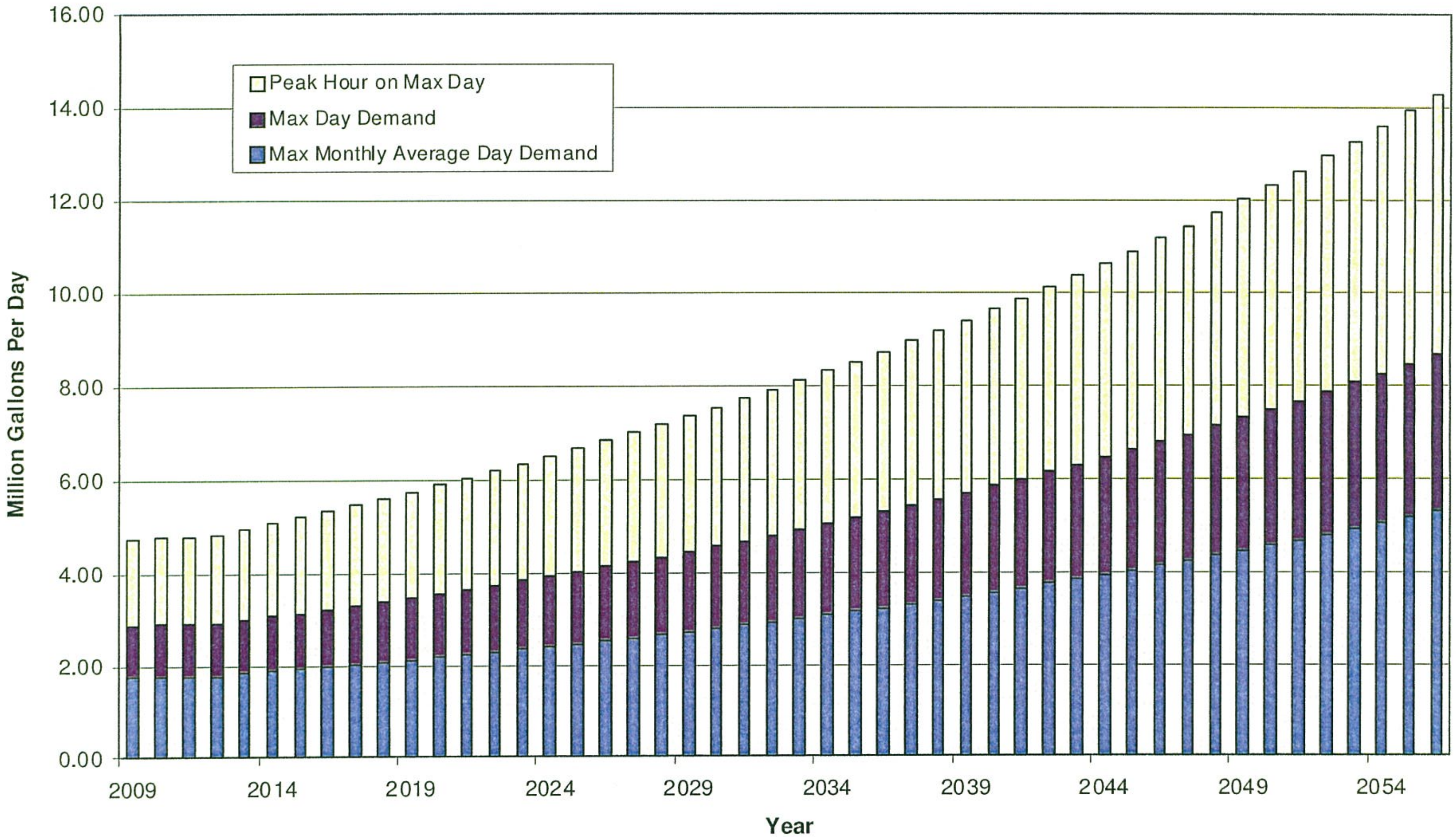


Figure 3.9: AJWC Existing Developed Community Predicted Maximum Monthly Average Day, Maximum Day and Peak Hour Demands

Final Report
Apache Junction Water Company

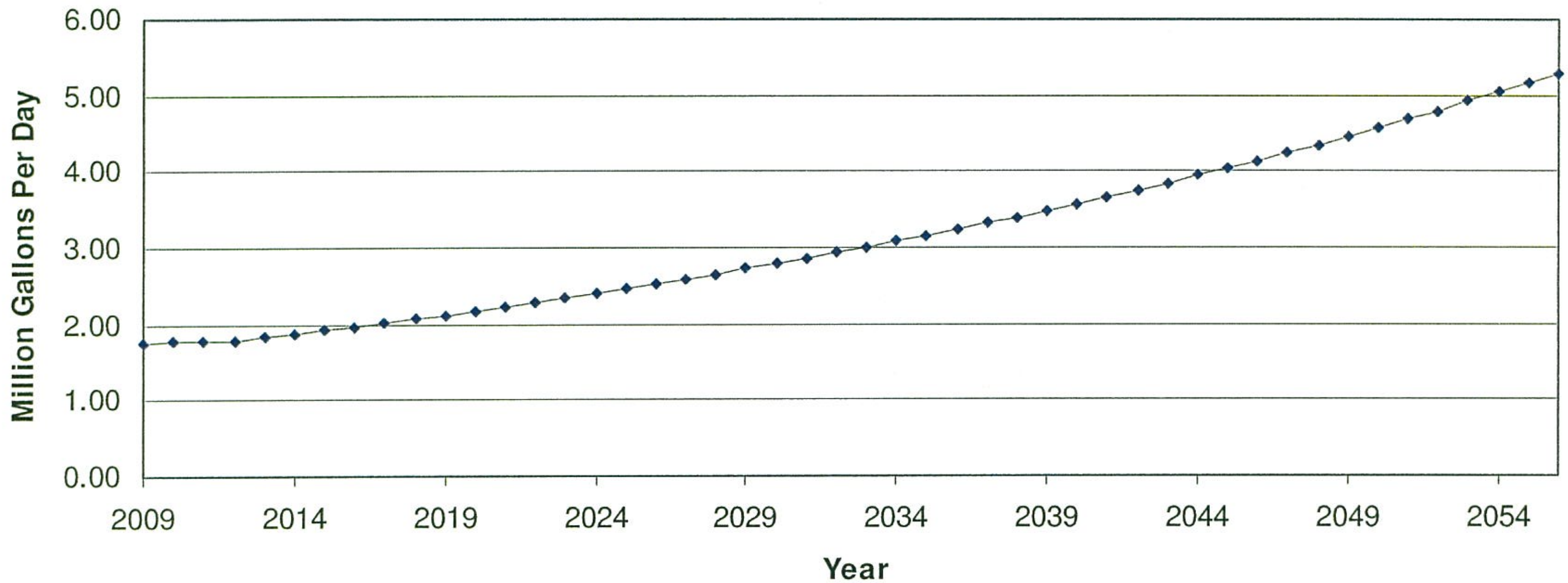


Figure 3.8: Projected Growth in Maximum Monthly Average Day Demands for Existing Community

3.5.2 Portalis Master Planned Community

Portalis is a Master Planned Community. Its growth rate is usually different and faster from the general growth rate of the rest of the City because of financial implications of slower growth rates. Similar sized utilities, such as the City of Litchfield Park, showed a growth rate that was similar to the growth rate proposed in this study. There is no impact of the growth rate on the current CIP or future system upgrades. However, the growth rate will define the water use/recharge and CAP credit balance.

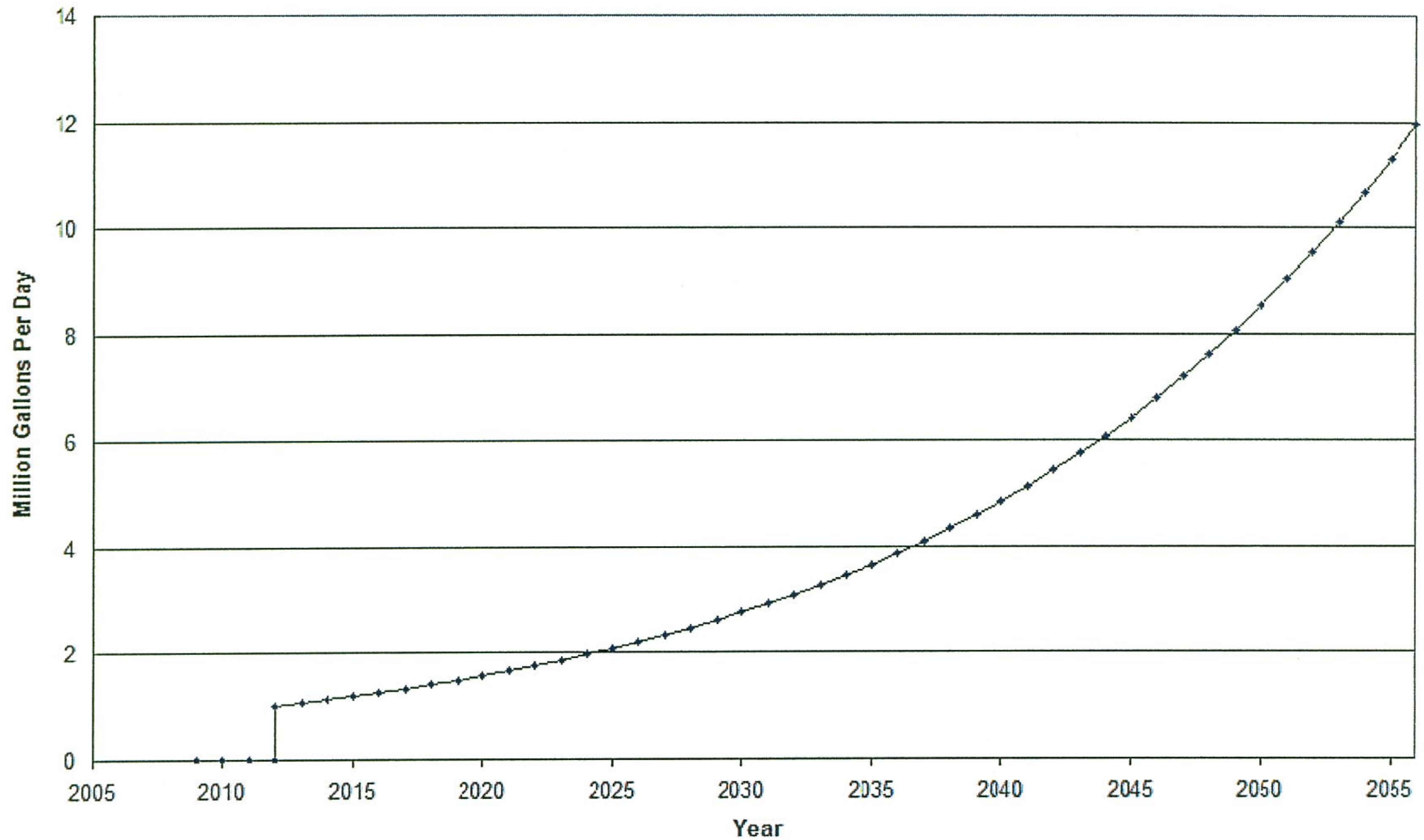
The Portalis development is expected to grow at 5.8% per year. This rate of growth is based on observed growth of the community of Anthem, Arizona, a similar master planned community to Portalis. Available data indicates the community grew 67% between 2000 and 2007 (OnBoard LLC, 2007). Assuming an annual 10% growth spurt during boom years (2005 to 2007), a growth rate of 5.8% per year was back calculated for the more sustainable period of 2000 to 2004.

Figure 3.10 illustrates the predicted growth in maximum monthly average day demands for the Portalis development. In order to meet the expected maximum monthly average day demand in 2012, a 1.0 MGD reliable capacity is required. This capacity expectation is based on the observed growth rate and needs of Anthem, Arizona, a similar development to the Portalis community.

At the projected growth rate of 5.8% per year, build-out is expected to occur in 2056. The build-out capacity required at build-out will be 12.81 MGD (maximum month average day demand).

3.5.3 Storage/Production Capacities

Figure 3.9 illustrates the future requirements in terms of water use demands on the established community system. There are several ways to provide the required volumes. Maximum monthly average day demands could be provided by production capacity, and maximum day and/or peak hour demands could be provided by storage capacity. Any combination between these two extremes are possible. For example, it may be feasible to provide enough production capacity to meet the maximum day scenario. The various alternatives are addressed in Section 5.



AJWC
Apache Junction Water Company

Figure 3.10: Projected Growth in Maximum Monthly Average Day Demands for Portalis

Final Report
Apache Junction Water Company

NCS
Narasimhan Consulting Services, Inc.

SECTION 4
WATER RESOURCES

4.1 RESOURCES OVERVIEW

AJWC's current water resources include groundwater supply using three production wells, and surface water supply using their Central Arizona Project (CAP) allotment. The options for future groundwater sources include developing new wells for the established AJWC service area and new well development for the Portalis community. Wastewater recharge credits are purchased and accumulated in a recharge credit bank, which can be applied to future overdrafts of groundwater. Surface water resource options include usage through the Arizona Water Company or City of Mesa interconnections, or recharge of CAP water. The portion of the annual CAP allotment not used for potable supply is available for recharge and recharge credit. For drinking water treatment, AJWC can chose to take delivery of CAP water treated by the City of Mesa through an existing agreement, or alternatively build its own treatment plant in the future. AJWC desires to balance the various sources to obtain a sustainable, economically feasible arrangement through a blend of groundwater wells, surface water treatment and wastewater recharge.

4.2 CONJUNCTIVE USE PROGRAM

The optimal blend of groundwater and surface water resources is one which is cost-effective and considers the balance between utilizing groundwater resources without depleting the reserve of recharge credits. In the long run, the desired goal is an 80% surface water, 20% groundwater split. In working toward that goal, the feasibility of implementing either a 50% surface water, 50% groundwater blend or a 75% surface water, 25% groundwater split are considered here.

4.2.1 Effluent Recharge, Recovery and Reserve Criteria

Currently, 80% of effluent is recharged and 20% is used in landscaping. No potable water is used for turf irrigation or landscaping. AJWC currently has 30,000 acre-feet (ac-ft) in recharge credits, and is currently buying 1,200 ac-ft/yr.

4.2.2 CAP Recharge

All current wells in the AJWC system are classified as recovery wells (using recharge credits).

4.2.3 Water Use Balance

A conceptual water resource balance is shown in Figure 4.1. AJWC customer demand is met with supply from groundwater pumping and surface water from AJWC's CAP allotment. A portion (25%) of this demand goes to consumptive use, such as garden watering, and the remainder (75%) is treated at the Superstition Mountains Communities Facilities District No. 1 wastewater treatment plant (WWTP). About 20% of the WWTP effluent is used for irrigation, and 80% is recharged and is accumulated in credits in a groundwater recharge bank. These credits are available as a groundwater resource which can be pumped to supply AJWC customer demand.

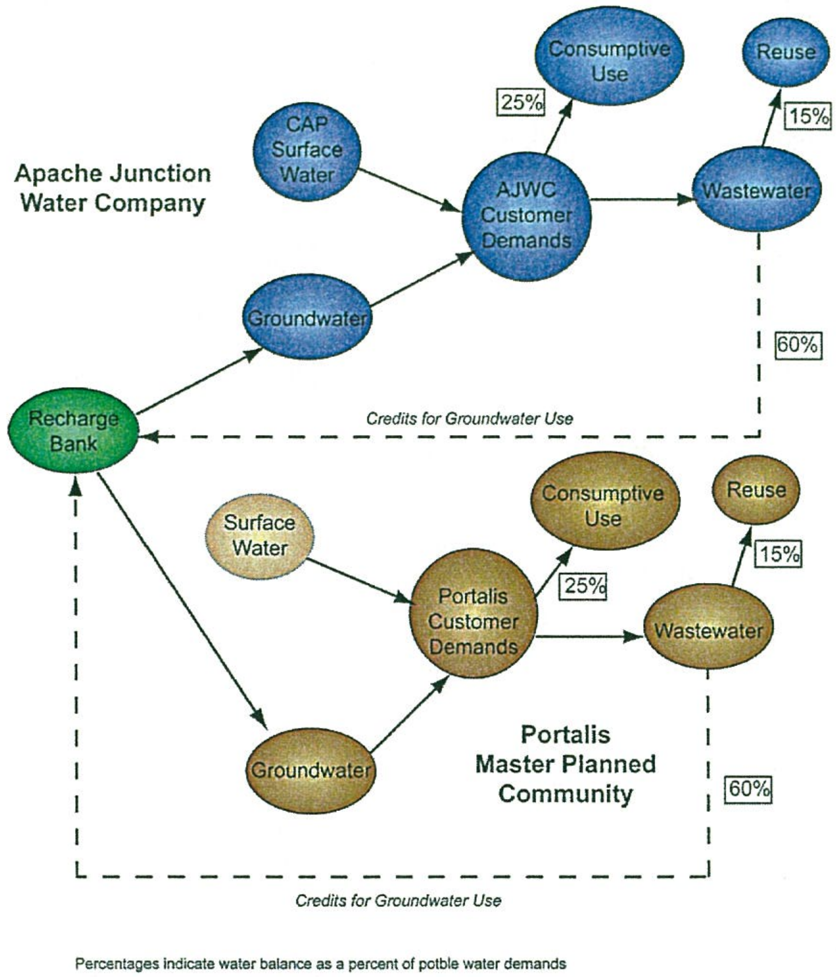


Figure 4.1: AJWC's Water Resource Balance Diagram

For Portalis, customer demand will be supplied through surface water and groundwater. It is assumed that similar to AJWC, about 25% of the demand will be consumptive use, and that 75% will be treated at the WWTP. About 20% of the effluent will be reused as irrigation, and 80% will be recharged into the groundwater recharge bank.

4.3 GROUNDWATER RESOURCES

4.3.1 Operational Constraints

Primary operational concerns with groundwater resources are the capacity of installed wells and water quality. It is assumed, based on historical experience, that future wells within the AJWC service area will be limited to a 600 gpm pumping capacity. Water quality may require treatment or blending for arsenic and/or possibly nitrate contamination.

4.3.2 Drought Susceptibility

Groundwater resources are not subject to peaking limits, seasonal dry-ups and drought, notwithstanding capacity limitations. Given that Arizona is a junior rights holder with respect to Colorado River resources (and CAP water rights), a reliable groundwater source is critical in securing future water reserves. A healthy reserve of groundwater credits is desired when drought conditions threaten surface water sources, therefore, it is important to maintain this reserve. Banked groundwater credits should be maintained at a minimum of 10,000 ac-ft (3,260 MG).

The target of maintaining 10,000 ac-ft of banked recharge credits in the long term provides AJWC with sufficient capacity to meet the average day demand at build-out for five years using only groundwater sources, provided wastewater is recharged continuously for aquifer sustainability.

In order for the Portalis system to meet the same reserve capacity criteria (i.e., meet the average day demand at build-out for five years using only groundwater sources), long term banked recharge credits need to be maintained at 24,000 ac-ft. Thus, in the long term, a total of 34,000 ac-ft would be needed to protect both communities from a 5-year extreme drought condition.

4.4 SURFACE WATER RESOURCES

4.4.1 Central Arizona Project

The AJWC has a CAP allocation of 2,919 ac-ft/yr (2.61 MGD). AJWC receives recharge credit for a portion of this surface water allocation not used and recharged.

AJWC has been accumulating credits since 1997, and, as of 2009, has accumulated 30,000 ac-ft 9775.54 ~~(9.78 MG)~~. This balance of storage credits can be applied to future overdraft of groundwater use, if needed, to meet future demands as expansion occurs.

AJWC also has an agreement with the City of Mesa, to receive treated CAP water through an interconnection to the Mesa water system. This agreement, signed March 17, 2006, stipulates that the City of Mesa will provide treatment and delivery of AJWC's CAP allotment (2,919 Ac-ft/yr) at an in initial cost of $254.56/MG used, plus a capacity charge of $9,380.00 per month based on a usage of 0.6 MGD. These charges are adjusted based on actual usage. The $256.56/MG cost is adjusted annually on the effective date based on the *Consumer Price Index - All Urban Consumers* (CPI), as published by the US Bureau of Labor Statistics, from the same month of the previous year, using the month preceding the effective date. The capacity charge is adjusted annually based on actual usage. Based on actual usage and billings, the unit cost of water to AJWC under this agreement is $1.00 per 1,000 gallons. For planning purposes, this cost is assumed to increase by 10% for future unknowns, contingencies and changes in the agreement. Also, in future years, a 2% per year increase was considered for the CPI.

Build out average day demand for AJWC is 4.8 MGD, while that of Portalis is 10.9 MGD. The total demands imposed by both developments together is approximately 15.7 MGD. From the historical records, it is observed that the total recharge to demand ratio is approximately 0.6. This means that approximately 60% of 15.7 MGD of consumed water would be recharged leaving about 15% water for reuse purposes (while 25% is consumptive use). Therefore, to maintain a usage rate that does not either build up a bank or draw a bank down, groundwater can only be used as much as it can be recharged. The total groundwater use would be approximately 9.4 MGD. Approximately 6.3 MGD of surface water would be required for build-out. This corresponds to CAP credits of 7,033 ac-ft/yr. AJWC has a CAP allotment of 2,919 ac-ft/yr. An additional 4,114 ac-ft/yr would be required in the long term under this sustainable scenario.

4.5 INTERCONNECTIONS

AJWC has emergency interconnections with the City of Mesa and with the Arizona Water Company (AWC). It is AJWC's intent to use the City of Mesa as the primary interconnect source and retain AWC as an emergency backup source.

4.6 NON-REVENUE WATER

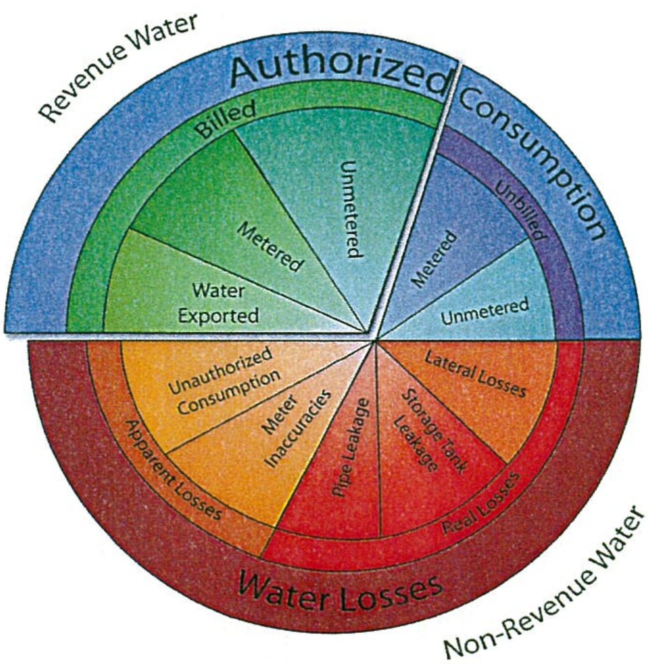


Figure 4.2: Revenue Water vs. Non-Revenue Water

Potential revenue recovery is attainable through management of AWJC's system unaccounted water losses. Non-revenue water can be composed of unbilled authorized consumption, such as internal use, but also from unauthorized consumption (theft), customer meter inaccuracies, leakage from transmission and distribution mains, storage tank overflows, and leakage from service connections (Figure 4-2).

It is recommended that AWJC conduct a detailed non-revenue study to determine what mitigative mechanisms are possible and the feasibility of recovering lost revenue.

4.7 WATER SUPPLY OPTIONS

AJWC currently has 30,000 acre-feet (ac-ft) in accumulated recharge credits, and is purchasing wastewater recharge credits at a rate of 1,200 ac-ft/yr. In addition, AJWC has a CAP allocation of 2,919 ac-ft/yr, and can receive recharge credit for the potion of this surface water allocation not used and recharged. This balance of storage credits can be applied to future overdrafts of groundwater use, if needed, to meet future demands as expansion occurs.

The AJWC service area can be supplied by one of the options below:

1. **Continue using groundwater (similar to the existing strategy):**
This is not a recommended option because it may become expensive to sustain the assured water supply designation. Additionally, it may deplete groundwater sources and could hurt the capacity of the utility to supply water in the event of a drought.

2. **Utilize surface water from interconnections (primarily the 16-inch interconnect from Mesa):**
The current goal of the utility is to reach 80% supply of the existing demands using surface water from the City of Mesa. The interconnect is on Baseline and Signal Butte Rd. There is a 16-inch line available that supplies both Storage Tank #1 and #2. This 16-inch line can supply up to approximately 5 MGD without much headloss. The infrastructure is already built for this option. There is an Arizona Water Interconnect that can supply 250 gpm of flow to AJWC as well. However, it is AJWC's preference to keep this as an emergency interconnect only. Therefore, this connection was not used in any comparisons in this Master Plan.

3. **Construct an AJWC owned Water Treatment Plant:**
Under this option, AJWC will develop a new water treatment plant (WTP) with a capacity to supply 80% of demands for a maximum month average day condition. The peak month variations would be handled using the water from the City of Mesa interconnect. This would allow developing a utility-owned WTP without excessive costs. A cost benefit analysis and recharge credit analysis were performed to determine the most cost-effective and value-added strategy for AJWC customers. Section 4.8 compares several options and their impacts on recharge credits available to AJWC. Section 4.9 considers water supply cost comparisons for Options #2 and #3 presented below.

4. **Share plant capacity at the City of Mesa Water Treatment Plant:**
If the total present worth cost of this option is significantly lower than Option #2 or #3, then this could be a viable alternative. Through this option, AJWC will own production capacity at the new City of Mesa WTP. A separate study should be conducted to address viability of this option.

4.8 WATER SUPPLY - RECHARGE CREDIT COMPARISON

Three scenarios were considered for analyzing the status of the recharge credit bank:

(1) Baseline surface water usage (1.0 MGD consistent with the current baseline condition water use strategy)
(2) Meeting 75% of demand with surface water, and 25% of demand with groundwater
(3) Meeting 50% of demand with surface water, and 50% of demand with groundwater

Scenario 1 is illustrated in Figure 4.3. At the predicted rate of future demand, current source water usage, and current rate of recharge credit accumulation, the bank of recharge credit will be exhausted by 2045.

Scenario 2 is illustrated in Figure 4.4. Increasing the portion of future demand served by 75% surface water, and 25% groundwater will enable recharge credits to increase and stabilize over the planning period to build-out. This scenario, as in Scenario 1, assumes that the current rate of credit accumulation, without excess CAP credit purchase, is maintained.

Scenario 3 is illustrated in Figure 4.5. Increasing the portions of future demand to be supplied equally by surface and groundwater provides a balance in resources and maintains a desired target of long-term reserve capacity (10,000 ac-ft) until build-out.

Assuming an 80% and 20% surface water to groundwater ratio for the AJWC service area and a total of 6.3 MGD surface water treatment plant requirement, Portalis will require a new treatment plant (or expansion of an AJWC treatment plant) to 3 MGD. Figure 4.6 shows a graph of recharge credit bank accumulation with the conjunctive use strategy including the Portalis master planned community.

4.9 WATER SUPPLY COST OPTIONS

In this section a discussion of the cost comparison of utilizing surface water from the interconnect versus developing AJWC's own WTP is presented. Section 4.9.1 describes utilizing the City of Mesa interconnect, while Section 4.9.2 describes developing an AJWC WTP.

4.9.1 Treatment by City of Mesa, Wholesale to AJWC

As detailed in Section 4.4.1, AJWC has an agreement with the City of Mesa to receive treated CAP water through the interconnection to the Mesa water system. Based on actual usage and billings, the unit cost of water to AJWC under this agreement is $1.00 per 1,000 gallons. This cost was increased by 10% for future unknowns, contingencies and changes in the agreement. Also, in future years, a 2% per year increase was considered for the CPI.

4.9.1.1 1.0 MGD Surface Water Usage with Mesa Interconnect

- Annualized 20-year costs, including groundwater costs: $449,000
- Present value (20 years, 6%), including groundwater costs: $5,158,000

This option assumes continued annual purchase of wastewater recharge credits (1,200 ac-ft per year) for sustainability and that the annual CAP allotment is purchased only equal to the need for surface water until the recharge credit bank of 30,000 acre-ft is reduced to 10,000 acre-ft (Year 2040). After 2040, additional CAP credits would be purchased to replenish the groundwater supply to maintain a 10,000 acre-ft bank.

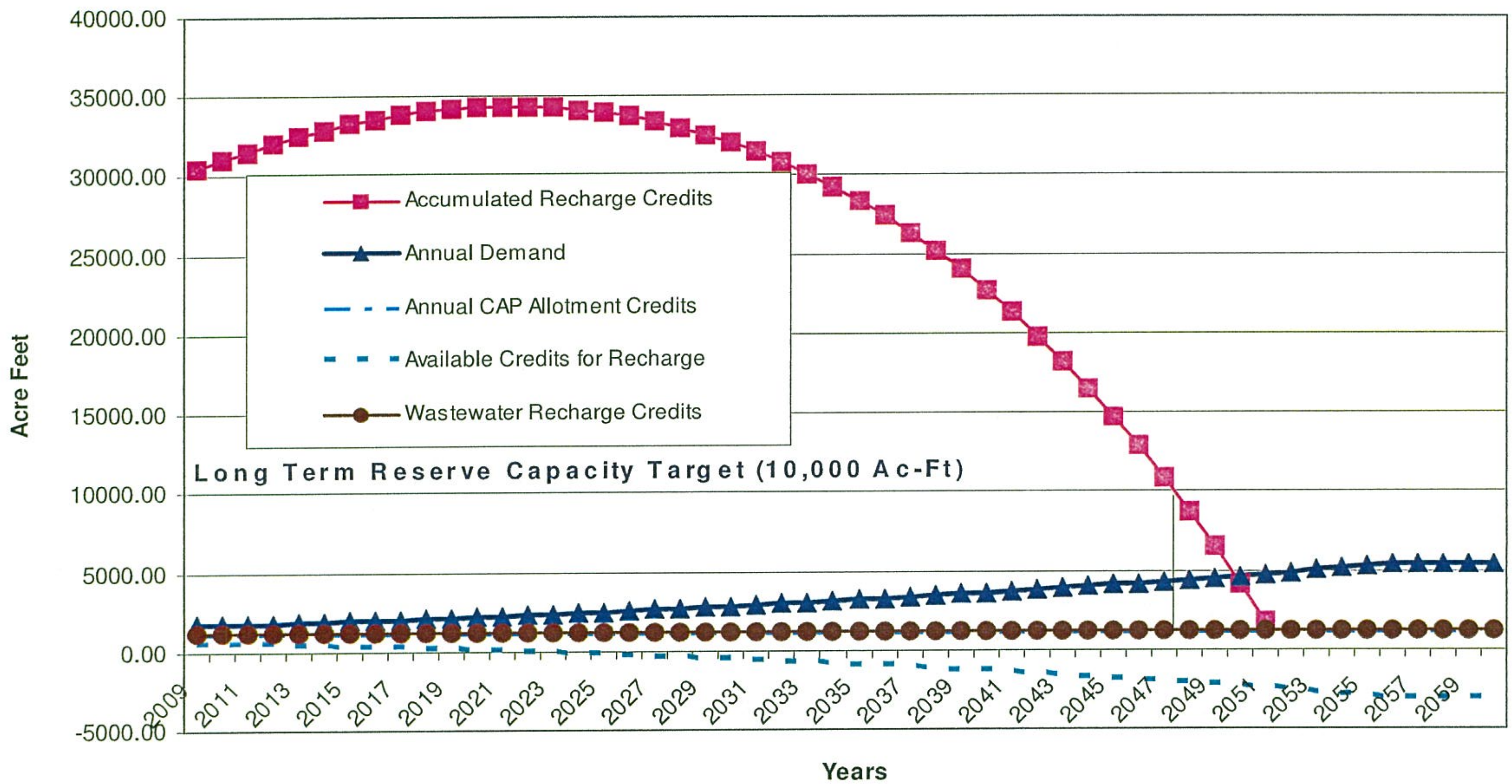


Figure 4.3: Scenario 1 - Current Condition - 1.0 MGD Surface Water Use

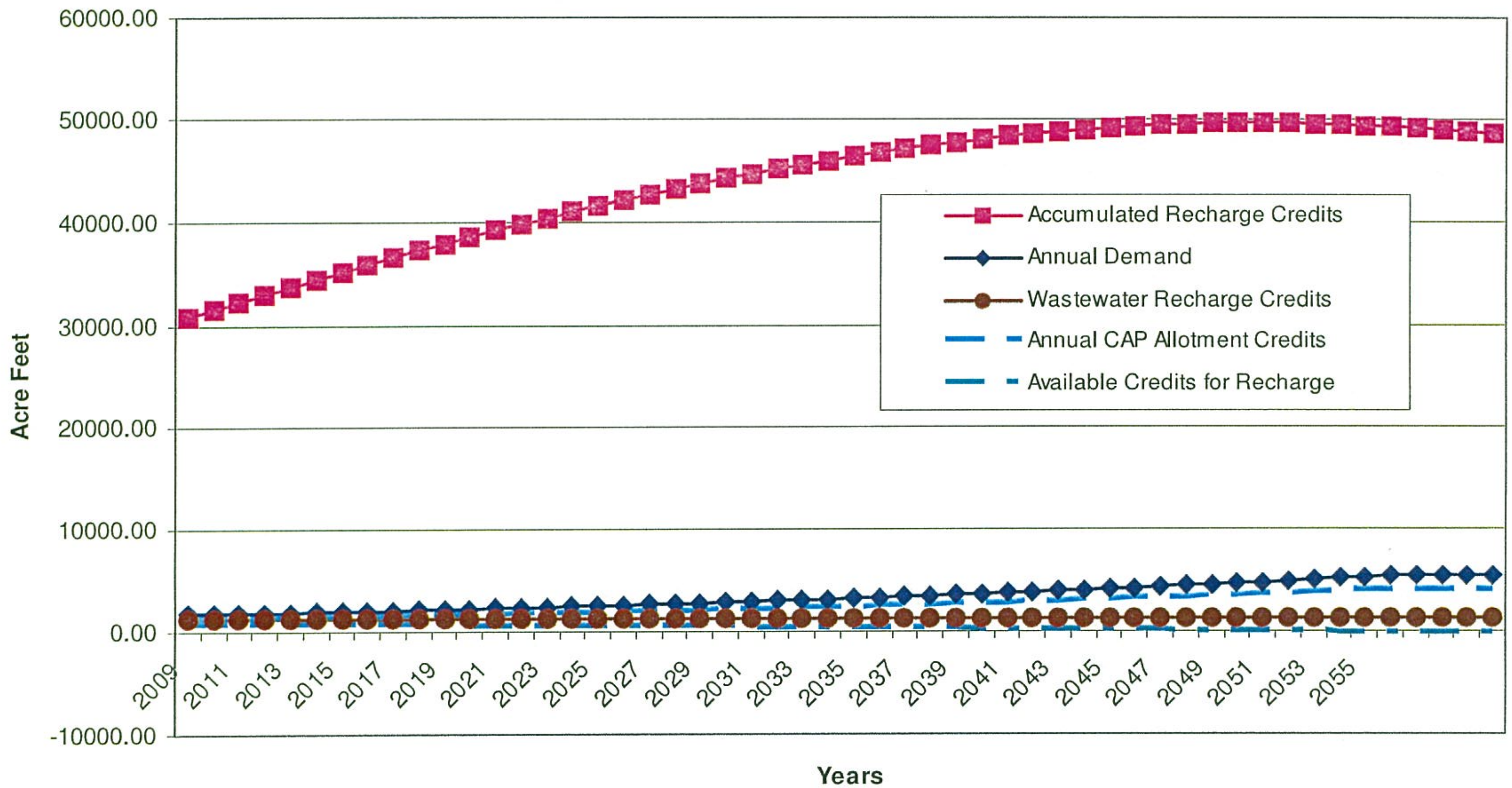
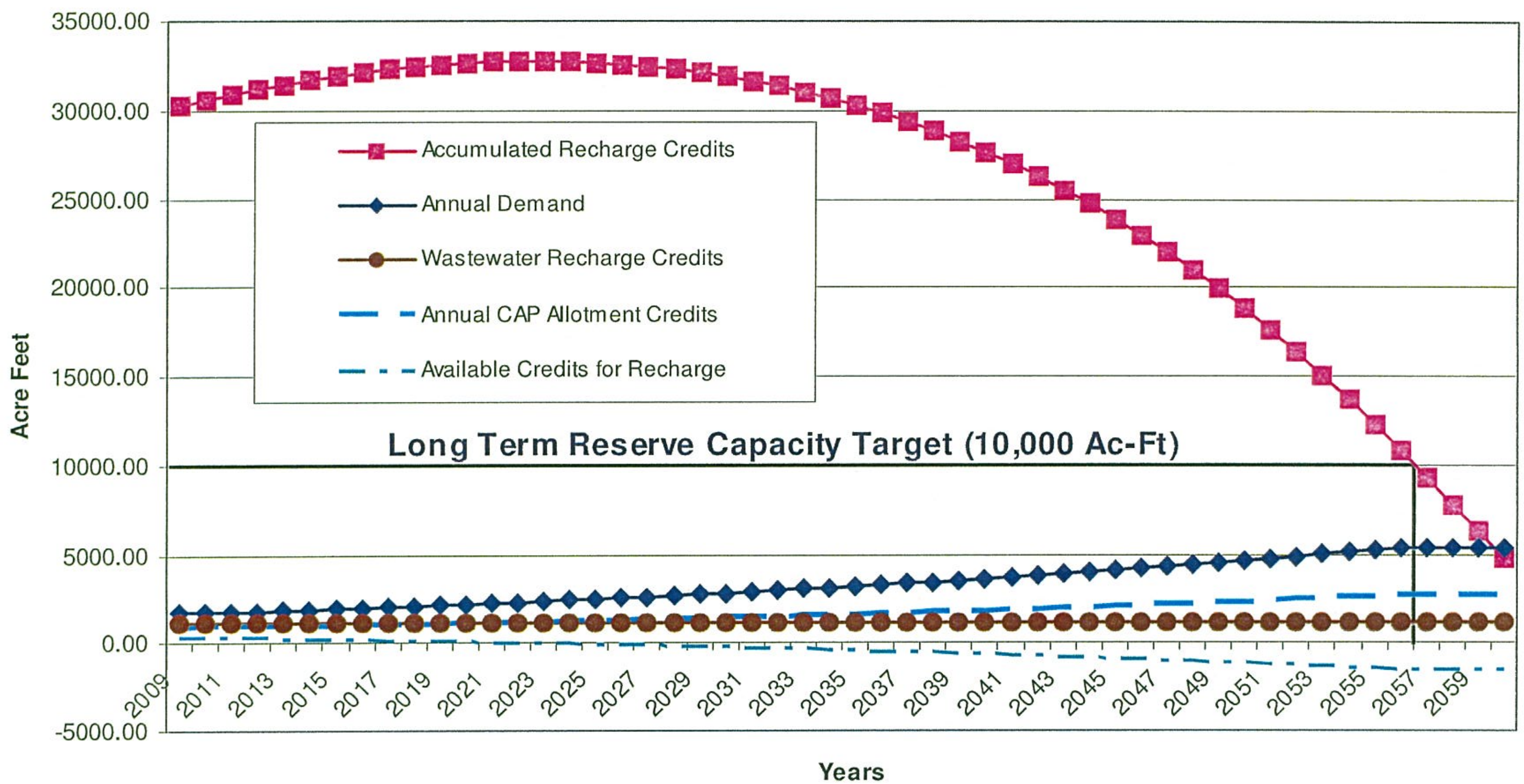


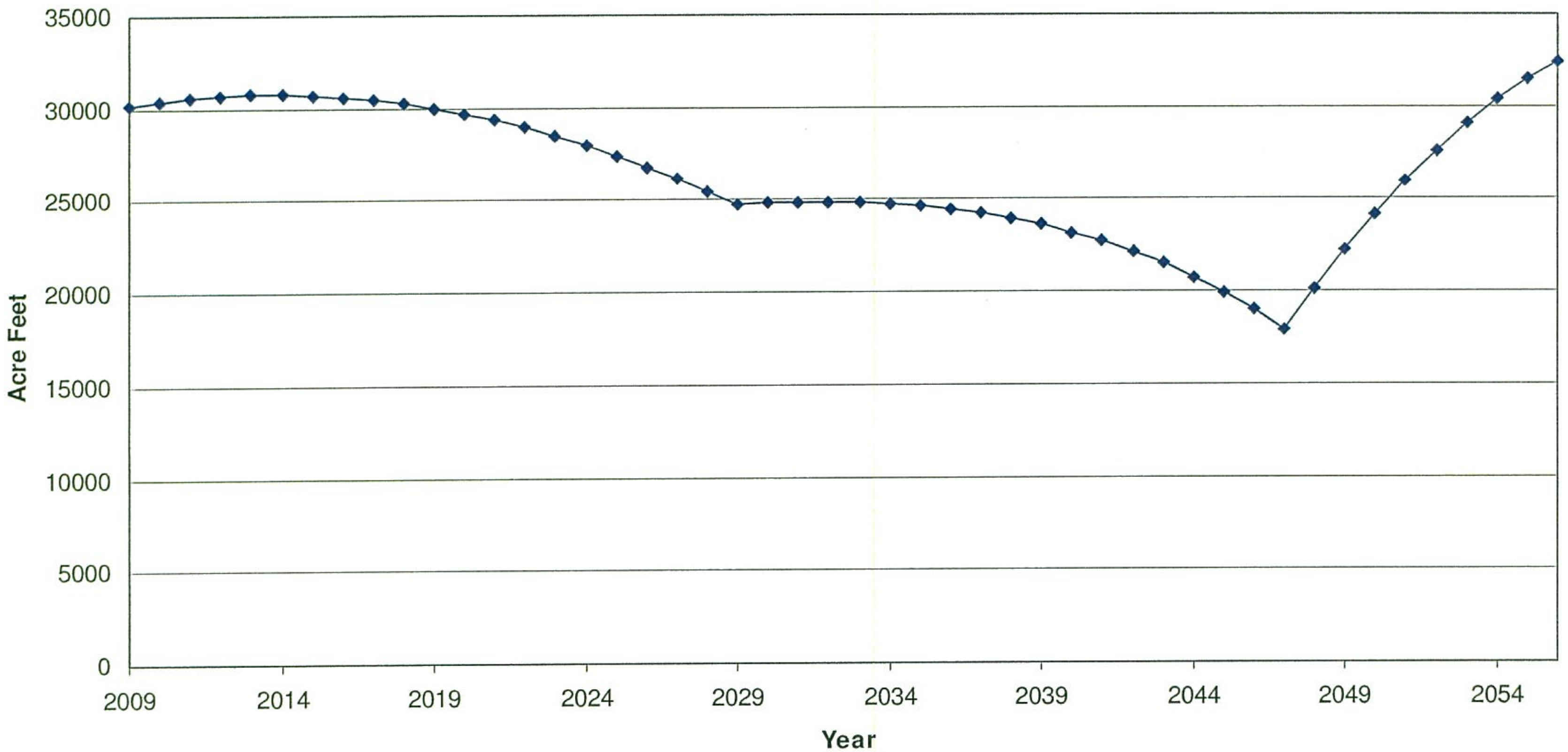
Figure 4.4: Scenario 2 - 75% Surface Water and 25% Groundwater



AJWC
Apache Junction Water Company

Figure 4.5: Scenario 3 - 50% Surface Water and 50% Groundwater

NCS
Narasimhan Consulting Services, Inc.


35000
30000
25000
20000
15000
10000
5000
0
Acre Feet
2009
2014
2019
2024
2029
2034
2039
2044
2049
2054
Year

4.9.1.2 75% Surface Water with Mesa Interconnect, 25% Groundwater

- Annualized 20-year costs, including groundwater costs: $654,000
- Present value (20 years, 6%), including groundwater costs: $7,496,000

This option assumes continued annual purchase of wastewater recharge credits (1,200 ac-ft per year) for sustainability and that the annual CAP allotment is purchased only equal to the need for surface water.

4.9.1.3 50% Surface Water with Mesa Interconnect , 50% Groundwater

- Annualized 20-year costs, including groundwater costs: $495,000
- Present value (20 years, 6%), including groundwater costs: $5,674,000

This option assumes continued annual purchase of recharge credits (1,200 ac-ft per year) for sustainability. Also, the CAP allotment is purchased only equal to the need for surface water until the recharge credit bank of 30,000 acre-ft is reduced to 10,000 acre-ft (Year 2057). After 2064, additional CAP credits would be purchased to replenish the groundwater supply to maintain a 10,000 acre-ft bank.

4.9.2 Separate AJWC Water Treatment Plant

Under this scenario, a new surface WTP would be constructed for AJWC to take delivery of the CAP water. The size of the WTP would vary based on the three water resource options discussed above. The treatment processes included in the plant would be lined raw water storage, chlorine dioxide pre-oxidation, package water treatment system (Trident or similar) using coagulation, high rate clarification and dual media filtration, and chlorine for secondary disinfection. This treatment train was selected based on discussions with the AJWC, ability of the processes to comply with drinking water regulations and cost comparisons from other similar WTP projects for CAP water. The costs of providing a separate WTP for the various water resource options are presented below:

4.9.2.1 1.0-MGD Surface Water with New WTP

- 1.0-MGD Treatment Plant Capital Costs: $2,243,000
- Annual Operating Cost: $146,000
- Annual Groundwater O&M Cost: $83,400
- Total Present Value (20 yrs, 6%): $4,874,000
- Annualized Cost: $425,000

The capital costs do not include land costs for the new site, but include 15% for engineering and construction management. This option assumes continued annual purchase of wastewater recharge credits (1,200 ac-ft per year) for sustainability and that the annual CAP allotment is purchased only equal to the need for surface water until the recharge credit bank of 30,000 acre-ft is reduced to 10,000 acre-ft (Year 2040). After 2040, additional CAP credits would be purchased to replenish the groundwater supply to maintain a 10,000 acre-ft bank.

4.9.2.2 75% Surface Water with New WTP, 25% Groundwater

- Capital Costs for New 1.6-MGD WTP: $3,588,000
- Annual Operating Cost: $233,000
- Annual Groundwater Cost: $43,000
- Present Value (20 yrs, 6%): $6,445,000
- Annualized Cost: $562,000

The capital costs do not include land costs for the new site, but include 15% for engineering and construction management. This option assumes continued annual purchase of wastewater recharge credits (1,200 ac-ft per year) for sustainability.

4.9.2.3 50% Surface Water with New WTP, 50% Groundwater

- 1.1-MGD Surface Water Treatment Plant Capital Costs: $2,377,000
- Annual Operating Cost: $155,000
- Annual Groundwater Cost: $87,000
- Present Value (20 yrs, 6%): $5,145,000
- Annualized Costs: $449,000

The capital costs do not include land costs for the new site, but include 15% for engineering and construction management. This option assumes continued annual purchase of recharge credits (1,200 ac-ft per year) for sustainability. Also, the CAP allotment is purchased only equal to the need for surface water until the recharge credit bank of 30,000 acre-ft is reduced to 10,000 acre-ft (Year 2064). After 2064, additional CAP credits would be purchased to replenish the groundwater supply to maintain a 10,000 acre-ft bank.

4.10 PORTALIS INFRASTRUCTURE CONCEPT

The Portalis master planned community is projected to have demands that are much larger than the build-out demands projected by the existing AJWC service area. For AJWC, it is important to ensure that the demands are sustainable and that the infrastructure is robust. Figure 4.7 shows the location of the AJWC proposed water treatment plant. This location would be within the Portalis service area. There are several ways to supply water to the Portalis community:

1. **Supply using several groundwater wells:**
   This is the proposed option by the developer of the community. However, for this option, AJWC needs to consider recharge issues as identified in Section 4.8. Additionally, in order to minimize cost on operations, it is recommended that several hubs of wells be developed with common treatment facilities. Each facility should be able to pump up to Storage Tank #2. This provides an interoperability and redundancy in the system. Additionally, if Storage Tank #2 cannot provide sufficient pressures under gravity for Portalis then a booster pump station to supply water to Portalis should be provided at Storage Tank #2. This will allow moving water from the AJWC existing service area to the Portalis community.

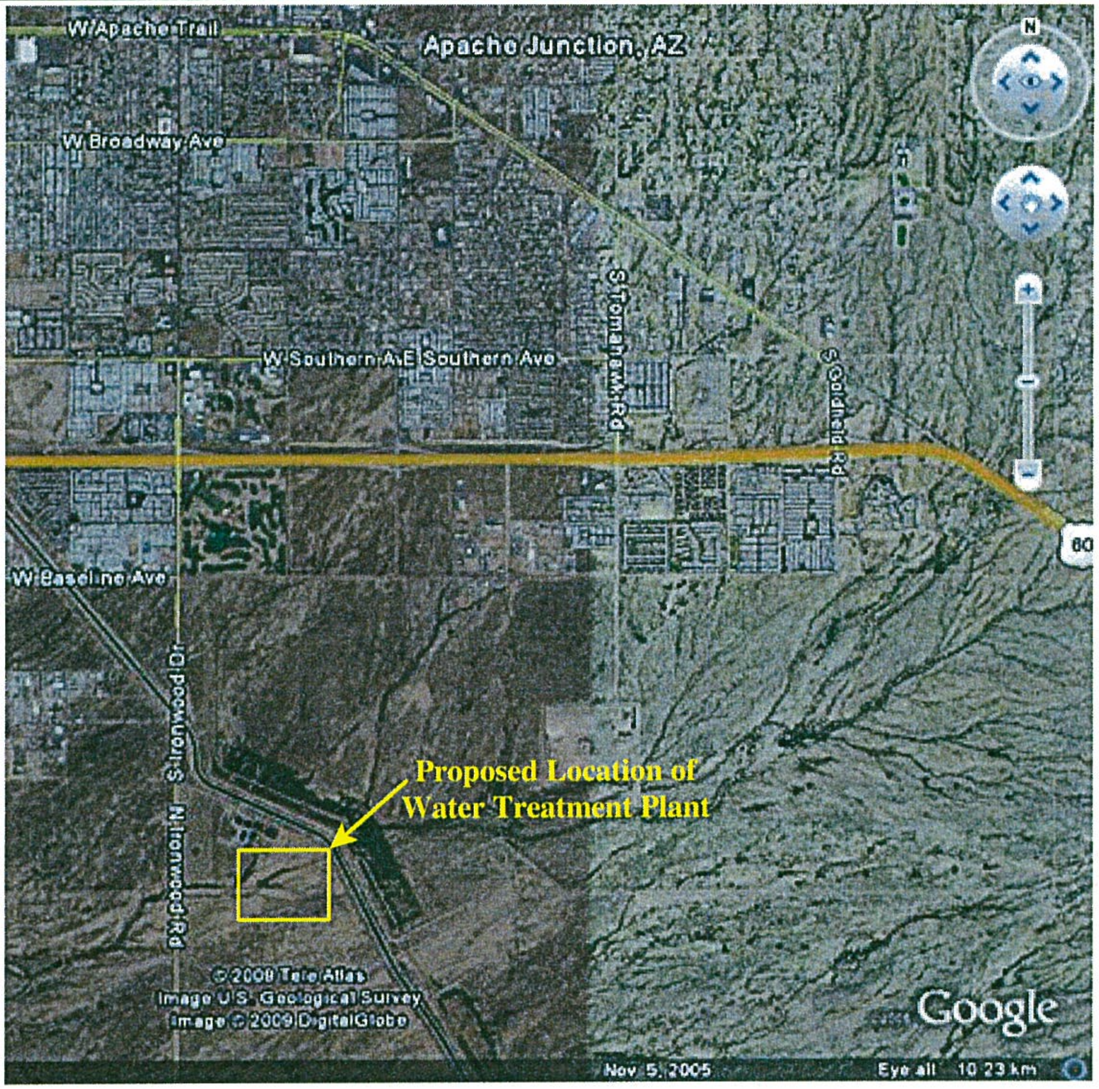


Figure 4.7: Location of Proposed Water Treatment Plant for AJWC

2. **Share the cost of new treatment plant/purchase production capacity:**
In addition to groundwater wells, the Portalis community should provide a new treatment plant with a capacity equal to approximately 3 MGD. It is expected that the new facility will be brought online with intermediate growth expansion on the AJWC treatment plant. There may be a need for more expansion based on the actual growth rate of Portalis. This facility should be able to pump up to Storage Tank #2. This provides an interoperability and redundancy in the system. Additionally, if Storage Tank #2 cannot provide sufficient pressures under gravity for Portalis, then a booster pump station to supply water to Portalis should be provided at Storage Tank #2. This will allow moving water from the AJWC existing service area to the Portalis community.

3. **Construct a new Water Treatment Plant:**
Alternatively, Portalis can provide a new water treatment plant for its service area (up to 3 MGD at build out). This facility should be able to pump up to Storage Tank #2. This provides an interoperability and redundancy in the system. Additionally, if Storage Tank #2 cannot provide sufficient pressures under gravity for Portalis, then a booster pump station to supply water to Portalis should be provided at Storage Tank #2. This will allow moving water from the AJWC existing service area to the Portalis community.

4.11 SUMMARY AND RECOMMENDATIONS

A comparison of the two water delivery methods (separate WTP versus Mesa interconnect) for the three water resource scenarios is presented below:

Scenario 1 - 1 MGD Surface Water Usage With Mesa Interconnect

Separate AJWC Treatment Plant (1.0 MGD): $4,874,000 PW (Annualized Cost $425,000)
Mesa Agreement (1.0 MGD): $5,158,000 PW (Annualized Cost $449,000)

Scenario 2 - 75% Surface Water, 25% Groundwater

Separate AJWC Treatment Plant (1.6 MGD): $6,445,000 (Annualized Cost $562,000)
Mesa Agreement: $7,496,000 (Annualized Cost $654,000)

Scenario 3 - 50% Surface Water, 50% Groundwater

Separate AJWC Treatment Plant (1.1 MGD): $5,145,000 (Annualized Cost $449,000)
Mesa Agreement: $5,674,000 (Annualized Cost $495,000)

Based on the above analysis, it is more cost-effective for AJWC to develop its own surface WTP than to have continued reliance on the Mesa interconnect. Also, based on balancing costs and long term water resource goals, water resource Scenario 3 (50% surface water and 50% groundwater) is recommended for the short term. This will provide a long term sustainable groundwater supply that is available for surface water drought conditions while balancing the overall costs to AJWC. As the WTP is expanded, the AJWC main service area will move towards meeting the 80% surface water, 20% groundwater goal. Further, the cost-effectiveness of providing surface water through a new jointly-owned WTP with the City of Mesa should also be evaluated in a separate study. *

When the Portalis master planned community develops, it should provide a 3 MGD treatment plant to AJWC to maintain the recharge credit bank and sustainable operations.

A detailed 5-year CIP that includes these recommendations is attached as Appendix B to this report.

* MET W/ MARK HOLMES, BRYAN DRAPER FROM C.O.M. TO TALK ABOUT TIMING – MAYBE NO CAP. WTP UNTIL 2020 → AJ. SHOULD BUILD OWN W.T.P.

SECTION 5
WATER PRODUCTION INFRASTRUCTURE

5.1 EXISTING FACILITIES

AJWC operates three wells (Wells 5, 6 and 8) and, as supplemental sources, obtains water from the Arizona Water Company and the City of Mesa via interconnections. Water from these interconnections is blended with groundwater in storage tanks. Wells 5 and 6 have capacities of 600 and 500 gallons per minute (gpm), respectively. Well 8 has a production capacity of approximately 250 gpm. Water from the wells is conveyed to four system storage tanks located at two booster stations, with a combined capacity of 3 million gallons (MG).

The true capacity of the three existing permitted wells is 1.95 MGD. Further, the 16-inch Mesa interconnect has a capacity of 5 MGD. The Arizona Water interconnect has a capacity of around 0.8 MGD though the typical flow rate of 250 gpm. For the established AJWC service area at the projected rate of growth, the true capacity will match the expected maximum monthly average day demand in 2044.

For Portalis, in order to meet initial peak day demands in 2012 (estimated development date), approximately 1.86 MGD in firm capacity will be required.

5.2 METHODOLOGY

Water supply during peak demand conditions can be provided either through the storage tanks or through the production facilities. Storage facilities are usually more cost effective to construct compared to water treatment plants (WTPs) to meet peak demands. Section 5.2.1 describes strategies for balancing WTP expansion with existing/new storage in the system.

5.2.1 Storage/Production Capacities

There are multiple temporal variations in demands:

1. Demands vary diurnally (i.e., different demands at different times of day)
2. Demands vary daily (i.e., different demands on different days)
3. Demands vary seasonally
4. Demands vary annually

The demand factors of most concern to a utility are:

1. Maximum Day to Average Day Ratio

   This ratio signifies how much additional demand will be imposed on a system during the maximum day compared to an average day. For a large utility, maximum day demand could be a considerably large value compared to a smaller utility. However, the storage availability at smaller utilities are usually larger as they are dictated more by fire, emergency and flex operational requirements rather than demand requirements. This could lead to the possibility of using storage to manage larger variations in flows. The maximum day to average day ratio for AJWC is 1.8.

2. Peak Hour to Average Day Ratio

   This ratio signifies how much additional demand will be imposed for a small fraction of time on this system. This is usually exclusively supplied by the storage. If a utility does not have sufficient storage, then it is supplied by pumps or other conveyance equipment. The ratio is typically used for sizing pipes. As the demands increase, this could become a dominating factor. The peak hour to average day ratio for AJWC is 3.6.

3. Maximum Month Average Day to Average Day Ratio

   Maximum month average day demand signifies a demand condition that will be higher than most days of the year. There could be a lot of days higher than the maximum month average day. For a small utility, designing a surface WTP for this demand condition may allow supplying surface water for a majority of the year. The rest of the time, water can be supplemented with wells and other water sources, such as interconnects. The maximum month average day to average day ratio for AJWC is 1.1.

If a surface WTP is required, it can be sized on various criteria. However, if sufficient redundancy is available for the service area, it can be sized for Maximum Month Average Day demands with peak demands supplied through either interconnect water, well water or storage tanks. This reduces the reliance on sizing the WTP with capacities that will not be required for the majority of the year.

5.2.2 Water Treatment Plant Description

One option to provide future surface water is for AJWC to build its own surface WTP to treat its CAP allotment, as opposed to buying wholesale from the City of Mesa. For planning purposes, a typical surface water treatment train is assumed (similar to other similar applications in the CAP system). Costs are estimated and presented in Section 8.

The assumed treatment processes includes lined raw water storage, chlorine dioxide pre-oxidation, package water treatment system (Trident or similar) using coagulation, high rate clarification and dual media filtration, and chlorine for secondary disinfection. This train was selected based on discussions with AJWC personnel, ability of the process to comply with drinking water regulations and cost comparisons from other similar WTP projects for CAP water.

The Trident package water treatment system is composed of high-rate settling, adsorption clarification, mixed media filtration and chlorine disinfection. This multiple-barrier process is well-suited for all surface and groundwater applications, including high turbidity and color, variable water conditions, and enhanced coagulation operation. The process would also include chlorine dioxide for pre-oxidation control.

In this treatment train, coagulant and polymer are added at the influent to support the flocculation process. A sludge recycle flow is introduced near the coagulation point to aid in floc formation. This recycle flow also serves to maintain the steady-state solids concentration and to minimize variations in influent solids concentration. The tube clarification stage reduces influent solids concentration prior to the adsorption clarifier stage, leaving the majority of coagulated particles in the tube clarifier. Overall, the tube clarifier reduces plant waste volume and improves organics removal.

In the second stage, a buoyant adsorption media bed provides second-stage clarification. The media further reduces solids prior to filtration. Captured solids are periodically flushed from the clarifier using an air-water combination.

Mixed media filtration removes the remaining solids using a bed of anthracite, sand and high-density garnet. Disinfection treatment is provided by a chlorination system (gas or liquid) to inactivate bacteria.

5.2.3 Water Treatment Plant Expansion Schedule

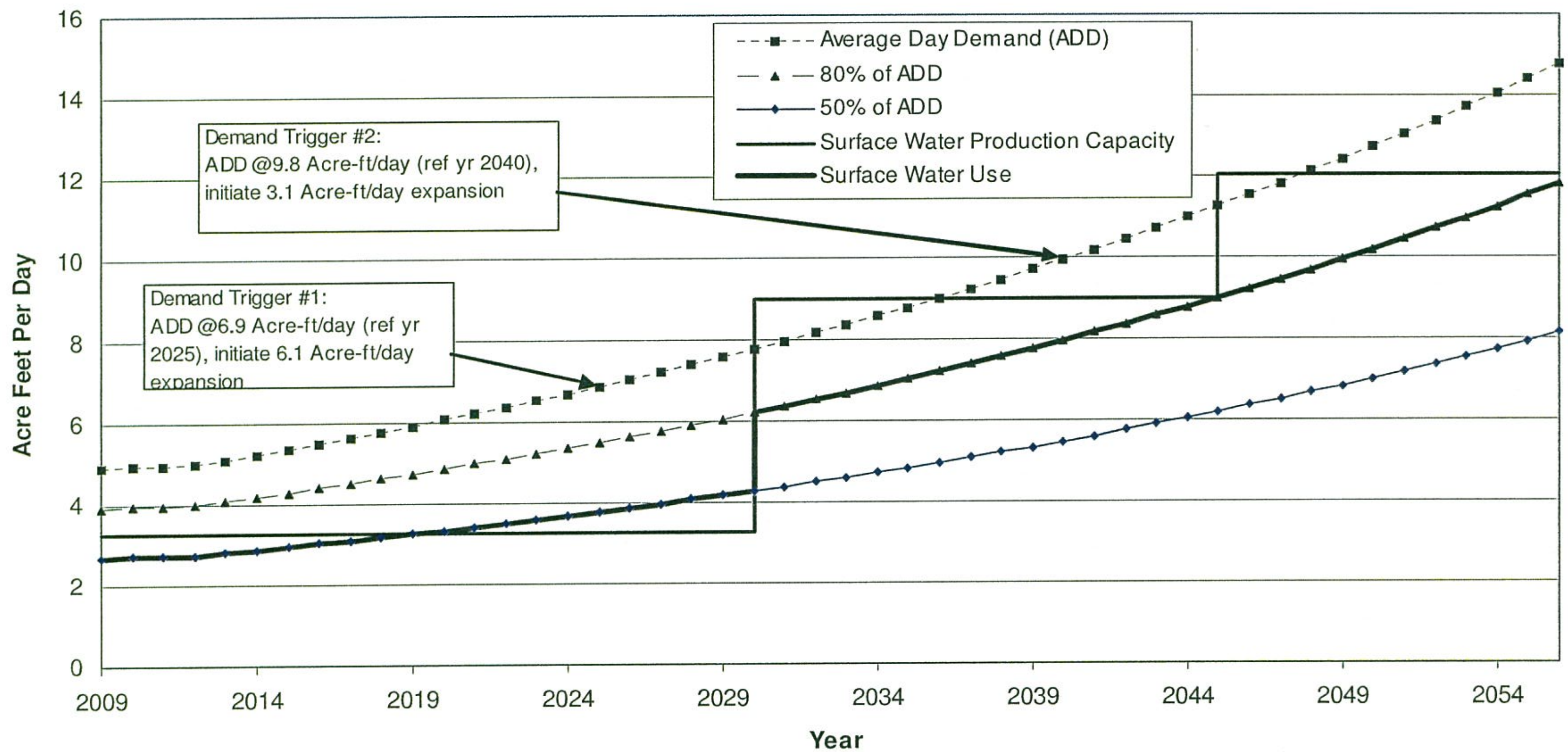
To facilitate planning, demand milestones have been identified to trigger CIP planning actions five years in advance. This will allow sufficient time to secure funds and complete design and construction of needed infrastructure. Demand triggers have been identified five years prior to when true capacity equals the projected maximum monthly average day demand. Figure 5.1 illustrates the surface water use and the demand triggers for expansion.

Initially a 1.1 MGD surface water treatment plant is planned to come on-line by 2015. Prior to 2015, surface water will be obtained through the Mesa interconnect. Surface water will make up 50% of the average day demands until 2030. As of 2019, the additional water required to meet 50% of the demand in excess of the WTP capacity will be supplied through the Mesa interconnect.

The transition to 80% surface water and 20% groundwater will occur in 2030 when a 2.0 MGD surface water treatment expansion is recommended, providing a total surface water treatment capacity of 3 MGD. The trigger to begin CIP planning actions for this expansion is at an average day demand of 2.25 MGD, expected to occur in 2025.

The next expansion trigger is expected in 2040 (or when average day demand reaches 3.2 MGD), when a 1.0 MGD expansion will need to be initiated to come on-line by 2045. This will provide a total capacity of 4.0 MGD, sufficient to maintain the 80% surface water, 20% groundwater split until build-out and beyond. — CURRENT/EXISTING SERVICE AREA —

For Portalis, a 3 MGD total surface water treatment plant is recommended to come on-line by 2030 in order to maintain the balance between groundwater use and recharge credit reserves to meet drought conditions.



AJWC Apache Junction Water Company

Figure 5.1: AJWC Existing Developed Community Only
Surface Water Demand Triggers Based on Average Day Demand

Final Report
Apache Junction Water Company

NCS Narasimhan Consulting Services, Inc.

5.2.4 Groundwater Expansion Schedule

A wellfield expansion schedule has been developed to provide groundwater only supply in severe drought conditions. Under this scenario, such as a Stage 4 Drought Condition, compulsory conservation and mandated shutoff rules will necessitate a 50% reduction in maximum month average day demand. Well capacity will be needed to meet this demand, without surface water supplementation. Figure 5.2 shows the demand trigger (when 50% of the maximum month average day demand reached 1.75 MGD, or when maximum month average day demand reaches 3.48 MGD) to provide this capacity. When this demand is realized, a 1.0-MGD expansion should be initiated to provide severe drought protection through build-out.

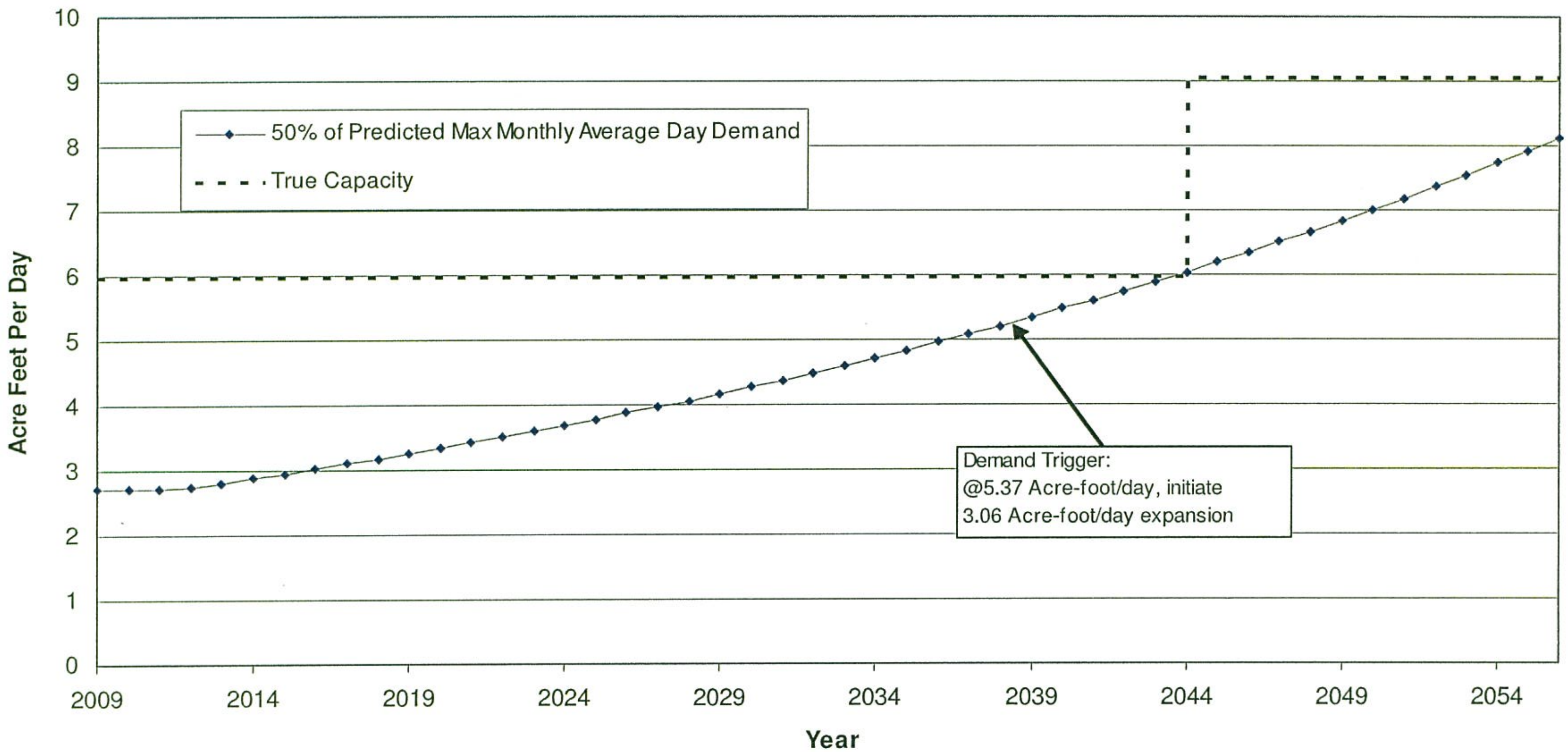


Figure 5.2: Demand Trigger for Groundwater Expansion for Existing Community

SECTION 6
WATER MODEL DEVELOPMENT AND CALIBRATION

6.1 INTRODUCTION

This section provides a summary on the water model development and calibration activities. A detailed description of water model development and calibration is provided in Appendix A.

Several different data sources were available for the development of the AJWC system model. The data sources include:

1. AutoCAD DWG files for the utility transmission and service lines, streets and hydrants
2. Quarter section map for Apache Junction area
3. Water billing data as an Excel file showing consumption per meter
4. Dimensions of storage tanks
5. Control logic data (set points)
6. USGS elevation maps
7. Streets shapefile from USGS and streets shapefile from AJWC

6.2 NETWORK DEVELOPMENT

Based on the review of the available sources, GIS data and Quarter Section maps were utilized to create the integrated water model.

6.2.1 Elevation Extraction

Water models calculate pressure as the last step. Pressures themselves are not critical to the solution of the water network equations. Water network equations are dependent on hydraulic grade lines and water demands. Once the hydraulic grade calculations are completed, elevations are subtracted from the hydraulic grade line to calculate pressure head in terms of length. This pressure head is then converted to pressure in pounds per square inch (psi) by using the specific gravity of water and performing unit conversion. It is essential to start with correct elevations in order to obtain correct pressures. In order to obtain elevations at several different locations, USGS elevation maps were used. However, when overlaying USGS elevation maps, it was observed that the street alignments in USGS (and thus the elevations) do not overlay perfectly. Because the differences seemed minor in most cases, the determination was made to use the USGS elevations. Elevations were extracted by overlaying the water distribution model over the USGS elevation maps and interpolating to extract elevation at the junctions.

6.3 DEMAND ALLOCATION

In order to carry out the demand allocation, NCS utilized the billing data provided by AJWC. AJWC provided the billing data as an Excel (.xls) file showing consumption per meter.

The Excel file has approximately 4,122 customer accounts. Each account has a meter ID and monthly consumption (in gallons). In order to utilize this information in the water distribution system model for the AJWC service area, the Excel-based meter data has to be converted into a GIS-based data format, such as a shapefile. This allows a modeler to allocate the demands to specific nodes in the model. The process of assigning Excel data with addresses on each row to a specific location on the surface of the earth is called geocoding. Geocoding is the process of finding associated geographic coordinates (often expressed as latitude and longitude) from other geographic data, such as street addresses or zip codes. With geographic coordinates, the features can be mapped and entered into a GIS platform. (*Source: Wikipedia, http://en.wikipedia.org/wiki/Geocoding*). This is an ArcGIS-based functionality that relies heavily on how well the meter addresses are recorded. If there are typographical errors, then an automated correlation cannot be obtained. For the AJWC model, several techniques were utilized, including correcting errors and updating the base streets shapefile to introduce new streets where construction has been carried out.

Once a majority of these errors were eliminated by a review and corrections procedure, the new meter shapefile had 4,037 meters. The Excel file had 4,122 meters, therefore an excellent level of geocoding was achieved. The meters whose addresses did not match are listed in Appendix D.

An automated demand allocation strategy was followed to allocate demands. The following logic describes the demand allocation procedure:

1. Thiessien Polygons were created around each node of the system. Thiessien Polygons are polygons prepared to ensure that one polygon surrounds each junction and intersects the straight line connecting any two junctions at a 90° angle. While creating Thiessien Polygons, it was further ensured that the polygons break at the pressure zone boundaries and do not allocate demands to incorrect nodes.

2. All the billing meters within the polygons were allocated to the junction within the polygon.

3. Some of the meters that were not geocoded do not have an associated address. Some of the billing meters' addresses fall outside the boundary of the Apache Junction service area. These meters were not used for demand allocation. However, the production data was used to ensure that the total demands are correct.

6.4 CONTROL STRATEGY

NCS organized a field visit with the AJWC operations staff to note the set points and operating strategy for all major facilities. These strategies were incorporated into the control logic of the facilities.

AJWC had provided pump operating set points across the system. These set points were introduced into the system.

6.5 FACILITY INFORMATION

Facility information, such as booster pump definitions, tank volumes, diameters and heights, was obtained from discussions and documents from AJWC staff.

6.6 CALIBRATION

The calibration criteria based on accepted industry standards for utilities are presented below (similar to the EPA criteria for the initial distribution system evaluation):

Flow Criteria:

Modeled flows should be within 5% of the measured flows at all locations of measurement.

Pressure Criteria:

The total difference between the measured and modeled data at all points in steady state calibration should be within 5% (or 3 psi pressure difference whichever is more) and should be within 10% for extended period calibration (or 7 psi pressure difference whichever is more).

As a result of this coordinated exercise with engineering and operations staff, a high level of confidence was built into the model. A steady state model calibration and an extended period simulation (EPS) calibration were conducted. Tables 6.1, 6.2 and 6.3 show the EPS comparison for flows and pressures as well as a steady state comparison. As evidenced in the table, the calibration is achieved for all parameters.

Table 6.1: Observed Versus Modeled Pressures

Pressure Recorder Number	Modeled Pressure (psi)	Observed Pressure (psi)	Error (psi)	Error (%)
PR - 1	82	76	6	7%
PR - 2	59	58	1	2%
PR - 4	54	54	0	0%
PR - 5	61	60	1	2%
PR - 6	75	69	6	8%
PR - 7	66	60	6	9%
PR - 11	59	57	2	3%
PR - 12	74	72	2	3%
PR - 13	82	76	6	7%
PR - 14	75	69	6	8%
PR - 15	77	73	4	5%
PR - 16	85	79	6	7%

Table 6.2: Flow Comparison at Water Plant Discharge Stations

Water Plants	Modeled Flow (gpm)	Observed Flow (gpm)	Error (psi)	Error (%)
Booster 1 Discharge	1,133	1,125	8	1%
Booster 2 Discharge	354	364	-10	-3%
Booster 2 Inflow	335	324	11	3%

Table 6.3 : Hydrant Test Comparison

Data Location	Observed Data			Modeled Data		Error Calculations			
	Residual Hydrant Static Pressure (psi)	Residual Hydrant Residual Pressure (psi)	Flowing Hydrant Flow (gpm)	Residual Hydrant Static Pressure (psi)	Residual Hydrant Residual Pressure (psi)	Error (psi) - Residual Hydrant Static Pressure (psi)	Error (%) - Residual Hydrant Static Pressure (psi)	Error (psi) - Residual Hydrant Residual Pressure (psi)	Error (%) - Residual Hydrant Residual Pressure (psi)
Location 1	78	60	837	80.4	57.1	-2.4	2.9	-3.08%	4.83%
Location 2	48	40	666	50.4	37.8	-2.4	2.2	-5.00%	5.50%
Location 3	42	58	666	42	60.1	0	-2.1	0.00%	-3.62%
Location 4	58	40	750	55.7	39.3	2.3	0.7	3.97%	1.75%
Location 5	85	48	837	86.3	45.7	-1.3	2.3	-1.53%	4.79%

In general, the model seems to provide a very good correlation between observed values and modeled values in the system for flows and pressures. It is recommended, however, that with a new GIS mapping program, a better correlation is developed between the USGS alignments and AJWC alignments so that the elevations can be used directly without requiring readjustment of the elevation/model overlay.

SECTION 7
WATER DISTRIBUTION SYSTEM INFRASTRUCTURE

7.1 INTRODUCTION

This section defines the strategy adopted for predicting infrastructure upgrades to the existing distribution system. The existing distribution system consists of two booster stations, each with its own storage tanks.

Distribution system infrastructure consisting of several elements, including reservoirs (storage tanks), pumps, pipes and PRVs, were evaluated. Section 7.2 discusses the methodology for the evaluation.

In addition to this, it is essential to evaluate the operational flexibility that is available by segregating the utility service area into different pressure zones. Section 7.5 describes evaluation of pressure zones.

7.2 METHODOLOGY

The water distribution model was used for estimating the usage requirements for all distribution system infrastructure upgrades. However, several facilities, such as storage tanks and pumps, have requirements that are based on various factors, such as fire flows and peak hour demands. These requirements dictate the sizing of these facilities. Detailed sizing requirements are presented in subsequent sections. The criteria used for sizing is presented below:

- Piping upgrades are defined based on Maximum Day + Fire Flow Demand or peak hour, whichever is dominating
- Minimum Pressure in the system should be no less than 20 pounds per square inch (psi) for fire flow conditions and 40 psi for peak hour conditions
- Maximum Velocity in the system should be no more than 8 feet per second (fps) during fire flow conditions and no greater than 5 fps during peak hour conditions.

The required fire flow estimate used for piping upgrades was 1,500 gpm for commercial services and 1,000 gpm for residential services. This was based on information from the Apache Junction Fire Marshall. Based on the hydraulic modeling runs, upgrades were identified for booster stations to meet the maximum day fire flow and peak hour demand conditions.

7.3 STORAGE TANKS

Storage tanks provide water for use in emergencies, peaking and fire flow conditions. They help equalize variations in demands caused by a number of different factors. The total storage required for a utility should be based on fire storage required + emergency storage + diurnal peaking storage.

7.3.1 Emergency Storage

Emergency storage is calculated as 10% of maximum day demand. This is approximately equal to 340,000 gallons for current conditions. For intermediate conditions (approximately year 2030) the total storage required is 450,000 gallons and for buildout 864,000 gallons.

7.3.2 Fire Storage

Through conversations with the Fire Marshall for the City of Apache Junction, it was determined that the maximum fire flow requirement is 1,500 gpm within the City at all locations for a period of 3 hours. Therefore, the total volume of water storage required currently is 270,000 gallons.

However, for future storage predictions, better storage estimates can be obtained by using industry standard parameters, such as fire storage estimates based on formula for minimum fire flow defined by the American Insurance Association. The formula states that the required fire flow should be:

$Q = 1020 * P^{0.5}*(1-0.01*P^{0.5})$

Where

Q = Flow rate in gpm
P =Population in 1000s

Assuming that the demand increase is proportional to population increase, it can be estimated that the AJWC population should increase to approximately 19,900 people by 2030 (intermediate CIP time frame). Using the above formula, this equates to 4,341 gpm of fire flow for 3 hours, which would equate to approximately 781,000 gallons of storage.

Up to build-out, the Portalis population should increase to 38,100 people. It is assumed that if the Portalis master planned community develops, it will handle fire storage requirements as a part of the development. Otherwise, during the next Master Plan update, additional storage capacity for system demands in that area should be considered. This translates to approximately 5,907 gpm of fire flow for 3 hours, which equals approximately 1.06 MG of storage.

This approach was recommended by the American Insurance Association for future planning. This formula, in some cases, may underpredict the actual fire flow requirement based on the Fire Code, while in other cases it may recommend a more conservative number. It is essentially a population-based requirement as opposed to the Fire Code Criteria, which is has land usage-based requirements. The City of Phoenix design standards states that storage for fire fighting capabilities should be based on the required fire flow rate for the most intensive land use within the zone multiplied by duration.

7.3.3 Diurnal Storage

Total diurnal storage required for any given system is approximately equal to the difference in the peak hour to maximum day demand. The peak hour to maximum day ratio is approximately 2 based on the flow metering exercise that was conducted in AJWC.

The short term maximum day demand for the AJWC service area is 3.4 MGD. The total equalization storage for meeting the diurnal variation for the short term condition (up to 2015) is approximately 2.8 MG.

7.3.4 Total Storage Required

Minimum Total Storage Required (MG) = Emergency Storage (MG) + Fire Flow Storage (MG) + Diurnal Storage (MG)

7.3.4.1 Short-Term Storage (Up to 2015)

The requirements for short-term storage are:

- Emergency Requirements = 340,000 gallons
- Fire Flow Storage = 270,000 gallons
- Diurnal Equalization Storage = 3,400,000 gallons

The total minimum firm storage capacity required for the short term is approximately 4 MG. The existing system's firm storage capacity is approximately 2 MG (with one 1 MG tank out of service). Therefore, an additional 2 MG of storage capacity will be required in the short term CIP. This will be comprised of additional storage at the water treatment plant and one new storage tank of 1 MG at Booster Station #2. These storage tanks will also help with operations and maintenance as well as flexible operations requirements.

7.3.4.2 Intermediate Term Storage (Year 2030)

The requirements for intermediate storage are:

- Emergency Requirements = 450,000 gallons.
- Fire Flow Storage = 781,000 gallons.
- Diurnal Storage = 4,500,000 gallons

The total minimum firm storage capacity required for the intermediate term is approximately 5.8 MG of firm capacity.

For the intermediate scenario, an additional storage capacity of 1.8 MG will be required by 2030 (or similar demand trigger).

7.3.4.3 Build Out

The requirements for build-out storage are:

- Emergency Requirements = 864,000 gallons.
- Fire Flow Storage = 1,060,000 gallons.
- Diurnal Storage = 8,640,000 gallons.

Thus, the total minimum firm storage capacity required for build out is approximately 10.5 MG of firm capacity.

For the build out scenario, an additional storage capacity of 4.7 MG will be required by build out.

7.4 PUMPS

There are no elevated tanks in the system. Therefore, booster pumps need to be able to supply peak hour demands every day with minimum pressures every where in the system to stay above 40 psi as the minimum design criteria.

System needs require enough pumping capacity in terms of flows and pressures and low headloss. Head losses can be reduced with larger pipe diameters. Too little headloss may require large pipe sizes resulting in higher costs. However, having reasonable headlosses by ensuring pipe velocities do not exceed 5 fps and having large pumps, the same results can be achieved through lower overall costs.

The peak hour demand for the short term scenario (2015) is approximately 6.8 MGD. The current firm pumping capacity for the AJWC service area is 4.4 MGD (i.e., 2.7 MGD at Booster Station #1 and 1.7 MGD at Booster Station #2). For short term requirements, there is a deficit of approximately 2.4 MGD. This can be corrected by adding additional pumps at Booster Station #1 (1.3 MGD) and Booster Station #2 (1.7 MGD). This will raise the firm capacity to 7.5 MGD.

The peak hour demands for the intermediate scenario (2030) is approximately 9 MGD. For the intermediate scenario, an additional 1.5 MGD pump capacity will be required at Booster Station #1. This will raise the firm capacity to 9.2 MGD.

The peak hour demands for the build-out scenario is approximately 17.3 MGD. For build-out, additional booster pumps totaling a flow of 8 MGD discharging at approximately 70 psi would be required.

7.5 PRESSURE ZONE MANAGEMENT

Figure 7.1 shows elevation variations through AJWC service area. Pressure zones are developed in water systems to allow flexibility in operations between large elevation changes. With approximately 150 feet of elevation difference, the pressure difference between the lowest and highest point in the zone is approximately 65 psi. Thus, when the lowest node is at 100 psi, the highest location in the zone is 35 psi. Therefore, an elevation variation above 150 feet will lead to either too low pressures in one part of the zone or too high in the other.

Having, too low a difference in elevation can also lead to further problems with pressure zone management. The recommended elevation difference is approximately 100 feet, which is similar to the elevation differences in pressure zones of cities around AJWC, such as the City of Phoenix.

The elevation variations through the AJWC service area shows that most of the utility locations are within 100 feet of elevation variation. However, there is one small area that has higher variation. Therefore it is proposed that an additional pressure zone be developed by adding a PRV on the 12-inch line from Booster Station #2 along the Baseline Road alignment towards Ironwood Road as shown on Figure 7.2.

Furthermore, elevation variations for Portalis are substantial and therefore one or more zones should be developed in that region.

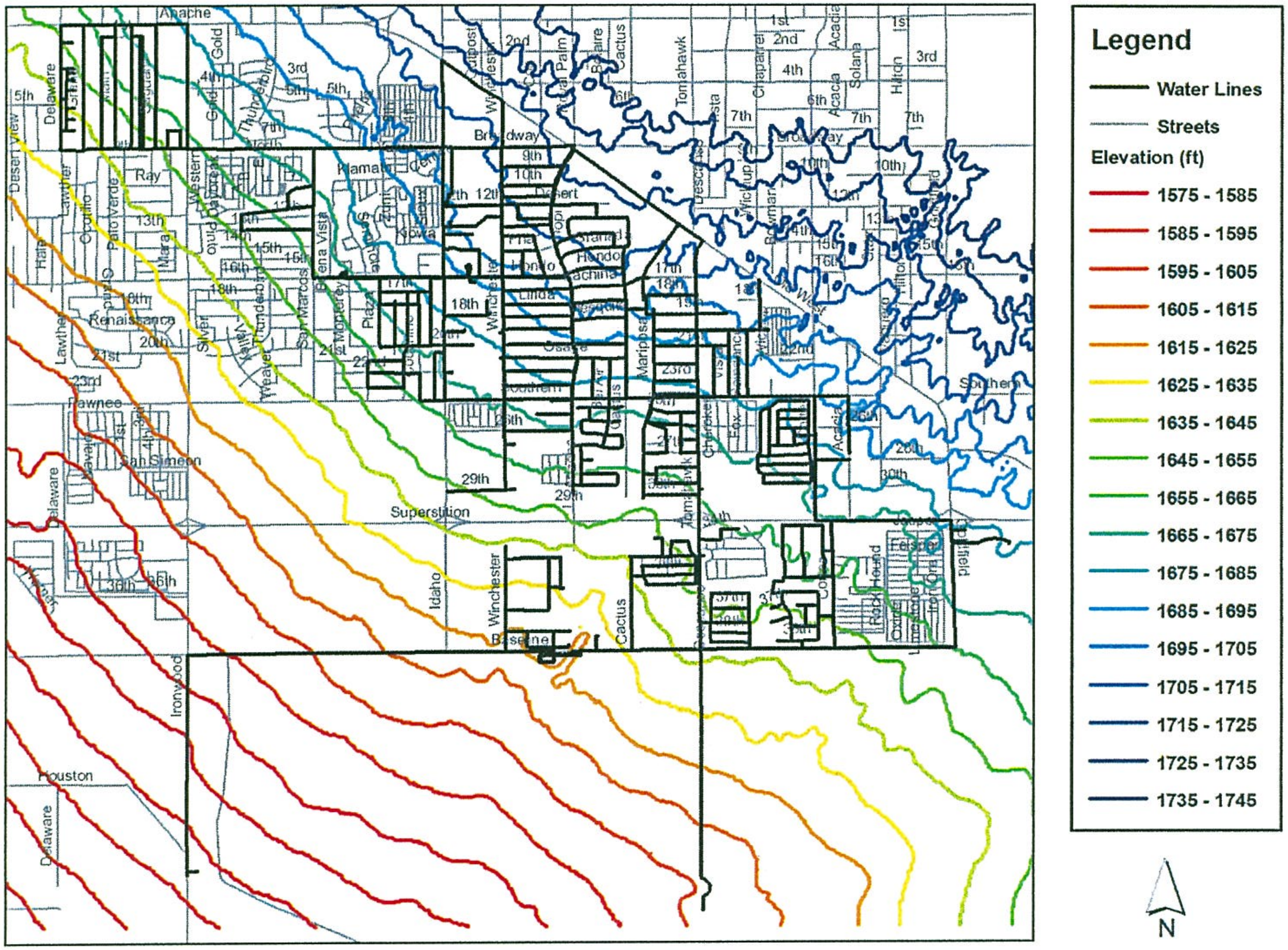


Figure 7.1: Elevation Variations Through AJWC Service Area

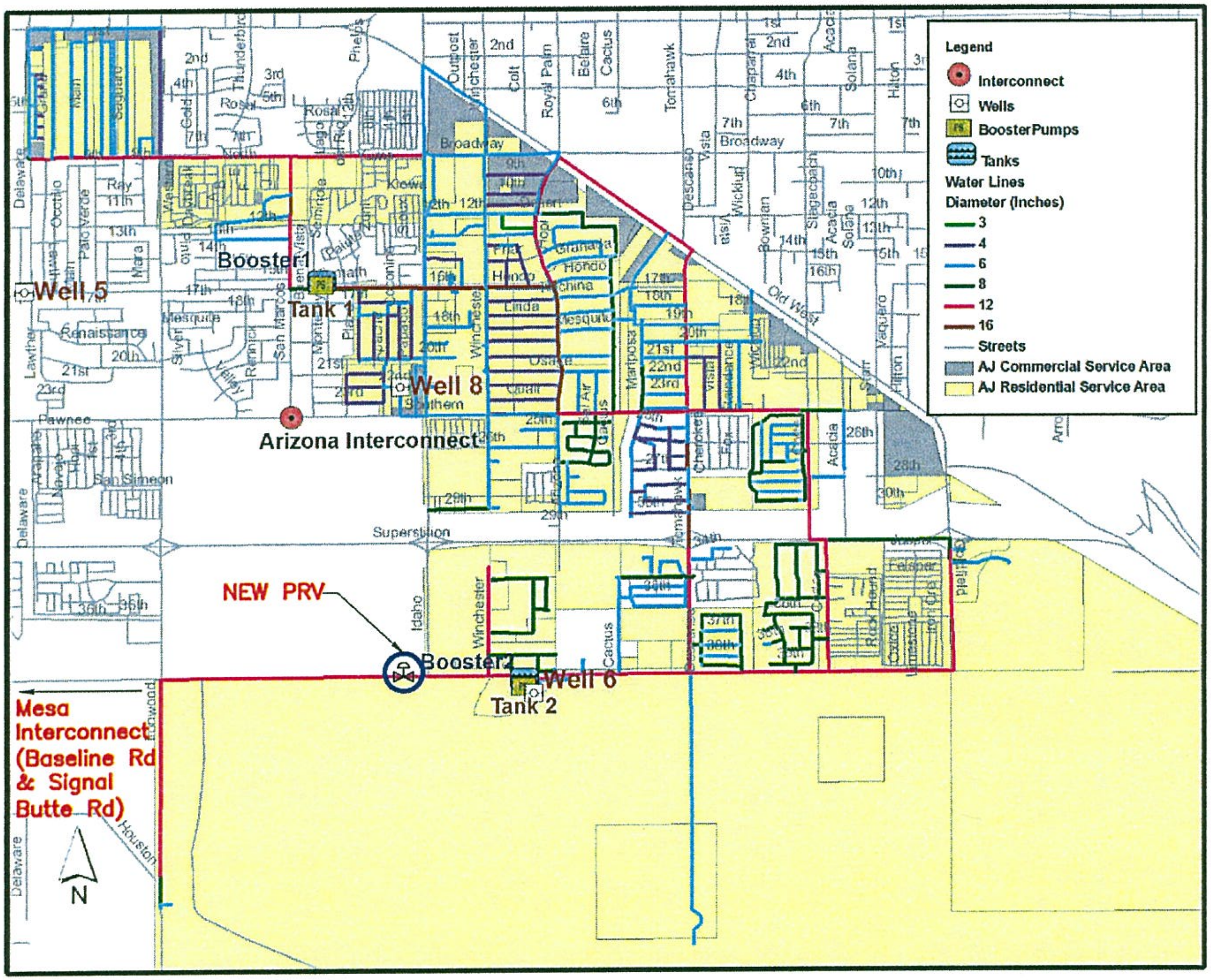
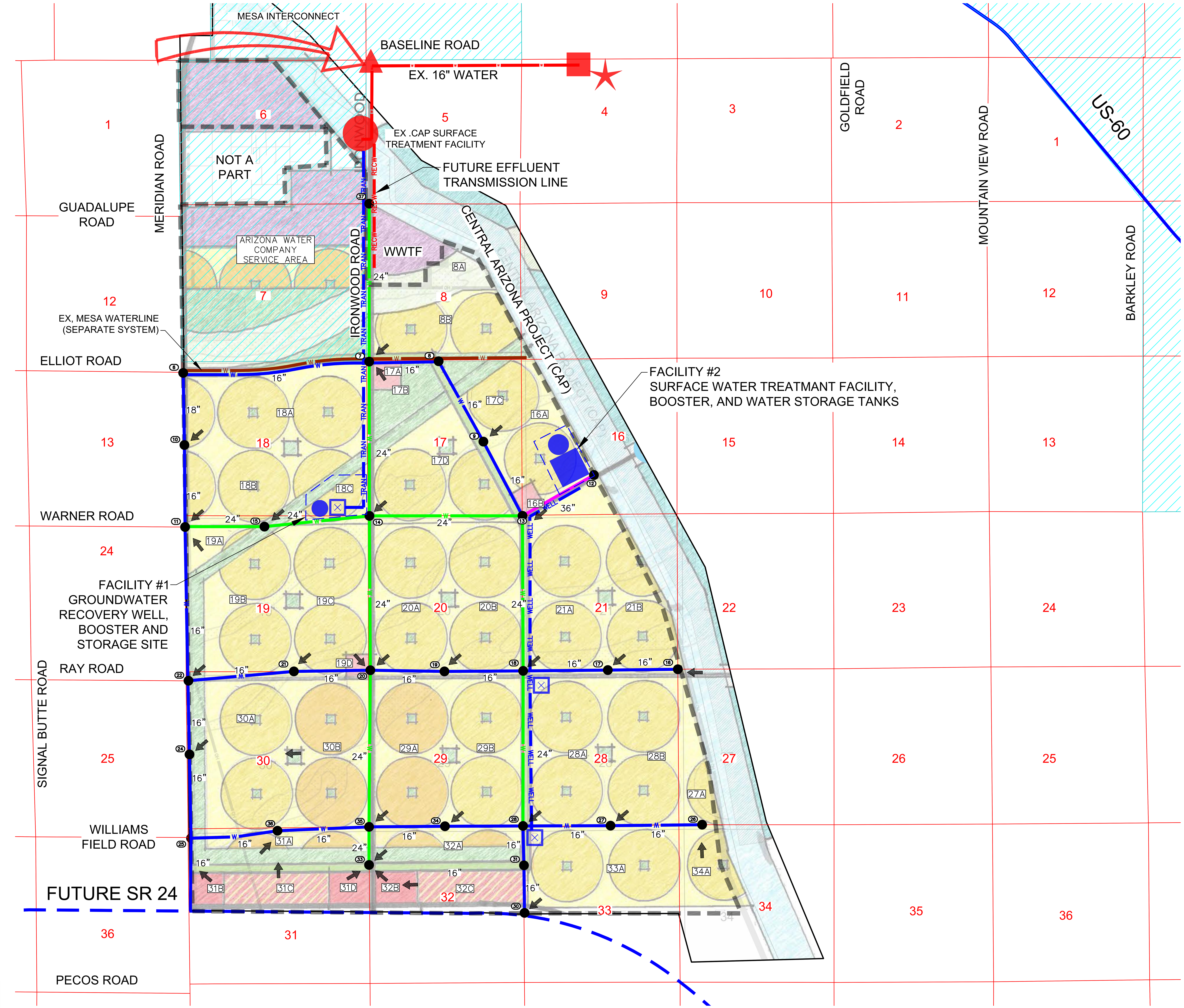


Figure 7.2: Proposed PRV Location in AJWC Service Area

AJWC Apache Junction Water Company

NCS Narasimhan Consulting Services, Inc.

APPENDIX H



LEGEND

OVERALL PLANNING AREA (8,090± ACRES)

SECTION

WATER ANALYSIS AREA ID

APACHE JUNCTION WATER DISTRICT CAP SURFACE WATER TREATMENT FACILITY (2MGD CAPACITY, UPGRADEABLE TO 10MGD)

APACHE JUNCTION WATER DISTRICT PUBLIC WORKS STORAGE TANK SITE (2MGD STORAGE, UPGRADEABLE)

APACHE JUNCTION WATER DISTRICT WELL SITE

APACHE JUNCTION – MESA INTERCONNECT (5MGD ALLOCATION)

GROUNDWATER RECOVERY WELL. (~1.4 MGD)

PLANNING AREA BUILDOUT: 3 WELL SITES

PROPOSED SURFACE WATER TREATMENT FACILITY.

PROPOSED WATER STORAGE TANKS.

FACILITY #1 BUILDOUT DEMAND (~10 MGD)

FACILITY #2 BUILDOUT DEMAND (~20 MGD)

WATER ANALYSIS

ANALYSIS NODE & ID

PARCEL DEMAND INDICATOR (DEMAND ON NODE)

PROP. WATER PIPE

16–INCH

24–INCH

30–INCH

36–INCH

42–INCH

WELL SOURCE TRANSMISSION LINE (SIZE TBD)

CAP SURFACE WATER TO STORAGE 24" TRANSMISSION LINE

FUTURE 12" EFFLUENT TRANSMISSION LINE FROM WWTF TO WATER TREATMENT FACILITY FOR DIRECT POTABLE REUSE.

NOTE:
EXHIBIT IS FOR CONCEPTUAL PURPOSES ONLY AND IS DEPENDENT ON DETAILED SITE PLANNING, ENGINEERING, ALTA SURVEY AND CITY REVIEWS/APPROVALS.

No.	REVISIONS	DATE	BY

Kimley»Horn

1001 WEST SOUTHERN AVENUE, SUITE 131
MESA, ARIZONA 85202 (480) 207-2666

KHA PROJECT	
DATE	OCT. 2019
SCALE	AS SHOWN
DESIGNED BY	ZJH
DRAWN BY	TAF
CHECKED BY	JMB

CONCEPTUAL
NOT FOR CONSTRUCTION
SUBJECT TO
ENGINEERING AND CITY
REVIEW AND APPROVAL

CONCEPTUAL WATER INFRASTRUCTURE EXHIBIT

ASLD 8500 PLANNING PARCEL

PINAL COUNTY ARIZONA

SHEET NUMBER

APPENDIX I


MESA INTERCONNECT
BASELINE ROAD
EX. 16" WATER
EX .CAP SURFACE TREATMENT FACILITY
NOT A PART
ARIZONA WATER COMPANY SERVICE AREA
WWTF
GUADALUPE ROAD
MERIDIAN ROAD
IRONWOOD ROAD
CENTRAL ARIZONA PROJECT (CAP)
GOLDFIELD ROAD
MOUNTAIN VIEW ROAD
BARKLEY ROAD
US-60
EX. MESA WATERLINE (SEPARATE SYSTEM)
ELLIOT ROAD
WARNER ROAD
FACILITY #1 GROUNDWATER RECOVERY WELL, BOOSTER AND STORAGE SITE
RAY ROAD
SIGNAL BUTTE ROAD
WILLIAMS FIELD ROAD
PROP. LIFT STATION
FUTURE SR 24
PECOS ROAD
NORTH
GRAPHIC SCALE IN FEET
0 750 1500 3000
LEGEND
OVERALL PLANNING AREA (8,090± ACRES)
AUCTION PARCEL (2,783± ACRES)
SECTION
WATER ANALYSIS AREA ID
APACHE JUNCTION WATER DISTRICT CAP SURFACE WATER TREATMENT FACILITY (2MGD CAPACITY, UPGRADEABLE TO 10MGD)
APACHE JUNCTION WATER DISTRICT PUBLIC WORKS STORAGE TANK SITE (2MGD STORAGE, UPGRADEABLE)
APACHE JUNCTION WATER DISTRICT WELL SITE
APACHE JUNCTION – MESA INTERCONNECT (5MGD ALLOCATION)
FACILITY #1:
AUCTION PARCEL DEMAND (~7.4 MGD)
AUCTION PARCEL STORAGE (4 MG)
GROUNDWATER RECOVERY WELL (1 WELL SITE). REQUIRES TRANSMISSION TO WATER TREATMENT FACILITY. (~1.4 MGD)
PROP. WATER PIPE
16–INCH
24–INCH
30–INCH
36–INCH
42–INCH
CAP SURFACE WATER TO STORAGE 24" TRANSMISSION LINE
NOTE:
EXHIBIT IS FOR CONCEPTUAL PURPOSES ONLY AND IS DEPENDENT ON DETAILED SITE PLANNING, ENGINEERING, ALTA SURVEY AND CITY REVIEWS/APPROVALS.
Kimley»Horn
© 2019 KIMLEY-HORN AND ASSOCIATES, INC.
1001 WEST SOUTHERN AVENUE, SUITE 131
MESA, ARIZONA 85202 (480) 207-2666
KHA PROJECT
DATE OCT. 2019
SCALE AS SHOWN
DESIGNED BY ZJH
DRAWN BY TAF
CHECKED BY JMB
CONCEPTUAL
NOT FOR CONSTRUCTION
SUBJECT TO
ENGINEERING AND CITY
REVIEW AND APPROVAL
CONCEPTUAL WATER INFRASTRUCTURE EXHIBIT
ASLD 8500 AUCTION PARCEL
PINAL COUNTY ARIZONA
SHEET NUMBER

APPENDIX J

ASLD 8500 - Water Infrastructure Analysis

Apache Junction Water Demand Criteria [1]

Land Use	Density	Population Density	Maximum Day Demand [1]	
Residential	(0-8 du/acre)	3.2	440	gpd/du
High Density Residential	(8+ du/acre)	2	440	gpd/du
Commercial			1.5	gpd/sf
Industrial			3,000	gpd/acre [2]
Retail			1.5	gpd/sf
General			220	gpcpd

(1) Per Apache Junction Engineering Design Guidelines and Policies: Table 10-5.1

(2) Industrial demand per City of Phoenix Used

Water Design Criteria [3]

Peak Hour Factor	1.7 x Maximum Day
System Pressure	60-100 PSI in Maximum Day
Water Main Design	Maximum Day Plus Fire Flow
Appurtenances (Boosters, Reservoirs, etc.)	Max Day with provision for fire flow an emergency flows
Velocity	Less than 5 fps
Headloss	Less than 10 ft per 1,000 ft

(3) Per Apache Junction Engineering Design Guidelines and Policies: Section 10-5-2

Pipe Size Requirements [4]

Street Classification	Min Pipe Size
Local Street	8 Inch
Collector (mid-section)	12 Inch
Parkway & Arterial or Section Line Streets	16 Inch

(4) Per Apache Junction Engineering Design Guidelines and Policies: Section 10-5-3

Fire Flow Requirements [5]

Land Use	Max Building Size (SF)[6]	Fire Flow (Gallons per minute)
Residential	>3,600	1,500
Medium Density Residential	3,600	1,000
Retail & Commercial	100,000	4,000
Industrial	250,000	4,000

(5) Per 2006 International Fire Code Section B105 & Table B105.1

(6) Based on type V-B Construction (lowest fire rating)

ASLD 8500 - Water Infrastructure Analysis

Auction Parcel Demands

Section	Land Use	Area (sq.-ft)	Area (Acres)	Density		Yield		Unit Demand		Maximum Day Demand (MGD)	Peak Hour Demand (MGD)	Fire Flow Demand (GPM)
17A	Neighborhood Commercial	653,400	15.0	7,500.00	sqft/ac	112,500	sq.-ft	1.5	gpd/sf	0.17	0.29	4,000
17B	Parks and Other Open Space	6,534,000	150.0	0.00	0.00							
17C	Residential	6,534,000	150.0	3.50	du/ac	525	units	440	gpd/du	0.23	0.39	1,500
17D	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	440	gpd/du	0.54	0.92	1,500
18A	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	440	gpd/du	0.54	0.92	1,500
18B	Residential	12,196,800	280.0	3.50	du/ac	980	units	440	gpd/du	0.43	0.73	1,500
18C	Residential	4,573,800	105.0	3.50	du/ac	368	units	440	gpd/du	0.16	0.27	1,500
19A	Residential	1,960,200	45.0	3.50	du/ac	158	units	440	gpd/du	0.07	0.12	1,500
19B	Residential	17,206,200	395.0	3.50	du/ac	1,383	units	440	gpd/du	0.61	1.03	1,500
19C	Residential	11,979,000	275.0	3.50	du/ac	963	units	440	gpd/du	0.42	0.72	1,500
19D	Neighborhood Commercial	653,400	15.0	7,500.00	sqft/ac	112,500	sq.-ft	1.5	gpd/sf	0.17	0.29	4,000
20A	Residential	13,068,000	300.0	3.50	du/ac	1,050	units	440	gpd/du	0.46	0.79	1,500
20B	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	440	gpd/du	0.54	0.92	1,500
	Total		2,780							4.34	7.38	

ASLD 8500 - Water Infrastructure Analysis

Planning Parcel Project Demand

Section	Land Use	Area (sq.-ft)	Area (Acres)	Density		Yield		Unit Demand		Maximum Day Demand (MGD)	Peak Hour Demand (MGD)	Fire Flow Demand (GPM)
6A	Enterprise Technology	8,712,000	200.0	0.25	F.A.R.	2,178,000	sq.-ft	3,000	gpd/acre	0.60	1.02	4,000
6B	Enterprise Technology	3,049,200	70.0	0.25	F.A.R.	762,300	sq.-ft	3,000	gpd/acre	0.21	0.36	4,000
7A	Enterprise Technology	8,712,000	200.0	0.25	F.A.R.	2,178,000	sq.-ft	3,000	gpd/acre	0.60	1.02	4,000
7B	Medium Residential (Within AWC Service Area)	8,712,000	200.0	6.00	du/ac	1,200	units	440	gpd/du	0.53	0.90	1,000
7C	Parks and Other Open Space	23,740,200	545.0	0.00	0.00							
8A	Parks and Other Open Space	6,534,000	150.0	0.00	0.00							
8B	Residential	10,018,800	230.0	3.50	du/ac	805	units	440	gpd/du	0.35	0.60	1,500
16A	Residential	7,840,800	180.0	3.50	du/ac	630	units	440	gpd/du	0.28	0.47	1,500
16B	Neighborhood Commercial	653,400	15.0	7,500.00	sqft/ac	112,500	sq.-ft	1.5	gpd/sf	0.17	0.29	4,000
17A	Neighborhood Commercial	653,400	15.0	7,500.00	sqft/ac	112,500	sq.-ft	1.5	gpd/sf	0.17	0.29	4,000
17B	Parks and Other Open Space	6,534,000	150.0	0.00	0.00							
17C	Residential	6,534,000	150.0	3.50	du/ac	525	units	440	gpd/du	0.23	0.39	1,500
17D	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	440	gpd/du	0.54	0.92	1,500
18A	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	440	gpd/du	0.54	0.92	1,500
18B	Residential	12,196,800	280.0	3.50	du/ac	980	units	440	gpd/du	0.43	0.73	1,500
18C	Residential	4,573,800	105.0	3.50	du/ac	368	units	440	gpd/du	0.16	0.27	1,500
19A	Residential	1,960,200	45.0	3.50	du/ac	158	units	440	gpd/du	0.07	0.12	1,500
19B	Residential	17,206,200	395.0	3.50	du/ac	1,383	units	440	gpd/du	0.61	1.03	1,500
19C	Residential	11,979,000	275.0	3.50	du/ac	963	units	440	gpd/du	0.42	0.72	1,500
19D	Neighborhood Commercial	653,400	15.0	7,500.00	sqft/ac	112,500	sq.-ft	1.5	gpd/sf	0.17	0.29	4,000
20A	Residential	13,068,000	300.0	3.50	du/ac	1,050	units	440	gpd/du	0.46	0.79	1,500
20B	Residential	15,246,000	350.0	3.50	du/ac	1,225	units	440	gpd/du	0.54	0.92	1,500
21A	Residential	13,939,200	320.0	3.50	du/ac	1,120	units	440	gpd/du	0.49	0.84	1,500
21B	Residential	8,712,000	200.0	3.50	du/ac	700	units	440	gpd/du	0.31	0.52	1,500
27A	Residential	4,356,000	100.0	3.50	du/ac	350	units	440	gpd/du	0.15	0.26	1,500
28A	Residential	13,068,000	300.0	3.50	du/ac	1,050	units	440	gpd/du	0.46	0.79	1,500
28B	Residential	13,939,200	320.0	3.50	du/ac	1,120	units	440	gpd/du	0.49	0.84	1,500
29A	Medium Residential (Within AJWD Service Area)	11,979,000	275.0	6.00	du/ac	1,650	units	440	gpd/du	0.73	1.23	1,000
29B	Residential	13,939,200	320.0	3.50	du/ac	1,120	units	440	gpd/du	0.49	0.84	1,500
30A	Residential	13,068,000	300.0	3.50	du/ac	1,050	units	440	gpd/du	0.46	0.79	1,500
30B	Medium Residential (Within AJWD Service Area)	11,979,000	275.0	6.00	du/ac	1,650	units	440	gpd/du	0.73	1.23	1,000
31A	Medium Residential (Within AJWD Service Area)	6,316,200	145.0	6.00	du/ac	870	units	440	gpd/du	0.38	0.65	1,000
31B	District Core	2,178,000	50.0	20,000.00	sqft/ac	1,000,000	sq.-ft	1.5	gpd/sf	1.50	2.55	4,000
31C	Mixed Use Commercial	5,880,600	135.0	12,500.00	sqft/ac	1,687,500	sq.-ft	1.5	gpd/sf	2.53	4.30	4,000
31D	District Core	2,178,000	50.0	20,000.00	sqft/ac	1,000,000	sq.-ft	1.5	gpd/sf	1.50	2.55	4,000
32A	Medium Residential (Within AJWD Service Area)	5,445,000	125.0	6.00	du/ac	750	units	440	gpd/du	0.33	0.56	1,000
32B	District Core	1,742,400	40.0	20,000.00	sqft/ac	800,000	sq.-ft	1.5	gpd/sf	1.20	2.04	4,000
32C	Mixed Use Residential	5,880,600	135.0	20.00	du/ac	2,700	units	440	gpd/du	1.19	2.02	1,000
33A	Residential	13,939,200	320.0	3.50	du/ac	1,120	units	440	gpd/du	0.49	0.84	1,500
34A	Residential	4,791,600	110.0	3.50	du/ac	385	units	440	gpd/du	0.17	0.29	1,500
	Total		8090.00							18.75	31.88	

ASLD 8500 - Water Infrastructure Analysis

Planning Parcel Demand Summary

Land Use		Area (Acres)	Density		Yield		Population Density	Population	Unit Demand		Demand MGD	Fire Flow GPM
Enterprise Technology		470	0.25	F.A.R.	5,118,300	sq.-ft	-	-	3,000	gpd/acre	1.41	4000
Parks and Other Open Space		845	0		0		-	-	0			0
Residential		5,300	3.5	du/ac	18,550	units	3.2	59,360	440	gpd/du	8.16	1,500
Medium Residential (Within AWC Service Area)		200	6.0	du/ac	1,200	units	3.2	3,840	440	gpd/du	0.53	1,000
Medium Residential (Within AJWD Service Area)		820	6.0	du/ac	4,920	units	3.2	15,744	440	gpd/du	2.16	1,000
Mixed Use Residential		135	20	du/ac	2,700	units	2.0	5,400	440	gpd/du	1.19	1,000
Mixed Use Commercial		135	12,500	sqft/ac	1,687,500	sq.-ft	-		1.50	gpd/sf	2.53	4,000
Neighborhood Commercial		45	7,500	sqft/ac	337,500	sq.-ft	-		1.50	gpd/sf	0.51	4,000
District Core		140	20,000	sqft/ac	2,800,000	sq.-ft	-		1.50	gpd/sf	4.20	4,000
Total		8,090						84,344			20.69	
Total (Within AJWD Service Area)		6,575						80,504			18.75	

APPENDIX K

FlexTable: Reservoir Table

Active Scenario: Mad Day Plus Fire Flow

Label	Elevation (ft)	Flow (Out net) (MGD)	Hydraulic Grade (ft)	Zone
R-1	1,713.80	6.0	1,713.80	LD1
R-2	1,720.00	12.7	1,720.00	LD1

Fire Flow Node FlexTable: Fire Flow Report

Active Scenario: Mad Day Plus Fire Flow

Label	Elevation (ft)	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)
J-6	1,495.00	1,500.0	4,000.0	85	63
J-7	1,535.00	2,000.0	4,000.0	75	64
J-8	1,550.00	1,500.0	4,000.0	66	63
J-9	1,545.00	1,500.0	4,000.0	68	63
J-10	1,490.00	1,500.0	4,000.0	88	63
J-11	1,485.00	1,500.0	4,000.0	94	63
J-12	1,560.00	1,500.0	4,000.0	69	64
J-13	1,540.00	2,000.0	4,000.0	76	63
J-14	1,515.00	1,500.0	4,000.0	86	64
J-15	1,500.00	1,500.0	4,000.0	89	63
J-16	1,560.00	1,500.0	4,000.0	46	58
J-17	1,545.00	1,500.0	4,000.0	63	57
J-18	1,530.00	1,500.0	4,000.0	73	59
J-19	1,510.00	1,500.0	4,000.0	78	61
J-20	1,500.00	2,000.0	4,000.0	84	62
J-21	1,485.00	1,500.0	4,000.0	84	62
J-22	1,470.00	1,500.0	4,000.0	88	62
J-24	1,465.00	1,000.0	4,000.0	81	61
J-25	1,455.00	2,000.0	4,000.0	80	61
J-26	1,560.00	1,500.0	4,000.0	36	58
J-27	1,540.00	1,500.0	4,000.0	58	50
J-28	1,520.00	1,500.0	4,000.0	74	56
J-30	1,510.00	1,500.0	4,000.0	63	56
J-31	1,515.00	1,500.0	4,000.0	69	56
J-33	1,485.00	2,000.0	4,000.0	81	60
J-34	1,500.00	1,500.0	4,000.0	77	59
J-35	1,485.00	1,000.0	4,000.0	84	60
J-36	1,465.00	2,000.0	4,000.0	76	61

FlexTable: Junction Table

Active Scenario: Mad Day Plus Fire Flow

Label	Elevation (ft)	Demand (MGD)	Hydraulic Grade (ft)	Pressure (psi)
J-6	1,495.00	0.0	1,712.25	94
J-7	1,535.00	0.5	1,713.77	77
J-8	1,550.00	0.0	1,714.73	71
J-9	1,545.00	0.2	1,715.97	74
J-10	1,490.00	0.5	1,711.64	96
J-11	1,485.00	0.5	1,711.55	98
J-12	1,560.00	0.0	1,720.00	69
J-13	1,540.00	0.5	1,717.82	77
J-14	1,515.00	0.5	1,713.80	86
J-15	1,500.00	0.2	1,712.48	92
J-16	1,560.00	0.0	1,710.10	65
J-17	1,545.00	0.3	1,710.10	71
J-18	1,530.00	0.5	1,710.09	78
J-19	1,510.00	0.5	1,706.52	85
J-20	1,500.00	0.6	1,704.83	89
J-21	1,485.00	0.4	1,702.69	94
J-22	1,470.00	0.6	1,701.11	100
J-24	1,465.00	1.2	1,693.85	99
J-25	1,455.00	1.5	1,689.80	102
J-26	1,560.00	0.3	1,707.03	64
J-27	1,540.00	0.5	1,707.16	72
J-28	1,520.00	0.5	1,707.20	81
J-30	1,510.00	0.5	1,706.90	85
J-31	1,515.00	0.0	1,707.07	83
J-33	1,485.00	4.2	1,697.09	92
J-34	1,500.00	0.5	1,701.43	87
J-35	1,485.00	0.7	1,698.18	92
J-36	1,465.00	2.9	1,689.71	97

FlexTable: Pipe Table

Active Scenario: Mad Day Plus Fire Flow

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (MGD)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-6	3,151	J-8	J-9	16.0	130.0	6.000	-1.1	1.17	0.000
P-7	2,464	J-6	J-10	16.0	130.0	6.000	0.8	0.90	0.000
P-8	2,764	J-10	J-11	16.0	130.0	6.000	0.3	0.29	0.000
P-9	2,702	J-12	J-13	36.0	130.0	6.000	11.7	2.56	0.001
P-10	5,478	J-13	J-14	24.0	130.0	12.000	4.1	2.01	0.001
P-11	3,588	J-14	J-15	24.0	130.0	6.000	2.9	1.42	0.000
P-12	2,677	J-15	J-11	24.0	130.0	6.000	2.7	1.35	0.000
P-13	3,278	J-9	J-13	16.0	130.0	6.000	-1.3	1.42	0.001
P-14	5,608	J-7	J-14	24.0	130.0	12.000	-0.3	0.14	0.000
P-15	2,453	J-16	J-17	16.0	130.0	6.000	0.0	0.00	0.000
P-16	2,584	J-17	J-18	16.0	130.0	6.000	0.1	0.12	0.000
P-17	2,955	J-18	J-19	16.0	130.0	6.000	1.9	2.13	0.001
P-18	2,541	J-19	J-20	16.0	130.0	6.000	1.4	1.53	0.001
P-19	2,592	J-20	J-21	16.0	130.0	6.000	1.6	1.72	0.001
P-20	3,590	J-21	J-22	16.0	130.0	6.000	1.1	1.25	0.000
P-21	5,213	J-22	J-11	16.0	130.0	12.000	-2.5	2.77	0.002
P-23	2,530	J-24	J-22	16.0	130.0	6.000	-3.0	3.35	0.003
P-24	3,769	J-24	J-25	16.0	130.0	6.000	1.8	2.03	0.001
P-26	3,138	J-26	J-27	16.0	130.0	6.000	-0.3	0.35	0.000
P-27	2,572	J-27	J-28	16.0	130.0	6.000	-0.2	0.20	0.000
P-28	1,656	J-30	J-31	16.0	130.0	6.000	-0.5	0.54	0.000
P-29	1,305	J-31	J-28	16.0	130.0	4.000	-0.5	0.54	0.000
P-30	3,046	J-34	J-28	16.0	130.0	6.000	-2.4	2.71	0.002
P-31	4,193	J-36	J-35	16.0	130.0	6.000	-2.6	2.86	0.002
P-32	2,043	J-36	J-25	16.0	130.0	6.000	-0.3	0.36	0.000
P-33	2,551	J-34	J-35	16.0	130.0	6.000	2.0	2.17	0.001
P-34	1,307	J-35	J-33	24.0	130.0	4.000	4.2	2.08	0.001
P-35	4,937	J-35	J-20	24.0	130.0	12.000	-5.6	2.74	0.001
P-37	4,932	J-28	J-18	24.0	130.0	12.000	-3.6	1.76	0.001
P-38	5,242	J-18	J-13	24.0	130.0	12.000	-5.9	2.90	0.001
P-39	5,239	J-20	J-14	24.0	130.0	12.000	-6.4	3.14	0.002
P-47	6,330	J-6	J-7	16.0	130.0	12.000	-0.8	0.90	0.000
P-48	2,370	J-7	J-8	16.0	130.0	6.000	-1.1	1.17	0.000
P-56	4,903	J-17	J-27	12.0	130.0	12.000	0.6	1.23	0.001
P-57	6,551	J-17	J-12	12.0	130.0	12.000	-1.0	2.05	0.002
P-59	2,036	R-2	J-12	100.0	130.0	0.000	12.7	0.36	0.000
P-61	2,437	R-1	J-14	100.0	130.0	0.000	6.0	0.17	0.000

FlexTable: Junction Table

Active Scenario: Peak Hour

Label	Elevation (ft)	Demand (MGD)	Hydraulic Grade (ft)	Pressure (psi)
J-6	1,495.00	0.0	1,699.05	88
J-7	1,535.00	0.9	1,703.18	73
J-8	1,550.00	0.0	1,705.76	67
J-9	1,545.00	0.4	1,709.08	71
J-10	1,490.00	0.9	1,697.39	90
J-11	1,485.00	0.8	1,697.16	92
J-12	1,560.00	0.0	1,720.00	69
J-13	1,540.00	0.8	1,714.05	75
J-14	1,515.00	0.9	1,703.25	81
J-15	1,500.00	0.3	1,699.68	86
J-16	1,560.00	0.0	1,693.13	58
J-17	1,545.00	0.5	1,693.13	64
J-18	1,530.00	0.8	1,693.09	71
J-19	1,510.00	0.9	1,683.47	75
J-20	1,500.00	1.1	1,678.91	77
J-21	1,485.00	0.7	1,673.16	81
J-22	1,470.00	1.0	1,668.90	86
J-24	1,465.00	2.0	1,649.25	80
J-25	1,455.00	2.6	1,638.34	79
J-26	1,560.00	0.5	1,684.79	54
J-27	1,540.00	0.8	1,685.14	63
J-28	1,520.00	0.8	1,685.25	71
J-30	1,510.00	0.8	1,684.44	75
J-31	1,515.00	0.0	1,684.90	74
J-33	1,485.00	7.2	1,657.88	75
J-34	1,500.00	0.8	1,669.67	73
J-35	1,485.00	1.2	1,660.87	76
J-36	1,465.00	4.9	1,638.08	75

FlexTable: Pipe Table

Active Scenario: Peak Hour

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Minor Loss Coefficient (Local)	Flow (MGD)	Velocity (ft/s)	Headloss Gradient (ft/ft)
P-6	3,151	J-8	J-9	16.0	130.0	6.000	-1.8	1.99	0.001
P-7	2,464	J-6	J-10	16.0	130.0	6.000	1.4	1.54	0.001
P-8	2,764	J-10	J-11	16.0	130.0	6.000	0.5	0.50	0.000
P-9	2,702	J-12	J-13	36.0	130.0	6.000	19.9	4.35	0.002
P-10	5,478	J-13	J-14	24.0	130.0	12.000	6.9	3.40	0.002
P-11	3,588	J-14	J-15	24.0	130.0	6.000	4.9	2.42	0.001
P-12	2,677	J-15	J-11	24.0	130.0	6.000	4.6	2.29	0.001
P-13	3,278	J-9	J-13	16.0	130.0	6.000	-2.2	2.42	0.002
P-14	5,608	J-7	J-14	24.0	130.0	12.000	-0.5	0.24	0.000
P-15	2,453	J-16	J-17	16.0	130.0	6.000	0.0	0.00	0.000
P-16	2,584	J-17	J-18	16.0	130.0	6.000	0.2	0.20	0.000
P-17	2,955	J-18	J-19	16.0	130.0	6.000	3.3	3.62	0.003
P-18	2,541	J-19	J-20	16.0	130.0	6.000	2.3	2.60	0.002
P-19	2,592	J-20	J-21	16.0	130.0	6.000	2.6	2.92	0.002
P-20	3,590	J-21	J-22	16.0	130.0	6.000	1.9	2.13	0.001
P-21	5,213	J-22	J-11	16.0	130.0	12.000	-4.2	4.71	0.005
P-23	2,530	J-24	J-22	16.0	130.0	6.000	-5.1	5.69	0.008
P-24	3,769	J-24	J-25	16.0	130.0	6.000	3.1	3.45	0.003
P-26	3,138	J-26	J-27	16.0	130.0	6.000	-0.5	0.60	0.000
P-27	2,572	J-27	J-28	16.0	130.0	6.000	-0.3	0.34	0.000
P-28	1,656	J-30	J-31	16.0	130.0	6.000	-0.8	0.92	0.000
P-29	1,305	J-31	J-28	16.0	130.0	4.000	-0.8	0.92	0.000
P-30	3,046	J-34	J-28	16.0	130.0	6.000	-4.2	4.61	0.005
P-31	4,193	J-36	J-35	16.0	130.0	6.000	-4.4	4.86	0.005
P-32	2,043	J-36	J-25	16.0	130.0	6.000	-0.6	0.62	0.000
P-33	2,551	J-34	J-35	16.0	130.0	6.000	3.3	3.69	0.003
P-34	1,307	J-35	J-33	24.0	130.0	4.000	7.2	3.53	0.002
P-35	4,937	J-35	J-20	24.0	130.0	12.000	-9.5	4.66	0.004
P-37	4,932	J-28	J-18	24.0	130.0	12.000	-6.1	3.00	0.002
P-38	5,242	J-18	J-13	24.0	130.0	12.000	-10.0	4.93	0.004
P-39	5,239	J-20	J-14	24.0	130.0	12.000	-10.8	5.33	0.005
P-47	6,330	J-6	J-7	16.0	130.0	12.000	-1.4	1.54	0.001
P-48	2,370	J-7	J-8	16.0	130.0	6.000	-1.8	1.99	0.001
P-56	4,903	J-17	J-27	12.0	130.0	12.000	1.1	2.11	0.002
P-57	6,551	J-17	J-12	12.0	130.0	12.000	-1.8	3.51	0.004
P-59	2,036	R-2	J-12	100.0	130.0	0.000	21.6	0.61	0.000
P-61	2,437	R-1	J-14	100.0	130.0	0.000	10.2	0.29	0.000

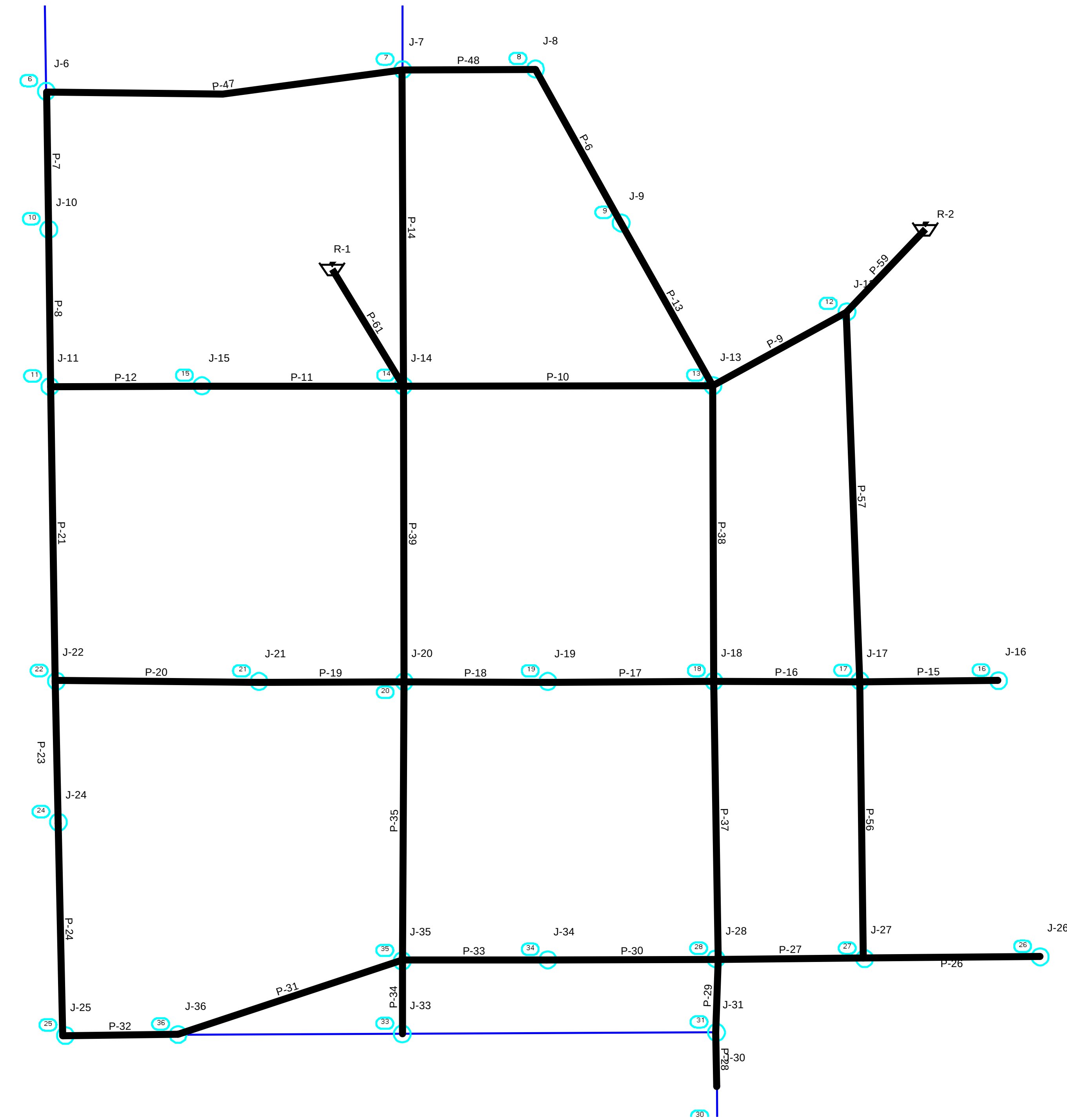
FlexTable: Reservoir Table

Active Scenario: Peak Hour

Label	Elevation (ft)	Flow (Out net) (MGD)	Hydraulic Grade (ft)	Zone
R-1	1,703.25	10.2	1,703.25	LD1
R-2	1,720.00	21.6	1,720.00	LD1

Scenario: Mad Day Plus Fire Flow

Active Scenario: Mad Day Plus Fire Flow



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666

APPENDIX L

LD 8500 - Auction Parcel
Conceptual Opinion of Probable Cost

Water Unit Cost Assumptions

	Unit Costs Per L.F.			
Water Pipe Size	Pipe	Valve[(1)]	Fire Hydrant[(2)]	Vertical Realignment[(3)]
8	$ 60	$ 2,000	$ 5,000	$ 2,000
12	$ 70	$ 3,000	$ 5,000	$ 4,000
16	$ 100	$ 8,000	$ 9,500	$ 8,000
24	$ 180	$ 20,000	$ 9,500	$ 10,000

(1) Assumes 1,000 foot valve spacing per Apache Junction Engineering Guidelines
(2) Assumes 500 foot fire hydrant spacing per Apache Junction Engineering Guidelines
(3) Assumes 1 Vertical Alignment per 1/4 mile of waterline

LD 8500 - Auction Parcel

Arterial Roadway Water Infrastructure Conceptual OPC

Item	Unit	Quantity	Sewer Pipe Size (Inches)	Unit Price	Total
8" D.I.P Water Line	LF	8,952	8	$ 60	$ 537,120
8" Gate Valve, Box, and Cover(1)	EA	9	8	$ 2,000	$ 17,904
8" Vertical Realignment (3)	EA	7	8	$ 2,000	$ 13,772
16" DIP Water Pipe	LF	36,730	16	$ 100	$ 3,673,000
16" Gate Valve, Box, and Cover(1)	EA	37	16	$ 8,000	$ 293,840
16" Vertical Realignment (3)	EA	28	16	$ 8,000	$ 226,031
24" D.I.P Water Line	LF	27,340	24	$ 180	$ 4,921,200
24" Gate Valve, Box, and Cover (1)	EA	27	24	$ 20,000	$ 546,800
24" Vertical Realignment (3)	EA	21	24	$ 10,000	$ 210,308
Fire Hydrant Assembly for 12" or smaller (2)	EA	18	12	$ 5,000	$ 89,520
Fire Hydrant Assembly for 16" or larger (2)	EA	128	16	$ 9,500	$ 1,217,330
				Subtotal	$ 11,746,825
			Contingency	15.0%	$ 1,762,024
				Arterial Water Infrastructure Total	$ 13,508,848

Infrastructure Construction, Development, Permit Fee	% of Infrastructure Costs	
Construction Surveying	2%	$270,177
Mobilization / De - Mobilization	1%	$135,088
Post Design Services	1%	$135,088
Preliminary Design	3%	$405,265
Final Design	6%	$810,531
Plan Review	2%	$270,177
Agency Permit	2%	$270,177
Tax Rate (65% of 9.6%)	6.2%	$842,952
	Subtotal	$ 3,139,456
	Total	$ 16,648,305

Facilities					
Item	Unit	Quantity		Unit Price	Total
Ex. CAP Treatment Facility Improvements (4)	LS	1		$12,800,000	$12,800,000
Booster Facility Site # 1 with Storage (5)(6)	LS	1		$10,000,000	$10,000,000
Groundwater Recovery Well Site (7)	LS	1		$3,700,000	$3,700,000
24" D.I.P CAP Transmission (8)	LF	13000		$180	$2,340,000
				Facility Subtotal	$ 28,840,000
			Contingency	20.0%	$ 5,768,000
				Facility Total	$ 34,608,000

Facility Construction, Development, Permit Fee	% of Infrastructure Costs	
Mobilization / De - Mobilization	1%	$346,080
Construction Management/Post Design Services	6%	$2,076,480
Preliminary Design	3%	$1,038,240
Final Design	6%	$2,076,480
Plan Review	2%	$692,160
Agency Permit	2%	$692,160
Tax Rate (65% of 9.6%)	6.2%	$2,159,539
	Subtotal	$ 9,081,139
	Total	$ 43,689,139
	Auction Water Infrastructure/Facility Total	$ 60,337,444

The Conceptual Opinion of Probable Cost above was prepared based on limited information available and the ENGINEER's understanding of the project. Since the ENGINEER has no control over labor, materials, equipment or services furnished by others or over the Contractor(s)' method of determining prices, or over the competitive bidding or market conditions; the opinions of probable costs provided herein are made on the basis of experience and qualifications. The opinions of probable costs represents the best judgment as an engineer, familiar with the construction industry; but the ENGINEER cannot and does not guarantee that proposals, bids or actual project or construction cost will not vary from the opinion of probable cost.

Notes/Assumptions:

(1) 1000' valve spacing per AJEGP.

(2) 500' hydrant spacing per AJEGP.

(3) Assumes 1 Vertical Alignment per 1/4 mile of waterline.

(4) Pipe and fittings shall be ductile iron per Apache Junction Engineering Design Guidelines and Policies (AJED).

(5) Per discussions with Apache Junction Water District (AJWD), 2MGD expansions, up to 6MGD total. Estimate includes expansion of solids facility building. Assumed to be constructed in 3 Phases (2MGD Expansions).

(6) Storage Volume assumed to be max day demand + fire flow for 2-hour rating (3000 gpm for 60 minutes). 4MG Estimated for Auction Demand.

(7) Booster Facility to serve initial auction demands. Booster sized for peak hour demands per AJEGP. Includes standby power and sodium hypochlorite system. Vertical turbine pumps (VFD driven) system.

(8) Groundwater Recovery Well Site to serve initial auction demands. Estimate includes drilling, equipping, and on-site treatment. Assumed 1000 gpm rate, 200HP. Includes estimated standby power and hypochlorite disinfection system. Per discussions with AJWD, groundwater well capabilities to serve 20% of the total project demands, 80% surface source.

(9) Transmission line from Existing CAP treatment facility to Booster Facility #1 with Storage per discussions with AJWD.

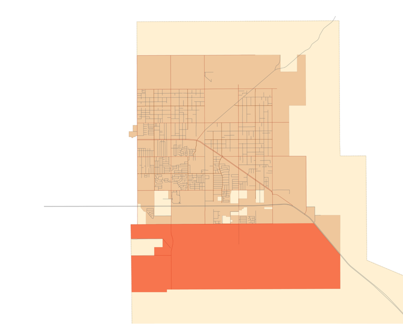
APPENDIX M

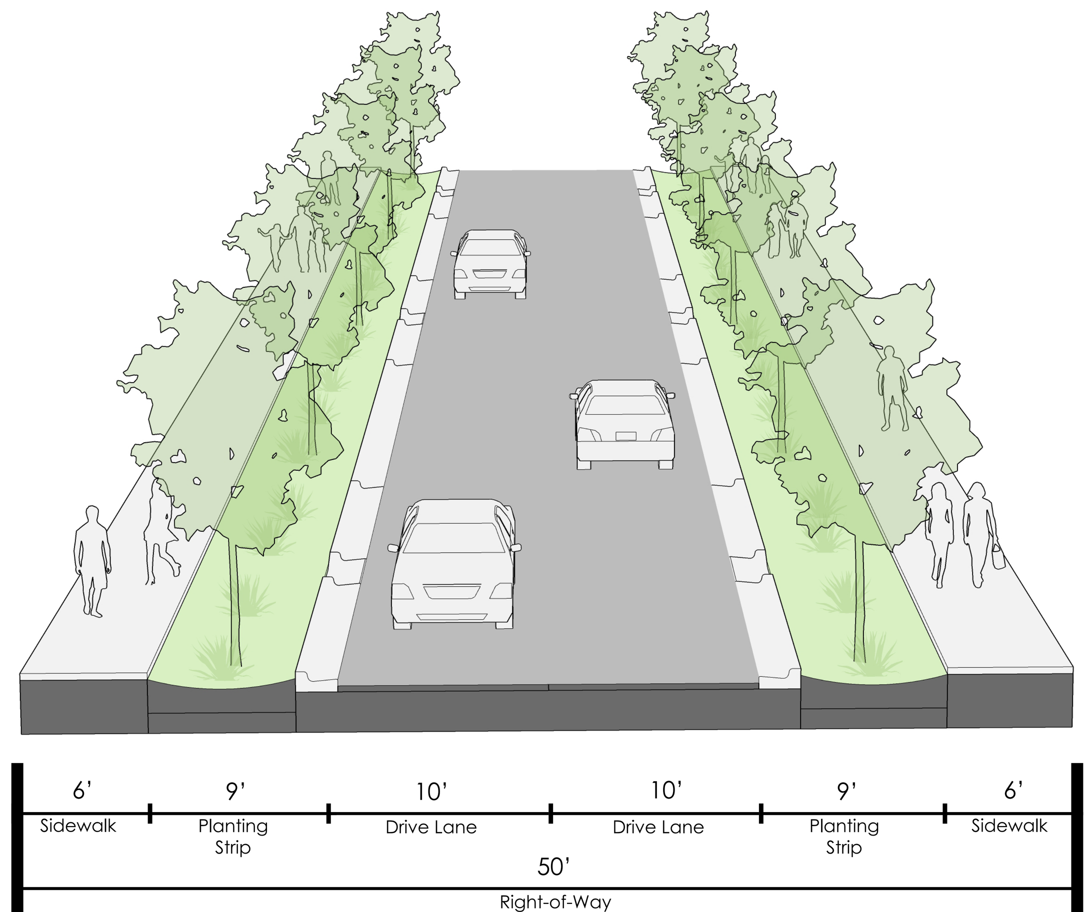
Lost Dutchmen Heights Streets (LDH)

Apache Junction
Active Transportation Plan
December 20, 2018

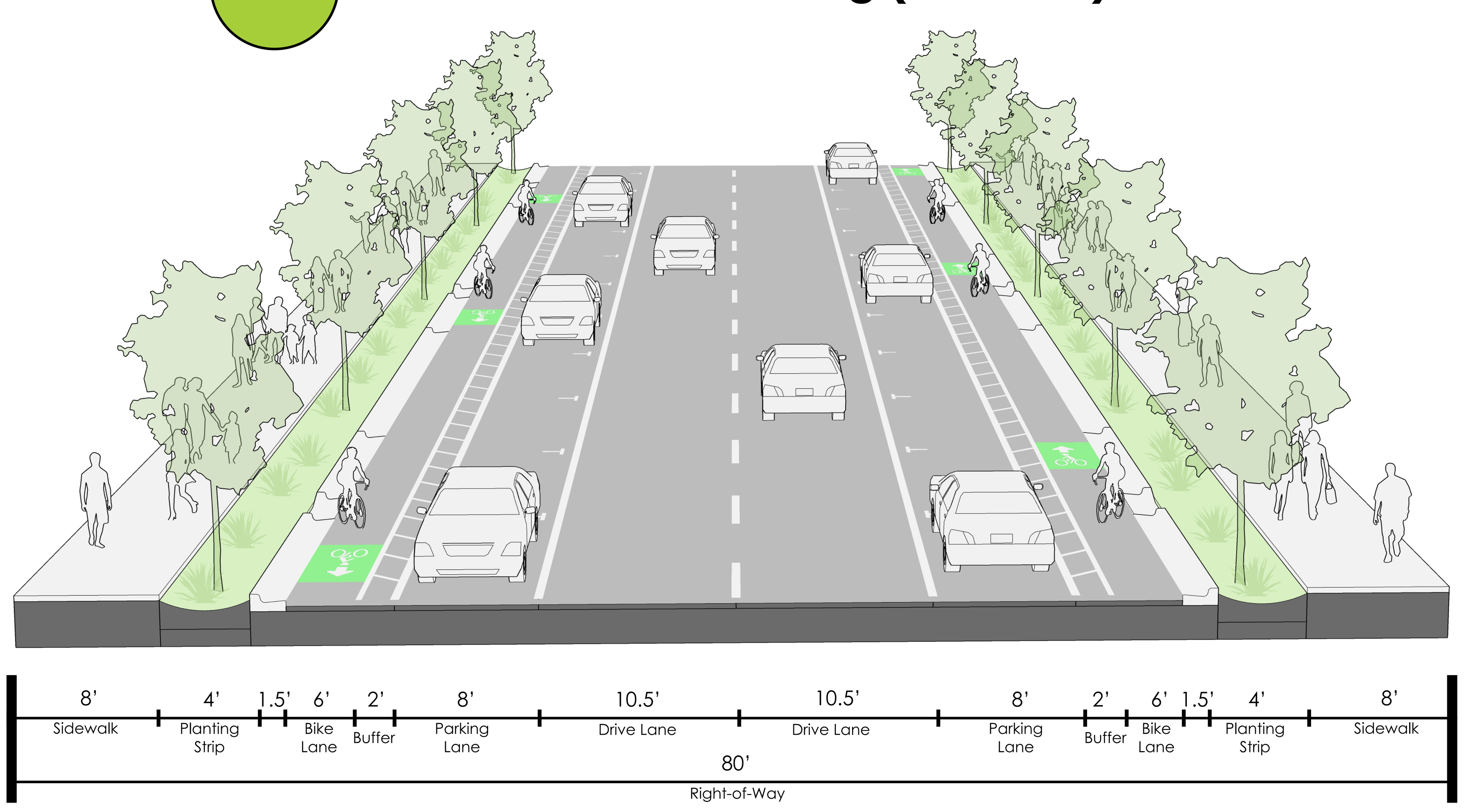
LDH - Neighborhood (50' ROW)

KEY MAP

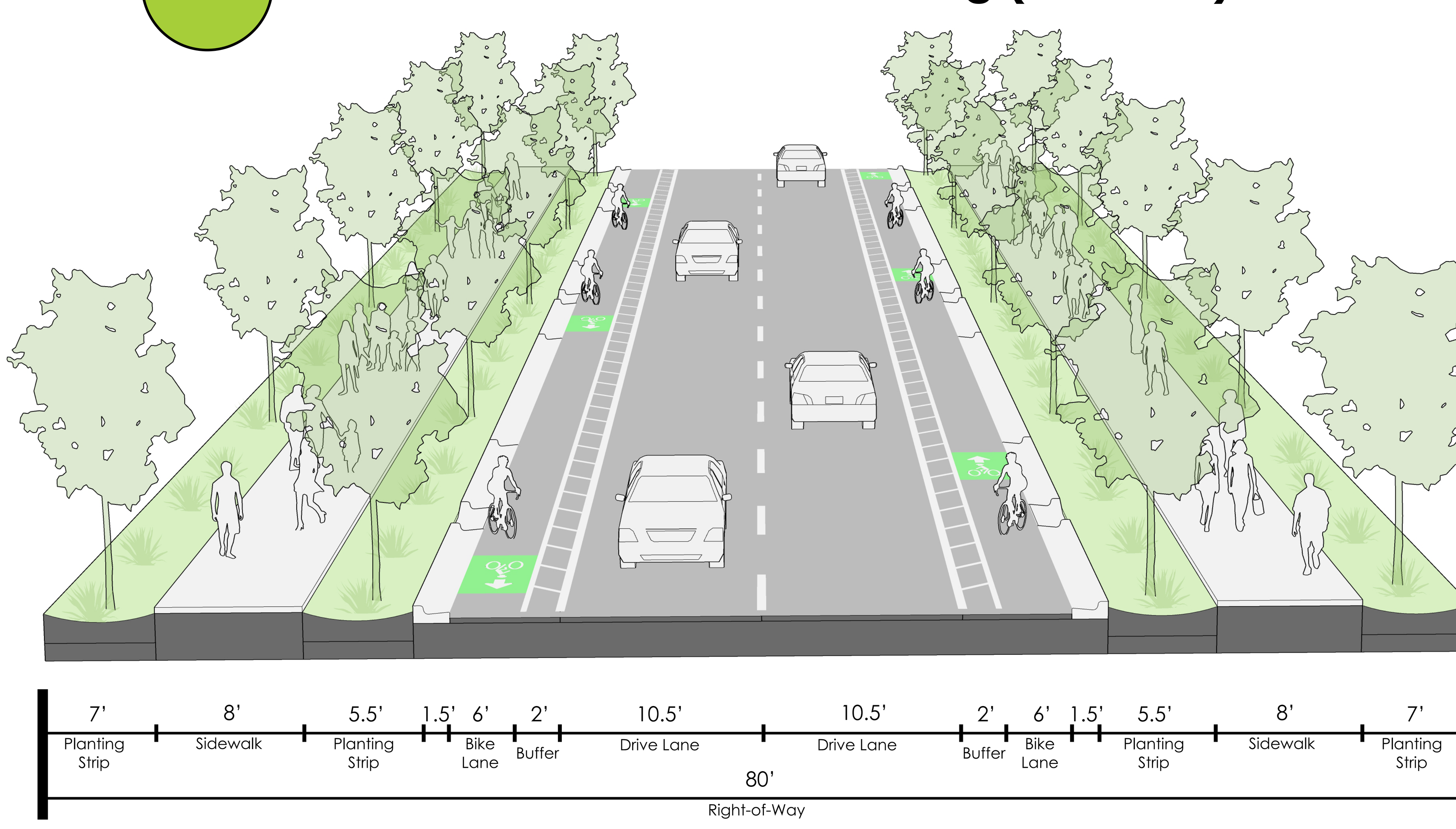




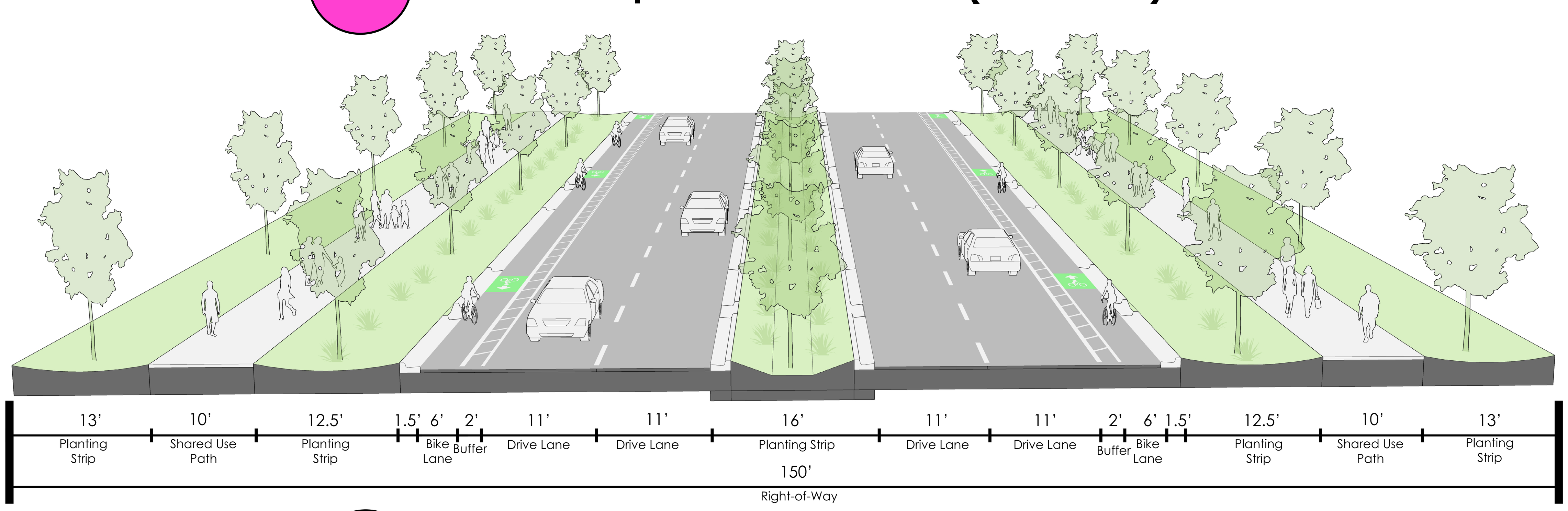
LDH - Collector Parking (80' ROW)



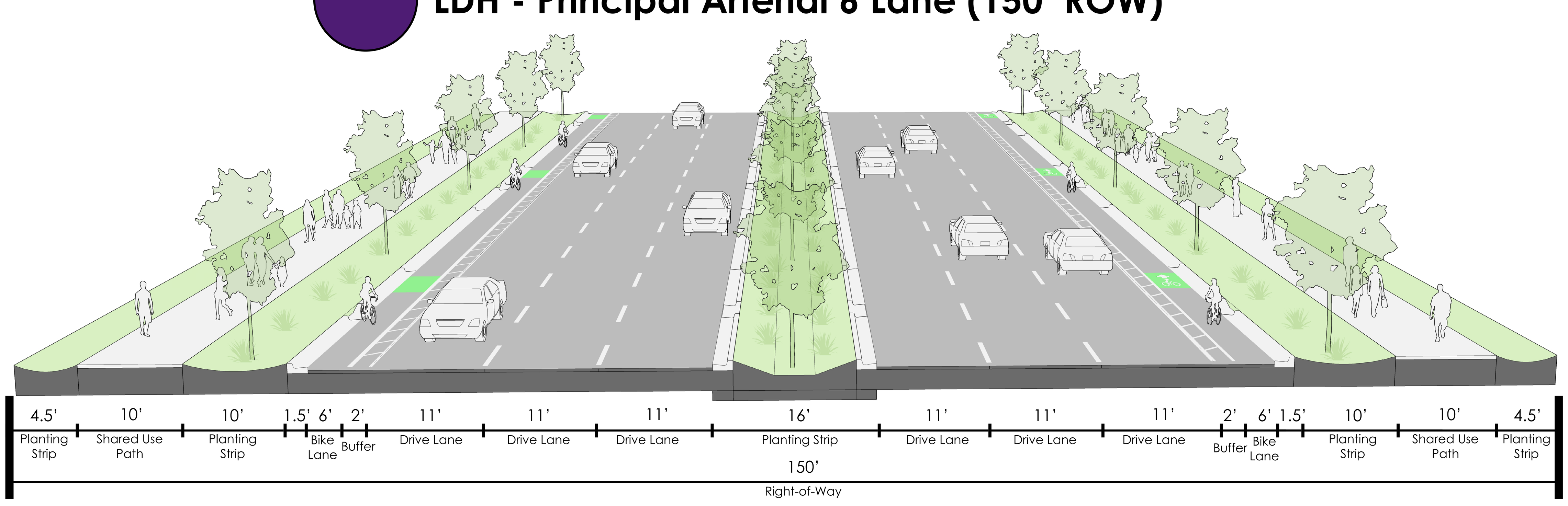
LDH - Collector without Parking (80' ROW)



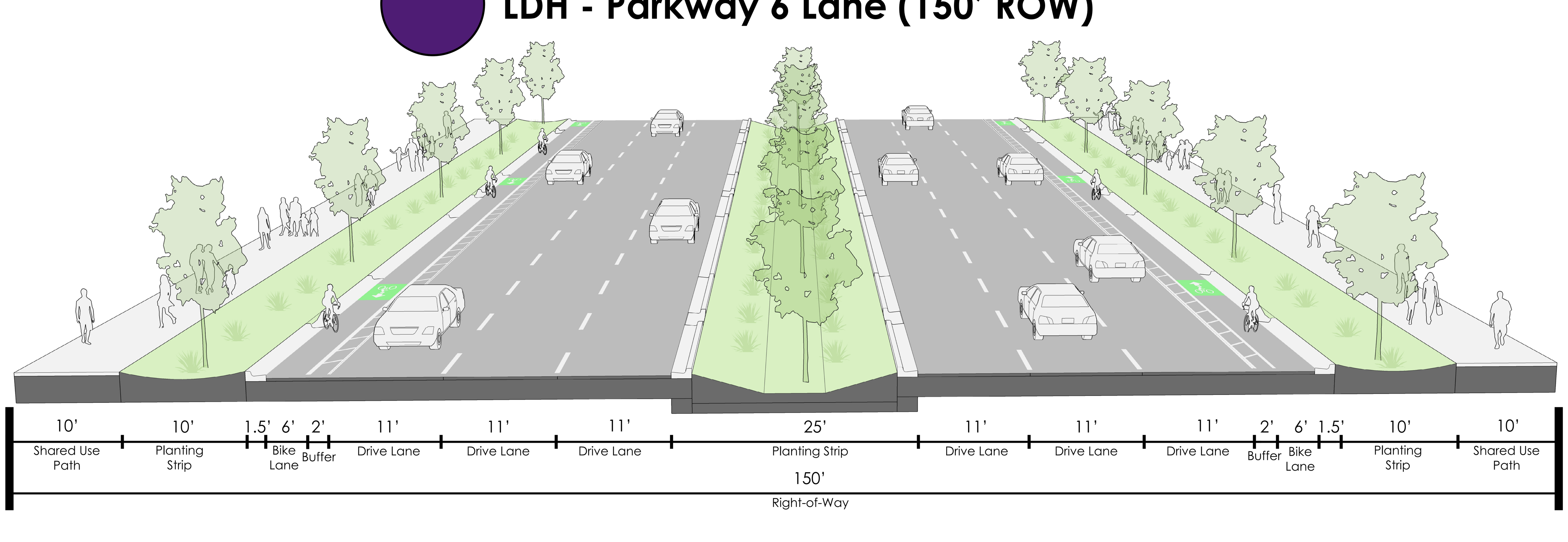
LDH - Principal Arterial 4 Lane (150' ROW)



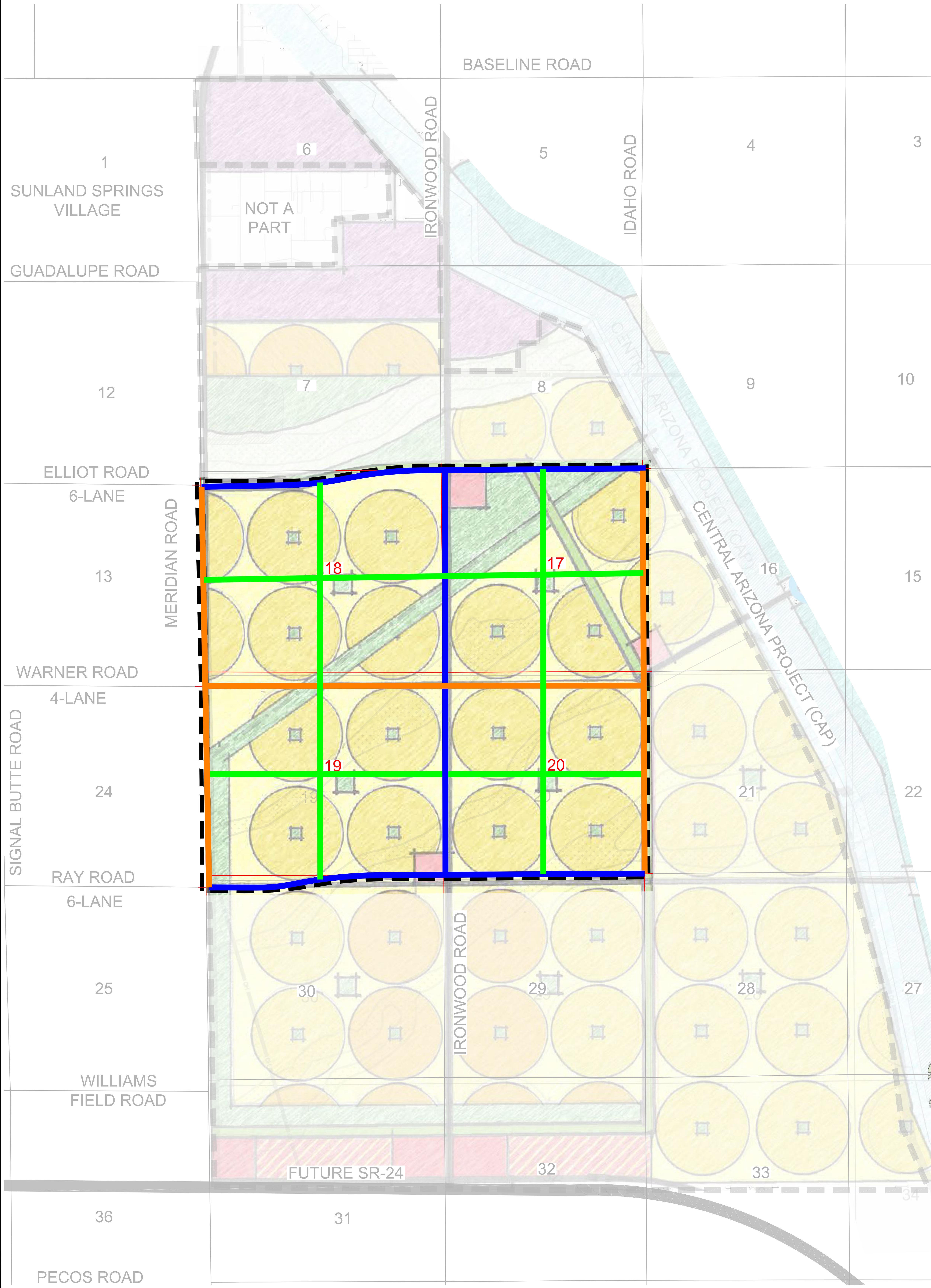
LDH - Principal Arterial 6 Lane (150' ROW)



LDH - Parkway 6 Lane (150' ROW)



APPENDIX N



LEGEND

OVERALL PLANNING AREA (8,090± ACRES)

AUCTION PARCEL (2,783± ACRES)

6-LANE SECTION LINE ARTERIAL

4-LANE SECTION LINE ARTERIAL

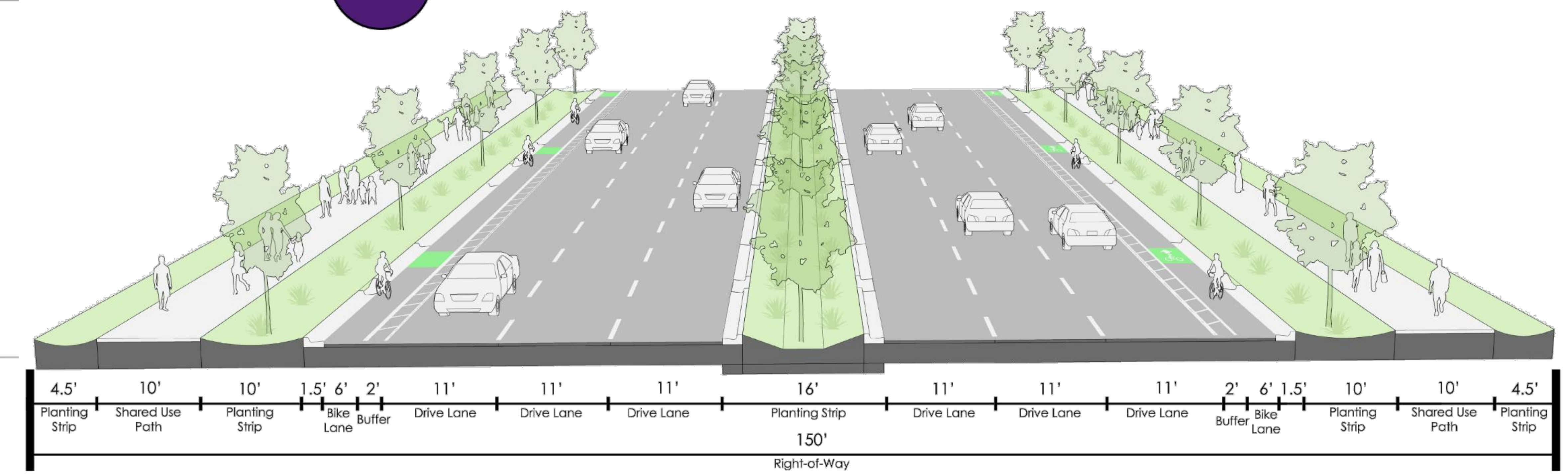
COLLECTOR STREET

SECTION

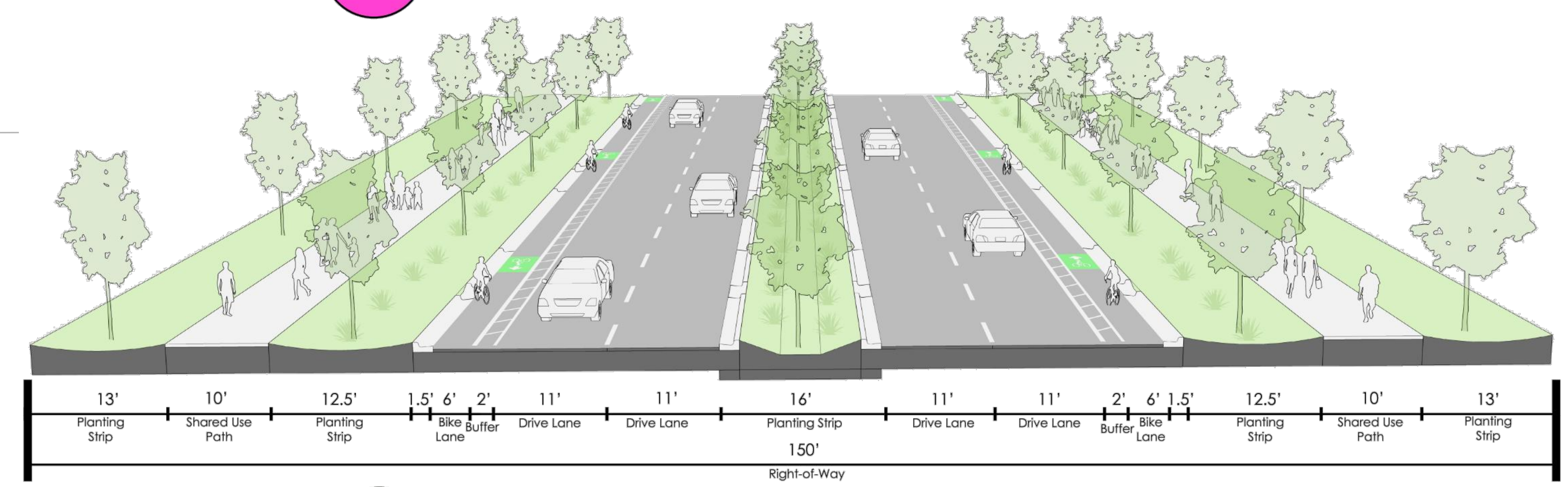
NORTH

GRAPHIC SCALE IN FEET
0 750 1500 3000

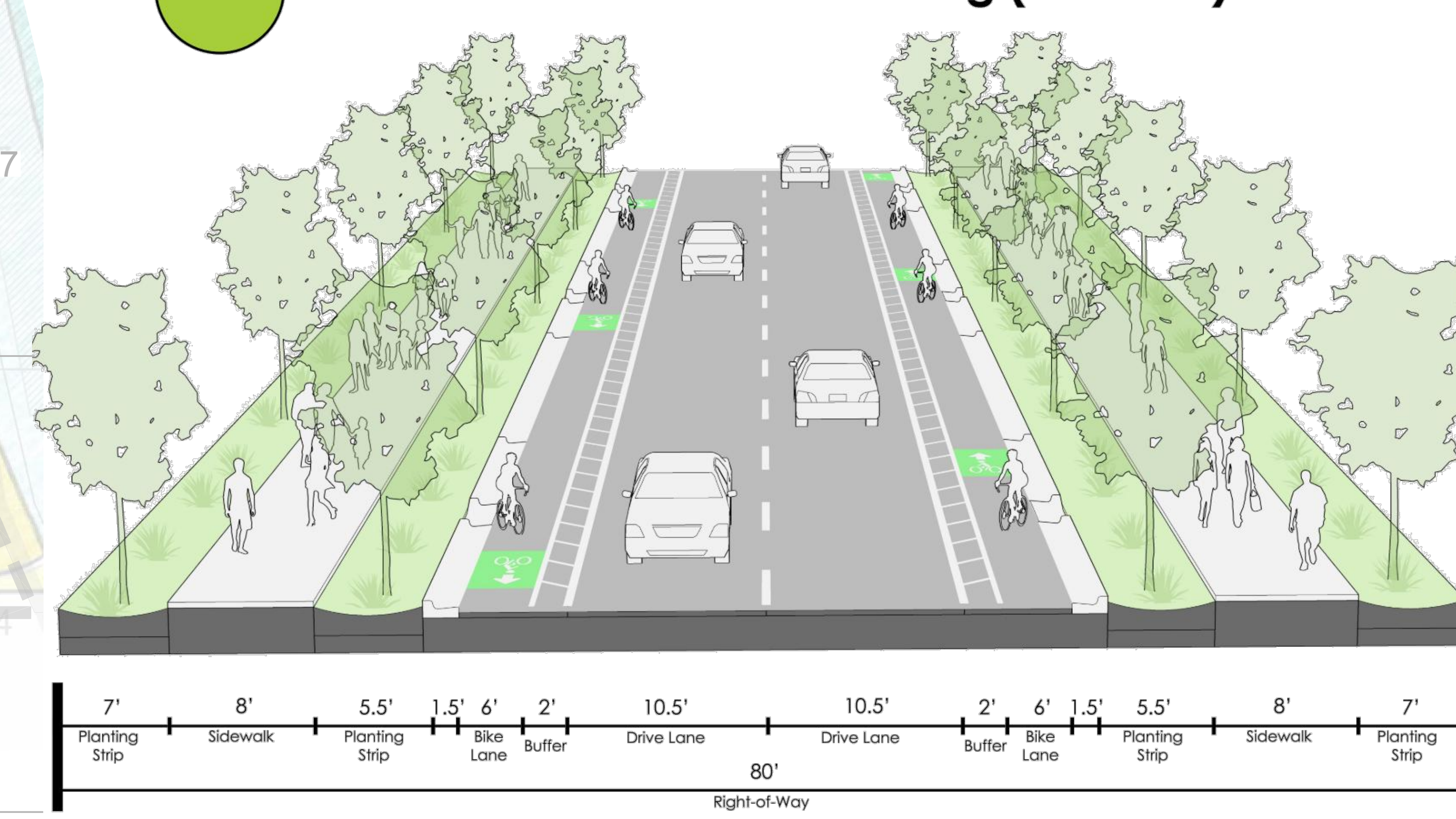
LDH - Principal Arterial 6 Lane (150' ROW)



LDH - Principal Arterial 4 Lane (150' ROW)



LDH - Collector without Parking (80' ROW)



NOTES:

1. ROADWAY SECTIONS ARE CONCEPTUAL BASED ON THE CITY OF APACHE JUNCTION'S ACTIVE TRANSPORTATION PLAN AND ARE SUBJECT TO REVIEW AND APPROVAL BY THE CITY OF APACHE JUNCTION AND SUBJECT TO CHANGE. ANTICIPATED SECTION ROADWAY IMPROVEMENTS INCLUDE 2 MILES OF LDH–PRINCIPAL 6–LANE ARTERIAL (150' ROW), 2 MILES OF LDH–PRINCIPAL 4–LANE ARTERIAL (150' ROW), AND 2 MILES OF LDH COLLECTOR WITHOUT PARKING (80' ROW).

2. ROADWAY IMPROVEMENTS INCLUDE ALL PAVEMENT/SUBGRADE, CURB & GUTTER, STORM–DRAIN AND STORMWATER SYSTEMS, MEDIANS, SIDEWALKS, LANDSCAPING, DRY AND WET UTILITIES, AND STREET LIGHTING PER CITY OF APACHE JUNCTION STANDARDS. SUBJECT TO REVIEW & APPROVAL BY CITY OF APACHE JUNCTION.

No.	REVISIONS	DATE	BY

Kimley»Horn

1001 WEST SOUTHERN AVENUE, SUITE 131
MESA, ARIZONA 85202 (480) 207-2666

KHA PROJECT	
DATE	OCT. 2019
SCALE	AS SHOWN
DESIGNED BY	ZJH
DRAWN BY	TAF
CHECKED BY	JMB

CONCEPTUAL
NOT FOR CONSTRUCTION
SUBJECT TO
ENGINEERING AND CITY
REVIEW AND APPROVAL

CONCEPTUAL ROADWAY
INFRASTRUCTURE EXHIBIT

ASLD 8500 AUCTION PARCEL

PINAL COUNTY ARIZONA

SHEET NUMBER

APPENDIX O

LD 8500 Date: 11/18/2019

Auction Parcel Roadway Infrastructure OPC

Kimley»Horn

Auction Parcel Roadway Infrastructure Cost Per Section

Section Improvements		(Miles) 1/2 Street 6-lane	(Miles) 1/2 Street 4-lane	Quantities (Miles) Full Street Collector	(Miles) 1/2 Street Ironwood	(EA) Signals		Cost
	17	1	1.6	2	1	3	$	20,552,400.00
	18	1.2	2.2	2	1	3	$	23,113,200.00
	19	1.2	2.2	2	1	3	$	23,113,200.00
	20	1	2	2	1	3	$	21,819,600.00
						Total	$	88,598,400

Auction Transportation Facility Costs

Street Improvements	Cost Per L.F.	Each Signal	Cost Per Mile
6-Lane 1/2 Street Section	$625	-	$ 3,300,000.0
4-Lane 1/2 Street Section	$600	-	$ 3,168,000.0
Collector Full Street Section	$850	-	$ 4,488,000.0
Ironwood 1/2 Street Widening	$420	-	$ 2,217,600.0
Signal (Each Intersection)	-	$330,000	-

The Conceptual Opinion of Probable Cost above was prepared based on limited information available and the ENGINEER's understanding of the project. Since the ENGINEER has no control over labor, materials, equipment or services furnished by others or over the Contractor(s)' method of determining prices, or over the competitive bidding or market conditions; the opinions of probable costs provided herein are made on the basis of experience and qualifications. The opinions of probable costs represents the best judgment as an engineer, familiar with the construction industry; but the ENGINEER cannot and does not guarantee that proposals, bids or actual project or construction cost will not vary from the opinion of probable cost.

Notes/Assumptions:

(1) Cost per linear foot (L.F.) for each roadway section estimates 35% additional costs for contingency, mobilization/de-mobilization, design fees, plan review fees, agency permit fees, and taxes included.

(2) Street drainage assumed to be captured via catch basins to roadside retention, no underground storm drain system anticipated.

(3) 6-Lane, 4-Lane, and Ironwood Road widening excludes water and sewer infrastructure costs (provided per separate OPC for arterial roadways). Collector roadways include an assumption of 8 inch sewer and 12-inch water pipe construction in the per L.F. cost.

(4) Arterial pavement section assumed to be 5.5"AC on 12" ABC. Collector pavement section assumed to be 4" on 8" ABC.

(5) Street lighting and dry utility trenching estimate included. Street light spacing assumed at 200' spacing.

APPENDIX P

drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

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

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' NAVD 88. Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations shown in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 12. The **horizontal datum** was NAD 83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

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

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

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1992 or later.

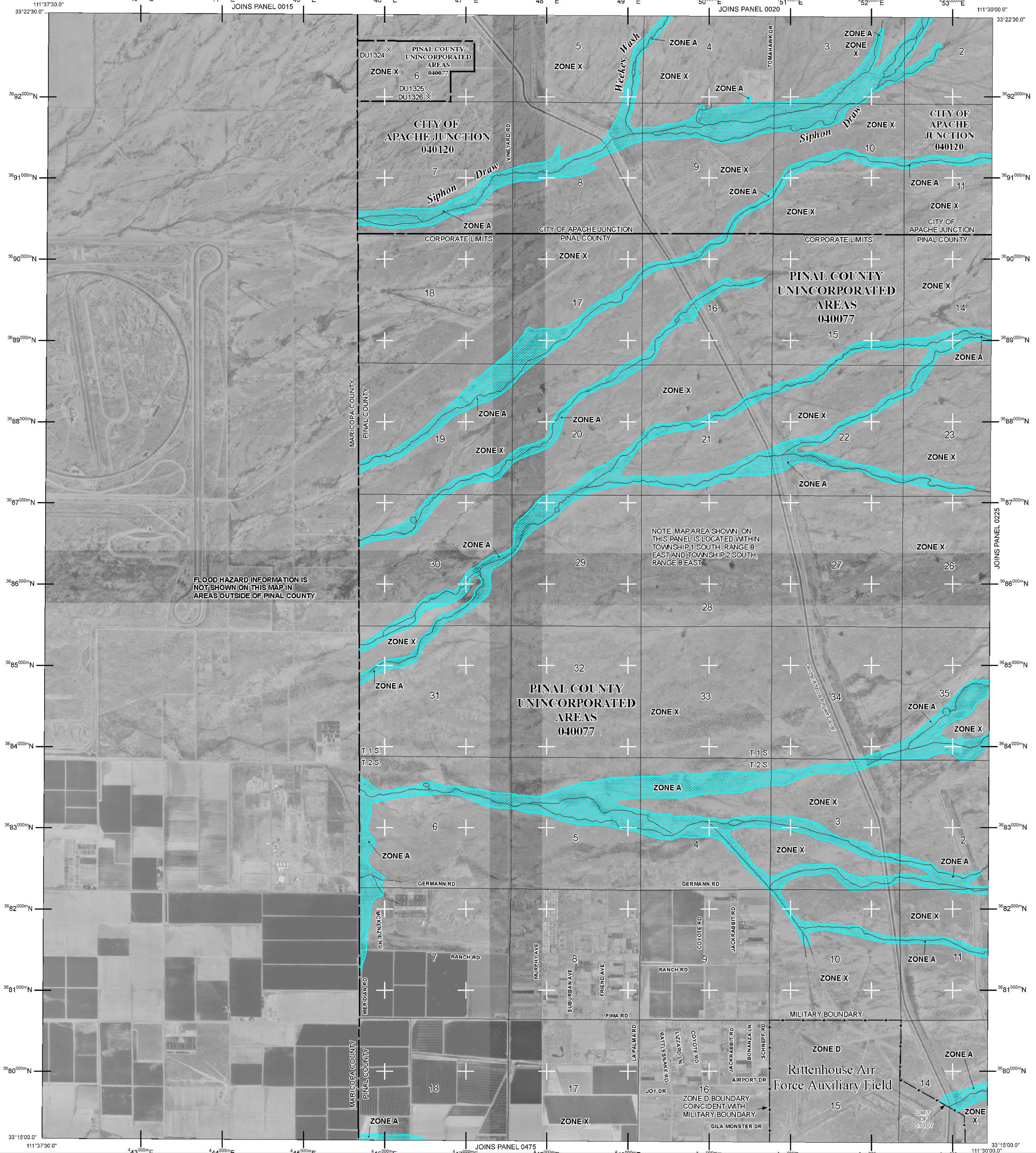
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result,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

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

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

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

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



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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - - 23	Transect line
97° 07' 30", 32° 22' 30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4276^{000M}	1000-meter Universal Transverse Mercator grid values, zone 12
600000 FT	5000-foot grid ticks: Arizona State Plane coordinate system, central zone (FIPSZONE 0202), Transverse Mercator
DX5510 x	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
December 4, 2007
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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

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

N

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

PANEL 0200E

NATIONAL FLOOD INSURANCE PROGRAM

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

PANEL 200 OF 2575

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PINAL COUNTY, UNINCORPORATED AREAS	040077	0200	E
APACHE JUNCTION, CITY OF	040120	0200	E

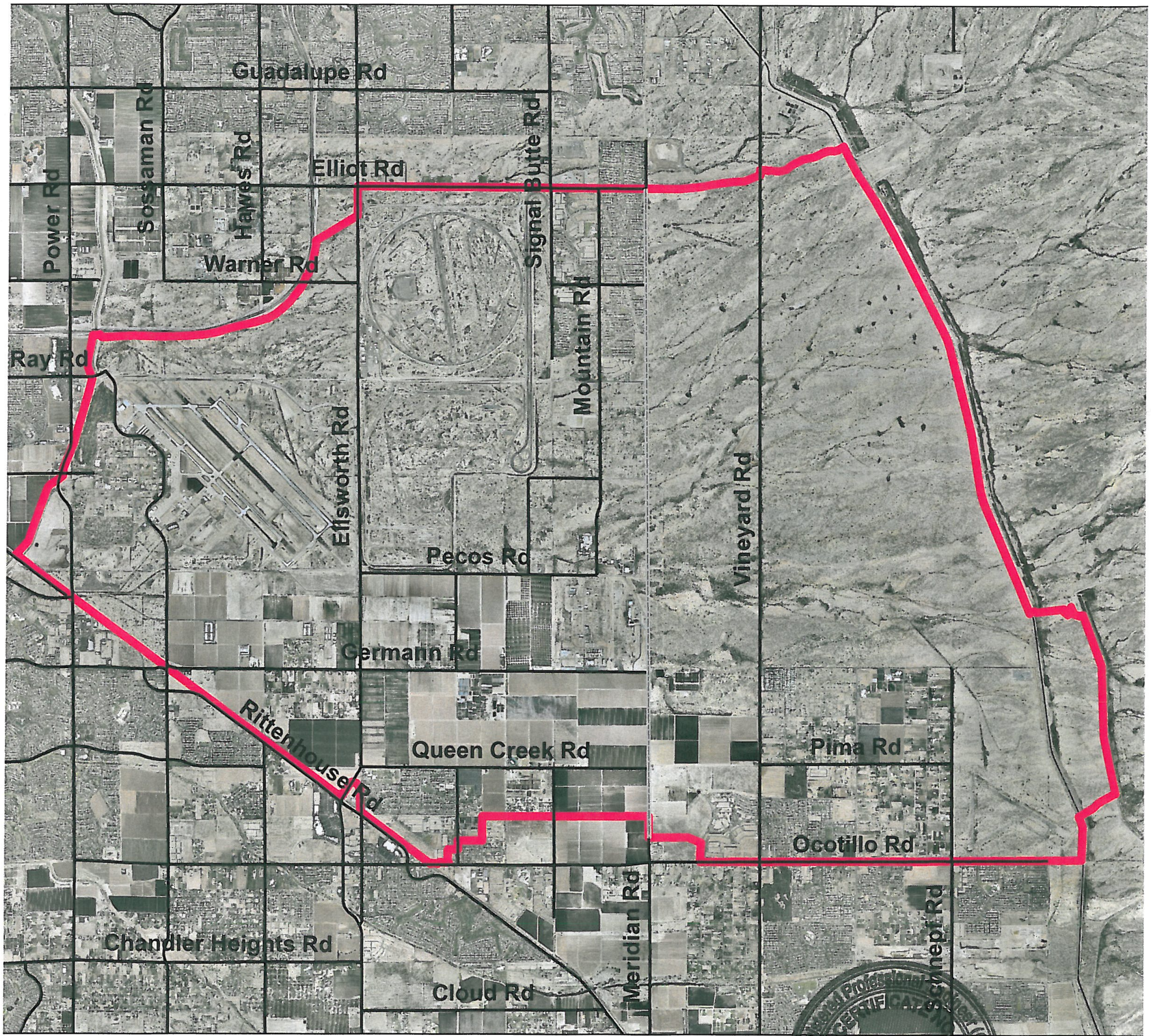
Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject

MAP NUMBER
04021C0200E

EFFECTIVE DATE

APPENDIX Q

East Mesa Area Drainage Master Plan Update



Prepared by:
Flood Control District of Maricopa County
Engineering Division
Hydrology & Hydraulics Branch
August 2011

Registered Professional Engineer (Civil)
CERTIFICATE NO.
37883
CATHERINE WEDIG
REGESTER
Date Signed 8/11/11
ARIZONA, U.S.A.

EXPIRES 9/30/11

East Mesa Area Drainage Master Plan Update

Hydrologic Analysis

Registered Professional Engineer (Civil)
CERTIFICATE NO. 37883
CATHERINE WEDIG REGESTER
Date Signed 8/11/11
ARIZONA, U.S.A.

Catherine J. Regester

EXPIRES 9/30/11

Table of Contents

List of Tables

List of Exhibits

List of Appendices

Appendix E – Maps

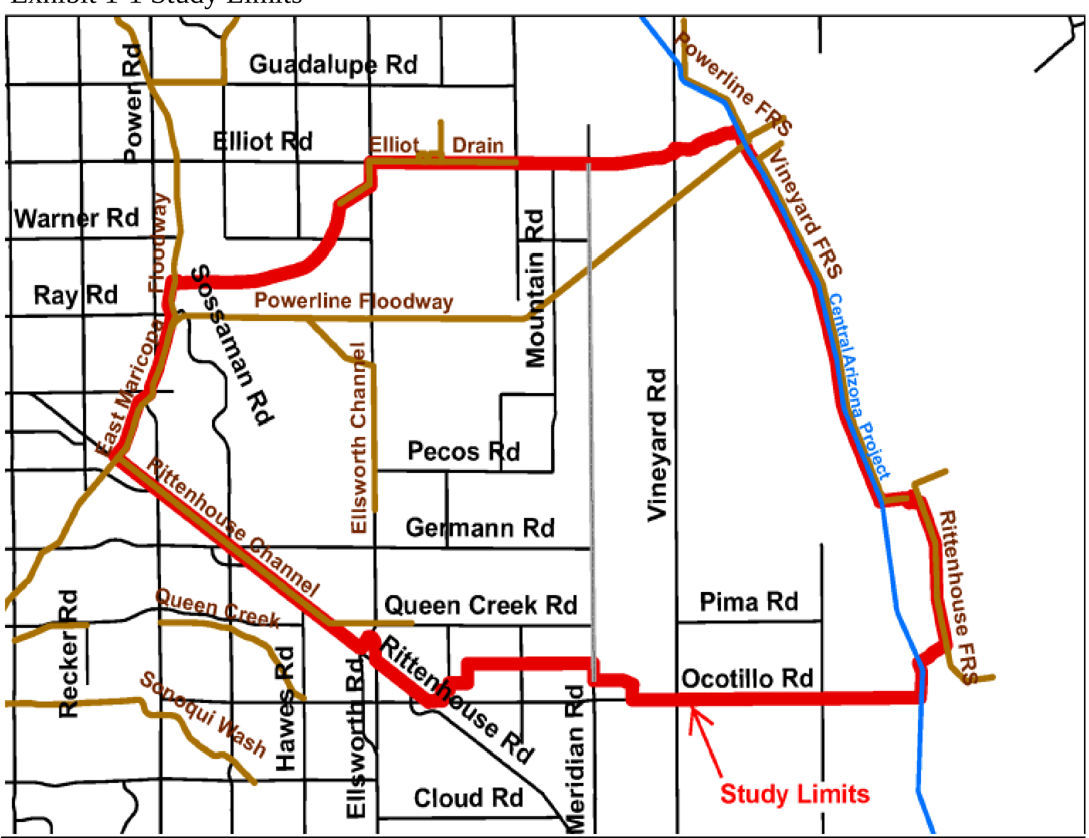
East Mesa Area Drainage Master Plan (ADMP) Update Hydrologic Analysis

Section 1: Introduction

The purpose of this study was to develop new regional hydrologic models for a portion of the East Mesa Area Drainage Master Plan (EMADMP) study area generally bounded on the west by East Maricopa Floodway (EMF) and the Loop 202 freeway, on the north by Elliott Road, on the south by Ocotillo Road and Rittenhouse Channel, and on the east generally by the Central Arizona Project Canal (CAP) (See Exhibit 1-1); and, to analyze the hydraulic capacity of the Powerline Floodway, Ellsworth Channel, and the Rittenhouse Channel considering the newly developed hydrology.

The analyses were to utilize the new NOAA 14 rainfall depth. The scope of work included data collection, development of existing conditions hydrologic models, preparation of future conditions hydrologic models, comparison of the results with the previous models for the study area, and hydraulic analysis of existing drainage structures within the study area.

Exhibit 1-1 Study Limits



The user of this study should note that the hydrologic and hydraulic models developed under this study are for regional planning purposes and are not necessarily of the level of detail required for individual site development, design, and/or construction.

1.1 Reported and Observed Flooding

In March 2009, a mailer was sent out to residents in the East Mesa ADMP Update planning area requesting information on any known flooding issues. The following is a summary of the responses:

- Flooding at the intersection of Mountain Road and Williams Field Road with every storm event. Residents have no way to travel north with Mountain Road being the only thru north street.
- Flooding issues described as unsurpassable on Mountain Road between Warner and Pecos Roads.
- During heavy rains, a wash backed up and flooded a garage on Ivanhoe Street with 4 inches of water.

Photos were provided for a storm event occurring on September 9, 2006 in the vicinity of Galveston and Mountain Roads. Precipitation records at the District's Williams Field Road Gage (ID #6575, located at Meridian Road, ¼ mile north of Williams Field Road) showed 0.91 inches of rainfall on September 7, 2006 followed by 1.57 inches of rainfall on September 9, 2006. As of June 2011, the September 9, 2006 storm yielded the greatest 15 minute rainfall (0.83 inches), the greatest 1 hour rainfall (1.50 inches), and the greatest 3 hour rainfall (1.57 inches) recorded at this gage (established July 3, 2001).

Photo 1: Galveston Road. Looking east from intersection of Mountain and Galveston Roads. (September 9, 2006)

Photo 2: Mountain Road. Looking north from intersection of Mountain and Galveston Roads. (September 9, 2006)

Flooding has also been reported along Erie Street which is just south of and runs parallel to Galveston Road.

On December 29 and 30, 2010, a storm event resulted in the flooding of a portion of Mountain Road just north of the intersection with Williams Field Road. The District's Williams Field Road Gage reported a total rainfall of 0.71 inches over this two day period.

Photo 3: Mountain Road. Looking north from intersection of Mountain and Williams Field Roads. (December 30, 2010)

In the early 1990s, an agricultural berm along the Meridian Road alignment, just south of the intersection with Germann Road, breached during a storm event and produced flooding in the crop field to the west. Photos of the breach may be found in *Section 6.1.1 Existing Conditions* of this report.

Section 2: Local Government Abstract

Section not applicable.

Section 3: Survey and Mapping Information

3.1 Field Survey Information

The District performed field survey for supplemental information and verification of the HEC-RAS modeling of the Rittenhouse Channel, the CAP canal, and Powerline Floodway. Survey data as described below and photographs of the culverts may be found in Appendix B.

- Rittenhouse Channel: On July 15 and 16, 2009, the District surveyed seven drop structures in the channel, starting with the structure at the confluence with the EMF and the next six structures upstream of that structure. Inlet/outlet invert elevations at the Power and Pecos Roads culverts were also obtained.

- CAP: On December 1, 2009, the District surveyed the inlet/outlet invert and headwall elevations for the pipe crossing the CAP which connects Subbasin E7 to existing conditions Subbasin E6/future conditions Subbasin E6B.

- Powerline Floodway: On March 4, 2010, the District surveyed two culverts on the General Motors Proving Ground site. The first was located approximately 1300 ft east of Ellsworth Rd. The second was located approximately 1200 ft west of the Signal Butte Rd alignment. Both culverts were constructed recently.

3.2 Mapping

Four topographic mapping sources were utilized in the study. Approximate coverage areas within the study area and details of the mappings are as follows:

- *Desert Drive Area Mapping*

  Location: East of Meridian Rd, south of the Elliot Rd alignment, and north of Germann Rd;
  Contour interval: 2 ft;
  Vertical Datum: NAVD 1988;
  Flight date: 4/13/2006;
  Source: Mapping provided by the Arizona State Land Department (ASLD).

- *Lost Dutchman Heights Mapping*

  Location: East of Meridian Rd and north of the Elliot Rd alignment;
  Contour interval: 2 ft;
  Vertical Datum: NAVD 1988;
  Flight date: 5/25/2007;
  Source: Mapping provided by the Arizona State Land Department.

- *Southeast Mesa ADMP (200' Mapping*

  Location: West of Ellsworth Rd and north of the Ray Rd alignment;
  Contour interval: 2 ft;
  Vertical Datum: NGVD 1929;
  Flight date: 10/23/1996;
  Source: Mapping under contract FCD 95-32.

- *Mesa Mapping*

  Location: All remaining areas within the study area not covered by the above three mappings;
  Contour interval: 2 ft;
  Vertical Datum: NAVD 1988;
  Flight date: 3/10/2008;
  Source: Mapping under contract FCD 07-39.

Section 4: Hydrology

4.1 Method Description

4.1.1 Technical Procedures

Estimation of flood discharges were determined based on the technical procedures presented in the District's *Drainage Design Manual, Hydrology*, adopted by the Maricopa County Board of Supervisors on November 18, 2009.

4.1.2 Computer Modeling

The U.S. Army Corps of Engineers' HEC-1 computer program, Version 4.1 (dated June 1998), was used for the hydrologic modeling. HEC-1 input parameters were developed using the Flood Control District of Maricopa County's Drainage Design Management System (DDMS) ST.APP – Version 4.1.9 (dated May 2009), developed by KVL Consultants, Inc. Sub-basin areas, existing conditions land use, time of concentration paths, and routing paths were all developed in a geodatabase using ArcGIS Version 9.3.1, developed by ESRI.

Before the completion of this study, the District released DDMS ST.APP – Version 4.6.0 (dated August 12, 2010). This version allowed for the input of custom JD records whereas version 4.1.9 did not. As aerial reduction factors for both 1 and 5 sq-mi were desired inputs but were not default values of the DDMS, version 4.6.0 was used solely for the purpose of customizing the JD records for the 24-hour storms.

4.2 Parameter Estimation

4.2.1 Drainage Area (Subbasin) Boundaries

Subbasin boundaries were delineated based on the topographic mapping data noted in section 3.2 of this report. The original East Mesa ADMP served as a foundation to the delineations. Subbasins from the *Desert Drive Area Study*, by JE Fuller for the ASLD, and the *Signal Butte Corridor Improvement Study: US 60 to Rittenhouse Road*, by EPS Group, Inc. for MCDOT, were also reviewed and utilized as guides in the delineations. Field investigations provided additional data.

Subbasins in the vicinity of Mountain Rd, north of Williams Field Rd and south of the Powerline Floodway were broken down into smaller subbasins than those in the original ADMP in order to provide better definition of flow paths for analyses of reported flooding problems in the area.

A subbasin naming convention was attempted. Subbasins named 'P' all drain to the Powerline Floodway. Subbasins 'E' or which contain 'E' as the sole letter (i.e. 22E) all drain to the Ellsworth Channel. Subbasins 'R' drain to the Rittenhouse Channel. And, subbasins 'EMF' or 'EM' drain directly to the East Maricopa Floodway (EMF) without first entering one of the three previous channels mentioned.

For the future conditions analyses, subbasins named 'GM' were added to the modeling. The 'GM' subbasins represent the area included in the *Master Drainage Report for Mesa Proving Grounds* (dated September 25, 2008) by Wood Patel & Associates, Inc. Data for these subbasins was, generally, not developed under this EMADMPU (see section 4.6.1.11 for more information on the GM subbasins) but was obtained directly from the *Master Drainage Report*. The 'GM' subbasins north of the Powerline Floodway drain to the Floodway, with the exception of GM4 which will drain to the San Tan Freeway Channel under ultimate conditions. The subbasins south of the Powerline Floodway will drain to the proposed SR 24 Freeway Channel and, ultimately, also into the Powerline Floodway.

Existing and future conditions subbasins maps may be found in Appendix E.

4.2.2 Watershed Work Maps

All work was performed in the ARCGIS environment.

4.2.3 Gage Data

Water-level gages in the watershed are limited to District gage ID #6708 in the Powerline Floodway at Ellsworth Road. Established 2/13/08, the gage has recorded only four storm flow events, all occurring in late 2010. Due to limited data, including storm events occurring at the conclusion of the study, information from this gage was not used for calibration of this study.

4.2.4 Statistical Parameters

There is no site specific statistical data available for the study area. However, subbasin discharges were compared to the USGS Region 13 Southern Arizona Low-Mid Elevation regional regression curve for reasonableness. Additionally, the existing conditions subbasin unit discharges were analyzed against those in the original ADMP, the *Desert Drive Area Study*, by JE Fuller, and the *Ironwood Drive – Ocotillo Rd to US 60* study, by Kimley-Horn and Associates, Inc. for comparison.

4.2.5 Precipitation

Point precipitation values are the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 values as determined in the DDMS using a shape file of the study limits. The DDMSW utilizes the NOAA

Atlas 14, Volume 1 – Semiarid Southwest, Version 4.0, June 19, 2006 per the District's *Drainage Design Manual, Hydrology*.

Table 4.2.5-1 NOAA 14 Point Precipitation Values (in inches)

Duration	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
5 MIN	0.251	0.340	0.408	0.500	0.572	0.645
10 MIN	0.383	0.518	0.621	0.762	0.871	0.981
15 MIN	0.474	0.642	0.770	0.944	1.079	1.216
30 MIN	0.639	0.865	1.037	1.272	1.453	1.638
1 HOUR	0.791	1.070	1.283	1.574	1.799	2.027
2 HOUR	0.897	1.193	1.422	1.731	1.971	2.219
3 HOUR	0.944	1.239	1.472	1.797	2.055	2.324
6 HOUR	1.126	1.438	1.686	2.025	2.293	2.572
12 HOUR	1.278	1.611	1.874	2.231	2.505	2.785
24 HOUR	1.547	1.982	2.330	2.809	3.184	3.579

Table 4.2.5-2 Comparison of East Mesa ADMP (NOAA 2) to East Mesa ADMP Update (NOAA 14) Point Precipitation Values (in inches)

NOAA Atlas	100-yr, 2-hr	10-yr, 24-hr	50-yr, 24-hr	100-yr, 24-hr
NOAA 2	2.600	2.300	3.200	3.600
NOAA 14	2.219	2.330	3.184	3.579

Depth-area reduction factors were used to convert the point rainfall to an equivalent uniform depth of rainfall over the entire watershed.

Table 4.2.5-3 Depth-Area Reduction Factors for 100-Year, 24-Hour Duration Rainfall

Area (sq-mi)	Ratio to Point Rainfall	Rainfall (inches)
0	1.000	3.579
1	0.995	3.561
5	0.975	3.490
10	0.950	3.400
20	0.918	3.286
30	0.900	3.221
40	0.887	3.175
50	0.877	3.139
60	0.87	3.114

Table 4.2.5-4 Depth-Area Reduction Factors for 6-Hour Duration Rainfall

Area (sq-mi)	Ratio to Point Rainfall	Rainfall (inches)
0	1.000	2.572
0.5	0.994	2.557
2.8	0.975	2.508
16	0.922	2.371
90	0.810	2.083

4.2.6 Physical Parameters

4.2.6.1 Soils

USDA Natural Resources Conservation Service (NRCS) Soil Survey data was used for the identification of soil map units within each subbasin. Data from three soil surveys was used. Those surveys are:

- *Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona;*
- *Eastern Maricopa and Northern Pinal Counties Area, Arizona;* and,
- *Eastern Pinal and Southern Gila Counties, Arizona.*

4.2.6.2 Existing Conditions Land Uses

Existing land uses were determined based on 2009 aerial photos and field inspection; and, on City of Mesa and Town of Queen Creek General Land Use Plans for existing developed areas.

For natural desert areas, vegetative cover and impervious area percentages were estimated based on the aerial photos.

For developed areas, aerial photos and the General Land Use Plans were reviewed and land use codes were assigned per categories within the DDMSW. DDMSW default values for vegetative cover and impervious area, based on the land use code, were typically used. Exceptions to this occur where the aerial photo shows a significant difference from the default values. Notable differences occur in the subdivisions north and south of the Powerline Floodway between Signal Butte and Meridian Roads. In these areas, many of the sites have been graded, with retention basins constructed, but few to no homes have been constructed. In some areas, the roadways have been graded but not paved. These items were considered when assigning percent vegetative cover and percent impervious to the land use within the individual subbasins.

4.2.6.3 Future Conditions Land Uses

Future conditions land uses for those areas within Maricopa County were based on the *City of Mesa 2025 General Plan* (adopted by the City Council on June 24, 2002) and the *Town of Queen Creek General Plan Update 2008* (adopted May 21, 2008).

For the area within Pinal County, the *Land Use Plan* included in the *Pinal County Comprehensive Plan* (adopted November 18, 2009) was reviewed. The plan showed the entire study area as Moderate Low Density Residential (1–3.5 du/ac). The Town of Queen Creek, however, includes a portion of Pinal County in its planning area. That area within this study area in Pinal County is: the area between ADOT's proposed SR 24 (formerly, SR 802) Freeway alignment and Germann Rd; and, the area bounded by Germann Rd on the north, Ironwood Rd on the east, Ocotillo Rd on the south, and the Maricopa/Pinal County line on the west. For these areas, the Town's *General Plan* land use data was used.

For the area within Pinal County, north of ADOT's proposed SR 24 Freeway alignment, discussions with the Arizona State Land Department indicated that, although one single land use is not likely, Medium Density Residential (5-10 du/ac) may be a reasonable overall approximation of the future conditions land use for this area for determining an estimation of runoff.

For the General Motors Proving Ground site, land use data from the *Master Drainage Report for Mesa Proving Grounds* (dated September 25, 2008) by Wood Patel & Associates, Inc. was incorporated into the study. All future conditions subbasins named "GM" use land use data from this report.

4.2.6.4 Rainfall Losses

The Green and Ampt Infiltration Equation within HEC-1 was used to determine rainfall losses. More information on the methodology and procedures for determining the input parameters may be found in the District's *Drainage Design Manual, Hydrology*.

4.2.6.4.1 Surface Retention Loss

Surface retention loss, or initial abstraction (IA), values used, are, typically, the default values from the DDMSW based on the land use code. However, in some cases, under existing conditions only, the land use code does not completely and accurately describe the existing land use conditions. Examples of this occur in areas where development is underway but is not fully completed. This is the case in several residential developments in the study area. For these instances, the IA values were modified to correspond to more similar land uses. Examples of areas where IA has been modified are a subbasin including a portion of the Williams Gateway Airport, where there is substantial natural desert area around the impervious area; and, the subdivisions around Powerline Floodway where residential construction is not complete.

4.2.6.4.2 Hydraulic Conductivity (XKSAT)

XKSAT values from the District's GIS soils database were used where available. Soils covered by the *Eastern Pinal and Southern Gila Counties, Arizona* soil survey (approximately the area east of Meridian Rd and north of Germann Rd; and, east of Schnepf Rd between Ocotillo and Germann Rds) are not currently in the District's database. For this area, soils maps were downloaded from the NRCS Web Soil Survey website. Soil profile data, from the soil survey, was reviewed and XKSAT values were determined and assigned by District staff per procedures in the District's *Drainage Design Manual, Hydrology*. (See Tables in the DDMSW for XKSAT values.)

4.2.6.4.3 Capillary Suction (PSIF)

PSIF values were calculated by the DDMSW based on the bare ground XKSAT values.

4.2.6.4.4 Volumetric Soil Moisture Deficit (DTHETA)

The three conditions for DTHETA are dry, normal, and wet (or saturated) based on the antecedent moisture condition. The selection of the condition of DTHETA was made based on the land use as follows:

- Dry – Nonirrigated lands, such as natural desert and rangeland; and, subdivisions for which construction appears to have stopped leaving a large amount of vacant graded land.

- Normal – Irrigated lawn, turf, pastures, and agricultural land.

- Wet – Major drainage channels.

Values for DTHETA were calculated by the DDMSW based on the bare ground XKSAT values.

4.2.6.5 Connected Impervious Area (RTIMP)

Aerial photos were reviewed and compared to the default values within the DDMSW. Modifications to the default values were made where deemed appropriate based on the aerial photos. (See *Land Use* data in the DDMSW for modifications to RTIMP values.)

4.2.6.6 Unit Hydrograph Procedure

The Valley S-graph was used to develop the runoff hydrographs from the subbasins. The S-graph method requires the estimation of a basin lag parameter. Basin lag is based on the length of the longest watercourse within the subbasin (L) and its corresponding slope (S), the length of the watercourse to a point opposite the centroid of the subbasin (L_{ca}), and the estimated mean Manning's n for all channels within the subbasin (K_{n}).

4.2.6.6.1 Length (L) and Slope (S)

Length and slope of the longest watercourse were determined in the GIS from the topographic mapping described in section 3.2. "Longest" was evaluated in terms of time.

4.2.6.6.2 Length to a Point Opposite the Centroid (L_{ca})

No irregular basins were observed, therefore, L_{ca} was approximated by 0.5L.

4.2.6.6.3 Selection of K_n Values

Selection of K_n values is an inherently subjective process. For this study, the DDMSW default values were reviewed and modified in consideration of the following subbasin characteristics:

- Percentage of the site covered by connected impervious area (RTIMP); Higher RTIMP areas and denser developed areas were assigned lower K_n values;

- Distribution of retention in the subbasin. Higher K_n values were considered for subbasins which had retention distributed throughout the area as opposed to isolated areas or at the subbasin outlet;

- Values used for similar land use conditions in other studies, including the original East Mesa ADMP.

Table 4.2.6.5.3-1 K_n Values by Land Use Code

Land Use Code	Description	K_n
110	Rural Residential (<= 1/5 du per acre)	0.065
120	Estate Residential (1/5 du per acre to 1 du per ac)	0.050 - 0.060
130	Large Lot Residential - Single Family (1-2 du per ac)	0.050
140	Medium Lot Residential - Single Family (2-4 du per ac)	0.045 - 0.050
150	Small Lot Residential - Single Family (4-6 du per ac)	0.045 – 0.050
160	Very Small Lot Residential - Single Family (>6 du per ac)	0.040 – 0.050
170	Medium Density Residential - Multi Family (5-10 du per ac)	0.040 – 0.050
180	High Density Residential - Multi Family (10-15 du per ac)	0.030
190	Very High Density Residential - Multi Family (>15 du per ac)	0.025 – 0.050
200	General Commercial (Commercial where no detail available)	0.035
210	Specialty Commercial (<=50,000 sq. ft.)	0.020
220	Neighborhood Commercial (50,000 to 100,000 sq. ft.	0.020
230	Community Commercial (100,000 to 500,000 sq. ft.)	0.020
240	Regional Commercial (500,000 to 1,000,000 sq. ft.)	Not Used(1)
250	Super-Regional Commercial (>= 1,000,000 sq. ft.)	Not Used(1)
300	General Industrial (Industrial where no detail available)	0.020 - 0.050
310	Warehouse/Distribution Centers	0.020
320	Industrial	0.030 - 0.080(2)
400	Office General (Office where no detail available)	0.020 – 0.035
410	Office Low Rise (1-4 stories)	Not Used(1)
420	Office Mid Rise (5-12 stories)	Not Used(1)
430	Office High Rise (13 stories or more)	Not Used(1)
510	Tourist and Visitor Accommodations (Hotels, motels, resorts)	0.030
520	Educational (Schools and universities)	0.020 - 0.055
530	Institutional (Includes hospitals and churches)	Not Used(1)
540	Cemeteries	Not Used(1)
550	Public Facilities (community centers, libraries, sub-stations)	0.030 – 0.050
560	Special Events (stadiums, sports complexes and fairgrounds)	0.025
570	Other Employment - low (Proving grounds and landfills)	Not Used(1)
580	Other Employment - medium	Not Used(1)
590	Other Employment - high	0.020
600	General Transportation (where no detail available)	0.020
610	Transportation (railways, transit centers, freeways)	0.020
620	Airports (Includes public use airports)	0.030 - 0.050
700	General Open Space (Open space where no detail available)	Not Used(1)
710	Active Open Space (Includes parks)	0.030 – 0.050
720	Golf courses	0.030 - 0.100
730	Passive Open Space (Includes mountain preserves and washes)	0.050
740	Water	0.015
750	Agriculture	0.080 - 0.100
810	Business Park (enclosed industrial, office or retail)	0.020
900	Vacant (Existing land use database only)	0.025 - 0.090

(1) “Not Used” indicates that this land use code in the DDMSW was not utilized in this study.
(2) Includes GM Proving Grounds Existing Conditions Subbasins E26, E30, and P8 which are predominantly natural desert.

4.2.7 Routing Parameters

Normal depth routings were used for all routings reaches with the exception of E7STOR which is a reservoir routing for the ponding area behind the CAP in Sub-basin E7. Reach lengths for the normal depth routings were determined in the GIS.

4.2.7.1 Cross Sections

Cross sections were taken using the topographic mapping identified in section 3.2. In areas of similar land use, routing cross sections were sometimes repeated from subbasin to subbasin with adjustments to slope made per the subbasin topography.

Cross sections for the Powerline Floodway were taken from the as-built plans. Changes in cross section were made wherever there was a change in the cross section indicated on the as-builts. The cross section data was first input into the Bentley FlowMaster program for estimation of a velocity for the reach for comparison to the HEC-1 wave celerity. Then, the cross sectional data was input into the HEC-1 with each change in cross section as an individual routing reach. Some of these HEC-1 routing reaches did not produce reasonable results or correspond well to the FlowMaster output. In these cases, the reach was replaced with an extension of the upstream or downstream reach, as appropriate, to produce more reasonable results.

Cross sections for the Ellsworth Channel were taken from the design HEC-RAS model for the structure as prepared by AMEC and contained in the *Final Drainage Report, Ellsworth Road – Phase I – Germann Road to Ray Road*, dated May 23, 2005. Velocities in the HEC-RAS were compared to the wave celerity computed in the HEC-1 for reasonableness.

Cross sections for the Rittenhouse Channel were taken from the FEMA approved HEC-RAS model for the structure (LOMR Case No. 99-09-509P, effective September 28, 1999, with subsequent revision under LOMR Case No. 99-09-1296P, effective October 28, 1999, to correct a FIRM panel suffix only, i.e. no changes to the flooding were performed under the second LOMR). Velocities in the HEC-RAS were compared to the wave celerity computed in the HEC-1 for reasonableness.

Cross sections for the East Maricopa Floodway (EMF) were taken from *East Maricopa Floodway Capacity Assessment*

HEC-RAS model, prepared by HNTB, FCD contract 97-06. Wave celerity for the EMF sections was not checked as the discharges shown for the EMF in this study do not include the drainage from the areas to the north of Elliot Road. Wave celerity will be checked and re-worked, if required, when this model is integrated into the EMF modeling network.

Table 4.2.7.1-1 Wave Celerity for Land Use and Flow Conditions

Flow Type	Wave Celerity (fps)
Sheet Flow (natural desert, agriculture)	0.5 to 1.5
Sheet Flow Areas Downstream of Culverts (natural desert)	1 to 2
Shallow Concentrated Flow (roads with side ditches)	2 to 4
Channel Flow (natural washes, small constructed channels)	2 to 6
Channel Flow (regional conveyance channels)	Per Design HEC-RAS

4.2.7.2 Mannings' Roughness Coefficients

Values for Mannings' 'n' were, typically, estimated based on aerial photos and on field reconnaissance.

For the concrete lined portion of the Powerline Floodway, an 'n' value of 0.016 was assigned. Although somewhat higher than normally used for concrete linings, this value is thought to more appropriately reflect increased roughness due to minor shifting and uplifting of the concrete which has occurred in various sections of the Floodway.

Mannings' 'n' values for the Ellsworth and Rittenhouse Channels are from the design HEC-RAS models for those structures.

4.2.7.3 NSTPS Determination

NSTPS were determined through an iterative process. An initial input of 5 NSTPS was assumed for all routings and the model was run within the DDMSW. DDMSW then computes the NSTPS based on the formula: reach length/average velocity/time interval. The original assumption of 5 NSTPS was then replaced by the NSTPS output from the DDMSW starting at the upstream limits of the watershed and working downstream, one routing at a time. Routing velocity and attenuation was reviewed. The NSTPS were then either accepted or adjusted further to obtain reasonable attenuations and translations of the hydrographs.

4.3 Problems Encountered During the Study

4.3.1 Special Problems and Solutions

4.3.1.1 XKSAT Values

DDMSW – Version 4.1.9 (dated May 2009) was used for the modeling of this study. It was discovered during the course of this study that the DDMSW version did not adjust the XKSAT values for vegetation cover for values of XKSAT $\geq$ 0.40. Therefore, manual adjustments were made and the results were input into the DDMSW as custom values.

4.3.1.2 Agricultural S-Graph

The agricultural S-graph was considered for use in subbasins with all agricultural land use. However, review of the shape of the hydrograph generated by this S-graph showed an unexplained "spike" in the ascending limb of the hydrograph. This appeared to be a mathematical anomaly. However, because of this, and the fact that the difference in peak discharge with the valley S-graph was small, it was decided to use the valley S-graph.

4.3.1.3 Aerial Reduction/Cumulative Subbasin Areas

Subbasin E7 lies on the east side of the Central Arizona Project (CAP) canal. Runoff from this subbasin enters Subbasin E6 via an existing 36" diameter concrete culvert. As the discharge from this subbasin is small due to the available storage volume behind the CAP, Subbasin E7 was assumed to be hydrologically separate from the rest of the study area and the 1.12 sq-mi area of the subbasin was not included in the aerial reduction for the remainder of the study area.

For the future conditions, Subbasins GM4 and EMF1A will drain to the San Tan Freeway channel and, then, into the EMF. These two subbasins will need to be included with the HEC-1 model to the north that includes the Elliott Basins. Subbasin parameters were developed for GM4 and EMF1A but, as they do not impact structures being analyzed in this study, they are not included in the HEC-1 model.

4.3.1.4 E7STOR

Subbasin E7 lies on the east side of the CAP. The outfall for this subbasin is a 36” diameter concrete pipe over the CAP. A reservoir routing was performed at E7STOR to account for ponding. Pipe discharge data was developed using survey data obtained by District survey staff on December 1, 2009 (see electronic files for survey data and photos). Discharges were determined with Bentley CulvertMaster, version 3.2. Storage volume was estimated based on mapping data identified in section 3.2.

It was assumed for the future conditions model that ADOT would be required to show no loss of storage in the area due to freeway construction and, therefore, the storage routing was included in the future conditions model as well as the existing.

4.3.1.5 Existing Conditions Retention

Retention requirements for urban development were established in the early 1970s. For the City of Mesa, Town of Queen Creek, and Unincorporated Maricopa County, the requirement has been for containment of the 100-yr, 2-hr runoff volume.

Existing conditions retention volumes were derived from several sources, including as-built plans, design plans/reports, the original East Mesa ADMP, and existing topographic data. In terms of reliability of the data, when data was available from more than one source, the order of the data used, from most relied upon to least, was:

1) *As-built plans* which stated the as-built volume;

2) *Design plans* which stated the as-built volume;

3) *Design reports* for which the proposed location could be determined from the report and the construction of the basin could be confirmed from the aerial photos;

4) *Topographic data* which indicated the presence of a basin. When this data was used, a calculation for estimated required volume based on V = CPA (volume = runoff coefficient X precipitation X area) was also performed as a check for reasonableness of the volume calculation based on the topographic data. NOAA 2 rainfall was used in the CPA calculations as the basins were constructed prior to the acceptance of the NOAA 14 data.

In the case of the retention basin on the TRW site (Subbasin E25), the source of the volume was the original East Mesa ADMP for which the HEC-1 model noted that this volume was from the site's Drainage Report. Based on the topographic contours of the basin, the volume appeared reasonable and, therefore, was used in this study.

Retention volumes are input into the HEC-1 as diversions on DT records. The net effect is to divert the front end of the subbasin hydrograph, up to the retention volume, out of the system. In all cases, the volumes used in the HEC-1 modeling are 80% of the provided, designed, or estimated volumes. The volumes are reduced by 20% to account for small areas in the watershed not draining to the basins and for reduction in volume which may occur due to sedimentation and/or increased vegetation or placement of amenities, such as picnic tables, playground equipment, etc.

4.3.1.6 Future Conditions Retention

Future conditions retention values were determined by taking 80% of the 100-yr, 2-hr storm runoff volume. HEC-1 was used to compute the 100-yr, 2-hr storm volume. No new retention volumes were computed for existing developed subbasins. For subbasins which were partially developed, the retention volume was computed based on the percentage of the subbasin which remained to be developed plus the existing retention volume for the existing development.

Two HEC-1 models were used to compute the 100-yr, 2-hr runoff volumes: one for areas within Maricopa County and one for areas within Pinal County. The two were determined separately due to the different precipitation depth requirements of the two counties within the study area. Maricopa County design criteria calls for the average recurrence interval precipitation depth. Pinal County uses the upper bound of the 90% confidence interval precipitation depth.

For Maricopa County the precipitation depth was determined in the PREFRE subroutine in the DDMS using the entire study limits for area. The value used for the 100-yr, 2-hr rainfall in Maricopa County was 2.219 inches.

The precipitation depth for Pinal County was determined by first looking at the range of precipitation depths over the Pinal portion of the watershed. Point precipitation depths were queried at approximately the midpoint of the north, south, east, and west study boundaries in Pinal County and one point approximately in the center of the Pinal County study area. The exact points chosen are shown on an exhibit in Appendix C. The range of values for the 90% confidence interval was from 2.63 to 2.69 inches. The center value of 2.65 inches was chosen as this appeared to be a reasonable average for the watershed in consideration of the overall range of values and this point's location in the center of the Pinal County watershed. Additionally, the average recurrence interval values at this point for the 100-yr, 24-, 6-, and 2-hr depths corresponded well with those used for the entire study area.

4.3.1.7 Detention Basins

Detention basins are modeled in a similar manner to retention basins. In the case of detention basins, however, that portion of the subbasin hydrograph less than or equal to the maximum discharge from the detention basin(s) continues to runoff, while the volume above the maximum discharge is diverted out of the system until the retention volume is exceeded.

The maximum outflow from the detention basins was obtained from drainage reports and input into the HEC-1 as an inflow on the DI record with a corresponding diversion discharge of zero cfs on the DQ record. Above the maximum discharge, each increase in inflow yields a corresponding diversion discharge up to the retention volume and is modeled as such on the DI/DQ records.

4.3.1.8 Stockponds

Stockponds are small, earthen impoundment areas. Earthen diversion dikes, typically, divert water into the stockponds which serve as livestock watering facilities. Stockponds are fairly common throughout the watershed, particularly, in the area east of Meridian Road. The impacts of stockponds on the hydrology of the subbasins have been considered to a small degree in this study as the flow path lengths consider flow into, out of, and around stockponds where the path encounters one of these structures. Storage capacity, however, was considered insignificant and not included in the HEC-1 modeling.

4.3.1.9 Storm Drains

Storm drain systems in the study area are limited to local development sites with the exception of 2128 lf of twin 72" CIPC pipes on the upstream end of the Rittenhouse Channel, east of Ellsworth Road. The Rittenhouse storm drain was considered in the modeling in respect to HEC-1 routing velocity. However, the storm drain systems (primarily, 36" diameter and less) within local developments, which typically carry on-site flows to retention basins, were not considered in the modeling due to their limited capacity and the regional nature of the HEC-1 hydrologic modeling for this study.

4.3.1.10 Ironwood Drive

Ironwood Drive (a.k.a Vineyard Road and Gantzel Road) is a north-south road running through the study area in Pinal County. The road runs, generally, perpendicular to the natural drainage paths of the area. In recent years, the original two-lane road has been reconstructed as a four-lane principal arterial from Ocotillo Road to US 60. Reconstruction included both a widening and a raising of the road by several feet through the study area. This study attempted to model the impacts of the road on the drainage in the area. A detailed explanation of the procedure used to model these impacts for the area south of the Powerline Floodway is contained in the file *Ironwood Rd Split Flow Calcs.pdf* (see electronic files) in Appendix C.

Flows north of the Powerline Floodway were analyzed based on the HEC-RAS modeling provided to the District by Kimley-Horn and Associates (KHA) under District Permit 2006P090. A rating curve was developed at the culverts, evaluating flow through the culverts versus by-pass flow. This data was then input onto DI/DQ records in the HEC-1. All flow by-passing the culverts for this area north of the Powerline Floodway was assumed to fall into the Powerline Floodway.

4.3.1.11 GM Subbasins

The GM subbasins data utilized the parameters from the *Master Drainage Report for Mesa Proving Grounds* (dated September 25, 2008) by Wood Patel & Associates, Inc. Subbasin routing data from this report was also utilized. However, when wave celerity was unreasonable, modifications were made to the routing data to produce more reasonable results.

Subbasin 15 in the *Master Drainage Report* included a proposed realignment of Powerline Floodway. For the EMADMPU, the proposed realignment was included in the modeling. However, a separate subbasin for just the Powerline Floodway was not considered. Instead, portions of Subbasin 15 were incorporated into GM Subbasins 10, 11, and 14, on the north side of the Powerline Floodway.

Required retention volumes in the *Master Drainage Report* were computed using a NOAA14 precipitation depth of 2.19 inches and the equation V = CPA, where V = required retention volume, in acre-feet; C = the runoff coefficient for the drainage area (dimensionless); P = precipitation depth, in feet; and, A = area, in acres. The required retention volumes were re-computed in the HEC-1 for the EMADMPU (with the 2.219 inches precipitation depth) and compared to those in the *Master Drainage Report*. Values were very similar between the two.

For the EMADMPU, retention volumes from the *Master Drainage Report* were used rather than those calculated in the HEC-1. For consistency with the rest of the EMADMPU, 80% of the retention volumes were used in the study's HEC-1 models.

4.3.2 Modeling Warning and Error Messages

4.3.2.1 Existing Conditions HEC-1 Warning Messages

The model displays warning messages of "ROUTED OUTFLOW IS GREATER THAN MAXIMUM OUTFLOW IN STORAGE-OUTFLOW TABLE" at routing reaches E31E30, E33P9A, and E33P9B.

100-Yr, 24-Hr HEC-1

- E31E30 is a section of the Ellsworth Channel. The original routing cross section identified the ground elevation at station 100 (the first station in the 8 point cross section) as elevation 1386.09 and the maximum channel capacity was calculated to be 1600 cfs. The 1600 cfs capacity and the 1501 cfs HEC-1 calculated peak discharge were contained at station 244 (the eighth point in the 8 point cross section) but neither was contained by station 100. This is consistent with the HEC-RAS results which show flows uncontained by the channel on the west side for a portion of this reach. Results of the HEC-RAS indicate depths of the spill over the left channel bank to be shallow, typically less than 1foot, with the potential for some flows to fall back into the channel. The results of the HEC-1 model compared well with the HEC-RAS. Station 100 was artificially raised (to elevation 1387.00 to match station 244) to verify the capacity and discharge calculations with containment. A capacity of 1593 cfs was computed for the modified cross section. The discharge along this reach was calculated in the HEC-1 as 1501 cfs for both the 1386.09 and the 1387.00 elevations for station 100. The discharge hydrographs for JD records 0.01, 1, and 5 sq-mi all have peak discharges above the 1600 cfs. Therefore, the "WARNING" message is displayed. The calculated 1501 cfs (drainage area equals 18.86 sq-mi) is contained within the modified section and compares well with the HEC-RAS and, therefore, was accepted as reasonable.

- E33P9A and E33P9B are consecutive reaches of the Powerline Floodway. The computed channel capacity (3004 cfs for 'A' and 2721 cfs for 'B') is exceeded for JD records 0.01, 1, and 5 sq-mi for 'A' and 0.01, 1, 5, and 10 sq-mi for 'B'. The drainage area for 'A' and 'B', however, is 33.27 sq-mi. For this size drainage area, the peak discharges of 2524 cfs and 2514 cfs for 'A' and 'B', respectively, are contained within the channel section. The results were accepted as reasonable.

100-Yr, 6-Hr HEC-1

- E31E30 is a section of the Ellsworth Channel. A capacity of 1600 cfs was computed for the modified cross section. The discharge along this reach was calculated in the HEC-1 as 821 cfs. The discharge hydrographs for JD records 0.01 and .5 sq-mi all have peak discharges above the 1600 cfs. Therefore, the "WARNING" message is displayed. The calculated 821 cfs (drainage area equals 18.86 sq-mi) is contained within the routing section and, therefore, was accepted as reasonable.

- E33P9A and E33P9B are consecutive reaches of the Powerline Floodway. The computed channel capacity (3004 cfs for 'A' and 2721 cfs for 'B') is exceeded for JD records 0.01 and .5 sq-mi for both 'A' and 10 sq-mi 'B'. The drainage area for 'A' and 'B', however, is 33.27 sq-mi. For this size drainage area, the peak discharges of 1386 cfs and 1383 cfs for 'A' and 'B', respectively, are contained within the channel section. The results were accepted as reasonable.

4.3.2.2 Future Conditions HEC-1 Warning Messages

100-Yr, 24-Hr HEC-1

- The model displays warning messages of “ROUTED OUTFLOW IS GREATER THAN MAXIMUM OUTFLOW IN STORAGE-OUTFLOW TABLE” and “WARNING EXCESS AT PONDING LESS THAN ZERO FOR PERIOD. EXCESS SET TO ZERO” at routing reach GM1T5. OUTFLOW GREATER THAN MAXIMUM occurs only for a JD record value of .01 sq-mi. GM1T5 has an area of 1.32 sq-mi. For this hydrograph, the routed outflow is 640 cfs which is less than the 655 cfs channel capacity. For the second message, the less than zero values occur on day 5 of the hydrograph. The receding limb of the hydrograph has reached zero values by day 2 of the storm. Therefore, it is reasonable to set the excess to zero.

- The model displays warning messages of “ROUTED OUTFLOW IS GREATER THAN MAXIMUM OUTFLOW IN STORAGE-OUTFLOW TABLE” at GM9T14. The peak flow for JD record .01 sq-mi exceeds the 796 cfs channel capacity. However, the drainage area for this routing is 3.08 sq-mi and the 723 cfs discharge is contained in the channel for this flow. Therefore, the results were accepted.

- At routing reach G13T14, the warning message “MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 425 TO 494” is displayed. The computed discharge in this reach is 366 cfs which is less than 425 cfs. The routed hydrograph was also reviewed and no oscillations or outflows greater than the peak inflow were present.

- At routing reach G14E26, the warning message “MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 83 TO 3045” is displayed. The 775 cfs discharge falls within this range. The hydrograph shows multiple peaks, consistent with the multiple upstream inflow hydrographs. The results, therefore, seem reasonable and were accepted.

- At routing reach E10E17, the warning message "MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 253 TO 1752" is displayed. The computed discharge in this reach is 175 cfs which is less than 253 cfs. The routed hydrograph was also reviewed and no oscillations or outflows greater than the peak inflow were present.

- The model displays warning messages of "ROUTED OUTFLOW IS GREATER THAN MAXIMUM OUTFLOW IN STORAGE-OUTFLOW TABLE" at 80233B. The peak flow for JD record .01, 1, 5, 10, and 20 sq-mi exceeds the 1580 cfs channel capacity. However, the drainage area for this routing is 21.3 sq-mi and the 1564 cfs discharge is contained in the routing section for this flow. Therefore, the results were accepted.

- E33P9A and E33P9B are consecutive reaches of the Powerline Floodway. The computed channel capacity (3004 cfs for 'A' and 2721 cfs for 'B') is exceeded for JD records 0.01, 1, and 5 sq-mi for 'A' and 0.01, 1, 5, and 10 sq-mi for 'B'. The drainage area for 'A' and 'B', however, is 33.27 sq-mi. For this size drainage area, the peak discharges of 1727 cfs and 1694 cfs for 'A' and 'B', respectively, are contained within the channel section. The results were accepted as reasonable.

- RITBAS is the subbasin that includes the Rittenhouse Basin. Outflow is through a pipe into the EMF. As the basin discharge is dependent on the discharges in the EMF, no discharge data was entered into the EMADMPU HEC-1 model. Elevation-storage data from the final HEC-RAS unsteady flow model for the basin design was input into the model but no basin discharge values were used. Essentially, for this study, it was assumed that rainfall on the basin is captured by and stays in the basin. Therefore, the warning message is reasonable. Revisions may be required if the data in this model is used in a comprehensive analysis of the EMF. However, flows from this subbasin have no effect on the structures being analyzed in this study. So no attempt was made to eliminate this warning message.

- The model displays warning messages of "ROUTED OUTFLOW IS GREATER THAN MAXIMUM

OUTFLOW IN STORAGE-OUTFLOW TABLE” at R5R8. The drainage area for this routing is 1.22 sq-mi and the 470 cfs discharge is contained in the 487 cfs capacity routing section. Therefore, the results were accepted.

100-Yr, 6-Hr HEC-1

- The model displays warning messages of “ROUTED OUTFLOW IS GREATER THAN MAXIMUM OUTFLOW IN STORAGE-OUTFLOW TABLE at routing reach GM1T5. OUTFLOW GREATER THAN MAXIMUM occurs only for JD record values of .01 and .05 sq-mi. GM1T5 has an area of 1.32 sq-mi. For this hydrograph, the routed outflow is 376 cfs which is less than the 655 cfs channel capacity. Therefore, it is results were accepted.

- The model displays warning messages of “ROUTED OUTFLOW IS GREATER THAN MAXIMUM OUTFLOW IN STORAGE-OUTFLOW TABLE” at GM9T14. The peak flow for JD record .01 sq-mi exceeds the 796 cfs channel capacity. However, the drainage area for this routing is 3.08 sq-mi and the 368 cfs discharge is contained in the channel for this flow. Therefore, the results were accepted.

- The model displays warning messages of “ROUTED OUTFLOW IS GREATER THAN MAXIMUM OUTFLOW IN STORAGE-OUTFLOW TABLE” at 80233B. The peak flow for JD record .01 and .5 sq-mi exceeds the 1580 cfs channel capacity. However, the drainage area for this routing is 21.3 sq-mi and the 678 cfs discharge is contained in the routing section for this flow. Therefore, the results were accepted.

- The model displays warning messages of “ROUTED OUTFLOW IS GREATER THAN MAXIMUM OUTFLOW IN STORAGE-OUTFLOW TABLE” at R5R8. The drainage area for this routing is 1.22 sq-mi and the 427 cfs discharge is contained in the 487 cfs capacity routing section. Therefore, the results were accepted.

4.4 Calibration and Comparison with Other Studies

As explained in section 4.2.3, there is no water-level gage data in the watershed available for physical calibration of the discharges or volumes. However, HEC-1 computed subbasin discharges were compared to the USGS Region 13 Southern Arizona regional regression curve and the Malvick curve for reasonableness. Existing conditions subbasin and concentration point discharges typically were lower than the regional regression curve. However, a few of the existing conditions subbasins are fully developed and these produce discharges close to the regional regression curve. These higher discharges are not transferred on to the concentration points due to consideration of on-site retention in the modeling within the developed subbasins.

The results of the comparisons the existing conditions HEC-1 discharges to the regression and Malvick curves for the 100-year, 24-hour and the 100-year, 6-hour storms are shown in the following exhibits:

Exhibit 4.4-1 Comparison of **100-year, 24-hour Existing Conditions Subbasin Discharges** to Region 13 Regional Regression and Malvick Discharges

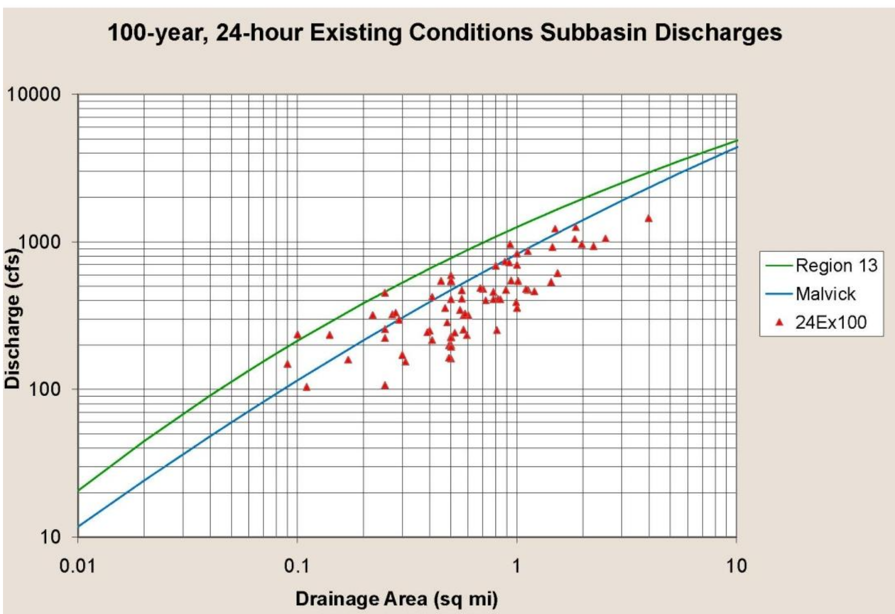


Exhibit 4.4-2 Comparison of **100-year, 24-hour Existing Conditions Concentration Point Discharges** to Region 13 Regional Regression and Malvick Discharges

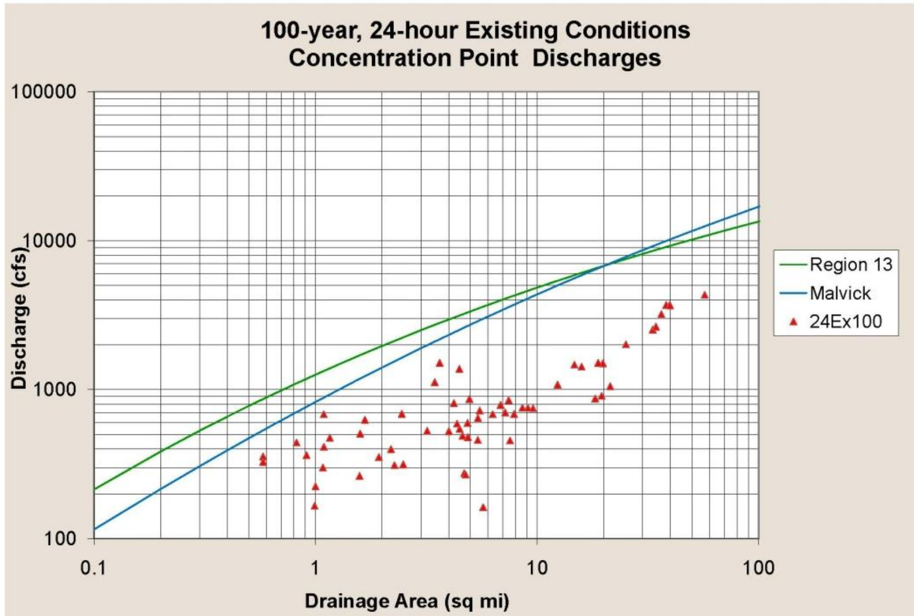


Exhibit 4.4-3 Comparison of **100-year, 6-hour Existing Conditions Subbasin Discharges** to Region 13 Regional Regression and Malvick Discharges

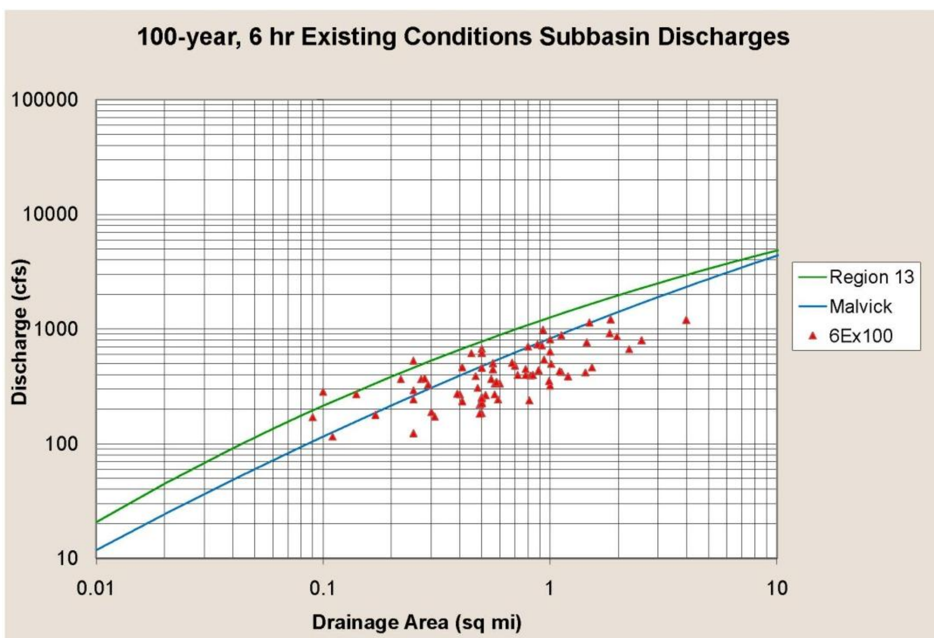
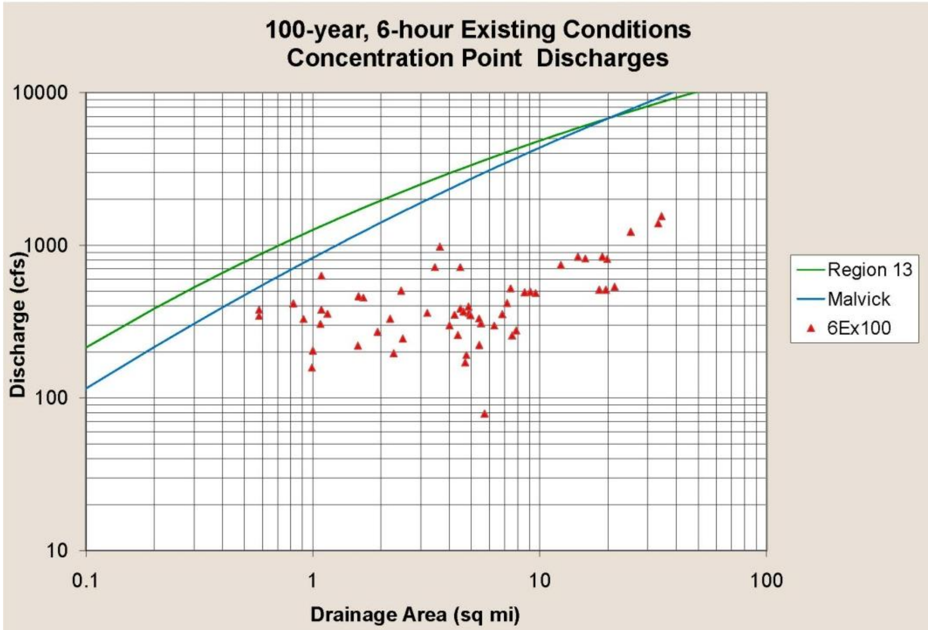


Exhibit 4.4-4 Comparison of **100-year, 6-hour Existing Conditions Concentration Point Discharges** to Region 13 Regional Regression and Malvick Discharges



Additionally, the existing conditions subbasin unit discharges were compared to those in the original ADMP, the *Desert Drive Area Study*, by JE Fuller, and the *Ironwood Drive – Ocotillo Rd to US 60* study, by Kimley-Horn and Associates, Inc. (KHA) for general agreement.

Comparison with the original ADMP showed general agreement for similar land uses of similar size sub-basins. For the natural desert area, east of Meridian Road, the Update sub-basins are smaller in size than the original ADMP and produce higher unit discharges than the original study as would be expected due to the aerial reduction factors.

The JE Fuller study typically identified larger sub-basins than those of the Update. As would be expected, with the smaller sub-basins, the Update hydrology generally showed higher unit discharges for sub-basins covering the same general area as the JE Fuller study because of the aerial reduction factors. However, where a more one-to-one comparison could be made between sub-basins, in size and in location, the unit discharges matched reasonably well between the two studies with the Update tending towards slightly lower discharges.

The KHA study identified sub-basins more similar in size to the Update hydrology. The unit discharges for the Update were more similar to the KHA study but tended to be slightly higher than the KHA study.

Where sub-basins were similar in size and location, the Update tended toward slightly higher peak discharges than the KHA study.

Future conditions subbasins, except in areas already developed, produced higher HEC-1 discharges than the existing conditions and more closely matched values of the regional regression and Malvick curves. Future conditions concentration points were not evaluated as the assumed on-site retention renders a comparison with the regression curves meaningless.

The results of the comparisons of the future conditions HEC-1 discharges to the regression and Malvick curves for the 100-year, 24-hour and the 100-year, 6-hour storms are shown in the following exhibits:

Exhibit 4.4-5 Comparison of **100-year, 24-hour Future Conditions Subbasin Discharges** to Region 13 Regional Regression and Malvick Discharges

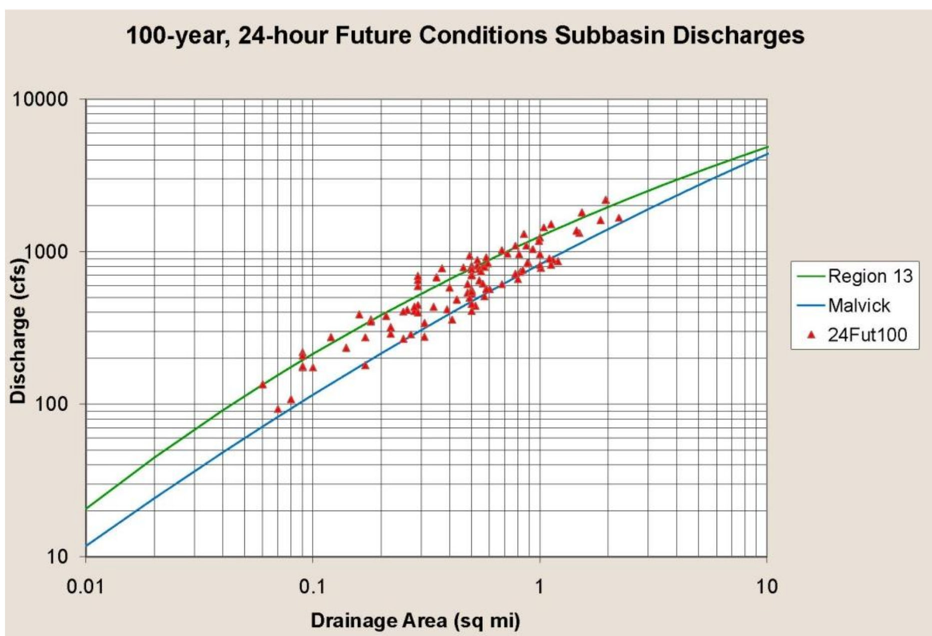
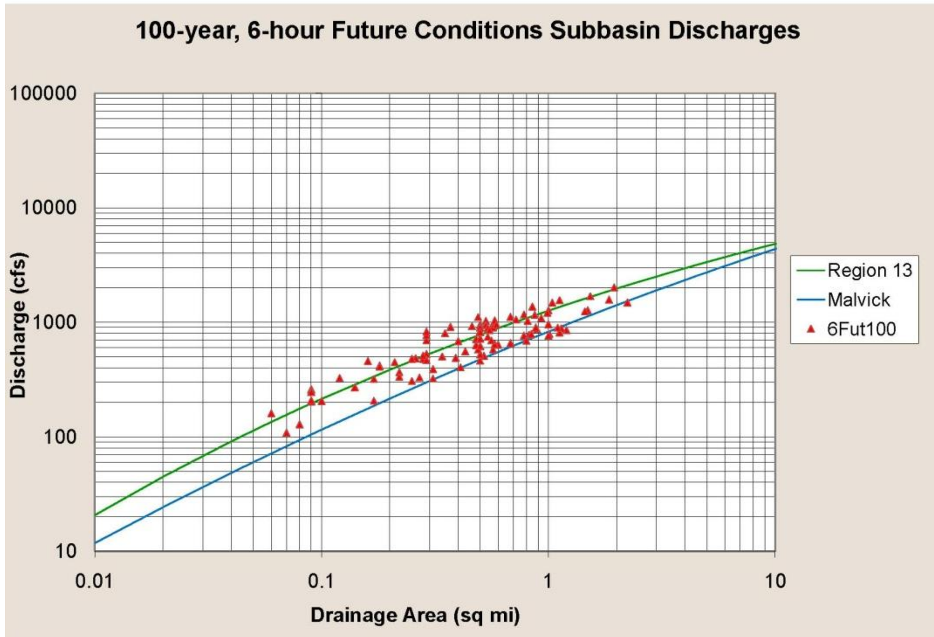


Exhibit 4.4-6 Comparison of **100-year, 6-hour Future Conditions Subbasin Discharges** to Region 13 Regional Regression and Malvick Discharges



100-yr, 2-hr runoff volumes computed in HEC-1 were compared to those computed using V=CPA for private developments and compared reasonably well.

Wave celerity was reviewed for reasonableness. Routing velocities were compared to the existing hydraulic analyses for Ellsworth Channel and Rittenhouse Channel. FlowMaster calculations were performed for velocity comparisons along varying segments of the Powerline Floodway. Velocities were also evaluated based on the existing or expected land use conditions as summarized in *Table 4.2.7.1-1 Wave Celerity for Land Use and Flow Conditions*. Modifications to routing input parameters ('n' values, slope, etc. and, sometimes, NSTPS) were made, as necessary, to attempt to match (within reasonable limits) the expected velocities. These modifications were often noted with comments within the DDMS in the individual routings.

4.5 Final Results

4.5.1 Hydrologic Analysis Results

The results of the hydrologic analyses are provided in the following spreadsheets. Results are provided in two formats: one in the order of the HEC-1 computations and the other in alphanumeric order.

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
P1	0.39	**104**	4.67	95	12.67	**222**	4.67	194	12.67	**272**	4.67	244	12.67
DRPFW	0.39	**45**	4.67	39	12.67	**142**	4.67	118	12.67	**186**	4.67	161	12.67
DP1PFW	0.39	**59**	4.67	56	12.67	**80**	4.67	76	12.67	**86**	4.67	83	12.67
P1P2	0.39	**32**	7.17	30	15.25	**54**	6.58	49	14.58	**61**	6.5	58	14.5
P2	0.58	**133**	4.83	130	12.83	**280**	4.83	258	12.75	**345**	4.83	326	12.75
CPP2	0.58	**132**	4.83	130	12.83	**279**	4.83	258	12.75	**344**	4.83	327	12.75
P2P4	0.58	104	5.08	**109**	13.08	**241**	5	231	13	**305**	5	300	13
P4	0.5	**339**	4.5	291	12.5	**523**	4.5	459	12.5	**614**	4.5	536	12.5
RETP4	0.5	**339**	4.5	291	12.5	**523**	4.5	459	12.5	**614**	4.5	536	12.5
DIVP4	0.5	0	0	0	0	0	0	0	0	0	0	0	0
CPP4	1.08	104	5.08	**109**	13.08	**241**	5	231	13	**305**	5	300	13
P4P6	1.08	56	5.5	**90**	13.5	162	5.33	**198**	13.33	220	5.25	**263**	13.25
P6	0.5	**355**	4.42	310	12.42	**568**	4.42	502	12.42	**672**	4.42	592	12.42
RETP6	0.5	**355**	4.42	310	12.42	**568**	4.42	502	12.42	**672**	4.42	592	12.42
DIVP6	0.5	0	0	0	0	0	0	0	0	0	0	0	0
CPP6	1.58	56	5.5	**90**	13.5	162	5.33	**198**	13.33	220	5.25	**263**	13.25
P6P7	1.58	30	6	**79**	14	115	5.92	**177**	13.75	175	5.75	**236**	13.67
DRPFW	0.39	**45**	4.67	39	12.67	**142**	4.67	118	12.67	**186**	4.67	161	12.67
P1PFW	0.39	**29**	4.92	25	12.92	**115**	4.83	92	12.83	**156**	4.83	135	12.83
P3	0.52	**101**	5	95	13	**216**	5	191	13	**265**	5	242	13
CPP3	0.91	89	5	**119**	13	246	5	**275**	12.92	329	4.92	**363**	12.92
P3P5	0.91	85	5.08	**114**	13.08	242	5	**271**	13	325	5	**358**	13
P5	0.25	**158**	4.58	138	12.58	**247**	4.58	218	12.58	**291**	4.58	256	12.58
RETP5	0.25	**158**	4.58	138	12.58	**247**	4.58	218	12.58	**291**	4.58	256	12.58
DIVP5	0.25	0	0	0	0	51	5.17	**65**	13.08	151	4.92	**163**	12.83
CPP5	1.16	85	5.08	**114**	13.08	250	5.08	**322**	13.08	355	4.92	**475**	12.92
P5P7	1.16	64	5.17	**109**	13.17	221	5.17	**300**	13.17	346	5	**463**	13
P7	0.45	**326**	4.42	291	12.42	**521**	4.42	464	12.42	**613**	4.42	544	12.42
RETP7	0.45	**326**	4.42	291	12.42	**521**	4.42	464	12.42	**613**	4.42	544	12.42
DIVP7	0.45	0	0	0	0	0	0	**4**	16.83	**188**	4.83	129	12.83
CPP7	3.19	64	5.5	**110**	13.83	234	5.83	**297**	13.58	360	5.67	**528**	13
P7P8A	3.19	4	8.25	**104**	14.17	105	6.17	**285**	13.83	214	5.92	**464**	13.25

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
P8	3.98	481	6.08	**725**	14.08	973	6.08	**1220**	14	1201	6.08	**1449**	14
DIVP8	3.98	361	6.08	**543**	14.08	730	6.08	**915**	14	901	6.08	**1087**	14
DIVP8	3.98	120	6.08	**181**	14.08	243	6.08	**305**	14	300	6.08	**362**	14
CPP8	7.18	107	6.17	**270**	14.08	286	6.08	**557**	14	418	6.08	**701**	13.92
P8E33B	7.18	102	6.33	**260**	14.25	280	6.33	**542**	14.17	410	6.25	**692**	14.08
E1	0.89	139	4.83	**184**	12.83	341	4.83	**374**	12.83	437	4.83	**472**	12.83
DRE2	0.89	102	4.83	**133**	12.83	269	4.83	**296**	12.83	354	4.83	**383**	12.83
DE1S	0.89	37	4.83	**51**	12.83	72	4.83	**77**	12.83	83	4.83	**88**	12.83
E1E10	0.89	27	6.17	**37**	14.08	41	6.17	**48**	14.83	48	6.58	**55**	15
E10	0.82	130	4.92	**161**	12.92	308	4.92	**326**	12.92	392	4.92	**411**	12.92
CPE10	0.82	131	4.92	**162**	12.92	326	4.92	**345**	12.92	416	4.92	**442**	12.92
E10E17	0.82	114	5.25	**143**	13.25	283	5.17	**302**	13.17	372	5.08	**396**	13.08
E17	0.27	**190**	4.42	165	12.42	**308**	4.42	272	12.33	**364**	4.42	322	12.33
RETE17	0.27	**190**	4.42	165	12.42	**308**	4.42	272	12.33	**364**	4.42	322	12.33
DIVE17	0.27	0	0	0	0	0	0	0	0	**20**	5	19	13.08
CPE17	1.09	114	5.25	**143**	13.25	283	5.17	**302**	13.17	378	5.08	**413**	13.08
E17E21	1.09	77	5.83	**125**	13.83	213	5.67	**266**	13.58	302	5.58	**358**	13.5
E21	0.41	**223**	4.5	203	12.5	**383**	4.5	352	12.5	**464**	4.5	423	12.5
RETE21	0.41	**223**	4.5	203	12.5	**383**	4.5	352	12.5	**464**	4.5	423	12.5
DIVE21	0.41	0	0	0	0	**24**	5.25	8	13.58	**211**	4.83	186	12.83
DRE2	0.89	102	4.83	**133**	12.83	269	4.83	**296**	12.83	354	4.83	**383**	12.83
RTE1E2	0.89	74	5.33	**98**	13.33	213	5.25	**234**	13.25	287	5.17	**316**	13.17
E2	0.78	141	4.92	**166**	12.92	315	4.92	**325**	12.92	396	4.92	**409**	12.92
CPE2	1.67	85	5	**206**	13	310	5	**472**	13	453	5	**627**	13
DRE3	1.67	28	5	**67**	13	151	5	**277**	13	265	5	**408**	13
DE2S	1.67	57	5	**139**	13	159	5	**195**	13	189	5	**219**	13
E2E11	1.67	32	8.17	**92**	16.25	113	8.17	**151**	15.92	148	8	**173**	15.83
E11	0.6	122	4.83	**124**	12.83	**269**	4.83	251	12.83	**334**	4.83	318	12.83
CPE11	2.27	36	4.92	**120**	12.83	133	4.83	**246**	12.83	196	4.83	**311**	12.83
E11E18	2.27	15	5.92	**83**	13.83	98	5.75	**173**	13.75	150	5.75	**236**	13.58
E18	0.22	**205**	4.33	183	12.33	**315**	4.33	277	12.33	**365**	4.33	319	12.33
CPE18	2.49	128	4.33	**179**	12.33	209	4.33	**273**	12.33	245	4.33	**315**	12.33

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E18E21	2.49	109	4.67	**146**	12.58	189	4.58	**235**	12.58	225	4.58	**274**	12.58
CPE21	4	113	4.67	**188**	14	237	6	**390**	13.75	299	5.83	**526**	13.67
E21E22	4	73	5.42	**163**	14.67	154	6.67	**367**	14.17	265	6.33	**498**	14
DRE3	1.67	28	5	**67**	13	151	5	**277**	13	265	5	**408**	13
RTE2E3	1.67	21	5.58	**47**	13.67	124	5.5	**241**	13.42	239	5.42	**365**	13.33
E3	2.23	132	5.33	**391**	13.25	486	5.25	**748**	13.25	667	5.25	**935**	13.25
E2SE3	3.9	72	5.33	**403**	13.33	419	5.33	**938**	13.25	680	5.33	**1259**	13.25
DRE4N	3.9	2	5.33	**148**	13.33	159	5.33	**545**	13.25	347	5.33	**804**	13.25
DE3S	3.9	70	5.33	**255**	13.33	261	5.33	**394**	13.25	333	5.33	**455**	13.25
E3E12	3.9	62	5.75	**247**	13.75	254	5.83	**347**	14.5	290	6.42	**401**	14.5
E12	0.57	**138**	4.92	135	12.92	**270**	4.92	256	12.92	**332**	4.92	318	12.92
CPE12	4.47	62	5.75	**288**	13	291	5.17	**468**	12.92	384	5	**546**	12.92
E12E19	4.47	59	6	**279**	13.92	292	5.83	**418**	13.67	367	5.75	**488**	13.58
E19	0.14	**159**	4.25	139	12.25	**235**	4.25	205	12.25	**270**	4.25	234	12.25
CPE19	4.61	82	4.25	**280**	13.83	292	5.83	**420**	13.67	367	5.75	**490**	13.58
E1922E	4.61	79	4.42	**279**	14.17	286	6.08	**408**	14	360	6.08	**474**	13.92
22E	0.09	**98**	4.25	87	12.25	**147**	4.25	130	12.25	**170**	4.25	149	12.25
E20	0.17	**87**	4.5	77	12.5	**149**	4.5	133	12.5	**178**	4.5	159	12.5
E2022E	0.17	**72**	4.83	61	12.83	**123**	4.83	107	12.75	**148**	4.83	129	12.75
CP22E	4.87	135	4.33	**284**	13.42	286	6.08	**413**	14	361	6.08	**480**	13.92
22EE22	4.87	80	5.83	**279**	14.67	278	6.83	**395**	14.83	349	6.83	**453**	14.75
E22	0.25	**117**	4.67	111	12.67	**202**	4.67	188	12.67	**243**	4.67	223	12.67
CPE22	7.44	140	5.5	**425**	14.67	362	6.75	**695**	14.33	521	6.58	**850**	14.08
E22E26	7.44	134	5.92	**421**	15	357	7.08	**692**	14.58	513	7.17	**820**	14.83
DRE4N	3.9	2	5.33	**148**	13.33	159	5.33	**545**	13.25	347	5.33	**804**	13.25
RTE3E4	3.9	2	5.67	**114**	13.58	145	5.58	**496**	13.5	329	5.58	**750**	13.42
E4N	0.31	**67**	4.92	61	12.92	**140**	4.92	122	12.92	**172**	4.92	154	12.92
CPE4N	4.21	4	5	**134**	13.5	155	5.5	**546**	13.42	350	5.5	**813**	13.42
DRE4	4.21	1	5	**84**	13.5	99	5.5	**416**	13.42	254	5.5	**651**	13.42
DE4NS	4.21	3	5	**51**	13.5	56	5.5	**130**	13.42	96	5.5	**162**	13.42
E4NE13	4.21	2	8.08	**44**	14.58	45	6.92	**105**	15.17	77	7.17	**131**	15.33
E13	0.48	**137**	4.92	125	12.92	**251**	4.92	231	12.92	**306**	4.92	284	12.83

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
CPE13	4.69	28	4.92	**120**	12.92	123	4.92	**223**	12.92	171	4.92	**275**	12.83
E13E24	4.69	18	6.25	**94**	13.92	93	6.17	**158**	14.42	126	6.25	**196**	14.42
DRE4	4.21	1	5	**84**	13.5	99	5.5	**416**	13.42	254	5.5	**651**	13.42
RTE4E4	4.21	1	7.67	**46**	14.92	68	6.83	**312**	14.33	189	6.5	**515**	14.25
E4	1.2	108	5.33	**182**	13.25	293	5.25	**364**	13.25	386	5.25	**462**	13.25
CPE4	5.41	12	5.33	**172**	13.25	138	5.33	**385**	14.25	222	5.25	**645**	14.17
DRE5	5.41	11	5.33	**162**	13.25	129	5.33	**372**	14.25	211	5.25	**630**	14.17
DE4S	5.41	1	5.33	**10**	13.25	8	5.33	**13**	14.25	11	5.25	**15**	14.17
E4E14N	5.41	1	8	**8**	14.58	7	6.67	**13**	15.33	10	6.5	**14**	15.17
E14N	0.3	**75**	4.83	68	12.83	**154**	4.83	135	12.83	**188**	4.83	171	12.75
CPE14N	5.71	4	4.83	**63**	12.83	49	4.83	**128**	12.83	79	4.83	**162**	12.75
E4NE24	5.71	1	7.67	**43**	14.08	30	6.17	**87**	14.25	58	6.08	**106**	14.42
DRE5	5.41	11	5.33	**162**	13.25	129	5.33	**372**	14.25	211	5.25	**630**	14.17
RTE4E5	5.41	9	6	**131**	13.67	116	5.75	**344**	14.58	195	5.75	**583**	14.42
E5	1.43	98	5.25	**206**	13.25	307	5.25	**421**	13.25	416	5.25	**534**	13.25
CPE5	6.84	12	5.33	**273**	13.33	196	5.58	**604**	13.33	353	5.5	**789**	13.33
DRE6	6.84	0	5.33	**41**	13.33	28	5.58	**250**	13.33	93	5.5	**356**	13.33
DE5S	6.84	12	5.33	**232**	13.33	168	5.58	**354**	13.33	260	5.5	**433**	13.33
E5E14	6.84	11	6.5	**209**	15	155	7	**318**	14.67	238	6.92	**390**	14.67
E14	0.7	198	4.75	**211**	12.75	386	4.75	**392**	12.75	478	4.75	**479**	12.75
CPE14	7.55	36	4.83	**209**	15	181	4.75	**368**	12.75	256	4.75	**455**	12.75
E14E24	7.55	23	5.83	**198**	15.83	151	5.67	**300**	15.83	225	7.92	**373**	15.83
E24	0.88	352	4.75	**373**	12.75	610	4.75	**620**	12.75	733	4.75	**734**	12.75
RETE24	0.88	277	4.58	**300**	12.58	**378**	4.42	340	12.33	**395**	4.33	325	12.25
DIVE24	0.88	278	4.92	**373**	12.75	610	4.75	**620**	12.75	733	4.75	**734**	12.75
E7	1.12	148	5.42	**205**	13.33	330	5.33	**385**	13.33	421	5.33	**473**	13.33
E7STOR	1.12	0	8.33	0	16.33	4	8.33	**5**	16.25	6	8.25	**7**	16.25
E7E6	1.12	0	12.75	0	21.25	3	11.67	**5**	18.33	6	10.17	**7**	17.75
DRE6	6.84	0	5.33	**41**	13.33	28	5.58	**250**	13.33	93	5.5	**356**	13.33
RTE5E6	6.84	0	6.92	**23**	14.08	19	6.17	**225**	13.83	83	5.92	**329**	13.75
E6	2.53	214	5.5	**460**	13.42	602	5.5	**859**	13.42	796	5.5	**1053**	13.42
E8	1.1	148	5.25	**206**	13.25	335	5.25	**385**	13.25	426	5.25	**479**	13.25

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E8E6	1.1	121	6.17	**182**	14.08	221	6.25	**251**	15	253	6.75	**307**	15.33
CPE6	3.63	214	5.5	**510**	13.5	643	5.67	**1174**	13.5	977	5.67	**1514**	13.5
DRE9	3.63	1	5.5	**8**	13.5	13	5.67	**238**	13.5	144	5.67	**509**	13.5
DE6S	3.63	177	5.5	**502**	13.5	630	5.67	**936**	13.5	833	5.67	**1005**	13.5
E6E15	3.63	167	6.17	**428**	15.42	547	7.33	**826**	15.08	747	7.17	**938**	15
E15	0.78	181	4.92	**202**	12.92	359	4.92	**375**	12.92	447	4.92	**458**	12.92
DRE9	3.63	1	5.5	**8**	13.5	13	5.67	**238**	13.5	144	5.67	**509**	13.5
RTE6E9	3.63	1	6.25	**7**	14.08	11	6.08	**199**	13.83	132	5.92	**456**	13.75
E9	0.72	166	5	**177**	13	319	5	**329**	13	397	5	**401**	13
CPE9	4.35	53	5.08	**171**	13	188	5.08	**321**	13	258	5	**591**	13.67
DRR5	4.35	1	5.08	**49**	13	63	5.08	**159**	13	112	5	**374**	13.67
DE9S	4.35	52	5.08	**122**	13	125	5.08	**163**	13	146	5	**217**	13.67
E9E16	4.35	39	6	**107**	13.75	116	5.75	**150**	13.67	138	5.75	**196**	14.5
E16	0.4	**120**	4.83	110	12.83	**220**	4.83	204	12.83	**269**	4.83	250	12.83
CPE16	4.75	38	6	**122**	13.5	141	5.5	**212**	13.25	191	5.17	**269**	12.92
E16E15	4.75	35	6.42	**120**	14	138	5.83	**209**	13.58	187	5.67	**259**	13.42
CPE15	12.37	180	6.17	**423**	14	536	7.25	**888**	15.08	742	7.17	**1078**	14.92
E15E24	12.37	66	7.58	**412**	15.58	421	7.5	**859**	15.5	624	7.67	**1046**	15.33
CPE24	14.73	69	5.33	**630**	15.58	559	6.25	**1224**	15.58	840	7.75	**1470**	15.42
E24E28	14.73	57	8.92	**600**	16.5	552	7.33	**1190**	16.5	821	8.75	**1427**	16.33
E23	0.11	**51**	4.5	46	12.5	**95**	4.5	85	12.5	**115**	4.5	104	12.5
E23E27	0.11	**23**	5.75	21	13.83	**51**	5.58	46	13.58	**66**	5.5	61	13.5
E27	0.47	**186**	4.83	173	12.83	**321**	4.83	299	12.83	**387**	4.83	356	12.83
CPE27	0.58	**178**	4.83	173	12.83	**312**	4.83	299	12.83	**377**	4.83	356	12.83
E27E28	0.58	**163**	5	160	13	**283**	5	272	13	**346**	5	329	13
E28	0.56	**257**	4.83	249	12.83	**426**	4.83	401	12.83	**503**	4.83	470	12.83
CPE28	15.87	176	4.92	**599**	16.5	549	7.33	**1190**	16.5	818	7	**1427**	16.33
E28E31	15.87	153	5.58	**591**	16.92	536	8	**1166**	17	791	7.5	**1400**	16.83
E25	0.93	523	4.58	**529**	12.58	**834**	4.58	824	12.5	**984**	4.5	965	12.5
RETE25	0.93	523	4.58	**529**	12.58	**834**	4.58	824	12.5	**984**	4.5	965	12.5
DIVE25	0.93	0	0	0	0	0	0	0	0	0	0	0	0
E25E29	0.93	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order														
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E29	1	110	5.75	**152**	13.67	252	5.67	**290**	13.67	321	5.67	**357**	13.67
CPE29	1.93	69	5.75	**149**	13.67	204	5.75	**285**	13.67	271	5.67	**352**	13.67
E29E31	1.93	38	8.83	**102**	16.08	155	7.83	**213**	15.67	216	7.67	**272**	15.5
E32	0.25	**34**	4.92	33	12.92	**96**	4.92	85	12.92	**123**	4.92	107	12.92
E32E31	0.25	25	5.42	25	13.42	**79**	5.25	70	13.25	**104**	5.25	90	13.25
E31	0.81	69	5.58	**94**	13.58	185	5.58	**199**	13.58	238	5.58	**252**	13.58
CPE31	18.86	153	5.58	**655**	16.5	562	8.08	**1250**	16.92	841	7.67	**1514**	16.75
E31E30	18.86	117	6.33	**652**	17	551	8.67	**1237**	17.25	821	8.17	**1501**	17.08
E30	0.94	265	5.33	**285**	13.33	453	5.33	**464**	13.33	539	5.33	**546**	13.33
CPE30	19.8	180	6.17	**652**	17	538	8.67	**1237**	17.25	812	8.17	**1501**	17.08
E30E26	19.8	176	6.33	**651**	17.08	537	8.75	**1233**	17.33	809	8.17	**1497**	17.17
E26	1.83	385	5.25	**510**	13.17	748	5.25	**875**	13.17	918	5.25	**1043**	13.17
CPE26	25.17	347	5.5	**779**	16.58	893	5.75	**1572**	15.75	1224	5.75	**2015**	14
E26E33	25.17	325	6.25	**767**	17.08	883	6.08	**1549**	16.08	1211	6.08	**1989**	14.25
E33	0.92	338	4.83	**369**	12.83	597	4.83	**614**	12.83	717	4.83	**727**	12.83
CPE33	33.27	353	6.33	**923**	14.25	1000	6.08	**1952**	14.17	1391	6.08	**2530**	14.17
E33P9A	33.27	347	6.5	**919**	14.33	996	6.17	**1947**	14.25	1386	6.17	**2524**	14.25
E33P9B	33.27	342	6.67	**913**	14.42	993	6.33	**1940**	14.33	1383	6.33	**2514**	14.33
P9	1.12	**505**	5.08	502	13.08	**764**	5.08	750	13.08	**882**	5.08	864	13.08
CPP9	34.39	392	5.33	**965**	14.25	1131	5.92	**2035**	14.17	1548	5.92	**2644**	14.17
P9EMF1	34.39	385	5.5	**960**	14.42	1126	6.08	**2029**	14.33	1542	6.08	**2636**	14.25
EMF1	1.97	374	5.58	**484**	13.58	706	5.58	**810**	13.58	858	5.58	**962**	13.58
RETEM1	1.97	**19**	4	17	11.92	**16**	3.83	15	11.83	**19**	3.83	18	11.83
DIVEM1	1.97	374	5.58	**484**	13.58	706	5.58	**810**	13.58	858	5.58	**962**	13.58
CPEMF1	36.37	546	5.58	**1210**	13.67	1473	5.83	**2510**	13.75	1994	5.83	**3216**	13.75
EM1EM2	36.37	537	5.75	**1199**	13.92	1467	6	**2502**	13.92	1987	6	**3211**	13.92
EMF2	1.85	679	5.17	**732**	13.17	1044	5.17	**1087**	13.17	1213	5.17	**1254**	13.17
RETEM2	1.85	601	5.17	**654**	13.17	966	5.17	**1009**	13.17	1135	5.17	**1176**	13.17
DIVEM2	1.85	78	3.92	78	11.83	**445**	6	440	14	**819**	5.67	782	13.67
CPEMF2	38.22	604	5.75	**1269**	13.92	1522	6	**2566**	13.92	2152	6.17	**3701**	13.92
EM2M3A	38.22	602	5.83	**1268**	14	1519	6.08	**2565**	13.92	2143	6.17	**3667**	14
EM2M3B	38.22	597	6	**1265**	14.08	1515	6.08	**2560**	14	2130	6.25	**3623**	14.08

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
EMF3	1.49	574	4.75	**668**	12.75	955	4.75	**1045**	12.75	1138	4.75	**1226**	12.75
CPEMF3	39.71	653	5.92	**1319**	14	1572	6.08	**2637**	14	2174	6.25	**3701**	14.08
EMF3RB	39.71	651	5.92	**1317**	14.08	1570	6.08	**2633**	14	2163	6.25	**3682**	14.08
RITBAS	0.1	**180**	4	148	12	**251**	4	208	12	**283**	4	236	12
CPRITB	39.81	651	5.92	**1317**	14.08	1569	6.08	**2633**	14	2161	6.25	**3682**	14.08
RBEMF4	39.81	629	6.42	**1300**	14.5	1548	6.42	**2608**	14.33	2133	6.5	**3592**	14.33
R2	0.68	**245**	4.83	239	12.83	**419**	4.83	407	12.83	**507**	4.83	486	12.83
RETR2	0.68	**88**	4.25	25	12	**74**	4.08	8	11.25	**90**	4.08	7	10.75
DIVR2	0.68	**245**	4.83	239	12.83	**419**	4.83	407	12.83	**507**	4.83	486	12.83
R3	0.41	**99**	5	91	13	**192**	4.92	173	12.92	**234**	4.92	216	12.92
CPR2R3	1.09	259	4.83	**318**	12.83	507	4.83	**562**	12.83	631	4.83	**683**	12.83
R2R3R6	1.09	140	6.58	**210**	14.42	361	6.33	**404**	14.25	464	6.25	**501**	14.25
R6	0.5	**233**	4.67	202	12.67	**386**	4.67	342	12.67	**460**	4.67	409	12.67
CPR6	1.59	141	4.67	**213**	14.42	360	6.33	**409**	14.25	463	6.25	**506**	14.25
R6R9	1.59	73	8.67	**152**	16.75	246	8.5	**314**	16.25	334	8.25	**399**	16.17
R9	0.59	79	5.25	**86**	13.17	**192**	5.17	184	13.17	**242**	5.17	233	13.17
CPR9	2.19	67	8.58	**152**	16.75	242	8.5	**314**	16.25	330	8.33	**399**	16.17
R9R11	2.19	48	13.67	**126**	19.58	189	11.25	**263**	18.92	264	10.92	**336**	18.67
R11	0.99	122	5.5	**167**	13.5	277	5.5	**316**	13.5	352	5.5	**389**	13.5
DRR5	4.35	1	5.08	**49**	13	63	5.08	**159**	13	112	5	**374**	13.67
R5	0.5	**333**	4.5	288	12.5	**526**	4.5	465	12.5	**622**	4.5	546	12.5
RETR5	0.5	**7**	3.42	3	6.33	**6**	2.83	3	5	**6**	2.67	4	4.67
DIVR5	0.5	**333**	4.5	288	12.5	**526**	4.5	465	12.5	**622**	4.5	546	12.5
CPR5	4.85	150	4.5	**280**	12.5	310	4.5	**491**	12.5	396	4.5	**598**	12.5
R5R8	4.85	108	5.33	**181**	13.75	231	5.83	**333**	13.75	307	5.83	**415**	13.75
R8	0.55	**161**	4.83	152	12.83	**299**	4.83	281	12.83	**366**	4.83	345	12.83
CPR8	5.4	132	4.92	**252**	12.83	256	4.92	**386**	12.83	331	5.75	**460**	13.67
R8R11	5.4	124	5.5	**234**	13.25	247	5.5	**349**	14.17	316	6.17	**435**	14.17
CPR11	8.58	152	5.5	**369**	13.5	373	5.5	**628**	13.5	492	5.5	**755**	13.5
R11R13	8.58	124	5.92	**352**	13.92	359	6	**581**	14.08	473	6.08	**701**	14.08
R13	0.5	**81**	5.17	73	13.17	**184**	5.17	162	13.17	**230**	5.17	200	13.17
CPR13	9.08	137	5.92	**380**	13.83	379	5.92	**627**	14	496	6	**755**	14

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
R13R16	9.08	125	6.25	**372**	14.25	370	6.25	**607**	14.5	485	6.5	**730**	14.58
R16	0.5	**51**	5.33	49	13.33	**143**	5.25	128	13.25	**184**	5.25	162	13.25
CPR16	9.58	125	6.25	**384**	14.17	371	6.25	**622**	14.5	486	6.5	**749**	14.58
R16R21	9.58	99	7.17	**364**	15.08	351	7.08	**603**	15.5	469	7.5	**724**	15.58
R21	0.84	166	5.17	**185**	13.17	321	5.17	**336**	13.17	397	5.17	**408**	13.17
R1	1.45	257	4.83	**410**	12.83	599	4.83	**747**	12.75	765	4.83	**922**	12.75
R1R4	1.45	139	6.5	**255**	14.42	400	6.25	**498**	14.17	535	6.17	**634**	14.08
R4	1	217	4.58	**287**	12.58	496	4.58	**562**	12.58	633	4.58	**698**	12.58
CPR4	2.45	120	4.58	**281**	12.58	370	6.33	**555**	12.58	504	6.17	**688**	12.58
R4R7	2.45	80	7.17	**264**	12.92	320	6.83	**494**	13.17	438	6.83	**616**	14.75
R7	1	399	4.67	**431**	12.67	678	4.67	**699**	12.67	813	4.67	**832**	12.67
RETR7	1	399	4.67	**431**	12.67	678	4.67	**684**	12.58	**799**	4.58	729	12.5
DIVR7	1	23	5.58	**66**	13.5	363	4.83	**632**	12.75	576	4.83	**832**	12.67
CPR7	3.45	96	7.25	**269**	14.67	351	5.17	**902**	12.75	718	4.92	**1120**	12.67
R7R10	3.45	57	8.17	**253**	15.17	282	7.25	**792**	13.33	569	5.33	**977**	13.25
R10	1.01	182	5	**239**	13	394	5	**442**	13	496	5	**544**	13
RETR10	1.01	182	5	**239**	13	325	4.83	**370**	12.83	361	4.75	**408**	12.75
DIVR10	1.01	78	5.5	**121**	13.5	287	5	**442**	13	471	5.08	**544**	13
CPR10	4.46	57	8.17	**282**	13.58	341	5.5	**1092**	13.25	717	5.42	**1379**	13.17
R10R12	4.46	38	12	**193**	17.83	205	9.75	**590**	15.58	354	7.75	**862**	15.33
R12	0.49	75	5.17	75	13.17	**176**	5.17	158	13.17	**219**	5.17	199	13.17
CPR12	4.95	38	12	**193**	17.83	202	9.75	**591**	15.58	349	7.75	**864**	15.33
R12R15	4.95	33	14.42	**183**	19	172	11.42	**497**	16.75	310	10.5	**723**	16.42
R15	0.56	**202**	4.67	191	12.67	**370**	4.67	337	12.67	**445**	4.67	412	12.67
RETR15	0.56	**65**	4.17	7	11.58	**48**	4.08	5	10.25	**50**	4	5	9.67
DIVR15	0.56	**202**	4.67	191	12.67	**370**	4.67	337	12.67	**445**	4.67	412	12.67
CPR15	5.51	60	4.67	**182**	19	175	4.67	**496**	16.75	308	10.5	**723**	16.42
R15R18	5.51	38	5.58	**179**	19.5	149	11.17	**471**	17.25	298	10.92	**685**	16.83
R18	0.8	342	4.58	**347**	12.58	**584**	4.58	577	12.58	**701**	4.58	688	12.58
RETR18	0.8	342	4.58	**347**	12.58	**584**	4.58	577	12.58	**701**	4.58	688	12.58
DIVR18	0.8	0	0	0	0	0	0	**9**	16	138	5.17	**177**	13.17
CPR18	6.3	38	5.58	**179**	19.5	149	11.17	**471**	17.25	298	10.92	**683**	16.83

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
R18R22	6.3	27	6.75	**171**	20.17	131	11.58	**442**	17.75	284	11.5	**652**	17.33
R22	0.57	94	5.08	**98**	13.08	**216**	5.08	201	13.08	**268**	5.08	254	13.08
R14	0.5	**89**	5	86	13	**205**	5	182	13	**255**	5	228	13
RETR14	0.5	**35**	4.42	30	12.33	**40**	4.25	30	12.17	**41**	4.17	25	12.08
DIVR14	0.5	**89**	5	86	13	**205**	5	182	13	**255**	5	228	13
R14R17	0.5	39	7.75	**40**	15.75	**121**	6.92	106	15	**160**	6.75	145	14.83
R17	0.49	**58**	5.42	57	13.33	**145**	5.33	130	13.33	**183**	5.33	164	13.33
CPR17	0.99	39	5.42	**57**	13.33	121	5.33	**130**	13.33	158	5.33	**166**	14.75
R17R22	0.99	28	5.92	**39**	14.75	93	5.75	**102**	14.33	128	5.75	**142**	15.67
CPR22	7.87	157	15.92	**174**	20.17	199	11.58	**465**	17.83	277	11.5	**685**	17.33
R22R21	7.87	22	18.58	**171**	20.58	117	6.58	**456**	18.08	268	11.92	**669**	17.67
CPR21	18.28	227	7.33	**436**	14.83	388	6.92	**724**	14.67	511	6.75	**872**	15.75
R21R25	18.28	75	8.25	**423**	15.33	378	7.33	**716**	15.17	507	7.17	**869**	16.08
R25	0.28	**184**	4.42	161	12.42	**309**	4.33	278	12.33	**371**	4.33	331	12.33
R20	0.5	**56**	5	47	13	**172**	4.92	150	12.92	**225**	4.92	194	12.92
RETR20	0.5	**56**	5	47	13	**172**	4.92	150	12.92	**225**	4.92	194	12.92
DIVR20	0.5	0	0	0	0	**99**	5.33	75	13.42	**189**	5.08	142	13.17
R20R23	0.5	0	0	0	0	**53**	6.08	33	14.33	**119**	5.67	90	13.83
R23	0.5	**100**	5.17	94	13.08	**204**	5.08	180	13.08	**248**	5.08	224	13.08
RETR23	0.5	**76**	4.92	64	12.83	**102**	4.58	81	12.5	**111**	4.5	91	12.42
DIVR23	0.5	**100**	5.17	94	13.08	**204**	5.08	180	13.08	**248**	5.08	224	13.08
CPR23	1	60	5.17	**94**	13.08	160	5.08	**180**	13.08	204	5.08	**224**	13.08
R23R25	1	46	5.75	**77**	13.67	131	5.83	**154**	13.67	163	5.92	**189**	13.75
CPR25	19.56	254	8.08	**430**	15.25	375	7.33	**733**	15	511	7.17	**907**	14.75
R25R24	19.56	73	8.33	**430**	15.33	375	7.33	**733**	15.08	511	7.17	**907**	14.75
R19	1.53	98	5.17	**234**	13.17	336	5.17	**486**	13.17	463	5.17	**613**	13.17
RETR19	1.53	29	5.17	**63**	13.17	165	5.17	**315**	13.17	292	5.17	**442**	13.17
DIVR19	1.53	69	5.25	**171**	13	171	5	171	12.5	171	4.67	171	12.33
R19R24	1.53	59	5.92	**166**	13.92	169	5.92	**171**	14	171	5.92	171	14
R24	0.29	**147**	4.42	134	12.42	**269**	4.42	245	12.42	**326**	4.42	297	12.42
CPR24	21.38	72	8.33	**458**	15.25	375	7.33	**846**	14.5	534	7	**1054**	14.5
R24EM4	21.38	68	8.67	**451**	15.42	369	7.42	**838**	14.75	529	7.17	**1046**	14.67

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
EMF4	0.25	**274**	4.17	239	12.17	**451**	4.17	386	12.17	**528**	4.17	452	12.17
CPEMF4	57.09	629	6.42	**1516**	15.08	1546	6.5	**3237**	14.5	2126	6.58	**4335**	14.42

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
22E	0.09	**98**	4.25	87	12.25	**147**	4.25	130	12.25	**170**	4.25	149	12.25
22EE22	4.87	80	5.83	**279**	14.67	278	6.83	**395**	14.83	349	6.83	**453**	14.75
CP22E	4.87	135	4.33	**284**	13.42	286	6.08	**413**	14	361	6.08	**480**	13.92
CPE10	0.82	131	4.92	**162**	12.92	326	4.92	**345**	12.92	416	4.92	**442**	12.92
CPE11	2.27	36	4.92	**120**	12.83	133	4.83	**246**	12.83	196	4.83	**311**	12.83
CPE12	4.47	62	5.75	**288**	13	291	5.17	**468**	12.92	384	5	**546**	12.92
CPE13	4.69	28	4.92	**120**	12.92	123	4.92	**223**	12.92	171	4.92	**275**	12.83
CPE14	7.55	36	4.83	**209**	15	181	4.75	**368**	12.75	256	4.75	**455**	12.75
CPE14N	5.71	4	4.83	**63**	12.83	49	4.83	**128**	12.83	79	4.83	**162**	12.75
CPE15	12.37	180	6.17	**423**	14	536	7.25	**888**	15.08	742	7.17	**1078**	14.92
CPE16	4.75	38	6	**122**	13.5	141	5.5	**212**	13.25	191	5.17	**269**	12.92
CPE17	1.09	114	5.25	**143**	13.25	283	5.17	**302**	13.17	378	5.08	**413**	13.08
CPE18	2.49	128	4.33	**179**	12.33	209	4.33	**273**	12.33	245	4.33	**315**	12.33
CPE19	4.61	82	4.25	**280**	13.83	292	5.83	**420**	13.67	367	5.75	**490**	13.58
CPE2	1.67	85	5	**206**	13	310	5	**472**	13	453	5	**627**	13
CPE21	4	113	4.67	**188**	14	237	6	**390**	13.75	299	5.83	**526**	13.67
CPE22	7.44	140	5.5	**425**	14.67	362	6.75	**695**	14.33	521	6.58	**850**	14.08
CPE24	14.73	69	5.33	**630**	15.58	559	6.25	**1224**	15.58	840	7.75	**1470**	15.42
CPE26	25.17	347	5.5	**779**	16.58	893	5.75	**1572**	15.75	1224	5.75	**2015**	14
CPE27	0.58	**178**	4.83	173	12.83	**312**	4.83	299	12.83	**377**	4.83	356	12.83
CPE28	15.87	176	4.92	**599**	16.5	549	7.33	**1190**	16.5	818	7	**1427**	16.33
CPE29	1.93	69	5.75	**149**	13.67	204	5.75	**285**	13.67	271	5.67	**352**	13.67
CPE30	19.8	180	6.17	**652**	17	538	8.67	**1237**	17.25	812	8.17	**1501**	17.08
CPE31	18.86	153	5.58	**655**	16.5	562	8.08	**1250**	16.92	841	7.67	**1514**	16.75
CPE33	33.27	353	6.33	**923**	14.25	1000	6.08	**1952**	14.17	1391	6.08	**2530**	14.17
CPE4	5.41	12	5.33	**172**	13.25	138	5.33	**385**	14.25	222	5.25	**645**	14.17
CPE4N	4.21	4	5	**134**	13.5	155	5.5	**546**	13.42	350	5.5	**813**	13.42
CPE5	6.84	12	5.33	**273**	13.33	196	5.58	**604**	13.33	353	5.5	**789**	13.33
CPE6	3.63	214	5.5	**510**	13.5	643	5.67	**1174**	13.5	977	5.67	**1514**	13.5
CPE9	4.35	53	5.08	**171**	13	188	5.08	**321**	13	258	5	**591**	13.67
CPEMF1	36.37	546	5.58	**1210**	13.67	1473	5.83	**2510**	13.75	1994	5.83	**3216**	13.75
CPEMF2	38.22	604	5.75	**1269**	13.92	1522	6	**2566**	13.92	2152	6.17	**3701**	13.92

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
CPEMF3	39.71	653	5.92	**1319**	14	1572	6.08	**2637**	14	2174	6.25	**3701**	14.08
CPEMF4	57.09	629	6.42	**1516**	15.08	1546	6.5	**3237**	14.5	2126	6.58	**4335**	14.42
CPP2	0.58	**132**	4.83	130	12.83	**279**	4.83	258	12.75	**344**	4.83	327	12.75
CPP3	0.91	89	5	**119**	13	246	5	**275**	12.92	329	4.92	**363**	12.92
CPP4	1.08	104	5.08	**109**	13.08	**241**	5	231	13	**305**	5	300	13
CPP5	1.16	85	5.08	**114**	13.08	250	5.08	**322**	13.08	355	4.92	**475**	12.92
CPP6	1.58	56	5.5	**90**	13.5	162	5.33	**198**	13.33	220	5.25	**263**	13.25
CPP7	3.19	64	5.5	**110**	13.83	234	5.83	**297**	13.58	360	5.67	**528**	13
CPP8	7.18	107	6.17	**270**	14.08	286	6.08	**557**	14	418	6.08	**701**	13.92
CPP9	34.39	392	5.33	**965**	14.25	1131	5.92	**2035**	14.17	1548	5.92	**2644**	14.17
CPR10	4.46	57	8.17	**282**	13.58	341	5.5	**1092**	13.25	717	5.42	**1379**	13.17
CPR11	8.58	152	5.5	**369**	13.5	373	5.5	**628**	13.5	492	5.5	**755**	13.5
CPR12	4.95	38	12	**193**	17.83	202	9.75	**591**	15.58	349	7.75	**864**	15.33
CPR13	9.08	137	5.92	**380**	13.83	379	5.92	**627**	14	496	6	**755**	14
CPR15	5.51	60	4.67	**182**	19	175	4.67	**496**	16.75	308	10.5	**723**	16.42
CPR16	9.58	125	6.25	**384**	14.17	371	6.25	**622**	14.5	486	6.5	**749**	14.58
CPR17	0.99	39	5.42	**57**	13.33	121	5.33	**130**	13.33	158	5.33	**166**	14.75
CPR18	6.3	38	5.58	**179**	19.5	149	11.17	**471**	17.25	298	10.92	**683**	16.83
CPR21	18.28	227	7.33	**436**	14.83	388	6.92	**724**	14.67	511	6.75	**872**	15.75
CPR22	7.87	157	15.92	**174**	20.17	199	11.58	**465**	17.83	277	11.5	**685**	17.33
CPR23	1	60	5.17	**94**	13.08	160	5.08	**180**	13.08	204	5.08	**224**	13.08
CPR24	21.38	72	8.33	**458**	15.25	375	7.33	**846**	14.5	534	7	**1054**	14.5
CPR25	19.56	254	8.08	**430**	15.25	375	7.33	**733**	15	511	7.17	**907**	14.75
CPR2R3	1.09	259	4.83	**318**	12.83	507	4.83	**562**	12.83	631	4.83	**683**	12.83
CPR4	2.45	120	4.58	**281**	12.58	370	6.33	**555**	12.58	504	6.17	**688**	12.58
CPR5	4.85	150	4.5	**280**	12.5	310	4.5	**491**	12.5	396	4.5	**598**	12.5
CPR6	1.59	141	4.67	**213**	14.42	360	6.33	**409**	14.25	463	6.25	**506**	14.25
CPR7	3.45	96	7.25	**269**	14.67	351	5.17	**902**	12.75	718	4.92	**1120**	12.67
CPR8	5.4	132	4.92	**252**	12.83	256	4.92	**386**	12.83	331	5.75	**460**	13.67
CPR9	2.19	67	8.58	**152**	16.75	242	8.5	**314**	16.25	330	8.33	**399**	16.17
CPRITB	39.81	651	5.92	**1317**	14.08	1569	6.08	**2633**	14	2161	6.25	**3682**	14.08
CPTEMP	9.2	81	5.33	**347**	12.75	385	4.75	**588**	12.75	483	4.75	**706**	12.75

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DE1S	0.89	37	4.83	**51**	12.83	72	4.83	**77**	12.83	83	4.83	**88**	12.83
DE2S	1.67	57	5	**139**	13	159	5	**195**	13	189	5	**219**	13
DE3S	3.9	70	5.33	**255**	13.33	261	5.33	**394**	13.25	333	5.33	**455**	13.25
DE4NS	4.21	3	5	**51**	13.5	56	5.5	**130**	13.42	96	5.5	**162**	13.42
DE4S	5.41	1	5.33	**10**	13.25	8	5.33	**13**	14.25	11	5.25	**15**	14.17
DE5S	6.84	12	5.33	**232**	13.33	168	5.58	**354**	13.33	260	5.5	**433**	13.33
DE6S	3.63	177	5.5	**502**	13.5	630	5.67	**936**	13.5	833	5.67	**1005**	13.5
DE9S	4.35	52	5.08	**122**	13	125	5.08	**163**	13	146	5	**217**	13.67
DIVE17	0.27	0	0	0	0	0	0	0	0	**20**	5	19	13.08
DIVE21	0.41	0	0	0	0	**24**	5.25	8	13.58	**211**	4.83	186	12.83
DIVE24	0.88	278	4.92	**373**	12.75	610	4.75	**620**	12.75	733	4.75	**734**	12.75
DIVE25	0.93	0	0	0	0	0	0	0	0	0	0	0	0
DIVEM1	1.97	374	5.58	**484**	13.58	706	5.58	**810**	13.58	858	5.58	**962**	13.58
DIVEM2	1.85	78	3.92	78	11.83	**445**	6	440	14	**819**	5.67	782	13.67
DIVP4	0.5	0	0	0	0	0	0	0	0	0	0	0	0
DIVP5	0.25	0	0	0	0	51	5.17	**65**	13.08	151	4.92	**163**	12.83
DIVP6	0.5	0	0	0	0	0	0	0	0	0	0	0	0
DIVP7	0.45	0	0	0	0	0	0	**4**	16.83	**188**	4.83	129	12.83
DIVP8	3.98	361	6.08	**543**	14.08	730	6.08	**915**	14	901	6.08	**1087**	14
DIVP8	3.98	120	6.08	**181**	14.08	243	6.08	**305**	14	300	6.08	**362**	14
DIVR10	1.01	78	5.5	**121**	13.5	287	5	**442**	13	471	5.08	**544**	13
DIVR14	0.5	**89**	5	86	13	**205**	5	182	13	**255**	5	228	13
DIVR15	0.56	**202**	4.67	191	12.67	**370**	4.67	337	12.67	**445**	4.67	412	12.67
DIVR18	0.8	0	0	0	0	0	0	**9**	16	138	5.17	**177**	13.17
DIVR19	1.53	69	5.25	**171**	13	171	5	171	12.5	171	4.67	171	12.33
DIVR2	0.68	**245**	4.83	239	12.83	**419**	4.83	407	12.83	**507**	4.83	486	12.83
DIVR20	0.5	0	0	0	0	**99**	5.33	75	13.42	**189**	5.08	142	13.17
DIVR23	0.5	**100**	5.17	94	13.08	**204**	5.08	180	13.08	**248**	5.08	224	13.08
DIVR5	0.5	**333**	4.5	288	12.5	**526**	4.5	465	12.5	**622**	4.5	546	12.5
DIVR7	1	23	5.58	**66**	13.5	363	4.83	**632**	12.75	576	4.83	**832**	12.67
DP1PFW	0.39	**59**	4.67	56	12.67	**80**	4.67	76	12.67	**86**	4.67	83	12.67
DRE2	0.89	102	4.83	**133**	12.83	269	4.83	**296**	12.83	354	4.83	**383**	12.83

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DRE2	0.89	102	4.83	**133**	12.83	269	4.83	**296**	12.83	354	4.83	**383**	12.83
DRE3	1.67	28	5	**67**	13	151	5	**277**	13	265	5	**408**	13
DRE3	1.67	28	5	**67**	13	151	5	**277**	13	265	5	**408**	13
DRE4	4.21	1	5	**84**	13.5	99	5.5	**416**	13.42	254	5.5	**651**	13.42
DRE4	4.21	1	5	**84**	13.5	99	5.5	**416**	13.42	254	5.5	**651**	13.42
DRE4N	3.9	2	5.33	**148**	13.33	159	5.33	**545**	13.25	347	5.33	**804**	13.25
DRE4N	3.9	2	5.33	**148**	13.33	159	5.33	**545**	13.25	347	5.33	**804**	13.25
DRE5	5.41	11	5.33	**162**	13.25	129	5.33	**372**	14.25	211	5.25	**630**	14.17
DRE5	5.41	11	5.33	**162**	13.25	129	5.33	**372**	14.25	211	5.25	**630**	14.17
DRE6	6.84	0	5.33	**41**	13.33	28	5.58	**250**	13.33	93	5.5	**356**	13.33
DRE6	6.84	0	5.33	**41**	13.33	28	5.58	**250**	13.33	93	5.5	**356**	13.33
DRE9	3.63	1	5.5	**8**	13.5	13	5.67	**238**	13.5	144	5.67	**509**	13.5
DRE9	3.63	1	5.5	**8**	13.5	13	5.67	**238**	13.5	144	5.67	**509**	13.5
DRPFW	0.39	**45**	4.67	39	12.67	**142**	4.67	118	12.67	**186**	4.67	161	12.67
DRPFW	0.39	**45**	4.67	39	12.67	**142**	4.67	118	12.67	**186**	4.67	161	12.67
DRR5	4.35	1	5.08	**49**	13	63	5.08	**159**	13	112	5	**374**	13.67
DRR5	4.35	1	5.08	**49**	13	63	5.08	**159**	13	112	5	**374**	13.67
E1	0.89	139	4.83	**184**	12.83	341	4.83	**374**	12.83	437	4.83	**472**	12.83
E10	0.82	130	4.92	**161**	12.92	308	4.92	**326**	12.92	392	4.92	**411**	12.92
E10E17	0.82	114	5.25	**143**	13.25	283	5.17	**302**	13.17	372	5.08	**396**	13.08
E11	0.6	122	4.83	**124**	12.83	**269**	4.83	251	12.83	**334**	4.83	318	12.83
E11E18	2.27	15	5.92	**83**	13.83	98	5.75	**173**	13.75	150	5.75	**236**	13.58
E12	0.57	**138**	4.92	135	12.92	**270**	4.92	256	12.92	**332**	4.92	318	12.92
E12E19	4.47	59	6	**279**	13.92	292	5.83	**418**	13.67	367	5.75	**488**	13.58
E13	0.48	**137**	4.92	125	12.92	**251**	4.92	231	12.92	**306**	4.92	284	12.83
E13E24	4.69	18	6.25	**94**	13.92	93	6.17	**158**	14.42	126	6.25	**196**	14.42
E14	0.7	198	4.75	**211**	12.75	386	4.75	**392**	12.75	478	4.75	**479**	12.75
E14E24	7.55	23	5.83	**198**	15.83	151	5.67	**300**	15.83	225	7.92	**373**	15.83
E14N	0.3	**75**	4.83	68	12.83	**154**	4.83	135	12.83	**188**	4.83	171	12.75
E15	0.78	181	4.92	**202**	12.92	359	4.92	**375**	12.92	447	4.92	**458**	12.92
E15E24	12.37	66	7.58	**412**	15.58	421	7.5	**859**	15.5	624	7.67	**1046**	15.33
E16	0.4	**120**	4.83	110	12.83	**220**	4.83	204	12.83	**269**	4.83	250	12.83

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E16E15	4.75	35	6.42	**120**	14	138	5.83	**209**	13.58	187	5.67	**259**	13.42
E17	0.27	**190**	4.42	165	12.42	**308**	4.42	272	12.33	**364**	4.42	322	12.33
E17E21	1.09	77	5.83	**125**	13.83	213	5.67	**266**	13.58	302	5.58	**358**	13.5
E18	0.22	**205**	4.33	183	12.33	**315**	4.33	277	12.33	**365**	4.33	319	12.33
E18E21	2.49	109	4.67	**146**	12.58	189	4.58	**235**	12.58	225	4.58	**274**	12.58
E19	0.14	**159**	4.25	139	12.25	**235**	4.25	205	12.25	**270**	4.25	234	12.25
E1922E	4.61	79	4.42	**279**	14.17	286	6.08	**408**	14	360	6.08	**474**	13.92
E1E10	0.89	27	6.17	**37**	14.08	41	6.17	**48**	14.83	48	6.58	**55**	15
E2	0.78	141	4.92	**166**	12.92	315	4.92	**325**	12.92	396	4.92	**409**	12.92
E20	0.17	**87**	4.5	77	12.5	**149**	4.5	133	12.5	**178**	4.5	159	12.5
E2022E	0.17	**72**	4.83	61	12.83	**123**	4.83	107	12.75	**148**	4.83	129	12.75
E21	0.41	**223**	4.5	203	12.5	**383**	4.5	352	12.5	**464**	4.5	423	12.5
E21E22	4	73	5.42	**163**	14.67	154	6.67	**367**	14.17	265	6.33	**498**	14
E22	0.25	**117**	4.67	111	12.67	**202**	4.67	188	12.67	**243**	4.67	223	12.67
E22E26	7.44	134	5.92	**421**	15	357	7.08	**692**	14.58	513	7.17	**820**	14.83
E23	0.11	**51**	4.5	46	12.5	**95**	4.5	85	12.5	**115**	4.5	104	12.5
E23E27	0.11	**23**	5.75	21	13.83	**51**	5.58	46	13.58	**66**	5.5	61	13.5
E24	0.88	352	4.75	**373**	12.75	610	4.75	**620**	12.75	733	4.75	**734**	12.75
E24E28	14.73	57	8.92	**600**	16.5	552	7.33	**1190**	16.5	821	8.75	**1427**	16.33
E25	0.93	523	4.58	**529**	12.58	**834**	4.58	824	12.5	**984**	4.5	965	12.5
E25E29	0.93	0	0	0	0	0	0	0	0	0	0	0	0
E26	1.83	385	5.25	**510**	13.17	748	5.25	**875**	13.17	918	5.25	**1043**	13.17
E26E33	25.17	325	6.25	**767**	17.08	883	6.08	**1549**	16.08	1211	6.08	**1989**	14.25
E27	0.47	**186**	4.83	173	12.83	**321**	4.83	299	12.83	**387**	4.83	356	12.83
E27E28	0.58	**163**	5	160	13	**283**	5	272	13	**346**	5	329	13
E28	0.56	**257**	4.83	249	12.83	**426**	4.83	401	12.83	**503**	4.83	470	12.83
E28E31	15.87	153	5.58	**591**	16.92	536	8	**1166**	17	791	7.5	**1400**	16.83
E29	1	110	5.75	**152**	13.67	252	5.67	**290**	13.67	321	5.67	**357**	13.67
E29E31	1.93	38	8.83	**102**	16.08	155	7.83	**213**	15.67	216	7.67	**272**	15.5
E2E11	1.67	32	8.17	**92**	16.25	113	8.17	**151**	15.92	148	8	**173**	15.83
E2SE3	3.9	72	5.33	**403**	13.33	419	5.33	**938**	13.25	680	5.33	**1259**	13.25
E3	2.23	132	5.33	**391**	13.25	486	5.25	**748**	13.25	667	5.25	**935**	13.25

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E30	0.94	265	5.33	**285**	13.33	453	5.33	**464**	13.33	539	5.33	**546**	13.33
E30E26	19.8	176	6.33	**651**	17.08	537	8.75	**1233**	17.33	809	8.17	**1497**	17.17
E31	0.81	69	5.58	**94**	13.58	185	5.58	**199**	13.58	238	5.58	**252**	13.58
E31E30	18.86	117	6.33	**652**	17	551	8.67	**1237**	17.25	821	8.17	**1501**	17.08
E32	0.25	**34**	4.92	33	12.92	**96**	4.92	85	12.92	**123**	4.92	107	12.92
E32E31	0.25	25	5.42	25	13.42	**79**	5.25	70	13.25	**104**	5.25	90	13.25
E33	0.92	338	4.83	**369**	12.83	597	4.83	**614**	12.83	717	4.83	**727**	12.83
E33P9A	33.27	347	6.5	**919**	14.33	996	6.17	**1947**	14.25	1386	6.17	**2524**	14.25
E33P9B	33.27	342	6.67	**913**	14.42	993	6.33	**1940**	14.33	1383	6.33	**2514**	14.33
E3E12	3.9	62	5.75	**247**	13.75	254	5.83	**347**	14.5	290	6.42	**401**	14.5
E4	1.2	108	5.33	**182**	13.25	293	5.25	**364**	13.25	386	5.25	**462**	13.25
E4E14N	5.41	1	8	**8**	14.58	7	6.67	**13**	15.33	10	6.5	**14**	15.17
E4N	0.31	**67**	4.92	61	12.92	**140**	4.92	122	12.92	**172**	4.92	154	12.92
E4NE13	4.21	2	8.08	**44**	14.58	45	6.92	**105**	15.17	77	7.17	**131**	15.33
E4NE24	5.71	1	7.67	**43**	14.08	30	6.17	**87**	14.25	58	6.08	**106**	14.42
E5	1.43	98	5.25	**206**	13.25	307	5.25	**421**	13.25	416	5.25	**534**	13.25
E5E14	6.84	11	6.5	**209**	15	155	7	**318**	14.67	238	6.92	**390**	14.67
E6	2.53	214	5.5	**460**	13.42	602	5.5	**859**	13.42	796	5.5	**1053**	13.42
E6E15	3.63	167	6.17	**428**	15.42	547	7.33	**826**	15.08	747	7.17	**938**	15
E7	1.12	148	5.42	**205**	13.33	330	5.33	**385**	13.33	421	5.33	**473**	13.33
E7E6	1.12	0	12.75	0	21.25	3	11.67	**5**	18.33	6	10.17	**7**	17.75
E7STOR	1.12	0	8.33	0	16.33	4	8.33	**5**	16.25	6	8.25	**7**	16.25
E8	1.1	148	5.25	**206**	13.25	335	5.25	**385**	13.25	426	5.25	**479**	13.25
E8E6	1.1	121	6.17	**182**	14.08	221	6.25	**251**	15	253	6.75	**307**	15.33
E9	0.72	166	5	**177**	13	319	5	**329**	13	397	5	**401**	13
E9E16	4.35	39	6	**107**	13.75	116	5.75	**150**	13.67	138	5.75	**196**	14.5
EM1EM2	36.37	537	5.75	**1199**	13.92	1467	6	**2502**	13.92	1987	6	**3211**	13.92
EM2M3A	38.22	602	5.83	**1268**	14	1519	6.08	**2565**	13.92	2143	6.17	**3667**	14
EM2M3B	38.22	597	6	**1265**	14.08	1515	6.08	**2560**	14	2130	6.25	**3623**	14.08
EMF1	1.97	374	5.58	**484**	13.58	706	5.58	**810**	13.58	858	5.58	**962**	13.58
EMF2	1.85	679	5.17	**732**	13.17	1044	5.17	**1087**	13.17	1213	5.17	**1254**	13.17
EMF3	1.49	574	4.75	**668**	12.75	955	4.75	**1045**	12.75	1138	4.75	**1226**	12.75

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
EMF3RB	39.71	651	5.92	**1317**	14.08	1570	6.08	**2633**	14	2163	6.25	**3682**	14.08
EMF4	0.25	**274**	4.17	239	12.17	**451**	4.17	386	12.17	**528**	4.17	452	12.17
P1	0.39	**104**	4.67	95	12.67	**222**	4.67	194	12.67	**272**	4.67	244	12.67
P1P2	0.39	**32**	7.17	30	15.25	**54**	6.58	49	14.58	**61**	6.5	58	14.5
P1PFW	0.39	**29**	4.92	25	12.92	**115**	4.83	92	12.83	**156**	4.83	135	12.83
P2	0.58	**133**	4.83	130	12.83	**280**	4.83	258	12.75	**345**	4.83	326	12.75
P2P4	0.58	104	5.08	**109**	13.08	**241**	5	231	13	**305**	5	300	13
P3	0.52	**101**	5	95	13	**216**	5	191	13	**265**	5	242	13
P3P5	0.91	85	5.08	**114**	13.08	242	5	**271**	13	325	5	**358**	13
P4	0.5	**339**	4.5	291	12.5	**523**	4.5	459	12.5	**614**	4.5	536	12.5
P4P6	1.08	56	5.5	**90**	13.5	162	5.33	**198**	13.33	220	5.25	**263**	13.25
P5	0.25	**158**	4.58	138	12.58	**247**	4.58	218	12.58	**291**	4.58	256	12.58
P5P7	1.16	64	5.17	**109**	13.17	221	5.17	**300**	13.17	346	5	**463**	13
P6	0.5	**355**	4.42	310	12.42	**568**	4.42	502	12.42	**672**	4.42	592	12.42
P6P7	1.58	30	6	**79**	14	115	5.92	**177**	13.75	175	5.75	**236**	13.67
P7	0.45	**326**	4.42	291	12.42	**521**	4.42	464	12.42	**613**	4.42	544	12.42
P7P8A	3.19	4	8.25	**104**	14.17	105	6.17	**285**	13.83	214	5.92	**464**	13.25
P8	3.98	481	6.08	**725**	14.08	973	6.08	**1220**	14	1201	6.08	**1449**	14
P8E33B	7.18	102	6.33	**260**	14.25	280	6.33	**542**	14.17	410	6.25	**692**	14.08
P9	1.12	**505**	5.08	502	13.08	**764**	5.08	750	13.08	**882**	5.08	864	13.08
P9EMF1	34.39	385	5.5	**960**	14.42	1126	6.08	**2029**	14.33	1542	6.08	**2636**	14.25
R1	1.45	257	4.83	**410**	12.83	599	4.83	**747**	12.75	765	4.83	**922**	12.75
R10	1.01	182	5	**239**	13	394	5	**442**	13	496	5	**544**	13
R10R12	4.46	38	12	**193**	17.83	205	9.75	**590**	15.58	354	7.75	**862**	15.33
R11	0.99	122	5.5	**167**	13.5	277	5.5	**316**	13.5	352	5.5	**389**	13.5
R11R13	8.58	124	5.92	**352**	13.92	359	6	**581**	14.08	473	6.08	**701**	14.08
R12	0.49	75	5.17	75	13.17	**176**	5.17	158	13.17	**219**	5.17	199	13.17
R12R15	4.95	33	14.42	**183**	19	172	11.42	**497**	16.75	310	10.5	**723**	16.42
R13	0.5	**81**	5.17	73	13.17	**184**	5.17	162	13.17	**230**	5.17	200	13.17
R13R16	9.08	125	6.25	**372**	14.25	370	6.25	**607**	14.5	485	6.5	**730**	14.58
R14	0.5	**89**	5	86	13	**205**	5	182	13	**255**	5	228	13
R14R17	0.5	39	7.75	**40**	15.75	**121**	6.92	106	15	**160**	6.75	145	14.83

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
R15	0.56	**202**	4.67	191	12.67	**370**	4.67	337	12.67	**445**	4.67	412	12.67
R15R18	5.51	38	5.58	**179**	19.5	149	11.17	**471**	17.25	298	10.92	**685**	16.83
R16	0.5	**51**	5.33	49	13.33	**143**	5.25	128	13.25	**184**	5.25	162	13.25
R16R21	9.58	99	7.17	**364**	15.08	351	7.08	**603**	15.5	469	7.5	**724**	15.58
R17	0.49	**58**	5.42	57	13.33	**145**	5.33	130	13.33	**183**	5.33	164	13.33
R17R22	0.99	28	5.92	**39**	14.75	93	5.75	**102**	14.33	128	5.75	**142**	15.67
R18	0.8	342	4.58	**347**	12.58	**584**	4.58	577	12.58	**701**	4.58	688	12.58
R18R22	6.3	27	6.75	**171**	20.17	131	11.58	**442**	17.75	284	11.5	**652**	17.33
R19	1.53	98	5.17	**234**	13.17	336	5.17	**486**	13.17	463	5.17	**613**	13.17
R19R24	1.53	59	5.92	**166**	13.92	169	5.92	**171**	14	171	5.92	171	14
R1R4	1.45	139	6.5	**255**	14.42	400	6.25	**498**	14.17	535	6.17	**634**	14.08
R2	0.68	**245**	4.83	239	12.83	**419**	4.83	407	12.83	**507**	4.83	486	12.83
R20	0.5	**56**	5	47	13	**172**	4.92	150	12.92	**225**	4.92	194	12.92
R20R23	0.5	0	0	0	0	**53**	6.08	33	14.33	**119**	5.67	90	13.83
R21	0.84	166	5.17	**185**	13.17	321	5.17	**336**	13.17	397	5.17	**408**	13.17
R21R25	18.28	75	8.25	**423**	15.33	378	7.33	**716**	15.17	507	7.17	**869**	16.08
R22	0.57	94	5.08	**98**	13.08	**216**	5.08	201	13.08	**268**	5.08	254	13.08
R22R21	7.87	22	18.58	**171**	20.58	117	6.58	**456**	18.08	268	11.92	**669**	17.67
R23	0.5	**100**	5.17	94	13.08	**204**	5.08	180	13.08	**248**	5.08	224	13.08
R23R25	1	46	5.75	**77**	13.67	131	5.83	**154**	13.67	163	5.92	**189**	13.75
R24	0.29	**147**	4.42	134	12.42	**269**	4.42	245	12.42	**326**	4.42	297	12.42
R24EM4	21.38	68	8.67	**451**	15.42	369	7.42	**838**	14.75	529	7.17	**1046**	14.67
R25	0.28	**184**	4.42	161	12.42	**309**	4.33	278	12.33	**371**	4.33	331	12.33
R25R24	19.56	73	8.33	**430**	15.33	375	7.33	**733**	15.08	511	7.17	**907**	14.75
R2R3R6	1.09	140	6.58	**210**	14.42	361	6.33	**404**	14.25	464	6.25	**501**	14.25
R3	0.41	**99**	5	91	13	**192**	4.92	173	12.92	**234**	4.92	216	12.92
R4	1	217	4.58	**287**	12.58	496	4.58	**562**	12.58	633	4.58	**698**	12.58
R4R7	2.45	80	7.17	**264**	12.92	320	6.83	**494**	13.17	438	6.83	**616**	14.75
R5	0.5	**333**	4.5	288	12.5	**526**	4.5	465	12.5	**622**	4.5	546	12.5
R5R8	4.85	108	5.33	**181**	13.75	231	5.83	**333**	13.75	307	5.83	**415**	13.75
R6	0.5	**233**	4.67	202	12.67	**386**	4.67	342	12.67	**460**	4.67	409	12.67
R6R9	1.59	73	8.67	**152**	16.75	246	8.5	**314**	16.25	334	8.25	**399**	16.17

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
R7	1	399	4.67	**431**	12.67	678	4.67	**699**	12.67	813	4.67	**832**	12.67
R7R10	3.45	57	8.17	**253**	15.17	282	7.25	**792**	13.33	569	5.33	**977**	13.25
R8	0.55	**161**	4.83	152	12.83	**299**	4.83	281	12.83	**366**	4.83	345	12.83
R8R11	5.4	124	5.5	**234**	13.25	247	5.5	**349**	14.17	316	6.17	**435**	14.17
R9	0.59	79	5.25	**86**	13.17	**192**	5.17	184	13.17	**242**	5.17	233	13.17
R9R11	2.19	48	13.67	**126**	19.58	189	11.25	**263**	18.92	264	10.92	**336**	18.67
RBEMF4	39.81	629	6.42	**1300**	14.5	1548	6.42	**2608**	14.33	2133	6.5	**3592**	14.33
RETE17	0.27	**190**	4.42	165	12.42	**308**	4.42	272	12.33	**364**	4.42	322	12.33
RETE21	0.41	**223**	4.5	203	12.5	**383**	4.5	352	12.5	**464**	4.5	423	12.5
RETE24	0.88	277	4.58	**300**	12.58	**378**	4.42	340	12.33	**395**	4.33	325	12.25
RETE25	0.93	523	4.58	**529**	12.58	**834**	4.58	824	12.5	**984**	4.5	965	12.5
RETEM1	1.97	**19**	4	17	11.92	**16**	3.83	15	11.83	**19**	3.83	18	11.83
RETEM2	1.85	601	5.17	**654**	13.17	966	5.17	**1009**	13.17	1135	5.17	**1176**	13.17
RETP4	0.5	**339**	4.5	291	12.5	**523**	4.5	459	12.5	**614**	4.5	536	12.5
RETP5	0.25	**158**	4.58	138	12.58	**247**	4.58	218	12.58	**291**	4.58	256	12.58
RETP6	0.5	**355**	4.42	310	12.42	**568**	4.42	502	12.42	**672**	4.42	592	12.42
RETP7	0.45	**326**	4.42	291	12.42	**521**	4.42	464	12.42	**613**	4.42	544	12.42
RETR10	1.01	182	5	**239**	13	325	4.83	**370**	12.83	361	4.75	**408**	12.75
RETR14	0.5	**35**	4.42	30	12.33	**40**	4.25	30	12.17	**41**	4.17	25	12.08
RETR15	0.56	**65**	4.17	7	11.58	**48**	4.08	5	10.25	**50**	4	5	9.67
RETR18	0.8	342	4.58	**347**	12.58	**584**	4.58	577	12.58	**701**	4.58	688	12.58
RETR19	1.53	29	5.17	**63**	13.17	165	5.17	**315**	13.17	292	5.17	**442**	13.17
RETR2	0.68	**88**	4.25	25	12	**74**	4.08	8	11.25	**90**	4.08	7	10.75
RETR20	0.5	**56**	5	47	13	**172**	4.92	150	12.92	**225**	4.92	194	12.92
RETR23	0.5	**76**	4.92	64	12.83	**102**	4.58	81	12.5	**111**	4.5	91	12.42
RETR5	0.5	**7**	3.42	3	6.33	**6**	2.83	3	5	**6**	2.67	4	4.67
RETR7	1	399	4.67	**431**	12.67	678	4.67	**684**	12.58	**799**	4.58	729	12.5
RITBAS	0.1	**180**	4	148	12	**251**	4	208	12	**283**	4	236	12
RTE1E2	0.89	74	5.33	**98**	13.33	213	5.25	**234**	13.25	287	5.17	**316**	13.17
RTE2E3	1.67	21	5.58	**47**	13.67	124	5.5	**241**	13.42	239	5.42	**365**	13.33
RTE3E4	3.9	2	5.67	**114**	13.58	145	5.58	**496**	13.5	329	5.58	**750**	13.42
RTE4E4	4.21	1	7.67	**46**	14.92	68	6.83	**312**	14.33	189	6.5	**515**	14.25

Table 4.5.1-2 Existing Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RTE4E5	5.41	9	6	**131**	13.67	116	5.75	**344**	14.58	195	5.75	**583**	14.42
RTE5E6	6.84	0	6.92	**23**	14.08	19	6.17	**225**	13.83	83	5.92	**329**	13.75
RTE6E9	3.63	1	6.25	**7**	14.08	11	6.08	**199**	13.83	132	5.92	**456**	13.75

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
P1	0.39	**276**	4.5	232	12.5	**422**	4.5	357	12.5	**489**	4.5	418	12.5
RETP1	0.39	**276**	4.5	232	12.5	**422**	4.5	357	12.5	**489**	4.5	418	12.5
DIVP1	0.39	0	0	0	0	0	0	**24**	13.67	95	5	**150**	12.83
DRPFW	0.39	0	0	0	0	0	0	**5**	13.67	39	5	**81**	12.83
DP1PFW	0.39	0	0	0	0	0	0	**19**	13.67	56	5	**69**	12.83
P1P2	0.39	0	0	0	0	0	0	**14**	14.5	35	5.5	**47**	13.42
P2	0.58	**362**	4.58	317	12.58	**554**	4.58	486	12.58	**644**	4.58	569	12.58
RETP2	0.58	**362**	4.58	317	12.58	**554**	4.58	486	12.58	**644**	4.58	569	12.58
DIVP2	0.58	0	0	0	0	0	0	**44**	13.75	152	5.08	**212**	13
CPP2	0.96	0	0	0	0	0	0	**44**	13.75	103	5.08	**212**	13
P2P4	0.96	0	0	0	0	0	0	**36**	14.83	62	5.58	**142**	13.42
P4	0.5	**339**	4.5	291	12.5	**523**	4.5	459	12.5	**614**	4.5	536	12.5
RETP4	0.5	**339**	4.5	291	12.5	**523**	4.5	459	12.5	**614**	4.5	536	12.5
DIVP4	0.5	0	0	0	0	0	0	0	0	0	0	0	0
CPP4	1.46	0	0	0	0	0	0	**36**	14.83	62	5.58	**142**	13.42
P4P6	1.46	0	0	0	0	0	0	**31**	15.5	31	6.08	**119**	13.92
P6	0.5	**288**	4.67	247	12.67	**444**	4.67	390	12.67	**520**	4.67	456	12.67
RETP6	0.5	**288**	4.67	247	12.67	**444**	4.67	390	12.67	**520**	4.67	456	12.67
DIVP6	0.5	0	0	0	0	0	0	0	0	0	0	0	0
CPP6	1.96	0	0	0	0	0	0	**31**	15.5	31	6.08	**119**	13.92
P6GM8	1.96	0	0	0	0	0	0	**28**	16.08	16	6.33	**110**	14.25
GM8G10	1.96	0	0	0	0	0	0	**28**	16.33	15	6.58	**106**	14.42
DRPFW	0.39	0	0	0	0	0	0	**5**	13.67	39	5	**81**	12.83
P1PFW	0.39	0	0	0	0	0	0	**3**	14.67	17	5.33	**38**	13.17
P3	0.52	**287**	4.67	245	12.67	**439**	4.67	376	12.67	**509**	4.67	441	12.67
RETP3	0.52	**287**	4.67	245	12.67	**439**	4.67	376	12.67	**509**	4.67	441	12.67
DIVP3	0.52	0	0	0	0	0	0	**40**	14	128	5.33	**165**	13.25
CPP3	0.91	0	0	0	0	0	0	**41**	14	97	5.33	**201**	13.25
P3P5	0.91	0	0	0	0	0	0	**33**	14.25	82	5.42	**176**	13.33
P5	0.25	**170**	4.58	147	12.58	**261**	4.58	229	12.5	**306**	4.58	268	12.5
RETP5	0.25	**170**	4.58	147	12.58	**261**	4.58	229	12.5	**306**	4.58	268	12.5
DIVP5	0.25	0	0	0	0	18	5.42	**34**	13.25	**136**	4.92	121	12.92

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order														
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year				
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour		
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	
CPP5	1.16	0	0	0	0	9	5.42	**37**	14.25	89	5.42	**203**	13.33	
P5P7	1.16	0	0	0	0	6	5.67	**35**	14.42	76	5.5	**185**	13.42	
P7	0.43	**311**	4.5	275	12.5	**479**	4.5	419	12.5	**555**	4.5	485	12.5	
RETP7	0.43	**311**	4.5	275	12.5	**479**	4.5	419	12.5	**555**	4.5	485	12.5	
DIVP7	0.43	0	0	0	0	58	5.25	**60**	13.17	**237**	4.92	212	12.92	
CPP7	3.17	0	0	0	0	15	4.42	**51**	16.42	132	5.17	**252**	12.92	
P7GM14	3.17	0	0	0	0	0	0	**50**	16.92	67	5.75	**210**	13.33	
GM1	0.34	**286**	4.42	251	12.42	**434**	4.42	377	12.42	**501**	4.42	435	12.42	
GM2	0.68	**655**	4.33	603	12.33	**968**	4.33	888	12.33	**1114**	4.33	1023	12.33	
GM3	0.29	**494**	4.08	417	12.08	**681**	4.08	577	12.08	**767**	4.08	651	12.08	
CPG123	1.32	952	4.25	**1029**	12.17	1438	4.25	**1521**	12.17	1662	4.25	**1747**	12.17	
RETG1	1.32	952	4.25	**1029**	12.17	1438	4.25	**1521**	12.17	1662	4.25	**1747**	12.17	
DIVG1	1.32	0	0	0	0	140	4.75	**354**	12.75	465	4.75	**847**	12.58	
GM1T5	1.32	0	0	0	0	92	5	**223**	12.92	376	4.92	**640**	12.67	
GM5	0.18	**263**	4.17	224	12.17	**364**	4.17	310	12.17	**410**	4.17	349	12.17	
RETG5	0.18	**263**	4.17	224	12.17	**364**	4.17	310	12.17	**410**	4.17	325	12.17	
DIVG5	0.18	0	0	**10**	13.42	199	4.33	**218**	12.33	292	4.33	**334**	12.25	
CPG5	1.49	0	0	**8**	13.42	118	4.5	**246**	12.92	410	4.92	**686**	12.67	
GM5T7	1.49	0	0	**5**	14.92	87	5.17	**206**	13.25	333	5.17	**571**	12.92	
GM6	0.37	**565**	4.17	482	12.17	**802**	4.17	685	12.17	**909**	4.17	777	12.17	
RETG6	0.37	**565**	4.17	482	12.17	**802**	4.17	685	12.17	**909**	4.17	777	12.17	
DIVG6	0.37	0	0	0	0	269	4.33	**282**	12.33	501	4.25	**552**	12.25	
GM7	0.22	**184**	4.33	161	12.33	**286**	4.33	249	12.33	**333**	4.33	290	12.33	
RETG7	0.22	**184**	4.33	161	12.33	**286**	4.33	249	12.33	**333**	4.33	290	12.33	
DIVG7	0.22	0	0	0	0	2	5.67	2	16.75	**131**	4.67	71	12.75	
CPG7A	0.58	0	0	0	0	270	4.33	**282**	12.33	502	4.25	**552**	12.25	
CPG7B	2.08	0	0	**5**	14.92	108	4.67	**236**	12.33	347	5.17	**633**	12.92	
GM7T9	2.08	0	0	**4**	15.92	84	5.08	**200**	13.42	321	5.25	**585**	13	
GM8	0.56	**523**	4.33	459	12.33	**784**	4.33	692	12.33	**907**	4.33	798	12.33	
RETG8	0.56	**523**	4.33	459	12.33	**784**	4.33	692	12.33	**907**	4.33	798	12.33	
DIVG8	0.56	0	0	0	0	95	4.75	**192**	12.67	396	4.58	**516**	12.5	
GM9	0.09	**117**	4.17	99	12.17	**180**	4.17	153	12.17	**208**	4.17	177	12.17	

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RETG9	0.09	**117**	4.17	99	12.17	**180**	4.17	153	12.17	**208**	4.17	177	12.17
DIVG9	0.09	0	0	0	0	0	0	0	23.83	**12**	4.5	5	12.75
CPG9A	0.65	0	0	0	0	95	4.75	**192**	12.67	373	4.58	**516**	12.5
GM10	0.28	**280**	4.33	242	12.33	**414**	4.33	357	12.33	**475**	4.33	409	12.33
RETG10	0.28	**280**	4.33	242	12.33	**414**	4.33	357	12.33	**475**	4.33	409	12.33
DIVG10	0.28	0	0	**4**	16.08	227	4.58	**236**	12.5	**359**	4.5	329	12.42
GM11	0.08	**67**	4.25	56	12.25	**109**	4.25	91	12.25	**128**	4.25	108	12.25
RETG11	0.08	**67**	4.25	56	12.25	**109**	4.25	91	12.25	**128**	4.25	108	12.25
DIVG11	0.08	0	0	0	0	0	0	**1**	23	1	5.83	**4**	13.33
CPG11	0.36	0	0	**4**	16.08	227	4.58	**236**	12.5	**359**	4.5	329	12.42
CPG9B	3.08	0	0	**7**	17.42	164	4.75	**344**	12.75	459	4.83	**946**	12.5
GM9T14	3.08	0	0	**7**	18.42	109	5.25	**299**	12.92	368	5	**723**	12.75
GM12	0.12	**210**	4.08	177	12.08	**289**	4.08	244	12.08	**325**	4.08	275	12.08
RETG12	0.12	**210**	4.08	177	12.08	**289**	4.08	244	12.08	**325**	4.08	217	12
DIVG12	0.12	1	6.17	**13**	12.83	157	4.25	**212**	12.17	**265**	4.17	255	12.17
G12T13	0.12	0	6.83	**8**	13.5	74	4.5	**82**	12.42	128	4.42	**130**	12.33
GM13	0.29	**417**	4.17	352	12.17	**608**	4.08	519	12.08	**696**	4.08	596	12.08
RETG13	0.29	**417**	4.17	352	12.17	**608**	4.08	519	12.08	**696**	4.08	596	12.08
DIVG13	0.29	0	0	0	0	48	4.5	**75**	12.42	209	4.33	**376**	12.25
CPG13	0.41	0	6.83	**8**	13.5	122	4.5	**156**	12.42	307	4.33	**471**	12.25
G13T14	0.41	0	6.92	**7**	13.92	95	4.58	**132**	12.5	270	4.42	**366**	12.33
GM14	0.35	**477**	4.17	400	12.17	**700**	4.17	591	12.17	**801**	4.17	678	12.17
RETG14	0.35	**477**	4.17	400	12.17	**700**	4.17	591	12.17	**801**	4.17	676	12.17
DIVG14	0.35	0	0	**5**	19.5	161	4.42	**254**	12.33	358	4.33	**546**	12.25
CPG14A	0.76	0	0	**7**	13.92	141	4.42	**292**	12.33	450	4.33	**708**	12.25
CPG14B	3.84	0	0	**10**	21.33	134	5.17	**386**	12.92	433	5	**849**	12.75
CPG14C	7.01	0	0	**8**	24	88	5.17	**328**	12.92	326	5.08	**781**	12.75
G14E26	7.01	0	0	**8**	24.08	85	5.25	**328**	13	318	5.17	**775**	12.75
E1	0.89	**475**	4.58	468	12.58	**742**	4.58	718	12.58	**869**	4.58	842	12.58
RETE1	0.89	**475**	4.58	468	12.58	**742**	4.58	718	12.58	**869**	4.58	842	12.58
DIVE1	0.89	0	0	0	0	0	0	**64**	13.83	150	5.17	**289**	13.08
DRE2	0.89	0	0	0	0	0	0	**42**	13.83	112	5.17	**223**	13.08

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DE1S	0.89	0	0	0	0	0	0	**22**	13.83	38	5.17	**66**	13.08
E1E10	0.89	0	0	0	0	0	0	**14**	14.75	23	5.75	**46**	13.67
E10	0.82	**428**	4.67	412	12.67	**665**	4.67	631	12.67	**777**	4.67	739	12.67
RETE10	0.82	**428**	4.67	412	12.67	**665**	4.67	631	12.67	**777**	4.67	739	12.67
DIVE10	0.82	0	0	0	0	0	0	**63**	13.92	141	5.25	**284**	13.08
CPE10	1.71	0	0	0	0	0	0	**42**	13.92	57	5.25	**251**	13.17
E10E17	1.71	0	0	0	0	0	0	**39**	15	36	5.67	**175**	13.5
E17	0.27	**180**	4.5	154	12.5	**280**	4.5	245	12.5	**329**	4.5	287	12.5
RETE17	0.27	**180**	4.5	154	12.5	**280**	4.5	245	12.5	**329**	4.5	287	12.5
DIVE17	0.27	0	0	0	0	4	6.17	**18**	13.5	104	4.92	**123**	12.83
CPE17	1.98	0	0	0	0	1	6.17	**43**	15	31	5.67	**191**	13.5
E17E21	1.98	0	0	0	0	0	7.58	**41**	15.58	23	6	**169**	13.83
E21	0.31	**215**	4.5	187	12.5	**332**	4.5	291	12.5	**389**	4.5	341	12.5
RETE21	0.31	**215**	4.5	187	12.5	**332**	4.5	291	12.5	**389**	4.5	341	12.5
DIVE21	0.31	0	0	0	0	62	5.08	**63**	13	**201**	4.83	175	12.83
CPE21A	2.29	0	0	0	0	7	5.08	**48**	13.08	72	5.17	**179**	13.83
E21G20	2.29	0	0	0	0	6	5.33	**45**	15.75	71	5.33	**172**	14
DRE2	0.89	0	0	0	0	0	0	**42**	13.83	112	5.17	**223**	13.08
RTE1E2	0.89	0	0	0	0	0	0	**25**	14.92	53	5.83	**125**	13.67
E2	0.78	**423**	4.67	401	12.67	**651**	4.67	612	12.67	**762**	4.58	716	12.58
RETE2	0.78	**423**	4.67	401	12.67	**651**	4.67	612	12.67	**762**	4.58	716	12.58
DIVE2	0.78	0	0	0	0	0	0	**61**	13.83	139	5.25	**306**	13.08
CPE2	1.67	0	0	0	0	0	0	**46**	14.83	56	5.25	**239**	13.17
DRE3	1.67	0	0	0	0	0	0	**5**	14.83	16	5.25	**100**	13.08
DE2S	1.67	0	0	0	0	0	0	**41**	14.83	40	5.25	**147**	13.17
E2E11	1.67	0	0	0	0	0	0	**39**	15.5	31	6.25	**134**	14.08
E11	0.6	**356**	4.58	315	12.58	**548**	4.58	484	12.58	**637**	4.58	567	12.58
RETE11	0.6	**356**	4.58	315	12.58	**548**	4.58	484	12.58	**637**	4.58	567	12.58
DIVE11	0.6	0	0	0	0	0	0	**44**	13.83	140	5.17	**200**	13.08
CPE11	2.27	0	0	0	0	0	0	**52**	15.5	31	5.17	**193**	13.08
E11E18	2.27	0	0	0	0	0	0	**52**	16.58	14	7.08	**163**	15
E18	0.22	**205**	4.33	183	12.33	**316**	4.33	278	12.33	**365**	4.33	320	12.33

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RETE18	0.22	**2**	3.08	1	5	**2**	1.83	1	4.5	**2**	1.83	1	4.17
DIVE18	0.22	**205**	4.33	183	12.33	**316**	4.33	278	12.33	**365**	4.33	320	12.33
CPE18	2.49	129	4.33	**180**	12.33	210	4.33	**273**	12.33	246	4.33	**315**	12.33
E18E21	2.49	114	4.58	**155**	12.5	196	4.5	**246**	12.5	231	4.5	**287**	12.5
CPE21B	3.9	104	4.58	**154**	12.5	180	4.5	**245**	12.5	213	4.5	**285**	12.5
G20G21	3.9	89	4.83	**125**	12.75	163	4.75	**215**	12.67	197	4.67	**254**	12.67
DRE3	1.67	0	0	0	0	0	0	**5**	14.83	16	5.25	**100**	13.08
RTE2E3	1.67	0	0	0	0	0	0	**5**	15.92	4	6.25	**53**	14.08
E3	2.23	766	4.92	**941**	12.92	1254	4.92	**1431**	12.92	1486	4.92	**1665**	12.92
RETE3	2.23	766	4.92	**941**	12.92	1254	4.92	**1431**	12.92	1486	4.92	**1665**	12.92
DIVE3	2.23	0	0	0	0	0	0	**132**	14.67	60	5.67	**622**	13.58
E2SE3	3.9	0	0	0	0	0	0	**131**	14.67	31	7.17	**625**	13.58
DRE4N	3.9	0	0	0	0	0	0	**3**	14.67	1	7.17	**306**	13.58
DE3S	3.9	0	0	0	0	0	0	**128**	14.67	31	7.17	**319**	13.58
E3E12	3.9	0	0	0	0	0	0	**101**	15.08	17	7.75	**272**	13.92
E12	0.57	**325**	4.67	284	12.67	**497**	4.67	434	12.67	**577**	4.67	509	12.67
RETE12	0.57	**325**	4.67	284	12.67	**497**	4.67	434	12.67	**577**	4.67	509	12.67
DIVE12	0.57	0	0	0	0	0	0	**44**	13.92	137	5.25	**188**	13.17
CPE12	4.47	0	0	0	0	0	0	**117**	15.08	17	7.75	**319**	13.92
E12E19	4.47	0	0	0	0	0	0	**114**	15.42	12	8.25	**276**	14.67
E19	0.14	**159**	4.25	139	12.25	**235**	4.25	205	12.25	**270**	4.25	234	12.25
RETE19	0.14	1	3.17	1	4.58	1	2.58	1	4.67	1	1	1	4.33
DIVE19	0.14	**159**	4.25	139	12.25	**235**	4.25	205	12.25	**270**	4.25	234	12.25
CPE19	4.61	82	4.25	**136**	12.25	129	4.25	**200**	12.25	150	4.25	**278**	14.67
E1922E	4.61	70	4.42	**125**	12.42	115	4.33	**187**	12.33	136	4.33	**270**	15
22E	0.09	**168**	4.08	141	12.08	**230**	4.08	194	12.08	**259**	4.08	219	12.08
RET22E	0.09	**168**	4.08	141	12.08	**230**	4.08	194	12.08	**259**	4.08	194	12
DIV22E	0.09	0	0	**5**	13.83	76	4.25	**134**	12.17	**191**	4.17	178	12.17
E20	0.17	**108**	4.42	93	12.42	**174**	4.42	151	12.42	**206**	4.42	180	12.42
RETE20	0.17	**97**	4.33	70	12.33	**109**	4.25	61	12.08	**114**	4.17	65	12.08
DIVE20	0.17	**106**	4.5	93	12.42	**174**	4.42	151	12.42	**206**	4.42	180	12.42
E2022E	0.17	**87**	4.58	80	12.58	**168**	4.5	147	12.5	**200**	4.5	175	12.5

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
CP22E	4.87	70	4.42	**174**	12.5	199	4.5	**343**	12.42	283	4.42	**404**	12.42
22EE22	4.87	66	4.5	**152**	12.58	189	4.67	**311**	12.5	268	4.58	**372**	12.5
E22	0.16	**296**	4.08	249	12.08	**407**	4.08	343	12.08	**458**	4.08	387	12.08
RETE22	0.16	**296**	4.08	249	12.08	**407**	4.08	343	12.08	**458**	4.08	342	12
DIVE22	0.16	0	0	**8**	13.92	138	4.25	**231**	12.17	**329**	4.17	317	12.17
CPE22	7.25	125	4.75	**254**	12.67	341	4.75	**515**	12.58	477	4.58	**618**	12.58
E22G22	7.25	108	5.25	**193**	13	301	5	**443**	12.83	429	4.92	**552**	12.83
GM21	0.21	**286**	4.25	241	12.25	**396**	4.25	335	12.25	**447**	4.25	379	12.25
RETG21	0.21	**286**	4.25	241	12.25	**396**	4.25	335	12.25	**447**	4.25	360	12.17
DIVG21	0.21	0	0	**13**	13.67	174	4.5	**216**	12.42	291	4.42	**347**	12.33
G21T22	0.21	0	0	**10**	14.08	141	4.58	**180**	12.5	244	4.5	**298**	12.42
GM22	0.09	**159**	4.17	134	12.17	**219**	4.17	184	12.17	**246**	4.17	208	12.17
RETG22	0.09	**159**	4.17	134	12.17	**219**	4.17	176	12.08	**234**	4.08	199	12.08
DIVG22	0.09	0	0	**7**	13.42	93	4.33	**143**	12.25	**192**	4.25	177	12.17
CPG22A	0.31	0	0	**15**	14	168	4.5	**210**	12.5	288	4.42	**347**	12.42
CPG22B	7.55	108	5.25	**193**	13	360	5	**509**	12.83	529	4.83	**635**	12.75
G22E26	7.55	102	5.42	**183**	13.17	345	5.17	**497**	12.92	518	5	**618**	12.92
DRE4N	3.9	0	0	0	0	0	0	**3**	14.67	1	7.17	**306**	13.58
RTE3E4	3.9	0	0	0	0	0	0	**2**	15.33	0	7.92	**210**	13.83
E4N	0.31	**182**	4.67	154	12.67	**278**	4.58	236	12.67	**322**	4.58	277	12.58
RETE4N	0.31	**182**	4.67	154	12.67	**278**	4.58	236	12.67	**322**	4.58	277	12.58
DIVE4N	0.31	0	0	0	0	0	0	**22**	13.92	72	5.25	**118**	13.08
CPE4N	4.21	0	0	0	0	0	0	**14**	14.25	0	7.92	**235**	13.83
DRE4	4.21	0	0	0	0	0	0	**5**	14.25	0	7.92	**157**	13.83
DE4NS	4.21	0	0	0	0	0	0	**10**	14.25	0	7.92	**78**	13.83
E4NE13	4.21	0	0	0	0	0	0	**7**	16.25	0	9.92	**55**	14.58
E13	0.48	**414**	4.42	351	12.42	**618**	4.42	530	12.33	**713**	4.42	615	12.33
RETE13	0.48	**414**	4.42	351	12.42	**618**	4.42	530	12.33	**713**	4.42	615	12.33
DIVE13	0.48	0	0	0	0	0	0	**31**	13.5	147	4.83	**201**	12.75
CPE13	4.69	0	0	0	0	0	0	**21**	14	12	6.17	**142**	12.75
E13E24	4.69	0	0	0	0	0	0	**18**	14.83	7	7	**86**	13.42
DRE4	4.21	0	0	0	0	0	0	**5**	14.25	0	7.92	**157**	13.83

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RTE4E4	4.21	0	0	0	0	0	0	**3**	17.25	0	11.33	**88**	14.75
E4	1.2	462	4.92	**485**	12.92	725	4.92	**739**	12.92	853	4.92	**865**	12.92
RETE4	1.2	462	4.92	**485**	12.92	725	4.92	**739**	12.92	853	4.92	**865**	12.92
DIVE4	1.2	0	0	0	0	0	0	**76**	14.33	128	5.67	**362**	13.5
CPE4	5.41	0	0	0	0	0	0	**62**	14.67	0	11.33	**289**	13.58
DRE5	5.41	0	0	0	0	0	0	**57**	14.67	0	11.25	**278**	13.58
DE4S	5.41	0	0	0	0	0	0	**5**	14.67	0	10.75	**11**	13.67
E4E14A	5.41	0	0	0	0	0	0	**3**	16	0	12.42	**9**	14.67
E14A	0.48	**364**	4.5	306	12.5	**546**	4.5	461	12.5	**630**	4.5	538	12.42
RET14A	0.48	**364**	4.5	306	12.5	**546**	4.5	461	12.5	**630**	4.5	538	12.42
DIV14A	0.48	0	0	0	0	1	7.08	**48**	13.42	164	4.92	**218**	12.83
E6A	0.58	**625**	4.25	550	12.25	**908**	4.25	803	12.25	**1039**	4.25	919	12.25
RETE6A	0.58	**625**	4.25	550	12.25	**908**	4.25	803	12.25	**1039**	4.25	919	12.25
DIVE6A	0.58	0	0	0	0	12	6.33	**77**	13	216	4.67	**333**	12.58
E6AE5A	0.58	0	0	0	0	3	7.67	**46**	13.92	94	5.17	**159**	13.08
DRE5	5.41	0	0	0	0	0	0	**57**	14.67	0	11.25	**278**	13.58
RTE4E5	5.41	0	0	0	0	0	0	**37**	15.42	0	12.92	**200**	14
E5A	1.14	485	4.83	**500**	12.83	752	4.83	**757**	12.83	882	4.83	**885**	12.83
RETE5A	1.14	485	4.83	**500**	12.83	752	4.83	**757**	12.83	882	4.83	**885**	12.83
DIVE5A	1.14	0	0	0	0	0	0	**86**	14.08	152	5.5	**384**	13.33
CPE5A1	6.55	0	0	0	0	0	0	**62**	15.33	0	12.83	**294**	14
CPE5A2	7.13	0	0	0	0	0	0	**82**	15.25	94	6.08	**358**	13.5
E5A14A	7.13	0	0	0	0	0	0	**82**	15.5	14	6.58	**324**	14.25
CPE14A	7.61	0	0	0	0	0	0	**92**	15.5	164	6.5	**345**	13.75
E1424A	7.61	0	0	0	0	0	0	**88**	16.58	14	7.08	**321**	14.42
E24A	0.53	**574**	4.33	492	12.33	**825**	4.33	710	12.33	**943**	4.33	812	12.33
RET24A	0.53	**574**	4.33	492	12.33	**825**	4.33	710	12.33	**943**	4.33	807	12.25
DIV24A	0.53	0	0	**11**	16.42	342	4.58	**432**	12.5	570	4.5	**704**	12.42
CP24A	8.62	0	0	**7**	19.33	46	4.92	**288**	12.58	151	4.92	**549**	12.42
E247A1	8.62	0	0	**7**	20.83	25	5.42	**254**	13	100	5.33	**515**	12.83
E247A2	8.62	0	0	**6**	21.25	23	5.58	**169**	13.08	91	5.5	**364**	12.92
E27A	0.54	**453**	4.58	394	12.5	**654**	4.5	568	12.5	**746**	4.5	647	12.5

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RET27A	0.54	**453**	4.58	394	12.5	**654**	4.5	568	12.5	**746**	4.5	647	12.5
DIV27A	0.54	0	0	**9**	18.08	297	4.92	**310**	12.83	435	4.83	**478**	12.75
CPE27A	12.81	102	5.42	**184**	13.17	341	5.17	**748**	13	652	5.17	**1233**	12.92
E2726A	12.81	64	6.33	**118**	13.83	265	5.67	**596**	13.42	541	5.5	**984**	13.17
GM16	0.07	**61**	4.33	51	12.33	**93**	4.33	79	12.33	**108**	4.33	93	12.33
RETG16	0.07	**61**	4.33	51	12.33	**93**	4.33	79	12.33	**108**	4.33	93	12.33
DIVG16	0.07	0	0	0	0	5	5	**12**	12.83	38	4.58	**42**	12.58
G16T19	0.07	0	0	0	0	3	5.42	**7**	13.17	23	4.75	**29**	12.75
GM18	0.17	**185**	4.25	158	12.25	**277**	4.25	238	12.25	**319**	4.25	274	12.25
RETG18	0.17	**185**	4.25	158	12.25	**277**	4.25	238	12.25	**319**	4.25	274	12.25
DIVG18	0.17	0	0	0	0	42	4.67	**62**	12.58	137	4.5	**178**	12.42
CPG18	0.24	0	0	0	0	42	4.67	**62**	12.58	137	4.5	**178**	12.42
GM19	0.09	**123**	4.17	105	12.17	**178**	4.17	152	12.17	**203**	4.17	174	12.17
RETG19	0.09	**123**	4.17	105	12.17	**178**	4.17	152	12.17	**203**	4.17	174	12.17
DIVG19	0.09	0	0	0	0	**63**	4.33	34	12.42	**112**	4.25	77	12.33
CPG19A	0.33	0	0	0	0	62	4.33	**73**	12.58	164	4.5	**218**	12.42
GM20	0.18	**261**	4.17	225	12.17	**369**	4.17	317	12.17	**418**	4.17	359	12.17
RETG20	0.18	**261**	4.17	225	12.17	**369**	4.17	317	12.17	**418**	4.17	359	12.17
DIVG20	0.18	0	0	0	0	89	4.5	**113**	12.42	230	4.33	**244**	12.33
CPG19B	0.51	0	0	0	0	122	4.42	**145**	12.42	315	4.33	**368**	12.42
G19E26	0.51	0	0	0	0	53	5.08	**66**	13.08	**196**	4.83	182	12.83
GM17	0.1	**113**	4.17	96	12.17	**176**	4.17	150	12.17	**205**	4.17	174	12.17
RETG17	0.1	**113**	4.17	96	12.17	**176**	4.17	150	12.17	**205**	4.17	174	12.17
DIVG17	0.1	0	0	0	0	0	0	**4**	13.92	22	4.58	**35**	12.5
G17E26	0.1	0	0	0	0	0	0	**4**	14.42	11	4.92	**19**	12.83
E26A	0.87	**699**	4.5	665	12.5	**1015**	4.5	959	12.5	**1159**	4.5	1093	12.5
RET26A	0.87	**699**	4.5	665	12.5	**1015**	4.5	959	12.5	**1159**	4.5	1093	12.5
DIV26A	0.87	0	0	**12**	18.5	307	4.83	**485**	12.83	571	4.83	**843**	12.67
1650UP	0.87	0	0	0	0	0	0	0	0	0	0	0	0
802ELS	0.87	0	0	**12**	18.5	307	4.83	**485**	12.83	571	4.83	**843**	12.67
CPE26A	21.3	65	6.33	**119**	13.83	282	5.83	**805**	13.42	709	5.5	**1592**	13.17
80233B	21.3	49	6.67	**100**	14.17	254	6	**778**	13.5	678	5.58	**1564**	13.25

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E7	1.12	429	4.92	**449**	12.92	690	4.92	**702**	12.92	815	4.92	**820**	12.92
RETE7	1.12	429	4.92	**449**	12.92	690	4.92	**702**	12.92	815	4.92	**820**	12.92
DIVE7	1.12	0	0	0	0	0	0	**29**	15.17	91	5.75	**234**	13.67
E7STOR	1.12	0	0	0	0	0	0	0	0	0	0	**1**	25.67
E7E6	1.12	0	0	0	0	0	0	0	0	0	0	**1**	30
E6B	1.95	1171	4.58	**1312**	12.58	1748	4.58	**1907**	12.58	2016	4.58	**2187**	12.58
RETE6B	1.95	1171	4.58	**1312**	12.58	1748	4.58	**1907**	12.58	2016	4.58	**2187**	12.58
DIVE6B	1.95	0	0	0	0	9	6.58	**213**	13.58	227	5.58	**897**	13
E8	1.1	475	4.75	**497**	12.75	758	4.75	**770**	12.75	895	4.75	**901**	12.75
RETE8	1.1	475	4.75	**497**	12.75	758	4.75	**770**	12.75	895	4.75	**901**	12.75
DIVE8	1.1	0	0	0	0	0	0	**70**	14.08	141	5.42	**378**	13.25
E8E6	1.1	0	0	0	0	0	0	**43**	15.25	75	6.17	**191**	14
CPE6	3.05	0	0	0	0	22	4.67	**210**	13.67	289	5.58	**897**	13
DRE9	3.05	0	0	0	0	0	0	**1**	13.67	1	5.58	**104**	13
DE6S	3.05	0	0	0	0	0	0	**209**	13.67	226	5.58	**788**	13
E6E15	3.05	0	0	0	0	0	0	**153**	14.25	145	6.17	**497**	13.58
E15	0.78	**688**	4.33	647	12.33	**1015**	4.33	955	12.33	**1167**	4.33	1096	12.33
RETE15	0.78	**688**	4.33	647	12.33	**1015**	4.33	955	12.33	**1167**	4.33	1096	12.33
DIVE15	0.78	0	0	0	0	18	5.92	**120**	13	239	4.75	**431**	12.67
DRE9	3.05	0	0	0	0	0	0	**1**	13.67	1	5.58	**104**	13
RTE6E9	3.05	0	0	0	0	0	0	**1**	14.67	0	6.58	**26**	13.42
E9	0.72	**631**	4.42	579	12.42	**921**	4.42	846	12.42	**1056**	4.42	968	12.42
RETE9	0.72	**631**	4.42	579	12.42	**921**	4.42	846	12.42	**1056**	4.42	968	12.42
DIVE9	0.72	0	0	0	0	7	6.58	**102**	13.17	222	4.83	**372**	12.75
CPE9	0.72	0	0	0	0	7	6.58	**102**	13.17	222	4.83	**372**	12.75
DRR5	0.72	0	0	0	0	0	6.58	**13**	13.17	102	4.83	**196**	12.75
DE9S	0.72	0	0	0	0	7	6.58	**89**	13.17	120	4.83	**177**	12.75
E9E16	0.72	0	0	0	0	2	7.67	**59**	13.83	77	5.33	**122**	13.25
E16	0.4	**411**	4.33	346	12.33	**598**	4.33	508	12.33	**684**	4.33	582	12.33
RETE16	0.4	**411**	4.33	346	12.33	**598**	4.33	508	12.33	**684**	4.33	582	12.33
DIVE16	0.4	0	0	0	0	3	6.5	**48**	13.08	134	4.67	**213**	12.58
CPE16	1.12	0	0	0	0	2	6.5	**81**	13.83	77	5.33	**201**	12.58

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E16E15	1.12	0	0	0	0	1	8.75	**80**	14.08	59	5.83	**189**	12.83
CPE15	4.95	0	0	0	0	8	4.92	**252**	14.25	239	6.17	**689**	13.58
E1524B	4.95	0	0	0	0	0	0	**222**	14.75	137	6.67	**621**	13.83
E5B	0.29	**314**	4.25	262	12.25	**460**	4.25	387	12.25	**528**	4.25	447	12.25
RETE5B	0.29	**314**	4.25	262	12.25	**460**	4.25	387	12.25	**528**	4.25	447	12.25
DIVE5B	0.29	0	0	0	0	10	5.83	**41**	12.92	132	4.58	**204**	12.5
E5E14B	0.29	0	0	0	0	7	6.67	**27**	13.58	57	5.08	**89**	12.92
E14B	0.53	**623**	4.25	533	12.25	**898**	4.25	774	12.25	**1025**	4.25	884	12.25
RET14B	0.53	**623**	4.25	533	12.25	**898**	4.25	774	12.25	**1025**	4.25	884	12.25
DIV14B	0.53	0	0	0	0	15	6.17	**74**	12.92	259	4.58	**372**	12.5
CP14B	0.81	0	0	0	0	12	6.17	**74**	12.92	191	4.58	**371**	12.5
E14E24	0.81	0	0	0	0	6	7.17	**63**	13.92	83	5.08	**180**	13
E24B	0.46	**575**	4.25	490	12.25	**814**	4.25	695	12.25	**923**	4.25	788	12.25
RET24B	0.46	**575**	4.25	490	12.25	**814**	4.25	695	12.25	**923**	4.25	788	12.25
DIV24B	0.46	0	0	**5**	21.42	**250**	4.58	238	12.58	473	4.5	**572**	12.42
CPE24B	6.23	0	0	**3**	23.67	53	4.92	**252**	14.83	152	4.67	**697**	13.83
E24E28	6.23	0	0	**2**	25	43	5.25	**244**	15.25	144	4.92	**660**	14.17
E28B	0.54	**552**	4.42	480	12.42	**785**	4.42	681	12.42	**890**	4.42	773	12.42
RET28B	0.54	**552**	4.42	480	12.42	**785**	4.42	681	12.42	**890**	4.42	773	12.42
DIV28B	0.54	0	0	**7**	18.67	297	4.75	**377**	12.67	**614**	4.58	555	12.58
CPE28B	6.77	0	0	**5**	23.92	90	4.92	**277**	12.75	355	4.92	**676**	14.17
E28E31	6.77	0	0	**4**	24.67	66	5.5	**246**	15.67	229	5.25	**650**	14.42
E25	0.93	**633**	4.58	611	12.58	**941**	4.5	903	12.5	**1087**	4.5	1038	12.5
RETE25	0.93	**633**	4.58	611	12.58	**941**	4.5	903	12.5	**1087**	4.5	1038	12.5
DIVE25	0.93	0	0	0	0	0	0	0	0	0	0	**23**	18.08
E25E29	0.93	0	0	0	0	0	0	0	0	0	0	**20**	19.75
E29	1	**751**	4.5	740	12.5	**1107**	4.5	1079	12.5	**1273**	4.5	1237	12.5
RETE29	1	**751**	4.5	740	12.5	**1107**	4.5	1079	12.5	**1273**	4.5	1237	12.5
DIVE29	1	0	0	**17**	17.5	335	4.83	**640**	12.75	610	4.83	**906**	12.67
CPE29	1.93	0	0	**13**	18.83	217	5.17	**577**	12.75	574	4.83	**897**	12.67
E29E31	1.93	0	0	**13**	20.42	127	5.67	**303**	13.17	359	5.25	**573**	13
E32	0.25	**283**	4.25	237	12.25	**417**	4.25	351	12.25	**479**	4.25	404	12.25

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RETE32	0.25	**283**	4.25	237	12.25	**417**	4.25	351	12.25	**479**	4.25	394	12.17
DIVE32	0.25	0	0	**5**	16	141	4.5	**192**	12.42	262	4.42	**344**	12.33
E32E31	0.25	0	0	**5**	17.5	54	4.92	**79**	12.83	123	4.75	**155**	12.75
E31	0.81	**601**	4.5	566	12.5	**891**	4.5	838	12.5	**1027**	4.5	964	12.42
RETE31	0.81	**601**	4.5	566	12.5	**891**	4.5	838	12.5	**1027**	4.5	964	12.42
DIVE31	0.81	0	0	**15**	17	283	4.83	**466**	12.75	560	4.67	**835**	12.58
CPE31	9.76	0	0	**20**	24.08	104	5.58	**521**	13.25	466	5.5	**1095**	13
E31E30	9.76	0	0	**20**	24.75	72	6.17	**454**	13.75	395	6	**963**	13.42
E30B	0.88	**540**	4.83	511	12.83	**786**	4.83	739	12.83	**898**	4.83	844	12.83
RET30B	0.88	**540**	4.83	511	12.83	**786**	4.83	739	12.83	**898**	4.83	844	12.83
DIV30B	0.88	0	0	**9**	20.5	248	5.33	**415**	13.25	503	5.25	**619**	13.08
CPE30	10.64	0	0	**20**	24.67	135	6.17	**605**	13.58	511	5.92	**1307**	13.33
E30E26	10.64	0	0	**18**	25.08	101	6.42	**595**	13.67	498	6	**1282**	13.42
E26B	0.26	**302**	4.33	259	12.33	**427**	4.33	366	12.33	**484**	4.33	415	12.33
RET26B	0.26	**302**	4.33	259	12.33	**427**	4.33	366	12.33	**484**	4.33	415	12.33
DIV26B	0.26	0	0	**3**	19.42	**185**	4.58	178	12.58	**326**	4.5	280	12.5
CPE26	10.9	0	0	**18**	25.08	104	6.33	**603**	13.67	506	6	**1299**	13.42
E26E33	10.9	0	0	**16**	26.58	72	6.83	**527**	14.25	453	6.58	**1157**	13.83
E33B	0.85	**846**	4.33	807	12.33	**1207**	4.33	1148	12.33	**1371**	4.33	1304	12.33
RET33B	0.85	**846**	4.33	807	12.33	**1207**	4.33	1148	12.33	**1371**	4.33	1304	12.33
DIV33B	0.85	0	0	**14**	17.5	359	4.67	**630**	12.58	641	4.5	**972**	12.5
CPE33B	33.05	49	6.67	**102**	14.17	244	6.08	**778**	13.58	640	5.58	**1759**	13.92
E33P9A	33.05	40	7.08	**81**	14.5	212	6.33	**701**	13.67	545	6.58	**1727**	14
E33P9B	33.05	32	7.58	**67**	15	185	6.5	**671**	14.75	525	6.67	**1694**	14.08
P9	1.12	**985**	4.42	958	12.42	**1377**	4.42	1338	12.42	**1557**	4.42	1513	12.42
RETP9	1.12	**806**	4.25	465	12.08	**863**	4.17	177	11.75	**891**	4.08	137	11.5
DIVP9	1.12	**985**	4.42	958	12.42	**1377**	4.42	1338	12.42	**1557**	4.42	1513	12.42
CPP9	34.17	524	4.58	**854**	12.42	789	4.42	**1198**	12.42	896	4.42	**1762**	14.08
P9EMF1	34.17	390	4.92	**627**	12.67	722	4.67	**1046**	12.58	846	4.67	**1728**	14.17
EMF1B	1.04	**926**	4.42	901	12.42	**1309**	4.42	1271	12.42	**1484**	4.42	1442	12.42
REMF1B	1.04	**926**	4.42	901	12.42	**1309**	4.42	1271	12.42	**1484**	4.42	1442	12.42
DEMF1B	1.04	0	0	**23**	16.33	407	4.75	**681**	12.67	769	4.75	**1142**	12.58

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
CPEMF1	35.21	390	4.92	**627**	12.67	718	4.67	**1044**	12.58	855	5	**1941**	12.67
EM1EM2	35.21	378	5.25	**694**	12.83	743	4.83	**1029**	12.75	862	4.75	**1804**	12.83
EMF2	1.85	937	4.83	**977**	12.83	1374	4.83	**1409**	12.83	1577	4.83	**1610**	12.83
RETEM2	1.85	859	4.83	**899**	12.83	1296	4.83	**1331**	12.83	1499	4.83	**1532**	12.83
DIVEM2	1.85	78	3.67	78	11.33	**865**	5.33	814	13.33	**1263**	5.17	1181	13.17
CPEMF2	37.06	453	5.25	**771**	12.83	817	4.83	**1101**	12.75	1137	5.33	**2187**	13.42
EM2M3A	37.06	417	5.33	**613**	13	754	4.92	**1045**	12.92	1083	5.42	**2153**	13.5
EM2M3B	37.06	377	5.5	**570**	13.17	698	5.08	**1020**	13.08	1050	5.5	**2133**	13.58
EMF3	1.49	706	4.75	**766**	12.75	1090	4.75	**1144**	12.75	1272	4.75	**1324**	12.75
RETEM3	1.49	706	4.75	**766**	12.75	**1009**	4.58	801	12.42	**1076**	4.5	812	12.33
DIVEM3	1.49	270	5.33	**614**	12.92	1024	4.83	**1144**	12.75	1272	4.75	**1324**	12.75
CPEMF3	38.55	374	5.5	**954**	13.08	995	5.25	**1767**	12.83	1435	5	**2481**	13
EMF3RB	38.55	368	5.58	**888**	13.17	983	5.08	**1750**	12.92	1438	5.17	**2465**	13
RITBAS	0.29	**522**	4.08	431	12.08	**732**	4.08	610	12.08	**829**	4.08	693	12.08
RITBAS	0.29	0	0	**1**	12.5	0	0	**1**	12.92	0	0	**1**	12.92
CPRITB	38.84	368	5.58	**888**	13.17	983	5.08	**1750**	12.92	1438	5.17	**2465**	13
RBEMF4	38.84	332	6.33	**654**	13.75	858	5.75	**1496**	13.42	1350	5.67	**2291**	13.83
R2	0.68	**342**	4.67	323	12.67	**551**	4.67	519	12.67	**655**	4.67	612	12.67
RETR2	0.68	**342**	4.67	323	12.67	**459**	4.5	383	12.42	**478**	4.42	398	12.33
DIVR2	0.68	204	4.92	**254**	12.83	519	4.75	519	12.67	**655**	4.67	612	12.67
R3	0.41	**211**	4.67	181	12.67	**339**	4.58	301	12.58	**403**	4.58	358	12.58
RETR3	0.41	**211**	4.67	181	12.67	**339**	4.58	301	12.58	**403**	4.58	330	12.5
DIVR3	0.41	0	0	**3**	16.08	240	4.83	**241**	12.75	342	4.75	**352**	12.67
CPR2R3	1.09	204	4.92	**254**	12.83	551	4.75	**718**	12.75	754	4.75	**962**	12.67
R2R3R6	1.09	36	7.17	**64**	15.25	254	6.5	**331**	14.33	407	6.33	**467**	14.17
R6	0.5	**233**	4.67	202	12.67	**386**	4.67	342	12.67	**460**	4.67	409	12.67
CPR6	1.59	141	4.67	**200**	12.67	280	4.67	**338**	12.67	394	6.33	**470**	14.25
R6R9	1.59	115	5	**162**	13	246	4.92	**305**	14.67	345	6.67	**434**	14.58
R9	0.59	**576**	4.33	503	12.33	**832**	4.33	733	12.33	**952**	4.33	840	12.33
RETR9	0.59	**576**	4.33	503	12.33	**832**	4.33	733	12.33	**952**	4.33	840	12.33
DIVR9	0.59	0	0	0	0	19	6	**102**	13	238	4.75	**351**	12.67
CPR9	2.19	115	5	**162**	13	244	4.92	**337**	13	327	6.75	**609**	12.67

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
R9R11	2.19	77	5.67	**138**	13.58	190	5.42	**303**	15.17	293	7.17	**476**	13.25
R11	0.99	**691**	4.5	688	12.5	**1043**	4.5	1022	12.5	**1207**	4.5	1179	12.5
RETR11	0.99	**691**	4.5	688	12.5	**1043**	4.5	1022	12.5	**1207**	4.5	1179	12.5
DIVR11	0.99	0	0	**8**	21.58	318	4.83	**460**	12.83	502	4.83	**859**	12.67
DRR5	0.72	0	0	0	0	0	6.58	**13**	13.17	102	4.83	**196**	12.75
R5	0.5	**333**	4.5	288	12.5	**526**	4.5	465	12.5	**622**	4.5	546	12.5
RETR5	0.5	**7**	3.42	3	6.33	**6**	2.83	3	5	**6**	2.67	4	4.67
DIVR5	0.5	**333**	4.5	288	12.5	**526**	4.5	465	12.5	**622**	4.5	546	12.5
CPR5	1.22	249	4.5	**287**	12.5	426	4.5	**463**	12.5	510	4.5	**544**	12.5
R5R8	1.22	204	4.83	**242**	12.75	357	4.83	**392**	12.83	427	4.83	**470**	12.92
R8	0.55	**518**	4.42	445	12.42	**748**	4.42	647	12.42	**855**	4.42	741	12.42
RETR8	0.55	**518**	4.42	445	12.42	**748**	4.42	647	12.42	**855**	4.42	741	12.42
DIVR8	0.55	0	0	0	0	19	6	**91**	13.08	193	4.83	**366**	12.67
CPR8	1.77	204	4.83	**242**	12.75	355	4.83	**392**	12.83	451	4.83	**721**	12.67
R8R11	1.77	155	5.17	**219**	13.08	298	5.08	**357**	13.25	375	5.25	**581**	13.33
CPR11	4.95	147	5.42	**280**	13.33	452	5.25	**714**	12.83	669	5.25	**1147**	13.25
R11R13	4.95	141	5.83	**272**	13.67	381	5.75	**652**	13.75	608	5.75	**1049**	13.75
R13	0.5	**491**	4.33	409	12.33	**729**	4.33	612	12.33	**838**	4.33	708	12.33
RETR13	0.5	**491**	4.33	409	12.33	**729**	4.33	612	12.33	**838**	4.33	705	12.25
DIVR13	0.5	0	0	**10**	16.25	292	4.58	**362**	12.5	493	4.5	**599**	12.42
CPR13	5.45	141	5.83	**272**	13.67	383	5.75	**675**	13.75	618	5.75	**1071**	13.75
R13R16	5.45	128	6.17	**266**	13.92	357	6.17	**640**	14.25	583	6.25	**1005**	14.25
R16	0.5	**546**	4.25	458	12.25	**788**	4.25	666	12.25	**901**	4.25	765	12.25
RETR16	0.5	**546**	4.25	458	12.25	**788**	4.25	666	12.25	**901**	4.25	765	12.25
DIVR16	0.5	0	0	**16**	14.75	294	4.58	**368**	12.5	527	4.42	**604**	12.42
CPR16	5.95	128	6.17	**266**	13.92	371	6.08	**661**	14.25	595	6.25	**1024**	14.25
R16R21	5.95	98	7.33	**236**	14.67	319	6.92	**601**	15.25	529	7.17	**925**	15.33
R21	0.84	**424**	4.67	413	12.67	**671**	4.67	649	12.67	**790**	4.67	757	12.67
RETR21	0.84	**361**	4.5	300	12.5	**441**	4.33	333	12.25	**530**	4.33	305	12.17
DIVR21	0.84	341	4.67	**413**	12.67	**671**	4.67	649	12.67	**790**	4.67	757	12.67
R1	1.45	599	4.58	**730**	12.58	1035	4.58	**1164**	12.58	1244	4.58	**1372**	12.58
RETR1	1.45	599	4.58	**730**	12.58	1035	4.58	**1164**	12.58	1244	4.58	**1372**	12.58

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DIVR1	1.45	0	0	0	0	0	0	**22**	15.08	105	5.17	**308**	13.08
R1R4	1.45	0	0	0	0	0	0	**18**	20.42	31	7.33	**108**	15.25
R4	1	311	4.58	**377**	12.58	615	4.58	**673**	12.58	764	4.58	**817**	12.58
CPR4	2.45	154	4.58	**369**	12.58	435	4.58	**660**	12.58	571	4.58	**802**	12.58
R4R7	2.45	134	4.92	**304**	13	368	5.08	**513**	13.08	476	5.08	**621**	13.08
R7	1	498	4.58	**522**	12.58	810	4.58	**823**	12.58	959	4.58	**965**	12.58
RETR7	1	498	4.58	**522**	12.58	810	4.58	**823**	12.58	**959**	4.58	938	12.5
DIVR7	1	0	0	**25**	14.25	356	4.83	**624**	12.75	642	4.83	**890**	12.67
CPR7	3.45	139	4.92	**304**	13	568	5.08	**990**	12.75	882	4.83	**1259**	12.67
R7R10	3.45	75	5.67	**274**	13.42	439	5.5	**853**	13.25	737	5.33	**1040**	13.33
R10	1.01	416	4.83	**426**	12.83	666	4.83	**667**	12.83	**787**	4.83	781	12.83
RETR10	1.01	416	4.83	**426**	12.83	666	4.83	**667**	12.83	**787**	4.83	781	12.83
DIVR10	1.01	0	0	0	0	24	6.33	**110**	13.83	185	5.42	**358**	13.33
CPR10	4.46	75	5.67	**274**	13.42	439	5.5	**853**	13.25	727	5.33	**1384**	13.33
R10R12	4.46	53	6.33	**217**	13.83	347	5.83	**725**	13.67	600	5.75	**1124**	13.67
R12	0.49	**698**	4.17	587	12.17	**979**	4.17	828	12.17	**1108**	4.17	939	12.17
RETR12	0.49	**698**	4.17	587	12.17	**979**	4.17	828	12.17	**1108**	4.17	850	12.17
DIVR12	0.49	0	0	**26**	13.92	402	4.42	**550**	12.33	744	4.33	**887**	12.25
CPR12	4.95	53	6.33	**217**	13.83	359	5.83	**764**	13.67	609	5.75	**1165**	13.67
R12R15	4.95	32	8.33	**153**	15.25	269	7	**590**	14.67	477	6.75	**949**	14.58
R15	0.56	**385**	4.5	338	12.5	**594**	4.5	528	12.5	**694**	4.5	616	12.5
RETR15	0.56	**385**	4.5	338	12.5	**582**	4.42	477	12.42	**596**	4.33	537	12.33
DIVR15	0.56	**106**	4.92	105	12.92	501	4.58	**528**	12.5	**668**	4.5	616	12.5
CPR15	5.51	32	8.33	**159**	15.25	263	7	**598**	14.67	468	6.75	**953**	14.58
R15R18	5.51	24	9.25	**140**	15.92	226	7.5	**564**	15.08	431	7.17	**901**	15
R18	0.8	**362**	4.67	352	12.67	**582**	4.67	560	12.67	**689**	4.67	661	12.67
RETR18	0.8	**362**	4.67	352	12.67	**582**	4.67	560	12.67	**689**	4.67	661	12.67
DIVR18	0.8	0	0	0	0	46	5.67	**108**	13.5	235	5.17	**354**	13.08
CPR18	6.3	24	9.25	**140**	15.92	226	7.5	**572**	15.08	421	7.17	**907**	15
R18R22	6.3	18	10.33	**121**	16.67	186	8.17	**534**	15.58	384	7.75	**852**	15.42
R22	0.57	**530**	4.33	462	12.33	**784**	4.33	689	12.33	**902**	4.33	794	12.33
RETR22	0.57	**530**	4.33	462	12.33	**784**	4.33	689	12.33	**902**	4.33	794	12.33

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DIVR22	0.57	0	0	**13**	15.33	402	4.58	**432**	12.5	636	4.5	**723**	12.42
R14	0.5	**571**	4.25	479	12.25	**829**	4.25	703	12.25	**950**	4.25	806	12.25
RETR14	0.5	**571**	4.25	479	12.25	**829**	4.25	703	12.25	**950**	4.25	751	12.17
DIVR14	0.5	0	0	**21**	14	359	4.5	**458**	12.42	622	4.42	**746**	12.33
R14R17	0.5	0	0	**15**	15.17	159	4.92	**220**	12.83	300	4.75	**370**	12.75
R17	0.49	**330**	4.58	279	12.58	**497**	4.58	427	12.58	**576**	4.58	497	12.58
RETR17	0.49	**330**	4.58	279	12.58	**497**	4.58	427	12.58	**576**	4.58	497	12.58
DIVR17	0.49	0	0	**4**	20.42	193	4.92	**219**	12.83	342	4.83	**360**	12.75
CPR17	0.99	0	0	**15**	15.17	217	4.92	**436**	12.83	428	4.83	**729**	12.75
R17R22	0.99	0	0	**13**	16.75	132	5.33	**275**	13.25	302	5.17	**519**	13.08
CPR22	7.87	18	10.33	**122**	16.67	431	7.92	**575**	15.58	663	7.5	**893**	15.42
R22R21	7.87	14	12.92	**115**	17.25	160	8.67	**550**	15.92	356	8.08	**857**	15.67
CPR21	14.65	**454**	4.92	432	12.58	768	7	**838**	15.58	716	7.33	**1519**	15.58
R21R25	14.65	74	7.92	**178**	15.42	313	5	**815**	15.83	573	7.08	**1466**	15.92
R25	0.28	**297**	4.25	250	12.25	**443**	4.25	378	12.25	**510**	4.25	436	12.25
RETR25	0.28	**297**	4.25	250	12.25	**443**	4.25	346	12.17	**464**	4.17	402	12.17
DIVR25	0.28	14	4.92	**25**	12.83	296	4.42	**353**	12.33	**479**	4.33	406	12.33
R20	0.5	**415**	4.42	305	12.42	**621**	4.42	482	12.42	**719**	4.42	562	12.42
RETR20	0.5	**415**	4.42	305	12.42	**621**	4.42	482	12.42	**719**	4.42	562	12.42
DIVR20	0.5	0	0	0	0	**149**	4.83	103	12.92	**366**	4.67	296	12.67
R20R23	0.5	0	0	0	0	47	5.58	47	13.75	**160**	5.08	141	13.17
R23	0.5	**488**	4.33	409	12.33	**714**	4.33	608	12.33	**821**	4.33	700	12.33
RETR23	0.5	**488**	4.33	409	12.33	**714**	4.33	608	12.33	**821**	4.33	700	12.33
DIVR23	0.5	0	0	**8**	17.67	248	4.67	**309**	12.58	**493**	4.5	492	12.5
CPR23	1	0	0	**8**	17.67	148	4.67	**309**	12.58	295	4.5	**492**	12.5
R23R25	1	0	0	**6**	20.42	62	5.08	**135**	13	163	4.83	**282**	12.75
CPR25	15.93	74	7.92	**181**	15.42	343	5	**828**	15.83	575	7	**1484**	15.92
R25R24	15.93	73	8	**181**	15.42	340	5	**827**	15.92	575	7	**1484**	15.92
R19	1.53	962	4.42	**1066**	12.5	1450	4.42	**1566**	12.5	1686	4.42	**1808**	12.42
RETR19	1.53	962	4.42	**1066**	12.5	1450	4.42	**1566**	12.5	1686	4.42	**1808**	12.42
DIVR19	1.53	0	0	**33**	16.67	272	5.17	**875**	12.75	843	4.83	**1558**	12.58
DETR19	1.53	0	0	0	0	201	4.83	**704**	12.75	672	4.83	**1387**	12.58

Table 4.5.1-3 Future Conditions HEC-1 Model Results in Model Order														
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DIV19R	1.53	0	0	**33**	16.67	171	5.17	171	12.67	171	4.83	**229**	13.17
R19R24	1.53	0	0	**28**	18.42	111	6.17	**160**	13.92	158	5.92	**191**	13.83
R24	0.29	**274**	4.33	231	12.33	**405**	4.33	346	12.33	**467**	4.33	400	12.33
RETR24	0.29	**274**	4.33	231	12.33	**405**	4.33	346	12.33	**467**	4.33	400	12.33
DIVR24	0.29	0	0	**5**	17	162	4.67	**196**	12.58	288	4.5	**305**	12.5
CPR24	17.75	73	8	**180**	15.42	341	5	**865**	15.75	621	6.92	**1526**	15.92
R24EM4	17.75	63	8.42	**170**	15.67	263	5.33	**860**	15.83	615	7.08	**1516**	16
EMF4	0.06	**98**	4.08	82	12.08	**141**	4.08	119	12.08	**160**	4.08	135	12.08
CPEMF4	55.93	327	6.33	**737**	13.75	907	5.75	**1802**	13.42	1410	5.58	**2851**	13.92

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
1650UP	0.87	0	0	0	0	0	0	0	0	0	0	0	0
22E	0.09	**168**	4.08	141	12.08	**230**	4.08	194	12.08	**259**	4.08	219	12.08
22EE22	4.87	66	4.5	**152**	12.58	189	4.67	**311**	12.5	268	4.58	**372**	12.5
80233B	21.3	49	6.67	**100**	14.17	254	6	**778**	13.5	678	5.58	**1564**	13.25
802ELS	0.87	0	0	**12**	18.5	307	4.83	**485**	12.83	571	4.83	**843**	12.67
CP14B	0.81	0	0	0	0	12	6.17	**74**	12.92	191	4.58	**371**	12.5
CP22E	4.87	70	4.42	**174**	12.5	199	4.5	**343**	12.42	283	4.42	**404**	12.42
CP24A	8.62	0	0	**7**	19.33	46	4.92	**288**	12.58	151	4.92	**549**	12.42
CPE10	1.71	0	0	0	0	0	0	**42**	13.92	57	5.25	**251**	13.17
CPE11	2.27	0	0	0	0	0	0	**52**	15.5	31	5.17	**193**	13.08
CPE12	4.47	0	0	0	0	0	0	**117**	15.08	17	7.75	**319**	13.92
CPE13	4.69	0	0	0	0	0	0	**21**	14	12	6.17	**142**	12.75
CPE14A	7.61	0	0	0	0	0	0	**92**	15.5	164	6.5	**345**	13.75
CPE15	4.95	0	0	0	0	8	4.92	**252**	14.25	239	6.17	**689**	13.58
CPE16	1.12	0	0	0	0	2	6.5	**81**	13.83	77	5.33	**201**	12.58
CPE17	1.98	0	0	0	0	1	6.17	**43**	15	31	5.67	**191**	13.5
CPE18	2.49	129	4.33	**180**	12.33	210	4.33	**273**	12.33	246	4.33	**315**	12.33
CPE19	4.61	82	4.25	**136**	12.25	129	4.25	**200**	12.25	150	4.25	**278**	14.67
CPE2	1.67	0	0	0	0	0	0	**46**	14.83	56	5.25	**239**	13.17
CPE21A	2.29	0	0	0	0	7	5.08	**48**	13.08	72	5.17	**179**	13.83
CPE21B	3.9	104	4.58	**154**	12.5	180	4.5	**245**	12.5	213	4.5	**285**	12.5
CPE22	7.25	125	4.75	**254**	12.67	341	4.75	**515**	12.58	477	4.58	**618**	12.58
CPE24B	6.23	0	0	**3**	23.67	53	4.92	**252**	14.83	152	4.67	**697**	13.83
CPE26	10.9	0	0	**18**	25.08	104	6.33	**603**	13.67	506	6	**1299**	13.42
CPE26A	21.3	65	6.33	**119**	13.83	282	5.83	**805**	13.42	709	5.5	**1592**	13.17
CPE27A	12.81	102	5.42	**184**	13.17	341	5.17	**748**	13	652	5.17	**1233**	12.92
CPE28B	6.77	0	0	**5**	23.92	90	4.92	**277**	12.75	355	4.92	**676**	14.17
CPE29	1.93	0	0	**13**	18.83	217	5.17	**577**	12.75	574	4.83	**897**	12.67
CPE30	10.64	0	0	**20**	24.67	135	6.17	**605**	13.58	511	5.92	**1307**	13.33
CPE31	9.76	0	0	**20**	24.08	104	5.58	**521**	13.25	466	5.5	**1095**	13
CPE33B	33.05	49	6.67	**102**	14.17	244	6.08	**778**	13.58	640	5.58	**1759**	13.92
CPE4	5.41	0	0	0	0	0	0	**62**	14.67	0	11.33	**289**	13.58

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
CPE4N	4.21	0	0	0	0	0	0	**14**	14.25	0	7.92	**235**	13.83
CPE5A1	6.55	0	0	0	0	0	0	**62**	15.33	0	12.83	**294**	14
CPE5A2	7.13	0	0	0	0	0	0	**82**	15.25	94	6.08	**358**	13.5
CPE6	3.05	0	0	0	0	22	4.67	**210**	13.67	289	5.58	**897**	13
CPE9	0.72	0	0	0	0	7	6.58	**102**	13.17	222	4.83	**372**	12.75
CPEMF1	35.21	390	4.92	**627**	12.67	718	4.67	**1044**	12.58	855	5	**1941**	12.67
CPEMF2	37.06	453	5.25	**771**	12.83	817	4.83	**1101**	12.75	1137	5.33	**2187**	13.42
CPEMF3	38.55	374	5.5	**954**	13.08	995	5.25	**1767**	12.83	1435	5	**2481**	13
CPEMF4	55.93	327	6.33	**737**	13.75	907	5.75	**1802**	13.42	1410	5.58	**2851**	13.92
CPG11	0.36	0	0	**4**	16.08	227	4.58	**236**	12.5	**359**	4.5	329	12.42
CPG123	1.32	952	4.25	**1029**	12.17	1438	4.25	**1521**	12.17	1662	4.25	**1747**	12.17
CPG13	0.41	0	6.83	**8**	13.5	122	4.5	**156**	12.42	307	4.33	**471**	12.25
CPG14A	0.76	0	0	**7**	13.92	141	4.42	**292**	12.33	450	4.33	**708**	12.25
CPG14B	3.84	0	0	**10**	21.33	134	5.17	**386**	12.92	433	5	**849**	12.75
CPG14C	7.01	0	0	**8**	24	88	5.17	**328**	12.92	326	5.08	**781**	12.75
CPG18	0.24	0	0	0	0	42	4.67	**62**	12.58	137	4.5	**178**	12.42
CPG19A	0.33	0	0	0	0	62	4.33	**73**	12.58	164	4.5	**218**	12.42
CPG19B	0.51	0	0	0	0	122	4.42	**145**	12.42	315	4.33	**368**	12.42
CPG22A	0.31	0	0	**15**	14	168	4.5	**210**	12.5	288	4.42	**347**	12.42
CPG22B	7.55	108	5.25	**193**	13	360	5	**509**	12.83	529	4.83	**635**	12.75
CPG5	1.49	0	0	**8**	13.42	118	4.5	**246**	12.92	410	4.92	**686**	12.67
CPG7A	0.58	0	0	0	0	270	4.33	**282**	12.33	502	4.25	**552**	12.25
CPG7B	2.08	0	0	**5**	14.92	108	4.67	**236**	12.33	347	5.17	**633**	12.92
CPG9A	0.65	0	0	0	0	95	4.75	**192**	12.67	373	4.58	**516**	12.5
CPG9B	3.08	0	0	**7**	17.42	164	4.75	**344**	12.75	459	4.83	**946**	12.5
CPP2	0.96	0	0	0	0	0	0	**44**	13.75	103	5.08	**212**	13
CPP3	0.91	0	0	0	0	0	0	**41**	14	97	5.33	**201**	13.25
CPP4	1.46	0	0	0	0	0	0	**36**	14.83	62	5.58	**142**	13.42
CPP5	1.16	0	0	0	0	9	5.42	**37**	14.25	89	5.42	**203**	13.33
CPP6	1.96	0	0	0	0	0	0	**31**	15.5	31	6.08	**119**	13.92
CPP7	3.17	0	0	0	0	15	4.42	**51**	16.42	132	5.17	**252**	12.92
CPP9	34.17	524	4.58	**854**	12.42	789	4.42	**1198**	12.42	896	4.42	**1762**	14.08

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
CPR10	4.46	75	5.67	**274**	13.42	439	5.5	**853**	13.25	727	5.33	**1384**	13.33
CPR11	4.95	147	5.42	**280**	13.33	452	5.25	**714**	12.83	669	5.25	**1147**	13.25
CPR12	4.95	53	6.33	**217**	13.83	359	5.83	**764**	13.67	609	5.75	**1165**	13.67
CPR13	5.45	141	5.83	**272**	13.67	383	5.75	**675**	13.75	618	5.75	**1071**	13.75
CPR15	5.51	32	8.33	**159**	15.25	263	7	**598**	14.67	468	6.75	**953**	14.58
CPR16	5.95	128	6.17	**266**	13.92	371	6.08	**661**	14.25	595	6.25	**1024**	14.25
CPR17	0.99	0	0	**15**	15.17	217	4.92	**436**	12.83	428	4.83	**729**	12.75
CPR18	6.3	24	9.25	**140**	15.92	226	7.5	**572**	15.08	421	7.17	**907**	15
CPR21	14.65	**454**	4.92	432	12.58	768	7	**838**	15.58	716	7.33	**1519**	15.58
CPR22	7.87	18	10.33	**122**	16.67	431	7.92	**575**	15.58	663	7.5	**893**	15.42
CPR23	1	0	0	**8**	17.67	148	4.67	**309**	12.58	295	4.5	**492**	12.5
CPR24	17.75	73	8	**180**	15.42	341	5	**865**	15.75	621	6.92	**1526**	15.92
CPR25	15.93	74	7.92	**181**	15.42	343	5	**828**	15.83	575	7	**1484**	15.92
CPR2R3	1.09	204	4.92	**254**	12.83	551	4.75	**718**	12.75	754	4.75	**962**	12.67
CPR4	2.45	154	4.58	**369**	12.58	435	4.58	**660**	12.58	571	4.58	**802**	12.58
CPR5	1.22	249	4.5	**287**	12.5	426	4.5	**463**	12.5	510	4.5	**544**	12.5
CPR6	1.59	141	4.67	**200**	12.67	280	4.67	**338**	12.67	394	6.33	**470**	14.25
CPR7	3.45	139	4.92	**304**	13	568	5.08	**990**	12.75	882	4.83	**1259**	12.67
CPR8	1.77	204	4.83	**242**	12.75	355	4.83	**392**	12.83	451	4.83	**721**	12.67
CPR9	2.19	115	5	**162**	13	244	4.92	**337**	13	327	6.75	**609**	12.67
CPRITB	38.84	368	5.58	**888**	13.17	983	5.08	**1750**	12.92	1438	5.17	**2465**	13
DE1S	0.89	0	0	0	0	0	0	**22**	13.83	38	5.17	**66**	13.08
DE2S	1.67	0	0	0	0	0	0	**41**	14.83	40	5.25	**147**	13.17
DE3S	3.9	0	0	0	0	0	0	**128**	14.67	31	7.17	**319**	13.58
DE4NS	4.21	0	0	0	0	0	0	**10**	14.25	0	7.92	**78**	13.83
DE4S	5.41	0	0	0	0	0	0	**5**	14.67	0	10.75	**11**	13.67
DE6S	3.05	0	0	0	0	0	0	**209**	13.67	226	5.58	**788**	13
DE9S	0.72	0	0	0	0	7	6.58	**89**	13.17	120	4.83	**177**	12.75
DEMF1B	1.04	0	0	**23**	16.33	407	4.75	**681**	12.67	769	4.75	**1142**	12.58
DETR19	1.53	0	0	0	0	201	4.83	**704**	12.75	672	4.83	**1387**	12.58
DIV14A	0.48	0	0	0	0	1	7.08	**48**	13.42	164	4.92	**218**	12.83
DIV14B	0.53	0	0	0	0	15	6.17	**74**	12.92	259	4.58	**372**	12.5

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DIV19R	1.53	0	0	**33**	16.67	171	5.17	171	12.67	171	4.83	**229**	13.17
DIV22E	0.09	0	0	**5**	13.83	76	4.25	**134**	12.17	**191**	4.17	178	12.17
DIV24A	0.53	0	0	**11**	16.42	342	4.58	**432**	12.5	570	4.5	**704**	12.42
DIV24B	0.46	0	0	**5**	21.42	**250**	4.58	238	12.58	473	4.5	**572**	12.42
DIV26A	0.87	0	0	**12**	18.5	307	4.83	**485**	12.83	571	4.83	**843**	12.67
DIV26B	0.26	0	0	**3**	19.42	**185**	4.58	178	12.58	**326**	4.5	280	12.5
DIV27A	0.54	0	0	**9**	18.08	297	4.92	**310**	12.83	435	4.83	**478**	12.75
DIV28B	0.54	0	0	**7**	18.67	297	4.75	**377**	12.67	**614**	4.58	555	12.58
DIV30B	0.88	0	0	**9**	20.5	248	5.33	**415**	13.25	503	5.25	**619**	13.08
DIV33B	0.85	0	0	**14**	17.5	359	4.67	**630**	12.58	641	4.5	**972**	12.5
DIVE1	0.89	0	0	0	0	0	0	**64**	13.83	150	5.17	**289**	13.08
DIVE10	0.82	0	0	0	0	0	0	**63**	13.92	141	5.25	**284**	13.08
DIVE11	0.6	0	0	0	0	0	0	**44**	13.83	140	5.17	**200**	13.08
DIVE12	0.57	0	0	0	0	0	0	**44**	13.92	137	5.25	**188**	13.17
DIVE13	0.48	0	0	0	0	0	0	**31**	13.5	147	4.83	**201**	12.75
DIVE15	0.78	0	0	0	0	18	5.92	**120**	13	239	4.75	**431**	12.67
DIVE16	0.4	0	0	0	0	3	6.5	**48**	13.08	134	4.67	**213**	12.58
DIVE17	0.27	0	0	0	0	4	6.17	**18**	13.5	104	4.92	**123**	12.83
DIVE18	0.22	**205**	4.33	183	12.33	**316**	4.33	278	12.33	**365**	4.33	320	12.33
DIVE19	0.14	**159**	4.25	139	12.25	**235**	4.25	205	12.25	**270**	4.25	234	12.25
DIVE2	0.78	0	0	0	0	0	0	**61**	13.83	139	5.25	**306**	13.08
DIVE20	0.17	**106**	4.5	93	12.42	**174**	4.42	151	12.42	**206**	4.42	180	12.42
DIVE21	0.31	0	0	0	0	62	5.08	**63**	13	**201**	4.83	175	12.83
DIVE22	0.16	0	0	**8**	13.92	138	4.25	**231**	12.17	**329**	4.17	317	12.17
DIVE25	0.93	0	0	0	0	0	0	0	0	0	0	**23**	18.08
DIVE29	1	0	0	**17**	17.5	335	4.83	**640**	12.75	610	4.83	**906**	12.67
DIVE3	2.23	0	0	0	0	0	0	**132**	14.67	60	5.67	**622**	13.58
DIVE31	0.81	0	0	**15**	17	283	4.83	**466**	12.75	560	4.67	**835**	12.58
DIVE32	0.25	0	0	**5**	16	141	4.5	**192**	12.42	262	4.42	**344**	12.33
DIVE4	1.2	0	0	0	0	0	0	**76**	14.33	128	5.67	**362**	13.5
DIVE4N	0.31	0	0	0	0	0	0	**22**	13.92	72	5.25	**118**	13.08
DIVE5A	1.14	0	0	0	0	0	0	**86**	14.08	152	5.5	**384**	13.33

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DIVE5B	0.29	0	0	0	0	10	5.83	**41**	12.92	132	4.58	**204**	12.5
DIVE6A	0.58	0	0	0	0	12	6.33	**77**	13	216	4.67	**333**	12.58
DIVE6B	1.95	0	0	0	0	9	6.58	**213**	13.58	227	5.58	**897**	13
DIVE7	1.12	0	0	0	0	0	0	**29**	15.17	91	5.75	**234**	13.67
DIVE8	1.1	0	0	0	0	0	0	**70**	14.08	141	5.42	**378**	13.25
DIVE9	0.72	0	0	0	0	7	6.58	**102**	13.17	222	4.83	**372**	12.75
DIVEM2	1.85	78	3.67	78	11.33	**865**	5.33	814	13.33	**1263**	5.17	1181	13.17
DIVEM3	1.49	270	5.33	**614**	12.92	1024	4.83	**1144**	12.75	1272	4.75	**1324**	12.75
DIVG1	1.32	0	0	0	0	140	4.75	**354**	12.75	465	4.75	**847**	12.58
DIVG10	0.28	0	0	**4**	16.08	227	4.58	**236**	12.5	**359**	4.5	329	12.42
DIVG11	0.08	0	0	0	0	0	0	**1**	23	1	5.83	**4**	13.33
DIVG12	0.12	1	6.17	**13**	12.83	157	4.25	**212**	12.17	**265**	4.17	255	12.17
DIVG13	0.29	0	0	0	0	48	4.5	**75**	12.42	209	4.33	**376**	12.25
DIVG14	0.35	0	0	**5**	19.5	161	4.42	**254**	12.33	358	4.33	**546**	12.25
DIVG16	0.07	0	0	0	0	5	5	**12**	12.83	38	4.58	**42**	12.58
DIVG17	0.1	0	0	0	0	0	0	**4**	13.92	22	4.58	**35**	12.5
DIVG18	0.17	0	0	0	0	42	4.67	**62**	12.58	137	4.5	**178**	12.42
DIVG19	0.09	0	0	0	0	**63**	4.33	34	12.42	**112**	4.25	77	12.33
DIVG20	0.18	0	0	0	0	89	4.5	**113**	12.42	230	4.33	**244**	12.33
DIVG21	0.21	0	0	**13**	13.67	174	4.5	**216**	12.42	291	4.42	**347**	12.33
DIVG22	0.09	0	0	**7**	13.42	93	4.33	**143**	12.25	**192**	4.25	177	12.17
DIVG5	0.18	0	0	**10**	13.42	199	4.33	**218**	12.33	292	4.33	**334**	12.25
DIVG6	0.37	0	0	0	0	269	4.33	**282**	12.33	501	4.25	**552**	12.25
DIVG7	0.22	0	0	0	0	2	5.67	2	16.75	**131**	4.67	71	12.75
DIVG8	0.56	0	0	0	0	95	4.75	**192**	12.67	396	4.58	**516**	12.5
DIVG9	0.09	0	0	0	0	0	0	0	23.83	**12**	4.5	5	12.75
DIVP1	0.39	0	0	0	0	0	0	**24**	13.67	95	5	**150**	12.83
DIVP2	0.58	0	0	0	0	0	0	**44**	13.75	152	5.08	**212**	13
DIVP3	0.52	0	0	0	0	0	0	**40**	14	128	5.33	**165**	13.25
DIVP4	0.5	0	0	0	0	0	0	0	0	0	0	0	0
DIVP5	0.25	0	0	0	0	18	5.42	**34**	13.25	**136**	4.92	121	12.92
DIVP6	0.5	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order														
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DIVP7	0.43	0	0	0	0	58	5.25	**60**	13.17	**237**	4.92	212	12.92
DIVP9	1.12	**985**	4.42	958	12.42	**1377**	4.42	1338	12.42	**1557**	4.42	1513	12.42
DIVR1	1.45	0	0	0	0	0	0	**22**	15.08	105	5.17	**308**	13.08
DIVR10	1.01	0	0	0	0	24	6.33	**110**	13.83	185	5.42	**358**	13.33
DIVR11	0.99	0	0	**8**	21.58	318	4.83	**460**	12.83	502	4.83	**859**	12.67
DIVR12	0.49	0	0	**26**	13.92	402	4.42	**550**	12.33	744	4.33	**887**	12.25
DIVR13	0.5	0	0	**10**	16.25	292	4.58	**362**	12.5	493	4.5	**599**	12.42
DIVR14	0.5	0	0	**21**	14	359	4.5	**458**	12.42	622	4.42	**746**	12.33
DIVR15	0.56	**106**	4.92	105	12.92	501	4.58	**528**	12.5	**668**	4.5	616	12.5
DIVR16	0.5	0	0	**16**	14.75	294	4.58	**368**	12.5	527	4.42	**604**	12.42
DIVR17	0.49	0	0	**4**	20.42	193	4.92	**219**	12.83	342	4.83	**360**	12.75
DIVR18	0.8	0	0	0	0	46	5.67	**108**	13.5	235	5.17	**354**	13.08
DIVR19	1.53	0	0	**33**	16.67	272	5.17	**875**	12.75	843	4.83	**1558**	12.58
DIVR2	0.68	204	4.92	**254**	12.83	519	4.75	519	12.67	**655**	4.67	612	12.67
DIVR20	0.5	0	0	0	0	**149**	4.83	103	12.92	**366**	4.67	296	12.67
DIVR21	0.84	341	4.67	**413**	12.67	**671**	4.67	649	12.67	**790**	4.67	757	12.67
DIVR22	0.57	0	0	**13**	15.33	402	4.58	**432**	12.5	636	4.5	**723**	12.42
DIVR23	0.5	0	0	**8**	17.67	248	4.67	**309**	12.58	**493**	4.5	492	12.5
DIVR24	0.29	0	0	**5**	17	162	4.67	**196**	12.58	288	4.5	**305**	12.5
DIVR25	0.28	14	4.92	**25**	12.83	296	4.42	**353**	12.33	**479**	4.33	406	12.33
DIVR3	0.41	0	0	**3**	16.08	240	4.83	**241**	12.75	342	4.75	**352**	12.67
DIVR5	0.5	**333**	4.5	288	12.5	**526**	4.5	465	12.5	**622**	4.5	546	12.5
DIVR7	1	0	0	**25**	14.25	356	4.83	**624**	12.75	642	4.83	**890**	12.67
DIVR8	0.55	0	0	0	0	19	6	**91**	13.08	193	4.83	**366**	12.67
DIVR9	0.59	0	0	0	0	19	6	**102**	13	238	4.75	**351**	12.67
DP1PFW	0.39	0	0	0	0	0	0	**19**	13.67	56	5	**69**	12.83
DRE2	0.89	0	0	0	0	0	0	**42**	13.83	112	5.17	**223**	13.08
DRE2	0.89	0	0	0	0	0	0	**42**	13.83	112	5.17	**223**	13.08
DRE3	1.67	0	0	0	0	0	0	**5**	14.83	16	5.25	**100**	13.08
DRE3	1.67	0	0	0	0	0	0	**5**	14.83	16	5.25	**100**	13.08
DRE4	4.21	0	0	0	0	0	0	**5**	14.25	0	7.92	**157**	13.83
DRE4	4.21	0	0	0	0	0	0	**5**	14.25	0	7.92	**157**	13.83

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order

HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
DRE4N	3.9	0	0	0	0	0	0	**3**	14.67	1	7.17	**306**	13.58
DRE4N	3.9	0	0	0	0	0	0	**3**	14.67	1	7.17	**306**	13.58
DRE5	5.41	0	0	0	0	0	0	**57**	14.67	0	11.25	**278**	13.58
DRE5	5.41	0	0	0	0	0	0	**57**	14.67	0	11.25	**278**	13.58
DRE9	3.05	0	0	0	0	0	0	**1**	13.67	1	5.58	**104**	13
DRE9	3.05	0	0	0	0	0	0	**1**	13.67	1	5.58	**104**	13
DRPFW	0.39	0	0	0	0	0	0	**5**	13.67	39	5	**81**	12.83
DRPFW	0.39	0	0	0	0	0	0	**5**	13.67	39	5	**81**	12.83
DRR5	0.72	0	0	0	0	0	6.58	**13**	13.17	102	4.83	**196**	12.75
DRR5	0.72	0	0	0	0	0	6.58	**13**	13.17	102	4.83	**196**	12.75
E1	0.89	**475**	4.58	468	12.58	**742**	4.58	718	12.58	**869**	4.58	842	12.58
E10	0.82	**428**	4.67	412	12.67	**665**	4.67	631	12.67	**777**	4.67	739	12.67
E10E17	1.71	0	0	0	0	0	0	**39**	15	36	5.67	**175**	13.5
E11	0.6	**356**	4.58	315	12.58	**548**	4.58	484	12.58	**637**	4.58	567	12.58
E11E18	2.27	0	0	0	0	0	0	**52**	16.58	14	7.08	**163**	15
E12	0.57	**325**	4.67	284	12.67	**497**	4.67	434	12.67	**577**	4.67	509	12.67
E12E19	4.47	0	0	0	0	0	0	**114**	15.42	12	8.25	**276**	14.67
E13	0.48	**414**	4.42	351	12.42	**618**	4.42	530	12.33	**713**	4.42	615	12.33
E13E24	4.69	0	0	0	0	0	0	**18**	14.83	7	7	**86**	13.42
E1424A	7.61	0	0	0	0	0	0	**88**	16.58	14	7.08	**321**	14.42
E14A	0.48	**364**	4.5	306	12.5	**546**	4.5	461	12.5	**630**	4.5	538	12.42
E14B	0.53	**623**	4.25	533	12.25	**898**	4.25	774	12.25	**1025**	4.25	884	12.25
E14E24	0.81	0	0	0	0	6	7.17	**63**	13.92	83	5.08	**180**	13
E15	0.78	**688**	4.33	647	12.33	**1015**	4.33	955	12.33	**1167**	4.33	1096	12.33
E1524B	4.95	0	0	0	0	0	0	**222**	14.75	137	6.67	**621**	13.83
E16	0.4	**411**	4.33	346	12.33	**598**	4.33	508	12.33	**684**	4.33	582	12.33
E16E15	1.12	0	0	0	0	1	8.75	**80**	14.08	59	5.83	**189**	12.83
E17	0.27	**180**	4.5	154	12.5	**280**	4.5	245	12.5	**329**	4.5	287	12.5
E17E21	1.98	0	0	0	0	0	7.58	**41**	15.58	23	6	**169**	13.83
E18	0.22	**205**	4.33	183	12.33	**316**	4.33	278	12.33	**365**	4.33	320	12.33
E18E21	2.49	114	4.58	**155**	12.5	196	4.5	**246**	12.5	231	4.5	**287**	12.5
E19	0.14	**159**	4.25	139	12.25	**235**	4.25	205	12.25	**270**	4.25	234	12.25

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E1922E	4.61	70	4.42	**125**	12.42	115	4.33	**187**	12.33	136	4.33	**270**	15
E1E10	0.89	0	0	0	0	0	0	**14**	14.75	23	5.75	**46**	13.67
E2	0.78	**423**	4.67	401	12.67	**651**	4.67	612	12.67	**762**	4.58	716	12.58
E20	0.17	**108**	4.42	93	12.42	**174**	4.42	151	12.42	**206**	4.42	180	12.42
E2022E	0.17	**87**	4.58	80	12.58	**168**	4.5	147	12.5	**200**	4.5	175	12.5
E21	0.31	**215**	4.5	187	12.5	**332**	4.5	291	12.5	**389**	4.5	341	12.5
E21G20	2.29	0	0	0	0	6	5.33	**45**	15.75	71	5.33	**172**	14
E22	0.16	**296**	4.08	249	12.08	**407**	4.08	343	12.08	**458**	4.08	387	12.08
E22G22	7.25	108	5.25	**193**	13	301	5	**443**	12.83	429	4.92	**552**	12.83
E247A1	8.62	0	0	**7**	20.83	25	5.42	**254**	13	100	5.33	**515**	12.83
E247A2	8.62	0	0	**6**	21.25	23	5.58	**169**	13.08	91	5.5	**364**	12.92
E24A	0.53	**574**	4.33	492	12.33	**825**	4.33	710	12.33	**943**	4.33	812	12.33
E24B	0.46	**575**	4.25	490	12.25	**814**	4.25	695	12.25	**923**	4.25	788	12.25
E24E28	6.23	0	0	**2**	25	43	5.25	**244**	15.25	144	4.92	**660**	14.17
E25	0.93	**633**	4.58	611	12.58	**941**	4.5	903	12.5	**1087**	4.5	1038	12.5
E25E29	0.93	0	0	0	0	0	0	0	0	0	0	**20**	19.75
E26A	0.87	**699**	4.5	665	12.5	**1015**	4.5	959	12.5	**1159**	4.5	1093	12.5
E26B	0.26	**302**	4.33	259	12.33	**427**	4.33	366	12.33	**484**	4.33	415	12.33
E26E33	10.9	0	0	**16**	26.58	72	6.83	**527**	14.25	453	6.58	**1157**	13.83
E2726A	12.81	64	6.33	**118**	13.83	265	5.67	**596**	13.42	541	5.5	**984**	13.17
E27A	0.54	**453**	4.58	394	12.5	**654**	4.5	568	12.5	**746**	4.5	647	12.5
E28B	0.54	**552**	4.42	480	12.42	**785**	4.42	681	12.42	**890**	4.42	773	12.42
E28E31	6.77	0	0	**4**	24.67	66	5.5	**246**	15.67	229	5.25	**650**	14.42
E29	1	**751**	4.5	740	12.5	**1107**	4.5	1079	12.5	**1273**	4.5	1237	12.5
E29E31	1.93	0	0	**13**	20.42	127	5.67	**303**	13.17	359	5.25	**573**	13
E2E11	1.67	0	0	0	0	0	0	**39**	15.5	31	6.25	**134**	14.08
E2SE3	3.9	0	0	0	0	0	0	**131**	14.67	31	7.17	**625**	13.58
E3	2.23	766	4.92	**941**	12.92	1254	4.92	**1431**	12.92	1486	4.92	**1665**	12.92
E30B	0.88	**540**	4.83	511	12.83	**786**	4.83	739	12.83	**898**	4.83	844	12.83
E30E26	10.64	0	0	**18**	25.08	101	6.42	**595**	13.67	498	6	**1282**	13.42
E31	0.81	**601**	4.5	566	12.5	**891**	4.5	838	12.5	**1027**	4.5	964	12.42
E31E30	9.76	0	0	**20**	24.75	72	6.17	**454**	13.75	395	6	**963**	13.42

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E32	0.25	**283**	4.25	237	12.25	**417**	4.25	351	12.25	**479**	4.25	404	12.25
E32E31	0.25	0	0	**5**	17.5	54	4.92	**79**	12.83	123	4.75	**155**	12.75
E33B	0.85	**846**	4.33	807	12.33	**1207**	4.33	1148	12.33	**1371**	4.33	1304	12.33
E33P9A	33.05	40	7.08	**81**	14.5	212	6.33	**701**	13.67	545	6.58	**1727**	14
E33P9B	33.05	32	7.58	**67**	15	185	6.5	**671**	14.75	525	6.67	**1694**	14.08
E3E12	3.9	0	0	0	0	0	0	**101**	15.08	17	7.75	**272**	13.92
E4	1.2	462	4.92	**485**	12.92	725	4.92	**739**	12.92	853	4.92	**865**	12.92
E4E14A	5.41	0	0	0	0	0	0	**3**	16	0	12.42	**9**	14.67
E4N	0.31	**182**	4.67	154	12.67	**278**	4.58	236	12.67	**322**	4.58	277	12.58
E4NE13	4.21	0	0	0	0	0	0	**7**	16.25	0	9.92	**55**	14.58
E5A	1.14	485	4.83	**500**	12.83	752	4.83	**757**	12.83	882	4.83	**885**	12.83
E5A14A	7.13	0	0	0	0	0	0	**82**	15.5	14	6.58	**324**	14.25
E5B	0.29	**314**	4.25	262	12.25	**460**	4.25	387	12.25	**528**	4.25	447	12.25
E5E14B	0.29	0	0	0	0	7	6.67	**27**	13.58	57	5.08	**89**	12.92
E6A	0.58	**625**	4.25	550	12.25	**908**	4.25	803	12.25	**1039**	4.25	919	12.25
E6AE5A	0.58	0	0	0	0	3	7.67	**46**	13.92	94	5.17	**159**	13.08
E6B	1.95	1171	4.58	**1312**	12.58	1748	4.58	**1907**	12.58	2016	4.58	**2187**	12.58
E6E15	3.05	0	0	0	0	0	0	**153**	14.25	145	6.17	**497**	13.58
E7	1.12	429	4.92	**449**	12.92	690	4.92	**702**	12.92	815	4.92	**820**	12.92
E7E6	1.12	0	0	0	0	0	0	0	0	0	0	**1**	30
E7STOR	1.12	0	0	0	0	0	0	0	0	0	0	**1**	25.67
E8	1.1	475	4.75	**497**	12.75	758	4.75	**770**	12.75	895	4.75	**901**	12.75
E8E6	1.1	0	0	0	0	0	0	**43**	15.25	75	6.17	**191**	14
E9	0.72	**631**	4.42	579	12.42	**921**	4.42	846	12.42	**1056**	4.42	968	12.42
E9E16	0.72	0	0	0	0	2	7.67	**59**	13.83	77	5.33	**122**	13.25
EM1EM2	35.21	378	5.25	**694**	12.83	743	4.83	**1029**	12.75	862	4.75	**1804**	12.83
EM2M3A	37.06	417	5.33	**613**	13	754	4.92	**1045**	12.92	1083	5.42	**2153**	13.5
EM2M3B	37.06	377	5.5	**570**	13.17	698	5.08	**1020**	13.08	1050	5.5	**2133**	13.58
EMF1B	1.04	**926**	4.42	901	12.42	**1309**	4.42	1271	12.42	**1484**	4.42	1442	12.42
EMF2	1.85	937	4.83	**977**	12.83	1374	4.83	**1409**	12.83	1577	4.83	**1610**	12.83
EMF3	1.49	706	4.75	**766**	12.75	1090	4.75	**1144**	12.75	1272	4.75	**1324**	12.75
EMF3RB	38.55	368	5.58	**888**	13.17	983	5.08	**1750**	12.92	1438	5.17	**2465**	13

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order														
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
EMF4	0.06	**98**	4.08	82	12.08	**141**	4.08	119	12.08	**160**	4.08	135	12.08
G12T13	0.12	0	6.83	**8**	13.5	74	4.5	**82**	12.42	128	4.42	**130**	12.33
G13T14	0.41	0	6.92	**7**	13.92	95	4.58	**132**	12.5	270	4.42	**366**	12.33
G14E26	7.01	0	0	**8**	24.08	85	5.25	**328**	13	318	5.17	**775**	12.75
G16T19	0.07	0	0	0	0	3	5.42	**7**	13.17	23	4.75	**29**	12.75
G17E26	0.1	0	0	0	0	0	0	**4**	14.42	11	4.92	**19**	12.83
G19E26	0.51	0	0	0	0	53	5.08	**66**	13.08	**196**	4.83	182	12.83
G20G21	3.9	89	4.83	**125**	12.75	163	4.75	**215**	12.67	197	4.67	**254**	12.67
G21T22	0.21	0	0	**10**	14.08	141	4.58	**180**	12.5	244	4.5	**298**	12.42
G22E26	7.55	102	5.42	**183**	13.17	345	5.17	**497**	12.92	518	5	**618**	12.92
GM1	0.34	**286**	4.42	251	12.42	**434**	4.42	377	12.42	**501**	4.42	435	12.42
GM10	0.28	**280**	4.33	242	12.33	**414**	4.33	357	12.33	**475**	4.33	409	12.33
GM11	0.08	**67**	4.25	56	12.25	**109**	4.25	91	12.25	**128**	4.25	108	12.25
GM12	0.12	**210**	4.08	177	12.08	**289**	4.08	244	12.08	**325**	4.08	275	12.08
GM13	0.29	**417**	4.17	352	12.17	**608**	4.08	519	12.08	**696**	4.08	596	12.08
GM14	0.35	**477**	4.17	400	12.17	**700**	4.17	591	12.17	**801**	4.17	678	12.17
GM16	0.07	**61**	4.33	51	12.33	**93**	4.33	79	12.33	**108**	4.33	93	12.33
GM17	0.1	**113**	4.17	96	12.17	**176**	4.17	150	12.17	**205**	4.17	174	12.17
GM18	0.17	**185**	4.25	158	12.25	**277**	4.25	238	12.25	**319**	4.25	274	12.25
GM19	0.09	**123**	4.17	105	12.17	**178**	4.17	152	12.17	**203**	4.17	174	12.17
GM1T5	1.32	0	0	0	0	92	5	**223**	12.92	376	4.92	**640**	12.67
GM2	0.68	**655**	4.33	603	12.33	**968**	4.33	888	12.33	**1114**	4.33	1023	12.33
GM20	0.18	**261**	4.17	225	12.17	**369**	4.17	317	12.17	**418**	4.17	359	12.17
GM21	0.21	**286**	4.25	241	12.25	**396**	4.25	335	12.25	**447**	4.25	379	12.25
GM22	0.09	**159**	4.17	134	12.17	**219**	4.17	184	12.17	**246**	4.17	208	12.17
GM3	0.29	**494**	4.08	417	12.08	**681**	4.08	577	12.08	**767**	4.08	651	12.08
GM5	0.18	**263**	4.17	224	12.17	**364**	4.17	310	12.17	**410**	4.17	349	12.17
GM5T7	1.49	0	0	**5**	14.92	87	5.17	**206**	13.25	333	5.17	**571**	12.92
GM6	0.37	**565**	4.17	482	12.17	**802**	4.17	685	12.17	**909**	4.17	777	12.17
GM7	0.22	**184**	4.33	161	12.33	**286**	4.33	249	12.33	**333**	4.33	290	12.33
GM7T9	2.08	0	0	**4**	15.92	84	5.08	**200**	13.42	321	5.25	**585**	13
GM8	0.56	**523**	4.33	459	12.33	**784**	4.33	692	12.33	**907**	4.33	798	12.33

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
GM8G10	1.96	0	0	0	0	0	0	**28**	16.33	15	6.58	**106**	14.42
GM9	0.09	**117**	4.17	99	12.17	**180**	4.17	153	12.17	**208**	4.17	177	12.17
GM9T14	3.08	0	0	**7**	18.42	109	5.25	**299**	12.92	368	5	**723**	12.75
P1	0.39	**276**	4.5	232	12.5	**422**	4.5	357	12.5	**489**	4.5	418	12.5
P1P2	0.39	0	0	0	0	0	0	**14**	14.5	35	5.5	**47**	13.42
P1PFW	0.39	0	0	0	0	0	0	**3**	14.67	17	5.33	**38**	13.17
P2	0.58	**362**	4.58	317	12.58	**554**	4.58	486	12.58	**644**	4.58	569	12.58
P2P4	0.96	0	0	0	0	0	0	**36**	14.83	62	5.58	**142**	13.42
P3	0.52	**287**	4.67	245	12.67	**439**	4.67	376	12.67	**509**	4.67	441	12.67
P3P5	0.91	0	0	0	0	0	0	**33**	14.25	82	5.42	**176**	13.33
P4	0.5	**339**	4.5	291	12.5	**523**	4.5	459	12.5	**614**	4.5	536	12.5
P4P6	1.46	0	0	0	0	0	0	**31**	15.5	31	6.08	**119**	13.92
P5	0.25	**170**	4.58	147	12.58	**261**	4.58	229	12.5	**306**	4.58	268	12.5
P5P7	1.16	0	0	0	0	6	5.67	**35**	14.42	76	5.5	**185**	13.42
P6	0.5	**288**	4.67	247	12.67	**444**	4.67	390	12.67	**520**	4.67	456	12.67
P6GM8	1.96	0	0	0	0	0	0	**28**	16.08	16	6.33	**110**	14.25
P7	0.43	**311**	4.5	275	12.5	**479**	4.5	419	12.5	**555**	4.5	485	12.5
P7GM14	3.17	0	0	0	0	0	0	**50**	16.92	67	5.75	**210**	13.33
P9	1.12	**985**	4.42	958	12.42	**1377**	4.42	1338	12.42	**1557**	4.42	1513	12.42
P9EMF1	34.17	390	4.92	**627**	12.67	722	4.67	**1046**	12.58	846	4.67	**1728**	14.17
R1	1.45	599	4.58	**730**	12.58	1035	4.58	**1164**	12.58	1244	4.58	**1372**	12.58
R10	1.01	416	4.83	**426**	12.83	666	4.83	**667**	12.83	**787**	4.83	781	12.83
R10R12	4.46	53	6.33	**217**	13.83	347	5.83	**725**	13.67	600	5.75	**1124**	13.67
R11	0.99	**691**	4.5	688	12.5	**1043**	4.5	1022	12.5	**1207**	4.5	1179	12.5
R11R13	4.95	141	5.83	**272**	13.67	381	5.75	**652**	13.75	608	5.75	**1049**	13.75
R12	0.49	**698**	4.17	587	12.17	**979**	4.17	828	12.17	**1108**	4.17	939	12.17
R12R15	4.95	32	8.33	**153**	15.25	269	7	**590**	14.67	477	6.75	**949**	14.58
R13	0.5	**491**	4.33	409	12.33	**729**	4.33	612	12.33	**838**	4.33	708	12.33
R13R16	5.45	128	6.17	**266**	13.92	357	6.17	**640**	14.25	583	6.25	**1005**	14.25
R14	0.5	**571**	4.25	479	12.25	**829**	4.25	703	12.25	**950**	4.25	806	12.25
R14R17	0.5	0	0	**15**	15.17	159	4.92	**220**	12.83	300	4.75	**370**	12.75
R15	0.56	**385**	4.5	338	12.5	**594**	4.5	528	12.5	**694**	4.5	616	12.5

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order														
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year				
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
R15R18	5.51	24	9.25	**140**	15.92	226	7.5	**564**	15.08	431	7.17	**901**	15
R16	0.5	**546**	4.25	458	12.25	**788**	4.25	666	12.25	**901**	4.25	765	12.25
R16R21	5.95	98	7.33	**236**	14.67	319	6.92	**601**	15.25	529	7.17	**925**	15.33
R17	0.49	**330**	4.58	279	12.58	**497**	4.58	427	12.58	**576**	4.58	497	12.58
R17R22	0.99	0	0	**13**	16.75	132	5.33	**275**	13.25	302	5.17	**519**	13.08
R18	0.8	**362**	4.67	352	12.67	**582**	4.67	560	12.67	**689**	4.67	661	12.67
R18R22	6.3	18	10.33	**121**	16.67	186	8.17	**534**	15.58	384	7.75	**852**	15.42
R19	1.53	962	4.42	**1066**	12.5	1450	4.42	**1566**	12.5	1686	4.42	**1808**	12.42
R19R24	1.53	0	0	**28**	18.42	111	6.17	**160**	13.92	158	5.92	**191**	13.83
R1R4	1.45	0	0	0	0	0	0	**18**	20.42	31	7.33	**108**	15.25
R2	0.68	**342**	4.67	323	12.67	**551**	4.67	519	12.67	**655**	4.67	612	12.67
R20	0.5	**415**	4.42	305	12.42	**621**	4.42	482	12.42	**719**	4.42	562	12.42
R20R23	0.5	0	0	0	0	47	5.58	47	13.75	**160**	5.08	141	13.17
R21	0.84	**424**	4.67	413	12.67	**671**	4.67	649	12.67	**790**	4.67	757	12.67
R21R25	14.65	74	7.92	**178**	15.42	313	5	**815**	15.83	573	7.08	**1466**	15.92
R22	0.57	**530**	4.33	462	12.33	**784**	4.33	689	12.33	**902**	4.33	794	12.33
R22R21	7.87	14	12.92	**115**	17.25	160	8.67	**550**	15.92	356	8.08	**857**	15.67
R23	0.5	**488**	4.33	409	12.33	**714**	4.33	608	12.33	**821**	4.33	700	12.33
R23R25	1	0	0	**6**	20.42	62	5.08	**135**	13	163	4.83	**282**	12.75
R24	0.29	**274**	4.33	231	12.33	**405**	4.33	346	12.33	**467**	4.33	400	12.33
R24EM4	17.75	63	8.42	**170**	15.67	263	5.33	**860**	15.83	615	7.08	**1516**	16
R25	0.28	**297**	4.25	250	12.25	**443**	4.25	378	12.25	**510**	4.25	436	12.25
R25R24	15.93	73	8	**181**	15.42	340	5	**827**	15.92	575	7	**1484**	15.92
R2R3R6	1.09	36	7.17	**64**	15.25	254	6.5	**331**	14.33	407	6.33	**467**	14.17
R3	0.41	**211**	4.67	181	12.67	**339**	4.58	301	12.58	**403**	4.58	358	12.58
R4	1	311	4.58	**377**	12.58	615	4.58	**673**	12.58	764	4.58	**817**	12.58
R4R7	2.45	134	4.92	**304**	13	368	5.08	**513**	13.08	476	5.08	**621**	13.08
R5	0.5	**333**	4.5	288	12.5	**526**	4.5	465	12.5	**622**	4.5	546	12.5
R5R8	1.22	204	4.83	**242**	12.75	357	4.83	**392**	12.83	427	4.83	**470**	12.92
R6	0.5	**233**	4.67	202	12.67	**386**	4.67	342	12.67	**460**	4.67	409	12.67
R6R9	1.59	115	5	**162**	13	246	4.92	**305**	14.67	345	6.67	**434**	14.58
R7	1	498	4.58	**522**	12.58	810	4.58	**823**	12.58	959	4.58	**965**	12.58

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
R7R10	3.45	75	5.67	**274**	13.42	439	5.5	**853**	13.25	737	5.33	**1040**	13.33
R8	0.55	**518**	4.42	445	12.42	**748**	4.42	647	12.42	**855**	4.42	741	12.42
R8R11	1.77	155	5.17	**219**	13.08	298	5.08	**357**	13.25	375	5.25	**581**	13.33
R9	0.59	**576**	4.33	503	12.33	**832**	4.33	733	12.33	**952**	4.33	840	12.33
R9R11	2.19	77	5.67	**138**	13.58	190	5.42	**303**	15.17	293	7.17	**476**	13.25
RBEMF4	38.84	332	6.33	**654**	13.75	858	5.75	**1496**	13.42	1350	5.67	**2291**	13.83
REMF1B	1.04	**926**	4.42	901	12.42	**1309**	4.42	1271	12.42	**1484**	4.42	1442	12.42
RET14A	0.48	**364**	4.5	306	12.5	**546**	4.5	461	12.5	**630**	4.5	538	12.42
RET14B	0.53	**623**	4.25	533	12.25	**898**	4.25	774	12.25	**1025**	4.25	884	12.25
RET22E	0.09	**168**	4.08	141	12.08	**230**	4.08	194	12.08	**259**	4.08	194	12
RET24A	0.53	**574**	4.33	492	12.33	**825**	4.33	710	12.33	**943**	4.33	807	12.25
RET24B	0.46	**575**	4.25	490	12.25	**814**	4.25	695	12.25	**923**	4.25	788	12.25
RET26A	0.87	**699**	4.5	665	12.5	**1015**	4.5	959	12.5	**1159**	4.5	1093	12.5
RET26B	0.26	**302**	4.33	259	12.33	**427**	4.33	366	12.33	**484**	4.33	415	12.33
RET27A	0.54	**453**	4.58	394	12.5	**654**	4.5	568	12.5	**746**	4.5	647	12.5
RET28B	0.54	**552**	4.42	480	12.42	**785**	4.42	681	12.42	**890**	4.42	773	12.42
RET30B	0.88	**540**	4.83	511	12.83	**786**	4.83	739	12.83	**898**	4.83	844	12.83
RET33B	0.85	**846**	4.33	807	12.33	**1207**	4.33	1148	12.33	**1371**	4.33	1304	12.33
RETE1	0.89	**475**	4.58	468	12.58	**742**	4.58	718	12.58	**869**	4.58	842	12.58
RETE10	0.82	**428**	4.67	412	12.67	**665**	4.67	631	12.67	**777**	4.67	739	12.67
RETE11	0.6	**356**	4.58	315	12.58	**548**	4.58	484	12.58	**637**	4.58	567	12.58
RETE12	0.57	**325**	4.67	284	12.67	**497**	4.67	434	12.67	**577**	4.67	509	12.67
RETE13	0.48	**414**	4.42	351	12.42	**618**	4.42	530	12.33	**713**	4.42	615	12.33
RETE15	0.78	**688**	4.33	647	12.33	**1015**	4.33	955	12.33	**1167**	4.33	1096	12.33
RETE16	0.4	**411**	4.33	346	12.33	**598**	4.33	508	12.33	**684**	4.33	582	12.33
RETE17	0.27	**180**	4.5	154	12.5	**280**	4.5	245	12.5	**329**	4.5	287	12.5
RETE18	0.22	**2**	3.08	1	5	**2**	1.83	1	4.5	**2**	1.83	1	4.17
RETE19	0.14	1	3.17	1	4.58	1	2.58	1	4.67	1	1	1	4.33
RETE2	0.78	**423**	4.67	401	12.67	**651**	4.67	612	12.67	**762**	4.58	716	12.58
RETE20	0.17	**97**	4.33	70	12.33	**109**	4.25	61	12.08	**114**	4.17	65	12.08
RETE21	0.31	**215**	4.5	187	12.5	**332**	4.5	291	12.5	**389**	4.5	341	12.5
RETE22	0.16	**296**	4.08	249	12.08	**407**	4.08	343	12.08	**458**	4.08	342	12

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RETE25	0.93	**633**	4.58	611	12.58	**941**	4.5	903	12.5	**1087**	4.5	1038	12.5
RETE29	1	**751**	4.5	740	12.5	**1107**	4.5	1079	12.5	**1273**	4.5	1237	12.5
RETE3	2.23	766	4.92	**941**	12.92	1254	4.92	**1431**	12.92	1486	4.92	**1665**	12.92
RETE31	0.81	**601**	4.5	566	12.5	**891**	4.5	838	12.5	**1027**	4.5	964	12.42
RETE32	0.25	**283**	4.25	237	12.25	**417**	4.25	351	12.25	**479**	4.25	394	12.17
RETE4	1.2	462	4.92	**485**	12.92	725	4.92	**739**	12.92	853	4.92	**865**	12.92
RETE4N	0.31	**182**	4.67	154	12.67	**278**	4.58	236	12.67	**322**	4.58	277	12.58
RETE5A	1.14	485	4.83	**500**	12.83	752	4.83	**757**	12.83	882	4.83	**885**	12.83
RETE5B	0.29	**314**	4.25	262	12.25	**460**	4.25	387	12.25	**528**	4.25	447	12.25
RETE6A	0.58	**625**	4.25	550	12.25	**908**	4.25	803	12.25	**1039**	4.25	919	12.25
RETE6B	1.95	1171	4.58	**1312**	12.58	1748	4.58	**1907**	12.58	2016	4.58	**2187**	12.58
RETE7	1.12	429	4.92	**449**	12.92	690	4.92	**702**	12.92	815	4.92	**820**	12.92
RETE8	1.1	475	4.75	**497**	12.75	758	4.75	**770**	12.75	895	4.75	**901**	12.75
RETE9	0.72	**631**	4.42	579	12.42	**921**	4.42	846	12.42	**1056**	4.42	968	12.42
RETEM2	1.85	859	4.83	**899**	12.83	1296	4.83	**1331**	12.83	1499	4.83	**1532**	12.83
RETEM3	1.49	706	4.75	**766**	12.75	**1009**	4.58	801	12.42	**1076**	4.5	812	12.33
RETG1	1.32	952	4.25	**1029**	12.17	1438	4.25	**1521**	12.17	1662	4.25	**1747**	12.17
RETG10	0.28	**280**	4.33	242	12.33	**414**	4.33	357	12.33	**475**	4.33	409	12.33
RETG11	0.08	**67**	4.25	56	12.25	**109**	4.25	91	12.25	**128**	4.25	108	12.25
RETG12	0.12	**210**	4.08	177	12.08	**289**	4.08	244	12.08	**325**	4.08	217	12
RETG13	0.29	**417**	4.17	352	12.17	**608**	4.08	519	12.08	**696**	4.08	596	12.08
RETG14	0.35	**477**	4.17	400	12.17	**700**	4.17	591	12.17	**801**	4.17	676	12.17
RETG16	0.07	**61**	4.33	51	12.33	**93**	4.33	79	12.33	**108**	4.33	93	12.33
RETG17	0.1	**113**	4.17	96	12.17	**176**	4.17	150	12.17	**205**	4.17	174	12.17
RETG18	0.17	**185**	4.25	158	12.25	**277**	4.25	238	12.25	**319**	4.25	274	12.25
RETG19	0.09	**123**	4.17	105	12.17	**178**	4.17	152	12.17	**203**	4.17	174	12.17
RETG20	0.18	**261**	4.17	225	12.17	**369**	4.17	317	12.17	**418**	4.17	359	12.17
RETG21	0.21	**286**	4.25	241	12.25	**396**	4.25	335	12.25	**447**	4.25	360	12.17
RETG22	0.09	**159**	4.17	134	12.17	**219**	4.17	176	12.08	**234**	4.08	199	12.08
RETG5	0.18	**263**	4.17	224	12.17	**364**	4.17	310	12.17	**410**	4.17	325	12.17
RETG6	0.37	**565**	4.17	482	12.17	**802**	4.17	685	12.17	**909**	4.17	777	12.17
RETG7	0.22	**184**	4.33	161	12.33	**286**	4.33	249	12.33	**333**	4.33	290	12.33

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order														
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RETG8	0.56	**523**	4.33	459	12.33	**784**	4.33	692	12.33	**907**	4.33	798	12.33
RETG9	0.09	**117**	4.17	99	12.17	**180**	4.17	153	12.17	**208**	4.17	177	12.17
RETP1	0.39	**276**	4.5	232	12.5	**422**	4.5	357	12.5	**489**	4.5	418	12.5
RETP2	0.58	**362**	4.58	317	12.58	**554**	4.58	486	12.58	**644**	4.58	569	12.58
RETP3	0.52	**287**	4.67	245	12.67	**439**	4.67	376	12.67	**509**	4.67	441	12.67
RETP4	0.5	**339**	4.5	291	12.5	**523**	4.5	459	12.5	**614**	4.5	536	12.5
RETP5	0.25	**170**	4.58	147	12.58	**261**	4.58	229	12.5	**306**	4.58	268	12.5
RETP6	0.5	**288**	4.67	247	12.67	**444**	4.67	390	12.67	**520**	4.67	456	12.67
RETP7	0.43	**311**	4.5	275	12.5	**479**	4.5	419	12.5	**555**	4.5	485	12.5
RETP9	1.12	**806**	4.25	465	12.08	**863**	4.17	177	11.75	**891**	4.08	137	11.5
RETR1	1.45	599	4.58	**730**	12.58	1035	4.58	**1164**	12.58	1244	4.58	**1372**	12.58
RETR10	1.01	416	4.83	**426**	12.83	666	4.83	**667**	12.83	**787**	4.83	781	12.83
RETR11	0.99	**691**	4.5	688	12.5	**1043**	4.5	1022	12.5	**1207**	4.5	1179	12.5
RETR12	0.49	**698**	4.17	587	12.17	**979**	4.17	828	12.17	**1108**	4.17	850	12.17
RETR13	0.5	**491**	4.33	409	12.33	**729**	4.33	612	12.33	**838**	4.33	705	12.25
RETR14	0.5	**571**	4.25	479	12.25	**829**	4.25	703	12.25	**950**	4.25	751	12.17
RETR15	0.56	**385**	4.5	338	12.5	**582**	4.42	477	12.42	**596**	4.33	537	12.33
RETR16	0.5	**546**	4.25	458	12.25	**788**	4.25	666	12.25	**901**	4.25	765	12.25
RETR17	0.49	**330**	4.58	279	12.58	**497**	4.58	427	12.58	**576**	4.58	497	12.58
RETR18	0.8	**362**	4.67	352	12.67	**582**	4.67	560	12.67	**689**	4.67	661	12.67
RETR19	1.53	962	4.42	**1066**	12.5	1450	4.42	**1566**	12.5	1686	4.42	**1808**	12.42
RETR2	0.68	**342**	4.67	323	12.67	**459**	4.5	383	12.42	**478**	4.42	398	12.33
RETR20	0.5	**415**	4.42	305	12.42	**621**	4.42	482	12.42	**719**	4.42	562	12.42
RETR21	0.84	**361**	4.5	300	12.5	**441**	4.33	333	12.25	**530**	4.33	305	12.17
RETR22	0.57	**530**	4.33	462	12.33	**784**	4.33	689	12.33	**902**	4.33	794	12.33
RETR23	0.5	**488**	4.33	409	12.33	**714**	4.33	608	12.33	**821**	4.33	700	12.33
RETR24	0.29	**274**	4.33	231	12.33	**405**	4.33	346	12.33	**467**	4.33	400	12.33
RETR25	0.28	**297**	4.25	250	12.25	**443**	4.25	346	12.17	**464**	4.17	402	12.17
RETR3	0.41	**211**	4.67	181	12.67	**339**	4.58	301	12.58	**403**	4.58	330	12.5
RETR5	0.5	**7**	3.42	3	6.33	**6**	2.83	3	5	**6**	2.67	4	4.67
RETR7	1	498	4.58	**522**	12.58	810	4.58	**823**	12.58	**959**	4.58	938	12.5
RETR8	0.55	**518**	4.42	445	12.42	**748**	4.42	647	12.42	**855**	4.42	741	12.42

Table 4.5.1-4 Future Conditions HEC-1 Model Results in Alphanumeric Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
RETR9	0.59	**576**	4.33	503	12.33	**832**	4.33	733	12.33	**952**	4.33	840	12.33
RITBAS	0.29	**522**	4.08	431	12.08	**732**	4.08	610	12.08	**829**	4.08	693	12.08
RITBAS	0.29	0	0	**1**	12.5	0	0	**1**	12.92	0	0	**1**	12.92
RTE1E2	0.89	0	0	0	0	0	0	**25**	14.92	53	5.83	**125**	13.67
RTE2E3	1.67	0	0	0	0	0	0	**5**	15.92	4	6.25	**53**	14.08
RTE3E4	3.9	0	0	0	0	0	0	**2**	15.33	0	7.92	**210**	13.83
RTE4E4	4.21	0	0	0	0	0	0	**3**	17.25	0	11.33	**88**	14.75
RTE4E5	5.41	0	0	0	0	0	0	**37**	15.42	0	12.92	**200**	14
RTE6E9	3.05	0	0	0	0	0	0	**1**	14.67	0	6.58	**26**	13.42

Section 5: Hydraulics

5.1 Method Description

The District's *(Draft) Drainage Design Manual, Hydraulics*, June 2010, (adoption by the Maricopa County Board of Supervisors pending) served as the technical guide for hydraulics related issues.

5.1.1 Powerline Floodway

Modeling limits are from the top of the drop structure at the confluence with the Ellsworth Channel to the CAP. This reach encompasses the concrete lined portion of the floodway. Additional survey is required to include the unlined reach downstream of the confluence as field inspection of this reach indicated that the width of the Floodway does not match that on the as-built drawings. Review of the topographic mapping data does not always support the slopes on the as-builts. Additionally, a bridge was constructed near the confluence with the EMF which appears to have changed the cross sectional area of the Floodway from what is shown on the as-builts. It is, therefore, advisable that detailed survey data be obtained for this reach before proceeding with hydraulic modeling of this reach.

Flow discharges used in the hydraulic modeling were runoff discharges determined in this Update. Although the Powerline Floodway serves as the principal outfall channel for the Powerline/Vineyard/Rittenhouse (PVR) dam system, discharges from the PVR system were not considered in the discharges.

Elevations are from the Powerline Floodway As-Built plans with datum noted as "feet above mean sea level datum". New feature data (noted below) has been added by approximating the relationship of the new data to the as-built plans. The as-built plan profile has been held in most instances.

Data for the model was developed primarily using As-Built plans for the Powerline Floodway. Supplemental data was obtained for new and modified road crossings as follows:

- Ellsworth Rd: Culvert was extended per MCDOT's "Ellsworth Rd Phase I - Germann Rd to Ray Rd" As-Built plans, dated 6/6/07.

- Culvert crossing, approx. 1300 ft east of Ellsworth Rd, added per additional survey by the FCDMC on 3/4/10.

- Culvert crossing, approx. 1200 ft west of the Signal Butte Rd Alignment, added per additional survey by the FCDMC on 3/4/10.

- Culvert crossing, approx. at the Signal Butte Rd Alignment, added per field inspection by the FCDMC on 2/10/11.

- Modifications from Signal Butte Rd Alignment to Meridian Rd were based on the "Gila River Ranches - Unit 2" As-Built plans, dated 11/27/07 and associated bridge as-built plans for Mountain and Meridian Rd bridges.

- Ironwood Rd: Culvert was extended based on the "Ironwood Drive - Ocotillo Rd to US 60" design plans/report by Kimley-Horn & Assoc., dated 2006, for the Pinal County DPW.

5.1.2 Ellsworth Channel

Modeling limits are from the confluence with the Powerline Floodway to the new Pecos Road alignment (approximately ½ mile south of the original Pecos Road on the east side of Ellsworth Road. The design HEC-RAS model was used for the hydraulic modeling.

5.1.3 Rittenhouse Channel

Modeling limits are from the confluence with the EMF to Ellsworth Road and include the entire reach of the open channel portion of the Rittenhouse Channel. The pipe system, under and to the east of Ellsworth Road is not included in this analysis.

The geometry files are the original CLOMR HEC-RAS model files with modifications to the Power and Pecos Roads culverts by AMEC in 2007. Although a LOMR was approved for the Rittenhouse Channel, a separate LOMR HEC-RAS model was never prepared. The CLOMR model became the LOMR/effective HEC-RAS model. The model reflects the current road improvement projects in this area. No changes were made to the geometry files for the ADMPU analyses.

5.1.4 Ironwood Road

A description of the Ironwood Road Split Flow/Diversion modeling is included in Appendix C.

5.2 Work Study Maps

Delineation work maps were not developed for this study since the study was not intended as a delineation study.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients ('n' values)

5.3.1.1 Powerline Floodway

The roughness coefficient for the concrete portion of the Powerline Floodway was set at 0.016 to reflect increased roughness due to warping and buckling of the concrete sections which occurs throughout the length of the Floodway. The overbank 'n' values were set at 0.025 to reflect the bare earth conditions of the earthen fill above the concrete sections.

5.3.1.2 Ellsworth Channel

The design conditions 'n' values were used for the entire length of the modeling. The channel is maintained by the City of Mesa and is relatively free of vegetation. The range of channel 'n' values is from 0.013 for concrete culvert aprons to 0.040 for rip-rap areas with a typical channel 'n' of 0.028 to 0.032 for the majority of the channel. Overbank areas were assigned an 'n' value of 0.025 in the design but, under the design flow conditions, all flows are confined to the channel with no overbank flow.

5.3.1.3 Rittenhouse Channel

The design conditions 'n' values were used for the entire length of the modeling. The channel is maintained by the District and is relatively free of vegetation. The channel 'n' values used in the design model are 0.027 for the earthen portion of the channel and 0.035 for the rip-rap areas. The overbank areas were assigned an 'n' value of 0.035 but, under the design flow conditions, all flows are confined to the channel with no overbank flow.

5.3.1.4 Ironwood Road Split Flow/Diversion

The majority of the flows in the Ironwood Road model are left overbank flows. An 'n' value of 0.035 was assigned to the left overbank. The channel was assumed to be, basically, the narrow flow area immediately adjacent to the roadway fill. An 'n' value of 0.030 was assigned to the "channel". Channel and left overbank velocities are nearly equal. The right overbank area is the east shoulder of the road with an assigned 'n' value of 0.025. Very little flow occurs in the right overbank.

5.3.2 Expansion and Contraction Coefficients

The contraction/expansion coefficients were set at 0.1/0.3 respectively for the majority of the channel cross sections where flows were subcritical. These were increased at the bridges, culverts, and other abrupt changes in cross section as deemed appropriate.

In the case of Powerline Floodway, where most of the flows were supercritical, the contraction/expansion coefficients were set, typically, in the range of 0.01 – 0.03 for contraction and 0.03 – 0.05 for expansion. In the vicinity of culverts where subcritical flow was expected the contraction was set at 0.1 – 0.2 and the expansion at 0.3 – 0.4.

5.3.3 Computer Modeling

The U.S. Army Corps of Engineers' HEC-RAS, version 4.1.0 (January 2010) was used for hydraulic modeling of the Powerline Floodway, Ellsworth Channel, the Rittenhouse Channel and the Ironwood Road Split Flow/Diversion. The Ellsworth Channel and the Rittenhouse Channel models were originally developed in earlier versions of HEC-RAS. The HEC-RAS model for the Powerline Floodway was developed under this study and, therefore, was developed using version 4.1.0.

The Ironwood Road Split Flow/Diversion was originally developed using HEC-RAS 3.1.3. Version 4.1.0 was released after the calculations were completed. (Version 4.0 had a known issue with the lateral weir routine on another project and, therefore, was not used on this project.) A comparison of the results using version 4.1.0 was made. There were only minor differences in the results of the two versions with a maximum difference in water surface elevation of 0.08 ft also yielding a maximum change in discharge of 5.98 cfs. These differences were considered insignificant to the overall regional model and the results of version 3.1.3 were left in the HEC-1 model.

5.4 Cross Section Description

Cross sections are oriented left to right looking downstream. In the cases of Powerline Floodway, Ellsworth Channel, and Rittenhouse Channel, annotation tying the river stationing to the as-built stations is provided in the cross section descriptions within the HEC-RAS models.

5.5 Modeling Considerations

5.5.1 Hydraulic Jump and Drop Analysis

Hydraulic jump and drop analyses were performed within the HEC-RAS models. No additional calculations were performed.

5.5.2 Bridges and Culverts

Bridges and culverts were modeled in HEC-RAS. No additional calculations were performed.

In the case of Powerline Floodway, reviewing 2010 aerial photography shows that a new bridge has been constructed over the Floodway between the Signal Butte Road Alignment and Mountain Road. This bridge was not present at the beginning of this project. However, the design was such that the bridge was to span the Floodway with no change in cross sectional area. Therefore, this bridge should have no impacts on the functioning of the Floodway as an open channel.

5.5.3 Levees and Dikes

There were no analyses of levees or dikes performed under this study.

5.5.4 Islands and Split Flows

Split Flow analyses were performed in the Ironwood Road Split Flow/Diversion HEC-RAS analyses using the lateral weir routine with the inclusion of culverts.

5.5.5 Ineffective Flow Areas

Ineffective flow areas were included as deemed appropriate.

5.5.6 Supercritical Flow

See individual HEC-RAS models for any supercritical flow locations.

5.6 Floodway Modeling

Floodway modeling was not applicable to this study.

5.7 Problems Encountered During the Study

5.7.1 Special Problems and Solutions

No special problems were encountered during the hydraulic modeling.

5.7.2 Modeling Warning and Error Messages

HEC-RAS warnings and notes were reviewed. There was nothing unexpected in these messages. There were no error messages.

5.8 Calibration

There is only one water-level gage on the Powerline Floodway (see section 4.2.3) with very limited data and no water-level gages on Ellsworth Channel and Rittenhouse Channel. Therefore, calibration of the data with gage data was not possible.

Section 6: Final Results

6.1 Comparison with Previous ADMP Discharges

Comparison with previous studies is not always appropriate due to differences in subbasin boundaries and locations of concentration points. The tables in the following sections show comparisons at major roadway intersections or channel/roadway intersections as reasonable from the differing hydrologic studies.

6.1.1 Existing Conditions

The original East Mesa ADMP hydrology was developed by the District and is presented in the *East Mesa Area Drainage Master Plan, Hydrologic Analysis, Volumes 1 and 2* (dated October 1998). Development of the hydrology included preparation of DDMS files and HEC-1 models.

Dibble & Associates (FCD contract #95-32), utilizing the results of the hydrologic analyses, performed the planning portion of the ADMP and identified the drainage problems and proposed solutions for the area. The results of the Dibble study are presented in the *Southeast Mesa Area Drainage Master Plan, Alternatives Analysis Report* (dated October 1997) and the *East Mesa Area Drainage Master Plan, Recommended Design Report* (dated July 1998).

The original ADMP existing conditions hydrologic (HEC-1) model included the EMADMP Update study area plus the area north of Elliot Road (the northern study limit for the Update) to the US 60. There have been several modifications to the hydrologic analyses (HEC-1 model) over the years. Many of the revisions pertained to design/construction projects north of and outside of this Update's study limit. Revisions noted in the HEC-1 model are:

- The hydrology (HEC-1 model) was revised in December 1999 by Huitt-Zollars, Inc. for the *Queen Creek/Sanokai Wash Hydraulic Master* Plan (FCD contract #98-26) and the *East Maricopa Floodway Capacity Mitigation Study* (FCD contract # 1999C056). Revisions included updates to the existing conditions land uses.

- In May 2002, the HEC-1 model was revised to reflect existing conditions land use based on 2001 aerial photographs; and, to reflect the design of ADOT's Santan Freeway Channel and the District's *Elliot Road Detention Basins and Outfall Channel* design project (FCD contract 2000C010). Both of these projects lie to the north of the EMADMP Update study area. It also appears that land use changes were only in areas north of Elliot Road and, therefore, north of the Update study area.

- The HEC-1 model was then revised in June 2002 to include the Ellsworth Channel from Pecos Road to the Powerline Floodway.

- In December 2002, a revision was made to reflect an extension of the Crismon Channel, *Phase II* of the *Elliot Road Detention Basins and Outfall Channel* project. This change is north of the EMADMP Update study area.

- In April 2003, a further revision was made to reflect the *Elliot Road Detention Basins and Outfall Channel* project to the north. Additionally, changes were made in the subbasins draining to the Ellsworth Channel to reflect revisions made by Dibble & Associates under the *Ellsworth Road and Channel* design project.

- The names of several concentration point names were revised in July 2006. There were no changes impacting the discharges.

The data presented in this Update are based on the existing conditions as of January 2009. Table 6.1.1-1 compares the results of the Update to the original East Mesa ADMP (Oct. 1998) and the last technical revisions model of April 2003.

Table 6.1.1-1 Comparison of **Existing Conditions** Discharges with Previous Studies' Existing Discharges

Location	Study Discharges (Q)		
	East Mesa ADMP Oct. 1998 (cfs)[1]	East Mesa ADMP Revised Apr. 2003 (cfs)[1]	East Mesa ADMP Update Mar. 2011 (cfs)[1]
Powerline Floodway @ Signal Butte Rd	1200	1200	550
Powerline Floodway @ Ellsworth Rd	1400	1150	700
Powerline Floodway @ Confluence w/Ellsworth Channel	4700	3900	2550
Williams Field Rd @ Mountain Rd	600	650	500
Williams Field Rd @ Signal Butte Rd	1100	1100	850
Williams Field Rd @ Perimeter Channel/Ellsworth Channel	3650	3550	2000
Pecos Rd @ Signal Butte Rd	2800	2950	1450
Pecos Rd @ Crismon Rd	2750	2900	1400
Pecos Rd @ Ellsworth Rd	--	2850	1500
Germann Rd @ Signal Butte Rd	400	400	750
Germann Rd @ Crismon Rd	650	700	750
Germann Rd @ Ellsworth Rd	750	750	750
Queen Creek Rd @ Meridian Rd	--[2]	1000	1400
Queen Creek Rd @ Signal Butte Rd	--[2]	950	850
Queen Creek Rd @ Crismon Rd	--[2]	900	700
Rittenhouse Channel (Queen Creek Rd) @ Ellsworth Rd	750	800	700
Rittenhouse Channel @ Germann Rd	800	800	900
Rittenhouse Channel @ Pecos Rd	1450	1400	1050

[1] All flows rounded to nearest 50 cfs.

[2] Area south of Queen Creek Rd not studied in original East Mesa ADMP.

Significant development has occurred in the watershed within recent years. The Powerline Floodway's watershed between Signal Butte Rd and Meridian Rd has been substantially, although not completely, developed. In this area, development includes construction of on-site 100-yr, 2-hr retention basins and no significant channelization. This has resulted in a decrease in flows to the Powerline Floodway over those determined for the existing conditions for previous studies (see Table 6.1.1-1). The decreases in discharges for the Powerline Floodway to 550 and 700 cfs at Signal Butte Rd and Ellsworth Rd, respectively, are direct results of development within the watershed with the on-site retention and no significant channelization. It should also be noted that the 550 and 700 cfs compare very favorably to the future conditions discharges (400 and 600 cfs, respectively) computed in the previous ADMP. In the previous ADMP, the land use assumptions for the watershed east of Meridian Rd match those of the existing conditions in this update. Therefore, a reasonable match would be expected.

Flows along Williams Field Rd at Mountain Rd and Signal Butte Rd also compare favorably to the previous ADMP. There has been development with on-site retention in the northern portion of this watershed between Signal Butte Rd and Meridian Rd. Therefore, a slight reduction in discharges from the previous ADMP would be expected.

Along Pecos Rd, the subbasin discharges within Maricopa County match closely with those of the previous ADMP (for example, update Subbasin E24, Q = 750 cfs versus the previous ADMP Subbasin 78D, Q = 750 cfs; and, update Subbasins E27 + E28, Q = 350 cfs + 450 cfs = 800 cfs versus the previous ADMP Subbasin 78E, Q = 850 cfs). The difference appears to be with the modeling of the Pinal County watershed and the diversion along Ironwood Road. In some instances, the discharges crossing Ironwood Road are cut in half by the impacts of the road. For example, at CPE5, the concentration point at approximately Ironwood Rd and Pecos Rd, the discharge is 800 cfs. This 800 cfs is then split, with approximately 350 cfs diverted to the south and only 450 cfs crossing under Ironwood Rd. Another significant diversion occurs in the next subbasin south where the combined flow at CPE6 is approximately 1500 cfs. The flow split in this watershed yields 500 cfs diverted south and 1000 cfs continuing across Ironwood Rd. Additionally, there is approximately 3 sq-mi of watershed (Subbasins R2, R3, R5, R6, R8, and R9) in Pinal County which, in the previous ADMP, was assumed to be diverted north to Pecos Rd along the Meridian Rd alignment. This Update assumes that this area continues west along Germann Rd and Queen Creek Rd. This assumption was made based on a storm event of the early 1990s where a farm embankment south of Germann Road breached and flows inundated a portion of the area between Germann and Queen Creek Roads. The change in the watershed area, along with the attenuation of flows resulting from the diversion of flows along Ironwood Rd, are, likely, the reasons for the decrease in flows in Maricopa County along Pecos Rd. Ultimately, this decrease in flow along Pecos is a contributing factor to the decrease in flows in the Ellsworth Channel.

Photo 4: Breach in farm embankment south of Germann Road. Breach occurred during storm event of early 1990s. (Looking north along Meridian Road alignment from south of Germann Road.)

Photo 5: Breach in farm embankment south of Germann Road. Breach occurred during storm event of early 1990s. (Looking east from south of Germann Road at approximate Meridian Road alignment.)

That portion of the previous ADMP watershed not included in the drainage area to Pecos Rd is included in the update watershed to Germann Road. Consequently, flows to Germann at Signal Butte increase somewhat over the previous ADMP.

Along Queen Creek Rd and the Rittenhouse Channel, update discharges are very similar to those in the previous ADMP. The decrease at the Rittenhouse Channel at Pecos Rd in the update appears to be a difference in subbasin drainage at this location. The previous ADMP showed a substantial portion of the Williams Gateway Airport (Subbasin 81A) discharging into the Rittenhouse Channel at Pecos. Although a portion of 81A does appear to be appropriately modeled as draining to the channel, the topographic data does not support the concept of the entire 81A getting to the channel. Additionally, the intersection at Pecos and Power Rd was recently improved and resulted in a raising of the intersection which also impedes flows from the north from entering the channel at this location. For these reasons, a decrease in flow at this location would be expected.

6.1.2 Future Conditions

A significant difference between this update and the previous ADMP future conditions is in the treatment of the watershed area in Pinal County. The previous ADMP assumed existing conditions runoff equals future conditions runoff in Pinal County. This followed Pinal County's standard of the time where development was required to show that post-development discharges would not exceed pre-development discharges. Since the ADMP, Pinal County has revised its standard to require 100-yr, 2-hr retention, using the upper bound of the 90% confidence interval precipitation depth (see section 4.6.1.6).

This update assumes development per land use plans (see section 4.2.6.3 Future Conditions Land Use) with on-site retention per Maricopa County or Pinal County standards, as appropriate. It is important to note that the 100-yr, 2-hr precipitation depth used for the Maricopa County portion of the watershed was 2.219 inches, whereas, for Pinal County it was 2.65 inches. The previous ADMP used 2.60 inches, the NOAA 2 precipitation depth. This means that retention volume requirements within Maricopa County will decrease from those of the previous ADMP. (That point will be demonstrated in the forthcoming discussion.) In contrast, Pinal County will require retention volumes greater than Maricopa County and volumes very similar to what would have been required using the NOAA 2 rainfall.

Table 6.1.2-1 Comparison of **Future Conditions** Discharges with Previous Studies' Future Discharges

Location	Study		
	East Mesa ADMP Nov. 1998 (cfs)[1]	East Mesa ADMP Revised May. 2002 (cfs)[1]	East Mesa ADMP Update Mar. 2011 (cfs)[1]
Powerline Floodway @ Signal Butte Rd	400	400	250
Powerline Floodway @ Ellsworth Rd	600	600	800
Powerline Floodway @ Confluence w/Ellsworth Channel	2950	2900	1750
Williams Field Rd @ Mountain Rd	600	650	300
Williams Field Rd @ Signal Butte Rd	900	950	600
Williams Field Rd @ Crismon Rd	900	950	650
Pecos Rd @ Signal Butte Rd	500	1300	700
Pecos Rd @ Crismon Rd	1200	1200	700
Pecos Rd @ Ellsworth Rd	1100	1100	1100
Germann Rd @ Signal Butte Rd	350	500	1150
Germann Rd @ Crismon Rd	300	500	1100
Germann Rd @ Ellsworth Rd	400	450	1000
Queen Creek Rd @ Meridian Rd	450	950	1400
Queen Creek Rd @ Signal Butte Rd	350	950	1200
Queen Creek Rd @ Crismon Rd	450	900	950
Rittenhouse Channel (Queen Creek Rd) @ Ellsworth Rd	300	800	900
Rittenhouse Channel @ Germann Rd	750	750	1500
Rittenhouse Channel @ Pecos Rd	800	1800	1550

[1] All flows rounded to nearest 50 cfs.

[2] Area south of Queen Creek Rd not studied in original East Mesa ADMP.

The Powerline Floodway flows reduced at Signal Butte Rd from the existing and from the previous future studies. This is reasonable considering that development of the entire watershed had not occurred under existing conditions. Pinal County Subbasins P1, P2, and P3 all show lower discharges after development with on-site retention than under the existing conditions. With Pinal County now requiring 100-yr, 2-hr on-site retention, it is also reasonable that the flows have decreased from the previous ADMP.

In regard to the slight increase in flows in the Floodway at Ellsworth, this may be due to the subdivision of the 4 sq-mi area into 14, much smaller, subbasins and the timing of the peaks from those subbasins.

The Powerline Floodway at Ellsworth Channel is showing a decrease in flows similar to that shown for the existing conditions. This is explained by a combination of increased retention, particularly in Pinal County, attenuation of flows along Ironwood Rd, and a decrease in watershed area as explained in the previous section (see section 6.1.1).

Along Williams Field Rd, the flows are decreasing due, primarily, to the retention in Pinal County as is evidenced by the 150 to 200 cfs decrease in flows at the Maricopa County line at each of the three concentration points (CPE10, CPE11, and CPE12) which is carried through the Maricopa subbasins.

Flows along Pecos Rd are greatly reduced form the existing conditions, primarily, due to the watershed area being reduced (15.87 sq-mi at Crismon and Pecos under existing conditions and 6.77 sq-mi under future conditions) by the proposed SR 24 freeway. On the north side of the freeway, flows at the County line increase slightly (300 to 350 cfs, CPE14N and CPE14A, respectively) due to the freeway blocking flows from continuing south along Ironwood Rd and directing them to the west.

In the Germann Rd watershed, much of the Pinal County portion of the watershed is developed. Therefore, reductions at the County line do not occur in this watershed. However, the substantial increase in flows from the existing conditions (existing 750 cfs to future 1100 cfs) appears to be, primarily, the result of development on agricultural land, and, particularly, Subbasin R11. Under existing conditions, the R11 discharge is approximately 400 cfs for the 100-yr, 24-hr storm. For the same storm under future conditions, the R11 discharge is approximately 1200 cfs before retention, reduced to only 850 cfs after retention. This combines with the Pinal County watershed to produce a combined discharge of approximately 1150 cfs. This flow rate then continues to be transferred down the watershed.

Subbasin R16 is another agricultural watershed within the Germann Rd watershed. R16 shows similar results to those of R11. The existing conditions discharge from R16 is approximately 150 cfs for the 100-yr, 24-hr storm. For the future conditions, it is approximately 750 cfs before retention and approximately 600 cfs after retention. The results for these two subbasins are typical of the other existing agricultural subbasins. Zoning for the agricultural areas is typically general or light industrial. In these cases, the required retention is insufficient to bring flows down to or below existing conditions discharges.

In the Queen Creek Rd watershed, the area within Pinal County is approximately 50% developed. Therefore, the impacts of added retention are not substantial as in areas to the north. The peak at the County line is driven by the existing development to the east and, therefore, the existing and future flows are essentially the same.

Increases in discharges along Queen Creek Rd within Maricopa County are the result of the transfer of the peaks from Pinal County downstream as is evidenced by the timing of the hydrographs at CPR10. However, if flows were to be stopped at the County line, peak discharges in Maricopa County would still be approximately the same due to development of existing agricultural areas which yields essentially the same peak discharges.

The increase in discharges within the Rittenhouse Channel is the result of increases within the watershed due to development of agricultural land and increases in routing velocities. The increase at Germann Rd is caused by the combination of increased flows coming down the Rittenhouse Channel plus increased flows down Germann Rd and the peaks of both of these flows being close to coincident. Under the existing conditions there is approximately 2 hours between the two peaks. With increased velocities under future developed conditions, the peaks are only approximately 20 minutes apart. Thereby, the additive effects of the two combined hydrographs are more pronounced.

6.2 Channel Capacity

The discharges (Q) chosen for the HEC-RAS modeling were selected by comparing the 100-yr, 24-hr and the 100-yr, 6-hr peak discharges from the HEC-1 models and selecting the higher of the two values.

6.2.1 Powerline Floodway

For the Powerline Floodway, the 100-yr, 24-hr discharges were higher at all locations along the channel except at HEC-1 identifier DRPFW, the Ironwood Rd diversion hydrograph flows from Subbasin P1, for the existing conditions. At this location, the 100-yr, 6-hr storm exceeded the 24-hr discharge by approximately 25 cfs. For the future conditions, the 100-yr, 24 hr discharge was higher in all cases.

Since no inflow runoff was computed upstream of this location in this update, the Natural Resources and Conservation Service's (NRCS) calculated discharge for runoff from the Powerline Flood Retarding Structure (FRS) emergency spillway area (54 cfs) was used to model the upper reach of the Floodway. No principal spillway flows from the dams were assumed in assessing the capacity of the Powerline Floodway in this study.

The discharges used in the modeling are shown in Table 6.2.1-1. The design discharges are from the original NRCS's (previously known as the Soil Conservation Service (SCS)) *Powerline Channel Design*, dated 1964. Since that time modifications have been made to the Floodway and the capacity of the Floodway may have changed. Every attempt has been made to incorporate these modifications into the hydraulic modeling of the Floodway. (See Section 5.1.1 for a listing of known changes which have occurred since the original construction of the Floodway.)

Table 6.2.1-1 Comparison of Powerline Floodway Existing Conditions Discharges to Future Conditions Discharges to Design Conditions Discharges

HEC-1 Identifier	Existing Conditions Q (CFS)	Future Conditions Q (CFS)	Design Conditions Q (CFS)
N/A (Flow from Powerline FRS Emergency Spillway area)	54	54	600
DRPFW (Flow diverted south along Ironwood Rd from P1. Assumed to all be captured by the Floodway)	161	81	600 (1)
CPP3 (at Meridian Rd)	363	201	662 (1)
CPP5 (at Mountain Rd)	475	203	662 (1)
CPP7 (at Signal Butte Rd Alignment)	528	252	833 (1)
CPP8 (existing) **CPG14C** (future) (at Ellsworth Rd)	701	781	1200 (1)
CPE26A (at SR 24 Channel)	N/A	1592	1200

(1) Modifications have been made to the Floodway along this reach since the original design.

Most of the Powerline Floodway flows in the supercritical flow regime. Freeboard was analyzed using the NRCS design criteria for supercritical flow (0.25d, where d = calculated depth of flow). From the report *Powerline Channel Design*, SCS, 1964, it appears that the freeboard criteria may have actually been 0.2d for the Floodway. However, 0.25d was used in evaluating the freeboard under this update study. A check, using NRCS's freeboard criteria of $0.2H_e$ (where H_e is the energy head) for subcritical flow at several locations, yielded nearly the same freeboard requirement (within 0.1 – 0.2 ft) as using the supercritical criteria. Therefore, the supercritical criteria was used throughout.

In the HEC-RAS modeling, the top of the concrete lining was used as the top of bank. There is, typically, a 0.5 to 1.0 ft earthen berm above the top concrete on each side of the Floodway.

The results of the freeboard analyses show, under existing conditions, a flow slightly (0.3 ft) above the concrete liner on the upstream side of the Ellsworth Rd culverts and a flow depth, essentially, at the height of the concrete liner at the culverts to the west of the Signal Butte Rd alignment. Freeboard criteria, per NRCS standards, is violated upstream of the Ellsworth Rd culverts and upstream of all three culverts within the GM Proving Grounds (includes culvert identified as Signal Butte Rd alignment).

For the future conditions, the freeboard analyses show flow above the concrete liner upstream of the confluence with the Ellsworth Channel, upstream of a bridge crossing between the confluence with Ellsworth Channel and Ellsworth Rd, approximately a 500 ft reach approximately 1250 ft west of Ellsworth Rd, and upstream of Ellsworth Rd. The freeboard criteria is violated, essentially, the reach from the confluence with Ellsworth Channel to upstream of Ellsworth Rd. (See Appendix D for Freeboard Analyses and hydraulic modeling results.)

6.2.2 Ellsworth Channel

For Ellsworth Channel, the 100-yr, 24-hr discharges were higher than the 100-yr, 6-hr discharges at all locations along the channel for both existing and future conditions. The discharges used in the modeling are shown in Table 6.2.2-1. The design conditions discharges for the Ellsworth Channel were the 100-yr, 24-hr discharges based on future land use conditions, including 100-yr, 2-hr on-site retention, and full construction of CIP structures as proposed in the original ADMP. CIP includes construction of two Pecos Basins, Pecos Channel, Pecos Lateral, and the Meridian Road Channel.

Table 6.2.2-1 Comparison of Ellsworth Channel Existing Conditions Discharges (Q) to Future Conditions Discharges to Design Discharges

HEC-1 Identifier	Existing Conditions Q (CFS)	Future Conditions Q (CFS)	Design Conditions Q (CFS)
E31 (Subbasin E31)	252	835	600
E29E31 (routed flow from Crismon Rd to Ellsworth Rd, south of Pecos Rd)	272	Not Used	600
CPE31 (at Ellsworth & Pecos Rds)	1514	1095	600
CPE30 (south of Williams Field Rd alignment & Ellsworth Rd)	1501	1307	1172
CPE26 (north of Williams Field Rd alignment & Ellsworth Rd)	2015	1299	1744

Under existing conditions, although several of the downstream sections lack the required freeboard, spillage of flows from the channel does not appear likely until approximately cross section 12000. Flows are fully contained by cross section 14491. (The reach from cross section 12000 to 14491 is approximately the eastern limit of Subbasin P9.) This reach is consistent with the overtopping limit identified for the interim conditions by AMEC in the Ellsworth Channel design. The AMEC report identified a distance of approximately 3400 ft north of Pecos Road. The analysis presented in this EMADMPU report indicates a distance of approximately 2500 ft north of Pecos Road.

At CPE31, a discharge of 600 cfs was used for the design of the channel. The HEC-1 model (SEBT-N2.dat) used for the design of the Ellsworth Channel, per notes in the model, was a model prepared by Dibble & Associates (January 2000) which was modified by Collins/Pina Engineering (July 2000) for the *East Maricopa Floodway Capacity Mitigation and Multi-Use Corridor Study*. In the design model, the flows down Pecos Rd at Ellsworth were 548 cfs (78ET84). Flows from the agricultural field to the south (assuming developed conditions) were 590 cfs (R84) after retention. The two combined for a peak discharge of 599 cfs (C84) which essentially indicates that the two peaks were non-coincident. Therefore, 600 cfs was used for the design. Consistent with the original future conditions ADMP model, the channel design model also assumed the construction of two detention basins in Pinal County to reduce the flows along Pecos Rd.

The future conditions model developed in this update to the ADMP (which does not include two detention basins to reduce flows along Pecos Rd) shows a discharge of 1095 cfs at CPE31, an increase of approximately 500 cfs over the design model. To determine what is causing the peak at this location and to see if this could possibly be the result of a decreased retention volume from the agricultural fields, the four inflows at this location were separated into two groups – the Pecos Rd routed flows (E28E31(650 cfs) + E29E31(573 cfs)) and the two agricultural fields (assuming developed conditions) to the south (E31 (835 cfs after retention) + E32 (344 cfs after retention). If Subbasins E31 and E32 are removed from the model, the discharge at CPE31 becomes approximately 850 cfs. This shows that there is some additive effect of the two hydrographs along Pecos Rd. When E31 and E32 are combined in a separate calculation, the combined hydrograph peak is 906 cfs. Considering the timing of the hydrographs, E31 + E32 are contributing the most flow to the peak. However, approximately 200 cfs from the Pecos Rd flows are also adding to the peak.

The freeboard analysis does not show any overtopping of the channel banks under the future conditions. The freeboard criteria, however, is violated from the culverts at the Williams Field Rd alignment to the upstream end of the channel.

6.2.3 Rittenhouse Channel

For Rittenhouse Channel, the 100-yr, 24-hr discharges were higher than the 100-yr, 6-hr discharges at all locations along the channel for both existing and future conditions. The discharges used in the modeling are shown in Table 6.2.3-1.

The existing conditions HEC-1 model shows discharges close to, or somewhat less than, the design discharges. The hydraulic modeling (HEC-RAS project: RCex.prj) shows the existing conditions flows fully contained within the channel. There are some slight violations of the freeboard criteria at various sections between Germann Rd and approximately 2200 ft upstream of the Hawes Rd alignment.

Table 6.2.3-1 Comparison of Rittenhouse Channel Existing Conditions Discharges (Q) to Future Conditions Discharges to Design Discharges

HEC-1 Identifier	Existing Conditions Q (CFS)	Future Conditions Q (CFS)	Design Conditions Q (CFS)
CPR18 (at Ellsworth & Queen Creek Rds)	683	907	516
CPR22 (approx. 1500 ft downstream of Hawes Rd alignment)	685	893	813
CPR21 (at Germann Rd)	872	1521	1053
CPR25 (at Pecos Rd)	907	1486	1400
CPR24 (at Power Rd)	1054	1528	1500

The future conditions HEC-1 model shows increases in discharge over those of the existing conditions. (See section 6.1.2 for a discussion of the reasons for the increases in discharges in the Rittenhouse Channel.) The future conditions hydraulic model (HEC-RAS project: RCfut.prj) shows potential containment issues at, and immediately upstream of, Sossaman and Germann Roads. This is due to the large combined flow in the channel at Germann Road (CPR21).

Under the future conditions, there are freeboard violations throughout the length of the channel. In addition to the Sossaman and Germann Rds location, the more significant freeboard violations occur upstream of the Power Rd and Pecos Rd crossings.

6.3 Issues for the Next Phase of the ADMP Update

The following issues are noted as suggested items for further review and/or analysis during the next phase of the ADMP Update for Maricopa County:

- Reported flooding of roadways in the area of Ivanhoe, Galveston, and Erie Streets between Mountain Road and the county line; and, along Mountain Road from Ivanhoe to Williams Field Road.

- Significant discharges along Pecos Road in both existing and future conditions.

- Potential freeboard deficiencies in the Ellsworth Channel under future conditions flow rates.

- Potential increases in future flow rates over those of existing conditions along Germann Road.

- Potential increases in future flow rates over those of existing conditions along Queen Creek Road.

- Potential freeboard deficiencies in the Rittenhouse Channel along the majority of the channel under future flow rates.

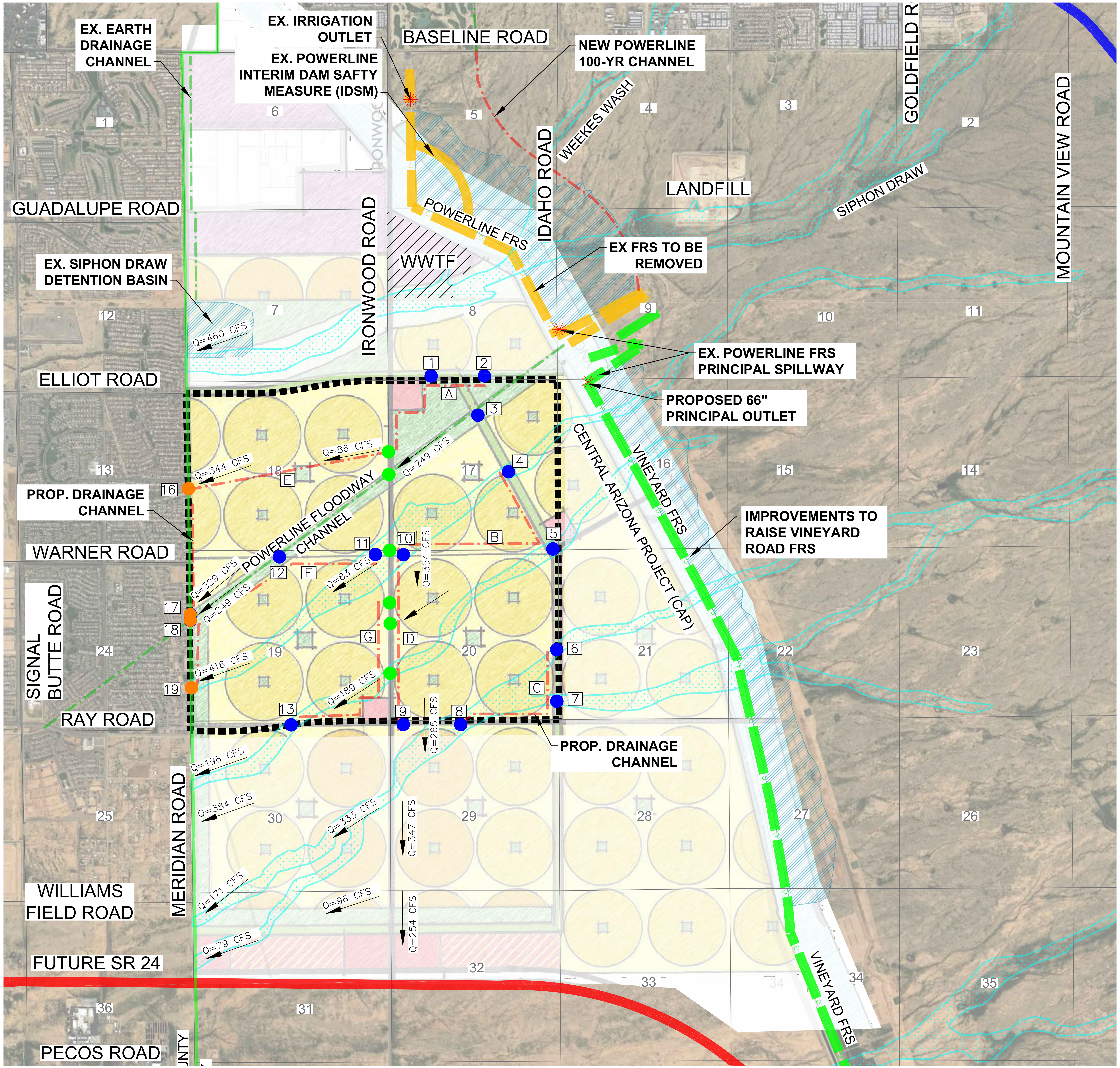
- Possible capacity issues in the Rittenhouse Channel in the vicinity of Sossaman and Germann Roads.

- Possible capacity issues at the existing culverts along the Powerline Floodway.

- Extension of the HEC-RAS model downstream, to include the earthen portion of channel between the East Maricopa Floodway and the confluence with the Ellsworth Channel, may be advisable. Field survey has recently been obtained for this portion of the Floodway.

- Coordination with Williams Gateway Airport regarding future development plans.

APPENDIX R



LEGEND

- COUNTY LINE
- EXISTING HIGHWAY
- FUTURE HIGHWAY
- AUCTION PARCEL
- EXISTING DRAINAGE CHANNEL
- PROPOSED DRAINAGE CHANNEL
- EXISTING DRAINAGE FRS (FLOOD RETARDING STRUCTURE)
- EXISTING DRAINAGE FRS TO BE REMOVED
- FIMA FLOOD HAZARD AREA ZONE A
- AREAS WITH POTENTIAL PONDING PER PINAL COUNTY ADMP
- SECTION
- EXISTING CROSSING, CULVERT AT ULTIMATE ROADWAY WIDTH.
- EXISTING CROSSING, CULVERT REQUIRED IMPROVEMENTS
- EXISTING CROSSING, NO CULVERT. IMPROVEMENTS REQUIRED.
- PROPOSED CROSSING. CULVERT IMPROVEMENTS REQUIRED.
- A PROPOSED CHANNEL ID
- 5 PROPOSED CULVERT ID

NOTE:

1. EXHIBIT IS FOR CONCEPTUAL PURPOSES ONLY AND IS DEPENDENT ON DETAILED SITE PLANNING, ENGINEERING, ALTA SURVEY AND CITY REVIEWS/APPROVALS
2. FLOWS PER EAST MESA AREA DRAINAGE MASTER PLAN, 100-YR 6-HOUR HEC-1 ANALYSIS.
3. ADDITIONAL CULVERT OR DRAINAGE IMPROVEMENTS MAY BE REQUIRED IN ADDITION TO WHAT IS CONCEPTUALLY SHOWN. DRAINAGE IMPROVEMENTS ARE SUBJECT TO ENGINEERING, CITY REVIEW, AND APPROVAL.

Estimated Culvert Sizing

ID[1]	RCBC/RCPC[4]	Adjacent Road	Size[2] [ft]	100-yr, 6-hr Flow [cfs]	Length [ft]
1	RCPC	Elliot Road	2-36"	90	80
2	RCPC	Elliot Road	2-36"	90	80
3	RCBC	Idaho Road	8'x4'	249	160
4	RCBC	Idaho Road	8'x4'	219	160
5	RCPC	Idaho Road	2-36"	132	80
6	RCBC	Idaho Road	8'x4'	167	80
7	RCPC	Idaho Road	2-36"	133	80
8	RCBC	Ray Road	2-8'x4'	434	80
9	RCBC	Ray Road	8'x4'	265	80
10	RCBC	Warner Road	2-6'x4'	354	160
11	RCPC	Warner Road	2-36"	83	160
12	RCBC	Warner Road	8'x4'	249	160
13	RCBC	Ray Road	6'x4'	189	80
16	RCBC	Meridian Road	2-6'x4'	344	80
17	RCBC	Meridian Road	2-6'x4'	329	80
18	RCBC	Meridian Road	8'x4'	249	80
19	RCBC	Meridian Road	2-8'x4'	416	80

1. "Orange" Culverts are proposed culvert expansions. The existing culvert sizes are unknown. Sizing for these culverts were determined based on the 100-yr, 6-hr flow.
2. Assumes that any flows less than 135 cfs, will use 2-36" RCPCs.

Estimated Channel Sizing

ID	Channel Type	Adjacent Roadway[2]	Bottom Width[1] [ft]	100-yr, 6-hr Flow [cfs]	Length [ft]
A	Earthen Trapezoidal - 1	Elliot Road	10	180	4,701
B	Earthen Trapezoidal - 2	Idaho Road	15	351	6,134
C	Earthen Trapezoidal - 3	Idaho Road	20	434	4,624
D	Earthen Trapezoidal - 2	Warner Road	15	354	5,612
E	Earthen Trapezoidal - 2	Elliot Road or Meridian Road	15	344	6,262
F	Earthen Trapezoidal - 3	Warner Road	20	416	7,915
G	Earthen Trapezoidal - 1	Ray Road	10	189	5,919

1. Note all channels are earthen channels with 4:1 side slopes and have 0.1% longitude slopes
2. Assumes the channel improvements will be constructed along with the proposed upstream or downstream roadway improvements to allow for connectivity.
3. Channel cost is based on the assumptions that 60% of the channel will be landscape rock, 30% will be turf, and 10% will be RipRap for erosion protection and drop structures.

NORTH

GRAPHIC SCALE IN FEET
0 750 1500 3000

No.	REVISIONS	DATE	BY

Kimley»Horn

© 2019 KIMLEY-HORN AND ASSOCIATES, INC.
1001 WEST SOUTHERN AVENUE, SUITE 131
MESA, ARIZONA 85202 (480) 207-2666

KHA PROJECT
DATE OCT. 2019
SCALE AS SHOWN
DESIGNED BY ZJH
DRAWN BY TAF
CHECKED BY JMB

CONCEPTUAL
NOT FOR CONSTRUCTION
SUBJECT TO
ENGINEERING AND CITY
REVIEW AND APPROVAL

CONCEPTUAL DRAINAGE INFRASTRUCTURE EXHIBIT

ASLD 8500 AUCTION PARCEL

PINAL COUNTY ARIZONA

SHEET NUMBER

APPENDIX S

LD 8500 - Drainage Infrastructure Conceptual OPC

Date: 11/18/2019

City of Apache Junction

Prepared by Kimley-Horn and Associates

Auction Drainage Culvert Cost Per Adjacent Roadway

Street Name	Culvert[1,2,3]	Culvert Length (ft)	Costs Culvert Cost	Total
Elliot Road	1	160	$ 111,200	$ 111,200
Elliot Road	2	160	$ 111,200	$ 111,200
Idaho Road	3	160	$ 178,400	$ 178,400
Idaho Road	4	160	$ 178,400	$ 178,400
Idaho Road	5	160	$ 111,200	$ 111,200
Idaho Road	6	160	$ 178,400	$ 178,400
Idaho Road	7	160	$ 111,200	$ 111,200
Ray Road	8	160	$ 286,400	$ 286,400
Ray Road	9	160	$ 178,400	$ 178,400
Warner Road	10	160	$ 230,400	$ 230,400
Warner Road	11	160	$ 111,200	$ 111,200
Warner Road	12	160	$ 178,400	$ 178,400
Ray Road	13	160	$ 138,400	$ 138,400
Meridian Road	16	80	$ 124,400	$ 124,400
Meridian Road	17	80	$ 124,400	$ 124,400
Meridian Road	18	80	$ 98,400	$ 98,400
Meridian Road	19	80	$ 152,400	$ 152,400
Subtotal				$ 2,602,800

1. Culverts 15-23 are proposed culvert expansions. The existing culvert sizes are unknown. Sizing for these culverts were determined based on the 100-yr, 6-hr flow.

2. Assumes that any flows less than 135 cfs, will use 2-36'' RCPCs.

3. RCBC costs include concrete, reinforcing steel, structural excavation, & structure backfill. RCBC costs also assumes 0' to 10' of fill on culverts, 3000 psi concrete for RCBCs, and 20 degree skew for headwall/wingwall.

Auction Drainage Channel Cost Per Adjacent Roadway

Street Name[2]	Channel ID[1]	Channel Length (ft)	Channel Cost[3]	Total
Elliot Road	A	4,700	$ 225,481	$ 225,481
Idaho Road	B	6,200	$ 368,512	$ 368,512
Idaho Road	C	4,600	$ 293,666	$ 293,666
Warner Road	D	5,600	$ 332,849	$ 332,849
Elliot Road or Meridian Road	E	6,300	$ 371,261	$ 371,261
Warner Road	F	7,900	$ 497,930	$ 497,930
Ray Road	G	5,900	$ 285,078	$ 285,078
Subtotal				$ 2,374,776
Infrasrucutre Costs Subtotal				$ 4,977,576

Construction, Development, Permit Fee

	Percentage of Infrastructure Costs	
Contingency	15%	$746,636
Construction Surveying	2%	$99,552
As Builts/Record Drawings	1%	$49,776
Mobilization / De - Mobilization	1%	$49,776
Post Design Services	1%	$49,776
Preliminary Design	3%	$149,327
Final Design	6%	$298,655
Plan Review	2%	$99,552
Agency Permit	2.0%	$99,552
Subtotal		$ 1,642,600

Total Infrastructure Costs	$ 6,620,176

The Conceptual Opinion of Probable Cost above was prepared based on limited information available and the ENGINEER's understanding of the project. Since the ENGINEER has no control over labor, materials, equipment or services furnished by others or over the Contractor(s)' method of determining prices, or over the competitive bidding or market conditions; the opinions of probable costs provided herein are made on the basis of experience and qualifications. The opinions of probable costs represents the best judgment as an engineer, familiar with the construction industry; but the ENGINEER cannot and does not guarantee that proposals, bids or actual project or construction cost will not vary from the opinion of probable cost.

1. Note all channels are earthen channels with average 5:1 side slopes, 0.1% longitude slopes, and assumes a mannings n value of 0.022
2. Assumes the channel improvements will be constructed along with the proposed upstream or downstream roadway improvements to allow for connectivity.

3. Channel cost is based on the assumptions that 60% of the channel will be landscape rock, 30% will be turf, and 10% will be RipRap for erosion protection and drop structures.

LD 8500 - D INPUT

ID	Culvert/Channel	Size [ft]	Culvert Type RCPC	Length [ft]	Estimated Cost per Inlet Wingwall per ADOT SD 6.08	RCPC Inlet Wingwall Unit Cost Per MAG STD	Estimated Cost per Outlet Wingwall per ADOT SD 6.08	RCPC Outlet Wingwall Unit Cost Per MAG STD	Estimated Cost for RCBC per linear feet Per ADOT SD [$]	Estimated Cost for RCPC per linear feet
1	RCPC	2-36"	4'x4'	160	7,450	5,100	10,950	5,100	625	220
2	RCPC	2-36"	4'x4'	160	7,450	5,100	10,950	5,100	625	220
3	RCBC	8'x4'		160	7,450		10,950		1,000	
4	RCBC	8'x4'		160	7,450		10,950		1,000	
5	RCPC	2-36"	6'x4'	160	7,450	5,100	10,950	5,100	750	220
6	RCBC	8'x4'		160	7,450		10,950		1,000	
7	RCPC	2-36"	6'x4'	160	7,450	5,100	10,950	5,100	750	220
8	RCBC	2-8'x4'		160	7,450		10,950		1,675	
9	RCBC	8'x4'		160	7,450		10,950		1,000	
10	RCBC	2-6'x4'		160	7,450		10,950		1,325	
11	RCPC	2-36"	4'x4'	160	7,450	5,100	10,950	5,100	625	220
12	RCBC	8'x4'		160	7,450		10,950		1,000	
13	RCBC	6'x4'		160	7,450		10,950		750	
16	RCBC	2-6'x4'		80	7,450		10,950		1,325	
17	RCBC	2-6'x4'		80	7,450		10,950		1,325	
18	RCBC	8'x4'		80	7,450		10,950		1,000	
19	RCBC	2-8'x4'		80	7,450		10,950		1,675	

Assumptions for RCBC costs
-Cost includes concrete, reinforcing steel, structural excavation, & structure backfill
-Designed per SD std. with 0' to 10' of fill on culverts
-3000 psi concrete
-assume OG is 5 feet above culvert for excavation
-Ex & backfill limits per ADOT SD 6.01 (4 of 5)
-Assume 20 degree skew for headwall/wingwall costs

RCBC costs include concrete, reinforcing steel, structural excavation, & structure backfill. RCBC costs also assume 0' to 10' of fill on culverts and 3000 psi concrete for RCBCs.

Infrastructu	Turf		Rock		Riprap				
	Area [sf]	Cost	Area [sy]	Cost	Area [sy]	Thickness [y]	Cost	Cost per Channel	Cost per Linear Foot
A	45,348	$ 45,348	17,635	$ 79,359	2,519	0.5	$ 100,774	$ 225,481	$47.97
B	74,114	$ 74,114	28,822	$ 129,700	4,117	0.5	$ 164,698	$ 368,512	$59.44
C	59,061	$ 59,061	22,968	$ 103,357	3,281	0.5	$ 131,247	$ 293,666	$63.84
D	66,942	$ 66,942	26,033	$ 117,148	3,719	0.5	$ 148,759	$ 332,849	$59.44
E	74,667	$ 74,667	29,037	$ 130,667	4,148	0.5	$ 165,927	$ 371,261	$58.93
F	100,142	$ 100,142	38,944	$ 175,249	5,563	0.5	$ 222,539	$ 497,930	$63.03
G	57,334	$ 57,334	22,297	$ 100,335	3,185	0.5	$ 127,409	$ 285,078	$48.32
H	41,466	$ 41,466	16,126	$ 72,566	2,304	0.5	$ 92,147	$ 206,179	$49.09
I	40,323	$ 40,323	15,681	$ 70,565	2,240	0.5	$ 89,606	$ 200,494	$60.76
J	49,758	$ 49,758	19,350	$ 87,076	2,764	0.5	$ 110,573	$ 247,406	$52.64
							SUM:	$ 3,028,855	

Cost Per Unit			Percent of Area
Turf	$1.0	per square foot	20%
Rock	$4.5	per square yard	70%
Riprap*	$80.0	per cubic yard	10%

APPENDIX T

SYMBOL KEY

LAND USE	AREA	DENSITY	YIELD
PARKS & OPEN SPACE	160 ac	-	-
CANAL	-	-	-
RESIDENTIAL	2,580 ac	3.5 u/ac	9,030 units
NEIGHBORHOOD COMM.	45 ac	7.5k sqft/ac	338k sqft
TOTAL	2,785 ac		
	TOTAL RESIDENTIAL		9,030 units
	TOTAL NON-RESIDENTIAL		338k sqft

ASLD 8500

LAND USE PLAN FOR AUCTION PROPERTY
CONCEPTUAL LAND USE PLAN

10.17.19

SYMBOL KEY

LAND USE	AREA	DENSITY	YIELD
ENTERPRISE TECHNOLOGY	470 ac	.25 F.A.R.	5.1m sqft
PARKS & OPEN SPACE	845 ac	-	-
CANAL	-	-	-
RESIDENTIAL	5,300 ac	3.5 u/ac	18,550 units
MEDIUM RESIDENTIAL	1,020 ac	6 u/ac	6,120 units
MIXED USE RESIDENTIAL	135 ac	20 u/ac	2,700 units
MIXED USE COMMERCIAL	135 ac	12.5k sqft/ac	1.7m sqft
NEIGHBORHOOD COMM.	45 ac	7.5k sqft/ac	338k sqft
DISTRICT CORE	140 ac	20k sqft/ac	2.8m sqft
TOTAL	8,090 ac		
	TOTAL RESIDENTIAL		27,370 units
	TOTAL NON-RESIDENTIAL		9.9m sqft

ASLD 8500

MAP SHOWING MASTER PROPERTY CONCEPTUAL LAND USE PLAN

10.17.19