

# BUCKEYE/SUN VALLEY AREA DRAINAGE MASTER STUDY GUIDELINES FOR DEVELOPMENT



CONTRACT FCD 2002C027

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GUIDELINES FOR DEVELOPMENT  
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**INTRODUCTION**

Communities and jurisdictions develop regulations, codes, ordinances, guidelines, standards, development conditions, and/or recommendations (regulations) to mitigate/minimize flooding and erosion impacts to public health, safety, and general welfare that might result from flooding caused by surface runoff of rainfall. At times, special conditions may exist in some watersheds that are not adequately covered by existing floodplain or drainage regulations. In these cases, additional rules or guidelines for development are needed to mitigate these specific flooding and erosion hazards. Within the Buckeye/Sun Valley watershed, the State of Arizona, Maricopa County, the Flood Control District of Maricopa County (District), and the Town of Buckeye have adopted measures (see Section 3 – Existing Regulations) to manage flooding and erosion-related problems. These proposed guidelines for development outlined herein have been prepared to address the specific flooding and erosion hazards associated with the Buckeye/Sun Valley watershed that may not be addressed under current regulations.

These Guidelines for Development have been organized into the following five sections:

**Section 1 - Description of Project Area:** provides a general description of the project area including land ownership and jurisdiction, existing and future land use, existing and projected population for the area, and zoning.

**Section 2 - Regulatory Authority:** addresses the regulatory authority to develop guidelines to govern development as it impacts flooding and erosion including specific regulations that apply to the Buckeye/Sun Valley watershed.

**Section 3 - Existing Regulations:** presents an overview of the regulations adopted by the Arizona Department of Water Resources (ADWR), Maricopa Association of Government (MAG), Maricopa County, the District, and Town of Buckeye to control flooding and erosion, the principals these regulations are based on, objectives of regulatory tools, and existing structural and non-structural mitigation methods.

**Section 4 - Potential Flooding and Erosion Impacts within the Buckeye/Sun Valley Area Resulting from Development:** provides an overview of the general flooding and erosion impacts associated with development within the Buckeye/Sun Valley watershed including: reduced surface storage; increased impervious area; concentration of flows; diversion of runoff; increased peak discharge, volume, or velocity of runoff; increased erosion; and increased sediment deposition.

**Section 5 - Specific Flooding and Erosion Hazards Associated with the Buckeye/Sun Valley ADMS Areas and Associated Guidelines for Development:** identifies unique flooding and erosion conditions and hazards within the four watersheds of the Buckeye/Sun Valley study area that may not be adequately addressed under existing regulations and require special consideration (existing conditions), the potential flooding and erosion impacts that may result from development (issues), and goals and objectives for associated guidelines for development in these areas.

Following these sections is a summary conclusion and a list of references. **Appendix A** contains a table identifying the status of development approvals for planned or current development within the Buckeye/Sun Valley ADMS area as of July 21, 2004. **Appendix B** contains an abbreviated summary/excerpts of applicable existing regulations, codes, ordinances, guidelines, standards, and development conditions from the State of Arizona Department of Water Resources, MAG, Maricopa County, the District, and the Town of Buckeye.

## **SECTION 1 - DESCRIPTION OF PROJECT AREA**

### **GENERAL DESCRIPTION**

The Buckeye/Sun Valley ADMS project is located in the Buckeye and Sun Valley areas in western Maricopa County. The project area is bounded on the west by the Hassayampa River, on the north by Gates Road, on the east by Dean Road and the White Tank Mountains, and on the south by the Gila River. It is divided into four distinct areas based on hydrologic, geographic, and land use characteristics (**Figure 1 - Study Area Boundaries map**). These include:

- Area 1 – Buckeye
- Area 2 – Hassayampa
- Area 3 – Buckeye Structures
- Area 4 – North Sun Valley

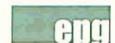
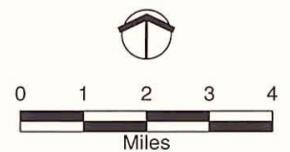
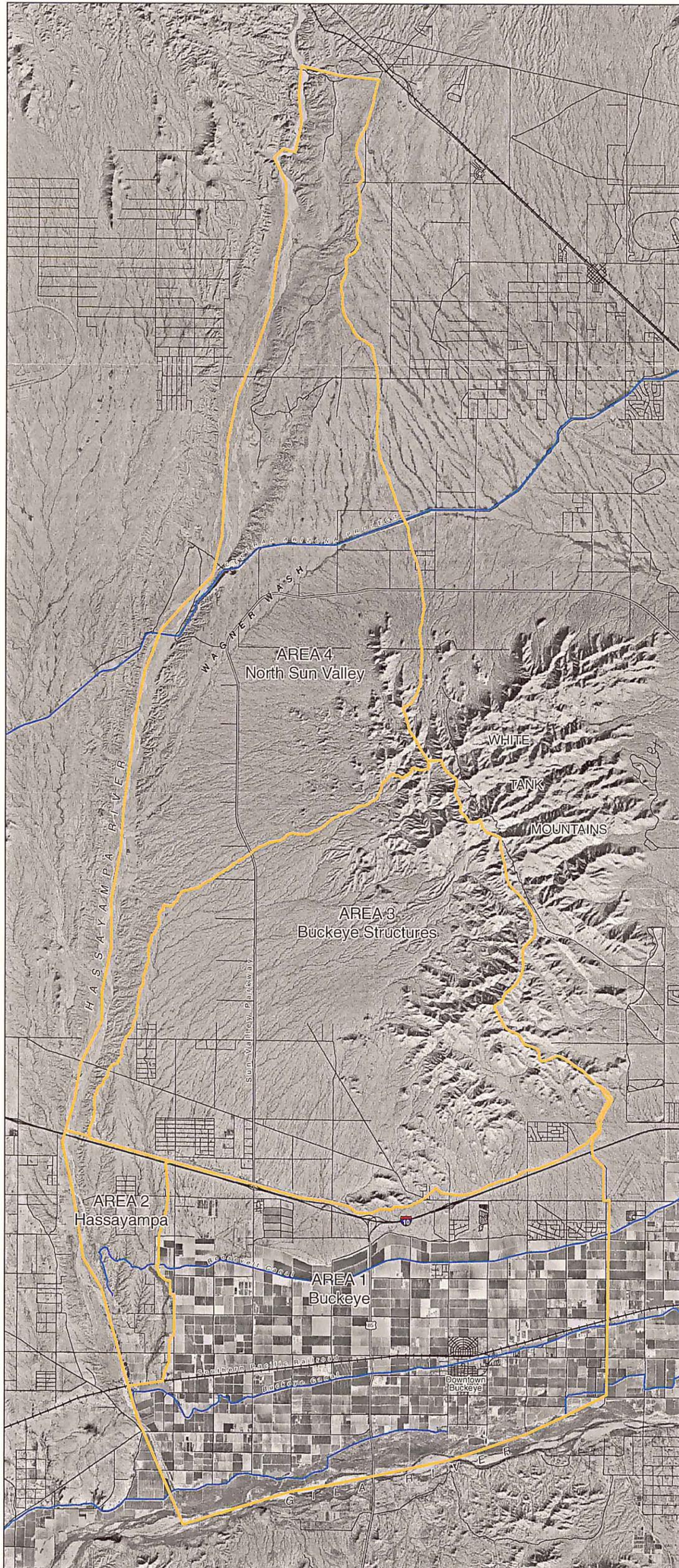
Areas 1 (Buckeye) and 2 (Hassayampa) are located south of Interstate 10 (I-10). Area 1 covers approximately 85 square miles and contains most of the existing developed and agricultural areas within the project area, including downtown Buckeye. It is protected by the Buckeye Flood Retarding Structure (FRS) system, and stormwater within Area 1 flows into the Gila River. Along the Gila River are lands owned by the Bureau of Land Management (BLM) and managed by the Arizona Game and Fish Department (AGFD). State Route 85, Roosevelt Irrigation District (RID) canals, and the Southern Pacific Railroad traverse Area 1.

Area 2 is the smallest area, covering approximately 12 square miles. Area 2 also is protected by the Buckeye FRS system; however, stormwater within Area 2 flows into the Hassayampa River. Although there are some agricultural lands and dispersed residences within Area 2, most of the area is undeveloped and characteristic of the natural Sonoran Desert.

Area 3 (Buckeye Structures) and Area 4 (North Sun Valley) are within the Sun Valley watershed north of I-10 and west of the White Tank Mountains. Area 3 is approximately 92 square miles and includes portions of the White Tank Mountain Regional Park (WTMRP), BLM lands, and Arizona National Guard's Buckeye Military Reservation. The majority of this area consists of natural, undeveloped Sonoran Desert with the exception of a few areas of large lot residences, local streets, and the Sun Valley Parkway. Stormwater within Area 3 flows from the White Tank Mountains, across the alluvial fans, and into the Buckeye FRSs where it is then conveyed to the Hassayampa River.

# STUDY AREA BOUNDARIES

Figure 1



Area 4 (North Sun Valley) includes the North Sun Valley area and covers approximately 91 square miles. Stormwater within Area 4 flows from the White Tank Mountains, across the alluvial fans, into the Hassayampa River. This area is mostly undeveloped natural Sonoran Desert with two major existing structures within the area—the Sun Valley Parkway and the Central Arizona Project (CAP) Canal. Wagner Wash, a major drainage feature, runs through Area 4 to the Hassayampa River. Area 4 also contains part of the WTMRP, BLM lands, and a Luke Air Force Base auxiliary field.

All four areas are experiencing some level of development activity. Several large development projects have progressed in Area 1 and there is significant activity ongoing to develop the infrastructure necessary to support it. Area 2 has only seen small single-lot projects so far, but at least one developer is working on assembling a large block of land within the area. Several very large master-planned community developments are progressing through preliminary phases of planning and design in Areas 3 and 4.

## **LAND USE – EXISTING AND FUTURE**

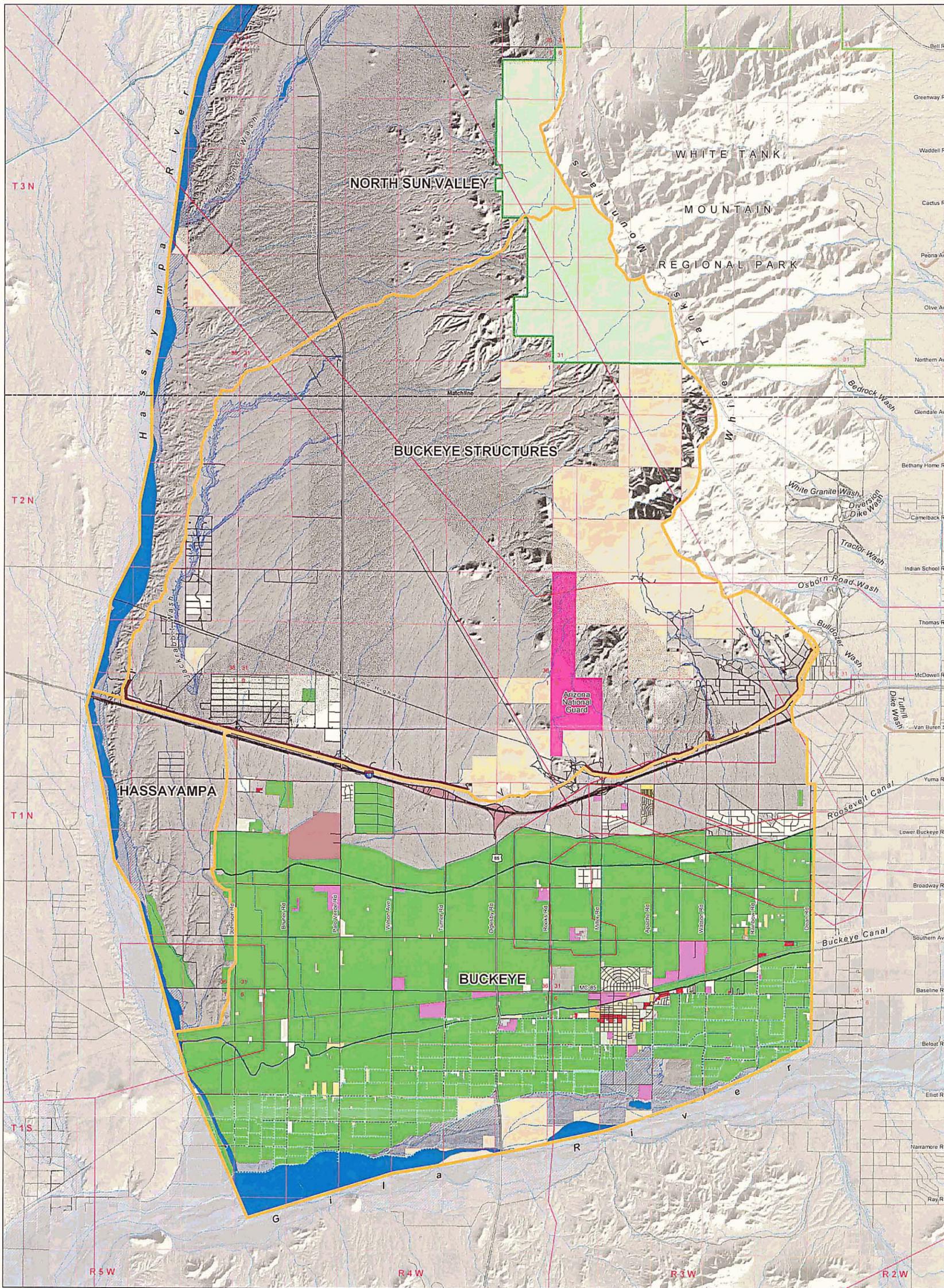
Existing land use in the study area consists generally of vacant desert land to the north of I-10 and agricultural lands to the south of I-10. The Buckeye Area (Area 1) contains most of the existing agricultural and developed lands within the project area, including downtown Buckeye. Other land uses include open space, military use, transportation, rural/estate residential, medium-density residential, industrial, commercial, mining, grazing, public/quasi-public, and water (**Figure 2 [Panels 1 and 2] - Existing Land Use maps**).

The predominant future land use, as projected by various planning documents for the area, is anticipated to be large-lot residential and neighborhood commercial. A number of large master-planned developments have already been approved, and several more are pending (**Appendix A**). As part of the Maricopa Association of Governments' (MAG) *Desert Spaces Plan*, large areas of open space are recommended for protection, conservation, or for environmentally sensitive development (**Figure 3 [Panels 1 and 2] - Desert Spaces Plan maps**). Other projected future land uses in the study area include mixed use, commercial, transportation, mining, military, public/quasi-public, and water (**Figure 4 [Panels 1 and 2] - Future Land Use maps**).

### **Land Use Categories**

Land use categories within the overall project area are depicted on the accompanying maps (**see Figure 2 - Existing Land Use and Figure 4 - Future Land Use maps**). The land use categories were derived from data provided by MAG and the Town of Buckeye's General Plan. These maps illustrate the existing and planned land use within the project area including the designation of residential use according to the number of dwelling units per acre (du/ac). The following residential land uses appear on the maps:

- Rural Residential – less than or equal to 1/5 du/ac
- Estate Residential – 1/5 du/ac to 1 du/ac
- Large Lot Residential – single family (1 du/ac to 2 du/ac)
- Medium Lot Residential – single family (2-4 du/ac)



**Existing Land Use**

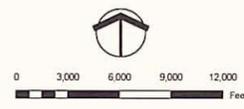
- |                            |  |
|----------------------------|--|
| Bureau of Land Management  | Transportation/Airport/Railroad            |
| Military                   | Open Space                                 |
| Rural/Estate Residential   | Water                                      |
| Large Lot Residential      | Agriculture                                |
| Medium Lot Residential     | Vacant/Undeveloped                         |
| Small Lot Residential      | Bureau of Land Management Utility Corridor |
| Medium Density Residential |  |
| High Density Residential   |  |
| Commercial                 |  |
| Industrial                 |  |
| Office/Business Park       |  |
| Public/Quasi Public        |  |

**Reference Features**

- |                           |
|---------------------------|
| Study Area Boundary       |
| Floodway                  |
| 100 Year Floodplain       |
| Major Street              |
| Street                    |
| FCDMC FRS                 |
| Central Arizona Project   |
| Irrigation District Canal |
| Stream                    |
| Township & Range          |
| Section                   |
| Transmission Line         |

**Sources**

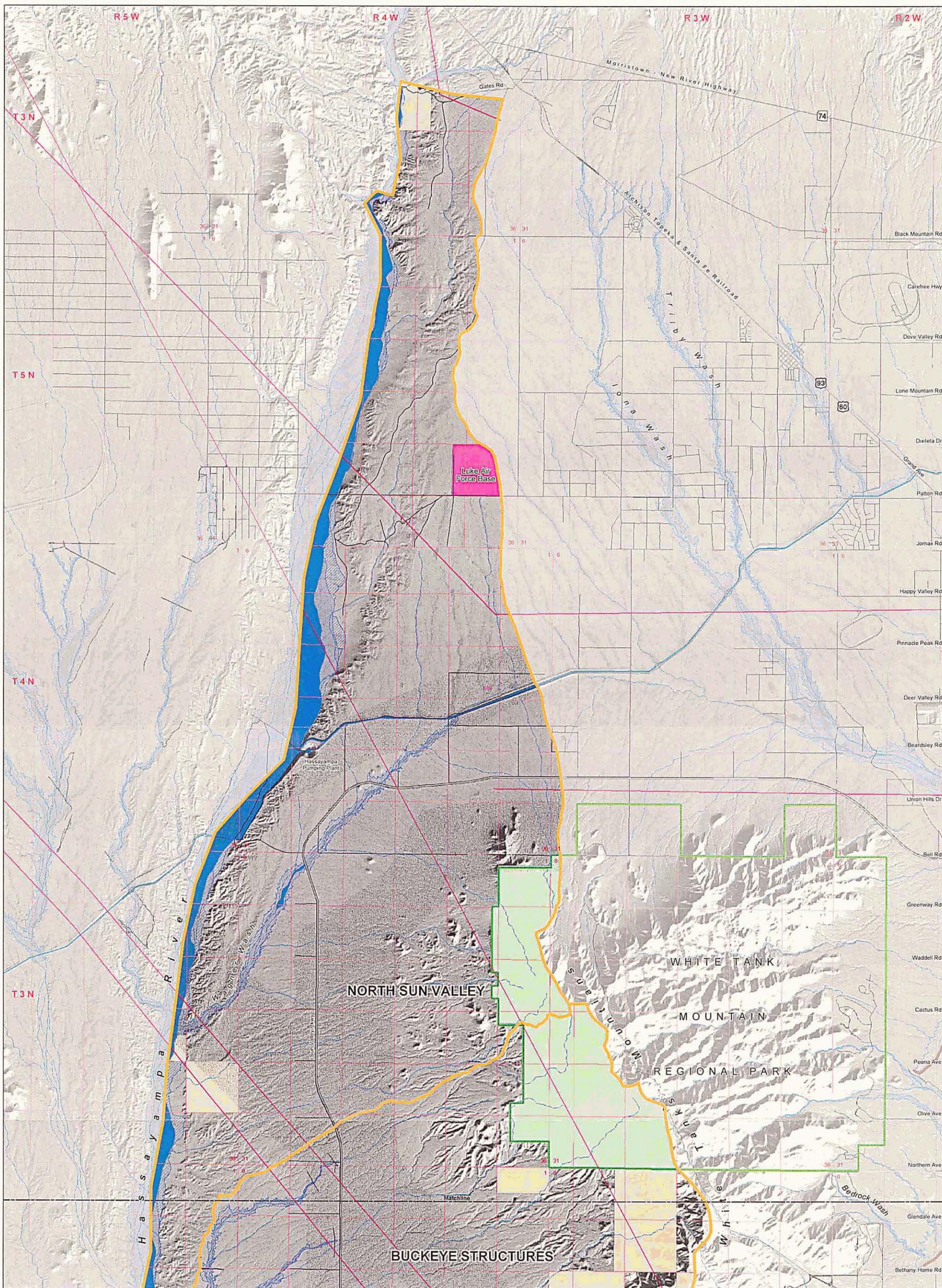
Base Map Data: Flood Control District of Maricopa County, 2003. Imagery inside study boundary. Maricopa County, 2003. 5-foot pixel resolution. Imagery outside study boundary. Maricopa County, 2001. 20-foot pixel resolution.  
 Land Use: Maricopa Association of Governments, 2000. Bureau of Land Management, 2004.



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**EXISTING  
 LAND USE**

Figure 2 Panel 1/2  
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**Existing Land Use**

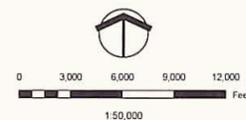
|  |                            |  |  |
|--|----------------------------|--|--|
|  | Bureau of Land Management  |  | Transportation/Airport/Railroad            |
|  | Military                   |  | Open Space                                 |
|  | Rural/Estate Residential   |  | Water                                      |
|  | Large Lot Residential      |  | Agriculture                                |
|  | Medium Lot Residential     |  | Vacant/Undeveloped                         |
|  | Small Lot Residential      |  | Bureau of Land Management Utility Corridor |
|  | Medium Density Residential |  |  |
|  | High Density Residential   |  |  |
|  | Commercial                 |  |  |
|  | Industrial                 |  |  |
|  | Office/Business Park       |  |  |
|  | Public/Quasi Public        |  |  |

**Reference Features**

|  |                           |
|--|---------------------------|
|  | Study Area Boundary       |
|  | Floodway                  |
|  | 100 Year Floodplain       |
|  | Major Street              |
|  | Street                    |
|  | FCDMC FRS                 |
|  | Central Arizona Project   |
|  | Irrigation District Canal |
|  | Stream                    |
|  | Township & Range          |
|  | Section                   |
|  | Transmission Line         |

**Sources**

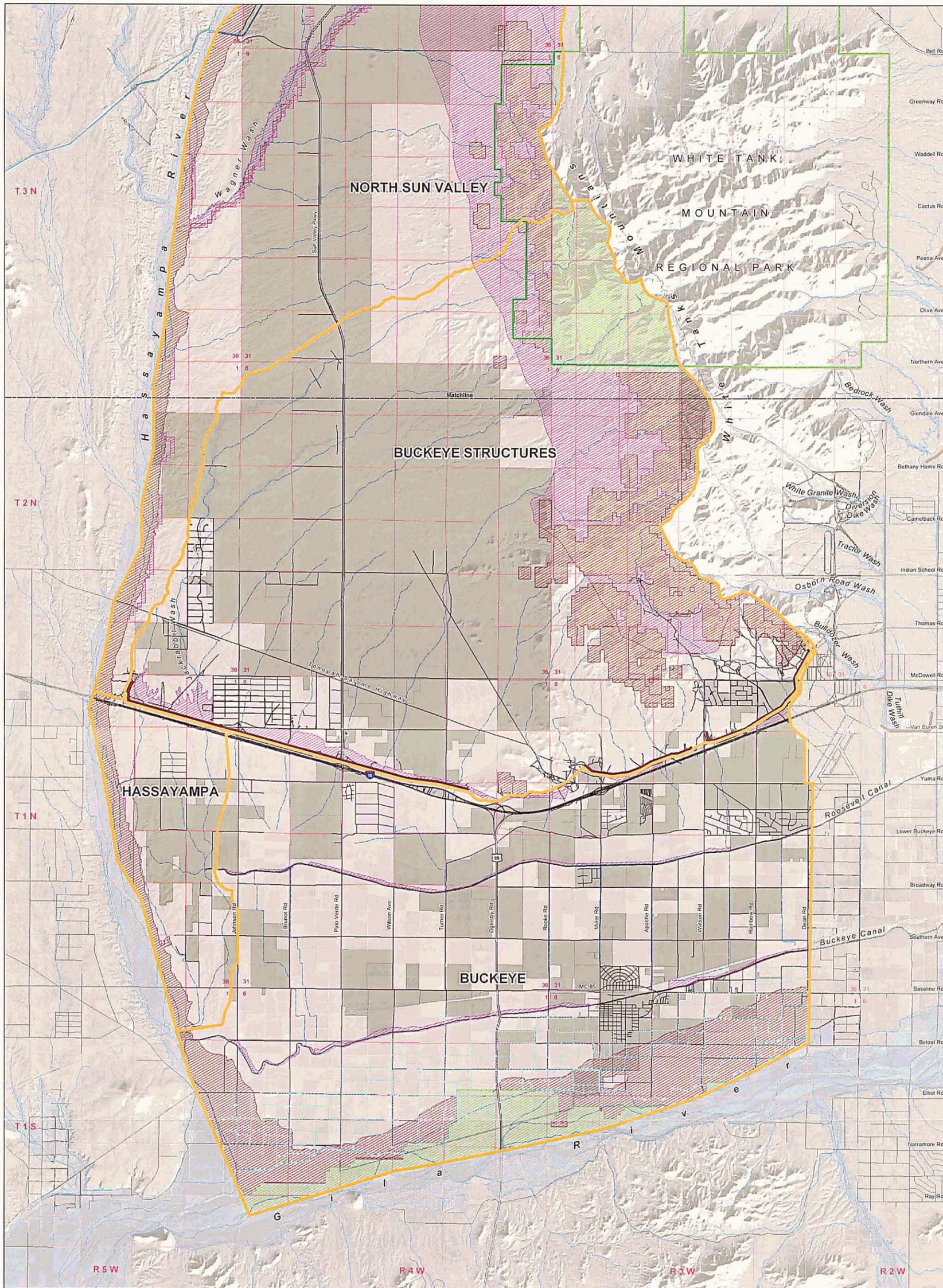
Base Map Data: Flood Control District of Maricopa County, 2003. Imagery inside study boundary. Maricopa County, 2003, 5-foot pixel resolution; Imagery outside study boundary. Maricopa County, 2001, 20-foot pixel resolution.  
 Land Use: Maricopa Association of Governments, 2000. Bureau of Land Management, 2004.



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**EXISTING  
 LAND USE**

Figure 2 Panel 2/2  
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**MAG Desert Spaces Plan**

- Environmentally Sensitive Development Area
- Conservation Area
- Secured Open Space

**Jurisdiction**

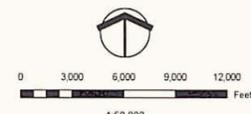
- Unincorporated Maricopa County
- Town of Buckeye
- City of Surprise

**Reference Features**

- Study Area Boundary
- Floodway
- 100 Year Floodplain
- Major Street
- Street
- FCDMC FRS
- Central Arizona Project
- Irrigation District Canal
- Stream
- Township & Range Section

**Sources**

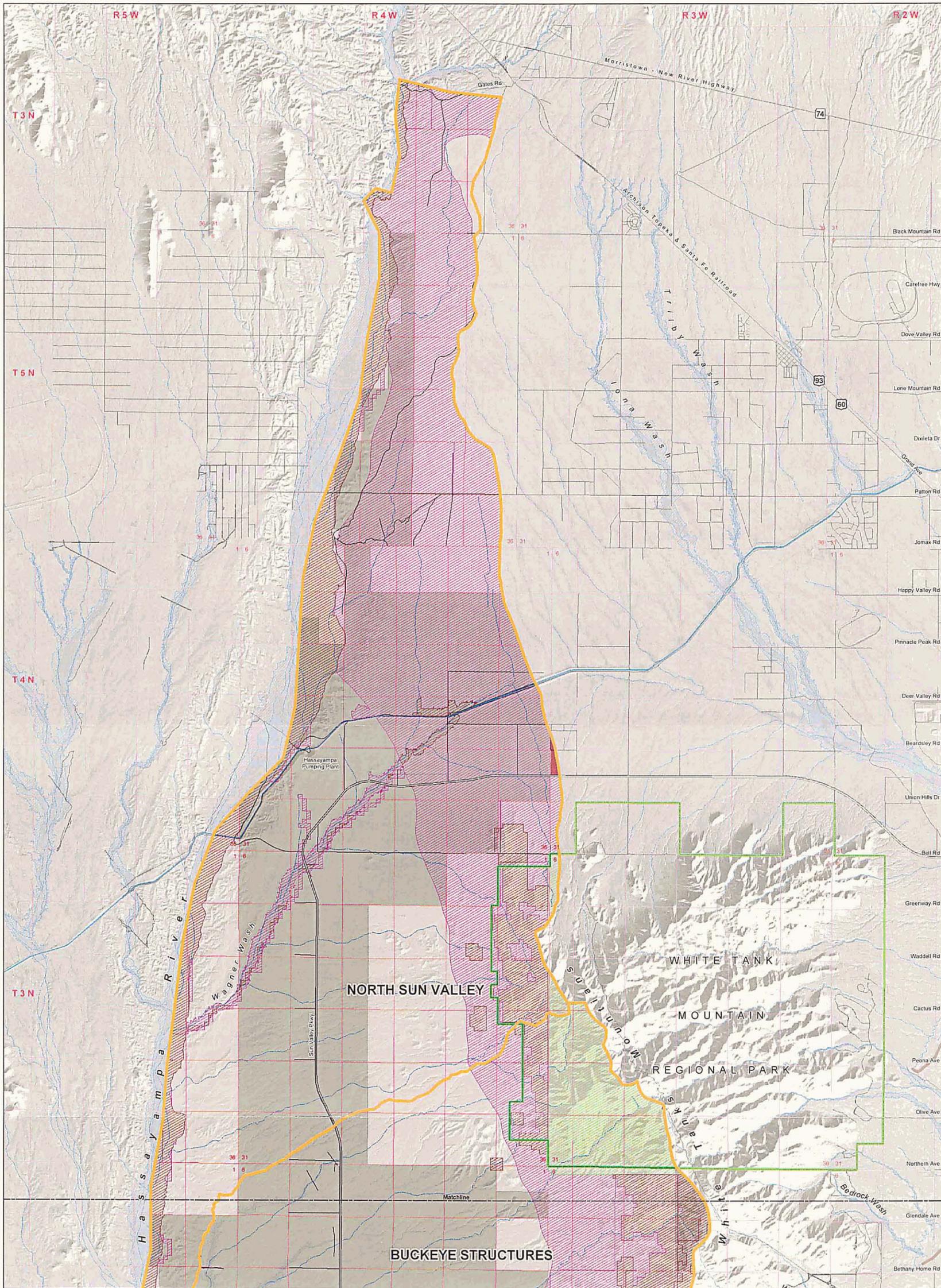
Desert Spaces Plan, Maricopa Association of Governments, 1996; Jurisdiction, Arizona State Land Department, 2004; Base Map Data, Flood Control District of Maricopa County, 2003; Imagery inside study boundary, Maricopa County, 2003, 5-foot pixel resolution; Imagery outside study boundary, Maricopa County, 2001, 20-foot pixel resolution.



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**DESERT SPACES PLAN**

Figure 3 Panel 1/2  
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**MAG Desert Spaces Plan**

-  Environmentally Sensitive Development Area
-  Conservation Area
-  Secured Open Space

**Jurisdiction**

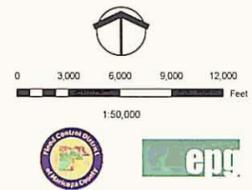
-  Unincorporated Maricopa County
-  Town of Buckeye
-  City of Surprise

**Reference Features**

-  Study Area Boundary
-  Floodway
-  100 Year Floodplain
-  Major Street
-  Street
-  FCDMC FRS
-  Central Arizona Project Irrigation District Canal
-  Stream
-  Township & Range Section

**Sources**

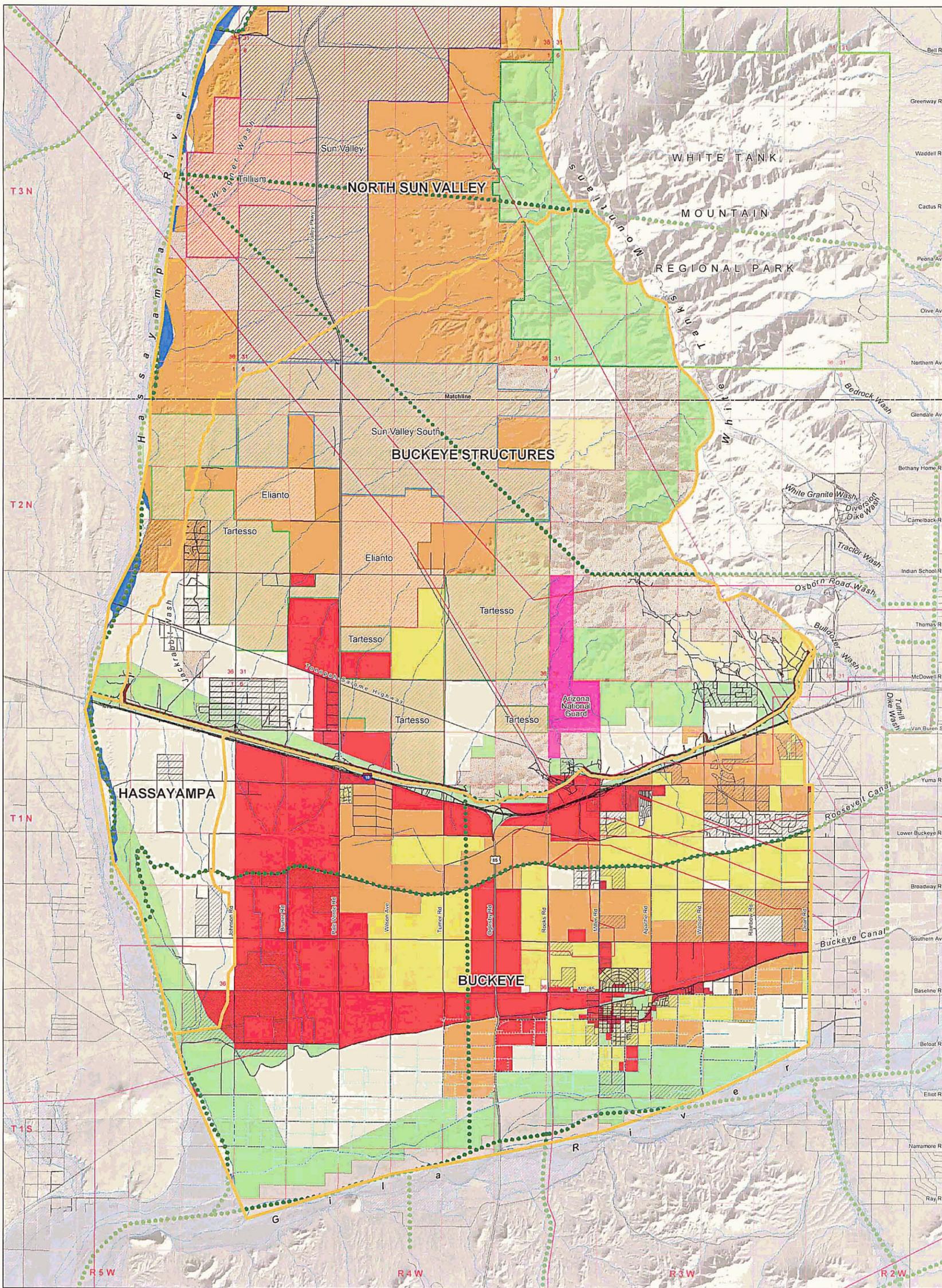
Desert Spaces Plan, Maricopa Association of Governments, 1995; Jurisdiction, Arizona State Land Department, 2004; Base Map Data, Flood Control District of Maricopa County, 2003; Imagery inside study boundary, Maricopa County, 2003, 5-foot pixel resolution; Imagery outside study boundary, Maricopa County, 2001, 20-foot pixel resolution.



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**DESERT SPACES PLAN**

Figure 3 Panel 2/2  
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**Future Land Use**

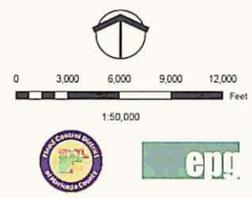
- |                          |                           |   |
|--------------------------|---------------------------|---|
| Rural/Estate Residential | Active Open Space         | Master Plan Developments                  |
| Large Lot Residential    | Water                     | Planned/Proposed Residential Subdivisions |
| Medium Lot Residential   | Mixed Use                 | Proposed Trail Corridor                   |
| Small Lot Residential    | Military                  |   |
| Neighborhood Commercial  | Bureau of Land Management |   |
| Community Commercial     | BLM - Disposal Lands      |   |

**Reference Features**

- |                           |
|---------------------------|
| Study Area Boundary       |
| Floodway                  |
| 100 Year Floodplain       |
| Major Street              |
| Street                    |
| FCDMC FRS                 |
| Central Arizona Project   |
| Irrigation District Canal |
| Stream                    |
| Township & Range Section  |
| Transmission Line         |

**Sources**

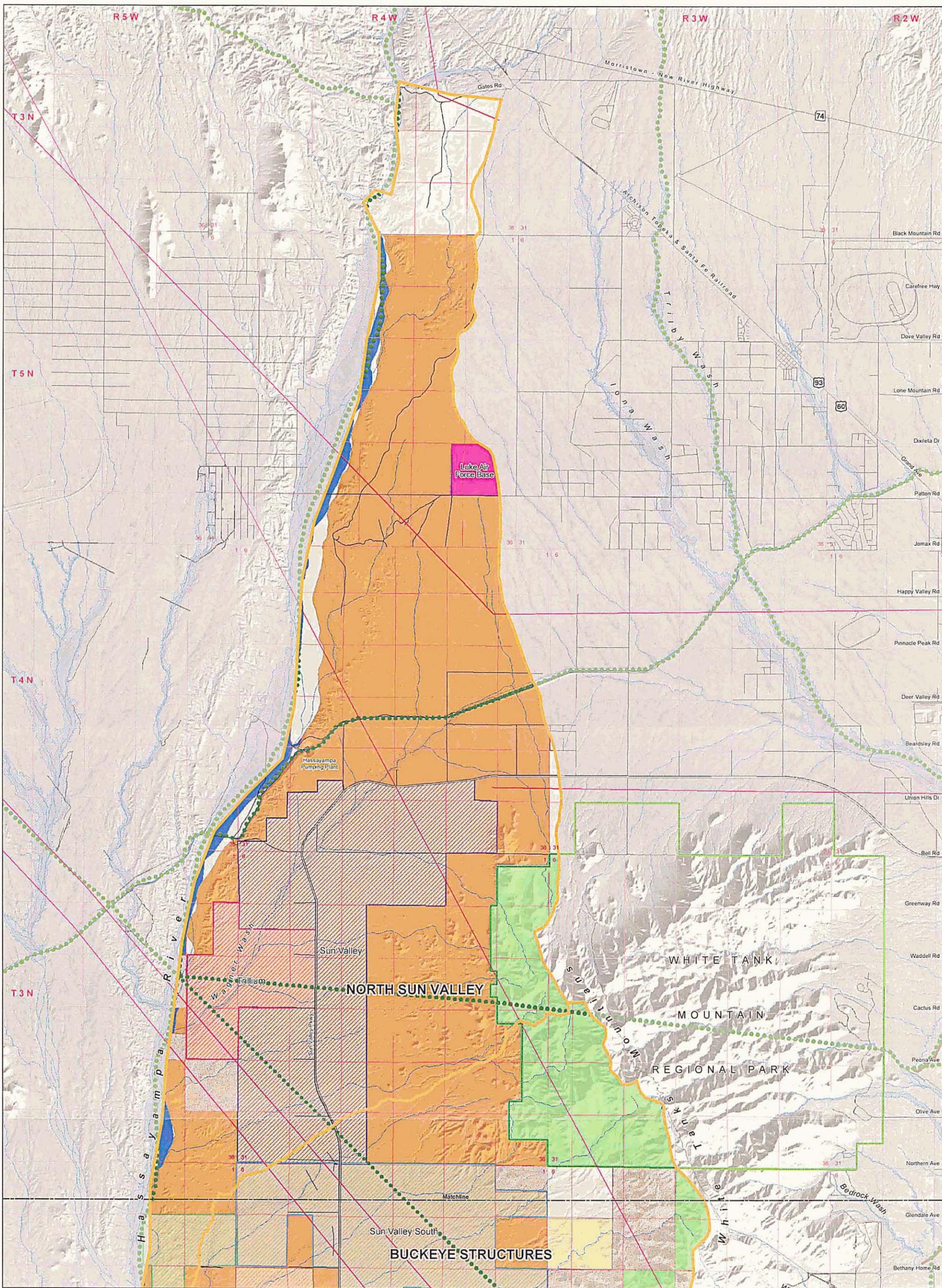
Base Map Data: Flood Control District of Maricopa County, 2003. Imagery inside study boundary: Maricopa County, 2003, 5-foot pixel resolution. Imagery outside study boundary: Maricopa County, 2001, 20-foot pixel resolution.  
 Land Use: Maricopa Association of Governments, 2000; Bureau of Land Management, 2004; Maricopa County, 2004; ENERMap, 2004; Maricopa County Department of Transportation, 2004.



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**FUTURE  
 LAND USE**

Figure 4 Panel 1/2  
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**Future Land Use**

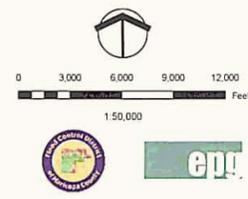
- |                          |                           |   |
|--------------------------|---------------------------|---|
| Rural/Estate Residential | Active Open Space         | Master Plan Developments                  |
| Large Lot Residential    | Water                     | Planned/Proposed Residential Subdivisions |
| Medium Lot Residential   | Mixed Use                 | Proposed Trail Corridor                   |
| Small Lot Residential    | Military                  |   |
| Neighborhood Commercial  | Bureau of Land Management |   |
| Community Commercial     | BLM - Disposal Lands      |   |

**Reference Features**

- |                           |
|---------------------------|
| Study Area Boundary       |
| Floodway                  |
| 100 Year Floodplain       |
| Major Street              |
| Street                    |
| FCDMC FRS                 |
| Central Arizona Project   |
| Irrigation District Canal |
| Stream                    |
| Township & Range Section  |
| Transmission Line         |

**Sources**

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 Land Use: Maricopa Association of Governments, 2000; Bureau of Land Management, 2004; Maricopa County, 2004; ENERMap, 2004; Maricopa County Department of Transportation, 2004.



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**FUTURE  
 LAND USE**

Figure 4 Panel 2/2  
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- Small Lot Residential – single family (4-6 du/ac)
- Medium Density Residential – multi-family (5-10 du/ac)
- High Density Residential – multi-family (10-15 du/ac)

Other size-specific future land uses include:

- Neighborhood Commercial – 50,000 to 100,000 square feet
- Community Commercial – greater than 100,000 square feet

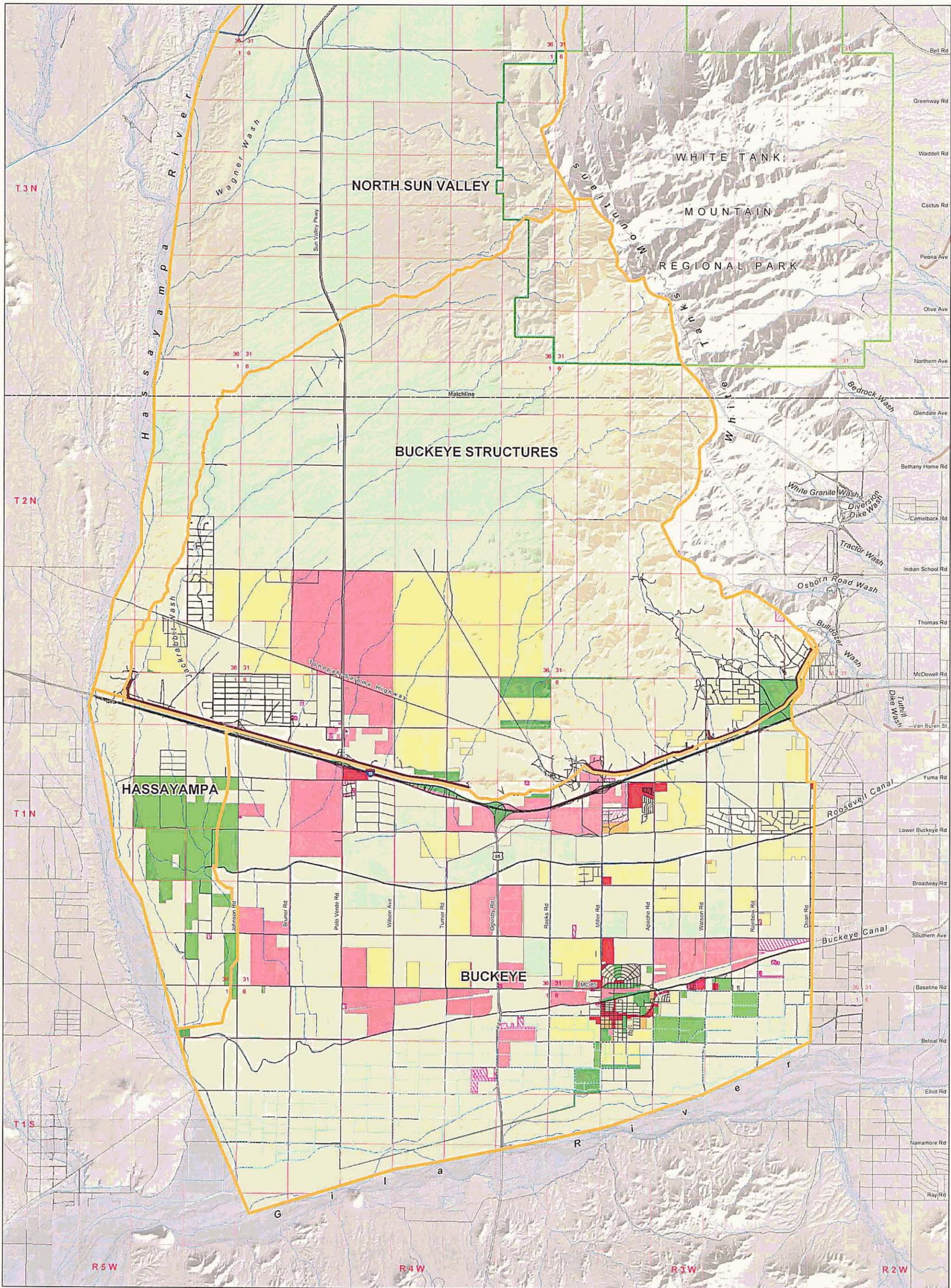
## ZONING

The predominant zoning of the project area is rural. The areas of unincorporated Maricopa County are primarily Rural-190 (Rural Zoning District – 190,000 square feet per dwelling unit) or Rural 43 (Rural Zoning District – 1 acre per dwelling unit). In the incorporated areas of the Town of Buckeye, the predominant zoning is Rural Residential or Planned Area Development, with a mixture of higher density residential, multiple family residential, commercial, and industrial zones identified throughout the developed area of the town (south of I-10) (**Figure 5 [Panels 1 and 2] - Zoning maps**).

## SECTION 2 - REGULATORY AUTHORITY

Specific statutes were identified previously by Entellus, Inc. for the Wittmann Area Drainage Master Study (ADMS) Update, whose study area is adjacent to and shares many drainage characteristics with the Buckeye/Sun Valley ADMS. This section of the report is taken from the Draft Wittmann Area Drainage Master Study Update Draft Interim Rules of Development Report, Volume RD Part III, March 2005 (**Reference 1**) with modifications adapted specifically for the Buckeye ADMS area.

Governmental entities are limited in their powers to those the State has expressly granted them. The Arizona Revised Statutes (ARS) describes these powers and duties. The Statutes are divided into Titles (or chapters) that address the various governmental entities in Arizona. Title 11 (**Reference 2**) addresses county authority to regulate. Special districts, such as the Flood Control District, are addressed in Title 48 (**Reference 3**). State statutes, Maricopa County ordinances authorized under ARS Title 11, and the District ordinances, authorized under ARS Title 48, grant the power to adopt and enforce regulations, as well as develop guidelines for governing floodplains and floodplain management. ARS Title 9, Chapter 4 provides authority to municipalities to prepare a general plan for the development of the municipality that consists of a statement of community goals and development policies that include flood control. Following are applicable citations from the statutes that relate to the development of guidelines or rules for development. The italicized sections within the statutes highlight language that relates specifically to development guidelines.



**Zoning**

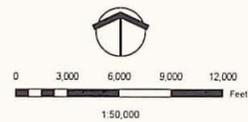
- |                        |                               |
|------------------------|-------------------------------|
| <b>Town of Buckeye</b> | <b>Maricopa County</b>        |
| Commercial Center      | Multiple Family Residential   |
| General Commerce       | Residential, 43K SF Min       |
| Mixed Residential      | Residential, 190K SF Min      |
| Planned Community      | Zoning Cases Pending Approval |
| Planned Residential    | Special Use                   |
| Rural Residential      |                               |
| Special Use            |                               |

**Reference Features**

- Study Area Boundary
- Floodway
- 100 Year Floodplain
- Major Street
- Street
- FCDMC FRS
- Central Arizona Project
- Irrigation District Canal
- Stream
- Township & Range Section

**Sources**

Base Map Data: Flood Control District of Maricopa County, 2003. Imagery inside study boundary: Maricopa County, 2003, 5-foot pixel resolution. Imagery outside study boundary: Maricopa County, 2001, 20-foot pixel resolution.  
 Zoning: Town of Buckeye, 2004, Maricopa County, 2004.

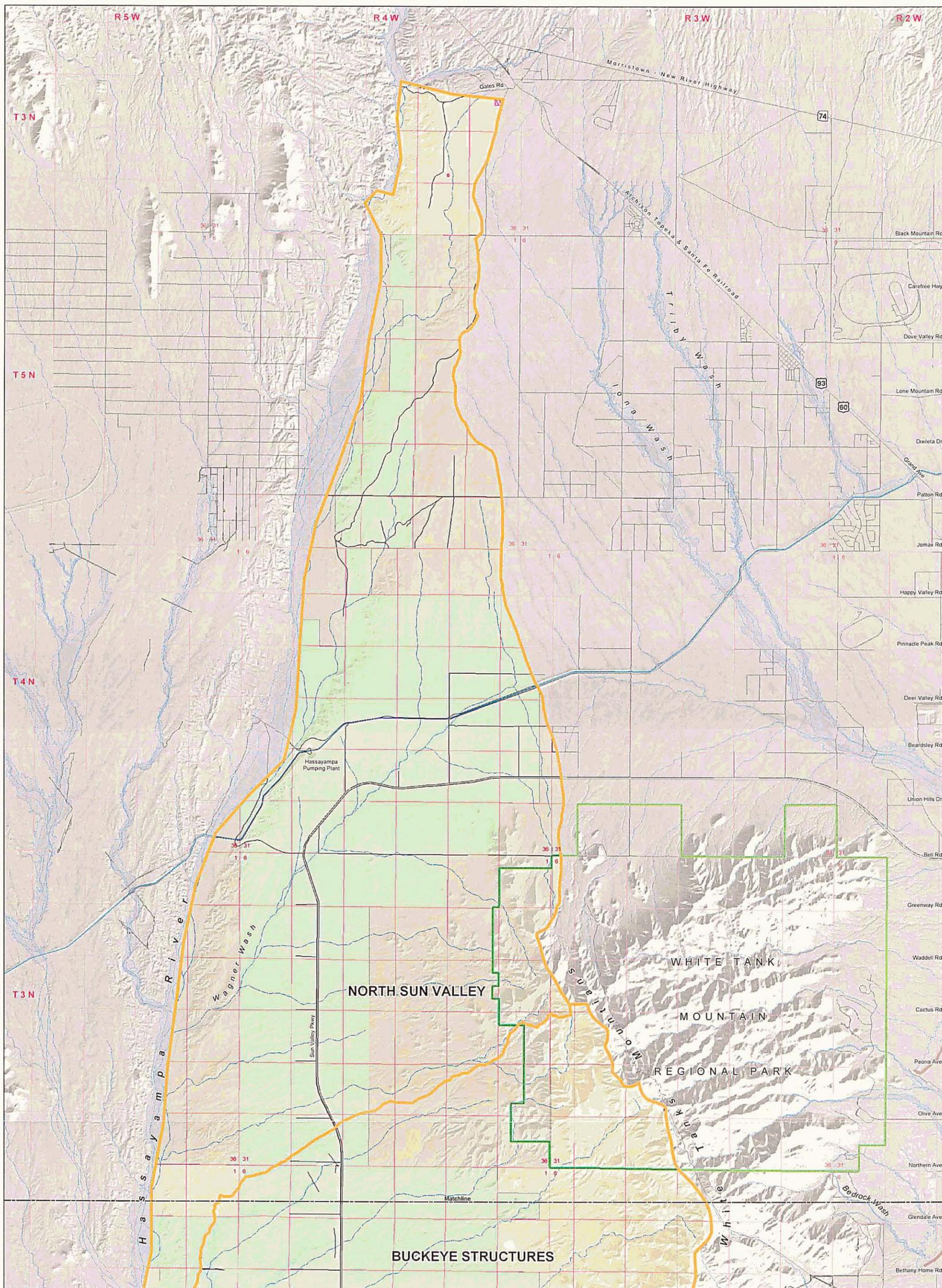


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**ZONING**

Figure 5 Panel 1/2  
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**Zoning**

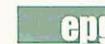
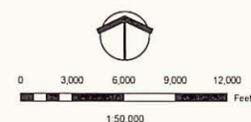
- |                        |                               |
|------------------------|-------------------------------|
| <b>Town of Buckeye</b> | <b>Maricopa County</b>        |
| Commercial Center      | Multiple Family Residential   |
| General Commerce       | Residential, 43K SF Min       |
| Mixed Residential      | Residential, 190K SF Min      |
| Planned Community      | Zoning Cases Pending Approval |
| Planned Residential    | Special Use                   |
| Rural Residential      |                               |
| Special Use            |                               |

**Reference Features**

- Study Area Boundary
- Floodway
- 100 Year Floodplain
- Major Street
- Street
- FCDMC FRS
- Central Arizona Project
- Irrigation District Canal
- Stream
- Township & Range Section

**Sources**

Base Map Data: Flood Control District of Maricopa County, 2003. Imagery inside study boundary: Maricopa County, 2003, 5-foot pixel resolution; Imagery outside study boundary: Maricopa County, 2001, 20-foot pixel resolution.  
 Zoning: Town of Buckeye, 2004; Maricopa County, 2004.



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**ZONING**

Figure 5 Panel 2/2  
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## ARIZONA REVISED STATUTES

State statutes specifically pertaining to “development guidelines” include the following:

ARS 48-2664.D. Powers of board of directors: The board may adopt equitable by-laws, *rules and regulations* and perform all acts necessary to carry out the purposes of this chapter.

ARS 48-3609.B. Except as provided in section 48-3610, the board shall *adopt and enforce regulations governing floodplains and floodplain management in its area of jurisdiction* which shall include the following:

1. *Regulations for all development of land, construction of residential, commercial or industrial structures or uses of any kind which may divert, retard or obstruct floodwater* and threaten public health or safety or the general welfare.

ARS 9-461.05 .E. General plans; authority; scope: The general plan shall include for cities of fifty thousand persons or more and may include for cities of less than fifty thousand persons the following elements or any part or phase of the following elements:

1. A conservation element for the conservation, development and utilization of natural resources, including forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals and other natural resources. The conservation element may also cover:
  - (a) The reclamation of land.
  - (b) *Flood control.*
  - (c) Prevention and control of the pollution of streams and other waters.
  - (d) *Regulation of the use of land in stream channels and other areas required for the accomplishment of the conservation plan.*
  - (e) Prevention control and correction of the erosion of soils, beaches and shores.
  - (f) *Protection of watersheds*

## DRAINAGE REGULATIONS FOR MARICOPA COUNTY

Maricopa County has adopted drainage regulations (*Drainage Regulations for Maricopa County*, dated 2004 [Reference 4]) “pursuant to ARS 11-151, Sections 30 and 36 and ARS 11-251.05 authorizing the Board of Supervisors to adopt and enforce all ordinances necessary to the full discharge of the duties of the Board of Supervisors as the legislative authority of the county government; and to enforce standards for excavation, landfill and grading to prevent unnecessary loss from erosion, *flooding* and landslides” (Drainage Regulations for Maricopa County, Chapter 1 – Section 101 Statutory Authority). Maricopa County Planning and Development Department “regulates drainage of all land within the unincorporated areas of Maricopa County to promote and protect the health, peace, safety, comfort, convenience, and general welfare of county residents” and “administers the regulations and coordinates with other

agencies to ensure that new development does not increase runoff, divert flows or back water onto other properties” (Maricopa County website, www.maricopa.gov).

The *Drainage Regulations for Maricopa County*, dated 2004 (**Reference 4**), provide specific guidance for “development guidelines” associated with Area Drainage Master Studies.

### Chapter 3 - Definitions

#### Section 301. Definitions

3. Area Drainage Master Study (ADMS) – a study to develop stormwater hydrology for a watershed, to define drainage systems, identify potential flood hazard areas, drainage problems and recommend solutions and standards for sound floodplain and stormwater management. The ADMS identifies alternative solutions to a given flooding or drainage problem. An Area Drainage Master Plan (ADMP) identifies the preferred alternative. An ADMP, unique to the subject watershed *provides minimum criteria and standards (for flood control and drainage) for land use and development.*

### Chapter 11 - Area Drainage Master Study

#### Section 1101. Adoption

Whenever an Area Drainage Master Study authorized under this regulation has been completed, such plan *including uniform rules for development* may be submitted to the Board of Supervisors for adoption as an Area Drainage Master Plan. If adopted by the Board of Supervisors, the District shall enforce the Area Drainage Master Plan under this Regulation.

## STATE AND LOCAL FLOODPLAIN REGULATIONS

The District Board of Directors has adopted floodplain regulations as required by state statute. In the current regulations, amended in 1993 (**Reference 5**), further basis is found for “development guidelines” in the following sections:

### Article III. Definitions

#### Section 301.

6. Area Drainage Master Study (ADMS): A study to develop hydrology for a watershed, to define watercourses, identify potential flood problem areas, drainage problems and recommend solutions and standards for sound floodplain and stormwater management. The ADMS will identify alternative solutions to a given flooding or drainage problem. An Area Drainage Master Plan (ADMP) identifies the preferred alternative. *An ADMP, unique to the subject watershed provides minimum criteria and standards (for flood control and drainage) for land use and development standards (for flood control and drainage) for land use and development.*

## Article XIV. Other Flood Hazard Zones

### Section 1402. Flood Hazard Development Standards

1. *Standards adopted for development* contained in a Watercourse Master Plan, Area Drainage Master Plan or other hydrologically oriented master plan shall be consistent with sound floodplain management practices and this Regulation.

6. *The standards, provisions, criteria and requirements for development* in flood hazard zones imposed by an authorized master plan shall meet or exceed the requirements of this Regulation.

The Town of Buckeye has adopted the Town of Buckeye Development Code (2005) (**Appendix B**) that outlines the following development guidelines for floodplain regulations:

### Article Five Property Development Standards

#### Section 7-5-5 Flood Control

- A. *Floodplain Management: The Maricopa County Flood Control District is responsible for all floodplain management activities within the Town corporate limits of the Town. The District is authorized to exercise the powers and duties set forth in Title 45, Chapter 10, Article 4, Arizona Revised Statutes, within all areas of the Town.*

## **SECTION 3 - EXISTING REGULATIONS**

As discussed in the introduction, these guidelines for development have been prepared to address the specific flooding and erosion hazards associated with the Buckeye/Sun Valley watershed that may not be adequately addressed under current regulations. The ADWR, MAG, Maricopa County, the District, and Town of Buckeye have all adopted regulations to control flooding and erosion. **Appendix B** contains an abbreviated summary of applicable regulations currently in place. Applying these existing regulations can effectively control many of the flooding and erosion problems within the Buckeye/Sun Valley ADMS area. These regulations are based on the following general principals:

- Development shall be done in such a manner as to not put the general public at increased risk to flooding and erosion.
- Drainage planning and design shall not increase or transfer detrimental drainage effects to other areas.
- Development and basin-wide master drainage plans shall include a full range of preventive and corrective approaches, including the following:
  - maintaining the integrity of existing drainage patterns

- establishment of selected major drainage routes, by the use of purchase, dedication, development rights, and easements
  - storage and attenuation of stormwater runoff
  - construction of drainage works
- The combination of strategies shall balance engineering, economic, environmental, and social factors in relationship to stated comprehensive planning goals and objectives.

Preservation of drainage characteristics is a fundamental objective of controlling flooding and erosion that are inherent in these principals. Regulatory tools adopted by ADWR, MAG, Maricopa County, the District, and/or Town of Buckeye to meet this objective include:

- Restricting/prohibiting development in 100-year floodplains
- Regulating uses and fill material within a floodplain
- Regulating erosion setbacks
- Regulating slope and erosion restrictions
- Regulating standards for cut and fill
- Discouraging the location of structures which would increase water ponding and sheet flow
- Discouraging the location of structures that would alter current stormwater patterns

Structural and non-structural mitigation methods adopted by ADWR, MAG, Maricopa County, the District, and/or the Town of Buckeye to meet this objective include:

- Preparation of a master grading and drainage plan prior to development
- Maintaining points from which drainage flows to and from property
- Maintaining volume and type of flow to and from property
- Protecting fill material
- Minimizing removal of existing vegetation
- Protecting excavation adjacent to any floodplain crossing, utility structures, or facilities
- Placing building pads above the 100-year storm level
- Reclaiming areas of disturbance
- Designing development to conform to natural landforms and features
- *Controlling on-site and off-site drainage prior to development*
- Using stormwater harvesting and detention basins to reduce increased stormwater flows
- *Controlling on-site and off-site drainage prior to development*
- Designing development to conform to natural landforms and features
- Protecting sloping wash edges and managing vegetation
- Avoiding increased stormwater runoff into washes and drainages
- Designing roads and wash crossings to be perpendicular to, or near perpendicular to washes
- Proper design of bridges and culverts
- Placing invert elevation of culverts at wash bottom elevations
- Providing sediment traps
- Minimizing the length of slopes
- Minimizing the steepness of slope
- Providing a rough surface for runoff to cross

- Limiting exposure of disturbed areas and maintaining existing vegetation
- Stabilizing disturbed areas with vegetation, mulch, etc.
- Avoiding ground clearing far in advance of site grading
- Establishing erosion hazard zones to restrict development on erosive soils

#### **SECTION 4 - POTENTIAL FLOODING AND EROSION IMPACTS WITHIN THE BUCKEYE / SUN VALLEY AREA RESULTING FROM DEVELOPMENT**

Development within the Buckeye/Sun Valley project area may reduce surface storage of stormwater runoff, increase impervious area, concentrate stormwater runoff flows, and divert runoff. These products of development can potentially result in flooding and erosion problems including increased peak discharge, volume, and/or velocity of runoff; and erosion and sediment deposition. The various causes and effects also were evaluated as part of the Wittmann ADMS Update, and the discussion presented in this section includes information from the Wittmann ADMS Update Draft Interim Rules of Development Report, Volume RD Part III (Entellus, 2005) (Reference 1).

##### **REDUCED SURFACE STORAGE**

Reducing surface storage area by grading individual lots to reduce ponding areas, by erecting structures within ponding or flood prone areas, or through other means increases both the peak flow and the volume of runoff generated by a given storm unless measures are implemented to compensate for the increased runoff (e.g., retention basins, etc.).

##### **INCREASE IMPERVIOUS AREA**

Reducing the soil surface area available for rainfall infiltration by the construction of buildings and pavement surfaces increases the impervious area of a site. As a result, peak flow and runoff volume increase unless measures are implemented to compensate for the loss of soil infiltration (e.g., retention basins, etc.).

##### **CONCENTRATION OF FLOWS**

Development generally concentrates flows more quickly than under natural conditions by increasing the impervious area of a site, reducing surface storage, and displacing runoff, especially in areas where a significant portion of the drainage is sheet flow (like the Buckeye/Sun Valley watershed). Without other controls in place, concentrated flows tend to move through the watershed more quickly; can increase peak flows due to the timing of combined flows from adjacent sub-basins; can increase the volume of runoff and the potential for erosion; and change the point of entry of drainage onto another property during a runoff event.

## **DIVERSION OF RUNOFF**

Although diversion of runoff is not allowed under current drainage regulations it is a potential concern. It has the potential to change the peak discharge, volume, velocity, and/or the point of entry of runoff onto another property during a runoff event; increase flood depths; cause flooding in areas adjacent to the pre-development floodplain; increase the potential for erosion; and modify flow break/split locations by filling one channel that otherwise may not have previously had as much or any flow.

## **INCREASED PEAK DISCHARGE, VOLUME, OR VELOCITY OF RUNOFF**

An increase in peak discharge, whether through a reduction in surface storage, an increase of impervious area, concentration of flows, or a combination of all three may have several flooding and erosion impacts, including:

- enlarged area of property (on- or off-site) within the floodplain, placing existing structures within or adjacent to the pre-development floodplain at risk of a greater flood impact or making previously developable areas subject to increased flood and erosion mitigation, if developed
- change the peak discharge, volume, or velocity of runoff and the point of entry of drainage onto another property during a runoff event
- increased downstream flooding as a result of existing drainage structures (natural and constructed channels, basins, culverts, etc.) downstream of newly developed areas becoming undersized due to increased upstream runoff
- increased erosion, sedimentation, and flooding resulting from inadequate existing erosion control structures, grade control structures, and bank stabilization features downstream of newly developed areas due to increased upstream runoff
- increased erosion of areas with highly erodible soils downstream of newly developed areas
- increased potential for sedimentation, resulting in a loss of drainage structure capacity and increased flooding and maintenance

## **INCREASED EROSION**

Concentration of flows and/or increased peak discharge in areas with highly erodible soils may cause bank erosion and long-term channel bed degradation, resulting in loss of property and riparian habitat, increased potential damage and likelihood of failure of existing structures (e.g., roads, culverts, bridges, buildings, etc.), clogging or filling of downstream structures, increased maintenance, and the need for grade control structures and bank stabilization measures.

## **INCREASED SEDIMENT DEPOSITION**

Increased deposition caused by increased upstream erosion or changes in the flow pattern of runoff may result in a loss of channel capacity, increased flooding, and downstream erosion as "clean or hungry" water is released and additional sediment is picked up. Sediment deposition also may alter the flow path of runoff and create or modify flowsplits by filling one channel forcing more water into another that may not have had as much or any flow previously.

## **SECTION 5 - SPECIFIC FLOODING AND EROSION HAZARDS ASSOCIATED WITH THE BUCKEYE / SUN VALLEY ADMS AREA AND ASSOCIATED GUIDELINES FOR DEVELOPMENT**

While the guiding principles used to develop existing regulations are appropriate, there are unique conditions and hazards that require special consideration. As discussed, the guidelines for development in this report address the specific flooding and erosion hazards associated with the Buckeye/Sun Valley watershed that may not be adequately addressed under current regulations. Each of the four areas within the Buckeye/Sun Valley ADMS study area (see **Figure 1- Study Area Boundaries map**) exhibit unique flooding and erosion conditions. Following is a description of the unique existing conditions, potential flooding and erosion impacts that may result from development (issues), and associated guidelines for development in these areas (**Figure 6 – Flooding and Erosion Areas map**).

### **AREA 1 - BUCKEYE**

In Area 1, three conditions exist for consideration of specific guidelines for development to mitigate flooding and erosion impacts. They are:

- Development of Undeveloped Natural Sonoran Desert
- Development of Agricultural Lands/Fields
- Development within Urbanized Areas

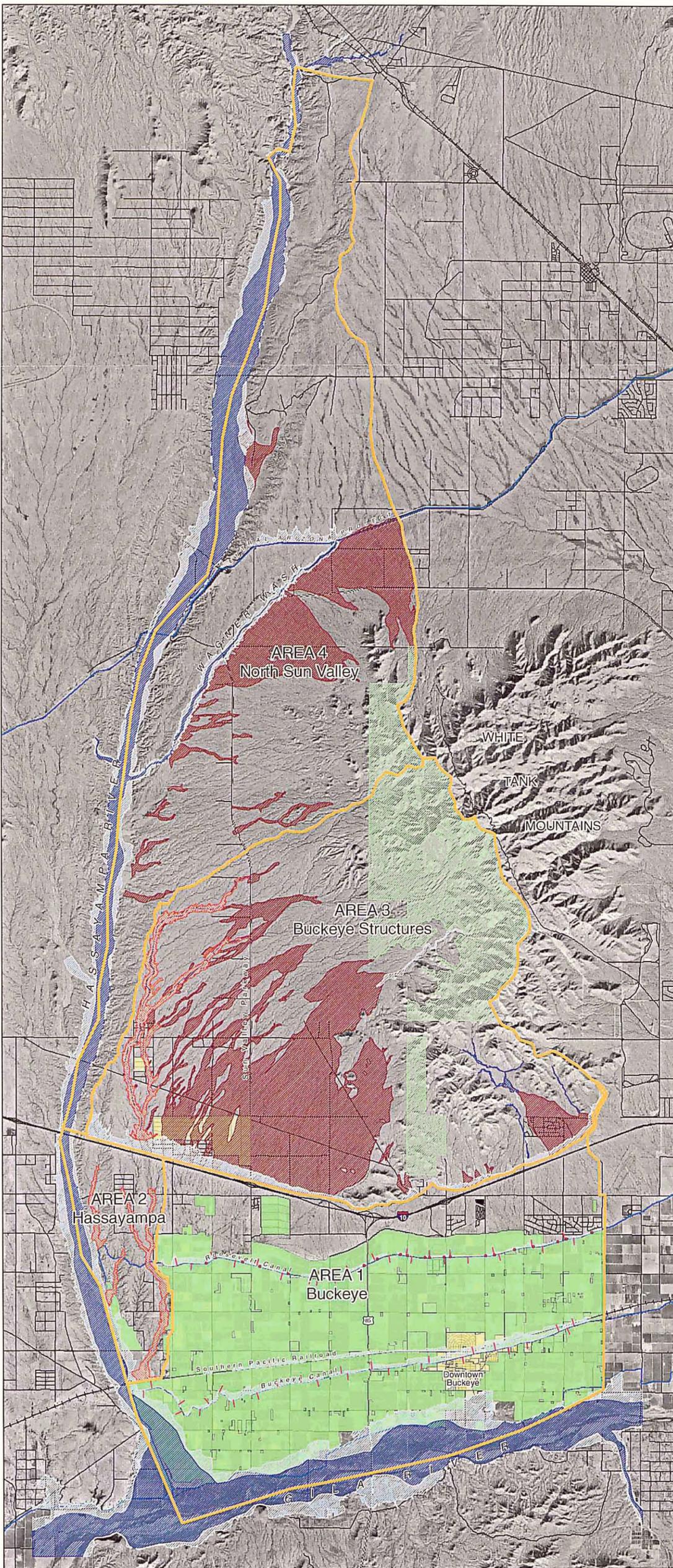
#### **Development of Undeveloped Natural Sonoran Desert**

##### **Existing Conditions**

The existing drainages and historical washes associated with undeveloped natural Sonoran Desert areas within Area 1 are still intact, and although the Buckeye FRSs have cut off the historic drainage from the White Tank Mountains, local stormwater runoff continues to sheet-flow into the natural drainages and washes of the area.

##### **Issue**

Development in these areas may have the potential to increase erosion or deposition of sediment in these natural washes and drainages.



# Buckeye/Sun Valley Area Drainage Master Study

## FLOODING AND EROSION AREAS

### Legend

#### Areas of Unique Flooding and Erosion Considerations

##### AREA 1 - Buckeye

- Undeveloped Natural Sonoran Desert Areas
- Agricultural Lands/Fields
- Urbanized Areas

##### AREA 2 - Hassayampa

- Undeveloped Natural Sonoran Desert Areas
- Agricultural Lands/Fields

##### AREA 3 - Buckeye Structures

- Undeveloped Alluvial Fans
- Low Density Alluvial Development

##### AREA 4 - North Sun Valley

- Undeveloped Alluvial Fans

#### Potential Flood/Erosion Hazard Areas

- Floodway
- Areas of 100-year flood
- Areas of active alluvial fan flooding
- Areas of undetermined but possible flood hazards (not evaluated in this study)
- Erosion Hazard Zones
- Canal Overtopping Location

Note:  
Not all hazards within the study area have been evaluated and identified including delineations of all floodplains, erosion hazards for the Hassayampa River, etc.

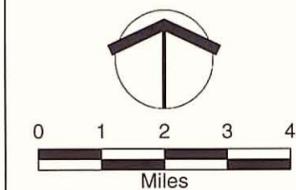


Figure 6

## **Guideline for Development**

### Goal

- Minimize erosion and deposition of sediment by preserving existing sediment transport conditions of drainages and washes.

### Objectives

- Encourage developers to minimize site disturbance.
- Encourage developers to plan and design development to respond to the natural landforms of the site.
- Require new structures to locate building pad elevations a minimum of 12 inches above the adjacent 100-year flood elevation.
- Encourage developers to configure regional drainage channels that allow water to be conveyed safely through and around proposed developments.
- Require perimeter walls or fences to have weep holes that allow sheet flow to pass through the property without concentrating flows and/or ponding water around the structures. Alternatively, solid perimeter walls or fences could be set back from the property line to allow flow to pass between properties.

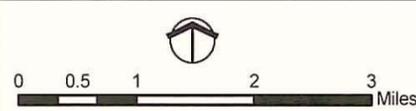
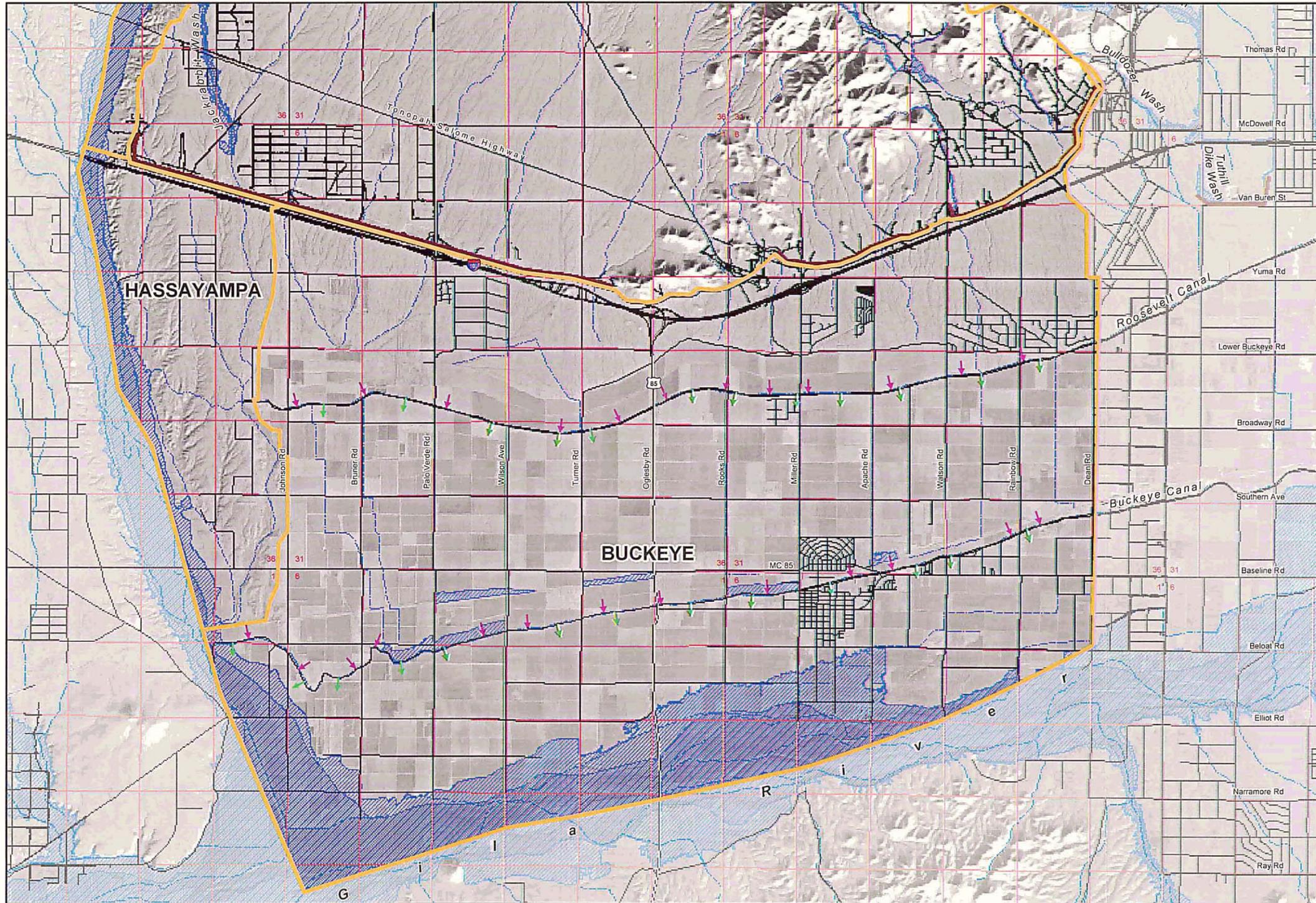
## **Development of Agricultural Lands/Fields**

### **Existing Conditions**

Agricultural lands make up the majority of land within Area 1. These lands are most often leveled and terraced with natural drainage corridors no longer existing. The soils are highly permeable, absorbing much of the natural precipitation. Because of the level fields and irrigation berms characteristic of the agricultural lands, much of the runoff is retained onsite. Runoff not retained on the fields tends to travel south on adjacent shallow ditches and/or existing roadways, eventually draining into the Gila River. The Roosevelt Irrigation district (RID) Canal, the Buckeye Irrigation Canal, and the Southern Pacific Railroad run east and west across this area causing stormwater runoff to pond behind, drain along, and/or overtop these structures (**Figure 7 – Canal Overtopping Areas map**).

### **Issues**

Prior hydrologic and hydraulic analyses have not considered the retention function of agricultural fields and have assumed that onsite retention is negligible. This assumption has resulted in large floodplains along the drainage obstructions such as the irrigation canals and railroad. As fields have been replaced by subdivisions, reduced retention conditions have effectively increased the runoff



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F.C.D. CONTRACT NO. 2002C027

**Legend**

- North Bank Canal Overtopping Location
- South Bank Canal Overtopping Location

**Reference Features**

- Study Area Boundary
- Floodway
- 100 Year Floodplain
- FCDMC FRS
- Street
- Stream

- Township & Range Section

**Sources**

Base Map Data: Flood Control District of Maricopa County, 2003; Imagery inside study boundary: Maricopa County, 2003, 5-foot pixel resolution; Imagery outside study boundary: Maricopa County, 2001, 20-foot pixel resolution.

**CANAL OVERTOPPING LOCATIONS**

**Figure 7**

PREPARED BY:  
Date: January 7, 2006



reaching downstream areas because the fields that formerly retained the stormwater have been eliminated. Additionally, the existing canals could overtop during a large, infrequent runoff event resulting in a unique flooding hazard.

## **Guideline for Development**

### Goals

- Maintain the stormwater runoff characteristics of the existing agricultural land including volume, peak discharge, and form and function of point of discharge of stormwater runoff.
- Minimize increased runoff directed toward the canals and railroad lines so that flooding of downstream areas is not worsened.

### Objectives

- Require developers to perform an analysis of pre- vs. post-development conditions of stormwater runoff that account for existing retention conditions on the agricultural fields per the findings of the Buckeye/Sun Valley ADMS.
- Require developers to retain the difference in volume between pre- and post-development conditions and maintain pre-development flow conditions.
- Encourage developers to provide a regional solution of basins and drainage corridors to convey stormwater runoff to the Gila River. Spreader basins or other engineering controls that re-establish sheet flow conditions may be considered as an interim solution to a regional solution.
- Require developers to maintain the existing characteristics of flow along the canals and railroad lines, and account for stormwater runoff inundation areas due to overtopping of the canals and railroad.
- Encourage developers to configure regional drainage channels that allow water to be conveyed safely through and around proposed developments.
- Require perimeter walls or fences to have weep holes that allow sheet flow to pass through the property without concentrating flows and / or ponding water around the structures. Alternatively, solid perimeter walls or fences could be set back from the property line to allow flow to pass between properties.

## **Development Within Urbanized Areas**

### **Existing Conditions**

The urbanized areas within Area 1 are primarily those that have been developed in the downtown Buckeye area. Stormwater runoff within these areas is typically diverted to avoid inundation of

existing structures and conveyed by the existing streets. Streets and existing structures are often flooded by stormwater runoff.

### **Issues**

The primary flooding issues associated with development within the urbanized areas of Area 1 include the diversion and concentration of flow from construction of structures (new buildings and additions, walls, fences, etc.).

### **Guidelines for Development**

#### **Goal**

- Minimize flooding of existing structures and improvements as the area continues to develop.

#### **Objectives:**

- Require new structures to locate building pad elevations a minimum of 12 inches above the adjacent 100-year flood elevation.
- Encourage developers to configure development to allow water to move freely between and around structures.
- Require perimeter walls or fences to have weep holes that allow sheet flow to pass through the property without concentrating flows and / or ponding water around the structures. Alternatively, solid perimeter walls or fences could be set back from the property line to allow flow to pass between properties.

### **AREA 2 – HASSAYAMPA**

In Area 2, two conditions exist for consideration of specific guidelines for development to mitigate flooding and erosion impacts. They are:

- Development of Undeveloped Natural Sonoran Desert
- Development of Agricultural Lands/Fields

#### **Development of Undeveloped Natural Sonoran Desert**

##### **Existing Conditions**

Area 2 is primarily undeveloped and characterized by Sonoran Desert areas with natural drainages and washes. Stormwater runoff is generally conveyed via sheet-flow into these natural drainages and washes, which are currently intact and function to convey stormwater runoff to the Hassayampa River. Many of the existing drainages and washes are deeply incised

from higher volumes of runoff that occurred prior to construction of the Buckeye FRS system. Federal Emergency Management Area (FEMA) 100-year floodplains are being mapped for this area. In addition, Erosion Hazard Zones (EHZs) have been delineated as part of the Buckeye/Sun Valley ADMS.

### **Issues**

Development in these areas may have the potential to increase erosion or deposition of sediment in these natural washes and drainages.

### **Guideline for Development**

#### Goal

- Minimize erosion and deposition of sediment by preserving existing sediment transport conditions of drainages and washes and regulating erosion hazard zones.

#### Objectives

- Encourage developers to minimize site disturbance.
- Encourage developers to plan and design development to respond to the natural landforms of the site.
- Encourage developers to maximize the use of existing incised washes.
- Restrict development within erosion hazard zones.

### **Development of Agricultural Lands/Fields**

#### **Existing Conditions**

Within Area 2 are agricultural lands and fields located near the Hassayampa River. Similar to the condition in Area 1, these lands are leveled and terraced and the natural drainage corridors no longer exist. The soils are highly permeable, absorbing much of the natural precipitation. Because of the level fields and irrigation berms characteristic of the agricultural lands, much of the runoff is retained onsite. Runoff not retained on the fields tends to travel southwest toward the Hassayampa River.

#### **Issues**

Prior hydrologic and hydraulic analyses have not considered the retention function of agricultural fields and have assumed that onsite retention is negligible. As these areas are developed, this assumption effectively increased the runoff reaching downstream areas because the retention requirements for development (under regulations prior to the Buckeye/Sun Valley ADMS) don't

account for the increased retention of the agricultural fields that formerly retained the stormwater. Additionally, concentration of flows may create additional erosion within the floodplain of the Hassayampa River.

## **Guideline for Development**

### Goals

- Maintain the stormwater runoff characteristics of the existing agricultural land including volume, peak discharge, and form and function of point of discharge of stormwater runoff.
- Minimize impacts to the sloping river edges, terraces, banks, and existing vegetation of the Hassayampa River.

### Objectives

- Require developers to perform an analysis showing pre- vs. post-development conditions of stormwater runoff that account for existing retention conditions on the agricultural fields per the findings of the Buckeye/Sun Valley ADMS.
- Require developers to retain the difference in volume between pre- and post-development conditions and maintain pre-development flow conditions.
- Encourage developers to provide a regional solution of basins and drainage corridors to convey stormwater runoff to the Hassayampa River. Spreader basins or other engineering controls that re-establish sheet flow conditions may be considered as an interim solution to a regional solution.
- Require developers to protect the sloping river edges, terraces, banks, and existing vegetation of the Hassayampa River.

## **AREA 3 – BUCKEYE STRUCTURES AND AREA 4 - NORTH SUN VALLEY**

Development on alluvial fans is the principal drainage and erosion condition within Area 3 and Area 4 to be addressed through specific guidelines for development to mitigate flooding and erosion impacts.

### Development of Alluvial Fans

#### **Existing Conditions**

Area 3 and Area 4 are very similar in character to each other, as well as the adjacent areas of the Wittmann watershed, and are defined by the undeveloped alluvial fans at the base of the White Tank Mountains. Area 3 drains into the Buckeye FRSs, while Area 4 drains directly into the Hassayampa River. The alluvial fans are characterized by unstable flow with split flow conditions

and erodible soils. Several active alluvial fans have been identified within Areas 3 and 4 (see **Figure 6 – Flooding and Erosion Areas map**). EHZs also have been identified for Area 3 (Area 4 has not been studied). Sun Valley Parkway runs through both areas and crosses several drainages. Low-density development has occurred on the alluvial fan in the Buckeye Structures Area. Wagner Wash, which currently supports noteworthy stands of vegetation and provides a natural wildlife corridor, serves as the principal drainage corridor through the North Sun Valley Area.

## Issues

The unstable and split flow characteristics of alluvial fans make it difficult to predict peak flow in a given channel or wash, which results in unreliable estimates of peak flows. In addition, development can artificially shift the location of a split flow and cause unexpected flooding in another area downstream. Control of the apex of the active alluvial fans and conveyance of flow through the entire fan (a regional solution) is necessary for development within the active alluvial areas.

Due to the high erodibility of the soils commonly encountered on alluvial fans, roadway crossings (including Sun Valley Parkway) and roadway intersections can be severely damaged, restricted, or negatively affected by floodwaters. Flows redirected along the roadway shoulder must eventually cross the road or intersecting roads. If provisions are not made for handling these flows, significant damage and restricted access may occur. Runoff from erodible soils also may create water quality concerns, in addition to the overriding concern of soil loss. Roads may become impassable due to floodwater and/or high concentrations of sediment, and/or structural damage, causing significant safety concerns.

## Guideline for Development

Because many of the flooding issues in Areas 3 and 4 are similar to those of the Wittmann watershed, many of the goals and objectives identified in the Wittmann ADMS Update Rules of Development Report, Volume RD Part III Interim Rules of Development Report (**Reference 1**) have been directly applied here.

## Goals

- Preserve existing sheet flow conditions, wherever possible, or mitigate increased velocity, peak flows, and erosion associated with diversion, channelization and/or reduction of sheet flow areas.
- Identify split flow conditions and prevent development from affecting the distribution of flows and downstream drainage paths.
- Control the apex of the active alluvial fans and conveyance of flow through the entire fan (provide a regional solution).
- Prevent severe flood damage to roadways and roadways from damaging the drainage system.

- Minimize erosion and deposition of sediment by preserving existing sediment transport conditions of drainages and washes and regulating erosion hazard zones.

### Objectives

- Require developers to control the apex of the active alluvial fans and conveyance of flow through the entire fan (provide a regional solution).
- Require developers to maintain existing flow paths and distribution and prevent future conditions from altering downstream conditions.
- Require developers to protect the sloping river and wash edges, terraces, banks, and existing vegetation of the Hassayampa River and Wagner Wash.
- Restrict development within erosion hazard zones.
- Require developers to minimize the concentration of flows caused by roadways.
- Require developers to design culverts and other roadway crossings for peak flows and sediment load capacity to prevent clogging or changing of sediment transport characteristics of the drainage system.
- Require new structures to locate building pad elevations a minimum of 12 inches above the high point of the property.
- Encourage developers to configure regional drainage channels that allow water to be conveyed safely through and around proposed developments.
- Require perimeter walls or fences to have weep holes that allow sheet flow to pass through the property without concentrating flows and / or ponding water around the structures. Alternatively, solid perimeter walls or fences could be set back from the property line to allow flow to pass between properties.

### SUMMARY

Preliminary development goals and objectives have been presented in this report to address special problems in the Buckeye/Sun Valley ADMS area that are not fully covered in existing regulations. These goals and objectives will be refined and more specific development guidelines prepared, along with accompanying policies, during the next planning phases, including the Sun Valley ADMP and the Buckeye ADMP.

## REFERENCES

1. Wittmann Area Drainage Master Study Update, Interim Rules of Development Report, Volume RD, Part III, Contract FCD 2002C029, *Flood Control District of Maricopa County*, March 2005
2. Arizona Revised Statues Title 11
3. Arizona Revised Statues Title 48
4. Drainage Regulations for Maricopa County, *Maricopa County*, 2004
5. Floodplain Regulations for Maricopa County, *Flood Control District of Maricopa County*, 1986 and subsequently amended
6. Interim Projections of Population, Housing and Employment by Municipal Planning Area and Regional Analysis Zone, *MAG*, July 2003

**APPENDIX A**

**DEVELOPMENT APPROVALS**

| <b>TABLE 1<br/>PLANNED OR CURRENT DEVELOPMENT WITHIN THE BUCKEYE/SUN VALLEY ADMS STUDY AREA</b> |                         |                          |                          |                                     |               |
|---|-------------------------|--------------------------|--------------------------|-------------------------------------|---------------|
| <b>Name</b>   | <b>Size<br/>(acres)</b> | <b>Housing<br/>Units</b> | <b>Developer</b>         | <b>Status</b>                       | <b>Source</b> |
| Alder Farms   |                         |                          |                          |                                     | 4             |
| Allenville  |                         |                          |                          |                                     | 4             |
| Bell 3000   | 3,010                   |                          | Cypress Group            |                                     | 1             |
| Blue Hills  | 130                     | 495                      | Blue Hills, LLC          | Under Review                        | 2             |
| Blue Horizons   | 565                     | 2,22                     | AMI, LLC                 | Approved - To begin in Fall of 2001 | 2             |
| Buckeye Municipal Airport   |                         |                          |                          | Approved                            | 2             |
| Buckeye North   |                         |                          |                          |                                     | 4             |
| Buckeye Park (Valencia Re-Plat)   | 21                      | 117                      |                          | Approved                            | 2             |
| Buckeye Rancho  |                         |                          |                          |                                     | 4             |
| Buena Vista   | 72                      | 410                      | Phoenix Land Development | Under Construction                  | 2             |
| Buena Vista (Phase II)  | 125                     | 621                      | Phoenix Land Development | Approved                            | 2             |
| Cholla Ranch (Multi-Family)   | 14                      | 180                      | The Wallach Companies    | Under Construction                  | 2             |
| Clayton Thayer  |                         |                          |                          |                                     | 4             |
| D&R Encatade Estates  |                         |                          |                          |                                     | 2             |
| Desert Moon Estates   | 200                     | 800                      |                          | Concept                             | 2             |
| Desert Moon Shadow  |                         |                          |                          |                                     | 2             |
| Dove Cove Estates   | 80                      | 348                      | Pierce Properties        | Under Review                        | 2             |
| Duncan Manor  |                         |                          |                          |                                     | 4             |
| East Allenville   |                         |                          |                          |                                     | 4             |
| East Sunland  |                         |                          |                          |                                     | 4             |
| Elianto   |                         |                          |                          |                                     | 4             |
| Elliot Sunset Phase 2   |                         |                          |                          |                                     | 2             |
| Elms Tract  |                         |                          |                          |                                     | 4             |

**TABLE 1  
PLANNED OR CURRENT DEVELOPMENT WITHIN THE BUCKEYE/SUN VALLEY ADMS STUDY AREA**

| <b>Name</b>                  | <b>Size<br/>(acres)</b> | <b>Housing<br/>Units</b> | <b>Developer</b>      | <b>Status</b>                         | <b>Source</b> |
|------------------------------|-------------------------|--------------------------|-----------------------|---------------------------------------|---------------|
| Estrella                     |                         |                          |                       |                                       | 2             |
| Estrella Gardens             |                         |                          |                       |                                       | 4             |
| Festival Ranch Area Plan     | 2,842                   | 7,329                    |                       | Approved                              | 2             |
| Festival Ranch/Del Webb      | 3,000                   |                          | Del Webb              | 11/03-at risk grading                 | 1             |
| Festival Ranch Master Plan   | 10,105                  | 24,176                   | Lyle Anderson         | Approved                              | 2             |
| Frys (commercial)            |                         |                          |                       |                                       | 2             |
| George Tract                 |                         |                          |                       |                                       | 4             |
| Hassayampa Ranches           |                         |                          |                       |                                       | 4             |
| Heather Place II             | 73                      | 291                      | Doug Patterson        | Under Review                          | 2             |
| Hopeville                    |                         |                          |                       |                                       | 4             |
| Ironwood Vista               | 28                      | 113                      | Anderson and Kalish   | Approved - To begin in Spring of 2002 | 3             |
| Marionneaux Property         | 310                     | 930                      |                       | Concept                               | 3             |
| Miller Estates               | 66                      | 291                      | Larry Fink            | Under Review                          | 3             |
| Miller Road Commercial Ctr.  | 40                      |                          |                       | Under Development                     | 3             |
| Morek Voight Buckeye Phase 1 |                         |                          |                       |                                       | 3             |
| Narramore Estates            | 14                      | 60                       | Voyager               | Under Construction                    | 3             |
| Nesselrotte Place            |                         |                          |                       |                                       | 4             |
| Norte Vista                  | 40                      | 39                       | Whiteplex Association | Approved                              | 3             |
| Northwood Park               | 121                     | 108                      | Voyager               | Under Construction                    | 3             |
| Palo Verde Townsite          |                         |                          |                       |                                       | 4             |
| Parkman Ranch                | 160                     | 633                      | GY0100                | Approved                              | 3             |
| Parkside at Buckeye          | 51                      | 214                      | Anderson and Kalish   | Approved                              | 3             |
| Phoenix Skyline West         |                         |                          |                       |                                       | 4             |
| PJ Farms                     | 806                     | 2,500                    |                       | Concept                               | 3             |
| Rancho Buena Vista           | 92                      | 376                      | Anderson and Kalish   | Approved                              | 3             |
| Rancho Vista                 |                         |                          |                       |                                       | 3             |

**TABLE 1  
PLANNED OR CURRENT DEVELOPMENT WITHIN THE BUCKEYE/SUN VALLEY ADMS STUDY AREA**

| Name                         | Size (acres) | Housing Units | Developer                        | Status                                | Source |
|------------------------------|--------------|---------------|----------------------------------|---------------------------------------|--------|
| River Wood (Multi-Family)    | 15           | 130           | Glen Walling                     | Under Construction                    | 3      |
| Roston-Westpark              | 1,280        |               |                                  |                                       | 1      |
| Roston Westpark              | 1,060        | 3,235         | Roston Company                   | Approved - To begin in Winter of 2001 | 3      |
| Serena                       | 32           | 150           | Great Western Homes              | Under Construction                    | 3      |
| Shea Sunset phase 1          |              |               |                                  |                                       | 3      |
| Spurlock Ranch               | unavailable  |               | Lyle Anderson / 10,000 West, LLC |                                       | 1      |
| Stage Coach Estates phase 2  |              |               |                                  |                                       | 3      |
| Sun Valley Area Plan         | 3,181        | 7,626         | 10K, LLC/Spurlock                | Approved                              | 3      |
| Sundance                     | 2,016        | 6,933         | Hancock                          | 50% (?) built                         | 1      |
| Sun Valley                   | 10,880       |               | Phoenix Holdings                 |                                       | 1      |
| Sun Valley South             | 6,400        |               |                                  |                                       | 1      |
| Sun Valley Master Plan       | 13,285       | 34,196        | 10K, LLC/Spurlock                | Under Review                          | 3      |
| Sun Valley South Master Plan | 11,193       | 29,218        | SDI                              | Approved                              | 3      |
| Sweetwater Estates           |              |               |                                  |                                       | 4      |
| Tartesso                     | 8,000        |               | Stardust                         |                                       | 1      |
| Tartesso Master Plan         | 2,254        | 9,005         | Stardust                         | Approved                              | 3      |
| Tartesso North Master Plan   | 3,751        | 12,322        | Stardust                         | Approved                              | 3      |
| Tartesso West                | 6,000        |               | Stardust                         |                                       | 1      |
| Terra Vista                  | 81           | 312           | Anderson and Kalish              | Approved                              | 3      |
| Trillium                     |              |               |                                  |                                       | 4      |
| Valencia                     |              |               |                                  |                                       | 4      |
| Valencia Homes               |              |               |                                  |                                       | 4      |
| Valencia Manor               |              |               |                                  |                                       | 4      |
| Verrado                      | 8,801        | 14,082        | DMB                              | Approved - To begin in Spring of 2002 | 3      |

**TABLE 1  
 PLANNED OR CURRENT DEVELOPMENT WITHIN THE BUCKEYE/SUN VALLEY ADMS STUDY AREA**

| <b>Name</b>          | <b>Size (acres)</b> | <b>Housing Units</b> | <b>Developer</b>    | <b>Status</b> | <b>Source</b> |
|----------------------|---------------------|----------------------|---------------------|---------------|---------------|
| Vestar               |                     |                      |                     |               | 3             |
| Vista de Montana     | 278                 | 1,100                | Columbia Properties | Approved      | 3             |
| Watson Estates       |                     |                      |                     |               | 3             |
| West Phoenix Estates |                     |                      |                     |               | 4             |
| Westwind             | unavailable         |                      |                     |               | 1             |
| White Tanks Vista    |                     |                      |                     |               | 4             |
| Wurts Place          |                     |                      |                     |               | 4             |
| Yonker               |                     |                      |                     |               | 3             |

Sources:

- <sup>1</sup> Information Provided by W.C. Scouten Associates, Inc – Town of Buckeye Development Engineer (contract)
- <sup>2</sup> Published Data from the Town of Buckeye
- <sup>3</sup> Other Information Provided by the Town of Buckeye (Phil Garthwright, Planning Director)
- <sup>4</sup> Information Obtained from PBS&J Data Collection Report and Maricopa County Assessors Web Site

Status of Town of Buckeye developments current as of July 21, 2004 telephone conversation with Buckeye Planning Director Phil Garthwright.

## APPENDIX B

### SUMMARY OF APPLICABLE EXISTING REGULATIONS, CODES, ORDINANCES, GUIDELINES, STANDARDS, AND DEVELOPMENT CONDITIONS

#### A. State of Arizona Department of Water Resources

##### 1. SS4-95 State Standard for Identification of and Development within Sheet Flow Areas (January 1995)

Document details minimum floodplain management standards for identification of and development within sheet flooding areas in Arizona. Application of these guidelines will not be necessary if the local community or county has in effect a drainage, grading, or stormwater ordinance which, in the opinion of the Department, results in the same or greater level of flood protection as application of these guidelines would ensure.

#### **Development Standards for Sheet Flow Areas**

##### Required Development Standards

#### **Natural and Urban Sheet Flow Areas**

Habitable structures built in areas subject to natural sheet flooding shall at minimum:

- Elevate the lowest finished floors of all habitable structures. Elevation requirements are described in the *Method of Flow Analysis* section of this document.
- Use appropriate site grading practices to direct nuisance runoff away from the building pad.

#### **Distributary and Anastomosing\* Flow Areas**

Habitable structures built in areas subject to distributary and anastomosing flooding shall at minimum:

- Elevate the lowest finished floor of all structures. Elevation requirements are described in the Method of Flow Analysis section of this document.
- Protect the building foundation and related facilities from scour damage and from undercutting from erodible channel banks.
- Use appropriate site grading to direct nuisance runoff away from the building pad.

[\*Anastomosing flow is quasi-sheet flooding with slightly incised flow lines, which creates a system of interwoven channels. Anastomosing flow differs from sheet flow (greater) and distributary flow by the (lesser) degree of flow line incision.]

Recommended Development Standards

### Single Lot Development

- Chain link fences should be elevated 0.5 feet above adjacent grade (a single-strand wire may be allowed below the chain link), or be designed to collapse under hydrostatic pressure, or set back from property line.
- Fences over existing natural channels/flow paths should be elevated or configured to pass bankfull flows unobstructed. Fences that obstruct flow can trap flood debris, and cause erosion or diversion of flow.
- Solid perimeter walls should be set back from property lines to provide flow conveyance between lots, or should have the ability to pass drainage through the walls. Walls designed to pass drainage through should be designed to account for blockage of openings by vegetation and floating debris, and should be able to withstand hydrostatic pressure and scour caused by flow impingement.
- Site grading and building pad locations should allow for continuity of drainage for all recognizable flow paths.
- Homes in single lot developments should be aligned parallel to the primary flow direction.
- Manufactured housing should be anchored to prevent flotation and overturning.
- Building pads should be protected against scour damage.
- Zoning densities higher than 1 residence per acre (RAC) are not recommended in designated sheet flow areas unless drainage studies that analyze potential concentration of flow and downstream impacts are completed or regional flood control facilities are constructed.
- Significant backwater conditions may occur in sheet flow areas upstream of roadways with drainage structures that are not sized for the 100-year flood. Flood depths resulting from these backwater conditions may exceed depths indicated by local geomorphology or field conditions. Required finish floor elevations should consider the potential for backwater. Finished floors should be elevated at least to 0.5 feet above the elevation of the roadway, which creates the backwater conditions.

### Major Development

Major developments are defined as legal subdivisions with proposed densities greater than one residence per acre (RAC), or industrial/commercial developments. For major developments in sheet flow areas, the following standards are recommended:

- Development should not divert or concentrate flow on adjacent properties, unless concentrated flow is conveyed in a drainage facility or natural channel with demonstrated capacity for the base flood discharge.
- Drainage studies prepared for major developments should evaluate the hydrologic impacts to the point where the sheet flow enters a drainage facility or natural channel with demonstrated capacity for the base flood discharge.
- Major facilities should be protected from scour caused by flow concentration and from erosion of adjacent channel banks.

**2. SS5-96 State Standard for Watercourse System Sediment Balance (September 1996)**

Document contains three guidelines for identification of, and development within erosion hazard areas, watercourses with a net sediment deficit, and watercourses with a net sediment surplus. These guidelines are:

Guideline 1: Lateral Migration Setback Allowance for Riverine Floodplains in Arizona

Guideline 2: Channel Degradation Estimation for Alluvial Channels in Arizona

Guideline 3: Evaluation of River Stability Impacts Associated with Sand and Gravel Mining

Application of these guidelines will not be necessary if the local community or county has in effect a drainage, grading, or stormwater ordinance which, in the opinion of the Department, results in the same or greater level of flood protection as application of these guidelines would ensure.

**3. SS6-96 State Standard for Development of Individual Residential Lots within Floodprone Areas (May 2005)**

Document provides Site Plan Checklist and sample site plans for drainage and floodplain information. Guidelines apply to individual residential lots located in all flood hazard areas identified either by the FEMA as part of the National Flood Insurance Program or by the local Floodplain Administrator. Application of these guidelines will not be necessary if the local community or county has in effect a drainage, grading, or stormwater ordinance which, in the opinion of the Department, results in the same or greater level of flood protection as application of these guidelines would ensure.

**4. SS7-98 State Standard for Watercourse Bank Stabilization Development of Individual Residential Lots within Floodprone Areas (May 1998)**

Document provides guidelines for the development of designs for watercourse bank stabilization for fulfilling the requirements of Flood Insurance Studies, and local community and county flood damage prevention ordinances.

**B. Maricopa Association of Governments**

**1. *Desert Spaces Environmentally Sensitive Development Areas (ESDA): Policies and Design Guidelines* (June 2000)**

The Desert Spaces Plan is a regional open space plan for Maricopa County that provides policies and design guidelines to protect sensitive open spaces while allowing for growth and development. The Plan categorized public and private lands with high open space values as *Environmentally Sensitive Development Areas*. These areas were originally called

"retention areas," meaning areas to retain and protect the integrity and character of undeveloped, environmentally sensitive lands, yet provide for appropriate development. The Plan also mapped Conservation Areas, which included secured open spaces, public and private lands with outstanding open space value, and Fragile Areas, undeveloped lands that have fragile natural resources. The last two categories are recommended to be protected from development.

## **ESDA Policies**

The following policies are taken directly from the ESDA Plan. Policies which did not apply to the Rules of Development were omitted.

### Policies for Rivers and Washes for all ESDA lands

1. Discourage new development, except recreation, within 100-year floodplains, especially major drainage corridors.
2. Rehabilitate the open space system as it passes through the urban cores by revegetating riverbanks.
3. Provide access for recreation, non-motorized transportation, and maintenance and security vehicles along the edge of the corridor as defined by the limits of the 100-year floodplain.
4. Develop linear improvements such as roads and utility corridors, where appropriate, to run parallel to, not in, the regionally significant rivers and washes.
5. Design all road crossings to accommodate trails and to minimize disturbance of the natural environment.
6. Emphasize non-structural flood control techniques where feasible. Choose and foster flood control methods that retain and maintain natural flooding and riparian vegetation while minimizing damage to private property.
7. Limit impacts to riparian habitats to those required for road and utility crossings. Revegetate disturbed areas using indigenous Sonoran Desert vegetation to restore and match the existing natural characteristics and functions.
8. Conserve corridors along ephemeral washes that include the floodway, floodplain, and an appropriate upland buffer to allow a transition to urbanized areas. Limit recreational activities in conservation corridors to reduce impacts.
9. Place linear utility lines parallel to rivers and washes and use them to further buffer the transitions to urbanized areas.
10. Limit the use of flood control structures, and encourage non-structural techniques. If required, construct control structures outside the 100-year floodplain and associated upland buffer. Promote the use of flood control structures or designs that can be contoured and revegetated to simulate natural conditions and perform natural functions.
11. Properly manage and plan for extra surface storm water runoff created by additional hardscape of development.
12. Minimize on-site losses or adverse impacts to rivers and washes. Prevent off-site (downstream) loss or damage to the natural landscape character along rivers and washes.

### Sonoran Desert Vegetation Policies

1. Encourage development, such as cluster development, to preserve meaningful open space. Development that does not require mass grading of the remaining areas of upper Sonoran Desert vegetation will protect the region's "sense of place," wildlife habitat, drainage, and scenic quality.
2. Where development occurs, impacted lands should be repaired to match existing natural areas. Visually enhance areas with sparse (Lower Sonoran) vegetation by using plant species that provide contrast in color and vertical diversity.

### Agricultural Development Policies

1. Encourage grading techniques that respect the topography of the land, utilizing terracing rather than mass grading. Use areas that are not usable for building sites as open space zones.
2. Explore sharing uses, such as parking, between community facilities.

### Grading/Drainage Policies

1. Developers should produce a master grading plan that respects the natural features of a site, especially on sensitive slopes of the Sonoran Bajada and Sonoran Foothills.
2. Avoid mass grading of sensitive natural areas. Guidelines define when mass grading is appropriate, applicable, and beneficial for smaller lot developments.
3. Developers are encouraged to create roadway standards that are responsive to site grades and steeper slopes.
4. Innovative grading solutions are encouraged to minimize large retaining walls, steep landscape banks, and excessive cut and fill requirements to create buildable parcels.
5. Developers are encouraged to examine split-level products and side yard retaining walls as a way to reduce grading impacts. In addition, they are required to adhere to federal and local accessibility codes regarding maximum slope criteria.
6. Changes to drainage should be carefully integrated into a master drainage plan that recognizes existing drainage and wash patterns, discharge locations, and storm water flows.
7. Creative design for storm water harvesting and detention ponds should be considered to reduce increased storm water flows and provide the opportunity to channel storm rainwater to the Sonoran Desert plant material.
8. Integrate natural drainage into the development as an environmental amenity feature, such as trails and open spaces.

### Resource Rehabilitation Policies

Gravel pits located in natural rivers and washes should be rehabilitated to match natural conditions where appropriate.

## Land Classification Categories (LCCs)

Based on combination of vegetation and landform (see Section 5.2)

- Hillside slope is part of landform, which affects soils, hydrology, and visual sensitivity. Slope also may correlate with cultural resource types and influences recreational opportunities.
- Landform classes based on slope:
  - Valley Floor – flatter developable lands with 0 to 3% slope;
  - Bajada – gently sloping hillside lands with 3% to 6% slope;
  - Foothills – steeper hillside lands with over 6% slope.

## **Design Guidelines**

### A. For all LCCs:

#### Land Resources – Rivers & Washes

- A significant river or wash has an influence on the character of the landscape, they can be measured and rated by the size or amount of stormwater flow.
- Larger washes with greater amount of water flow generally produce significant amounts of vegetation and sustain a significant amount of wildlife within the wash corridor.
- All washes, recognized by the “waters of the U.S. designation,” are subject to the 404 permitting criteria and planning process.
- Natural wash character can be retained by protecting the sloping wash edges and vegetation, while allowing continuous, unimpeded storm water flows.
- Wash edges should be managed to avoid increased storm water runoff impact from future adjacent development areas.
- Design of wash crossings and hydrology should retain natural geomorphology of washes.

#### Development Activities – Grading & Drainage

- Site grading and drainage changes must blend into the natural landform and vegetation. Natural techniques are encouraged in place of structural or engineered techniques.
- Drainage changes should carefully integrate grading and drainage routes, especially at development edges where storm water drainage discharges into existing washes and channels. The shape of drainage channels should be natural smooth curves. Straight hard surfaced channels should be avoided. Techniques such as energy dissipater should be considered, to reduce flow rates from man-made channels or culverts to natural areas. Storm water flow rates must be reduced to help mitigate erosion of sensitive channel side slope and vegetation edges.
- Creative storm water harvesting and detention ponds should be considered, where appropriate, to reduce increased storm water flows and provide the opportunity to allow storm rainwater to enhance growth of the existing Sonoran Desert plant

material. These water-harvesting areas should be designed with a naturally graded shape to match the existing topography and provide for a higher intensity of natural plant material.

## B. LCC 1: Lower Sonoran, Valley Floor

### Rivers & Washes (LCC-1)

- Within the floodplain, channels undergo periodic surface shifting, which results in wide, braided channel systems.
- Road and utility crossings should be perpendicular or nearly perpendicular to washes.
- Roads crossing large washes should be bridged. If culverts are used, they should be appropriately sized to prevent headcutting.
- Development should occur outside of the 100-year floodplain. Flood control structures should be limited to floodwalls at the edge of developed areas. Conserved wash corridors should be wide enough to accommodate natural braiding and changes in active channel location. Larger washes should not be artificially channelized. Banks of smaller washes can be stabilized only if no other option exists, by re-contouring to no more than 3:1 native fill slopes that are revegetated with indigenous plants at natural species composition and densities.

### Grading/Drainage (LCC-1)

- Master grading plans should respect the sensitive natural features of the Lower Sonoran Desert vegetation of the Valley Floor.
- Total mass grading of large tracts of land should be prohibited, especially in areas of sensitive vegetation.
- Preserve open space along edges and streets.
- Total mass grading should be avoided across large sensitive and visually exposed areas of the Valley Floor. Site grading may be appropriate in LCC-1, in smaller lot developments, when the site is not visually exposed.
- Innovative grading solutions and terrace grading techniques are encouraged to minimize retaining walls and steep banks. Cut and fill solution should balance earth moving. The shape of new grades should be smooth, especially at development edges that need to blend into the natural topography of the gently rolling Valley Floor.
- Large turfed areas in public open spaces are discouraged, in order to minimize water consumption. However, turfed detention basins should supplement park turfed recreation and green space areas. Turf drainage spaces are not considered in lieu of recreational turf areas.

### C. LCC-2: Lower Sonoran, Bajada

Rivers & Washes, same as Valley Floor (LCC-1), except:

- Washes can be crossed by bridging, placement of appropriately sized culverts, or construction of low flow channels.
- Grading/Drainage (LCC-2)
- Discourage total mass grading of large tracts of land, especially in this LCC-2 with bajada slopes and Lower Sonoran vegetation.
- Master grading plans should respect the sensitive natural features of the Bajada topography and the sensitive Lower Sonoran Desert vegetation.
- Total mass grading should be avoided across large sensitive and visually exposed areas of the Bajada lands. Site grading may be appropriate in LCC-2, in smaller lot developments, when the site is not visually exposed.
- Innovative grading solutions are encouraged to minimize large retaining walls and steep banks. Cut and fill solutions should balance earth moving. The shape of new grades should be smooth, especially at development edges that need to blend into the natural Bajada topography and slopes. Special care should be given to protect and enhance the sensitive Lower Sonoran Desert vegetation in this topography, especially for site gradients above 5 percent.
- Developers are encouraged to propose split-level buildings, as a technique to reduce grading impacts. Grading should be done carefully to integrate the natural slope with the new grades. Drainage changes should carefully integrate grading and drainage routes, especially at development edges where storm water drainage discharges into existing washes and channels. The shape of drainage channels should be natural smooth curves, with natural materials such as rocks and boulders. Straight hard-surfaced channels should be discouraged. Techniques such as energy dissipaters should be considered, to reduce flow rates from man-made channels or culverts to natural areas. Storm water flow rates should be reduced to help mitigate erosion of sensitive channel side slopes and protect the sensitive Lower Sonoran vegetation edges along these natural Bajada lands.
- Creative storm water harvesting and small detention ponds should be considered, in appropriate areas of this LCC-2, to reduce increased storm water flows and provide the opportunity to allow storm water to enhance growth of the existing Lower Sonoran desert plant material. These water-harvesting areas should be designed with a naturally graded shape to match the existing topography and provide for a higher intensity of Lower Sonoran plant material.

### D. LCC-3 Lower Sonoran, Foothills (6%+ slopes)

Rivers & Washes, same as for LCC-2, except:

- Wash conservation corridors should include an upland buffer to appropriately buffer the corridor from adjacent development.
- Washes should be crossed only with low flow crossings to facilitate wildlife movement.
- Grading / Drainage LCC-3, same as LCC-2, except add:

- Slopes at the edge of all development should be designed with soft flowing lines, avoid straight earth berms, and side slopes should not exceed 1:5.

E. LCC-4 Upper Sonoran, Valley Floor (0-3% slopes)

Grading / Drainage: same as previous LCCs.

F. LCC-5 Upper Sonoran, Bajada (3-6% slopes)

Recommended for low density, single-family residential development.

- Single-family residential development should be limited to building envelopes or cluster developments.
- Residential projects should be limited to split level homes to minimize the impact of development on the landform as well as within the landscape.

G. LCC-6 Upper Sonoran, Foothills (6% slopes)

Same as LCC-5 Upper Sonoran, Bajada (3-6% slopes)

**2. *MAG Desert Spaces Plan, Management Approaches* (map, April 2003)**

Map shows locations of Environmentally Sensitive Development Areas ("Retention Areas"), Conservation Areas, and Secured Open Space. Layer incorporated into map products.

**C. Maricopa County**

***2020 Eye to the Future: Development Master Plan Guidelines***

Requires discussion of the proposed drainage plan, including methods and strategies for accommodating on-site and off-site drainage, locations of proposed drainage and retention areas, general directions of stormwater runoff, and statement that all development will be in accordance with the drainage and floodplain regulations for Maricopa County (page 11).

***2020 Eye to the Future: Environmental Element Report – Surface Water: Floodplains***

Contains a general description of floodplains and information about floodplains in Maricopa County.

**Maricopa County Zoning Ordinance**

Section 1113 references Floodplain Regulations of Maricopa County for zoning compliance.

## **D. Flood Control District of Maricopa County**

- 1. *Uniform Drainage Policies and Standards for Maricopa County (1987; in revision).***  
New version will reference the new drainage design manuals (volumes 1-3)

### **Policies**

- Drainage planning and design shall be based on the principle of not increasing or transferring detrimental drainage effects to other areas.
- Development and basin-wide master drainage plans shall include a full range of preventive and corrective approaches, including the following:
  - Maintaining the integrity of existing drainage patterns;
  - Establishment of selected major drainage routes, by the use of purchase, dedication, development rights, and easements;
  - Storage and attenuation of stormwater runoff; and
  - Construction of drainage works.

The combination of strategies shall balance engineering, economic, environmental, and social factors in relationship to stated comprehensive planning goals and objectives.

## **2. Floodplain Regulations for Maricopa County**

Summary of development requirements and relevant excerpts:

### **General Guidelines**

Regulations are applicable to all lands within a delineated floodplain and watercourses or contributing watersheds that have flows greater than 50 cfs during a 100-year flood event.

Uses prohibited in a floodplain are listed in Article IX. Floodway, Section 902, p. 18, and include septic systems, landfills, some types of fill materials such as junk or tires, etc., buildings, homes, buoyant storage materials, and others.

Fill material for purposes other than solid waste landfills shall not include junk, trash, tires, garbage, wood, or other buoyant materials nor hazardous, toxic, or deleterious material and shall be protected as needed against scour and erosion by riprap or other protective measures as approved by the Floodplain Administrator.

In order to control erosion and preserve the natural and beneficial functions of the floodplain, removal of vegetation shall be the minimum necessary for development.

Erosion setbacks shall meet applicable Arizona State Standards or as determined by the Floodplain Administrator.

## Article V. Administration

### Section 502. Floodplain Use Permit

- A. Floodplain Use Permit shall be obtained prior to commencing any proposed addition, alteration or change of any building, structure, land or other use within a delineated floodplain, except as exempted by applicable law and within the unincorporated county when a watercourse or contributing watershed has flows greater than 50 cfs (cubic feet per second) during a 100-year flood event unless a Drainage Clearance has been issued.

## Article IX. Floodway

Uses for which a Floodplain Use Permit may be granted are listed in the Floodplain Regulations of Maricopa County (Article IX. Floodway, Section 901. Floodplain Use Permit, p. 17). Any development, which would increase the base flood elevation or flood damage potential, is prohibited.

### Section 902. Floodway Development Standards

No structure, excavation, or fill material (including fill material for roads, dikes, and levees), deposit, obstruction, storage of material or equipment, or other uses shall be permitted which alone or in combination with existing or future uses, in the opinion of the Floodplain Administrator, would cause an increase in the base flood elevations or flood damage potential.

1. Septic systems, whether public or privately owned, shall not be located wholly or partially within a floodway.
2. In accordance with A.R.S. 49-767(B)(2), solid waste landfills or any part of such facility, whether public or privately owned, shall not be located wholly or partially within a floodway or within ½ mile of a 100-year floodplain that has 100-year flows in excess of 25,000 cfs, as determined by FEMA.
4. Structures and uses permitted within the floodway shall not include buildings and shall have a low flood damage potential, shall be located so as to minimize obstruction to flood flows with any utilities floodproofed, and shall not be designed or utilized for human habitation.
7. Sand and Gravel Extraction. (specific requirements for this use are listed in the Floodplain Regulations of Maricopa County) a, b, c, d, and g.

## Article X. Floodway Fringe

### Section 1002. Floodway Fringe Development Standards

2. In order to control erosion and preserve the natural and beneficial functions of the floodplain, removal of vegetation shall be the minimum necessary for the development.

#### 12. Sand and Gravel Extraction.

A Floodplain Use Permit for the extraction of sand and gravel or other materials within the floodway fringe shall be granted if the applicant shows that excavations will not have a cumulative adverse impact nor be of such depth, width, length, or location as to present a hazard to life or property or to the watercourse in which they are located and comply with any applicable Watercourse Master Plan adopted by the Board of Directors subject to the following conditions:

- a. Unprotected excavations shall not be permitted so close to any floodplain crossings, utility structures, or facilities as to cause or have the potential to cause an adverse effect on such crossings, utilities, or similar facilities.
- b. No stockpiling of tailings, overburden, or sand and gravel which may obstruct, divert, or retard the natural flow of tributaries to the main watercourse except as specifically approved by the Floodplain Administrator in a particular Floodplain Use Permit shall be permitted.
- c. Dikes or levees are permitted provided it can be shown by the applicant that such dikes or levees will not adversely affect structures, road or utility crossings, other public or private property, will not cause erosion or diversion of flood flows onto property outside the delineated floodplain, and will not create a danger to life or property.
- d. The plan of development shall include a plan of reclamation to leave the land when the approved use is terminated in such a condition as to maintain stability of the delineated floodplain or to an improved condition to enhance higher use of the land.
- e. A plan of development shall be submitted with an application for a Floodplain Use Permit to the Floodplain Administrator. The Floodplain Administrator will determine whether an engineered plan will be required and whether a sediment transport analysis is necessary.
- f. Any significant change, as determined by the Floodplain Administrator, in a previously approved plan of development shall require an application to amend the approved plan of development.
- g. In order to control erosion and preserve the natural and beneficial functions of the floodplain, removal of vegetation shall be the minimum necessary for development.
- h. The plan of development is subject to post-flood review and possible modification if necessary due to flood related changes in river morphology.
- i. Erosion setbacks shall meet Arizona State Standards or as approved by the Floodplain Administrator.

Article XI. Zone A Delineations

Section 1102. ZONE A Delineation Development Standards

1. Uses shall be permitted within the Zone A Delineations as set forth above, provided that the base flood elevation is not more than two (2) feet above the existing ground elevation either at the site of the proposed use or along a line perpendicular to the direction of flow between such site and the limit of the delineated floodplain.
2. In Zones AE and A, without a delineated Floodway, development shall be permitted provided that the base flood elevation is not more than two (2) feet above the existing ground elevation and provided it is demonstrated that the cumulative effect when combined with existing and anticipated development shall not increase the water surface elevation beyond the allowable one-foot rise.
12. All subdivision proposals and other proposed new developments greater than fifty (50) lots or five (5) acres, whichever is the lesser, shall include within such proposals base flood elevation data.

Article XIII. Alluvial Fan Areas

Section 1301. Development in Alluvial Fan Zone A

- 1a. Development within an Alluvial Fan High Hazard area (AFHH), Alluvial Fan Uncertain Flow Distribution Area (AFUFD), and Alluvial Fan Floodway (AAFF) shall be regulated in a manner similar to a floodway. Only major engineering measures as outlined in 44 CFR 65.13 can be used to mitigate the alluvial fan flood hazard in these areas.
- b. Development within an Alluvial Fan Zone A (AFZA) shall be regulated in a manner similar to a Zone A riverine floodplain. Development may require an engineered plan.

Section 1302. Development in Alluvial Fan Zone AO

2. The applicant shall make adequate provisions to maintain all natural and improved drainage or flood conveyance systems.

Article XIV. Other Flood Hazard Zones

Section 1402. Flood Hazard Development Standards

1. Standards adopted for development contained in a Watercourse Master Plan, ADMP, or other hydrologically oriented master plan shall be consistent with sound floodplain management practices and this Regulation.

5. The standards, provisions, criteria and requirements for development in flood hazard zones imposed by an authorized master plan shall meet or exceed the requirements of this Regulation.

**3. *The Drainage Regulation for Maricopa County (also called the Drainage Regulation for the Unincorporated Area of Maricopa County, September 26, 1988)***

Chapter 6 - General Provisions

This article sets forth the general requirements for Drainage Clearance, Drainage Report/Plan (Development), Design Parameters, and Drainage Report/Plan (Site).

Section 601. Drainage Clearance

A drainage clearance shall be required for any development or substantial improvement, which may have an adverse effect on existing drainage.

Section 602. Drainage Report/Plan (Development)

A drainage report/plan shall be required for all commercial, industrial, and multiple-family residential developments and all subdivisions. A revised drainage report may be required for any undeveloped or partially developed portions of an approved plan when no development or improvements have occurred for two or more years.

Section 603. Design Parameters

The entire drainage retention and runoff conveyance system shall be designed to eliminate or minimize stormwater runoff effects and convey the runoff through the development with minimum detrimental effects to the development or to any other property. No system shall be approved if the effect may cause an increase in the peak discharge, volume, or velocity of runoff or change the point of entry of drainage onto other property during the runoff event. No system shall be approved that does not conform to the Best Management Practice Standards in controlling erosion and reducing sediment load.

All development shall conform to the standards and criteria contained in the Drainage Design Manual.

1. Storm Frequency Criteria
2. Retention of Storm Drainage (see subheadings for requirements, p. 10)
3. Stormwater Disposal
4. Drywell Design
5. Road Design (see subheadings)
6. Finished Floor Elevation

- 7. Floodplain Development
- 8. Landscaping/Grading

Note from FCD website: Clarification of Drainage Regulations

On-site retention of all self-generated runoff from the 100-year, 2-hour rainfall event is required FOR ALL SUBDIVISIONS--REGARDLESS OF LOT SIZE, as noted in Section 603 of the Drainage Regulations. On-lot retention is permitted (but not encouraged) only if lots are greater than one acre. On-lot retention IS NOT PERMITTED for lots less than one acre.

For environmental reasons, the "first flush" of stormwater runoff must always be retained onsite. This volume must be greater than or equal to 0.5 inch of runoff. Retention of the 100-year, 2-hour rainfall automatically takes care of the "first flush" requirement.

As always, the ultimate outfall from the subdivision must discharge at the same location as during pre-development of the site. The stormwater discharge at the ultimate outfall of the subdivision must not be greater than pre-development conditions. The retention requirement does not guarantee that discharge peaks may not increase at the ultimate outfall, thus post development hydrologic analysis will be required for most subdivisions to ensure no increase in peak discharge at the ultimate outfall.

Section 604. Drainage Report/Plan (Site)

For developments including but not limited to single family residence, building additions, swimming pools within already fenced property, utility sheds, cabanas or similar structures, and similar uses within ineffective flow areas or adequately protected by upslope drainage control structures, a drainage report/plan is not required. However, in such cases, the following minimum information shall be submitted to obtain a drainage clearance:

1. A site plan of the property
2. Any supporting information, which the Drainage Administrator deems necessary to evaluate the drainage clearance
3. Finished Floor Elevation

If a drainage report/plan is required, it shall be prepared and sealed by an Arizona Registered Professional Civil Engineer.

Chapter 7 - Drainage Report/Plan

Additional Drainage Report/Plan requirements for master planned areas, residential developments, commercial and industrial developments, and hillside districts are explained in detail in Articles VII, VIII, IX, and X of the Drainage Regulations of Maricopa County.

4. **Drainage Design Manual for Maricopa County, Volume I Hydrology (also called the Hydrology Manual, November 2003), Draft; 1/1/1995 version is enforced**

This manual provides technical procedures for the estimation of flood discharges for the purpose of designing stormwater drainage facilities in Maricopa County. The manual provides criteria and design guidance for estimation of peak discharges and runoff volumes for use in identifying flood hazards and design of drainage facilities in Maricopa County. Manual does not include any agency-specific policies and standards. As this manual is still in draft form, the January 1, 1995 Hydrology Manual is still in effect until further notice.

5. **Drainage Design Manual for Maricopa County, Volume II Hydraulics (also called the Hydraulics Manual, September 2003, Draft)**

This manual provides technical criteria and hydraulic design guidance for storm drainage facilities in Maricopa County (such as street drainage, water catchments, storm drains, ditches, channels, etc.).

6. **Drainage Design Manual for Maricopa County, Volume III Erosion Control (also called the Best Management Practices and Erosion Control Manual, January 1993)**

The purpose of the Best Management Practices and Erosion Control Manual is to provide guidance to agencies, engineers, and contractors in complying with the EPA's requirements and procedures for the National Discharge Elimination System (NPDES) General Permit for stormwater discharges from construction sites (applies to all construction sites of five (5) or more acres).

| TABLE 4.1<br>EXISTING ARIZONA LAWS AND TYPICAL LOCAL ORDINANCES WITH<br>POTENTIAL APPLICATIONS AS BMPs FOR STORMWATER POLLUTION CONTROL |  |  |
|---|--|--|
| Regulation  | Activity   | Potential BMP  |
| Floodplain Management and Drainage Standards  | Control of Velocity<br>Detention/Retention<br><br>Bank Stabilization and Outlet Controls | <ul style="list-style-type: none"> <li>• Control of erosion.</li> <li>• Runoff control of sediment, pollutants, and quantity.</li> <li>• Erosion and sediment controls</li> </ul>                      |
| ADEQ and US Corps of Engineers  | 401 and 404 Permits<br>BMPs for Construction   | <ul style="list-style-type: none"> <li>• Erosion control, sediment control, long-term sediment balance, and minimize pollutants.</li> <li>• Vegetative controls to preserve riparian areas.</li> </ul> |
| Zoning Regulations  | Cluster Development<br><br>Hillside Development  | <ul style="list-style-type: none"> <li>• Minimize runoff and impervious areas.</li> <li>• Slope and erosion restriction. May include revegetation or stabilization.</li> </ul>                         |

| TABLE 4.1<br>EXISTING ARIZONA LAWS AND TYPICAL LOCAL ORDINANCES WITH<br>POTENTIAL APPLICATIONS AS BMPS FOR STORMWATER POLLUTION CONTROL |                                     |  |
|---|-------------------------------------|--|
| Regulation  | Activity                            | Potential BMP  |
|   | Landscape/Open Space                | <ul style="list-style-type: none"> <li>• Vegetative BMPs perimeter controls and reduction of runoff.</li> </ul>                              |
| Uniform Building Codes  | Chapter 70 – Excavating and Grading | <ul style="list-style-type: none"> <li>• Minimize erosion and sedimentation.</li> <li>• Standards for stable cut and fill slopes.</li> </ul> |
|   | Plumbing Code                       | <ul style="list-style-type: none"> <li>• Prevention of illicit connections</li> </ul>  |
| Fire Code   | Storage of Materials                | <ul style="list-style-type: none"> <li>• Pollutant controls. Hazardous materials.</li> </ul>   |
| Air Quality   | Dust Controls                       | <ul style="list-style-type: none"> <li>• Sediment and dust controls.</li> </ul>  |
| ADEQ-Sanitary Sewer   | Approval to Construct               | <ul style="list-style-type: none"> <li>• Control of illicit plumbing connections to sanitary and storm sewers.</li> </ul>                    |

### 6.1 Site Planning

Erosion and sediment controls are an integral part of project planning and design. Normal project planning and design includes consideration of drainage, soil, topography, and special site features such as native vegetation. Many of the federal NPDES requirements are compatible with the normal development standards and public works planning practices used in Arizona. Typical local standards in Arizona generally include:

1. Floodplain and stormwater management and drainage design:
  - Preservation of floodplains and washes.
  - Local detention and retention requirements.
  - Erosion protection and sediment transport balance.
  - Drainage design standards.
  
2. Grading standards and erosion protection:
  - Uniform Building Codes, Chapter 70.
  - Hillside development regulations.
  - Grading ordinances or grading design standards.
  - Roadway drainage standards.
  - Dust control requirements.
  
3. Land use requirements
  - Protection of native plants.
  - Buffer areas and open space requirements.
  - Landscape requirements and design manuals.

## Temporary Erosion and Sediment Controls

### 1. Limiting Exposure of Disturbed Areas

The staging and timing of construction can minimize the size of exposed areas and the length of time the areas are exposed and subject to erosion.

The grading may be staged so that only small areas are exposed to erosion at any one time, with only the areas that are actively being developed exposed. As soon as construction is complete in one area, stabilize the remaining exposed graded areas.

A key aspect of this management strategy is to retain the existing vegetation and ground cover where feasible, especially along existing washes and along the downstream perimeter of the site.

### 2. Stabilize Disturbed Areas with Vegetation, Mulch or by Other Means

Native vegetation provides the first and best line of defense against erosion and sedimentation and does so at the least cost to the contractor, while minimizing the need to revegetate or provide structural controls.

Temporary ground covers such as temporary seeding, mulch, chemical and fabric stabilizers provide quick, continuous ground cover to protect the soil from erosion until permanent vegetation can be established or permanent construction is installed.

While temporary vegetative ground cover can be a very effective method of preventing erosion, the re-establishment of vegetation in the arid regions of Arizona is not always practical. Timing of re-vegetation efforts is critical to the success of any revegetation effort. A more practical approach, especially for areas where the stabilization is temporary, may be the use of magnesium chloride or lignum sulfate. These two chemical measures do not have an adverse impact on plant life and are a low-cost stabilization treatment. Unacceptable treatments include oil treatment or sodium chloride. Ground cover of gravel, decomposed granite, wood chips, or mulch may also be used separately or with vegetation.

### 3. Slope Protection

Slope length and steepness are among the most critical factors in determining erosion potential. Increasing slope length and steepness increases the velocity of runoff, which greatly increases its erosion potential.

To prevent erosive velocities from occurring on long or steep slopes, the slopes may be terraced at regular intervals. Terraces will slow down the runoff and provide a place for small amounts of sediment to settle out. Slope benches are usually constructed with ditches along them or are back-sloped at a gentle angle toward the hill. These benches and ditches intercept runoff before it can reach an erosive velocity and divert it to a stable outlet. Slope stability for cuts and fills should conform to Uniform Building Code standards or to the soil report recommendations.

Overland flow velocities can be kept low by minimizing slope steepness and length and by providing a rough surface for runoff to cross. Driving a bulldozer up and down a slope (called trackwalking) creates tread marks parallel to the contours. These miniature terraces both slow runoff velocity and provide flat places for vegetation to hold. Raking or discing the soil surface before seeding also keeps runoff velocities down and increases plant establishment rates. Vegetation, once established, will further reduce runoff rates.

#### 4. Perimeter Controls

When vegetative cover is removed from land, the soil becomes highly susceptible to erosion. Runoff may cause erosion if allowed to cross the exposed soils, particularly when the denuded areas are on slopes. Use of perimeter controls, such as dikes or ditches, to divert upland runoff away from a disturbed area to a stable outlet is recommended. The two most common applications of these diversion devices are to intercept runoff on cut or fill slopes and to prevent runoff from entering a disturbed area, such as a group of building pads. The flow can then be taken to the downstream area of the project site and released back into the natural drainage pattern. Depending on the size of the drainage, slope, and other factors affecting erosion, the diverted water may require a spreading basin or other temporary form of energy dissipator before returning to the natural downstream drainage.

In constructing any perimeter channel or berm to divert flow, the contractor must insure that these controls do not adversely impact surrounding properties. The contractor is also reminded that these structures for sediment control are only for the average runoff. The structures are temporary and need not provide for large capacity flows.

#### 5. Sediment Trapping

Some erosion during construction is unavoidable. The function of a sediment barrier is to prevent sediment from leaving a site after the soil has been eroded from its place of origin. Sediment-laden runoff should be detained on-site so that the soil particles can settle out before the runoff enters receiving waters.

The most common sediment barriers are sediment basins and traps, straw bale dikes, and silt fences. Locate sediment basins and traps at low points below disturbed areas. Use earth dikes or swales to route drainage from disturbed areas on gentle to moderate slopes.

Storm runoff temporarily ponds up behind these barriers, which allows sediment to settle out. Gradually the water seeps out, leaving the silt behind (Reference 11).

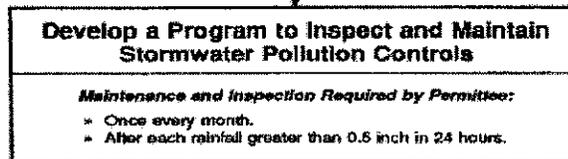
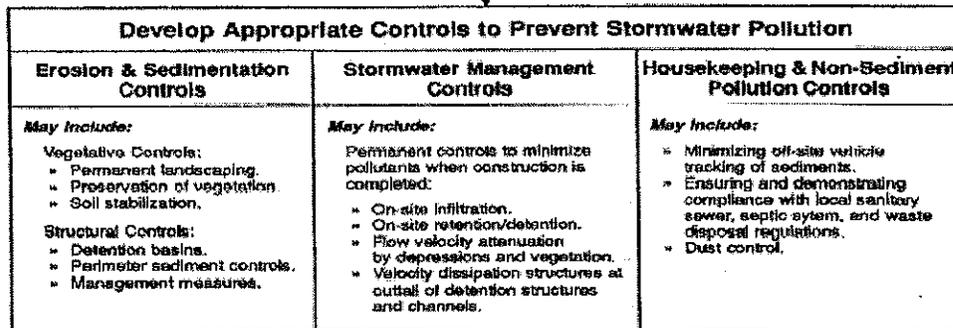
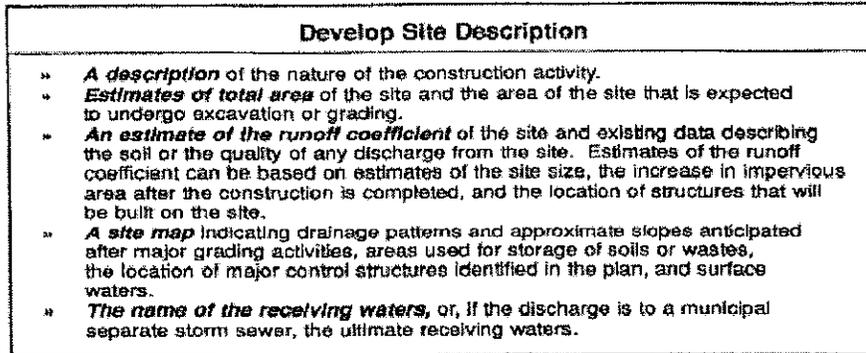


Figure 5.1  
The SWPPP Process

## **6.2 Selection Process**

The site designer should select the control tactics which are best suited to the site, then select from suggested BMPs based upon consideration of cost, material availability, topography, location, and duration of exposure. In selecting BMPs suitable for a site and developing a SWPPP, a five-step selection process may be used. A discussion of this step-by-step approach follows.

### **6.2.1 Step I: Construction Scheduling**

The first step in selecting BMPs is to compare the project schedule with on-site management measures that can limit the exposure of the project site to erosion and sedimentation. The management measures to be examined all have a similar goal, which is to minimize the amount of site subject to erosion. Consider the following strategies:

1. Sequence construction activities so that denuded areas are not exposed for long periods of time.
2. Schedule landscaping and other work that permanently stabilizes the area to be done immediately after the land has been graded to its final contour.
3. Alter the project schedule to minimize the amount of denuded areas during the wet summer months of July, August, and September and the winter months of November, December, and January.
4. Construct permanent stormwater control facilities early in the project schedule and then utilize these structures for controlling erosion and sedimentation. For example, stormwater detention basins could be built early in a large project and used as sedimentation basins during the rest of the construction period.

### **6.2.2 Step 2: Limiting Exposed Area**

The second step is to examine the site plan to determine appropriate methods for reducing the volume of stormwater which will run across the denuded areas of the project site. Limiting the exposure of graded areas to off-site runoff may involve vegetative and structural controls as well as on-site management options. To effectively determine appropriate volume control measures, the designer should review a map of the project site with sufficient topographic detail so that existing and proposed drainage patterns can be identified and existing and proposed permanent stormwater control structures located. On this map identify the following:

- Locations where stormwater enters and exits the site. Include both sheet and channel flow for the existing and final grading contours.
- Locate permanent stormwater collection, drainage and control structures.
- Identify locations subject to high rates of erosion, areas of steep slopes, and unlined channels. Long slopes over 100' in length are considered as areas of moderate to high erosion potential.

- Categorize slopes as:
  - Low Erosion Potential 05%
  - Moderate Erosion Potential 5-10%
  - High Erosion Potential Over 10%
- Identify those areas where existing vegetation will not be disturbed by construction activity, and establish clearing limits.
- Identify the boundaries between drainage basins if your site has more than one drainage outlet, and then calculate the approximate area of each drainage basin.

With this information, consider the following methods for reducing the volume of runoff affecting your construction site:

#### Runoff Volume Reduction:

1. Divert upslope water from entering the unvegetated areas of the construction site by constructing dikes and swales.
2. Divert or intercept stormwater before it reaches long and/or steep slopes. Use temporary dikes, swales, pipe slope drains.
3. Release captured stormwater at a slow and controlled rate to prevent damage to downstream drainageways and structures.

#### Vegetative Controls:

1. Increase the soil's ability to absorb moisture through vegetative means, surface roughening, and mulching.
2. Stage grading so the native vegetation provides a buffer to slow and disperse runoff.

### **6.2.3 Step 3: Runoff Velocity Reduction**

The third step involves selecting BMPs to reduce the velocity of runoff across denuded areas, steep slopes, and drainage channels. Structural practices to be considered are listed under the "Runoff Velocity Reduction" portion of Figure 6.1 (page 6-2). Appropriate applications of these BMPs should include:

1. Limit length of slopes to 50 feet. Construct mid-slope diversion (swales) on longer slopes to intercept runoff.
2. Build check dams or other energy dissipation structures in unlined drainage channels to slow runoff velocity and encourage settlement of sediments.
3. Roughen slopes to increase the absorption of rainfall and slow runoff.
4. Limit slopes to 3:1, where practical.
5. Provide for spreading of concentrated stormwater flows into overland sheet flow.

6. Intercept runoff before it reaches steep slopes using diversion dikes, swales, or other barriers.
7. Protect slopes with mulches, matting, or other types of temporary or permanent soil stabilization.
8. Provide velocity reducing structures or riprap linings at stormwater outfalls.

#### **6.2.4 Step 4: Sediment Trapping**

Once measures have been taken to limit exposure, runoff volume, and velocity, the last step in controlling erosion and sedimentation is to separate as much sediment from the stormwater as possible before the water leaves the project site.

The appropriate controls for doing this all work on the same principle in that the velocity of sediment laden runoff is slowed by temporary barriers or basins which pond the stormwater to allow sediments to settle out. Appropriate strategies for implementing sediment trapping controls include:

1. Direct sediment-laden stormwater to temporary sediment traps.
2. Direct off-site stormwater away from denuded areas and away from temporary sediment traps.
3. Construct temporary sediment traps or basins at the drainage outlet for the site. When more than one basin is required due to the size of the site, construct these basins to operate in parallel. Do not allow the discharge from one basin to enter the inlet of another basin.
4. When permanent stormwater detention basins are to be constructed, convert these basins to temporary use as a sediment trap or basin.
5. Construction sites with relatively flat slopes that produce sheet flow runoff are appropriate for temporary sediment barriers such as:
  - Silt fences
  - Straw bale barriers
  - Sand bag barriers
  - Gravel filter berms
6. Protect municipal storm drainage structures from sediment clogging by providing inlet protection for area drains and curb inlets.

#### **6.2.5 Step 5: Good Housekeeping**

The fifth step in selecting practices to control stormwater pollution deals with preventing contamination of stormwater by materials other than sediment. The BMP Matrix provides

several methods for preventing non-sediment stormwater pollution by construction materials, equipment, and wastes. Not all of these practices will apply to every construction site; the suitability of a BMP depends upon how the operator conducts his or her activities. For example, the BMP on Equipment Maintenance Procedures may or may not apply to a given project if maintenance work is done off-site. The SWPPP designer should consider all of the suggested Housekeeping Control Practices and select those which are appropriate for the project. For a particular project, the contractor may develop other BMPs which would better meet the specific site needs.

After the SWPPP designer has reviewed the five controllable factors and selected appropriate BMPs, the final stage of the process is to review the site map. All BMPs should be located with all major structural and non-structural controls, and areas of permanent or temporary stabilization shown.

The BMP fact sheets in this manual provide design, construction, inspection, and maintenance standards for temporary controls. In using these BMPs, the designer should be aware that these standards are temporary measures and are not for permanent drainage improvements.

- Flow diversions should not adversely impact off-site properties. The historic flow patterns should be maintained.
- These BMPs are for control of the average rainfall event of 0.22 to 0.66 inch in the Phoenix area.
- For permanent measures the designer is referred to the local stormwater jurisdiction for information and standards.

## 7. Drainage Clearance Permit

Three major concerns must be addressed to obtain Drainage Clearance:

- Increased runoff as a result of building and paving must be accommodated by detention or retention basins to prevent flooding downstream.
- Off-site flows must continue to enter and exit the property in the same place.
- Buildings must be floodproofed by putting the floors above the 100-year storm level.

## E. Town Of Buckeye Development Code (1996)

### Section 7-5-5 Flood Control

- "Provisions for drainage shall meet the requirements of the *Uniform Drainage Policies and Standards for Maricopa County*. Facilities shall be installed to provide for the adequate containment and disposal of surface water and to maintain any natural drainage course, on any property or parcel within or affecting the Town."
- A drainage report is to be submitted to and approved by the Town Engineer.
- "No system shall be approved if the effect may cause an increase in the peak discharge, volume or velocity of runoff or change the point of entry of drainage onto other property during the runoff event."

- Retention of Storm Drainage: "The retention system shall be designed to reduce the post-development runoff to less than or equal to the pre-development runoff. For rural developments, on-site two (2) hour one hundred (100) year retention volume may be required."
- On-site retention facilities may include natural depressions or human-made basins. Dry wells are prohibited.
- Individual lot retention shall not be permitted in residential subdivisions with a lot size of less than one-half (1/2) acre, except in conjunction with multiple family development.

#### **Section 7-6-2 Rural Subdivisions**

- Drainage: Natural drainage areas outside of designated building envelopes must be preserved. Care is to be taken when establishing the building envelope to locate outside existing drainage areas. A natural drainage area is within twenty-five (25) feet of where water collects or drains in the course of a storm event.