PIMA COUNTY
WASTEWATER RECLAMATION

2016 WASTEWATER FACILITY PLAN

August 2016

PIMA COUNTY

WASTEWATER RECLAMATION

"At RWRD we prepare for tomorrow, today!"

Jackson Jenkins, Director

PIMA COUNTY
WASTEWATER RECLAMATION

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August 24, 2016

Greetings,

The Regional Wastewater Reclamation Department of Pima County is proud to present the 2016 Wastewater Facility Plan (2016 Facility Plan), the first comprehensive plan update since 2006. This document was made possible through the commitment of RWRD's staff who provided time and resources to updating this Facility Plan over the past two years.

RWRD's ultimate goal is to serve the health and welfare of the residents of Pima County and to maintain the department's valuable assets that have been funded over the years by the citizens of Pima County.

Efficient and well-maintained wastewater treatment and conveyance systems are critical to the economic health of the region. Our department is committed to continuing its role as an industry leader in the management and sustainability of the water reclamation cycle and other renewable resources in Pima County.

In this Facility Plan, RWRD shares its vision, goals and accomplishments, and discusses potential constraints the wastewater industry will be facing in the coming years. We are hopeful that you will find this document a great source of information about your regional wastewater system.

Sincerely,

Jackson Jenkins, Director

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Agua Nueva Water Reclamation Facility.

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ABBREVIATIONS AND ACRONYMS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADOA	Arizona Department of Administration
ADWF	Average Dry Weather Flow
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
APP	Aquifer Protection Permit
APWA	American Public Works Association
ARS	Arizona Revised Statutes
ASLD	Arizona State Land Department
AWBA	Arizona Water Banking Authority
AZPDES	Arizona Pollutant Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
BMP	Best Management Practices
BNROD	Biological Nutrient Removal Oxidation Ditch
CAP	Central Arizona Project
CCTV	Closed Circuit Television
CEP	Conservation Effluent Pool
CHP	Combined heat and power
CIP	Capital Improvement Program
CIPP	Cured In Place Pipe
CMMS	Computerized Maintenance Management System
CMOM	Capacity, Management, Operation, and Maintenance
CNG	Compressed Natural Gas
COP	Certificates of Participation
CRAO	Compliance and Regulatory Affairs Office
DMAFB	Davis-Monthan Air Force Base
DMA	Designated Management Agency/Area
EPA	U.S. Environmental Protection Agency
ERP	Enforcement Response Plan
FOG	Fats, Oil and Grease
GIS	Geographical Information System
GPD	Gallons Per Day
GRD	Groundwater Replenishment District
HAMP	Houghton Area Master Plan
HCR	Houghton Road Corridor
HUD	Housing and Urban Development
IFPS	Integrated Facilities Planning System
IGA	Intergovernmental Agreements
IWC	Industrial Wastewater Control
KERP	Kino Environmental Restoration Project
LEED	Leadership in Energy and Environmental Design
MGD	Million Gallons per Day
NACWA	National Association of Clean Water Agencies
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
PACP	Pipeline Assessment Condition Program
PAG	Pima Association of Governments
PCRWRD	Pima County Regional Wastewater Reclamation Department
PDWF	Peak Dry Weather Flow
POTW	Publicly Owned Treatment Works
PPS	Pollution Prevention School
PVC	Polyvinylchloride
RAC	Residences per Acre
ROMP	Regional Optimization Master Plan
RTP	Regional Transportation Plan
SAPCO	Sustainable Action Plan for County Operations
SAWRSA	Southern Arizona Water Rights Settlement Act
SCADA	Supervisory Control and Data Acquisition
SDCP	Sonoran Desert Conservation Plan
SECAP	Sahuarita East Conceptual Area Plan
SHARP	Southeast Houghton Area Recharge Project
SSIIP	Sewer System Inspection and Inventory Project
SSO	Sanitary Sewer Overflow
SWIP	Southwest Infrastructure Plan
SWOCG	Odor Control Group
SWOCP	System-Wide Odor Control Program
TAMA	Tucson Active Management Area
TEP	Tucson Electric Power
TMDLs	Total Maximum Daily Loads
USFS	U.S. Forest Service
USGBC	United States Green Building Council
VCP	Vitrified Clay Pipe
WESC	Water and Energy Sustainability Center
WEST	(University of Arizona) Water and Energy Sustainability Technology (Center)
WIFA	Water Infrastructure Finance Authority
WISP	Water & Wastewater Infrastructure, Supply and Planning
WRF	Water Reclamation Facility/ Wastewater Reclamation Facility - The two terms have the same meaning and are used interchangeably in this document to define wastewater treatment facilities. The term 'water reclamation facility' (WRF) defines the eight PCRWRD's treatment facilities.

EXECUTIVE SUMMARY

Items being analyzed at the Pima County Regional Wastewater Reclamation Department, Water and Energy Sustainability Center.

Pima County Regional Wastewater Reclamation Department has undergone significant changes since the 2006 Metropolitan Area Facility Plan Update. The beginning of 2014 marked the end of operations for the Roger Road WRF as flows were diverted to the completed Agua Nueva WRF. Additionally, the Ina Road WRF has been expanded and renamed the Tres Rios WRF. Both the Tres Rios WRF and the Agua Nueva WRF now meet ADEQ discharge requirements for nitrogen reduction. In addition, expansion and upgrade projects incorporating Best Available Demonstrated Control Technology (BADCT) were completed at Avra Valley WRF (2007, 2009), Corona de Tucson WRF (2007), and Tres Rios WRF (2014).

The Regional Optimization Management Plan (ROMP) has served as one of the Department's primary planning documents for the past several years. ROMP construction allowed PCRWRD to meet new, more stringent ADEQ regulatory requirements for the reduction of ammonia, nitrogen and phosphorous nutrients in the effluent discharges. The new regulations were significant drivers of the major treatment process upgrades at the Tres Rios WRF and construction of a new state-of-the-art water reclamation system at the Agua Nueva WRF. Both facilities are now equipped with high-end technology that produces effluent to ADEQ standards.

Because of the ROMP program, our main treatment facilities, Agua Nueva and Tres Rios, as well as the Plant Interconnect, are equipped with the best available odor control and odor monitoring technologies. The ROMP implementation resulted in a great reduction of the long-standing odor problems affecting mostly the west side of town. With the completion of ROMP, the Department has undergone a shift from substantial treatment system improvements to upgrading the conveyance system. Future decisions remain regarding the use of biosolids and biogas, effluent and nutrient management, energy management, potential uses of the Roger Road facility, and operations at sub-regional systems, to name a few.

In spite of substantial rate increases that were necessary to fund improvements, upgrades and expansion, Pima County rates are still well within the mid-range for sewer utilities nationally. PCRWRD will strive to deliver industry-leading service without increasing its user or system fees beyond industry-median levels.

PCRWRD supports the Pima County Board of Supervisors' adopted policies for sustainability. These policies establish a far reaching series of sustainability initiatives and goals directed at enhancing the sustainability of County government operations in areas of alternative fuel vehicles, green building, renewable energy and efficiency, waste reduction, water conservation and management, and green purchasing. In regard to sustainable water conservation and management, PCRWRD plays a major role in producing effluent for regional beneficial use in aquifer replenishment and in irrigating turf, landscape and environmental restoration projects. In regard to renewable resources, PCRWRD is strengthening sustainability within its operations through a variety of projects and programs, including Biogas Sale and Utilization Project, Biosolids Land Application Program, Struvite Recovery Project, Energy Audit and Planning Program, and Solar Power Projects.

Reclaimed water is a vital, locally generated, renewable resource and a key component in Pima County's available water resources. Its usage aids in mitigating demand on potable water systems, sustaining groundwater levels and preserving green infrastructure throughout the community. It also plays a key role in environmental enhancement, such as riparian habitat restoration projects. Reclaimed water produced from the main Pima County water reclamation facilities is a drought-proof alternative water supply that generally grows along with potable water use.

There has been a noticeable drop in effluent production at the treatment facilities in the past years. The decline can be attributed to the combined effects of the economic downturn, water conservation efforts and drought management. While the PCRWRD's sub-regional facilities, Green Valley, Avra Valley and Corona de Tucson, will continue discharging all available reclaimed water and accruing long-term storage credits, the future distribution and use of the County's share of effluent produced at Tres Rios and Agua Nueva will be determined based on the County's projected needs, established policies (Board of Supervisors' Policy F 54.9) and future plans envisioned in the County's Strategic Plan for the Use of Reclaimed Water (SPUR).

To achieve long-term reliability, PCRWRD is looking at ways to diversify its biosolids products and outlets to avoid dependency on one outlet and/or contractor. Diversifying will require a significant investment by PCRWRD. Although Class A biosolids can easily be marketed to the public for application to lawns and gardens, there are no regulatory mandates requiring PCRWRD to produce Class A biosolids at this time. PCRWRD will continue monitoring regulatory changes and will explore opportunities to diversify its biosolids products to Class A status, which, in the future, could become a viable revenue stream for the Department.

A partnership between PCRWRD and the private sector was developed in order to explore beneficial use of biogas and to reduce the carbon footprint of wastewater treatment processes. The use of the private sector for the sale of biogas has also been explored. It has been determined that the private delivery approach would maximize economic gain through regional/national markets.

PCRWRD has developed a hydraulic model that provides a critical capacity assessment that is required by ADEQ for planning purposes. The model is calibrated as needed to reflect current conditions in the conveyance system tributary to the Agua Nueva and Tres Rios facilities. By using the hydraulic model results, PCRWRD is able to plan for augmentation and rehabilitation projects, giving priority to those with the highest rank of need for repair. The two most common causes of conveyance system surcharge are pipeline obstructions and insufficient pipeline capacity. Since 2008, more than 85 miles of sewer lines have been rehabilitated. PCRWRD continues to monitor the sewers identified as needing augmentation. Interceptors of particular concern include the North Rillito Interceptor and the Southeast Interceptor. There are also stretches of smaller diameter lines along Golf Links Road, Kolb Road, and 22nd Street that require attention.

Presently, the schedule for design and construction of PCRWRD's treatment capacity expansions will be determined by the increase in facility influent wastewater flows and loads. Meanwhile, future capacity expansion at the sub-regional facilities will be phase-planned depending on incremental service demand and development activities in the service areas.

Based on the existing conditions and goals set forth in this Facility Plan, the following list of recommendations reflect the Department's continued efforts in the provision of quality sewer service and renewable resources in Pima County. Therefore, RWRD will continue to:

Regulatory Requirements

- Maintain permit compliance schedules.
- Improve accessibility, timeliness and accuracy of environmental information.
- Hold periodic Intergovernmental Agreement and sewer service review meetings with all municipalities in PCRWRD's service area.
- Work on relationships with the Pascua Yaqui Tribe and the Tohono O'odham Nation to the Intergovernmental Agreement level.
- Work with other Pima County departments and local jurisdictions on concurrency, Sonoran Desert Conservation Plan goals, and the beneficial reuse of effluent.
- Maintain strong relationships with EPA, the Federal Water Quality Coalition, ADEQ and others to have a proactive role in reviewing and configuring regulations and initiatives.

Service Area Growth

- Monitor and evaluate regional growth to ensure continued level of service areas demand is met.
- Manage the County's wastewater service area, considering service area expansions when it furthers long-term social, economic, and environmental interests of the ratepayers.

Economic Development

- Invest in Pima County's future by expanding regional public sewer system to encourage expansion of major employment centers (such as Raytheon, Tucson International Airport, the University of Arizona Science and Technology Park, and World View), and relocation in the Aerospace, Defense and Technology Research and Business Park.
- Plan and schedule critical interceptor and sewer improvements to meet the industry requirements at economically critical sites, to make industrially zoned lands concept-ready for development.
- Work with the Tucson Airport Authority, ADOT, and others to provide the sewer infrastructure needed to best position Ryan Airfield as a sub-regional employer.

Sustainability and Resource Recovery

- Take a lead role in the efforts of fulfilling Pima County's sustainability goals defined in the SAPCO.
- Implement the action items set forth in the City/County 2011-2015 Action Plan for Water Sustainability.
- Integrate sustainability into daily operations and business decision-making process.
- Monitor regulatory and public perception change of current biosolids treatment and uses.
- Work on building a stronger public private partnership to maximize economic gain from biogas sale through regional and possibly national markets.
- Monitor and adopt new treatment and water reclamation technologies.
- Develop partnerships with other agencies and research institutes to leverage limited resources more efficiently.
- Collaborate on multi-jurisdictional and regional land use and water resources planning efforts focused on developing water and energy efficiencies in conveyance, treatment, and utilization of water.

Conveyance System

- Recalibrate and test the hydraulic flow model for a concurrency and a better understanding of changing conditions (population growth, climate change, potable water demand change, etc.) affecting the system capacity and operation.
- Expand the CCTV Assessment Program.
- Maintain systematic manhole repair and rehabilitation program organized by proximity to other repairs.
- Work on the development of policies and procedures for utilization of public wastewater pump stations.

Treatment System

- Monitor growth and development in sub-regional service areas in order to plan for adequate capacity expansion.
- Enhance the System-Wide Odor Control Program at the sub-regional facilities.
- Discuss with the Town of Sahuarita conceptual plans for the construction of a new regional water reclamation facility to serve the Sahuarita East Conceptual Area Plan area, Green Valley and Corona de Tucson.
- Explore different utilization options and leasing opportunities for the reuse of old Roger Road WRF site.
- Consider the construction of a new regional water reclamation facility to serve Southlands.
- Consider decommissioning of the Pima County Fairgrounds WRF upon conversion of the facility to the gravity system or a pump station.
- Consider decommissioning of the Arivaca Junction WRF upon completion of the proposed gravity sewer extension to the Green Valley WRF.
- Consider replacing the existing Mt. Lemmon WRF with a new modern facility.

Effluent Production and Use

- Collaborate with Tucson Water on groundwater recharge and replenishment projects.
- Collaborate with the Pima County Flood Control District and the Natural Resources, Parks and Recreation Department on direct delivery of reclaimed water from PCRWRD's facilities to multi-use recreational and restoration projects.
- Collaborate with other water providers and local citizen groups on recharge, reuse, and water conservation activities.
- Evaluate options to maximize and make efficient use of reclaimed water for multi-use projects, including environmental, restoration, replenishment, and reuse.
- Work closely with other Pima County agencies to identify and coordinate existing and potential new effluent utilization opportunities.
- Implement the Strategic Plan for the Use of Reclaimed Water.
- Explore innovative methodologies for reclaiming renewable resources.
- Develop regional reclaimed water policy and effluent utilization practices.
- Explore recharge credit opportunities at sub-regional facilities.

Funding

- Use Sewer Obligation Bonds and Certificates of Payment as the primary instruments to finance sewer infrastructure projects until a 'Pay as You Go Program' is established.

CERTIFICATIONS AND AWARDS

The PCRWRD is a recipient of many certifications and awards.

Since 1998, the year PCRWRD began tracking National Association of Clean Water Agencies (NACWA) awards, the Department has received 68 NACWA awards: 18 Platinum, 27 Gold, and 23 Silver Awards. The NACWA Peak Performance Awards program recognizes member agencies for excellence in wastewater treatment as measured by their compliance with the National Pollutant Discharge Elimination System (NPDES) permit limits in meeting clean water effluent discharge standards. In Arizona this permit is known as Arizona Pollutant Discharge Elimination System, or AZPDES permit. Permit requirements for wastewater agencies in Arizona are overseen by the Arizona Department of Environmental Quality (ADEQ). More than 3,000 parameters are analyzed and measured under NPDES (and AZPDES) permit each year.

There are three levels of awards within the Peak Performance Awards program: Platinum, Gold and Silver. Platinum Awards, the highest NACWA award designation, recognize 100% compliance with AZPDES per-

mits over a consecutive five-year period. Gold Awards recognize 100% compliance with AZPDES permits with no AZPDES permit violations for a one-year period. Lastly, Silver Awards are presented to facilities with no more than five permit violations over a one-year period.

In 2015, the Arizona Chapter of the American Public Works Association (APWA) selected PCRWRD's Integrated Sustainability and Resource Recovery Program for the winner of the Project of the Year Award in the category of Sustainability. The APWA award reinforces the strong leadership that was provided by PCRWRD through its Sustainability and Energy Management Office (SEMO). That office, now dissolved, addressed all aspects of sustainability in a holistic manner.

Another important award, the AZ Water Association's 2015 Wastewater Treatment Project of the Year Award, was awarded to the Tres Rios Water Reclamation Facility Capacity and Effluent Upgrade Project for outstanding engineering excellence and achievement in the categories of water system, water treatment plant, wastewater system, wastewater treatment plant, and water reuse. Lastly, the PCRWRD's ROMP program was among the top seventeen projects (out of 120 project abstracts in eight categories submitted) selected for the 2015 Environmental Excellence Award in the category of Buildings and Structures/Industrial and Public Works that demonstrated a high level of environmental commitment and contributed to the state's overall sustainability. PCRWRD's buildings and structures that were erected and reconfigured, as a result of ROMP, have significantly improved the quality of effluent being produced by PCRWRD[1]. ROMP's other environmental impacts include supporting wildlife habitat and recreating a flowing river heritage; introducing state-of-the art technology that reduces odor complaints; improving habitat for an aquatic vertebrate community; and the induction of an annual celebration known as the Living River of Words.

In 2014, PCRWRD received three Platinum and two Silver NACWA Awards. The NACWA Platinum Awards were presented to the Avra Valley, Green Valley and Mt. Lemmon facilities for their consistent record of full NPDES compliance for calendar years 2009 to 2013. The recipients of the 2014 NACWA Silver Awards were the Agua Nueva and Tres Rios facilities.

Also in 2014, the Tres Rios Water Reclamation Facility received the "Public Works Project of the Year" Award from the American Public Works Association, in the category of Public Works Projects in the Environment with a budget over $75 million. This award recognized PCRWRD, the design consultants and project contractors, as well as the award-winning aspect of the project: Tres Rios WRF's ability to high-quality effluent, a beneficial renewable water source for the community. The same year, at the AZ Water Association 87th Annual Conference, the Agua Nueva WRF was presented the AZ Water Association Wastewater Treatment Plant of the Year – Large System Award. A large system is defined as serving a population greater than 50,000. The Agua Nueva WRF serves approximately 150,000 households and businesses. The new facility was also selected for its use of state-of-the-art equipment and processes that produce high quality effluent.

The PCRWRD's new Water and Energy Sustainability Center was designed and built to meet the United States Green Building Council's (USGBC) nationally-recognized "Leadership in Energy and Environmental Design (LEED)" Silver Certification standards. This privileged designation was granted for many sustainable features and energy-saving measures incorporated into the building design. Energy-saving measures are projected to result in an approximate 38.9% reduction in annual energy costs.

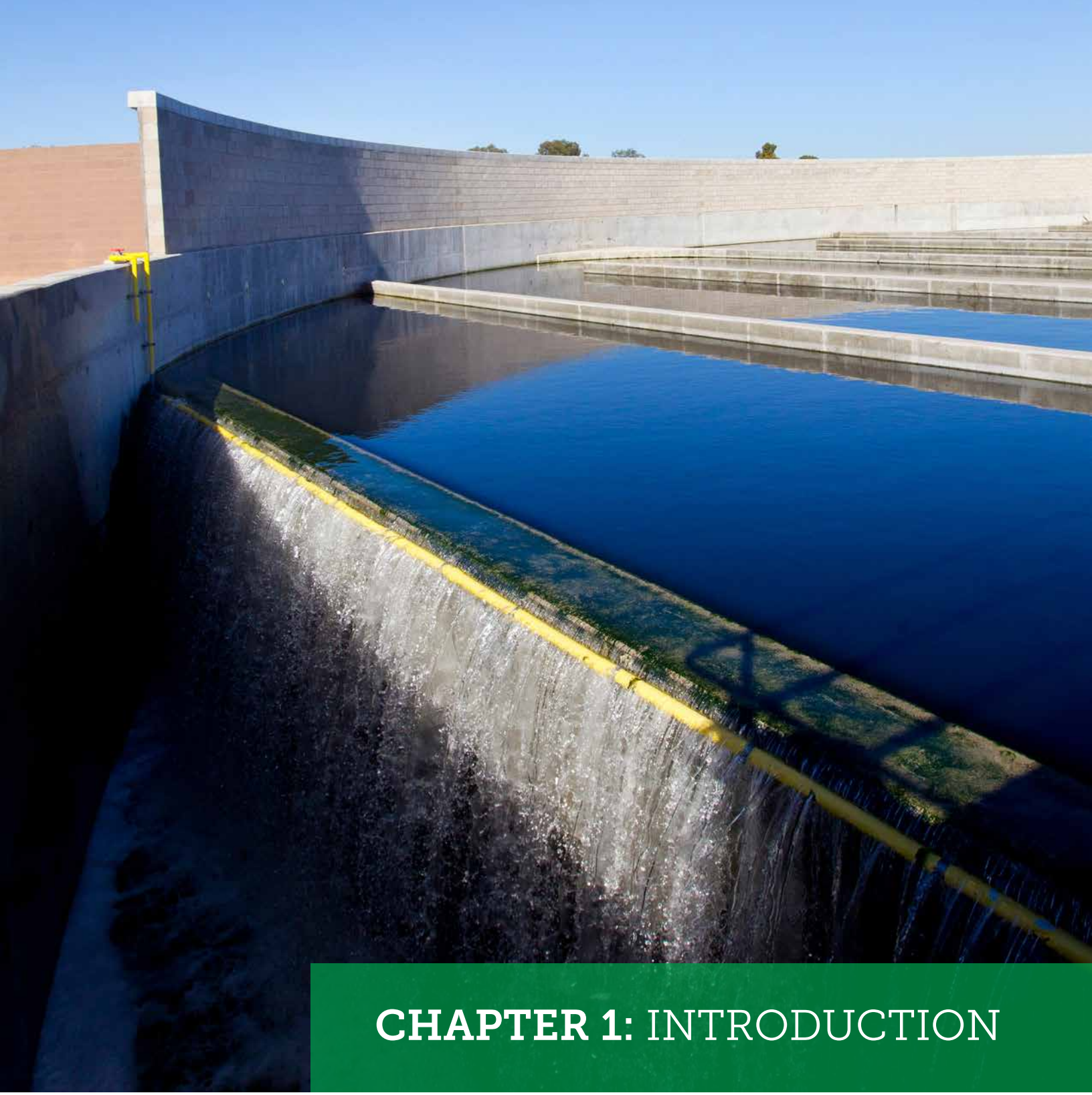
In 2008, the Conveyance Division received three management standard certifications, becoming the first public or private entity in the country to receive all three certifications. The Division now operates under these certifications from the International Organization for Standardization (ISO) and the Occupational Health and Safety Assessment Series (OHSAS) with the Business Management System of Goals and Core Values that reflect the Division's commitment to operate above and beyond their regulatory requirements and to facilitate continuous improvement in the areas of environmental management systems, quality management systems, and occupational health and safety management systems.

In September 2016, PCRWRD will receive the first Utility of the Future Today Award in honor of its exceptional performance, efficient operations, and its commitment to water quality innovation. The award comes from the Utility of the Future Today Recognition Program launched earlier 2016 by a partnership of several water sector organizations (listed below). The program celebrates the advancements made by progressive wastewater industries nationwide to provide sustainable, efficient, and innovative ideas to improve water quality.

Below are PCRWRD's certifications and awards in list format:

- National Association of Clean Water Agencies Awards (NACWA)
  - Since 1998, 21 Platinum, 27 Gold, 23 Silver.
- American Public Works Association (APWA), Arizona Chapter Awards
  - Tres Rios WRF (2014 Public Works Project of the Year Award in the category of Public Works Projects in the Environment with the budget over $75 million);
  - PCRWRD's "Integrated Sustainability and Resource Recovery Program" (2015 Project of the Year Award in the category of Sustainability);
- Arizona Water Association Awards
  - Agua Nueva WRF (2014 Wastewater Treatment Plant of the Year – Large System Award);
  - Tres Rios Water Reclamation Facility Capacity and Effluent Upgrade Project (2015 Wastewater Treatment Project of the Year Award in the categories of Water System, Water Treatment Plant, Wastewater System, Wastewater Treatment Plant, and Water Reuse);
- Arizona Forward (Association) and Salt River Project
  - ROMP (2015 Environmental Excellence Award in the category of Buildings and Structures/Industrial and Public Works).
- Leadership in Energy and Environmental Design (LEED) Sliver Certification
  - Water and Energy Sustainability Center.
- Utility of the Future Today Award (NACWA, Water Environment Federation, Water Environment Research Foundation and Water Reuse with support from EPA)
  - PCRWRD is the first time recipient of this award that recognizes national wastewater leaders in environmental technology and research and water quality innovation efforts.

[1] The EPA-funded report and project, A Living River, aims to measure, track and communicate water quality and environmental improvements in the Lower Santa Cruz River that are the result of recent major upgrades to the Agua Nueva and Tres Rios water reclamation facilities. The third Living River Report, which describes the changing conditions in the period between October 1, 2014 - September 30, 2015, tracked many significant improvements in the river conditions since the facility upgrades. The improvements include: improved water quality and clarity; improved aquatic habitat and supporting environment; improved infiltration in the river bed which has resulted in the doubling of the aquifer recharge rate; and a significant reduction in the number of reports on long-standing odors along The Loop.



CHAPTER 1: INTRODUCTION

Agua Nueva Water Reclamation Facility.

1.1 PURPOSE OF THE FACILITY PLAN

The PCRWRD's most recent update to the Facility Plan was completed in 2006, following earlier versions in 1978 and 1990. A minor update in 2010 outlined projects the department has undertaken over the past four years. Most notable among these projects was the ROMP project.

To maintain compliance with changing Federal, State and local regulations associated with wastewater discharge permits, facilities expansion plans and numerous environmental regulations, PCRWRD must periodically revisit - and if deemed necessary - update the content of its Facility Plan. When necessary, PCRWRD updates the Plan to help project its long-term capital expenditure needs. The purpose of this document is to answers questions about future system needs; to contrast future needs with forecasts from previous Facility Plan Updates; and to examine likely future changes that have the potential to affect system capacity and service operations.

This Facility Plan does not have a planning horizon because the existing estimates of how much investment will be needed over the next 20 or more years are uncertain. Factors such as population growth, water conservation and reclaimed water use, influence the amount of wastewater to be treated. These factors are uncertain and difficult to project. Wastewater projects described in this Facility Plan are near-term projects listed in the current Five-Year CIP.

1.2 FACILITY PLAN GOALS

This Facility Plan is organized to:

- Present the water reclamation system in Pima County;Forecast growth and system expansion within the Metropolitan Area and sub-regional service areas;Identify the regulatory and institutional issues that impact the collection, treatment and disposal of effluent and utilization of biosolids;
- Describe current status and proposed future of the conveyance and treatment systems; and
- Discuss PCRWRD's efforts in supporting countywide sustainability efforts.

PCRWRD's ultimate goal is to serve the health and welfare of the residents of Pima County and to maintain the department's valuable assets that have been funded over the years by the citizens of Pima County. Efficient and well-maintained wastewater treatment and conveyance systems are critical to the economic health of the region. This plan is a tool that will help the department realize the following goals:

- Provide reliable wastewater service – both near term and long term;
- Protect the public health, safety and the environment;
- Protect and improve the region's water resources;
- Provide for growth in concurrence with local land use planning strategies;
- Ensure the County has adequate authority and control to meet future wastewater needs;
- Improve the quality of effluent produced at water reclamation facilities (to meet the multiple needs of direct reuse, recharge, environmental restoration and public amenities and future water needs); and
- Collaborate with land use and water resources planners to develop water and energy efficiencies in the conveyance, treatment and reclamation of water.

This Facility Plan is designed to answer the following questions:

- **How will growth affect the system?** Growth is inevitable and creates demand for new sewer services. The amount, distribution and timing of growth within the PCRWRD service area will affect the extension of the collection system, location of new treatment facilities and improvements to existing treatment facilities. With the expansion of the Tres Rios WRF, the future capacity demands in the Tucson metropolitan area have been met for at least 15 or more years. The planning of system expansions in sub-regional service areas includes monitoring of development activities and future-planned projects that may affect system capacity in these service areas. Chapter 3 discusses the evolving growth areas that will likely require expansion of systems to serve expanding populations. Treatment capacity expansion is planned for the Green Valley WRF, the Corona de Tucson WRF and the Avra Valley WRF. In addition, a new water reclamation facility may be required to serve the southeastern portion of the county and anticipated growth in the Town of Sahuarita.
- **How will future regulatory changes impact effluent quality requirements and the operations and maintenance of the treatment and conveyance systems?** Regulatory changes, which may impact how PCRWRD water reclamation facilities operate in the near future, are primarily a result of anticipated regulations that will likely be required by the federal and state governments. Regulations and facility permits are constantly changing and evolving based on local conditions and national/regional initiatives. Changes to water quality standards, including current and emerging contaminants, and more stringent environmental regulations, are expected to evolve in the near future. Chapter 2 discusses these anticipated changes and the potential impacts on the conveyance and treatment operations of the systems.
- **How does PCRWRD contribute to countywide efforts to create a more sustainable community?** PCRWRD's goal is to minimize chemical and energy consumption in operations; maximize use of renewable water and energy; and maximize resource recovery from wastewater collection and treatment processes to benefit the environment and the community. Sustainability is an integral part of PCRWRD's business, and is one of the department's six business pillars. PCRWRD strives to be an industry leader in the management and sustainability of the water reclamation cycle and other renewable resources such as reclaimed water, biosolids, biogas and nutrients recovery. Chapter 4 provides more details on PCRWRD's sustainability efforts.
- **How can the treatment and conveyance system be continuously maintained?** PCRWRD has conducted extensive condition assessments at the major treatment facilities and throughout the conveyance system as part of asset management required by Capacity, Management, Operations and Maintenance (CMOM) Program. These evaluations identified immediate and long-term treatment expansion needs, and conveyance augmentation and rehabilitation needs in the regional sewer system. As a result, treatment capacity was expanded at the Tres Rios WRF accompanied with the construction of a new Agua Nueva WRF. Based on the condition assessment results, more than 17 miles of sewer lines were rehabilitated since 2008. In a system of 76,800 manholes, only 2,000 manholes are in need of repair.

  Extensive control measures have been taken to reduce odor issues in both the conveyance and treatment systems. The control of odors is necessary for PCRWRD to be a good neighbor to those

who work, live, play or commute near our facilities. Odor control also is important because the most prominent odor-causing gas (hydrogen sulfide) is corrosive and can damage sewer lines and treatment facility pipes, tanks and vessels.

Utilization of new technology allows for accurate and efficient collection of data and plays a critical role in the PCRWRD's asset management. Through the implementation of system-wide conveyance system augmentation and rehabilitation programs, PCRWRD is able to systematically identify and successfully complete many projects.

- **How will the growth, regulatory and rehabilitation requirements be funded?** About 93% of PCRWRD revenue is provided by ratepayers. The remaining 7% comes from development-related sources, including connection fees and capital contributions. Regular operations and maintenance (O&M) expenditures are funded through this revenue. PCRWRD's Capital Improvement Program budgets rely heavily on revenue bonding. Funding for large projects is secured through the sale of sewer revenue bonds, obligation bonds and public infrastructure loans.
- **How will future water supply imbalances change the use of and demand for reclaimed water?** State and federal water management agencies have identified future water supply and demand imbalances in the Colorado River Basin and in Arizona. These imbalances will affect the Colorado River and Lake Mead and will result in future reductions of the delivery of Colorado River water to multiple end users. Arizona will incur the largest reduction because of its junior water rights status. Consequently, Arizona water sectors are considering adaptive management strategies. Persistent drought conditions, which began in 1999, have resulted in the consideration of adaptive management strategies to address imbalances in water supply and demand. Reclaimed water is a renewable, consistent source of water. It is prominent in water planning and plays a critical role in meeting future demands; reducing or delaying development of new water supply sources; and increasing the future reliability of water delivery to municipal and industrial water providers. In Arizona, overall water use is the same as it was in 1957. This is attributable to several factors, including the development of the reclaimed water delivery infrastructure, progressive water conservation measures, and substantial water savings due to significant declines in farming.

Reclaimed water is an important water resource for each of the regional water providers in Pima County. Water providers rely increasingly on reclaimed water to augment supply and ensure future reliability. Pima County is using its share of reclaimed water to replace groundwater used at its recreational facilities, to replenish the aquifer and to provide for environmental restoration. The use of reclaimed water helps maintain other water resources.

1.3 STRUCTURE OF THE FACILITY PLAN

The main body of this Facility Plan (Plan) consists of seven chapters. Supporting studies and documents are contained in the appendices. The Plan's purpose and goals are discussed in this chapter (Chapter 1). A review of the wastewater regulatory framework and institutional drivers is summarized in Chapter 2. The service area characteristics are discussed in Chapter 3 and provide context for the Plan. Sustainability efforts, driven by public, county and department concern are covered in Chapter 4. Chapters 5 and 6 review the capacities and capabilities of the conveyance and treatment facilities, respectively, to meet expected future needs and to capitalize on possible future opportunities. Finally, Chapter 7 discusses Resources Management and PCRWRD's involvement in the production of renewable resources that have multiple beneficial uses. The main body of the Plan is followed by an in-depth, stand-alone basin analysis for sub-regional service areas.

1.4 BACKGROUND

PCRWRD operates and maintains the second largest wastewater reclamation system in Arizona. The department's service area encompasses approximately 393 square miles and includes five jurisdictions, unincorporated areas and tribal reservations in Pima County. The system's 260,000 customers are served by 500 PCRWRD employees who work primarily in the areas of planning and development, conveyance of wastewater and wastewater treatment.

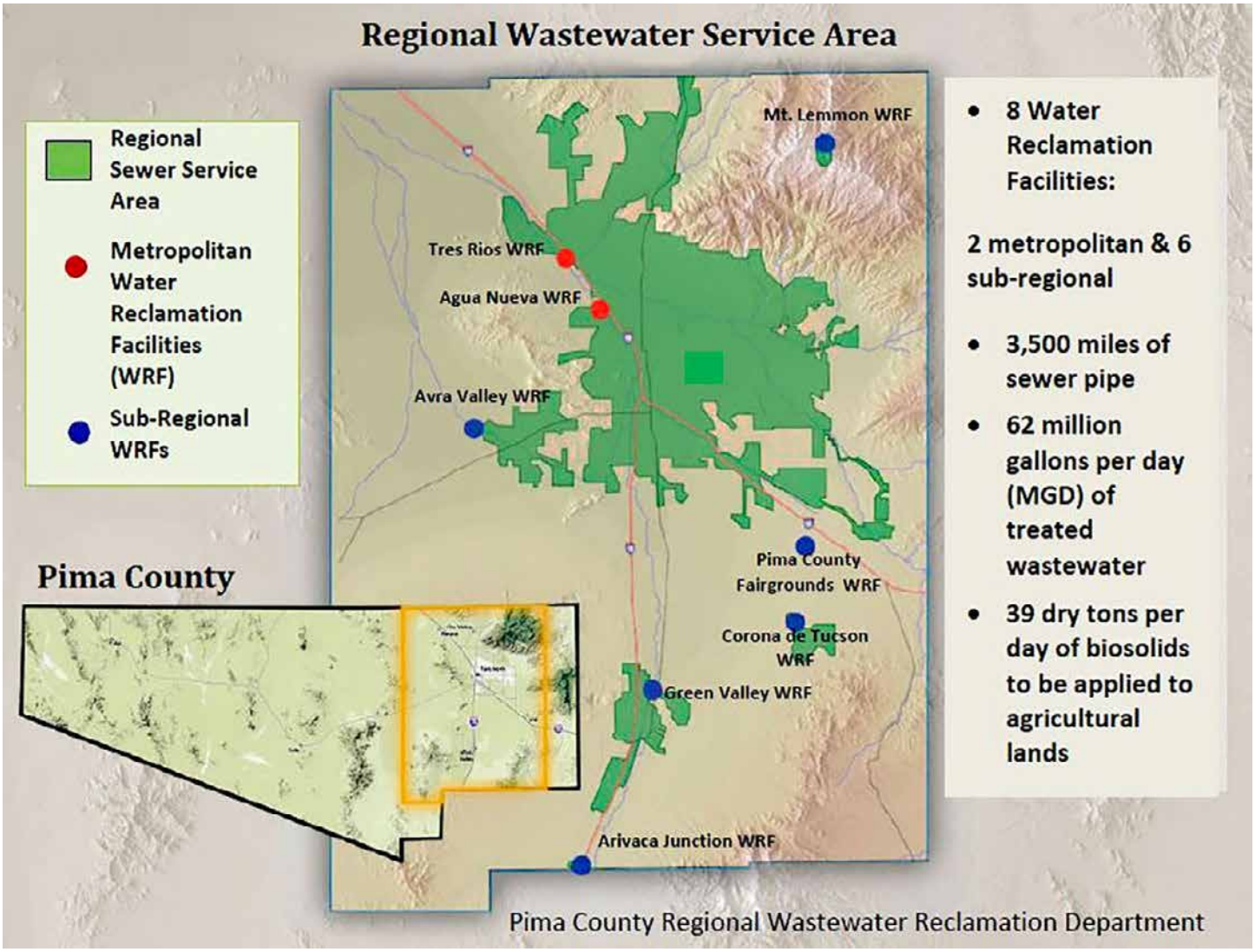
OUR MISSION

To protect the public health, safety, and environment by providing quality service, environmental stewardship and renewable resources.

With a total permitted capacity of 95 million gallons per day (MGD), PCRWRD provides 97% of Pima County's sewage treatment capacity. PCRWRD's operations consist of 3,500 miles of public sewer lines that convey 62 MGD of wastewater daily to two metropolitan facilities (the Agua Nueva WRF and the Tres Rios WRF) and six sub-regional facilities. The facilities serve the cities of Tucson and South Tucson, the towns of Marana, Oro Valley, and Sahuarita, and the unincorporated communities of Summerhaven (Mt. Lemmon), Arivaca Junction, Avra Valley, Green Valley, Corona de Tucson, and Catalina.

Pima County has completed construction of the Regional Optimization Master Plan (ROMP), which began capital improvements in FY 2008/09. Other improvements not part of the ROMP have been made to the conveyance system and other treatment facilities. The initial ROMP program budget was $720 million; however, the county completed the work for only $605 million due to favorable construction costs and diligent scope management. The federally mandated ROMP program provided upgrades and improvements at the Tres Rios WRF. The upgrades and improvements have ensured the department can meet higher quality effluent standards for discharges into the Santa Cruz River. The ROMP program also increased the facility's treatment capacity from 37.5 MGD to 50.0 MGD. This expansion guarantees that the capacity demands of the community are met for at least the next 15 years.

The 32 MGD Agua Nueva WRF produces exceptionally high-quality effluent with the potential for multiple beneficial uses. It is a key resource for meeting future water needs and the effluent produced at the Agua Nueva WRF can be used for groundwater recharge and environmental restoration projects. The ROMP was the single largest public works capital investment program ever undertaken in Pima County.



How does PCRWRD operate?

Pima County is authorized to own and operate the regional sewer system by Arizona Revised Statutes §11-264. The federal Clean Water Act, (CWA), established to protect surface waters, governs system operation by employing a variety of regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways and to help finance municipal wastewater treatment facilities. The wastewater treatment function is primarily covered under Section 208 of the CWA, which requires that a framework be established to coordinate treatment on a regional basis.

PCRWRD is the Designated Management Agency (DMA) for the County, as recognized in the Area-Wide Water Quality Management Plan (the 208 Plan). In Pima County, the Arizona Pollutant Discharge Elimination System (AZPDES) governs effluent quality for surface discharge standards and the Aquifer Protection Program (APP) governs aquifer discharge standards.

PCRWRD operates financially as an enterprise fund. Ratepayers contribute the largest portion of PCRWRD revenues (estimated 93% in FY 2014/15). A smaller portion of PCRWRD revenues comes from development-related sources including connection fees and capital contributions. Regular operations and maintenance (O&M) expenditures are funded through these revenues.

Revenues from sewer connection fees are used to pay for conveyance system expansions and increased treatment capacity needed to serve new connections to the system.

Connection fees are charged according to water meter size, the larger the water meter, the higher the connection fee. The County in July 2012 changed the method to charge sewer connection fees from a Fixture Unit Equivalent model to one based on water meter size. The change reduced the "typical" residential sewer connection fee to about $2,300.

The County uses revenue from sewer user fees to cover the expense of administration, system operation and system maintenance. In spite of substantial rate increases that were necessary to fund the ROMP, Pima County's rates are still well within the mid-range for sewer utilities nationally.

Other revenue includes fees for the review of engineering plans, inspections of physical improvements, permits and fines. Another source of income is fees charged for the discharge of septic waste at a treatment facility.

The FY 2008/09 Capital Improvement Program (CIP) budget of $121.6 million was mostly devoted to financing the ROMP program. Since then, the CIP budget has been reduced. In FY 2014/15, the CIP budge was $84.9 million, followed by an adopted capital budget in FY 2015/16 of $47.5 million. The projected FY 2018/19 CIP budget is $25.7 million.

The adopted Operations and Maintenance (O&M) budget for FY 2015/16 is $84.5 million. This budget is slightly higher than the FY 2014/15 FY budget of $83.9 million. About 39% of the O&M budget goes to employee compensation and about 58% of the budget goes to operating expenditures. Three percent is spent on capital expenditures. Operating expenses are expected to increase by two percent each year.

The Economies of Scale

It is PCRWRD's intention to continue as the regional sewer service provider and maintain low cost user and connection fees that are achieved through economies of scale. When planning for system expansion, PCRWRD communicates with other local Designated Management Agencies (the Town of Marana and the Town of Sahuarita) to ensure adequate services are provided in the areas needed. Regular communication is especially important when planning for the provision of sewer services in joint-planning areas that can be serviced by more than one Designated Management Agency.

Looking Forward

With the completion of the ROMP program, PCRWRD is poised to meet future capacity demands and regulatory requirements while producing a growing renewable water resource. Had the regulatory requirements not been met, the County would have faced steep fines and additional oversight and mandates by regulatory agencies, potentially triggering a growth moratorium. Even with the financial constraints that came with a slowdown in the economy, PCRWRD completed the ROMP on time and met all regulatory requirements. Although the sewer user rates had to be increased to finance ROMP, they are still well within the mid-range for sewer utilities nationally and in the state.

PCRWRD strives to improve its historic performance in the provision of quality services and the production of valuable renewable resources. PCRWRD continues to build trust among its stakeholders, local jurisdictions and current and future customers. To leverage limited resources more efficiently, the department develops and maintains partnerships with other agencies and research institutions. It also strives to implement economically and environmentally sound strategies that result in compliance with regulatory requirements while meeting the needs of the community. Looking ahead, PCRWRD will continue to find ways to adapt to changing circumstances and socioeconomic trends in the county, particularly in the areas of government regulations, population growth and technological innovations.

Changing the Perception of Wastewater

In recent years, the wastewater industry has changed from a treatment-only model to a resource-recovery model. Wastewater is no longer viewed as waste, but as a valuable renewable resource that can benefit the environment and the community in many ways.

Pima County's primary goal is "to maximize use of renewable water and energy resources to benefit the environment and the community." To meet this goal, PCRWRD is focused on recovering the values from wastewater through the conversion of wastes into useful resources: nutrients, biosolids and biogas. Accordingly, PCRWRD is looking for ways to generate revenues by utilizing its byproducts in an environmentally sustainable manner, while also offsetting wastewater treatment costs.

Focus on Renewable Resources

One of PCRWRD's visions is to be an industry leader in the management and sustainability of the water reclamation cycle and other renewable resources. This vision is reflected in the department's provision of high quality effluent and other valuable byproducts of treated wastewater. By improving and upgrading its treatment process, Pima County now benefits from high quality effluent that is used in many environmental projects, including habitat restoration, park irrigation, and groundwater replenishment. Biogas is another byproduct of the wastewater treatment process that will soon be available on the market. Pima County's goal is the beneficial use of 80% of its biogas by FY 2018/19. To accomplish this goal, PCRWRD has developed a system-wide master plan for the beneficial utilization of both biosolids and biogas produced from County wastewater treatment processes. The department is also looking for cost-effective and sustainable ways to treat side stream flows and recover resources from waste streams. These efforts are meant to reduce the overall carbon footprint of wastewater treatment processes. These efforts have resulted in the building of partnerships with globally recognized companies that will facilitate the production and sale of wastewater byproducts (biogas and biosolids) on a regional and possibly national scale.

OUR GOAL

PCRWRD is committed to providing planning and engineering solutions to help ensure safe, efficient and sustainable water reclamation infrastructure for our customers.

Use of high-quality effluent, or reclaimed water, is expected to increase in the coming years as the region focuses on using alternative water sources to offset demand for limited, non-renewable groundwater. To this end, PCRWRD plans to build on the success of the ROMP program by continuing to produce A+ quality effluent at its water reclamation facilities, while also staying in compliance with potential federal and state changes in effluent quality standards. The department will continue to be an industry leader by taking innovative approaches to meeting environmental regulatory objectives. Future work will enhance and maintain the rapport and professional respect PCRWRD has with key regulatory agencies.

1.5 ACCOMPLISHMENTS

PCRWRD has taken the following actions and has completed the following projects since the 2006 Facility Plan Update:

- PCRWRD developed and is using a state-of-the-art hydraulic flow model of the regional conveyance system. Through the use of this model, the department is in compliance with CMOM re-

Tres Rios Water Reclamation Facility - Water Campus, Central Laboratory.

quirements for capacity augmentation based on a once-in-ten-years 24-hour storm event. The model provides critical capacity assessment of the conveyance system for planning purposes. Further refinement and evaluation of the model is ongoing.

- PCRWRD has established the Infrastructure Survey Program for Growth and Capacity Planning (ISPGCP) project. ISPGCP project areas are defined as public conveyance structures tributary to the sub-regional WRFs of Green Valley, Avra Valley, and Corona de Tucson.
- PCRWRD uses the Pipeline Assessment and Certification Program developed by the National Association of Sewer Service Companies (NASSCO) to assess and rank the condition of the conveyance system. The assessment provides an understanding of deterioration rates in the conveyance system. The assessment and subsequent NASSCO ranking provide guidance for project prioritization, capital improvement budgets and the infrastructure planning process. PCRWRD has increased efforts to assess the condition of the conveyance system through the use of closed circuit television (CCTV) technology. CCTV technology is used to establish a baseline condition of the conveyance system. It also provides information on the size and material of pipe, structural defects, blockages, and the build-up of grit in the conveyance system.
- PCRWRD completed the ROMP, which resulted in the following projects and benefits:
  - Transfer of flow through the Plant Interconnect from the Agua Nueva WRF service area to the expanded Ina Road WRF;
  - Improvements, upgrades, and a 12.5 MGD expansion at the Ina Road WRF (renamed Tres Rios WRF)
  - Rehabilitation of the existing biosolids facility at the Tres Rios WRF;
  - Centralization of biosolids processing at the Tres Rios WRF; and,
  - Construction and operation of the Agua Nueva WRF.
- The department developed a system-wide Biosolids and Biogas Utilization Master Plan. Implementation of the plan is underway.
- The department developed a Five-Year Energy Efficiency Improvement Action Plan. Implementation of the plan is underway:
  - Conduct a comprehensive energy efficiency study of seven water reclamation facilities;
  - Increase the Use of Renewable Energy (plan implementation in process); and
  - Install solar panels at the Roger Road and Ina Road facilities (completed in 2010 and 2011).
- The System-Wide Odor Control Program (SWOCP) (established in 2008) addresses odors associated with the conveyance and treatment of wastewater, particularly in the areas surrounding the Roger Road WRF. A significant part of SWOCP consisted of odor abatement features built into the ROMP program. The new Plant Interconnect, the new Agua Nueva WRF and the upgraded Tres Rios WRF are all equipped with the best available odor control and odor monitoring technologies. The implementation of the ROMP resulted in a great reduction of the long-standing odor problems on the Westside of Tucson. PCRWRD has implemented and continues to implement odor control projects that are not part of the ROMP in areas of the system where odors are problematic.
- System-Wide Supervisory Control and Data Acquisition (SCADA) and flow meter technology are important technologies that the department uses at the Tres Rios WRF, the Agua Nueva WRF and the sub-regional facilities, as well as in the conveyance system. Staff at the Operations Control Center, located at the Tres Rios WRF, provide system-wide SCADA management around the clock.

- Through education and enforcement, PCRWRD improved its compliance with the ADEQ regulatory requirements based on CMOM standards for conveyance system operations. These efforts

1.6 FACILITIES PLANNING

What is Facilities Planning?

Public facilities protect the health, welfare and safety of the community. These facilities are planned for, developed and maintained through facilities planning. Facilities planning ensures amenities such as sewer, water, electrical power, parks, open space, and roads (to name a few) are available to community residents.

Public facilities help to define a community, so it is important that facilities planning is consistent with the desires and needs of the community. Roads, for instance, provide development opportunities on previously inaccessible land, thus guiding the development patterns of the community. In the same way that the network of roads and highways provide access and link a community, water and sewer patterns also define the patterns and location of growth. Developers actively seek land and locations where access to public facilities exist and where adequate infrastructure is readily available to serve their new developments. Developers prefer connecting to an existing system rather than assuming the financial risks involved in building new systems.

Water and sewer systems shape development in a different way than roads. As opposed to leading development into new areas, water and sewer systems generally control where development is likely to occur. Water and sewer agencies adopt policies to support community growth goals, adhere to respective regulations and policies and strive to maximize operational efficiencies and economies of scale.

Operational efficiencies include the design of systems that require minimal energy inputs and maintenance. For wastewater, this generally means using gravity. Most wastewater treatment facilities are located near the lowest elevation in a community and usually along a waterbody. This location allows the community's wastewater to flow via gravity to the treatment facility, requiring little or no additional energy such as electrical pumps. Treatment facilities are often located along waterbodies so they can efficiently discharge treated effluent into them without using additional energy. Challenges to operational efficiencies occur when development is allowed downstream of the community's treatment facility. When this happens, sewage must be pumped uphill to the existing treatment facility; or if demand is high enough, the construction of another treatment facility further downstream.

Since the 1970s, many communities across the country have looked for more cost-effective means of providing public services through a regional approach. Wastewater treatment facilities are very expensive and typically represent large investments by local ratepayers. Combining the resources of multiple jurisdictions enables the construction of cost-effective facilities that are large enough to handle present and future needs of the jurisdictions. PCRWRD took the regional approach to reach economies of scale by providing cost-effective regional service throughout eastern Pima County. The regional approach stems from the Section 208 Areawide Water Quality Management Plan. The Plan's purpose is to ensure that water quality planning measures are implemented through a regional approach. The 208 Plan emphasizes the regionalization of wastewater treatment and discourages the proliferation of small, privately owned treatment facilities. Concerns associated with potential impacts to water quality and the long-term reliability of small plants lends support to the concept of the regionalization of wastewater treatment.

1.7 PLANNING PROCESS

The wastewater planning process is driven by land use, infrastructure and resource management planning documents created and adopted by jurisdictional agencies to guide future development decisions. The department depends on several plans and documents to guide its planning processes:

- Pima County Comprehensive Plan Update – Pima Prospers[1] (Pima Prospers);
- Plan Tucson;
- Imagine Greater Tucson;
- Tucson Water Plan 2000-2050
- The Southwest Infrastructure Plan;
- System-Wide Supervisory Control and Data Acquisition; and
- The City/County Water & Wastewater Infrastructure, Supply and Planning Study.

The information about location and type of targeted growth areas identified in these documents is important to meeting future wastewater service demands.

PCRWRD's 2016 Facility Plan looks to the guiding principles included in the five main elements of the County's Pima Prospers document. The County's goals and policies are found in those five elements.

Pima Prospers includes a Policy Plan that will guide the region's growth, conservation and community design over the next 20 years. The Wastewater Treatment Element of Pima Prospers includes one goal, 10 policies and implementation measures as described below:

Goal 1: Efficiently manage and operate the County's wastewater system

Policy 1: Enhance opportunities for aquifer recharging at the water reclamation facilities to:

a) Increase our existing water supply; and
b) Diversify our regional water resources.

Policy 2: Support future sewer system expansions into regional growth areas.

Policy 3: Encourage growth in areas with or in close proximity to existing infrastructure.

Policy 4: Utilize existing rights-of-way for the placement and realignment of public sewer systems while preserving environmentally sensitive areas through a coordinated approach.

Policy 5: Continue to support development of regional economic opportunities and new development through well-planned infill sewer system capacity expansions.

Policy 6: Continue to improve operational efficiencies to reduce costs.

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[1] A long-range, 20-year comprehensive plan that sets the framework for the physical development of the County. It includes the County's vision, guiding principles, goals, policies and implementation strategies necessary to maintain and enhance Pima County's quality of life over the next decades.

Policy 7: Periodically review policies that cover costs associated with new development to ensure that growth pays for itself.

Policy 8: Continue to monitor emerging technologies in wastewater and consider new technologies that improve cost and operational efficiencies within the public sewer system.

Policy 9: Incorporate emerging technologies and alternative design and construction practices into guidelines and standards that facilitate new development.

Policy 10: Include land use planning in the evaluations and planning for sewer system expansions.

Goal 1 Implementation Measures:

a. Integrate land use planning changes into sewer system planning.
b. Establish strategies to support growth close to existing sewer infrastructure and feasible extension of infrastructure to Focused Development Investment Areas.
c. Continue to explore opportunities for aquifer recharge via water reclamation facilities.
d. Assure that sewer conveyance system extensions are undertaken with priority to Focused Development Investment areas. (Pima Prospers, Policy Volume, Physical Infrastructure Connectivity, page 4.20).

Compliance with Adopted Board Policies

As part of the PCRWRD's ongoing effort to protect the public health, public safety and the environment, a connection between the Comprehensive Plan policies and the operation of public sewer conveyance and treatment facilities can be found in the adopted Pima County Code of Ordinances (Title 7 - Environmental Quality, Chapter 7.21 Liquid Waste and Title 13 - Public Services, Division II - Sewers).

The Board of Supervisors has adopted several policies, found in the Pima County Code of Ordinances, that impact the built environment and the provision of wastewater services. Pursuant to Code of Ordinance 7.21.027.B. minimum lot size, "Single-family residential lots smaller than one acre shall be connected to a sanitary sewer system which leads to a waste treatment works other than a leach field disposal system." (Pima County, Arizona, Code of Ordinances, Title 7, Chapter 7.21-Liquid Waste, Article II. – Sewage System Construction, 7.21.027 – Minimum lot size). Additional policies require developers fund and install any extensions of the sewer system necessary to serve their developments. As a result of the expenses associated with extending and constructing elements of a sewer conveyance system, development tends to occur in a compact and radial pattern, relative to the surrounding existing development. These policies help ensure that new development in the Tucson metropolitan area occurs in a planned and organized manner. Some developers may pursue large tracks of undeveloped land because that land is inexpensive, however, in terms of wastewater conveyance and treatment, such developments are expensive and inefficient.

On May 1, 2007, the Board of Supervisors unanimously adopted Resolution No. 2007-84, which establishes a far-reaching set of sustainability initiatives, many of which set specific goals for the way Pima Country departments operate. The Sustainable Action Plan for County Operations (2014 SAPCO, Resolution No. 2014-63), adopted on June 17, 2014, is an adaptive plan responsive to new ideas, technologies, partnerships, and shifts in available resources. The desired results are: Creating a "greener," healthier built environment; increasing water and energy conservation, efficiency and independence; improving air quality and reducing greenhouse gas emissions; conserving irreplaceable natural and cultural resources; encouraging the use of eco-friendly products and services; increasing employee participation in workplace sustainability; and reducing County expenses over the long term. In complying with the County's sustainability goals, PCRWRD set priorities to (1) reduce building water consumption by at least 10 percent by fiscal year 2018/19; (2) maximize the use of renewable energy (e.g. solar and biogas) for wastewater treatment operations; (3) maintain the carbon intensity of County regional wastewater collection and treatment operations at the same level in fiscal year 2018/19 as in fiscal year 2013/14; (4) continue to invest in sustainability training and encourage employees to reduce, reuse, and recycle, maximize the use of environmentally friendly products, and create a healthy and pleasant workplace. Such activities are in compliance with the 2014 SAPCO.

As a result of the regional and collaborative water planning efforts between the City and the County, the "Water & Wastewater Infrastructure, Supply and Planning Study (WISP)" was adopted (Resolution No. 21479 (February 2010) and 2010-16 (January 2010) with the purpose of developing a regional approach toward more efficient use of water, including water conservation and the evaluation of available alternative uses for non-potable water sources. WISP is the result of a multi-year study of water and wastewater infrastructure, supply and planning issues "to assure a sustainable community water source is available, given continuing pressure on water supplies caused by population growth and the environment." The subsequent Action Plan for 2011-2015 was approved in 2010 by the City of Tucson Mayor and Council and the Pima County Board of Supervisors. The Action Plan is organized around four distinct elements: (1) Water Supply, (2) Comprehensive Integrated Planning, (3) Respect for the Environment, and (4) Water Conservation (or "Demand Management"). The improved water quality of effluent produced at the regional water reclamation facilities augments renewable water supplies, fosters increased uses of reclaimed water supplies and sustains riparian restoration.

Pima County Board of Supervisors' Policy F 54.9, Water Rights Acquisition, Protection and Management, recognizes the value of all County and Flood Control District owned, managed and acquired water resources and associated rights and credits. These resources, rights and credits must be preserved and managed for the public benefit, interest and welfare. County Policy F 54.9 states, "The County may enter into agreements to buy, sell, lease, exchange, use, improve, operate, manage and maintain County owned and acquired wastewater, effluent and reclaimed water that inure to the benefit of citizens of Pima County." In complying with this directive, PCRWRD produces treated effluent that is suitable for multiple beneficial uses to water resource planning and environmental restoration with the intent to: (1) Maximize the production and use of County reclaimed water, (2) Prioritize the beneficial use of County reclaimed water to achieve highest and best use, (3) Enable full utilization of County reclaimed water as efficiently as possible through strategic planning (Strategic Plan for Use of Reclaimed Water), and (4) Identify reclaimed water, a locally renewable water resource, as the most viable water supply to augment surface water and groundwater supplies.

CHAPTER 2: WASTEWATER UTILITY FRAMEWORK

The LEED Silver Certified Agua Nueva Water Reclamation Facility allows Pima County to meet new strict environmental standards for effluent discharges into the Santa Cruz River.

Regulatory and institutional drivers have the potential to affect PCRWRD's facility planning process and assets management efforts. Chapter 2 discusses how each driver influences facility planning activities.

2.1 REGULATORY DRIVERS

Wastewater infrastructure must comply with federal, state, and local regulatory requirements. Primary regulatory drivers include surface water, groundwater (aquifer) and reclaimed water regulations. Other regulatory drivers include biosolids and air quality.

Major regulatory drivers affecting PCRWRD facility planning activities include:

- Federal, State and local regulatory programs for water quality of surface water discharges, groundwater discharges and reuse activities (regulated by EPA, AZDEQ, and PCDEQ);
- Federal and State regulatory programs for biosolids production and utilization (regulated by EPA and AZDEQ); and
- Federal, State and local regulatory programs for air quality regulations (regulated by EPA ADEQ and PCDEQ).

Table 2-1 is a summary of major regulatory drivers and relevant permits associated with PCRWRD's treatment and collection systems.

PCRWRD tries to anticipate changes in regulations that might be issued by the EPA and ADEQ. By understanding trends in the wastewater industry and corresponding regulatory agencies, PCRWRD can prepare in advance for needed changes when new regulations are adopted.

New mandates that required improvements in the quality of effluent discharged into the Santa Cruz River prompted the planning and implementation of the ROMP program. The ROMP resulted in the upgrade and expansion of the Tres Rios WRF, the construction of the Agua Nueva WRF and the subsequent decommissioning of the old Roger Road WRF. The ROMP also provided the department the opportunity to focus on capacity planning and analysis of other major system components, including biosolids management, sub-regional facilities, conveyance systems and general treatment processes. The ROMP prompted the department to develop a roadmap to expand capacities and enhance regulatory compliance flexibility for future regulatory modifications.

Treatment system regulatory requirements include: water quality discharge standards for ammonia, nitrogen and over 126 priority pollutants; stormwater waste; biosolids utilization regulations; air quality regulations for plant generators and engines; industrial waste control; and odor control requirements.

Conveyance system regulatory requirements include: Capacity, Management, Operations, and Maintenance (CMOM) permit requirements; odor control requirements; spill reporting and remediation and design requirements.

These regulatory-program mandates, and the specific facility permits issued under these programs, affect the future regulatory requirements of the Pima County regional water reclamation system. Potential future impacts include additional nutrient removal requirements at the treatment facilities; new regulations for discharges to effluent-dependent waterways; additional CMOM regulations for the conveyance system; and more stringent biosolids regulations.

Regulatory requirements are significant drivers of Pima County's Capital Improvement Program (CIP) projects and CIP implementation schedules. More-stringent ADEQ regulatory requirements for the reduction of ammonia, nitrogen and phosphorous nutrients in effluent discharges prompted the major treatment process upgrades at the Tres Rios WRF and the construction of a new state-of-the-art water reclamation system at the Agua Nueva WRF. Both facilities are now equipped with high-end technology that produces effluent to ADEQ standards.

Similarly, the CMOM Program is a significant driver for asset management and infrastructure planning of PCRWRD's conveyance system. The CMOM program requires evaluation of infrastructure capacity both in terms of the assessment of existing infrastructure as well as planning for new infrastructure. Established by the Environmental Protection Agency in 2005, the CMOM Program is aimed at assisting agencies in managing collection systems to avoid sewer overflows. The EPA delegated primacy to the State of Arizona in 2003; therefore, it is ADEQ that oversees the department's compliance with CMOM regulations.

2.1.1 FACILITY COMPLIANCE STATUS

PCRWRD holds 41 facility operating permits that regulate the department's water reclamation facilities. The permits and programs include the Arizona Pollution Discharge Elimination System (AZPDES) for effluent quality and biosolids, the Arizona Aquifer Protection Permit Program (APP) for groundwater discharge, the Arizona Reclaimed Water Permits for the use of reclaimed water, and the Pima County Department of Environmental Quality Permits for air quality. There also are 11 septage tank pumper permits currently held by PCRWRD (**Table 2-2** and **Table 2-3**). The department ceased operations of the centrally located Randolph Park WRF [1] in 2014. The Randolph Park WRF stopped treating wastewater after construction of the Agua Nueva WRF began producing high-quality reclaimed water. While in operation, the Randolph Park WRF held an APP and reuse permit. The facility could be restarted if necessary.

[1] The facility treated wastewater from the Tucson metropolitan area en route to the Roger Road WRF/Agua Nueva WRF and had a permitted capacity of 3.0 MGD. The treatment process consisted of anoxic tanks, aeration tanks, membrane bioreactors and UV disinfection. The facility was decommissioned primarily due to high O&M costs.

Table 2-1 Regulatory Programs and Permits

Program Level	Regulatory Programs				Permits
	Treatment System Regulations			Conveyance System Regulations	Treatment & Conveyance
Federal	Water quality: surface water discharges; groundwater discharges; reuse activities (all program levels)	Biosolids production & disposal (Federal & State level);	Air Quality (all program levels)	CMOM Program regulations (Federal & State level)	
State					AZPDES* for effluent quality & L13; APP** for groundwater discharge; Arizona Reclaimed Water permits; Industrial Stormwater permit
Local					PCDEQ*** permit for air quality

*Arizona Pollution Discharge Elimination Systems
**Arizona Aquifer Protection Permit Program
***Pima County Department of Environmental Quality

Table 2-2 Facility Operating Permits Summary (March 2015)

Facility	AZPDES	APP	Reuse	Industrial Stormwater	Air Quality	Dam	Hazardous Waste	COE	ADWR Recharge	USFS	Jurisdictional Waters	Total
Arivaca Junction	NA	P100640	R105345	NA	NA	NA	NA	NA	NA	NA	NA	2
Avra Valley	AZ0024121	P100642	R105498	AZMSG-2010	ATO #3301 GP #300 & GP #301	No. 10.19	NA	NA	NA	NA	Black Wash	6
Corona de Tucson	NA	P100644	NA	AZMSG-2010	ATO #3302 GP #300	NA	NA	NA	#73-211284 71-211284	NA	NA	5
CMOM	NA	Type 2.05 GP #20061111	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
Green Valley	AZ0024937	P100629	R100629	AZMSG-2010	ATO #891 GP #300	No. 10.15	NA	NA	NA	NA	Santa Cruz River	6
Tres Rios	AZ0020001	P100630	R511460	AZMSG-2010	Class II #1903	NA	CESQG	NA	NA	NA	Santa Cruz River	6
KERP	AZ0025291	P103617	R105667	NA	NA	NA	NA	GP #27	NA	NA	Santa Cruz River	4
Mt. Lemmon	AZ0022250	Type I GP	NA	NA	NA	NA	NA	NA	NA	SAN0139	Unnamed Wash	3
Pima County Fairgrounds	NA	Type I GP	NA	NA	NA	NA	NA	NA	NA	NA	NA	1
Agua Nueva	AZ0026107	P100655	R511386	AZMSG - 2010	NA	NA	NA	NA	NA	NA	NA	5
WES Center	NA	NA	R511386	NA	#1913	NA	CESQG	NA	NA	NA	NA	1
High Plains Recharge									#71-563876		NA	1
Total	**6**	**10**	**6**	**5**	**5**	**2**	**2**	**1**	**3**	**1**		**41**

* This summary does not include construction permits.
**The WES Center and Agua Nueva operate under the same air permit. The Agua Nueva and WES center operate under the same reuse permit.

Table 2-3 Septage Tank Pumper Permits

ADEQ#	1879	1883	2222	2223	1884	1882	2228	1878	1981	2369	2398	Total = 11

Note: These are re-permitted each year in September. It is possible a number may change then.

Permitted County Water Reclamation Facilities

PCRWRD operates eight (8) permitted water reclamation facilities. The permits required for each facility are dependent on how the facility disposes of its effluent. Effluent is discharged or reused in the following ways:

- Surface Water - Requires an Arizona Pollutant Discharge Elimination System (AZPDES) permit.
- Groundwater - Requires an Aquifer Protection Permits (APP).
- Reuse - Requires a Reclaimed Water Permit (but may be used as part of an APP).

In addition to these discharge-permitting options, each facility may also need to comply with stormwater discharge, air quality and biosolids regulations.

Of the eight permitted PCRWRD facilities, six (6) hold permits to discharge treated effluent to surface waters under the jurisdiction of the Clean Water Act ("jurisdictional waters"). The facilities are the Agua Nueva WRF, the Avra Valley WRF, The Green Valley WRF, the Kino Environmental Restoration Project, the Mt. Lemmon WRF and the Tres Rios WRF. Most of these facilities have aquifer protection permits and several have permits for reuse of treated wastewater. The remaining facilities do not discharge to jurisdictional waters, but have other applicable permits (e.g., aquifer protection or reuse).

2.1.2 TREATMENT: REGULATORY REQUIREMENTS

Pima County's treated effluent can either be discharged to jurisdictional waters or be reused for different beneficial purposes, such as environmental restoration projects, irrigation of parks, or aquifer replenishment. The choice of where and how to discharge effluent determines which permits are necessary for facility operations. Each of these permits contains treatment requirements based on the final disposal or use of the water. It is important to recognize the primary driver for treatment requirements is not the permit per se, but the requirements established for the end use of the treated effluent. For example, if the treated effluent is discharged to jurisdictional waters, the treatment requirements are dependent on the uses of that waterbody. Similarly, if the treated effluent is reused, the treatment requirements depend on the type of reuse. The following is a brief discussion of the regulatory programs that ultimately dictate the treatment requirements established in each facility's discharge permit.

SURFACE WATER PROTECTION

Surface water protection mandates and activities are primary regulatory drivers that dictate treatment requirements for PCRWRD facilities. Water quality standards establish the basis for effluent quality requirements. These requirements become more stringent with time. The quality of surface waters that receive effluent discharges is regularly assessed by ADEQ. If the surface water quality is found not to meet the State standards for surface water quality, treatment requirements become more stringent. The most recent ADEQ requirements for the reduction of ammonia and nitrogen in effluent discharges drove the treatment process upgrades at the Tres Rios and Agua Nueva facilities. The following section discusses regulatory drivers for surface water protection.

Federal and State Water Quality regulations have evolved over the years. Amendments to the Water Pollution Control Act of 1948 and the 1972 Clean Water Act (and its 1987 amendment) provide the current framework for surface water quality regulations in the United States and Arizona. The objective of the Clean Water Act is to "restore and maintain the chemical, physical, and biological, integrity of the Nation's water" (Section 101(a)). The Act's Section 303 requires states to establish water quality standards for all surface waters under Clean Water Act jurisdiction. ADEQ administers this duty for Arizona.

Surface water quality standards include three components: a) designated uses, b) water quality criteria and c) an anti-degradation policy. ADEQ has established designated uses on jurisdictional waters throughout Arizona, which must be protected when treated effluent is discharged. **Table 2-4** includes PCRWRD's facilities that are permitted to discharge to jurisdictional waters and the uses that must be protected.

Water quality criteria, which include both narrative and numeric, are established to protect the designated uses. The narrative criteria generally requires all waters, regardless of the designated uses, be "free from pollutants in amounts or combinations" that could have adverse effects, such as being "toxic to humans, animals, plants, and other organisms." The numeric criteria provide protection for each of the designated uses – the numeric thresholds vary depending on the type of receptor (e.g. humans, fish or wildlife).

The anti-degradation regulatory policy defines how the State implements water quality criteria to protect designated uses, for example through establishment of a discharge permit. The policy separates waters into three tiers:

- Tier 1 applies to all surface water and provides a minimum level of protection.
- Tier 2 applies to waters in which the surface water quality standards are lower than the quality of the effluent discharged into those waters.
- Tier 3 applies to waters designated as "unique" or outstanding national resource waters in which no degradation of water quality is allowed.

ADEQ published final anti-degradation implementation procedures in April 2008. These procedures define how the anti-degradation policy is implemented in practice. Under this draft, all jurisdictional waters to which PCRWRD discharges are classified as Tier 1 waters. Accordingly, as long as the effluent discharged to these waters meets the applicable water quality standards, does not cause a violation of the standards and meets applicable Best Available Technology requirements, PCRWRD can receive a permit to discharge.

Arizona Pollutant Discharge Elimination System Permit (AZPDES)

In compliance with ARS Title 49, Chapter 2, Article 3.1, the Federal Pollution Control Act and Arizona Administrative Code (AAC) Title 18, Chapter 9, Articles 9 and 10, a facility requires an AZPDES permit to discharge treated effluent to jurisdictional waters. ADEQ mandated PCRWRD to significantly improve the quality of the effluent (total nitrogen and ammonia reduction) discharged into the Santa Cruz River. Through the implementation of the ROMP, the new Agua Nueva WRF and the upgraded Tres Rios WRF now meet the regulatory compliance requirements.

AZPDES permits also require Whole Effluent Toxicity (WET) testing to implement the narrative toxic criterion. Through the use of indicator test species, WET tests are intended to assess the cumulative or synergistic toxic effects associated with the effluent discharge. The most commonly used WET test species include: a fish, water flea, and a green algae species. WET testing assesses both short-term (acute effects) indicated by mortality endpoint and long-term (chronic effects) indicated by growth and reproduction endpoints.

Table 2-4 Facilities Discharging to Jurisdictional Waters

PCRWRD Facility - Jurisdictional Water	Protected Uses
Agua Nueva WRF – Santa Cruz River	Aquatic & Wildlife (effluent-dependent water), Partial Body Contact; Agricultural Livestock
Avra Valley WRF – Black Wash	Aquatic & Wildlife (ephemeral), Partial Body Contact
Green Valley WRF - Santa Cruz River (Tubac Bridge to Agua Nueva WRF Outfall)	Aquatic & Wildlife (ephemeral), Partial Body Contact; Agricultural Livestock
Tres Rios WRF - Santa Cruz River (Agua Nueva WRF Outfall to Baumgartner Road)	Aquatic & Wildlife (effluent-dependent water), Partial Body Contact
Kino ERP (KERP) – Santa Cruz River (Tubac Bridge to Agua Nueva WRF Outfall)	Aquatic & Wildlife (ephemeral), Partial Body Contact; Agricultural Livestock
Mt. Lemmon WRF – Unnamed Wash	Aquatic & Wildlife (ephemeral), Partial Body Contact

AZPDES permits are valid for five years. However, the permits may be amended at any time if the circumstances that formed the basis of the original permit application change. This typically results from the establishment of more stringent water quality standards. PCRWRD has six (6) facilities that hold AZPDES permits: the Tres Rios WRF, the Agua Nueva WRF, the Kino Environmental Restoration Project (KERP), the Avra Valley WRF, the Green Valley WRF, and the Mt. Lemmon WRF (Table 2-2).

WATER QUALITY ASSESSMENT

The CWA requires states to assess water quality data every two years. This requirement is used to evaluate whether the wastewater agency has met the mandated water quality standards in its jurisdictional waters. If adequate data from a waterbody shows the applicable standards have not been attained, the waterbody is found to be impaired and is placed on the state 303(d) List (Impaired Waters List). Waters which have insufficient water quality data to place them on the impaired water list, but have sufficient data to indicate a potential water quality concern, are placed on the State's Planning List. Planning List waters become the priority for additional monitoring.

Total Maximum Daily Loads (TMDLs) typically are developed for impaired waters. Through the TMDL development process, regulators evaluate the cause of non-attainment of water quality standards. The resulting TMDL establishes a plan to achieve water quality standards in the listed water – typically through activities intended to reduce pollutant loads. If a wastewater facility is discharging into an impaired waterway, the TMDL process likely will result in more stringent effluent limitations. In turn, this likely will lead to the requirement for upgrades to the treatment facility.

AQUIFER PROTECTION REGULATIONS

Arizona has established an aquifer protection permitting program for facilities that discharge pollutants to the aquifer or to land surfaces in which there is a reasonable probability that the pollutant will reach the aquifer. State regulations dictate that a wastewater treatment facility cannot cause an exceedance of the groundwater quality standards limits. These standards are generally equivalent to the Federal maximum contamination levels (MCLs) established to protect drinking water supplies. The MCLs are relatively static and only rarely change, compared to the surface water quality standards. Accordingly, more certainty exists regarding regulatory expectations for the protection of groundwater.

The completion of the regulatory-mandated ROMP resulted in the production of high-quality effluent at the Agua Nueva Water Reclamation Facility.

Aquifer Protection Permit (APP)

In compliance with Arizona Revised Statutes (ARS) §§ 49-241 - 49-252 and AAC R18-9-101 - R18-9-403, any facility that discharges a pollutant to an aquifer (groundwater), either directly or to a reasonable probability, must have an APP. Permits are issued either as individual or general permits. PCRWRD facilities generally require individual permits, which include specific treatment performance requirements for new and existing facilities. Included in these permits are a broad requirement to apply "best available demonstrated control technology."

Permit requirements for new facilities differ from requirements for existing facilities. If an existing facility is expanded or facility operations are changed, (i.e.: increased design flow, significant increase in pollutant discharge, or re-designation of point of compliance), new facility permitting requirements are applied to the modified facility. PCRWRD holds ten (10) APPs (Table 2-2).

RECLAIMED WATER REGULATIONS

An alternative to direct surface water discharge of treated effluent is to reclaim the water for reuse. Effluent that is treated and directly land applied for beneficial use, termed "direct reuse," must meet specific requirements for reclaimed water. ADEQ's classification of reclaimed water falls into three primary classes: A, B, and C. These classifications are based on treatment technologies that yield a particular effluent quality. Additional classes A+ and B+ are associated with treatment technologies that result in nitrogen concentrations of < 10 mg/L and high-quality reclaimed water. The decision to implement specific treatment technologies is based on the quality of reclaimed water required for the end use.

Reclaimed Water Permit

A reclaimed water permit is required by ADEQ for sewage treatment facilities that generate reclaimed water for direct reuse (AAC R18-9-713). Currently, all PCRWRD Reclaimed Water Permits are general permits. A Reclaimed Water Permit is not needed for effluent discharges (permitted under the AZPDES or APP programs) if that effluent is withdrawn from an aquifer or receiving water at a point downstream of the discharge location. The use of such water is not considered direct use.

There are three general permits – Type 1 permits apply to the use of gray water. Type 2 permits cover individual facilities. Type 3 permits cover various situations including reclaimed water blending facilities; permit holders who have multiple end users; and certain gray water situations where the Type 1 general permit does not apply. Most PCRWRD facilities producing water for reuse are covered under the Type 2 General Permit. Permit requirements depend on the quality of the effluent and the intended type of reuse. PCRWRD holds six (6) Reclaimed Water Permits (Table 2-2).

OTHER APPLICABLE REGULATORY PROGRAMS AND PERMIT REQUIREMENTS

There are other regulatory programs that affect treatment requirements, either at a treatment facility or associated with the wastewater conveyance system. These programs include, but

are not limited to, wastewater pretreatment, biosolids handling, stormwater management and air quality. Although cumulative regulatory requirements of these programs are significant from a management standpoint, they are not important regulatory drivers with regard to treatment facility expectations for the quality of the discharged effluent.

The following is a brief description of the permit requirements associated with the operation of PCRWRD facilities.

- **Wastewater Pretreatment –** As part of the federally-mandated Pretreatment Program, PCRWRD developed an Enforcement Response Plan that serves as a substantive policy statement, outlining penalties for violations of the Industrial Wastewater Ordinance. The program identifies and controls sources of industrial wastewater that have potential to harm the publicly owned treatment works (POTW), including the collection system, the treatment facilities, and the workers at those facilities.
  PCRWRD established the Pollution Prevention School (PPS) to educate businesses, industries and the public about pretreatment wastewater requirements. The school's success is reflected in the declining number of permit violations. For example, in 1995, the number of Notices of Violation issued for a variety of violations ranged between 25 and 30 per month. Today, this number averages between 3 and 5 per month. The very successful PPS is well recognized by a number of jurisdictional agencies.
- **Biosolids –** The biosolids program imposes requirements on the generation of biosolids as well as the entities that further treat, distribute, or use the biosolids. In Arizona, both the EPA and ADEQ have regulatory requirements for biosolids handling; however, the EPA has given ADEQ complete jurisdiction of the biosolids program for Pima County. Compliance requires that the department submit an annual report to both ADEQ and EPA.
- **Air Quality –** Carried out by the EPA, the Clean Air Act's objective, through various programs, is to control emission of air pollutants coming from sources such as chemical plants, utilities and steel mills. At a local level, Title 17, Air Quality Control of the Pima County Code, sets limits and regulations to prevent and reduce air pollution originating in Pima County. The Pima County Department of Environmental Quality (PCDEQ) issues air quality permits to industries and facilities that emit regulated pollutants to ensure that these emissions do not harm public health or cause significant deterioration in areas that presently have clean air. Permit requirements depend on how the discharging facility is classified (e.g. as a major or minor source). PCRWRD holds five (5) air quality permits, with the Tres Rios WRF being classified as a major source (Class I)(Table 2-2). In addition, PCRWRD also has two (2) permits for portable engine generators.
- **Stormwater Management –** Wastewater facilities are required to comply with Stormwater Quality Regulations for the discharge of stormwater associated with industrial activities. The program is administered under the Federal Multi-Sector General Permit (MSGP), but ADEQ has its own MSGP general permit. Meeting MSGP requirements is achieved through the filing of a Notice of Intent and the establishment of a stormwater management plan for each facility. Five (5) PCRWRD treatment facilities hold the industrial stormwater permit, in addition to the Richey Road Field Operation Facility, which also holds the industrial stormwater permit.

2.1.3 FUTURE REGULATORY IMPACTS

Regulatory constraints, which may affect how PCRWRD water reclamation facilities operate in the near future, are primarily a result of focus areas of the federal government. These issues include changes to the water quality standards for chloride, selenium, ammonia, conductivity, and emerging contaminants such as personal care product ingredients, antibiotics, and pharmaceuticals. Additionally, numeric limits for stormwater runoff at PCRWRD facilities and construction sites at those facilities may significantly alter how these facilities operate and adversely affect costs associated with control of stormwater waste streams.

IMPAIRED WATER STATUS

Twice during the last several years, EPA and ADEQ have listed the Santa Cruz River segments receiving flow from Pima County wastewater treatment facilities as "impaired." These listings were based on a very limited data set. However, PCRWRD has demonstrated a commitment to compliance with federal and state water quality standards by sampling, analyzing, and reporting the results of over 1,000 effluent discharge analyses each year. Each time the Santa Cruz River has been listed as impaired, data has demonstrated that the designation was erroneous.

To ensure water quality standards are met, ADEQ has periodically sampled and continues to sample segments of the Santa Cruz River into which our water reclamation facilities discharge on a daily basis. Pollution control projects such as the ROMP have dramatically changed the ecological state and chemical composition of this watershed in recent years. As a result, the three segments of the Santa Cruz River, once unsustainable for most aquatic species because of high ammonia concentrations, are now robust water segments teeming with aquatic life. This is the result of PCRWRD exceeding the water standards required by EPA and ADEQ.

As part of the Living River Project funded by the EPA, volunteers from Pima County, the Sonoran Institute, the U.S. Fish and Wildlife Service, the Arizona Game and Fish Department and the University of Arizona collect Santa Cruz River samples at four locations each quarter. The outcome of these efforts has demonstrated PCRWRD's commitment to the protection of the environment and public, and in particular, the Santa Cruz River. The value of this water resource has increased each year over the past decade as a result.

2.1.4 CONVEYANCE: REGULATORY REQUIREMENTS

AQUIFER PROTECTION PERMIT REGULATIONS

Capacity, Management, Operations, and Maintenance Permits (CMOM) – ADEQ established the general permit for CMOM (AAC R18-9-C305, 2.05 General Permit) within the APP program in 2005. The program accesses the sequenced improvements to the conveyance system over a 10-year period. ADEQ Compliance Enforcement actions resulting from sanitary sewer overflows (SSOs) are based on the improvements realized through the progress of the CMOM implementation and overall conveyance system improvements. Accordingly, this permit allows for the consideration of improvements to the conveyance system when ADEQ considers Compliance Enforcement actions.

One of the fundamental underlying requirements of the CMOM Program pertains to maintaining sufficient capacity to convey base

The Tres Rios Water Reclamation Facility is a 2014 national American Public Works Association award winner in the category of public works projects in the environment.

flows and peak wet weather flows resulting from a 10-year, 24-hour storm event. (A 10-year event does not necessarily happen every 10 years. A 10-year storm event can happen in any year, or even in consecutive years. However, such severe storms are likely to occur once in a decade.) Design criteria for wastewater infrastructure is based on a 10-year, 24-hour storm event. PCRWRD has operated under CMOM program requirements since 2006. To comply with the CMOM plan requirements, PCRWRD developed programs that outline how compliance is maintained. The department completed the last CMOM Plan in 2014. See Chapter 5 for more details.

OTHER REGULATIONS

Sanitary Sewer Overflows (SSO)

The CMOM Program seeks to reduce the occurrence of sanitary sewer overflows (SSOs) and improve compliance with the ADEQ regulatory requirements for the wastewater conveyance system operations. To reduce the occurrence of SSOs, PCRWRD established a flow monitoring system consisting of permanent and temporary meters. Data on depth and velocity of flow is collected at 37 permanent flow-monitoring sites, with the majority of these sites located in the area's tributary to the Agua Nueva and Tres Rios WRFs. All sanitary sewer overflows are reported as Clean Water Act exceedances.

Odor Control

ADEQ modified the APP regulations to include a section on odor control for major modifications of existing and for new wastewater facilities. This rule states "The owner or operator of a sewage treatment facility shall not operate the facility so that it emits an offensive odor on a persistent basis beyond the setback distances specified in subsection (I)." (AAC R18-9-B201.J). A wastewater facility that is undertaking a major modification must meet certain setback requirements as a way to protect neighboring properties from odor emission. At the time of publication, there was no measurable criterion specified for the enforcement of this rule.

PCRWRD developed the System-Wide Odor Control Capital Program (SWOCP) to address potential future conveyance and treatment odor control issues. This effort marked the beginning of an aggressive effort to address odor problems associated with sewer collection and treatment processing. During the first years of the SWOCP, odor control improvements were ranked and prioritized by each project's potential to provide rapid and substantial improvement in odor control and its cost effectiveness. Associated with this effort was the odor abatement plan set forth by the 2007 ROMP. Previous department efforts to control odors resulted in the investment of over $7 million at the Roger Road WRF to provide interim odor control at the facility during the multi-year planning and construction phases of the ROMP. Today, the Tres Rios WRF and the

Tres Rios Water Reclamation Facility.

Agua Nueva WRF are equipped with state-of-the-art odor control technology and monitoring systems. Additional control measures have been taken to correct odor problems at sub-regional facilities, in some force mains and in some pump station systems.

Stormwater Quality Regulations

Wastewater facilities are required to comply with Stormwater Quality Regulations for discharge of stormwater associated with industrial activities. The program is administered under the Federal Multi-Sector General Permit (MSGP), but ADEQ has its own MSGP general permit. The MSGP is self-implementing through the filing of a Notice of Intent and establishment of a stormwater management plan for each facility. ("Self-implementing" means the agency that holds the permit is responsible for carrying out all the necessary actions to comply with the requirements and prove it has complied through a specified documentation process.)

2.1.5 MAJOR PROJECTS AND PROGRAMS

PCRWRD is strengthening regulatory compliance through a variety of projects and programs including the following:

Biological Nutrient Removal at Tres Rios WRF – PCRWRD is designing a full-scale trihalomethanes (THM) mitigation pilot for large-scale operations. This pilot will use a portion of the high strength ammonia-laden centrate to create chloramine and thereby minimize THM formation. An official report on the pilot project to test the use of THM-formation prevention was nearing completion at the time of publication. Following the release of the report, a scope of work will be developed for a project to be implemented at the Tres Rios WRF.

Nutrient (Struvite) Recovery Project – PCRWRD is working toward side stream treatment of digested sludge centrate. This treatment will allow the department to improve treatment facility operations and to retrieve struvite and other nutrients for beneficial reuse. The struvite recovery process will provide significant cost reductions in operation and maintenance. These reductions will be realized through the reduction in Ferric Chloride dosing, the removal of struvite deposits from pipes and the reduction of nutrients load to the wastewater treatment processes. In addition, the recovered struvite will be marketed as a commercial fertilizer.

Disinfection Enhancement at Corona de Tucson WRF – As a result of discussions with ADEQ, the Compliance and Regulatory Affairs Office (CRAO) developed a scope of work to provide disinfection using a precast chlorine contact basin at the Corona de Tucson WRF. This sampling method provides more reliable and accurate readings. A hydrostatic tank was repurposed from the decommissioned Roger Road WRF and incorporated into the service water system at the Corona de Tucson WRF.

Total Residual Chlorine (TRC) – To address the detection limit challenges associated with TRC, PCRWRD worked with the Western Coalition of Arid States to develop a strategy that allows for the monitoring of sulfite, a component in the dechlorinating agent. The sulfite monitoring would be done in lieu of TRC monitoring. Stoi-

chiometry dictates that if sulfite exists in solution, then all of the residual chlorine is effectively neutralized. As a result, maintaining a residual concentration of sulfite demonstrates full compliance with the residual chlorine permit limit. With ADEQ's concurrence, a study period has been incorporated into the Agua Nueva WRF's AZPDES permit with projected completion in FY 2016/17

Water Quality Research – To better understand the impacts of improved water quality on infiltration rates and other environmental changes in the wetland/riparian areas of the Santa Cruz River, PCRWRD is partnering with the Pima County Regional Flood Control District and the Pima County Office of Sustainability and Conservation on the Living River Project. This project is funded through an EPA grant.

Recharge and Groundwater Storage at Sub-Regional WRFs – In an effort to maximize recharge and groundwater storage, PCRWRD is looking to recharge reclaimed water from sub-regional facilities, where possible. Corona de Tucson, the only sub-regional WRF with a groundwater storage permit, has served as a proving ground, enabling the department to enhance operational efficiency and increase recharge credits. PCRWRD is looking to build on this success and secure permits for the Avra Valley and Green Valley WRFs.

Avra Valley WRF – As part of the latest treatment capacity expansion at the facility, the percolation basins were emptied, excavated deeper and reconfigured to maximize future recharge infiltration. The facility has been receiving recharge credits since its Underground Storage Facility (USF) permit became effective on September 14, 2015. With a potential recharge capacity of up to 4,480 acre feet annually, these credits add to the County's long-term storage account at the Arizona Department of Water Resources. This stored water can be recovered throughout the Tucson Active Management Area and be used to offset groundwater pumping. Credits also can be sold or exchanged for property, easements or anything else of value.

Green Valley WRF – This facility operates a biological nutrient removal process and an older aerated lagoon system. Water discharged from the Green Valley WRF is recharged off site. Robson Creek Ranch accrued 1,280 acre feet of recharge credits in 2013 from the County's delivery of effluent to its recharge basins. A groundwater storage permit will be sought in the future for storage of up to 3,500 acre feet a year (actual storage capacity is yet to be determined).

Cortaro Marana Irrigation District (CMID) Groundwater Savings Facility – CMID has obtained a facility permit for a Groundwater Savings Facility (GSF) and is partnering with the Metro Water District and the Bureau of Reclamation for delivery of effluent to agricultural operations. The use of effluent in agriculture saves groundwater. Effluent for this purpose will be delivered from the Tres Rios WRF. The County may opt in to accrue long-term storage credits for delivered effluent.

SHARP Constructed Recharge Project – In 2011, Pima County and the City of Tucson entered into an intergovernmental agreement for a joint-constructed recharge project known as the Southeast Houghton Area Recharge Project (SHARP). The project was mutually agreed upon in a settlement for the 2002 Speedway sinkhole event. A joint Recharge Oversight Committee (JROC) was formed with city and county administrative and technical staff who supervise and review the project activities. Pima County would have the option to use this facility for recharging the balance of its metropolitan reclaimed water or lease its storage capacity to other water managers. However, PCRWRD is considering to withdraw from participating in the SHARP project due to other priorities for the use of our water resources.

Evaluation of Conditions at the Mt. Lemmon WRF – The Mt. Lemmon WRF is a small facility that operates under a general permit, serving a small population of users in the Summerhaven community. The following options will be evaluated upon completion of a facility condition assessment: 1) major rehabilitation, expansion or replacement of the facility or 2) close down the facility and haul all sewage off the mountain, conveying it to the Tres Rios WRF via existing gravity sewer.

2.1.6 OPPORTUNITIES

In addition to the opportunities that became available with the completion of the Water and Energy Sustainability Center ("Water Campus"), PCRWRD will continue to explore other opportunities to address potential challenges imposed by new regulatory requirements, specifically water quality requirements. The following is a short description of each opportunity and major projects and programs as presented in the Compliance Pillar of PCRWRD's Strategic Plan.

Disinfection Enhancements – Disinfection is the most critical step in the treatment process for ensuring protection of the public health. This process also presents the greatest challenge for maintaining compliance, especially when chlorination is the method of disinfection. Chlorination requires careful management due to daily sampling requirements. In addition, numerous chemical interactions and daily monitoring of disinfection parameters (E. coli and fecal coliforms) require keen attention. PCRWRD also must keep surface water discharges free of chlorinating agents, maintain adequate dissolved oxygen levels and prevent excessive formation of disinfection by-products such as Thrihalomethane (THM).

Fairgrounds WRF – The Fairgrounds WRF is a small, 20,000 gallons per day (on a monthly basis average), evaporative/percolation lagoon facility that operates under a general permit. Upgrades to this facility are problematic since any improvements would necessitate an expensive nutrient removal process. Additionally, the sporadic nature of flows makes biological treatment difficult, if not altogether impossible. A potential solution would be to divert flows from the Fairgrounds WRF to a nearby interceptor or to the Corona de Tucson WRF (see Chapter 6).

Corona de Tucson WRF – Despite producing high-quality denitrified water, the Corona de Tucson WRF does not have an engineered disinfection system. Instead, it relies on soil aquifer treatment. Unfortunately, this method can result in false exceedances and is prone to interferences caused by inclement weather. For these reasons, the department has plans to install a more traditional disinfection process.

Industrial Wastewater Control Program – Each year, the Industrial Wastewater Control (IWC) program employees take more than 1,000 samples at a variety of businesses and organizations in Pima County. The sampling serves to ensure discharges into the sanitary sewer system are in compliance with Pima County's pre-

treatment ordinance. Sampling also determines if the organizations are meeting monitoring and environmental permit requirements. PCRWRD conducted compliance inspections at over 700 permitted and non-permitted facilities last year. IWC issues 30-50 Notices of Violations (NOVs) each year to area businesses. There are opportunities for the department to work more closely with commercial and industrial users to reduce the number of NOVs issued annually.

Research and Education Partnerships – With the completion of the Water and Energy Sustainability Center expansion, the University of Arizona (UA) will provide staff and students from the Agricultural and Life Sciences Department and the Engineering Department to conduct research on the next generation of treatment technology. This is an opportunity to prepare for the anticipated new regulatory requirements for such things as emerging contaminants and other predicted changes to federal and state regulations. Additionally, there also is an opportunity to partner with the City of Tucson, the UA and CH2M Hill to study advanced oxidation treatment for direct potable reuse.

2.2 INSTITUTIONAL DRIVERS

PCRWRD operates within the institutional framework established by Pima Association of Governments (PAG) by way of the Designated Management Agency (DMA) designation and 208 Plans. It also operates under state legislation that provides for bonding authorization and IGAs with local jurisdictions. This section identifies the institutional and legal framework PCRWRD operates in, ranging from the Clean Water Act to Intergovernmental Agreements.

Clean Water Act (CWA) [33 U.S.C. §1251 et.seq.] – The objective of the CWA is to restore and maintain the chemical, physical and biological integrity of the Nation's waters. Pursuant to this objective, Congress declared a national policy that area-wide wastewater treatment management planning processes be developed and implemented to ensure adequate control of sources of pollutants in each State.

REGIONAL WATER QUALITY PLANNING – THE 208 PLAN PROCESS

In implementing the Clean Water Act in 1975, the Governor of Arizona designated the *Pima Association of Governments (PAG)* as the regional water quality planning agency for all of Pima County (excluding tribal lands). As a result, PAG is responsible for administering area-wide wastewater treatment planning objectives outlined in the Clean Water Act [Section 208] in Pima County. Through PAG, local, State and tribal governments coordinate transportation, environmental quality and population growth planning efforts.

PAG also is responsible for preparing and implementing Areawide Water Quality Plans, commonly referred to as "208 Plans." The implementation and development of the 208 Plan ensures a ***regional approach*** for water quality planning. Except for tribal lands, it applies to all of Pima County and provides unified policy and management direction for control and utilization of wastewater throughout the county. Through the 208 planning process, local jurisdictions, the business community, various industries, environmental groups, public interest groups and the general public have an opportunity to participate in regional planning for water quality protection.

Planning for the treatment of municipal wastewater is a key part of 208 planning. Another key element is the identification of the existing wastewater treatment facilities in Pima County, as well as any facilities that have been proposed as part of approved plans. The 208 Plan emphasizes the regionalization of wastewater treatment and discourages the proliferation of small, privately owned treatment facilities. Concerns about potential impacts to water quality and long-term reliability of small plants, lend support to the concept of regionalization of wastewater treatment. It is 208 Plan policy to treat all wastewater in regional facilities, except for remote areas or areas where it can be clearly demonstrated that a small plant is environmentally and economically preferable to regional treatment and serves the public good.

REGIONAL WATER QUALITY MANAGEMENT – THE DESIGNATED MANAGEMENT AGENCY

PCRWRD is the wastewater management agency for most of eastern Pima County. PAG works closely with PCRWRD and ADEQ to ensure implementation of the 208 Plan in Pima County. The fact that PCRWRD has been designated as the wastewater management agency authority under the Area Wide 208 Plan is due in part to the 1979 Merger of the City and Pima County wastewater systems. In the State of Arizona, towns, municipalities and improvements districts generally perform wastewater treatment management. Pima County's authority to construct and operate a regional sewage system is derived from A.R.S. § 11-264:

> *"Any county with a population between one million and two million persons may purchase, construct or operate a sewage system, including the collection, transportation, pumping, treatment and disposal of sewage, and charge fees and levy taxes therefor, if the county secures the assent by resolution of the governing bodies of those incorporated cities and towns representing not less than one-half of the population of the county before purchase, construction or operation of a sewage system. Once an initial assent is given no further assent is necessary to operate or improve the system."*

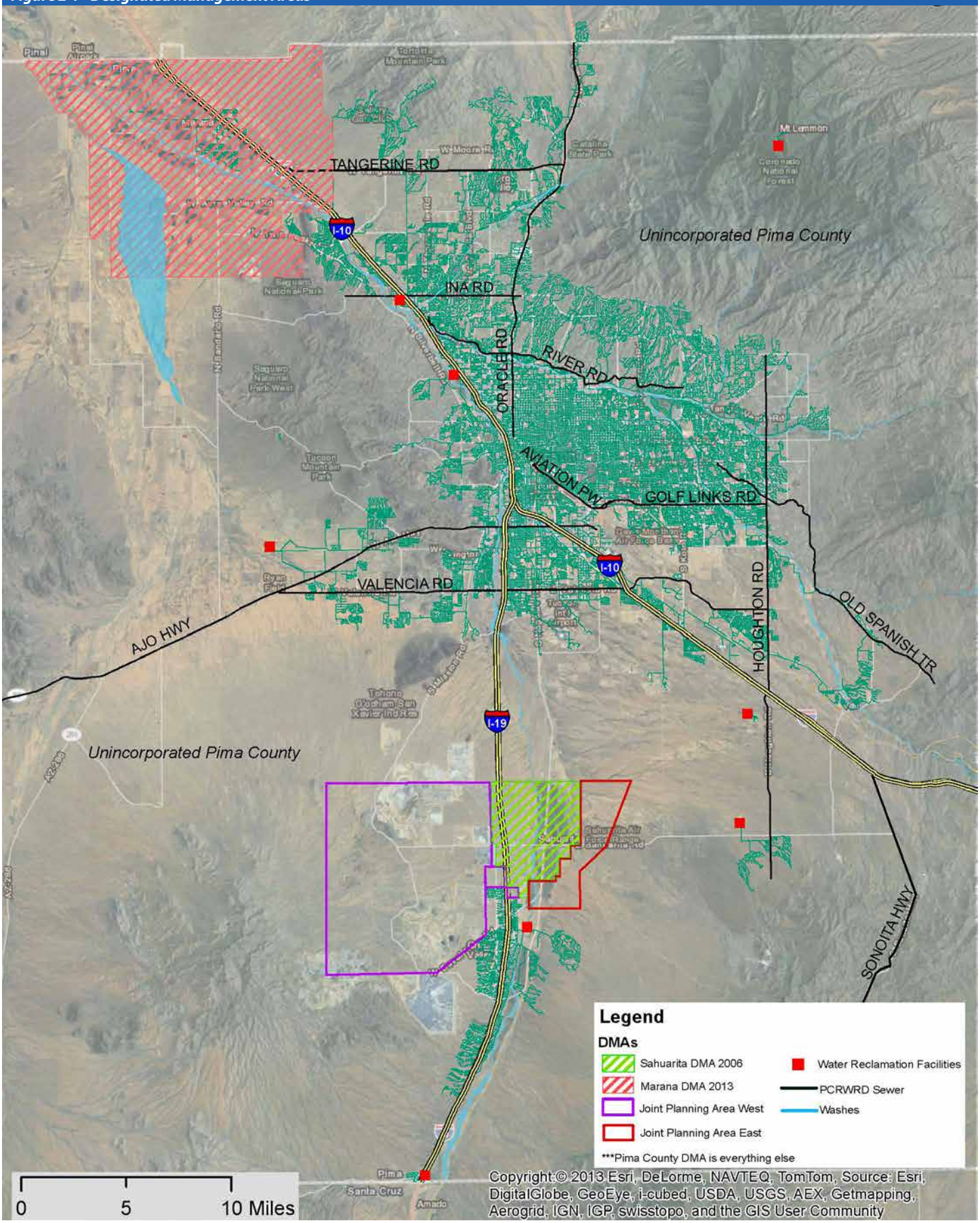
The legislature also conferred on Pima County the authority to issue revenue bonds for sewer projects.

208 Plan Amendments

In 2006, PAG released the first comprehensive update of the Areawide Water Quality Management Plan (208 Plan) since 1978. The update designated two designated management areas (DMAs): the Pima County DMA and the 1999 Town of Sahuarita DMA. The 208 Plan also determined the boundaries between the two DMAs and their respective management areas. The boundaries are further identified by determining the most practical and technically-and- economically-feasible service facility for the joint planning areas. The Town of Sahuarita's DMA boundary encompasses approximately 18 square miles, including most of the northern portion of the Town, while the southern portion of the Town is within the Pima County DMA and is served by the Green Valley WRF. See **Figure 2-1** for DMAs' boundaries.

In 2008, PAG began the process to amend the 208 Plan to include the Town of Marana DMA 208 Amendment. In 2013, the Town was granted DMA status. Ownership of the Marana WRF and the associated collection system was transferred from Pima County to the Town of Marana. The Rillito Vista WRF, located in Marana, was

Figure 2-1 Designated Management Areas



also transferred to the Town at a later time. The Town of Marana DMA boundary encompasses approximately 117 square miles and includes mostly the western portion of the Town. The DMA's eastern boundary is defined by the Dove Mountain Outfall sewer. This sewer is owned by Pima County but also serves the Town of Marana's system (Figure 2-1).

Another amendment to the 208 Plan was approved in 2009 to allow for implementation of the ROMP program, which included major treatment and conveyance system improvement projects.

The Pima County DMA boundary includes the areas of eastern Pima County outside of the Sahuarita and Marana DMAs. Several sewage treatment facilities are operated by entities other than the Town of Sahuarita, Town of Marana, or Pima County. These privately ownedfacilities are within Pima County's DMA, but they were either constructed prior to implementation of the 208 Plan, or PCRWRD declined to provide service to the areas. The sewage treatment facilities currently operated by entities, other than the three Designated Management Agencies, include: Adonis mobile-home park; Ajo Improvement Company; Arizona State Prison; the unincorporated community of Lukeville; Marana High School; Milagro Subdivision; Management Training Corporation (MTC); Organ Pipe Cactus National Monument; Saguaro Ranch Guest Ranch; Sahuarita High School Wetlands; the UA Science and Technology Park; and the U.S. Forest Service – Palisades Ranger Station. These facilities are likely to continue operating under current capacity and serving limited areas. Any expansion of their service area would require approval and certification in the 208 Plan Amendment. More information about each of these facilities can be found in the 208 Plan, the Areawide Water Quality Management Plan, prepared in fulfillment of Section 208 of the Clean Water Act (PAG, March 2006).

OPERATION OF THE REGIONAL SEWER SYSTEM

As the designated wastewater management authority, Pima County has adopted wastewater ordinances and entered into IGAs with local jurisdictions in support of the 208 Plan to provide for the regionalization of wastewater services. Pima County is pursuing formal IGAs with the Tohono O'odham and Pascua Yaqui nations for the sewer service provided to these entities. Pima County also has entered into an agreement with Pinal County to provide sewer service to a development just across the Pima County line, which is topographically tributary to Pima County's sewer system. In the most recent IGA between the County and the Town of Marana (effective April 9, 2013), the Town was entitled to ownership of the Marana WRF and the non-flow through sewer system in Marana. (Flow through sewers carry flows from areas outside of Marana's jurisdictional boundaries, including sewers tributary to the Marana WRF. Non-flow through sewers are sewers that carry flows that originate within Marana's jurisdictional boundaries.) The County is entitled to retain ownership of the flow-through sewer system in Marana. PCRWRD also is a party to numerous master sewer service agreements and individual sewer service agreements. The department uses these agreements to plan, allocate, and track capacity demands on conveyance and treatment facilities.

PCRWRD operates as an enterprise fund. This allows the department to devote all of its revenue to the operation, maintenance and expansion of the Publicly Owned Treatment Works. Its funds remain separated from Pima County's general fund and from other Pima County departments. As an enterprise fund, the department is in a position to establish the proper amounts that users should be charged for using the system. It also is able to establish the amounts new users should be charged for connecting to the system. The department has used this financial independence to secure funding for large projects through selling bonds and through obtaining public infrastructure loans. As a result, PCRWRD is required to maintain its operations in compliance with covenants to bond purchasers and public financing authorities.

INTERGOVERNMENTAL AGREEMENTS FOR THE PROVISION OF SEWER SERVICES

Pima County has implemented the regional sewer system by entering into intergovernmental agreements (IGAs) with the local jurisdictions, including the Cities of Tucson and South Tucson, and the Towns of Sahuarita, Marana, and Oro Valley. The essential terms of these agreements grant Pima County the authority to:

- Operate regional sewer facilities within their jurisdictions;
- Access their rights-of-way for the purposes of operating and maintaining the regional system, and
- Establish service and design requirements and standards for that system.

Pima County also has maintained working relationships and agreements for sewer service with the Tohono O'odham and Pascua Yaqui governing bodies and is actively engaged in planning efforts with these entities.

Pima County's intergovernmental agreement with the City of Tucson **imposes additional requirements**. These requirements stem from the City of Tucson's transfer of its sewer system to Pima County to form a large percentage of the regional system. The obligations under the agreement and the supplemental agreements that have followed are described below.

1979 IGA

On June 26, 1979, the City of Tucson and Pima County entered into the 1979 Sewer Transfer Agreement ("the 1979 IGA") and associated license agreements ("1979 Licenses"). These agreements transferred the City's sewerage system to the County and granted each jurisdiction licenses in each others' rights of way for the purpose of public improvements. The 1979 Licenses also provided terms under which the City and the County would reimburse each other for the cost of relocating water and wastewater improvements within in City and County rights of way.

The 1979 IGA also defines control of effluent produced at the County's metropolitan wastewater treatment facilities. The IGA states that all effluent (with the exception of 10%) from the metropolitan area's treatment/water reclamation facilities will remain under the unilateral control of the City. The 10% that is not under the control of the city is owned by Pima County, which is restricted in the way it can use that effluent. Allowable uses include on County parks, golf courses and recreational facilities or transfer of effluent to the Cortaro Marana Irrigation District.

The first 28,200 acre feet of treated effluent is allocated to satisfy the obligations of the Southern Arizona Water Rights Settlement Act (SAWRSA). These 28,200 acre feet must be supplied by the metropolitan wastewater treatment facilities. The metropolitan area is defined as an area that is or may be served by the Roger Road WRF (now the

Tres Rios Water Reclamation Facility, Supervisory Control and Data Acquisition (SCADA).

Agua Nueva WRF), the Ina Road WRF (now the Tres Rios WRF) or the Randolph Park WRF (decommissioned in December 2014). Included in this definition are any future collection and treatment facilities that are physically integrated into the metropolitan sewerage system.

The 1979 IGA further provides that Pima County maintain effluent quality at the metropolitan area treatment/water reclamation facilities in accordance with Federal and/or State standards for discharge into waters of the United States. The City cannot require treatment in excess of NPDES permit standards and agrees to provide any additional treatment in excess of these standards in order to meet reuse plans.

1982 First Supplemental to the 1979 Licenses Agreement

In the 1982 First Supplement to the 1979 Licenses Agreement, the City and the County established a reimbursement formula for the relocation of water lines and wastewater lines when those lines had to be relocated due to the other jurisdiction's construction activities.

Water lines constructed by the county in the county's rights of way required both utilities to pay 50 percent of the relocation costs. The same formula held true for sewer lines constructed by the city in the city right of way. This formula did not apply if the relocation construction was undertaken by one of the utilities at its own direction. It also did not apply if the relocated facilities had been substantially deteriorated.

In the 2007 Second Supplement to the 1979 Licenses Agreement, both the City and the County agree to pay the full costs of utility relocations made by the other party within their respective rights of way.

2000 Supplemental IGA

The City of Tucson and Pima County revised some of the terms of the 1979 IGA in the 2000 Supplemental Intergovernmental Agreement (IGA), dated February 7, 2000. Through that Supplemental IGA, the City and the County agreed that effluent is an important long-term renewable source of water in the Tucson Active Management Area, and that the costs of treating it to reclaimed water standards should be borne by those who use the reclaimed water. The 2000 Supplemental IGA also provides that, each year up to 10,000 acre feet of effluent are to be reserved for use in riparian projects, and that additional amounts can be made available for this purpose if both parties agree. The 2011 Conservation Effluent Pool IGA provides details for how the effluent, set aside for riparian projects, will be used. (See below for the section entitled 2011 Conservation Effluent Pool (effective January 25, 2011.) Provisions included in this IGA also allow other water providers reasonable access to effluent as long as they pay all associated costs.

The 2000 Supplemental IGA also provides that the City of Tucson waive its rights to unilateral control over the use and disposition of effluent discharged from PCRWRD's treatment plants in non-metropolitan areas. In addition, the treatment and distribution costs associated with effluent used for private purposes cannot be passed on to city or county taxpayers within the City of Tucson's limits. Finally, the County agrees that it will not charge less per acre foot than the City's actual average operating costs for production/treatment per acre foot of reclaimed water at its reclaimed water facility adjacent to the Roger Road Treatment Plant.

2003 Wheeling Agreement

This long-standing IGA, between Pima County and the City of Tucson, establishes provisions for the County to wheel its effluent share in the City reclaimed water distribution system for delivery to County facilities.

2011 Conservation Effluent Pool (effective January 25, 2011)

This intergovernmental agreement between Pima County and the City of Tucson defines the provisions for the use and allocation of effluent and reclaimed water in the conservation effluent pool for environmental restoration of riparian projects. The County is engaged in the operation of wastewater treatment facilities that produce secondarily treated effluent, a portion of which is delivered to the city reclaimed water system. By the Conservation Effluent Pool (CEP) agreement, 10,000 acre feet per year of effluent from the metropolitan area wastewater reclamation facilities can be used for projects promoting habitat conservation plans or environmental restoration projects approved jointly by the City and the County. To date, no CEP water has been used. The jurisdictions must first develop administrative procedures establishing the process for considering CEP requests, allocating and apportioning of water, accounting for quantities used and reporting of project status requirements. Unused CEP water does not accrue from year to year.

2011 IGA South Houghton Area Recharge Project (SHARP)

This intergovernmental agreement between Pima County and the City of Tucson is for the construction of a joint recharge project. The IGA is based on the Settlement Agreement of disputed claims between Pima County and the City that arose from a major street collapse on Speedway Boulevard between Melrose Avenue and Yucca Street on September 7, 2002. The settlement is achieved by the funding and implementation of a joint constructed recharge project, the Southeast Houghton Area Recharge Project. The joint project will allow both parties to physically store water for replenishment of the aquifer and for potential future use. This objective is achieved by the design, permitting, construction and operation of the joint construction recharge project facilities in a phased manner over a period of time. PCRWRD is, however, considering to withdraw from participating in the SHARP project due to other priorities for the use of our water resources.

2.2.1 INSTITUTIONAL CONSTRAINTS

In addition to the above listed IGAs that impose additional regulations, PCRWRD is also constrained by the following litigation and settlements that define control of effluent:

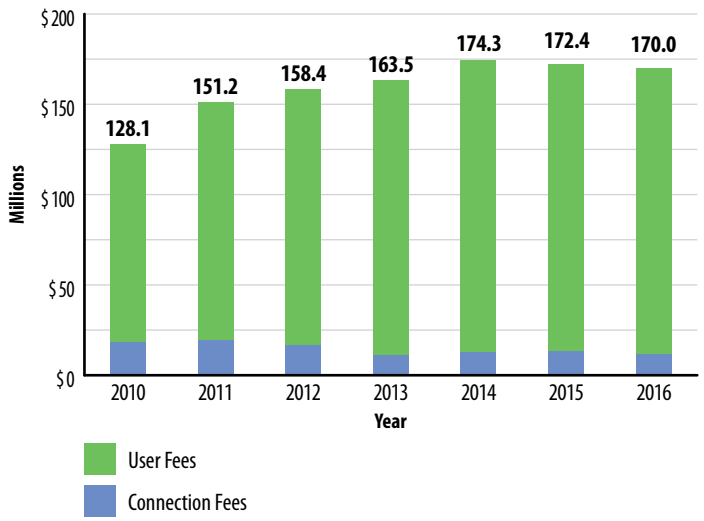
United States v. City of Tucson, No. CV 75-039 TUC FRZ

In this litigation, the United States acted as trustee for the Papago Indian Tribe concerning over-pumping of groundwater in southern Arizona. As the ultimate settlement of the case, the law anticipates that 28,200 acre feet of effluent will be made available to the United States Department of Reclamation annually for purposes of resolving the litigation (also known as the Southern Arizona Water Rights Settlement Act of 1982. The litigation in this case is being resolved via passage and adoption of Public Law 108-451 and various implementing agreements.

Agreement for Effluent Reuse between Pima County and Quail Creek LLC

Through this Agreement between Pima County and Robson Creek LLC, Robson Creek LLC agrees to contribute toward the costs of upgrading the Green Valley WRF and to pay the County a fee for effluent produced from the plant. The County agrees to construct and operate the necessary treatment facilities. The County agrees to provide an average flow of 1.0 MGD at the delivery point located along the southern property boundary of the Green Valley WRF. Robson Creek LLC agrees to take delivery of a minimum of 365 million gallons of effluent per year (the amount established by the 1990 Agreement) and a minimum of 25 million gallons per month. Quantities of effluent not taken by Robson are reverted to the County.

Figure 2-2 Total System Revenues



Source: 2016 Draft Financial Plan PCRWRD

2.3 FINANCIAL DRIVERS AND CONSTRAINTS

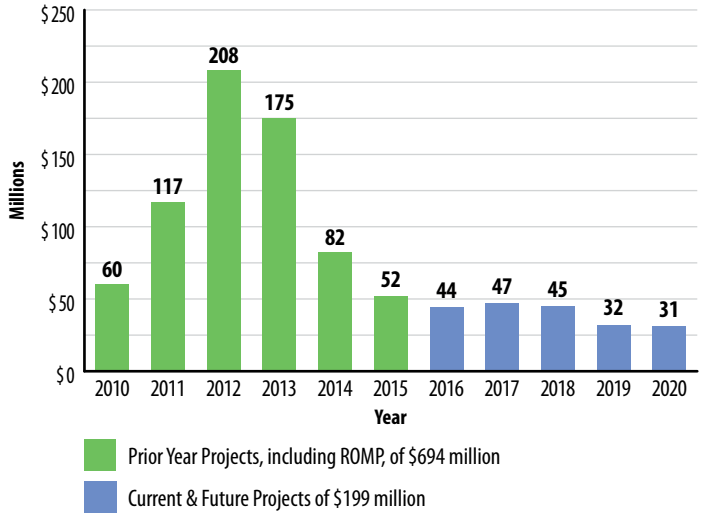
PCRWRD establishes and maintains the sewer user fee and user charge system within the requirements of the Clean Water Act, under the auspices of the Arizona Department of Environmental Quality, which has been given primacy by the United States EPA. The department also is subject to the requirements of Resolution 1991-138, which sets out the bond covenants for the issuance of sewer revenue bonds. Resolution 1991-138 dictates for what purposes and in what order Pima County must use PCRWRD's revenues to satisfy its obligations to the ratepayers and bondholders.

TOTAL REVENUES

Over the past eight years, total sewer system revenues increased more than 60 percent from $106 million in FY 2008/09 to $170 million in FY 2015/16. These revenue increases are due primarily to annual rate increases in user fees. **Figure 2-2** shows total revenues from 2010 to 2016 and the portion of those revenues attributable to connection fees and attributable to user fees. User fees are expected to continue to contribute about 90% of total PCRWRD revenue. The principal factor affecting revenue from future connection fees is the level of new constructions within Pima County. Annual connection fees are expected to remain below $20 million for the foreseeable future.

For its Capital Improvement Program budget, PCRWRD relies heavily on revenue bonding. Funding for large projects is secured

Figure 2-3 Capital Project Costs



Source: 2016 Draft Financial Plan PCRWRD

through the sale of sewer revenue bonds, obligation bonds, and public infrastructure loans. As a result, the department is required to maintain and finance its operations in compliance with covenants to the bond purchasers and the public financing authorities.

DEBT SERVICE PAYMENTS

Starting in 2009, PCRWRD increased user fees to finance the Regional Optimization Master Plan program. The ability to raise fees was a significant factor when planning for ROMP. As can be seen in **Figure 2-3**, construction activity for the ROMP peaked in 2008 and has declined steadily since then. PCRWRD will experience much lower capital needs in the coming years. Looking ahead, the department estimates between $30 million and $35 million of capital improvements will be needed annually to maintain rehabilitation of the treatment and conveyance systems. For more detailed information refer to the 2016 PCRWRD's Financial Plan.

Because of the ROMP, PCRWRD has issued significant debt in the last few years. Currently, the department's outstanding debt is $609 million. The department anticipates some additional debt in the next few years even though the annual level of projects is declining. As a result, total debt service payments are expected to continue to increase in the short term. Debt service for FY 2015/16 is $68.8 million, down from $71.3 million the previous year. Debt service is expected to remain relatively flat thereafter through 2023 and decrease rapidly after FY 2022/23, if no additional debt is issued after 2020

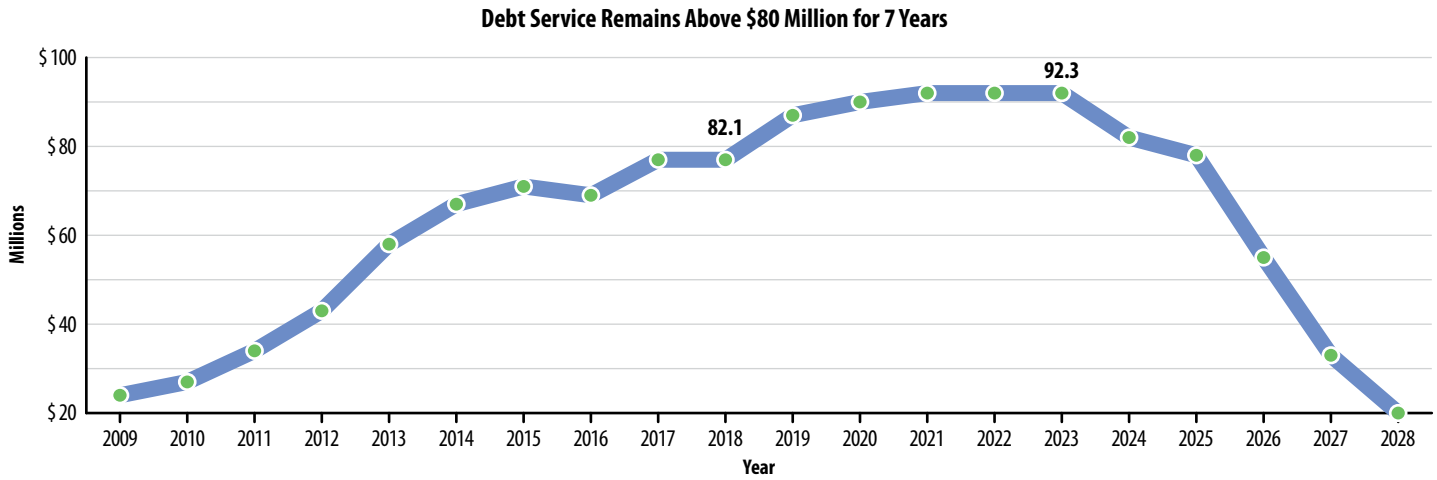
Figure 2-4 shows the historical rise in debt service payments and the projected payments through 2028. It is important to note that these estimates assume that the County will not issue new sewer revenue-pledged debt after 2020. This assumption is based on staff's belief that the County will be able to use recurring Certificates of Participation to fund ongoing capital projects after 2020. If the County does issue more debt secured by sewer revenues after 2020, the estimated debt service will increase.

For more detailed information refer to the 2016 PCRWRD's Financial Plan.

2.4 PLANNING CONSTRAINTS – CONCURRENCY

Pima County's policy of concurrency states that actual development cannot occur until available public infrastructure has the capacity to accommodate service demands caused by the new development. Pima County departments adopted this policy to address infrastructure development in rapidly growing areas. To comply with the County policy, PCRWRD conducts concurrency reviews. However, implementing the concept of concurrency has a very different impact on PCRWRD than other County departments. First, to ensure capacity availability, PCRWRD has required developers to install, at their expense, the entire sewer conveyance system for the development, as well as any off-site public sewer necessary

Figure 2-4 Historical Debt Service Payments



Source: 2016 Draft Financial Plan PCRWRD

to connect to the regional public sewer conveyance and treatment system. Second, in some instances, treatment capacity may not be available to accommodate new service demands. Increases in capacity at the large metropolitan water reclamation facilities require major expansions of multiple millions of gallons per day. Different problems occur at the smaller outlying facilities, which have limited capacities designed to serve specific developments. Problems are created when the size and speed of a development affect the available capacity of the treatment facility that would serve the development. Another constraint is that, in the regional service area, comprised of multiple jurisdictions, concurrency does not address all decisions related to the need for, or provision of, capacity and service. For these reasons, PCRWRD is preforming concurrency reviews on a case-by-case basis, especially in regard to the smaller sub-regional facilities. The department also works closely with the Pima County Development Services Department and individual developers to meet the goals of the concurrency policy.

PCRWRD has incorporated these policies into its operational and planning activities, including design and construction of interceptors and treatment facilities.

ENVIRONMENTAL CONSTRAINTS

In addition to the Clean Water Act, PCRWRD operates under and must remain in compliance with numerous Federal and State mandates, including the National Environmental Policy Act; the Federal Endangered Species Act; the Migratory Bird Treaty Act; the Arizona Native Plant Law; the City of Tucson Native Plant Ordinance; the Town of Marana Native Plant Permit; the Town of Oro Valley Environmentally Sensitive Land Ordinance; and the Pima County Native Plant Protection Ordinance.

2.5 CONCLUSIONS

- PCRWRD currently meets all regulatory compliance requirements.
- Regulatory constraints that may affect how PCRWRD water reclamation facilities operate in the near future are primarily a result of federal government focus areas.
- Changes to water quality standards, including current and emerging contaminants, and more stringent environmental regulations, are expected to evolve in the future.
- Effluent that discharges into the Santa Cruz River meet federal and state water quality standards, which was not the case in the past. The segments of the Santa Cruz River that receive flows from PCRWRD wastewater treatment facilities have been removed from the list of 'impaired waters.'
- As a result of pollution control projects, such as ROMP, the ecological state and chemical composition of the Santa Cruz River watershed have dramatically changed improved in recent years.
- The high level of construction activity for the ROMP peaked in 2008 and has declined steadily since then. The result is much lower capital needs in the coming years. Although the ROMP and its high-associated costs are behind us, the department needs to focus attention and resources on the rehabilitation of the conveyance system.
- Debt service payments have to be addressed.

2.6 OUTLOOK

- Maintain permit compliance schedules and budgets.
- Improve accessibility, timeliness and accuracy of environmental information.
- Hold periodic Intergovernmental Agreement and sewer service review meetings with all the municipalities in PCRWRD's service area.
- Continue to work with the Pascua Yaqui Tribe and the Tohono O'odham Nation with the goal of entering into mutually beneficial Intergovernmental Agreements.
- Work with other Pima County departments and local jurisdictions on concurrency and the beneficial reuse of effluent.
- Maintain strong relationships with EPA, the Federal Water Quality Coalition, ADEQ and others to have a proactive role in reviewing and configuring regulations and initiatives.

CHAPTER 3: SERVICE AREA CHARACTERISTICS AND DYNAMICS

Anthon Ellert rinses out containers at the Pima County Regional Wastewater Reclamation Department, Water and Energy Sustainability Center.

This Chapter summarizes some of the larger land use and socio-economic characteristics of the PCRWRD service area. The department revised the population and sewer service needs projections from the last Plan update to reflect current trends and changes that are characteristic of the region and the service area. The department also evaluated the potential uses of vacant land to project future flows and determine needed capacity. The projected numbers will serve the department's efforts in long-range planning for conveyance and treatment capacity expansions.

3.1 SERVICE AREA CHARACTERISTICS

3.1.1 LOCATION AND SIZE OF SERVICE AREA

The regional service area consists of the Agua Nueva/Tres Rios service area (which includes most of the metropolitan Tucson area) and several smaller sub-regional service areas, which include unincorporated areas of Pima County.

The Agua Nueva/Tres Rios service area encompasses approximately 333 square miles and is served by two principal water reclamation facilities: the Agua Nueva WRF and the Tres Rios WRF (formerly the Ina Road WRF[1]). They are located on the west side of Interstate 10 (I-10) and serve five jurisdictions: the City of Tucson, the City of South Tucson, the Town of Marana, the Town of Oro Valley, and Pima County. Together, the two facilities function as a single interchangeable system providing treatment and reclamation of wastewater for the entire region. **Figure 3-1** highlights the service basin area in blue and shows the jurisdictions that fall into the service basin boundaries.

The remainder of PCRWRD's service area covers approximately 60 square miles and includes six geographically-separated areas that are served by smaller sub-regional facilities: the Green Valley WRF, the Avra Valley WRF, the Corona de Tucson WRF, the Pima County Fairgrounds WRF, the Arivaca Junction WRF and the Mount Lemmon WRF (**Figure 3-1**). See **Table 3-1** for information on size of service areas and current permitted capacity of each facility. (Chapter 6 discusses the treatment facilities in more detail.)

3.1.2 GEOGRAPHY AND TOPOGRAPHY OF SERVICE BASIN

Located primarily in eastern Pima County, PCRWRD's service area is surrounded by mountains on most sides, including the Santa Catalina, Rincon, Santa Rita, and Tortolita ranges **(Figure 3-1)**. The generally gentle slope of the basin floor tends to increase rapidly as it nears the various mountain ranges. Surface runoff generally flows northward and westward through the basin. Elevations in this basin range from 3,720 feet in the southeast to 2,030 feet in the northwest. The Santa Cruz River is the major surface drainage channel and flows northward through Pima County to Pinal County. To take advantage of the gravity flow provided by the shape and slope of the basin, the Agua Nueva WRF and the Tres Rios WRF are located on the Santa Cruz River on low-lying areas on the western edge of the basin.

3.1.3 JURISDICTIONS WITHIN PCRWRD SERVICE AREA

The Agua Nueva and Tres Rios WRFs serve the Town of Oro Valley, the City of Tucson, the City of South Tucson, and parts of unincorporated county. With the exception of the northwest area of the Town of Marana, PCRWRD's metropolitan facilities serve the residents and business of the town. Residents and businesses in the northwest area of the Town of Marana receive service from the Marana WRF, which the town owns and operates. **Figure 3-1** on the previous page shows the geographical location of the jurisdictions relative to the Agua Nueva/Tres Rios service area. Unincorporated communities such as Green Valley, Avra Valley, Arivaca Junction, Fairgrounds, Corona de Tucson and Mt. Lemmon, have separate service areas served by sub-regional facilities.

Table 3-2 shows the percentage of land mass of each jurisdiction in the Agua Nueva/Tres Rios service basin. Unincorporated Pima County has the largest land mass at 45.9%, followed by the City of Tucson (38.3%), the Town of Marana (8.7%), the Town of Oro Valley (6.9%), and the City of South Tucson with less than 1% of the landmass in the service basin. Similar to the Town of Marana, the Town of Sahuarita has its own sewer system and treatment facility that operate independently from Pima County's regional system. The Town of Sahuarita's system provides sewer and wastewater treatment service to a limited area within Sahuarita's jurisdictional boundaries.

PCRWRD may provide service to areas outside the County's jurisdictional limits to benefit the general health, environment and economy of those areas. At the request of Pinal County, PCRWRD provides service to an area north of the Pima/Pinal County line along State Route 77. Service by Pima County is the most practical alternative for this area.

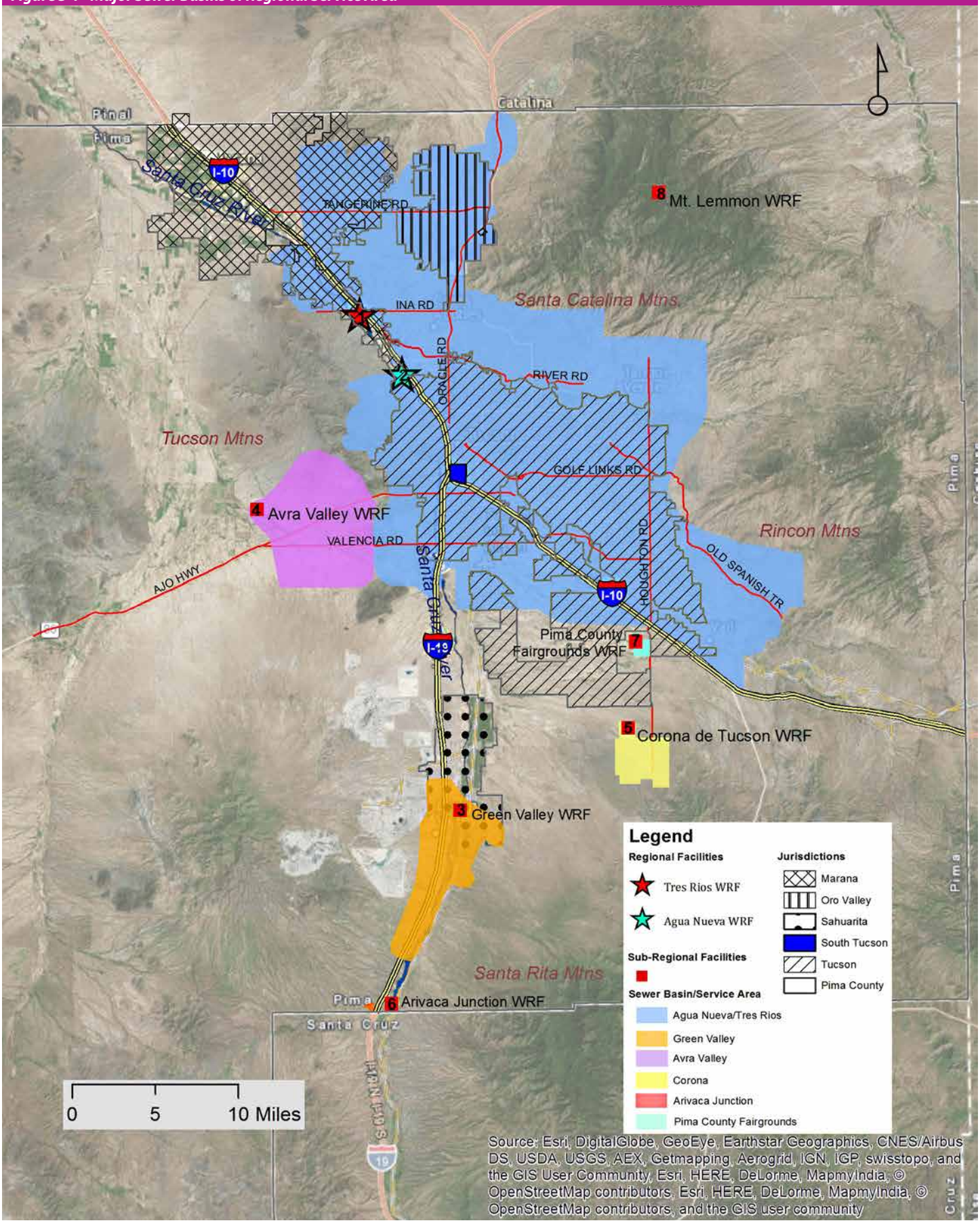
[1] With the recent expansion and upgrades the Ina Road WRF has been renamed Tres Rios.

Table 3-1 Sewer Basins, Service Areas, Water Reclamation Facilities – Size and Capacity

Major Sewer Basin	Approx. square miles	Approx. acres	PCRWRD's Service Area	Approx. square miles (data collected 04/06/2016 based on quarter sections)	Approx. acres	Water Reclamation Facility / Service Area	Permitted Capacity (million of gallons per day)	Length of Sewer (approx. miles) per Service Area
Agua Nueva / Tres Rios	515	329,600	Agua Nueva/Tres Rios	332.75	212,960	Agua Nueva WRF	32.0	3,090
						Tres Rios WRF	50.0	
Green Valley	55	35,200	Green Valley	26.75	17,120	Green Valley WRF	4.1	226
Avra Valley	66	42,240	Avra Valley	24.00	15,360	Avra Valley WRF	4.0	121
Corona de Tucson	46	29,440	Corona de Tucson	6.25	4,000	Corona de Tucson WRF	1.3	42
Total Basin Area	**682**	**436,480**	Arivaca Junction	1.75	1,120	Arivaca Junction WRF	0.100	5
			Mt. Lemmon	0.75	480	Mt. Lemmon WRF	0.015	2
			Pima County Fairgrounds	0.25	160	Pima County Fairgrounds WRF	0.020	1.0
			Total Service Area	**392.50**	**251,200**	Randolph Park*	3.0	
						Total Permitted Capacity & Length of Sewer	**94.54**	**3,487**

* Temporarily ceased operations

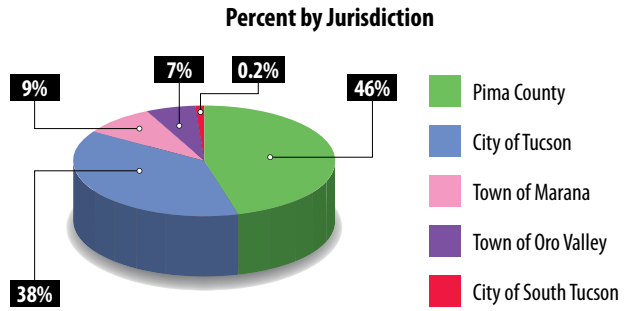
Figure 3-1 Major Sewer Basins of Regional Service Area



Agua Nueva Water Reclamation Facility Construction.

Table 3-2 Area within Agua Nueva/Tres Rios Service Basin by Jurisdiction

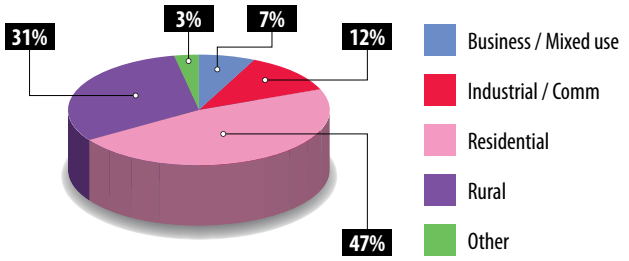
Jurisdiction	Acres	Square miles	% Total
Pima County	147,878	231	45.9%
City of Tucson	123,552	193	38.3%
Town of Marana	27,891	44	8.7%
Town of Oro Valley	22,298	35	6.9%
City of South Tucson	653	1	0.2%
Total	**322,272**	**504**	**100.0%**



3.1.4 LAND USE

The Agua Nueva/Tres Rios service basin covers most of the Tucson metropolitan area. The basin area consists of mostly urban residential land uses (47%). Rural land use comprises 31% of usage, followed by industrial/commercial activities, which comprise 12% of use. Business/mixed use and other land uses (open space, parking, etc.) comprise 7%. Finally, 3% of use is attributed to "other." (**Figure 3-2**). The urban residential land uses typically generate the most wastewater. (Water use and wastewater generation by different land uses in Tucson and Pima County are discussed in Chapter 7.) The rural land uses are dissimilar from urban residential uses because rural uses are not anticipated to connect to the sanitary sewer system. Rural lots usually are located far from existing public sewers and are large enough to accommodate private on-site sep-

Figure 3-2 Agua Nueva/Tres Rios Service Basin Land Use



tic systems. Rural land uses can contribute to the wastewater system when septic tanks are pumped and the septage is disposed of in the wastewater system.

Figure 3-3 includes the land use types for all jurisdictions within the service basin. The figure shows a simplified, relative proportion for the land use categories: business/mixed use, industrial/commercial, residential, rural, and other. The residential land use category is a predominant land use type contributing to the Agua Nueva/Tres Rios service basin in all four jurisdictions. In the sub-regional service areas, residential land use also accounts for the highest percentage of all land uses. It is likely that the residential land use will continue to constitute the majority of land in PCRWRD's service areas. The amount of available vacant land that is suitable for high-density use development is an important factor in calculating future capacity needs of the public sewer system.

How does the land use relate to wastewater?

Different land uses have different effects on water use and consequently on wastewater production. Recent studies on water consumption by land-use category in the Tucson metropolitan area show that residential single-family use is the second largest contributor of wastewater at 46%. Combined multi-family and industrial/commercial uses account for 54%. Chapter 7 provides more detailed information about water use in the region.

The department used the following assumptions to classify jurisdictional land use categories:

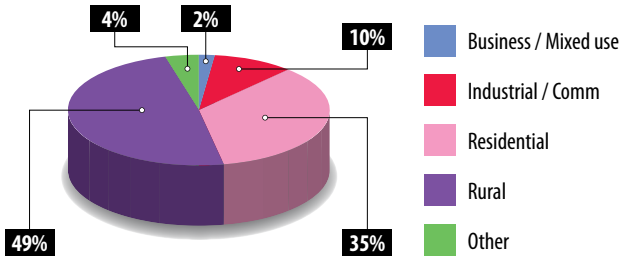
- City of Tucson: Planned Area Developments (PADs) are part of the 'Business/Mixed Use category;
- Other: This category includes parking and open spaces;
- Unincorporated Pima County: Suburban and rural areas are grouped as rural;
- Oro Valley: PAD areas are divided evenly between residential and commercial/industrial.

Land Use and Infrastructure Planning in Pima County

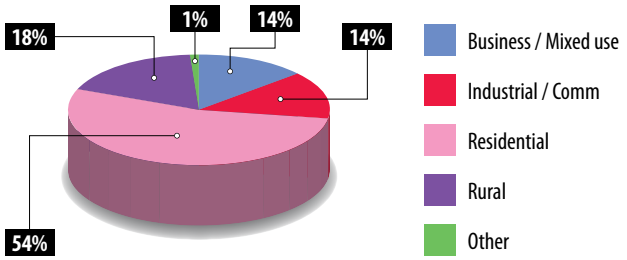
Pima County directs growth by planning for and directing land use and infrastructure to suitable areas where infrastructure is in place and services are available to support growth. This practice leads to more financially sustainable forms of development. Keeping this in mind, the County established the Concurrency Management System (CMS). The CMS provides the basis for monitoring infrastructure impacts of land development and determines whether infrastructure improvements are keeping pace with the rate of land development.

Figure 3-3 Percentage of Jurisdictional Land Use in Agua Nueva/ Tres Rios Service Basin

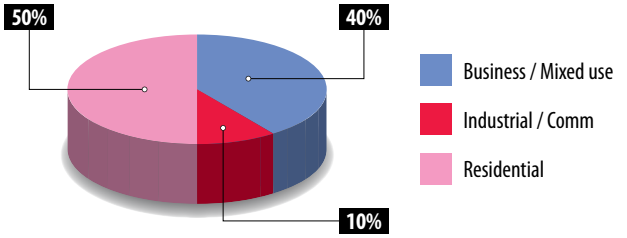
Pima County's Area of Agua Nueva / Tres Rios Service Basin



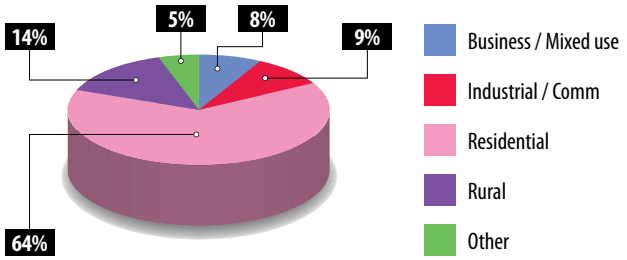
City of Tucson's Area of Agua Nueva / Tres Rios Service Basin



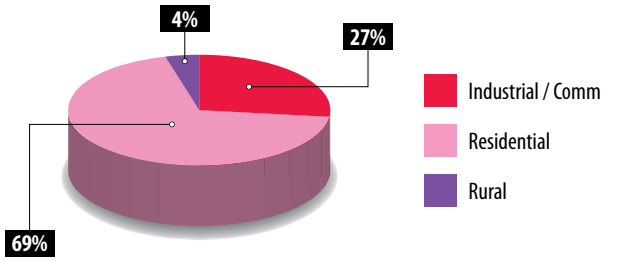
City of South Tucson's Area of Agua Nueva / Tres Rios Service Basin



Town of Marana's Area of Agua Nueva / Tres Rios Service Basin



Town of Oro Valley's Area of Agua Nueva / Tres Rios Service Basin



Pima Prospers introduced the concept of an Integrated Facilities Planning System (IFPS). The intent of the IFPS is to provide an efficient and measurable planning process that allows for a comprehensive evaluation of infrastructure needs tied to the Capital Improvement Program. The IFPS includes an Integrated Monitoring System to ensure level-of-service standards are met. PCRWRD is part of this integrated monitoring effort.

3.1.5 LAND OWNERSHIP

Existing land ownership patterns within and surrounding the PCRWRD service area, affect the current and future distribution of land development. Private land constitutes the majority of land in the PCRWRD service area. As shown in **Figure 3-4**, private land makes up 71% of the Agua Nueva/Tres Rios basin area. With the exceptions of the Corona de Tucson service area, (where the majority of land is State Trust Land) and the Mt. Lemmon service area (which is located in the National Forest), private land comprises the largest percentage of land in the sub-regional service basins. The State of Arizona Land Department owns second largest land percentage (16%). See **Figure 3-5** for the land ownership percentage for the entire service area.

The timing of development on private land is primarily driven by market demand and is difficult to predict. Most of the private land in unincorporated Pima County is still undeveloped. The extent and density of development on some of this land is constrained by the open space requirements of the Conservation Land System land-use policies. Outside of the preserved areas and national monuments, much of the private land in unincorporated Pima County is developed at a low density, or is designated for agricultural use or mining. PCRWRD provides limited or no service to these areas. Pockets of private vacant land designated for medium-to-high-density development exist in the metropolitan area and local jurisdictions.

The Arizona State Land Department, the National Forest Service and the Bureau of Land Management all own land in Pima County (**Figure 3-4**). The State Trust Land comprises 16% of the entire service area. The majority of the State Trust Land is located adjacent to the sub-regional service areas of Green Valley, Corona de Tucson, and Avra Valley.

The State Trust Land also accounts for the largest percentage of undeveloped land in unincorporated Pima County, specifically east of Interstate 19 (I-19) and south of I-10. Due to relatively close proximity to urbanized areas and existing infrastructure, it is likely that the State Trust Land in this area will be released for sale and development prior to the release of any other State Trust Land in the county. Another area that likely will be developed in the near future is the Houghton Road Corridor, where nearly 12,000 acres of the State Trust Land are expected to be developed as master-planned communities.

The State Trust Land is under constant evaluation for realizing the best return for trust beneficiaries. Projecting how and when these lands will be converted to developed parcels is nearly impossible. Also, changing development conditions make these lands difficult to time into the land market. This uncertainty presents a significant challenge when planning for growth and service expansion.

The Tohono O'odham Nation comprises the largest land mass in the central portion of the county. The Native American San Xavier District is part of this land mass but is physically separated from the Tohono O'odham lands. The Tohono O'odham land is mostly undeveloped. The Pascua Yaqui Tribe has a growing land ownership in the southwest part of the Tucson metropolitan area; most of this land is undeveloped. The majority of developed Pascua Yaqui Tribe land is within the Avra Valley service basin and the southern portion of the Agua Nueva/Tres Rios service basin. The tribal lands comprise 11% of the total Avra Valley service area.

Federal lands in Pima County are owned by the Bureau of Reclamation and the Bureau of Land Management and are comprised of natural preserves, forests and parks. The Coronado National Forest, the Saguaro National Park, the Tucson Mountain Park, the Las Cienegas National Conservation Area and the Santa Rita Environmental Range and Wildlife Area cover thousands of acres of land west, northeast and southeast of the PCRWRD service area (See Figure 3-4.) These lands define development boundaries of the county and are strictly protected from development.

3.1.6 REGIONAL PLANNING

Numerous jurisdictional and infrastructure plans have been adopted in Pima County in response to the increased growth over the past decade. These plans serve as guidelines toward achieving near and long-term land development and infrastructure planning goals in specific areas of the county. Some of the important jurisdictional and infrastructure plans and relevant actions are discussed in the following section. PCRWRD played a role in the creation of some of these plans.

JURISDICTIONAL PLANS

2015 Pima Prospers

Pima County updated its Comprehensive Plan in 2015; this is the third update since 1992. The update, Pima Prospers, takes a comprehensive look at the region's growth, conservation and community design for the next 20 years. As explained in the document, Pima Prospers is a "living document" that allows for change due to evolving circumstances, extraordinary opportunities, or critical needs. Pima County intends to align its annual budget, capital improvement program, and future bonding programs in accordance with Pima Prospers guidelines. County agencies will periodically review and adjust their policy documents, (e.g.: facilities expansion plans), to ensure they are in conformance with Pima Prospers' goals and policies.

2013 Plan Tucson

The City of Tucson's Mayor and Council updated the city's general plan document, Plan Tucson, in 2013. Plan Tucson sets forth public policies for physical, economic and social development of the City that are in compliance with community values and best practices. The goals and objectives presented in the document serve as a framework for land development and infrastructure planning in the City of Tucson. Part of this document covers sustainability and the use of renewable water resources. The document states that the use of reclaimed water, as an alternative to non-potable water use, will continue to increase as the community continues to grow. With a capacity of nearly 95 MGD, PCRWRD contributes to the reclaimed water supply by producing high-quality effluent for the community and the environment.

Figure 3-4 Service Area Land Ownership Map

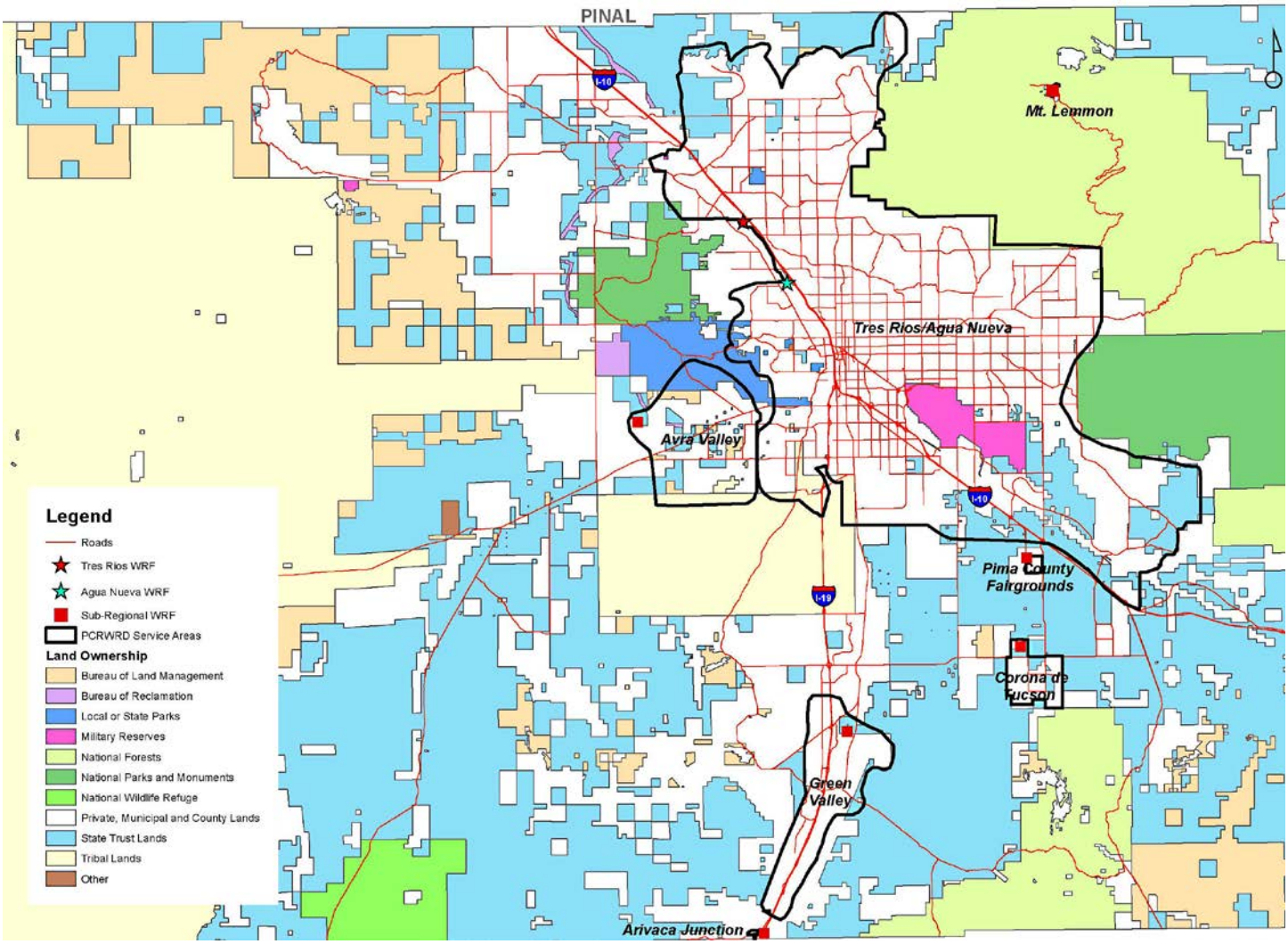
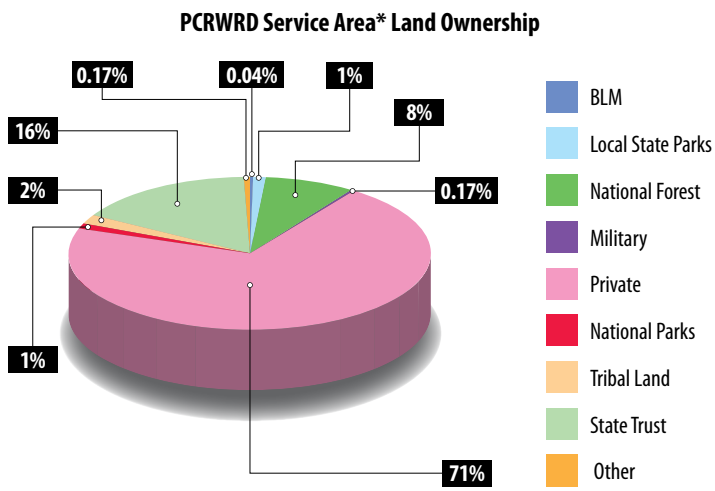


Figure 3-5 Service Area Land Ownership by Percentage

All Service Areas	Acres	Percentage
BLM	2,766	0.04%
Local State Parks	38,764	0.61%
National Forest	516,460	8%
Military	10,729	0.17%
Private	4,481,726	71%
National Parks	88,074	1%
Tribal Land	143,121	2%
State Trust	1,039,238	16%
Other	399	0.01%
Total	**6,321,277**	**100.00%**



* PCRWRD Service Area includes the Agua Nueva/Tres Rios service basin and the sub-regional service basins of Green Valley, Avra Valley, Corona de Tucson, Pima County Fairgrounds, Arivaca Junction and Mount Lemmon.

Tucson Mountain Park.

Sonoran Desert Conservation Plan

The Sonoran Desert Conservation Plan (SDCP) is Pima County's plan for "balancing the conservation and protection of our cultural and natural resource heritage with our efforts to maintain an economically vigorous and financially responsible community." The SDCP includes five focus elements: critical habitats and biological corridors; riparian areas; mountain parks; historical and cultural preservation; and ranch conservation. These elements, along with fiscal analyses, are critical components of the County's land management plan. The SDCP identifies the types of development that improve the tax base and the relationship of such development to the sewer service area. The development of some lands would be too costly for the existing tax base.

The 2001 Pima County Comprehensive Land Use Plan integrated the conservation principles into the County's land-use policies.

The SDCP set the stage for later efforts, such as the City/County Water Infrastructure Study, and the reinvestment in the county's sewage treatment facilities. Treatment facility upgrades have resulted in high-quality effluent/reclaimed water for irrigation of local parks, maintenance of biological corridors and rehabilitation of riparian habitats.

INFRASTRUCTURE PLANS/STUDIES

2007 Southwest Infrastructure Plan

County planners identified the Southwest Area of Pima County as a potential and strategic growth area. The boundaries of the Southwest Infrastructure Plan (SWIP) include Sandario Road on the west, Tucson Mountain Park on the north, Mission Road on the east and the Tohono O'odham-San Xavier District and Pascua Yaqui land on the south. The purpose of the SWIP is to provide a basis for infrastructure decision making related to development in the southwest area. It quantifies the nature, phasing, financial impacts and funding possibilities for improvements to flood control; parks and recreation; transportation; and wastewater infrastructure for future growth. The SWIP includes plans for wastewater system expansion.

2010 City of Tucson/Pima County Water/Wastewater Infrastructure Supply and Planning Study

PCRWRD's Water Resource Unit played an important role in the development and adoption of the City/County Water & Wastewater Infrastructure Study Phase II Final Report (Report). The unit also

played a critical role in the subsequent adoption of Resolution 2010-16, which supported the implementation of the Report. The report and accompanying studies include 19 shared goals and 56 recommendations for water sustainability intended to advance integrated water resource planning. The resulting Action Plan is organized around four distinct elements: water supply; comprehensive integrated planning; respect for the environment; and water conservation. Water conservation also is referred to as "demand management."

Tucson Water Plan: 2000-2050

Tucson Water's long-range planning document, Water Plan: 2000-2050, is an assessment of the utility's resource and system plans and ability to reliably use available water supplies through 2050. The latest revision, the 2012 Update, incorporated revised population and demand projections (based on the economic downturn and declining water usage) and service area policy changes. Through a scenario planning approach, potable demand is expected to increase from 104,000 acre feet used in 2012, to a range between 120,000 and 145,000 acre feet annually by 2030, and then to a range between 147,000 and 178,000 acre feet by 2050. Projections indicate that Tucson Water's potable demand will not exceed its current CAP allocation until 2040. Demand for reclaimed water will increase incrementally to an additional 1,360 acre feet in 2020 and then expand by 500 acre feet every year for five years.

Tucson Water's Recycled Water Master Plan, completed in 2013, focuses on the development of a phased indirect potable reuse program to fully utilize its reclaimed allocation and reduce reliance on CAP water for potable supply.

2040 Regional Transportation Plan

The 2040 Regional Transportation Plan (RTP) is a long-range vision of the transportation needs for the Tucson area and eastern Pima County through the year 2040. The plan includes a list of projects to meet the 2040 RTP goals. A significant number of roadway improvement projects are planned in the southeastern portion of the county. Major projects include improvements for Old Nogales Highway, Old Vail Connection Road, Houghton Road, Pima Mine Road, Wilmot Road, Swan Road, Alvernon Way and Sahuarita Road. Existing or imminent development trends, land use patterns, present and projected transportation demands, and safety considerations are the basis for improvement areas. The 2040 RTP also supports multi-modal transportation projects and expansion of a transit system throughout the region.

OVERVIEW OF CURRENT AND FUTURE DEVELOPMENT TRENDS AND ACTIVITIES

New development in the county primarily consists of the absorption of platted land that already has access to the infrastructure for utility services. Examples are the master-planned communities in Marana (Gladden Farms, Saguaro Bloom, Continental Ranch, and Dove Mountain), Oro Valley (Rancho Vistoso), the Green Valley area (Canoa Ranch), and Corona de Tucson (Fagan Ranch, Santa Rita). These development areas already receive sewer service from the Town of Marana or PCRWRD.

Given the aftermath of the recent economic recession, new development has been rather slow. However, infill development near the University of Arizona and the downtown area along Broadway Boulevard and Congress Street, consisting of student housing and other high-density projects, had an impact on the conveyance system's capacity. Small adjustments had to be installed to provide for the concentrated infill growth. Outside of the Tucson metropolitan area, new development is expected in the southeastern portion of the county. The Regional Transportation Authority (RTA) has plans to invest in major roadway improvements and transit-oriented projects to serve future growth in this area. Over the past decade, this area has seen an increasing number of residential developments. Major economic centers are also planned along the I-10 corridor. They include the Bridges and the UA Bioscience Park, the UA Science and Technology Park, and the Aerospace, Defense and Technology Research and Business Park. The proposed 16-mile Sonoran Corridor will connect I-10 and I-19 and is an important economic development surface transportation improvement. Additionally, the Aerospace Parkway south of Raytheon is anticipated to provide for significant industrial- and aerospace-related growth in the region.

PCRWRD has been actively involved in a discussion with developers about servicing options for lands affected by the Sahuarita East Conceptual Area Plan (SECAP). Adjacent to the northeast boundary of the Town of Sahuarita, this area is planned for major regional development over the next 20-30 years. Because of its scale and location, the development of this area will require upgrades to the treatment capacity at the Sahuarita and the Green Valley treatment facilities. An extension of the conveyance system also will be needed. Construction of a new regional water reclamation facility that would offset demands on the Green Valley, the Sahuarita, and the Corona de Tucson service areas is a possibility. The timing of the new facility is critical and will mainly be driven by growth as well as the timing of the proposed extension of the sewer line north from Elephant Head Road to the Canoa Ranch Development. To serve new development, the Green Valley WRF will eventually need be expanded. Construction of the new facility could potentially lead to a closing of both the Arivaca Junction and Green Valley facilities. Additional planning and research is required to determine the location, size and treatment options for a new regional facility.

Annexations

Annexation is an effective growth management tool that allows jurisdictions to control development in a more orderly and efficient way, directing it toward existing infrastructure and readily available services, such as water and wastewater. Both the City of Tucson and Pima County support this development philosophy.

An annexation area may include new developments that, if located within the joint planning area, could receive sewer services from more than one jurisdiction. PCRWRD will monitor development activities in the proposed annexation areas so the department can evaluate service options and coordinate sewer improvement plans with the towns of Marana and Sahuarita. A description of recently annexed and planned jurisdictional annexations appears below. In some of these areas, PCRWRD is providing only limited service or no service at all. The department has evaluated and discussed possible servicing options with the respective jurisdictions. Although annexation can change jurisdictional boundaries at any time, the service areas specified in the designated management areas do not change.

The four-land bridge across the Cañada Del Oro Wash along La Cholla Blvd in Oro Valley.

City of Tucson - Southeast of Tucson Metropolitan Area

The general area surrounding the I-10/Sonoita Highway 83 interchange (**Figure 3-6**) is defined on the City's map as an annexation priority area. Tucson Water has plans for potable water system expansion to this area (Water Plan: 2000-2050). The 2040 RTP includes recommendations for roadway improvement and transit-oriented projects. However, at this time, PCRWRD has no plans for sewer service expansion in this area.

Town of Sahuarita - Sahuarita East Conceptual Area Plan

The Town of Sahuarita plans to annex 47 square miles of vacant land that is just east of its current boundaries. The plan calls for a large-scale development featuring a mixture of land uses. The Sahuarita East Conceptual Area Plan (SECAP) calls for major infrastructure improvements over the next 20-30 years. The area is located within the PAG 208 Joint Planning Area, which means that either PCRWRD or the Town of Sahuarita could provide service. In a service demand analysis prepared by the University of Arizona, scenario planning for the SECAP, Sahuarita and the Green Valley area found that a new regional water reclamation facility would be necessary to serve anticipated growth in this part of the region. PCRWRD is currently negotiating possible servicing options with the Town of Sahuarita.

Town of Oro Valley

Annexation of nearly 107 acres of land by the Town of Oro Valley-changed the planning area boundary of this jurisdiction in 2013 by extending it to the southwest. PCRWRD will continue to serve the Town's expanding planning area.

3.2 PLANNING FOR POPULATION GROWTH

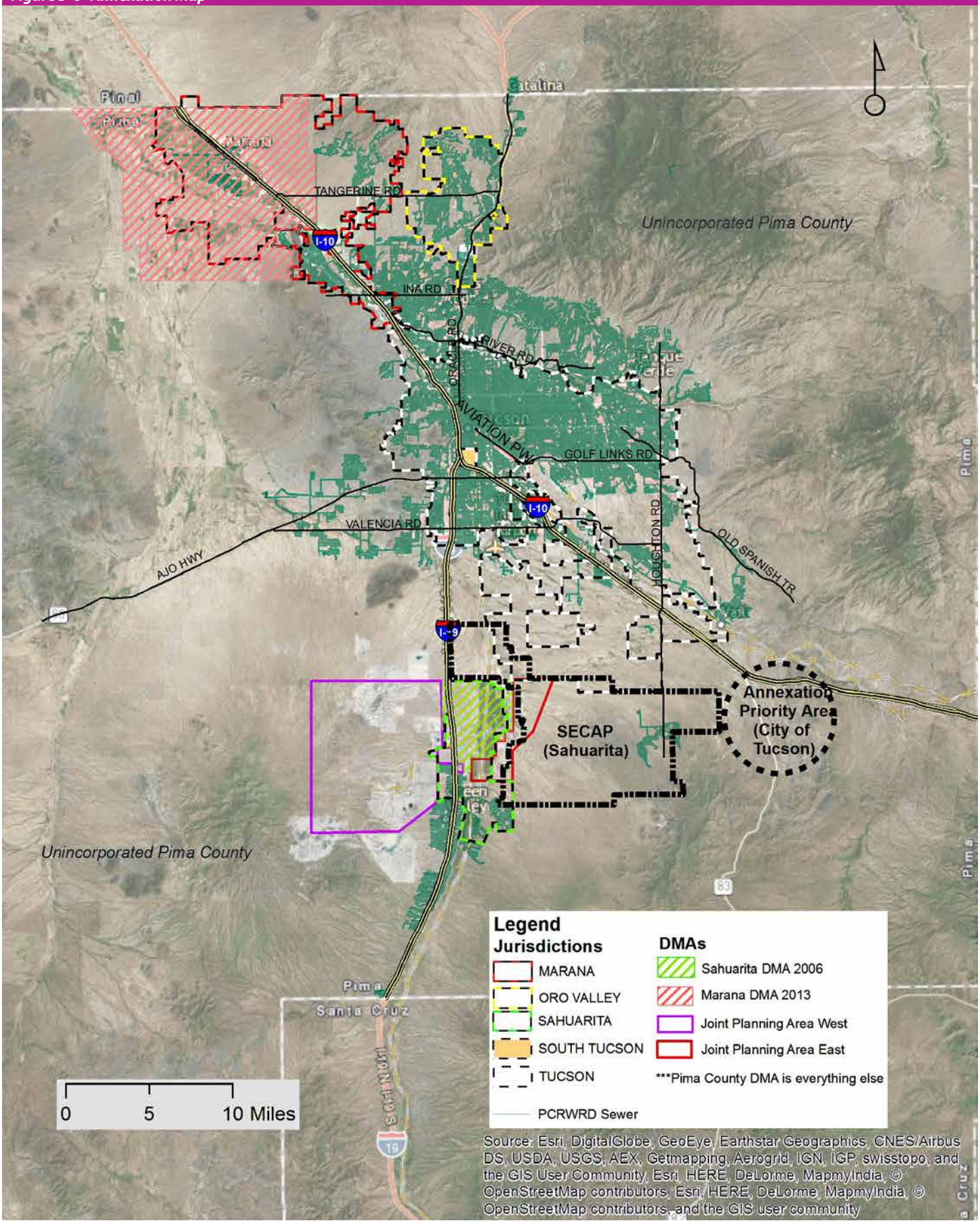
When planning for wastewater infrastructure, PCRWRD considers the following factors and conditions that affect the wastewater system: available capacity in the current system, the location of growth, the projected rate of growth, the projected volume of wastewater generated by growth and the needed capacity in our systems to provide for growth. Population projections play an important role in the long-range planning for capital improvement projects. Population growth and land development provide the basis for projecting wastewater flows. Growth patterns will dictate where the capacity has to be increased, both for sewer infrastructure and treatment facilities.

PCRWRD continuously monitors development activities in the following active project areas to ensure capacity is adequately planned in the conveyance system for new development:

- Marana Twin Peaks: Cascada Specific Plan; other commercial, retail and residential developments;
- Avra Valley: Sendero Pass, Pomegranate Farms, Tucson Mountain Ranch, Pascua Yaqui developments;
- Green Valley/Sahuarita: Farmers Investment Company (FICO) Development, Sahuarita East Conceptual Area Plan (SECAP);
- Vail/Corona de Tucson: Hook M Ranch, Fagan Ranch and Santa Rita Foothills Estates;
- Tucson Downtown;
- The University of Arizona (UA): student housing and university projects along the north Speedway Boulevard corridor;
- Southlands: Verano, UA Bioscience Park at the Bridges Development, UA Science and Technology Park, Aerospace, Defense and Technology Research and Business Park, and other planned development projects along the I-10 corridor;
- Southeast Planning Area: Houghton Area Master Plan (HAMP) and Rocking K; and
- Sonoran Corridor.

System expansion and improvement projects needed to serve new development in these areas have been planned or are the subject of discussion between the PCRWRD and developers. These discussions

Figure 3-6 Annexation Map



involve development coordination and capacity planning. Financing for some of these projects will come from the developers, while other projects will require County Capital Improvement Program funding.

3.2.1 PIMA COUNTY AND SERVICE AREA POPULATION

The vast majority of Pima County's population lives in the Tucson metropolitan area. The urban population residing in the incorporated jurisdictions of Tucson, Oro Valley, Marana, Sahuarita and South Tucson make up most of the 1.02[2] million people living in the county. A portion of the population also resides within a large ring of unincorporated urban areas and the growing satellite communities of Catalina, Green Valley and Ajo. Most of the unincorporated rural areas are sparsely populated.

The 2010 Census shows a 16.2% growth (136,517 people) between 2000 and 2010 in Pima County. **Table 3-3** shows the county's projected population through the year 2050, as officially adopted by the Arizona Department of Administration. Population is projected to grow between 1.0 to 1.6 percent per year over the next two decades, with a growth rate of less than one percent projected after 2038.

Based on the total combined average influent flow of 56.2 MGD at the Agua Nueva and the Tres Rios facilities, approximate-

[2] As of July 1, 2015, Pima County population was estimated at 1,022,079 (Population Projections 2013-2050, Arizona Department of Administration)

Table 3-3 Pima County Population 2012-2050 and Agua Nueva/Tres Rios Service Area Population Projections

Year	ADOA Projected Population*	Numeric Change	Growth %	Agua Nueva / Tres Rios		Agua Nueva WRF		Tres Rios WRF	
				Service Area Population**	Numeric Change	Service Area Population**	Numeric Change	Service Area Population**	Numeric Change
2012	990,380	4,299	0.43%						
2013	998,325	7,945	0.80%						
2014	1,008,442	10,117	1.01%	702,500	7,119	320,000	3,243	382,500	3,876
2015	1,022,079	13,637	1.35%	709,619	9,596	323,243	4,371	386,376	5,225
2016	1,037,232	15,153	1.48%	719,215	10,663	327,614	4,857	391,601	5,806
2017	1,053,578	16,346	1.58%	729,878	11,502	332,471	5,239	397,407	6,263
2018	1,069,924	16,346	1.55%	741,381	11,503	337,711	5,240	403,670	6,263
2019	1,085,277	15,353	1.44%	752,883	10,804	342,950	4,921	409,933	5,883
2020	1,100,021	14,744	1.36%	763,687	10,375	347,872	4,726	415,815	5,649
2021	1,114,656	14,635	1.33%	774,062	10,298	352,597	4,691	421,464	5,607
2022	1,129,233	14,577	1.31%	784,360	10,258	357,288	4,673	427,071	5,585
2023	1,143,733	14,500	1.28%	794,618	10,203	361,961	4,648	432,657	5,555
2024	1,158,161	14,428	1.26%	804,820	10,153	366,609	4,625	438,212	5,528
2025	1,172,515	14,354	1.24%	814,973	10,100	371,233	4,601	443,740	5,499
2026	1,186,792	14,277	1.22%	825,073	10,047	375,834	4,577	449,239	5,470
2027	1,200,985	14,193	1.20%	835,120	9,987	380,411	4,549	454,710	5,438
2028	1,215,082	14,097	1.17%	845,107	9,920	384,960	4,519	460,147	5,401
2029	1,229,113	14,031	1.15%	855,027	9,873	389,479	4,497	465,549	5,376
2030	1,243,099	13,986	1.14%	864,900	9,842	393,976	4,483	470,924	5,359
2031	1,257,074	13,975	1.12%	874,742	9,834	398,459	4,479	476,283	5,354
2032	1,270,943	13,869	1.10%	884,576	9,760	402,938	4,446	481,637	5,314
2033	1,284,724	13,781	1.08%	894,335	9,697	407,384	4,417	486,951	5,280
2034	1,298,443	13,719	1.07%	904,033	9,654	411,801	4,398	492,231	5,257
2035	1,312,101	13,658	1.05%	913,687	9,610	416,199	4,378	497,488	5,233
2036	1,325,707	13,606	1.04%	923,297	9,575	420,577	4,361	502,720	5,213
2037	1,339,260	13,553	1.02%	932,872	9,537	424,938	4,344	507,934	5,193
2038	1,352,759	13,499	1.01%	942,408	9,499	429,282	4,327	513,126	5,172
2039	1,366,210	13,451	0.99%	951,907	9,466	433,609	4,312	518,298	5,154
2040	1,379,622	13,412	0.98%	961,373	9,438	437,921	4,299	523,452	5,139
2041	1,393,047	13,425	0.97%	970,810	9,447	442,220	4,303	528,591	5,144
2042	1,406,516	13,469	0.97%	980,257	9,478	446,523	4,317	533,734	5,161
2043	1,420,047	13,531	0.96%	989,735	9,522	450,840	4,338	538,895	5,185
2044	1,433,676	13,629	0.96%	999,258	9,590	455,178	4,368	544,080	5,222
2045	1,447,403	13,727	0.96%	1,008,848	9,660	459,546	4,400	549,301	5,260
2046	1,461,245	13,842	0.96%	1,018,507	9,740	463,946	4,437	554,561	5,303
2047	1,475,233	13,988	0.96%	1,028,247	9,843	468,383	4,484	559,864	5,360
2048	1,489,377	14,144	0.96%	1,038,091	9,953	472,867	4,534	565,224	5,419
2049	1,503,681	14,304	0.96%	1,048,044	10,065	477,401	4,585	570,643	5,480
2050	1,518,154	14,473	0.96%	1,058,109	10,184	481,986	4,639	576,124	5,545

* Pima County population projections 2013-2050, Arizona Department of Administration

**2015 population estimates based on the average monthly effluent flow at Agua Nueva WRF - 25.6 MGD and Tres Rios WRF - 30.6 MG and 80 gallons per person per day)

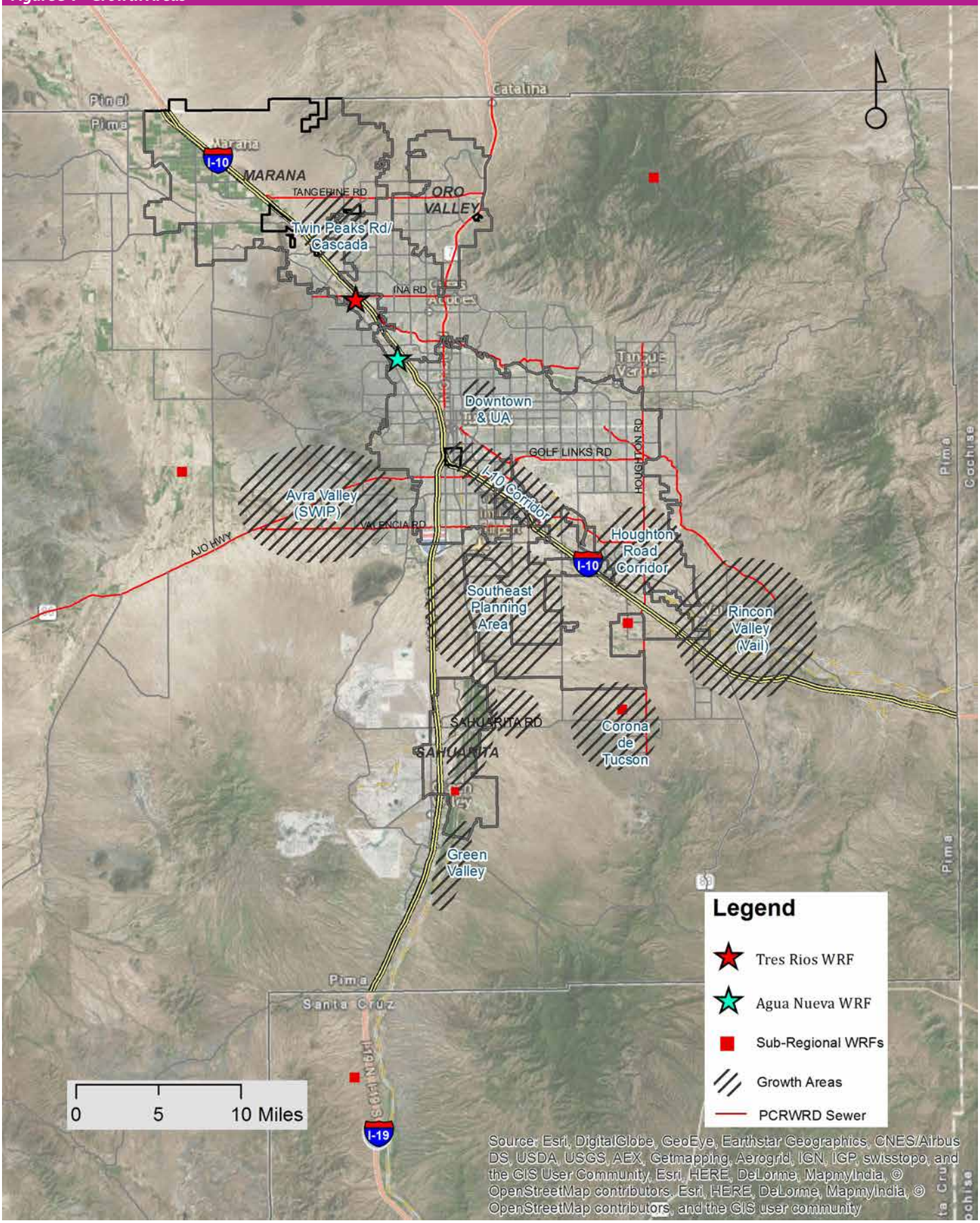
New biodigesters at the Tres Rios Water Reclamation Facility are a crucial part of the County's plan to utilize methane gas generated at the facility to produce clean energy and reduce carbon emissions.

ly 702,500 people in the Agua Nueva/Tres Rios sewer service area receive sewer service. The Agua Nueva WRF has a capacity of 32 MGD. The Tres Rios WRF has a capacity of 50 MGD. **Table 3-3** shows the service area population through the year 2050 based on the projected annual growth rate of between 1% and 1.6%. In terms of population growth, PCRWRD looks at development activities and planned development projects to evaluate the impact of additional population on the system's capacity. It is especially important to monitor the location of high-density developments, such as subdivisions and student housing projects, which result in high levels of water use and the associated high levels of wastewater production. Monitoring of current development activities and jurisdictional long-term development plans is crucial to system capacity planning. Chapter 6 includes more details on the Agua Nueva/Tres Rios service area population and projects.

3.2.2 AREAS OF GROWTH

As defined by state statute, growth areas are areas "that are particularly suitable for planned multimodal transportation and infrastructure expansion and improvements designed to support a planned concentration of a variety of uses, such as residential, office, commercial, tourism and industrial uses." Several local planning and visioning documents (Plan Tucson, Comprehensive Plan, Imagine Greater Tucson), have identified the regional growth areas

Figure 3-7 Growth Areas



to be the towns of Marana, Oro Valley[3] and Sahuarita, the community of Green Valley, and the areas including the Rincon Valley[4], the Southeast Planning Area[5], the Avra Valley area (Southwest Infrastructure Plan (SWIP)[6], and the Houghton Road Corridor. Other growth areas include the Corona de Tucson area, the Tucson downtown area and the University of Arizona area (**Figure 3-7**). Previous growth rates show these areas have undergone rapid urbanization over the past decades.

[3] Oro Valley is close to being built out for residential land use but will continue to develop its commercial and other non-residential uses.

[4] The Rincon Valley lies in the far southeast end of Pima County; it encroaches the Saguaro National Park in the northern portion and the Coronado National Forest in the eastern portion. The area includes the community of Vail. It extends south to I-10; its western boundary is roughly defined by the Pantano Wash. Major developments include the Rancho del Lago subdivisions and the mostly undeveloped Rocking K project.

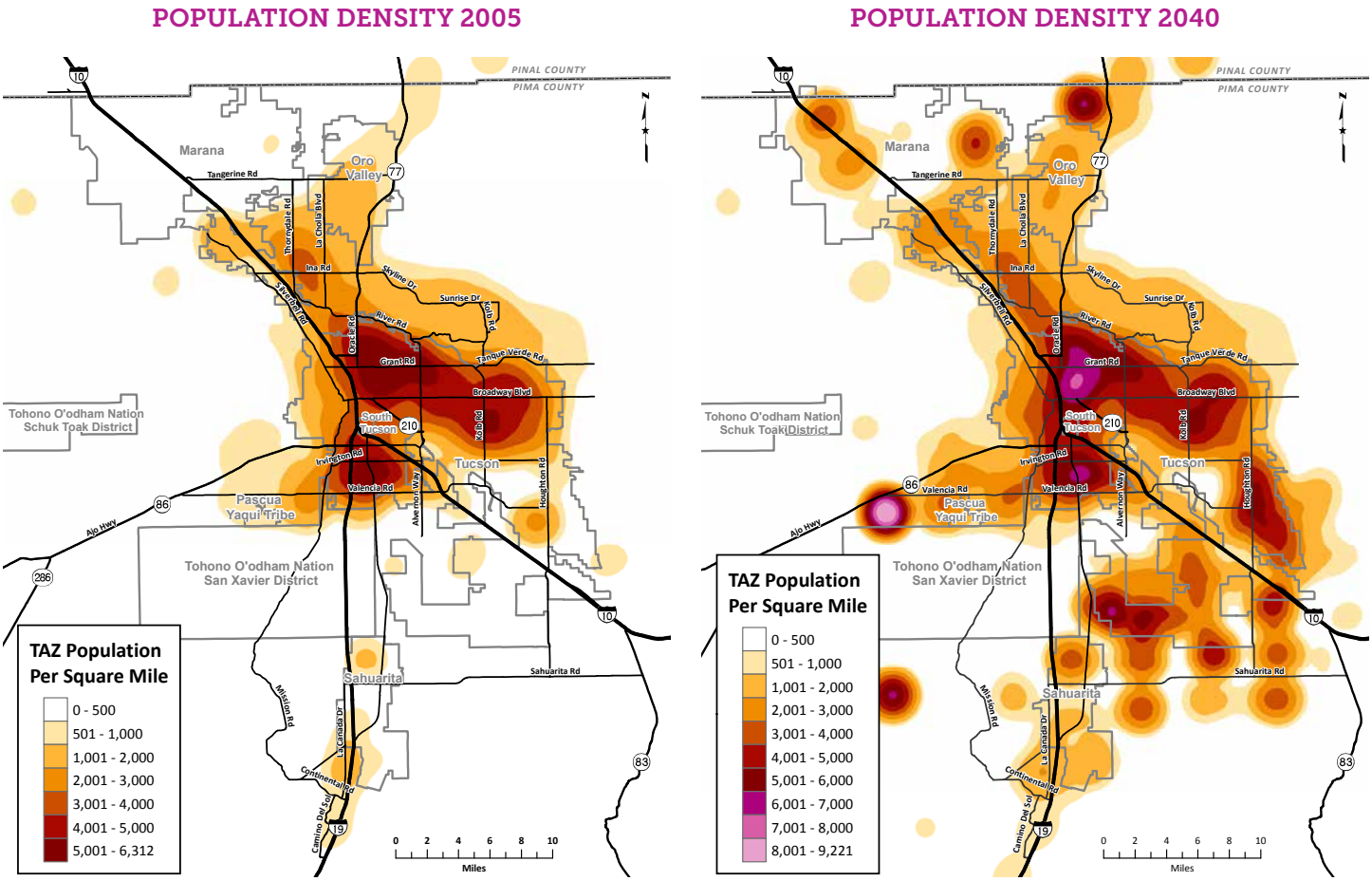
[5] The Southeast Planning Area generally extends south of I-10 to the Santa Rita Experimental Range and Wildlife Area, and between Old Nogales Highway to the west and Sonoita Highway to the east.

[6] SWIP is bounded by Sandario Road on the west, Tucson Mountain Park on the north, Mission Road on the east, and the Tohono O'odham-San Xavier District and Pascua Yaqui land on the south.

As explained in Pima Prospers, most of the growth in the county is expected to occur in incorporated jurisdictions, most notably the City of Tucson, the Town of Marana and the Town of Sahuarita. Comparatively, there is only modest room for growth in unincorporated areas. Nearly 35% of projected growth in unincorporated areas is expected by 2035. Pima Prospers further explains that growth in unincorporated areas is not expected to drive "massive increase in new public infrastructure and/or the suburbanization of rural or open space land with significant physical constraints."

The Pima Association of Governments (PAG) has issued population estimates based on transportation planning modeling through Transportation Analysis Zones (TAZ). Transportation modeling takes into account local planning data such as comprehensive plans, general plans, special plans, habitat conservation plans, building permit data and designated future land uses. The TAZ population projections prepared for 2040 indicate an expansion of population densities in five general areas of the county: north and west of the Town of Marana, north and west of the Town of Oro Valley, the southwest (SWIP) area, the east (HAMP and Rocking K), the southeast (Southlands, I-10 corridor), and the south (the Town of Sahuarita, Green Valley) (**Figure 3-8**). An increase in concentration of employment centers has also been projected in these areas.

Figure 3-8 Pima County Population Density 2005-2040



Source: PAG

Table 3-4 Permitted and Remaining Treatment Capacity

	Water Reclamation Facility (WRF)	Permitted Capacity (MGD)	Average Annual Daily Effluent Flow (MGD)	Remaining Capacity (MGD)	Additional Number of Residential Units that Could be Served (216 gal per day per unit)	Additional Number of People that Could be Served (2.7 persons per residential unit)
1	Tres Rios WRF	50.0	30.6	19.4	89,815	242,500
2	Agua Nueva WRF	32.0	25.6	6.4	29,630	80,000
3	Green Valley WRF	4.1	1.8	2.3	10,718	28,938
4	Avra Valley WRF*	4.0	1.3	0*		
5	Randolph Park WRF**	3.0	2.3	0.7		
6	Corona de Tucson WRF*	1.3	0.295	0*		
7	Arivaca Junction WRF	0.100	0.043	0.057	264	713
8	Pima County Fairgrounds WRF	0.020	0.014	0.006	29	79
9	Mt. Lemmon WRF	0.015	0.003	0.012	57	154
Total		**94.54**	**61.9**	**28.9**	**130,512**	**352,383**

* Avra Valley WRF and Corona de Tucson WRF have all capacity allocated.
** Temporarily ceased operations.

3.3 FLOW PROJECTIONS

This section evaluates the potential of vacant land available for development in the Agua Nueva/Tres Rios sewer basin as identified by GIS analysis. The evaluated land is within the sub-basins that are tributary to the metropolitan water reclamation facilities. Build-out of vacant developable land was projected for each tributary sub-basin to determine possible additional flows. Because it is primarily driven by unpredictable market demands, development in these sub-basins may occur at any time and at any location. For this reason, build-out projections do not include any specific timeframes. **Table 3-5** and **Table 3-6** present the results and explanation of the GIS analysis. The land use build-out and flow projections were based on the following assumptions:

Land Use Build-out Assumptions

- Private vacant land is developable to expected densities
- Development density is based on current zoning designation
- Flow Projection Assumptions
- 2.7 people per household
- 80 gallons per day per person
- 1,000 gallons per day per acre projected for now-vacant industrial and commercial land with the potential to be developed

Information on the permitted and the remaining treatment capacity and average monthly effluent flow at the two metropolitan and six sub-regional facilities is presented in **Table 3-4**. A total of 28.9 MGD of currently available treatment capacity could serve approximately 130,512 additional residential units or 352,383 people. Based on the projected growth rates, the county is not expected to add this many people until approximately 2040[7] (**Table 3-3**).

LAND USE BASED FLOW PROJECTIONS FOR THE AGUA NUEVA/TRES RIOS SEWER BASIN

A sewer sub-basin is defined as an area within the service area where wastewater may be collected and conveyed downhill by gravity. The region's major sewer basin, served by the Agua Nueva and Tres Rios WRFs, is comprised of 96 sewer sub-basins. Wastewater from one or more tributary sub-basins is conveyed by gravity through the network of collectors to a receiving interceptor and then downstream to the wastewater treatment facilities. The interceptors with the largest number of tributary sub-basins, covering the largest surface area, include the Southeast Interceptor (SEI), the South Rillito Interceptor (SRI), the North Rillito Interceptor (NRI), and the Cañada del Oro Interceptor (CDO).

Table 3-5 shows the amount of vacant land that can be converted into higher densities as permitted by existing zoning. Because residential use contributes to the largest portion of land in

Table 3-5 Vacant Acres per Interceptor Tributary Area

Interceptor	Vacant Residential (Acres)	Potential No. of SFR Units	Vacant Commercial/ Industrial/Other (Acres)	Total Vacant Developable Acres
ACSE	14	173	52	66
NWO	262	745	111	373
P&R	113	228	44	157
PTI	380	1,734	293	673
SCC/SCE	50	574	114	164
SCI	188	1,312	107	295
SEI	1,586	11,273	4,463	6,049
SRI	188	1,497	42	230
SWI	753	1,637	219	972
CDO	3,631	5,751	712	4,343
CRI	5,729	8,907	446	6,175
NRI	1,871	2,550	192	2,063
TVI	70	395	41	111
Total	**14,835**	**36,776**	**6,836**	**21,671**

[7] Current population 1,022,079 + 352,383 additional people = 1,374,462

The Kino Environmental Restoration Project (KERP) is a series of basins developed to detain and store storm and reclaimed water, create flood control and reestablish a riparian ecosystem.

the sewer basin, the department used single-family residential use to calculate residential land build-out. The department assumed 216 gallons per unit to calculate residential use. (This figure is based on 2.7 persons per household times 80 gallons of wastewater generated per person per day.) Other land uses include commercial, industrial and other non-residential uses. An assumption of 1,000 gallons per day per acre was applied to commercial and other non-residential uses.

The GIS analysis results show that the largest amount of estimated developable land (over 2,000 acres) is in the sub-basins that are tributary to the following interceptors: the North Rillito Interceptor (NRI), the Canada del Oro Interceptor (CDO), the Southeast Interceptor (SEI), and the Continental Ranch Interceptor (CRI).

As shown in **Table 3-6**, the sub-basins with the highest volume of projected build-out flow (over 2 MGD) are: the CRI, the CDO and the SEI. Because they are mostly undeveloped, the SEI sub-basins are expected to add more development than the CRI and the CDO sub-basins. The GIS analysis also shows that the SEI sub-basins have more vacant land zoned for residential use than other sub-basins; therefore, they are expected to contribute the highest build-out flow of 6.9 MGD. The CDO and CRI sub-basins are projected to generate 5.58 MGD and 2.37 MGD, respectively.

Because of the existing bottleneck and capacity issues in some segments of the SEI, PCRWRD continues to monitor growth to ensure that adequate capacity is available for new development in the SEI sub-basins.

Based on the projected build-out, the department projects a total additional flow of 18.6 MGD for the Agua Nueva/Tres Rios sewer basin. Current development trends and growth rates suggest that the Tres Rios and the Agua Nueva facilities will have enough combined capacity to handle these additional flows (before reaching 75% capacity) to meet demand until 2021 [8] or beyond. After 2021, capacity expansion plans will be based on the estimated capacity demand in the service area. The sub-regional service areas of Green Valley, Avra Valley, Corona de Tucson, and Fairgrounds are expected to expand in the future to meet continued demand for sewer services. Future capacity expansion at the sub-regional facilities will be phase-planned based on the timing of planned developments and projected demand.

Growth in the service area will require adequate sewer system augmentation and expansion to serve additional populations. To plan accordingly for systems expansion as required by ADEQ, PCRWRD's hydraulic model provides a critical capacity assessment for major service areas. The model is periodically calibrated to reflect current conditions in the conveyance system tributary to the Agua Nueva and Tres Rios facilities. By using the hydraulic model results, PCRWRD is able to plan for augmentation and rehabilitation projects, giving a priority to those with the highest rank of need for repair. (See Chapter 5 for more details on hydraulic modeling.)

*[8] 61.5 MGD is 75% of the total capacity of 82 MGD at the metropolitan WRFs. Total monthly average flow: 56.2 MGD (serving approx. 702,500 people). Remaining capacity: 5.3 MGD (service for 66,250 additional people). Based on the projected growth rates from **Table 3-3**, the Agua Nueva/Tres Rios service area is expected to reach the population of 768,750 (702,500 + 66,250) by the year 2021.*

Table 3-6 Flow Projections per Interceptor Tributary Area

Interceptor	Residential Flow (MGD): 216 gallons per day per unit	Commercial/Other Flow (MGD): 1,000 gallons per day per acre	Total Projected MGD
Agua Nueva WRF			
ACSE	0.04	0.05	0.09
NWO	0.16	0.11	0.27
P&R	0.05	0.04	0.09
PTI	0.37	0.29	0.67
SCC/SCE	0.12	0.11	0.24
SCI	0.28	0.08	0.36
SEI	2.43	4.46	6.90
SRI	0.32	0.23	0.55
Total	**3.79**	**5.39**	**9.17**
Tres Rios WRF			
SWI	0.35	0.22	0.57
CDO	1.24	4.34	5.58
CRI	1.92	0.45	2.37
NRI	0.55	0.19	0.74
TVI	0.09	0.04	0.13
Total	**4.2**	**5.2**	**9.4**

3.4 CONCLUSIONS

Based on the service area characteristics discussed in this chapter:

- It is important to continuously monitor and evaluate regional growth to ensure the department continues to meet the needs of the service areas.
- Expansion of the treatment and conveyance systems is predicated upon growth. The development community is the primary driver of growth.
- Current development trends and growth rates suggest that the Tres Rios WRF and the Agua Nueva WRF have enough combined capacity (before reaching 75% of capacity) to meet the projected demand until 2021. After 2021, the estimated capacity demand will prompt planning of expansions to meet capacity demand in the service area.
- Service areas with allocated capacity in the treatment system are Avra Valley, Green Valley, and Corona de Tucson. (Allocated capacity is capacity that is promised to specific developers because they have already paid for expansions.)
- Future capacity expansion at the sub-regional facilities will result in phase-planned expansions based on estimated and projected service demand.

3.5 OUTLOOK

Based on the service area characteristics discussed in this chapter, PCRWRD should consider the following actions:

- Continue to monitor growth in all service areas.
- Continue to closely monitor growth in the service areas tributary to the Avra Valley WRF and the Corona de Tucson WRF. These facilities have allocated capacities and will require expansion to serve new customers.

CHAPTER 4: SUSTAINABILITY

Compost processed at Tohono O'odham Nation's San Xavier Co-op Farm.

In May 2007, the Pima County Board of Supervisors adopted Resolution No. 2007-84 in support of County Sustainability initiatives. In August 2008, the County published its first Five-Year Sustainability Action Plan for County Operations (the 2008 SAPCO Plan). Both the County and the City of Tucson have taken serious steps in meeting sustainability goals and prioritizing actions to accomplish these goals. Special emphasis is placed on the concept of land use, transportation and infrastructure integration, as well as on efforts to increase the level of renewable resources use and conservation of the natural environment.

The solar field at the Agua Nueva Water Reclamation Facility provides 1 MW of clean renewable energy. Approximately 7.6% of PCRWRD electricity is supplied by solar power.

With the passage of Resolution No. 2007-84, the Board of Supervisors initiated a systematic approach of integrating the goals of sustainability into numerous facets of Pima County operations, including energy management and conservation, building construction, waste reduction, and water conservation.

'Achieving balance between economic development, social well-being, and environmental protection to ensure the needs of current generations can be met without compromising the ability of future generations to meet their own needs.' (SAPCO 2008)

The SAPCO 2008 calls for numerous sustainability goals and actions that would help the County improve its performance in the area of sustainability. Major updates to the SAPCO will be conducted every five years to summarize the plan implementation process and ongoing monitoring and evaluation programs. The 2014 SAPCO Update is the first major update to the original five-year SAPCO. SAPCO recommends specific actions for enhancing County performance in the following nine areas: (1) Minimizing the Carbon Footprint of County Government, (2) Renewable Energy and Energy Efficiency, (3) Green Building, (4) Alternative Fuel Vehicles (5) Water Conservation and Management, (6) Land Conservation and Management, (7) Waste Reduction, (8) Green Purchasing, and (9) Health and Wellness.

SUSTAINABILITY GOAL

To minimize chemical and energy consumption in operations, maximize use of renewable water and energy, and maximize resource recovery to benefit the environment and the community.

PCRWRD has taken, and will continue to take, a lead role in the efforts of fulfilling Pima County sustainability goals as defined in the SAPCO. The PCRWRD's commitment to integrating sustainability into its daily operations and business decision-making process is reflected in the following objectives:

- Maximize treated effluent (reclaimed water) reuse;
- Maximize resource recovery;
- Reduce chemical and energy consumption;
- Maximize the use of renewable energy;
- Reduce waste production from daily operations;
- Maximize the use of environmentally friendly products;
- Create a healthy and pleasant work place; and
- Provide sustainability training.

VISION FOR THE FUTURE

PCRWRD is taking a lead role in fulfilling the sustainability goals as set forth in the adopted Resolution and Action Plan. Sustainability is an integral part of PCRWRD's business, and is one of the six business pillars of the PCRWRD. The PCRWRD's vision is to be an industry leader in the management and sustainability of the water reclamation cycle and other renewable resources. The PCRWRD's goal is to minimize chemical and energy consumption in operations, maximize water reuse, the use of renewable energy, and resource recovery from wastewater collection and treatment processes.

OUR VISION

To be an industry leader in the management and sustainability of the water reclamation cycle and other renewable resources.

The end product of the treatment process (high-quality reclaimed water) is considered the region's primary, growing renewable water resource. Put to beneficial use in landscaping, aquifer augmentation and environmental enhancement, reclaimed water can help to offset the region's reliance on limited, non-renewable groundwater resources. PCRWRD is committed to advancing Pima County's vision and adopted policies for a sustainable water future through maximizing beneficial use of its reclaimed water supply.

Since the completion of the Regional Optimization Master Plan (ROMP), the improved quality of the treated water produced at PCRWRD facilities has increased opportunities to beneficially reuse this reclaimed water resource. PCRWRD views maximizing reuse and recharge of recycled water produced at facilities as a critical opportunity. Other Pima County departments, including Transportation, Flood Control, Natural Resources, Parks and Recreation, and Stadium District, rely on a cost-effective supply of recycled water. PCRWRD supports increased use of Pima County's recycled water to replenish the aquifer, sustain environmental restoration projects and irrigate county facilities. See Chapter 7 for more details on the reclaimed/recycled water production and reuse.

4.1 MAJOR PROGRAMS AND PROJECTS

The operation of wastewater treatment facilities is energy intensive; and advanced technology required to produce useful and high-quality biological byproducts from the treatment process is costly. In spite of these high costs, PCRWRD is committed to sustainability.

The department uses solar energy in the operation of the Agua Nueva WRF, the Tres Rios WRF and the Water and Energy Sustainability Center. Over the next five years, the department plans to install solar panels at the Green Valley WRF and the Corona de Tucson WRF. The department also uses methane gas, a byproduct of the treatment process, as an energy source for facility processes and operations.

To strengthen sustainability in its operations, PCRWRD has developed a variety of projects and programs. Five major programs are planned over the FY 2014/15 to FY 2018/19 strategic planning cycles. They include:

1. Water Resources Management (Chapter 7)
2. Resource Recovery (Chapter 7)
3. Energy Management/Optimization Program (detailed below)
4. Research and Technology (detailed below)
5. Culture Change (detailed below)

4.1.1 ENERGY MANAGEMENT/OPTIMIZATION PROGRAM

The consumption of traditional sources of energy is costly and has a negative effect on the environment and human health. PCRWRD strives to reduce these negative effects and the long-term operating costs associated with more traditional energy sources. To accomplish this, the department maximizes energy efficiency and increases the amount of renewable energy it uses.

There is a direct correlation between the consumption of water and energy. Traditional power plants require fresh water for cooling. Some of that water is lost in the power-production process. Energy is required to pump, move and treat water. Solar energy systems conserve water that would have been lost in more-traditional power generation systems. Energy demands are reduced significantly when pumping and moving water is not required.

Energy is a big part of PCRWRD's overall operating expenses, representing 15%-20% of plant operations and maintenance costs. Water reclamation facilities and pump stations in particular are highly energy intensive. From 2000 to 2014, most of PCRWRD's wastewater reclamation facilities have been expanded and upgraded to produce high quality reclaimed water. As a result, the department's energy demand has increased. PCRWRD spends over $6 million a year for energy. The department's goal is to reduce overall energy consumption and associated costs by implementing an effective energy management program. PCRWRD developed a five-year Energy Efficiency Improvement Action Plan to guide the department's energy program. The purpose of the Energy Management/Optimization Program is to maximize the use of energy-related assets, thereby reducing both energy costs and consumption.

PCRWRD HANDLES MULTIPLE RENEWABLE RESOURCES

High Quality Treated Effluent
PCRWRD reclaims over 60 million gallons of wastewater per day.

Biosolids
Our system generates over 10,000 dry tons per year of "nutrient rich" biosolids.

Biogas
Our digesters produce an average of 800,000 cubic-feet per day of biogas, mainly biomethane.

Nutrients
Our systems receive over 3,000 pounds of phosphorus and 26,000 pounds of nitrogen per day.

Solar
PCRWRD purchases solar power from two solar farms (1 MW each). Approximately 7.6% of our electricity is supplied by solar power.

Energy Conservation
PCRWRD consumes over 40,000 kwh per year and spends approximately $6 million on electricity.

SOLAR ENERGY PROJECTS

PCRWRD is the second largest energy consumer in Pima County government. To maximize energy efficiency and increase the use of renewable energy, the County has been seeking sites that can accommodate larger solar energy projects with the potential to serve the department's water reclamation facilities and other Pima County facilities.

In 2010 and 2011, the County contracted the construction of solar power projects adjacent to the Tres Rios and Agua Nueva WRFs. Both projects are one-megawatt facilities.

The electric energy generated at these two solar facilities is used to augment power for the wastewater treatment processes at the two regional wastewater facilities. In FY 2013/14, these two facilities generated 4,034,785 kWh of energy; this is enough energy to power almost 400 homes for a year. The department's solar energy projects are expected to reduce CO2 emissions by 1,100 metric tons per year.

In the next five years, the department will complete the construction of solar energy projects planned for the Green Valley and Corona de Tucson WRFs. The department projects the savings from these solar energy projects to be $4.5 million to $7.7[1] million over 20 years. The actual savings will be dependent on increases in commercial power rates. Upon the completion of these solar projects, solar power will account for about 15.6% of the total power purchased by PCRWRD. The department expects to meet the County's solar power goal of 15% energy from solar power ahead of its 2025 goal.

4.1.2 RESEARCH AND TECHNOLOGY

Over the years, wastewater treatment has evolved as new processes and technologies are developed and marketed. In the future, treatment processes will continue to adapt and change to meet stricter regulations and public demands. With the advent of modern technologies and population growth, the department's mindset about waste has undergone fundamental changes. As the second largest wastewater utility in Arizona, PCRWRD has contributed significantly to establishing Southern Arizona as a global leader in environmental technology, research innovation, with a constant emphasis on water quality. This started with the upgrade of the two main treatment facilities in 2014 and continues through the creation of the Water Campus, a central hub for research and innovation related to water sector advancements. PCRWRD pays close attention to new technologies and continues to develop partnerships with other agencies and research institutions to leverage our limited resources more efficiently. The Water Campus was created through public-private partnership among Pima County and seven area sectors who use the facility for water quality innovation. As technologies improve and evolve, PCRWRD is reusing more water and is converting waste into useful resources.

PCRWRD's ongoing projects in the area of Research and Technologies include:

- Continued collaboration with the University of Arizona, a tenant in the new laboratory at the WESC;
- Control of Trihalomethane through the use of centrate to reduce chemical use;
- A grant-funded research project with the Water Energy Research Foundation and the City of Chicago. The research project is entitled "Sustainable Struvite Control Using Residual Gas from Digester Gas Cleaning Process;"
- Technical presentations at various State and National conferences.

PCRWRD's Research and Technology Program is focused on evaluation of technologies that can improve the performance or reduce the costs of wastewater management practice.

[1] *This savings calculation includes a canceled solar energy project at the Avra Valley WRF.*

4.1.3 CULTURE CHANGE

Creating a green culture among employees has become a PCRWRD priority. The department continues to invest in sustainability training and encourages employees to reduce, reuse and recycle; maximize the use of environmentally friendly products; and create a healthy and pleasant workplace. Such activities advance the goals of the Pima County Board of Supervisors' Resolutions on Sustainability (first adopted in May 2007, and again in June 2014). These activities adhere to the 2014 SAPCO.

One of the Action Items in the Pima County Sustainable Action Plan calls for each County department to designate Eco-Champions. Eco-Champions help to coordinate recycling and conservation activities in their respective departments. PCRWRD employees are actively involved in this effort.

4.2 CONCLUSIONS

Based on the sustainability goals discussed in this chapter:

- PCRWRD is committed to integrating sustainability into its daily operations and business decision-making process.
- PCRWRD developed a variety of projects and programs to strengthen sustainability in its operations.
- PCRWRD set a goal to reduce overall energy consumption and costs by implementing an effective energy management program. To meet that goal, the department developed a five-year Energy Efficiency Improvement Action Plan.
- PCRWRD initiated solar energy projects to serve the Agua Nueva and Tres Rios WRFs, maximizing energy efficiency and increasing the proportion of renewable energy consumption. Plans for solar energy projects at the Green Valley and Corona de Tucson WRFs are being evaluated.

4.3 OUTLOOK

Based on the sustainability objectives and goals discussed in this chapter, PCRWRD will continue to pursue the following actions:

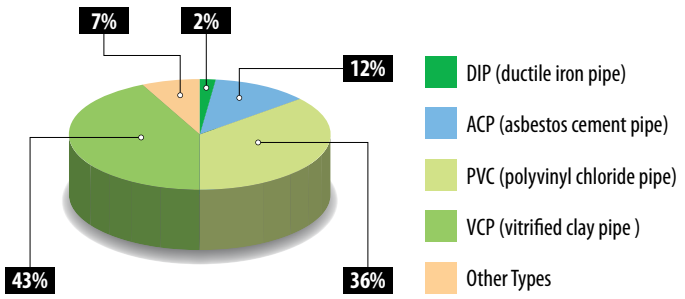
- Take a lead role in the efforts to fulfill Pima County's sustainability goals defined in the SAPCO.
- Implement the Energy Management/Optimization program's goals to minimize chemical and energy consumption in operations.
- Implement the Facility Energy Audit for all sub-regional facilities.
- Implement solar energy projects at the Green Valley WRF and the Corona de Tucson WRF.
- Maximize use of renewable water and energy and resource recovery.
- Monitor and adopt new treatment and water reclamation technologies.
- Develop partnerships with other research agencies and institutions that specialize in renewable resources research and production.
- Implement Green Team sustainability training programs.

CHAPTER 5: CONVEYANCE SYSTEM

PCRWRD's Conveyance Crew Performing Manhole Inspection and Maintenance.

This chapter describes existing conveyance infrastructure operated and maintained by PCRWRD's Conveyance Division and provides a summary of the current programs and projects.

Figure 5-1 Pima County Conveyance System Materials Chart



OVERVIEW

The PCRWRD's extensive conveyance system facilitates wastewater flow of nearly 62 MGD, from a variety of industrial, commercial and residential customers in eastern Pima County. The system serves the cities of Tucson and South Tucson, the towns of Marana, Oro Valley and Sahuarita, and unincorporated Pima County, including the communities of Green Valley, Summerhaven (Mt. Lemmon), Arivaca Junction, Avra Valley, Corona de Tucson and Catalina. The system also extends north into Pinal County to serve the Eagle Crest development.

CONVEYANCE GOAL

Provide quality service, pollution prevention, and public health and safety protection for current and future generations of Pima County residents. Enhance the sustainability of our community and our associated lifestyle through operations and maintenance of the Conveyance System.

The operation, inspection and maintenance of the public sewer conveyance system are the responsibility of the PCRWRD Conveyance Division. Through the use of a computerized maintenance management system, the Division provides an extensive, proactive year-round preventive maintenance program, as well as specialized activities including: sanitary sewer overflow-reduction efforts, vector (roach) control, system administration, asset management, capital improvement projects, conveyance rehabilitation projects, system inspections, pumping systems and odor control activities. PCRWRD manages several programs to address the prevention of Sanitary Sewer Overflows. The division's programs contribute to the overall low number of SSOs occurring in the PCRWRD system. The two most common causes of conveyance system surcharge are pipeline obstructions and insufficient pipeline capacity.

PCRWRD has developed a hydraulic model that provides a critical capacity assessment which is required by the Arizona Department of Environmental Quality (ADEQ) for planning purposes. The model is calibrated as needed to reflect current conditions in the conveyance system tributary to the Agua Nueva and Tres Rios facilities. By using hydraulic model results, PCRWRD is able to plan for augmentation and rehabilitation projects, giving priority to those with the highest rank of need for repair.

5.1 EXISTING CONVEYANCE SYSTEM

The PCRWRD's entire regional conveyance system consists of nearly 3,500 miles of public sanitary sewer lines, over 76,800 manholes and cleanouts, and 26 active pump/lift stations within a 393 square mile service area. The regional system contains the main metropolitan Tucson system as well as sub-regional sewer systems serving Avra Valley, Corona de Tucson, Arivaca Junction, Green Valley, Pima County Fairgrounds and Summerhaven.

The sewer lines in the regional conveyance system date from the early 1900s to the present and were constructed using various pipe materials, including reinforced concrete pipe (lined, unlined, centrifugally-spun and vertically cast), asbestos cement pipe (ACP), ductile iron pipe (DIP), salt glazed clay pipe, vitrified clay pipe (VCP), plastic truss pipe, and polyvinyl chloride pipe (PVC). The regional conveyance system materials are depicted in **Figure 5-1.**

The largest percentage (37.1%) of the total sewer pipes in the regional conveyance system was built more than 25 years ago (**Figure 5-2**). The very old pipes built more than eighty five years ago comprise less than two percent of the system and serve parts of the Tucson downtown area and older neighborhoods. Pipes built in the past fifteen years comprise 16.2% of the entire system.

Figure 5-3 illustrates the regional conveyance system by built period.

5.1.1 METROPOLITAN CONVEYANCE SYSTEM

The metropolitan conveyance system is the largest system within the regional system. The metropolitan systems conveys flow, primarily by gravity, to the community's two major water reclamation facilities: the 32 MGD Agua Nueva WRF and the 50 MGD Tres Rios WRF. The metropolitan conveyance system conveys nearly 62 MGD Average Dry Weather Flow (ADWF) to these facilities.

Figure 5-2 Pima County Conveyance System Age Chart

Built Period	Sewer Lines (mi)	Age (Year)	% of Total
1900-1930	67	85+	1.9%
1931-1950	133	65+	3.8%
1951-1970	981	45+	28.1%
1971-1990	1,297	25+	37.1%
1991-2010	972	5+	27.8%
2011-Present	44	0-5	1.3%
Total	**3,494**		**100.0%**

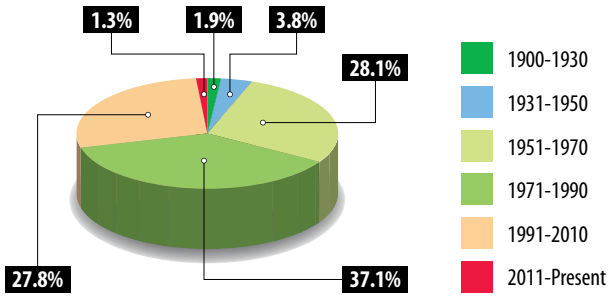


Figure 5-3 Pima County Conveyance System by Built Period

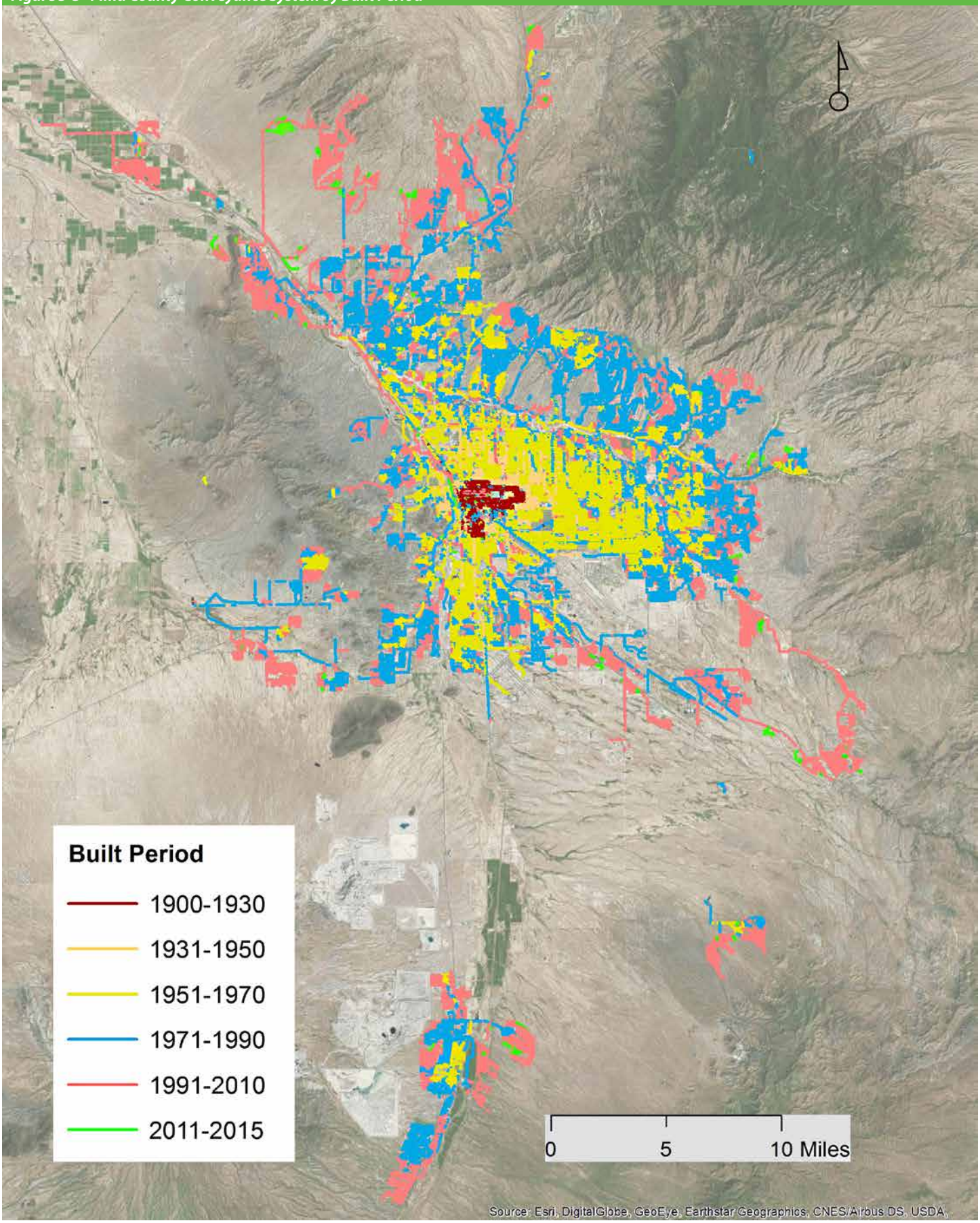
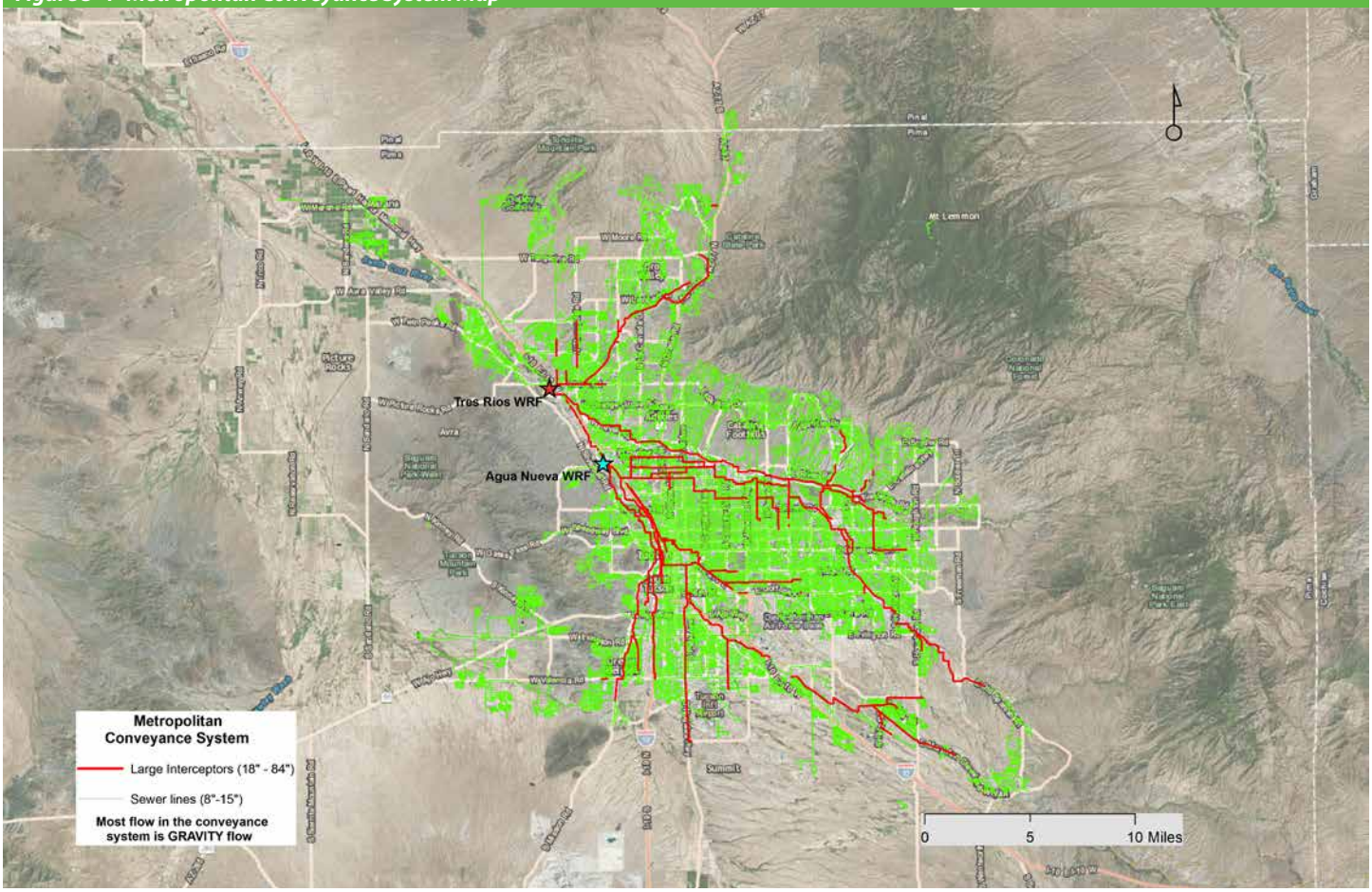


Figure 5-4 Metropolitan Conveyance System Map



The metropolitan system is comprised of approximately 3,090 miles of sewer pipes. The majority (97%) of the metropolitan systems contains pipes that are 8 to 15 inches in diameter. The remaining lines are large interceptor pipes of up to 78 inches in diameter. The interceptor system, shown in **Figure 5-4**, forms the backbone of the system.

The metropolitan system's largest pipe is 78 inches in diameter. Several segments of this pipe comprise the sewer line G-74-08 that commences east of I-10 near the W. Prince Road exit, runs under I-10 and continues north parallel to the interstate. The G-74-08 sewer line is approximately 4,200 feet long and terminates just north of S. Sweetwater Drive. The 84-inch pipe (sewer line G-74-008, 200 linear feet) that terminated at the now-decommissioned Roger Road plant's headworks has been cleaned, plugged and placed out of service.

5.1.2 SUB-REGIONAL CONVEYANCE SYSTEM

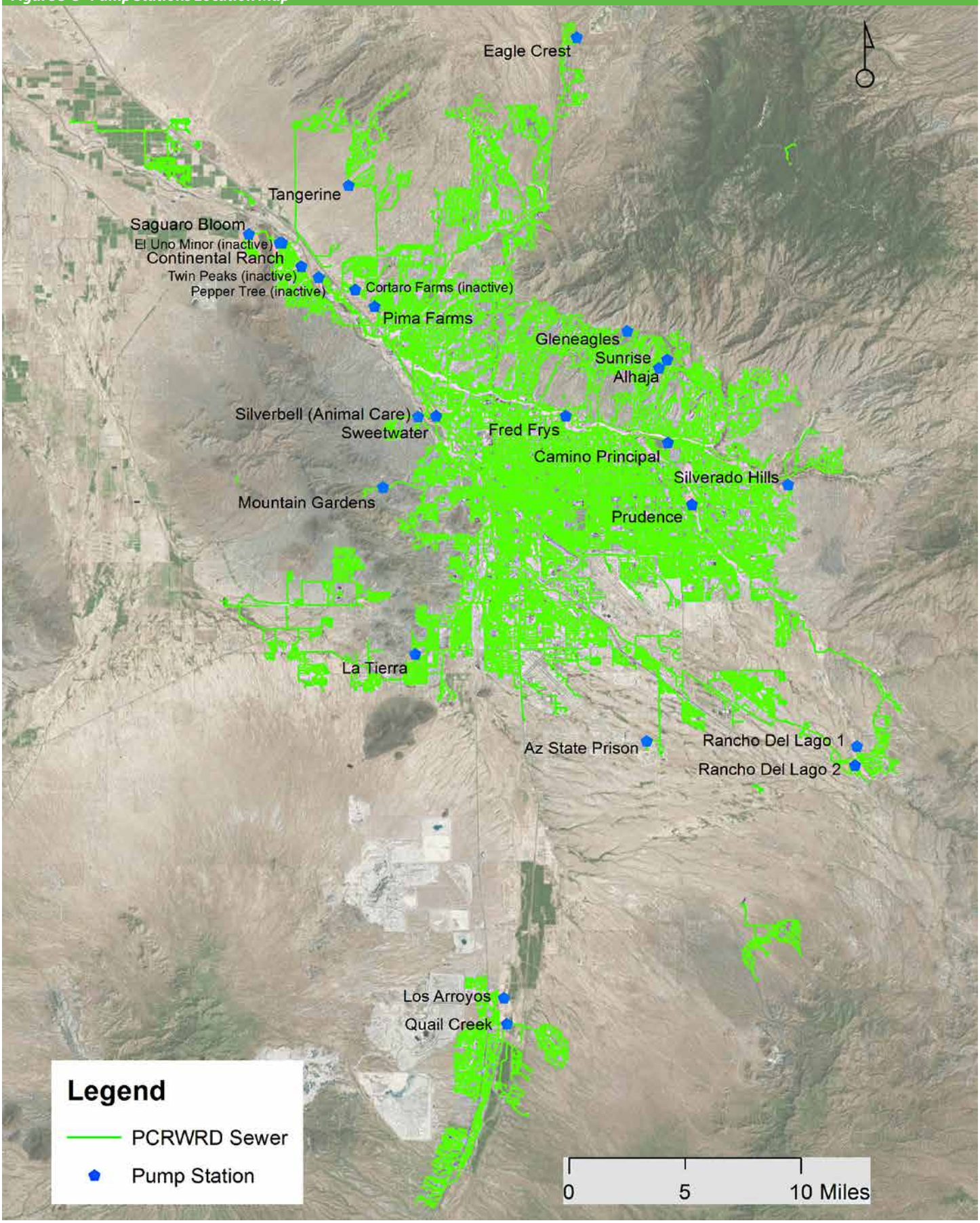
The sub-regional conveyance systems serve the Green Valley, Avra Valley, Corona de Tucson, Arivaca Junction, Pima County Fairgrounds, and Summerhaven areas. The sub-regional conveyance system transports 5.7 MGD ADWF to the sub-regional water reclamation facilities. The sub-regional conveyance system is comprised of nearly 400 miles of public sewer pipes that range from 8 to 30 inches in diameter. The two largest 30-inch sewer lines serve the Green Valley service area. They are located approximately 1.5 miles south of the Green Valley WRF. Sewer line G-86-127 runs parallel and west of the Santa Cruz River. This line conveys flows from the upstream collection system located on the west side of the Santa Cruz River. Sewer line G-85-040 conveys flows from the subdivisions east of the Santa Cruz River, along the east and west side of S. Old Nogales Highway (e.g. Madera Highlands Villages and Farmers Investment Co. (FICO) land. Both lines feed into the 21-inch sewer that conveys flows to the Green Valley WRF.

5.1.3 PUMP STATIONS

The regional wastewater reclamation conveyance system includes 26 pump/lift stations (**Figure 5-5**)The pumps range from one to 600 horsepower at the Continental Ranch Regional Pump Station (CRRPS) and pump from 13 to 4,000 gallons of wastewater per minute. Regional pump stations, such as the CRRPS, Rancho del Lago 1, Rancho del Lago 2, Los Arroyos, and Quail Creek pump station, serve larger basin areas. Most pump stations serve smaller areas, subdivisions, specific developments or individual properties. Four inactive pump stations (Pepper Tree, Twin Peaks, Cortaro Farms, and the El Uno Minor pump stations) are on standby as a backup to CRRPS should it experience a catastrophic failure. As development expands and the sewer system grows, some pump stations will be taken off line when gravity sewers are constructed and are available to replace them.

Pump station improvement projects that are scheduled according to the 5-year CIP budget projections include the construction

Figure 5-5 Pump Stations Location Map



Continental Ranch Regional Pump Station, GAC Unit.

of the Sabino Creek pump station and the rehabilitation of the Principal, Silverbell, and Silverado pump stations. The rehabilitation of the AZ State Prison pump station will include the addition of a mechanical bar screen installed for solid waste removal due to the excessive debris that is discharged into the public system from the prison. The largest pump station in the system, the CRRPS, will be rehabilitated and a second force main will be installed for increased capacity. The La Tierra pump station is scheduled to be taken off line by converting to a gravity system.

The Saguaro Bloom pump station, built in 2013 to serve the Saguaro Bloom subdivision in the Town of Marana, is currently operated and maintained by PCRWRD. Wastewater from this pump station is conveyed to the Tres Rios WRF. In the future, the operation and maintenance of this pump station will be transferred to the Town of Marana. Before this transfer occurs, Marana will install a new force main and gravity sewer system that will convey wastewater to the Marana WRF. The new force main and gravity sewer is currently under design. The construction of the new force main and transfer of the Saguaro Bloom pump station is scheduled for the fall 2016.

5.2 MAJOR PROGRAMS AND PROJECTS

The primary operation and maintenance responsibility of the Conveyance Division is to prevent the occurrence of Sanitary Sewer Overflows (SSOs), as required by ADEQ. PCRWRD manages several programs to address that responsibility, and each contributes to the overall low number of SSOs occurring in the Pima County's system.

Primary Conveyance Equipment:

- Rodder
- Combo Unit
- CCTV Unit

Scheduled Maintenance:

- Rodding, Flushing, and CCTV

Preventive Maintenance:

- Area Rodding and CCTV

Unscheduled Maintenance:

- Rodding, Flushing, and CCTV

Other:

- Flow Metering
- Manhole Inventory and Inspection

Scheduled Maintenance Program

The Scheduled Maintenance Program centers on scheduled responses to problem areas that work crews identify through the use of remote-control inspection devices in sewer lines. This program focuses on the removal of roots, grease, and other obstructions that can cause sanitary sewer overflows. Sewer reaches identified through this program have Maintenance cycles on "problem reaches" range from three months to four years. Staff uses six combination vacuum/pressure trucks to maintain these lines. Rodding and CCTV inspections also critical components of this program.

Preventive Maintenance Program

The Preventive Maintenance Program systematically cleans all sewer lines that are 15 inches in diameter or smaller every five years. The program covers more than 73,000 reaches of the conveyance system. An integral part of the Preventive Maintenance Program is the "Area Rodding Program," The Area Rodding Program uses industrial-size "plumbers' snakes," to cut the tree roots, break up debris and clear blockages in wastewater lines.

Emergency Response Plan

The Emergency Response Plan's activities contain, remediate and mitigate conditions that could lead to an emergency. The Sanitary Sewer Overflow (SSO) Response Program is the key component of the emergency response plan, ensuring rapid responses to overflows. Overflows are invariably caused by blockages and/or breakages of sewer pipes, primarily resulting from root- growth, grease and vandalism. Under the Clean Water Act, all sanitary sewer overflows (even one drop of wastewater) are exceedances. The department reports all exceedances in compliance with the Act. **Figure 5-6** shows the department's success in reducing SSOs.

Fats, Oils and Grease Program

The Fats Oils and Grease Program (also known as the Grease Campaign) educates the general public about the consequences of pouring grease and oils down the drain. The educational program uses brochures, outreach events, sewer bill inserts and public service announcements to teach residents how to properly dispose of fats, oils and grease. The department organizes a grease recycling events following the holidays when high-fat content foods are typically prepared. The collected grease is recycled into biodiesel.

Vector (Roach) Control Program

Through this program, manhole interiors are coated with a latex-based insecticide. The insecticide, which targets the American Peripleneta roach (sewer roach), is effective for two years. The sewer roach is the only type of roach that can survive in the sewer. The program operates on a continuous two-year cycle.

Odor Control Program

The Odor Control Program operates and maintains 32 odor control systems, including sixteen (16) chemical dosing stations and 16 vapor treatment units throughout the conveyance system. The purpose of the program is to reduce odors in problematic areas throughout the conveyance system. Since 2007, the department has invested more than $10 million and continues to expand the system-wide odor control program.

Asset Management Program

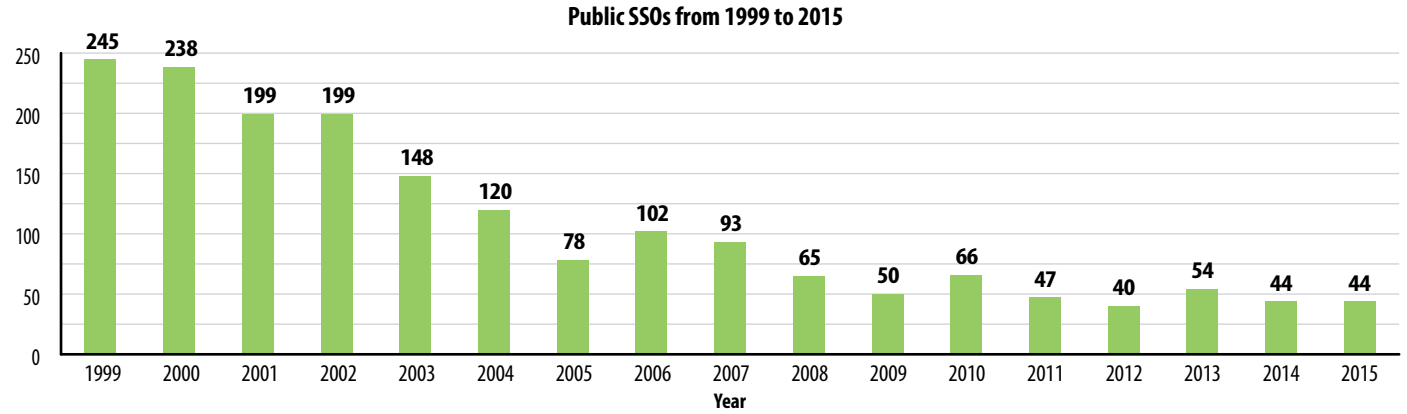
The Asset Management Program manages all conveyance system assets and maintenance activities, and maintains 1.5 million historical records. A key component of this program is the *Computerized Maintenance Management System (CMMS).*

Conveyance Condition Assessment

The Conveyance Conditions Assessment Program consists of the *Sanitary Sewer Inventory and Inspection Program (SSIIP)*, *Closed Circuit Television Inspection (CCTV)*, and assessment using the *Pipeline Assessment Condition Program (PACP)*. The SSIIP has compiled the global positioning system location and condition data for more than 65,000 manholes, and efforts continue toward the collection of data for new and outlying manholes. Through CCTV inspections, the department has inspected and continues ongoing inspections at regular intervals. Approximately 77% or more than 2,700 miles of the entire regional system have been CCTV inspected.

Pima County requires that operators assigned to the Pipeline Assessment and Certification Program (PACP) hold specialized certification. Staff uses international defect code standards to evalu-

Figure 5-6 Sanitary Sewer Overflows



ate and grade infrastructure based on a scale of 1 (very good) to 5 (needs immediate attention).

Flow Metering

The flows in the conveyance system are monitored via two flow metering programs: a permanent flow metering program and a temporary flow metering program.

Through the permanent flow metering program, 47 flowmeters have collected flow information from the same representative and/or critical points in the conveyance systems over very long periods of time, typically over many years. Forty three (43) of these permanent flow metering sites are located in the areas tributary to Agua Nueva and Tres Rios WRFs and the remainder are within the collection systems tributary to the sub-regional WRFs. Flow depth, flow velocity, water temperature and flow rate values are typically collected at five minute intervals by these meters. The data from 35 of these flow meters is transmitted in near real time to Central Control Room and Flow Monitoring Group staff for use via a Supervisory Control and Data Acquisition (SCADA) system. Alarm capabilities built into the SCADA system allow Central Control Room and Flow Monitoring Group staff to detect abnormal operating conditions at these 35 permanent flow metering locations.

In the temporary flow metering program, anywhere from 20 – 35 additional flow meters also collect flow information at any given time from other representative and/or critical locations in the conveyance system, but for much shorter periods of time. They are typically in place from one month to one year. Temporary flow meters also collect flow depth, flow velocity, water temperature and flow rate values at five minute intervals. These flow meters are not connected to the SCADA system. Instead, the data from these meters is manually downloaded and is readily accessible only to Flow Monitoring Group staff. Temporary flow meters can also be equipped with alarm capabilities to detect abnormal operating conditions.

The primary purpose of both flow metering programs is to collect accurate flow data during dry weather conditions, wet weather conditions and unusual operations of the conveyance system. Unusual operations include pump-around operations and transfers of flow from one sewer line to another. The higher flows during wet weather and unusual operations provide valuable insight as to how the conveyance system will perform in the future, when the dry weather flows are expected to be higher due to development. The secondary purpose of both programs is to detect abnormal operating conditions within the conveyance system. Examples of abnormal operating conditions include partial stoppages, sewer line breaks and sanitary sewer overflows (SSOs).

The flow data from both programs is typically used for:

- Sewer capacity determinations;
- Planning of capital improvement projects;
- Hydraulic flow model calibration;
- Design of flow management bypass systems;
- Monitoring for abnormal operating conditions during bypass operations;
- Inflow and infiltration and other studies;
- Odor control;

Flow Meter Placement.

- General Operations;
- Billing of large private sewer users.

5.3 CONVEYANCE SYSTEM AUGMENTATION AND REHABILITATION

PCRWRD has to look ahead to keep the useful life of its infrastructure in place by extending the life of the infrastructure or by replacing it. The department visually inspects and monitors every foot of pipe, analyzing whether it is in good enough condition to last another five to ten years, or whether it needs immediate repair. Although sewer-line infrastructure typically has a 50-year useful life, PCRWRD has 100-year-old sewers that are still operating perfectly. The clay pipe that was installed in the 1900s will not typically erode or decay, but root intrusions and other defects can require repairs.

Augmentation and rehabilitation projects of the conveyance system are generally driven by population growth and asset management – the population growth in the service area dictates capacity expansion needs and sewer augmentation, while the asset management identifies rehabilitation projects needed to maintain the integrity of the system.

The PCRWRD's augmentation and rehabilitation projects are financed and managed through the annual Capital Improvement Program (CIP). The Operations and Maintenance Program includes a variety of maintenance operations ranging from emergency and scheduled maintenance operations to CCTV inspections, area rodding, odor abatement, root and vector control and others.

5.3.1 AUGMENTATION

When planning for new infrastructure, PCRWRD looks at both the near-term and long-term planning horizons in its Capital Improvement Program (CIP) and population and development projections. PCRWRD periodically assembles a system-wide strategic plan, as required by significant developments in the specific areas

of high growth. Basin studies and development capacity planning are tools to decide planning approach.

Augmentation projects provide more capacity by increasing pipe diameter or by building parallel sewers. The rehabilitation projects include pipe and manhole repair and public sewer pumping system rehabilitation. Construction of new conveyance facilities to serve growth and development is made in compliance with regulatory requirements, design specifications and codes.

The Conveyance Augmentation Program allows for the construction of additional sewer lines or larger sewer pipes where flow restrictions are occurring or are predicted to occur. The purpose of the program is to provide needed capacity to serve future customers and fix bottlenecks in the system.

One of the major recent augmentation projects constructed to convey flows between the Tres Rios and Agua Nueva facilities and serve the greater Tucson metropolitan area is the Plant Interconnect. This interceptor consists of five miles of sewer pipes ranging between 60 and 72 inches in diameter and has a permitted capacity to carry 79.7 MGD of wastewater per day.

5.3.2 SERVICE AREA GROWTH AND WASTEWATER PROJECTS

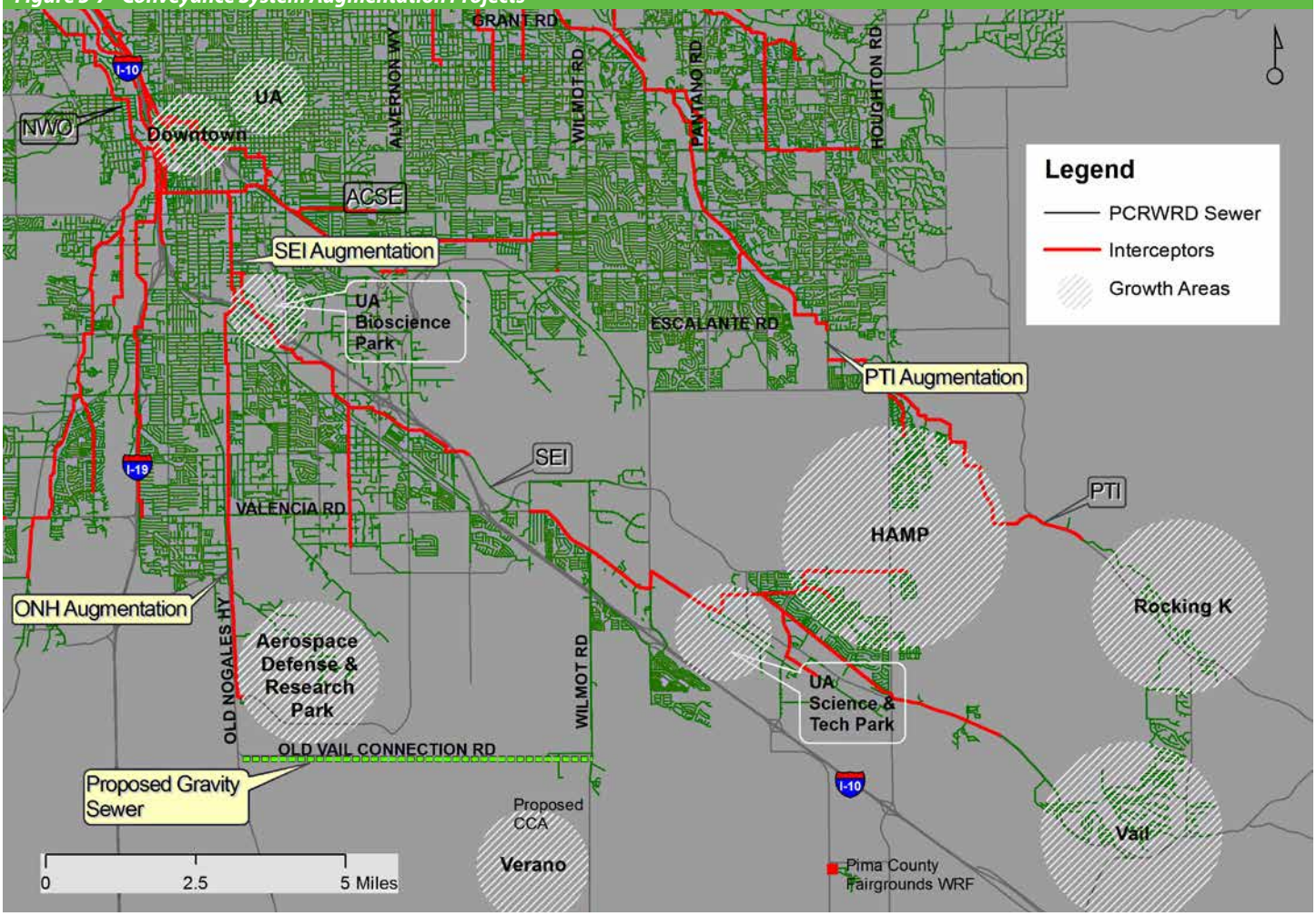
This section provides a description of recently completed and planned augmentation and other CIP projects in the metropolitan and the sub-regional service areas. New development projects are briefly discussed, followed by the discussion of augmentation projects required to serve future growth.

Several major augmentation projects are planned over the next five years: the Southeast Interceptor Project, the Aerospace Corridor/ONH Augmentation Project, and the Speedway/UA Augmentation Project. Implementation of these projects will enhance the overall reliability of the conveyance system, provide service to new customers and ensure PCRWRD's compliance with the Capacity, Management, Operation, and Maintenance (CMOM) requirements.

Based on the recent hydraulic model calibration results, the interceptors of particular concern include the North Rillito Interceptor (NRI) and the Southeast Interceptor (SEI). There are also stretches of smaller lines along Golf Links Road, Kolb Road and 22nd Street that require augmentation. For the NRI, the areas of concern include

Sewer Pipes, Manhole Barrels and Cone Sections.

Figure 5-7 Conveyance System Augmentation Projects



various portions west of Country Club Road paralleling River Road. The SEI has portions paralleling Park Avenue that are in need of augmentation. Current conveyance capacity augmentation studies include the Southeast Interceptor Study and Design, the Aerospace Corridor Sewer Study and the UA Future Growth Analysis.

AGUA NUEVA/TRES RIOS SERVICE AREA

Service Area Development Outlook

The majority of new developments requiring capacity in the downstream system will occur southeast of the PCRWRD service area, in the area known as the Southlands. In addition to numerous residential projects that are currently in the planning phase or in construction, there are major non-residential projects that will significantly impact the system capacity. The projects are: the Aerospace, Defense and Technology Research and Business Park (projected 2020 buildout); a large-scale mixed-used development, the UA Bioscience Park (known as the Bridges); and the UA Science and Technology Park. A large-scale residential development, Verano, is also planned in this area (**Figure 5-7**).

The completion of augmentation work on some of the interceptors in this service area, such as the Southeast Interceptor (SEI), is critical for future developments to be adequately served. The Capital Improvement Program has identified several improvement projects that require immediate attention. Many of these improvements will be made directly by the developments requiring capacity, but others will require the County to fund these projects. Department funding is typically offset by charging the developers connection fees. These projects are described in Figure 5-7.

Contributing to the Southeast Interceptor (SEI)

Most new developments north of I-10 and south of Valencia Road will be gravity-sewered to the SEI. Growth along the I-10 corridor is anticipated to add additional 6.1 MGD from contributing new developments. Due to the continued growth in the tributary areas of the interceptor, it has been determined that the SEI will need to be augmented to handle additional flows. The additional capacity is required for the system to comply with CMOM. The 30-inch segment of the SEI along Euclid Avenue, between 36th and 18th Street, has been identified as being in need of augmentation, as shown by the modeling results of the 10-year, 24-hour storm event. It was determined that this interceptor is close to 75% d/D[1] during Peak

[1] *In accordance with AAC R18-9-E301(D) (public sewer design standards), the ratio of the depth of flow in the pipe (d) to the diameter of the pipe (D) shall not exceed 0.75 for Peak Dry Weather Flow conditions (d/D ≤ 0.75)*

Dry Weather Flow. An alignment study is completed and a new alignment with alternative route has been chosen. The alternative route will provide capacity relief for this segment of the interceptor. The proposed alternative route will start in 36th Street head west, then follow the railroad tracts north and connect to the existing SEI in 18th Street. The cost estimate for this CIP project is $18.5 million.

Contributing to the Old Nogales Highway (ONH) Interceptor

The ONH Interceptor connects to the SEI near the Benson Highway/I-10 interchange. Unless the department constructs a new treatment facility in this area, the ONH Interceptor will serve most new development south and north of Old Vail Connection Road and west of Wilmot Road. Staff projects that flow generated by new developments would require augmentation of the ONH Interceptor. PCRWRD has selected an alignment option that will allow new developments to connect to the ONH via extended gravity sewer in Old Vail Connection Road. See **Figure 5-7** for the location of new developments relative to the ONH.

Aerospace Corridor Sewer Study - Old Vail Connection Road

In addition to augmentation projects required for the Old Nogales Highway, Southeast Interceptor, and North Rillito Interceptor, an extension of a sewer line along Old Vail Connection Road west of Wilmot Road will be required to serve future Aerospace, Defense and Technology Research and Business Park growth, planned just south of Raytheon and Tucson International Airport (see **Figure 5-7**). It is estimated that the extended sewer would have enough capacity to serve exiting (e.g. State Prison) and future planned developments in the area, such as Verano and the Corrections Corporation of America (CCA) facility.

Contributing to the Pantano Interceptor (PTI)

Most new developments north of Valencia Road and east of Pantano Road either connect or will connect to the PTI. Additional flows are expected from the HAMP and Rocking K developments. If and when those projects are constructed, the PTI and downstream collection system will require augmentation.

Harrison Road Sewer Line Augmentation

To avoid surcharging and potential overflow problems, PCRWRD installed a new 18-inch sewer line in Harrison Road between Millmar Road and Escalante Road. The sewer augmentation was completed in 2014. The augmentation provides additional capacity for anticipated growth in the tributary areas.

Contributing to the North Rillito Interceptor (NRI)

North Rillito Interceptor Relief (NRIR) Project

An earlier calibrated version of the hydraulic model showed that capacity issues may exist for portions of the NRI that are downstream of the Tucson Siphon, especially during the 10-year, 24-hour storm event. A subsequent route study showed that reducing flow by redirecting it to the South Rillito Interceptor (SRI) was preferred over augmentation of the interceptor. The North Rillito Interceptor Relief (NRIR) project will connect the NRI and the SRI at the Columbus Boulevard alignment. The project includes construction of approximately 1,863 feet of new pipe. When completed, the NRIR will allow PCRWRD to divert 10 million gallons of wastewater a day from the NRI to the SRI. This effort will reduce the potential for sewer overflows and ensure compliance with CMOM. The department completed the rehabilitation of 3.9 mile segment of the SRI between Columbus Boulevard and the Tucson Boulevard intersection in 2014.

The CIP Program also includes the NRI project, which is a series of rehabilitation projects on the North Rillito Interceptor. This project will improve the integrity of the conveyance system serving portions of northern and eastern Tucson. The NRI project is 10 miles in length; most of the work entails the rehabilitation and repair of existing sewer lines.

Downtown Area

The Tucson downtown area has been revitalized over the past several years by the addition of many new and infill developments. Because of the increase in general flow, certain portions of downtown's relatively old collection system had to be augmented or repaired. PCRWRD will continue to monitor development activities in the downtown area, especially in the eastern portion where more development is expected to occur in the coming years.

The University of Arizona (UA) Future Growth Analysis

The University of Arizona's near and long-term planned campus expansion has invited higher densities to the campus and created a significant impact on the existing sewer system. Available and additional capacity needed for this planned growth has been the topic of ongoing discussions between PCRWRD and University officials. Several existing reaches serving the UA campus were identified will require augmentation. There are additional concerns about adjacent vacant private and University properties that also will require capacity in the future. PCRWRD is monitoring development activities on these properties, as well as new student housing and campus developments north of the Speedway Blvd corridor and around the Banner University Medical Center.

The Speedway Boulevard Area Capacity Augmentation Alignment Study, Design and Construction project is an augmentation project planned to provide additional conveyance capacity for the future UA developments that are anticipated west of Campbell Avenue along the Speedway Boulevard corridor.

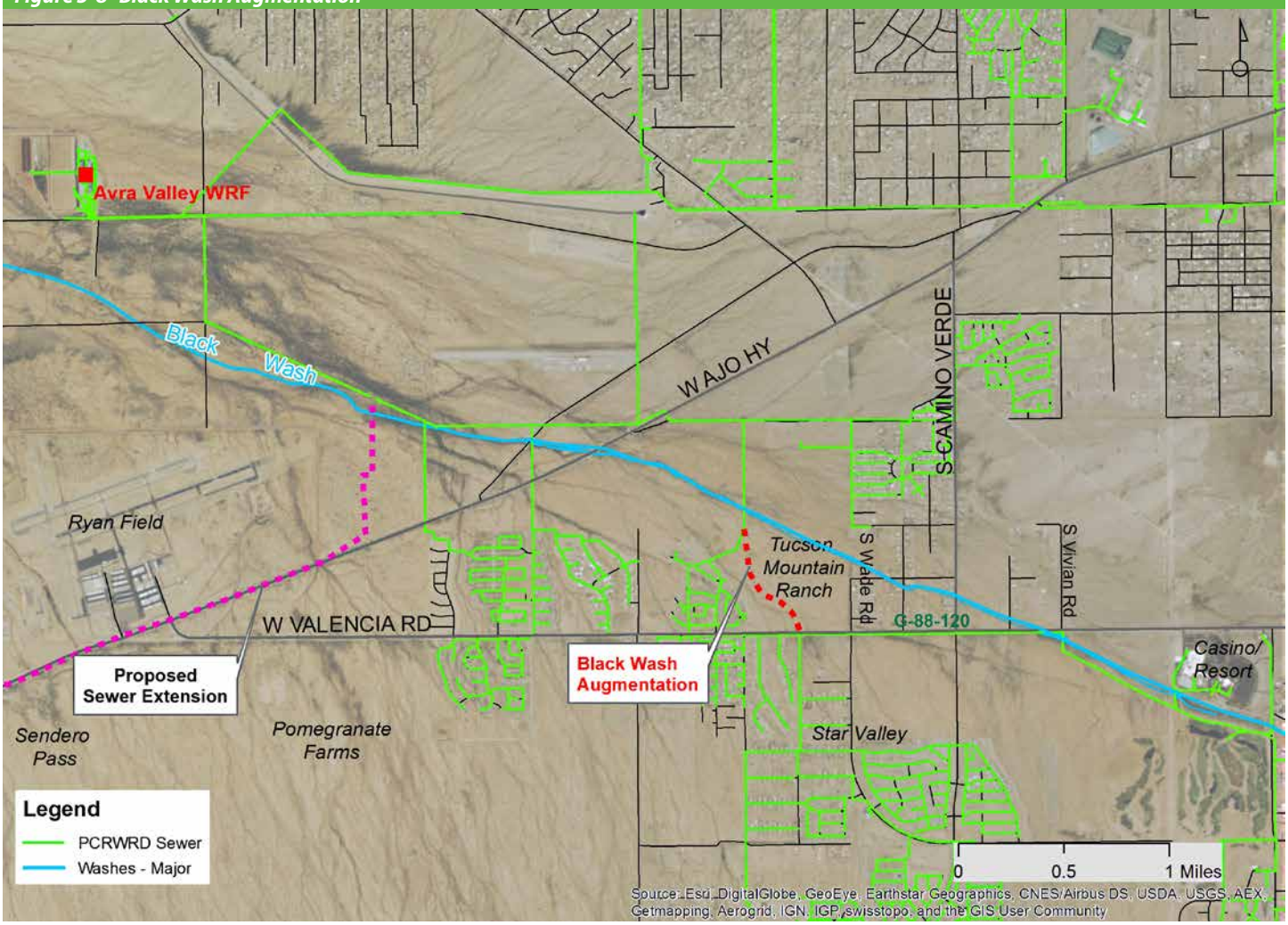
Continental Ranch Service Area

To accommodate growth in the area served by the Continental Ranch pump station, the department is planning to construct a force main to provide redundancy. While this project is planned within the next five years, its timing is dependent on development trends and capacity needs in the areas served by the pump station.

AVRA VALLEY SERVICE AREA

The Avra Valley Service Area is undergoing rapid growth and change as many residential and commercial developments continue to develop. The ability of the conveyance system to serve new developments in the service area is rather limited. Necessary augmentation projects will be needed to bring the system in line with capacity demands. New developments (i.e.: Sendero Pass and

Figure 5-8 Black Wash Augmentation



Pomegranate Farms) are required to pay for the extension of the public sewer along the Ajo Highway. The proposed line extension will connect the two developments to the existing 21-inch sewer line east of Ryan Field and convey flow northerly to the Avra Valley WRF (**Figure 5-8**).

Black Wash Augmentation

PCRWRD has identified the segment of the existing 12-inch sewer line (G-88-120) in Valencia Road west of Wade Road as the segment where conveyance augmentation is most needed to adequately serve new commercial and residential developments in the area, (e.g.: Tucson Mountain Ranch and Star Valley). The objective of this augmentation is to relieve some or all of the flows from the Valencia Road sewer line by redirecting the flow northerly to an existing sewer line that is one half mile to the northwest. Adequate conveyance capacity is available in the large 15-inch sewer. This CIP project, titled the Black Wash Augmentation, is intended to provide capacity relief for the segment of sewer between Vivian and Wade Roads.

Pima County/Pascua Yaqui Tribe IGA

One of the factors that will influence the availability of system capacity in the Avra Valley service area is the resolution of the IGA for sewer service between Pima County and the Pascua Yaqui Indian Tribe. The County provides wastewater conveyance and treatment services to the Reservation. The 25-year term IGA was recently renewed (effective December 16, 2014) for continuation of the wastewater service through the year 2039.

PIMA COUNTY FAIRGROUNDS SERVICE AREA

The Pima County Fairgrounds has been a positive economic driver for tourism and related economic development activities in the region. The revenue generated by the Pima County Fair has grown to nearly double over the past years. The County recognizes that there is a significant need to improve the Fairgrounds property to enhance other economic development activities, including connecting the Fairgrounds to the public sewer via gravity sewer. Such will allow significant additional expansions associated with the Fair and other related activities associated with this property throughout the year. Investing in the wastewater infrastructure would contribute to the promoting tourism as the Fairgrounds area continues to grow and expands.

The PCRWRD's goal is to eventually remove the Fairgrounds stabilization ponds from service and re-route the existing flows to the Southeast Interceptor (SEI). This decision is primarily driven by

Conveyance Crew Performing Manhole Inspection and Maintenance.

a steadily increasing amount of influent flow coming to the ponds over the past years.

Conversion to Gravity Sewer

PCRWRD evaluated several alignment alternatives for the provision of future sewer service at the Fairgrounds. The most cost-effective alternative is a gravity sewer that would connect to the SEI and would require construction of an on-site pump station and approximately 15,000 feet of force main. The proposed gravity line would connect to the SEI near the Rita Road/I-10 interchange. As recommended in the feasibility study conducted by RBF Consulting (2010), installation of an equalization tank would be required to attenuate existing flows, followed by a phased decommission of the facility. As noted in the study, the conversion to the gravity system would be reasonable only if sufficient flow is generated to properly maintain the system and avoid odor issues. Several private investors are currently negotiating with the County to bring high-end racetracks, sports car clubs, a racing school and other related businesses to the area south of the existing racetracks. Until other developments generate more flow, the utilization of septic systems remains the only service option for this area.

GREEN VALLEY SERVICE AREA – ARIVACA JUNCTION GRAVITY SEWER LONG-RANGE PLANNING PROJECT

Studies indicate the possibility of gravity conveyance of sewage from the existing Arivaca Junction WRF to the Green Valley WRF. The Arivaca Junction WRF could be eliminated once the existing gravity sewer line along I-19 is extended allowing conveyance of the sewage to the Green Valley WRF. This would require a gravity sewer extension between the existing termination point on the upstream end in Elephant Head Road and the Green Valley service area on the downstream end. Approximately 4.5 miles separate these two points.

The existing 12-inch public gravity sewer line G-95-159 commences at the Arivaca Junction WRF and terminates downstream at Elephant Head Road. PCRWRD constructed the sewer line in 1999. The conceptual approach is to extend the existing gravity sewer line from Elephant Head Road to a point at the northeast corner of Canoa Ranch Block 1 where it would connect with a 12-inch sewer line required to be installed by the Canoa Ranch developer, as outlined in the "Master Sewer Service Agreement between Pima County and the Fairfield "Canoa Ranch," LLC. The connection would allow Pima County to close the Arivaca Junction WRF, thereby eliminating its

dependence on adjacent ranch land for effluent disposal.

The timing of a planned sewer extension is mainly driven by future Canoa Ranch developments. High costs associated with the project makes completion of the line unfeasible if undertaken solely by PCRWRD. PCRWRD has designed and approved engineering plans for the downstream Phase 1 (G-2006-130) and Phase 2 (G-2006-172) of the gravity line. The installation of the first two phases largely depends on the timing of the Canoa Ranch Development, which is unknown at this time. After the completion of Phase 2, Pima County will construct Phase 3. Phase 3 entails the construction of approximately one mile of gravity sewer from the current terminus at Elephant Head Road to the connection point of Phase 2 sewer line (**Figure 5-9**).

The Pima County Regional Flood Control District (PCRFCD) offered another concept for the disposal of effluent from Arivaca Junction. This idea involves utilization of the existing gravity line from Arivaca Junction WRF to Elephant Head Road, where a scalping plant and an 8-inch force main could be installed to convey flows to Old Canoa Ranch for the park irrigation and habitat restoration. This option depends on funding by PCRWRD. No further discussion of this alternative has taken place.

5.3.3 REHABILITATION

With the completion of all major components of the ROMP, PCRWRD is focusing its attention on the repair and rehabilitation of the conveyance system. Just as our aging treatment facilities required repair and rehabilitation, reaches of the aging sanitary sewer system also are in need of repair and rehabilitation. Most rehabilitation projects are scheduled within a five-year planning horizon. The extensive *Conveyance Rehabilitation Program* planned over the next five years will support the community's capacity for economic development and growth and PCRWRD's vision to be an industry leader.

The purpose of the Conveyance Rehabilitation Program is to manage system assets through repairs and sewer pipe linings or replacements to mitigate expensive and potentially catastrophic events that could result in public exposure to raw sewage and sewer service disruption. Since 2008, over 450,000 linear feet (over 85 miles) of sewer lines have been rehabilitated. The vast majority were identified using CCTV and rehabilitated with Cured In Place Piping (CIPP) technology. Over the next five years, approximately $109 million will be expended on projects system wide. Major conveyance rehabilitation projects include the North Rillito Interceptor (NRI), the South Rillito West Central Interceptor (SRWCI), and the Continental Ranch Regional Pump Station. Additionally, a large number of smaller Job Order Contract projects also will be completed over the five-year planning horizon.

PCRWRD also plans to invest $9.2 million on the repairs of eight pump stations over the next five years. Some pump stations will be rehabilitated while others will be taken off line after conversion to a gravity-feed system. Efforts to bring old systems up to current design standards will incorporate advanced odor control and energy efficient technologies. Many safety features, such as improving access and installing safety equipment, will be included. Force main route studies are a major component of these projects and minimization of environmental impacts will play a critical role in decision making.

Typical Manhole Frame, Cover and Collar Cover.

SANITARY SEWER INVENTORY AND INSPECTION PROGRAM

PCRWRD designed the *Sewer System Inspection and Inventory Program (SSIIP)* in 2001 to improve the knowledge of the conveyance system manholes and structures. The initial contract and subsequent contracts with an engineering firm ensured the development of information on the department's public manholes and cleanouts. By using GIS sewer maps and orthophoto digital data, 25,000 manholes were identified and recommended for rehabilitation and repair based on the assessed existing conditions. The inventory provided data is used by Conveyance in support of daily field maintenance activities, as well as documentation used by field and office personnel to verify location and connectivity of conveyance assets.

Manhole Rehabilitation

In 2001, Pima County contracted with an engineering firm to locate, inventory and assess its network of manholes and cleanouts in a project called Sanitary Sewer Inventory and Inspection Program (SSIIP). The process was continued in 2010 locating manholes not found in the initial project. Identifying and repairing defective portions of the conveyance system advances the goals of the CMOM Plan and is in accordance with the November 2006 ADEQ permit granted to PCRWRD. In this project, as manholes were located, workers assessed various components and gave a grade or classification that would help to prioritize repairs. This resulted in the identification of over 25,000 manholes needing various types of repairs. Needed repairs ranged from minor to major. Examples included removal of corrosion and rust; readjustments; rehabilitation of cracks and breaks on deteriorating manholes; and complete manhole removal and replacement. The department ranked the manholes on a scale of 1 to 3, with 1 indicating good condition and 3 indicating critical condition. The department used a number of procurement methods to make the repairs, including as-needed contracts and individual project contracts. During this time, PCRWRD developed the current system of prioritizing and financing manhole repairs as

Figure 5-9 Arivaca Junction WRF Canoa Ranch Sewer

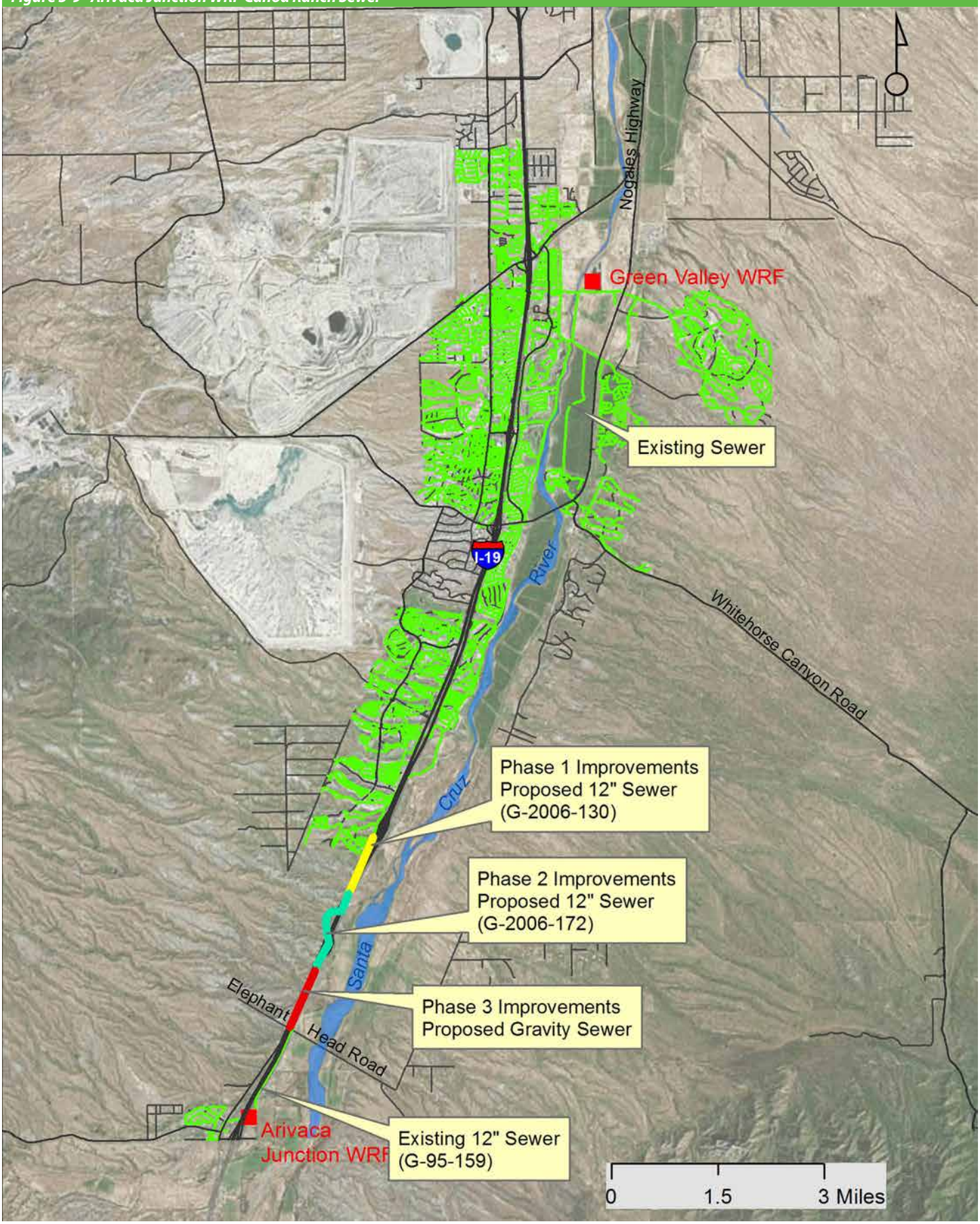


Figure 5-10 Closed Circuit Television Inspection

part of the System-Wide Conveyance Rehabilitation Program. The department took care of the most critical manholes first. Of the total 25,000 manholes initially identified, less than 1,000 category 3 manholes still need to be repaired. Those repairs will take place in the next five years. Manhole repairs continue on an as-needed and emergency basis. The current system utilizes the Job Order Contract (JOC) process and the resulting Job Orders are grouped by geographic areas.

CLOSED CIRCUIT TELEVISION PROGRAM

PCRWRD uses Closed Circuit Television (CCTV) Program to identify and prioritize line rehabilitation projects. The CCTV program performs structural condition assessments and operational performance assessments. It also can determine if new sewers, conform to CMOM regulations before they can be accepted into the public system. CCTV activities provide data on existing conditions and maintenance needs of the community's sewer infrastructure.

In 2003, only 230 miles of the interceptor systems were CCTV inspected (2006 Metropolitan Area Facility Plan Update). PCRWRD is on track to complete the state-mandated televised recording of the entire conveyance infrastructure by December 2016. Today, CCTV inspection has been completed on more than 2,700 miles of the 3,500 mile-long sewer system. The department plans to complete the inspection of the remaining 900 miles of sewer lines by the end of 2016. Following that, the CCTV Program will continue televise the entire system again over the following 10 years in compliance with CMOM requirements. PCRWRD's intention is to increase inspection of interceptor systems to once every five years to ensure the system's integrity. The data from CCTV activities feeds the annual development of the CIP and Sewer Maintenance Programs fostering proactive and cost-effective maintenance of Pima County's wastewater conveyance system. The use of CCTV decreases disruption to sewer service and traffic flow that would occur if other types of assessment had to be used. **Figure 5-10** shows cabled cameras attached to small electric transporters that are routinely used to inspect and assess the conveyance system.

CCTV is the most definitive means to visually inspect the inside of a sewer pipe. PCRWRD has operated three (3) CCTV units for many years and CCTV is requested when rodding or flushing staff observe indicators of a damaged sewer pipe or very heavy grease. More than a decade ago, PCRWRD began a system-wide methodical CCTV inspection program with a third party contractor to inspect the entire system. The approach was to begin inspections in the city center and work outward. This contract is still underway, with 77% of the system now televised.

Cured in Place Pipe Rehabilitation

The Cured in Place Pipe (CIPP) system allows contractors to rehabilitate pipes without extensive excavation. Pipes are accessed via manholes and a flexible synthetic liner. The liner is inserted in the sewer with water or compressed air. It is then cured using steam, hot water or UV light. **Figure 5-11** below shows the same section of pipe pre and post-CIPP repair. These 2012 images were captured using CCTV.

The 2006 Metropolitan Area Facility Plan Update has a section dedicated to the conveyance system assessment. Of special concern were the segments of the collection system comprised of unlined reinforced concrete pipes. These pipes are prone to failure because of the long-term exposure to corrosive sewer gases. The plan identifies a significant number of manholes with various needs and levels of priority for repair priority. Since 2006, the department has repaired portions of the collection system rated as "poor" or "immediate attention required", including portions of the following major interceptors: Aviation Corridor, the Canada del Oro, the Old Nogales Highway, the Pantano, the Santa Cruz, the South Rillito, the Southwest, and the Tanque Verde.

An integral part of Pima County's GIS mapping database is data that physically locates the public sanitary sewage conveyance system. This conveyance system electronic map library is continuously updated by the Mapping and Records staff and is available to the public.

OPERATION AND MAINTENANCE PROGRAM

System-Wide Odor Control Program

Odor is a common nuisance that can occur as wastewater travels from the source (homes and businesses) to the location of a wastewater treatment facility. Major factors that may increase the possibility of sulfides, the element attributed to many odiferous chemical compounds, include, but are not limited to, hydraulic conditions,

Figure 5-11 Cured in Place Pipe Rehabilitation

flow quantity and flow travel time. Typically, the highest concentrations of hydrogen sulfide in the conveyance system are in larger diameter sewer lines, at the pump stations, at force mains, discharges and at siphons. Odor complaints around treatment facilities increased after significant facility expansions and the encroachment of development on the buffer space around the facilities.

Over the past several years, PCRWRD implemented a system-wide odor control plan. This plan includes the use of odor control infrastructure and equipment as well as monitoring equipment on plant site to continuously measure odor-causing gases. Information from monitoring equipment helps odor control technicians respond when odors become problematic at treatment facilities. PCRWRD's System Wide Odor Control Group (SWOCG) staff also operates and maintains thirty two (32) odor control systems in the conveyance system, including sixteen (16) chemical feed sites and sixteen (16) vapor units. The SWOCG staff is responsible for coordinating the development, improvement and implementation of the PCRWRD's odor control plans with respect to regulatory compliance, information management, capital improvement planning and budgeting, and O&M.

Data show a drop in the number of complaints in the last six months of each calendar year between 2006 and 2014. The number of complaints from these time frames dropped from 357 in 2006 to 184 in 2014. These reductions can be attributed to a number of improvements, including an odor control project at the Roger Road WRF biotowers before the decommissioning of the Roger Road WRF, the increased use of carbon filters and the implementation of the ROMP.

The following are long-term odor control measures as defined in the ROMP Program to reduce and mitigate odor formed by various sources of emissions in the conveyance and treatment systems:

- Minimize odor potential in the collection system with pH adjustments, oxygen addition and chemical addition;
- Cover openings and channels in the treatment process properly;
- Collect and treat odorous air; and
- Disperse treated air into the atmosphere in such a way as to minimize any odor impact to the surrounding communities.

The implementation of these measures required the establishment of short and long term system-wide odor control conveyance and treatment system improvement plans. Short-term and near-term odor control improvements are typically those that can be quickly implemented without significant resources. Long-term odor control improvements typically require long design/construction time frames, require CIP budgeting and may not be needed until future wastewater collection or treatment facilities are constructed.

Looking forward, the long-term Odor Control Program is to proactively abate sewer odors using a holistic approach that includes consistent flow monitoring. Consistent monitoring will provide accurate flow data and reduce the amount of chemicals needed in the conveyance system. Another odor control tool is the Interceptor Model. CH2M Hill created this model which works in conjunction with GIS software to simulate the generation of odors in the conveyance system. The model predicts liquid-phase sulfide concentrations and vapor-phase H2S concentrations for individual pipe sections. The model calibrates 15 to 21 inch diameter pipes that are tributary to the Agua Nueva and Tres Rios WRFs. The department applies the model to these pipes because they generate the most odors.

These approaches are best way to accurately analyze and forecast levels of odiferous compounds based on various hydraulic conditions. The end result is a more cost-efficient reduction in gases that cause odors and corrode conveyance system infrastructure. In addition to liquid and vapor odor treatment solutions, PCRWRD incorporates the Best Management Practices (BMPs) into its design guidelines.

PCRWRD's Utility Modification Program funds projects for sewer and manhole relocation or adjustment when such relocations or adjustments are needed for County or other jurisdictional/utility agency projects to move forward.

5.4 HYDRAULIC MODELING

As required by CMOM, PCRWRD's hydraulic model provides critical capacity assessments for planning purposes. A well-calibrated

hydraulic model is needed to meet the ever-changing capacity needs of the conveyance system. The model requires constant adjustments and modifications (calibration) to address changing conditions, including new sewer connections, population fluctuations, water conservation impacts and drought management.

The first calibration was finalized in 2008 and relied on Transportation Analysis Zone data. The second calibration occurred in 2012 and relied on water data. A comprehensive re-calibration of the hydraulic model occurred in the Spring of 2016 for the metropolitan collection system. Additional re-calibration efforts are underway for the various sub-regional collection systems. The model enables the testing of various scenarios that can gauge the impacts of population growth on the conveyance and treatment systems. One of these scenarios includes testing for capacity during storm events. PCRWRD is required to ensure conveyance capacity in the event of a 10-year, 24-hour storm event, as established by CMOM. A 10-year storm event has a 10% probability of occurring in any given year. To accomplish this, PCRWRD takes the dry weather calibrated model for the system and adds storm flows. The model is used as a planning tool to predict the occurrence of potential surcharge problems. PCRWRD is consistently making improvements to the model.

5.5 CONCLUSIONS

Based on the existing conditions and future anticipated needs discussed in this chapter, the following are conclusions about the PCRWRD's conveyance system:

- To reduce the occurrence of sewer system overflows (SSOs), PCRWRD has been following a rigorous O&M regime of area rodding, scheduled maintenance and has television-inspected 77% of the system.
- To better understand the operation of the sewer system and to detect early signs of system problems, PCRWRD established a flow monitoring system consisting of permanent and temporary meters. Forty-seven permanent flow monitoring sites collect data on depth and velocity of flows. The majority of these sites located in the areas tributary to the Agua Nueva and Tres Rios WRFs.
- To mitigate odors emitted from the sewer conveyance system and treatment facilities PCRWRD implemented the System-Wide Odor Control Program. Over the past several years, the odor control projects have achieved noticeable reduction of odors in both the conveyance and treatment systems. Long-term improvements in the conveyance system are ongoing.
- To better understand how the system is functioning and how it will function in the future under a number of potential scenarios, the department uses a hydraulic model. The results of this model indicate areas of concern are the North Rillito Interceptor and the Southeast Interceptor.

5.6 OUTLOOK

Based on the near-term conveyance system needs discussed in this chapter, PCRWRD should consider the following actions:

- Implementation of several major augmentation projects will enhance the overall reliability of the conveyance system, provide service to new customers and ensure PCRWRD's compliance with CMOM. These projects are: the Southeast Interceptor Project, the Aerospace Corridor/ONH Augmentation Project and the Speedway/UA Augmentation Project.
- Southeast Interceptor (SEI) augmentation: Under construction as of July 2016. The construction of the project is expected to be completed by the end of 2017.
- The Central University area augmentation: Due to the recent expansion of private student housing near the University, there is limited capacity for any possible future expansions to the campus. Augmentation of downstream collection system is required.
- Additional force main for the Continental Ranch Pump Station: A second force main is needed for redundancy and expected increased development in the area. The charter for this project is complete.
- Old Nogales Interceptor (ONH) augmentation and extension: Portions of ONH are in need of augmentation and rehabilitation. The interceptor augmentation will serve the proposed Aerospace Corridor development and other new developments in adjacent areas.
- Extension of the public sewer in Old Vail Connection Road to accommodate planned developments in the area is planned.
- Remove the Pima County Fairgrounds WRF from service and reroute the existing flows to the SEI.
- Augmentation of the segment of 12-inch sewer line (G-88-120) in Valencia Road west of Wade Road in the Avra Valley WRF to adequately serve new commercial and residential developments in the area.

CHAPTER 6: TREATMENT SYSTEM

Tres Rios Water Reclamation Facility.

This chapter describes the existing infrastructure of the eight water reclamation facilities operated by PCRWRD and provides a summary of the current conditions and the outlook of each facility.

OVERVIEW

PCRWRD provides 97% of the total wastewater treatment capacity for Pima County. As a result of the Regional Optimization Master Plan (ROMP), Pima County is now an industry leader in using state-of-the-art technology to produce high-quality reclaimed water and other treatment byproducts that can be beneficially used. PCRWRD is now poised to not only meet future capacity demand of the growing population and regulatory requirements, but also to produce a growing renewable water resource. PCRWRD is poised to contribute to community-wide water resource sustainability by offsetting the demand for limited potable water resources through the production of high-quality reclaimed water.

TREATMENT GOAL

Provide clean and safe water for beneficial use in the reclaimed water cycle, generate biosolids products that can be beneficially utilized, and beneficially use a renewable gas product, while protecting the public health, safety and the environment, while also meeting all regulatory requirements mandated by state and federal agencies.

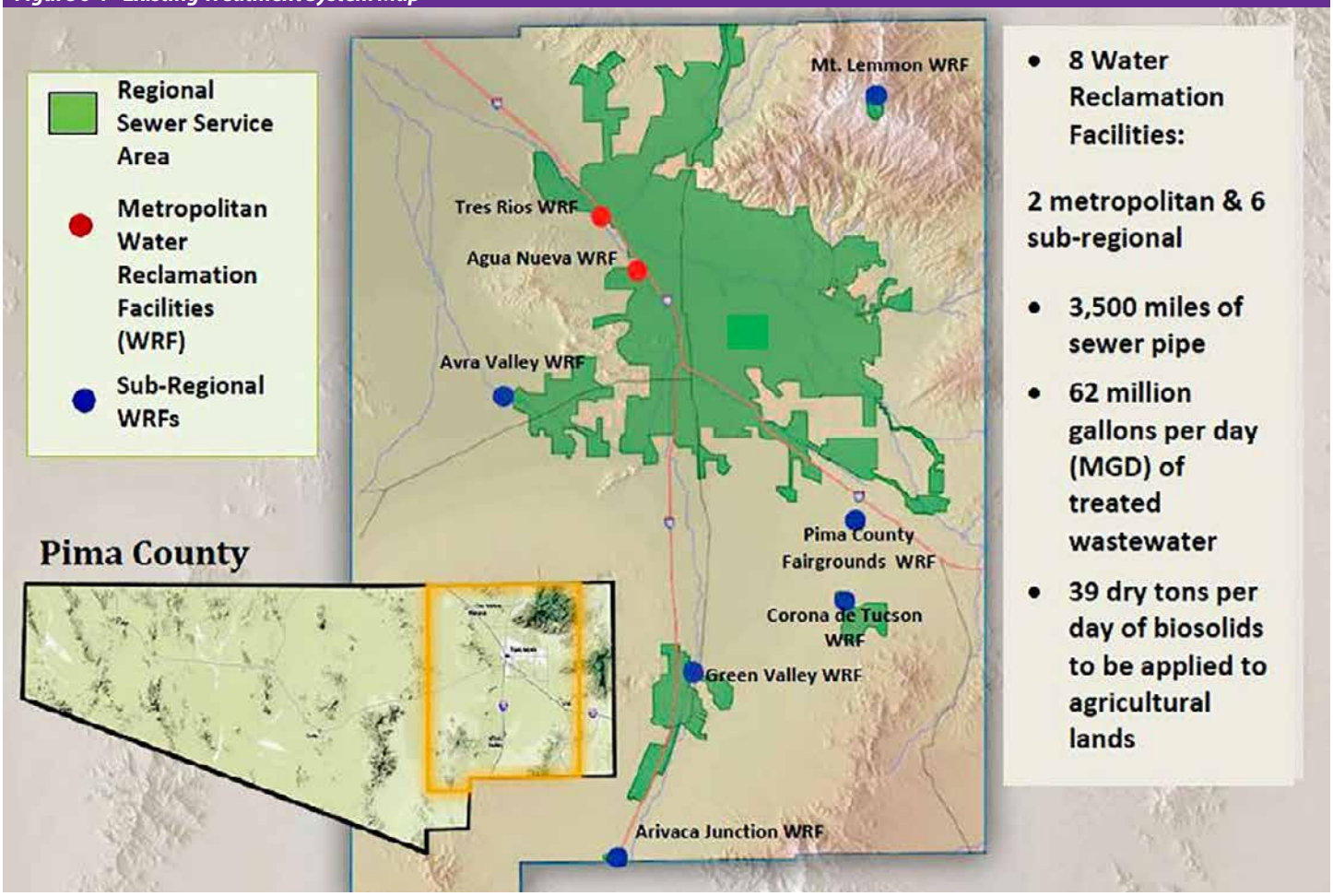
In addition, PCRWRD is focusing on optimizing its ability to recover byproducts from its treatment operations. There is an enormous opportunity to contribute to a cleaner environment through recovery and reuse of treatment byproducts in a cost-effective manner. Biosolids, biogas and nutrients are all byproducts of the wastewater treatment process. Biosolids will continue to be beneficially used in land applications across the community. Biogas will be captured and sold to regional and national markets for beneficial reuse. Also on the horizon are a side stream treatment program (to recover nutrients and use them for agricultural purposes), and an Energy Management Program (to address the rise in energy usage associated with the new innovative treatment technologies).

Over the next years, CIP treatment projects will include proactive equipment replacement to prevent equipment failures and maintain compliance. Over the next five years, the department will invest approximately $5 million in small projects and equipment purchases. These investments will address regulatory compliance commitments and safety improvements. Key projects include sludge screening, ARC Flash Study/Compliance, lighting protection, process piping improvements, replacement of aging electrical equipment and improvements to process water.

6.1 EXISTING TREATMENT SYSTEM

Treatment of wastewater in Pima County is achieved through large publicly-owned treatment (water reclamation) facilities, pri-

Figure 6-1 Existing Treatment System Map



Pima County Regional Wastewater Reclamation Department, Water and Energy Sustainability Center.

vately-owned facilities serving smaller residential communities or individual septic systems. Large treatment facilities serve the Tucson metropolitan area, the Catalina Foothills, Oro Valley and a major portion of the Town of Marana. The sub-regional facilities serve unincorporated areas, rural communities and subdivisions. Privately owned treatment facilities serve rural areas where it is impractical to connect to the public sewer.

The publicly-owned treatment facilities in Pima County are owned and operated by three designated management agencies: the PCRWRD, the Town of Sahuarita, and the Town of Marana. PCRWRD's treatment facilities are divided into metropolitan facilities and sub-regional facilities. PCRWRD owns two metropolitan water reclamation facilities: the Tres Rios WRF (formerly known as the Ina Road WRF) and the Agua Nueva WRF. PCRWRD operates the Tres Rios WRF. CH2MHill operates the Agua Nueva WRF for Pima County under a 15/5 year Design-Build-Operate (DBO) Agreement. (The 15/5 year agreement provides for CH2MHill's operation of the facility for 15 years, at the end of which the county has the option to extend that agreement for an additional five years.)

The six sub-regional water reclamation facilities are: the Arivaca Junction WRF, the Avra Valley WRF, the Corona de Tucson WRF, the Green Valley WRF, the Mt. Lemmon WRF and the Pima County Fairgrounds WRF (**Figure 6-1**). Each facility is discussed in more details on the following pages.

PCRWRD's water reclamation facilities have a combined permitted capacity of 95 MGD per day. (**Table 6-1**). On average, the department treats nearly 62 MGD of wastewater and produces 39 dry tons of biosolids for agricultural use daily. Permitted treatment capacities of the department's water reclamation facilities range from 15,000 gallons per day to 50 million gallons per day. Treatment technologies vary from evaporative lagoons to complex treatment works. Current service area populations range from approximately 42 people (2010 Census) served by the Mt. Lemmon WRF to an estimated830,000 people (2010 Census) living in the Agua Nueva/Tres Rios combined service areas.

Table 6-1 Regional Treatment Capacity

	Water Reclamation Facility (WRF)	Permitted Capacity (MGD)	Average Annual Daily Effluent Flow (MGD)	Remaining Capacity (MGD)
1	Tres Rios WRF	50.0	30.6	19.4
2	Aguan Nueva WRF	32.0	25.6	6.4
3	Green Valley WRF	4.1	1.8	2.3
4	Avra Valley WRF*	4.0	1.3	0*
5	Randolph Park WRF**	3.0	2.3	0.7
6	Corona de Tucson WRF*	1.3	0.295	0*
7	Arivaca Junction WRF	0.100	0.043	0.057
8	Pima County Fairgrounds WRF	0.020	0.014	0.006
9	Mt. Lemmon WRF	0.015	0.003	0.012
Total		**94.54**	**61.9**	**28.9**

* Avra Valley WRF and Corona de Tucson WRF have all capacity allocated.
** Temporarily ceased operations.

6.1.1 METROPOLITAN WATER RECLAMATION FACILITIES

The Tucson metropolitan area, the Catalina Foothills, Oro Valley, a southeastern portion of the Town of Marana and a large portion of the community south of the Rillito River are served by the two major treatment facilities: the Agua Nueva WRF and the Tres Rios WRF.

WATER AND ENERGY SUSTAINABILITY CENTER ("WATER CAMPUS") AND AGUA NUEVA WATER RECLAMATION FACILITY

The Water and Energy Sustainability Center (WESC) (also called Water Campus), including the new Agua Nueva Water Reclamation Facility (WRF), is located west of I-10 and northwest of the old Roger Road WRF site (**Figure 6-2**).

The state-of-the-art, county-owned facility is designed to meet new ADEQ requirements by reducing the levels of ammonia and nitrogen from the effluent discharged into the Santa Cruz River. The construction of the Water Campus and the expansion and upgrade of the Tres Rios WRF occurred simultaneously. (The Tres Rios WRF is located five miles to the north of the Agua Nueva WRF.) The Water Campus includes a central laboratory, the Compliance and Regulatory Affairs Office work space, a training center and a solar energy project.

The Water Campus is key to PCRWRD's water reuse efforts, which currently provide turf irrigation needs to golf courses, community parks, schools and recharge the aquifer. Its laboratory currently performs over 48,000 annual analyses to ensure water reuse quality, achieving the highest designates water quality, Class A+.

The University of Arizona Water and Energy Sustainable Technology Center (the WEST Center) is a new facility co-located with the Water Campus that is focused on water treatment and monitoring technologies, alternative energy, and resource recovery. WEST facilitates technology transfer between the University of Arizona, public utilities, and the private sector.

Service Area

The Agua Nueva/Tres Rios service area encompasses approximately 333 square miles and consists of more than 3,090 miles of public sewer line. The total sewer basin area encompasses approximately 515 square miles.

Service Area Population

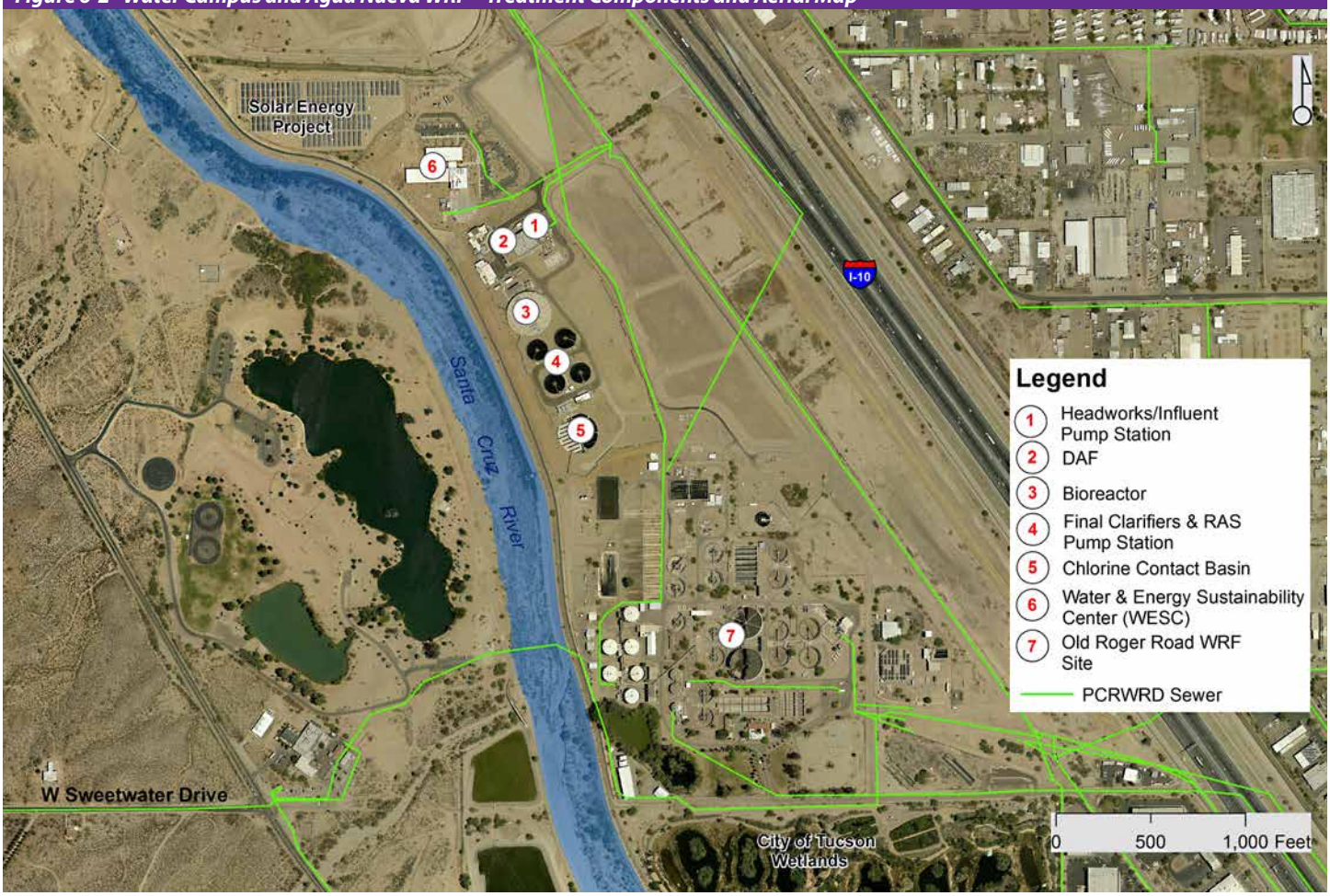
Based on the 2015 average monthly flow of 25.6 MGD, the Agua Nueva WRF serve approximately 320,000 people. Based on the 2015 average monthly flow of 30.6 MGD, the Tres Rios WRF serve approximately 383,000 people. Together, the two facilities served approximately 703,000 people in 2015.

The Agua Nueva WRF now supplies much higher-quality reclaimed water to the City's distribution system.

Treatment Method

The Agua Nueva WRF utilizes a 5-stage Bardenpho treatment process to achieve nutrient removal. Solids collected at the facility are conveyed to the upgraded Tres Rios WRF via a sludge force main.

Figure 6-2 Water Campus and Agua Nueva WRF – Treatment Components and Aerial Map



Tres Rios Water Reclamation Facility, Secondary Clarifiers.

The basic treatment system components of the Agua Nueva WRF include[1]:

- Headworks Facilities
- Influent Pump Station
- Influent Screening Facilities
- Influent Grit Removal Facilities
- Dissolved Air Flotation
- Aeration Tanks (Bardenpho Process)
- Blower Facilities
- Disinfection
- Effluent Filters
- Sludge Transfer Pump Station (sludge is conveyed to Tres Rios for processing)
- Odor Control Facilities

See **Figure 6-2** for a facility layout.

Drainage Method and Location

Although the Agua Nueva WRF is permitted to produce class B+ effluent, the facility produces Class A+ reclaimed water, utilizing chlorination for disinfection. After dechlorination, it also meets AZPDES permit standards for discharge to the Santa Cruz River, as well as numeric Aquifer Water Quality Standards. The department sends an average of 18 MGD of the total effluent produced to the City of Tucson reclaimed water system. The remaining effluent is conveyed to the same outfall previously used by the Roger Road WRF and is discharged into the Santa Cruz River.

Capacity

The Agua Nueva WRF has a permitted capacity of 32.0 MGD.

Current Flows

The average monthly influent flow in 2014 was 21.6 MGD, and in 2015 it was measured at 25.6 MGD, or a 4 MGD increase. The facility is not held to the typical 75% of capacity concerns. Excess flows from the facility are diverted to Tres Rios WRF via the Plant Interconnect designed to carry 79.7 MGD of wastewater per day.

TRES RIOS WATER RECLAMATION FACILITY (WRF)

The Tres Rios WRF is Pima County's largest facility. In 2013, PCRWRD changed the facility's name from the Ina Road WRF to the Tres Rios WRF. This change recognized the substantial reconfiguration and expansion of the facility. Located in the northwestern part of the Tucson basin, the facility began operating in 1979 as a 25 MGD, high-purity oxidation, activated sludge process. Capacity at the facility increased in 2006 with the addition of a 12.5 MGD Biological Nutrient Removal Activated Sludge (BNRAS) process. That expansion increased the overall combined plant capacity to 37.5 MGD. The Tres Rios WRF is a 2014 national American Public Works Association award winner in the category of public works projects in the environment.

TRES RIOS

Tres Rios represents the confluence of three water bodies near the facility:

- **The Santa Cruz River** which receives the effluent discharges from the Tres Rios facility;
- **The Canada del Oro** which merges with the Santa Cruz River north of Santa Cruz River and Rillito River confluence; and
- **The Rillito River** which merges with the Santa Cruz River just south of the Tres Rios facility.

The most recent ADEQ requirements for reduction of ammonia and nitrogen in effluent discharges were the primary drivers for the treatment process upgrades at the Tres Rios WRF. Upgrades and an expansion allowed the department to meet regulatory treatment and capacity requirements. Through the ROMP program, the Tres Rios WRF increased capacity from 37.5 MGD to 50.0 MGD. A new plant interconnect pipeline between the Agua Nueva and the Tres Rios facilities allows sewage flow from the Agua Nueva Service area to be diverted to the Tres Rios WRF.

[1] *Refer to the Regional Optimization Master Plan Achievements and Status Report dated February 2014 for a detailed list of system components.*

Treatment Method

The Tres Rios WRF Capacity and Effluent Quality Upgrade project consisted of many overall site improvements. They include the following components (see **Figure 6-3** for a facility layout):

- Expansion of preliminary and primary treatment facilities;
- Replacement of the west train HPO process with a new 25 MGD 5-stage Bardenpho process;
- Replacement of BNRAS process with a Bardenpho process train;
- New aeration tanks and secondary clarifiers for each train;
- New chlorine contact basins with chemical feed and mixing equipment; and
- Additional biosolids processing facilities with new sludge thickening, anaerobic digestion, digested sludge thickening/dewatering, and final storage and load-out facilities.

The new 12.5 MGD expansion resulted in the new east and west trains at the facility. The five-stage Bardenpho process which includes biological nutrient removal replaced the old high purity oxygen biological treatment process. There also were improvements to the headworks facility, solids processing and electrical systems. The new Bardenpho treatment process provides conformance with today's strict environmental standards for effluent discharges. See **Figure 6-3** for the major treatment components and facility layout.

Drainage Method and Location

The addition of the Bardenpho process achieves compliance with regulatory requirements to reduce total nitrogen concentrations to 8 mg/L or less. The Tres Rios WRF uses chlorination to disinfect. The facility is permitted for the production of Class B+ re-

Tres Rios Water Reclamation Facility – Sludge Conveyance Pipes.

Figure 6-3 Tres Rios WRF – Treatment Components and Aerial Map

claimed water. Effluent discharges to the Santa Cruz River flow into the Lower Santa Cruz Managed Recharge Project which extends along the river channel from Cortaro Road to Trico Road.

Capacity

The Tres Rios WRF has a permitted capacity of 50.0 MGD.

Current Flows

The average monthly influent flow in 2014 was 32.4 MGD (65% capacity), and in 2015 it was measured at 30.6 MGD (61% capacity).

Outlook of Facility

The Tres Rios WRF can handle an additional 85,750[2] service people, or 31,760 single family residential (SFR) units, before reaching 75% capacity. (Once a treatment facility reaches 75% capacity, the facility owner must begin planning for expansion.) Based on the projected Pima County growth rate of between 1% and 1.6%, the Tres Rios WRF will reach 75% capacity by 2029[3] (see **Table 3-3**, Tres Rios Service Area Population Projection, page 74). The facility is expected to reach full capacity when an additional 242,000[4] people (89,630 SFR units) is served by the system. The Tres Rios WRF will not reach full capacity until there is a population of 625,000[5] in its service area. The population is not expected to reach this level until after 2050.

*[2] 50.0 MGD*0.75/80 GPD – 383,000 people currently served = 85,750 additional people at 75% capacity*

[3] 383,000 current + 85,750 additional = 468,750 total people served at 75% capacity

[4] 50.0 MGD/80 GPD – 383,000 people currently served = 242,000 additional people at full capacity

[5] 383,000 current + 242,000 additional = 625,000 total people at full capacity

6.1.2 SUB-REGIONAL WATER RECLAMATION FACILITIES

Smaller communities in unincorporated Pima County receive service from the six sub-regional water reclamation facilities: the Green Valley WRF, the Arivaca Junction WRF, the Avra Valley WRF, the Corona de Tucson WRF, the Pima County Fairgrounds WRF, and the Mount Lemmon WRF. A short history, a description of the treatment processes and facility outlooks appear below.

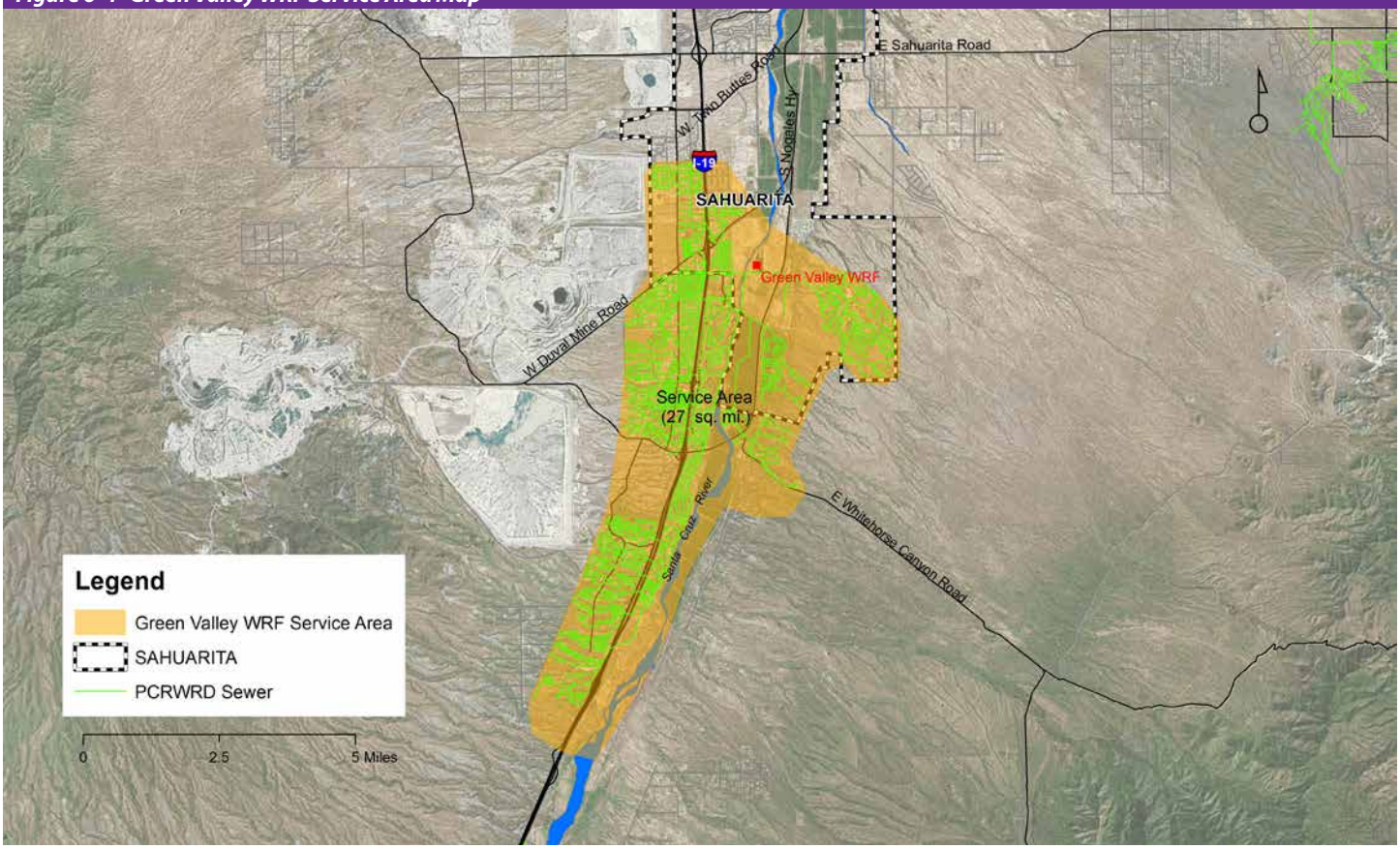
GREEN VALLEY WRF

The Green Valley WRF is located approximately 29 miles south of Tucson along the east side of the Santa Cruz River. The facility began operating in 1964.

Service Area

The Green Valley WRF service area encompasses approximately 27 square miles and consists of 226 miles of public sewer line. The total sewer basin area encompasses approximately 55 square miles **(Figure 6-4**). The service area extends along both sides of I-19 and primarily serves the retirement community of Green Valley and a

Figure 6-4 Green Valley WRF Service Area Map



small southern part of the Town of Sahuarita. The properties served are west and east of the Santa Cruz River. The service area extends roughly 9.5 miles north to south, from about a half-mile south of Twin Buttes Road, to about a mile and a half south of the Duval Mine water line road. Along most of its length, the current service area is between one mile and four miles wide from east to west. Land use in the service area is primarily residential and commercial.

Service Area Population

Based on the 2015 average monthly flow of 1.84 MGD, the Green Valley WRF currently serves approximately 23,000 people.

Treatment Method

The facility is comprised of two independent treatment trains, a 2.1 MGD aerated lagoon system with percolation bed disposal built in 1981, and a 2.0 MGD Biological Nutrient Removal Oxidation Ditch (BNROD) facility built during a 2003 expansion. Combined, both treatment trains provide a total permitted capacity of 4.1 MGD. The BNROD acts as the primary treatment process while the lagoon system acts as an overflow system. Each treatment train shares a common headworks, a 2.1 million gallon lined emergency influent storage basin and an influent pump station.

Discharge Method and Location

The 2.0 MGD BNROD constructed in 2003 produces Class A+ reclaimed water. Under the APP and the AZPDES, PCRWRD has the option to recharge the effluent or discharge it into the Santa Cruz River. However, the department only utilizes its recharge option. Recharge is accomplished through two different methods. Through a collaborative agreement with Robson Community's Quail Creek Ranch, the BNROD facility provides a daily minimum of 1.0 MGD effluent to the Quail Creek community. Quail Creek recharges the effluent. The aerated lagoon effluent is discharged to one of RWRD's onsite percolation beds. The department thickens solids onsite and pumps the solids into holding tanks. The department uses trucks to wet-haul the biosolids to a discharge point in the metropolitan area conveyance system for final treatment at the Tres Rios WRF.

The department plans to submit an application for modification of an APP to allow some of the BNROD effluent to be discharged to the percolation basins. This change will increase infiltration rates and should demonstrate the site's highest recharge capacity using the present basin configuration. New recharge basins to be built east of the current plant site are under design. PCRWRD has storage capacity for up to 2,335 acre feet per year, but will try to obtain an ultimate capacity of 3,500 acre feet per year.

Capacity

The current design capacity of the Green Valley WRF is 4.1 MGD.

Current Flows

The average monthly influent flow in 2014 was 1.78 MGD (43% capacity), and in 2015 it was measured at 1.84 MGD (45% capacity). Influent quantities to the Green Valley WRF vary by season. Historical flow data shows a drastic reduction in flow during the summer months, with the lowest flows generally occurring in June. Peak flows for the facility generally occur in February. This trend is reflective of the retirement and winter visitor demographic of the Green Valley area. The highest average monthly flow was recorded in February 2011 and was 2.216 MGD (54% capacity).

Outlook of Facility

The rate of growth will determine future expansion of the facility. Expansion will most likely occur as an additional 2.0 MGD BNROD system. The Green Valley WRF can handle an additional 15,438[6] people (5,718 SFR units), before reaching 75% capacity. Projections indicate the population will reach this level in 2029 (total 38,438[7] people). The facility is expected to reach full capacity when an additional 28,250[8] people (10,463 SFR units) connect to the system. Projections indicate the area will not reach a full capacity population of 51,250[9] until after 2045. See **Appendix B, Table B.9-2 Green Valley WRF Service Area Population Projections 2045.**

The department has evaluated an option to increase the permitted treatment capacity from 4.1 MGD to 6.0 MGD. The future of the lagoon system is uncertain, as the BNROD can compactly and efficiently treat larger amounts of wastewater. PCRWRD recently purchased 290 acres of adjacent State Trust Land to secure a 1,000-foot wide buffer that is required for a facility expansion. The cost of the purchase was $1.1 million.

Considerations and plans for the Green Valley WRF include:

- Move forward with a BNROD capacity expansion. A recommended option is to optimize the existing 2.0 MGD BNROD to operate at least 2.5 to 2.8 MGD. The proposed expansion includes two additional secondary clarifiers capable of treating 1.0 MGD and a new tertiary disk filter.
- Continue to monitor general population growth and wastewater flows in the service area.
- Continue to implement the System-Wide Odor Control Program at the facility.
- Continue with SCADA and automation improvements.

ARIVACA JUNCTION WRF

The Arivaca Junction WRF is located approximately 30 miles south of Tucson, near the Santa Cruz County line and west of the Santa Cruz River. This 3.2-acre facultative lagoon facility has been in operation since 1972.

Service Area

The Arivaca Junction WRF service area encompasses approximately 1.8 square miles and consists of 5 miles of public sewer lines. The service area includes a small rural residential area west of I-19 and north of Arivaca Road (**Figure 6-5**).

Service Area Population

The Arivaca Junction service area encompasses 293 lots. Based on the 2015 average monthly flow of 43,000 gallons per day (GPD), the Arivaca Junction WRF serves approximately 538 people .

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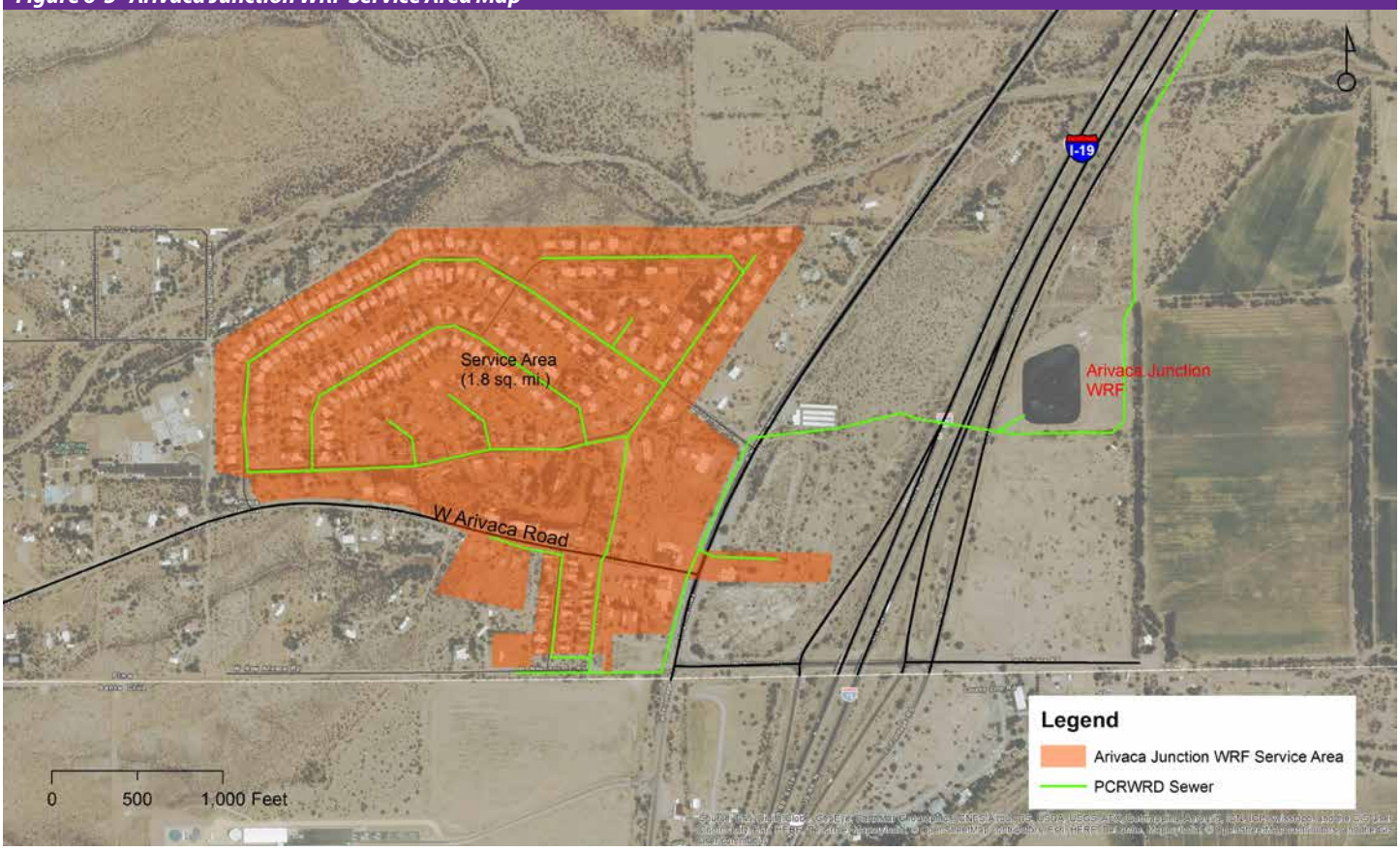
*[6] 4.1 MGD*0.75/80 GPD – 23,000 people currently served = 15,438 additional people at 75% capacity*

[7] 23,000 current + 15,438 additional = 38,438 total people served at 75% capacity

[8] 4.1 MGD/80 GPD - 23,000 people currently served = 28,250 additional people at full capacity

[9] 23,000 current + 28,250 additional = 51,250 total people at full capacity

Figure 6-5 Arivaca Junction WRF Service Area Map



Treatment Method

With a current permitted treatment capacity of 100,000 GPD, the lagoon treatment system processes wastewater generated in two residential subdivisions. Chlorination is the method of disinfection. The lagoon is an unlined aerated facultative stabilization pond with three electric surface aspirating aerators/mixers and two wind-driven aerators/mixers.

In 2009, an upgrade to the lagoon treatment process included the addition of two fiberglass tanks that assist in the disinfection and chlorination of treated effluent before it is reused for irrigation. With the addition of the fiberglass tanks, the chlorination and disinfection of the wastewater can now be monitored more closely.

Discharge Method and Location

Effluent produced at the Arivaca Junction WRF is rated as Class C and is currently used at the adjacent Oswald Cattle Company Ranch (formerly known as Reventone Ranch). It is used for irrigation. The Oswald Cattle Company maintains reuse rights through an Effluent Reuse Agreement/Contract (11-03-R-133090-0803) with Pima County. The agreement expires in 2019.

Capacity

The permitted treatment capacity of the Arivaca Junction WRF is 100,000 GPD.

Current Flows

The average monthly influent flow in 2014 was 51,000 GPD (51% capacity), and in 2015 it was measured at 43,000 GPD (43% capacity). The highest average monthly flow was recorded in December 2007 and was 80,000 GPD (80% capacity).

Outlook of Facility

The Arivaca Junction WRF can handle an additional 400[10] people (148 SFR units), before reaching 75% capacity. The 75% capacity population is 938[11]. The facility would reach full capacity by adding 712[12] (264 SFR units). The full capacity population is 1,250[13]. Growth in the service area depends on the development of several vacant residential and commercial parcels.

Considerations and plans for the Arivaca Junction WRF include:

- Continuation of regular operations and maintenance of the facility are ongoing. Significant improvements at the facility, unless deemed necessary (in the event of an emergency or prevention of an emergency) are unlikely.
- Effluent disposal is a concern. If the Oswald Cattle Company stops taking the effluent, there would be a challenge to manage it on-site.

*[10] 100,000 GPD*0.75/80 GPD – 538 people currently served = 400 additional people at 75% capacity*

[11] 538 current + 400 additional = 938 total people at 75% capacity

[12] 100,000 GPD/80 GPD – 538 people currently served = 712 additional people at full capacity

[13] 538 current + 712 additional = 1,250 total people at full capacity

- Given the current average daily flows of 0.043 GPD (43% capacity) and slow growth in the service area, the Arivaca Junction WRF is not expected to reach 75% capacity in the near future. Considering the existing land uses and land ownership surrounding the facility, new sewer connections to the facility are not expected. There are no plans for the facility to serve areas in Santa Cruz County.
- The Arivaca Junction WRF will be reevaluated for closure upon completion of the proposed gravity sewer connection to the Green Valley WRF.
- Continue enhancement of the System-Wide Odor Control Program at the facility.

AVRA VALLEY WRF

The Avra Valley WRF is located approximately 20 miles southwest of Tucson in southern Avra Valley, north of Highway 86 (Ajo Highway) and east of Three Points. The facility has been in operation since 1967.

Service Area

The Avra Valley WRF service area encompasses approximately 24 square miles and consists of 121 miles of public sewer line. The total sewer basin area encompasses approximately 66 square miles (**Figure 6-6**). The service area is roughly centered on the intersection of Highway 86 and San Joaquin Road. From this point the service area extends roughly four miles to the north, four miles to the south, four miles to the west, and three miles to the east. This is a semi-rural but rapidly growing area. Land use in the service area is mostly rural residential. The entire service area is gravity fed, with no pump stations.

The population in the Avra Valley service area expanded rapidly between 2000 and 2005. During this period, a large casino, owned by the Pascua Yaqui Tribe began operating and contributing flows to the facility. The Avra Valley WRF serves approximately 15,875 people in unincorporated Pima County and the Pascua Yaqui Indian Reservation.

In 2006, a group of developers entered into a Sewer Facilities Development Agreement with PCRWRD (Amendment 1, Resolution 2006-324) to construct upgrades to the Avra Valley facility. The facility upgrades would provide capacity for several respective trust-held properties and future developments (see **Appendix A** for details). In 2009, the Avra Valley WRF was expanded to process a total of 4.0 MGD, in anticipation of predicted future loads.

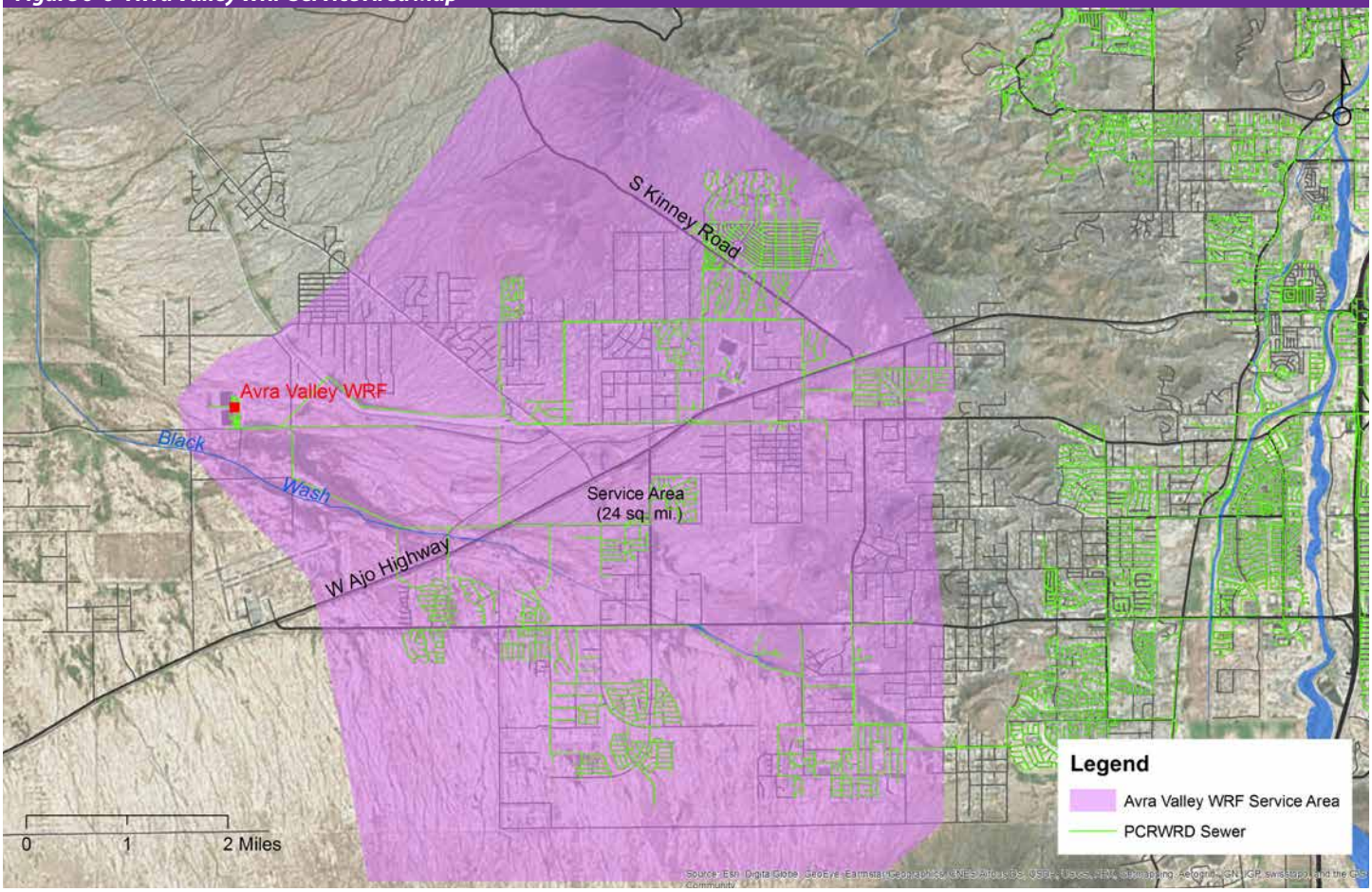
Service Area Population

Based on the 2015 average monthly flow of 1.27 MGD, the Avra Valley WRF currently serves approximately 15,875 people .

Treatment Method

The treatment facility has a permitted capacity of 4.0 MGD

Figure 6-6 Avra Valley WRF Service Area Map



Avra Valley Water Reclamation Facility.

using two oxidation ditches for achieving nitrification and denitrification. A combination of sand filtration and UV treatment is the method of disinfection. The treatment process consists of a lift station with submersible pumps with metering; a headworks with screens and grit removal; a lined emergency influent storage basin; two (2.0 MGD each) oxidation ditches with surface aeration; secondary clarifiers with return activated sludge and wasting; and sand filters and UV systems. Solids thickening occurs onsite followed by wet-hauling to the Tres Rios WRF for treatment.

Discharge Method and Location

Effluent from the facility can meet Class A+ quality standards, but is permitted for Class B+ reclaimed quality. Discharged occurs primarily by percolation through five recharge basins. Onsite reuse is possible for irrigation and dust control. The department can discharge effluent to the Black Wash under the facility's AZPDES permit, but does not do so at this time.

The Avra Valley WRF has been receiving recharge credits since its Underground Storage Facility (USF) permit became effective on Sept 14, 2015. The facility has a permit that allows up to 4,480 acre-feet of credit at the site.

Capacity

The design capacity of the Avra Valley WRF is 4.0 MGD.

Current Flows

The average monthly influent flow in 2014 was 1.21 MGD (30% capacity), and in 2015 it was measured at 1.27 MGD (32% capacity). The highest average monthly flow was recorded in March 2012 at 1.49 MGD (37% capacity).

Outlook of Facility

All remaining capacity at the Avra Valley WRF has been allocated to developments that paid for treatment expansion in 2009. The facility can handle an additional 21,625[14] people (8,009 SFR units) before reaching 75% capacity. The 75% capacity population is 37,500[15]. Projections indicate that the population in this area will reach that level in 2030 (See Appendix A, Table A-8 Rate of Growth and Population Projections Summary Table, Effective Population). However, population growth could occur much more quickly if existing dormant subdivisions begin construction following a recovery in the housing market. The facility is expected to reach full capacity when additional 34,125[16] people (12,639 units) is served by the system. Projections indicate that the area will not reach a full capacity population of 50,000[17] until after 2035.

Considerations and plans for the Avra Valley WRF include:

- Continue to monitor general population growth and wastewater flows in the Avra Valley area.
- Continue to monitor proposed subdivisions, especially Pomegranate Farms, Sendero Pass, Diablo Village, Tucson Mountain Ranch, and Star Valley Estates for resumption of development.
- Plan for capacity expansion at the Avra Valley WRF in the event that sudden population growth occurs following an economic upturn.

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*[14] 4.0 MGD*0.75/80 GPD – 15,875 people currently served = 21,625 additional people at 75% capacity*

[15] 15,875 current + 21,625 additional = 37,500 total people at 75% capacity

[16] 4.0 MGD/80 GPD – 15,875 people currently served = 34,125 additional people at full capacity

[17] 15,875 current + 34,125 additional = 50,000 total people at full capacity

CORONA DE TUCSON WRF

The Corona de Tucson WRF is located 22 miles southeast of Tucson in unincorporated Pima County. The facility site is northwest of the intersection of Sahuarita Road and Houghton Road (**Figure 6-7**).

In 2005, PCRWRD entered into a Master Sewer Service Agreement (MSSA) with a group of developers, resulting in the addition of a 1.0 MGD closed loop reactor (CLR) treatment facility. Through the MSSA, the department serves or will serve parts of the New Tucson subdivision and the subdivisions of Sycamore Canyon, Oasis Santa Rita, Santa Rita Foothills, Bells at Santa Rita and Santa Rita Ranch.

Service Area

The current Corona de Tucson WRF service area encompasses approximately 6.3 square miles and consists of 42 miles of public sewer line. The service area includes multiple residential subdivisions in the vicinity of the Sahuarita Road and Houghton Road intersection. Some of these subdivisions are Sycamore, New Tucson, Santa Rita Ranch and Santa Rita Bel Air Estates. Land use in the service area is mostly residential. The total sewer basin area encompasses approximately 46 square miles and extends east, northeast and northwest of the existing service area.

Service Area Population

Based on the 2015 average monthly influent flow of 0.295 MGD, the Corona de Tucson WRF currently serves approximately 3,700 people.

Treatment Method

The Corona de Tucson WRF consists of the existing lagoon system and the Biological Nutrient Removal Ditch (BNROD) facility. The treatment process includes a headworks, grit removal, influent parshall flumes, two CLR oxidation ditches, submersible motive pumps, a jet aeration system, diversion structures, a RAS/WAS pump station, sludge holding tanks, a scum pump station and recharge basins.

Discharge Method and Location

Effluent is discharged into percolation basins designed and permitted for groundwater recharge. Soil aquifer treatment (SAT) is the method of disinfection. No sludge is processed onsite. All sludge is hauled to the Tres Rios WRF for treatment.

Capacity

The design capacity of the Corona de Tucson WRF is 1.3 MGD.

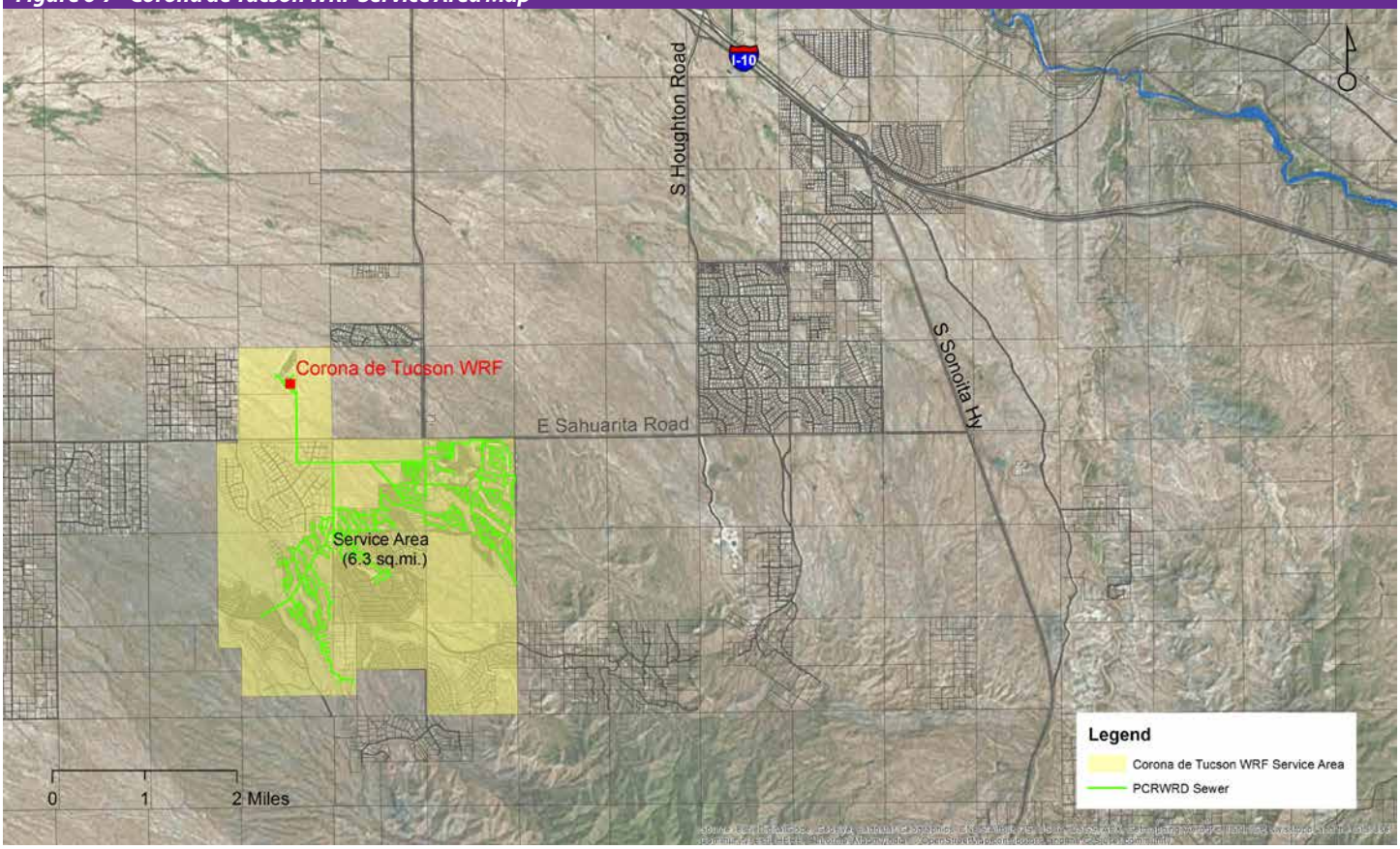
Current Flows

The average monthly influent flow in 2014 was 0.287 MGD (22% capacity), and in 2015 it was measured at 0.295 (23% capacity). The highest average monthly flow was measured in January of 2013 at 0.292 MGD.

Outlook of Facility

The Corona de Tucson WRF service area is still under development and additional capacity is expected for the tributary areas.

Figure 6-7 Corona de Tucson WRF Service Area Map



All the remaining capacity of 1.0 MGD has been allocated to developments that paid for the treatment expansion. Capacity for these developments has been secured via the MSSA. At this time, the Corona de Tucson WRF does not have sufficient capacity to handle additional flow from new developments.

The facility can currently handle an additional 8,488[18] people (3,144 SFR units), before reaching 75% capacity. The 75% capacity population is 12,188[19]. It would be difficult to predict when the additional SFR units in the Corona de Tucson WRF service area will be built. More than 3,000 units are expected to be built in several existing and planned subdivisions in the coming years. If a recovery in the housing market boosts construction activities, development of these new units could occur any time now. The facility will reach full capacity when an additional 4,690 SFR units (12,550[20] people) connect to the system, the timing of which would be difficult to predict. The full capacity population is 16,250[21].

Considerations and plans for the Corona de Tucson WRF include:

- The available capacity at the Corona de Tucson WRF for adjacent areas is limited. All of the remaining unused capacity (1.0 MGD) is currently allocated.
- The facility does not have sufficient capacity to handle additional flow from new developments. Expansion of treatment capacity is required to support future growth in adjacent areas.
- PCRWRD continues to monitor growth in the area and coordinates with developers to match growth and capacity needs. A project planning process currently is under way for Hook M Ranch, a new master-planned development just west of the facility site. If this development is to be served by the Corona de Tucson WRF, the developer will be required to pay for additional treatment capacity at the facility.
- The department continues the implementation the System-Wide Odor Control Program at the facility.
- The department continues to implement SCADA and operations upgrades.

[18] *1.3 MGD*0.75/80 GPD – 3,700 people currently served = 8,488 additional people at 75% capacity*

[19] *3,700 current + 8,488 additional = 12,188 total people at 75% capacity*

[20] *1.3 MGD/80 GPD – 3,700 people currently served = 12,550 additional people at full capacity 3,700 current + 12,550 additional = 16,250 total people at full capacity*

[21] *3,700 current + 12,550 additional = 16,250 total people at full capacity*

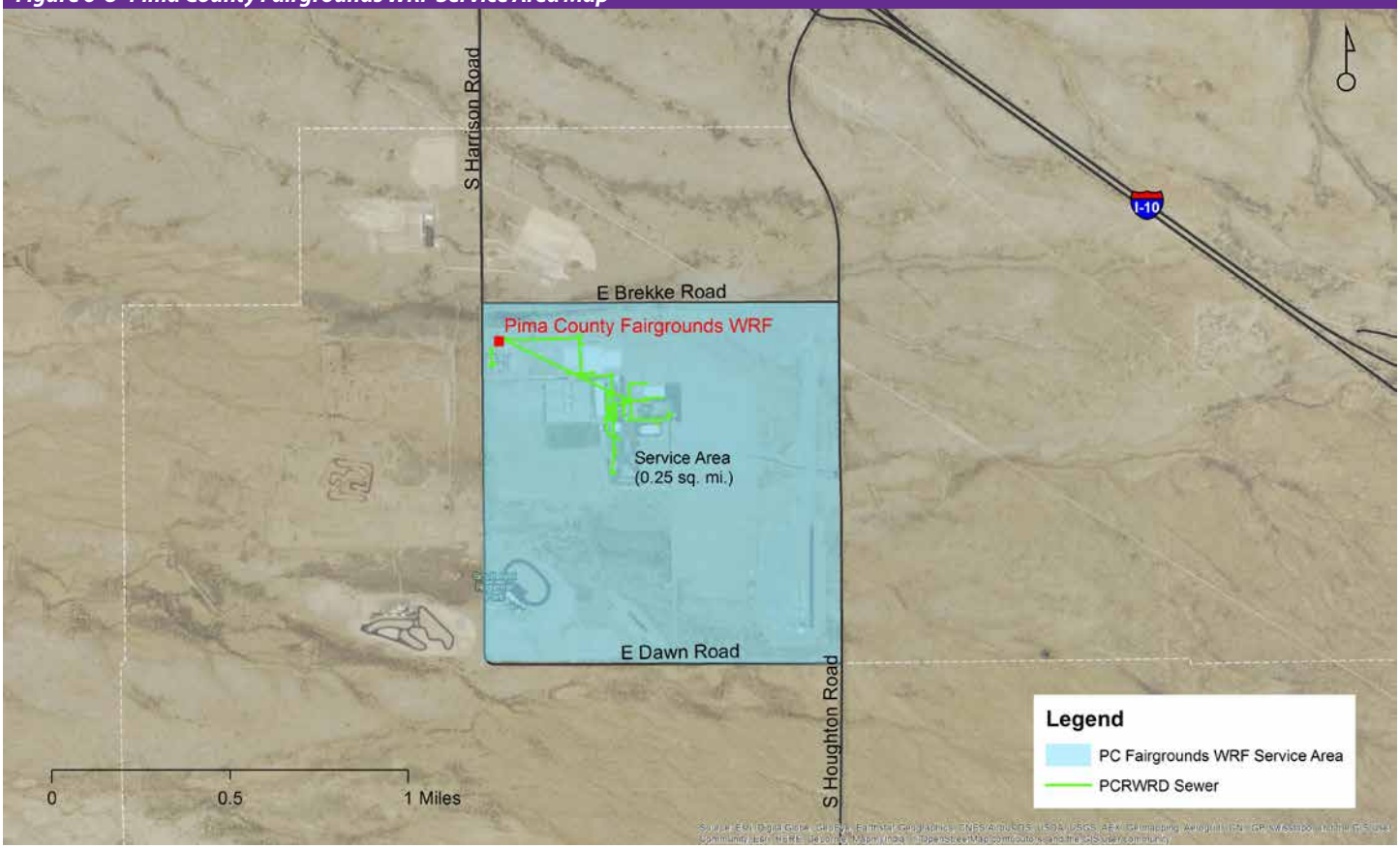
PIMA COUNTY FAIRGROUNDS WRF (FAIRGROUNDS WRF)

The Pima County Fairgrounds WRF is located approximately 18 miles southeast of Tucson at the county fairgrounds south of I-10 and west of Houghton Road (**Figure 6-8**).

Service Area

The Fairgrounds WRF service area encompasses 0.25 square mile and consists of one mile of public sewer line. The service area includes only the fairgrounds property; however a variety of public meetings and events take place on the property.

Figure 6-8 Pima County Fairgrounds WRF Service Area Map



Mount Lemmon Water Reclamation Facility.

Service Area Population

Based on the 2015 average monthly flow of 13,720 GPD, the Fairgrounds WRF currently serves the equivalent of approximately 6,860 people . However, during annual the 10-day County Fair event, the influent flow is much higher. Influent flows of more than 63,700 GPD were recorded during the fair event in April of 2013. This is equivalent to 31,850 people (assuming 2 gallons per person per day).

Treatment Method

The Fairgrounds WRF consists of two primary stabilization ponds and an overflow pond. Potential service by gravity for areas outside of the fairgrounds is limited.

Discharge Method and Location

The facility uses stabilization ponds and the effluent is disposed of through evaporation and percolation.

Capacity

The facility operates under a general APP permit and is limited to 20,000 GPD of flow based upon an annual average.

Current Flows

The average monthly influent flow in 2014 was 9,700 GPD (49% capacity), and in 2015 it was measured at 13,720 GPD (69% capacity). The highest flows occur in the month of April during the county fair. The highest average monthly flow was recorded in April 2013 at 63,800 GPD.

Outlook of Facility

The full capacity at the Fairgrounds WRF is exceeded during county fair events when more people use the system than the facility can handle. Excess wastewater flow is diverted into an overflow pond where it percolates. The remaining wastewater is vault-and-hauled off site and discharged into the downstream conveyance system. Growth in the Fairgrounds WRF service are will primarily be driven by future developments on the Fairgrounds property.

A Fairgrounds WRF and Alignment Feasibility Analysis prepared by RBF Consulting in 2010, discussed several potential alternatives to the facility, including the diversion of flow by gravity to the Southeast Interceptor (SEI) and subsequent decommissioning of the existing ponds. The proposed near-term plan for the facility is to retain the existing pond treatment process and add a pump station and force main (approximately 15,000 linear feet) that will tied into the SEI to handle the excess flows during large events at the Fairgrounds facility. The proposed force main would connect to the SEI near the Rita Road/I-10 interchange. The pump station and force main will serve as an overflow or equalization facility to the ponds.

The long-term plan proposes a gravity connection to the SEI, provided that the necessary base flow from new developments occurs. Service by a gravity sewer has been determined to be the

most cost-effective alternative. Considerations and plans for the Fairgrounds WRF include:

- PCRWRD will continue monitoring peak flows at the facility during the month of April.
- PCRWRD has no current plans to increase the size of the facility. In the event that development in the Fairgrounds service area materializes, conversion to the gravity system or force main will become a possibility.
- PCRWRD will continue to consider the most cost-effective option of the extension of a gravity sewer line from the Fairgrounds WRF to the Southeast Interceptor, where it would connect near the Rita Road/I-10 interchange. The Fairgrounds WRF would be decommissioned upon conversion to the gravity system.
- PCRWRD will continue to enhance the System-Wide Odor Control Program at the Fairgrounds WRF.

MOUNT LEMMON WRF

The Mt. Lemmon WRF is located in the Village of Summerhaven in the Catalina Mountains, north of Tucson. The facility began operating in 1982 under a special use permit issued by the United States Forest Services (USFS).

The special use permit was amended in 2004 to accommodate 30 additional connections, as long as monthly average flows do not exceed 12,500 GPD and a maximum flow of 17,000 GPD on any given day. The special use permit related documents referenced by the permit allow for up to 77 connections. The total flow allowed by the special use permit did not increase in the 2004 Amendment, even though additional connections were approved. Fire recovery efforts prompted the increase in allowable connections.

Service Area

The Mt. Lemmon WRF service area encompasses approximately 0.75 square miles and consists of 2 miles of public sewer line. The service area includes the community of Summerhaven. **Figure 6-9** illustrates the service area. Pursuant to the agreement between Pima County and USFS, only 77 properties can receive service. The service area is primarily residential, with a few commercial customers such as restaurants and gift shops. One public toilet facility also contributes flow to the facility. The 2003 Aspen fire destroyed most of the buildings in Summerhaven and severely impacted the Mt. Lemmon service area.

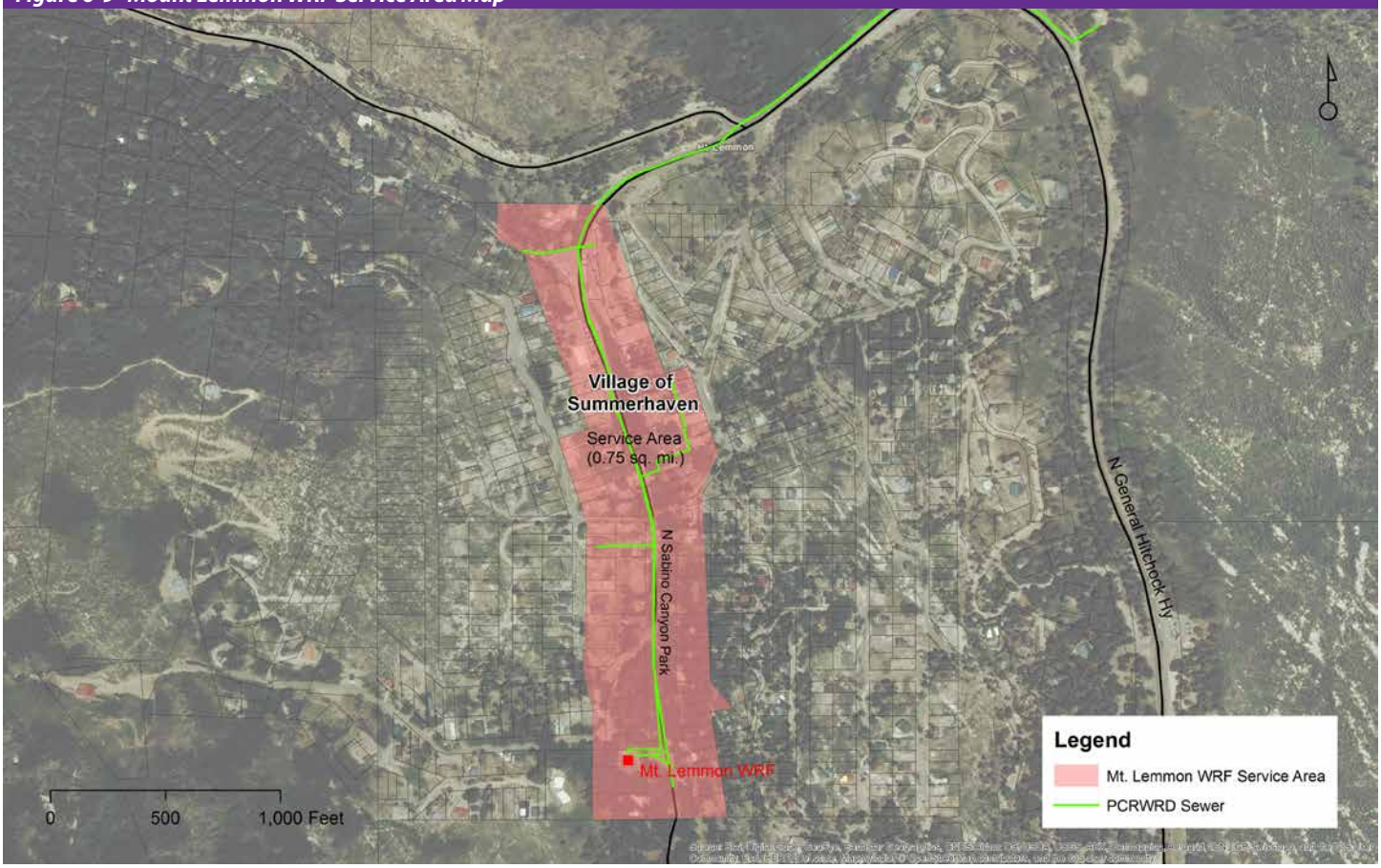
Service Area Population

There are currently 31 active connections in the Mt. Lemmon WRF service area. Based on the 2015 average monthly influent flow of 2,700 GPD the Mt. Lemmon WRF serves a population of approximately 34.

Treatment Method

Due to high-altitude weather extremes, the treatment facility operates inside a building. The Mt. Lemmon package plant uses an oxidation ditch and clarifier for secondary treatment. Chlorination and

Figure 6-9 Mount Lemmon WRF Service Area Map



dechlorination processes provide disinfection treatment of domestic sewage. Sludge is stored in a waste holding tank and is aerated to reduce odors. PCRWRD transports the sludge offsite and deposits it into the county collection system at Manhole 8716-03 at Tanque Verde Road.

Discharge Method and Location

The department discharges the effluent generated at the facility to a spray field where the effluent irrigates forest vegetation. During freezing or inoperable conditions, the department disposes of effluent via three combined outfalls. The AZPDES permit allows discharge to these outfalls only during the aforementioned freezing or inoperable conditions.

Capacity

The Mt. Lemmon WRF is rated to treat a total of 15,000 GPD. The facility operates under a special use permit issued by the USFS that authorizes a treatment capacity of 17,000 GPD, provided the daily average flows do not exceed 12,500 GPD average flow.

Current Flows

The average monthly influent flow in 2014 was 1,900 GPD (13% capacity), and in 2015 it was 2,700 GPD (18% capacity). The highest average monthly flow occurred in March 2010 at 7,211 GPD (48% capacity).

Outlook of Facility

The average monthly influent flow of 2,500 GPD, measured over a nine year period (2006 through 2015), indicates that the facility operates well below permit limits at 17% capacity. However, peak flows on holidays and weekends can reach up to three times the base flow to the facility (Mount Lemmon Service Area Watershed and Wastewater Management Plan, EEC, Inc., et al., 2008). While peak flows are currently below permit limits, potential flows from planned commercial properties could create higher flows and significantly alter peaking factors. Such conditions could consume all remaining treatment capacity.

According to the EEC 2008 Study, expansion of the sewer service area is not economically feasible. The Aspen Fired destroyed many large lots that had used septic systems. As redevelopment of these lots occurs, it is possible that they might connect to the extended sewer. However, topography and distance from the existing system would make the expansion of the gravity sewer to most of these lots very expensive (EEC, et. al, 2008). The same assumption is made for lots in Summerhaven West and Ski Valley. If conveyance were cost effective for these locations, it is possible that the combined three areas could accommodate new service users. (EEC, Inc., et al, 2008).

Water conservation has become an important topic of discussion in the Summerhaven community. A more efficient use of effluent, such as discharging the treated effluent to Sabino Creek to enhance base flow, is supported by many stakeholders and the community. Other new uses under discussion include fire suppression, snowmaking and irrigation of revegetated and reforested areas to reduce soil erosion and create more green space.

Considerations and plans for the Mt. Lemmon WRF include:

- Continue to monitor potential development on vacant lots in the Mt. Lemmon WRF service area. In addition, monitor development on lots outside the service area for a possible connection to the sewer system.
- Continue to maintain PCRWRD's involvement in ongoing sustainable planning efforts that include watershed management, water supply and water distribution.
- The Mt. Lemmon WRF is 30 years old. The department is presently evaluating options to replace this aging facility, and weighing the options of rehabilitating the existing facility or replacing it with a modern facility. PCRWRD believes that providing this popular tourist destination with a new water reclamation facility is an appropriate investment for the county and the community.

6.2 MAJOR PROJECTS AND PROGRAMS

The $605 million ROMP program was the single largest public works capital investment program ever undertaken in the history of Pima County. The completion of the regulatory-mandated ROMP provided upgrades and improvements to the Tres Rios WRF treatment system and resulted in the production of high-quality effluent at the Agua Nueva WRF.

The ROMP project consisted of three major components: 1) the Plant Interconnect[22], 2) the construction of a new water and energy sustainability center and a new water reclamation facility (the Agua Nueva WRF) and 3) the treatment process upgrade and expansion of the Ina Road WRF (renamed the Tres Rios WRF).

The Plant Interconnect, which is equipped with the best available odor control and monitoring technologies, provides for flow management between the Agua Nueva and Tres Rios facilities. Total treatment capacity at the Tres Rios WRF increased by 12.5 MGD (total capacity is 50 MGD). With this expansion and the treatment process upgrades, PCRWRD has met the community's future capacity demands and regulatory requirements. In addition, the state-of-the-art the Agua Nueva WRF produces exceptionally high-quality reclaimed water and other treatment byproducts that can be beneficially reused.

By January 2014, PCRWRD had met the regulatory compliance deadline for both the Tres Rios WRF and Agua Nueva WRF. The department decommissioned the old Roger Road plant in accordance with existing regulatory requirements. The evaluation of potential uses for the 46-acre Roger Road plant site is underway. The facility is located close to the center of Tucson has the potential of being a valuable asset to Pima County and the community. Its proximity to the Santa Cruz River lends itself to Pima County's goals of linear parks and open space expansions.

BIOSOLIDS AS A BYPRODUCT OF WASTEWATER TREATMENT PROCESS

The new 5-stage Bardenpho process at the Tres Rios WRF, which includes biological nutrient removal, has improved the processing of biosolids through higher levels of de-watering. The de-watering process has been evolving over a number of years. Improvements

[22] The Plant Interconnect was awarded the 2013 American Public Works Association (APWA) project of the Year under the category of "Outstanding Large Environmental Public Works Project," with a project cost between $25 million to $75 million. The APWA Public Works Projects of the Year awards promote excellence in the management and administration of public works projects.

Tres Rios Water Reclamation Facility - Bardenpho Unit and Odor Control.

have resulted in improved treatment options and a reduction in the amount of material that must be hauled.

PCRWRD produces 39 dry tons per day of biosolids. All biosolids processing in Pima County is centralized at the Regional Biosolids Facility at the Tres Rios WRF. The centralized location provides for co-generation of biogas and a one-point distribution site for this treatment process byproduct. All the Class B biosolids produced by the Tres Rios WRF is beneficially used through an agricultural land application program, which is by far one of the most effective programs in the nation. The biosolids from sub-regional facilities is hauled as a liquid slurry, discharged into the collection system and conveyed to the Tres Rios WRF.

PCRWRD continues to evaluate the needs and benefits of upgrading the existing biosolids stabilization process. The department now produces a Class B biosolids but is considering upgrading to a process that would produce a Class A biosolids product. Class A biosolids require additional pathogen removal. Some of the potential biosolids products PCRWRD has evaluated include: liquid slurry, dewatered cake, thermally dried product, compost, and topsoil blend. The department has also been evaluating potential biosolids market opportunities. See Chapter 7 for more details on Biosolids production and utilization.

As part of the treatment process, PCRWRD also utilizes new advanced sewage sludge digestion technology to maximize biogas generation. The Tres Rios facility's anaerobic digesters currently produce an average of 800,000 cubic feet per day of biogas.

ODOR CONTROL PROGRAM

State-of-the-art technology detects odor emissions at specific system locations including at the headworks, grit tanks, fine screens, primary clarifiers, scrubbers, and sludge drying beds. In accordance with the ROMP and the System-Wide Odor Control Program (SWOCP), the department addresses odor abatement with two main approaches. The first approach, implements improvements recommended by the ROMP through the targeting of key network interceptors. The second approach, set forth in the SWOCP, involves responding to customer complaints and keen attention to maintenance of the system. Together, these approaches have remediated odor issues related to routine maintenance as well as more complicated issues, such as system capacity demands and hydraulic conditions.

Future process expansions include suitable cost-effective odor control measures to preempt potential odor emissions. PCRWRD's System Wide Odor Control Group (SWOCG) staff operates and monitors 44 odor control systems at the treatment facilities, including 34 carbon absorbers, nine bio filters and one bio trickling filter.

SUPERVISORY CONTROL AND DATA ACQUISITION

The Supervisory Control and Data Acquisition (SCADA) systems are computerized/electronic systems that enhance automation at the wastewater treatment facilities and monitor flows in the sanitary sewer system. Facilities with SCADA systems include the Tres Rios, Agua Nueva, Avra Valley, Corona de Tucson, and Green Valley WRFs. The SCADA systems replaced the manual collection of data and log books with electronic records. The SCADA system allows for the efficient operation and maintenance of PCRWRD's facilities. The SCADA system also provides 24/7 centralized monitoring and control of security conditions at PCRWRD's treatment facilities and pump stations.

SYSTEM-WIDE TREATMENT REHABILITATION PROGRAM

This System-Wide Treatment Rehabilitation Program includes projects that allow for the ongoing rehabilitation, enhancement and replacement of process equipment and structures. The program acts as an umbrella to combine smaller projects into CIP projects. The System-Wide Treatment Rehabilitation Program focuses on proactive equipment replacement to prevent equipment failures and maintain compliance. Over the next five years, PCRWRD will invest $11 million in small projects and equipment purchases. Additionally, a potential expansion of the Green Valley WRF may also take place.

6.3 TREATMENT SYSTEM EXPANSION

PCRWRD has been proactive in expanding and upgrading the sub-regional water reclamation facilities in response to the county's projected growth and development. All new treatment facilities

and significant expansions must meet Best Available Demonstrated Control Technology regulation requirements. The department will determine design and constructions schedules based on actual increases in facility influent flows and loads. When PCRWRD increases capacity at its existing facilities, it also retrofits and updates older equipment and plant elements.

With the completion of the ROMP, the department has met ADEQ's regulatory requirements at the Agua Nueva and Tres Rios WRFs. However, there are some projects in the CIP Program that must still be completed. Continuing projects include:

- Side Stream Treatment of Digested Centrate (potential nutrient recovery and reuse)
- Carbon Dioxide Separation and Reuse (study by U of A is currently underway. A pilot demonstration project at the Tres Rios WRF is scheduled for the Summer 2016.)
- Fats, Oil and Grease (FOG)/Food Waste Co-digestion Study (scope of study under preparation)
- Biosolids Land Application Property Purchase (evaluation underway for purchase of approximately 1,200 acres of State-owned land within economical hauling distance from the Tres Rios WRF).

Green Valley and Sahuarita Long-Term Treatment System Needs

The long-term planning goals of the Town of Sahuarita to eventually develop the majority of agricultural land east of I-19 into master-planned communities, will result in a significant increase in the demand for sewer services over time. The Town Sahuarita owns and operates a 3.0 MGD treatment facility located downstream from the Green Valley WRF. Over the long run, the existing Sahuarita and Green Valley treatment facilities will not be able to handle projected flows generated by the increased population from projected growth. Both parties will require new and/or expanded wastewater treatment facilities or other viable economic solutions for handling future wastewater flows.

PCRWRD requested that the University o of Arizona to conduct a study to evaluate different sewer service options. That study suggests a new regional water reclamation facility may be the most viable solution for the treatment of flows from Sahuarita, Green Valley and future master planned developments. This option could require shutting down the existing Sahuarita, Green Valley and Arivaca Junction facilities.

6.4 CONCLUSIONS

Based on the existing conditions and future anticipated needs discussed in this chapter, the following are conclusions about PCRWRD's treatment system:

- With the recent treatment system upgrades and capacity expansions at the Tres Rios and Agua Nueva WRFs, the regional wastewater treatment system is equipped to adequately serve existing users and meet growing community needs well into the future. The existing capacity is sufficient for at least the next ten to fifteen years.
- The Corona de Tucson WRF facility currently does not have sufficient capacity to handle additional flow from new developments. The remaining unused capacity (1.0 MGD) is allocated to developments that paid for capacity expansion in 2007. Expansion of treatment capacity is required to support future growth in adjacent areas.
- The department will move forward with a BNROD capacity expansion at the Green Valley WRF. A recommended option is to optimize the existing 2.0 MGD BNROD to operate at least 2.5 to 2.8 MGD.
- The department has laid the foundation for a new water reclamation facility to serve anticipated growth in the Southlands, should the need arise. The timing of facility construction depends on the progress of development activities in the area. If a facility is constructed, it is imperative that the reclaimed water produced there remain in the upper basin for reuse or recharge.
- The department's goal is to eventually remove the Fairgrounds stabilization ponds from service and re-route the existing flows to the Southeast Interceptor. This decision is being driven by steadily-increasing influent flows.
- The department is presently evaluating options to replace the aging Mt. Lemmon facility, and weighing the options of rehabilitating the existing facility or replacing it with a modern facility.

6.5 OUTLOOK

Based on the near-term treatment system needs discussed in this chapter, PCRWRD will continue to:

- Monitor population growth and wastewater flows in its service areas, especially in the Green Valley, Avra Valley, and Corona de Tucson service areas where the department has allocated existing capacity. Expansion in these areas will soon be necessary.
- Implement the System-Wide Odor Control Plan at the sub-regional facilities. In addition to odor control, the department will seek to be a good neighbor to surrounding neighborhoods by instituting noise abatement and creating pleasant aesthetics at the facilities.
- Implement security improvements at the sub-regional facilities.
- Improve the ability to identify critical assets, prioritize repairs and manage equipment maintenance program more efficiently.
- Optimize technology to advance Reliability Centered Maintenance (RCM). The RCM ensures the replacement of equipment and parts before they fail, by ensuring they are available in advance.

CHAPTER 7: RESOURCES MANAGEMENT

Green Valley Water Reclamation Facility.

The wastewater industry contributes to creating a more sustainable environment by producing renewable resources from the byproducts of the wastewater treatment/reclamation process. Making wastewater treatment more sustainable is a trend in today's industry. PCRWRD is looking for opportunities to recover resources from wastewater, such as energy from biogas and nutrients from biosolids.

The improved quality of reclaimed water produced at PCRWRD's water reclamation facilities enhances the use of recharge, environmental restoration and irrigation of public amenities, such as parks, golf courses and ball fields. The Pima County Natural Resources Parks and Recreation Department increased the number of County parks served by reclaimed water from 10 parks to 22 parks. This 120% increase in County parks that use reclaimed water reduces the strain on the region's groundwater supply.

7.1 WATER RESOURCES MANAGEMENT

Water is an important determinant of future growth. As such, the availability and access to water supply often dictate the location, density and the pace of growth in a particular area. The availability of water and sewer service plays a significant role in shaping growth in the region. Population growth brings an increase in demand for water. According to the Tucson Water Department's long range *Water Plan: 2000-2050*, we will have enough water to meet the needs of our growing community, but only if we use all of our available water resources and seek new ones. In the Tucson metropolitan area and in some areas of unincorporated Pima County, planning efforts have led to the increased use of reclaimed water, a renewable resource.

In regard to sustainable water conservation and management, PCRWRD plays a major role in producing effluent for regional beneficial use in aquifer replenishment and in irrigation of turf, landscape and environmental projects.

In 2007, the Pima County Board of Supervisors adopted the Sustainable Action Plan for County Operations (SAPCO). Readopted in 2014, this plan includes the following goals for water conservation and management:

1. Ensure that public projects are multi-benefit, including restoration, stormwater management, recharge and public amenity.
2. Maximize County water resource assets, including groundwater rights, surface water rights and the production and use of reclaimed water to sustain and protect the natural environment.
3. Optimize water use efficiency in County operations.

The 2014 Pima County Sustainable Action Plan describes the following actions to support the County's sustainability policies and water conservation and management goals:

- ***Reduce water consumption in facilities –*** Pima County, including PCRWRD, will increase its water use efficiency by reducing water consumption in its buildings by at least percent 10% by FY 2018/19.
- ***Increase reclaimed water at County parks –*** Pima County will maximize its water resource assets by increasing the number of County parks and miles of trails served by reclaimed water generated at PCRWRD water reclamation facilities by 10% by FY 2018/19.
- ***Establish and maintain natural habitats –*** Pima County will expand the number of acres of natural habitat established or maintained by County renewable water resources by 5% by FY 2018/19. Renewable water includes reclaimed water produced at PCRWRD water reclamation facilities.

Recycled Water as an Alternative to Drinking Water

Population growth, severe droughts and climate change accompanied with the growing scarcity of potable water supplies continue to affect many communities nationwide. Consequently, many communities are looking to alternative sources of water supply to supplement variable rainfall and meet the demands of population growth. A diversified portfolio of water sources is required to ensure public health and social, economic and environmental sustainability. One option is to augment drinking water supplies with advanced treated recycled water.

The use of purified water for industrial processes or drinking is not new. Scientifically-proven advances in water purification technologies allow communities to reuse water for many different purposes. The water purification process includes three major steps: membrane filtration, reverse osmosis and UV/advanced oxidation. The way in which potable reused water is delivered determines whether it is called direct potable reuse (DPR) or indirect (IPR) potable reuse. In DPR projects, highly purified recycled water is introduced directly into the raw water supply feeding a water treatment plant. IPR requires purified water pass through an environmental buffer, such as a groundwater aquifer or a reservoir before its delivery to users.

IPR has been successfully implemented in the United States, Europe and Singapore. With more than 40 years of experience, California has the highest number of IPR projects in the U.S. Other states with full-scale IPR demonstration projects include Arizona, Colorado, Texas, Florida and Virginia (Int. J. Environ. Res. Public Health, 2009, v.6, pg. 1176).

The City of Tucson's Recycled Water Master Plan establishes IPR as its primary strategy for additional renewable water supplies. This strategy increases system reliability and retains a valuable water resource within the County. The City of Tucson uses some of its allocated effluent to produce reclaimed water for irrigation, dust control, firefighting and industrial uses. PCRWRD's production of high quality effluent will become part of the pre-treatment process debate should IPR planning move forward.

7.1.1 WATER POLICIES

Water policies can influence other industries' decision-making when planning a new facility location or service expansion. Although water policies may not have a direct impact on sewer service operations, it is important to understand their impact on community growth and development patterns. The availability of water services generally controls where development with supported sewer services is likely to occur. Water agencies in charge of utilities adopt policies to support community growth goals and then adhere to subsequent regulations. In a desert environment with limited water supply, the boundaries of designated water service areas often coincide with the jurisdictional boundaries of a city or town. Enforcement of certain types of water policies, such as those that make water service available only to properties within the city limits, encourages more orderly planned development. In turn, there is a reduction in unwanted sprawl and proliferation of unincorporated suburbs. Such policies direct growth and development to areas where water supply is available.

Not long ago, the Tucson Water Department policy was to serve almost everyone who wanted water as long the person or organization could pay for the service. The only exception was for landowners so far from the city, that maintenance costs for the extended infrastructure were prohibitive. Subsequent revisions to the

Students doing a water quality and macroinvertabrate study along the riverbank of the Santa Cruz River as part of The Living River of Words project. The project introduces area students to the wonders of a desert riparian habitat and teaches them about this unique resource in our community.

water policy restricted new water service in unincorporated areas. In 2010, new revisions to the policy established a map of areas in which the City is obligated to provide service. These are called the Tucson Water obligated service areas. The City of Tucson denies developments outside the obligated water service area. However, the new policy does provide an opportunity for developers to appeal a denial for water service outside the City's obligated service area. A special board comprised of City employees makes the final decision on such appeals. Areas outside the obligated service area can receive service through two options described below.

CURRENT TUCSON WATER DEPARTMENT POLICY

The Tucson Water Department will give priority to commercial developments that create high-paying jobs that benefit the local economy and invest in new and expanded facilities. Areas outside the City's obligated service area can receive service through two options:

1. The property is surrounded on three sides by parcels served by the Tucson Water Department and have a net developable area of less than 20 acres for residential, or less than 50 acres for commercial uses. Mixed use developments will also use the less than 50-acre criterion as long as the residential portion is less than 20 acres.
2. The developer makes a $5 million investment in new or expanded facilities, creates at least 25 new jobs at 150% of mean annual earnings and the new employer pays 75% of employee health premiums. (Source: "Resolution 22080" adopted by the Mayor and Council on July 9, 2013).

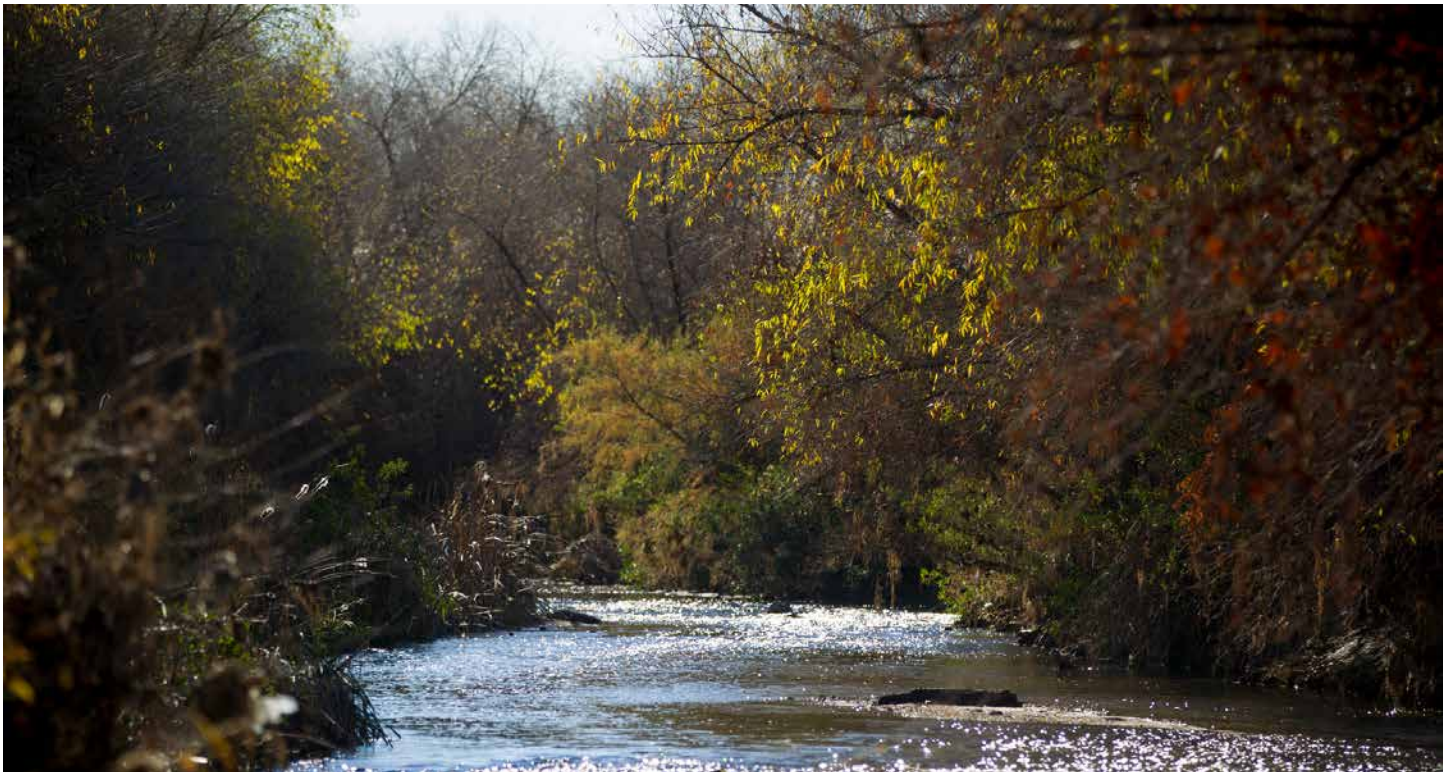
7.1.2 WATER SOURCES IN TUCSON AND PIMA COUNTY

GROUNDWATER

The Assured and Adequate Water Supply Program of the Arizona Department of Water Resources (ADWR) has designated five Active Management Areas (AMAs) to protect and preserve limited groundwater supplies in each AMA. ADWR requires that each new subdivision within the AMAs provide a demonstration of physical water availability, a designation of assured water supply, an analysis of assured water supply and a certificate of assured water supply.

The depth of groundwater in eastern Pima County typically ranges from 50 feet to greater than 700 feet below ground elevation. The main groundwater source in developed eastern Pima County is the Tucson Watershed Basin which includes the Upper Santa Cruz Sub-Basin and the Avra Valley Ground Water Sub-Basin. Based on previously defined groundwater monitoring sites, the depth to water in the Tucson Watershed Basin ranges between 6 feet to 615 feet below ground level. Groundwater in Pima County generally flows north to northwest (PAG 208 Plan Amendment, Draft June 2008).

A long-time dependence on groundwater resources has resulted in a significant lowering of the water table in some areas of the Tucson basin. This is particularly true in areas where groundwater is pumped to support mining, agriculture and residential development. For example, in Green Valley, between 1940 and 1995, the groundwater level dropped from 50 feet below ground to 150 feet below ground. In many basin areas defined by mining and agri-



The riparian habitat along the Santa Cruz River is dependent on discharges from the Agua Nueva and Tres Rios WRFs.

culture, alternatives to pumping groundwater are limited due to the lack of recharge facilities or infrastructure needed to deliver reclaimed water to those areas.

Competition for the limited groundwater supplies has resulted in water management guidelines and efforts to find new water resources. Today, the primary goal is to attain a safe yield. Safe yield is accomplished when the amount of water withdrawn from the aquifer does not exceed the amount of water that is replenished. Some areas of the county have experienced rising groundwater levels, from 1 to 30 feet. This is a result of the reduction of groundwater pumping due to the use of a blend of Central Arizona Project (CAP) water and groundwater.

The development of reclaimed water infrastructure could allow for the delivery of reclaimed water to agricultural lands and the reduction of groundwater pumping. Pima County is partnering in a phased effort with the Cortaro-Marana Irrigation District, the Metro Domestic Water Improvement District and the Bureau of Reclamation to establish an ADWR-permitted Groundwater Savings Facility (GFS). The GFS would save groundwater through the use of reclaimed water for agriculture.

GROUNDWATER REPLENISHMENT DISTRICT

In 1993, the Arizona legislature created the Central Arizona Groundwater Replenishment District (GRD). The GRD helps growing subdivision with no access to renewable water meet assured water supply rules. Participation in the GRD is voluntary and consists of two types of members: member lands and member service areas. Member lands are typically subdivisions wherein the GRD agrees to replenish the groundwater that will be pumped to serve the subdivision. In turn, the subdivision agrees to pay GRD's costs to acquire renewable water and replenish it on behalf of the subdivision.

Member service areas are typically water providers, cities or towns. A service area will receive a designation of assured water supply by joining the GRD. The GRD acquires renewable water and replenishes it on behalf of the service area. The water is not necessarily replenished in the same area it is withdrawn.

SURFACE WATER

The Santa Cruz River is the primary surface water drainage site in eastern Pima County. Approximately 60 miles long and mostly ephemeral, the river flows north through the Upper Santa Cruz Valley Sub-Basin and northwest into the Avra Valley Sub-Basin. Major tributaries of the Santa Cruz River in the Upper Santa Cruz Valley Sub-Basin are the Canada del Oro Wash, which drains the northern part of the Santa Cruz Valley and the Rillito Creek, which drains areas north and east of Tucson. The Tres Rios WRF and the Agua Nueva WRF actively discharge into the Santa Cruz River, significantly contributing to the aquifer recharge and environmental restoration projects along the river. Although the Green Valley WRF also is permitted to discharge to the Santa Cruz River, all effluent generated at that facility is recharged.

The largest single imported source of renewable water supply available to the Tucson area is the Central Arizona Project (CAP). Until a decade ago, Tucson was one of the largest, if not the largest, U.S. city, totally dependent on groundwater. Today, Central Arizona Project (CAP) water is used more than twice as much as groundwater (*Water Plan: 2000-2050*). Via a system of canals, tunnels, pumping plants and pipelines, the CAP delivers Colorado River water from Lake Havasu to its terminus, located southwest of Tucson. Several regional water providers, with the water rights granted through the

Arizona Water Settlement Act, receive allocations of this resource.

Initial construction of the CAP began in 1973. The 336-mile long backbone aqueduct system reached Tucson in 1993, followed by construction of new and modified dams in 1994. Completion of non-Indian agricultural water distribution systems and most municipal water delivery systems occurred in the late 1980s. Several Indian distribution systems remain to be built. Projections indicate that full development of these systems could require another 20 years or longer, depending on the availability of funds. The CAP is the largest and most expensive aqueduct system ($5 billion) ever constructed in the United States. The Central Arizona Water Conservation District manages and operates the CAP.

COLORADO RIVER BASIN STUDY

The Colorado River supplies water to seven states, including Arizona. The CAP delivers its annual share of 1.5 million acre feet of Colorado River water to Pima, Pinal and Maricopa counties. A Bureau of Reclamation study of the Colorado River Basin projects a basin-wide shortfall of 3.2 million acre feet annually by the year 2060. ADWR reached a similar conclusion in its report, *Arizona's Next Century: A Strategic Vision for Water Supply Sustainability.* Continued growth will be dependent on the importation or acquisition of new water supplies, as some areas of the state are expected to experience constrained growth due to water shortages.

Lake Mead, which is fed by the Colorado River, is the supply source for CAP water. Forecasts indicate a continuous decline in the lake's water supply. This decline is due, in part, to recurring over-allocation of water to the Basin states, because those allocations exceed the amount of water feeding the reservoir. Although the ongoing drought exacerbates this problem, the over-drawing of water from Lake Mead would be a problem even if there were not a drought. The water level at Lake Mead serves as a trigger for mandatory reductions of CAP water. The increasing probability of lower water levels corresponds to the likelihood of reduced CAP water delivery to Pima County. Initial reductions would only affect the agriculture sector.

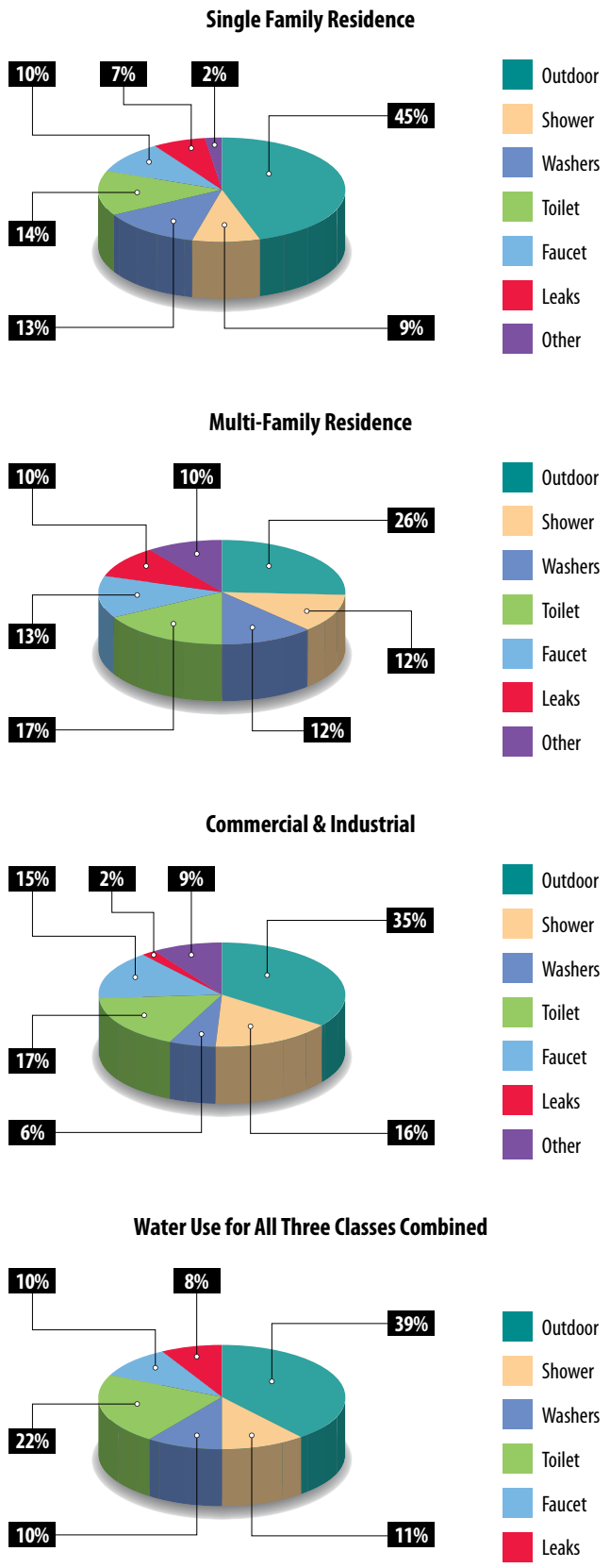
Both the Bureau of Reclamation and ADWR studies recommend using all water supplies as efficiently as possible and expanding the use of reclaimed water for non-potable purposes. Effluent has and will continue to be a key water supply in the state's management plans and the attainment of safe yield. Both reports agree that no one strategy will solve future imbalances of water supplies and that augmentation will be required despite conservation and reuse efforts.

7.1.3 WATER USAGE IN TUCSON AND PIMA COUNTY

In the mid-1980s, residential and commercial water use in the Tucson metropolitan surpassed agricultural use, industrial use and use on tribal lands (WISP). This important shift marked the likelihood of continued increasing water use in the growing urbanized areas and a corresponding increase in wastewater flows. Based on population projections from the U.S. Census and the Pima Association of Governments, the community will continue to grow in the decades to come.

Not all potable system water in urban areas (i.e.: outdoor use, water distribution system leaks) makes its way into the wastewater system. **Figure 7-1** shows the estimated use of municipal water by three different user groups: single-family residential, multi-family

Figure 7-1 Water Use by Land Use Category



Source: 2011-2015 Action Plan for Water Sustainability, City/County Water & Wastewater Infrastructure, Supply and Planning Study, 2010

Riparian Santa Cruz River near Cortaro Road.

residential and commercial and industrial. As shown in the figure (see "Water Use for All Three Classes Combined" pie chart), a significant amount (39%) of water use occurs outdoors. Indoor uses, such as showers, washers, toilets, and faucets represent 53% of water use. This water makes its way into the wastewater system. The remaining 8% of water is lost to leaks in the water distribution system.

A single family residence is estimated to use almost as much water outdoors (45%) as indoors for showers, washers, toilets and faucets (46%). Multi-family residential and commercial/industrial users are estimated to contribute 54% of water used into the wastewater system. Due to larger landscaping areas to irrigate commercial/industrial users use more water than multi-family residential users. Although commercial/industrial users are estimated to contribute a relative similar proportion per connection, the overall number of residential users grossly outnumbers the commercial/industrial connections.

The total per capita water usage rate of 177 GPCD (gallons per capita per day) was fairly consistent during the early 2000s for Tucson Water's customers. The GPCD included water used to supply both potable and non-potable demands. From the mid-2000s to the present, the potable GPCD rate has decreased substantially from a high of about 160 in 2005 to about 130 in 2012. The drivers for this decrease include increased conservation efforts, economic conditions, water and sewer rates, and other factors, as explained in the *2012 Update Water Plan: 2000-2050*.

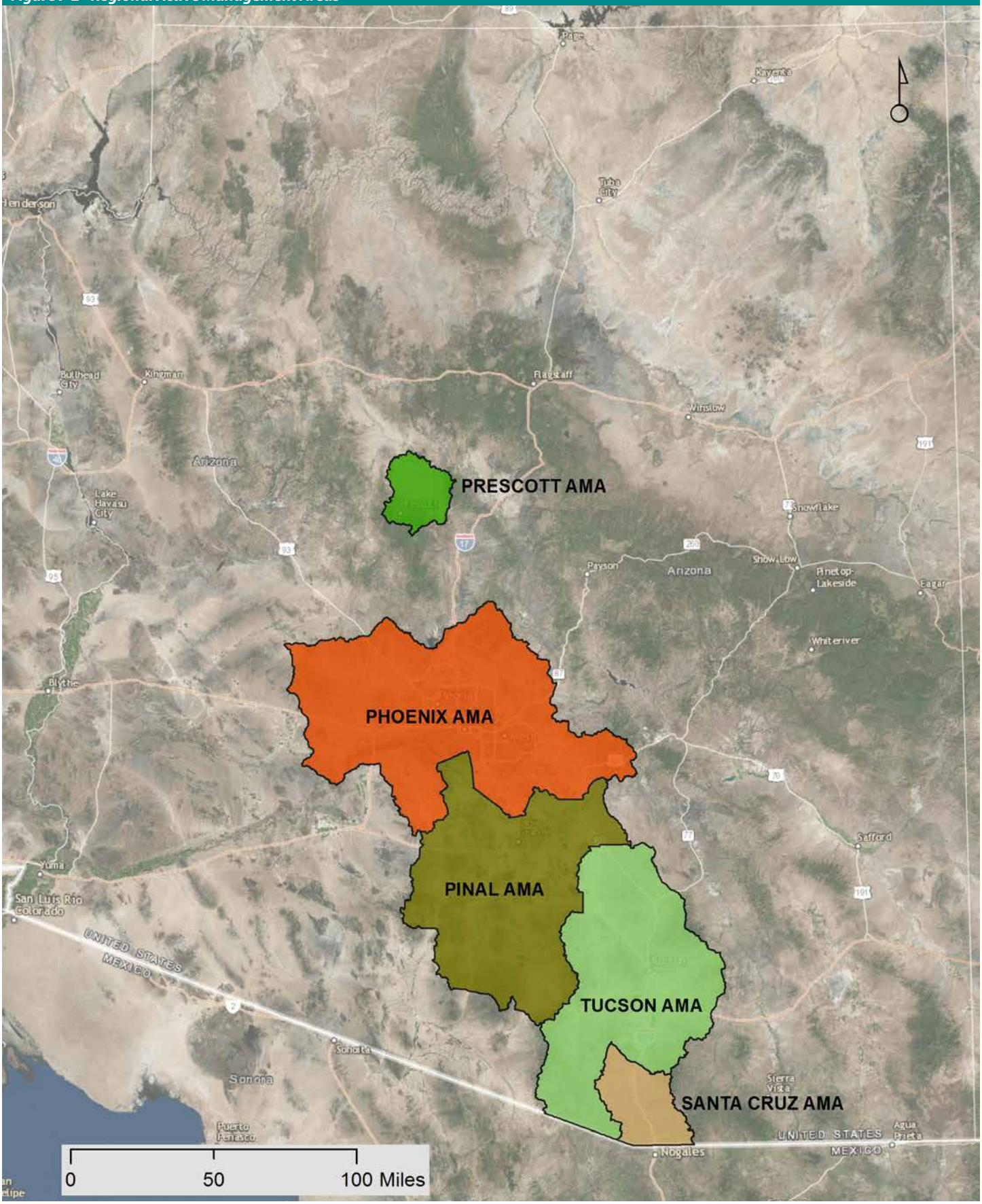
While the figures above illustrate general water use quantities by land use type, a 2013 water demand analysis shows that the average water use by single family residences (SFR) has been declining since the late 1990s, and is likely to continue in the coming years. (Gary Woodard from Montgomery & Associates Water Resource Consultants performed the analysis for Pima County.) A portion of this reduction is attributable to low-flush toilets and water-efficient fixtures installed in all new homes. Local trends also show that in addition to the effects of more water-efficient appliances, behavioral changes are also affecting lower-water use rates. Although water consumption is declining in both existing homes and newly constructed homes, new home construction is yielding greater efficiencies when compared to existing homes. A new SFR built in the mid-2000s uses approximately a third of the water as a home built in 1995. This declining trend in water use is likely to continue.

As further explained by Montgomery & Associates, long-term declines in household-level water demand in Pima County have created uncertainty for municipal providers, wholesalers, wastewater facilities and regulators. This trend also poses numerous planning challenges because it impacts decisions about implementing capital improvements, acquiring new supplies, setting rates, designing conservation programs and reusing reclaimed water.

7.1.4 TUCSON ACTIVE MANAGEMENT AREA

The 1980 Groundwater Management Act manages the groundwater resources in areas of intense use, and led to the creation of five Active Management Areas, one of which is Tucson (**Figure 7-2**). The primary goal for the Tucson Active Management Area (TAMA) is to ensure safe-yield. The Groundwater Management Act requires that by 2025, groundwater withdrawals do not exceed the amount

Figure 7-2 Regional Active Management Areas



Source: Arizona Department of Water Resources

At the Agua Nueva WRF, the efficient reuse of effluent is an essential component of conserving and managing water resources.

of groundwater that is replaced. TAMA consists of over 3,800 square miles and includes the Avra Valley and the Upper Santa Cruz Sub-Basins. According to the *Water Plan 2000-2050*, more than 300,000 acre feet of water is required annually for TAMA to meet this goal.

The Groundwater Management Code provides a management structure for accounting and allocating water resources while requiring new growth to acquire renewable water sources. New developments can no longer rely solely on mined groundwater - a finite resource. New subdivisions within an AMA must demonstrate an assured water supply for a 100-year period. Groundwater may serve as an assured supply, provided it is replenished by a renewable water source. The Central Arizona Groundwater Replenishment District (CAGRD) replenishes Central Arizona Project (CAP) water on behalf of enrolled landowners or water providers. This replenishment, or recharge, is meant to meet the primary goal of safe yield. Recharge of both CAP water and effluent contributes to the beneficial management of the TAMA. Pima County plans to maximize recharge capabilities at its water reclamation facilities, although at this time, the Corona de Tucson WRF is the only facility with an ADWR Recharge permit.

The largest of thirteen CAP allocation holders in the TAMA is the City of Tucson (Tucson Water Department), with a current allocation of 144,172 acre-feet per year. Other allocations within the TAMA may be used directly by their holders; may be wheeled to other water providers by the City (future agreements with water holders would be necessary); or may be made available for lease or purchase (*Water Plan: 2000-2050*).

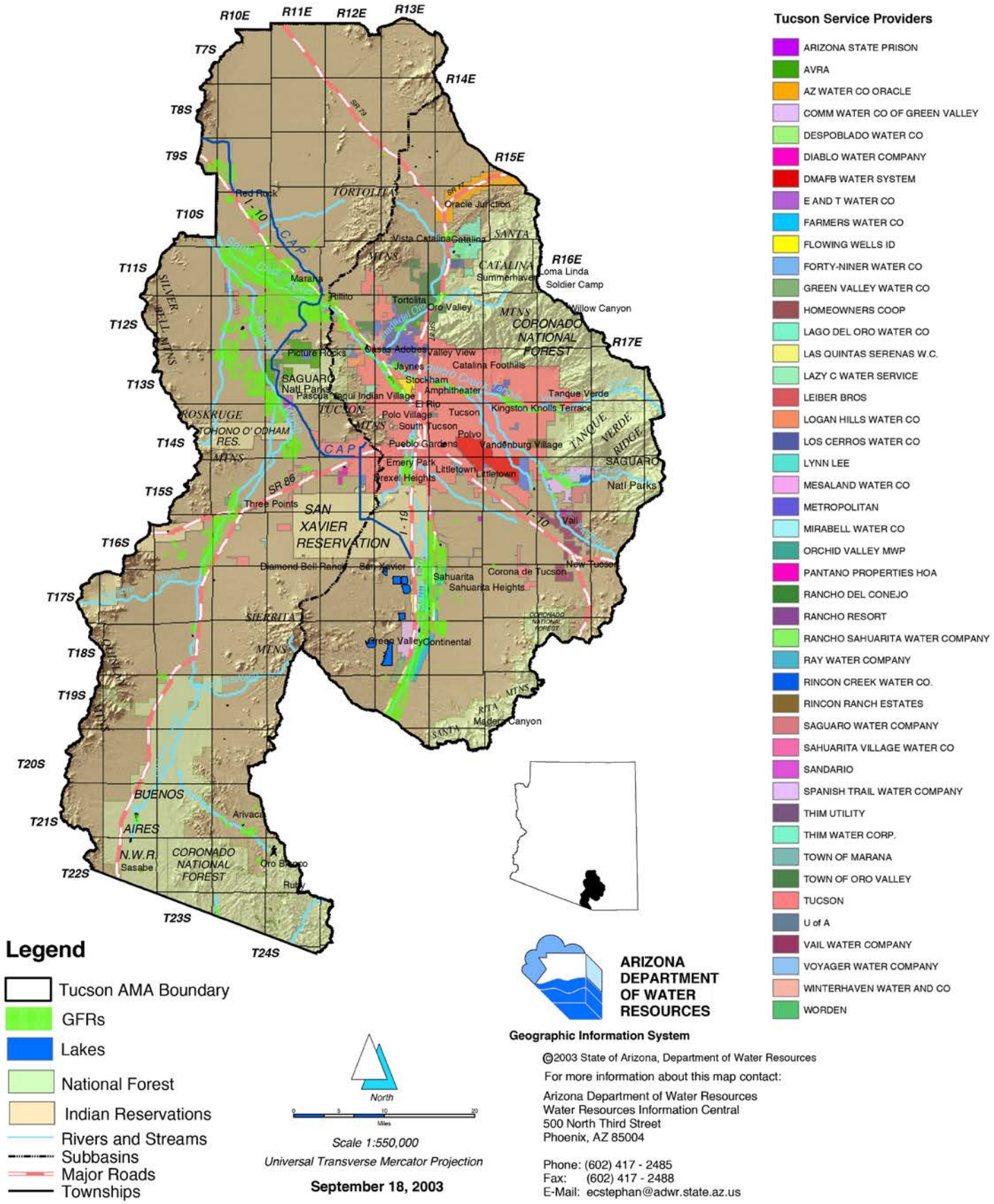
In 2000, the Tucson Water Department prepared its long-term *Water Plan 2000-2050* to initiate a dialogue between the utility and the Tucson community about water resource challenges that must be addressed in the coming years. The community's water resource challenges involve increasing system reliability and securing sustainable water supplies for the existing service area population, and for anticipated growth. The Tucson Water Department will continue to meet its water demands through a diverse water portfolio consisting of groundwater, CAP water and reclaimed water. Both the *Water Plan 2000-2050* and subsequent updates demonstrate that the City has adequate water resources available for current users and an estimated 370,000 additional customers.

The City of Tucson Water Department is the largest municipal water provider in the County. Additional water providers include the Metropolitan Water Improvement District, Marana Water, the Town of Oro Valley, the Community Water of Green Valley, the Flowing Wells Irrigation District, the Lago Del Oro Water Company, the Avra Valley Water Co-Op, and others (**Figure 7-3**).

PROJECTED TUCSON WATER SERVICE AREA

In 2010, the City of Tucson adopted a Water Service Area Policy that limits expansion of the Tucson Water Department's service area. The policy includes a map that established existing obligated service areas, expansion areas, non-expansion areas, and unresolved

Figure 7-3 Tucson Active Management Area



areas. The majority of undeveloped southeastern portion of the county, including the Southlands and Corona de Tucson, falls within the Tucson Water obligated service area (shown in light blue in **Figure 7-4**). There are also areas in this portion of the county that would require annexation before the City could provide water service. Undeveloped areas outside of the Tucson Water Department's obligated areas will be served by other providers as shown on the City's long-range planning area map (**see Figure 7-4**).

To the north, the projected Tucson Water obligated service area includes undeveloped lands along the eastern edge of the Town of Marana boundary. Farther to the southwest, the Tucson Water Department has plans to provide services to partially developed Diamond Bell Ranch located southeast of the Sasabe State Highway and Diamond Bell Ranch Road intersection area. PCRWRD has plans to expand sewer services in these areas.

7.1.5 WATER AND WASTEWATER PLANS AND STUDIES

CITY/COUNTY WATER & WASTEWATER INFRASTRUCTURE, SUPPLY AND PLANNING STUDY (WISP)

As a result of the regional and collaborative water planning efforts between the City and the County, the two jurisdictions adopted the *Water & Wastewater Infrastructure, Supply and Planning Study* (WISP) in 2008. This document outlines a regional approach toward more efficient use of water, including water conservation and the evaluation of available alternatives to non-potable water sources. WISP represents a multi-year study of water and wastewater infrastructure, supply and planning issues. A WSIP goal is "to assure a sustainable community water source is available, given continuing pressure on water supplies caused by population growth and the environment." In 2010, the City of Tucson Mayor and Council and the Pima County Board of Supervisors approved the subsequent Action Plan for 2011-2015.

2011-2015 ACTION PLAN FOR WATER SUSTAINABILITY

City and County staff created the 2011-2015 Action Plan to implement goals and recommendations adopted with the Phase 2 Water Study Report. The Phase 2 Report established a framework for sustainable water resources planning, including 19 goals and 56 recommendations within four interconnected elements: Comprehensive Integrated Planning, Respect for the Environment, Water Supply and Demand Management. The Phase 2 Report built upon the Phase 1 Report, which included an extensive inventory of water and wastewater infrastructure. As the demand for alternative water supplies increases, PCRWRD plays a critical role in supplying high-quality effluent for multi-benefit projects in the county. PCRWRD's Effluent Management Plan outlines the use of reclaimed water to replenish groundwater supplies, irrigate landscape in area parks and create riparian habitats in the community. More details about the 2011-2015 Action Plan and water conservation and water sustainability projects in Pima County are provided in Section **7.1.6**.

2014 TUCSON WATER RECYCLED WATER MASTER PLAN

The Tucson Water Department recently released the Recycled Water Master Plan. The Plan promotes higher use of reclaimed water by augmenting potable supply with IPR. To this end, the City will treat reclaimed water; recharge it to the aquifer; filter it through the aquifer; and recover it for advanced treatment before mixing it with the potable supply.

New recycled water programs are predicated on the conclusion that the reclaimed water system is not expected to gain significant additional demand. Therefore, new uses of recycled water are necessary for full utilization and maximization of this water resource. Full utilization is a compelling goal as the Tucson Water Department expects shortages to the City's CAP allocation due to drought and climate change. For these reasons, the City is shifting its strategy to decrease reliance on CAP supplies. Plans for supplementing the City's CAP allocation include the use of recycled water, replenishment through the Central Arizona Groundwater Replenishment District, the use of credits from the Arizona Water Banking Authority), reliance on long term storage credits and incidental recharge.

IPR is the primary strategy to establish additional renewable water supplies outlined in the Tucson Water Department's Recycled Water Master Plan. The plan seeks to use now-unutilized recycled water to increase system reliability and retain a valuable water resource in the county. PCRWRD's production of high-quality effluent will become part of the pre-treatment process debate if IPR reuse planning moves forward. If IPR does become a significant water source, the City of Tucson will join many other communities in the Southwest that use IPR to meet their water needs.

7.1.6 2011-2015 ACTION PLAN FOR WATER SUSTAINABILITY

In 2010, the City of Tucson and Pima County completed the WISP Study which established shared goals for water sustainability. These goals approved by the City of Tucson Mayor and Council and the Pima County Board of Supervisors are meant to advance integrated water resource planning. The **City /County Goals for Water Sustainability** are:

COMPREHENSIVE INTEGRATED PLANNING

Goal: Encourage sustainable urban forms of growth.

Ensure that the urban form of growth enhances beneficial water/energy, environment, economic and social outcomes through inclusion of diverse housing types and compact, environmentally sensitive and walkable communities.

Goal: Direct growth to sustainable growth areas.

Direct future growth away from environmentally sensitive areas and closer to existing infrastructure through infrastructure investments, regulation, policies and open space acquisitions.

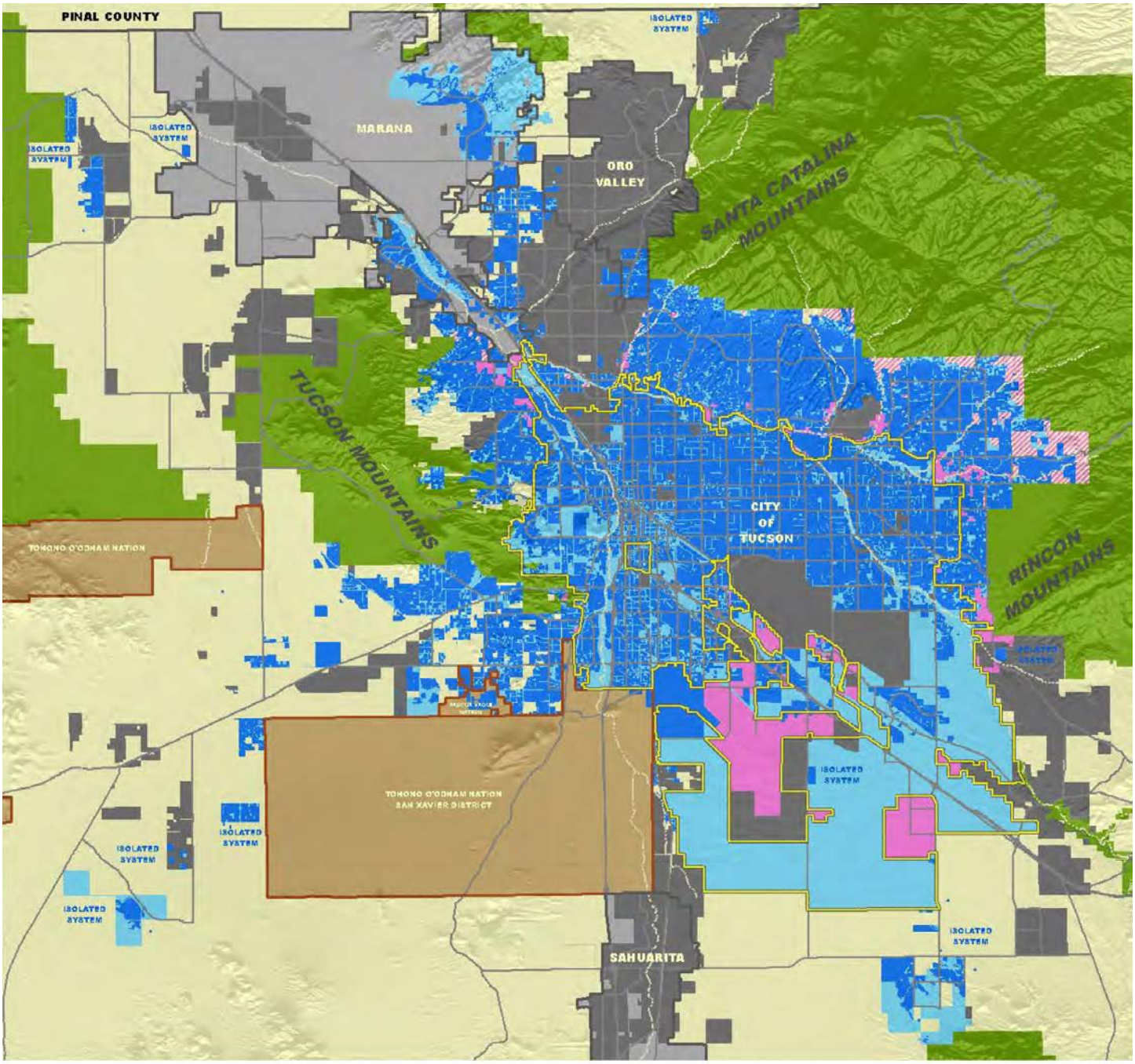
Goal: Integrate land use and water resource planning.

Enhance efforts to link land use and water resource planning to foster increased use of renewable water resources in new developments and balance economic, environmental and human needs for water.

Goal: Growth should pay for itself over time and be financially sustainable.

Ensure that full cost of new development is considered and that growth-related costs for water and wastewater are recovered.

Figure 7-4 Tucson Water Long-Range Planning Area



Existing Obligated Service Area

- Currently Served
- Not Currently Served

Expansion Areas

- Proposed Service Area - Annexation Required
- Proposed Service Area - Annexation May Be Required

Non-Expansion Areas

- Unincorporated Pima County
- Other Water Provider
- Other Jurisdiction
- Reservation
- Parks

0 1 2 4 6
Miles
8/28/2013

Source: 2012 Update Water Plan 2000-2050, December 2013

RESPECT FOR ENVIRONMENT

Goal: Preserve existing riparian areas through coordinated regulation, policy and outreach.

Pursue a coordinated approach to preserving existing riparian areas and foster increased public support of protection and maintenance of healthy ecosystems.

Goal: Identify needs and opportunities for future restoration.

Pursue a collaborative, comprehensive and systematic strategy to identify needs, opportunities, resources and partnerships to implement cost-effective regional environmental restoration.

Goal: Ensure that public projects are multi-benefit, including restoration, stormwater management, recharge and public amenity.

Maximize beneficial use of reclaimed water, rainwater and stormwater in flood control, water and wastewater treatment facilities and other capital projects.

Goal: Ensure the future of riparian and aquatic habitat along the effluent-dependent reach of the Santa Cruz River.

Evaluate alternative strategies for protection of the riparian and aquatic habitat along the effluent-dependent reach of the Santa Cruz River by building upon prior research and planning studies.

Goal: Develop water supply for the environment.

Ensure an adequate amount of water is available to meet the seasonal needs of restored habitats.

WATER SUPPLY

Goal: Work collaboratively to acquire new water supplies for reliability.

Expand cooperative efforts to buttress our existing supplies and diversify our water resource portfolio to prepare for potential shortages stemming from climate change and drought.

Goal: Maximize and make efficient use of effluent and other locally renewable water supplies.

Reduce use of ground water for non-potable water needs through greater emphasis on locally-renewable resources such as reclaimed water, rainwater and gray water.

Goal: Address regulatory barriers to maximizing local supplies.

Pursue regulatory changes that will protect public health and safety while providing flexibility to foster increased uses of reclaimed water to offset use of groundwater for non-potable demands.

Goal: Be prepared for climate change and drought.

Pursue adaptive, flexible, multi-pronged preparedness strategies such as diversification of water supplies, improved demand management and increased reliance on water harvesting.

DEMAND MANAGEMENT

Goal: Increase the effectiveness of conservation programming through coordinated planning and evaluation.

Improve monitoring of water-use trends to increase our ability to target inefficient and high water use areas, and to encourage innovation in water conservation research, methods and reporting.

Goal: Establish common water conservation goals and targeted methods.

Develop shared goals to provide a foundation for increasing regional consistency and coordination.

Goal: Mange demand through the design of the built environment.

Incorporate consistent low water usage development standards into new construction and establish land forms that reduce the "water footprint" of the built environment.

Goal: Manage demand through changing behaviors.

Enhance coordinated education programs to enable implementation of efficient practices. Assess public preferences for conservation methods to better understand and communicate the benefits of conserving water.

Goal: Increase the use of rainwater and stormwater.

Coordinate efforts to maximize and evaluate the benefits of rainwater harvesting to meet outdoor needs, reduce demands on potable supplies, increased floodwater retention and limit migration of contaminants.

The following are **action items and specific projects** that Pima County departments are pursuing or have completed to meet the Water Conservation and Water Sustainability Goals:

- ***Develop/Update Consistent Water Efficiency Standards –*** All new land use zoning changes in unincorporated Pima County are reviewed for water consumption and conservation using criteria established in the Site Analysis Requirements approved by the Pima County Board of Supervisors in March 2010.

- ***The Conservation Effluent Pool (CEP) –*** An agreement for the use of effluent to support riparian projects has been completed. A City/County CEP Task Force identified candidate projects for CEP water in 2013. The first request for a volume dedicated to Santa Cruz River is being reviewed by City/County staff and CEP administrators. A better understanding of impacts from the increased infiltration rate from higher quality and production capacity at the Agua Nueva WRF is needed. The proposed request is pending modification and approval. Do not know what this is trying to say. Am waiting to hear back from RWRD.

- ***Riparian Mitigation Guidelines –*** Updated guidelines that protect riparian habitat were approved by the Board of Supervisors in November 2011.

- ***SHARP (Southeast Houghton Area Recharge Project) –*** The City of Tucson Mayor and Council and the Pima County Board

of Supervisors approved this joint City/County recharge project in the southeast Houghton Road area (approximately one half mile southwest of Houghton and Irvington Roads) in 2011. The project will provide for effluent reuse and habitat restoration. The project is planned to provide the capability to recharge reclaimed water that would ordinarily be discharged into the Santa Cruz River, resulting in beneficial use of this water in the metropolitan area. PCRWRD is, however, considering to withdraw from participating in the SHARP project due to other priorities for the use of our water resources.

- ***ROMP (Regional Optimization Master Plan)*** – PCRWRD has completed Improvements to Pima County's metropolitan water reclamation facilities. This program has improved effluent quality and is expected to provide the City with more flexibility in the delivery of reclaimed water in the Tucson area. Improved water quality can better meet the needs for recharge, environmental restoration and public amenities, such as parks, golf courses and ball fields. 22 County parks are currently served by reclaimed water.

- ***State Blue Ribbon Panel on Water Sustainability*** – Recommendations to advocate for regulatory changes that expand the use of reclaimed water, stormwater and greywater were advanced. Additional efforts are contingent on the State legislature and the Water Resources Development Commission.

- ***Tucson Water's Water Service Area Policy*** – The Mayor and Council approved recommended refinements to water service area policy in July 2013. This policy establishes the process for connecting new developing areas outside the city limits to the City of Tucson's municipal water utility. A priority is given to developers who create high-paying jobs and invest $5 million in new or expanded facilities.

- ***CAP Order*** – In 2012, the City took delivery of its full CAP allocation at its recharge facilities.

7.2 EFFLUENT GENERATION AND UTILIZATION

Effluent is the product of the wastewater treatment process and is an important renewable water supply for this region. Effluent produced at PCRWRD's treatment facilities should be utilized to the maximum extent possible in lieu of groundwater. Numerous planning and policy documents affirm [1] this is a key goal to benefit County water resource management. It is also a vital strategy of the State's Third Management Plan to achieve sustainable safe yield. PCRWRD's will continue to evaluate options to maximize and make efficient use of reclaimed water for multi-use projects including environmental restoration, replenishment and reuse. The department has a strategic plan for effluent utilization.

7.2.1 CURRENT TRENDS IN EFFLUENT PRODUCTION

Trends in effluent production are indicative of influences of water conservation and drought conditions. In addition, many rural areas in the county are not connected to a public sewer and rely on individual on-site (septic) systems for residential sewage treatment and disposal. In less dense, rural areas, the lack of a connection to a public sewer system means the wastewater generated there cannot be turned into reclaimed water. Restrictions on unregulated wildcat subdivisions limit septic systems and result in more connections to the regional sewer system. Wastewater that is treated by the public system can be reused and helps in limiting the pumping of groundwater.

ADWR's report, Arizona's Strategic Vision for Water Supply Sustainability, identifies the potential for a long-term imbalance between water supply and demand over the next 100 years. It recommends that Arizona identify and develop additional supplies over the next 20 to 100 years. ADWR urges the development of new water supply sources such as treated wastewater, desalinated brackish groundwater and weather modification.

Pima County has the legislative authority under ARS §11-264 to construct and operate the majority of regional wastewater systems in the County, making it the major producer of effluent water in the region. In 2015, PCRWRD produced 94% of all effluent in the county at its metropolitan facilities. Together, the metropolitan water reclamation facilities produced a total of 61,356 acre-feet (AF) of effluent, or 764 AF less than in 2014. PCRWRD's sub-regional facilities produced the remaining 6% or 3,862 AF. (**Table 7-1**).

[1] *See Board Policy 54.9, WISP Phase 2 Recommendations, Sustainability Action Plan for County Operations.*

Table 7-1 Effluent Production in 2015

Water Reclamation Facility (WRF)	Effluent Produced (acre-foot)	% Effluent Produced
Agua Nueva WRF	27,568	42.3%
Tres Rios WRF	33,788	51.8%
Sub-total Metropolitan WRFs	61,356	94.1%
Sub-total Sub-Regional WRFs	3,862	5.9%
TOTAL Effluent Produced	**65,218**	**100.0%**

Source: Effluent Generation Usage Report, PCRWRD, 2015

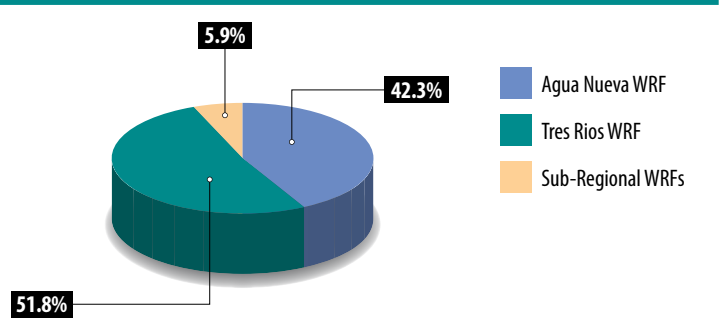


Figure 7-5 Effluent Produced by Metropolitan WRFs (2003-2015)

Year	Total Effluent (AF)
2003	68,197.80
2004	68,253.40
2005	69,007.20
2006	69,067.10
2007	68,298.50
2008	68,540.30
2009	66,176.14
2010	64,539.08
2011	63,916.63
2012	61,392.64
2013	60,572.48
2014	62,120.00
2015	61,356.25

Source: Effluent Generation Usage Report, PCRWRD, 2015

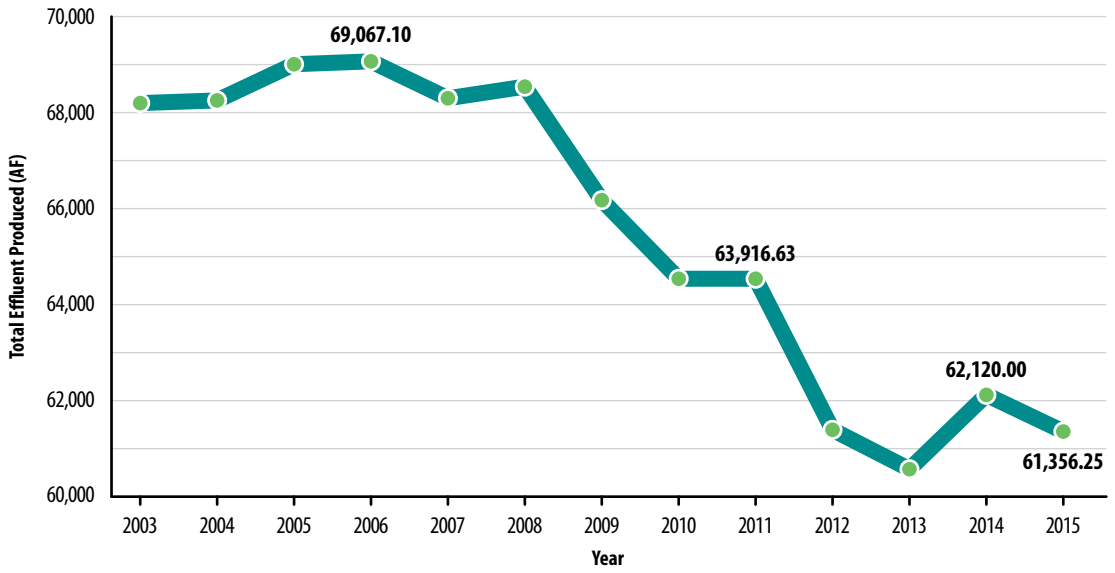


Figure 7-5 presents the total effluent produced by metropolitan facilities (Tres Rios, Roger Road, Agua Nueva, and Randolph) since 2003. The Agua Nueva WRF startup date was December 17, 2013. The chart shows a distinct drop in effluent production by metropolitan facilities in the past years. There was 6,842 AF less effluent produced in 2015 than in 2003, indicating a 10% decline in the production during this time period. This trend can be attributed to the combined effects of the economic downturn, water conservation efforts and drought management.

PCRWRD's Effluent Management Plan includes using reclaimed water to replenish groundwater supplies, irrigate landscaping in area parks, and create riparian habitats in the community. Other parties can buy effluent for these same purposes. Following advanced treatment, effluent can be recovered for either direct or indirect reuse to supplement the potable water supply, as explained earlier in this chapter.

EFFLUENT GENERATION AND UTILIZATION REPORT

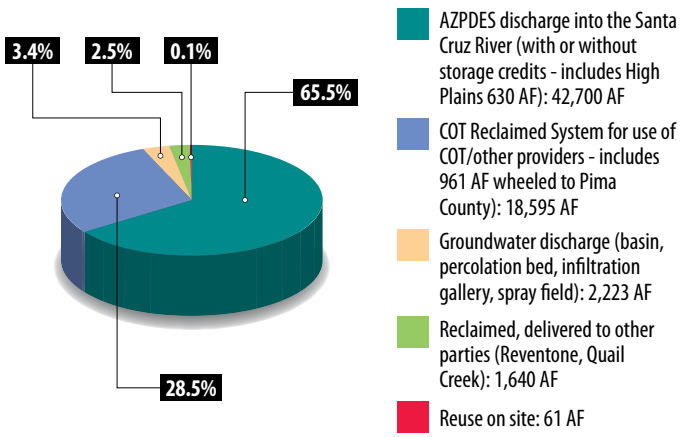
Every year, PCRWRD prepares an effluent generation and utilization report in which it accounts for its effluent entitlement use, including amounts that are recharged, stored underground, recovered, sold or put to direct public use. The need to prepare the report stems from Pima County's 2003 Wheeling Inter-Governmental Agreement (IGA) with the City of Tucson. The effluent report highlights several important water management factors, including:

- Allocation of specific amounts of effluent from metropolitan water reclamation facilities (WRFs) to the City of Tucson and others, such the U.S. Bureau of Reclamation under the Southern Arizona Water Rights Settlement Act (SAWRSA);
- Amount of the county's effluent stored at underground recharge facilities; and,
- Use of reclaimed water by the County.

Ownership of the effluent that Pima County produces at its metropolitan treatment facilities is allocated as follows:

- IGAs allocate the first 28,200 acre feet to satisfy obligations under SAWRSA;
- IGAs reserve the next 10,000 AF for the Conservation Effluent Pool (CEP) (if when there is an active CEP project);
- IGAs allocate 90% of the remaining effluent to the City of Tucson; and,
- IGAs allocate the remaining 10% of effluent to Pima County.

Figure 7-6 Effluent Delivery and Distribution in Pima County in 2015



Source: Effluent Generation and Utilization Report, PCRWRD, 2015
Note: This chart ony shows effluent from all Pima County RWRD facilities. There are other facilities which are non-PC that generate effluent.

The total volume of effluent PCRWRD facilities produce has declined every year since 2008, presumably due to factors such as economic decline, increased water conservation and drought conditions in the region. **Figure 7-5** displays effluent production data from 2003 through 2013 showing an 11.2% decline over the 10-year period.

Figure 7-6 shows the various modes of delivery or discharge for all metropolitan and sub-regional effluent, and the total effluent volume distributed to respective beneficiaries.

Sub-regional facilities with on-site effluent treatment processes include the Green Valley, Arivaca Junction, and Avra Valley facilities.

The completion of the regulatory-mandated ROMP provided upgrades and improvements to the Tres Rios WRF treatment system and resulted in the reduction of ammonia, nitrogen and phosphorous nutrients in the effluent discharges.

Effluent produced at the Corona de Tucson WRF is used for groundwater recharge, while a portion of the effluent treated at the Green Valley facility is delivered to Robson/Quail Creek for groundwater recharge.

A portion of treated effluent produced at the Arivaca Junction facility is used for restricted agricultural uses at a nearby ranch. Effluent produced at the Mt. Lemmon WRF is disposed of through an off-site sprayfield and through surface water discharge that is tributary to the San Pedro River under an AZPDES permit. The effluent generated at the Fairgrounds facility is disposed of through evaporation and percolation.

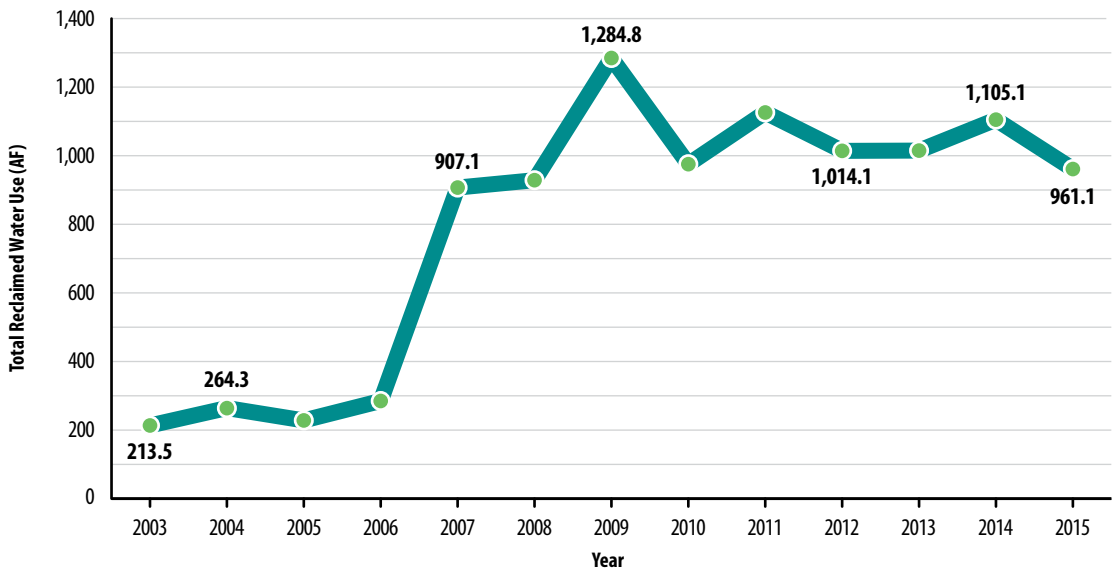
Pima County has three reclaimed water recharge sites:

- **Lower Santa Cruz Managed Recharge Project –** This is a collaborative project of the Cortaro-Marana Irrigation District, the City of Tucson, Pima County, the US Bureau of Reclamation, the Metropolitan Domestic Water Improvement District, the Flowing Wells Irrigation District, the Spanish Trail Water Company and the Town of Oro Valley. The project has an ADWR permit to store up to 43,000 acre-feet per year. Pima County's annual contribution of effluent to this project has ranged from a low of 58 acre-feet at its inception to a high of 1,219 acre-feet in 2014. Managed recharge facilities consist of effluent or CAP water discharged to a natural stream channel that allows water to percolate to the aquifer without the assistance of a designed and constructed facility. There is a 50% cut to the aquifer for effluent stored at managed facilities. In other words, for every 100 acre-feet of effluent stored at a managed facility, 50 acre-feet of long term storage credits can accrue to the storer's account.
- **Marana High Plains Effluent Recharge Project –** This project (constructed in 2002), has an ADWR permit to recharge up to 600 acre-feet of effluent per year. This multi-purpose facility is designed to recharge treated effluent from the Santa Cruz River into the aquifer, and allow for the study of wildlife habitat associated with the recharge. The basin side slopes are vegetated with emergent plants and riparian trees. The Pima County Regional Flood Control District (PCRFCD) constructed the Marana High Plains in cooperation with the U.S. Bureau of Reclamation, the Arizona Water Protection Fund, the Cortaro-Marana Irrigation District and the Town of Marana.
- **The Corona de Tucson WRF –** This facility has an ADWR permit to recharge up to 1,120 acre-feet of effluent per year. Treated effluent from the facility is recharged in percolation basins at the treatment site.

Both the Marana High Plains and Corona de Tucson project are

Figure 7-7 Reclaimed Water Use by Pima County (2003-2015)

Yearly Reclaimed Water Use by Pima County from Tucson Water's Reclaimed System	
Year	Total Reclaimed (AF)
2003	213.5
2004	264.3
2005	228.2
2006	284.9
2007	907.1
2008	928.6
2009	1,284.8
2010	975.3
2011	1,126.0
2012	1,014.1
2013	1,014.9
2014	1,105.1
2015	961.1



Source: Effluent Generation Usage Report, PCRWRD, 2015

constructed recharge facilities that accrue long term storage credits at a rate of 100 percent. This means that for every acre-foot of effluent stored, Pima County accrues one acre-foot of long term storage credits.

In the near future, the Avra Valley WRF is expected to begin accruing groundwater recharge credits after it receives a groundwater storage permit from ADWR. With a potential recharge capacity of over 1,400 acre-feet annually, these credits will add to the County's long-term storage account at ADWR.

According to the Tucson Water Department's long-range Water Plan 2000-2050, effluent will continue to be used to meet reclaimed water (non-potable) demands. In its long range plan, the Tucson Water Department projects that effluent will comprise approximately 8% of Tucson's water supply. Although direct potable reuse of reclaimed water may not be a viable alternative at this time, this resource will most likely be used indirectly through a sequenced program of enhanced treatment, recharge, recovery and blending with other water sources prior to delivery (Water Plan 2000-2050). The City's Recycled Water Master Plan recommends a phased implementation plan for an indirect potable reuse program.

As with the potable system, it is expected that the bulk of the future growth in reclaimed water demand will occur in the southern portion of the City's projected service area. (Water Plan 2000-2050).

RECLAIMED WATER USAGE BY PIMA COUNTY

The Tucson Water Department delivers PCRWRD's allocation of metropolitan reclaimed water though its reclaimed water distribution system. The county uses its share of reclaimed water to control dust at construction sites, to sustain vegetation and to support environmental restoration projects (Effluent Generation and Usage Report, PCRWRD, 2014). **Figure 7-7** provides historical data about Pima County's reclaimed water use.

During the years 2003-2015, Pima County's usage of reclaimed water increased significantly while production decreased slightly. The most significant annual increase of 218.4%, occurred in 2007. The above-average usage is attributable to efforts increase the use of reclaimed water for non-potable uses. The decline in effluent production is influenced by factors such as economic decline, increased water conservation and drought conditions in the region.

To maximize the use of reclaimed water for non-potable uses, the City suggests the following:

"Encourage Sewer Connections. To provide a greater volume of municipal wastewater effluent for potential reuse, changes in ordinance and/or code should be considered to encourage sewer connections to reduce the number of septic tank systems installed within the City's projected service area" (Water Plan: 2000-2050, pg. ES-5).

> The reclaimed water produced by PCRWRD is a renewable resource that will provide a water source and sustain the environment for Pima County residents now and into the future.

The current Pima County Code Ordinance, Title 7, Chapter 7.21.027 prohibits on-site disposal septic tanks on a single-family residential lot of less than one acre. Chapter 7.21.037.D. of the Code requires properties to connect to the public sanitary sewerage system with available capacity if the property is located within two hundred feet of the sewer system. Connection to the public sewer enables this water to be captured in a reclamation facility where it can be put to beneficial use, unlike water used in septic tanks.

PCRWRD'S EFFLUENT STORAGE AND LONG-TERM STORAGE CREDITS

Pima County effluent that is not put to direct public use or used for environmental restoration projects, is stored underground where it replenishes the aquifer. This stored water is "banked" for

future use and serves to replenish the aquifer until it is recovered. Credits can also be sold or exchanged for property, easements or anything else of value. PCRWRD accrues long term storage credit for its effluent stored in the aquifer at several underground storage facilities permitted by ADWR. An accounting of the water stored by Pima County is maintained by PCRWRD in the Effluent Generation and Utilization Report published annually. **Table 7-2** displays PCRWRD's long-term storage credits accumulated since 2003. These credits represent a valuable water resource that could be withdrawn in the future in accordance with the Water Rights Policy established by the Board of Supervisors.

ENVIRONMENTAL RESTORATION

Figure 7-8 depicts the Regional Environmental Restoration Projects which include:

1. Marana High Plains Effluent Recharge Project (28 acres) – see page 105 for project description.
2. Bosque Basin at WBSCR (7.5 acres) – This environmental restoration and floodplain mitigation project includes habitat restoration, preservation and protection and open space preservation along the West Branch of the Santa Cruz River (WBSCR), south of Silverlake Road and east of Mission Road. The WBSCR area is one of highest-biodiverse portions of the Santa Cruz River floodplain near Tucson. The entire project consists of 73 acres.

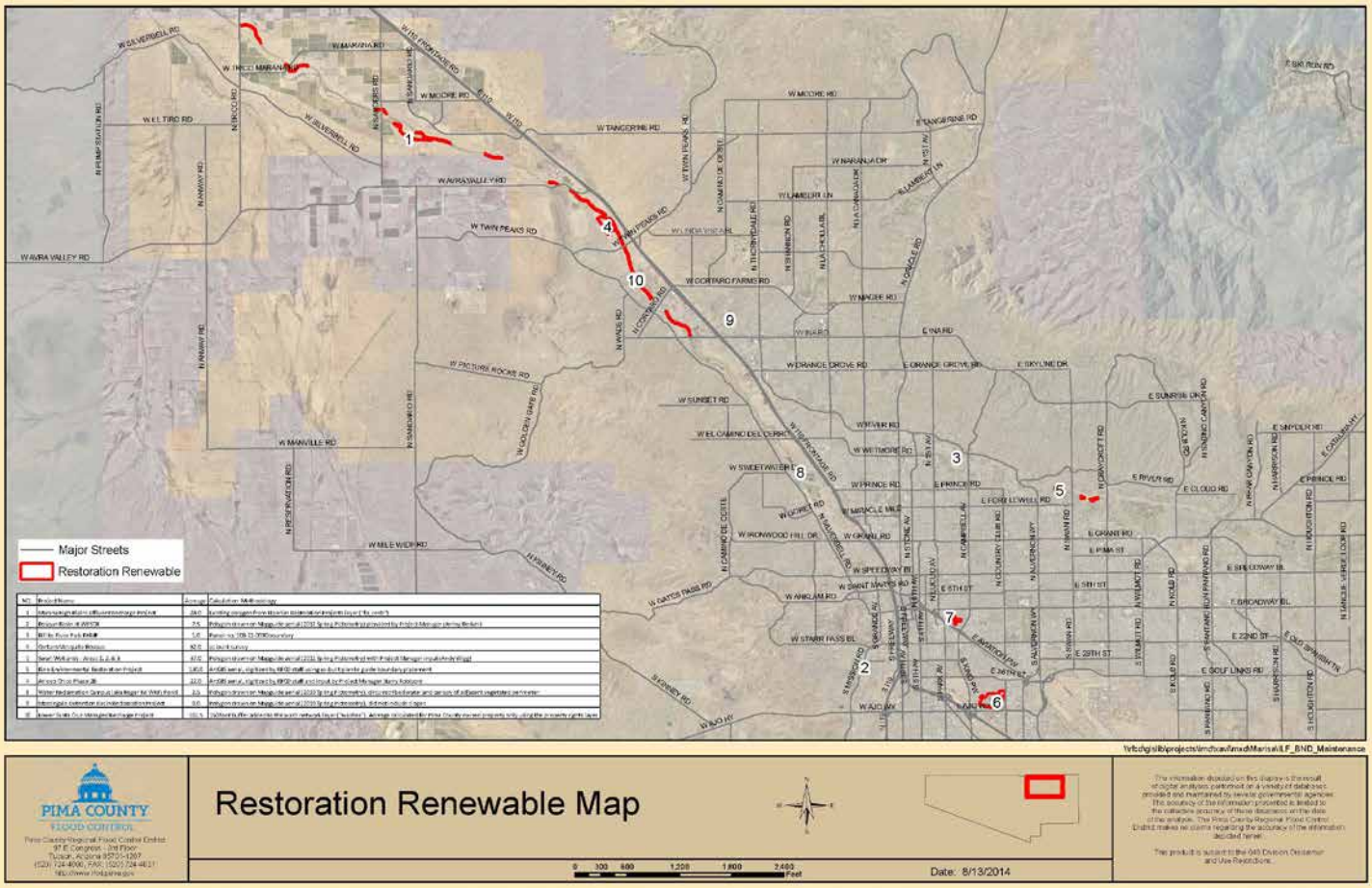
Table 7-2 Long-Term Storage Credits

Year	County Share of Metro Effluent (AF)	County Storage Credits (AF)	Cumulative Credits (AF)
2003	3,999.80	58.10	58.10
2004	4,005.30	449.30	507.40
2005	4,080.70	535.10	1,042.50
2006	4,086.70	532.30	1,574.80
2007	4,009.90	788.38	2,363.18
2008	4,034.00	1,025.89	3,389.07
2009	3,821.10	977.41	4,366.48
2010	3,633.91	1,085.37	5,451.85
2011	3,571.66	990.06	6,441.91
2012	3,319.26	1,131.71	7,573.62
2013	3,237.25	962.69	8,542.31
2014	3,391.99	1,339.37	9,875.68
2015	3,315.63	1,910.89	11,786.57

Source: Effluent Generation and Utilization Report, PCRWRD, 2015

3. Rillito River at Swan Wetlands Ecosystem Restoration Project (60 acres) – The Pima County Flood Control District, in cooperation with the U.S. Army Corps of Engineers, completed the Rillito River

Figure 7-8 Regional Environmental Restoration Projects Map



Source: Pima County Regional Flood Control District

at Swan Wetlands Ecosystem Restoration Project in 2008. This entire environmental restoration project consists of four planning areas and encompasses approximately 60 acres along the south bank of the Rillito River from Craycroft Road to just west of the Columbus Boulevard alignment.

4. Cortaro Mesquite Bosque (82 acres) – This habitat restoration project increases the biological diversity and plant community structure of the Santa Cruz River floodplain, and provides wildlife habitat. Completed by PCRFCD in 2008, the project is located on the Santa Cruz River floodplain terrace adjacent to Continental Ranch residential development upstream of Twin Peaks Road.
5. Kino Environmental Restoration Project (KERP) (130 acres) – The KERP is located in the southeastern area of Tucson, along the north and south side of Ajo Way and east of S. Kino Parkway. It is one of the largest reclaimed water storage facilities in Pima County. Construction of the multi-faceted KERP project took place in the mid-1990s under a cooperative agreement between the U.S. Army Corps of Engineers, the Pima County Flood Control District and the Pima County Regional Wastewater Reclamation Department, KERP has three primary purposes: to restore native ecosystem; harvest urban stormwater; and, control flooding. The facility is permitted for a maximum monthly average inflow of 2.0 MGD of reclaimed water. Most of the reclaimed water provides irrigation to nearby practice fields at Kino Stadium.
6. Arroyo Chico Phase 2B (22 acres) – This project, referred to as the Park Avenue Detention Basin Complex, is part of a multi-phase flood control, environmental restoration and recreation project. PCRFCD and the City of Tucson constructed the project in cooperation with the U.S. Army Corps for Engineers. The total project area encompasses approximately 6 miles of the Arroyo Chico Wash from Alvernon Way to its confluence with the Santa Cruz River near St. Mary's Road. The project provides the opportunity for environmental restoration of the degraded riparian ecosystem, preservation of existing native habitats and recreational improvements for the neighboring communities.
7. Water Reclamation Campus (40 acres) – The Agua Nueva WRF, part of PCRWRD's Water Reclamation Campus, allows Pima County to meet new strict environmental standards for effluent discharges into the Santa Cruz River. The Agua Nueva WRF produces Class A+ effluent, a higher-quality Effluent than the effluent produced at the now- decommissioned Roger Rd. WRF. The high-quality effluent benefits the ecosystem and expands applicable uses for the City's reclaimed water system customers. The facility provides a large volume of renewable water for recharging the aquifer or for reuse. Maximizing reclaimed water is a strategy advocated in the Bureau of Reclamation's Colorado Basin Study report and in Arizona's Strategic Vision for Water Sustainability planning.
8. Massingale Detention Basin Reclamation Project (9 acres) – This project is located west of Denny Dunn Park at the intersection of Massingale Road and Camino de Oeste. The basin drains a 2.6 square mile watershed in a residential neighborhood and is capable of storing 103 acre feet of stormwater. Despite being the most urbanized basin in PCRFCD's inventory, this basin serves important secondary functions by providing wildlife habitat and recharging the local aquifer.
9. Lower Santa Cruz Managed Recharge Project (161.5 acres) - see page 105 for project description.
10. Paseo de las Iglesias Phase 1 (110 acres) – This project is located along the Santa Cruz River from Ajo Way to Silverlake Road. The Pima County Flood Control District constructed this multi-use project which includes erosion protection, a river park and environmental restoration. Reclaimed water irrigates new trees, shrubs and cacti along 2.7 miles of pathway that links to other river park improvements and the Julian Wash. The Paseo de Iglesias project is part of a 7-mile continuous river park.

7.3 RESOURCE RECOVERY

Over the past decade, there has been a significant shift in the perception of wastewater and its byproducts (nutrients, biosolids and biogas). Once viewed as waste and a nuisance, today, wastewater and its byproducts are valuable renewable resources with multiple beneficial purposes. The wastewater industry has recognized the social and economic value of wastewater byproducts. The mindset of the industry has transformed from a treatment model to resource recovery model. This transformation reflects PCRWRD's sustainability goals to maximize the use of renewable water and energy resources for the benefit of the environment and the community.

PCRWRD is contributing to the county-wide resource recovery and sustainability efforts through a variety of projects and programs, including:

- Biogas Sale and Utilization Project
- Biosolids Land Application Program
- Nutrient (Struvite) Recovery Project
- Energy Audit and Planning Program
- Solar Power for three sub-regional water reclamation facilities

PCRWRD's biosolids are recycled as a fertilizer and soil conditioner in the agriculture industry.

PCRWRD's System-Wide Biosolids and Biogas Utilization Master Plan provides a framework for comprehensive biosolids management and includes strategies for the maximum utilization of biogas. The Plan evaluates the following alternatives:

- Increasing the production of biogas cleaned to pipeline quality ("biomethane") and sold to premium commercial markets via regional pipelines;
- Cogenerating of biogas to produce electricity and heat to dry sludge and produce Class A biosolids;
- Compressing biomethane to make Compressed Natural Gas (CNG) to fuel PCRWRD and county vehicles;
- Side streaming (digested sludge centrate) treatment to retrieve struvite and other nutrients for beneficial reuse and to improve treatment facility operations.
- Developing a contingency plan for land application of biosolids.

To achieve long-term reliability, PCRWRD has been studying ways to diversify its biosolids products and disposal outlets to avoid dependency on one outlet or contractor. One way to increase market opportunities and generate more interest in utilization of biosolids products is to upgrade the quality of biosolids, from the current Class B quality to a Class A quality. The department has identified available markets for both biosolids and biogas and has estimated the life-cycle costs for each alternative (This information

appears in the System-Wide Biosolids and Biogas Utilization Master Plan.) The department has also tested available technologies and has evaluated a number of alternative delivery methods, including private financing and/or private ownership.

7.3.1 BIOGAS SALE AND UTILIZATION PROJECT

Biogas is a byproduct generated during wastewater sludge treatment. It is a renewable resource that can be used in lieu of fossil fuels, thereby reducing dependence on petroleum products. Produced during the anaerobic digestion process, two major components of biogas are methane and carbon dioxide.

The County has a goal to have at least 15% of the electricity consumed by County facilities be generated or offset by renewable resources. By FY 2018/19, PCRWRD plans to use approximately 80% of its biogas for beneficial purposes each year. The Biogas Sales and Utilization Project will convert wasted digester gas (that is currently being flared at the Tres Rios WRF) into a natural gas-like commodity that will potentially generate revenue for the department. Revenue from this source will offset a portion of the Tres Rios WRF's operations and maintenance costs to benefit PCRWRD's rate payers.

Beginning in the 1970s, PCRWRD beneficially used biogas through a combined heat and power (CHP) facility at the old Ina Road WRF. **Table 7-3** shows the data for the past four fiscal years on the total digester gas consumed for power and heat. During ROMP planning, the department decided to shut down the CHP power generation facility to eliminate high operations and maintenance costs. Although the old CHP facility is not operational, the department is able to use some biogas to provide heat to certain treatment processes. The department was able to close the aging CHP facility by accepting a favorable tariff from Tucson Electric Power for power supply for the Tres Rios WRF.

Table 7-3 Digester Gas Consumed for Power and Heat

Gas Consumed for Power and Heat (MMBTU)	FY2010-11	FY2011-12	FY2012-13	FY2013-14
Ina Road/Tres Rios WRF Digester	67,317	63,310	18,881	5,903
Roger Road WRF Digester	50,661	31,198	8,306	Facility closed
Total Digester Gas Consumed for Power & Heat (MMBT)	**117,978**	**94,508**	**27,187**	**5,903**

MMBTU - One Million British Thermal Units

BIOGAS - CHALLENGES AND OPPORTUNITIES

PCRWRD is exploring opportunities to beneficially use biogas through a public/private partnership delivery method. The private delivery approach is seen as an opportunity to maximize possible economic gain through regional/national markets. A public/private partnership can explore these and other opportunities for beneficial use of biogas and reduce the carbon footprint of the County's wastewater treatment processes. PCRWRD is still exploring partnership options with the private sector to implement its Biogas Sales and Utilization Project. The resulting service contract will include an agreement to design-build-finance-own-operate a large-scale biomethane upgrading facility at the centralized biosolids handling facility at the Tres Rios WRF. The new biomethane upgrading facility will treat and compress the biogas for natural gas pipeline injection.

PCRWRD's primary role in this partnership will be to provide digester gas that will be cleaned to natural gas pipeline quality (biomethane) and then sold on the open market. The County will receive a commission on gross sales and lease payments for the land provided for the facility that will produce the biogas. Generated revenue is expected to offset wastewater treatment operation costs. The 15-year contract will carry an option for a 5-year extension.

PCRWRD is also exploring utilization options of compressed natural gas (CNG) that could fuel County vehicles. CNG is natural gas (primarily methane) maintained at a pressure above 3,100 psi. CNG-fueled vehicles are becoming very popular worldwide. PCRWRD initiated a White Paper study that found that conversion of the County fleet into a CNG-fueled fleet to be cost-effective.

The department is also considering a study that could help develop a plan to introduce food waste and fats, oil and grease into the biogas production process. These materials which produce gases during the waste decomposition process, could be used in biogas production.

The System-Wide Biosolids and Biogas Utilization Master Plan identified several potential biogas utilization options, including:

- Purify biogas to pipeline quality and sell to the renewable energy market;
- Purify biogas to pipeline quality and compress it to fuel PCRWRD fleet vehicles and possibly other County fleet vehicles. There is also the potential to sell biogas to external customers;
- Construct a new CHP facility to generate electricity.

7.3.2 BIOSOLIDS

Biosolids is the nutrient rich byproduct of the wastewater biological treatment processes – a never ending resource. Research shows that biosolids enriches soils and keeps them productive and healthy. All the Class B biosolids produced at the centralized biosolids treatment location at the Tres Rios WRF, is currently used for local agricultural land applications.

In February 1978, a Regional Metropolitan Tucson Wastewater Management System Facility Plan, adopted by the Pima County Board of Supervisors, recommended that the solids generated through the wastewater process receive anaerobic digestion and then be used as a soil amendment in accordance with Arizona Department of Health Services guidelines. PimaGro Systems, Inc. received the first contract for biosolids reuse on June 14, 1983 with an annual cost to the County of $535,343.

The Regional Biosolids Facility (RBF) at the Ina Road Water Pollution Control Facility began its operation on July 7, 1987. The department pumped digested sludge generated at the Roger Road and Ina Road facilities to the RBF. Staff centrifuged the sludge to about 8% solids and loaded it onto tanker-trucks. The Biosolids contractor then hauled and applied the sludge to agricultural fields in Pima and Pinal Counties.

In 1993, new federal rules (40CFR503) were promulgated to ensure safe utilization of biosolids. The new rules allowed several options for the utilization/disposal of biosolids, including land application, composting, landfilling, etc. In 1994, Pima County began land-applying biosolids under the new regulations at a cost of $1.23 million.

Today, the combined biosolids production at the RBF is about 38.5 dry tons daily with an annual cost of $1.48 million. The current

Biosolids Management Program is one of the most cost-effective programs in the nation. The County pays approximately $106 per dry ton for sludge (with 6% solid content or higher). By comparison, some communities in California pay over $300 per ton to dispose of their biosolids. **Table 7-4** shows historical data on biosolids production by PCRWRD's facilities.

Table 7-4 Biosolids Production by Fiscal Year

	Biosolids (Dry Tons)
FY01-02	8,054
FY02-03	8,688
FY03-04	8,126
FY04-05	9,357
FY05-06	9,473
FY06-07	10,269
FY07-08	10,945
FY08-09	11,013
FY09-10	11,310
FY10-11	11,447
FY11-12	10,669
FY12-13	10,410
FY13-14	12,563
FY14-15	14,053

LAND APPLICATION PROGRAM

Since the 1980s, PCRWRD has applied its biosolids to agricultural lands for soil augmentation to reuse/recover valuable nutrients and carbon. The department expects that agricultural land application will continue to be an option for biosolids utilization in the future.

Pima County is pursuing with ASARCO to renew a contract to accommodate Biosolids generated occasionally from the ponds at the Green Valley WRF. Pima County had previously used Biosolids generated by the Green Valley WRF BNROD process and prepared in the drying beds at Green Valley WRF for ASARCO tailing reclamation. Pima County ceased preparing Biosolids in the drying beds starting May 2014; therefore, the production of Biosolids at Green Valley WRF is limited to occasional solids generated in the lagoon process ponds.

CHALLENGES AND OPPORTUNITIES

To avoid dependency on one outlet and/or contractor and to achieve long-term reliability, PCRWRD is looking at ways to diversify its biosolids products and outlets. A future vision is for the department to develop a marketing plan..

The University of Arizona under contract with Pima County designed and operated a pilot project from January through April 2015 for the conversion of undigested sludge at the Green Valley WRF to a Class A quality Biosolids. The process was site-specific approved for the Green Valley WRF by EPA PEC. The demonstration project for mine tailing reclamation utilized the MagnaGro Process™, which is a patented sludge treatment process that uses a sealed closed system reactor to treat wastewater sludge to a Class A quality Biosolids. The process produced 267 wet tons of undigested Cake sludge. The average Cake percent solids content was 13.9%, and the treated Cake total metric dry tons for the period was 34.6 metric dry tons.

Although the current biosolids land application program is cost-effective and reliable, in the future it may become vulnerable to a number of economic, social and political changes. Potential changes include the loss of agricultural lands due to urbanization or drought, loss of public acceptance, loss of a viable contractor and loss of political support for the current utilization method. According to the estimates in the System-Wide Biosolids and Biogas Utilization Master Plan, Pima County will need to secure nearly 3,000 acres of land every year for future biosolids application. The report predicts that this number will increase to 4,791 acres annually by 2030. Allocation of land for this use presents a challenge as less agricultural land is available because of continued growth and development. Political forces also could create additional challenges, for example, the Town of Marana could disallow land application of biosolids within its jurisdictional boundaries. This would create an extreme hardship for the department as most of the land application sites for the County's biosolids are in Marana. For all these reasons, PCRWRD initiated an investigation of other potential beneficial-use option. The objective was to develop a pathway for diversifying the County's biosolids program should circumstances beyond the department's control compromise the reliability of the current program.

PCRWRD will monitor regulatory changes and will explore opportunities to diversify biosolids products. Treatment to Class A quality may become a viable option for the future. The System-Wide Biosolids and Biogas Utilization Master Plan recommends the following utilization options and market opportunities:

- Explore county owned land for future biosolids utilization;
- Convert to thermophilic (operate at a high temperature of 130-135 degrees or higher) digestion to produce Class A biosolids;
- Convert to thermophilic digestion followed by greenhouse solar dryers to produce a Class A dry product; and,
- Keep the current operation and add greenhouse solar dryers to produce a Class B dry product.

Pima County Market Opportunities

County-owned historic ranches – Pima County Natural Resources Parks and Recreation Department might be interested in using biosolids on county-owned ranches, such as Canoa Ranch. These ranches could benefit from biosolids products to reclaim degraded ranch lands that were formerly agricultural fields. The County could apply biosolids to such lands to grow native grass for seed.

Landfills – Solid Waste Division - Pima County Department of Environmental Quality (PDEQ) is considering the use of biosolids as landfill cover. PDEQ is also considering combining collected yard waste with biosolids to create compost. Since Pima County has closed all its landfills this is probably no longer an option.

Habitat restoration – PCRFCD is considering the potential future use of biosolids for habitat restoration where public access is restricted.

Landscaping – PCDOT is considering the potential future use of biosolids for landscape projects where public access is restricted.

Private Sector Market Opportunities

- Freeport-McMoRan (FMI) (mining; mine tailing reclamation)
- Fairfix Company LLC (commercial compost retailer)

Lab Technician Jesus Hernandez looks at a solution at the Pima County Regional Wastewater Reclamation Department, Water and Energy Sustainability Center.

- Avragro Systems Inc. (private hauler and applier; agriculture)
- Other contract land appliers
- Cement manufacturing companies
- Coal-fired power plant (TEP)

7.3.3 NUTRIENT RECOVERY AND REUSE

Sludge thickening and dewatering processes produce nutrient-rich side-stream flows. Currently, side stream flows are returned to the headworks, where they are mixed with influent and are sent back through the wastewater treatment process. If handled correctly, side-streams could be great candidates for potential nutrient recovery and reuse because the department could turn phosphate-rich nutrients into agricultural fertilizers.

PCRWRD is looking for sustainable and cost-effective ways to treat side stream flows and recover resources from waste streams thereby reducing the overall carbon footprint of the wastewater treatment processes. The department conducted a feasibility study (based on economic, environmental and social criteria) to evaluate side stream treatment options, including struvite recovery.

The RBF at the Tres Rios WRF receives primary sludge and waste activated sludge (WAS) from the Tres Rios and Agua Nueva WRFs. The Tres Rios WRF also processes WAS from the Avra Valley, Green Valley, Mt. Lemmon and Corona de Tucson WRFs. The combined sludge is thickened in Gravity Belt Thickeners (GBTs) and anaerobically digested in mesophilic digesters. Centrifuges then dewater the digested sludge prior to agricultural land application. The sludge thickening/dewatering process, (in GBTs and centrifuges), results in side-streams, which are rich in nutrients like phosphorus and nitrogen. Side-streams from the solids processing include centrate from the digested sludge dewatering centrifuges, overflows from the primary sludge gravity thickeners and filtrate from the waste activated sludge GBTs. The combination of nutrients and minerals form scaling and deposits, (known as struvite) in the Tres Rios WRF's pipes, valves, fittings and instruments. These deposits reduce the carrying capacity of the pipes, resulting in high operating and maintenance costs.

NUTRIENT RECOVERY – CHALLENGES AND OPPORTUNITIES

Struvite Recovery

Struvite is a mineral compound (magnesium ammonium phosphate hexahydrate: MgNH4PO4+6H2O) formed by the combination of ammonia, magnesium and phosphate in wastewater recycle streams under certain temperature and pH conditions. To prevent the struvite formation, PCRWRD feeds ferric chloride at strategic locations. Ferric chloride binds with phosphorus and precipitates out from the liquid phase and is removed in the solids. This chemical reaction prevents the formation of struvite.

A better solution for struvite control is to precipitate and extract struvite under controlled conditions and recover it as agricultural

fertilizer. Struvite has a commercially desirable formulation of phosphate, ammonia and magnesium with slow-release characteristics. Struvite recovery provides the dual benefits of minimizing unintended struvite scaling and extracting a fertilizer product that has the potential to generate revenue from the agricultural market. The struvite recovery process would save significant costs in operation and maintenance, mainly in Ferric Chloride costs, cleaning of pipes with struvite deposits and reducing nutrients load to the wastewater treatment processes. The recovered struvite could be marketed as a commercial fertilizer.

7.4 CONCLUSIONS

The following conclusions summarize PCRWRD's contributions to the county-wide resource recovery and sustainability efforts:

- A recent water demand analysis (2013) shows that average water use by single family residences (SFR) has been declining since the late 1990s and is likely to continue in the coming years.
- PCRWRD plays a critical role in the increasing demand for alternative water supplies (discussed in the 2011-2015 Action Plan) by providing quality effluent for multi-benefit projects in the county.
- PCRWRD's Effluent Management Plan includes using reclaimed water to replenish groundwater supplies, irrigate landscape in area parks and create riparian habitats in the community.
- PCRWRD is contributing to the county-wide resource recovery and sustainability efforts through a variety of projects and programs, including: Biogas Sale and Utilization Project, Biosolids Land Application Program, Nutrient (Struvite) Recovery Project, Energy Audit and Planning Program and Solar Power Projects.
- PCRWRD's System-Wide Biosolids and Biogas Utilization Master Plan provides a framework for comprehensive biosolids management and includes strategies for the maximum utilization of biogas.
- PCRWRD produces about 38.5 dry tones of biosolids daily at its Regional Biosolids Facility. The annual disposal cost is $1.48 million. The department's Biosolids Management Program is one of the most cost-effective programs in the nation. The County currently pays approximately $106 per dry ton (6% solid content or higher) for sludge disposal.
- PCRWRD is looking at ways to diversify its biosolids products and outlets to achieve long-term reliability and to avoid dependency on one outlet or contractor.
- PCRWRD has identified available markets for both biosolids and biogas and has evaluated life-cycle costs for each alternative. The department has also tested available technologies and has evaluated a number of alternative delivery methods including private financing and/or private ownership.

7.5 OUTLOOK

Based on the near-term effluent reuse and resource recovery goals discussed in this chapter, Pima County should consider the following actions:

- PCRWRD will continue to implement the action items listed in the 2011-2015 Action Plan for Water Sustainability;
- PCRWRD will continue to evaluate options to maximize and make efficient use of reclaimed water for multi-use projects, including environmental restoration, replenishment and reuse;
- PCRWRD has a Strategic Plan for the use of reclaimed water and is exploring recharge credit opportunities at the sub-regional water reclamation facilities;
- PCRFCD and Pima County Natural Resources Parks and Recreation Department should explore opportunities for reclaimed water delivery directly from PCRWRD facilities to multi-use recreational and restoration projects;
- PCRWRD will work closely with other Pima County agencies to identify and coordinate existing and potential effluent utilization opportunities.
- PCRWRD will continue to monitor growth and its effects on the department's facilities and on regulations that affect biosolids production and use;
- PCRWRD will continue monitoring regulatory trends and public perception of current biosolids treatment and uses;
- PCRWRD will continue exploring opportunities for the County to acquire agricultural lands for future land application sites;
- PCRWRD will address capacity and struvite buildup on thickening/dewatering centrifuges, increase storage (bladder basin) and upgrade electrical systems at transfer systems; and
- PCRWRD will maintain membership and active participation in professional organizations dealing with biosolids and biogas treatment and use.

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APPENDIX A: AVRA VALLEY BASIN AREA STUDY

Avra Valley Water Reclamation Facility.

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LIST OF ACRONYMS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADWF	Average Dry Weather Flow
ADWR	Arizona Department of Water Resources
APP	Aquifer Protection Permit
ASLD	Arizona State Land Department
AZPDES	Arizona Pollutant Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
BLM	Bureau of Land Management
BNROD	Biological Nutrient Removal Oxidation Ditch
CAP	Central Arizona Project
CIP	Capital Improvement Program
GPD	Gallons Per Day
IGA	Intergovernmental Agreement
MOA	Memorandum of Agreement
MGD	Million Gallons per Day
MSL	Mean Sea Level
PAG	Pima Association of Governments
PCRWRD	Pima County Regional Wastewater Reclamation Department
PDWF	Peak Dry Weather Flow
RAC	Residences per Acre
SWIP	Southwest Infrastructure Plan
SDCP	Sonoran Desert Conservation Plan
TAZ	Transportation Analysis Zone
WRF	Water Reclamation Facility

Tucson Mountain Park.

EXECUTIVE SUMMARY

The Avra Valley sewer basin area experienced rapid growth in the past decade but is now growing very slowly due to the change in economic conditions. A 2009 expansion leaves the Avra Valley WRF with significant available treatment capacity. The facility has a capacity of 4.0 MGD of which 30-35% is currently in use. The *Avra Valley Basin Area Study by WRF* (the Study) predicts capacity needs up to the year 2050.

The Study Area encompasses approximately 66 square miles and is roughly bounded by the Tucson Mountain Park to the north, Camino De Oeste to the east, the San Xavier District of the Tohono O'odham Nation to the south, and Sierrita Mountain Road to the west. Much of the Study Area is vacant land with significant wash and drainage features. Roughly centered in the Study Area is Ryan Field Airport. Other developments are generally residential in nature, at low-to-medium density.

The Study Area boundaries are similar to those defined by the Southwest Infrastructure Plan (SWIP) which provides a basis for infrastructure decision-making related to development in the southwest area. As a detailed long range plan for the closely aligned Study Area, the SWIP forms the basis for much of this Avra Valley WRF Basin Area study. Future growth expectations in the SWIP are reflected in this study.

Development in the Avra Valley WRF basin area is primarily infrastructure driven. The lack of infrastructure on the west side will require developers to build infrastructure along with their developments. Many lots in large developments, such as Star Valley Estates, have infrastructure (roads, utilities, driveways, etc.) but lack such improvements such as sidewalks, lighting, landscaping etc. These developments have remained in this state for a number of years. The Pascua Yaqui Tribe owns significant areas of non-trust land within the Avra Valley WRF service area. Gradual development of Star Valley Estates, Pomegranate Farms and Sendero Pass could add an additional 8,000 units once demand in housing market returns.

Mid to long term projections (supported by Pima Prospers and the Southwest Infrastructure Plans) anticipate residential development of 4-5 residences per acre (RAC) will fill most of the area south of Ajo Highway and east of Sandario Road. It is expected that by 2040, this area will be nearing complete buildout, with medium density residential units covering most of the developable land. Industrial and commercial businesses around Ryan field and a number of small commercial activity centers will support the residential developments.

Conclusions and Recommendations

- The Avra Valley WRF is expected to reach the 75% capacity limit (3.0 MGD) by the year 2030. However, if the housing market improves rapidly and such developments as Pomegranate Farms, Sendero Pass, Star Valley Estates, Diablo Village, and Tucson Mountain Ranch are completed and sold quickly, 75% capacity could be reached sooner than 2030.
- The department will monitor the general population growth and wastewater flows in the Avra Valley WRF service area.

A.1 INTRODUCTION

A.1.1 PURPOSE OF THE STUDY

The purpose of the Study is to provide analysis of and set goals for the conveyance and treatment needs of the Avra Valley WRF extended service area for the year 2050. The Study evaluates the conveyance and treatment system needs by projecting development and population growth in the area.

The Study area lies to the southwest of downtown Tucson and is generally bounded by Sierrita Mountain Road on the west, the San Xavier District of the Tohono O'odham Nation to the south, Caballo Road on the east and Tucson Mountain Park to the north. The area measures approximately 66 square miles. More detailed information on the area boundaries of the Study is presented in Section **A.4.1**

The economic downturn of 2009 halted many planned developments in the Avra Valley WRF basin area, which todays contains minimal development. Pima County's 2007 Southwest Infrastructure Improvement Plan was written with the expectation of significant growth in the area. Those expectations may require modification for the purposes of predicting future wastewater conveyance and treatment needs.

A.1.2 STATEMENT OF NEED

The Study is the second comprehensive long-range planning study of the Avra Valley WRF service basin. The first study, in 2002, led to the 2009 expansion of the facility. That study significantly over-predicted growth in the area, even before the economic downturn. A review of materials from previously-approved studies played a part in the 2002 long-range wastewater planning study. Despite uncertain growth conditions, this Study seeks to provide adequate documentation for the capacity and treatment requirements of the Avra Valley WRF service area with projections through 2050. Justifications for the study include:

- Growth trajectory has changed since the drafting of the Metropolitan Area Facility Plan Update and Southwest Infrastructure Plan in 2006 and 2007;
- Committed capacity and actual flows are more uncertain than ever;
- Upgrades of the Avra Valley WRF in 2009 provide greater capacity; and
- Finance preparation is needed in advance of future projects.

A.1.3 STRUCTURE OF THE STUDY

Future sewer service is predicated on land use change. As land use intensity increases, wastewater treatment needs rise. The County completed a comprehensive review of anticipated land use changes to ensure consistency with the Southwest Infrastructure Plan (SWIP). The department used updated projections based on the land use build-out model, these projections were more current than older SWIP Projections. However, the wastewater discharge planning assumptions (listed below) were also used in the projection of future flows to the Avra Valley WRF.

A.1.4 METHODS USED

The analysis of generally-accepted projection data and the review of previously published documents are primary sources for this report.

The department uses multiple sources of population data and predictions to create a population growth model. Resources for the effort include the Transportation Analysis Zone (TAZ) data by PAG, the U.S. Census data, and population data from the Pima County *Southwest Infrastructure Plan*. Beginning in 2011, the department has performed sequential analyses of population growth every five years.

Qualitative research encompassed a review of existing facility plans, basin studies, federal, state, and local regulations, facility permits for regulatory compliance and regional plans (such as the ROMP and the PAG 208 Plan).

PCRWRD uses the following wastewater discharge planning assumptions in flow projections:

- 80 gallons of wastewater generated per day per person (Arizona Administrative Code, Title 18, Chapter 9, Table 1. Unit Design Flows).
- 2.7 persons per household (used to estimate wastewater production by single-family households).

A.2 REGULATORY COMPLIANCE

This section outlines RWRD's compliance with operating permits, federal, state other regulatory requirements related to the Avra Valley WRF. There are also sewer service agreements and intergovernmental agreements (IGAs) between the County and other entities, both public and private, for the provision of sewer service or for the reuse of effluent. The sewer service agreements typically outline certain commitments and requirements from each party.

A.2.1 PERMITS

Table A-1 includes current Avra Valley WRF operating permits.

AQUIFER PROTECTION PERMIT (APP)

In compliance with Arizona Revised Statutes (ARS) §§ 49-241 thru 49-252 and Arizona Administrative Code (AAC) R18-9-101 thru R18-9-403, any facility that discharges a pollutant to an aquifer, either directly or to a reasonable probability, must have an Aquifer Protection Permit (APP). Wastewater facilities are designated as "discharging" facilities and require an APP. There are a number of requirements to receive a permit. The most significant is the use of best available demonstrated control technology, which ensures the aquifer water quality standards are not violated at the point of compliance.

The Avra Valley WRF has an APP (P-100642) valid for the life of the facility unless suspended or revoked (AAC R18-9-A213). (The permit provides permission for PCRWRD to operate the facility over the groundwater of the Tucson Active Management Area and the Avra Valley groundwater sub-basin in Township 14S, Range 11E, Section 36 of the Gila and Salt River Baseline and Meridian). The 4.0 MGD BNROD capacity expansion was permitted on April 23, 2009.

AIR QUALITY PERMIT

The Avra Valley WRF holds a General Air Quality Operating Permit (#300 and #301) for New Resource Performance Standards Generators/Engines.

Table A-1 Avra Valley WRF Operating Permits (March 2015)							
Facility	AZPDES	APP	Reuse	Industrial Stormwater	Air Quality	Dam	Jurisdictional Waters
Avra Valley	AZ0024121 (Expiration 22-June-19)	P100642	R105498 (Expiration 16-March-19)	AZMSG-2010	ATO #3301, GP #300 & GP #301 (Expiration 30-June-18)	No. 10.19	Black Wash

REUSE PERMIT

The Avra Valley WRF complies with requirements specified in AAC R18-9-701 through R18-9-704, R18-9-708(B), R18-9-709, and R18-9-714 for the direct reuse of reclaimed water. The facility holds a Type 2 Reclaimed Water General Permit (Number: R105498) for the use of Class B+ reclaimed water for on-site irrigation at the facility.

DISCHARGE PERMIT (AZPDES)

In compliance with ARS Title 49, Chapter 2, Article 3.1, the Federal Pollution Control Act and Arizona Administrative Code (AAC) Title 18, Chapter 9, Articles 9 and 10, the facility requires a permit to discharge treated domestic wastewater into a watercourse.

The Avra Valley WRF holds a permit (Number: AZ0024121) to discharge treated domestic wastewater into the Black Wash, an ephemeral tributary to Brawley Wash. No effluent is currently discharged into Black Wash. The facility has been receiving recharge credits since its Underground Storage Facility (USF) permit became effective on September 14, 2015. The permit allows up to 4,480 acre-feet of credit at that site. In addition, the facility is permitted to discharge stormwater associated with industrial activities under the terms and conditions of Arizona Department of Environmental Quality's (ADEQ) Arizona Pollutant Discharge Elimination System (AZPDES) Stormwater Multi-Sector General Permit(s).

LICENSE OF APPROVAL FOR DAM

In compliance with *ARS Title 45, Chapter 6, Article 1*, the use of a dam to impound water requires a license issued by the Department of Water Resources of the State of Arizona. Avra Valley WRF holds a license (File Number: 10.19) to impound water using a dam and reservoir, issued on August 3, 2004.

A.2.2 INTERGOVERNMENTAL AGREEMENTS

1979 IGA (EFFLUENT USE)

According to the 1979 IGA and Supplemental IGA, the County is entitled to 10% of the effluent from metropolitan-area treatment facilities. The Avra Valley WRF is not a metropolitan-area facility. After contribution of Avra Valley's effluent to the Conservation Effluent Pool, the remaining effluent owned by the City of Tucsonis available for city's uses within the parameters established by the 1979 IGA and Supplemental IGA.

1980 MOA YAQUI

This agreement between PCRWRD, the Pascua Yaqui Tribe and the U.S. Indian Health Service dictates that PCRWRD will provide sewer service and treatment for the New Yaqui Village development.

1990 HUD WW MOA YAQUI

The construction of 44 HUD-assisted housing units on the Pascua Yaqui reservation prompted the provision of additional sewer capacity on the reservation. PCRWRD agreed to allocate capacity for a further 1,000 units beyond those already served.

1996 RIGHT OF WAY AGREEMENT

This agreement describes and grants to Pima County, an easement on Pascua Yaqui land for the purposes of building and maintaining a sewer.

2011 CONSERVATION EFFLUENT POOL (EFFECTIVE JANUARY 25, 2011)

This intergovernmental agreement between Pima County and the City of Tucson defines the provisions for the use and allocation of effluent and reclaimed water in the Conservation Effluent Pool for environmental restoration of Riparian Projects. The County is engaged in the operation of wastewater treatment facilities that produce secondarily-treated effluent, a portion of which is delivered to the City Reclaimed Water system. By this agreement, reasonable quantities of effluent will be reserved for use in Riparian Projects.

2014 PASCUA YAQUI INDIAN TRIBE/ PIMA COUNTY IGA

One of the factors that will influence the availability of system capacity in the service area includes the resolution of the IGA for sewer service between Pima County and the Pascua Yaqui Indian Tribe. The County provides wastewater conveyance and treatment services to the Reservation. The 25-year term IGA has been renewed for continuation of the wastewater service through the year 2039. Under Section 9, Best Management Practices, the County and the Tribe acknowledge and agree that it is in the best interest of both parties to develop protocols for governing the management of the public sewer facilities within the Pascua Pueblo.

This 'mini satellite agreement' outlines several requirements for the parties:

- The County is responsible for the operation and maintenance of the public sewer facilities located within the Tribal land.
- The Tribe must provide access to the County for the purposes of constructing, maintaining and operating the public sewer facilities across Tribal land.
- The County is responsible for developing and maintaining the current industrial wastewater program;
- The County is responsible for developing a communications protocol for the discussion of issues relating to system operations, best management practices and future Tribal wastewater system capacity requirements.

According to Section 9.4 of the IGA, the parties are responsible for developing a method to track:

- Proposed new Pascua Pueblo connections to the public sewer facilities; and
- Changes in upstream property use for existing connections to public sewer facilities within the Pascua Pueblo (CTN-WW-15*62, December 16, 2014).

A.3 PLANNING EFFORTS

Comprehensive land use plans have been developed covering all of Pima County. The Avra Valley Basin Area falls into the Avra Valley Planning Area of the Comprehensive Plan Update - Pima Prospers. County and municipal General Plans are required by Arizona "Smart Growth" legislation. The law sets periodic reviews and mandates that changes to General Plans receive voter approval.

PIMA COUNTY INFRASTRUCTURE PLANS

Pima County integrates and coordinates infrastructure planning with the oversight of different committees and the Capital Improvement Program. Collaboration of planning for flood control, transportation, parks and recreation, open space and wastewater management is critical to the planning process.

2002 AVRA VALLEY BASIN STUDY

The 2002 study suggested that treatment capacity expansion would be required to meet projected population growth and service demand for the area. To this end, the department added a new treatment train to the Avra Valley WRF, expanding its capacity to 4.0 MGD.

2007 SOUTHWEST INFRASTRUCTURE PLAN (SWIP)

County planners identified the Pima County's Southwest Area as a potential and strategic growth area. To accommodate population growth, improvements to and expansion of the existing infrastructure are needed. The purpose of this infrastructure plan is to provide the basis for infrastructure decision-making related to development in the Southwest Area. The Plan quantifies the nature, phasing, financial impacts and funding possibilities for flood control, parks and recreation, transportation, wastewater infrastructure. The plan also outlines other improvements needed for future saturation growth within the Southwest Area limits (*Pima County Southwest Infrastructure Plan*, November 2007).

REGIONAL FLOOD CONTROL DISTRICT

Long range master drainage plans have been developed by the Pima County Regional Flood Control District (RFCD). Drainage problems can be a primary constraint on land development. The Southwest Basin Management Study, Black Wash Drainage Analysis, Brawley Wash Floodplain Study and the Brawley Wash Primary Flood Corridor Study are all relevant to the Avra Valley Basin Study Area.

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

The Pima County Department of Transportation (PCDOT) and the Pima Association of Governments (PAG) have developed long range transportation plans for Pima County. The roadway improvements set a basis for potential growth and development opportunities in areas currently lacking roadway infrastructure or adequate roadway capacities to serve growth. Improved transportation infrastructure results in an opportunity for the expansion of existing wastewater conveyance system to serve new development.

PAG 2040 REGIONAL TRANSPORTATION PLAN (PAG 2040 RTA)

PAG's 2040 RTA is the region's long range transportation plan for eastern Pima County and the Tucson metropolitan area. Key projects in the Study Area are:

- State Route 86 (Valencia Road to Kinney Road) Widening Project: Widening of Ajo Way/SR-86 to a 4-6 lane desert parkway with paved shoulders, landscaping and irrigation.
- Valencia Corridor Project: Widening of Valencia Road between Ajo Way and Old Spanish Trail to a 4-8 lane desert parkway, with bicycle lanes and sidewalks; implementation of other access management improvements; and construction of grade-separated intersections at various intersections.

PAG 2015-2019 TRANSPORTATION IMPROVEMENT PLAN (PAG 2015-2019)

The Transportation Improvement Plan (TIP) is a rolling five-year schedule and budget of proposed transportation improvements that seeks to optimize the use of available federal, state and local funds and resources to serve the region's multi-modal transportation needs. The TIP implements the long-range transportation plans. The major roadway projects planned in the 2015-2019 TIP for the southwest area include improvements to Valencia Road (between Mark Road and Ajo Highway) and Ajo Highway (between Sandario Road and Sasabe State Highway 286).

A.3.1 PREVIOUS WASTEWATER PLANS AND BASIN STUDIES

The *2006 Metropolitan Area Facility Plan Update* outlines a system-wide approach for the growth and rehabilitation of PCRWRD's conveyance and treatment systems. The plan lists population growth and regulatory change as primary concerns to be addressed during the planning process. Maintenance and financing the needed changes also were critical issues.

The Avra Valley WRF and its service area have been the subject of previous plans and studies over the past 25 years:

- 2002 Avra Valley Basin Study;
- 2006 Metropolitan Area Facility Plan Update;
- 2006 Areawide Water Quality Management Plan (208 Plan Update); and,
- 2010 Avra Valley Sub-Basin Study

A.4 STUDY AREA ANALYSIS

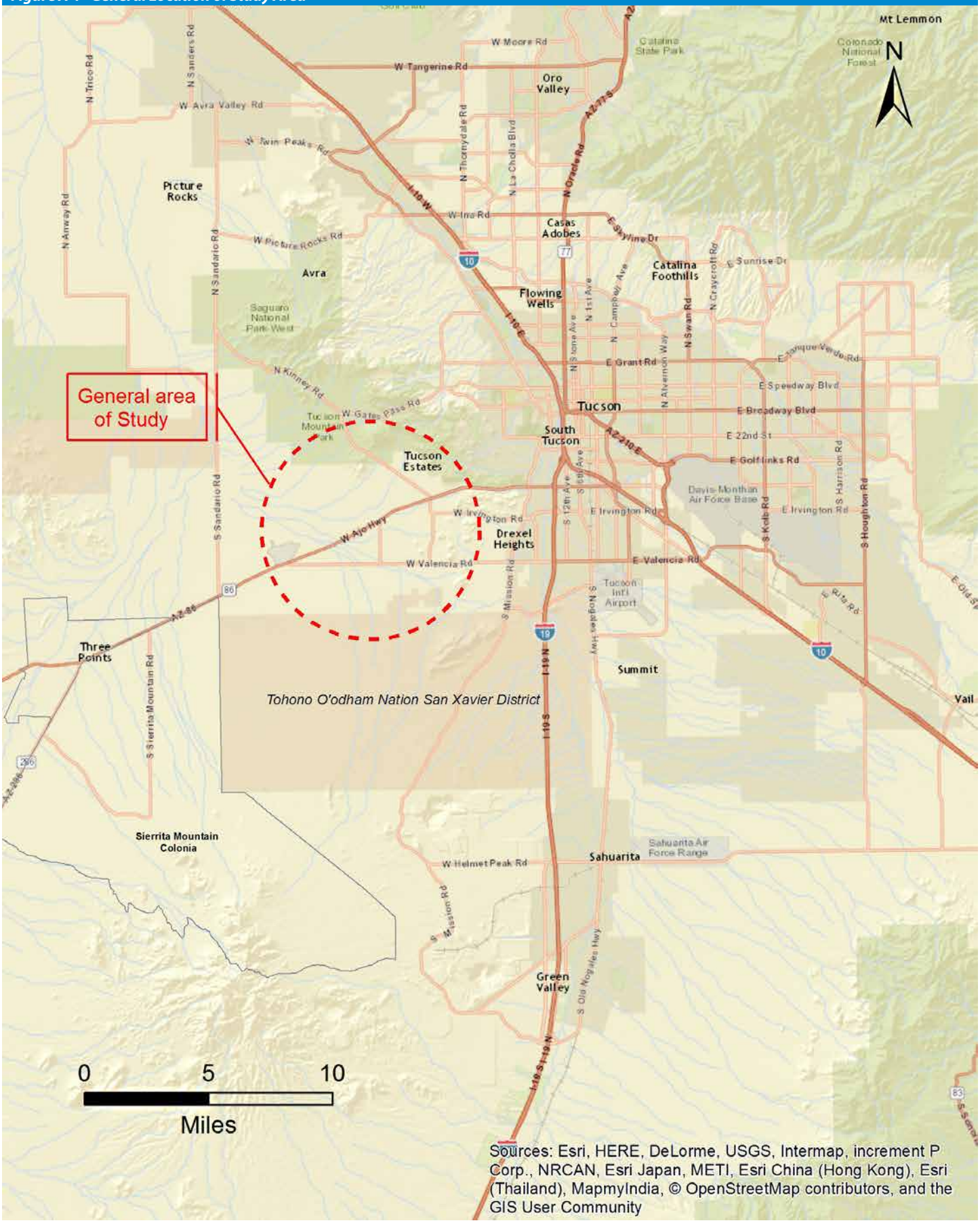
A.4.1 STUDY AREA BOUNDARY

The general location of the Avra Valley Basin Area (the Study Area) is shown on **Figure A-1** below. The Study Area is generally located west of I-19, north of the San Xavier District of the Tohono O'odham Nation, southeast of the Tucson Mountains, and east of the Sierrita Mountain Road alignment.

Several factors used in the establishment of the Study Area boundaries include: location of the existing gravity sewer, topographic constraints, land use regulations, land ownership and the availability of vacant land for development.

Topographical limits include the range of the Black Wash watershed and the elevation of the Avra Valley WRF. The use of gravitational conveyance requires that the service area be at a higher elevation than the treatment facility. In addition, all land west of Sandario Road, (outside of the Tohono O'odham Nation) is designat-

Figure A-1 General Location of Study Area



Avra Valley Water Reclamation Facility has been in operation since 1967.

ed by the Conservation Lands System (CLS) . The CLS open space set-aside requirements mean that areas designated as Special Species Management Areas, Important Riparian Areas and Biological Core Management Areas are developable at lower densities (one residence per acre). This type of development is not economical for sewer connections. An exception is found in regulations under the Multiple Use Management Areas which requires 66% set aside and high density clusters that are serviceable by the public sewer.

Several large areas, that will not be developed within the timeframe of this study, surround much of the Study Area (**Figure A-2**). Other areas are not part of Pima County's jurisdiction.

- To the north, Tucson Mountain Park and the Bureau of Reclamation Habitat Mitigation Area provide clear Study Area limits.
- To the south, the San Xavier District of the Tohono O'odham Nation provides another clear boundary. The extreme southern boundary is drawn two miles south of the northwest corner of the San Xavier District of the Tohono O'odham Nation. This is two miles from the nearest point of potential sewer service and according to the Southwestern Infrastructure Plan, over 6 miles from the nearest current sewer line.
- To the east, the boundary is defined by the existing gravity sewer and is adjacent to the Agua Nueva/Tres Rios Sewer Basin.
- To the west, the land is a patchwork of private, state and federal parcels. Some of the private parcels are low-density subdivisions with septic fields. The west boundary is the only boundary that is not easily established.

Figure A-2 Defined Study Area and Boundary Constraints

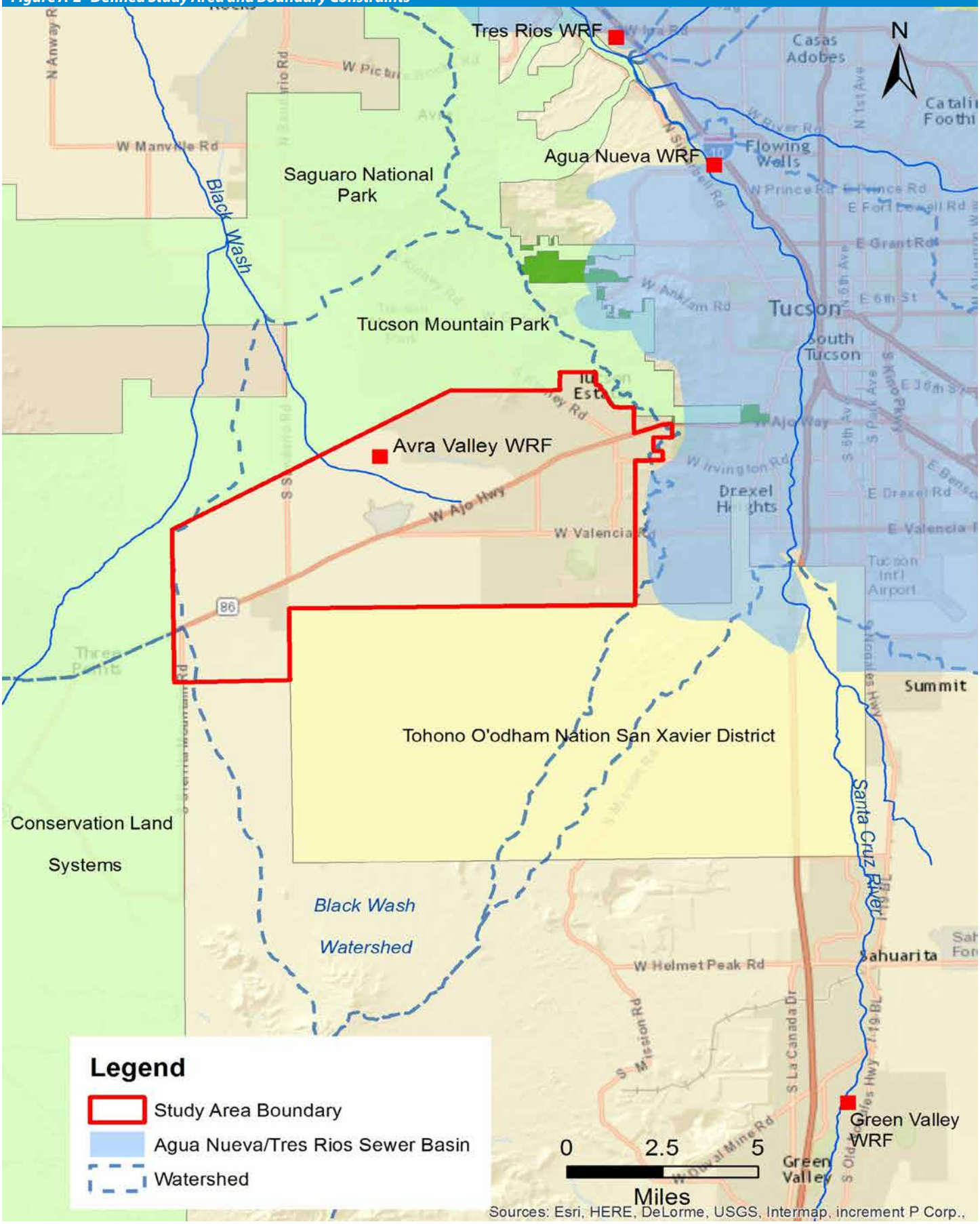
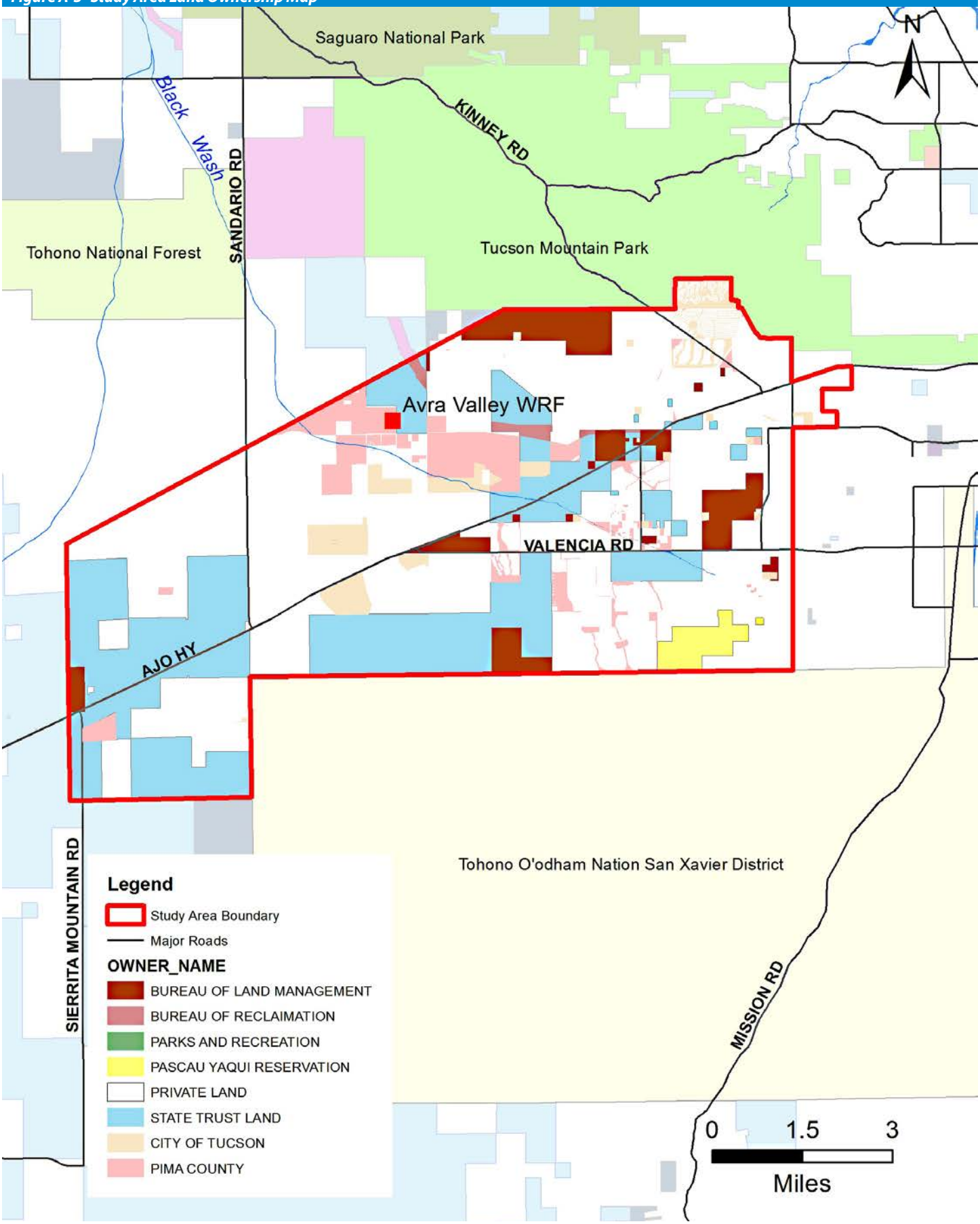


Figure A-3 Study Area Land Ownership Map



A.4.2 LAND OWNERSHIP

Land ownership in the Study Area is predominantly private; however, land owned by federal, state, tribal, county and city governments is significant, as shown in **Figure A-3**.

Federal lands are either owned by the Bureau of Reclamation (in connection with the CAP), or the Bureau of Land Management.

State Trust Lands are distinguished from federal lands as they are not public. They are reserved for the Trust beneficiaries, the largest of which is the state school system. Trust Lands must be sold for the highest and best use in order to fulfill the State's Trust Land mission. Development of State Trust Land depends on the timing of land sales by the State Land Department. The Arizona Board of Regents also owns a number of parcels within the Study Area.

The Pima County Flood Control District owns multiple parcels (each in excess of 40 acres) in the vicinity of Black Wash; the District also owns other smaller parcels throughout the Study Area. Tucson Water owns parcels relating to the Avra Valley wellfield and CAP water treatment. The Tucson Airport Authority owns the Ryan Field Airport site.

Table A-2 shown below includes the percentage of land ownership for the Study Area as determined using data from the Pima County GIS. The majority of land within the Study Area is in private ownership, although the Arizona State Land Trust is a significant landowner in the area, particularly to the south and west.

The Pascua Yaqui Tribe owns significant areas of non-trust land within the Study Area (**Figure A-4**). Pima County has extended an

Table A-2 Study Area Land Ownership Percentage

Ownership	Area (Acres)	Percent of Total
Private and miscellaneous	21,901	49.04%
Arizona State Trust Lands	8,736	19.56%
Other Federal Lands	4,410	9.87%
City of Tucson	2,611	5.85%
Pima County	2,477	5.55%
BLM	2,413	5.40%
Pascua Yaqui Trust	1,510	3.38%
Pascua Yaqui fee lands	589	1.32%
Bureau of Reclamation (BR)	13	0.03%
Total	**44,659**	**100%**

Source: Pima County GIS, 2016

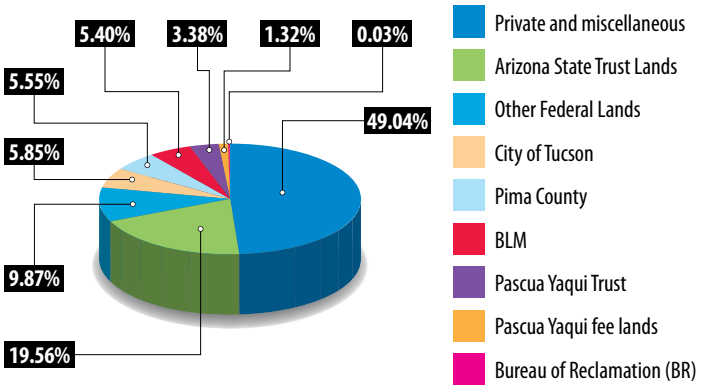
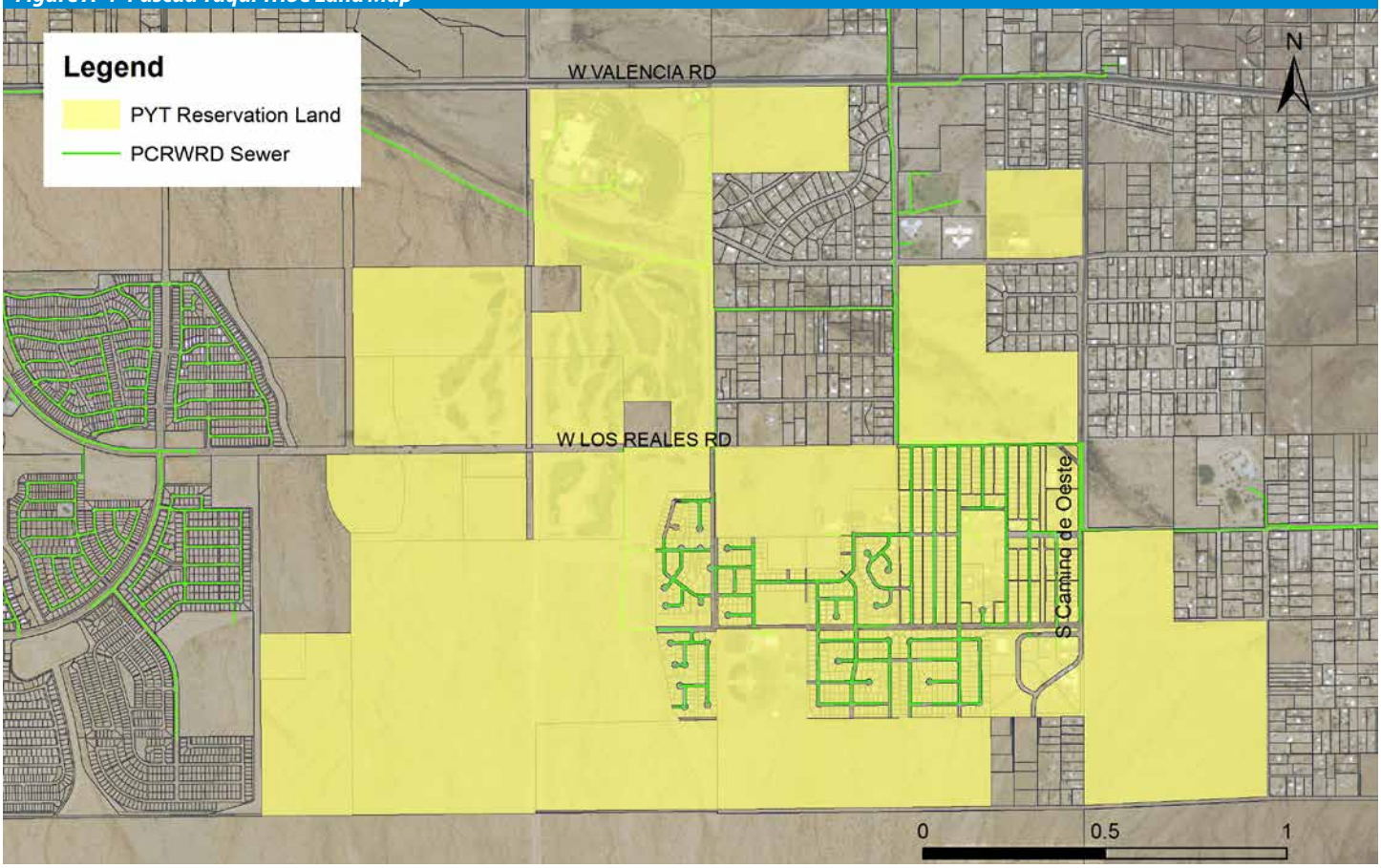


Figure A-4 Pascua Yaqui Tribe Land Map



Robles Pass at Tucson Mountain Park.

agreement through the year 2039 with the Pascua Yaqui Tribe to accept sewage from both Pascua Yaqui Trust lands and Fee lands.

BEYOND THE STUDY AREA BOUNDARIES

San Xavier District of the Tohono O'odham Nation (SXD) – The Avra Valley Basin Study Area does not include any part of the Tohono O'odham Nation. The Nation maintains private sewers which do not contribute to the Avra Valley WRF.

Tucson Mountain Park – The Tucson Mountain Park limits the northern edge of the Study Area. It will not be developed within the study time horizon.

Bureau of Reclamation Wildlife Mitigation Corridor – Between the Tohono O'odham Nation and the Tucson Mountain Park, the Bureau of Reclamation holds a Wildlife Mitigation Corridor surrounding the CAP canal. This land will not be developed in the study time horizon.

Arizona State Trust Land (ASLD) – Many acres of ASLD-controlled land in Southwest Pima County are located outside the Study Area. The department assumes that to reduce infrastructure costs related to development, the ASLD will release for sale, lands inside the Study Area. Although lands are under constant evaluation for garnering the best return for trust beneficiaries, changing

Table A-3 Study Area Land Use Percentage

Land Use		Area (Acres)	Percent of Total Acres
LIR	Low Intensity Rural	13,339	31.57%
MIU	Medium Intensity Urban	11,585	27.42%
RS	Resource Sensitive	3,192	7.56%
LIU-0.3	Low Intensity Urban 0.3	3,001	7.10%
I	Urban Industrial	2,683	6.35%
PDC	Planned Development Community	2,623	6.21%
PY_TRIBE	Pascua Yaqui Tribe	2,035	4.82%
LIU-1.2	Low Intensity Urban 1.2	864	2.04%
RC	Resource Conservation	842	1.99%
MLIU	Medium Low Intensity Urban	699	1.65%
CAC	Community Activity Center	570	1.35%
LIU-3.0	Low Intensity Urban 3.0	530	1.25%
NAC	Neighborhood Activity Center	139	0.33%
SAN XAV	San Xavier District - Tohono O'odham	63	0.15%
LIU-0.5	Low Intensity Urban 0.5	37	0.09%
RX	Rural Crossroads	33	0.08%
MFC	Multifunctional Corridor	15	0.04%
Total		**42,250**	**100%**

Source: Pima County GIS, 2016

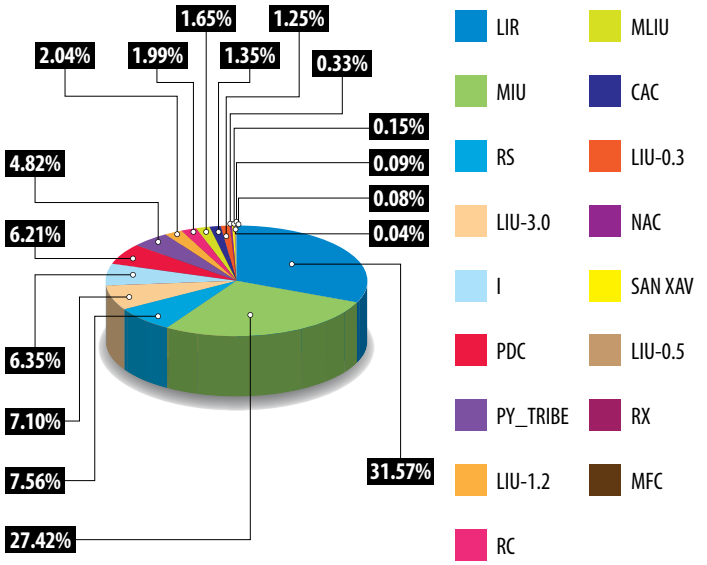
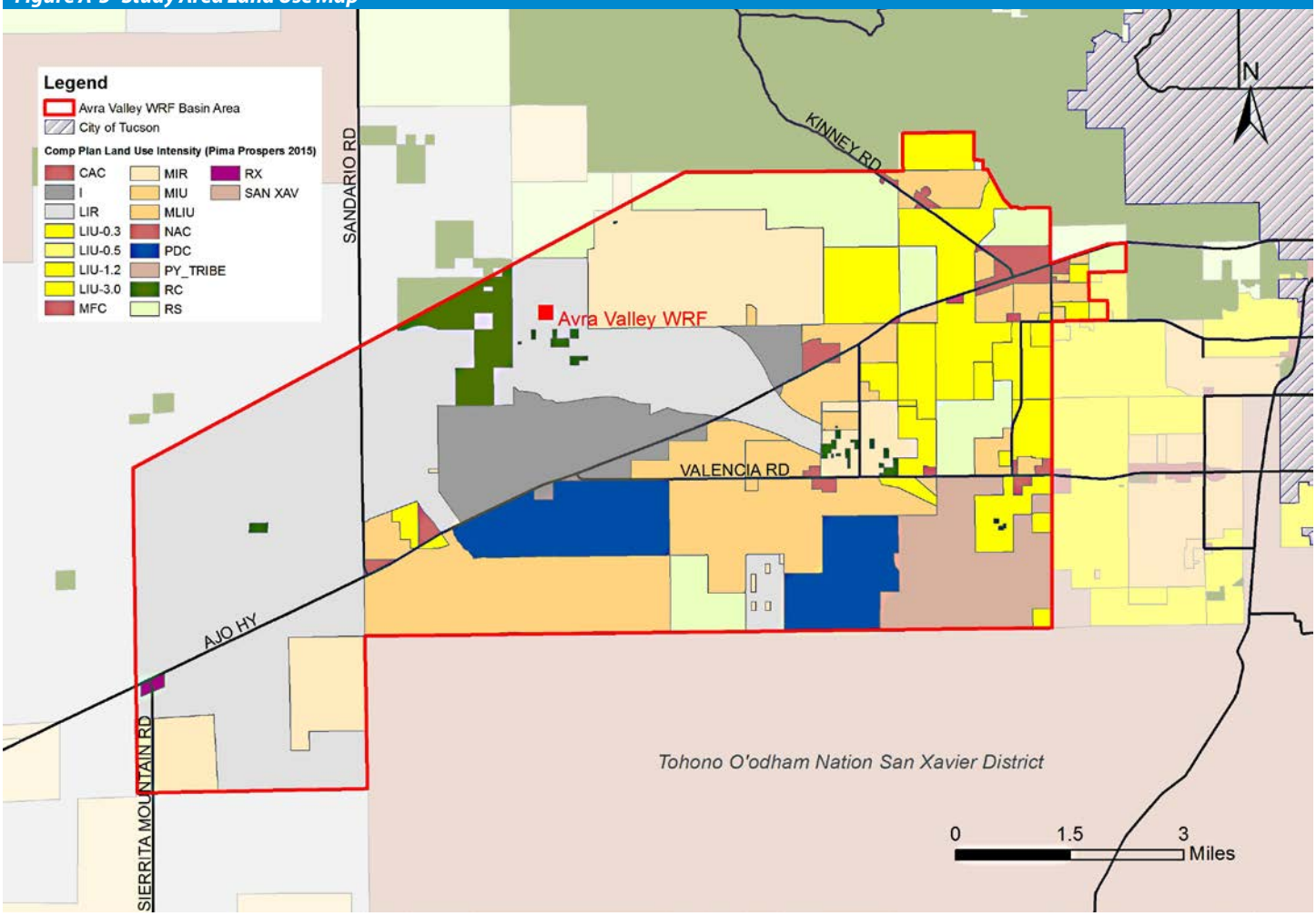


Figure A-5 Study Area Land Use Map



Acronyms for Figure A-5 Study Area Land Use Map

CAC	Community Activity Center	**MFC**	Multifunctional Corridor	**RC**	Resource Conservation
I	Urban Industrial	**MIR**	Medium Intensity Rural	**RS**	Resource Sensitive
LIR	Low Intensity Rural	**MIU**	Medium Intensity Urban	**RX**	Rural Crossroads
LIU-0.3	Low Intensity Urban 0.3	**MLIU**	Medium Low Intensity Urban	**SAN XAV**	San Xavier District - Tohono O'odham
LIU-0.5	Low Intensity Urban 0.5	**NAC**	Neighborhood Activity Center		
LIU-1.2	Low Intensity Urban 1.2	**PDC**	Planned Development Community		
LIU-3.0	Low Intensity Urban 3.0	**PY_TRIBE**	Pascua Yaqui Tribe		

Source: Pima County GIS

conditions make these lands difficult to time into the land market.

Sierrita Mountain Colonia – The federal government recognizes an area of 114 square miles to the southwest of the Study Area, as a colonia. This area is characterized by substandard housing and limited infrastructure.

Three Points Colonia – A small colonia of just over 13 square miles lies southwest of the Study Area and west of the Sierrita Mountain Colonia . Both colonias are depicted in Figure A-1.

A.4.3 EXISTING LAND USE AND ZONING

Figure A-5 shows the Study Area land uses. Intensity of development is generally highest toward the eastern end of the Study Area, closer to the City of Tucson. Throughout the Study Area, and particularly in the west, many parcels both large and small are vacant.

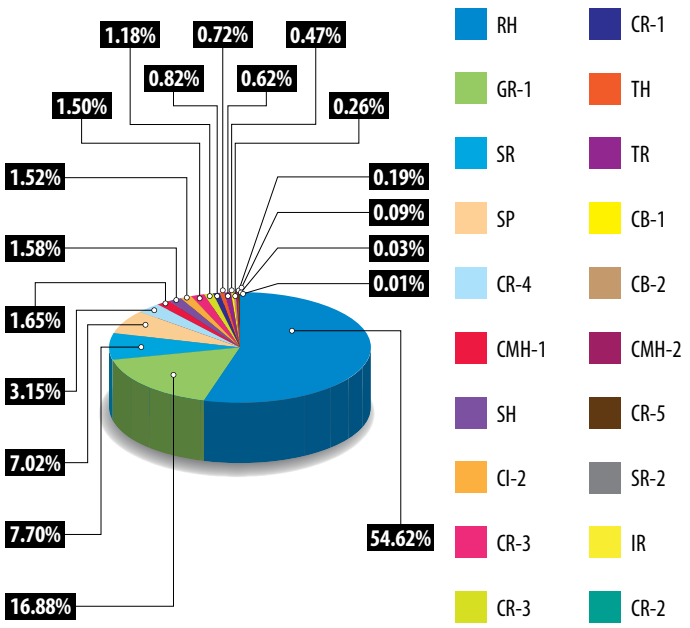
Development is primarily infrastructure driven; this is apparent at the western end of the Study Area which is largely undeveloped. All forms of development have been heavily impacted by the economic beginning in 2007. Many lots in large developments, such as Star Valley Estates in the southeast of the Study Area, have such infrastructure as roadways, driveways, available utility service but improvements such as sidewalks, landscaping streetlights, etc. have not been completed. These conditions have not changed for a number of years.

Table A-3 depicts the general distribution of land use within the Study Area, as per Pima County GIS. A Low Intensity Rural (LIR) designation appears to be a prevailing land use in the Study Area.

Table A-4 Zoning Districts Percentage

Land Use	Area (Acres)	Percent of Total Acres
RH	23,078	54.62%
GR-1	7,131	16.88%
SR	3,253	7.70%
SP	2,965	7.02%
CR-4	1,331	3.15%
CMH-1	698	1.65%
SH	666	1.58%
CI-2	643	1.52%
CR-3	632	1.50%
CR-1	497	1.18%
TH	348	0.82%
TR	303	0.72%
CB-1	262	0.62%
CB-2	198	0.47%
CMH-2	111	0.26%
CR-5	79	0.19%
SR-2	37	0.09%
IR	11	0.03%
CR-2	5	0.01%
Total	42,250	100%

Source: Pima County GIS



Existing zoning is almost exclusively single-family residential – Zones SR (Suburban Ranch), RH (Rural Homestead), GR-1 (Rural Residential), CR-1 (Single Residence) and CR-3 (Single Residence) (**Figure A-6**). Some CR-4 (Mixed Dwelling Type) and CR-5 (Multiple Residence) zones exist, and generally apply to lots of over 10 acres in size.

Commercial zoning, both CB-1 (Local Business) and CB-2 (General Business) is scattered along the major corridors of Ajo Highway and Valencia Road. Ryan Field Airport is located in the Suburban Homestead Zone. See **Table A-4** for the total percentage of each zone district in the Study Area.

Outside of the boundaries of the Pascua Yaqui Nation, there are two specific plans: Pomegranate Farms and Sendero Pass (**Figure A-6**). Pomegranate Farms covers approximately 640 acres and would, if constructed, consist of 3,000 dwelling units and 67 acres of commercial and mixed use property, which includes a possible school site. Sendero Pass, immediately to the west, covers approximately 837 acres, and if constructed, would consist of approximately 3,500 dwelling units, 68 acres of mixed use property, 60 acres of commercial development and a 10-acre school site. The development is anticipated to generate a build-out Average Dry Weather Flow (ADWF) and Peak Dry Weather Flow (PDWF) of 0.82 MGD and 1.84 MGD, respectively. This project requires the construction of a public offsite outfall system consisting of a combination of 8, 12, 18, and 21-inch public gravity sewer mains (Sewer Basin Report for Sendero Pass, JN 4015, Rick Engineering Co., November 11, 2013).

A.4.4 DEVELOPMENT CONSTRAINTS

Constraints for future development in the area are both physical and environmental and include underutilized land that is platted but remains undeveloped or partially developed, the Ryan Field Airport and the Conservation Lands System. Existing subdivisions throughout the Study Area are of relatively low density and unlikely to become redevelopment projects while so much vacant land remains available. At some point, unbuilt subdivisions will likely be completed as planned, particularly those with infrastructure already in place.

The Ryan Field Airport presents limitations on development due to noise and regulatory constraints. Vicinities around the airport are generally unsuitable for residential use, but may be appropriate for industrial use.

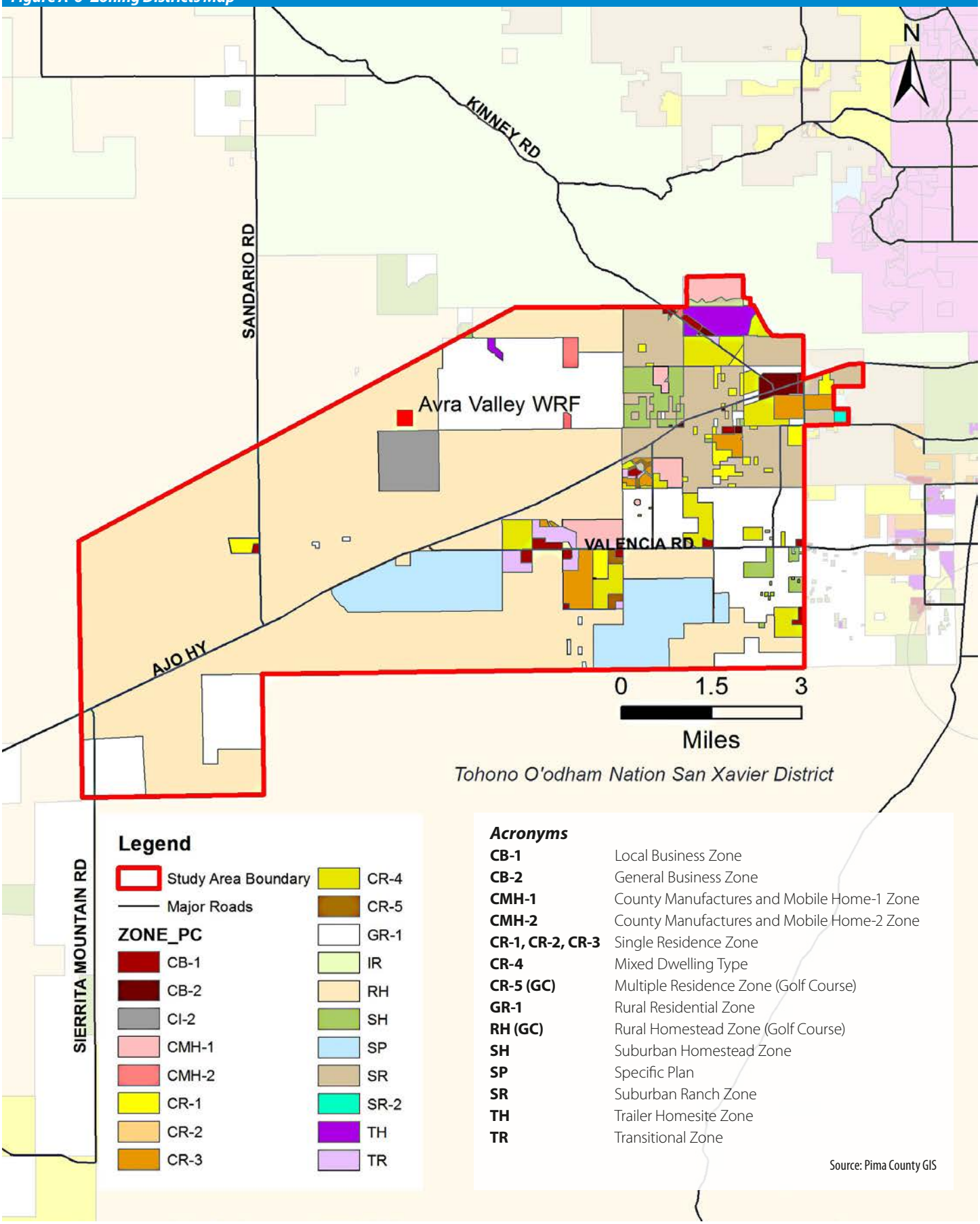
The Study Area contains a significant amount of conservation sensitive land as defined in the Sonoran Desert Conservation Plan (SDCP). Development of the SDCP began in 1998; The Pima County Board of Supervisors adopted it in 2001. The SDCP is used as a growth management tool, directing growth to less-environmentally sensitive areas. The Sonoran Desert Conservation Plan also impacts future land use and the ability for lands to be rezoned. Under current zoning standards, if an area is to be rezoned (most likely to a higher density), open space set asides are required in alignment with Conservation Land System classifications. Classifications include:

- Important Riparian Areas - requiring a 95% set aside,
- Biological Core Management Areas – requiring an 80% set aside,
- Multiple Use Management Areas requiring a 66% set aside.

Throughout the Study Area are Important Riparian Areas, although these are generally narrow ribbons due to their nature. More significantly, the westernmost portion of the Study Area, and some parts of the northwestern portion, are designated Multiple Use Management Areas. Given that these areas are also far removed from existing infrastructure, development is unlikely within the time horizon of the Study.

The Tucson Trap and Skeet Club facility located immediately to the east of Ryan Field has been given a half-mile buffer to prevent

Figure A-6 Zoning Districts Map

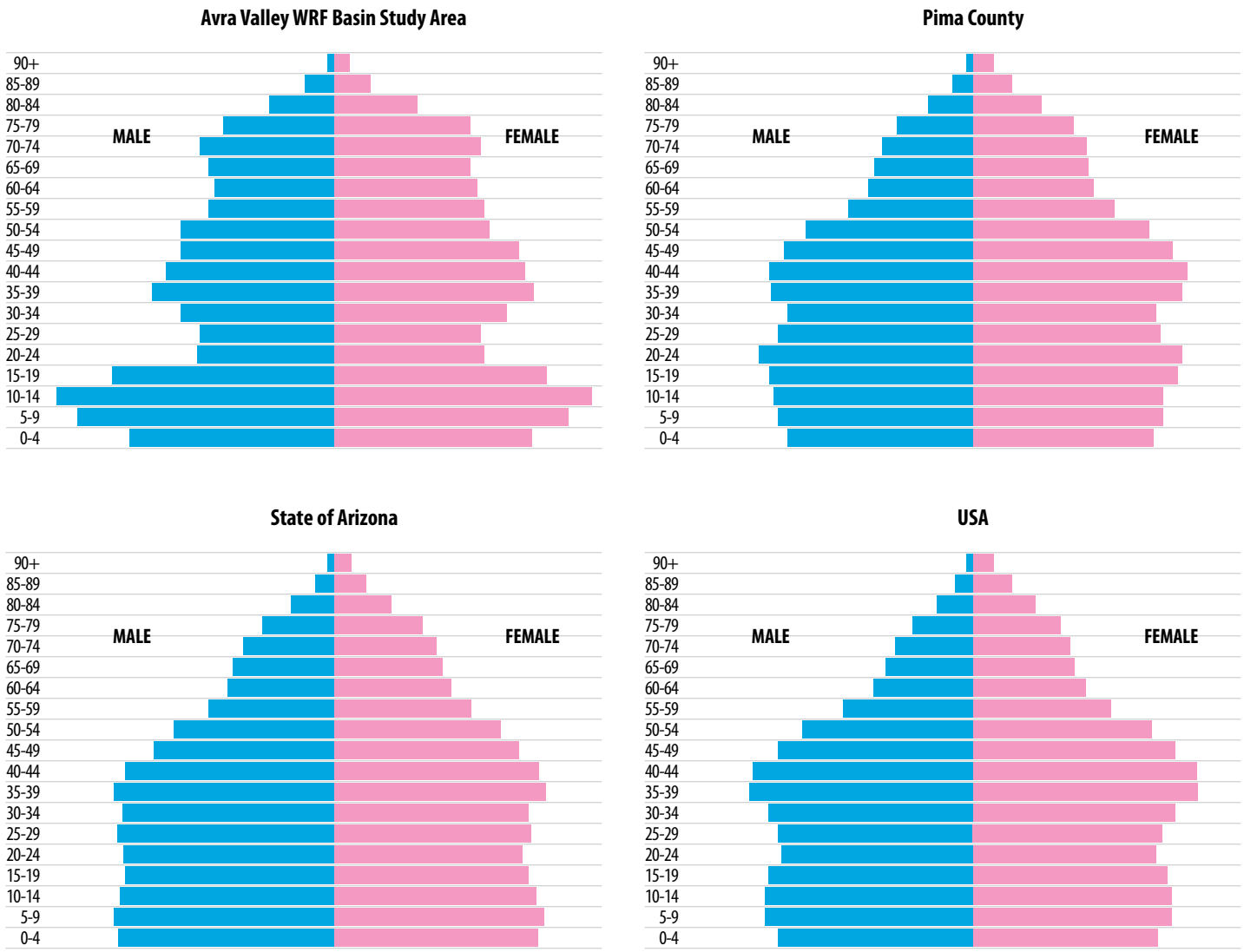


Acronyms

CB-1	Local Business Zone
CB-2	General Business Zone
CMH-1	County Manufactures and Mobile Home-1 Zone
CMH-2	County Manufactures and Mobile Home-2 Zone
CR-1, CR-2, CR-3	Single Residence Zone
CR-4	Mixed Dwelling Type
CR-5 (GC)	Multiple Residence Zone (Golf Course)
GR-1	Rural Residential Zone
RH (GC)	Rural Homestead Zone (Golf Course)
SH	Suburban Homestead Zone
SP	Specific Plan
SR	Suburban Ranch Zone
TH	Trailer Homesite Zone
TR	Transitional Zone

Source: Pima County GIS

Figure A-7 Population Pyramids for Study Area, County, State and USA



Source: U.S. Census 2010

encroachment of residential or other noise-sensitive uses upon a nationally important sporting facility.

Development within the Pascua Yaqui Reservation is not controlled by Pima County and is tied to tribal population growth more than market forces.

Outlook

Given the present economic conditions, significant changes in land use do not appear likely to occur in the near term. However, with many lots already partially improved in Star Valley Estates and specific approved plans for Pomegranate Farms and Sendero Pass, some 8,000 units could be completed relatively quickly once economic conditions improve.

In the mid to long term, proposals for residential development at 4-5 RAC fill most of the area south of Ajo Highway and east of Sandario Road, with multiple commercial and mixed use centers providing employment and services. Industrial and commercial uses are proposed around Ryan Airfield.

A.4.5 DEMOGRAPHICS AND POPULATION

The most important factor in assessing the need for wastewater services is the population and the demographics of that population. This section provides a general overview of the demographics and population of the Avra Valley Basin Study Area and attempts to predict future population change.

DEMOGRAPHICS

Figure A-7 shows the population pyramid for the Study Area, compared to Pima County, Arizona and the USA. The input data comes from the U.S. Census 2010. The Study Area clearly has a very different demographic to any of the comparison areas. Ages 5-19 have higher representation in the Study Area than in the comparisons areas, but those aged 20-49 have lower representation. There is also a higher representation of those aged 65-79. There is no significant difference in the balance of the sexes compared to the comparison areas. The demographic data suggests that the area consists primarily of retirees and families with an above average

number of children. There is no obvious way in which these demographics would have an abnormal effect upon wastewater flows.

According to the U.S. Census 2010, the total number of housing units in the Study Area is 12,437. With a population of 31,334, the average household consists of 2.5 persons. This is in contrast to 2.7 persons per household currently used by PCRWRD in estimating wastewater production by single-family household).

POPULATION ESTIMATES AND PROJECTIONS

Population analysis for Pima County is available from a variety of sources including the U.S. Census Bureau, Pima County and the Pima Association of Governments. The 2010 U.S. Census data provides block-by-block population counts, allowing an accurate determination of the population within the Avra Valley Basin Study Area at the time of the census. While accurate for the population at the time of the Census (April 2010), forecasting from the U.S. Census data relies on extrapolating from past population growth and does not consider land use constraints.

Pima County's Southwest Infrastructure Plan provides an expected buildout population for the year 2050. This buildout population is based upon proposed land use patterns, which themselves account for a variety of constraints, in much the same way as previously published basin studies have examined potential growth areas. By interpolation, a 2050 population can be estimated.

The Pima Association of Governments has issued population estimates based on transportation planning modeling through TAZ. Transportation modeling takes into account local planning data, such as comprehensive plans, general plans, special plans, habitat conservation plans, building permit data and designated future land uses. The TAZ analysis offers regional data for eastern Pima County.

SERVICE AREA POPULATION PROJECTIONS

The department used two models to establish population projections and corresponding future wastewater flows for the Study Area:

- Land use buildout (SWIP) and
- The Effective Population model.

Staff can use projections based on a rate of growth analysis for each of the five subsequent years.

The need for facility expansion is based on a service population that would generate an ADWF of 3.0 MGD (75% capacity) and 4.0 MGD (100% capacity). The figures below are calculated based on 80 gallon per capita per day:

- 75% capacity would be met when the population reaches 37,500
- 100% capacity would be met when the population reaches 50,000.

PCRWRD used population data from the U.S. Census data and the PAG TAZ data to project that the Avra Valley WRF will reach 75% capacity in 2020. The land use buildout model also suggested that the capacity expansion would have been required as soon as 2015. However, that benchmark was not reached in 2015 and it is doubtful that it will be reached by 2020. Use of anything but the Effective Population model discussed below, would likely result in the significant overestimation of flows because over half of the 2010 population was not connected to the public sewer. Many future developments will not necessarily be connected either.

See Section **A.7** for more details on population estimates and projection methods.

Table A-5 Effective 2050 Buildout Population

Sub-Basin	Total Population	Effective 2050 Buildout Population
1	36,904	29,654
2	23,512	21,244
3	20,623	19,688
4	5,743	3,424
5	8,073	6,288
6	17,240	13,338
7	6,229	1,231
8	5,500	4,010
Non-serviceable area by gravity	4,126	0
Pascua Yaqui Trust Lands	4,499	4,499
West of Sandario Road	2,053	0
Total	**134,472**	**103,376**

1) Land Use Buildout (SWIP)

Previous basin studies have attempted to identify potential growth areas and predict buildout populations for those areas. In the case of the Avra Valley WRF, the majority of the Basin Study Area is covered by the Southwest Infrastructure Plan (SWIP), which has already made these predictions. Thus, the SWIP will provide a buildout scenario for population analysis. Phase II of the SWIP provides a single, preferred buildout scenario for most of the Study Area. The area west of Sandario Road is not included in the SWIP; however, the joint Pima County/City of Tucson white paper *Location of Growth, Urban Form, and Cost of Infrastructure*, clearly shows no expectation of new development of significant intensity west of Sandario Road. This expectation holds true even when the total population of eastern Pima County reaches 2 million and even if development continues to follow current patterns. This model is not tied to a specific time point, but PAG projects the population of Pima County will reach 2 million after 2050. For the purposes of these population estimates, the 2010 Census population for the area west of Sandario Road (2053 people) has been added to all future populations; however, no growth has been added. This area falls below the 1.33 RAC threshold.

Also not included in the SWIP is the Pascua Yaqui Trust Land. The U.S. Census data analysis suggests slow growth of 0.63% from 2000 to 2010. The assumption is that this rate of growth (less than 1% annually) will continue steadily to 2050.

The SWIP preferred buildout scenario for 2050 is shown in **Table A-5** below, and features PCRWRD projections. The wastewater analysis in SWIP adjusted the population estimates to eliminate areas not serviceable by gravity, and areas with a buildout RAC of below 1.33. It is not cost-effective to serve such low-density areas with sewers. This results in an estimated population of 103,376 for the SWIP area in the year 2050, which is only 77% of the total population of 134,472 within the Avra Valley Basin Study Area.

A geometric growth rate calculation was conducted using the 2010 U.S. Census as the most accurate estimate of present population, and the 2050 buildout estimate. Interpolation provides a predicted total (not effective) population of 134,472 for the entire Study Area for the year 2050. This represents a growth rate of 3.77%. This growth model suggested that the Avra Valley WRF will reach 75% capacity around the year 2015 and 100% capacity around the year 2023 . The facility did not reach 75% capacity in 2015 and will not

reach 100% capacity in 2023. These projections are far too aggressive considering current development trends and wastewater flows.

2) Effective Population

Using ESRI ArcMap to "clip" 2010 Census Data to the existing PCRWRD-serviced areas suggests that at most, only 16,718 of the 31,334 people living in the Study Area are connected to the PCRWRD system. Influent to the Avra Valley WRF suggests that only 16,250[1] people are currently PCRWRD service users, which is only 52% of the total population of the Study Area. The remaining population in the service area is most likely using private septic systems. If 16,250 is taken as the 2015 effective population, and 103,376 for the effective 2050 population, the exponential growth calculation gives a growth rate of 5.67%, which is relatively high for this slowly-growing area.

Households and Vacancy Rates

The U.S. Census Bureau indicated a total 2,487 housing units with a 2.9% homeowner vacancy rate for the Avra Valley area in 2010. This is was equivalent to the county's homeowner vacancy rate for the same year.

A.4.6 WATER RESOURCES

Almost all of this Study Area lies within the Tucson Water service area, with groundwater being the area's main water source. The Diablo Water Company serves a relatively small area including the subdivisions of Tucson Mountain Ranch, Diablo Village Estates, Camino Verde Estates, Eagle Point Estates, Sonoran Ranch Estates, and the Caddis Haley Estates.

Groundwater overuse in the latter half of the 20th Century led to severely-declining groundwater levels and the beginning of subsidence (land sinking) in and around the Tucson area. In addition, Arizona law requires Tucson and other groundwater-dependent communities to reduce reliance on this limited resource and concentrate on using renewable water supplies.

Sections of the Central Arizona Project (CAP) canal convey Colorado River water to the existing CAP transmission facilities and reservoirs located in the northeastern portion of the Study Area. The Central Avra Valley Storage and Recovery Project (CAVSARP), located northwest of the Study Area (near the intersection of Sandario Road and Mile Wide Road), allows Tucson Water to use Colorado River water as a drinking water supply through a process known as recharge and recovery.

Reclaimed Water System

Tucson Water builds, operates and maintains the region's reclaimed water system which serves reclaimed water to golf courses, parks, schools, and other outdoor needs. In recent years, more emphasis has been placed on the improvement and continued construction of the region's reclaimed water system as a way to support regional renewable water resources efforts. Because the City's reclaimed water service area lies outside this Study Area, reclaimed water supplies from the City are unavailable in the Study Area. Reclaimed water produced at the Avra Valley WRF is used for recharge and riparian conservation purposes in the immediate vicinity of the facility.

[1] Using monthly average flow of 1.3 MGD and dividing by 80 GPD.

A.5 SEWER BASIN AND TRIBUTARY AREAS

This section examines the sewer basins within the Study Area, as defined by the *2002 Avra Valley Basin Study* and are unchanged in this study.

A sewer basin is defined as a topographical area that consists of one or more tributary areas from which wastewater flows by gravity to the larger sanitary sewer system. As illustrated in Figure A-8 the Study Area is comprised of the Avra Valley Sewer Basin and areas not tributary to any part of the sanitary sewer system.

AVRA VALLEY SEWER BASIN

The Avra Valley Sewer Basin, as shown in **Figure A-8**, comprises ten sub-basins AV1 to AV10, and is separated from the Tres Rios Basin Group by a ridge extending south from the Tucson Mountains. Most of the basin's east portion lies within the Black Wash watershed. The watershed area covers approximately 40 square miles. The total sewer basin area encompasses approximately 66 square miles.

Sub-Basin AV1

Sub-basin AV1 is immediately south of the Avra Valley WRF and measures approximately 0.7 square miles. Land in the sub-basin has been subdivided for industrial use (called "Grant Industrial Sites" and "Millstone Industrial District"), but is almost entirely undeveloped. With the exception of a 200 foot stretch of the 24-inch sewer line running parallel to Snyder Hill Road, AV1 does not contain sewer infrastructure.

Sub-Basin AV2

Sub-basin AV2 is the westernmost basin of the Avra Valley Sewer Basin, stretching from the southwest boundary of AV1 south to the San Xavier District of the Tohono O'odham Nation, and includes the western half of Ryan Field Airport. It measures approximately 8.4 square miles and contains little development and no sewer infrastructure. The existing development is large-lot subdivisions north of Valencia Road. Two sections in the far south area of the sub-basin are State Trust Land.

Sub-Basin AV3

Sub-basin AV3 measures approximately 6.6 square miles. It includes the eastern half of Ryan Field airport and a partly-completed medium density subdivision which is connected to the Avra Valley WRF by a 21-inch sewer line. The remainder of the sub-basin is split roughly equally between large private lots, State Trust Land, and Bureau Land Management (BLM) land.

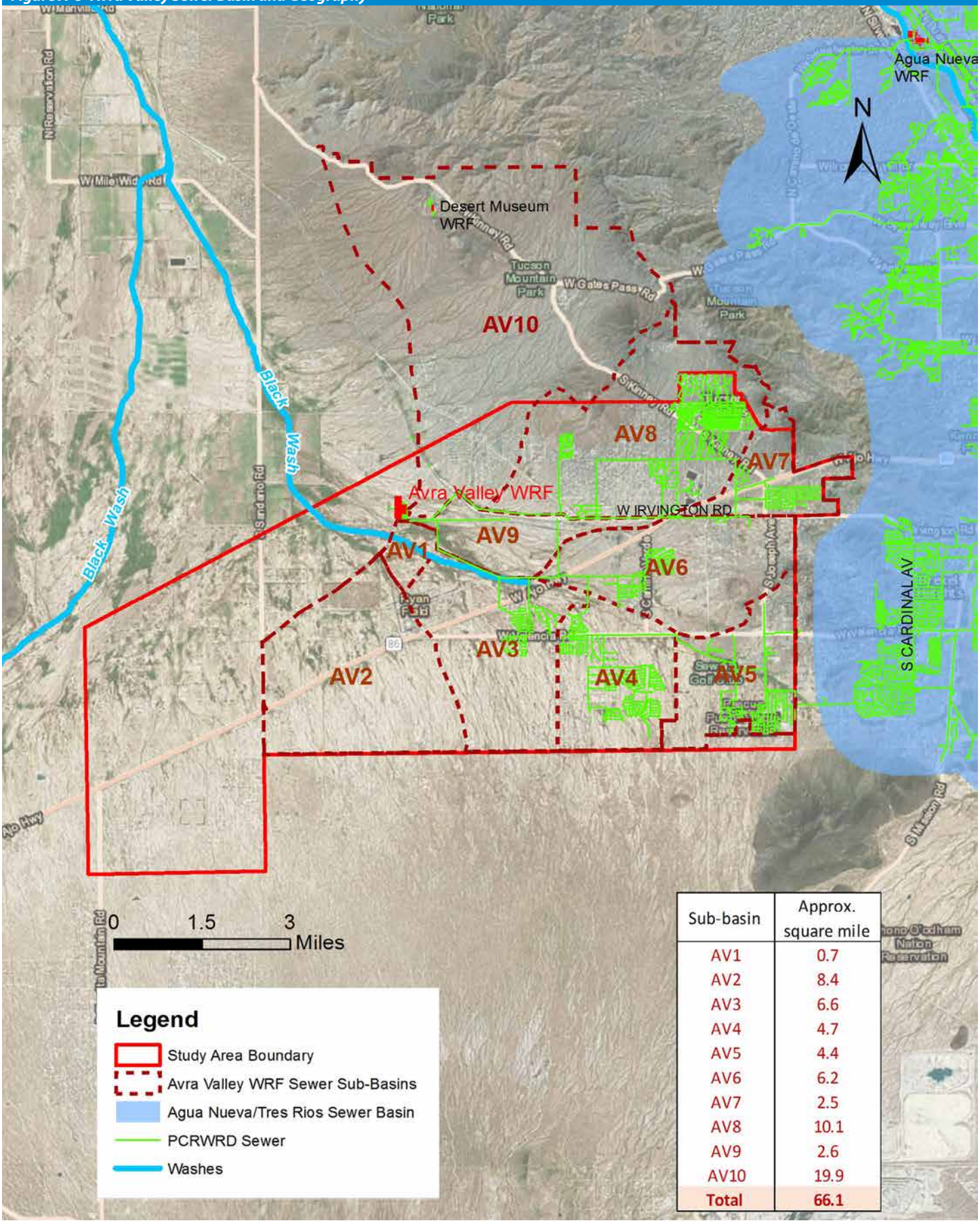
Sub-Basin AV4

Sub-basin AV4 measures approximately 4.7 square miles. It is significantly developed. The sub-basin includes the subdivisions of Star Valley and Diablo Villages connected to the Avra Valley WRF via an 18-inch collector line. Roughly half of the lots in the subdivisions remain unbuilt. A half-section of State Trust Land accounts for most of the remaining land in the sub-basin.

Sub-Basin AV5

Sub-basin AV5 measures approximately 4.4 square miles. It is the most southeasterly sub-basin of the group. Most of the sub-basin is

Figure A-8 Avra Valley Sewer Basin and Geography



Sub-basin	Approx. square mile
AV1	0.7
AV2	8.4
AV3	6.6
AV4	4.7
AV5	4.4
AV6	6.2
AV7	2.5
AV8	10.1
AV9	2.6
AV10	19.9
Total	**66.1**

Avra Valley Water Reclamation Facility.

Pascua Yaqui Trust land. The sub-basin includes housing, casino and hotel developments connected to Avra Valley WRF via sub-basin AV4 through a 12-inch collector line. At one time, an abandoned pipe connected it to sub-basin 94 of the Agua Nueva/Tres Rios Sewer Basin.

Sub-Basin AV6

Sub-basin AV6 measures approximately 6.2 square miles, and contains a number of subdivisions. However, only two subdivisions receive sewer service; these subdivisions are connected to the Avra Valley WRF through an 18-inch sewer. As is common in much of this Study Area, many of the subdivisions are only partially built, and a number consist only of infrastructure improvements. Undivided parcels in this sub-basin are mostly State Trust and BLM land.

Sub-Basin AV7

Sub-basin AV7 measures approximately 2.5 square miles. It is the easternmost sub-basin of the group. It contains three sewer-serviced subdivisions. An abandoned pipe formerly connected it to sub-basin AV8 to the north, but flows are now conveyed westward via a 12-inch collection line. Undeveloped land consists mostly of large lots in private ownership. A small portion of the sub-basin forms part of Tucson Mountain Park.

Sub-Basin AV8

Sub-basin AV8 measures approximately 10.1 square miles. It includes a large number of subdivisions, roughly half of which are served by the sewer system. Flows go to the Avra Valley WRF via a 21-inch sewer line. With the exception of Tucson Estates, most subdivisions are low density. The remaining undeveloped land is either in State Trust or BLM ownership, or forms part of the Tucson Mountain Park.

Sub-Basin AV9

Sub-basin AV9 measures approximately 2.6 square miles. It is mostly undeveloped. All flows from this sub-basin to the Avra Valley WRF pass through AV9, into a 24-inch sewer line aligned with Snyder Hill Road. Much of the land is State Trust; but an additional constraint on development is the half-mile buffer around Tucson Trap and Skeet Club located in the sub-basin. The BLM and Bureau of Reclamation also hold parcels in the sub-basin.

Sub-Basin AV10

Sub-basin AV10 measures approximately 19.9 square miles and is mostly undeveloped. A majority of the sub-basin is in the Tucson Mountain Park, and therefore is not part of the Study Area. The southern tip of the basin contains low-density subdivision developments, but no sewer infrastructure. Vacant land outside of the Tucson Mountain Park is in BLM and State Trust ownership. In the north of the sub-basin, the Arizona-Sonora Desert Museum has its own treatment facility.

A.6 EXISTING WASTEWATER INFRASTRUCTURE IN THE SOUTHWEST AREA

PCRWRD is the only wastewater service provider for the area, and the Avra Valley WRF is the sole water reclamation facility. The tributary conveyance system is limited; and many developments within the sewer basin are not connected to the facility. Areas of less dense rural population, most of which are wildcat subdivisions, are served by septic systems.

A.6.1 CONVEYANCE SYSTEM

The entire service area is gravity fed, with no pump stations. Conveyance structures are limited to manholes and cleanouts. The conveyance system consists of approximately 121 miles of public sewer pipes that range from 6 to 24 inches in diameter (**Figure A-9**). There are 2,173 public manholes and 155 cleanouts in the service area (GIS data analysis, April 2014).

Figure A-10 depicts the age of pipes within the Avra Valley WRF

Figure A-9 Avra Valley Sewer Basin and Conveyance System

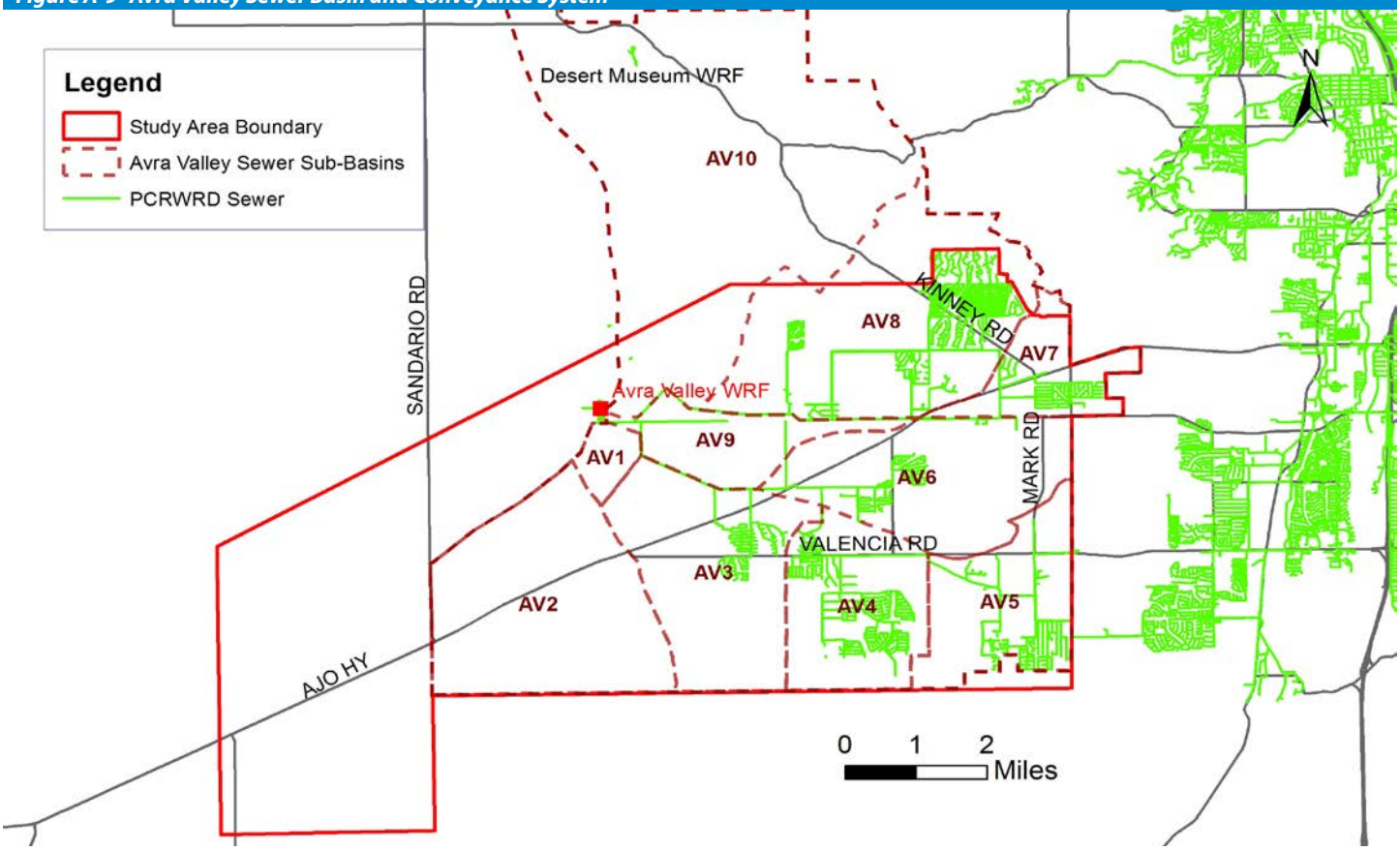
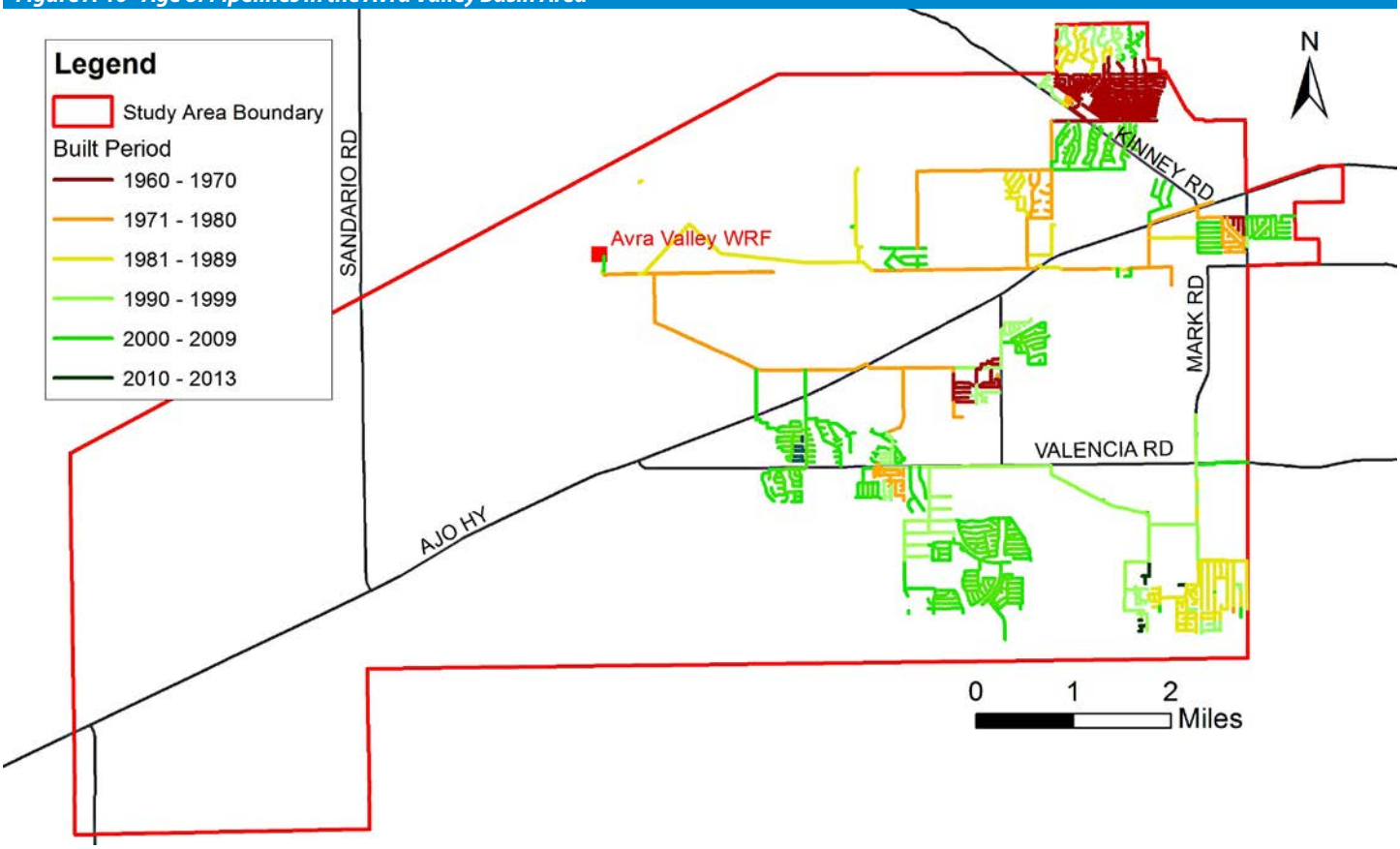


Figure A-10 Age of Pipelines in the Avra Valley Basin Area



service area. The ages vary widely; some subdivisions are served by sewers that are more than 40 years old. Other subdivisions are still under construction and are served by very new sewers. The larger sewers in the Service Area are generally more than 30 or 40 years old.

CRITICAL CIP PROJECTS

There is currently one planned CIP augmentation project to bring the existing public sewer system in line with capacity demand. This augmentation project will provide capacity relief to the existing downstream conveyance system and will provide conveyance capacity for new developments.

Black Wash Augmentation

The results of the Southwest Avra Valley Sub-Basin Study conducted in 2010 concluded that the Valencia Road sewer conveyance system west of Wade Road is in need of augmentation. The augmentation of the 12-inch Pascua Yaqui Lift Station Relief Sewer (G-88-120) in Valencia Road would help to meet the capacity needs of commercial development in the Tucson Mountain Ranch, a Pascua Yaqui casino/resort, and the assured capacity promised to the Star Valley development. This augmentation will direct some or all of the flows in the Valencia Road sewer line northerly to an existing line one half mile to the northwest where adequate conveyance is available in a large 15-inch line (**Figure A-11**). Upon completion of the project, the additional capacity will allow for the connection of new developments planned on tribal land and surrounding areas.

In addition to the CIP augmentation project, a proposed public sewer extension along the Ajo Highway right-of-way would serve two major developments: Sendero Pass and Pomegranate Farms. Both are south and west of the Valencia Road and Ajo Highway interchange. The developer-built sewer extension will connect east of Ryan Field to the existing 21-inch public sewer line that conveys wastewater northerly to the Avra Valley WRF.

A.6.2 TREATMENT SYSTEM

All wastewater collected in the Avra Valley WRF service basin is treated at the Avra Valley WRF.

AVRA VALLEY WATER RECLAMATION FACILITY

Facility Location and Service Area

The Avra Valley WRF is located roughly 10 miles southwest of Tucson in Township 14S, Range 11E, Section 36. The facility site lies at approximately 2,360 feet above mean sea level (msl). The site, which has a total area of 140.39 acres, has been the location of a facility since 1967. The Black Wash runs south (2,360 feet above msl)

Figure A-11 Black Wash Augmentation

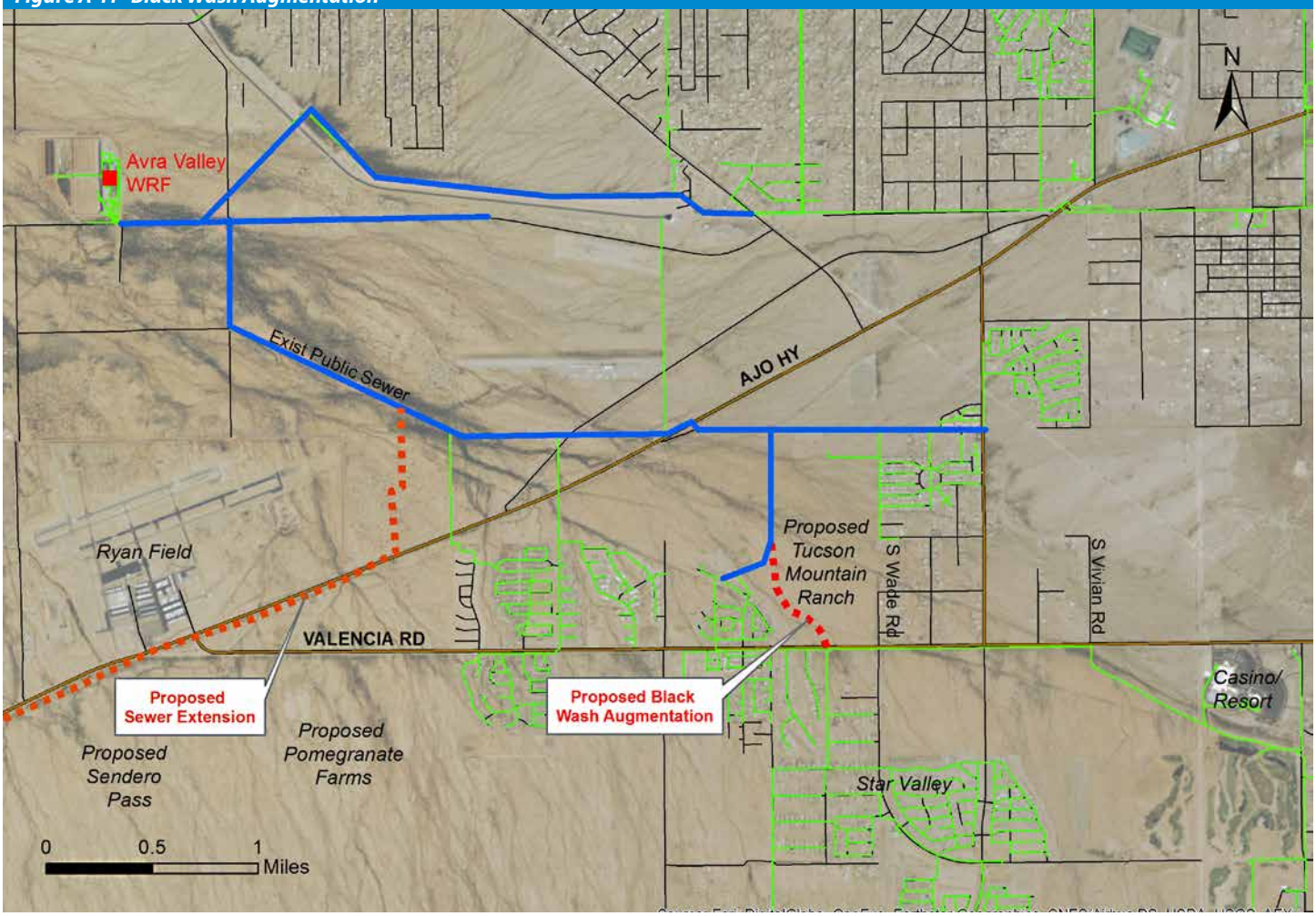


Table A-6 Avra Valley WRF Annual Influent Flow								
Year	Capacity (MGD)	Annual Average Influent (MGD)	Percent Capacity (Avg Amt Influent/ Capacity)	Peak Influent (Monthly Avg Amt in MGD)	Percentage of Capacity (Peak Influent/Capacity)	Lowest Influent (Monthly Avg Amt in MGD)	Percentage of Capacity (Lowest Influent/Capacity)	Percentage Change Peak to Low
2001	2.2	0.81	36.8%	December, 0.91	41.4%	May, 0.75	34.1%	17.6%
2002	2.2	0.93	42.3%	February, 0.98	44.5%	April, 0.87	39.5%	11.2%
2003	2.2	0.95	43.2%	August, 1.00	45.5%	September, 0.91	41.4%	9.0%
2004	2.2	0.97	44.1%	February, 1.02	46.4%	July, 0.93	42.3%	8.8%
2005	2.2	1.01	45.9%	December, 1.06	48.2%	May, 0.94	42.7%	11.3%
2006	2.2	1.10	50.0%	December, 1.25	56.8%	July, 0.91	41.4%	27.2%
2007	2.2	1.20	54.5%	February, 1.30	59.1%	June, 1.08	49.1%	16.9%
2008	2.2	1.21	55.0%	January, 1.28	58.2%	June, 1.14	51.8%	10.9%
2009	4.0	1.17	29.3%	April, 1.30	32.5%	December, 1.05	26.3%	19.2%
2010	4.0	1.10	27.5%	April, 1.20	30.0%	May, 0.96	24.0%	20.0%
2011	4.0	0.92	23.0%	December, 1.32	33.0%	July, 0.27	6.8%	79.5%
2012	4.0	1.36	34.0%	March, 1.49	37.3%	January, 1.10	27.5%	26.2%
2013	4.0	1.28	31.9%	September, 1.38	34.5%	June, 1.14	28.5%	17.4%
2014	4.0	1.21	30.3%	February, 1.32	33.0%	June, Sept, 1.15	28.8%	12.9%
2015	4.0	1.27	31.8%	November, 1.32	33.0%	Jul, 1.21	30.3%	8.3%

Source: PCRWRD Compliance and Regulatory Affairs Office

and west (2,330 feet above msl) of the facility site. None of the effluent is discharged into the Black Wash.

Zoning for the facility and the majority of the surrounding area is Rural Homestead (RH). Zoning south of the facility is General Industrial (CI-2). All of the land surrounding the facility is vacant. Land ownership surrounding the facility is State Trust Land on the north and the east, and Pima County on the west and the south.

The population in the area served by the Avra Valley WRF grew rapidly in the period from 2000 to 2005. During this period, a large casino, constructed and operated by the Pascua Yaqui Tribe, began contributing flows to the Avra Valley facility. In 2009, the Avra Valley WRF was expanded to process a total of 4.0 MGD in readiness for predicted future loads.

Facility Capacity and Current Flows

The Avra Valley WRF has a permitted capacity of 4.0 MGD. The average monthly flow recorded in 2015 was 1.27 MGD (32% capacity). The highest average monthly flow was recorded in the month of March 2012 at 1.49 MGD (37% capacity) (**Table A-6**).

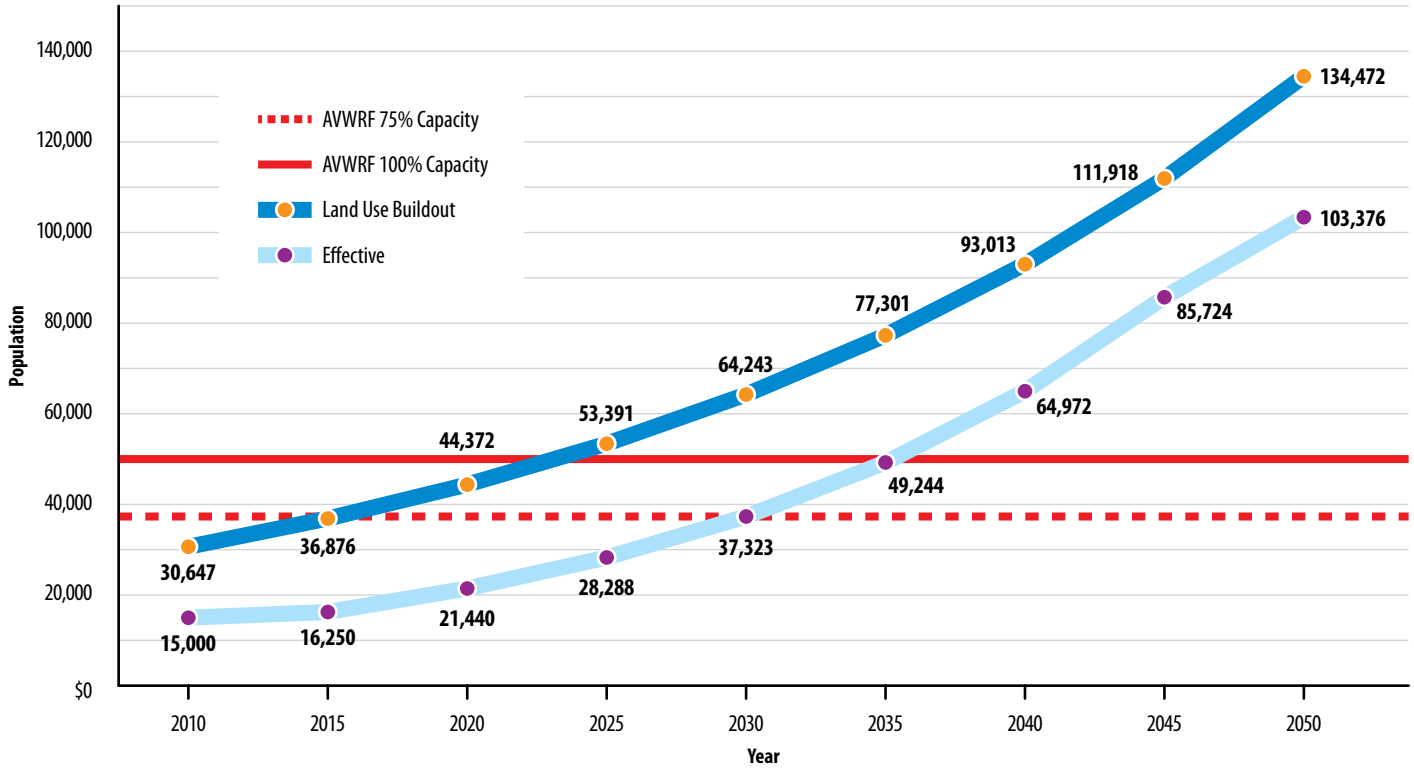
Treatment Process

The Avra Valley WRF operates by using two oxidation ditches to achieve nitrification and denitrification. It utilizes sand filtration; UV treatment is the method of disinfection. The treatment process consists of a lift station with submersible pumps with metering, a headworks with screens and grit removal, a lined emergency influent storage basin, two (2.0 MGD each) oxidation ditches with surface aeration, secondary clarifiers with return activated sludge and wasting, followed by the sand filters and UV systems. Solids are thickened onsite and then wet-hauled to the conveyance system for treatment at Tres Rios.

The sewage enters the WRF through a lift station, discharging through mechanically cleaned screening channels to two parallel 2.0 MGD biological nutrient removal oxidation ditches (BNRODs) for nitrification and denitrification. The resulting activated sludge mixed liquor runs into four secondary clarifiers, where quiescent conditions encourage the sludge to settle and scum to rise. The majority of the secondary clarifier activated sludge is returned to the BNRODs, some is wasted to the solids handling where it is dewatered to be hauled to the conveyance system for disposal to the Tres Rios WRF. Scum is also pumped to the thickeners where it is combined with the wasted sludge to be hauled away. In the case of a maintenance malfunction or an emergency, scum and wasted sludge can be pumped into a lined 109,000 gallon drying bed. The secondary clarifier effluent is passed to four tertiary sand filters, then finally to two ultraviolet disinfection channels before it is discharged to the five recharge basins.

Effluent from the Avra Valley WRF meets Class A+ standards but is permitted for Class B+ reclaimed quality. Effluent is discharged by percolation through five groundwater recharge basins. The de-

Figure A-12 Study Area Growth and Flow Projections



partment holds a groundwater storage permit from ADWR accrues groundwater recharge credits. The facility is permitted to reuse its effluent for onsite irrigation and onsite construction project dust control; it also has the option of discharging Avra Valley WRF effluent into the Black Wash under an AZPDES permit. However, at this time, PCRWRD is opting not to reuse or discharge the facility's effluent in these manners. Instead, PCRWRD is recharging all the effluent generated at the Avra Valley WRF.

OUTLOOK OF FACILITY

Based on the current average monthly influent flow of 1.27 MGD, the Avra Valley WRF serves approximately 15,875 people (ADWF 1.27 MGD at 80 GPD per person). The facility can serve an additional 21,625 people before reaching 75% capacity and 33,750 people before reaching full capacity. The Effective Population estimates suggest that these events would occur around 2030 and 2035 respectively, but could occur much more quickly if a housing recovery were to result in a rapid completion and sale of units in existing subdivisions. All the remaining capacity has been allocated to the area developers who paid for treatment expansion in 2009.

A.6.3 FLOW PROJECTIONS

For the Avra Valley WRF to reach 75% capacity (37,500 people) in 2030, as suggested by the Effective Population model (see **Figure A-12**), the serviced population would have to more than double in that time, growing by 21,625[2] people. However, an increase of 21,625 people may not take that long. The completion of Pomegranate Farms, Sendero Pass, Diablo Village, Tucson Mountain Ranch, and the remaining lots of Star Valley Estates would create a total of around 8,000 units, all connected to the Avra Valley WRF. Using PCRWRD's standard assumption of 2.7 persons per household, this equates to 21,600 people. The use of 2.5 persons per household from the U.S. Census 2010, equates to 20,155 people. Projections show that the facility could reach full capacity population of 50,000 in approximately 2035, which would be possible only after the existing and planned subdivisions have been fully developed and occupied.

The challenge in predicting the timing of necessary expansions lies with the relatively small current population served by the Avra Valley WRF, in an area with large parcels of vacant developable land. Population growth is likely to be stepped rather than smooth as large numbers of housing units come onto the market simultaneously. The uncertain economic conditions in the near term also make the timing of the first step upward difficult to predict.

DEVELOPMENTS WITH COMMITTED CAPACITY

In 2006, a group of developers (**Table A-7**) entered into a Sewer Facilities Development Agreement with the PCRWRD (Amendment 1, Resolution 2006-324) to construct upgrades to the facility, ensuring treatment capacity for several respective trust-held properties and future developments of Sonoran Ranch, Pomegranate Farms, Desert Meadows and Desert Meadows West (KB Home) and Diablo Village. A list of developments with committed capacity at the Avra Valley WRF appears in the table below.

[2] 37,500 (at 75% capacity) – 15,875 currently served = 21,625 additional people

A.7 POPULATION ESTIMATES AND PROJECTION METHODS

This section provides a detailed description of projection methods discussed in Section A.4.5. Different sources of information were reviewed and compared in the projection models for the Avra Valley Basin Study Area, including: the PAG's TAZ data, the U.S. Census data and the Southwest Infrastructure Plan (SWIP) data. The population estimates and projections based on land use buildout are the most accurate available. The SWIP is a reliable indicator of which development is likely to be connected to the public sewer system.

The Geometric Growth Rate Calculation

For a population measured annually, growing by a constant percentage of its whole each year, the population for a particular year can be calculated as:

$$P_n = P_0(1+r)^n$$

where: P_0 is the starting population
P_n is the population for year n
r is the rate of growth

Thus to calculate the rate of growth r:

$$\frac{P_n}{P_0} = (1+r)^n$$

$$\left(\frac{P_n}{P_0}\right)^{\frac{1}{n}} = 1+r$$

$$r = \left(\frac{P_n}{P_0}\right)^{\frac{1}{n}} - 1$$

Justification for Use

Geometric growth is a classical population growth model. Qualitatively, it describes growth in which the larger the population, the greater the absolute increase in population each year. This appears to correspond to the phenomenon of today's growth in a slowly-developed area. Early developments create momentum for further growth until the supply of developable land nears exhaustion and supply cannot match demand. As land supply nears exhaustion, growth will slow. This scenario is not represented by the geometric growth model.

Alternative models include linear growth and a variety of more complex curves.

A linear growth model represents constant absolute growth, (e.g. 50 housing units are to be completed and filled each year). Where growth is carefully planned, as in an individual subdivision, linear growth may well be the most appropriate model (presuming that the developer intends to sell equal portions of a development each year until complete).

Complex curves which are intended to model the shift from low demand/high supply to high demand/high supply to high demand/low supply require many assumptions to be made about extremely complex situations. In the absence of extensive research, making such assumptions would be highly subjective.

U.S. Census data shows that between 1960 and 2000 the vast majority of counties and metro areas in Arizona, including Pima County and Tucson, grew in a manner that more closely resembles geometric growth than linear growth.

Table A-7 Developments with Committed Capacity

Project/Development	Owner	Units
Diablo Village Estates	Diablo Village	338
Diablo Village Townhomes		59
Desert Meadows	KB HOME	136
Sonoran Ranch Estates		427
Desert Meadows West		330
Pomegranate Farms	Pomegranate	1,488
Sonoran Ranch Estates II	Sonoran Ranch	145
Camino Verde III	Trust 30226	80
Camino Verde Village		448
Starr Ridge	Trust 60040	105
Westview Pointe	Trust 60221 (60296 w/amendment)	114
Snyder Hill Estates	Trust 813	30
Kinney Village	Trust 817	112
Tucson Mountain Ranch	Trust 913	219
Total		**4,031**

Source: PCRWRD, 2013

A.7.1 POPULATION BASED ON TAZ DATA

Assumptions

- Population grows at a constant percentage per year, creating geometric growth.
- The population within each zone is evenly distributed. That is, if 30% of the TAZ area is within the Study Area, only 30% of the entire TAZ population will be assumed to reside within the Study Area.

Reservations

- The TAZ areas encompass large sections of land for which only large lot development is probable or has already occurred. These developments are not likely to connect to the PCRWRD conveyance system, resulting in an inflated estimate of the number of actual PCRWRD service users.

Method

1. Study Area boundary is created in ESRI ArcMap.
2. Layers are created in ArcMap for TAZ2010 and TAZ2045.
3. TAZ2010 and TAZ2045 layers are "clipped" to the Study Area boundary using ArcMap's geoprocessing tools.

4. Attribute tables for resulting clipped layers are exported to MS Excel.
5. Areas of clipped TAZs are divided by the original TAZ areas to give the proportion of each TAZ included within the Study Area.
6. Resulting proportion is multiplied by the TAZ population to give the population assumed to reside within the Study Area for each TAZ.
7. Populations are summed to give the total population of the Study Area for the years 2010 and 2045.
8. To calculate the rate of growth, the TAZ2010 total is used as P0 and the TAZ2045 total as P45 in the geometric growth rate calculation.
9. The resulting rate of growth (1.98%) is used to estimate the population for the years 2010 to 2050, by using the geometric growth calculation (Table A-8).

A.7.2 POPULATION BASED ON U.S. CENSUS DATA

Assumptions

- Population grows at a constant percentage per year, creating geometric growth.
- The population within each zone is evenly distributed. That is, if 30% of the U.S. Census block is within the Study Area, only 30% of the entire census block population will be assumed to reside within the Study Area.

Reservations

- The U.S. Census blocks encompass large sections of land for which only large lot development is probable or has already occurred. These developments are not likely to connect to the PCRWRD conveyance system, resulting in an inflated estimate of the number of actual PCRWRD service users.
- The interval between the Census 2000 and the Census 2010 is relatively short for the purpose of projecting accurate population for the year 2045 or 2050.

Method

1. Study Area boundary is created in ESRI ArcMap.
2. Layers are created in ArcMap for Census 2000 and Census 2010.
3. Census 2000 and Census 2010 layers are "clipped" to the Study Area boundary using ArcMap's geoprocessing tools.
4. Attribute tables for resulting clipped layers are exported to MS Excel.
5. Areas of clipped census blocks are divided by the original census block areas to give the proportion of each census block included within the Study Area.
6. Resulting proportion is multiplied by the census block population to give the population assumed to reside within the Study Area for each census block.
7. Populations are summed to give the total population of the Study Area for the years 2000 and 2010.
8. To calculate the rate of growth, the Census 2000 total is used as P0 and the Census 2010 total as P10 in the geometric growth rate calculation.
9. The resulting rate of growth (4.67%) is used to estimate the population for the years 2000 to 2050, by using the geometric growth calculation (Table A-8).

A.7.3 POPULATION BASED ON LAND USE BUILDOUT

Assumptions

- Pima County's 2007 Southwest Infrastructure Plan is a reliable indicator of future land use.
- U.S. Census 2010 data is the most accurate indicator of the 2010 population for the Study Area.
- Due to constraints of the Conservation Lands System and the distance from existing infrastructure, there will be no further development and no further population growth west of Sandario Road.
- Growth on the Pascua Yaqui reservation will continue with the same geometric rate of growth as in the period 2000 to 2010 (see reservations below). Growth on tribal lands is, to some degree, constrained by the rate of natural increase (affected by births/deaths) in the number of registered Pascua Yaqui, and has historically been slower than the rate of growth in the Study Area as a whole.

Reservations

- The Southwest Infrastructure Plan does not cover the Pascua Yaqui reservation.

Method

1. The Pascua Yaqui reservation boundary is created in ESRI ArcMap.
2. Census 2000 and Census 2010 layers (created earlier) are "clipped" to the reservation boundary using ArcMap's geoprocessing tools.
3. Attribute tables for resulting clipped layers are exported to MS Excel.
4. Areas of clipped census blocks are divided by the original census block areas to give the proportion of each census block included within the reservation.
5. Resulting proportion is multiplied by the census block population to give the population assumed to reside within the reservation for each census block.
6. Populations are summed to give the total population of the reservation for the years 2000 and 2010.
7. To calculate the rate of growth of the Pascua Yaqui reservation population, the Census 2000 total is used as P0 and the Census 2010 total as P10 in the geometric growth rate calculation.
8. The resulting rate of growth (0.63%) is used to estimate the Pascua Yaqui reservation population for the year 2050.
9. The same method is used to get the 2010 population for the area west of Sandario Road.
10. The buildout population in the Southwest Infrastructure Plan is added to the 2050 population for the Pascua Yaqui reservation and the 2010 population for the area west of Sandario Road. This gives the projected 2050 population for the Study Area as a whole.

Avra Valley Water Reclamation Facility has been receiving recharge credits since its Underground Storage Facility permit became effective on Sept 14, 2015.

11. To calculate the rate of growth for the Study Area, the Census 2010 total is used as P0 and the projected 2050 population as P50 in the geometric growth rate calculation.
12. The resulting rate of growth (3.77%) is used to estimate the population for the years 2000 to 2050, by using the geometric growth calculation (Table A-8).

A.7.4 EFFECTIVE POPULATION

Assumptions

- The population estimates based on Land Use Buildout are the most accurate estimates available.
- The Southwest Infrastructure Plan is a reliable indicator of which development is likely to be connected to the PCRWRD system.
- The Pascua Yaqui reservation will continue to contribute flows to the Avra Valley WRF and so can be included in the Effective Population.
- 80 GPD per person is an accurate estimate of wastewater generation.

Method

1. The PCRWRD layer from the Pima County GIS library was added to ESRI ArcMap.
2. The Census 2010 layer was "clipped" to the PCRWRD service area using ArcMap's geoprocessing tool.
3. The resulting layer was clipped to the boundaries of the Study Area.
4. The attribute table for the resulting clipped layer was exported to MS Excel.
5. Areas of clipped census blocks were divided by the original census block areas to give the proportion of each census block included within the Avra Valley WRF service area.
6. Resulting proportion was multiplied by the census block

Table A-8 Rate of Growth and Population Projections Summary Table													
		Geometric Rate	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
TAZ	Fixed Values	(60896/30647)^(1/35)-1	19,413		30,647							60,896	
	Calculated Values	1.98%	19,413	24,390	30,647	33,804	37,285	41,126	45,362	50,034	55,187	60,871	67,141
U.S. Census	Fixed Values	(30647/19413)^(1/10)-1	19,413		30,647								
	Calculated Values	4.67%	19,413	24,390	30,647	38,503	48,374	60,774	76,354	95,928	120,519	151,414	190,229
SWIP	Fixed Values	(134472/30647)^(1/40)-1			30,647								134,472
	Calculated Values	3.77%	21,175	25,475	30,647	36,876	44,372	53,391	64,243	77,301	93,013	111,918	134,472
Pascua Yaqui	Fixed Values	(3493/3279)^(1/10)-1	3,279		3,493								
	Calculated Values	0.63%	3,279	3,385	3,493	3,605	3,721	3,841	3,964	4,092	4,223	4,359	4,499
Effective	Fixed Values	(103376/16,250)^(1/35)-1			15,000								103,376
	Calculated Values	5.67%	8,641	11,385	15,000	16,250	21,440	28,288	37,323	49,244	64,972	85,724	103,376

population to give the population assumed to reside within the Avra Valley WRF service area for each census block.

7. Populations were summed to give the total population of the Avra Valley WRF service area for the year 2010.
8. The monthly average daily influent to Avra Valley WRF was divided by 80 GPD to give an alternative estimated contributing population.
9. The estimated contributing population from Step 8 was checked against the service area population from Step 7, to ensure that the contributing population was no greater than the service area population.
10. The effective population for wastewater purposes in the Southwest Infrastructure Plan was added to the estimated 2050 Pascua Yaqui reservation population to give the effective population for wastewater purposes for 2050.
11. To calculate the rate of growth of the effective population of the Study Area, the estimated contributing population for 2015 is used as P0 and the projected 2050 effective population as P50 in the geometric growth rate calculation.
12. The resulting rate of growth (5.67%) is used to estimate the effective population for the years 2015 to 2050, by using the geometric growth calculation (**Table A-8**).

The table below summarizes the different population projections based on the individual projection methods described above.

A.8 OUTLOOK OF SERVICE AREA

- If the Southwest Infrastructure Plan's buildout population estimate is correct, the maximum ADWF to the Avra Valley WRF in the foreseeable future is 8.3 MGD[3]. By the year 2030, the population served by Avra Valley WRF is expected to be approximately 37,323 people. This population will generate approximately 3.0 MGD of wastewater, or 75% of existing treatment capacity. An increase in serviced population of 20,000 should trigger the Charter process for an increase in facility capacity. Monitor existing subdivisions, especially Pomegranate Farms, Sendero Pass, Star Valley Estates, Diablo Village, and Tucson Mountain Ranch for resumption of development.

*[3] 103,376 people*80 GPD = 8.3 MGD*

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APPENDIX B: GREEN VALLEY BASIN AREA STUDY

Green Valley Water Reclamation Facility.

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LIST OF ACRONYMS

AAC	Arizona Administrative Code
ACP	Asbestos Cement Pipe
ADEQ	Arizona Department of Environmental Quality
ADWF	Average Dry Weather Flow
ADWR	Arizona Department of Water Resources
AMA	Active Management Area
APP	Aquifer Protection Permit
ASLD	Arizona State Land Department
AZPDES	Arizona Pollutant Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
BNROD	Biological Nutrient Removal Oxidation Ditch
CIP	Capital Improvement Program
DMA	Designated Management Agency/Area
EPA	U.S. Environmental Protection Agency
GPD	Gallons Per Day
GIS	Geographic Information System
GVCCC	Green Valley Community Coordinating Council
MGD	Million Gallons per Day
MH	Manhole
MSL	Mean Sea Level
NPDES	National Pollutant Discharge Elimination System
PAG	Pima Association of Governments
PCRWRD	Pima County Regional Wastewater Reclamation Department
PDWF	Peak Dry Weather Flow
PVC	Polyvinylchloride
RAC	Residences per Acre
ROMP	Regional Optimization Master Plan
SDCP	Sonoran Desert Conservation Plan
SECAP	Sahuarita East Conceptual Area Plan
SP	Specific Plan
TAZ	Traffic Analysis Zone
VCP	Vitrified Clay Pipe
WRF	Water Reclamation Facility
WRTF	Wastewater Treatment and Reclamation Facility

Green Valley Performing Arts Center.

EXECUTIVE SUMMARY

The Green Valley Basin Study serves as a long-range planning document that evaluates the conveyance and treatment systems needs for the extended Green Valley service area, an area that is experiencing population growth and new development.

The basin area extends north/northwest of the existing Green Valley WRF (including the Town of Sahuarita), and south to the Pima/Santa Cruz County line (including Arivaca Junction). The western boundary is roughly defined by the limits of existing and proposed subdivisions west of I-19. The eastern boundary follows Wilmot Road on the north and continues south, following the outer edges of the Quail Creek subdivision and the Canoa Land Grant. It continues easterly where it meets Madera Canyon Road and the Pima/Santa Cruz County line on the south. The basin area boundaries are depicted in **Figure B-1** and **Figure B-2**.

In Green Valley, new development is expected in the form of residential infill (e.g. Canoa Ranch) and smaller scale commercial developments. Due to the 2003 expansion of the Green Valley WRF, most of the residential developments already have allocated capacity.

Over the next several decades, thousands of acres of pecan groves in the Town of Sahuarita will be converted into residential and commercial properties. These large-scale master planned communities will create a significant impact on sewer service demand. PCRWRD has been actively involved in discussions with the developer about sewer service options. The department anticipates that as development of the area evolves, new demand will require major conveyance system augmentation, treatment capacity expansion and system upgrades at the Green Valley facility. Construction of a regional water reclamation facility that would treat sewage from areas currently served by the Green Valley, Sahuarita and Corona de Tucson facilities is a long-term planning goal.

This Study includes the projection of growth and its impact on the existing PCRWRD wastewater system over the next several years. It also identified growth areas that would require system improvements and capacity expansions. The projected growth areas consist of several infill areas (i.e.: Town of Sahuarita and Canoa Hills), a Farmers Investment Company (FICO) development, and development of a 60-square mile Sahuarita annexation area. Description of growth areas and their flow projections are provided in Section **B.4.4** Growth Areas.

Some future developments within the Pima County/Sahuarita Joint Planning Areas could be serviced by either of the two Designated Management Agencies (DMA) in the area: the Pima County DMA or the Town of Sahuarita DMA. The decision as to which DMA will be the service provider for any given future development will

be based on which agency can provide the most economically and technologically feasible sewer service to the area. This Study examines the Town's annexation plans in the joint planning areas and potential wastewater service demands. Sewer services currently provided to Sahuarita customers will continue to be split between the two DMAs.

The current and future development trends and population distribution in the projected service area, will affect long-range planning efforts for Green Valley. Given the retirement character of this community, the department anticipates that population and growth in the Green Valley community will remain relatively steady. However, PCRWRD expects more demographically-diversified growth in the extended service area. Information on demographics and population is provided in Section **B.4.6**.

PCRWRD conducted an assessment of the two existing processes that make up the Green Valley WRF: the 2.0 MGD BNROD and the 2.1 MGD facultative pond. The assessment verified capacity, efficiency and regulatory compliance for future needs and determined that the Green Valley WRF is nearing capacity in the 2.0 MGD Biological Nutrient Reduction Oxidation Ditch (BNROD) portion of the facility.

Due to the unknown regulatory environment that the department may face in future years, this assessment offers several facility treatment expansion options and phases to address potential regulatory and growth situations. They are explained in Section **B.7** Outlook.

Conclusions and Recommendations

Based on the Study Area analysis results, PCRWRD has identified the following conclusions and recommendations:

- The Green Valley Basin Study Area will continue to grow in population, especially in the areas outside of the current Green Valley WRF's service area boundary. PCRWRD anticipates near-term growth is anticipated in the remaining undeveloped parts of the Quail Creek, Madera Highlands, Stone House, Madera Reserve and the Canoa Ranch subdivisions. The department anticipates long-term growth through the development of FICO land and in the Sahuarita East Conceptual Plan Area.
- There is potential that the Arivaca Junction WRF flow (which represents 4% of the daily Green Valley WRF flow) will be diverted to the Green Valley WRF. PCRWRD shall plan and coordinate the construction of the Arivaca Junction WRF/Canoa Ranch gravity sewer with Canoa Ranch. This gravity sewer will serve the Canoa Ranch developments on the west side of I-19, and will divert flows from the Arivaca Junction WRF to the Green Valley WRF.
- The Green Valley WRF will eventually need to be expanded to be able to serve new development and flows from the Arivaca Junction WRF. The timing of the Green Valley WRF expansion is based on population projections for the area. These projections indicate the need for a second BNROD by 2029.
- Construction of a regional water reclamation facility that would treat sewage from areas currently served by the Green Valley, Sahuarita and Corona de Tucson facilities is a long-term planning goal. The new facility would eliminate the need for the Green Valley and Arivaca Junction facilities. More planning, research, and study is required to evaluate viable options for the construction of new regional facility.

B.1 INTRODUCTION

B.1.1 PURPOSE OF THE STUDY

The purpose of this Study is to provide analysis of and set long-range goals for the future conveyance and treatment needs of the Green Valley WRF, Arivaca Junction WRF and surrounding sewer basins.

B.1.2 STATEMENT OF NEED

The Green Valley WRF presents a unique treatment situation in the Pima County DMA. First, the facility, which is located within the Town of Sahuarita, operates within the only joint wastewater management area in Pima County. Second, the facility primarily serves a population that is demographically homogenous (retirees), which affects the amount and strength of influent flow. Finally, the facility has the largest capacity of the six sub-regional facilities managed by Pima County.

B.1.3 STRUCTURE OF THE STUDY

This Study represents an update to the previously conducted studies for the Green Valley basin area, the 1986 Green Valley Basin Long Range Wastewater Management Plan, and the 2006 Metropolitan Area Facility Plan Update. As such, the Study provides updated information on population, sewage flows, facilities, regulatory compliance, and environmental implications for this basin. Since Pima County is not the sole service provider for the basin area, the Study delineates the management areas and discusses the best options for future development in the Sahuarita/Green Valley area. In addition, the Study provides recommendations to maximize existing facilities and minimize capital costs for the County while ensuring compliance with federal, state and local regulations.

The Study discusses planning efforts relevant to the Green Valley Planning Area, and includes a full analysis of the Green Valley basin study area and existing infrastructure. In addition, a discussion on the nearby Sahuarita Wastewater Treatment and Reclamation Facility (WTRF) and the Arivaca Junction WRF and their impacts on the Green Valley WRF is included in this basin study.

B.1.4 METHODS USED

This document is the result of a mixed-methods approach of qualitative and quantitative analysis. Qualitative research encompassed a review of existing facility plans, basin studies, federal, state, and local regulations, facility permits for regulatory compliance and regional plans (such as the ROMP and the Pima Association of Governments ([PAG] 208 Plan). Quantitative analysis consisted of PCRWRD and EPA metering data related to the influent and effluent of the Green Valley Facility. Data from Pima County GIS and the Pima County Association of Governments' (PAG) TAZ[1] provided the basis for land use and population projections.

The department used geographical boundaries, topographical constraints and current and planned land uses to project a buildout population. The study outlines sequential analysis of population growth for each five-year increment. The 2010 TAZ population data provides information for the base year (2010) and for the projections for the forecast year of 2045. A variety of sources for popula-

[1] TAZ – Traffic Analysis Zone

Table B-1 Green Valley WRF and Arivaca Junction WRF Operating Permits (March 2015)							
Facility	AZPDES	APP	Reuse	Industrial Stormwater	Air Quality	Dam	Jurisdictional Waters
Arivaca Junction	NA	P100640	R105345 (Expiration 30-June-18)	NA	NA	NA	NA
Green Valley	AZ0024937 (Expiration 19-April-15)	P100629	R100629 (Expiration 24-Aug-19)	AZMSG-2010	ATO #891, GP #300 (Expiration 30-June-18)	No. 10.15	Santa Cruz River

tion analysis included the U.S. Census Bureau, the Arizona Department of Administration and PAG. Research also included facility site visits, visits to surrounding properties and interviews with facility and other PCRWRD employees.

PCRWRD uses the following assumptions in flow projections:

- 80 gallons of wastewater generated per day per person (Arizona Administrative Code, Title 18, Chapter 9, Table 1. Unit Design Flows).
- 2.7 persons per household (currently used by PCRWRD in estimating wastewater production by single-family household).
- 1.9 persons per household (currently used in estimating wastewater production in retirement community households).

B.2 REGULATORY COMPLIANCE

PCRWRD's wastewater infrastructure is in compliance with federal, state, and regulatory requirements. This section outlines the compliance requirements for the Green Valley WRF and the Arivaca Junction WRF, including the current operating permits. This section also reviews sewer service agreements and intergovernmental agreements (IGAs) between the County and other entities (both public and private) for the provision of sewer service or for the reuse of effluent. The sewer service agreements typically outline commitments and requirements for each party.

B.2.1 PERMITS

AQUIFER PROTECTION PERMIT (APP)

In compliance with *Arizona Revised Statutes (ARS) §§ 49-241 - 49-252 and AAC R18-9-101 - R18-9-403*, any facility that discharges a pollutant to an aquifer, either directly or to a reasonable probability, must have an APP. All wastewater facilities are designated as "discharging" facilities and require such a permit. Wastewater facilities must meet a number of requirements to receive a permit. The most significant requirement is to have best available demonstrated control technology, which ensures that aquifer water quality standards are not violated at the point of compliance.

The Green Valley WRF has an APP (P-100629) valid for the life of the facility unless suspended or revoked (*AAC R18-9-A213*). This permit became effective on August 12, 2009.

The Arivaca Junction WRF has an APP valid for the life of the facility (P-100640) unless suspended or revoked. This permit became effective on March 16, 2007.

ARIZONA POLLUTANT DISCHARGE ELIMINATION SYSTEM (AZPDES)

Arizona Pollutant Discharge Elimination System (AZPDES) permits uphold the implementation of *40 CFR 403* (General Pretreatment Regulations for Existing and New Sources of Pollutants). Permits are for a specified time not to exceed five years. The Green Valley WRF permit AZ0024937 is applicable to the BNROD train of the facility. The Green Valley WRF currently does not discharge effluent to the Santa Cruz River.

RECLAIMED WATER PERMIT

ADEQ requires reclaimed water permits for sewage treatment facilities that generate reclaimed water for direct reuse (*AAC R18-9-713*). The Green Valley WRF has a Type 2 Reclaimed Water General Permit that is valid through August 24, 2019. The permit allows the use of effluent generated at the Green Valley WRF for landscape irrigation and on-and-off-site dust control.

Table B-1 includes current Green Valley WRF and Arivaca Junction WRF operating permits.

FUTURE UNDERGROUND STORAGE FACILITY (USF) PERMIT

PCRWRD will submit an application for modification of an APP to allow some of the BNROD effluent to be discharged to the percolation basins. This change will increase infiltration rates. PCRWRD hopes to demonstrate the site's highest recharge capacity is tied to the present basin configuration. The department is in the process of developing designs for new recharge basins to be built east of the current plant site. Currently there is storage capacity for up to 2,335 acre feet. PCRWRD will try to obtain an ultimate capacity of 3,500 acre feet per year.

B.2.2 INTERGOVERNMENTAL AGREEMENTS (IGA)

Agreement for Effluent Reuse from the Green Valley WRF (January 2, 1990)

Partners in this IGA (adopted as Resolution No. 15177) for the use of effluent from the Green Valley WRF, has multiple partners. Current partners include Pima County, City of Tucson, Robson Creek and Farmers Investment Co. (FICO). Robson Creek LLC is the owner of the Quail Creek development which covers approximately 1,700 acres of land in southern Pima County, east of the Green Valley community. The Quail Creek Specific Plan advocates the irrigation of golf courses with that effluent. However, at this time, Robson Creek is recharging the effluent it receives and is not using it for irrigation. FICO is the owner of more than 6,000 acres of land (pecan grove) currently irrigated with effluent from the Green Valley WRF.

First Amendment to Agreement for Effluent Reuse (January 12, 2001)

By this Agreement between Pima County and Robson Creek

LLC, Robson Creek LLC agrees to contribute toward the costs of upgrading the Green Valley WRF and to pay the County a fee for effluent produced from the plant. The County agrees to construct and operate the treatment facilities and to provide an average flow of 1.0 MGD. Robson Creek LLC agrees to take delivery of a minimum of 365 million gallons of effluent per year (the amount established by the above Agreement) and a minimum of 25 million gallons per month. Quantities of Effluent that Robson does not take reverts to the County.

Addendum 1 to the 2000 Supplemental Effluent IGA (February 5, 2001) and Waiver of Rights under Section 4.1.3 for the First Amendment to Agreement for Effluent Reuse Between Pima County and Robson Quail Creek LLC

Under the 2000 Supplemental Effluent IGA, Pima County agrees to charge each user of effluent from a non-metropolitan wastewater treatment facility a certain fee per acre foot, which contains a production component fee. (A production component fee ensures that all costs associated with the treatment of effluent are recovered.) Under the terms of the subsequent "*First Amendment to Agreement for Effluent Reuse between Pima County and Robson Ranch Quail Creek, LLC*," Robson Creek agrees to contribute toward the costs of upgrading the non-metropolitan Green Valley WRF and pay the County a fee for effluent produced from the plant. However, the sum of Robson's contributions and fees will not exceed the current amount of the "production component fee" established in the 2000 Supplemental IGA (Section 4.1.3). The City's right to seek enforcement of Section 4.1.3's "production component fee" requirement as established in the above mentioned "First Amendment for Effluent Reuse" between the County and Robson Ranch Quail Creek, LLC has been waived.

Intergovernmental Agreement for the Provision of Sewer Services (Pima County/Town of Sahuarita)

On November 14, 2000, the Pima County Board of Supervisors passed Resolution No. 2000-227, which provided the Town of Sahuarita the authority to construct, purchase, acquire, own and maintain wastewater facilities pursuant to ARS §§ 9-511 and 9-514 with the authority to construct and maintain sewers and drains pursuant to ARS § 9-240 (B)(5)(a). The agreement allowed Pima County to maintain sanitary sewer connections for those currently served by the Green Valley WRF. It also ensured that the County would not grant rezoning or subdivision approvals for developments within the Town of Sahuarita's service area that would exceed the conveyance/treatment capacity of the facility.

Agreement between Pima County and Reventone Ranch, Inc. for Effluent Reuse (August 29, 2003)

This Agreement is for the use of effluent from the Arivaca Junction WRF. The Oswald Cattle Company (renamed Reventone Ranch, Inc.) currently maintains reuse rights through an Effluent Reuse Agreement/Contract with Pima County. That agreement expires in 2019. Total annual distribution of effluent to Oswald Cattle Company Ranch in 2011 was 7.81 million gallons, in 2012 it was 10.5 million gallons, and in 2013 it was 7.85 million gallons. Effluent is pumped to the ranch approximately every six weeks. A pump and piping system discharges to the chlorination feeder and tankage system and then to the ranch for agricultural irrigation use. PCRWRD currently pays the ranch for the effluent delivery. If the site ever becomes unavailable for discharge, it will be necessary to haul the effluent to the Green Valley WRF for disposal.

B.3 PLANNING EFFORTS

GREEN VALLEY COMMUNITY COORDINATING COUNCIL'S COMMUNITY PLAN

As an unincorporated community, Green Valley's local governance and land regulations are guided by Pima County and the Pima County Comprehensive Plan. Green Valley also is represented by the Green Valley Community Coordinating Council (GVCCC), a consortium of member Homeowners Associations (HOAs) that assists with communications between Green Valley residents and local, state, and federal government officials. The GVCCC has produced a community plan within an area defined as the Green Valley Planning Area. In an attempt to adhere to the community's vision for the future, the Study incorporates the GVCCC's Plan. This document cites the Green Valley Planning Area several times on the following pages.

JURISDICTIONAL PLANS

Pima County has developed comprehensive land use plans covering all of Pima County. The Green Valley Basin Area falls into the Upper Santa Cruz Planning Area of the Pima County Comprehensive Plan – Pima Prospers. Arizona "Smart Growth" legislation requires county and municipal General Plans. State law sets periodic reviews. Changes to General Plans require voter approval.

PIMA COUNTY INFRASTRUCTURE PLANS

Integrated and coordinated infrastructure planning in Pima County occurs with the oversight of different committees and the Capital Improvement Program. Collaboration of planning for flood control, transportation, parks and recreation, open space and wastewater management is critical to the planning process.

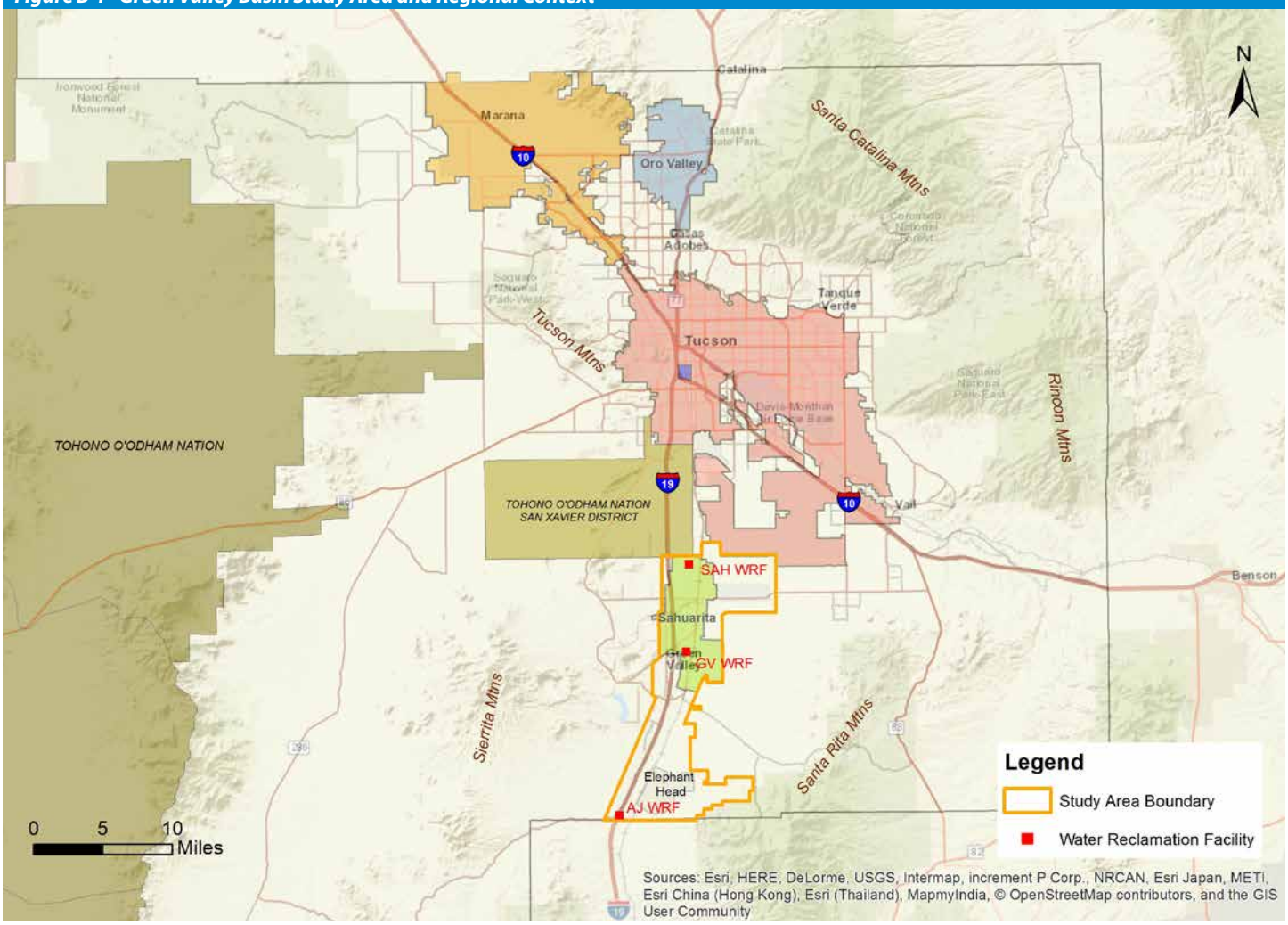
PIMA COUNTY DEPARTMENT OF TRANSPORTATION

The Arizona Department of Transportation and the Pima Association of Governments have produced long-range transportation plans. The PAG 2040 Regional Transportation Plan identifies major roadway and highway corridor improvements impacting the Green Valley and the Sahuarita areas. Roadway improvements establish potential growth and development opportunities in areas currently lacking roadway infrastructure or adequate roadway capacities to serve growth. New roadways often lead to opportunities for expansion of the existing wastewater conveyance system when new areas need service.

PAG 2040 Regional Transportation Plan (PAG 2040 RTP)

The PAG 2040 RTP is a long range transportation plan for metropolitan Tucson and eastern Pima County. The plan calls for improvements of arterial road corridors of Old Nogales Highway and Sahuarita Road. Proposals for improvements of collectors (such as El Toro Road in Sahuarita) and an extension and realignment of Country Club Road south of Santa Rita Road are part of the plan. See Section B.8 2040 RTP Roadway Projects.

Figure B-1 Green Valley Basin Study Area and Regional Context



PAG 2015-2019 TRANSPORTATION IMPROVEMENT PLAN (PAG 2015-2019 TIP)

The TIP is a rolling five-year schedule and budget of proposed transportation improvements that seeks to optimize the use of available federal, state and local funds and resources to serve the region's multi-modal transportation needs. The TIP implements long-range transportation plans. The major roadway improvement projects in the 2015-2019 TIP for the Green Valley and Sahuarita area are shown in Section B.8. They include Sahuarita Road improvements, construction of a new roadway alignment between Old Nogales Highway and Nogales Highway, and Wilmot Road improvements north of Sahuarita Road.

B.3.1 PREVIOUS WASTEWATER PLANS AND BASIN STUDIES

The Green Valley WRF and its service area have been the subject of previous plans and studies over the past 25 years:

- 1986 The Green Valley Basin Long Range Wastewater Management Plan;
- 1987 Preliminary Sewer Basin Study and Master Plan for the Green Valley Area;
- 2006 Metropolitan Area Facility Plan Update; and,
- 2006 Areawide Water Quality Management Plan (208 Plan Update).

B.4 STUDY AREA ANALYSIS

Jurisdictional boundaries, topographical constraints, an evaluation of land ownership and current and projected land determined the Green Valley Basin Study Area. The following section describes land ownership and use in the Upper Santa Cruz Valley and four focus areas. There is also more in-depth analysis of the Green Valley WRF in the Implications Section.

B.4.1 STUDY AREA BOUNDARY

The Study Area is located approximately 13 miles south of the I-10/I-19 interchange, and is bounded by Pima Mine Road on the north and the Pima/Santa Cruz County line on the south (**Figure B-1**). The area extends approximately 19 miles south-north. This area encompasses the incorporated Town of Sahuarita and unincorporated areas of Green Valley and Arivaca Junction. The Ele-

Green Valley.

phant Head Colonia also falls within the Study Area boundary and encompasses approximately eight square miles (5,145 acres) south of Green Valley on the east side of I-19.

Pima County's wastewater conveyance system is a gravity flow model. To maximize flow and minimize the need for pump stations, the region's topography played a role in determining the Basin Study Area.

As depicted by **Figure B-2**, the Basin Study Area boundary roughly extends from the Duval Mine Road and Quail Creek subdivision north to Pima Mine Road and northeast to Wilmot Road. The southern boundary is defined by Santa Cruz County limits. The limits of the existing subdivisions west of I-19 define the western Basin Study Area boundary. The eastern boundary follows Wilmot Road on the north end and extends southerly, following the existing Quail Creek subdivision and Canoa Land Grant limits. The southern boundary includes an area east of the Elephant Head Colonia and extends farther east to Madera Canyon Road. The Old Nogales Highway and I-19 bisect the Study Area. Finally, the Study Area is further delineated by current and future land use and ownership as discussed in the following sections.

The greater Green Valley basin (Upper Santa Cruz Valley) encompasses approximately 270,000 acres. This Study concentrates on 71,200 acres divided into four focus areas within the geographical basin: the Green Valley Planning Area, the Town of Sahuarita, the unincorporated Arivaca Junction sewer service area and potential growth areas surrounding the existing infrastructure.

B.4.2 LAND OWNERSHIP

Existing land ownership patterns within and surrounding the Study Area will affect the current and future distribution of land uses. The land ownership in the Study Area is predominantly private (69%) with the remaining 31% owned by the Arizona State

Figure B-2 Green Valley Basin Study Area Boundary

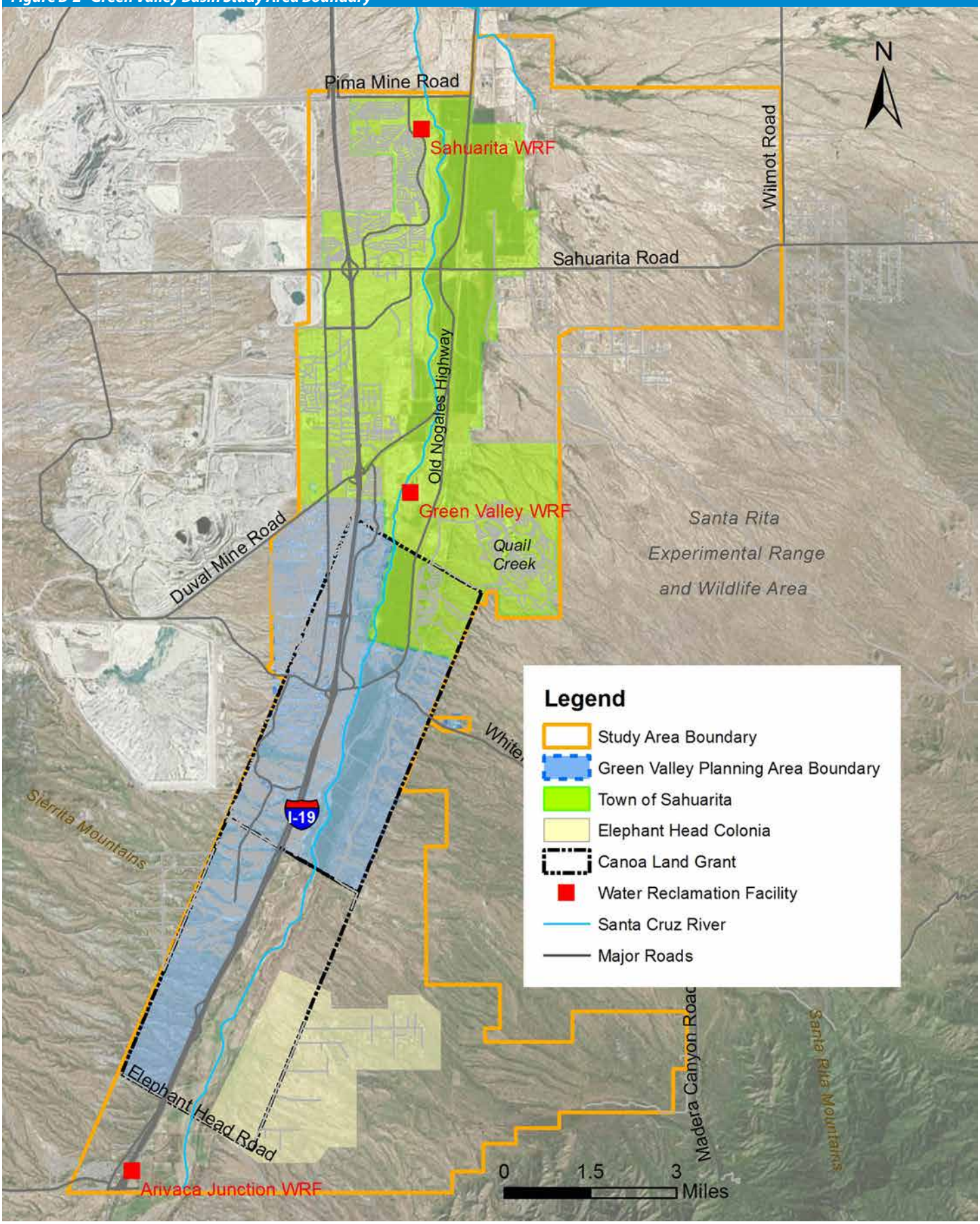
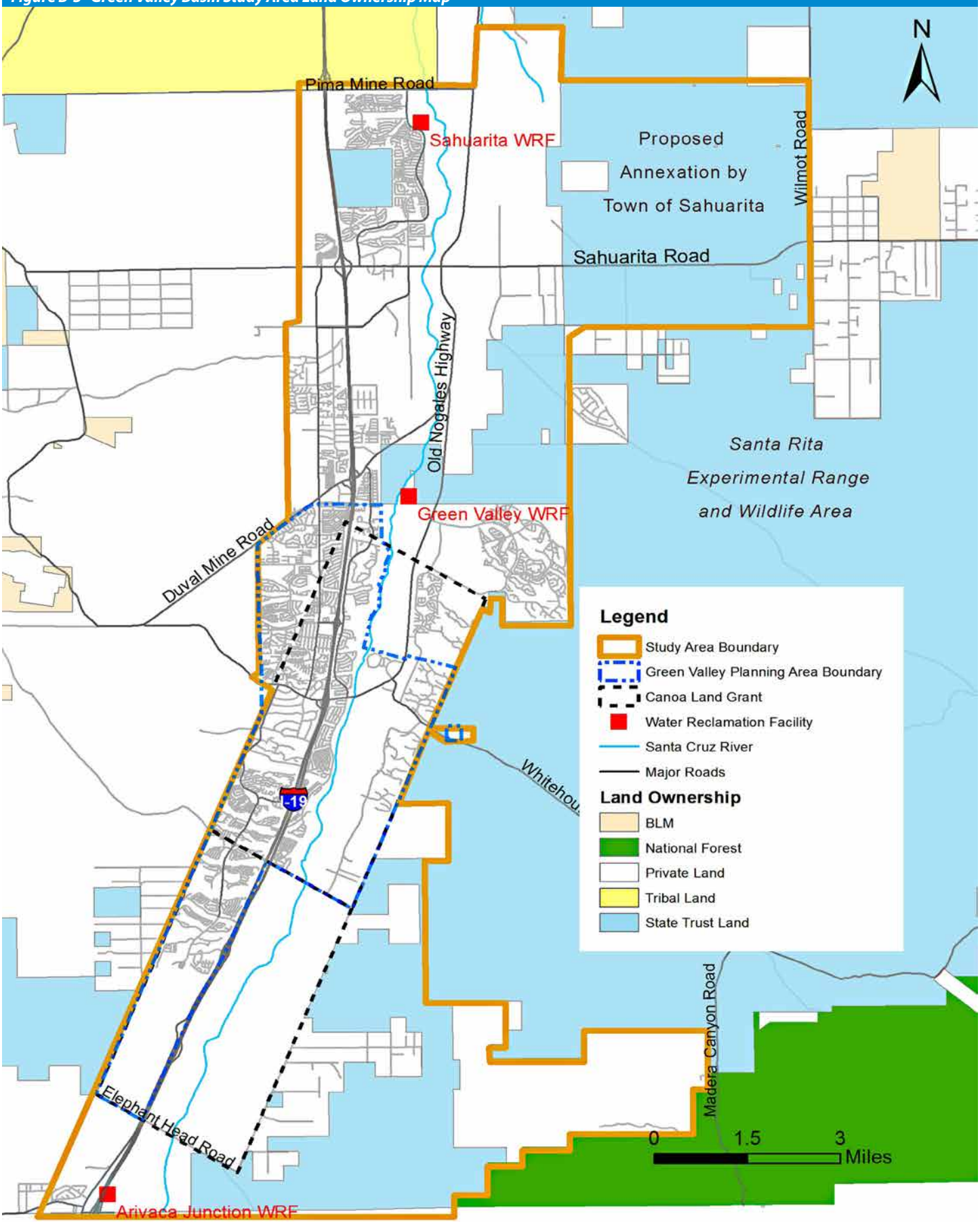


Figure B-3 Green Valley Basin Study Area Land Ownership Map



Green Valley.

Land Department (**Figure B-3**). The Study Area is almost entirely surrounded by the State Trust Land along its eastern boundary. Federal lands surrounding the Study Area are limited and consist of Bureau of Land Management (BLM) lands and the Coronado National Forest, part of the U.S. Forest Service (USFS).

Lands within the Green Valley Planning Area boundary and the Town of Sahuarita also are mostly privately owned. Land north of the Town of Sahuarita is owned by the Tohono O'odham Nation. At this time, there are no agreements between the San Xavier Reservation and Pima County for the provision of sewer service from the Green Valley WRF. The Arivaca Junction sewer service area is entirely owned by private entities. Future development on private lands will most likely occur along the I-19 corridor, or as an infill development in the existing communities.

State Trust Lands are typically reserved for the Trust beneficiaries, the largest of which is the state school system. State Trust Lands must be sold for the highest and best use to fulfill its mission to the beneficiaries. Two areas of State Trust Lands are in the vicinity of the Study Area. One is the State Trust Land in the northeast portion of the Study Area, and the other is the Santa Rita Experimental Range and Wildlife Area that stretches along Study Area's eastern boundary. Both are presented in Figure B-3. The Town of Sahuarita is proposing annexation of approximately 60 square miles of the State Trust Land adjacent to the Town's northeast boundary. The proposed annexation would extend the Town's limits east to Houghton Road and south, past Sahuarita Road; Pima Mine Road would serve as the northern boundary of the proposed annexation.

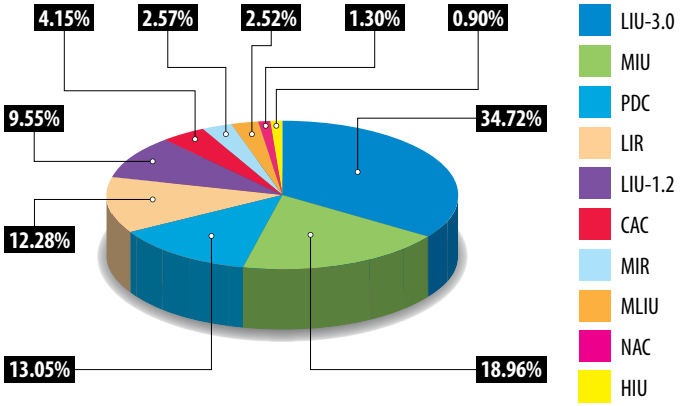
The Santa Rita Experimental Range and Wildlife Area consists of approximately 50,000 acres immediately east of the Study Area. Founded in 1903 by the USFS, the University of Arizona College of Agriculture administers this range. Due to the ongoing academic research at the Santa Rita Experimental Range and Wildlife Area, the potential for sale and development of this particular land is highly unlikely.

Pima County, through its land conservation program, owns the Historic Canoa Ranch. The Ranch consists of 4,800 acres of land bounded by I-19 on the west, Canoa Drive and Camino de Rancho Venado on the east, West Camino de Rondo on the north, and West Elephant Head Drive on the south (Figure B-3). The County purchased this area to provide stewardship and to preserve the historic ranch structures along the western bank of the Santa Cruz River. This area will remain undeveloped.

Table B-2 Green Valley Planning Area Land Use Percentage

Land Use		Area (Acres)	Percent of Total Acres
LIU-3.0	Low Intensity Urban 3.0	4,185	34.72%
MIU	Medium Intensity Urban	2,286	18.96%
PDC	Planned Development Community	1,573	13.05%
LIR	Low Intensity Rural	1,480	12.28%
LIU-1.2	Low Intensity Urban 1.2	1,151	9.55%
CAC	Community Activity Center	500	4.15%
MIR	Medium Intensity Rural	310	2.57%
MLIU	Medium Low Intensity Urban	304	2.52%
NAC	Neighborhood Activity Center	157	1.30%
HIU	High Intensity Urban	108	0.90%
Total		**12,054**	**100%**

Source: Pima County GIS, 2016



B.4.3 EXISTING LAND USE AND ZONING

GREEN VALLEY PLANNING AREA

The Green Valley Planning Area encompasses approximately 19 square miles. The planning area is depicted by a blue line in **Figure B-4**. The area encompasses the Canoa Land Grant (a remnant of Spanish law land claims) and runs south-north until it abuts the Town of Sahuarita's jurisdictional limits. Duval Mine Road defines its northern boundary while Elephant Head Road defines its southern boundary. The Santa Cruz River and the northeastern portion of the Canoa Land Grant defines its eastern boundary. The western boundary almost entirely overlaps the Canoa Land Grant's boundary. The planning area is bisected by I-19.

Land use in the Green Valley Planning Area is primarily residential with associated commercial services (i.e.: grocery, restaurants, medical offices/facilities, etc.). Agriculture exists along the eastern bank of the Santa Cruz River in the form of the FICO pecan orchards. Most of the land east and west of I-19 supports low to medium intensity use with more rural plots located farther from the Interstate.

The following table is the result of GIS analysis of land use acreage within the Green Valley Planning Area. The highest percentage of land use is low intensity urban 3.0 (LIU-3.0, 35%), followed by medium intensity urban (MIU, 19%) and planned development community (PDC, 13%) land use designation (**Table B-2**). Most of the land classified PDC is currently used for a pecan growing, but is planned for much higher densities in the future.

The predominately residential land uses on the west side of I-19 consist of subdivisions of various densities, ranging from very low (less than one residence per acre), to medium-high densities of up to 24 residences per acre. Many of the residential lots surround open space set-asides and golf courses.

South of Continental Road and west of I-19, there is a large area of unsewered residential lots in the subdivisions of Green Valley Acres, Green Valley Foothills, and Solar Del Viejo. These subdivisions include approximately 365 lots, many of which are vacant and are likely to receive service through private septic systems.

Commercial uses exist on both sides of I-19 consisting of pockets of retail stores and community activity centers. Two large retail clusters, one in the northern central section of the community and one in the southern section of the Canoa Ranch Master Planned Community, provide centralized retail and services. Almost all developments within the planning area receive sewer service from Pima County.

Table B-3 Green Valley Planning Area Zoning Districts Percentage

GV Planning Area Zoning		Total Acres	% of Zoning District within Green Valley Planning Boundary (12,487)
CB-1	Local Business Zone	236	1.89%
CB-2	General Business Zone	361	2.89%
CMH-1	County Manufactures and Mobile Home-1 Zone	26	0.21%
CMH-2	County Manufactures and Mobile Home-2 Zone	129	1.03%
CR-1	Single Residence Zone	552	4.42%
CR-2	Single Residence Zone	341	2.73%
CR-3	Single Residence Zone	1,396	11.18%
CR-4	Mixed Dwelling Type	277	2.22%
CR-5	Multiple Residence Zone	1,137	9.11%
CR-5 (GC)	Multiple Residence Zone (Golf Course)	155	1.24%
GR-1	Rural Residential Zone	5	0.04%
RH	Rural Homestead Zone	4,783	38.30%
RH (GC)	Rural Homestead Zone (Golf Course)	467	3.74%
SH	Suburban Homestead Zone	416	3.33%
SP	Specific Plan	543	4.35%
SR	Suburban Ranch Zone	20	0.16%
TH	Trailer Homesite Zone	106	0.85%
TR	Transitional Zone	1,537	12.31%
Total		**12,487**	**100%**

Source: Pima County GIS

The areas surrounding the Green Valley Planning Area are primarily low intensity rural land, zoned Rural Homestead (RH). The area consists largely of agricultural, conservation or state/federal lands, with some tracts of large-lot residential properties. The residential lots include the subdivision of Montana Vista on the west side of I-19 and north of Elephant Head Road. There is large-scale mining northwest of the planning area.

Table B-3 shows the results of GIS analysis of zoned acreage in the Green Valley Planning Area. The RH zoning (the dominant zoning district in the area), allows large-sized lots and densities of less than 1 RAC. The second prevailing zone is the TR zone, a zone suitable for both residential and commercial development. The percentage of single family residence zoning districts (CR Zone [5.4

Figure B-4 Green Valley Planning Area Land Use Map

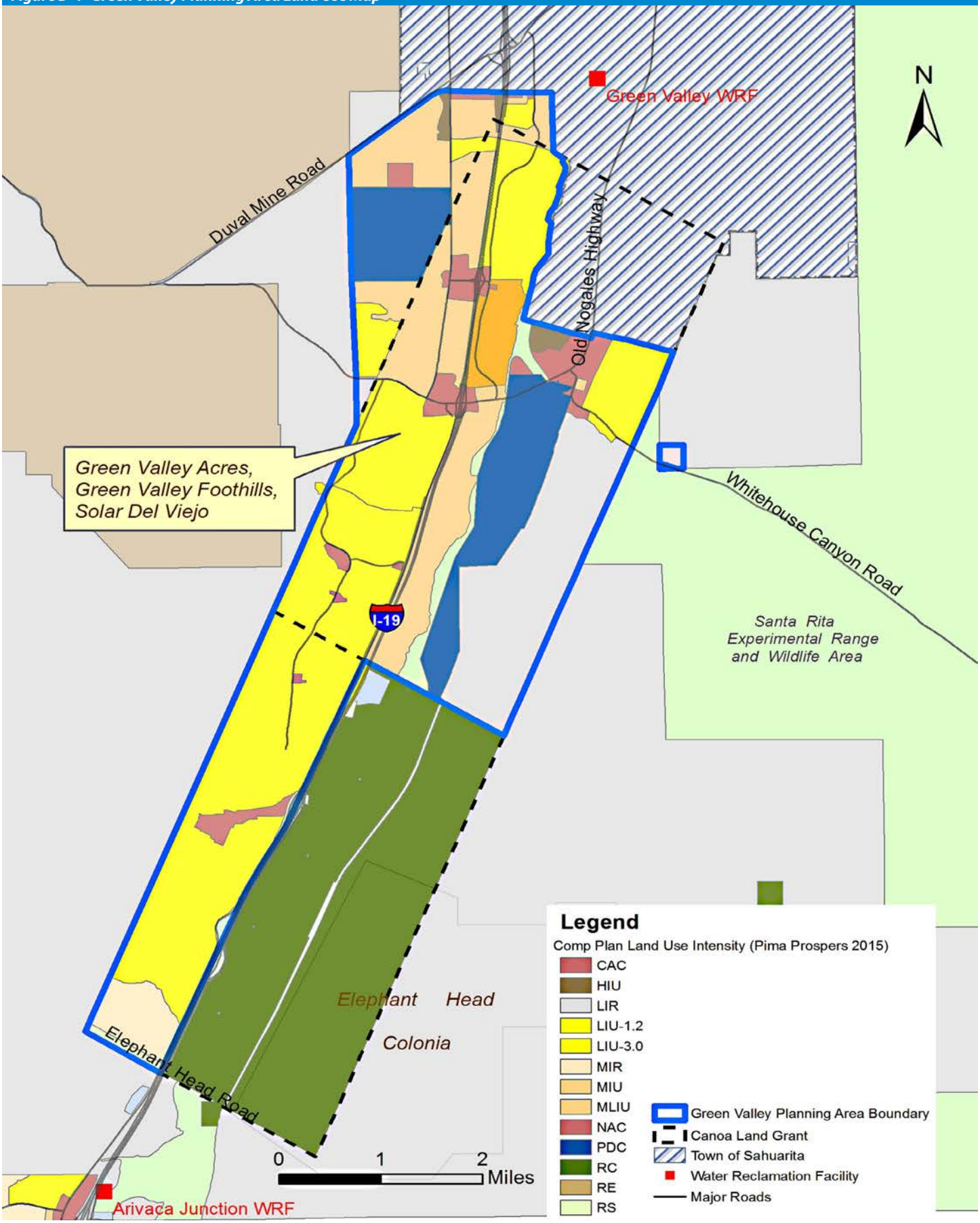
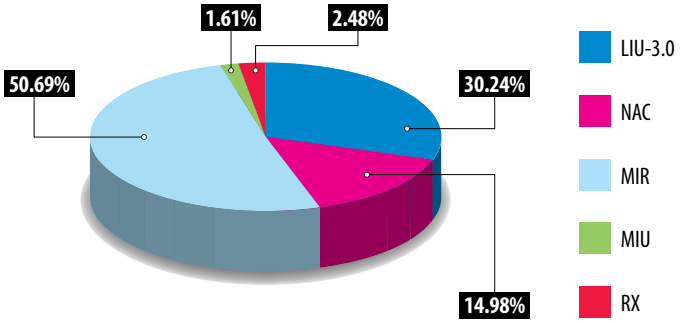


Table B-4 Arivaca Junction Land Use Percentage

Land Use		Area (Acres)	Percent of Total Acres
LIU-3.0	Low Intensity Urban 3.0	126.40	30.24%
NAC	Neighborhood Activity Center	62.61	14.98%
MIR	Medium Intensity Rural	211.85	50.69%
MIU	Medium Intensity Urban	6.73	1.61%
RX	Rural Crossroads	10.37	2.48%
Total		**417.96**	**100%**



RAC]) in the area appears to be slightly higher than other single family residence zones.

New development within the Green Valley Planning Area is likely to occur as infill development. PCRWRD anticipates construction of the planned medium-to-high density residential Canoa Ranch Block 5 development will take place in the coming years. This area is west of I-10. Approximately 540 acres south of the Canoa Ranch Block 5 also has the potential for higher-density development. The remaining planning area has a limited amount of developable vacant land.

It is unlikely that development in the Green Valley Planning Area will occur west of I-19. This area is part of the Canoa Ranch Historic Site and is owned by Pima County. The development potential in areas northwest of the planning area is limited due to the mining operations and the purchase of available land by those operations. Plans have been approved for the development of the existing pecan orchards that span from Sahuarita south through the Green Valley Planning Area. Development in this area will occur in phases over the next several decades.

TOWN OF SAHUARITA

The Town of Sahuarita is located 13 miles south of the I-10/I-19 interchange and between I-19 and Nogales Highway. The Town currently encompasses approximately 31 square miles. Its General Plan (Aspire 2035) identifies several growth areas that are highly likely to develop within the 10-year lifetime of the General Plan. These areas are concentrated around the major arterial road intersections and along the road interchanges with I-19. The State Trust Land plan area, east of the town's current jurisdictional limits, is now comprehensively planned as a part of the Sahuarita East Conceptual Area Plan (see **Figure B-6**). In addition, the Town's Special Planning Areas map shows a variety of land uses and densities planned on both sides of Nogales Highway and along the Santa Cruz River, where much of the Town's growth will occur as a result of future master-planned communities.

In 1999, in compliance with the PAG 208 Plan, the Town became a DMA. Since that time, the Town and Pima County each have service areas. There is a third area in which a development is tributary to both Pima County's and the Town's treatment facilities. The decision about which facility would treat sewage generated in this areas will be based on which of the two DMAs would be the most economical and feasible service provider.

The highest percentage of land use in Sahuarita is agricultural, followed by open space and residential. Only a small amount of land in the Town of Sahuarita is remains undeveloped. Most of the residential and commercial developments are located east of I-19 and in the northeastern portion of the Town. Large tracts of agricultural land lie along both sides of Nogales Highway. Most of the land west of the Town is vacant. Almost the entire western boundary of the Town is bounded by resource production or mining. The San Xavier Indian Reservation, part of the Tohono O'odham Nation, lies to the north. There are variations in land uses, ranging from residential and commercial to industrial, along the southern boundary and adjacent to the Green Valley Planning Area. Residential and public preserves abut the Town's east boundary.

The majority of planned development in Sahuarita will occur on land that is currently used for agricultural purposes. Over 5,600 acres of agricultural land owned by FICO is planned for development of master-planned communities that will take place over the next forty to fifty years. This scale of development will have a significant impact on system capacity for both the Sahuarita WTRF and the Green Valley WRF. While the portion of the development south of the Green Valley WRF would be gravity sewered to the Green Valley WRF (Sahuarita Farms Specific Plan, IV-53), the remaining development will require a new water reclamation facility to treat the potential 6.3 MGD of wastewater generated by the proposed FICO development.

ARIVACA JUNCTION

Arivaca Junction is a small unincorporated community approximately 32 miles south of the I-19/I-10 interchange. This community is located on the Pima/Santa Cruz County line on the western side of I-19. Land use in the Arivaca Junction is primarily residential. Limited commercial properties provide services for freeway motorists.

Lakewood Estates (which is comprised of two subdivisions), the Valley Manor subdivision and several residential and non-residential lots comprise the Arivaca Junction WRF service area. The Arivaca Junction facility serves an estimated 293 lots. Agricultural land and large low-density residential lots, served by septic systems, surround the service area. The facility lies east of I-19, in an area where the land is vacant and designated for resource transition and agricultural and low-intensity rural uses. Arivaca Junction is home to Sopori School, a 215-student elementary school, served by a septic system.

As an unincorporated community, Arivaca Junction is subject to Pima County Zoning Code. **Table B-4** provides an overview of land use designations in Arivaca Junction. A low intensity rural use

Peak flows for the facility generally occur in February. This trend is reflective of the retirement and winter visitor demographic in the Green Valley area, which results in the reduction in population in the hotter months.

(LIR) is the predominant land use in Arivaca Junction and the surrounding areas. Some 530 acres of land west of I-19 is designated a resource sensitive (RS) use.

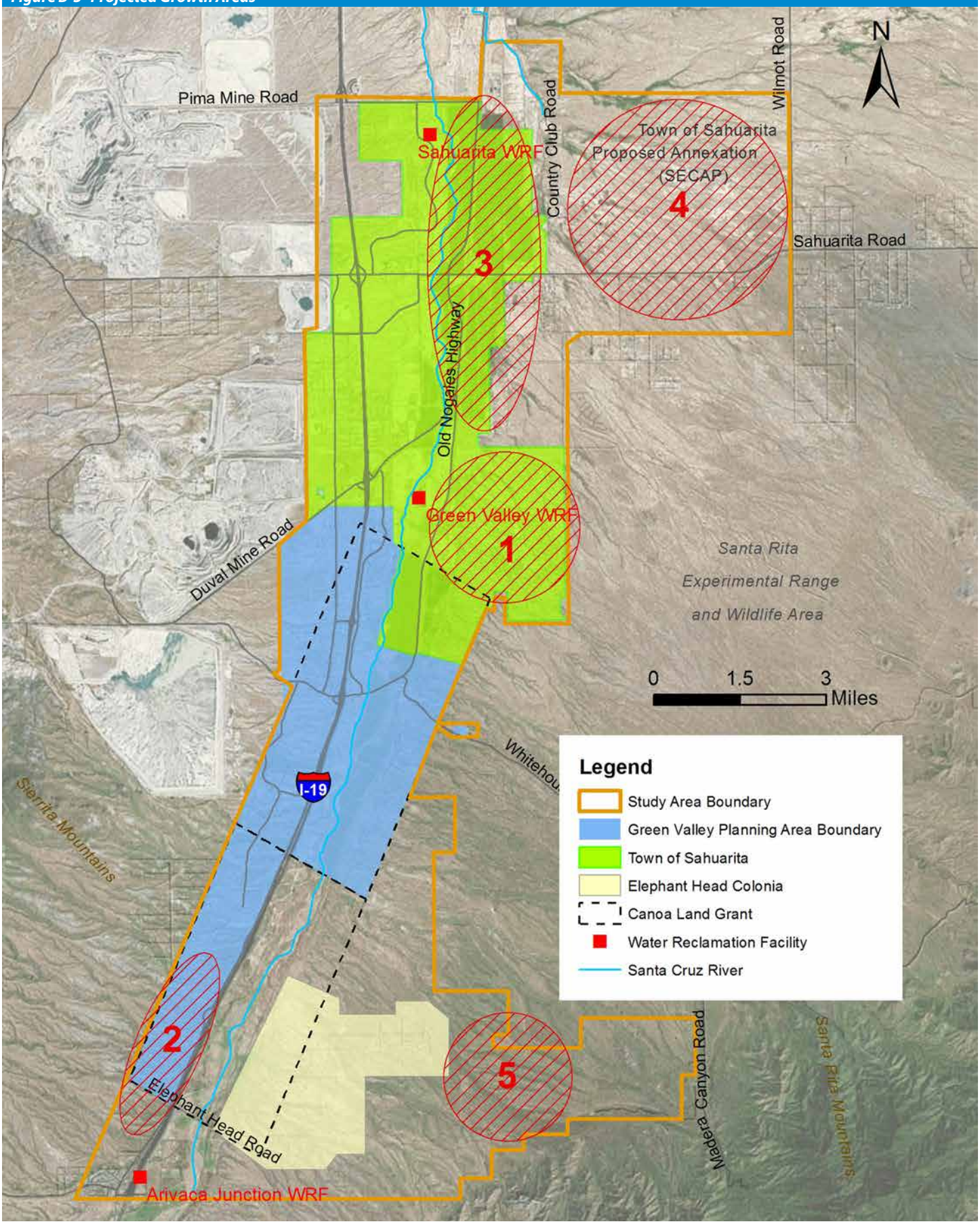
There are several development plans in Arivaca Junction that could influence further development between Arivaca Junction and the current Green Valley Planning Area. First, the Amado Territory Inn resort is located just south of the Pima/Santa Cruz County line. Second, there are plans for Sopori Ranch, a master planned community of 6,800 residential units that lies west of I-19 along the County line in Santa Cruz County. Finally, a ten-acre commercial development that includes a hotel, automobile service station and a car wash is planned south of the facility on the east side of the Interstate. At this point it is unclear if this development would be served by septic or the public sewer.

B.4.4 GROWTH AREAS

With a primary focus on vacant land, this section provides an assessment of land in areas outside the Green Valley Planning Area, the Town of Sahuarita, or the Arivaca Junction WRF service area. The assessment examines possible buildout of vacant lands and an assessment of potential developments. After the buildout of platted subdivisions, these vacant areas have the largest potential impact on the Green Valley WRF. Existing conditions, land ownership, potential for up-zoning and specific plans form the basis for the identification of these areas as potential growth areas. PCRWRD has ranked these areas according to the perceived development potential.

In Section **B.9** Population Projections Calculation, each area is evaluated based on current development trends and future poten-

Figure B-5 Projected Growth Areas



tial for development. These areas are: 1) Green Valley WRF service area, 2) Arivaca Junction North, 3) Rancho Sahuarita master-planned community and FICO Development, 4) Sahuarita East Conceptual Plan Area (SECAP), and 5) Elephant Head East. A full diagram of the areas is available in **Figure B-5**.

1) Green Valley WRF Service Area

This growth area includes infill of platted lands throughout the existing Green Valley WRF service area. The area is ranked high since vacant parcels will most likely be built out prior to additional subdivision development. There is particular interest in the Quail Creek and Madera Highlands subdivisions as they are currently in construction. Buildout of these subdivisions presents the most immediate impact on the Green Valley WRF. Other subdivisions under construction in this growth area include Stone House and Madera Reserve. See Section B.9 for detailed information on subdivisions.

2) Arivaca Junction North

The initial platting process and permitting has begun for the Canoa Ranch Block 5 and an adjacent Green Valley Hills subdivision. If private landowners sell, it is possible that development would continue south to Arivaca Junction. Over 3,600 acres of vacant land (a portion of the 114,400-acre county-preserved Marley Ranch west of I-19), surround the Arivaca Junction service area. This vacant land and 756 acres owned by Free McMoran Copper and Gold have the potential of being converted into residential properties

3) Rancho Sahuarita Specific Plan and FICO Development

This growth area is comprised of infill and future specific plan developments: the existing Rancho Sahuarita master-planned community and the Sahuarita Farms Specific Plan development. Located entirely within the Town of Sahuarita's DMA, the Rancho Sahuarita's remaining infill development will receive wastewater services from the Town of Sahuarita.

There also are plans for master-planned communities on 5,600 acres of farmland owned by the Farmers Investment Company (FICO). The Sahuarita Farms Specific Plan (SP) includes development standards for approximately 20,000 residential units, commercial, retail, recreation and other uses (see Section B.9.3 for more details). Only a small portion of this large-scale development could receive service through a gravity sewer to the Green Valley WRF.

4) Sahuarita East Conceptual Area Plan (SECAP)

The SECAP area, as depicted in **Figure B-5**, represents a largely vacant state-owned area that extends east of the current Town of Sahuarita's limits to Houghton Road, bounded by the Santa Rita Experimental Range and Wildlife Area to the south, the City of Tucson limits to the north; it extends up to Old Vail Connection Road at its northernmost limit. The Town of Sahuarita will annex and develop this 47-square mile area in phases over the 20-30 years. Plans for the SECAP area include a mixture of uses that will be supported by multimodal transportation and infrastructure expansion and improvements. According to Town of Sahuarita's General Plan, Aspire 2035, the SECAP area has a combined estimated buildout of 53,600 dwelling units and up to 134,000 people. Sewer service will be provided by either the Town of Sahuarita or Pima County.

5) Elephant Head East

The projected growth area east of the Elephant Head Colonia and west of the Coronado National Forest consists of approximately 4,500 acres of large undeveloped parcels. While there are individual property owners in the area, most of the land is divided by four land holding companies or trusts. This area is currently more than 3.25 miles from existing sewer lines. The likelihood of development requiring sewer service in this area is minimal. However, acknowledgment of the area is necessary for a complete understanding of the full Basin Study Area population buildout.

B.4.5 DEVELOPMENT CONSTRAINTS

In addition to the environmental and research constraints imposed by the Santa Rita Wildlife Range and Experimental Area, the Green Valley basin includes a number of conservation-sensitive lands as defined in the Sonoran Desert Conservation Plan (SDCP). Development of the SDCP began in 1998 by the Pima County Board of Supervisors and has consisted of an intergovernmental and public participatory planning process. The SDCP preserves critical habitat and biological corridors, provides riparian restoration, conserves mountain parks, assists in historical and cultural preservation and conserves Pima County's ranching tradition.

Green Valley and the areas surrounding the Santa Cruz River, south of Sahuarita, are one of the key wildlife corridors in the plan. In addition, the history behind the Canoa Ranch Historic Site makes the area a priority historic site in the cultural resources division of the plan. The area east of the development along I-19 to the Santa Rita Experimental Range and Wildlife Area received a designation of significant ranch lands, indicating a desire to maintain the open space provided by these lands. Finally, due to the natural riparian sites along the Santa Cruz River, the entire area, from Sahuarita to Arivaca Junction, has been selected for riparian restoration and rehabilitation in conjunction with an effluent-based riparian project.

CONSERVATION LAND SYSTEM (CLS)

The Sonoran Desert Conservation Plan also impacts future land use and the ability for lands to be rezoned. Depending on the classification within the Conservation Land System (CLS), if an area is to be rezoned to a higher density, open space set asides are required. The important Riparian Areas classification is most stringent classification, requiring a 95% set aside, followed by the Biological Core Management Areas classification with a required 80% set aside. The Multiple Use Management Areas classification requires a 66% set aside. Most of the areas surrounding the Green Valley Planning Area are Multiple Use Management Areas or Biological Core Management Areas. Areas surrounding the Santa Cruz River and its tributaries are Important Riparian Areas. While the CLS guidelines ensure development plans must respect environmentally sensitive areas, they also restrict the amount of land that can be developed and present constraints to future development in the area.

B.4.6 DEMOGRAPHICS AND POPULATION

The demographics of the population that receives wastewater services is among the most important factors in assessing those services. This section provides a general overview of the current demographics of the inhabitants of the sewer service basin.

Table B-5 TAZ Based Service Area Population Estimates and Projections								
Year	2010	2015	2020	2025	2030	2035	2040	2045
Entire Basin Study Area Population	46,861	51,612	56,844	62,607	68,953	75,944	83,643	91,330
Green Valley WRF Service Area Population	30,899 23,125 (based on actual ADWF, 1.85 MGD)	33,016 24,704	35,124	37,241	39,243	41,076	42,633	43,775

DEMOGRAPHICS

Demographics impact wastewater service and treatment capacity from the amount of influent to the strength of the influent. Historically, Green Valley has consisted primarily of age restricted-retirement communities. The 2010 U.S. Census Bureau indicates that the median age in Green Valley is 71.2.

Green Valley - Population Breakdown

- 25 and under 2.7%
- 26 – 61: 16.7%
- 62+: 80.6%
  - 65+: 72.0%
  - 75+ 37%

The GVCCC details the age distribution of the community in the *Green Valley Community Plan 2006*. The GVCCC acknowledges that Green Valley will remain a retirement community, however, it recognizes an increasing interest of younger retirees (55+) who seek to live in the area. To this end, the GVCCC anticipates that in addition to the expected seasonal fluctuation, a steadier year-round population will lead to the construction and occupation of new and more expensive primary residences. The influx of this younger population, will result in residents with a more active lifestyle, a greater interest in employment, higher incomes and a desire for diversified and more upscale services. This trend will create a positive impact on the local economy.

The Town of Sahuarita's market is families with children. In contrast to Green Valley, the median age in the Town is 34.4.

Town of Sahuarita – Population Breakdown:

- 19 and under: 31.3%
- 20-24: 3.8%
- 25-44: 30%
- 45-59: 13.4%
- 62+: 18.7%

Also in contrast with Green Valley's older population, the median age in Arivaca Junction is 35.3.

Arivaca Junction – Population Breakdown:

- 19 and under: 34.3%
- 20- 24: 4.8%
- 25-44: 22.2%
- 45 – 59: 20.7%
- 62+: 16%

POPULATION OVERVIEW

Population analysis for Pima County is available from a variety of sources including the U.S. Census Bureau, the Arizona Department of Administration and the PAG. The Green Valley WRF is responsible for service to sewered properties in Green Valley and in portions of the Town of Sahuarita.

PAG has issued population estimates based on transportation planning modeling (2045 Regional Transportation Plan) through the TAZ analysis. Transportation modeling takes into account local planning data such as comprehensive plans, general plans, special plans, habitat conservation plans, building permit data and designated future land uses. The TAZ analysis offers regional data for eastern Pima County.

The 2000 U.S. Census estimated a population of 17,283 living in Green Valley. The 2010 Census estimated the total population at 21,391, which reflects a 23% increase, or an annual growth rate of 2.2%. The TAZ population projections show 31,534 people living in the Green Valley community by 2045.

The 2010 Census data for the Town of Sahuarita was estimated at 3,242. The 2010 Census estimated the total population at 25,259, a growth rate of 680%, or an annual growth 22.8%. The TAZ population projections show that by 2045, there will be 54,729 people living in Sahuarita.

GREEN VALLEY WRF SERVICE AREA POPULATION

The first row of **Table B-5** includes the population projections for the entire Basin Study Area, including the Town of Sahuarita, Green Valley and Arivaca Junction. The TAZ population data shows 46,861 people lived in the area in 2010, which is 24,316 more than in 2000 (22,545). By the year 2045, the Basin Study Area is projected to have a population of 91,330.

The table shows that when the portion of population served by the Sahuarita WTRF and the population served by septic systems are subtracted from the entire basin study area population, in 2010, the Green Valley WRF served 30,899. By 2045, it is projected that the Green Valley WRF will be serving 43,775 people. This represents an annual growth of 1.0%. However, the population as estimated based on the 2010 average daily water flow (ADWF) of 1.85 MGD was lower than the TAZ estimates. This population was 23,125 and was used in the flow projections in Section B.6.3.

Communities served by septic systems include Madera Foothills Estates, Pasadera, and Colonia Real; all are located within the eastern boundary of the Canoa Land Grant. The Elephant Head Colonia, located further south, is also served by septic. Existing and future populations in the communities served by septic are likely to remain on septic, thus this population was not counted in the PCRWRD's population and flow projections.

It is important to note that a portion of the total 134,000 people that is expected to live in the SECAP area could potentially be served by the Green Valley WRF. The SECAP area is located in the Joint Planning Area East which can be served by either the Town of Sahuarita or Pima County. This population is included in the table above.

Green Valley Water Reclamation Facility.

Households and Vacancy Rates

The U.S. Census estimated that in 2010, there was a total of 17,322 housing units in Green Valley, and a 4.9% homeowner vacancy rate. The County's vacancy rate for that same year was 2.9%.

B.4.7 WATER RESOURCES

This section discusses the existing conditions of the hydrologic setting, water supply and floodplain. The Arizona Department of Water Resources (ADWR) through the Office of Assured and Adequate Water Supply Program has designated five Active Management Areas (AMAs) to protect and preserve the limited groundwater supplies within each area. The Green Valley basin and service area lies within the Tucson and Santa Cruz AMAs. ADWR requires that each new subdivision within the AMAs provides a demonstration of physical availability, a designation of assured water supply, an analysis of assured water supply and a certificate of assured water supply.

HYDROLOGIC SETTING

The Santa Cruz River is the primary surface drainage basin in eastern Pima County and the Basin Study Area. Approximately 60 miles long and mostly ephemeral (in Pima County), the river flows north through the Upper Santa Cruz Valley Sub-Basin and northwest into the Avra Valley Sub-Basin. Major tributaries of the Santa Cruz River in the Upper Santa Cruz Valley Sub-Basin are the Canada del Oro Wash and the Rillito Creek. The Canada Del Oro Wash drains the northern part of the Upper Santa Cruz Valley Sub-Basin. The Rillito Creek drains areas north and east of Tucson.

The Green Valley WRF is located approximately 250 feet from the Santa Cruz River, over groundwater of the Tucson AMA. Bank protections along the Santa Cruz River have been constructed to protect the facility during a 100-year flood event. Depth to the groundwater is approximately 150 feet below land surface. The groundwater runs north to northwest with the nearest point of use being the Quail Creek irrigation well (#I-4). This well is located approximately a half mile southeast (upgradient) of the Green Valley WRF.

WATER SOURCES

The Town of Sahuarita and the community of Green Valley are located in the Tucson AMA. The water service providers for the communities are the Community Water of Green Valley, the Green Valley Water Co., the Farmers Water Co., the Rancho Sahuarita Water Co., the Valle Verde del Norte Water Co. and the Las Quintas Serenas Water Co. At this time, groundwater is the only source of water for these communities. Other locations within the Tucson metropolitan area have access to Colorado River water through the Central Arizona Project (CAP). CAP infrastructure to serve the Green Valley basin has not been built.

Alternatives to pumping groundwater in the Green Valley area are limited. The federal government recently approved an eight-mile pipeline that would bring CAP water to the proposed Rosemont Copper Mine to eliminate potential groundwater overdraft by

Green Valley Water Reclamation Facility.

the mine. Other users could receive CAP allocations in the future; however multiple issues regarding CAP allocation prevail. A groundwater overdraft by farms, mines and other water companies serving homes and businesses in the Green Valley area remains a problem.

Currently three sites within the Study Area provide groundwater recharge to the aquifer. They are located at the Town of Sahuarita WTRF recharge site, the Green Valley recharge site, and the Robson Ranch Quail Creek water storage facility, which receives effluent from the Green Valley WRF.

The community of Arivaca Junction is located in the Santa Cruz AMA. The AMA consists of 716 square miles bounded entirely to the west and north by the Tucson AMA. Approximately 20,000 acre feet of water is used annually in the Santa Cruz AMA.

FLOODPLAIN

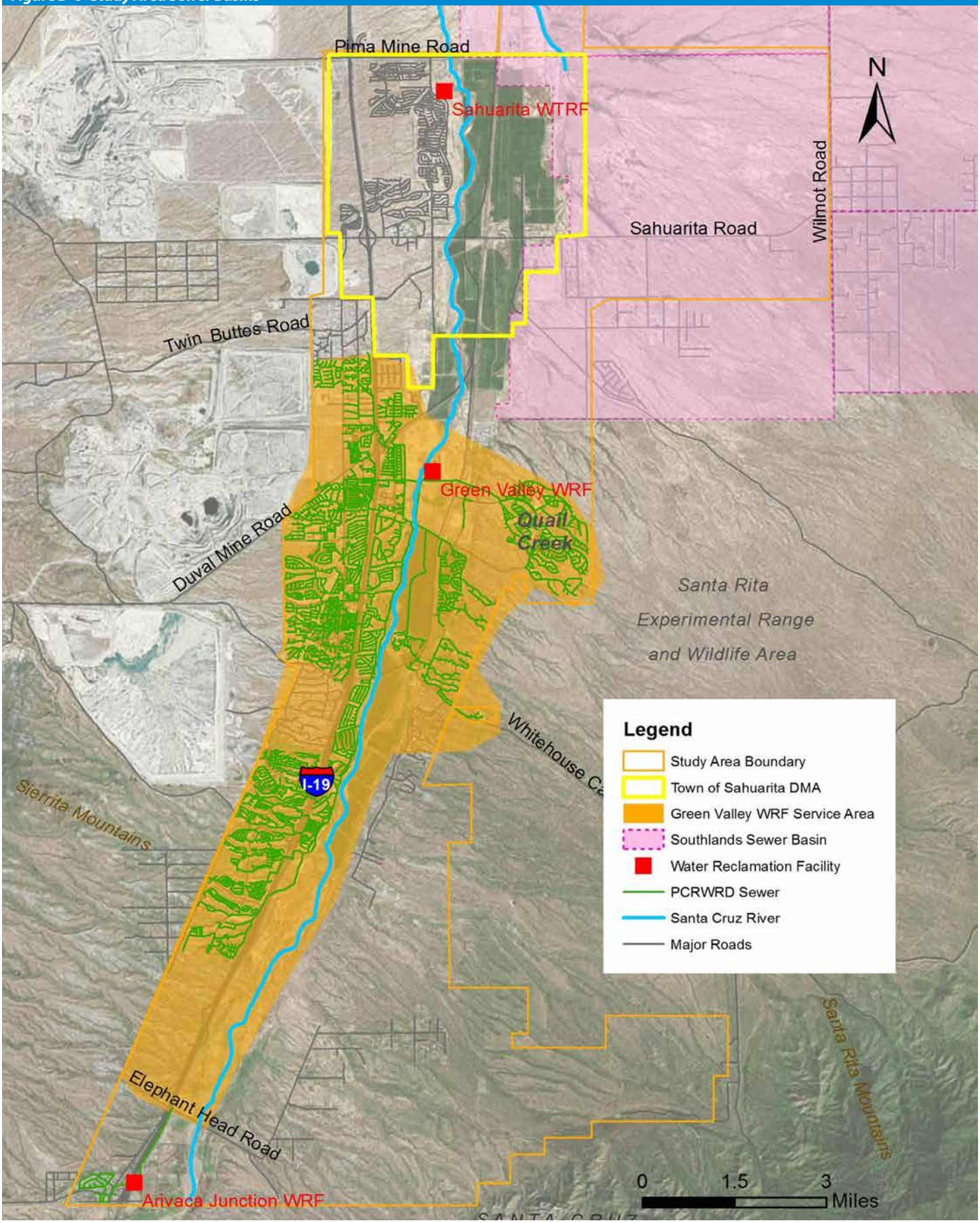
The Green Valley WRF is located in the 100-year floodplain of the Santa Cruz River. The 100-year floodplain affects development as well as pipe depth and placement. The U.S. Department of Homeland Security's Federal Emergency Management Agency's 100-year floodplain determines the necessity for additional permitting. Cases are assessed on a project-by-project basis; however current buildout and projected development is not occurring within the 100-year floodplain. Augmentation to the conveyance system could require additional permitting.

B.5 SEWER BASINS AND TRIBUTARY SUB-BASINS

A sewer basin is defined as a topographical area that consists of one or more tributary areas from which wastewater flows by gravity to the larger sanitary sewer system. The existing Green Valley Sewer Basin encompasses approximately 55 square miles and includes the Green Valley WRF service area and the southern portion of the Town of Sahuarita served by the facility (**Figure B-6**). Wastewater generated in these areas is conveyed by gravity to the Green Valley WRF. Adjacent sewer basins include the Town of Sahuarita WTRF service area to the north and the Southlands sewer basin to the northeast.

Located in the Upper Santa Cruz Valley, the Green Valley Sewer Basin ranges in elevation from 2,780 feet to over 6,100 feet above mean sea level (msl). The Sierrita Mountains (approximately 6,100 feet above msl) to the west and Santa Rita Mountains (approximately 6,200 feet above msl) to the east act as the high elevation points and provide the east/west boundaries of the sewer basin. The Santa Cruz River bisects these mountain ranges at the lowest point in the area. The Santa Cruz River ranges in elevation from 3,030 feet above msl at the Pima/Santa Cruz County line to 2,780 feet above msl at the Green Valley Water Reclamation Facility. The Santa Cruz River continues to decrease in elevation, north of the Green Valley WRF.

Figure B-6 Study Area Sewer Basins



TRIBUTARY SUB-BASINS

The Green Valley Sewer Basin can be further divided into 8 tributary sub-basins (**Figure B-7**). These divisions are based on a review of existing wastewater conveyance system, topography, tributary areas and projected growth. The sub-basins are: GV1, GV2, GV3, GV4, GV5, GV6, GV7, and GV8.

Sub-Basin GV1

The existing sewer network defines Sub-Basin GV1. The sub-basin measures approximately 3.5 square miles. The tributary area of GV1 consists of mostly residential developments. GV1 sits at a lower elevation than the Green Valley facility, so the department pumps sewage from the developments to the facility. There are two pump stations that serve the area, 8BLAR1 and 8B644 (**Figure B-7**). The department expects additional flow upon buildout of several platted subdivisions in GV1.

Sub-Basin GV2

The existing sewer network defines Sun-Basin GV2. The tributary area consists of the residential subdivisions of Quail Creek and Stone House that are still under construction. The sub-basin measures approximately 6.8 square miles. The department conveys Influent flows from the subdivisions via the Quail Creek pump station (8B6511) directly to the Green Valley WRF to the northwest.

Sub-Basin GV3

Sub-Basin GV3 extends on both sides of I-19 and encompasses approximately 16.2 square miles. The existing gravity sewer network defines this sub-basin. The tributary area of GV3 consists of the residential subdivisions of Madera Highlands, Madera Reserve, Santa Rita Springs and Springs at Santa Rita on the east side of I-19, and Canoa Ranch on the west side of I-19. The department expects additional flow upon buildout of these subdivisions.

Sub-Basin GV4

The existing sewer network defines Sub-Basin GV4. Its tributary area consists of residential developments and commercial developments along I-19. The sub-basin measures approximately 6.1 square miles. The 21-inch and 30-inch sewer pipes east of I-19 define the basin's eastern boundary. PCRWRD conveys influent from this area to the Green Valley facility to the north. The area comprising GV4 is fully developed and the department anticipates no new development that would require major system augmentation. There are several platted subdivisions that would contribute additional flow upon buildout. The sub-basin measures approximately 2.7 square miles.

Sub-Basin GV5

The existing sewer network and area topography define Sub-Basin GV5. The area generally slopes northwest to southeast towards the Santa Cruz River. GV5 consists of residential developments on the east and west side of I-19. The 18-inch main that conveys flow north to the Green Valley facility defines the sub-basin's eastern boundary. Private on-site septic systems serve residential developments in the northern portion of the sub-basin. There are several platted subdivisions that would contribute additional flow upon buildout. The sub-basin measures approximately 2.7 square miles.

Sub-Basin GV6

Sub-Basin GV6 encompasses approximately 19.3 square miles and includes the southeastern portion of the Basin Study Area which is mostly vacant land. Due to lack of sewer infrastructure in this sub-basin, topography and projected growth (Growth Area 5) define the sub-basin. GV6 slopes southeast to northwest towards the Santa Cruz River. The Elephant Head Colonia, which is served by septic systems, is in Sub-Basin GV6. Due to large parcel size and great distance from the public sewer (minimum 3.25 miles), the department expects that future development in GV6 will be dependent on septic systems. A connection to the Green Valley WRF would require a major system extension.

Sub-Basin GV7

Topography defines Sub-Basin GV7 which is located on the east side of I-19. This sub-basin gradually slopes southeast to northwest towards the Santa Cruz River. It encompasses 14.4 square miles. Farm and ranch land largely define this sub-basin. The Arivaca Junction WRF and the pump station 8B6501 are located in GV7, but serve residential subdivisions located in a different basin, west of I-19. Because PCRWRD plans to eventually remove the Arivaca Junction WRF from service, the department would convey flows from future developments in this sub-basin to the Green Valley WRF. There are no near-term development plans in GV7.

Sub-Basin GV8

The existing sewer network, topography, and projected growth define Sub-Basin GV8. This sub-basin includes the southern portion of the Canoa Ranch Master Planned Community (Canoa South), the area between West Elephant Head Road and Arivaca Junction, and the Arivaca Junction WRF service area. The entire sub-basin encompasses approximately 3.7 square miles. There are two planned subdivision developments in this area: Canoa Ranch South and Green Valley Hills. These developments would bring 6,800 more people in GV8.

B.6 EXISTING WASTEWATER INFRASTRUCTURE

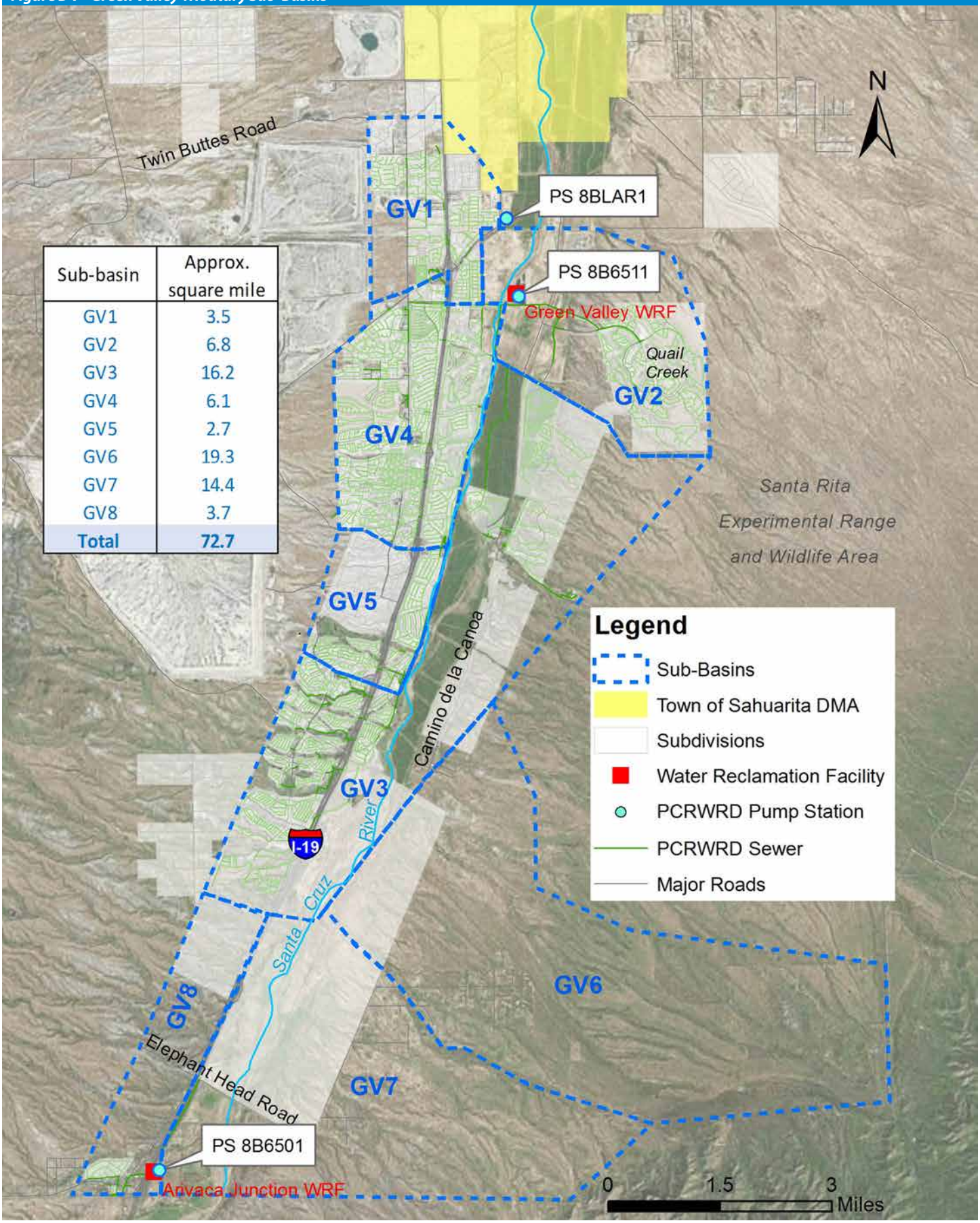
Two factors define sewer service in the Study Area: topography and the Pima County and Town of Sahuarita DMAs. Future developments in the designated Joint Planning Areas east and west of the Town of Sahuarita would be tributary to either DMA. The two agencies will continue to work together to decide which of the two will be the service provider at the time the demand for service arises.

B.6.1 CONVEYANCE SYSTEM

The conveyance infrastructure in the service area consists of approximately 226 miles of public sewer pipes that range from 8 to 30 inches in diameter. The service area consists of 86.0% residential, 14% commercial, and 0.1% industrial users. There are 4,811 public manholes and 385 cleanouts (GIS data analysis, April 2014).

There are no major augmentation projects planned in the Study Area at this time. The future development-driven extension of the existing gravity sewer from Elephant Head Road downstream to the Green Valley WRF, will be a joint effort between PCRWRD and the Canoa developers.

Figure B-7 Green Valley Tributary Sub-Basins



Sub-basin	Approx. square mile
GV1	3.5
GV2	6.8
GV3	16.2
GV4	6.1
GV5	2.7
GV6	19.3
GV7	14.4
GV8	3.7
Total	**72.7**

B.6.2 TREATMENT SYSTEM

There are three water reclamation facilities in the Basin Study Area. Two belong to Pima County and one belongs to the Town of Sahuarita. PCRWRD's sub-regional facilities in the Basin Study Area include the Green Valley WRF and the Arivaca Junction WRF. The following section provides a detailed description of each facility, including the treatment processes and facility outlook. There is also information on the Town of Sahuarita WTRF.

GREEN VALLEY WATER RECLAMATION FACILITY

Facility Location and Service Area

The Green Valley Water Reclamation Facility lies approximately 20.5 miles south of the I-10/I-19 interchange in Township 17S, Range 13E, Section 36. The facility is located in the Town of Sahuarita on four county-owned parcels totaling 68.4 acres. The facility is adjacent to the Santa Cruz River, an ephemeral river which flows north from headwaters in the San Rafael Valley, and lies at approximately 2,780 feet above msl. The depth to groundwater near the facility is approximately 150 feet below ground surface. The Green Valley WRF does not discharge effluent into the Santa Cruz River.

The facility borders the east bank of the Santa Cruz River; vehicular access to the facility is via South Old Nogales Highway to the east of the site. Surrounding land uses are primarily urban with medium density residential developments and commercial properties. Industrial mines are located within three miles to the west of the facility. Land ownership surrounding the facility is primarily State Trust Lands.

The Green Valley WRF service area encompasses approximately 27 square miles, and extends along both sides of I-19, primarily serving the retirement community of Green Valley and properties west of the Santa Cruz River. It also serves some properties east of the river. The service area includes the southern portion of the Town of Sahuarita. It extends roughly 9.5 miles north to south, from about a half-mile south of Twin Buttes Road, to about a mile and a half south of the Duval Mine Waterline Road. Along most of its length, the current service area is between one and four miles from east to west.

The facility's zoning, along with the majority of the surrounding area, is Rural Homestead (RH) as per Chapter 18.13 of the Town of Sahuarita Zoning Code. The closest residential subdivision, La Joya Verde III (also located within the Town), is approximately 1,400 feet due west of the facility's western property line. Robson's Quail Creek Master Planned Community is located just over one mile southeast of the facility's southeastern property boundary. Other close developments are at least 2,000 feet southwest and 2,500 to 3,000 feet northwest.

Facility Capacity and Current Flows

The Green Valley WRF has a permitted capacity of 4.1 MGD. The average monthly flow recorded in 2015 was 1.836 MGD (45% capacity). The highest average monthly flow was recorded in February of 2011 and was at 2.216 MGD (54% capacity) (**Table B-6**).

Influent flow to the facility varies by season. Annual influent averages appear in **Table B-6**. Historical flow data, available since 1999, indicates a drastic reduction in flow during the summer months, with the lowest flows generally occurring in June. Until 2003, the department calculated percent capacity on 2.1 MGD. In 2004, when the BNROD expansion went online, the department began calculating percent capacity on 4.1 MGD.

Peak flows for the facility generally occur in February. This trend is reflective of the retirement and winter visitor demographic in the Green Valley area, which results in the reduction in population during the hotter months. There is an average of 35.4% change in influent flows between the facility's peak and base months.

Treatment Process

Expansions of the treatment facility occurred in 1972, 1981, and 2003. The facility has two independent treatment trains: a 2.1 MGD aerated lagoon system with percolation bed disposal (constructed in 1981) and a 2.0 MGD BNROD (constructed during the 2003 expansion). Combined, both treatment trains provide a total permitted capacity of 4.1 MGD. The BNROD produces effluent that is sent to Quail Creek; the remaining wastewater is treated by the lagoons. Each treatment train shares a common headworks, a 2.1 million gallon lined emergency influent storage basin and an influent pump station.

Flow to the facility's headworks comes from two pipes and enters the facility at MH 7050-01B via two channels. Each channel has a mechanically-cleaned barscreen and washer compactor. One pipe is a 27-inch vitrified clay pipe (VCP) (built in 1978) which directs flow from the west and south. The second pipe is 21-inch PVC pipe that was built in 1990. This pipe directs flow from the east and south. The 27-inch VCP splits 380 feet from the facility (at MH 7050-01A1) into a 21-inch Asbestos Concrete Pipe (ACP) built in 1965 and a 16-inch ductile iron pipe. The ACP directs flows from the south. The 16-inch ductile iron pipe directs flow from the west and crosses the Santa Cruz River. All flows go through grit removal to the influent pump station located after the headworks. In addition, a pump station servicing the Quail Creek subdivisions is located at MH 7199-PMP. Just before the headworks, there is a lined emergency overflow basin. In the event of a general equipment failure in the treatment trains or headworks, sewage can be diverted to the emergency basin and can be stored there until operations return to normal. The 280,800 cubic-foot basin has an overflow capacity of 2.1 MGD.

Once influent clears the pump station, flow is split between the two treatment trains. The flow split is controlled by an automatically adjusting control gate. Operators determine the desired flow split, and adjust the gate to direct the influent flows. The BNROD is the primary treatment train, and receives flow up to a permitted capacity of 2.0 MGD (currently 1.8 MGD goes through BNROD). The BNROD treatment train has a 2.0 MGD biological nutrient removal oxidation ditch, two secondary clarifiers with return activated sludge and wasting sludge station, two disk filters, two chlorine contact chambers for disinfection and a service water pump station. The BNROD solids handling train consists of wasting to gravity belt thickeners, which discharge to two air mixed solids holding tanks. The thickened solids in the holding tanks can either be loaded into tankers and hauled to the Tres Rios collection system for disposal, or be pumped to a belt filterpress, sludge drying beds, and a dried-sludge storage area. This BNROD process produces effluent that meets the Class A+ reclaimed water requirements. At this time, the effluent from the BNROD process is sent to a contracted end user. It can also be discharged to the Santa Cruz River under a AZPDES

Table B-6 Green Valley WRF Annual Influent Flow								
Year	Capacity (MGD)	Annual Average Influent (MGD)	Percentage of Capacity (Avg Amt Influent/Capacity)	Peak Influent (Monthly Avg Amt in MGD)	Percent of Capacity (Peak Influent/ Capacity)	Lowest Influent (Monthly Avg Amt in MGD)	Percentage of Capacity (Lowest Influent/ Capacity)	Percentage Change Peak to Low
1999	2.1	1.563	74.43%	February, 1.903	90.62%	June, 1.252	59.62%	34.21%
2000	2.1	1.629	77.57%	February, 1.965	93.57%	July, 1.337	63.67%	31.96%
2001	2.1	1.655	78.81%	February, 2.037	97.00%	June, 1.344	64.00%	34.02%
2002	2.1	1.708	81.33%	February, 2.062	98.19%	June, 1.392	66.29%	32.49%
2003[1]	2.1	1.631	77.67%	February, 2.142	102.00%	November, 0.776	36.95%	63.77%
2004 [2]	4.1	1.634	39.85%	February, 1.950	47.56%	June, 1.317	32.12%	32.46%
2005	4.1	1.719	41.93%	February, 2.043	49.83%	June, 1.409	34.37%	31.03%
2006	4.1	1.780	43.41%	March, 2.105	51.34%	June, 1.45	35.37%	31.12%
2007	4.1	1.792	43.71%	February, 2.102	51.27%	June, 1.414	34.49%	32.73%
2008	4.1	1.789	43.63%	February, 2.180	53.17%	June, 1.420	34.63%	34.86%
2009	4.1	1.787	43.59%	February, 2.163	52.76%	June, 1.449	35.34%	33.01%
2010	4.1	1.846	45.02%	February, 2.210	53.90%	June, 1.499	36.56%	32.17%
2011	4.1	1.826	44.54%	February, 2.216	54.05%	June, 1.495	36.46%	32.54%
2012	4.1	1.771	43.20%	February, 2.170	52.93%	June, 1.455	35.49%	32.95%
2013	4.1	1.750	42.69%	February, 2.106	51.37%	June, 1.364	33.27%	35.23%
2014	4.1	1.775	43.29%	March, 2.115	51.59%	June, 1.405	34.27%	33.57%
2015	4.1	1.836	44.78%	February, 2.178	53.12%	June, 1.493	36.41%	31.45%

[1] November of 2003 indicated an anomaly in measuring data where all of the days had below 1.0 MGD. influent. This occurrence also happened beginning the 22 day of October; 0.842 on the 22nd, versus 1.663 on the 21st. December appears to be in the "normal" range with 1 December reading at 1.760 MGD.
[2] Capacity expansion by 2.0 MGD

permit. In the future, the plant's BNROD process will have the ability to discharge effluent to the onsite percolation/re-charge basins.

The second treatment train, the lagoon system, is rated at 2.1 MGD. It is comprised of two aerated primary ponds, two aerated secondary ponds and two polishing/finishing ponds. The lagoon process produces effluent that meets Class B reclaimed water requirements. The effluent from the lagoon system can only be discharged to the onsite percolation/recharge basins.

A collaborative agreement with Robson Ranch Quail Creek LLC is in place for BNROD effluent use. That agreement requires that PCRWRD provide a daily minimum of 1.0 MGD of effluent for use by Quail Creek subdivisions. A maximum of 2.0 MGD is allowed. In the future, any of the BNROD effluent (over 1 MGD), that is not discharged for reuse to Quail Creek subdivisions, will be discharged to one of the onsite percolation/recharge basins.

OUTLOOK OF GREEN VALLEY WRF

The department anticipates that eventually, the Green Valley WRF will receive wastewater flows now treated at the Arivaca Junction WRF. This will occur upon completion of a future developer-constructed interceptor. At this time, on average, the Green Valley WRF uses less than 50% of its daily capacity. The rate of growth in the service area will determine future expansion of the facility. Expansion will most likely occur through the construction of another BNROD system. The future of the lagoon system is uncertain because the BNROD process has the ability to more compactly and efficiently treat larger amounts of wastewater.

ARIVACA JUNCTION WATER RECLAMATION FACILITY

Facility Location and Service Area

The Arivaca Junction Water Reclamation Facility is located approximately 13 miles south of the Green Valley WRF in the community of Amado, Township 19S, Range 13E, Section 31. The facility is located on 10.5 acres adjacent to the east side of I-19, and approximately 1,700 feet north of the Pima/Santa Cruz County line. Access to the facility is via the I-19 frontage road. With the exception of the residential community that is served by the facility, the immediate surrounding land uses are primarily agricultural. Privately-owned ranch and farm land surrounds the facility. State Trust Land lies ap-

Table B-7 Arivaca Junction WRF Annual Influent Flow								
Year	Capacity (GPD)	Annual Average Influent (GPD)	Percentage of Capacity (Avg Amt Influent/Capacity)	Peak Influent (Monthly Avg Amt in GPD)	Percentage of Capacity (Peak Influent/Capacity)	Lowest Influent (Monthly Avg Amt in GPD)	Percentage of Capacity (Lowest Influent/Capacity)	Percentage Change Peak to Low
2006	100,000	60,000	60.00%	December, 62,000	62.00%	March-May, 57,000	57.00%	8.06%
2007	100,000	65,000	65.00%	December, 80,000	80.00%	June, 61,000	61.00%	23.75%
2008 [1]	100,000	59,000	59.00%	November, 71,000	71.00%	January, 60,000	60.00%	15.49%
2009	100,000	65,000	65.00%	September, 67,000	67.00%	July, October 62,000	62.00%	7.46%
2010	100,000	60,000	60.00%	June, 76,000	76.00%	Oct, Dec 55,000	55.00%	27.63%
2011	100,000	54,000	54.00%	August, 57,000	57.00%	April, 51,000	51.00%	10.53%
2012	100,000	52,000	52.00%	July, 61,000	61.00%	October, 42,000	42.00%	31.15%
2013	100,000	49,000	49.00%	August, 52,000	52.00%	April, 39,000	39.00%	25.00%
2014	100,000	51,000	51.00%	October, 62,000	62.00%	June, 44,000	44.00%	29.03%
2015	100,000	43,000	43.00%	January, 60,000	60.00%	October, November 39,000	39.00%	35.00%

[1] Meter out f service in October, 2008

proximately 1.25 miles directly east of the facility.

The service area of the facility is located on the west side of I-19 and includes the residential subdivisions of Lakewood Estates and Valley Manor. The service area consists of 293 contributing lots and pipes ranging in diameter from 6 inches to 12 inches. There is a total of five miles of pipe. While there are commercial developments in the area, a Pima County Sanitary Sewer Connection Records Search indicates that only a few of those commercial properties are connected to the system. There are 80 public manholes and four cleanouts in the service area (GIS data analysis, April 2014).

The facility and the service area are located within one mile of each other. Elevation for the Arivaca Junction WRF ranges from 3,100 feet above sea level at the service area to 3,060 feet above sea level at the facility. A 12-inch VCP delivers the wastewater from the service area to the Arivaca Junction WRF. The pipeline continues east around the Arivaca Junction WRF and continues north along I-19 for approximately 1.5 miles where it terminates north of Elephant Head Road. This stretch of pipe is part of the system that will eventually connect the Arivaca service area to the Green Valley WRF.

Facility Capacity and Current Flows

The 3.2-acre lagoon has a permitted treatment capacity of 100,000 gallons per day and treats the wastewater generated from the neighboring subdivisions.

Treatment Process

In operation since 1972, the Arivaca Junction WRF is a facultative lagoon (shallow pond where sunlight, bacteria and air interact to treat wastewater). Chlorination is the method of disinfection. The lagoon is an unlined aerated facultative stabilization pond with three electric surface aspirating aerators/mixers and two wind-driven aerators/mixers.

Average annual influent flows to the facility range from 43,000 GPD to 65,000 GPD (**Table B-7**). There is currently a 30% variance in flow from winter to summer. Conveyance is through VCP to Pump Station 8B6501 which is located at the southwest corner of the facility. The pump station has been completely rebuilt and includes a new reinforced concrete wet well, and above-ground valves and piping. There is a new maintenance driveway. New pumps were selected based on existing development conditions, increasing capacity to 270 gallons per minute at 31 Total Dynamic Head (TDH). (TDH is the total equivalent height that a fluid is to be pumped, while taking into account friction losses in the pipe).

An upgrade to the lagoon treatment process in 2010 included the addition of two fiberglass tanks that stand adjacent to the pond and assist in the disinfection and chlorination of the treated effluent before it is reused for irrigation purposes. With the addition of the fiberglass tanks, the chlorination and disinfection of the wastewater can now be monitored more closely. The addition of the tanks, a higher form of technology improved the operation of a low technology facility.

The effluent produced at this facility is Class C reclaimed water. It is disinfected through the addition of sodium hypochlorite. PCRWRD disposes of the effluent at the adjacent Oswald Cattle Company Ranch (formerly known as Reventone) where it is used for irrigation. The Oswald Cattle Company maintains reuse rights through an Effluent Reuse Agreement/Contract (11-03-R-133090-0803) with Pima County. That agreement expires in 2019. A pump and piping system discharges to the chlorination feeder and tankage system and then to the ranch. The ranch requires that PCRWRD maintenance personnel be on hand at all times during the effluent delivery. The department, which pays the ranch for the effluent delivery, pumps the effluent to the ranch approximately every six weeks. If for any reason this site becomes unavailable, the department will have to haul Arivaca WRF effluent to the Green Valley WRF for disposal.

Green Valley Water Reclamation Facility.

OUTLOOK OF ARIVACA JUNCTION WRF

Previous plans indicate a connection between the termination point at MH 6568-01 and the existing Green Valley conveyance system which is four miles northeast. Once connected, all flows from the Arivaca Junction WRF would be conveyed to the Green Valley WRF, allowing Pima County to close the Arivaca Junction facility. The sewer connection would eliminate the Arivaca Junction WRF's dependence on the disposal of effluent at the neighboring ranch.

The construction of the sewer extension is dependent on the developers of the Canoa Ranch subdivisions who agreed to complete the two most downstream phases of the extension. The department has designed and approved engineering plans for the downstream Phase 1 (G-2006-130) and Phase 2 (G-2006-172) of the gravity line. The final phase, which consists of the construction of approximately one mile of gravity sewer from the current terminus at Elephant Head Road to the connection point of Phase 2 sewer line, will be completed by the County (see Section **B.10** Arivaca Junction WRF Canoa Ranch Sewer).

The initial planned completion date of the connecting interceptor had been the summer of 2009. Due to the economic recession of 2008, development in the area slowed. A new completion date is projected for some time between 2020 and 2025. The high costs associated with the project makes it unfeasible for PCRWRD to complete the project without the developer's assistance.

Along with the sewer extension, a scalping plant that would treat the combined effluent from the Arivaca Junction facility is planned at the Old Canoa Ranch. The Old Canoa Ranch would be the recipient of the reclaimed water which would be used for park irrigation and habitat restoration.

PCRWRD will continue to operate and maintain the Arivaca Junction WRF, but there are no plans for significant improvements. Such improvements would only be necessary in the event of an emergency or the prevention of an emergency. Both these scenarios are unlikely. Depending on daily flow, the facility operates between 60% to 67% capacity. Considering the existing land uses and land ownership surrounding the facility, new sewer connections are not expected, and the facility will not reach 75% capacity in the foreseeable future.

SAHUARITA WASTEWATER TREATMENT AND RECLAMATION FACILITY

In 1999, the Town of Sahuarita became a DMA in compliance with the PAG 208 Plan. At that time, it was only the second DMA in Pima County. The Upper Santa Cruz (greater Green Valley) service basin has been divided into three service areas in accordance with the 208 Plan: one for the Town of Sahuarita, one for Pima County,

Green Valley Water Reclamation Facility.

and one joint planning area (**Figure B-8**).

The Sahuarita WTRF has a 17 square mile management area south of Pima Mine Road. The facility bisects the northern boundary of the designated management area. The area extends south one-half mile past Twin Buttes Road, and tapers inward to its southern most point. The Green Valley WRF provides service to the area south of this point. Conveyance for both facilities is by gravity flow. Two joint planning areas are directly east and west of Sahuarita's designated management area. The western area encompasses nearly 68 square miles and the eastern area encompasses approximately 12 square miles.

Facility Location and Service Area

The Sahuarita WTRF is located approximately 14 miles south of the I-10/I-19 interchange in Township 16S, Range 13E, Section 36. The facility is located on approximately 59 acres on South Rancho Sahuarita Boulevard in the Town of Sahuarita.

The Sahuarita WTRF service area consists of the Rancho Sahuarita master-planned community located east and south of the facility. A 1999 sewer service agreement between the Town of Sahuarita and Rancho Sahuarita limited the plant's service area to 4,219 acres in and around Rancho Sahuarita. Expansion of the service area would require voter approval. The service area includes approximately 45 miles of sewer lines and over 1,100 manholes (Town of Sahuarita FY 2015 Adopted Budget).

Surrounding land use in the immediate area is primarily medium density, privately owned and residential. To the east is the northernmost portion of the FICO's Green Valley Pecan Orchards, the largest-irrigated pecan orchards in North America.

Facility Capacity and Treatment Process

Since becoming a DMA, the town has outlined and begun implementation of a six-phase 3.0 MGD buildout of the facility. The facility, has a capacity of 1.5 MGD. In early 2013, ADEQ granted the Town permission to increase capacity from 1.5 MGD to 3.0 MGD. An average daily flow in 2014 was approximately 850,000 gallons (Town of Sahuarita FY 2015 Adopted Budget). The current treatment process is oxidation ditches using a biodenitrification process. The Town discharges its effluent to onsite rapid infiltration basins. The facility site also includes over 13 acres of recharge basins for reclaimed water. The town digests its biosolids and then transports it to a state-approved landfill.

OUTLOOK OF SAHUARITA WTRF

The Phase V Expansion of the Sahuarita WTRF will bring the current capacity of 1.5 MGD to a permitted capacity of 3.0 MGD (Town of Sahuarita FY 2015 Adopted Budget). The expansion is necessary to support a growing community. Flows are expected to reach 75 percent capacity around 2020, and the town is preparing expansion plans accordingly. The expansion will benefit the Town of Sahuarita and future residents of the now-undeveloped areas of Rancho Sahuarita.

Figure B-8 Town of Sahuarita DMA and Joint Planning Areas

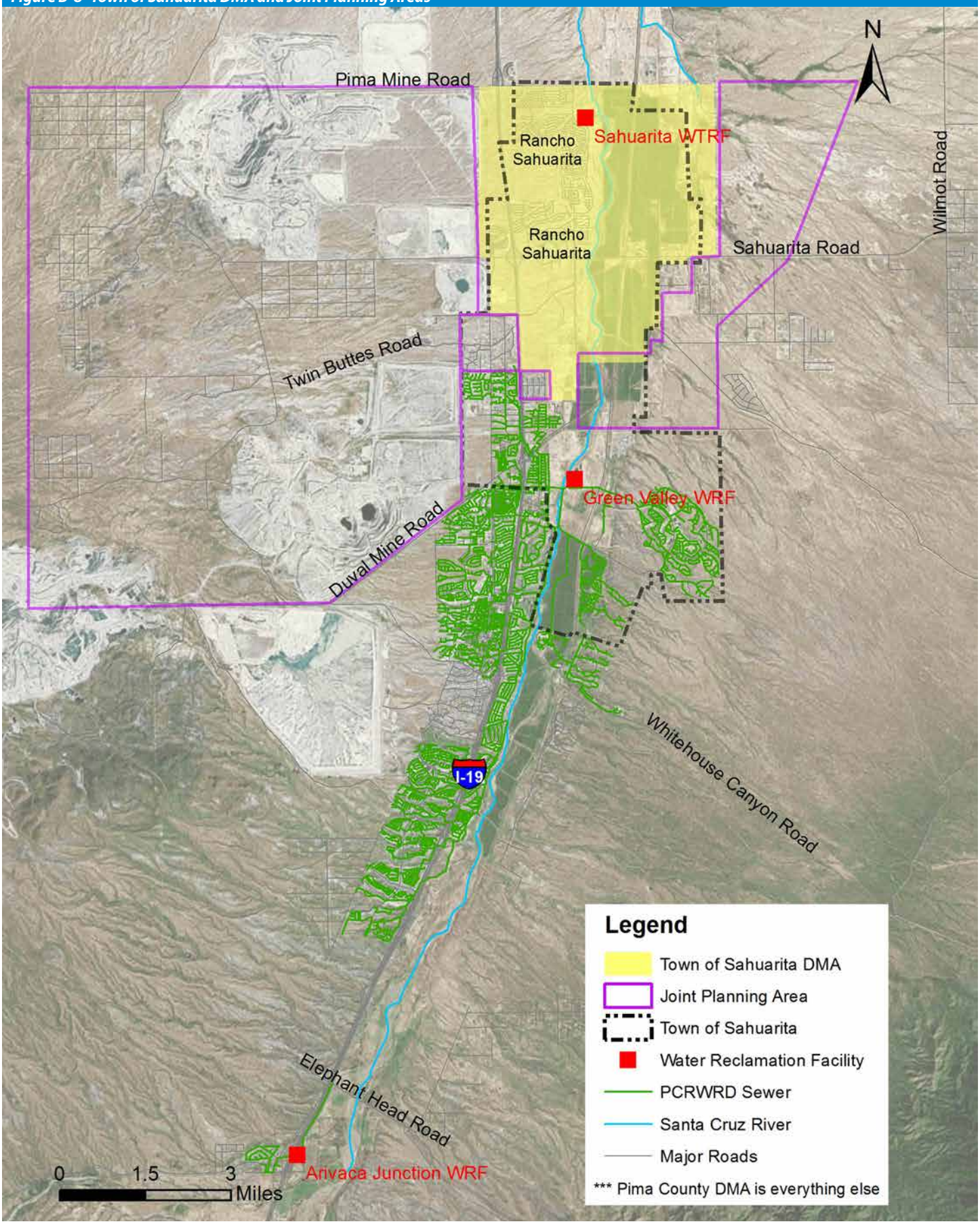


Table B-8 ADWF and PDWF for the Projected Service Area								
Year	2010	2015	2020	2025	2030	2035	2040	2045
Existing Service Area Population Projection (0.0133% annual gorwth) [1]	23,125	24,704	26,391	28,194	30,119	32,176	34,373	36,721
SECAP Population (Total Projected minus Current Service Area)	0	0	8,733	9,047	9,124	8,900	8,260	7,054
Total Projected Service Area Population (based on U.S Census and TAZ data)	**23,125**	**24,704**	**35,124**	**37,241**	**39,243**	**41,076**	**42,633**	**43,775**
ADWF (MGD)**	1.85*	1.84*	2.81	2.98	3.14	3.29	3.41	3.50
PDWF (MGD)***	3.18	3.15	4.69	4.95	5.18	5.42	5.59	5.74

[1] Beginning 2020, the projections include SECAP population to be served by Green Valley WRF
* Actual ADWF measured at the WRF
** Population x 80 GPD per person
*** PDWF = ADWF x PF

Table B-9 Dry Weather Peaking Factor								
Year	2010	2015	2020	2025	2030	2035	2040	2045
Green Valley WRF Service Area Population	23,125	24,704	35,124	37,241	39,243	41,076	42,633	43,775
Peaking Factor (PF)*	1.72	1.71	1.67	1.66	1.65	1.65	1.64	1.64

* PF = (6.177 x p^-0.233) + 1.128, where p is upstream population

B.6.3 FLOW PROJECTIONS FOR THE GREEN VALLEY WRF SERVICE AREA

The projected Green Valley WRF service area boundary is depicted in **Figure B-9.** The service area boundary includes the existing service area and the projected growth areas that would be tributary only to the Green Valley WRF. A portion of SECAP population that will likely be served by the Green Valley WRF is also included in the flow projections.

Table B-8 shows the projected average dry weather and peak dry weather flows for the projected service area.

Based on the average daily flow of 1.84 MGD (2015), the Green Valley WRF currently serves approximately 23,000 people. The Green Valley WRF can handle an additional 15,438[2] people before reaching 75% capacity limit. Projections indicate the population will reach this level in 2029 (total 38,438[3] people). See **Table B.9-2**, Section **B.9** Population Projections Calculation. The facility can handle an additional 28,250[4] people before reaching full capacity. Projections indicate the area will not reach a full capacity population of 51,250[5] until after 2045.

The Peak Dry Weather Flow (PDWF) projections shown above were calculated based on the dry weather peaking factors (PF) from **Table B-9**:

The department projects the Green Valley WRF will reach 75% capacity (3.075 MGD) by the year 2029. The planned expansion to increase the facility capacity to 6.0 MGD can be accomplished by adding an additional 2.0 MGD to the existing BNROD capacity. Expansion options for the facility is discussed below.

The Green Valley WRF Treatment Capacity Expansion Options

The proposed expansion includes two secondary clarifiers capable of treating 1.0 MGD and a new tertiary disk filter. With the addition of the two new clarifiers the facility could be pushed to at least 2.5 to 2.8 MGD through the existing BNROD. With the addition of a new tertiary disk filter, additional clarifiers would allow the treatment system to take full advantage of the BNROD and possibly recharge all effluent produced at the Green Valley WRF for water credits. The expansion is tentatively scheduled for FY 2027/2028, but may occur later given the slow growth in the area.

B.7 OUTLOOK OF SERVICE AREA

The timing of the planned gravity sewer line that will allow the transfer of flow from the Arivaca Junction WRF to the Green Valley WRF depends largely on the timing of the downstream development in Canoa Ranch. The developer will construct the first two phases of the downstream extension. The County will construct the final phase, including the upstream reach extension. The project schedule is unknown at this time.

The department has been actively involved in a discussion with developers about servicing options for lands affected by the Sahuarita East Conceptual Area Plan (SECAP). Because of its scale and location, the development of this area will require upgrades to the treatment capacity at the Sahuarita and the Green Valley treatment facilities. An extension of the conveyance system also will be needed. Construction of a new regional water reclamation facility that would offset demands on the Green Valley, the Sahuarita, and the Corona de Tucson service areas is a possibility. The timing of the new facility is critical and will mainly be driven by growth as well as the timing of the proposed extension of the sewer line north from Elephant Head Road to the Canoa Ranch Development. To serve new development, the Green Valley WRF will eventually need be expanded. Construction of the new facility could potentially lead to a closing of both the Arivaca Junction and Green Valley facilities. Additional planning and research is required to determine the location, size and treatment options for a new regional facility.

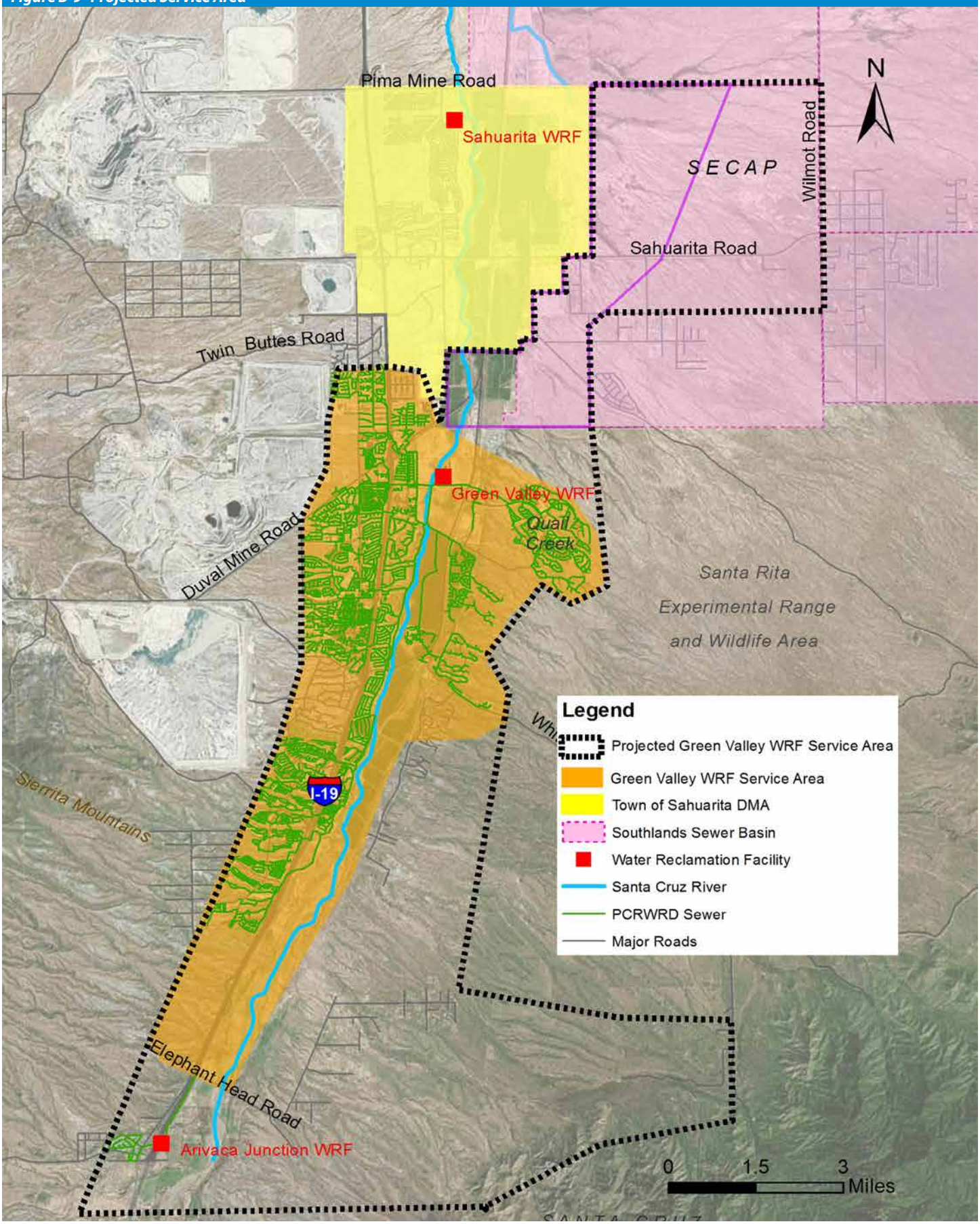
*[2] 4.1 MGD*0.75/80 GPD – 23,000 people currently served = 15,438 additional people at 75% capacity*

[3] 23,000 current + 15,438 additional = 38,438 total people served at 75% capacity

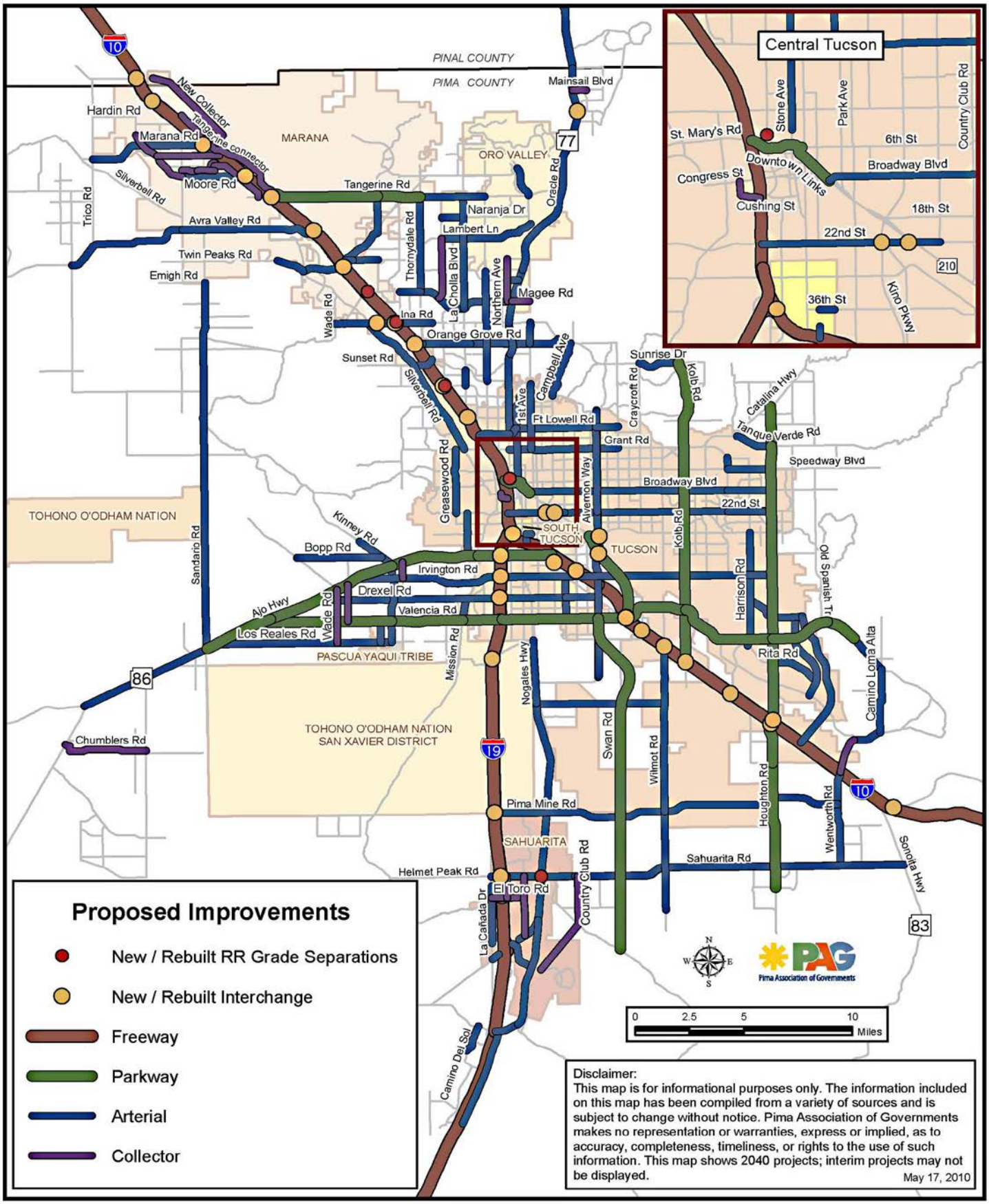
[4] 4.1 MGD/80 GPD - 23,000 people currently served = 28,250 additional people at full capacity

[5] 23,000 current + 28,250 additional = 51,250 total people at full capacity

Figure B-9 Projected Service Area



B.8 2040 RTP ROADWAY PROJECTS



Green Valley.

B.9 POPULATION PROJECTIONS CALCULATION

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B.9.1 POPULATION ESTIMATES AND PROJECTIONS

Two core methods were used to establish population estimates to the year 2045: the PAG Traffic Analysis Zones and land use build-out. Estimates based on a rate of growth analysis are then provided for each subsequent five-year period.

TRAFFIC ANALYSIS ZONES

The PCRWRD utilized PAG's Traffic Analysis Zones (TAZs) to determine population projections within the Basin Study Area. PAG provided the data for the year 2010 and 2045. The population growth rate was determined by using the 2010 PAG figures (TAZ2010) for the base year and the 2045 PAG figures (TAZ2045) for the forecast year.

There are 63 total TAZ areas that comprise the Basin Study Area (**Figure B.9-1**). Twelve AZ areas are partially included within the boundary: 65, 641, 643, 658, 668, 675, 827, 828, 901, 908, 909, and 943.

The Joint Planning Area includes the TAZs 335, 413, 657, 659, 662, 666, 667, 900, 901, 902, and 903.

The population that is served by septic systems includes TAZs: 335, 368, 413, 660, 664, 666, 900, 901, 902, 903, 904, 905, 908, 909, 939, 941, and 943.

ASSUMPTIONS

- Population grows at a constant percentage per year, creating geometric growth.
- TAZ data represents the most accurate data available for population estimates at this time.
- The population within each zone is evenly distributed. That is, if 30% of the TAZ area is within the Study Area, only 30% of the entire TAZ population will be assumed to be in the study area.
- Household occupancy rate is 2.7 people per dwelling unit, unless otherwise specified, e.g.: 1.9 people per dwelling unit in active-adult or age-restricted communities.

METHODOLOGY

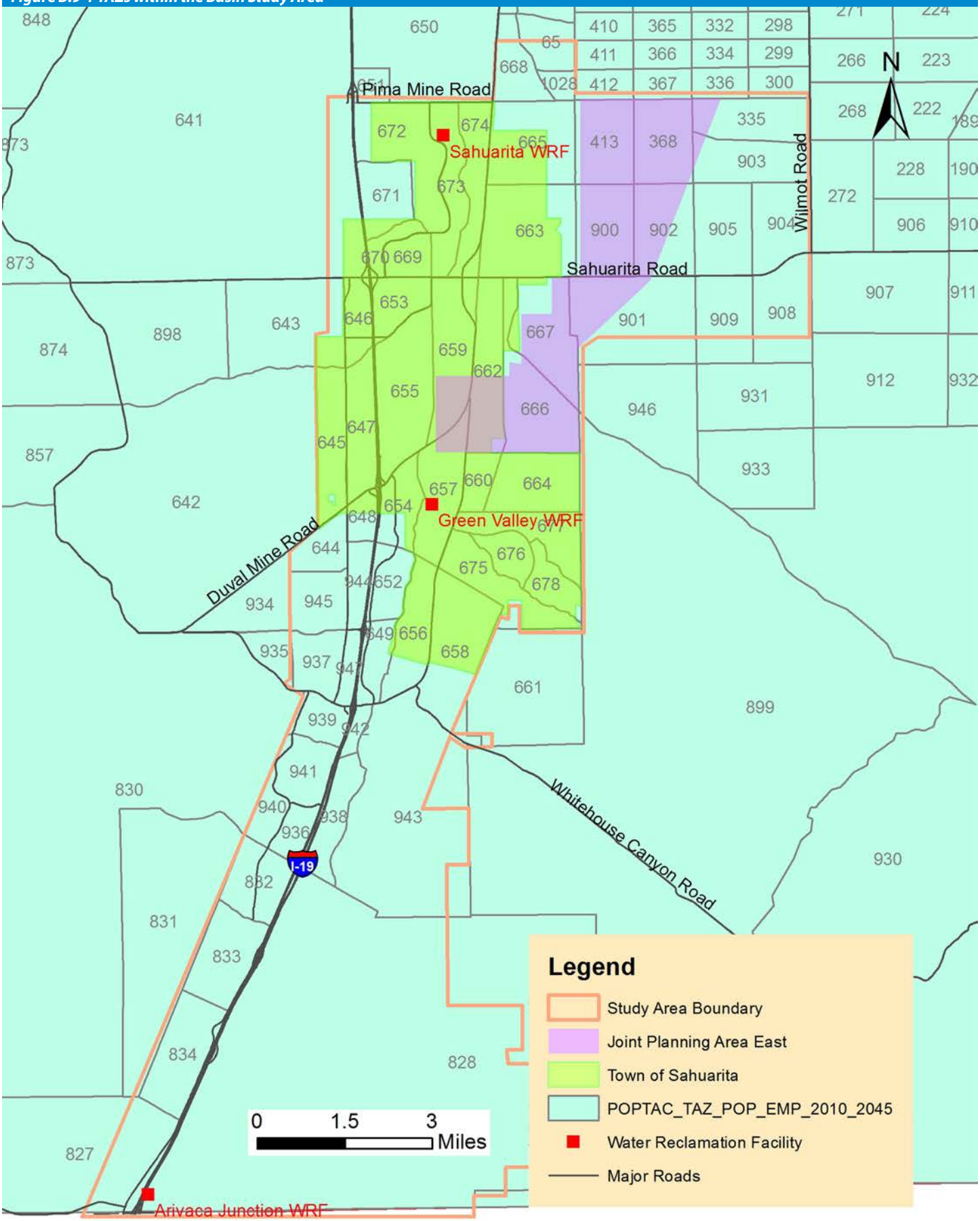
1. Using ArcGIS software, the relevant TAZ areas were selected and extracted to create an individual layer.
2. The projected Basin Study Area was overlaid on the new layer.
3. The measurement tool was used to determine the area from the TAZs.
4. A percentage of the total area was assessed.
5. The equivalent percentage of the area was applied to the total population of the TAZ areas for the year 2010 and 2045.

Based on TAZ2010 population data, the Green Valley Basin Study Area had 46,861 people in 2010, and is anticipated to have 91,330 people by 2045 (**Table B.9-1**). This corresponds to a 1.9% annual geometric growth rate for the entire area.

Table B.9-1 Green Valley Basin Study Area TAZ Projections 2045

TAZ	HHPOP_2010	HHPOP_2045	% of TAZ area within GV Basin Study Area	GV Basin Study Area TAZ2010 Population	GV Basin Study Area TAZ2045 Population
65	0	15	51%	0	8
335	0	18		0	18
368	0	193		0	193
413	0	268		0	268
641	479	1,001	4%	21	44
643	153	265	18%	28	48
644	2,183	2,319		2,183	2,319
645	992	1,180		992	1,180
646	67	90		67	90
647	2,266	3,032		2,266	3,032
648	1,155	1,132		1,155	1,132
649	1,078	1,087		1,078	1,087
652	1,020	984		1,020	984
653	0	257		0	257
654	1,274	1,811		1,274	1,811
655	2,296	6,947		2,296	6,947
656	683	1,110		683	1,110
657	55	975		55	975
658	1,875	3,517	96%	1,807	3,389
659	0	1,540		0	1,540
660	0	0		0	0
662	18	2,270		18	2,270
663	98	1,957		98	1,957
664	0	0		0	0
665	0	1,343		0	1,343
666	2	3,180		2	3,180
667	637	1,284		637	1,284
668	0	268	82%	0	221
669	1,240	1,817		1,240	1,817
670	458	1,103		458	1,103
671	15	6,046		15	6,046
672	10,014	11,249		10,014	11,249
673	1,203	1,781		1,203	1,781
674	3	1,423		3	1,423
675	18	1,377	92%	16	1,273
676	824	1,279		824	1,279
677	875	1,484		875	1,484
678	921	1,078		921	1,078
827	1,166	1,613	12%	140	193
828	637	1,006	83%	531	838
832	1,803	1,843		1,803	1,843
833	1,073	1,350		1,073	1,350
834	21	2,809		21	2,809
900	0	1,015		0	1,015
901	794	5,611	73%	577	4,082
902	0	715		0	715
903	0	18		0	18
904	0	21		0	21
905	0	79		0	79
908	2	33	71%	2	23
909	0	107	71%	0	76
936	721	791		721	791
937	2,139	2,182		2,139	2,182
938	1,649	1,749		1,649	1,749
939	312	329		312	329
940	1,008	1,072		1,008	1,072
941	1,022	1,118		1,022	1,118
942	579	561		579	561
943	282	1,177	86%	242	1,010
944	1,297	1,312		1,297	1,312
945	1,907	2,257		1,907	2,257
947	589	667		589	667
1028	0	0		0	0
			Total Population	**46,861**	**91,330**

Figure B.9-1 TAZs within the Basin Study Area



When the population served by the Town of Sahuarita facility and the population served by septic systems are subtracted from the population figures cited above, the Green Valley WRF service area counts 23,125 people in 2010 and 43,775 in 2045. **Table B.9-2** shows population for the projected Green Valley WRF service area.

The Arivaca Junction WRF service area lot count is listed in **Table B.9-3**. There currently is estimated 540 people living in the service area.

The Census data indicates an unrealistically high growth rate of 108% between 2000 and 2010 for the Basin Study Area.

B.9.2 LAND USE BUILDOUT

In addition to TAZ population data, PCRWRD established capacity projections for land use buildout by examining

- The buildout of currently zoned and platted lands,
- An analysis of specific plans, and
- An assessment of available land built to expected and maximum capacity.

The GIS data analysis provided the base assessments of available lands and currently zone/platted lands.

For the purposes of this study, the following assumptions regarding the land use buildout projections were made:

- Maximum residential units per acre are based on the Pima County Zoning Code and Town of Sahuarita Zoning Code.
  - Exemptions are made for cases in which investigation yields unrealistic maximums (such as Transitional Zones).
  - In instances where rezoning may occur (up-zoning) an analysis of the Conservation Land System was included (66% open space in Multiple Use Management Areas, 80% open space in Biological Core Areas, 95% open space in Important Riparian Areas); this is primarily relevant to Growth Area 5.
  - All calculations for maximum residential units per acre include a 10% infrastructure and easement set-aside.
  - Average residential units per acre are calculated to include a 10% infrastructure and easement set-aside in addition to a 30% open space set aside.
- For Growth Areas where zoning is expected to increase, Residential Units per Acre were calculated using a low (2 RAC), medium (4 RAC), and high (6 RAC) density. These RAC calculations are based on analysis of existing land-use density in the Green Valley/Town of Sahuarita area. Analysis of this type was primarily employed in Growth Area 4.
- Calculations assumed a household occupancy rate of 2.7 people per dwelling unit, unless the study area was an active adult or age restricted community. These areas were calculated at 1.9 people per dwelling unit.

The following section includes buildout projections based on the five assumptions described above.

B.9.3 GROWTH AREAS

Figure B.9-2 shows general location of the five projected growth areas, followed by a detailed description of each.

Table B.9-2 Green Valley WRF Service Area Population Projections 2045

Year	Population	Growth
2010	23,125	308
2011	23,433	312
2012	23,744	316
2013	24,060	320
2014	24,380	324
2015	24,704	329
2016	25,033	333
2017	25,365	337
2018	25,703	342
2019	26,045	346
2020	35,124	302
2021	35,426	305
2022	35,731	307
2023	36,038	310
2024	36,348	313
2025	37,241	320
2026	37,561	323
2027	37,884	326
2028	38,210	329
2029	38,539	331
2030	39,243	337
2031	39,580	340
2032	39,921	343
2033	40,264	346
2034	40,610	349
2035	41,076	353
2036	41,429	356
2037	41,786	359
2038	42,145	362
2039	42,507	366
2040	42,633	367
2041	43,000	370
2042	43,369	373
2043	43,742	376
2044	44,119	379
2045	43,775	376

Table B.9-3 Arivaca Junction WRF Service Area Lot Count

Arivaca Junction WRF Service Areas	Total Number of Lots Served by Arivaca Junction WRF
Lakewood Estates (1-150)	150
Lakewood Estates (1-144) (1 vacant)	73
Valley Manor (1-29)	29
Other residential lots (3 vacant)	28
Non-residential lots	13
Total	**293**

Figure B.9-2 Growth Areas

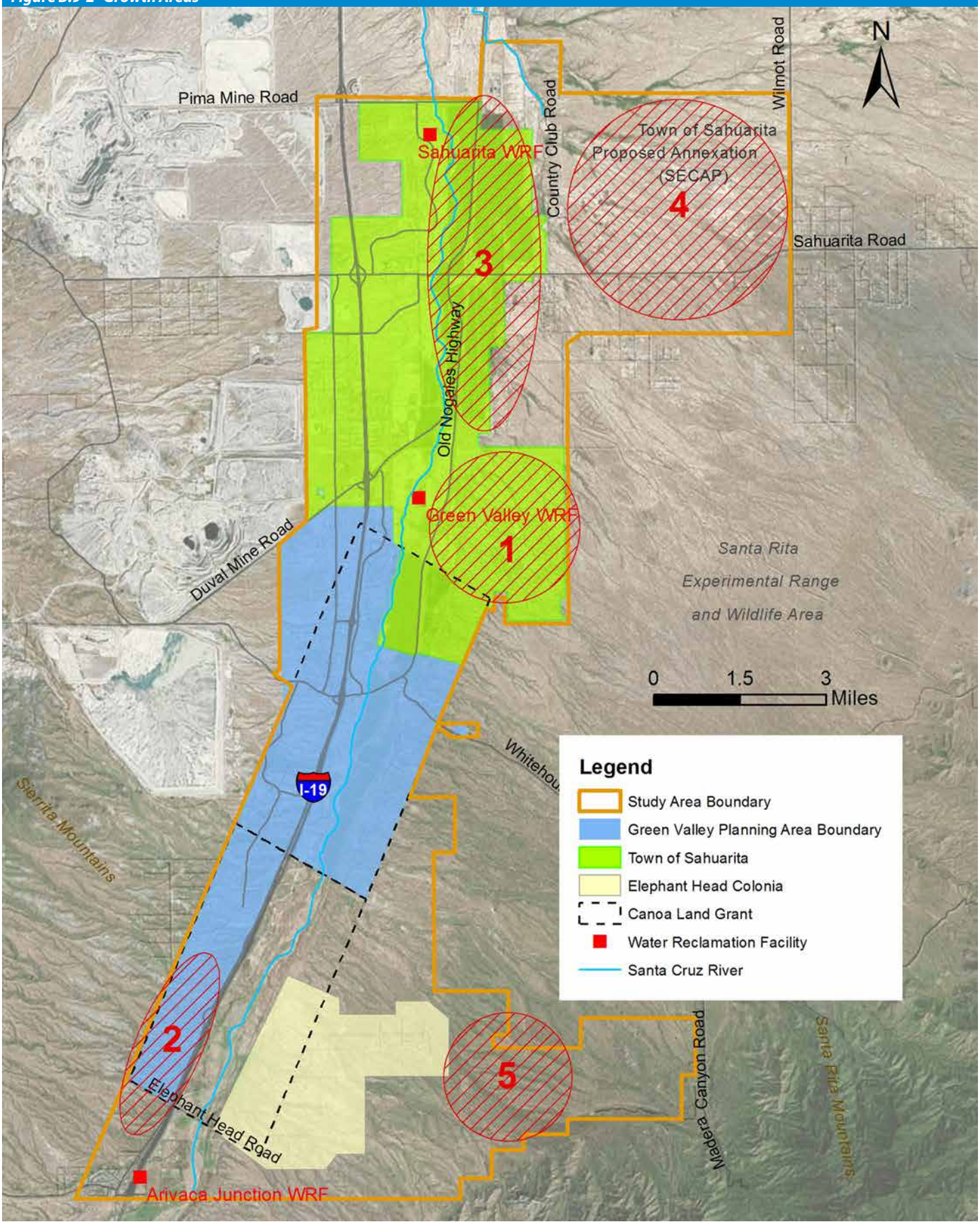


Table B.9-4 Growth Area 1 (Green Valley Developments) Population and Flow Projections				
Development Area	Target Units per Specific Plan	Units with allocated capacity per SSA	Population (2.7 pp/hh and 1.9 pp/hh)	Flow (ADWF)
Madera Highlands Villages SP	1,800	1,488	4,018	321,408
Quail Creek	5,000	2,264	4,302	344,128
Stone House		230	621	49,680
Madera Reserve		181	489	39,096
Total Buildout	**6,800**	**4,163**	**9,429**	**754,312**

Table B.9-5 Growth Area 1 (Green Valley Developments) TAZ Projected Growth			
TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
656	683	1,100	417
657	55	975	920
658	1,807	3,389	1,582
675	16	1,273	1,257
677	875	1,484	609
678	921	1,078	157
Total	**4,357**	**9,310**	**4,953**

GROWTH AREA 1 (GREEN VALLEY WRF SERVICE AREA)

Buildout largely occurs with the completion of Quail Creek and Madera Highlands subdivisions , as well as other subdivisions to the south, including Stone House and Madera Reserve (**Table B.9-4**).

The total buildout population for Growth Area 1 is 9,429. Based on the growth rate of 2.5% (**Table B.9-5**), the buildout growth is projected to occur before 2042 (**Table B.9-6**). This growth could occur sooner if the housing market in the area improves. As of March 2015, there was a total of 1,464 undeveloped lots in Growth Area 1.

Growth Area 1 Geometric Rate of Growth (2010-2045, annual): 2.5%

GROWTH AREA 2 (ARIVACA JUNCTION NORTH)

Buildout in this Growth Area will occur with the completion of the Canoa Ranch South and the Green Valley Hills developments. Projections for development of mostly ranch land between Elephant Head Road (south of Green Valley Hills) and the subdivisions of Arivaca Junction were based on the assumption that this ranch land will eventually be sold and developed.

A basin study by PCRWRD (July 2010) estimated a population for this area of approximately 6,817. It counts 1.9 people per household for Canoa Ranch South and 2.7 people per household for Green Valley Hills. The U.S. Census shows the mean housing units per acre for this area is 2.49.

The above-mentioned ranch land consists of approximately 900 acres; 300 acres could be developed after the 66% set aside required for a Multiple Use Management Area. After an additional 40% deduction for onsite and offsite improvements, the total developable land is 180 acres. At 2.49 units per acre, this land could yield a total of 448 units. At 2.7 people per household, the area

Table B.9-6 Growth Area 1 Population at 2.5% Annual Growth Rate		
Year	Population	Growth
2010	4,357	109
2011	4,466	112
2012	4,578	114
2013	4,692	117
2014	4,809	120
2015	4,930	123
2016	5,053	126
2017	5,179	129
2018	5,309	133
2019	5,441	136
2020	5,577	139
2021	5,717	143
2022	5,860	146
2023	6,006	150
2024	6,156	154
2025	6,310	158
2026	6,468	162
2027	6,630	166
2028	6,795	170
2029	6,965	174
2030	7,139	178
2031	7,318	183
2032	7,501	188
2033	7,688	192
2034	7,881	197
2035	8,078	202
2036	8,280	207
2037	8,487	212
2038	8,699	217
2039	8,916	223
2040	9,139	228
2041	9,368	234
2042	9,602	240
2043	9,842	246
2044	10,088	252
2045	10,340	259

Table B.9-7 Growth Area 2 (Arivaca Junction North) TAZ Projected Growth			
TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
827	140	193	53
828	531	838	307
833	1,073	1,350	278
834	21	2,809	2,788
Total	**1,765**	**5,190**	**3,425**

would reach a buildout population of 1,210.

The buildout population for Growth Area 2 includes the Canoa Ranch (6,817), undeveloped ranch land (1,210) and the Arivaca Junction (547[6]) a total of 8,574 people. It is difficult to predict when this population will occur. Based on TAZ data analysis presented in **Table B.9-7**, a Geometric Rate of Growth of 3.2% was calculated for Growth Area 2. See **Table B.9-8** for 5-year incremental growth figures. The buildout population of 8,783 is expected to occur after 2055.

Growth Area 2 Geometric Rate of Growth (2010-2045, annual): 3.2%

GROWTH AREA 3 (RANCHO SAHUARITA SPECIFIC PLAN AND FICO DEVELOPMENT)

Growth Area 3 is comprised of infill and future specific plan developments, the Rancho Sahuarita Specific Plan (SP) and the Sahuarita Farms Specific Plan of FICO Development. The Rancho Sahuarita SP calls for 11,680 dwelling units (3,084 acres) with a gross density of 3.79 units per acre. A projected buildout population is 32,704 (2.8 persons per household, 2010 U.S. Census). Located entirely within the Town of Sahuarita's DMA, Rancho Sahuarita will be served entirely by the Town's sewer system.

Most of the land in Area 3 is owned by FICO. The company is proposing to develop 5,600 acres as a master-planned community over a 50-year period. The FICO's Sahuarita Farms SP calls for development of 19,056 residential units and millions of square feet of commercial, retail, employment, recreational and other uses. Assuming a household size of 2.7 residents per household, this plan will add an additional 51,451 people to the area. According to the Specific Plan, approximately 17,827 units (48,133 people) will be built within the Town's DMA. It is possible that approximately 1,229 units (3,318 people) will receive wastewater services from the Green Valley WRF.

*[6] 540 currently served + 4 vacant lots*1.8 people per household*

Table B.9-8 Growth Area 2 Population at 3.2% Annual Growth		
Year	Population	Growth
2010	1,765	56
2011	1,821	58
2012	1,879	60
2013	1,939	62
2014	2,000	64
2015	2,064	66
2016	2,130	68
2017	2,197	70
2018	2,267	72
2019	2,339	74
2020	2,414	77
2021	2,491	79
2022	2,570	82
2023	2,651	84
2024	2,736	87
2025	2,823	90
2026	2,913	93
2027	3,005	96
2028	3,101	99
2029	3,199	102
2030	3,301	105
2031	3,406	108
2032	3,514	112
2033	3,626	115
2034	3,741	119
2035	3,860	123
2036	3,983	127
2037	4,110	131
2038	4,241	135
2039	4,375	139
2040	4,515	144
2041	4,658	148
2042	4,806	153
2043	4,959	158
2044	5,117	163
2045	5,190	165

Table B.9-9 Growth Area 3 (Rancho Sahuarita SP and FICO Development) Proposed Units and Population				
Development	Number of Proposed Dwelling Units	Population	Population within Town of Sahuarita DMA	Population within Pima County DMA
Rancho Sahuarita Specific Plan	11,680	2.8 pp/hh 32,704	32,704	NA
Sahuarita Farms Specific Plan	19,056	2.7 pp/hh 51,451	48,133	3,318
Total	**30,736**	**84,155**	**80,837**	**3,318**

Table B.9-10 Growth Area 3 (Rancho Sahuarita SP and FICO Development) TAZ Projected Growth			
TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
641	21	44	23
663	98	1,957	1,859
665	0	1,343	1,343
666	2	3,180	3,178
667	637	1,284	647
668	0	221	221
669	1,240	1,817	577
670	458	1,103	645
672	10,014	11,249	1,235
673	1,203	1,781	577
674	3	1,423	1,420
901	577	4,082	21
908	2	23	21
909	0	76	76
Total	**14,256**	**29,583**	**15,327**

Total buildout population for the two specific plans is 84,155 (**Table B.9-9**). The timing of the buildout population is difficult to predict at this time. Based on TAZ data analysis presented in **Table B.9-10**, an annual growth rate of 2.14% was calculated for Growth Area 3. See **Table B-9-11** for 5-year incremental growth figures.

As explained in the Sahuarita Farms Specific Plan, this large-scale project will require construction of a new wastewater treatment facility.

Growth Area 3 Geometric Rate of Growth (2010-2045, annual): 2.14%

GROWTH AREA 4 (SAHUARITA EAST CONCEPTUAL AREA PLAN - SECAP AREA)

Growth Area 4 is a large area to the east of the current Town of Sahuarita limits known as the Sahuarita East Conceptual Area Plan (SECAP). Upon annexation by the Town, the SECAP will be developed as a mixed use development with a combined estimated buildout of 53,000 dwelling units and up to 134,000 people. See **Figure B.9-3** for the proposed land uses. The majority of land is currently owned by the Arizona State Land Department (ASLD). Several parcels are owned by private entities or the City of Tucson. The Pima County Natura Resources Parks and Recreation Department owns a small diagonal portion of the land.

The following (**Table B.9-12**) is a breakdown of land use designations as proposed for SECAP in Aspire 2035.

TAZ population data analysis underestimates the Growth Area 4 buildout population indicating only 2,836 people living in the area by 2045 (**Table B.9-13**). Growth Area 4 is anticipated to have at least 136,000 people upon development of SECAP.

Table B.9-11 Growth Area 3 Population at 2.14% Annual Growth		
Year	Population	Growth
2010	14,256	305
2011	14,561	312
2012	14,873	318
2013	15,191	325
2014	15,516	332
2015	15,848	339
2016	16,187	346
2017	16,534	354
2018	16,887	361
2019	17,249	369
2020	17,618	377
2021	17,995	385
2022	18,380	393
2023	18,773	402
2024	19,175	410
2025	19,586	419
2026	20,005	428
2027	20,433	437
2028	20,870	447
2029	21,317	456
2030	21,773	466
2031	22,239	476
2032	22,715	486
2033	23,201	496
2034	23,697	507
2035	24,204	518
2036	24,722	529
2037	25,251	540
2038	25,792	552
2039	26,344	564
2040	26,907	576
2041	27,483	588
2042	28,071	601
2043	28,672	614
2044	29,286	627
2045	29,583	633

Figure B.9-3 SECAP Proposed Land Uses

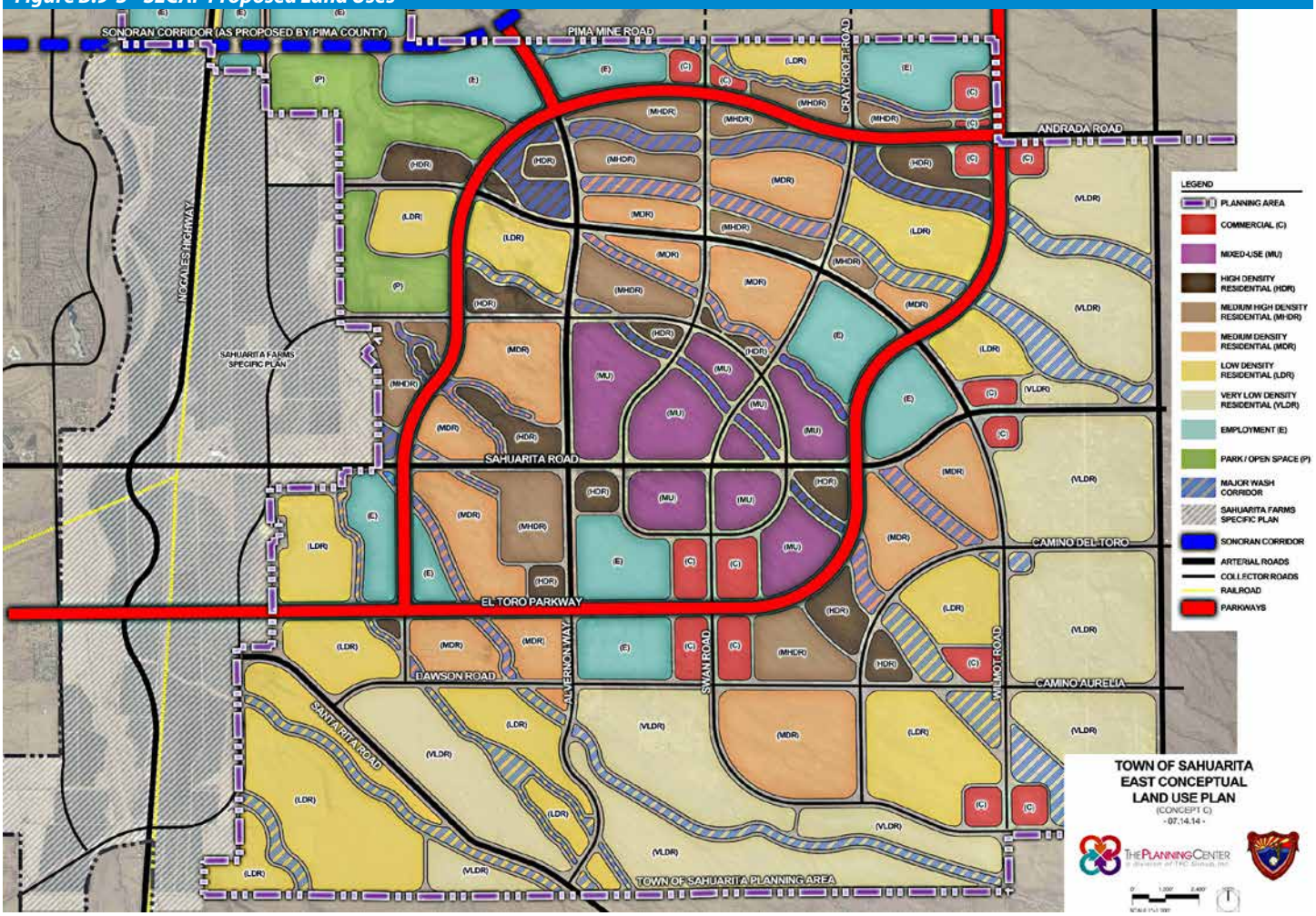


Table B.9-12 Growth Area 4 (SECAP Development) Proposed Land Uses

Proposed Land Use Mix*		
Land Use	**Total Acreage**	**Percent**
Very Low Density Residential (VLDR)	4,943	16.4%
Low Density Residential (LDR)	8,476	28.1%
Medium Density Residential (MDR)	4,526	15.0%
Medium High Density Residential (MHDR)	1,696	5.6%
High Density Residential (HDR)	1,426	4.7%
Mixed Use (MU)	1,549	5.1%
Commercial (C)	1,288	4.3%
Employment (E)	4,909	16.3%
Infrastructure/Schools	276	0.9%
Parks/Open Space (P)**	1,100	3.6%
Adopted Specific Plans	0	0.0%
Total Acres	30,189	100.0%
Square Miles	47.17	100.0%

*Excludes those portions of planning area east of Wilmot and south of Sahuarita Road.
**It is expected that total acreage for parks and open space will exceed the acreage and percent shown here. Parks and open space will be provided in all planned land-use areas.
Source: Town of Sahuarita General Plan - Aspire 2035

Table B.9-13 Growth Area 4 TAZ Projected Growth without SECAP Development

TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
65	0	8	8
228	7	9	2
272	360	362	2
335	0	18	18
368	0	193	193
413	0	268	268
900	0	1,015	1,015
902	0	715	715
903	0	18	18
904	0	21	21
905	0	79	79
906	69	65	-4
907	782	763	-19
912	352	343	-9
931	0	12	12
933	0	1	1
946	252	768	516
1028	0	0	0
Total	**1,822**	**4,658**	**2,836**

Bridge over Santa Cruz River at Elephant Head Road

GROWTH AREA 5 (ELEPHANT HEAD EAST)

Growth Area 5 is located east of Elephant Head Colonia near the entrance to Madera Canyon. The area includes approximately 4,500 acres of large, vacant parcels that are owned by investment companies or private owners. There are three large land owners in the area.

A description of the area is found below:

- Approximate TAZ 828 area: 23,463 acres
- Approximate Basin Study Area within TAZ 828: 19,463 acres (83%)
- Approximate Growth Area 5 within Basin Study Area: 4,500 acres
- Population is assumed to be evenly distributed across the TAZ

Growth Area 5 is zoned Rural Homestead (RH) and is within the Pima County Conservation Land System (CLS). If property in this area is rezoned, regulations required for Biological Core Management Areas will apply: (an 80% open space set aside). Important Riparian Areas regulations (95% open space set aside) also apply if rezoning occurs.

The following are development scenarios based on the existing zoning designation and potential up-zoning.

Scenario 1:

Assuming the RH zoning remains and no CLS regulations are triggered, the maximum density will remain at 1.3 RAC with a 40% infrastructure/easement set aside. **Table B.9-14** contains total buildout population projections.

Scenario 2:

If property is rezoned, the CLS-required 80% open space set aside would apply. **Table B.9-15** contains total buildout population projections.

Scenario 2, which features low density development, is the most realistic buildout scenario. The scenario projects a population of 3,420. The existing population shown in the table below is served by septic systems and is not included in the buildout population.

Based on TAZ data presented in **Table B.9-16**, a Geometric Rate of Growth of 1.33% was calculated for Growth Area 5. Given that no development activities are on the horizon in Area 5, and there is relatively slow growth in the surrounding areas, it is difficult to predict any realistic timeframe for the area's buildout.

Growth Area 5 Geometric Rate of Growth (2010-2045, annual): 1.33%

Table B.9-14 Growth Area 5 (Elephant Head East) Development Scenario 1

Scenario 1 Total Developable Land: 2,700 acres	RH Zone Max 1.3 RAC
Max Units	3,510
Pop (1.9 people per household)	6,669
Pop (2.7 people per household)	9,477

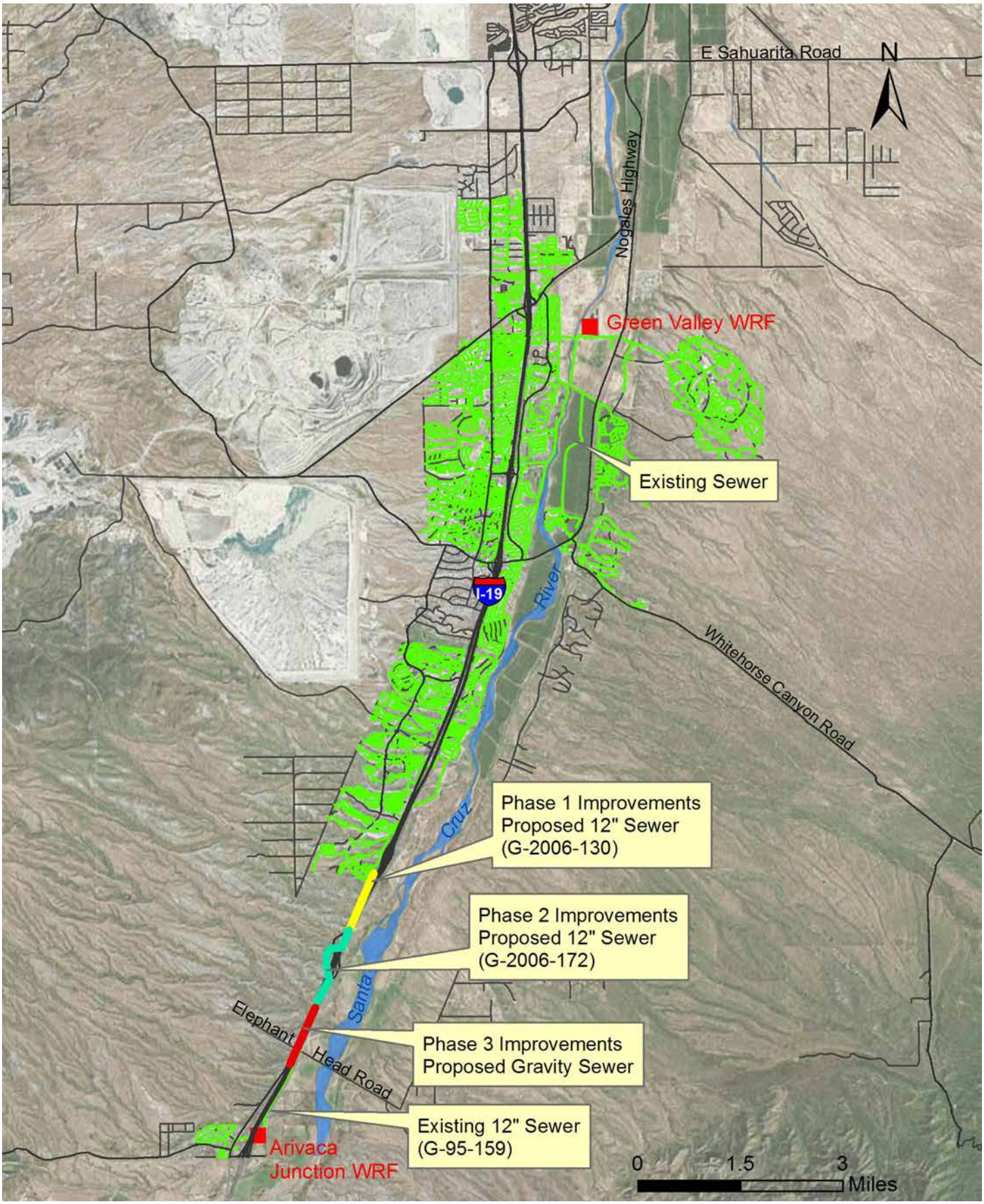
Table B.9-15 Growth Area 5 (Elephant Head East) Development Scenario 2

Scenario 2 Total Developable Land: 900 acres	Low (2 RAC)	Average (2.5 RAC)	Medium (4 RAC)	High (6 RAC)
Max Units	1,800	2,250	3,600	5,400
Pop (1.9 people per household)	3,420	4,275	6,840	10,260
Pop (2.7 people per household)	4,860	6,075	9,720	14,580

Table B.9-16 Growth Area 5 TAZ Projected Growth

TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
828	531	838	307
Total	**531**	**838**	**307**

B.10 ARIVACA JUNCTION WRF CANOA RANCH SEWER



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APPENDIX C: MOUNT LEMMON BASIN AREA STUDY

The Mt. Lemmon Water Reclamation Facility is located at the south end of Summerhaven, a community approximately 29 miles north of Tucson in the center of the Santa Catalina Mountains at an elevation of 8,000 feet.

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LIST OF ACRONYMS

APP	Aquifer Protection Permit
AZPDES	Arizona Pollution Discharge Elimination System Program
CDP	Census Designated Place
CIP	Capital Improvement Program
MGD	Million Gallons Daily
ML	Mount Lemmon (zoning designation)
MT	Mount Lemmon
MLWID	Mount Lemmon Water Improvement District
PCRWRD	Pima County Regional Wastewater Reclamation Department
PAG	Pima Association of Governments
RVC	Rural Village Center
USFS	United States Forest Service
UV	Ultraviolet
WRF	Water Reclamation Facility

Due to high-altitude weather extremes, the Mt. Lemmon Water Reclamation Facility is housed within a building.

EXECUTIVE SUMMARY

The Mt. Lemmon WRF service area largely consists of residential properties and several commercial properties in the community of Summerhaven. The United States Forest Service (USFS) limits the number of sewer connections on Mt. Lemmon to 77. There are currently only 31 active connections in the Mt. Lemmon WRF service area. Larger residential lots in the adjacent East and West Summerhaven are served by septic or vault systems.

Topographical conditions in the service area affects both on and off site disposal options. The steep terrain also directly impacts the costs associated with collection of the sewage from homes and conveyance to the facility.

The Mt. Lemmon WRF operates well under the 75% capacity limit. Discharge from the facility is currently prohibited from entering the Sabino Creek Watershed by both state law and also the current amended 208 Certified Area-wide Water Quality Management Plan (EEC, Inc., et al., 2008).

A number of developed and platted lots in and adjacent to Summerhaven that could be served by sewer still rely on private septic or vault systems. Like other service areas in the county, developers are responsible for constructing adequate sewage conveyance systems to connect to the existing conveyance system. However, physical constraints that contribute to high cost of sewer connection in the Mt. Lemmon WRF sewer service area are an obstacle to developers wishing to connect to the PCRWRD collection system.

At this time, PCRWRD does not have plans for financing the expansion of the sewer conveyance system on Mt. Lemmon. The existing gravity collection system is sufficient to handle expected flows through build out. Future connections to the collection systems will be allowed, provided adequate treatment capacity exists. Connection costs would be the responsibility of the developer/property owner.

Conclusions and Recommendations

The conclusions and recommendations presented below are referenced from the "Mount Lemmon Service Area Watershed Study & Wastewater Management Plan" conducted by EEC, Inc., et al. in 2008. All information is current and recommendations are relevant to the existing Mt. Lemmon WRF service area conditions.

- Continue to monitor development activities on vacant lots within the service area;
- Monitor flows to the Mt. Lemmon WRF to compare actual flow to projected flow;
- Continue to evaluate the condition of the Mt. Lemmon WRF, as well as the existing conveyance system;
- Continue to be involved in on-going planning efforts to ensure a unified integrated approach to watershed management, water supply and water distribution. Such efforts will ensure a sustainable future for Summerhaven;
- Develop new opportunities and uses for treated effluent;
- Continue to use the current spray field until other disposal options are developed; and,
- Monitor the potential for changes in the facility's permit to allow the discharging of effluent to Sabino Creek. This would require changes in public sentiment and to the law that currently prohibits this manner of effluent disposal.

C.1 INTRODUCTION

C.1.1 PURPOSE OF THE STUDY

The purpose of this Basin Study is to provide an analysis of and set goals for the conveyance and treatment needs of the Mt. Lemmon WRF service area. The Study evaluates the conveyance and treatment system needs through the projection of future population growth and development activities in the area.

C.1.2 STATEMENT OF NEED

In 2008, Engineering and Environmental Consultants, Inc., et al conducted the most recent comprehensive long-range planning study of the Mt. Lemmon WRF service area: the "Mount Lemmon Service Watershed Study and Wastewater Management Plan". This study is referenced throughout this document as the "EEC 2008 Study". Since the writing of the EEC 2008 Study, no significant development or regulatory changes have occurred in the service area. PCRWRD reviewed and updated the recommendations in the EEC 2008 Study for consistency with the existing service area conditions. This Basin Study is an update to the EEC 2008 Study.

C.1.3 STRUCTURE OF THE STUDY

Future sewer service is predicated on land use change. As land use intensity increases, water reclamation needs rise. During the comprehensive review of the Mt. Lemmon WRF basin area, PCRWRD looked at existing zoning designations and anticipated potential land use changes. This information coupled with the wastewater discharge planning assumptions (listed below) helped the department project future flows to the Mt. Lemmon WRF.

C.1.4 METHODS USED

Analysis of generally accepted projection data is a primary source for this basin study. U.S. Census data was used in population estimates and projections for the Mt. Lemmon WRF service area.

Qualitative research encompassed a review of existing facility plans, basin studies, federal, state, and local regulations, facility permits for regulatory compliance, and regional plans (such as ROMP and PAG 208 Plan).

PCRWRD uses the following wastewater discharge planning assumptions in flow projections:

- 80 gallons of wastewater generated per day per person (Arizona Administrative Code, Title 18, Chapter 9, Table 1. Unit Design Flows).
- 2.7 persons per household (currently used by PCRWRD in estimating wastewater production by single-family household).

C.2 REGULATORY COMPLIANCE

Wastewater infrastructure is in compliance with federal, state, and regulatory requirements. This section outlines the compliance requirements for the Mt. Lemmon WRF, including the facility's current operating permits. There are also sewer service agreements and intergovernmental agreements (IGAs) between the County and other entities, both public and private, for the provision of sewer service or for the reuse of effluent. The sewer service agreements usually outline certain commitments and requirements from each party.

The Federal National Environmental Policy Act (NEPA) Process

The community of Summerhaven is surrounded by Coronado National Forest. The forest is federal land. Because the adjacent land is federally owned, use of it not only requires special-use permitting, but also results in National Environmental Policy Act (NEPA) requirements that apply to requests for special use.

The National Federal Policy Act ensures that all Federal Agencies' policies, plans and programs would be given careful consideration of their impacts on the environment. The Act, and guidelines set forth by the Council on Environmental Quality make it mandatory that an environmental impact statement (EIS) be written whenever there is a significant potential of adverse impact on the environment as a result of EPA action.

There are three aspects of the NEPA process which are determined based on the significance of the project and impact on the environment. There is a Categorical Exclusion and decision Memo for projects determined to have no issues or impact on the environment. Projects that result in non-significant to significant environmental impacts require an Environmental Assessment (EA) of and an Environmental Impact Statement (EIS). Significant changes to the existing disposal option at the Mt. Lemmon WRF would require an EA or EIS submittal.

C.2.1 PERMITS

United States Forest Service Special Use Permit

A special-use authorization is a legal document such as a permit, term permit, lease or easement which allows use, rights or privileges on USFS land. The authorization is granted for a specific use of land for a specific period of time whether long term or temporary. All requests must be consistent with laws, regulations, orders, policies of the USFS and all applicable state and local laws. Furthermore, the permit must be consistent with standards and guidelines in the applicable Forest Land and Resources Management Plan.

The current Mt. Lemmon WRF discharges to a spray field located in the Coronado National Forest federal land with the permission of the USFS under a special use permit. The Mt. Lemmon WRF operates under Special Use Permit SAN0139, issued on April 10, 2003 and amended through Amendment 1 dated December 1, 2004. The permit allows the use of a 10-acre area.

The special use permit was amended in 2004 to accommodate 30 additional connections, as long as monthly average flows do not exceed 12,500 GPD and the maximum of 17,000 GPD gallons in one day. The 30 additional connections were added as part of fire recovery efforts. The special use permit allows for up to a total 77 possible connections that are authorized by the permit and other related documents referenced by the permit. The total flow allowed by the special use permit was not increased in Amendment 1, even though additional connections were added. This may be a reaffirmation of the USFS objective stated in the current special use permit regarding discharge of the effluent within the same watershed of origin. The current USFS special use permit expires on June 1, 2022. Provided there are no changes to plant operation or increase in flow beyond the 12,500 GPD monthly average, the special use permit does not require modification.

The current special use permit expires on June 1, 2022. Provided there are no changes to facility operations or increase in flow be-

Mt. Lemmon Water Reclamation Facility, Laboratory Unit.

yond the 12,500 GPD monthly daily average, the special use permit does not require modification.

The Mt. Lemmon WRF also operates under an AZPDES (AZ0022250) and a Type I General APP permit. The General APP regulates discharges to local aquifer. The AZPDES permit is to allow the discharge of effluent from the facility to unnamed washes, which is permitted only during freezing or inoperable conditions of the spray fields. The discharge flow records show that the facility has not discharged to the washes since 2002 (AZPDES, Fact Sheet, pg 2).

Discharge from the facility is currently prohibited from entering the Sabino Creek Watershed by both state law (ADEQ rule in AAC R18-11-123(A) and also the current amended 208 Certified Area-Wide Water Quality Management Plan (EEC, Inc., et al., 2008). The current AZPDES permit is valid through 2016.

Table C-1 includes current Mt. Lemmon WRF operating permits.

C.3 PLANNING EFFORTS

Comprehensive land use plans have been developed covering the entire Pima County. The Mountain Lemmon WRF service area falls into the Catalina Foothills Planning Area of the Pima County Comprehensive Plan – Pima Prospers. Arizona "Smart Growth" legislation requires county and municipal General Plans. State law sets periodic reviews. Changes to General Plans require voter approval.

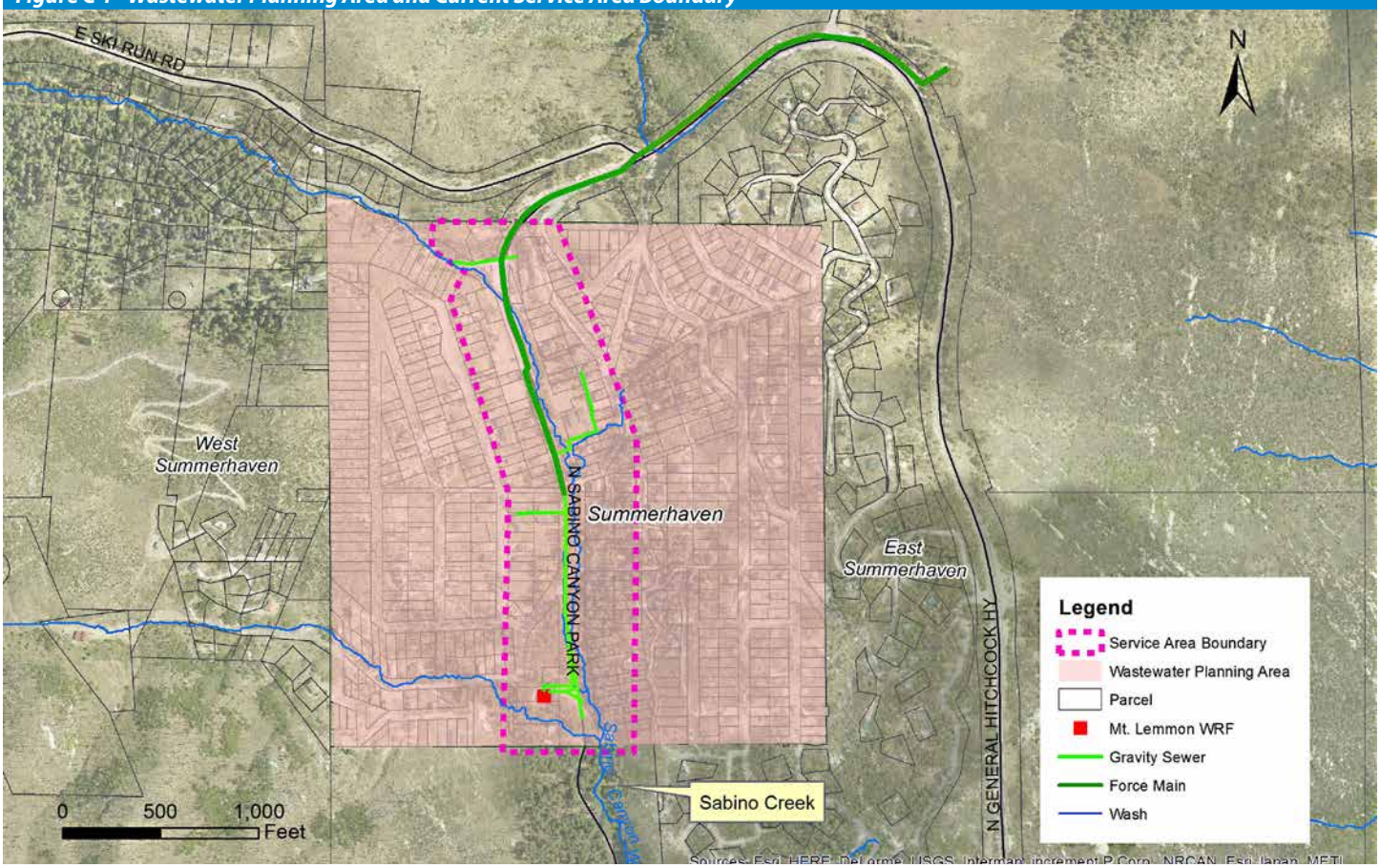
PIMA COUNTY INFRASTRUCTURE PLANS

Integrated and coordinated infrastructure planning in Pima County is accomplished with the oversight of different committees and the Capital Improvement Program. Collaboration of planning for flood control, transportation, parks and recreation, open space and wastewater management is critical to the planning process.

Table C-1 Mt. Lemmon WRF Operating Permits (March 2015)

Facility	AZPDES	APP	USFS	PAG 208 Plan	Jurisdictional Waters
Mt. Lemmon	AZ0022250 (Expiration 10-May-16)	Type I GP (P-100345) (Rule Conditions no longer satisfied)	Special Use SAN0139 (Expiration 1-Jun-22)		Unnamed Wash
Flow Limits	12,500 GPD Mo. Ave, 17,000 GPD Daily Peak	20,000 GPD	12,500 GPD Mo. Ave, 17,000 GPD Daily Peak	18,189 GPD (1981) and no Discharge to Sabino Creek	
Renewal/Replacement Time	~ 18 months	~ 18 months	NEPA - up to 2 years	~ 9-18 months	

Figure C-1 Wastewater Planning Area and Current Service Area Boundary



C.3.1 PREVIOUS WASTEWATER PLANS AND BASIN STUDIES

The Mount Lemmon Service Area Watershed Study and Wastewater Management Plan by EEC, Inc. et al., (the EEC 2008 Plan) recommended the replacement of the existing facility. The EEC 2008 Plan includes a 20-year planning horizon and provides recommendations for the facility improvements based on estimated service demand for the time horizon. Because new development is not occurring in the service area, the replacement option is not considered a near-term priority.

A prerequisite for the facility expansion is the extension of the conveyance system. The lack of an extended conveyance system is the reason existing conveyance system service is limited primarily to lots fronting the public sewer. Without an extended public conveyance to connect new homes to the facility, many private lot owners would rather remain on septic or vault systems than pay for costly extensions of private sewers and associated connection fees.

C.4 SERVICE AREA ANALYSIS

C.4.1 WASTEWATER PLANNING AREA AND CURRENT SERVICE AREA BOUNDARY

The wastewater planning area (WPA) consists of the one square mile of high density lots in Summerhaven (**Figure C-1**). East and West Summerhaven were not included in the WPA because the lots in these areas are larger and can accommodate a wider range of on-site private, alternative wastewater systems compare to the smaller lots in the WPA. The Mt. Lemmon WRF currently serves a limited number of lots along Sabino Canyon Park Road. The service area boundary is presented as a dashed magenta line in the figure. Sabino Canyon which flows from the north to the south bisects Summerhaven into two halves. East and West Summerhaven are located on the hills on either side of the square mile. All drainage in Summerhaven flows towards the Sabino Creek, the lowest point in the terrain.

C.4.2 LAND OWNERSHIP

The community of Summerhaven is bounded on all sides by Coronado National Forest. The Forest is managed by the United States Forest Service (USFS), an agency of the U.S. Department of Agriculture. The land ownership in and adjacent to the service area is primarily private surrounded by national forests.

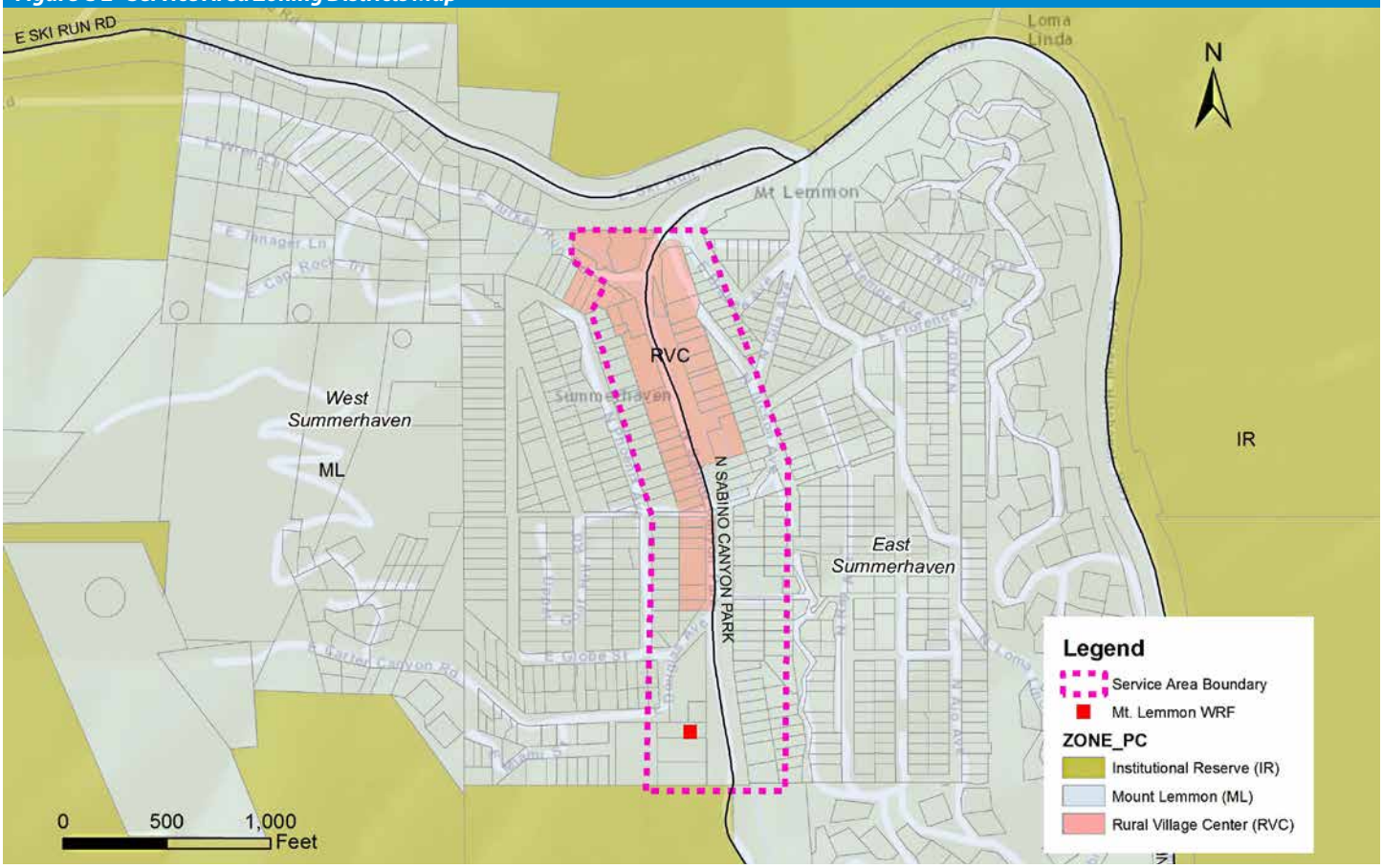
There are two lots south of the Mt Lemmon WRF. One lot is vacant and the other houses an inactive school building; both are owned by Pima County. These lots could be used for a future facility expansion or upgrade.

C.4.3 EXISTING LAND USE AND ZONING

The service area land use is primarily residential with a few commercial enterprises and a community center.

Zoning in Summerhaven is a mixture of Rural Village Center (RVC)

Figure C-2 Service Area Zoning Districts Map



and Mount Lemmon (ML). RVC zoning is limited to the lots adjacent to Sabino Canyon Park Road and Turkey Run Lane (see **Figure C-2**). RVC is generally designated to provide a mixed-use village center including commercial and residential uses, planned and designed for the convenience of a suburban or rural area, with the purpose of preserving the suburban character of "downtown" Summerhaven.

The surrounding ML zoning provides for a minimum lot size of 36,000 square feet, however the zoning regulations allow for smaller lot sizes for lots recorded prior to June 19, 2003 (EEC, Inc., et al., 2008). The primary use of land in the ML zoning is individual home sites.

C.4.4 SERVICE AREA BUILDOUT

Several residential, commercial and retail projects, including a hotel, have been planned in the Mt. Lemmon WRF service area. The future projects include the Alpine (residential and restaurant), the Ponderosa (hotel), the Orchards (residential), and the Lodge Summerhaven (hotel). Individual homes will continue to be constructed on lots with an ML zone designation. Flows from planned commercial properties will have higher flows and significantly different peaking factors, potentuially consume all remaining treatment capacity.

Based on GIS data analysis, there are approximately 343 lots available for development in Summerhaven East and the Summerhaven West. Of the 343 availble lots, 315 are zoned ML and 28 are zoned RVC. The department used previously-collected data by EEC, Inc., et al. for the comparison purposes. Properties with potential for development include existing vacant lots and damaged lots that have not been rebuilt since the 2003 Aspen fire. Undevelopable lots with high slopes, as identified by ECC, Inc., were not included in this count. A total of approximately 58 acres are available for development.

C.4.5 DEVELOPMENT CONSTRAINTS

The area surrounding the Mt. Lemmon WRF service area is steeply sloped; there is only a limited amount of flat land available for development. A number of lots have been platted but are not likely to be developed due to topographic constraints. (Typically, a lot with an average slope greater or equal to 40% is considered an improbable construction site.) There are many platted lots in East and West Summerhaven that could potentially be connected to the sewer; however, connecting to the sewer could be economically infeasible for the owners.

C.4.6 SERVICE AREA POPULATION

Census 2010 estimated a total of 40 people living in the community of Summerhaven which the Census Bureau designates CDP (Census Designated Place). This CDP includes the Mt. Lemmon service area and the western portion of Summerhaven (which is not part of the Mt. Lemmon service area). The population of the service area in 2000 was counted at 11; the 2010 census counted the population of the service area at four. The low population estimates are attributed to a low number of permanent residences registered in the area.

Figure C-3 Conveyance System

The TAZ population data includes the Mt. Lemmon Service Area in TAZ 687, which encompasses the entire northeast corner of the county (approximately 248,000 acres). Population data for TAZ 687 indicates 163 people lived in this area in 2010, and 295 people are projected to live in the area in 2045, a figure that corresponds to an annual growth rate of 1.74%. Given the size of the TAZ area and its wilderness classification, it is difficult to project the future population of the area.

C.4.7 WATER RESOURCES

Two entities possess water rights in the Mt. Lemmon region, the USFS and the Mt. Lemmon Water Improvement District (MLWID). The USFS and MLWID have been operating independent water supply systems since 1944. The USFS water rights were recorded for the region as early as 1902. The USFS has rights to 35.49 acre-feet per year combined between surface water rights and well pumping/groundwater rights. The MLWID supplies community drinking water and relies mostly on spring water as their drinking source. The District has existing rights to six wells and three springs in the Mt. Lemmon region (EEC, Inc., et al., 2008).

More efficient reuses of effluent, such as discharging the treated effluent to Sabino Creek to enhance base flow, could be considered in the future. However, this would require improvements to the facility to meet more stringent water quality standards and a change in state law. Other potential beneficial uses for effluent include utilization of effluent for fire suppression, snowmaking and irrigation of revegetated and reforested areas to reduce soil erosion and create more green space.

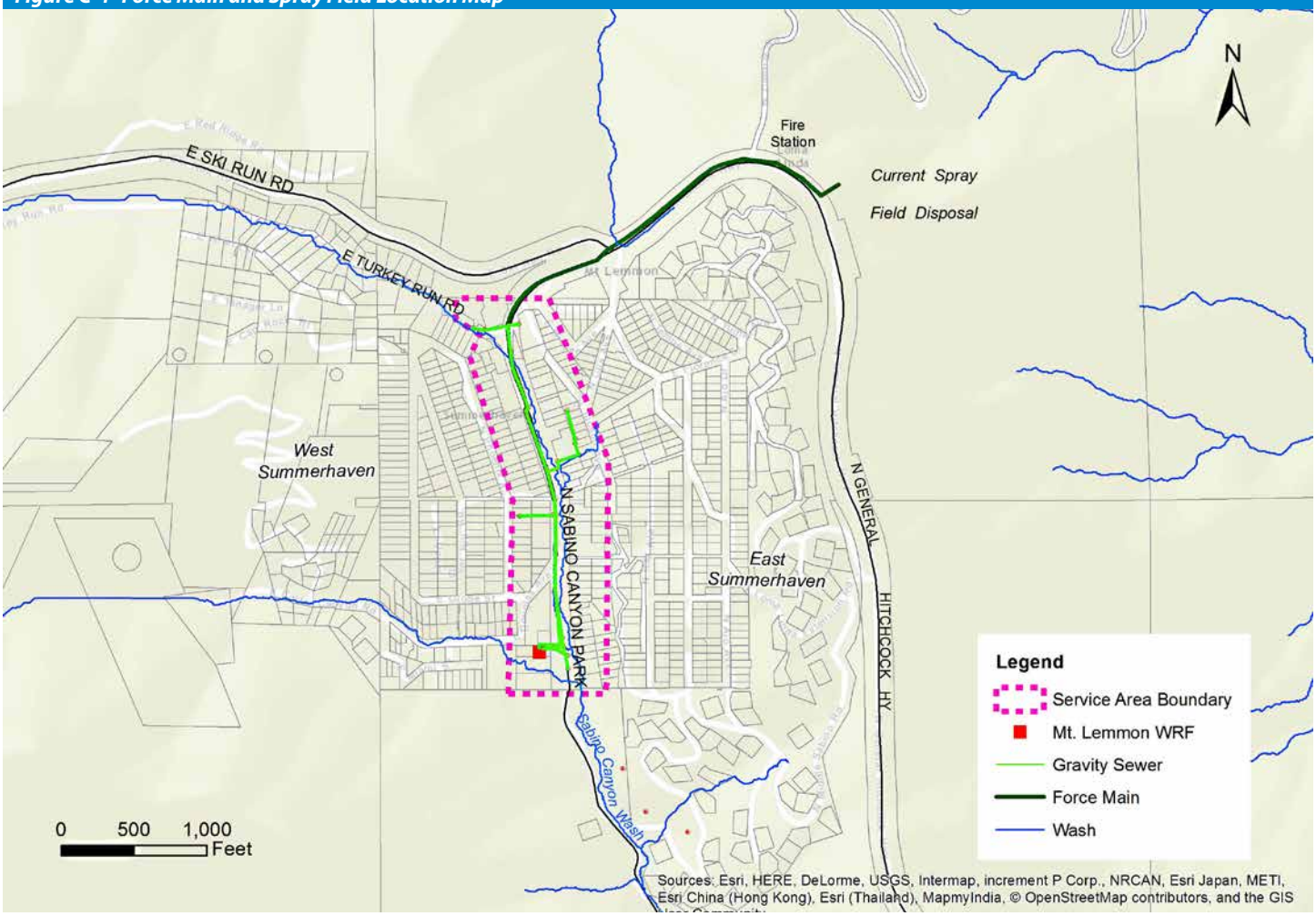
C.5 EXISTING WASTEWATER INFRASTRUCTURE

C.5.1 CONVEYANCE SYSTEM

The existing conveyance system consists of approximately 2 miles of gravity sewer lines ranging from 6 to 8 inches in diameter, 27 manholes and 2 cleanouts. The 8-inch sewer collector main (G-81-039) commences at the intersection of Turkey Run Road and Sabino Canyon Park Road, runs southerly and parallel to Sabino Canyon Park Road and Sabino Creek, and terminates at the influent pump station located on the west side of Sabino Canyon Park Road, immediately north of the Mt. Lemmon WRF (**Figure C-3**).The collector line is sized for flow up to 500,000 GPD. The EEC 2008 Plan indicated the size of this collector line is sufficient to accept flows from all foreseeable future developments within the service area.

In the past, there was significant inflow into the conveyance sys-

Figure C-4 Force Main and Spray Field Location Map



tem during snow melt and heavy rain events. Over the past five years, the department has lined the public sewers and manholes. This has greatly reduced inflow and infiltration, however, there may still be some flow coming from open HCS stubs. Following the Aspen Fire, the department performed smoke tests on the system. These tests allowed staff to identify fire-related openings in the system. The openings (whether in the public system or a private system) were sealed to eliminate the large amount of inflow that was entering the sewers through the damaged pipes and HCSs.

C.5.2 TREATMENT SYSTEM

The existing treatment system consists of a water reclamation facility, an influent pump station and approximately 4,000 feet of force main that convey effluent to the disposal spray fields (**Figure C-4**).

Parallel to the 8-inch collector line runs a force main, which continues upstream in General Hitchcock Highway and terminates in the spray fields. The effluent disposal facilities consist of:

1. An effluent force main;
2. An effluent storage tank;
3. A booster pumping station;
4. Six effluent spray fields with 13 spray heads in each field; and
5. Three surface discharge points.

The pump station has a working volume of approximately 1,800 gallons and is equipped with dual 5HP grinder pumps (EEC, Inc., et al., 2008).

The effluent spray field system of 6 sub-spray fields consists of underground distribution piping within a 10-acre area. The original idea of the spray field was to minimize erosion. Significant structural damage to the spray field was caused by the Bullock and Aspen fires that occurred in 2002 and 2003 and left only one-third of the system (in the northern portion), functional. Rehabilitation of the spray filed was completed in the FY 2013/14.

MOUNT LEMMON WATER RECLAMATION FACILITY

The Mt. Lemmon WRF began operations in 1984 and was constructed to replace a failing wastewater storage system and in response to septic systems concerns in the area of Sabino Creek. Given concerns over Creek water quality, the facility was required to discharge treated effluent north of Summerhaven on National Forest land.

Facility Location and Service Area

The Mt. Lemmon WRF is located at the south end of Summerhaven at 12633 N. Sabino Park Road (**Figure C-2**). The facility sits on a small lot owned by Pima County. The service area includes 77 lots.

Table C-2 Mt. Lemmon WRF Annual Influent Flow								
Year	Capacity (GPD)	Annual Average Influent (GPD)	Percentage of Capacity (Avg Amt Influent/Capacity)	Peak Influent (Monthly Avg Amt in GPD)	Percentage of Capacity (Peak Influent/Capacity)	Lowest Influent (Monthly Avg Amt in GPD)	Percentage of Capacity (Lowest Influent/Capacity)	Percentage Change Peak to Low
2006	15,000	3,014	20.09%	August*, 12,711	Capacity Exceeded	January, 1,612	10.75%	87.32%
2007	15,000	2,514	16.76%	December, 4,798	31.99%	April, 1,837	12.25%	61.71%
2008	15,000	3,339	22.26%	February, 6,203	41.35%	May, 2,198	14.65%	64.57%
2009	15,000	2,211	14.74%	January, 3,631	24.21%	October, 1,734	11.56%	52.24%
2010	15,000	3,079	20.53%	March, 7,211	48.07%	December, 1,463	9.75%	79.71%
2011	15,000	1,664	11.09%	July, 2,163	14.42%	November, 1,322	8.81%	38.88%
2012	15,000	2,235	14.90%	July, 2,652	17.68%	February, 1,658	11.05%	37.48%
2013	15,000	2,413	16.09%	July, 3,126	20.84%	April, 1,803	12.02%	42.32%
2014	15,000	1,885	12.57%	June, 2,267	15.11%	February, 1,501	10.01%	33.79%
2015	15,000	2,669	17.79%	August, 3,303	22.02%	March 1,952	13.01%	40.90%

*High flow of 12,711 GPD measured in August 2006 was due to manhole repair

Facility Capacity and Current Flows

The Mt. Lemmon WRF is rated for a capacity of 15,000 GPD. The facility operates under a special use permit issued by the USFS that authorizes a treatment capacity of 17,000 gallons per day, provided the daily average flows do not exceed 12,500 GPD average flow. The amount of daily influent at the Mt. Lemmon WRF varies considerably depending on tourists and other fluctuations, such as weekend and holiday visitors.

The average monthly flow recorded in 2015 was 2,669 GPD (18 % capacity). The highest average monthly flow was recorded in March of 2010 and was at 7,211 GPD (48% capacity) (**Table C-2**).

The average monthly influent flow of 2,500 GPD, as measured in the past seven years (2006 through 2015), indicates the facility operates well below the permit limits. However, peak flows on holidays and weekends can reach up to three times the base flow to the facility. Peak flows are currently below permit limits[1]. In addition to all approved residential and commercial connections, one public toilet facility also contributes flow to the facility.

The wastewater treatment facilities typically apply for permit amendments for expansion when flows approach 75% of current facility capacity. The 75% level for this facility is 11,250 GPD. The facility currently operates well below the 75% capacity limit.

The spray field discharges Class B effluent at a minimum of 2,500 GPD. Actual daily discharges vary considerably depending on tourist use and other fluctuations (e.g. weekend and holiday visitors use) (EEC, et al., 2008).

[1] The highest peak influent of approximately 12,700 GPD (85% capacity) was recorded in August of 2006 (Table C-2). The high flows were attributed to a contractor relocation of three manholes in the Sabino Canyon roadway improvement project, which promoted temporary significant inflows from Sabino Creek and groundwater (EEC, Inc., et al., 2008, pg 36).

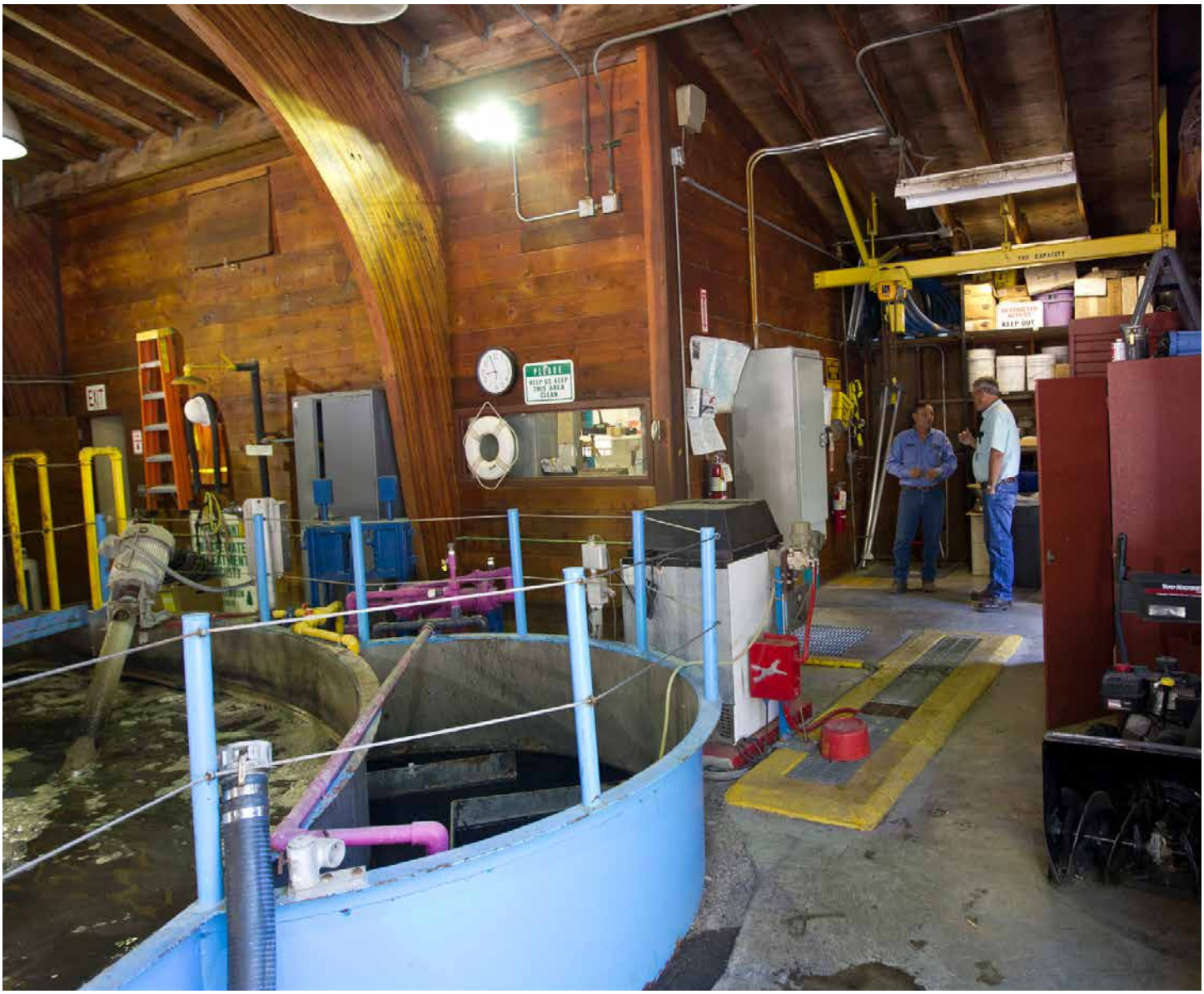
Treatment Process

Due to the weather extremes at this location, the treatment facility is housed within a building. The collection system flows by gravity to a lift station located at the treatment plant. The lift station pumps directly intoan oxidation ditch. The Mt. Lemmon WRF uses an oxidation ditch without nutrient removal for the biological treatment. The flow then goes to a secondary clarifier which is located in the center of the oxidation ditch. After settling, the effluent flows to a chlorine contact chamber, then to a flow measuring Parshall flume and finally to the effluent pump station. The effluent is pumped one mile to the spray field holding tank. The effluent is disposed by pumping from the tank to the spray heads.

All the effluent generated at the facility is discharged to a spray field and reused for irrigation of forest vegetation. In the event the spray heads are inoperative, the effluent can be disposed via three combined outfalls, which discharge to unnamed washes, all tributary to the San Pedro River. The discharge to the washes is permitted only during freezing or inoperable conditions of the spray field (AZPDES permit). The sludge that is collected in the secondary clarifier is wasted and stored in a waste holding tank. The contents of the holding tank are aerated to reduce odors. Sludge is then hauled off the mountain to the collection system at Tanque Verde Road at manhole 8716-03.

Recharge and injection are not recommended for disposal of treated effluents due to costs and uncertainties associated with the local geology, and sensitive springs which are the primary source of drinking water (EEC, Inc., et al., 2008).

There has been a discussion in the past to use some of the effluent for irrigation of the community areas or for fire fighting purposes. Another option under consideration is to discharge the effluent to the Sabino Creek watershed to enhance base flow. This option would require compliance with various state and federal regulations, and PCRWRD would need to obtain an AZPDES permit, APP, USFP special



Mt. Lemmon Water Reclamation Facility utilizes an oxidation ditch and clarifier for secondary treatment.

use permit, an Environmental Assessment (EA) and possibly an Environmental Impact Statement (EIS). Local residents and stakeholders are generally supportive of the idea of returning properly-treated effluent to the Sabino Creek watershed (EEC et. al., 2008).

OUTLOOK OF FACILITY

The Mt. Lemmon WRF currently serves approximately 31 connections. The USFS special use permit allows for additional 46 connections for a total of 77 connections. Several projects will contribute to an increased influent flow. These include residential (the Alpine, the Ponderosa, the Orchards) and commercial projects, as well as a hotel (the Lodge Summerhaven), totaling an estimated flow of 11,580 GPD. In addition to these, remaining permitted connections would also contribute additional flow sometime in the future.

The EEC 2008 Study explained that the trend in development in Summerhaven is different than previous practices. Rebuilt homes are larger, have more stories and contribute more wastewater to the system. Lots in East and West Summerhaven are larger compared to the smaller lots in the service area and can accommodate a wider range of on-site private, alternative wastewater systems. These lots could connect to the public sewer, however the high connection cost due to topographic constraints would make this option economically infeasible for the owners.

In response to current treatment and conveyance system improvement needs the following Mt. Lemmon WRF service area CIP projects are under consideration:

- Replacement of Spray Field Force Line
- Conveyance System Rehabilitation
- Odor Control – Ventilation of Building
- SCADA and Automation Upgrades

Upon completion of the facility condition re-assessment the department will evaluate the following options:

- Major rehabilitation and/or expansion of the existing facility; or
- Replacement of the existing facility with a new modern facility.

C.6 OUTLOOK OF SERVICE AREA

According to the EEC 2008 Study, the expansion of the current service area does not seem to be economically feasible. Many destroyed larger lots that were previously served by septic are still waiting to be redeveloped and possibly connected to an extended sewer. However, expanding a gravity sewer to most of these lots would be expensive due to topography and distance from the existing system. The same assumption is made for the lots in Summerhaven West and Ski Valley farther west. These areas could potentially be served by a public sewer system but at the expense of developers or property owners. The existing sewer line in Turkeyhead Road could potentially be extended to serve these areas.

The USFS and public preserve land surrounding the facility suggests little potential for development in this area. This means that all land-use options for expansion and disposal necessitate one of the following and related permits as needed to support the uses (EEC, Inc., et al., 2008):

- Access and use of USFS land by special use permit;
- Acquisition of private land; or
- Agreements with private owners through a political agency, management district, right of way, easement or other legal process.

In addition, inaccessible, steep terrain coupled with high cost of construction on slopes makes the majority of undeveloped areas in Summerhaven unsuitable for development. Furthermore, the EEC 2008 Plan indicates that topographic, geologic, and soils constraints make some areas unsuitable for septic tanks.

C.7 REFERENCES

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APPENDIX D: SOUTHEAST WASTEWATER PLANNING AREA STUDY

The Study Area encompasses approximately 300 square miles.

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LIST OF ACRONYMS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADWF	Average Dry Weather Flow
ADWR	Arizona Department of Water Resources
AFB	Air Force Base
AMA	Active Management Area
APP	Aquifer Protection Permit
ASLD	Arizona State Land Department
AZPDES	Arizona Pollutant Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
BNROD	Biological Nutrient Removal Oxidation Ditch
BNRAS	Biological Nutrient Removal Activated Sludge
CCA	Corrections Corporation of America
CIP	Capital Improvement Program
CLR	Closed Loop Reactor
CMOM	Capacity, Management, Operations, and Maintenance
DMA	Designated Management Agency/Area
DMAFB	Davis Monthan Air Force Base
EPA	U.S. Environmental Protection Agency
GPD	Gallons Per Day
HAMP	Houghton Area Master Plan
HCS	House Connection Sewer
IGA	Intergovernmental Agreement
MGD	Million Gallons per Day
MH	Manhole
MSL	Mean Sea Level
ONH	Old Nogales Highway Interceptor
PAG	Pima Association of Governments
PCC	Pima County Code
PCRWRD	Pima County Regional Wastewater Reclamation Department
PCRFCD	Pima County Regional Flood Control District
PDWF	Peak Dry Weather Flow
PTI	Pantano Interceptor
PVC	Polyvinylchloride
PWWF	Peak Wet Weather Flow
RAC	Residences per Acre
RCP	Reinforced Concrete Pipe
ROMP	Regional Optimization Master Plan
SAT	Soil Aquifer Treatment
SDCP	Sonoran Desert Conservation Plan
SEI	Southeast Interceptor
TAZ	Transportation Analysis Zone
VCP	Vitrified Clay Pipe
WRF	Water Reclamation Facility

The Study Area includes the region's major employers, Raytheon, Tucson International Airport and, Davis Monthan Air Force Base (DMAFB), among others.

EXECUTIVE SUMMARY

The Southeast Wastewater Planning Area (the Study Area) has experienced rapid population growth in the past two decades and has been designated as one of the fastest growing areas of the region in terms of the addition of new residential units. PCRWRD must pay close attention to capacity and infrastructure planning to accommodate future growth in this area.

Several factors have been considered when deciding on the boundaries of the Southeast Area. They include:

- Topographic constraints,
- Land use regulations,
- Land ownership and availability of land for development,
- Current and planned development patterns, and
- Location of existing infrastructure.

The Study Area encompasses approximately 300 square miles and is roughly defined by Old Nogales Highway on the west, Golf Links Road/Old Spanish Trail on the north, State Highway 83 (Sonoita Highway)/Pistol Hill Road on the east, and the Santa Rita Experimental Range on the south (three miles south of Sahuarita Road). Projections show that the Study Area will accommodate a large portion of population growth of the City of Tucson and unincorporated Pima County.

The Study Area includes the region's major employers, the UA Science and Technology Park, Raytheon, Tucson International Airport and, Davis Monthan Air Force Base (DMAFB). Service expansion is anticipated as new growth located in several master-planned communities materializes. Diamond Ventures has reactivated the Rocking K development and is seeking approvals for two new specific plan communities south of I-10: the Verano and Hook M Ranch developments. In addition, the city-planned Houghton Area Master Plan (HAMP) provides a framework for organizing development along the newly widened Houghton Road corridor, north of I-10.

The Study Area is served by two sub-regional treatment facilities, the Corona de Tucson Water Reclamation Facility (WRF) and the Fairgrounds WRF. The existing conveyance infrastructure serving the area's population is comprised of a sewer network that conveys sewage to the facilities for treatment. Sewage generated in the areas tributary to the Southeast and the Pantano Interceptors is conveyed to by the metro conveyance system for treatment at the Agua Nueva WRF.

PCRWRD has identified the need for a new sub-regional water reclamation facility to serve the Southeast Planning Area. The department has located and evaluated a potential site for the facility. Given the emerging developments in the service area, the department is planning an expansion of the Corona de Tucson WRF. In addition, the City of Tucson and Pima County are studying the existing Houghton Reservoir site as a potential location for recharge basins.

The current actual flows and future committed capacity at the Corona de Tucson WRF are equal to the facility permitted treatment capacity. Additional capacity cannot be granted at the time

of this writing. Development to the north and west of the facility, Hook M Ranch, and other existing platted developments) cannot be connected to the Corona De Tucson WRF without an expansion in treatment capacity.

The seasonal fluctuations in flows at the Fairgrounds WRF create operational and cost-efficiency problems to PCRWRD. The construction of new development near the Fairgrounds has been considered on several occasions. The Fairgrounds WRF does not have much capacity available and therefore would require expansion.

There are several options for the Fairgrounds WRF service area expansion. The most favorable and cost effective option is to construct a gravity line north from the facility to redirect the flows to the Southeast Interceptor (SEI). However, this option is not viable until there are sufficient flows from the Fairgrounds site. After connecting to the public sewer, the Fairgrounds WRF will be decommissioned.

Conclusions and Recommendations

- The department has initiated steps to accommodate future development in the Southeast Planning Area with augmentations to the SEI, the ONH and a planned Aerospace Corridor Interceptor.
- The expansion of the Corona de Tucson WRF is necessary to support growth in the service area. The capacity expansion will require purchase of State Trust Land for the facility expansion and the anticipated noise and odor mitigation buffer.
- The most cost-effective option for the Fairgrounds WRF is to extend the proposed 10-inch sewer line from the facility to the SEI.
- The department is considering the use of a new regional WRF or a package plant when appropriate and has selected the facility location.
- The department is monitoring development activity and wastewater flows within the Southeast Planning Area.

D.1 INTRODUCTION

D.1.1 PURPOSE OF THE STUDY

The purpose of this Study is to provide an evaluation of current and evolving development trends, as well as an analysis of future infrastructure needs in the Southeast Planning Area. While there are many basin studies for individual expansion projects, no study provides a comprehensive examination of population growth, development trends, predictions for capacity demands and needs, or allocation of future facilities in the Southeast Planning Area. This Study provides information on population, regulatory compliance, and environmental implications relevant to the use of Study Area facilities. The study provides recommendations to maximize existing facilities and minimize capital costs for the County, while ensuring compliance with federal, state, and local regulations. The department used a comprehensive review of collected material from previously approved studies to prepare of this study.

In addition, a comprehensive review of anticipated land use changes has been undertaken and the results correlated with demographic projections and historic wastewater use formulae to calculate anticipated flows to be added to the Southeast Sewer Interceptor, Pantano Sewer Interceptor and the Old Nogales Highway Interceptor. The flows that may be logically added to the existing Corona de Tucson WRF are calculated as allocated.

PCRWRD has reviewed preliminary studies for a new wastewater treatment facility, and has evaluated separate scenarios for bringing that facility on-line. The department is also evaluating a treatment facility designed to scalp influent and has chosen the facility location. To this end, the department has developed different scenarios and has preliminary calculations on the impacts to effluent flows. Because the need for this facility remains undetermined, the benefits and costs will be evaluated and ranked in a future review.

D.1.2 STATEMENT OF NEED

Future sewer service is predicated on land use change. As land use intensity increases, wastewater treatment needs rise. The following events, circumstances, or issues have in general triggered the need for preparation of this Study:

- Growth trajectory has altered since the publishing of the 2006 Metropolitan Area Facility Plan Update.
- The development process has concretized conceptual schemes – emerging trends are more measurable.
- Infrastructure serving the region is approaching capacity.
- Financing of infrastructure requires time to develop and buy-in by the owner and users.

A rapid population growth in the Southeast Planning Area over the past decades, and specifically in the master planned communities, prompted the need for further analysis of development trends and their impact on the existing conveyance and treatment system in the area. The need for construction of an additional treatment facility had been determined prior to the writing this plan. However, as of publication, the 2010 population projections for the Southlands service area have not materialized due to the economic slowdown, which has left most of the area underdeveloped.

D.1.3 STRUCTURE OF THE STUDY

This Study begins with a basic overview of the Southeast Wastewater Planning Area. Next, the Study reviews the various regulatory drivers for compliance at the federal, state, and local level, as well as regional plans and studies directing growth and infrastructure improvements in Pima County. A full analysis of the planning area and existing infrastructure at the Corona de Tucson WRF and Fairgrounds WRF follows. The objective of the Study is to provide analysis of and set goals for the conveyance and treatment needs of the Southeast Wastewater Planning Area as discussed in the Existing Wastewater Infrastructure Section of the Study.

D.1.4 METHODS USED

Both qualitative and quantitative research and data analyses went into the preparation of this document. Analysis of generally accepted projection data and review of previously published documents are the primary sources for this report.

Qualitative research included a review of existing facility plans, basin studies, federal, state and local regulations, facility permits for regulatory compliance and regional plans (such as ROMP and PAG 208 Plan). Quantitative research and data analysis consisted of metering data related to the influent and effluent of the Corona de Tucson WRF and Fairgrounds WRF. The Pima County GIS data and

Table D-1 Corona de Tucson WRF and Fairgrounds WRF Operating Permits (March 2015)						
Facility	AZPDES	APP	Reuse	Industrial Stormwater	Air Quality	ADWR Recharge
Corona de Tucson	NA	P100644	NA	AZMSG-2010	ATO #3302, GP #300 (Expiration 30-June-18)	#73-211284 & #71-211284 (Expiration 10-Feb-29)
Pima County Fairgrounds	NA	Type I GP	NA	NA	NA	NA

TAZ population data, as well as the 2010 U.S. Census Bureau data were utilized in land use and population projections.

The study outlines sequential analysis of population growth for each five-year increment. Sources for population analysis included the U.S. Census Bureau, the Arizona Department of Administration and PAG. Daily wastewater flow histories and land use buildout maps helped to project maximum, high, medium, and low flow scenarios. Research also included facility site visits, visits to surrounding properties and interviews with facility and other PCRWRD employees.

PCRWRD uses the following wastewater discharge assumptions in flow projections:

- 80 gallons of wastewater generated per day per person (Arizona Administrative Code, Title 18, Chapter 9, Table 1. Unit Design Flows).
- 2.7 persons per household (currently used by PCRWRD in estimating wastewater production by single-family household).

D.2 REGULATORY COMPLIANCE

Wastewater infrastructure is in compliance with federal, state, and regulatory requirements. This section outlines the compliance requirements for the wastewater facilities within the Study Area, including the current operating permits. There are also sewer service agreements and intergovernmental agreements (IGAs) between the County and other entities, both public and private, for the provision of sewer service or for the reuse of effluent. The sewer service agreements usually outline certain commitments and requirements from each party.

D.2.1 PERMITS

AQUIFER PROTECTION PERMIT (APP)

In compliance with *Arizona Revised Statutes (ARS) §§ 49-241 thru 49-252 and Arizona Administrative Code (AAC) R18-9-101 - R18-9-403*, any facility that discharges a pollutant to an aquifer, either directly or to a reasonable probability, must have an APP. Wastewater facilities are designated as "discharging" facilities and require such an APP. There are a number of requirements to receive a permit. Most significant are the inclusion of best available demonstrated control technology (BADCT), which ensures the aquifer water quality standards are not exceeded at the point of compliance.

The Corona de Tucson WRF has an APP (P-100644) valid for the life of the facility unless suspended or revoked (*AAC R18-9-A213*). The permit gives permission to PCRWRD to operate the facility over groundwater of the Upper Santa Cruz groundwater sub-basin in the Tucson AMA groundwater basin in Township 17 S, Range 15 E, Section 10, Gila and Salt River Baseline and Meridian. This permit became effective August 7, 2007.

The Fairgrounds WRF has an APP (P-100634), effective April 4, 1996 and valid for the life of the facility.

AIR QUALITY PERMIT

The Corona de Tucson WRF does not require a General Air Quality Permit but maintains the General Air Quality Operating Permit (permit number 300, permit class II) for Generators.

UNDERGROUND STORAGE FACILITY PERMIT

In compliance with *ARS Title 45, Chapter 3.1., Article 2*, prior to construction of an underground storage facility, a water reclamation facility must secure a Constructed Underground Storage Facility Permit. The permit is issued by the Arizona Department of Water Resources. The Corona de Tucson WRF has an Underground Storage Permit (Permit No. 71-211284.0000), effective February 10, 2009 and valid through February 2029.

WATER STORAGE PERMIT

In compliance with *ARS Title 45, Chapter 3.1., Article 3*, a Water Storage Permit must be secured by a water reclamation facility to store water. The permit is issued by the Arizona Department of Water Resources. The Corona de Tucson WRF has a Water Storage Permit (Permit No. 73-211284.0000). The effective date is February 10, 2009. It is valid through February 2029.

Table D-1 includes current Corona de Tucson WRF and Fairgrounds WRF operating permits.

D.2.2 INTERGOVERNMENTAL AGREEMENTS

1979 IGA (EFFLUENT USE)

Pursuant to 1979 IGA and Supplemental IGA, the County is entitled to use 10% of the effluent from metropolitan-area treatment facilities after contributing a portion of effluent to the Conservation Effluent Pool. The City owns the remaining effluent, which is available to the City within the parameters established by the 1979 IGA and Supplemental IGA.

DMAFB SETTLEMENT AGREEMENT 1988 (EFFECTIVE OCTOBER 25, 1988)

The original agreement granted the City of Tucson the right to use certain sewer lines located on the DMAFB that were built after the DMAFB funded expansion of the City's water reclamation facility. Responsibility for sewer services within the base transferred from the City to the County via the 1979 IGA. The 1988 settlement agreement between the DMAFB and the County resolved legal disputes relating to user and connection fees that occurred before the

County took over the ownership of the sewer system.

STATE PRISON IGA 119325-00 1994 (EFFECTIVE SEPTEMBER 20, 1994)

Part of the agreement between the Arizona Department of Administration, Arizona Department of Corrections, and Pima County, allows connection of the prison's sanitary sewer facilities located on Wilmot Road to the public sewer system.

MANAGEMENT AGREEMENT FOR THE PIMA COUNTY FAIRGROUNDS (EFFECTIVE FEBRUARY 6, 2007)

This Management Agreement is an amendment to the 1986 lease agreement between Pima County and the Southwestern Fair Commission ("Manager") for the county-owned Pima County Fairgrounds. The Manager has operated the Fairgrounds since 1986. The Fairgrounds property is used to conduct an annual fair as well as other public events, concerts, shows and exhibitions for the benefit of the public. Pursuant to the Agreement, the County and the Manager are encouraged to work together on developing a long-range master plan to include planned uses and operations for other county-owned properties in the area of the Fairgrounds. Sewage generated on the Fairgrounds property is treated at the Fairgrounds WRF using a ponding system. Decisions about new connections to the treatment system and the installation of new flow meters are made cooperatively between the two parties. The County is not obligated to build a new treatment system to increase treatment capacity and receives reimbursements for all costs related to maintenance, repair and operation of the treatment system. The Agreement expires on June 30, 2031.

IMPLEMENTATION OF THE CONSERVATION EFFLUENT POOL (EFFECTIVE JANUARY 25, 2011)

The IGA between Pima County and the City of Tucson defines the provisions for the use and allocation of reclaimed water in the Conservation Effluent Pool for environmental restoration of riparian projects. The County is engaged in the operation of wastewater treatment facilities that produce treated effluent, a portion of which is delivered to the City Reclaimed Water system. By this agreement, both parties will reserve reasonable quantities of effluent for use in riparian projects.

D.3 PLANNING EFFORTS

In response to increased growth over the past two decades, Pima County and other governmental agencies had developed numerous plans focusing on the Southeast Planning Area. Some of these plans include: the Houghton Area Master Plan, the Davis Monthan Air Force Base Joint Land Use Study, PCDOT and PAG transportation plans for Sahuarita Road, Houghton Road and I-10, the Sonoran Desert Conservation Plan, and plans for the Bioscience, Medical, Aerospace and Technology Employment Center Transportation Corridors.

The Study Area has been the focus of a number of comprehensive land use plans. The majority of the Study Area falls into the Southeast and the Central Planning Areas. The eastern portion of the Study Area falls into the Rincon Valley Planning Area of the Pima County Comprehensive Plan – Pima Prospers. The southwestern portion of the Study Area is part of the Town of Sahuarita Planning Area. County and municipal General Plans are required by Arizona "Smart Growth" legislation, the law sets periodic reviews and any changes to the General Plans require voter approval.

PIMA COUNTY INFRASTRUCTURE PLANS

Pima County conducts integrated and coordinated infrastructure planning in conjunction with a variety of committees and the Capital Improvement Program. Collaboration of planning for flood control, transportation, parks and recreation, open space and wastewater management is critical to the planning process.

REGIONAL FLOOD CONTROL DISTRICT

Drainage problems can be a primary constraint for land development. To this end, the Pima County Regional Flood Control District (PCRFCD) has developed long range master drainage plans. The 2008 Lee Moore Wash Drainage Study outlines future approaches to mitigating extensive sheet flows in Southlands. The study suggests adding a regional detention basin and designating general areas in which flooding will impede development.

PIMA COUNTY DEPARTMENT OF TRANSPORTATION

The Arizona Department of Transportation and the Pima Association of Governments have produced long range transportation plans. The PAG Southeast Area Arterial Study and the PAG 2040 Regional Transportation Plan identify major roadway and highway corridor improvements that would impact the Southeast Planning Area.

PAG Southeast Area Arterial Study

In 2002, PAG initiated the Southeast Area Arterial Study in response to deficient roadway infrastructure in the growing southeast region of Tucson. The study analyzed roadway improvements necessary to accommodate anticipated growth. As a part of the study, PAG developed a new traffic circulation and access framework and updated its travel demand model. The Major Streets and Routes Plan was developed for the Southeast Area. The roadway improvement plans call for the construction of east/west arterial corridors of Old Vail Connection Road, Pima Mine Road, Andrada Road and Sahuarita Road, and north/south arterials, including Country Club Road, Swan Road, Alvernon Way, Wilmot Road, and Houghton Road (Section **D.10** 2040 RTP Roadway Projects). The roadway improvements may attract new development requiring water and wastewater service expansion in the southeast region.

PAG 2040 Regional Transportation Plan (PAG 2040 RTP)

The PAG 2040 RTP is a long-range transportation plan for metropolitan Tucson and eastern Pima County. Roadway improvements establish potential growth and development opportunities in areas currently lacking roadway infrastructure or adequate roadway capacities to serve growth. New roadways often lead to opportunities for expansion of the existing wastewater conveyance system when new growth areas need service. The PAG 2040 RTP calls for major roadway construction and corridor improvements that will impact the Southeast Planning Area south of I-10, east of I-19, north of Sahuarita Road and west of Sonoita Highway (see Section **D.10**

The first phase of the Sonoran Corridor construction was the realignment of Hughes Access Road for the new Aerospace Parkway.

2040 RTP Roadway Projects). In addition to new roadway construction that will improve access to the existing and potential new developments in the area, the 2040 RTP includes the purchase and preservation of the Pima Mine Road, Sahuarita Road, and Swan Road right-of-ways, as well as improvements on Wilmot Road and Houghton Road, the arterial roads that serve the highest concentration of population.

As shown on the roadway projects map, plans for Houghton Road include turning it into a parkway that will improve connectivity to the areas south of I-10 all the way to Corona de Tucson. In addition, there are plans for an express bus route from Houghton Road (north of I-10) that will increase connectivity with Broadway Boulevard.

Sonoran Corridor and Aerospace Parkway

The Sonoran Corridor is a proposed county highway that would link I-19 south of Tucson to I-10 east of the city. The Sonoran Corridor would connect I-10 near Rita Road on the far southeast side with I-19 near Pima County Mine Road (Section **D.8** Sonoran Corridor and Aerospace Parkway). The 16-mile corridor is considered "the most important economic development surface transportation improvement in the region." The first phase of the corridor construction, was the realignment of Hughes Access Road for the new Aerospace Parkway, starting at South Nogales Highway and connecting to Alvernon Way south of Tucson International Airport. The second phase would extend the Aerospace Parkway east to I-10, with the third, and final, segment running south to Pima Mine Road then west, connecting with I-19.

The Aerospace Parkway is the envisioned parkway-freeway combination that would cut through an area south and east of the current Raytheon facility, where significant industrial and aerospace-related growth is expected to occur. In addition to accommodating more traffic, the relocated road will provide Raytheon with additional buffer area to accommodate expansion.

Swan-Alvernon Alignment Study

In the 1980s, Pima County determined that Alvernon Way and Swan Road could be impacted by the expansion of the Tucson airport to the east. The subsequent amendment to the Major Street and Scenic Routes Plan shows Alvernon Way realigned to Swan Road south of Los Reales Road (Section **D.10** 2040 RTP Roadway Projects). The plan establishes a 150-foot right-of-way for the new yet-to-be- built alignment that will connect to the proposed Aerospace Parkway.

PAG 2015-2019 TRANSPORTATION IMPROVEMENT PLAN (PAG 2015-2019 TIP)

The TIP is a rolling five-year schedule and budget of proposed transportation improvements that seeks to optimize the use of available federal, state and local funds and resources to serve the region's multi-modal transportation needs. The TIP implements long-range transportation plans. The major roadway improvement

The Harrison Greenway connects the Julian Wash Greenway and the Pantano Wash River park.

projects in the Southeast Planning Area that are planned for the years 2015 - 2019 include the improvements of Old Vail Connection Road, Hughes Access Road, Wilmot Road and Rita Road.

D.3.1 WASTEWATER PLANNING EFFORTS

Based on the projected growth and future service demands, PCRWRD has plans for conveyance system augmentation and extension in the Southeast Planning Area. The major conveyance projects include the augmentation of the Old Nogales and the Southeast Interceptors. A proposed extension project includes an extension of the existing sewer line in Old Vail Connection Road west of Wilmot Road to the Old Nogales Interceptor.

The proposed augmentation projects will serve near-term developments such as Verano master-planned community and the Aerospace, Defense and Technology Research and Business Park. A long-range planning vision includes construction of a new treatment facility or a scalping plant. The department has selected a location for that facility. More details about the proposed augmentation projects and possible service options are discussed in Section **D.6.4.**

D.3.2 PREVIOUS WASTEWATER PLANS AND BASIN STUDIES FOR THE SOUTHEAST PLANNING AREA

Basin studies of the Southeast Planning Area include:

- 1980 Southeast Area Plan Development Capability;
- 1982, 1999 Rancho del Lago Sewer Basin Study;
- 1988 Houghton - Hill Sewer Basin;
- 1994 Harrison – Pantano Service Wastewater Plan;
- 1999 Rincon Creek Interceptor Sewer Basin & Alignment Study;
- 2000/Rincon Creek Interceptor Sewer;
- 2003 Corona de Tucson Basin Study;
- 2008 Houghton Area Master Plan (HAMP) Potable and Reclaimed Water Conceptual Plan;
- 2011 Southeast Area Sub-Regional Wastewater Reclamation Facility (WRF) Study; and,
- 2016 Sewer Route Study - Verano Offsite Sewer Alignment Feasibility Study.

D.4 STUDY AREA ANALYSIS

D.4.1 STUDY AREA BOUNDARY

PCRWRD identified the boundary of the Southeast Wastewater Planning Area (Study Area) by reviewing a collection of Pima County 2040 time horizon plans. These include Pima County Regional Flood Control District (RFCD) plans and studies of the Lee Moore Wash, transportation plans from ADOT, PAG and plans from the City of Tucson, and Tucson Water.

Figure D-1 depicts the regional context and general location of the Study Area. The Study Area generally encompasses the southeastern portion of the Tucson metropolitan area.

The Study Area's boundary is shown as a red dashed circle on the figure. It is depicted this way to reflect the area's dynamic nature as defined by the horizon plans of multiple jurisdictions noted above.

Figure D-1 General Location of Study Area

The vast majority of land within the Study Area became part of the City of Tucson through annexations that have occurred since 1980.

The Study Area is roughly centered around Golf Links Road/Old Spanish Trail on the north, Santa Rita Experimental Range on the south, the Nogales Highway and the Town of Sahuarita's boundaries on the west and Sonoita Highway/Pistol Hill Road on the east. I-10 bisects the Study Area into the northern and southern half.

Located within the Upper Santa Cruz Valley, the Study Area generally slopes from southeast to northwest. The elevation ranges from over 2,500 to over 5,000 feet above mean sea level (msl). Farther east, the Rincon Mountains (approximately 8,400 feet above msl) act as the high elevation points and provide the east boundary of the general sewer basin area. The Lee Moore Wash floodplain in the southern area ranges in elevation from 2,680 feet to the southeast to 2,570 feet above msl to the northwest. Along with the Santa Cruz River, the Lee Moore Wash serves as the western boundary of the sewer basin area.

Several major washes and their tributaries traverse the Study Area and drain to the Santa Cruz River. The washes include: the Lee Moore Wash, the Julian Wash, the Pantano Wash and the Tanque Verde Creek.

From the wastewater planning perspective, the department recognizes that the Southeast Interceptor has separate northern and southern tributary areas. The northern area generally drains to the Agua Nueva/Tres Rios Sewer Basin, while the southern area drains to both the Agua Nueva/Tres Rios and the Southlands Sewer Basins.

D.4.2 LAND OWNERSHIP

The land ownership for the Study Area is predominantly State Trust with the remaining land owned by federal, county or city government, or private entities (see **Figure D-2**). Federal land in the area belongs to the Bureau of Land Management (BLM) land and U.S. Forest Service.

State Trust Lands are reserved for the Trust's beneficiaries, the largest of which is the state school system. To fulfill its mission to the beneficiaries, the Arizona State Land Department (ASLD) must sell State Trust Land for the highest and best use. Development of State Trust Land depends on the timing of land sales by the Arizona State Land Department (ASLD).

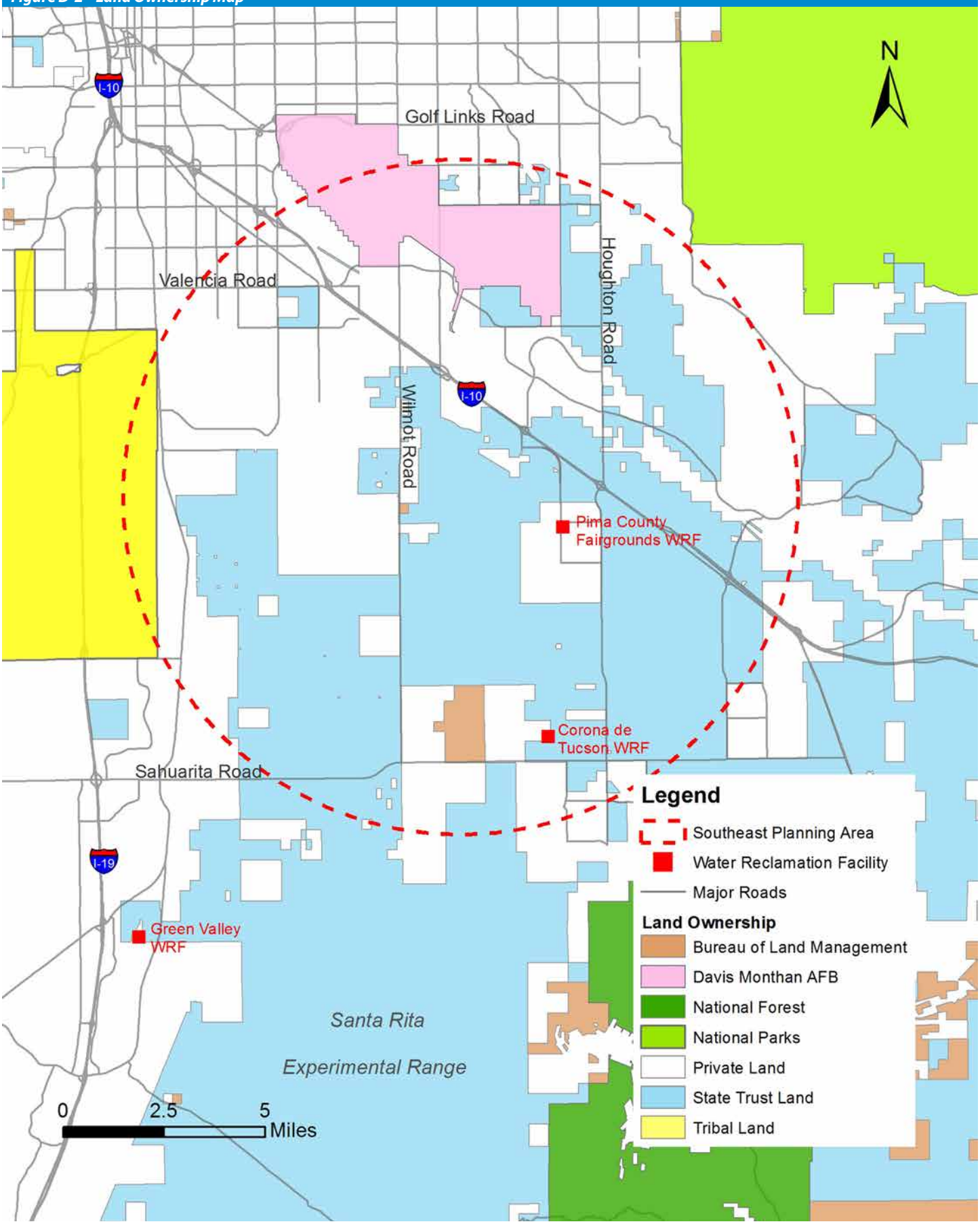
There are tracts of developed and vacant land throughout the Study Area. The City of Tucson, Pima County and private holders are among the property owners. Private owners include trust companies, corporations, and individuals.

The vast majority of land within the Study Area became part of the City of Tucson through annexations that have occurred since 1980. The Dave Mountain Air Force Base (DMAFB) owns approximately 16.7 square miles (10,690 acres) of land. The presence of the Air Force Base limits development in this area. Tohono O'odham Nation owns land west of the Study Area and west of Nogales Highway.

Outlook

The existing land ownership in and surrounding the Study Area will affect current and future land uses. It is likely that a vast amount of State Trust Land will remain undeveloped since there is no im-

Figure D-2 Land Ownership Map



Hughes Access Road is a key infrastructure piece to the county's Sonoran Corridor economic development master plan.

mediate demand for this land. Development of federal lands is unlikely to occur during this planning horizon.

During the past decade, the Southeast Planning Area emerged as one of the fastest growing areas of the region in terms of new residential units. Development of private land appeared in the form of low to medium density residential subdivisions and commercial developments, primarily concentrated along the I-10 corridor.

To limit infrastructure costs, continued development of private lands will occur in or adjacent to the existing subdivisions. Development on private land is likely to remain fairly static for the time being, given the relatively low to moderate demand for the development of this land.

D.4.3 EXISTING LAND USES

Pima County Land Uses

The Southeast Planning Area has become a focus of long-range planning efforts as development pressure has increased significantly in the past years. The majority of land is vacant primarily due to ownership by the ASLD.

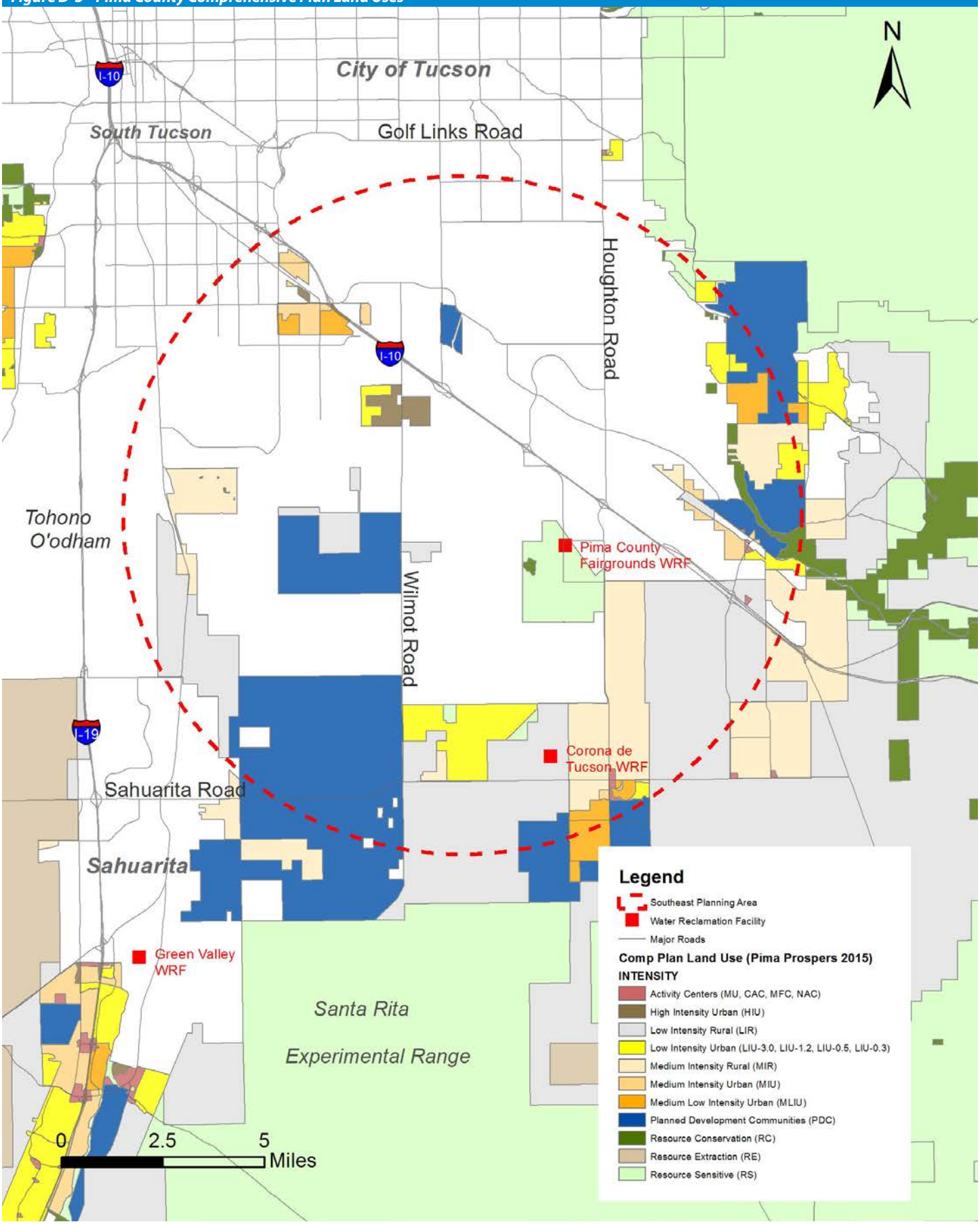
The northern portion of the area is more densely populated with a mix of land uses ranging from urban and rural residential to commercial and industrial uses (see **Figure D-3**). More diversified land uses are found in the northwestern portion, south of the I-10/Nogales Highway interchange where more private land exists. Land densities generally diminish towards the south.

The majority of commercial uses in the northern portion are affiliated with the I-10 corridor. In the southern portion, commercial uses exist between I-10 and I-19 or in the vicinity of the Corona de Tucson WRF service area. Industrial uses are associated with the DMAFB area and its vicinity. Other significant land uses in the Southeast Planning Area include agriculture (owned by ASLD), open space, recreational uses, and, to a lesser extent, mining extraction. The area has two active landfill sites, one owned and operated by DMAFB, and the other owned and operated by the City of Tucson, located south of Los Reales Road and east of Swan Road.

Private land in the southern half of the area consists of mostly rural and suburban residential land uses. Rural residential use typically consists of larger, septic system-served lots often categorized as 'wildcat subdivisions'. They exist north and south of Sahuarita Road. Suburban residential land uses are concentrated near the intersection of Sahuarita Road and Houghton Road (the Corona de Tucson WRF service area subdivisions). (This area also includes 2-acre lots served by septic systems in Sycamore Springs on the south side of Sahuarita Road.). A number of subdivisions are under construction: Santa Rita Ranch, southeast of the Sahuarita/Houghton intersection, and the subdivisions of New Tucson and Sycamore Canyon located southwest.

The timing of new development on private land is primarily driven by growth and the housing market in the area. Infill devel-

Figure D-3 Pima County Comprehensive Plan Land Uses



opment will gradually take place in the existing subdivisions, while commercial development needed to support demands of the growing area will occur along the I-10 corridor, likely in the form of community centers.

City of Tucson Land Uses and Zoning

The prevalent City land use in the northern portion of the Study Area is light industrial surrounded by suburban residential, low density residential developments (minimum 3.31 acre lot size). Other common land use categories include heavy industrial and high density residential uses which allow for smaller lot and urban-type development (**Figure D-4)**. A great portion of the Southeast Planning Area within the city limits is State Trust Land and remains undeveloped.

The prevalent City zoning district in the southern half of the Study Area is Rural Homestead (RH), which allows for low-density residential (minimum 4.13-acre lot size). The RH zoning, as described in the City of Tucson Zoning Code, is intended to "…preserve the character and encourage the orderly growth of rural areas in the county" and "…to encourage rural development in areas lacking facilities for urban development and to provide for commercial and industrial development only where appropriate and necessary to serve the needs of the rural area." The higher land densities are concentrated along the Houghton Road corridor and existing residential developments near the intersection of Sahuarita and Houghton Roads. County zoning designations for these areas are: CR-1, CR-2, and CR-3. Approximately 17 square miles of State Trust Land on both sides of Houghton Road are designated for a master-planned community known as the Houghton Area Master Plan.

The existing subdivisions and master-planned communities surrounding the Sahuarita and Houghton Roads intersection have low to medium/high intensity urban land use designation, and densities of up to 10 RAC.

NOTE: Land developed in unincorporated Pima County is often incompatible with City development standards. A typical example is 'wildcat subdivisions'. These unplanned developments present problems for providing infrastructure provision, budgeting, public safety response, health-welfare issues, legal access, and community cohesion. They generally lower the value of adjacent land use due to their unplanned, inefficient, and typically unsightly nature. Unincorporated county jurisdictions have limited or no control over theses substandard enclaves. The City's intention is to pursue effective growth management through the annexation of State Land. This gives the City more control over the land development activities, and therefore over the spread of wildcat subdivisions.

LANDS BEYOND THE STUDY AREA

West of Old Nogales Highway - San Xavier District of the Tohono O'odham Nation (SXD)

The Pima County Southwest Infrastructure Plan (SWIP) only extends west of I-19 and south to the northern line of the San Xavier District of the Tohono O'odham Nation. The Nation's private sewers contribute to the Agua Nueva WRF. Lands south of the San Xavier District lie within a mineral district and are unlikely to be developed.

East of Sonoita Highway/Pistol Hill Road in Cochise County

The Northwest Cochise County Area Plan covers the area immediately east of the Pima-Cochise County line, along I-10. This is a region that is undergoing significant development, with more development in the planning stages. This growth could spill over the County line into the PCRWRD service area.

Arizona State Trust Land

A large amount of ASLD-controlled land in southeastern Pima County is located outside the Study Area. State Trust Lands are under constant evaluation for garnering the best return for trust beneficiaries. Changing conditions make these lands difficult to time into the land market. It is expected that the ASLD will first release for sale lands inside the Study Area to reduce infrastructure costs related to development. State Trust Lands with significant mineral potential are generally not released for sale. The Santa Rita Experimental Range is a 50,000-acre state wildlife preserve that lies east of the Town of Sahuarita. It is operated by the University of Arizona. Due to the ongoing academic research the potential for sale and development of this land is highly unlikely. The experimental range is the oldest natural resource-based agricultural research facility in the world.

Bureau of Land Management

Further south of the Study Area, more than 45,000 acres of former ranch land known as Cienegas National Conservation Area are shared between the Pima County and the Santa Cruz County. This conservation area is managed by the Bureau of Land Management under principles of multiple-use and resource preservation. It is not anticipated this land will be developed within the time horizon of this study.

National Forests and National Parks

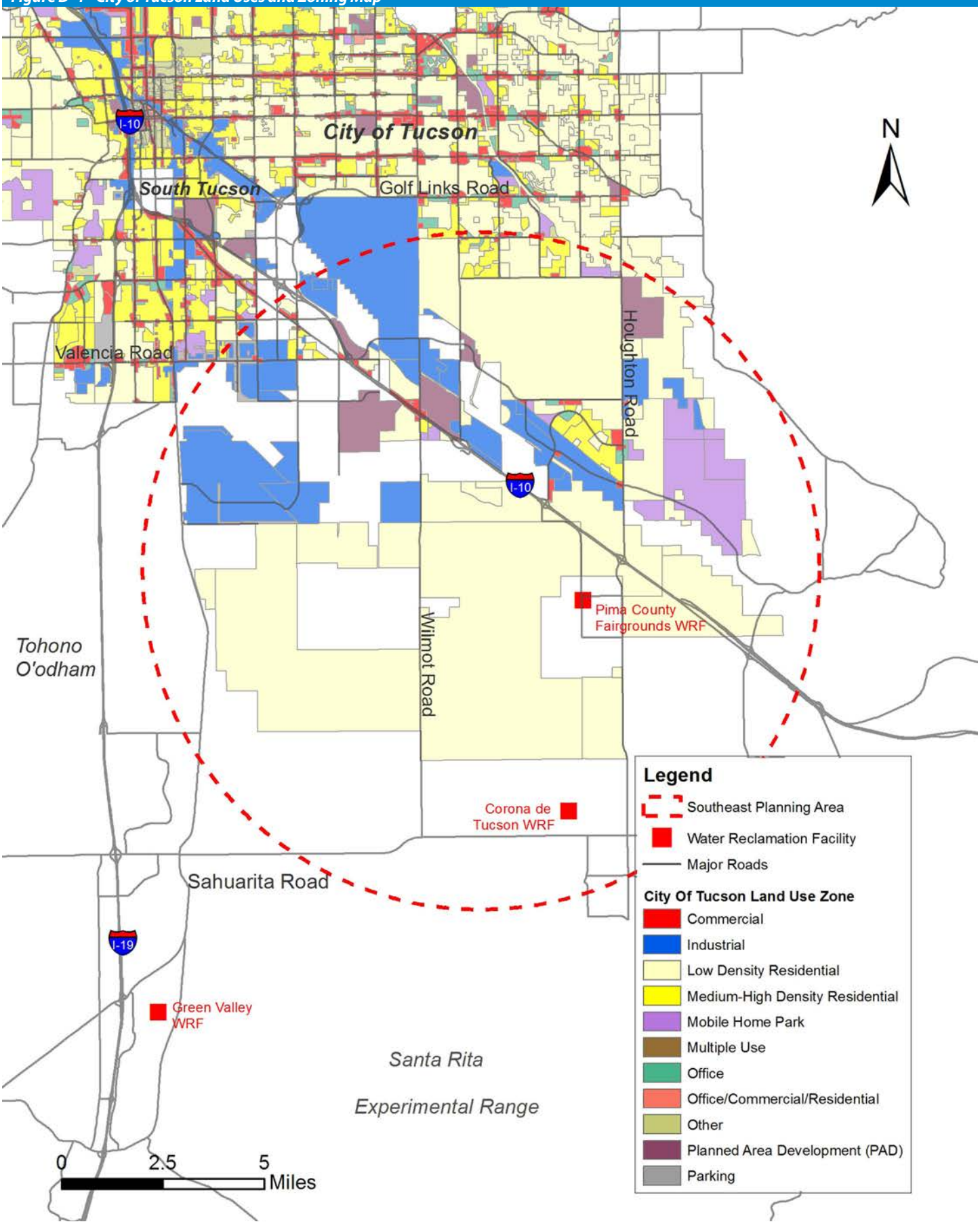
The Coronado National Forest has jurisdiction over large tracts of land north, east and south of the Study Area. The Saguaro National Park is located east of Freeman Road and north and east of Old Spanish Trail. These lands will not be developed within the time horizon of this study.

Outlook

Future development within the Study Area must comply with the various jurisdictional land-use plans, including the Pima County Comprehensive Plan - Pima Prospers, the City of Tucson General Plan (Plan Tucson), and to a lesser degree the Town of Sahuarita General Plan (Aspire 2035). Review of the existing land use plans indicates that most of undeveloped land in the area will be for low to medium density rural or urban development. There is a special emphasis on open space preservation, as this area consists of a significant amount of environmentally sensitive lands. Future developments are expected to occur on private lands, along I-10 and at the major road intersections, and in the vicinity of existing developments where infrastructure is already in place.

The Study Area falls within the Southeast Planning Area, the Central, and the Rincon Valley Planning Area, as defined by Pima Prospers. While the majority of undeveloped land in the Southeast and the Rincon Valley is designated for low density rural uses, there are areas designated for medium to high density-urban uses with densities ranging from 0.3 to 10 residences per acre. Densities of 3

Figure D-4 City of Tucson Land Uses and Zoning Map



residences per acre are also common in these planning areas. Land uses associated with the Tucson International Airport and DMAFB military airport operations and industrial activities are found in the northern half of the Southeast Planning Area. Development in the northern half of theRincon Valley Planning Area is limited due to the presence of the national preserves.

For lands immediately east of the Town of Sahuarita, in the Southeast Planning Area, Sahuarita's General Plan, Aspire 2035, calls for land designations that encourage a mixture of residential, commercial, recreation, and other uses. It is anticipated that this 47-square mile area will be annexed by the Town of Sahuarita in the near future. Lands in the vicinity of the Pima County Fairgrounds WRF are designated for low intensity rural (LIU), resource sensitive (RS), and military airport (MA) uses.

D.4.4 GROWTH AREAS

There are several major infill and proposed new residential development projects in the Study Area that reinforce the assertion that development pressure is persistent in this part of the county. The projects are located within growth areas as discussed in the following section. They include: the Corona de Tucson WRF service area, the Rancho del Lago Development, Verano Development, Rocking K Development, and the Houghton Area Master Plan (**Figure D-5**).

In Section **D.9** Population Projections Calculation, each area is evaluated based on current development trends and future potential for development.

Large-scale commercial and industrial developments have also been planned in this area. The proposed 2,830-acre Aerospace, Defense and Technology Research and Business Park between Hughes Access and Old Vail Connection Roads will require major infrastructure improvements, including relocation of Hughes Access Road to the south, as well as an extension of the existing public sewer line in Old Vail Connection Road.

THE CORONA DE TUCSON WRF SERVICE AREA

This growth area includes infill of platted lands located south of the Corona de Tucson WRF in the subdivisions of Sycamore Canyon, Santa Rita Ranch, New Tucson Units and Fagan Ranch. More than 3,000 residential units are expected to be built in the forthcoming years. It is likely that the platted lots in the area will be built before any new subdivisions in other growth areas.

The 700-acre Hook M property located about one mile north of Sahuarita Road and about midway between Wilmot and Houghton Roads, is the site of the proposed master-planned community. Plans for the development feature medium density residential, commercial, retail uses, and a school, with wastewater service from the Corona de Tucson WRF. Farther to the west, the Sahuarita East Conceptual Area Plan (SECAP) calls for major infrastructure improvements over the next 20-30 years to support long-term plans for a large-scale mixed-use development. The SECAP area is located east of the current Town limits, north and south of Sahuarita Road and extends all the way to Houghton Road on the east. The SECAP area has a combined estimated buildout of 53,600 dwelling units with a projection of up to 134,000 people (Aspire 2035).

RANCHO DEL LAGO

This growth area includes the Rancho del Lago development. PCRWRD expects 181 new units will be completed as soon as the housing market recovers. There are several platted subdivision north of Rancho del Lago. They include: Vista del Lago, Rincon Knolls, McCloskey Property, Riverwalk at Rancho del Lago, Four Seasons, Rancho Solado Estates, and Rancho Coronado.

VERANO DEVELOPMENT

The Verano Development is a master-planned community that will include a variety of land uses. The future community is almost entirely surrounded by the State Trust Land except for the north side which is shared with the private land holders. A substantial amount of State Trust Land is within the Lee Moore Wash floodplain. Any future development south of Verano is subject to CLS regulations (e.g. 95% land dedication for important riparian habitat area).

Just northeast of Verano on Wilmot Road, the Corrections Corporation of America (CCA) has plans to build a prison facility that will facilitate up to 5,000 beds. A gravity sewer will be constructed along Old Vail Connection Road to connect these developments to the Old Nogales Highway Interceptor (ONH) upon the augmentation of ONH.

ROCKING K

Rocking K is another planned master community located south of the Saguaro National Monument and east of the Houghton Area Master Plan. Plans include low to high density residential subdivisions, commercial uses and offices, recreational uses and open space. There are large-sized lots to the south of this area; to the north (north of Old Spanish Trail), there is undeveloped private land. The area north of Old Spanish Trail is subject to CLS restrictions (i.e.: important riparian areas and biological core management areas).

THE HOUGHTON AREA MASTER PLAN (HAMP)

The HAMP planning area is located in the southern portion of Tucson along Houghton Road north of I-10; it covers approximately 17 square miles. The area is master planned for a mixture of residential, commercial and recreational uses with a substantial amount of land preserved for open space. Some of the first subdivisions built on the east side of Houghton Road and south of Irvington Road are Civano, Sierra Morado Unit, Mesquite Ranch, and Pavilions.

Approximately three-fourths of the land within the HAMP area boundaries is managed by the State Land Department. Land acquisition and development of the area is on hold. No recent actions on land acquisition have been recorded.

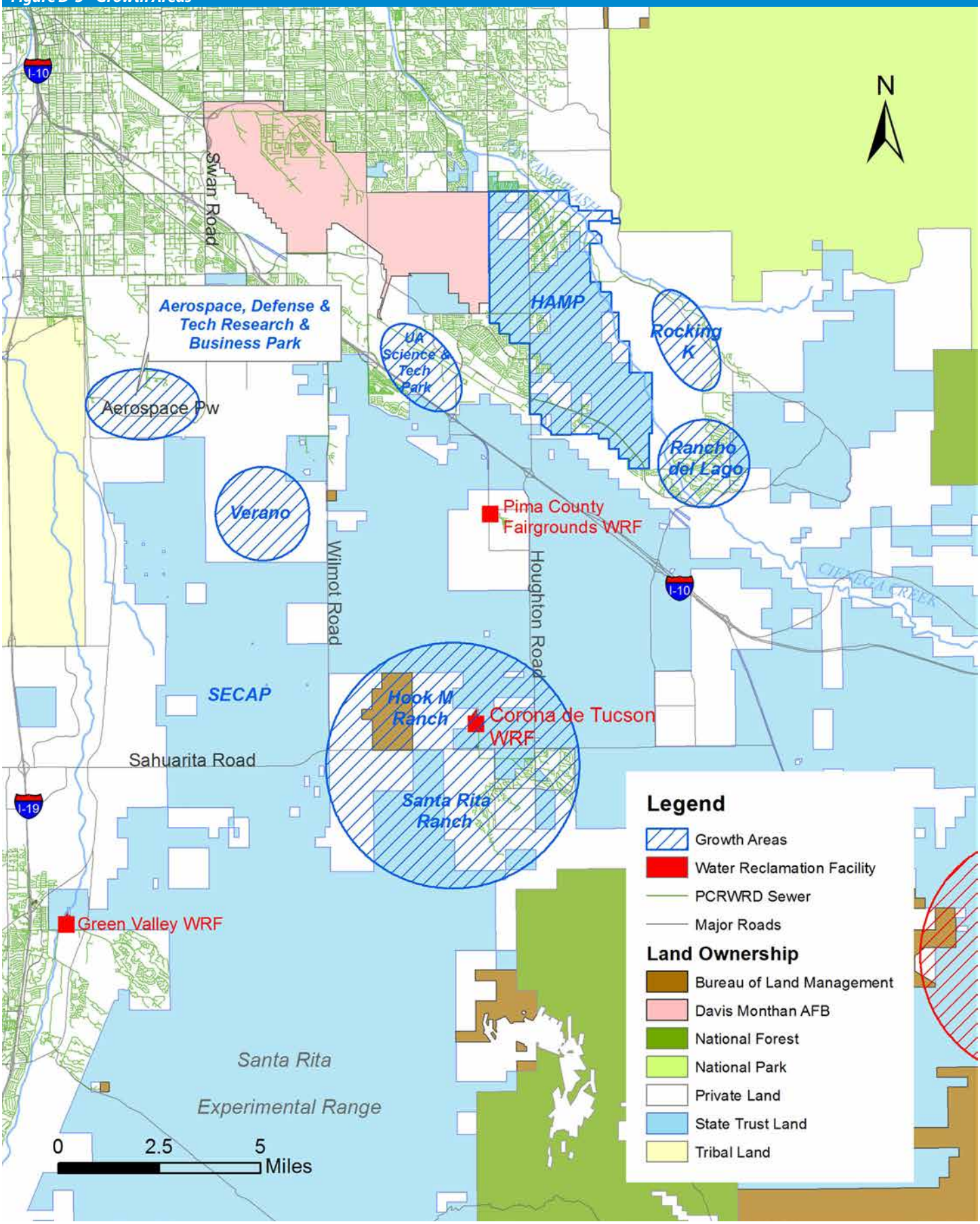
OTHER FUTURE DEVELOPMENTS WITHIN THE STUDY AREA

The following major non-residential developments are also planned in the Southeast Planning Area. Wastewater flows generated by these developments will be gravity sewered to the Southeast Interceptor.

UA Bioscience Research Park, the Bridges and Tucson Market Place

This mixed-use project encompasses 350 acres and is located at 36th Street and Kino Parkway. The project is an urban park design

Figure D-5 Growth Areas



and will include a global life science center, residential and commercial developments, a hotel, open space and recreational opportunities. KB Homes is proposing approximately 700 homes in the Bridges.

UA Science and Technology Park

The UA Science and Technology Park is a 1,345-acre high technology research and commerce center located on Rita Road. The Tech Park serves as one of the region's largest employment centers and is home to several high technology companies and educational organizations. The Tech Park was developed by IBM in 1978 and was purchased by the University of Arizona in 1994. It owns and operates its own sewage treatment facility consisting of an extended aeration system with a capacity of 0.15 MGD. The recent onsite expansion included a 130-room hotel.

Century Park Research Center

The Century Park, located south of Valencia Road on Kolb Road, sits on a 293-acre site, of which only 28 acres appear to be developed. The Century Park currently contains approximately 100,000 square feet of warehousing space. It is also home to the "Port of Tucson", transportation and logistics operation that benefits from I-10 and rail access at the Park.

Aerospace, Defense and Technology Research and Business Park

This major economic development project lies just south of Raytheon, north and south of the new Hughes Access Road realignment named Aerospace Parkway. The project plans call for 2,800 acres and major roadway improvements. The first tenant to locate within this project is World View, one of many large-scale economic development projects anticipated in this part of the county.

World View

Construction of the facility that will be the headquarters for World View Enterprises, Inc., a company specialized in the high-altitude balloon technology, is underway. A new sewer alignment along with other dry utility alignments is being constructed along Aerospace Parkway to accommodate this and future development in the area.

D.4.5 DEVELOPMENT CONSTRAINTS

Future development in the area is largely constrained by the existing land ownership, as well as topographical and hydrological conditions. As long as there is a sufficient supply of private land available for development, demand for State Land will not materialize. Floodplain regulations will likely limit the extent of new development within those areas that are prone to flooding. Similarly, conservation land regulations (i.e.: the Conservation Land System in Pima County) include restrictions on development densities that would adversely impact environmentally sensitive areas.

Water Supply

Tucson Water is the primary water supplier for properties inside the City of Tucson limits and will provide water service to the properties located within those limits. The areas outside of the Tucson Water service area mainly dependent on private wells and groundwater supply. The levels of groundwater in southeast Pima County have declined significantly in the past years. Given the fact that the significant amount of vacant land is in the groundwater-dependent areas, any new development may be constrained by a limited water supply.

Flood Control

The southern portion of the Southeast Planning Area is located within the 100-year Lee Moore Wash floodplain (more details in Section **D.4.7**). Drainage problems can be a primary constraint on developing land. Lands within the 100-year floodplain require additional permitting as per the U.S. Department of Homeland Security Federal Emergency Management Agency, and may be difficult to develop. EPA has increasingly emphasized a watershed-based approach to address water quality problems and has required state designated management agencies to include it into the 208 process. (ADEQ worked with the Designated Planning Agencies on incorporating a watershed-based approach into the 208 process, but noted that "this is a slow process because the Designated Planning Agencies were established on political jurisdictional lines and pollution knows no boundaries". 208 Plan Update [2006], page 137).

Several areas were identified in the Lee Moore Wash Basin Management Study (LMWBMS) as being heavily impacted by flooding during the rainy season. Records show the majority of drainage complaints come from the areas near the Old Nogales Colonia (known as Summit), and north and south of Sahuarita Road. The majority of development in these areas is rural residential subdivisions with minimum roadway and drainage improvements. Development in these areas would require extensive flood control measures, and expensive drainage and road improvements. The Lee Moore Wash Basin Management Study (prepared by Stantec Consulting, Inc. in 2008) evaluated existing floodplain conditions and provided an assessment of future improvement needs for the Lee Moore Wash Management Study Area.

The Lee Moore Wash watershed area is an area of environmentally sensitive lands, including riparian habitat resources, biological corridors, and cultural sites. As explained in the LMWBMS, these lands are designated for conservation purposes by various jurisdictional plans. Development on these lands is restricted.

Conservation Land System (CLS)

In addition to the environmental constraints by floodplain regulations, the Southeast Planning Area, specifically the easternmost portion, includes a number of conservation sensitive lands identified in the Sonoran Desert Conservation Plan (SDCP). Development of the SDCP began in 1998. The Pima County Board of Supervisors adopted it in 2001 as a growth management tool that directs growth to less environmentally sensitive areas through the Conservation Land System (CLS). The CLS guidelines impose restrictions on medium to high density developments via open space requirements. There are several CLS classifications, but the Important Riparian Areas classification is most stringent, requiring a 95% set aside of open space. The Biological Core Management Areas classification requires an open space set aside of 80% and the Multiple Use Management Areas classification requires a 66% set aside.

While most of the northern portion of the Study Area is outside the CLS designated boundaries, areas east and southeast fall within the Multiple Use Management and Biological Core Management Area classifications. The southern portion is largely affected by the

ANCLUS provides guidance to local jurisdictions in establishing policies to achieve land use compatibility in areas exposed to high levels of aircraft noise.

Lee Moore Wash floodplain and therefore by the Important Riparian Areas restrictions. While the CLS guidelines ensures environmental sensitivity in developments constructed in these areas, they also restrict the amount of land that can be developed, presenting significant constraints to future development.

The City of Tucson Habitat Conservation Plan (HCP) provides additional conservation programs to promote conservation of natural resources and habitat protection for the Southlands sub-area. The primary component of the HCP Southlands conservation program is the protection of habitat within the Petty Ranch and Fagan watersheds.

Airport Noise Control and Land Use Compatibility Study (ANCLUS)

In 1980, the Tucson Airport Authority, in conjunction with the City of Tucson and Pima County, undertook the development of an ANCLUS. The purpose of the study was to provide guidance to local jurisdictions in establishing policies to achieve land use compatibility in areas exposed to high levels of aircraft noise. As part of the study, programs were developed to mitigate high levels of aircraft noise on existing noise-sensitive uses.

Height and noise control regulations limit the development of vacant land in the vicinity of Tucson International Airport and DMAFB to only airport compatible land uses. Residential developments on properties located within the DMAFB Approach and Departure Corridor boundary and near the I-10 and Houghton Road interchange are subject to sound attenuation requirements, making these properties less desirable for development. Similarly, the Tucson International Airport Noise Zones regulations require that specific land uses provide sound attenuation measures, including additional building insulation.

Davis Monthan Joint Land Use Study (JLUS)

The Joint Land Use Study (JLUS) was a collaborative program by the City of Tucson, Pima County, DMAFB and others to facilitate implementation of compatible land uses around the DMAFB. The main purpose of the program is to protect the DMAFB's economic benefits through the facilitation of compatible land uses near the base. A key component of the program is a rezoning and acquisition of land located in high noise areas with an intention to prevent the encroachment of non-compatible land uses.

The boundary of the JLUS Study includes the majority of the northern portion of the Study Area. In general, the JLUS area has five identified zones where construction of critical infrastructure, such as fire protection, police communication, sewage and water treatment facilities, and water storage facilities is discouraged.

Development restrictions in designated high noise areas of the AFB to only compatible uses may create pressure on development of State Land.

D.4.6 DEMOGRAPHICS AND POPULATION

Perhaps most important in the assessment of wastewater services is the population and demographic for whom the PCRWRD is providing services. Changes in population impact wastewater service and treatment capacity in terms of the amount of influent and the strength of the influent. This section provides a general overview of the current population and demographics of the Southeast Planning Area sewer service basins.

POPULATION OVERVIEW

The current population is concentrated in the urban areas of the City of Tucson northwest of the Study Area, along the I-10 and Houghton Road corridors, in Vail, near the Sahuarita Road and Houghton Road intersection and between Old Nogales Highway and Wilmot Road. The remaining of the Study Area, characterized by wildcat subdivisions, is more sparsely populated. The public sewer system serves the majority of the Study Area population.

Population data for Pima County is available from a variety of sources, including the U.S. Census Bureau, the Arizona Department of Administration and the Pima Association of Governments. The Southeast Planning Area is a large geographic area that consists of two designated census places (DCPs), Corona de Tucson and Vail. To estimate the total population for the entire Southeast Planning area, the department would need census data analysis for individual census blocks or a transportation analysis zone (TAZ) data analysis. The department only analyzed those areas with a high potential for development and evident growth. These areas include: the Corona de Tucson WRF service area, Vail, and the HAMP planning area. A population projection for some smaller development projects that could affect the service demand was also analyzed. See Section D.9 Population Projections Calculation, for a list of these projects and population projections.

The 2000 U.S. Census Bureau estimated the total population for Corona de Tucson at 813; the population in 2010 was estimated at 5,675, an annual growth rate of 21.4%. This growth is attributed to the rapid development of the Corona de Tucson service area over the past two decades. In Vail, the total population was estimated at 2,484 in 2000 and 10,208 in 2010, an annual growth rate of 15.2%.

While the Corona de Tucson and Vail are DCPs, the HAMP planning area and Southlands are not. For that reason, the population estimates for HAMP and Southlands were calculated using available TAZ data. The TAZ data analysis shows 1,219 individuals living in the HAMP area in 2000 and 9,230 individuals in 201, an annual growth rate of 22.4%. The Southlands Sewer Basin population estimate in 2000 and 2010 were 11,574 and 20,188, respectively. This represents an annual growth rate of 5.72%.

TAZ 2045 projections suggest an annual growth rate of 3.19% for Southlands and 7.16% for the HAMP planning area.

Households and Vacancy Rates

The U.S. Census Bureau estimated a total of 2,165 housing units with the 3.3% homeowner vacancy rate for Corona de Tucson in 2010; this was slightly higher than the county's vacancy rate of 2.9% for the same year. In Vail, there were 3,754 housing units with an estimated 3.7% vacancy rate in 2010.

DEMOGRAPHICS

The Southeast Planning Area appears to be an attractive destination to medium income families, particularly to couples with children because of available housing options and desirable distance to quality local schools. Demographic data is available for two designated census places in the Southeast Planning Area: Corona de Tucson and Vail. Corona de Tucson is located on the southeast edge of the metropolitan Tucson area and is concentrated around the intersection of Sahuarita and Houghton Roads in the Santa Rita Mountain foothills. Development of Corona de Tucson area dates back to the early 1960s with the development of New Tucson and the area now known as Santa Rita (Bel Air, Estates, etc.). Corona de Tucson is a family oriented community. The 2010 U.S. Census Bureau estimated that 69.7% households in Corona de Tucson consist of married couples. The population of individuals 21 years of age and older comprises 67.6% of the total population, while only 8.3% of population is over the age of 65. The median population age is 34.6. An average household size is 2.81.

In the Vail community, located approximately six miles northeast of the Corona de Tucson, married couples comprise 69.1% of the total population. The population of individuals 21 years of age and older comprises 65.7% of the total population, while only 7.3% of population is over the age of 65. According to 2010 U.S Census, the median population age is 35.5. An average household size is 2.98.

POPULATION SERVED BY THE CORONA DE TUCSON WRF

Based on the 2015 average influent flow of 0.295 MGD, a tributary population is 3,700. The tributary population has increased by 113% since 2006 (1,738). Growth in the service area will be primarily driven by development of future subdivisions.

D.4.7 WATER RESOURCES

This section discusses the existing conditions of the hydrologic setting, floodplains and water supply affecting the Study Area. Two water companies serve the developed parts of the Southeast Planning Area. Tucson Water serves the Corona de Tucson subdivisions while the subdivisions north and south of the I-10/Sonoita Highway interchange receive service from Vail Water Company.

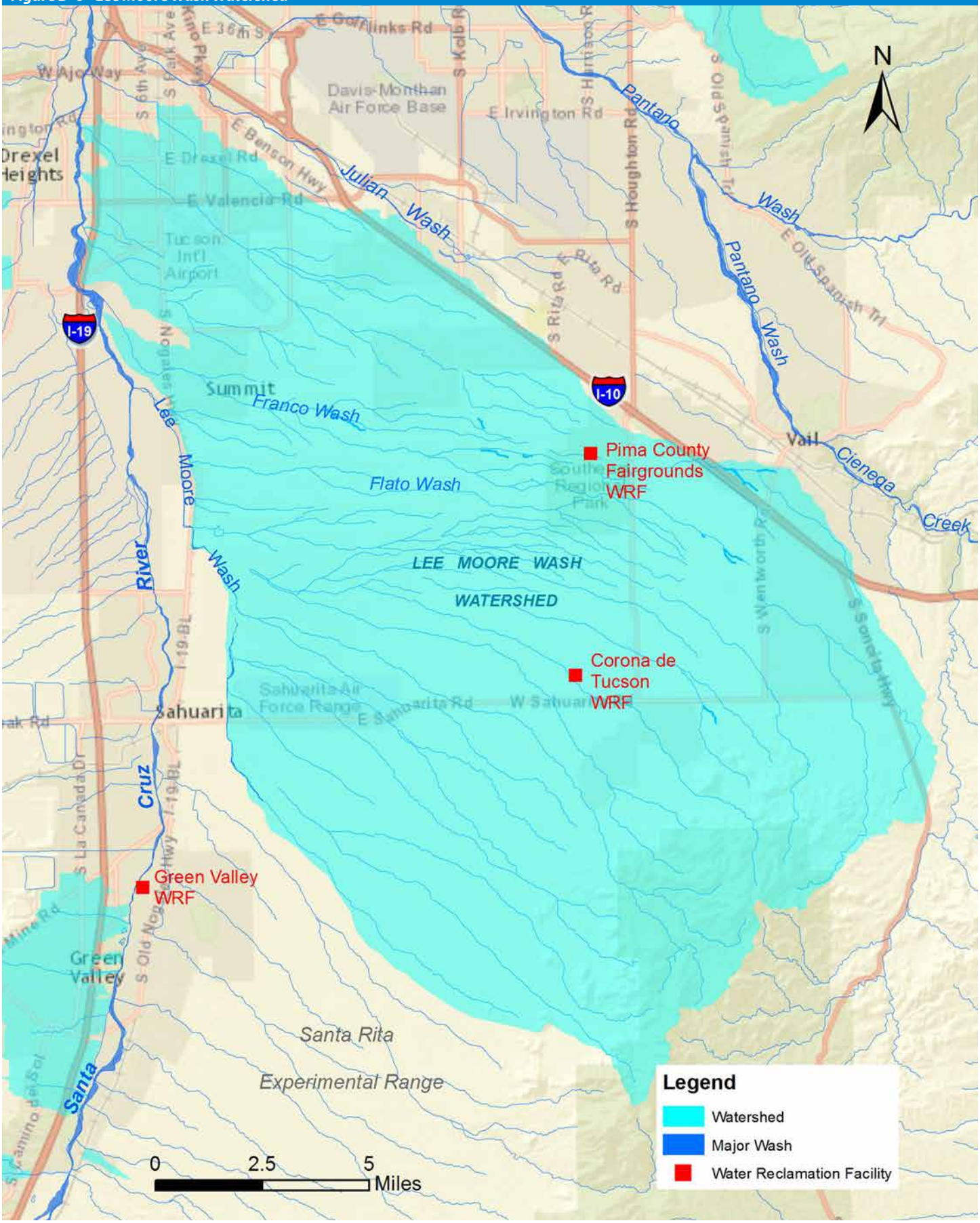
The Arizona Department of Water Resources requires that each new subdivision provides a demonstration of the physical availability, designation of assured water supply, analysis of assured water supply and a certificate of assured water supply.

Hydrologic Setting

Two major watersheds merge in the northwestern portion of the Study Area. They are the Upper Santa Cruz watershed and the Rillito watershed. They are among the two most populated watersheds in the PAG's planning area. A large number of production wells supplying the Tucson area's municipal water operate in these watersheds, making them a very important water resource for the region (PAG 208 Plan).

The Santa Cruz River is the primary surface drainage basin in the Upper Santa Cruz watershed. Major tributaries to the Santa Cruz River within the Study Area boundaries are the Lee Moore Wash and the Julian Wash. The Lee Moore Wash runs north and stretches approximately six miles in length before draining into the Santa Cruz River, in the upper northwest corner of the Study Area (**Figure D-6**). There are eight tributaries draining into the Lee Moore Wash. They include: Gunnery Range Wash, Sycamore Canyon Wash, Fagan

Figure D-6 Lee Moore Wash Watershed



Julian Wash near Thomas Jay Park.

Wash, Cuprite Wash, Petty Ranch Wash, Flato Wash, Summit Wash and Franco Wash. The tributaries vary in surface size from a few square miles to more than 30 square miles.

The Julian Wash generally runs southeast to northwest. Along its entire length, the Julian Wash has only one tributary designated as 'Unknown'. The Tucson Diversion Channel merges to the wash near the I-10/S. Kino Parkway interchange. The Southeast Interceptor is constructed along the Julian Wash.

The northwestern portion of the Study Area falls within the Rillito watershed. The Rillito watershed includes most of central and eastern Tucson, the northern Tucson suburbs, and Vail. Because it provides a significant part of the natural groundwater recharge for the Tucson basin, the PAG 208 Plan cites this watershed as a very important to the community's water resource planning. The Pantano Wash is the primary drainage basin within the Rillito watershed. The wash consists of several tributaries, of which the largest are Rose Hill Wash, Rolling Hills Wash, Atterbury Wash, Old Spanish Trail Wash, Rincon Creek, and Agua Verde Creek. The Pantano Wash is the lowest point of the tributary sewer area. The Pantano Interceptor generally follows the Pantano Wash and the Rincon Creek.

Lee Moore Wash Floodplain

The southern portion of the Study Area is located within the 100-year Lee Moore Wash floodplain, which is bounded by the Santa Rita Mountains to the south and southeast, the Franco Wash to the north, and the Santa Cruz River to the west (see Figure D-6). The Lee Moore Wash watershed area consists of approximately 197 square miles with the headwaters situated to the southeast in the Santa Rita Mountains. The watershed is comprised of eight tributaries generally draining west-northwest and eventually into the Santa Cruz River.

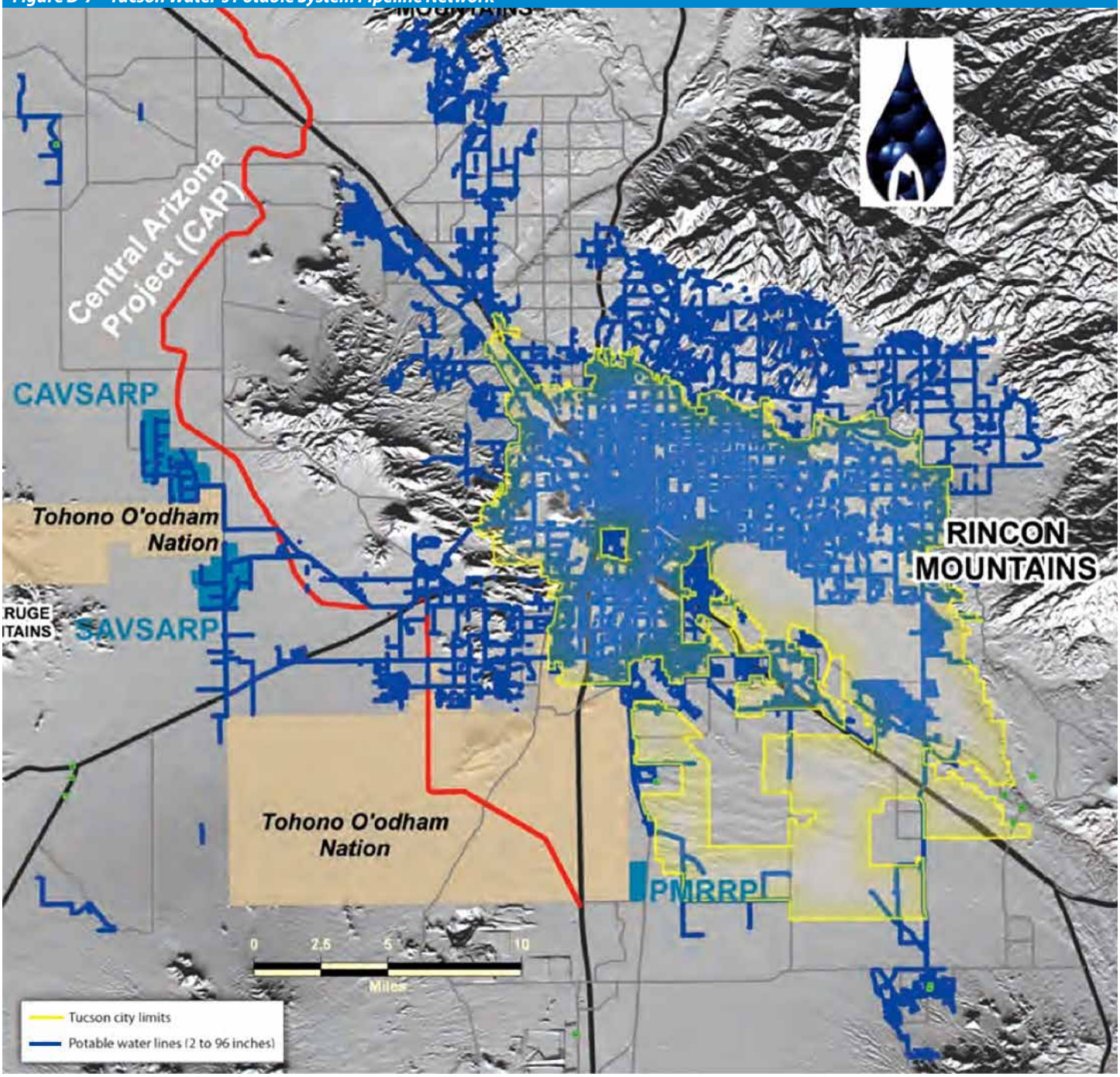
The Lee Moore Wash Basin Management Study by Stantec Consulting, Inc. (2008) outlined approaches in mitigating extensive sheet flooding and provided a comprehensive flood control protection program for impacted areas. The study suggested adding a regional detention basin and designating general areas where flooding may impede development.

Water Sources

Tucson Water is the water provider for the majority of the Southeast Planning Area. The DMAFB has its own water system, while the Vail area is served by Vail Water Company. Other smaller water companies provide service to the rest of the population. Other locations within the Tucson metropolitan area have access to Colorado River water through Central Arizona Project (CAP) canals, however alternatives to pumping groundwater in the Southeast Planning Area are limited due to lack of infrastructure.

An expansion of Tucson Water's potable system is planned for the Southeast Planning Area as depicted in **Figure D-7** (2012 Update Water Plan 2000-2050). Wastewater infrastructure plans shall

Figure D-7 Tucson Water's Potable System Pipeline Network



Source: 2012 Update Water Plan 2000-2050, Tucson Water

be coordinated with the long-range water system plans in the region. An increase in reclaimed water demand is expected as a response to growth and an increasing need for renewable resources.

Groundwater Supply

Groundwater is the primary source of water for the Study Area. In the Upper Santa Cruz region, groundwater flow is generally toward the northwest. The largest groundwater resource serving the Tucson metropolitan area is the Central Wellfield. The Central Wellfield generally serves the northern portion of the Study Area. The wellfields serving the southern portion include:

- The Santa Cruz (SC) Wellfield, southeast of the city,
- The Southside (SS) Wellfield, south of the Tucson Airport Remediation Project (TARP) facility, and
- The TARP (groundwater treatment project), located in the south-central area.

Together, the wellfields comprise a groundwater supply network of 29 wells producing a total of 20 MGD of drinking water.

The federal government has approved an eight-mile pipeline that will bring CAP water to the proposed Rosemont Copper Mine

The KERP project is a series of basins developed to detain and store storm and reclaimed water, create flood control and reestablish a riparian ecosystem.

southeast of the Study Area. The new water resource may lessen the groundwater overdraft expected to be caused by the mine, but it is unlikely to relieve a regional overdraft caused by existing Green Valley pumping by farms, other mines and other water companies. Issues regarding CAP allocation prevail, and declines of the water table are expected to continue due to a lack of other water supply alternatives in the area.

Groundwater Recovery

In the area examined in the Lee Moore Wash Basin Management Study (LMWBMS), groundwater levels in some wells have dropped from 1 to 25 feet, while in other areas wells have gained between 3 and 76 feet. Water levels in the eastern portion of LMWBMS appear to have declined an average of 12 feet in a 10-year period (LMWBMS, 2008).

One of the long-term goals of Tucson Water is to reduce the consumption of groundwater. To realize this, an alternative of using a "Clearwater Blend" of recharged Colorado River (Central Arizona Project) water and Avra Valley groundwater has been used since 2001. Today, the Clearwater Blend makes up 50% of the region's potable water supply. By using this renewable supply, there has been a reduction in the pumping of numerous groundwater wells; this has resulted in natural recharge which is slowly replenishing the groundwater.

As a result, groundwater levels have risen by more than 30 feet in central Tucson, and at least 5 feet under most of the city.

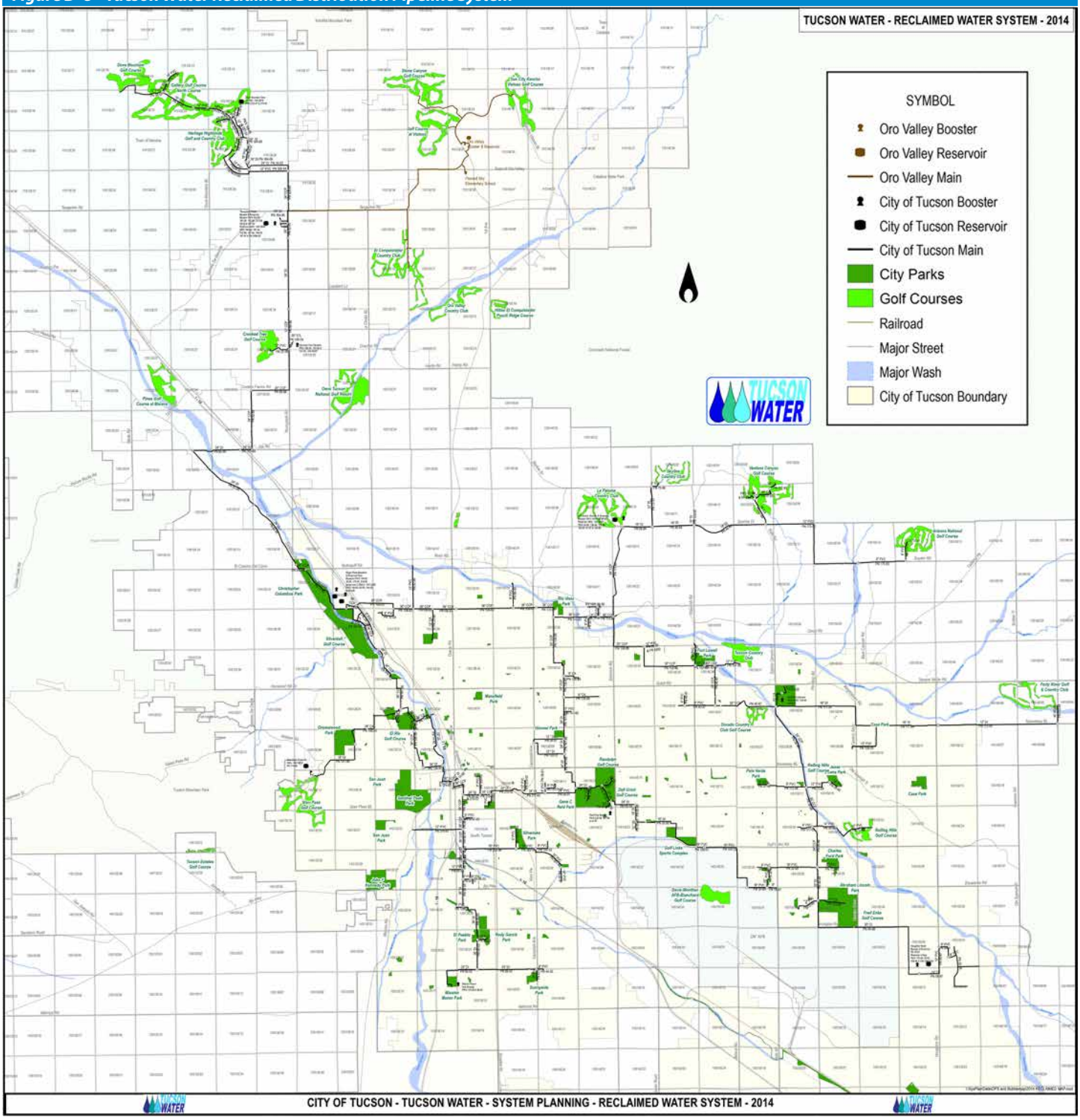
There are several groundwater recharge projects located in the vicinity of the Study Area. They include Pima Mine Road, FICO-Sahuarita and ASARCO. The Corona de Tucson WRF also provides groundwater recharge.

D.4.8 RECLAIMED WATER SYSTEM

Tucson Water builds, operates and maintains the region's reclaimed water system which serves golf courses, parks, schools and other outdoor needs (see **Figure D-8**). In recent years, more emphasis has been placed on the improvement and continued construction of the region's reclaimed water system. These efforts support the greater use of renewable water resources.

The Kino Environmental Restoration Project (KERP) is one of the largest reclaimed water storage facilities in Pima County. It is located in the southeastern area of Tucson, at the northwest corner of Ajo Way and Country Club Road. The facility was developed between 1998 and 2002 by PCRFCD in cooperation with the U.S. Army Corps of Engineers. The KERP facility consists of 27 acres of watercourse and riparian habitat in the 102-acre Ajo Basin. Before the development of the KERP facility, the Ajo Basin was a stormwater retention basin. The restoration project serves three primary purposes: to function as native ecosystems, to harvest urban stormwa-

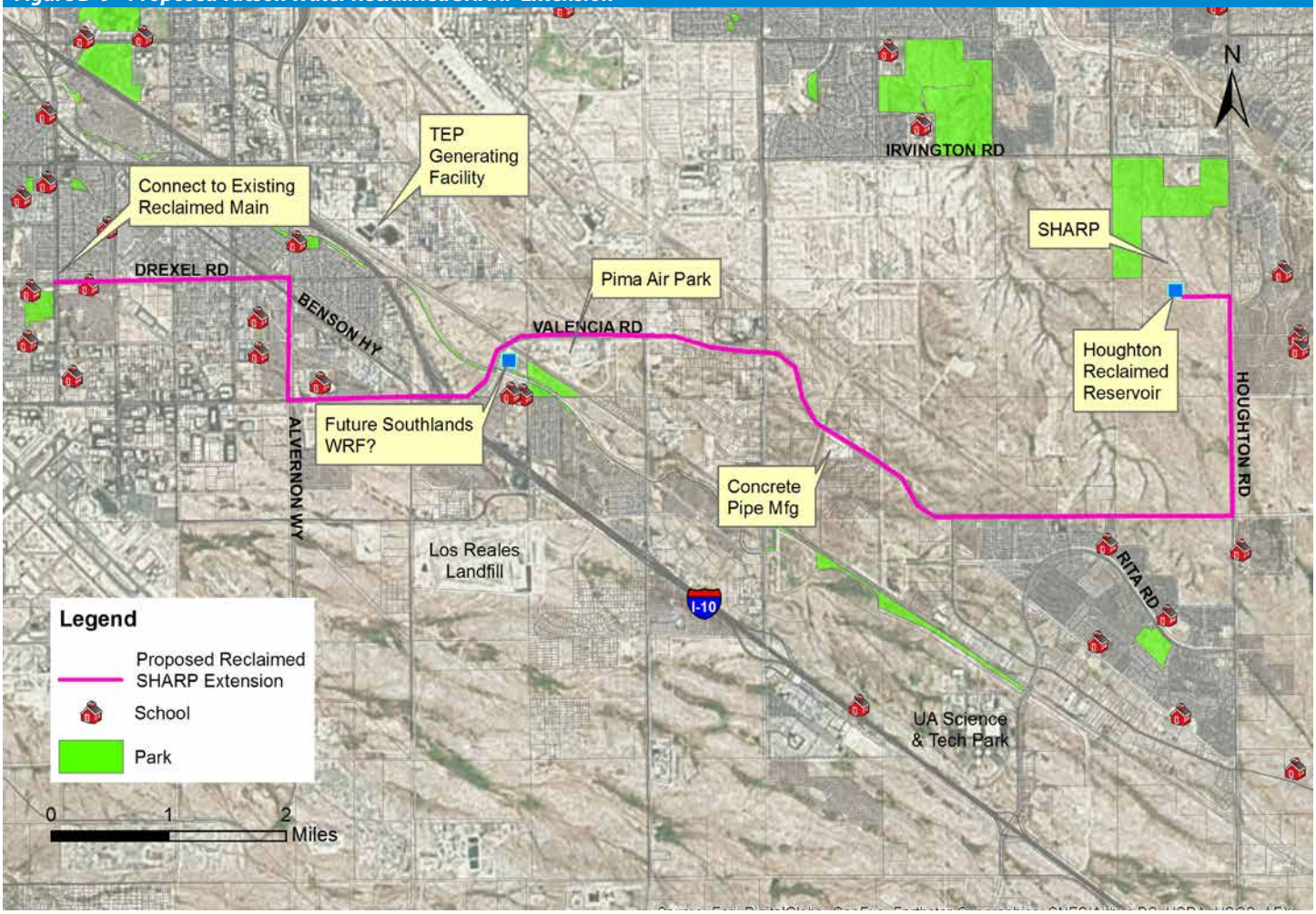
Figure D-8 Tucson Water Reclaimed Distribution Pipeline System



ter and to control flooding. The facility is permitted for a maximum monthly average inflow of 2.0 MGD of reclaimed water. Most of the reclaimed water is used for irrigation of the nearby practice fields at Kino Stadium.

The Southeast Planning Area relies heavily upon groundwater use and its renewable resources. The level of groundwater is constantly in decline and alternatives to groundwater use are very limited. Existing reclaimed water lines within the southeastern metropolitan area are located northerly and their extent is largely limited to the HAMP area. The 4.5 MGD Houghton Reservoir is located in the northwestern portion of HAMP to supply existing residences of the Civano community. The reclaimed water line begins from Civano and runs along Irvington Road to the west, then turns north on Pantano Road and extends farther north, covering the Tucson

Figure D-9 Proposed Tucson Water Reclaimed SHARP Extension



Source: Houghton Area Master Plan Wastewater Conceptual Plan, Melcolm Pirnie, Inc. 2008

metropolitan area (Malcolm Pirnie, March 2008).

The conceptual reclaimed water system studies for the Southeast Planning Area have identified potential reclaimed water users in the areas surrounding HAMP. They include the Rita Ranch, Rancho del Lago, and the Rocking K areas. These areas include parks, school sites and golf courses that could use reclaimed water for irrigation (Malcolm Pirnie, March 2008).

Several recharge basins are also proposed in the Southeast Planning Area for groundwater recharge. Such basins could potentially benefit the entire county. The construction of recharge basins in the far southeast region of the county is particularly important to avoid loss of the recharged supply to the downstream counties (e.g. Pinal County). The existing Houghton Reservoir site is proposed for a seasonal underground storage of effluent. The Southeast Houghton Area Recharge Project (SHARP), would allow both the City of Tucson and the County to store water for replenishment of the aquifer and potential future use. **Figure D-9** depicts the proposed reclaimed water line that starts at the Houghton Reservoir site and continues south along Houghton Road following Valencia Road west and connecting to the existing reclaimed water main near Drexel Road and Campbell Avenue. PCRWRD is considering to withdraw from participating in the SHARP project due to other priorities for the use of our water resources.

D.5 SEWER BASINS AND TRIBUTARY AREAS

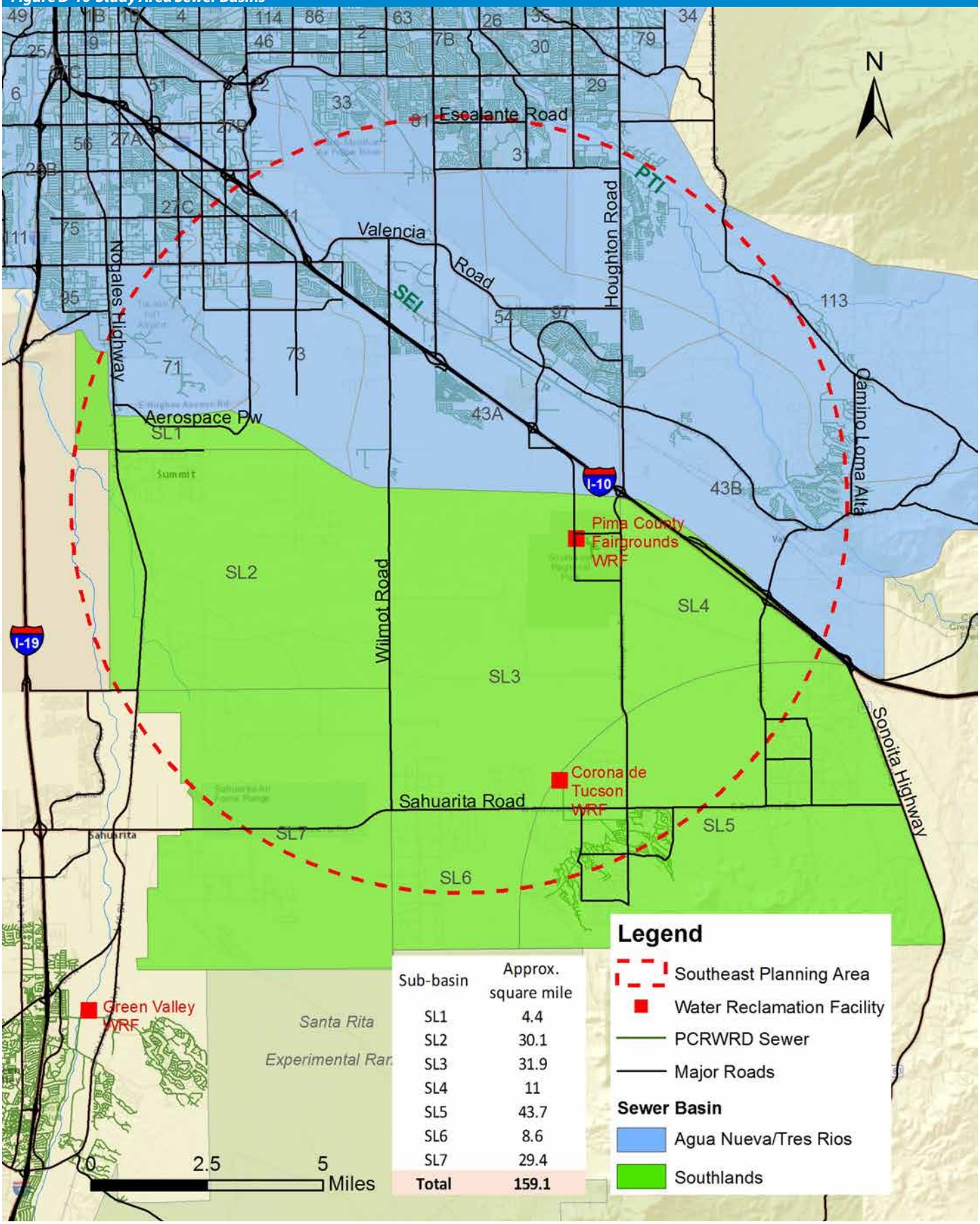
A sewer basin is a topographical area that contributes to a point within the larger sanitary sewer system. As illustrated in **Figure D-10**, this Study Area includes the Agua Nueva/Tres Rios Sewer Basin and the Southlands Sewer Basin.

AGUA NUEVA/TRES RIOS SEWER BASIN

The Study Area falls within the southeastern portion of the Agua Nueva/Tres Rios Sewer Basin. The sewer basin roughly extends from Nogales Highway on the west to past Camino Loma Alta on the east, and from Escalante Road on the north to I-10/Sonoita Highway to the southeast. The southern boundary is shared with the Southlands Sewer Basin. These boundary limits are defined based on natural drainage patterns, topography and existing sewer infrastructure. Approximately 141 square miles of the sewer basin falls within the Study Area.

The Study Area north of I-10 is in the Agua Nueva/Tres Rios Sewer Basin. The Study Area south of I-10 also is in the Agua Nueva/Tres Rios Sewer Basin with the exception of the southern portion which falls in the Southlands Sewer Basin. Almost all flows generated in

Figure D-10 Study Area Sewer Basins



Sub-basin	Approx. square mile
SL1	4.4
SL2	30.1
SL3	31.9
SL4	11
SL5	43.7
SL6	8.6
SL7	29.4
Total	**159.1**

the Study Area are gravity sewered to the Southeast Interceptor. Flows generated in the very northeastern portion of the Study Area, in sub-basin 113 (i.e.: Rocking K and a northern portion of HAMP), are gravity sewered to the Pantano Interceptor (PTI) (**Figure D-10**).

SOUTHLANDS SEWER BASIN

The Southlands Sewer Basin overlays most of the southern portion of the Study Area and encompasses approximately 160 square miles. It includes the areas south of I-10 tributary to the SEI. The Southlands Sewer Basin extends from Nogales Highway on the west to I-10/Sonoita Highway on the east, and from Hughes Access Road and I-10 on the north to Santa Rita Experimental Range on the south. The sewer basin consists of seven tributary sub-basins, SL1 thru SL7. The sub-basin boundaries are defined by major roads and the natural drainage patterns. The following is a more detailed analysis of each of the seven sub-basins and a review of the potential impact of future developments on the existing sewer systems.

For planning purposes, PCRWRD has assigned "collection points" for tributary systems that ultimately may terminate at one of the metropolitan facilities or the Corona de Tucson WRF or Fairgrounds WRF.

Sub-basin SL1 crosses Old Nogales Highway and covers a portion of the Tohono O'Odham Nation San Xavier District. It extends south of Hughes Access Road to Old Vail Connection Road to Swan Road (if Swan Road were extended) on the east. SL1 is mostly undeveloped with the majority of land in private holdings. The sub-basin measures approximately 4.4 square miles.

Sub-basin SL2 also crosses Nogales Highway. It extends to Pima Mine Road and to Wilmot Road on the east, encompassing approximately 30.1 square miles. Many acres of land in SL2 west of Old Nogales Highway are held by mineral interests, so it is unlikely these lands will be developed for sewage-producing uses. The Old Nogales Highway Colonia in SL2 is served by septic.

Sub-basin SL3 shares its western boundary (Wilmot Road) with sub-basin SL2, and its eastern boundary (Houghton Road) with sub-basin SL4. Its northern boundary is roughly one mile north from the Fairgrounds WRF, while its southern boundary is defined by Sahuarita Road. The sub-basin measures approximately 31.9 square miles. Two water reclamation facilities are located in SL3: the Corona de Tucson WRF and the Fairgrounds WRF. SL3 consists of mostly State Trust Land with the exception of a portion of land owned by the BLM and a private land owned by Hook M Ranch. Hook M Ranch is a planned large-scale development in SL3 just northwest of the Corona de Tucson WRF. This development will be sewered to the Corona de Tucson WRF.

Sub-basin SL4 has a north-east boundary defined by I-10 and Houghton Road. The southern boundary is defined by large lots located southwest of the I-10/Sonoita Highway interchange. SL4 consists primarily of properties dependent on private on-site septic systems. The sub-basin encompasses 11 square miles. SL4 consists of a large amount of the State Trust Land that it is very unlikely to attract any new developments requiring public sewer service in the near future.

Sub-basin SL5 shares its northern boundary with sub-basin SL4. It is bounded by Sonoita Highway on the east. SL5 extends to Coronado National Forest on the south and includes most of the Corona de Tucson WRF service area. The western boundary runs southeasterly from the Corona de Tucson WRF. The sub-basin measures approximately 43.7 square miles. The majority of vacant private land in the eastern portion of SL5 sits next to large residential parcels currently served by septic systems. It is anticipated that future population in this area will continue to utilize private on-site septic systems. The ownership in SL5 is predominantly State Trust Land.

Sub-basin SL6 comprises the smallest area of all of the Southlands sub-basins. Sub-basin SL6 is located west of SL5, south of Sahuarita Road. Its western boundary is Wilmot Road (if Wilmot Road were extended). Its southern boundary is the Santa Rita Experimental Range. SL6 is located downstream from the Corona de Tucson WRF and consists of mostly septic users. The sub-basin measures approximately 8.6 square miles. The land ownership in SL6 is shared between private holdings and State Trust Land. There are currently no known new developments planned in SL6.

Sub-basin SL7 is located south of SL2 and is comprised of mostly State Trust land. Its northern boundary is defined by Pima Mina Road and its eastern boundary is Wilmot Road. The eastern boundary remains coincident with the Town of Sahuarita's boundary until it joins the north line of the Santa Rita Experimental Range on the south. SL7 measures approximately 29.4 square miles and consists of mostly septic users south of Sahuarita Road. In addition, the northern half of the sub-basin includes 60 square miles planned for annexation and future development by the Town of Sahuarita.

D.5.1 SEWER SERVICE AREAS

PCRWRD is the only wastewater service provider for the Study Area. Two county-owned facilities operate in the Study Area boundary: the Corona de Tucson WRF and the Fairgrounds WRF (**Figure D-11**).

The northern portion of the Study Area is generally located in the Agua Nueva/Tres Rios WRFs service area. Wastewater from this portion of the Study Area is conveyed to the Agua Nueva WRF via the Southeast or the Pantano Interceptor. The southern portion of the Study Area includes the Corona de Tucson WRF service area and the Fairgrounds WRF service area. The primary wastewater service users of the Corona de Tucson WRF are the subdivisions located south of the facility. The Fairgrounds WRF service area is limited to providing wastewater services to the fairgrounds.

Unincorporated less-dense rural areas use private septic systems. These areas include the Old Nogales Colonia, large residential lots north and south of Sahuarita Road and residential areas south of I-10 and west of Sonoita Highway. It is assumed that these areas will remain on septic.

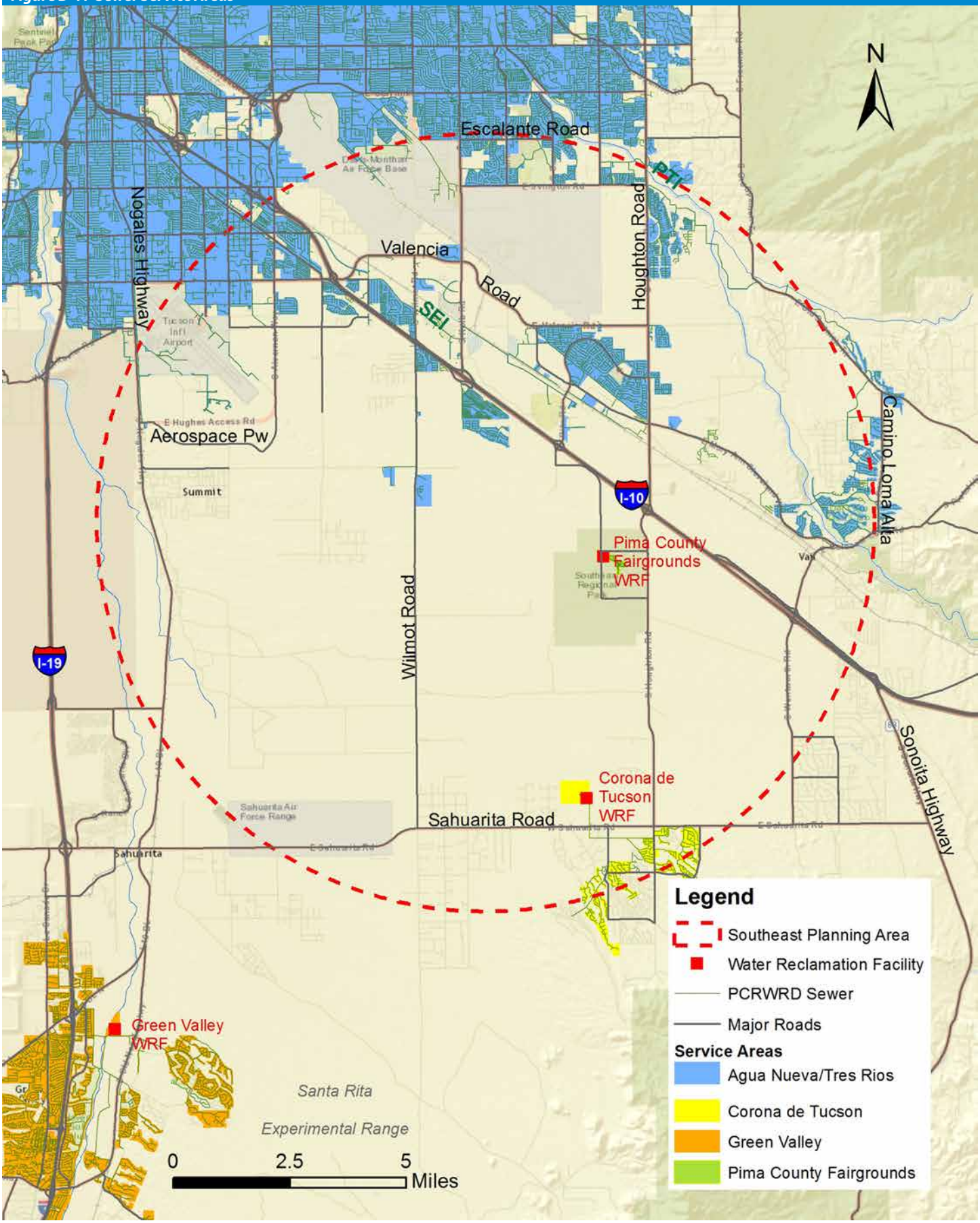
D.6 EXISTING WASTEWATER INFRASTRUCTURE

The majority of the wastewater collected in the Southeast Planning Area is conveyed to the metropolitan facilities for treatment. However, there are flows conveyed to and treated at the Corona de Tucson WRF and the Fairgrounds WRF.

D.6.1 TREATMENT SYSTEM

Treatment capacity in the Southeast Planning Area is divided between the large metropolitan area water reclamation facilities (the

Figure D-11 Sewer Service Areas



Agua Nueva WRF and the Tres Rios WRF) and smaller sub-regional facilities (the Corona de Tucson WRF and the Fairgrounds WRF). The two sub-regional facilities fall within the Study Area boundaries and are described below (**Figure D-12**). Under an agreement with Pima County, the UA Science and Technology Park owns and operates a wastewater treatment facility that has an extended aeration system with a capacity of 0.15 MGD.

CORONA DE TUCSON WRF

Facility Location and Service Area

Approximately 22 miles south of the City of Tucson, the Corona de Tucson sits on approximately 200 acres of county-owned land located north of Sahuarita Road and west of Harrison Road (if Harrison Road were extended). Vehicular access to the facility is via Sahuarita Road approximately 2,500 feet to the south of the facility. The facility primarily serves residential properties, although some commercial properties are also connected to the system. Land ownership surrounding the facility to the north, east, and south is State Trust Land. To the west is privately owned land. The land surrounding the facility is low intensity rural.

The service area encompasses approximately 6.3 square miles. The sewer basin encompasses approximately 46 square miles. The elevation ranges from 3,560 feet above sea level at the service area to 3,120 feet above sea level at the facility. The service area consists of subdivisions located south of Sahuarita Road and east and west of Houghton Road. The subdivisions include Sycamore Canyon, Santa Rita, New Tucson Unit, Oasis Santa Rita and the Bells at Santa Rita.

The service area conveyance system consists of approximately 42 miles of public sewer pipes that range from 6 to 21 inches in diameter. There are 783 public manholes and 18 cleanouts in the service area (GIS data analysis, April 2014). The depth of groundwater is approximately 450 feet below the facility and the direction of groundwater flow is towards the northwest.

Facility Capacity and Current Flows

The Corona de Tucson WRF has a permitted capacity of 1.3 MGD. In 2015, the facility treated an average monthly flow of 0.295 MGD (22.69% capacity), which is slightly more than in the previous years (see **Table D-2**).

Facility Overview

The facility consists of two treatment trains. The main train con-

Table D-2 Corona de Tucson WRF Annual Influent Flow

Year	Capacity (MGD)	Annual Average Influent (MGD)	Percentage of Capacity (Avg Amt Influent/Capacity)	Peak Influent (Monthly Avg Amt in MGD)	Percentage of Capacity (Peak Influent/Capacity)	Lowest Influent (Monthy Avg Amt in MGD)	Percentage of Capacity (Lowest Influent Capacity)	Percentage Change Peak to Low
1999	0.3	0.047	15.67%	Jan, Aug, 0.052	17.33%	November, 0.041	13.67%	21.15%
2000	0.3	0.046	15.33%	December, 0.052	17.33%	May, Jun, Aug, Sep, 0.042	0.00%	100.00%
2001	0.3	0.041	13.67%	March, 0.052	17.33%	Jun, Aug, Oct, Nov 0.036	12.00%	30.77%
2002[1]	0.3	0.052	17.33%	July 0.067	22.33%	December, 0.043	14.33%	35.82%
2003	0.3	0.052	17.33%	November, 0.063	21.00%	January, 0.042	14.00%	33.33%
2004	0.3	0.079	26.33%	Nov, Dec 0.094	31.33%	January, 0.063	21.00%	32.98%
2005	0.3	0.103	34.33%	December, 0.119	39.67%	April, 0.090	30.00%	24.37%
2006[2]	1.3	0.139	10.69%	December, 0.179	13.77%	January, 0.115	8.85%	35.75%
2007	1.3	0.205	15.77%	July, 0.266	20.46%	June, 0.177	13.62%	33.46%
2008	1.3	0.228	17.54%	July, 0.243	18.69%	June, 0.216	16.62%	11.11%
2009	1.3	0.248	19.08%	November, 0.265	20.38%	January, 0.224	17.23%	15.47%
2010	1.3	0.254	19.54%	December, 0.269	20.69%	June, 0.224	17.23%	16.73%
2011	1.3	0.260	20.00%	November, 0.274	21.08%	June, 0.222	17.08%	18.98%
2012	1.3	0.271	20.85%	December, 0.291	22.38%	June, 0.241	18.54%	17.18%
2013	1.3	0.275	21.15%	January, 0.292	22.46%	June, 0.238	18.31%	18.49%
2014	1.3	0.287	22.08%	December, 0.296	22.77%	June, 0.266	20.46%	10.14%
2015	1.3	0.295	22.69%	August, 0.309	23.77%	June, 0.267	20.54%	13.59%

[1] Data for the month of January not available. [2] 1.3 MGD design capacity used in calculation from 2006 to present (The WRF expansion from 0.3 MGD to 1.3 MGD occurred in 2005).

Figure D-12 Facilities Location Map

sist of a headworks with grit removal followed by two 0.5 MGD each closed loop reactors (CLR) with internal clarification. The clarifier effluent feeds a service water system with the remaining effluent disposed of in three recharge basins. There is also solids handling for the wasted sludge. The older system consists of two original stabilization ponds with a capacity of 0.3 MGD, one evaporation pond, and four soil aquifer treatment basins (SAT).

The original treatment system consisted of a lagoon built in the 1970s to treat sewage from the New Tucson #1 subdivision. The original treatment system consisted of headworks, clarifier and a pair of lagoons and was design to treat 0.117 MGD. The subsequent expansion of the system to 0.3 GPD was completed in 1983 as growth in the Sahuarita Road/Houghton Road area outpaced the lagoon's capacity.

In 2005, the PCRWRD entered into a Master Sewer Service Agreement (MSSA) with a group of developers and the facility was expanded with the addition of a 1.0 MGD CLR treatment facility. The expansion work was completed in 2007.

The existing conveyance sewer is comprised of 6 to 21-inch pipes that convey the flows from the subdivisions on the south. Sewage enters the facility through an 18-inch gravity interceptor. The flow can then be directed to the old stabilization pond system or the CLR system or a combination of both.

Treatment Process

The 1.0 MGD CLR facility includes

- A headworks with two 6 mm rotary drum micro strainers,
- One combined grit chamber,
- A diversion structure,
- Two influent Parshall flumes,
- Two 0.5 MGD CLRs consisting of a Spiraflo clarifier in an inner concrete tank surrounded by an oxidation ditch,
- A RAS/WAS pump station,
- Sludge holding tanks,
- A scum pump station, and
- A service water facility.

Each oxidation ditch is equipped with

- Four jet aeration units,
- Submersible pump,
- Plant water supply line,
- Air supply line,
- Air nozzles, and
- A backflush line.

The blowers are housed in the mechanical and control building. The effluent from the CLR treatment trains flows by gravity to the facility's recharge basins.

The 0.3 MGD stabilization pond system consists of a primary aerated lagoon, a secondary aerated lagoon, and an evaporation pond. The secondary lagoon effluent can also be discharged to SAT basins through temporary pumps and pipes. None of the effluent from either treatment system leaves plant site. All effluent is evaporated or recharged on site.

Sludge generated on site is pumped into holding tanks where it is mixed with polymer to cause settling. The supernatant is then pumped back to the plant and the solids are wet-hauled off site to a location in the conveyance system that is tributary to the Tres Rios WRF.

OUTLOOK OF FACILITY

According to PCRWRD's July 6, 2004 analysis of the Master Sewer Facilities Development Agreement 14-03-S-134690-0704, there is no capacity available for further development in the Corona de Tucson WRF service area. Based on the current average monthly influent flow of 0.295 MGD, the Corona de Tucson WRF currently serves approximately 3,700 people (80 GPD per day per person). All the remaining capacity of 1.0 MGD has been allocated to developers who paid for treatment expansion in 2007.

The facility can handle an additional 8,488 people before reaching 75% capacity and 12,500 people before reaching full capacity. Growth in the service area will be driven by infill and development of future subdivisions.

Plans for the treatment and conveyance system expansion will be needed to support future growth in the area. The capacity expansion is based on the following assumptions:

- Current capacity status: 1.3 MGD
- Allocated Capacity: 1.28 MGD
- Hook M Ranch: 0.38 MGD
- Total allocated capacity: 1.66 MGD

The timing of the expansion is primarily development-driven (e.g. Hook M Ranch development). Expansion Options 1 and 2 listed below include the decommissioning of the existing lagoon and the installation of additional CLR or BNROD capacity, with the conversion of the lagoon system to percolation basins. Options 3 and 4 propose to retain the existing 0.3 MGD lagoon and install additional CLR and BNROD capacity.

Current Status:

- One 0.3 MGD Lagoon System
- Two 0.5 MGD Closed Loop Reactors (CLR)

Expansion Options:

1. 2.0 MGD
   a) Install two 0.5 MGD CLRs
   b) Decommission 0.3 MGD Lagoon System
2. 3.0 MGD
   a) Install one 2.0 MGD BNROD
   b) Decommission 0.3 MGD Lagoon System
3. 2.3 MGD
   a) Install two 0.5 MGD CLRs
   b) Retain 0.3 MGD Lagoon System
4. 3.3 MGD
   a) Install one 2.0 MGD BNROD
   b) Retain 0.3 MGD Lagoon System

PIMA COUNTY FAIRGROUNDS WATER RECLAMATION FACILITY (FAIRGROUNDS WRF)

The Fairgrounds WRF presents a unique situation because of its seasonal use and periodically high flow rates that occur during the annual Pima County Fair. There is minimal to no flow during the summer months.

Facility Location and Service Area

The Fairgrounds WRF is located approximately 18 miles southeast of Tucson. The facility sits on an 8.8-acre county-owned parcel south of I-10 and east of Houghton Road. The facility operates year round during the annual county fair held every spring at the fairgrounds, during which the highest flows of the year are produced.

Table D-3 Pima County Fairgrounds WRF Annual Influent Flow								
Year	Capacity (MGD)	Annual Average Influent (GPD)	Percentage of Capacity (Avg Amt Influent/Capacity)	Peak Influent (Monthly Avg Amt in GPD)	Percentage of Capacity (Peak Influent/Capacity)	Lowest Influent (Monthly Avg Amt in GPD)	Percentage of Capacity (Lowest Influent/Capacity)	Percentage Change Peak to Low
2008	20,000	8,200	41%	April, 37,800	Capacity Exceeded	August, 1,000	5%	97%
2009	20,000	5,100	26%	April, 29,800	Capacity Exceeded	May, June 200	1%	99%
2010	20,000	4,900	25%	April, 20,000	100.00%	June, 700	4%	97%
2011	20,000	8,600	43%	April, 41,500	Capacity Exceeded	June, 2,000	10%	95%
2012	20,000	6,000	30%	April, 21,900	Capacity Exceeded	June, 180	1%	100%
2013	20,000	12,100	61%	April, 63,800	Capacity Exceeded	June, 53	0%	100%
2014	20,000	9,700	49%	April, 35,100	Capacity Exceeded	June, 114	1%	100%
2015	20,000	13,700	69%	April, 54,600	Capacity Exceeded	Jul, 100	1%	100%

Gravity flow to the facility from areas outside the fairgrounds is limited. Vehicular access to the facility is via Harrison Road. Land uses served by the facility are primarily residential and, to a lesser degree, commercial. The land surrounding the facility is owned by Pima County. The majority of land surrounding the Fairgrounds is vacant State Trust Land.

The Fairgrounds WRF service area encompasses 0.25 square miles. The elevation ranges from 3,050 feet above sea level at the service area to 3,020 feet above sea level at the facility. The service area conveyance system consists of approximately one mile of pipes ranging from 6 to 10 inches in diameter. There are 17 public manholes and 2 cleanouts in the service area (GIS data analysis, April 2014).

Facility Capacity and Current Flows

The facility's permitted capacity is 35,000 GPD. The facility operates under a general APP permit and is limited to 20,000 GPD of flow based upon average monthly influent. The average monthly influent flow recorded in 2015 was at 13,700 GPD (69% capacity). The highest average monthly influent flow of 63,800 GPD was recorded in April of 2013 (**Table D-3**). Excess wastewater generated during the fair events is diverted into an overflow pond and let to percolate. The remaining wastewater is vault-and-hauled off site and discharged into the downstream conveyance system.

Treatment Process

The Fairgrounds WRF consists of two primary stabilization ponds located in the northwest corner of the site, and an overflow pond. The facility operates under a general APP permit (P-100634). The disposal is percolation.

OUTLOOK OF FACILITY

"The Fairgrounds WRF and Alignment Feasibility Analysis" prepared by RBF Consulting in 2010 discussed several potential alternatives to the facility, including the diversion of flow by gravity to the Southeast Interceptor and the subsequent decommissioning of the existing ponds. The most cost-effective option is to extend the proposed 10-inch sewer line from the facility to the SEI near the Rita Road/I-10 interchange.

The proposed near-term plan for the facility is to retain the existing pond treatment process and add a pump station and force main (approximately 15,000 linear feet) that will tied into the SEI to handle the excess flows during large events at the Fairgrounds facility. The proposed force main would connect to the SEI near the Rita Road/I-10 interchange. The pump station and force main will serve as an overflow or equalization facility to the ponds.

The long-term plan proposes a gravity connection to the SEI, provided that the necessary base flow from new developments occurs. Several developments have been considered on or adjacent to the Fairgrounds. They include the Southeast Regional Park, a shooting range, a local school, a government complex and others.

The Fairgrounds WRF currently does not have much capacity available and therefore would require expansion to serve new development.

D.6.2 PUMP STATIONS

There are currently three pump stations serving the Study Area. A pump station (PS-19, ID 8BASP1), located on Old Vail Road serves the Arizona State Correctional Facility and delivers sewage to a gravity sewer in Wilmot Road. Two pump stations, PS-25 (ID 8BRDL1) and PS-26 (ID 8BRDL2) lift sewage out the Rancho del Lago subdivision to the Pantano Wash Valley into collector sewers. The collector sewers connect to the SEI through a sewer line running along Mary Ann Cleveland Way.

D.6.3 CONVEYANCE SYSTEM

The Study Area is served by several interceptors and an array of collector sewers. Conveyance facilities include the HCSs (house connection sewers), manholes, lift stations and force mains, diversion structures and siphons. Minor upstream private collection systems are at the University of Arizona, the Tucson International Airport and at the DMAFB (CMOM, 2009).

INTERCEPTORS

There are several interceptors serving the Study Area (see **Figure D-13**). These interceptors are:

- The Southeast Interceptor (SEI),
- The Pantano Interceptor (PTI),
- The Old Nogales Highway Interceptor (ONH),
- The Aviation Corridor to the Santa Cruz Interceptor (ACSC),
- The Aviation Corridor to the Southeast Interceptor (ACSE),
- The Santa Cruz Interceptor (SCI), and
- The Santa Cruz Central Interceptor (SCC).

These interceptors convey sewage collected by a network of smaller sewer lines from tributary areas to the downstream collection system. The interceptors serving the Southeast Planning Area range in size from 18 inches to 60 inches in diameter.

The Southlands is served by the SEI and ONH. The ONH and ACSC both join the SEI which subsequently joins the SCC which terminates at the Agua Nueva and Tres Rios facilities.

Old Nogales Highway (ONH) Interceptor

The ONH Interceptor was constructed in 1968 with additional phases constructed in 1974 and 1987. The interceptor ranges in size from 18-inch to 24-inch in diameter and extends from Hughes Access Road to I-10 and Park Avenue along the Old Nogales Highway alignment. From Hughes Access Road north to Valencia Road it follows First Avenue north to Fair Street (about a half mile south of Ajo Way). It then jogs west to follow the Union Pacific Railroad right-of-way for a little more than three-fourths of a mile. Finally, it turns northeast and joins the SEI near the westbound Park Avenue to the I-10 entrance ramp.

There is one 15-inch diameter sewer line along Irvington Road feeding into the ONH Interceptor. The ONH has one siphon (the Veteran's siphon) which is located north of Ajo Way near the Union Pacific Railroad.

ONH OUTLOOK

A sewer system for properties located more than a half mile south of I-10 and west of the Corona de Tucson WRF service area will ultimately connect to the ONH Interceptor, unless a new treatment facility is constructed to serve this area.

PCRWRD[1] is in the process of evaluating the sewer alignment that would ultimately connect the proposed Verano Development and the CCA prison facility to the ONH Interceptor. Approximately 4.3 MGD of ADWF is expected to be generated by the two developments, which would require augmentation of the existing sewers. The proposed sewer alignment includes an extension of the exiting sewer line in Old Vail Connection Road west of Wilmot Road. The future sewer extension, called the Aerospace Corridor Interceptor (ACS), would also serve the Aerospace, Defense and Technology Research and Business Park planned just south of Raytheon and Tucson International Airport. It is estimated that the proposed extended sewer would provide enough capacity to serve both the existing and future developments in the area.

[1] Several constraints have been identified by PCRWRD that may affect the timing, location and constructability of the proposed route alignments. These constraints include: land acquisition, topography, environmental issues and presence of cultural resources. The route alignment with the least number of constructability constraints will be selected.

Southeast Interceptor (SEI)

The SEI conveys wastewater generated in the far southeastern portion of the county to the downtown area via the Santa Cruz Interceptor (SCI), and further to the Agua Nueva WRF. The SEI joins the SCI west of I-10 at 18th Street.

The upstream end of the SEI commences at the Rita Ranch near the intersection of Rita Road and Old Vail Road in a public drainageway, in the northeast corner of Section 21, Township 15 South, Range 15 East. The SEI generally follows the Julian Wash and the Tucson Diversion Channel to the intersection of Park and I-10 before turning north. The SEI is comprised of pipe that is 21 inches, 30 inches and 60 inches in diameter. It is constructed predominantly of Reinforced Concrete Pipe material. The interceptor was installed in the early to mid-1980s with the final phases completed in 1986.

The SEI receives flows from:

- The Rita Ranch and Rancho del Lago subdivisions,
- A short segment of internal sewer just west of Pantano Road,
- Collector sewers serving the corrections complex and
- Two subdivisions south of I-10 at Wilmot Road,
- A sewer line serving the Littletown area,
- The Country Club public sewer, and
- A variety of sewers which join the SEI near the intersection of Park and I-10.

The sewer lines range in size from 15 inches to 24 inches and are constructed mostly of PVC and VCP material.

The 30-inch segment of the interceptor that runs along Euclid Avenue between 36th Street and 18th Street is currently operating at or close to 75% d/D during peak PDWF. (d/D = the ratio of the depth of flow in relation to the diameter of the pipe.) Potential sanitary sewer overflow may occur during a 10-year, 24-hour storm event. It has been determined that augmentation in this segment of the SEI is necessary.

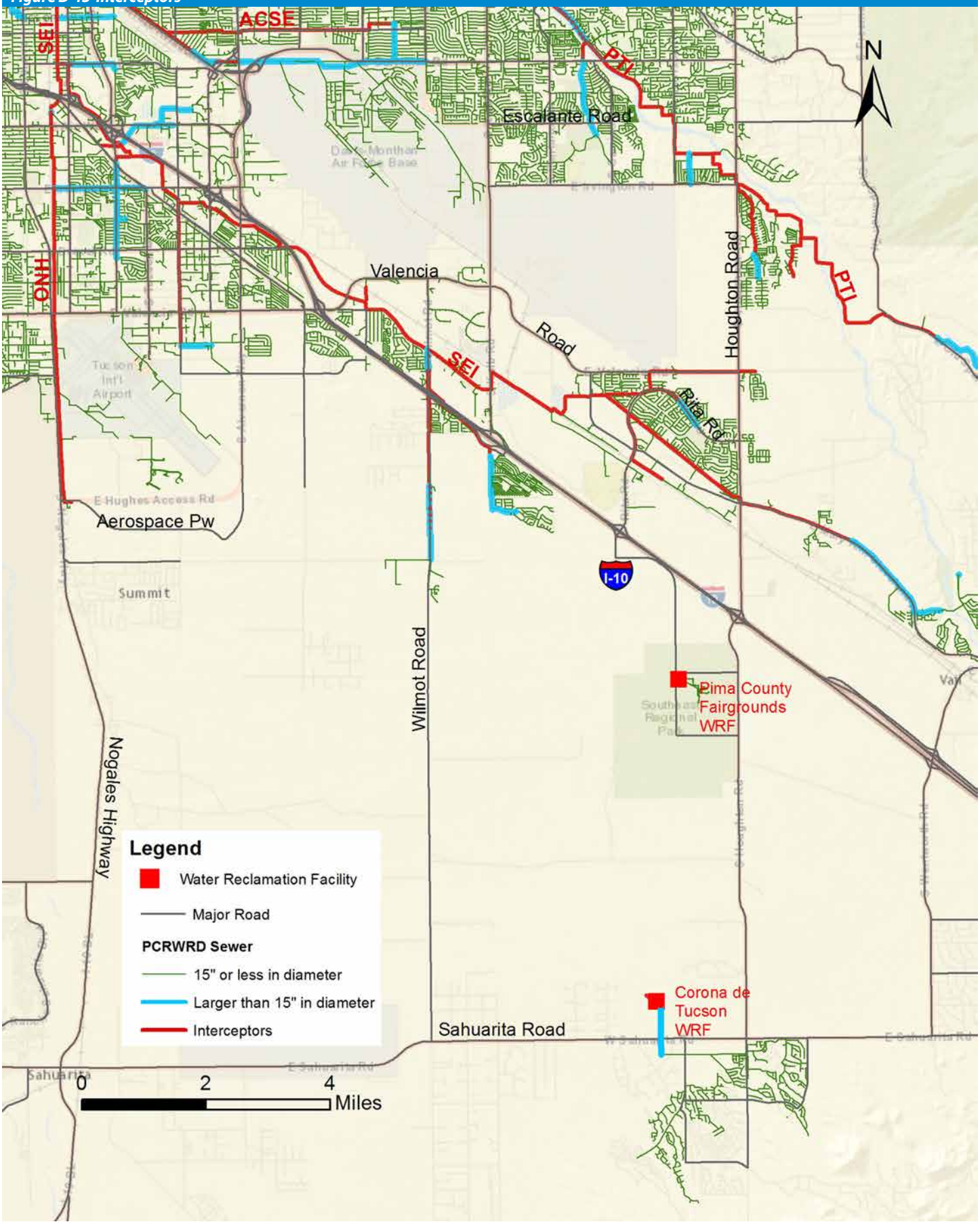
SEI OUTLOOK

Lands north of I-10 and south of Valencia Road will connect to the SEI. Sewered lands north of I-10 and south of Valencia Road will connect to the SEI. Numerous projects that are tributary to the SEI have been approved or are in the planning stage. Many of these projects could begin at any time.

Growth along the I-10 corridor is anticipated to add additional 6.1 MGD from contributing new developments. As estimated in the PCRWRD's 2010 SEI analysis, the additional flow would surpass the allowed PDWF capacity of 14.1 MGD (75% d/D) at the intersection of 31st Street and Euclid Avenue (MH# 9917-29).

Augmentation of the SEI system is required for the conveyance system to adequately serve future developments. The analysis states that this additional capacity is required to remain in compliance with CMOM's requirements related to PWWF associated with a 10-year, 24-hour storm event. Augmentation alternatives and cost estimates were evaluated by PCRWRD. The proposed augmentation is currently under construction and includes a new alignment that starts from the segment of the existing SEI in 36th Street heading west and following the railroad tracts north, connecting to the existing SEI in 18th Street. The cost estimate for this CIP project is $18.5 million.

Figure D-13 Interceptors



Pantano Interceptor (PTI)

Most properties north of Valencia Road and east of Pantano Road connect or will connect to the PTI. The PTI extends from the 22nd Street terminus to the southeast, collecting sewage from a pair of sewers – one to the Rocking K master planned community to the southeast, the other south along Houghton Road towards the Civano community. The collector sewers range in size from 15-inches to 24-inches in diameter. Additional capacity may be expected from the HAMP area and Rocking K development.

PCRWRD installed a new 18-inch line in Harrison Road between Millmar and Escalante Roads in 2014 to avoid surcharging and potential overflow problems, and to provide additional capacity for anticipated growth in the tributary areas. Newly submitted development plans for 6,882 units in Rocking K will require augmentation of the 18-inch pipe in Millmar Avenue and several reaches of the 8-inch pipe in the downstream Academy Village development. The augmentation is necessary to serve the Rocking K and Rincon Creek development areas.

Aviation Corridor to Santa Cruz Interceptor (ACSC)

The Aviation Corridor Interceptor is segmented into two individual lines, the Aviation Corridor to Santa Cruz Interceptor (ACSC) and the Aviation Corridor to Southeast (ACSE). These lines convey flows from the southeast portion of Tucson to the Agua Nueva WRF. The ACSC conveys flows from the flow management structure located at 18th Street and Vine, northwest to the downtown area. The ACSE conveys flows to the SEI from the DMAFB, along the Aviation corridor through the flow management structure.

Lands west of Pantano Road and north of Valencia will connect to the ACSC. The DMAFB and the ARMAC occupy large portions of the land which will contribute sewage to the ACSC. The Golf Links Siphon carries ACSC sewage under the Tucson Diversion Channel.

Tanque Verde Interceptor (TVI)

In the extreme northeast corner of the Study Area (defined by Golf Links Road (if Golf Links Road were extended) and Old Spanish Trail) there is a small region which is served by the Tanque Verde Interceptor (TVI). Another small area is largely developed and is dependent on septic systems. It is anticipated that no additional flows from new developments in the Study Area will be conveyed to the TVI.

D.6.4 FUTURE CONVEYANCE SYSTEM NEEDS

Growth and new development in the Study Area triggers the need for conveyance and treatment capacity. The determination of future sewer service areas is based on future plans for development.

A new gravity interceptor, the Aerospace Corridor Interceptor (ACS), is planned along Old Vail Connection Road, to provide east-west connection between the existing public sewer near Wilmot Road and the Old Nogales Highway Interceptor (ONH).

PCRWRD is evaluating an offsite sewer alignment option for the proposed Verano Development. The proposed gravity sewer would convey flows from Verano to the ONH and further to the metro conveyance system. The analysis of available capacity and future contributing capacity at the ONH has been completed and the project design is underway.

The department has evaluated possible closure of the Fairgrounds WRF. One possibility to enable the closure of the facility would be to convey treated flows from the plant o the SEI. Before this could happen, the department would require adequate and consistent volume and velocity to avoid the occurrence of odor issues in the system. In 2010, RFB Consulting evaluated several sewer line alignment alternatives.

NEW WATER RECLAMATION FACILITY

The department has identified a need for a new[2] water reclamation facility to serve the far southeast edge of the Tucson metropolitan area. In 2011, the engineering firm Malcolm Pirnie evaluated potential locations in the "Southeast Area Sub-Regional Wastewater Reclamation Facility (WRF) Study." The selected facility site consists of five county-owned parcels totaling fifteen acres bordered by the Julian Wash on the south and UPRR tracks on the north side, while Valencia Road defines the site's east boundary (**Figure D-14**).

The facility would be constructed soon after the PTI and SEI sewers approach capacity. The timing of the HAMP area development was considered a major factor in determining capacity in the interceptors. Today HAMP remains mostly undeveloped. Until sufficient flow is sustained, the HAMP area's existing flows will continue to be conveyed to the metropolitan water reclamation facilities. Another factor affecting the timing of the plant construction is the construction of the proposed reclaimed water line by Tucson Water. The proposed line is discussed in Section **D.4.8** Reclaimed Water System.

SEWER SERVICE OPTIONS

PCRWRD is evaluating the sewer service options for new developments in the Southlands Sewer Basin. The timing of system expansion to serve new growth is primarily driven by the timing and location of new development. Flow from new developments immediately north and south of I-10 is tributary to the Agua Nueva/Tres Rios Sewer Basin and will be gravity sewered to the SEI. Local topography, development agreements and other factors will drive future service options for the area.

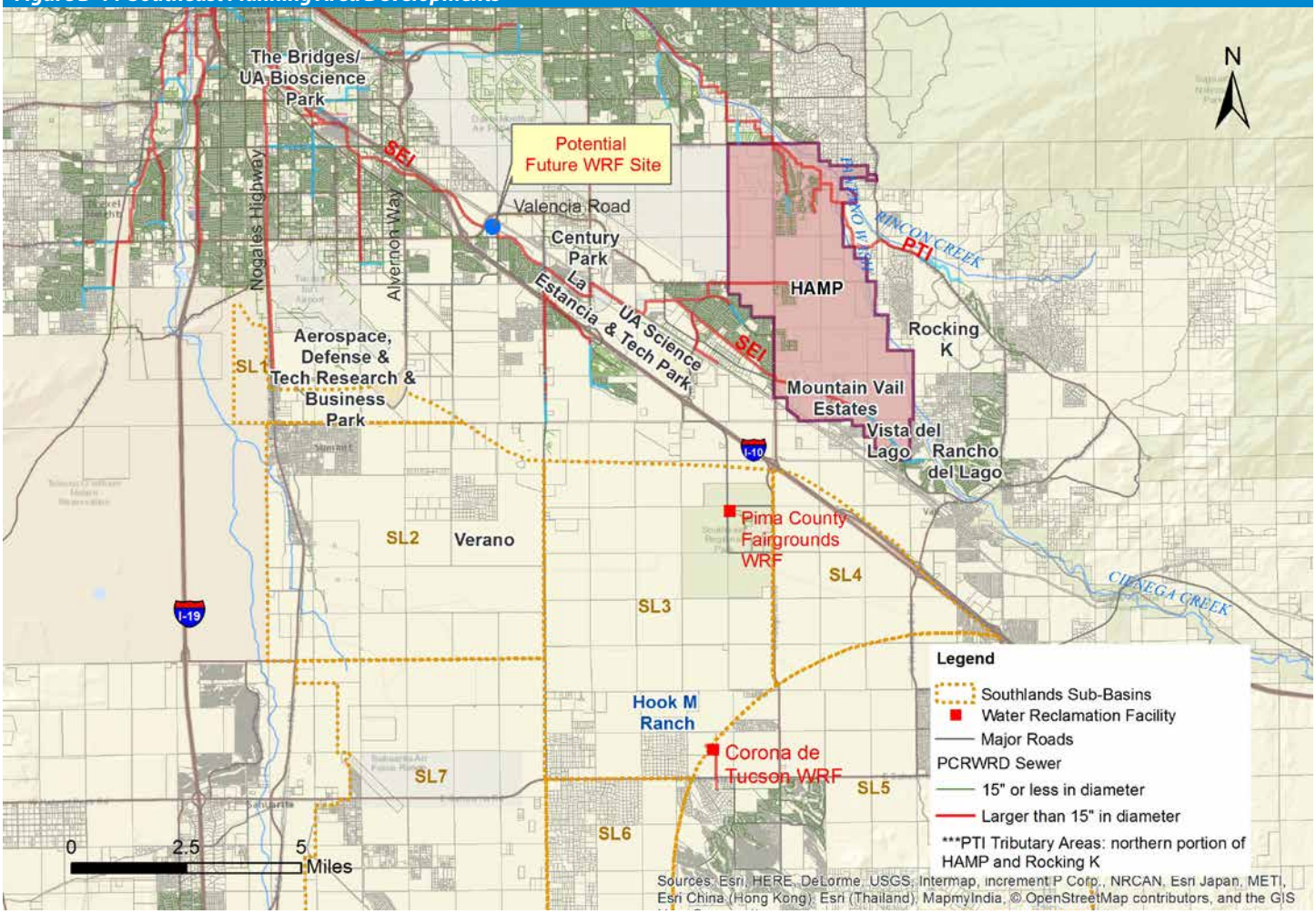
Areas south of I-10 in the Southlands Sewer Basin

Sewage generated by new developments could be conveyed by gravity to the SEI, or to the existing public sewer system in the Corona de Tucson WRF service area, provided that sufficient treatment capacity is available. The proposed gravity sewer would commence at Wilmot Road and run westerly along Old Vail Connection Road before it connects to the existing ONH Interceptor north. A force main is required to convey flows from Verano to the proposed sewer alignment. In addition to Verano, several other projects would potentially benefit from the proposed alignment. They include the new CCA prison facility on Wilmot Road and the Aerospace, Defense and Technology Research and Business Park south of Raytheon.

The areas with the potential for development include the Southlands sub-basins SL1, SL2, SL3, SL5, and SL7 (**Figure D-14**). The proposed Aerospace, Defense and Technology Research and Business Park will be gravity sewered to the ONH sewer interceptor. Because of the low elevation and the lack of gravity, some portions of SL2

[2] *The 2006 Metropolitan Area Facility Plan Update called for the construction of a new facility in 2010 or 2015. This assessment was based on high population projections and service area demands that were anticipated at the time of Plan Update writing.*

Figure D-14 Southeast Planning Area Developments



and SL3 could not be served by the Corona de Tucson WRF (located upstream). The most logical solution for SL2 and SL3 would be a connection to the SEI. For any new development west of Verano, a force main would be necessary to convey flows to the proposed gravity sewer.

It is proposed that the Hook M development in the southern portion of SL3 to be served by Corona de Tucson WRF. The onsite collection of wastewater would be a gravity system. However, due to the low elevation of the project site, the construction of a lift station and force main would be required to connect to the facility.

A new sewer alignment that would transfer flows from the Fairgrounds WRF (northern half of SL3) to the SEI has been evaluated. The easternmost portion of SL4 as well as the northeastern corner of SL5 are comprised of larger residential lots served by septic. The nearest public sewer is located more than two miles north in Santa Rita Ranch. It is anticipated that future low-density developments in SL5 will continue to be served by private septic systems. If public sewer is required, the most economically feasible option would be to connect to the SEI. Flows from the southwestern portion of SL5 are treated at the Corona de Tucson WRF. Additional flows would require facility expansion.

The existing properties in the adjacent SL6 will likely remain on septic. PCRWRD has no plans for a sewer extension in this area. The northwestern portion of SL7 is within the County/Sahuarita DMA joint planning area and could be served by either jurisdiction. There has been some discussion about the construction of a new regional water reclamation facility to serve this area.

Areas North of I-10

Two major developments (Rocking K and the HAMP) north of I-10 will significantly impact the system capacity. According to Harrison-Pantano Service Area Wastewater Plan (which is a part of Rocking K Specific Plan), the proposed Rocking K development is estimated to contribute 1.5 MGD of ADWF and approximately 3.3 MGD of PWWF. Rocking K is located less than 4 miles southeast of the PTI. The developer is required to provide necessary downstream capacity. PCRWRD is currently monitoring the timing and development of Rocking K to ensure that capacity is available as needed.

The HAMP area is located in the northeastern portion of the Study Area, west of Rocking K. There is considerable uncertainty about the timing of development in the HAMP area. Private parties are likely to purchase a substantial amount of State Trust Land. Flows from the existing subdivisions are gravity-sewered to the SEI and the PTI. Malcolm Pirnie's 2008 "Houghton Area Master Plan (HAMP) Potable and Reclaimed Water Conceptual Plan" evaluated sewer service options for the remaining undeveloped HAMP area.

The study includes a larger area surrounding HAMP and the areas on higher elevations that may contribute flows to HAMP. The study estimated treatment capacity of 7.7 MGD (ADWF) for the buildout year 2030. The entire area, including the surrounding tributary areas, would contribute a total of 12.7 MGD (ADWF) upon buildout.

In addition to a proposed new treatment facility, the study also evaluates the proposed augmentation of the existing conveyance system. Out of several scenarios, the PTI conveyance scenario appears to be the most cost-effective because it takes maximum advantage of existing infrastructure and provides the most flexibility to accommodate future planning modifications. Upgrades to the PTI conveyance system will be required if the new treatment facility is built.

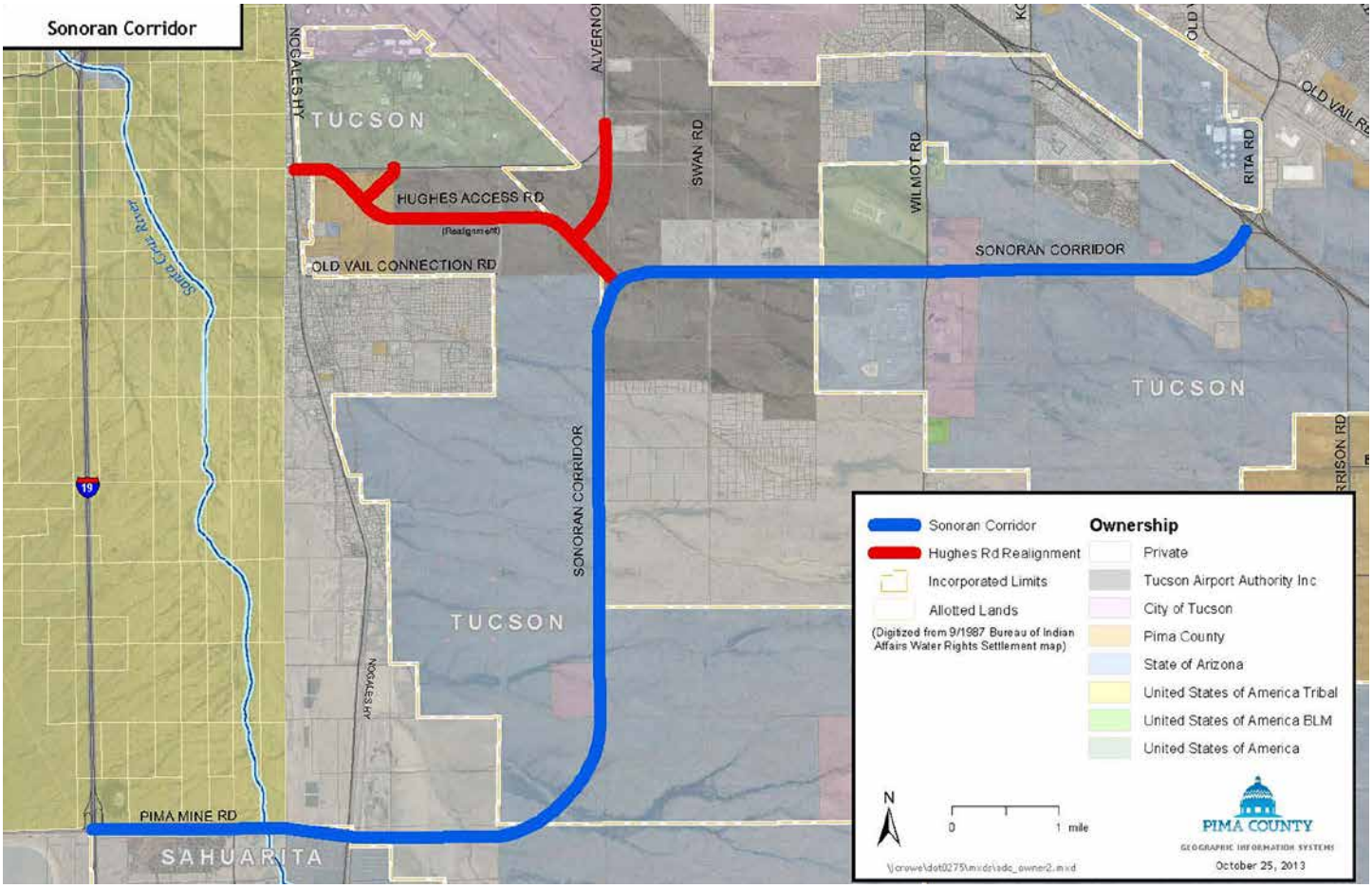
D.7 OUTLOOK OF SERVICE AREA

PCRWRD will continue to monitor development activity and wastewater flows within the Southeast Planning Area to ensure adequate conveyance and treatment capacity is available. The average influent at the Corona de Tucson has increased over the past years and is expected to continue as a result of infill development and new development. For some service users, capacity has been secured through the MSSA. However, there is much projected development that does not have committed capacity. An example is the Hook M Ranch with a projected 0.38 MGD (ADWF), 0.77 MGD (PDWF), and 0.85 MGD (PWWF). At this time, the Corona de Tucson does not have sufficient capacity to handle additional flow from new development.

The expansion of the Corona de Tucson WRF will be necessary to support growth. The capacity expansion will require purchase of State Trust land for the facility expansion and the anticipated noise and odor mitigation buffer. PCRWRD continues to monitor growth in the Corona de Tucson WRF service area and coordinate with developers to match growth and capacity needs.

For the time being, the Fairgrounds WRF will continue to provide onsite treatment for the existing users. Once the necessary base flow is created by new development, the facility will connect to the SEI.

D.8 SONORAN CORRIDOR AND AEROSPACE PARKWAY



The first phase of the corridor construction was the realignment of Hughes Access Road for the new Aerospace Parkway, starting at South Nogales Highway and connecting to Alvernon Way south of Tucson International Airport.

D.9 POPULATION PROJECTIONS CALCULATION

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D.9.1 TRAFFIC ANALYSIS ZONE DATA

PCRWRD used PAG's Traffic Analysis Zones (TAZ) to determine population projections in the Southeast Wastewater Planning Area (the Basin Study Area). PAG provided the data for the year 2010 and 2045. Population growth rate was determined by using the 2010 PAG figures (TAZ2010) for the base year and the 2045 PAG figures (TAZ2045) for the forecast year.

SOUTHLANDS SUB-BASINS SL1 – SL7

The Southlands sewer basin is comprised of seven sub-basins, SL1 thru SL7 (**Figure D.9-1**). Growth rates were calculated for each individual sub-basin. There are existing and future populations in SL4 and portions of SL5 that are likely to remain on septic systems. These areas are characterized by large lots.

There are 118 total TAZ areas that comprise the Southlands sewer basin (**Figure D.9-1**). Sixteen (16) TAZ areas (153, 174, 294, 330, 360, 478, 571, 650, 662, 663, 665, 666, 667, 899, 933, and 946) are partially included within the sewer basin boundary (**Table D.9-1**).

Table D.9-1 Southlands Sewer Sub-basins TAZ Population 2010-2045

Basin Num	TAZ	HHPOP 2010	HHPOP 2045	% of Sewer Basin within TAZ area	Southlands Sewer Basin TAZ2010 Population	Southlands Sewer Basin TAZ2045 Population
SL1	360	2	6	14.0%	0	1
SL1	478	8	8	73.6%	6	6
SL1	571	916	907	33.9%	310	307
SL2	60	8	205		8	205
SL2	61	6	6		6	6
SL2	62	26	299		26	299
SL2	63	0	242		0	242
SL2	64	205	202		205	202
SL2	65	0	15		0	15
SL2	294	0	0	34.8%	0	0
SL2	295	0	962		0	962
SL2	296	0	2,049		0	2,049
SL2	297	1	236		1	236
SL2	298	1	150		1	150
SL2	299	0	2		0	2
SL2	300	0	4		0	4
SL2	330	0	0	83.9%	0	0
SL2	331	1	215		1	215
SL2	332	0	199		0	199
SL2	333	316	548		316	548
SL2	334	0	92		0	92
SL2	336	0	107		0	107
SL2	364	1	226		1	226
SL2	365	0	209		0	209
SL2	366	0	134		0	134
SL2	367	0	97		0	97
SL2	402	0	270		0	270
SL2	406	0	401		0	401
SL2	407	0	237		0	237
SL2	409	1	219		1	219
SL2	410	0	70		0	70
SL2	411	0	128		0	128
SL2	412	0	81		0	81
SL2	477	3,752	4,096		3,752	4,096
SL2	650	876	3,208	24.4%	214	783
SL2	668	0	268		0	268
SL2	958	0	1,585		0	1,585
SL2	959	0	3,359		0	3,359
SL2	960	38	35		38	35
SL2	961	0	1,797		0	1,797
SL2	1028	0	0		0	0
SL3	153	0	155	63.5%	0	99
SL3	156	237	234		237	234
SL3	158	1	299		1	299
SL3	174	0	373	45.9%	0	171
SL3	175	0	3		0	3
SL3	176	0	150		0	150
SL3	189	0	158		0	158
SL3	190	23	21		23	21
SL3	204	0	347		0	347
SL3	205	0	194		0	194
SL3	222	0	207		0	207
SL3	223	0	170		0	170
SL3	224	0	110		0	110
SL3	228	7	10		7	10
SL3	246	0	136		0	136
SL3	266	0	184		0	184
SL3	267	0	103		0	103
SL3	268	0	241		0	241
SL3	269	0	310		0	310
SL3	270	0	161		0	161
SL3	271	0	240		0	240
SL3	272	360	362		360	362
SL3	906	69	65		69	65
SL3	910	206	201		206	201
SL3	1093	9	8		9	8
SL4	84	0	170		0	170
SL4	125	0	415		0	415
SL4	126	0	71		0	71
SL4	127	0	216		0	216
SL4	128	0	90		0	90
SL4	129	0	281		0	281
SL4	918	0	164		0	164
SL4	919	925	2,718		925	2,718
SL5	106	0	78		0	78
SL5	128	0	90		0	90
SL5	156	237	234		237	234
SL5	910	206	201		206	201
SL5	911	896	875		896	875
SL5	913	0	9		0	9
SL5	914	0	210		0	210
SL5	915	0	230		0	230
SL5	916	2,315	4,202		2,315	4,202
SL5	917	0	187		0	187
SL5	919	925	2,718		925	2,718
SL5	921	160	1,080		160	1,080
SL5	932	163	159		163	159
SL5	948	0	274		0	274
SL5	949	2,675	2,666		2,675	2,666
SL5	950	115	110		115	110
SL5	951	4	198		4	198
SL5	952	148	152		148	152
SL5	953	976	959		976	959
SL5	954	823	806		823	806
SL6	907	782	763		782	763
SL6	911	896	875		896	875
SL6	912	352	343		352	343
SL6	932	163	159		163	159
SL7	335	0	18		0	18
SL7	368	0	193		0	193
SL7	413	0	268		0	268
SL7	662	18	2,270	3.3%	1	74
SL7	663	98	1,957	21.7%	21	425
SL7	665	0	1,343	54.2%	0	727
SL7	666	2	3,180	86.3%	2	2,746
SL7	667	637	1,284	91.0%	580	1,168
SL7	899	0	0	1.1%	0	0
SL7	900	0	1,015		0	1,015
SL7	901	794	5,611		794	5,611
SL7	902	0	715		0	715
SL7	903	0	18		0	18
SL7	904	0	21		0	21
SL7	905	0	79		0	79
SL7	908	2	33		2	33
SL7	909	0	107		0	107
SL7	931	0	12		0	12
SL7	933	0	1	31.7%	0	0
SL7	946	252	768	91.8%	231	705
				Total Population	**20,187**	**59,661**

Figure D.9-1 TAZs within the Southlands Sewer Basin

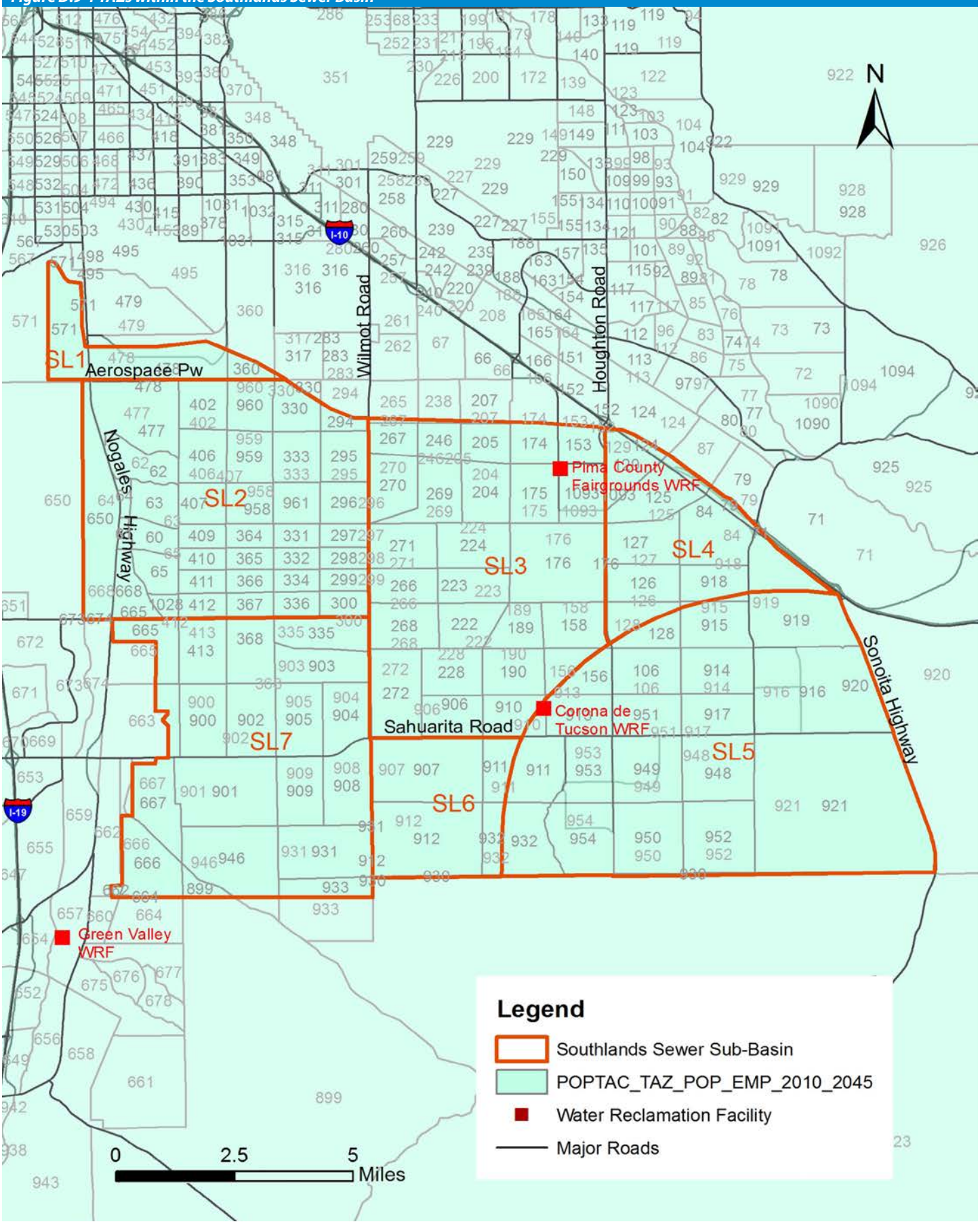


Table D.9-2 Sub-Basins SL1-SL7 Population Summary Table

Year	Southlands Sub-Basins							
	SL1	SL2	SL3	SL4	SL5	SL6	SL7	Total*
2010	316	4,569	911	925	9,643	2,193	1,631	20,188
2015	316	5,640	1,136	1,149	10,322	2,193	2,226	22,982
2020	316	6,961	1,417	1,427	11,049	2,193	3,039	26,402
2025	316	8,592	1,768	1,772	11,826	2,193	4,148	30,615
2030	316	10,605	2,205	2,201	12,659	2,193	5,661	35,840
2035	316	13,090	2,751	2,734	13,550	2,193	7,727	42,361
2040	316	16,157	3,432	3,395	14,504	2,193	10,548	50,545
2045	314	19,526	4,184	4,125	15,437	2,140	13,936	59,662
Annual Growth Rate	-0.02%	4.30%	4.52%	4.43%	1.37%	-0.07%	6.42%	3.19%
Population Change 2010-2045[1]	-2	14,957	3,273	3,200	5,794	-53	12,305	39,474

*Total population was calculated based on projected growth rate in each sub-basin.

ASSUMPTIONS

- Population grows at a constant percentage per year, creating geometric growth.
- TAZ data represents the most accurate data available for population estimates at this time.
- The population within each zone is evenly distributed. That is, if 30% of the TAZ area is within the Study Area, only 30% of the entire TAZ population will be assumed within the study area.
- Household occupancy rate is at 2.7 people per single family unit and 1.9 people per multi-family unit.

METHODOLOGY

1. Using ArcGIS software, the relevant TAZ areas for the Southlands sewer basin were selected and extracted to create an individual layer.
2. The Southlands sewer basin boundary with the sub-basin boundaries was overlaid on the new layer.
3. The measurement tool was used to determine the area from the TAZs included within the Southlands sewer basin.
4. A percentage of the total area was assessed.
5. The equivalent percentage of the area was applied to the total population of the TAZ areas for the years 2010 and 2045.

D.9.2 POPULATION ANALYSIS RESULTS FOR THE SOUTHLANDS

Table D.9-2 shows TAZ-based population projections for the sub-basins through the year 2045. Approximately 59,662 people are projected to live in the entire area by the end of the forecast year. Most of the growth is anticipated to occur in sub-basins SL2 (Old Nogales Highway Colonia), SL5 (Corona de Tucson WRF service area) and SL7 (east of the Town of Sahuarita's limits). The annual growth rate for the basin area is 3.19%. The table below shows projected growth rates for individual sub-basins.

RATE OF GROWTH CALCULATION FOR SOUTHLANDS SUB-BASINS SL1 – SL7

Geometric Rate of Growth formula was used in annual growth rate calculation:

$$R = \left(\frac{P_n}{P_0}\right)^{\frac{1}{n}} - 1$$

Where:

R = rate of growth
n = number of time periods (n = 35 years)
P_n = population count in period n (ending population)
P_o = population count at time 0 (original population)

Thus,
R = (59,661/20,187)^1/35 - 1
R = 0.0319 (x 100)
R = 3.19%

The annual growth rate for the entire Southlands sewer basin is 3.19%.

The following tables present the growth rate calculations for individual SL sub-basins projected to gain population in the following years. The sub-basins SL1 and SL6 are projected to have population loss, therefore, no tables were provided for these sub-basins.

Table D.9-3 Sub-basin SL2 TAZ Projected Growth			
TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
60	8	205	197
61	6	6	0
62	26	299	273
63	0	242	242
64	205	202	-3
65	0	15	15
294	0	0	0
295	0	962	962
296	0	2,049	2,049
297	1	236	235
298	1	150	150
299	0	2	2
300	0	4	4
330	0	0	0
331	1	215	214
332	0	199	199
333	316	548	232
334	0	92	92
336	0	107	107
364	1	226	225
365	0	209	209
366	0	134	134
367	0	97	97
402	0	270	270
406	0	401	401
407	0	237	237
409	1	219	218
410	0	70	70
411	0	128	128
412	0	81	81
477	3,752	4,096	344
650	214	783	344
668	0	268	268
958	0	1,585	1,585
959	0	3,359	3,359
960	38	35	-3
961	0	1,797	1,797
1028	0	0	0
Total	**4,569**	**19,526**	**14,957**

SL2 Geometric Rate of Growth (2010-2045, annual): 4.30%

Table D.9-4 Sub-basin SL2 Population Growth 2010-2045		
Year	Population	4.30% Growth
2010	4,569	196
2011	4,765	205
2012	4,970	214
2013	5,184	223
2014	5,407	233
2015	5,640	242
2016	5,882	253
2017	6,135	264
2018	6,399	275
2019	6,674	287
2020	6,961	299
2021	7,260	312
2022	7,572	326
2023	7,898	340
2024	8,238	354
2025	8,592	369
2026	8,961	385
2027	9,347	402
2028	9,749	419
2029	10,168	437
2030	10,605	456
2031	11,061	476
2032	11,537	496
2033	12,033	517
2034	12,550	540
2035	13,090	563
2036	13,653	587
2037	14,240	612
2038	14,852	639
2039	15,491	666
2040	16,157	695
2041	16,851	725
2042	17,576	756
2043	18,332	788
2044	19,120	822
2045	19,526	840

Table D.9-5 Sub-basin SL3 TAZ Projected Growth			
TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
153	0	99	99
156	237	234	-3
158	1	299	298
174	0	171	171
175	0	3	3
176	0	150	150
189	0	158	158
190	23	21	-2
204	0	347	347
205	0	194	194
222	0	207	207
223	0	170	170
224	0	110	110
228	7	10	3
246	0	136	136
266	0	184	184
267	0	103	103
268	0	241	241
269	0	310	310
270	0	161	161
271	0	240	240
272	360	362	2
906	69	65	-4
910	206	201	-5
1093	9	8	-1
Total	**911**	**4,184**	**3,273**

SL3 Geometric Rate of Growth (2010-2045, annual): 4.52%

Table D.9-6 Sub-basin SL3 Population Growth 2010-2045		
Year	Population	4.52% Growth
2010	911	41
2011	952	43
2012	995	45
2013	1,040	47
2014	1,087	49
2015	1,136	51
2016	1,188	54
2017	1,241	56
2018	1,298	59
2019	1,356	61
2020	1,417	64
2021	1,482	67
2022	1,548	70
2023	1,618	73
2024	1,692	76
2025	1,768	80
2026	1,848	84
2027	1,932	87
2028	2,019	91
2029	2,110	95
2030	2,205	100
2031	2,305	104
2032	2,409	109
2033	2,518	114
2034	2,632	119
2035	2,751	124
2036	2,875	130
2037	3,005	136
2038	3,141	142
2039	3,283	148
2040	3,432	155
2041	3,587	162
2042	3,749	169
2043	3,918	177
2044	4,095	185
2045	4,184	189

Table D.9-7 Sub-basin SL4 TAZ Projected Growth			
TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
84	0	170	170
125	0	415	415
126	0	71	71
127	0	216	216
128	0	90	90
129	0	281	281
918	0	164	164
919	925	2,718	1,793
Total	**925**	**4,125**	**3,200**

SL4 Geometric Rate of Growth (2010-2045, annual): 4.43%

Table D.9-8 Sub-basin SL4 Population Growth 2010-2045		
Year	Population	4.43% Growth
2010	925	41
2011	966	43
2012	1,009	45
2013	1,053	47
2014	1,100	49
2015	1,149	51
2016	1,200	53
2017	1,253	56
2018	1,308	58
2019	1,366	61
2020	1,427	63
2021	1,490	66
2022	1,556	69
2023	1,625	72
2024	1,697	75
2025	1,772	79
2026	1,851	82
2027	1,933	86
2028	2,018	89
2029	2,108	93
2030	2,201	98
2031	2,299	102
2032	2,400	106
2033	2,507	111
2034	2,618	116
2035	2,734	121
2036	2,855	126
2037	2,981	132
2038	3,114	138
2039	3,251	144
2040	3,395	150
2041	3,546	157
2042	3,703	164
2043	3,867	171
2044	4,038	179
2045	4,125	183

Table D.9-9 Sub-basin SL5 TAZ Projected Growth			
TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
106	0	78	78
128	0	90	90
156	237	234	-3
910	206	201	-5
911	896	875	-21
913	0	9	9
914	0	210	210
915	0	230	230
916	2,315	4,202	1,887
917	0	187	187
919	925	2,718	1,793
921	160	1,080	920
932	163	159	-4
948	0	274	274
949	2,675	2,666	-9
950	115	110	-5
951	4	198	194
952	148	152	4
953	976	959	-17
954	823	806	-17
Total	**9,643**	**15,437**	**5,794**

SL5 Geometric Rate of Growth (2010-2045, annual): 1.37%

Table D.9-10 Sub-basin SL5 Population Growth 2010-2045		
Year	Population	1.37% Growth
2010	9,643	132
2011	9,775	134
2012	9,909	136
2013	10,045	138
2014	10,182	139
2015	10,322	141
2016	10,463	143
2017	10,607	145
2018	10,752	147
2019	10,899	149
2020	11,049	151
2021	11,200	153
2022	11,353	156
2023	11,509	158
2024	11,667	160
2025	11,826	162
2026	11,988	164
2027	12,153	166
2028	12,319	169
2029	12,488	171
2030	12,659	173
2031	12,832	176
2032	13,008	178
2033	13,186	181
2034	13,367	183
2035	13,550	186
2036	13,736	188
2037	13,924	191
2038	14,115	193
2039	14,308	196
2040	14,504	199
2041	14,703	201
2042	14,904	204
2043	15,109	207
2044	15,316	210
2045	15,437	211

Table D.9-11 Sub-basin SL7 TAZ Projected Growth			
TAZ	TAZ 2010 Pop	TAZ 2045 Pop	Growth 2010-2045
335	0	18	18
368	0	193	193
413	0	268	268
662	1	74	73
663	21	425	404
665	0	727	727
666	2	2,746	2,744
667	580	1,168	588
899	0	0	0
900	0	1,015	1,015
901	794	5,611	4,817
902	0	715	715
903	0	18	18
904	0	21	21
905	0	79	79
908	2	33	31
909	0	107	107
931	0	12	12
933	0	0	0
946	231	705	474
Total	**1,631**	**13,936**	**12,305**

SL7 Geometric Rate of Growth (2010-2045, annual): 6.42%

Table D.9-12 Sub-basin SL7 Population Growth 2010-2045		
Year	Population	6.42% Growth
2010	1,631	105
2011	1,736	111
2012	1,847	119
2013	1,966	126
2014	2,092	134
2015	2,226	143
2016	2,369	152
2017	2,521	162
2018	2,683	172
2019	2,855	183
2020	3,039	195
2021	3,234	208
2022	3,441	221
2023	3,662	235
2024	3,897	250
2025	4,148	266
2026	4,414	283
2027	4,697	302
2028	4,999	321
2029	5,320	342
2030	5,661	363
2031	6,025	387
2032	6,412	412
2033	6,823	438
2034	7,261	466
2035	7,727	496
2036	8,224	528
2037	8,751	562
2038	9,313	598
2039	9,911	636
2040	10,548	677
2041	11,225	721
2042	11,945	767
2043	12,712	816
2044	13,528	869
2045	13,936	895

D.9.3 GROWTH AREAS

As noted in the long-range facility and infrastructure planning documents for the Southeast Planning Area, a substantial increase in growth is anticipated in the foreseeable future.

The majority of infill growth is expected to occur in the platted subdivisions of the Corona de Tucson WRF service area. These subdivisions include Santa Rita Ranch, Sycamore Canyon, and New Tucson Unit. Growth is also anticipated in the master-planned communities of Rancho del Lago, Rocking K, HAMP, Verano, and Hook M Ranch.

Planned non-residential developments include the UA Bioscience Park at the Bridges, the UA Science and Technology Park, and the Aerospace, Defense and Technology Research and Business Park. These employment-related projects will lead to population growth in this area.

Figure D.9-2 depicts general areas of growth in the Southeast Planning Area.

THE CORONA DE TUCSON WRF SERVICE AREA

The majority of development in this growth area is expected to occur in sub-basin SL5. This growth area also includes sub-basin SL6 and the southeastern portion of sub-basin SL3. Growth in the western and southwestern portion of SL5 occurs in the Corona de Tucson WRF service area.

The Santa Rita Specific Plan area is currently under development. Of the 5,307 lots (Amendment Resolution 2007-68) planned in this specific plan area, approximately 2,129 lots were platted but remain unbuilt in the subdivisions of Oasis Santa Rita, Santa Rita Ranch Block 1, Santa Rita Ranch II, Santa Rita Foothills, Sycamore Canyon, New Tucson Unit, Fagan Ranch, and Ocotillo Preserve. Due to the fluctuating nature of home vacancy rates in the area, it is difficult to estimate an accurate population figure for these subdivisions. TAZ-based projections show 1.37% annual growth in SL5.

There are an additional 182 acres of private land in Santa Rita Ranch, of which 36.4 acres are developable after the 80% CLS open space set aside requirement. A residential development and an elementary school are planned for these 36.4 acres. If a density of 4 to 6 RAC is applied to the area, this development could yield 146 to 218 new units (394 to 589 people). An additional 306 acres of State Trust Land remains undeveloped in the Santa Rita Specific Plan area. Approximately 60 acres of this land could potentially be developed (after 80% CLS deduction), adding 240 to 360 more units and approximately 648 to 972 more residents to the area.

The 700-acre master planned community of Hook M Ranch is planned in sub-basin SL3. This community will feature 1,336 single family units, 400 multi-family units, commercial and retail uses and a school. Hook M Ranch is located about midway between Wilmot and Houghton Roads, approximately one mile north of Sahuarita Road. This development could attract as many as 5,000 people. TAZ-based projections show 4.52% annual growth in SL3.

Finally, sub-basin SL6 consists of mostly large parcels served by private on-site septic systems. The department anticipates that the existing population will continue to use septic systems. No new development is anticipated in SL6. TAZ-based projections show population loss in SL6.

Table D.9-13 HAMP Planning Area Population Projections

Year	TAZ Population Projection	Growth
2010	9,230	
2015	13,067	3,837
2020	18,499	5,432
2025	26,189	7,690
2030	37,076	10,887
2035	52,489	15,413
2040	74,310	21,821
2045	100,135	25,825

Farther to the west, in sub-basin SL7, the Sahuarita East Conceptual Area Plan (SECAP) calls for major infrastructure improvements over the next 20-30 years to support long-term plans for a large-scale mixed-use development. The SECAP area is located in the Joint Planning Area and could receive wastewater services from either Pima County or the Town of Sahuarita, or potentially from a new regional treatment plant. TAZ based projections show 6.42% annual growth in SL7.

RANCHO DEL LAGO

The department expects that growth in this area will occur in the form of infill development in the remaining blocks of the Rancho del Lago subdivision. This subdivision has 181 available lots.

THE VERANO DEVELOPMENT

The proposed 3,200-acre master-planned community Verano lies approximately one mile south of Old Vail Connection Road west of Wilmot Road in sub-basin SL2. Plans for the area include approximately 8,000 single-family and multi-family units, a 46-acre school site, 118-acre of mixed uses, and a 71-acre park/recreational area. (Verano Offsite Sewer Alignment Feasibility Study, Westland Resources, Inc., April 2016). TAZ-based projections show 4.30% annual growth in SL2.

ROCKING K

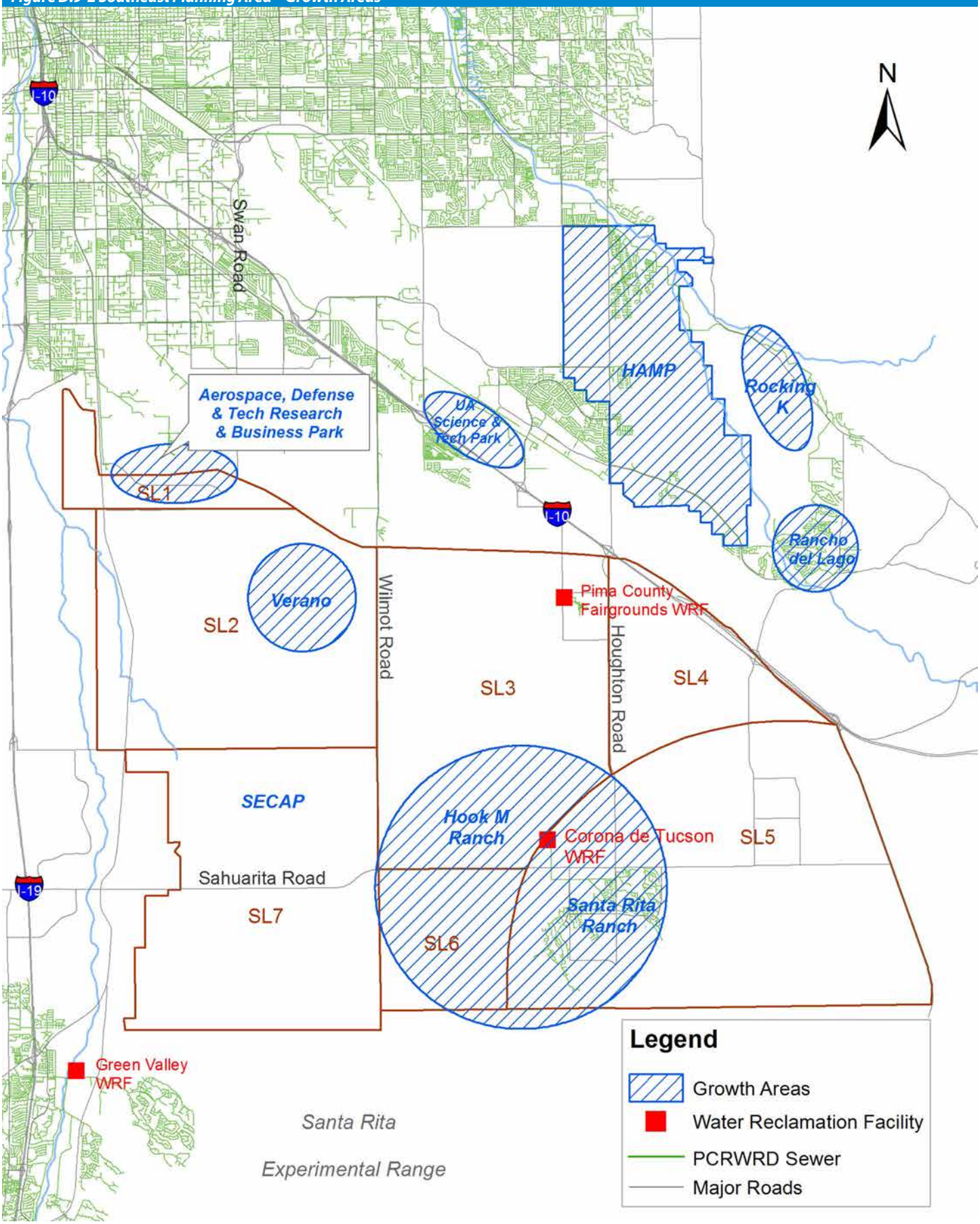
The Rocking K development proposes 6,882 units including low to high density single and multi-family residential units. Population projections (2.7 persons per household) indicate more than 18,500 people living in this area at buildout.

As a side note, the Rocking K development was originally planned for nearly 12,000 homes, four major resorts and associated work and shopping complexes. The rezoning case, approved more than 20 years ago, was one of the most controversial in Pima County history.

HAMP PLANNING AREA

The HAMP planning area includes over 10,800 acres of land planned for development of several master-planned communities. **Table D.9-13** shows TAZ based projections and approximately 100,135 people living in the HAMP area by 2045. Census data showed 9,230 people living in this area in 2010. It is projected that HAMP will grow 7.16% annually.

Figure D.9-2 Southeast Planning Area – Growth Areas



D.9.4 LAND USE BUILDOUT

Buildout population projections were calculated using current and expected land uses within the Southeast Planning Area. Projections based on land-use buildout were established using three primary methods: buildout of currently zoned and platted lands, analysis of specific plans, and an assessment of available land built to expected and maximum capacity. GIS data analysis provided the base assessments of available lands and currently zone/platted lands.

The following assumptions regarding the land use buildout were made:

- The majority of State Trust Land is excluded from calculations. The exception is the State Trust Land that has been slated or planned for development. This land includes: HAMP Planning Area and a portion of Santa Rita Ranch owned by the State Land Department.
- Developable land after deduction and other land-use impacts
  - 40% set aside for infrastructure, easements, open space, etc.;
  - CLS land – open space and riparian habitat set-aside requirements for up-zoning (66% open space in Multiple Use Management Areas, 80% open space in Biological Core, 95% open space in Important Riparian Areas);
  - Persons per household for single family units; 1.9 persons per household for multi-family units;
  - No commercial developments are included in the buildout projections; and
  - Information about areas zoned as specific plans (e.g. Verano Development, Rocking K, HAMP, Santa Rita Ranch, and Hook M Ranch) was derived from relevant documents. This information included proposed land uses, RAC and the number of proposed units
- For the Growth Areas where zoning is expected to increase, residential units per acre were calculated using a low (2 RAC), medium (4 RAC), and high (6 RAC) density. These RAC calculations are based on analysis of existing land use density in the Southeast Planning Area. Analysis of this type was primarily employed in population projections or the State Trust Land parcel. The following formulas were used in calculating population projections:
  - Residential Uses per Existing Zoning:
    Units = Acres x Residence per Acre (RAC)
  - For Probable Zoning (up zoning - low/med/high RAC scenarios)
    Units = Acres x LOW (2 RAC) density
    Acres x MED (4 RAC) density
    Acres x HIGH (6+ RAC) density

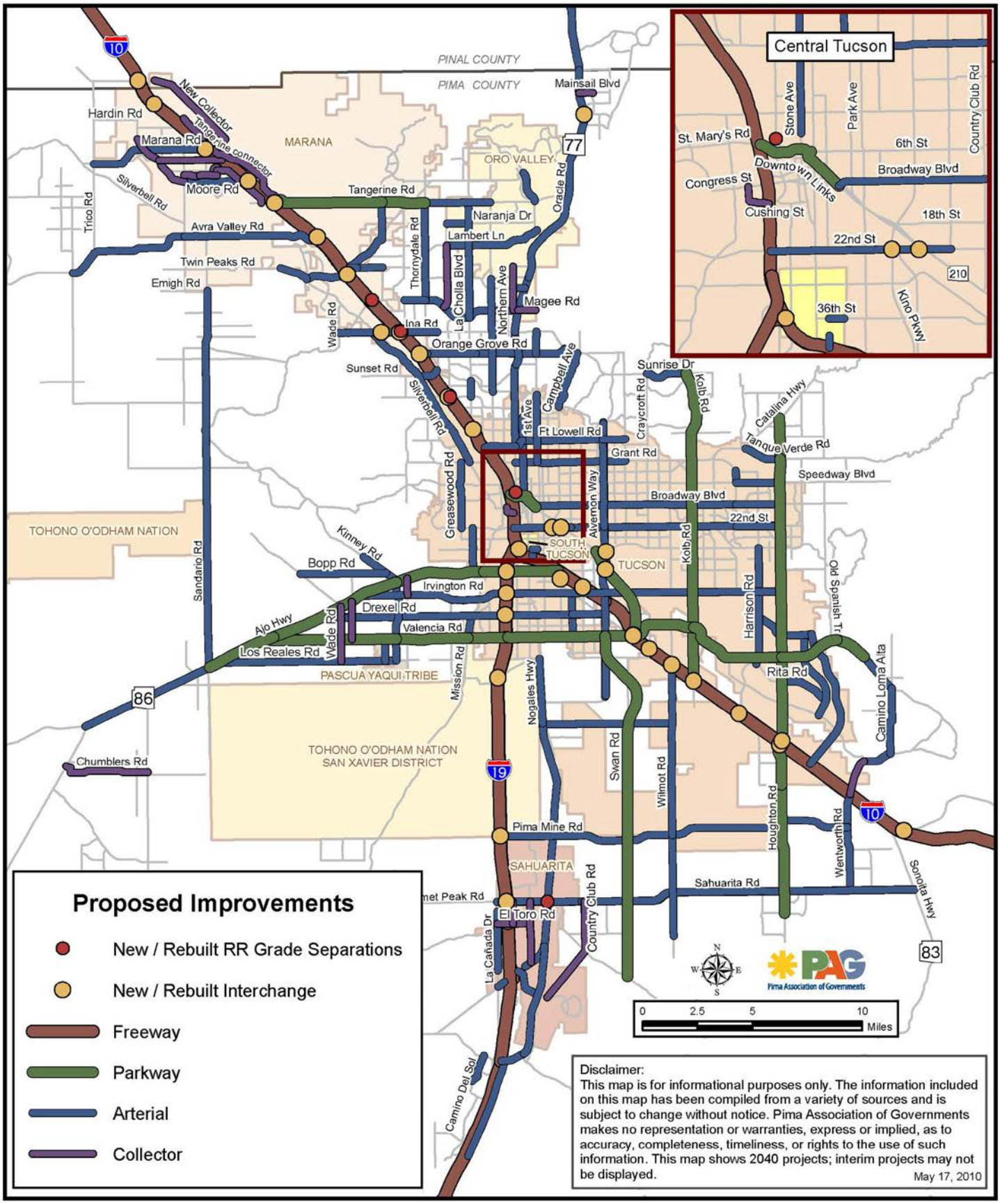
PCRWRD reviewed specific plans, development plans and basin studies were for information on buildout population in the Southeast Planning Area. **Table D.9-14** includes a total number of residential lots (units) planned in the Southeast Planning Area. The table divides the existing and planned developments based on service area location into those that receive sewer service via the SEI or PTI and those served by one of the metropolitan facilities (Agua Nueva WRF or Tres Rios WRF) or those served by the Corona de Tucson WRF. An additional 152,631 people are expected to live in the Southeast Planning Area at buildout. The projections include only residential developments. However, several planned non-residential developments (e.g. the UA Science and Technology Park, the Century Park Research Center and the Bio Science Park and Tucson Market Place at the Bridges) will significantly impact the SEI capacity.

Table D.9-14 Developments and Buildout Projections Summary Table

Tributary to SEI		
Project Name RAC (residence per acre)	**Number of Lots, SFR, MFR Units**	**Projected Population [2]**
Rocking K*	6,882	18,581
HAMP* - 6,752 acres; 4-6 RAC	27,008 - 40,512	109,382
Rancho del Lago Blks 37 & 38	181	489
Rancho Salado Estates	47	127
Rancho Coronado	43	116
Four Seasons, Phase 1	320	864
McCloskey Property	29	78
Riverwalk at Rancho del Lago	85	230
Rincon Knolls, Phase I	226	610
Rincon Knolls, Phase II	172	464
Rincon Knolls III	59	159
Rincon Knolls, Phase IV	45	122
Vista del Lago	123	332
Vista del Lago Norte (lots 40-70, 89-114 & 133-197	119	321
Mountain Vail Estates	501	1,353
Rita Ranch #28	45	122
Interstate 10/Kolb Road	114	308
VP Commerce Center	99	267
La Estancia de Tucson Phase 1	115	311
La Estancia de Tucson Phase 2	109	294
La Estancia de Tucson Phase 3	80	216
Irvington Place	755	2,039
Sunnyside Pointe	267	721
Copper Vista	29	78
The Bridges [3]	700	1,890
Sub-total	**51,657**	**139,474**
Corona de Tucson WRF Service Area		
Project Name RAC (residence per acre)	**Number of Lots, SFR, MFR Units**	**Projected Population [2]**
New Tucson Unit No. 5 (1-312); 255 lots*	312	842
New Tucson Unit No. 6 (1-75); 51 lots*	75	203
New Tucson Unit No. 7 (1-159*)	159	429
New Tucson Unit No. 8 (1-455); 251 lots*	455	1,229
New Tucson Unit No. 9 (1-404*)	404	1,091
New Tucson Unit No. 10 (1-325*)	325	878
Santa Rita Ranch II (1-301); 68 lots*	301	813
Santa Rita Ranch III (1-275*)	275	743
Santa Rita Foothills Estates (1-76*)	76	205
Santa Rita Foothills Estates II (1-8*)	8	22
Sycamore Canyon Block 1 (1-49*)	49	132
Sycamore Canyon Block A (1-18); 5 lots*	18	49
Sycamore Canyon Block B (1-57); 42 lots**	57	154
Sycamore Canyon II Block C; 44 acres, 0.33 RAC	15	39
Sycamore Canyon II Block D; 18 acres, 0.33 RAC	6	16
Sycamore Canyon II Block E; 10 acres, 0.33 RAC	3	9
Sycamore Canyon II Block F; 8 acres, 0.33 RAC	3	7
Sycamore Canyon II Block G; 37 acres, 0.33 RAC	12	33
Sycamore Canyon II (1-431*)	431	1,164
Fagan Ranch (1-242*)	242	653
Hook M Ranch (1,366* SFR; 400* MFR)	1,766	4,448
Sub-total	**7,674**	**13,157**
TOTAL (buildout)	**59,331**	**152,631**

*Northern portion of this development is tributary to PTI.
**Unbuilt as of February 2015
[1] Includes only residential projects currently under construction or planned in the future
[2] 2.7 people per single-family unit and 1.9 people per multi-family unit
[3] Student population that will reside in the proposed student housing project not included

D.10 2040 RTP ROADWAY PROJECTS



Source: 2040 Regional Transportation Plan, PAG

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Raymond J. Carroll, District 4
Richard Elías, District 5

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Chuck Huckelberry

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PIMA COUNTY

WASTEWATER RECLAMATION

2661-100316-RTP HT