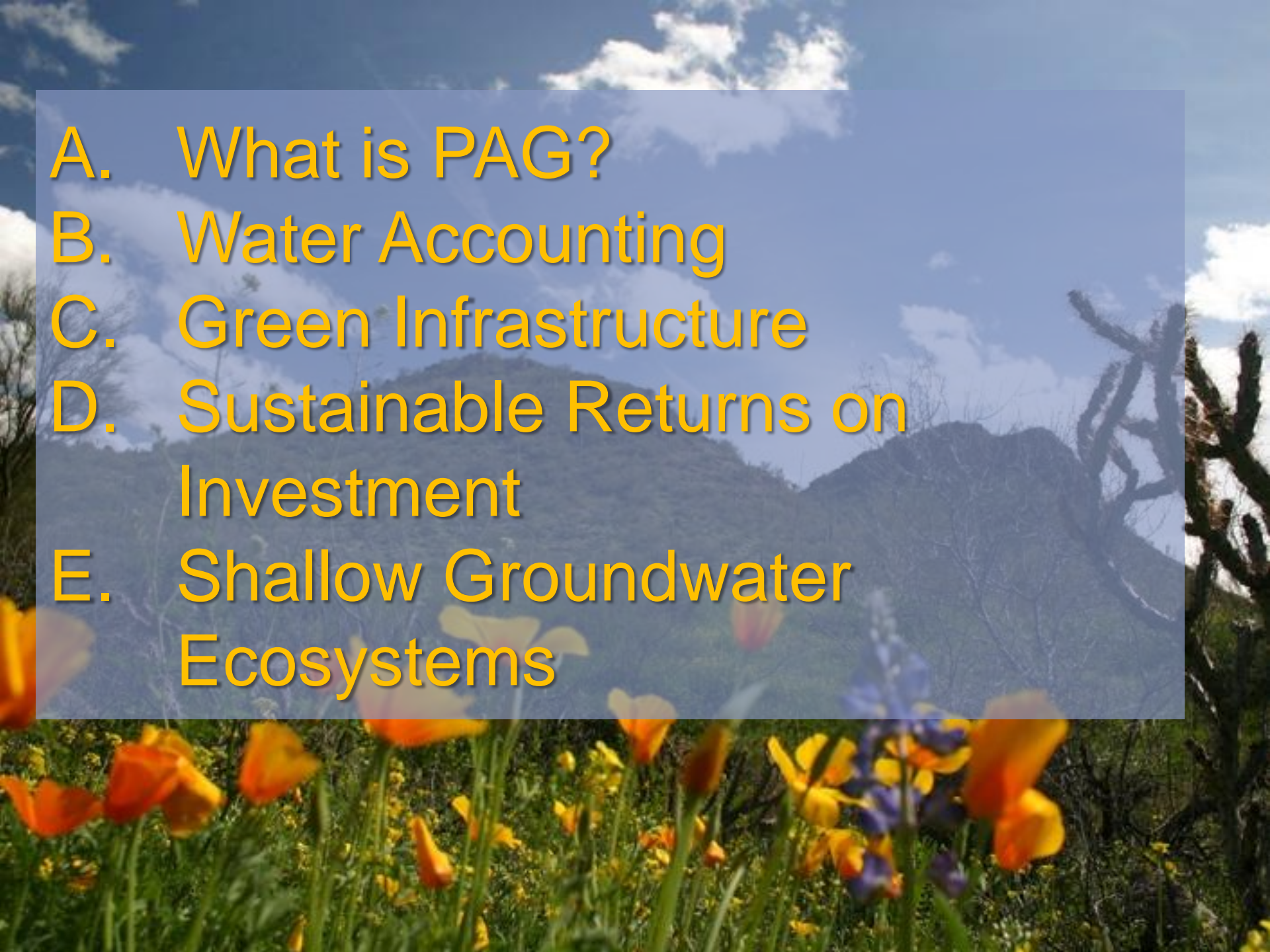


Pima Association of Governments

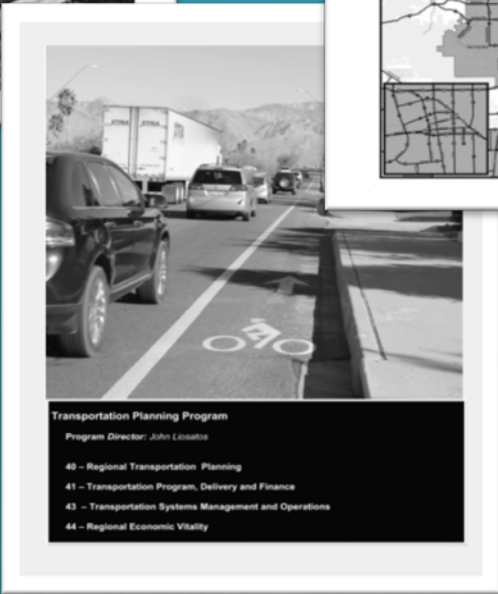
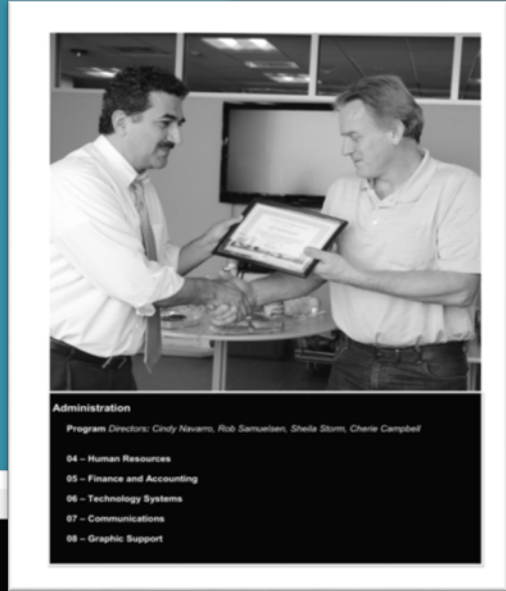
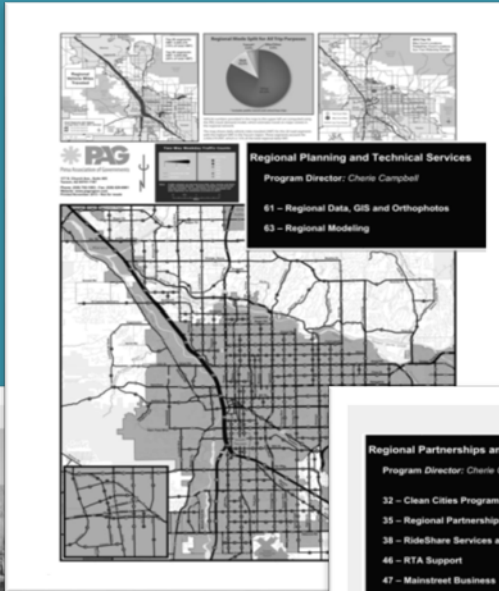
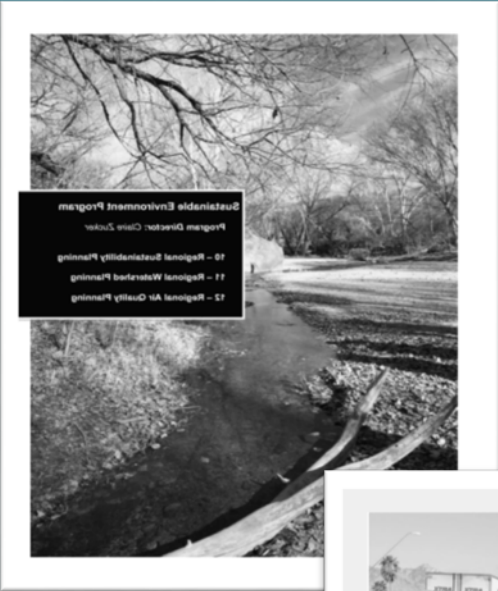


Interactive water map and implications for green infrastructure and shallow groundwater area planning in the Tucson basin

SWAN, March 2015

- 
- A. What is PAG?
- B. Water Accounting
- C. Green Infrastructure
- D. Sustainable Returns on Investment
- E. Shallow Groundwater Ecosystems

Technical Services



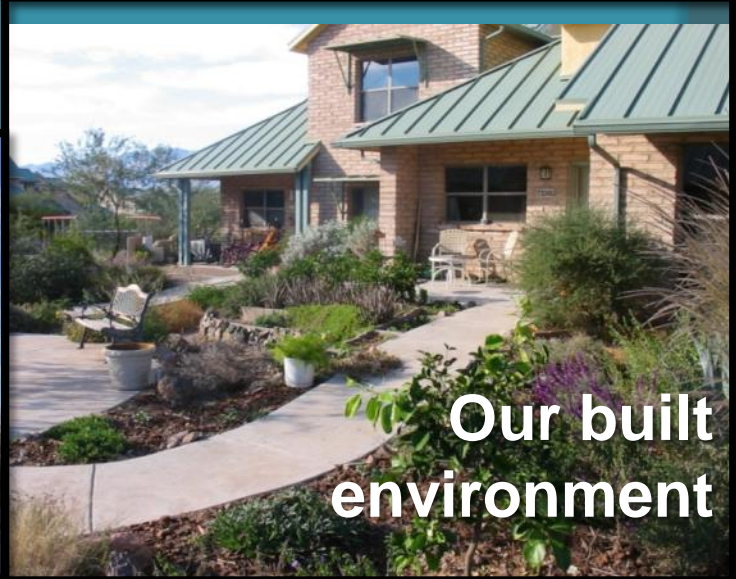
Sustainable Environment

Transportation

Administration

Regional Partnerships

Sustainable Environment



**Environmental
Planning Advisory
Committee (EPAC)**



**Air Quality
Subcommittee**



**Collaborative
Riparian
Health
Assessments**



PAG Committees

**Watershed
Planning
Subcommittee**



**Stormwater
Management
Working Group**



PAG Sustainable Environment

Linking key planning elements to build a resilient future

- ▶ Air Quality
 - Greenhouse gas
 - Solar energy
- ▶ Watershed Planning
 - Water quality
 - Water resources
- ▶ Climate Resilience
 - Green infrastructure



Provide local governments with objective, reliable information, communicating a regional perspective on key water issues.

Climate Resilience



Extreme Weather Vulnerability

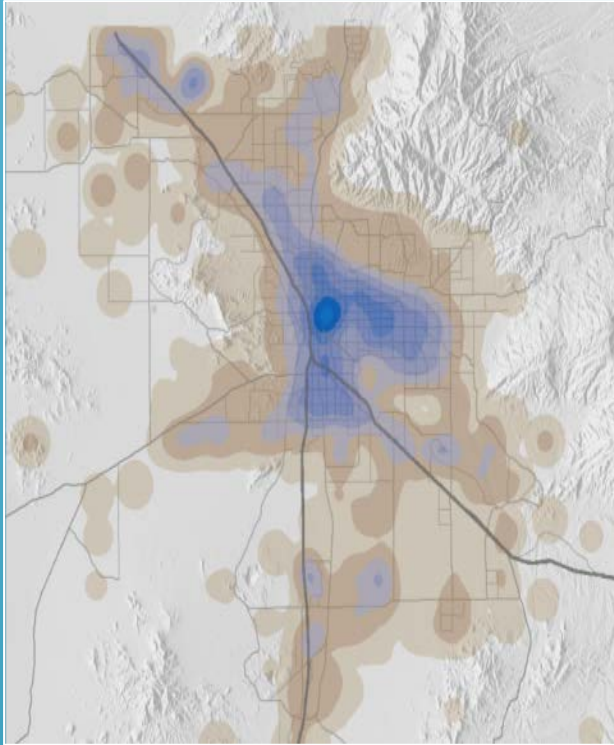
Stressors: precipitation and heat

Impacts: Urban and Natural Systems: wildfires, heat damaged infrastructure, runoff volumes, tire failures

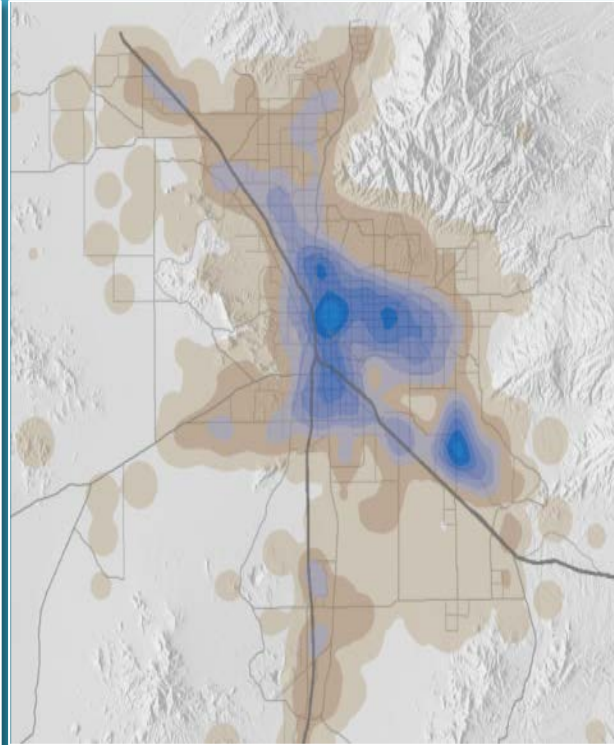
- ▶ Higher temperatures, more days above 100°
- ▶ Unpredictable precipitation

Population Planning

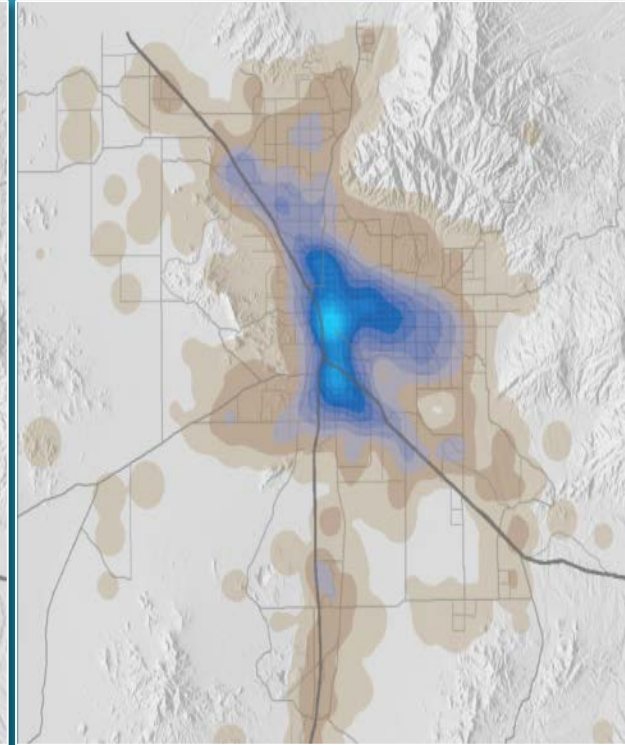
Edge Growth



Planned Future



Vision Future



New Land Developed	315 sq miles
--------------------	--------------

Population Density	2,113 ppl/sq. mile
--------------------	--------------------

New Land Developed	234 sq miles
--------------------	--------------

Population Density	2,360 ppl/sq. mile
--------------------	--------------------

New Land Developed	98 sq miles
--------------------	-------------

Population Density	3,240 ppl/sq. mile
--------------------	--------------------

Public Engagement

<http://gismaps.pagnet.org/RTPSurvey/>

How Should We Invest in our Transportation System?

On this page you can choose how you think we should invest our future transportation dollars.

Before getting started, we need to estimate how much funding will be available for transportation improvements. To establish a baseline funding estimate, we need to know whether you support extending the Regional Transportation Authority (RTA).

Do you support additional future transportation projects? (What is the RTA?) Yes No

Budget

\$4.7 Billion (Committed Funds)

\$4.9 Billion

Pie chart funding element color code: • Maintenance • Roads • Bike/Ped • Transit • Programs

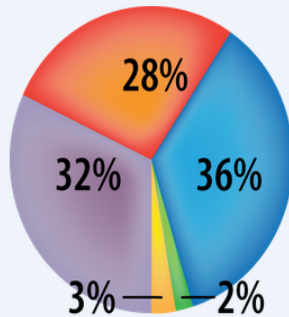
Maintain the current approach to transportation funding



Maintain the current approach to transportation funding This option would largely maintain the region's existing approach to transportation investments. In this option:

[Click Here For More Information](#) ⓘ

Emphasize preserving the current transportation system



Emphasize preserving the current transportation system This option would increase the proportion of regional funding dedicated to preserving the existing system. In this option:

[Click Here For More Information](#) ⓘ

- Funding dedicated to preserving the current transportation system would significantly improve the condition of roadways
- The operation of the transit system would be maintained and funding would be available for a few high capacity services, such as streetcar extensions, BRT, or light rail, on selected corridors.

Emphasize more investments in transit and bike/pedestrian infrastructure



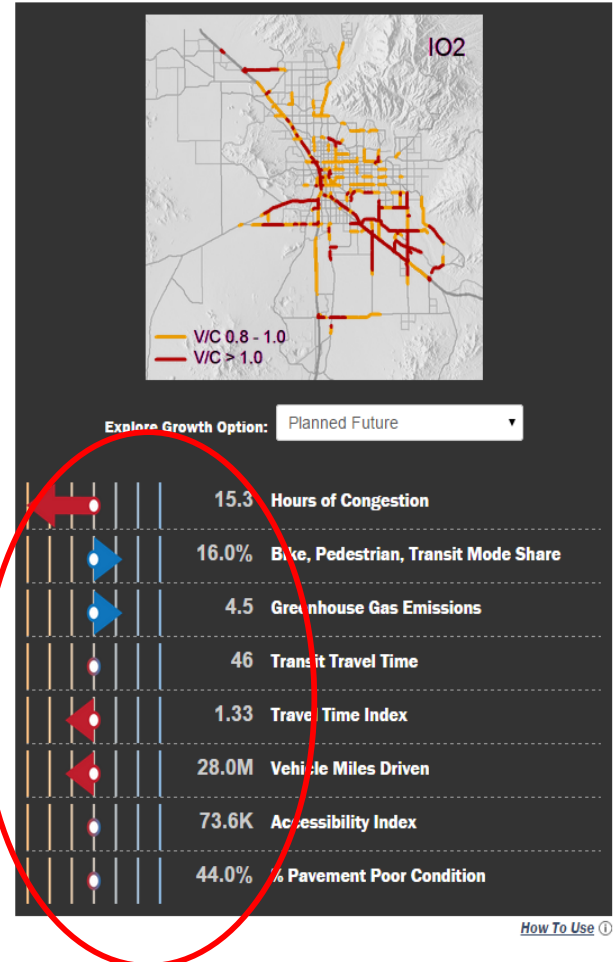
Emphasize more investments in transit and bike/pedestrian infrastructure This option would emphasize more funding for transit service and bike and pedestrian improvements. In this option:

[Click Here For More Information](#) ⓘ

Emphasize more investments in cross-town traffic movement and inter-regional trade connections

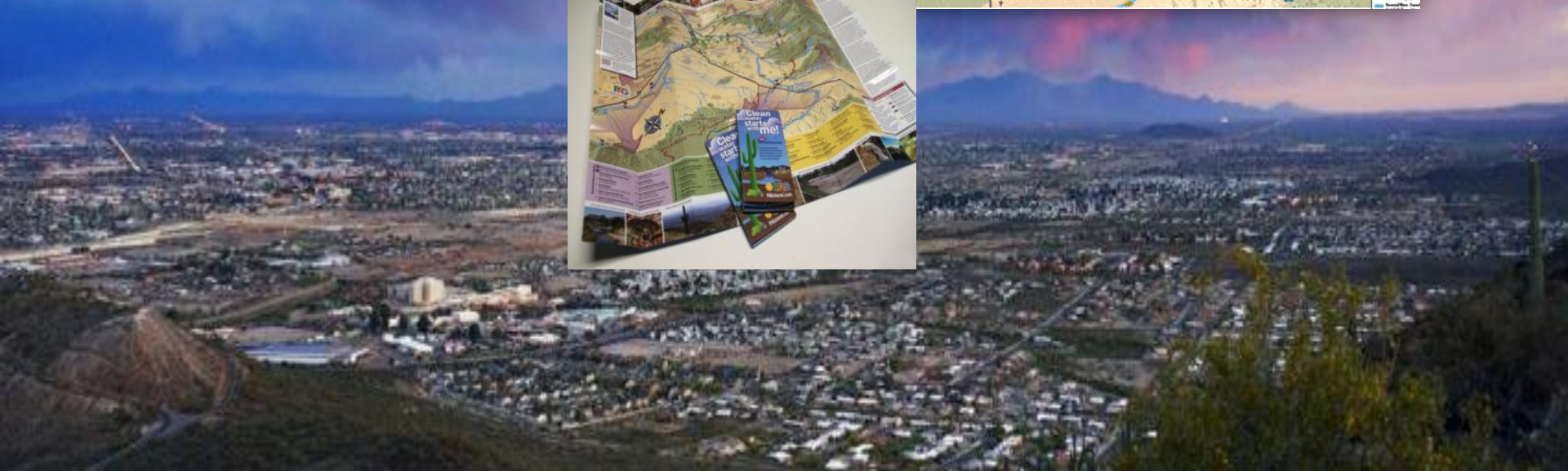
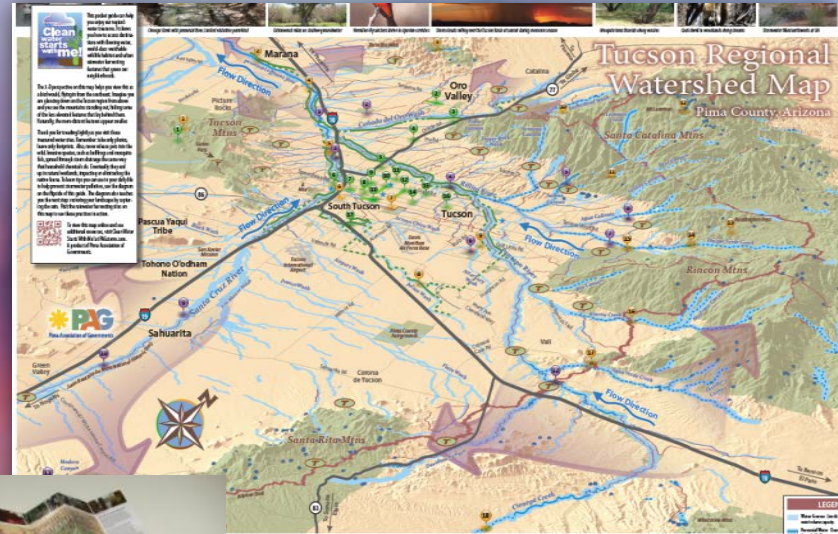


Emphasize more investments in cross-town traffic movement and inter-regional trade connections This option would focus investments to expanding roadway capacity and cross-town traffic flows as well as focusing on connections important for the

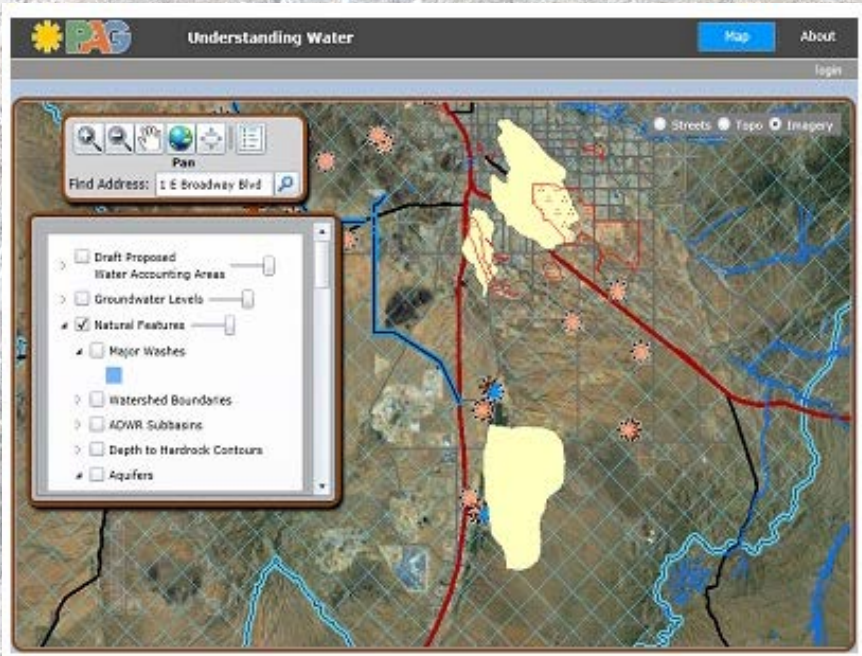


Region-wide water data

Setting the stage for regional thinking about our watershed



PAG Web-based Interactive Maps - Water

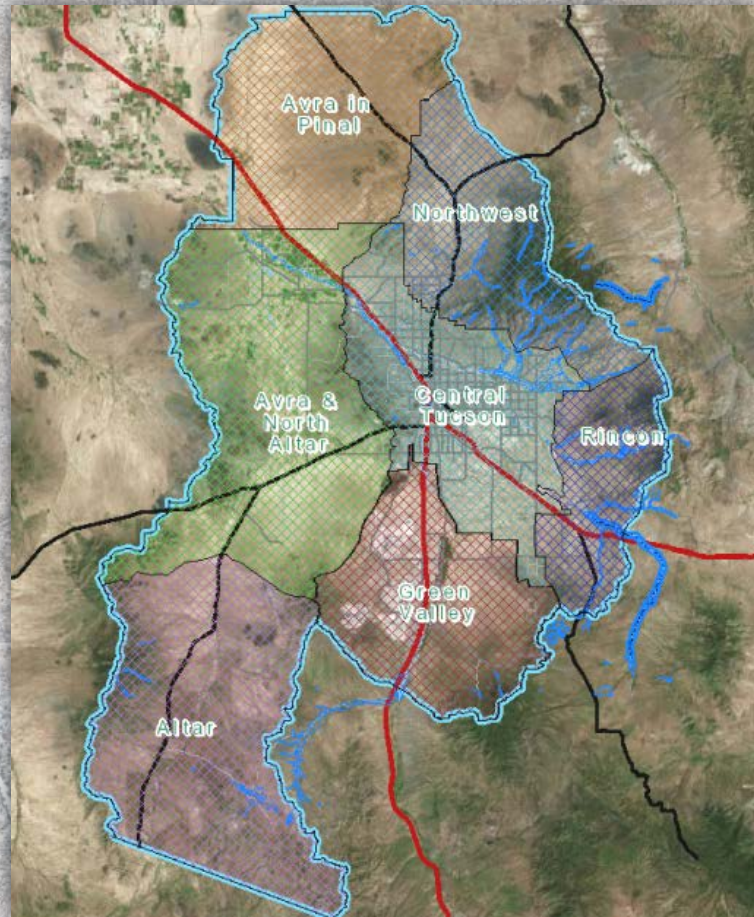


Water
Resource
Accounting



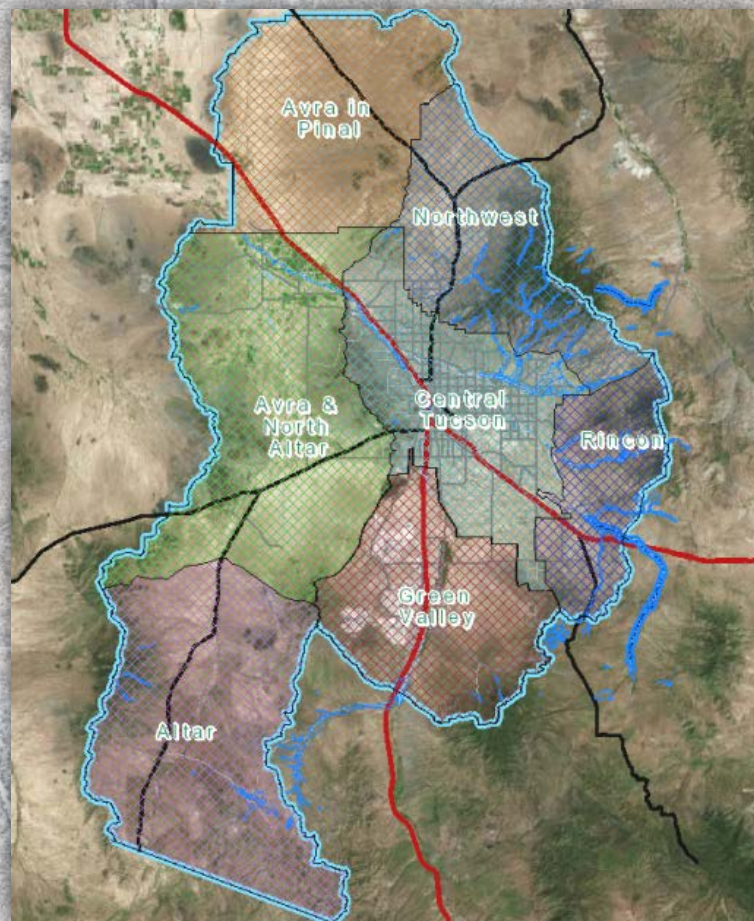
Green Stormwater
Infrastructure
Prioritization

Shallow Groundwater Dependent Ecosystems



Water Accounting Areas

- In response to ADWR enhanced aquifer management discussions
- Sub-basin balance plus paper water
- ADWR is taking the next step
- Data will be available for each accounting area



SGWAs were a key driver for PAG

- Urban periphery
- Wells Not Receiving Coordinated Drought Messaging
- Localized conditions
- Water for the Environment

Water Level Change 2000-2010 (ADWR) and WAAs

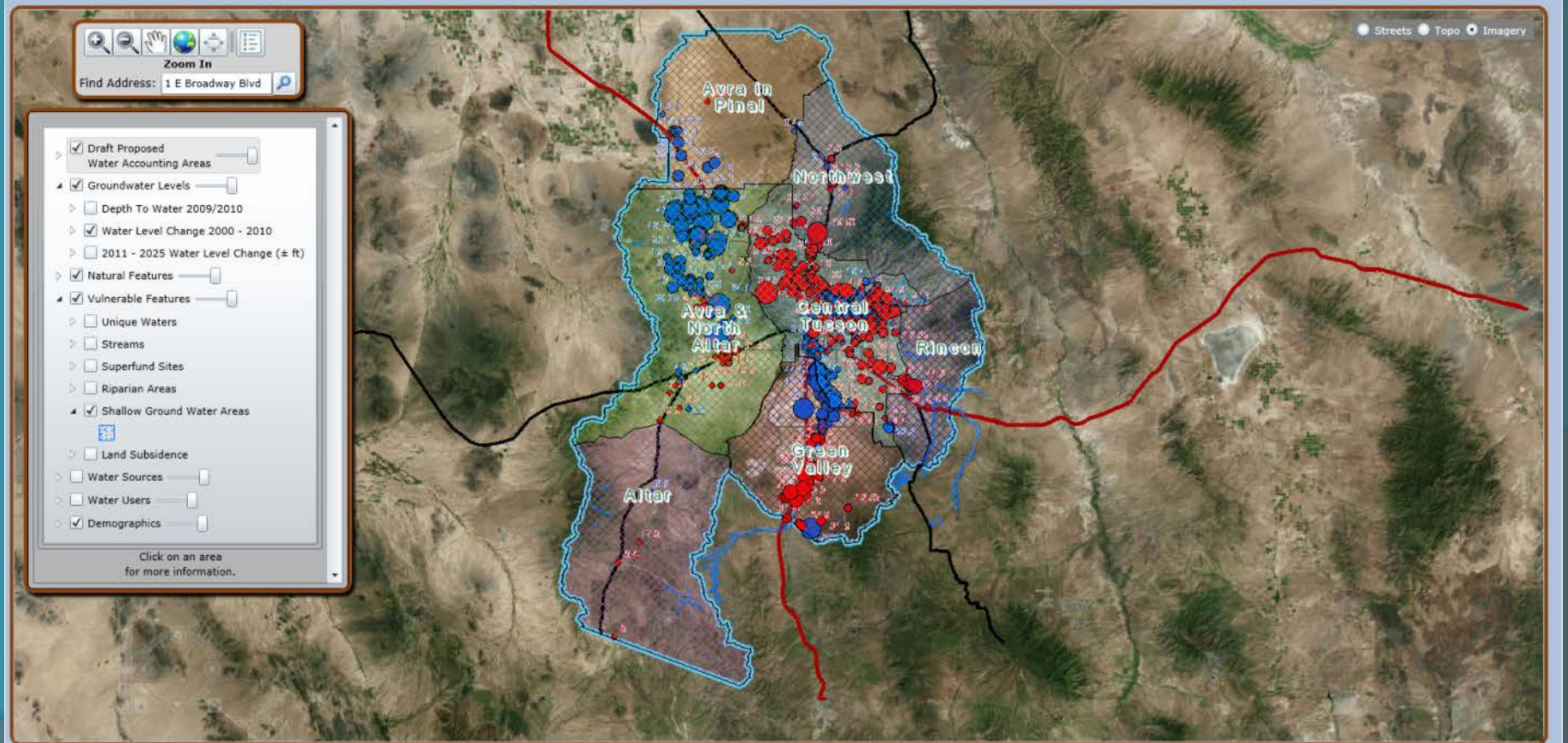
File Edit View History Bookmarks Tools Help

Google C... Los Ange... az What you... Challeng... The Poeti... Kyl Cente... PAG Wee... The gentr... Outlook... Getting t... Tucson El... 18 Google C... PAG Wee... Institute ... 1 E Broad... Tucson...

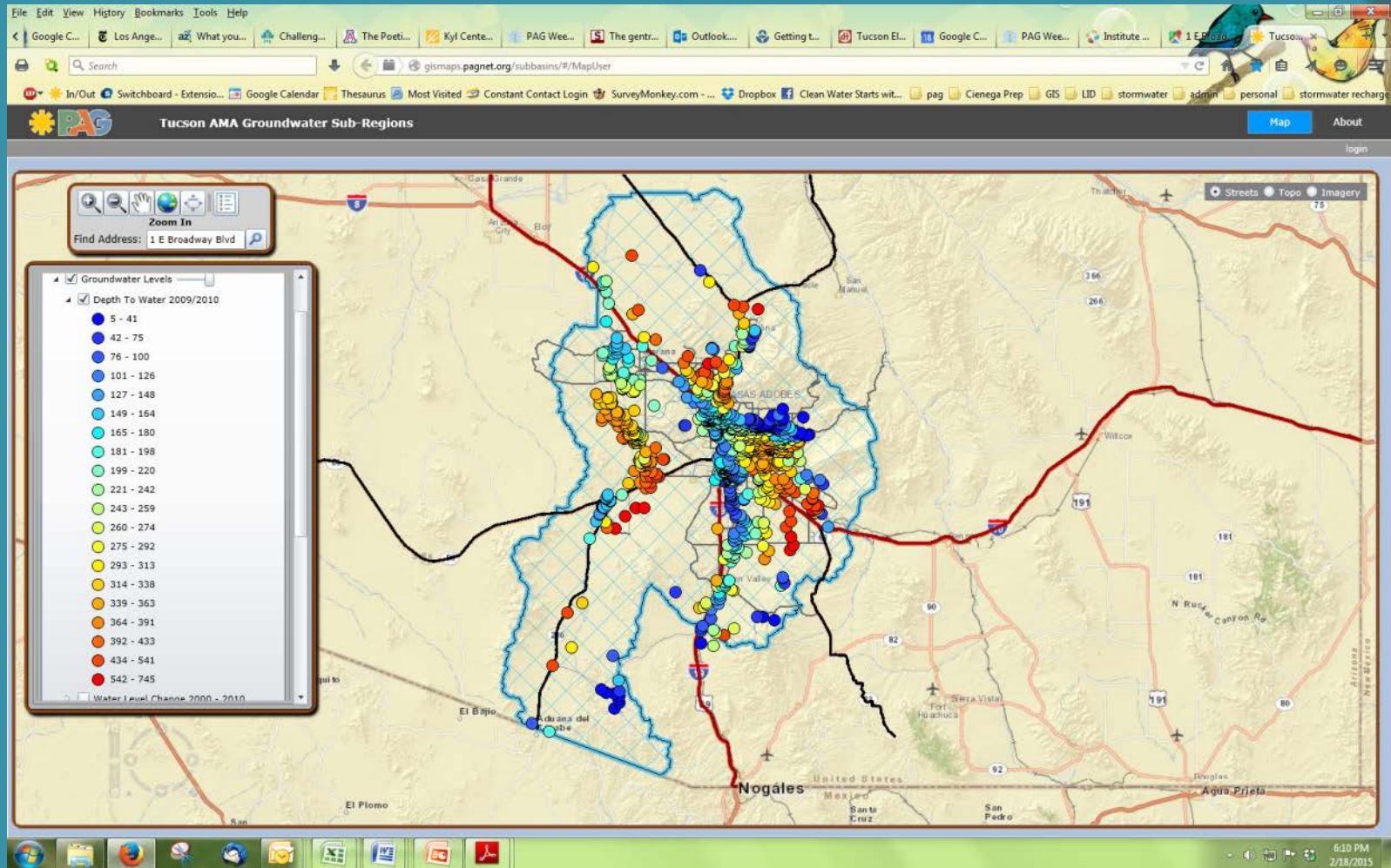
gismaps.pagnet.org/subbasins/#/MapUser

In/Out Switchboard - Extensio... Google Calendar Thesaurus Most Visited Constant Contact Login SurveyMonkey.com - ... Dropbox Clean Water Starts wit... pag Cienega Prep GIS LID stormwater admin personal stormwater recharge

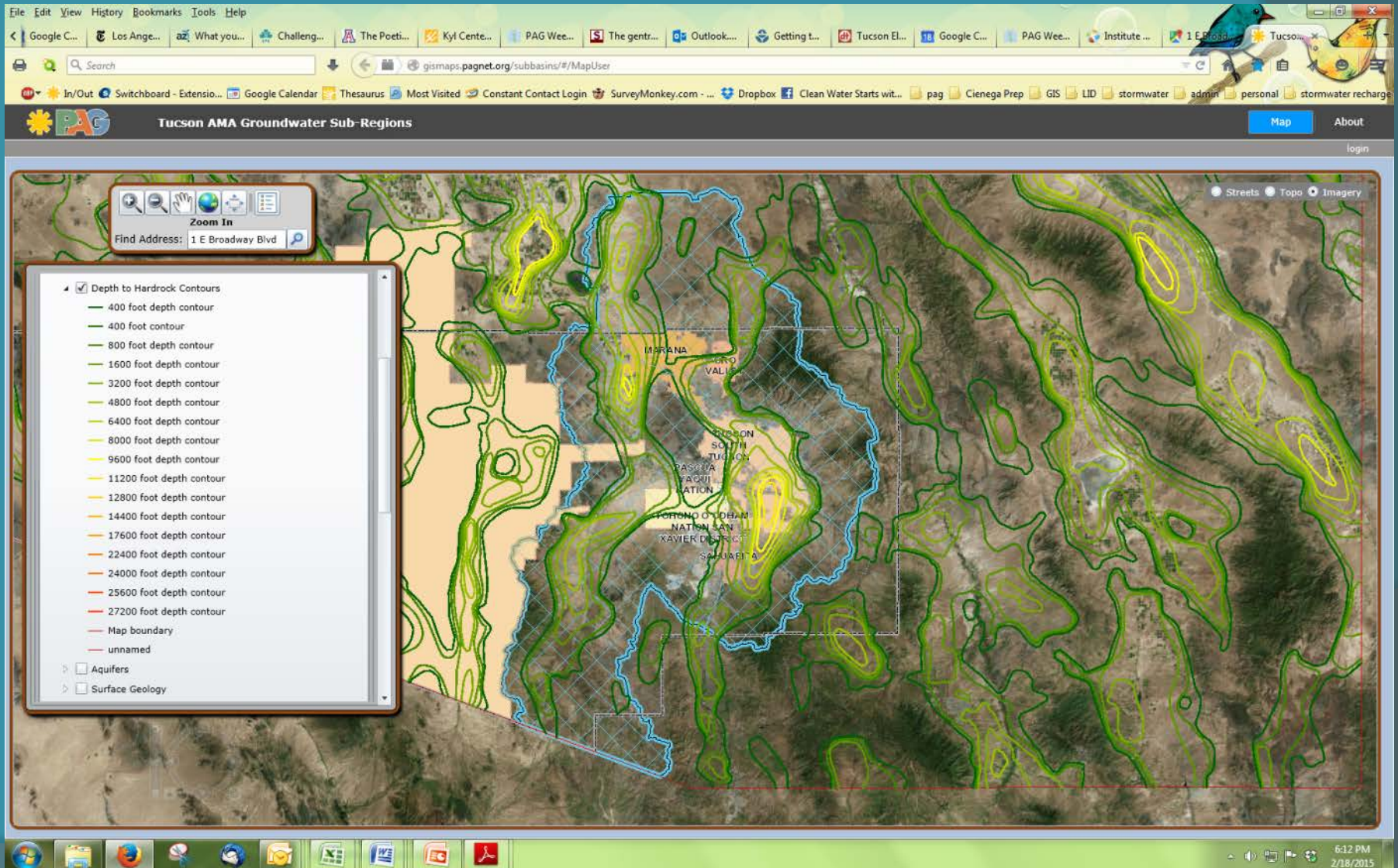
Tucson AMA Groundwater Sub-Regions Map About login



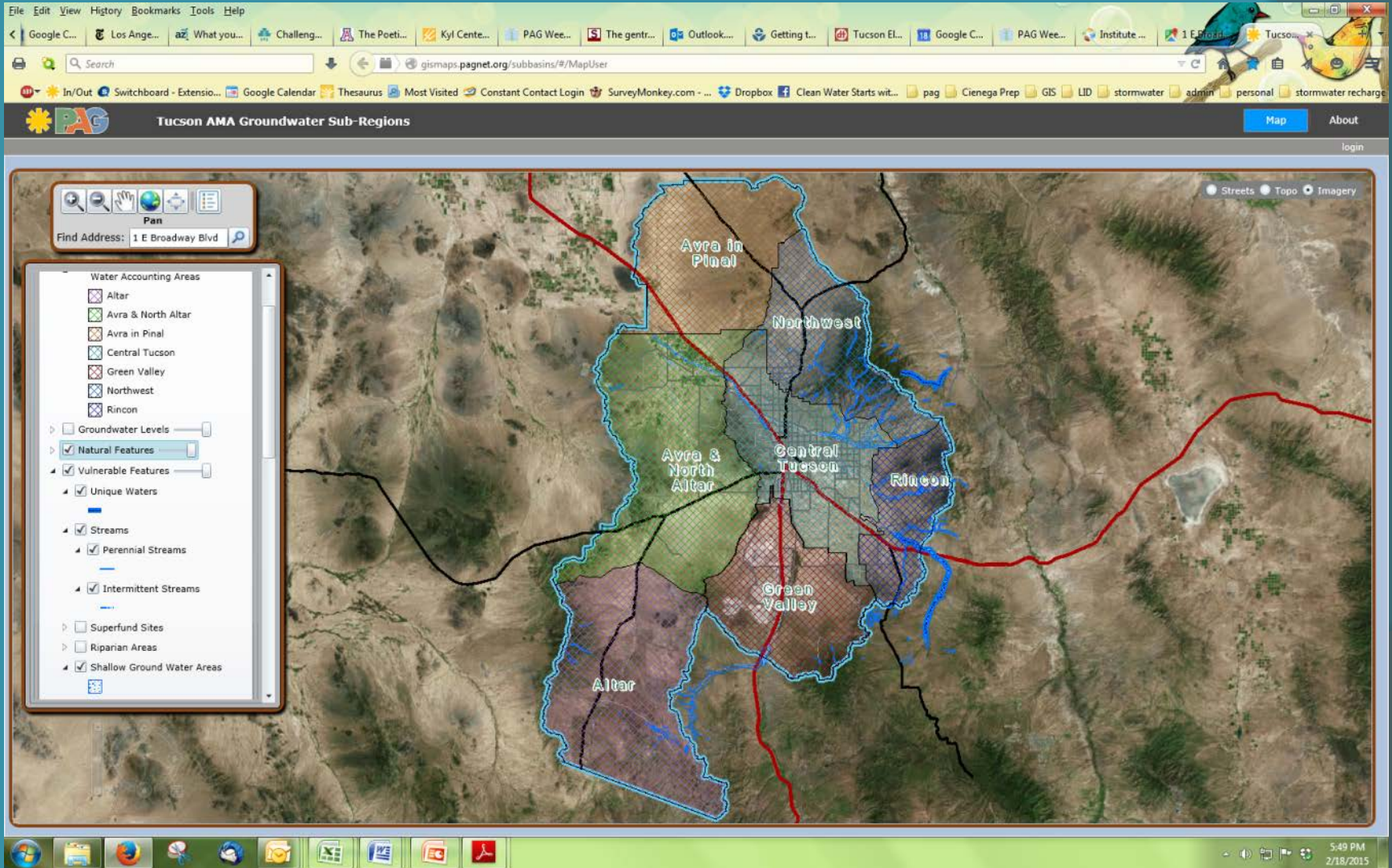
Depth to Water



Depth to hard rock and jurisdictions



WAAs and SGWAs and intermittent streams



Exempt and non-exempt wells

The screenshot displays a web browser window with the URL `gismaps.pagnet.org/subbasins/#/MapUser`. The page title is "Tucson AMA Groundwater Sub-Regions". The map shows a large area with a grid overlay and numerous blue dots representing wells. A legend on the left side of the map is expanded, showing the following categories and sub-categories:

- Intermittent Streams
- Superfund Sites
- Riparian Areas
- Shallow Ground Water Areas
- Land Subsidence
- Water Sources
- Water Users
- Wells
 - All Shallow Wells
 - All Active Wells
 - Exempt Wells
 - Non-Exempt Wells
- CCNs (Private Water Company)
- GFRS (Grandfathered Rights)
- Irrigation Districts
- Water Utilities
- CAGR

The map also features a search bar with the address "1 E Broadway Blvd" and a "Zoom In" button. The bottom of the browser window shows the Windows taskbar with the system clock indicating 6:03 PM on 2/18/2015.

National Forest

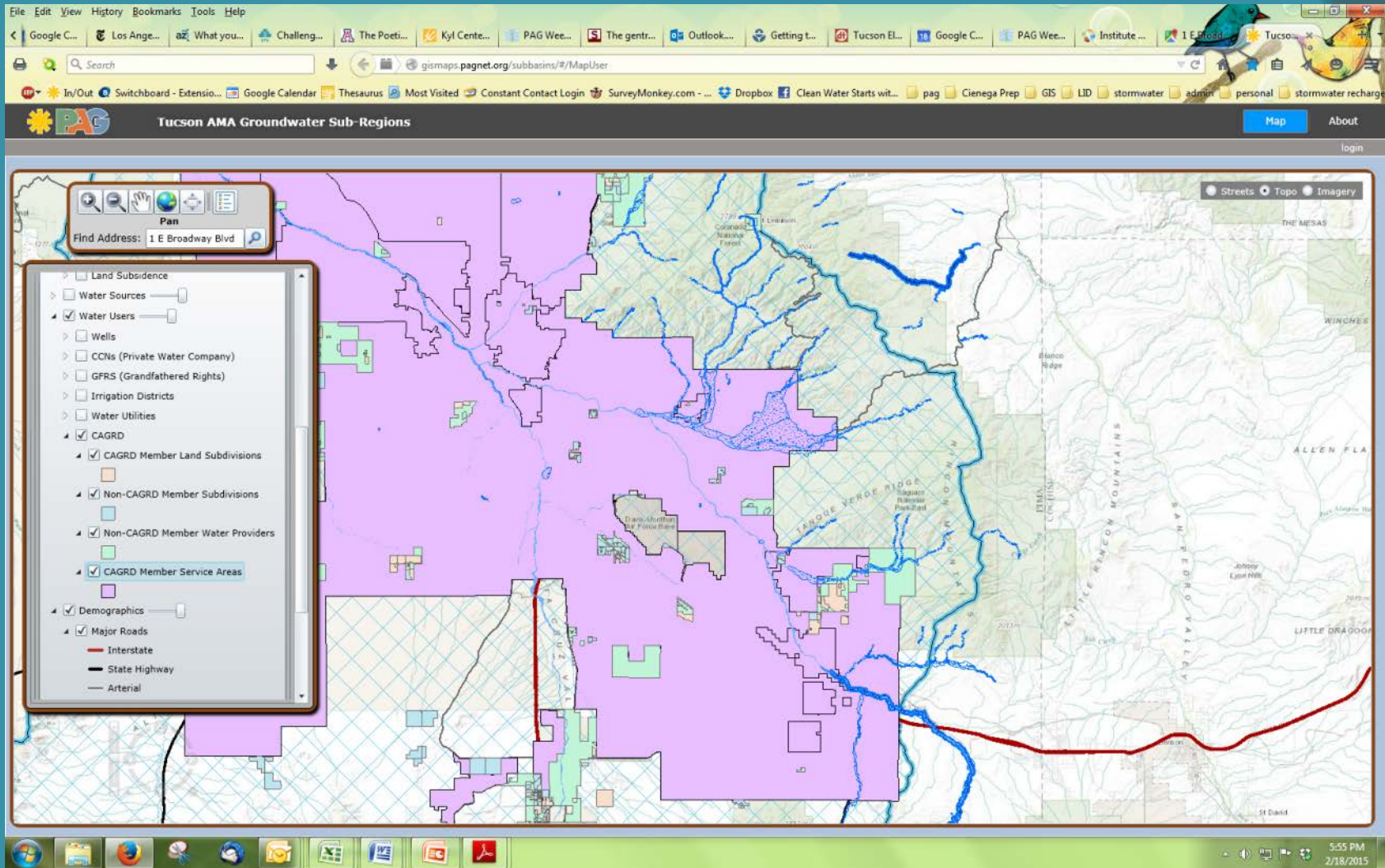
Private water companies, grandfathered rights, irrigation districts, water utilities

The screenshot shows a web browser window displaying a GIS application titled "Tucson AMA Groundwater Sub-Regions". The browser's address bar contains the URL "gismaps.pagnet.org/subbasins/#/MapUser". The map interface includes a search bar with the text "Find Address: 1 E Broadway Blvd" and a "Pan" control. A legend on the left side of the map lists various data layers with checkboxes:

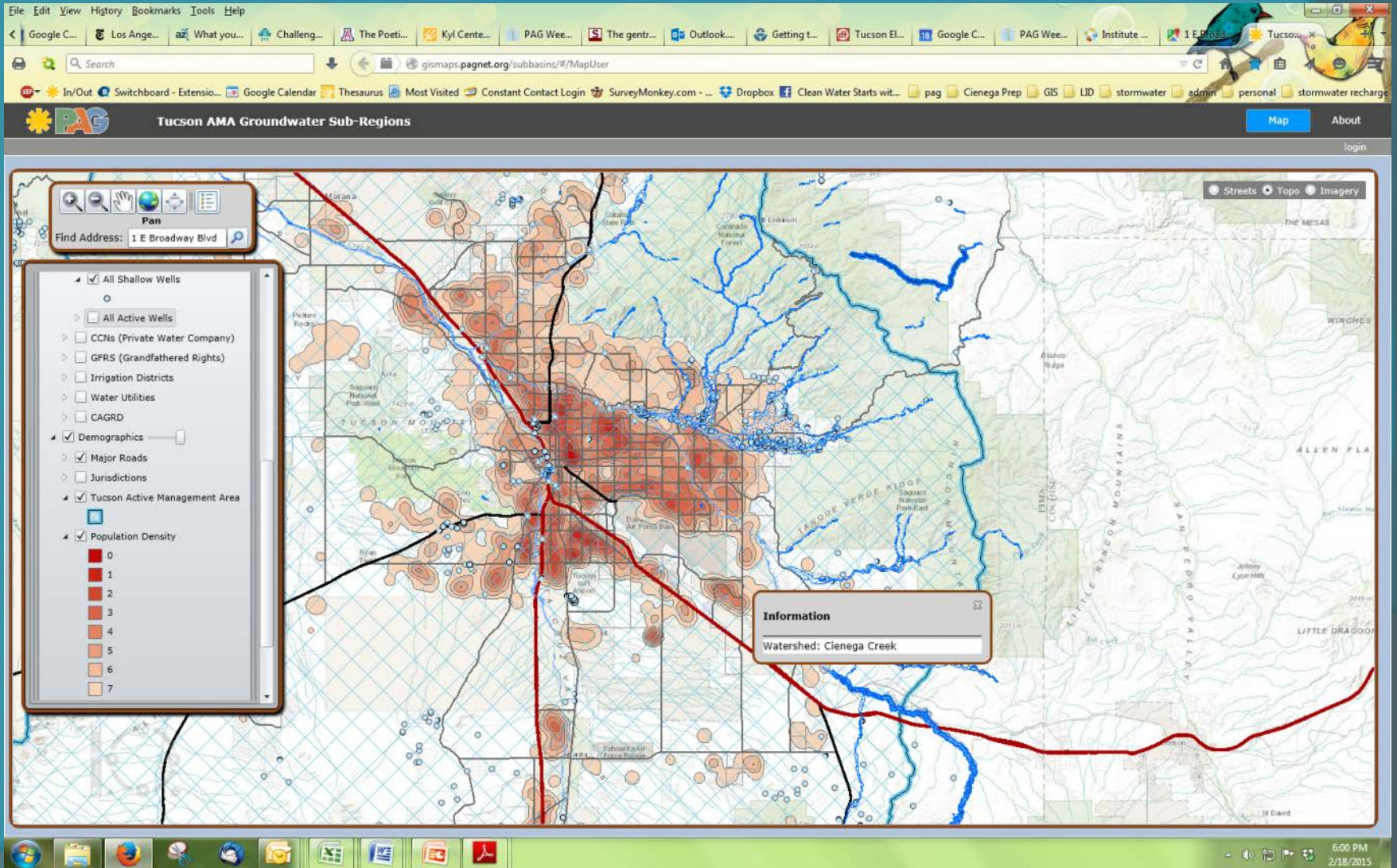
- Water Sources
- Water Users
 - Wells
 - CCNs (Private Water Company)
 - GFRS (Grandfathered Rights)
- Irrigation Districts
- Water Utilities
 - Water Systems
- Water Companies
- Water Providers
- CAGR
- Demographics
- Major Roads
 - Interstate
 - State Highway
 - Arterial
 - Collector

The map itself shows a complex network of water infrastructure, including canals, pipelines, and wells, overlaid on a topographic map of the Tucson area. The legend uses different colors and patterns to represent these various features. The browser window also shows several open tabs and a taskbar at the bottom with various application icons.

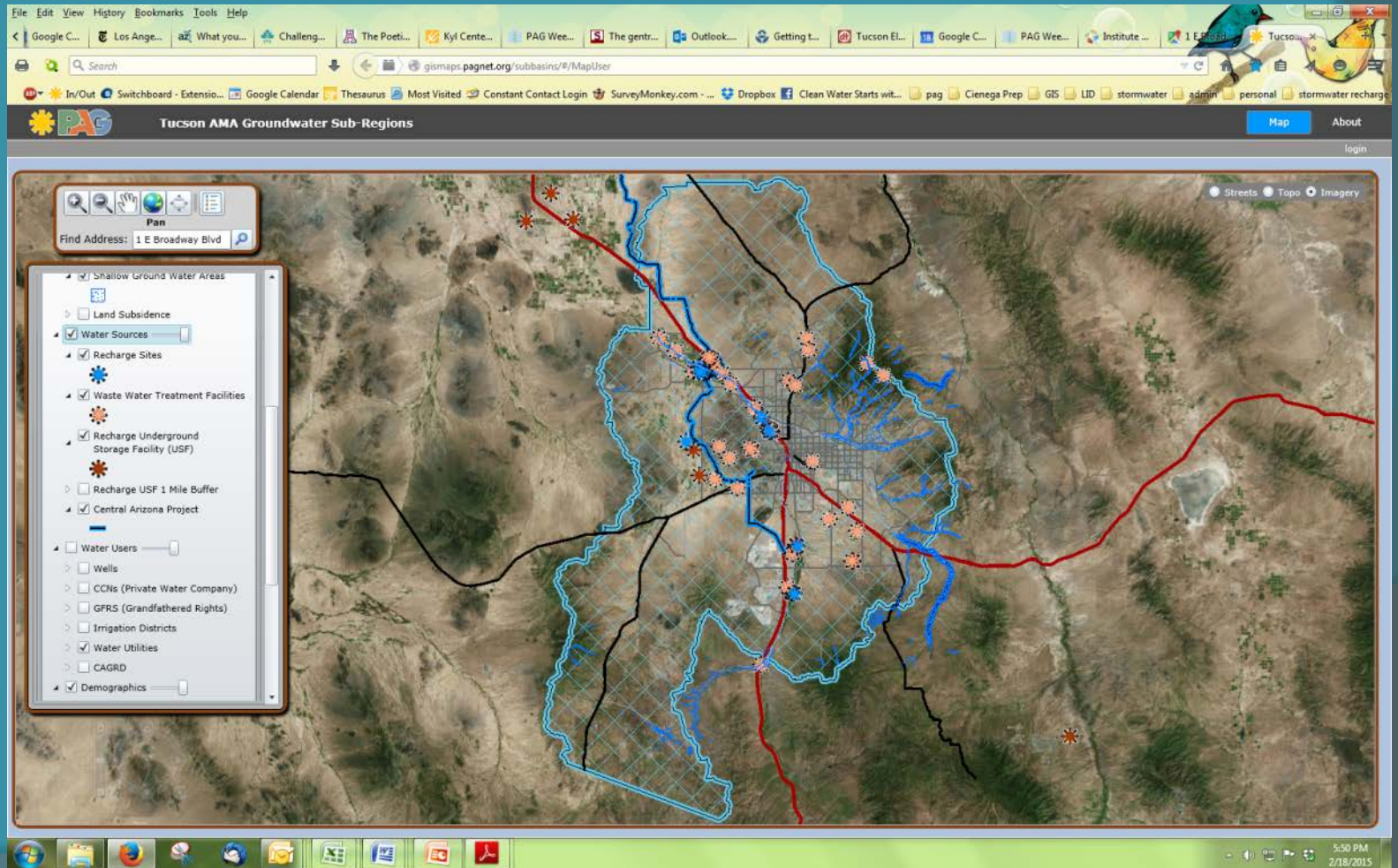
GRD and SGWAs



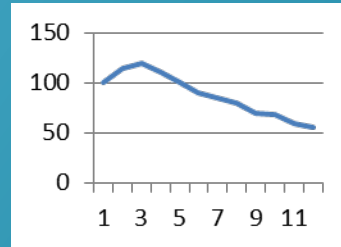
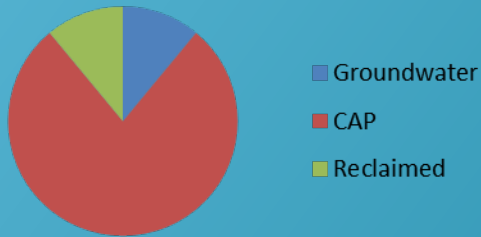
Population density and shallow wells



CAP, Recharge, WWTPs, USFs and SGWAs

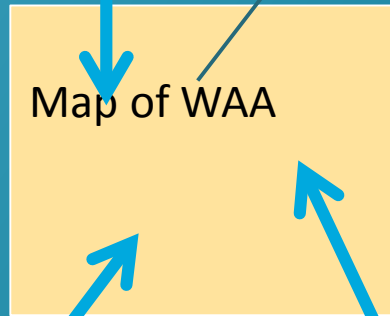
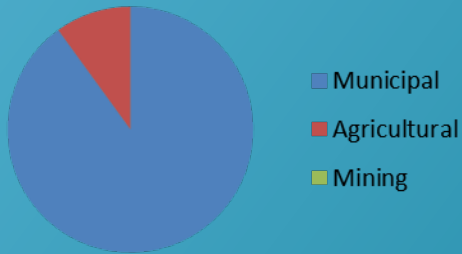


(FUTURE) WATER ACCOUNTING AREA SUMMARY CENTRAL TUCSON

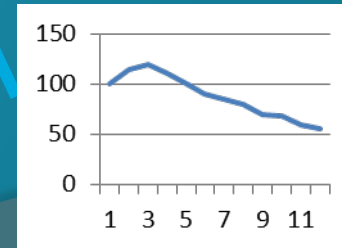
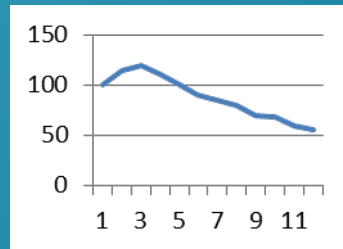
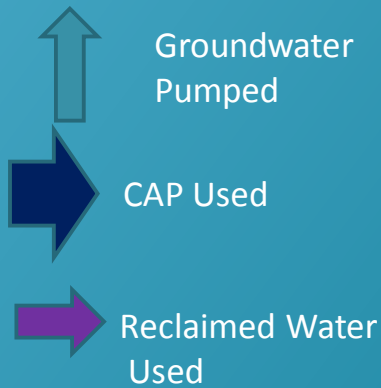


Number of Exempt Wells
 Number of Non-Exempt Wells
 Volume of CAP Recharged
 Volume of CAP Recovered

Map Includes Dots for Wells:
Municipal, Agriculture, Mining and Exempt



Average Water Level Change
 2013 – 2014 XXX
 2000 – 2014 XXX



Arid West Stormwater... our “Other” water

- Intermittent
- Often channelized
- Runs through streets
- Picking up pollutants



Green Infrastructure

Utilizing stormwater flows in the built environment

- ▶ PAG resolution
- ▶ Web-based prioritization tool
- ▶ Regional collaboration



Economic Vitality – Winter 2015

Green Infrastructure for Regional Vibrancy Resolution

A PAG resolution recognizing the value of green infrastructure / Low Impact Development

Particularly emphasizes impacts to **economic vitality**

- Increase home property values and commercial business success
- Attract a professional workforce and new business
- Build urban tourism and connect to ecotourism
- Counteract heat and water resource concerns



Heat Resilience Through Shading

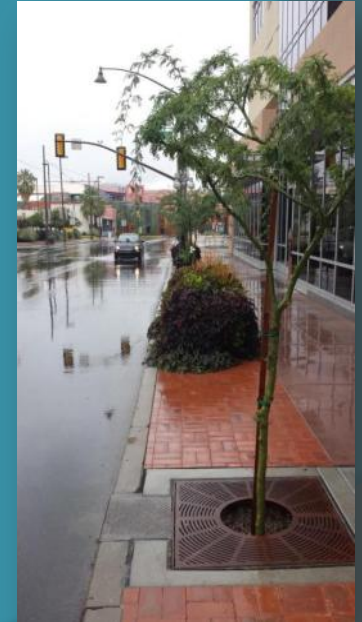


Sonoran Viewscapes & Branding



Pedestrian Buffers

Mobility Safety



Reduced Irrigation

Business Vibrancy

Economic Vitality – Winter 2015

Green Infrastructure Business Case. . .

Answering the question: Is green infrastructure cost effective?

Autocase: A locally calibrated design tool Integrated into the Envision Rating System

- Assesses the Return on Investment over a project's life cycle
- Considers arid region pay back



Financial Benefits

Increased Value- Pavement longevity
Property and sales

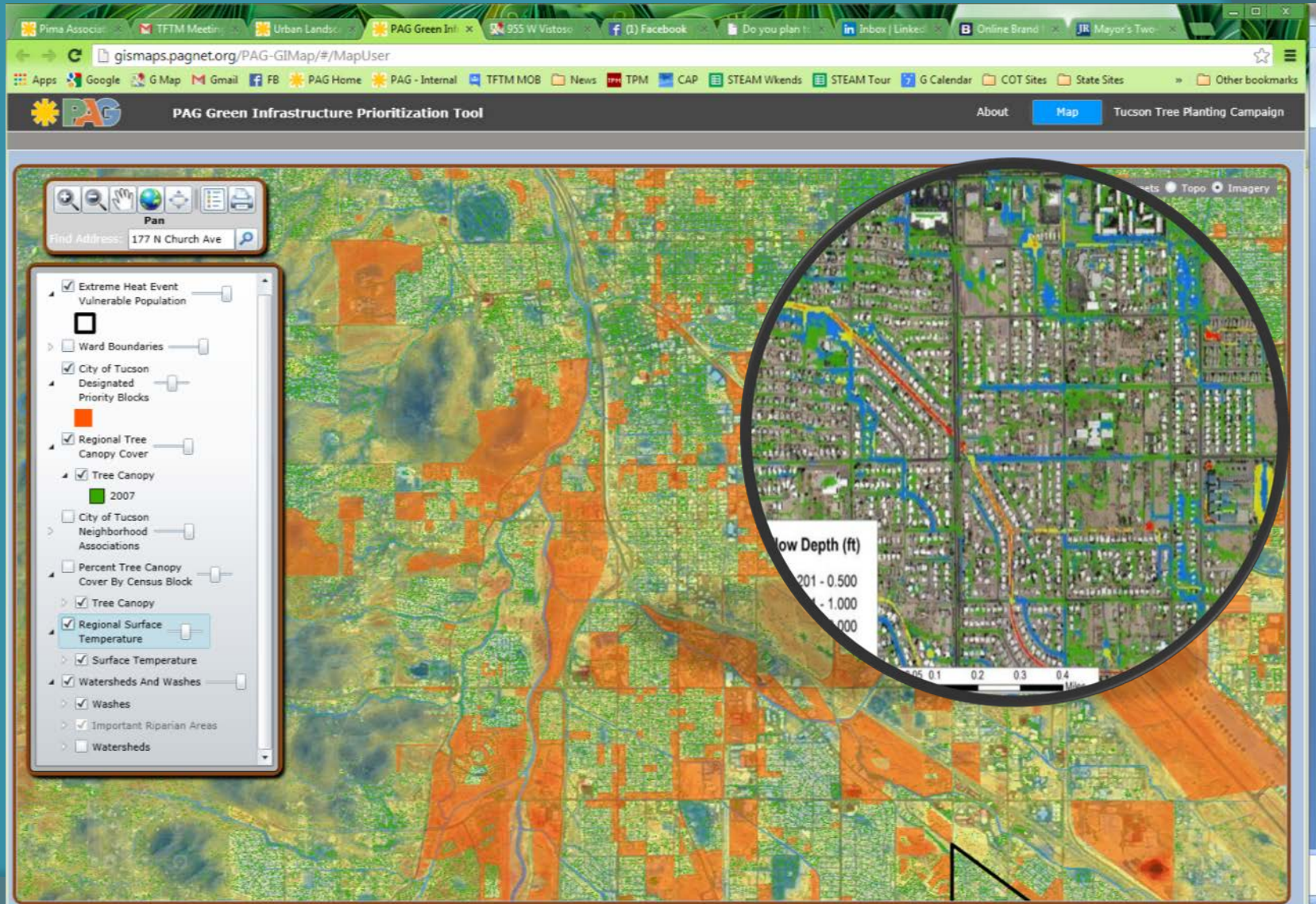
Increased Safety- Traffic accidents
Heat injury / mortality
Flooding

Reduced Costs- Irrigation
Air pollution
Energy



AutoCASE™

Green Infrastructure Combating Heat



Regional Collaboration

Transportation & Flood Control Engineers | Landscape Architects | Development Managers | Water Resource Managers | Stormwater Quality Planners | Researchers & Educators

You're Invited Low Impact Development Workshop 2015

APRIL 9: PLAN THE FUTURE COURSE OF LID EFFORTS AND CELEBRATE OUR REGIONAL SUCCESSSES

- LID guidance manual
- Case studies catalog
- PAG GI/LID resolution
- Regional efforts and policies
- AutoCase benefits analysis: LID adds economic and social value

APRIL 10: INTERACTIVE FIELD EXPERIENCE

- Design successes, best practices & lessons learned
- Technical training provided by Watershed Management Group

★ ASFPM Continuing Education for CFMs:
7 credits for day one, 3 credits for day two

Organized by voluntary partners of the LID Working Group in Pima County:
Pima County Regional Flood Control District, Pima Association of Governments,
City of Tucson Office of Conservation, UA's Water Resources Research Center,
Pima County Department of Environmental Quality and Department of Transportation,
Watershed Management Group, Stantec, Wheat Design Group, Town of Marana,
Conserve 2 Enhance, and additional partners.

FREE - registration is now open!
Limited space. Lunch included.

For details and to RSVP by March 26, go to www.PAGstorm.com/construction

PRESENTATIONS/DISCUSSION

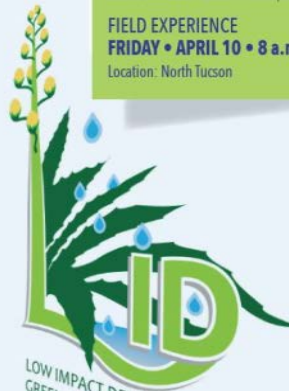
THURSDAY • APRIL 9 • 8 a.m. - 5 p.m.

Location: Tucson Electric Power, downtown Tucson

FIELD EXPERIENCE

FRIDAY • APRIL 10 • 8 a.m. - 12 p.m.

Location: North Tucson



LOW IMPACT DEVELOPMENT/
GREEN INFRASTRUCTURE

Sponsors:



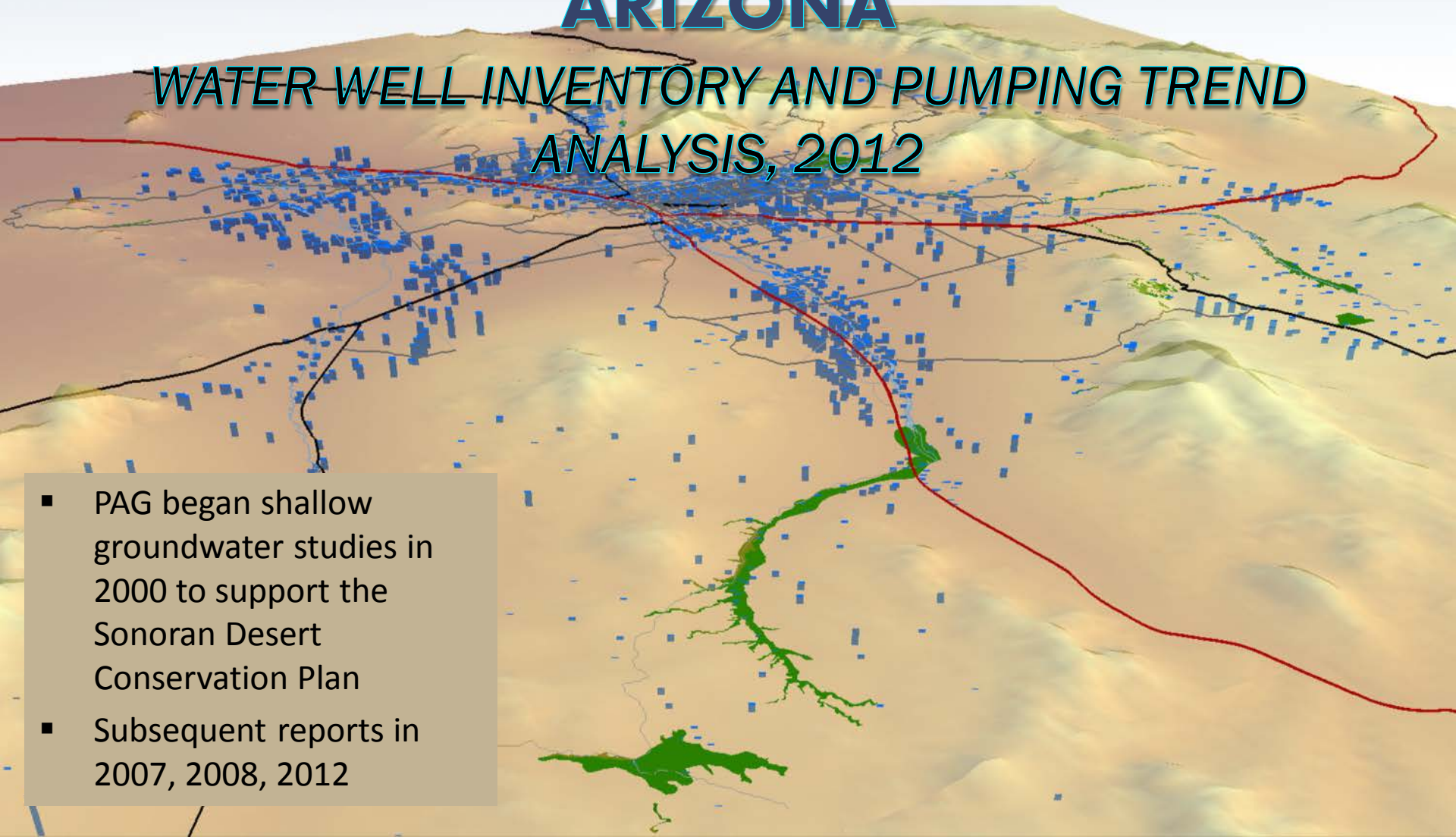
Pima Association of Governments

- ▶ Arid LID conference Presentation and facilitated workshop to assess next steps
- ▶ PC guidance manual, 2015
- ▶ Case Studies 20 (commercial, streets, institutional)

SHALLOW GROUNDWATER AREAS IN EASTERN PIMA COUNTY, ARIZONA

WATER WELL INVENTORY AND PUMPING TREND ANALYSIS, 2012

- PAG began shallow groundwater studies in 2000 to support the Sonoran Desert Conservation Plan
- Subsequent reports in 2007, 2008, 2012



Shallow Groundwater Areas Identification



Groundwater within
50 feet of surface
Commonly supports
numerous private
wells

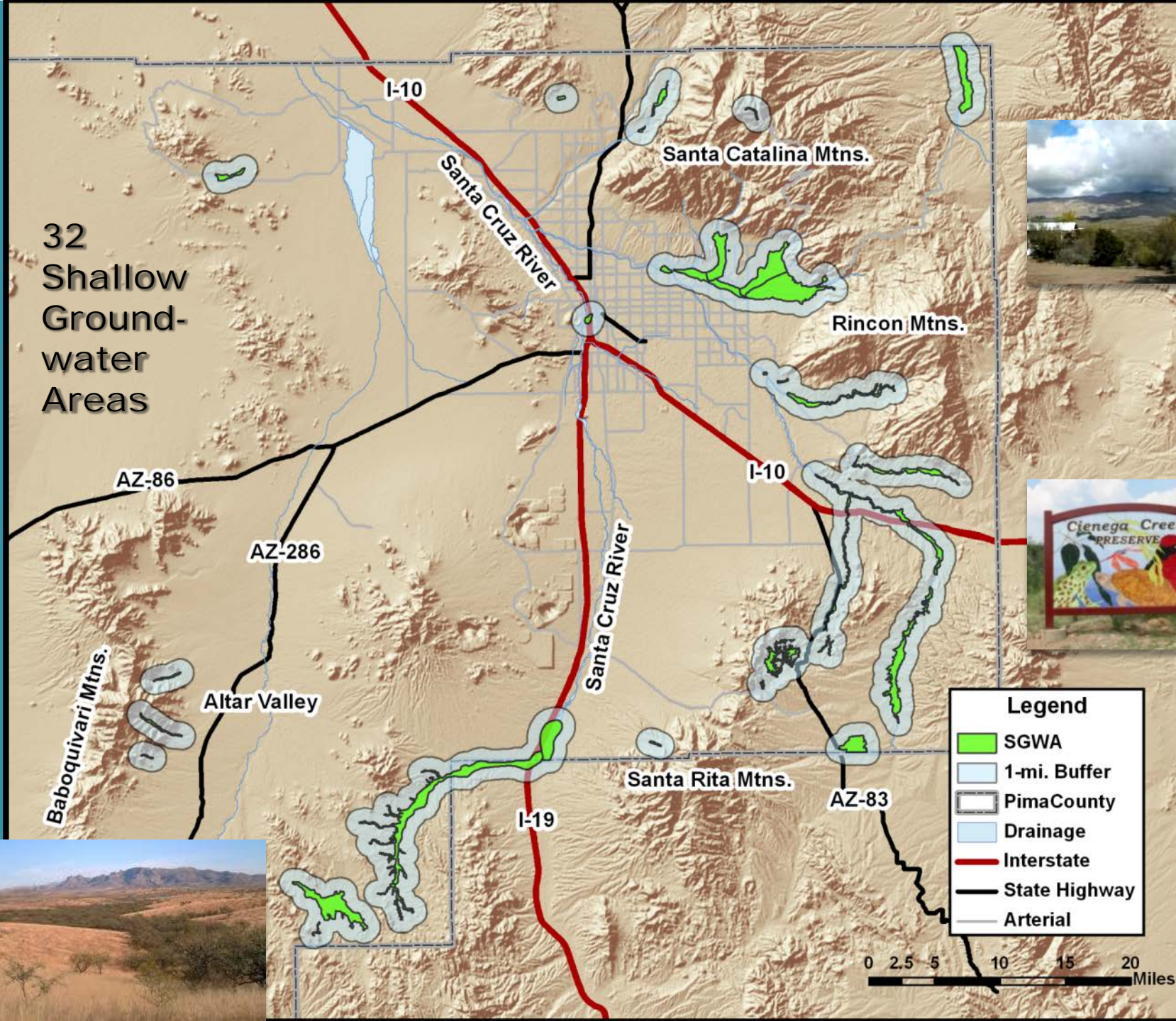
May, or may not,
have surface water
Important for Arizona
species

Rare and precious in
the Sonoran Desert

Identification based on...

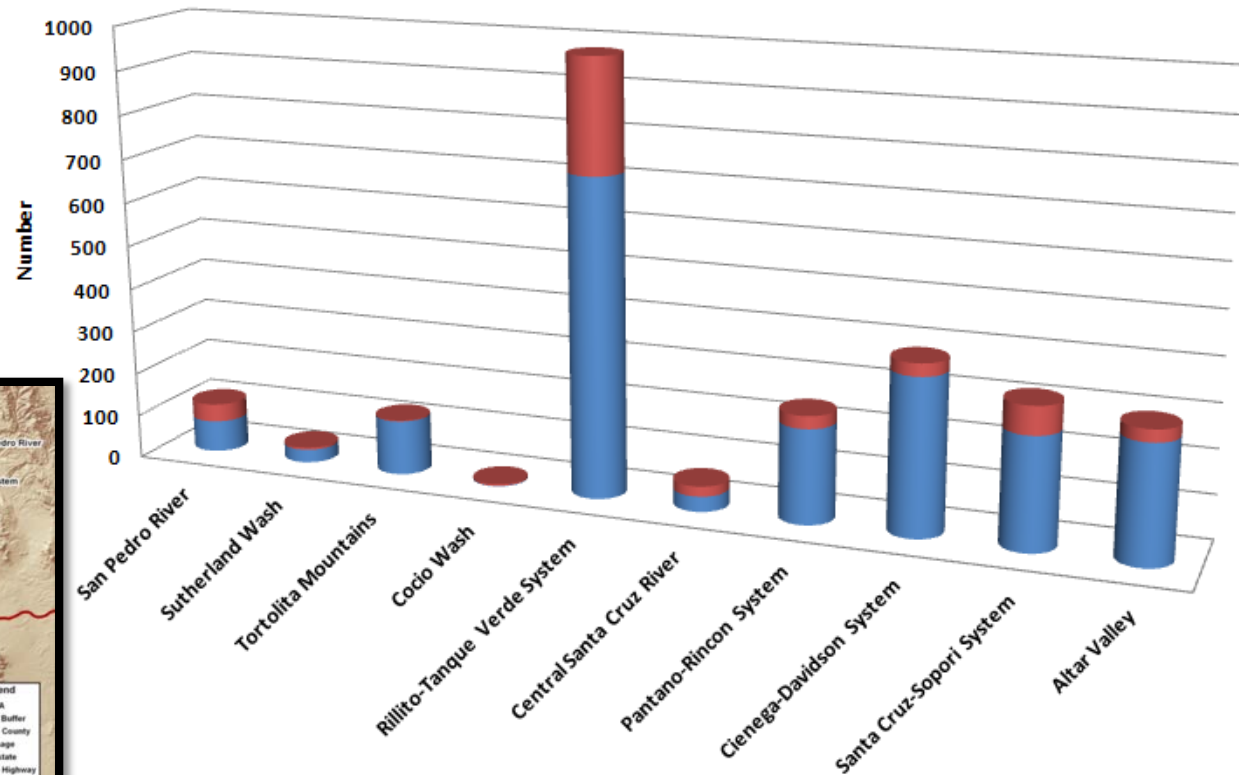
- Well data review
- Field vegetation surveys
- Aerial imagery & topographic maps

32 Shallow Groundwater Areas

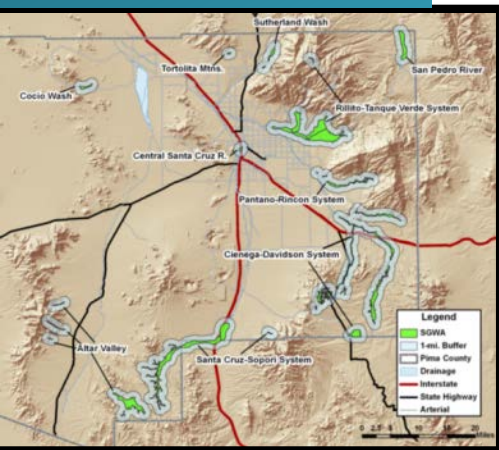


Exempt/Non Exempt Comparison

Numbers of Exempt and Non-exempt Wells by Region (2012)



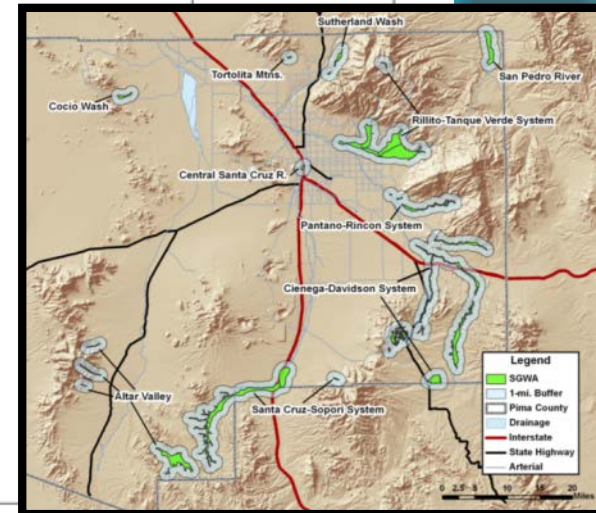
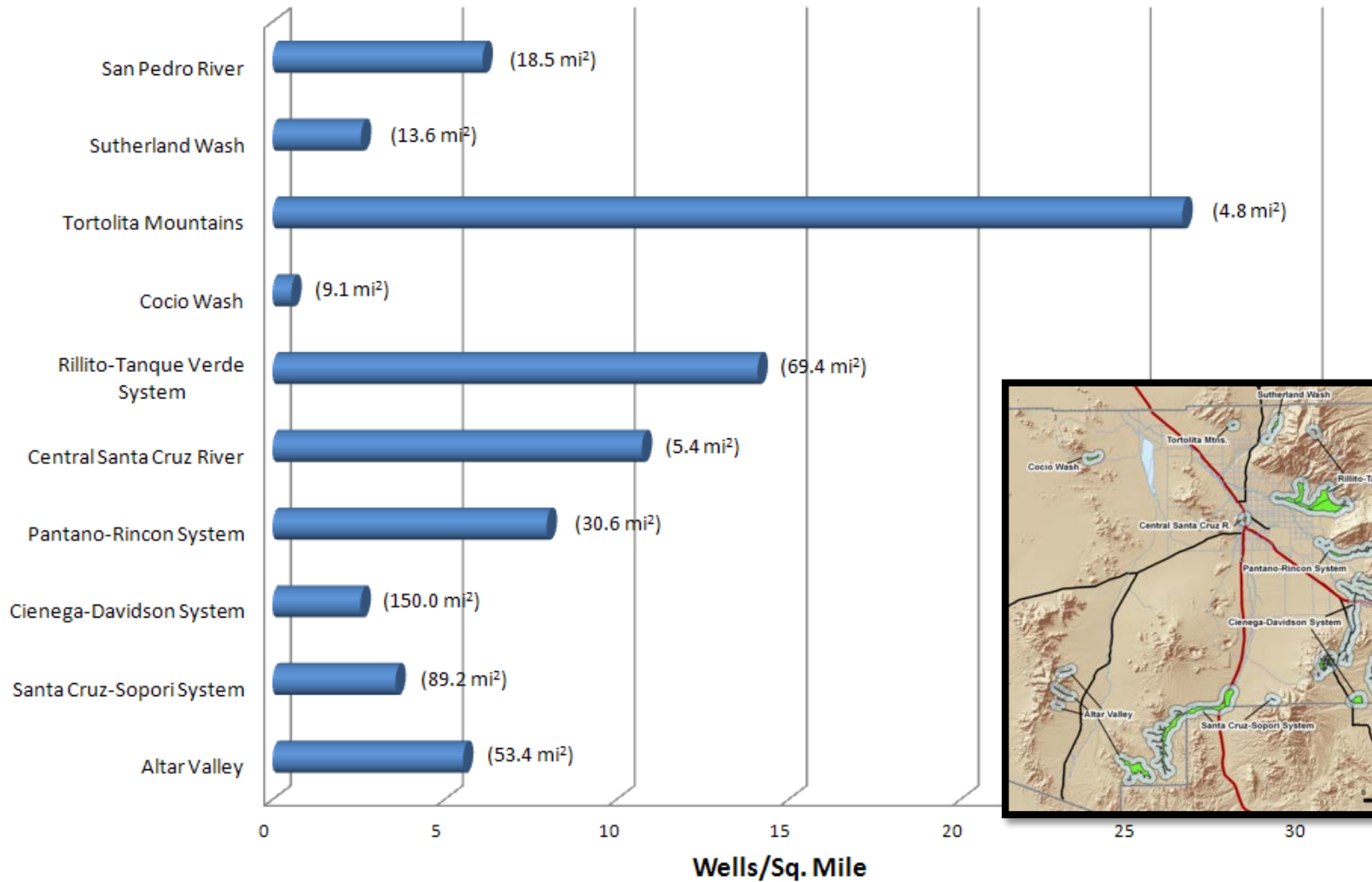
Generally, More Exempt Wells than Non-Exempt



Region	San Pedro River	Sutherland Wash	Tortolita Mountains	Cocio Wash	Rillito-Tanque Verde System	Central Santa Cruz River	Pantano-Rincon System	Cienega-Davidson System	Santa Cruz-Sopori System	Altar Valley
# Non-exempt Wells	41	5	2	4	257	23	29	29	64	28
# Exempt Wells	72	30	125	1	722	35	215	355	255	268

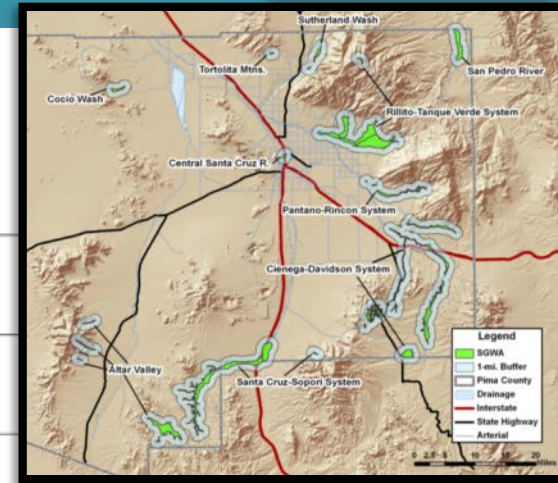
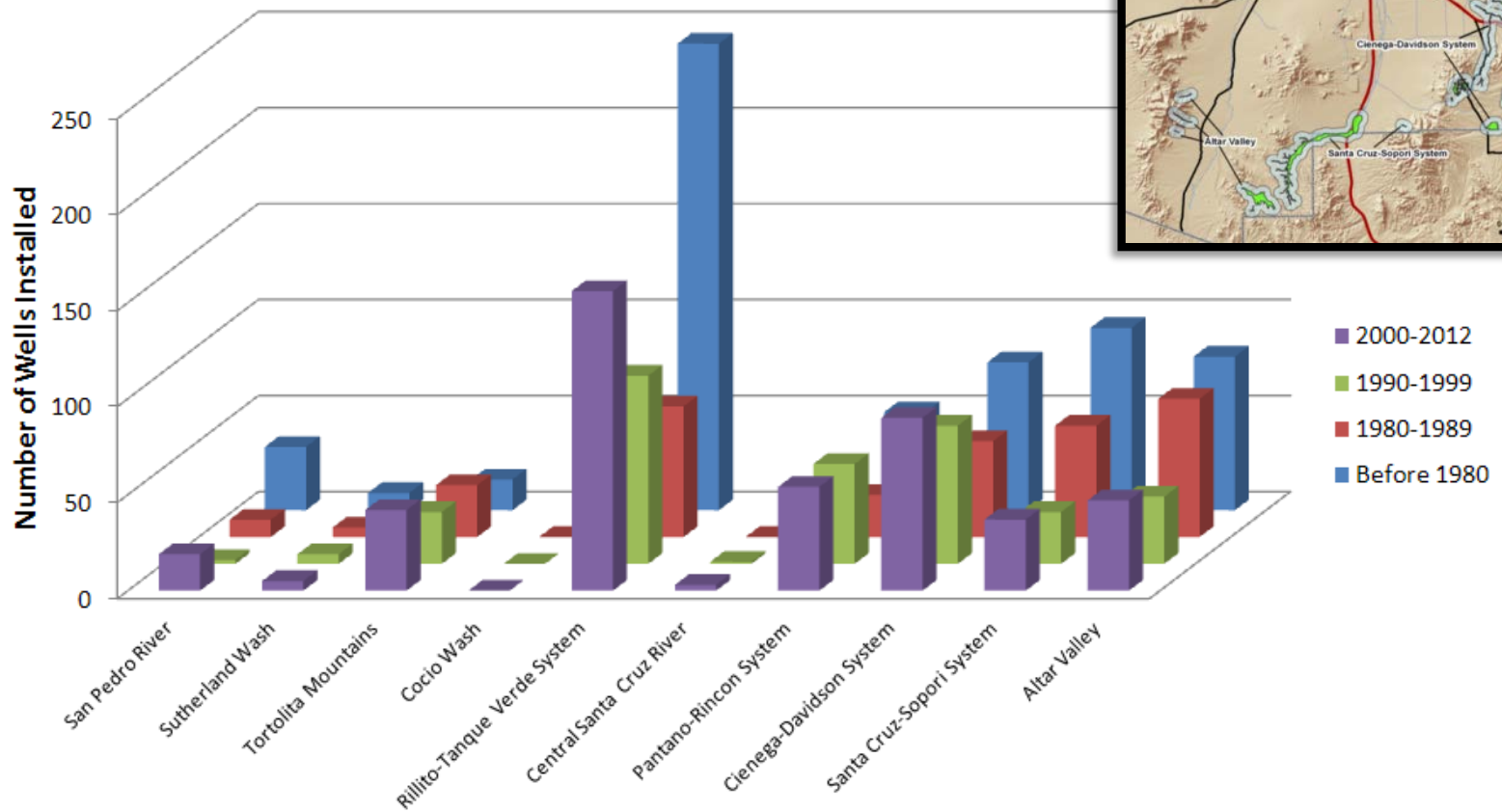
Well Density

Well Density



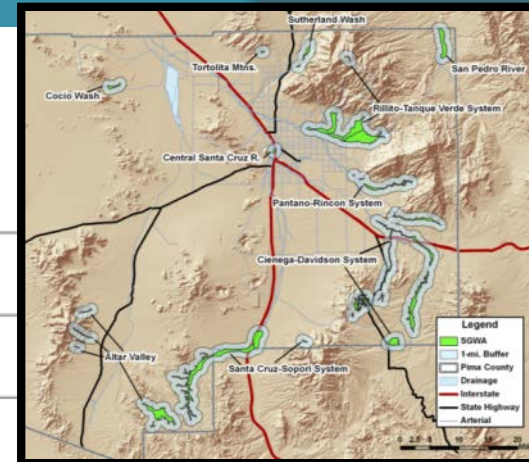
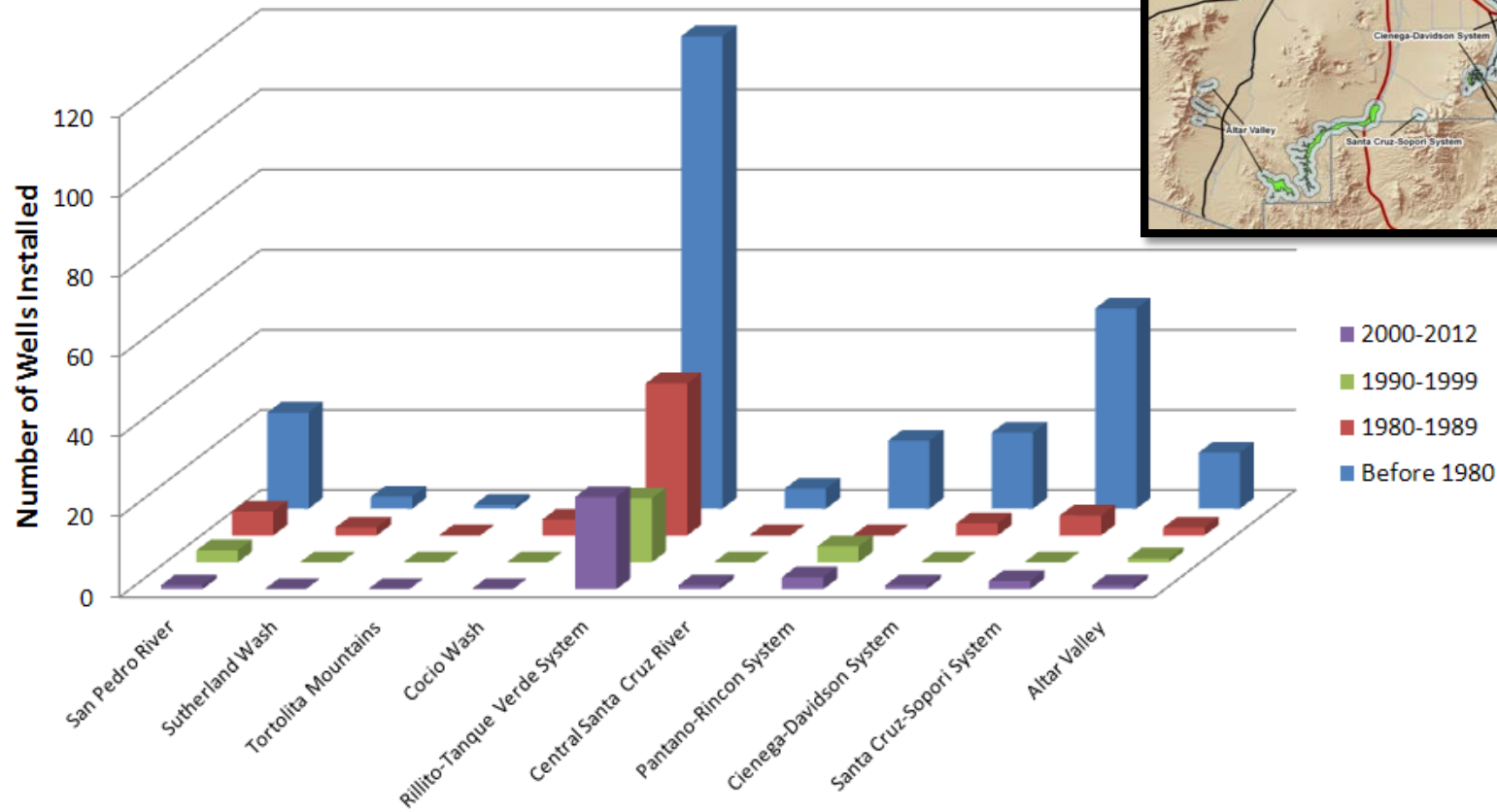
Drilling Trends - Exempt Wells

Exempt Well Installations

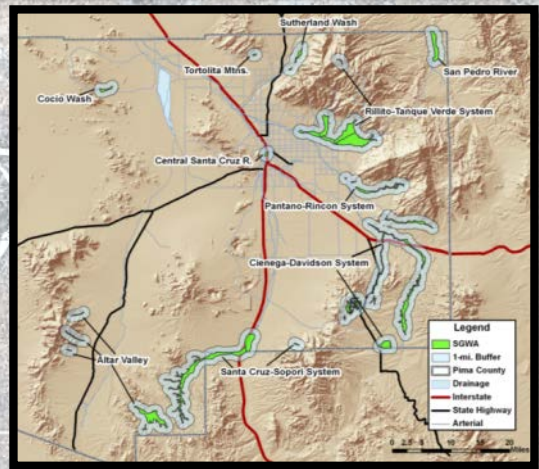
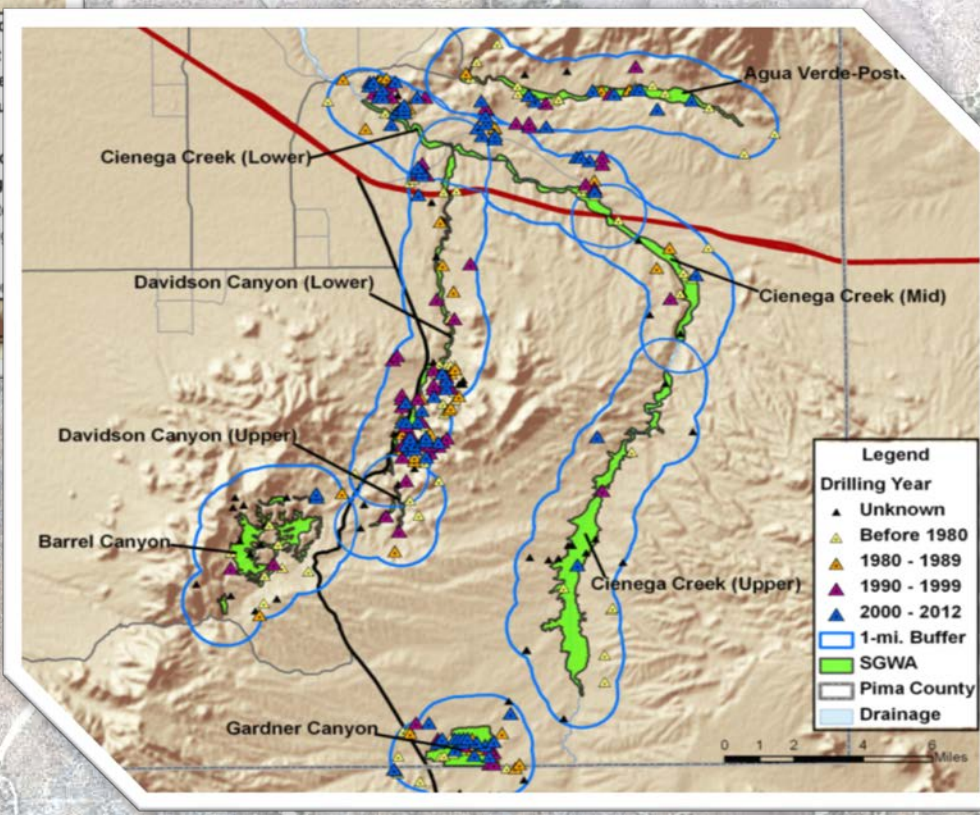
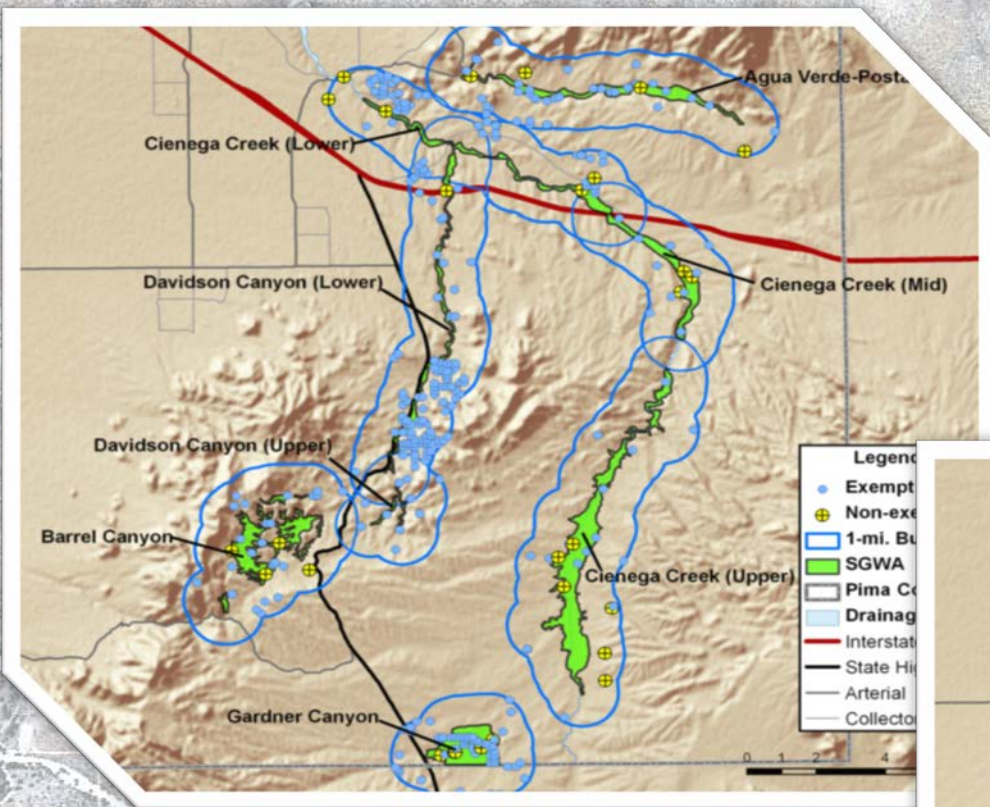


Drilling Trends – Non-exempt Wells

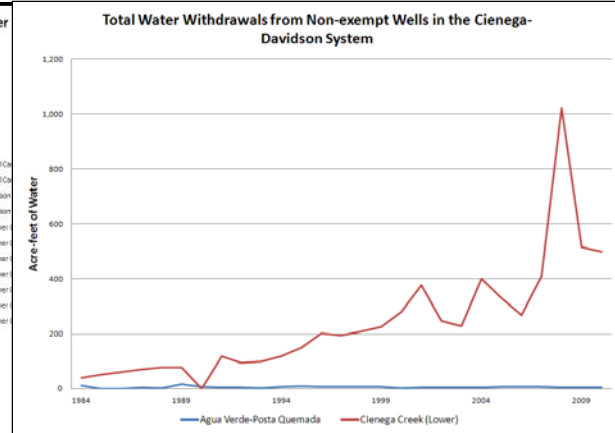
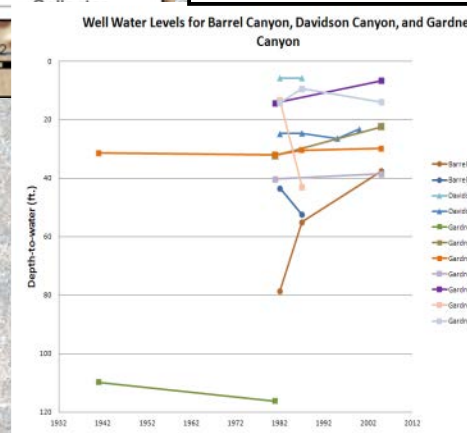
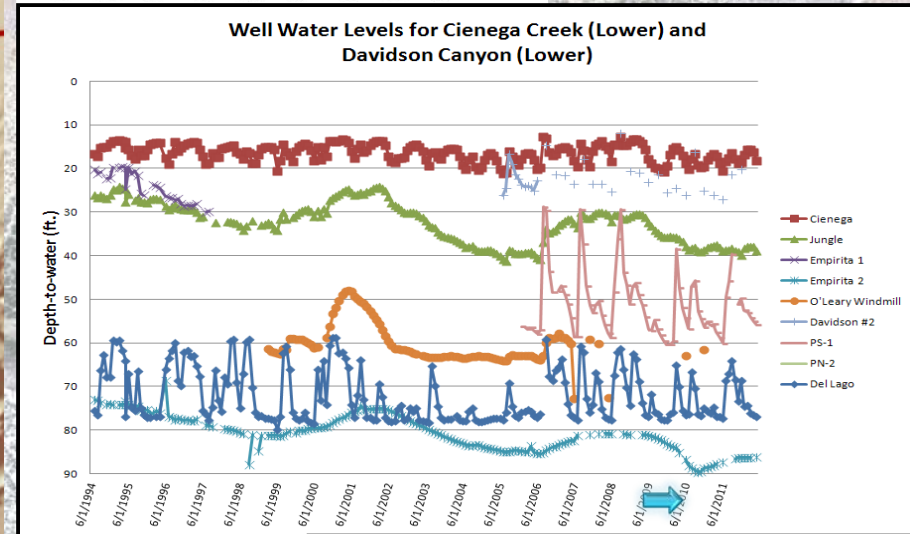
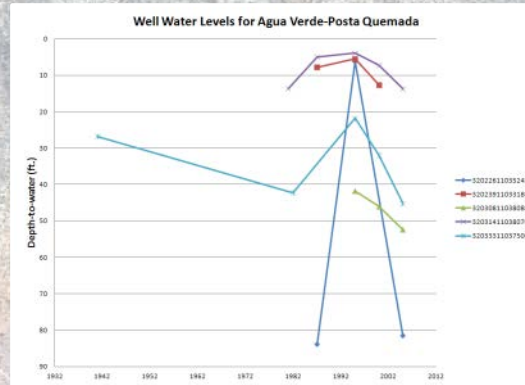
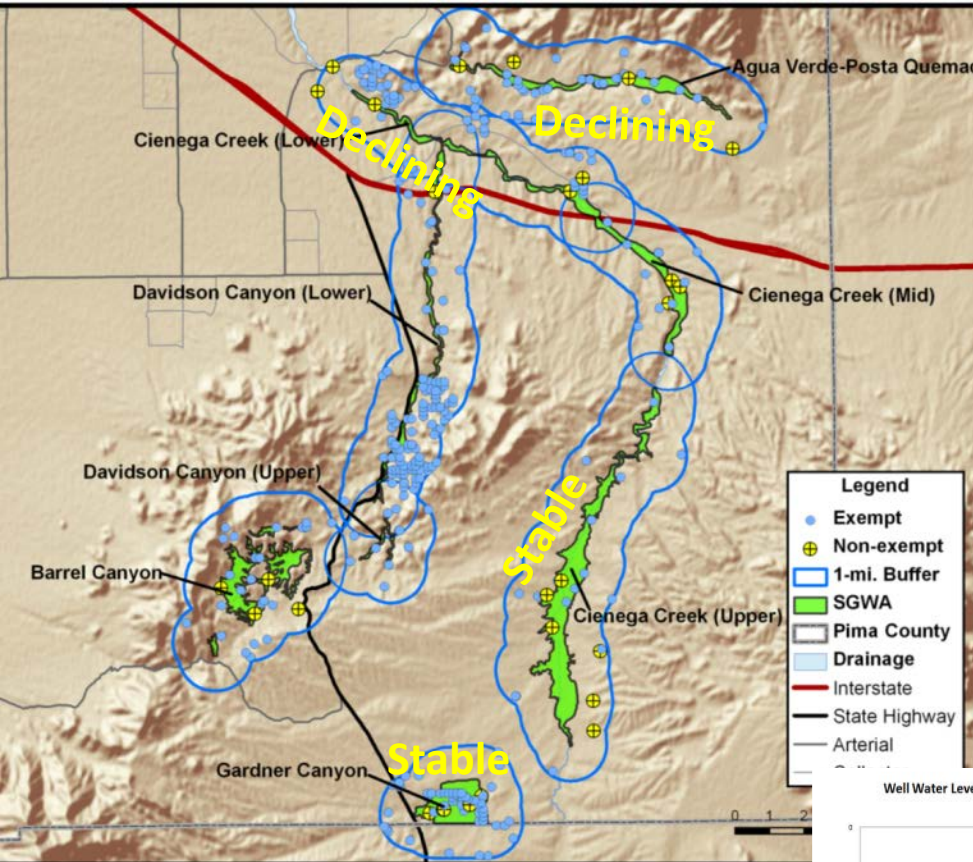
Non-exempt Well Installations



Cienega Creek Region

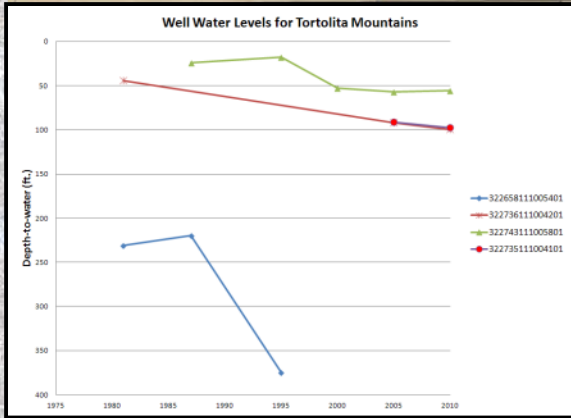
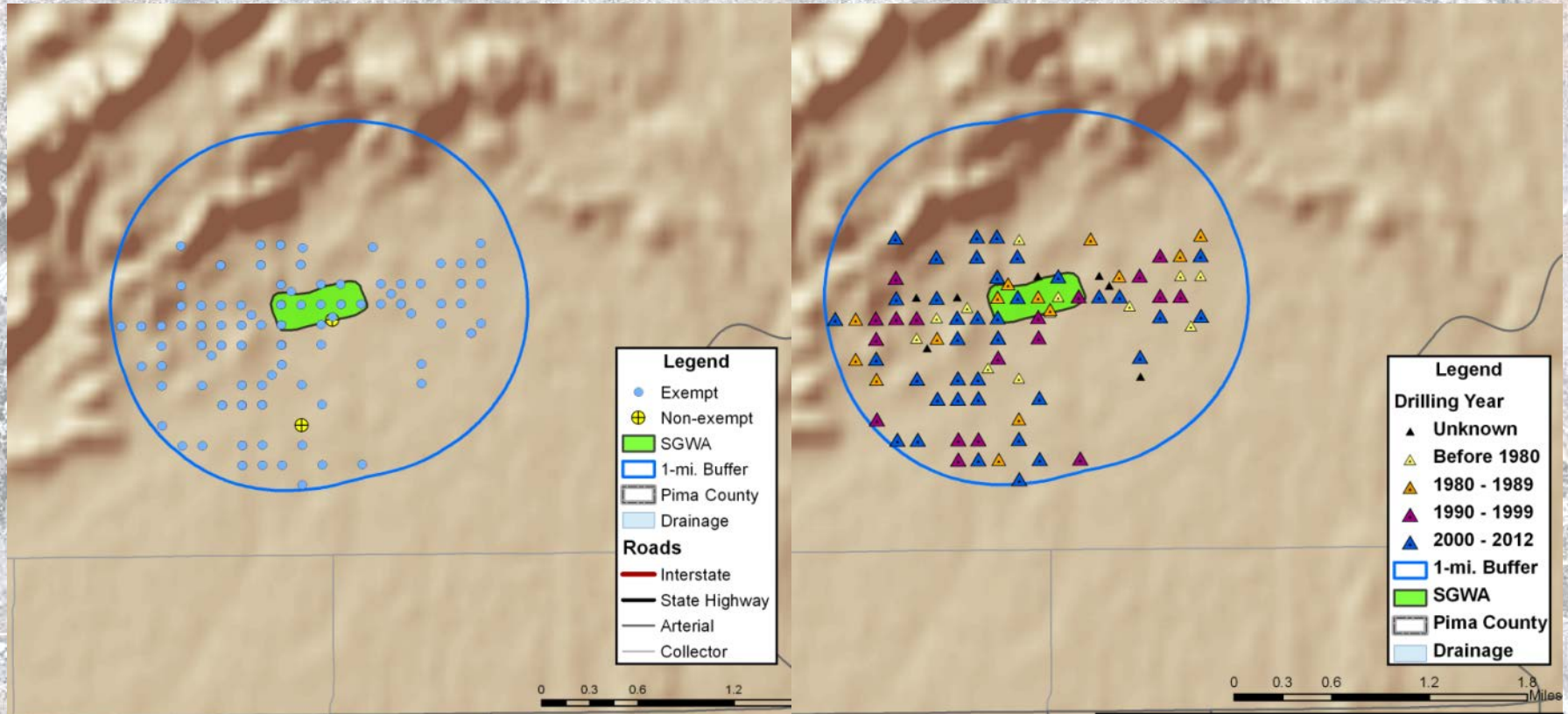


Cienega Creek Region

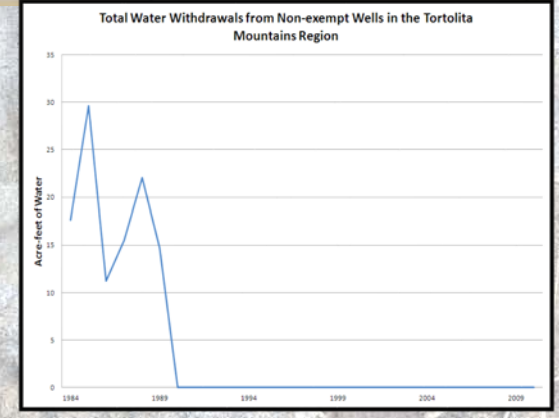


Low-moderate well density
Low-moderate drilling activity
 ⚙️ **Low water withdrawals**
 ⚙️ **Stable, declining, inconclusive**

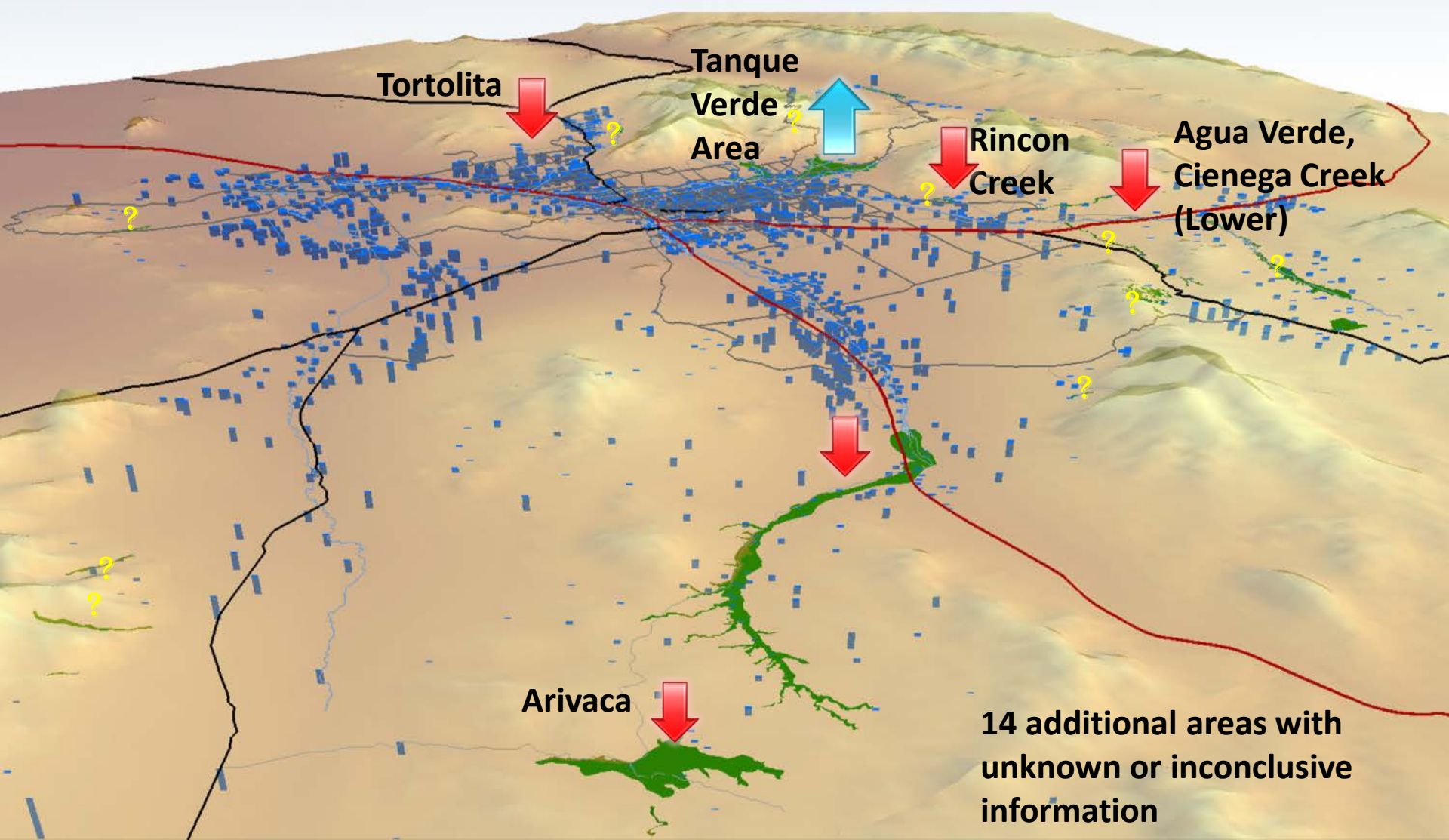
Tortolita Mountains Region



- ⚙️ ⚙️ **Very high well density**
- ⚙️ **Moderate drilling activity**
- ⚙️ **Moderate water withdrawals**
- ⚙️ ⚙️ **Declining water levels**



Declining Shallow Groundwater Areas





Drought and Planning

- Consider local conditions vs CAP supply
- Private well pumping will likely increase with local drought and heat
- Consider restoration possibilities in shallow aquifer (head water) areas
-

Questions?

Claire Zucker, czucker@pagnet.org
Mead Mier, mmier@pagnet.org
PAG Sustainable Environment
(520) 792-1093