

CONSERVATION TECHNICAL PAPER FOLLOW UP

Follow-up Items

1. **Correct page 6 of the report regarding the role of the Pima County Planning and Zoning Commission.**

RESPONSE: Staff has made this correction in on-line version.

2. **Clarify what is meant by water efficiency goals**

REPSONSE: **Water efficiency** can be defined as:

1. The accomplishment of a function, task, process, or result with the minimal amount of water feasible;
2. An indicator of the relationship between the amount of water required for a particular purpose and the amount of water used or delivered.
http://en.wikipedia.org/wiki/Water_efficiency_-_cite_note-0#cite_note-0 (Wikipedia).
3. Water efficiency differs from water conservation in that it focuses on reducing waste, as opposed to restricting use.

Examples of water efficiency measures – i.e. actions that use less water for the same or better result - include running full loads of laundry and installing displacement devices inside toilets. Water harvesting, which includes the passive detention of rainwater or the stored use of rainwater for later use, increases the potential for beneficial use of that water and is therefore a water efficiency measure.

Examples of water conservation measures include restricting the installation of water fountains or front yard lawns since these actions result in reduced water use but the end use or product is also reduced or eliminated.

Establishing shared measurable water efficiency goals promotes development and implementation of appropriate and consistent strategies across jurisdictions and agencies. It also enhances the ability of the many professionals from different agencies, jurisdictions and departments, all with a role in water conservation, to develop consistent education and information programs. Lastly, the ability to measure and report progress towards goals is key to achieving results. The often repeated phrase in the field of performance improvement is “what gets measured gets done”.

Additionally, public perceptions that water conservation could negatively impact their quality of life and encourage future growth are a disincentive for people to conserve water. Efficiency goals and measures, when understood and effectively implemented, have the capacity to address these public perceptions, enhance quality of life benefits in the community, and contribute to water use reductions.

Different goals may be established for different scales of development: the building or lot scale; the subdivision or neighborhood scale; and the community scale. Examples include:

City/County Water & Wastewater Study Oversight Committee

Building / lot scale efficiency goal

- All interior residential structures achieve a 30 percent reduction over baseline water use consistent with LEED standards by 2014

Neighborhood scale efficiency goal

- 50 percent of required landscaping in new subdivisions is irrigated with a locally generated water source by 2014

Community-scale efficiency goal

- Achieve a 10% Increase in irrigation efficiencies of existing turf facilities community-wide by 2014

3. The paper does not focus enough on conservation in the existing built environment. We need to set standards for redevelopment and infill that include requirements, incentives and rebates in the permitting process. We also need to address barriers in the current code that prevent people from redeveloping.

RESPONSE: All City of Tucson and Pima County ordinances with water conservation requirements apply to in-fill new construction. In re-development projects there are opportunities to require water efficient plumbing and irrigation with renovations and remodeling of existing buildings. However, opportunities to address water conservation through ordinances and standards are limited in re-development because most building uses are “grandfathered” as they precede the adoption of new regulation. Regulations such as Proposition 207 that effectively grandfather most existing uses of land or property make it difficult to retroactively impose new standards on existing construction.

Of greater importance for conservation in the existing built environment are education, water pricing, incentives and rebates, leak detection and use of reclaimed water.

More information on opportunities for water conservation in the existing built environment is provided below.

Standards for re-development and infill:

City of Tucson

The City of Tucson has more opportunities for infill new construction and re-development projects than Pima County. Any project that would require a new plan would be subject to the ordinance. If construction occurs inside the building (a Tenant Improvement a.k.a. a TI permit) and is not an expansion, the ordinance would not apply.

City of Tucson ordinances with water conservation requirements are listed below.

- Ordinance 7178 – Plumbing Codes (1989 concurrent with Pima County - Requires the use of water-efficient plumbing fixtures including 1.6 gallon per flush toilets, 2.5 gallon per minute showerheads and faucets.
- Ordinance 7522 – Xeriscape Landscaping and Screening Regulations (1991) - Affects all commercial and multi-family construction projects. The ordinance requires adherence to Xeriscape principles, including limitation on high water-use plantings/features, low water-use plant requirements, and appropriate irrigations system design.

City/County Water & Wastewater Study Oversight Committee

- Ordinance 10597 – Rainwater Collection and Distribution Requirements (2008) - To be effective July, 2010; Mandates that 50% of new commercial construction landscape water demand be met through the use of water harvesting practices and technologies.
- Ordinance 10579 – Residential GreyWater (2008) - To be effective July 2010; Mandates all new residential construction include the installation of stub-outs for greywater systems at a later date.
- Ordinance 6096 – Water Waste and Tampering (1984, updated 1989 and 2000). Initial penalty established at minimum of \$250; \$500 for subsequent penalty within three year period. Penalties can be waived through attendance of Water Waste Diversion Program. Violations currently defined as:
 1. Allowing water to escape property
 2. Allowing water to pond greater than ¼ inch, or greater than 150 square feet on any street or parking lot
 3. Washing driveways, sidewalks, parking areas with an open hose/under normal system pressure
 4. Operating misting systems in unoccupied non-residential areas
 5. Operating a permanently installed irrigation system with a broken head or emitter, or a head spraying more than 10% of the spray onto a street or parking lot
 6. Failing to repair a controllable leak.
- Ordinance 8461 - Emergency Water Conservation (1995) - Allows prohibitions or limitations on certain types of uses of water under emergency conditions. Restricted uses include car washing, landscape watering, filling/refilling of swimming pools.
- Ordinance 10380 – Drought Preparedness and Response (2006) - Provides for a phased, coordinated response to ongoing drought conditions. Allows prohibitions or limitations on certain types of uses of water under varying drought conditions.

Pima County

Pima County in-fill and re-development areas surround the City of Tucson and include older mixed use areas such as Dodge and Alvernon, Benson Highway and the Flowing Wells neighborhood.

Infill new construction on a vacant lot surrounded by other development would typically be coming in with a development plan that would be required to meet current standards. All Pima County ordinances with water conservation requirements would apply to those projects. In re-development in which someone is taking down existing structures and re-building to a different use, the ordinances and standards would also apply in some cases. However, for many re-development projects, existing standards (other than the plumbing code) do not apply. For example, expansions of 25% or less do not trigger regulatory requirements. If the expansion is greater than 25% the property owner may have to bring the site up to code.

The following ordinances have requirements that apply to new construction infill in the County and to re-development projects where there is a change of use.

- Ordinance 18.59 - The Golf Course Zone Ordinance: Prohibits the use of groundwater for newly zoned golf courses.

City/County Water & Wastewater Study Oversight Committee

- Chapter 18.73 of the Zoning Code (Title 18 of the Pima County Code) - is the Landscape Section provides general standards for buffer yards, landscape designs and landscape plans. Preservation of native, on-site vegetation is a primary objective of site planning. The code specifies the use of reclaimed water, effluent or CAP water on turf applications over ten acres and turf use shall be for functional uses only, such as play or picnic areas. Landscaped areas will use a separate reclaimed ready irrigation system to promote the use of effluent. Water conserving irrigation systems will incorporate rain sensors and be capable of seasonal adjustments. Large water fountains and water features are restricted.¹
- Title 15 of the Pima County Code governing Building and Construction gives Pima County authority to adopt and update building codes. The International Plumbing Code (2007-106) and International Residential Code (2006-91) apply equally to redevelopment and infill at the building level. Water conservation requirements include: automatic faucets in commercial buildings and common use buildings, waterless urinals in commercial buildings, individual metering in new multi-family residential units and new and remodeled pools, spas and hot tubs to have covers to reduce evaporation.²
- Ordinance 8.70 - Water Wasting. Was approved in conjunction with Pima County's Drought Response plan. Prohibits wasteful use of water and Civil penalties for violations. Violations are reported by the public and are investigated by staff at the Health Department.
- Ordinance 18.72.010 - Native Plant Preservation. Promotes water conservation by retaining established, existing drought tolerant vegetation that requires no supplemental irrigation and minimal maintenance after plant establishment. The ordinance requires that a plan be submitted whenever the area of grading for a project is at or exceeds 14,000 square feet and the total lot area is 36,000 square feet or greater, or when the subdivision plat requires it.

Additionally, Pima County offers LEED services to Arizona, New Mexico and California. Residential applicants may submit their sites for LEED certification and Pima County will award points towards their LEED certification for use of water conservation measures such as rainwater harvesting, greywater, drought tolerant landscaping, and water efficient irrigation systems.

The primary tools for achieving water conservation in existing structures is through incentives and education, rather than regulations and a summary of key opportunities in these areas is provided below.

Incentives

In 2006, The Tucson Water Conservation Task Force issued a report titled "Water Efficiency: Water Conservation Program recommendations for Tucson's Water Future" which recommends a number of incentive-based conservation measures. The CCTF recommendations were based on qualitative analysis relative to customer acceptability factors and rigorous cost-benefit

¹ See <http://municipalcodes.lexisnexis.com/codes/pima/> Title 18-Zoning.

² See <http://www.pimaxpress.com/Building/PDFs/2007/2006%20International%20Plumbing%20Code.pdf> and Appendix G of <http://www.pimaxpress.com/Building/PDFs/2007/2006%20International%20Residential%20Code.pdf>

City/County Water & Wastewater Study Oversight Committee

analysis. The CCTF recommended incentive measures that have been implemented or are under development include:

- Single Family targeted Ultra Low Flow (ULF) toilet rebate
- Multi-family irrigation system upgrade rebate
- Multi-family high efficiency toilet rebate
- Commercial Industrial targeted ULF toilet rebate
- Commercial/Industrial pre-rinse spray valve rebate
- Commercial/Industrial waterless urinal rebate

Other recommended measures that have yet to be implemented include:

- Commercial/Industrial sub-metering (indoor/outdoor) incentive
- Single Family greywater incentive

In addition to the above list of relatively new incentive-based conservation measures, prior to the CCTF recommendations, Tucson Water had a number of pre-existing incentive programs which are summarized below:

- **Rates** - ¢. 25 buys:
 - 1 gallon from vending machine
 - 125 gallons from Tucson Water
- **Rebate Programs/ Tucson Water currently offers the following:**
 - 1. Residential HET Rebate Program** – 50% of purchase price of approved HET fixture, maximum \$120. Maximum \$200 rebate per household.
 - 2. Multi family HET Rebate Program** – 50% of purchase price of qualifying HET fixture, maximum \$100 per fixture.
 - 3. Commercial Industrial HET Rebate Program** – 50% of purchase price of qualifying HET fixture, maximum \$100 per fixture.
- **Commercial Irrigation System Upgrade Rebate** – One third the cost up to \$5,000 per location to improve system with irrigation audits, sub-meter, weather-based or soil sensor-based controller.
- **Other Incentives**
 1. RinseSmart Program – Free high pressure pre-rinse sprayer installs for restaurants or commercial kitchens
 2. Restaurant Table Tents/Menu Stickers – “Want a Glass of Water? Just Ask” free and distributed through AZ Restaurant Association
 3. WaterSmart Business Program – Incentives to encourage business water efficiency. Similar to LEED for water efficiency practices and certification at Copper, Gold, Silver and Platinum level. Program launch - Spring 2009.

Education

Interest in water conserving landscape practices, including residential water harvesting, stormwater harvesting, and greywater is growing among residential customers in the Tucson area. Continued emphasis on education, training and direct assistance to foster voluntary actions to implement these and other water efficient practices among individuals and within neighborhoods has significant potential to increase water conservation in the built environment.

City/County Water & Wastewater Study Oversight Committee

There are many opportunities in the community to learn about these techniques through the University of Arizona, non-profits and the City of Tucson. The City and County also partner with these groups in providing education and training in water conservation measures and in implementing demonstration projects. Continued collaborations also have significant potential to advance water conserving practices.

Following is a brief summary of Tucson Water's extensive Conservation Program:

General public information

Designed to promote water conservation and inform about issues:

1. Pamphlets and Brochures
2. Public Service Announcements
3. Community Events (Civic, trade, neighborhood events, etc.)
4. Beat the Peak

Education and training

Designed to educate and train participants in structured classroom setting:

- **Water Smart Landscape Workshops** – Two-hour workshops targeting residential customers. Workshop topics include:
 1. Drip Irrigation Design, Installation, and Maintenance
 2. Plant Selection and Design
 3. Irrigation Timer use and Irrigation Scheduling
 4. Water Harvesting
- **SmartScape Landscaper Workshops** – Series of workshops designed to teach landscape professionals, property managers, and homeowner associations about water conservation practices in landscape management.
- **Smartscape Program** – (Previously known as the LOW 4 Program) Offers landscape water conservation programs to commercial users, school districts, and general public.
- **Landscape Water Audit Training**
- **Turf Maintenance Workshop**
- **Youth Education Program**

Classroom materials for specific grade levels designed to teach about water supply, conservation, and quality issues.

 1. **'Da Drops – Grade 3** Student Activity book and Supplemental Teacher Guide for classroom use designed to teach about water cycle, groundwater, and water distribution.
 2. **Our Water, Our Future – Grade 5** Classroom Curriculum Packet designed to teach students about water cycle, water supply, and water quality.
 3. **Tucson Toolkit – Grades 7-8** Student Activity Book and Supplemental Teacher Guide designed to teach about water cycle, water quality, and water conservation.
 4. **High School Program** – The program is designed to bring water studies into broader curricular areas by building capacity among teachers and encouraging students to develop water-related projects.

City/County Water & Wastewater Study Oversight Committee

5. **Teacher Internship Program** – Two-Week paid internship offered to high school teachers. Development of classroom materials and assistance with development of subsequent elements are work products.
6. **Education Outreach** – The Education Outreach program provides classroom presentations and tours, and supports other education related programs.
7. **Wetlands Program** – Tours and classrooms presentations that help students understand about wastewater treatment, recharge, and conservation.
8. **Student Projects** – Regional Science Fair awards, River of Words poetry contest, Water Expo.
9. **Sweetwater Wetlands Guidebook**
10. **Project WET** – Project WET (Water Education for Teachers) is a nationally developed program that provides teachers with training and materials to improve teaching methods about water in the classroom.

Direct assistance programs

These programs are designed to provide direct assistance to customers in helping them reduce their water use.

- **Zanjero Program** – A residential water-auditing program designed to maximize water conservation potential around the home. The service includes leak detection, replacement of showerheads and aerators, and adjustments of toilets. Landscaping is assessed, and appropriate irrigation requirements are determined. Customers are provided a report showing water and dollar savings.
- **WaterSmart Business Program** – Water conservation assistance program targeting commercial and industrial customers. Facility audits are conducted to identify all uses of water and identify conservation potential.

Comments/Recommendations/Themes

1. Mark Stratton cautioned against using GPCD (gallons per capita per day) as the sole benchmark of conservation progress because each water provider has different types of customers and other issues that affect GPCD.
2. We have for a long time had a strong conservation ethic in Tucson. The next increment of improvement in conservation is going to be more expensive to achieve.
3. Conservation requirements have a cost associated with them that someone must pay and we need to be aware of this. We need to consider cost effectiveness of solutions as well as reliability and measurability of these solutions and compare costs to other conservation approaches and the cost to acquire new water. In some cases, retrofitting the built environment would be cheaper than mandating requirements for new development (e.g. toilet replacement is cost-effective and has measurable and reliable results).
4. Price signals are key to conservation. If water is inexpensive, people will not value it.
5. It is important to distinguish what people are paying when they pay their water bill – base rate (energy, infrastructure, etc.) and commodity rate. Only the commodity rate relates to

City/County Water & Wastewater Study Oversight Committee

usage. We need a new way of structuring our rates that will not link less water used with higher rates and it will likely involve base rates going up.

6. We should acknowledge that at the end of the day, using less water does allow more people to move here. At the same time, we should tie more efficient use of water to improved quality of life.

**City/County Water & Wastewater Study Oversight Committee
Technical Report Follow Up from April 23, 2009 Committee Meeting
DROUGHT PLANNING WHITE PAPER**

Follow-up Items

- Describe the relationship between the Secretary of Interior declaring a shortage on the Colorado River and Tucson Water and Pima County's drought plan responses.

Response: Under Pima County's Drought Response Plan, a declaration by the U.S. Secretary of the Interior of either a shortage on the Colorado River or a curtailment of water delivered through the Central Arizona Project canal to any local water provider may increase the drought level by one stage. Under Tucson Water's Drought Preparedness and Response Plan, regional indicators and local system indicators are considered in declaring drought stages. Regional indicators include severe or sustained drought in the Colorado River watershed as well as declared shortages on the river and any associated CAP water delivery reductions.

- Define Drought.

Response: According to the Arizona Drought Preparedness Plan: A sustained, natural reduction in precipitation that results in negative impacts to the environment and human activities.

- Need to determine how can we include the rural water users in the drought discussion. (Public comment)

Response: All water users are welcome to participate in the Local Drought Impact Group. Public meetings are held bimonthly and information can be found at <http://www.pima.gov/drought/>

Comments/Recommendations/Themes

1. Drought in this community seems normal. We need to become a drought resistant community.
2. The main drought indicator for the region should be the health of the Colorado River. While currently Tucson Water is the only local water provider to deliver Central Arizona Project (CAP) water, all water providers that rely on the Central Arizona Groundwater Replenishing District (CAGRD) for recharge are dependent on CAP water supplies and should be monitoring drought indicators for the Colorado River Basin.
3. Local indicators are also important since local drought conditions can impact water demand. Local indicators for all water providers should include vegetation stress.
4. Resources need to be identified for the City and County to undertake scenario planning to improve drought preparedness in the face of the uncertainties surrounding climate change and global warming.
5. There is a need for consistent public messages regarding drought stages and responses of different water providers and jurisdictions. The Local Drought Indicator Group serves as a coordinator for such messages. The Local Drought Indicator Group should be commended for the work they have done so far to coordinate plans and messages.
6. All drought management plans should include a goal at the beginning of the plan. The goal could be as simple as referencing the regulation mandating the plan.

**Location of Growth, Urban Form, and Cost of Infrastructure
TECHNICAL PAPER FOLLOW UP**

Follow-up Items

1. Concern was raised that this paper did not adequately address 1) the relationship between growth and water and wastewater infrastructure and 2) the cost of growth

Response: These issues will be addressed in July and August Technical Reports on these specific topics.

2. Provide a set of maps showing the difference between the 4 scenarios

Response: Maps will be distributed at the July Committee meeting.

3. On page 85 of the report, clarify what is meant by the sentence "Link urban form to activity space-time measures..."

Response: Residents of densely developed neighborhoods with more retail stores and better connected streets generally have smaller area sizes of daily activity and shorter daily travel distance. Retail mix and street connectivity are key factors relating to individuals' uses of space while building density is less important. See White Paper Reference No. 26.

4. On page 82 of the report, further explain Table 15

Response: Nine consequences of urban form were identified for use as qualitative comparators between the Growth Scenarios. The White Paper team assigned none, one, two, or three checkmarks for each combination of comparator and Growth Scenario. These decisions were made on the basis of the entire process and cumulative findings.

5. On pages 51- 53, the usefulness and validity of the data in Figures 21-24 is questioned

Response: R2 is a statistic that will give some information about the goodness of fit of a model. In regression, the R2 coefficient of determination is a statistical measure of how well the regression line approximates the real data points. An R2 of 1.0 indicates that the regression line perfectly fits the data. The weak reported R2 values reflect the simple nature of the analysis. It is suspected that many of the Traffic Analysis Zone (TAZ) have other significant variables that could be controlled for in a more complete and exhaustive analysis. The density thresholds may be where diminishing returns begin; the point is that there are general visible patterns and relationships between the graphed variables. The variability is worth investigating.

6. On page 6 of the report, CO2 emission # seems low

Response: The information came from the following report www.energy.ca.gov/places/

City/County Water & Wastewater Study Oversight Committee

7. On page 53, clarify measure of density and water usage

Response: Data presented in the White Paper was annual per capita usage by TAZ (Figure 23) and was gallons per person per day by utility (Figure 24).

8. Further explanation of the Conservation Lands System (CLS) and Habitat Conservation Plans and their relationship to the habitat protection scenario

Response: For Pima County, the Conservation Lands System is a policy and not an ordinance. Although the County can only implement it in unincorporated Pima County, the mapping data exists for all of Pima County making it simple for other jurisdictions to adopt it consistently. Two other jurisdictions have adopted the CLS: The City of Tucson adopted the CLS in October 2008 for annexations, and the City Council directed that the CLS be incorporated into the General Plan during the next update. The City is also undertaking a Habitat Conservation Planning process for the Greater Southlands - including quite a bit of land that is currently in unincorporated county. This process is building off of the CLS and will include conservation strategies for areas outside of the CLS in addition to what is protected through the CLS. The Town of Oro Valley, in 2008, adopted the CLS for the massive proposed annexation of 9,000 acres of State Trust land north of Oro Valley. The majority of the rest of the Town is built out. As for implementation of the CLS, the County is committed to both land acquisition and development set asides to achieve the goals of the CLS.

Comments/Recommendations/Themes

1. The following factors strongly affect if, how and where we grow and will make it difficult to achieve these scenarios:
 - Land values are a major driver of density that needs to be considered.
 - Economic factors are a significant factor in how communities grow– where are the jobs?
 - Availability of private land and release of State Land strongly influence where growth will occur.
 - Growth will be influenced to go to areas that are undeveloped unless we protect those areas.
 - It is still so much cheaper to build on the edge than to do infill.
2. A blend of the growth scenarios might make the most sense. We don't want to give the impression that these scenarios are mutually exclusive. What are the attributes of these scenarios that might be combined?
3. Density should come with public investment and benefits. Taxpayer savings through more efficient growth should be invested in new and upgraded infrastructure to serve more dense areas. In the past we've seen increases in density without increased investment in infrastructure and services – we need commitments to do these things before we commit to density.
4. Need to use caution with benchmark data because in some cases, correlations aren't that strong, and the benchmark communities are different than Tucson (e.g. types of water resources available).
5. Increasing density can disrupt existing neighborhoods making it impractical and may not be desirable.

City/County Water & Wastewater Study Oversight Committee

6. Scenarios need to include job centers and areas for recreation.
7. We need to lay this out for the public – we need input and education.
8. It is important to consider what governments have control over when it comes to growth.
We are more likely to influence the form of growth than how many people come here.
9. Government should not be dictating density in terms of minimum residences per acre (RAC).
Instead government should plan, construct and phase infrastructure in desired growth areas.
10. The economics of the status quo scenario are unsustainable.
11. Do we have enough water for 2 million people?

Issues for Regional or State-level Discussion

1. It is very important that this discussion happen regionally, because how the other jurisdictions grow has a big impact on how the City and County will grow.

City/County Water & Wastewater Study Oversight Committee
Technical Report Follow Up
RECLAIMED WATER WHITE PAPER

Follow-up Items

1. Definitions and uses of effluent and reclaimed
 - Need to better define wastewater, effluent and reclaimed water.
 - Describe various uses and regulatory requirements of each.
 - Describe regulatory barriers to using reclaimed water for riparian enhancement.

Response: **Will provide additional information here**

2. Quality of reclaimed water
 - Need to describe the importance of matching the quality of water to the aquifer where it is being recharged.
 - Concern expressed that quality of groundwater where reclaimed is recharged will be degraded.
 - Concern expressed about how recharge of reclaimed and effluent will affect the soil, salt content, contaminants, and the environment over time.

Response: *These issues will be addressed in Technical Report on Additional Water Resources*

Comments/Recommendations/Themes

1. Reduction of turf should be a goal.
2. Public health issues need to be considered in use of reclaimed water.
3. There were comments made for and against whether ratepayers should subsidize bringing reclaimed water to sites that create a public benefit but have no price incentive or don't have an ability to pay.
4. Location decisions for wastewater treatment plants should take into account how effluent can be used for beneficial purposes close to the site.
5. We should explore how reclaimed can be used for recreational purposes such as lakes.
6. Reclaimed should be more expensive for areas further out.
7. Need to be cautious in making "overcoming regulatory barriers" a goal in that these regulations are there to protect people and the environment

Issues for Regional or State-level Discussion

1. State water law and state water planning need to be addressed.

**RIPARIAN PROTECTION
TECHNICAL PAPER FOLLOW UP**

Follow-up Items

1. Provide definitions of hydro-riparian, meso-riparian and shallow groundwater.

Response:

Hydro-riparian habitat is generally associated with perennial watercourses, where plant species such as cottonwood and willow are present. This is the rarest type of riparian habitat in Pima County and is vital to wildlife species who utilize the habitat for critical life cycle stages.

Meso-riparian habitats are associated with areas with shallow ground water and/or intermittent stream flow. Mesquite bosques are characteristic of this habitat type.

Shallow Groundwater - Several definitions of shallow groundwater have been discussed. PAG (2008) classified them in Pima County as areas having a depth to water of 50 feet or less. In areas with a lack of water level data, Shallow groundwater areas in Pima County were demarcated by indicator plants that thrive on shallow groundwater, including cottonwood, willow and thickets of large mesquite.

2. Could satellite imagery be used as an educational tool to help people see the impacts of groundwater pumping?

Response:

Yes. Satellite Infrared (IR) imagery was used to delineate riparian areas with field confirmation for Pima County MapGuide overlays for 1990 data and updated in 2002. Satellite methods include Landsat Thematic Mapper (TM) data that has been pioneered by the USGS to delineate vegetation using normalized difference vegetation Indices (NDVI). With the use of nearby monitor wells, many of the shallow groundwater areas in Eastern Pima County are monitored to evaluate potential riparian loss. The IR imagery is a tool to show changes over time as water levels decline. The Satellite imagery too may be more cost effective in areas where monitor wells and aerial photography are scarcer to show changes over time using NDVI. NDVI is also a good tool to show differences in plant vigor as water tables drop.

Comments/Recommendations/Themes

1. The number of exempt wells is so significant that we would need a way to limit existing exempt wells at the local level to really protect riparian areas. Wheeling renewable supplies to areas with exempt wells is an option but whether the community would be willing to subsidize this is a question.
2. Planned communities are much better than "wildcat" developments, from a riparian protection perspective. We need to make sure we are not encouraging "wildcatting" by heaping too many regulations on subdivisions.

Issues for Regional or State-level Discussion

1. State level legislative issues are key to this issue of controlling exempt wells.

STORMWATER MANAGEMENT TECHNICAL PAPER FOLLOW UP

Comments/Recommendations/Themes

1. The water harvesting/traffic calming devices on 9th St. in Rincon Heights neighborhood are a good model. We should educate people about stormwater harvesting opportunities in their neighborhood.
2. There is a need to coordinate between local, state and federal projects that are dealing with flood control.
3. Where we have the opportunity we should watercourses most like their natural state – the Santa Cruz River south of Irvington is an example.
4. Figures 11, 12 and 13 are confusing and need more explanation.

Response: Additional text has been added to the paper as well as the figure captions to better describe the significance of the figures. A revised version of the report has been posted to the web site.