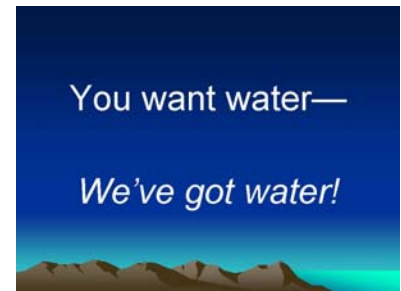


**Presenter #3:
NANCY FREEMAN, EXECUTIVE DIRECTOR,
GROUNDWATER AWARENESS LEAGUE: STORM
WATER RECHARGE**



MS. FREEMAN: Well, I know why I'm going last, because I think this is very inspiring; to me it is. When I lived in Green Valley, I searched around and pestered Ken Seasholes and found out we had a 40,000 acre-foot deficit per year, and so I joined a community garden over in Sahuarita, and they told me, "Don't plant anything in the summer." And I go, "Yeah, it's too hot." "No, it all gets washed away because of the floods."

Last year, our tool shed, which is a huge tool shed with two or three rot tillers, and all sorts of other tools in it, got washed across the garden and only got stopped by the fence. And I go, "There's that much water, you know. Why isn't somebody doing something?" So, I started talking to the different people in the neighborhood and they have photographs and it's true, we've got water.



Davis Rd., Sahuarita



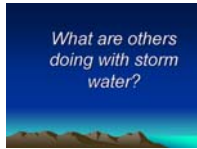
Delgado Rd., Sahuarita



El Toro Rd., Sahuarita



This is El Toro Road. This is Delgado Road. And this - oh, pardon me - that first one was Davis Road. This is El Toro Road.



And so we wanted to think about, "What are others doing with their storm water?" This is a reservoir in Colorado where you can go fishing; California, too, catch the storm water. Apache in New Mexico, is a managed wildlife refuge which is absolutely incredible. If you been there, it's something not to miss.

Wolford Reservoir, Colorado



Bosque de la Apache, New Mexico



which refuge haven't

Barnwell Park Golf Course - stormwater channel, retention basins and storage tanks - Australia

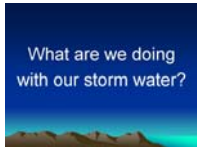


And this - of course, Australia, they got there before we did when it came to low water supplies. So, this is an example of a golf course that catches its storm water and stores it and uses it. Now, this is more sophisticated.

This is also in Australia and on the website is posted their plan for water management in this whole district, and it's a really incredible, logical plan.



Kaurna Park Wetlands - Site for the Hidden - Edinburg Park Water Supply Project



What are we doing with our storm water? Somebody's backyard. Cleaning water out of their home. This is a rescue team from Green Valley. They didn't have vehicles to get in there, so they had to borrow a backhoe thing. And these are kids going home from school. Their home's not quite the same as it used to be.

Filling up back yards



Green Valley rescue had to borrow a back-hoe/tractor



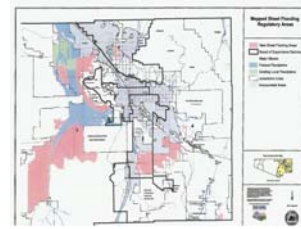
A tough trip home from school



Home is not quite the same!



Now, this is a map of the floodplains in Tucson. Now, the pink areas are what the Flood Department has called the new sheet floodplains, so this is the region, one of the regions that I'm speaking of, which is south of Sahuarita Road, but these areas exist all over Tucson, and if you notice even part of it is a FEMA floodplain areas. So, this is not rainwater harvesting. This is serious storm water and flooding.



Why is amount of flood water increasing?

Maintenance issues:

- Ditches filled in along roads
- Washes silted up
- Culverts clogged up

Key issues:

- Swiftly moving water creates hard-pan
- New roads and housing developments

And, of course, many people in Tucson are stopped by not being able to get home from their jobs when there is a big rain storm event. And I will mention that this particular area - I'm sure they all have their own stories - it was settled in the '70s. A lot of the people there worked for

Hughes, and they wanted to get away

from it all. And during the 1983 and the 1993 storm events, they had no problems at all with flooding.

So, there's new water being created, and why is this flood water increasing?

Another moonscape due to flood water flows



Land turned into hard pan from fast flowing water



Some of it is definitely maintenance issues. In this region, the ditches are filled up along Sahuarita Road, washes are silted up. Washes that used to be six feet are now two feet, culverts are clogged up. Some people swear that the ditches haven't been cleaned out in 20 years.

A new development in a sheet flood plain without a single flood management facility



Damage at Wilmont and Sahuarita Rd. due to flood waters

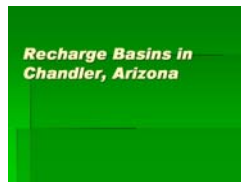


Now, there are some key issues. Swiftly-moving water creates hardpan, so it's going to move swifter. And also new roads and housing developments. Now, this is a piece of State Trust Land just to see the hardpan that's been created by swiftly-moving water moving over it in that same region. New developments.

Now, this is actually along Wilmot and Sahuarita Road. There's been a lot of development on Wilmot, and this is what the result has been. And, as you can see, a lot of this water is delivering down Sahuarita Road downhill.

How much water do we have?
No one knows — here's a couple of possibilities:
Santa Rita Rd-Delgado Region = 1,000 acres
• Rain events = 6 inches to 3 feet of overflow
• Excess = 1 ft over 1,000 acres = 1,000 af
Same scenario: Wilmot to Country Club

So, how much water do we have in these floodplains? I mean, really no one knows. But, the region that I'm working with - there's about 1,000 acres involved. In rain events, there's six inches to three feet of overflow, and I'm talking about overflow. What's left of the washes and the ditches are totally full. So, we ves us 1,000 acre-feet of water and that is in the one region, and then there's another region from Wilmot to Country Club, the very same scenario. And this is 1,000 acre-feet of water every time it rains a good monsoon rain, four times this year.



Turf isn't necessary, river rocks work



Now, they have recharge basins in Chandler. And I used to live in Chandler, and I just think they were doing a super job there. You don't have to use turf with recharge basins; some of those use the rocks.

Sand and plants work too!



Recharge basin #1 in Chandler —
A soccer field



Now, this is actually a soccer field, and this soccer field is a recharge basin. And what happens when it rains? Well, nobody plays soccer for two days, you know; it's just the reality. And then how - oh, you make sure the water infiltrates. You notice the dry wells on the far end because it delivers down to this end and there's mandated to have the water cleared in 48 hours because

mosquitoes will form in 36 hours. What do you do if, historically, traditionally doesn't clear? Simple. You put in another dry well. This is another recharge basin; it's got parts and metal equipment.

Dry wells on low end of field —
Enough to clear water in 48 hours



Now, as it turns out, Chandler has 3,763 dry wells in it, which is, you know, it happened over a long period of time; it didn't happen overnight. What's the cost of a dry well? Ten to \$15,000 each. Now - and this shows how the dry wells are mainly just in the open green space. And the historical recharge estimate for this area when it was under agriculture and not

used for housing, the recharge was 191 acre-feet annual. Now they're getting 3,600 to 4,600 acre-feet, and this is what they call "incidental." These are places that had flooding; they put in a dry well to take care of the flooding problem. They really weren't attempting to augment the groundwater recharge.

Recharge basin #2—
A neighborhood park with picnic facilities



Other projects in Arizona, it's Tucson, kind of fuzzy photo, but there it is, Kino storm water project; that's in 2001; and there it is in 2005; that catches storm water to use for the ballpark.

And this is El Coronado Ranch in Cochise County, before picture, and notice those stubs, those stubs are actually branches of a willow tree that - not rooted or anything; after picture.

The park has metal play equipment



Drywells by land use classification

Land Use	Total Drywells (estimate)
Single Family Residential	1548
Multi Family Residential	470
Commercial	545
Industrial and Airports	101
Schools, Churches, Hospitals	512
Infrastructure	105
Parks, Golf Courses	107
Agriculture	16
Water	113
Desert, Vacant Land	245
Total	3763

And now we've been talking

about rural area. I want to just quickly give this information on Santa Monica, which did a storm water recycling facility. Santa Monica, as it turns out, has 12 inches of rain per year, the same as Tucson. And I'm just going to go through it quickly, just to show you what you have to go through when

Santa Monica Urban Runoff Recycling Facility

(Note: Santa Monica has 12" of annual rainfall, same as Tucson)

- Reuse a local water resource.
- Keep a pollution source out of Santa Monica Bay.
- Reduce imported water supplies & impacts on other watersheds.
- Open, walk-through facility to educate the public.
- Up to 500,000 gallons/day, avg. is 325,000
- 3% of City's daily water use.
- \$12 Million
- \$175,000 O&M



you're filtering and catching urban storm water. But, there is an interesting story here, and that is look at, they got their money from so many different sources, that ISTEA is a federal pool of money - considered with transportation, but also EPA has funds, but basically we're thinking about projects upstream.

We're in a basin, all the water is flowing downstream to us. If we get the flooding taken care of in the perimeters, then there's going to be less flooding in Tucson itself.



"after" — a wonderful riparian habitat



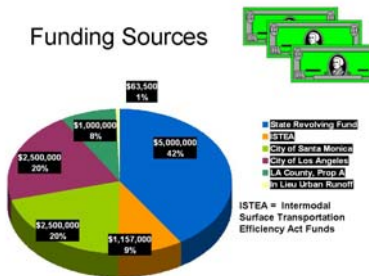
And I ran across in the - from Douglas County, the Colorado Storm Water Management Website, a little paragraph that is just so appropriate.

"Nature has claimed a prescriptive easement for floods via its floodplains that cannot be denied without public and private cost. Flooding can result in loss of life, increased threats to public health and safety, damage to public and private property, damage to public infrastructure and utilities, and economic impacts to residents of the County. In contrast, natural floodplains provide many benefits to the citizens of the County, including natural and attenuation of flood peaks, water quality enhancement, groundwater recharge, wildlife habitat, and movement corridors for wildlife, and opportunities for recreation."

Estimated groundwater recharge summary

Historical recharge estimate	= 191 acre feet annual
Stormwater runoff from Dry wells	= 2610-3320 (afa)
Turfgrass and Agriculture Infiltration (from precipitation)	= 1290 (afa)
Potential Enhanced Groundwater Recharge	= 3900-4600 afa

So, I want to think of this storm water as an asset and that we can use as recharge in some areas, and recharge the water where it is instead of moving it around and paying for a lot of infrastructure. Thank you.



The price is high for collecting urban stormwater

Tobacco is a toxin, and if we collect water in the peripheral regions, we will help the flooding in Tobacco Road.

Advantages:

- Lower cost of recharge facilities
- No water going to the Santa Cruz River, creating both pollution and flooding concerns

However, Santa Monica was able to tap into a variety of funding sources:

Floodplain Philosophy

Nature has claimed a prescriptive assessment for floods, via its floodplains, that cannot be denied without public and private cost. Flooding can result in loss of life, increased threats to public health and safety, damage to public and private property, damage to public infrastructure and utilities, and economic impacts to the residents of the County. In contrast, natural floodplains provide many benefits to the citizens of the County, including natural attenuation of flood peaks, water quality enhancement, groundwater recharge, wildlife habitat and movement corridors, and opportunities for recreation.

—From Douglas County, Colorado Stormwater Management website

Nancy Freeman
Groundwater Awareness League
www.g-a-l.info

CHAIRMAN JIM BARRY: Thank you, Nancy. Very good. (Applause.)

CHAIRMAN JIM BARRY: Very informative. Okay. We're going to do Call to the Audience.

* * * * *