# Seeking Sustainability:
## Managing Water in a Changing World

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***Brian Richter***
***Director, Global Freshwater Strategies***

# Global Annual Water Cycle


Percentages reflect proportion of total available rainfall (combined green and blue water).

Series: VIZUALIZING WATER
Title: Global Water Flows, Slide 2
Created by: Brian Richter, Jason Pearson
Reference: 2012.WATER.GLOBAL.02

Version: 16
Date: Sep 06 2012

Sources: Cooper et al. (ASHRAEJ 2012); Döll (ERL 2009); Mekonnen and Hoekstra (UNESCO-IHE 2011); Molden et al. (IWMI 2007); Shiklomanov (IWRA 2000); Solley et al. (USGS, 1998)



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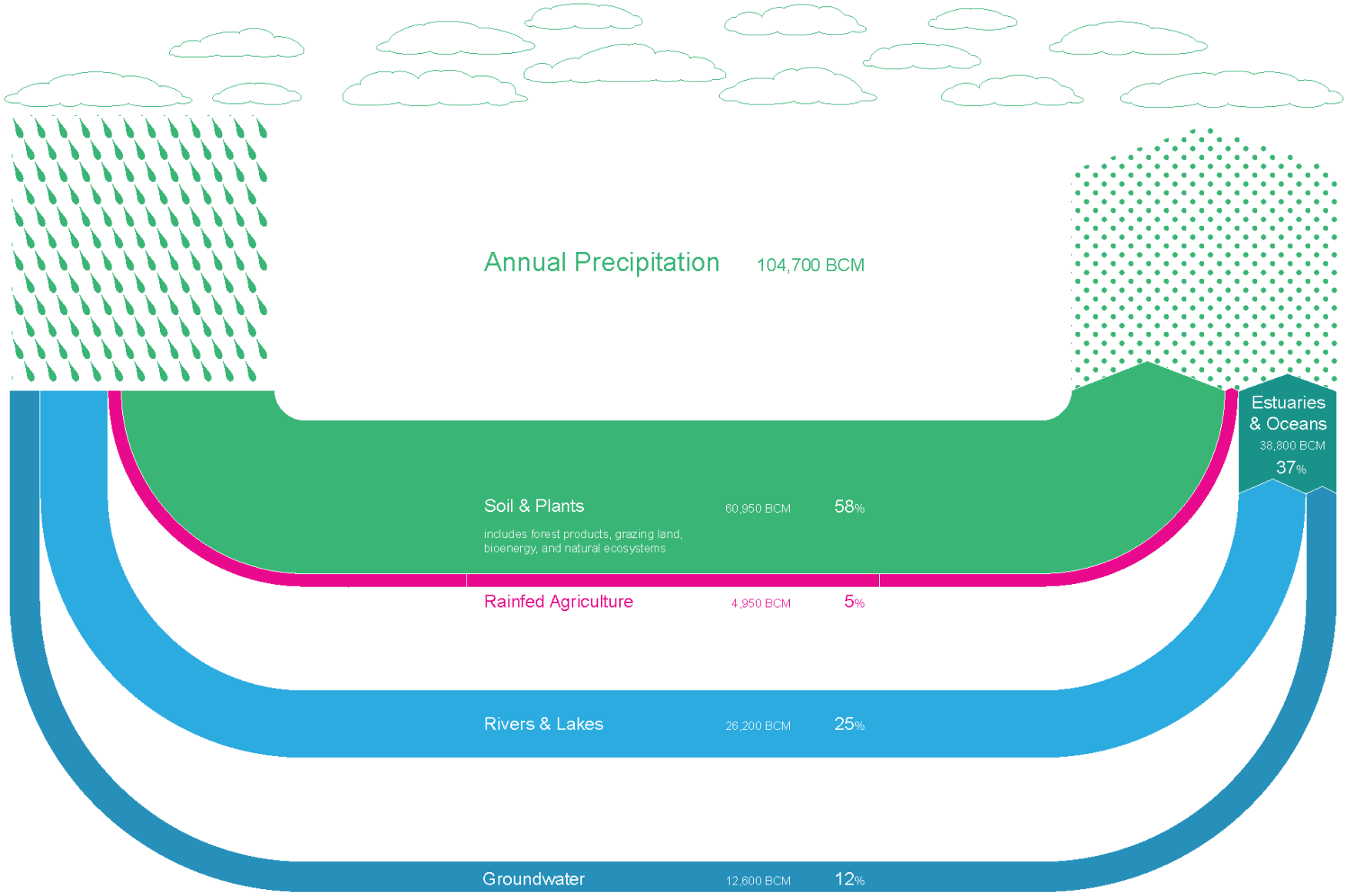
# Global Annual Water Cycle




Percentages reflect proportion of total available rainfall (combined green and blue water).

Series: VIZUALIZING WATER
Title: Global Water Flows, Slide 3
Created by: Brian Richter, Jason Pearson
Reference: 2012.WATER.GLOBAL.03

Version: 16
Date: Sep 06 2012

Sources: Cooper et al. (ASHRAEJ 2012); Döll (ERL 2009); Mekonnen and Hoekstra (UNESCO-IHE 2011); Molden et al. (IWMI 2007); Shiklomanov (IWRA 2000); Solley et al. (USGS, 1998)



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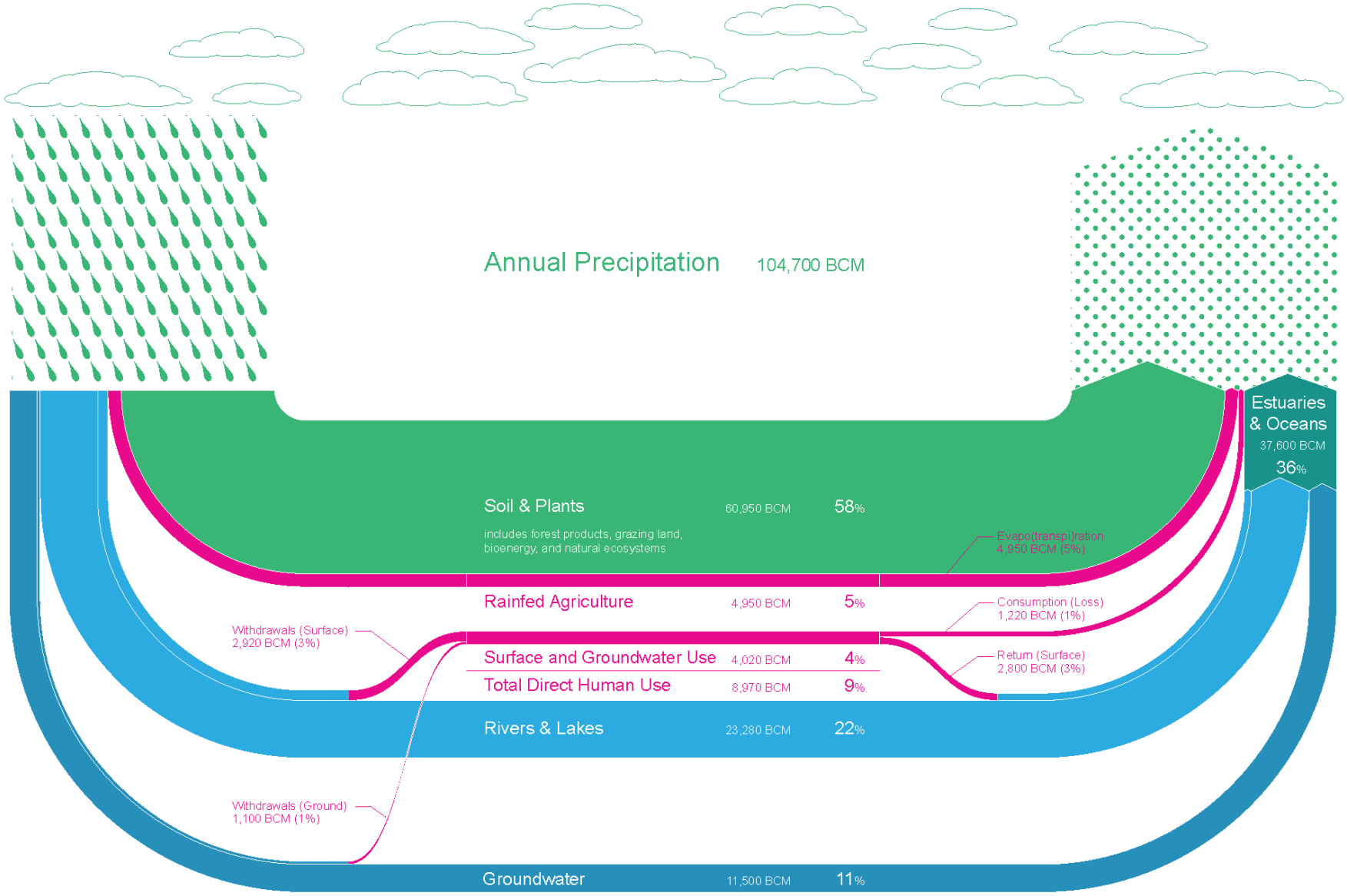
# Global Annual Water Cycle




Percentages reflect proportion of total available rainfall (combined green and blue water).

Series: VIZUALIZING WATER
Title: Global Water Flows, Slide 4
Created by: Brian Richter, Jason Pearson
Reference: 2012.WATER.GLOBAL.04

Version: 16
Date: Sep 06 2012

Sources: Cooper et al. (ASHRAEJ 2012); Döll (ERL 2009); Mekonnen and Hoekstra (UNESCO-IHE 2011); Molden et al. (IWMI 2007); Shiklomanov (IWRA 2000); Solley et al. (USGS, 1998)



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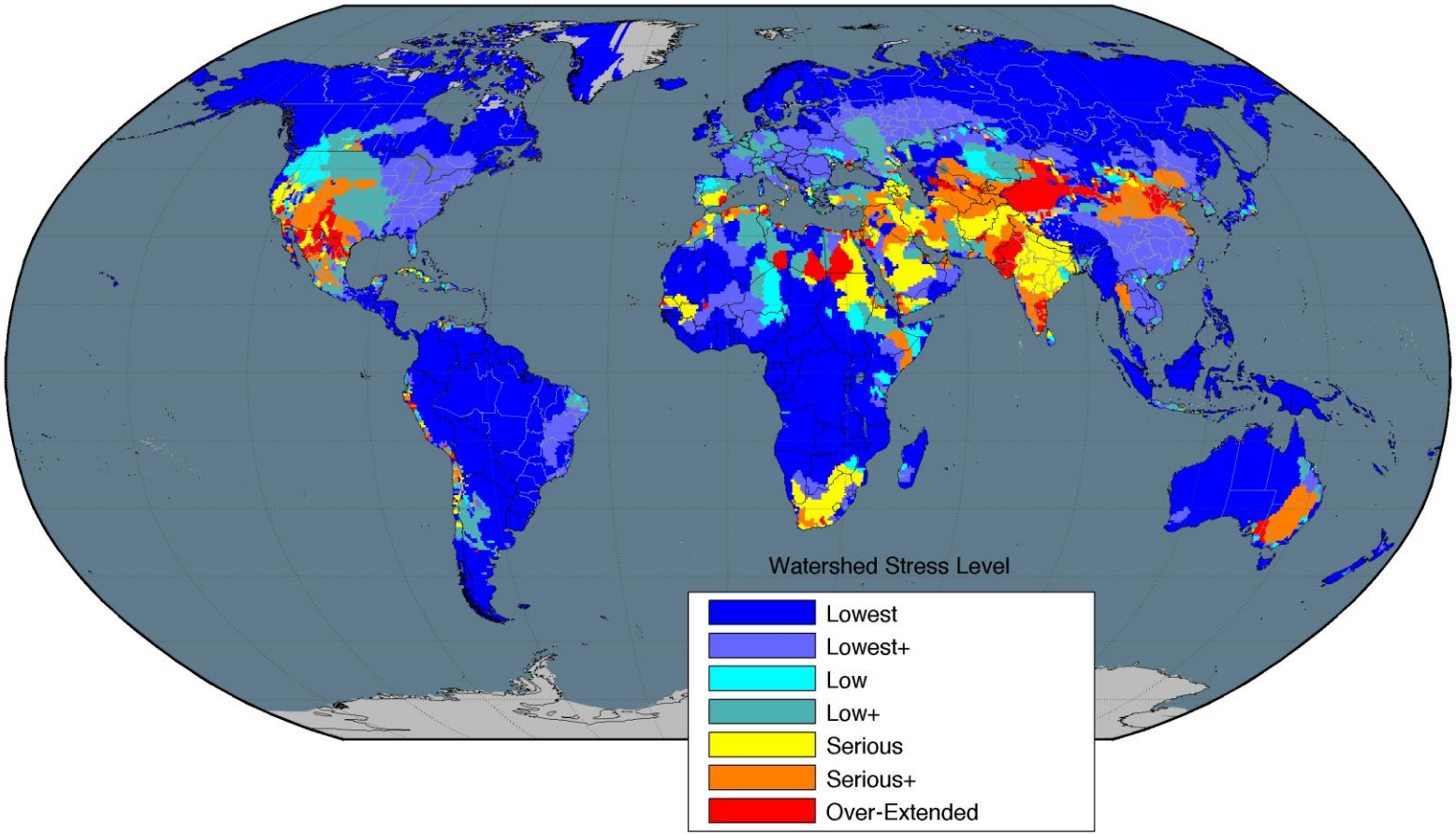
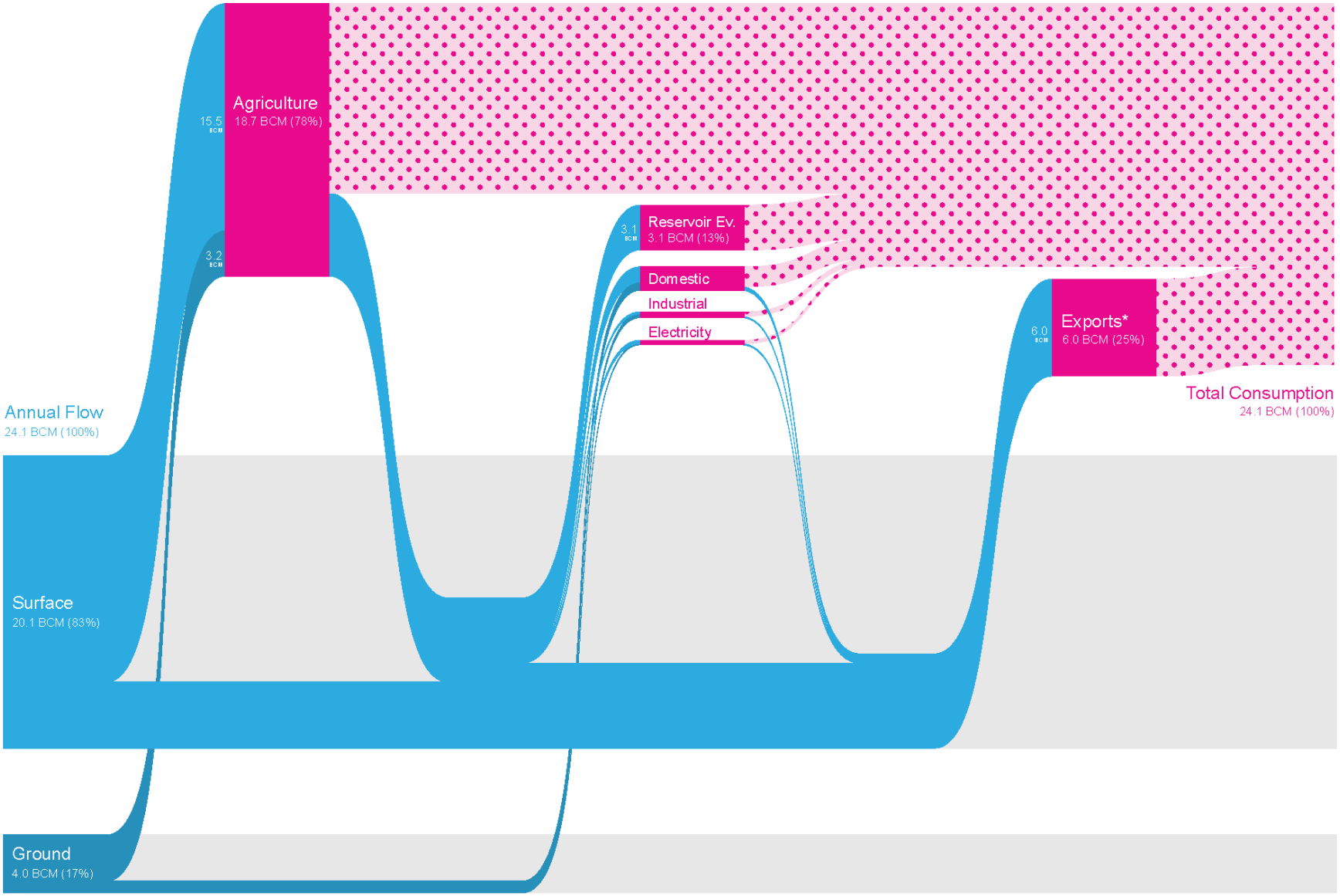
# Water Scarcity



# Colorado River Basin : Withdrawals and Consumption




Percentages reflect proportion of total available blue water (surface and ground).

*Exports are estimated at 6.8 BCM (28% of annual blue water flow), but have been reduced to 6.0 BCM (25% of annual flow) in this diagram to reflect 100% consumption of annual flow. The additional 0.8 BCM (3%) of estimated consumption would represent depletion of existing stocks, but this amount is sufficiently small to be within the margin of error of estimation and has therefore been removed to simplify the diagram.

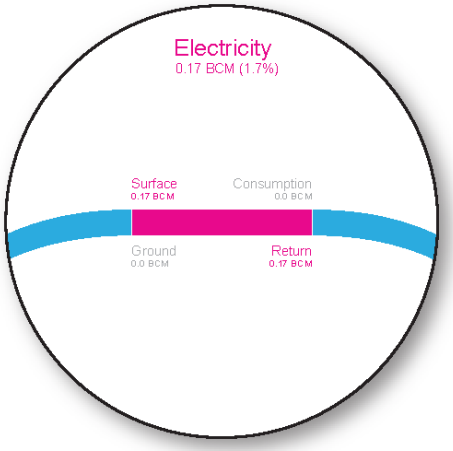

Series: VIZUALIZING WATER
Title: Colorado River Basin, Slide 6
Created by: Brian Richter, Jason Pearson
Reference: 2012.WATER.COLORADO.06

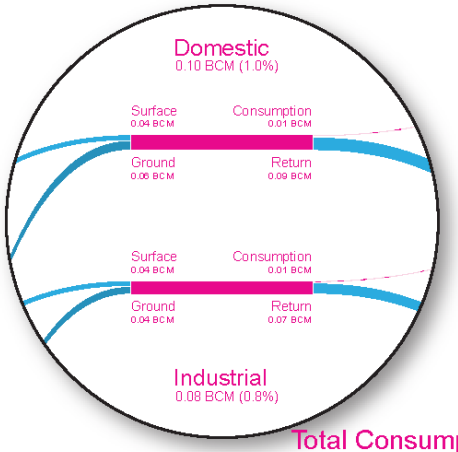
Version: 16
Date: Sep 06 2012

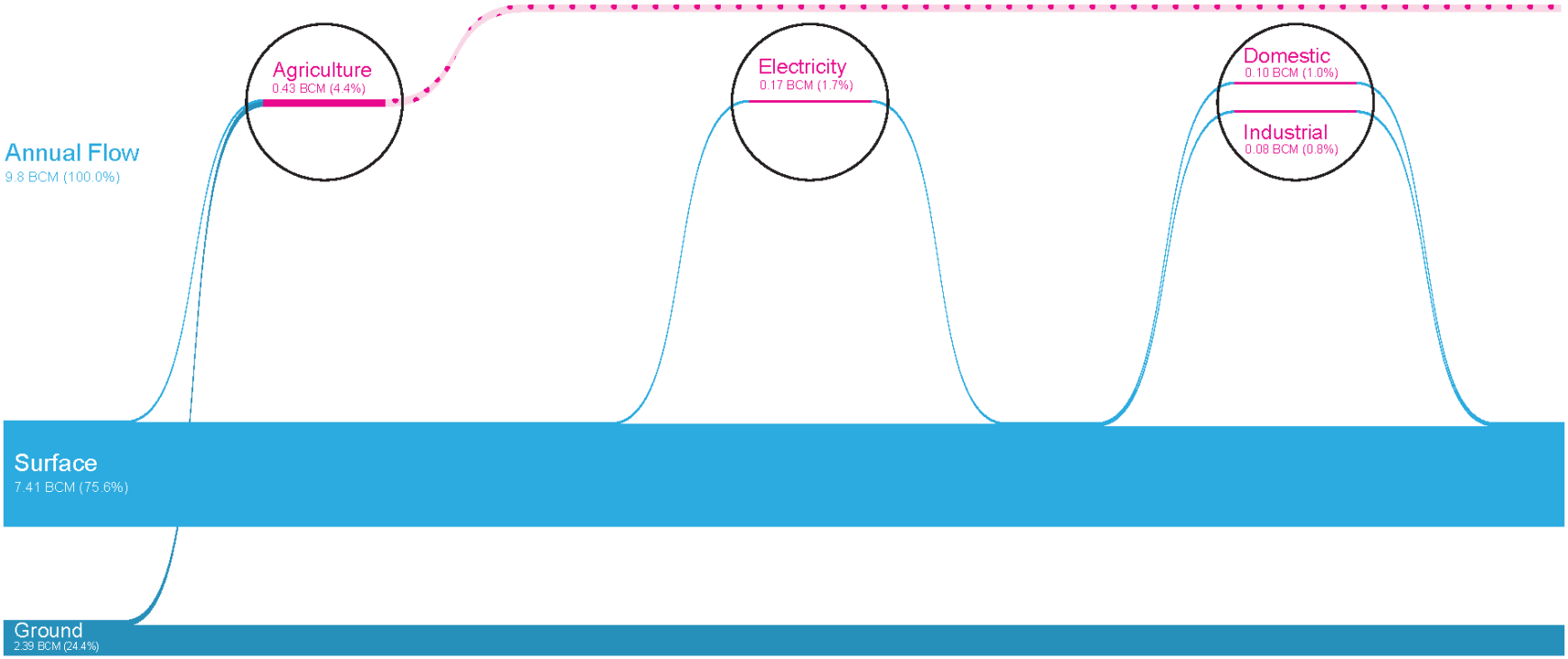
Sources: Cooper et al. (ASHRAEJ 2012); Döll (ERL 2009); Mekonnen and Hoekstra (UNESCO-IHE 2011); Molden et al. (IWMI 2007); Shiklomanov (IWRA 2000); Solley et al. (USGS, 1998); USDoI (2004, 2011).

Photo: Jonathan Waterman

# ACF River Basin : Flint River


Percentages reflect proportion of total available blue water (surface and ground).

Series: VIZUALIZING WATER
Title: ACF River Basin, Slide 5
Created by: Brian Richter, Jason Pearson
Reference: 2012.WATER.ACF.05

Version: 16
Date: Sep 10 2012

Sources: Cooper et al. (ASHRAEJ 2012); Döll (ERL 2009); Mekonnen and Hoekstra (UNESCO-IHE 2011); Molden et al. (IWMI 2007); Shiklomanov (IWRA 2000); Solley et al. (USGS, 1998); Maella and Fanning (USGS 2011); ACFS (Black & Veatch, 2012), US Army Corps of Engineers Unimpaired Flow Data Set



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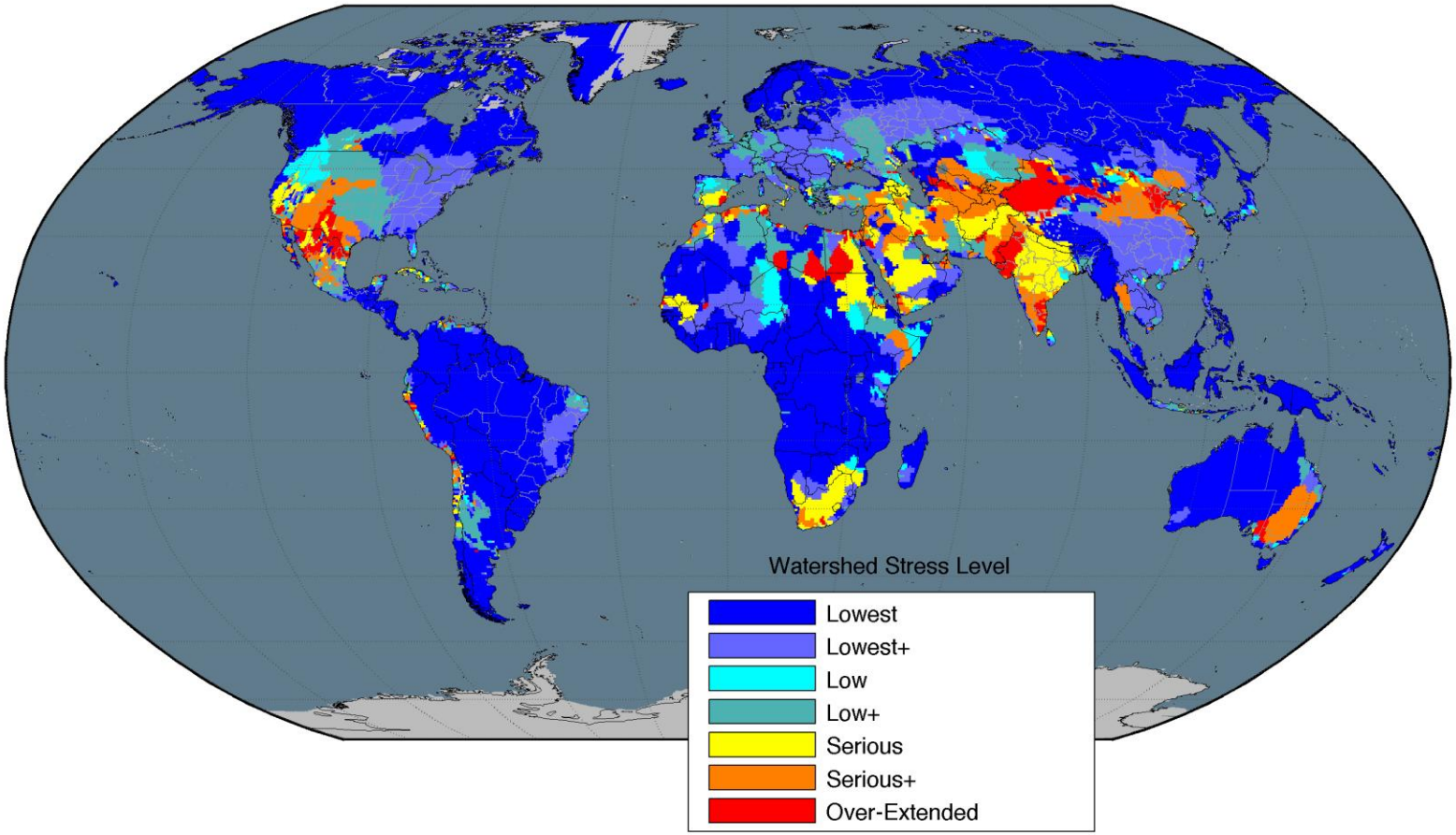
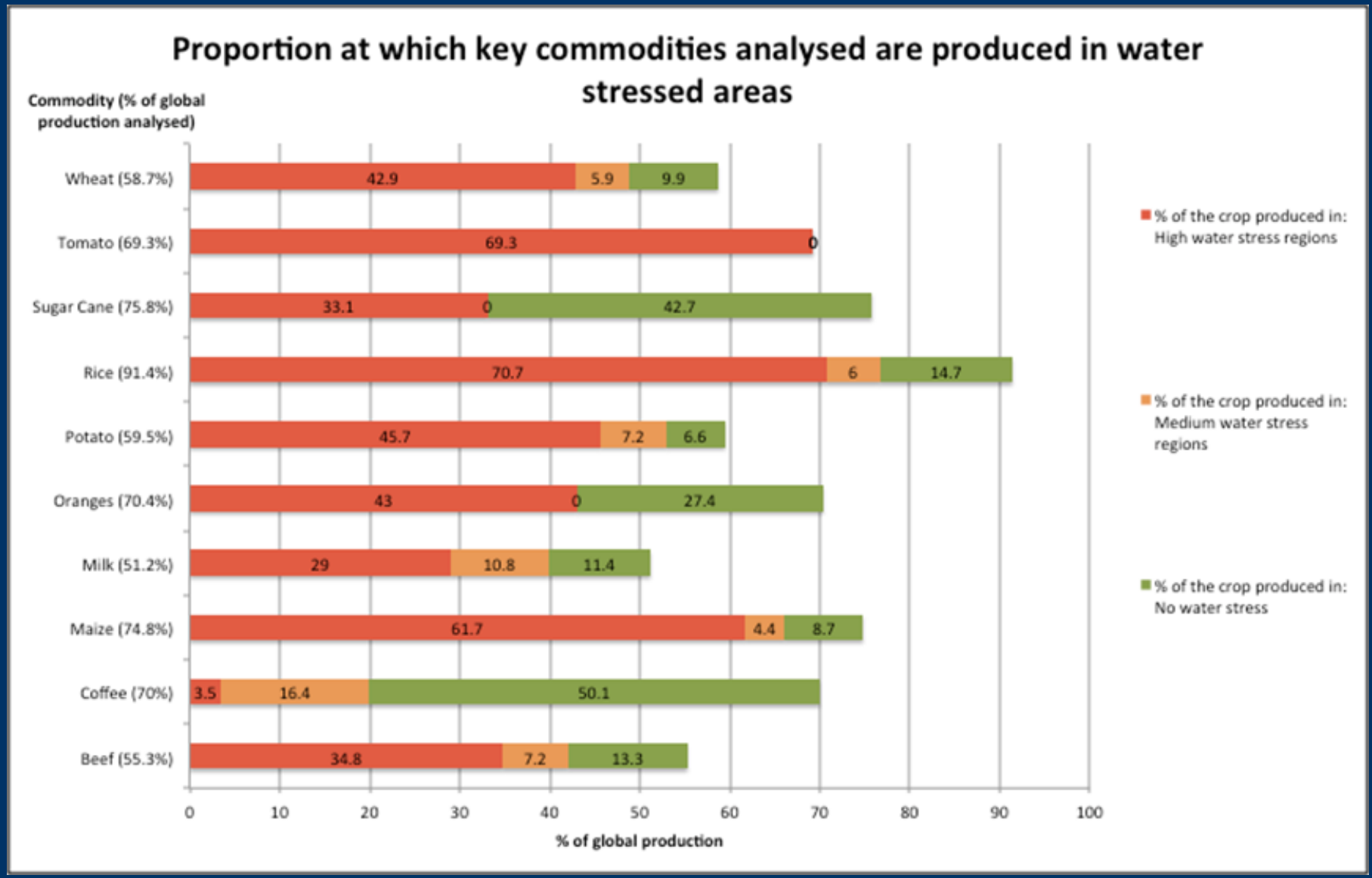
Photo: Steve Golladay

# Water Scarcity

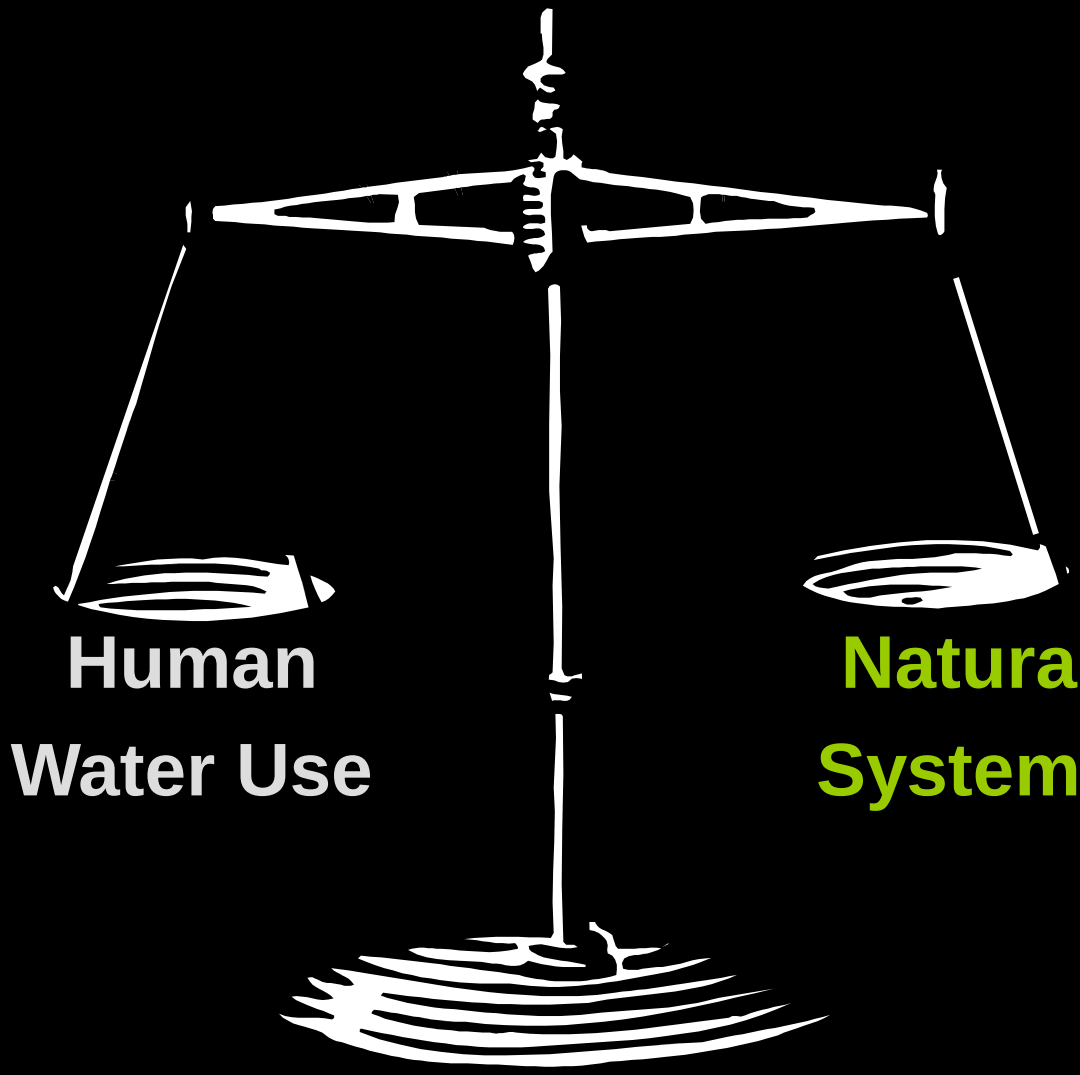



Only 15% of basins are water-scarce
But 50% of cities >100k population depend on them




Source: Marco Daniel, SAI Platform, 2012

# A Balance is Essential



# Blue River

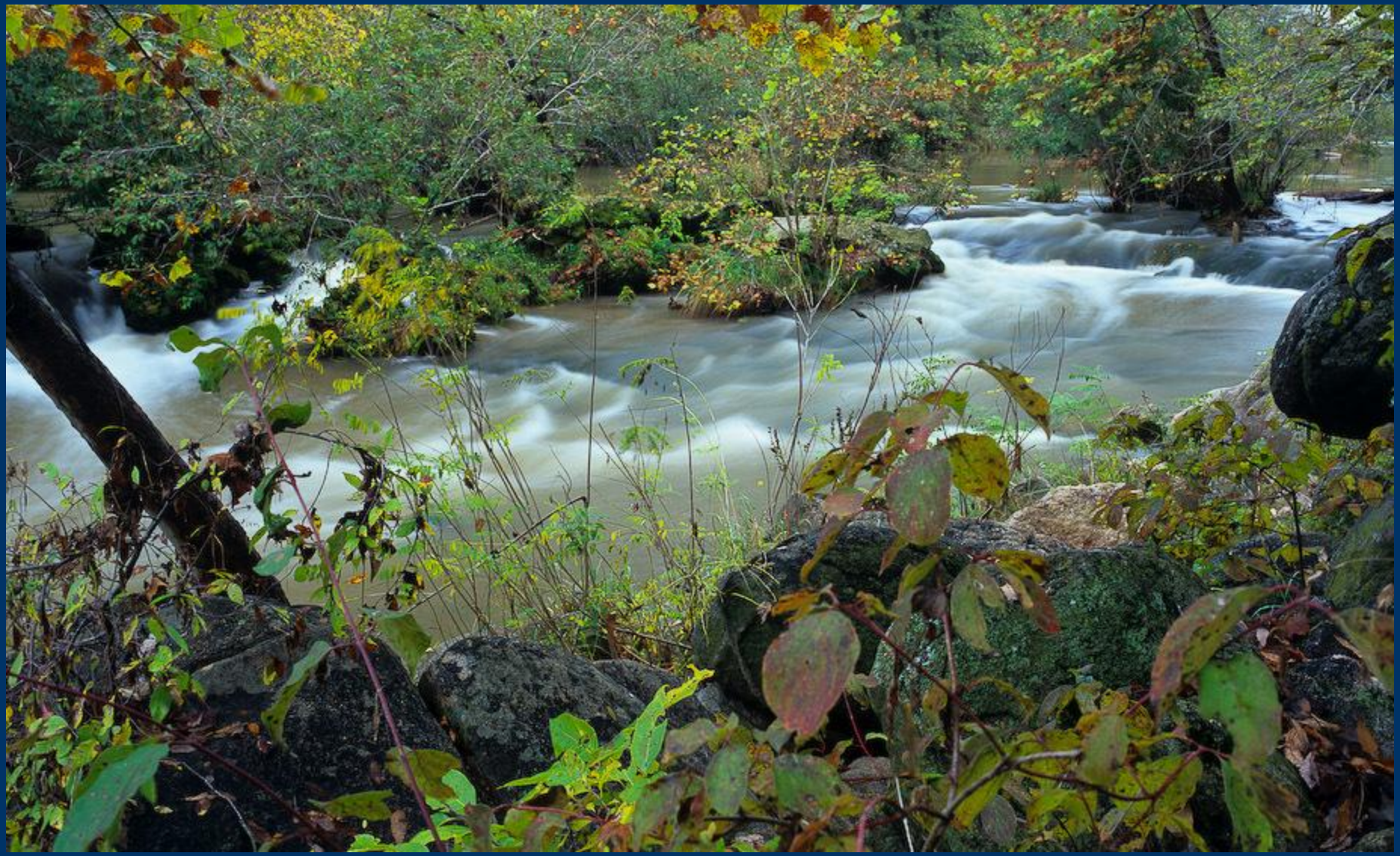


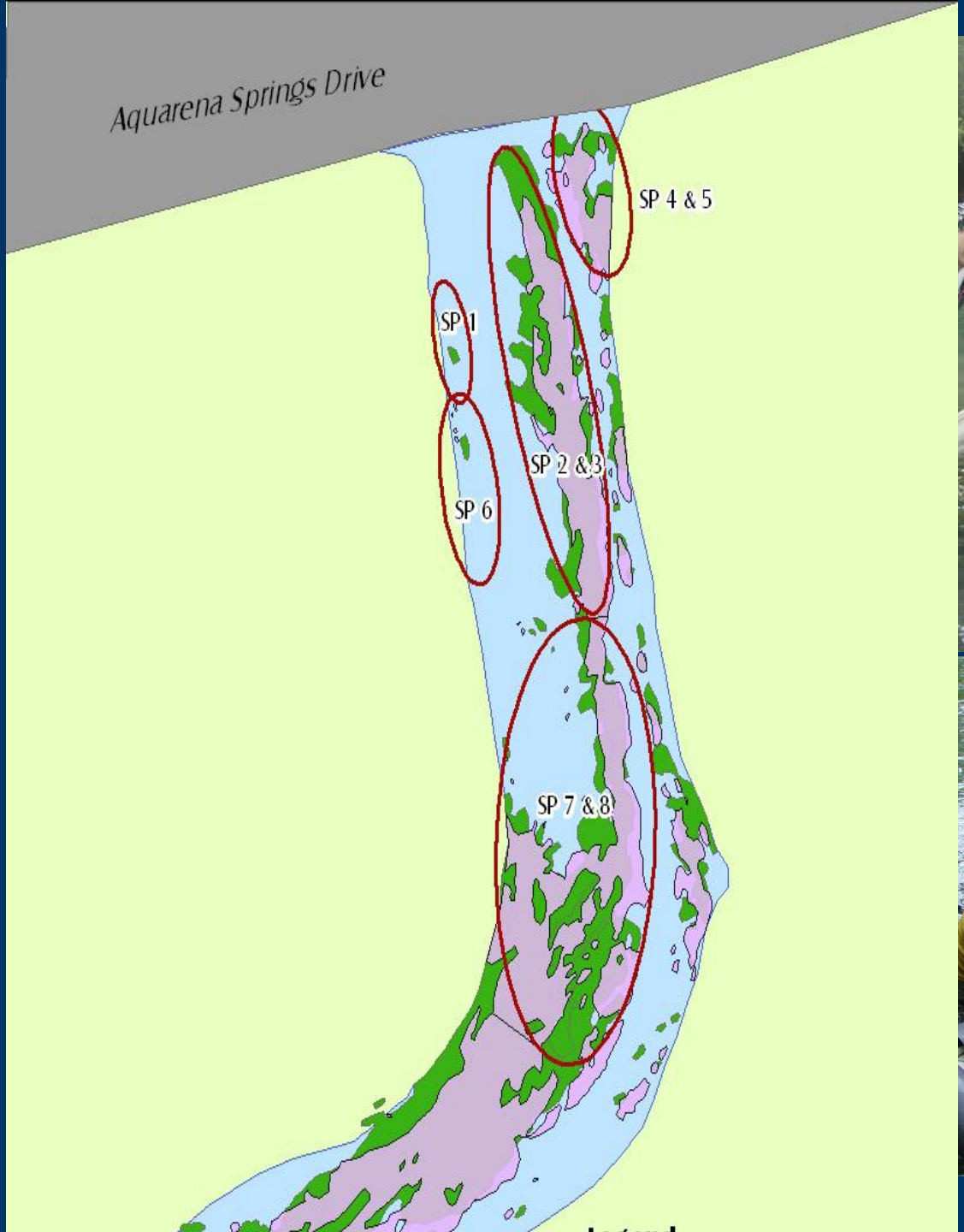
Photo: Kim Baker @ oklahomaphotography.com

# Oklahoma Rivers

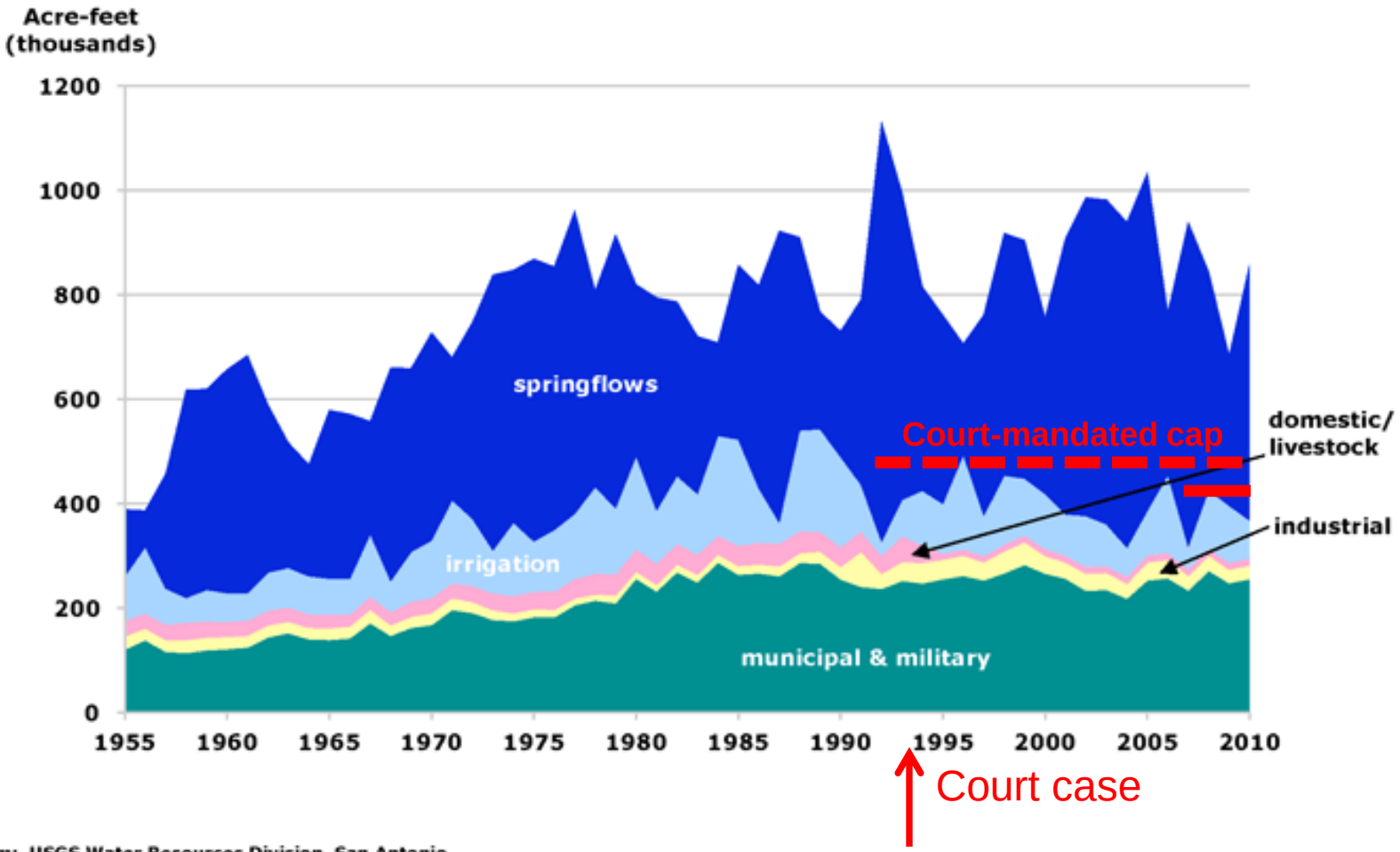
# The Edwards Aquifer Region

## San Antonio and Barton Springs Segments


Rogers River Resort.
San Marcos, Texas.


Aquarena Springs Drive
SP 4 & 5
SP 1
SP 2 &3
SP 6
SP 7 &8

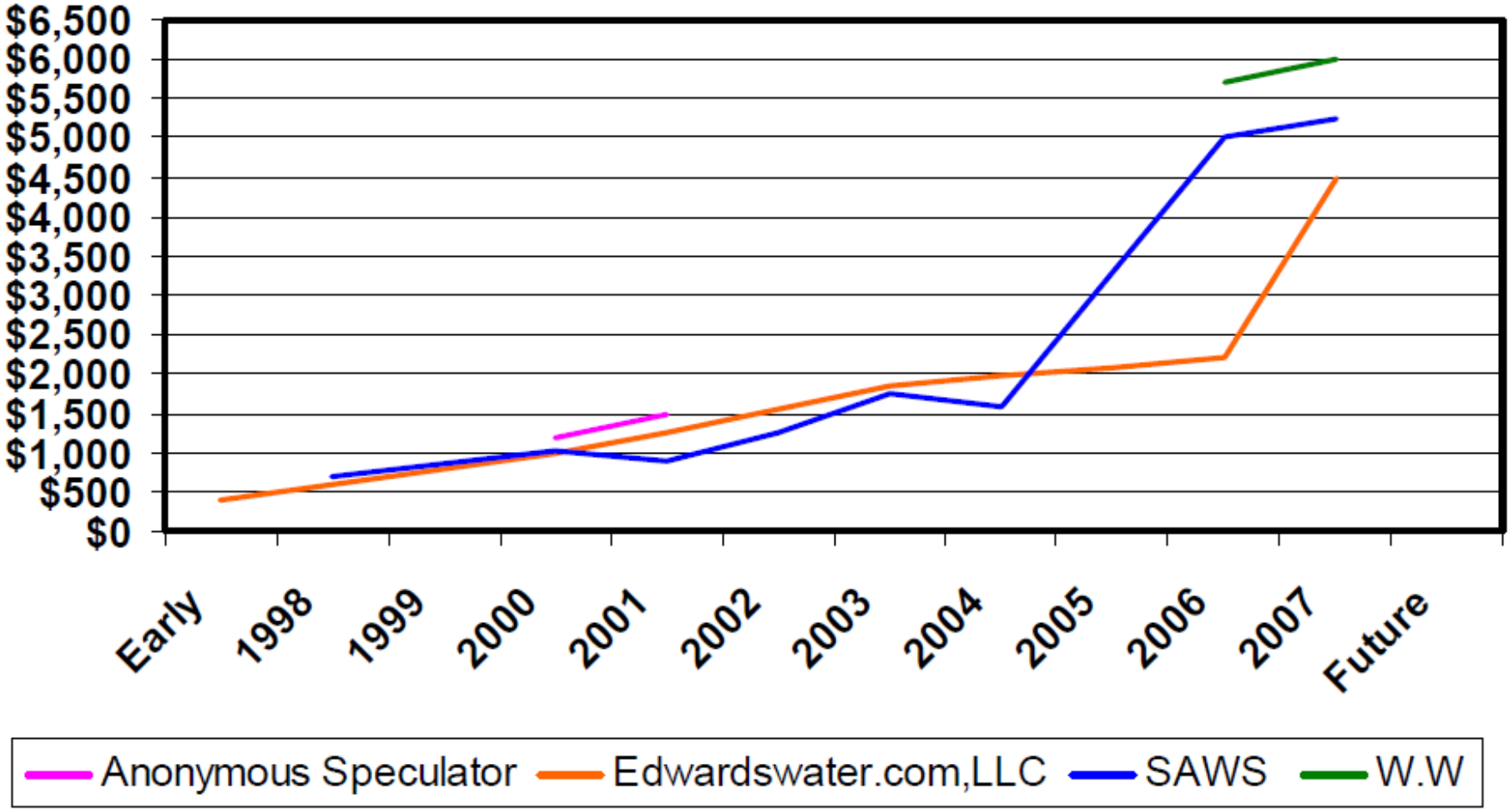
## Annual Discharge from the Edwards Aquifer by Use
1955 to 2010




data from: USGS Water Resources Division, San Antonio

## Market Players Price Points

Value has risen 6x in 10 years






CONSERVATION
Main
Drought Restrictions
Year-Round
Stage 1
Stage 2
Stage 3
Stage 4
Variance Requests
Outdoor Conservation Programs & Rebates
Indoor Programs & Rebates
Commercial Programs & Rebates
Your Role in Conservation
Ordinance
Conservation Case Studies
Calendar of Events
Request Information
LIKE US ON facebook
FOLLOW US ON twitter

# Drought Restrictions

San Antonio Water System uses drought restrictions, established by city ordinance, to proactively manage the region's water resources. The restrictions limit water use based on specific levels of the Edwards Aquifer. City Council approved new drought level triggers in 2009.

QUICK LINKS
Variance Requests
Low-Water Plant List
Ordinance
All Programs & Rebates

## Year-Round

Year-Round wateri
Aquifer level is abo
READ MORE

## Stage 1

Stage One begins
level at the monito
READ MORE

## Stage 2

Stage Two begins
level at the monito
READ MORE

## Stage 3

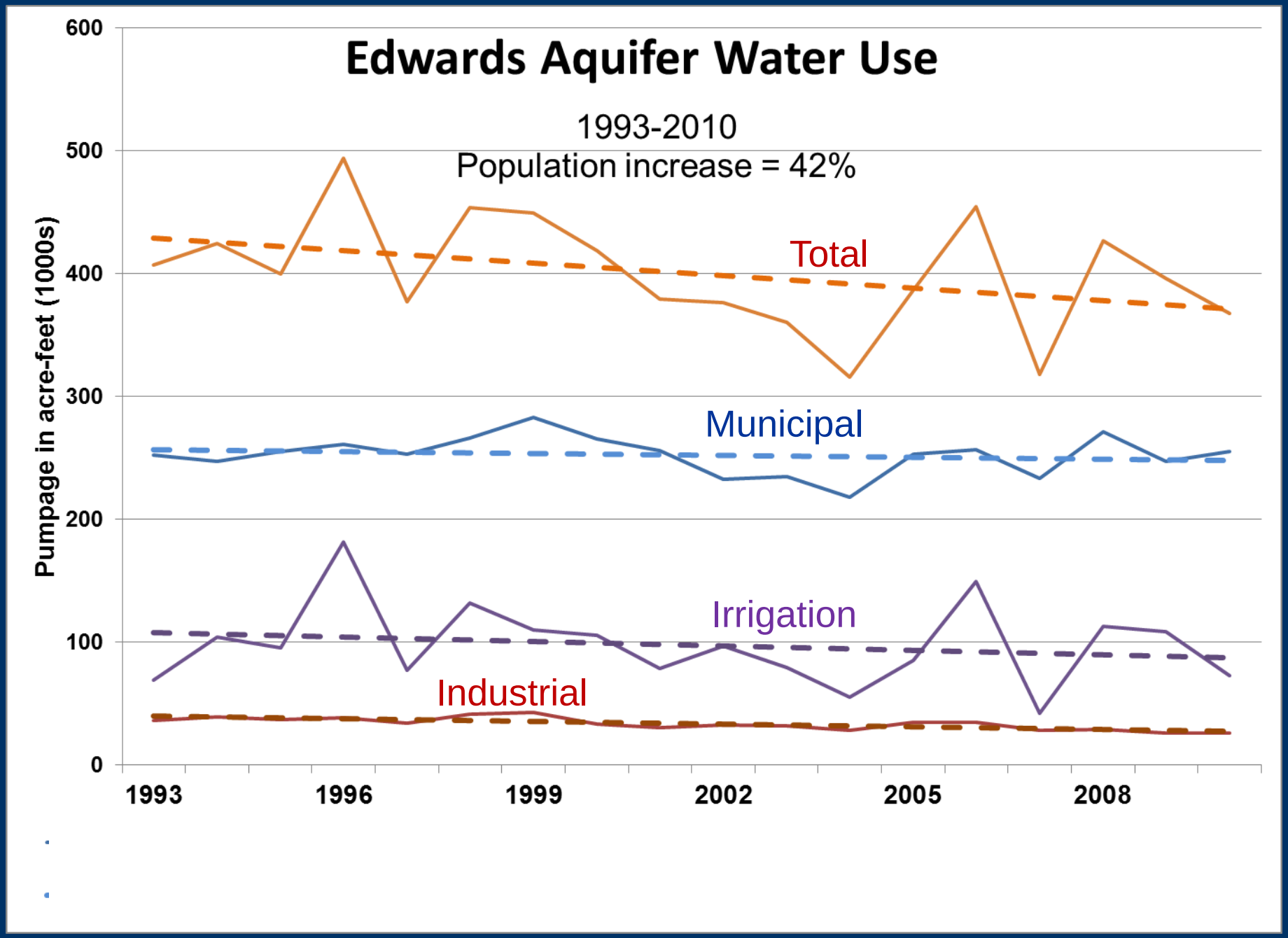
Stage Three begin
level at the monito
READ MORE

## Stage 4

Stage Four restrict
Manager upon con
Stage Three declar
READ MORE


Photo: Blake Gordon, TNC Magazine


GALLONS PER MINUTE
300
400
500
200
600
100
700
800
08-4-1232
19309
GALLONS X 100
HEMET, CALIFORNIA


Edwards Aquifer Water Use
1993-2010
Population increase = 42%
Total
Municipal
Irrigation
Industrial
Pumpage in acre-feet (1000s)
600
500
400
300
200
100
0
1993
1996
1999
2002
2005
2008

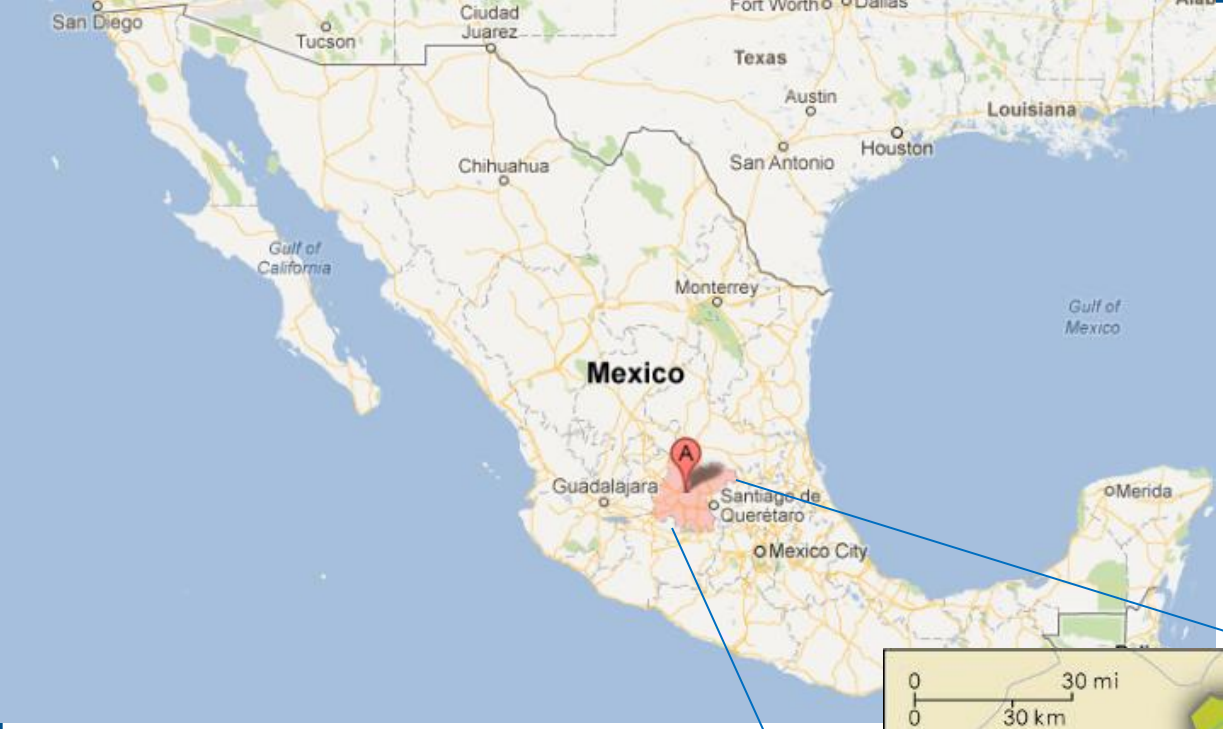
# Stepping Stones to Sustainability

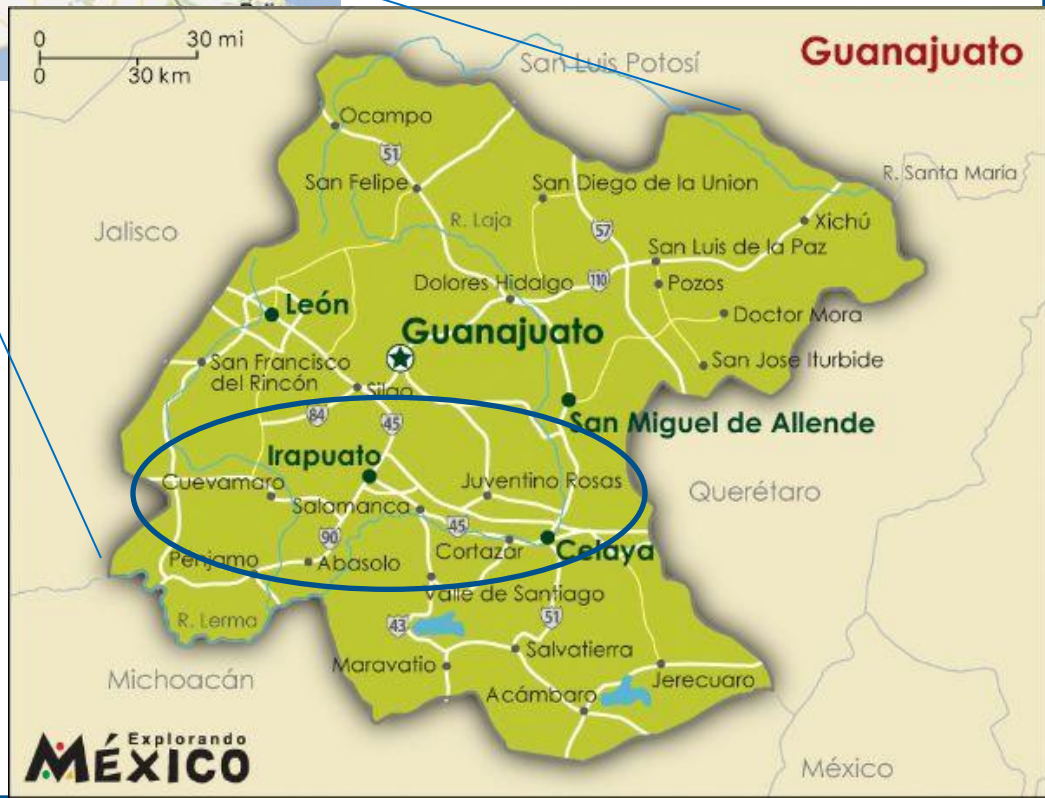
- Determine the volume of water use that provides optimal benefits for communities, companies, and ecosystems.
- Formally cap water allocations at that level.
- Clearly define water permit allocations for each water user. Monitor use. Enforce against overuse.
- If over-allocated already, develop a plan to reduce water consumption to the optimal level:
  - Invest heavily in water-conserving measures
  - Create a water market to facilitate trades
  - Buy down remaining water use as necessary to achieve cap

High Plains Underground Water Conservation District, Texas

# General Mills Pilot Site
# Irapuato, Mexico


# El Bajío Growing Region



# The Challenge: Growth and Aquifer Depletion

| Aquifer | Average annual fall of static levels (m) |
|---|---|
| Laguna Seca | 2.50 |
| Laja-San Felipe | 1.20 |
| Silao-Romita | 3.00 |
| Valle de León | 1.50 |
| Valle del Río Turbio | 2.00 |
| Valle de Celaya | 3.00 |
| La Cuevita | 0.50 |
| Valle de Acámbaro | 2.00 |
| Salvatierra | 1.50 |
| Irapuato-Valle de Santiago | 2.00 |
| Pénjamo-Abasolo | 3.00 |
| Lago de Cuitzeo | 1.00 |
| Moroleón-Cienega Prieta | 1.25 |
| Apaseos | 3.50 |
| **State Average** | **2.03** |

*Source: Jaime D. Hoogesteger van Djik, 2004*

# Action on the Ground: Drip Irrigation


www.nature.org/water