May 27, 2015

Role of Reuse in Valued Water Management:

Responding to the New Normal

Northwest Water Reuse Conference
Boise, ID

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Wastewater Practice Leader

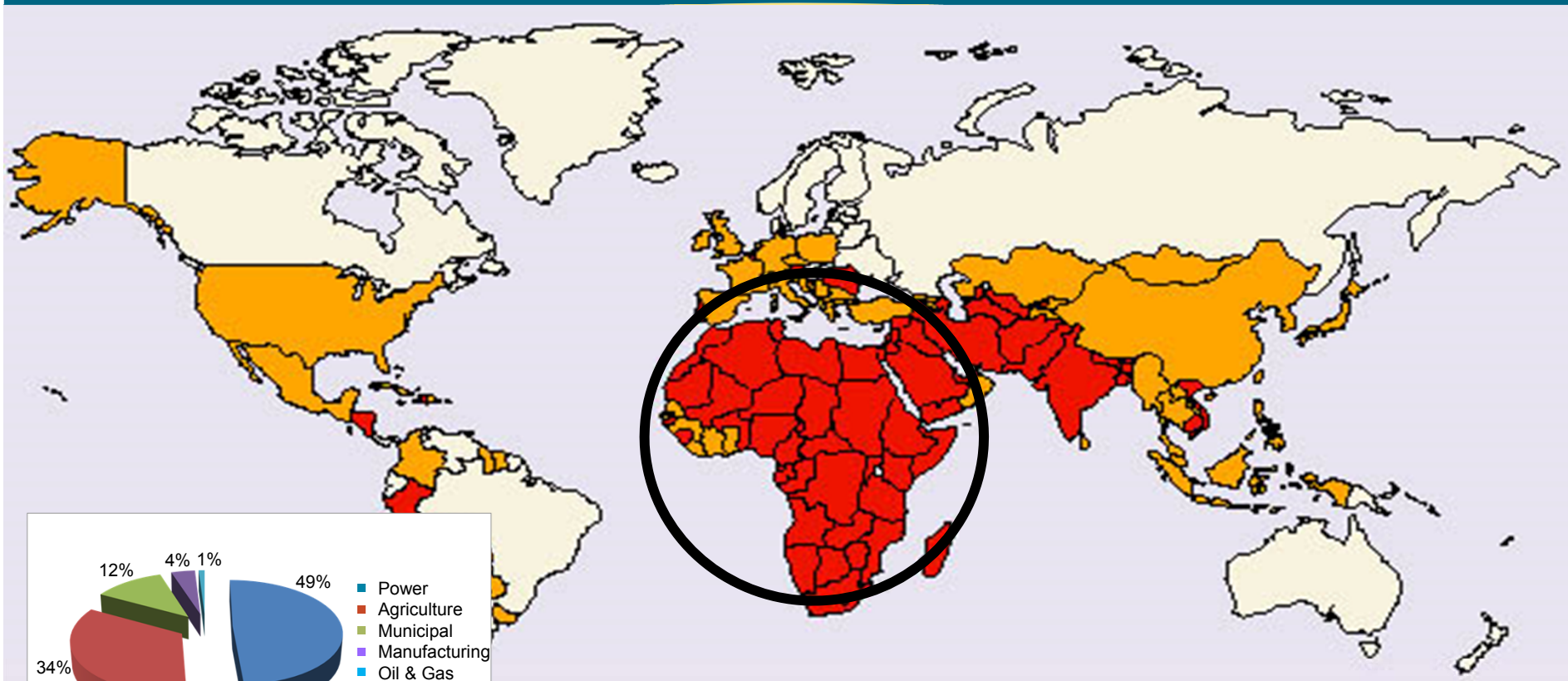
MWH®

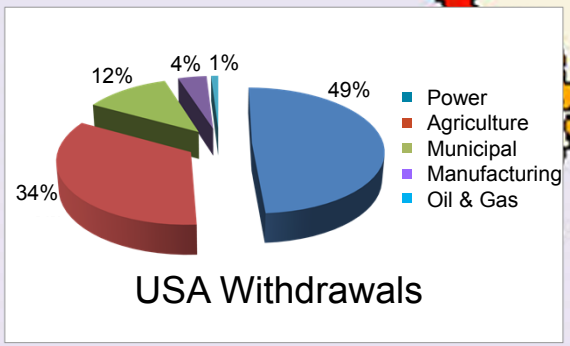
BUILDING A BETTER WORLD

Outline

- Perspective: The New Normal?
- The “One Water” Goal
- One Water Accounting
- One Water Assessment
- Case Study
- Integrating Virtual Water
- The reality of economics

World's Current Vulnerability to Water Scarcity

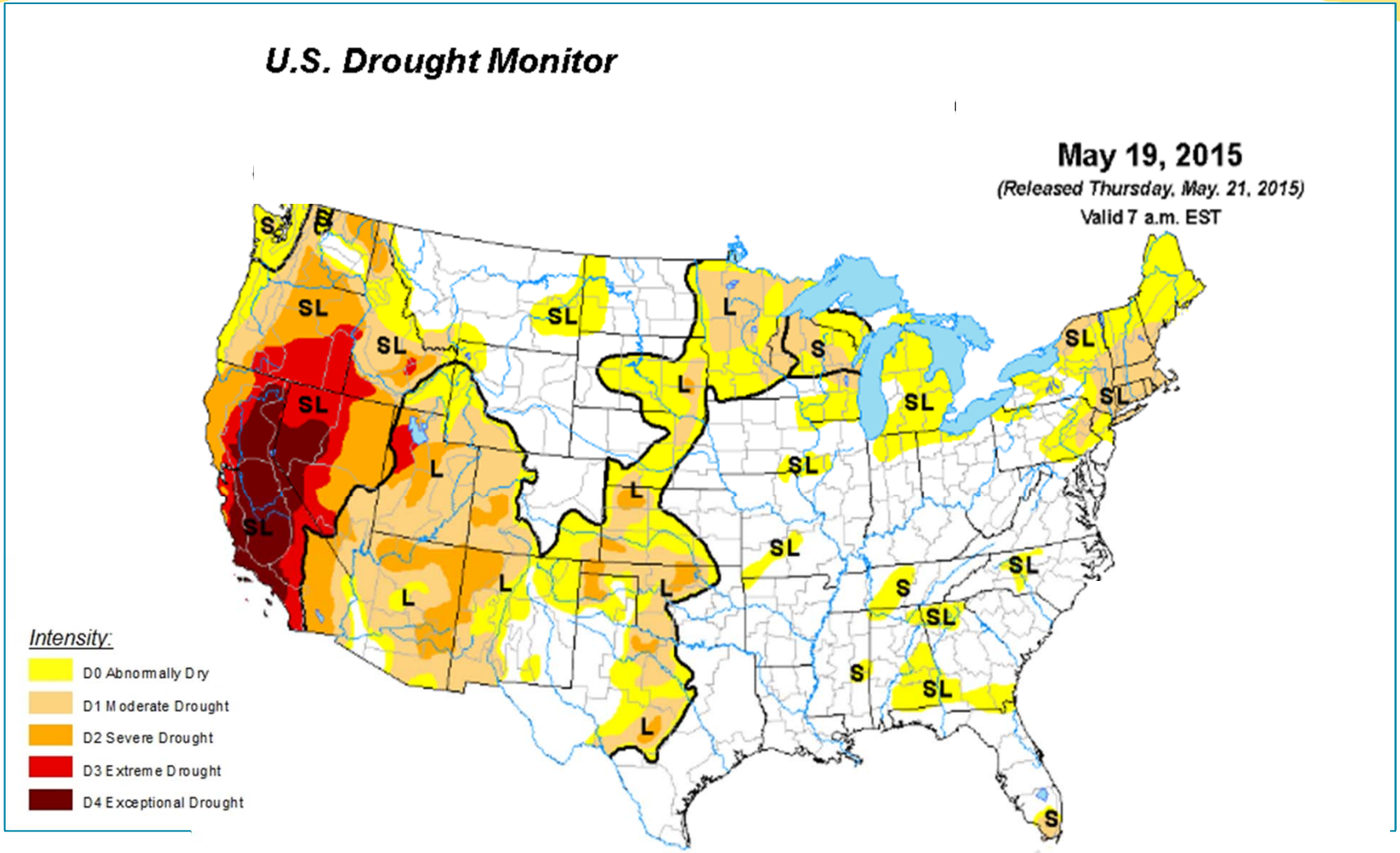




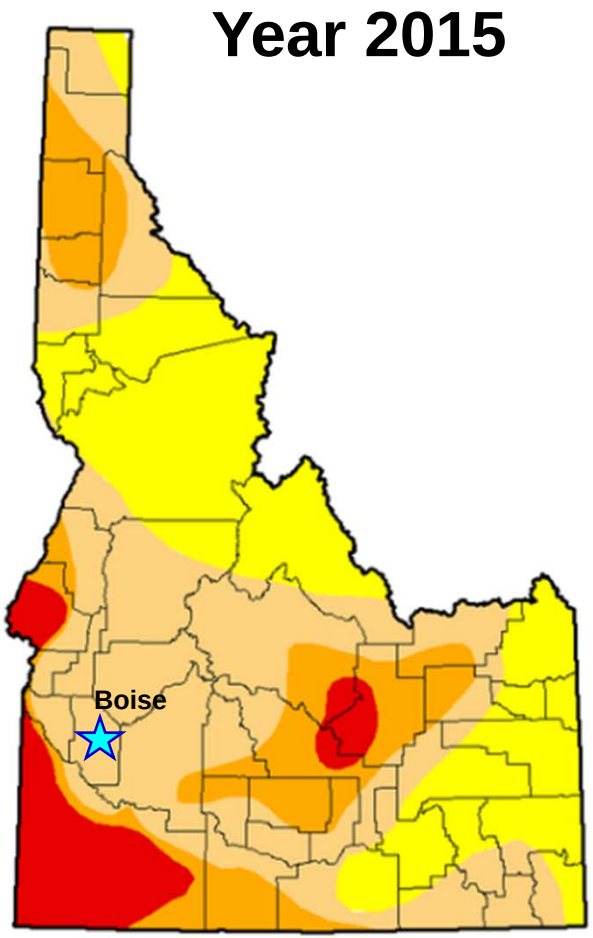
$$WSR = \frac{\text{Total Withdrawal}}{\text{Total Renewable}}$$

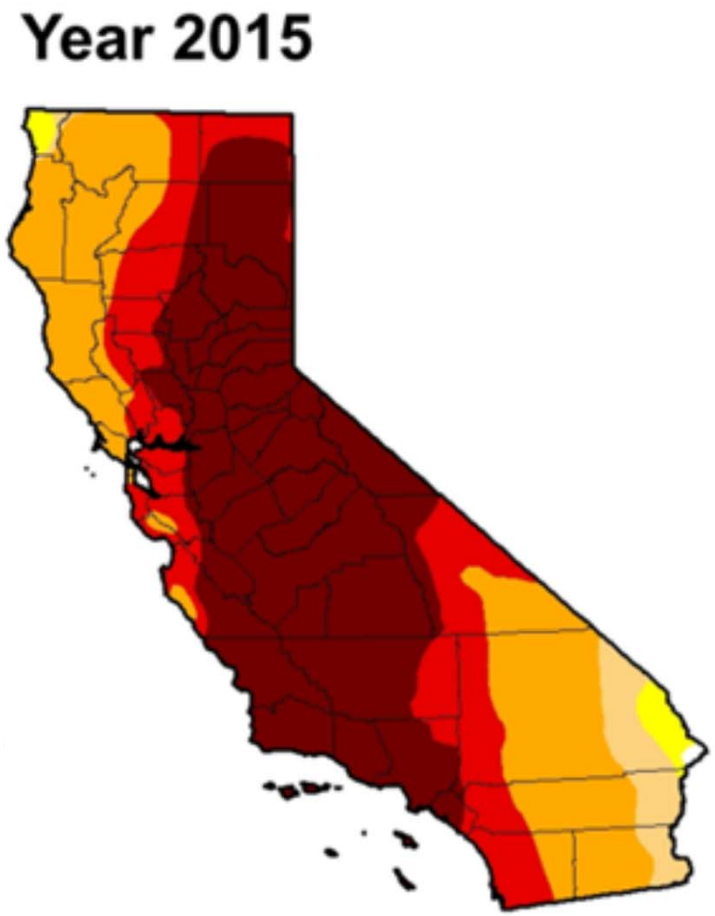
- Limited or no vulnerability to water stress
- Vulnerable to water stress
- High vulnerability to water stress

Drought Trends in the US



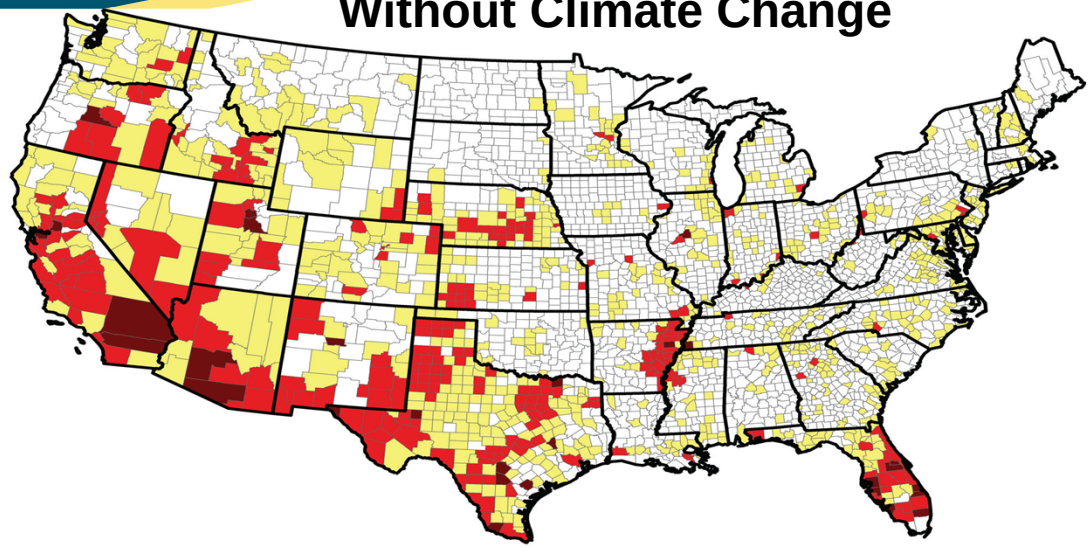
Unprecedented conditions are driving new ways of thinking



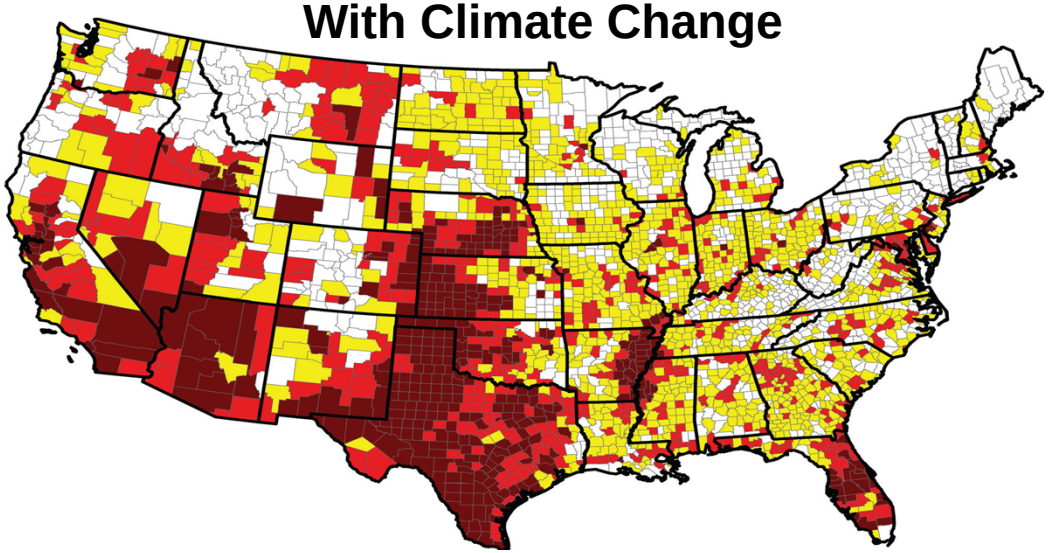


2050 Water Supply Sustainability Index

Without Climate Change



With Climate Change



Risk based on :

1. Water demand as percent of available precipitation
2. Groundwater use as percent of precipitation
3. Susceptibility to drought
4. Freshwater withdrawal increase
5. Summer water deficit

- Extreme
- High
- Moderate
- Low

Is Water Scarcity Becoming the New Normal?

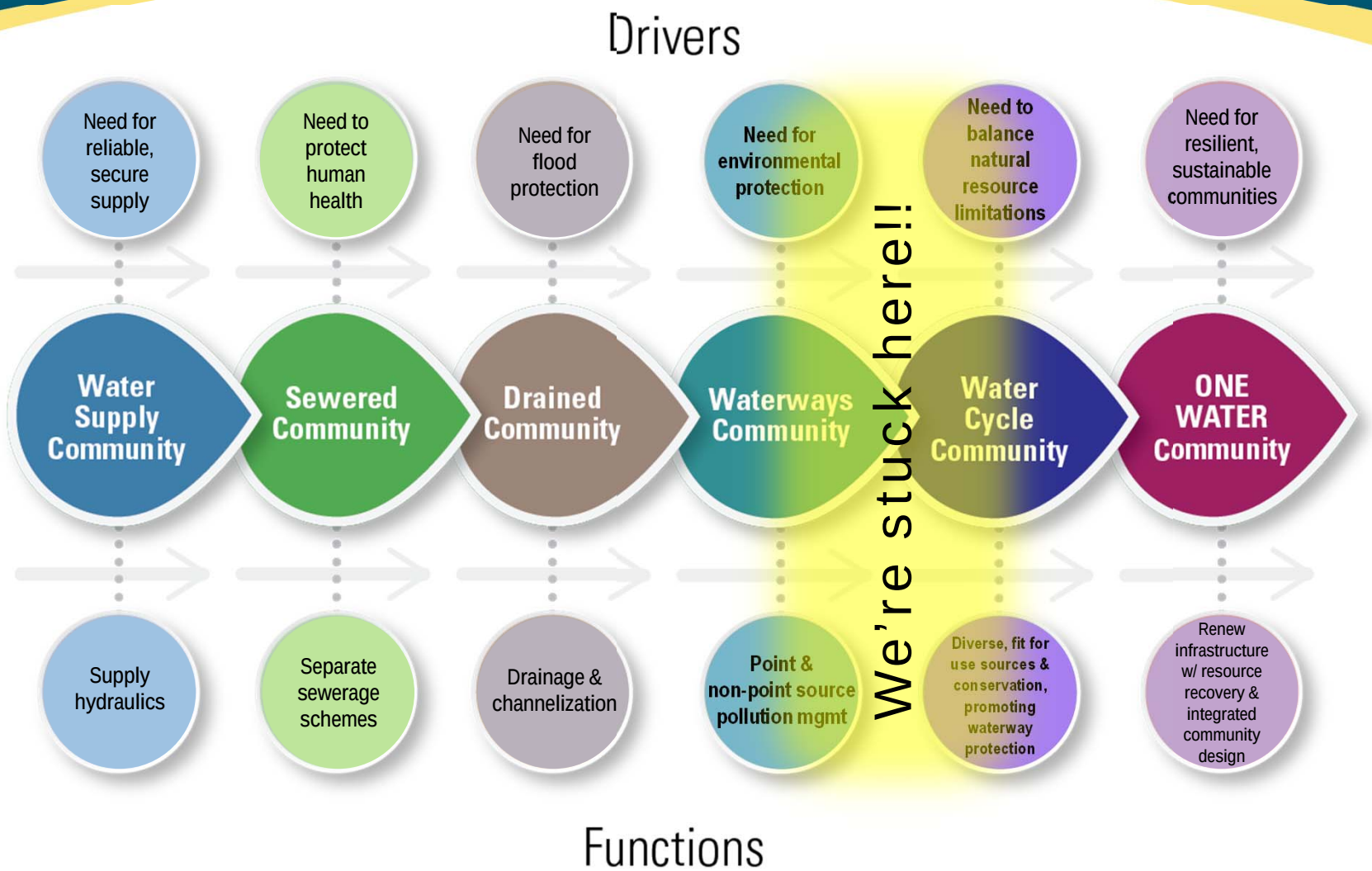
Scarcity does not give the luxury of time!!

New Normal Demands New Solutions

Challenges Include:

- Climate change impacts
- Water shortages/drought
- Catastrophic events
- Degradation of water quality
- Reliability and redundancy limitations
- Population growth w/ reduced consumption
- Demand for lower-cost solutions

New Normal Demands a "One Water" Cultural Solution

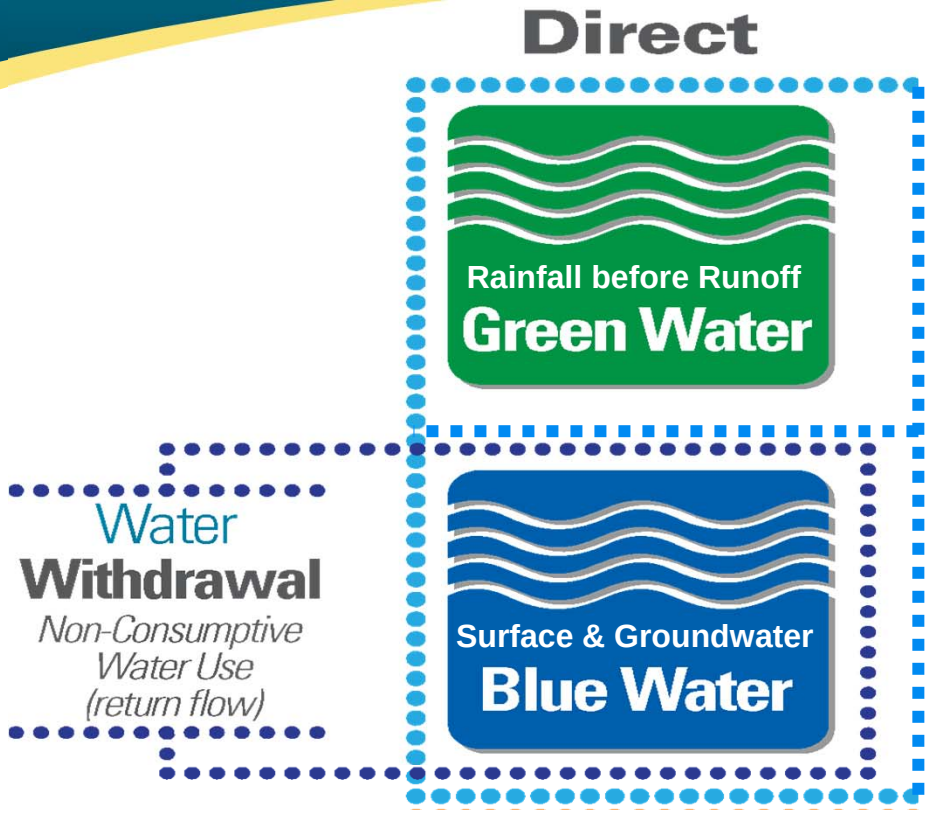


Adapted from: Howe, C., et al (2013)

New Normal Demands Water Reuse: Must change our view of water demand!!

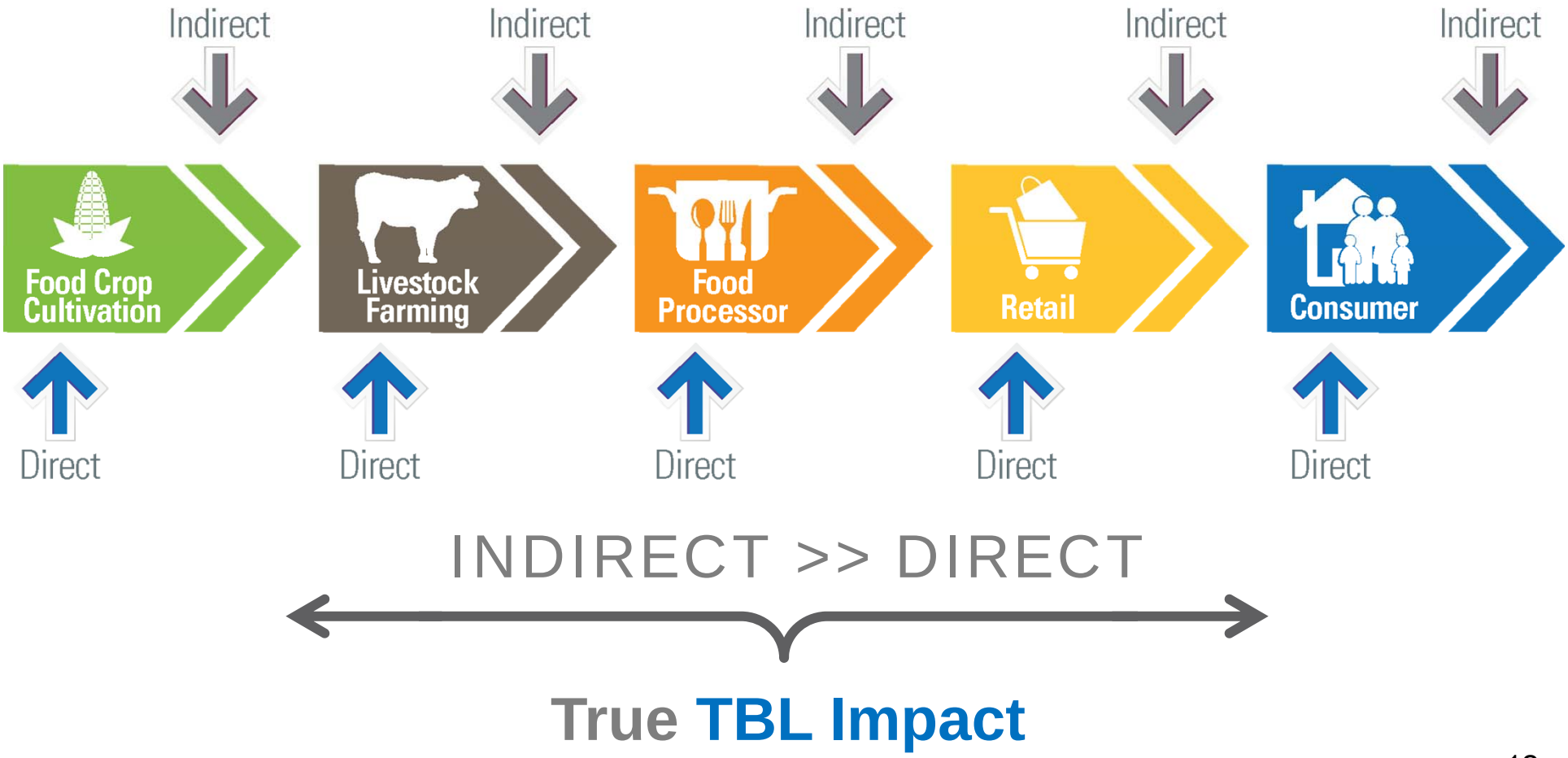
Water Footprinting raises our awareness of the true value of water

New Normal Demands the Water Footprint of Producers and Consumers



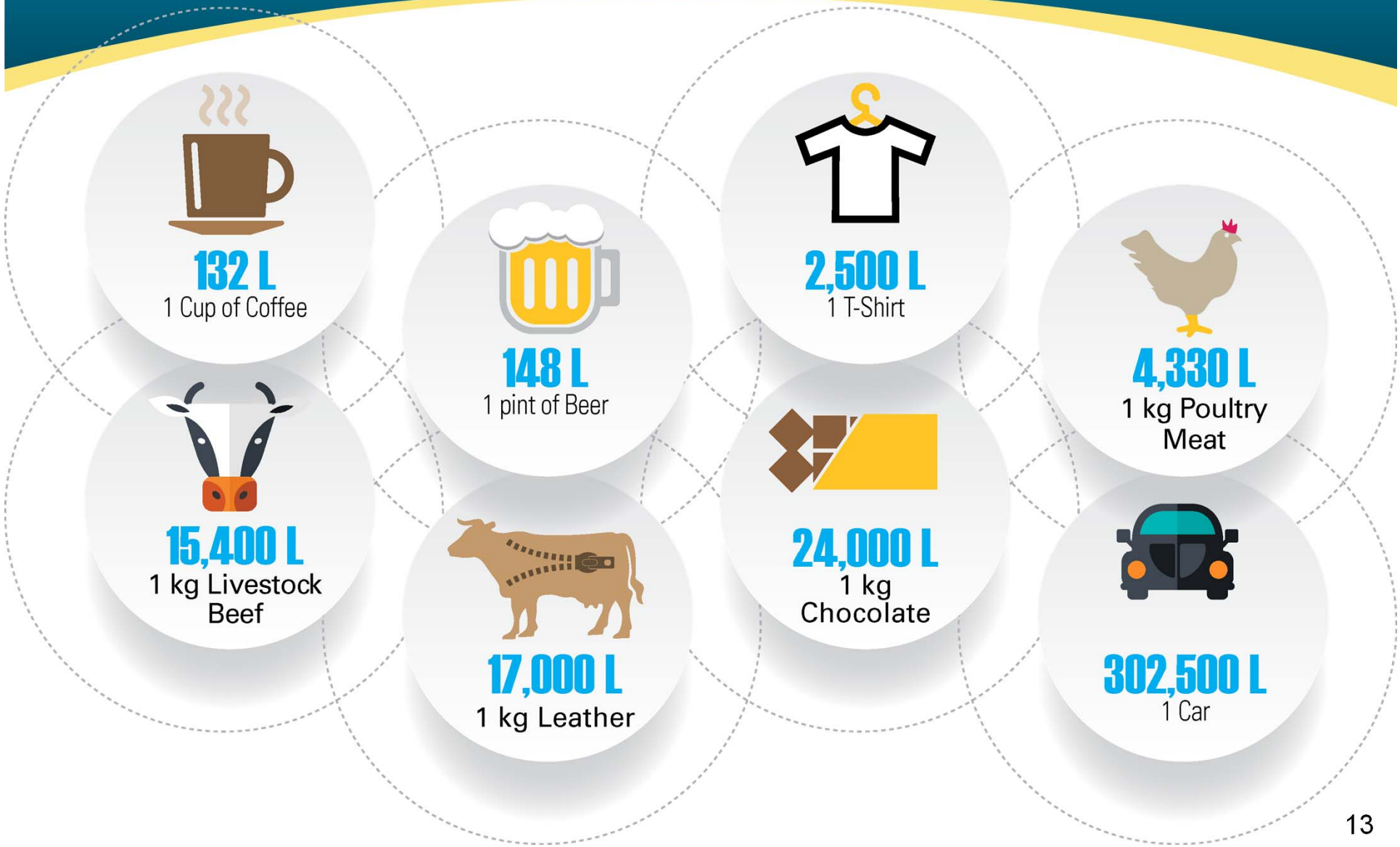
Adapted from: Hoekstra, A.Y., et al, 2011

Water Footprint Accounts for the Entire Supply Chain

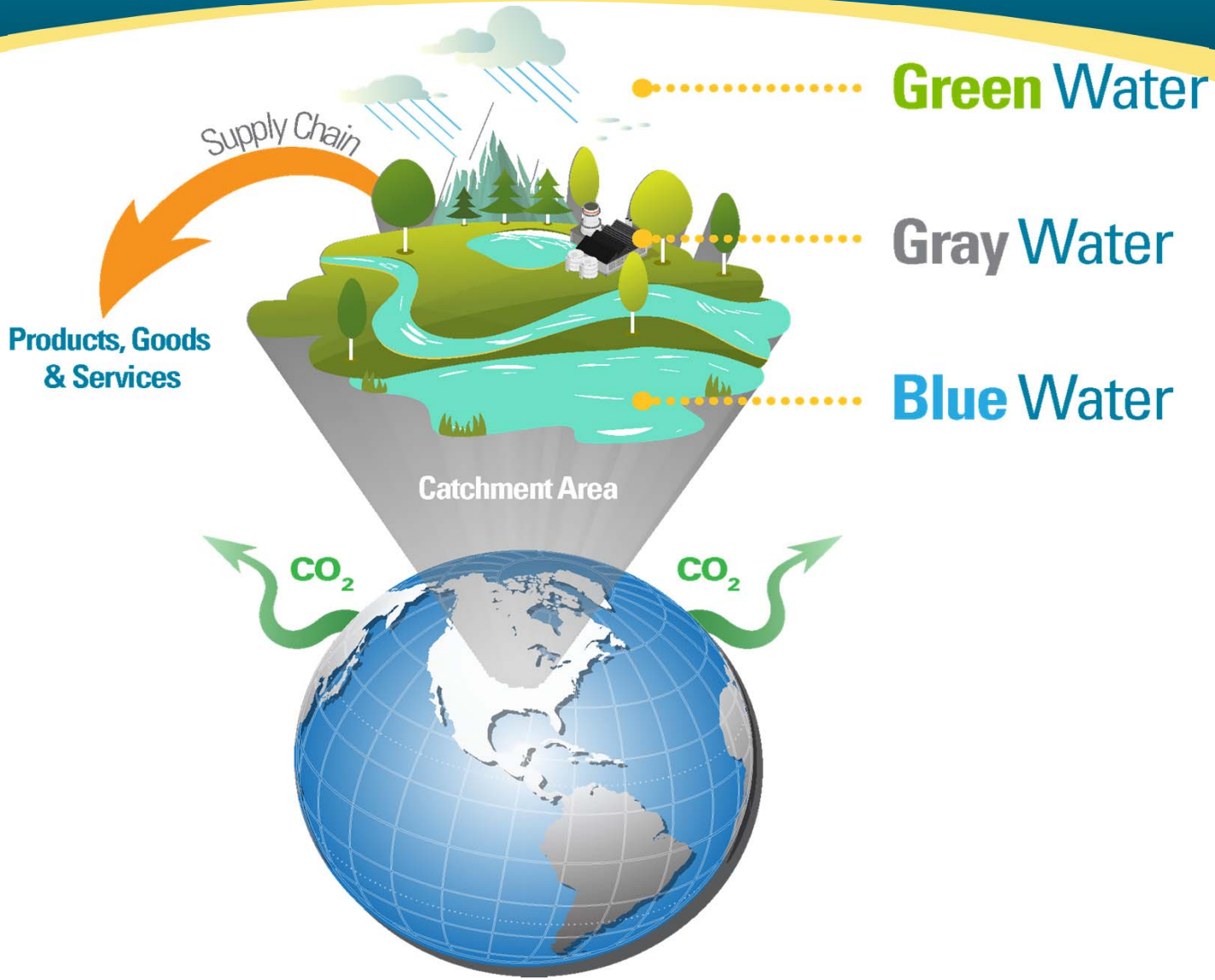


Adapted from: Hoekstra, A.Y., et al, 2011

Water Footprinting: Quantifiable Cradle-to-Grave Volumes of Water Consumed

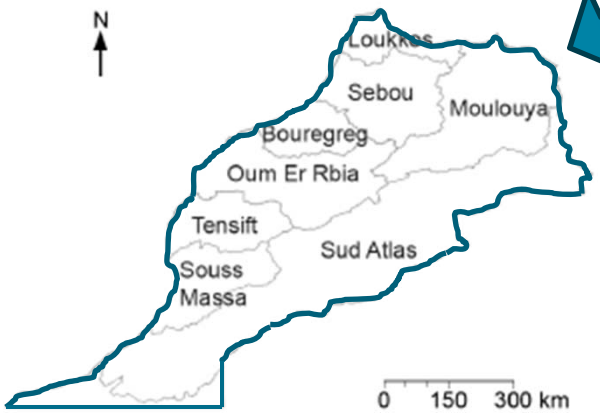


Water Footprint is Geographically and Temporally Sensitive



Water Footprint Assessment Case Study: Morocco

Population: 33 million
Area: 446,550 km²



- High groundwater depletion rate
- Saltwater intrusion increasing
- Surface waterbodies polluted

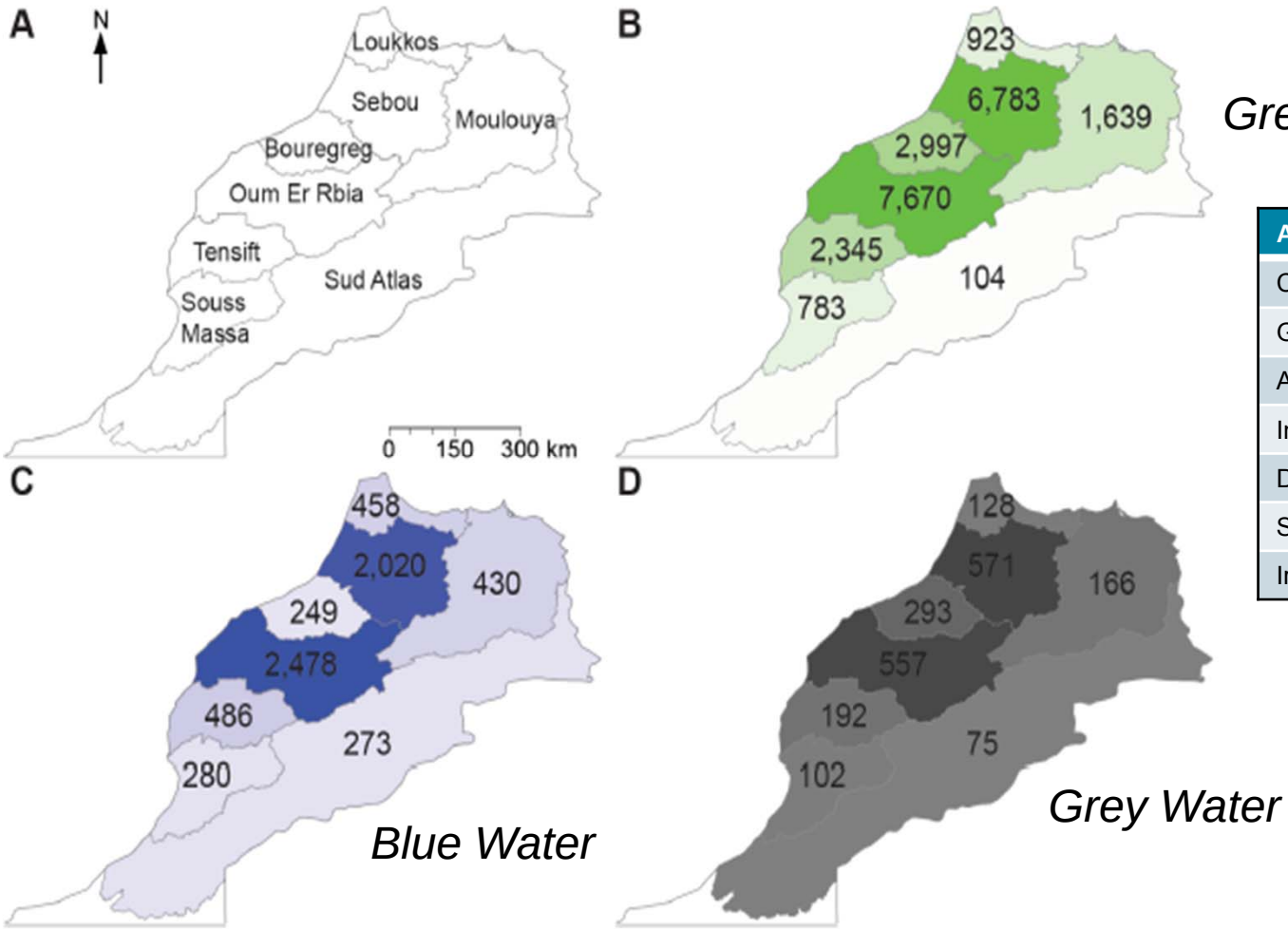
Water Plan: Supply/Demand Strategy

- 130 reservoirs operating; plans to increase
- N-S inter-basin water transfer
- Seawater desalination
- Irrigation efficiencies
- Reuse of treated wastewater

Source: Schyns & Hoekstra - 2014

Water Footprint Assessment Case Study: Morocco

Water Footprint of production by basin (Mm^3/yr)



Green Water

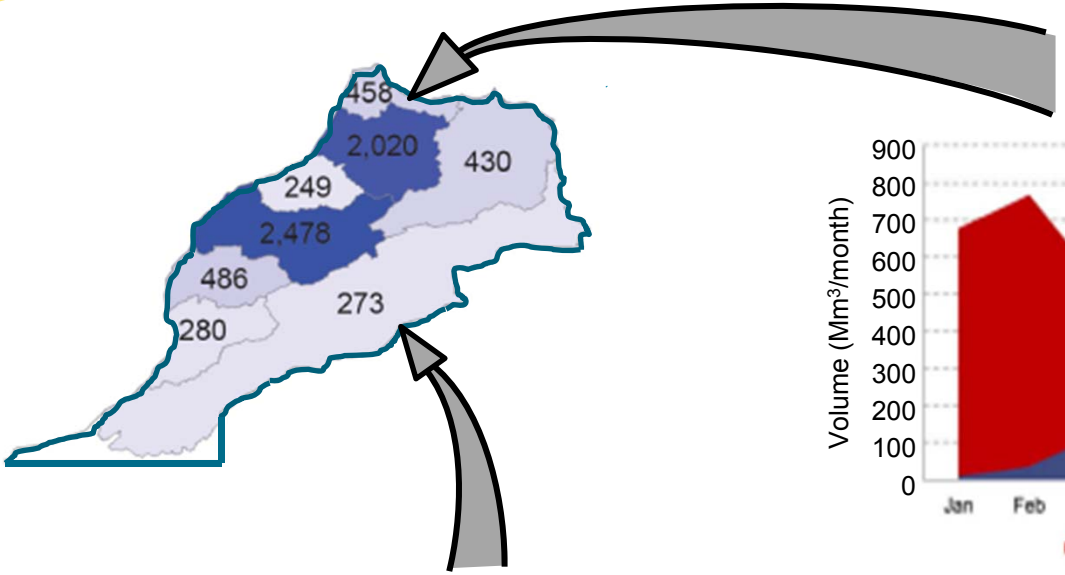
Blue Water

Grey Water

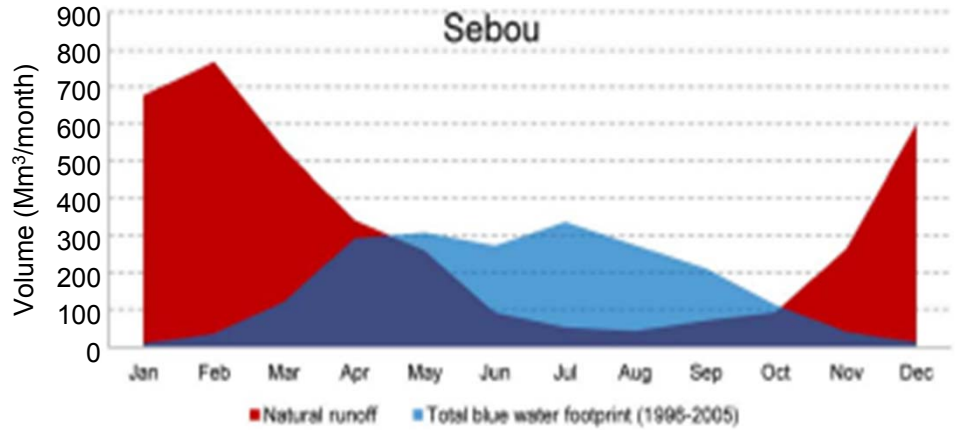
Activity	WF Component
Crop Production	Green, Blue, Grey
Grazing	Green
Animal Water	Blue
Industrial	Blue, Grey
Domestic	Blue, Grey
Storage	Blue
Irrigation Networks	Blue

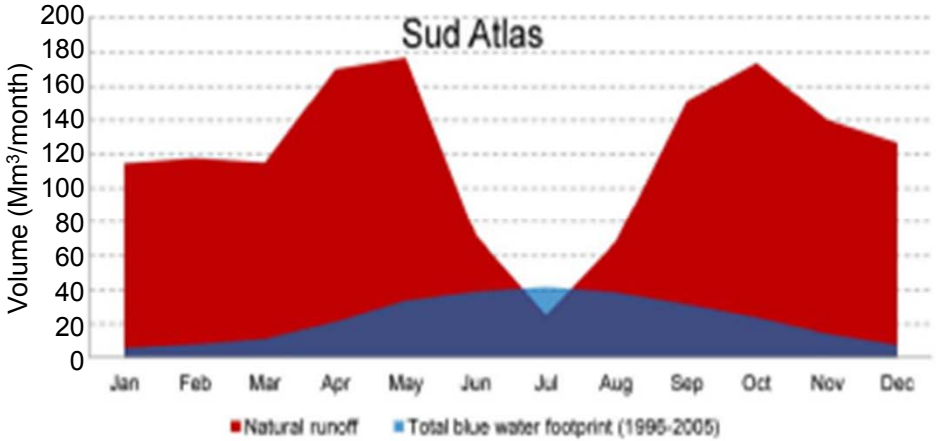
Total Water Footprint
77% Green
18% Blue
5% Grey

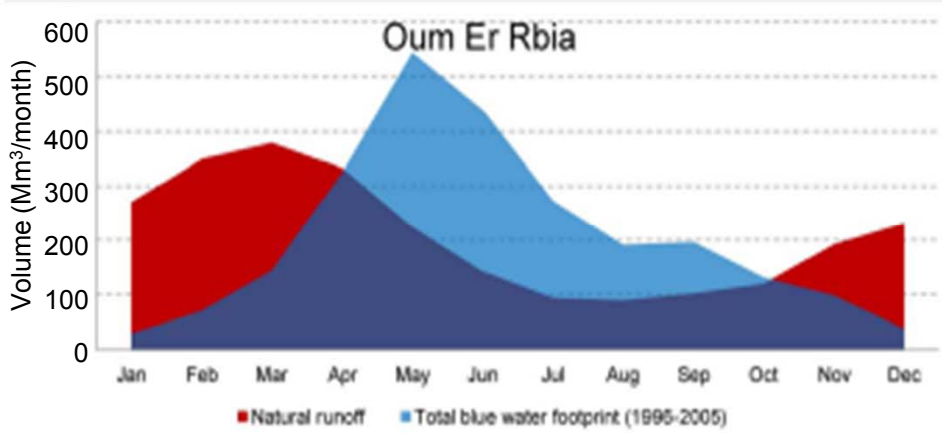
Water Footprint Assessment Case Study: Morocco



63% of the total WF in these two basins

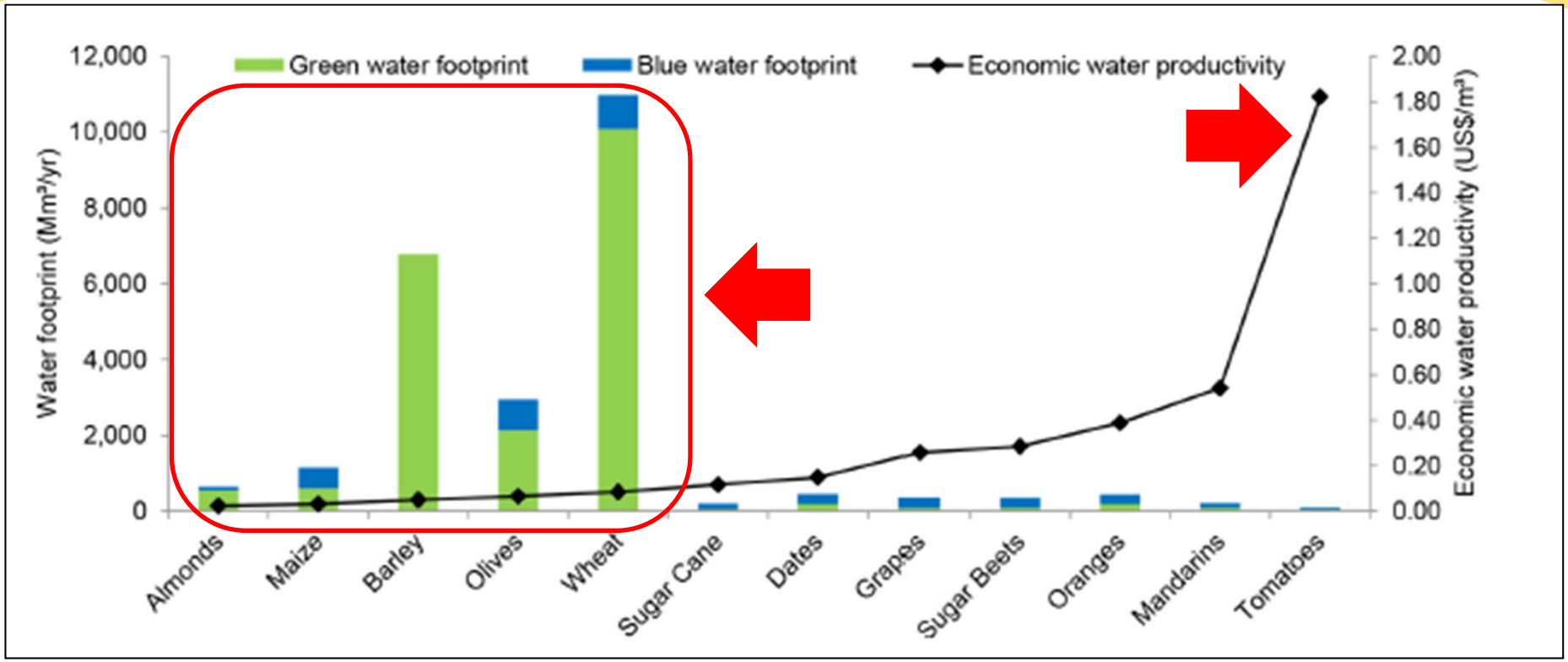






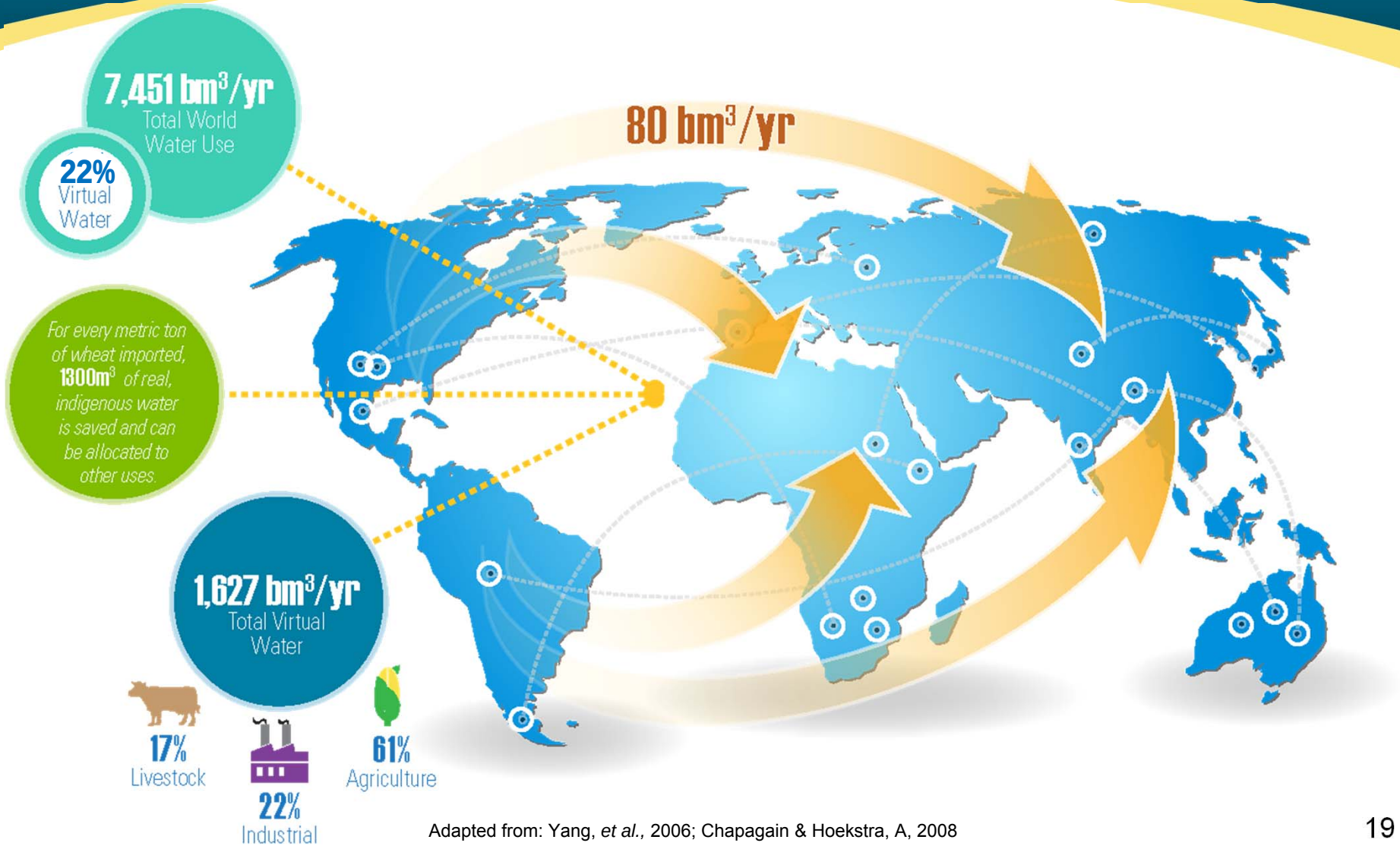
Water Footprint Assessment Case Study: Morocco

Why "waste" water on the lower valued crops?



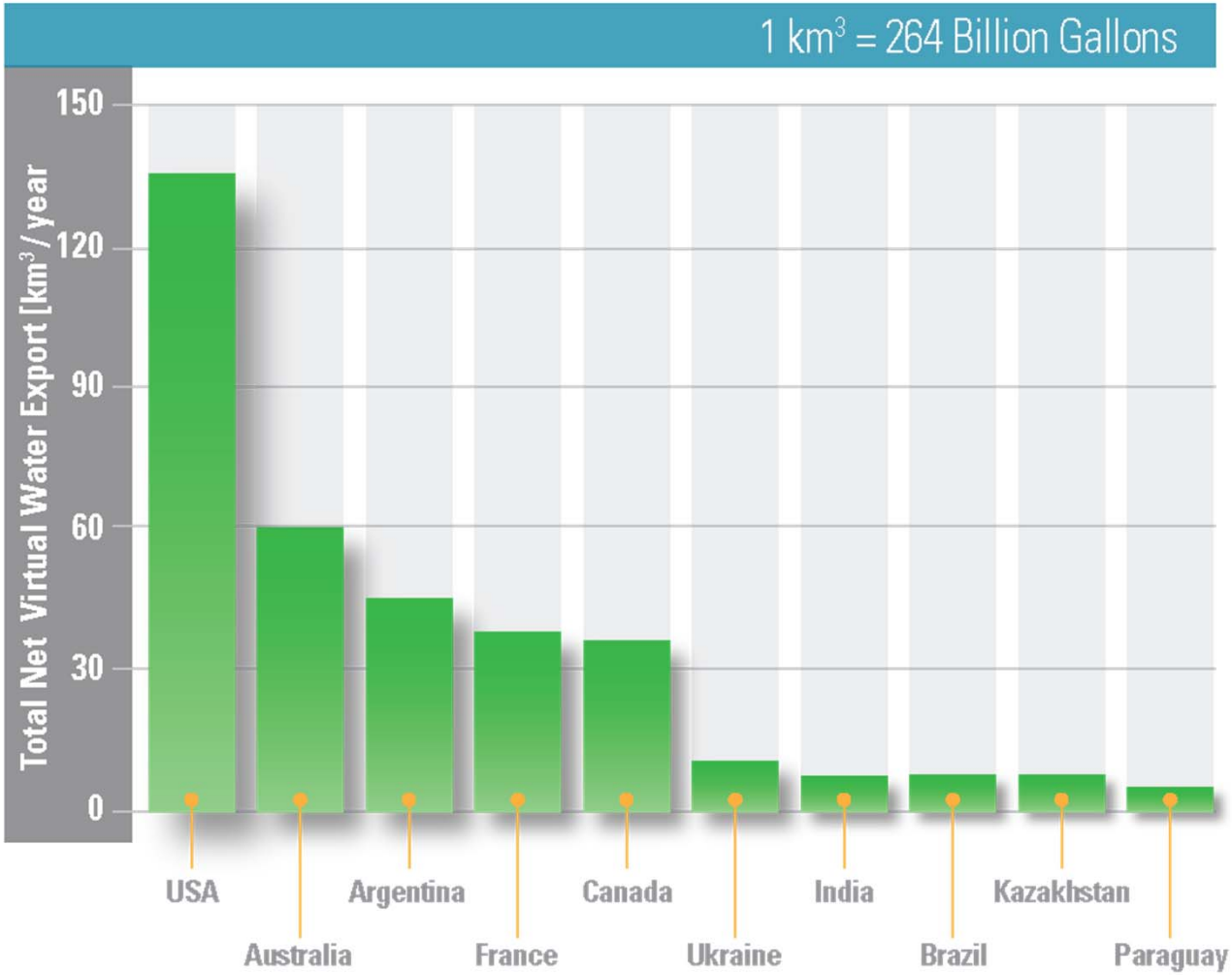
- *Relocate crops to basins with more balanced WF*
- *Focus on crops with higher economic value per m^3 of WF*
- *Saves between 700 and 1275 Mm^3/yr*
- *Replaces supply infrastructure requirements*

New Normal Demands Virtual Water Flows



Adapted from: Yang, *et al.,* 2006; Chapagain & Hoekstra, A, 2008

World Leaders in Virtual Water Movement

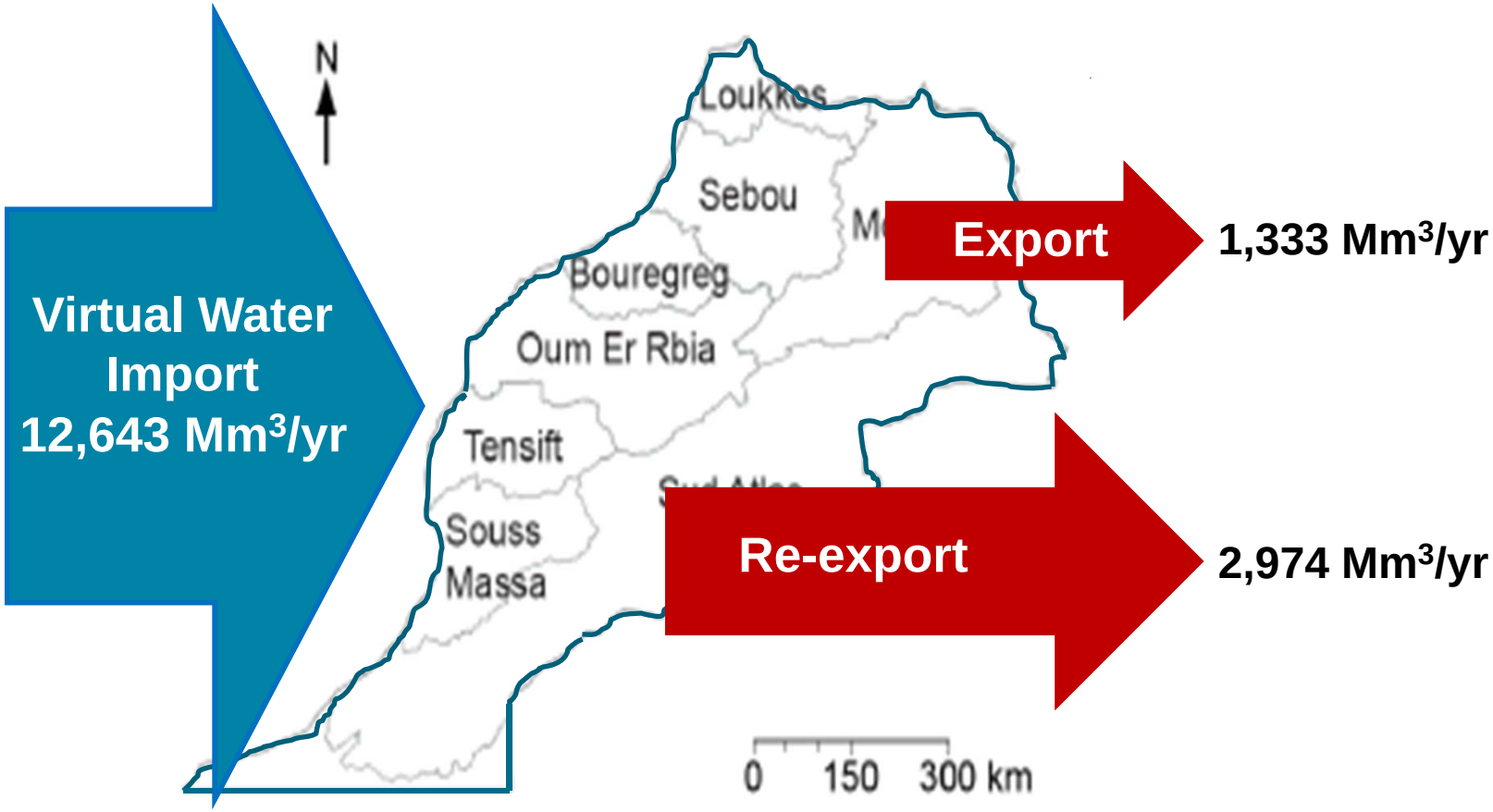


Liu, *et al.*, 2011

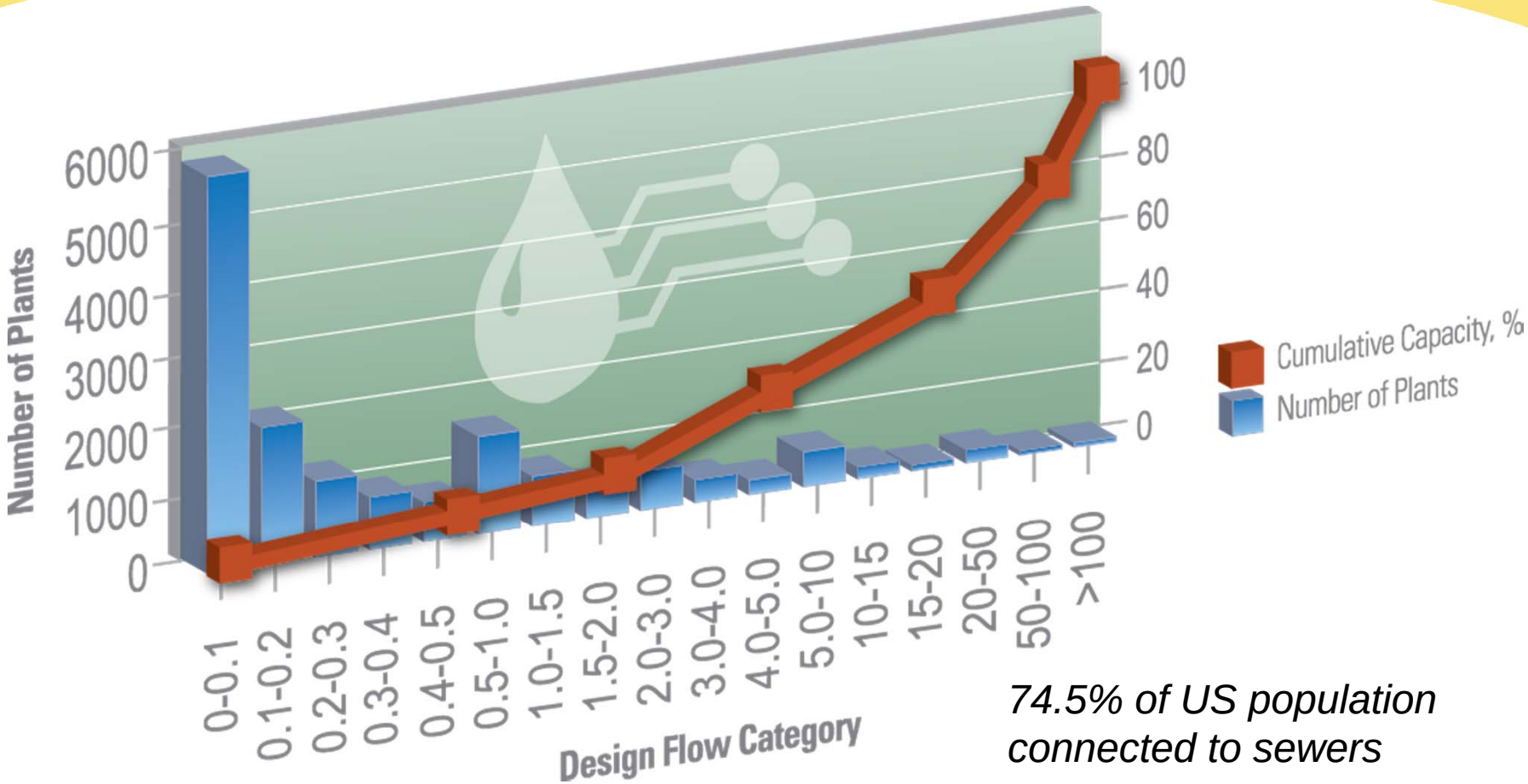
Liu, et al., unpublished

Morocco's Virtual Water Budget

Virtual Water Value = $12.4 billion/yr



Water Reuse: Requires Capacity



74.5% of US population connected to sewers

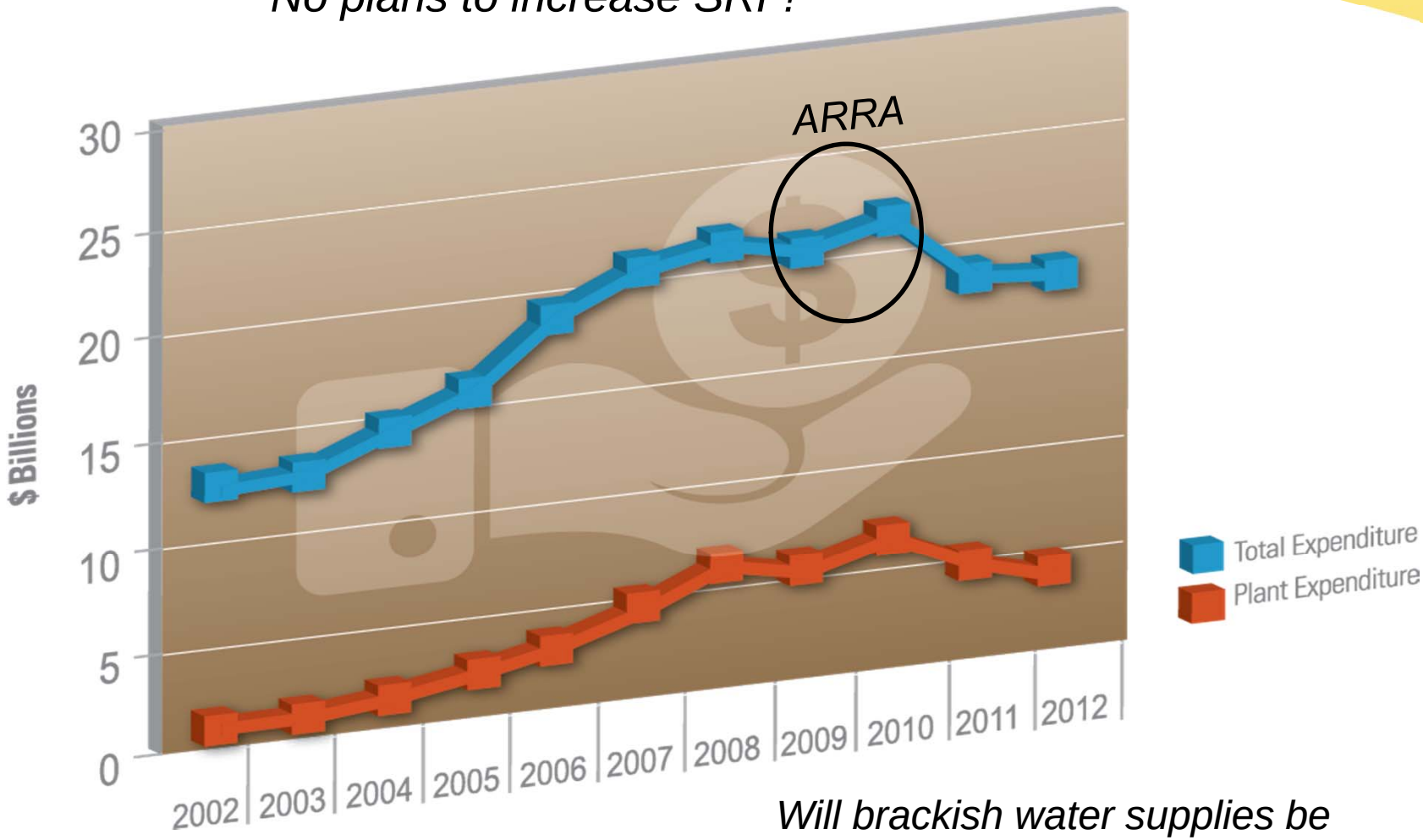
60.4 bm^3 wastewater produced annually

0.17 bm^3 wastewater treatment design capacity

Source: Global Water Intelligence: Market Insight: USA (2014)

New Normal Demands Water Infrastructure Investment

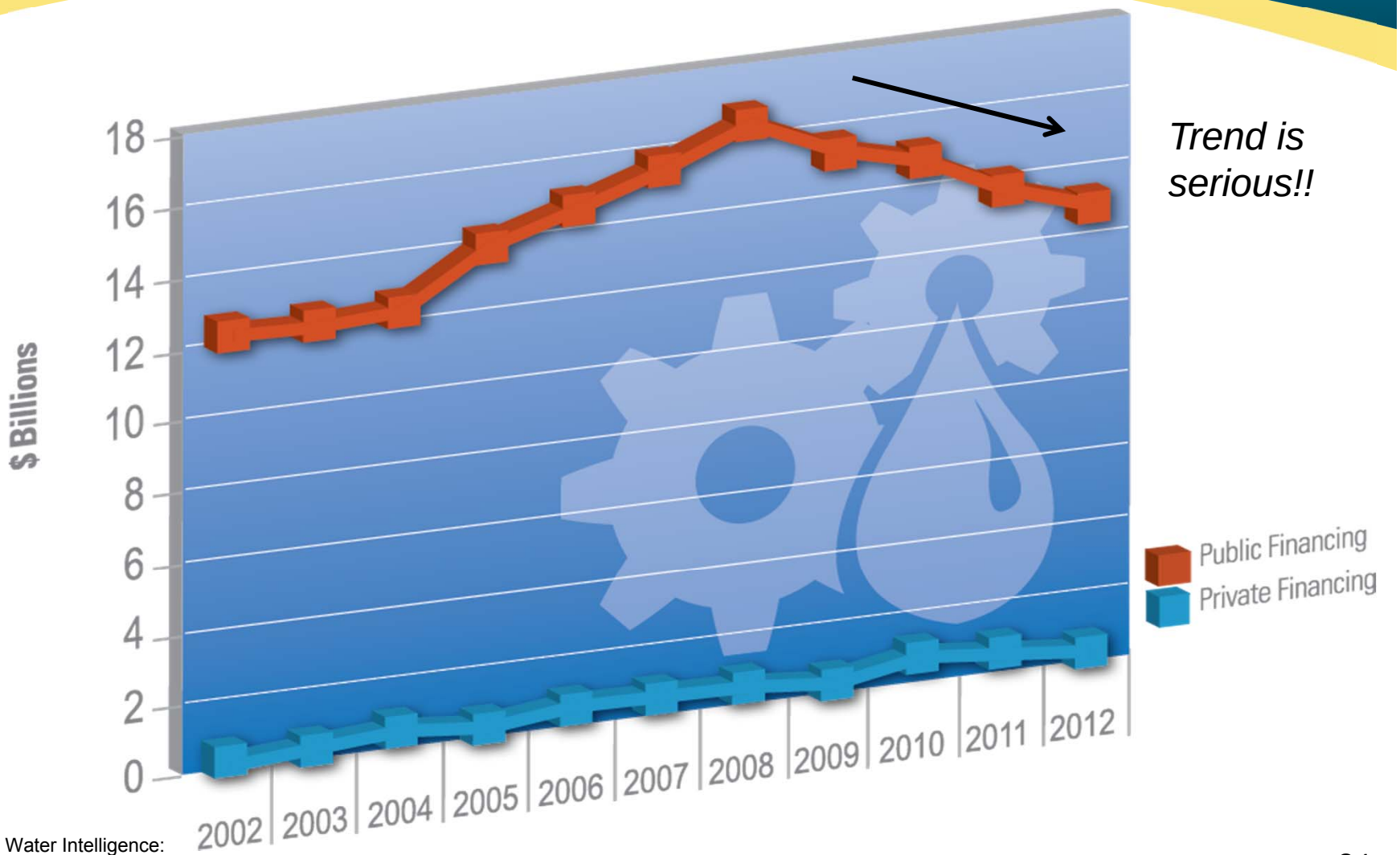
No plans to increase SRF!



Will brackish water supplies be cheaper than reuse in long term?

Source: Global Water Intelligence: Market Insight: USA (2014)

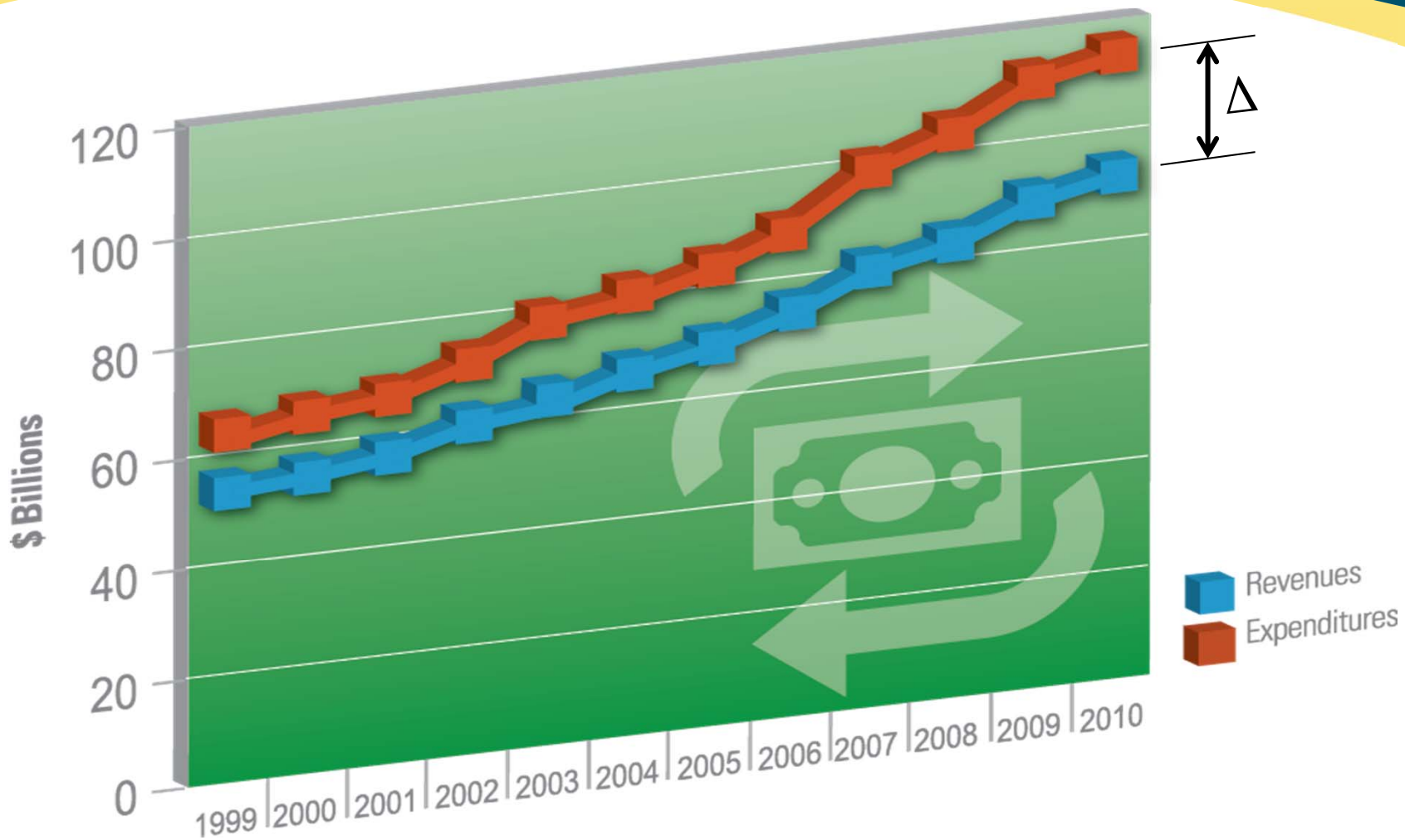
New Normal Demands Increases in Private Investment



Trend is serious!!

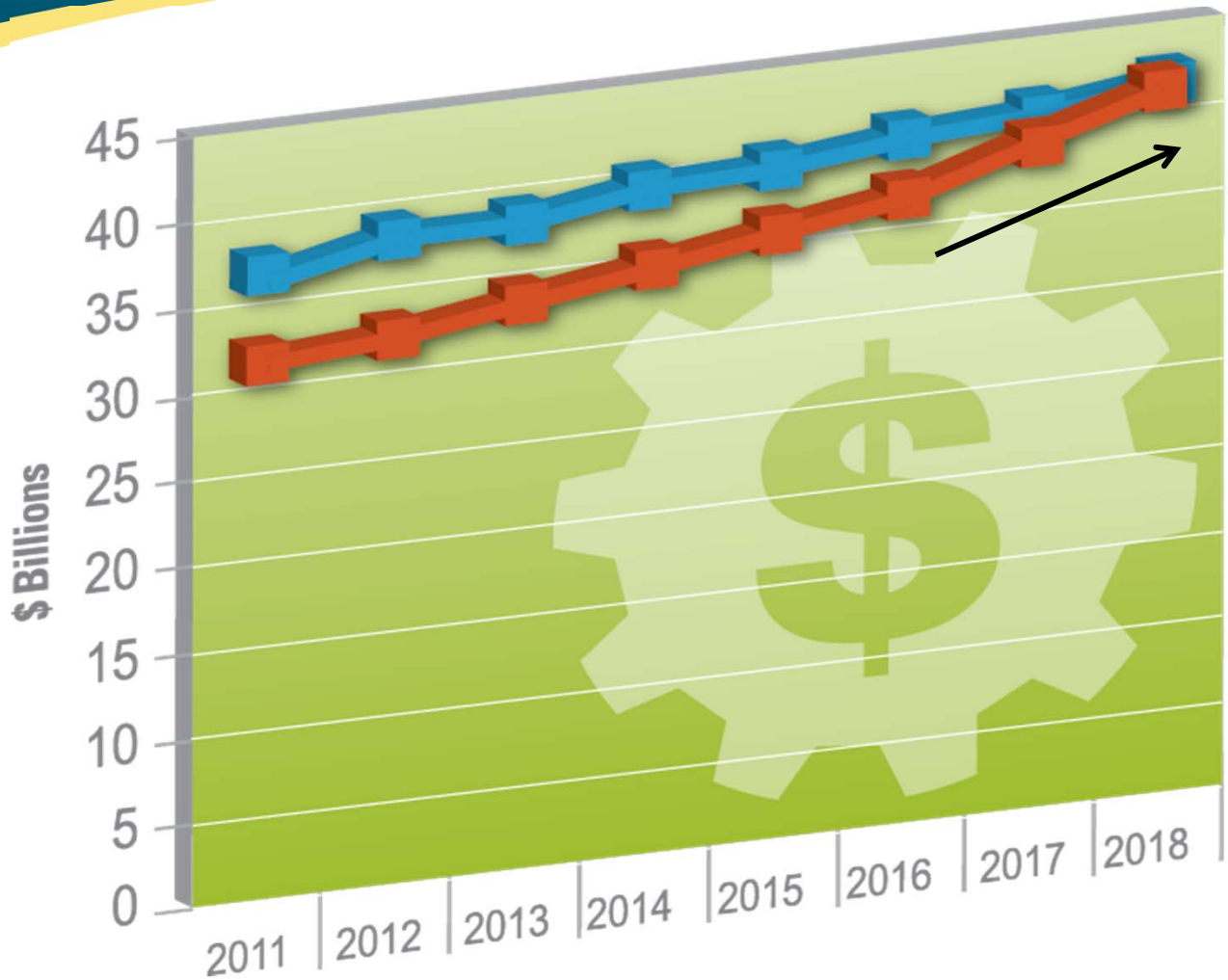
Source: Global Water Intelligence: Market Insight: USA (2014)

Water Reuse: Costs Exceeding Revenues



Source: Global Water Intelligence: Market Insight: USA (2014)

New Normal: Annual O&M Costs Rising



This trend is discouraging water reuse opportunities!!

Water Supply & Treatment
Wastewater Treatment

Source: Global Water Intelligence: Market Insight: USA (2014)

Summary

- Is the New Normal here?
- One Water culture is attainable…but…
- Footprinting is not enough…assessments needed
- Need to embrace the role of virtual water flow
- Private investment must increase dramatically
- Water Reuse demands the true value of water

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