

# Impacts of Water Conservation and Storm Water Management

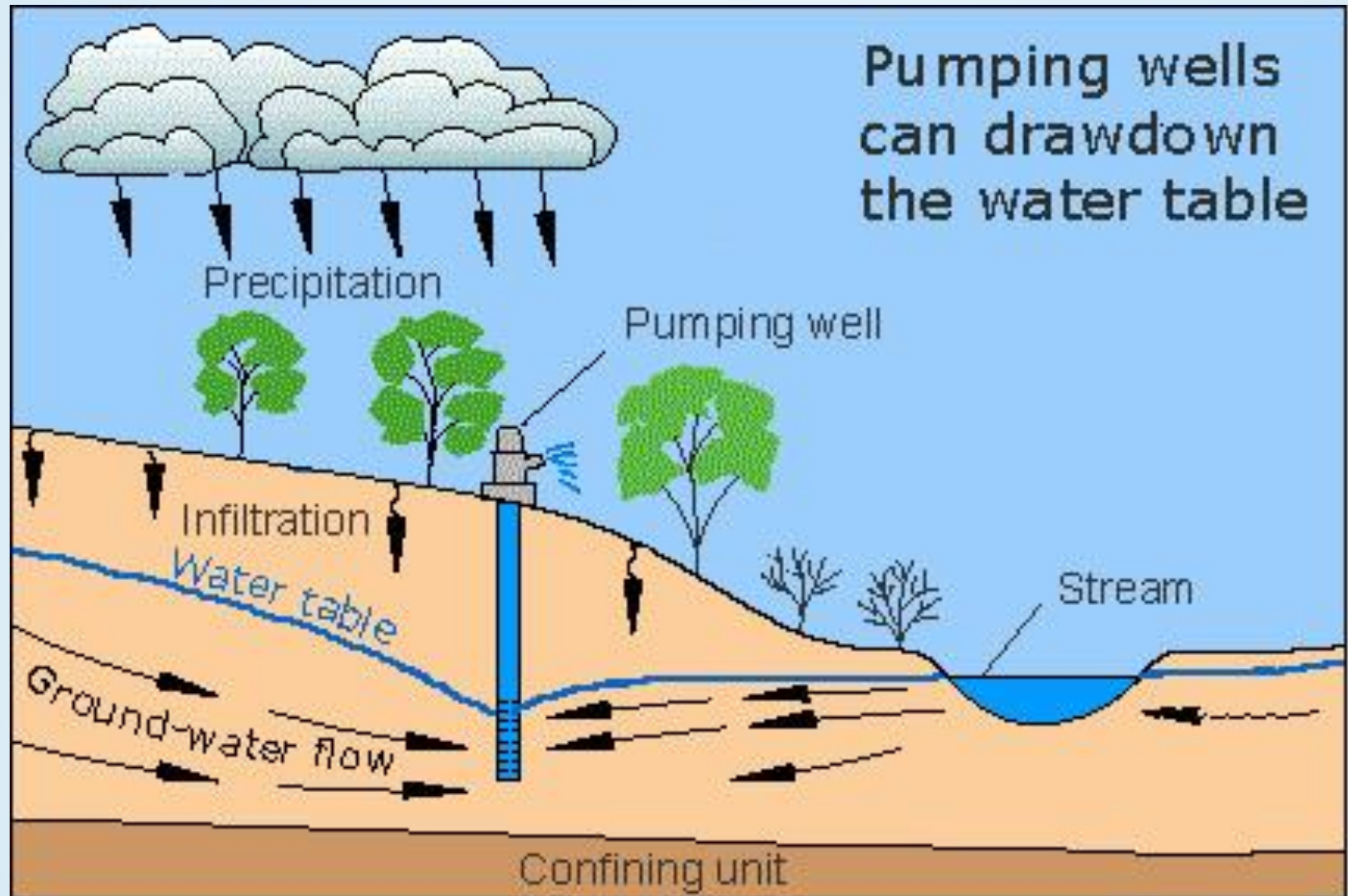
(on costs, environmental benefits, and quality of life)

James W. Ridgway, PE

March 18, 2015



Pumping wells  
can drawdown  
the water table

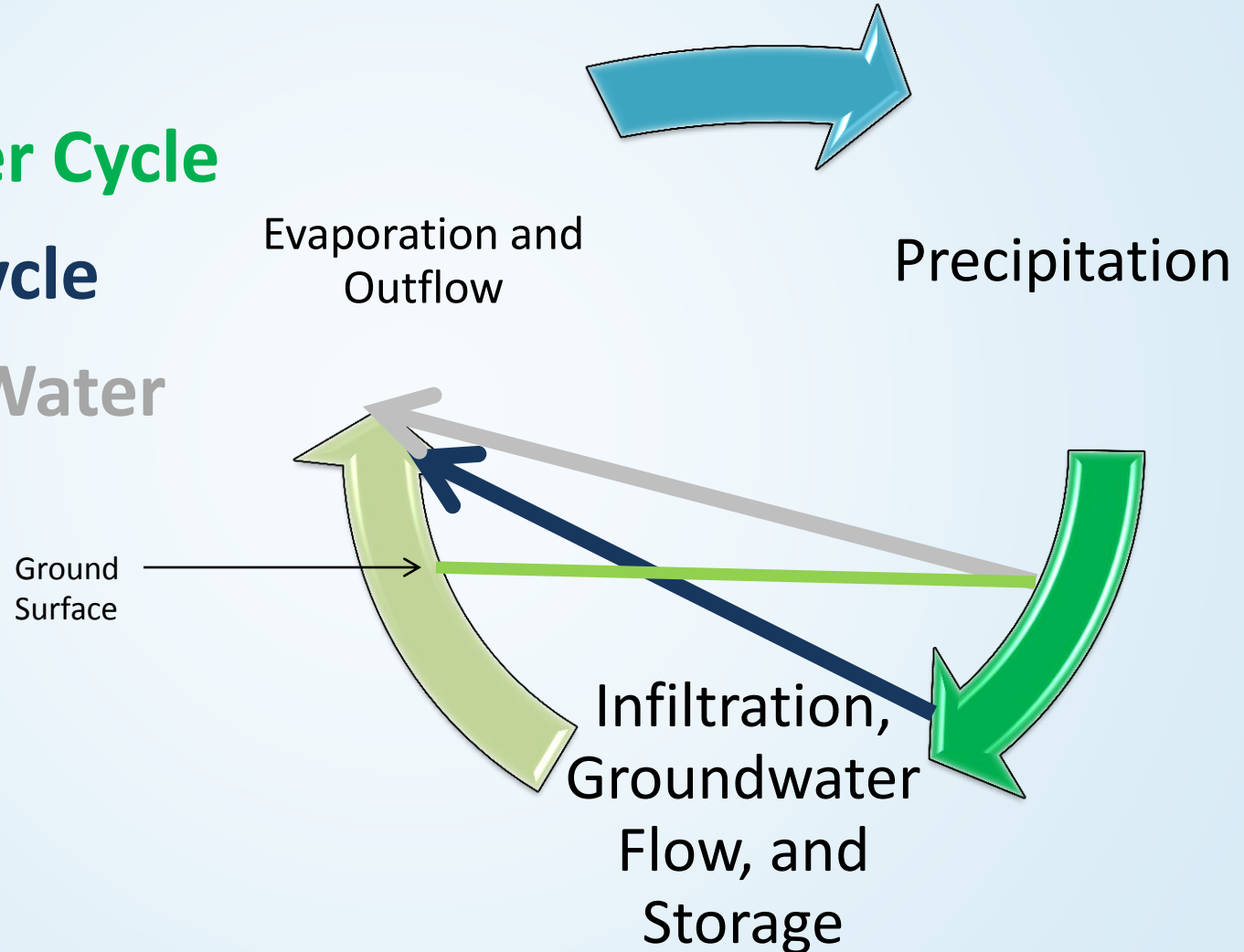


# The Three Water Cycles

**Natural Water Cycle**

**Water Use Cycle**

**Interrupted Water Cycle**



# Past Practices

## Still needed – but with caveats

- Drainage/Flooding must be managed
- Prioritizing resources
- Timely technology introduction

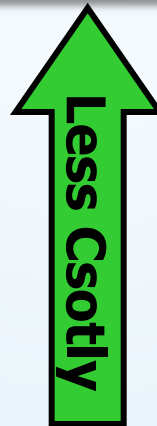
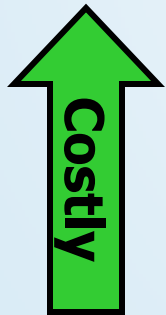
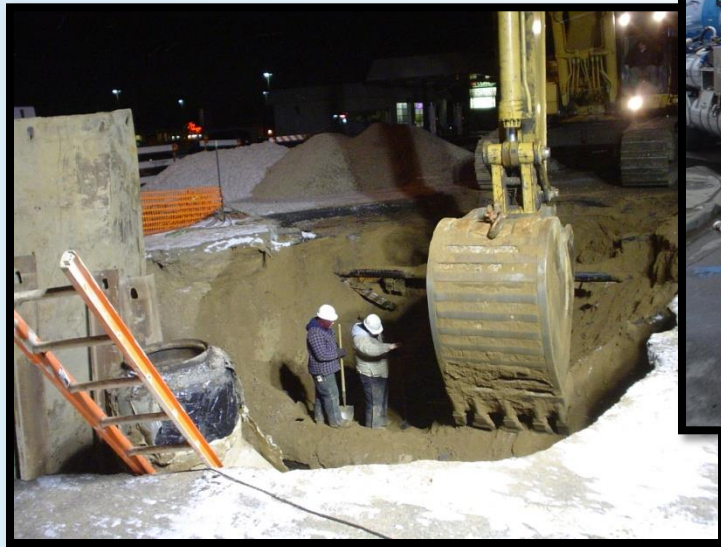




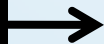




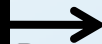
Is there a better way?



REACTIVE



PREVENTATIVE



PREDICTIVE

Reconn





**Belleville, MI – 4,600 SF Rain Garden installed in 2012 to intercept storm water from roof drain and parking lot.**







**Wayland, MI – 700 SF Rain Garden installed in 2012 to intercept storm water from roof drains**







**Okemos, MI – Rain Gardens and bioswales installed in 2010 to intercept storm water from parking lots and roads**







**Various Sites – Rain Gardens and bioswales**





# Factors that Dictate Water Use Impacts

- Type of water supply used
- Local hydrology
- Development patterns
- Upstream water use
- Storm water design
- Wastewater discharge location



# Different Water Sources Cause Different Impacts

- What are the impacts if 1 MGD of water is withdrawn from...
  - A Great Lake?
  - A groundwater aquifer?
  - A river source?



# Urbanization Impacts

- More impervious surfaces
- More debris in runoff
- Less natural infiltration
- Increasing storm sewer and POTW flows
- Blacktop temperatures
- More CSO's

# Runoff Gallons per Road Mile

Cover Type	Soil Type	Area (sf)	Area (ac)	Runoff Volume, V (ft <sup>3</sup> )	Runoff Volume (gallons)	Yearly Average Volume (gal)
<b>Assuming D Type Soils</b>						
Pavement and Rooftop	D	126,720	2.9091	8,352	62,473	1,360,946

- 1-inch Rain
- 24 Foot Wide Road
- 1 mile long
- Does not include parking lots or runoff from land adjacent to roads





**Bloomfield Hills, MI – Rain Gardens installed in 2010 to intercept storm water from road**



# How much water runs off of a 1 mile road, 24 feet wide?

- Assuming a 1 inch rain event, approximately 400 Million Gallons of water runs off from impervious surfaces alone.
  - 5400 miles of roads in all of Oakland County = 7.3 million gallons per year
  - 450 miles of roads in Region of Waterloo = Over 600 million gallons per year
  - 330 miles of roads in Guelph = Almost 450 million gallons per year



# Rooftop Capture

- What size ?
- Reused?
- Controlled Release



# Recharge and Projecting Water Use Reductions

- Main recharge occurs primarily in winter snow melt and spring rains
- Summer rainfall more likely to evaporate off the surface
- Need to look at spring rainfall and impact on groundwater levels
  - Anticipate lower groundwater levels during main outdoor watering season
  - Provide public education on potential need for outdoor watering reductions

# Wells Sensitive to Rainfall and Use

- Recharge comes primarily from snow melt and spring rains
- Summer rain is more likely to evaporate and not go to recharge
- Groundwater levels are generally very good (in Oakland County, Waterloo and Guelph.
- Static levels of water table fluctuate based on rainfall and well use.
- Need to monitor storm water movement to ensure groundwater does not have significant water diverted to streams directly.



# The Cost and Value of Green Infrastructure

Management Practice	Proposed Area (ac)	Area (sf)	Volume Captured (cf)	Volume Captured (gal)	Contractor
Urban Reforestation	1.00	43,560	489	3,659	\$110,000
Forest Retention	1.00	43,560	6,850	51,932	\$110,000
Wet Meadow	1.00	43,560	43,560	325,872	\$80,000
Native Prairie	1.00	43,560	339	2,539	\$30,000
Agriculture	1.00	43,560	339	339	\$28,000
Rain garden	0.01	218	1,234	9,233	\$3800
Bioswales	20.00	linear feet	420	3142	\$900
	0.01	420			

# Summary of Lessons Learned for Decision-Making

- Learn from past mistakes
- Use integrated water system planning
- Manage both water supply and water management in planning
- Combine water conservation/efficiency and green infrastructure programs

# Broader Impacts Vision

- Support the ecological and societal impacts of water withdrawals and distribution
- Lower Long term costs
- Communities benefit environmentally, economically by conserving water and restoring hydrology