

Keys to Success: Water Recycling in Small and Disadvantaged Communities

Dr. Bruce Macler

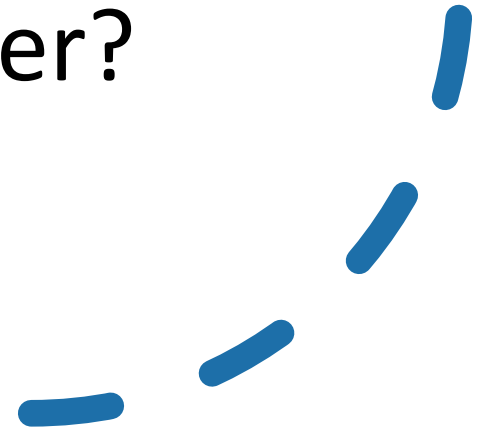
Dave Smith, USEPA Region 9



Talk Overview

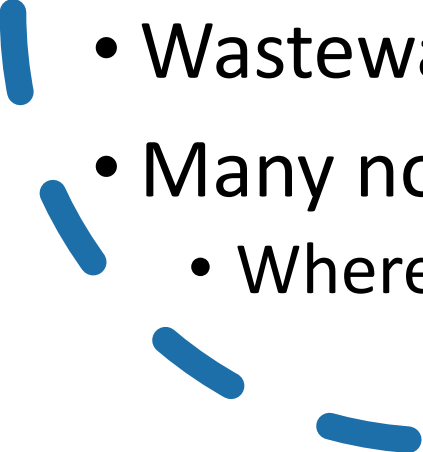


- Why recycle water?
- EPA's National Water Reuse Action Plan
- Some examples
- What we heard from small systems
- What's involved in recycling wastewater & stormwater?
- Keys to success
- Funding





Waste Not, Want Not: Opportunities for Water Recycling

- Much inland wastewater is treated, then evaporated/infiltrated, or dumped in a river
 - In coastal areas, most treated water disposed in the ocean
 - Most stormwater discharged with minimal treatment
 - Wastewater at home or building can also be reused on site
 - Many non-potable uses only require additional disinfection
 - Where salt or trace contaminants are not issues
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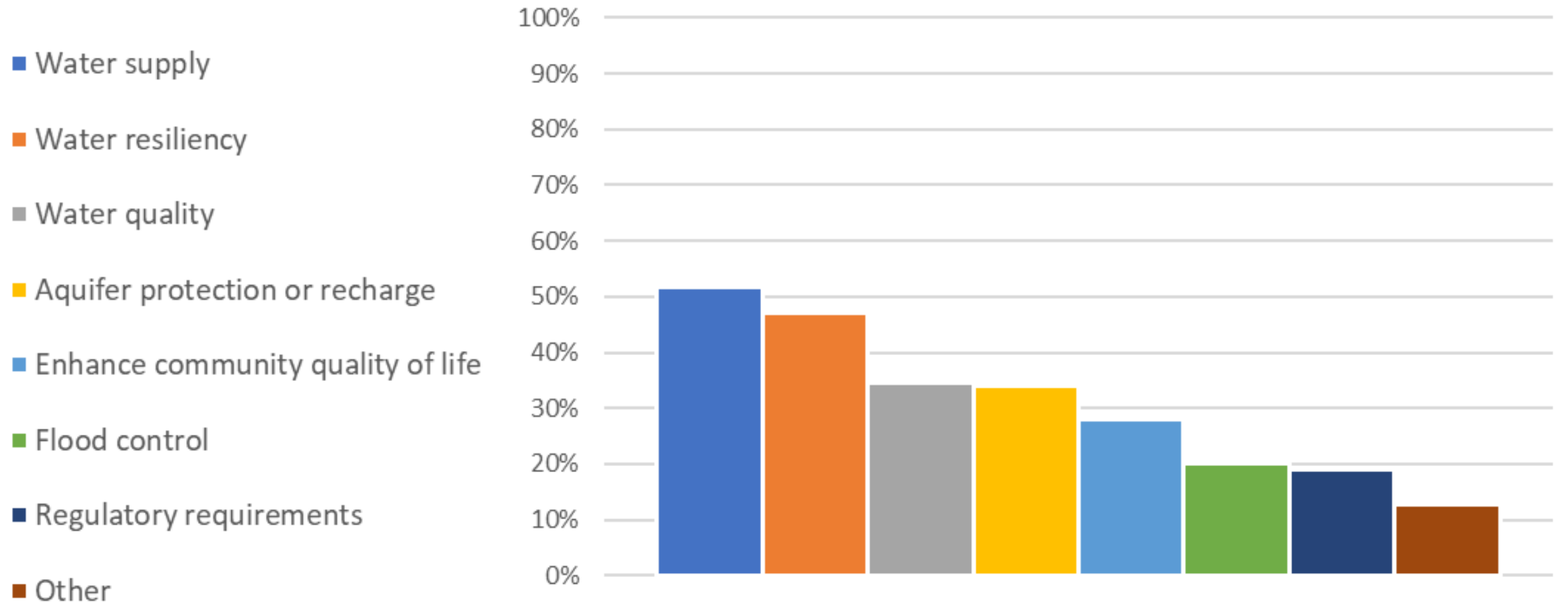
Why Bother to Recycle Water?

- Wastewater and stormwater are valuable
- Makes limited local supplies go farther
- Diverse supply builds redundancy/resilience
- Greater control over water quality
- Stormwater capture helps flood control

WRAP Action 8.5: Advancing Water Reuse in Disadvantaged and Small Communities

- Part of 2020 Water Reuse Action Plan (WRAP)
- Two Outreach and Listening Sessions
- Training for Tribes
- Pilot projects to help individual communities
- Partnering with WRA, NRWA, USDA-RD, AWWA

Small System Interests In Recycling



Uses for Recycled Water

- **Community:** parks, landscaping, golf courses, dust control
- **Agriculture:** food crops, non-food crops, livestock watering
- **Impoundments:** recreational water bodies, landscape features
- **Environment:** wetlands, stream flow augmentation
- **Groundwater recharge:** salinity barriers, potable use, aquifer stability
- **Drinking water:** augment surface supplies
- **Industry:** cooling, boiler water, oil/gas production, food processing



Recycling Water for Agricultural Uses

- **Rupert, ID**
 - Town of about 6000 people in South-Central Idaho
 - Recycling municipal wastewater
- **Recycling solution**
 - Provide nutrient rich treated wastewater for agricultural irrigation and treated biosolids for fertilizer
 - Recycling 350 million gal/year



Reclaiming Wastewater and Stormwater For Landscape Irrigation

- **Shakopee Mdewakanton Sioux, MN**
 - Treatment Plant upgraded 2005, includes advanced treatment and large “green roof”
- **Water Reuse Solution**
 - Irrigates landscapes, wetlands, golf course
 - Enhanced habitat for wildlife
 - Green roof reduces stormwater runoff
 - Considering aquifer recharge



Reclaiming Wastewater for Gardens, Toilets & Firefighting

- **Santa Ynez Chumash Tribe, CA**
 - Needs water for new casino; supply limited
- **Water Reuse Solution:**
 - Treat wastewater for toilet flushing, cooling tower, and landscape irrigation.
 - Membrane-based facility treats 67,000 gpd
 - Also used for fighting wildfires



Reclaimed Wastewater for Wetlands and Groundwater Recharge

- **Lacey, WA**
 - New wastewater plant needed
- **Water Reuse Solution-**
 - New treatment facility polishes water quality through 5 wetland ponds
 - Water from ponds infiltrated to recharge drinking water aquifer



Onsite Non-Potable Reuse

- Recycle water at home or building scale
- Capture and treat:
 - Greywater- wash water from washing clothes, dishes, or people
 - Rainwater/Stormwater- water from rooftops or around buildings
 - Condensate from cooling systems
 - Blackwater- sewage (not advised for most)
- Onsite treatment may be required
- Onsite reuse:
 - irrigation
 - toilet flushing
 - cooling



Courtesy of Bernalillo County, NM

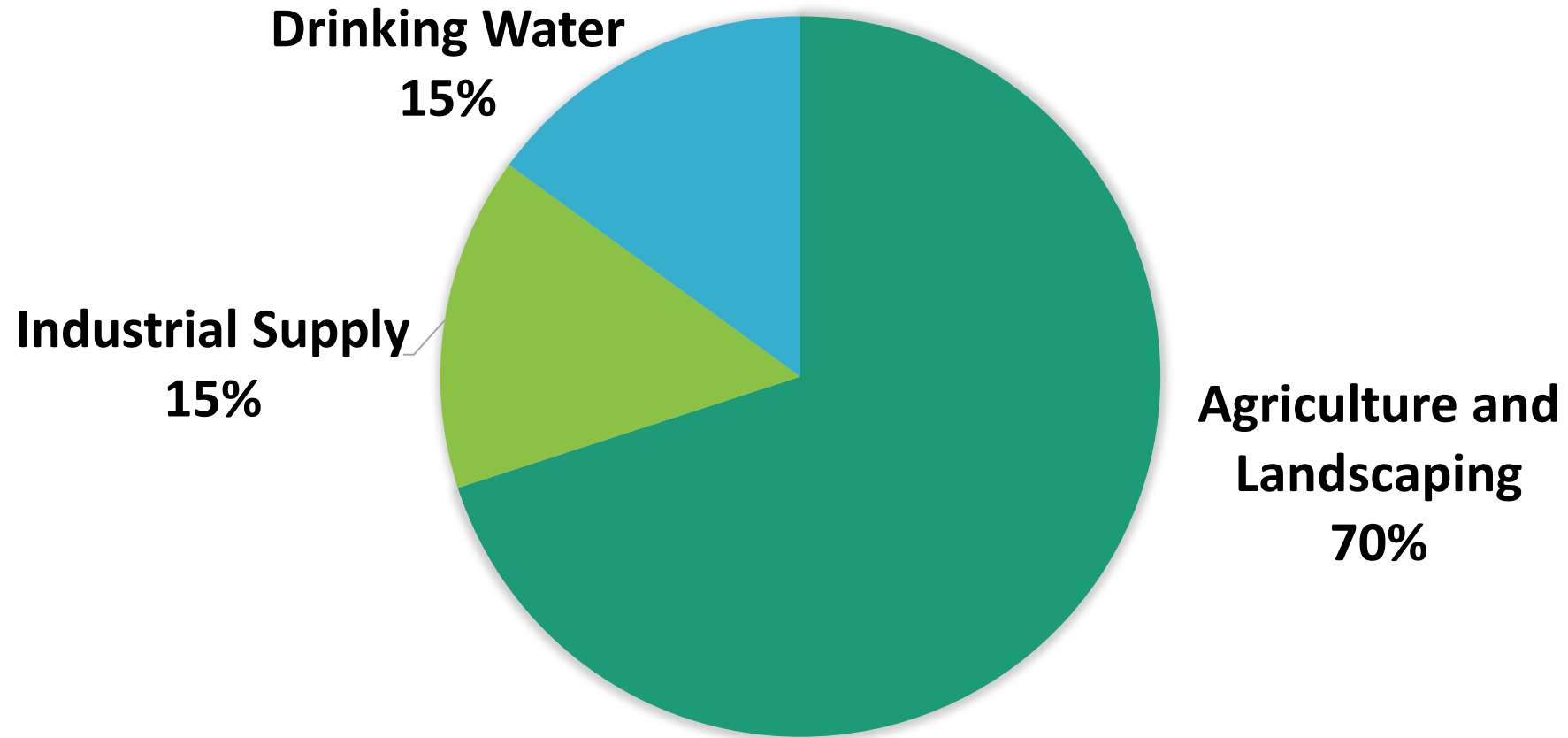
Recycling for Human Consumption “Potable Reuse”

- Much wastewater now treated, discharged to streams and rivers
- Often a source of drinking water in downstream communities
 - “De facto” reuse
 - Dilution counts for something...



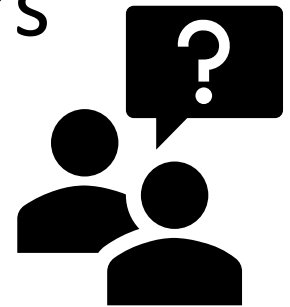
Bottom Line: Water Recycling in the US

Only about 3% of US wastewater is reused



Recycling for Your Community?

- Big opportunities to reuse and not waste water
- Many small communities already successful
- Need to be ready:
 - Technical, financial and operational skills
 - Financial resources
- You can learn from the experiences of others
- There are tools and resources that can help



Questions to Ask Yourself

- Do we need or want more water?
- Do we have other good reasons to do this?
- Do we have wastewater/stormwater available for reuse?
- Do we have technical, financial, managerial capacity?
- Do we have a treatment location, distribution capacity?
- Will our customers and decision-makers be ok with this?
- Are we clear about treatment needed to safely recycle our water?

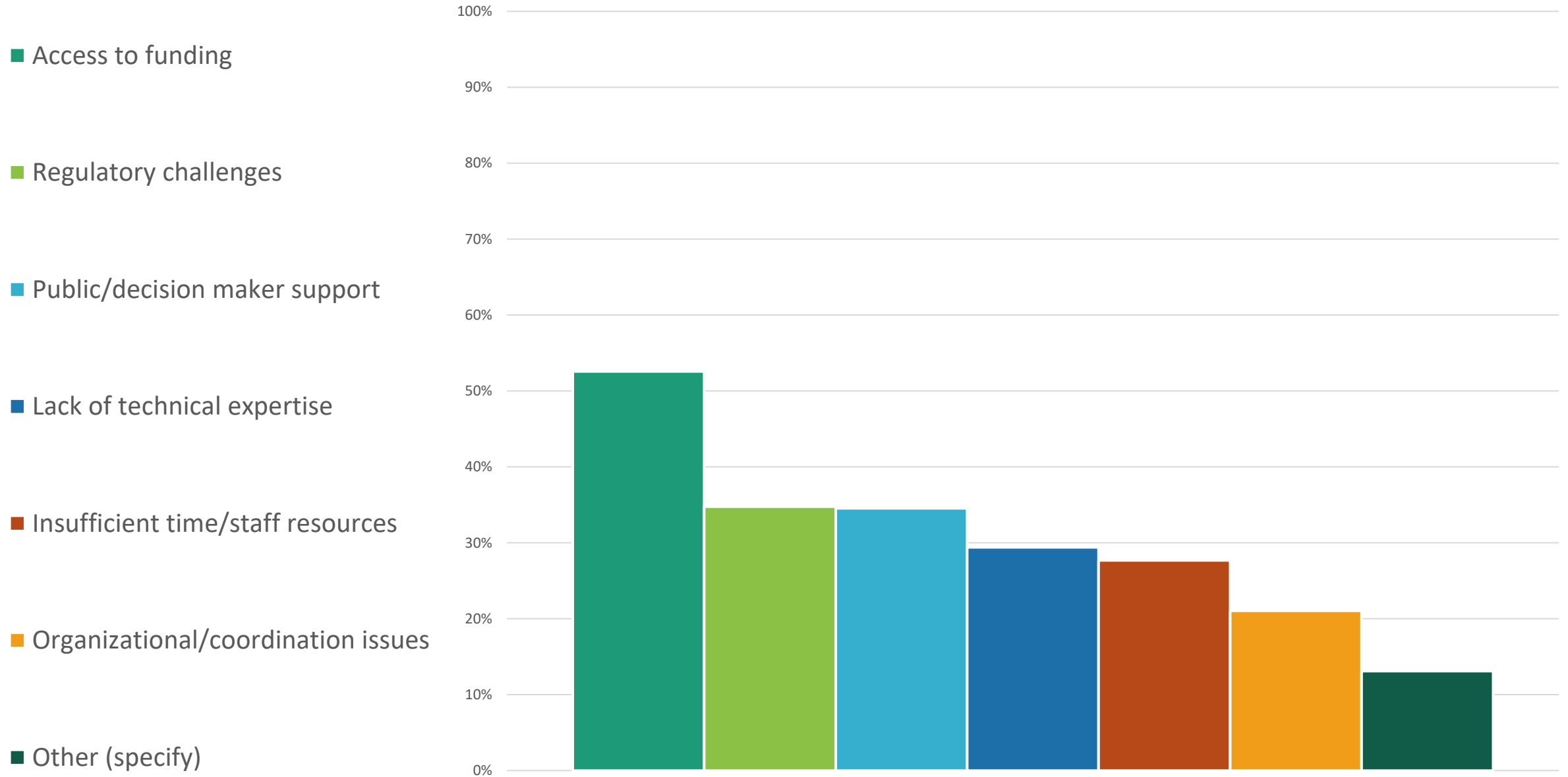


Disincentives to Recycle



- Plenty of free or cheap water
- Don't recognize supply as vulnerable
- Lack of money for infrastructure, O&M
- Lack of distribution systems for recycled water
- Public and decision-maker mistrust
- Regulatory hassles and delays

Key Barriers To Reuse



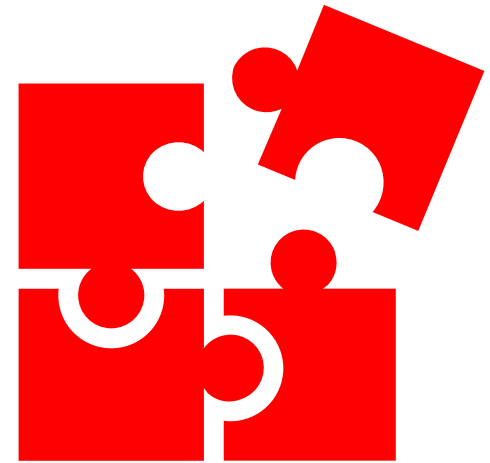
What Help is Needed?

- Project assessment and planning
- Technical training
- Financial planning and support
- Regulatory assistance
- Communications and public outreach
- Funding



How to Do Recycling: Assembling the Parts

- Water sources
- Technologies for wastewater and stormwater recycling
- Regulatory compliance
- Operational needs
- Public acceptance
- Financing



Starting Points: Wastewater

- Need a centralized source of wastewater
 - Wastewater treatment plant
 - Multi-family septic system
 - Other large volume source (casino, factory)
- Need a reason to do it
- Need space for treatment, ability to distribute
- Need resources to:
 - Build treatment and distribution facilities
 - Staff and maintain facilities
 - Work with your customers and community members

Treatment:

What's in the Wastewater?

Depends on source, but for sewage:

- Microorganisms: protozoa, bacteria, viruses
- Salt, trace metals and other inorganic materials
- Natural organic materials
- Household products, medicine residues
- Possibly, industrial wastes



Starting Points: Stormwater

- Need locations where stormwater can be captured
 - Developed areas with impervious surfaces (roofs, parking lots)
- Need room to capture and store
 - Ideally over a groundwater aquifer or near where water is needed (e.g., near landscaped area needing irrigation)
- Need a reason to do it
- Need resources to build, staff and maintain facilities



Treatment: What's in Stormwater?

Depends on source, but in most communities:

- Microorganisms: protozoa, bacteria, viruses
- Sediment and debris
- Pesticides and nutrients
- Metals and other inorganic materials
- Sometimes other organics

How Much Treatment Do You Need?

- Depends on intended use
 - Most non-potable uses just need to kill microorganisms
 - Potable reuse requires much more treatment
- Traditional wastewater treatment removes most metals and organic compounds
- Tertiary filtration and disinfection kills most microorganisms
- Advanced treatment can pretty much get rid of everything else
- Similar approaches apply to stormwater, depending on source

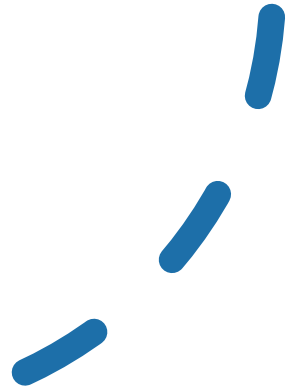
Recycling Wastewater for Non- Potable Uses

- Primary treatment: removal of settled and floating materials
- Secondary treatment: biological oxidation to remove organics
- Tertiary treatment: filtration, disinfection
- Flow equalization
- Source control



Recycling Stormwater for Non- Potable Uses

- Sediment settling
- Maybe filtration through geomedia for additional pollutant removal
- Possibly disinfection where human contact possible



Potable Reuse Treatment Needs

- **Wastewater treatment**
 - Primary: removal of settled and floating materials
 - Secondary: biological oxidation to remove organics
 - Tertiary: filtration, disinfection
 - Advanced tertiary: oxidation (ozonation, UV/peroxide), reverse osmosis to remove trace chemicals, denitrification/nitrification
- **Drinking water treatment**
 - Coagulation, filtration, disinfection

How to Build Capacity to Recycle

- Consider all water infrastructure needs
- Build community/leader support
- Determine treatment needs
- Plan with the regulators
- Identify durable funding plan to cover construction and O&M costs
- Obtain needed operator training



Operational Capacity: Wastewater

- **Wastewater Recycling**

- Reliable performance record
- Stable funding and management structure
- Solid operator training and coverage
- Advanced training where advanced technologies used
- Robust system monitoring and asset management capability



Operational Capacity: Stormwater

- **Stormwater Capture and Use**
 - Stable funding, management, and maintenance staffing
 - Adequate training to properly install and maintain BMPs
 - Robust monitoring from capture to use



Permitting, Community Support, and Funding



- Regulatory Considerations
- Building community and decision-maker support
- Paying for Recycling

Federal Regulatory Requirements for Water Recycling

- No direct requirements governing recycling
- Clean Water Act NPDES permits for wastewater and stormwater discharges
- Groundwater injection – Underground Injection Control (UIC) permitting
- For potable reuse, Safe Drinking Water Act
 - Filtration
 - Disinfection
 - MCLs

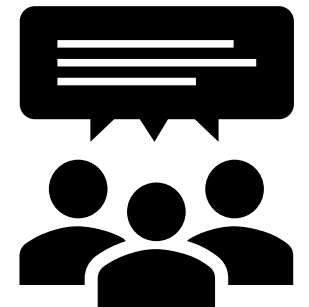


State Regulatory Requirements

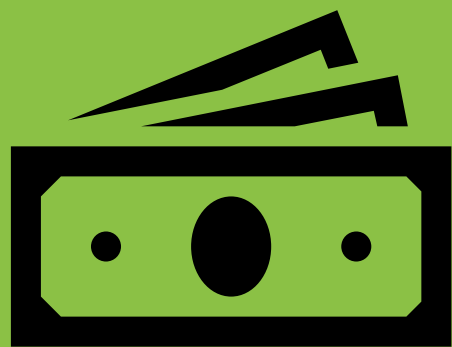
- Most are specific to the end use
- Most are progressively more stringent
 - Low risk (non-edible crops, trees)
 - Medium risk (parks, edible crops)
 - High risk (drinking water)
- Increased disinfection and toxic chemical removal required
- State recharge requirements affect infiltration/injection
- Case-by-case state regulation
- More info from WaterReuse Association and WRAP 2.1

Build Community Support

- Essential to gain public and leader trust early in process:
 - That recycled water is necessary
 - That recycled water is safe
 - That you are capable of doing this well
- Be transparent, include the public in planning



Paying for Reuse




- Many funding sources available
- Grants and loans have pros and cons
- Some local funding needed
 - match grants
 - repay loans
 - operations and maintenance
- Federal sources
 - EPA, including new Infrastructure Bill
 - USDA-RD
 - Bureau of Reclamation
 - FEMA
- EPA Water Finance Clearinghouse



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Help Through Existing Programs

- Existing circuit rider/technical assistance programs
 - National Rural Water Association
 - USDA-Rural Development
 - Rural Community Assistance Partnership
 - Environmental Finance Centers
 - WRAP 8.5 Pilot Projects
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Help, and Where to Find It

US EPA's Water Reuse Action Plan: (www.epa.gov/waterreuse/water-reuse-action-plan)
- WRAP Action 8.5: (www.epa.gov/waterreuse/national-water-reuse-action-plan-online-platform?action=8.5)

WaterReuse Association (www.watereuse.org)
- Guide to State Regulations (www.watereuse.org/advocacy/state-policy-and-regulations/)

USDA-Rural Development: (www.rd.usda.gov/)
National Rural Water Association: (www.nrwa.org)
Rural Community Assistance Partnership: (www.rcap.org)

Written guide to water recycling resources: (www.epa.gov/sites/default/files/2020-07/documents/action_2.2.15_milestone_6_water_reuse_references_for_tribal_reuse_projects_508.pdf)

Guide to funding sources: (www.epa.gov/sites/default/files/2020-07/documents/action_2.2.15_milestone_6_federal_funding_sources_for_tribal_reuse_projects_508.pdf)

EPA Water Finance Clearinghouse (www.epa.gov/waterdata/water-finance-clearinghouse)

Case Studies from Washington State: (<https://your.kingcounty.gov/dnrp/library/2005/kcr2275.pdf>)

Macler, B, S. Bishop and D. Smith (2021). Smaller Utilities: Put That Wastewater and Stormwater to Use! Opflow 47, 10:

Questions
and
Comments?



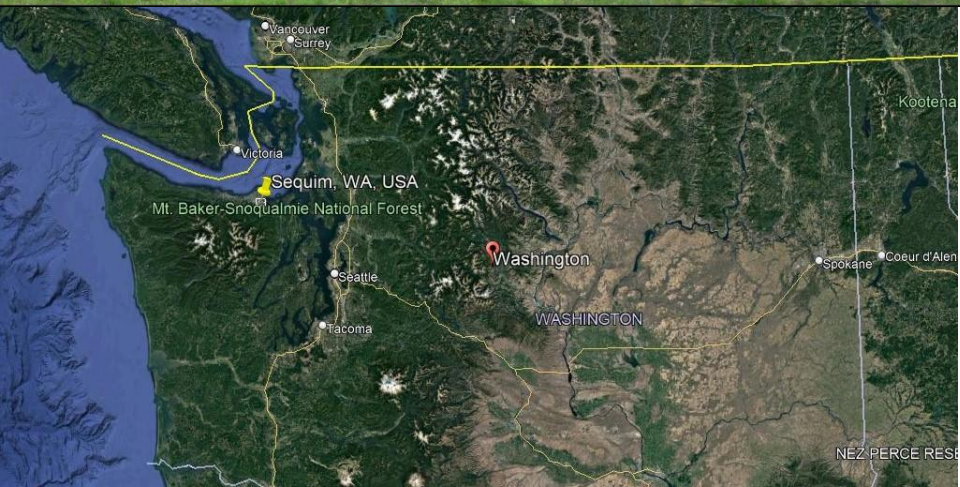
Thank you!

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- **City of Sequim, Washington**
- **Location \approx North Olympic Peninsula**
- **Population \approx 7,800**
- **Rainfall \approx 15"-17"**
- **Distance to Pacific Ocean \approx 85 miles**
- **Distance to Hoh Rain forest \approx 105 miles**
 - **Hoh Rain Forest annual rainfall \approx 140 inches**
- **Rain shadow... !**

City of Sequim Water Reclamation Facility

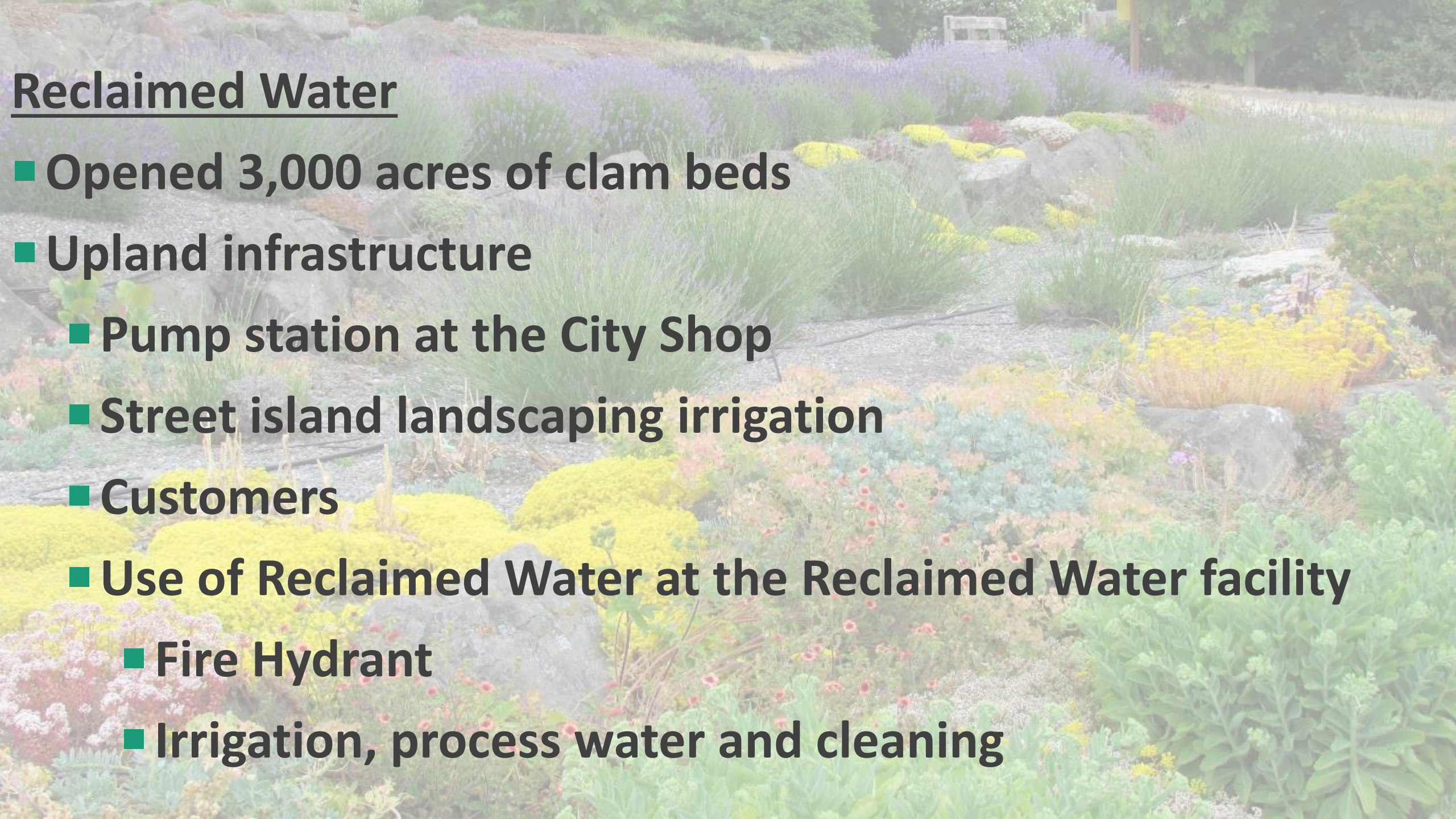


Date: 2/17/2021



Why Did Sequim Move to a 100% Class “A” Reclaimed Water?

- **Lawsuit**
- **Settlement Agreement**
- **Advisory Group**
- **Upland**
 - **Reclaimed Infrastructure**
 - **28-acre Reuse Demonstration Site**
 - **12-acre playfield for soccer**
 - **Bandshell for music, education and festivals**



Reclaimed Water

- **Opened 3,000 acres of clam beds**
- **Upland infrastructure**
 - **Pump station at the City Shop**
 - **Street island landscaping irrigation**
- **Customers**
 - **Use of Reclaimed Water at the Reclaimed Water facility**
 - **Fire Hydrant**
 - **Irrigation, process water and cleaning**

Reclaimed Water

Reuse Demonstration site

- Irrigation
- Toilet flushing
- Storage pond
- Migratory water flow ponds
- Stream augmentation
- Rapid Infiltration pilot project
- Fire hydrant

What has worked in Reclaimed Water Upland Use

- City property irrigation
- Construction water
- Street cleaning
- Sewer Jet/VAC Truck
- Flushing sanitary sewer mains
- The Rapid Infiltration Pilot Project is a work in progress

What doesn't work with Reclaimed Water

- Reclaimed Water usage by customers

The largest benefit of Reclaimed Water for Sequim

- The environment
- Irrigation of City properties
 - The City has complete control of the reclaimed water.
 - Using reclaimed water for irrigation saves our drinking water up to 600k GPD