Opportunities for Achieving Next Generation Water Infrastructure in California, Oregon and Washington

Funding for this report generously provided by the Scherman Foundation's Katharine S. and Axel G. Rosin Fund

We are at a pivotal point with tremendous opportunity. Our nation's water supply and wastewater infrastructure is well beyond its designed lifespan[1]. In far too many communities, it is straining to meet current demand. This poses present-day impacts and serious future threats to our drinking water quality and the health of our communities and natural waterways. While performance lags, the cost to operate and maintain these systems increases. Even performing at their peak, most systems are not designed to remove the ever-increasing pollutants or recover the precious nitrogen and phosphorus nutrients in our wastewater.

We need to accelerate the adoption of the next generation water infrastructure that will protect and preserve our planet's precious water resources for all species. While preparing for population growth, we still need to protect public health, meet climate resiliency needs, and fulfill global sustainability commitments. Components of this next generation water infrastructure exist now. Examples can be found in pioneering projects and communities around the nation and the world. In many cases, these systems use less water and energy, recycle water repeatedly, capture nutrients for beneficial use, and perform at a cost below conventional water treatment systems.

Operating at the intersection of public health and personal hygiene, water-related innovations often meet the most resistance to change. The relatively low cost consumers pay at the tap discourages investment in site or neighborhood scale water collection, reuse, and treatment infrastructure. In addition, non-profits and other organizations that share a common interest in "legalizing" sustainable and regenerative water infrastructure often operate in isolation, making advocacy efforts less effective. To accelerate adoption of next generation water infrastructure allied partners will need to make a concerted effort to learn from projects on the cutting edge, change perceptions among professionals and the public, and work collaboratively across disciplines to change the way we govern innovation. It is a not choice between centralized and decentralized systems. To maintain healthy, resilient, and safe communities into the future, we need to effectively integrate decentralized systems into existing centralized systems.

With support from the Rosin Fund of the Scherman Foundation, Recode, the International Living Futures Institute (ILFI), and Oregon Environmental Council are working together with a broad base of stakeholders to identify barriers and create and test solution pathways over three years. While the focus of this work is in California, Oregon, and Washington, the research, findings, and approach will have broader applicability.

BUILDING BRIDGES

The development and scope of this project have been informed by our previous years of research in this field as well as the work of many others. ILFI's work is summarized in part in the following reports, found at living-future.org/research/:

- *Making The Switch: Transitioning Toward Integrated Water Management in Puget Sound*
- *Policy Making for Healthy, Resilient Water Systems in The Puget Sound*
- *Clean Water, Healthy Sound: A Life Cycle Analysis of Alternative Wastewater Treatment Strategies in The Puget Sound Area*
- *Regulatory Pathways to Net Zero Energy Water*
- *Toward Net Zero Water – Best Management Practices for Decentralized Sourcing And Treatment*
- *Achieving Water Independence in Buildings: Negotiating The Challenge of Water Reuse in Oregon*

[1] *The Economic Benefits of Investing in Water Infrastructure*. Retrieved from: http://bit.ly/RW-eii

Examples of others' work that has informed this project includes:

The Center for Sustainable Infrastructure's 2017 high-level report "*A Northwest Vision for 2040 Water Infrastructure*[2]" outlines innovative financial and policy approaches for water utilities and their communities to create resilient next generation water infrastructure. The report's focus is on how water utilities and our governments finance water supply, wastewater treatment, stormwater, and flood prevention infrastructure. They interviewed utility managers, technical experts, engineering consultants, design innovators, non-profit leaders, tribal officials, and equity advocates. Consistent with our early research findings, the report emphasizes that with the rapidly changing world of water treatment, distribution systems and technology, we must focus on regulating *performance* rather than the *process*.

The San Francisco Public Utilities Commission (SFPUC) partnered with the U.S. Water Alliance in 2016 to convene the National Blue Ribbon Commission for Onsite Non-Potable Water Systems. The National Blue Ribbon Commission is comprised of public health agencies and water utilities from nine states and the District of Columbia. Their mission is to advance best management practices that jurisdictions can use to support on-site non-potable water systems for building. The Commission has published their work in the recent publication entitled *Risk Based Framework for the Development of Public Health Guidance for Decentralized Non-potable Water System.*[3] .

DEFINING NEXT GENERATION WATER

Many terms can be used to describe the approach to and the goals of sustainably managing water and human waste at an appropriate scale within the built environment.

Next generation water considers the impacts of the larger-scale built environment on watershed health, both seasonally and over the long-term, prioritizing this as a framework. The watershed's flora and fauna, which provide numerous benefits for people, are adapted to its historic water balance. In next-generation-water-towns and cities, water leaves the site to evaporate, infiltrate or run off in volumes and timing that closely match the historic water balance, while still providing for the needs of people and industry. Rainfall is captured and treated for reuse, which generates graywater. Untreated graywater can be used for irrigation. Toilets and urinals might be waterless or treated graywater flushes toilets, which generates blackwater. Treated blackwater and excess stormwater recharges groundwater or evaporates. Excess stormwater runs off. Next generation water also includes nutrient cycling and food systems, which are regenerative building opportunities. All the water and nutrients are in a dynamic equilibrium at the micro- and macro-scales.

This term "Next Generation Water" provides a working definition of what we are trying to achieve based on performance, instead of process or prescriptive approaches. Some examples of water conservation and watershed health strategies that support our goals include graywater and blackwater on-site treatment and reuse, rainwater harvesting, low impact development/green infrastructure, nutrient recovery and innovations in agriculture such as dry land farming. Other technologies that conserve water and are also part of the next generation water conversation include items such as waterless urinals, composting toilets, urine diverting dry toilets, amended soils and native plants. Systems and approaches can be optimized at various scales from the site to the neighborhood to the watershed depending on the project context and climate.

OUR PROCESS

In early 2017, Recode and ILFI conducted over fifty targeted interviews with green building practitioners, regulators, manufacturers, non-profit leaders, customers, and early adopters of next generation water approaches from across the country. We asked interviewees what water-related barriers or issues they encountered as they pursued ambitious water goals and innovative water strategies, including those in the Living Building Challenge. Interviewees

[2] http://bit.ly/RW-2040
[3] http://bit.ly/RW-rbf

also shared how they interacted with different agencies and their strategies and ideas for how to overcome the barriers they encountered on their permitting path.

We also gathered feedback through the Water Summit at the 2017 Living Future unConference[4]. We combined presentations with active engagement and invited over 70 attendees to rank our barriers. They ranked Barriers 3, 4, and 5 as their highest priorities. From that, one of these three barriers were assigned to different tables for discussion and a report back to the group. Participants recorded ideas on giant sticky notes that our team transcribed and incorporated into our work. We solicited a review of this work. Final comments have been incorporated into this document.

NARROWING OUR SCOPE

ILFI and Recode staff ranked the solutions and barriers we heard during these interviews on a scale of one to five based on the impact the ideas or barriers have on sustainability, social equity, replicability/transferability, return on investment, and timeline for change to occur. For example, some ideas with a high impact for sustainability would take a long time to implement, so ranked lower overall on our list.

Through these processes, this document represents a vetted and finalized version of our top ten solutions pathways.

WHAT'S NEXT

Recode and ILFI will focus on implementing, testing, and reporting on three of the key solution pathways by the end of 2019.

We believe that good ideas, like seeds, need to be disseminated widely to ensure propagation. While Recode and ILFI will be focusing on three of these opportunities, our hope in sharing this list is that others will be inspired to work with us or take on different opportunities. Together, we can match passion and expertise with on-the-ground need to honor and protect our precious water for all species for generations.

[4] http://sched.co/8Y4j

Achieving Next Generation Water Infrastructure
Top Ten Barriers and Possible Solution Pathways

RANK	BARRIER	SOLUTION PATHWAY IDEA(S)
1	 **MAP HOTSPOTS** There is no consensus or readily available guidance on when and where different water system technologies are appropriate.	Map hotspots where decentralized water strategies could be useful for a specific locale due to pressing water infrastructure issues like sewer overflows or drought. Such a map would help municipalities and water utilities better communicate to owners and developers where and what kind of water technologies would help address local issues. Document and share the methodology to create a map of local hotspots.
2	 **DATABASE** More data is needed on the operational performance of newer water reuse technologies (like large non-potable water reuse systems).	Create a database to share performance data on new and existing technologies. Make this a living database which demonstrates the performance of all systems (conventional and next generation) to real events. This performance evaluation database will provide an effective, quantified approach to infrastructure planning.

3

TRUE VALUE OF WATER

Financial motivators for innovative water systems largely don't exist, and don't equitably distribute funds between the stakeholders.

"Water is a major expense and an intensely variable one. Case studies would be helpful. Ultimately it would be good to demonstrate that water saving strategies should be a policy priority worth the extra expense up front."

– Erik Pattison, Housing Developer for ROSE Community Development

"There's a social justice aspect to water utilities having the same ongoing costs; those who can't afford to upgrade to these new on-site systems are footing the bill for maintaining the municipal infrastructure. No city I know of has ever separated out these services they're providing for users."

- Colleen Mitchell, Herrera Environmental Consultants

a. Municipal/County Scale: Clarify where decentralized approaches would help municipal water quality, quantity, resiliency, and other goals. Provide trainings and other technical support.

Create appropriate incentives to encourage adoption of next generation water including ideas like:

- Replicate the Living Building Challenge Pilot Program in Seattle
- Create a community of water that promotes a lifestyle around water culture and identify (includes a numerical goal, upward positive pressure, round table, supports innovation)
- Offer a capital offset for developers, extra density, or area allowances
- Separate incentives from the buildings

b. Utility Providers:

- Monetize the cost of water while providing every person/household with a subsistence/baseline volume of water for free
- Change metering approach
- Reduce water meter size for residential applications to reduce system development charges
- Meter wastewater so that sewer bills are based on discharge, not potable water use. Adjust the wastewater tap fee based on metering
- Provide non-potable water at slightly reduced fees
- Apply penalities if different forms of water aren't separated
- Charge large users more

c. Developers and Owners: Create financial case studies for next generation water precedents. How have other projects made the case, what has been the actual return on investment? Create grant programs to incentivize hardware investments. Include report on how other city's (like San Francisco PUC) grant programs have benefited their area. Create funding streams that are tied to the title of the home, similar to PACE for solar, low flow water fixtures, and energy upgrades.

d. Practitioners: For water capture, reuse, and treatment practices, develop professional education and trainings for practitioners and evaluate how these systems can help their bottom line.

- *Upcoming Resource: The Urban Fabrick Collaborative is in the process of finalizing the "Design Professional's Practice Guide to Integrating Onsite Water Use and Reuse."*[5]

e. Public/Private Partnerships for Research and Development (R&D): Quantify and standardize costs for new technologies and systems to speed up innovation and demonstrate a regulation path. Higher education should be the research organization to demonstrate the technology to reduce utility R&D cost.

f. Building Appraisers: Educate them about the added value of on-site water systems so funding mechanisms support water reuse. Target seminars and talks to real estate and lending and banking institutions.

[5] http://bit.ly/RW-dppg

4	 **REGULATORY PATHWAY** Some jurisdictions lack a management and regulatory structure for water provisioning and wastewater treatment at scales smaller than city scale but larger than single-family residential. When jurisdictional water "champions" leave, institutional knowledge is lost.	a. In partnership with regulatory officials, draft a reasonable management model and regulatory pathway for projects between single-family residential and municipal water works while maintaining reasonable costs per user. • *Upcoming resource: San Francisco PUC and others are developing model regulations and local programs* b. Draft an Ordinance Memorandum of Understanding that identifies and records responsibilities and who has what authority. Create a systems approach to coordinate central utilities and decentralized systems. Use lessons learned from the energy sector. c. Provide "roadmaps" that explain the regulatory process for different thresholds (e.g. number of units or project size). d. Support adoption of a performance code to replace or sit alongside the current prescriptive regulations. e. Develop a monitoring metric scaled to the project size that is practical and cost-effective to implement such as a "Miniscale Operator License" for daily/weekly activities with support from more highly trained individuals for monthly and more technical activities. f. Make the case to jurisdictions that includes compelling value propositions related to resilience, health, combined sewer overflow, flood damage, downstream waste cost. g. Remove the "undue hardship" regulatory requirement and the "high performance" incentive during the permit process. h. Provide staff with incentives to adopt regulations: o Checklist tools o Use a "safety valve" approach so small cities can send to state for review and approval similar to the Underground Injection Control and 1200-C construction permits for stormwater)

5	**PARADIGM SHIFT** We lack a larger vision for next generation water. *"Decentralized water reuse and centralized water infrastructure practitioners need to start thinking collaboratively at a watershed scale. We need to discover the optimal scale and integration for both decentralized and centralized water reuse while recognizing that it will likely differ from watershed to watershed throughout the state."* - Debbie Franco, California Governor's Office of Planning and Research	a. Create high-level (possibly state level) goals to support and catalyze local initiatives. For example, "5% of all urban water is generated from on-site reuse." b. Re-value the true cost of water to quantify the cost impact that development projects have on downstream pollution and upstream treatment. c. Encourage larger paradigm shifts across all agencies (e.g. US Water Alliance; 'One Water' movement) grounded in watershed health and sustainability. Shift from waste management to resource management attitude and approach. Clarify the comparative long-term public health risk of on-site treatment compared to municipal treatment. d. Develop regional alliances. Share local level successes. e. Need higher level goals appropriate for bioregions and globally. f. Provide incremental goals to achieve paradigm shift, breaking up the steps for local jurisdictions. Rank and prioritize code changes. g. Set targets and enforce and regulate these. h. Increase public awareness regarding the consequences of maintaining the status quo as it relates to water use (e.g. ad campaign exposing the dangers of water resource depletion showing examples of other countries or communities who have failed to address the issues and the result of inaction.) Match a small dose of fear and big dose of hope to an action that's do-able.
6	 **NATIONAL STANDARD** We lack a national standard for treatment and reuse of non-potable water adopted by all states.	a. A national standard and framework for reuse of non-potable water adopted by all states. • *Existing Resource: In 2017, the National Blue Ribbon Commission to Accelerate the Adoption of Onsite Water Reuse created recommended guidelines for non-potable water reuse for health departments and actionable recommendations for consideration by the US EPA[6]. They also foster state-level peer exchange and learning among water utilities and state public health agencies that are working to establish standards and practices for on-site water reuse.* b. Develop a task force to track federal government actions to organize "resistance" efforts and "support" efforts by the community as appropriate and timely. We cannot let the divisive agenda of our federal government undermine the progress that has been and must continue to be made at the state and county level and at the federal level.

[6] http://bit.ly/2zquaUy

7	 **CONFLICTING CODES** Jurisdictions inconsistently interpret existing rules due to a lack of consistent regulations for different types of water and nutrient reuse (blackwater, greywater, rainwater, stormwater, compost, etc.).	a. Work with regulators to create state specific roadmaps to next generation water with links to additional resources to help agencies explain how current regulations work and save projects time and frustration. b. Create and normalize terms for different types of water across jurisdictions (plumbing, environmental health, etc.). c. Create consistent permit pathways for water collection, treatment, and reuse projects at all scales. • *Upcoming resource: San Francisco PUC and others are developing model regulations and local programs*
8	 **OUTREACH** The public lacks confidence in water and wastewater treatment systems and possesses overarching misconceptions around health and sanitation.	a. Share ways to combat the public health concerns related to water and nutrient reuse systems. For example, a guide and webinar on how to address the most common concerns about composting toilets. • *Upcoming Resource: Blue Ribbon Commission Non-potable Reuse's health guidelines can serve as a resource in addressing public health concerns.* • *Existing Resource: Marketing Non-potable Recycled Water: A Guidebook for Successful Public Outreach & Customer Marketing by the Water Reuse Foundation*[7]. b. Targeted education campaign about the safety of water reuse for a specific jurisdiction to show where the low hanging fruit projects are for that area and explain the local supply and treatment issues. Glorify the process of water reuse as "Purified Water" and make the concept sound more attractive to the general public.
9	 **JURISDICTIONAL AUTHORITY** Agencies lack the organizational capacity for program management.	If jurisdictions lack the financial resources, staff or other internal components to effectively adopt new building codes for health, safety or sustainability, then they need to have the ability to adopt or delegate their authority (e.g. to the state or federal government) to a method that allows change to occur.

[7] http://bit.ly/RW-mnrw

10	 **TECHNOLOGY** Technology & industry need further development.	a. Need NSF certified products. b. Performance standards are needed to allow alternative treatment trains. c. Develop an expert practitioner database so that project teams and building owners can easily source out and hire water consultants to help solve design challenges within their region. d. Support the development of off-the-shelf solutions that have been tested and approved by brand name manufacturers to reduce risk at all scales, similar to buying an off-the-shelf water delivery system such as a faucet, toilet, shower head, dehumidifier, coffee maker, water dispensing refrigerator etc. These product examples all pose potential health risks to those using them, yet there is very little concern among the public due to a high level of trust in the products and manufacturers supporting them. How many typical buyers check to see if the water dispensing system on the refrigerator they are considering buying at Home Depot is NSF certified etc., yet it is highly likely that this water dispensing refrigerator will serve as the sole source from which the buyer will drink water from on a daily basis.

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Thank you to our amazing interviewees and reviewers who generously shared their ideas and experiences with us. Your insights were and continue to be invaluable!

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