The Promise of a New Paradigm

If we hope to deliver on the promise of a paradigm shift in our relationship to water, we must:

- Rethink the relationship of water management in light of critical planetary thresholds of climate change, nutrient and phosphorus cycles, land use, biodiversity, and toxic chemical pollution;
- Search for solutions that work with and mimic nature;
- Manage infrastructure systems for productivity, stability, and resilience;
- Restore natural hydrology – rebuild ecosystem services;
- Blend building-scale, district-scale and centralized infrastructure networks;
- Close loops – reuse water, energy, and nutrients locally;
- Avoid waste – recover energy, nutrients, chemicals from wastewater;
- Build the green economy and high-skill jobs;
- Beautify – aim for healthy and "enriched" communities, the Common Wealth;
- Integrate institutions and policies to enable synergies;
- Innovate and adapt;
- Demand holistic designs that lower total direct costs and/or maximize multiple values (profits for developers, health and prosperity for communities);
- Break down silos between water, stormwater, wastewater managers, urban planners, architects, and scientists;
- Pilot systems designed at all scales;
- Redefine professional practice to this broader vision of the future.

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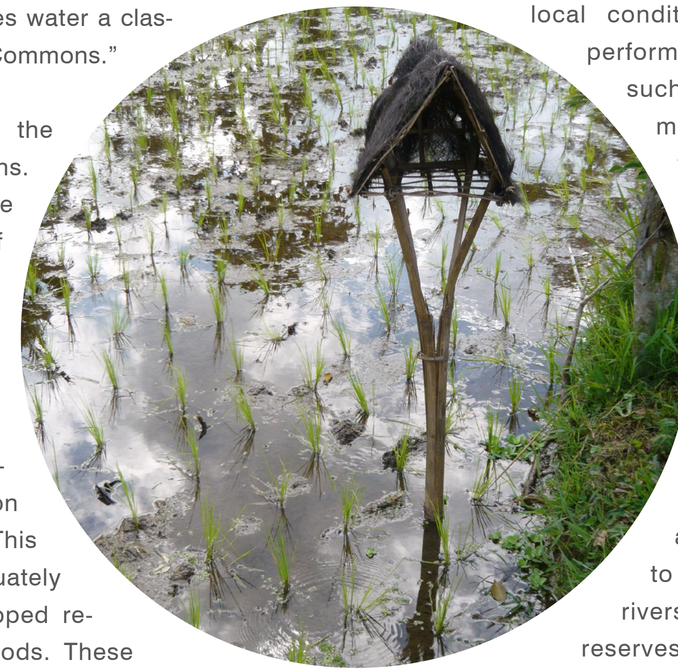
RESTORING THE WATER COMMONS

21st Century Water Management

Water is fundamental to life. It is a resource that is commonly shared. While some benefit from its use, all share in the costs of its abuse. This makes water a classic case of the "Tragedy of the Commons."

We fail if we only focus on the pieces of the Water Commons. Our peril is by missing the whole we risk the unraveling of ecosystems, lost communities, and environmental degradation.

Until now, our water, wastewater, and stormwater infrastructure has relied on an industrial model of specialization and economies of scale. This "siloed approach" has adequately protected the public in developed regions from pathogens and floods. These systems store and pipe clean water long distances into population centers and transport wastewater pollutants away. This worked well when energy was cheap and resources were plentiful, but those times are behind us. How sustainable will these strategies be as populations increase, costs rise, and resources shrink? How resilient will these systems be as climate change places even greater stresses on the natural-man-made system that we have built?



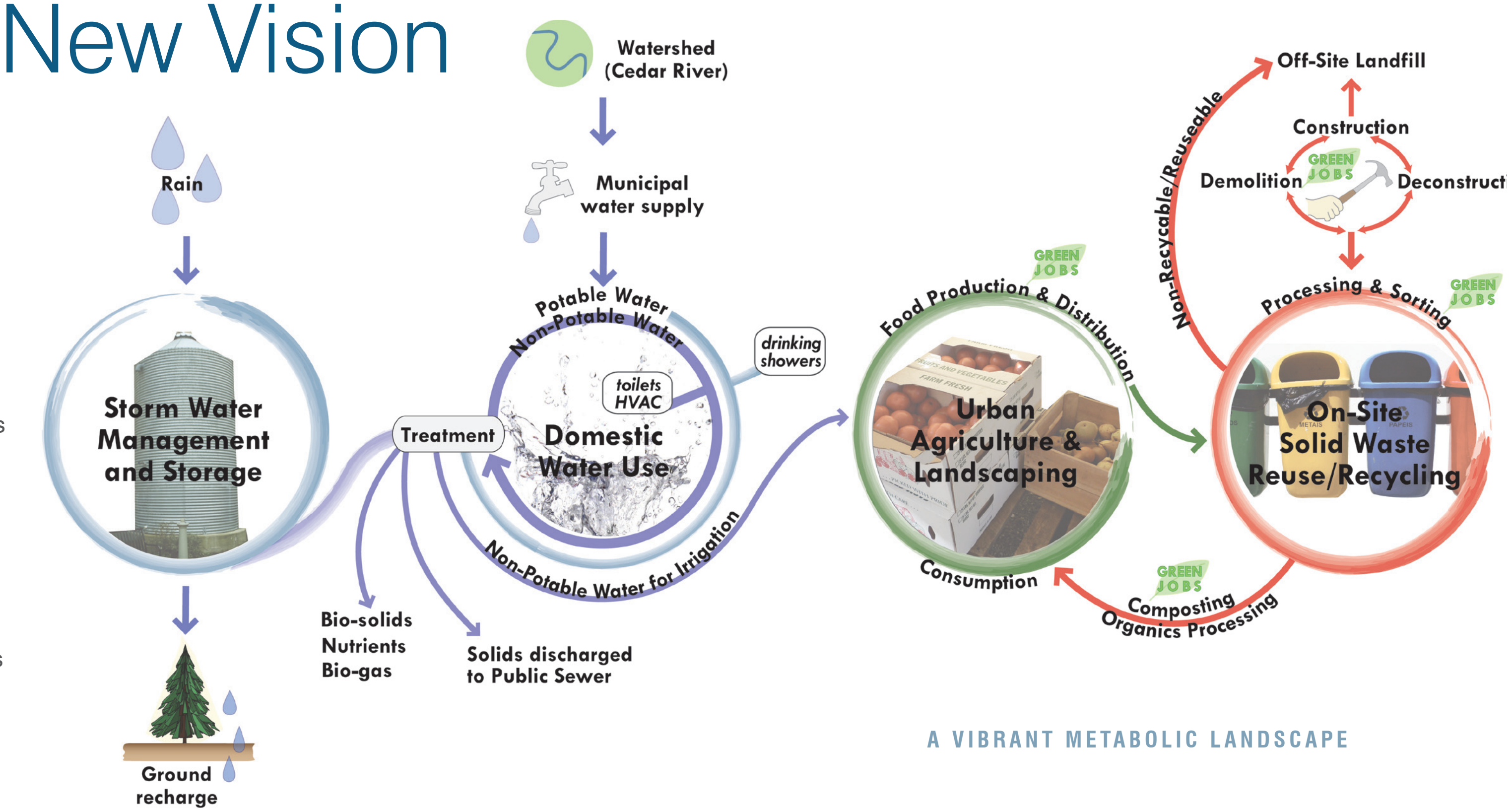
Restoring the Water Commons relies on design principles found in nature: in particular, interdependencies and integration, loops and reuse, and adaptation to local conditions. Already many high-performance treatment technologies such as membrane bioreactors mimic biological designs. As we've demonstrated in the energy sector, there are alternative approaches in water that can meet our needs and restore natural resource patterns and functions across a landscape. These "smart, clean, and green" approaches create a wealth of services and benefits at the local level to remove toxins from ponds, rivers and estuaries, groundwater reserves, habitat and landscapes, and evaporative cooling and nutrient cycles in the Commons.

A new paradigm for 21st Century water management is emerging just in time. This new paradigm builds upon our understanding of the linkages between things, rebuilds feedback loops between cause and effect, and reshapes our relationship to water, the source of life on earth.

Transitioning to a New Vision

We know that cities accommodate half the world's population, yet water security is not assured for billions of people. Pollution limits water supply for potable purposes and is the vector for avoidable disease and death. The cost of traditional infrastructure is priced out of reach for most of the world's people. Climate change impacts cities with droughts, floods, and sea level rise. The uncertainty of these climate change impacts changes the design reliability of the systems already in place. Life is made even tougher in regions where the infrastructure is already deficient. Fortunately there are good examples of integrated solutions that create resilience in the face of uncertainty. These transitions reflect a new market. They begin to reframe how we think of the services we expect from urban infrastructure. Some of those transitions are:

- from a linear approach for water systems where discrete systems are deployed to collect water, treat water, use water, and get rid of water to a more restorative and regenerative approach where integrated systems provide water, energy, and resource recovery linked with land use design, regulation, and community health.
- from water and wastewater systems designed using historical rainfall records to a range of multiple and overlapping techniques that create urban resilience and better accommodate the uncertainty around climate change.



A VIBRANT METABOLIC LANDSCAPE

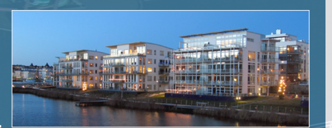
- from utilities tracking costs alone to utilities evaluating the full array of benefits that come from investment and technology choices they make. It's not just accounting any more, but value creation!
- from building prototype projects to redirecting existing flows of capital so that we routinely create this new paradigm, this new normal.
- from a business-as-usual toolkit to an expanded toolkit of options for our water and urban infrastructure that includes the latest high-tech options, the latest low-tech and the latest natural systems strategies too.
- from institutions and regulations that block innovation to new generations of regulators and government entities that encourage innovation.
- from elected officials accepting the status quo to elected leaders insisting on integrated solutions.

In truth, these transitions are still the exception - not the rule. Most governments and utilities struggle to maintain their current infrastructure systems. They don't have the expertise or time or resources to study a new way of doing business. And most consulting companies realize that they have to serve the market that exists, not markets that may or may not be on the horizon. Most universities teach the same curriculum they have taught for decades and that match accreditation standards. Most government regulators are satisfied to enforce the laws they already have on the books rather than make changes that might create problems they can't predict.

Yet pioneers exist across this planet. From Stockholm to Singapore, from Seattle to Sao Paulo new projects are being created. China, Korea, Australia and Turkey have national initiatives that are setting the stage for this transition. New projects and technologies and new partners are reaching out to collaborate on behalf of this new idea for urban infrastructure. Planners and architects, regulators and funders, transportation engineers and water experts, mechanical engineers and energy experts are recognizing their role in helping to create a more integrated future.

CASE STUDY

Hammarby Sjöstad, Sweden
Site area: 200 hectares
Housing units: 10,000 apartments,
20,000 residents (projected)
Commercial Space: 2,000,000 sq m.



Hammarby Sjöstad is a sustainable mixed-use development adjacent to the center city of Stockholm. A redevelopment of a formal industrial area, the development was initiated as part of Stockholm's bid for the 2004 Summer Olympics. A main circulation artery serves the city is a boulevard along which almost all ground floor space is dedicated to businesses and other commercial uses. Additional commercial space is clustered in buildings distributed throughout the development. The development pattern of HS is based on the model of Stockholm's old city – the urban form is modeled closely on the historic fabric in order to provide continuity and to capitalize on Stockholm's successful urban environment.

Water forms the heart of the development – Lake Hammarby is the "blue eye" of the city. The lake is lined with walkways, docks, parks, and mixed-use buildings that engage that waterfront – the lake is the primary public space and the center of the community.

The environmental aspects of the redevelopment are a critical part of the success of the city. The redevelopment was designed around decontamination of brownfield sites, extensive public transportation options, energy use reduction, and recycling water and waste. The "Hammarby Model," developed through cooperation between Birka Energy, Stockholm Water Company, and the City of Stockholm Waste Management Bureau, includes doubling the efficiency of energy production, waste reduction and energy conservation. The development includes an innovative sewage treatment plant. Waste is cleaned and purified at a central plant and waste is turned into biogas for cooking. Excess heat generated in the purification process is used to provide heat to buildings. The sewage facility also includes an experimental waste recycling program for use in agricultural production.

Broadening the Objectives

The Baltimore Charter in 2007 stated:

Water is at the heart of all life. In the past, we built water and wastewater infrastructure to protect ourselves from diseases, floods, and droughts. Now we see that fundamental life systems are in danger of collapsing from the disruptions and stresses caused by this infrastructure.

New and evolving water technologies and institutions that mimic and work with nature will restore our human and natural ecology across lots, neighborhoods, cities, and watersheds.

The Charter challenges all water managers to think, plan, and implement in a broadened problem statement. We have assumed that first cost is the primary decision-making driver in each siloed project. We need to expand the set of objectives that guide capital spending. Restoring the Water Commons means accounting for the links between water and climate change, quality of life in communities, energy use, land use, nitrogen and phosphorus cycles, toxicity, and biodiversity. It means thinking of all of these pieces as part of one plan – water supplies, stormwater management, flood control, energy, transportation, solid waste, jobs, quality of life – rather than as separate projects.
In particular, we need to be mindful of the critical "hard-wired" thresholds in the Earth's environment, and respect the nature of the planet's climatic geophysical, atmospheric, and ecological processes.

Some additional values that could be integrated into an expanded objective function:

- Create cost effectiveness across functions and media (water, energy, livability, etc.)
- Shrink the environmental footprint
- Reintroduce the evaporation cycle
- Consider alternatives that include and extend beyond utility function
- Close loops by reducing or eliminating import or export of resources and pollutants
- Evaluate solutions at multiple scales including beyond the project boundary
- Seek ecological analogues for system design
- Design to mitigate global environmental hazards.
- Future-proof investments by evaluating incremental investments that maintain system flexibility
- Favor solutions that increase resilience of the system in light of a future of unpredictable change
- Create and integrate innovations as part of a constant design-implement-review loop

CASE STUDY

20 River Terrace –
The Solaire
Completed 2003
Building area: 357,000 sq ft
27-story, 293-unit residential tower in Manhattan,
New York City
LEED Gold, Green Building Challege Level 2.0

The Solaire was the first building designed in accordance with the new environmental guidelines of the Battery Park City Authority, the entity that oversees construction in Battery Park City, a district of Manhattan. The building was designed to consume 35% less energy, reduce peak electricity demand by 65%, and use 50% less potable water than a conventional residential highrise.

A wastewater treatment and reuse system was constructed on site – this system provides water for the cooling tower and for the building's toilets. Rainwater is collected for irrigation of a green roof and rooftop garden. The green roof is the equivalent of 57% of the site area. The roof design includes a water retention layer that slows the flow of water, maximizing opportunity for evaporation and plant uptake. The stormwater system includes a 10,000 gallon stormwater tank that separates sediment and treats the water. This system has allowed for significant landscaping on and around the building, but requires no potable water for outdoor use.