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NON-GOVERNMENTAL ORGANIZATIONS: ENHANCING THEIR ROLE IN ADVANCING THE NEW WATER INFRASTRUCTURE PARADIGM

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Coalition for Alternative Wastewater Treatment,
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They gratefully acknowledge, in particular, the participation and insights of the following individuals: Glen Daigger, Nancy Stoner, Mark Shannon, Ed Clerico, Steve Moddemeyer, Rich Sustich, and Patrick Lucey. These individuals have also formed the nucleus of the new Water Alliance that has been proposed as part of this project. This report was written by Valerie I. Nelson, Becky Smith, Polly Vail, and Paul Schwartz, and does not necessarily represent the views of individuals and organizations that participated in workshops and other discussions and reviews.

ABSTRACT AND BENEFITS

The objective of this project was to enhance and strengthen the role of nongovernmental organizations (NGOs) in defining and implementing a new water infrastructure paradigm. Sustainable water management will increasingly incorporate new systems that use, treat, store and reuse water efficiently at small scales and that blend designs into restorative water hydrologies. Such approaches will help the existing centralized infrastructure adapt to emerging water shortages, financial shortfalls, energy constraints, and polluted environments. They also have been found to create multiple benefits for communities, in terms of water quantity and quality protection, air quality and public health improvements, property value increases, recreational space, and climate mitigation.

Changing an entrenched paradigm of institutions and practices requires an extended period of conversation and research among professionals, government, and the public, along with piloting of on-the-ground projects. Over time, these insights and experiences serve as the basis for broad policy and institutional reform to mandate or incentivize new approaches. While there is currently an interest in sustainability issues within the federal policy community, reform of the scope and nature required must entail a spreading of ideas and broad-based mobilization of support throughout the country.

This project created the foundation for increased civil society engagement in shifting the water paradigm at all three levels – national, state, and local. The following objectives were accomplished:

- Gaining support for 21st century water management concepts within the Clean Water Network, a national education and advocacy network of over 1,100 clean water organizations from around the country;
- Development of a new Water Alliance of multiple professional, utility, academic and environmental constituencies seeking to further 21st century water approaches in federal governance;
- Drafting of consensus statements and documents, which reflect the perspectives of professional stakeholders and which resonate with the values and concerns of the public and opinion leaders;
- Creation of an NGO-led multi-stakeholder alliance and agenda for reform in Massachusetts, an approach which can serve as a model for other state-level networks;
- Design of an education and outreach program for Cape Cod towns and for Boston, which can be models for assistance to other communities facing water crises and searching for alternatives nationwide.

Participants in the project have stated their intentions and mapped out their strategies for future collaborative work in stimulating and guiding the civic engagement required for a transition to sustainable water management.

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CHAPTER 1.0

INTRODUCTION

Summary of Objectives and Approach of the Project

The overall objective of this project was to enhance and strengthen the role of non-governmental organizations (NGOs) in defining and implementing a new water infrastructure paradigm. NGOs need to become more active participants in:

- Shaping the structure of the new water infrastructure paradigm
- Developing the value proposition and message to the public
- Disseminating information and case studies to myriad stakeholders and communities
- Analyzing shifts in government policies and market initiatives to support the new paradigm
- Working with communities to implement innovative approaches

It is vital that this work also be in consultation and partnership with other key participants in the water sector, including engineers, researchers, professionals, managers, architects, and elected officials.

The project focused on several interrelated initiatives at the national, state, and local levels, including:

- Creating a forum at the national level for NGOs to share information and develop strategies – through the Clean Water Network
- Building the structure of a broad, new alliance of NGOs and of non-traditional partnerships with academics, engineers, utilities, manufacturers, and others in the private sector
- Developing language and concepts for water policymakers and practitioners, and for the general public
- Creating a model for developing an alliance and a set of strategies to advance the new paradigm at the state level – Massachusetts as a case study
- Creating a model for education and assistance to community-level activists, partnerships, and projects – Cape Cod towns and Boston were selected as pilot case studies
- Soliciting preliminary recommendations and feedback on the emerging paradigm -- from the discussions of Clean Water Network members with experts and advocates in innovative water management at the national, Massachusetts, and local pilot case study levels

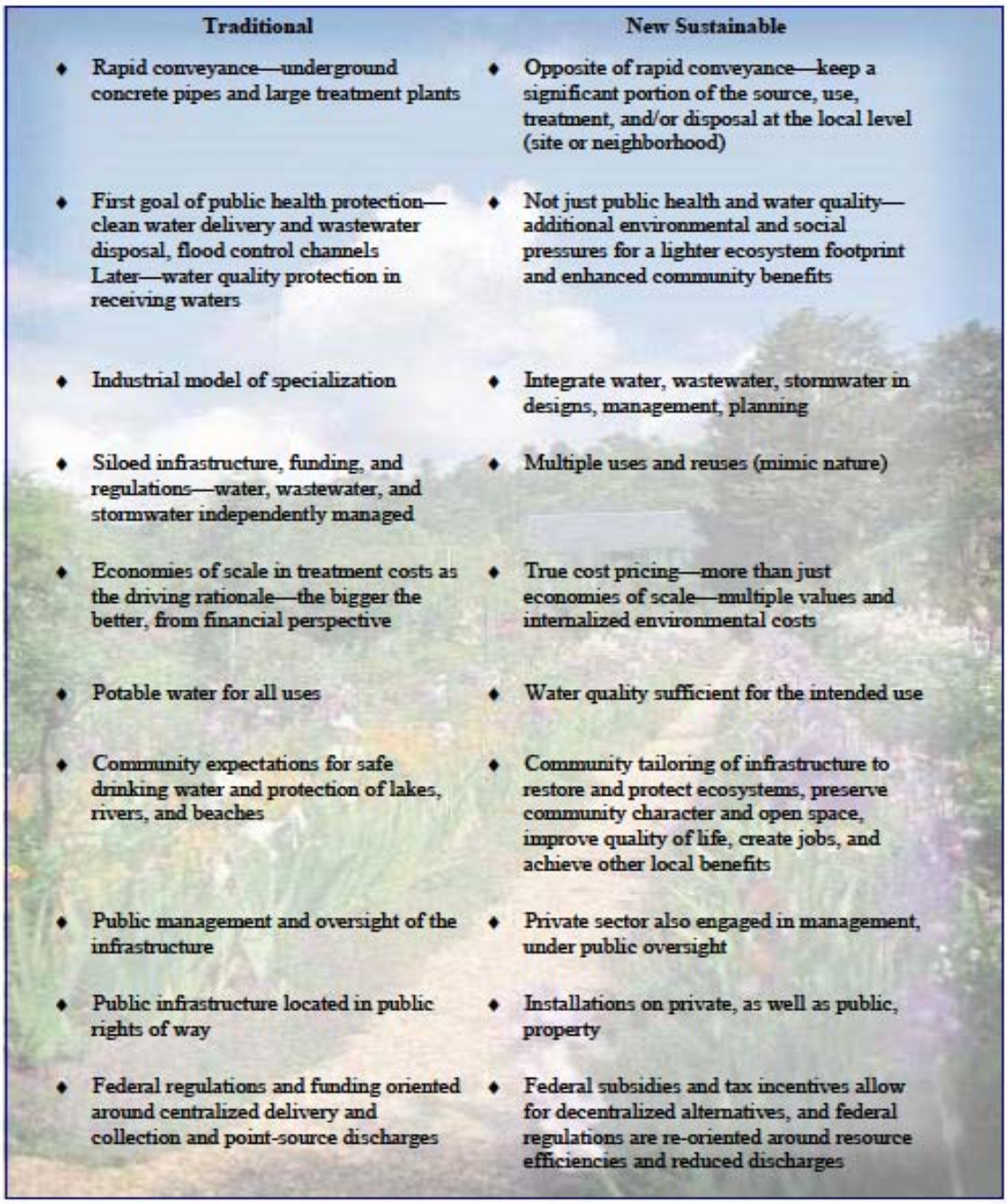
The national Clean Water Fund (the research arm of Clean Water Action) in Washington, D.C. and in Boston was the primary partner with the Coalition for Alternative Wastewater Treatment (CAWT) in the project. The long-run goal was for these organizations to continue convening the national forum and to implement widely the recommendations for a new alliance and models for state and local activism after this project had ended. While the initial emphasis

was on environmental NGOs, a broader alliance will include other social, religious, and community development organizations as well.

Currently, the preponderant influence of NGO constituencies at the national, state, and local levels is in support of the status quo conventional infrastructure. Advocacy has centered largely on tighter enforcement of Clean Water Act provisions and increased funding for conventional water and sewer systems. However, a variety of local innovators and new partnerships are gaining visibility, particularly in "green infrastructure" (distributed stormwater management) and in water efficiency and conservation.

This project was intended to provide an "accelerant" to broader NGO consideration of a new water infrastructure paradigm that also included decentralized wastewater treatment, reuse, and integrated water management and green building, more generally. The fact that "top-down" NGO leadership at the national level has been increasingly interested in decentralized and integrated approaches is an important factor in assuring long-term continuity after the project ends. It is also intended that the model for collaboration that is developed in Massachusetts will be replicated in other states.

Following are the general differences between the old and the new paradigms for water management, into which NGOs and other stakeholders will insert their values, perspectives, talents, and expertise. Donella Meadows and others have pointed out that the tipping points from old to new are not well understood or predictable. The best that can be done is a continuous critique and challenge to the structure of older approaches and new challenges, along with a deepening understanding of a new model and piloting of efforts on the ground. The most promising niche opportunities are in communities where old approaches are strikingly inadequate to meet environmental and financial crises and where new technologies and designs can provide substantially more benefits and/or lower cost.


Traditional
New Sustainable
Rapid conveyance—underground concrete pipes and large treatment plants
Opposite of rapid conveyance—keep a significant portion of the source, use, treatment, and/or disposal at the local level (site or neighborhood)
First goal of public health protection—clean water delivery and wastewater disposal, flood control channels Later—water quality protection in receiving waters
Not just public health and water quality—additional environmental and social pressures for a lighter ecosystem footprint and enhanced community benefits
Industrial model of specialization
Integrate water, wastewater, stormwater in designs, management, planning
Siloed infrastructure, funding, and regulations—water, wastewater, and stormwater independently managed
Multiple uses and reuses (mimic nature)
Economies of scale in treatment costs as the driving rationale—the bigger the better, from financial perspective
True cost pricing—more than just economies of scale—multiple values and internalized environmental costs
Potable water for all uses
Water quality sufficient for the intended use
Community expectations for safe drinking water and protection of lakes, rivers, and beaches
Community tailoring of infrastructure to restore and protect ecosystems, preserve community character and open space, improve quality of life, create jobs, and achieve other local benefits
Public management and oversight of the infrastructure
Private sector also engaged in management, under public oversight
Public infrastructure located in public rights of way
Installations on private, as well as public, property
Federal regulations and funding oriented around centralized delivery and collection and point-source discharges
Federal subsidies and tax incentives allow for decentralized alternatives, and federal regulations are re-oriented around resource efficiencies and reduced discharges

Need for a Network of Local Advocates and Experts and for Demonstration Projects

The general picture of innovation that emerged through an earlier CAWT workshop series was of scattered and uncoordinated projects cropping up across the country, shaped by local needs, and generally led by local visionaries and activists (in the case of new management models, by the private sector as well). However, these local leaders continue to face substantial obstacles, from siloed bureaucracies to risk-averse engineers to a skeptical public.

Three great institutions in the U.S. were discussed for their capabilities in creating the momentum for a more widespread and significant change in the paradigm. These include: federal and state governments; private markets and institutions; and voluntary NGOs, or civil society. Of these three, it was concluded, the greatest hope for the leading edge of innovation would be in civil society. Local projects driven by civic activism are the arena for new ways of thinking to be tested – whether in pilot installations of new technologies and designs, or in exploration of new institutions and policies.

Momentum for major change in federal policies and regulations can only build slowly from an expanding base across the country of NGO awareness and support, as well. The private sector is currently stymied by restrictive and fragmented regulations, and the full potential for creative invention and entrepreneurial innovation is similarly not realized until civil society pushes for new openings for the private sector to play a larger role.

Innovative NGO Alliances and Philosophies

This project was intended to assist NGOs in creating positive momentum for a shift in the water infrastructure paradigm. There are two promising elements of current NGO engagement in the new paradigm. First, as discussed above, NGOs are quite often the key instigators and partners in innovative projects at the local level. These civil society organizations can include:

- Environmental NGOs, including Clean Water Action chapters, watershed organizations, river and pond restoration advocates, nature conservation chapters, and open space advocates
- Neighborhood associations concerned about growth and development, ecosystem protection, and services
- Affordable housing, community development, and green jobs advocacy organizations
- "Sustainable" community advocates
- Taxpayer and fiscal watchdogs

Secondly, there are interesting cross-cutting partnerships with non-traditional allies emerging within the environmental community itself. Examples are:

- Green Cities – A loose coalition, also described in the PBS series *Edens Lost and Found*, has formed in the core cities of Chicago, Philadelphia, Seattle, and Los Angeles. In the water arena, these groups have been pushing for green roofs, tree plantings, parks, community gardens, stream daylighting, and habitat restoration. Participants in these coalitions have been

environmental justice, neighborhood revitalization, and green jobs groups seeing soft path infrastructure as a job generator for inner city workers;

- Bioneers – This network, with a yearly conference at multiple sites around the country, pulls in speakers such as John Todd of *Living Machines*, Janine Benyus, author of *Biomimicry*, Amory Lovins of the Rocky Mountain Institute and others involved in social activism and the arts. Bioneers refers to new ideas and systems "out of the heart of nature;"
- Ecological engineering – a close parallel to Bioneers in philosophy and system design, this group including members such as David del Porto and Carol Steinfeld has been working on small-scale wastewater reuse and recycling projects, and has had strong links to projects on university campuses;
- Green Building – there has been some effort to include water-efficiency, stormwater management, and innovative wastewater treatment in the LEED point system;
- Green infrastructure – at the national level, a Memorandum of Understanding has been signed with EPA to promote distributed stormwater management, and NRDC and the Low Impact Development Center have been key partners in this effort;
- Water and climate change – NRDC in California has prepared a report, *In Hot Water*, which argues for decentralized infrastructure, and other environmental NGOs are beginning to explore these issues;
- Cooperative conservation – the Sand County Foundation and others have been developing projects in the philosophy of Aldo Leopold, where private landowners join with environmentalists and others in local, adaptive management reflecting an "ecological ethic;"
- Clean Tech and E2 – environmental groups have begun to partner with venture capitalists to promote markets and investments primarily in sustainable energy technologies, but also in water technologies;
- Alliance for Water Efficiency – a new coalition of environmental and industry participants to promote water-efficient appliances and landscaping.

The goal of this project was to start the building of a broader alliance or "movement" for a sustainable water infrastructure, that would mirror and incorporate the strengths and lessons of these other recent partnerships in pushing government to align with a new sustainability vision and promise at all levels.

A Blending of National, State, and Local Activism

Any emergent new way of thinking and new set of alliances needs to be operating at national, state, and local levels. The national conversation is important as groups coalesce to work with EPA and other federal agencies around proposed shifts in federal policies, funding, and regulations. A forum is also needed at that level for discussion of emerging insights and stories that can be disseminated across the country. States are important as "laboratories of democracy", where more innovation is possible than currently at the federal level, and where problems and solutions are more directly processed and understood at the ground level. Finally, local communities are ultimately where the new ideas have to be demonstrated, and where the American public reorients its values, thoughts, and behaviors around new infrastructure forms (the process called "co-evolution").

This project facilitated work at national, state, and local levels through workshops in the Clean Water Network and development of a multi-stakeholder alliance at the national level; through intensive work on coalition-building and strategies in Massachusetts; and through testing of tech transfer in several pilot communities. The research and outreach was iterative, and lessons learned at each of the levels were used to improve materials and approaches as the project proceeded.

Outline of the Report

This report documents the numerous presentations, interviews, meetings, and other dialogue between project collaborators, including Valerie Nelson (CAWT), Paul Schwartz (Clean Water Fund – Washington, D.C.), and Becky Smith (Clean Water Fund, Boston), and a wide range of environmental and other constituencies at the federal level and in Massachusetts. The report also presents education and outreach agendas and power point presentations, along with consensus language and written documents developed for use at national, state, and local levels.

Chapter 2.0 describes the presentations on 21st Century: Smart, Clean, and Green Water Infrastructure made by Nelson, Schwartz, and Smith at a wide variety of Clean Water Network and other environmental conferences. The "transition" document adopted by the Clean Water Network for the Obama Administration is presented, along with next steps for future work.

Chapter 3.0 describes the systematic building of a multi-stakeholder alliance of environmental NGOs, academic researchers, engineers, architects, industry, and other constituencies. A consensus "Statement of Support" for new approaches is presented, along with a policy portfolio for action. Next steps include a recommended formal establishment of a Water Alliance, including an active website and outreach strategy.

Chapter 4.0 presents "The Story of Water: OH! H2O!", written by Polly Vail for outreach to the general public and opinion leaders.

Chapter 5.0 describes the development of a multi-stakeholder alliance in Massachusetts, including background interviews, presentations, an educational "lunch series," and conversations with state agencies and the legislature. This project will continue with education and outreach, and with development and advocacy for progressive state policies and funding in Massachusetts, and the model will be disseminated to other states through the Clean Water Fund and the Clean Water Network.

Chapter 6.0 presents the development of an education and outreach model to Cape Cod towns and Boston, which is assisting NGO and professional alliances in promoting consideration of sustainable water management alternatives. Next steps include continued work in these sites, as well as dissemination of lessons learned and information materials to other local communities facing similar challenges around the country.

Chapter 7.0 summarizes general findings and conclusions of the project, along with planned next steps.

The appendices include a sample of Powerpoint presentations by key speakers at project-sponsored events, including by Ed Clerico, Glen Daigger, Patrick Lucey, Steve Moddemeyer, Valerie Nelson, Paul Schwartz, Mark Shannon, and Nancy Stoner. Other presentations or background materials for workshops will be provided upon request to the project team.

One objective of the report was to develop core language or "labeling" that captures the essence of the water paradigm shift, in terms that would resonate with the public. These phrases are scattered throughout the project and include:

- 21st Century or Next Generation Infrastructure
- Smart, Clean, Green Water Management
- Cities and Towns of the Future
- Better, Faster, Cheaper Alternatives

A number of summary documents emerged from the extended discussion with environmental organizations and other constituencies. Of particular significance are the following, which may be found in various chapters in the report:

- Smart, Clean & Green: 21st Century Sustainable Infrastructure (a Clean Water Network "Transition" document for the Obama Administration and Congress found in Chapter 2.0)
- Statement of Support for Cities and Towns of the Future: Smart, Clean and Green Water Management – (found in Chapter 3.0)
- The Policy Portfolio – (found in Chapter 3.0)
- The Story of Water: OH! H2O! -- (found in Chapter 4.0)
- Rethinking Infrastructure: Smarter, Cleaner, Greener (found in Chapter 5.0)

CHAPTER 2.0

CLEAN WATER NETWORK FORUM AT NATIONAL LEVEL

This project assisted in the development of a forum for NGO discussion about the potential for a new water infrastructure paradigm to enhance water quality and quantity protection and to achieve multiple other environmental, social, and economic benefits for the nation. This forum was intended to serve several purposes: information transfer and education about both the benefits of the emerging soft path components and the costs of perpetuating the current hard path approach; and discussions about the applicability of new approaches to critical issues in local communities.

Clean Water Network

The key partners in this task were the CAWT (Nelson) and CWN (Schwartz). Creation of a national forum for education and discussion among clean water organizations has been through the Clean Water Network. Nancy Stoner of NRDC as a member of the Network "wet weather" steering committee has also been supportive of advancing "21st century" concepts, in addition to her work on advancing "green" stormwater infrastructure.

The Clean Water Network (CWN) is a coalition of more than 1,100 public interest organizations across the country working together to strengthen and implement federal clean water and wetlands policy. It is the largest national coalition working to defend and strengthen the federal Clean Water Act. Members in the Network receive monthly news bulletins, legislative alerts, and educational materials. The Network also hosts events, trainings and regional workshops on topics of interest to the membership.

Presentations and briefings were made at the following Clean Water Network workshops and events:

Event:	**Clean Water Network Regional Caucus on: Global Warming and the Mississippi River Basin Impacts and Solutions**
Date:	July 12, 2008
Location:	Dubuque, Iowa
Speaker:	Valerie Nelson
Title:	"Green Infrastructure's Role in Reducing Global Warming in the Mississippi River Basin"

Event:	**2009 Clean Water Week, "Renewing America's Commitment to Clean Water"**
Date:	February 24, 2009
Location:	Washington, D.C.
Title:	Clean Water Infrastructure Panel Discussion Today and Tomorrow: Exploring clean water infrastructure policy and technology ideas
Speaker:	Andy Lipkis, TreePeople, Los Angeles
Speaker:	Patrick Lucey, Aqua-Tex, Victoria, B.C.
Speaker:	Paul Schwartz, Washington, D.C.

Event:	**Smart, Clean and Green: 21st Century Water Management in the Great Lakes**
Date:	October 22-23, 2009
Location:	Buffalo, New York
Speaker:	Paul Schwartz
Title:	Smart, Clean, and Green Water Management

Briefings – Environmental Conferences and Workshops

Event:	River Network's River Week 2009
Date:	May 29-June 1, 2009
Location:	Baltimore, MD
Speakers:	Becky Smith, Paul Schwartz,
Title:	21st Century Water: Building the Transformation

Event:	**Massachusetts Environmental Trust's MA Water Resources Conference**
Date:	November 10, 2009
Location:	Worcester, MA
Speaker:	Paul Schwartz, Becky Smith
Title:	Rethinking Infrastructure: Smarter, Cleaner, Greener

Event:	**UUSC and UU Legislative Ministry of CA**
Date:	April, 2009
Location:	Walnut Creek, California
Speaker:	Paul Schwartz
Title:	21st Century Water Infrastructure and the Human Right to Water

Event:	**Interfaith Center on Corporate Responsibility (ICCR) Annual Meeting**
Date:	September, 2009
Location:	New York, NY
Speaker:	Paul Schwartz
Title:	21st Century Water Infrastructure and the Human Right to Water

Participation in Environmental Workshops:

Event: **Clean Tech and Beyond: A Roundtable for Economic Drivers of the Green Economy – Massachusetts Green Jobs Coalition (MAGJC)**
Date: January 9, 2009
Location: Boston, MA
Participant: Valerie Nelson

Event: **Federal Stimulus Funding Advocacy Meeting**
Date: January 12, 2009
Location: Barr Foundation, Boston, MA
Participant: Valerie Nelson

Event: **Infusing Equity in the Economic Recovery**
Dates: May 8, 2009
Location: Barr Foundation, Boston, MA
Participant: Valerie Nelson

Event: **JALSA Environmental Task Force on Green Jobs and Green Jobs Training**
Date: February 13, 2009
Location: Boston, MA
Participant: Valerie Nelson

Attendee at Environmental Conferences:

Event: **A New Safety Net for Working Families: Green Jobs and Low-Wage Workers**
Date: April 21, 2009
Location: Urban Institute, Washington, D.C.
Participant: Valerie Nelson, Paul Schwartz

Event: **Apollo Alliance National Conference: Good Jobs Green Jobs**
Date: February 4-6, 2009
Location: Washington, D.C.
Attendee: Paul Schwartz

Transition Statement

This topic and statement (drafted by Nelson) were the 2nd highest in a list of approximately 30 topics for consideration by the Obama Administration and were recommended by a group of clean water organizations assembled by Nancy Stoner of NRDC. This statement was also subsequently adopted by the Clean Water Network.

Smart, Clean & Green: 21st Century Sustainable Water Infrastructure

Big-pipe, centralized infrastructure for water, stormwater, and wastewater services is not sustainable over the long-term. These municipal systems consume too much water, disrupt too many ecosystems, and use too much energy to move water and wastewater around. Growing populations, increasing land development, and climate change will make these problems much worse.

Sustainable water systems in the future will use, treat, store, and reuse water efficiently at a small scale and will blend designs into restorative water hydrologies. Low impact development and green infrastructure will restore natural infiltration and evaporation cycles, which will temper droughts, reduce flooding and combined sewer overflows, improve air quality, and moderate temperature. Nitrogen, phosphorous, biogas, and other resources in wastewater will be captured for fertilizer and renewable energy supplies, and will no longer be contributors to widespread eutrophication of lakes and estuaries. Legislation to promote these designs would include:

- funding for research and demonstration projects;
- funding for water use efficiency, reuse, and conservation programs,
  - including hardware incentives (WaterSense) and education programs;
- Clean tech venture capital funding;
- tax incentives for builders and homeowners;
- development of national standards for water-efficiency, green infrastructure, and reuse;
- incorporation of water-efficiency, green infrastructure, and reuse standards in federal funding for Clean Water and Drinking Water State Revolving Funds;
- support for utilities that implement sustainable designs; requirements for integrated water, energy, and resource management;
- inclusion of "Just Add Water" provisions that piggyback water with all energy programs and mandates where appropriate,
- federal facility use of sustainable water systems;
- green collar job education and training programs;
- funding for local governmental entities to prepare long-term integrated water resource management plans that meet minimum criteria, such as including analysis of all of the following:
  - impacts of climate change,
  - wastewater,
  - water supply,

- stormwater,
- source water protection,
- floodplain protection,
- protection of forests, riparian buffers, wetlands, headwaters, and other natural landscapes and aquatic resources, and

- involving a cross-agency implementation plan, and would prioritize for all types of federal funding those investments identified through a long-term integrated water resource management plan.

Planned Next Steps for the Clean Water Network and Environmental NGOs

1. Substantially increase efforts in the area of decentralized wastewater treatment, reuse, and resource recovery – propose a new ad hoc committee be formed to advance "smart, clean, green" or "better, faster, cheaper" approaches;

2. Identify unsewered communities in crisis over wastewater issues and build on lessons, materials, and strategies from the Cape Cod case described in Chapter 7.0. Possibilities include towns in Chesapeake Bay (Anne Arundel County), New Jersey, New York (Hudson River Valley), and Wisconsin (Door County), where nitrogen from septic systems is polluting groundwater, estuaries, and drinking water supplies;

3. Continue to develop integrated water-energy resource management (IRM) concepts generally, and for urban areas in particular;

4. Articulate issues and proposals in "Brown Bag" lunch and other discussions with U.S. EPA and other federal agencies;

5. Propose a special workshop/forum in 2010 or 2011 – for *Smart, Clean, Green Wastewater Approaches* in both unsewered and urban areas (IRM).

CHAPTER 3.0

A NEW WATER ALLIANCE

The second task of this project was to establish a multi-stakeholder national alliance to advance a new water paradigm. This alliance would include environmental and other NGOs, in partnership with researchers, clean tech entrepreneurs, engineers, architects, planners, utility managers, and elected officials. Key constituencies were identified and leaders in each were approached to participate in the project. Informational briefings were provided for Congress, federal agencies, and other organizations based in Washington, D.C. Interviews and meetings were held to discuss the ideas and practices in a new approach. Several consensus documents were written, which have been and will continue to be used in building support for, and education about, new water infrastructure approaches. Finally, recommendations for the core structure of a formalized Water Alliance were developed.

Identification of Key Stakeholders

This broad-based alliance is vital to developing, over time, a proper understanding of the new paradigm, to assisting in research and pilot projects, to sending a message and education the public, and to building the political momentum and will for paradigm change.

The following major constituencies and key leaders from each were approached and agreed to participate in signing statements of support and in participating in educational briefings and workshops:

Valerie Nelson – Coalition for Alternative Wastewater Treatment,
Paul Schwartz – Clean Water Action and Clean Water Fund
Nancy Stoner – Natural Resources Defense Council
Glen Daigger – CH2M HILL, President-Elect International Water Association
Rich Sustich – U.S. Strategic Water Alliance Trustee, Village of Lake Zurich, Illinois
Mark Shannon – U.S. Strategic Water Alliance, University of Illinois at Urbana-Champaign
Ed Clerico – Alliance Environmental
Steve Moddemeyer – CollinsWoerman

Other supporters of various policy statements have included:

Ken Kirk – Clean Water America Alliance (National Association of Clean Water Agencies)
Jeff Moeller – Water Environment Research Foundation
Mike Hoover – Reuse Think Tank, North Carolina State University
Neil Weinstein – Low Impact Development Center
Mark Modzelewski – Water Innovations Alliance

Jerry Stonebridge – National Onsite Wastewater Recycling Association
Dominique Lueckenhoff, U.S. EPA – Chair, Steering Committee, Green Highways Partnership
Gerald Iwan – National Environment Services Center, West Virginia University
Jennifer Newland – Canaan Valley Institute

Informational Briefings

Congressional Roundtables

Three briefings were convened in the House of Representatives and Senate in the fall of 2008. Congressman James Oberstar introduced a briefing on September 18th in the Transportation and Infrastructure Committee room.

September 18, 2009 – Congressional Roundtable

The agenda of speakers in the House included:

Glen Daigger, CH2MHill, Colorado – An Engineer's Perspective on Sustainable Water Infrastructure
Ed Clerico, Alliance Environmental, New York – Case Study: Water-efficiency, Stormwater and Wastewater Reuse in the City
Mark Shannon, University of Illinois-Champain/Urbana – Achieving Sustainability through Research and Development
Craig Lindell, Aquapoint, Massachusetts – Cleantech Manufacturing, Green Jobs, and Community Development
Nancy Stoner, NRDC, Washington, D.C. – Green Infrastructure and Healthy Ecosystems
Valerie Nelson, Coalition for Alternative Wastewater Treatment – The Federal Role in Building a 21st Century Water Infrastructure

December 18, 2008 – Congressional Roundtables

Save the date: Tuesday, December 16th, 10:00 a.m. – noon and 2:00 – 4:00 p.m.
(same presentation at each)

Please join us for a briefing on 21st Century Water Resource Infrastructure

What: Briefing on emerging smart, clean, and green approaches in water management – systems that use, treat, store, and reuse water efficiently at small scales and that blend designs into restorative hydrologies.

Where: 10:00 a.m. – noon, House Office Room to be determined
2:00 – 4:00 p.m. – Senate Office Room to be determined

When: Tuesday, December 16th

The list of presenters includes:

- Paul Schwartz, Clean Water Fund, Facilitating Presenters
- Andy Lipkis, TREE People, Los Angeles – Integrated Resource Planning in the City

• Glen Daigger, CH2M HILL, Colorado – An Engineer's Perspective Sustainable Water Infrastructure
• Ed Clerico, Clerico Assoc, New York – Case Study: Water-efficiency, Stormwater and Wastewater Reuse in the City
• Rich Sustich, University of Illinois-Champain/Urbana – Achieving Sustainability through Research and Development
• Craig Lindell, Aquapoint, Massachusetts – Cleantech Manufacturing, Green Jobs, and Community Development
• Nancy Stoner, NRDC, Washington, D.C. – Green Infrastructure and Healthy Ecosystems

• Valerie Nelson, Coalition for Alternative Wastewater Treatment, Massachusetts – The Federal Role in Building a 21st Century Water Infrastructure

We hope you will be attending one of the briefings on December 16th.
Paul Schwartz Valerie I. Nelson
Clean Water Action Coalition for Alternative Wastewater Treatment

Please RSVP to:
pschwartz@cleanwater.org, or
Valerie.i.nelson@gmail.com

February 25, 2009: Federal Agency briefing sponsored by the Water Environment Research Foundation

http://www.werf.org/AM/Template.cfm?Section=Decentralized_Systems&CONTENTID=9842&TEMPLATE=/CM/ContentDisplay.cfm

Panel 1: Prospectives from University, NGO, Private, and Other Organizations

An Ecologist's Perspective on Healthy Water Systems
Patrick Lucey, Aqua-Tex, British Columbia

Case Study: Water-efficiency, Stormwater and Wastewater Reuse in the City
Edward Clerico, Alliance Environmental, LLC, New Jersey

Achieving Sustainability Through Research and Development
Mark Shannon, University of Illinois at Urbana-Champaign

Green Infrastructure and the Green Economy
Paul D. Schwartz, Clean Water Action, Washington, D.C.

Integrated Resource Planning in the City
Andy Lipkis, Tree People, Los Angeles

Evaluating Energy/Water Synergies at the District Scale
Steve Moddemeyer, CollinsWoerman

The Federal Role in Building a 21st Century Water Infrastructure
Valerie I. Nelson, Coalition for Alternative Wastewater Treatment, Massachusetts

Panel 2: Federal Agency Perspectives

Robert Goo, U.S. Environmental Protection Agency (U.S. EPA)

Kenneth Belt, United States Forest Service (USFS)

Jay Garland, Dynamic Corp (NASA Contractor)

Lynda Stanley, National Research Council (NRC)

Paul Bishop, National Science Foundation (NSF)

Elaine Phelen, House Science Committee, Subcommittee on Energy and Environment

WEFTEC: Water Environment Federation's Annual Technical Exhibition and Conference

Glen Daigger, Ed Clerico, and Steve Moddemeyer presented papers at the 2009 WEFTEC conference in Orlando, Florida. The agenda was as follows:

TS122 Distributed Water Infrastructure Networks in Cities and Watersheds

Track: Small Communities ; Water Reclamation & Reuse
When: Wednesday, October 14, 2009, 1:30pm - 5:00pm
Where: Orange County Convention Center, Room 304H, Level 3

S122 Distributed Water Infrastructure Networks in Cities and Watersheds

Solutions for Small Communities/Innovative Technology Forum/Young Professionals

Session Moderator: *Valerie Nelson*
Session Assistant Moderators: *Paul Schwartz, Jeff Moeller*

1:30 PM An Engineer's Perspective on Past and Future Urban Water Management Infrastructure Challenges
G.T. Daigger

2:00 PM A New Era of Decentralized Water Resource Management: Water Reuse as Integrated Infrastructure
E. Clerico

21st Century Water and Energy Housing
S. Moddemeyer

Poster

The Baltimore Charter for Water Sustainable Systems
V.I. Nelson
Office of Management and Budget

Sally Ericsson, Associate Program Director for Environment, Resources, and Science on October 19, 2009 met with five members of the Water Alliance, including Valerie Nelson, Paul Schwartz, Nancy Stoner, Glen Daigger, and Rich Sustich. The Policy Portfolio (see below) was presented by the participants.

Interviews and Meetings

Event:	**Dialogue on Sustainable Water Infrastructure**
Date:	September and December, 2008
Location:	Aspen Institute, Colorado
Participants:	Paul Schwartz, Nancy Stoner, Glen Daigger

Event:	**Examining U.S. Freshwater Systems and Services: Infrastructure and the Built Environment**
Date:	May 20-22, 2009
Location:	Wingspread Center, Johnson Foundation, Racine, Wisconsin
Participants:	Paul Schwartz, Glen Daigger, Jeff Moeller

Event:	**Examining U.S. Freshwater Systems: Public Health Threats and Solutions**
Date:	December 15-16, 2009
Location:	Wingspread Center, Johnson Foundation, Racine, Wisconsin
Participant:	Paul Schwartz

Event:	**Water Innovations Alliance Conference**
Date:	May 16, 2009
Location:	New York City
Speaker:	Valerie Nelson
Title:	Panel discussion on "Water: The Need for Innovation"

Event:	**National Dialogue: Integrated National Water Policy**
Date:	September 14-15, 2009
Location:	Clean Water America Alliance, Washington, D.C.
Speaker:	Valerie Nelson
Title:	Network Infrastructure: Cities of the Future

Event:	**Transitioning to Sustainability: The Challenge of Developing Sustainable Urban Systems**
Date:	September 23, 2009
Location:	National Academy of Sciences, Washington, D.C.
Participants:	Valerie Nelson, Paul Schwartz

Consensus Statement of Support and Policy Portfolio

The following Statement of Support was drafted in the spring of 2009 and has been disseminated widely.

Statement of Support for Cities and Towns of the Future: Smart, Clean, and Green Water Management

Preamble
The genius of science and design in the 21st century is the discovery of "smart, clean, and green" ways to capture the value of resources. "Smart" because they unlock the complex designs of nature and use information and signaling to achieve efficiencies. "Clean" because they capture and use resources and methods that don't involve significant externalities in extraction or disposal. And, "green" because they rely to a much higher degree on vegetation, and in the process begin to restore the natural ecosystem and its wide and deep benefits.

Purpose
To bring together organizations that share the goal of rebuilding America's "Cities and Towns of the Future" through implementation of smart, clean, and green water and related infrastructure management.

Goals
Smart, clean and green infrastructure in America's cities and towns can protect and restore water resources and ecosystems, reduce energy use, and improve public health and the quality of life for residents. The undersigned organizations support:

- Use of smart, clean, and green engineering and natural systems design to build and rebuild Cities and Towns of the Future;
- Investigation and demonstration of models to incorporate 21st century engineering and design into existing centralized and resource-intensive infrastructure, buildings, and communities,
- Demonstration of smart, clean, and green technologies and management strategies in urban, suburban, and rural areas and at the site/building, neighborhood, municipal, and watershed scales;
- Development of advanced monitoring and realtime control systems for watershed and infrastructure management;
- Assessment of the benefits and costs of using innovative water management approaches. Determine the impacts these alternatives have on energy and material use, air quality and other resources. Evaluate the ecological and ecosystem impacts of these practices on water resources, soil health, biota, and overall community sustainability;
- Implementation of economic incentives for adopting smart, clean, and green technologies and designs, including standards, labeling, rebates and tax credits, full cost utility pricing and infrastructure grants and loans;
- Funding of scientific research leading to the development of more efficient and clean technologies and designs, community development strategies, and policies;

- Support for clean tech investments by companies in new technologies and markets for provision of services, treatment, recycling and reuse;

- Creation of green jobs through workforce development for design, installation, and maintenance of new infrastructure and buildings;

- Development of new models for incorporating smart, clean, and green approaches into federal regulatory, economic development, and funding programs.

- Development of policy mechanisms, guidance and other tools to assist states and local governments understand, design and implement more sustainable (smart, clean and green) water management systems

- Promotion of integrated water resource management programs that utilize a water balance approach at the watershed scale to optimize – to the maximum extent technically feasible – the management and use of stormwater, wastewater, and drinking waters to reduce ecological impacts, energy consumption, and green house gas emissions.

21st Century Infrastructure and Buildings – Smart, Clean, and Green

The design model for Cities and Towns of the Future includes:

- Systems designed to use the right water for the right purpose, i.e., systems designed to differentially treat water based on the use based on the assumption that not all water needs to be treated to potable water standards
- Prevention of pollution before it gets into the waste stream (including the re-engineering of some products through green chemistry to mitigate or eliminate ecological damage);
- Reduction of energy needs by avoiding pumping and long-distance transport of water and wastewater, i.e., the use of decentralized onsite treatment systems where appropriate;
- The selection of water infrastructure that has the lowest embodied energy footprint based on the lifespan of the system (construction and operation and maintenance)
- Wastewater recycling and non-potable, “fit for purpose” reuse instead of disposal;
- Rainfall harvesting and reuse to supplement potable water supplies, where safe and appropriate to maintenance of minimum ecosystem streamflows and restoration of healthy watersheds;
- Energy, chemical, and nutrient recovery from wastewater;
- Habitat and natural system restoration;
- Re-vegetation to restore evapotranspiration capacity and to promote aquifer recharge and pollutant removal through soil based vegetated systems;

- Green infrastructure to help beautify cities and towns and revitalize neighborhoods;
- Elimination of excessive water supply system losses associated with the typical potable-quality water supply systems.

Smart, Clean, and Green Infrastructure Benefits

Smart, clean, and green infrastructure and designs have the following benefits for the nation:

- *Water security* – More efficient use of water and implementation of systems to reuse and recycle water can lower the per capita use of water dramatically and facilitate protection of supplies for all potable and non-potable uses;

- *Cleaner water* – New technologies can keep toxic chemicals out of surface and subsurface water sources and the ecosystem, and reuse recovers nutrients from treatment plant effluents;

- *Restored ecosystems functions* – Engineered and natural systems designs can restore ecological functions in urban and suburban cities and protect natural systems in rural areas and towns;

- *Efficient resource use* – Distributed small-scale infrastructure and integrated building design can reduce energy use and recover resources from wastewater;

- *Climate moderation* – Reductions in greenhouse gases and restoration of evapotranspiration cycles can moderate trends in global warming and reduce the city "heat island" effects by reducing temperatures;

- *Green jobs* – New infrastructure and design will create millions of new jobs, ranging from science and engineering to manufacturing, installation, and management in low-income urban neighborhoods as well as rural communities;

- *Economic competitiveness* – Reestablish America's scientific and engineering leadership and rebuild our high-tech manufacturing for exports to both developed and developing countries if it starts now in earnest;

- *Community revitalization* – Improved air quality, moderated temperatures, green job development, green schools, hospitals and housing, restored parks, vegetation, and urban rivers will enhance the quality of life in cities and towns;

- *Cost savings* – Integrated water and energy engineering and design can lower costs and enhance the value of infrastructure and building in cities and towns;

- *Resilience* – Integrated resource management and planning will work better in responding to and bouncing back from severe climatic events such as increased numbers of and higher intensity storms and longer and deeper droughts;

- *Social Equity and Access* – 21st century technologies and approaches have the promise of both lowering overall costs, increasing benefits, and simplifying operations and maintenance.

This unlocked potential should help many small, rural, and low-income communities gain access to safe and affordable water and related community redevelopment strategies.

Background

Traditional water management has relied on a low-tech, industrial-scale engineering and economic model mostly developed in the 1800s. With a goal of public health protection, big pipe systems were built to transport clean water into and wastewater out of urban neighborhoods. This model, which produced important health and ecological gains for our communities, has also shown a down side.

In recent years, a concern has been growing that this "paradigm" of big-pipe water management is not sustainable, both from a natural resource and an economic perspective. The appropriation of huge volumes of water from the ecosystem and its release as partially-treated effluent into rivers, lakes, and oceans has been increasingly disruptive to those ecosystems. Population growth, climate change, agricultural practices, energy production and delivery, and other practices will challenge this approach further.

Signs of stress are seen in falling groundwater levels and decreasing dry-weather stream flows (and unnatural peak flows during wet weather), destructive eutrophication of lakes and estuaries, disappearance of wetlands, increasing dead zones in coastal areas, and other catastrophic changes in hydrological functions. Climate change is expected to exacerbate patterns of droughts and heavy rainfalls, putting both water supplies and flood control measures at risk. Reductions in evapotranspiration from vegetation destruction are being studied as potentially significant contributors to global warming.

Drinking water systems lose huge amounts of water (a U.S. average of 20%) from their leaky distribution pipes, existing treatment technologies were not designed to eliminate emerging biological and chemical contaminants that are increasingly found in sourcewaters, and treating all water to new and more stringent standards is both increasingly difficult and expensive. Except for the small amount of water needed for potable uses, the delivery and treatment of entire, ever increasing, supplies to that most stringent level is extremely wasteful of energy, chemicals and money. Most cities and towns have been unwilling to charge ratepayers the full cost of repairing and replacing the existing, often inadequate infrastructure, so collapsing pipes and breakdowns in delivery systems and treatment plants have become more frequent, while innovation is minimally on the radar screen.

The 2007 Baltimore Charter for Sustainable Water Systems asserts an alternative approach to water management that "mimics and works with nature." Natural systems create an abundance of value and diversity, where species cooperate and one species' waste is another species' resource. These naturally-balancing ecosystems have been steadily deteriorating under a century-long, highly-disruptive human extraction and use of resources in the industrial era.

An emerging paradigm relies instead on design principles found in nature: in particular, integrated systems, efficiency and reuse, and adaptation to local context. Many of the new high-

performance treatment technologies, such as membranes, “mimic” biological and chemical designs that scientists are discovering in nature (biomimicry). Just as recently found in the energy arena, there are alternative approaches that can restore natural resource patterns and functions found across a landscape. These new design approaches create a wealth of services and benefits at the local level and can help restore the ecological and societal well-being of the global Commons as well.

Opportunities also exist in integrated design, rather than in narrower specialized thinking and practice. To paraphrase, the “sum of the conventional parts” in the traditional approach has been much less than the “whole” in infrastructure services. Integrated design can increase productivity of the larger system, while also serving the separate functional needs of the parts.

Another resource to be tapped from nature is the efficiency and high-performance of its organisms and systems. Biologists and chemists are looking more and more to nature for models to re-engineer products and processes. Membranes in nature, for example, are inherently more efficient than those used in water and wastewater treatment, because of active rather than passive transport mechanisms inherent in biological versions.

Finally, as Ian McHarg wrote in the late 1960’s, by locating activities in the most appropriate places in a watershed, natural resource “streams of value” can be tapped with less cost and disruption. McHarg laid out guidelines for locating farms, ports, forests, wildlife corridors, cities, etc. There are lessons to be learned, as well, from “networks” of “nodes” and “links” in nature that assure resilience and adaptability to external shocks to the system.

A birds-eye view of the new infrastructure would reveal “networks” of decentralized, repurposed, and at times hybridized systems. Some of the innovative treatment and resource recovery technologies would be “embedded” in subdivisions, apartment complexes, or individual homes and offices. Other functions would be taken over by vegetative “green infrastructure”, such as green roofs and walls, trees, and swales along roads and restored streams, riparian areas, and wetlands. Water and sewer lines might be slip-lined and repurposed for potable or reclaimed water, water storage and distribution, and heat recovery. Monitoring and control technologies would be key elements in managing these systems and in protecting public health and the environment.

These engineered and green networks mimic the natural systems of nodes and links in nature, where water both recycles and supports life at a local scale, but also is a linkage and transport mechanism across a landscape and into the atmosphere. Adopting these systems in cities and towns can cost less to provide water and sanitation services than current approaches and can also add significant benefits in terms of air quality, energy savings and production, recreation, beauty and aesthetics, increased property values, and jobs. Innovative pricing, incentives, and new performance-based regulatory mechanisms will be required to ensure that these sustainable practices are adopted and that the remaining watershed and global “externalities” are also addressed by developers, homeowners, industries, and municipalities.

Some leading-edge infrastructure experts are now suggesting that these "networks" of engineered and green energy and water systems need to be integrated and also be co-engineered with transportation, solid waste, buildings, and other urban infrastructure management. The lessons of nature are that such integration can lead to significant synergies of design, cost-savings, and an abundance of positive benefits for society.

For example, an "eco-block" incorporating architectural innovations, wind and solar power, green roof and wall cooling, rainwater harvesting, water reuse and energy recovery, and nutrient recycling into community gardens, can be nearly "off-the-grid" in both energy and water, and can be located at transportation "hubs". These new designs of infrastructure may cost less in dollars and will both improve the quality of life in urban communities and begin to protect and restore the ecological Commons.

Paralleling the shift in technologies will be a shift in the institutions and markets for resource management. Municipal utilities evolved for each single-service "monopoly" in the form of separate centralized systems for water supply, stormwater transmission, and wastewater discharge (and in some cases energy generation/distribution). But embedded and green infrastructure "nodes" in homes, subdivisions, and commercial establishments engage a wide range of private firms, non-profit groups, and other city agencies (such as parks and recreation, housing, job training, etc), and the developer and property-owner will have many more choices for technologies and design and ongoing maintenance services. Municipalities and other local governments can anticipate more complex and highly-productive new roles in coordinating municipal utilities and agencies internally and in overseeing the new private and non-profit sector externally through ordinances, incentives, education, and inspections.

A new policy framework for cities and towns of the future will be necessary to maximize the strengths of new markets, but also to direct those markets toward protection and restoration of the Water Commons, rather than to "commodity" water. Current policies protect public health in important ways, but also impede the discovery of efficiencies and adoption of innovative technologies and designs. Market forces do need to be unleashed, but only if goals, incentives, and safeguards are in place to advance the public interest, including the health and functioning of ecosystems and communities.

Finally, the solutions to water management in the 21st century will require a high level of interdisciplinary collaboration and broad public engagement. Here also, nature serves as a model for the benefits of collaboration and cooperation in society, as opposed to the specialization and hyper-individualism of the 20th century. Networks of conversations and pilot projects will serve as the foundation for creative invention and enhancement of the "Common Wealth."

Supporting organizations – in progress

For information, contact valerie.i.nelson@gmail.com or pschwartz@cleanwater.org

Valerie I. Nelson
Coalition for Alternative Wastewater Treatment

Nancy Stoner
Natural Resources Defense Council

Paul Schwartz
Clean Water Action and Clean Water Fund

Neil Weinstein
Low Impact Development Center

Tom Groves
National Onsite Wastewater Recycling Association

Mark Shannon
U. S. Strategic Water Initiative

Jennifer Newland
Canaan Valley Institute

Mark Modzelewski
Water Innovations Alliance

Mike Hoover
International Decentralized Water-Wastewater Reuse Think Tank

Jeff Moeller
WERF

Gerald Iwan
National Environmental Services Center, WVU

Dominique Lueckenhoff, U.S. EPA
Chair, Steering Committee,
Green Highways Partnership

Glen Daigger
CH2M HILL

Hon. Rich Sustich
Trustee, Village of Lake Zurich, Illinois

Ken Kirk
Clean Water America Alliance

Potential future signatories include leadership from the International Water Association (IWA), the Water Environment Federation (WEF), the National Association of Clean Water Authorities (NACWA), and the American Planning Association (APA).

A shorter version of this statement was presented at the Clean Water America Alliance national policy dialogue in September, 2009.

NETWORK INFRASTRUCTURE
Cities of the Future

Valerie I. Nelson
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Traditional water management has relied on a low-tech, industrial-scale engineering and economic model established in the 1800's. With a goal of public health protection, big pipe systems were built to transport clean water into and wastewater out of urban neighborhoods. An emerging water paradigm relies instead on design principles found in nature: integrated systems, efficiency and reuse, and adaptation to local context.

A birds-eye view of the new urban infrastructure would reveal "networks" of decentralized and repurposed centralized systems for water, energy, and other urban services. Some of the innovative treatment and resource recovery technologies would be "embedded" in subdivisions, apartment complexes, or individual homes, stores, and offices. Other functions would be taken over by vegetative "green infrastructure", such as green roofs and walls, trees, and swales along roads and restored streams, riparian areas, and wetlands. Water and sewer lines might be slip-lined for potable or reclaimed water, water storage, and heat recovery. Networks of telemetry and control technologies would be key elements in managing these systems and in protecting public health and the environment.

For example, an "eco-block" incorporating architectural innovations, wind and solar power, green roof and wall cooling, rainwater harvesting, water reuse and energy recovery, and nutrient recycling into community gardens, can be nearly "off-the-grid" in both energy and water, and can be located at transportation "hubs". These new and efficient designs may cost less in dollars than traditional centralized systems, in part because valuable resources are recovered and in part because long-distance transport costs are avoided. They will also improve the quality of life and work in urban communities and, by virtue of their lighter "footprint", begin to restore the ecological Commons in surrounding watersheds, oceans, and climate patterns.

Federal water policy questions are:

1. Current regulations "lock-in" old technologies and inhibit investment in innovative designs. How can the federal government jumpstart scientific research, pilot projects, and private sector investment in breakthrough approaches?
2. Funding of siloed "least cost" solutions favors centralized systems with low marginal costs for each water or sewer connection. How can federal funding programs create incentives for integrated project designs that maximize a broader suite of community services and benefits at all scales?
3. The multiplicity of federal laws and regulations inhibits integrated network infrastructure and flexible local design. How can federal "sustainability" legislation be drafted that mandates infrastructure be built in accordance with nature's design principles -- integrated systems, efficiency and reuse, and adaptation to local context?

4. How can the federal government insure that this new approach, typically seen first in upper-income subdivisions and gentrified redevelopments, helps small, rural communities and low-income urban neighborhoods gain access to safe and affordable water and related community redevelopment strategies as well.

The Policy Portfolio

The following document was presented to Sally Ericsson, Associate Program Director, Office of Management and Budget, on October 19, 2009. In attendance were Valerie Nelson, Paul Schwartz, Glen Daigger, Nancy Stoner, and Rich Sustich, all leadership members of the multi-stakeholder alliance.

RESEARCH, EDUCATION, EXTENSION – $500 MILLION
21st Century Infrastructure – Smart, Clean, and Green

Research Agendas:

- Water Availability and Quality – OSTP inter-agency group, September 2007 (House bill – stalled in Senate)
- WERF – Smart, Clean, and Green – February, 2009
- National Academy of Sciences – September, 2009
- U.S. Strategic Water Initiative – October, 2009

Excerpt from December, 2008 letter to Congressional committees re funding for "lab-ready" jobs:

We recommend the following allocation of $100 million to national research and development programs coordinated by EPA:

- EPA's sustainable infrastructure research program;
- Water Environment Research Foundation (including the Congressionally authorized National Decentralized Water Resources Capacity Development Project based at WERF);
- Drinking Water Research at the Water Research Foundation;
- Science Committee-recommended project on "soft path" water infrastructure at the National Academy of Sciences;
- Water-related research led by EPA in the Zero-Net Energy Building research initiative;
- EPA's water-climate research agenda;
- EPA-National Science Foundation collaboration in applications of emerging science to innovative water treatment technologies; and
- Other discretionary research and education programs at EPA, including the National Small Flows Clearinghouse of the National Environmental Services Center at West Virginia University.

Applied research in other federal agencies should be coordinated, including those which have in the recent past explored innovative technologies and designs in water management. Information on the mission and activities of these research programs can be found at: http://sustainablewaterforum.org/fed/cat.pdf. Funding for these "ready" programs and research institutions across the country could include:

- Department of Agriculture – Cooperative State Research, Education, and Extension Service (CREES) and U.S. Forest Service – Urban Forestry;
- Department of Commerce -- National Sea Grant College Program, National Estuarine Research Reserves, and National Institute of Standards and Technology

- Department of Defense – National Environmental Technology Test Sites
- Department of Energy – Energy Efficiency and Renewable Energy-water nexus
- Department of Health and Human Services – Centers for Disease Control – National Center for Environmental Health
- Department of Housing and Urban Development – Partnership for Advancing Technology in Housing (PATH)
- Department of the Interior -- Bureau of Reclamation Water Reclamation and Reuse Program and USGS – National Institutes for Water Resources
- Department of Transportation – Green Highways Initiative.

INFRASTRUCTURE CHALLENGE GRANTS
Cities and Towns – Smart, Clean, and Green

Primary agencies: EPA, DOE
Secondary agencies: USDA (Forest Service/RUS), HUD, DOT, Commerce

Fundamental redesign of integrated urban infrastructure services

(vs. "green reserve" in Clean Water SRF, which funds siloed approaches in green infrastructure or water efficiency or energy efficiency or decentralized wastewater; vs. Green Impact Zone, which targets diverse agency budgets on a neighborhood – but which has broader funding streams, focus on energy – weatherization, smart grid)

- Integrated infrastructure design – water, wastewater, stormwater, energy, solid waste, transportation
- Embedded or nested into building and neighborhood scales
- Repurposed central system infrastructure
- Efficiencies and recovered resources – work with and mimic nature
- Examples – non-potable reuse, biogas recovery and sewer heat mining, green roofs, stream restoration, rainwater harvesting, nutrient recovery into gardens – "eco-block"

Multiple benefits/outcomes:

- Lighter environmental footprint – lower per capita potable water use, energy consumption and carbon footprint
- Ecosystem restoration – water returned to natural systems, restored hydrologies
- Healthier communities – air quality, lowered temperatures, green space, clean water, removal of toxics, community gardens/nutrient recovery
- Lower costs of services – synergy of integrated designs
- Economic benefits – neighborhood revitalization, green jobs
- Public-private financing – costs of infrastructure partly absorbed into building construction, private utilities

Phase I: planning and design

Review: technical designs and benefits/outcomes

Phase II: construction

Examples:

- Los Angeles – Andy Lipkis, TREE People
- Seattle – Steve Moddemeyer, CollinsWoerman
- New York – Ed Clerico, Battery Park and Co-op Housing

FUNDING – Break Down Silos in Current Funding and Expand Market Transformation Strategies

I. Infrastructure grants and loans to municipalities – wastewater, water, stormwater, energy, transportation, buildings, schools, hospitals, housing

Changes in Guidelines:

- Expand eligibilities for innovative approaches that "lighten footprint"
- Provide incentives (additional subsidization) for innovative approaches
- Require integrated resource plan as a condition of grant or loan
- Require calculations of full range of benefits and costs to public health, environment, economy
- Radical concept – fund only "21st century systems"

EPA – Clean Water and Safe Drinking Water SRF's
USDA – Rural Development/RUS wastewater grants and loans – currently restricted to "publicly owned facilities" except in a few branch offices
HUD – Community Development Grants
EDA – infrastructure grants/loans
Army Corps
Bureau of Reclamation

II. Market Transformation Strategies – "Just Add Water" to Energy approaches

- Federal facilities – October 5, 2009 Federal Leadership in Environmental, Energy, and Economic Performance – includes all "categories" – could stress importance of recovering energy from wastewater stream, could aim for lowering "water footprint"
- Standards and labeling – EPA needs to work on non-potable reuse standards, in particular
- Tax incentives for builders and homeowners
- Clean technology support – Small Business Administration, venture capital loans, etc.
- Green collar job education and training programs
- Portfolio standards for municipalities – water-efficiency or reuse – reduction in potable water use

REGULATORY REFORM – 21st century Infrastructure
Integrated – water, energy, solid waste, transportation
Embedded or nested in buildings and neighborhoods, along with repurposed Centralized infrastructure

Federal level: siloed, point-source permits:

- NPDES permits – wastewater treatment plants
- SDWA – public water supply systems
- Long-term control plans – CSOs and MS-4s for stormwater runoff
- Army Corps – flood and sediment control
- Endangered Species Act

Missing: Nonpoint sources, integrated planning (water quality and quantity)

State and Local Level regulations and permitting:

- Water withdrawals
- Groundwater discharge permits (underground injection controls)
- Building codes
- Septic system regulations
- Zoning and land Use

Problems with Existing Approach

- Sewer bias – vs. decentralized approaches (EPA pushes communities into NPDES program)
- Storm sewer bias –vs. green infrastructure, stormwater retention
- Short timeframes for alternatives analysis – public attention too late
- Siloed actions – without consideration for whole water system impacts
- Financial risks for innovation – local community, engineer are risk-averse
- Failure to consider full range of potential health and community benefits
- Inefficiencies in priority-setting – need a watershed approach

Opportunities for Incremental Reform:

- Question whether increased enforcement within existing system is best strategy
- Disconnect OMB performance ratings from narrow permit listings (EPA is sewering-up small communities in order to achieve higher scores)
- Develop model consent decrees/long-term control plans (stormwater) that incorporate adaptive management, somewhat less in effluent control but significantly higher community and public health benefits – Daigger – Syracuse and Louisville; Nancy Stoner – Philadelphia/EPA Headquarters
- TMDLs with groundwater discharge permits – Valerie Nelson/Paul Schwartz – model for Cape Cod towns/Conservation Law Foundation – EPA should be taking the lead in dealing with nonpoint-source wastewater into groundwater/surface water

Long-term goal for integrated infrastructure:
Sustainability Act – multiple benefits and outcomes as performance goals

Recommendations for a Water Alliance

A Statement of Purpose and Mission were drafted by Polly Vail for the formal establishment of a Water Alliance.

STATEMENT OF PURPOSE/MISSION

THE WATER ALLIANCE
LEADING THE CONVERSATION BY LIVING THE PRINCIPLES

Mission

The Water Alliance is an international coalition of Water Infrastructure professionals. Our expertise stems from the collective talent of our scientists, academics, policy experts and practitioners working throughout the world.

Since our membership has breadth and depth, we serve many functions: information clearinghouse, reliable and original research resource, project management and legislative advisors.

We are leading the conversation on sustainability and resilience through our projects and research, speaking engagements, and publications.

Recommended Goals

1) Develop communications projects that extend our reach to the general public and opinion leaders.

a) We will develop "OH! H2O. Water. The Eureka Topic of Our Time." as a video and establish an interactive website.

b) We will develop and manage an e-mail list comprised of our own contacts. We will also purchase lists, and gather member information as they sign up.

c) We will manage the e-mail list including and importantly deleting names of users who do not want to receive e-mails from us.

d) We will manage our search engine profile and have a search engine optimization and management process.

For a high impact presence on the Internet we will:

- Compose and deliver customized newsletters
- Create and archive interviews with our founders
- Organize Water Infrastructure news from our founders and other sources
- Create a BLOG posting area on our site and engage outside opinion

2) Partner with high-impact organizations for symposiums and events. (e.g.)

a) The Institute for Sustainable Communities
b) Conservation International

3) Communicate with federal and state governments.

Planned Next Steps for the Water Alliance

1. Formally establish the Water Alliance
2. Create a website for the Alliance
3. Appoint an advisory committee
4. Prepare written documents for the website
5. Seek funding for preparation of a video based on the Story of Water
6. Recommend strategy and approach to planning activities and priorities for the Alliance, which would include an initial focus on decentralized wastewater, reuse, and resource recovery, along with the broader perspective of "all water".
7. Advocate incremental recommendations for federal policy action, including:

1. HUD-DOT-EPA collaboration for Livable Communities Initiative re stormwater, transportation – add DOE, USDA for energy, water, wastewater, reuse

2. EPA's Urban Water Initiative – incorporate 21st century water infrastructure concepts, including energy, wastewater, reuse infrastructure

3. Chesapeake Bay Program – incorporate 21st century water infrastructure concepts, including energy, wastewater, reuse infrastructure

4. EPA – Merge WaterSense, green infrastructure, decentralized wastewater programs in the Office of Water

5. EPA – provide additional funding for Sustainable Infrastructure Research grant to WERF, and include funding for Decentralized Water Resources Collaborative (NDWRCDP)

6. EPA – increase research funding for green infrastructure

7. EPA – request agency to develop a model budget and workplan to incorporate significant "research and development" and "extension activities" into its mission

8. EPA – continue permit-writing exercise for green infrastructure/CSOs and initiate work on groundwater discharge/TMDLs for wastewater

9. EPA – update national standards and guidelines for non-potable reuse

10. USDA – request Rural Development to take branch office approach to financing private infrastructure to the national level

11. USDA – expand funding for CREES to expand into smart, clean, green infrastructure

12. Army Corps of Engineers – expand consideration of multiple benefits and outcomes

13. DOE – fully explore potential energy recovery from wastewater stream and water system

14. DOE – emphasize water infrastructure in federal facilities and net zero-energy initiatives

CHAPTER 4.0

THE STORY OF WATER

Polly Vail has prepared a story for a Water Alliance website and outreach to the general public and multiple stakeholders, including filming of a video. The goal of her effort was to blend the best ideas and language, in order to achieve the greatest "resonance" in civil society and among elected officials opinion leaders, and water professionals.

OH ! H2O !

Water is the **EUREKA** topic of our time.

Water is everywhere. It's vital. It's at the heart of our economy and the heart of our most pressing issues. When we add Water to our conversations about the economy and healthcare, we get to the heart of our problems. Water is the solution we are looking for.

Water puts power into our economy and suffuses our lives. We need lots of Water for energy, agriculture, transportation, real estate, consumer and industrial manufacturing, and our services and health care sectors. We need lots of clean Water for our own health. How we allocate and use Water in the coming years will determine what kind of a world we live in.

Water is our most precious resource.

But, the way we are squandering our water supplies is deplorable.

We need solutions and promising practices. We need to make sense of Water.

Using each of our five senses we begin to immerse ourselves with the issues facing us. We need to ***see*** the issues clearly and ***listen*** to the facts. We need to be assured that when we ***taste*** and ***smell*** our water, it's safe. Let's get in close ***touch*** with our elected officials and make sure they are in touch with our needs.

Let's not forget our ***sense of wonder*** about water. Water is an awesome power that we need to protect.

1) *SEEING* CLEARLY

Some problems are hidden and some are invisible. What we can't see *IS* hurting us.

A) We have a national water shortage problem, but only a few regions of the country see it. In just three years, 26 states will be facing severe droughts. The fights have already begun with states suing each other over water rights. In at least one case, the dispute has gone all the way to the Supreme Court. Maryland vs. Virginia sued over water rights to the Potomac River. How fitting that this river runs right by our Nation's Capital!

This is a national problem requiring a national debate. The Water Alliance, an international coalition of water experts puts it very simply: "We need a 50-year water bill that addresses forthrightly the problems of water shortages, degradation and infrastructure."

B) Globally, we're involved with solving our energy problems, ***but we need to expand the issue*** to see it clearly. What we actually have is an energy / water nexus problem. As our population grows, so will our energy and water needs. This makes our energy footprint and our water footprint a pair. We need a coordinated effort to march successfully toward our dual-purpose goals of energy reduction and water expansion.

C) Our water infrastructure is ***out of sight*** and therefore out of mind. Our vast network of underground pipes is about 800,000 miles long, 100 years old and in need of hundreds of billions of dollars worth of repairs.

What we see is the problem of water main breaks, but that's just a sliver of the problem. We need to look at the enormity of the problem and develop a systems solution.

D) Water infrastructure is being allocated little in the American reconstruction and recovery stimulus spending. It's seems to be an ***invisible*** problem.

Making water issues ***transparent rather than invisible*** will bring us closer to solving our allocation conflicts, our energy needs, and to shoring up our infrastructure.

2) *HEARING* WHAT MATTERS

Misleading messages are taking us down the wrong road.

The race to achieve a sustainable future is as serious as any arms race. Honest information is a big weapon that we can use to win. We need to hear the facts.

A) We hear a lot from bottled water and water purification companies on what is "pure" what is "soft". We need to hear more from our own municipal water systems. If we did, we would come to realize that most bottled water costs 1,000 X what tap water costs. If we advocate for clean water from our own taps and our own groundwater instead of buying water by the bottle, we will go a long way toward sustainability.

B) There are worthy groups advocating for wilderness preservation and species protection. Their ad campaigns are emotional. We need to hear more about how to make ***our habitat*** sustainable,

our economy robust and ***our communities*** resilient. Some people confuse or conflate the messages. We need to differentiate them.

C) There is a phrase that is becoming more and more commonplace and we need to be able to discuss it when we hear it. The phrase is: "Water is the next oil." We can't look at these problems sequentially. They are intertwined issues with equal urgency and we can't create "alternative water" sources.

Although there is a lot of noise, there are also some promising "messaging" practices.

The Swedes now include a carbon footprint calculation next to nutritional information in food products. Some US textile companies now calculate their water footprint and add it to their marketing campaigns along with "Made in the USA." Books, magazines, and brochures have begun to include the number of trees and gallons of water used in production. Consumers appreciate it and sales follow. Apple's IPhone is developing applications for carbon footprint calculations. Water can follow. Ford Motors and Coca Cola have also begun to boast about their responsible use of water as part of their branding efforts.

Consumers have shown they are motivated to learn about the carbon and water footprint of our products and will buy accordingly. So, let's make this information available and let's make it loud and clear.

3 , 4) CONTAMINANTS WE CAN'T *TASTE OR SMELL?*

We can't detect the unsafe chemicals infiltrating our water system. That stinks!

Household cleaning products, personal care products, pesticides, plastics, animal feed products, industrial chemicals, solvents, dry cleaning chemicals, paints, nano-materials, road salt, and second-hand pharmaceuticals are creating a witches brew in our waters.

We are learning about this from reliable news sources, yet we are being told to "be patient, and let experts study the problem."

According to scientists at the University of Maryland, water treatment can transform some of these contaminants but many can't be removed from our water, so we are stuck with them.

Europe has already done extensive research and has a list of harmful chemicals and has banned them. We should do the same.

Other countries have developed cheap, easy ways to get unused pharmaceuticals out of our system. They have "drop off" and "mail in choices". We deserve this as well.

We can also advocate for cheap and easy home testing kits and good labeling and information about our everyday products.

If we can't smell or taste these contaminants, we need to be able to sniff them out by some other means.

5) KEEPING IN *TOUCH* WITH OUR ELECTED OFFICIALS

Advocates on Capitol Hill.

We need to make sense of our water laws. That's common sense. But, this is going to be a ***big*** challenge. Every sector of our economy depends on vast amounts of cheap water. Our population is growing. We are reworking our energy landscape and water scarcity issues are flaring up all around the country. The rivalries are bound to be fierce as we debate who owns our rivers, lakes and groundwater.

A) We can't fairly allocate and use water unless and until we map our water supplies and define water rights.

B) We can't fairly allocate and use water until we connect our water supplies to our zoning laws.

Good zoning laws are critical. Groundwater conservation districts, low impact development zones and smart growth zones can promote and nurture resilient communities.

C) We go a long way toward sustainability when our laws support smart practices like harvesting the rain from our roofs, roads and lawns, or trading in "grass for cash" as they did in Las Vegas. These empower consumers and spur business growth.

D) LEED (Leadership in Environmental and Energy Design) is another sustainability tool. Septic and well systems can be held to the same standards as our cars and be checked and certified within reason.

We need to pay close attention to legal precedents. We need to track the trends and make sure our interests are being protected. Our Water laws need to reflect our sustainability goals.

6) WONDER… OUR *SIXTH* SENSE

The power of water goes beyond our five senses.

Water is at the heart of all life. It runs through all of us. It connects us. It is vital and spiritual.

Water is exquisitely soft as it trickles over a baby's skin in the tub. It's fierce and harsh as it pounds mountains into boulders, boulders into rocks, rocks into stones, stones into sand that crunches under your feet.

Water's surface is pure tension that can buoy a multi-ton container ship or allow a pebble to sink. It can be soft and yielding to a skilled diver off a diving board or it can be hard and unforgiving to the novice.

It's formless and formidable. It conceals and illuminates. It is transformational, essential, precious, non-renewable, and finite.

We need to protect this resource and its awesome power.

Next Steps: MAKING SENSE OF WATER

Promising Practices and a Vision for the Future

The Water Alliance is leading the conversation by living the principals of a new paradigm for Water. This Alliance is an international coalition of scientists, engineers, environmentalists and land use experts. They have the deep reservoirs of experience we need right now to see and feel our way to a sustainable future.

The Water Alliance calls for:

1) Replacing our broken pipes with a new infrastructure. Engineers have already devised smaller, localized water systems that don't waste potable water and don't create more potable water than is needed.

These smaller systems are tied to the groundwater below and powered by renewable energy sources available at the local level.

2) Using green infrastructure. The Chicago Climate Action Plan is on board with their recommendations already. As the city says in the action plan literature: "By capturing raindrops where they fall, stormwater can be managed using rain gardens, swales, permeable pavement, and other low-impact approaches. This practice, called green infrastructure reduces the amount of stormwater waste that must be treated and accounts for a .10 MMTCO2e reduction. In 2007, the City passed a stormwater ordinance that requires large developments to capture the first half inch of rain fall onsite."

The co-benefits are enormous. These projects protect and regenerate topsoil and add green beauty to our landscapes. This green infrastructure will help offset our carbon footprint in a meaningful way.

3) New infrastructure and new water systems have virtually NO waste. Scientists and engineers know how to capture and recover the methane, hydrogen, nitrogen and phosphorous and create new forms of renewable energy. In England venture funds are thriving for companies converting "waste" into energy. Water's waste can be added to this menu of choices.

4) Understanding the water/energy nexus and advocating for using water wisely. Again, the City of Chicago is an example of promising practices. “Getting Water to households and businesses uses a great deal of power. Pumping, distributing, and heating water takes energy and produces emissions. Consider this: a faucet that runs for five minutes uses as much energy as a 60 watt light bulb lit for 14 hours. The city’s water main replacement effort saves 160 gallons per day. When buildings are retrofitted for energy efficiency, they can also be improved for water efficiency, resulting in an additional drop of .04MMTco2e in greenhouse gas emissions.

5) Connecting human capital to water capital. As we fix our water infrastructure, we add tremendous value to our communities and to that place we call home. Developing and implementing new system will require the work of highly skilled employees. So our vision will create opportunities for economic development “learning for earning”.

Water is the EUREKA topic of our time.

When you wake up tomorrow morning and go through your day, think about your Water. For breakfast maybe you will have some coffee, soda, juice, toast, eggs, or cereal. They ALL required a lot of water to get to you. Walk into your bathroom to brush your teeth, take a shower and flush. Imagine that experience if you had to worry about your water supply or cleanliness. Look around your house. Every appliance required water for production and your house or apartment itself required water for production. Look outside at your sidewalks or green space. They required water. As you leave your residence, consider the water needs of your mode of transportation. Look at the trees and buildings you pass. And consider what is underground that you can’t see.

OH! H2O!

Immerse yourself in the topic of water. Use all your senses including your sense of wonder when you think of water. It is everywhere. It is NON-renewable and it is finite.

It is precious.

CHAPTER 5.0

MODEL STATEWIDE ALLIANCE – MASSACHUSETTS

Developing a Model for a Statewide Coalition

A promising arena for stitching together a new coalition in support of a new water infrastructure is at the state level. While constrained to a large extent by the funding and regulatory requirements of the federal government, states nevertheless have significant resources and powers of their own to initiate change in water policy and management. States and statewide constituencies are also close enough to the ground level of environmental problems and municipal politics to be able to test the realistic applicability of new ideas.

This project worked to initiate a statewide coalition and strategy in Massachusetts. There are a number of reasons why Massachusetts was a good test case for building NGO support and partnerships around new, more sustainable approaches. While in a wet area of the country, the state has nevertheless been experiencing water shortages in the Eastern part of the state. These problems stem, in large part, from the construction of conventional wastewater infrastructure which transports wastewater and groundwater infiltration into ocean outfalls.

The water quantity problems in conventional wastewater engineering have created fertile ground for discussions about decentralized alternatives. Stronger storms have also become an issue in flood control, and the Charles River Watershed green infrastructure programs are successfully moderating flows, in contrast to other rivers in the state where there has been significant damage to homes.

Cape Cod's aquifer and estuaries have been contaminated by septic systems, and proposals for expensive sewers are being advanced. Sprawl development has been encouraged by large lot septic system codes, and Smart Growth advocates and homebuilders would like to see a more nuanced water/wastewater infrastructure approach. Finally, NGOs and the Mayor of Boston are finally beginning to take an interest in green roofs, tree planting, etc.

Massachusetts also has key academic leadership within the state, including Vladimir Novotny at Northeastern (co-author with Paul Brown of a new IWA book on a new water paradigm), Sarah Slaughter, an engineer at the Sloan School of Business at M.I.T., and Jack Ahern at U Mass/Amherst. Progressive engineers and manufacturers have been working out of Massachusetts, including David del Porto, Carol Steinfeld, Craig Lindell, and Pio Lombardo. CDM's Boston office has also been helping to lead their "Cities of the Future" initiatives. There are several NGOs that have focused on green infrastructure, including the Charles River Watershed Association, eight Towns in the Bay, and an Alewife redevelopment project.

Surprisingly, there had been no effort prior to this project to create a broad coalition of these diverse advocates and experts that have pieces of the vision of a more sustainable approach to water infrastructure. Again, following the pattern described above at the national level, most of the influence of mainstream environmental constituencies has been in efforts to increase funding for conventional infrastructure, as in support for a proposed water infrastructure funding bill in the state legislature.

NGOs aren't generally aware of, nor do they attend, public hearings on CWSRF projects. Arguably the most effective environmental law group, the Conservation Law Foundation, is aware of the problems created by conventionally-engineered projects, but lacks the information to propose alternatives. A very large gap has thus developed between the potential for a new water infrastructure paradigm to emerge in the state and the organizational capacity of these experts and advocates to jumpstart and facilitate that transition.

This project supported an effort to:

- Create a multi-stakeholder network for water management reform
- Interview a wide range of experts and advocates
- Provide education and outreach materials and sessions
- Identify water problems in the state
- Identify needs and opportunities for state policy reform
- Target several local reform projects (see Chapter 5.0)

Creation of a Multi-Stakeholder Network

Nelson and Smith systematically developed a contact list of a variety of stakeholder experts and advocates in Massachusetts. Individuals were identified from the following groups:

- Clean water advocacy
- Watershed organizations
- Toxics campaign advocates
- Environmental justice organizations
- Universities and colleges
- Clean tech companies
- Engineering firms
- Contractors and installers
- State agencies
- Local agencies
- Federal agencies
- Renewable energy advocacy
- Architectural firms and builders

MASSACHUSETTS Smart, Clean, Green Network

Clean Water Action and the Coalition for Alternative Wastewater Treatment are working to form the "Massachusetts Smart, Clean, Green Infrastructure Network". This Coalition will identify the broad range of water quantity and quality problems in Massachusetts and study the options for more sustainable designs and approaches. Thus far, participating constituencies include environmental organizations, engineers, manufacturers, architects, government officials, academics, and others. We hope to learn from and build onto existing momentum in this direction.

A starting definition of sustainable infrastructure includes systems that "use, treat, store, and reuse water efficiently at a small scale and that blend designs into restorative water hydrologies". These would include rain gardens and green roofs, water-efficient appliances and landscaping, decentralized wastewater systems, digestors to recover energy and nutrients from wastewater, and others that conserve resources and restore ecosystems and healthy communities.

If you are interested in participating in this project, or have ideas about individuals or groups for outreach, please contact Becky Smith at Clean Water Action at bsmith@cleanwater.org or 617.338.8131 x210 or Valerie Nelson at www.sustainablewaterforum.org

In late September, 2009, we will launch our online network tool, which we invite you to visit: www.smartcleangreen.org.

A list of 250+ stakeholder names and affiliations is attached in Appendix I. This list has constituted the mailing list for the Boston lunch series and other workshops in the state and these individuals will be a continuing resource for education and policy advocacy.

How stakeholder groups were identified (a model for other states)

Creating a multi-stakeholder network requires tracking down individuals who are often unaware of each other and are not known by NGOs that might have an interest in creating a similar list in their own states. The following sources are a start:

- Clean Water Network member organizations (website)
- National Onsite Wastewater Recycling Association (NOWRA) chapters (website)
- Consortium of Institute for Decentralized Wastewater Treatment faculty (website)
- Water Research Institutes – USDA-funded
- Water Innovations Alliance members
- Water Environment Federation leadership
- Green building organizations

Surprisingly, one of the best sources of contacts was a continuous reading of local and statewide media, which frequently contained articles about water problems, technology innovation, or research.

Interviews and Meetings

Nelson and Smith conducted a wide range of outreach interviews and attended meetings and workshops, both to learn more about water-related problems and opportunities in the state and to introduce concepts of "21st century" water management into a wide variety of ongoing "conversations" about these problems.

Interviews with progressive water paradigm leadership:

Interviews were conducted with leadership in environmental advocacy, engineering, policy, and technology:

- Jack Clark, Audubon Society
- Peter Shelley, Conservation Law Foundation
- Bob Zimmerman and Kate Bowditch, Charles River Watershed Association
- Russell Cohen and Cindy del Papa, Mass Riverways Program
- Sarah Slaughter, M.I.T.
- Vladimir Novotny, Northeastern University
- David DeLorenzo, DEP
- Mark Modzelewski, Water Innovations Alliance
- Martin Pillsbury, Metropolitan Area Planning Council
- Christine Tabak, Merrimack River Watershed Council

- Andre Leroux , Smart Growth Alliance
- Patricia Jones, Unitarian Universalist Service Committee

Meetings and Workshops

Event:	**Kick-off Meeting: Massachusetts Coalition for Sustainable Water Infrastructure**
Date:	June 20, 2008
Location:	Gloucester, MA
Facilitators:	Valerie Nelson, Paul Schwartz, Becky Smith

Event:	**MetroFuture Leadership Dialogue, Metropolitan Area Planning Council**
Date:	August 12, 2008
Location:	Boston, MA
Participants:	Valerie Nelson, Becky Smith

Event:	**Water Visioning Group (streamflow issues)**
Dates:	Multiple meetings in summer and fall, 2008
Location:	Boston
Participants:	Valerie Nelson, Becky Smith, John McNabb

Event:	**New Water Paradigm**
Date:	January 26, 2009
Location:	Barr Foundation, Boston, MA
Speaker:	Valerie Nelson
Title:	Sustainable Water Systems
Participants:	Becky Smith, Paul Schwartz

Event:	**"A Conversation with Congressman John Tierney: Greening our Economy, Sustaining Our Workforce**
Date:	April 15, 2009
Location:	Middleton, MA
Participant:	Valerie Nelson

Event:	**UUSC Board Meeting**
Date:	January 30, 2009
Location:	UUSC HQ, Cambridge, MA
Speaker:	Becky Smith
Title:	Water and Climate Change

Event:	**Meeting with City of Boston Environment Department: Jim Hunt and Bryan Glasscock**
Date:	February 6, 2009

Location: City Hall Boston, MA
Participants: Steve Moddemeyer, Valerie Nelson, Becky Smith

A number of events listed in Chapter 2.0, including environmental justice workshops, were also held in Boston and attended by Valerie Nelson.

Education and Information Sessions

The following education and outreach sessions were organized by Nelson and Smith. Each event included in the audience a diverse set of multi-stakeholder leadership in Massachusetts, many of whom had not previously met.

The goal of the "lunch series" has been to introduce leading-edge water paradigm concepts and case studies from other parts of the country and Canada, in terms of: decentralized solutions; Integrated Resource Management; water-energy nexus; re-use systems; cities and towns of the future; green jobs market potential; and multiple benefit projects, including triple bottom line, green jobs, quality of life, natural systems use and value, and social benefits.

Boston Lunch Series:

Event: **Sustainable Water Forum Lunch Series**
Date: December 4th, 2008
Location: The Boston Foundation offices, Boston, MA
Speaker: Patrick Lucey, Aqua-Tex, Victoria, B.C.
Title: Smart Development, Watersheds, & Climate Change: Brown into Green into Gold

Event: **Sustainable Water Forum Lunch Series**
Date: February 5th, 2009
Location: Church on the Hill, Beacon Hill, Boston, MA
Speaker: Steve Moddemeyer, CollinsWoerman, Seattle
Title: Cities of the Future: Urban Sustainability and Water

Please Join Us for a Lunchtime Forum
Sustainable Water Management Approaches
Speaker: Steve Moddemeyer

- What: Lunchtime Speaker on Sustainable Water Management Approaches
- Who: Steve Moddemeyer
- Where: Church on the Hill
    - 140 Bowdoin Street, Beacon Hill
    - Boston, MA 02108
- When: Thursday, February 5th, 12:00-2:00pm
- Sandwich lunch provided; **Please RSVP to this email address by 5pm, Tuesday, February 3rd**

We will have lunch at noon with time for networking, followed by keynote speaker Steve Moddemeyer (please see his bio, attached.) As a City Planner, Steve has been responsible for creating a new award-winning landscaping ordinance for commercial development that improves environmental functions in dense urban business districts of Seattle. Steve's talents integrate a blending of governmental policy-making with knowledge of sciences, engineering, landscape ecology, urban design, economic development, sustainable design, and strategic visioning. Steve writes and speaks internationally on "Cities of the Future", integrated water strategies, green infrastructure and sustainable infrastructure topics.

Event: **Sustainable Water Forum Lunch Series**
Date: March 13th, 2009
Location: Church on the Hill, Boston, MA
Speaker: Ed Clerico, Alliance Engineering
Title: Water Efficiency and Water Resource Management

The final session in the lunch series was intended to showcase Massachusetts innovators in water management, many of whom, for lack of a receptive regulatory climate for innovation, have been forced to practice outside the state.

Event: **Smart, Clean, and Green Infrastructure Show and Tell: Local Practitioners**
Date: June, 17th, 2009
Location: Church on the Hill, Beacon Hill, Boston, MA

Speaker: Bryan Glascock, Director, Environment Department, City of Boston
Title: Stormwater Management in Boston

Speaker: Bob Zimmerman, Charles River Watershed Association
Title: "Greening" the Blackstone Town Hall

Speaker: David Del Porto, Ecological Engineering Group
Title: Ecocycl**ET:** The New Green Paradigm for Water Reuse

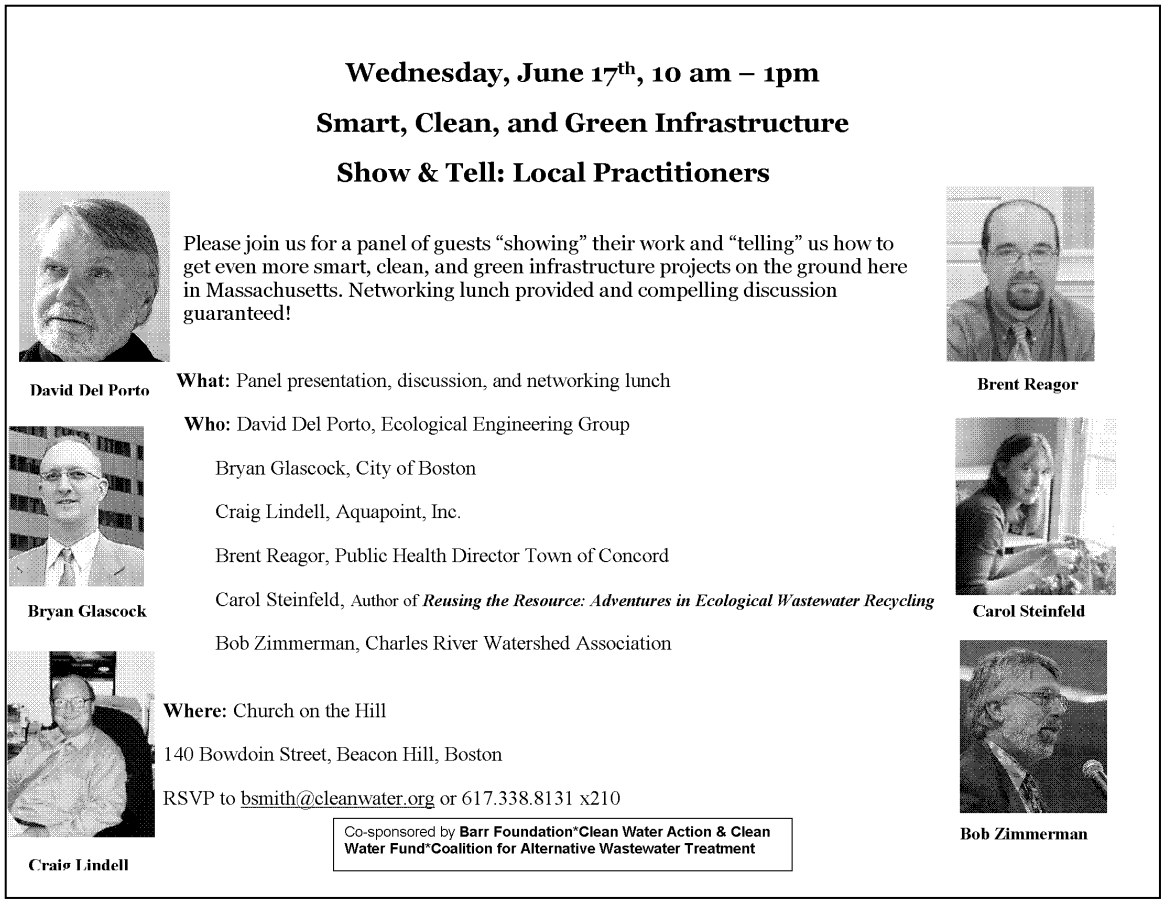
Speaker: Carol Steinfeld, Author
Title: Reusing the Resource: Adventures in Ecological Wastewater Recycling

Speaker: Craig Lindell, Aquapoint, Inc.
Title: Distributed Wastewater Management, Capital Formation, Job Formation, and the Watershed Agenda

Speaker: Brent Reagor, Public Health Director, Town of Concord
Title: "Shifting the Water Resources Paradigm"

Ken Moraff from EPA and Kathy Baskin from the Commonwealth of Massachusetts provided, at our invitation, favorable comments on interest and openness to innovative water policies and practices.

In attendance were the following State Representatives: Rep. Frank Smizik, Rep. Carolyn Dykema, Rep. Denise Provost, and staff for Sen. O'Leary.



Defining Water Problems and Opportunities in the State

Nelson, Smith, and Schwartz met for two days in June, 2009 to articulate and summarize the dominant problems and opportunities in the state of Massachusetts, including: water-related crises and stresses; a long-term vision for sustainability; strengths and weaknesses of Massachusetts institutions; allies; and state policy opportunities.

Water Problems

An initial goal of the interviews and research in the Massachusetts project was to identify and characterize the critical water infrastructure-related problems in the state that could potentially be addressed through 21st century approaches. These problems might be surfacing as a result of observable ecosystem stresses, Clean Water Act violations, or community development needs. As such, they become topics of conversation, regulatory enforcement, and legislative initiatives.

Water supply and quality – Taunton River, Charles River, Ipswich River

Problem: Low flows due to overdrawing and draining of groundwater through sewers to ocean outfalls; poor quality due to stormwater; impairment due to high effluent content and industrial contaminants

Opportunity: Conservation and efficiency measures, stormwater management, Low Impact Development techniques and requirements, non-potable reuse and local recharge

Aging infrastructure – older cities and towns

Problem: Infiltration & Inflow, disruptive leak events, aging treatment plants, combined sewer overflows
Opportunity: Designing lower-cost next generation innovative and alternative systems, satellite treatment for local reuse, recharge, and resource recovery, green building and lower energy footprint

Unsewered areas – Cape Cod

Problem: Nitrogen loading to nearby soils and waters, eutrophication of estuaries and ponds
Opportunity: Movement away from conventional sewer designs to clusters and potentially new permeable barrier technologies, integrated resource management investments

Growth areas – Route 495 (outer Beltway for Boston)
Problem: Desire for growth capacity likely to accelerate conventional sewer systems, impacting water quality, quantity, and development
Opportunity: Lighter water and energy footprint subdivision designs and affordable housing

Stormwater management – watersheds
Problem: Nonpoint source wet weather runoff leading to water quality impairments
Opportunity: "Green infrastructure" to detain and treat runoff in soils and vegetation, rainwater harvesting, increased evaporation and cooling

Water/Energy/climate nexus:
Problem: Not recognized
Opportunity: Rebuild neighborhoods and communities around principles of Integrated resource management and multiple benefits

Toxics action agenda
Problem: PCPP's and Endocrine Disruptors are "emerging contaminants of concern"; Stormwater
Opportunity: Pollution prevention, source separation, localized treatment; green chemistry and other manufacturing processes

A general pattern emerges from a listing of problems. The backdrop to the list is the reigning paradigm, where water problems are addressed in siloed areas of drinking water, stormwater, and wastewater, and separate from energy use. The default solutions are still generally the large centralized pipe and treatment plant approaches. Innovative concepts are introduced at the margins as incremental modifications of design and institutions.

However, once a community or the state as a whole is willing to start with a narrow problem, but open the discussion to a broader framework, then comprehensive new approaches can become possible. For example, a town on Cape Cod might be pushed to adopt TMDL-based wastewater projects, but also initiate studies and pilot projects around a larger ecosystem services and community development perspective. The town might enlarge the management approach to incorporate all water, energy and other resource objectives and practices that would cost less and achieve superior benefits.

In effect, then, any narrow or siloed problem that focuses the attention of a city or town can open the door for that community to take a longer-term, more comprehensive view of integrated resource management and multiple benefits.

Vision of a Sustainable Massachusetts

Assuming that communities and state government did open dramatically their consideration of integrated infrastructure problems and opportunities, what could cities and towns "look like" in the future?

- SMART – smart information networks, telemetry; monitoring and control in rivers, buildings, other systems; consolidated metering for water and energy

- CLEAN
    - Less disruptive use of resources (less use of water and energy, less long-distance transport of water and wastewater)
    - Not managing water in a way that introduces pollutants into the environment via big pipes and treatment plant effluent, but instead capture rainwater, eliminating sewer overflow by keeping water local and providing for recharge of groundwater)
    - Keeping toxins from entering environment, by pollution prevention and resource recovery of chemicals

- GREEN – using natural systems, restoring ecosystem functions, bringing vegetation back to the cities for stormwater retention and evaporative cooling

- 21st CENTURY – science will uncover technologies to achieve required treatment, reuse, and recovery standards at a variety of scales

Guidelines for Achieving the Vision? – A Back-Casting Exercise

What measures need to be taken now to achieve this longer-term vision?

- Implement pilot projects for every aspect. Give incentives and remove risks for developers, utilities, homeowners, and commercial entities (i.e., Wal-Mart): permit→fund→mandate

- Develop a state role in support of innovation. With the Massachusetts energy policy approach in mind, give public incentives for early adopters, as with purchase of solar panels

- Create investment incentives for innovative technology developers

- Implement local ordinances for sustainable infrastructure in buildings, similar to Seattle's Green Factor

- Re-invigorate the ethic of innovation among all stakeholders and government agencies

- Encourage multiple benefit air solutions and projects, including those eco-benefits and services, as well as jobs-creation, training, equity, and urban redevelopment services

How Massachusetts compares to other states

- Exemplary use of SRF funds for septic upgrades in communities (revolving loan funds)
- Energy efficiency pilot projects and federal stimulus funding at wastewater treatment facilities
- Conservation standard: 65 gallons/person/day and 10% or less unaccounted for water loss per municipal
- Active and innovative Coastal Zone Management program
- Individuals in federal and state agencies who have expressed interest and commitment to innovative in IRM/SCG like Ken Moraff, EPA; Kathy Baskin, Executive Office of Energy and Environmental Affairs
- New Reuse standard
- Water Management Act and safe yield (water allocation) determinations
- Website on keeping water local
- New ecosystem services program in state government
- Active environmental constituencies and expertise
- Strong stormwater, watershed restoration expertise – Charles River Watershed Association
- Depth of academic resources in water management – M.I.T., University of Massachusetts, Northeastern University, Clark University

What Massachusetts lacks and where the state may be behind other states

- Water in green building, green jobs programs
- Innovations in cluster wastewater management
- Financing incentives and priorities for small-scale systems
- Strong links between research and practice
- Smart Growth planning and wastewater management
- Integrated Resource Management in planning
- Water efficiency approaches
- Wastewater reuse infrastructure

- Energy recovery and capture

Policy reform initiatives – a potential state legislative agenda:

A "brainstorming" list of possible incremental or transformative initiatives includes:

- Requirement for state or federal grants and loans that local water projects must have been reviewed in an integrated resource management approach and plan process;
- Set-aside of incentive funding for innovative projects
- Requirements by state economic development programs that practices of sustainable water management be included in community investment projects, including funding for shopping malls, affordable housing, downtown development, etc.
- State tax incentives for clean tech venture capital investment in water
- Rebates and tax credits for developer and customer installation of sustainable water management in building projects or homes
- Requirement that all public buildings practice sustainable water management, including state parks and government facilities, county and local buildings, schools, etc.
- Connection of integrated resource management planning to specific watershed stresses
- All public buildings have incentives and mandates, including state parks and buildings; also regional and municipal
- Creation of a water research and development or "incentives" fund with contributions by private entities and/or water districts
- Workforce Development: "Just Add Water" – training for jobs in "green" stormwater landscaping, green roofs, small-scale treatment, reuse, and resource recovery
- Development of curriculum and certification for engineers, consultants, architects, planners licensed to practice in Massachusetts for new water techniques and technologies
- Revolving loan programs for innovative projects on private property
- Integrated planning and funding for green impact zones and communities with federal, state, and local funding mandates, such as stimulus money to concentrate resources in a place-based way, i.e., Fairmount Transportation Corridor
- Growth and development to tie-in to "Big Map" for expected growth corridors vs. need for green-space conservation, etc.
- Expansion of the reuse standard to allow for non-potable reuse in residential developments
- DEP to develop a formal approach to piloting new technologies and practices within NPDES and TMDL processes, as on Cape Cod
    - Set-asides, portfolio requirements, "allow→fund→mandate"
    - Models for "adaptive management" that continuously streams in innovative improvements
- Groundwater evaluations and reexamination of state UIC (underground injection control) for disposing of wastewater; incorporation of groundwater into Integrated Resource Management
- State to harness ideas, R&D, and pilots of universities, possibly in a consortium structure
- Valuation of water services for trading

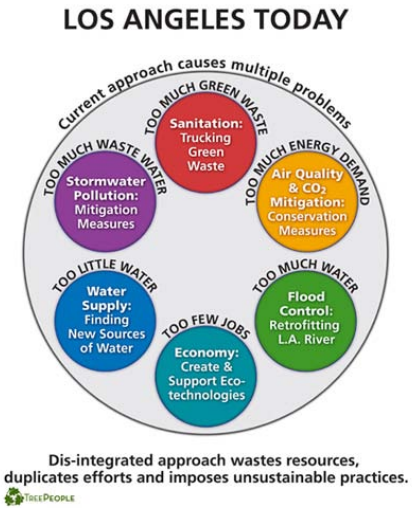
- Historic evapo-transpiration rates benchmarked and a new goal set with methods to return to historic rates prior to loss of vegetative cover
- State-developed grand vision for holistic water "Commons"
- Expansion of MS4 stormwater program to include a broader, multi-benefit perspective which includes energy, air quality, and other community benefits along with water quality improvements
- "Just Add Water" technologies to Massachusetts Technology Collaborative, which has been limited to grants and incentives for renewable energy and efficiency projects

Proposed Progressive Policy Approach for Commonwealth of Massachusetts

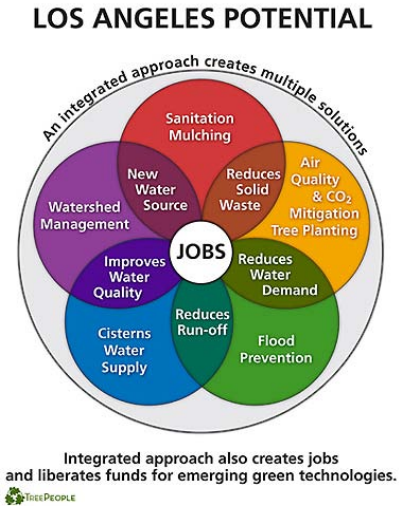
In the fall of 2009, Nelson summarized the following description of progressive policy approaches that could be adopted in Massachusetts:

Rethinking Infrastructure: Smarter, Cleaner, Greener

The Problem Traditional large-scale systems for supplying drinking water, treating wastewater, and handling storm water for cities and towns – conventional centralized "big pipe" systems and infrastructure – use and waste too much energy and too much water. They are causing long-term ecosystem disruption such as "dewatering" even relatively water-rich regions such as the Northeast. With these systems, we have succeeded at undoing nature's number one instinct, which is to keep water local: on the land, in tree and plant cover, and in the aquifer, to use and re-use it in a cycle that wastes the least energy and water quantity and that naturally filters it for improved quality along the way.



Dis-integrated approach wastes resources, duplicates efforts and imposes unsustainable practices.
TreePeople



Integrated approach also creates jobs and liberates funds for emerging green technologies.
TreePeople

The Benefits Truly integrated water system planning and designs meet the requirements of the triple bottom line; economic, social, and ecological profits are simultaneously maximized. These systems use, treat, store, and reuse water much more efficiently, so that even when applied on a smaller scale, the positive impacts are far from small. We have done such extensive damage to ecosystems that, moving forward, our infrastructure must be, and can be, capable of ***restoring*** some of nature's original functions and value. These softer-path, more appropriately scaled technologies and system designs follow an ecological systems approach. They are unique to each community's water needs, and necessarily involve community members in planning processes for

water, energy, and development decisions. They make communities more livable by delivering higher returns in water quality, ecosystem preservation and restoration, and human and ecological health protection per dollar invested than conventional systems, and can save a municipality millions of dollars over their traditional counterparts.

One Local Example Cape Cod communities are facing a crisis of expensive and environmentally devastating proportions: the nitrogen coming from their original septic systems is damaging the estuaries of the region, and the communities are faced with legal action. The towns and cities seem to be approaching their solutions alone, and are finding that traditional big-pipe sewering solutions will cost upwards of $50K and $60K *per household.* This kind of approach may immediately damage the Cape's sole source aquifer from which each community draws its drinking water, and will likely not see nitrogen levels reduced for many years. At upwards of one billion dollars for wastewater solutions for this limited geographic region, there must be *Smarter, Faster, Cheaper* solutions.

Roadmap for a Progressive State Government

Progressive governance or "framing" of local wastewater decision-making can in principle be provided at either the state or the federal level. Currently, permits and enforcement for decentralized and nonpoint source systems are the responsibility of state, and derivatively, local authorities. States have been incrementally engaged in professionalizing and upgrading the capacity of the decentralized wastewater sector. For example, Minnesota has attempted to redesign its funding program to give early preferences to decentralized solutions and Massachusetts has established a pilot and testing program to stream in new onsite system technologies.

It is apparent from the Cape Cod and other cases that state or federal governments need to be proactive in a host of other ways. A progressive government would:

- **actively seek information on the leading edge** of technology development and design across the country and the rest of the world;
- **provide this information to engineers, towns, non-profits, and citizens groups**;
- **fund research and demonstration projects**;
- **require towns to fairly and completely study the alternatives** both for achieving TMDL compliance and for receiving CWSRF and state funding;
- **provide guidelines for adaptive management**, experimentation and enforceable deadlines for compliance with outcomes in a town;
- **work through the permitting ramifications** of encouraging adoption of innovative approaches over time.

Looking further ahead, a progressive state government could also begin to move in the direction of requiring integrated resource planning by communities, including not only wastewater, but water use, stormwater, energy, solid waste and other resource materials. State governments could:

- **require cities and towns to complete integrated resource plans**;
- **provide financial assistance only for projects that were consistent with such integrated plans**;

- **require public investments in schools, municipal buildings, state parks, and other public facilities to be "green";**
- **fund community and subdivision demonstration projects of integrated resource designs and services**;
- **set standards and incentives** for a continuous "lightening" of the water and energy footprint;
- **provide tax incentives and rebates** to homeowners and developers and incentives for clean tech investors in green building and water technologies.

Planned Next Steps

1. Create an Online Platform tool for the Network – CWF will launch an online platform to collect, archive, disseminate, and build upon existing and emerging research, project examples, tools, and learnings on the content of the New Water Paradigm. This online platform will include, at a minimum, the following: speaker's materials, meeting minutes, participant contact information, outside readings, outside event listings, and blog or other real-time sharing and collaborating space for each resulting discussion group.

2. Continue working with the state legislature and administration on a progressive policy agenda – innovation strategies, incentives and "Just Add Water" to renewable and efficiency energy incentive programs.

3. Continue working with Cape Cod towns on wastewater issues and transfer these lessons to Route 495 towns.

4. Inspire and inform individuals, groups, municipalities in order that they pursue "Innovative and Alternative" ideas.

5. Help connect projects with resources and financial incentives for innovation.

6. Continue developing integrated resource management concepts for Boston, including formation of a multi-stakeholder task force.

CHAPTER 6.0

DEVELOPING A MODEL FOR ASSISTANCE TO NGOS AT THE LOCAL LEVEL

Local communities are where innovative concepts and technologies are ultimately tested. They are also the arena where the public most directly engages in debate over new values and institutions. In the water arena, federal regulatory requirements and enforcement actions are still dictating conventional hard path infrastructure solutions. But activists, with considerable technical support, can occasionally succeed in creating the conditions for innovative projects to be built.

Innovative concepts could achieve majority support in a community if an alignment of different values and interests among segments of the community were stitched together. For example, self-styled environmentalists in a community might be concerned about water and resource protection, while developers might see lower costs and higher revenues for Green Building. Local contractors might see an increase in local green jobs as well. Still other voters might be concerned about preserving community character and neighborhoods. And, fiscal conservatives might see conventional infrastructure as wasteful and a drain on municipal budgets.

To date, the most successful examples of local soft path innovation have been in "green" stormwater infrastructure. Advocates have found that many Mayors and other local officials have been receptive to proposals for green roofs, tree plantings, etc. The political appeal is from visibility and attractiveness to local residents, and the multiple community benefits that these projects can achieve. Similar efforts could succeed in a new water infrastructure paradigm, which includes water-efficiency and conservation, stormwater management, and wastewater reuse and resource recovery, but the value proposition for the new paradigm and the alliance of shared interests need to be designed.

The challenge for environmental NGOs at the local level is to combine the complex task of building alliances and public support with the technical requirements of envisioning a new approach. An advocate for exploration of a more sustainable water infrastructure needs the following tools:

- An overarching understanding of the new paradigm objectives, design principles, technologies, and institutions
- A value proposition and case study stories or examples to present to the community
- Models for building partnerships and alliances within the community
- Access to technical information and expertise and models for initiating a broad integrated planning process using outside consultants

- Resource lists of soft path experts
- Identification of funding sources for demonstration projects and alternatives
- Approaches to dealing with local and state bureaucracies and regulatory requirements
- Models for public-private collaboration on capacity-building, training, social marketing, etc.

Advocates would also need to develop a robust, multi-stakeholder alliance with progressive engineers, clean tech entrepreneurs, political leadership, and academics**.**

Demonstration and Pilot Projects

Demonstration projects are particularly important to advance innovation in local communities for the following reasons:

1. Decision makers, such as elected officials and the public, need to see concrete examples of innovative approaches. Pilot projects are needed to demonstrate the efficacy of innovative technologies or projects in controlled settings. Demonstration projects generally explore the feasibility of these approaches in real communities and markets.

2. Risk aversion pervades the water resource infrastructure sector and engineers and utility managers, in particular, need to develop greater comfort with innovation approaches.

3. While most of the creativity and innovation in integrated soft path water infrastructure is occurring at local levels, the barriers to innovation are severe – an engineering bias against soft path systems, siloing of local agencies, siloing and narrow, mission-driven agendas of federal and state programs affecting local government, indifference of most of the public, restrictive local ordinances, and others – incentive funding of soft path projects is needed to help in overcoming these barriers.

4. Scale issues – more is known about the performance of distributed systems (rain gardens, onsite wastewater systems) at the individual lot level than at the subdivision or community-wide level. Demonstration projects should provide data on multiple levels.

Because so few citizens are aware of the complex issues surrounding community choices of hard path vs. soft path infrastructure, they are currently ill-prepared to take on an effective advocacy role for 21st century approaches. Existing information and tools are not adequate, even if groups take an interest in the question. For example, demonstration case studies are few and far between, so advocates can't point to neighboring towns. Performance data on systems is sparse. Models to estimate the cumulative economic and water quality impacts of various approaches are not adequately developed. And, volunteer activists do not know who in the private sector or utility fields to seek out for these answers, or how to establish stronger, more diverse alliances.

Project Activities

This project explored a number of opportunities for local engagement, including in Portsmouth, N.H., Gloucester, MA, Lowell, MA, Action, MA, the Boston metropolitan area, and Cape Cod. Presentations or interviews have been held with activists in each of these locations. To date, the primary focus for follow-up, ongoing local case study work has been in Boston (addressed in the statewide lunch series described in Chapter 5.0) and on Cape Cod.

Cape Cod

Substantial background on Cape Cod sewering and nitrogen TMDL issues has been gleaned from attendance at the following workshops and briefings:

Event: **Innovative and Alternative Onsite Systems & Nitrex Reactive Barrier**
Date: Jun 12, 2008
Location: Waquoit Bay National Estuarine Research Reserve (WBNERR)
Attendee: Valerie Nelson

Event: **Cluster Systems: A Decentralized Approach to Enhanced Wastewater Treatment**
Date: August 6, 2008
Location: WBNERR
Attendee: Valerie Nelson

Event: **Centralized Wastewater Treatment/Sewering**
Date: September 11, 2008
Location: WBNERR
Attendee: Becky Smith

Event: **Community Planning Processes: Lessons Learned and Best Practices**
Date: November 13, 2008
Location: WBNERR
Attendee: Valerie Nelson

Event: **Understanding and Navigating the Regulatory Framework for Wastewater Planning**
Date: October 28, 2009
Location: WBNERR
Attendee: Valerie Nelson

Nelson and Smith have so far organized the following three workshops and outreach sessions on Cape Cod:

Event: **21st Century Water Management: Smart, Clean, and Green**
Date: May 22nd, 2009

Location:	Waquoit Bay National Estuarine Research Reserve, Falmouth, MA
Speaker:	Patrick Lucey
Title:	Sustainable Water Management Approaches
Speaker:	Ed Clerico
Title:	Case Studies: Water Efficiency, Stormwater and Wastewater Reuse in Foxboro, MA and NYC
Speaker:	Valerie Nelson
Title:	Cities and Towns of the Future
Speaker:	Bruce Douglas
Title:	Potential Applications on Cape Cod

SUSTAINABLE WATER FORUM

21st Century Water Management: Smart, Clean and Green

May 22, 2009
Waquoit Bay National Estuarine Research Reserve
9:00 am – 12:00 pm

Innovations in water management in the U.S. and internationally are offering the promise for more efficient and beneficial water, stormwater, and wastewater infrastructure. This informational session will look at water management in a larger context and include presentations describing the leading-edge of new practices from the perspectives of ecology, engineering, economics, and community development. The session will be relevant to municipal officials, engineers, state and local resource managers, water and wastewater commissioners, planners, DPW directors, and environmental groups. Information will be presented on:

- advancements in water-efficiency, reuse, and recovery of energy and nutrients
- the nexus of water and energy systems, and how energy use can be reduced
- new techniques in green infrastructure and integrated water management in buildings
- how the new smart, clean, and green infrastructure enhance public health, job creation and the quality of life in communities

8:00 am – 09:00 am	**Coffee and Sign-In**
9:00 am – 09:15 am	**Welcome and Opening Remarks** *Becky Smith, Water Organizer and Diesel Coordinator, Clean Water Action* *Tonna-Marie Rogers, Coastal Training Program Coordinator, Waquoit Bay Research Reserve*
09:15 am – 10:00 am	**Sustainable Water Management Approaches** *Patrick Lucey, President, Aqua-Tex, British Columbia* This presentation will describe Dockside Green in Victoria (the first LEED™ platinum community) and other integrated water management development projects in British Columbia, Canada. These urban and suburban developments are incorporating ecological restoration, and energy and heat recovery practices, and are improving air quality, learning in schools, property values, and other community benefits.
10:00 am – 10:40 am	**Case Studies: Water Efficiency, Stormwater and Wastewater Reuse in Foxboro, MA and N.Y.City** *Ed Clerico, President, Alliance Environmental, LLC, New Jersey* This presentation will describe wastewater and stormwater reuse systems built in Gillette Stadium in Foxboro and in the Solaire residential building in Battery Park in New York City. These projects dramatically reduce the use of potable water and discharge into sewers. Treated water is used for toilet flushing, cooling towers, landscaping, laundry, and community gardens.
10:40 am – 11:00 am	Coffee Break
11:00 am – 11:20 am	**Cities and Towns of the Future** - *Valerie Nelson, Director, Coalition for Alternative Wastewater Treatment* This session will discuss emerging designs for cities and towns that reduce their water and energy "footprint" and enhance the quality of life in communities. Design principles include integrated systems, minimization of waste and capture of resources, and adaptation to local ecology.
11:20 am – 11:40 pm	**Potential Applications on Cape Cod** – *Bruce Douglas, Vice-President, Stone Environmental, Inc.* Bruce Douglas will offer reflections on how the new approaches described may be applied to Cape Cod.
11:40 pm - 12:00 pm	**Q & A/ Group Discussion**
12:00 pm	**Adjourn**
12:00 – 1:00 pm	**Networking Lunch (provided)**

Please register online at www.waquoitbayreserve.org . For more information contact Tonna-Marie Rogers at 508-457-0495 x 110.

Co-sponsored by:	*Clean Water Action and Clean Water Fund* *Coalition for Alternative Wastewater Treatment* *Waquoit Bay National Estuarine Research Reserve*

Event:	**Cleaning the Waters and Saving Taxpayer Money, Too**
Date:	September 12, 2009
Location:	Chatham Community Center
Speakers:	Jim Kreissl
	Pio Lombardo
	Patrick Lucey
	Matt Patrick

Event:	**Rethinking Sewers on Cape Cod: Better, Faster, Cheaper Alternatives**
Date:	December 5, 2009
Location:	Mashpee, MA Senior Center
Speaker:	Representative Matt Patrick
Speaker:	Becky Smith, CWF
Speaker:	Valerie Nelson, CAWT
Speaker:	Pio Lombardo, Lombardo Associates
Speaker:	Jim Kreissl, retired EPA
Speaker:	Craig Goodwin, NCS Wastewater Solutions
Speaker:	Craig Lindell, Aquapoint, Inc.
Speaker:	Bruce Douglas, Stone Environmental
Speaker:	David Cotton, Wastewater Technologies, Inc.

Other Local Education and Outreach

Event:	**21st Century Water Management**
Date:	May 20, 2009
Location:	Gloucester, MA
Speaker:	Patrick Lucey, Aqua-tex, Victoria, B.C.

Event:	**Smart, Clean, Green: Integrated Resource Management**
Date:	May 19, 2009
Location:	Portsmouth, NH
Speaker:	Patrick Lucey, Aqua-tex, Victoria, B.C.

CLEAN WATER ACTION
MASSACHUSETTS

Rethinking Sewers on Cape Cod: Better, Faster, Cheaper Alternatives

Saturday, December 5th, 9am-4pm, Mashpee Senior Center

9:00 Coffee and Sign-in

9:15 **Welcome** Representative Matt Patrick & Becky Smith, Clean Water Action

Introduction Valerie Nelson, Coalition for Alternative Wastewater Treatment

9:45 **Primer on Wastewater Management** Jim Kreissl, retired EPA

10:15 **Cluster System Case Studies: Cost, Reliability, & Management**

Craig Goodwin, Northwest Cascade (National, HQ Washington State)

10:40 Coffee Break

10:50 David Cotton, Orenco Systems, Inc. (National, HQ Oregon)

11:15 Craig Lindell, Aquapoint (National, HQ New Bedford)

11:30 Roundtable Discussion/Q&A

12 Noon **Networking Lunch** Provided

12:30 **Press Statements** Speakers will also be available for brief interviews

1:00 **Choosing a Sustainable Wastewater Management Approach** Jim Kreissl (Kentucky)

1:30 **Wastewater Management and Smart Growth**, Valerie Nelson

2:00 **The Cape Challenge: TMDL's and Clusters** Pio Lombardo, Lombardo Assoc. (Mass.)

2:30 **Integrated Resource Management** Bruce Douglas, Stone Environmental (VT)

3:00 Break

3:15 Roundtable Discussion/Q&A

About the Program

The projected costs of sewers are staggering for Cape towns, so it is important to take a more careful look at the alternatives. Conventional sewers are very expensive, but also have adverse consequences, such as disruptions in water hydrology and uncontrolled growth and development. They are also projected to take twenty to thirty years to achieve their goals of removing nitrogen from the estuaries and embayments of Cape Cod.

We will be exploring how cluster systems, in particular, can offer superior alternatives to sewers on the Cape. Cluster systems can meet the performance requirements of the nitrogen TMDL's and also be substantially cheaper than sewers. They can be installed in "hot spots" and show faster recovery in the estuaries.

That's a win for the homeowner and a win for the environment.

This workshop will provide Cape Cod residents and town leadership with more information about how cluster systems in other states have been working. We'll also show how comprehensive wastewater management planning should include the full range of financial, environmental, and community concerns.

We'll hear how other communities have dealt with growth and development concerns, how decentralized alternatives can meet the TMDL requirements for Cape Cod, and how towns might consider integrated planning of water, energy, and solid waste management to achieve cost-savings.

Other parts of the country are proceeding with "21st century" technologies and designs, and Massachusetts' engineering firms appear not to have paid enough attention to that progress. This workshop proposes to begin to fill that information gap and provide Cape Cod towns with "Better, Faster, Cheaper" alternatives.

You are invited to come for all or part of the day. RSVP's are for a lunchtime headcount; pre-registration is not required. If you plan to have a sandwich, however, please do RSVP.

Co-sponsored by:

Representative Matt Patrick
Clean Water Action & Clean Water Fund
Coalition for Alternative Wastewater Treatment

Cape Cod Clean Water Coalition for Cost Effective Alternatives

Planned Next Steps

1. Provide continued technical assistance to CC stakeholders
2. Use Cape Cod problems and opportunities to educate state policy makers about 21st century approaches
3. Begin a public advocacy campaign in Cape Cod, including potential for a canvassing team to work in Cape Cod towns
4. Further develop an integrated resource management program in Boston – an alliance-building and education program for IRM designs and pilot projects

CHAPTER 7.0

GENERAL FINDINGS, CONCLUSIONS, AND NEXT STEPS

This project has initiated an ongoing process to engage environmental and other NGOs, in partnership with professional experts and other stakeholders, in stimulating and guiding a paradigm shift in water management. The premises and priorities of the project were built on insights from earlier studies and these have been generally confirmed.

The larger strategies of stimulating a paradigm shift include the three elements:

- Expanded conversations and research within and among NGOs, academic institutions, venture capitalists, planners, architects, utilities, etc.
- Pilot and demonstration projects at different scales
- Incremental, and eventually large-scale reform of governance – federal, state, and local policies, funding, and regulations

Strategies for engaging NGOs in this multi-year process are based on the earlier insights:

Lack of Earlier Strategies to Mobilize a Paradigm Shift

- 21st century concepts and implementation are scattered and small in number across the country, although international engineering leadership is beginning to push the leading-edge via a Cities of the Future committee;
- While there is impressive talent and expertise in American universities, engineering firms, progressive utilities and NGOs, these resources are disconnected and uncoordinated;
- There is no education and outreach program to inform and educate practitioners on these approaches
- There is no effective strategy or mobilization for change in the existing centralized paradigm or institutions
- As a result, policymakers and elected officials may have an interest in sustainability concepts, but have no political pressure from stakeholder groups or public sentiment backing a legislative reform agenda
- Tremendous inertia and "drag" in the system prevents innovative practitioners from gaining a significant base from which to expand and force change

Effective New Strategies for Reform

- A Water Alliance of multiple stakeholders is an effective approach to organizing learning, education, and advocacy

- Significant changes in national policies and funding require a strong local and state foundation demanding change
- Local projects are where the leading-edge of the field can be created
- Local communities need national expertise and assistance to understand problems and opportunities in new ways
- Attention of local communities can be gained with a narrowly-defined water quality or quantity crisis, but "open the door" for more holistic, integrated, multiple benefit approaches
- State government is an important mid-point for action, because states implement federal environmental laws, have authority over many local-scale regulations (including septic systems, building codes, etc.) and control the allocation of funding of much of federal resources and significant state resources
- NGOs will push innovators to be responsive to concerns in the following aspects:
  - public health protection, particularly contaminants of concern
  - climate change
  - energy use, methane gases from water and wastewater infrastructure

Planned Next Steps

Put in motion are the following major building blocks that will be developed as a follow-up to this foundational project:

- Formal creation of a Water Alliance at the national level – with an advisory board, website, national policy focus, and education and outreach strategy
- Continued education of federal bureaucracies and Congressional committees, with a particular focus on decentralized wastewater treatment, reuse, and resource recovery (green infrastructure and water-efficiency are relatively well-covered by existing organizations and networks)
- Continued work in Massachusetts on developing a multi-stakeholder alliance, working with local communities, and developing a state legislative and policy agenda
- Further assistance and engagement in pilot projects in Cape Cod towns, Gloucester, and in Boston
- Transfer of this statewide network and local outreach model to other states, including New York, Maryland, New Jersey, and Wisconsin
- Development and implementation of a public outreach campaign with the "Story of Water"

A national network can serve the following purposes: bring soft path advocates together to share lessons learned about the implementation of soft path approaches; seek to provide them over time with information and tools generated through a wide variety of projects; seek their continued input on priority research topics; and help them develop collaborations with other local stakeholders and experts.

APPENDIX A

AN ENGINEER'S PERSPECTIVE ON PAST AND FUTURE INFRASTRUCTURE CHALLENGES

An Engineer's Perspective on Past and Future Infrastructure Challenges

Glen T. Daigger, Ph.D., P.E., BCEE, NAE
Senior Vice President and Chief Technology Officer

CH2MHILL

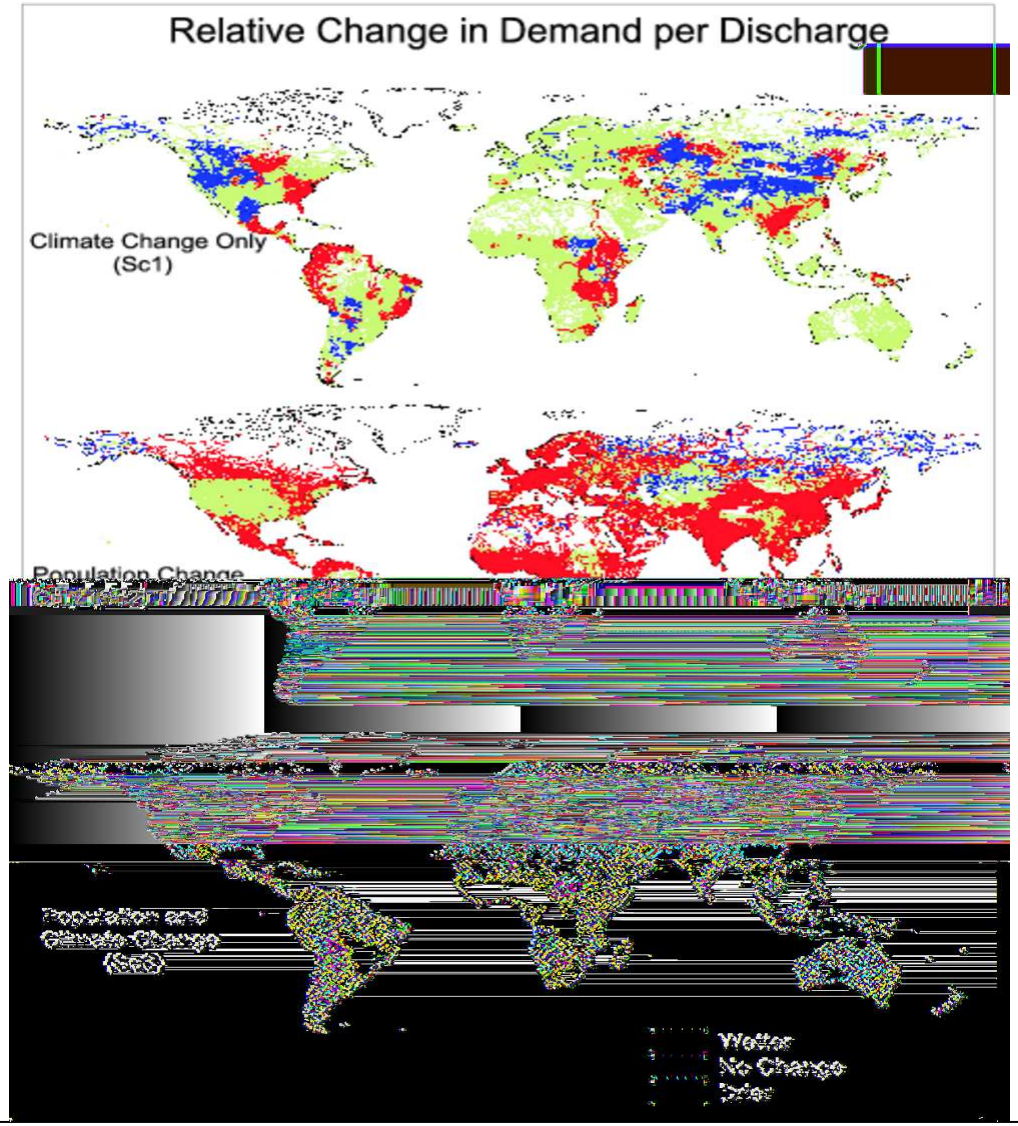
Federal Leadership is Needed to Meet Emerging Challenges

- In Spite of Long-Standing Federal Participation, Today Water is Viewed as Local Issue
- We Are Approaching a Global and National "Tipping Point" Which Will Demand Action
  - Water Abundance → Water Scarcity
  - Predictability → Instability
- National Implications of "Tipping Point" Include:
  - Economic and Energy Security
  - Competitiveness
- Solutions Offered by Emerging Paradigm
  - Integrated Recovery, Recycle and Reuse Solutions
- Federal Leadership Needed to Accelerate Transition

Global Water Crisis Caused by:

- Population Growth
- Increased Living Standard
- Climate Change
- Urbanization

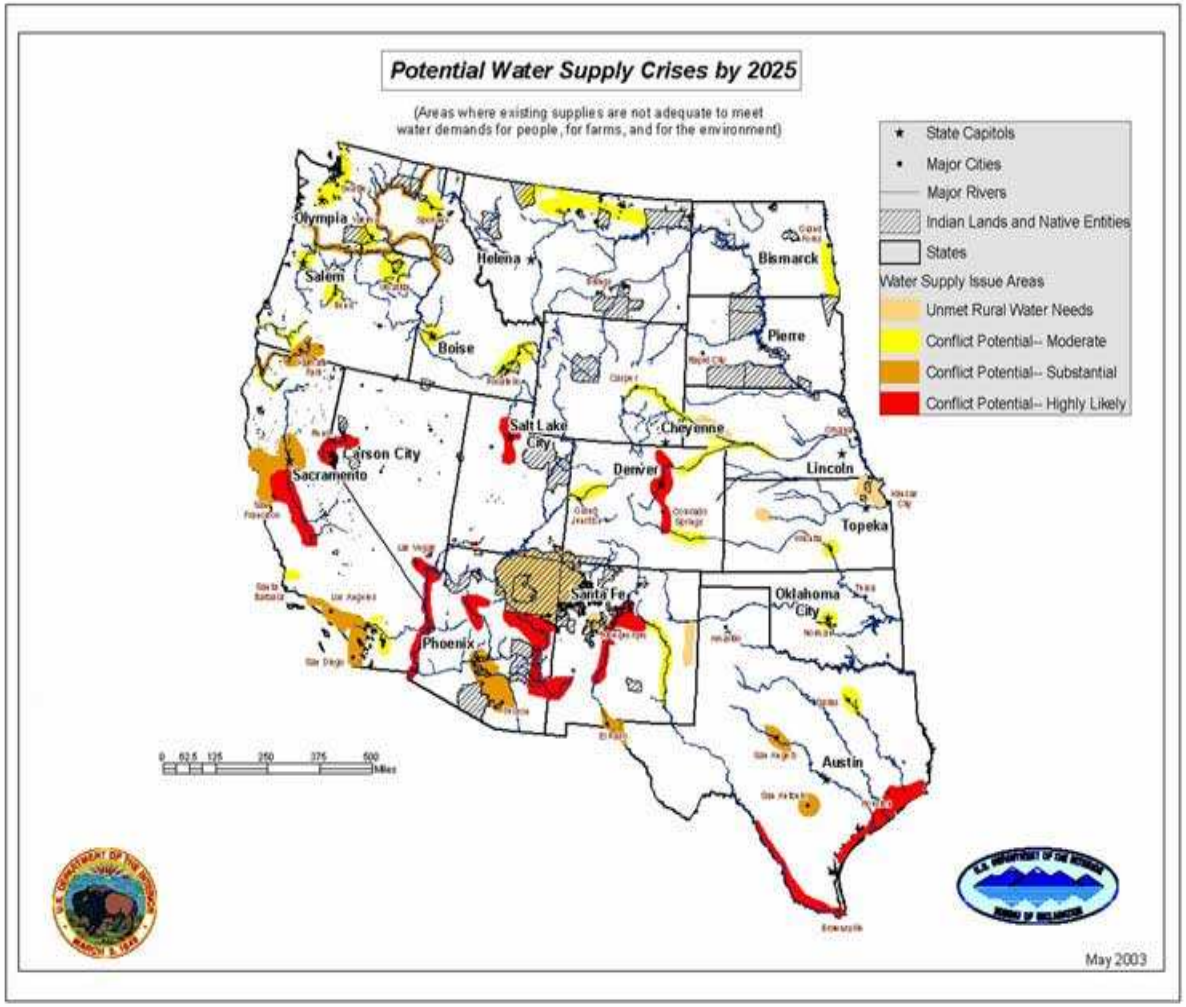
Nearly Half of Human Population Will Experience Water Stress by 2025



CH2MHILL

US Water Crisis Caused by:

- Population Growth
- Development
- Movement to Sun Belt and the West
- Climate Change
- Energy and Water are Linked
  - Fuel Abstraction
  - Power Production
  - Cooling



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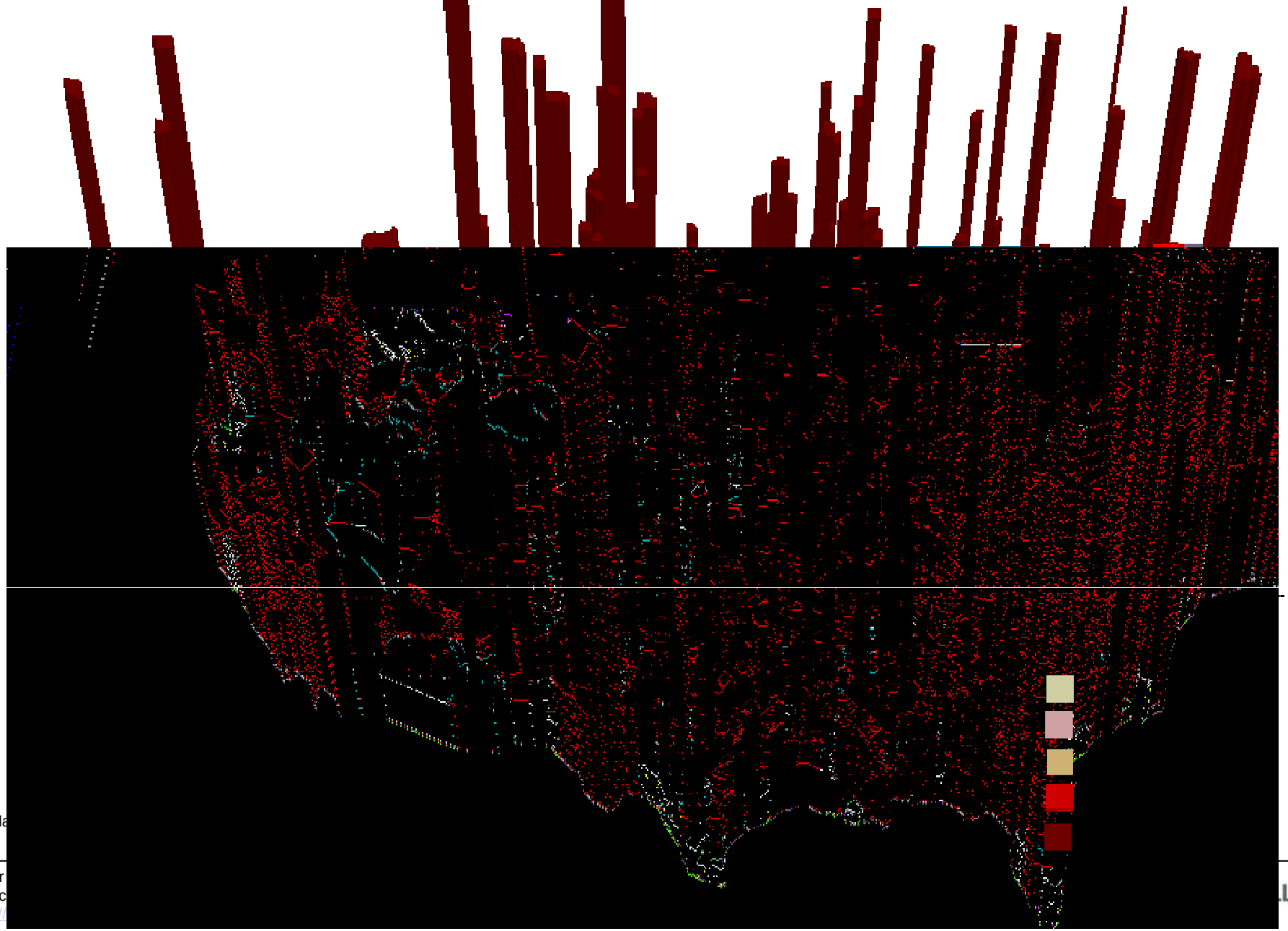
2030 Projected % Increase (since 2000)



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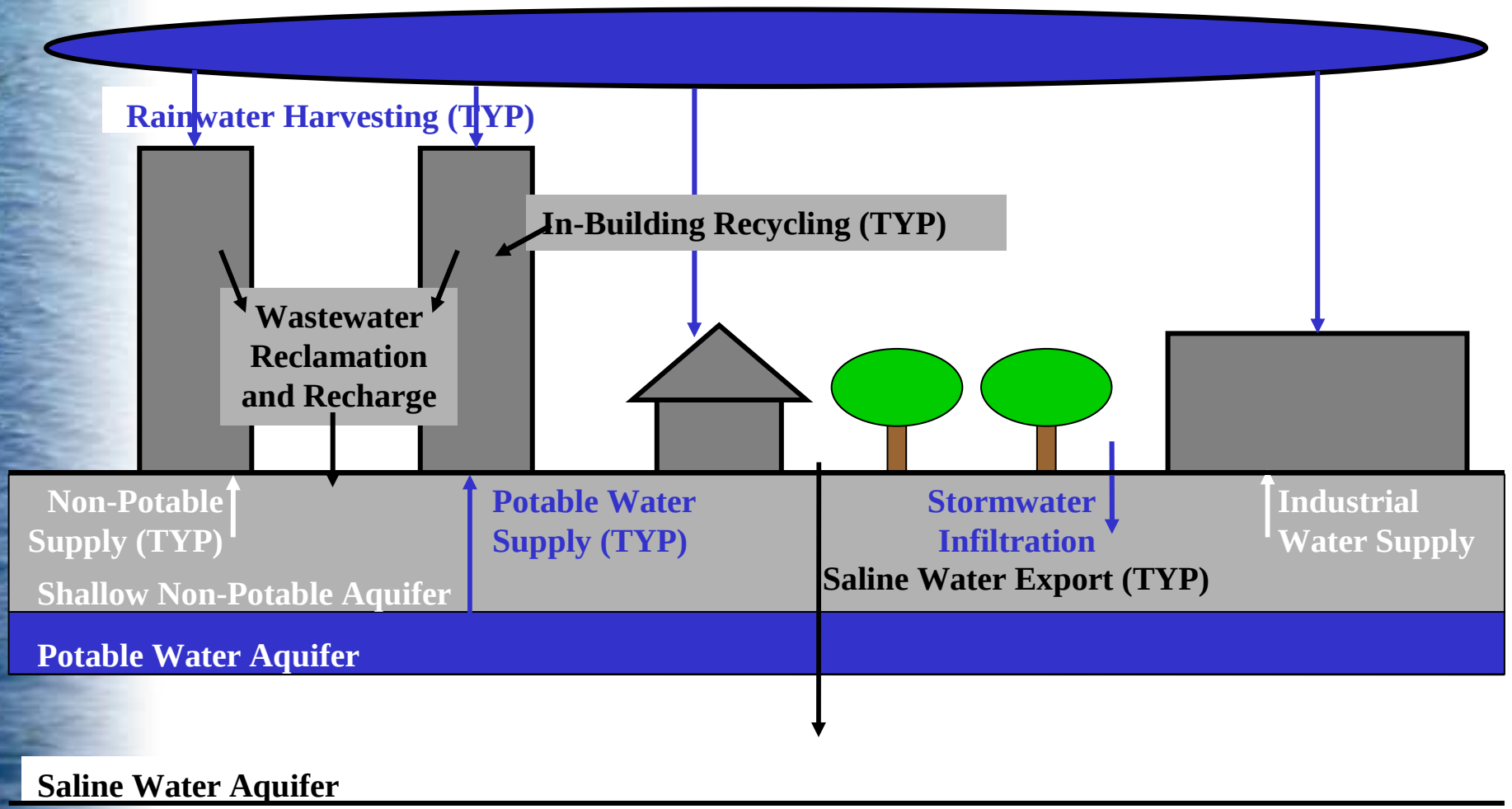
Future Paradigm: Recovery, Recycle, Reuse



CH2MHILL

Other Countries Are Now Leading the Way

- RECYCLED WATER PASSES TASTE TEST: PUB chairman Tan Gee Paw (right) and a panel of international experts who declare reclaimed water fit to drink showed yesterday that they were ready to drink it themselves. The Straits Times hit the streets with samples on Tuesday.

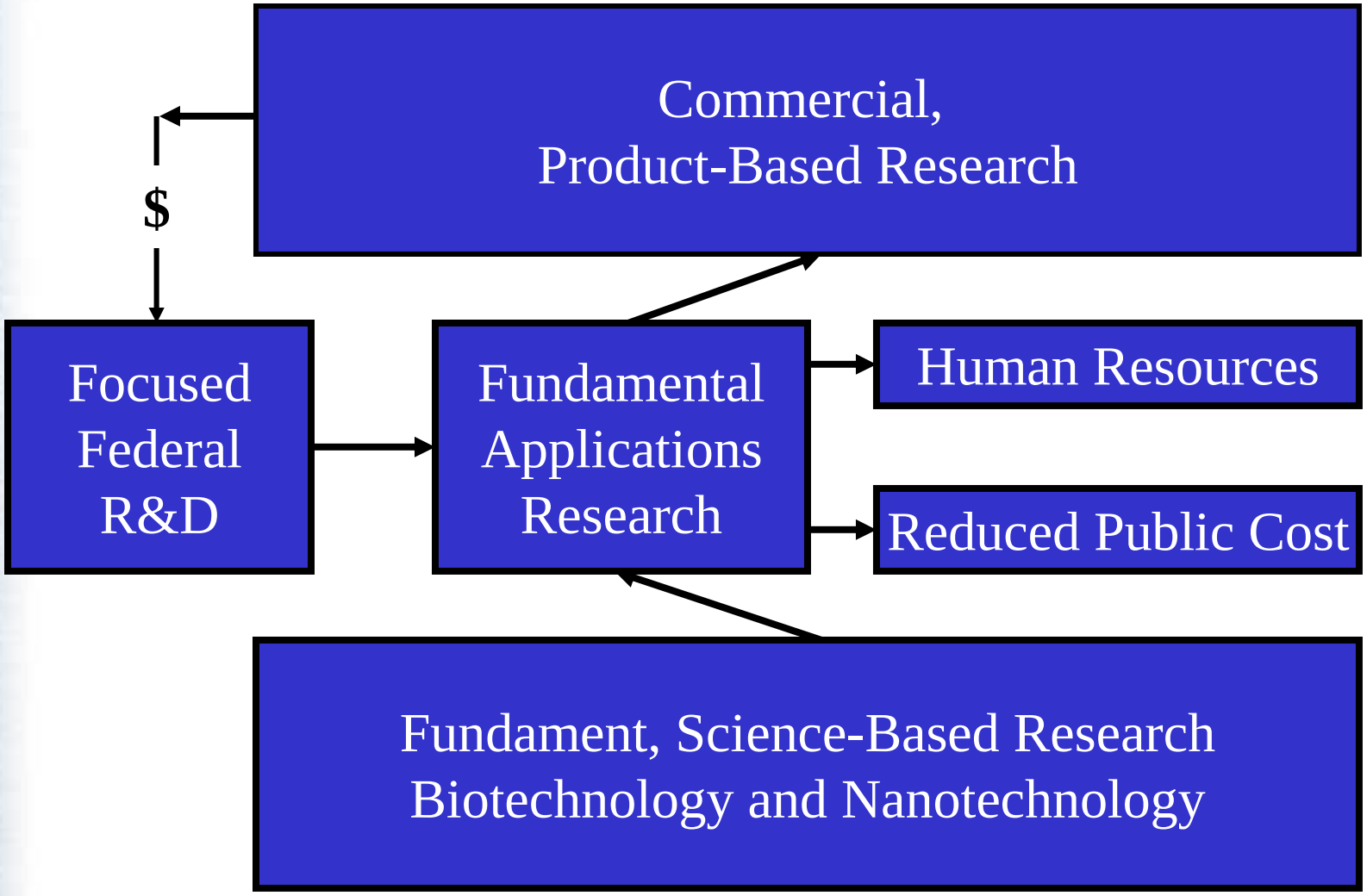
  -- HOW HWEE YOUNG

CH2MHILL

Federal Leadership is Needed to Ensure Water Security and Competitiveness

- Accelerate Transition to New Water Management Paradigm by Setting Efficiency and Recovery Standards
  - 150 gal/person/day → 75 gal/person/day → 37.5 gal/person/day
  - Incentivize Nutrient Recycling
  - GHG and Carbon Trading Policies That Reflect Unique Role of Water
- Fund Focused R&D Program to "Fill the Gap" Between Basic Research and Commercialization

Appropriate Federal Investments Pay Off Strategically and Financially



Federal Leadership is Needed to Ensure Water Security and Competitiveness

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  - 150 gal/person/day → 75 gal/person/day → 37.5 gal/person/day
  - Incentivize Nutrient Recycling
  - GHG and Carbon Trading Policies That Reflect Unique Role of Water
- Fund Focused R&D Program to "Fill the Gap" Between Basic Research and Commercialization

APPENDIX B

ACHIEVING SUSTAINABILITY THROUGH RESEARCH AND DEVELOPMENT

Center *of* Advanced Materials *for* the Purification of Water *with* Systems

Achieving Sustainability Through Research and Development in Water

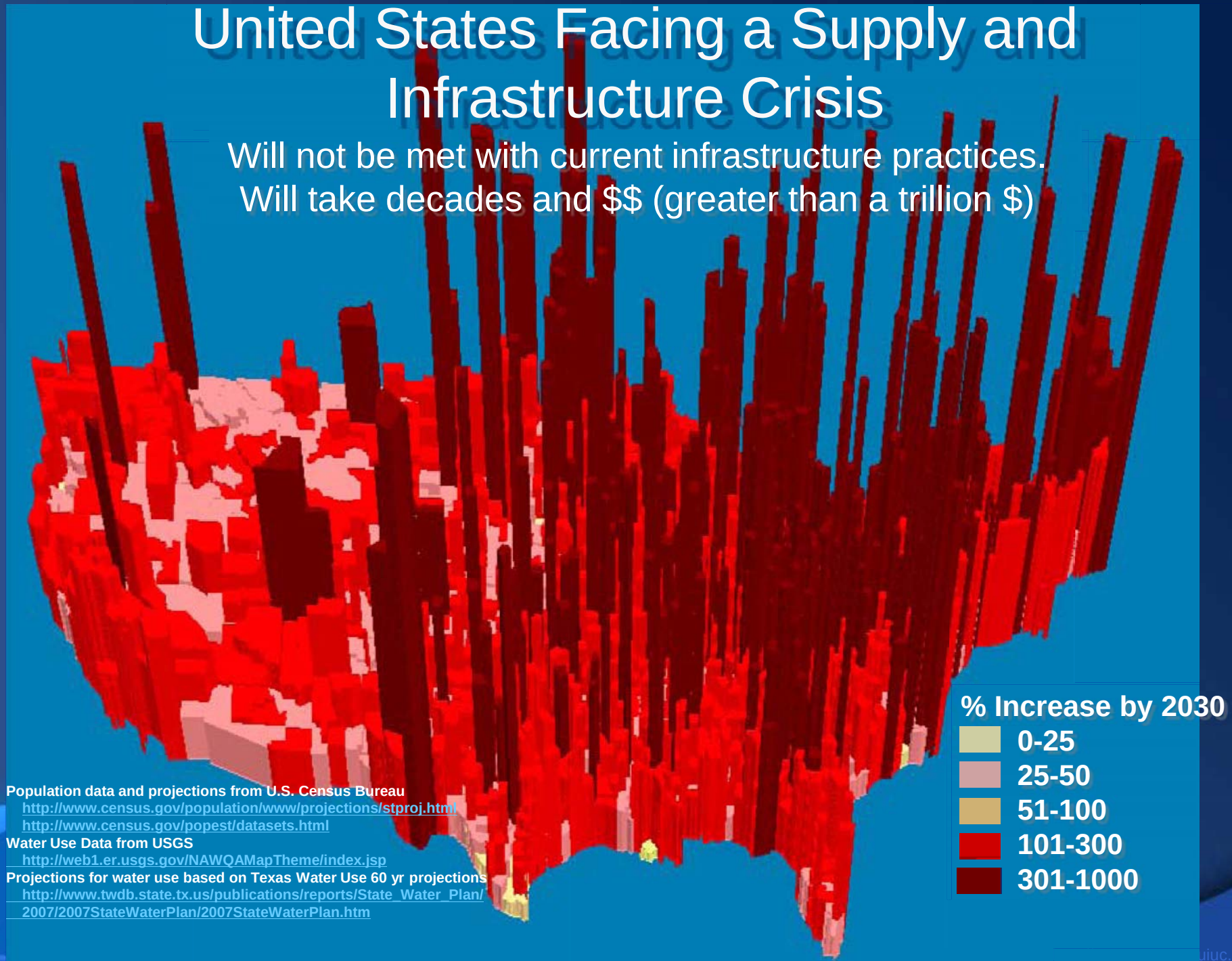
Mark A. Shannon
Director *WaterCAMPWS*
University of Illinois
Founder US Strategic Water Initiative

USSWI

waterCAMPWS

United States Facing a Supply and Infrastructure Crisis

Will not be met with current infrastructure practices.
Will take decades and $$ (greater than a trillion $)



Population data and projections from U.S. Census Bureau
http://www.census.gov/population/www/projections/stproj.html
http://www.census.gov/popest/datasets.html
Water Use Data from USGS
http://web1.er.usgs.gov/NAWQAMapTheme/index.jsp
Projections for water use based on Texas Water Use 60 yr projections
http://www.twdb.state.tx.us/publications/reports/State_Water_Plan/2007/2007StateWaterPlan/2007StateWaterPlan.htm

Why Water Technology Advancement is Needed

- Federally funded research from 1950's and 60's brought about membrane water treatment systems that have transformed new water treatment systems worldwide.
- New technologies are now being developed that can create a new transformation to the total water infrastructure.
- However, bulk of water innovation is now overseas, with a reverse brain drain underway. Researchers trained in the U.S. are going overseas to conduct R&D and to implement new technologies. Innovation thrust is in Asia, Europe, and the Mideast. Offering huge salaries to U.S. researchers.
- The United States can regain the innovation and competitive lead: We still have the best scientists, engineers, universities, and labs in the world.

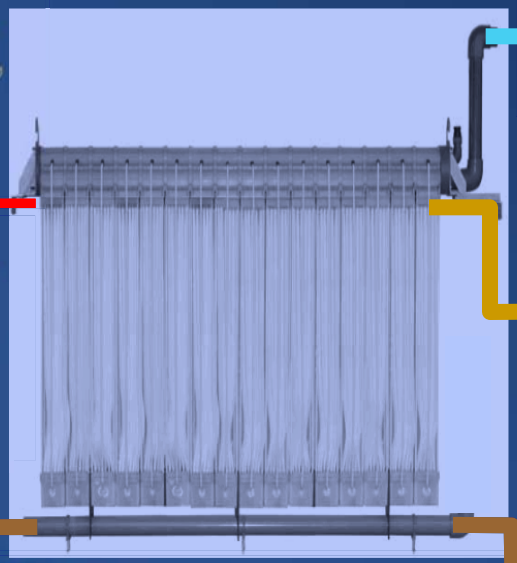
There Are Many Opportunities

- We are far from the natural law limits for separating contaminants from water: Lots of room to improve!
- Traditional methods in developed world are capital, energy and chemical intensive. Costs can be reduced!
- New materials and systems are being developed that can dramatically drop the cost of treating water and to aid the energy/water nexus (Switzerland).
- Innovation from our universities, national, state, and industrial laboratories need to be accelerated into practice and into the marketplace.

Siemens SkyHydrant

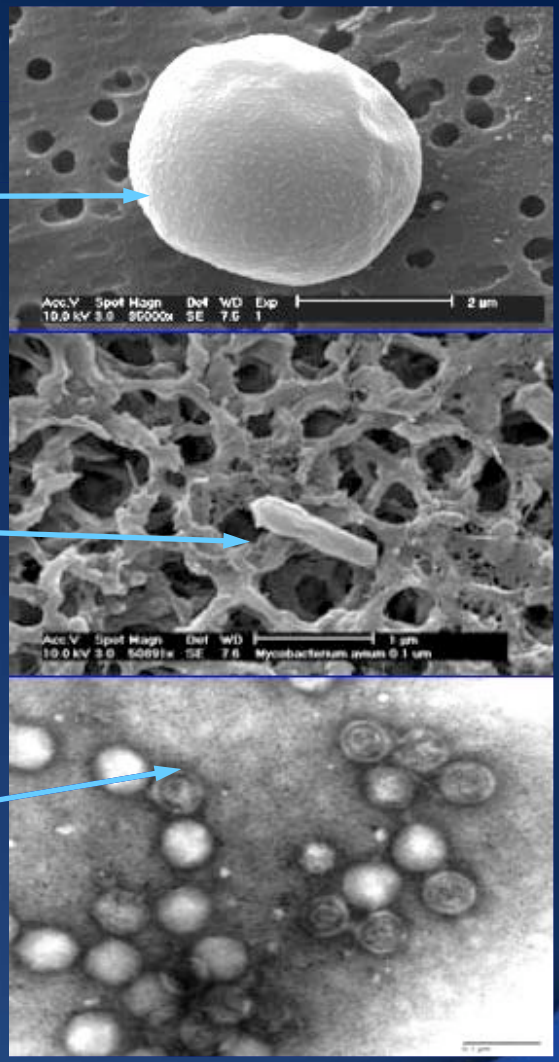
Recovery & Reuse of Water Creates a Resource

- Can be used for Point-of-Discharge to recharge aquifers or use locally in non-potable uses. Saves $$, energy, & chemicals.
- Membrane Bio-Reactors (MBR) can generate energy when cleaning water, rather than consuming energy
- NF membrane ensures high quality and safety



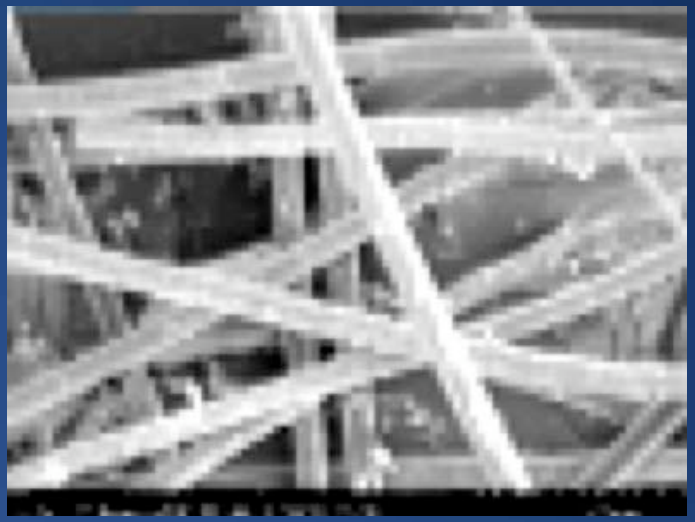
Disinfection of Hard to Treat Pathogens, Without Intensive Chemical Treatment

Use of nanostructured membranes and particles, catalysts, and photocatalysts and light to inactivate pathogens in water, without using chlorine or other powerful oxidants that can themselves form toxic compounds.

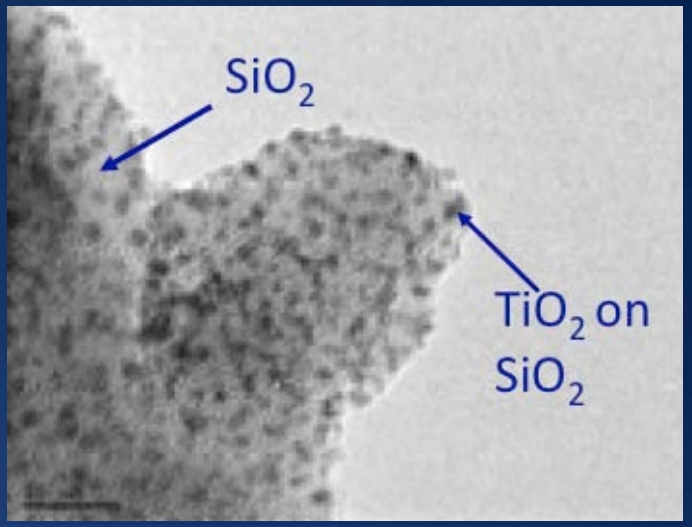


Page & Mariñas, UIUC

Cleansing Water of Toxins with Sunlight



Ndiege, Chandrasekharan, Masel, and Shannon, UIUC

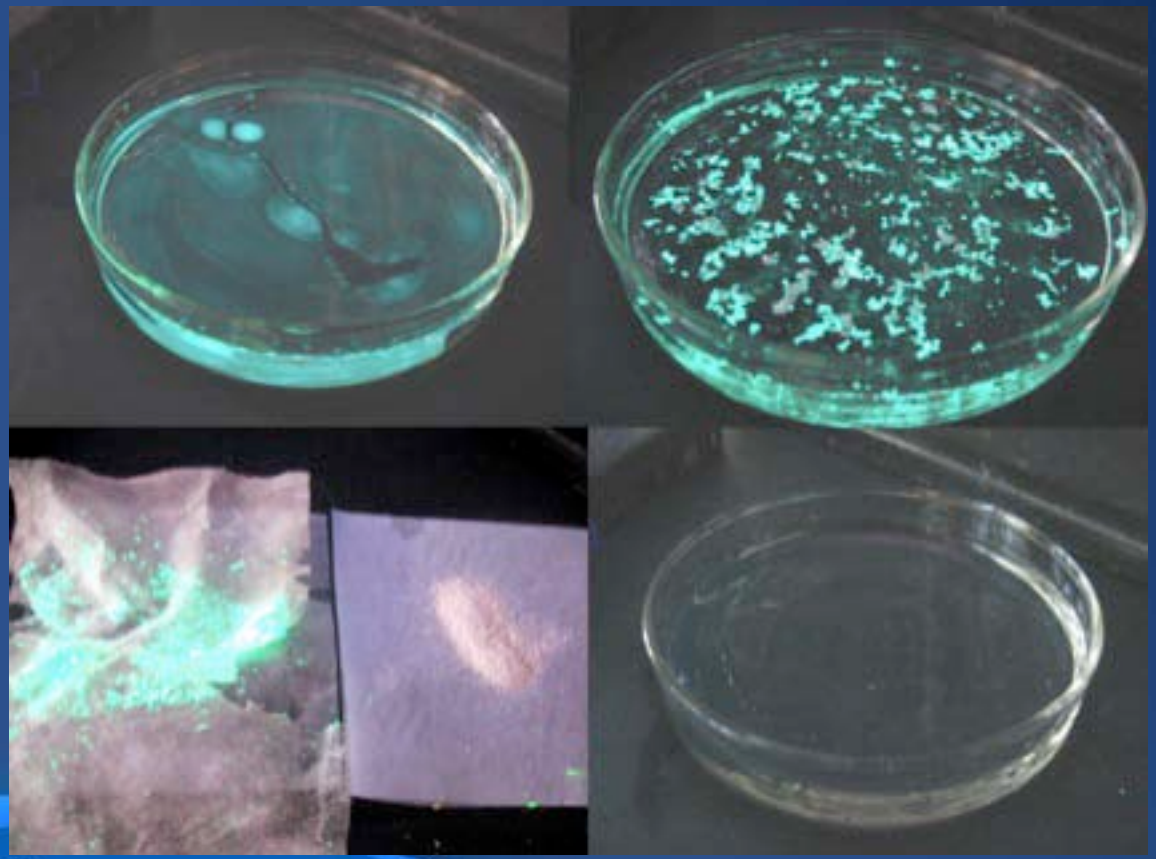


TEM micrograph of 2 nm diameter TiO_2 on 20 nm diameter SiO_2 particles

Can use low-cost treated silica (sand) to remove all organic compounds from water at high rates using free sunlight. Can remove carcinogens, toxic compounds, endocrine disrupters, and pathogens too, all without using chlorine.

Removing Petroleum Byproducts from Water

"Organic–Inorganic Hybrid Materials that Rapidly Swell in Non-Polar Liquids: Nanoscale Morphology and Swelling Mechanism," Burkett, Underwood, Volzer, Baughman, and Edmiston, Chemical Materials 2008. Absorbent Materials, Inc.



New low-cost absorbable glass can remove virtually all petroleum byproducts like benzene, MTBE, distillates, and oil from water. Can be used over and over again. Can recover energy from wastewater.

Key innovation in the water/energy nexus.

The Global Innovation Imperative For Water

- Need to increase supplies from all sources, while protecting public health and the environment.
- There are many key questions that can be answered by U.S. scientists. Companies can generate lots of good jobs by providing solutions. Else we will import from overseas.
- There is a Global Innovation Imperative underway in water. The U.S. needs to lead this Innovation Imperative.
- The Federal Government can reinvigorate academy if R&D can be funded AND to move research out of the lab into practice with U.S. companies (USSWI).

APPENDIX C

WATER EFFICIENCY AND WATER RESOURCE MANAGEMENT

Water Efficiency and Water Resource Management

Edward A. Clerico, P.E. , LEED® AP
President, Alliance Environmental LLC

March 13, 2009

eclerico@AllianceEnvironmentalLLC.com

Alliance Environmental LLC

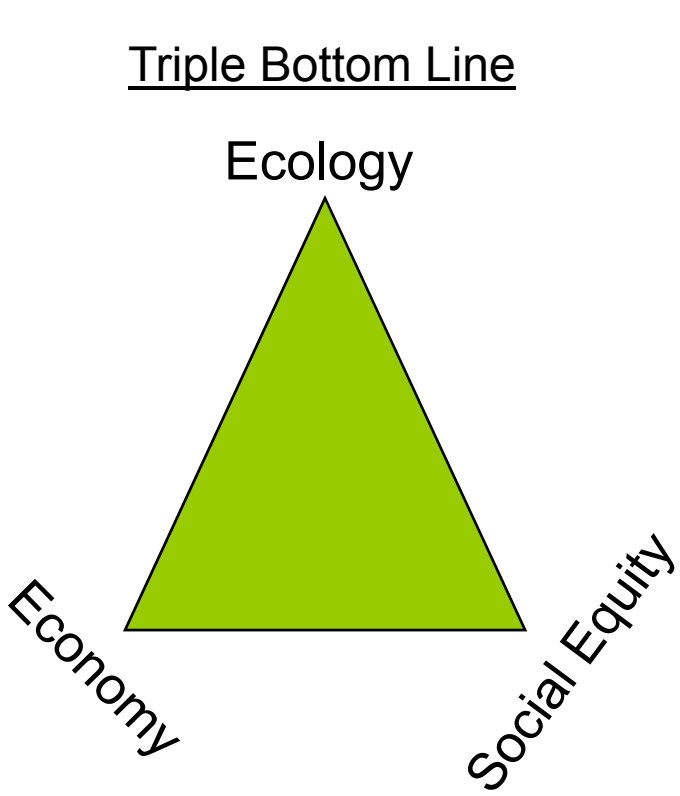

Carriage Farm
• Reduced impervious cover
• Reduce water demand 43%
• Organic land management – integrated pest management
• Filter surface water runoff
• Groundwater recharge at preexisting conditions
• Improved biodiversity aspects
Ecology as Infrastructure
2006 10 3

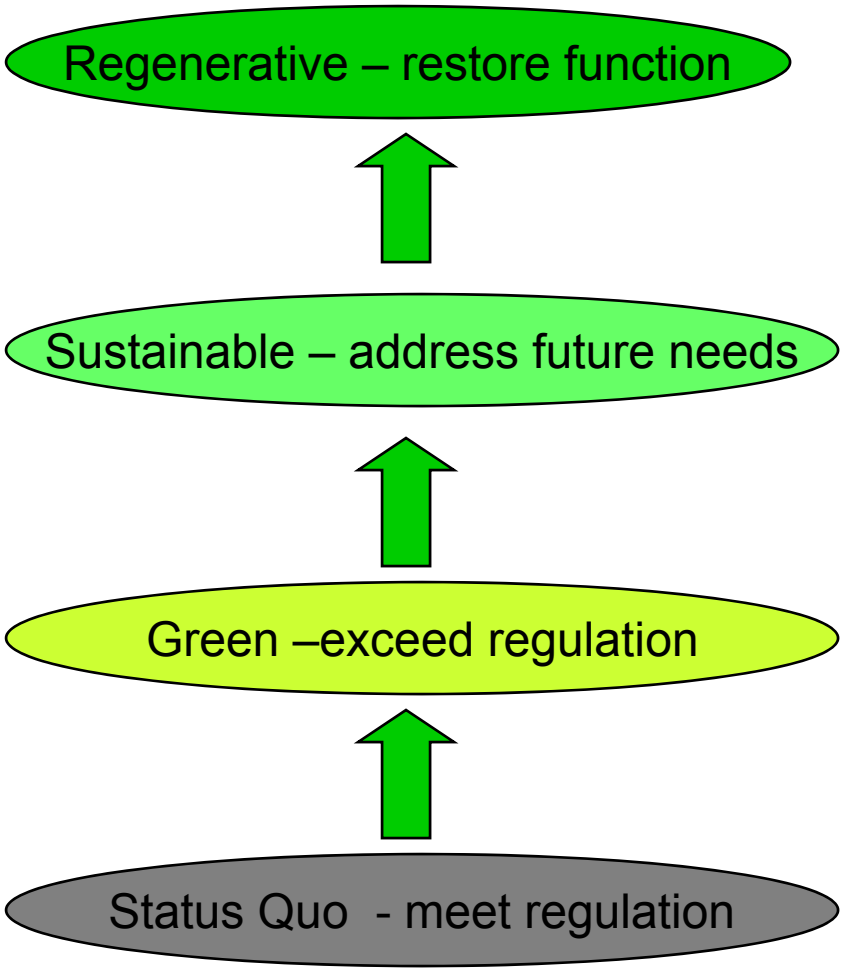
Overview

- Success and acceptance of water reuse
- Need to link water and energy (and carbon in general)
- Economics favoring water reuse – use of incentives and correlation with full cost pricing
- Adaptability of water reuse to existing communities as well as new construction
- Provide an overview of the live projects that are driving demand for a decentralized water reuse utility
- Illustrate the integrated roles of engineers, architects, landscape architects and asset managers as components of an integrated water resource program

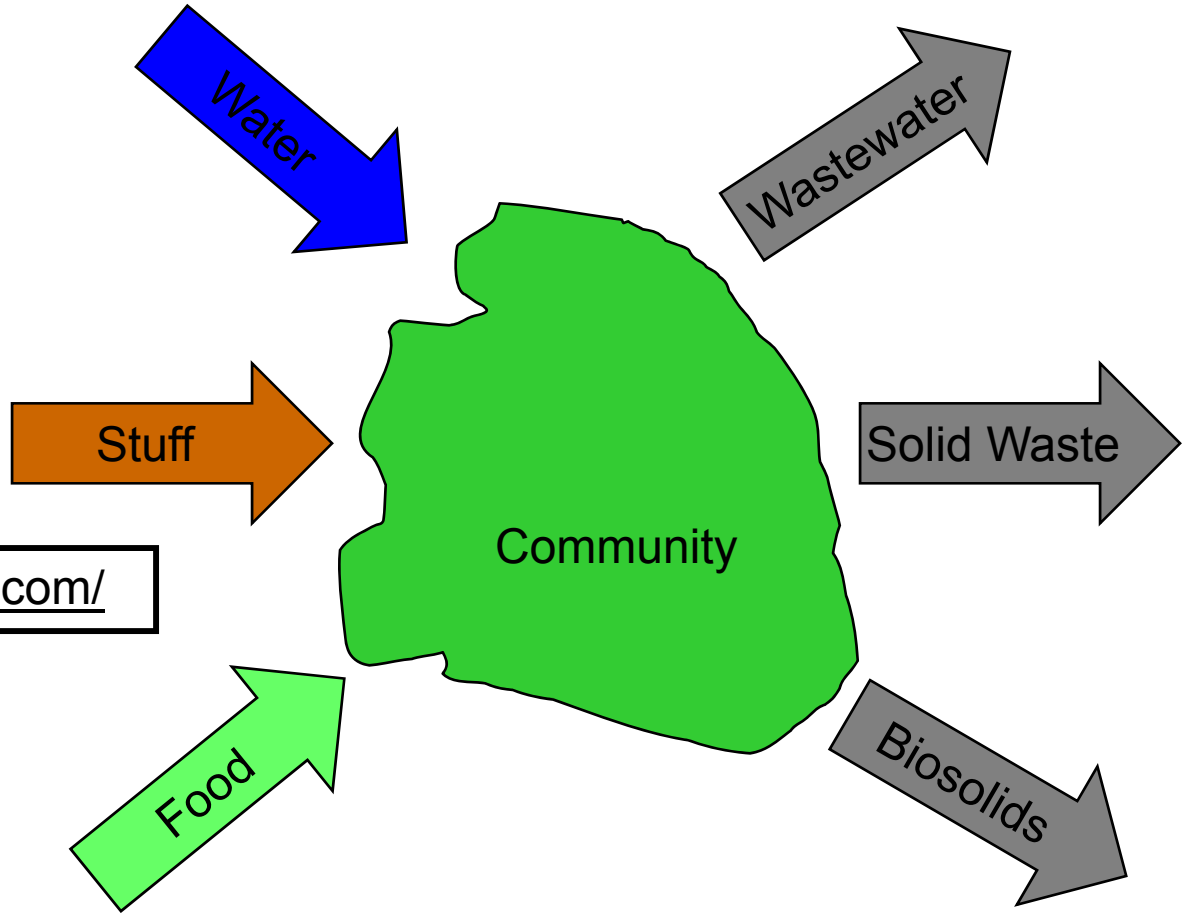
Linear vs. Integrated Systems

Water Resource Management as a Component of Sustainability Planning and Implementation





Segregated Systems Approach Is Not Sustainable

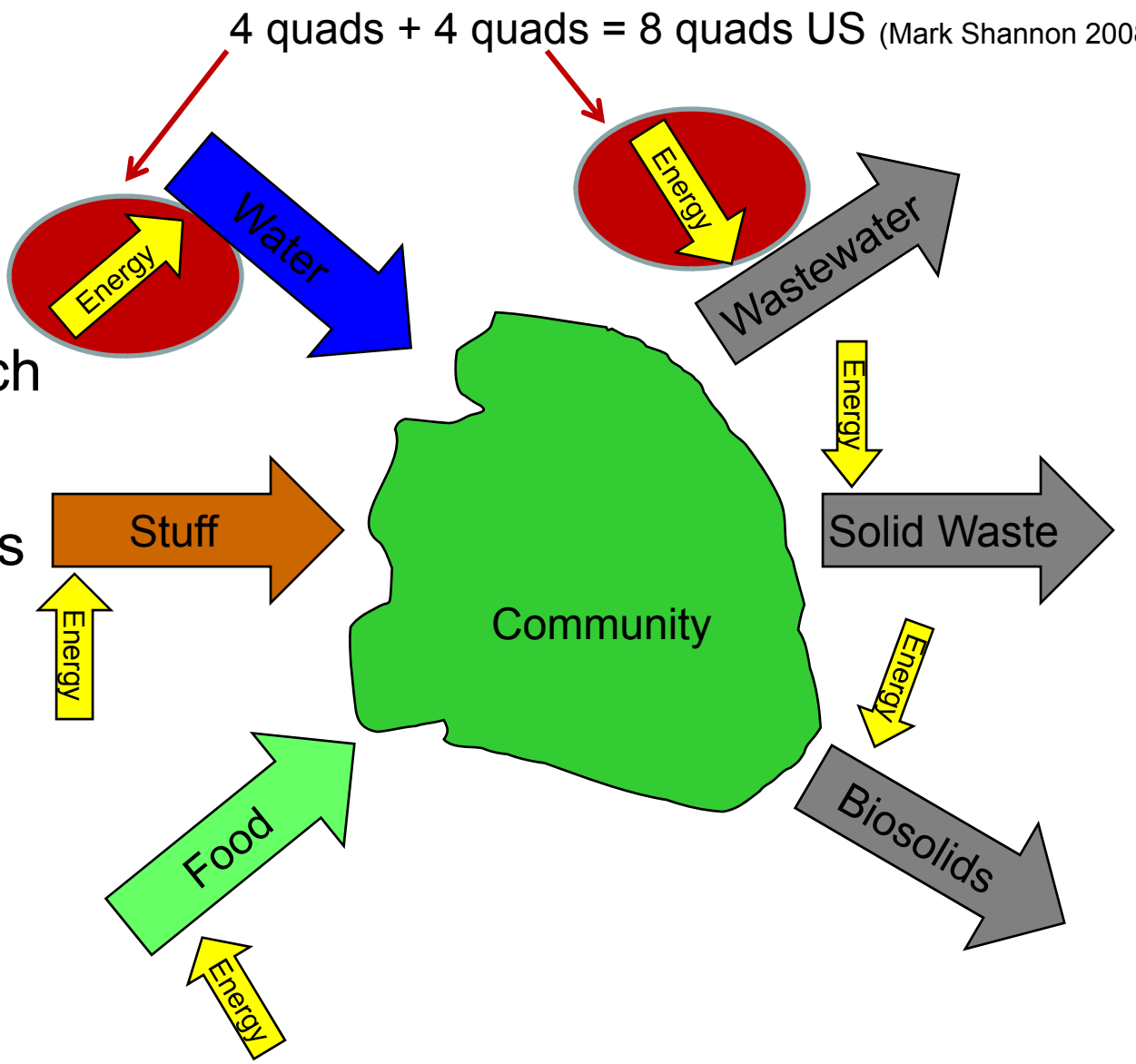


http://www.storyofstuff.com/

Systems Segregation and Fragmentation Creates Inadequate Function

<u>Linear Segmented Approach</u>

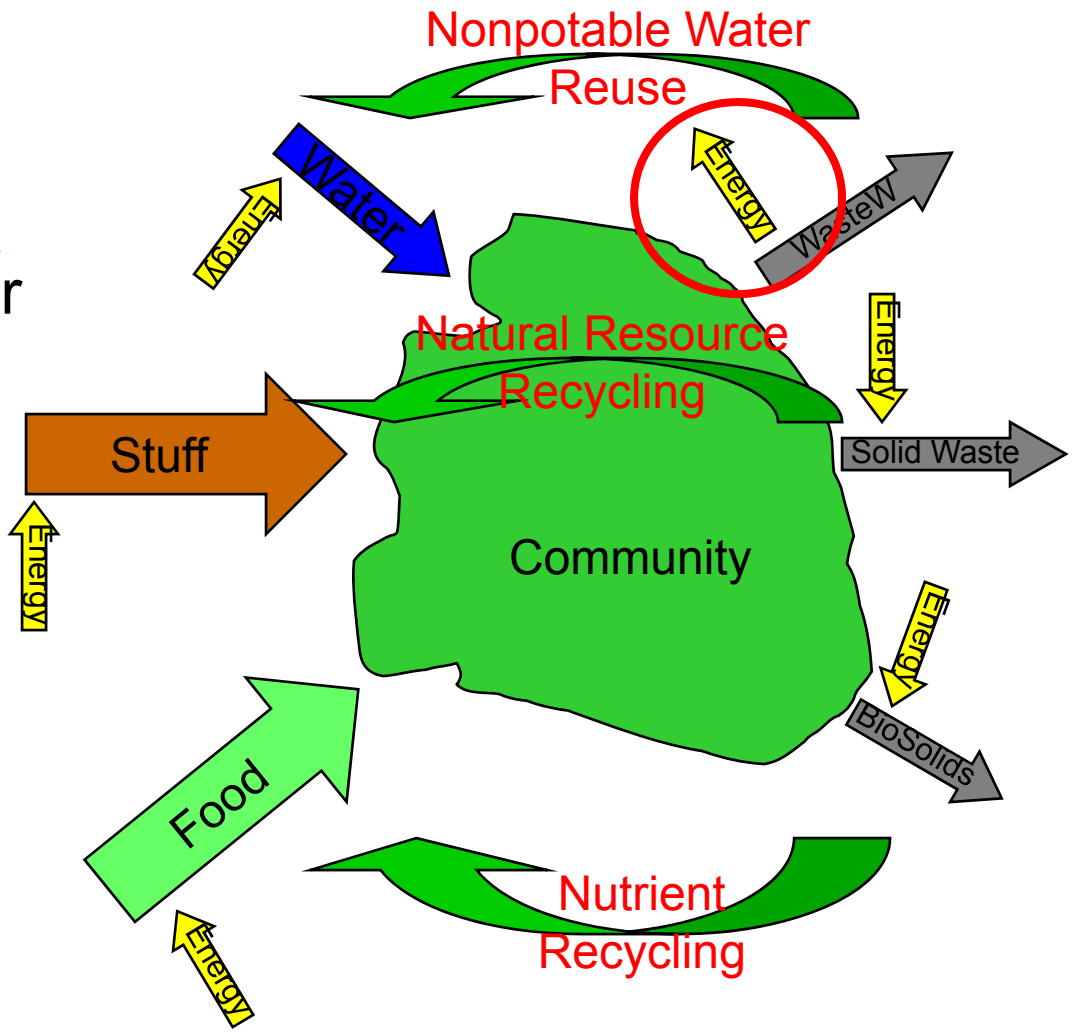
- Adds energy at each step
- Depletes resources on supply side
- Contaminates environment on disposal side



Functional System Integration to Achieve Higher Sustainability Levels

<u>Integrated Systems Reduce and Reuse</u>

- Add less energy at each step and extract energy post consumer use
- Use less natural resources on production side
- Release less contaminants to environment on post consumer side



American Standard

The quintessential dual flush toilet – What's in Your Tank?

- If given the choice would you flush your toilet with bottled water?
- So why is this our current standard?

The Philosophical View

Change that is very gradual is difficult to perceive.

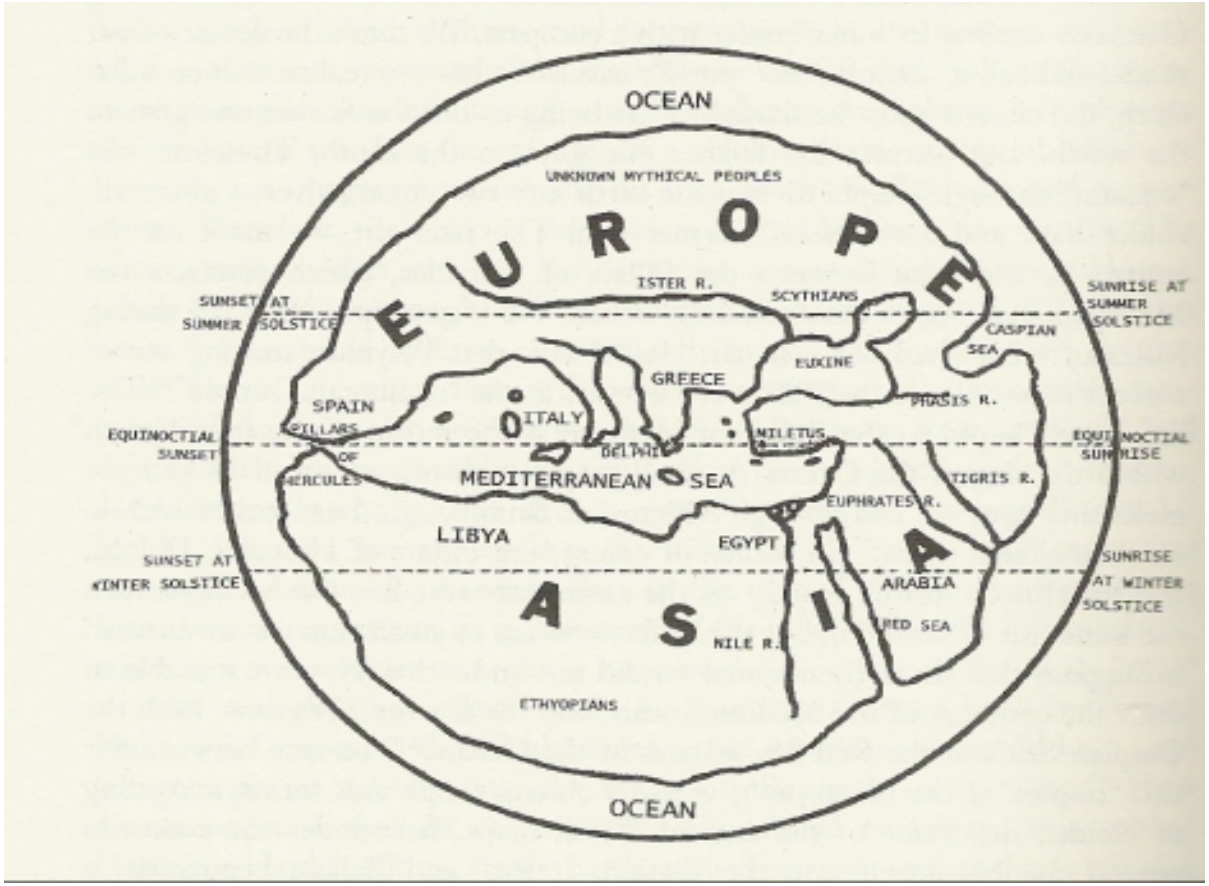
What land mass?

Which geologic period?

One of our favorite cities

Dramatic change can be very quick if it simply requires a change in perspective.

Dramatic change is transformation



Anaximander, a philosopher from Miletus who lived during the **first half of the 6th century B.C., is credited with making the first map of the known world ... His map was unfortunately lost so the depiction above was derived from written descriptions. The convention that north is up was simply a interpretive decision that became the basis for all maps thereafter. (Note – the first compass was probably invented 400 years later in China, Qin Dynasty)**

Hubble's view of N-90 star forming region – We have learned how to establish new dimensional conventions and perspectives.

Water Reuse is Environmental Transformation That Begins with a Simple Change in Perspective

- 1,200 GPD per capita to operate US economy, but less then 1 GPD per capita is actually consumed, in theory the other 1,199 GPD could readily be reuse water
- Using potable water to flush toilets, irrigate lawns and wash clothes is rather uncivilized and uncaring given the fact alternatives are available.

Our Current Perspective Dates to 500 BC

The Roman Goddess of the sewers, *Cloacina,* carried wastes to the river - so began our modern perspective on waste management - dilution is the solution.

“Problems cannot be solved at the same level of awareness that created them.” Einstein

Perception

There is so much water on Earth that

A. We can discharge pollutants into our water resources and the natural water cycle will purify and protect us

B. There is 319 million trillion gallons of water on earth and at current rates of consumption it would take

   i. 491 years before water would be reused if all 6 billion people used as much as U.S. economy (1,200 GPCD) or

   ii. 8,421 years before water would be re-consumed by another human if all 6 billion people consumed as much as New York City residents (70 GPCD)

It is difficult for us to fully appreciate and care about a repercussion that takes many life times to realize.

New Perspective

- Actual age of reuse water is often days instead of hundreds of years – this is a time frame that we can fully appreciate - Ohio River during low flow period is 50% wastewater effluent near Louisville

- Surface water flow is flashy during rainfall events and quick to diminish during dry periods due to reduced recharge

Reality

"U.S. Geological Survey (USGS) scientists found **12 of the 22 (55%) pharmaceuticals**, and **32 of the 47 (77%) organic wastewater chemicals** looked for in the watershed. Many of the water samples contained a complex mixture of pharmaceuticals, wastewater chemicals, pesticides, and trace metals"

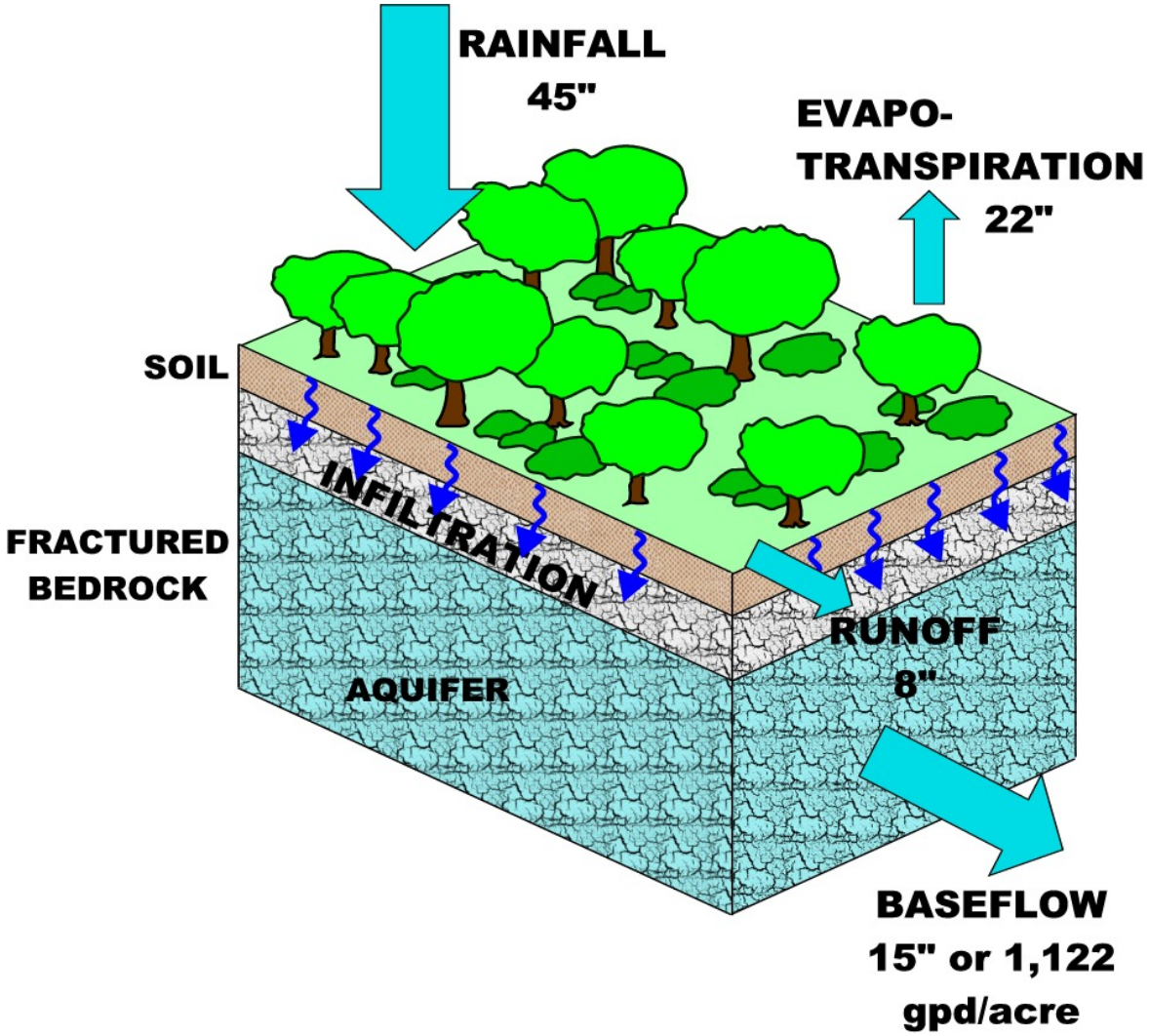
USGS Toxic Substances Hydrology Program – Boulder Creek Watershed, Colorado - November 2006

Parameter	Use/Source	Base Flow (ug/l)
caffeine	stimulant	0.28
ibuprofen	anti-inflammatory	0.11

Water Balance

Considerations for the Site Aspects and Overall Water Balance

LEED Sustainable Sites



LEED Sustainable Sites

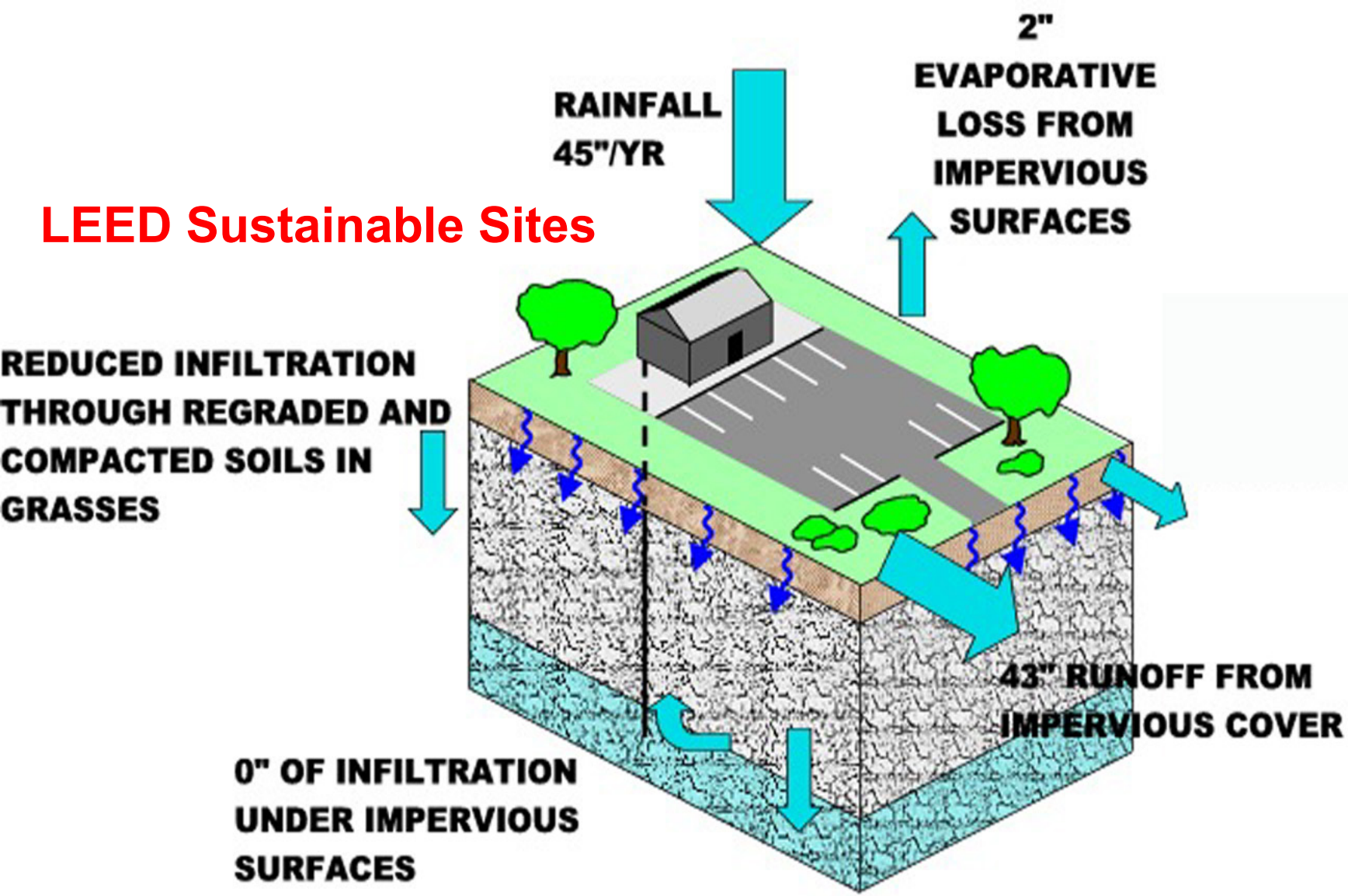
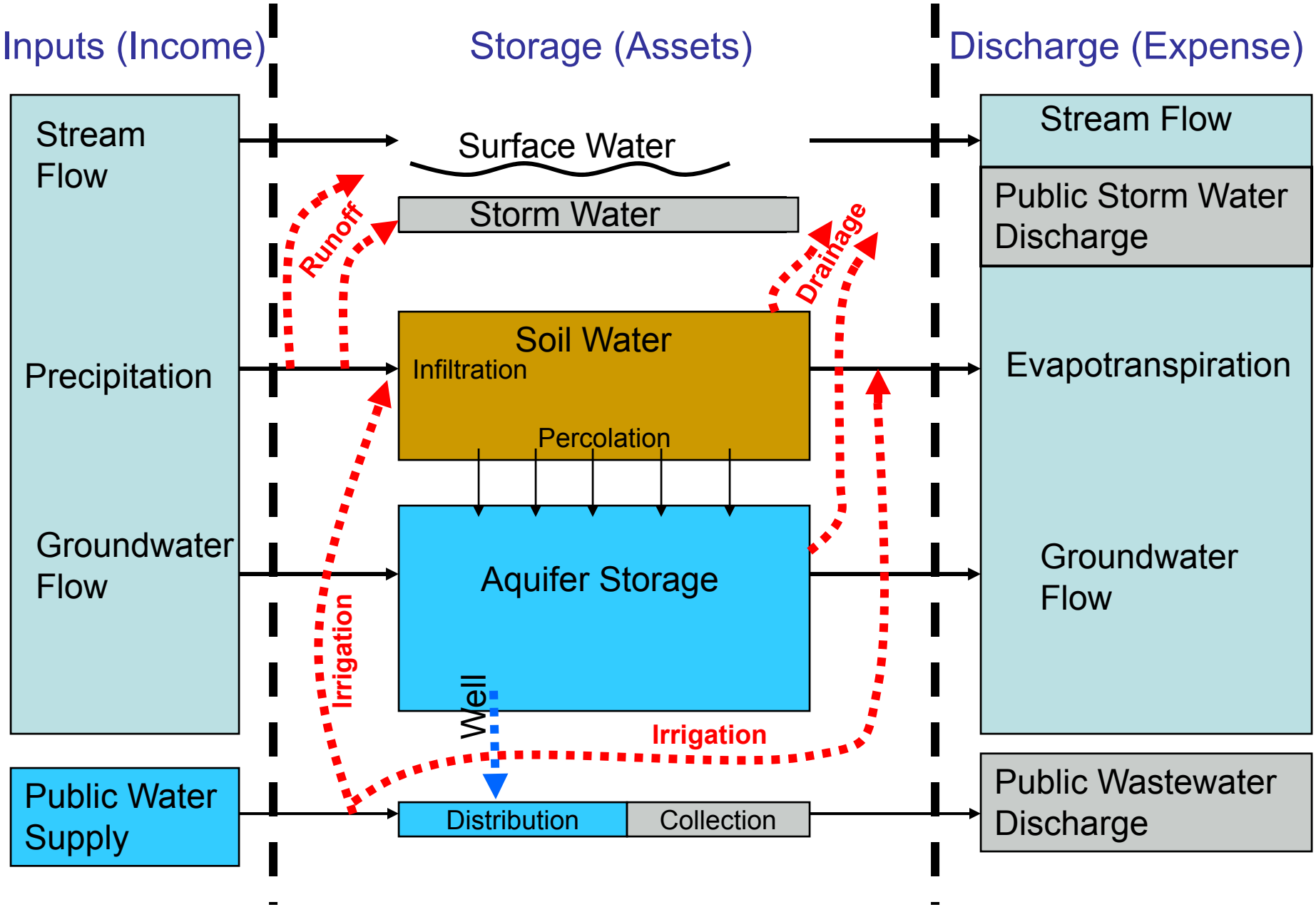


Figure 1 - Dynamic Balance Sheet for Water

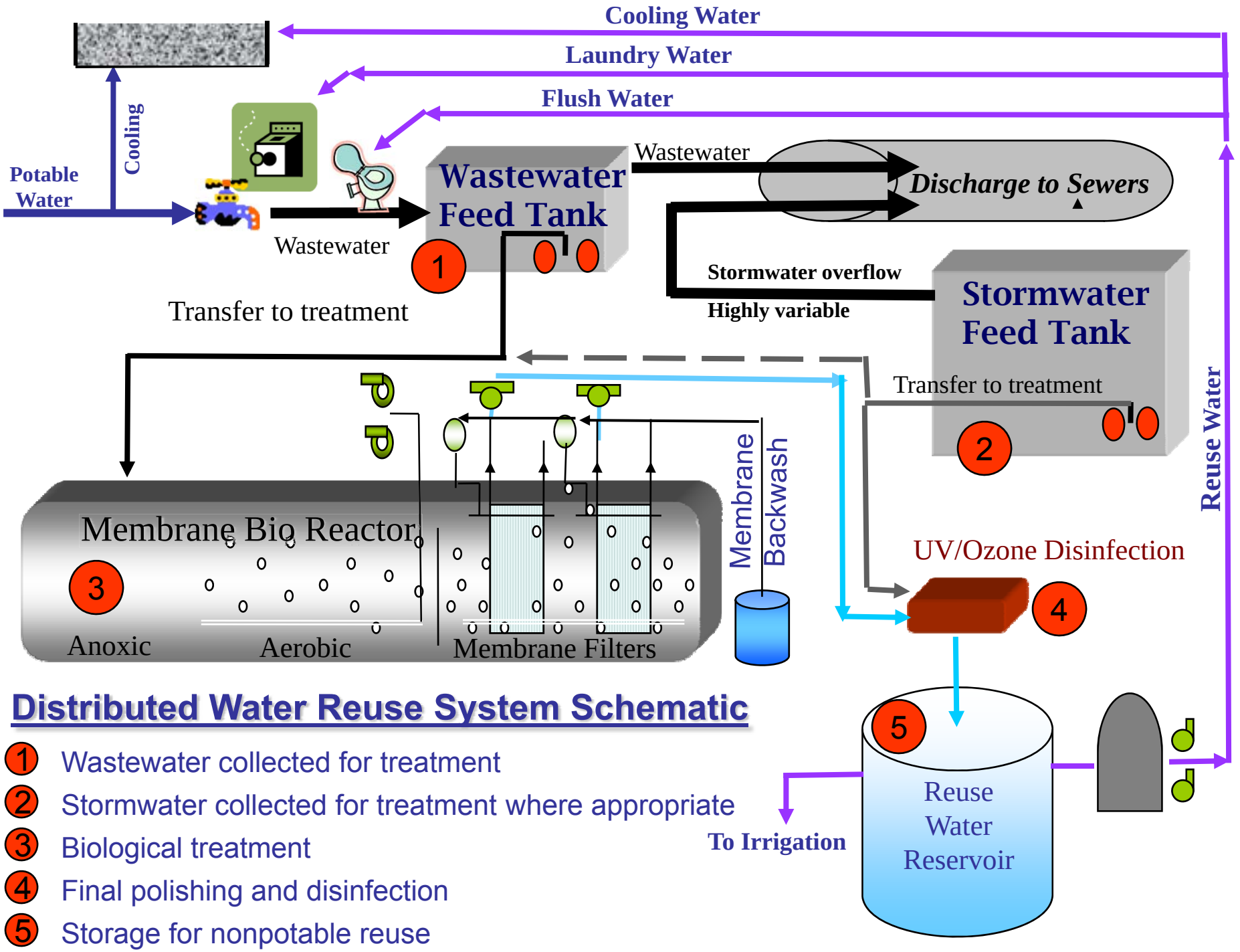


Direct Reuse –

A Component of Future Water Resource Management

Distributed Water Reuse Systems

Building Type	*Date of 1st System*	*Water Reuse*	*Water Uses*
Research	1987	95%	Toilet flushing
Office	1989	95%	Toilet flushing
School	1990	75%	Toilet flushing
Commercial Centers	1993	70%	Toilet flushing
Stadiums	1996	75%	Toilet flushing
Urban Residential High Rise	2000	50%	Toilet flushing, cooling, irrigation and laundry
30 Systems	**20 Years**	**80% Reuse Nonresidential 50% Reuse Residential**	



Distributed Water Reuse System Schematic

1. Wastewater collected for treatment
2. Stormwater collected for treatment where appropriate
3. Biological treatment
4. Final polishing and disinfection
5. Storage for nonpotable reuse

Water Reuse Performance Standards (NJ/NYC)

NJDEP Category 1 RWBR
Public Access Systems

Parameter	RWBR Requirement	Sample Type
Flow Rate		Continuous
Total Nitrogen	<10 mg/L*	Grab
Total Suspended Solids (TSS)	5 mg/L	Grab
Fecal Coliform	14 col/100 mL (2.2 weekly avg.)	Grab
Turbidity	2 NTU**	Continuous
Disinfection	100 mJ/cm^2 (UV) / 1 mg/L (CPO)	Continuous

Notes:

* The NJDEP may impose a total nitrogen concentration limitation greater than 10 mg/L if the permittee can demonstrate that a concentration greater than 10 mg/L is protective of the environment.

** A statistically significant correlation between turbidity and TSS shall be established prior to commencement of the RWBR program. For UV disinfection, in no case shall the level of turbidity exceed 2 NTU while still maintaining the 5 mg/L maximum level for TSS.

NYC Department of Health
Performance Standards for Reuse

Parameter	Standard
pH	6.5-8
BOD	<10 mg/L
Total Suspended Solids (TSS)	<10 mg/L
Fecal Coliform	<100 / 100 mL
Turbidity	<.5 NTU (95%) / <5 NTU (Max)

Notes:

1. DOH letter dated January 19, 2005 required chlorine to be monitored in stormwater tanks and recorded daily in a monthly operations log. Maintain free residual of 0.5 mg/L.
2. James Luke, P.E. with DOH believes the Department lowered the performance standard for Fecal Coliform to <1 per 100 mL. AE has requested written confirmation on this and has not received anything to date.

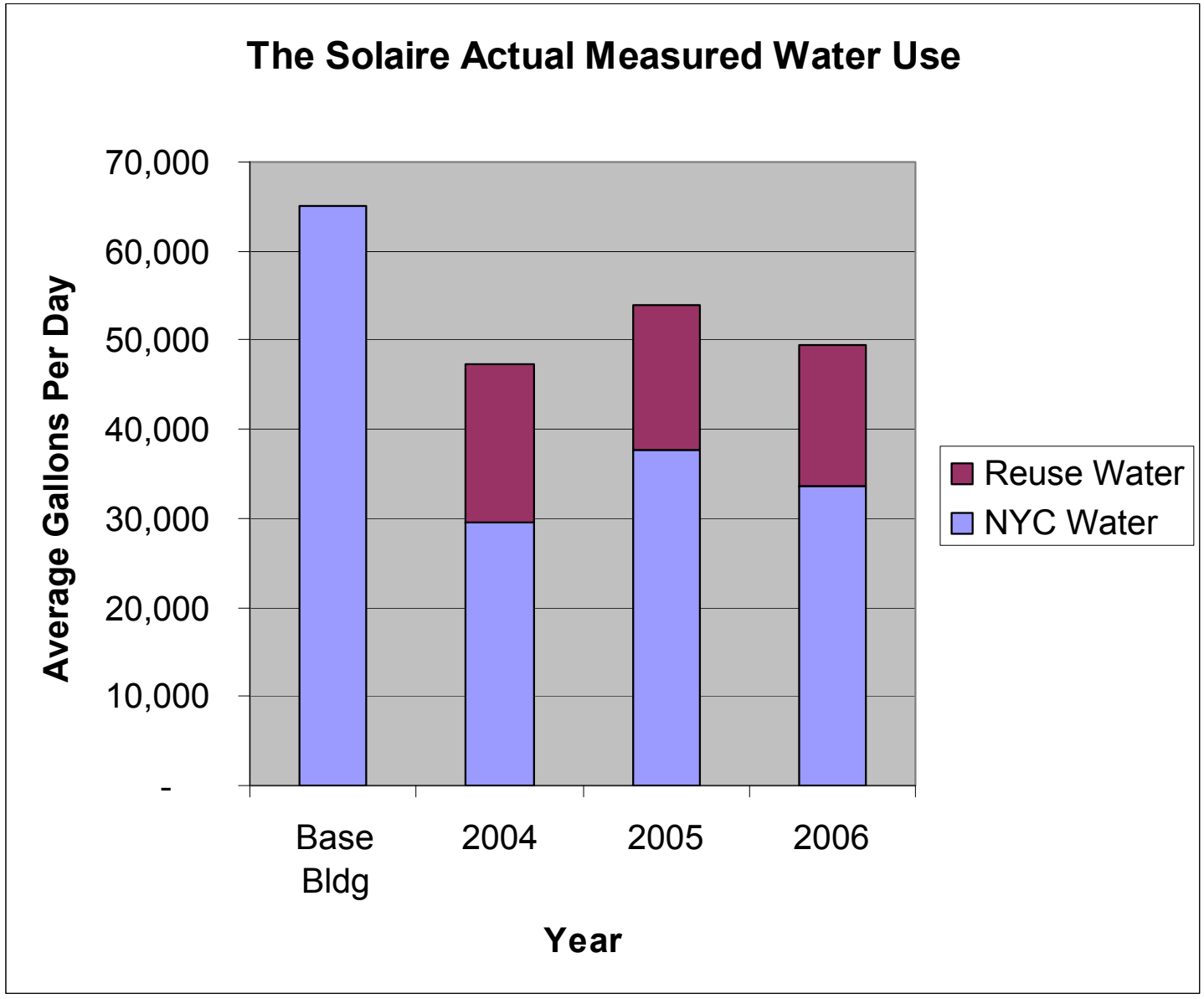
New England Patriots Stadium Foxboro, Massachusetts

- Applications of reuse are growing in size and commercial status.
- 68,000 seat stadium represents beneficial reuse at prime public and institutional sites.
- System provides reuse capacity to entire commercial zone within Town of Foxboro.

Decentralized Urban Water Reuse
Battery Park City – New York

Background

- 293 units
- 25,000 GPD WW treatment plant
- LEED™ Gold Certification
- Water Efficiency earns 5 points under USGBC LEED™ rating system
- **48% reduction in water use**
- **56% reduction in wastewater discharge**

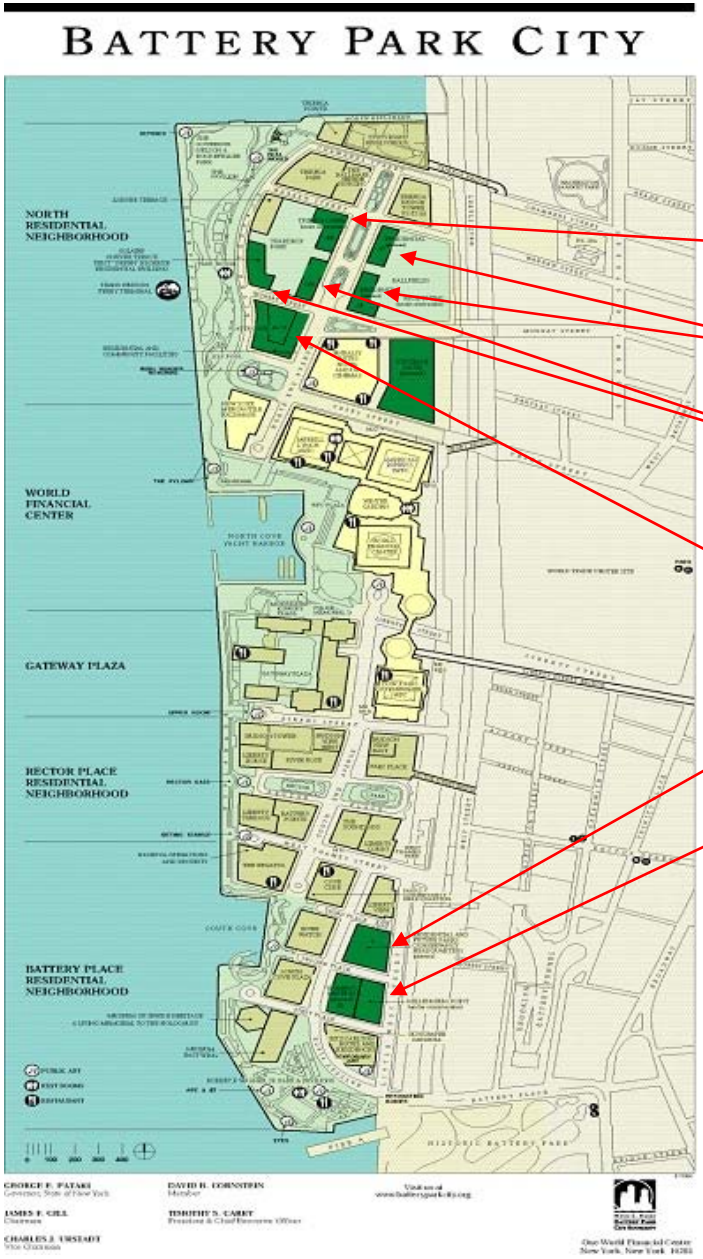

The Solaire Actual Measured Water Use
Average Gallons Per Day
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
Base Bldg
2004
2005
2006
Year
Reuse Water
NYC Water

Managing micro-watersheds in urban environments – drawing reuse water from multiple sources for multiple end uses


MEMBRANE
BACKWASH
STORAGE
TANK
ODOR
CONTROL
SYSTEM
SyncroFlo

Key NYC Drivers for Water Reuse

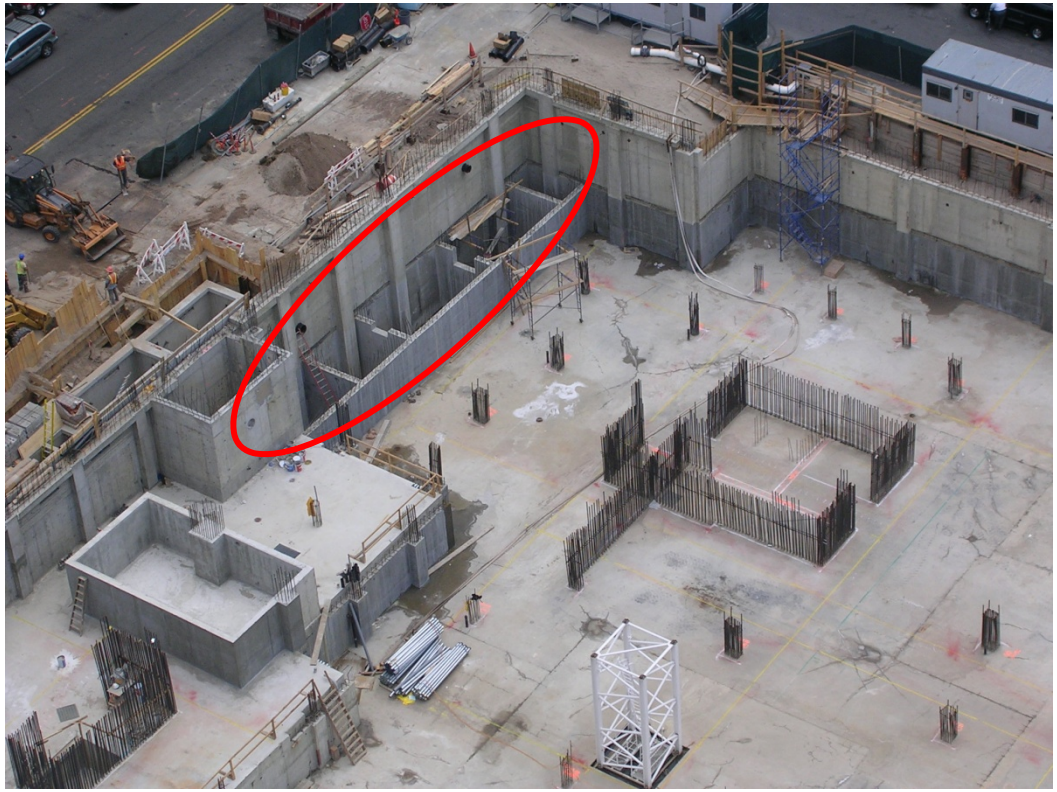
- **Diminishing water supply** and need for repair to Delaware Aqueduct Tunnel
- Wastewater management systems unable to meet stringent environmental protection standards – **Combined Sewer Overflows**
- Stormwater management needs growing as water quality protection standards advance
- **Green Building initiatives**
  - United States Green Building Council's Leadership in Energy and Environmental Design (LEED®)
  - Battery Park City Authority's Sustainable Urban Development Initiative
- New York City DEP Comprehensive **Water Reuse Incentives**



Integrated Water Reuse Systems

- Site 19B – Tribeca Green
- Site 23 – 24 Millstein Properties
- Site 18A and 18 B- The Solaire and The Verdesian
- Site 16-17 – Riverhouse
- Site 3 – Albanese Development
- Site 2 – Millennium Point
- The Helena – 57th Street – Durst Development

Preliminary Capital Costs Projections



- Construct tanks as integral part of foundation walls to economize – concrete represents approximately 35% of costs
- $45/GPD capacity for small system of 25,000 GPD = $1 M
- $21/GPD capacity for medium system of 300,000 GPD = $6.3 M
- $16/GPD capacity for larger system of 500,000 GPD = $8 M
- Includes concrete tanks, start-up and 6 months operations
- Other Costs Factors
  - Distribution System
  - Stormwater treatment, storage and interconnection

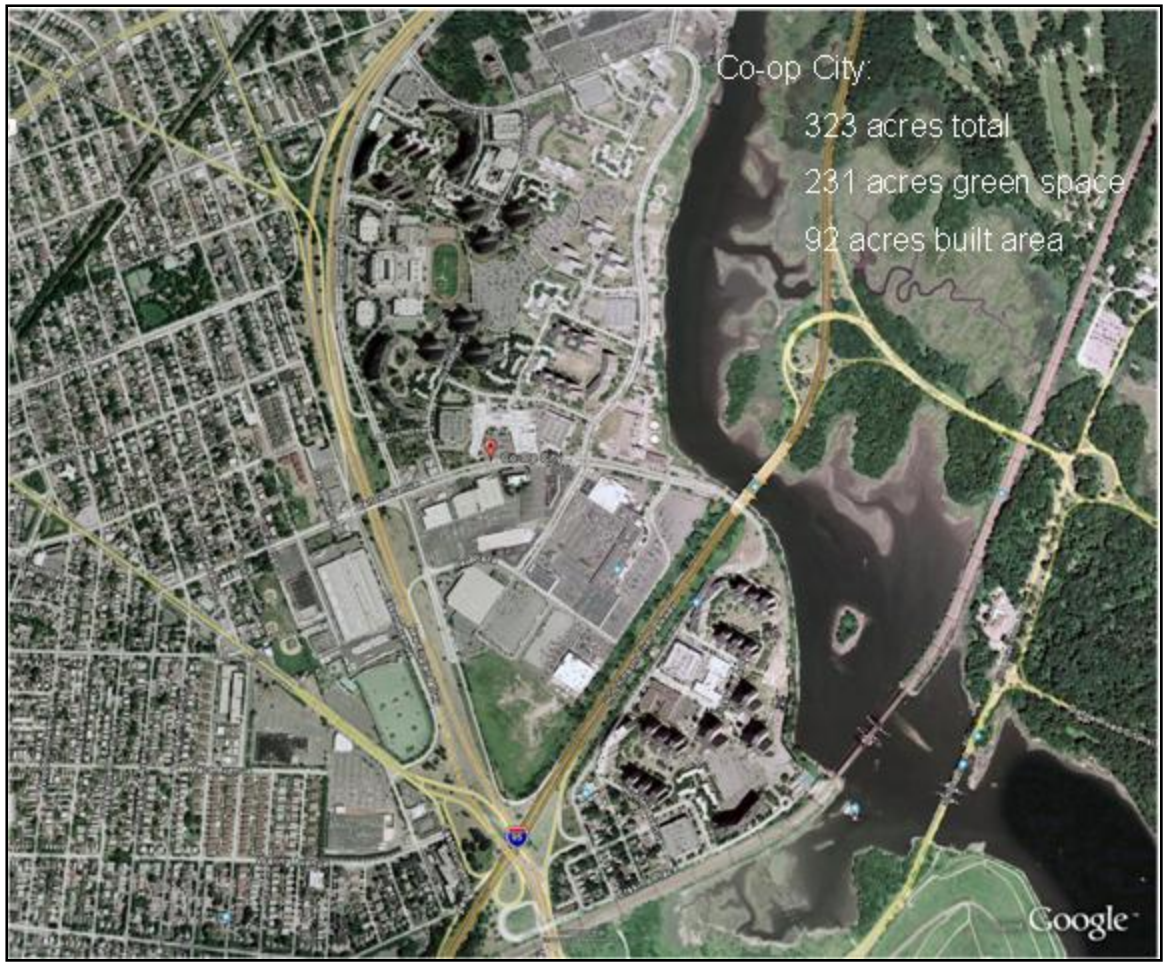
Co-op City

- Population:
  45,000 – 55,000

- Residential Use:
  15,000 residential units
  35 high-rise buildings
  7 townhouse clusters

- Commercial Use:
  3 shopping centers
  >40 offices

- Infrastructure & Utilities:
  NYC Public Water & Sewer
  Cooling Tower / Power Plant



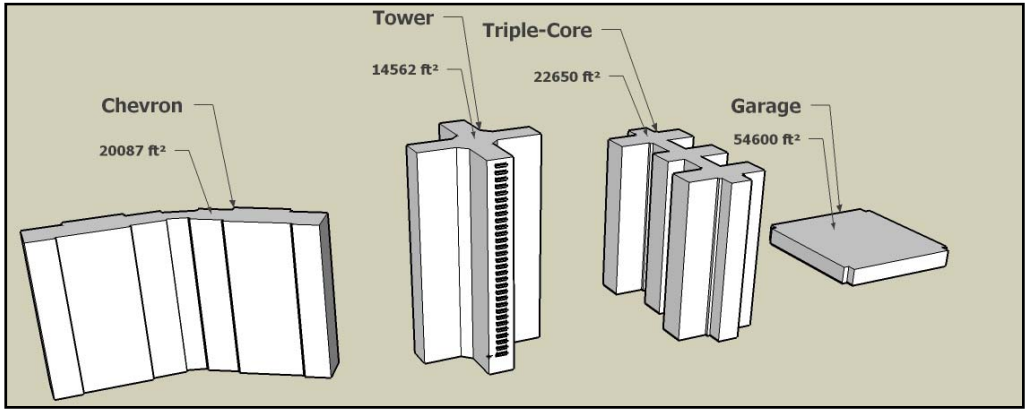
Co-op City: Water Usage

- Co-op City Water Usage: Riverbay Corporation

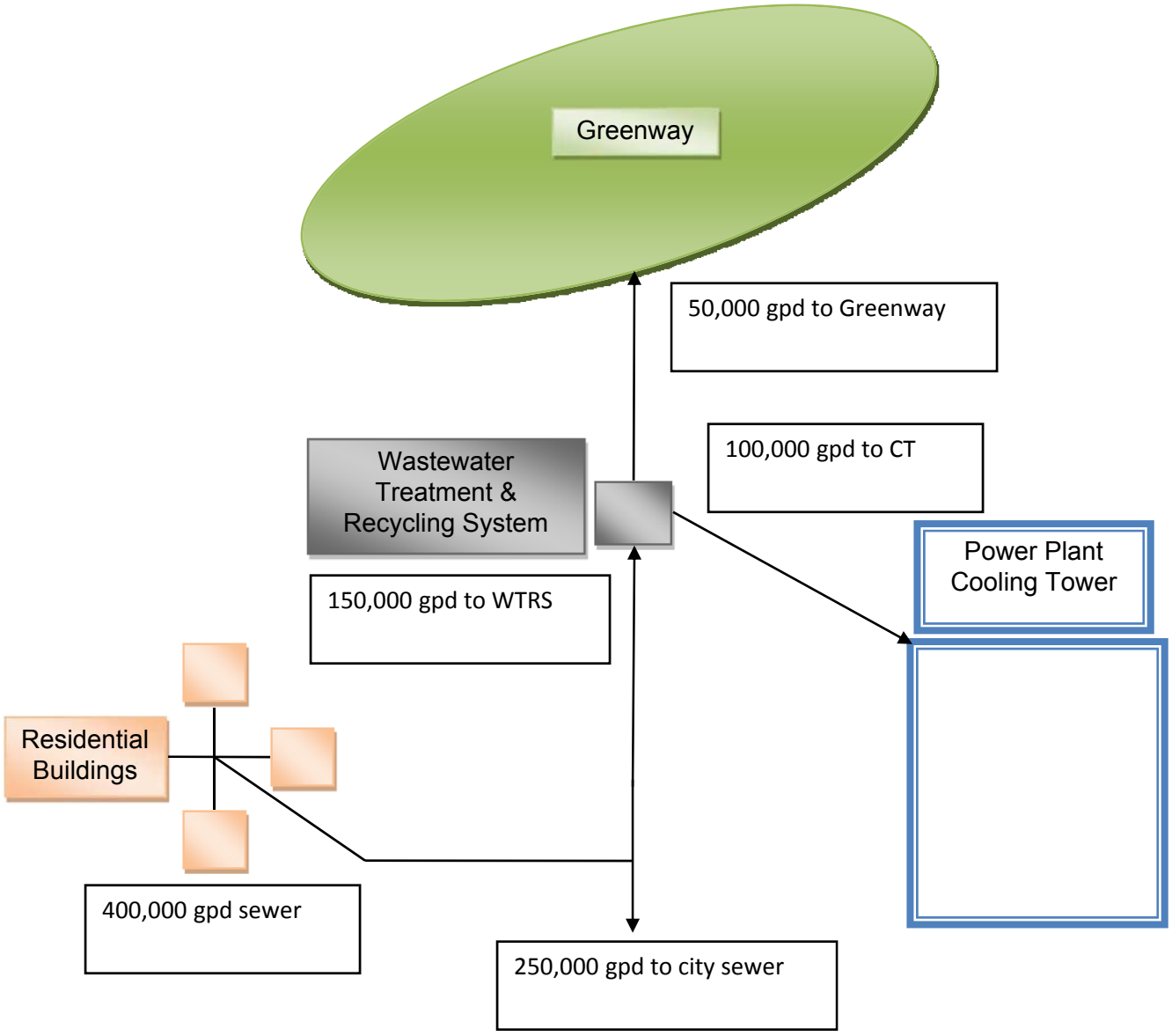
Residential Use (gpd)	3,400,000
Commercial Use (gpd)	370,000
(gpd)	375,000
Total Usage (gpd)	4,145,000

- Cooling Tower Power Plant Average Water Usage

March – June (’07)	270,000 gpd
June – September (’07)	730,000 gpd
September – December (’07)	300,000 gpd
December – March (’07-‘08)	250,000 gpd
Annual Average	375,000 gpd



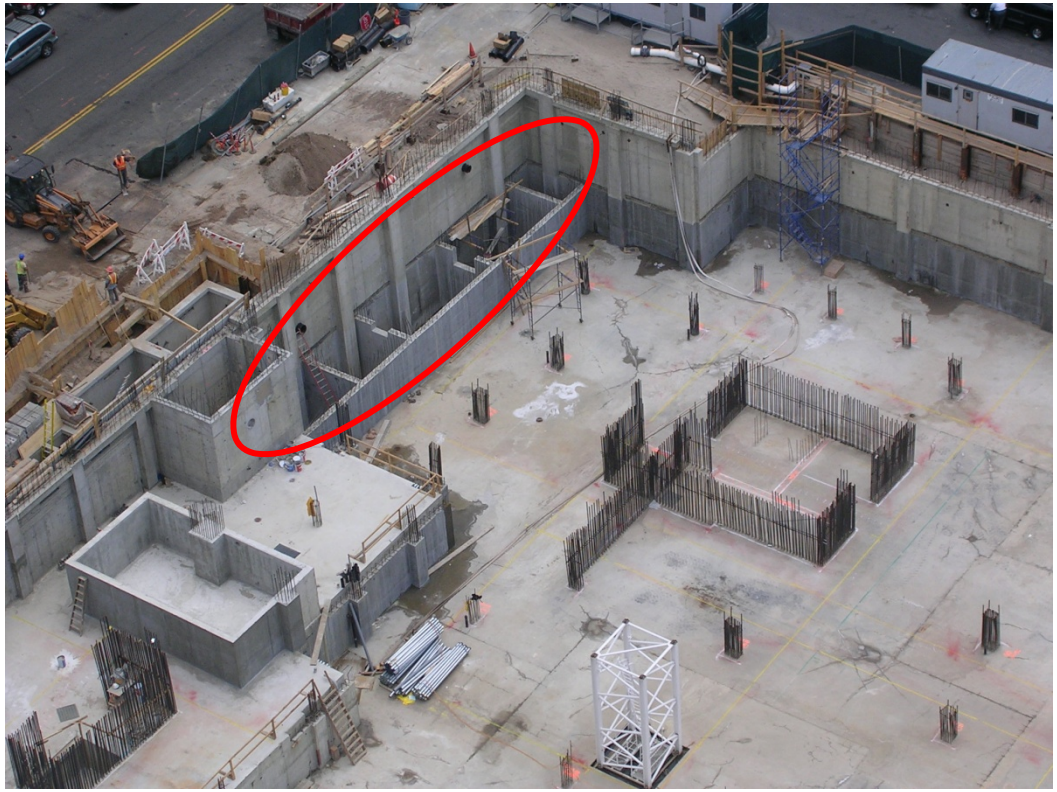
Co-op City: Water Reuse Diagram



Economics of Decentralized Water Reuse Systems –

Delivering water resource infrastructure affordably on a neighborhood and site basis

Preliminary Capital Costs Projections



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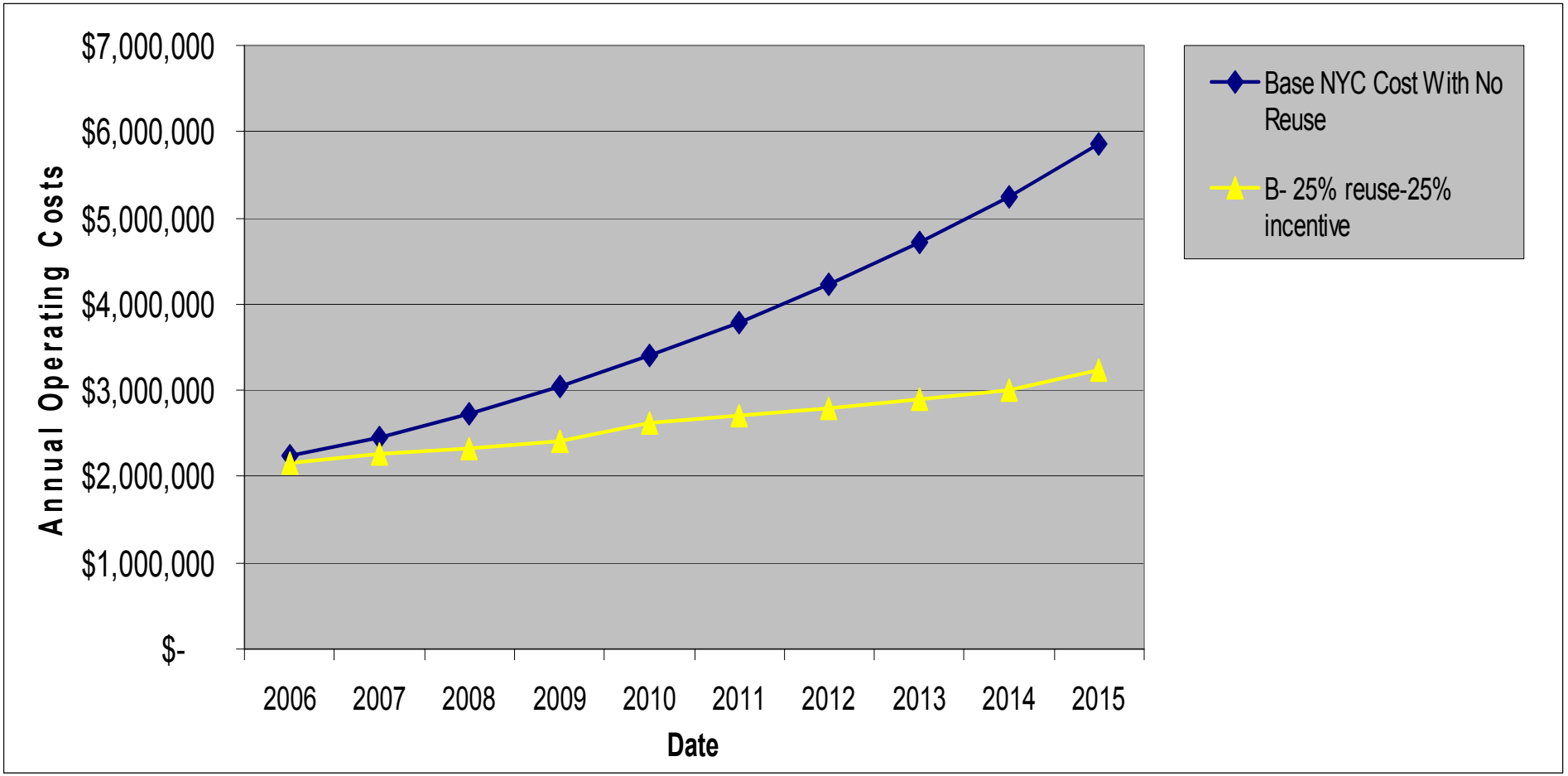
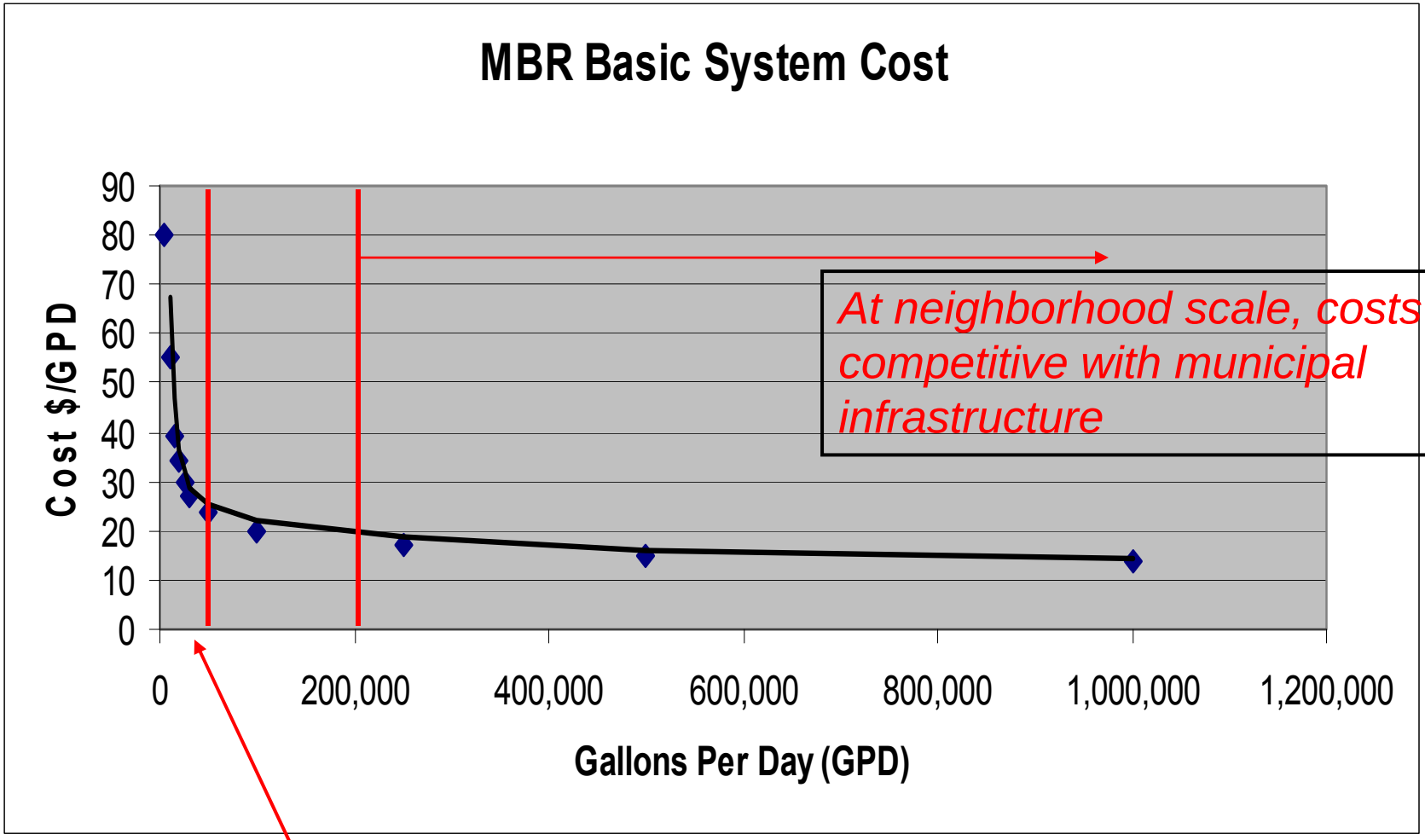
- Other Costs Factors
  - Distribution System
  - Stormwater treatment, storage and interconnection

Figure 3
500,000 GPD Water Reuse Economics

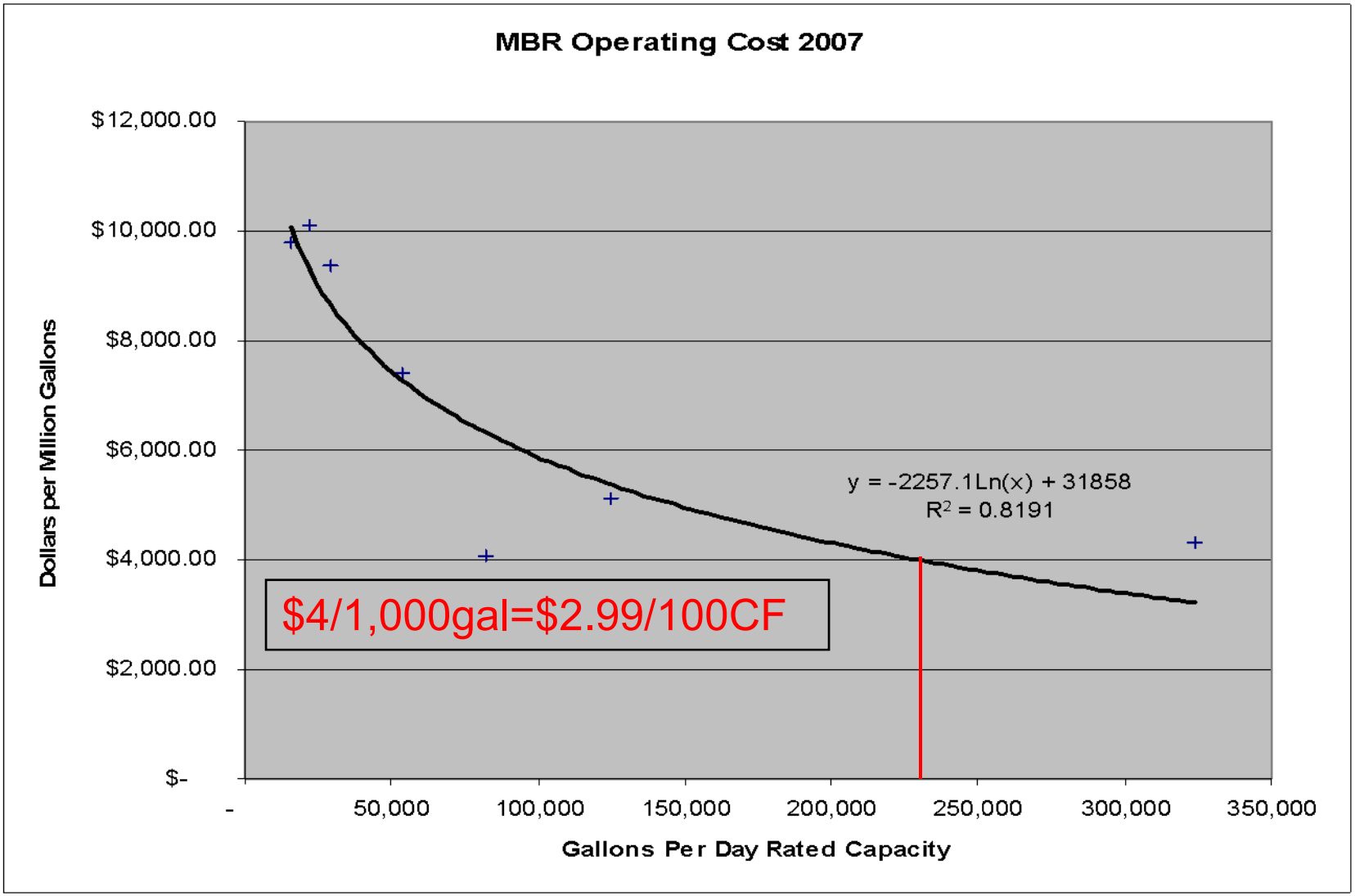


NYC rates increased 65% in four years and are projected to increase 15% per year for the next four years

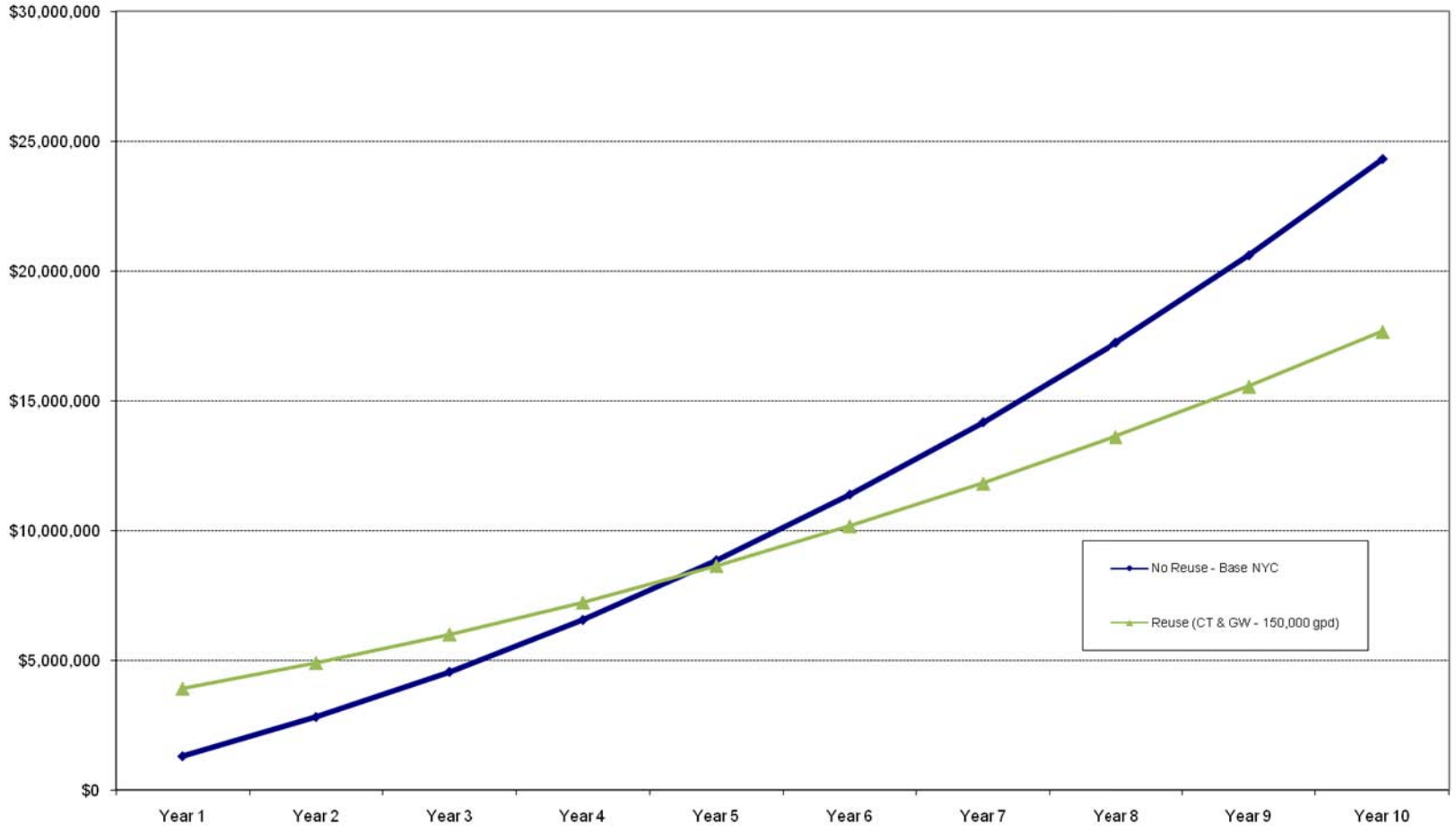
Water Reuse MBR Treatment Plant Base Costs



Economy of Scale – Direct Operations Cost



Co-op City: Preliminary Economic Model

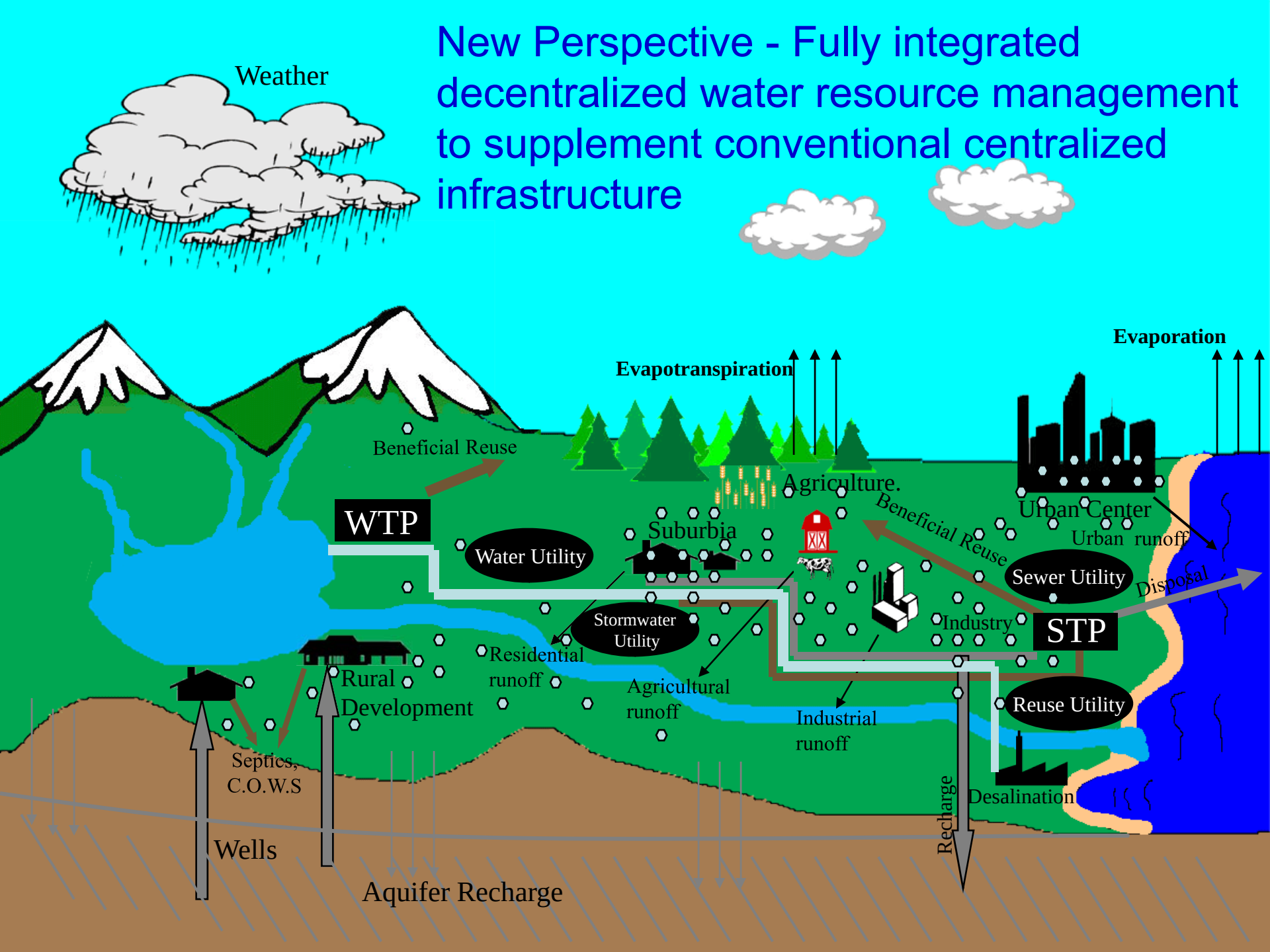


Decentralized Systems –

Delivering the infrastructure on a neighborhood and site basis

Beyond LEED

New Perspective - Fully integrated decentralized water resource management to supplement conventional centralized infrastructure



Benefits of Decentralized Systems

- **"Just-In-Time, Just-The-Right-Size"** service delivered without excess capital - built to exact customer needs and specifications
- **Avoid** undesirable **secondary impacts** (i.e. sprawl), yet allow modern planned development concepts
- Conducive to **"Smart Growth"** and **"Low Impact Development"** concepts that incorporate stormwater reuse, groundwater recharge and integrated water resource management
- Provide higher quality effluent that has **nutrients removed** – simply because it has to be acceptable for reuse
- **Eliminate infiltration and inflow** conditions that are readily addressed in small systems
- **Lower security risk** due to smaller size and greater dispersion

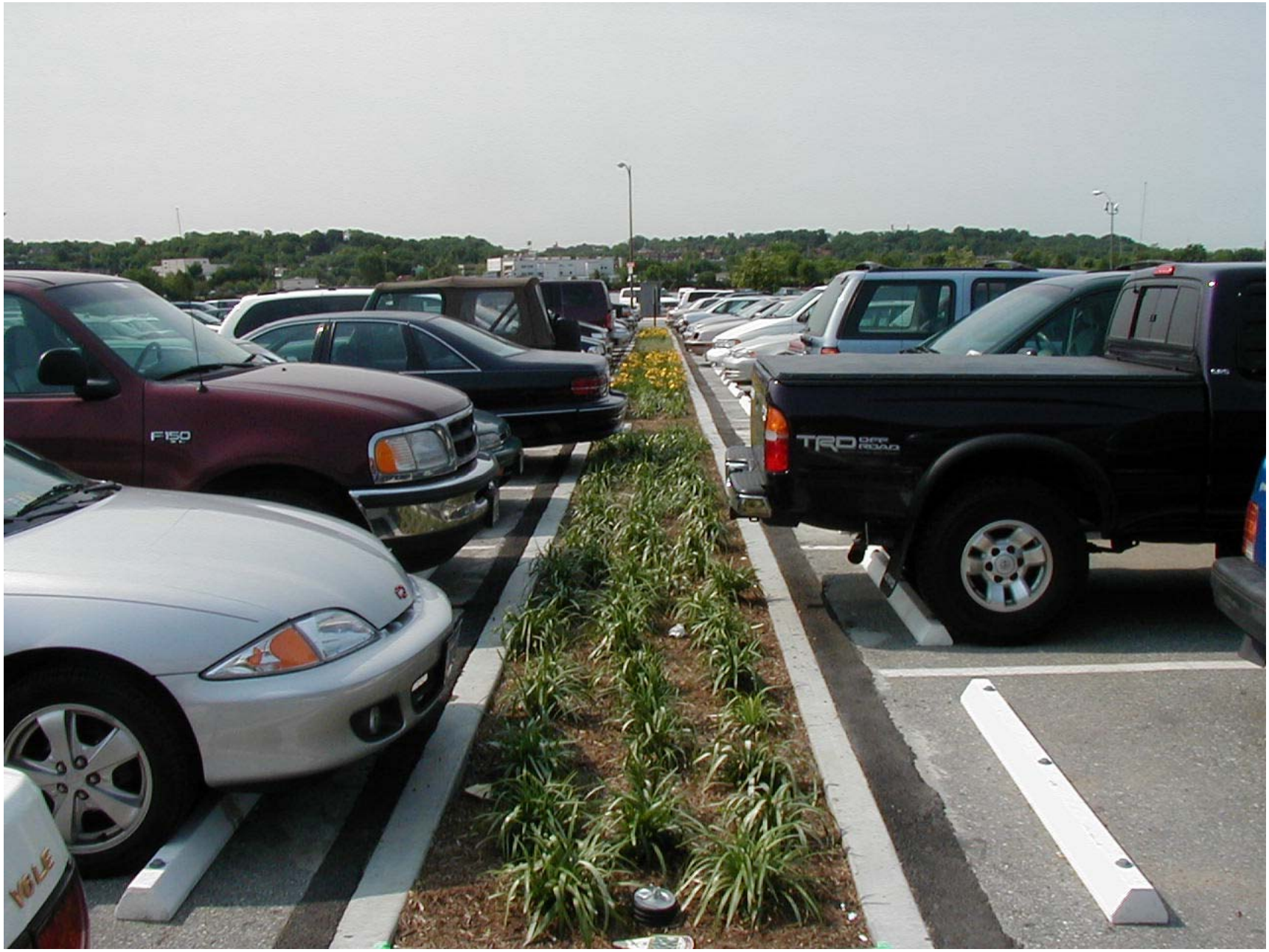
Drawbacks of Decentralized Systems

- Lose **economy of scale** benefits due to smaller size
  - <50,000 GPD most expensive
  - 50,000 to 150,000 moderately expensive
  - 150,000 to 500,000 GPD more competitive
  - > 500,000 GPD most competitive
- Typically require **higher levels of treatment** to achieve reuse standards which some would consider a drawback
- To date they **lack significant public subsidies** that are offered to regional scale systems and as a result they experience higher user fees
- Learning how to provide effective decentralized management

Other Important Considerations

- Non-point Source methods that incorporate stormwater Best Management Practices with simple approaches
- Indirect water reuse that incorporates groundwater recharge
- Passive treatment methods that consume less energy


Low Impact Development In Paved Parking Lot
From Vicki Gartland_Harvard
Ecological Conference - 2003


F150
TRD OFF ROAD

Rain Garden – Simple, Low Cost

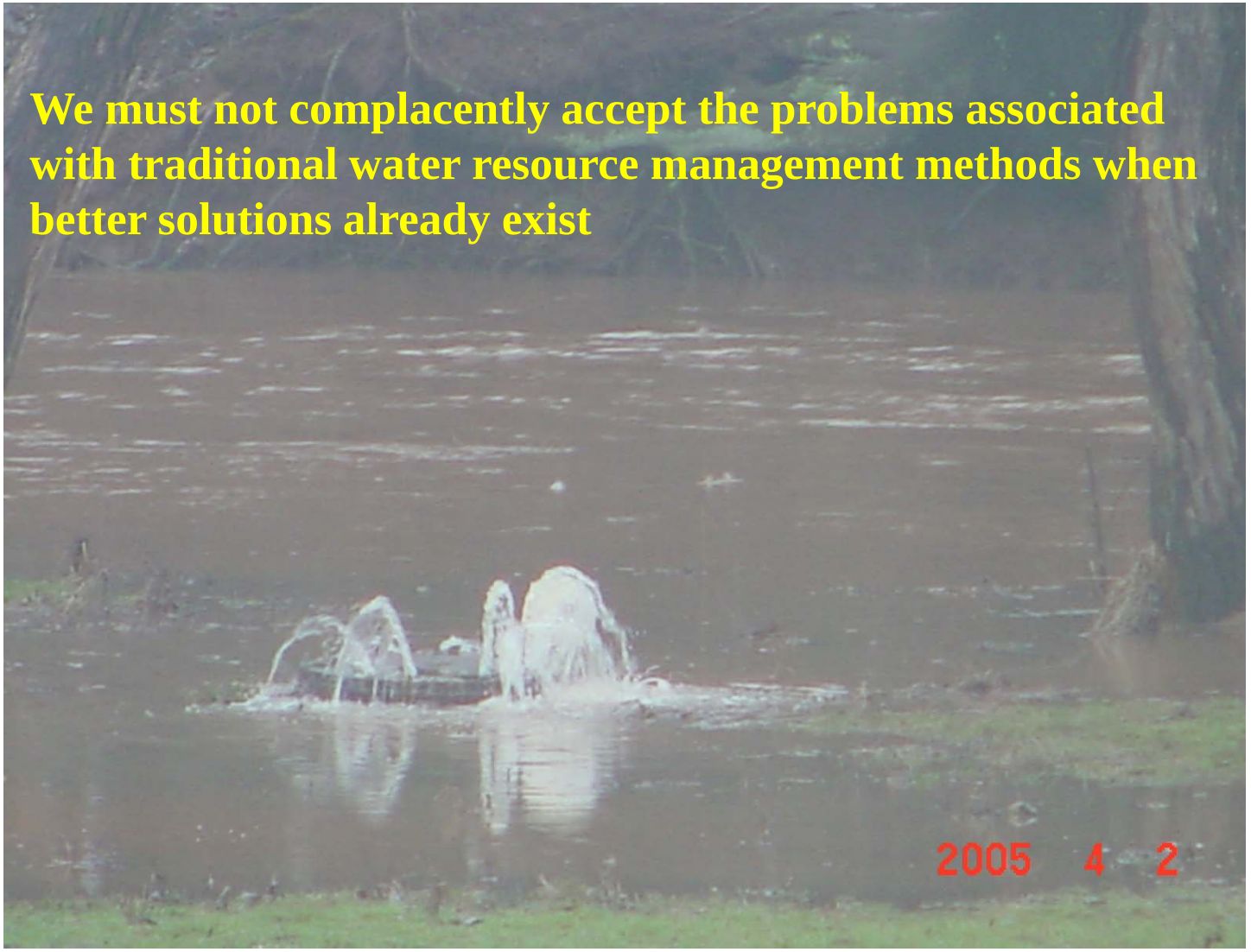
- Recharge runoff from impervious surfaces – zero net increase in rate and quantity of runoff from 2 yr storm
- Filter surface runoff
- Detain and recharge surface runoff

- Reuse sidewalk demolition sections for spillways between paddies

Solar Aquatics System

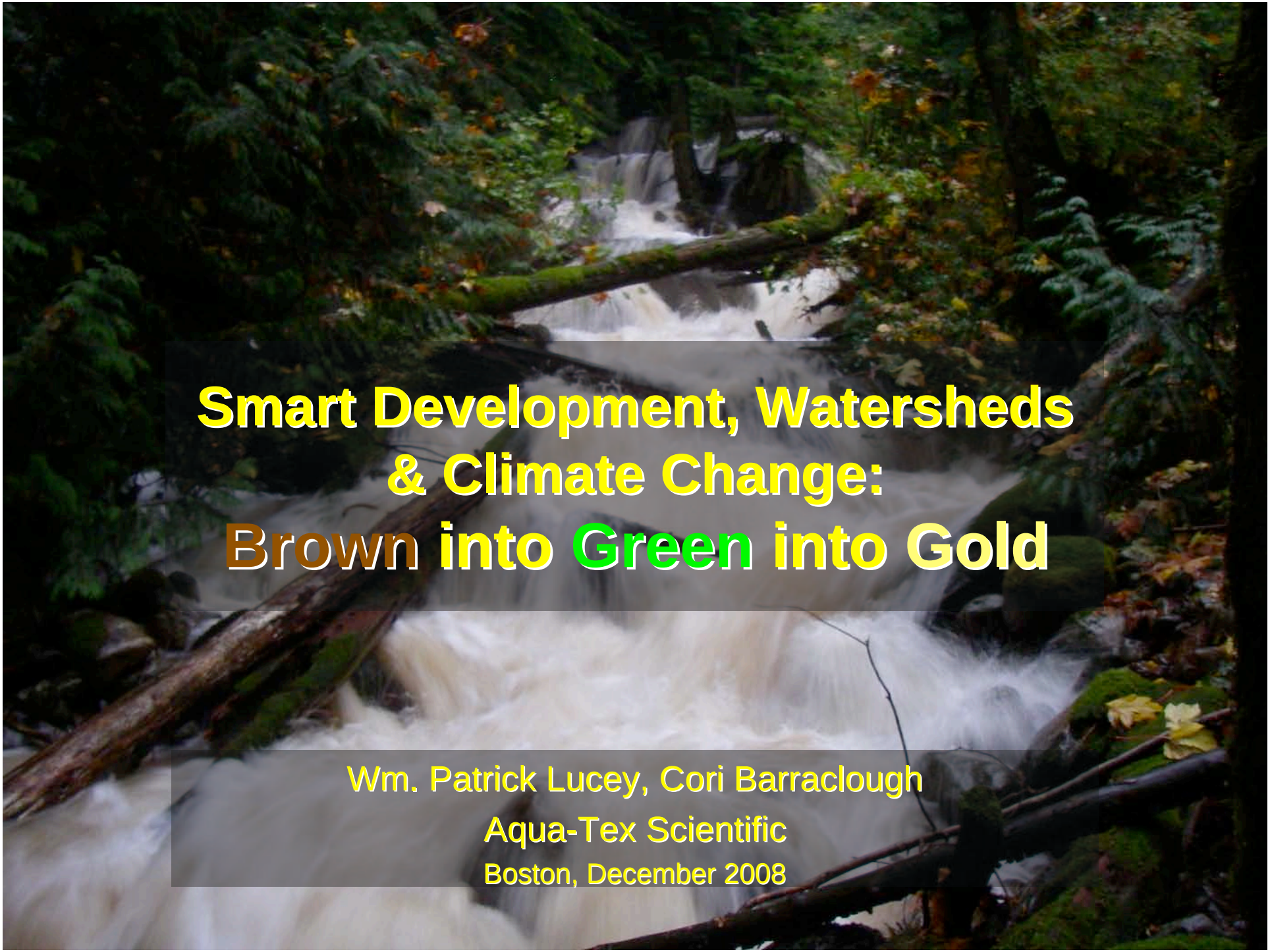
Julian Woods, Pennsylvania
Michael Zavoda, P.E.

- 12 homes
- Community built and operated
- Treated effluent flushes toilets and irrigates a flower nursery


We must not complacently accept the problems associated with traditional water resource management methods when better solutions already exist
2005 4 2

APPENDIX D

SMART DEVELOPMENT, WATERSHEDS, AND CLIMATE CHANGE: BROWN INTO GREEN INTO GOLD

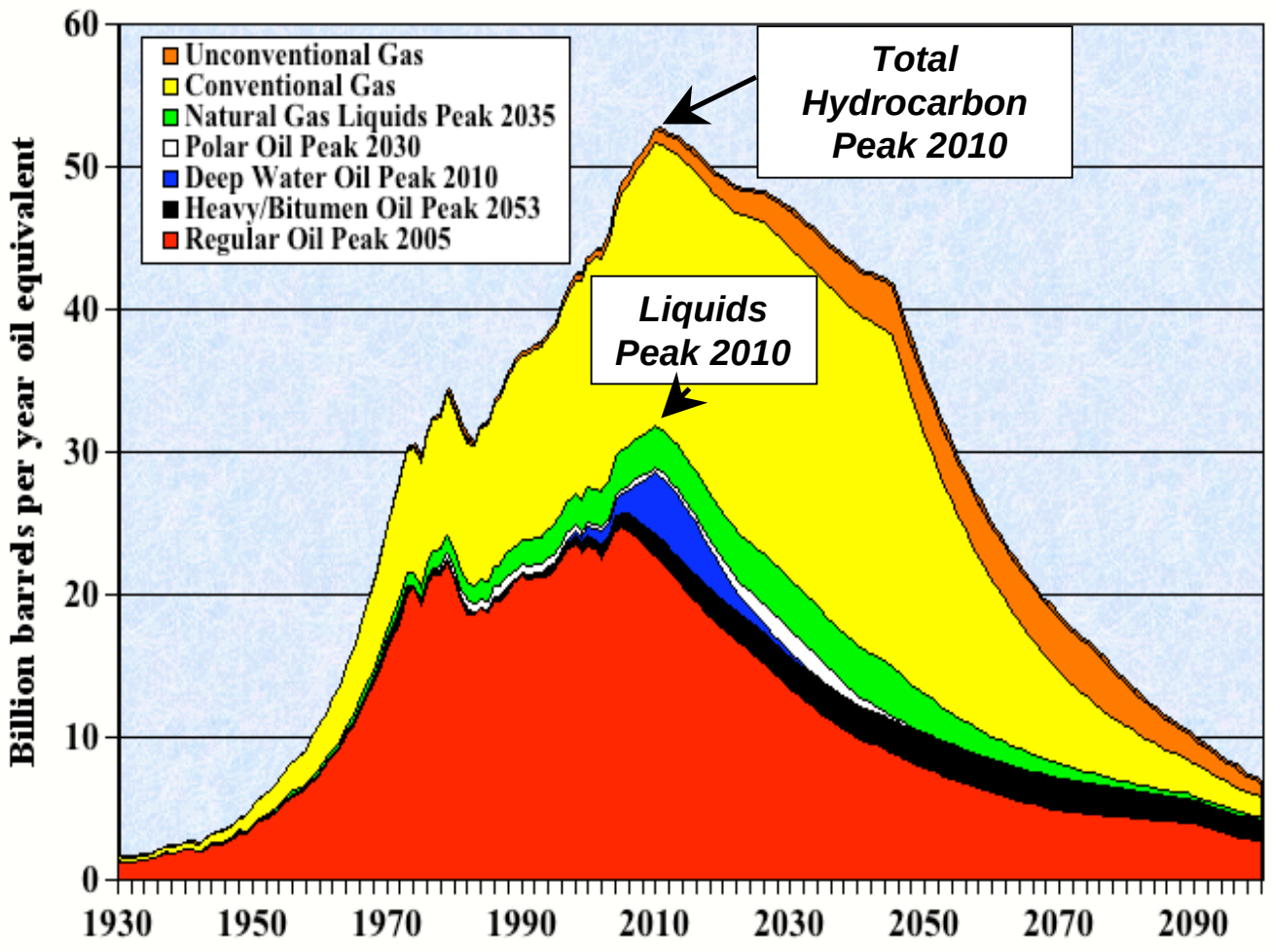


Smart Development, Watersheds & Climate Change: Brown into Green into Gold

Wm. Patrick Lucey, Cori Barraclough
Aqua-Tex Scientific

Boston, December 2008

Campbell's (2007) Base Case History and Forecast of World Hydrocarbon Production 1930-2100

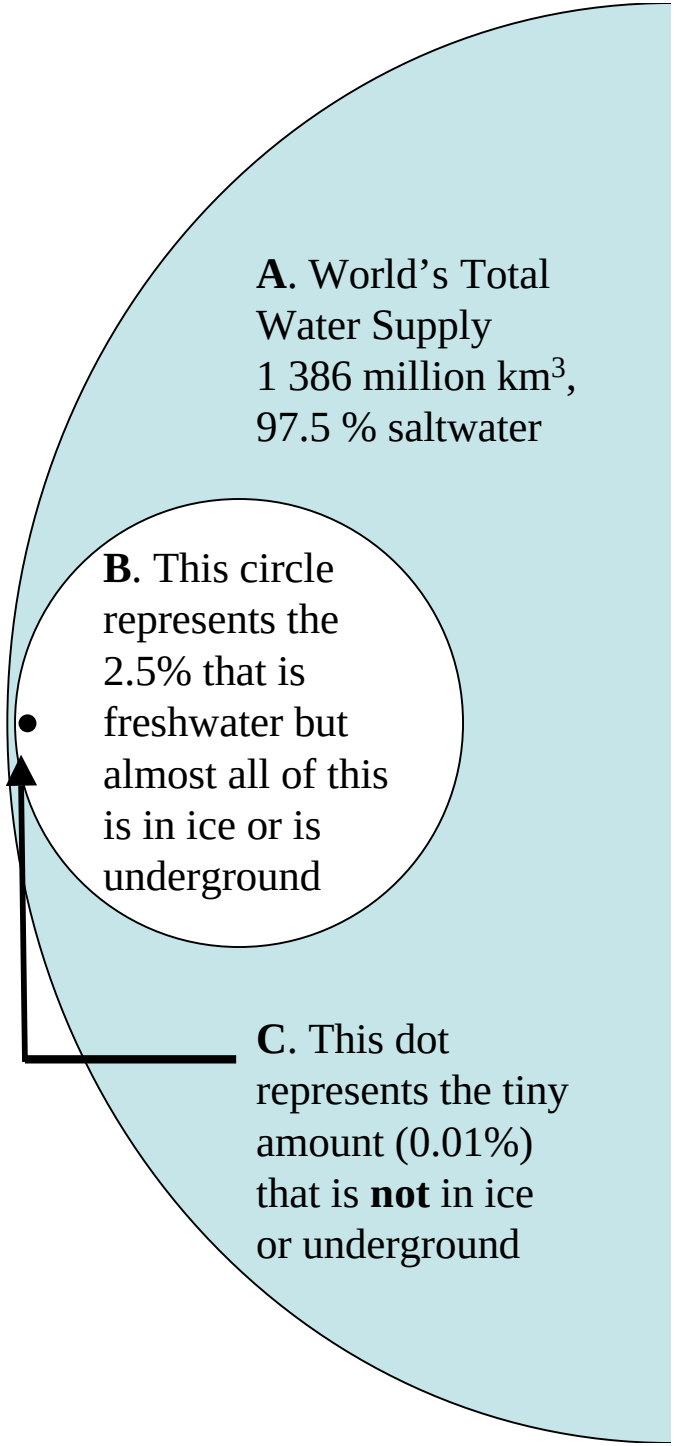


The history of the world is written not in ink but in water (Chinese Proverb)

World's Water System

World's Water Supply	Volume (km^3)
Total Volume	1 385 984 610
Salt Water (97.47%)	
– Oceans	1 338 000 000
– Groundwater (to 2000 m)	12 870 000
– Inland seas	85 400
Freshwater (2.53%)	
– Glaciers and snow	24 064 100
– Groundwater	10 530 000
– Permafrost	300 000
– Lakes	91 000
– Soil Moisture	16 500
– Atmospheric Water	12 900
– Marshes	11 470
– Rivers	2 120
– Water in Plants & Animals	1 120

Source: DFO 1987

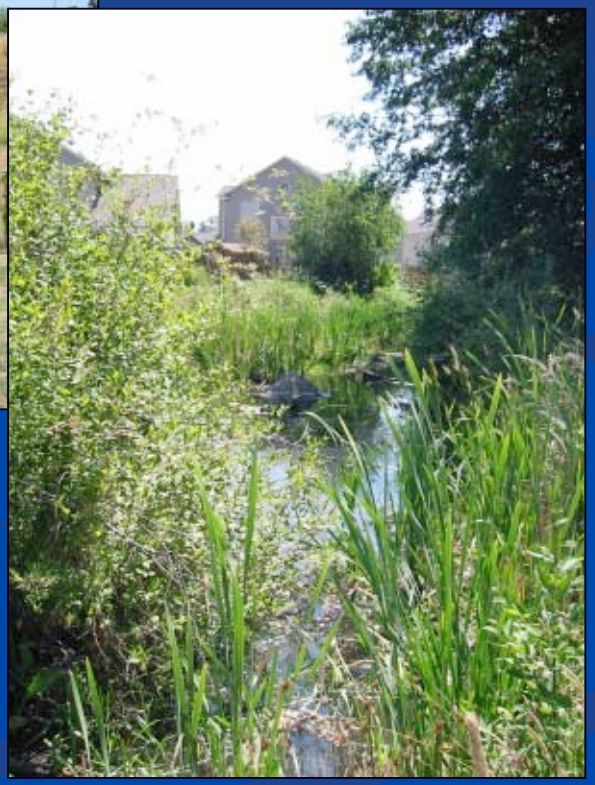


Valuing Nature's Infrastructure

Conventional
(Engineering)

"Green"
(Environmental
Engineering)

$ $

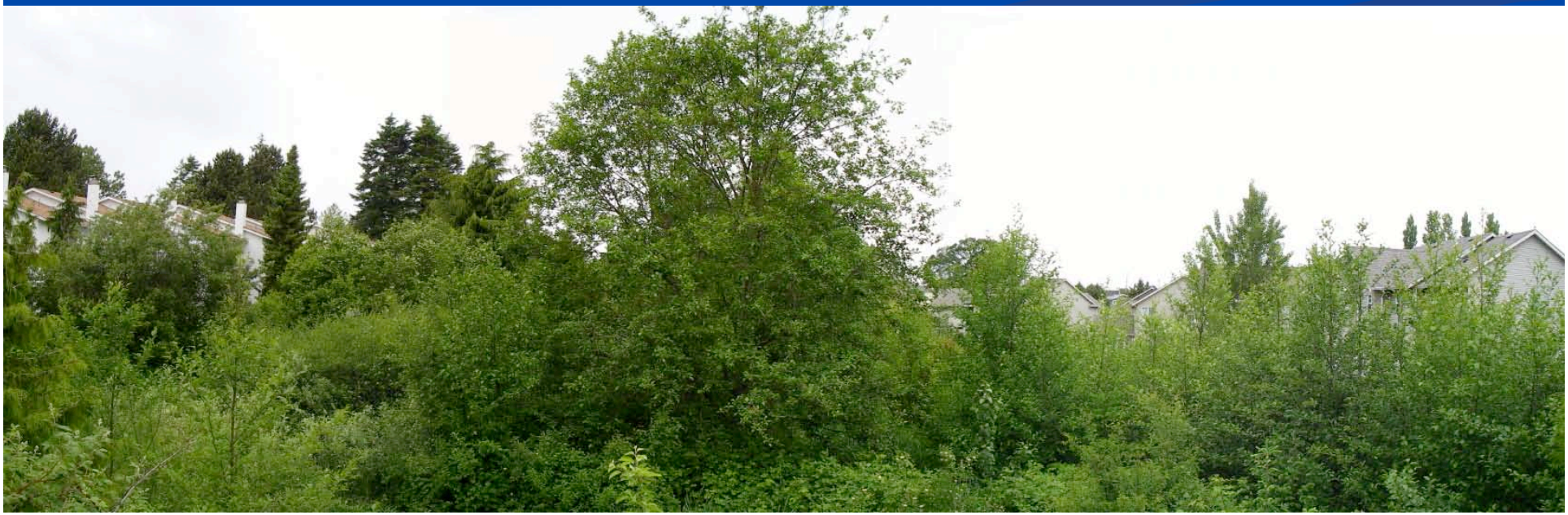


Ecological Approach
(Engineered Ecology™)

Neighbourhood
“Suburban” scale

Willowbrook Subdivision

- Degraded stream
- Stormwater bylaw prompted restoration
- 31 homes proposed within the 200 year floodplain
- Community requested restoration




1999


May 2006

Willowbrook: The Reality

Dense Urban
“Downtown” Scale

Dockside Green: Existing Brownfield Site

Dockside Green: Conceptual Design

LEED™ platinum

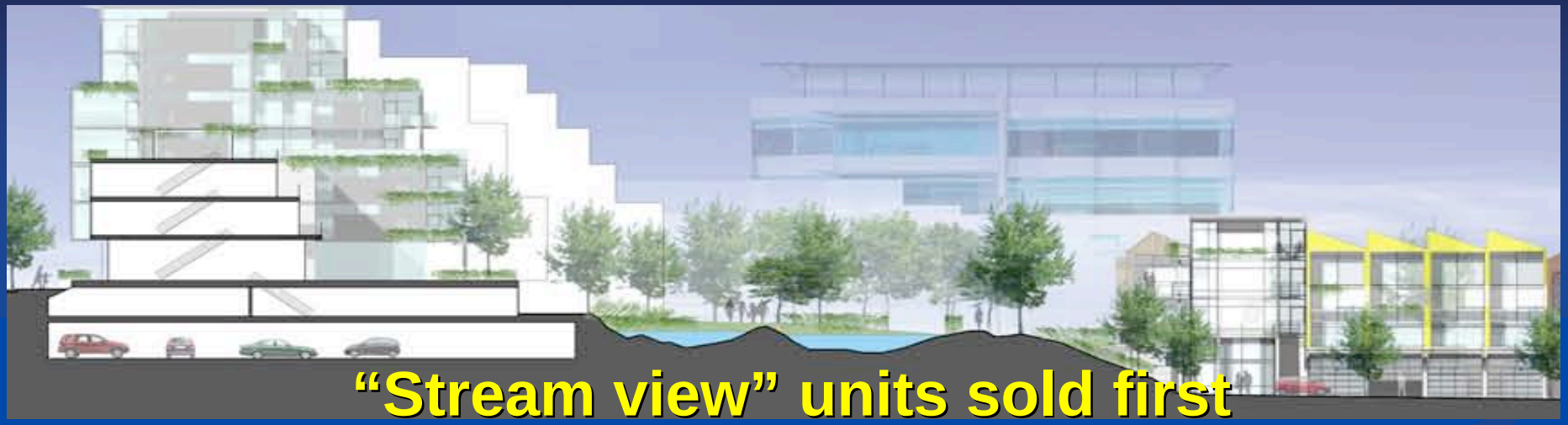
Water + Energy

Integrated Design Process

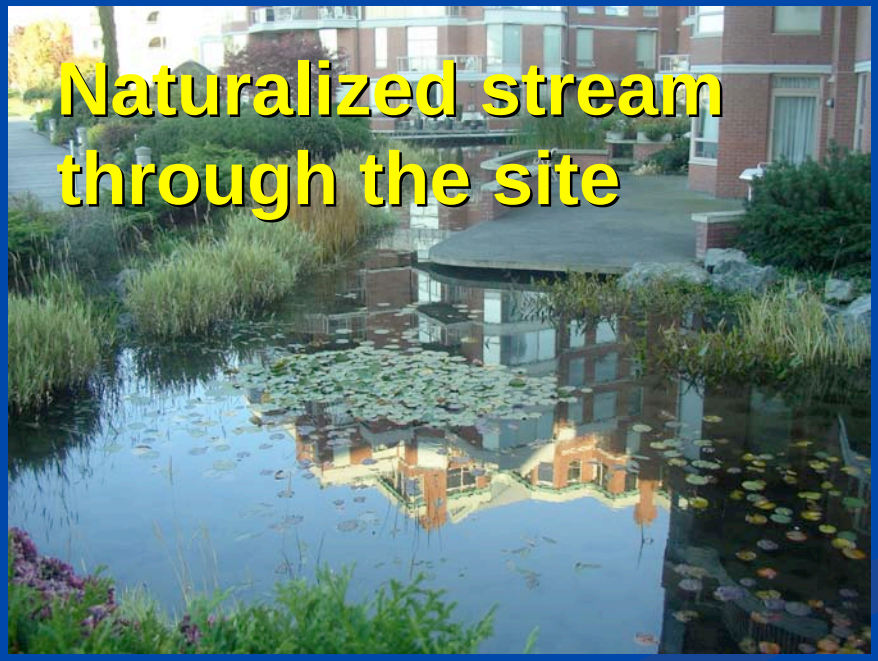
Engineered Ecology
Closed loop
Design based on **value**

Saves enough water annually to supply the whole city for 1 day

Integrated Design = Value



"Stream view" units sold first



Naturalized stream through the site

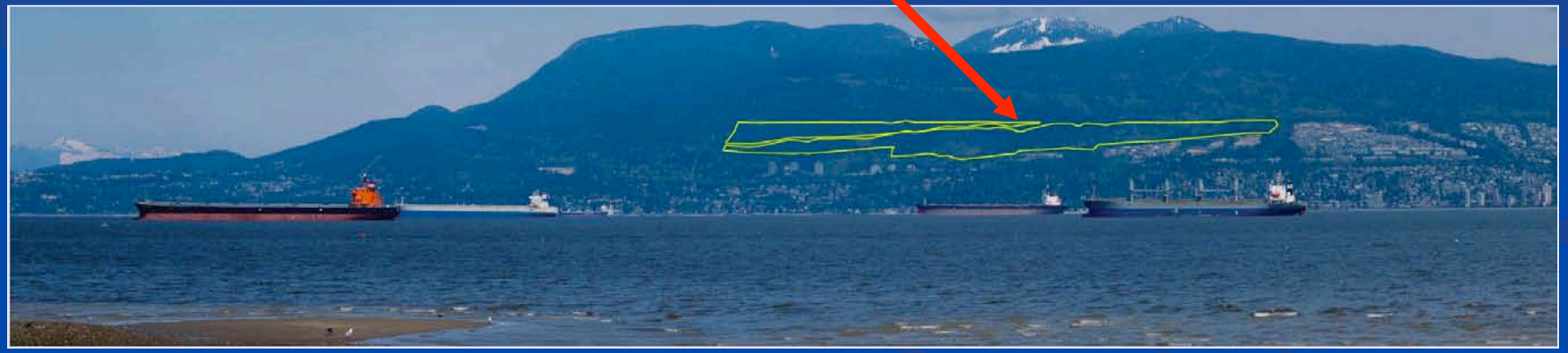
Celebrates water
Visible landscape feature

Landscape Scale

Long-Term Thinking

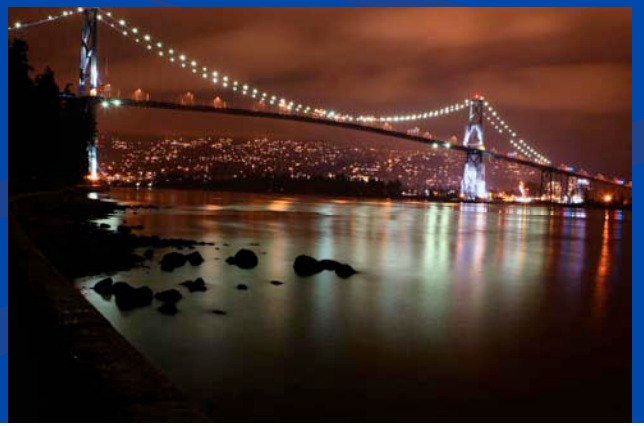
Rodgers Creek- British Pacific Properties

209 acres (3500 acres)



Original subdivision laid out in 1931 by the Olmstead brothers

Built Lions Gate Bridge



Definition of Preliminary Planning and Conservation Areas

DRAFT

Preliminary Planning and Conservation Areas

Working together, District staff and the Rodgers Creek land owners identified areas where development planning should focus. These development planning areas are enclosed in black outlines on the above map. The configuration of these potential development areas depends on the confirmation of road alignments, especially for the extension of the Chippendale connector road. District staff have not approved development within all of the areas shown. Final boundaries will be determined at the Development Permit stage and may be smaller than the areas shown, resulting in more conservation area being transferred to the District. Lands outside of the outlines will not be developed and will be preserved and enhanced.

The preliminary planning areas have been numbered and lettered for reference purposes.

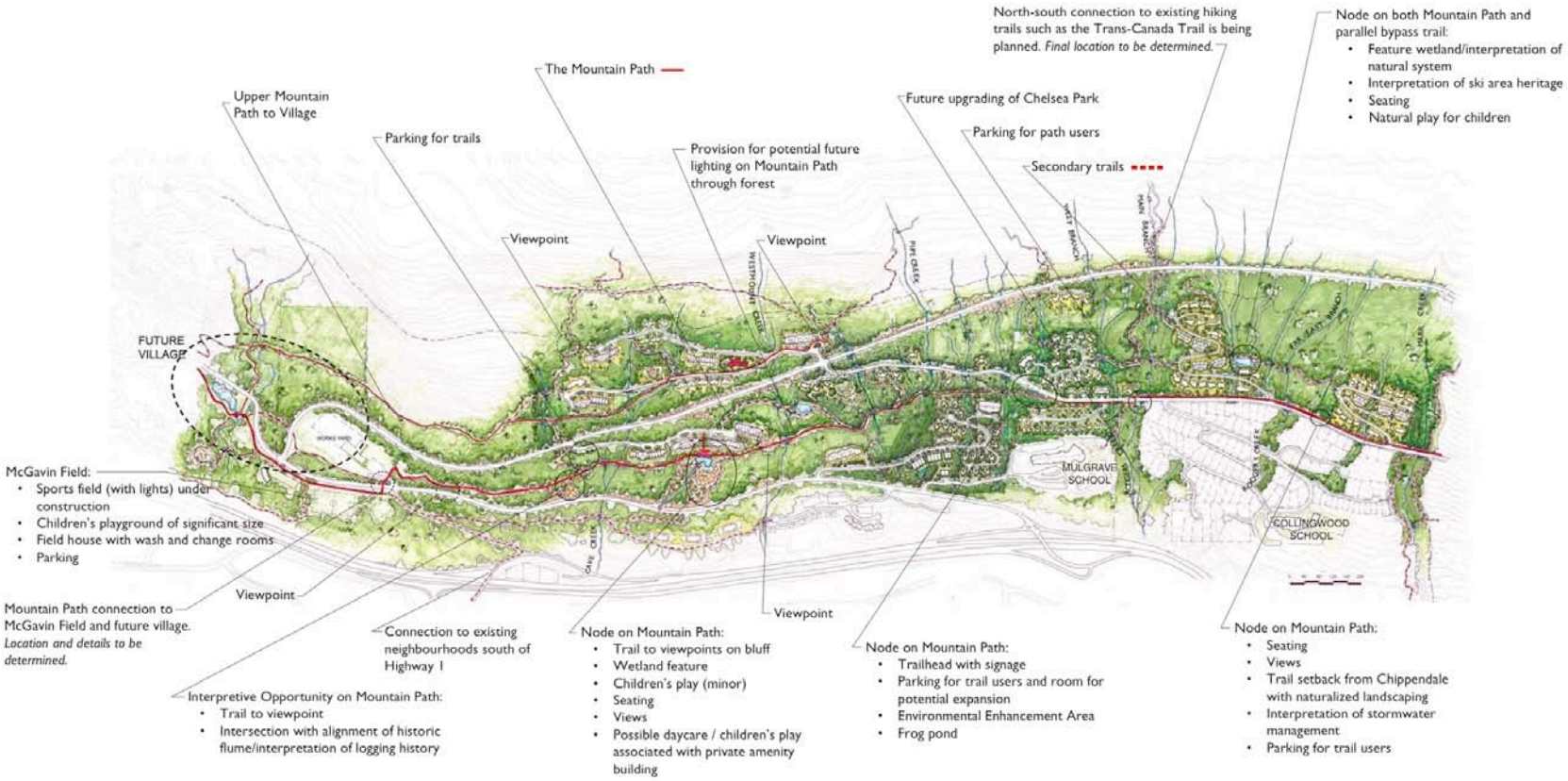
Note: After the original Sieve Analysis was completed, the western boundary of the ADP Area above upper Cypress Bowl Road was expanded. The rationale for this expansion and the Sieve Analysis for this expanded area is included in Appendix A.

LEGEND

- PROTECTED SENIOR GOVERNMENT SETBACK AREA
- STEEPER SLOPES
- POTENTIAL GEOTECHNICAL CONSTRAINTS - FURTHER INVESTIGATION REQUIRED
- STEEP SLOPES - FURTHER INVESTIGATION REQUIRED
- MUNICIPAL SETBACK AREA - FURTHER INVESTIGATION REQUIRED
- DEVELOPMENT AREA
- LARGE FEATURE TREE
- C04 TRAIL/ ROAD (EXISTING)
- C04 MOUNTAIN PATH (PROPOSED)

A Sense of Place

DRAFT

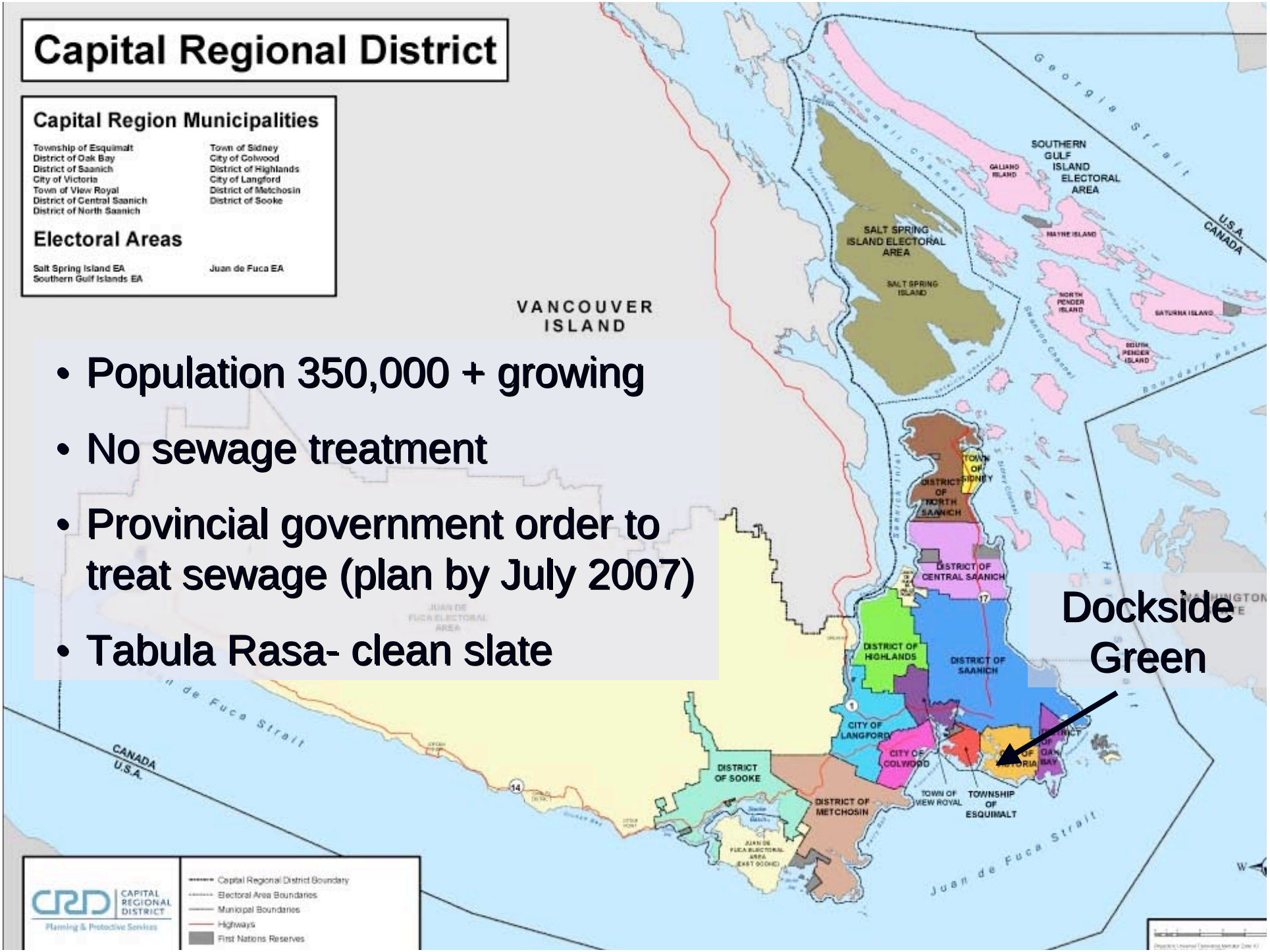


City Scale

Whole City Change

Truth can never be told so as to be understood, and not be believed. (Blake)

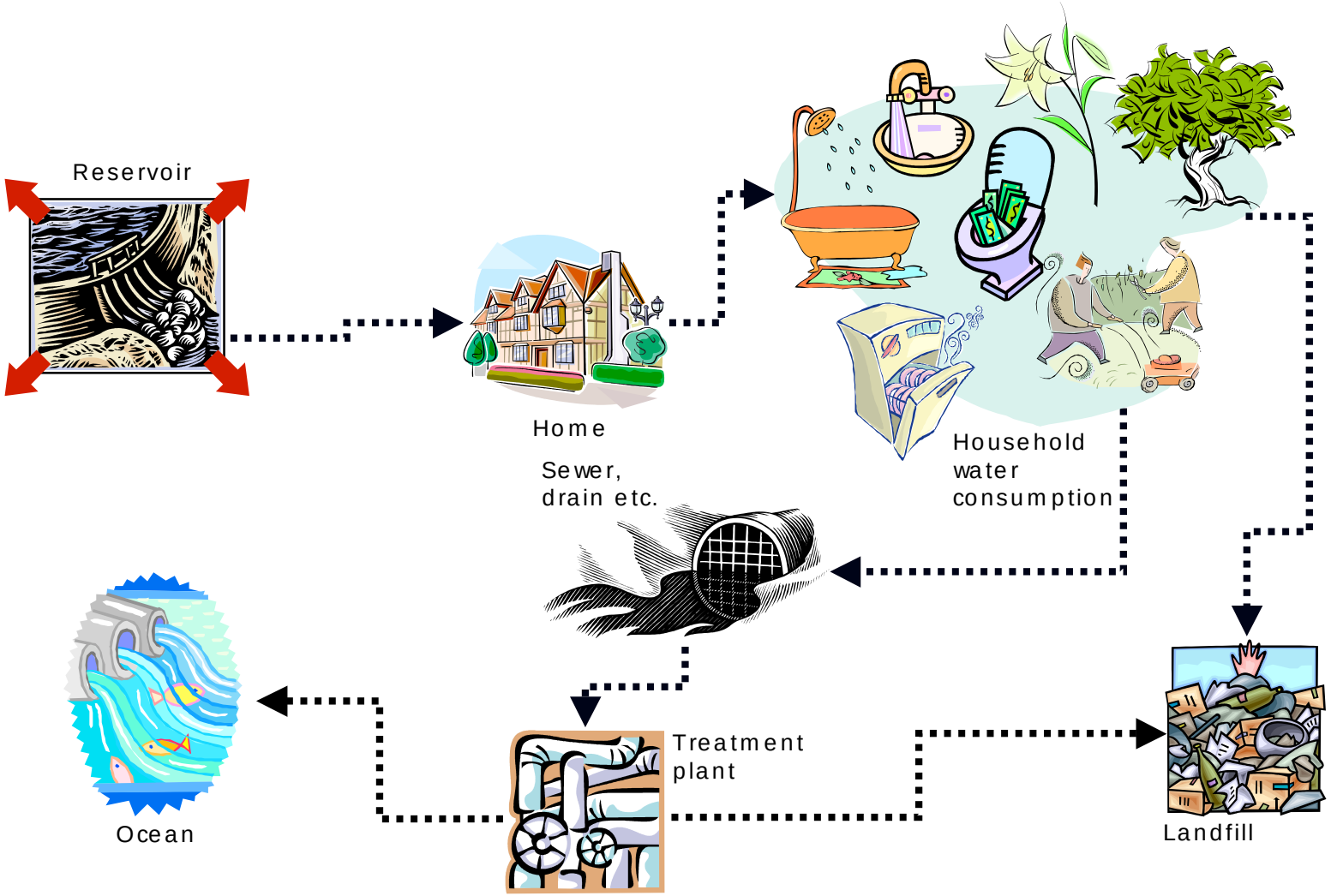
Capital Regional District



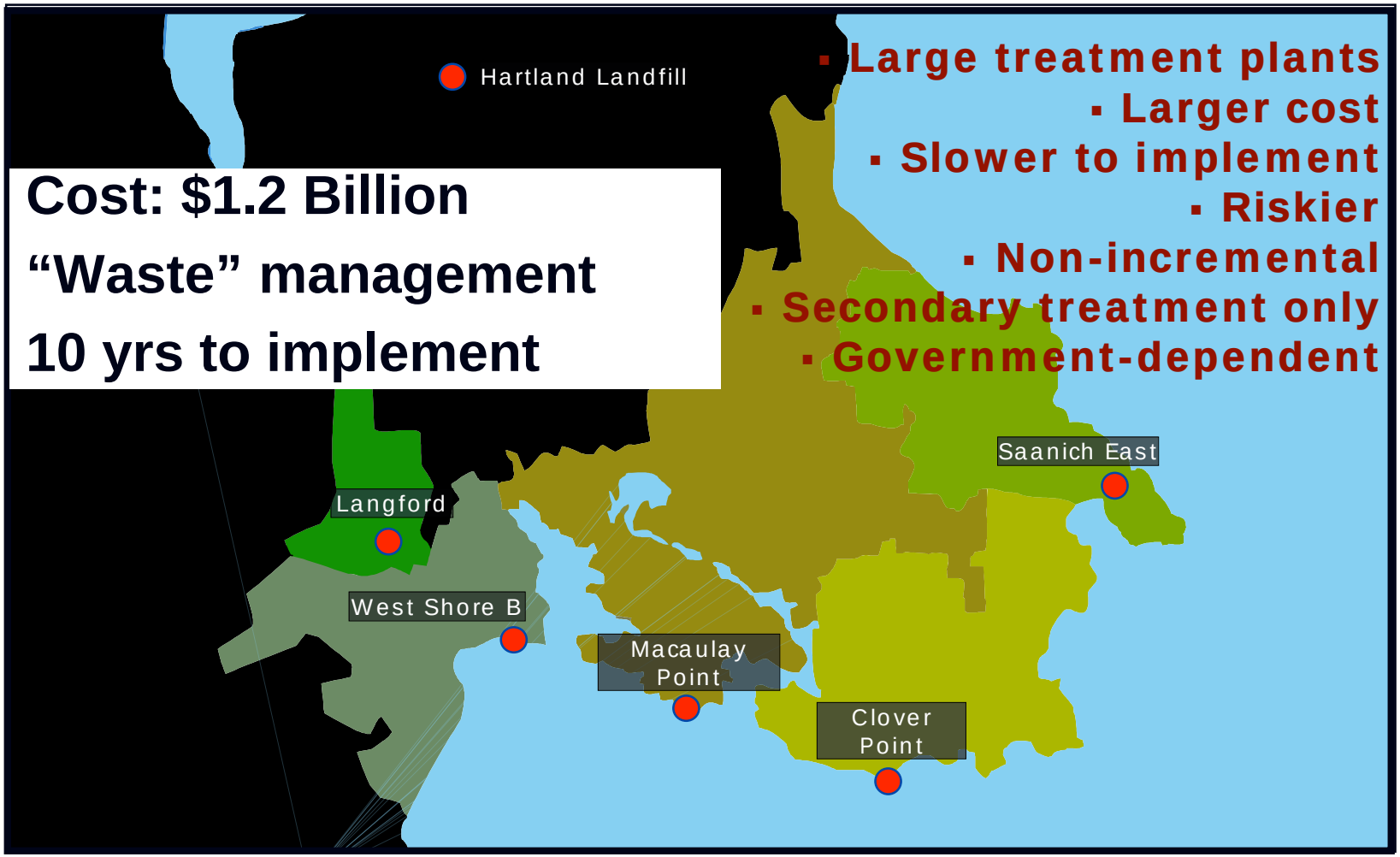
- Population 350,000 + growing
- No sewage treatment
- Provincial government order to treat sewage (plan by July 2007)
- Tabula Rasa- clean slate

Dockside Green

Traditional Sewage Treatment

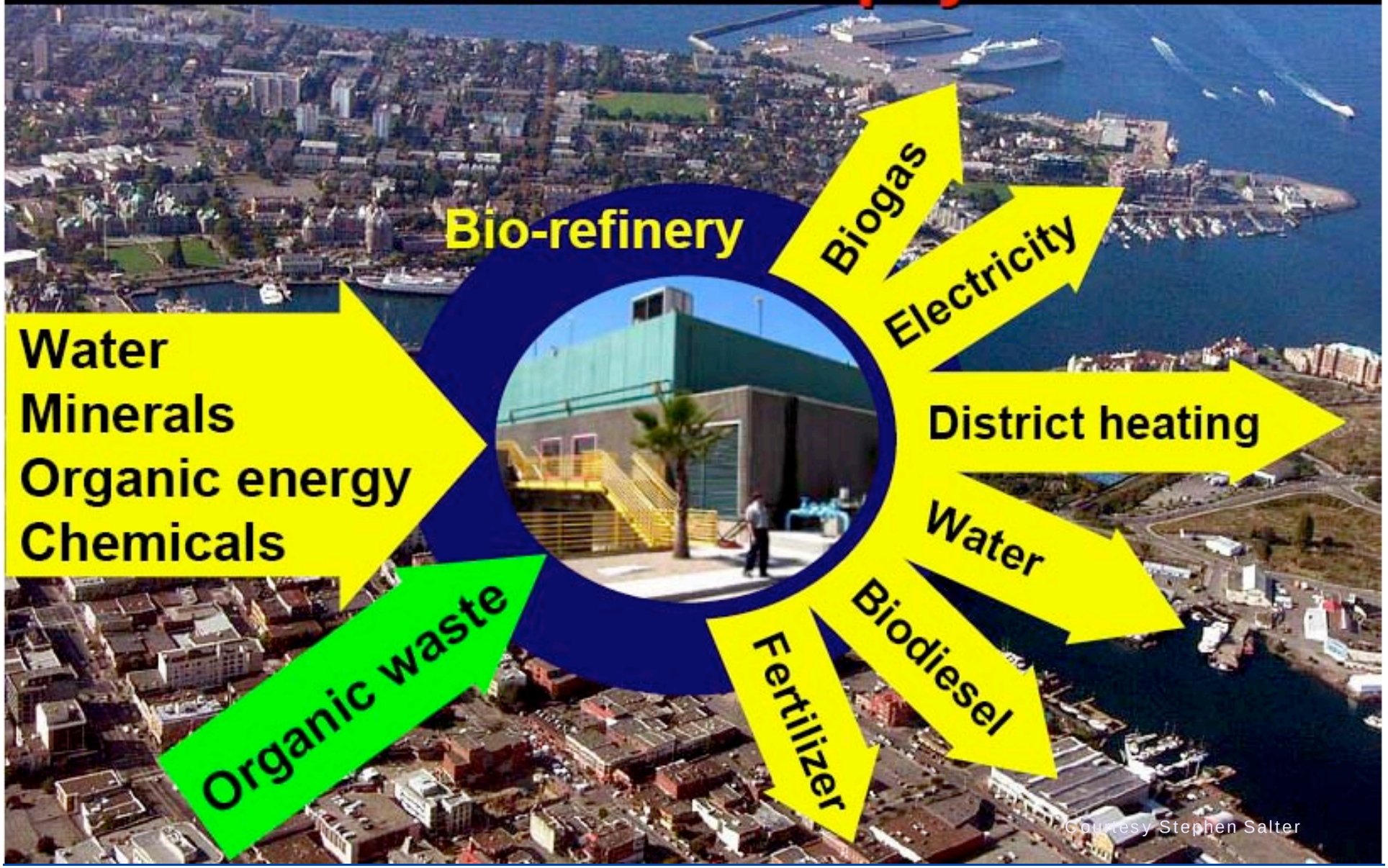


Locations: Traditional Approach



If our focus is the community

we'll make waste pay



Resources from waste

Biodiesel

Fuel

or

Electricity

Oil & grease

Biogas

District heating
& cooling

Sewage

Garbage

Treatment

Heat
pump

Disinfection

Water for
industry,
irrigation

Courtesy Stephen Salter

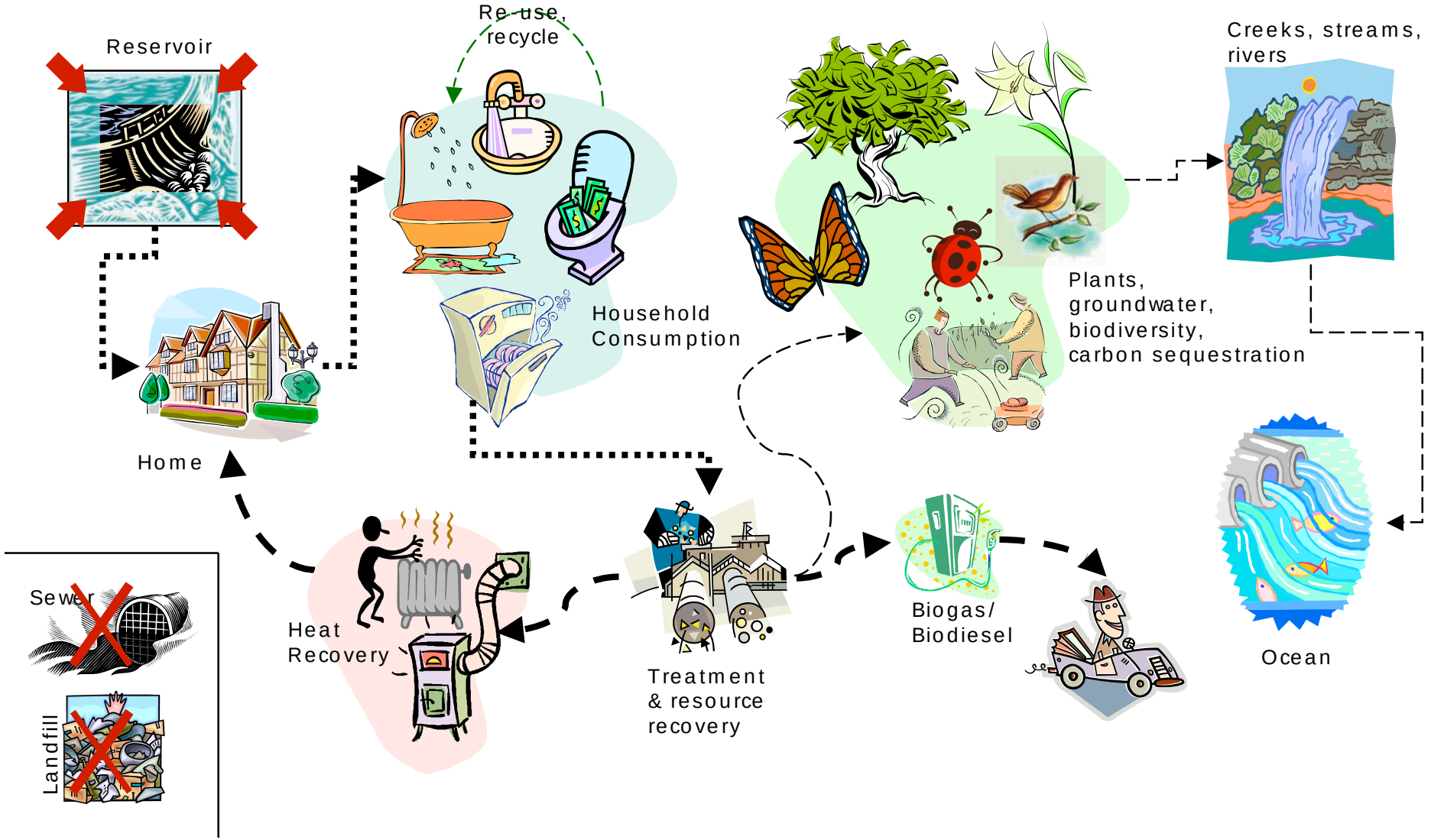
Courtesy Stephen Salter

Biogas runs 30 buses in Stockholm so far, and will increase the number to 200 by 2010, by producing more biogas from organic waste in the Henriksdals plant. Each biogas bus added in the inner city displaces an ethanol-powered bus to the suburbs, where a diesel-powered bus retires.

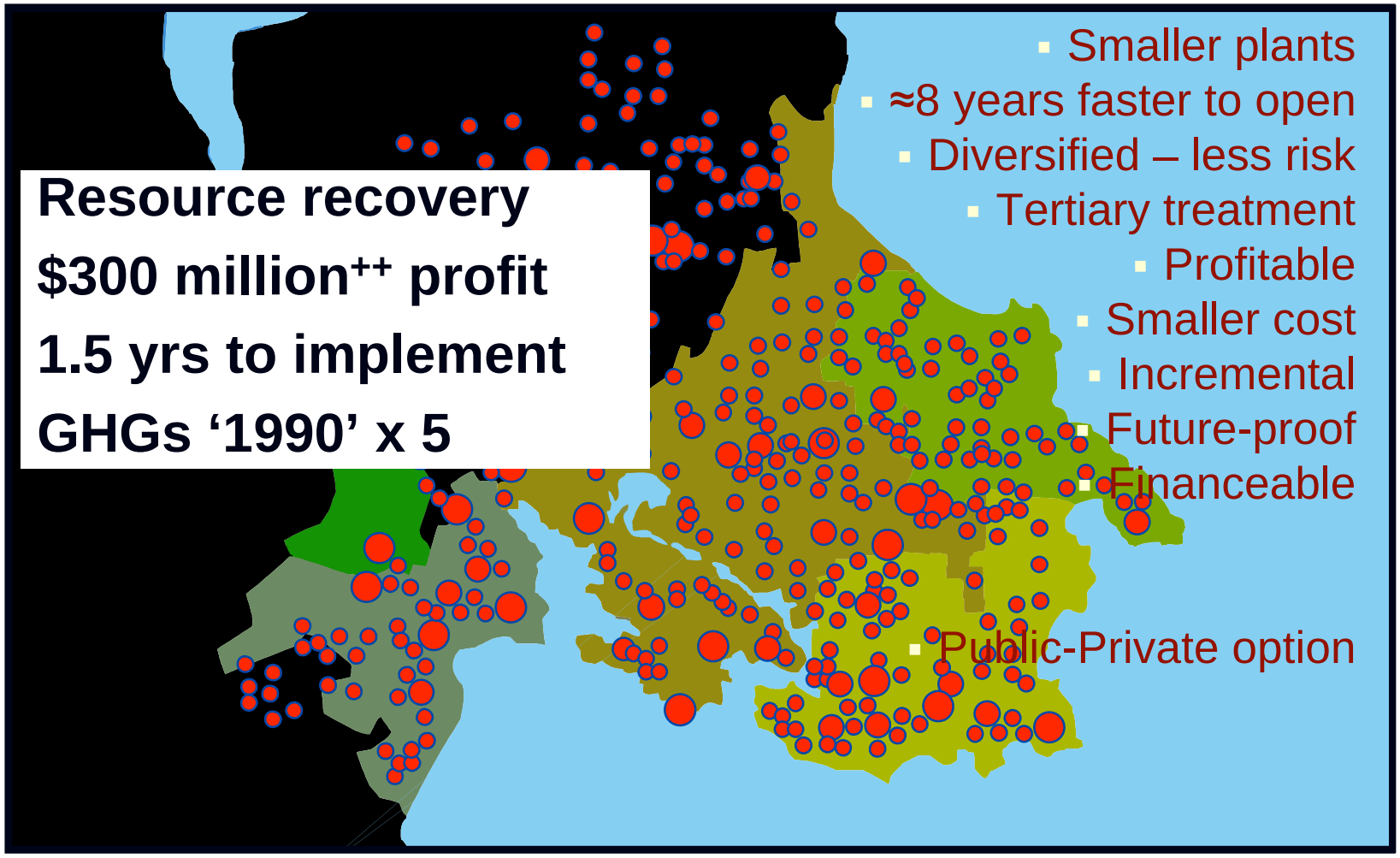
Stockholm's energy company (Fortum Energi) uses heat pumps to extract heat from treated sewage effluent to provide hot water and heating to 80,000 apartments, including the Hammarby Sjöstad development. After the heat has been extracted, effluent is just above freezing. This "coolth" is directed through a separate network of district cooling pipes for refrigeration and air conditioning. The sewage plant is paid for this energy as well as for their biogas, which helps offset the cost of treatment.

Gothenburg's energy company (Göteborg Energi) also uses heat pumps to extract heat from treated effluent, to provide hot water and heat to 36,000 apartments through their district heating pipes. Energy companies pay to insulate their clients' buildings, which allows more clients to be added to the district heating network. In this arrangement the interests of the energy company and the environment are completely aligned.

Integrated Resource Management (IRM)



Locations: Integrated Approach



Wastewater Approach: Financial Comparison

Traditional approach

Cost: $1.2bn

Integrated approach

Profit: $300m

Financial Difference [NPV]: +$1.5bn

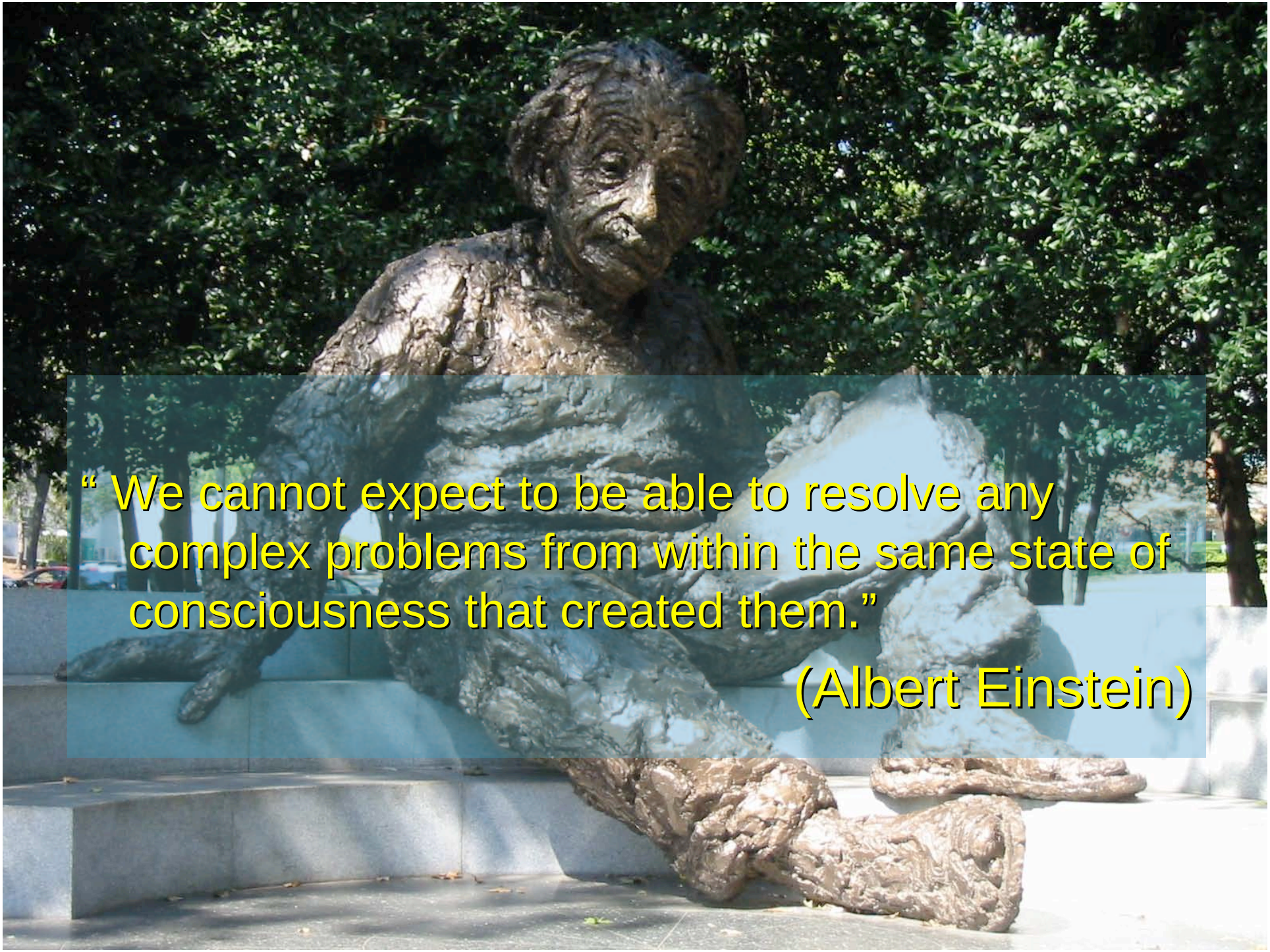
Barriers to Implementation

- Regulatory
- Governance
- Education

21st Century Imperative

- Integrated Resource Management (IRM)
  - Nexus Water-Energy
  - Integrate built form & Human behaviour
  - Valuation (make it profitable $$)
- Integrated Planning & Design
  - Water Plans
  - Energy Plans
  - Green Cities Initiatives
- Transformational/ Whole City Change ~~(Boutique)~~
- Climate Change Action Plans
  - Carbon offset monies ($ billions)
  - Valuation-based financial incentives
  - Political support for innovative strategies


Kazakhstan
Mongolia
Uzbek
Kyrgyz
Tajik
Pakis
rth Korea
outh Korea
Burma
Hong Kong
Sri Lanka
Brunei
Malaysia
Maldives
600,000,000 people in 30 years (UNDP, 2007)
China adding 625,000 cars to cities per **month**

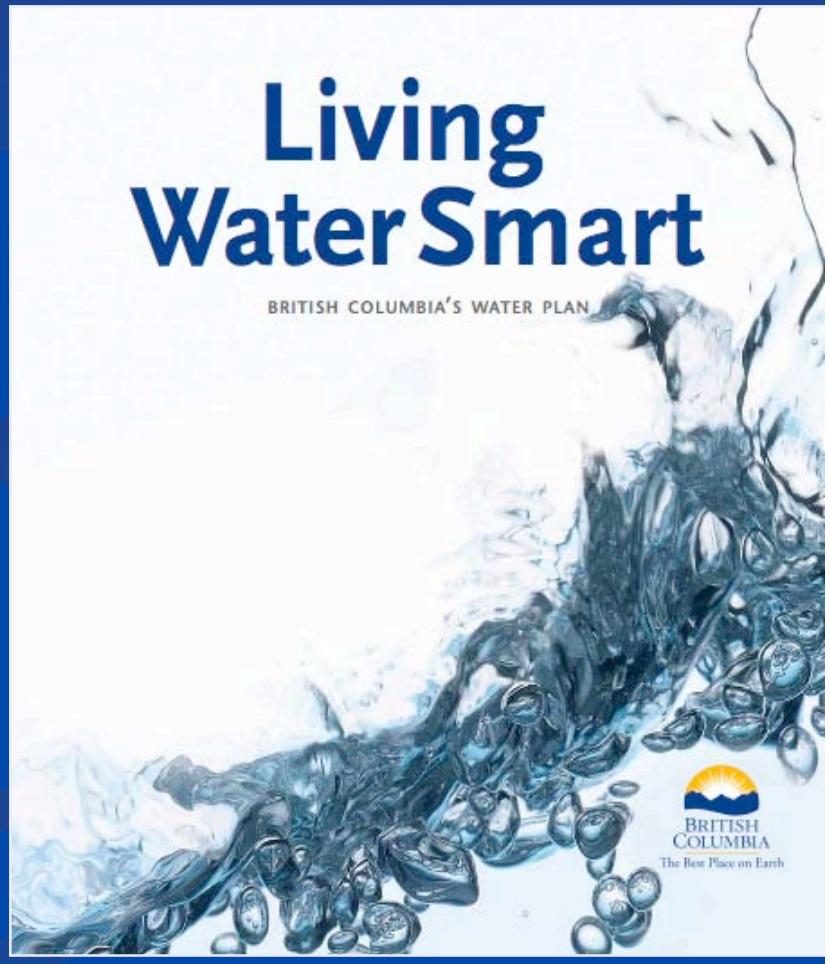

“ We cannot expect to be able to resolve any complex problems from within the same state of consciousness that created them.”
(Albert Einstein)

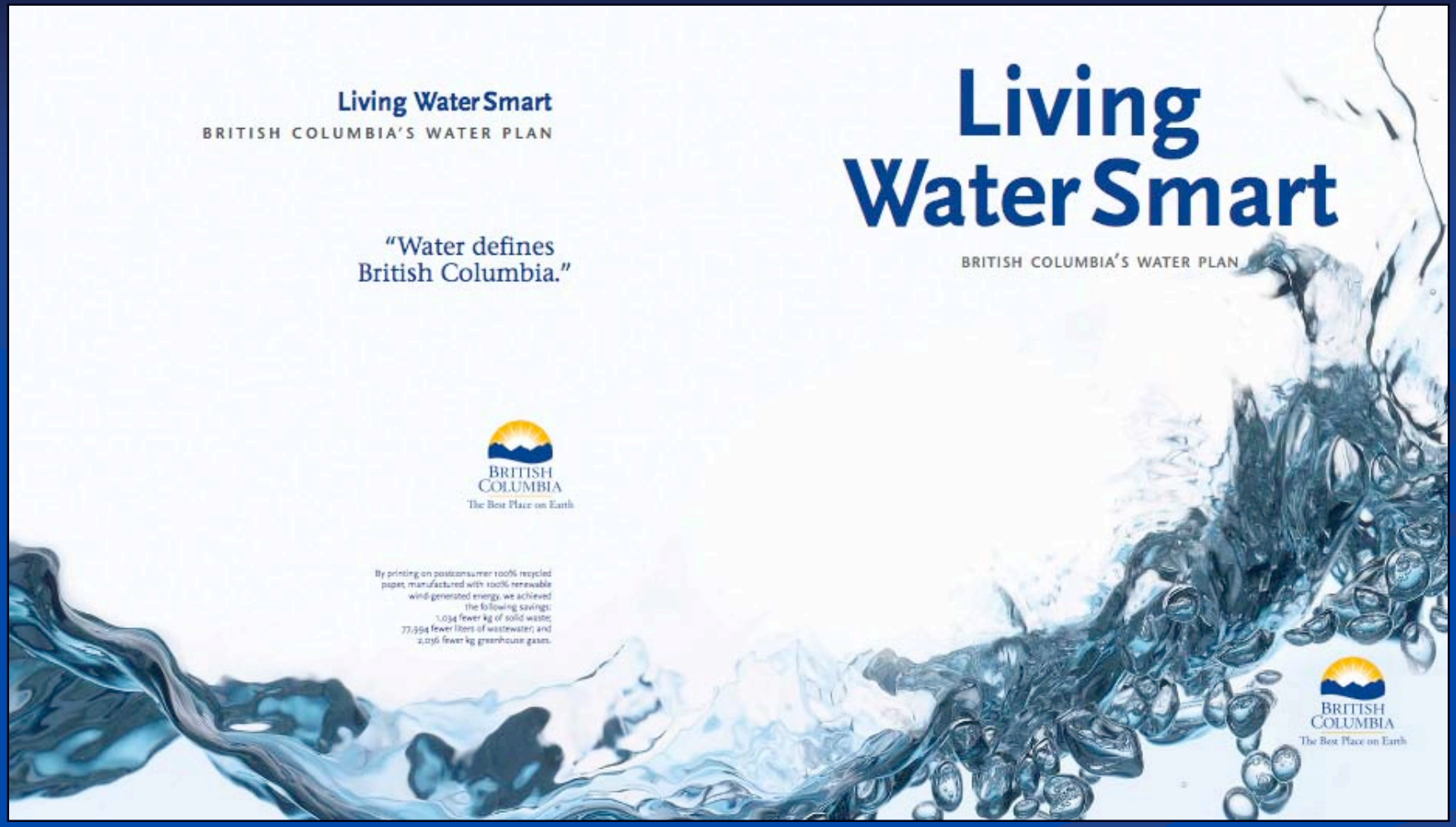
The Change We Need

"Vision, without implementation, is hallucination"

- General Colin Powell (ret.)

Imagination & courage




Living WaterSmart
BRITISH COLUMBIA'S WATER PLAN
"Water defines
British Columbia."
BRITISH
COLUMBIA
The Best Place on Earth
By printing on postconsumer 100% recycled paper, manufactured with 100% renewable wind-generated energy, we achieved the following savings:
1,034 fewer kg of solid waste;
77,394 fewer liters of wastewater; and
2,036 fewer kg greenhouse gases.
Living
WaterSmart
BRITISH COLUMBIA'S WATER PLAN
BRITISH
COLUMBIA
The Best Place on Earth

Traditional vs. Integrated Approach

Traditional

- Traditional approach only assesses costs, no revenues
- No heat recovery
- Solid waste treated as a “waste” not a “resource”
- Waste disposal in remote location
- Public funding (taxes)
- Build now for future needs (high upfront costs)

Integrated

- Integrated approach includes cost and revenues
- Heat recovery
- Biogas
- Reclaimed water
- GHG credits
- Nutrient recovery
- Resource re-use close to source
- Private sector partnerships
- Phased in- scaleable


• Nature’s Engineers were once present all over the world
• Beaver dams created lakes & wetlands
• Slowed runoff, captured sediment, captured nutrients, enriched soils
• Recharged groundwater
• Very diverse habitat

Valuing Ecology

"World Business Council on Sustainable Development has defined the crucial question of the 21st Century as – *how do we value Natural Capital (ecosystem services) in a free market economy."*

Bruce Sampson, VP, BC Hydro

"There is only one bottom line and it is profit … but with profit we can help satisfy the other bottom lines."

Tony Howard, VP, British Petroleum:
Globe 2006

APPENDIX E

INTEGRATED VISION FOR 21ST CENTURY CITIES

COLLINS WOERMAN

Integrated Vision

for 21st Century Cities

STEVE MODDEMEYER | COLLINSWOERMAN
smoddemeyer@collinswoerman.com

integrated vision

1) What cities can be
2) Traditional and soft path approaches
3) The Green Factor
4) Energy/water
5) Semi-autonomous buildings
6) Sustainable Infrastructure

Painting by Clayton James “Higgins Slough”

cities must adapt

- The world has changed
  - Climate change
  - Urbanization and growth
  - Energy costs
  - Infrastructure costs
- No longer acceptable
  - Dump carbon into the atmosphere
  - Allow pollution into water
  - Deplete natural and food resources
  - Waste energy

grayscape: pumps and pipes


Route of Upper Rouge CSO Tunnel, Detroit


Portland CSO Tunnel


King County Metro CSO Tunnel

soft path – green roofs

Ballard Library, Seattle Photo: Hydrotech

soft path – green alleys

VANCOUVER COUNTRY LANES: PHOTO FROM CITYFARMER.ORG

soft path – stormwater swales

PORTLAND BUREAU OF ENVIRONMENTAL SERVICES PHOTO: KEVIN ROBERT PERRY

soft path – living walls

FROM ECOSALON.COM PHOTO: ANN DEMEULEMEESTER

soft path – rainwater harvesting

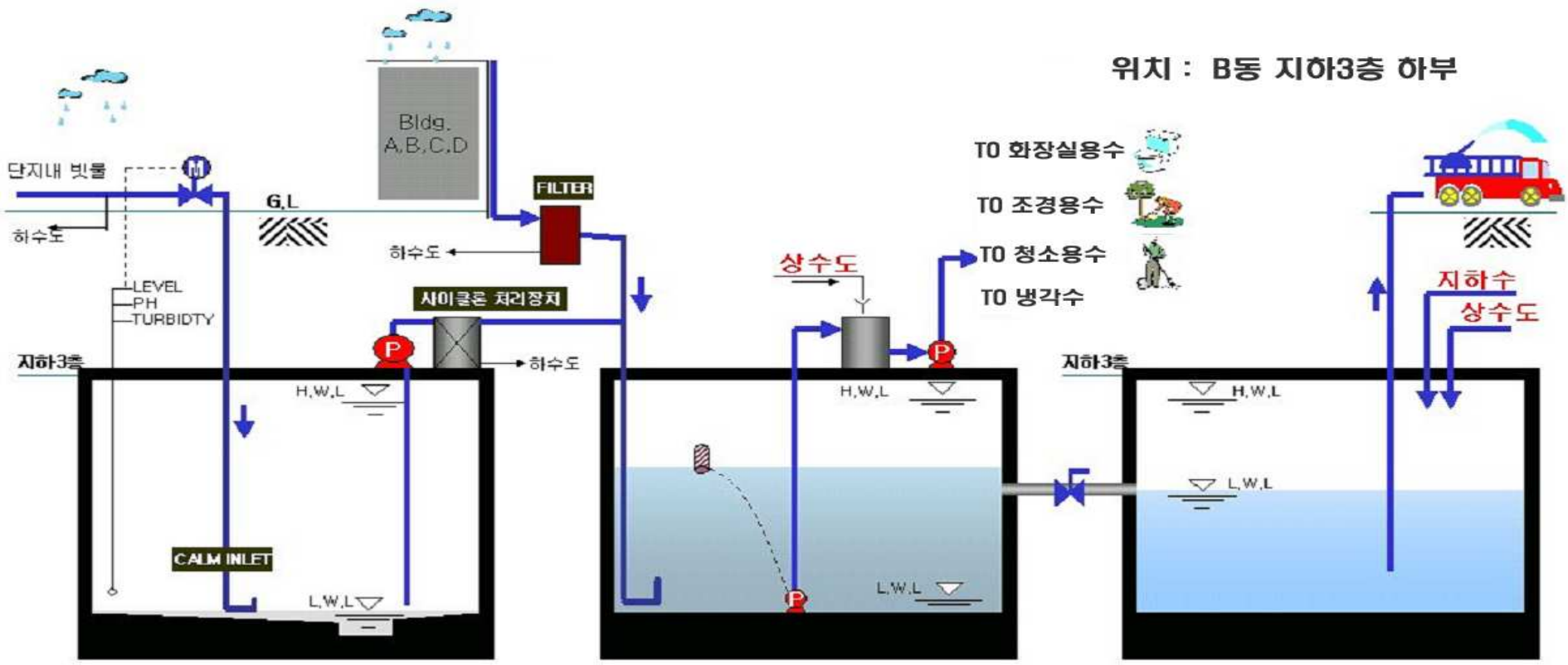
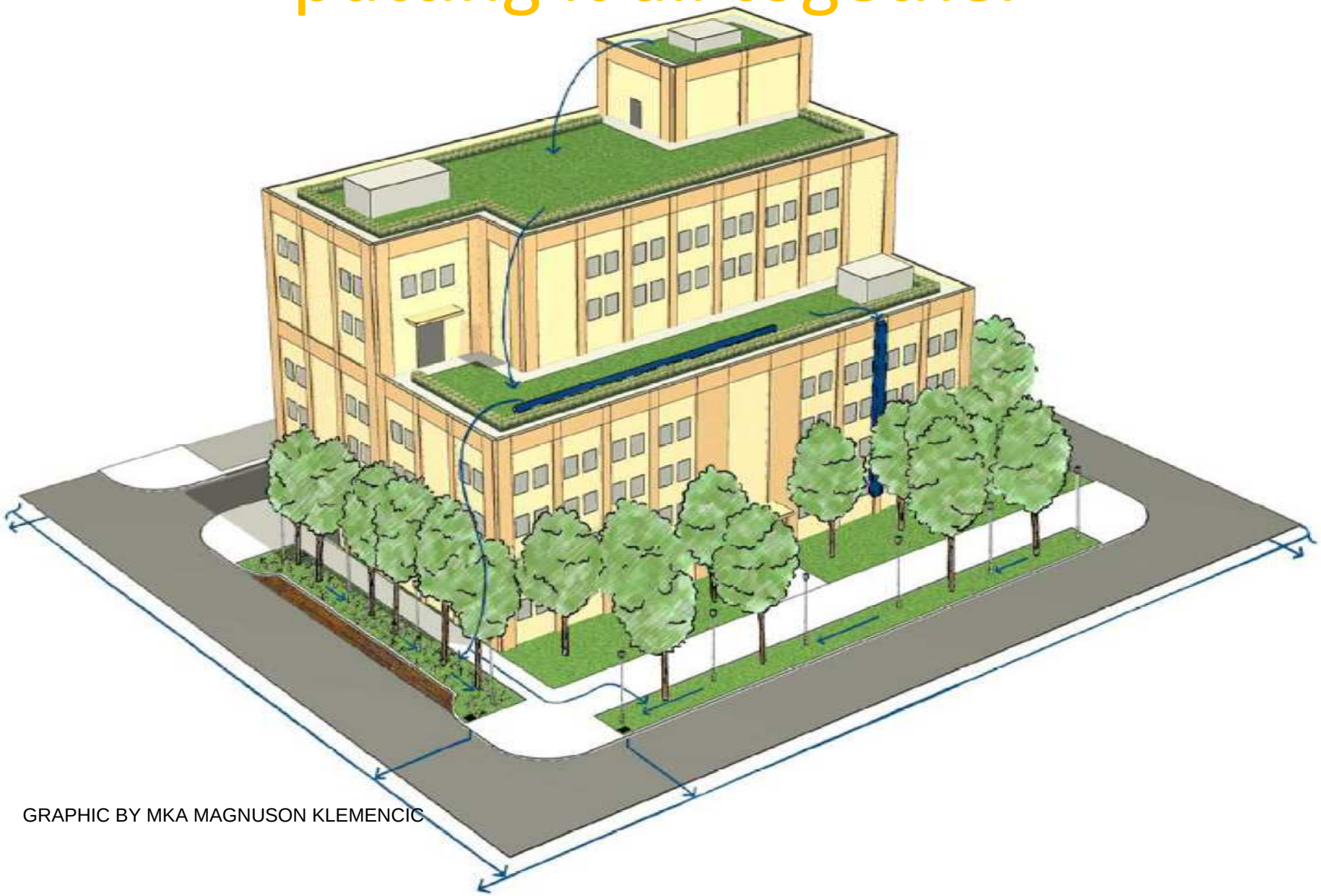


Image: Han Mooyoung, Korea National University

soft path – onsite wastewater reuse

Image: GreenPlayBook.org

putting it all together

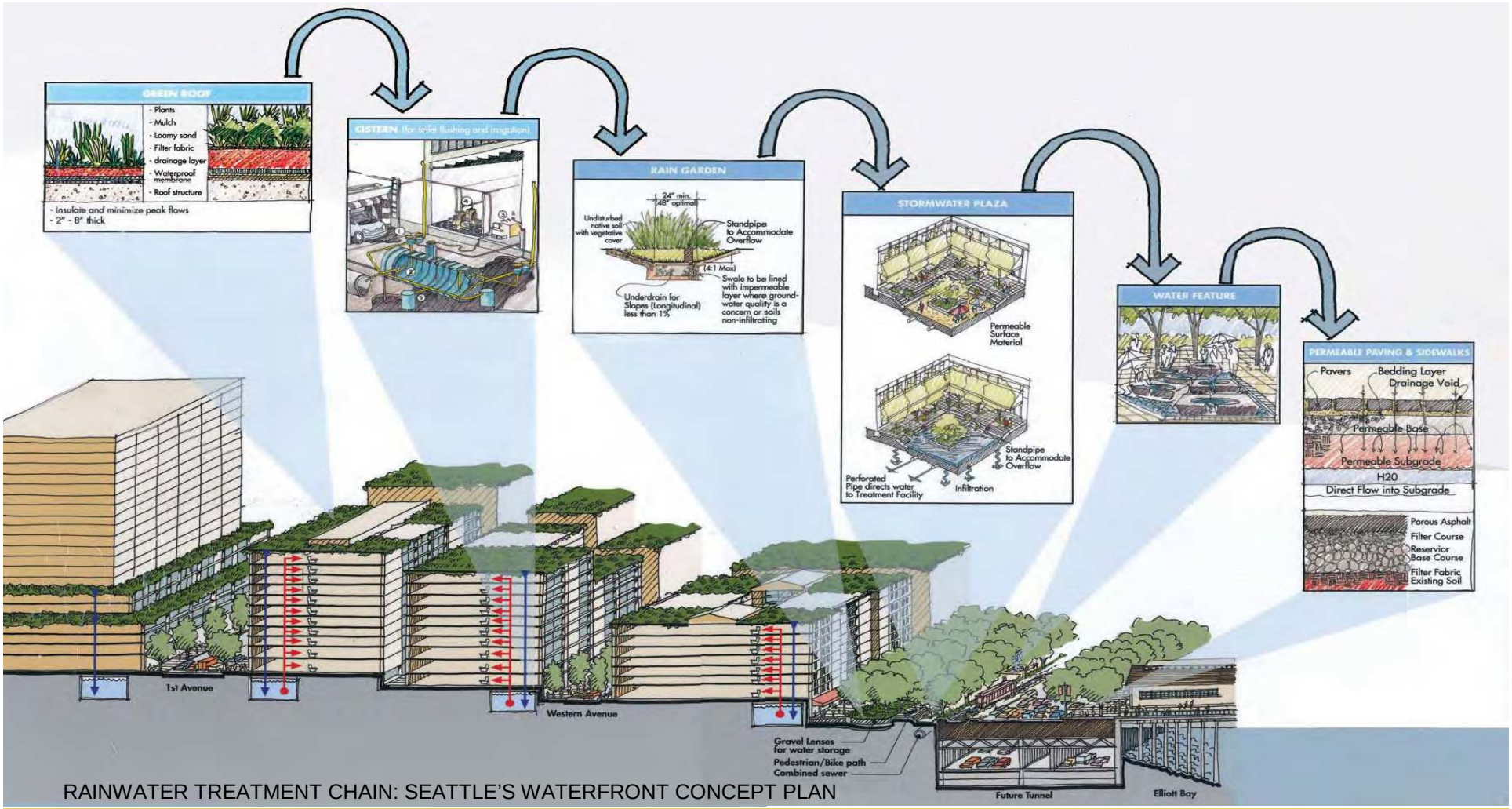


GRAPHIC BY MKA MAGNUSON KLEMENCIC

putting it all together

SKYSCRAPERCITY.COM RESIDENCE ANTILIA IN MUMBAI RELIANCE INDUSTRIIES ARCHITECTS PERKINS + WILL

rainwater treatment chain



RAINWATER TREATMENT CHAIN: SEATTLE'S WATERFRONT CONCEPT PLAN

San Francisco – low impact development

- Study shows CSO peak flow reductions from LID
- 5-yr storm down 10-14%
- Street trees and downspout disconnects most effective

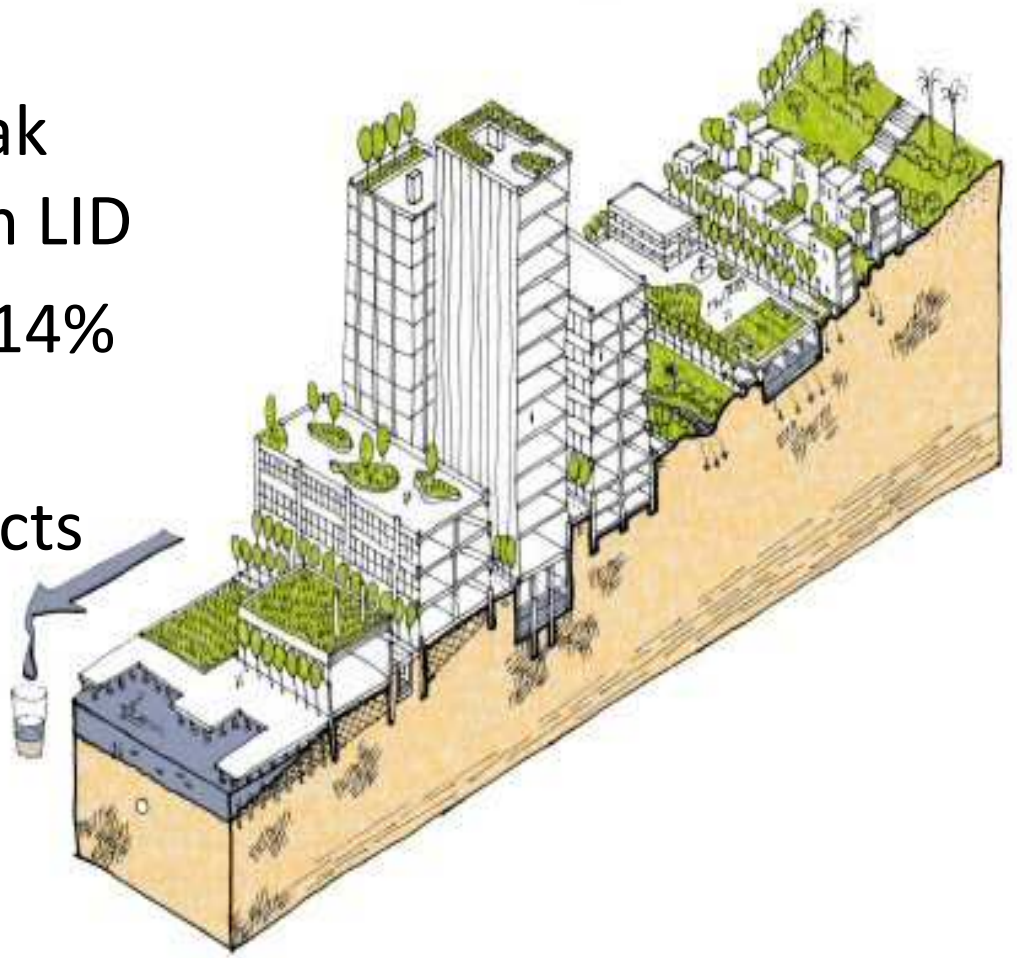
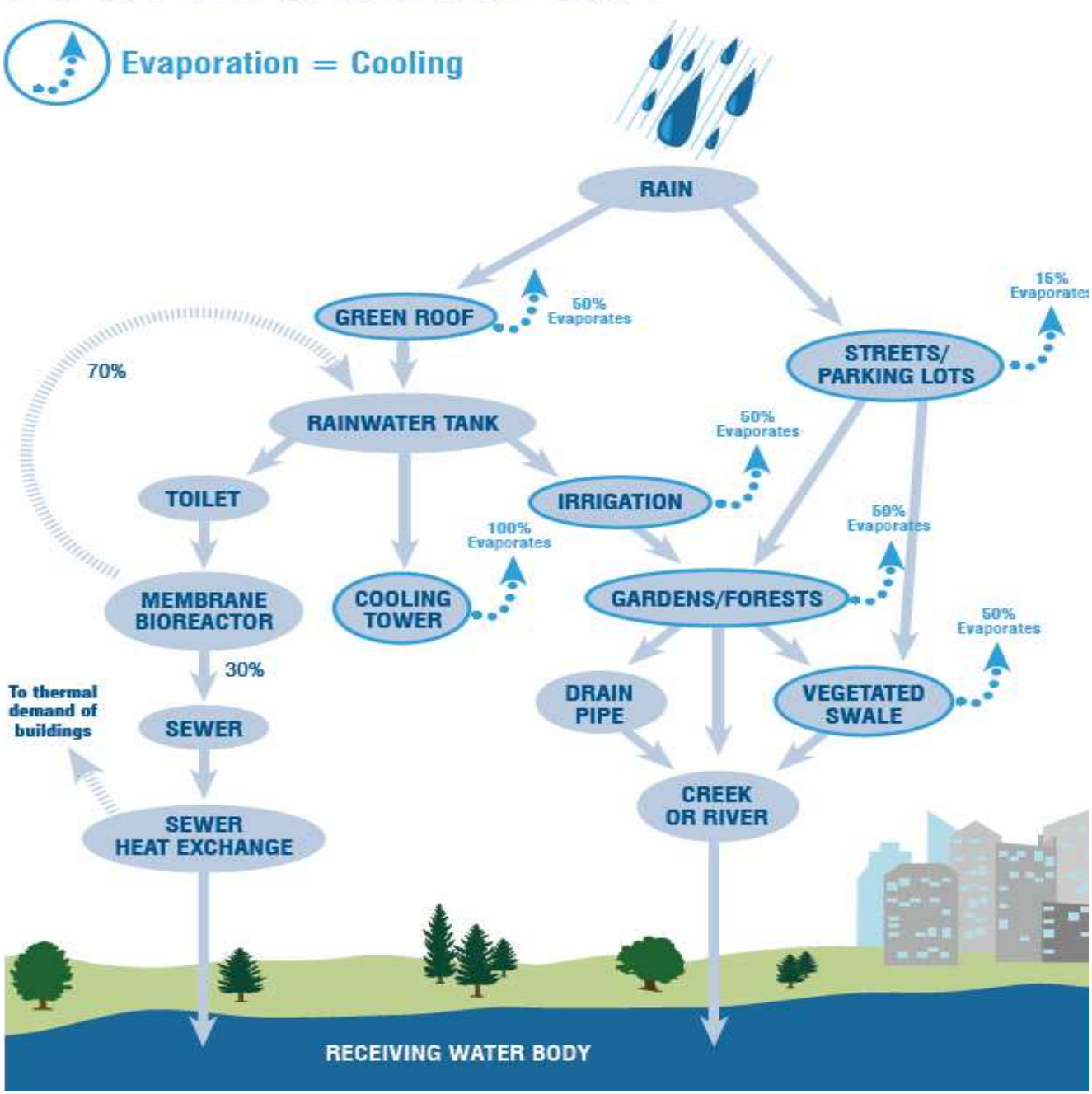
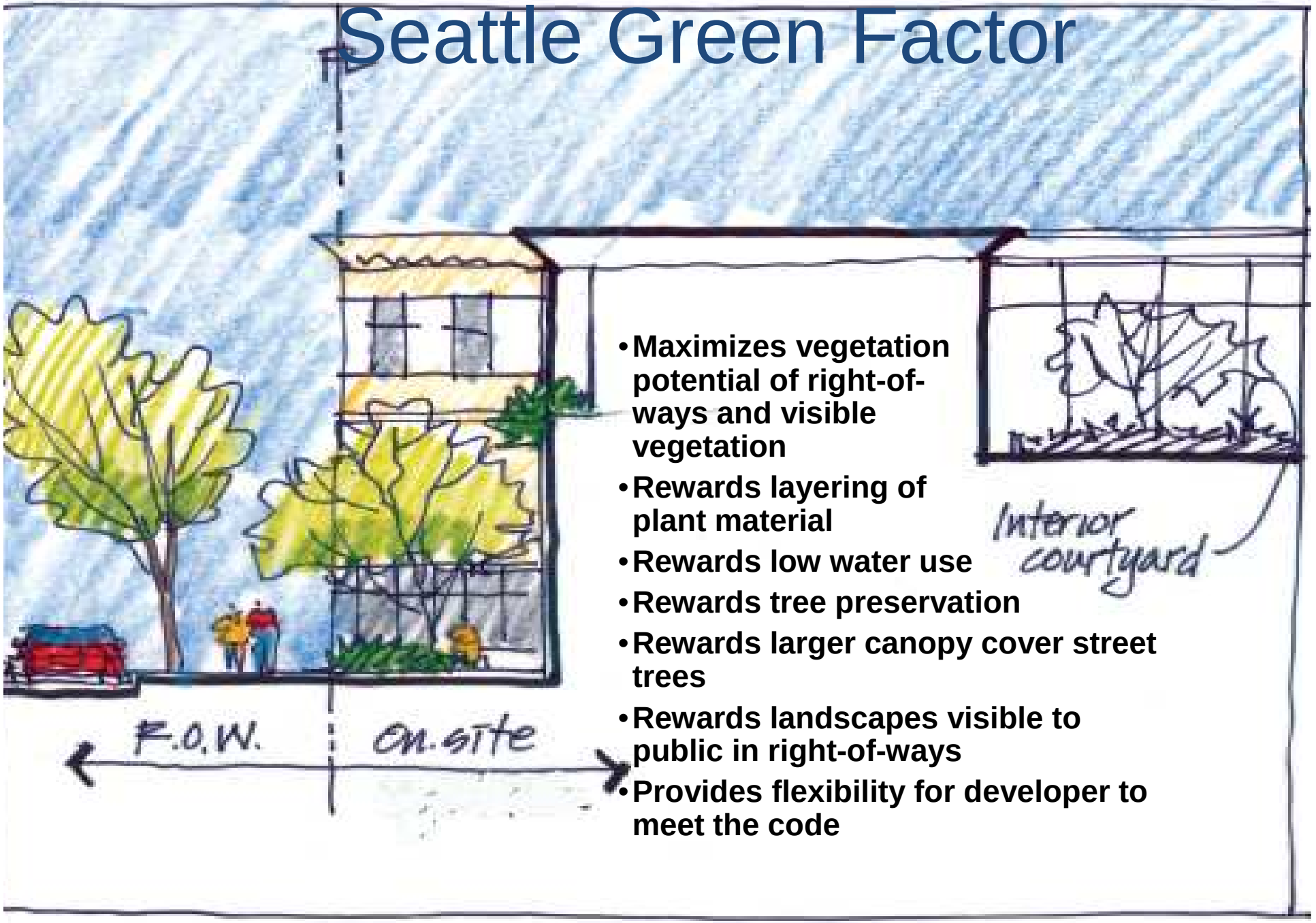


Image from City of San Francisco Water's Low Impact Development http://sfwater.org/detail.cfm/MC_ID/14/MSC_ID/361/MTO_ID/541/C_ID/3903

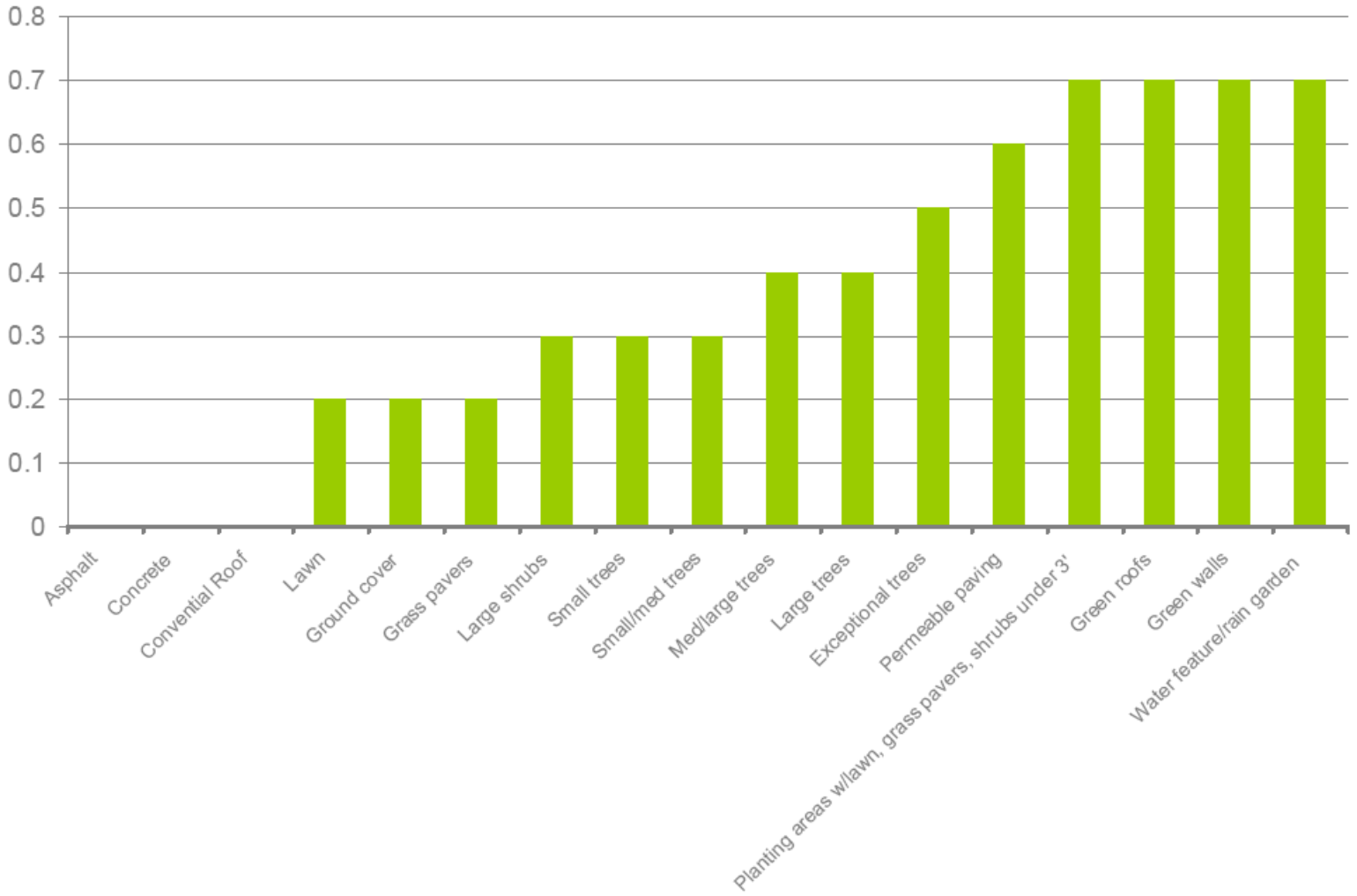

Evaporation = Cooling
RAIN
GREEN ROOF
50% Evaporates
15% Evaporates
STREETS/ PARKING LOTS
70%
RAINWATER TANK
50% Evaporates
TOILET
IRRIGATION
100% Evaporates
50% Evaporates
MEMBRANE BIOREACTOR
COOLING TOWER
GARDENS/FORESTS
50% Evaporates
30%
To thermal demand of buildings
SEWER
DRAIN PIPE
VEGETATED SWALE
CREEK OR RIVER
SEWER HEAT EXCHANGE
RECEIVING WATER BODY

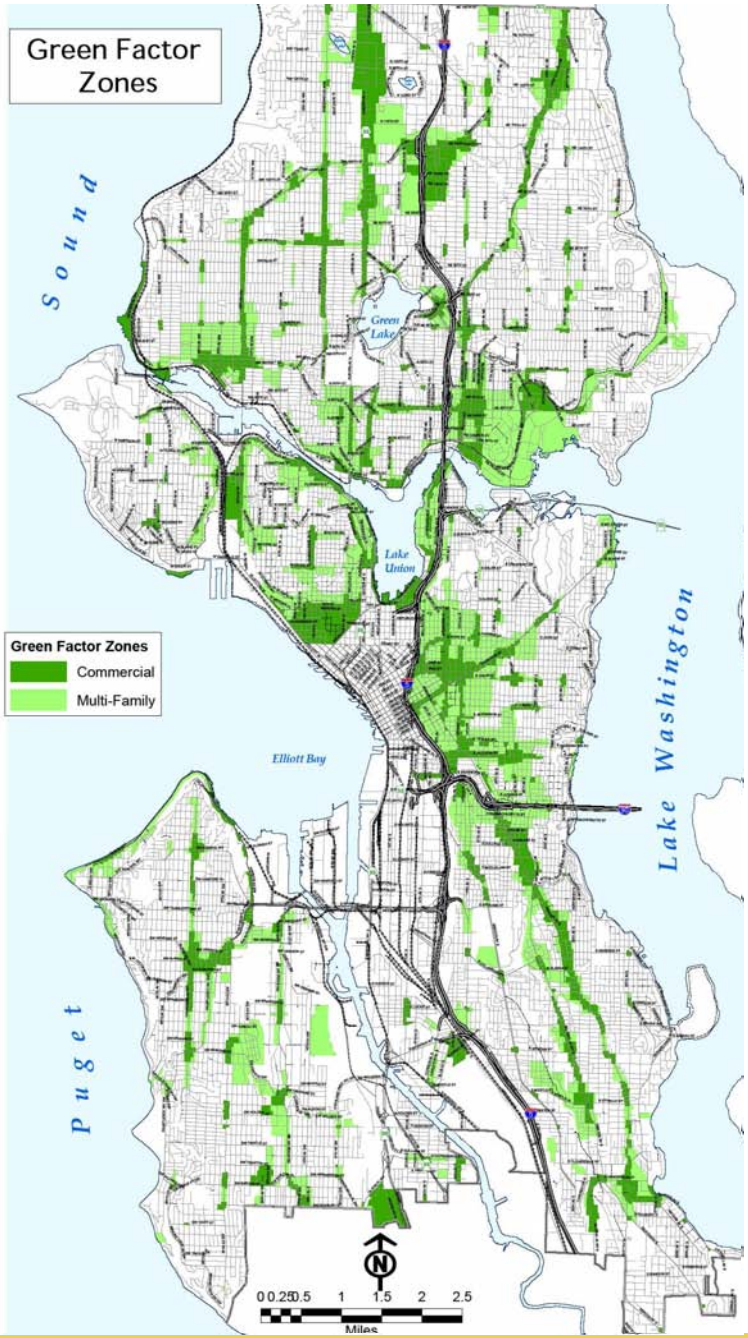
Seattle Green Factor



- **Maximizes vegetation potential of right-of-ways and visible vegetation**
- **Rewards layering of plant material**
- **Rewards low water use**
- **Rewards tree preservation**
- **Rewards larger canopy cover street trees**
- **Rewards landscapes visible to public in right-of-ways**
- **Provides flexibility for developer to meet the code**

SEATTLE / *green factor*




Green Factor Zones
Sound
Green Lake
Lake Union
Lake Washington
Elliott Bay
Puget
Green Factor Zones
Commercial
Multi-Family
N
0 0.25 0.5 1 1.5 2 2.5
Miles

Yesler Terrace - Seattle

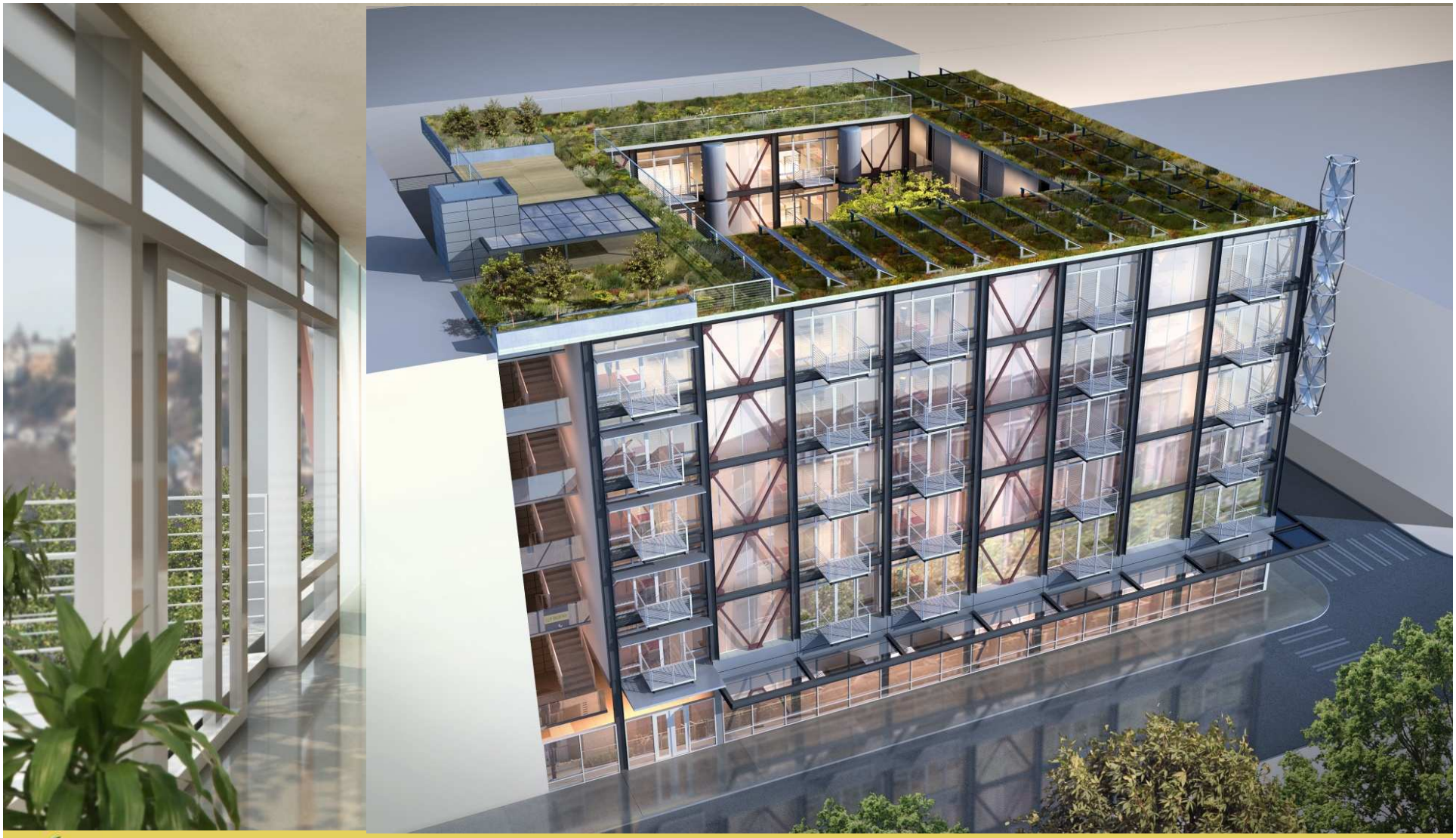
- 41 acres
- 561 housing units
- 3,000-5,000 housing units by 2020


Neighborhood center and market area
Neighborhood row house street
Medical office building/parking

energy/water study

Current Performance	Alternative Performance
Meet energy code	Net zero energy
Meet water code	Net zero water use
Extend combined sewers	Net zero wastewater
Install storm water ponds	Zero runoff
Install electric resistance heaters	District energy system
No maximization of daylighting	Daylighting maximized
Air conditioning	Natural ventilation
Landscaping for aesthetics only	Landscaping optimized for cooling and stormwater
Conventional transportation	Integration of electric cars
Conventional waste disposal	Zero waste

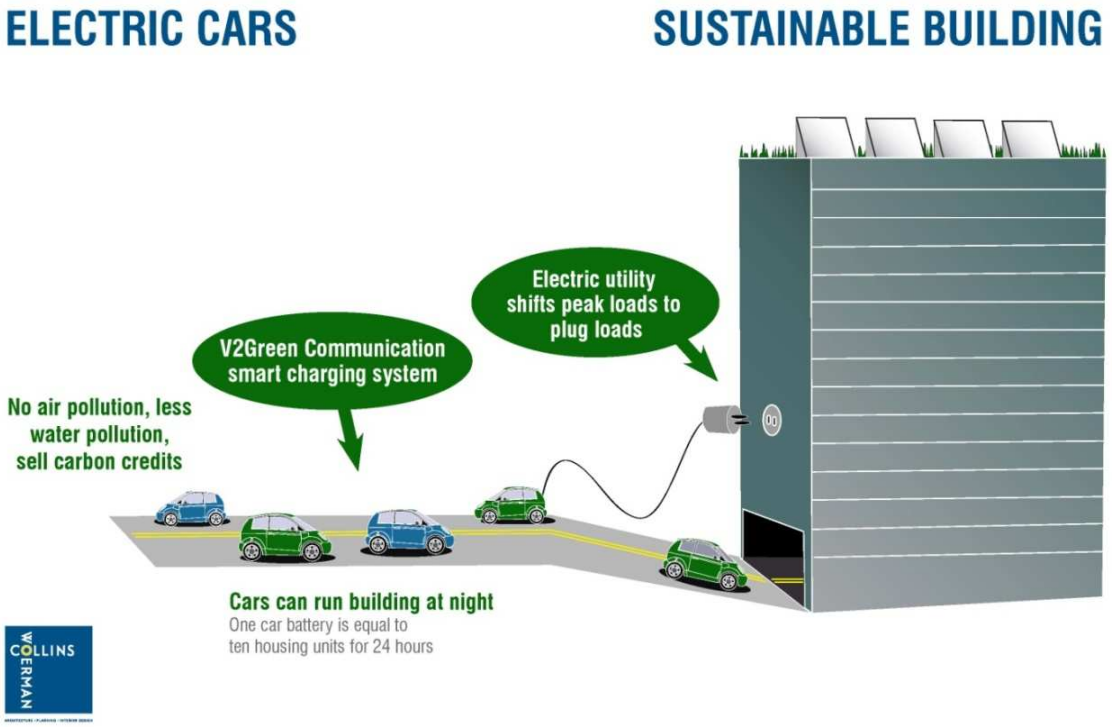
sustainable workforce housing



Moddemeyer: Integrated Strategies

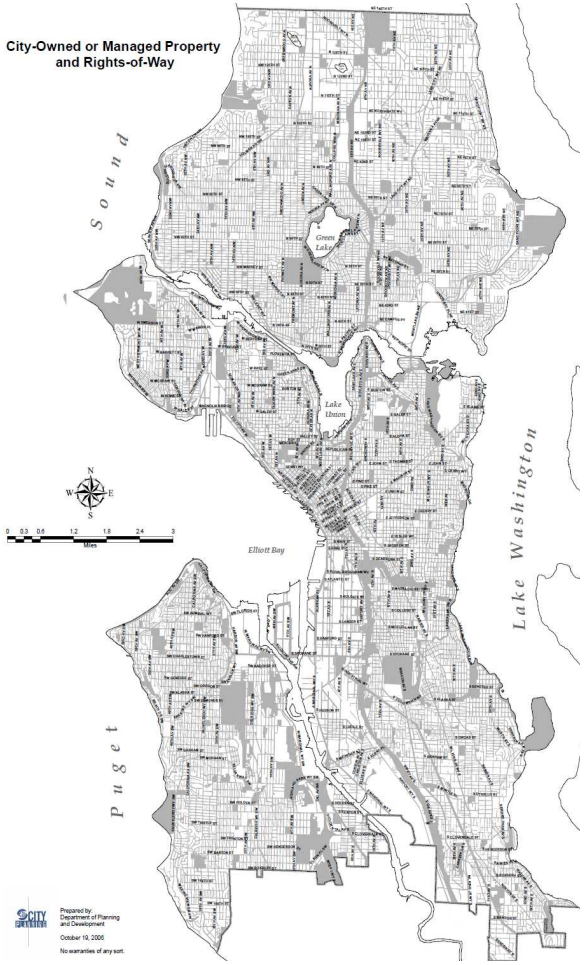
vehicle to building

- All-electric cars
- 1 car battery = 10 housing units for 24 hours
- Peak load leveling
- Shift pollution away from urban areas
- Can be used with “flex car” systems



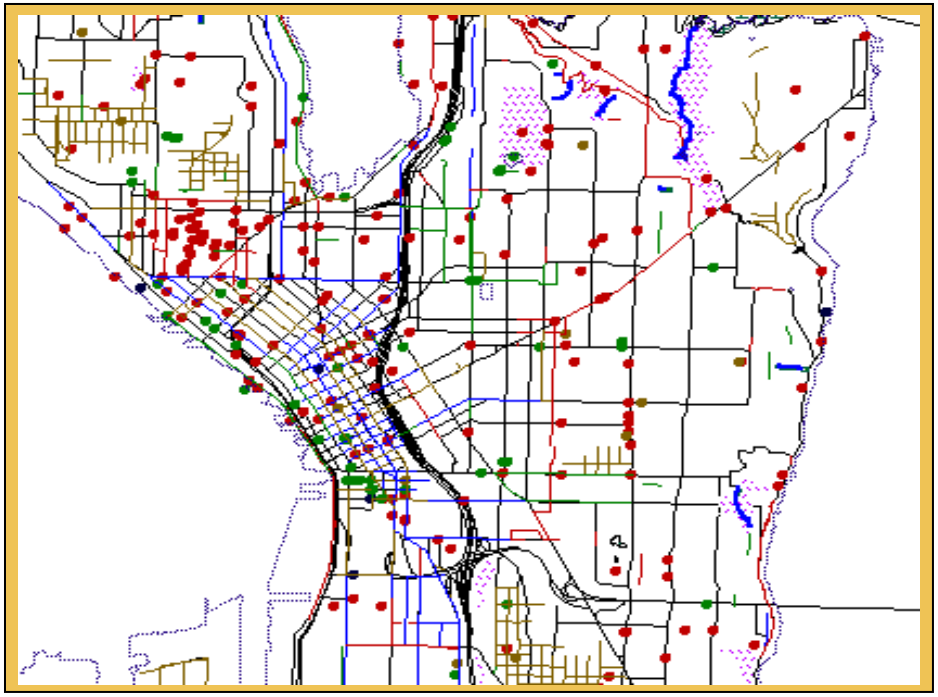
sustainable infrastructure

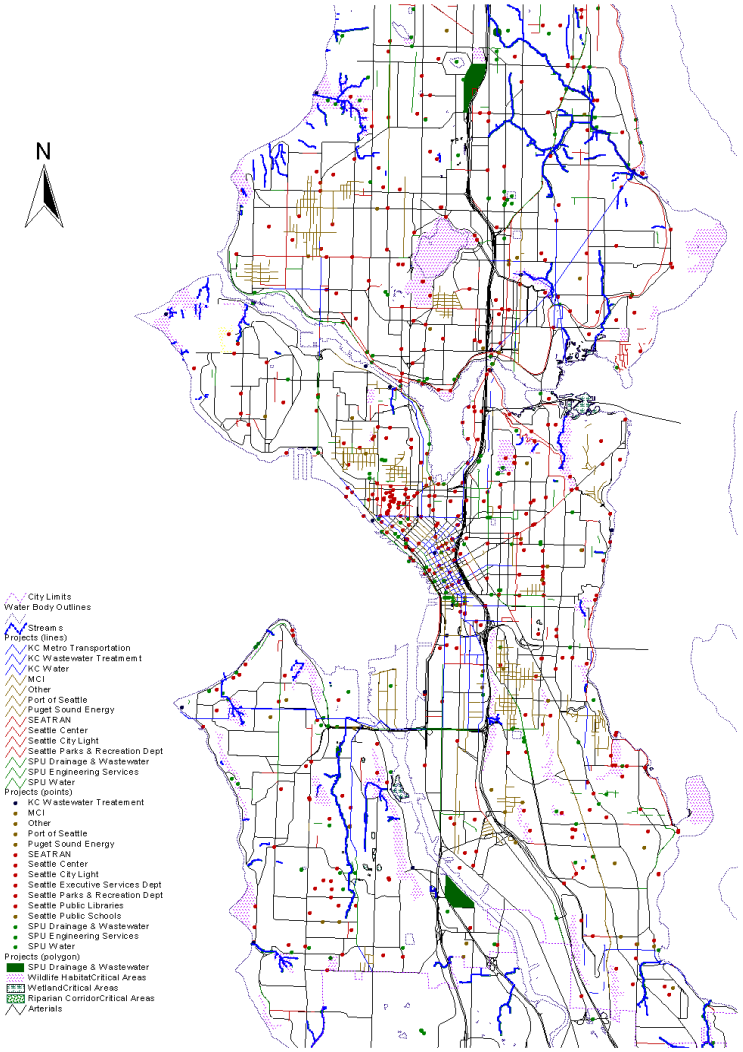
- The City of Seattle owns
  24 square miles IN the city



sustainable infrastructure

We spend much of $650 million each year to maintain and improve it.



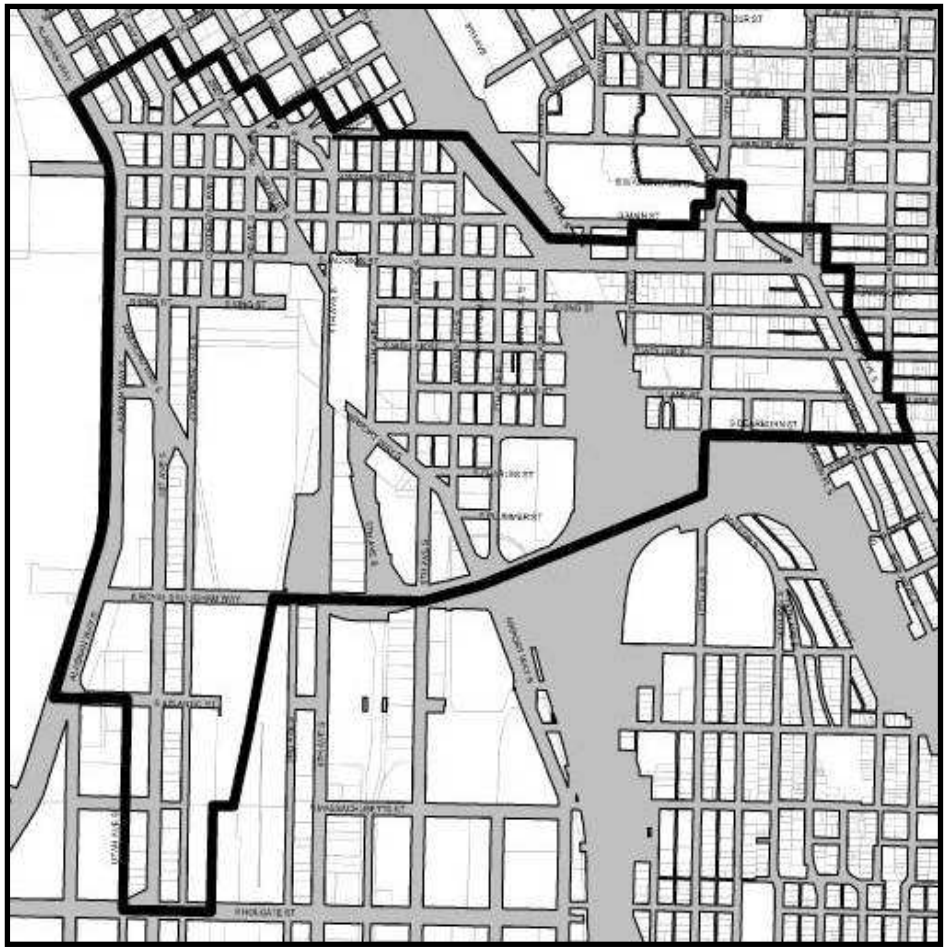


integrated urban ecosystem

Manage all public urban lands as an integrated urban ecosystem that

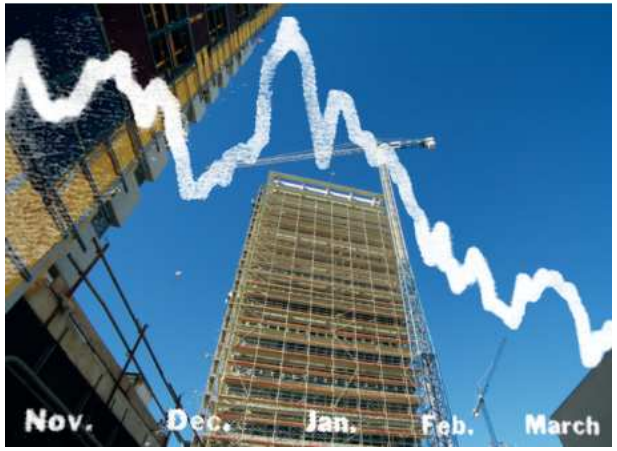
- *Provides mobility*
- *Open space*
- *Recreation*
- *Habitat*
- *Aesthetic beauty*

Use asset management and triple bottom line accounting to compare alternatives



capital spending can hurt you

- Build the wrong things
- Build the right things the wrong way
- Sink operations and maintenance money into infrastructure that will drain your resources year after year

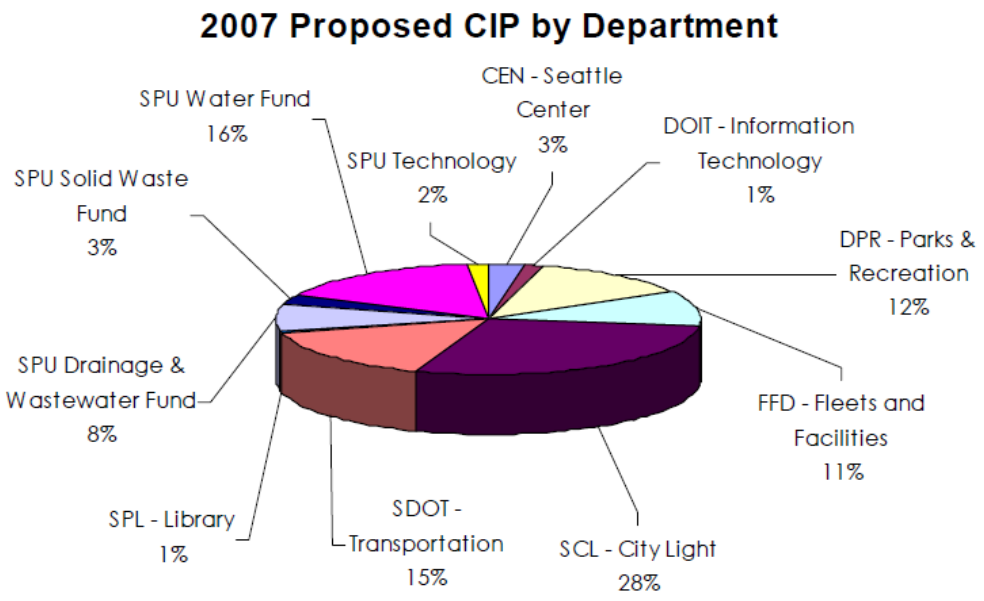


capital spending can HELP you

- Energy alternatives are now in play
- Energy efficiency is essentially free
- Low impact decentralized solutions can nest into centralized “legacy” systems
- Consider integrated alternative solutions that cross lines of business
- Demand that every dollar spent provide multiple services

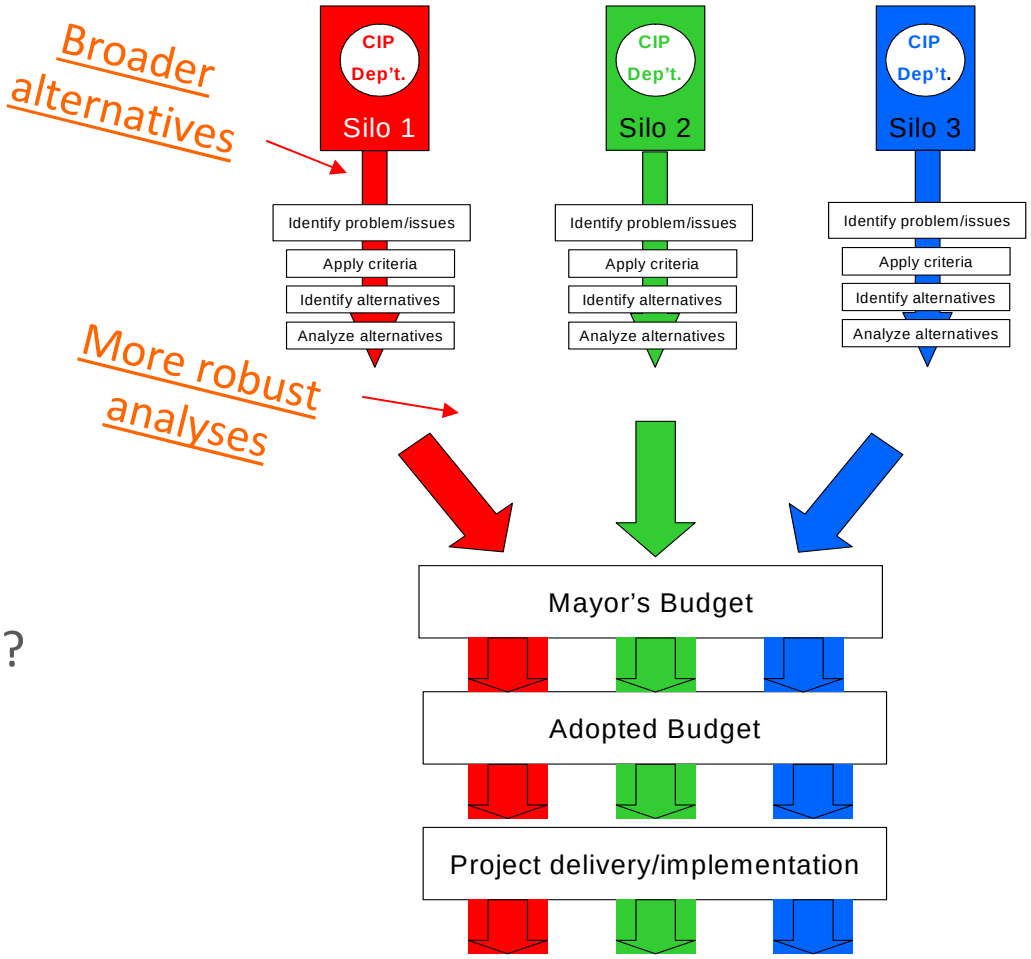
silo-thinking can preclude sustainability

- We tend to spend that money with a “silo” perspective because of tradition and funding restrictions



sustainability + asset management+ TBL

- Are we missing opportunities for sustainable investments because of we don't look broadly enough at alternatives?
- Can we apply asset management tools to sustainable projects to get more value per dollar spent?
- Can we use triple-bottom line accounting?

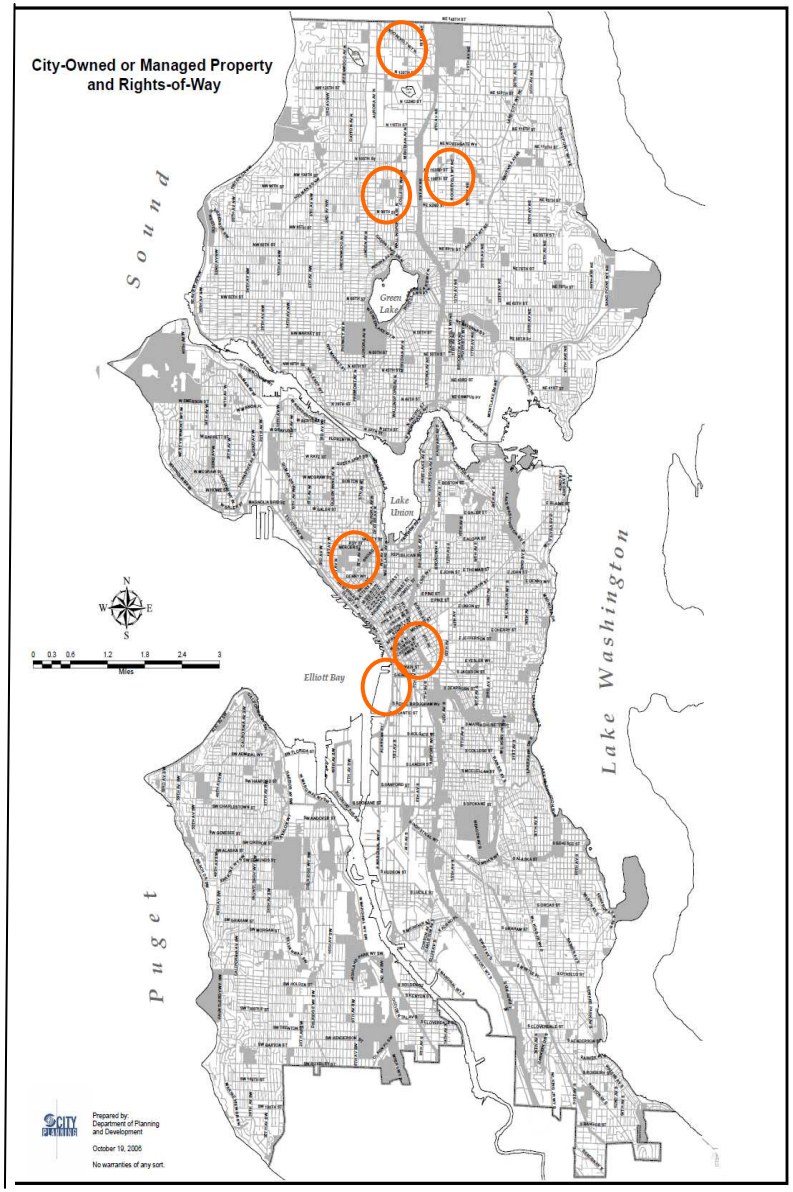


test the ideas

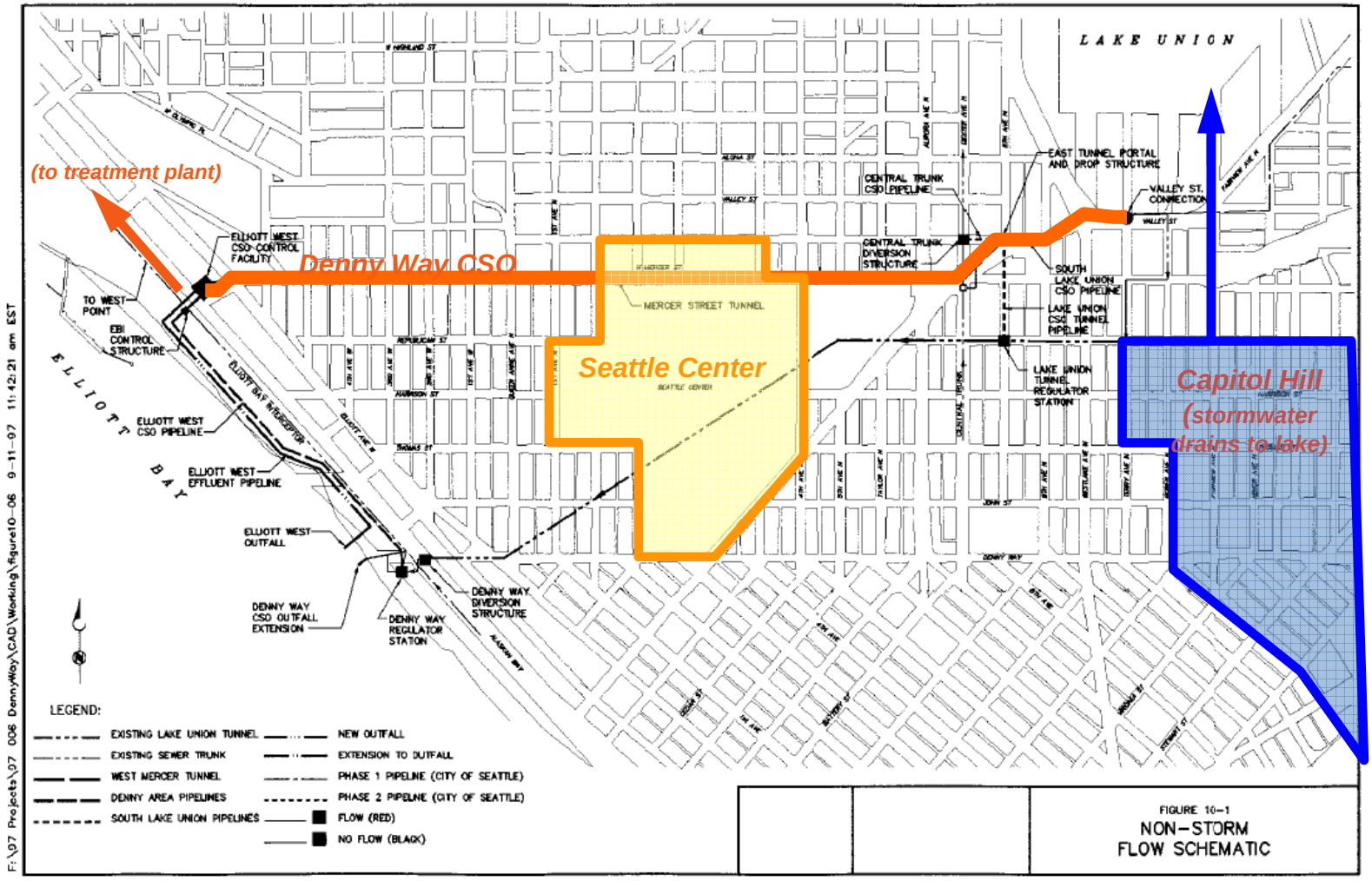
- Pilot projects
- Process alternatives

projects

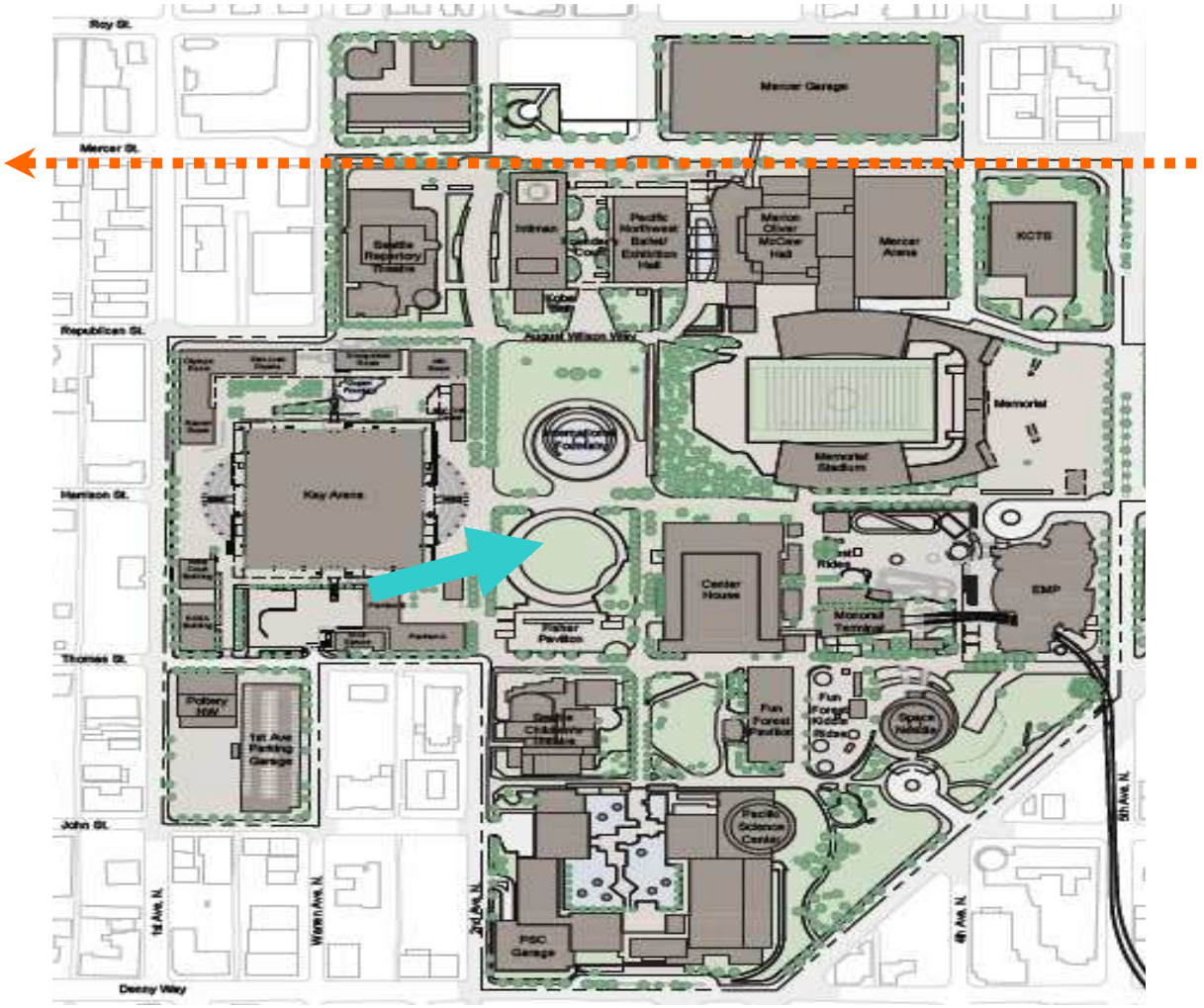
1. Swap polluted stormwater for clean Seattle Center water
2. Compare energy conservation in a district with new demands for shore-to-ship electricity to protect air quality
3. Consider underground voids in historic Seattle for stormwater collection and reuse
4. Evaluate stormwater treatment facilities as a fundamental design element to a new city park
5. Re-imagine mobility strategies for a neighborhood with multi-family growth but no sidewalks
6. Re-purposing water supply reservoir surfaces for urban agriculture or other neighborhood needs



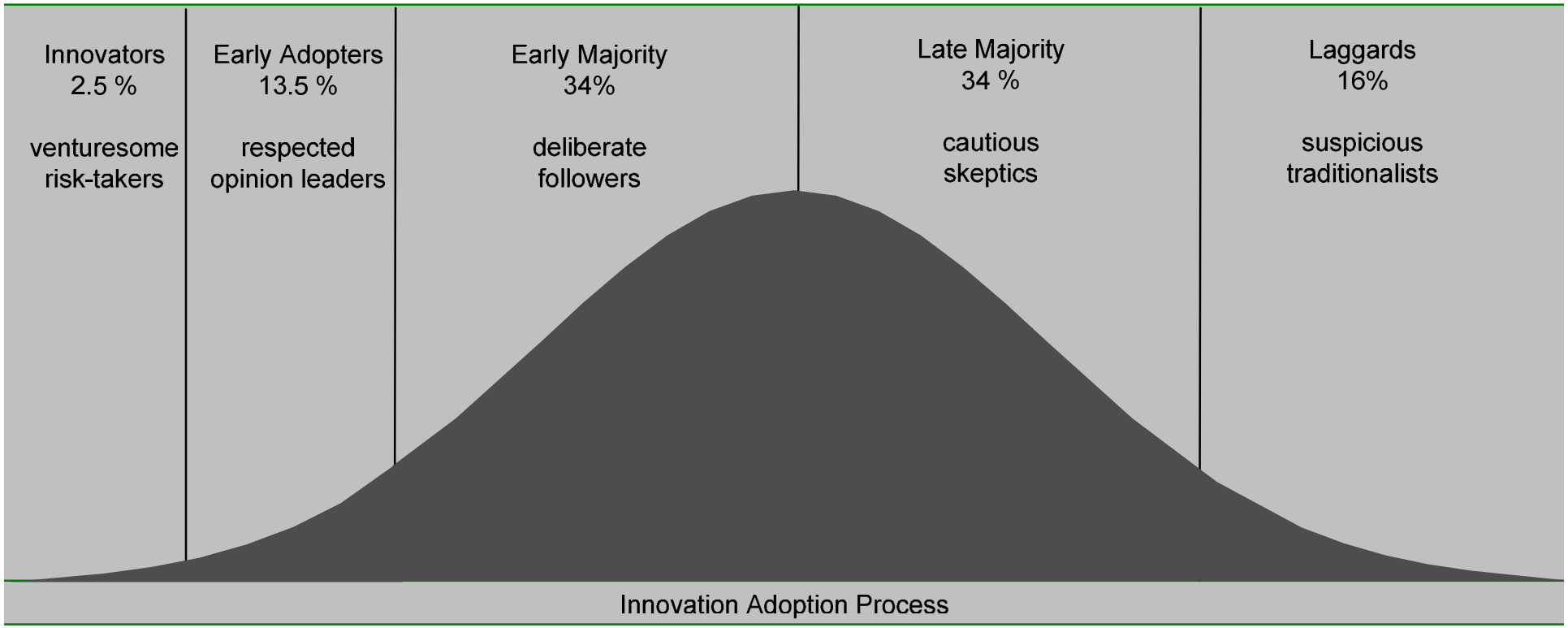
Seattle Center water swap



Seattle Center water swap



innovation adoption



after Everett M. Rogers, Diffusion of Innovation, 2003


Thank you!

APPENDIX F

THE FEDERAL ROLE IN BUILDING A 21ST CENTURY WATER INFRASTRUCTURE

The Federal Role in Building a 21st Century Water Infrastructure

Valerie I. Nelson

February 25, 2009

Current governance -- public health and “industrial” engineering

- Modern sanitation and safe drinking water achieved through centralized distribution or collection
- Regulations and subsidies for sewers and water lines, “siloed” functions and economies of scale
- Incrementally-tighter requirements for nonpoint sources, effluent quality, and flow/quantity
- The model perpetuates environmental damage, wastes resources, and thwarts innovation

Governance for 21st Century Water Management

- Goal for a lighter, healthier “footprint” in the Commons – restoration of hydrological flows and habitat, energy use, climate change, resilience, nutrient recovery, evaporative cooling, re-hydrating land
- Value added to communities and economy – parks, air quality, beauty, local food, green jobs, new products and companies

New engineering and architectural design – complexity at all scales

- Integrated and multi-purpose
- “Networks” of centralized and decentralized
- Infrastructure embedded in buildings and neighborhoods – “eco-blocks”
- Green infrastructure – natural systems providing ecosystem and social services
- Repurposed centralized systems – e.g., potable water only, heat recovery, storage, reuse

Governance to support and set standards for the new paradigm

- Short-term: reduce current barriers – expand eligibilities, require integrated planning
- Long-term: identify “externalities” and opportunities for added value – at all scales
- Target incentives and mandates based on likely responses, equity concerns, and other market failures

Research, Development, Demonstration – a classic "public good"

- Cutbacks in traditional federal role in water infrastructure research started in 1980's
- Private research fell in parallel
- Other countries have substantially higher funding, e.g. $200 million Singapore/MIT partnership
- Office of Science and Technology Policy recommends a renewed focus on inter-agency water research

Market transformation strategies – add to the “green energy” model

- National standards – unify fragmented state and local ordinances and markets
- WaterSense labeling programs
- Requirements in public buildings – including schools, multi-family housing, military bases
- Clean tech venture capital funding
- Tax incentives for builders and homeowners
- Bulk purchasing for municipalities
- Ecosystem services markets and trading

Future statutory reform

- Integrated municipal infrastructure – water, energy, transportation, green space, building and street designs, etc.
- Block grants and integrated planning
- Adaptive management -- continuous improvement and “emergent design” (set performance goals)
- Comprehensive watershed or regional management – water quality and quantity, ecosystem and social benefits

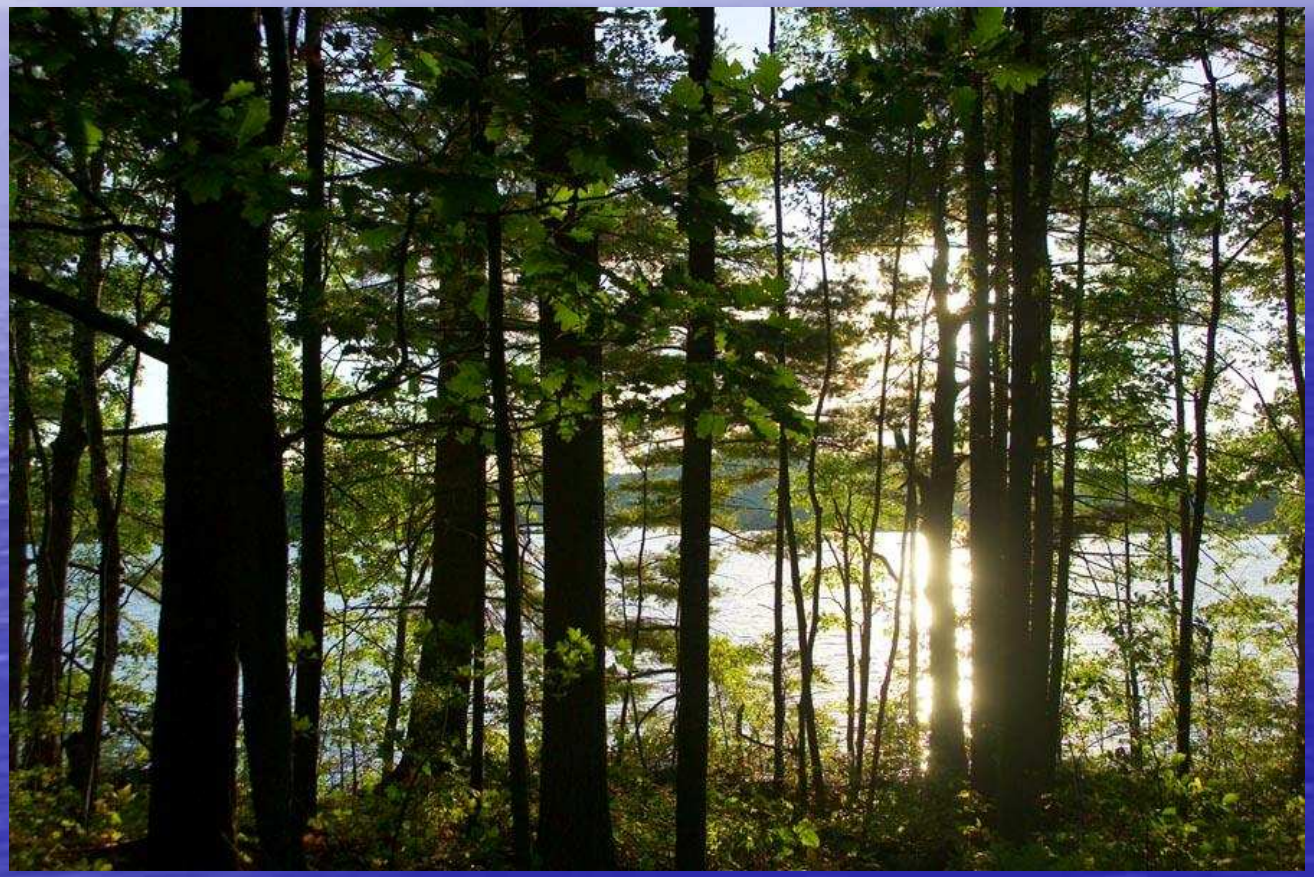
APPENDIX G

WATER FOR THE 21ST CENTURY

Water for the 21st Century

Paul Schwartz
Vermont Law School
July 23rd, 2009
www.Cleanwateraction.org

Original Green Infrastructure

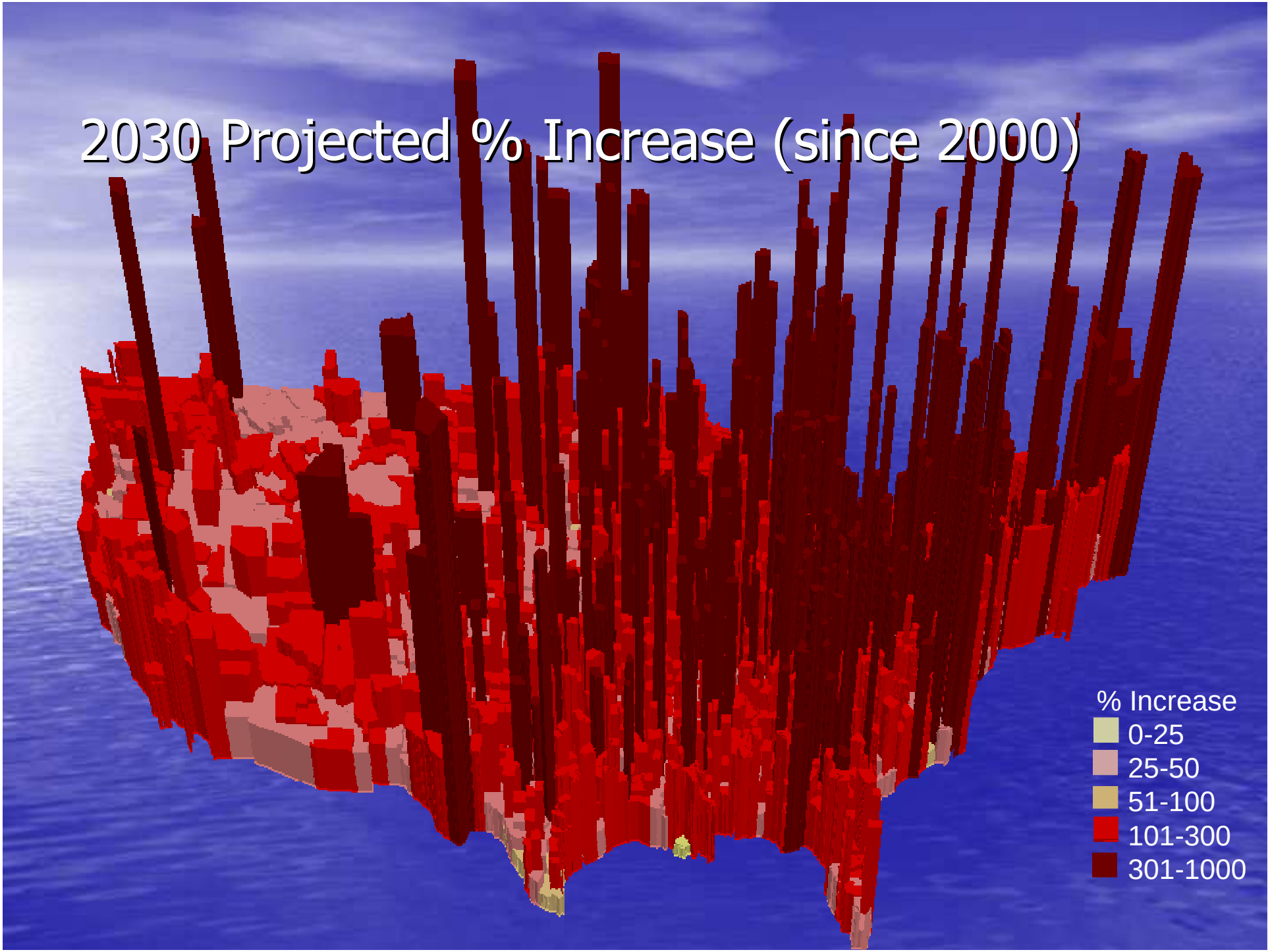


Emerging Global Water Issues
The Looming Water Crisis

- The demand for freshwater increased sixfold between 1900 and 1995, twice the rate of population growth.
- Nearly 70 percent of global and U.S. freshwater withdrawals are directed toward agriculture, mainly for irrigation

The Global Water Cycle is Broken and in Flux

- Due to inappropriate land use and land management practices, uncoordinated and rapid growth of urban areas, and loss of natural flood storage wetlands, floods are becoming more frequent.
- According to the Intergovernmental Panel on Climate Change, the frequency of droughts could rise by 50 percent in certain parts of the world by 2050.


2030 Projected % Increase (since 2000)
% Increase
0-25
25-50
51-100
101-300
301-1000

The traditional infrastructure paradigm

- The traditional model of centralized, big-pipe infrastructure relies on an industrial model of specialization and economies of scale
- This approach is wasteful, environmentally disruptive, and ultimately not sustainable as populations increase and more and more land is developed over time
- Climate change-related extremes of heavy storms and droughts will place even greater stresses

A New Water Infrastructure Paradigm

- "Sustainable water systems in the future will use, treat, store, and reuse water efficiently at a small scale and will blend designs into restorative water hydrologies."

The new paradigm that works with and mimics nature

Nature

- Recycles everything
- Banks on diversity
- Rewards cooperation
- Creates beauty and abundance and no waste
- Uses only the energy it needs
- Rebuilds from disturbances
- Can collapse from extreme stress

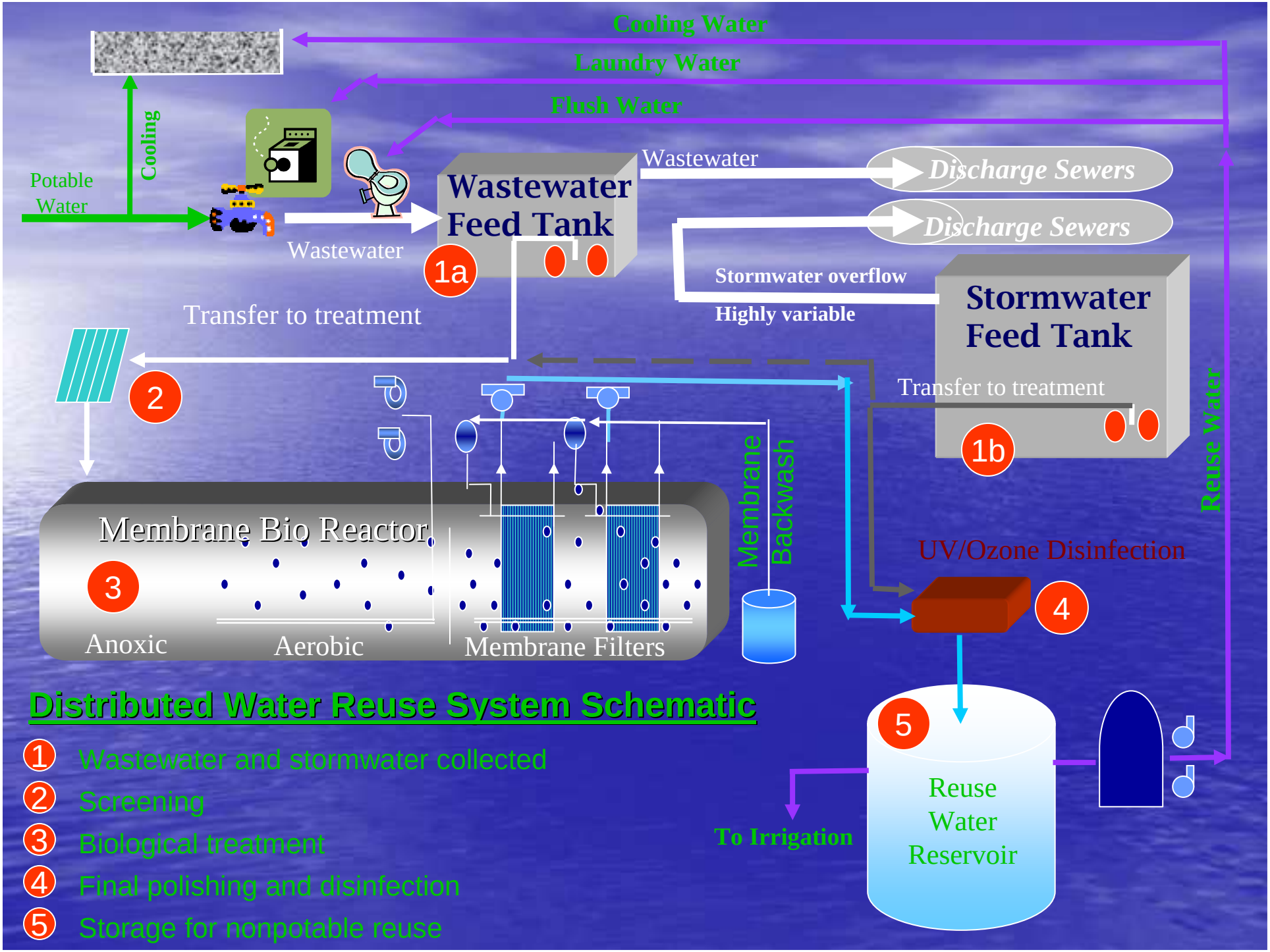
Portland streetscape.
Photo courtesy of Martina Keefe

The Solaire – Opened 2003

- 293 Residential Units
- 25,000 GPD WW treatment plant
- LEED™ Gold Certification
- **48% reduction in water use**
- **56% reduction in wastewater discharge**

- 30 systems predate The Solaire beginning in 1987 – up to 95% reuse in commercial applications

Integrated Water Resource Management



Distributed Water Reuse System Schematic

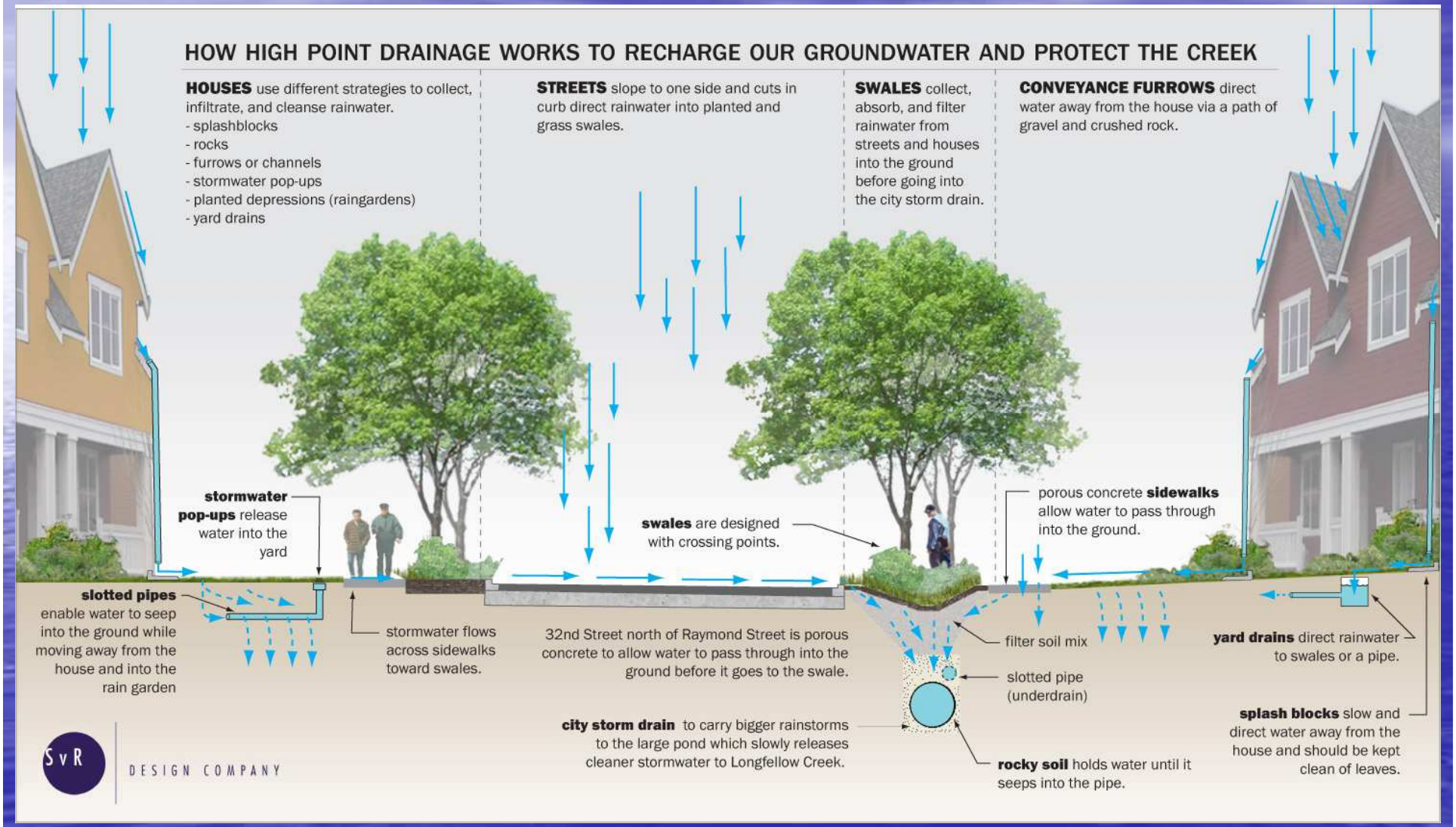
1. Wastewater and stormwater collected
2. Screening
3. Biological treatment
4. Final polishing and disinfection
5. Storage for nonpotable reuse

High Point, Seattle: Neighborhood Level

- Hope VI Project
- 120 acres of urban infill
- 1,600 housing units
- Neighborhood center, library & mixed used
- Density ranges: 16 units/acre – 25 units/acre
- 65% reduction of stormwater into Longfellow Creek
- Integrated natural drainage system (NDS) distributed over 34 blocks
- Each block uses site-specific drainage strategies

Source: USEPA Watershed Academy Webcast, Smart Growth and Green Infrastructure (11/28/07)

High Point, Seattle



Source: USEPA Watershed Academy Webcast, Smart Growth and Green Infrastructure (11/28/07)

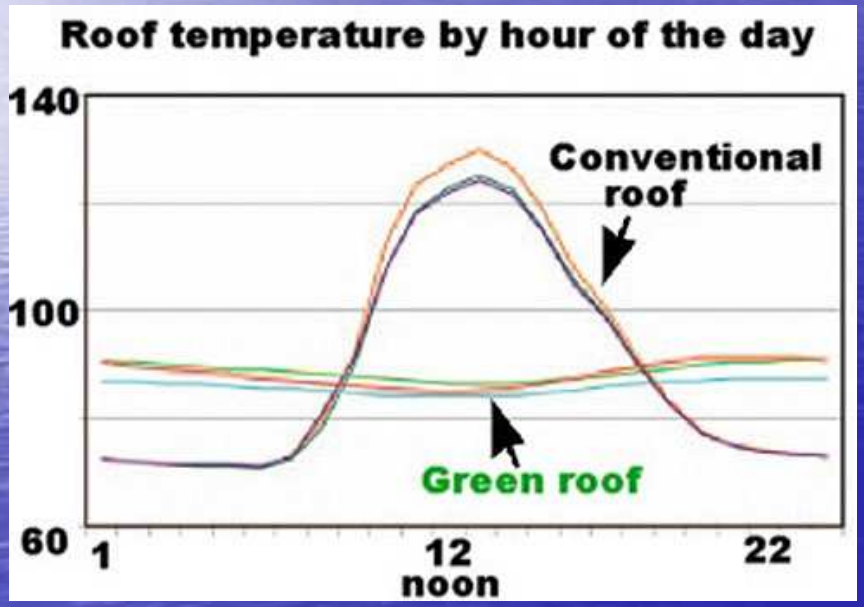
Environmental Benefits of Green Infrastructure

Maplewood, MN.
Photo Courtesy of Bob Newport, U.S. EPA, Region 5

- Reduces sewer overflows
- Filters polluted stormwater
- Recharges groundwater
- Reduces heat island effect
- Improves air quality
- Provides wildlife habitat and recreational space
- Protects stream banks
- Conserves energy
- Conserves water
- Prevents flooding
- Captures carbon
- Reduces greenhouse gas pollutants
- Improves urban aesthetics

Improves urban aesthetics

Global Warming Benefits of Green Infrastructure



- Vegetation captures runoff reducing overflows, pollution, treatment costs
- Infiltration enhances depleted water supplies, saving energy and GHG emissions as well as water
- Trees provide shade, cool the air by evapotranspiration and capture carbon
- Wetlands capture floodwaters, purify water, reduce storm surges
- Green roofs/vegetation reduces urban heat island and insulates buildings
- Stabilized stream hydrology better withstands changes in volume and timing of flows

Economic Benefits: Homeowner Savings

- Reduced maintenance costs
- Increased property value
- Enhanced aesthetics
- Greater sense of community
- Lowered water bills

Health and Safety Benefits

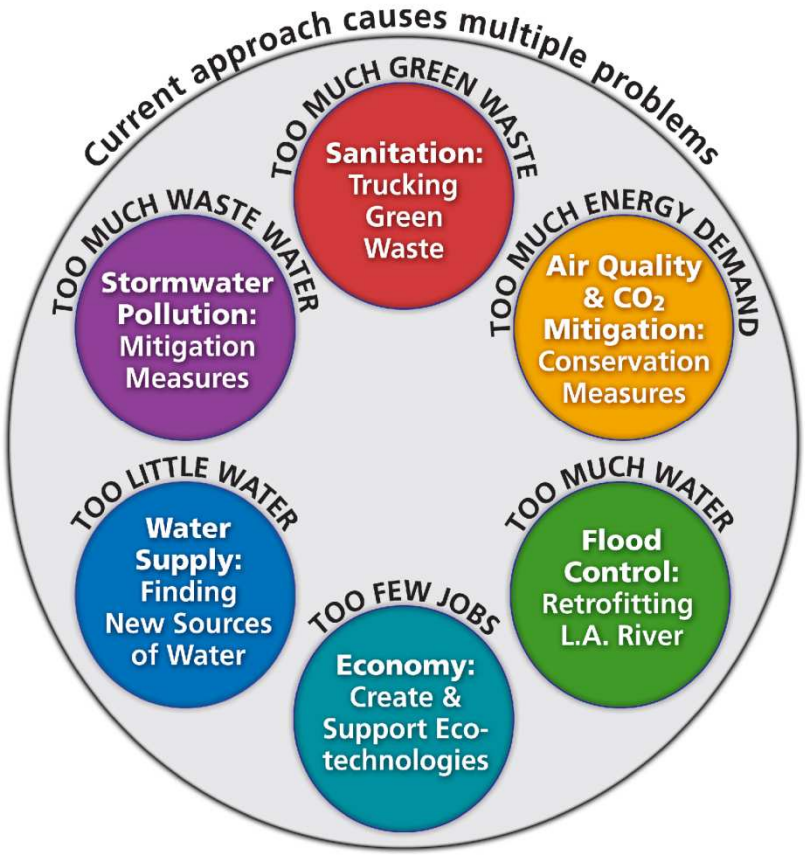
- Studies show green infrastructure
  - Hastens surgery recovery, decreases sick rates, reduces stress
  - Enhances cognitive functioning: school performance, worker productivity, creativity
  - Open space, walkable neighborhoods encourage physical activity, increasing fitness and weight loss

Economic Benefits: Job Creation

- Creates new jobs for architects, designers, researchers, engineers, construction workers, maintenance workers, landscapers, nurseries, etc.
- Approximately 5 jobs would be created for every 100,0000 square feet of green roof installed in D.C.
- 1,700 jobs per year for ten years just to install green roofs in D.C.
- TreePeople projects creation of 50,000 new jobs from LA's citywide green infrastructure initiative

The need for integrated management

LOS ANGELES TODAY

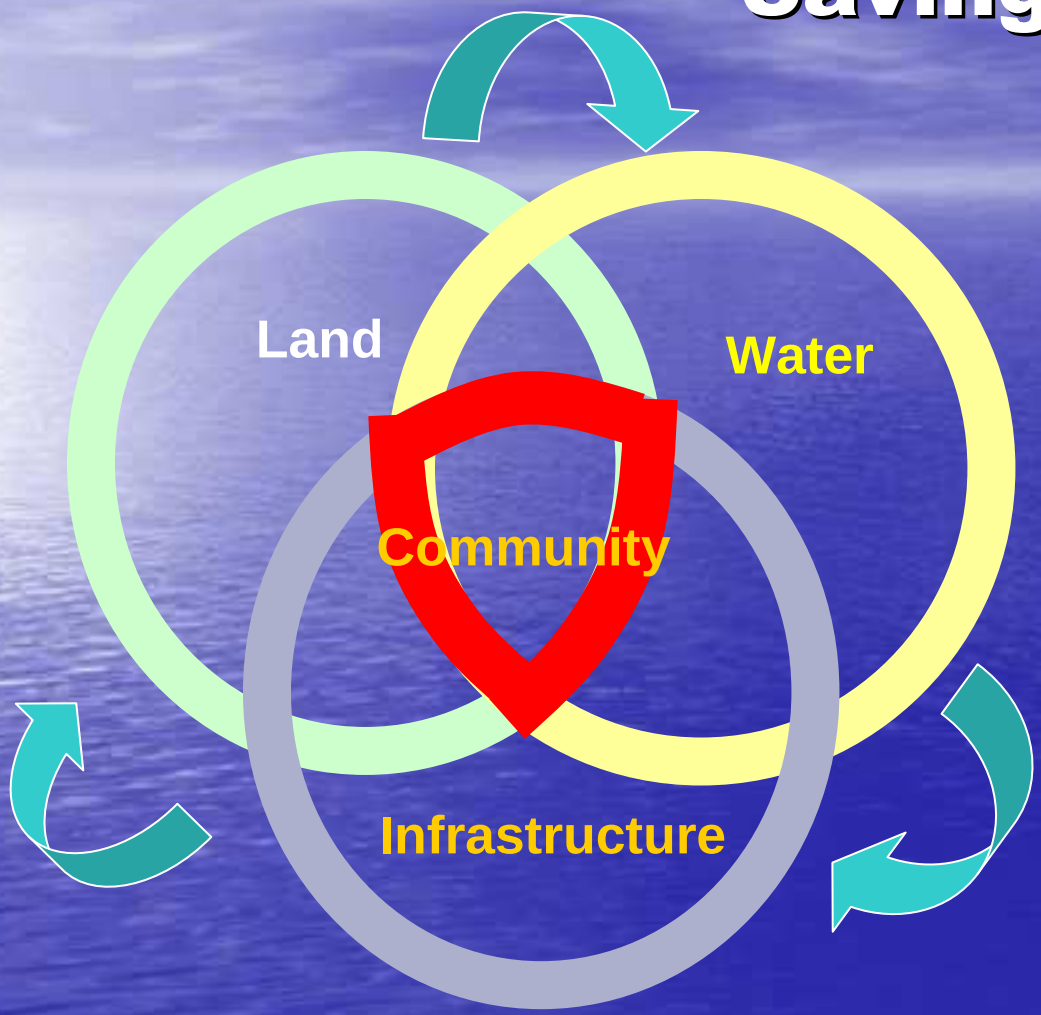


Dis-integrated approach wastes resources, duplicates efforts and imposes unsustainable practices.

LOS ANGELES POTENTIAL

Integrated approach also creates jobs and liberates funds for emerging green technologies.

Economic Benefits: Community Savings



Credit: Howard Neukrug, City of Philadelphia

- Reduced long-term infrastructure costs
- Avoided centralized storage and treatment costs
- Avoided stream restoration and drinking water filtration costs
- Energy cost savings
- Nutrient and chemical recovery and reuse
- Leverage private investment
- Green Jobs
- More tax revenue from enhanced properties
- Fewer crimes/less violence

Legislation to promote these designs would include:

- funding for research and demonstration projects;
- funding for water use efficiency and conservation programs,
  - including hardware incentives (WaterSense) and education programs;
- Clean tech venture capital funding;
- tax incentives for builders and homeowners;

- development of national standards for water-efficiency, green infrastructure, and reuse;
- incorporation of water-efficiency, green infrastructure, and reuse standards in federal funding for Clean Water and Drinking Water State Revolving Funds;
- support for utilities that implement sustainable designs; requirements for integrated water, energy, and resource management;

- federal facility use of sustainable water systems;
- green collar job education and training programs;
- funding for local governmental entities to prepare long-term integrated water resource management plans that meet minimum criteria, such as including analysis of all of the following:

- Planning to include impacts of climate change, wastewater, water supply, stormwater, source water protection, floodplain protection, protection of wetlands, headwaters, and other aquatic resources
- involving a cross-agency implementation plan, and would prioritize for all types of federal funding those investments identified through a long-term integrated water resource management plan

Future statutory reform

- Comprehensive watershed management – water quality and quantity, ecosystem considerations
- Adaptive management and learning – continuous improvement
- Integrated infrastructure – water, energy, transportation, green space, building and street designs, etc.

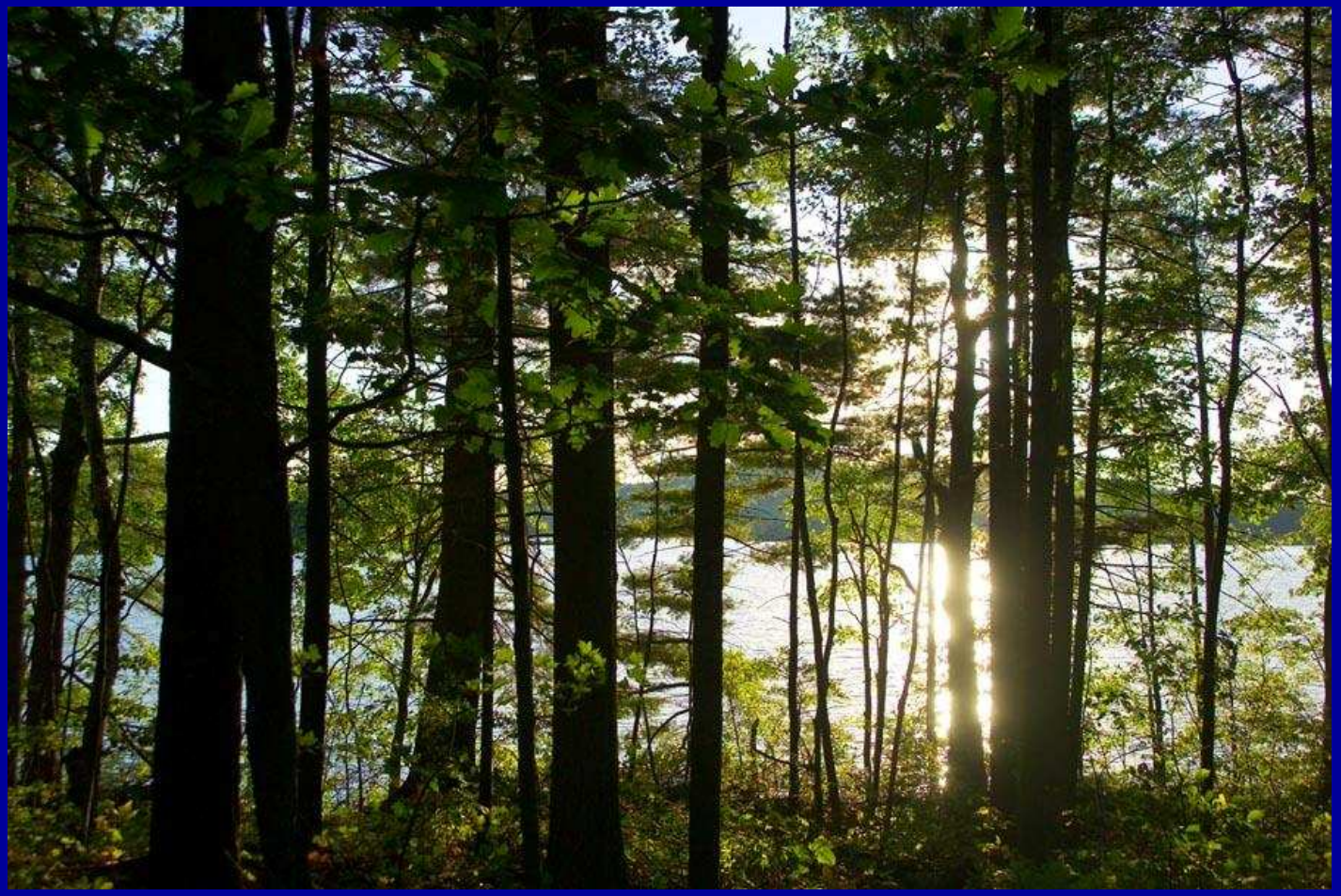
APPENDIX H

THE MULTIPLE BENEFITS OF GREEN INFRASTRUCTURE

The Multiple Benefits of Green Infrastructure

Nancy Stoner
Water Program
Natural Resources Defense Council
September 18, 2008

Original Green Infrastructure



Credit: Ian Britton, FreeFoto.com

Green Infrastructure

Portland streetscape.
Photo courtesy of Martina Keefe

- Green infrastructure uses soil and vegetation to manage and treat precipitation naturally rather than collecting it in pipes.
- It preserves natural systems and uses engineered systems such as green roofs, rain gardens, and vegetated swales to mimic natural functions.
- Green infrastructure often accompanies approaches that capture and re-use stormwater and wastewater.

Environmental Benefits of Green Infrastructure

Maplewood, MN.
Photo Courtesy of Bob Newport, USEPA, Region 5

- Reduces sewer overflows
- Filters polluted stormwater
- Recharges groundwater
- Reduces heat island effect
- Improves air quality
- Provides wildlife habitat and recreational space
- Protects stream banks
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High Point, Seattle: Neighborhood Level

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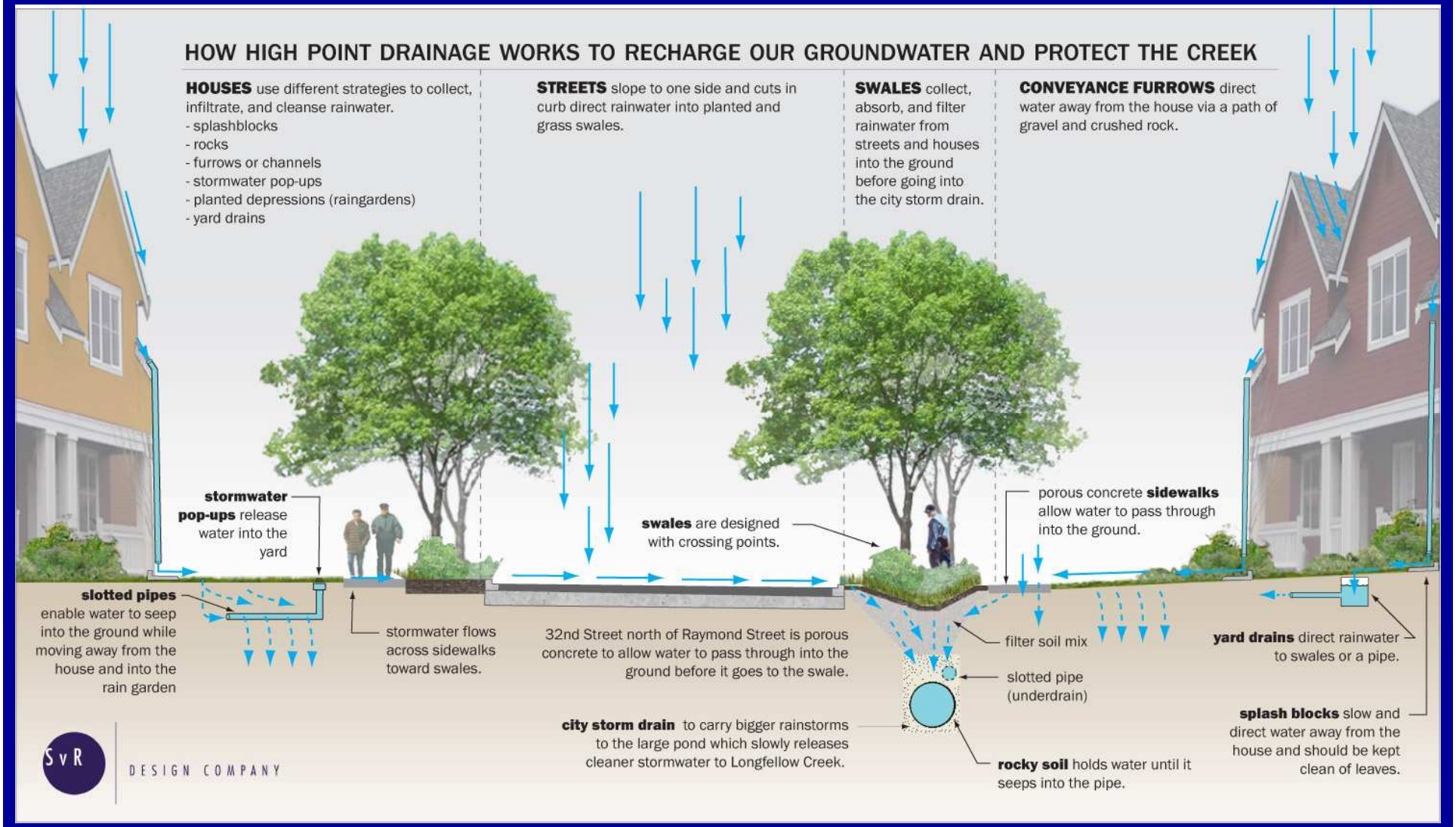
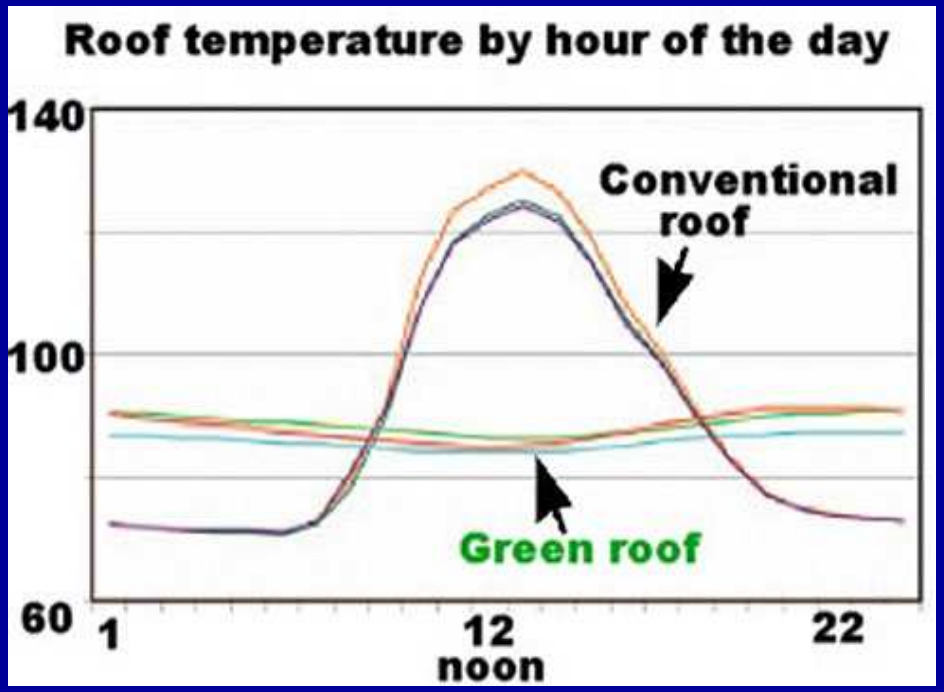
Source: USEPA Watershed Academy Webcast, Smart Growth and Green Infrastructure (11/28/07)

High Point, Seattle



Source: USEPA Watershed Academy Webcast, Smart Growth and Green Infrastructure (11/28/07)

Global Warming Benefits of Green Infrastructure



Florida 2 month average from ASHRAE (via *USA Today*)

- Vegetation captures runoff reducing overflows, pollution, energy used for treatment
- Infiltration enhances depleted water supplies, saving energy and GHG emissions as well as water
- Trees provide shade, cool the air by evapotranspiration and capture carbon
- Wetlands capture floodwaters, purify water, reduce storm surges
- Green roofs/vegetation reduces urban heat island and insulates buildings
- Stabilized stream hydrology better withstands changes in volume and timing of flows

Economic Benefits: Job Creation

Installation of Permeable Pavers.
City of Portland, BES

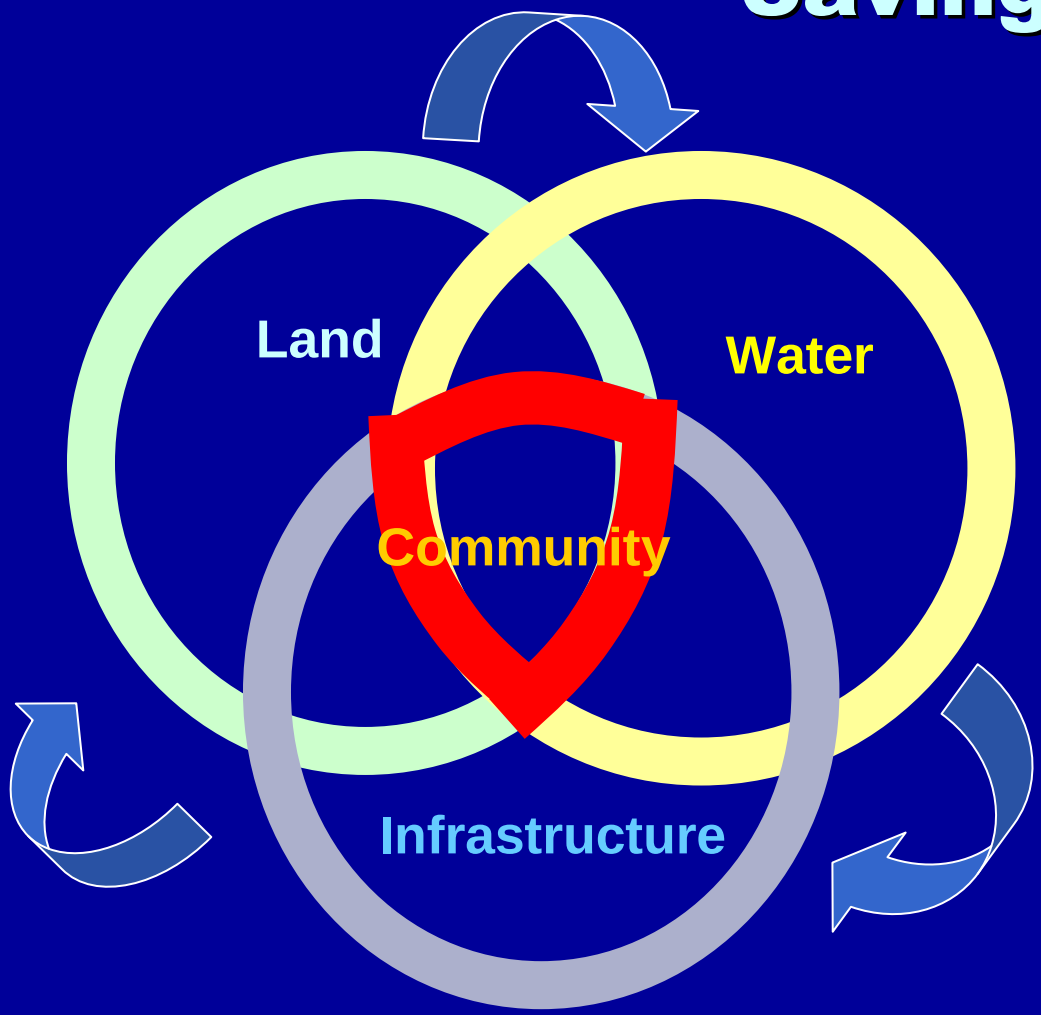
- Creates new jobs for architects, designers, engineers, construction workers, maintenance workers, landscapers, nurseries, etc.
- Approximately 5 jobs would be created for every 100,0000 square feet of green roof installed in D.C.
- TreePeople projects creation of 50,000 new jobs from LA's citywide green infrastructure initiative

Economic Benefits: Builder and Developer Savings

- Cost savings from avoided hard infrastructure
- Green infrastructure premium
- Faster sales
- Higher lot yields

Prairie Crossing: Gray's Lake, IL

Economic Benefits: Community Savings



Credit: Howard Neukrug, City of Philadelphia

- Reduced long-term infrastructure costs
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- More tax revenue from enhanced properties
- Fewer crimes/less violence

Economic Benefits: Homeowner Savings

- Reduced maintenance costs
- Increased property value
- Enhanced aesthetics
- Greater sense of community
- Lowered water bills

Cisterns collect rooftop runoff for reuse in Chicago. *Credit: Abby Hall, USEPA*

Health and Safety Benefits

- Studies show green infrastructure
  - Hastens surgery recovery, decreases sick rates, reduces stress
  - Enhances cognitive functioning: school performance, worker productivity, creativity
  - Open space, walkable neighborhoods encourage physical activity, increasing fitness and weight loss

Image: Stormwater Magazine
Data: Interlocking Concrete Paver Magazine – Autumn Trails, Moline, IL

Contact Information:

Nancy Stoner
NRDC
202-289-2394
nstoner@nrdc.org
www.nrdc.org

APPENDIX I

MASSACHUSETTS MODEL STAKEHOLDER LIST

CLEAN WATER ACTION
MASSACHUSETTS

Model Statewide Stakeholders – Massachusetts

Name	Organization	Category
Jack Ahern	UMass Amherst	Academic
Peter Chandonait	UMASS Lowell	Academic
Janet Clark	Toxics Use Reduction Institute	Academic
Tim Downs	Clark U Worcester	Academic
Joan Fitzgerald	Northeastern University	Academic
Tom Flanagan	UMass Dartmouth	Academic
Robert France	Harvard School of Design	Academic
Ed Glaeser	Harvard	Academic
Simon Gruber		Academic
James Heintz	Political Economy Research Institute	Academic
Polly Hoppin	Umass Lowell, CWF Board	Academic
Brian Howes	Coastal Systems Program	Academic
John Knott	Noisette, South Charleston, NC	Academic
Judy Meredith	Public Policy Institute	Academic
Shelley Metzenbaum	UMASS Boston	Academic
Nadira Najib		Academic
Vladimir Novotny	Northeastern University	Academic
Amy Perlmutter	Perlmutter Associates	Academic
Bob Pollin	UMass Amherst	Academic
Robert Pollin	Political Economy Research Institute	Academic
Colin Polsky	Clark U Coastal Research	Academic
Robert Pontius, Jr.	Clark U Coastal Research	Academic
Nathan Rawding	Tufts	Academic
Tonna-Marie Rogers	Waquoit Bay Estuarine	Academic
Peter Shanahan	MIT	Academic
Sarah Slaughter	Sloan Sustainability Initiative, MIT	Academic
Ann Spirn	M.I.T.	Academic
Roger Stern	Princeton Environmental Institute	Academic
Tellus Institute		Academic
Gordon R.Thompson	Institute for Resource and Security Studies	Academic
	New Alchemy Institute	Academic
Professor	Woods Hole oceanographic professor	Academic
Sam Krasnow	Environment Northeast	Academic/Advocate
ValerieNelson	CAWT	Academic/Advocate
Action MA		Advocate
Ibrahim Abdul-Matim	Green For All Fellow	Advocate

Dan Bakal	CERES	Advocate
Sue Bass	Belmont Citizens Forum	Advocate
Barbra Batshalom	Green Roundtable	Advocate
Sue Beede	MA Rivers Alliance	Advocate
Gene Bennett	Alternatives for Community & Environment	Advocate
Kyla Bennett	New England PEER	Advocate
Julia Blatt	MA Rivers Alliance	Advocate
Kate Bowditch	Charles River Watershed Association	Advocate
Betsy Boyle	CERES	Advocate
Bob Brooks	Green Roundtable	Advocate
Gregory Caplan	Living Structures INC	Advocate
Armando Carbonell	Lincoln Land Institute	Advocate
Priscilla Chapman	Mass Audubon Taunton campaign	Advocate
Jack Clarke	Mass Audubon	Advocate
Sue Coakley	Northeast Energy Efficiency Partnerships, Inc.	Advocate
Alison Cohen	Mystic River Watershed Association	Advocate
Ian Cooke	Neponset River Watershed Association	Advocate
Jill Cowie	Watershed Action Alliance (of SE Mass)	Advocate
John & Connie Craycroft	Cedar Swamp Conservation Trust	Advocate
Alexandra Dawson	Sierra Club	Advocate
Paul Deare	Action for Regional Equity	Advocate
Janet Domenitz	MassPIRG	Advocate
Andrea Donlon	Conn. River Watershed Council	Advocate
Pine DuBois	Jones River Watershed Association	Advocate
Sheila English	Wood Tech Systems & Friends of Post Office Square	
James Ferris	Green Berkshires	Advocate
Alison Field-Juma	Organization for the Assabet River	Advocate
Nancy Goodman	Environmental League of MA	Advocate
Tim Gray	Housatonic River Initiative	Advocate
Nancy Hammett	MA Rivers Alliance	Advocate
Ed Himlan	Mass. Watershed Coalition	Advocate
Melissa Hoffer	Conservation Law Foundation	Advocate
Robb Johnson	The Nature Conservancy	Advocate
Patricia Jones	UUSC	Advocate
Steve Kaiser		Advocate
EK Kalsa	Mystic River Watershed Alliance	Advocate
Don Keeran	Assoc. For the Preservation of Cape Cod	Advocate
Lee Ketelsen	Clean Water Action/Clean Water Fund	Advocate
Carolyn LaMarre	Taunton River Watershed Alliance	Advocate
Andre Leroux	Massachusetts Smart Growth Alliance	Advocate
Juan Leyton	N2N	Advocate
Bill Loesch	BOLD Teens/ Green Buildings Dorchester	Advocate
Cindy Luppi	CWA/CWF	Advocate
Kerry Mackin	Ispswich River & MA Rivers Alliance	Advocate
Jay McCaffrey	Sierra Club	Advocate
Deirdre Menoyo	Mass Rivers Alliance	Advocate

Mary Michaelman	ACES Acton	Advocate
Tom Palmer	Friends of the Blue Hills	Advocate
Anne Paulsen	Former State Representative	Advocate
Fred Paulsen	Mystic River Watershed Assn	Advocate
Steve Pearlman	Neponset River Watershed Assn	Advocate
Sue Phelan	Green Cape	Advocate
Mark Rasmussen	The Coalition for Buzzards Bay	Advocate
Pam Resor	Mass Rivers Alliance	Advocate
Heidi Ricci	Mass Audubon	Advocate
Mark Robinson	Compact of Cape Cod Conservation Trusts	Advocate
Mike Ryan	Friends of Middlesex Fells Reservation	Advocate
Max Schenk	8 Towns and the Bay	Advocate
Steve Seymour	CWF Board	Advocate
Peter Shelley	Conservation Law Foundation	Advocate
Eileen Simonson	Water Supply Citizens Advisory Committee	Advocate
Becky Smith	Clean Water Action/Clean Water Fund	Advocate
Christine Tabak	Merrimack River Watershed Council	Advocate
Eleanor Tillinghast	Green Berkshires	Advocate
Kurt Tramposch		Advocate
Margaret van Deusen	Charles River Watershed Association	Advocate
Maria Van Dusen	Mass Rivers Alliance	Advocate
Mettie Whipple	Eel River Watershed Assoc. & MA Rivers Alliance	Advocate
Mary Whitney	Essex County Forum	Advocate
Janet Winn	Berkshire Environmental Action Team	Advocate
Bob Zimmerman	Charles River Watershed Association	Advocate
Eric	MassPIRG	Advocate
Bob Wilber	MA Audubon	Advocate
Penn Loh	ACE	Advocate/EJ
Rob Adler	EPA	Agency
Kathy Baskin	Director of Water Policy, EOEEA	Agency
Greg Bialecki	EOEEA	Agency
AndreaBistany	Office of Coastal Zone Management	Agency
Chris Boelke	EPA	Agency
Chris Busch	City of Boston	Agency
Scott Calisti	Division of Capital Asset Management	Agency
David Cash	EOEEA	Agency
Russ Cohen	EOEEA	Agency
David DeLorenzo	DEP	Agency
Cindy Delpapa	MA River Ways	Agency
Stephen Druschel	Hamilton Mass. Board of Health	Agency
Lucy Edmondson	DEP	Agency
Rosalyn Elder	Division of Capital Asset Management	Agency
Michele Girard	MACC	Agency
Bryan Glascock	City of Boston	Agency
Tom Groves	NEIWPCC/NOWRA	Agency
Steven Halterman	DEP	Agency

Paul Hogan	DEP	Agency
Jim Hunt	office of Boston Mayor Menino	Agency
Eric Hutchins	NOAA	Agency
Kyra Jacobs	EPA	Agency
Ken Kimmell	EOEEA	Agency
Alicia McDevitt	MEPA	Agency
Ken Moraff	EPA	Agency
Madelyn Morris	DEP	Agency
Atlaf Mulla	Dept. of Capital Assets Mgt	Agency
Daniel Nvule	MWRA	Agency
Janet Pfister	EOEEA	Agency
Dorrie Pizzella	EEOA	Agency
Susanne Rasmussen	City of Cambridge	Agency
Brent Reagor	Environmental Business Council	Agency
Alice Savage	Town of Easton	Agency
Michael Sites	MACC	Agency
Alan Slater	MA DEP Water Reuse	Agency
Mark Swingle	Division of Capital Asset Management	Agency
Jason Turgeon	EPA	Agency
Steve Benz	Sasakit Associates (The Green Roundtable)	Architect
Russ Feldman	TBA Architects	Architect
Steve Moddemeyer	Collins Woerman	Architect
Laurie Mooney	BTA+ Architects, Inc.	Architect
Elizabeth Wylie	Finegold Alexander + Associates	Architect
Boston Society of Architects		Architect
Greg McGregor	McGregor Associates	Attorney
Kerri Russell	Conservation Law Foundation	Attorney
Matthew Costa	MNI Environmental Systems	CleanTech Mfgs
Patricia Glaza	CTSI	CleanTech Mfgs
Elliot Jacobson	Action Energy	CleanTech Mfgs
Craig Lindell	Aquapoint	CleanTech Mfgs
Pio Lombardo	Lombardo and Associates	CleanTech Mfgs
Mark Modzelewski	Water Innovation Alliance	CleanTech Mfgs
Phil Reidy	Rainwater Recovery Systems	CleanTech Mfgs
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Arlene O'Donnell		Consultant
Stephanie Polluck	Blue Wave Strategies	Consultant
Bill Reed	Integrative Design Collaborative	Consultant
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Paul Matthews	495/MetroWest Corridor Partnership	Developer
Bill Napolitano	SRPEDD	Developer
Bob Van Meter	Local Initiatives Support Corporation	Developer
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Andrew Wang	National Bureau of Economic Research	Economist
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Abby Rockefeller	ReSource Institute for Low Entropy Systems	Eco-Sanitation

Carol Steinfeld	Ecovita/Ecowaters	Eco-Sanitation
Kalila Barnett	Community Labor United	EJ/Green Jobs
Lisa Clauson	Community Labor United	EJ/Green Jobs
Darlene Lombos	Community Labor United	EJ/Green Jobs
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Dan Alveraz	Dewberry	Engineer
Amanda Davis	Aquatic Eco-Logic	Engineer
David del Porto	Ecological Engineering	Engineer
Bruce Douglas Stone	Environmental	Engineer
Bill Doyle	Sasakit Associates	Engineer
David S. Eggleton	Applied Ecologics	Engineer
Steve Engler	Sasaki	Engineer
Wendi Goldsmith	The Bioengineering Group	Engineer
Mike Hanlon	Weston and Sampson	Engineer
Scott Horsely	Horsley & Witten	Engineer
Isabelle Montesi	Bioengineering Group	Engineer
Jim Newman	Building Green	Engineer
Tom Pedersen	CDM	Engineer
George Preble	Beals and Thomas	Engineer
Rocco Rossi	Dewberry	Engineer
Erik Ruoff	The Green Engineer (The Green Roundtable)	Engineer
Chris Schaffner	The Green Engineer (The Green Roundtable)	Engineer
John Thomas	Beals and Thomas	Engineer
Jonathon Todd	Todd Ecological	Engineer
Mike Wilson	CH2MHill	Engineer
Pat Brandes	Barr Foundation	Foundation
Ruth Goldman	Barr Foundation	Foundation
Bill Hinkley	Massachusetts Environmental Trust	Foundation
Heeten Kalan	New World Foundation	Foundation
Stefan Lanfer	Barr Foundation	Foundation
Melinda Marble	Barr Foundation, Deputy Director	Foundation
Anne McQueen	The Boston Foundation	Foundation
Andrea Mitrovich	Clinton Foundation	Foundation
Gioia Perugini	Hemenway & Barnes /Jane's Trust	Foundation
Jenny Russell	Merck Family Fund	Foundation
Karen Weber	Foundation for a Green Future, Inc.	Foundation
Prentice Zinn	Cox Trust	Foundation
	The Boston Foundation	Foundation
Chris Cato	YouthBuild U.S.A.	Green Jobs
Laurie Leyshon	MAGJC	Green Jobs
Rep. Daniel Bosley		MA Legislator
Rep. Carolyn Dykema		MA Legislator
Sen. Jamie Eldridge		MA Legislator
Sen. Jack Hart		MA Legislator
Sen. Robert Hedlund		MA Legislator
Sen. Pat Jehlen		MA Legislator

Sen. Robert O'Leary		MA Legislator
Rep. Jeffrey Sanchez		MA Legislator
Rep. Frank Smizik		MA Legislator
Rep. Robert Spellane		MA Legislator
Sen. Karen Spilka		MA Legislator
Rep. Cleon Turner		MA Legislator
Ben Healey	Office of Representative Smizik	MA Legislature
Sam Cleaves	MAPC	Planner
Martin Pillsbury	Metropolitan Area Planning Council	Planner
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Colleen Corona	Easton, MA	Miscellaneous
George Dentino	Mansfield, MA	Miscellaneous
John Dettling		Miscellaneous
Dana Dillworth		Miscellaneous
Sheila Frace		Miscellaneous
Eric Hooper	Sharon, MA	Miscellaneous
Stephanie Hurley		Miscellaneous
Jill Kelly		Miscellaneous
Steve Morgan		Miscellaneous
Dan Ottenheimer	Gloucester, former Health Director	Miscellaneous
Marcus Quigley		Miscellaneous
Raquel Resendiz		Miscellaneous
Priscilla Ryder	Mass Society of Municipal Conservation Professionals	Miscellaneous
Wayne Southworth	Easton, MA	Miscellaneous
Dee Spiro		Miscellaneous
Robert Stavins		Miscellaneous
John Stone	Abington, MA	Miscellaneous
Bob Terrell		Miscellaneous
Seth Tuler		Miscellaneous
DonnieWesthaven	Whitman, MA	Miscellaneous