Baltimore Charter on Sustainable Water Systems

Valerie I. Nelson

Coalition for Alternative Wastewater Treatment,
Gloucester, MA, USA, valerie.i.nelson@gmail.com

ABSTRACT

The Baltimore Charter on Sustainable Water Systems was drafted as a commitment to design and advance new water systems that mimic and work with nature. These systems will both protect public health and safety and will restore natural and human landscapes. This Charter was signed on March 15, 2007 by participants in a long-range planning workshop convened by the Water Environment Research Foundation (WERF). This workshop followed the international conference, Water for All Life: A Decentralized Infrastructure for a Sustainable Future, which met from March 12-14 in Baltimore, Maryland, USA. The conference was convened by the National Onsite Wastewater Recycling Association, International Water Association, and WERF.

Keywords: water, international, collaboration, infrastructure, biomimicry

1 THE WATER AND WASTEWATER CRISIS AND OPPORTUNITIES

Communities across the United States and internationally are facing a growing crisis in water resource protection. Water and sewer systems built over the last one hundred years are deteriorating, and estimates for the "gap" in available funding for repair and replacement are in the hundreds of billions of dollars. New developments in suburban and rural areas also require water supply enhancements and new infrastructure. Statutory requirements for source water protection, stormwater and combined sewer overflows, TMDL's, groundwater protection, and flood control will add billions more in spending.

In the past, engineers have designed "rapid conveyance" centralized water distribution and sewer and stormwater collection networks that are managed by central authorities. Unfortunately, these conventionally-engineered piping networks have also been highly-disruptive of natural ecologies of water and land. Centralized infrastructure projects have seriously drained aquifers and led to saltwater intrusion along coastlines, reduced normal streamflows, increased flooding, and degraded natural habitats.

The signatories to the Baltimore Charter intend to introduce designs and institutions that mimic or work with nature into a "hybrid" system of centralized and decentralized infrastructure. Future research into micro-ecologies of bacteria and macro-ecologies of watersheds, and transformational examples of institutional innovation and cultural change will shift the optimal mix more and more towards nature's localized, multi-functional and abundant forms.

2 PRINCIPLES OF DESIGN IN NATURE

Nature operates with patterns and principles that we can adapt to our treatment of water:

- Nature creates order and builds from the bottom up with modular units
- Nature is multi-functional in its forms
- Nature adapts and adjusts to changing conditions
- Nature is cyclic and recycles, uses and reuses
- Nature creates beauty and abundance and no waste

3 ENGINEERED ECOLOGIES OF WATER, LAND, ENERGY AND CLIMATE

Nature and man can cooperate to rebuild healthy communities and restore natural ecologies through incorporation over time of sustainable infrastructure designs and principles, with water at the center of these designs. Emerging examples of these concepts include:

- *Onsite and neighborhood treatment* – small-scale technologies that mimic natural membranes and filters and that utilize soils and smart localized controls

- *Onsite and neighborhood reuse* -- Closed-loop water systems in residential and commercial buildings, where stormwater and wastewater are treated and reused for landscape irrigation, toilet flushing and cooling, and where minimal waste leaves the site

- *Green infrastructure* -- Rain gardens that trap stormwater and sustain trees and plants. These plants restore beauty and improve air quality in cities, moderate energy flows, and provide potential food sources

- *Smart Growth* -- Patterns of neighborhood development that interconnect nature and the built

environment, preserve open space and respect natural drainage flows

- *Green Cities* -- Restoration of natural cycles of water infiltration and evaporation in cities and towns, through localized treatment and groundwater recharge, trees, parks and roof gardens, and stream daylighting and restoration

- *Watershed restoration* -- Restoration of natural watershed flows and functions, through localized water use and recycling into natural wetlands, groundwater, and air. These systems will restore and preserve vegetation and wildlife, and minimize climate changes and warming.

4 BENEFITS OF DECENTRALIZED SYSTEMS

Decentralized water and wastewater infrastructure creates the following benefits:

- *Lower costs for water supply* – costly water supply enhancements can be avoided through onsite water use efficiencies, wastewater reuse, and rainwater harvesting. Impacts of droughts can be moderated.

- *Lower costs of maintaining existing infrastructure* – flow rates in existing water and sewer systems can be reduced through decentralized efficiencies and reuse in office buildings and infill developments

- *Lower costs for new infrastructure* – new developments can be accommodated with targeted small-scale infrastructure that is competitive with centralized infrastructure and with more benefit to the community and the environment.

- *Greater resilience* – small-scale treatment units are more resilient than centralized systems in hurricanes and floods, and less vulnerable to accidents and terrorism.

- *Ecological restoration* – decentralized systems can reduce the discharge of pollutants and replenish aquifers, restore streamflows and habitats.

- *Resource efficiencies* – small-scale treatment units can save on energy costs and recycle nutrients into landscaping and agriculture.

- *Community benefits* – green infrastructure has been shown to improve air quality, preserve open space, and create local jobs.

- *Private financing* – small-scale treatment units on individual properties can be financed privately, thereby saving money for municipalities.

- *International competitiveness* – American advancements in sustainable water systems can be utilized in developing countries, such as China and India, and high-tech research, manufacturing and engineering jobs can be created in the U.S. to serve these markets.

5 RESEARCH CHALLENGES

Research is needed in the following topics to advance new water systems [1]:

- *Integrated sustainable water infrastructure*--minimize resource utilization and maximize resource recovery through intelligent, efficient, adaptable, sustainable technologies

- *Natural systems and water cycling*--understand the major natural elements and switches controlling the water cycle

- *Social institutions and decision making*—engage communities in integrated design and planning for water sustainability which will result in cost savings, water protection and healthier communities

- *Public Health*--understand the impacts of all types of water and wastewater systems on human health

- *Policies* -- An effective integrated water management strategy and associated policies

- *Regulations* – a new unified methodology

- *Economics* – full cost pricing

- *Demonstration projects* – demonstrating the integrated water systems vision in community and Green Building projects

- *Market Research*--identify target audience sectors

- *Water Literacy in the Public*--develop effective and scientifically accurate messages

Clean Technology 2008, www.ct-si.org, ISBN 978-1-4200-8502-0

6 THE BALTIMORE CHARTER ON SUSTAINABLE WATER SYSTEMS

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

New and evolving water technologies and institutions that mimic and work with nature will restore our human and natural ecology across lots, neighborhoods, cities, and watersheds. We need to work together in our homes, our communities, our workplaces, and our governments to seize the opportunities to put these new designs in place.

Our group of scientists, engineers, environmentalists, government officials, manufacturers, and members of the private sector are part of the solution. We have both the opportunity and obligation to participate with others on this task of transforming how we think and act in relation to water.

We commit to implementing more sustainable water systems by expanding uses and opening new markets for small-scale treatment processes, advancing research on micro-biological and macro-ecological scales, inventing new technologies based on nature's lessons, creating new management and financial institutions, reforming government policies and regulations, and elevating water literacy and appreciation in the public.

Signatories:

This Charter was signed on March 15, 2007 by participants in a long-range planning workshop convened by the Water Environment Research Foundation (WERF). This workshop followed the international conference, Water for All Life: A Decentralized Infrastructure for a Sustainable Future, which met from March 12-14 in Baltimore, Maryland, USA. The conference was convened by the National Onsite Wastewater Recycling Association, International Water Association, and WERF.

Bonnie Bailey – Water Environment Federation, Virginia
Gunnar Baldwin – TOTO USA, Inc., New Hampshire
Cori Barraclough – Aqua-Tex Scientific Consulting, Ltd., Canada
Matthew Byers – Zoeller Pumps, Kentucky
Edward Clerico – Alliance Environmental, New Jersey
Yehuda Cohen – Hebrew University of Jerusalem, Israel
Patrick M. Condon – University of British Columbia, Canada
Edward J. Corriveau – Pennsylvania DEP
Glen Daigger – CH2MHill, Colorado
Todd Danielson – Loudoun County Sanitation Authority, Virginia
Bruce Douglas – Stone Environmental, Inc., Vermont
Ray Ehrhard – Washington University, Missouri
Rick Gelting – U.S. Centers for Disease Control and Prevention*
Robert Goo – U.S. Environmental Protection Agency
Mooyoung Han – Seoul National University, Korea
Xiaodi Hao – Beijing Institute of Civil Engineering and Architecture, China
Juli Beth Hinds – City of South Burlington, Vermont
Goen E. Ho – Murdoch University, Australia
Carol Howe, SWITCH, Netherlands
Katsuki Kimura – Hokkaido University, Japan
Chris Kloss – Low Impact Development Center, Maryland
James Kreissl – Water Environment Federation, Kentucky
Bruce Lesikar – Texas A&M, Texas
Patrick Lucey – Aqua-Tex Scientific Consulting, Ltd, Canada
Cynthia Mitchell – Institute for Sustainable Futures, Australia
Steve Moddemeyer – City of Seattle, Washington
Jeff Moeller – Water Environment Research Foundation
Valerie I. Nelson – Coalition for Alternative Wastewater Treatment, Massachusetts
Stacy Passaro – Passaro Engineering, Maryland
David Potts – Geomatrix, Connecticut
Robert Rubin – North Carolina State University, North Carolina
Marco Schmidt – Technical University of Berlin, Germany
Paul Schwartz – Clean Water Action, Washington, D.C.
Sandra Schuler – Huber Technology, Germany
Robert L. Siegrist – Colorado School of Mines, Colorado
Jerry Stonebridge – National Onsite Wastewater Recycling Association, Washington
Nancy Stoner – Natural Resources Defense Council, Washington, D.C.
George Tchobanoglous – University of California at Davis, California
Joseph V. Thanikal – Kumarageoun College of Technology, India
Zaini Ujang – University Technology of Malaysia, Malaysia
Robert Zvara – Architect, Slovakia

*Note: The findings and conclusions in this document are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

For information on the conference and the Charter, go to: www.waterforalllife.org or contact Valerie I. Nelson at (978) 283-7569 or Valerie.I.Nelson@gmail.com

REFERENCE

[1] Clark, M. et al. 2007. "Long-Range Planning for Decentralized Stormwater and Wastewater Treatment Research: Workshop Summary." Project No. 04-DEC-8W, National Decentralized Water Resources Capacity Development Project by Stone Environmental, Inc., Montpelier, VT.