

Sustainable Resource Management

The Natural Step for Microconstituents

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Introduction of Presenter

- New Englander
- Outdoorswoman and Traveler
- Educator and Mother
- Geologist, Soil Scientist, Water Quality Professional
- Trained in Europe
- Leader on Interdisciplinary Design Teams for 15 years
- Sustainable Design Advocate
- President, Bioengineering Group
- Director, Center for Urban Watershed Renewal





Sustainable Development:

“...development that meets the needs of the **present** without compromising the ability of **future** generations to meet their own needs.”

--World Commission on Environmental Development
(Bruntland, 1987)

Our Firm Puts Sustainability into Practice

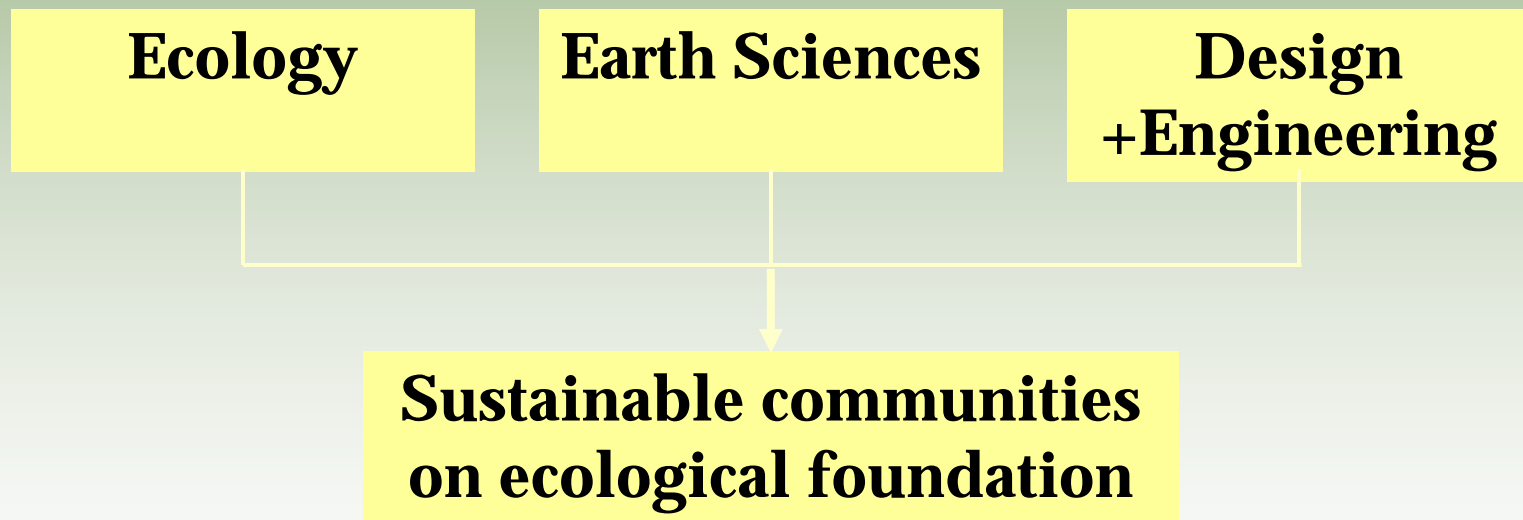
**In a sustainable human
environment, departure from
the natural condition requires
a management strategy that
can maintain ecosystem
function**



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Interdisciplinary Design Approach



Defining sustainability

- **Dr. Karl-Henrik Robert**
 - Swedish oncologist
 - Monkeys in the trees
- **The Natural Step**
 - Collaborative process
 - Inspired by the cell
 - The earth as a closed system
 - Only sunlight as input

The four system conditions

1. Substances from the earth's crust must not systematically increase in nature
2. Substances produced by society must not systematically increase in nature



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The four system conditions

3. The physical basis for the productivity and diversity of nature must not be systematically deteriorated
4. We must be efficient enough to meet basic human needs



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Basic science foundation

1. **Nothing disappears: Conservation of matter; First Law of Thermodynamics**
2. **Everything spreads: Second Law of Thermodynamics; organic matter decays, pollution disperses**



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Unsustainable

- **Fossil fuel and mineral extraction**
- **Uncontrolled use of chemicals**
- **Degradation of natural systems**
- **Ignoring present and future human needs**

Sustainable

**Meeting the needs of the present
without compromising the ability
of future generations to meet
their own needs**



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Sustainability

*Implies Healthy Ecosystem
Function*

- **Water is retained**
- **Soil loss is minimized**
- **Nutrients are recycled**



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WATER

Engineering Problem or Ecological Resource?



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BIOSOLIDS

Engineering Problem or
Ecological Resource?



Primary solids



Final solids



Compost



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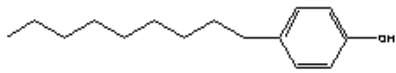
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SOURCES & FATES

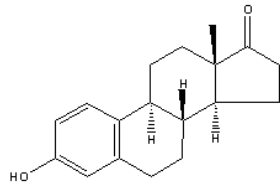
NPEOs



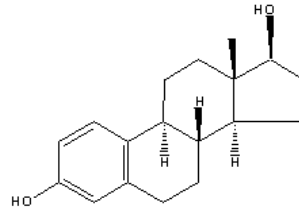
NP



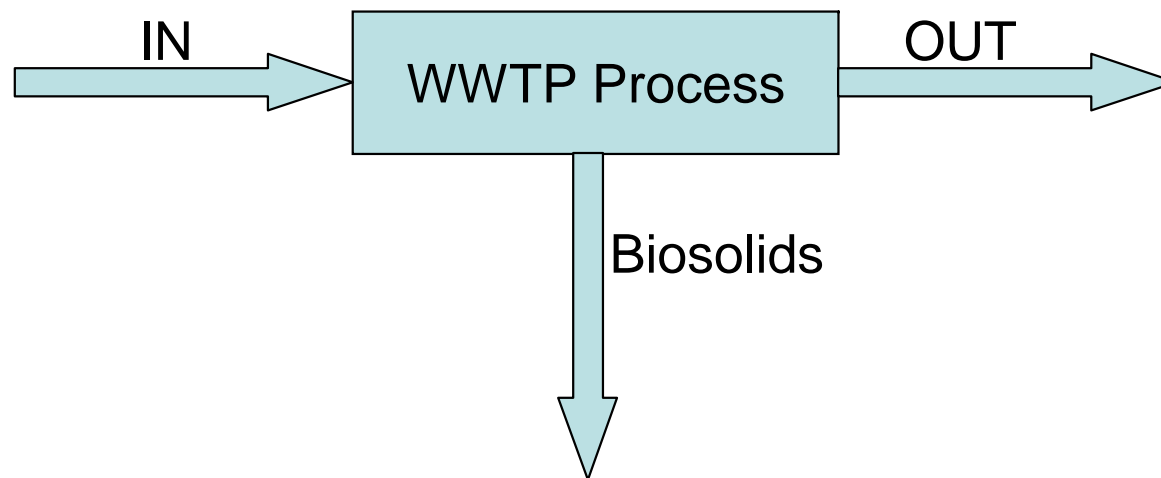
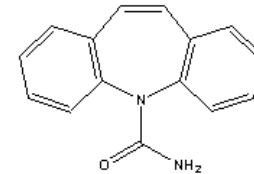
E1



E2



Carbamazepine



Scales of Ecological Function

Planetary scale – global sustainability

Regional scale – quality of life

Watershed scale – stream health

Site scale – parcels of ownership

Meter scale – soil volume, land area

Micro scale – biogeochemistry



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EDC Removal

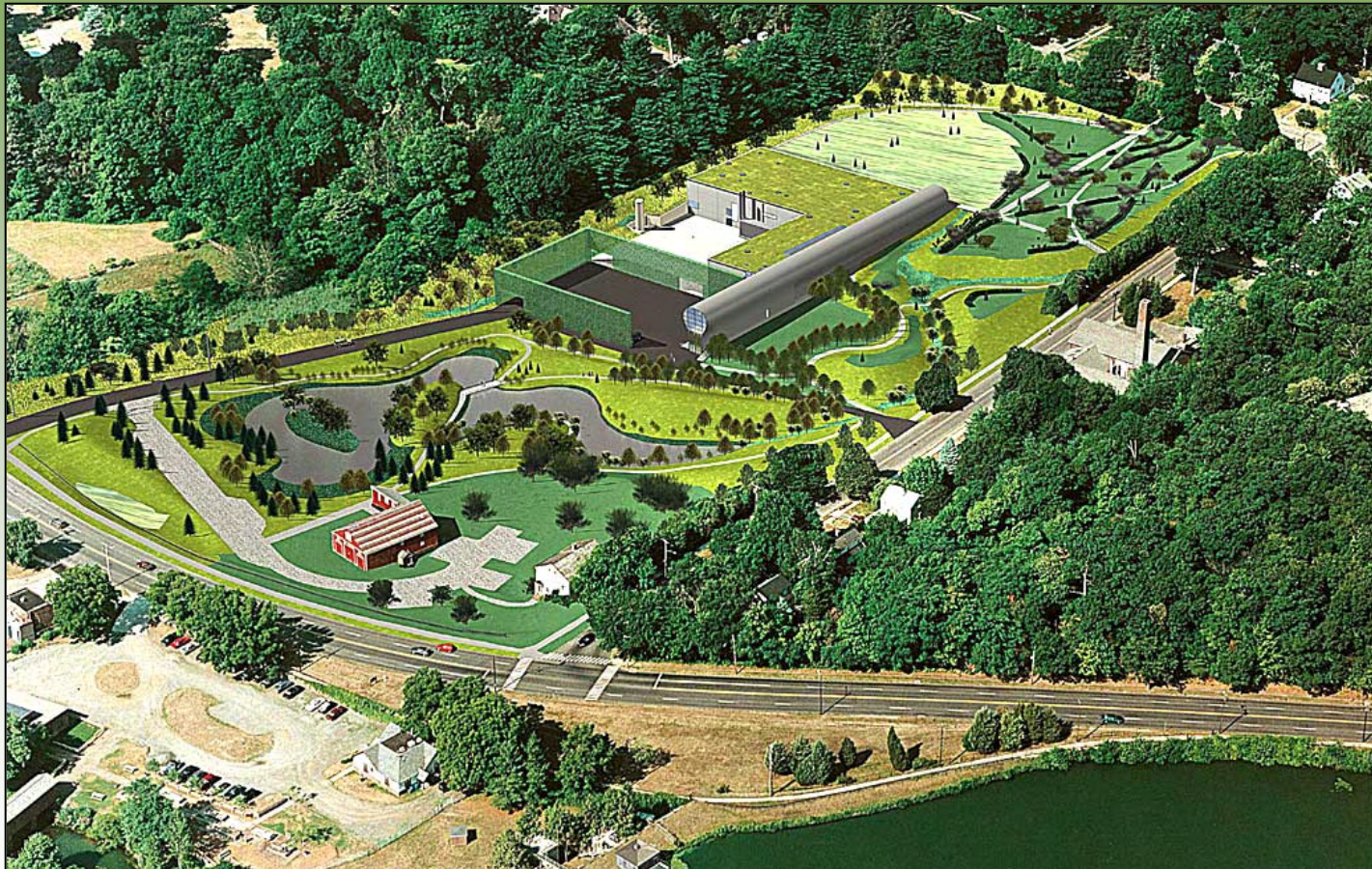
Options for control

- Candidates for source reduction
 - Surfactants that degrade into EDCs such as nonylphenol [NP]
- Candidates for early removal through modified treatment process
 - research needed?
- Removal processes that add ecological value
 - composting for enhanced degradation

\$

Each project, and its budget,
is your next opportunity to
achieve sustainability

Whitney Water Purification Facility and Park Hamden, CT



Simulation courtesy of Steven Holl Associates, New York City



Sustainability Consultant: Roles and Integration

Green Roof Design

Wetland Restoration Design

Stormwater Management

Water Quality Treatment

Water Recycling

Materials Reuse

Native Plantings



Stewardship: Need and Opportunity

Connected to impaired
Long Island Sound estuary

Within actively developing
Region

On S.C.C. Regional Water
Authority land

Adjoining historic dam, etc.

Vocal abutting neighbors





Outside:

Innovative design



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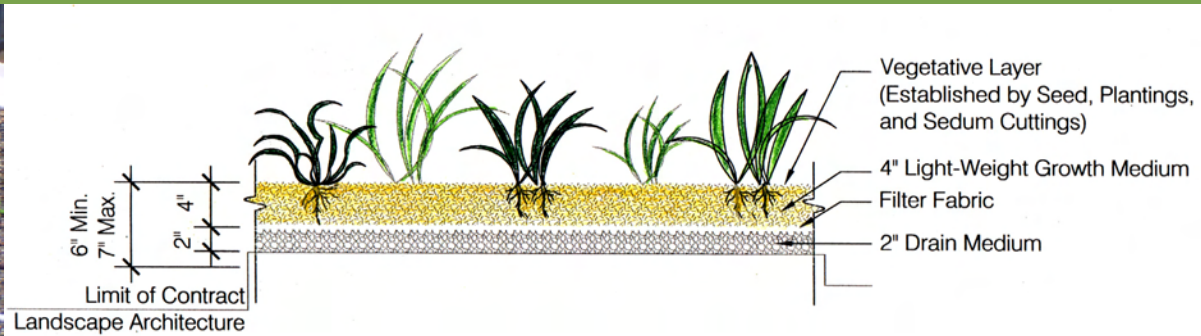
Inside:

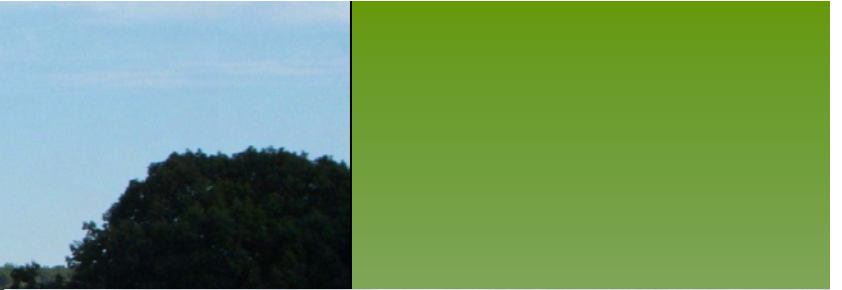
**Showcase
the natural
setting**

Site Construction



Vegetated Rooftop System





**Winner AIA COTE
Award 2007**

Priorities:

Keep impacts on site

Mitigate offsite problems

Raise public consciousness

Inspire and appeal