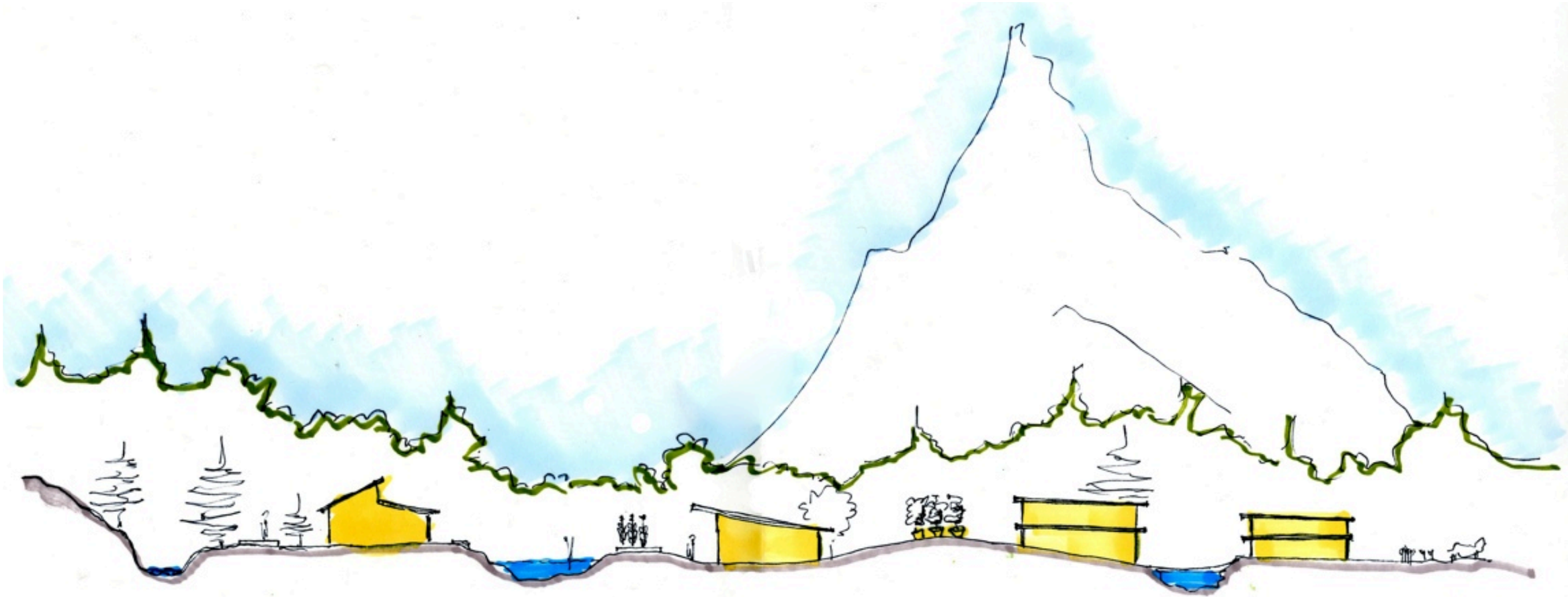
Closing the Loop:

an innovative waste management plan for Springwater



<u>residential</u>
passive solar design
shared walls
strict waste guidelines
during construction
green roofs
grey water reuse

<u>community green</u>
constructed wetland
community gardens
central compost
facility
walking paths/paths
for waste collection

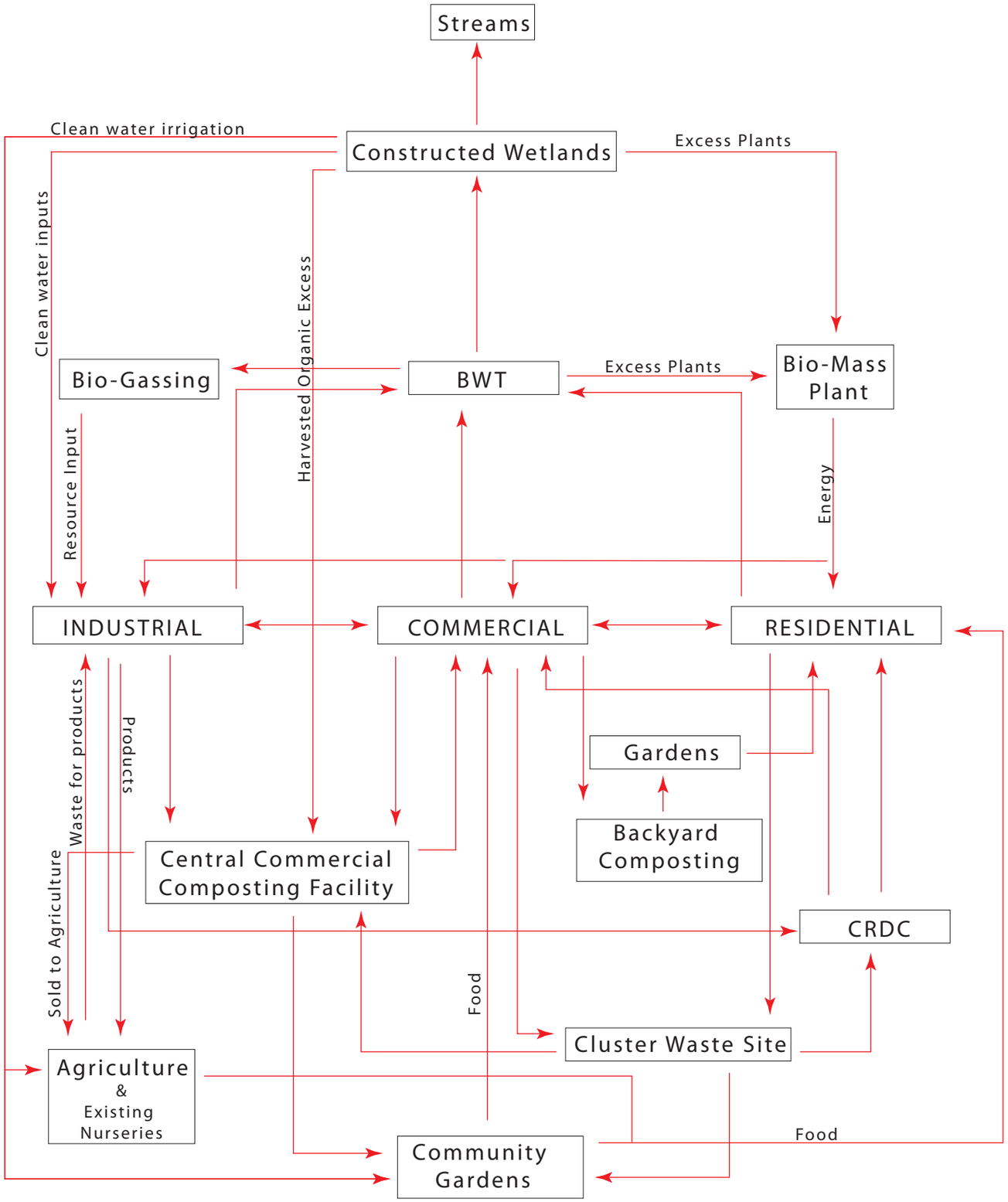
<u>community node</u>
biological wastewater
treatment
central resource
distribution center
nodal waste collection

<u>existing nursery</u>
increased production
of native species
for restoration
uses compost
biodegradable pots

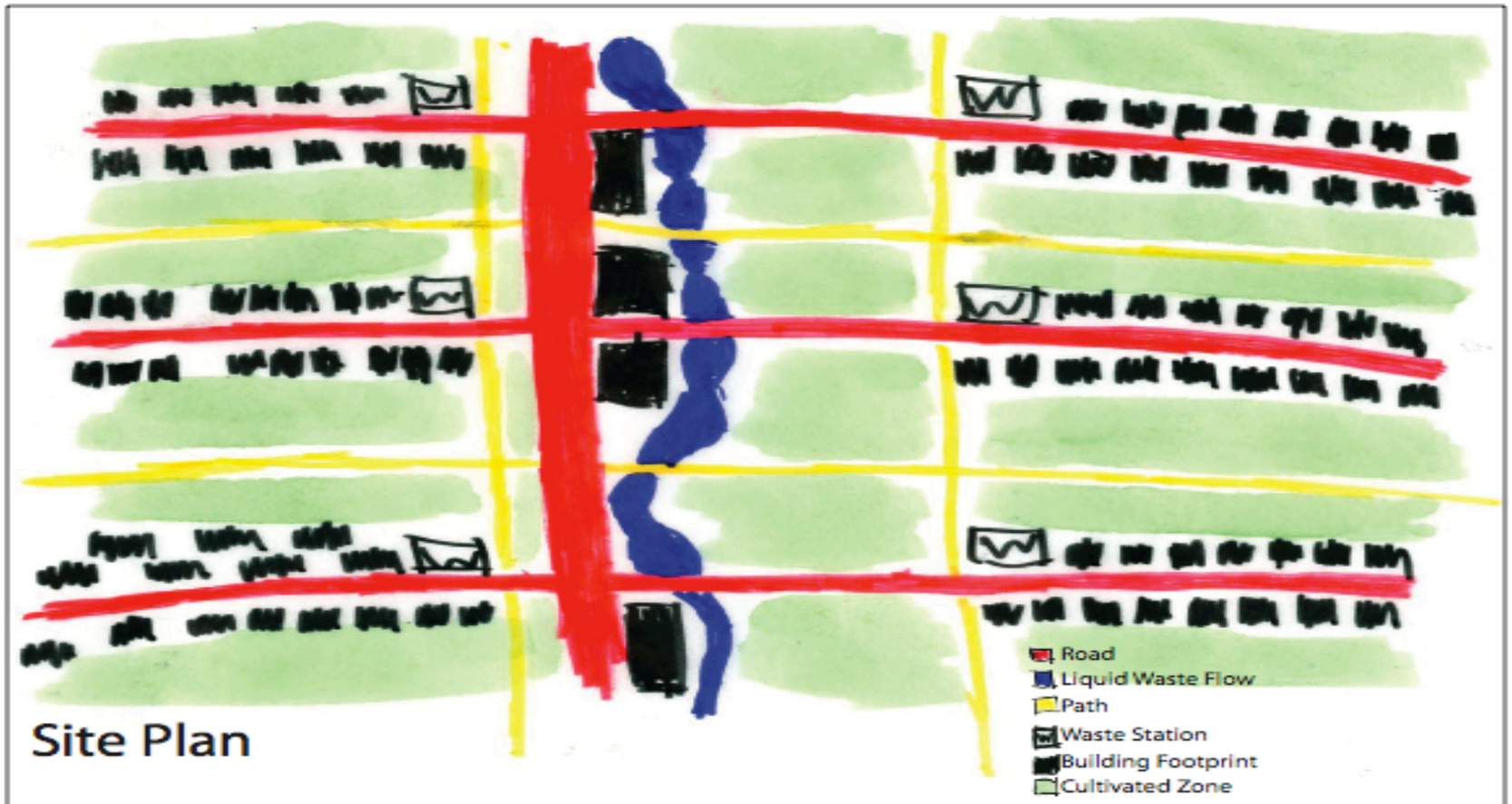
<u>eco -industrial park</u>
biodegradable pots
restoration materials
compost
bio-packaging
refillable containers
food products
biogas/ biomass
energy production
constructed wetland

<u>agricultural lands</u>
dairy farms: milk,
cheese, manure
(for biodegradable pots/
biogas energy
production)
agricultural waste such
as straw used
for biodegradable
packaging

Comprehensive Diagram



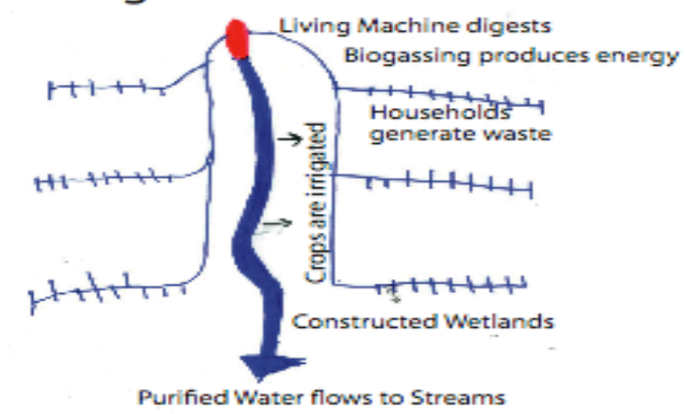
Residential Node (Linear)



Site Plan

Here, the residential node, composted of multiple housing clusters, is built around a central boulevard. Liquid waste management and community gardens provide landscaping and contribute towards a community that adresses waste and food production on site. Public buildings or commercial establishments are located along the main road. Only recyclables and true trash leave the node.

Sewage and Wastewater

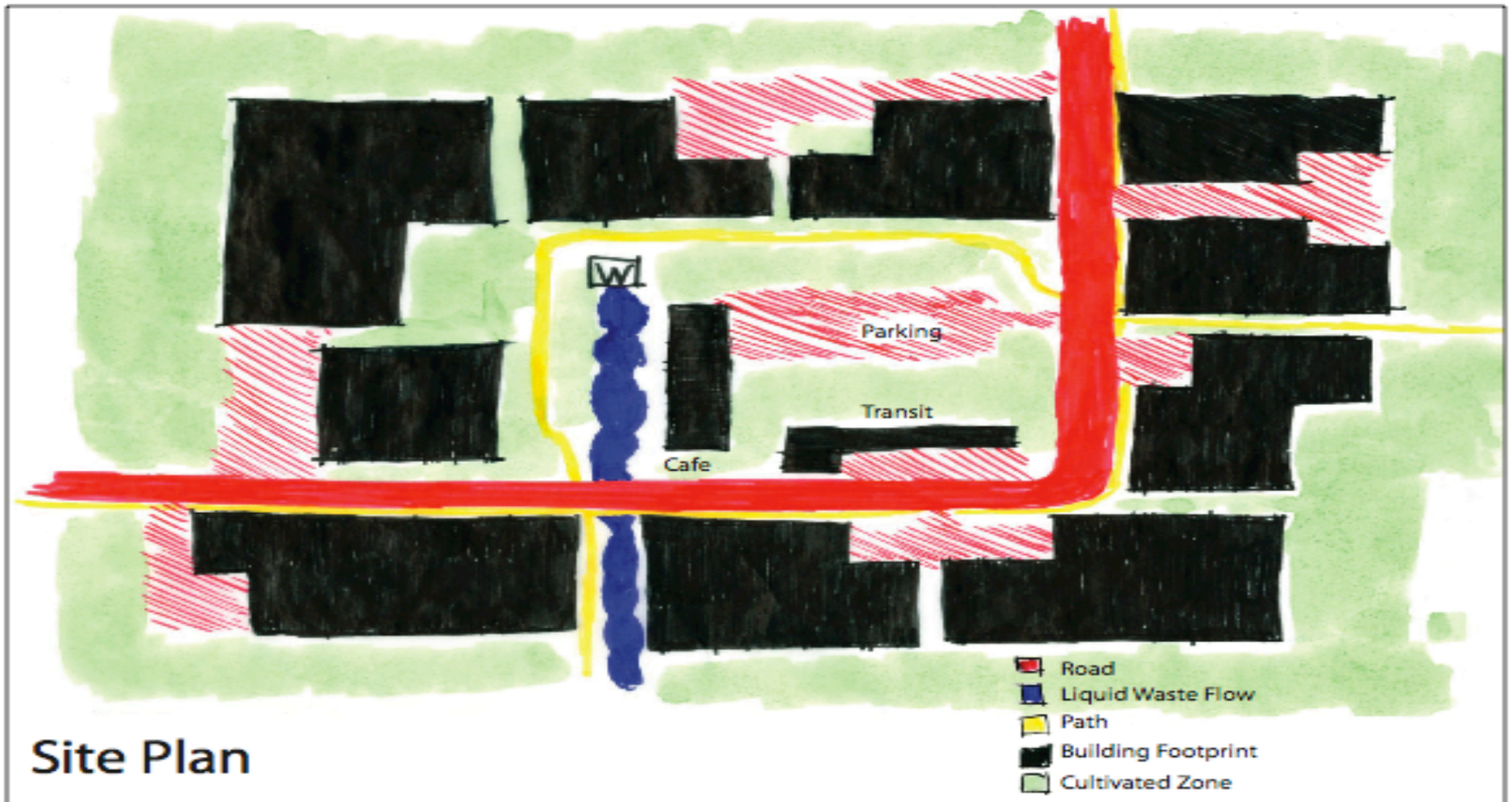


Solid Organic Waste

Organic waste is composted either in backyards, or at central bins. Compost from backyards fertilizes personal gardens, while that from communal piles is applied to community gardens. Organic waste does not leave the node in which it was generated.

Organic Waste sink
Composting site
Organic Waste flow

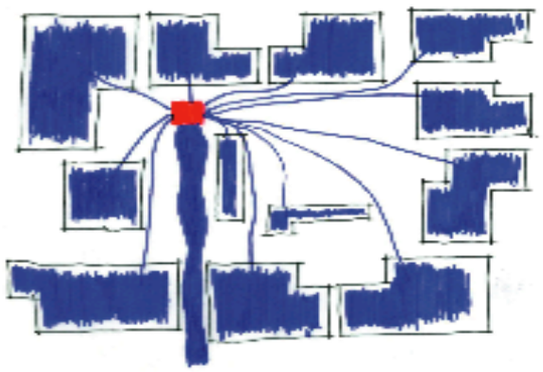
Industrial Node



Site Plan

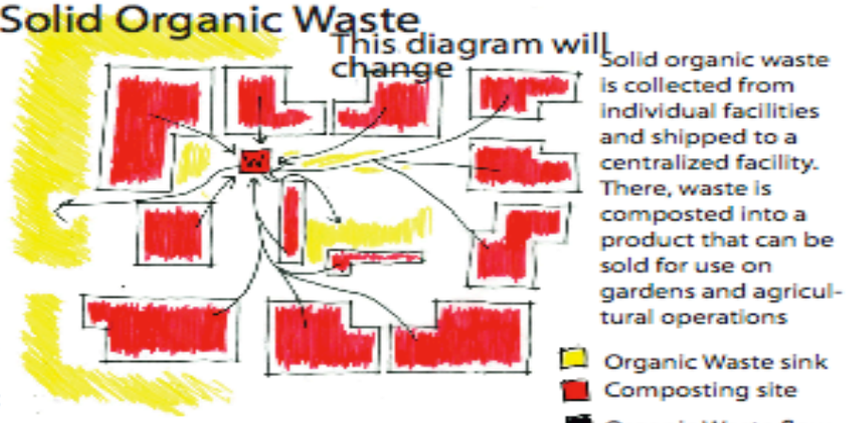
Here, the industrial node, composted of multiple industrial facilities, is built around a public center. Liquid waste management occurs within the node, and individual factors biologically remediate anything toxic. Solid organic waste and recyclables are collected and processed at a central facility. These industrial nodes could house a series of complementary facilities, forming a small industrial ecosystem.

Sewage and Wastewater



Wastewater in industrial nodes is though a living machine and constructed wetlands. Nothing but water suitable for introduction to local streams leaves the site. Individual factories are responsible for bioremediation of waste the larger system cannot handle

Solid Organic Waste



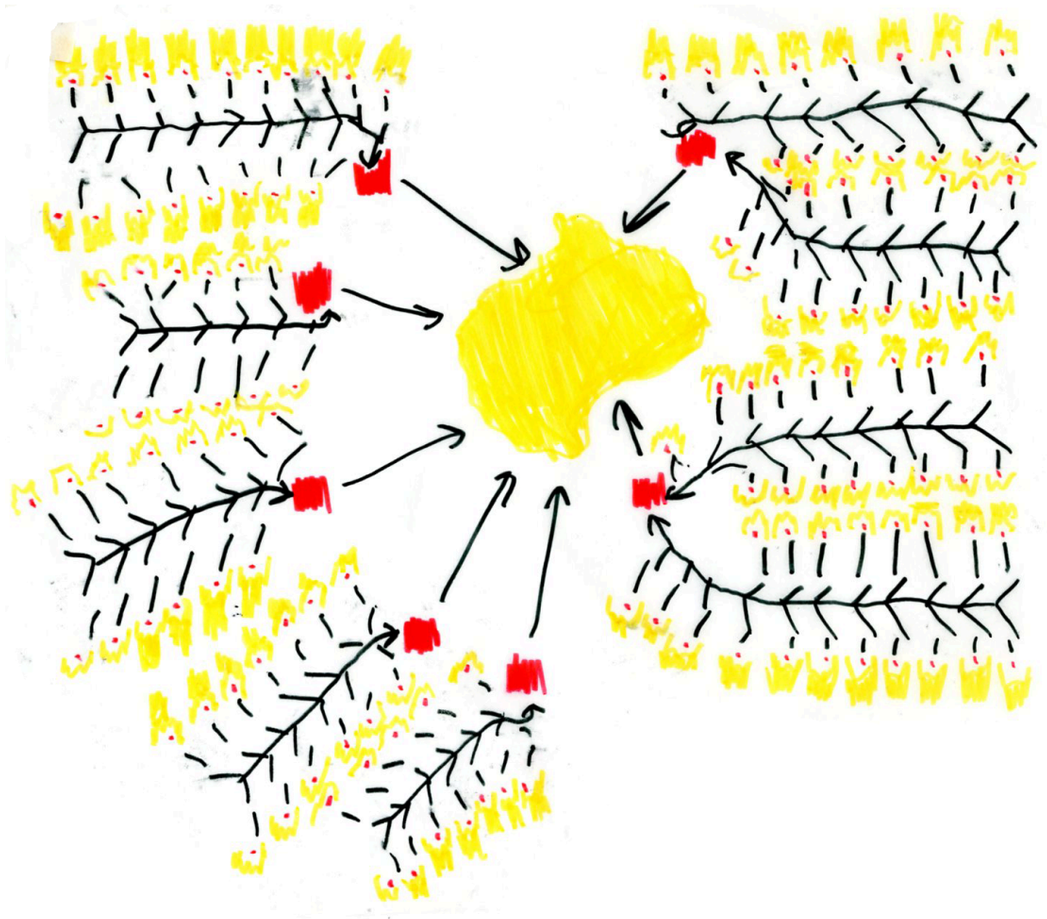
Solid organic waste is collected from individual facilities and shipped to a centralized facility. There, waste is composted into a product that can be sold for use on gardens and agricultural operations

Composting Organic Waste

- Solid waste composted aerobically
- Done in tumblers
- Piles
- Via curbside collection

Residential

- Tier 1: Backyard
- Tier 2: Communal piles



Commercial/Industrial

- Tier one: On-site
- Tier two: Central facility

Why?

- Close the loop
- New economic development
- Benefit existing industries
- Preserve landfill capacity
- Reduce infrastructure

Reuse as an Industry

- Goodwill / St Vincent De Paul's
  - Furniture, Cloths, ex.

- Bring Recycling / Urban Ore
  - Windows, gravel, ex.

THE REBUILDING CENTER

of Our United Villages, a Non-profit Organization

In Springwater

- **Central Resource Center**

1) Collects any type of resource

2) Sorts and files

3) Distributes to organizations for sale

Biological Wastewater Treatment

Water and waste from biological wastewater treatment can be used to grow food or non-food crops.

Synergies

Energy:
- methane production (explained in biomass/biogas section)

Agriculture:
- treated wastewater for irrigation
- composted human manure (not allowed by current regulations)
- reduces chemical fertilizer use

Aquaculture:
- recirculated water from BWT discharge can be used in a closed-loop
- lower food transport costs

Barriers to Implementation

Human Health Concerns
- fecal contamination relates only to raw human waste; not composted

Cost Considerations
- cost effective to up to 250 homes or 80,000 gallons per day

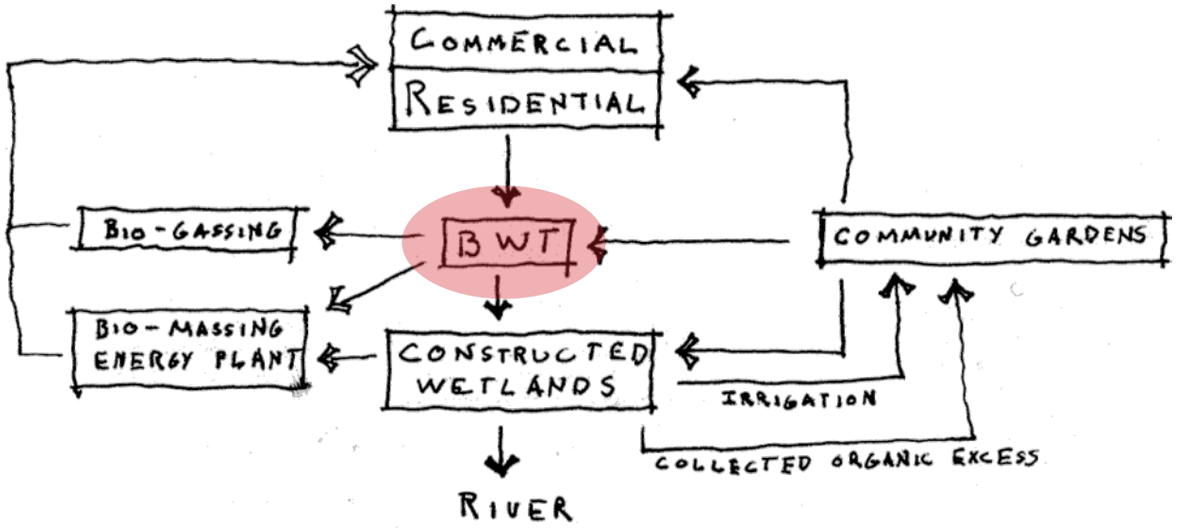
Ecological Effectiveness
- phosphorous levels treated to only 50%
- regulations

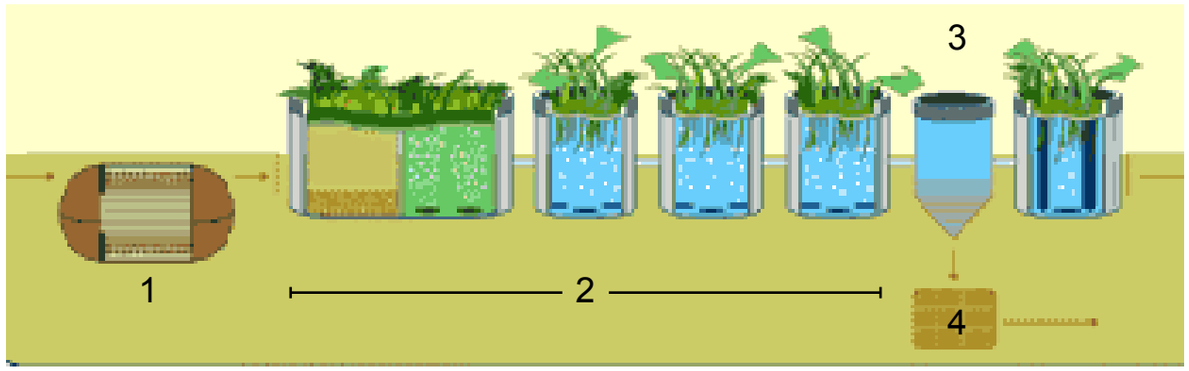
Images (directly above and right): Oberlin College Living Machine™

Image (directly above): Urban Aquaculture Center

Comprehensive Waste Management Plan
Gresham, OR (Springwater)

Biological Wastewater Treatment





Images (from Top): Biological wastewater treatment within the suggested system in Springwater. BWT treats commercial and industrial wastes and redistributes the by-products and end products for bio-gas-sing, bio-massing (energy) and into constructed wetlands.

(bottom): The Living Machine™ system of biological wastewater treatment uses an anaerobic reactor (1) filled with bacteria treat sewage and wastewater. After the initial reactor, wastewater moves to a series of aerobic reactors (2) for further separation. Solid waste is finally separated from water in the clarifier (3) and ecological fluid beds (4). The latter takes the treated solid waste, and the former releases water.

Benefits

Ecological:

- mimics an ecological process
- clean water entering watershed
- restore groundwater aquifers

Financial:

- infrastructure cost savings
- energy inputs are minimal
- easier maintenance

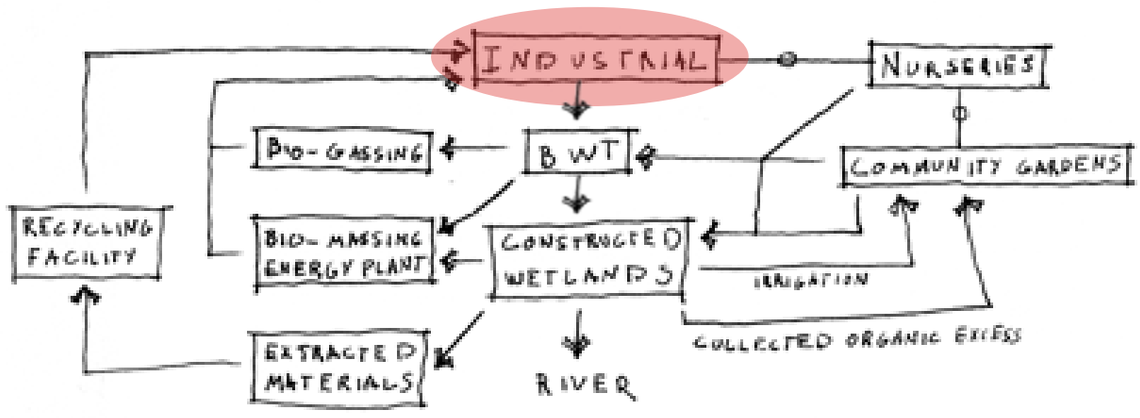
Flexibility

- diffuse or centralized
- simple calculations for design and upgrades

The above image is an aerobic reactor at Oberlin College's Living Machine™

Comprehensive Waste Management Plan
Gresham, OR (Springwater)

Proposed Industrial Waste Treatment Process



Waste Flow Diagram

Proposed system

Waste water:

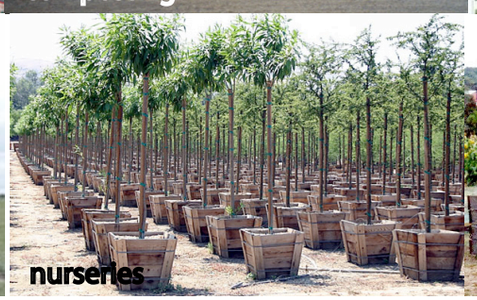
- flows from industry site to local node treatment center
- first treated at tailored BWT for most contaminents
- flows directly into further tailored wetlands
- used for local irrigation or flows into streams

Organic Waste:

- localized compost sites
- central commercial compost facility

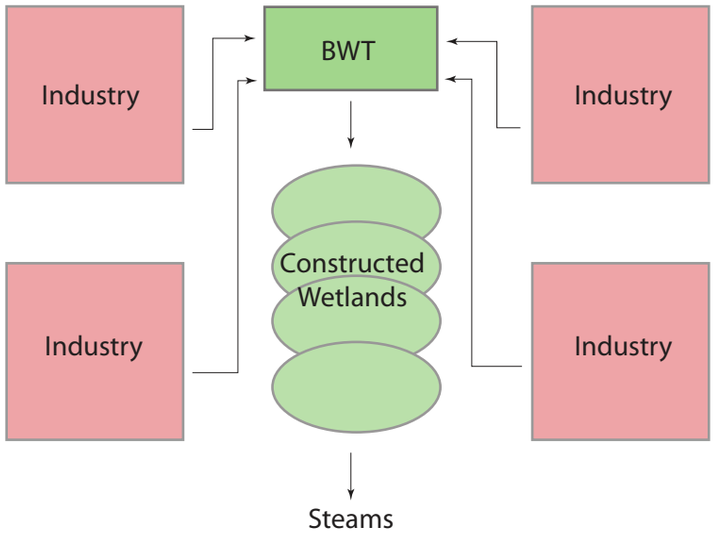
Solid Waste:

- Central Recycling facility
- CRDL facility



Comprehensive Waste Management Plan
Gresham, OR (Springwater)

Proposed Industrial Waste Treatment Process



Spatial Arrangement Concept Diagram (Waste water)

Benefits

Ecological:

- promotes local vegetation
- clean waster enters water table
- utilizes biological processes
- reduces transportation risks

Financial:

- infrastructure/transportation savings
- energy inputs are minimal
- outputs/byproducts can be sold
- localized system
- easier maintenance
- diffuse or centralized
- simple calculations for design and upgrades

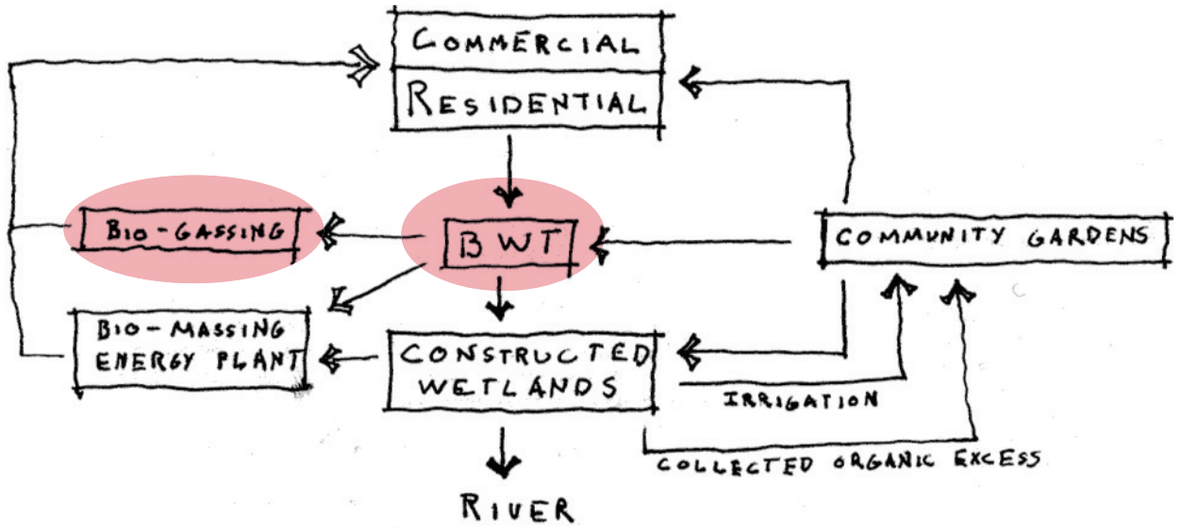
Industrial Facilities produce specifically toxic waste that is discharged to nodal treatment system

Tailored BWT system treats most industrial waste

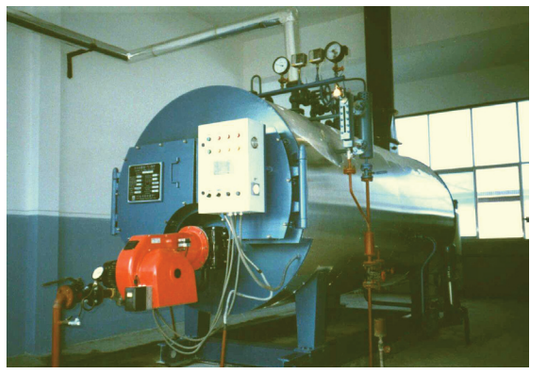
Partially treated wastewater flows into constructed wetlands for final treatment

Comprehensive Waste Management Plan
Gresham, OR (Springwater)

Anaerobic Digestion and Energy Generation



Cogeneration Engine

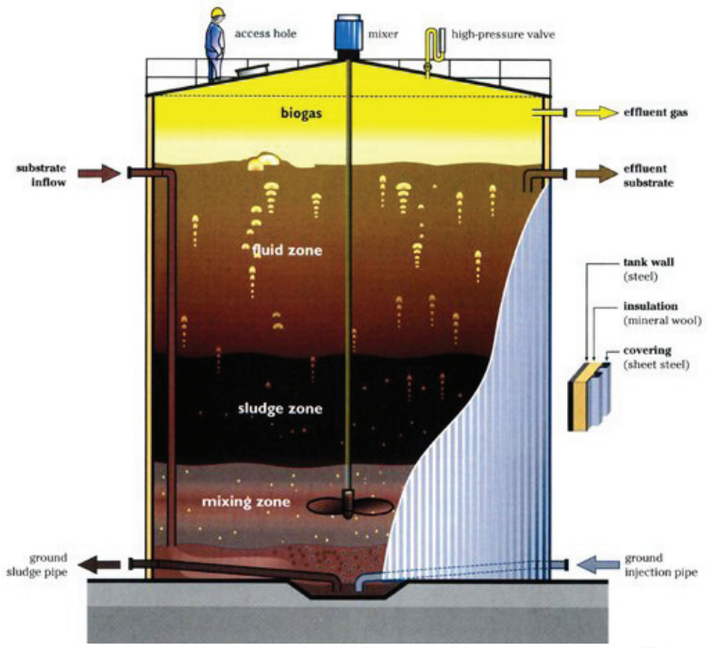


Biogas Boiler

Benefits

Financial:
- heat and electrical energy
- input to natural gas stream
- vehicle fuel
- fertilizer
- plastic strengthening agent
- compost
- feedstock for biodegradable plant containers or other packaging

Ecological:
- uses natural processes
- captures potential atmospheric methane
- offsets dirty energy production
- by-products improve soil health



Comprehensive Waste Management Plan

Gresham, Oregon (Springwater)

Anaerobic Digestion and Energy Generation

Potential Products from Fields Amended with Anaerobic Digestion By-products


Planter Pots from Pressed Plant Fibers

Synergies

Energy
- methane generation

Transportation
- vehicle fuel

Agriculture
- compost
- soil stabilizer
- moisture retainer
- fertiliser

Industry
- process or space heat
- electricity generation
- feedstock


Biogas Fueled Garbage Fleet, Malmo, Sweden


Gas Water Heater


Herbs Dried with Heat from Cogeneration

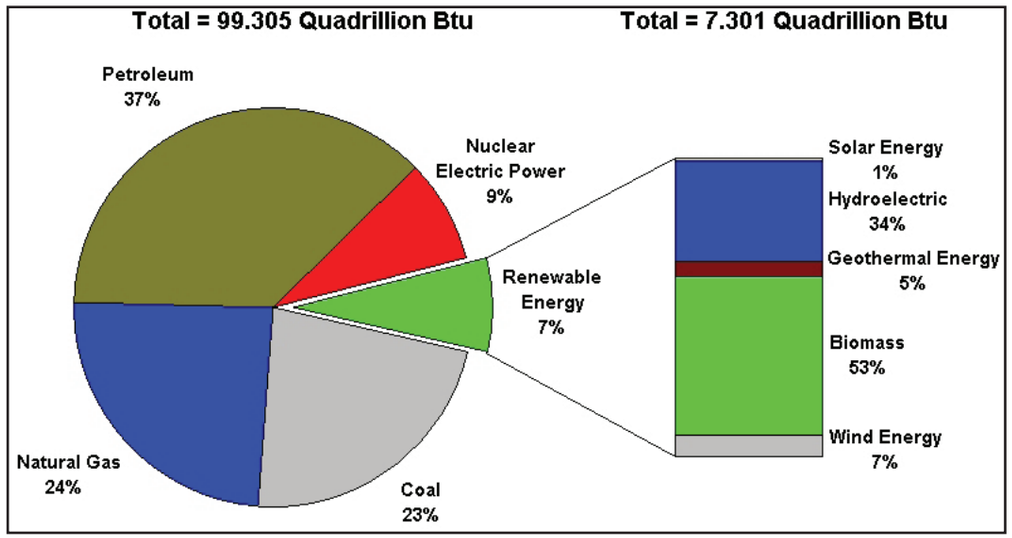
Anaerobic Digestion and Energy Generation

Regional

Columbia Boulevard Wastewater Treatment Plant, Portland, Oregon

- Anaerobic digestion generates biogas
- Phosphoric acid fuel cell manufactured by ONSI Corporation
- 82 million gallons of wastewater treated per day
- Generate an estimated 1,400,000 kilowatt-hours a year
- $60,000 a year saved in energy costs
- 736 tons of carbon dioxide emissions offset annually

National



Renewable Energy Consumption in the Nation's Energy Supply, 2008

Global

Global Potential

- .95 to 3.8 quadrillion Btus
- 25% to 100% of current global energy use

European Union

- 2%-9% annual increase in electrical generation from biomass between 1990 and 2000
- 10% of energy supply from biomass by 2010 (goal)

Sweden, future goals

- 10% of energy supply from biomass by 2010
- 40% energy from biomass by 2020

Germany, as of 2005

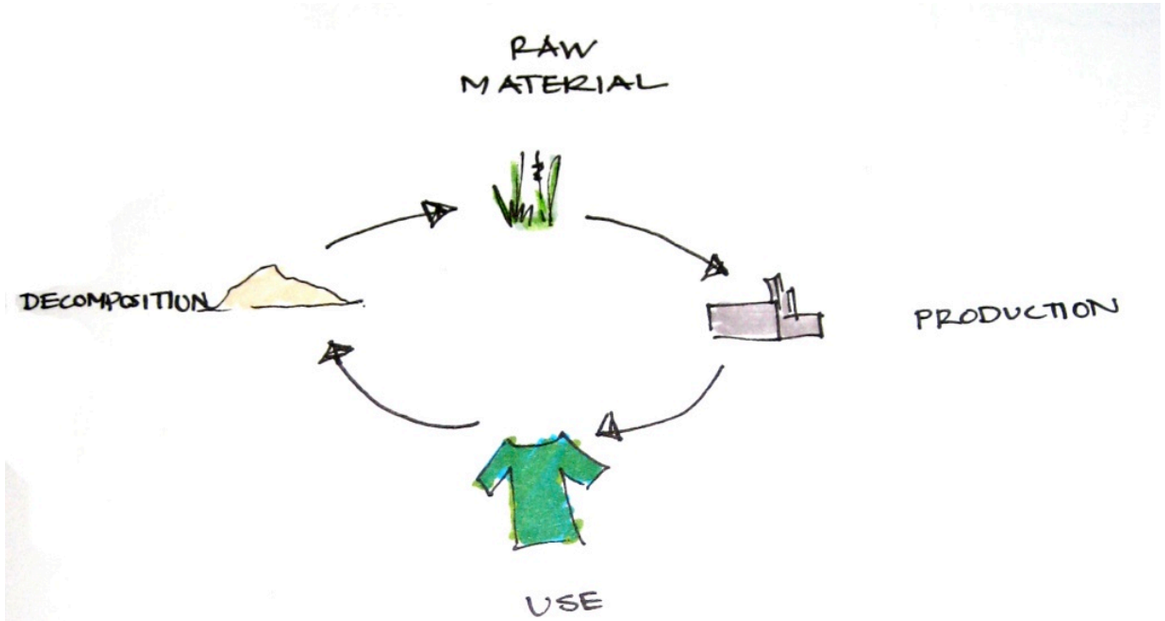
- ~3,000 biogas plants
- ~600 MW potential

Comprehensive Waste Management Plan

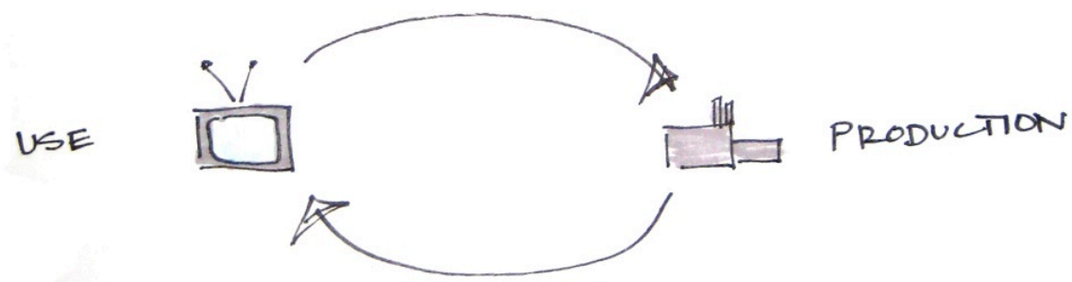
Gresham, Oregon (Springwater)

Eco-Industry

biological metabolism



technological metabolism



Specific Industries for Springwater

compost

provided from city collection
used at nurseries

ecological restoration products

mats for slope stabalization
meshes for vapor retention around trees
seed germination blankets

biodegradable plant containers

made from paper fiber, agricultural waste, and cow manure
paper fiber can be directly harvested from the city's recycling stream
cow manure and agricultural waste sourced from nearby farms

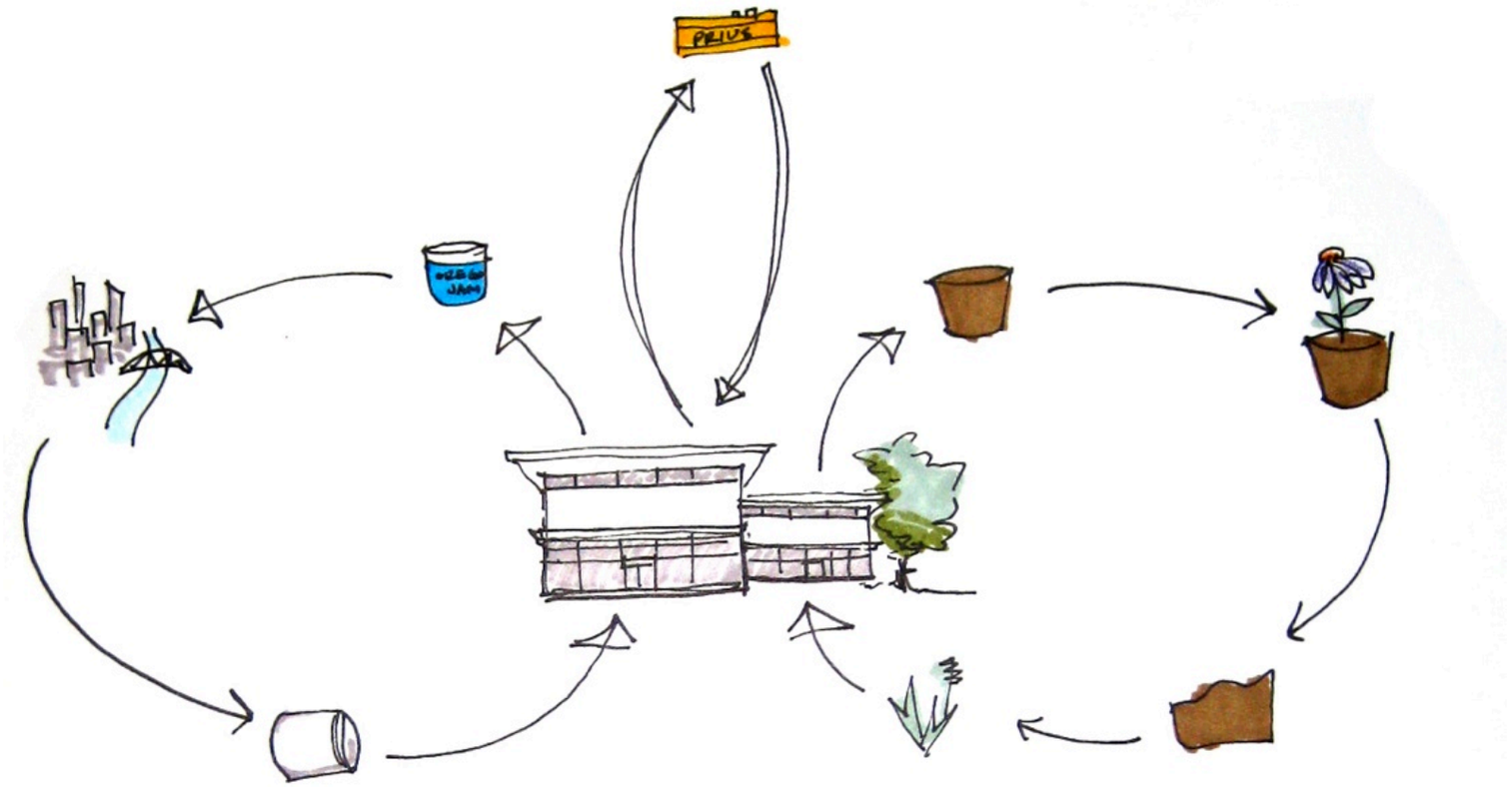
biodegradable packaging

paper molded packaging: 100% post consumer paper
biodegradable to-go containers: bamboo, wheat stock, reed, corn, and straw

refillable containers

manufacturers of food products and cosmetics will be mandated to use refillable containers

Product Cycles



SPRINGWATER
ECO-
INDUSTRIAL
PARK

waste=energy

waste= food

waste= opportunity