Opportunities in Ecological Design



Jonathan Todd Lawrence, Kansas 2006

"A sustainable society is one that can persist over generations, one that is far seeing enough, flexible enough and wise enough not to undermine ether its physical or social systems of support."

Donella Meadows



John Todd Ecological Design

- ? Helping industry, municipalities and agriculture meet sustainable community, county, state and federal waste water standards
- ? Green, cost effective water solutions.
- ? Aesthetic.
- ? Low energy requirements
- ? Low lifetime operating costs.
- ? Improved community relations.
 - Offering a diverse set of solutions to meet the project goals. Integration of the best available appropriate technologies and whole systems design approach.

Ecological Technologies



Borrowing from the wisdom of nature. The stream, the marsh and the pond

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Using Natures Wisdom as a Matrix

- ? ECO Machines accelerate nature's own water purification process.
- ? ECO Machines incorporate helpful bacteria, fungi, plants, snails, clams, and fish that thrive by breaking down and digesting organic pollutants, pollutants that normally deprive the water of oxygen.
- ? This clean, simple approach efficiently transforms high-strength industrial wastewater and sewage into water clean enough to be recycled for reuse.

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Nine Principles for Designing ECO Machines

- ? Microbial Communities:
- ? Photosynthetic Communities:.
- ? Linked Ecosystems and the Law of the Minimum: At least three distinct types of ecological systems need to be linked together to produce living machines.
- ? Pulsed Exchanges: Nutrient and Micronutrient Reservoirs:

- ? Geological Diversity and Mineral Complexity: Steep Gradients:
- ? Phylogenetic Diversity:
- ? The Microcosm as a Tiny Mirror Image of the Macrocosm:

TSS Treatment Performance South Burlington, Vermont Living Machine



CBOD 5 Treatment Performance South Burlington, Vermont Living Machine



Ammonia Treatment Performance South Burlington, Vermont Living Machine











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The Restoration of Waters













June

August

October



FIG. 6 SECTION















TRAVIS LOOP | WEST HAWAII TODAY

David Chai, director of natural resources at the Four Seasons Resort Hualalai, points to the pond which won an award for its use of phytoremediation.

FOUR SEASONS POND WINS ENVIRONMENTAL PROTECTION AGENCY AWARD

BY TRAVIS LOOP WEST HAWAII TODAY tloop@westhawaiitoday.com

When a chef at Four Seasons Resort Hualalai needs fish or shrimp for a dish, a fresh supply is available at the fifth hole of the golf course.

That's where the "living machine" is located.

The 3-million-gallon pond is an example of phytoremediation — the treatment of environmental problems using plants.

Water in the Four Seasons pond is filtered by floating islands of plants with extensive root systems that are colonized by nutrient-consuming bacteria. The water is then clean enough to be stocked with moi, mullet, milkfish and Pacific White Shrimp, which are used in the resort restaurant.

The pond – dubbed a "living machine" for its use

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of micro-organisms — was recognized by the Environmental Protection Agency at an awards ceremony Thursday in San Francisco. The facility is only one of two recipients from the state.

"The selection for the award was based on the promotion of innovative ideas, addressing of environmental problems over the long term and the ability to be replicated in other places," said Dean Higuchi, EPA press officer in Honolulu.

The pond, called Lake Punawai, was built in 2001 with the requirements of being energy efficient, visually pleasing and able to provide fish for the restaurant, said David Chai, director of natural resources at Four Seasons Resort Hualalai. The resort partnered with Natural Systems Inc. and

SEE POND PAGE 4A

When the EPA looked at this project, we saw a good example of how a business can interact with the environment and turn it into something positive for both their operations and natural resources.

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FROM PAGE ONE

POND: System allows fish, shrimp to be grown, saves money

CONTINUED FROM PAGE 1A

Ocean Arks International to create a phytoremediation system that met the criteria.

Two-and-a-half acres in size and 10 feet in depth, the pond is lined with a foot of gravel and features two floating islands of plants. Chai said bacteria and micro-organisms were introduced to the root systems and gravel bed.

A three-horsepower pump circulates water through the islands, allowing plants and bacteria to remove pollution and excess nutrients, such as phosphorus and nitrogen.

"We have basically built a mini-ecosystem to keep the pond clean and remove waste from the fish," Chai said.

About 80,000 shrimp and thousands of fish live in the pond and can be harvested for the resort restaurant. Oysters are also found in the waters, although their role is in filtration, not food.

The pond saves energy costs for the Four Seasons as well, Chai said.

"If we set up another area as a fish pond without this system, it would cost close to \$10,000 a month in power —

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TRAVIS LOOP | WEST HAWAII TODAY

On the fifth hole at the Four Seasons Resort Hualalai's golf course, a pond was built four years ago that filters water through plants, allowing fish and shrimp to be grown in the pond and used at the resort's restaurant.

this one runs about \$400," Chai said.

The dual benefits for the environment and Four Seasons also contributed to the selection for an EPA award.

"When the EPA looked at this project, we saw a good example of how a business can interact with the environment and turn it into something positive for both their operations and natural resources," Higuchi said.

Honolulu officials hope to replicate the pond's success in the heavily polluted Ala Wai Canal, which borders Waikiki. Pending approval by the state Board of Land and Natural Resources, a 3,396-foot-long, 30-inchwide floating platform of plants would be placed in the canal to clean up the urban waterway, according to an Oahu newspaper.

Letter from the Four Seasons

? Morris,

The filtration system installed by Ocean Arks Int. using 2 restorers for our 3 million gallon golf course water feature has worked amazingly well. In addition to having an aesthetic water feature, we stocked our brackish-water lake with 80,000 Pacific White shrimp 300,000 oysters, and nearly 6,000 fish in an attempt at aquaculture to supply our Resort restaurants. After 2 years of operation our aquaculture venture is still going strong and the lake looks beautiful. Operating costs are minimal compared to other lakes of similar size, and we attribute this to an efficient natural filtration method. Low nutrient levels are consistently maintained, and the lake bottom has absolutely no accumulation of silt or debris.

David Chai Hualalai Resort Natural Resources Manager





展用西關(左海公园)





福州省安河









Baima Canal 500 meters long 12,000 pe (City Average: 8,000 pe/km)

Design Parameters and Goals

Z	Estimated Influent	Required
Flow (m3/day)	3,000	Effluzent
BOD (mg/l)	240	<30
NH3 (mg/l)	40	<15
COD (mg/l)	Z>500	<50
D.O. (ppm)	Z	>2

- Remove odors and floating material
- Provide an installation that is energy efficient, biologically stable, and beautiful















Architecture &

Ecology









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YMCA Kitchener/ Waterloo, Ontario




















Omega Institute

Waste Water Treatment for 700 Overnight Guests and Employees

So, why not in my backyard?

? Ecological systems become an asset to the communities where they are located.

Living Systems in Taos, New Mexico put this Living Machine in the pool room.















Ecological Processes to Covert Waste to Value Added Products

? The South Burlington greenhouse pilot to convert spent brewery grain and liquid waste to value added products



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