Progressing toward:

The Drainless Kitchen
The Recirculating Laundry

Fig. 1- Demo-model for the Drainless Kitchen set up at EBO Cosult Ltd. 29 March 1999. The water is purified to drinking water quality before being recycled. Not connected to water supply or sewer systems.

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I. Description of the realizations and of achievements.

Fig. 2 - Aquarium system at Tandkarpen - Amagerbrogade 9B – DK 2300 Copenhagen S.

Basis for the project (UN Sustainable Development, Agenda 21, chapter 18)

Water is needed in all aspects of life. The general objective is to make certain that adequate supplies for water of good quality are maintained for the entire population of this planet, while preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities within the capacity limits of nature and combating vectors of water-related diseases. Innovative technologies, including the improvement of indigenous technologies, are needed to fully utilize limited water resources and to safeguard those resources against pollution.

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The Recirculating Laundry

EBO Consult A/S offers the installation of the above-mentioned systems based on our ecological designer's past and present work with green technology, which has focussed on the following areas:

* Dome building
* Organic gardening
* Hydroponics
* Aquaculture
* Recirculating aquaculture systems for fish and plants
* Green purification systems
* Ecological housing
* Specialised greenhouse production

Through his work as project manager for Frederiksberg Økologiske Xperimentarium (commonly known as FRØX and an experimental division of EBO), our ecological designer has developed the following from 1997 to 1999:

A demo-model for a **Green Recirculating Laundry**, that was set up in Copenhagen at EBO Consult in July 1997 in a 6.000-litre, sectioned, glass aquarium. Clothes was successfully washed in the same water that had been recirculating in the system for two and a half years. Though the water was purified for recycling, it did not comply with drinking-water standards.
The idea for a **Green Recirculating Laundry** arose after a visit to an aquarium shop, "Tandkarpen", Amagerbrogade 9B, DK-2300 Copenhagen S, where the large, sectioned aquarium shown on page 2, is set up.

Brief description of the Tandkarpen system:

The shop contains a series of large interconnected aquariums arranged in a stair-like formation. The water flow starts in the highest, hindmost section. The water is pumped up from the purification system in the cellar.

The excess water overflows from one aquarium section to the next. The water ends up in the lowest aquarium from where the excess water flows through a sand filter and UV-illumination in the cellar.

After flowing through the sand filter and the UV illumination, the water is sent to a collection tank from where it is pumped back into the aquarium system.

A perforated bed plate is placed in each section of the aquarium, and a plastic pipe is attached to this bed plate. Oxygen is pumped to the bed plates to aerate the filtration material placed over the bed plates.

This aeration system is used in all the shop's aquariums and is probably the most commonly used bed filter for aquarium owners in Denmark. The same system is used in **the Green Recirculating Laundry** and **the Drainless Kitchen.**

Fig. 3 - The green recirculating laundry at Kompagnistræde.

Green Recirculating Laundry

EBO Consult set up the large aquarium in Kompagnistræde in July 1997 based on the model from Tandkarpen's aquarium. The purpose of the system was to purify the water from the building's washing machine so it could be reused.

From the outset, a decision was made to use biodegradable washing powders in the system, in this case Green Clean and Rent Naturligt. Ecover and Bluecare were used in the **Drainless Kitchen** at FRØX.

The wash water was sent directly from the washing machine to the large sectioned aquarium. This aquarium was oversized for demonstration purposes since the impressive, illuminated demonstration system was designed to be seen by the large crowds passing by the Kompagnistræde address during the course of a day from 10 a.m. to 11 p.m.

Plants (primarily native to Denmark) were part of the purification process and were placed on "rafts" on the water surface of the aquariums, like in various other aquaculture systems:

* The New Alchemy Institute (Cape Cod, Massachusetts, USA).
* The Environmental Research Laboratory (Tucson, Arizona, USA)
* Nordvestjysk Folkecenter (Thy, Denmark)
* Grynebækken (Svaneke, Denmark)
* Stensund Folk High School (Sweden)
* Fløng Produktionshøjskole (Denmark), and many more.

Since the stair-like formation was not required for getting the water to flow, a sectioned aquarium was chosen for the Kompagnistræde system in which the water flowed from one section to the next along the bed and surface areas.

The water was purified by movement through and aeration in the system, which contained fish, snails, micro-organisms, plants and mineral/biological bed filters.

The water left the system as overflow and was piped into a collection tank. The water was exposed to UV illumination in the collection tank and was ready for reuse when the washing machine was started.

Fig. 4 - Demo-model for the Green Circulating Laundry that was set up at EBO Consult in Kompagnistræde in July 1997. The laundry washed in the same water for 4 years.

The Drainless Kitchen

In autumn 1998, the 3B Joint Administration Office became interested in a biological wastewater treatment system for their large launderette at Folehaven, at the time consisting of 23 machines with a daily discharge of 30 m³ of wastewater, and commissioned EBO Consult to carry out this assignment.

At the same time however, EBO Consult was informed that the water must comply with drinking-water standards, before it could be reused in a communal launderette. This requirement was stipulated by the following Danish authorities:

* Environmental Protection Agency
* Ministry of Housing and Urban Affairs
* National Board of Health
* Environmental Control for the Municipality of Copenhagen

This led to the construction of a demo-model of the Drainless Kitchen on 29 March 1999, as the basis for the experimental set-ups that EBO Consult was compelled to undertake before – after five months of experiments – the recirculating water complied with the drinking water requirements. After this, we were able to continue our work with the large system designed for Folehaven. In this system, the total water volume should be six times the volume to be treated each day.

The water in the Drainless Kitchen is not considered to be heavily contaminated wastewater. This system contains the following:

1 septic tank with 180 litres of water
1 treatment system with 720 litres of water
1 collection tank with 180 litres of water

The total water volume in the system is roughly 1000 litres. It looks like it can process two to three washes per machine per day.

For nine months (as per December 1999), EBO Consult washed dishes and clothing in the same water.

After one month of washing only clothing to soften the recycled water, a dishwashing machine was also started. After some five months of experimental work, our efforts to meet the drinking-water requirements – as mentioned above - were successful. Eight series of samples were taken from the purified water in the Drainless Kitchen. All the samples were taken by the Copenhagen Environmental Laboratory under the Food Control Authority. Although the recycled water gradually approached drinking water standards, the requirement had still not been met after the first seven measurements. EBO Consult and HOH Water Technology have continuously modified the system to improve the measurement results.

The next-to-last modification, made on 19 July 1999, involved the installation of a larger UV disinfection system.

The result of this modification is shown in the sample taken Thursday, July 29. Drinking water quality had still not been attained, however. The final adjustment was made on 18 August 1999. The result of this change came on September 1, when drinking water quality was achieved. The first seven measurements showed that a micron filter and UV illumination were unable to produce drinking water quality since the bacteria count in the water was still too high.

Results of water samples taken from the "Drainless Kitchen" at FRØX

Sampling date	Physical characteristics (appearance, odour, taste)	Aerobic bacteria count 37° C after 48 hours per ml. Test DS 2254	Aerobic bacteria count 21° C after 72 hours per ml. Test DS 2252	Coliform bacteria at 37° C per 100 ml. Test DS 2255	Thermal-tolerant coliform bacteria per 100 ml. Test DS 2255
16 April 1999	Clear	16.000	2.000	54	< 1
5 May 1999	Clear	7.100	140.000	92	< 1
31 May 1999	Clear	>2.000	>2.000	> 161	< 1
7 June 1999	Clear	2.400	190	3	< 1
15 June 1999	Clear	130	860	> 1	< 1
6 July 1999	Clear	560	360	> 1	< 1
29 July 1999	Clear	760	940	54	< 1
20 August (*)	Clear	98	12	< 1	< 1
Drinking water requirement	Clear	max. 20	max. 200	< 1	< 1

After five months of development work, FRØX and HOH Water Technology succeeded in attaining drinking-water quality before the water is recycled.

HOH instructed EBO Consult to add 1.7 ml of a 40% H_2O_2 solution (hydrogen peroxide) to the 150 litres of water in the collection tank every day. Hydrogen peroxide disinfects the water by killing the bacteria. In this process, H_2O_2 is broken down into water (H_2O) and oxygen (O), which are naturally harmless in the system. Any hydrogen peroxide residuals remaining in the water after the elimination of all the bacteria are decomposed into hydrogen and oxygen during the UV illumination process.

The last sampling on 30 August 1999 showed that all parameters fulfilled the drinking-water requirements , with the exception of the aerobic bacteria count at 37° C, which was at 98, when it must be less than 20. EBO Consult therefore increased the admixture of hydrogen peroxide to 1.9 ml per day to solve this problem.

System description of the Drainless Kitchen

The following is a general description of the experimental system. A Miele - W 979 –Allwater washing machine and a Miele - G 665 dishwashing machine were installed in the system. The water from the two machines was sent to an aerated septic tank with a maximum capacity of 200 litres from which the water was removed as overflow. The water from the septic tank was led to the sectioned biological treatment system which has a capacity of 720 litres. The water was circulated through the treatment system, assisted by aerated bed filters, in the same manner as in Kompagnistræde. This technique is commonly used in aquarium shops. The first two sections of the processing system were filled with a 25-cm layer of mineral/biological filtration material. The first two sections also contained fish and snails.

Plants were grown on the water surface of the third treatment chamber. The thickness of the mineral/biological filtration material in this section is 75 cm. The water surface was 5 cm above the top of the filtration material. Various house plants were placed on top of the filtration material so

the flower pots are standing in 5 cm of water. The water was oxidized 24 hours a day and after 4 months 16 hours a day. The water flowed from the last section in the biological treatment system to the collection tank. The collection tank contained a submersible pump of the make Grundfos Jet Sub – SQE 2-35.

A circulation pump, Grundfos ups 25-40, propelled the water from the collection tank through a micron filter, that collected suspended particles > 25 mμ., further on through a UV illumination unit of the make Trojan –Aqua UV-705 to kill bacteria and back to the collection tank. It is necessary to circulate 24 hours a day to keep drinking water standard

The jet sub pump supplied the washing machine with the required water at a pressure of 3 bars.

Fig. 5 - Demo-model for the Drainless Kitchen set up at EBO Consult on 29 March 1999. Dishes and clothes washed in the same water for almost 2 years. The water was purified to drinking water quality before being recycled. Not connected to water supply or sewer.

Biological treatment process

In the beginning, the process of purifying the soapy water into clear water in the biological system took eight to twelve hours. After a seven-month period during which the number of micro-organisms have multiplied in the septic tank and the mineral/biological filter, it takes one to one and a half hours to purify soapy water into clear water.

Since the contamination level of this system is low, it does not appear that the capacity of the system needs to be six times the volume of water processed each day to meet the official requirement. EBO Consult is continuously modifying the system to reduce energy consumption and improve other factors. At first, the bed filters were aerated 24 hours a day, but after a seven-month run-in of the system, the system is aerated only 20 hours a day.

The next task for EBO Consult was to reduce the size of the biological system by developing and designing a biological purification unit tailored for the dimensions of a conventional kitchen.

What are the perspectives of the "Drainless Kitchen"?

This system is intended to recycle the water that flows into the household as drinking water from the municipal water supply.

At present, the consumer pays a water rate for the water supplied to the household. One fee covers the water itself, while another fee covers the discharge and purification of the water. The total rate for one cubic metre of water is minimum 30 DKK up to 65 DKK.

To start with, water was pumped into the system shown here to fill up the aquarium and the two tanks.

When installing a kitchen table with a sink, the water for the sink must come from a tank placed on the kitchen table.

The tank is filled with drinking water. The water from the kitchen sink flows into the septic tank from where it continues into the biological treatment system.
An overflow unit is placed on the collection tank. Overflow from the collection tank would normally be sent to the sewer system, if the system had been placed in an ordinary household.

Occasionally water needs to be added due to evaporation from water surfaces and plants and to replace the water removed from the system in wet clothing.

What about small systems?

In October 1999, EBO Consult established a demonstration model for ordinary households, a so-called biological treatment unit on a household scale. It was important to dimension this system so it could fit in a kitchen or cellar.

It should be noted that the volume required for this unit is four to six times the volume of the water to be treated every day. Based on an average per capita daily consumption of 60 litres of water in the washing machine, a system volume of 250 to 400 litres is generally sufficient, which corresponds to the size of a large aquarium. The treatment system has the same size as a washing machine, i.e. a LxWxH of 60 x 60 x 80 cm.

In the winter 2000 EBO Consult established a biological treatment unit for one washing machine and one dishwasher in a kindergarten at Solrød Strand, south of Copenhagen. The unit consist of a room divided aquarium at a size of 60 x 120 x 85 which means it can fit under a kitchen table (see picture underneath)

Fig. 6 - „Drainless Kitchen Unit“ at Mosebo Kindergarten.

Large Green Launderette at Folehaven

As mentioned on page 5 The 3B Joint Adm. requested EBO Consult to calculate the specifications for a biological treatment system for the large communal launderette at Folehaven. The first proposal was ready in December 1998 and formed the basis for continued project work together with the firm of architects Jørgen Hammelboe ApS and the firm of consulting engineers Torben Wormslev.

Fig. 7 - Proposed layout of the laundry, drawn by Anders Henriksen for EBO Consult.

The launderette serves a housing area consisting of 941 tenancy units. Before the renovation the launderette discharged 30 m³ of washing water every day amounting to water rates of 320.000 DKK annually.

The goal was to get the water consumption down to 20 m3 a day by renewing the washing machines and a overall energy saving by changing all the machines in the launderette.

The water consumption after the implementation of these replacements is 15 m³ per day.

Sub-project overview	**Initial expenditures**	**Annual savings**
New washing machines,		
tumble dryers, rotary ironers, etc.	3.843.000 DKK	270.000 DKK
Modernisation of existing laundry	2.310.000 DKK	
Green purification system	1.535.000 DKK	200.000 DKK
Use of rain water	63.000 DKK	7.700 DKK
Heat recirculator	189.000 DKK	5.000 DKK
Total	7.940.000 DKK	482.700 DKK

Technological components in the treatment system:

Micron filter
UV illumination units
Hydrophore pump
Circulation pumps
Air pump

All the official Danish approvals for the communal launderette was received from the Environmental Protection Agency, the National Board of Health, the Ministry of Housing and the Environment Health Control for the Municipality of Copenhagen (November 1999).

A specific Launderette Task Group was appointed at Folehaven, and the group recommended that a referendum be held on the entire project among the residents of the 941 housing units.

The referendum was held on 10 January 2000, and the residents approved the establishment of the project .

Four to five months was required for rebuilding the facilities, acquiring new machinery and establishing the biological treatment system, etc.

The Torben Wormslev firm, in the person of Søren Knudsen, has been in charge of all financial calculations for the establishment of the renovated launderette. The prices are shown in the table on page 9.

Fig. 8 - The opening day - 25 Agust 2000.

The launderette is located on the first floor in a central boiler house that was previously coal-fired.

Description of the system

As previously mentioned, the estimated amount of washing water to be purified and recycled amounts to 20 m³ per day.

The ecological design requires the capacity of the entire treatment system to be four to six times this volume. The following processes occur in the launderette.

1. *Septic tank with two-day retention time for washing water*

The water from the washing machines is piped to the former coal silo located in the cellar. This tank functions like an anaerobic septic tank in which the retention period is two days. This means that 40 m³ of the total volume are used in this tank.

2. *Aquaculture tanks and biological filters*

The above-mentioned tanks are placed in the former bathroom area beneath the launderette. The water is pumped from the septic tank to eight aquaculture tanks which have a total volume of approx. 32 m³.

The water flows through the eight aquaculture tanks with mineral/biological filters which is also where the micro-organisms are found. The micro-organisms transform the biodegradable material into nutrients that can be absorbed by the plants. Snails, zooplankton and fish are found in these containers, and plants grow on the water surface of the containers.

3. Sectioned treatment aquarium

The water is pumped from the last of the eigth to a large sectioned treatment aquarium with a capacity of some 8.5 m³. The total length of the treatment aquarium is 8 metres. Every section of this aquarium has a mineral/biological bed filter. The water is aerated 24 hours a day.

The overflow water from the last section in the treatment aquarium is piped under the floor into the last large area with biological filter and the planted marsh area.

Fig. 11 - The sectioned glass aquarium has a total length of approximately 8 metres. Its principle design is the same as the system in Kompagnistræde. A mineral/biological filter is established at the bottom. The beds of the sections are interconnected from one section to the next.

4. The final mineral/biological filter.

The last mineral/biological filter constitutes the next-to-last phase in the water treatment process that takes place in the launderette room itself.

This filter is adjoined to the planted marsh area in one large container.

The filter is made in a 1.5-metre-high section with open water at the inflow to the section and open water at the outflow to the planted marsh area.

The water flows out as overflow from the biological filter and continues into the planted marsh area.

5. Planted marsh area

In the planted marsh area, the treated water receives its final cleansing before being sent to the collection tank. The former swimming pool is used as the collection tank. The pool can hold 23 m³ water. The planted marsh area is 1.1 metres high. Open, unobstructed water visible at the inflow and outflow of the marsh area. The central part of the marsh area looks like a bed of pebbles/gravel in which various house plants are placed. These plants receive nutrients from the water that continuously flows through the planted marsh area. As stated above, the final section of the marsh area will be open, unobstructed water. The water from this area will flow through an overflow pipe to the collection tank.

Fig. 12 - The final mineral / biological filter, with the marsh area in the back.

All plants in the Launderette are illuminated by growing lamps.

6. Collection tank

To get drinking water quality in the collection tank, a circulation pump circulates 8m³ water/hour 24 hours a day through a sand filter and a UV unit. A centrifugal pump delivers water to the washing machines at the required pressure. The water is taken directly after the UV unit in order to have the cleanest water.

Thorough investigations have been made of the environmental aspects of the launderette, e.g. the washing powders currently being used at Folehaven and the ones recommended by EBO Consult for use from now on.

Here are the results

Water savings

In the Copenhagen area a cubic metre of tapped water costs about 4 euros.

Since our water treatment system saves water up to 100 % depending on the vaporization you have 100 % water savings.

Rainwater in storage tanks compensates the vaporized water.

In Folehaven they have used the launderette for 5 years and the daily reused amount of water is 15 cubic metre.

In the small launderettes (3 washing machines) you will have savings of 1 cubic metre a day.

Since water is a scarce and well protected resource in Denmark our water treatment system fulfils the national water protecting guidelines.

Washing powder savings

The ecological foundation of the various projects at EBO Consult demanded that the environmental impact of washing powders and softeners be investigated.

In the Drainless Kitchen, and in the above-mentioned launderettes, the water is purified using biological processes. For this very reason, it is important that washing powders and softeners are biodegradable and that they are not harmful to the fish and plants in the aquariums.

We use green labelled washing powder in our water treatment systems. The Danish Label Secretariat tests and labels washing powders.

Normally tapped water in Denmark is characterized as hard water.

During the implementation of our water treatment system we test the water. After one week of re-cycling the water, the water is softened. Washing in soft water means less washing powder, and the results show a reduction of washing powder of 40 %.

This means savings for the user and cheaper washing.

Energy savings

Normally tapped water is about 8^{o} C and in ordinary launderettes this will be the start temperature for the washing machine

In our water treatment system the water is about 20^{o} C since the water runs in tanks and aquariums in a closed system.

We have not calculated the energy savings but it‘s obvious that we have some savings on this point.

Visibility

As the photos of the Folehaven launderette show our water treatment system is visible for all users. Since fish and plants are living beside the washing machines the users feel that they can have confidence in the effectiveness of the water treatment system.

The green launderette has become a show case of ecological sound solutions with a lot of visitors from inside and outside Denmark.

Another aspect is the social impact of the launderette. The launderette has become a common area for all users. Before the changes the users left the launderette when they had filled the washing machine. Now, the users sit around tables - in a café - to enjoy soft drinks and to talk about common issues.

The children enjoy to watch the fish and some of them ask their parents to go to visit the launderette just to watch what is going on in the open aquariums. There has been no grafitti or something like that in the launderette.

The inhabitants around the building where the launderette is situated have arranged picnics in the launderette and they held a „water concert“ broadcasted in the Danish Radio.

Fig. 15 - The Green Launderette has been working for 5 years.

II. Participants and partners.

The idea and design of the drainless kitchen and the Green Launderette has been developed in cooperation with manufacturers of machinery for launderettes (i.e. Miele, Vascandia (Ipso) and Saniva) and washing powder (i.e. Henkel, Biolab and Vascandia).

Miele has developed brochures in Danish for all housing areas in order to sell machinery and Green Launderettes as a special brand. HOH Water Technology has spread out their knowledge about UV.

The Large Green Launderette has been implemented by:

Builder: Fællesadministrationen 3B, Fagforeningernes Boligforening - Afdeling

Folehaven (housing association).

Technician: Engineering firm Torben Wormslev Energy & Environment, dealing with calculations and dimensioning the pipes etc

Idea and design of the biological treatment system: The Green Launderette – EBO Consult Ltd.

Beside the abovementioned companies the Copenhagen Energy and Water Utility Company has tested the energy consumption.

The Environmental Protection Agency, the National Board of Health, the Ministry of Housing and the Environmental Health Control for the Municipality of Copenhagen have all been involved in the project as authorities. The project was implemented thanks to these authorities.

The project has received grants from The Green Foundation (The Ministry of Energy and Environment) and the City Ecological Foundation of Copenhagen (The City of Copenhagen).

III. Analysis of environmental aspects.

The goals for the Green Launderettes are

- to minimize use of pure tap water – with the purification and reuse of waste water
- to avoid outlet of polluted wash water.
- to reduce the energy consumption in every wash process which will result in annual savings.
- to reduce demand for water, the emission of CO_2 and washing powder.
- to visualize the possibility to take care of the environment locally as well as globally.
- to involve the tenants in housing areas actively in the design and daily routines in the green launderette.
- to save resources, to avoid outlet of waste water by recirculating and purifying the water and to visualize to everybody the purification of the water by using living organisms.
- to purify the water to a drinking water quality, which means that the quality of the wash is obtained, and there will be no problems with patogenic bacteria in the recycled water.

The Green Launderette in Folehaven has been running for 5 years with a 15 m^3 daily treatment of waste water which has saved water costs according to the estimations. A satisfying report on the water quality has been made with some proposals to optimize the process.

As a follow-up on the report EBO Consult has made a design description, including the biological and chemical processes in the water treatment system. The technical design description has been converted into a popular description for all customers in the launderettes.

In order to follow-up on the wash quality a questionnaire has been handed out to the customers. Some customers find the wash quality worse than before the renovation of the launderette; most customers feel that the wash quality is status quo or has improved and like the idea of saving water.

Since the hard tap water has become soft water in the biological treatment system the washing powder costs have been reduced.

The Copenhagen Energy utility company has tested the consumption of electricity. Apparently the air pumps and grow lamps use more electricity than expected. Tests have been made to minimize the consumption.

The pay-back time for the launderette is expected to be 6-7 years. This is based on the experiences for the first 5 years and on Danish prices. It seems as if the Green Launderette can be characterized as the Economical Launderette too.
The economical results are based on the following parameters:

- ***Saving water costs***. For many years Danes have paid for pure water and for the purification of water after use. The reuse of water minimizes heavy costs for many housing areas, where you normally find common launderettes for the inhabitants.
- ***Saving energy costs***. Energy is an expensive resource in Denmark. Minimization of energy costs might be followed by visible reductions in your rent in rental housing areas.
- ***Saving washing powder costs***. Having the same wash quality as in ”normal launderettes” the reduction of washing powder enhance the awareness of acting ecologically while saving money.

The Green Launderette is based on the development of our idea and design for the future launderette as a Green Resource for people in housing areas. Though the water treatment system functions biologically and on “back to nature basis” the design of the Green Launderette is completely new.

IV. Analysis of technological aspects.

Our design of the biological treatment system has been inspired by Ralph Caplan’s concept of “situation design” which he says consists of “seizing a purpose; defining the situation or problem; identifying constraints and organizing materials, people and events in a way that can be modelled and visualized in advance”. The pilot projects have been essential show cases and have given the fundamental guidelines in the further development of the system.

Our pilot projects have led to adjustments in the technical structure of the treatment system. The aeration system has been optimised and we soon realized that our pilot projects have been over sized. Later projects are small systems operating in limited areas – e.g. in cellars.

The goal for optimisation of the technical design is to industrialize the components in order to keep the Green Launderette as a low cost investment. By researching the storage tank market we realized that the industrialization is optimal in this field.

At the moment we are capable of installing a new treatment system for a medium sized launderette (3-6 washing machines) within 3-4 days. Earlier on we installed the treatment system in one or two weeks.

Since our system is flexible (drainless kitchen, small or big launderettes) we have started to make drawings of treatment systems for house boats too, where the environmental impact of house boats in Copenhagen harbour (waste water and toilet flush) has led to new environmental regulations. The new treatment units can be placed beside the tanks in the house boat and are expected to become a "green evolution" on the house boat market.

The flexible system gives us the opportunity to install the treatment system in many ways. Most of our clients want an open area with plants and fish, visible for the customers.

The open area design has led to a new concept for launderettes. Most launderettes are boring places where you don't want to spend much of your time.

Our Green "Open" Launderettes has got the reputation of being "social launderettes".

The "social" launderette has the following characteristics:

- All over the launderette tables and chairs are placed to make it comfortable for customers to visit the launderette.
- In the launderette you can buy soft drinks and the whole social atmosphere is similar to a café.
- Concerts ("water-music") and picnics have been arranged in the launderette.
- Children like to accompanying their parents to the launderette – just to watch the fish.
- The launderette has become a common area for all.

Technically we design the launderette according to the customers' demands and with truly respect of the biological processes which are necessary in order to have an optimal Green Launderette.

Tests of water quality and aeration of waste water are conducted frequently, using oxygen measurement tools and strips indicating the water hardness. After a short introduction the tests can be made by the caretaker of the estate/launderette.

Technologically our idea is to keep the treatment system as simple as possible in order to create a situation where people understand and trust the system.

V. Literature of reference.

Cities for a small planet, Richard Rogers & Philip Gumuchdjlan

The Politics of the Artificial, Victor Margolin

Danish publications about urban ecological approaches, Agenda 21 etc. (Danish Ministry of Environment)

"Grøn teknologi i praksis", by Ove Loland, Copenhagen 1997. (Danish)

"Spildevandsrensning 3. udgave", by Ove Loland, Bornholms Naturskole Grynebækken, 1990. (Danish)

The Environment Comes Home, The House of the Future, Phoenix, Arizona, USA, 1995, by David Pijawka etc.

The Design of Living Technologies for Waste Treatment, by John Todd and Beth Josephson,

From Eco-Cities to Living Machines, Pinciples of Ecological Design, 1993, Nancy and John Todd .

Commercial Hydroponics, John Mason, 1994.

Articles, brochures etc. provided by the Danish Veterinary University of Copenhagen.