

## Ecological Engineering

### Concerning waste-water treatment:

“Waste-water” is NOT a “waste-product” - but is in fact an highly important potential resource.

It is most important to distinguish - between the relative simple systems necessary to utilize normal household grey and black water and between systems capable of treating industrial process waste-water.

These two flows should NEVER be mixed - as they require different technologies for their solution. Consideration should also be given to toilet systems and the possible separate collection of urine - if possible and socially acceptable or through the use of separate urinals. Urine is highly suitable for fertilizer use [dilute 1 unit of urine with app.10 units of water].

Please consult the different files on the accompanying CD-3 - The Integrated farming system and low-cost agricultural energy systems - where many systems are fully described.

Also - search the Internet under the following search-words:

### Ecological Engineering:

Reed-bed systems

Permaculture

Ocean Arks International

Living Machines

Dyke-pond systems

Chinese Dyke Pond Systems

### Plants, Algae, Trees, etc, - for ecological engineering water treatment systems:

Reed - *Phragmites australis*

Bulrush - *Scirpus spp.*

Cattail - *Typha spp.*

Reed mannagrass - *Glyceria maxima*

Sedge - *Carex spp.*

Rush - *Juncus spp.*

Pale yellow iris - *Iris pseudoacorus*

Duckweed - *Lemnaceae*

Algae - from single cells to plants over 100 meters long -[Kelp - *Macrocystis*]

Willow - *Salix* [also highly suitable for energy-forest use]

### Litterature etc:

1: The First and Second International Conferences on Ecological Engineering: -

a: Ecological Engineering Conference. Stensund Peoples High School, Sweden 1991

b: Recycling the Ressource. Staudenmann, Schönborn, Etnier, Transtec Publications Ltd. Zurich, Switzerland 1996 ISBN. 0-87849-741-2

2: Ecotechnology for Wastewater Treatment. Etnier, Noren, Bogdanowicz,

Coalition Clean Baltic Poland 1997 ISBN 83-903702-3-9

3: Handbook of Agricultural Energy Potential of Developing Countries.

James A. Duke, CRC Press, Florida USA 1987 ISBN 0-8493-3640-6 (set of volumes)

4: Making Aquatic Plants Useful. National Academy of Sciences, Washington DC USA 1976/87

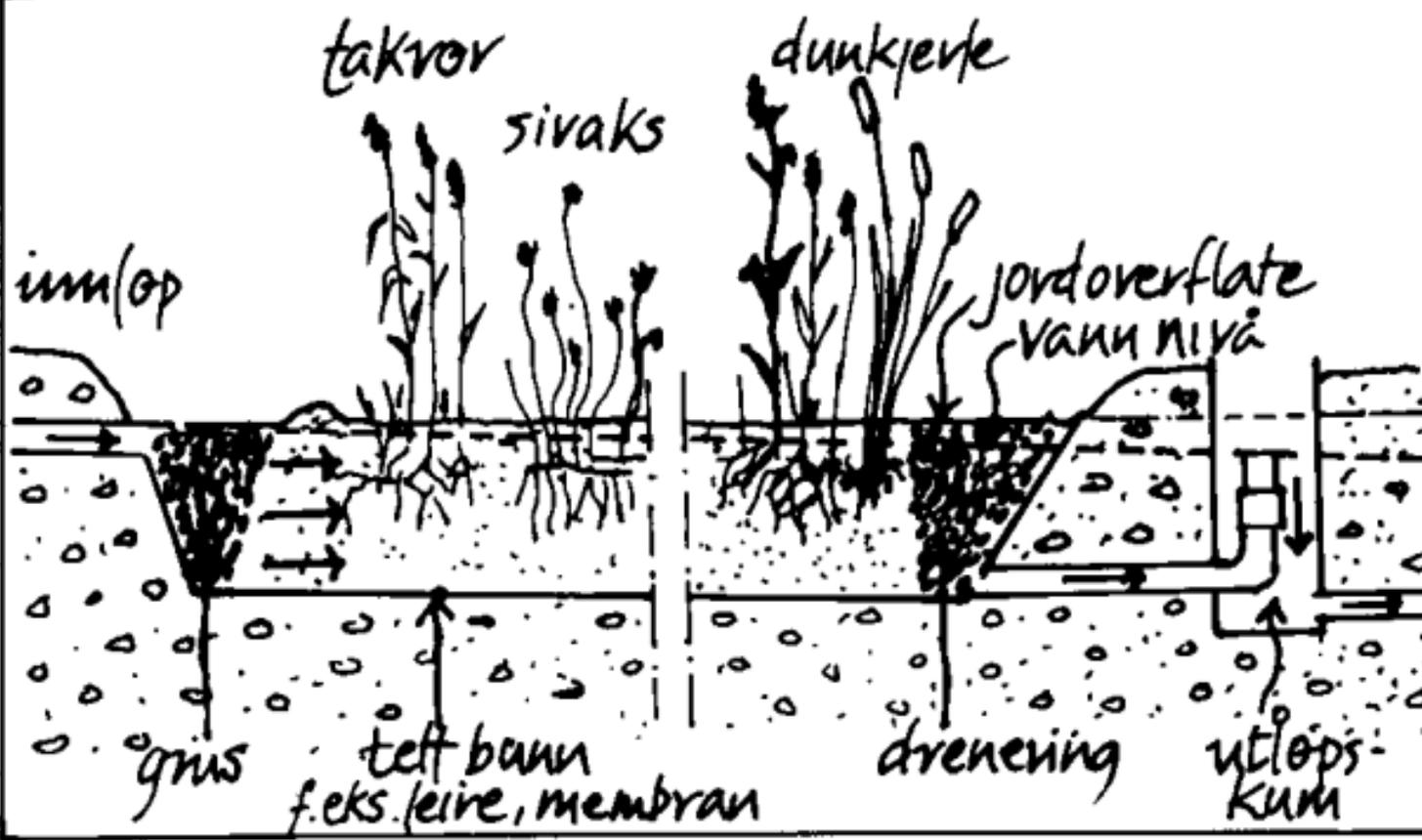


Fig. 75 Tverrsnitt av et våtmarksfilter med horisontal strømning

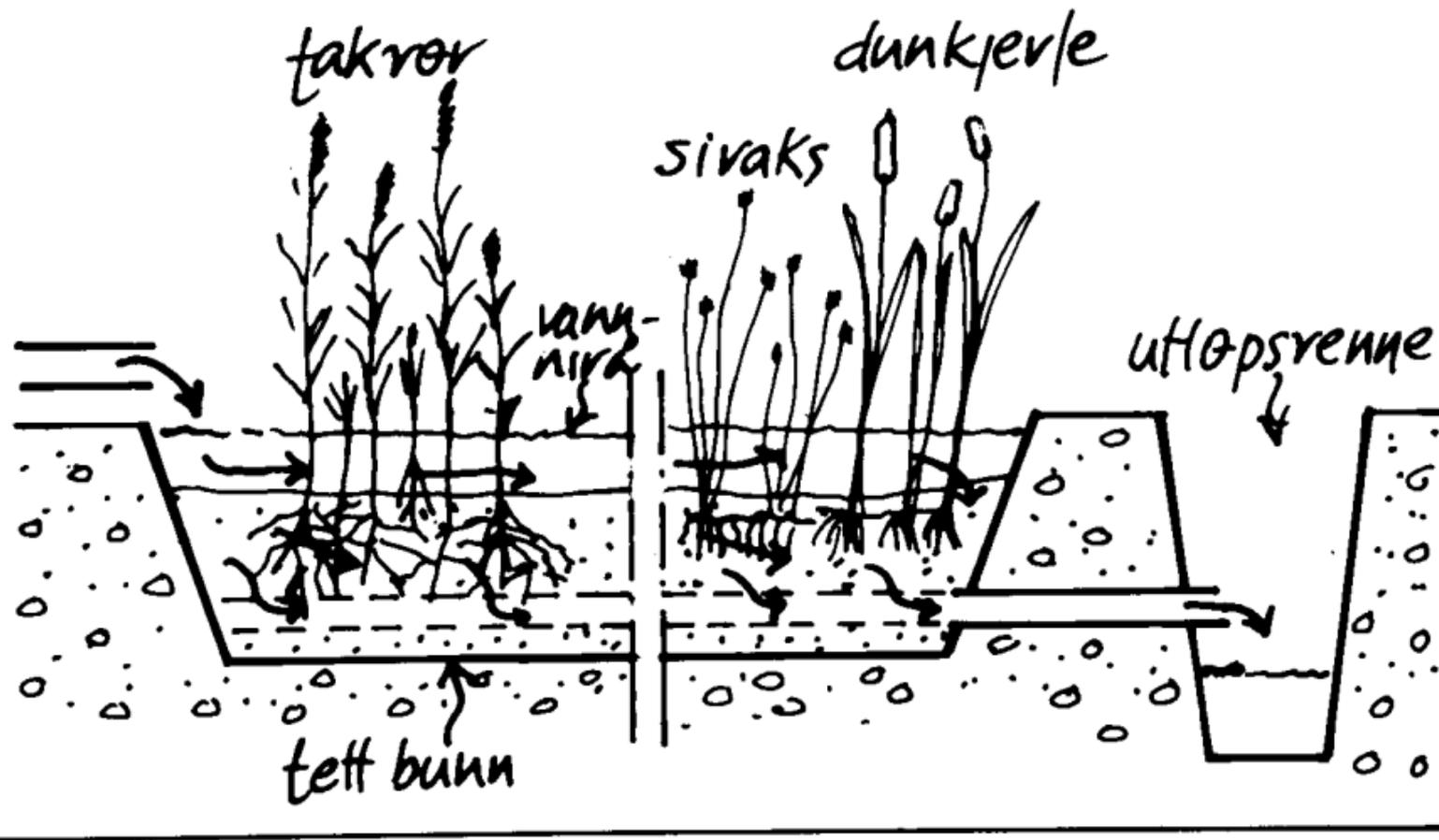
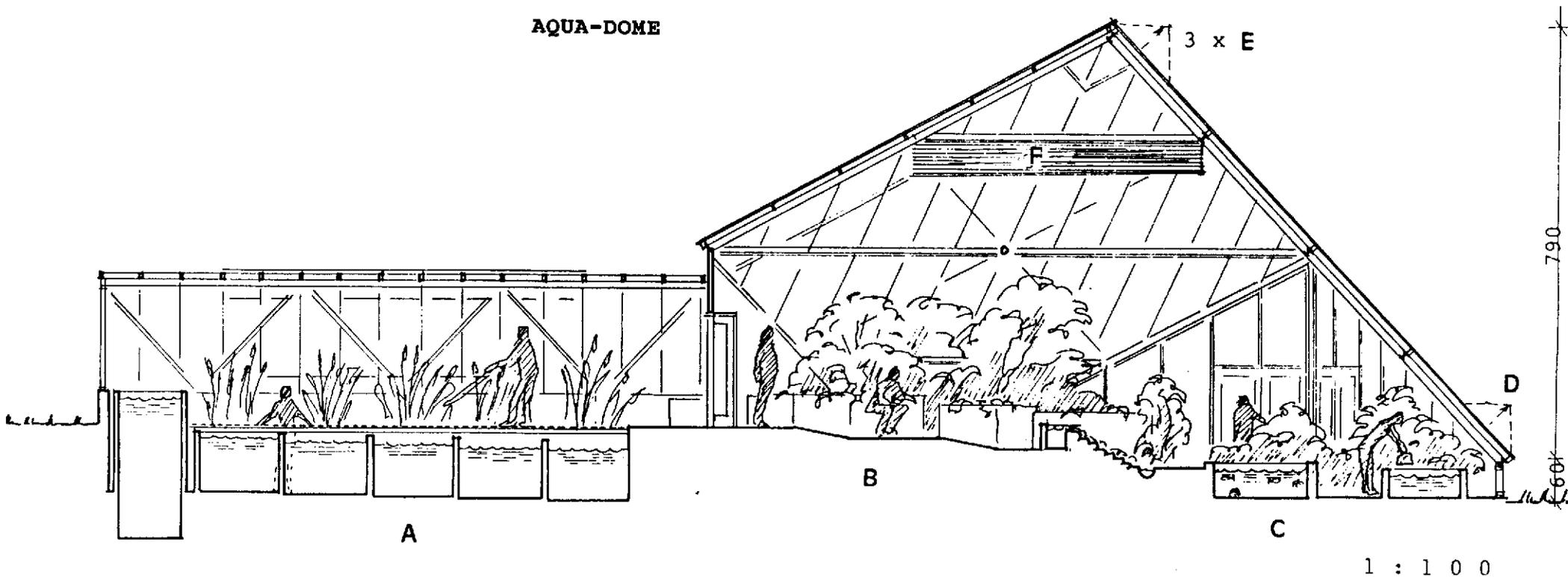
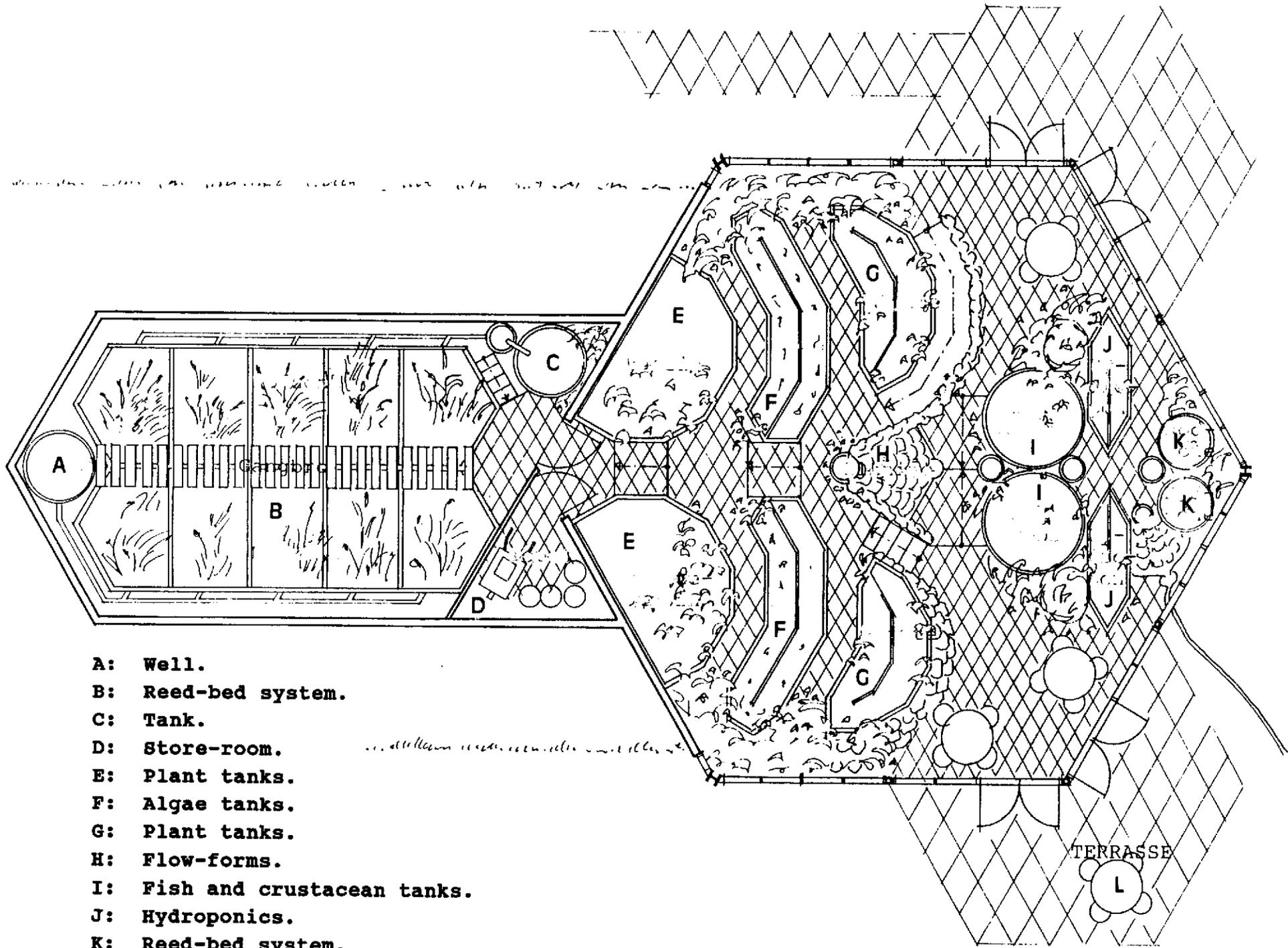


Fig. 77 Tverrsnitt av et våtmarksfilter med vertikal strømning

# AQUA-DOME



- A: Reed-bed system.
- B: Plant and algae tanks.
- C: Fish and crustacean tanks.
- D: Window opening.
- E: 3 window openings.
- F: Cooling unit to condense moisture from air.



- A: Well.**
- B: Reed-bed system.**
- C: Tank.**
- D: Store-room.**
- E: Plant tanks.**
- F: Algae tanks.**
- G: Plant tanks.**
- H: Flow-forms.**
- I: Fish and crustacean tanks.**
- J: Hydroponics.**
- K: Reed-bed system.**
- L: Terrace.**

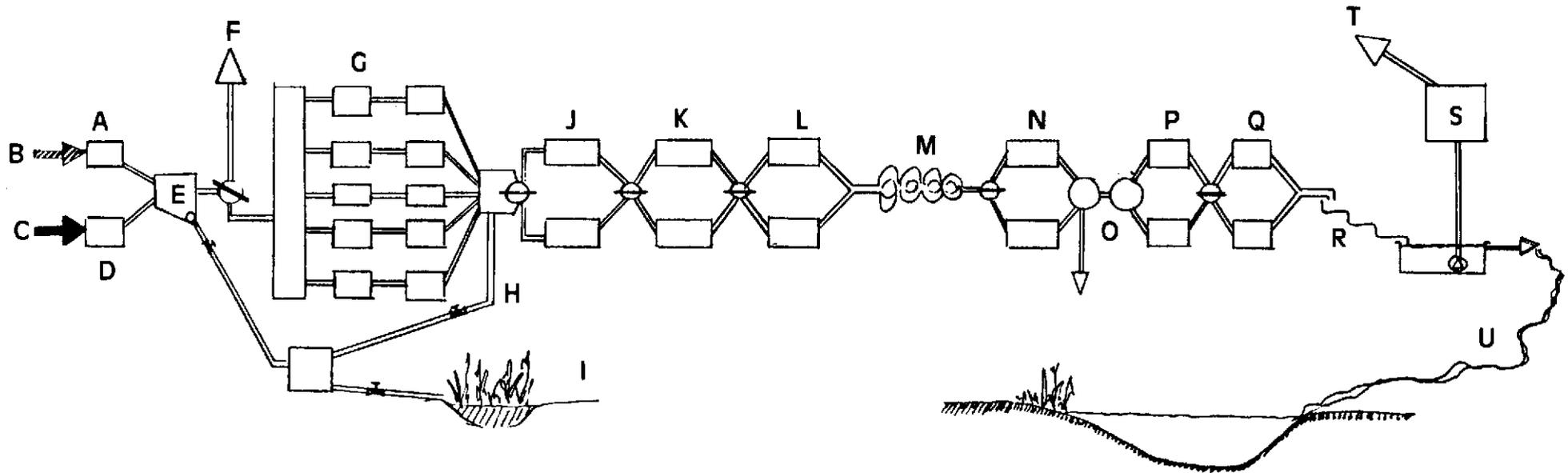
PLAN 1:100







## FLOWDIAGRAM:



A: Sand-trap.  
B: Grey water.  
C: Black water.  
D: Septic tank.  
E: Holding tank with pump.  
F: Emergency by-pass drain.  
G: Vertical reed-bed system.  
H: Sludge removal.  
I: Sludge bed.  
J: Floating plants.  
K: Algae - Zoo plankton.

L: Various plants.  
M: Flow-forms.  
N: Fish - Crustaceans.  
O: Sludge filter section.  
P: Hydroponics.  
Q: Vertical reed-bed system.  
R: Flow-forms.  
S: Possible UV-( etc. )-treatment.  
T: Return to toilet-flush.  
U: To pond.

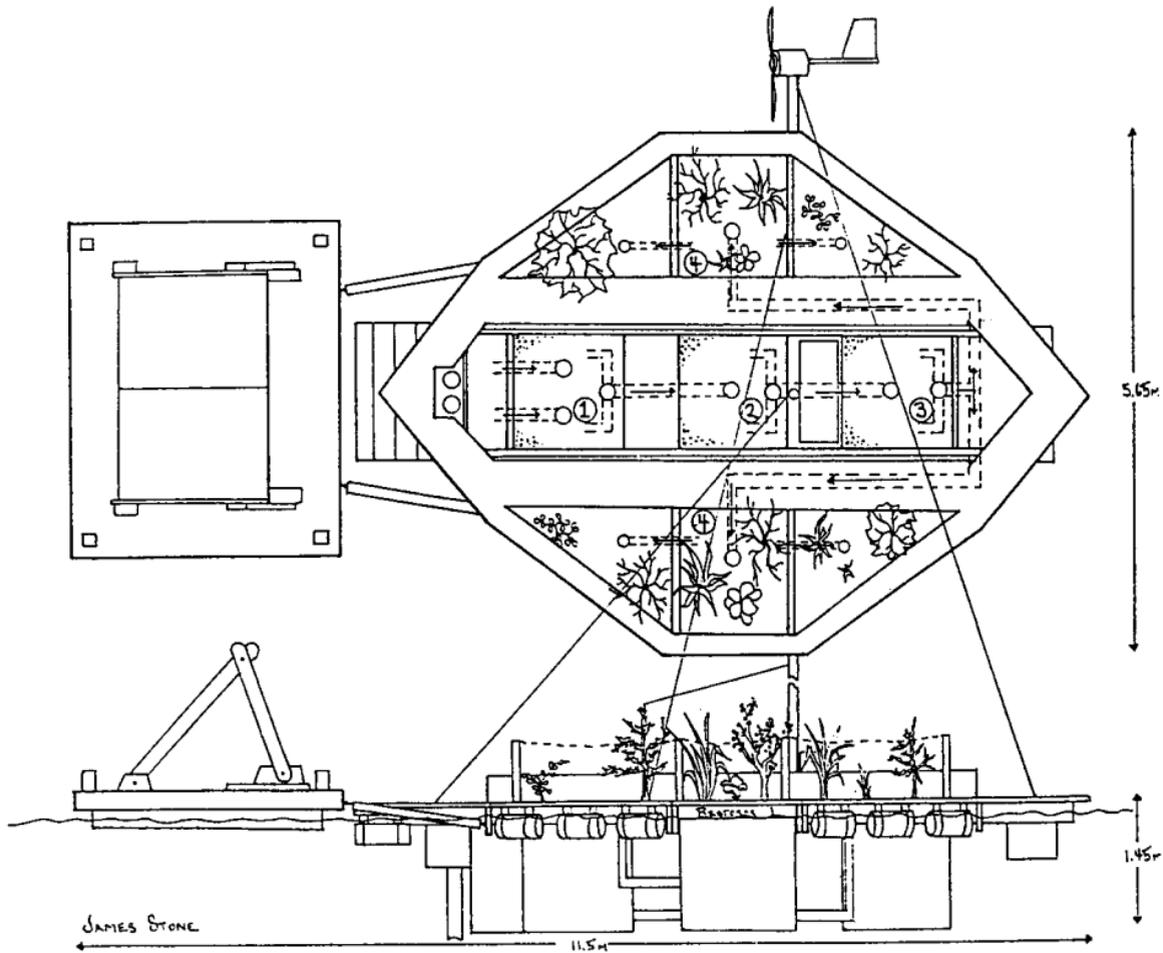


Figure 1: Plan and Elevation of Restorer 1 - Flax Pond, Harwich