



The Aga Khan Award for Architecture

ARCHITECT'S RECORD
 2001 AWARD CYCLE
I. IDENTIFICATION

Project Title Sustainable architecture for the Chumbe
 Street Address Chumbe Island Island Coral Park
 City Zanzibar Country Tanzania

II. PERSONS RESPONSIBLE**A. Architect/Planner**

Name Georg Fiebig, Jan Hülsemann, Per Krusche
 Mailing Address _____
 City see reverse side Postal Code _____
 Country _____ Telephone _____
 Facsimile _____ E-mail _____
 Principal Designer teamwork

B. Client

Name Chumbe Island Coral Park Ltd.
 Mailing Address PO Box 3203
 City Zanzibar Postal Code _____
 Country Tanzania Telephone + 255 24 2231040
 Facsimile _____ E-mail chumbe@zitec.org

C. Project Affiliates/Consultants

Please list those involved in the project and indicate their roles and areas of responsibility (e.g. engineers, contractors, economists, master craftsmen, other architects, clients, etc.). Please cite addresses and telephone numbers separately.

Name	Role
Sibylle Riedmiller	Managing Director CHICOP
Georg Fiebig	6/94 - 12/95 Projectmanager, Building Supervisor
Jan Hülsemann	3/96 - 7/98 Projectmanager, Building Supervisor
Per Krusche	Project Advisor
Bakari, Ali Khamis	Administrator
Abdi Haji Ussi	Foreman
Jumbe Askari	Purchasing officer
Ali Bashiru, Juma Hussa, Yussuf Hlabu	Maintenance officer

II. PERSONS RESPONSIBLE

<u>A. Architects</u>		
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<u>C. Project Affiliates / Client</u>		
Sibylle Riedmiller	PO BOX 130 Tanga / Tanzania	Tel. +255 27 26 43 557 e-mail: chumbe.island@raha.com
Building workers and CHICOP staff contact Eleanor Carter	c/o CHICOP PO BOX 3203 Zanzibar / Tanzania	Tel.,Fax: +255 24 2231040 e-mail: chumbe@zitec.org

III. TIMETABLE

(please specify year and month)

A. Commission 6/93

B. Design Commencement 4/94 // 5/96 Completion 6/96 // 8/97

C. Construction Commencement 8/94 // 8/97 Completion 12/96 // 5/98

D. Occupancy 7/98

Remarks Phase 1: Guest accomodation // Phase 2: Visitors Centre

IV. AREAS AND SURFACES

(please indicate in square metres)

A. Total Site Area approx. 25.000 bungalows Centre

B. Ground Floor Area approx. 600 160 360

C. Total Combined Floor Area approx. 820 240 500
(including basement(s), ground floor(s) and all upper floors)

Remarks buildings are open to the surrounding nature, so no exact figures are given

V. ECONOMICS

(please specify the amounts in local currency and provide the equivalent in US dollars. Specify the date and the rate of exchange in US dollars at the time.)

	Amount in Local Currency	Amount in US dollars	Exchange Rate	Date
A. Total Initial Budget		1 Million		1991 - 1998
B. Cost of Land		land lease for 10 years		
C. Analysis of Actual Costs				
1. Infrastructure	TSH 15 Mill	23.000	660	5/98
2. Labour	TSH 42 Mill	64.000		
3. Materials a)	TSH 45 Mill	68.000		
4. Landscaping b)	DEM 60.000	33.000	1,8	10/94
5. Professional Fees	DEM 150.000	83.000		8/94 - 7/98
6. Other				
D. Total Actual Costs (without land)		271.000		
E. Actual Cost (per sq. meter)		330		
Remarks	see reverse side			

V. ECONOMICS

REMARKS

- A. Overall investments of approx. 1 Million US\$ over eight years include the initial phase of legal project implementation, series of biological baseline surveys, landsurveys, the build up of infrastructure, employment of staff, training of parkrangers, the setting up of nature trails and education programmes and the building costs. Due to the fluctuating inflation rate in Tanzania over this long period it is almost impossible to give one figure of the exchange rate.
- C. Only the proportional investments for the building activities are specified here.
1. Boats and transport expenses to Chumbe island
 2. Labour costs for the foreman, the builders and labourers.
 3. a) Local materials
 4. b) Technical equipment imported from Europe
 5. There have been almost no professional fees for the design itself. Instead of this, salaries have been paid over the whole period of the construction process of four years for the overall project management and the building supervision. The proportional salary for building supervision is specified in this row. Important engineering contributions were made on a voluntary idealistic basis

VI. PROJECT DESCRIPTION

Chumbe Island is situated 12 km south-west of Zanzibar Town and covers an area of approximately 20 ha. It is an uninhabited island dominated by coral rag forest and bordered, on its western shore, by a fringing coral reef of exceptional biodiversity and beauty. Based on the initiative of Chumbe Island Coral Park Ltd (CHICOP), a private company created for the management of Chumbe, the island was gazetted in 1994 as a protected area by the Government of Zanzibar.

This created the first marine park in Tanzania. The reserve includes a reef sanctuary and protected forest and has become a rare example of a still pristine coral island ecosystem in an otherwise heavily over-exploited area. The overall aim of CHICOP is to create a model of sustainable conservation area management where ecotourism supports conservation and education.

For this, all infrastructural developments on Chumbe island are strictly based on sustainable building and environmental technology that have close to zero impact on the environment.

Seven bungalows were built to accommodate visitors, designed to allow a close experience of natural adventure.

The former lighthouse keeper's house has been restored with a newly constructed roof dome. It is now converted into a Visitors' Centre that accommodates the restaurant and exhibits environmental information about the island reserve for guests, and includes a classroom for environmental education.

All buildings generate their own water and energy, with rainwater catchment, solar water heating and photovoltaic electricity. Sewage is completely avoided by the use of compost toilets and vegetative filtration of shower water through plant beds. Buildings are designed to catch sea breezes for ventilation and do not require air-conditioning. Organic kitchen waste is recycled in the compost beds that provide for the compost toilets. Any other waste is removed from the island.

Please refer also to the attached 'Clients Project Description'.

VII. MATERIALS, STRUCTURE, AND CONSTRUCTION

Each building unit is erected on a massive base that gives space for the cistern, rainwater filter, compost chamber and wastewater filter. Each base is made of prefabricated earth-cement-bricks, covered by a dense sand-cement plaster. Partitions and arches avoid the use of any other materials, particularly iron reinforcement. The pavement of the ground floors is made with the very common technique of coloured cement with additional ornaments designed with inserted pieces of broken tiles.

The thick walls of the ruin of the former lighthouse keeper's house, made of coral rocks with earth and covered with lime plaster have been restored.

The technical towers and interior partition walls were built with earth-cement-bricks and lime plaster.

The roof structures are designed to channel the rainwater directly into the gutters and filter at the base of the buildings. They are built with the very common technique of casuarinia-tree-poles, joined with sisal- and coconut-ropes. The trees have been harvested from Zanzibari plantations. The innovative idea for this construction was to bend the freshly cut trees to form statically-advantageous latticed shell constructions. Therefore no additional loadbearing framework structures were needed to support the roof shell itself. The roof dome of the Centre has a free span of 21 metres between the footings and 30 metres between the openings.

The rooves are thatched by „makuti“, large shingles made from coconut leaves. Upper platforms, stairs, fences, rails and furniture are also constructed from poles in local techniques. Bamboo, reeds and branches, commonly used to produce fishtraps, mats and household articles have been used in Chumbe for shutters, partitions and furniture. Coconut and mininga wood have been used for boards. The photovoltaic and the solar heating systems, and other such technical components were imported from Europe.

VIII. PROJECT SIGNIFICANCE AND IMPACT

The architecture of Chumbe underlines the unique character of the island as a landmark in the channel of Zanzibar. The feature of the buildings follows strictly the technical and environmental requirements in a marine nature reserve and climate and cultural aspects.

Many local small scale industries were involved in the building process with a creative interchange about new ideas in traditional and common building techniques.

The architecture of Chumbe gives built examples for environmental friendly housing technology and proves the functioning of all systems. For this, it is of significance for planners and architects in the region to transform the Chumbe experience into future projects.

The project provides valuable experiences in sustainable housing technologies for remote areas and gives new ideas in the combination of engineering structures with traditional building techniques.

The overall project of CHICOP has achieved its aims in several professional fields. Seven Government departments were involved in negotiating the project in the initial phase, followed by intense discussions on the Management Plan 1995-2005 in the Advisory Committee.

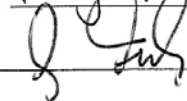
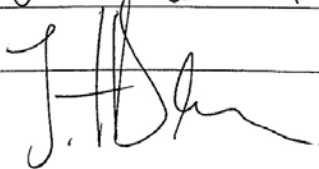
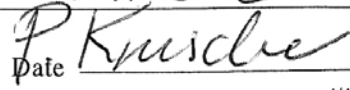
In detail, CHICOP

- Has secured continued protection of valuable flora and fauna.
- Helps restocking of locally depleted fisheries and promotes recovery of degraded coral reef ecosystems. The sanctuary provides a protected breeding ground for fish, corals and other species which are expected to then spread out to recolonise nearby overfished and degraded areas.
- Contributes to biodiversity conservation and ecological restoration, by effectively protecting a coral reef which has at least 90% of the scleractinian coral species ever recorded in East Africa;
- Provides training ground for local people in conservation area management.
- Helps to create environmental awareness among fishermen of adjacent villages.
- Provides a direct source of income to local fishermen.
- Contributes to raise conservation awareness and understanding of the legal and institutional requirements among government officials.
- Has created unique facilities for environmental education for school children and other visitors. Nature trails and educational materials (in Kiswahili and English) have been developed about the forest and the reef.
- Co-operates with the Harbours Authority to keep the lighthouse functioning.
- Offers valuable research opportunities for Tanzanian and foreign research institutions.
- Provides valuable experience in the financially sustainable management of protected areas.

All employment on the island is targeted at the neighbouring fishing communities, which promotes awareness raising at all levels and empowers the local Zanzibari community to feel committed towards the preservation of their natural heritage.

CHICOP has gained much regional, national and international attention. Chumbe is on the UN list of Protected Areas. The project was chosen to represent Tanzania at the EXPO2000 Hannover, Germany. Chumbe was the 1999 Global Winner of the British Airways Tourism for Tomorrow Award. In 2000 Chumbe Island Coral Park also won the Global500 Award of the United Nations Environmental Programme (UNEP).

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Name (please print)	Georg Fiebrig	Jan Hülsemann	Per Knusche
Signature			
			Date 27.12.2000 ^{4/4}

**HOUSE MAINTENANCE SCHEDULE
AND
TECHNICAL INFORMATION**

1. INSPECTION WALK**ALL AROUND THE BANDAS****every second day**

Tools: wheelbarrow, shovel, rake, hedge clipper, short and long brush scraping iron

- **Keep the area around the bandas clean!**

Collect any rubbish and dispose of it.

- Check termite groves: brush and scrape out all dust deposits, larvae, dirt, and, **if any, remove termite trails**

daily

- Brush and fix (if loose) back curtain walls

- Check the makuti roofs for dirt, dead animals, leakages and clean or fix.

- Clean out draingutter; foul flush basin and sand filter from buds, leaves, makuti, dirt, dead animals...

The draingutter and the filter must always be clean.

- Makuti hanging into or outside the gutter must be lifted and fixed again, or it must be cut off.

- Check greywater chamber when the house is used. If water stays above the gravel, the chamber and the downpipe to the plantbed filter must be cleaned

When the house is used

- Check the waterlevel in the plantbed filter (no. 5, centre). There shall be always some remaining water.

- If you smell any odour coming out of the openings or ventilation screen of the compost toilet chamber

Follow trouble shooting manual

- Cut out the bushes around the bandas, if branches and sprays grow too close to the roofs

- Check the sandy strip around the bandas for termites, rat trails etc. Clean and rake the strip. Inform manager of any evidence of rats and do not remove until it has been inspected.

- Clean and rake the walkway in front of the bandas

- Check the overflows of the cistern for tight mosquito net.

AROUND THE CENTRE

- Keep the rocks and sandstrips on the plot tidy and clean

- Check and clean the rough filter (green bucket), remove floating fat and dispose of it.

Weekly

- Check iron parts at the footings of roof construction. If rust develops, steelbrush and paint with red oxide.

Twice a year

2. INSPECTION**INSIDE THE BANDAS****every second day**

tools: brushes, cloths, duster, small screwdriver, torch

- **Keep the bandas clean !**
- Keep louvers and windows closed, check fittings and rolls
- Brush out platform, benches, balustrades and floors
- Pump up water. The drums must always be full.
Caution: don't leave the hot water panel empty, it might overheat. If no water is available, cover the panel with light plastic sheet.
- Check taps and joints for leakages / close taps
- Check if toilet seat is fixed tightly
clean the seats overall with cloth
- Check the toilet for odour, flying insects and spiders inside the toiletrim. check if there are any ant or termite tracks
- Shake the battery and wipe off dust from connections
- Check battery water levels
- Check lights, sockets and switches

Follow trouble
shooting manual

Once a week

3. BEFORE GUESTS ARRIVE

- Check all functions: lights
water / pump up water
compost toilets / smell , visible faeces
- Replace compost basket.
Fill with a mixture of various leaves, peat moss, shreds
- Clean toilet seat, basin, tiles , taps and showerheads.
(vinegar, water)
- Refer to housekeeping, serving

Follow trouble
shooting manual

4. AFTER GUESTS HAVE DEPARTED

- Turn off watertaps (shower)
- Empty out waste basket
- Look into the toilet with a torch. If faeces are visible cover with a few handful of compost material.
If the pile becomes too high, open side door and push down the pile with a stick.
If any odour comes out of the toilet:

Always

Follow trouble
shooting manual

5. WATER SUPPLY**OUTSIDE THE BANDAS**

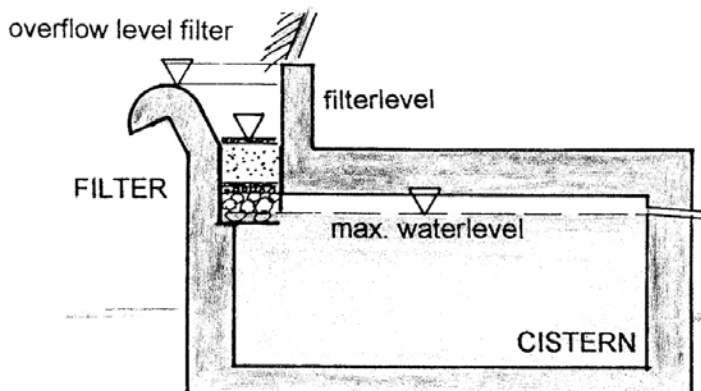
See illustration no. 1

- Remove leaves, makuti, dirt and buds from the drain the sand filter and below the stones in the filter. Inspection walk / after rainfalls
- Clean out the foul flush basin from floating matter After rains > 2mm
- Remove covering layer (kokoto) and the upper 10 cm of the filter sand and wash out all organic matter. Refill again. Once a year before the big rain
- If the filter material sinks below the marked level, the covering layer must be filled again
caution: if the filter material sinks down considerably (more than 10 cm) the composition of the filter material might be wrong and sand is washed into the cistern
build up new filter and clean out cistern Check after rain
- Check and clean out cistern, suction valve and airpipes*
Check the plaster for cracks inside. If any, repair with appropriate compound. Once a year when empty before rain season
- Check and replace the mosquito nets at the overflows
check overflows and outlet pipes for proper functioning. Twice a year when filled up
- Check the cistern and filter for leakages (moist areas on the outside plaster) and control the waterlevel.
Repair plaster of the cistern or filter, if leakages have been found, or if the waterlevel is sinking too fast
- Clean hot water panel / check tight seal of fittings Twice a year
- Change filter material and clean the cistern properly inside all partitions by brushing and scrubbing After 5 years or when permeability or water quality is reduced.

INSIDE THE BANDAS

See illustration no. 2

- Check all installations for leakages and for tight seal of fittings and lids. Weekly
- Check the roof for leakages During rain

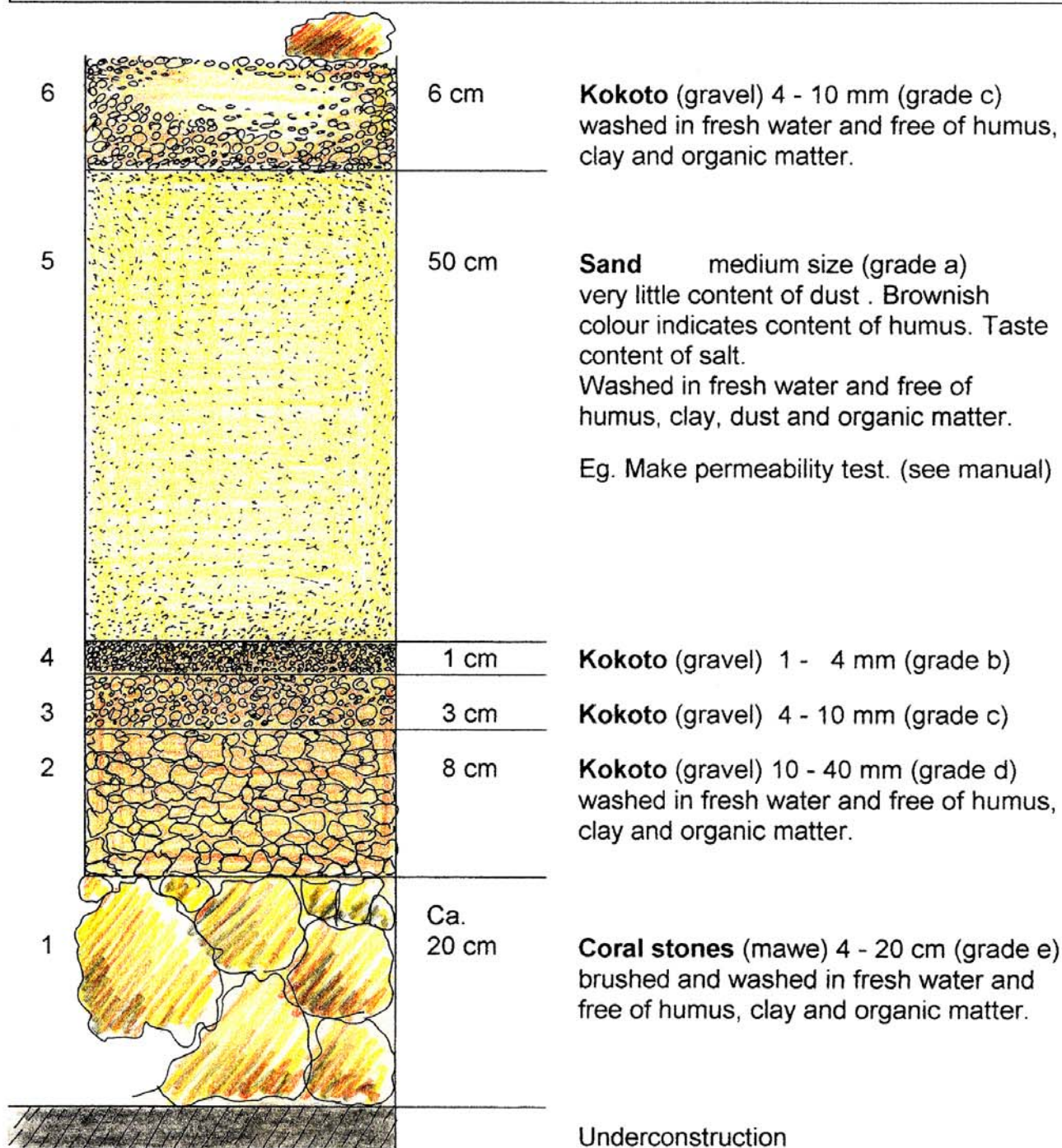
Illustration no. 3

Alternation of rainwater filter:

Dry filter at house no. 3. The water passes the sand under pressure. Filter material dries out in dry season

Convenient to experiment with different materials such as charcoal or diatomaceous earth

* to equalize air pressure between the cistern partitions, drill two holes of 16mm per partition

BUILD UP A NEW FILTER**FILTER MATERIAL**

SAND	0,1 - 1 mm	Mesh size 1 mm □	GRADE A
GRAVEL	1 - 4 mm	4 mm □	GRADE B
GRAVEL	4 - 10 mm	10 mm □	GRADE C
GRAVEL	10 - 40 mm	40 mm □	GRADE D
STONES	40 - 200 mm	Select by hand	GRADE E

6. GREYWATER DISPOSAL

See illustration no. 1

- Check greywater chamber when the house is used. If water stays above the filter, the chamber and the downpipe to the plantbed filter must be cleaned. Roots might have grown into the irrigation pipe and blocked the outlets. They must be removed. Place the pipe in a bed of kokoto to support the irrigation.
- The covering layer of the filter must be fine gravel (grade b) to avoid mosquito breeding.
- Clean the filter from dirt and rubbish wash or exchange filtermaterial
- Check the waterlevel in the plantbed filter no. 5, centre) some water should always remain in the filter to maintain the biological balance
- Cut the reed in the greywater filter down to 10 cm

When the house is used

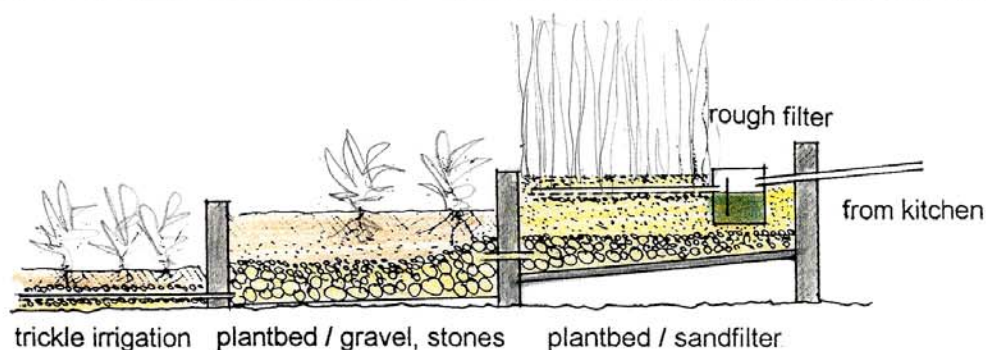
When often used:
once a year

See illustration no. 6

Before the big rain

Illustration no. 6.

GREYWATER
CLARIFICATION
IN STEPS
(CENTRE)



For clarification **the wastewater from the kitchen** first passes a rough filter (the green bucket in the filter bed)

- to collect solid particles
- to separate oil and grease from the wastewater

illustration no. 6 + 7

After this, the water trickles through a planted sandfilter. Finally the water flows into the plantbed next to the kitchen.

- Empty out and wash the collecting dish in the bucket.
- Remove the floating oil and grease layer from the bucket and dispose on the compost

Daily after use

Weekly

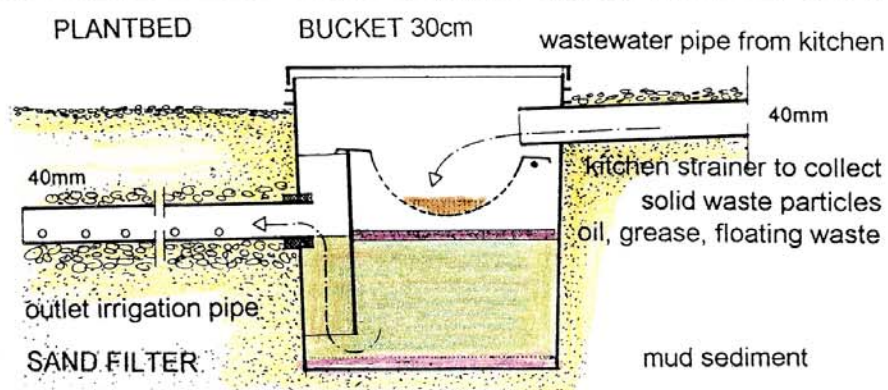


Illustration no. 7

ROUGH FILTER

to separate solid particles and oil from the wastewater

7. COMPOST TOILETS**CLIVIVUS MULTRUM**

See illustration no. 8

- Check for odour and termite tracks
follow trouble shooting manual Inspection walk
- Keep always a basket full of mixed leaves, peat moss and splinter (almost dry) next to the toilet Inspection
- Look inside the toilet with a torch.
If you see faeces; the pile becomes too high; it looks like too wet; many insect are flying in the toilet; it smells badly follow trouble shooting manual After guests have left
- Test the downdraft of the toilet with a burning cigarette: the smoke should be drafted down the chute.
- Open the lid at the bottom of the ventilation pipe.
Check sufficient updraft in the pipe (burning cigarette), and for condensed water. Ev. Brush out the ventilation pipe Every three months
- Open both doors and check the compost material.
Ckeck also the screws and wing nuts of the doors, clean (steelbrush) and grease. Check the plastic hose seals of the doors for tight fitting. Every three months
- Take out one or two buckets full of compost material. Once a year
first in 2000
- During dry periods without using the toilet, spray little amounts of water to keep the pile moist.
- **Follow the trouble shooting manual**

8. GARDEN; COMPOST HEAPS

- Keep the ways and paths clean, cut out branches
- Cover with sand from the beaches
- Keep the waste baskets clean, replace when broken
- During long dry seasons, water the garden areas around the centre
- The compost heaps must be used alternately.
Feed only one heap at any time until it becomes high. Then cover the heap with some makuti, and keep it always moist to maintain a rich biological life in the composter. Take only from the other compost heap for gardening and to fill the baskets for the toilets, until it is finished.
- Cut leaves and branches into small pieces (2 - 4" long) before disposing on the heap
- Try to maintain a variety of different organic matter for a richer biological life in the compost heaps as well as in the toilet chambers (different leaves, humus soil, try to find some peat moss, cow dung etc. to enrich the compost)

COMPOST TOILET**CLIVIVUS MULTRUM****TROUBLE SHOOTING MANUAL**

Problem	Possible reason	Response
Odour comes out of the toilet and / or out of the insect screen in the removal door	There are obstructions in the vent pipe such as spider webs, covered by dead flies, leaves, etc, or the wind cowl at the top is blocked	Open the lid at the bottom of the pipe. Sweep the vent pipe with a long brush, clean the cowl, ev. Fix an insect screen on top of the pipe.
	The air pressure in the container is higher than outside	Increase the thermic draft in the vent pipe. Paint the vent pipe black at the top third of its height. Increase their length.
	The vent pipe is disconnected somewhere	Check the bottom lid for tight seat and seal. Follow the vent pipe all the way up and correct possible disconnections
Odour comes out of the doors of the compost chamber	The doors are not closed tightly	Open the doors and check the seals (plastic hose). Clean and adjust the seals and the wall. The hose must seal the gap between wall and door completely and tight.
Odour is strong from the vent of the roof	The process leans towards putrefaction (becomes partial anaerobic)	Open removal door and check if liquid has build up Increase the draft
Liquid builds up fast in the compost chamber and has an ammonia odour.	The compost pile is not firmly sitting on the bottom of the chamber. (the material might got hung up the air ducts, preventing the liquid from being absorbed by the waste pile)	Stoke the pile. Caution: don't bend or demolish the halfround pvc air ducts in the pile Increase the updraft of vent pipe
	There is not enough absorbing material on the bottom of the chamber.	Add some dry soil or peat moss into the removal chamber to absorb the liquid. Remove the soaked material again and fill into the compost chamber through the control door.
	The pile is not mixed homogeneously with absorbing material (too many palmleaves)	Mix the pile, add some dry peat moss, distribute in the compost chamber. Watch the airducts.

COMPOST TOILET	CLIVIVUS MULTRUM	TROUBLE SHOOTING MANUAL
Problem	Possible reason	Response
Liquid builds up fast but doesn't smell	There is enough peat moss in the bottom but the waste pile doesn't absorb the liquid	Stoke the pile, especially if it is dry on the top. This can be normal following a high input of liquid after a period unused.
	Water vapour condenses on the inside of the compost chamber and the vent pipe and drains back through the pile	Increase the updraft of the vent pipe. Open the bottom lid and release the water. Paint the pipe black and extend its height.
The waste pile below the toilet becomes too high	The openings in the partitions in the compost chamber are too small and the slope of the chamber is not sufficient	Open the control door and push the pile down towards the removal opening with a long stick. Watch the air ducts.
Insects are flying up the chute	Many insects orientate themselves toward odour. If the draft is faint or reversed they may get out.	Increase the draft. Check to see if there is a liquid build-up with odour; if so, follow that instruction.
		Many insects tend to fly towards light. A small hole (½") with a movable lid in the control door might help. Switch the lid, and the fly will disappear.
Insects are too numerous	The insect screen in the removal door is damaged	Check the screen and the seals of the doors and repair or adjust
	The prey / predator balance is offset.	Use an organic insecticide (like pyrethrin) according to the directions.* Rake up some grass and leaves and add this for a richer predator live in the composter
The insect population temporarily gets out of control	It is possible that an explosion of one particular species may occur.	Keep a non-pest strip accessible as an insurance for such conditions. Hang the non-pest strip in the chute under the toilet. This will only kill those insects that stay in the chute without affecting the microbes in the compost pile.
Ants or termites build their tracks into the compost chamber	The seals of the doors or the toilet seat are not fitting tight.	Follow the tracks and destroy the nest. Adjust or repair the seals.

*) it has been reported that some mild insecticides work in keeping down flying insects without seeming to interfere with the decomposition process (baytex; pratt's white fly spray; hargate, made from mineral oil, sesame oil, and pyrethrum)

8. PHOTOVOLTAIC EQUIPMENT**BANDAS**

- Shake the battery, watch the level of acid. If the acid sinks below the MIN. mark, refill with distilled water. every inspection
- clean the terminals from dust and check for tight fitting. Inspection
Even a thin layer of dust contains salt and results in leakage current and short circuits causing discharge.
- Check lights. If lights are not working:
 - check fuse (keep always a collection of fuses 5 - 15A in the store)
 - check switch and the string, clean from dust, add little vaseline to the mechanism
 - check the lamp for tight fitting (add vaseline to connector)
 - check wires and connectors, clean and brush the wireends, tighten screws of the connectors, add vaseline
 If all lights are not working:
 - check the battery and the charging controller / check connections and terminals
 - measure the voltage of the battery.

The voltage of the batteries must always be between 11,9 V and 14,1 V
- Check the solarpanels. They must always be clean. If leaves or particles lay on the panel, it cuts off automatically and does not supply anymore current. Clean panels if necessary during a long dry period from dust. When ever you can see the panels
- Check the scaffold and fitting of the solarpanels Every year
- Check all wiring / replace After 5 years

CENTRE

- Check the voltage of the battery with a voltmeter. Every week until the charging controllers have been adjusted.
The voltage of the battery must always be between 11,9 V and 14,1 V
If voltage sinks below 11,9 V switch off the load
If voltage raise to more than 14,1 V, the battery starts to gas. Switch off the charging (in the control units)
- Clean the battery, check acid level / fill up distilled water Every week
- Check lights, switches connectors and wires like in the bandas
- If the radio is not working: Check like in the bandas
disconnect antenna wire, clean and brush out connector and add some vaseline.
- Call the electrician for check and maintenance half a year
- For any malfunctions you can not trace and for major repairs and alterations contact the electrician

Shaaban Hassan Vuai
tel. 32527 (office)
POBox 585

Illustration no. 1.

PRINCIPLE OF RAINWATER CATCHMENT AND GREYWATER DISPOSAL

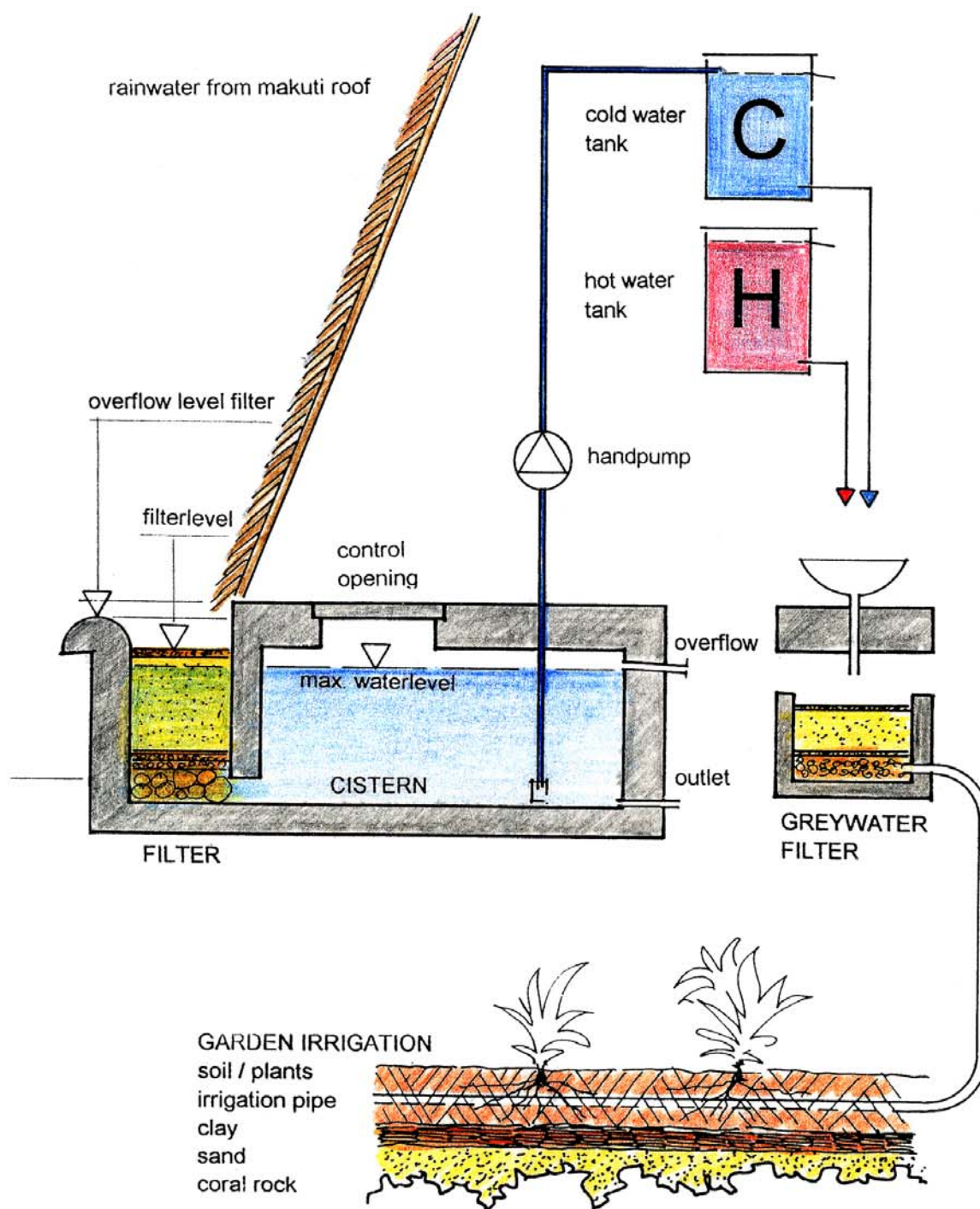
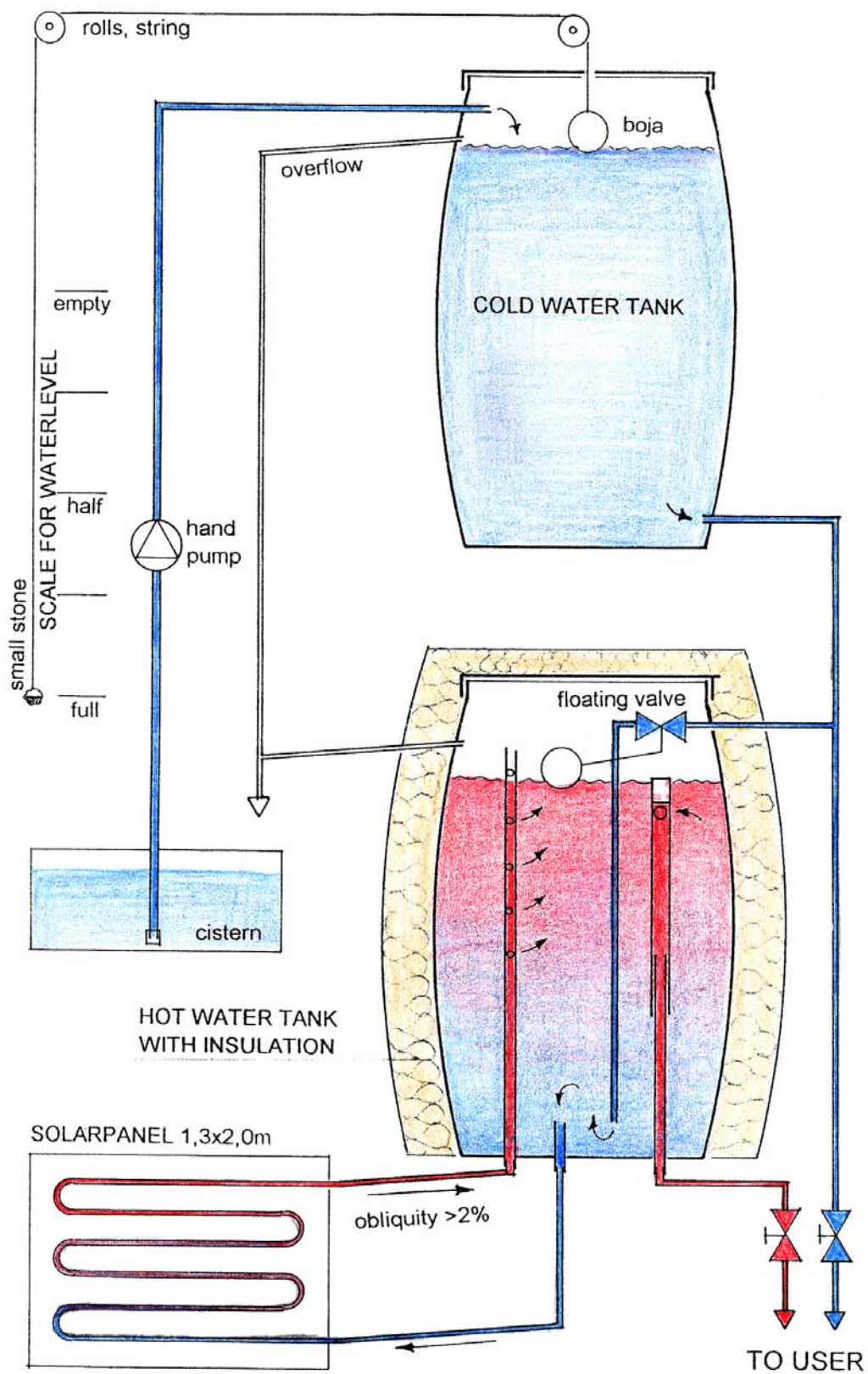


Illustration no. 2.

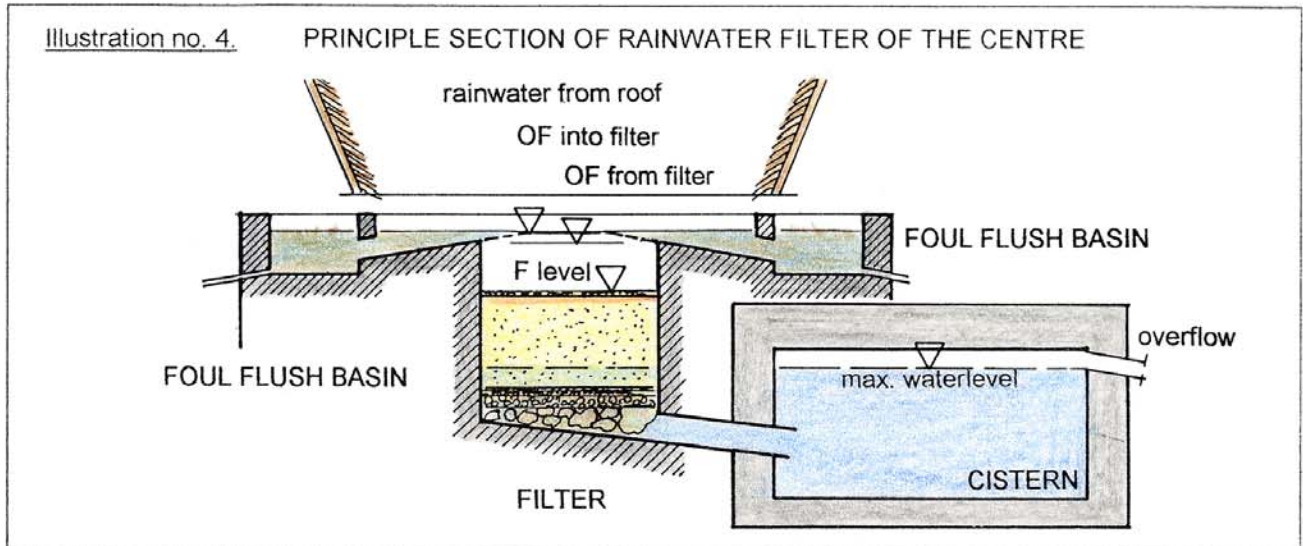
HOT WATER SUPPLY



THE FILTER OF THE CENTRE

Illustration no. 4 shows in principle the rainwater catchment of the centre. The rainwater from the makuti roof first flows into foul flush basins beside the filter, to separate leaves, dirt and dust washed from the roof after a dry period. In heavy rains the foul flush basins, containing ca. 100 ltr., fill up fast. Then the water flows pours into the filter, which can take a huge amount of water at any time.

The outlets ($\frac{1}{2}$ " pipes) should always be open, so that the water can flow out of the basins slowly.



CISTERNS OF THE CENTRE

Illustration no. 5 shows the two different cisterns below the entrance area of the centre:

- The **cistern no. 4**, below the kitchen contains ca. 6 m³ of water for cooking and cleaning dishes. It must only be filled with clear water from the cisterns next to the lighthouse and below the staffhouse.
- The other **cistern departments no. 1 - 3** contain ca. 50 m³ of rainwater coming from the makuti roof. This water can be used for house cleaning, maintenance of boat engines and for gardening.
- Connect pump with the concerning suction pipe, when water is needed.

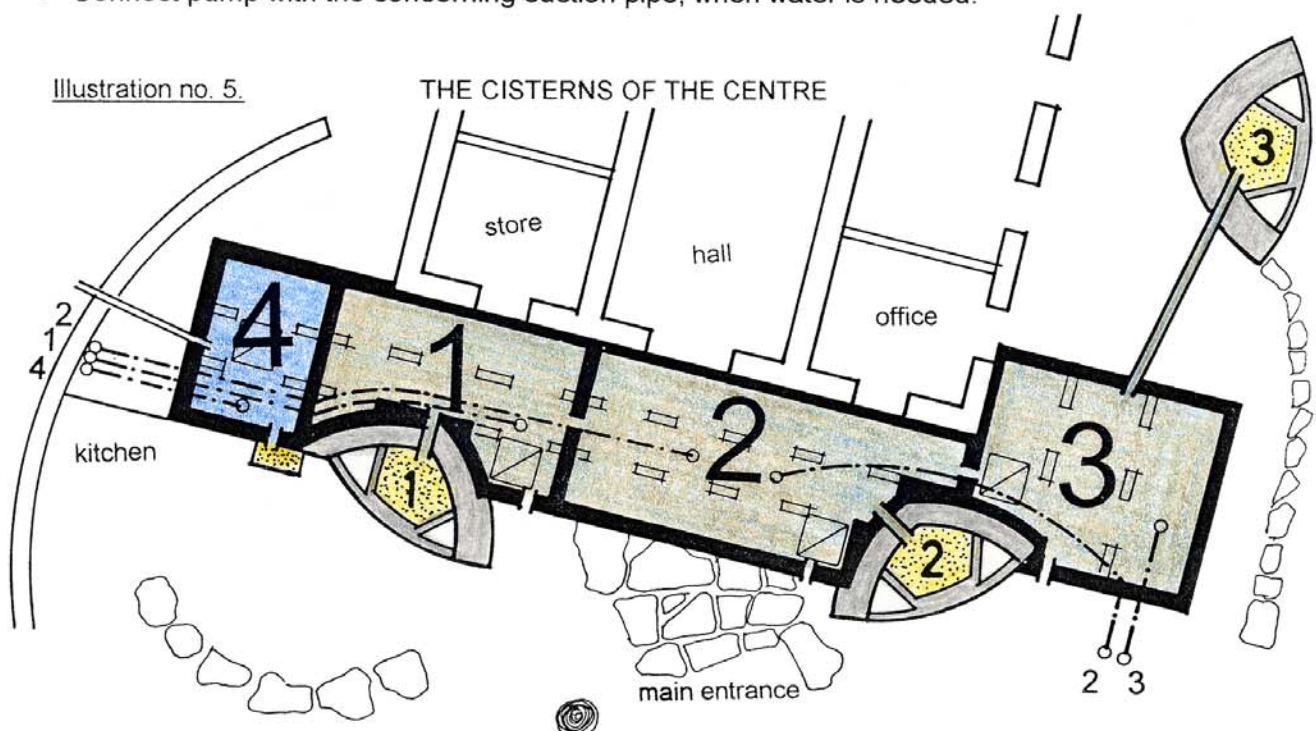


Illustration no. 8

COMPOST TOILET (CLIVIUS MULTRUM)

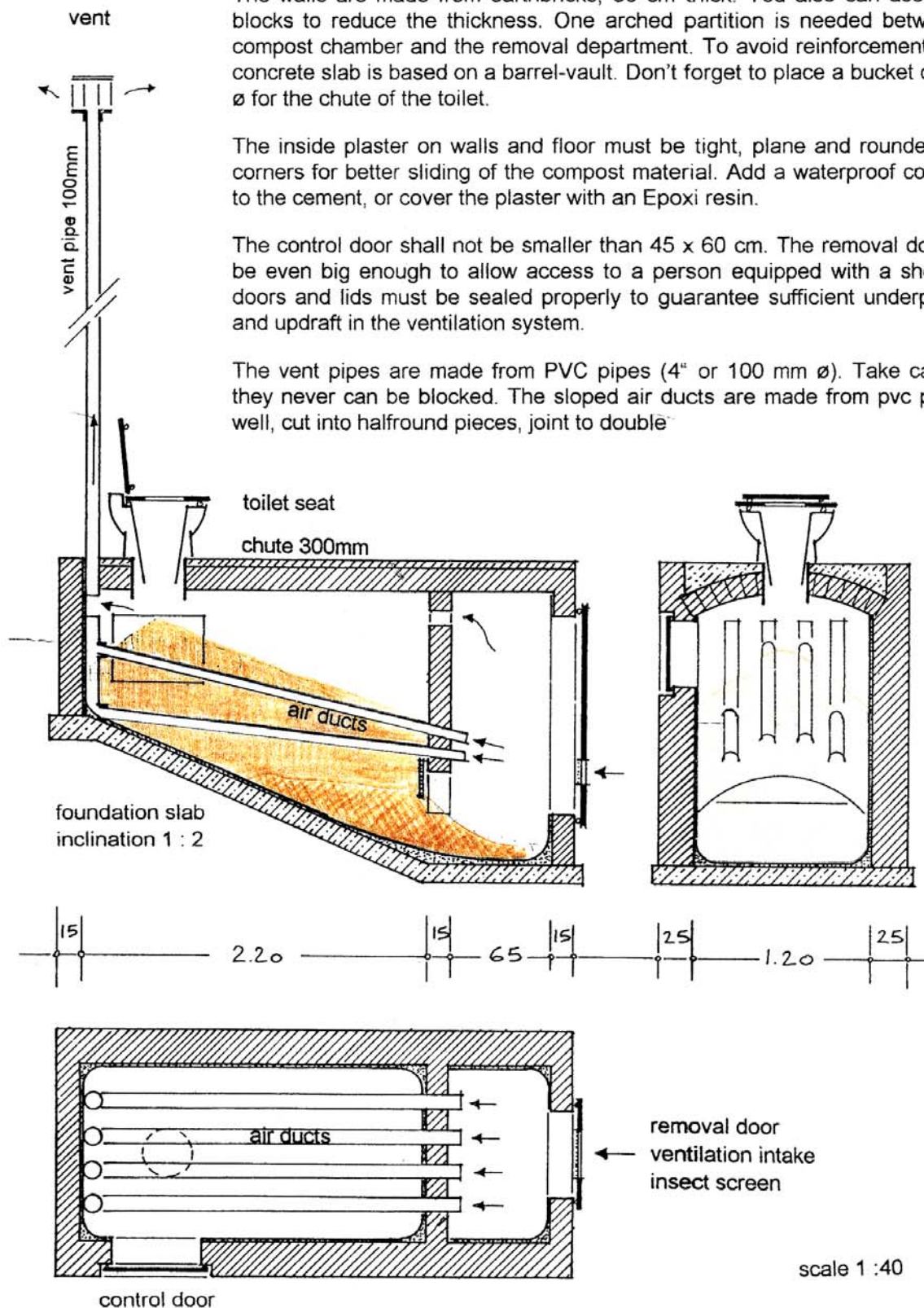
The foundations for the compost chambers on Chumbe island are concrete slabs, ca. 12 cm thick, casted on the strong coral rock. According to climate conditions, no reinforcement has been used. The slope of the foundation slab shall be not less than 1m height to 2 m length.

The walls are made from earthbricks, 30 cm thick. You also can use cement blocks to reduce the thickness. One arched partition is needed between the compost chamber and the removal department. To avoid reinforcement the top concrete slab is based on a barrel-vault. Don't forget to place a bucket of 30 cm \varnothing for the chute of the toilet.

The inside plaster on walls and floor must be tight, plane and rounded in the corners for better sliding of the compost material. Add a waterproof compound to the cement, or cover the plaster with an Epoxi resin.

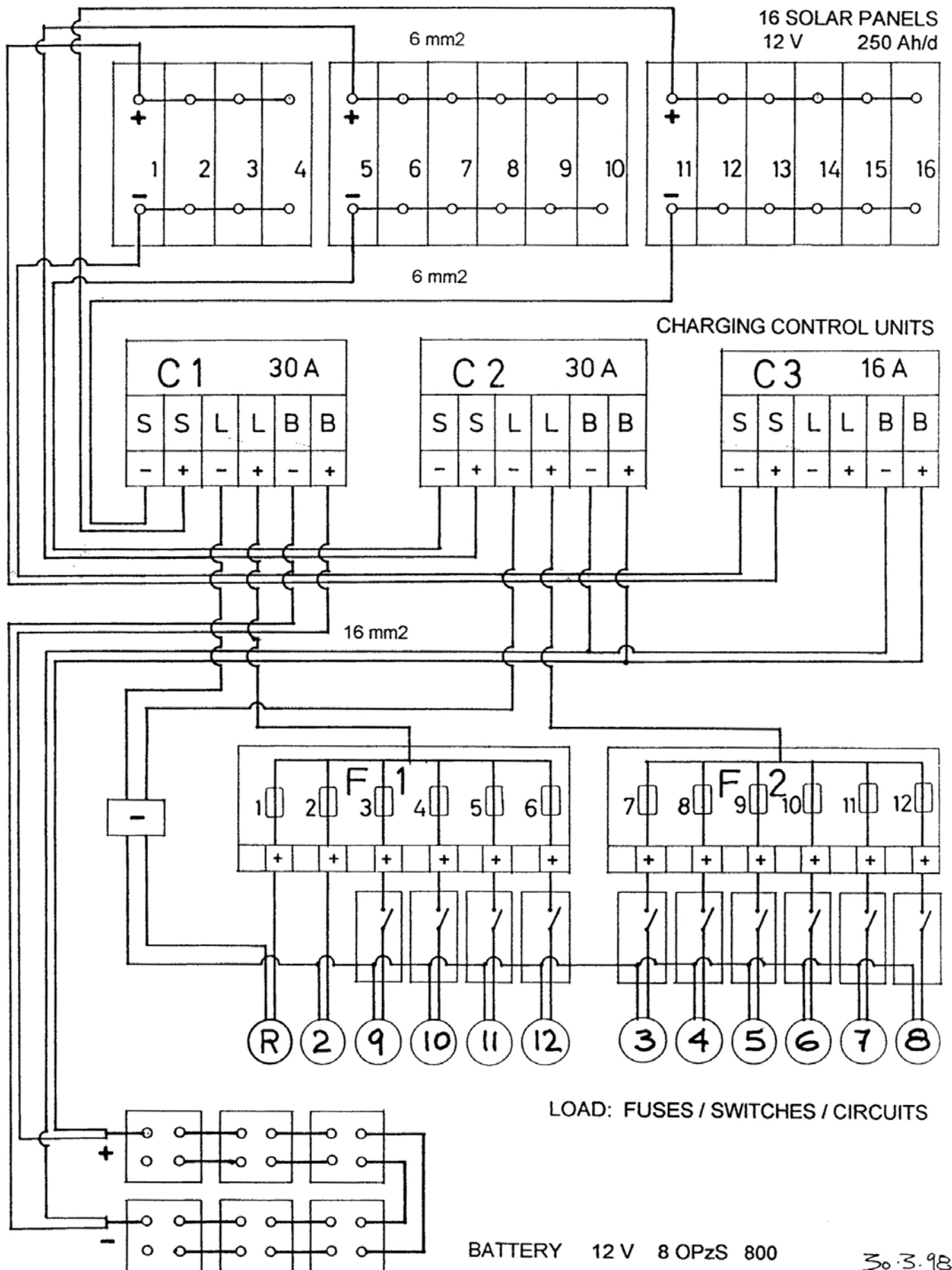
The control door shall not be smaller than 45 x 60 cm. The removal door must be even big enough to allow access to a person equipped with a shovel. All doors and lids must be sealed properly to guarantee sufficient underpressure and updraft in the ventilation system.

The vent pipes are made from PVC pipes (4" or 100 mm \varnothing). Take care, that they never can be blocked. The sloped air ducts are made from pvc pipes as well, cut into halfround pieces, joint to double



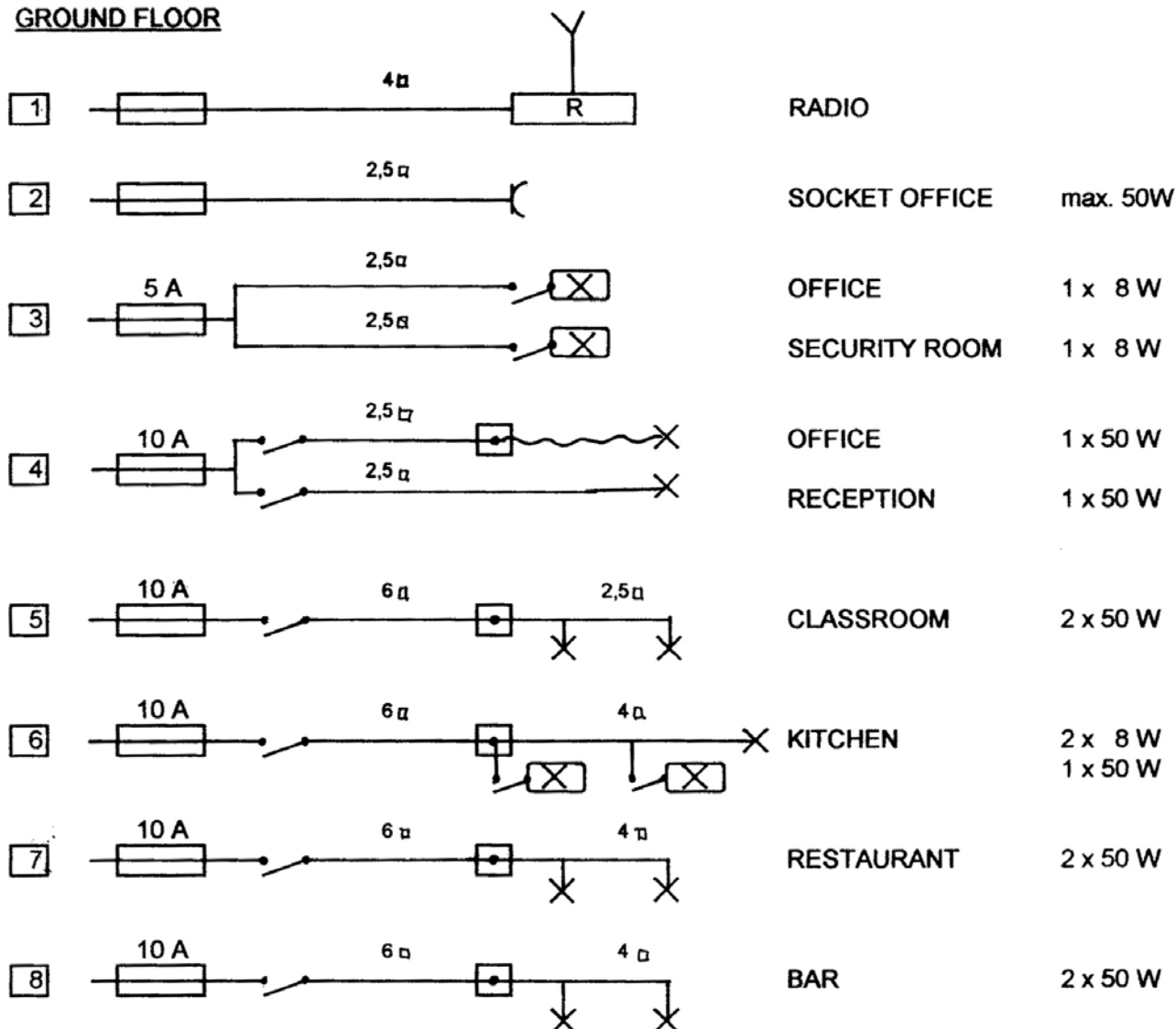
CHUMBE ISLAND CORAL PARK • VISITOR'S CENTRE

ELECTRIC POWER GENERATION WIRING DIAGRAM

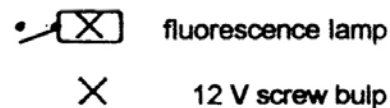
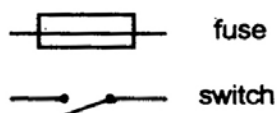
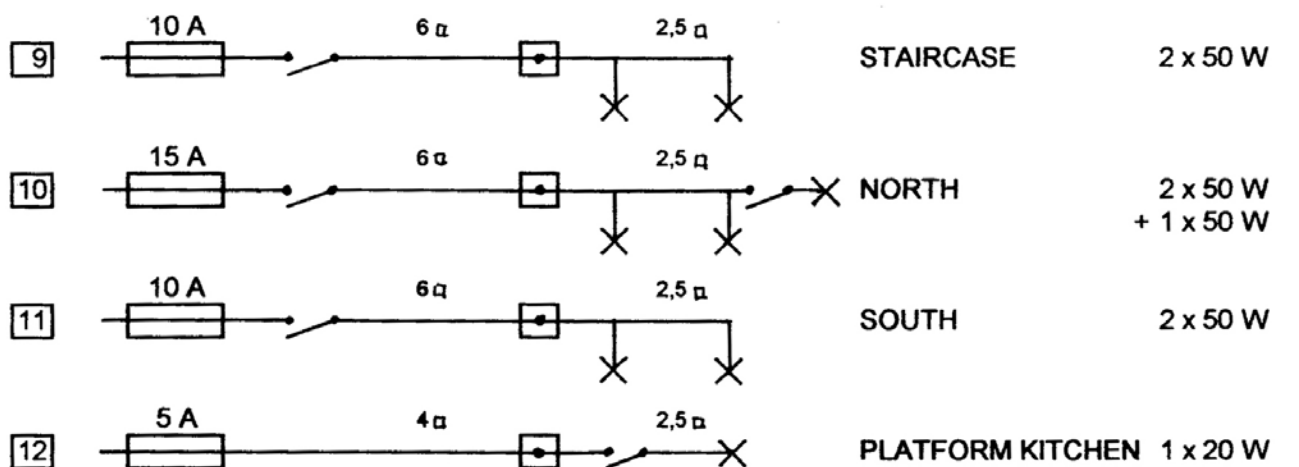


ELECTRICAL INSTALLATION / CIRCUITS

GROUND FLOOR



UPPER FLOOR



'Clients Project Description'

The Chumbe Island Coral Park Project in Zanzibar/Tanzania -

Where eco-architecture helped save a pristine coral island for future generations.

The project site

Chumbe Island is situated 8 miles south-west of Zanzibar Town and covers an area of approximately 20 ha. It is an uninhabited island dominated by coral rag forest and bordered, on its western shore, by a fringing coral reef of exceptional biodiversity and beauty. Based on the initiative of Chumbe Island Coral Park Ltd, a private company created for the management of Chumbe, the island was gazetted in 1994 as a protected area by the Government of Zanzibar.

This created the first marine park in Tanzania, and to our knowledge also the first and only private marine park in the world. The reserve includes a reef sanctuary and protected forest and has become a rare example of a still pristine coral island eco-system in an otherwise heavily over-exploited area.

Objectives

In its orientation, the project is non-commercial, while operations follow commercial principles. The overall aim of CHICOP is to create a model of sustainable conservation area management where ecotourism supports conservation and education.

For this, all infrastructural developments on Chumbe island are strictly based on state-of-the-art of Eco-architecture and environmental technology. Former fishermen were trained as park rangers to educate local fishermen on the benefits they can gain from respecting the reef sanctuary and forest reserve. Profits from the tourism operations are to be re-invested in conservation area management and free island excursions for local schoolchildren.

Finances

About two thirds of the investment costs of appr. 1 Million US\$ were financed privately by the project initiator (a conservationist and former manager of donor-funded aid projects). Several project components, such as the construction of the Visitors' Centre, biological baseline surveys, the Aders' duikers sanctuary, the park rangers patrol boats and nature trails got some funding from donors, e.g. GTZ-GATE, GTZ-EM, the German Tropical Forest Stamp Program, EC-Microprojects, the Netherlands Embassies in Kenya and Tanzania, the WWF-Tanzania, the International School Schloss Buchhof, Munich, the Zoo Munich-Hellabrunn and the Chicago Zoological Society among others. This covered about one third of the investment costs.

More than 40 volunteers from several countries provided, and continue to provide, crucial professional support for between one month to three years. Running costs are now covered from income generated through ecotourism.

Conservation area management

The Project employed and trained four former fishers from adjacent villages as park rangers, and stationed them on the island. They patrol the reef and the island, keep daily monitoring records on any observations, assist researchers and guide foreign and local visitors over the marine and terrestrial nature trails.

Permitted uses of the marine park include recreation (swimming, snorkelling, underwater photography), education and research. Extractive and destructive activities, such as fishing, anchorage, collection of specimen (even for research) are not allowed. Research is co-ordinated with the Institute of Marine Sciences of the University of Dar es Salaam and regulated by the Chumbe Island Management Plan 1995-2005.

As a result of successful management the coral reef has become one of the most pristine in the region, with 370 species of fish (Fiebig 1995) and over 200 species of scleractinian coral, at least 90% of all recorded in East Africa (Veron, pers.com. 1997). In addition, the coral communities in the sanctuary have survived the 1998 bleaching event much better than most other reefs in the region.

The forest covering the island is one of the last pristine 'coral rag' forests in Zanzibar (Beentje 1990) and has now become a sanctuary for the highly endangered Aders' duiker (*Cephalophus adersi*) probably facing imminent extinction from poaching and habitat destruction (Kingdon 1997). The island also has probably the world's largest population of the rare Coconut crabs (*Birgus latro*) recorded as 'data deficient' in the IUCN Red data book. Attracted by the abundant fish in the reef sanctuary, the rare Roseate terns (*Sterna dougalli*) bred on Chumbe Island in 1994 (Iles 1995).

In summary, project activities from 1991-2000 were:

- * Gazetting of the Western reef and the island was negotiated from 1991;
- * Park rangers were employed and trained by volunteers from 1993, basically in interaction with fishers, monitoring techniques and tourist guidance skills;
- * Also with the help of volunteers and some limited donor funds, baseline surveys and species lists on the island's flora and fauna were conducted from 1993;
- * An Advisory Committee was established, with representatives of the Departments of Fisheries, Forestry and Environment, the Institute of Marine Sciences of the University of Dar es Salaam and village leaders of neighbouring fishing villages;
- * A Management Plan 1995-2005 was produced in 1995 and guides project operations since then;
- * Forest and marine nature trails were developed from 1993 with informational material in English and Kiswahili;
- * Rats (*Rattus rattus*) were eradicated in 1997;
- * A Sanctuary for the highly endangered Ader's duiker (*Cephalopus adersi*) is being established from 1997;
- * The ruined lighthouse keeper's house was rehabilitated as Park HQ and Visitors' Centre 1997-98;
- * Seven visitors' bungalows ('eco-bungalows') and the Visitors' Centre were constructed according to state-of-the-art eco-architecture (rainwater catchment, greywater recycling, compost toilets, photovoltaic power generation);
- * Free excursions to the island are regularly organised for local school-children;
- * Tourism operations (day excursions and overnight stay) started in 1997/1998.

CHICOP is registered with the World Conservation Monitoring Center (WCMC) and has been chosen for presentation at the EXPO2000 World Exhibition in Hannover/Germany for its achievements in private conservation area management and the innovative eco-architecture of all buildings.

In 1999 the project won the British Airways Tourism for Tomorrow Southern Regional and Global Awards. In 2000 Chumbe Island Coral Park also won the Global500 Award of the United Nations Environmental Programme (UNEP).

Project Achievements:

a) Cultural and social:

Essential to the closing of the reef to fishing was the close relationship with the local fishing communities in their understanding and support of the Chumbe reef sanctuary. Due to the excellent work of the park rangers, there are now no major problems with infringements from fishers or other users, and the project is well accepted by the local communities (Carter et.al. 1997).

In addition, the project offers swimming and snorkelling lessons particularly to schoolgirls who are not normally given that chance in the Islamic tradition.

b) Built Heritage

Chumbe Island was uninhabited for many decades, but had historical buildings that were either left untouched or carefully restored by CHICOP:

- * A historic lighthouse, built by the British in 1904, is kept functioning with the AGA gas system installed in 1926. The Chumbe Park Rangers now make sure that the lights are working for the traditional dhows that have no modern means of navigation. They report to the Harbour Authority of Zanzibar when the gas supply has to be replenished, something that did not happen for decades before CHICOP took over the management of Chumbe Island. The lighthouse provides spectacular views of Zanzibar and the Chumbe Sanctuary.

- * A protected historic mosque on the island is left untouched and still used daily by the Chumbe staff on the island. This is one of the few mosques of Indian architecture in Zanzibar, built for the Indian lighthouse keepers by their community at the turn of the century.

- * The former lighthouse keeper's house has been carefully restored and converted into a Visitors' Centre that harbours the restaurant and exhibits of environmental information about the island reserve for all guests, and includes a classroom for local schoolchildren.

c) Natural Environment

On Chumbe Island, conservation work is pro-active. Rangers patrol the island to ensure that the laws prohibiting fishing and anchoring on the protected reef and guarding of the closed coral-reef forest habitat are met. They monitor any event or infringement, and their reports provide daily data from 1992, on the type, number and names of vessels involved, nature of the intended activity and the fishers' reaction to the rangers' intervention. They also record observations on any major change in the coral reef, such as storm damage or coral bleaching.

d) Pollution, waste management and environmental impact

The Visitors' Centre and seven 'eco-bungalows' were all built with state of the art eco-architecture and eco-technology that have close to zero impact on the environment.

All buildings generate their own water and energy, with rainwater catchment, solar water heating and photovoltaic electricity. Sewage is completely avoided by the use of compost toilets and vegetative filtration of shower water through plant beds. Buildings are designed to catch sea breezes for ventilation and do not require air-conditioning. Organic kitchen waste is recycled in the compost beds that provide for the compost toilets. Any other waste is removed from the island.

e) Management of visitor numbers

Overnight capacity does not exceed around 5000 visitors/year. No further construction of overnight facilities is planned. Day visitation to the park is also limited and regulated by the tides to avoid any damage to the coral reef by boats crossing over in low waters.

f) Environmental Communication

While coastal communities depend on fishing for their survival in Tanzania and Zanzibar, there is little evidence of traditional reef management or awareness about the limitations of the resource (Scheinman & Mabrook 1996). The national language Kiswahili has no word for corals (referred to as 'mawe na miamba', stones and rocks). Also formal education does not yet provide environmental knowledge on coral reefs as they are not covered in the syllabi of primary and secondary education. As a result, decades of destructive fishing methods (dynamite, smashing corals and beach-seining) have met with little public and governmental concern (UNEP-RSRS 1989, Horrill 1992, Guard 1997).

To help improve this situation, the Chumbe Project provides environmental information, education and training to the following groups:

*** The Park Rangers.** The hands-on approach in capacity building and monitoring through inexpensive on-the-job-training of local fishers by volunteers has produced very competent and committed park rangers. They manage the Reef Sanctuary with no other means of enforcement than persuasion of their fellow fishers.

*** Fishers.** The rangers educate fishers by stressing the role of the protected area as a breeding ground for fish. This has proved very successful. Village fishers now generally respect the park boundaries and report that catches outside the boundaries have increased since the establishment of the sanctuary.

*** Government officials.** The project has also helped to raise conservation awareness and understanding of the legal and institutional requirements among government officials. Seven Government departments were involved in negotiating the project in the initial phase, followed (among other issues) by intense discussions on the Management Plan 1995-2005 in the Advisory Committee. This has improved political support and prepared the ground for improvements in the legal framework. Recent environmental legislation passed in 1997 provides for private management of protected areas.

*** Schoolchildren.** Island excursions are provided free of charge to local schoolchildren. This is organised in co-operation with local NGOs in Zanzibar. Many of these children come from schools within fishing communities where the children benefit from learning about the resources upon which many of their families' livelihoods depend, and upon which they may be likely to depend upon themselves in later life.

*** Ecotourists.** Visitors to the island are offered a wide range of nature experiences, such as guided snorkelling along marine trails in the forest sanctuary, guided walks in the intertidal zone, mangrove cave and forest trails, accompanied by environmental exhibits and information in the Visitors' Centre. Accommodation is in so-called 'eco-bungalows' that demonstrate state-of-the-art technologies of water and waste management and energy provision.

g) Leadership

Coral reef conservation can work on the ground, and be sustained by ecotourism. The Chumbe experience suggests that private management of marine protected areas is technically feasible and efficient even when the enforcement by the State is not available or ineffective. This is probably the case for reefs that are not yet over-exploited by communities depending on them for their survival.

A private protected area such as Chumbe can provide important community benefits, particularly in capacity building, biodiversity conservation and restocking of fisheries resources. The Chumbe Reef Sanctuary is a safe haven for endangered species and breeding grounds for corals, reef fishes and other organisms that are severely depleted

elsewhere. With the predominantly northerly currents in the Zanzibar channel and the sanctuary being located South of all major fishing grounds off Zanzibar town, depleted areas downstream are potentially restocked.

h) Sustainable Tourism

Chumbe Island combines sustainable tourism with sustainable conservation area management. While most protected areas around the world are dependent on financial support by Governments or by large donor agencies, the revenue generated from tourism on Chumbe Island provides for the conservation and education programmes run in the park. Following people have considerably

i) Major assistance has been given by

Suzanne Fiebig, for the coral & fish surveys and Ranger training

Dr. Peter Koehler, for the birds,

Dr. Ulrike Koehler, for the forest vegetation, jointly with Dudley also for the forest trail;

Dudley Iles, for birds, Roseate Tern ringing,

Dr. Patrick Sleeman, the Rat Eradication Campaign, 1997

Prof. Henning Wiesner, Zoo-Munich Hellabrunn, for the Duiker translocation program,

Antje Foerstle & Rainer Vierkoetter, for the Marine Nature Trails & Ranger training;

Colin Poulton & Horst Neckenig, for the feasibility study & economics of the project;

References

- BEENTJE, H.J. (1990) A Reconnaissance Survey of Zanzibar Forests and Coastal Thicket, FINNIDA-COLE, Zanzibar
- CARTER, E., NYANGE, O., SAID, Y., (1997), Management Experiences of the Chumbe Reef Sanctuary 1992-1996, Paper presented at the National Coral Reef Conference, 2-4 December, Zanzibar
- CHUMBE ISLAND CORAL PARK (1995), Management Plan 1995-2005, Zanzibar
- CHUMBE ISLAND CORAL PARK (1999), Progress Report 1992-1999, Zanzibar
- FIEBIG, S. (1995), Fish species list and management report on the Chumbe Reef Sanctuary
- GUARD, M. (1997) Dynamite Fishing in Southern Tanzania, Miombo 17, Wildlife Conserv. Soc. of Tanzania, Dar es Salaam
- HORRILL, C. (1992) Status and Issues Affecting the Marine Resources around Fumba Peninsula, COLE-Zanzibar Environmental Study Series, Number 12.
- ILES, D.B. (1995), Roseate Terns, Miombo, No.13, July 1995, Wildlife Conservation Society of Tanz., Dar es Salaam
- KINGDON, J. (1997), The Kingdon Field Guide to African Mammals, Academic Press, 372-373
- RIEDMILLER, S. (1991) Environmental Education in Zanzibar: Proposals for Action, Dept. of Environment, FINNIDA, Zanzibar
- RIEDMILLER, S. (1998) The Chumbe Island Coral Park Project, A Case Study of Private Management of a Marine Protected Area, Paper presented at IUCN-Regional Workshop on Marine Protected Areas, Tourism and Communities, 11-13.5.98, Mombasa/Kenya
- RIEDMILLER, S. (1998) The Chumbe Island Coral Park Project, Management experiences of a private marine conservation project, Paper presented at the ICRI-International Tropical Marine Ecosystems Management Symposium, 23-26.11.98, Townsville/Australia
- RIEDMILLER, S. (1999) The Chumbe Island Coral Park: A Private Marine Conservation Project, InterCoast Network Spring 1999, Coastal Resources Center, University of Rhode Island, USA
- SCHEINMAN, D. & MABROOK, A. (1996), The Traditional Management of Coastal Resources, Tanga Coastal Zone Conservation and Development Programme, Tanga/Tanzania, June 1996
- UNEP-RSRS, (1989) Coastal and marine environmental problems of the United Republic of Tanzania. By M. PEARSON. UNEP Regional Seas Reports and Studies No.106
- WATKINS, C.W., BARRETT, M., PAINE, J.R. (1996), Private Protected Areas, A Preliminary Study of Private Initiatives to Conserve Biodiversity in Selected African Countries, World Conserv. Monitoring Centre (WCMC), Cambridge, December 1996