DRAFT

REPUBLIC OF VANUATU

DEPARTMENT OF GEOLOGY, MINES AND RURAL WATER SUPPLY

DESIGN STANDARDS FOR RAINWATER CATCHMENT WATER SUPPLIES

Introduction

This standard sets the minimum design criteria used by the Department of Geology, Mines and Rural Water Supply in the design of rainwater catchment water supply systems. This level of service provides the minimum requirements for drinking and cooking during the dry season.

Water quality

Rainwater catchment water supplies have inherent problems with water quality due to the ingress of matter collected on the catchment roof. The consumer is required to make every effort to keep roof areas and gutters clean and to prevent mosquito breeding in the tank.

Average Percapita Consumption:	5	l/c/d
Water Storage:	To meet the maximum cumulative monthly deficit between consumption and collection.	
Minimum Roof Area:	1	m^2/person
Design Annual Rainfall:	Annex A	
Mean Monthly Rainfall (MMR):	Annex A	
Rainwater Collection Factor:	0.8	l/m^2/mm rainfall

Notes:

1. Monthly consumption = 5 l/c/d x design population x 30 days
2. Monthly collection = Roof area x MMR x 0.8
3. Monthly surplus/deficit = Monthly consumption - collection

Design Period: 10 years

1 mm rain x 1 m^2 roof = 1 e x 0.08 l

Existing roof area available: Nil

Existing water storage
One unfinished 10,000 gall traditional underground tank.

Existing water storage deficit/credit
Q3 = Q1-Q2 = 0-(765x2)
= 0-9,180
= -9,180 gallons
S = 10,000. Q4 = + 820 gallons.

Comment

A small village and the existing traditional tank when completed and provided with roof catchment should be sufficient for immediate needs. The tank bottom and walls require plastering and outlet pipe fitted.

Recommendation

Complete traditional type tank in accordance with this report and provide 750 sq.ft. of roof catchment.

Priority rating: 36.

5. NANGWEA VILLAGE

Population: 50.

Number and condition of existing roofs
One iron roof requiring minor repairs and painting to prevent rusting.

Existing roof area available: 1,290 sq.ft.

Existing water storage
One unfinished 10,000 gall traditional underground tank.

Existing water storage deficit/credit
Q3 = Q1-Q2 = (13.26x1,290)-(765x50)
= 17,105-38,250
= - 21,145 gallons
S = 10,000 gall. Q4 = - 11,145 gallons.

Comment
This is one of the larger villages. The existing traditional tank requires further plastering to walls and base, and a roof has to be constructed. As the tank has been located at the bottom of the village, a handpump is required to supply other parts of the village.

Recommendation
To overcome the water deficit, another 10,000 gall traditional tank should be constructed or two 5,000 gall ferrocement tanks with an additional 800 sq.ft. of catchment area. The roof to be constructed over the existing unfinished tank will provide part of this area.

Proof — 19

THOD OF ASSESSING VILLAGE WATER CATCHMENT AND STORAGE QUIREMENTS

Rainfall

The only rainfall data available is that for the seven-year period 1972-1978 (see Annex 5) which indicates an average annual rainfall for the project area of 108.15 inches (2,747 mm). Of significance is the dry season over the months of August to December. The total average of these five months amounts to 30 inches (762 mm).

Catchment

One inch of rain falling on a horizontal surface of 100 sq.ft. will produce 51.9 imp. gallons of water (say 52 galls), or 0.52 imp. g s/sq.ft. Therefore 100 sq.ft. of plan roof during the five c. ical dry months will produce 30x52 = 1,560 imp. gallons or 15.60 galls/sq.ft. Allowing for losses of 15% due to splash-off, evaporation, leakage, etc., this figure reduces to 1,326 gallons, or 13.26 galls/sq.ft.

Consumption

If consumption is restricted to 5 gallons/capita/day during the critical August-December period, one person will consume 5x153 days = 765 gallons.

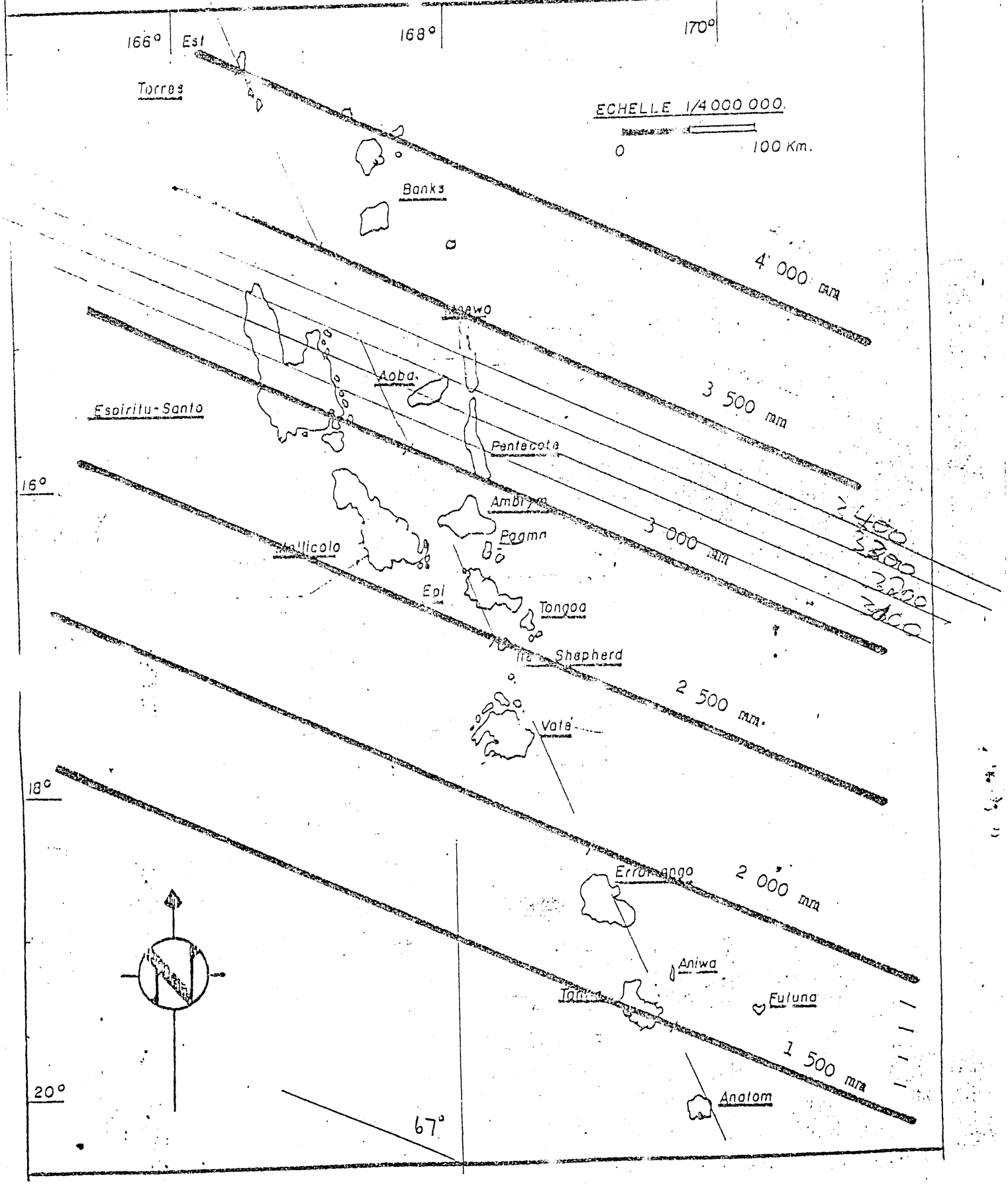
Computation of credit/deficit storage

P = population of village
A = total plan roof area (square feet) in the village suitable for rainwater catchment
S = existing tank storage capacity in the village (imp. gallons)
Q1 = total quantity of water (imp. gallons) which could be collected during the critical period
= 13.26xA.
Q2 = total quantity of water (imp. gallons) consumed by village population during the critical period
= 765xP.
Q3 = potential water credit/deficiit at existing "A" value
= Q1-Q2.
Q4 = gross water credit/deficit after adding existing storage capacity "S" to Q3.

MODELLED MEAN ANNUAL RAINFALL

FOR VANUATU

FIGURE 3



MEAN MONTHLY RAINFALL

9. Using the data at Table 1, mean monthly rainfall as a percentage of mean annual rainfall can be averaged over the six rainfall stations in Vanuatu. Thus, mean monthly rainfall can be determined using these average factors once the mean annual rainfall has been estimated.

10. The mean monthly rainfall factors are:

Mean Monthly Rainfall

MRF Jan = 0.131
MRF Feb = 0.113
MRF Mar = 0.140
MRF Apr = 0.099
MRF May = 0.076
MRF Jun = 0.068
MRF Jul = 0.058
MRF Aug = 0.050
MRF Sep = 0.051
MRF Oct = 0.066
MRF Nov = 0.068
MRF Dec = 0.080

11. Mean monthly rainfall is calculated using the factors above and the mean annual rainfall from Figure 3. IE:

Mean Monthly Rainfall (MMR) = ARF x MRF

DESIGN STANDARDS - SUMMARY

1. Public Standpipe Supplies

* Water quality - no coliforms / taste and visual appearance acceptable to the consumer
* Average percapita consumption - 50 l/c/d
* Peak day - 1.25 x av day
* Losses - 20 %
* Design life - 15 years
* Minimum storage - 40 % x av day
* No. of taps - 1 per 20 people
* No. of showers - 1 per 40 people
* Instantaneous demand - 70 % of fawcets running at 10 l/min

2. Protected Wells with Handpumps

* Water quality - as above
* Average percapita consumption - 50 l/c/d
* No. wells - 1 per 50 people
* Design period - 15 years
* Protected area - 30 m min from each handpump

3. Rainwater Catchment

* Water Quality - no faceal coliforms
* Average per capita consumption - 5 l/c/d (cooking/drinking only)
* Roof area - 1 sq m / pers
* Rainwater catchment - 20 % losses
* Design period - 10 years
* Storage - min of 3 months

Note : The central Island group has a rainfall varying between 2,200 mm/year and 3,200 mm/year. On average, a rainwater catchment system would involve one 5,000 gal tank and one 50 sq m roof per 50 people.

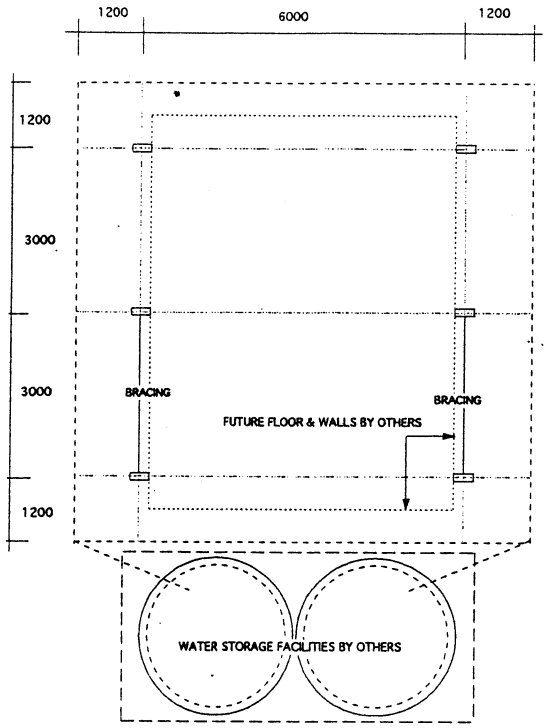
HEALTH SERVICES SUPPORT PROGRAM

RAIN WATER TANK CALCULATION TABLE

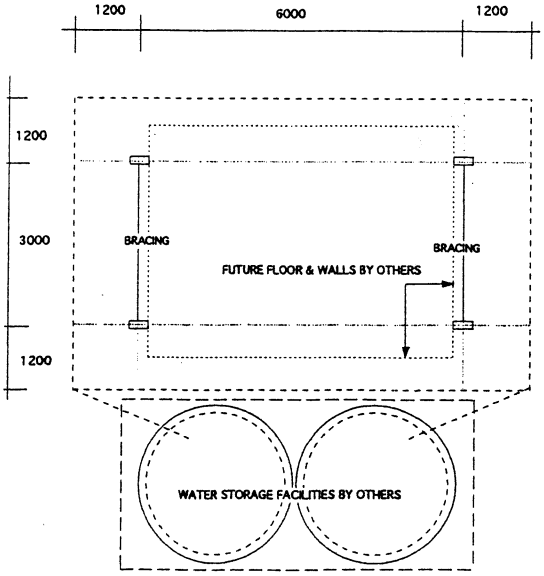
Based on Department of Health "Hydrologic Design Manual for Rain Catchment water supplies".

(a)	Location:	*				
(b)	Province:	*				
(c)	Zone (from rainfall map):					
(d)	House/Health Centre:	*				
(e)	Occupants		Residents	Staff	In-House Patients	Day Patients
(f)	Number of Persons	*	N°	N°	N°	N°
(g)	Per Capita Demand, litre/capita/day		80 l/c/d	15 l/c/d	20 l/c/d	5 l/c/d
(h)	Calculated Demand, litres/day	(f) x (g)	l/d	l/d	l/d	l/d
(i)	TOTAL daily demand – sum (h)					l/d
(j)	Roof size m_:	*				m_
(k)	Design for, normal dry season/very dry season:					
(l)	Alternative top up source available, Yes/No:				No	
(m)	Percentage reliably:					100%
(n)	Table N° : (from design manual)		T			
(o)	Calculated tank capacity:					l
(p)	Proposed Tanks				N° @	l

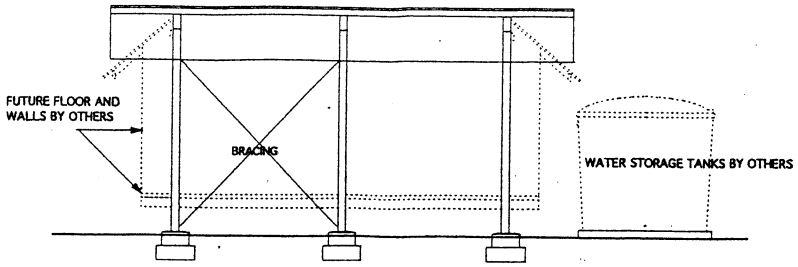
* to be completed by Architect



PLAN OF 2 BAY BUILDING



PLAN OF 1 BAY BUILDING



LONG SECTION OF 2 BAY BUILDING

GENERAL NOTES

THIS OPEN SIDED SHED LIKE BUILDING CONSISTS A SIMPLE ROOF FOR THYE COLLECTION OF RAIN WATER. THE BUILDING CAN BE FURTHER DEVELOPED WITH FLOOR AND WALLS BY OTHERS AS A FUTURE STAGE.

THE BUILDING IS TO BE PROVIDED IN KIT FORM TO CONSIST OF:
STRUCTURAL FRAME (POSTS AND BEAMS OR PORTALS)
HOLDING DOWN BOLTS AND NUTS.
PURLINS
ROOFING.
ALL NECESSARY FIXINGS, BRACINGS, TRIMING, PACKING, FASCIA PURLIN ETC.

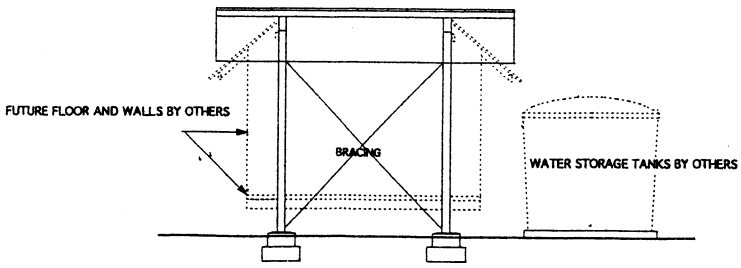
NOT INCLUDED IN THE KITS ARE:
MATERIALS FOR CONCRETE FOOTINGS.
GUTTERS AND DOWNPIPES.
WATER TANKS & ASSOCIATED PLUMBING

PRICES ARE SOUGHT FOR TWO SIZES OF BUILDING:
2 BAY BUILDING WITH 8400X8400 ROOF.
1 BAY BUILDING WITH 5400X8400 ROOF.

BUILDING COMPONENTS ARE TO BE PREFINISHED AS MUCH AS PRACTICAL TO WITHSTAND COASTAL (MARINE) CONDITIONS.
COMPONENTS ARE TO BE PREFABRICATED TO ALLOW EASE OF TRANSPORT. THE LONGEST COMPONENT SHALL BE 4000 LONG TO ALLOW FOR AIR FRIEGHT.
THE BUILDING SHOULD BE ABLE TO BE ASSEMBLED WITH SIMPLE TOOLS.
ALLOW FOR BOLTED CONNECTIONS GENERALLY.
NO SITE WELDING IS TO BE REQUIRED.

STRUCTURAL DESIGN REQUIREMENTS

1. DEAD LOAD:
   ROOF = 0.25 kPa
   WALL = 0.25 kPa
2. LIVE LOAD:
   ROOF = 0.25 kPa
3. EARTH QUAKE:
   ZONE 2
   ASSUMING SOFT SOIL
   C = 0.2
   I = 1.0 IMPORTANCE
   K = 1.0 STRUCTURAL TYPE
4. WIND LOADING:
   BUILDING CLASS 2
   25 YEARS RETURN PERIOD
   V25 = 28 M/S
   H = 3.2M TO EAVES LEVEL
   X = 15 DEG. ROOF PITCH
   T.C = 1 (TERRAIN CATEGORY)



LONG SECTION OF 1 BAY BUILDING

Drawing	SKETCH PLANS OF 1&2 BAY PRE-FABRICATED STEEL BUILD
Project	HEALTH SERVICES SUPPORT PRO NATIONAL DEPARTMENT OF HEAL