PD-AAX-974

PROGRESS REPORT OF ACTIVITIES

FOR

F.S.P.'s VAVA'U OUTER ISLAND

WATER SUPPLY PROJECT

EVALUATION OF PHASE ONE

(MAY 1987 - MARCH 1988)

BY

DENIS R. WOLFF
COUNTRY DIRECTOR/TONGA
THE FOUNDATION FOR THE PEOPLES
OF THE SOUTH PACIFIC

TABLE OF CONTENTS

LIST OF TABLES IN THE REPORT

LIST OF TABLES IN THE APPENDICES

1. INTRODUCTION

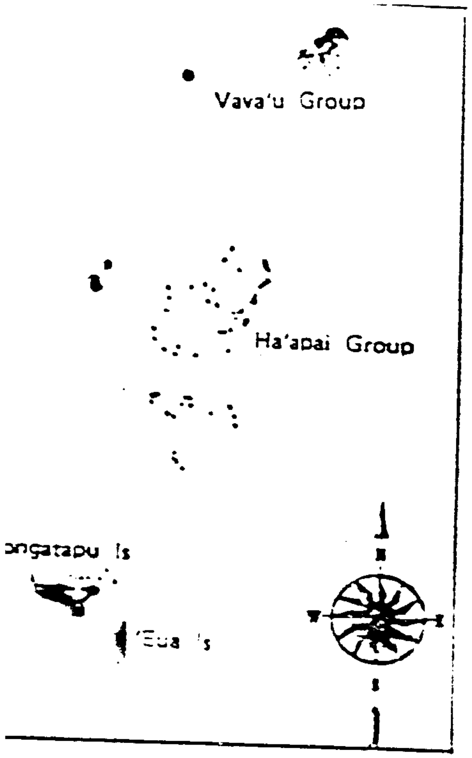
Based on FSP's extensive experience gained during the implementation of the USAID-funded Ha'apai Water Supply Project (1981 - 86), a request was made by Tonga Government through the Ministry of Health and the National Village Water Committee for consideration of a similar project in the outer-island villages of the Vava'u region. This target area was identified by the Ministry of Health as being of high priority for improvement of water supply, due to the absence of fresh groundwater resources and the resulting dependence of rainwater catchment.

Initial project funding of US$60,000 was secured through the generosity of the US-based Public Welfare Foundation (USPWF) and the United Methodist Committee on Overseas Relief (UMCOR). 82% of the funding from the two grants was allocated for direct field costs, with the balance allocated for other expenses.

Project implementation commenced in April 1987. For logistical and technical reasons, the project was divided into two phases. Phase One of the Vava'u Outer Island Water Supply Project involved the construction of 209 X 3000 gallon ferrocement water tanks (with associated guttering and catchment areas) in eight outer-island villages of the Vava'u region (see Table 1, page 2). An additional 230+ tanks in nine villages are planned for implementation in Phase Two of the project. In both phases, the overall goal is to improve fresh water supplies in the targeted outer-island villages, with the related goals of improving standards of health, sanitation and quality of life in these rural areas.

A progress report of activities to date was prepared for the period of January 1 - July 31, 1987. It was originally planned that a second progress report would cover the remainder of the 1987 calendar year. This was, however, delayed by the resignation of the previous FSP/Tonga Country Director in October 1987. As the present Country Director did not assume the position until mid-January 1988, and because implementation of Phase One was completed shortly thereafter, it was decided to carry out the following overall evaluation of Phase One activites instead.

On behalf of the people of the eight villages involved in Phase One of the project, FSP/Tonga would like to express thanks and appreciation to the donor agencies (USPWF, UMCOR, CIDA and Danchurchaid), to the field workers directly involved in the implementation of the project, and to the individuals who participated in the evaluation as representatives of their agencies/Ministries/organisations.



CIRCLED villages = Phase 1

SQUARED villages = Phase 2

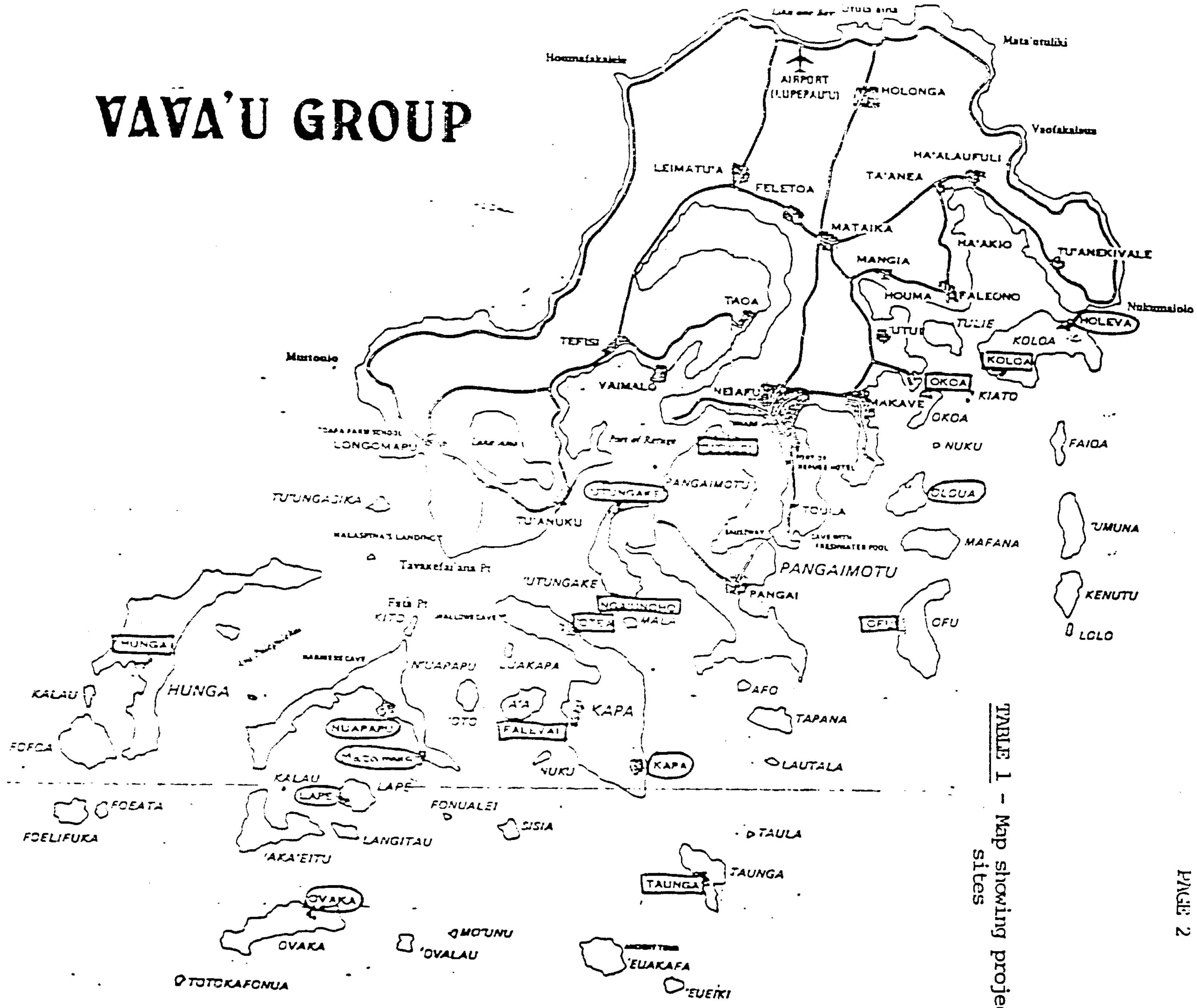


TABLE 1 - Map showing project sites

2. BACKGROUND

2.1 IMPLEMENTATION FRAMEWORK

Phase One of the project involved the construction of 209 water tanks in eight outer-island villages during the period of April 1987 to January 1988, as detailed below:

VILLAGE	NUMBER OF TANKS	IMPLEMENTATION TIMEFRAME
Olo'ua	20	June/July 1987
Lape	7	July
Ovaka	25	July/August
Matamaka	33	August/September
Nuapapu	41	September
Kapa	33	October/November
'Utungake	33	November/December
Holeva	17	December/January

The number of tanks per village was based on a thorough pre-implementation survey conducted in March 1987. During this survey, a comprehensive evaluation of each house in every village targeted for both phases of the project was undertaken. The overall results of this survey have provided the baseline data used thus far in project implementation (refer Appendix 1, Tables 1 & 2).

2.2 ORGANISATIONAL STRUCTURE OF PROJECT

a) Organisational Framework

Project staff responsible for implementation have been organised as an integrated management unit (see Table 2, page 4). It is noted that two changes have occurred in organisation framework since the beginning of Phase One. The first was the untimely death of Soane Lolesio, the Director of the Vaikau'aki Company. The position was immediately filled by his brother, Fuli Lolesio, who has been an integral part of the company since its inception. The second change was the transfer of Peace Corps Volunteer Lori Osmundsen from Vava'u to Niuatoputapu as part of her third-year extension. Lori (in tandem with Brian) was a part of the original field monitoring team. In both cases, their contribution to the project is greatly appreciated.

TABLE TWO - ORGANISATIONAL FRAMEWORK OF PROJECT

FSP FIELD OFFICE →
Country Director
Asst. C.D.
Office Staff
(Nuku'alofa)

↑ (dashed arrow from Ministry of Health)

MINISTRY OF HEALTH
MOH Public Health Officer (Nuku'alofa)
MOH/Vava'u personnel
World Health Organisation (WHO) Engineer (Nuku'alofa)

FIELD ORGANISER
Peace Corps Volunteer:
- Brian Robetor
(Neiafu, Vava'u)

COMMUNITY ORGANISER
Chief Extension Officer of Village Women's Development Programe:
- 'Aulola 'Apikotoa
(Neiafu, Vava'u)

CONSTRUCTION ORGANISER
Kuli Lolesio
- Vaikau'aki Company
- five labourers
(Neiafu, Vava'u)

b) Organisational Responsibilities

The FSP/Tonga Field Office provides overall administration of all project aspects. Technical input to the project is provided by MOH and WHO.

The Field Organiser, Community Organiser, and Construction Organiser function as a coordinated, inter-related project team, each with specific responsibilites, but each facilitating the others' efforts. An excellent example of teamwork in action is thus provided.

The Community Organiser is the primary contact point between the project and the village people involved. Her primary responsibility is to facilitate and coordinate the provision of the inputs required as local contribution for the project, in order to ensure that all necessary local components are available and in place prior to actual implementation. In addition to cash and materials, local contirbution also involved coordinating local transport of materials and personnel to the project site, as well as accomodation of project personnel while on site.

The Construction Organiser is the Director of the Vaikau'aki Company, an established small business firm in Vava'u which specialises in the construction of rain tanks and is responsible for the physical implementation of the project. This involves both the construction of 3000 gallon water tanks of a ferrocement design, and the installation of a guttering system. The end result is an integrated rain catchment/storage facility. It is noted that they are assisted in these efforts by village/local labour, as required.

The Field Orgnaiser facilitates and coordinates the above, as well as being responsible for financial reporting of fieldwork and procurement of needed project materials available in Vava'u.

2.3 BASIC FINANCING

The majority of project funding was secured through two seperate grants, from the United Methodist Committee on Overseas Relief (UMCOR) and the US-based Public Welfare Foundation (USPWF). These grants comprised 75% of the direct costs of the project.

Additional direct funding for the project was secured through the following:

1) a CIDA (Canadian International Development Assistance) grant provided through the Rural Development Programme of the Central Planning Department of the Government of Tonga, comprising 5% of direct costs.
2) a DANCHURCHAID grant, provided through the Tonga Community Development Trust (TCDT), comprising 4% of direct costs.
3) local cash contribution of T$50/tank, totaling 16% of direct costs.

A substantial level of indirect assistance was also provided. Project support infrastructure (provided by the FSP/Tonga Field Office, Country Director and staff) is funded by a grant from the United States Agency for International Development (USAID). Technical input and services from the Ministry of Health (MOH) and World Health Organisation (WHO) was provided at no charge to the project, as were the services of the Peace Corps Volunteers involved. A substantial amount of local community "in kind" contribution was also an integral part of the project.

Project funding was disbursed primarily for direct costs of materials, supplies and services. In addition to the purchase/delivery costs of materials and supplies, funds were disbursed to the Construction Organsier (on a "per tank" commission basis), as well as a modest monthly stipend paid to the Community Organiser. (Refer Appendix 3)

3. EVALUATION OF PHASE ONE

3.1 EVALUATION SCHEDULE

The evaluation was conducted from March 14 - 18, 1988, as follows:

14 March: Arrive Vava'u.
Visit/evaluate Holeva and 'Utungake

15 March: Visit/evaluate Ovaka, Lape and Nuapapu

16 March: Visit/evaluate Matamaka, Kapa and Olo'ua

17 March: Wrap-up sessions and forward planning of Phase Two

18 March: Depart Vava'u

The first two villages are located on islands which are connected by causeways to the main island, and are therefore accessible by surface transport. This transport consisted of the vehicle used by FSP - Village Women's Development (VWD) personnel in Vava'u, and a vehicle provided by the Ministry of Works (MOW). The remaining villages were accessible only by boat (refer map, page 2). The MOW/Vava'u boat was made available to the evaluation team on the second day of the evaluation, and use of a small Fisheries/Vava'u research boat on the third day. In all cases, the assistance of the organisations involved was very useful and most appreciated.

3.2 EVALUATION PARTICIPANTS

Participation was invited from a variety of sectors in order to obtain a wide-range of input into the evaluation of Phase One (and the resulting forward planning of Phase Two).

The Ministry of Health (MOH) was invited to participate as it is responsible for rural water supply in Tonga. MOH has also been involved in the project from its earliest stages. In this case, MOH/Vava'u Health Inspector Talanoa Lelei was identified to participate. He was specifically requested to provide input on the degree to which the project is meeting sectoral development objectives in the areas of health, sanitation and water supply.

The Central Planning Department (CPD) was invited to participate because of its overall coordinating role within the framework of Tonga Government, and its involvement in the development of the rural areas of Tonga through its Rural Development Programme. The identified participant was Ms. Tupou Lavemai, who staffs the CPD/Vava'u Field Office and is directly involved in the implementation of Tonga Government's Rural Development Program in Vava'u. She was specifically requested to provide input on the degree to which the project is meeting sectoral development objectives in the areas of rural and regional development.

The Ministry of Works (MOW) was invited to participate due to its involvement in the earlier Ha'apai Water Supply Project, and because of its membership of the National Village Water Committee. MOW/Vava'u Engineer Henele Tangitau particpated, and was specifically requested to provide comments on the quality of the tanks and other technical aspects.

The World Health Organisation (WHO) Engineer was invited to participate, due to his previous involvement in the project. Unfortunately, he was not in-country at the time.

In addition to the above, the evaluation team included the FSP/Tonga Country Director (Denis Wolff), the Chief Extension Officer of FSP - VWD Program in Vava'u (Ms. Aulola 'Apikotoa), the Field Organiser (Brian Robetor) and the Director of the Vaikauaki Company (Kuli Lolesio).

Finally, although not a direct part of the evaluation team, the contributions of MOH Vava'u Senior Medical Officer Dr. Laumeesi Malolo, and Fisheries/Vava'u Peace Corps Volunteer Mark Bondurant, are acknowledged. Both provided assistance in the area of transport: Dr. Malolo by agreeing to make available the MOH boat, and Mark Bondurant by piloting the small Fisheries boat.

In all of the above, the participation and/or contributionsof the specified individuals, Ministries and organisationswere of definite value to the effectiveness of the evaluation, and were much appreciated.

3.3 EVALUATION METHODOLOGY

The basic methodology used in the evaluation involved inspection of each individual tank and associated guttering/catchment system for the purposes of examining a variety of aspects relating to quality and effectiveness of the project. The FSP/Tonga Country Director carried out this detailed inspection, with the assistance of the other members of the evaluation team. In addition, the other participants were requested to evaluate each tank in line with developmental objectives of their particular sector (refer section 3.2).

A simple evaluation form and coding was devised and used throughout the evaluation (see Appendix 1, Table 3). The following aspects were examined and evaluated:

1) LEAKS: Three different classifications of leaks were used: Major, minor and seepage. Major leaks were characterised by visible water with flow perceptible to the eye. Minor leaks were characterised by visible water, but no perceptible flow. Seepage was characterised by damp spots on the tanks, but water not otherwise visible.

2) FENCES: The original technical guidelines (refer Appendix 2) for the project specified that each tank should be protected from animal damage by a fence. Fences were therefore evaluated on whether or not they were adequate to accomplish this task. (The construction of these fences was specified as a part of local contribution.)

3) SOAKPITS: The original technical guidelines for the project specified that each tank should have an associated soakpit in order to provide for proper drainage (with related sanitation/health aspects). Soakpits were evaluated on whether or not they were adequate for this task. In addition, it was noted whether or not a cover had been constructed as an additional protective measure. (The construction of soakpits was specified as local contribution. A small amount of cement was provided to assist in this.)

4) STRAINERS: Technical guidelines required that each tank be equipped with a sieve/strainer in order to exclude leaves, insects, etc. These strainers were examined to determine if they were correctly installed, and if they were adequately performing the task.

5) UNSEALED OPENINGS: In order to keep the collected water as clean as possible, it is desirable to seal or cover all openings where insects, leaves, etc. might enter the

tank. Each tank had three potential places: the top lid of the tank, the inlet (where the downpipe from the gutter attaches to the tank; this is the point where the strainer was commonly installed), and the overflow pipe. Each was examined to determine if insects or other materials could enter.

6) GUTTERING: The guttering associated with each tank was examined to determine if it was correctly installed and generally adequate. In relation to this, judgement was made on whether the length of guttering provided was appropriate to the size of the tank.

7) ROOF CATCHMENT: The catchment area associated with each tank was examined to determine if it was generally adequate for the task. In relation to this, the size of the roof was examined to determine if it was appropriate for the size of the tank; and the height of the catchment was examined to determine if it was appropriate in relation to the height of the tank.

8) APPROXIMATE ACTUAL CAPACITY: In each village a random sampling was done to determine how much water was actually in the tanks. This was then used to determine average actual capacity.

Data was also collected on the identification number of each tank, and the name of the family occupying the house, so that particular tanks problems can be tracked in the future.

3.4 NARRATIVE AND STATISTICAL REPORTS ON EACH VILLAGE

a) HOLEVA

The village of Holeva is located on the island of Koloa, due east of Neiafu (refer map, page 2). It is connected to the main island of Vava'u by a causeway link of approximately 0.8 kilometers in length. The village is approximately 13 kilometers distant from Neiafu by road. The 1986 census reported a population of 124 persons, living in 16 households. The village is a small one, and very concentrated. It appears to be a clean, well-kept community. The arrival of the evaluation team coincided with a ful-scale community clean-up effort, including mowing the entire village. The activities of the evaluation team were followed very closely by the community. Following the evaluation, a traditional presentation/drinking of kava was held, followed by discussions on what had been observed during the evaluation.

On the basis of the pre-implementation survey (refer Appendix 1, Tables 1 & 2), 17 tanks were constructed in Holeva; all of which were evaluated. 88% showed no leakage of any kind, with only minor seepage observed in the others. 71% were protected by a fence adequate to keep animals away from the tank. 88% had a soakpit, of which 67% also had a protective cover. All but one had a strainer installed, with 41% requiring cleaning. All of the tanks had at least one unsealed opening through which insects, etc. could enter the tank. All of the tanks were supported by adequate guttering and roof catchment; however 20% of these were of a less-than-optimum height and/or surface area. Random sampling of tanks indicated that the average tank was approximately 30% full. This was not surprising as Holeva was the last village to be implemented in Phase One. The resulting actual increase in water storage was estimated to be 15,300 gallons. (See Table 3, page 11)

b) <u>'UTUNGAKE</u>

The village of 'Utungake is located on the island of 'Utungake, which is southwest of Neiafu (refer map, page 2). It is accessible by land due to causeway links, and is approximately 9 kilkometers distant from Neiafu by road. The island is long and narrow, and surrounded on one side by the deep channel leading to the main harbour, and on the others by tidal flats of varying depth. The 1984 census reported a population of 254 persons, living in 47 households. The geography of the village required an extended evaluation period, which was attended by several local residents. The village was noted to be less tidy than the previous one, and the community as a whole did not seem to be as cohesive or dynamic as others. While the rest of the evaluation team was examining the tanks, the Community Organizer (in her capacity as CEO of the FSP/VWD Program) met with several members of the VWD groups and held serious discussions about the gener : state of the village. Some of these same points were later re-iterated during discussions about the water project.

Based on the pre-implementation survey (refer Appendix 1, Tables 1 & 2), 33 tanks were constructed in 'Utungake, all of which were evaluated. 5[illegible]% showed no leakage at all, with the remainder showing only minor (and generally harmless) leaks. Only 45% of the tanks were protected by a fence. 91% had a soakpit, of which 43% had a protective cover. All tanks but one had a strainer installed; 67% of the strainers

TABLE 3: EVALUATION DATA - HOLEVA

ORDER OF EVALUATION: 1/8

ORDER OF IMPLEMENTATION: 8/8

1986 POPULATION: 126

1986 NO. OF HOUSEHOLDS: 16

NO. TANKS CONSTRUCTED: 17

NO. TANKS EVALUATED: 17

LEAKS:
- Major - 0
- Minor - 0
- Seepage - 2
- None - 15

FENCES: 12

SOAKPITS: 15
- covered: 10

STRAINERS: 16
- dirty: 7
- at gutter: 5

UNSEALED OPENINGS
- Top Lid: 16
- Inlet: 5
- Overflow: 17

GUTTERING: 17
- Too Short: 7

ROOF CATCHMENT: 17
- Too Low: 7
- Too Small: 5

AVERAGE TANK APPROXIMATELY 30% FULL = 15,300 GALLONS TOTAL

TABLE 4: EVALUATION DATA - 'UIUNGAKE

ORDER OF EVALUATION: 2/8

ORDER OF IMPLEMENTATION: 7/8

1986 POPULATION: 254

1986 NO. OF HOUSEHOLDS: 47

NO. TANKS CONSTRUCTED: 33

NO. TANKS EVALUATED: 33

LEAKS:
- Major - 0
- Minor - 14
- Seepage - 0
- None - 19

FENCES: 15

SOAKPITS: 30
- covered: 13

STRAINERS: 32
- dirty: 22
- at gutter: 0

UNSEALED OPENINGS
- Top Lid: 33
- Inlet: 1
- Overflow: 33

GUTTERING: 33
- Too Short: 6

ROOF CATCHMENT: 33
- Too Low: 1
- Too Small: 6

AVERAGE TANK APPROXIMATELY 95% FULL = 94,050 GALLONS TOTAL

required cleaning. All of the tanks had at least one unsealed opening. All of the tanks were supported by adequate guttering and roof catchment, although in six cases the catchment area was of less-than-optimum size. A random sampling of the tanks indicated an average tank capacity of 95%, with a resulting actual increase in water storage of 94,050 gallons. (See Table 4, page 11)

c) OVAKA

The village of Ovaka is located on the island of Ovaka, approximately 21 kilometers southwest of Neiafu (refer map, page 2). It is accessible by boat only, a trip requiring approximately 2.5 hours. The 1986 Census reported a population of 114, occupying 24 households. The village is spread out over a well-kept, spacious area, filled with a large number of mango trees. The shade from these trees was a most refreshing break from the hot sun. The village is surrounded by a village fence to keep the animals from damaging scarce agriculturally productive areas. In addition, most houses had a surrounding fence to keep animals out of the immediate area. This was the best compromise seen between promoting agriculture without endangering the health/sanitation levels of the village. The general appearance of the village was one of the most pleasant encountered during the entire evaluation.

Based on the pre-implementation survey (refer Appendix 1, Tables 1 & 2), 25 tanks were constructed in Ovaka, all of which were evaluated. 64% showed no leakage of any kind, with the remainder showing only minor leaks or seepage. 88% of the tanks were protected by fences, generally a fence surrounding the entire household area. All but one tank had a soakpit, although only two of the soakpits had a protective cover. All but one tank had a strainer installed, with only 8% requiring cleaning. All tanks had at least one unsealed opening. All tanks had associated guttering and roof catchment of adequate quality, although 32% were of a less-than-optimum surface area and/or height. Random sampling indicated an average tank capacity of 75%, with a resulting actual increase in water storage of 56,250 gallons. (See Table 5, page 13)

d) LAPE

The village of Lape is located on the island of Lape, approximately 18 kilometers southwest of Neiafu. It is accessible only by boat, and is perhaps the smallest

TABLE 5: EVALUATION DATA - OVAKA

ORDER OF EVALUATION: 3/8

ORDER OF IMPLEMENTATION: 3/8

1986 POPULATION: 114

1986 NO. OF HOUSEHOLDS: 24

NO. TANKS CONSTRUCTED: 25

NO. TANKS EVALUATED: 25

LEAKS: Major - 0
Minor - 8
Seepage - 1
None - 16

FENCES: 22

SOAKPITS: 24
-covered: 2

STRAINERS: 24
- dirty: 2
- at gutter: 1

UNSEALED OPENINGS
- Top Lid: 25
- Inlet: 4
- Overflow: 24

GUTTERING: 25
- Too Short: 7

ROOF CATCHMENT: 25
- Too Low: 8
- Too Small: 7

AVERAGE TANK APPROXIMATELY 75% FULL = 56,250 GALLONS TOTAL

TABLE 6: EVALUATION DATA - LAPE

ORDER OF EVALUATION: 4/8

ORDER OF IMPLEMENTATION: 2/8

1986 POPULATION: 26

1986 NO. OF HOUSEHOLDS: 7

NO. TANKS CONSTRUCTED: 7

NO. TANKS EVALUATED: 7

LEAKS: Major - 0
Minor - 4
Seepage - 1
None - 2

FENCES: 6

SOAKPITS: 7
-covered: 2

STRAINERS: 6
- dirty: 1
- at gutter: 0

UNSEALED OPENINGS
- Top Lid: 5
- Inlet: 1
- Overflow: 6

GUTTERING: 7
- Too Short: 0

ROOF CATCHMENT: 7
- Too Low: 2
- Too Small: 0

AVERAGE TANK APPROXIMATELY 80% FULL = 16,800 GALLONS TOTAL

inhabited island in Tonga (refer map, page 2). The 1986 Census reported a population of only 26 persons, living in ; households. The community is quite small, but well-kept. As might be expected, such a small community is very cohesive. It was also noted that the community water tanks were in good condition (unlike some larger villages). This is attributed to a recognition of the scarcity of water resources in smaller villages.

Based on the pre-implementation survey (refer Appendix 1, Tables 1 & 2), 7 tanks were constructed in Lape, all of which were evaluated. 29% showed no leakage, with only minor leaks and seepage observed on the others. All tanks but one were protected by a fence. All had soakpits, 29% of which also had a protective cover. All but one had a strainer installed, with only one strainer requiring cleaning during the evaluation. In common with most tanks, 86% had at least one unsealed opening. The guttering was considered to be adequate on all tanks, as was the roof catchment. Two case were observed in which the roof was of less-than-optimum height. A random sampling of tanks indicated an average tank capacity of 80%, with a resulting actual increase in water storage capacity of 16,800 gallons. (See Table 6, page 13)

e) NUAPAPU

The village of Nuapapu is located on the island of Nuapapu, approximately 19 kilometers southwest of Neiafu (refer map, page 2). It is accessible only by boat, and is one of the larger outer islands, supporting two villages. The approach to Nuapapu Village is by a steep and difficult climb. The village itself is spread over a considerable area, with a central open green and community hall. The villagers, aware that this was our last stop of the day, had prepared an enormous feast, of which we partook prior to the survey.

Based on the pre-implementation survey (refer Appendix 1, Tables 1 & 2), 41 tanks were constructed in Nuapapu, all of which were evaluated. 68% showed no leakage, with the balance showing only minor leaks. 54% of the tanks had a protective fence surrounding them. 93% had a soakpit, 74% of which had a protective cover. 93% had a strainer installed, of which only 16% required cleaning. All of the tanks had at least one unsealed opening. All had guttering adequately installed, although 15% would have benefitted from additional guttering. One tank had no associated roof to serve as catchment, but all others had an adequate roof catchment system. 20% of the tanks were associated with roof catchments which were of a less-than-optimum height/area. A

TABLE 7: EVALUATION DATA - NUAPAPU

ORDER OF EVALUATION: 5/8

ORDER OF IMPLEMENTATION: 5/8

1986 POPULATION: 177

1986 NO. OF HOUSEHOLDS: 37

NO. TANKS CONSTRUCTED: 41

NO. TANKS EVALUATED: 41

LEAKS:
- Major - 0
- Minor - 13
- Seepage - 0
- None - 28

FENCES: 22

SOAKPITS: 38
- covered: 28

STRAINERS: 38
- dirty: 6
- at gutter: 8

UNSEALED OPENINGS
- Top Lid: 41
- Inlet: 5
- Overflow: 41

GUTTERING: 41
- Too Short: 6

ROOF CATCHMENT: 40
- Too Low: 8
- Too Small: 5

AVERAGE TANK APPROXIMATELY 90% FULL = 110,700 GALLONS TOTAL

TABLE 8: EVALUATION DATA - MATAMAKA

ORDER OF EVALUATION: 6/8

ORDER OF IMPLEMENTATION: 4/8

1986 POPULATION: 187

1986 NO. OF HOUSEHOLDS: 35

NO. TANKS CONSTRUCTED: 33

NO. TANKS EVALUATED: 33

LEAKS:
- Major - 1
- Minor - 15
- Seepage - 1
- None - 16

FENCES: 13

SOAKPITS: 29
- covered: 2

STRAINERS: 32
- dirty: 8
- at gutter: 7

UNSEALED OPENINGS
- Top Lid: 30
- Inlet: 4
- Overflow: 32

GUTTERING: 32
- Too Short: 5

ROOF CATCHMENT: 31
- Too Low: 8
- Too Small: 6

AVERAGE TANK APPROXIMATELY 80% FULL = 79,200 GALLONS TOTAL

random sampling indicated averaged tank capacity of 90%, with a resulting actual increase in water storage of 110,700 gallons. (See Table 7, page 15)

f) MATAMAKA

The village of Matamaka is also located on the island of Nuapapu (refer section 3.4.e). The 1996 Census reported a population of 187 persons, living in 35 households. The village is reasonably compact, although the rolling terrain makes it appear otherwise. The village is well-kept and of pleasant appearance.

Based on the pre-implementation survey (refer Appendix 1, Tables 1 & 2), 33 tanks were constructed, all of which were evaluated. 48% showed no leakage. With one exception, the balance showed only minor leaks and/or seepage.

Regarding the single exception, there were no major leaks as specifically defined within this evaluation; however, there were numerous minor leaks. So many, in fact, that the dominant color of the tank was not gray, but white (due to the calcium carbonate deposits characteristic of minor leaks). It is uncertain to what degree this type of problem is self-rectifying, or to what degree (if any) the capacity of the tank is reduced. Further evaluation will be required at a later time.

Only 39% of the tanks were protected by a fence adequate to keep animals at a distance. 88% had a soakpit, with two having protective covers as well. All tanks but one had a strainer installed, of which 24% required cleaning. All tanks but one had at least one unsealed opening. (The tank that was sealed completely was pointed out to the local residents as an example of what they should do.) All tanks but one were supported by adequate guttering and roof catchment, with 24% of a less-than-optimum height and/or surface area. A random sampling of tanks indicated that the average tank was full to 90% of capacity, for an actual increase in water storage of 79,200 gallons. (See Table 8, page 15)

g) KAPA

The village of Kapa is located on the eastern end of the island of Kapa, approximately 19 kilometers by boat south-southwest of Neiafu (refer map, page 2). The 1996 Census reported a population of 90 individuals, living in 25 households. The village is located at the top of a large and steep hill, and the surrounding terrain is very rugged. The dominant impression of the village is one of massive erosion; evidence of as much as 18-24" of lost topsoil was visible. Conversations with the villagers indicated that this has taken place within the past 30-50 years, concurrent with expansion of village population and physical size. In some places continued erosion could threaten the stability and integrity of both houses and water tanks. Special attention was given to such cases, and suggestions made concerning methods of stabilising the endangered area.

Based on the pre-implementation survey (refer Appendix 1, Tables 1 & 2), 33 tanks were constructed, all of which were evaluated. 55% showed no leakage at all. 30% showed only minor leakage and/or seepage.

Five cases of "white tanks" (refer section 3.4.f) were noted. In each case, it was noted that the tanks were very exposed, with little surrounding shade. Discussions with the Construction Organiser indicated that the exposure may have caused the tanks to dry too quickly and not cure properly, causing numerous small leaks. Provision of detailed instructions to the village people concerning curing requirements may remedy this in Phase Two. The condition of these tanks will be re-evaluated at a later time.

73% of the tanks had a protective fence. 85% had a soakpit, of which 46% had a protective cover. All tanks but one had a strainer installed, of which 28% required cleaning during the evaluation. All tanks had at least one unsealed opening. The guttering and roof catchment systems associated with all tanks was adequate, 18% were of a less-than-optimum height and/or surface area. A random sampling indicated that the average tank was filled to 95% of capacity, with a resulting actual increase in water storage of 94,050 gallons. (See Table 9, page 18)

h) OLO'UA

The village of Olo'ua is located on the island of Olo'ua, approximately 5 kilometers southeast of Neiafu (refer map, page 2); however, due to the route used by the evaluation team, a journey of over 30 kilometers was involved. The 1986 Census reported a population of 94 individuals, living in 17 households. The island is relatively low and flat, and the village is compactly located on the western side. This was the first village to be implemented, and served as a pilot project for the remainder of Phase One. The village people consider themselves fortunate to have been chosen to be

TABLE 9: EVALUATION DATA - KAPA

ORDER OF EVALUATION: 7/8

ORDER OF IMPLEMENTATION: 6/8

1986 POPULATION: 90

1986 NO. OF HOUSEHOLDS: 25

NO. TANKS CONSTRUCTED: 33

NO. TANKS EVALUATED: 33

LEAKS:
- Major - 5
- Minor - 9
- Seepage - 1
- None - 18

FENCES: 24

SOAKPITS: 28
- covered: 13

STRAINERS: 32
- dirty: 9
- at gutter: 4

UNSEALED OPENINGS
- Top Lid: 33
- Inlet: 4
- Overflow: 33

GUTTERING: 33
- Too Short: 2

ROOF CATCHMENT: 33
- Too Low: 6
- Too Small: 3

AVERAGE TANK APPROXIMATELY 95% FULL = 94,050 GALLONS TOTAL

TABLE 10: EVALUATION DATA - OLO'UA

ORDER OF EVALUATION: 8/8

ORDER OF IMPLEMENTATION: 1/8

1986 POPULATION: 94

1986 NO. OF HOUSEHOLDS: 17

NO. TANKS CONSTRUCTED: 20

NO. TANKS EVALUATED: 20

LEAKS:
- Major - 0
- Minor - 8
- Seepage - 0
- None - 12

FENCES: 16

SOAKPITS: 20
- covered: 15

STRAINERS: 20
- dirty: 1
- at gutter: 3

UNSEALED OPENINGS
- Top Lid: 18
- Inlet: 1
- Overflow: 19

GUTTERING: 6
- Too Short: 1

ROOF CATCHMENT: 20
- Too Low: 3
- Too Small: 3

AVERAGE TANK APPROXIMATELY 95% FULL = 57,000 GALLONS TOTAL

first, and were very pleased to see the return of the Field Organiser, Community Organiser and Construction Organiser.

Based on the pre-implementation survey (refer Appendix 1, Tables 1 & 2), 20 tanks were constructed in Olo'ua, all of which were evaluated. 71% showed no leakage, and the balance showed only minor leaks. 80% had a protective fence. 100% had a soakpit, of which 75% were covered. 100% had a strainer, of which only one required cleaning during the evaluation. All but one had at least one unsealed opening. All had adequate guttering and roof catchment, although 15% were of a less-than-optimum size and/or height. A random sampling indicated than the average tank was full to 95% of capacity, with a resulting actual increase in water storage of 57,000 gallons. (See Table 10, page 18)

3.5 SUMMARY OVERVIEW OF EVALUATION FINDINGS

100% of all tanks constructed in Phase One of the Vava'u Outer Island Water Supply Project were examined during the evaluation.

60% of the tanks showed no leakage of any sort. 37% showed minor leaks; this type of leak is generally considered to be self-sealing and not to reduce significantly the storage capacity of the tank. Only 3% of the tanks showed more serious leakage; however, even in these cases, the leakage was of the type that is potentially self-sealing. These tanks will be re-evaluated at a later point to determine if this is the case.

62% of all tanks had a surrounding fence sufficient to prevent the approach of animals. Construction of fences for the other tanks was encouraged.

91% of all tanks had a soakpit, with 4[illegible]% of all soakpits having a protective cover. Construction of soakpits for the balance remaining was encouraged.

96% of all tanks had a stainless steel strainer installed to prevent foreign material and insects from entering the tank and contaminating the water. All strainers were examined to determine if the design being used was effective. The majority of all strainers were clean. Only 28% of the strainers required cleaning, which was quickly and easily done during the evaluation. This indicates that the design presently used is effective. The importance of regular inspection and cleaning of strainers was emphasized to all involved. 14% of all strainers were installed at the gutter rainhead rather than at the inlet port on top of the tank.

This correlates with roof catchments of a lower-than-optimum height (as noted below).

Although the strainers effectively prevent the entry of insects and other foreign material into the tank, 96% - 98% of all tanks were not completely sealed, with the top lid of the tank and the overflow pipe being the common points. The villages were instructed in the simple remedy of covering the openings with screening materials. The top lid will be redesigned in Phase Two to provide a closer fit.

99.5% of the tanks had an effective guttering system attached and correctly installed. 16% of the guttering systems were felt to be shorter than desirable in relation to the size of the tank. This correlates with roof catchments of a less-than-optimum size (as noted below).

98.5% of the tanks had a roof catchment of suitable quality. 21% of these were lower than desirable; this commonly required that a new water inlet be made in the side of the tank, as the top of the tank was higher than the bottom of the guttering. As chopping a new hole in the side of tanks is obviously undesirable, this will be rectified in Phase Two through careful placement of tanks in relation to the roof catchments, and by using a slightly different design of water tank (shorter, but greater in diameter) where necessary. 17% of the roof catchments were felt to be small in relation to the size of the tank; however, in practical terms this means only that the tanks will take longer to fill up, and is therefore not believed to be a negative factor.

The maximum possible water storage capacity for Phase One was 627,000 gallons. A random sample of tanks in each village was carried out during the evaluation, indicating that, as an overall average, the tanks are filled to 80% of capacity, with a resulting actual increase in available water supply of 501,600 gallons. These figures increase to 87% and 546,000 gallons if the statistics relating to Holeva (the last village implemented in Phase One, completed only six weeks prior to the evaluation) are discounted. (See Table 11, page 21. Also, refer to Appendix 1, Table 4 for a comprehensive/comparative overview of evaluation data.)

TABLE 11: EVALUATION DATA - SUMMARY TOTALS

ORDER OF EVALUATION: ---

ORDER OF IMPLEMENTATION: ---

1986 POPULATION: 1,068

1986 NO. OF HOUSEHOLDS: 208

NO. TANKS CONSTRUCTED: 209

NO. TANKS EVALUATED: 209

LEAKS: Major - 6
Minor - 71
Seepage - 6
None - 126

FENCES: 130

SOAKPITS: 191
-covered: 85

STRAINERS: 200
- dirty: 56
- at gutter: 28

UNSEALED OPENINGS
- Top Lid: 201
- Inlet: 25
- Overflow: 205

GUTTERING: 208
- Too Short: 34

ROOF CATCHMENT: 206
- Too Low: 43
- Too Small: 35

AVERAGE TANK APPROXIMATELY 80% FULL = 501,600 GALLONS TOTAL

4. ANALYSIS OF RESULTS

4.1 OBSERVATION AND INTERPRETATION

The overall results of the evaluation of Phase 1 of the Vava'u Outer Island Water Supply Project are very favourable. It can generally be concluded that, firstly, the goals and objectives of the project are being successfully and effectively met, and, secondly, that the methods and techniques utilised are entirely suitable for the project and should be continued in Phase 2 with minor exceptions and revisions to the technical guidelines (refer Appendix 2), as detailed below.

The most numerically apparent issue to be resolved is that of unsealed openings. It is obviously in the best interest of the project and the people involved to ensure that the stored water remains clean and uncontaminated. 12% of all unsealed openings were located at the water inlet point, generally because the normal top entry point could not be used and a new inlet had been cut into the side of the tank. The major reasons for this were either poor tank placement and/or the roof being of less-than-optimum height. This is discussed at a later point in this section.

97% of all tanks had an unsealed opening either at the top lid or the overflow pipe. Regarding the latter, this is easily fixed by securely covering the pipe with a small piece of wire screen. The village people were instructed in this method during Phase 1 Evaluation, and this instruction will continue during Phase 2. This will be included as a necessary part of required community contribution. It would be primarily the responsibility of the Community Organiser to ensure that this contribution is made. Regarding the former, there appears to be a design flaw in the top lids. Discussions with the Construction Organiser concerning methods of resolving this flaw were undertaken during the wrap-up/forward planning session on Thursday 17 March 1988. It was agreed that a new form/mold for the top lid would be constructed, and fitted to a surrounding ridge of wet cement, to provide an even better seal. It is believed that this should eliminate this problem.

In regard to unsealed openings, a proposal was made that the top lids be permanently cemented shut to prevent entry of foreign matter which might contaminate the water, and to prevent the village people from removing water from the tanks by buckets when the water level is lower than the outlet tap. It is believed that this proposal is not entirely appropriate. The redesign of the top lid should effectively exclude any foreign material from the tank, and the proposed redesigning of the water outlet/tap (see later section) should permit the people to draw-off a greater portion of the stored water through the water tap. But, it is probably unavoidable that, at some point in time, there will be a need (either real or perceived) to gain entry to the tank. If necessary, the people would chop away the sealing cement, potentially damaging the tank. Since we can not prevent the people getting into the tank if they want to, the most appropriate option is that which reduces the possibility of damage to the tank. Therefore, permanently sealing the tanks is not supported.

It was noted that the water outlet/tap was approximately 8" to 10" above the base of the tank, as depicted in the technical guidelines (refer appendix 2). Assuming a standard 6' tank height, this results in 10% of the stored water being below the outlet tap. In times of drought, this is the reserve that the people would remove by buckets (with the associated possibility of contamination of the remaining water). In Phase 2, the outlet tap will be re-designed with a lower vertical rise, so that more of the stored water will be accessible through the outlet valve, and the need for manual access to the stored water will be reduced.

Also regarding the design of water outlet, it was noted that the pipes being used were galvanised iron (for strength), but the fittings (elbows, etc.) were of the standard PVC plastic variety (due to availability and ease of installation). Some leaks were noted due to insufficient bonding between the plastic fittings and the galvanised iron pipe. In a few cases during the evaluation, the Construction Organiser repaired loose fittings. Alternate methods of bonding should be sufficient to solve this problem and will be utilised during Phase Two. Possible methods include using an epoxy glue instead of PVC glue, and/or purchase of a thread-cutting tool, so that galvanised iron fittings can be used.

17% to 21% of all tanks had an associated roof catchment of less-than-optimum height/area. As noted in the original technical guidelines (refer Appendix 2), it was initially planned to utilise two separate sets of tank forms/molds, specifically to deal with houses of less-than-optimum height/area. It was later decided that the extra expense/labour involved in construction and transport of two separate sets of forms was too great for use in what was believed to be a relatively small number of cases. As described below, a modified version of this will be used during Phase 2 for use in houses of less-than-optimum height. Regarding the 17% of roof catchments of less-than-optimum area, they are generally associated with the 16% of tanks with guttering considered to be of a less than desirable length. In both cases, a small catchment area and/or short guttering means only that a longer period of time will be required to fill the tank to capacity. This is not felt to be significantly detrimental.

21% of all roof catchments were of a less-than-optimum height. In most cases, this meant that the bottom of the guttering was higher than the top of the tank, requiring that a new inlet be cut into the side of the tank. This has the negative effects of reducing tank capacity, potentially weakening the structure of the tank, and causing an unsealed opening. Regarding the last point, tanks in this situation generally had the strainers installed at the rainhead of the gutter, as installation in the side of the tank was not feasible.

It is planned during Phase 2 to utilise a different design of tank form/mold in order to better deal with houses of less-than-optimum height. The standard tank used in Phase I was approximately 9' in diameter and 6' in height. Of construction of three new forms is required prior to commencement of Phase 2, it was agreed during the wrap-up session that one of the forms will be approximately 10' in diameter and 5' in height. It can be used for any house, but will be specifically targeted for houses with a low roof.

In some cases, this situation could have been avoided by more careful placement of tanks. Responsibility for choosing the site for construction of a tank was not clearly defined during Phase 1. A tug-of-war sometimes resulted between project personnel and the tank recipients. In Phase 2, it shall be clearly understood that the project personnel (with the advice and assistance of the Ministry of Health) will choose the most appropriate site for a tank. Only if there is more than one suitable site will the recipient have a choice. In general, this will mean that a tank will always be located downhill of the roof catchment.

In many cases, the combination of better tank placement and new tank design will avoid the previously-mentioned problem. If, however, it does not, then the final method to be used would be excavation of the tank site to an appropriate depth. While this is noted in the original technical guidelines to be undesirable, it is believed that minor excavation (no more than, say 18") would be less detrimental than excluding a needy family from the benefits of the project. Excavation would, however, be a last resort, and the labour involved would be entirely the responsibility/contribution of the tank recipient.

The issue of tank placement was also examined in the context of what type of house/structure qualified for a water tank. The three types in question were: vacant houses, new (as-yet unbuilt) houses, and crude shelters.

Regarding vacant houses, it was common that a tank was desired for the house by the owners even if the house had been unoccupied for a considerable length of time and no set date for return of the owners was known. Regarding new (as-yet unbuilt) houses, tanks were sometimes targeted for a site on which a new house was to be built. And regarding crude shelters, this included all living structures which either had a thatched roof (unsuitable for roof catchment) and temporary structures (with tin roofs) which had been constructed expecially for the project.

The evaluation revealed the above involved less than 3% of the project (refer Appendix 1, Table 5). However, it is felt that the people involved must show a definite committment to fulfilling the project requirements. A useful way of demonstrating this committment in the cases of new houses and crude shelters would be to build a a strong sturdy roof catchment structure with the roof nailed in place, and peaked rather than flat. The walls could conceivably be thatched, as long as the roof is good. Such a structure would be a definite improvement over a crude shelter, and could be salvaged and re-used if a new house is actually built. Regarding vacant houses, it is believed that there must be some assurance of occupation in the immediate future, so that the tank will be properly maintained.

40% of all tanks had leaks of some sort. 93% of these were considered to be insignificant, generally self-sealing, and not detrimental to the tank. The few more serious cases (the "white tanks" mentioned in sections 2.4.f and 2.4.g) may potentially be downgraded in the future, following further evaluation. However, it is believed that steps can be taken to further reduce leakage. Technical discussions with the Construction Organiser indicated that the probable cause of most leaks was insufficient curing time, due to either too-rapid drying of the tank, or putting water in too soon. The latter is more associated with minor leaks. Phase 1 procedure involved installation of guttering (but not downpipe) as soon as possible after completion of tank construction. The tank recipients were given some basic information regarding the length of time required for proper curing. However, because of lack of understanding coupled with their desire for water, it was common for the people to install the downpipes themselves at the next rainfall. The reduced curing time increased the potential for leaks. It is proposed in Phase 2 to install guttering approximately one month after completion of tank construction, in order to avoid this situation. At the same time, the village people are to be given greater and more complete information regarding the curing of the tanks. This is of particular importance for the major leaks. It was noted that in all cases, the tanks involved were very exposed to the sun, with little or no shade. The resulting too-rapid drying (and again insufficient curing time) is believed to promote the large number of small leaks observed. Greater information should be provided to the village people concerning how they can assist in properly curing their tanks.

During the evaluation, the strainers were examined to determine if they were adequate for the purpose. Prior to the evaluation, a proposal had been made that a different strainer, designed to be self-cleaning, be used during Phase 2. However, based on the results of the evaluation (only 27% of the strainers had not been kept clean), it is believed that the strainer design currently in use (although not inherently self-cleaning) is suitable for the purpose, in addition to being more cost-effective.

It was noted that 12.5% of the houses included in the project already had another water tank existing at the site (refer Appendix 1, Table 5). While this was initially considered to be undesirable, further investigation revealed that more than half of these tanks were of an inadequate size and/or unacceptable condition (i.e.- either too small, or too leaky). Therefore, less than 5% of the houses in the project were "double-tanked". While not to be encouraged, this is felt to be an acceptable margin of error; in areas totally dependent on rain catchment, we felt that, when in doubt, it was better to build than not build. When such situations arise in Phase Two, it will be the joint responsibility of the Ministry of Health and project personnel to determine whether construction of a second tank is justifiable.

It was noted that nearly 25% of all tanks in Phase I were missing the final elbow connecting the downpipe to the water inlet (refer Appendix 1, Table 5). While not essential, this elbow is most useful in properly channeling the water (particularly during times of heavy rainfall) and should be retrofitted where missing.

4.2 SUMMARY OF RECOMMENDATIONS

1. Implementation of Phase Two of the Vava'u Outer Islan Water Supply Project should commence at the earliest convenient time, utilising the procedures, personnel and techniques which have been proven effective during Phase One of the project.

2. The active involvement of the Village Women's Development Program of FSP is acknowledged and commended, and is recommended for continuation.

3. The quality of workmanship of the Vaikau'aki Company is acknowledged and commended, and is recommended for continuation.

4. The quality of work and level of involvement of the Field Supervisor involved is commended and acknowledged, and is recommended for continuation.

5. The continued involvement of all relevant sectors, and the Ministry of Health in particular, should be continued and encouraged.

6. Monitoring of performance of Phase One tanks should be continued during Phase Two, as convenient and feasible. This applies in particular to the six tanks classified as having major leaks.

7. The progress of activities in Phase Two should be monitored on a quarterly basis.

8. The technical guidelines, procedures and techniques utilised in Phase One are to be continued in Phase Two, except as noted or otherwise modified in this report.

9. In the absence of a comprehensive re-survey of target sites in Phase Two, potential/possible population growth will be allowed for at the rate of a one per cent increase, for a projected Phase Two total of 230 tanks.

10. The design of the top lids of the water tanks is to be remodeled in order to achieve a closer fit and prevent entry of foreign matter/insects and contamination of water.

11. The overflow pipes must be fitted with a screen to prevent entry of foreign matter/insects into the tanks and contamination of water.

12. Tanks will continue to have a stainless steel strainer installed at the water inlet in order to prevent entry of foreign matter/insects and contamination of water.

13. The strainer and water inlet must be located on the upper surface of the tank, through use of alternate tank designs, careful placement of tanks, and/or minor excavation of site (as further specified below).

14. In order to accommodate houses of less-than-optimum height, one of the three tank forms/molds to be used in Phase Two should be of a shorter, broader design (approximately 5' in height and 10' in diameter), but of approximately the same capacity. All houses should have tanks of equal capacity.

15. Placement of tanks at project sites is to be the responsibility of project personnel and MOH. In general, the tank should be located as close to the house as feasible, given the constraints of the area required for the tank, and the related height of the tank in relation to the house.

16. Tanks should always be located downhill of the houses, to allow a free flow of water into the top entry point.

17. As a last resort, minor excavation of the project site is aaceptable in order to accomodate short houses.

18. If it is necessary to use more than one section of downpipe, there should be additional support.

19. The primary places for tanks to be located are houses which meet all of the following guidelines:

   - they are presently and permanently occupied;
   - they have a suitable roof catchment;
   - they have no existing/suitable water tank.

   If a house meets all of the above, it should definitely be considered for a tank. If it meets two of the above, it might be considered under certain circumstances (as defined below). If it meets one or none of the guidelines, a tank should not be constructed.

20. If a house already has an existing water tank, it might be considered for inclusion in the project only if the existing tank is of an inadequate and/or unacceptable size/condition. It will be the responsibility of project personnel and MOH to determine whether or not construction of a second tank is justifiable.

21. If a house is vacant, there must be a sufficient reason to believe that it will be occupied in the immediate future for a tank to be constructed. Careful investigation and inquiry should be made by project personnel.

22. If a house does not have a suitable roof catchment (such as a thatched roof), one must be provided before a tank can be constructed. The residents should be required to construct a sturdy, strong roof catchment area, preferably with a peaked roof, and with the roofing iron nailed into place. Crude and/or temporary shelters or structures are not acceptable as catchments.

23. The design of the water outlet/tap is to be remodeled in order to permit greater draw-off of water through the tap.

24. Use of alternate methods of bonding (galvanised) water pipe to (plastic) pipe fittings is to be explored.

25. The local contribution to the project in Phase 2 is to be as follows:

- Materials (sand, gravel, coral dust, etc)
- Transport
- Cash (T$65 per tank)
- Labour, as required by Vaikauaki
- Food and accomodation for Vaikauaki
- A good roof catchment area
- Fascia board suitable for guttering
- Soakpit (preferably with cover)
- Fence (good enough to keep animals out)

26. It will be the responsibility of the local people to ensure that all of their contribution is provided and available at the proper time. Provision of a tank and/or installation of guttering is dependent on the local contribution being made completely and in full <u>first</u>.

27. The installation of guttering should take place approximately one month after construction of tank, in order to allow for proper curing. At the same time, the villagers should be instructed in methods to promote safe and thorough curing.

28. Sufficient funds should be included in Phase Two to provide for retrofitting of elbows joining the downpipe to the water inlet.

5. <u>CONCLUSION</u>

The results of the evaluation of Phase 1 of the <u>Vava'u Outer Island Water Supply Project</u> confirm that the goals and objectives established for the project are successfully and effectively being met. Direct observation indicates increased storage of more than a half-million gallons of fresh and drinkable water. Preliminary estimations are that this constitutes a minimum 100% increase in water reserves. The impact on improved health/sanitation, general quality of life and standards of living in these rural areas is both highly significant and extremely positive. Phase 2 of the should commence implementation at the earliest possible time to further spread the project benefits to all targeted areas.

APPENDIX ONE: EVALUATION DATA TABLES

TABLE ONE: Summary of Pre-Implementation Survey of Outer-Island Vava'u Villages

TABLE TWO: Prioritisation of Villages for Project Implementation

TABLE THREE: Sample Evaluation Form

TABLE FOUR: Comprehensive/Comparative Overview of Evaluation Data

TABLE FIVE: Other Evaluation Data

TABLE SIX: Rebate Winners

TABLE ONE: Summary of Pre-Implementation Survey of Villages for Vava'u Outer Island Water Supply Project

VILLAGE	NO. OF HOUSEHOLDS W/O TANKS	WITH TANKS Good	WITH TANKS Poor	NO. OF CONSUMERS W/O TANKS	WITH TANKS	COMMUNITY TANKS	TOTAL NO. CONSUMERS
Koloa	22	11	2	141	105	5	246
Holeva	16	1	1	105	17	2	122
Okoa	25	10	3	161	107	6	268
Nga'unoho	25	4	1	131	47	5	178
'Utungake	20	5	13	108	109	10	217
'Utulei	14	11	5	76	82	6	158
Ofu	15	25	6	67	191	7	258
Olo'ua	23	1	1	142	14	4	156
Kapa	18	2	15	72	99	6	171
Taunga	17	5	4	92	81	5	173
Falevai	26	16	4	118	105	6	223
'Otea	19	11	3	107	76	5	183
Ovaka	15	3	10	114	91	5	205
Lape	6	0	1	38	7	1	45
Nuapapu	35	1	6	171	33	9	204
Matamaka	33	2	0	169	10	6	179
Hunga	31	37	5	209	279	10	488
17 Villages	360	145	80	2,021	1,453	98	3,474

NOTES:

1) The "Good - Poor" categorisation of households with tanks refers to overall condition of individual catchment systems.
2) "Community Tanks" include both 5000 gallon ferrocement tanks built with New Zealand aid, and old square block tanks (built by Tonga Government around 1920.
3) Consumer figures from 1986 Census

__TABLE TWO__: Prioritisation of Villages for Implementation

VILLAGE	% OF TOTAL HOUSEHOLDS WITHOUT TANKS, OR WITH TANKS IN POOR CONDITION	TOTAL NUMBER OF TANKS REQUIRED
Lape	100	7
Nuapapu	98	41
Olo'ua	96	24
Holeva	94	17
Matamaka	94	33
Kapa	94	33
Ovaka	89	25
'Utungake	87	33
Nga'unoho	87	26
Taunga	81	21
Okoa	74	28
Koloa	68	24
'Otea	67	22
Falevai	65	30
'Utulei	63	19
Hunga	49	36
Ofu	45	21
TOTAL NUMBER OF TANKS REQUIRED IN PROJECT		440

NOTES:
1) Prioritisation rankings were need based, and dependent on overall lack of adequate water storage facilities as indicated by the % of total village households without tanks or with tanks in poor condition.
2) The prioritisation rankings were reviewed and approved by the National Village Water Committee in [illegible] as the basis for proceeding with project implementation.

TABLE 3 - EVALUATION FORM (codes on reverse)

VILLAGE ______________

NAME OF FAMILY	LEAKS	FENCE	SOAKPIT	STRAINER	UNSEALED OPENINGS	GUTTERING	ROOF CATCH.	COMMENTS

DEFINITION OF CODES FOR EVALUATION OF PHASE ONE OF F.S.P.'s VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

1) TANK NO. - Every tank was inscribed by the construction team with a number indicating its order of construction within the project. This number is to be listed for future reference.

2) FAMILY NAME - The name of the family living in the house is to be noted for future reference.

3) LEAKS - The following codes are to be used:

M = Major leaks. These are defined as visible water with flow perceptible to the eye and/or such leaks as are considered to impair the ability of the tank to hold water.
m = Minor leaks. These are defined as visible water with flow not perceptible to the eye, and/or such leaks as are not considered to impair the ability of the tank to hold water.
S = Seepage. This is defined as damp spots visible on the exterior of the tank, with no flow of water.
C = Cracks. These are self-defined.

4) FENCE - All tanks are supposed to have a protecting fence of a quality adequate to keep animals away from the tank. A checkmark (✓) indicates the presence of such a fence, while a crossmark (✗) indicates its absence.

5) SOAKPIT - All tanks are supposed to have a suitable soakpit to provide proper drainage. A checkmark indicates the presence of such a soakpit, while a crossmark indicates its absence. Use of the subscript "c" indicates that the soakpit has a protective top cover/lid.

6) STRAINER - All tanks are supposed to have a stainless steel strainer installed at the water inlet to prevent entry of foreign material/insects into the tank. A checkmark indicates the presence of such a strainer, while a crossmark indicates its absence. Use of the subscript "D" indicates that the strainer required cleaning during the evaluation. Use of the subscript "G" indicates that the strainer was installed at the rainhead of the guttering rather than at the top of the tank. (This is generally associated with houses with low roof catchments. See code no. 9)

7) UNSEALED OPENINGS - This indicates openings in the tank through which insects and contaminating material might enter the tank. "L" indicates the top lid of the tank. "O" indicates the overflow pipe. "I" indicates the downpipe inlet (normally sealed with the strainer).

8) GUTTERING - Guttering is to be inspected to determine if it has been correctly installed and adequate. A checkmark indicates that it is, while a crossmark indicates that it isn't. Use of the subscript "S" indicates that the length of the guttering is considered to be undesirably short.

9) ROOF CATCHMENT - The roof is to be inspected to determine if it is of a suitable size and condition. A checkmark indicates that it is, while a crossmark indicates that it isn't. Use of the subscript "L" indicates that the roof was too low for the tank; that is, the bottom of the roof/guttering is lower than the top of the tank, requiring a new water entry to be cut into the side of the tank. Use of the subscript "S" indicates that the roof is considered to be undesirably small in relation to the size of the tank.

10) COMMENTS - In addition to other comments, the following codes might be used:

EM - the final elbow on the downpipe is absent
AT - there is another water tank at the same house
UH - the house is unoccupied
UD - the downpipe is inadequately supported
FB - there are problems with the fascia boards.

TABLE 4: Comprehensive/Comparative Overview of Evaluation Data

VILLAGE:	HOLEVA	'UTUNGAKE	OVAKA	LAPE	NUAPAPU	MATAMAKA	KAPA	OLO'UA	TOTAL
ORDER OF EVALUATION:	1/8	2/8	3/8	4/8	5/8	6/8	7/8	8/8	---
ORDER OF IMPLEMENTATION:	8/8	7/8	3/8	2/8	5/8	4/8	6/8	1/8	---
1986 POPULATION:	126	254	114	26	177	187	90	94	1068
TOTAL NUMBER HOUSEHOLDS (1986):	16	47	24	7	37	35	25	17	208
NUMBER TANKS CONSTRUCTED:	17	33	25	7	41	33	33	20	209
NUMBER TANKS EVALUATED:	17	33	25	7	41	33	33	20	209
LEAKS									
- Major:	0	0	0	0	0	1	5	0	6
- Minor:	0	14	8	4	13	15	9	8	71
- Seepage:	2	0	1	1	0	1	1	0	6
- None:	15	19	16	2	28	16	18	12	126
FENCES:	12	15	22	6	22	13	24	16	130
SOAKPITS:	15	30	24	7	38	29	28	20	191
- (Covered):	10	13	2	2	20	2	13	15	85
STRAINERS:	16	32	24	6	38	32	32	20	200
- (Dirty):	7	22	2	1	6	8	9	1	56
- (At Gutter):	5	0	1	0	8	7	4	3	28
UNSEALED OPENINGS									
- Top Lid:	16	33	25	5	41	30	33	18	201
- Inlet:	5	1	4	1	5	4	4	1	25
- Overflow:	17	33	24	6	41	32	33	19	205
GUTTERING:	17	33	25	7	41	32	33	20	208
- (Too Short):	7	6	7	0	6	5	2	1	34
ROOF CATCHMENT:	17	33	25	7	40	31	33	20	206
- (Too Low):	7	1	8	2	8	8	6	3	43
- (Too Small):	5	6	7	0	5	6	3	3	35
APPROX. % OF FULL CAPACITY:	30%	95%	75%	80%	90%	80%	95%	95%	80%

NOTE: Use of 1986 Census Statistics for Population and Households in connection with 1987 Pre-Implementation Survey Figures may result in apparent minor discrepancies.

TABLE 5: Other Evaluation Data

	MISSING FINAL ELBOW	ANOTHER TANK	INAPPROPRIATE HOUSES *
HOLEVA	2	1	1
UTUNGAKE	3	4	0
OVAKA	10	7	3
LAPE	3	1	0
NUAPAPU	5	5	2
MATAMAKA	16	2	4
KAPA	3	5	4
OLO'UA	10	1	1
TOTAL	52	26	15

* - The following types of houses were considered to be inappropriate: vacant houses; new (as-yet unbuilt) houses; and crude shelters. These are more fully discussed in section 4, page 24.

TABLE SIX: Rebate Winners

As part of the Project, the best tank in each village qualified for a rebate; that is, the local cash contribution of T$50.00 was returned to the individual. The following persons received rebates, as their tanks were considered to be the the best in each of their villages:

1) HOLEVA: Viliami [illegible]ota Tank #194
2) 'UTUNGAKE: Laulili Latu Tank #178
3) OVAKA: Mafi Moa'i Tank # 52
4) LAPE: Ahokavi Lautaha Tank # 27
5) NUAPAPU: Kolo Peau'ua Tank #125
6) MATAMAKA: Fono Moleni Tank # 83
7) KAPA: Siosaia Pule Taufa Tank #146
8) 'OLO'UA: Samiu Pasikala Tank # 15

Pictures of the above appear in Appendix Five.

APPENDIX TWO: ORIGINAL TECHNICAL GUIDELINES FOR FSP's VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

NOTE- Guidelines proposed for modification as a result of the evaluation are marked as follows:

STANDARDS FOR FSP
FERROCEMENT TANK CONSTRUCTION
IN VAVA'U

TANK

1. Standard Vaikau'aki 10 M^3 tank - approximatdely 6' high

* 2. Shortened Standard Vaikau'aki 8.33 M^3 tank - approximately 5' high.

   (To be constructed where height of catchment roof is too low for 6' tank)

3. Should be placed within 5' of house

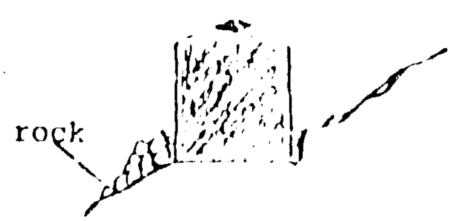
TANK FOUNDATION

1. On soft organic soils foundation should be 8" deep and filled with 1" to 2" coral gravel.

2. Must be level

* 3. No part of tank shall be underground

4. Where tank is on an incline, rock should be placed around tank to prevent erosion from roof runoff or tank overflow



ROOFING

Minimum acceptable roof areas should be:

1. 325 ft^2 for $10M^3$ tank

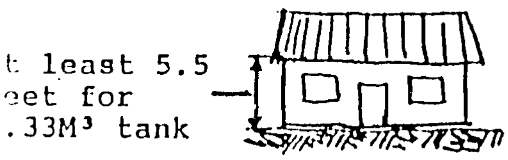
* 2. 270 ft^2 for $8.33M^3$ tank

3. No tanks are to be constructed for a "fale Tonga"

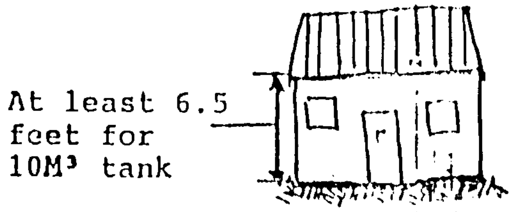
4. Minimum eaveheights are as follows:

   (a) 6.5 feet for $10M^3$ tank

   * (b) 5.5 feet for $8.33M^3$ tank

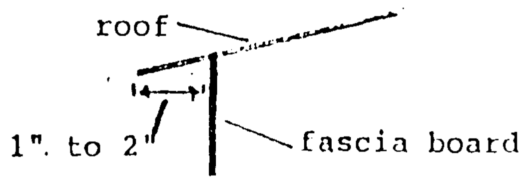


small tank



large tank

5. Roof overhang must be 1 to 2 inches over fascia board so gutter will catch water.



6. Roofs which are painted may cause lead poisoning MOH should determine lead content of paint on such roofs before tank is constructed.

<u>TANK OPENINGS</u>

1. Top tank cover should be secured shut to prevent contamination and mosquito entry

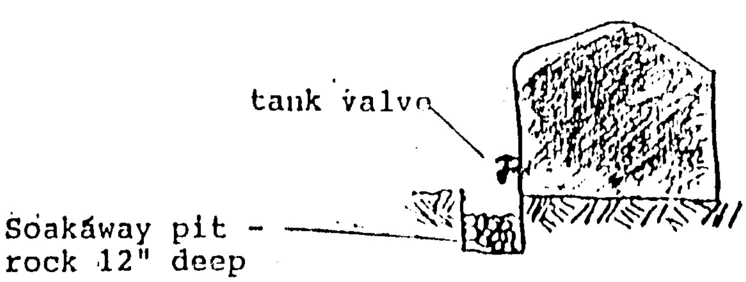
2. Opening for water from downpipe should have a strainer cemented in place

3. All water should be drawn from tap

<u>TAP AREA</u>

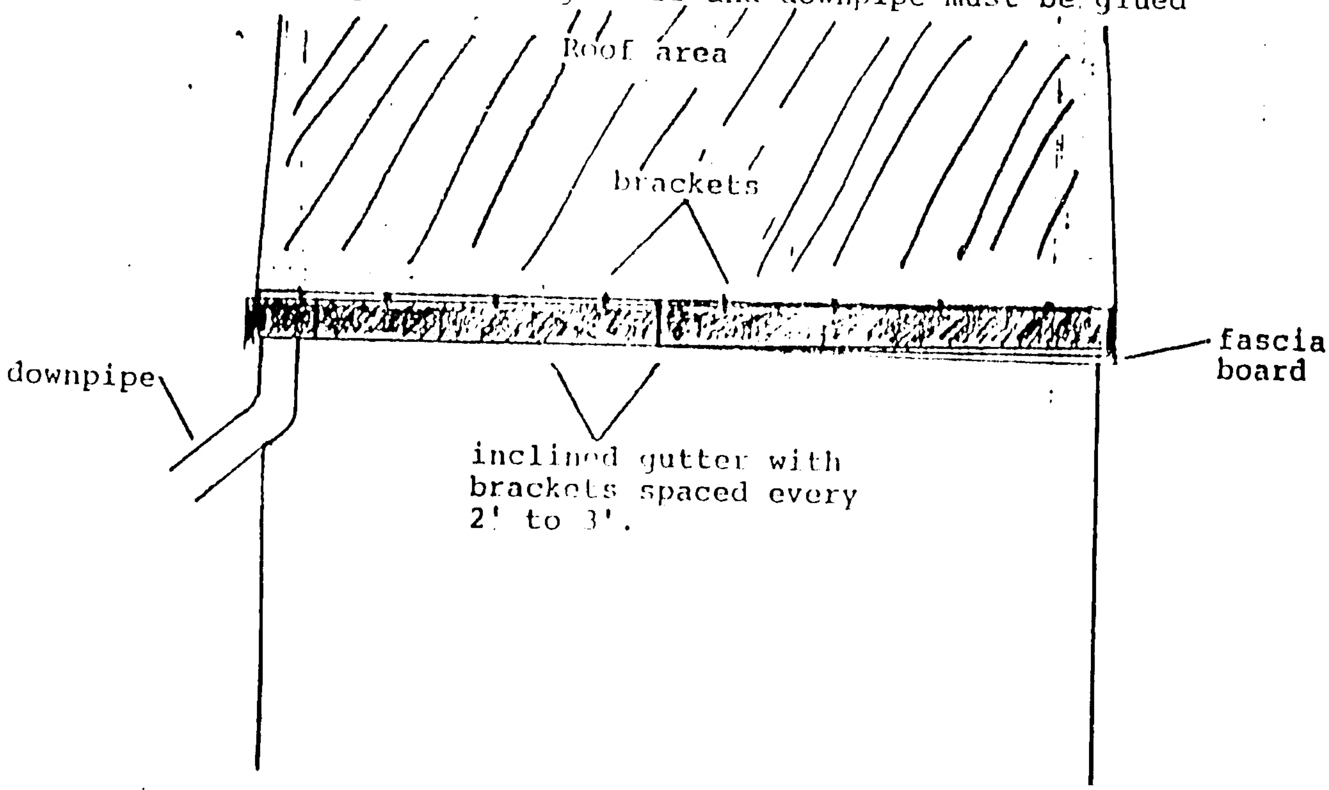
1. Tap area must be fenced or closed off so as to prevent entry of animals

2. Rock should be placed in the soakaway pit around the tap area and ... there should be a minimum open area under and around the tap of 18" x 18" x 18".



GUTTERING AND DOWNPIPE

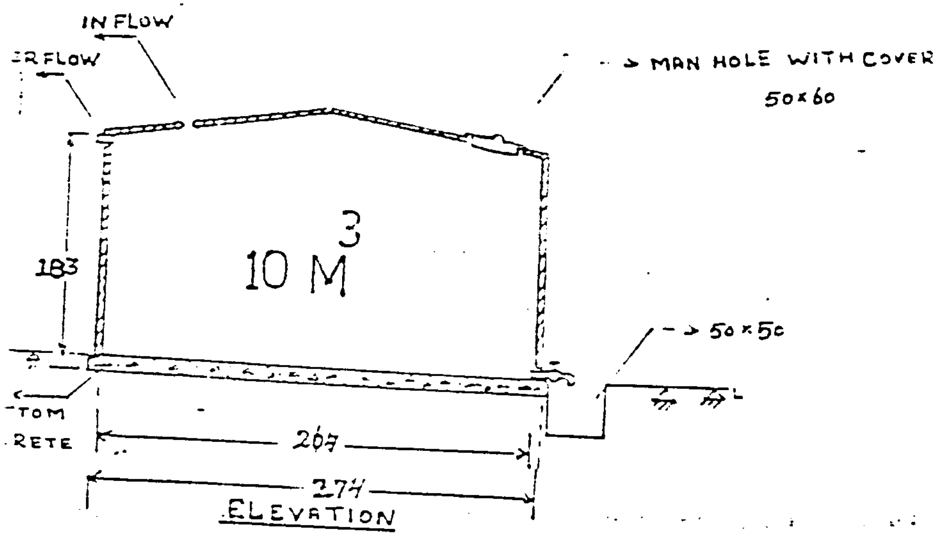
1. Guttering should be on a slight incline
2. Guttering must have stopends
3. Brackets for guttering should be spaced at least every 2 to 3 feet.
4. All joints for gutters and downpipe must be glued



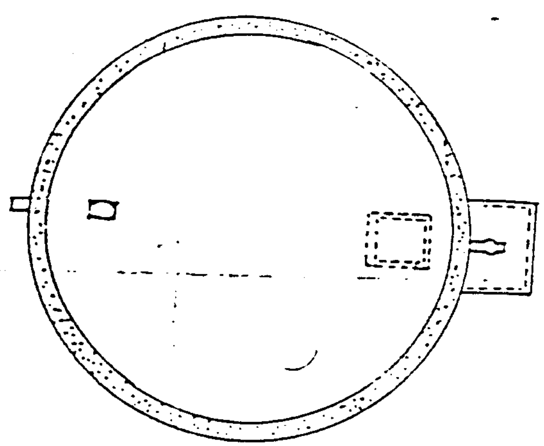
Appendix 3

...N OF $10M^3$ FERROCEMENT TANK. DETAILS OF REINFORCEMENT

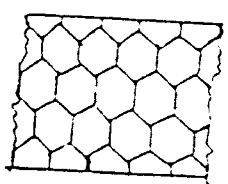
1



ELEVATION

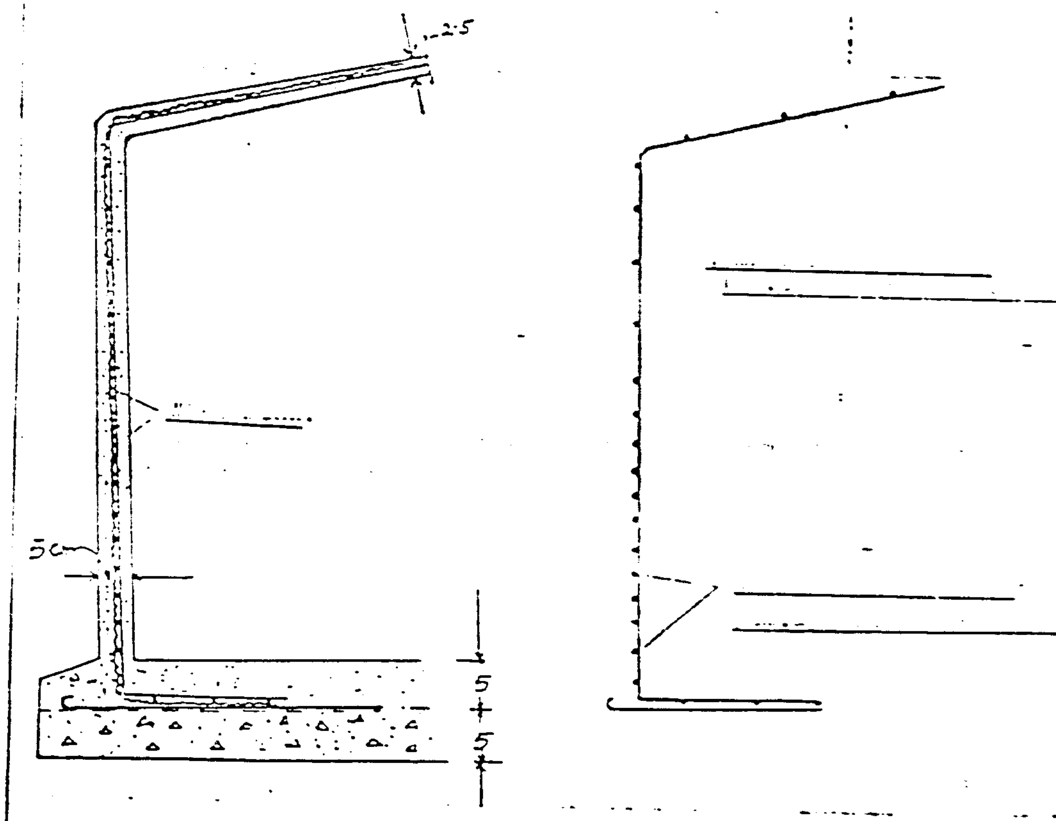


Plan

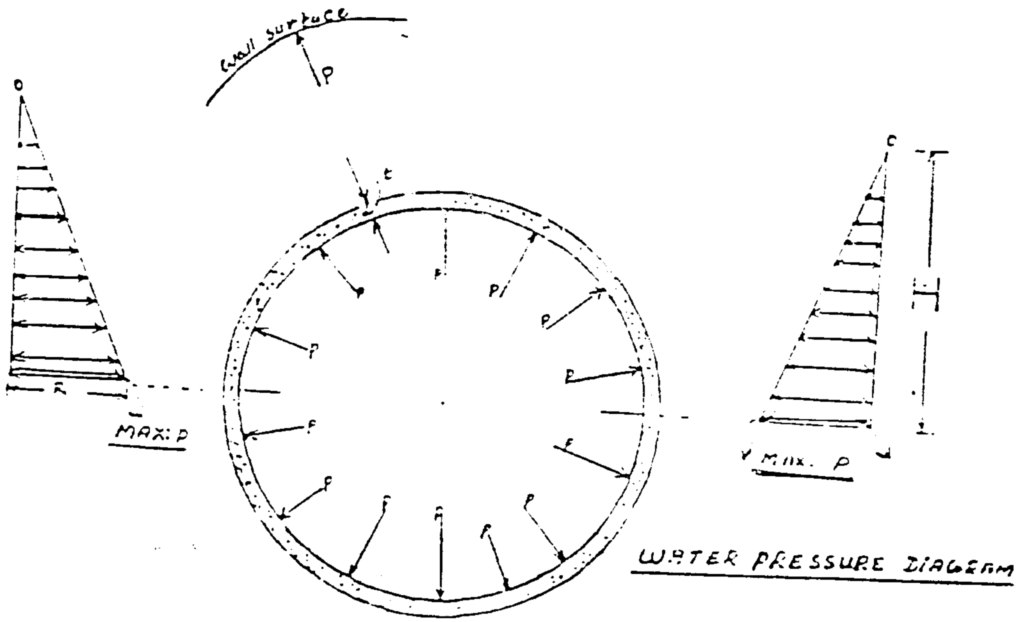


WIRE MESH

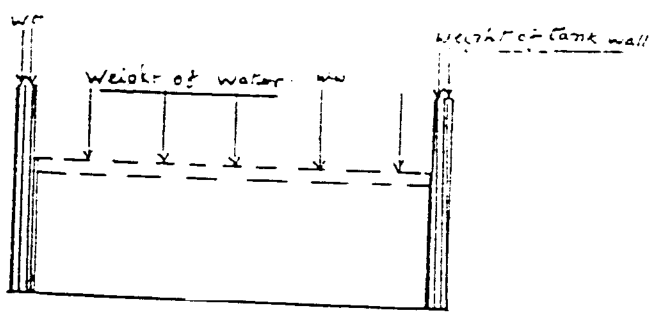
2



DESIGN OF 10 m³ FERRO CEMENT TANK
3

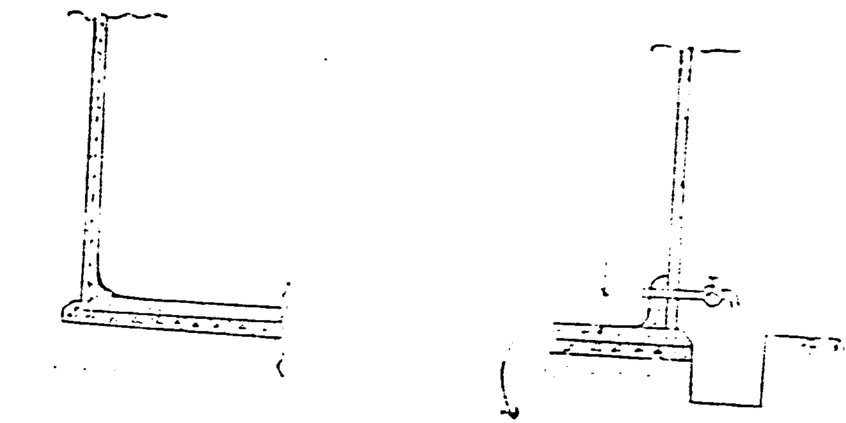


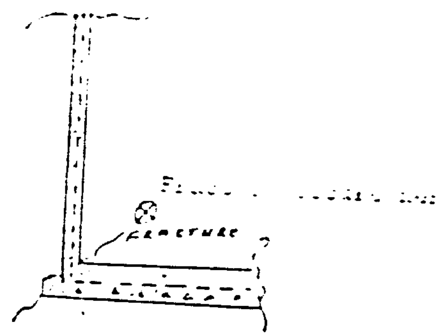
WATER PRESSURE DIAGRAM



LOADING DIAGRAM

DESIGN OF 10 m³ FERROCEMENT TANK
4





APPENDIX THREE: FINANCIAL DATA

TABLE ONE: Cost of MOH 10 Cubic Meter Water Tank (August 1987)

TABLE TWO: Original Master Budget for Phase One of FSP's Vava'u Outer Island Water Supply Project (May 1987 - March 1988)

TABLE THREE: Monetary Costs (Actual) for Phase One

TABLE FOUR: Non-Monetary Costs (Estimated) for Phase One

TABLE FIVE: Total Costs for Phase One

TABLE ONE: COST OF MOH 10 CU. METER WATER TANK, AUGUST 1987 (TONGAN $)

I. MATERIALS	QUANTITY	UNIT	TOTAL	WITH 15% INCREASE
Cement (40 kg. bag)	15.00 bags	7.83	117.45	135.07
Wire netting (4mm mesh)	25.00 meters	2.45	61.25	70.44
Plain wire (4mm mesh)	12.50 kg	1.79	22.03	25.73
Water Tap (1/2")	1.00	22.37	22.37	25.73
Water Pipe (40cm X 1/2")		1.04	1.04	1.20
Guttering (10' StormCloud)	3.00 sections	6.58	19.74	22.70
Down Pipes (10' sections)	2.00 sections	5.69	11.38	13.09
Gutter Brackets	10.00	.74	7.40	8.51
Bends (1X112 deg, 1X90deg)	2.00	2.85	5.70	6.56
Stop Ends	2.00	1.19	2.38	2.74
Overflow Pipe (2"X25cm)		.55	.55	.63
Rainhead	1.00	4.95	4.95	5.69
Gutter joints	2.00	.85	1.70	1.95
Black polythene plastic	5 square meters	3	15.00	17.25
Stainless steel strainer	1.00	8.91	8.91	10.25
Misc. fittings, PVC glue		5.00	5.00	5.75
		Sub-total	307.19	353.27

II. TANK FORMS (FOR 30 TANKS)

Timber:		
8"X2" - 10/14'	178.45	205.22
3"X2" - 6/12'	38.96	44.80
4"X2" - 2/9'	16.43	18.89
4"X1" - 20/12'	90.30	103.84
Plywood	12.52	14.40
Nails:		
4" - 3kg	4.47	5.14
3" - 1kg	1.33	1.53
2" - 3 kg	4.02	4.62
Total for 30 tanks	346.40	398.45
Sub-total for 1 tank	11.55	13.28

III. TOTAL COSTS PER TANK 318.74 366.56

Assume first 200 tanks at	318.74	=	63748.00
Assume next 240 tanks at	366.56	=	87974.40
Total Project Costs		=	151722.40
Total Project Costs divided by 440 tanks		=	344.82

OR SAY T$350.00 per tank for project

TABLE 2: ORIGINAL MASTER BUDGET FOR PHASE ONE OF FSP's VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

Item	FSP Grant	Local Contribution
Personnel	7,000	36,000
Materials and Supplies	35,000	35,600
Freight	3,000	1,500
Miscellaneous	4,180	
	$49,180	$73,100

FSP Grant:	$49,180	(40%)
Local Contribution:	$73,100	(60%)
TOTAL	$122,280	

TABLE 3: MONETARY COSTS (ACTUAL) FOR PHASE ONE OF FSP's VAVA'U OUTER ISLAND WATER SUPPLY PROJECT (May 1987 - March 1989)

Item	T$	US$
Personnel (Salaries, stipends and commissions)	15,123.00	10,712.60
Materials and Supplies	55,662.45	39,659.30
Freight	318.95	231.20
Miscellaneous	2,558.89	2,119.39
TOTAL	73,663.29	52,722.49

TABLE 4: NON-MONETARY COSTS (ESTIMATED) FOR PHASE ONE OF F.S.P.'s VAVA'U OUTER ISLAND WATER SUPPLY PROJECT (May '87 - March '99)

Item	T$	US$
Personnel		
- Unskilled labour	41,800.00	29,609.64
- Food for project personnel	7,695.00	5,450.87
- Accomodation for project personnel	2,671.88	1,892.67
Materials & Supplies		
- Sand & Gravel	3,762.00	2,680.41
- Roof Catchments	26,125.00	18,613.97
- Site preparation	2,090.00	1,489.12
Freight	2,910.00	2,109.40
- Neiafu to project site		
TOTAL	87,053.88	61,846.08

TABLE 5: TOTAL COSTS (Tables 3 + 4) FOR PHASE ONE OF F.S.P.'s VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

Item	Monetary	Non-Monetary	Total (US$)
Personnel	10,712.60	36,953.18	47,665.78
Materials & Supplies	39,659.30	22,783.50	62,442.80
Freight	231.20	2,109.40	2,340.60
Miscellaneous	2,119.32		2,119.32
TOTAL	52,722.42 (46%)	61,846.08 (54%)	114,568.57 (100%)

APPENDIX FOUR: FORWARD PLANNING FOR PHASE TWO OF FSP's VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

TABLE ONE: Total Projected Costs for Phase Two of FSP's Vava'u Outer Island Water Supply Project

TABLE TWO: Estimated Cost (4/88) of 2000 Gallon Ferrocement Water Tank for Phase Two of FSP's Vava'u Outer Island Water Supply Project

TABLE THREE: Monetary Costs (Projected) for Phase Two of FSP's Vava'u Outer Island Water Supply Project

TABLE FOUR: Non-Monetary/Local Costs (Estimated) for Phase Two of FSP's Vava'u Outer Island Water Supply Project

PHASE TWO OF FSP's VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

Phase One of the above project commenced in May 1987, and was completed in late January 1988, involving construction of 209 ferrocement water tanks (3000 gallon capacity) with associated rain catchments in eight different outer-island villages of Vava'u. The outer-islands of Vava'u were identified by the Ministry of Health as a priority area for improvement of water supply due to the absence of groundwater resources and the resulting dependence on rain catchment as the sole source of water for human consumption and domestic use.

The evaluation of Phase One confirmed that the goals and objectives of the project were being successfully and effectively met. These included the improvement of rural water supply through increased storage capacity for fresh water, with the related effects on improving standards of health and sanitation in these rural areas. The positive impact of this project on improving the quality of life and standard of living in rural/outer-island areas was also noted. At the completion of Phase One of the project, storage capacity totaling 627,000 gallons had been added to the water supplies of these villages, with more than one-half million gallons of fresh water actually available at the time of the evaluation. According to 1986 Census figures, the per capita increase in water supply is nearly 500 gallons per person.

Phase Two is planned to continue the work and benefits of the project, and will involve a minimum of 227 tanks in nine outer-island villages. The planned implementation schedule, and indicated number of tanks, are as follows:

1) Koloa	24 tanks
2) Okoa	28 tanks
3) 'Otea	22 tanks
4) Falevai	30 tanks
5) Hunga	36 tanks
6) Taunga	21 tanks
7) Ofu	21 tanks
8) Nga'unoho	26 tanks
9) 'Utulei	19 tanks
TOTAL	227 tanks

The above figures are based on a thorough survey done prior to the implementation of Phase One of the project. However, for planning purposes, an additional three tanks are budgeted into the project as minor contingency. The total number of tanks planned for Phase Two is therefore 230 tanks.

48

Based on current costs and estimates, the projected total cost of Phase Two of the project is nearly US$150,000 (see following data tables), with US$78,000 required to cover direct/monetary costs of the project. A grant of T$20,000 (approximately US$14,700) has already been secured through a grant from the Australian Government provided through the Rural Development Program of the Central Planning Department of the Government of Tonga. Additional funds of US$25,000 have been tentatively approved (pending availability of funds) through the Accelerated Impact Program of the United States Agency for International Development. These funds constitute 51% of funding required. Securing the additional funds required is a top priority for the project.

Baseline financial projections for Phase Two are as follows:

TABLE 1: TOTAL PROJECTED COSTS FOR PHASE TWO OF F.S.P.'s VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

Item	Monetary	Non Mon./Local	Total (US$)
Personnel	14,156.16	28,080.80	42,236.96
Materials & Supplies	57,456.86	35,611.59	93,268.45
Transport/Travel	3,133.53	3,815.53	6,949.06
Other	2,977.86	---	2,977.86
TOTAL	77,944.41 (54%)	67,507.92 (46%)	145,452.33 (100%)

(NOTE: Refer tables 3 and 4 for additional information.)

TABLE 3: MONETARY COSTS (PROJECTED) FOR PHASE TWO OF FSP's VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

Item	T$	US$
Personnel (Salaries, stipends and commissions)	19,200.00	14,156.16
Materials and Supplies	78,200.00	57,656.86
Transport/Travel	4,250.00	3,133.53
Other	4,066.00	2,997.86
TOTAL	105,716.00	77,944.41

Narrative Explanation of Table Three

1) Monetary Costs of Personnel are calculated as follows:

a) Commission for Vaikau'aki Company- T$60 will be paid upon completion of the tank, and T$20 will be paid following installation of guttering. The total commission per tank will be T$80, with total for 230 tanks equaling T$18,400.

b) Stipend for Community Organiser- T$40 will be paid monthly for a ten month period, equaling T$400.

Total Monetary Costs for Personnel = T$19,200

2) Monetary Costs for Materials and Supplies are calculated at the rate of T$340.00 per tank (refer Table 1 above) for 230 tanks, for a total cost of T$78,200.

3) Monetary Costs for Transport/Travel are calculated as follows:

a) Freight/Transport This item applies to cost of transporting project materials from Nuku'alofa to Vava'u, and to the cost of transport of material and supplies to/from the storage facilities. A preliminary allocation of T$1,500 is indicated.

b) Intra-island Travel This item applies to the cost of travel of project personnel within Vava'u. It is acknowledged that during actual implementation, tran'port of personnel to/from the project site is to be provided as a local contribution. This allocation is to facilitate access to project sites at any time, as required for pre-implementation coordination and

TABLE TWO: ESTIMATED COST (4/98) OF A 10 CU. METER/3000 GALLON WATER TANK FOR PHASE TWO OF FSP'S VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

1) MATERIALS REQUIRED	QUANTITY NEEDED	UNIT COST (T$)	TOTAL COST
Cement (40 kg. bags)	15 bags	7.83/bag	117.45
Wire mesh (105cm width, 4cm mesh, 1.4mm wire)	25m	2.13/m	53.25
Plain wire (4mmX25kg rolls)	12.5kg	1.68/kg	21.00
Water Tap (0.5" locking)	1	6.00 ea.	6.00
PVC Water Pipe (0.5" by 20')	0.4m	0.30/m	.12
Guttering (10' StormCloud)	3 lengths	7.07 ea.	21.21
Down Pipes (3" X 10')	2 sections	5.41 ea.	10.82
Gutter Brackets	10	0.57 ea.	5.70
Bends: 3" x 112 3" x 90	1 1	1.42 ea. 1.69 ea.	1.42 1.69
Stop Ends: 1 LH 1 RH	1 1	0.79 ea. 0.66 ea.	.79 .66
Overflow Pipe (2" x 6m Waste)	0.25m	1.03/m	.26
Rainhead	1	3.33 ea.	3.33
Gutter joints	2	0.54 ea.	1.08
Polythene (4m width)	4 m	2.19/m	8.76
Strainer (stainless steel)	1	8.91 ea.	8.91
Miscellaneous (glue, fittings, etc)		15.00	15.00
		Sub-total	277.45
		Contingency	41.62
		TOTAL	319.07

2) COST OF TANK FORMS (for 30 tanks)

Timber:			
8" x 2" x 14'	10 lengths		205.22
3" x 2" x 12'	6 lengths		44.00
4" x 2" x 9'	2 lengths		18.87
4" x 1" x 12'	20 lengths		103.04
Plywood			14.40
Nails: 4"	3 kg.		5.14
3"	1 kg.		1.53
2"	3 kg.		4.62
		Sub-total	398.41
		Contingency	39.84
		For 1 Tank Form	438.29
		FOR 3 TANK FORMS	1314.81
		PRO RATED COST PER TANK	14.61

3) TOTAL ESTIMATED COSTS

Materials	230 tanks at T$319.07/tank	73386.10
Forms	230 tanks at T$ 14.61/tank	3360.30
	GRAND TOTAL	76746.40
	COST PER TANK	333.68

SAY T$340 PER TANK

post-implementation monitoring of the project. A preliminary allocation of T$75/month for a period of ten months is indicated, for a total of T$750.00.

c) Inter-island Transport - This item applies to the cost of travel of project personnel from Nuku'alofa to Vava'u for the purpose of monitoring, supervising and evaluating the ongoing activities of the project. Based on past travel costs, a preliminary allocation of T$2,000.00 is indicated.

Total Monetary Costs for Tranport/Travel = T$4,250.00

4) Other Monetary Costs are estimated as follows:

a) Space - Project materials and supplies are presently being stored at the home of the Community Organiser. Efforts are being made to secure more suitable storage facilities (such as a large container) closer to the wharf. In the absence of such facilities, it is planned to improve the existing facilities. In either case, a preliminary allocation of T$400 is indicated.

b) Miscellaneous - This item is estimated at 4% of the above costs, equaling T$4,066.

Total Other Monetary Costs = T$4,066.00

TABLE 4: NON-MONETARY/LOCAL COSTS (ESTIMATED) FOR PHASE TWO OF F.S.P.'s VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

Item	T$	US$
Personnel		
- Site preparation	4,600.00	3,391.59
- Unskilled labour	20,700.00	15,262.11
- Food for project personnel	9,574.00	7,040.39
- Accomodation for project personnel	3,210.00	2,366.73
Materials & Supplies		
- Sand & Gravel	4,600.00	3,391,58
- Roof Catchments	28,750.00	21,197.30
- Cash Contribution	14,950.00	11,022.64
Transport/Travel		
- Freight of materials	3,450.00	2,543.60
- Transport of personnel	1,725.00	1,271.84
TOTAL	91,561.00	67,507.92

Narrative Explanation of Table Four

1) Non-Monetary/Other Costs of Personnel are calculated as follows:

a) Site Preparation- It is assumed that it will take two person two days to properly prepare the construction site for each tank. At the the standard daily-paid labour rate of T$5.00/day, and 230 tanks, the total value of this item is T$4,600.00.

b) Unskilled labour- It is assumed that each of the six members of the Vaikau'aki Construction Team will be assisted by a local person, for a total of six persons. It is assumed that the standard daily-paid labour rate of T$5.00 is appropriate. It is assumed that completion of a tank takes three days. Therefore, the total value of the unskilled labour for 230 tanks equals T$20,700.00.

c) Food- Four of the villages in Phase Two (involving 97 tanks) are accessible by land; it is assumed that project personnel will travel to/from the site each day, and therefore only lunch will be provided. It is assumed that the Vaikau'aki Construction Team will consist of six persons, and that 78 work-days will be required to complete these 97 tanks. At T$4.00/man/lunch, the total value of this equals T$1,872.00.

For the other five villages (involving 133 tanks), access is possible only by boat; it is therefore assumed that the project personnel will live on the island during implementation, and be fed three meals per day. It is assumed that 107 work-days will be required to complete these 133 tanks. At T$12/man/day (breakfast, lunch and dinner), the total value of this equals T$7,704.00.

The total estimated value of food for project personnel equals T$9,576.00.

d) Accomodation- Accomodation for the six members of the Vaikau'aki Construction Team will be required for a minimnum of 107 work-days. At T$5.00/man/night, the total value of this equals T$3,210.00.

The total value of non monetary/other costs involved in the Personnel Item is estimated to be T$38,086.00.

2) Non-Monetary/Other Costs of Materials and Supplies are calculated as follows:

a) Sand & Gravel- The sand and gravel required to construct one tank has an approximate market value of T$20.00. These materials will be provided by the tank recipients. The total value of this item is estimated to be T$4,600.00.

b) Roof Catchments- Each tank recipient must have or provide a suitable and acceptable roof to serve as a catchment area for the water tank. The estimated value of each catchment is approximately T$500.00, of which 25% (T$125) is considered applicable for the project. Therefore the total value of this item is T$28,750.00.

c) Cash Contribution for Materials & Supplies- Each tank recipient is required to make a cash contribution of T$65.00 per tank, to be used in the purchase of needed materials (generally used for guttering and fittings). The total value of this item is T$14,950.00.

The total value of non-monetary/other costs involved in the Materials and Supplies item is estimated to be T$48,300.00.

3) Non-Monetary/Other Costs for Transport/Travel are calculated as follows:

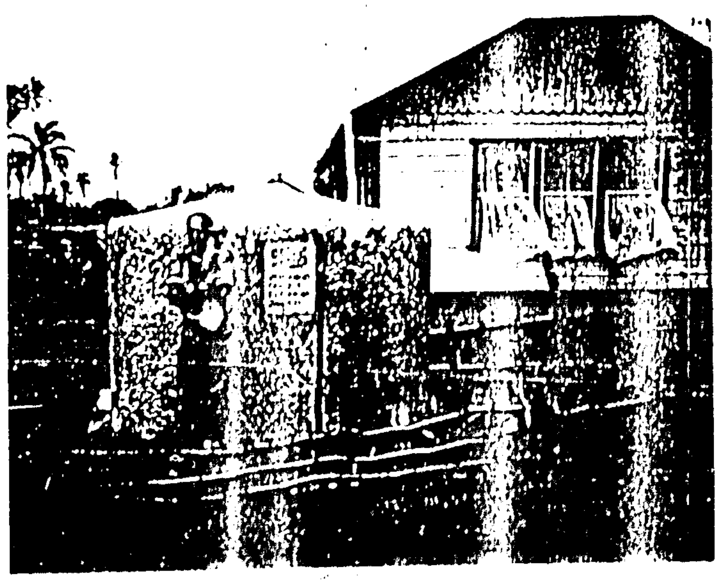
a) Freight- The different locations and accessibilities of project locations will result in widely varying costs of this item. It is assumed that an average cost for all of Phase Two is T$15.00/tank, for a total value of T$3,450.00.

b) Other Transport- It is assumed that in addition to transport/freight of materials, there will also be a need to transport project personnel at other times during the actual implementation of the project. The value of this item is estimated at T$7.50 per tank, for a total of T$1,725.00.

Total value of non-monetary/other costs related to Transport/Travel is estimated to be T$5,175.00.

APPENDIX FIVE: PICTURES FROM THE EVALUATION OF PHASE ONE OF FSP's VAVA'U OUTER ISLAND WATER SUPPLY PROJECT

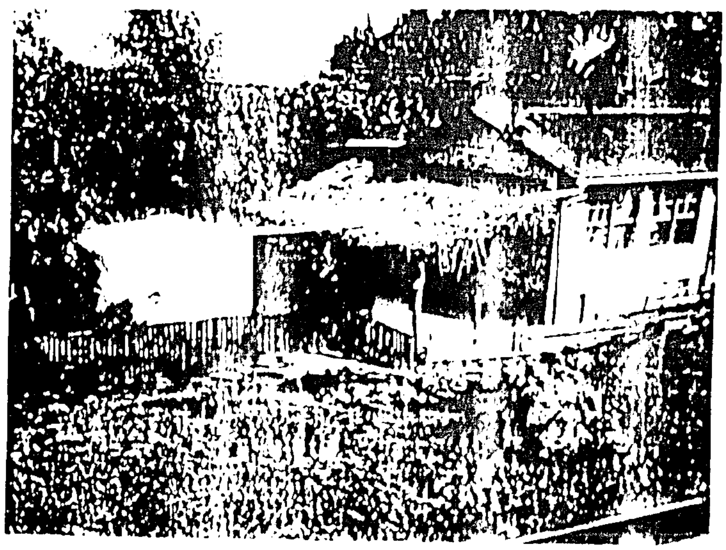
THE FIRST TANK



THE LAST TANK

5

BEST TANK – HOLEVA

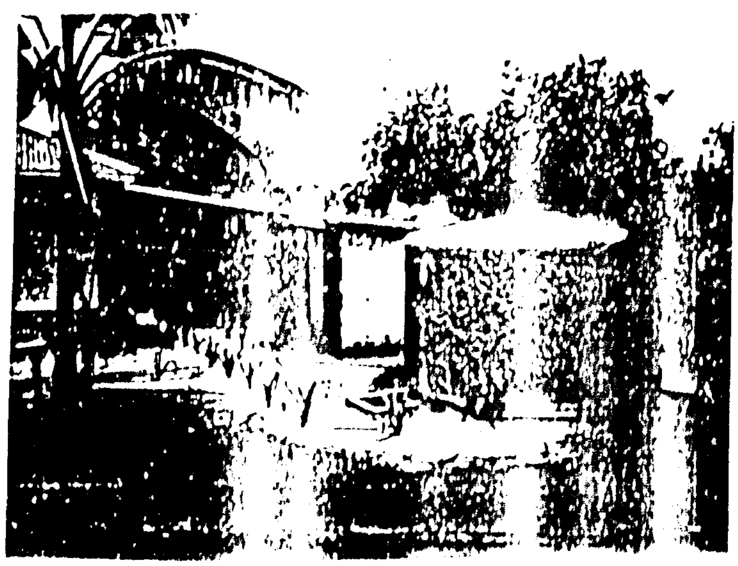


BEST TANK – TUHUGAKE

BEST TANK – OVAFA

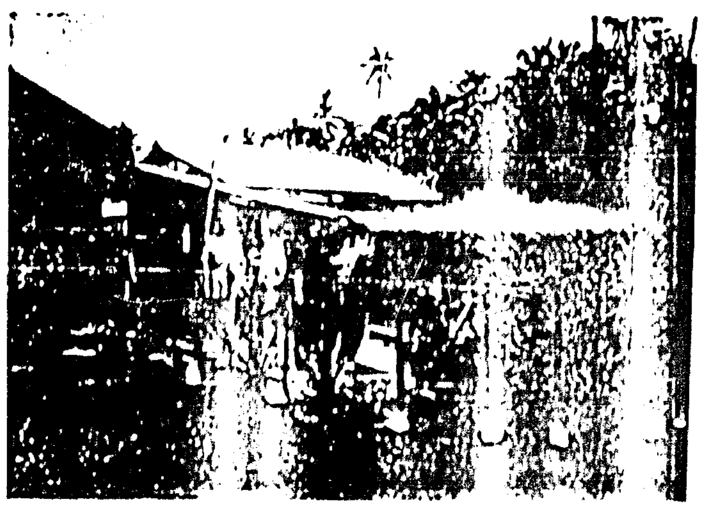
BEST TANK - LAPE

BEST TANK - NUAPAPU



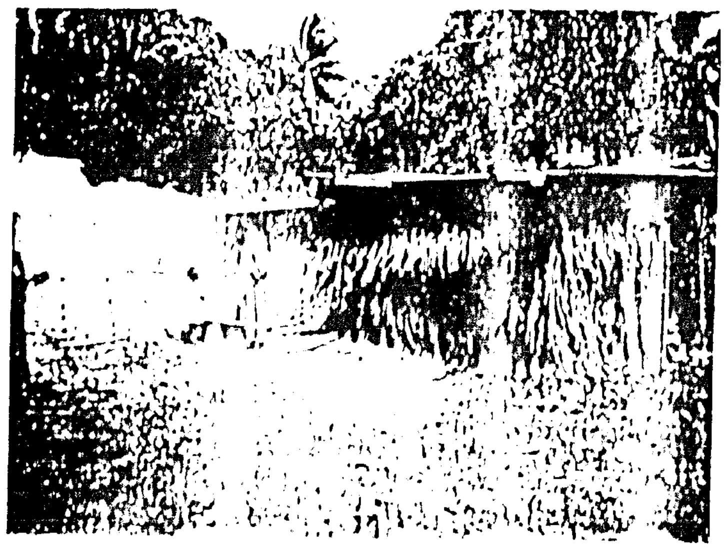
BEST TANK - MATAMAKA

BEST TANK - FAFA



BEST TANK - OLO'UA

EXAMPLE OF VERY POOR CATCHMENT



EXAMPLE OF CRUDE, TEMPORARY SHELTER

EXAMPLE OF MINIMUM ACCEPTABLE CATCHMENT