

**SUMMARY
TUVALU BORROW PIT INFILLING
PILOT PROJECT**

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TUVALU BORROW PIT INFILLING PILOT PROJECT

SUMMARY

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PURPOSE

- determine the suitability of the proposed lagoon materials which would be used in larger quantities to fill all the borrow pits and low lying areas on Fongafale;
- provide information on the likely effects on the environment if the full project went ahead.

OBJECTIVES

- map in detail sand deposits in the lagoon off Fongafale to further define quantities and quality of sand resources available;
- dredge approximately 2,500 cubic metres of lagoon sand from off Vaiaku Wharf;
- transport sand to a pilot pit area;
- infill the pilot area to test the lagoon sands suitability as land reclamation material;
- monitor the effects the pilot project has on the environment;
- identify the likely effects a major dredging project would have on the environment.

ACHIEVEMENTS

- an appropriate dredge system was designed and built in Fiji and transported to Funafuti;
- the dredge was operated and maintained by PWD and SOPAC for 18 months in Funafuti, including a 4 month suspension of operations when the weather was too rough to dredge;
- aerial photographs of the dredge operating were obtained with assistance from the RNZAF during a reconnaissance flight;
- moorings for the boat and barge were made, installed and maintained;
- sand resources and the environment off Vaiaku have been mapped in sufficient detail for use by a full scale dredging operation;
- approximately 1,000 cubic metres of sediment was dredged, transported, and used to infill the test site;
- the fill site and lagoon sediment used there has been monitored for 12-18 months:
 - the biology of the lagoon environment has been monitored before, during, and after dredging;
 - all aspects of dredging, transporting and pit infilling have been monitored and recorded;
 - the public of Funafuti and Tuvalu have been kept informed on the project primarily by public meetings, radio interviews, and regular visits to Funafuti by SOPAC staff;
- the project has been managed by PWD and monitored by a Project Coordinating Committee.

CONCLUSIONS

- lagoon sand available off Fongafale at 5-20 metres water depth is suitable for use as a fill material on Fongafale;
- lagoon sand available off Fongafale is probably suitable for a wide range of non-structural constructional uses such as concrete floors;
- lagoon sand suitable for fill material is present at 5-20 metres water depth in a large deposit off Vaiaku Wharf in more than sufficient quantities for the total infilling of borrow pits and other low lying areas on Fongafale;
- to fill all the borrow pits and other low lying areas on Fongafale (calculated to be 644,700 cubic metres by Gibb Australia, 1985) a major dredging project would be necessary and the time it would take would depend on dredging method and especially the method of delivery:
 - all resources for the full project would need to be imported except for labour which could be recruited locally for the project;
 - the dredging could be carried out in a number of ways and a full project would need to be carefully designed by a qualified and experienced engineer;
 - engineering operations and maintenance requirements are such that considerable costs will be incurred in setting-up and keeping a dredge operating (low maintenance equipment will be essential) and the most appropriate method would be by international contract for the whole job;
 - land ownership problems need to be resolved and a pit infilling program developed;
 - damage by the pilot dredging operation to the lagoon environment was barely measurable and of no consequence to on-going activities in the lagoon;
 - within the guidelines set, dredging can be carried out in the lagoon with minimal damage to the environment;
 - it cannot be overemphasised that the people of Fongafale will have to accept significant inconveniences that the implementation of such a large project will bring and awareness of this issue should be promoted widely.

RECOMMENDATIONS

If a full project is considered desirable, where all borrow pits and low lying areas are to be filled then the following is noted:

- if a clam shell dredging operation, similar to that now operating in Suva, Fiji, was used, then a project the same size as that operating in Suva would take at least 3 years and at current Fiji prices would cost at least \$ 3 million (maintenance costs would add to this significantly);
- if a dredging and pumping-to-site operation was used, then consideration would need to be given to disposal of muddy water at the site, and the fact that some pits are tidal and flush freely with the ocean;
- the November to March season would be a difficult time to dredge and equipment would need to be protected against occasional cyclonic storms or removed from the lagoon and stored during the westerly season:

- before proceeding further a dredging engineer would need to review all results, examine the site, and prepare a plan with costings which would be achievable on Funafuti.

Preliminary recommendations are that:

- the Tuvalu government review carefully the pits and low areas to be reclaimed, address land ownership issues and prepare a priority listing of areas to be filled - from this information an infilling plan and an infilling program should be prepared matched to needs;
- the Tuvalu government consider a less-than-full project where only certain priority pits and low areas are filled, other areas remaining unfilled or be used for other functions such as community solid waste disposal;
- an engineering consultancy investigate dredging and pit infilling methods, taking particular note of the need for low maintenance equipment, focussing on the type of dredging system and transporting methods which might be used, recalculate the volumes of pits to be filled, and the need for pit lining materials - this consultancy to draw up terms of reference, and prepare tender documents and contracts:
- SOPAC continue to assist PWD and support the small scale dredging of lagoon sands using the present equipment to supply Fongafale with non-structural sand for present needs, instead of mining beaches and other land areas.

Beginnings

1. In 1985 Gibb Australia produced a report on the Lagoon Bed Resources of Funafuti, which identified resources, suggested solutions for using these resources, and recommended that before establishing a dredging program to provide material for filling the borrow pits and low lying areas of Fongafale, that a PILOT PROJECT be carried out to test the suitability of the resource' and monitor the environment. The objectives of this study were to determine sources and quantities of the engineering and reclamation materials in the Funafuti Lagoon, and to assess and evaluate the practical, financial, environmental, and sociological aspects of the utilisation of these materials for land reclamation, coastal protection, engineering, and building construction.

2. Gibb Australia concluded that:

- reclamation of the borrow pits was feasible and found lagoon sediment suitable for reclamation purposes, subject to proving by a small pilot project, which would fill an area of about 50 square metres:
 - for cost and environmental reasons a small scale suction dredger, operating as close to the final point of delivery was favoured;
- dredging and land reclamation be carried out over a period of about 6 years, with equipment owned by the Tuvalu Government and operated and maintained by the equipment supplier;
- an estimated 644,700 cubic metres of lagoon sediment was required to fill all borrow pits and low lying areas on Fongafale;

- at 1985 prices the total land reclamation project would cost about AUD 1.36 million;
- no engineering or building materials could be found in the lagoon, and limited use of cobbles from the hurricane Bebe bank was recommended for this purpose.

3. Following from the work by Gibb Australia, a consulting firm, DEMAS, funded by UNDP, recommended in 1987 a number of options for the pilot project. The Tuvalu government chose to proceed with a pilot dredging project using a sandpump and hopper-barge combination, transporting the sand onshore using another pump directly into the pit.

SOPAC Involvement

4. Following AIDAB agreement to fund the pilot project, the Tuvalu government asked SOPAC in late 1988 if it would assist implement the project.

5. During 1989 SOPAC reviewed the pilot project and agreed to take on the coordination and management of the Pilot Project with assistance from SPREP whose role would be to prepare an EIA report. Prerequisites identified by SOPAC were that:

- the government identify a pit site for infilling during the pilot project and that free access be provided;
- some PWD equipment, such as a front-end loader, would be provided from time to time as necessary;
- technical assistance and other resources would be provided from Public Works, Agricultural, and Fisheries Departments on an occasional basis;
- the equipment purchased would remain the property of SOPAC and therefore be available for other projects in the region, except that it would stay in Tuvalu as long as it was needed and the government requested its further use in Tuvalu.

Purpose & Objectives

6. The Purpose of the Pilot Project, as requested by Tuvalu, was to:
- determine the suitability of the proposed lagoon materials which would be used in larger quantities to fill all the borrow pits and low lying areas on Fongafale;
 - provide information on the likely effects on the environment if the full project went ahead.
7. The Objectives of the Pilot Project therefore were to:
- map in detail sand deposits in the lagoon off Fongafale to further define quantities and quality of sand resources available;
 - dredge approximately 2,500 cubic metres of lagoon sand from off Vaiaku Wharf;
 - transport sand to a pilot pit area;
 - infill the pilot area to test the lagoon sands suitability as land reclamation material;
 - monitor the effects the pilot project has on the environment;

- identify the likely effects a major dredging project would have on the environment.

Approval

8. The project and plan were endorsed at the SOPAC Annual Session in October 1989.

Planning

9. In late 1989, early 1990 it was found necessary to redefine the project and reassess its costs. The Government informed SOPAC that part of the low lying pond north of PWD would be used as the test infill site. In view of the site selection and the fact that, contrary to the project definition, no equipment was available in Tuvalu, the equipment requirements and dredging plan were modified. Limiting factors on the dredging operations were:

- all equipment would have to be imported;
- sand would be dredged from as deep as 25 metres;
- sand would have to be transported overland and not pumped into a pit site;
- the equipment, especially hopper barge, would have to be carefully designed by a qualified person to take into account appropriate safety factors:
- the westerly season during the months of November to February, when the weather might be too rough to operate the dredge;
- the budget which was revised upwards to take into account the above factors.

10. All equipment would have to be shipped from Fiji to Funafuti on the Forum Micronesia and therefore could not exceed the 24 tonnes lifting capacity of that vessel. Although a SOPAC project, it was agreed that Tuvalu appoint its own project manager for internal coordination and management and PWD took over this responsibility early in 1990.

11. A new plan was presented to AIDAB who approved the additional expenditure.

Preparation

12. During 1990-1991 the equipment (barge, pusher boat, and dredge) was designed by a naval architect, after consultation with Suva based engineers. Equipment was tendered and constructed in 1991. Also at this time other equipment was ordered and SOPAC was assisted in this by a 6 month consultancy by a CFTC funded Dredging Engineer. This consultant defined the work in detail, setup the dredging project, and supervised testing of the equipment in Suva.

Implementation

13. Dredging began in April 1992 at the end of the 1991-1992 westerly season. Dredging was suspended December 1992 through March 1993 for the westerly

season and resumed in April 1993. Pilot Project dredging was concluded in September 1993. Almost 1,000 cubic metres of lagoon sand was dredged, transported and dumped at the pit site.

14. During preparations and throughout the implementation of the project the Project Coordinating Committee (PCC) met regularly. The following were represented on this Committee:

- Public Works:
- Lands:
- Fisheries:
- Agriculture:
- Health:
- Planning and Foreign Affairs:
- Environment:
- SOPAC.

These meetings were Chaired by Public Works who were also responsible for Project Management. Regular visits were made by SOPAC staff including Deputy Director, Marine Geologist, Marine Mechanic, and Dredging Engineer, all who attended PCC meetings where possible.

Environmental Monitoring

14. In 1990 SOPAC concluded that the biological monitoring of the pilot dredging be carried out independently. SPREP were approached and they produced a plan and budget which were accepted by SOPAC, and which AIDAB agreed to fund through SOPAC. SPREP contracted environmental biological consultants from Australia to do the work. Later the project was redefined to meet Australian environmental monitoring standards. Surveys were carried out specifically to note the effects that the pilot dredging might have on marine life. Six surveys were completed - two before dredging started, two during dredging, and two after dredging had been completed.

Reporting

15. Detailed results of all aspects of the dredging, mapping and monitoring are being collated and will be presented in a comprehensive final report.

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