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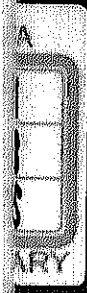


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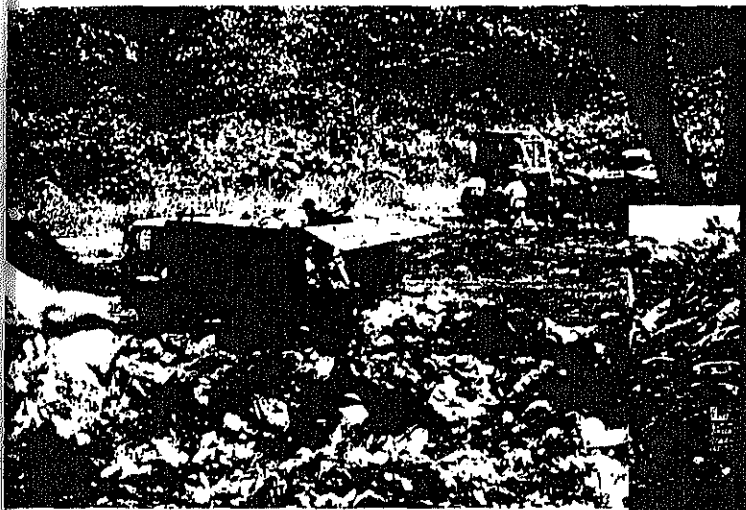
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WASTE MANAGEMENT STUDY



Project Formulation Study ON WASTE MANAGEMENT IN SAMOA



VOLUME 1
March 1998



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JAPANESE INTERNATIONAL CO-OPERATION AGENCY

Project Formulation Study
ON WASTE MANAGEMENT
FOR THE IMPROVEMENT OF
THE URBAN ENVIRONMENT IN SAMOA

FINAL REPORT

March 1998

XP0014/RP02

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1. INTRODUCTION

1.1 BACKGROUND

It is reported in several studies that waste disposal in Samoa (Apia) is currently occurring in a haphazard manner and this is creating a serious risk to human health and threatens to destroy natural resources such as mangrove foreshores and coastline which are vital to local industries such as tourism. This is occurring as a result of many factors, including a lack of funding and trained staff at the Department of Lands, Survey and Environment, Division of Environment and Conservation (DEC), the official agency responsible for environmental issues.

The Japanese International Co-operation Agency (JICA) recognises that the environmental sector is one of the highest priority sectors for assistance in Samoa and that waste management (disposal) is a major area of concern. JICA therefore has decided to conduct a study on waste management in urban Samoa to assess the situation and identify areas where Japan could offer assistance to improve the urban environment.

1.2 PROJECT OBJECTIVE

JICA's objective in undertaking this Project is to assess waste management in urban Samoa, especially Apia and the surrounding area, and identify suitable projects for Japanese assistance.

1.3 PROJECT METHODOLOGY

The state of waste management and the environment in Samoa (Apia) has been assessed by a number of different organisations in a number of previous studies eg. NEMS, ADB, and AusAID. To ensure maximum use of previous investigations and studies, a staged approach to the Project was adopted, which as a first step, involved a review of existing available information. This approach also allowed the scope of work to be tailored to achieving the Project objectives within the budget available. The staged scope of work involved the following:

Stage 1 - Project Kick Off and Initial Review Of Existing Waste Management Situation In Samoa (Apia)

1. Project kick off meeting.
2. Background data collection and review.
3. Initial review and assessment of the existing state of waste management in urban Samoa (Apia) (undertaken in Apia, Samoa).

4. Review of current waste management administration and legislation (including laws and regulations) (undertaken in Apia, Samoa).
5. Initial identification and review of the activities of other donors and international organisations in waste management in the region (undertaken in Apia, Samoa).
6. Preparation of a report on findings of Stage 1, and recommendations for Stage 2 investigations.

Stage 2 - More Detailed Review and Assessment Of Existing Waste Management Situation In Samoa (if required)

Subject to the findings of Stage 1, and consequent need for further work to achieve the objectives of the Project, the following tasks were undertaken:

7. Public awareness survey.
8. Waste depot waste characterisation analysis (based on vehicle data).

Stage 3 - Identification And Development Of Possible Waste Management Projects

9. Upon completion of the earlier investigation and assessment stages, the Project team identified, developed and compared possible sustainable projects suitable for Japanese assistance, which would improve urban waste management and consequently the urban environment in Samoa (Apia).
10. Final report preparation.

A copy of the Project Study Plan which describes the scope of the Project in more detail is attached in Appendix A.

1.4 SCOPE OF REPORT

This Report presents the findings of Stages 1, 2 and 3 of the Project and encompasses the following:

1. A description of the Stage 1 investigation;
2. A description of the state of waste management in urban Samoa (Apia);
3. A summary of the findings of the Stage 1 investigation;

4. Identification, comparison and assessment of potential projects for improving urban solid waste management in Samoa;
5. Project profiles for a selected shortlist of projects; and
6. Conclusions of the Project

2. DESCRIPTION OF STAGE 1 INVESTIGATION

2.1 GENERAL

Stage 1 of the Project involved the following Tasks:

1. A Project kick off meeting in Sydney (undertaken on 16 December, 1998);
2. Collection and review of existing available data;
3. A site trip to Samoa to review the existing waste management situation in Apia.

A description of Tasks 2 and 3 is provided in the following Section.

2.2 DATA COLLECTION

This Task involved the collection and review of all available background data. In addition to requesting relevant data from various agencies and authorities in Samoa, a literature review was also undertaken. The literature review was undertaken involving searching the Internet and various databases for relevant reports and papers. Key documents obtained during this task included:

- Western Samoa State of the Environment Report (1993);
- Western Samoa National Environment and Development Management Strategy (NEMS) (1993);
- Western Samoa Environmental Legislation Review (1993);
- AusAID's Pacific Regional and Multi-country Waste Management Development Project Pre-feasibility Study Draft Report (1997);
- Western Samoan Government's Draft National Waste Management Policy (1997);
- Land Based Pollution Sources of the Marine Environment: A Case Study (1994);
- GKW Apia Sewerage Project, Water Quality and Biological Studies (May 1993).

A full list of the documents / information obtained during Stage 1 of the Project is attached in Appendix B.

All this information has been reviewed and, where relevant, incorporated in this Report.

2.3 REVIEW OF EXISTING WASTE MANAGEMENT SITUATION IN APIA, SAMOA

The review of the existing waste management situation encompassed a review of background data followed by a site investigation trip to Samoa. The site investigation trip occurred from Tuesday, 13 January to Friday, 23 January, 1998, during which the following activities were undertaken:

- Consultation with relevant Samoan Government Departments, ie. Departments of Environment and Conservation (DEC), Health, Agriculture, Treasury, Public Works, Foreign Affairs, Women's Affairs and the Water Authority.
- Consultation with NGOs eg. O Le Siosiomaga, Women's Organisations, National University of Samoa (Maria Kerslake), USP.
- Consultation with industry, eg., Yazaki, Aldan (waste collection contractor), West End (recycling company), and Jaffas, including inspection of facilities/equipment.
- Inspection of waste management activities and facilities, eg. typical waste storage, waste collection service, waste minimisation activities, the current waste disposal depot at Tafa'igata, and the old waste disposal depot at Vaitoloa on Vaiusu Bay.
- Inspection of waterways, creeks and drains around Apia, including in-situ water quality testing and sampling for bacteriological testing.
- A review of current waste management administration, including:
 - DEC structure, resources and funds;
 - relevant legislation, eg., Lands, Survey and Environment Act, 1989; and
 - activities of other relevant Government Departments eg Health, Public Works, Water Authority, Agriculture (Quarantine).
- A review of public awareness and education activities, including consultation with the DEC's Education Officer, the O Le Siosiomaga Society, the Department of Health, Maria Kerslake of NUS and others.
- A review of the activities of other donor, regional and international organisations in waste management, eg., SPREP, WHO, FAO, UNDP, AusAID.

The results of the above activities are described in the Section 3 of this Report.

A copy of the schedule of work undertaken whilst in Samoa is attached Appendix C.

3. EXISTING STATE OF WASTE MANAGEMENT IN URBAN SAMOA

3.1 GENERAL

The existing state of waste management was reviewed during Stage 1 of this Project, and encompassed the following:

- Solid waste;
- Liquid waste (sewage and other wastewater);
- Special wastes eg. medical waste, septage / sludges, waste oil, and asbestos;
- Hazardous wastes;
- Waste management administration;
- Activities of other donors and international organisations in waste management in the region; and
- Public awareness/education activities and public perception.

The following Sections describe the current situation.

3.2 SOLID WASTE

3.2.1 Littering and Indiscriminate Dumping of Solid Waste

It was observed that littering and indiscriminate dumping of solid waste in public areas, particularly drains and waterways, is a common occurrence in Apia, however, it was less prevalent than apparent during the AusAID mission in February 1997.

It was noted that the Apia town centre was particularly clean compared to 12 months ago and this can probably be attributed to the significant increase in street cleaning activities. According to the DEC, the number of street cleaning staff was increased from 5 to 15 in April, 1997. However, it was observed that cleaning appeared to be limited to easily accessible places and, as a consequence, litter could be found in less accessible places, for example, drains.

However, the reduction in littering and indiscriminate dumping of solid waste may also be the result of awareness and education programs which have been conducted by the DEC, including

television coverage, and focused on littering. The DEC has also promoted and organised an annual clean-up day.

It should be noted that despite the above activities, during water quality testing, numerous small dumping sites were observed. Surprisingly, many were within the current waste collection area. No reason for this was identified.

3.2.2 Domestic Solid Waste

Generation

Domestic solid waste encompasses solid waste generated by households. This includes food waste, packaging, paper, plastics, used containers such as bottles and cans, as well as garden / yard waste.

Some investigation work into the characteristics of solid waste in Apia, undertaken by Gangaiya (1994), is reported in the Urban Development Strategy prepared by GHD (1996). This involved surveying and measuring the wastes generated by 25 different premises, which included households (of various socioeconomic status.), offices, shops, hotels and motels. The results indicate a domestic waste generation rate of approximately 0.52 kg / person/day, comprising:

<input type="checkbox"/>	vegetable and food (organic)	45%
<input type="checkbox"/>	paper	13%
<input type="checkbox"/>	textiles	3%
<input type="checkbox"/>	plastics	8%
<input type="checkbox"/>	garden waste	14%
<input type="checkbox"/>	metals	14%
<input type="checkbox"/>	glass	2%

The study also indicated that the bulk density of the garbage being generated was 350 kg/m³.

Storage and Collection

Most households in Apia use a half 44 gallon steel drum to store their solid waste. This drum is kept at the road side, commonly on a wooden platform approximately 1 metre high to prevent disturbance by animals such as dogs (see photograph in Appendix E). The DEC has recently been promoting the proper storage of solid waste, to help minimise littering, encouraging householder to use bins and / or plastic bags (if they cannot afford to buy a bin).

In Apia, domestic solid waste is collected from households by a private waste collection company under a contract with the Samoan Government, which is administered by the Division of Environment and Conservation (DEC), Department of Lands, Survey and Environment. Funds for operating the service are obtained from the Government. No charges are made direct to the householders. The waste collection service caters for approximately 6,000 households in the Apia urban area (see Figure 3.1), and involves the kerbside collection of domestic solid wastes on a twice weekly basis.

The AusAID mission in February 1997 found that there were numerous complaints about the inadequacy of the waste collection service. The waste collection contractor (Aldan) advised that the annual contract sum (WST 250,000) was insufficient to provide a better service. Later in 1997 the contract sum was increased (to WST 350,000 per annum). During this Project it was noted that there were fewer complaints about the waste collection service, however, it was identified that due to the short contract period (2 years) the contractor advised that it was not possible to organise finance to upgrade the collection equipment. As a result the contractor has to persist with old equipment which is prone to breakdown. The contractor also complained about the access to the waste depot, particularly during wet weather, and about the number of punctures trips to the landfill caused.

There is no public collection of solid waste in areas beyond that shown in Figure 3.1. In these areas households and other premises dispose of their solid waste in a number of ways, including burial, burning, composting, and dumping onto low lying land, into gullies, creeks and the sea.

Tafa'igata Waste Disposal Depot

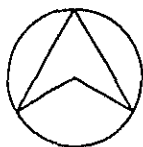
Domestic solid waste collected in Apia is currently disposed of at a waste disposal depot located in a rural area (Tafa'igata), approximately 10 km south west of the Apia town centre. See Figure 3.1 The depot was opened in 1992 and is operated by the DEC.

The waste disposal operation can be described as a classic "dump" with essentially uncontrolled tipping and little covering of waste. The site is staffed, but tipping of waste appears only semi-controlled. The pattern of filling appears quite random and it was advised that there is no plan for landfilling the site.

Although the site is staffed and there is a night watchman, the site is generally unfenced, allowing easy access for scavengers. Uncontrolled access to the site presents a potential health risks to the scavengers due to possible materials in the deposited waste, which could include hospital waste as well as hazardous type wastes.

Vehicle access to the site was quite reasonable on the days of inspection. The DEC advised that a new road was constructed in mid-1997. However, it is suspected that during wet weather access would not be good due to poor drainage of the road.

JICA SAMOA WAS PROJECT STUDY AREA



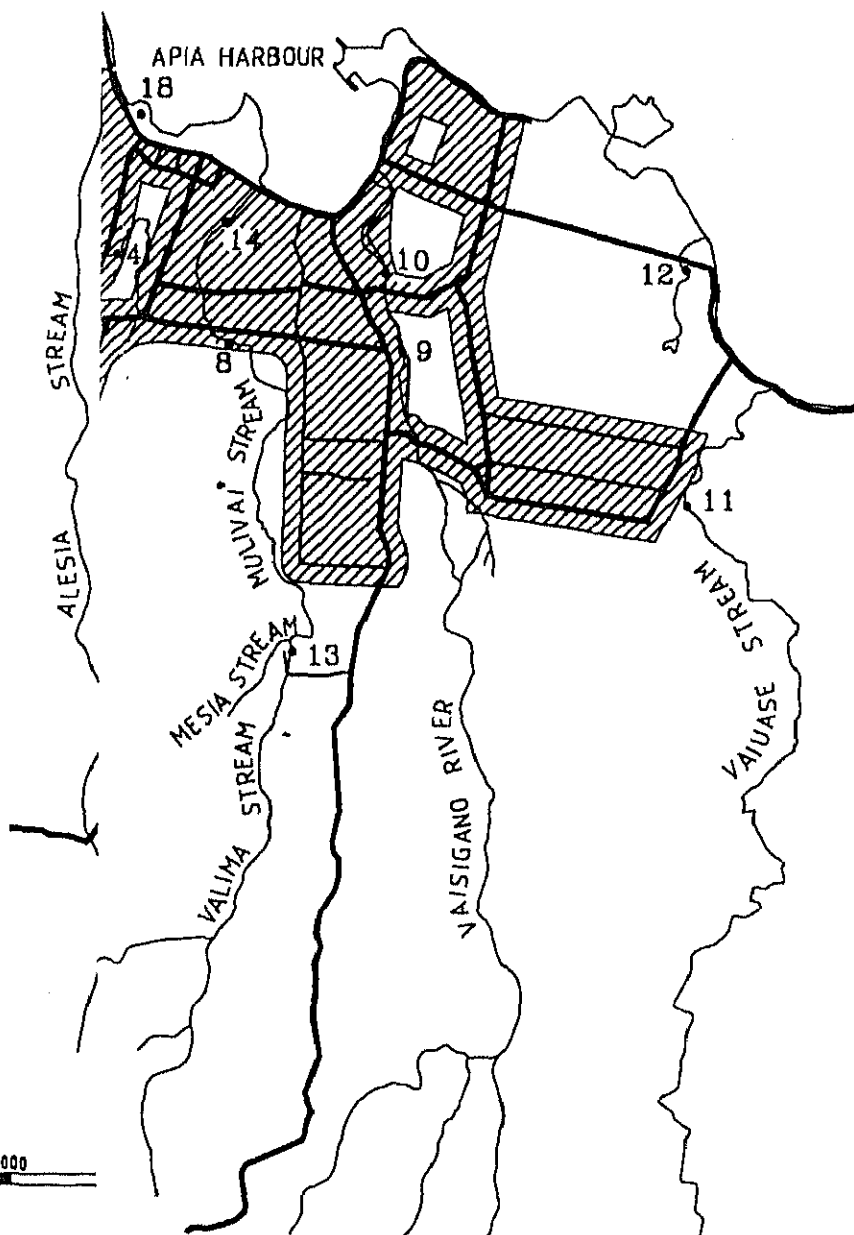
KEY TO WATER TESTING LOCATIONS

1. FULUASOU RIVER NEAR CRAIGS COMPOUND
3. VAITELE, OPPOSITE VAILIMA BREWERY
4. MANGROVE DRAIN AT FUGALEI
5. FULUASOU RIVER NEAR LEPEA
6. PAPASE'EA STREAM NEAR ALAFUA
7. GASEGASE STREAM AT VAIMOSO
8. MULIVAI STREAM AT LALOVAEA
9. VAISIGANO RIVER (HYDRO PS) AT LOTO SAMASONI
10. VAISIGANO RIVER AT LEONE
11. VAIVASE STREAM NEAR AIRPORT
12. MANGROVE DRAIN NEAR MOATA'A
13. VAILIMA STREAM NEAR NAFANNA
14. MULIVAI STREAM AT MAIST SCHOOL
16. FUGALEI DRAIN OPPOSITE TYRE SHOP
18. MAIN STORM DRAIN D/S OF CLOCK TOWER

LEGEND

 GREATER APIA URBAN AREA

0 200 400 600 800 1000



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FIGURE 3.1

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JICA SAMOA WASTE MANAGEMENT PROJECT


PROJECT STUDY AREA

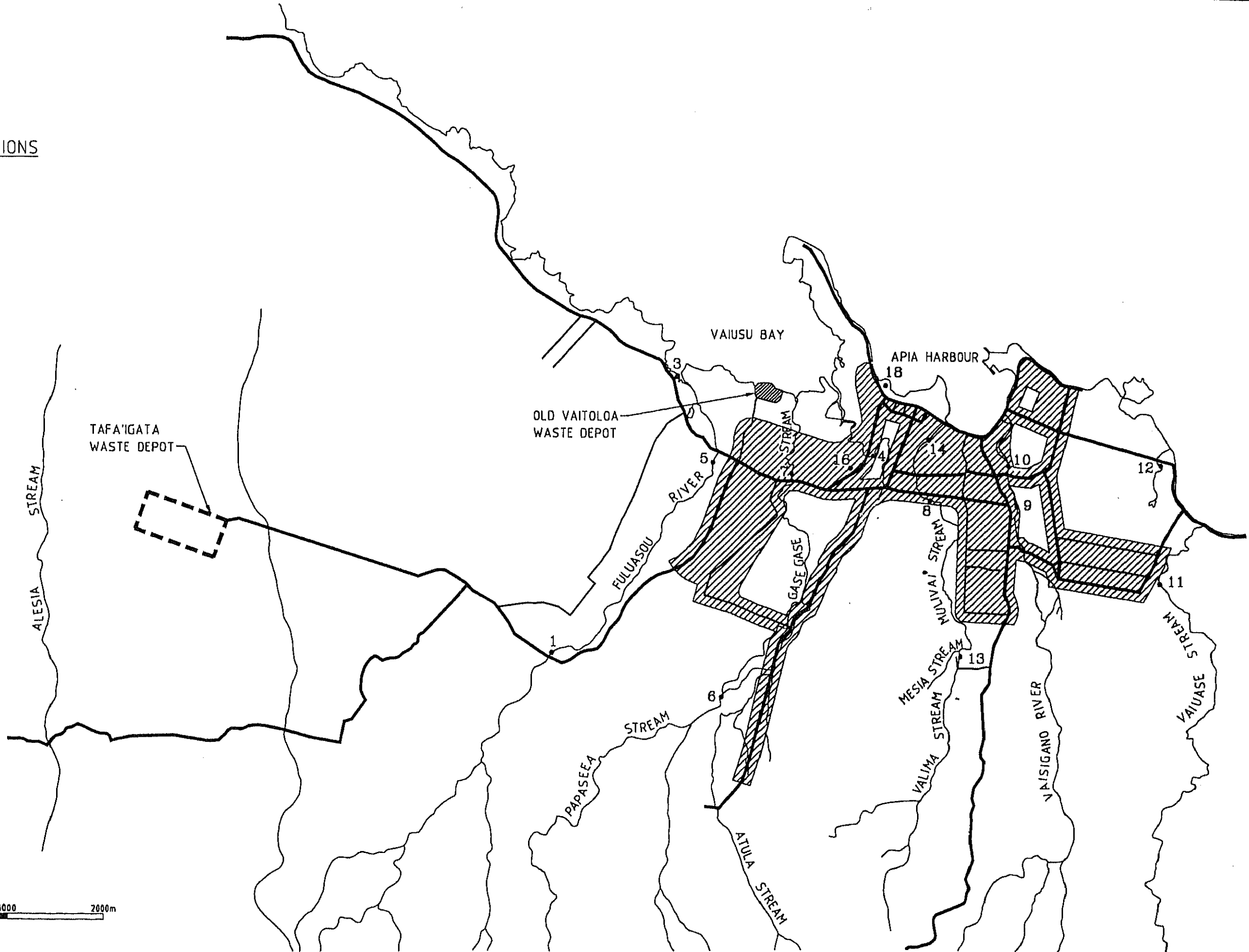


KEY TO WATER TESTING LOCATIONS

1. FULUASOU RIVER NEAR CRAIGS COMPOUND
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8. MULIVAI STREAM AT LALOVAEA
9. VAISIGANO RIVER (HYDRO PS) AT LOTO SAMASONI
10. VAISIGANO RIVER AT LEONE
11. VAIVASE STREAM NEAR AIRPORT
12. MANGROVE DRAIN NEAR MOATA'A
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14. MULIVAI STREAM AT MAIST SCHOOL
16. FUGALEI DRAIN OPPOSITE TYRE SHOP
18. MAIN STORM DRAIN D/S OF CLOCK TOWER

LEGEND

 GREATER APIA URBAN AREA



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FIGURE 3.1



There is no permanent landfilling equipment located at the depot eg. bulldozer or landfill compactor, and therefore little compaction and covering of the waste occurs. The DEC advise that a contractor is engaged on an as-required basis to spread, compact and cover the waste.

There are separate areas for the disposal of hospital waste, scrap steel, organic waste from the brewery and the coconut processing factory, and septage. The hospital waste and septage operation are described in Section 3.4. Scrap steel is kept separate in the hope that one day it may be able to be recycled. Organic waste from the brewery and coconut processing factory is disposed of in a separate area where it is allowed to decompose naturally. The decomposed material is often taken by local residents for use on gardens and farms. The DEC advised that the Giant African Snail is attracted to the heaps of waste and is causing problems.

A detailed inspection of the waste depot site identified that little is done to control or prevent environmental impacts as a result of the waste disposal operation eg. limited compaction and covering of the waste, no leachate (contaminated water) controls, no stormwater runoff controls, no landfill gas controls, no management plan for the depot. It would be expected that local groundwater and surface water is being affected by the waste depot operation, although the extent over which this occurs is not known.

The detailed inspection of the site included the excavation of three test pits to allow the underlying soils and rock to be classified. The results of this inspection identified that the soil depth at the site varies from less than 1 m to 2.5 m. The soils on the site are primarily silty in nature with some clay, which contain increasing amounts of basalt gravel with depth. In some cases the gravel pieces extended to the surface. The underlying bedrock is a highly vesicular basalt which is also appears highly fractured. Detailed logs of the test pits are attached in Appendix F along with photographs of the test pits. The primary conclusions that can be drawn from this investigation work include:

- The strata underlying the site would appear to be highly permeable and, as a result, any leachate generated by the landfilled waste would likely be contaminating local groundwater (subject to confirmation by more detailed hydrogeological investigation).
- Due to the rocky nature of the on site soils, there is limited suitable material available for the construction of a barrier (liner) to contain leachate generated by the landfilled waste. A liner could be constructed using the site soils but it would not likely meet Australian or international standards in terms of permeability requirements (meaning, it would likely leak).
- Due to shallow depth of soil on the site there is a limited supply of material for covering of the landfilled waste material. This will present some challenges when developing a plan for landfilling the site. In addition, should the complete soil profile be removed, leachate from any waste placed directly on the basalt would seep even more quickly to the underlying

groundwater, compared to the existing operation where waste is being placed generally at natural ground level.

The Water Authority reported that due to concerns about groundwater contamination, it decommissioned a groundwater bore in the vicinity of the waste depot and which was used for drinking water supply. However, the Water Authority reported that they did not have any data to confirm that the landfilling operation was contaminating the groundwater.

It was intended that, as part of this study, a waterway downstream of the waste depot would be tested to check for contamination as a result of the waste depot operation. However, there are no permanent waterways downstream of the waste depot. This is due to the topography of the area and the highly permeable ground. However, to obtain an indication of the quality of the surface water that may be running off the site during heavy rainfall, stagnant water which was ponding downhill of the landfilled waste was tested. The results of the testing indicated low dissolved oxygen levels (high organic content), high turbidity (approximately 400 NTU), and elevated levels of nitrate). The actual results of the testing are attached in Appendix F.

In completing this review of the Tafa'igata waste depot, some positive aspects of the depot that were identified include:

- A manned gatehouse.
- A detailed recording of vehicles and waste types entering the waste depot, including inspection of all vehicles entering the waste depot to check on the load.
- The large size of the site, which should be able to service the waste disposal needs of Apia for many years.
- The location of the site well away from residential areas.

Photographs of the site are attached in Appendix F.

Vaitoloa Waste Disposal Depot

Prior to the opening of the Tafa'igata waste depot, solid waste generated in Apia was disposed of at a waste dumping area at Vaitoloa. The depot was located on the edge of Vaiusu Bay. See Figure 3.1 According to the DEC the landfilling operation was a classic dump with no environmental controls and minimal maintenance.

The depot has been officially closed since 1992, however, indiscriminate dumping of waste has occurred at the site since closure, and remnants of waste material can be seen around the site. In the most part the site has naturally revegetated (mangrove and grass) even though the site was never properly capped and waste material is visible on the ground surface. There is also a large

amount of remnant steel lying around the site (parts of the old inter-island ferry) See photographs attached in Appendix G.

As part of this Project, a preliminary investigation of the site was undertaken to assess the current status of degradation of the landfilled waste. Given the location of the site next to Vaiusu Bay, the aggressive nature of a salt water environment and the high rainfall in Samoa, it was suspected that much of the waste should have been either stabilised by now or been leached away, even though only 6 years has passed since filling ceased (depending on conditions landfilled waste may take greater than 20 years to stabilise).

The investigation comprised the excavation of three test pits into the landfilled waste. The test pits were located progressively further from the shoreline of Vaiusu Bay. The purpose of the test pits was:

- Undertake a visual assessment of the condition of the waste material.
- Identify the depth of waste material.
- Identify the depth of any cover material.
- Determine the depth to the groundwater table (expected to be very shallow given the location of the site).
- Undertake insitu testing of the groundwater / leachate to obtain an indication of the strength of any leachate being generated and consequently an indication of the state of degradation of the landfilled waste.

The results of the investigation are attached in Appendix G. The results indicate the following:

- The landfilled waste at the site appears to have undergone significant degradation, particularly the organic material. The excavated material from the test pits looks much like soil, but contains a significant amount of plastic and metal.
- The depth of waste at the site varies from 0 - 1m, being 1m nearest the Vaiusu Bay shoreline and decreasing with distance inland (away from the shoreline).
- A layer of sediment / soil (up to 10 cm thick) has been deposited over the waste nearest the shoreline, which decreases in depth with distance from the shoreline. It is suspected that the sediment has been placed during water movement over the site during high tides and storms etc. Other parts of the site have no cover material and waste can be seen at the ground surface.

- The groundwater table was approximately 1 m below the existing ground level, although this increased with distance from the shoreline as the ground level rose.
- Testing of the groundwater indicated that degradation is still occurring and it is suspected will likely continue to occur for some time yet, albeit at a slow rate.

It was also noted that oil was particularly apparent in test pit no. 2, indicating that waste oil was disposed of at the site.

3.2.3 Commercial, Industrial and Other Solid Waste

Generation

Commercial, industrial and other solid waste encompasses solid waste generated at commercial and industrial premises, as well as other sites including building and demolition wastes.

Gangaiya (1994) undertook a broad waste characterisation study which encompassed households as well as offices, shops and some hotels and quantified the quantity and type of waste being generated. This data has been described in Section 3.2.2. As part of the same Study, Gangaiya (1994) also undertook a qualitative review of industrial waste generation. The types of commerce and industry identified included:

- food and beverage manufacturing;
- oil storage;
- mechanical work shops;
- photoprocessing and printing;
- saw mills;
- secondary products manufacturing eg. steel and aluminium fabricators;
- industrial chemical manufacturing;
- power plants; and
- other industries.

No specific waste characterisation data is available on the generation of commercial, industrial and other solid waste. However, during this Project it was identified that the DEC has been recording data on all vehicles that use the Tafa'igata waste depot. This is undertaken by the gatehouse attendant and information recorded includes vehicle registration, source of waste eg.

owner of vehicle, and the type of waste being dumped at the site. Most of this information relates to commercial and industrial solid waste as domestic waste is brought in by the waste collection contractor. The records kept by the DEC have been analysed, however, in their current form the data is of limited use. If this data is continued to be collected some changes are recommended. See the Report on the analysis of the data attached in Appendix L.

Storage and Collection

The storage of commercial, industrial and other solid waste varies greatly, depending on the type of premise and the quantity of waste generated. Waste containers observed included half steel 44 gallon drums, plastic bins, 240 L plastic mobile garbage bins (MGBs or "wheelie" bins), larger steel bins on wheels and steel open top dumpsters / skips.

Information collected during this Project indicates that all institutional, commercial, industrial, construction and demolition solid waste is required to be managed by the generator. However, many commercial premises in Apia make use of the domestic waste collection service, which services the area on a daily basis. This includes shops, stores, hotels, and offices.

Other premises, including industrial premises, generally transport and dispose of their solid waste at the Tafa'igata waste disposal depot. Some premises utilise a private waste contractor to provide waste collection and disposal services, including hire of a large steel bin eg 1.5 m³ in capacity, but many take their own solid waste to the waste depot. According to advice from two of the existing waste collection contractors, an increasing number of businesses are using private waste collection services.

Disposal

As for domestic solid waste, solid waste from commercial, industrial, and other sources is disposed of at the Tafa'igata waste disposal depot. Prior to 1992, such waste is disposed of at the Vaitoloa waste disposal depot. This operation has been described in Section 3.2.2.

3.2.4 Solid Waste Minimisation

Solid waste minimisation encompassed all activities which are undertaken to avoid and reduce waste generation and disposal. This includes:

- waste avoidance measures such as education programs;
- waste re-use eg. soft drink and beer bottles;
- waste recycling eg. of glass and aluminium cans; and

- waste reprocessing eg. composting.

During this Project, it was identified that some waste minimisation activities are occurring in Apia, however, the quantities of waste involved are believed to be limited.

Traditionally, all food scraps and other edible organic wastes are fed to the family pigs, chickens and dogs. This still occurs at many households, even in urban areas. It was identified that larger scale composting is being investigated by the Department of Agriculture (at Nu'u), the O Le Siosiomaga (who are pursuing commercial organic waste generators eg. brewery and coconut processing factory), and the University of South Pacific's School of Agriculture.

Glass beer bottles and some glass soft drink bottles are being re-used by a local beer and soft drink manufacturer. This is encouraged via a deposit refund on all bottles and bottle crates. However, several other soft drink manufacturers are now using PET bottles. Originally a deposit refund was offered for returned bottles, however, this is no longer paid and the collected bottles are disposed of at the Tafa'igata waste disposal depot.

Recycling of metals is also occurring in Apia. A private company collects scrap steel (primarily), aluminium (cans), copper and other valuable metals eg. lead and brass, for export to recycling markets. This particular company has advised that paper and glass recycling is not currently economically viable as the value of the material collected is less than the cost of collection and transport to markets.

3.2.5 Impacts on the Environment

Considering the information obtained during this stage of the Project the following environmental impacts are occurring:

Littering and Indiscriminate Dumping of Solid Waste

- Continued degradation of the quality of local waterways and drains, visually and environmentally.
- Continued visual impact.

Solid Waste Storage and Collection

- Litter, resulting from the lack of use of secure garbage containers.
- Consequent visual and environmental impact of the litter.
- Continued dumping of solid waste into streams and drains on the fringe areas of greater Apia where houses are not served a waste collection service.

Solid Waste Disposal

- Detrimental impacts on groundwater and possibly surface water quality impacts in the vicinity of the Tafa'igata waste depot, which could be impacting on local water resources eg. Water Authority's bore and possibly other freshwater springs downhill at Vaitele. Note this would be being caused by not only the landfilled waste but also the septage disposal activities.
- Nuisance created by the Tafa'igata waste depot eg. flies, vermin, odour and possibly dust, although primarily to users of the site due to the site's reasonably remote location.
- Potential health risks by allowing uncontrolled access and scavenging at the Tafa'igata waste depot.
- Continued leaching of contaminants from the Vaitoloa waste depot site, albeit at a slow rate, and consequent impacts on Vaiusu Bay.

3.2.6 Quarantine Waste

Quarantine waste is managed by the Department of Agriculture. AusAID recently (1995) provided two incinerators for quarantine waste: a large one at Faleolo International Airport and a small one at the main Apia Harbour Wharf. It was reported that the two incinerators should be swapped as most quarantine waste is generated at the harbour wharf. It was also reported that on occasions quarantine waste is disposed of at the Tafa'igata waste depot with the approval of the DEC ie. when there are unusually large quantities. The Department advised that they may be willing to accept medical waste at the Airport Incinerator, but due to Government policies they would need to charge the Health Department for such a service.

3.3 WASTEWATER (SEWAGE)

3.3.1 Domestic Wastewater

There is no centralised public sewerage system in Apia, Samoa. Wastewater generated by residential premises in urban areas is managed on site by a variety of systems, including septic tanks with soakage facilities (the most common system), pour-flush toilets, pit latrines and simple toilets over drains, creeks or the sea.

3.3.2 Other Wastewater

Wastewater generated at institutional, commercial and industrial premises is also managed on site, in a similar manner to domestic wastewater ie. septic tanks with soakage facilities. However, some of the larger premises, including some hotels, institutional buildings (National Hospital and other Government Buildings), commercial / industrial premises such as the brewery and Yazaki, have larger, more sophisticated treatment plants, with treated effluent being discharged to nearby drains or creeks or re-used.

The Vailima Brewery has a larger septic system which is used to treat the process wastewater as well as the sewage from amenity facilities on site. The effluent from this plant is discharged into the sea via a short outfall at Vaitele. According to Gangaiya (1994), the treated effluent contains a high level of organics and nutrients and is causing several impacts including algal growth and odours.

The Yazaki sewage treatment plant was inspected. The facility treats the sewage generated by more than 2,000 staff and the effluent is re-used as toilet flush water, thereby reducing the company's potable (mains) water demand. The treatment facility comprises a biological reactor, sedimentation tank, sand filter and ultra violet disinfection unit.

3.3.3 Impacts on the Environment

According to GHD (1996), a detailed study of freshwater and coastal water quality was undertaken in 1992/93 by GKW Consult. This study concluded the following:

- Sewerage contamination (high indicator bacteria, low dissolved oxygen, high biochemical oxygen demand (BOD), and high nitrogen) of freshwater was widespread in Apia.
- Testing of spring flows at Vaitele indicated sewerage contamination was occurring.
- Sewerage contamination has reduced the quality and natural environment values of the freshwater habitats around Apia.
- Water quality in the offshore West Reef was very good, apart from variable but generally high concentrations of nitrogen resulting from organic matter (predominantly land vegetation) washed into the coastal areas during heavy rainfall.
- The quality of Apia harbour was influenced by inflow from the Vaisigano River and Mulivai Stream, which cause reduced salinity and high suspended solids during heavy rainfall.

- Vaiusu Bay water quality was influenced by drainage water from Apia town and waste inputs at the eastern end of the bay and in the Vaitele area (as evidenced by high indicator bacteria, high nitrogen levels, large quantities of organic matter, plastic, paper, and cloth).

The GWK Report concluded that if the existing wastewater management practices continued, there would be increased degradation of freshwater and coastal waters, and there would be the possibility of serious algal blooms and major risks to public health (to people consuming seafood from the area and to people involved in water contact).

As part of this Project in-situ water quality testing was undertaken in a number of streams and waterways in and around Apia. The location of the testing is shown in 3.2. The in-situ testing encompassed testing the water using field equipment and test kits for the following parameters:

- pH;
- temperature;
- conductivity (and salinity);
- turbidity;
- dissolved oxygen;
- nitrate;
- nitrite;
- ammonia; and
- phosphate.

In addition, samples of the water were taken and analysed in a local laboratory for sewerage indicator parameters eg. faecal coliform and faecal streptococci.

The results of the testing indicate the following:

- the drains and waterways in and around Apia town are being impacted by current wastewater management practices, as indicated by low dissolved oxygen levels, elevated levels of nitrogen, high levels of ammonia, elevated turbidity, and high levels of faecal indicator bacteria.
- particular drains and waterways which are being affected include:
 - drains in the low lying western area Apia town flowing west into Vaiusu Bay (mangrove area);
 - main stormwater drain north of Apia town centre, flowing into the sea near the fishing boat wharf;
 - Mulivai Stream (from the hospital down to the sea);

- waterway at Vaitele;
- Gasegase Stream at Vaimoso;

A summary of the results and the raw test data is attached in Appendix D.

The above testing confirms the results of previous investigations undertaken by others eg. GKW Consult, ie. that wastewater from all premises is impacting on local streams around Apia, and consequently the need for changes in wastewater management practices.

Further information to support the need for changes to current wastewater management practices was provided by the WHO which indicates that many health problems are likely influenced by the poor local surface water quality, and this is reflected in the high number of cases of diarrhoea and gastroenteritis that occur in Samoa. These diseases are among the most common in Samoa.

3.4 SPECIAL WASTES

3.4.1 Medical Waste

Medical waste is generated in Apia by the public hospital and 4 private medical practices.

Medical waste generated at the National Hospital in Apia is currently managed by hospital maintenance staff. According to the Department of Health, contaminated wastes such as soiled bandages, dressings etc are separated and burnt on site in an old incinerator.

According to the Western Samoa State of Environment (SOE) report, SPREP(1996), separation and collection of medical waste at the hospital, including sharps and contaminated bandages and dressings, is inadequate, often resulting in the incorrect disposal of such wastes eg. disposal with general solid waste. Discussion with various people confirmed that this was still the situation. A Draft Hospital Waste Management Plan was obtained, which addresses this issue, however, the plan is yet to be implemented. The Department of Health advised that one of the major hurdles to implementing improved waste separation in the hospital is the lack of funds to purchase the appropriate containers.

The hospital waste incinerator was inspected. The Department of Health advised that the incinerator was some 30 years old and was not functioning properly. The diesel fuel firing system is no longer functional and the incinerator is fired using paper and wood. It is considered that such a method of operation would not achieve the desired combustion temperatures to efficiently burn the contaminated wastes. We believe this suspicion is confirmed by reports that the incinerator generates a lot of smoke. Advice to the 1997 AusAID team from the Department of Health was that the incinerator needs to be replaced.

Separated sharps from the hospital are disposed of at DEC's waste disposal depot in a separate trench, away from the public waste disposal area (see photographs attached in Appendix E). According to the DEC, the deposited medical waste (sharps) is manually covered after each load by DEC staff at the waste depot site. However, during the inspection of the medical waste disposal area at waste depot site, it was identified that the load of waste in the pit has been uncovered for a number of days.

Disposal of medical waste at the 4 private practices within Apia is the responsibility of the generator. The current collection and disposal practices are not known. The Department of Health advised that the waste is not disposed of at the hospital and as such it is suspected that the waste is being disposed of via the domestic / household waste collection service and therefore is being deposited at the Tafa'igata waste depot with other general solid waste. This presents some concern particularly considering the scavenging that occurs at the waste depot.

3.4.2 Septage / Wastewater Sludges

Wastewater sludges are generated by septic tanks and other wastewater treatment plants within and around Apia. According to information collected during the Project, currently these facilities are de-sludged on an as required basis ie. generally when the tank is full of sludge and overflowing.

De-sludging of septic tanks and wastewater treatment plants is undertaken by the Department of Public Works who have one tanker. A number of private companies also have tankers for de-sludging septic tanks. A fee is charged for the de-sludging service. De-sludging fees range upwards from WST 75, depending on volume.

Collected sludge is disposed at the Tafa'igata waste disposal depot in specially excavated trenches in an area separate from the general waste disposal area (see photographs in Appendix E). The septage is primarily water which slowly evaporates and seeps into the underlying strata. Given the highly permeable underlying strata, it is suspected that most of the septage water seeps into the underlying strata and ultimately into the local groundwater.

3.4.3 Waste Oil

A regional study into waste oil by the United Nations (March 1996) estimated that some 600,000L of oil is used each year in Western Samoa. Current practices for disposal of the waste oil are not known, however, some was being recycled at a recycling plant located in Apia by Aegis Oil (managed by a local business man).

The oil recycling process essentially involved heating to drive off lighter hydrocarbons, acidification, addition of diatomaceous earth, sedimentation and filtering. The product is a base

oil which may be mixed with additives to create a range of oils for various uses, including motor vehicle engines and gearboxes.

The oil recycling plant was not operational at the time of the Stage 1 investigation. The reasons for this are unknown, however, when interviewed by the AusAID mission in February 1997, the owner advised that there was a lack of support for the business from the local market and the Government, even though the waste oil is collected free of charge from within Apia.

It is suspected that waste oil is being disposed in a number of ways including disposal at the Tafa'igata waste depot, discharge into septic tanks, and possible dumping into drains, creeks, the sea, gullies and onto land. During this investigation waste oil was observed in the septage disposal pits at the Tafa'igata waste depot (see photographs in Appendix E), confirming that oils are being disposed of via the septic system. Waste oil was observed in the landfilled waste material at the old Vaitoloa waste depot, suggesting that waste oil is being disposed of at the Tafa'igata waste depot. It was also reported that waste oil was used to mark out playing fields and was burned.

3.4.4 Asbestos

Waste asbestos materials generated within the Apia area are managed by the Department of Health. Disposal is by burial at a separated area at the DEC's waste depot. Quantities of waste asbestos materials are not known.

3.4.5 Motor Vehicle Batteries

The current practices for the disposal of motor vehicle batteries are not fully known, however, some motor vehicle batteries are recycled in Apia by a private company which recovers the lead for export to recycling markets. The means of disposal of the battery acid and plastic case are not known.

3.4.6 Impacts on the Environment

Considering the information obtained during this stage of the Project the following environmental impacts are occurring:

Medical Waste

- Suspect emissions from the hospital's waste incinerator, and consequent impacts on people in the vicinity of the incinerator.

- Potential health risks from contact with the sharps at the Tafa'igata waste disposal depot.
- Potential health risks to scavengers at the Tafa'igata waste depot from exposure to medical waste (potentially from the private medical clinics).

Septage / Wastewater Sludges

- Poor performance of septic systems, due to lack of maintenance (desludging), resulting in impacts on the quality of water in local drains and creeks in Apia as well as local groundwater. These impacts have been discussed in Section 3.3.
- Contamination of groundwater underlying the Tafa'igata waste depot, due to the current septage disposal in pits at the depot.

Waste Oil

There are no disposal facilities operational in Apia. As a result disposal practices are not specifically known, however, suspected disposal practices include disposal at the Tafa'igata waste depot, discharge into septic systems (identified) and indiscriminate dumping onto land and into waterways. Potential impacts from these activities would include:

- Contamination of groundwater and surface water runoff at the Tafa'igata waste depot.
- Contamination of groundwater and surface water receiving oil contaminated effluent from septic system.
- Oil contamination of land and waterways (not observed).

Asbestos

Asbestos disposal presents primarily an occupational health and safety issue associated with storage and handling, rather than an environmental issue. Once asbestos is properly landfilled it no longer presents a threat to humans or the environment as it does not degrade and is not leachable.

Motor Vehicle Batteries

There are no facilities for the disposal of motor vehicle batteries. However, it is known that recovery of the lead for export and recycling is occurring (quantities unknown). Other disposal activities are not specifically known but would include disposal at the Tafa'igata waste depot. Potential environmental impacts from these activities could include:

- Possible impacts from the disposal of the battery acid (during the recycling operation), if dumped on land or in local waterways (possibly via the septic systems).

- Possible impacts on surface water and groundwater at the Tafa'igata waste depot (due to the acid in the batteries, however, given the buffering capacity of the waste material and the likely small quantities of acid this is not considered a major issue.

3.5 HAZARDOUS WASTES

It was identified during the Project that hazardous wastes and contaminated sites will be investigated under a SPREP project (funded by AusAID) - Management of Persistent Organic Pollutants (POPs) in Pacific Island Countries. As a result no further investigation of this waste stream was undertaken. However, the following information was obtained from the AusAID Report (1997).

Chemical use in Apia is not known nor regulated, although the types of chemical entering Western Samoa is controlled by customs. As a result, no information on waste disposal practices is available. However, it is known that waste timber treatment chemicals (copper/chrome/arsenic) did cause a problem at the Vaitele industrial area some years ago when drums at the disused site, which contained old chemicals, began leaking. The fire brigade disposed of the chemicals at the DEC's waste disposal depot. Another timber mill at Asau was also known to use copper/chrome/arsenic and as a result there may be contamination at the site.

It is also known that some old transformers are likely to contain oil which contains PCBs. Currently, old transformers are stockpiled at various locations around the island at Electric Power Company facilities. Essentially, the transformers are slowly rusting away along with other old equipment which is no longer used or serviceable.

3.6 WASTE MANAGEMENT ADMINISTRATION

3.6.1 Policy and Planning

General

Two primary documents were obtained which identify the Samoan Government's policy / strategy in regard to waste management. These are:

- The Western Samoan National Environment and Development Management Strategy (commonly referred to as NEMS).
- The Samoan Government's Draft National Waste Management Policy.

These documents are outlined in the following paragraphs.

National Environmental and Development Management Strategy (NEMS)

The NEMS was prepared in 1993 by a consultant working with a local "national" co-ordinating committee. In regard to waste management the document identified four objectives:

1. To prevent the pollution from domestic and industrial waste.
2. To reduce the amount of waste disposal and treatment.
3. To collect, analyse and disseminate information on waste management and related activities.
4. To create public awareness of the sustainable and safe management of waste, including toxic chemicals.

The document identifies numerous general activities to achieve the stated objectives, but focuses on three specific projects:

1. Preparation of a National Waste Management Strategy.
2. Improving hospital waste management.
3. Investigating and developing an integrated biogas project, aimed at managing highly organic liquid wastes such as septage, piggery waste and industrial organic wastes.

According to information obtained during this study the current status of the NEMS program is:

- A Draft National Waste Management Policy has been prepared by the DEC, as a first step prior to the development of a National Waste Management Strategy. This is discussed further below.
- No progress has been made on the hospital waste management project, although it was identified that a Draft Hospital Waste Management Plan was prepared by Department of Health staff which addressed some of the issues identified in the NEMS project outline, however, the Plan has not yet been implemented.
- No progress has been made on the biogas project.

Draft National Waste Management Policy

A Draft National Waste Management Policy was prepared by the DEC and submitted to the Minister for Land, Survey and Environment in 1997. The document identified the goal of the policy, provides an overview of the current waste management situation in Samoa, identifies the

main issues that need to be tackled, outlines the guiding principles adopted in developing the policy, defines the policy objectives and outlines an implementation program.

The six major waste management issues identified in the National Waste Management Policy are:

- The direction of economic development;
- A contaminated and unhealthy environment;
- Inadequate land use management;
- Degraded marine environment and accelerated deforestation of catchments;
- Threats to surface water and ground water quality; and
- Atmospheric pollution.

To address the above issues, the Policy outlines objectives which are similar to those in the NEMS:

1. To minimise, and prevent where possible, solid, liquid, and gaseous wastes from all sources.
2. To reduce the amount of waste for disposal and treatment.
3. To collect, analyse and disseminate information on waste management and related activities in objectives 1 and 2.
4. To create and promote awareness of the sustainable and safe management of waste, including toxic chemicals.
5. To establish control mechanisms, collection programs and disposal options that minimise environmental impact as much as possible for wastes that cannot be prevented.

The DEC advised that no response has yet been received from the Minister on the Draft Policy, although this has been promised in early 1998. After the document has been finalised, it is intended that the policy will be submitted to Cabinet for adoption by the Samoan Government in the second half of 1998.

3.6.2 Legislation and Regulations

Samoa has no specific and comprehensive legislation covering waste management. Aspects of the legislative system that can be applied to the management of wastes are included in the Agriculture, Health, Water, and Environment regulations. Details of the relevant regulations are given below.

The current legislation provides no enforceable regulations for Environmental Impact Assessment (EIA). EIA regulations have been drafted, but they have not been promulgated into law. Government has endorsed a policy of requiring EIA for all major projects, but this is not always applied effectively, either being omitted altogether, or being implemented long after the initial planning stage. It is not clear whether waste management is given serious consideration in the application of EIA. For example, were waste issues considered when one local soft drink manufacturer (Pepsi) was allowed to begin production using non-recyclable plastic bottles, while the main competitor was using recyclable glass bottles?

Another issue that has been proposed several times in draft legislation is the establishment of Management Authorities for urban areas in Samoa. If this was brought into effect it could provide an alternative management system for wastes (local government), which has proved effective in other countries.

The major legislative ordinance that can be used to manage wastes is the *Lands, Surveys and Environment Act 1989*. This was derived from the Land Ordinance 1959, to which certain environmental provisions, borrowed from overseas legislation, were added (Peteru, 1993). Although the Act itself does not specifically create the Division of Environment and Conservation (Peteru states that the Act refers to 'the Department'), it did in effect lead to the formation of the DEC. Under Division 8 of Part VIII of the Lands Survey and Environment Act 1989, the DEC is charged with the responsibility for solid waste management in Samoa under the title 'Control of Litter'. The provisions can be summarised as follows (Gangaiya, 1994):

- A) The Minister for Lands, Survey and Environment has the authority to designate Government or State land as a site for waste disposal by notification in the Gazette.
- B) Under the Act, it is an offence to litter a public place or to litter private land without the owner's consent. Provisions are available to:
 - 1. require offenders to clean up litter;
 - 2. instantly fine litterers WST 10;
 - 3. fine offenders, upon prosecution in court, up of WST 500 (individuals) and WST 5,000 (companies);
 - 4. fine offenders (after court prosecution) for refusing to comply with clean-up requirements.
- C) Administrators or owners of public places are required to provide rubbish bins and arrange for regular and efficient emptying mechanisms.

- D) DEC officers have the following powers to enforce the law:
1. prevention of littering of public places or private land;
 2. requiring offenders to remove litter;
 3. levy instant fines of WST 5
 4. offenders must provide their names and addresses
 5. charge offenders for not complying with the above provisions.
- E) The Department of Lands Survey and Environment can enter into contracts to fulfil its requirement to undertake solid waste management.

Implementation of this legislation has met with a number of difficulties. As discussed elsewhere, the DEC has a limited and defined budget for waste management activities. All the requirements for effective and efficient waste collection, transportation and disposal cannot be met with the present budget allocation. As a result, operations and activities must be prioritised, and some desirable actions cannot be completed. There are technical and cultural difficulties with attempting to apply the instant fine provision, particularly when a young DEC officer is dealing with an elderly Samoan. In addition, the cost of prosecuting offenders in court is now often more than can be recouped in the fines, if the case is successful. Few cases, therefore, ever proceed to court.

Other factors contributing to ineffective application of the legislation include the lack of specific requirements on the time intervals for rubbish removal, and for the handling of hazardous wastes.

Under Division 6 of Part VIII of the Lands, Survey and Environment Act, individuals and companies cannot discharge refuse matter of any kind into Samoan waters, or deposit wastes in places where they can be washed into water resources causing pollution. Regulations to control industrial waste discharge into coastal waters, however, have yet to be formulated.

The *Health Ordinance 1959* also contains provisions which relate to waste management, particularly sewage. A number of regulations in this ordinance, together with the *Samoan Village Regulations 1938*, control the construction of and maintenance of privies and other domestic operations which create situations which are offensive or dangerous to health. Fines under these regulations are, however, small (usually a maximum of tens of WST), and court action is usually needed for implementation.

Other legislation that may be utilised in waste management include *Petroleum Act 1984*, *Shipping Act 1972* and the *Port Control Regulations 1939*, which can be invoked to manage oil and ship wastes. The *Poisons Act 1958* can be utilised in the management of toxic chemicals,

including pesticides, and hazardous waste. Minimisation of wastes at source can be implemented using the *Customs Tariff Act 1975*, while the *Enterprise Incentives and Export Promotion Act 1992* can be used to provide incentives for effective utilisation of resources, and recycling of waste products (Peter, 1993). Improvement of consumer awareness of food and store packaging could be developed through provisions of the *Consumer Information Act 1988*.

Provisions of the *Water Authority Act 1993* to protect water resources can be implemented in the management of wastes. Inappropriate disposal of wastes can create major water pollution problems, and since protection of water quality is critical for national development, this provides another mechanisms to address poor waste disposal, particularly with reference to sewage. Cooperation between the Water Authority and DEC should be investigated in this context.

Peteru (1993) has recommended that imports be screened and preference given to alternatives which are 'biodegradable, non-toxic, durable, reusable, repairable or recyclable', and that tariffs on environmentally sound products be reduced or eliminated, with unfriendly products be banned or attract a high rate of duty.

3.6.3 Administration / Institutional Arrangements

General

As noted earlier, legislation relating to waste management in Samoa places responsibility on several government departments. These are the Division of Environment and Conservation within the Department of Lands, Survey and Environment (DLSE), the Department of Agriculture, the Department of Health and the Public Works Department. The main agency is the DEC, however the following paragraphs outline the roles and responsibilities of each of the Departments.

Department of Agriculture

The Department of Agriculture is involved primarily because of its responsibility for quarantine and for agricultural chemicals, including pesticides. A Pesticide Committee has been in operation for some time and a proposal to expand its role to take greater responsibility for all chemicals (especially hazardous materials) has been forwarded to the Director of Lands for consideration and presentation to Cabinet. This proposal would lead to an improvement in chemicals management, as the expanded Pesticide Committee would have representatives from all the Departments involved in waste management.

Quarantine operations occur mainly at Apia port and at Faleolo airport. The Department of Agriculture has an incinerator at each site, which seem to be working well, having the capacity to incinerate more material than current requirements.

The Agriculture Department also has a strong interest in sludge reuse and composting as these could provide valuable organic materials and nutrients for addition to the relatively infertile Samoan soils at a cost that would be competitive with imported fertilisers.

Department of Health

The Department of Health has an Environmental Health Unit to implement those provisions in the Health Act and related legislation that relate to the environment. This Unit is supposed to check on water quality (except drinking water which is the responsibility of the Water Authority), food distribution outlets, assess the Tafa'igata dump (for vermin, flies mosquito breeding areas), and play a role in approval of building permits to ensure that proposals present no health risks. The Health Education Unit undertakes public awareness campaigns, but these are limited by available funds, and usually do not focus on specific issues like waste management.

A major issue for the Department is the management of hospital and other medical wastes. This is discussed elsewhere, with the problem of incineration being identified. The possibility of using the Agriculture Department's incineration facilities has been discussed locally, but no satisfactory outcome has been achieved to date.

Co-operation with other government departments, particularly the DEC, seems satisfactory on paper (through government committees, eg., NEMS, Pesticide Committee), but in practice may suffer as a result of staff having such a wide range of activities.

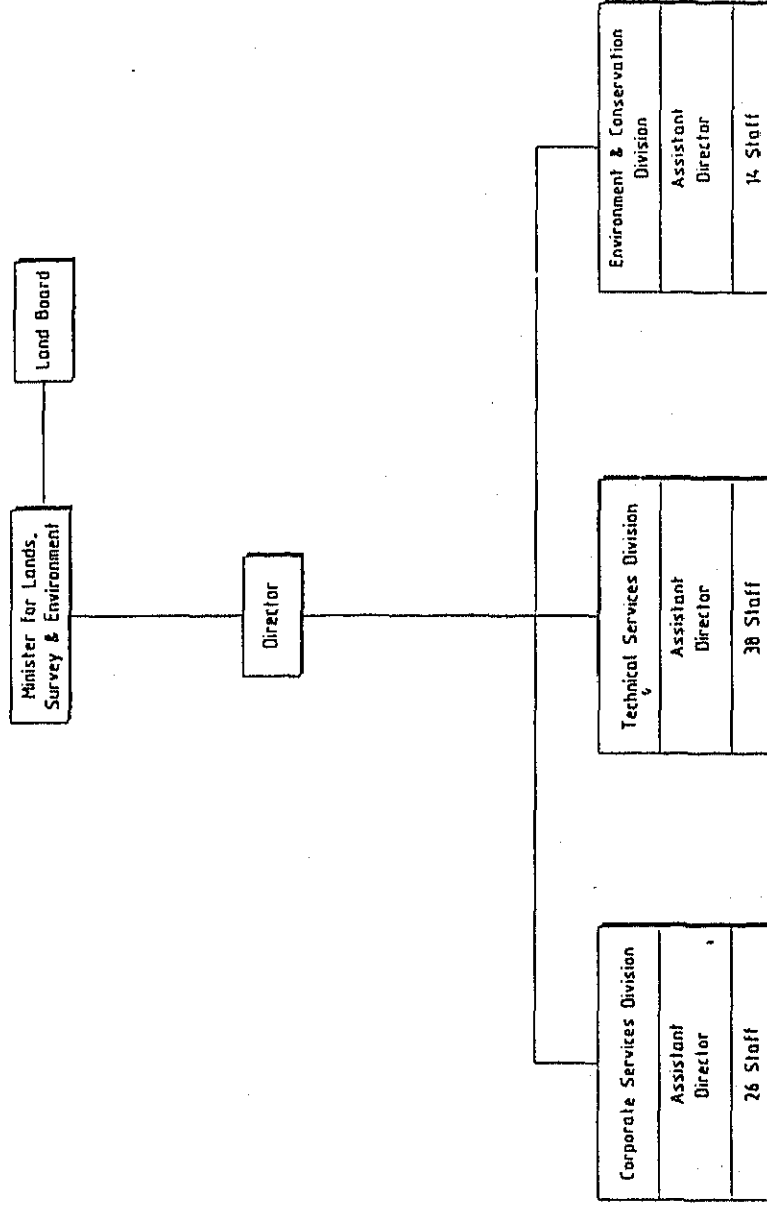
Public Works Department

The Public Works Department has a key role in waste management with its involvement in the approval of building permits. Applications must include provision for wastewater and sewage disposal, and by ensuring that such systems are appropriate for the building and the surrounding environment, PWD could play a major part in improving management of such materials. The main problem identified is that there is no rigorous inspection of buildings during construction to ensure that the approved system has actually been installed. This issue needs to be addressed, and this responsibility should be clearly allocated to a particular organisation (whether it be Health, PWD or DEC).

The Department of Lands, Survey and Environment (DLSE)

The major legislative ordinance relating to waste management is the Lands, Survey and Environment Act, 1989, which is administered by the DLSE. The authority of the Department has been described in Section 3.6.2. The DLSE operates through 3 divisions; Corporate Services, Technical Services, and Environment and Conservation, as shown in Figure 3.2. Figure 3.2 also shows the number of staff in each division.

JICA SAMOA WASTE MANAGEMENT PROJECT
 DEPARTMENT OF LANDS, SURVEY & ENVIRONMENT - GENERAL STRUCTURE



The Division of Environment and Conservation (DEC) is responsible for administering the environmental aspects of the legislation. Currently the DEC has 14 staff, and Figure 3.3 shows the current structure of the Division which is separated into 2 units. One unit focuses on national parks and reserves and the other focuses on environmental planning and education. A lack of resources has been acknowledged by the head of the DEC, who is now seeking to re-organise and increase the division size to 20 staff. The proposed new organisational structure is shown in Figure 3.4. Note that this proposed structure is yet to be approved and a revised (enlarged) budget obtained. It is interesting to note that the new structure does not show an officer directly responsible for waste management. Considering the work necessary to improve current waste management activities thought should be given to allocating an officer to specifically manage waste management activities.

The current budget (1997/98) of the DEC is outlined below:

Environment Management Services	\$ 1,024,255
Waste Management	\$ 559,226
National Environmental Management and Monitoring	\$ 128,784
Biodiversity National Parks	\$169,577
Educational Public Awareness	<u>\$ 166,668</u>
TOTAL	\$ 2,048,510

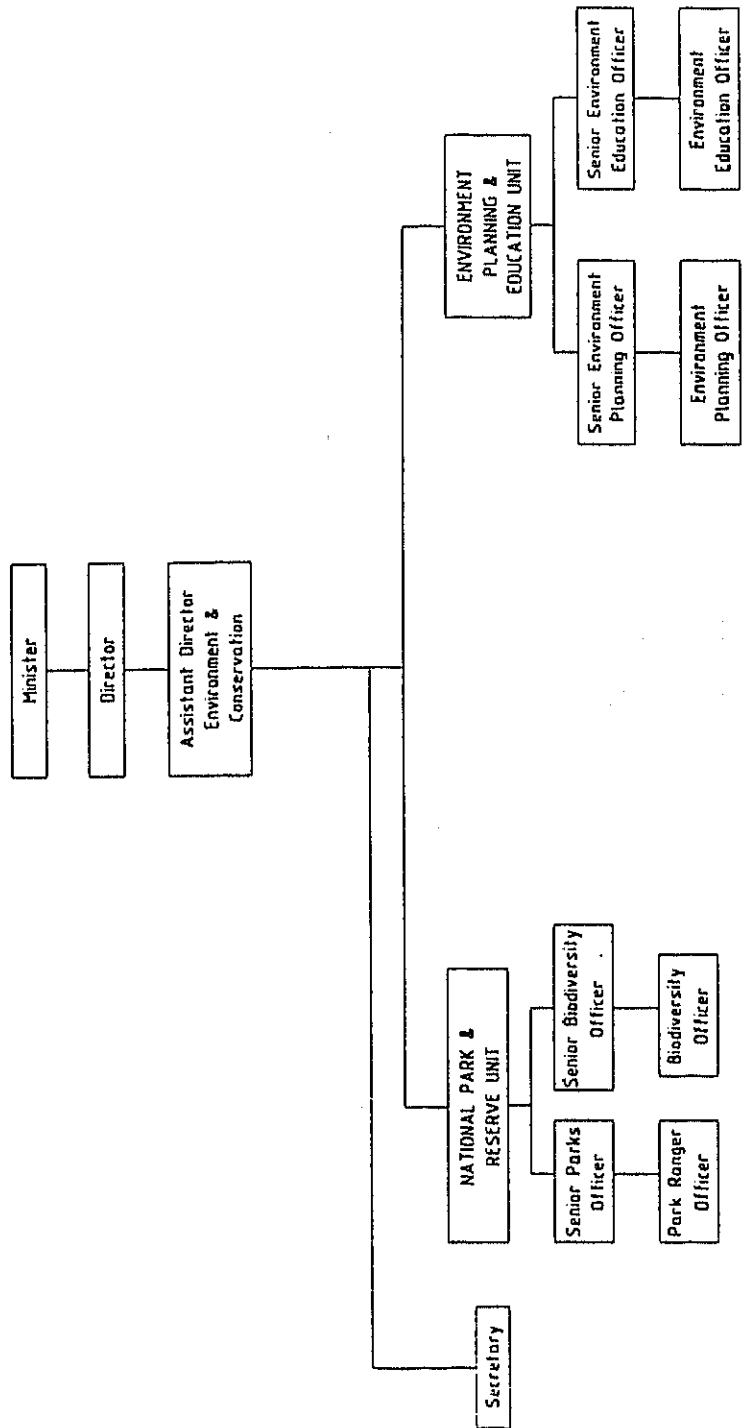
3.7 ACTIVITIES OF OTHER DONORS AND INTERNATIONAL ORGANISATIONS

3.7.1 General

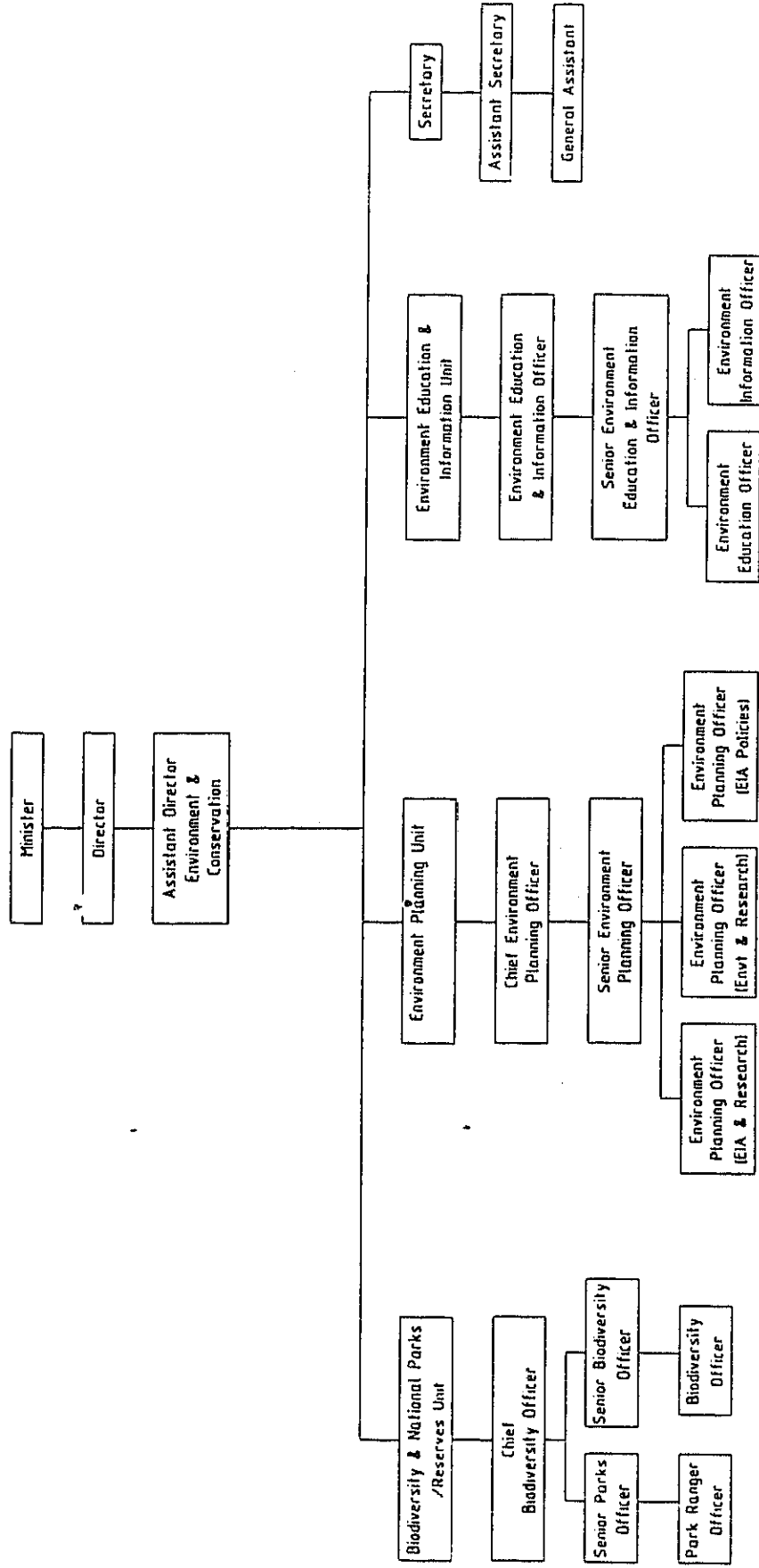
The activities of the following donors and international organisations were identified:

- Asian Development Bank (ADB);
- AusAID;
- NZODA;
- Food and Agriculture Organisation (FAO);
- Forum Secretariat;
- South Pacific Regional Environment Program (SPREP);

JICA SAMOA WASTE MANAGEMENT PROJECT
 ENVIRONMENT & CONSERVATION DIVISION - EXISTING STRUCTURE



JICA SAMOA WASTE MANAGEMENT PROJECT ENVIRONMENT & CONSERVATION DIVISION - PROPOSED NEW STRUCTURE



- UNESCO;
- United Nations Development Program (UNDP); and
- World Health Organisation (WHO)

A description of their activities in the area of waste management and related environmental fields follows.

3.7.2 Asian Development Bank

The ADB has been undertaking a project preparation exercise looking into the possibility of a loan to the Government of Samoa for a sewerage system in central Apia, some drainage works and other infrastructure (including housing through assistance to the Samoa Development Bank for loans). A proposal has been sent to ADB for consideration requesting a loan of USD13.86 million, with USD9.6 million for sewerage, USD0.57 million for drainage, USD1.28 million for other infrastructure and USD2.4 million for housing. No decision has been made on the project.

3.7.3 AusAID

AusAID is providing assistance to SPREP for regional waste management programs that include Samoa (see below). In the bilateral program, no projects specifically address waste management. A project of indirect interest is the institutional strengthening of the Water Authority, which provides support in financial management, assets management, human resources development and corporate management. This project complements EU programs providing a new water treatment and piping facilities, and the development of public awareness to reduce demand.

3.7.4 NZODA

NZODA, through the Development Cooperation Division (DEV) has been providing substantial assistance to the DEC in Samoa since its establishment in 1989/90. This service includes a combination of technical assistance and funding. NZODA funding covers such areas as:

- Training for Environmental Impact Assessments
- Public Awareness Campaigns
- Community Development
- Biodiversity Activities.

Funds (NZ\$170,000 in 1996/7, estimated NZ\$215,000 in 1997/8) can be used for hire of local consultants and to run national training courses (including bringing in overseas and regional personnel).

Current NZODA activities include:

- Management Service Consultants to assist with coordination and management of all NZODA inputs into the environment and conservation sector, including project development and monitoring, management of funding, and technical assistance to DEC. Up until 1996, a NZODA consultant was attached full-time to DEC, but now consultants (currently Ket Bradshaw and Mary-Jane Rivers) come to Samoa from New Zealand, every three months.
- Establishment of a Municipal Waste Deport in Savai'i - Local consultants and DEC staff are employed on this project, with La'ava Mulea as the DEC Officer in Charge. A TOR is currently being prepared. Funding is around NZ\$10,000. At a NZODA-Treasury meeting in 1997, Treasury gave approval for DEC to receive direct payment for this work, on the condition that the funds are strictly accounted for.
- School Waste Separation Project being developed and trialed at Malifa School - this is a pilot project (involving DEC staff) intended to lead to waste separation in other schools and villages. Wheelie bins have been provided to the school for waste separation activities. The project has been reviewed and separation is occurring and other schools are interested, but more training is needed as there are still problems with collection, and the separated waste is being thrown together during collection and disposal at the landfill. NZODA consultants see the need for follow-up activities to address separation at collection and at the landfill site, but this has not been investigated yet. DEV would be interested in cooperating with JICA on waste separation where NZODA could address the in-school separation issues, with JICA assisting with the mechanics of collection and 'disposal' (reuse) of the separated materials.
- Assessment of Environmental Awareness - this is due to start in mid-1998, and will address the source and effect/impact of information on environmental issues, including waste management. The project will cover both Upolu and Savai'i, and has Easter Galuvao as DEC Officer in Charge.
- EIA Study - this involves developing a check-list for environmental impact assessment, Easter Galuvao is the DEC Officer in Charge and SPREP is to be involved in the review of the outputs.
- Strategic Planning - a retreat involving NZODA consultants (Mary-Jane Rivers as facilitator) and DEC staff was planned for late February 1998, with the aim of achieving coherence in

DEC's work by providing time for DEC staff to assess their current status and future directions. This includes work load, budget, other resources, development of a strategic plan for coordination of donor and DEC resources and activities, and how to fit existing strategies (eg., NEMS) and plans into this. It is hoped that a corporate plan can also be developed.

- Attachment Training - DEV is considering attaching a DEC officer to a local authority in New Zealand, where she/he can study the authority's approach to waste management (eg., landfill management), and establish an ongoing relationship with waste management staff there.
- NGOs - DEV is looking into ways of assisting NGOs, including women's groups to become more involved in environmental management in Samoa, including in waste management.

Recent meetings between JICA and NZODA staff indicate that there is a strong willingness to cooperate in projects in Samoa (Rebecca Murphy, personal communication). To date, however, operational cooperation has proved difficult. There appears to be significant scope for coordination of inputs, with NZODA continuing to provide assistance with institution strengthening, training and community awareness.

3.7.5 Food and Agriculture Organisation

The FAO South Pacific Regional Office has no project activities dealing directly with waste management, but two components of the work program have some relevance to waste management Samoa. The main current programs are: Food Production, Women in Agriculture, and Agriculture and the Environment. One project is investigating and assessing of pesticide use in the home, with the aim of providing better advice for use and disposal to minimise the health impacts of such activities. FAO also has an interest in improving and expanding the use of composts, but there are no specific activities addressing this at present.

3.7.6 Forum Secretariat

In 1995, the Forum carried out an assessment of waste oil in the Region and provided a draft report on the issue (DDSMS, 1996). This report showed that the potential quantities of waste oil in Samoa were 300,000-400,000 L per annum. A new Secretariat staff person is following up on this report by attempting to get the oil companies operating in the Region to take responsibility for managing waste oil. This project will also involve Samoa.

3.7.7 South Pacific Regional Environment Program

SPREP is coordinating a number of waste management activities in the South Pacific Region, aimed at improving the overall management of all wastes, including waste minimisation, transportation and handling, reuse and recycling, disposal, and associated legislation. The projects are generally regionally based, but a number have activities relevant to Samoa.

Samoa is one of the countries destined to receive assistance under the SPREP Persistent Organic Pollutants project, funded by AusAID, and due to commence early in 1998. This project will assist in the management of persistent organic pollutants and waste oils by assessing the types and quantities involved, the facilities and expertise available to deal with these materials, developing improved handling and disposal procedures, and recommending legislative measures to ensure that effective management is established.

SPREP is also coordinating an environmental education and awareness project funded by the European Commission. This project, costing ECU600,000, will address a number of issues, including waste sources and management in 8 countries, one of which is Samoa.

SPREP is the designated secretariat for the Waigani Convention covering the transboundary movement of hazardous wastes in the South Pacific. There has been little activity relating to this in recent months.

3.7.8 UNESCO

UNESCO has a limited Pacific program. One activity that has some implication for waste management is the regional program on water resources development and management. Samoa is a collaborating country in this program, which involves some training and provision of consultants.

3.7.9 United Nations Development Program

UNDP's main operations in Samoa are related to primary education, fruit tree development and youth education. Environmental projects are operated at the regional level. These include capacity building for environmental management in the South Pacific (project in preparation) and assistance in the preparation of the Strategic Action Plan for Internal Waters proposal for GEF funding. Samoa is a likely beneficiary of these projects.

3.7.10 World Health Organisation

The WHO Subregional Office based in Apia covers Samoa, Tonga, Niue, Tokelau and Cook Islands. The Office works closely with National Health Departments to improve a spectrum of health services in each country including issues relating to environmental health. These activities include training workshops in proper disposal of domestic waste (especially in rural areas), and keeping the environment generally clean and healthy. WHO staff appreciate that improvement of waste management is a difficult task partly because of the multi-sectoral nature of the issue, but are continually working at facilitating inter-sector cooperation within Governments. WHO is involved in a range of environmental awareness activities through the Health Promoting Schools Program (a joint WHO/AusAID initiative) and the WHO Healthy Islands Program being developed for implementation in 2000/2001.

3.8 PUBLIC AWARENESS AND UNDERSTANDING

3.8.1 Public Awareness and Education Activities

General

To determine the extent of public awareness / education activities occurring in Apia, the following organisations were consulted:

- Department of Lands, Survey and Environment, Division of Environment and Conservation;
- Department of Health, Environmental Health Unit;
- O Le Siosiomaga Society; and
- various women's groups representatives.

The following paragraphs describe the activities of these organisations in regard to awareness and education activities relating to waste management.

Division of Environment and Conservation (DEC)

The DEC has an ongoing commitment to improving environmental awareness across the full range of nationally important issues. This is done through a combination of workshops, training activities, radio and television programs, and newspaper articles. Considerable emphasis is placed on activities in schools and in rural areas, working particularly with women's groups. To date there have been no intensive campaigns focussing specifically on waste management and related issues. A New Zealand poster document called 'The Wise Waste Manager' has been

distributed to schools and is being translated into Samoan for generally community use. No formal assessment of the effectiveness of these public awareness campaigns has been carried out.

Environmental Health Unit, Department of Health

The Environmental Health Unit of the Department of Health has very limited funds for waste management awareness development. The effectiveness of the work undertaken by the Health Education Unit has not been assessed. There is limited collaboration with DEC on public awareness activities, with most cooperation being facilitated through the work of government committees, eg., NEMS, Pesticide Committee.

O Le Siosiomaga Society

The O Le Siosiomaga Society is an active environmental lobby group in Samoa, whose activities are carried out by volunteers. It has ongoing sponsorship from the Swedish Society for the Conservation of Nature, and occasional support from other donors and charitable organisations. Currently the organisation is working on a proposal on waste management, including a major public awareness campaign on waste disposal. Dr Ken Lameta, Acting Director, reported that the effects of wastes on coastal areas are fairly well understood because of the impact on fishing, an important activity in Samoa life. The Society is very interested in recycling and reuse activities and is trying to initiate the use of brewery and coconut factory wastes for animal feed, together with the soup from the Hellaby meat processing factory. A proposal has been developed with the United Nations University for an integrated biomass model/demonstration system to be operated on a 20 hectare site near Apia.

The Society is not aware of much public awareness activity relating to waste management, but the Clean Up the World campaigns have been very successful. A number of small projects have been attempted including a Peace Corps training workshop for teachers that involved a rubbish survey around Apia in 1996. The South Pacific Commission Pacific Sustainable Development Network provided resources to permit some radio and television programs to be broadcast in 1997, and good feedback was received on these. The cost, however, at WST 440 for a 30 minute TV slot, and WST 100 per hour for radio is not sustainable within the Society's current budget. A set of environmental videos provided by Canada is available, but the use is limited mainly to schools as they are in English.

Women's Groups

Samoa has a large number of very active women's groups which develop and carry out activities covering many aspects of life in the country. Through the assistance of the Secretary of the Ministry for Women's Affairs (Mrs. Luagalau Foisaga), a meeting was arranged with the Women's Advisory Committee. The representatives at this meeting indicated that some waste issues were well recognised (particularly plastics management), but some were not appreciated or well

understood. There is only a limited appreciation of waste minimisation and recycling, but some local initiatives have been very successful (eg., the use of plastic soft drink bottles for handicrafts). There is some appreciation of the problems associated with the use and storage of wastes, but more education of women is needed. Training/awareness activities relating to septic tank management have, in the past, been focussed mainly on men; if women were given appropriate training, it is believed that the situation would be dramatically improved. The Village Beautification program of the Tourism Bureau has been quite successful, as the benefits to the country are readily apparent, and village communities have been active in punishing locals with 'in kind' fines for dumping on beaches.

Other Activities

A number of groups of volunteers (from Japan, USA, New Zealand, Australia, etc.) work in different capacities in Samoa. These volunteers work closely with the local communities and, in this way, can pass on some of the environmental awareness they bring from their home countries. This can be a very effective way of passing on waste management information, but no formal assessment of their impact has been carried out.

3.8.2 Public Perception and Understanding of Waste Management

As part of this Project, arrangements were made for a waste management public awareness survey to be carried out in the greater Apia area. This survey was completed by Mrs. Maria Kerslake, Head of the Department of Geography and Sociology at the National University of Samoa, assisted by staff of DEC, with advice provided by the CMPS&F team. The scope of the survey encompassed interviewing approximately 50 selected residents of Apia, asking approximately 50 questions related to waste management. Further detail on the scope of the survey is contained in the Terms of Reference for the Survey, which is attached in Appendix H.

Data was collected by interviewing the selected respondents (in Samoan) and completing the questionnaire provided (in English). A copy of the questionnaire (49 questions) is provided in the Appendix I. All the interviewers were bilingual English-Samoan. The survey was carried out in the second half of February 1998. Some 50 respondents living in the Apia area were interviewed, and the full report of the survey is given in Appendix H. A summary of the results of the survey is given below.

The questionnaire was designed to assess public awareness in the Apia area on waste management issues as well as pertinent information about the respondents, including gender, village, educational background and family income level.

The sample was selected according to the garbage collection routes used in urban Apia by the DEC, with 50 respondents from households and 4 from industry.

The villages (suburbs) chosen were selected from a list drawn to represent the three different waste collection areas used by the DEC. Once the villages were selected, the street names were then decided on the basis of density of population. Every second household in the chosen streets was interviewed until the number of required households was reached. Staff of the DEC involved in the process were briefed on the questionnaire instrument for clarity and a reliable presentation of information. A letter of introduction was written to accompany the interviewers to facilitate their accessibility to respondents.

The respondents included 24 males (45%) and 30 females (55%), ranging in age from 19 to 75 with the majority in the 26-50 age group. Children were not interviewed because it is culturally inappropriate in Samoa to interview them while older members of the family are present. The oldest family member present at the time of the survey was the person who was interviewed. More than 75% of the respondents had completed secondary or tertiary education. Household sizes varied from 3-30, with the majority being less than 10 persons per household. The majority of respondent's incomes fall between WST \$200 and \$500 per fortnight. The industries involved (4) employed 2015, 139, 115 and 50 employees.

The survey has revealed important information on the knowledge and awareness of respondents with regard to waste management. It has also revealed some interesting factors which will be useful in planning projects to address the waste management problems facing the people living in the Apia area.

The main findings of the public awareness survey can be summarised as follows:

- Most (80%) of the respondents stated that Samoa has a waste problem and have suggested several ways in which these can be reduced (see below).
- The majority (65%) of respondents stated that waste has an environmental impact, and a large majority (77%) think that rubbish and toilet waste disposal do affect the environment.
- The majority of the respondents use the Government Waste Collection System as their main waste disposal method. A large majority (83%) of the respondents were satisfied with the Government Collection System. Those who were dissatisfied suggested measures to improve this. Almost half (48%) of all respondents indicated that they are prepared to pay a small fee to improve the collection system.
- The majority of the respondents (52%) know where the rubbish depot is situated. The remainder, however, did not offer any comments regarding the rubbish depot. Most respondents are unaware of which Government Department looks after the Depot.
- A significant majority (63%) of the respondents stated that local industries produce waste, but when asked to identify the types of wastes, most did not know the specific details.

About a third (37%) of respondents stated that they know about industrial waste from general knowledge, while about a sixth (18%) stated they can tell from looking at the industrial site.

- Most respondents (81%) knew what materials should be composted but many (72%) did not know what compost is used for. Most respondents have no knowledge of how to manage a compost heap. They appear to have lost a lot of their traditional knowledge on composting.
- Almost all of the respondents do not have any knowledge on recycling, but about a quarter (26%) reuse plastic and other non-biodegradable material as part of their housekeeping.
- Over half (59%) of respondents are already separating their waste at home and the rest are prepared to separate waste in the future.
- The vast majority (89%) of respondents have flush septic toilet facilities. Problems identified by the respondents on management of their septic tank are very much visual problems. In general most do not understand how the system works. Most do not know how to care for their septic tank and how often they should be cleaned.
- Only a small proportion of respondents (9%) understood what hazardous waste is (the rest quoted a wide range of examples).
- The amount of information disseminated on waste management appears limited. Just over half (56%) of the respondents have seen or heard information on waste management, but 15% have seen or heard the information overseas. Thus less than half (41%) of the respondents had not seen or heard anything locally. Many could not clearly remember when they had encountered the waste information.
- The vast majority (83%) of respondents have not attended any workshop, seminar or training programme on waste management.

In summary, the level of awareness on waste management issues of the respondents is generally low. Many people in Apia are aware of the fact that waste is a problem and can identify the visual (unsightly) impacts that poor waste management creates. Awareness about specific waste issues such as waste separation, composting, recycling, reuse, and hazardous wastes is low. There appears to be a very heavy dependence on Government to deal with waste issues, and there is a need to develop programs that will assist people to adopt a more self-responsible attitude to waste management.

The impact of community awareness programs carried out to date on waste management appears relatively low, and a much greater effort is required in this area. There is probably a need to

undertake some research into the best methods of getting such information effectively across to the general public in Samoa.

The respondents were asked to suggest ways in which waste can be reduced in Samoa, and some of their answers were as follows:

- More public awareness education on waste management on radio, television and in the newspapers;
- Improve the collection system and provide more rubbish containers;
- People should start using biodegradable products/packages;
- More support for community groups especially the Women's Committees in the village to teach waste management programmes;
- There should be more workshops on litter awareness;
- Provide improved facilities at the Rubbish Depot;
- Institute legislation on littering and enforce the law;
- Better and improved drainage system and sewage disposal especially restaurants and public places in Apia;
- Hire enough workers to collect rubbish;
- Initiate recycling activities.

4. SUMMARY OF FINDINGS

4.1 SOLID WASTE

Littering and Indiscriminate Dumping of Solid Waste

- The Apia urban area appears to be much cleaner than 12 months ago and this can probably be attributed to clean up campaigns and education programs, and increased cleaning activities by Tourism and DEC. However, indiscriminate dumping of garbage is still common on the fringes of Apia, beyond the extent of the waste collection service, as well as in creeks and waterways within Apia (despite the waste collection service).

Generation & Storage

- Solid waste generation has been investigated previously by others and a copy of the report has been obtained. The report provides a good indication of the sources, types and quantities of solid waste being generated in Apia. In addition, data on the vehicles entering current waste depot at Tafa'igata has been recorded since 1995. This data can be analysed to obtain a good understanding of waste disposal in Apia eg. sources, types and quantities of waste being deposited at the depot.
- Storage of wastes in households and commercial/industrial premises generally appears quite good. However, there is room for improvement as waste storage is still contributing to litter eg., greater use of garbage bins / plastic bags/ other containers and stands. The DEC has recognised this problem and has been promoting the use of garbage bins or plastic bags.

Collection & Disposal

- Household waste collection is undertaken in most of the Apia town region by a contractor on behalf of the Government (managed by DEC). Coverage is approximately 60-70% of the households. Some complaints about the reliability of the service were reported, but not as many as were reported 12 months ago. It was also reported that to improve the waste collection service, the contract needs to be extended from the current 2 years to at least 5 years, to allow for the financing of new and replacement equipment.
- Commercial premises, industrial premises and Government offices / facilities are responsible for the disposal of their own wastes. Access to the current waste depot at Tafa'igata is free and many businesses / premises transport waste to the depot for disposal. An increasing number of businesses / premises are paying for a waste collection company (there are two major companies in Apia) to collect and transport waste to the Tafa'igata waste depot for disposal.

- The current waste disposal depot at Tafa'igata has been improved somewhat since inspection 12 months ago, but would still be having an impact on the surrounding environment. Investigation work at the site included a detailed inspection of current and past activities, excavation of tests pits to assess insitu soil conditions and the underlying rock, and surface water testing. Findings of the investigation work include:
- surface water run off is uncontrolled;
 - surface water runoff from the site is contaminated with sediment and organics. However, due to the ground conditions (highly permeable) runoff from the site would only occur under very wet conditions;
 - no leachate management measures are employed at the site;
 - the soils and bedrock underlying the site are highly permeable, and thus the risk of leachate contamination of the underlying groundwater is high;
 - little compaction and covering of waste occurs resulting in nuisance (odour, flies, vermin) as well as surface water contamination and increased leachate generation;
 - medical waste (sharps) is disposed of in a separate pit, away from the main tipping area, and the deposited waste is regularly covered;
 - septage is disposed of at the site in several pits, excavated in a separate area, and would be contributing to groundwater contamination.

Based on the investigation results, particular concerns with the landfilling operation include:

- lack of a plan for operation of the site, including a filling plan;
- leachate effects on underlying groundwater (and nearby springs), from both the landfilling and septage disposal operations;
- effects of uncontrolled runoff of contaminated stormwater;
- hazards presented by current medical waste disposal practices (lack of immediate covering);
- poor control over public access to the depot and consequent risks to the public, particularly in regard to the medical waste disposal activities;
- lack of regular compaction and covering of deposited waste, increasing nuisance as well as leachate generation, due to lack of landfilling equipment (due to lack funds);

- effect of septage disposal activities at the waste depot on groundwater quality (and the quality of nearby spring water quality);
- The old waste depot at Vaitoloa on Vaiusu Bay was investigated. Investigation included a detailed inspection of the site and excavation of test pits in the landfilled waste materials to determine the depth of fill and the degree of degradation of the landfilled waste materials. In-situ testing of the groundwater in the excavated test pits was also undertaken. The results of the investigation indicate the following:
- the site is substantially revegetated (naturally) by mangrove trees and grasses, however, there is a significant amount of uncovered waste material on the site (through which the grass and mangrove trees are growing!);
 - the depth of waste at the site varies from 0 - 1m, being 1m nearest the shoreline and decreasing with distance inland (away from the shoreline);
 - the groundwater table is located approximately 1 m below the existing surface level;
 - there is a large amount of remnant steel lying around the site (parts of the old inter-island ferry);
 - a layer of sediment / soil (up to 10 cm thick) has been deposited over the waste nearest the shoreline, which decreases in depth with distance from the shoreline. It is suspected that the sediment has been placed during water movement over the site during high tides and storms etc;
 - the deposited waste at the site has undergone significant degradation, particularly the organic material. However, water testing indicates that degradation is still occurring and will likely continue to occur for some time yet, albeit at a slow rate, and thus the waste will continue to have some impact on Vaiusu Bay;
 - Oil was particularly apparent in one test pit, indicating that waste oil was disposed of at the site.
- No specific information is available on commercial and industrial waste generation, although the Tafa'igata waste depot gate house records will provide a broad indication of the source, types and quantities of commercial and industrial solid waste.

Solid Waste Minimisation

- Solid waste minimisation activities occurring in Apia are limited to the following:
 - re-use of beer bottles and soft drink bottles by Vailima. A refund system is in place to encourage the return of the empty bottles. Pepsi also offers a small refund for the return of its PET soft drink bottles, however, the bottles are being landfilled at the Tafa'igata waste depot;
 - recycling of ferrous (scrap steel) and non-ferrous (copper, aluminium, lead, brass) metals by a private company (West End). West End pays for scrap metals. Usually, the generators bring the scrap metal to West End, although if the load is large enough West End will collect. West End reports that is constantly evaluating the recycling of paper, glass and plastics, and report that currently it is not economically viable (value of material is less than the cost of collection and transport);
 - some home composting in villages (suspected to be minor) - promoted by women's groups;
 - larger scale composting is being investigated by Department of Agriculture as well as the O Le Siosiomaga Society (who are pursuing commercial organic waste generators eg, brewery, coconut processing factory);

4.2 WASTEWATER

- All wastewater generated in Apia (domestic, Government, commercial and industrial) is managed on site via a variety of means eg. pit latrine, pour flush toilets, flush toilet with septic system and on-site treatment plants at some larger premises. The most common system is the septic system with / with out infiltration bed.
- Information collected on current wastewater management practices indicates the following:
 - septic tanks in the low lying areas of town have ineffective soakage pits due to the high groundwater table, which is leading to groundwater and surface water pollution and presenting significant health risks. Water quality testing undertaken during this Project and previous water quality testing confirm this;
 - there is limited maintenance of septic systems (including de-sludging), resulting in poor performance of the septic tanks and leading to consequent contamination of local groundwater and surface water;

- there is minimal follow-up of building approvals to check on sewerage/septic installations;
 - the overall result of the poor wastewater management practices is poor water quality, particularly in and around the Apia town area, which presents significant potential health risks to the general public. Water quality testing has indicated high levels of nutrients in some streams and drains and possible significant sewage contamination;
 - A project to sewer the low lying areas of Apia town is being progressed by the ADB and the Samoan Government. The project also involves some drainage works and housing finance. Currently this project is being assessed in detail by the ADB.
- Water quality testing undertaken as part of this Project confirms the previous findings of poor water quality around the low lying areas of Apia town and significant health risks to the general public. Faecal coliform testing confirmed the presence of sewage in several of the open drains and creeks around town.

4.3 SPECIAL WASTES

- Current medical waste management practices present some public health risks. Concerns include:
- a very old (> 30 years) and unreliable incinerator, that is not working properly;
 - limited separation of wastes in wards at the hospital (possibly resulting in some medical waste being disposed of with general rubbish);
 - a lack of containers for separated wastes at the hospital, due to lack of funds;
 - unknown waste management practices at private medical clinics;
 - potentially unsafe waste disposal practices at the Tafa'igata waste depot, particularly considering the uncontrolled public access to the site.
- There are several private companies removing and disposing of septage and wastewater sludges. The Department of Public Works also has a tanker for de-sludging tanks. As discussed previously, the desludging of septic tanks is not a regular practice and septage is disposed of at the Tafa'igata waste depot. Both issues are of concern.
- There are no facilities for the disposal of waste oil in Apia. It was reported that the Aegis Oil Recycling Plant was not operational;
- Asbestos waste disposal does not appear to be problem due to the small quantities.

- Motor vehicle batteries - some recovery of lead from motor vehicle batteries is occurring in Apia. The management of acid from the batteries is unclear.
- Quarantine waste is currently being managed in a satisfactory manner.

4.4 HAZARDOUS WASTES

- Hazardous wastes and contaminated sites will be investigated under a SPREP project (funded by AusAID) - Management of Persistent Organic Pollutants (POPs) in Pacific Island Countries. As a result, no further investigation of this waste stream was undertaken;

4.5 WASTE MANAGEMENT ADMINISTRATION

Policy and Planning

- Little progress has occurred with implementation of the NEMS:
 - a National Waste Management Strategy has not been prepared yet, although a Draft Policy has been prepared but not yet endorsed by the Government;
 - the hospital waste project has not been implemented, although a Draft Hospital Waste Management Plan has been prepared (but not implemented);
 - the biogas project also has not progressed.
- A Draft National Waste Management Policy has been prepared and submitted to the Minister of Lands, Survey and Environment for comment. It is planned the Policy before the end of 1998.

Legislation and Regulations

- There are several items of legislation that address waste management, these include legislation addressing agriculture, health, water and the environment. However, the Lands, Survey and Environment Act, 1989, has primary responsibility for waste management.
- The Division of Environment and Conservation (DEC) is responsible for administering the environmental aspects for the Lands, Survey and Environment Act, 1989. The Division has a current staffing level of 14 persons and it is generally acknowledged that the Division is understaffed.
- The Lands, Survey and Environment Act provides for some regulation of waste management activities, however, reported problems include:

- lack of resources / budget in the DEC;
- cultural factors in implementing fines due to the "chief" system;
- cost of prosecuting offenders versus the small fines that can be enforced; and
- lack of specific requirements on time to implement orders directed by DEC Officers;

Operation

- Obstacles to interdepartmental co-ordination and co-operation eg. Medical waste could possibly be disposed of at the Department of Agriculture's Airport quarantine waste incinerator, but isn't; and apparent lack of co-ordination in regard to water quality monitoring between the Water Authority, Department of Health, and DEC.

4.6 ACTIVITIES OF OTHER DONORS AND INTERNATIONAL ORGANISATIONS

Project of relevance being undertaken by other Donors and International organisations include:

- AusAID's Management of Persistent Organic Pollutants (POPs) in Pacific Island Countries Project - targeting chemical wastes and contaminated sites. This project is being managed by SPREP;
- ADB Infrastructure project for Apia, addressing sewerage, drainage and housing finance;
- NZODA
 - new Savai'i waste depot;
 - waste separation at schools program;
 - public awareness survey which will include solid waste management practices;
 - training of DEC staff in waste management;
- FAO
 - investigating and assessing pesticide use in the home;
- Forum Secretariat
 - investigating waste oil generation and disposal;

SPREP

- SPREP is coordinating a Regional Environmental education and awareness project funded by the European Union (EU) to commence soon;
- AusAID's POPs project;
- Waigani Convention - transboundary movement of hazardous waste

 WHO

- rural training workshops - some encompassing domestic waste disposal
- Health Promotion schools program
- Healthy Islands Program.

4.7 PUBLIC AWARENESS / PERCEPTION

Based on the results of the public awareness survey, the level of awareness and understanding of waste management issues of the respondents is generally low. Many people in Apia are aware of the fact that waste is a problem and can identify the visual (unsightly) impacts that poor waste management creates. Understanding of specific waste issues such as waste separation, composting, recycling, reuse, and hazardous wastes is low. There appears to be a very heavy dependence on Government to deal with waste issues, and there is a need to develop programs that will assist people to adopt a more self-responsible attitude to waste management.

The impact of community awareness programs carried out to date on waste management appears relatively low, and a much greater effort is required in this area. There is probably a need to undertake some research into the best methods of getting such information effectively across to the general public in Samoa.

5. POTENTIAL PROJECTS

5.1 GENERAL

Giving consideration to the findings of the Stage 1 investigation ie. current state of waste management in Apia, activities of other donors and international organisations, and current understanding of public perception, JICA could undertake a wide range of projects to improve the management of waste and consequently improve the urban environment in Samoa. Possible projects are outlined in the following sections.

No hazardous waste projects have been identified due to the AusAID project under way which should address all relevant issues. Also, due to the proposed sewerage of Apia town, identified wastewater projects are focused on short term improvements to the current problems.

Please note the cost estimates and likely project durations provided in the project outlines were "guesstimates" only and have been better defined in Section 6.

5.2 SOLID WASTE

Current solid waste management activities in Apia are causing detrimental impacts on the local environment. This includes:

- littering and indiscriminate dumping of waste, leading to visual degradation and water pollution;
- poor storage of waste leading to litter;
- the current Tafa'igata waste depot which would be having an impact on local surface waters and groundwater and presents a risk to users of the facility due to current medical waste management practices; and
- an old waste depot which would be having some detrimental impact on Vaiusu Bay.

In addition to the above impacts, other inadequacies identified included:

- there is no formal strategy for the management of Apia's solid waste;
- the current system focuses on waste collection and disposal, with little focus given to effective waste prevention and minimisation;

Further details on the issues identified above can be found in Sections 3 and 4.

To address the above identified problems JICA could undertake the projects outlined in Table 5.1

5.3 WASTEWATER (SEWAGE)

Current wastewater management activities are having a significant detrimental effect on the quality of waterways and drains in Apia, however, in light of the proposed ADB project to sewer a major portion of Apia town, only a few wastewater related projects have been identified, aiming to help improve local water quality in the interim. These are outlined in Table 5.2.

5.4 SPECIAL WASTES

Several issues were identified in regard to special wastes, with the primary problems being associated with medical waste, septage / wastewater sludges and waste oil. The identified potential projects to address these waste streams are outlined in Table 5.3.

5.5 DISCUSSION

There are many projects that JICA could fund to help improve the management of waste and consequently improve the urban environment in Samoa. These have been identified and outlined in previous sections (Sections 5.1 - 5.4). The projects vary greatly in cost and duration, and will have different impacts in regard to improving the existing state of waste management in Apia and improving the local environment.

In deciding which projects should be developed further, a subjective assessment of the projects was undertaken considering the following factors:

- cost of program;
- sustainability of the project, from an economic view point as well as an environmental view point;
- improvement to the local environment;
- reduction in human health risks;
- practicality and feasibility of implementation in Apia;
- public perceptions / acceptability; and
- likely success (in terms of implementation and expected outcomes).

TABLE 5.1: POTENTIAL SOLID WASTE MANAGEMENT PROJECTS

POTENTIAL PROJECT	INDICATIVE COST (AUD)	LIKELY DURATION (months)	INTENDED OUTCOME	ISSUES
GENERAL				
1. Preparation of a comprehensive solid waste minimisation and management strategy for Apia	\$75,000	6	A formal plan which considers solid waste management in Apia and sets out a strategy for minimising and managing waste for the next 20 years.	Should be prepared by DEC as a learning exercise, with assistance from specialist consultant.
2. Development of a sustainable system for generating income to fund solid waste management activities.	??	6-12	To provide a sustainable source of income to meet solid waste management cost.	Ability of local residents to pay for services.
LITTERING AND INDISCRIMINATE DUMPING OF WASTE				
1. Development and implementation of an education program to reduce the incidence of indiscriminate dumping of solid waste.	\$30,000	3	A reduction in the incidence of littering and indiscriminate dumping of waste across Apia.	Integration with NZODA education activities.
SOLID WASTE GENERATION				
1. Undertake a detailed commercial and industrial waste characterisation study.	\$40,000	3	To provide more detailed information for planning purposes.	None identified
SOLID WASTE STORAGE, COLLECTION AND DISPOSAL				
1. Development and implementation of an education/incentive program to encourage the use of secure waste containers.	\$60,000	3	Improved domestic waste storage and less litter in streets.	Integration with NZODA education activities.

POTENTIAL PROJECT	INDICATIVE COST (AUD)	LIKELY DURATION (months)	INTENDED OUTCOME	ISSUES
2. Provision of household garbage bins in Apia to improve storage of solid waste.	\$900,000	12	Improved domestic waste storage and less litter in streets.	Not a major problem. Householders likely to use the bins for other purposes.
3. Preparation of a revised waste collection contract.	\$15,000	1.5	Improved waste collection service by allowing the contractor to finance new equipment.	JOCV considering.
4. Extension of waste collection service to fringe areas of Apia.	\$150,000/yr	Ongoing	Reduced incidence of dumping of solid waste on the outskirts of Apia.	Financial sustainability - how to cover ongoing costs.
5. Improvement of the Tafa'igata Waste Depot:				
(i) Preparation of landfill management plan.	\$50,000	4	A formal plan for filling of the site which addresses both operational and environmental issues.	Should be prepared by DEC as a learning exercise, with assistance from specialist consultant.
(ii) Undertake a detailed hydrogeological investigation of the site.	\$100,000	4	To determine if groundwater contamination is occurring due to operation on the site.	Availability of suitable equipment in Apia.
(iii) Undertake upgrading works at the depot, including security fencing, road works and drainage works.	\$1,200,000	12	To improve control over access to the site, thus reducing potential health risks, improve access, and improve surface water management.	High cost.
(iv) Provide landfilling equipment, eg. tracked loader.	\$550,000	3	To allow regular compaction and covering of waste deposited at the landfill, thus reducing nuisance and leachate generation.	Financial sustainability - how to fund ongoing operating and maintenance costs.
(v) Provide landfill operational training to DEC site manager.	\$25,000	2	To improve the capability of DEC staff in regard to planning and operating the landfill site.	Need for skilled/educated site manager/foreman on site at all times.

POTENTIAL PROJECT	INDICATIVE COST (AUD)	LIKELY DURATION (months)	INTENDED OUTCOME	ISSUES
6. Rehabilitation of the old Vaitoloa waste depot site.	\$ millions	24-36	To minimise the impact of the old site on Vaiusu Bay.	Disturbance of the site and consequent impacts during the rehabilitation works. High cost for low perceived benefit.
SOLID WASTE MINIMISATION				
1. Investigate, develop and implement a commercial and industrial organic waste processing facility.	\$500,000	12-24	To reduce waste disposal whilst producing a useful product for local use.	Excellent opportunity to reduce waste generation and produce a useful product for local use Economics may not be favourable - must be low cost process.
2. Investigate and develop a domestic organic waste management program.	\$200,000	12	To reduce domestic organic waste (which comprises >60% of the waste stream), whilst producing a useful product for local use.	Would help reduce leachate impacts at the Tafa'igata waste depot. At source processing to avoid collection costs preferred.
3. Develop formal aluminium and other high value metal recycling program.	???	6	To reduce the quantity of metal being disposed of at the waste depot.	DEC to co-ordinate, working with local businesses.
4. Investigate, develop and implement a local waste minimisation program for glass, paper, wood, and plastic.	\$75,000	6	To reduce the quantity of glass, paper, wood and plastic being landfilled.	Export of these waste materials is not economically viable at this time. Local initiatives need to be developed.



TABLE 5.2: WASTEWATER PROJECTS

POTENTIAL PROJECT	INDICATIVE COST (AUSD)	LIKELY DURATION (months)	INTENDED OUTCOME	ISSUES
1. Investigation, development and implementation of a program to improve septic tank design, construction, operation and maintenance.	\$200,000	12	Improvement in the quality of surface water and groundwater, through improved septic tank performance.	Responsibilities across various authorities. High cost. Integration with AusAID project. Economic sustainability - who pays for the regular desludging of the septic tanks.
2. Provision of surface water quality testing equipment to the DEC to allow insitu water quality testing.	\$25,000	3	Equipment to allow DEC staff to monitor local surface water quality.	Training in the use of the equipment.



TABLE 5.3: POTENTIAL SPECIAL WASTE PROJECTS

POTENTIAL PROJECT	INDICATIVE COST (AUD)	LIKELY DURATION (months)	INTENDED OUTCOME	ISSUES
MEDICAL WASTE				
1. Facilitation of an agreement for the medical waste to be disposed of at the Airport Quarantine waste incinerator.	???	6??	A mechanism for appropriate disposal of medical waste from the hospital.	Funding - to pay Agriculture for the increased operational costs. OH&S issues in regard to handling the wastes.
2. Provision of a new incinerator to the Department of Health for disposal of hospital and other medical waste..	\$150,000	12-24	A mechanism for appropriate disposal of medical waste from the hospital.	Funding to cover ongoing operating and maintenance costs. Location and potential impacts.
3. Provision of funding to allow the establishment of a waste separation program within the National Hospital.	\$50,000	6	Improved waste management program within the National Hospital..	Ongoing funding to maintain the system implemented. Training of staff will be essential.
SEPTAGE/SLUDGE MANAGEMENT				
1. Investigation, design and development of an appropriate septage/sludge handling facility in Apia.	\$1,000,000	12-24	A facility which manages septage and sludge in an environmentally friendly manner.	Integration with the proposed AusAID sludge project.
WASTE OIL				
1. Investigate and develop a program to facilitate waste oil recycling.	???	>6	Environmentally acceptable disposal of waste oil.	Co-operation of the oil companies. Integration with Forum Secretariat activities.

The subjective assessment process involved rating each project for all the above criteria, by giving a score out of 5 for each criteria. The better the project rates the higher the score ie. 5 means the project rates excellent, whilst a score of 0 means the project rates very poorly. A matrix spreadsheet was developed to allow the total score for each project to be calculated. The projects were then ranked based on their overall scores. A copy of the matrix spreadsheet used by the Project Team to assess the potential projects is attached in Appendix J. A further refinement of the process is to weight each of criteria to reflect the assessors view of the importance of each criteria in the assessment process, ie. environmental outcome may be twice as important as cost, and therefore the environmental outcome score should be doubled (a weighting of 2 applied). For the assessment undertaken by the Project Team, weighting factors have not been applied. Consequently, the columns indicating the 'Total Score' and 'Rank' of each potential project have also been left intentionally blank.

The Project Team believes that focus should be placed on those projects which satisfy most of the criteria at acceptable cost. On the basis of the assessment / comparison undertaken by the Project Team, the projects recommended by the Project Team for further consideration/development in the next Stage of the Project were (not in order of priority):

- Preparation of a comprehensive solid waste minimisation and management strategy for Apia, including the development of a sustainable system of generating funds for implementation of the solid waste management strategy;
- Investigating and developing a commercial and industrial organic waste processing project;
- Investigating and developing a domestic organic waste processing program;
- Developing a formal recycling program for valuable metals;
- Investigating and developing a local waste minimisation program for paper, glass and plastics;
- Improvement of the Tafa'igata waste disposal depot;
- Septic tank performance improvement program;
- Improving medical waste management / disposal;
- Investigation, design and development of an appropriate septage / sludge management facility;

Reasoning for recommendation of the above projects is given in the following paragraphs:

Solid Waste Planning

It is important that a comprehensive waste management plan / strategy be prepared for Apia. Preparation of such a strategy / plan should be the first step in improving waste management in Apia. The plan should give careful consideration to all the relevant issues and result in a strategy / plan appropriate for Apia, which sets out how waste will be managed over the next 20 years or so. A critical aspect of the Plan would be the identification and development of a sustainable means of funding solid waste management activities to ensure satisfactory performance in the long term. Proceeding to implement various projects without such a plan in place may result in inappropriate developments.

Solid Waste Management Education

Although the results of the Public Awareness Survey indicate that public awareness and understanding of waste management as an environmental issue is low, considering the current activities of NZODA and the proposed EU program no further activity was recommended in regard to waste management education.

Solid Waste Minimisation

Significant focus should be placed on solid waste minimisation projects as a reduction in waste quantities will help reduce the impacts of any waste disposal operation. It is recommended that all waste types be investigated, however, initially efforts should focus on the high value metals or organic waste as such projects would have a much greater chance of success, result in a greater reduction in the quantity of waste landfilled (in the case of organic waste), plus help to reduce the pollution potential of the waste depot operation (from organic waste). There are some concerns about the success of developing a local large scale, sustainable system of reusing and recycling glass, paper and plastics. Although such a scheme would focus on domestic waste, and would therefore be high profile, it is likely that only small quantities of waste will actually be re-used / recycled. If waste is collected for reuse / recycling, and isn't, the public will only become sceptical of such schemes. It is therefore recommended the initially focus should be placed on those schemes that are most likely to be successful eg. organic waste processing or high value metal recycling, before tackling the more difficult waste types eg. plastics.

Solid Waste Storage, Collection and Disposal

Current solid waste collection services appear to be adequate. Although household waste storage is not good, it was considered that the cost of improving such was high and benefits would be minimal. However, there is a real need to improve the Tafa'igata waste depot operation to prevent continued impact on the local environment (groundwater and surface waters) and to reduce risks to the public. The steps toward achieving this have been outlined Table 5.1. An important aspect of the improvement program is the upgrading works and in particular the

drainage work component. Such works are an important aspect of the overall improvement program for the Tafa'igata waste depot, from both an operational and environmental perspective.

Although the old Vaitoloa waste depot would be having some impact on Vaiusu bay, the majority of the impacts from this site will have occurred as much of the deposited waste will have already been degraded. Future impacts of the site on Vaiusa will decrease with time. Considering the high cost to remediate the site, the likely detrimental impacts of the remediation operation on the bay and the perceived minor benefits of the project, it was considered that other projects would be more cost effective in improving the urban environment in Samoa.

Wastewater Management

The water quality in creeks and drains in an around the main part of Apia town are very poor and present significant risks to public health. It may be years before the proposed ADB project to sewer the town area is implemented and completed. And when it is completed there will still be a large number of septic tank systems operating beyond the proposed sewerage system. As such it is recommended that JICA consider a project to improve septic tank performance and consequently improve local water quality. It should be noted that such a project is being considered by AusAID, although as a regional project, and JICA may need to work with AusAID should they decide to run with the project.

The provision of testing equipment to the DEC should be approached with caution. Experience has shown that often such equipment is not used effectively due to lack of training, lack of maintenance, equipment failure and ongoing funding for consumables. As such, any project to provide testing equipment should incorporate steps to address these issues

Medical Waste Management

Medical waste management in Apia is poor and needs to be improved to reduce risks to the public as well as hospital staff. The cost of providing a new incinerator is significant particularly when considering that the Department of Agriculture have an incinerator with the capacity to manage the medical waste (although the suitability of the Airport incinerator needs to be confirmed by incinerator specialist or the supplier). If the obstacles discouraging inter-government department joint ventures can be overcome, utilising the existing incinerator would seem a more logical and cost effective solution. And as such it is recommended that this option be explored before considering the supply of a new incinerator.

The development and implementation of a proper waste separation program is an integral component of any project for improving waste management at the hospital and medical clinics. This needs to happen to ensure that the correct wastes are going to the incinerator for disposal, as well as reduce the risks to staff and public associated with current practices. Otherwise, the incinerator may be under or over utilised.

Septage / Sludge Management

It is recommended that a septage / sludge management facility be considered further in the project. Currently the septage disposal activities at the Tafa'igata waste depot (dumping into excavated pits and percolation of the free water into the underlying groundwater) would be having an impact on the underlying groundwater. This may be worse than the effects of the landfilling operation due to the highly permeable strata underlying the site and the highly mobile septage (liquid). Effects of the operation would include contamination of the groundwater by organic matter, nutrients, faecal matter/bacteria, and other contaminants that may be in the septage eg. oil, chemicals etc. To overcome the impacts of this operation would require constructing a more environmentally friendly sludge management facility. This may encompass a sludge drying bed (made from concrete) which drains the water from the sludge, allowing the solids to be used as a feed material for a composting operation. However, the project should include an investigation stage to ensure the most appropriate sludge management facility is selected.

6. SHORTLISTED PROJECTS

6.1 GENERAL

On the 20 March, 1998, a meeting was held with JICA to review the projects recommended in the previous section (Section 5) and agree a shortlist of projects for further development in Stage 3 of the Project. During the meeting each of the projects was discussed in some detail and CMPS&F explained the assessment process that was used to determine the shortlist of recommended projects. The assessment process involved a subjective comparison of the projects considering factors such as cost, sustainability, environmental outcomes, impacts on the community, likelihood of success, practicality and other relevant criteria (see Section 5.5).

Following the meeting, more detailed information was provided to JICA - Australia on each of the recommended projects and all relevant information was forwarded to JICA - Samoa for its consideration.

After careful consideration and further discussions a shortlist of projects was selected for further consideration, as listed below:

1. A solid waste management planning project, aimed at developing a sustainable waste management strategy for Apia which set outs how waste will be managed for the next 20 years;
2. A solid waste management education program, aimed at improving basic household waste management practices, discouraging littering, indiscriminate dumping of waste, and encouraging the use of secure household garbage containers to improve waste storage;
3. A solid waste minimisation project, aimed at minimising all types of waste eg. organic, metals, plastics, glass, paper;
4. A project for improving household waste storage by improving / providing household garbage stands in Apia;
5. A project to improve the Tafa'igata waste depot;
6. A project to supply water quality testing equipment to the Division of Environment, to allow monitoring of local stream water quality;
7. A project to improve the management / disposal of medical waste generated in Apia;
8. A project to provide a septage / sludge disposal facility in Apia.

The above shortlisted projects are outlined in the following section. Detailed Project Profiles are provided in Appendix K.

6.2 PROJECT DESCRIPTIONS

6.2.1 Solid Waste Management Planning Project

Rationale

There is currently a lack of waste management planning in Samoa. A Draft National Waste Management Policy has been prepared by the Department of Lands, Survey and Environment, Division of Environment and Conservation (DEC), however, the policy has not yet been formally adopted by the Government of Samoa. The National Environment and Development Strategies (NEMS) document prepared in 1993, included several waste management projects (one to prepare to prepare a national waste management strategy), however, none of the projects have yet been fully implemented. This lack of waste management planning has lead to the following:

- inadequate and inefficient waste management services;
- a reactionary approach to waste management issues;
- lack of landfill reserve;
- ineffective regulation of waste management activities;
- poor community awareness of the detrimental impacts of improper solid waste management;
- littering and indiscriminate dumping of solid waste, and consequent visual / aesthetic impacts resulting in decreased urban amenity;
- poor waste management practices and facilities, causing environmental impacts such as contamination of groundwater and surface waters and potential detrimental health impacts eg. contamination of drinking water supply, poor water quality, increased vermin and pest levels;
- excessive use of resources; and
- excessive consumption of scarce landfill space.

It is important that a comprehensive waste management plan / strategy be prepared for Apia. Preparation of such a strategy / plan should be the first step in improving waste management in

Apia. The plan should give careful consideration to all the relevant issues and result in a strategy / plan appropriate for Apia, which sets out how waste will be managed over the next 20 years or so. A critical aspect of the Plan would be the identification and development of a sustainable means of funding solid waste management activities to ensure satisfactory performance in the long term. Proceeding to implement various waste management projects without such a plan in place may result in inappropriate developments.

Project Objective

The objective of the project is to prepare a comprehensive and sustainable waste management strategy for Apia, which sets out how waste will be managed over the next 20 years.

Scope

The project would encompass the following:

1. A detailed review of existing waste management practices;
2. Data collection / baseline sub-studies;
3. Investigation, concept development and comparison of options;
4. Development of a preferred waste management strategy.

Further details are provided in the Project Profile attached in Appendix K.

Costs and Resources

The cost of the project would be approximately AUD \$115,000.

Implementation of the project will involve the engagement of a waste management consultant to manage and direct the project. Appropriate DEC staff will be required to undertake much of the preparation of the waste management plan.

Program

The project would run for approximately 12 months.

Issues

Issues that would need to be addressed to maximise the chance of success of the project include:

- Maximum involvement of DEC staff to ensure they take ownership of the Final Strategy (DEC staff should essentially prepare the Plan under the direction of a consultant);

- A sustainable means of funding waste management activities needs to be identified, otherwise the resulting strategy may not be able to be implemented.

Potential Impacts

Potential impacts of the project may include:

- Improved waste management practices leading to a reduction in public health risks and environmental impacts;
- Increased waste management costs;
- Strengthening of the capability of DEC staff in waste management planning.

Further details of this project are provided in Appendix K.

6.2.2 Solid Waste Management Education Program

Rationale

During this Project, evidence of poor waste management practices and indiscriminate dumping of solid waste into creeks and on land was observed across urban Apia. These poor waste practices are causing pollution of creeks and rivers and reducing the visual aesthetics of Apia.

As part of this Project, a public awareness survey was carried out. The results of the survey showed that the level of awareness on waste management issues in Apia is generally low. Many people in Apia are aware of the fact that waste is a problem and can identify the visual (unsightly) impacts that poor waste management creates. Awareness about specific waste issues such as waste separation, composting, recycling, reuse, and hazardous wastes is low. The survey also showed that there was a need for improved dissemination of waste management information as:

- respondents had only very limited knowledge of the specific waste types produced by local industries;
- most respondents knew what materials should be composted but many did not know what compost is used for or had no knowledge of how to manage a compost heap;
- most people had little knowledge on recycling;
- most people do not understand how septic systems work;
- only a small proportion of respondents understood what is meant by hazardous waste.

The amount of information disseminated on waste management appears limited. Less than half of the people interviewed reported seeing or hearing information locally on waste management, and many could not clearly remember when they had encountered the waste information. The vast majority of people have not attended any workshop, seminar or training program on waste management. The impact of community awareness programs carried out to date on waste management appears relatively low, and there is probably a need to undertake some research into the best methods of getting such information effectively across to the general public in Samoa.

Failure to undertake this project will result in continued indiscriminate dumping of waste and pollution of the local environment.

Project Objective

The objective of the project is to significantly improve waste management knowledge among Samoans, leading to reduced indiscriminate dumping of solid waste in creeks and to better storage and management of solids waste in households and other premises.

Scope

This project would involve development and implementation of an education program which aims to raise awareness of waste management as a serious environmental issue, generally improve waste management practices, specifically reduce the incidence of indiscriminate dumping of solid waste and specifically encourage improved on-site storage of wastes, ie., use stands and garbage bins. Tasks that would be undertaken include:

1. A supplementary public awareness survey;
2. Identification of key issues and approaches;
3. Development of the education program;
4. Implementation of the education program; and
5. Assessment of the effectiveness of the program.

It is envisaged that the education program would be staged, with the initial stages focusing on raising the awareness of the general community about waste management as a serious environmental issue and educating the public about basic "common sense" things that can be done to improve household waste management practices ie. do not throw rubbish on creek, do not dump oil in creeks, use a secure container (garbage bin) to store household garbage or use a garbage stand. Later stages would focus on more advanced activities such as recycling and home composting and other waste minimisation practices.

Further details are provided in the Project Profile attached in Appendix K.

Costs and Resources

The cost of the program would be of the order of AUD \$285,000.

Implementation of the projects would require input from an environmental education consultant, a local Samoan community consultant, and support from the relevant DEC staff.

Program

The project would run for a period of approximately 27 -39 months.

Issues

Issues that would need to be addressed to maximise the chance of success of the project include:

- Confirming the results of the Public Survey undertaken as part of this Study to ensure the project targets the right people and causes of environmental impact;
- Integration with other education programs ie. NZODA, EU, to ensure no duplication of activities;
- Implementation of the education program should be staged. Initial stages should focus on raising public awareness about waste management as a serious environmental issues and educating the general public about simple common sense things that can be done to improve household waste management practices. Later stages can focus on more detailed and complex waste management and minimisation activities.
- Maximise use of local consultants with experience in public education in Pacific Islands;
- Maximise involvement of local community group eg. women's groups.

Potential Impacts

Potential impacts of the project may include:

- An improvement in the visual aesthetics of Apia and an improvement in local surface water quality;
- A change in urban Samoan way of life in regard to waste management;

Further details of this project are provided in Appendix K.

6.2.3 Solid Waste Minimisation Project

Rationale

Land suitable for landfill operations in Samoa is scarce. This problem is primarily due to the existing traditional land ownership system, which results in government owning little land and having little control over land, thus providing few opportunities for establishing waste depots. In Samoa, a landfill site has been established at Tafa'igata which, under present conditions, should be able to cater for the needs of the Apia region for about 20 years. However, once this site has been filled, finding a new site may be a major problem.

Currently only limited waste minimisation (waste prevention, re-use, recycling, and reprocessing of waste) is occurring in Samoa. Activities currently being undertaken include reuse of glass bottles, reuse of waste plastic containers by householders, some recycling of aluminium and other high value metals, and some home composting.

Continuation of current waste generation and management practices will result in excessive resource consumption, rapid filling of the Tafa'igata waste depot and present the problem of finding a new waste depot site.

Consequently, there is a need to minimise the quantity of waste going to landfill, thus conserving the landfill site for waste which cannot be avoided, and thus reducing the detrimental impacts of the landfilling operations.

Project Objective

The objective of the project is to develop and provide assistance with the implementation of sustainable waste minimisation activities in Samoa. The project will focus on the Apia urban area, where waste management problems are most severe; and address all potential waste streams eg. commercial and industrial organic waste, domestic organic waste and other waste materials such as glass, paper, plastic and metals.

Scope

This project will involve the investigation, development and implementation of several waste minimisation activities focusing on the Apia area. The project would be separated into 4 separate programs addressing:

- aluminium and other metals;
- commercial and industrial organic waste;
- domestic organic waste; and

- glass, plastic and paper.

For each of the above waste streams / types, the following would be undertaken:

1. A feasibility study to investigate and assess the waste source, assess potential markets for products, assess public reaction and support for any possible schemes, assess likely support from industry, assess waste collection and processing options, and assess economics and sustainability. The outcome of the feasibility study would be a preferred scheme(s) for minimising the target waste stream / type.
2. Trial of the recommended scheme(s) - where necessary;
3. Implementation of the preferred scheme(s);

It is envisaged that the following schemes would be investigated, developed, trialed and possibly implemented:

1. A system for the collection and recycling of aluminium and other valuable metals. It is envisaged that a system of local drop off (collection) centres could be established in Apia and nearby villages, involving local community groups and NGOs (who undertake the activity as a means of raising funds). Collected material would then be sold to a local recycling merchant for export to overseas recycling markets.
2. A commercial and industrial organic waste processing facility located at the Tafa'igata waste depot. Waste materials would be transported to the depot by the waste generators where it is processed into compost or other organic products eg. mulch, potting mix, etc, for sale to local Apia residents and local farmers;
3. Schemes for the local collection, reuse, recycling and local reprocessing of glass, paper and plastic waste materials. Options that should be investigated include:
 - export recycling markets;
 - local collection and reprocessing of paper in fuel bricks;
 - local collection and processing of glass into drainage, concrete, or road making aggregate;
 - use of waste paper and plastics in handicrafts;
 - reuse of plastic shopping bags;
4. A domestic organic waste processing facility located at the Tafa'igata waste depot, incorporated with the facility processing commercial and industrial organic waste. Options

for waste collection should be examined as well as options for processing. It is envisaged that initially garden waste only would be processed, before expanding the operation to cater for kitchen food wastes.

Further details are provided in the Project Profile attached in Appendix K.

It is recommend that the minimisation of all waste types be investigated, however, initially efforts should focus on the high value metals or organic waste as such projects would have a much greater chance of success, result in a greater reduction in the quantity of waste landfilled (in the case of organic waste), plus help to reduce the pollution potential of the waste depot operation (from organic waste). There are some concerns about the success of developing a local large scale, sustainable system of reusing and recycling glass, paper and plastics. Although such a scheme would focus on domestic waste, and would therefore be high profile, it is likely that only small quantities of waste will actually be re-used / recycled. If waste is collected for reuse / recycling, and isn't, the public will only become sceptical of such schemes. It is therefore recommend the initially focus should be placed on those schemes that are most likely to be successful eg. organic waste processing or high value metal recycling, before tackling the more difficult waste types eg. plastics.

Costs and Resources

The cost of the proposed project addressing all waste streams as outlined above would be approximately AUD \$1,375,000. The cost of the separate programs would be

<input type="checkbox"/> commercial and industrial organic waste	AUD \$575,000
<input type="checkbox"/> domestic organic waste	AUD \$325,000
<input type="checkbox"/> aluminium and other high value metals	AUD \$150,000
<input type="checkbox"/> glass, plastic and paper	AUD \$325,000

Implementation of the program would require the input of several specialist consultants including a waste management engineer / planner, economist, institutional / legislative expert and community education specialist. The consultants would also need to be supported by relevant DEC staff. Further details are provided in Appendix K.

Program

The project would run for approximately 12-24 months.

Issues

Issues that would need to be addressed to maximise the chance of success of the project include:

- Focus should be initially placed on those waste streams where waste minimisation opportunities are greatest ie. easier to develop and implement and more likely to be sustainable. Considering such the recommended order of priority is high value metals; commercial and industrial organic waste; domestic organic waste; and glass, paper and plastic.
- Extensive involvement of relevant DEC staff, to ensure the DEC takes ownership of the waste minimisation projects and drive their implementation;
- Careful assessment of the available markets and options for waste materials (export and local);
- Consideration of avoided landfill waste disposal costs in any economic analysis;
- Careful selection of projects for trialing, considering economic sustainability and market stability;
- Community education, co-operation and support will be critical to the success of any waste minimisation project, as it will be necessary for the public to segregate their wastes for re-use, recycling and reprocessing; and
- Government support.

Potential Impacts

Potential impacts of the project may include:

- A significant reduction in the quantity of waste landfilled. This would reduce the impacts of the landfilling operation as well as assist in resource conservation;
- A change in urban Samoan way of life in regard to waste management eg. household waste segregation;
- Environmental impacts if waste processing operations are not properly designed and operated eg. composting operation;
- Increased waste management costs, possibly, to fund waste minimisation activities; and
- Possible legislative changes to restrict the import of non-recyclable products / materials.

Further details of the project are provided in Appendix K.

6.2.4 Solid Waste Storage Project

Rationale

Currently, domestic solid waste is typically stored at households on a stand, which is generally located on the road side (ready for collection). The stands are typically 1.5 m high and made of timber. The purpose of the stands is to prevent disturbance of the stored garbage by animals eg. dogs, and thus minimising litter and improving the amenity of the local area.

Many of the existing garbage stands are in a state of disrepair and many households do not have a stand. The result is that household garbage is left at the roadside at natural ground level and is therefore prone to disturbance by animals, often resulting in scattering of the garbage into drains and nearby waterways.

To address this problem it is proposed to undertake a project to repair or replace existing household garbage stands and provide new stands to those households that do not currently have a stand.

Project Objective

The objective of the project is to improve the storage of garbage at households by upgrading current garbage stands and thus minimise the litter resulting from poor garbage storage.

Scope

To improve domestic household garbage storage following scope of work is proposed:

1. Undertake a survey of existing household garbage stands and review and assess options for improving household waste storage;
2. Preparation of appropriate tender documentation, for provision of repairs to existing household garbage stands and provision and installation of new household garbage stands eg. fabrication drawings, specification and contract documentation;
3. Undertake tendering process to select contractor to undertake the upgrading works; and
4. Undertake works to upgrade household garbage storage eg. fabrication of new household garbage stands and repair work on existing garbage stands;

Further details are provided in the Project Profile attached in Appendix K.

Costs and Resources

The cost of the project would be approximately AUD \$475,000.

Implementation of the project would require the involvement of a waste management consultant to review the status of existing household waste storage and review options for improving household waste storage, develop tender documentation for the upgrading works and supervise the works. DEC staff would be required to provide support throughout the project, including staff to survey the condition of existing garbage stands and assist in undertaking the upgrading works.

Program

The project would run for approximately 9 months.

Issues

Issues that would need to be addressed to maximise the chance of success of the project include:

- The proposed garbage stands will reduce the disturbance and scattering of waste by animals but would not reduce the scattering of waste due to wind, nor reduce nuisance such as odour, flies and vermin (secure garbage container would be required to overcome these problems);

Potential Impacts

Potential impacts of the project may include:

- An improvement in household waste storage, leading to a reduction in the disturbance of household waste by animals;
- Income for a local contractor to fabricate the garbage stands (significant amount);

Further details of this project are provided in Appendix K.

6.2.5 Solid Waste Disposal Project

Rationale

Currently, all solid waste generated in Apia is disposed of at the Tafa'igata waste depot, which is located approximately 10 km south west of the Apia town centre. The waste depot can be described as a semi-controlled "dumping" operation with minimal compaction and covering of the deposited waste (leading to "unsanitary" conditions at the site). One reason for the lack of compaction and covering is the lack of funds and equipment to regularly undertake such. Few

measures are implemented at the site to control or prevent environmental impacts eg. there is limited compaction and covering of the deposited waste, no leachate (contaminated water) controls, no stormwater runoff controls, no landfill gas controls, and there is no plan of management for the operation. The site is located in an area where the soils/rock underlying the site are of high permeability, and as a consequence the risk of groundwater contamination (and nearby springs) due to the landfilling operation is high, particularly considering the current operating practices. Contamination of the underlying groundwater could lead to contamination of local springs, which are used for drinking water supply.

Another issue with the current waste disposal activities is the limited expertise and experience of the Division of Environment staff in planning, managing, supervising and day to day operation of a modern sanitary landfill waste depot. In particular, there is a lack of appropriate supervision of the waste depot operation - an appropriately trained supervisor should be on site at all times.

Project Objective

The objective of the project is to improve the operation of the Tafa'igata waste depot and thus minimise its impact on the local environment. This would include providing additional training for DEC staff in the planning and management of the landfill waste depots.

Scope

To improve the operation of the Tafa'igata waste depot the following scope of work is proposed:

1. Undertake a detailed geological / hydrogeological and geotechnical investigation of the site;
2. Preparation of plan of management for the waste depot;
3. Undertake the necessary upgrading works at the waste depot eg. surface water drainage, road works, fencing;
4. Provision of equipment to allow effective and efficient landfilling at the site;
5. Provision of training of appropriate Division of Environment staff, to allow effective planning, management, supervision and operation of the waste depot; and
6. Monitoring of the quality of surface water discharging from the waste depot site and downstream of the site (by DEC officers).

Further details of the scope of the project are provided in the Project Profile attached in Appendix K.

Costs and Resources

The cost of the project would be approximately AUD \$2,000,000.

Implementation of the project would require the engagement of consultants to undertake the geological / hydrogeological investigations, manage the preparation of the landfill management plan, organise the purchase of the necessary landfilling equipment (via tender) and the design and construction of a suitable storage shed for the equipment. DEC staff would be required to provide support during the project, become extensively involved in the preparation of the landfill management plan, assist during the obtaining of the landfilling equipment, and undergo various training. A contractor would be required to undertake the upgrading works.

Program

The project would run for approximately 12 - 18 months, although the water quality monitoring would be ongoing.

Issues

Issues that would need to be addressed to maximise the chance of success of the project include:

- The availability of a suitable drilling rig to undertake the geological / hydrogeological investigation work;
- The laboratory analysis of groundwater samples - would need to be sent to Australia or New Zealand;
- DEC staff should be extensively involved in the preparation of the landfill management plan to ensure they take ownership of the plan, thus improving the chances of successful implementation of the plan, and also as a training exercise for DEC staff;
- Funds for implementation of the landfill management plan eg. drainage works, fencing, etc;
- Source of funding for the operation and maintenance of the landfilling equipment;

Potential Impacts

Potential impacts of the project may include:

- A reduction in the environmental impact of the Tafa'igata waste depot eg. nuisance from flies, litter and odour, contamination of groundwater and surface waters, ;

- The introduction of charges for disposal of garbage at the Tafa'igata waste depot (to provide funds for running the depot), and consequent social impacts, possibly leading to deliberate dumping of waste elsewhere;

Further details of the project are provided in Appendix K.

6.2.6 Surface Water Quality Monitoring Project

Rationale

Work during the 1998 JICA project and information from previous studies clearly indicated that very little data has been collected or is being collected on surface water quality in Samoa. Very limited surface water quality testing has been carried out in the past in Apia by the Public Works Department (physio-chemical testing) and the Department of Health (microbiological testing), and the Water Authority tests drinking water supplies, most of which are groundwater or water collected in upstream catchment areas. Currently there is no program of testing streams, creeks, or nearshore coastal waters around Apia, partly because of a lack of suitable equipment/facilities and partly because of the lack of funding.

Given the likely impact of local industries and poorly managed septic systems, particularly in the Apia area, it is essential for good environmental management that some regular monitoring be carried out of surface waters in the area, to identify health risks to users of these water bodies, to identify environmental impacts, and to assess changes that occur as improved management of wastes occurs.

Project Objective

The objective is of the project to provide the DEC with equipment and training necessary to carry out regular monitoring of surface water bodies in the Apia area, and to initiate such a monitoring program in 1999. This would be part of an overall objective of monitoring and thus minimising the contamination of coastal, surface and ground waters from the waste depot, industry, septic tank effluent, including overflows, and related problems, as a contribution to health and sanitation improvements in Samoa.

Scope

The project would involve undertaking the following tasks:

1. Review the existing capability, programs, and facilities for water quality monitoring in Samoa (encompassing all relevant Government Departments eg. Water Authority, Department of Health), and identify and purchase suitable equipment for in situ testing of water quality for surface waters by DEC staff. It is anticipated that this would include:

- a multi-parameter water quality probe able to monitor dissolved oxygen, pH, turbidity, conductivity / salinity, and temperature; and
 - a portable water quality testing kit which is able to measure nitrogen compounds, phosphorus, and other relevant pollutants.
2. Undertake a training program involving at least 3 DEC staff in the use of the water quality testing equipment, design of monitoring programs and in data analysis and interpretation.
 3. Investigate, develop, and initiate a program to monitor surface water quality in the Apia area (including surface water discharging from the waste depot and creeks downstream), and produce regular annual reports on the results of the monitoring program. Where required, it will be necessary to organise for other Government Departments to undertake laboratory analysis for pollutants not able to be measured in-situ eg. Health Department to undertake bacteriological testing.

To undertake a comprehensive surface water quality monitoring program will require the co-operation of several Government Departments eg. DEC, Water Authority, Health Department. The Water Authority and the Health Department both have laboratories which will be required for measuring certain pollutants unable to be confidently measured insitu eg. bacteriological and biological testing. Co-operation of the Government Departments should be sought to avoid the duplication of equipment and facilities.

Costs and Resources

The cost of the project would be approximately AUD \$56,000.

Implementation of the project would require the engagement of a suitable consultant to identify and organise purchase of appropriate equipment, assist the DEC develop a water quality monitoring program, and train DEC staff in the operation and maintenance of the equipment. DEC staff will be required to prepare a water quality monitoring program, undergo training, and implement and report on the water quality monitoring program.

Program

The project would run for approximately 3 months, however, implementation of the monitoring program would be on going.

Issues

Issues that would need to be addressed to maximise the chance of success of the project include:

- Selection of appropriate equipment for use in Samoa, considering existing facilities / equipment in Apia, operation, maintenance and consumables. The equipment should be simple to use and maintain, spare parts / servicing should be readily available, and consumables should be reasonably priced and readily available;
- Obtaining the co-operation of the relevant Government Departments eg. DEC, Health Department and the Water Authority;
- Formal training in the operation and maintenance of the testing equipment;
- Source of funding for operation and maintenance of the equipment, and for consumables;

Potential Impacts

Potential impacts of the project may include:

- Improved surface water quality in and around Apia;
- Increased environmental monitoring capacity of the DEC;

6.2.7 Medical Waste Management Project

Rationale

Currently in Apia, medical waste is generated at the National Hospital and at 4 local private medical centres. Waste disposal practices at the National Hospital generally encompass the following:

- separation of the "contaminated" wastes eg. soiled bandages, and burning of the waste in the old incinerator at the hospital;
- separation of the sharps (needles) and disposal in a separate trench at the Tafa'igata waste depot;
- collection and disposal of general garbage from the hospital at the Tafa'igata waste depot.

It was reported during site inspections that the separation of the various waste materials at the hospital was not as good as it could be due to the lack of suitable containers for sharps and contaminated wastes, and a lack of training. As a result, it is possible for sharps and contaminated

wastes to be mixed with general garbage and disposed of at the Tafa'igata waste depot taking no special precautions.

The contaminated wastes generated by the hospital are disposed of at the hospital in an old incinerator located at the rear of the hospital. The incinerator is some 30 years old and originally was diesel fired. Some years ago the diesel injection system ceased to operate and repairs were not able to be made. As a result the incinerator is now fired by stoking the incinerator with wood and paper. Firing the incinerator using paper and wood is not likely to reach the design operating temperatures and therefore achieve effective destruction of the contaminated wastes. This then raises several concerns about emissions from the incinerator eg. smoke and other pollutants, and their potential effects on hospital patients and nearby residents.

Separated sharps are disposed of in a specially prepared trench at the Tafa'igata waste depot due to a lack of capacity to burn the waste at the hospital incinerator (and due to the problems with the old incinerator, as described above). The trench for the hospital waste is sign posted and is located along the access road to the main active waste dumping area. There are, however, no controls over access to the sharps disposal trench. At the time of the inspection of the waste depot a load of sharps had recently been deposited in the hospital waste trench, however, although the waste is supposed to be immediately covered, it had not been covered. Considering the lack of control over access to the hospital waste disposal area (and the waste depot site in general), this type of practice presents a real public health risk and should be addressed.

The current waste management practices of the 4 private medical centres are not known. However, it is known that the wastes are not being disposed of at the hospital's incinerator. Thus the disposal practices are likely presenting some risk to the public, particularly if the waste is being disposed of at the waste depot along with general rubbish.

Project Objective

The objective of the project is to improve medical waste management in Apia, thus minimising existing public health risks associated with current practices. This will essentially involve developing and implementing a rigorous waste separation program at the hospital and the 4 medical centres, and establishing a system for incineration of the separated medical waste eg. via utilisation of the Department of Agriculture's airport quarantine waste incinerator or provision of a new medical waste incinerator.

Scope

To improve medical waste management in Apia the following scope of work is proposed. Note that if a system for using the airport quarantine waste incinerator can be agreed, there would be no need for tasks 3 to 6.

1. Undertake a waste characterisation study which defines the types and quantities of medical waste being generated in Apia, from the hospital as well as the 4 medical centres (to allow an appropriate incinerator to be selected);
2. Investigate the opportunity to utilise the Department of Agriculture's airport quarantine waste incinerator for disposal of the medical waste;
3. Undertake an assessment of the environmental impacts of establishing a new medical waste incinerator. The assessment would give particular consideration to the location of the incinerator eg. at the hospital or elsewhere, and consequent impacts and practicality of its operation;
4. A review of options for medical waste incineration and preparation of a specification for an appropriate incinerator. This would consider the outcome of the environmental assessment and identify performance requirements such as air emission standards, fuel consumption, noise levels etc.;
5. Preparation of tender documentation and calling of tenders for provision of a medical waste incinerator;
6. Installation of a new medical waste incinerator in Apia, including training of Department of Health staff in the operation and maintenance of the incinerator.
7. Development and implementation of a program for medical waste separation at the National Hospital and the 4 Medical centres, including the provision of suitable containers and other equipment for the medical waste and training of all relevant staff.

Further details are provided in the Project Profile attached in Appendix K.

Costs and Resources

The cost of the project would be approximately AUD \$473,000. This assumes that a new incinerator is required to be provided but that sophisticated air pollution control equipment is not required for the incinerator.

Implementation of the project would require the engagement of a waste management consultant to undertake the waste characterisation study, prepare the specification for the incinerator,

undertake the environmental assessment study, and supervise the construction and commissioning of the incinerator. Department of Health or DEC staff will be required to help undertake the waste characterisation study and provide support throughout the implementation of the project.

Program

The project would run for approximately 12 months.

Issues

Issues that would need to be addressed to maximise the chance of success of the project include:

- Obtaining co-operation between the relevant Government Departments eg. Health Department and Department of Agriculture;
- Co-operation of the 4 medical centres;
- Determination of the need for sophisticated air pollution control equipment, if a new incinerator is provided; and
- Source of funding to operate and maintain the incinerator.
- Formal training of Department of Health staff in the operation and maintenance of the incinerator;

Potential Impacts

Potential impacts of the project may include:

- Reduced public health risks from the disposal of medical waste;
- A reduction in air pollution resulting from the operation of the existing incinerator;

Further details of the project are provided in Appendix K.

6.2.8 Septage / Sludge Management Project

Rationale

Currently, septage / sludge is disposed of at the Tafa'igata waste depot in excavated pits. This activity would be having a detrimental impact on the underlying groundwater, as a result of the percolation of the septage into the underlying strata and consequently the groundwater. The effect of the septage disposal activities could be worse than the effects of the landfilling operation,

due to the highly permeable strata underlying the site and the highly mobile septage (liquid). Possible effects of the operation would include contamination of the local groundwater (and consequently nearby springs) by organic matter, nutrients, faecal matter/bacteria, and other contaminants that may be in the septage eg. oil, chemicals etc.

To overcome the impacts of this operation, it is proposed that a more environmentally friendly sludge management facility be constructed at the waste depot.

It should be noted that although a centralised sewerage system is proposed for Apia, the sewerage system will only cover a small part of the Apia town centre (low lying areas). The areas outside of the town centre will still rely on septic tanks for wastewater disposal. As a result there will be a long term need for a septage / sludge management facility. Depending on the type of centralised sewage treatment system installed, septage / sludge may not be able to be disposed of at the centralised sewage treatment facility.

Project Objective

The objective of the project is to overcome the current impacts of the existing septage / sludge disposal activities at the waste depot by establishing a more environmentally friendly facility to manage the septage / sludge.

Scope

The project would encompass the following:

1. Investigation and assessment of septage / sludge management options

To ensure the most appropriate septage / sludge disposal facility is established, it is proposed to undertake a detailed investigation and assessment of existing sludge management practices, and a detailed review of options for managing the septage / sludge. The aim of the investigation is to identify and define the preferred sludge management process. This may encompass establishing a sludge drying bed at the Tafa'igata waste depot along with a facility to treat the resulting liquid. The dried sludge could be used as a raw material in a composting operation.

2. Design and documentation of the selected sludge management facility

Once the preferred sludge management facility is defined, the necessary documentation for construction of the facility would be prepared. This would include engineering drawings, specification, and contract documentation.

3. Construction and commissioning of the sludge management facility

Tenders would be called for the construction of the sludge management facility. A contractor would be engaged and the facility constructed. Assuming the facility is a sludge drying bed, construction would encompass excavation, concrete works, erection of metal roofing (possibly), and installation of a septic tank type treatment facility for treatment of the wastewater from the drying bed. It is proposed that a consultant would be engaged to supervise the construction of the facility. Alternatively the Department of Public works may be used.

4. Training of DEC staff in the operation and maintenance of the sludge management facility

To ensure proper operation and maintenance of the sludge management facility, it is proposed that the appropriate DEC (or Public Works) staff would be trained to undertake such.

Further details are provided in the Project Profile attached in Appendix K.

Costs and Resources

The cost of the project would be approximately AUD \$1,700,000.

Implementation of the project would require the engagement of an appropriate consultant to undertake the assessment of current septage / sludge management practices, review options for sludge management and design and document the selected septage / sludge facility. Support would be required from the DEC / Public Works / Water Authority throughout the project.

Program

The project would run for approximately 20 months.

Issues

Issues that would need to be addressed to maximise the chance of success of the project include:

- resolving who will be responsible for the operation and maintenance of the facility ie. DEC, Public Works or the Water Authority;
- identifying a long term source of funding for operation and maintenance of the facility.

Potential Impacts

Potential impacts of the project may include:

- a reduction in groundwater contamination in the locality of the Tafa'igata waste depot, and a consequent reduction in public health risks;
- increased septage / sludge management costs;
- additional staff required to operate and maintain the facility.

Further details of the project are provided in Appendix K.

6.3 SUMMARY OF SHORTLISTED PROJECTS

A summary of the shortlisted projects is provided in Table 6.1.

TABLE 6.1: SUMMARY OF SHORTLISTED PROJECTS

Project	Intended Outcome	Project Tasks	Estimated Cost (AU \$)	Likely Duration (mths)
<p>1. Solid Waste Management Planning</p> <p>1.1 Preparation of a comprehensive, sustainable solid waste minimisation and management strategy for Apia</p>	<p>A formal Plan which considers solid waste management in Apia and sets out a sustainable strategy for minimising and managing waste for the next 20 years. Includes development of a sustainable means of funding waste management activities</p>	<p>(i) Data collection, investigation of existing practices and detailed waste characterisation study, including identification of data required for strategy eg. population, demographics, development profile, employment profile, tourism</p> <p>(ii) Undertake public awareness survey to assess public awareness and understanding(UNDERTAKEN AS PART OF THIS STUDY)</p> <p>(iii) Investigate and assess options for managing waste, including funding, waste minimisation, collection, treatment and disposal options, and develop preferred strategy</p> <p>(iv) Submit to Government for adoption and implementation</p> <p style="text-align: right;">Total</p>	<p>\$30,950</p> <p>\$0</p> <p>\$84,725</p> <p>\$115,675</p>	<p>3</p> <p>3</p> <p>6</p> <p>12</p>
<p>2. Solid Waste Management Education</p> <p>2.1 Develop and implement an education program which aims to reduce the incidence of indiscriminate dumping of solid waste and encourage improved on site storage of wastes i.e., use stands and / garbage bins</p>	<p>A reduction in indiscriminate dumping of solid waste in creeks and improved storage of solid waste at households and other premises.</p>	<p>(i) Undertake detailed public awareness survey to assess public awareness and understanding</p> <p>(ii) Identification of key issues and approaches</p> <p>(iii) Develop education program</p> <p>(iv) Implement education program</p> <p>(v) Assessment of Effectiveness of the program</p> <p style="text-align: right;">Total</p>	<p>\$17,600</p> <p>\$6,550</p> <p>\$23,100</p> <p>\$216,400</p> <p>\$21,900</p> <p>\$285,550</p>	<p>1</p> <p>0.25</p> <p>1</p> <p>12</p> <p>1</p> <p>15.25</p>

TABLE 6.1: SUMMARY OF SHORTLISTED PROJECTS

Project	Intended Outcome	Project Tasks	Estimated Cost (AU \$)	Likely Duration (mths)
<p>3. Solid Waste Minimisation</p> <p>3.1 Investigate, develop and implement a commercial and industrial organic waste processing facility</p>	<p>To reduce commercial and industrial waste disposal whilst producing a useful product for local use.</p>	<p>(i) Undertake feasibility study to investigate and assess potential waste sources, potential markets for product, collection and processing options, and viability of such a scheme. Includes detailed waste characterisation study.</p> <p>(ii) Implement preferred scheme, including establishing agreements with waste generators, collection services and establishing a processing facility. Also, includes reaching agreements with markets, prior to establishing facility, if able.</p> <p style="text-align: center;">Sub total</p>	<p>\$75,000</p> <p>\$498,800</p> <p>\$573,800</p>	<p>6</p> <p>6</p> <p>12</p>
<p>3.2 Investigate and develop a domestic organic waste management program</p>	<p>A reduction in the disposal of domestic organic waste (which comprises >60% of the waste stream) at the waste depot, whilst producing a useful product for local use.</p>	<p>(i) Undertake feasibility study to investigate and assess the waste source, potential markets for products, collection and processing options, and viability of such a scheme. Should include detailed waste characterisation study and public survey.</p> <p>(ii) Implement preferred scheme. Likely to be at source management. However, may include establishing a collection service and processing facility, and establishing agreements with markets.</p> <p style="text-align: center;">Sub total</p>	<p>\$76,100</p> <p>\$248,800</p> <p>\$324,900</p>	<p>6</p> <p>6</p> <p>12</p>
<p>3.3 Develop formal aluminium and other high value metal recycling program</p>	<p>To reduce the quantity of metal being disposed of at the waste depot.</p>	<p>(i) Undertake feasibility study to investigate and assess the waste source, potential markets for products, collection and processing options, and viability of potential schemes. The study should include a waste characterisation study and extensive consultation with industry and community groups.</p>	<p>\$43,300</p>	<p>3</p>

TABLE 6.1: SUMMARY OF SHORTLISTED PROJECTS

Project	Intended Outcome	Project Tasks	Estimated Cost (AU \$)	Likely Duration (mths)
3.4 Investigate, develop and implement a local waste minimisation plan for glass, paper, plastic and wood	To reduce the quantity of glass, paper, plastic and wood waste being generated and disposed of to landfill.	(i) Implement preferred scheme. Likely to be based around using community groups for collection of the materials.	\$106,350	6
		Sub total	\$149,650	12
		(i) Undertake feasibility study to investigate and assess potential waste reduction, re-use, recycling and reprocessing options, potential markets for waste products, collection and processing options, and viability of potential schemes. The study should include a waste characterisation study, extensive consultation with local industry and community groups, and result in an action plan and implementation program for preferred schemes.	\$100,300	6
		(ii) Implement preferred waste minimisation schemes.	\$224,700	12
		Sub total	\$325,000	18
		Total	\$1,373,350	

TABLE 6.1: SUMMARY OF SHORTLISTED PROJECTS

Project	Intended Outcome	Project Tasks	Estimated Cost (AU \$)	Likely Duration (mths)
<p>4. Solid Waste Storage 4.1 Develop and implement a program for improving garbage stands (storage) in Apia</p>	To improve on site waste storage and consequently reduce disturbance of waste by animals	(i) Undertake a survey to identify the extent / need for repairs to existing garbage stands and for new garbage stands. (ii) Assess results of survey, develop documentation and program for undertaking required works, including preparation of cost estimate and tender documentation. (iii) Conduct tender process (iv) Undertake repair works / organise fabrication and distribute new stands	\$4,500 \$15,000 \$5,000 \$450,000 \$474,500	1 1.5 1.5 9 13
<p>5. Solid Waste Disposal 5.1 Undertake a detailed geological / hydrogeological / geotechnical investigation of the site</p>	To determine if groundwater contamination is occurring due to landfilling on the site and provide information necessary for the upgrading of the operation.	(i) Undertake necessary site investigations, analyse data, prepare report. Sub total	\$142,500 \$142,500	4 4
<p>5.2 Preparation of landfill management plan</p>	A formal plan for filling of the site which addresses both operational and environmental issues	(i) Undertake detailed site investigation and data collection, including site topographical survey (ii) Investigate, develop and design the necessary upgrading works, including plan of filling, leachate and stormwater works. (iii) Prepare landfill management plan Sub total	\$20,000 \$25,000 \$26,000 \$71,000	2 3 3 8 4
<p>5.3 Undertake upgrading works at the depot, including security fencing, road works and drainage works</p>	To improve control over access to the site, thus reducing potential health risks, improve access, and improve surface water management.	(i) Investigate, develop and design the necessary upgrading works	\$75,000	4

TABLE 6.1: SUMMARY OF SHORTLISTED PROJECTS

Project	Intended Outcome	Project Tasks	Estimated Cost (AU \$)	Likely Duration (mths)
5.4 Provide landfilling equipment e.g. tracked loader	To allow regular compaction and covering of waste deposited at the landfill, thus reducing nuisance and leachate generation	(ii) Prepare and call tenders for undertaking the works (iii) Construct the upgrading works Sub total	\$25,000 \$1,000,000 \$1,100,000	2 6 12
5.5 Provide landfill operational training to appropriate DEC staff	To improve the capability of DEC staff in regard to planning and operating the landfill site	(i) Prepare tender documentation for supply of equipment, construction of shed and training program (ii) Prepare and call tenders for the equipment and construction of the storage shed, including tender assessment (iii) Construct storage shed (iv) Purchase equipment and undertake training program - operation and maintenance Sub total	\$15,000 \$100,000 \$510,000 \$640,000	3 3 3 12
5.6 Undertake monitoring of quality of surface water discharged from waste depot site, before, during and after upgrading works (Part of Project No. 6)	Data to assess the quality of surface water discharging from the waste depot site, which will then allow potential environmental impacts to be identified.	(i) Identify / develop appropriate training course, select and send appropriate DEC staff. See Project No. 6 Sub total	\$48,600 See Project No. 6 \$48,600	3 Ongoing 3
Total			\$2,002,100	27
6. Water Quality Monitoring Equipment and Program				
6.1 Provision of surface water quality testing equipment to the DEC to allow insitu testing of drains, creeks and water courses in and around Apia (including surface water at the Tafaiata waste depot).	Equipment to allow DEC staff to monitor local surface water quality	(i) Identify suitable equipment, prepare specification, obtain quotes and purchase (ii) Prepare monitoring program and undertake relevant training of DEC staff. (iii) Implement monitoring program and report, under supervision of consultant Total	\$26,250 \$7,500 \$22,200 \$55,950	1 0.5 12 13.5

TABLE 6.1: SUMMARY OF SHORTLISTED PROJECTS

Project	Intended Outcome	Project Tasks	Estimated Cost (AU \$)	Likely Duration (mths)
7. Medical Waste Management in Apia 7.1 Provision of a new incinerator to the Department of Health for disposal of hospital and other medical waste	A mechanism for appropriate disposal of medical waste from the hospital	<p>(i) Undertake detailed waste characterisation study, encompassing hospital and medical centres</p> <p>(ii) Investigate the opportunity to utilise the existing quarantine waste incinerator at the airport to dispose of medical waste</p> <p>(iii) Undertake environmental impact assessment and obtain approvals</p> <p>(iv) Determine performance requirements for incinerator e.g., air emissions, noise, fuel supply, etc., and identify appropriate incinerator type and location.</p> <p>(v) Prepare and call tenders for an incinerator</p> <p>(vi) Construct and commission the incinerator (assumes no special air emissions controls)</p> <p>(vii) Develop and implement medical waste separation program</p>	<p>\$30,000</p> <p>\$11,250</p> <p>\$100,000</p> <p>\$15,000</p> <p>\$15,000</p> <p>\$160,000</p> <p>\$142,000</p> <p>\$473,250</p>	<p>3</p> <p>6</p> <p>2</p> <p>3</p> <p>3</p> <p>1</p> <p>18</p>
		Total		

TABLE 6.1: SUMMARY OF SHORTLISTED PROJECTS

Project	Intended Outcome	Project Tasks	Estimated Cost (AU \$)	Likely Duration (mths)
<p>8. Septage /Sludge Management 8.1 Investigation, design and development of an appropriate septage / sludge handling facility in Apia</p>	<p>A facility which manages septage and sludge in an environmentally friendly manner</p>	<p>(i) Investigate and assess in detail existing sludge management practices. Identify problems and investigate and assess options to overcome problems. Develop preferred sludge management plan. (ii) Undertake design and documentation of the preferred sludge management plan. This may involve design of a sludge treatment / disposal facility at the Tafai'ata waste depot eg sludge drying beds. (iii) Construct and commission the sludge treatment / disposal facility (iv) Undertake training of staff in operation and maintenance of the sludge treatment / disposal facility</p>	<p>\$50,000</p> <p>\$100,000</p> <p>\$1,500,000</p> <p>\$50,000</p> <p>\$1,700,000</p>	<p>3</p> <p>3</p> <p>12</p> <p>3</p> <p>21</p>
		Total		
		Grand Total	\$6,480,375	

7. CONCLUSIONS

Waste management in Samoa is occurring in a manner which is causing detrimental impact on the local environment and creating public health risks. This includes impacts on local surface water quality (marine as well as creeks and rains), likely impacts of local groundwater quality, potential health risks associated with the reduced water quality, visual degradation due to litter and dumping of wastes, and potential health risks created by current medical waste management practices. Reasons for the poor waste management practices include lack of planning, a lack of funds, a lack of appropriate waste management facilities, a lack of local expertise and experience in modern waste management practices, and poor public awareness and understanding about waste management as an environmental issue.

This Project has identified that there are many projects which JICA could fund to help improve waste management and consequently improve the urban environment in Samoa. A shortlist of projects for JICA consideration have been suggested, which encompass the following:

1. A solid waste management planning project, aimed at developing a sustainable waste management strategy for Apia which set out how waste will be managed for the next 20 years;
2. A solid waste management education program, aimed at improving basic household waste management practices, discouraging littering, indiscriminate dumping of waste, and encouraging the use of secure household garbage containers to improve waste storage;
3. A solid waste minimisation project, aimed at minimising all types of waste eg. organic, metals, plastics, glass, paper;
4. A project for improving household waste storage by improving / providing household garbage stands in Apia;
5. A project to improve the Tafa'igata waste depot;
6. A project to supply water quality testing equipment to the Division of Environment, to allow monitoring of local stream water quality;
7. A project to improve the management / disposal of medical waste generated in Apia;
8. A project to provide a septage / sludge disposal facility in Apia.

Detailed profiles for the shortlisted projects have been prepared and are attached in Appendix K. Each Project Profile addresses the following:

- rationale;

- objective;
- scope;
- cost and resources;
- program for implementation;
- issues to address when implementing the project; and
- potential impacts of the project.

The suggested projects vary greatly in scope, cost and potential benefits. The decision on which Project(s) should be funded will depend on many factors including local needs, preferences of the Samoan Government, costs, environmental outcomes, benefits to the public, sustainability and others. It is suggested that when comparing and assessing the different shortlisted projects, JICA could utilise the multi-criteria matrix analysis used previously.

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