

# **Initial Environmental Examination**

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**TONGA:**  
**Nuku'alofa Urban Development Sector Project**  
**Solid Waste Improvement Subproject**  
**Solid Waste Household Collection Services and**  
**Landfill Operation**

**Prepared by Planning and Urban Management Department (MLSNR)**  
**for the Asian Development Bank (ADB)**

This Initial Environmental Examination is a document of the Kingdom of Tonga. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

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## ABBREVIATIONS

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
EIA	environmental impact assessment
EMP	environmental management plan
GFP	grievance focal point
IEE	initial environmental examination
IUDSP	Integrated Urban Development Sector Project
m	meter
MECC	Ministry of Environment and Climate Change
MGB	mobile garbage bins
MLSNR	Ministry of Lands, Survey, and Natural Resources
NIIP	National Infrastructure Investment Plan
NUDSP	Nuku'alofa Urban Development Sector Project
O&M	operations and maintenance
PIC	project implementation unit
PMU	project management unit
PPTA	project preparatory technical assistance
PSC	project steering committee
PUMA	Planning and Urban Management Agency
TMOFM	Tapuhia Management and Operations Field Manual
TSWMP	Tonga Solid Waste Management Project
UIDP	Urban Infrastructure Development Plan
WAL	Waste Authority Limited

## I. Executive Summary

1. This Initial Environmental Examination (IEE) has been developed by the Tonga Planning and Urban Management Agency (PUMA) of the Ministry of Land, Surveys, and Natural Resources (MLSNR) for Waste Authority Limited (WAL). The IEE examines a proposed subproject of the Nuku'alofa Urban Development Sector Project (NUDSP). The NUDSP is funded by the Asian Development Bank (ADB). This IEE follows the requirements of ADB Safeguard Policy Statement, 2009, and is based on research and investigation carried out in May 2011 under the project preparatory technical assistance (PPTA).
2. The subproject to upgrade the existing solid waste management system has been assessed to be an urban infrastructure project of high priority.
3. The subproject consists of three components; upgrading the existing landfill site according to the design and operational standards previously in place; improving the household waste collection service; and improving the financial viability of WAL in order to sustain the system into the future.
4. The subproject will expand the safe waste disposal capacity of the Tapuhia landfill through constructing a new lined landfill cell area as per the facility design. It will also replace essential plant and equipment; implement an asset management plan; and develop accounting, billing and financial management capacity—allowing WAL to deliver more effective, as designed, household waste collection services and landfilling operations leading to a reversal of its current poor service delivery and precarious fiscal position.
5. No new facility or infrastructure is proposed, except for five village waste collection sites as a pilot to trial alternative models of community-driven waste management. These will essentially be five localized areas of public bins for community collection as an alternative to household collection.
6. No significant environmental impacts will occur from the implementation of this subproject, with an emphasis on improving environmental performance through plant and equipment upgrades, institutional strengthening and improvement of operational practices.
7. The solid waste management system was developed under the Tonga Solid Waste Management Project, funded by Australian Agency for International Development (AusAID) from 2004 to 2008. An Environmental Management Plan (EMP) and Tapuhia Management and Field Operations Manual (TMFOM) were developed as tools to systemize sound management and operational practices at the Tapuhia landfill, and to safeguard the environment. Environmental management of the waste management operations, as well as the monitoring were functioning well. However, over the last 18 months, the practical implementation of the operating systems has failed due to cost-cutting measures, changes in staff, and poor management decisions. As a result, the system has deteriorated to a point where environmental harm from waste operations may occur.
8. Both the EMP and the TMOFM have been reviewed and found to be relevant and appropriate. The documents operate in tandem, with the EMP providing the broader environmental management framework for operations, and the TMOFM providing the practical procedures and monitoring tools to ensure that environmental safeguards are systemized. The waste management system functioned well for approximately 4 years; but as plant and equipment failed through poor maintenance, the procedures were no longer followed. Without essential infrastructure in working condition, such as the landfill compactor, the operating procedures cannot be implemented. The focus of this IEE is how to reimplement procedures and ensure that they are sustained into the future. Institutional strengthening and organizational change are critical to the outcomes of this subproject.

9. The subproject has been analyzed in relation to climate change and adaption processes. Overall, it was found that climate change will have little impact on operations of the waste management system. The project will have a positive impact on reducing Tonga's greenhouse gas emissions, with the practice of burning rubbish to be further reduced through provision of effective collection services, along with ongoing awareness-raising and behavioral change campaigns.

10. Overall, the subproject provides a positive environmental benefit in the area of sustainable urban services. The development as a whole will increase reliability of household waste collections, upgrade landfill operations to achieve appropriate environmental performance, and improve the financial sustainability and operational capacity of WAL.

11. Environmental monitoring will be reinstated within WAL. During the project, a safeguards team, established within the project management unit in PUMA, will provide regular monitoring of the subproject and its outputs.

## II. Background

12. The NUDSP aims to improve the standard of living in Nuku'alofa, including in low-income residential areas. The outcome of the project will be effective, efficient, and sustainable urban services. This will be delivered through a sector grant, with project components including infrastructure investments, institutional strengthening, and capacity building.

13. This builds on an earlier ADB project, the Tonga Integrated Urban Development Project (TIUDP), which involved two key components; development of an urban planning and management system (UPMS), and implementation of seven priority urban infrastructure projects.

14. Under the NUDSP, subprojects have been selected from previously identified priority projects for urban infrastructure development. The projects previously identified under the Urban Infrastructure Development Plan (UIDP)<sup>1</sup> were upgraded to include priorities identified under the Tongan Government's National Infrastructure Investment Plan (NIIP). From this list, two core subprojects were selected. Remaining funds will be allocated through an urban development program facility, using the same selection criteria.

15. This IEE has been prepared to assess potential environmental risks and mitigation strategies for one of the core subprojects; the WAL solid waste household collection service and landfill operations.

16. The subproject focuses on plant replacement and upgrades to improve efficiencies of the household waste collection service, and performance of the existing landfill. There are minimal new facilities to be built under this subproject. The only construction elements are the lining of the second cell within the Tapuhia Landfill, as per the site design; and piloting five community-led village waste collection systems, which will involve placement of community waste bins.

17. The Tonga Solid Waste Management Project (TSWMP), funded by AusAID, was undertaken between 2004 and 2009. Under this project, an integrated waste management system was implemented for Tongatapu. Components included development of waste management legislation, creation of WAL, construction of the new landfill facility, implementation of a weekly waste collection service for households, and implementation of a user pays system. Emphasis was also placed on increasing community awareness through social marketing strategies to mobilize support and participation.

18. Construction of the Tapuhia Landfill commenced in 2005 following an extensive environmental impact assessment (EIA) process. Environmental safeguards were built into the operations of the facility through an EMP and the TMOFM. Both documents have been extensively reviewed and were found to be of high quality in their analysis, mitigation measures, and procedures.

19. However, the implementation of both the EMP and the TMOFM have been problematic, particularly in the last 18 months. With essential plant and equipment not repaired by WAL, the ability to operate the landfill effectively and in accordance with the procedures has been compromised. Management at WAL has not prioritized environmental safeguards or adherence to operation and maintenance (O&M) procedures for plant and equipment or the landfill. As a result, the effectiveness of the waste service has declined, and if not addressed, the landfill operations will create long-term environmental harm.

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<sup>1</sup> The UIDP was prepared under TA 7082-TON: *Urban Planning and Management System* (ADB, 2008 US\$700,000) and provides an urban infrastructure investment plan for Nuku'alofa for the period 2010/11 to 2030/31.

20. Under the TSWMP, in 2008 a sustainability trust fund was established through AusAID to provide funding for emergency situations such as major plant breakdowns. The aim was to provide a buffer for WAL in the postproject period. WAL accessed this fund in 2010, but following incomplete reconciliation and disbursement documentation for this first tranche, was reluctant to request further tranches. This situation has now been resolved, and funds will be available from mid-2011 for the intended purpose. As a result, some urgent aspects of the waste management system upgrade will be funded through AusAID, including the servicing of the leachate treatment system, and mechanical repairs to the landfill compactor and articulated wheeled loader. AusAID will also fund refurbishment of missing or damaged public bins, and repairs and servicing of existing waste collection compactors. All remaining works will be funded by the NUSDP. This funding agency complementary provides a collaborative approach to the challenges faced by WAL.

21. There is no requirement to undertake a new EIA or EMP process for this subproject. Both documents have been reviewed and remain relevant. The focus of this analysis is on gaps in previous implementation systems, and measures required to prevent this situation from re-occurring. While, the report has been structured as an IEE, most activities are deemed to have limited risk of adverse impacts as they are designed to prevent environmental degradation from existing poor waste management practices. The IEE process was undertaken to ensure any potential environmental impacts and mitigation measures from the ADB financed upgrades are considered and addressed. A new EMP for the Tapuhia Landfill was not written, as the construction works have been completed. Minimizing potential environmental impacts from landfill operations is covered extensively in the TMOFM. This field manual requires some updating by the solid waste specialist; and additional training to reinstate the procedures.

22. This IEE is based on site visits, consultations, and a review of secondary sources of information.

### **III. Policy, Legal and Administrative Framework**

23. Under the Environmental Impact Assessment Act, 2003 and the Environmental Impact Regulations 2010, there is no requirement for this subproject to submit a development proposal, as it is an upgrade of an existing system rather than a proposed new development. A copy of this IEE will be provided to Ministry of Environment and Climate Change (MECC) to inform them of the proposed improvements to the waste management system.

24. The Waste Management Act 2005 empowers the WAL to manage the waste of Tongatapu; and outlines WAL's core functions and responsibilities. Under the Act, the Minister for Environment (now Minister for Environment and Climate Change) has the responsibility to ensure that the approved authority, WAL, is implementing all waste management operations in accordance with the principles and standards of sound environmental management.

25. MECC was formally created by the Environmental Management Act 2010. The role of MECC is to protect the environment and promote sustainable development.

26. MECC are also the agency required to respond to any complaints from the public about environmental issues. The community of Vaini has made representations to MECC in relation to the landfill operations, particularly with regard to flies, odor, and litter originating from the uncompacted and uncovered waste mass.

27. In relation to the landfill operations and breaches to the EMP, MECC has made a number of formal representations to WAL, putting WAL on notice about breaches and providing a timeframe to rectify the issues highlighted. In each instance, the timeframe has lapsed with no improvements. MECC has now brought the matter to the Cabinet, asking for intervention. However, the timeframe has again lapsed. While MECC has been proactive in fulfilling its obligations under the Act, there appears to be a lack of political support to enforce the legislation.

28. WAL is a government owned enterprise. The Board and WAL management come under the auspices of the Public Enterprise Division of the Ministry of Finance, with obligations outlined in the Public Enterprise Act 2002 and the Companies Act 1995.

## IV. Description of Project

### A. Type of Project

29. The project will consist of upgrading plant and equipment and providing the necessary support to rebuild functional operating systems. There are three components:

- (i) Component 1: Upgrading Tapuhia Landfill
- (ii) Component 2: Improved Household Waste Collection Service
- (iii) Component 3: Financial Management/Accounting Support

### B. Project Category

30. The environmental screening process has followed the appropriate checklists provided in the ADB *Environmental Assessment Guidelines* (2003), and conforms to the *ADB Safeguard Policy Statement* of 2009.

31. The appropriate category for the WAL subproject according to ADB's classification system is C, as the proposed project itself is unlikely to have adverse environmental impacts. While an IEE is not necessary, all environmental implications need to be reviewed. An IEE format has been utilized to ensure that all aspects have been addressed.

### C. Need for the Project

32. Waste management services are essential for environmental protection and quality of life in Nuku'alofa. The operations of WAL have been impacted by poor revenue collection and poor adherence to the O&M procedures for its landfill, plant, and equipment. As a result, particularly in the last 18 months, services have deteriorated.

33. Improving waste services in the urban area has been identified as a priority in both the UIDP and the Tongan government's NIIP.

34. In the country environment review undertaken by ADB in 2010, a key challenge identified in Tonga is the growing trend towards modern "throw away" lifestyles.<sup>2</sup>

35. In the poverty and socioeconomic survey undertaken in the urban area as part of the PPTA, 70.7% of respondents use the WAL collection service to dispose of waste. In addition, 18.1% burn waste, 5.7% bury, 4.5% use waste for fill, and 0.7% throw waste away. This reflects nearly 30% of people still using poor waste management practices. This is a marked improvement on data provided by the 2006 national census which stated that 85% of households in Tonga burned their waste.<sup>3</sup>

36. Problems with the waste service, as reported in the project household survey, demonstrate high levels of unreliability, with 33% of households surveyed in the urban area experiencing irregular service, and 8% no service.

37. Poor practices such as burning of waste and widespread dumping on bush allotments or public roads and beaches have been identified as key health and environmental concerns for some time. Yet without adequate waste services, the practices of open burning and dumping will continue. With the implementation of the Tonga Solid Waste Management Project, the process of widespread behavioral change commenced. There is now a need to strengthen

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<sup>2</sup> ADB 2010: *Country Environment Review*, Tonga.

<sup>3</sup> Tonga Census 2006. Note that this statistic is for the whole of Tonga, not Nuku'alofa only.

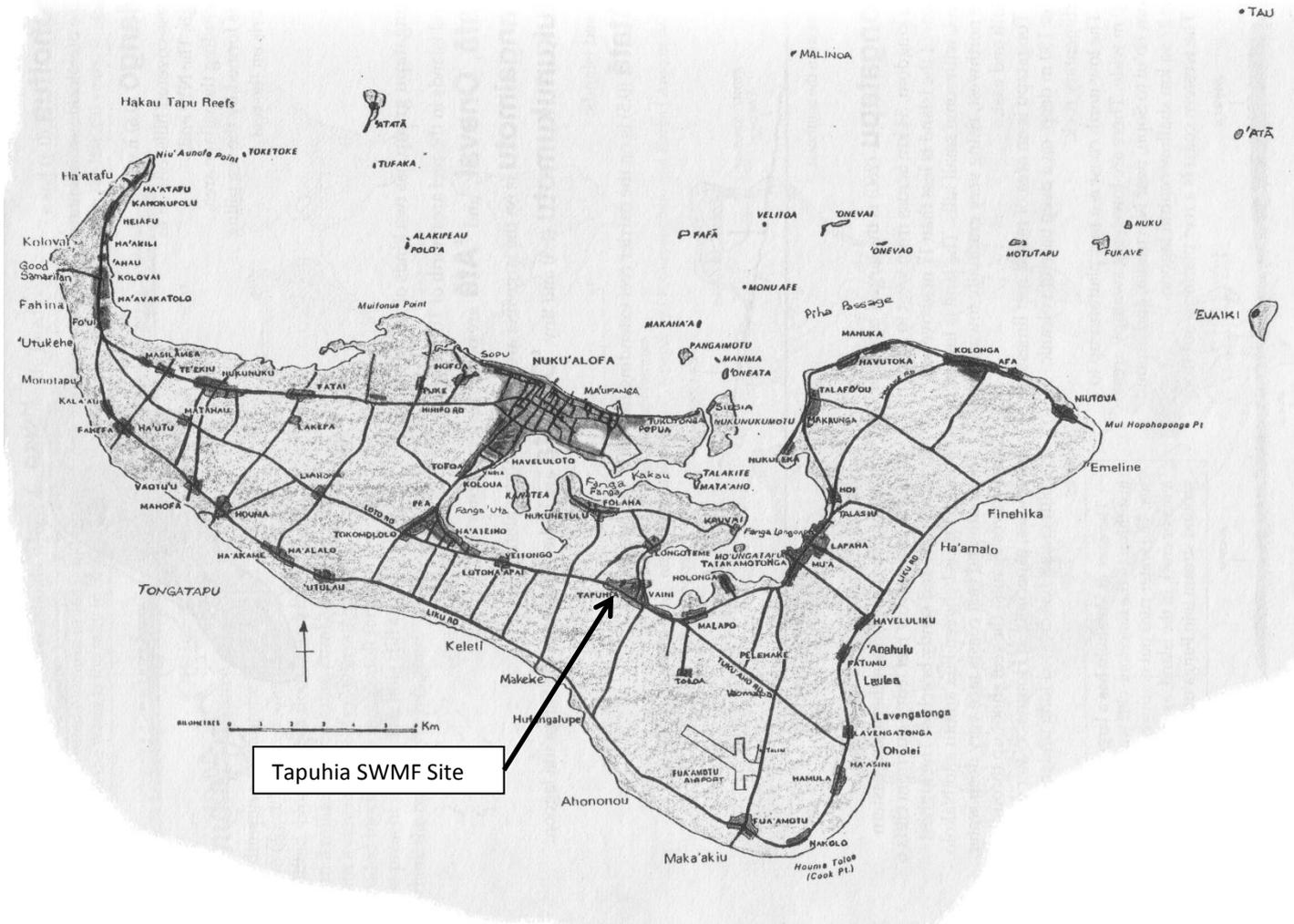
waste services to ensure that inroads already made are not eroded through poor service delivery.

38. Managing the solid waste of Nuku'alofa, and the Kingdom of Tonga as a whole is an urgent priority for environmental protection and reduction of health risks for current and future generations. If the project is not implemented, WAL would be unlikely to have the economic and technical resources to turn the operations around and reinstate an environmentally sound solid waste management system.

**D. Project Location**

39. The Tapuhia landfill is located at the government estate of Nu'alei. Formally a government owned quarry, the landfill is set in rural land adjoining the village of Vaini. Other nearby settlements are Folaha, Nukuhetulu, and Nu'alei. Figure 1 shows the location of the landfill within Tongatapu.

**Figure 1: Location of Tapuhia Landfill in Tongatapu**



## E. Detailed Description of Project

### 1. Component 1 - Upgrading Tapuhia Landfill

40. The waste collection services to be upgraded will be undertaken throughout Tongatapu. The pilot village waste collection sites will be in locations in Nuku'alofa,<sup>4</sup> to be determined based on a community engagement and selection process.

41. There is an urgent need to upgrade the operations and facilities at Tapuhia landfill to protect the surrounding environment (Figure 2). Over the past 1.5 years, WAL has allowed O&M practices to deteriorate to a stage where much of the plant and equipment at the landfill site is nonoperational, and waste is being initially dropped on the unprotected quarry floor before being transferred to the uncompacted, uncovered landfill area of cell 1. With the construction of cell 2, the Tapuhia facility will again have a secure cell for the deposition of waste, compaction, and then covering on a daily basis.

**Figure 2: Tapuhia Landfill Site**



42. Following the construction of cell 2, the uncompacted, uncovered waste in cell 1 can then be compacted and covered. This allows the construction of an access road on cell 1 waste for plant and equipment to install quarry wall protection (liner and clay cover) for a second lift in cell 1. Once the second lift is completed, further secure landfilling capacity will be available in this cell.

43. The wastewater treatment plant established at Tapuhia has also deteriorated. The pond for treated leachate was previously of a high standard, with fish and invertebrates evident in the water. Now the pond is stagnant, with extensive algal bloom, demonstrating the failure of the system to adequately treat the leachate water. The leachate treatment plant needs cleaning and recommissioning, which will be undertaken under the AusAID-funded component. Importantly, the operating practices for the whole site need to be reinstated, with an emphasis on how to maintain appropriate standards of wastewater treatment into the future. This component of the work is of critical importance to protect surrounding areas and groundwater from off-site contaminants.

44. The program of regular groundwater monitoring at the landfill has also lapsed, despite the testing operating effectively for approximately 5 years, 2 of these in the post TSWMP period. Some of the testing equipment is now missing or in disrepair. Monitoring will be reinstigated,

<sup>4</sup> In Tonga, the urban area is divided into districts and villages.

with an emphasis on practical implementation and systemizing the process. Two sets of replacement field testing kits will be purchased.

45. The project will provide technical assistance and training to support the introduction and implementation of an asset management plan. The other essential capacity development process is to ensure that operational procedures follow the existing management and operations field manual, the TMOFM. The TMOFM will be reviewed and reinstated with a training and follow-up package to ensure adherence to all checklists and procedures.

## **2. Component 2 – Improved Household Waste Collection Service**

46. Initially under the TSWMP, three waste collection compactors were purchased, two to service Nuku'alofa and the third for rural areas. Service schedules and operating standards were written to provide a system of infrastructure maintenance to underpin service reliability. Repair and servicing of the three compactor trucks has deteriorated, and only two units are currently operational. One of these is in urgent need of repair. As each of these units is reaching the end of its operating life (7 years), they will be replaced under the subproject. The replacement of these units will allow WAL to reinstate its weekly household waste collection service throughout Nuku'alofa and other urban centers across Tongatapu. This will be a critical factor in WAL's stated efforts to improve its revenue collection rates. The current compactor trucks will be sold to the local market.

47. As a further component of improving waste services and community participation, a pilot program to develop a community-led, village-level waste collection service in five villages will be implemented in Nuku'alofa. This village-level waste collection will address the issue of waste collection trucks being unable to drive past all households due to poor secondary roads in many villages. It will provide a consolidated waste collection point at a site in the village, that can be easily accessed by the collection truck. The village central waste collection point will utilize standard 240-liter municipal garbage bins). The pilot villages will be chosen utilizing a community, demand-driven selection process. This new approach has the potential of improving service and environmental outcomes given its community-led basis.

## **3. Component 3 – Financial Management / Accounting Support**

48. One of the challenges facing WAL is collection of the T\$10 per month fee levied on each household to cover the costs of operating waste services. Payment rates have been poor,<sup>5</sup> through inadequate collection methods and incentives, lack of enforcement mechanisms, and lack of broad support for payment of the fee. This support has been further eroded through the deterioration in service reliability and coverage. The household waste collection provides the main interface between WAL and the community. It is an imperative that the system be reinstated, along with an improved dialogue with service beneficiaries.

49. Improving financial management, billing, and revenue collection will take place through the supply and installation of an accounting/billing package and provision of technical assistance to improve billing and revenue collection. The project will also support the implementation of a comprehensive asset management plan for WAL to ensure that service standards are not compromised through poor maintenance leading to breakdowns.

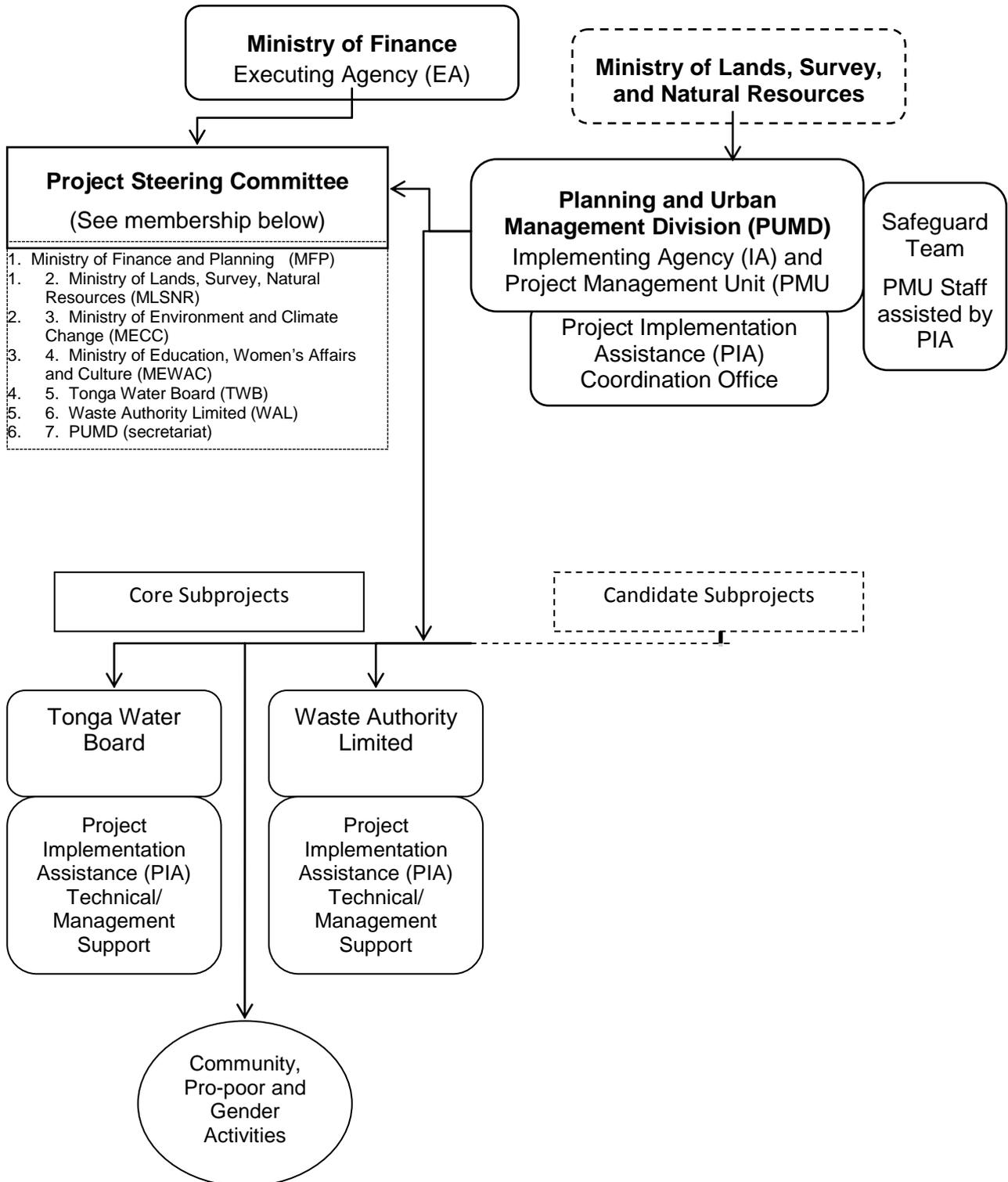
## **F. Project Implementation**

50. **Figure 3** provides an overview of the institutional arrangements for project implementation.

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<sup>5</sup> Estimated at 27%. ADB 2006: *Tonga Integrated Urban Development Project. Final Report.* Manila.

Figure 3: Project Organizational Chart



51. The executing agency for the project will be the Ministry of Finance. It will administer the overall project grant, and chair the project steering committee (PSC). The PSC will have seven members representing relevant government agencies. It will be responsible for overall direction, guidance, monitoring, and providing an oversight role for the program. The PSC will meet at

least on a quarterly basis to discuss the progress of the program. Its members will include a representative from MECC to review and provide inputs for the environmental aspects of quarterly monitoring reports.

52. The implementing agency will be PUMA within MLSNR. PUMA will be responsible for the oversight and operations of the PMU.

53. Project management unit (PUMA) will appoint a project manager and provide the PMU. The PMU will (i) serve as the secretariat for the PSC; (ii) undertake project management, administration, and interagency coordination at the executive level; (iii) maintain project accounts; (iv) oversee the procurement process; (v) prepare quarterly project progress updates and other reporting requirements; and (vi) prepare the project completion report to the government and ADB. The PMU will also be responsible for the overall implementation of the program including compliance with all policy actions, administration, disbursements, and maintenance of records.

54. The PMU will be made up of the staff members as outlined in Table 1.

**Table 1: Proposed PMU Staffing**

Position	Available	To be Recruited
Project manager – director PUMA <sup>a</sup>	1	
Office assistant <sup>a</sup>		1
Planner, urban – mid level, local <sup>c</sup>		1
Planner, gender – mid level, local <sup>b</sup>		
Planner, urban – junior level local <sup>a</sup>		1
Environmental specialist, local <sup>a</sup>		1
Accountant (part-time) <sup>a</sup>		1

<sup>a</sup>: Position funded by Government of Tonga.

<sup>b</sup>: Position funded by gender action plan, NUDSP.

<sup>c</sup>: Position funded by proposed accompanying technical assistance for urban planning.

55. Within the PMU, a safeguards team (ST) will be established to oversee all social/resettlement and environmental assessment and review activities. This will be staffed by the environmental specialist and the planner specialist (urban/community liaison officer/resettlement officer). Both of these positions are within PUMA. The PMU's project manager will supervise the ST.

56. Further support for the ST will be provided by the international planner with environmental specialization, and by the national consultant for social/community/gender/safeguards.

57. Currently, there is some capacity within PUMA for environmental assessment and review procedures. A focus of the NUDSP is strengthening capacity to manage strategic environmental planning issues, as well as the practical implementation of environmental plans and monitoring processes. Utilizing a permanent environmental specialist from PUMA will deliver practical training and increase the capacity of PUMA in this critical area. Capacity development for the PUMA is covered in the environmental assessment and review framework.

58. A project implementation cell (PIC) will be established in WAL to oversee the implementation of the subproject on a day-to-day basis. The project implementation assistance consultants will comprise of a solid waste management specialist (international consultant) and

an accounting/financial management specialist (national consultant), providing technical assistance, capacity development and project implementation support to the PIC.

59. Staff for the project implementation cell in WAL are outlined in Table 2.

**Table 2: Proposed WAL Staffing of Project Implementation Cell**

<b>Position</b>	<b>Available</b>	<b>To be Recruited</b>
Chief executive officer/ cell manager (CM)	1	
Corporate manager	1	
Operations manager	1	
Senior technical officer	1	
Accounting Officer	1	

60. The implementation cell will provide progress and expenditure reports to the PMU on a monthly basis and meet regularly with the PMU to ensure strong communication and coordination.

61. Project implementation assistance will be based within WAL, providing technical support to manage the contracting of civil works and procurement, and to implement improvements in effective service delivery, environmentally sustainable operating practices, and improved revenue collection. Capacity development of counterpart staff and improving systems will be integral to the role of the technical and management support consultants.

#### **G. Proposed Schedule for Implementation**

62. The project will be implemented over 2 years, with commencement expected in January 2013.

## V. Description of Existing Environment

### A. Location and Existing Land Use

63. The subproject components 1 (landfill improvements) and 3 (revenue collection and financial management) involve no new development locations. The landfill site is an existing facility located in an old quarry near the village of Vaini. The surrounding area is rural, with residents nearby experiencing impacts such as flies and odor due to the current poor operating practices. In component 2, the pilot scheme of community-led village waste collection areas in five selected villages will require some minor infrastructure development at locations in Nuku'alofa to be determined.

### B. Climate

64. The climate of Tonga is influenced by the trade winds of the South Pacific, and characterized by hot, humid summers and warm winters. Approximately 60% of the rain falls in the wet season (November to April), but the dry season also experiences occasional heavy rain. The wet season is the time for cyclones, with an average occurrence of 1.3 cyclones per year.

### C. Geology, Topography, and Soils

65. The islands of Tonga are either volcanic or uplifted coral limestone on a deep pile of sediment of volcanic origin. The volcanic islands form a linear chain on the west, with the coral islands to the east. Tongatapu itself is a raised coral island. Uneven uplift has resulted in a pronounced tilt from southeast to northwest. The maximum elevation on the southeast side is 65 meters (m) above mean sea level. The island is generally flat, apart from some small localized slopes.

66. The upper geological layer is formed by highly permeable Pliocene and Pleistocene limestone. This varies between 127 m to 247 m in thickness, and forms the main aquifer.<sup>6</sup> The freshwater lens on Tongatapu is well developed and contains a significant volume of water in storage.

67. Soils in Tongatapu were formed from a thick deposit of volcanic ash covering most of the island and ranging in thickness from about 5 meters in the west of the island to just 1 meter in the east.<sup>7</sup>

68. The hydrogeology of the Tapuhia area has been shown to contain freshwater up to 8 m below sea level. To compare this with the water lens in the rest of Tongatapu, the western part is about 1.0 - 2.5 meters below sea level, and to the east and mid land including Tapuhia area is about 5-8 m below sea level. The groundwater table underlying the site is very flat, with a gradient of less than 0.0255 towards the southeast (towards the village of Vaini). It is influenced by tides, sea level change, barometric pressure, recharge, pumping and drought. The rate of groundwater flow is estimated to be approximately 0.05m/day. In terms of water quality, the site is quite neutral (pH 6.4 to 7.7) and has low salinity (0.2 to 8 ppm), conductivity (700 – 1,200  $\mu\text{s/cm}$ ), temperature (21 to 27°C), and dissolved oxygen (< 1 mg/l).<sup>8</sup>

<sup>6</sup> Ramboll Sweden 2004: *Feasibility Study for Water Supply Improvement, Kingdom of Tonga*. Final Feasibility Report. UNOPS.

<sup>7</sup> L. Furness and S Helu 1993: *The Hydrology and Water Supply of the Kingdom of Tonga*. Ministry of Lands, Survey and Natural Resources. Tonga.

<sup>8</sup> AusAID 2005: *Final Project Environmental Management Plan*. Tonga Solid Waste Management Project.

## D. Ecological Resources

69. Tonga's economy is highly dependent on the environment, particularly through the agricultural and fishery sectors. Coastal resources are vital to livelihoods of Tongans. Coral reefs, mangroves and beaches are the main environmental components of the coast, and are facing threats from climate change, development and pollution.

70. A key ecological feature of Tongatapu is the Fanga'uta Lagoon, which is increasingly threatened by the pressures of poorly planned urban development. Pollution from inadequately built and unmaintained septic tanks, poor solid waste management practices, and clearance of mangrove areas are having serious cumulative impacts on the lagoon and its ecology. Levels of phosphate, nitrate and fecal coliforms now exceed the Australian standards for seafood, recreation, and risk of algal blooms. Despite an EMP written for the lagoon area in 2001, lack of resources and lack of will to implement the plan have resulted in continued deterioration.<sup>9</sup>

71. There are two bird species and 12 plant species recognized as endemic to Tonga. None of these occur on Tongatapu.<sup>10</sup>

## E. Water Resources

72. Groundwater has historically been viewed as an abundant resource in Tongatapu. However, in recent years the vulnerability of this resource is becoming apparent. The three main factors that place pressure on the sustainability of groundwater resources are

- (i) human activities (pumping, pollution, quarrying),
- (ii) natural occurrences (drought, salinity), and
- (iii) institutional issues (lack of legal protection and sustainable management practices).

## F. Groundwater Quality at Tapuhia Landfill

73. In the construction of the Tapuhia landfill, eight groundwater monitoring bores were installed both on and off-site. During the TSWMP, 3 rounds of groundwater sampling and analysis were undertaken in February 2006, April 2006, and August 2007. The testing covered a comprehensive suite of analytes, requiring analysis in a laboratory in Australia.

74. The three testing rounds provide a sound level of baseline data to understand the existing state of the groundwater, prior to and after landfilling operations had commenced. Following this, a study was undertaken by the TSWMP to interpret results to date and to review the monitoring program.<sup>11</sup> Recommendations were made for an affordable testing regime to be implemented, involving field testing of selected indicators. If results were above the parameters set for the indicator tests, a second-tier testing suite was recommended. More comprehensive suites as third and fourth tiers were then recommended if the results triggered further investigation.

75. Analysis of the baseline data demonstrated that concentrations of organochlorine and organophosphate pesticides, PAH, BTEX, TPH, total cyanide and mercury were all below detectable levels.<sup>12</sup> Trace metals were below World Health Organization 2006 guidelines for

<sup>9</sup> ADB 2007: *Initial Environmental Examination. Appendix G, Technical Assessment Report*. Tonga Integrated Urban Sector Project.

<sup>10</sup> Ibid.

<sup>11</sup> Tonga Solid Waste Management Project 2008: *Groundwater Monitoring Program Revision. Tapuhia Landfill. Kingdom of Tonga*. Coffey Geotechnics (NZ) Ltd. Auckland. New Zealand.

<sup>12</sup> White I, Falkland T, Fatai T 2009: *Vulnerability of Groundwater in Tongatapu, Kingdom of Tonga. Groundwater Evaluation and Monitoring Assessment*. SOPAC / EU Reducing the Vulnerability of Pacific APC States. Australian National University. Canberra.

drinking water with the exception of lead, which was detected at 25 times the recommended limit at one of the bores. Investigation of this pollution revealed that it was in existence prior to landfilling, and has been traced to a point source of an old machinery scrap-yard in the quarry. It is deduced that lead has leached from lead-acid batteries and created contaminated soil prior to the landfill operations.<sup>13</sup> There were also increased nitrate levels reported, particularly at one monitoring bore near the septage beds, demonstrating an ongoing need for monitoring, and adapting practices.

76. A standard means of monitoring leachate from groundwater at landfills is to examine specific chemical constituents and interpret the results. However, the monitoring program revision in 2008 reviewed data and evaluated which parameters could provide the best “signal” of a leachate problem. The review looked for parameters that could be effectively monitored on site, thus reducing the need to fund ongoing overseas laboratory testing, except on an as-needs basis.

77. Tiered monitoring programs are often used to streamline and optimize the data collection process. In this approach a screening level test is applied to evaluate if there is justification for more intensive investigation. **Table 3** presents the tiered monitoring process recommended by the TSWMP monitoring program review. The aim was to provide parameters with little risk of missing an important effect should one occur, in order to provide early detection.

**Table 3: Recommended Tiered Approach to Groundwater Monitoring**

	Up gradient wells 5, 4, 3	Down gradient wells 8, 1, 2	Leachate sump	Other observations
Tier 1	GW level, NH <sub>3</sub> , NO <sub>2</sub> /NO <sub>3</sub> , Fe, E.C.;	GW level, NH <sub>3</sub> , NO <sub>2</sub> /NO <sub>3</sub> , Fe, E.C.;	NH <sub>3</sub> , Fe, NO <sub>2</sub> /NO <sub>3</sub> , E.C.	Observe presence of fish, invertebrates, algae in treatment pond.
Tier 2	Lab analysis of NO <sub>2</sub> /NO <sub>3</sub> ; NH <sub>3</sub> ; Fe, Cu, Mn, Zn, Pb	Lab analysis of NO <sub>2</sub> /NO <sub>3</sub> ; NH <sub>3</sub> ; Fe, Cu, Mn, Zn, Pb (bacteria?)	Lab analysis of NO <sub>2</sub> /NO <sub>3</sub> ; NH <sub>3</sub> ; Fe, Cu, Mn, Zn, Pb	Monitor GW heights quarterly. Calculate rate of travel.
Tier 3	Full ions, metals	Full ions, metals (bacteria ?)	Full ions and metals, pesticides	
Tier 4	Organochlorine and organophosphate pesticides	Organochlorine and organophosphate pesticides	Organochlorine and organophosphate pesticides	

## G. Socioeconomic Environment

78. The economy of Tonga is largely based on agriculture and fisheries. Subsistence agriculture plays an important role throughout the country. In addition, remittances sent from relatives working abroad play a significant part in the Tongan economy as a whole, and in the economy of individual households. The global financial crisis in recent times has impacted on this economic flow, increasing the level of hardship experienced by many families in Tonga.

79. The population of Tonga is 101,991 distributed over 45 of its 172 islands.<sup>14</sup> The annual population growth has occurred at an average of 0.6% since 2000, and is not expected to increase due to migration patterns. However, there is a real drift to the urban area of Nuku'alofa, with a population growth of 1.9%. This is placing considerable pressures on urban services and

<sup>13</sup> Tonga Solid Waste Management Project 2008: OP. CIT.

<sup>14</sup> 2006 Tonga Census.

infrastructure. In the absence of strategic or urban planning mechanisms, this growth is also placing a significant burden on the natural environment.

80. The official poverty line in Tonga was established at \$2,586 per person per year in 2009. According to the Bureau of Statistics, 22% of people in Tonga are viewed as living below the poverty line.

81. In the poverty and socioeconomic survey, households were asked to comment on the fairness of pricing for a range of utility services: 57.1% agreed that the price for waste services was fair, with 18.2% were willing to pay more. With a number of dissatisfactions reported in the household survey, it seems clear that the acceptance of the low price of waste services is commensurate with poor service delivery outcomes.

## **H. Physical Cultural Resources**

82. There will be no impacts on physical cultural resources through the implementation of the subproject.

## **I. Quality of Life Values and the Sociocultural Environment**

83. Nuku'alofa has well-developed infrastructure for the provision of health and education. This is reflected in the 2006 Census data, with school enrollments for the age group of 6-14 showing almost all children (98%) were enrolled in schools. A key health challenge is improving the rates of noncommunicable diseases such as diabetes and heart disease. In the household survey, 19.3% of survey respondents reported heart problems within their households, and 25.1% of households reported diabetes, 97% of households surveyed said that they had good access to health facilities. Life in Tonga revolves around strong values of family and the church, and has a well developed historic and contemporary national identity.

## **VI. Potential Environmental Impacts and Mitigation Measures**

### **A. Impacts Related to Siting and Design**

84. The location of the five pilot village waste collection facilities will be selected after extensive consultation and planning. It is important that facilities are sited to minimize environmental harm, and to ensure that off-site pollution or loss of local amenity does not occur. Annex A lists key criteria for the selection of the five pilot sites to minimize risks to neighbors and the environment. The selected areas will be well-drained, accessible, and positioned to avoid potential issues of land use conflict. The collection points will be well designed with fencing, a hardstand concrete or sealed surface, and lockable gates to ensure that the facility is free from pigs and dogs and does not become a dumping ground.

85. There are no impacts foreseen from any other siting aspects of this subproject.

### **B. Impacts Related to Construction**

86. There are no environmental impacts foreseen in construction. The landfill works at Tapuhia will occur within the existing landfill site area, as per the original design. All construction will occur in an area of no public access. The TMOFM has a detailed procedure written for the construction of cell 2 in the landfill. This is attached as Annex B. This will form part of the bidding documents along with technical drawings and specifications. Only limited environmental impacts are expected from the minor works contract. However, it is critical that the landfill lining process is undertaken in accordance with the specifications in order to provide the level of environmental protection as per the design. As such, a full-time site supervisor will be assigned to the site as per the recommendation of the procedure attached in Annex B.

87. Construction involved in the pilot community-led waste collection areas will be minor, with potential impacts managed through standard construction processes and adequate supervision. The PMU will be responsible for detailing all environmental requirements within the bidding documents, and assessing the contractors' (including community based contractors if relevant) capacity for implementing the mitigation strategy outlined in the bid. These mitigation measures will be incorporated into the contract, along with provision for remediation works at the contractor's cost if breaches occur.

### **C. Impacts Related to Operations**

88. The components of this subproject are not adding to the existing system and infrastructure, but improving them to achieve a better level of environmental performance and service. However, this section provides an overview of potential impacts from the operations, along with relevant mitigation strategies.

#### **1. Tapuhia Landfill – Groundwater Protection**

89. With the reduced operating standards of the landfill, groundwater is at risk of contamination. Lining cell 2 and installing quarry wall protective lining will reinstate a secure landfill operation. The leachate treatment system will also be cleaned and repaired (funded separately by AusAID); ensuring a functional system of treatment for all leachate water.

90. To operate a landfill without groundwater and leachate monitoring is a high risk, as instances of pollution cannot be detected and responded to. Reinstating groundwater monitoring to the previous standard is an imperative. Two sets of equipment for groundwater field testing are included in the budget. Each set includes handheld field test meters and water level measuring sets. One set will be provided to WAL, with the other to MECC to allow them to undertake independent testing if required. The solid waste management specialist will work with

WAL and MECC to ensure that the regulatory groundwater monitoring and reporting to MECC is reinstated and systemized. The focus will be on sustaining the monitoring into the future through updating the water monitoring process in the TMOFM, training all site workers, and monitoring the testing process through the ST.

91. During the course of the project, if indicator tests present adverse findings, the appropriate level of subsequent testing will be required using the tiered testing system. Although this is the responsibility of WAL, there will be enough contingency within the subproject budget to undertake overseas laboratory analysis if required. In the event of this occurrence, the waste management specialist will work closely with WAL's chief technical officer to undertake required testing and analyze the results. The capacity to respond to adverse monitoring results is critical.

92. The procedure as written in the TMOFM requires updating to reflect the approach recommended in the earlier review. The waste management specialist will work with WAL to finalize the testing procedure, including frequency and reporting requirements, and appropriate monitoring forms. Field testing will be required as a quarterly procedure. On-site analysis will be undertaken for a range of parameters able to be tested using the field instruments provided. Any potential environmental emissions into the groundwater will be detected through the indicator screen tests, and will trigger a more detailed investigation and response.

93. Monitoring results will be reported to the WAL Board and MECC on a quarterly basis, with immediate reports to the WAL chief executive officer and MECC<sup>15</sup> of any unacceptable findings.

## **2. Tapuhia Landfill – Emissions from Landfill Operations**

94. Potential impacts of operations will be mitigated through maintaining proper operation of the wastewater treatment system, lining the new landfill area, and reinstating appropriate operations such as daily compaction and covering. By following the procedures as outlined in the EMP and the TMOFM, the environmental outcomes will be significantly improved. The project is not involved in developing a new landfill, but in upgrading the environmental performance of an existing landfill based on reinstating safeguard systems designed to achieve a high standard of environmental protection.

95. Landfill gas emissions were considered as a potential impact of landfill operations. Methane from landfill is a greenhouse gas emission, and, where feasible, landfill designs incorporate systems to capture this gas, utilizing it as an energy source where practical in large-scale landfills, and in other cases flaring the gas. However, gas generation is minor in the Tapuhia landfill, given the relatively low volumes of waste received. In the original EMP, it was considered highly unlikely that significant gas would be generated from the landfill. Given the small percentage of putrescible materials in the waste stream due to food scraps being fed to pigs, dogs, and chickens, the EMP determined that no mitigation strategy was required.

96. The main project risk is that the reimplemented systems will again fail in the postproject period. In order to mitigate this risk, the project will provide capacity development through the waste management specialist; and also through a training package delivered by the project implementation cell with the assistance of the environmental specialist from PUMA. The TOR for this training component is outlined in Annex C.

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<sup>15</sup> Under the Waste Management Act 2005, WAL is required to notify the Minister immediately if any matter relating to waste management may adversely affect human health or the environment;

### **3. Household Waste Collection – Operational Impacts**

97. No environmental impacts foreseen in relation to the waste collection service. Through upgrading the collection trucks and reinstating adequate maintenance procedures, the trucks will run more efficiently. The net environmental benefits of regular and reliable household waste collection will be a significant environmental gain, particularly for the urban area.

### **4. Village Waste Collection Pilot – Operational Impacts**

98. The pilot community waste collection service to be trialed in 5 villages will need to be operated effectively to ensure there are no environmental impacts. It will be critical to service bins regularly, and to provide enough bins to prevent any waste overflowing between collection times. Community ownership will be integral to the success of this trial. As an example, a funeral in the neighborhood creates large quantities of waste. The waste producers may use the village bins for convenience, or because of their sense of entitlement to use of the facility. Despite overflowing bins, the waste continues to accumulate; creating windblown litter; problems with dogs, insects, or vermin; and a loss of amenity, particularly for neighboring properties. In a situation with poor local ownership, WAL would be blamed for creating a problem in the community. If on the other hand, the community itself takes responsibility, discusses the situation internally, and resolves to take the excess waste directly to the landfill; there will be no environmental impact. Creating the second scenario will require strong community engagement processes, ongoing communication, and positive relationships internally within the community, and with WAL. Selection criteria for the pilot sites are included as Annex A.

### **5. Waste Management System – Overall Operational Impacts**

99. In all aspects of waste management operations, there is potential to make a substantial positive difference to the state of the environment. However, poorly managed waste services can also create environmental impacts. This is now seen in the current landfill operations. Unreliable household collections add to the potential for environmental harm. WAL itself is currently unsustainable from a financial viewpoint. Without improved revenue collection, accounting, and management; the future of WAL, and therefore the waste services, is uncertain. The assistance provided by the subproject will remedy these aspects. However, in terms of long-term environmental performance, the greatest risk is that the changes will not be sustained.

100. The emphasis of this IEE is on the pathway to improve the capacity of WAL. In terms of mitigating environmental risk, ensuring that WAL has the capacity to fulfill its obligations under the Waste Management Act 2005 is the most significant component.

## **VII. Capacity Development for WAL**

101. The solid waste management specialist working with WAL to implement the project will have a key role in developing the capacity of WAL at all levels. From the waste collectors to Board members, all participants need to understand the role of waste management in protecting the environment, and to be committed to achieving high standards of work.

102. A key implementation pathway is the reintroduction of the TMOFM. This document includes induction procedures for new staff, as well as a range of checklists for vehicle use and maintenance, and for site operating procedures at Tapuhia. Existing and previous staff who were familiar with the manual agreed that the system was effective. However, a number of newer staff have not utilized this resource.

103. A WAL training package will be provided within the subproject, providing a staged approach to improve the relevance and effectiveness of the TMOFM and the overall capacity of WAL staff on the ground. TOR for this training is outlined in Annex C.

104. The TMOFM is an excellent resource, with very detailed procedures for all aspects of landfill operations. However, the document is entirely in English, which may be a barrier for some site staff. It is important to refine the TMOFM, which will include translating some sections to the Tongan language, and delivering the training in Tongan where this will improve learning outcomes. The TMOFM needs to be a living document that is updated as procedures change. The updating and implementation of the TMOFM will be an inclusive and iterative process, with the WAL Chief Technical Officer responsible for ongoing updates. The training will take place incrementally, with training sessions provided regularly throughout the project period.

105. The solid waste management specialist will design the training modules in close collaboration with the environmental specialist from PUMA and WAL staff, particularly the chief executive officer and the existing WAL communications officer. The environmental specialist will deliver the training components required in Tongan language, with inputs from the solid waste management specialist as required.

## VIII. Information Disclosure, Consultation, and Participation

106. Meaningful public consultation is required throughout the project cycle to ensure that potential environmental and social impacts are fully disclosed, and mitigation measures are appropriate. The following are the key principles to be followed for consultation processes:

- Adequate and relevant information is disclosed in a timely manner.
- Information is readily accessible and understandable to affected people.
- Consultation is undertaken in a nonthreatening atmosphere, ensuring that all dialogue is free from intimidation or coercion.
- Processes are gender inclusive and responsive, and tailored to meet the needs of disadvantaged and vulnerable groups.
- Consultation is meaningful, with all relevant views of stakeholders and affected people taken into account for decision making in areas such as project design, environmental mitigation measures, sharing of development benefits and opportunities, and implementation issues.

107. In undertaking the PPTA, there has been extensive consultation undertaken with relevant stakeholders. Key issues of environmental concern were discussed, particularly with PUMA, MECC, the MLSNR Geology Section, WAL and the implementation team for the TUIDP. Broader discussion of environmental management capacity, and sustainable management of water resources within Tonga were undertaken as well as any relevant issues arising from this IEE.

108. Meaningful public participation has been encouraged throughout the project cycle using a range of mechanisms. Public consultation was conducted at the project level, and included environmental, social, and resettlement presentations. Meeting highlights from the initial project public briefing and discussion were broadcast on TV and over the radio. Two follow-up public discussions were facilitated, with the first being a discussion on developing a road map for urban development and the second seeking input on how to improve outcomes of the project for women and disadvantaged social groups. In each of these forums, sustainability was a key issue of discussion, particularly the means to implement this important concept within the Tongan context. Numerous follow-up discussions with individuals and groups harnessed a number of views and perspectives in relation to not only environmental issues associated with this subproject, but also the broader development direction for the urban environment in Tonga.

109. Public participation was also harnessed during the poverty and socioeconomic survey, with participants in the household and gender surveys given a brief overview of the project and comments elicited on potential impacts. Each respondent was provided with contact details for any follow up questions. This ensured that the basic project concept was made widely known throughout the project-affected areas.

110. In meetings with stakeholders and with the general public, all issues relating to environmental aspects were disclosed as part of the presentation. No concerns were expressed about environmental issues related to the subproject. There was endorsement of the need for improved waste management services and the landfill operations, and no concerns in relation to environmental impacts. The main issue discussed was the potential for environmental harm if no intervention occurs, with concerns voiced about increased illegal dumping and burning in the urban area.

111. Informal discussions were held with community members at Vaini, with many expressing dissatisfaction with current landfill operations, in particular over the past 18 months. Prior to this time, residents were satisfied with the landfill operations, and they believe that, if the previous operating systems were reinstated, the environmental impacts would cease. They emphasized the need to have trained staff and appropriate enforcement systems. No residents wished for

the site to be closed, and there were no issues of concern in relation to the environmental impacts of the subproject.

112. The consultation process did not inadvertently exclude participation. Forums for women only were undertaken to ensure that concerns could be expressed openly. While this elicited different perspectives, it did not bring forward any new concerns in relation to environmental issues. The socioeconomic survey results demonstrate that waste management is an issue of greater concern to women, particularly issues of infrequent service. Inadequate waste services have a greater impact on the day-to-day lives of women, who are more often the household members responsible for maintaining the home environment. Improving waste management services will therefore have a positive impact on households in this area, particularly women.

## **IX. Grievance Redress Mechanism**

### **A. General Principles**

113. ADB requires that a grievance redress mechanism be established and maintained. It should be designed to efficiently receive and facilitate the resolution of affected peoples' concerns and grievances about project-level social and environmental issues within a reasonable timeframe. The grievance redress mechanism should be scaled to the risks and impacts of the project. It will address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the community.

114. During project implementation, it is possible that people may have concerns about the project's environmental performance. People may perceive negative impacts during the construction or operational phase, and they have the right to have their complaint fairly heard and acted on. Many issues can be resolved effectively through timely communication, inquiry, and mitigation measures.

115. The grievance redress process was widely disseminated to all affected people during project consultations and focus group discussions. The grievance redress mechanism is in place for all safeguard issues, providing a streamlined process for any concerns or issues in relation to resettlement, social safeguards, and environmental impacts.

### **B. Grievance Coordination**

116. A grievance focal point (GFP) will be established by the district/town officer to coordinate and address all complaints and concerns arising from the subproject. The contact details have been provided to all affected persons.

117. The GFP will be assisted and supported by the PMU ST, which will maintain a register of complaints, keep track of their status and report to the director of the PSC. They will regularly track complaints received, actions taken, and the status of resolution. All communications with the affected person(s) will be documented, and whether management action has been taken to avoid community concerns in the future. Complaint forms will be distributed to the GFP to facilitate recording of complaints.

### **C. Grievance Procedures**

118. Affected persons will be informed that they should ask any questions or discuss grievances with their community leader or the district/town GFP by phone or in person; or to project staff visiting the area. The GFP is encouraged to discuss the issue with the contractor or ST, as often minor environmental impacts can be remedied with immediate action.

119. If these questions/grievances are not answered within 1 week they should be prepared in writing (using the assistance of the local community leader, church, or school if necessary). The complainant will also be informed that national and international project staff could assist them with writing a grievance if necessary.

120. Written complaints can be sent or delivered to the GFPs where they will be registered as being received, and will be treated confidentially. The District GFP will have 1 week to deliver a resolution to the affected person.

121. In the event that a satisfactory answer cannot be provided, the affected person may lodge the complaint with the PMU and receive a reply within 7 days.

122. Affected persons will have the right to take the dispute to the Minister of Lands, Survey, and Natural Resources, who will also have one week to respond.

123. In the event that the situation is not resolvable, or the complainant does not accept the decision, the affected person(s) may have recourse to the land court (or other relevant court). All court costs (preparation and representation) will be paid for by the project, regardless of the outcome.

124. Table 4 outlines a summary of the grievance resolution process.

**Table 4: Grievance Resolution Process**

Stages in Response Handling	Required Activities
Village Head or District/Town GFP	Verbally responds to questions and or complaints. May represent affected person in direct discussions with contractor or safeguards team.  If no response within 1 week, or response is unsatisfactory, affected person prepares a grievance in writing (utilize standard forms where possible).
District/Town GFP	Registers the written complaint and attempts to solve it. If complaint is not resolved in one week, it is passed by the GFP to the PMU for resolution.
PMU	Registers the written complaint and attempts to resolve it with the affected person within 1 week.  If a solution is not reached, the PMU refers it to the Minister MLSNR
Minster MLSNR	Consults with other Ministers, the GFP and PMU in the resolution of complaints.  Makes a decision within 1 week.  If the decision is still unacceptable to the complainant, s/he may take it before the Land (or other relevant) Court, with all costs paid for by the project.
Land (or other) Court	The court hears the case and makes a final decision that is binding on all parties.

125. In the postproject period, there remains the potential for environmental harm to occur through the operations of the waste management system. The grievance redress mechanism would revert to existing systems of environmental protection. Persons or groups can seek resolution of a grievance in relation to environmental harm through directly triggering the environmental complaint and investigation mechanism existing in place within MECC. Any complaints in relation to environmental matters are referred immediately to the Director of MECC. After assessing the nature of the complaint, it is delegated to the relevant staff member to investigate and report on the complaint and follow-up action taken.

126. If people feel the waste service is inadequate, or they have a specific complaint, they are able to contact WAL. However, given the lack of responsive management, many complaints were not followed up or redressed. This has had an impact on the level of community support for waste management services. As a part of the institutional capacity development, the system of complaint reporting and follow-ups will be reviewed and improved. This will serve as an important monitoring tool for the project, and will build the ability of WAL to proactively improve performance and community relations.

## X. Monitoring

### A. Internal Monitoring

#### 1. Monitoring Measures – Tapuhia Landfill

127. The existing TMOFM, there are extensive monitoring systems to ensure that the Tapuhia Landfill is maintained to a high standard. A number of quality verification checklists have been developed for the following components within the landfill site:

- (i) leachate system collection and control,
- (ii) leachate monitoring,
- (iii) surface water quality monitoring,
- (iv) site maintenance.
- (v) septage / sludge drying beds,
- (vi) special waste disposal,
- (vii) landfill operation,
- (viii) transfer station operation, and
- (ix) treated leachate storage pond and irrigation system.

128. Table 5 provides a summary of these quality verification measures, and the frequency of their required implementation.<sup>16</sup>

**Table 5: Tapuhia Landfill Quality Verification Measures**

Activity Schedule Tapuhia Solid Waste Facility								
Name	No.	Daily	Weekly	FN	Monthly	Quarterly	Biannual	Annual
Transfer Station	QVC 11.8				X			
Landfill Operation	QVC 12.8				X			
Special Waste Disposal	QVC 13.5				X			
Septage/Sludge Drying Beds	QVC 14.4				X			
Leachate Collection and Control	QVC 16.5				X			
WWTP Maintenance	QVC 17.3		X		X			X
Irrigation Register	QVC 18.3A	X						
Treated Leachate Storage Pond and Irrigation System	QVC 18.4				X			
Site Maintenance	QVC 19.7				X			
Surface Water Quality	QVC 20.5				X	X		
Leachate Flow Monitoring	QVC 20.7		X					
Annual and Biannual Groundwater Monitoring	PM 20.4						X	X

<sup>16</sup> Solid Waste Management Project for Tonga 2007: *Final Management and Operations Field Manual*. Final report to AusAID.

129. The documentation provided by these checklists provides a full suite of information to enable WAL's chief technical officer to manage the site to a high standard. The gap has been in the ongoing implementation of these checklists, and their interpretation.

130. The solid waste management specialist for the subproject will reinstate this internal monitoring system.

131. As a component of the site training, it will be important that site staff understand their monitoring obligations, and can complete the checklists accurately and on schedule.

## **2. Monitoring Measures – Waste Collection**

132. Whilst not in place currently, waste collectors previously collected data on the number of houses within each village from which waste was collected. These provide data is an excellent tool to understand the participation rates for the service. It is recommended that the solid waste management specialist and relevant WAL staff reinstate this system.

133. For the pilot community-led village waste collection systems, sound data recording will be implemented in order to assess the effectiveness of the system. Each time bins are emptied, the date and number of bins emptied need to be recorded as well as the general state of the facility, particularly any instances of waste dumped outside the bins, over-flowing bins, or poorly maintained / damaged infrastructure. This monitoring procedure will be incorporated as a new quality verification checklist within the TMOFM.

## **3. Monitoring Measures – Revenue Collection**

134. With the proposed new accounting system, generating reports on rates of revenue collection will be simplified, providing a clear indicator of progress for WAL. The system will be able to generate reports on rates of payment from individual households and businesses, as well as provide details at a village level.

## **4. Analysis and Reporting Procedures**

135. All the data collected need to be analyzed and utilized for ongoing planning and improvement programs. The solid waste management specialist will work with the chief technical officer to collate all information from the Tapuhia landfill and the waste collection system into quarterly reports. Accounting staff will generate monthly revenue reports.

136. Groundwater monitoring results using the indicator tests will be reported on a quarterly basis. The reports will be provided to the Board each quarter, and to improve the coordination and communication with MECC, a copy of the results will also be forwarded to MECC. In the event of adverse findings, the chief executive officer and MECC will be notified as soon as practical.

137. All complaints need to be collated with follow up actions reported. Any complaints need to be referred to the office and recorded, whether it is a collection, landfill, or billing complaint. The person within WAL who is responsible for the complaint register will also be required to follow up each complaint, either directly or through an appropriate person. Results of the follow up are to be recorded in the log book. A monthly complaints report is then generated for the chief executive officer. This can be very simple in format, detailing number of complaints, category (eg, collection, landfill, billing), and the number of issues satisfactorily resolved.

138. The chief executive officer and Board will receive all monitoring report summaries as detailed above.

## **B. Safeguards Team Subproject Monitoring**

### **1. Institutional / Organizational Arrangements**

139. In addition to improving internal monitoring mechanisms within WAL, it is important during the project period to use monitoring external to WAL to provide a greater level of accountability in their operations and commitment to environmental safeguards.

140. Given the responsibility of MECC to ensure that WAL is complying with the operating requirements of the Waste Management Act 2005, it is recommended that a staff member from MECC be invited to join the ST in the monitoring of waste management activities. This will ensure strong links among the project, PUMA, WAL and MECC. It will also assist to build capacity within MECC for environmental compliance monitoring.

141. All checklists and reports from WAL are to be made available to the team in order to assist them in their analysis. The project staff, particularly the waste management specialist will provide all necessary support for the ST to ensure they can effectively monitor the waste services and build their capacity as environmental professionals. In addition, the team will make visits to the landfill facility and community village waste collection areas to make additional field observations.

142. The draft monitoring audit checklist is provided as Annex D.

143. One of the outcomes of the project will be the implementation of a long-term waste system monitoring regime, with clear roles and responsibilities, information sharing, and budgetary allocation.

### **2. Implementation Time Frame**

144. The safeguard team will undertake the waste management system audits on a quarterly basis, with the final audit towards the end of the project. During this time, they will also work with WAL and MECC to make recommendations for any ongoing monitoring mechanisms to maintain sound environmental practices.

### **3. Capital / Recurrent Costs for Monitoring**

145. The capital cost for the groundwater monitoring equipment is \$1,900. This is covered in the project costing.

146. There are no additional capital or recurrent costs for this monitoring system. The costs of the internal monitoring are the responsibility of WAL, with assistance from the project budget if required for more detailed groundwater analysis following adverse screening test results. The costs of the ST have been covered within the environmental and social mitigation component of the overall project budget. There are no additional consultants required for environmental aspects of the project, as the framework and procedures are already well developed. It is the implementation mechanisms that need strengthening. The training will be delivered by the SWM specialist with the environmental specialist from PUMA, and as such is included in the subproject budget.

## **XI. Conclusion and Recommendations**

147. The upgrade of the waste management system will not involve any significant new facilities. The emphasis is on reinstating previous environmental safeguards, remediating the site to its previous state, and providing the plant and equipment required for operations in the immediate and medium term. An asset management plan will be implemented to make provision for long-term plant and machinery requirements.

148. The implementation of the project will result in major positive environmental benefits. Lining the second cell and improving the operations of the existing leachate management system at Tapuhia will result in significant environmental risk reduction. Reinstating appropriate landfill operating standards, such as daily compaction and covering, will resolve the issues of insects, vermin, odor, and windblown litter, thereby reducing impacts on neighboring houses and villages.

149. The groundwater monitoring program is fundamental to assessing the environmental performance of the Tapuhia landfill. The monitoring process as designed in the review of monitoring under the TSWMP will be implemented as an urgent priority. Early implementation as an immediate project priority will ensure adequate time to systemize the monitoring.

150. Upgrading the waste collection service through investing in new collection vehicles and improving O&M standards will result in a more effective waste collection service. This will reduce the incidence of burning and illegal dumping, as it provides people with a convenient alternative. The proposed pilot of developing community-led village waste collections in five areas will provide the means to test an alternative model suited to areas that are difficult to service with collection trucks. Preventing the waste bin areas from becoming sources of environmental impact will require careful site selection, appropriate design, and strong community ownership to ensure that they are managed effectively.

151. The EMP for the Tapuhia landfill, and the TMOFM provide a sound framework for ongoing management and operations. However, there is a requirement to ensure that the actual implementation does not decline. In addition to the technical assistance and capacity development delivered by the solid waste management specialist; a formal training component will be implemented to ensure that all procedures and checklists are practical and easily implemented by relevant staff. The training will involve the whole of WAL in team building, results planning, and performance monitoring; with the aim of developing a culture of efficient service delivery, responsiveness, and high quality and environmental standards.

152. Strengthening the sustainability of WAL as a business enterprise to operate into the future will underpin the ongoing operations of waste management services. This will provide a vital service to the urban environment, reducing a substantial burden on the environment through poorly managed landfill operations, and inappropriate dumping and burning practices within the community.

## **ANNEX A: Selection Criteria for Five Pilot Community Bin Sites**

153. To further WAL's efforts to deliver a waste collection service that is responsive to householder needs, a pilot program will be implemented to develop a community-led, village-level waste collection service in five villages. This village level waste collection will address the issue of the waste collection trucks being unable to drive past all households due to poor secondary roads in many villages. It will provide a consolidated, waste collection point at a site in the village, which can be easily accessed by the collection truck. The central waste collection point will utilize standard 240-liter municipal garbage bins. The pilot villages will be chosen utilizing a community, demand-driven selection process.

154. The following are some initial selection criteria for the pilot sites:

- (i) The community has a clear catchment area, stating the number of houses that will use the facility.
- (ii) Must have full agreement of all houses in the catchment area to participate in the pilot.
- (iii) A clear site is selected for the bin area, and agreement with the land owner / user has been attained. No loss of livelihood will occur through changing the land use.
- (iv) Site is in a convenient location with good access.
- (v) Site is well drained (not swampy or subject to regular flooding).
- (vi) Site will not cause a nuisance or impact on the amenity of neighboring houses or facilities.
- (vii) An individual or group is identified as responsible for taking care of the facility, ensuring it is kept in a clean and well-ordered state.
- (viii) The group has a strategy to respond to unauthorized external individuals or groups using the bins.
- (ix) The group has a strategy to respond to inappropriate use by members within the community.
- (x) The group agrees on a trial period of 12 months, after which an appraisal will be undertaken, and a plan developed to remove the facility or undertake to operate it into the long term.

## **ANNEX B: Procedure for Landfill Cell Construction from TMOFM**

### **A. Purpose and Scope**

155. To ensure that the Tapuhia Solid Waste Disposal Site has available developed landfill area for the deposition of waste received at the facility and is constructed managed and in a safe and efficient manner and compliant with the environmental requirements of the Operation Field Manual.

156. This procedure should be read in conjunction with the Technical Specifications and Construction Drawings for Cells 2, 3 and 4. All personnel involved in the construction process for cells 2, 3 and 4 at Tapuhia Solid Waste Disposal Site shall adhere to this procedure, including:

- (i) all Waste Authority personnel involved in construction management and programming for cells 2, 3 and ;.
- (ii) all Tapuhia Solid Waste Disposal Site personnel directed to the construction process; and
- (iii) all Contractors associated with the construction process associated with Cells 2, 3 and 4.

157. The Tapuhia landfill will be constructed in four substages. Substage 1 is the southwest cell, constructed and completed for commencement of landfill on in May 2006. Cells 2, 3, and 4 will be constructed before landfill space within the preceding cell is exhausted. The base of cell Stages 1, 2, 3, and 4 are lined with geosynthetic clay liner (GCL) in order to prevent leachate entering the ground beneath the cell. The GCL liner has been installed beneath 300 millimeters (mm) of protective clay cover and 300 mm of drainage layer, which forms the cell floor.

158. Cell 2 will be used as the description for the decision and construction processes required, however, the same methodology will be used for cells 3 and 4 unless otherwise changed by the WAL and a new procedure issued.

### **B. Procedure Details**

#### **1. Timing and Planning of Construction**

159. This procedure will define the critical processes and decisions required to ensure that cell 2 construction is undertaken so as to allow landfilling to proceed uninterrupted and that available developed landfill area is provided for the deposition of waste at all times throughout the life of the landfill.

160. The time allowed for project planning and contract management to completion of cell 2 should be taken as 12 months.

#### **2. Initial Assessment (Six Months of full operation)**

161. The initial assessment of available space for landfilling in cell 1 will be undertaken by the operations manager and technical officer of the WAL. This initial assessment shall give a clear indication as to when the construction of cell 2 should be commenced. Initial assessment shall be undertaken using the following procedures:

- (i) After 6 months of full operation, undertake a survey on site pick up of volume used on cell 1. This is obtained by using survey information from floor development in as constructed drawings as base line for survey findings.
- (ii) The finished levels of cell 1 before cell 2 is needed for waste will be

approximately 9–10 metres generally from floor development.

162. Following the formula below may be used to assess the available time left for landfilling on cell 1 or any subsequent cells;

$$\frac{(TV - UV)}{UV} \times T = AT \text{ (months available on cell 1 after initial assessment).}$$

Where;

I	= initial floor development survey heights
F	= floor area m <sup>2</sup> developed Cell 1
T	= time cell operated at time of survey pick up (months)
TV	= total Volume of Cell 1 at 9 metres fill (F x 9)
UV	= used Volume Floor area x average height of six monthly survey pick up (F x UV)
AV	= available Volume (TV – UV)
AT	= available Time (months)

163. By recording survey information at 6 monthly intervals, assessment may be made of the accuracy of AT in any given cell.

### 3. Planning and Programming

164. Once the initial assessment has been undertaken and the AT estimated, planning will then be undertaken giving at a minimum 6 months operation on cell 1 once cell 2 construction is completed. This will ensure landfilling space is always available for the deposition of waste. Planning shall include the following:

- (i) Prepare the program for project preparation and construction with the end of construction due for completion 6 months before cell 1 reaches usable height. Allow 12 months for documentation and construction completion.
- (ii) Use WAL to clear cell 2.
- (iii) Initial survey of cell 2 area.
- (iv) Prepare technical specification.
- (v) Prepare construction drawings.
- (vi) Prepare bill of quantities and operating budget.
- (vii) Assess material on site. (Bentofix, HDPE leachate collection pipe).
- (viii) Procure materials (if required).
- (ix) Prepare subcontract documentation.
- (x) Tender for subcontract construction and supply requirements.
- (xi) Assess and award tenders.

165. Assessment of subcontractors shall be done on capacity to complete works to programme.

### 4. Lessons Learned from Cell 1 Construction and Procedure Details

166. During construction of cell 1, valuable lessons were learned that may be used to streamline the construction process for all subsequent cells to be developed. The relevant details are discussed in dot points below:

- (i) Contractors employed on site must be supervised by the WAL at all times to ensure that any set out of works is correct and that quality standards are maintained. The construction process requires a full-time, on-site supervisor to oversee and control all construction levels, set out and checking of works in progress.

- (ii) All levels, lines, and construction pegs for earthworks should be set by the WAI's supervisor.
- (iii) Materials supplied by contractors must be checked for compliance against specifications in the contract of works. If materials do not comply with the specification they must be removed from works and replaced with compliant materials.
- (iv) After initial contract payment to contractors, subsequent contract payments should be made only on progress attained by the contractor. Payment schedules should be included in the contract.
- (v) Earthworks contractors require coaching in the methodology to achieve construction at a reasonable pace. They must be encouraged and understand the need for adequate plant and manpower.
- (vi) Clearing and preparation of the quarry wall will be undertaken during the base limestone floor clearing and preparation.
- (vii) Manual removal of clay liner to expose the Bentofix X1000 floor liner for jointing should be undertaken as early as possible for earthworks jointing. The exposed Bentofix X1000 should be plastic wrapped and edges pegged to prevent vehicle damage.
- (viii) During the importation of limestone or clay for the base or liner, sufficient trucks must be available to haul material at a reasonable rate for construction. Past experience shows that at least a minimum of five 10 m<sup>3</sup> haul trucks are required.
- (ix) Earthworks contractors must be encouraged to progress on one section of works at a time. They must also be guided and directed to finish the section fully before proceeding with the next section or process of works.
- (x) Placement of the first clay liner should proceed from the high point of the limestone base floor to the sump. This will ensure access for placement of the clay liner after rain events and allow shedding of water.
- (xi) Clay placed up the quarry wall to underlay the wall Bentofix liner should be placed as the clay floor liner proceeds.
- (xii) Lining of the quarry wall with Bentofix X2000 should be done horizontally where possible by the use of the lifting bar and excavator. The bottom is then folded back to allow lap over the floor Bentofix X1000 liner.
- (xiii) Installation of the Bentofix X1000 floor liner should proceed from the high point of the landfill cell across the full width of the cell. Enough Bentofix should be placed per day to allow complete coverage with clay by the end of the day's works. The leading edge of the Bentofix should be wrapped in plastic and not covered with clay to allow jointing on the following day.
- (xiv) On completion of the second clay liner the lines for subcell bunds should be set and clay bunds placed in conjunction with Leachate pipework and drainage blanket. This will require planning so as to allow access for trucks and placement of materials.
- (xv) Only subcells to be used for landfilling should be fully hooked to collect leachate.

## **C. Earthworks**

### **1. Clearing Cell 2**

- (i) Cell 2 area will be cleared and all unsuitable material removed and stockpiled for use as daily cover in the landfill operation.
- (ii) All large trees should be removed and cut for firewood.
- (iii) All smaller vegetation may be removed for composting or stockpiled and allowed to degrade for use as daily cover.

### **2. Construction Levels**

167. Levels for the construction of cell 2 and all subsequent cells can be taken by working from the leachate pipe invert level in the leachate pump sump. Limestone FL base development proceeds at 1% rising from the sump at 690 mm below invert of leachate pipe at sump. First clay liner FL proceeds at 1% rising from the sump at 390 mm below invert of leachate pipe at sump. Final clay layer FL proceeds at 1% rising from the sump at 90 mm below invert of leachate pipe at sump.

168. The following methodology for earthworks management and placement of local available clay (LAC) for the lining system will be used.

### **3. Stockpile Area and management of Materials Stockpile Area**

169. Stockpiling of limestone fill material will be undertaken by the contractor if required following approval of the engineer. The management of all stockpiles including access shall be the responsibility of the contractor. No clay for landfill lining systems will be stockpiled on site, other than material that has been rejected by the Engineer and is to be used as daily cover.

### **4. Borrow Material Clay Base Liner**

170. Borrow material will be won from suitable quarry areas approved by the engineer. The suitability for installation as a liner of the LAC will be approved by the Engineer before commencement of works. To facilitate the retention of field moisture. Borrow material shall be taken directly from cut-to-fill and will not be stockpiled at the quarry or site preceding placement as a liner.

## **D. Construction of Clay Base Liner**

### **1. Clay Liner Requirements**

171. The required compaction for lining material will be a dry density ratio of not less than 95% of the standard maximum dry density (AS1289.5.4.1). The moisture content will be ascertained by visual checking of cut to fill local clay delivered to site by the contractor and engineer.

172. The engineer may reject lining material delivered to site by the contractor due to lack of field moisture. This reject material will be stockpiled for future site use as daily cover.

### **2. Placement of Clay Liner**

- i. The lining material to form the base liner will be constructed to the lines, levels, grades and cross-sections as shown on the final approved Drawings.
- ii. Lining material will not be placed on a surface on which free water has ponded.
- iii. If the required density and moisture are not achieved the compacted material will be reworked in accordance with the specification, to meet the density and moisture content requirements. If the density and moisture content requirements again cannot be achieved, the failed lift will be removed at the Engineer's direction and stockpiled for future use as daily cover. Moisture content will be checked against specifications during construction by an approved oven-drying method.
- iv. The engineer may order trafficked sections to be ripped up and recompacted if s/he deems that the quality of these sections has deteriorated due to construction traffic.
- v. Placement will be undertaken in one layer to prevent lamination during placement. Height indicators will be used to guide plant operators as to the

- finished layer depth required.
- vi. Compaction by wheel rolling the material will be undertaken as soon as practicable after the material has been placed in the first instance by the articulated wheel loader (rubber tired) and assisted compaction by the delivery trucks.
  - vii. During placement and compaction the compacted layer will be cut while still "green" to an estimated height using the articulated wheel loader to achieve a smooth, trafficable surface and to assist delivery trucks.
  - viii. Final compaction will be undertaken using a vibrating flat drum roller of approximately 12 tons. This will be undertaken immediately after the initial cutting to height is undertaken. Compaction will proceed until no material movement is evident. This also assists in the sealing of the surface to maintain moisture and to shed rainfall.
  - ix. Height pegs will be installed on the finished area as soon as practicable and final trim undertaken by using a grader to finish to required levels. Any excess material will be removed to stockpile for future use as daily cover.
  - x. To assist the retention of moisture and prevent cracking the finished clay liner will be covered using building film as soon as is practical after attaining finished levels.

### **3. Moisture Conditioning**

173. It has been the experience of the Tonga Solid Waste Management Project that the moisture conditioning of LAC material used for the lining systems is not required when the clay material is taken directly from cut-to-fill. The engineer and contractor will assess the moisture condition of the material delivered as to its suitability for inclusion in the works.

174. It should be noted that LAC, if over optimum moisture content, is difficult to handle and that some adjustments to delivery may be required to allow in-situ LAC to dry in the borrow pit before cut-to-fill.

### **4. Personal Protective Equipment**

175. The following items are mandatory while working on the site.

- (i) high visibility vest or shirt, and
- (ii) steel cap boots.

## **ANNEX C: Terms of Reference for WAL Training Package**

### **A. Introduction**

176. The Waste Authority Ltd (WAL) is a public enterprise tasked with providing solid waste management services in Tongatapu. Under the Waste Management Act, 1995, WAL must provide these services in accordance with environmental standards as prescribed by the Minister for Environment and Climate Change. In recent years, WAL has not effectively met their obligations under the Act. The Tapuhia landfill has operated without adherence to the site EMP or O&M field manual, resulting in increased environmental impacts.

### **B. Objective / Purpose**

177. The WAL training package will be implemented to ensure that sound operating practices are reimplemented and systemized throughout the organization. The solid waste management (SWM) specialist will design a package to meet the needs of all WAL members, from the landfill site workers through to Board members. The Tapuhia Operations and Maintenance Field Manual (TMOFM) will be adapted and updated to provide simple and practical site operating procedures, induction processes, and ongoing monitoring mechanisms. All staff and management will understand their obligations to operate all aspects of the system with minimal environmental impacts, and high-service delivery standards. WAL staff will together form a cohesive, efficient, and responsive organization, committed to best practice in waste management.

### **C. Scope**

178. Training is required to implement a phased training over 2 years, with training to be delivered in the Tongan language wherever this provides a more effective learning environment. Training will vary between practical field based sessions and interactive workshop sessions. Training will be interactive, providing participants with the opportunity to input ideas from their practical experience, and will help shape the direction of the organization. The solid waste management specialist under the Nuku'alofa Urban Development Sector Project (NUDSP) will design and implement the training with the input and assistance of the environmental specialist from PUMA and the CEO and Communications Officer from WAL.

### **D. Detailed Tasks**

179. The following tasks will be required:

- (i) Analysis of existing induction, training and operating procedures from the TMOFM, including all checklists. Update any aspects to ensure they are easily understood and utilized by intended audience.
- (ii) Ensure that WAL staff understand their monitoring obligations and can complete the checklists accurately and on schedule for landfill operations, service schedules, vehicle operations and waste collection.
- (iii) Monitor checklist records and provide timely feedback if checklists are not used as intended.
- (iv) Effect team building for WAL, analyzing past lessons and setting a new direction for the organization.
- (v) Ensure that all WAL staff and Board members understand their obligations under the Act and have an understanding of best practice waste management standards and how they apply in the local context.
- (vi) Customer service training, developing a culture of responsive and service focused staff.

- (vii) Implement a responsive and effective complaints recording and response procedure.
- (viii) Undertake periodic reviews, including site visits to the Tapuhia landfill to check that procedures are followed and checklists implemented.
- (ix) Undertake site visits to household collection service runs, accompanying staff on their runs and ensuring that data recording is undertaken effectively, and that WAL staff have a professional interface with the community.
- (x) Lead organizational planning sessions that develop goals and activities for WAL that are measurable and output focused. The resulting action plans may be split into various functional sections such as landfill operations, waste collection, billing and revenue; with the whole of WAL aware of the goals and the results achieved. Progress is to be measured within each section, demonstrating performance against the targets; with results shared among the organization.
- (xi) Feedback results to all levels of staff and management, and seek ways to engage all participants in a process of ongoing organizational improvement.

## **E. Outputs**

- (i) Training design, detailing schedule and the training / participation modules. This can be adapted if required in response to the needs of the organization.
- (ii) An updated TMOFM with changes made where appropriate to ensure that checklists and procedures are easily understood and practical to implement.
- (iii) A WAL action plan based on participatory planning.
- (iv) Measurement and reporting of results against the plan.
- (v) Final report detailing the training purpose and goals, the program implemented, and the results achieved. The report will include recommendations for any ongoing training and organizational strengthening.

**ANNEX D: Waste Subproject Monitoring Checklist**

**Project** : Nuku'alofa Urban Development Sector Project

**Implementing Agency** : Planning and Urban Management Agency

**Subproject** : Waste Management System Upgrade

**Monitoring Agency** : Safeguards team

**Date** : \_\_\_\_\_

**Reporting Period** : \_\_\_\_\_

**1. Tapuhia Landfill**

WAL Staff Environmental Awareness	Yes / No	Actions Required	WAL Response / Comment
Staff inducted as per TMOFM?			
Staff have a copy of TMOFM?			

**Quality Checklist Compliance Inspection**

Quality Checklist (From TMOFM)	Checklist Completed? (Yes, No and No of checklists)	Checklists Effective? (1 to 5) <sup>a</sup>	Impact Observed / Location	Action Required	WAL Response / Comment	Endorsed by:	
						PIA	PMU
Transfer Station QVC 11.8							
Landfill Operation QVC 12.8							
Septage / Sludge Drying Beds QVC 13.5							
Leachate Collection and Control QVC 16.5							

Quality Checklist (From TMOFM)	Checklist Completed? (Yes, No and No of checklists)	Checklists Effective? (1 to 5) <sup>a</sup>	Impact Observed / Location	Action Required	WAL Response / Comment	Endorsed by:	
						PIA	PMU
WWTP Maintenance QVC 17.3							
Irrigation Register QVC 18.3A							
Treated Leachate Pond and Irrigation System QVC 18.4							
Site Maintenance QVC 19.7							
Leachate Flow Monitoring QVC 20.7							
Heavy Plant Prestart Checklists							
Heavy Plant Servicing Schedule							
Quarterly Indicator Testing of Groundwater							

<sup>a</sup> Mitigation effectiveness rating criteria (Indicative examples).

1. Very good (all required mitigations implemented).
2. Good ( the majority of required mitigations implemented).
3. Fair (some mitigations implemented).
4. Poor (few mitigations implemented).
5. Very Poor (very few mitigations implemented).

## 2. Waste Collection

WAL Staff Environmental Awareness	Yes / No	Actions Required	WAL Response / Comment
Staff inducted as per TMOFM?			
Staff have a copy of TMOFM?			

### Quality Checklist Compliance Inspection

Quality Checklist (From TMOFM)	Checklist Completed? (Yes, No and No of Checklists)	Checklists Effective? (1 to 5)*	Impact Observed / Location	Action Required	WAL Response / Comment	Endorsed by:	
						PIA	PMU
Pre-start vehicle checklist							
Compactor truck service schedules							
Waste Collection Data Sheets							

<sup>a</sup> Mitigation effectiveness rating criteria (Indicative examples).

1. Very good (all required mitigations implemented).
2. Good ( the majority of required mitigations implemented).
3. Fair (some mitigations implemented).
4. Poor (few mitigations implemented).
5. Very Poor (very few mitigations implemented).

## 3. Village Waste Collection Pilot Sites

### Quality Check Inspection

Quality Checklist (From TMOFM)	Datasheet Completed? (Yes, No and No of Checklists)	Pilot System Effective? (1 to 5)*	Impact Observed	Action Required	WAL Response / Comment	Endorsed by:	
						PIA	PMU

Quality Checklist (From TMOFM)	Datasheet Completed? (Yes, No and No of Checklists)	Pilot System Effective? (1 to 5)*	Impact Observed	Action Required	WAL Response / Comment	Endorsed by:	
						PIA	PMU
<b>PILOT Site 1</b>							
Collection Data Sheet Completed							
Visual Inspection of Site							
<b>PILOT Site 2</b>							
Collection Data Sheet Completed							
Visual Inspection of Site							
<b>PILOT Site 3</b>							
Collection Data Sheet Completed							
Visual Inspection of Site							
<b>PILOT Site 4</b>							
Collection Data Sheet Completed							

Quality Checklist (From TMOFM)	Datasheet Completed? (Yes, No and No of Checklists)	Pilot System Effective? (1 to 5)*	Impact Observed	Action Required	WAL Response / Comment	Endorsed by:	
						PIA	PMU
Visual Inspection of Site							

**PILOT Site 5**

Collection Data Sheet  
Completed

Visual Inspection of Site

- <sup>a</sup> Mitigation effectiveness rating criteria (Indicative examples).
1. Very good (all required mitigations implemented).
  2. Good ( the majority of required mitigations implemented).
  3. Fair (some mitigations implemented).
  4. Poor (few mitigations implemented).
  5. Very Poor (very few mitigations implemented).

**4. WAL Sustainability**

Village Name	No of Households Billed	No of Households Paid	%	WAL Response / Comment	Endorsed by:	
					PIA	PMU



**6. Health and Safety Incidents During Reporting Period (if relevant)**

Health and Safety Incidents (accidents, near misses) Outline nature of incident, name of affected persons, any injuries, property damage etc	Date / Location	Reported by	Action Taken	Further Action Required	Endorsed by:	
					PIC	PMU

**Summary of Actions Required and Follow-up (if relevant)**

Action Required	Timeframe (e.g. within one week)	Responsible Parties	Follow-up (to be completed if inspection/monitoring indicates actions are required)
			Required Action Taken:
			Effectiveness:
			Further Action Required?:

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Prepared by:

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Date:

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Inspection Completed by: \_\_\_\_\_

Date: \_\_\_\_\_

Signature: