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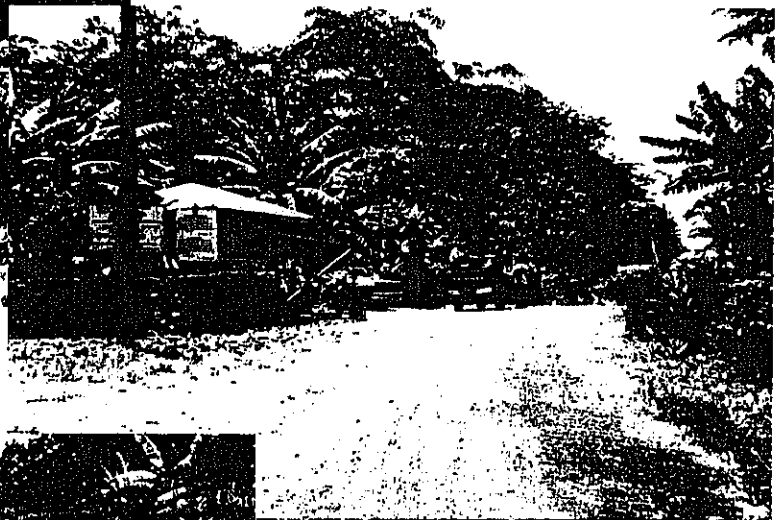
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98-12

WASTE MANAGEMENT STUDY



Project Formulation Study ON WASTE MANAGEMENT IN SAMOA



VOLUME 2
March 1998



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APPENDICES



APPENDIX A

PROJECT STUDY PLAN

JICA PROJECT IDENTIFICATION STUDY ON WASTE MANAGEMENT FOR THE IMPROVEMENT OF THE URBAN ENVIRONMENT IN SAMOA

STUDY PLAN

1. PROJECT APPRECIATION

Waste disposal in Samoa (Apia) is currently occurring in a haphazard manner and this is creating a serious risk to human health and threatens to destroy natural resources such as mangrove foreshores and coastline which are vital to local industries such as tourism. This is occurring due to a lack of funding and trained staff at the Department of Lands, Survey and Environment, the official organisation in charge of environmental issues.

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

The proposed project team is very aware and familiar with the poor state of waste management in Samoa, with two members of the project team having recently undertaken the Pre-Feasibility Study on Waste Management for the Aus AID (referenced in the Project Brief). As part of the AusAID Study (undertaken in February/March 1997), many of the work activities outlined in the Project Brief were undertaken. This included:

- A review of Samoa's National Environmental Management Strategy (NEMS), with regard to waste management (solid waste, hazardous waste, and wastewater);
- A review of existing waste management policies, planning, practices, and legislation in Samoa (Apia). This included a review of waste generation, waste collection and disposal, and recycling;
- A review of waste management administration in Samoa (Apia);
- Identification and review of the activities of other donors and international organisations in waste management in the region. This included WHO, UNDP, ADB, SPREP, NZ High Commission, EU, FAO and of course JICA;
- Identification, assessment and scoping of possible projects which would improve waste management in Samoa (Apia). Projects identified by the AusAID Study for Samoa included the following:
 - Management of persistent organic chemical (including waste oil);
 - Septic tank sludge management;
 - Integrated waste management in newly developing urban centres in the Pacific Islands;
 - Hazardous waste management strategy;
 - Improving urban solid waste storage, collection, and disposal;
 - Improving rural solid waste management;

As a result CMPS&F is very familiar with the existing waste management problems in Samoa, and would be able to utilise this knowledge to great benefit in undertaking the project, particularly avoiding duplication of tasks already undertaken.

2. PROJECT METHODOLOGY

2.1 GENERAL

The state of waste management and the environment in Samoa (Apia) has been assessed by a number of different organisations in a number of previous studies eg. NEMS, ADB, and AusAID (two members of the project team, Stuart Dever and John Morrison, were involved in the AusAID study). It is proposed that maximum use would be made of previous investigations and studies by adopting a staged approach to the project, which as a first step involves a comprehensive review of existing available information. A staged approach would avoid duplicating the work undertaken by others and maximise output for the budget allocated. This approach would also allow the scope of work to be tailored to achieving the project objectives and the budget available after the initial review of the existing situation. The proposed staged scope of work involves the following general tasks. The following Sections describe in more detail the proposed staged scope of work.

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

1. Project kick off meeting;
2. Background data collection and review.
3. Initial review and assessment of the existing state of waste management in urban Samoa (Apia);
4. Review of current waste management administration and legislation (including laws and regulations);
5. Initial identification and review of the activities of other donors and international organisations in waste management in the region;
6. Preparation of a report on findings of Stage 1, and recommendations for Stage 2 investigations.

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

Subject to the findings of Stage 1, and consequent need for further work to achieve the objectives of the Project, the following tasks may need to be undertaken (based on current knowledge of waste management in Apia):

7. Public awareness survey;
8. Waste characterisation survey / investigations;

Stage 3 - Identification And Development Of Possible Waste Management Projects

9. Upon completion of the earlier investigation and assessment stages, the project team would proceed to identify, develop and compare possible sustainable projects suitable for Japanese assistance, which would improve urban waste management and consequently the urban environment in Samoa (Apia).;
10. Final report preparation.

2.2 STAGE 1 - PROJECT KICK OFF AND INITIAL REVIEW OF EXISTING WASTE MANAGEMENT SITUATION IN SAMOA (APIA)

2.2.1 Task 1 - Project kick off meeting

It is proposed that the project commence with a kick-off meeting with JICA (Sydney Office) and key members of the project team. The objective of the meeting would be to agree the overall approach to the project, the program, scope of work and deliverable's. Project start-up would also involve preparation of the Project Quality Plan (PQP) which would be implemented throughout the project. Further details of the quality assurance activities are provided later in Section 3.

2.2.2 Task 2 - Background data collection and review

To maximise use of available information, thus avoiding duplication of activities previously undertaken by others, and therefore maximise output for the given budget, it is proposed that a comprehensive review of other relevant investigations and studies would be undertaken. This review would include the following documents:

- Samoa's National Environmental Management Strategy (NEMS);
- the ADB Urban Environment Master Plan Study;
- AusAID's Pacific Regional & Multi-Country Waste Management Development Project Pre-feasibility Study;
- Relevant policies, strategies, and plans of the Samoan Government (it is known that the Samoan Government had a Draft Waste Management Policy); and
- other relevant environmental / public health studies which are identified.

To assist this task the Department of Lands, Survey and Environment and SPREP would be consulted and a literature review would also be undertaken.

2.2.3 Task 3 - Initial review and assessment of the existing state of waste management in urban Samoa (Apia)

The aim of this task is to obtain an initial understanding of the current state of waste management in Samoa (Apia) by confirming and updating the information obtained in task 2, thus allowing the scope of any further investigation work in Stage 2 to be

finalised. The initial review would involve a site visit to Samoa (Apia) to undertake the following activities:

- briefing meeting with JICA - Samoa;
- speak to relevant Samoan Government agencies, including Department of Lands, Survey and Environment, Public Works, Department of Health and others;
- inspect and review current waste storage and waste collection activities;
- inspect and review the existing waste depot and the old waste depot;
- inspect and review existing recycling and waste processing activities;
- inspect and review wastewater and liquid waste management facilities (known to encompass primarily septic tanks - although it is known that a reticulated sewer and central wastewater treatment plant were proposed in the ADB study. It is also known that sludge from the septic tanks was being disposed of at an undersized facility at the existing waste depot);
- inspect and review existing hazardous waste management facilities ,after consultation with the relevant Government agencies eg. Department of Health, Department of Lands, Survey and Environment, Department of Agriculture (it is known that hospital waste was dumped at the existing waste depot and that there were no / limited facilities to manage other difficult wastes such as waste oil, pesticides / herbicides, grease trap waste, chemical wastes etc)
- speak to relevant community organisations such as the O le Siosiomaga Society and relevant Government Departments to gauge the current level of community awareness of waste management as an environmental issue, and what education activities, if any, are currently occurring;
- assessment of local facilities, services and equipment for undertaking any detailed investigation and assessment work in Stage 2;

The initial review of waste management activities would address all solid, liquid and hazardous wastes.

It is proposed that as part of this initial review and assessment, the inspection and review of the existing waste depot and old waste depot would encompass a detailed walkover of each site, in-situ testing of surface waters to assess any gross pollution (eg pH, DO, TDS, redox), excavation of backhoe trenches to assess the underlying soils, and if possible test ground waters in situ for gross pollution. This information would be used to determine the need for further investigation work eg. further water sampling and testing and soil sampling and testing.

2.2.4 Task 4 - Review of current waste management administration

In conjunction with Task 3, the project team would collect all necessary and relevant data to assess the current institutional arrangements in relation to waste management in Apia. This would include collecting and reviewing relevant legislation and regulations as

well as assessing the current implementing organisation ie. Department of Lands, Survey and Environment.

2.2.5 Task 5 - Initial identification and review of the activities of other donors and international organisations in waste management in the region.

In conjunction with Task 3, the project team would consult with other donors and international organisations to identify and review their activities in waste management in Samoa (Apia). This would include AusAID, WHO, UNDP, ADB, SPREP, NZ High Commission, EU, FAO and other relevant organisations;

2.2.6 Task 6 - Stage 1 Report

A short report presenting the findings of Stage 1 would be prepared for review by JICA. The report would also contain recommendations and details (scope and cost) for any further investigation work in Stage 2.

Allowance has been made for the Project Manager to meet with JICA in Sydney to discuss the outcomes of Stage 1.

2.3 STAGE 2 - MORE DETAILED REVIEW AND ASSESSMENT OF EXISTING WASTE MANAGEMENT SITUATION IN SAMOA (IF REQUIRED)

2.3.1 General

Depending on the findings of Stage 1, and consequent need for further investigations to achieve the objectives of the Project, based on our current knowledge of waste management in Samoa (Apia) the following tasks may need to be undertaken in Stage 2. Please note that the scope of work and budget provided in the attached table are suggested / nominal only at this stage and would be confirmed upon completion of Stage 1 of the Project. Also, it may be identified in Stage 1 that other work is required.

2.3.2 Task 7 - Public awareness survey

To obtain a more detailed understanding of public awareness of waste management as an environmental issue, there may be a need to undertake a survey of Apia and surrounding villages. It is proposed that if required, a local subconsultant would be engaged to undertake such a survey under the direction of the project team and report the findings of such.

2.3.3 Task 8 - Waste Characterisation Survey

It is known from previous work in Samoa that little information is available on the quantity and types of waste being generated in Apia and the surrounding villages. It would be beneficial to undertake some characterisation work to try to better determine such eg. vehicle counts at waste depot, visual observation of waste being disposed of at the waste depot, use of data from other similar sized South Pacific developments to provide an estimate / check of such.

It is known that AusAID were considering undertaking a Study to assess the extent of hazardous wastes in the South Pacific, and this included Samoa. Data from such a Study would be sought.

At this stage a nominal budget has been allocated for this as the actual scope of work would be dependent on the outcome of Stage 1.

2.4 STAGE 3 - IDENTIFICATION AND DEVELOPMENT OF POSSIBLE WASTE MANAGEMENT PROJECTS

2.4.1 General

Upon completion of the Stage 1 and Stage 2 investigation and assessment stages, the project team would proceed to identify and develop possible sustainable projects suitable for Japanese assistance which would improve urban waste management and consequently the urban environment in Samoa (Apia). The following sections outline the tasks that would be undertaken.

2.4.2 Task 9 - Identification, Development and Comparison of Possible Projects

Using all the data collected in Stages 1 and 2, the project team would proceed to identify, develop and compare possible support projects. This would encompass the following:

- Identification of activities / projects that would help improve the management of waste and consequently the urban environment in Samoa (Apia). It is noted that such projects should complement activities being undertaken by other donors / international organisations;
- Development of the possible projects. This would include defining the scope of the projects, staging required, implementation program, resources required, and estimated costs;
- Assessment and comparison of the projects considering feasibility, likely success, costs, environmental impact, social impact, financial and economic factors, potential impacts on local trade and commerce, risks and sustainability.

2.4.3 Task 10 - Final Report Preparation

A comprehensive report presenting the findings and outcomes of all stages of the project would be prepared and presented to JICA. Allowance has been made for the provision of a Draft Report (3 copies) for review by JICA. Upon receipt of JICA's comments the report would be finalised and 6 copies would be presented to JICA.

Allowance has been made for the Project Manager to meet with JICA - Sydney to discuss the Draft Report.

2.5 ESTIMATED STAFF INPUT AND COSTS

The estimated staff inputs and costs to undertake the above described tasks are shown in the attached table.

2.6 PROGRAM

The project would be undertaken in accordance with the attached Program. Please note the following:

- Tasks 3, 4 and 5 would be undertaken in Samoa (Apia) by Stuart Dever and John Morrison. Allowance has been made for Stuart Dever to spend approximately 10 days in Apia undertaking the necessary investigation work. Allowance has been made for John Morrison to spend 5 days in Samoa (Apia). Actual budgeted inputs are shown in the Manhours Table attached. The actual dates Stuart and John will be in Apia, Samoa, will be dependent on air travel availability. CMPS&F will advise JICA of the actual dates as soon as the bookings are made;
- If Task 7 is required it would be undertaken by a local consultant under the direction of John Morrison from Australia;
- If Task 8 is required it would be undertaken by Stuart Dever, with the assistance of the DEC and local labour. Stuart would stay an additional 2 days to set up and commence the survey.

APPENDIX B

**LIST OF DOCUMENTS/
INFORMATION GATHERED IN STAGE 1**

INFORMATION/DOCUMENTS COLLECTED

- "Land Based Pollution Sources of the Marine Environment in Western Samoa: A Case Study", Dr P Gangarya and Mr Inia Wele, for SPREP, June 1994
- "Making Bokashi (Compost)", Crops Division, Nu'u Crops Development Centre, Ministry of Agriculture, Fisheries, Forestry and Methorogy, Samoa, M Fugimure (JOCV), October 1997.
- Map of Western Samoa, South Pacific Maps Pty Ltd, 1996
- "Waste Management 2000 Project Proposal", Eco-Tour Samoa, (undated)
- Extract of ADB Aide Memoire, 27 June 1997, outline ADB Project on sewerage, drainage and housing assistance.
- Government of Western Samoa Urban Development Strategy Volume 2 - An Urban Development Program Apia-Integrated urban Development Project Technical Assistance No. 2480-SAM, by GHD for ADB, December 1996
- "Western Samoa State of the Environment Report", SPREP, 1993
- "Western Samoa National Environment and Development Management Strategies", SPREP, 1993
- "JICA Activities in Samoa", JICA Samoa, 1997
- SPREP Waste Management Activities
- "Water Quality Results for 1997/98", Samoa Water Authority, January 1998.
- Extract of Reports GKW, "Quality of Surface Waters, Vaiusu Bay and Lagoon Water, Surficial Sediment Quality and Shellfish Quality" 1984
- Draft Action Plan for Hospital Wastes in Samoa (Confidential), Department of Health, June 1996.
- Extract of SPEHIS Annual Report for the Year 1993 - Reported case of notifiable diseases for the Countries and Territories of the SPS Region - for Western Samoa
- Extract of "Annual Report of the Department of Health Planning, Information and Research Division, Dept. of Health, Apia Samoa.
- Financing Agreement between The Commission of the European Communities and Pacific ACP States for Pacific Regional Waste Awareness and Education Programme, October 1996.
- Tafiagate Waste Depot Gatehouse Vehicle Records, July 1996 - February 1997.
- Proposed Organisation Structure, DEC
- Existing Organisation Structure, Dept. of Lands, Survey & Environment and DEC
- Extract of 1997-1998 Western Samoan Government Budget Document - Department of Lands, Survey and Environment.

- Pacific Regional and Multi-Country Waste Management Development Project - Pre-feasibility Study, Draft Report, AusAID, April 1997.
- Central Bank of Samoa, Bulletin, September, 1997.
- Western Samoa Trade and Commerce Director, 1997/1998, prepared by Department of Trade, Commerce and Industry (undated).
- Western Samoa Topographical Map 1:20,000 Sheet 19 - upolu May 1983, NZ Mapping Services.
- Extract of "Apia Sewerage Project - Water Quality and Biological Studies" May 1993, GWK Consult. for Government of Western Samoa, Public Works Department - Marine Water Quality Results, pgs 3-2 to 3-8
- Draft Project Design Document: Management of Persistent Organic Pollutants (POPs) in Pacific Island Countries, AusAID + SPREP (undated).

APPENDIX C



SCHEDULE OF SITE TRIP TO SAMOA

JICA - WASTE MANAGEMENT IN SAMOA

SCHEDULE (ACTUAL)

| Date | Day | Activity | Details |
|-----------|-------|---|---|
| 13-Jan-98 | Tues | 18:00 Depart Sydney for Apia (Samoa) 5:15 Arrive Apia, Samoa 7:00 Check in Hotel (Insel Fehmam) 10:00 Meeting with JICA 11:30 Meeting with Foreign Affairs 13:30 Meeting with DEC - SD, JM, RM + JICA 3:00 Organise hire car + driving permits 4:00 Initial general inspection of Apia and surrounds | Polynesian PH836 Mr Fukase + Mr Takama Contact ?????? Mr Paiti Liu, Laavasa Malua, Mr Yasuda (JOCV) Apia Car Rentals |
| 14-Jan-98 | Wed | 9:00 Meeting with SPREP - SD & JM 11:00 Meeting with WHO - SD, JM & RM 13:00 Detailed general inspection of waste depot - Taafigaita 15:00 FAO meeting - JM & RM 15:00 Water Authority meeting - SD 16:00 Meeting with Public Works - SD, JM & RM 17:00 Meeting with Nat???? (lecturer at Atafua, USP) | Mr Andrew Munro & Mr Gerald Miles Dr Jano Annus, Ron Walters, & Pamela McCurvey? With DEC personnel Mr Mat Purea Mr Dennis Faamau, Mr Makino (JOCV) Mr Faologo Iosefa Falaniko Old friend of JM's |
| 15-Jan-98 | Thurs | 8:00 Inspection of old waste depot at Vaitofoa (on Vaiusu Bay) - SD, JM & RM 10:00 Meeting with Treasury - SD & RM 10:00 Meeting with Dept of Agriculture - JM 11:00 Meeting with DEC - Public awareness / education program - JM 11:00 Planning water quality testing and waste depot investigations - SD & JM 13:30 Meeting with Secretary for Women's Affairs - SD, JM & RM 15:00 Meeting with O le Siosiomaga Society - JM 15:00 Inspection of Yazaki manufacturing facility - SD, RM & Lesina (JICA) 16:00 Meeting with AusAID - SD, JM & RM | With DEC Personnel Mr Iulai Lavea, Ms Penelope Tevita Mr Bill Cable Ms Easter Galuvao Mrs Luagalou Foisaga Dr Ken Lameta - Acting Director Mr Misao Takazawa - Facilities Maintenance Manager Mr Chris Wheeler |
| 16-Jan-98 | Fri | 8:30 Nu'u Agriculture Station - JM & RM 8:30 West End Recycling and Waste Management - SD + DEC 10:00 Meeting with Dept of Health - Public Health - SD, JM & RM 11:00 Meeting with UNDP - JM & RM 11:30 Meeting with Maria Kerslake (NUS) - JM & RM 12:00 JICA Lunch | Contact names??? Mr Tui Sua Mr Tua Tepi & Mr Bill Bryce Mr Anthony Pattom & Georgina Bonin |

| | | | |
|-----------|-------|--|--|
| 17-Jan-98 | Sat | <p>15:00 Meeting with Jaffa's Sanitary Service - SD, JM, RM & DEC</p> <p>16:00 Meeting with Aidan Waste Management - SD, JM, RM & DEC</p> <p>9:30 Meeting with DEC - JM & RM</p> <p>10:00 Water quality testing - SD, JM & RM</p> <p>16:00 Finish</p> | <p>Mr Afa Fesili</p> <p>Mr Peseta Vai Tevaga - current waste collection contractor</p> <p>Mr Pati Liu - to discuss NEMS, legislation + other</p> |
| 18-Jan-98 | Sun | <p>7:00 RM departs Apia for Wellington (NZ)</p> <p>9:00 Rest Day</p> <p>4:00 Preparing Briefing Paper - SD & JM</p> <p>11:00 Finish</p> | <p>Air NZ ??</p> <p>For Monday Preliminary Debriefing</p> |
| 19-Jan-98 | Mon | <p>8:30 Debriefing to JICA, Samoan Govt + NGO's</p> <p>11:00 Meeting with Womens Groups - SD & JM</p> <p>13:30 Detailed investigation of old waste depot - SD, JM & DEC</p> <p>22:40 JM departs for Sydney via Fiji</p> | <p>Mrs Luagalou Foisaga</p> <p>Air Pacific FJ253</p> |
| 20-Jan-98 | Tues | <p>8:30 Meeting with Bill Bryce - SD, Mr Fukase</p> <p>10:00 Water quality testing - SD & DEC</p> <p>13:30 Detailed investigation of existing waste depot - SD & DEC</p> | <p>To organise FC Testing</p> |
| 21-Jan-98 | Wed | <p>8:30 Water quality testing - SD & DEC</p> <p>13:00 Water quality sampling for FC testing - SD</p> <p>16:30 Planning further investigation work</p> | |
| 22-Jan-98 | Thurs | <p>9:00 Meeting with Agriculture (Quarantine) - SD & DEC</p> <p>10:00 Meeting with Dept of Health - Health Resources Planning - SD & DEC</p> <p>11:00 Water quality testing - SD</p> <p>13:30 Water quality testing - SD</p> <p>16:00 Meeting with DEC</p> <p>16:30 Notes and information collation and review</p> | <p>Contact Name ????</p> <p>Ms Chamina Saili</p> <p>Mr Pati Liu & Laavasa Maulu</p> |
| 23-Jan-98 | Fri | <p>8:30 Debriefing Session with JICA</p> <p>12:00 Finish</p> | <p>Mr Takama, Mr Fukase + Others</p> |
| 24-Jan-98 | Sat | <p>Weekend - Cyclone Tui arrives</p> | |
| 25-Jan-98 | Sun | <p>Weekend - Cyclone Tui</p> | |
| 26-Jan-98 | Mon | <p>11:00 SD departs Apia for Sydney via Auckland</p> | <p>Polynesian PH 835</p> |

APPENDIX D

WATER QUALITY TEST RESULTS

| BOTTLE NO. | SITE NO. | LOCATION | MAP REF. | DATES TESTED | | | |
|--------------|----------|---|----------|--------------|------|------|------|
| | | | | 17-1 | 20-1 | 21-1 | 22-1 |
| 23 | 1 | Fuluasou River nr Craigs Compound | 136 691 | x | | | |
| - | 2 | Fuluasou River nr Papase'ea | 146 698 | - | - | - | - |
| 66 | 3 | Vaitele opposite Vailima Brewery | 143 726 | | | x | x |
| 99 | 4 | Mangrove Drain at Fugalei | 170 713 | x | | | x |
| pyrex 250mls | 5 | Fuluasou River nr Lepea | 154 713 | x | | | |
| - | 6 | Papase'ea Stream nr Alafua | 153 684 | | | Dry | |
| 108 | 7 | Gasegase Stream at Vaimoso | 163 709 | | | x | |
| kikusi 250 | 8 | Mulivai Stream at Lalovaea | 176 708 | | x | | x |
| 2 (P3) | 9 | Vaisagano River, Hydroat Loto Samasoni | 186 703 | | x | | |
| 106 | 10 | Vaisagano River at Leone | 185 709 | x | | | |
| - | 11 | Vaivase Stream nr Airport | 201 699 | Dry | | | |
| 97 | 12 | Mangrove Drain nr Moata'a | 201 712 | x | | | |
| - | 13 | Vailima Stream nr Nafanna (u/s of hospital) | | | x | | x |
| 22 | 14 | Mulivai Stream at Marist School Sports Ground | | | | x | x |
| 107 | 15 | Duplicate of 14 | | | | x | |
| 20 | 16 | Fugalei Drain opposite Tyre Shop at Vaimoso | | | | x | x |
| 101 | 17 | Duplicate of 3 | | | | x | |
| | 18 | Main Storm drain d/s of Clock Tower | | | | | x |

NOTE: Map used : Upolu Sheet 19 1:20000 Topographic Map

Dump: 13° 50'10"S , 171° 50' 13/

Appendix D:
Water Quality Test Results

JICA SAMOA WASTE MANGEMENT PROJECT
SUMMARY OF WATER QUALITY RESULTS

| NO. | SAMPLE LOCATION | DATE | WEATHER | FIELD TESTING RESULTS | | | | | | | | | | LABORATORY RESULTS (PRELIMINARY) | | |
|-----|--------------------------------------|---------|--------------------------|-----------------------|-----------|------|---------------------|------------|-----------------|----------------|----------------|----------------|------------------|----------------------------------|-----------------------------------|--|
| | | | | Temp (°C) | DO (mg/L) | pH | Conductivity (mg/L) | Salinity % | Turbidity (NTU) | Ammonia (mg/L) | Nitrite (mg/L) | Nitrate (mg/L) | Phosphate (mg/L) | *Faecal Coliform (per 100mL) | *Faecal Streptococcus (per 100mL) | |
| 1 | Fuluasou River at Craigs compound | 17-1-98 | Fine | 24.7 | 8.4 | 7.6 | 0.1 | <0.01 | 2 | <5 | <0.5 | 11 | 22 | nil | 200 | |
| 3 | Vaitele d/s of Brewery | 21-1-98 | Fine | 26.9 | 4.8 | 6.68 | 0.3 | 0.01 | 24 | <5 | 0.5 | 31 | 23 | 1280 | nil | |
| 3 | Vaitele d/s of Brewery | 22-1-98 | Overcast, rain overnight | 27.2 | 4.4 | 6.73 | 0.3 | 0.01 | 4 | Not tested | <0.5 | 41 | 21 | 150 | nil | |
| 4 | Mangrove Drain near Fugalei | 17-1-98 | Fine | 31.3 | 1.1 | 7.1 | 0.4 | 0.01 | 8 | <5 | 0.6 | 4 | 43 | | | |
| 4 | Mangrove Drain near Fugalei | 22-1-98 | Sunny, rain overnight | 30.5 | 0.4 | 7 | 0.6 | 0.02 | 38 | Not tested | <0.5 | <3 | 20 | 219900 | 170000 | |
| 5 | Fuluasou River near Lepoa | 17-1-98 | Fine | 26.3 | 7.1 | 8 | 0.1 | <0.01 | 3 | <5 | 0.6 | 4 | 19 | 40 | 200 | |
| 7 | Gasagase Stream at Vainoso | 21-1-98 | Fine | 27.3 | 4.5 | 6.67 | 0.3 | 0.01 | 25 | <5 | <0.5 | 6 & 7 | 18 | 20 | 200 | |
| 8 | Mulivai Stream at Lalovaea | 20-1-98 | Fine, rain overnight | 27.9 | 4.2 | 7.06 | 0.2 | <0.01 | 6 | <5 | 0.6 | 13 | 24 | 120 | 400 | |
| 8 | Mulivai Stream at Vaisigaga | 22-1-98 | Overcast, rain overnight | 27.9 | 3.8 | 7 | 0.2 | <0.01 | 6 | <5 | 1.4 & 1.7 | 24 | 17 | | | |
| 9 | River at Lelo Sumnasoni (near Hydro) | 20-1-98 | Fine, rain overnight | 25.8 | 8.6 | 7.5 | 0.2 | Not Tested | 10 | <5 | <0.5 | 3 | 16 | 2 | 100 | |
| 10 | Vaisigano at Leone | 17-1-98 | Fine | 26.9 | 6.5 | 7.8 | 0.1 | <0.01 | 3 | <5 | 0.6 | 4 | 24 | nil | nil | |

Appendix D:
Water Quality Test Results

JICA SAMOA WASTE MANGEMENT PROJECT
SUMMARY OF WATER QUALITY RESULTS

| NO. | SAMPLE LOCATION | DATE | WEATHER | FIELD TESTING RESULTS | | | | | | | | | | LABORATORY RESULTS (PRELIMINARY) | | |
|-----|-------------------------------------|---------|--|-----------------------|-----------|------|---------------------|------------|-----------------|----------------|----------------|----------------|------------------|----------------------------------|-----------------------------------|--|
| | | | | Temp (°C) | DO (mg/L) | pH | Conductivity (mg/L) | Salinity % | Turbidity (NTU) | Ammonia (mg/L) | Nitrite (mg/L) | Nitrate (mg/L) | Phosphate (mg/L) | *Faecal Coliform (per 100mL) | *Faecal Streptococcus (per 100mL) | |
| 12 | Mca'a Mangrove Drain | 17-1-98 | Fine | 31.7 | 5.6 | 6.9 | 14 | 0.8 | 5 | <5 | <0.5 | 5 | 30 | 180 | 200 | |
| 13 | Vailima Stream (Muivai) at Nafanua | 20-1-98 | Fine, rain overnight | 26.8 | 5.4 | 6.84 | 0.2 | <0.01 | 6 | Not Tested | <0.5 | <3 | 32 | | | |
| 13 | Vailima Stream (Muivai) at Nafanua | 22-1-98 | Overcast, rain overnight | 26.3 | 6.4 | 6.75 | 0.1 | <0.01 | Not Tested | Not Tested | <0.5 | <3 | 14 | | | |
| 14 | Stream at Marist School Sports | 21-1-98 | Fine, rain from overcast, rain overnight | 25.69 | 3.3 | 6.77 | 0.2 | <0.01 | 34 | <5 | <0.5 | 6 | 20 | 980 | 700 | |
| 14 | Stream at Marist School Sports | 22-1-98 | overcast, rain overnight | 26.5 | 2.9 | 6.77 | 0.2 | <0.01 | 8 | Not Tested | <0.5 | 5 | 17 | 1200 | 100 | |
| 16 | Fugalei Drain opposite tyre shop | 21-1-98 | Fine | 27.8 | 0.8 | 6.89 | 0.4 | 0.01 | 30 | <5 | <0.5 | <3 | 27 | 18000 | 3000 | |
| 16 | Fugalei Drain opposite tyre shop | 22-1-98 | Sunny, rain overnight | 28.8 | 1.1 | 6.93 | 0.4 | 0.01 | 8 | Not Tested | <0.5 | <3 | 18 | | | |
| 18 | Main storm drain Nth of clock tower | 22-1-98 | Overcast, rain overnight | 29.6 | 2.2 | 7.62 | 0.6 | 0.02 | 24 | 22 | <0.5 | <3 | 14 | | | |

* Note : Sampling undertaken on 21-1-98

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 2
 DESIGNER: SAD DATE: 17/1/98

LOCATION : 1 - Fulusou River at Craigs Compound

DATE : 17/1/98 11.00am

WEATHER : Fine

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|------------|-------------------------|----------------------------------|
| Colour | <u>No</u> | Oily sheen | <u>No</u> |
| Smell / Odour | <u>No</u> | Water level | <u>1m deep fast flowing</u> |
| Solids / Organics | <u>No</u> | Insects / Fauna / Flora | <u>Lots of vegn in river</u> |
| Photograph | <u>Yes</u> | | |

COMMENTS : River looks clear and healthy. Fast flowing

FIELD TESTING RESULTS :

| | | | |
|------------------------|-------------|-------------------|----------------|
| Temp (°C): | <u>24.7</u> | Ammonia (mg/L): | <u><0.5</u> |
| DO (mg/L): | <u>8.4</u> | Nitrite (mg/L): | <u><0.5</u> |
| pH : | <u>7.8</u> | Nitrate (mg/L): | <u>11</u> |
| Conductivity (ms/sec): | <u>0.1</u> | Phosphate (mg/L): | <u>22</u> |
| Salinity (%): | <u>0</u> | | |
| Turbidity (NTU): | <u>2</u> | | |

OTHER COMMENTS : Some rubbish around site - plastic plates
Main water supply intake 10kms u/s

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 4
 DESIGNER: SAD DATE: 17/1/98

LOCATION : 4 - Mangrove Drain near Fugalei

DATE : 17/1/98 12.30pm

WEATHER : Fine

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|---------------------------------|-------------------------|--|
| Colour | <u>Grey Green</u> | Oily sheen | <u>No</u> |
| Smell / Odour | <u>Sewage</u> | Water level | <u><1m - slow flowing</u> |
| Solids / Organics | <u>Yes- small/ No- plastics</u> | Insects / Fauna / Flora | <u>Small fish</u> (check species from Fiji studies) |
| Photograph | <u>Yes</u> | | |

COMMENTS :

FIELD TESTING RESULTS :

| | | | |
|------------------------|---|-------------------|---------------------------|
| Temp (°C): | <u>31.3</u> | Ammonia (mg/L): | <u><5</u> |
| DO (mg/L): | <u>1.1</u> | Nitrite (mg/L): | <u>0.6</u> |
| pH : | <u>7.1</u> | Nitrate (mg/L): | <u>4</u> (uncorrected) |
| Conductivity (ms/sec): | <u>0.4</u> | Phosphate (mg/L): | <u>43</u> |
| Salinity (%): | <u>0.01</u> | | |
| Turbidity (NTU): | <u>8 -surprising considering colour + fine solids</u> | | |

OTHER COMMENTS : In flowing drain from house/ store - 1m from sampling point

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 5
 DESIGNER: SAD DATE: 17/1/98

LOCATION : 10 - Vaisagano at Leone

DATE : 17/1/98 2.00pm

WEATHER : Fine

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|-------------------|-------------------------|--|
| Colour | <u>No</u> | Oily sheen | <u>No</u> |
| Smell / Odour | <u>No</u> | Water level | <u>0.5 - 1m fast flowing</u> |
| Solids / Organics | <u>very small</u> | Insects / Fauna / Flora | <u>many algae on river bed and rocks</u> |
| Photograph | <u>Yes</u> | | |

COMMENTS : Algal growth prolific covering about 30% of surface in middle 2/3 of river bed.

FIELD TESTING RESULTS :

| | | | |
|------------------------|-------------|-------------------|---------------------------|
| Temp (°C): | <u>26.9</u> | Ammonia (mg/L): | <u><5</u> |
| DO (mg/L): | <u>6.5</u> | Nitrite (mg/L): | <u>0.6</u> |
| pH : | <u>7.8</u> | Nitrate (mg/L): | <u>4</u> (uncorrected) |
| Conductivity (ms/sec): | <u>0.1</u> | Phosphate (mg/L): | <u>24</u> |
| Salinity (%): | <u>0</u> | | |
| Turbidity (NTU): | <u>3</u> | | |

OTHER COMMENTS :

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 7
 DESIGNER: SAD DATE: 20/1/98

LOCATION : 9 -Vaisagona River at Loto Sannasoni (nr Hydro P.S.)

DATE : 20/1/98 11.00am

WEATHER : Fine, but rain overnight

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|------------------------|-------------------------|--|
| Colour | <u>No - very clear</u> | Oily sheen | <u>No</u> |
| Smell / Odour | <u>No</u> | Water level | <u>0.5 - 1m low flow</u> |
| Solids / Organics | <u>No</u> | Insects / Fauna / Flora | <u>stream appeared active and healthy - lots of fish</u> |
| Photograph | <u>Yes</u> | | |

COMMENTS : quite a bit of algae growing on rocks on bottom of stream
popular swimming hole
prior to hydro P.S. water level used to be much higher (>1-2m)

FIELD TESTING RESULTS :

| | | | |
|------------------------|-------------|-------------------|----------------|
| Temp (°C): | <u>25.8</u> | Ammonia (mg/L): | <u><5</u> |
| DO (mg/L): | <u>8.6</u> | Nitrite (mg/L): | <u><0.5</u> |
| pH : | <u>7.5</u> | Nitrate (mg/L): | <u>3</u> |
| Conductivity (ms/sec): | <u>0.2</u> | Phosphate (mg/L): | <u>16</u> |
| Salinity (%): | <u>NT</u> | | |
| Turbidity (NTU): | <u>10</u> | | |

OTHER COMMENTS : _____

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 8
 DESIGNER: SAD DATE: 20/1/98

LOCATION : 8 - Mulivai Stream at Lalovaea (d/s of hospital)

DATE : 20/1/98 11.30am

WEATHER : Fine, but rain overnight

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|-----------------------------|-------------------------|--------------------------|
| Colour | <u>Very slightly cloudy</u> | Oily sheen | <u>Yes - slight</u> |
| Smell / Odour | <u>No</u> | Water level | <u>normal - low flow</u> |
| Solids / Organics | <u>No</u> | Insects / Fauna / Flora | <u>Lots of fish</u> |
| Photograph | <u></u> | | |

COMMENTS : Water appears murky probably due to bottom, tin cans, bit of algae on rock
Plenty of vegn on banks
In still portion of stream, algae growth with surface oily sheen

FIELD TESTING RESULTS :

| | | | |
|------------------------|----------------|-------------------|--------------|
| Temp (°C): | <u>27.9</u> | Ammonia (mg/L): | <u><5</u> |
| DO (mg/L): | <u>4.2</u> | Nitrite (mg/L): | <u>0.6</u> |
| pH : | <u>7.06</u> | Nitrate (mg/L): | <u>13</u> |
| Conductivity (ms/sec): | <u>0.2</u> | Phosphate (mg/L): | <u>24</u> |
| Salinity (%): | <u>too low</u> | | |
| Turbidity (NTU): | <u>6</u> | | |

OTHER COMMENTS : Site d/s of hospital

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 10
 DESIGNER: SAD DATE: 21/1/97

LOCATION : 14 - Mulivai Stream at Marist School sports ground

DATE : 21/1/97 10.30am

WEATHER : Fine

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|-----------------------------------|-------------------------|----------------------------|
| Colour | <u>Murky grey but quite clean</u> | Oily sheen | <u>No</u> |
| | <u>in bucket</u> | | |
| Smell / Odour | <u>No</u> | Water level | <u>normal - reasonable</u> |
| | | | <u>flow (spring fed)</u> |
| Solids / Organics | <u>very few</u> | Insects / Fauna / Flora | <u>Healthy, vegn, fish</u> |
| Photograph | <u>Yes</u> | | |

COMMENTS : Duplicate sample for FC 15

FIELD TESTING RESULTS :

| | | | |
|------------------------|----------------|-------------------|----------------|
| Temp (°C): | <u>25.6</u> | Ammonia (mg/L): | <u><5</u> |
| DO (mg/L): | <u>3.3</u> | Nitrite (mg/L): | <u><0.5</u> |
| pH: | <u>6.77</u> | Nitrate (mg/L): | <u>6</u> |
| Conductivity (ms/sec): | <u>0.2</u> | Phosphate (mg/L): | <u>20</u> |
| Salinity (%): | <u>too low</u> | | |
| Turbidity (NTU): | <u>34</u> | | |

OTHER COMMENTS : Small tributary feeding into Mulivai Stream

Sample taken down from junction of two streams

small stream is Spring fed

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 11
 DESIGNER: SAD DATE: 21/1/97

| | | | |
|--------------------------------|---|--------------------------------|---|
| LOCATION : | <u>16 - Fugalei Drain, opposite Tyre Shop</u> | | |
| DATE : | <u>21/1/97</u> | <u>11.00am</u> | |
| WEATHER : | <u>Fine</u> | | |
| GENERAL DESCRIPTION OF WATER : | | | |
| Colour | <u>Murky green, couldn't see bottom, clear in bucket</u> | <u>Oily sheen</u> | <u>No</u> |
| Smell / Odour | <u>slight sewage smell</u> | <u>Water level</u> | <u>normal</u> |
| Solids / Organics | <u>very few</u> | <u>Insects / Fauna / Flora</u> | <u>quite healthy with aquatic creepers, vegn, fish (small and medium in size)</u> |
| Photograph | <u>Yes</u> | | |
| COMMENTS : | <u>Old tyres, some rubbish and loose floating vegetation.</u> | | |
| | <u>Odd bubbles in water column - quite large</u> | | |
| | <u> </u> | | |
| | <u> </u> | | |
| | <u> </u> | | |
| FIELD TESTING RESULTS : | | | |
| Temp (°C): | <u>27.8</u> | Ammonia (mg/L): | <u><5</u> |
| DO (mg/L): | <u>0.8</u> | Nitrite (mg/L): | <u><0.5</u> |
| pH : | <u>6.89</u> | Nitrate (mg/L): | <u>2</u> |
| Conductivity (ms/sec): | <u>0.4</u> | Phosphate (mg/L): | <u>27</u> |
| Salinity (%): | <u>0.01</u> | | |
| Turbidity (NTU): | <u>30</u> | | |
| OTHER COMMENTS : | <u>Sample taken d/s of 3 tributaries.</u> | | |
| | <u>Two are drains crossing road.</u> | | |
| | <u> </u> | | |
| | <u> </u> | | |
| | <u> </u> | | |
| | <u> </u> | | |
| | <u> </u> | | |

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: In situ Testing SHEET NO: 12
 DESIGNER: SAD DATE: 21/1/97

LOCATION : 7 - Gasegase Stream at Vaimoso

DATE : 21/1/97 11.45am

WEATHER : Fine

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|---|-------------------------|--|
| Colour | <u>No, very clear in creek</u> | Oily sheen | <u>No</u> |
| Smell / Odour | <u>No</u> | Water level | <u>normal - reasonable flow</u> |
| Solids / Organics | <u>very few, little bit organic matter.</u> | Insects / Fauna / Flora | <u>Fish, healthy vegn on banks. Algae on rocks, Debris in water and on banks</u> |
| Photograph | <u></u> | | <u>Garden waste in creek</u> |

COMMENTS : Sample taken 15 metres d/s Vaimoso Bridge
Water / stream looked good and healthy and clear
Large amount of dumped rubbish on banks of stream

FIELD TESTING RESULTS :

| | | | |
|------------------------|-------------|-------------------|----------------------------------|
| Temp (°C): | <u>27.3</u> | Ammonia (mg/L): | <u>0</u> |
| DO (mg/L): | <u>4.5</u> | Nitrite (mg/L): | <u><0.5</u> |
| pH: | <u>6.67</u> | Nitrate (mg/L): | <u>6&7</u> (two readings) |
| Conductivity (ms/sec): | <u>0.3</u> | Phosphate (mg/L): | <u>18</u> |
| Salinity (%): | <u>0.01</u> | | |
| Turbidity (NTU): | <u>25</u> | | |

OTHER COMMENTS :

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 13
 DESIGNER: SAD DATE: 21/1/98

LOCATION : 3 - Vaitele, d/s of brewery

DATE : 21/1/98 12.15pm

WEATHER : Fine

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|-------------------|-------------------------|-----------------------------|
| Colour | <u>very clear</u> | Oily sheen | <u>No</u> |
| Smell / Odour | <u>No</u> | Water level | <u>Normal - low tide</u> |
| Solids / Organics | <u>No</u> | Insects / Fauna / Flora | <u>healthy vegn on bank</u> |
| Photograph | <u>Yes</u> | | |

COMMENTS : catchment encompasses s/w from brewery plus drain discharge from
snackfood factory and ice cream factory
creek is tidal - fresh water only sampled from drain discharge

FIELD TESTING RESULTS :

| | | | |
|------------------------|-------------|-------------------|--------------|
| Temp (°C): | <u>26.9</u> | Ammonia (mg/L): | <u><5</u> |
| DO (mg/L): | <u>4.8</u> | Nitrite (mg/L): | <u>0.5</u> |
| pH : | <u>6.68</u> | Nitrate (mg/L): | <u>31</u> |
| Conductivity (ms/sec): | <u>0.3</u> | Phosphate (mg/L): | <u>23</u> |
| Salinity (%): | <u>0.01</u> | | |
| Turbidity (NTU): | <u>24</u> | | |

OTHER COMMENTS :

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 14
 DESIGNER: SAD DATE: 22/1/98

LOCATION : 13 - Vailima St near Nafanna (upstream of hospital)

DATE : 22/1/98 11.30am

WEATHER : Overcast - had rain overnight

GENERAL DESCRIPTION OF WATER :

| | | | |
|--------|-----------|------------|---|
| Colour | <u>No</u> | Olly sheen | <u>Yes - Bitumen road sealed yesterday (21/1)</u> |
|--------|-----------|------------|---|

| | | | |
|---------------|-----------|-------------|---------|
| Smell / Odour | <u>No</u> | Water level | <u></u> |
|---------------|-----------|-------------|---------|

| | | | |
|-------------------|---------|-------------------------|-------------------------|
| Solids / Organics | <u></u> | Insects / Fauna / Flora | <u>Shrimps in creek</u> |
|-------------------|---------|-------------------------|-------------------------|

Photograph

COMMENTS : Vegetation on river banks
small amount of rubbish - plastic plates

FIELD TESTING RESULTS :

| | | | |
|------------|-------------|-----------------|-----------|
| Temp (°C): | <u>26.3</u> | Ammonia (mg/L): | <u>NT</u> |
|------------|-------------|-----------------|-----------|

| | | | |
|------------|------------|-----------------|----------------|
| DO (mg/L): | <u>6.4</u> | Nitrite (mg/L): | <u><0.5</u> |
|------------|------------|-----------------|----------------|

| | | | |
|------|-------------|-----------------|----------|
| pH : | <u>6.75</u> | Nitrate (mg/L): | <u>2</u> |
|------|-------------|-----------------|----------|

| | | | |
|------------------------|------------|-------------------|-----------|
| Conductivity (ms/sec): | <u>0.1</u> | Phosphate (mg/L): | <u>14</u> |
|------------------------|------------|-------------------|-----------|

Salinity (%): too low

Turbidity (NTU): Equipment failure

OTHER COMMENTS : Round 2 of testing

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 15
 DESIGNER: SAD DATE: 22/1/98

LOCATION : 8 - Mulivai Stream at Lalovaea

DATE : 22/1/98 12.30pm

WEATHER : overcast - very light sprinkling of rain - had rain overnight

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|---------------------------------|-------------------------|------------------------------|
| Colour | <u>bit murky - mainly clear</u> | Oily sheen | <u>yes - around edge</u> |
| | <u>fine suspended solids</u> | | |
| Smell / Odour | <u>No</u> | Water level | <u>normal - slow flowing</u> |
| Solids / Organics | <u>fine suspended</u> | Insects / Fauna / Flora | <u>fish in stream</u> |

Photograph _____

COMMENTS : Duplicate sample for FC 15

FIELD TESTING RESULTS :

| | | | |
|------------------------|----------------|-------------------|----------------------|
| Temp (°C): | <u>27.9</u> | Ammonia (mg/L): | <u><5</u> |
| DO (mg/L): | <u>3.8</u> | Nitrite (mg/L): | <u>1.4 & 1.7</u> |
| pH : | <u>7</u> | Nitrate (mg/L): | <u>24 & 23</u> |
| Conductivity (ms/sec): | <u>0.2</u> | Phosphate (mg/L): | <u>17</u> |
| Salinity (%): | <u>too low</u> | | |
| Turbidity (NTU): | <u>6</u> | | |

OTHER COMMENTS : Round 2 of testing

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 16
 DESIGNER: SAD DATE: 22/1/98

LOCATION : 14 - Mulivai Stream at Marist School sports ground

DATE : 22/1/98 1.50pm

WEATHER : Mostly sunny (clearing from overcast) - had rain overnight

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|-------------------------------------|-------------------------|--------------------------------------|
| Colour | <u>grey cloudy - can see bottom</u> | Oily sheen | <u>No</u> |
| | <u>washwater colour</u> | | |
| Smell / Odour | <u>No</u> | Water level | <u>slightly lower than yesterday</u> |
| Solids / Organics | <u>very few</u> | Insects / Fauna / Flora | <u>fish in stream</u> |
| | | | <u>insects on surface</u> |
| Photograph | <u>Yes</u> | | |

COMMENTS : Not flowing so fast as yesterday
Rubbish on bottom

FIELD TESTING RESULTS :

| | | | |
|------------------------|----------------|-------------------|----------------|
| Temp (°C): | <u>26.5</u> | Ammonia (mg/L): | <u>NT</u> |
| DO (mg/L): | <u>2.9</u> | Nitrite (mg/L): | <u><0.5</u> |
| pH : | <u>6.77</u> | Nitrate (mg/L): | <u>5</u> |
| Conductivity (ms/sec): | <u>0.2</u> | Phosphate (mg/L): | <u>17</u> |
| Salinity (%): | <u>too low</u> | | |
| Turbidity (NTU): | <u>8</u> | | |

OTHER COMMENTS : Round 2 of testing

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 17
 DESIGNER: SAD DATE: 22/1/98

LOCATION : 4 - Mangrove Drain at Fugalei

DATE : 22/1/98 2.00pm

WEATHER : Sunny (overcast on hills) - had rain overnight

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|---|-------------------------|--|
| Colour | <u>very murky grey, opaque washwater colour</u> | Oily sheen | <u>No</u> |
| Smell / Odour | <u>Yes sewage smell</u> | Water level | <u>high tide , low flow</u> |
| Solids / Organics | <u>no solids - bit murky can't see bottom of bucket</u> | Insects / Fauna / Flora | <u>insects on surface fish present</u> |
| Photograph | <u>_____</u> | | |

COMMENTS :

FIELD TESTING RESULTS :

| | | | |
|------------------------|-------------|-------------------|----------------|
| Temp (°C): | <u>30.5</u> | Ammonia (mg/L): | <u>NT</u> |
| DO (mg/L): | <u>0.4</u> | Nitrite (mg/L): | <u><0.5</u> |
| pH : | <u>7</u> | Nitrate (mg/L): | <u>1</u> |
| Conductivity (ms/sec): | <u>0.6</u> | Phosphate (mg/L): | <u>20</u> |
| Salinity (%): | <u>0.02</u> | | |
| Turbidity (NTU): | <u>38</u> | | |

OTHER COMMENTS : Round 2 of testing

CLIENT: JICA JOB NO: XP0014
 PROJECT TITLE: Samoa Waste Management
 ITEM: Insitu Testing SHEET NO: 19
 DESIGNER: SAD DATE: 22/1/98

LOCATION : 3 - Vaitele, just N of main road, opposite Vaillima Brewery

DATE : 22/1/98 2.45pm

WEATHER : overcast with sunny breaks - had rain overnight

GENERAL DESCRIPTION OF WATER :

| | | | |
|-------------------|--------------|-------------------------|---|
| Colour | <u>clear</u> | Oily sheen | <u>No</u> |
| Smell / Odour | <u>No</u> | Water level | <u>normal - low flow</u> |
| Solids / Organics | <u>No</u> | Insects / Fauna / Flora | <u>Fish</u> <u>grass and healthy trees</u> |
| Photograph | <u></u> | | |

COMMENTS :

FIELD TESTING RESULTS :

| | | | |
|------------------------|-------------|-------------------|----------------|
| Temp (°C): | <u>27.2</u> | Ammonia (mg/L): | <u>NT</u> |
| DO (mg/L): | <u>4.4</u> | Nitrite (mg/L): | <u><0.5</u> |
| pH : | <u>6.73</u> | Nitrate (mg/L): | <u>41</u> |
| Conductivity (ms/sec): | <u>0.3</u> | Phosphate (mg/L): | <u>21</u> |
| Salinity (%): | <u>0.01</u> | | |
| Turbidity (NTU): | <u>14</u> | | |

OTHER COMMENTS : Round 2 of testing

APPENDIX E

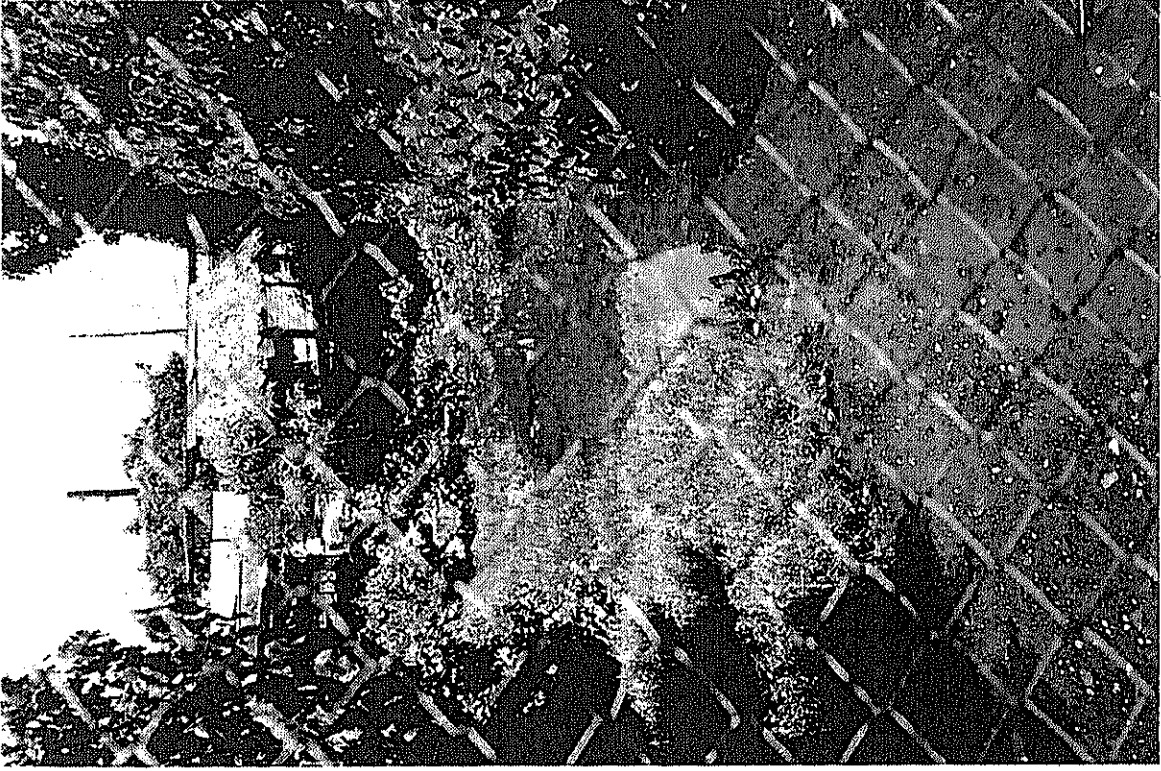
GENERAL SITE INVESTIGATION PHOTOGRAPHS



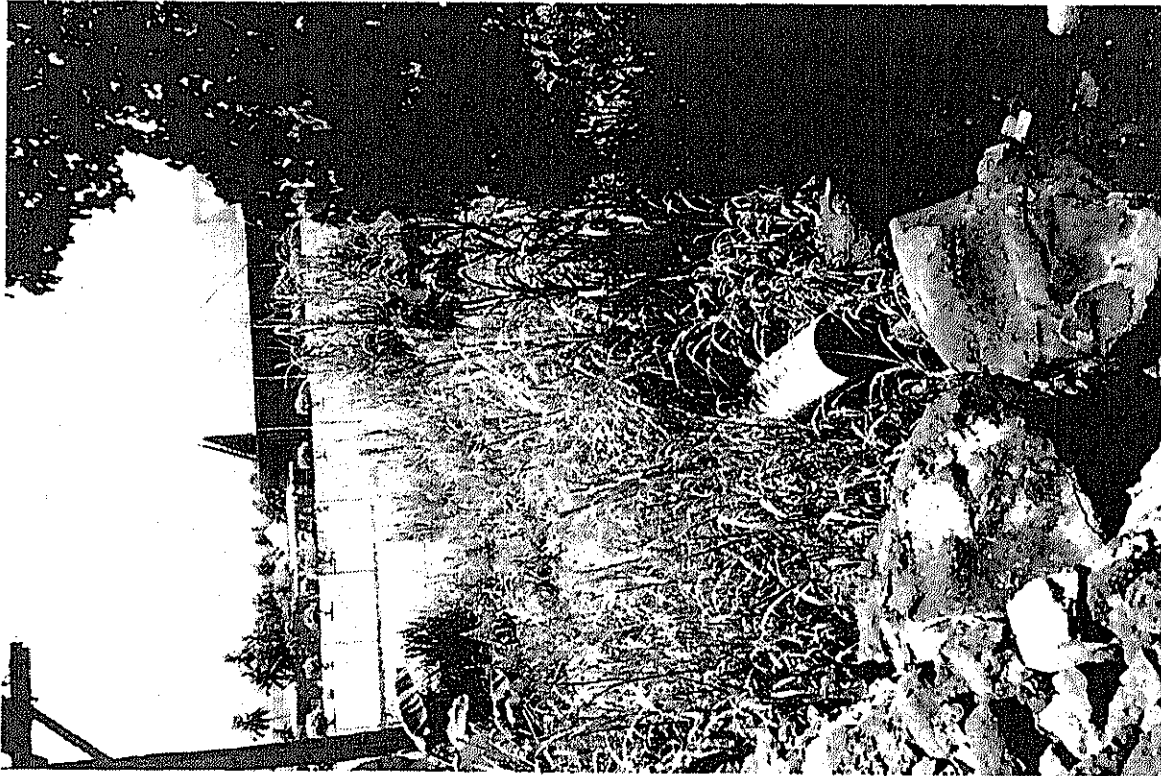
SW1- FULUASOU RIVER AT CRAIGI COMPOUND



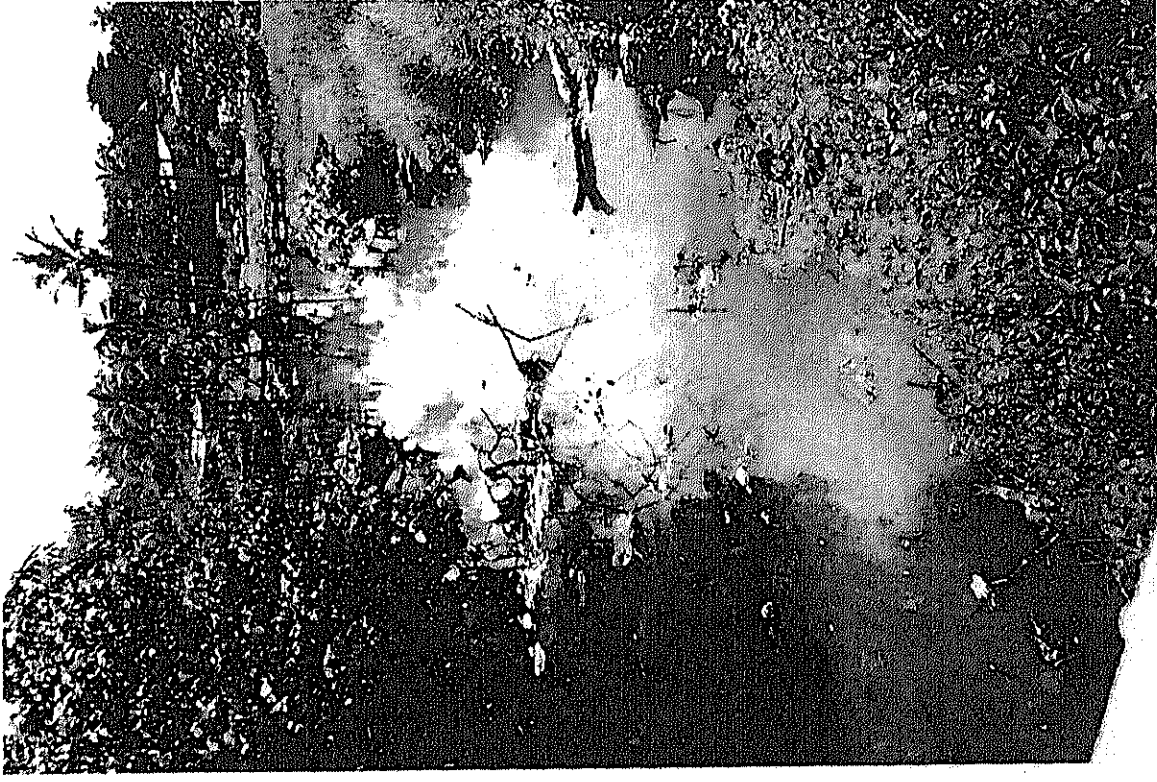
SW7 - GASEGASE STREAM AT VAIMOSO



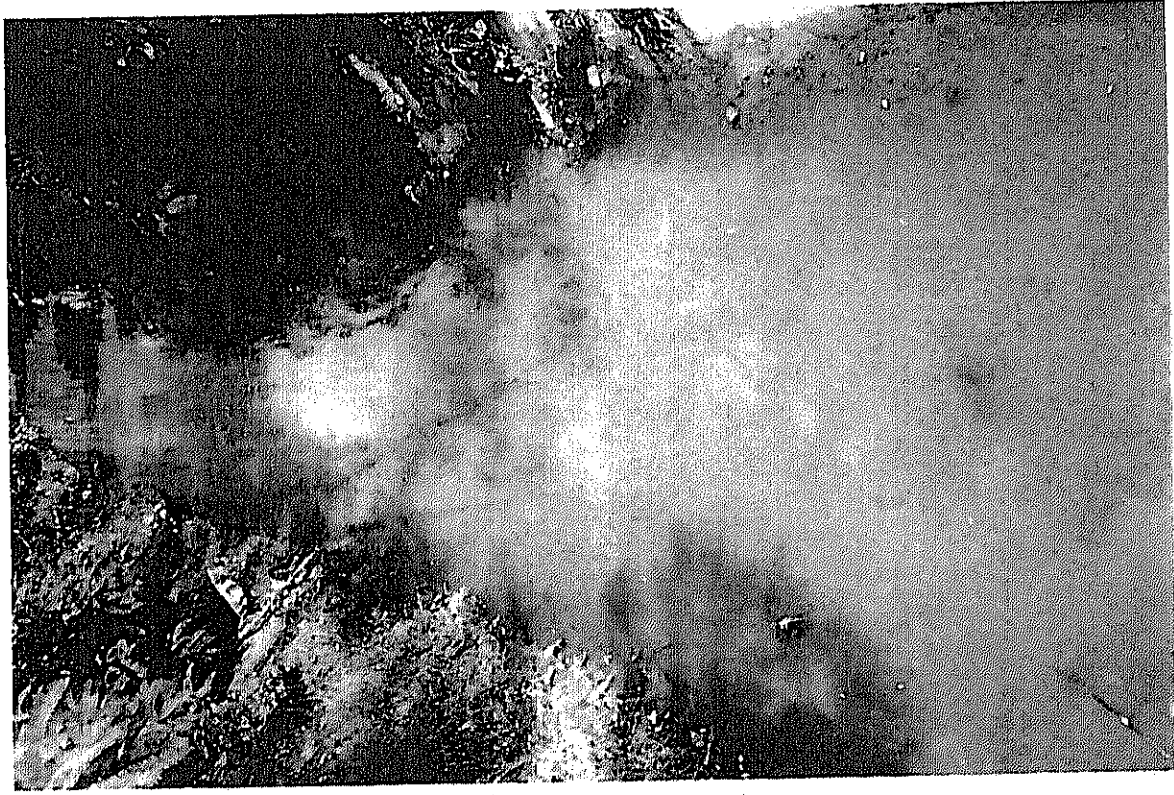
Looking Downstream



SW3 - STORMWATER DRAIN AT VAITELE, OPPOSITE VAILIMA BREWERY

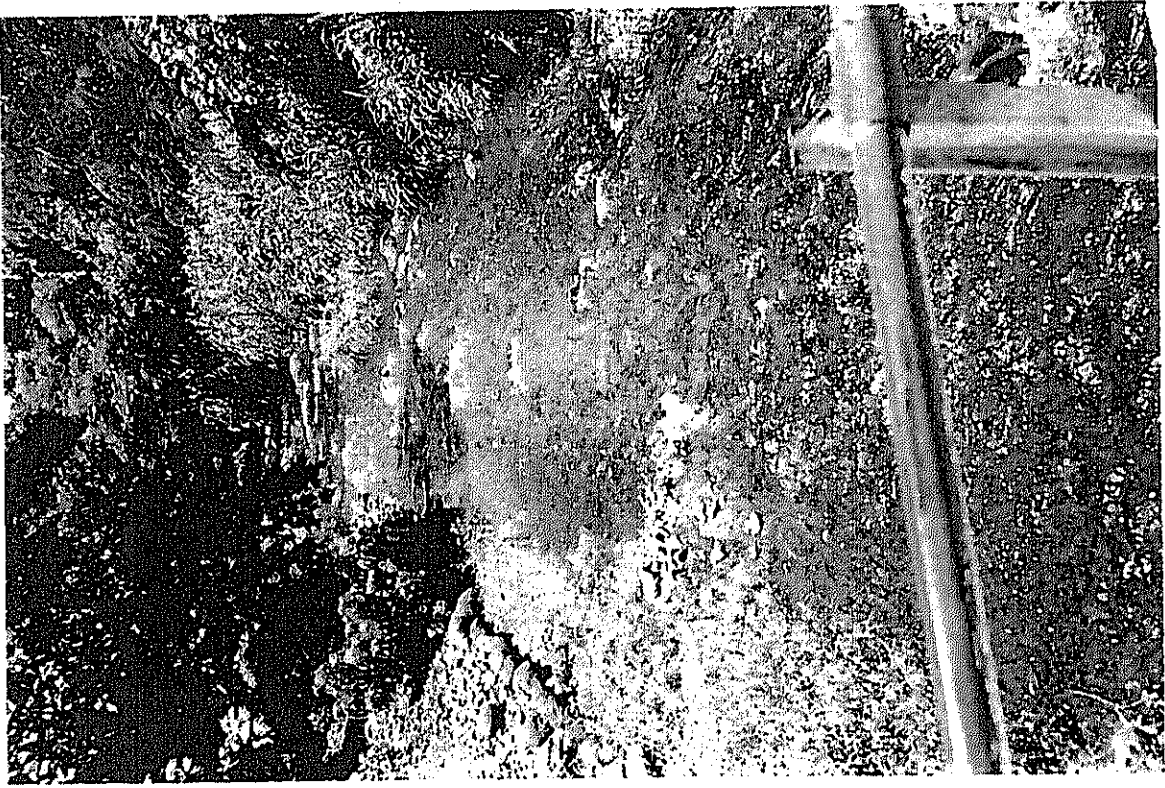
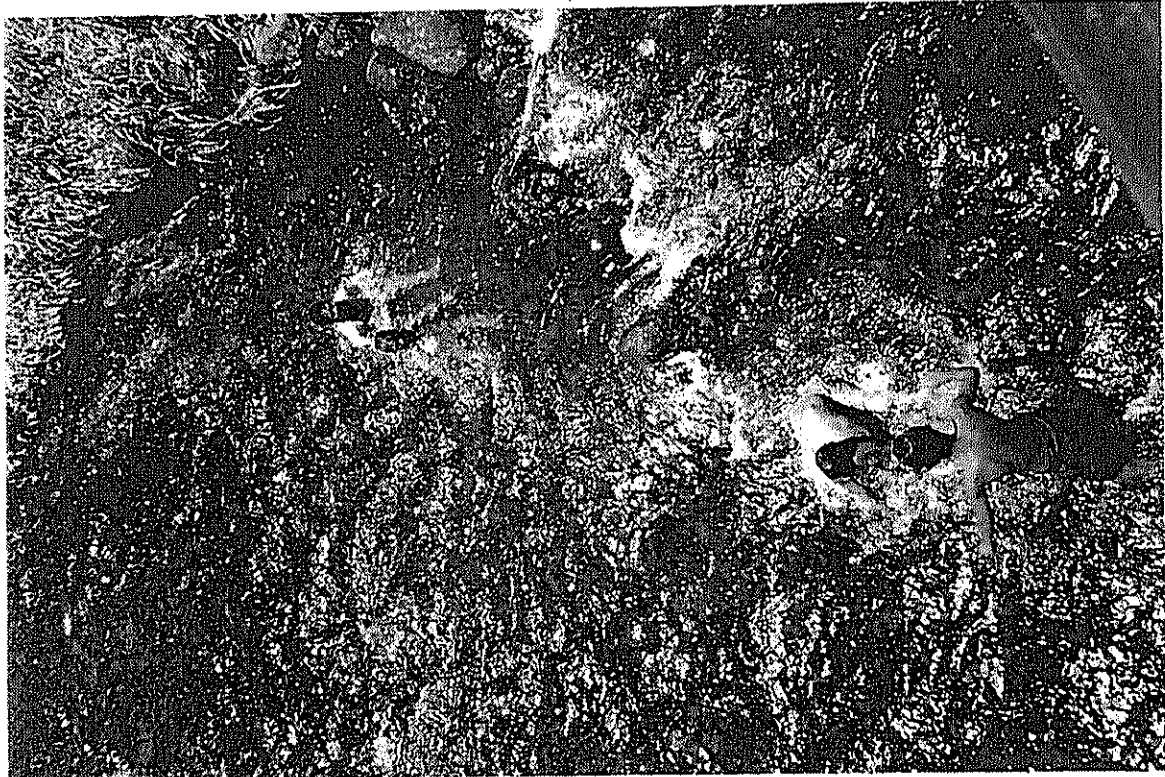


Looking Downstream



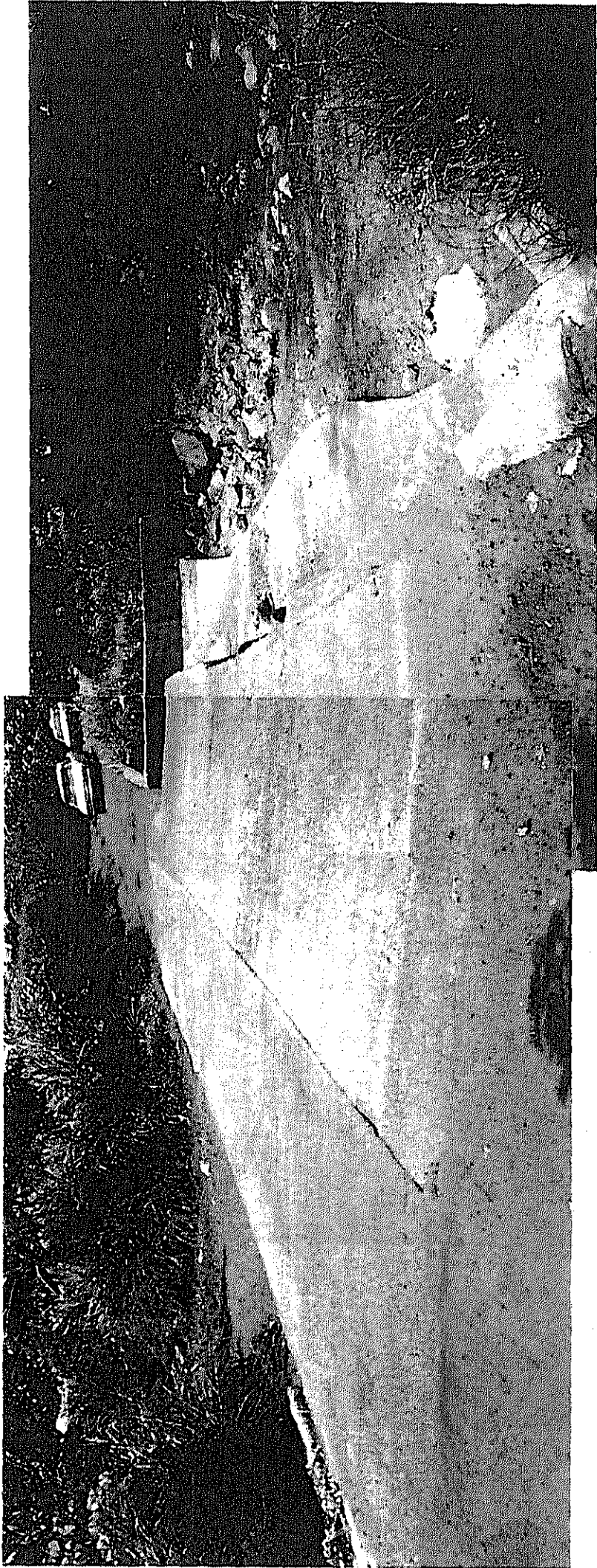
Looking Upstream

SW4 - MANGROVE DRAIN AT FUGALEI



Looking Upstream

SW5 - FULLJASOU RIVER AT LEPEA



SW6 - PAPASEEA STREAM, NEAR ALAFUA - DRY



SW6 - LOOKING DOWNSTREAM



Looking Downstream



SW8 - MULIVAI STREAM AT LALOYAEA



SW8 - MULIVAI STREAM AT LALOVAEA



Looking Upstream

SW9 - VAISIGANO RIVER ADJACENT TO HYDRO POWER STATION



Looking Downstream



SW10 - VAISIGANO RIVER AT LEONE



SW12 - MANGROVE DRAIN AT MOATA'A



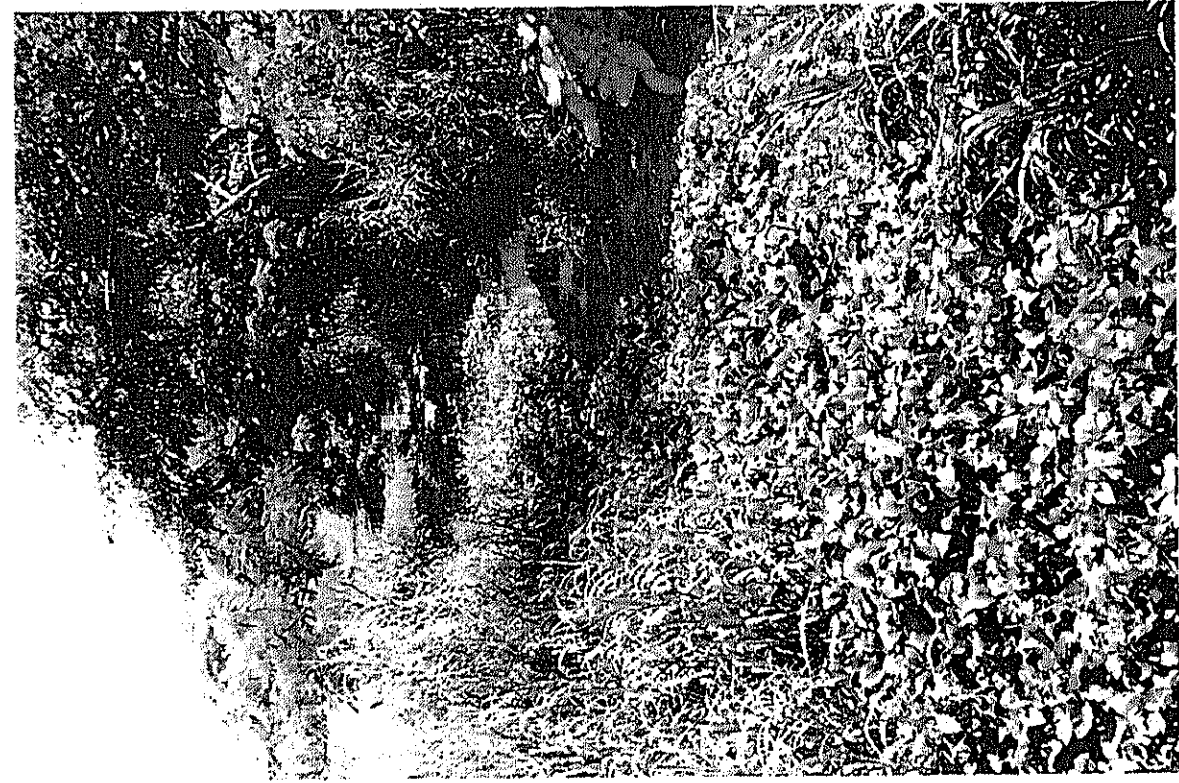


RUBBISH DUMPED AT SW12 SAMPLING LOCATION



SW13
VAILIMA STREAM
AT NATANUA

Looking
Upstream



Looking Downstream



Side Stream

SW14 - MULIVAI STREAM AT MARIST SCHOOL



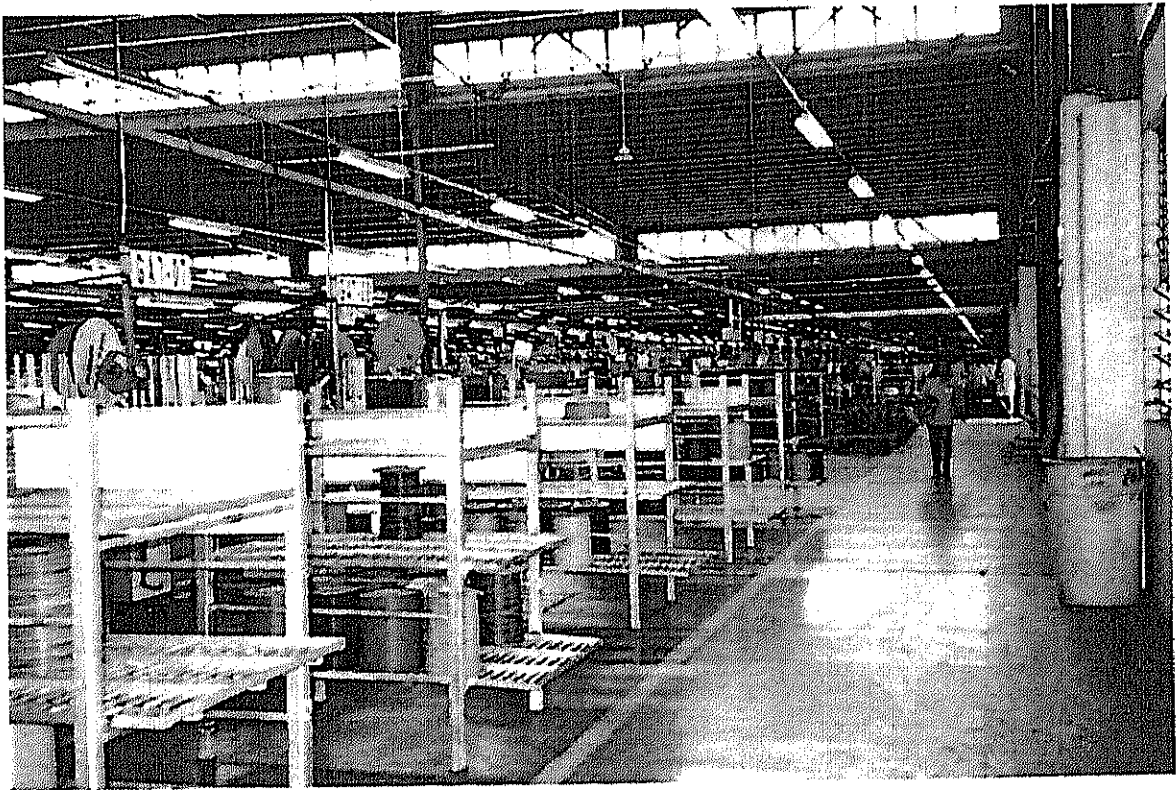
SW14 - UPSTREAM WATER

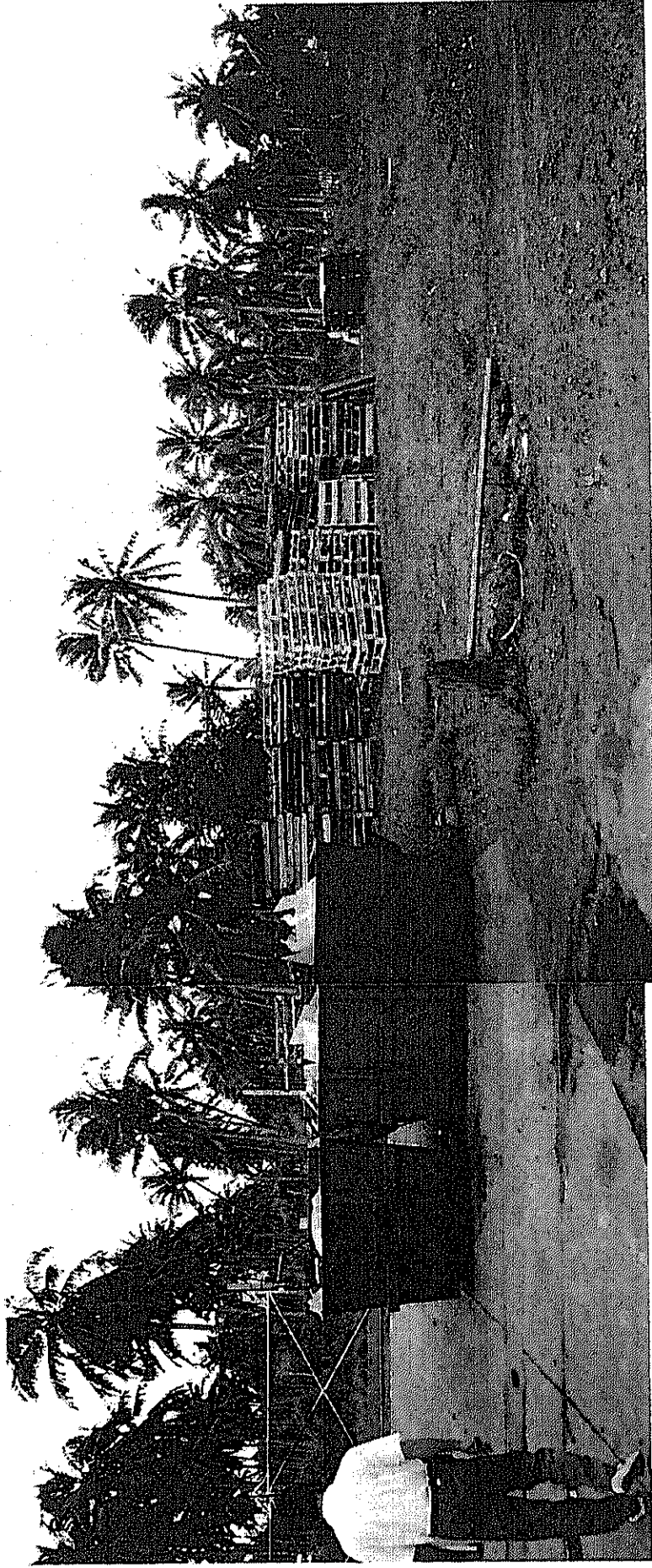


SW16 - FUGALI DRAIN ADJACENT TO TYRE SHOP



SW18
MAIN STORM
DRAIN
NEAR TOWN
CENTRE

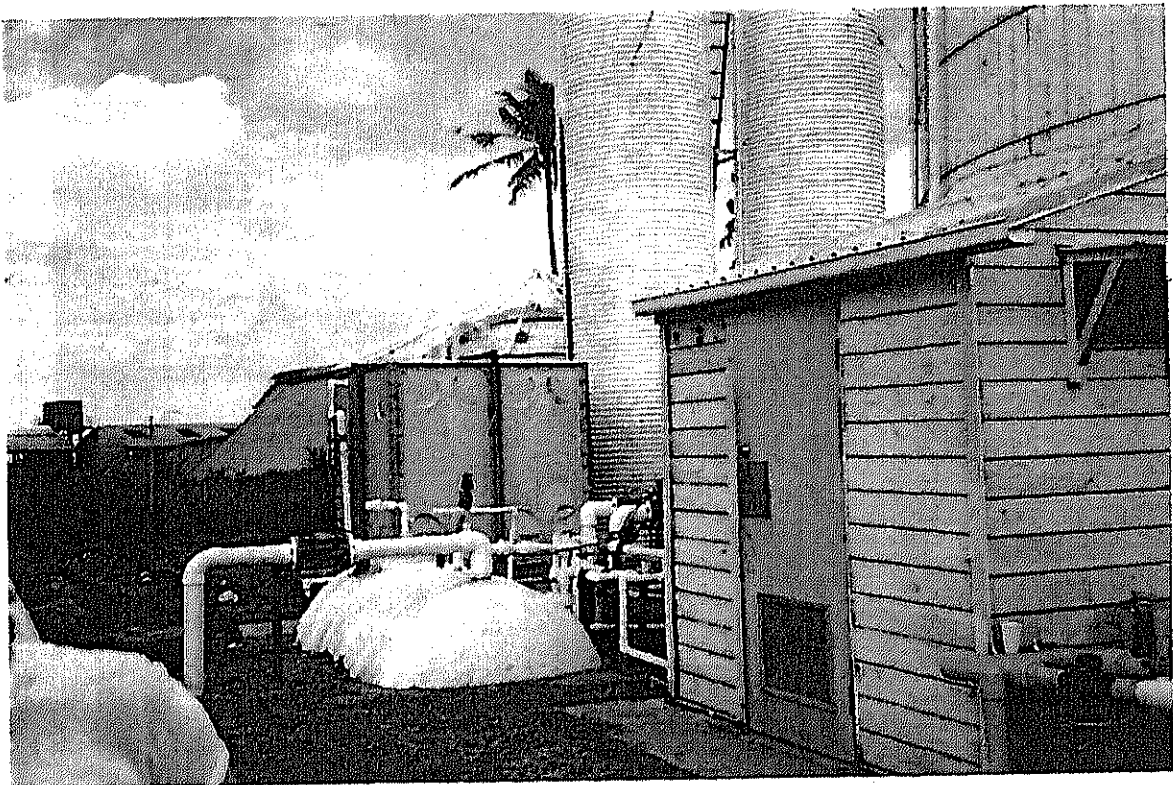


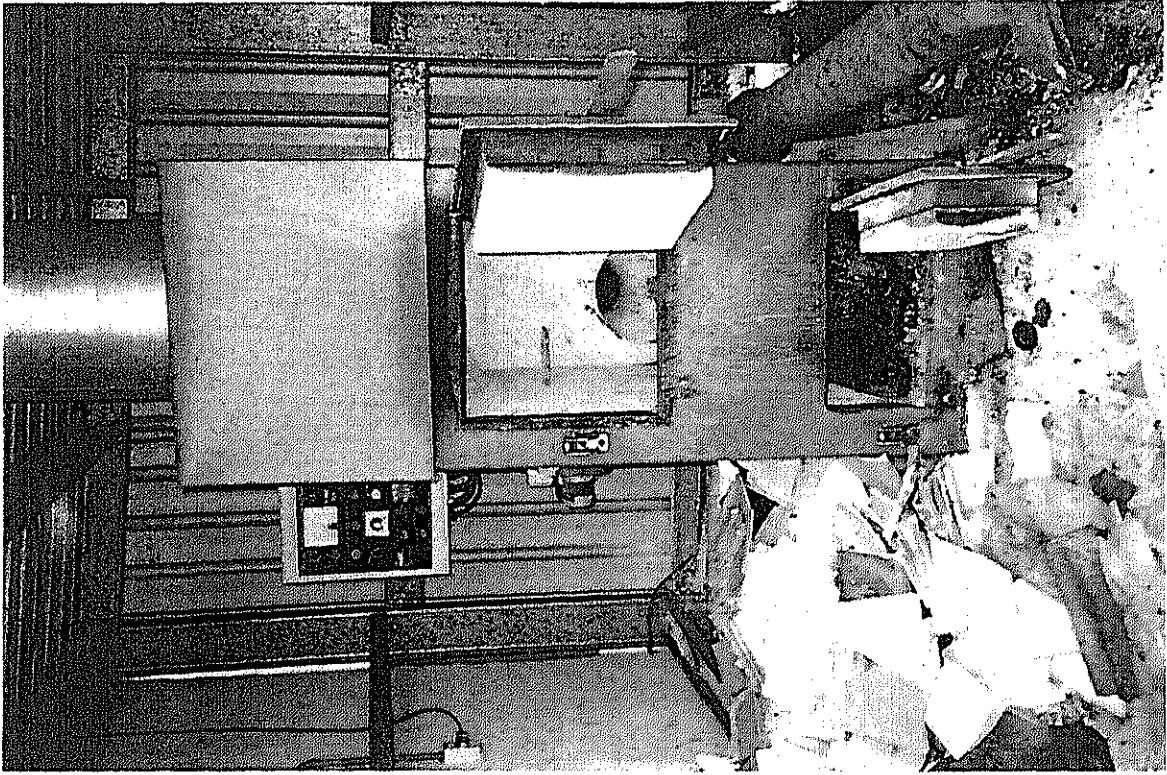


SOLID WASTE STORAGE AT YAZAKI

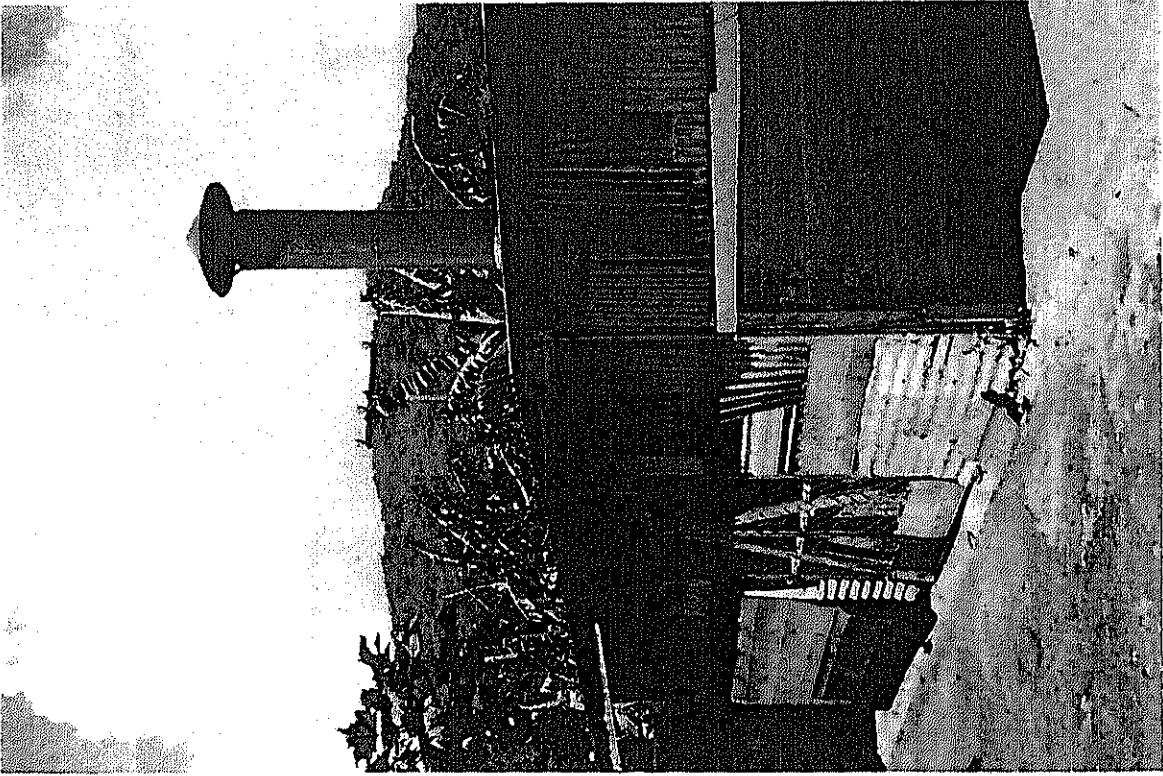


YAZAKI WASTEWATER TREATMENT PLANT -
ZERO DISCHARGE (EFFLUENT RE-USED FOR TOILET FLUSH)





QUARANTINE WASTE INCINERATOR AT WHARF



HOSPITAL WASTE INCINERATOR



TYPICAL GARBAGE STAND



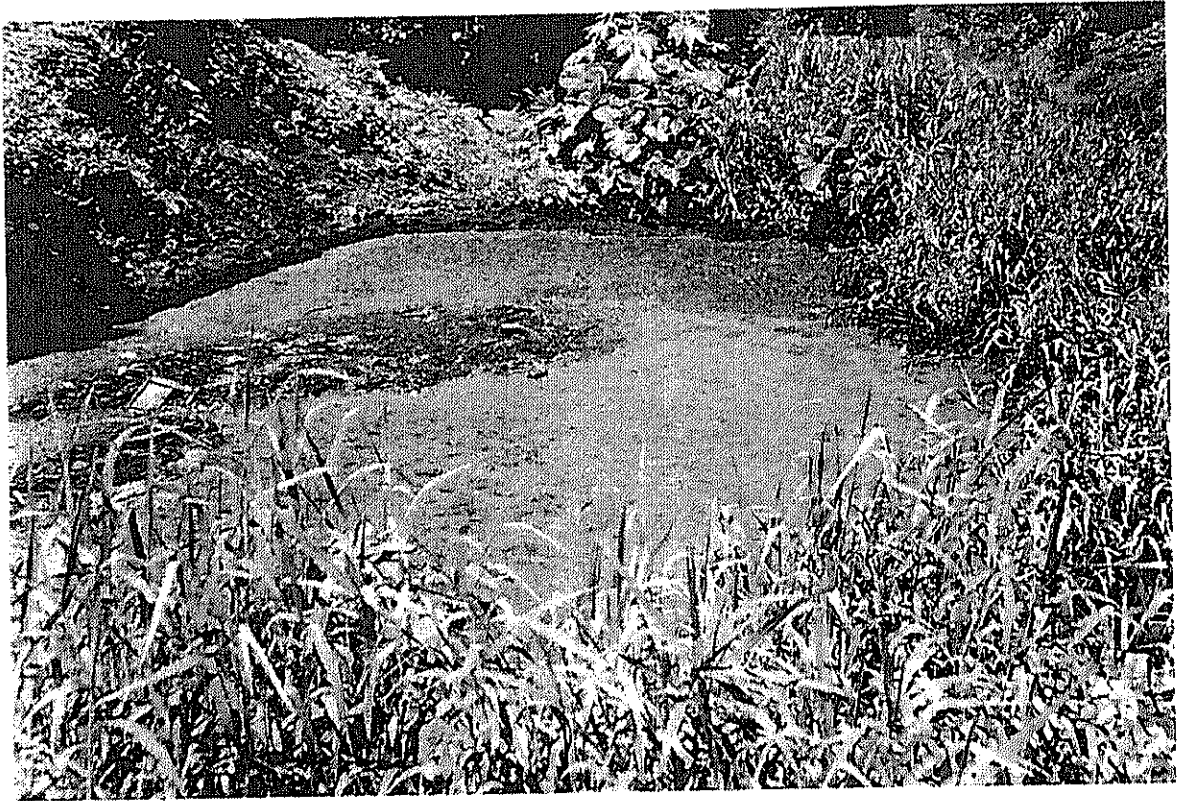
TYPICAL
GARBAGE
STANDS



TAF A'IGATA WASTE DEPOT ENTRANCE



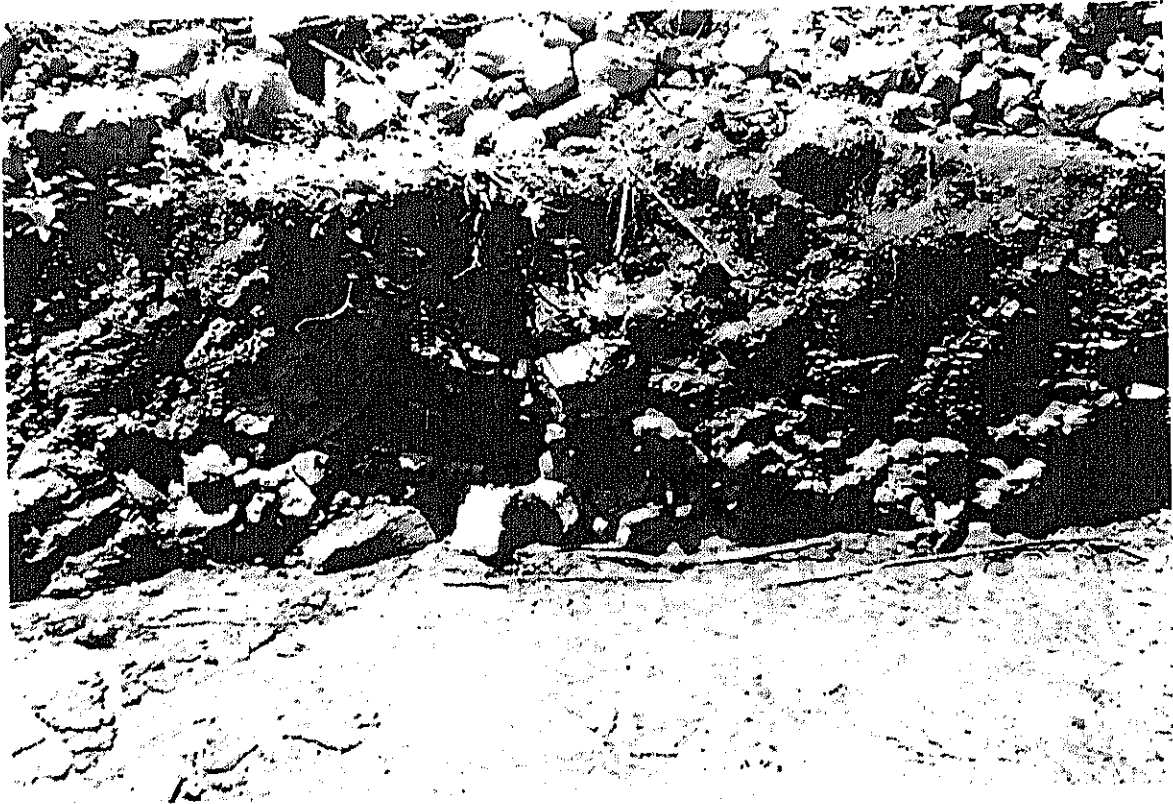




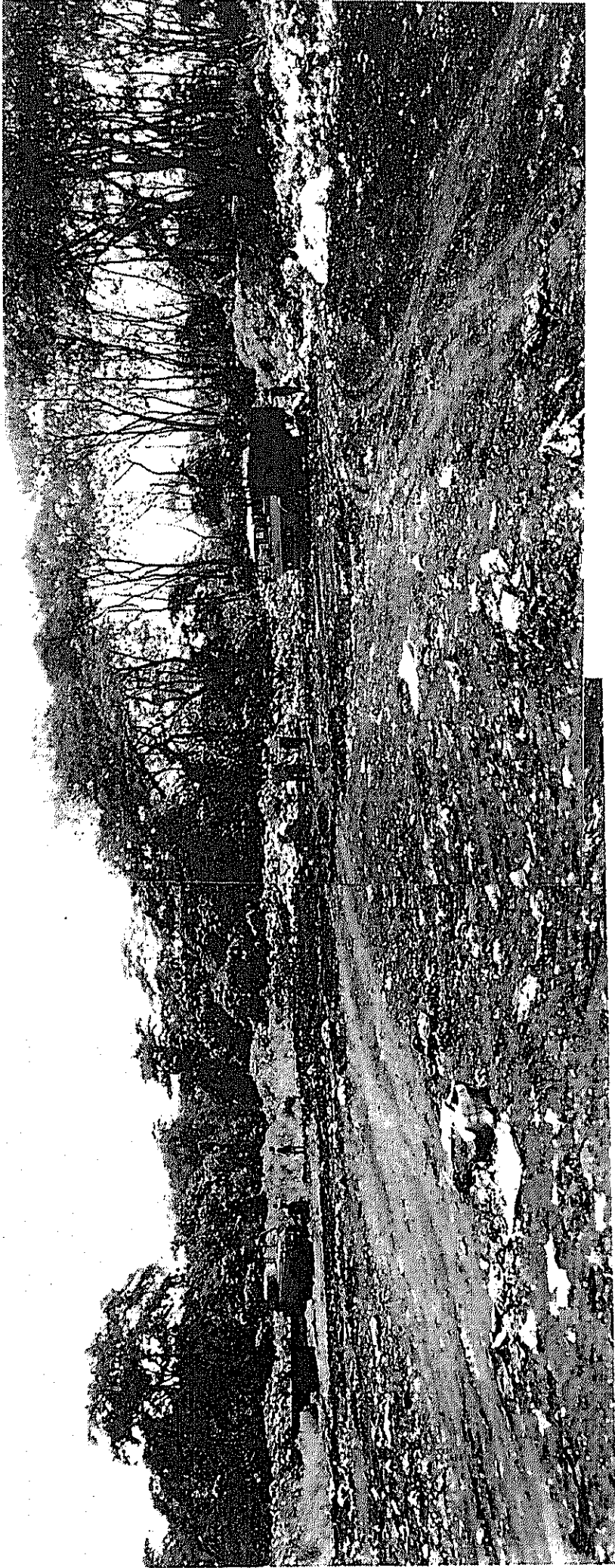
SEPTAGE DISPOSAL
PITS



SEPTAGE DISPOSAL PITS

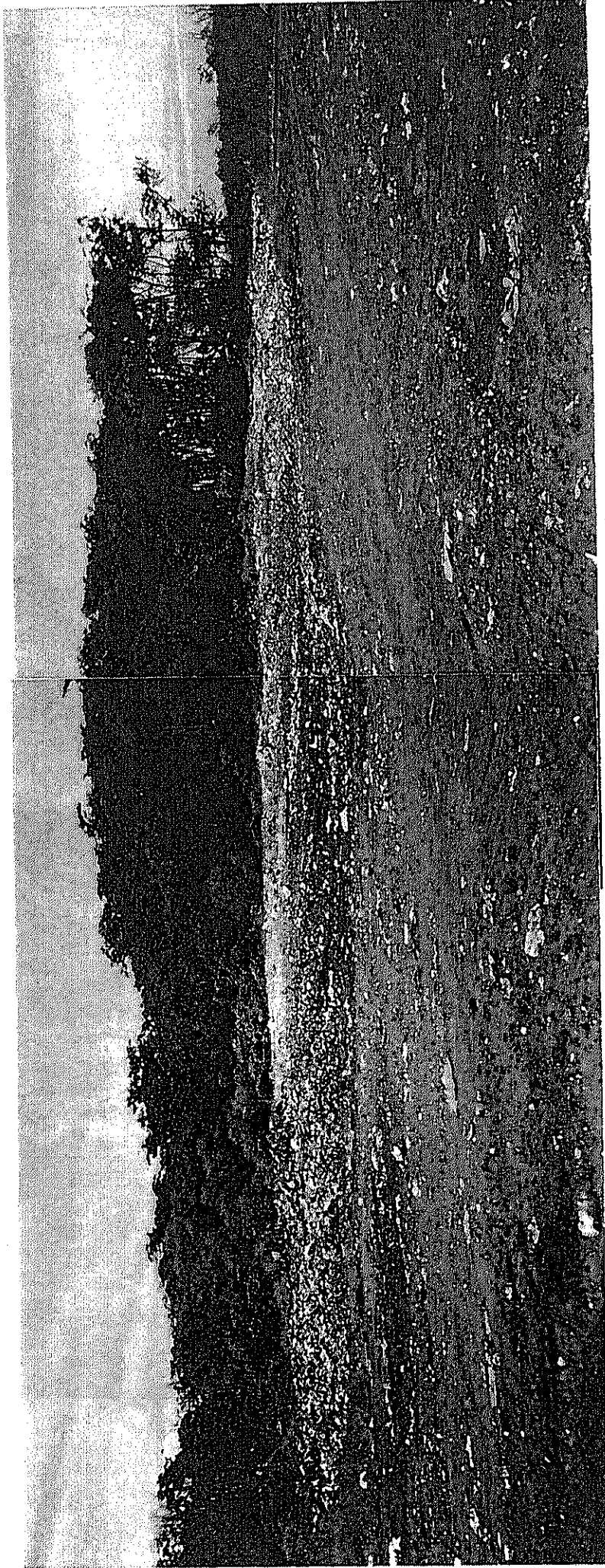


Note: ROCKY (PERMEABLE) SOIL



ACTIVE TIPPING AREA





INACTIVE AREA OF LANDFILL



INACTIVE LANDFILLED AREA

Note: SURFACE WATER RUNOFF



CONTAMINATED SURFACE WATER RUNOFF



TAFALICATA WASTE DEPOT



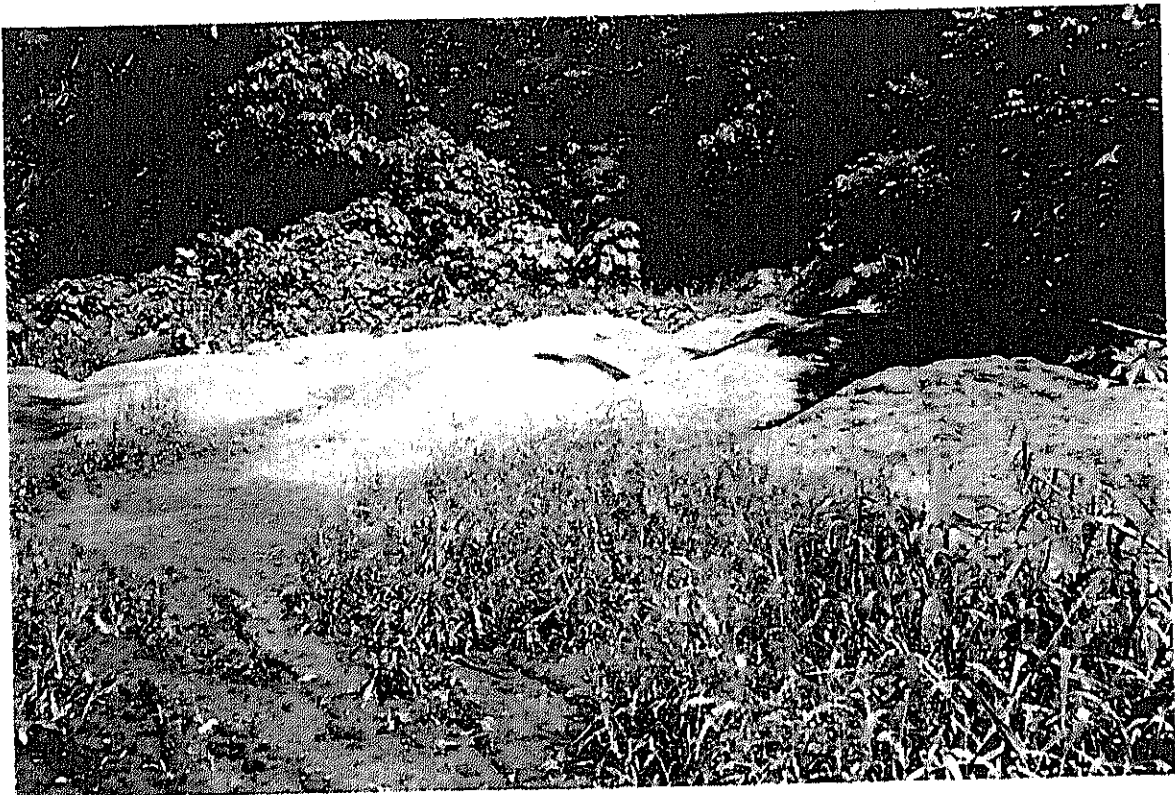
SEPARATION OF STEEL SCRAP

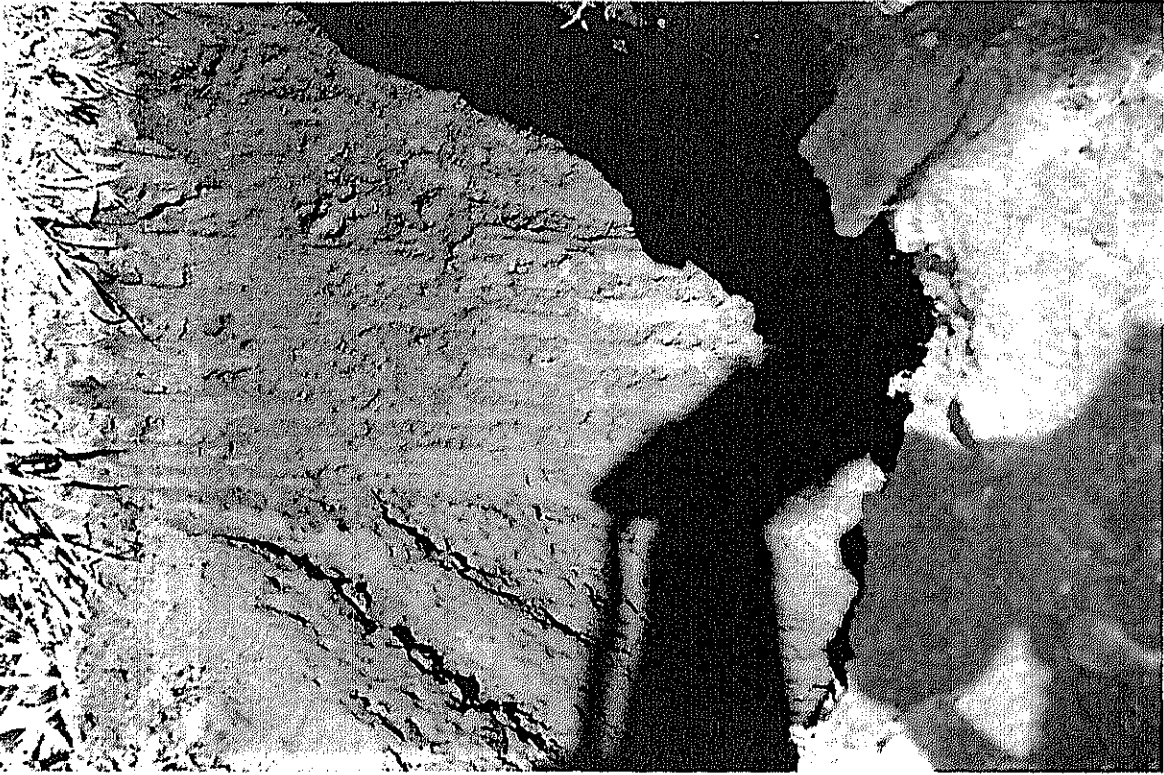


CONFIDENTIAL DOCUMENT DISPOSAL

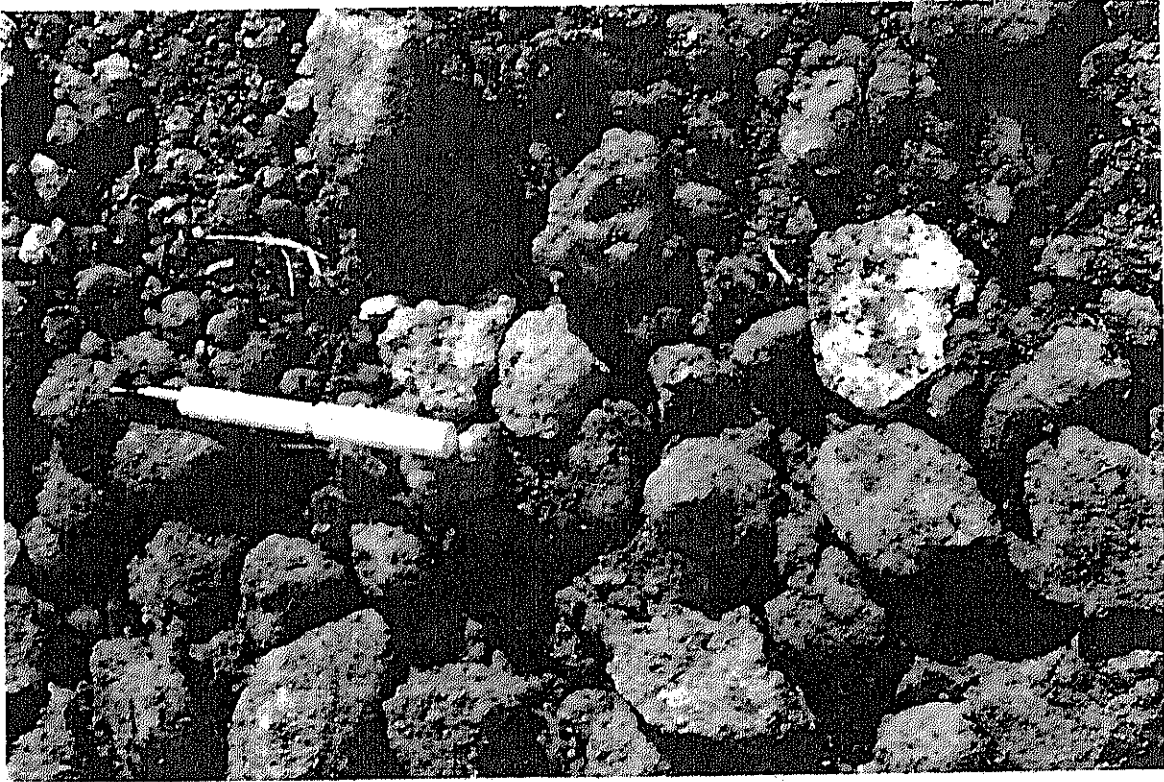
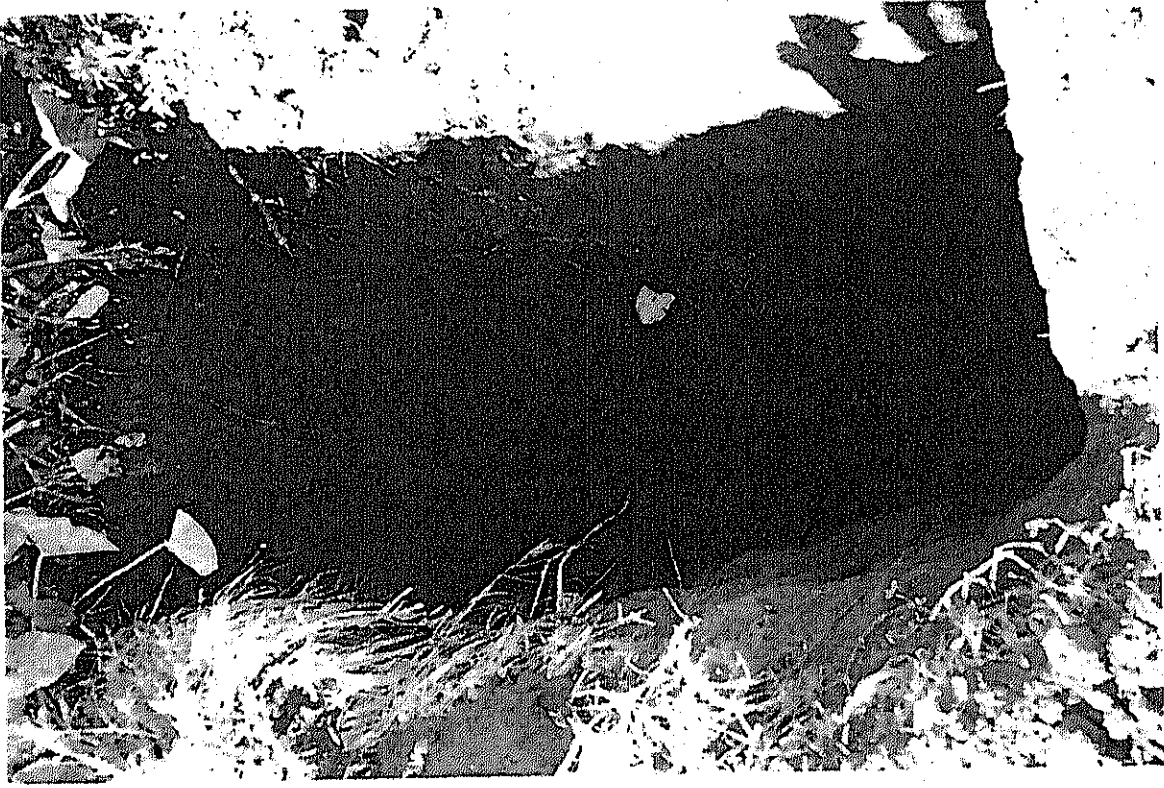


WASTE "YEAST" MATERIAL FROM BREWERY
- UNDERGOING NATURAL DEGRADATION

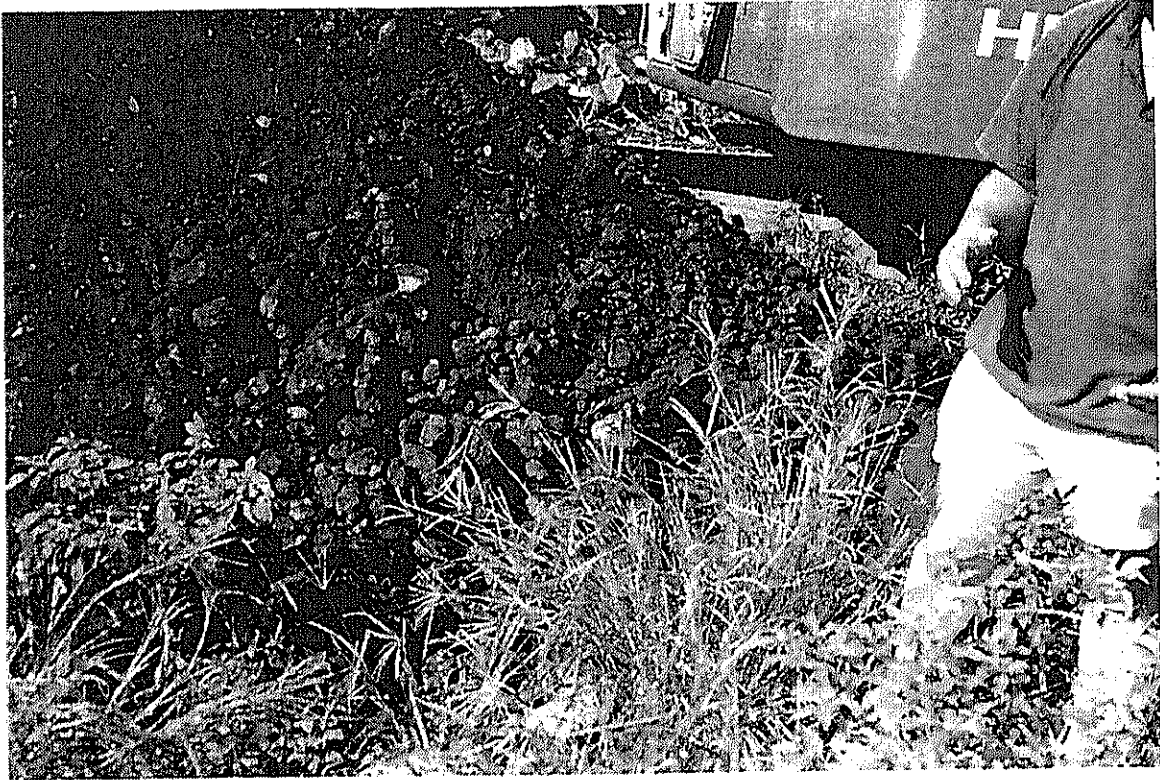




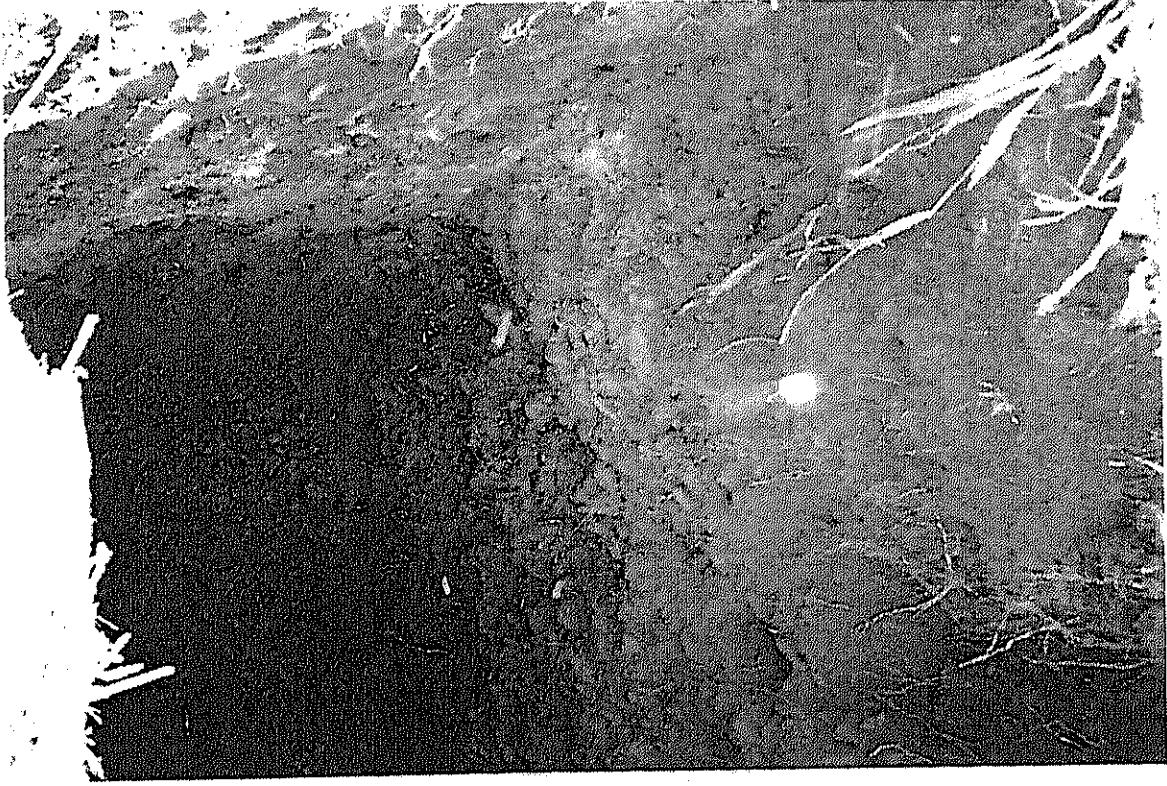
TAFU'IGATA WASTE DEPOT - TEST PIT NO. 1



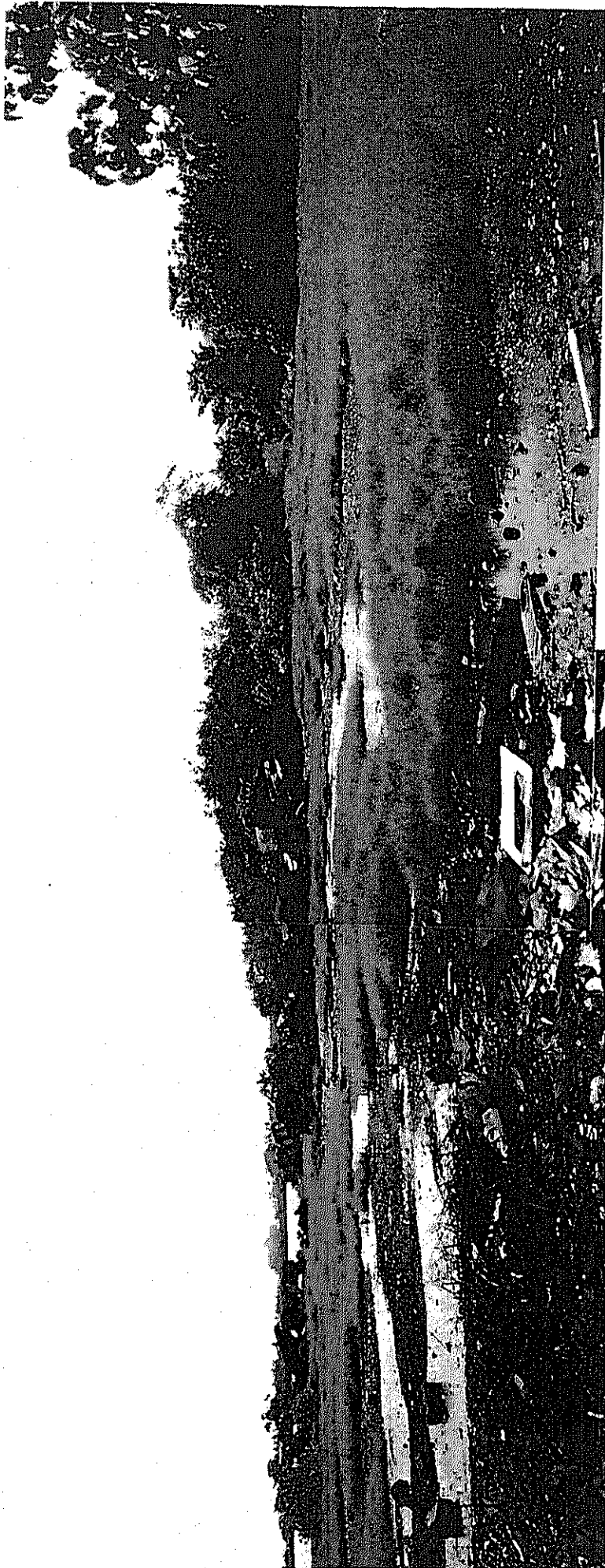
TAFI'IGATA WASTE DEPOT TEST PIT NO. 2



EXCAVATED
MATERIAL
FROM
TEST PIT
No. 2



TAGAYCATA WASTE DEPOT - TEST PIT NO. 3

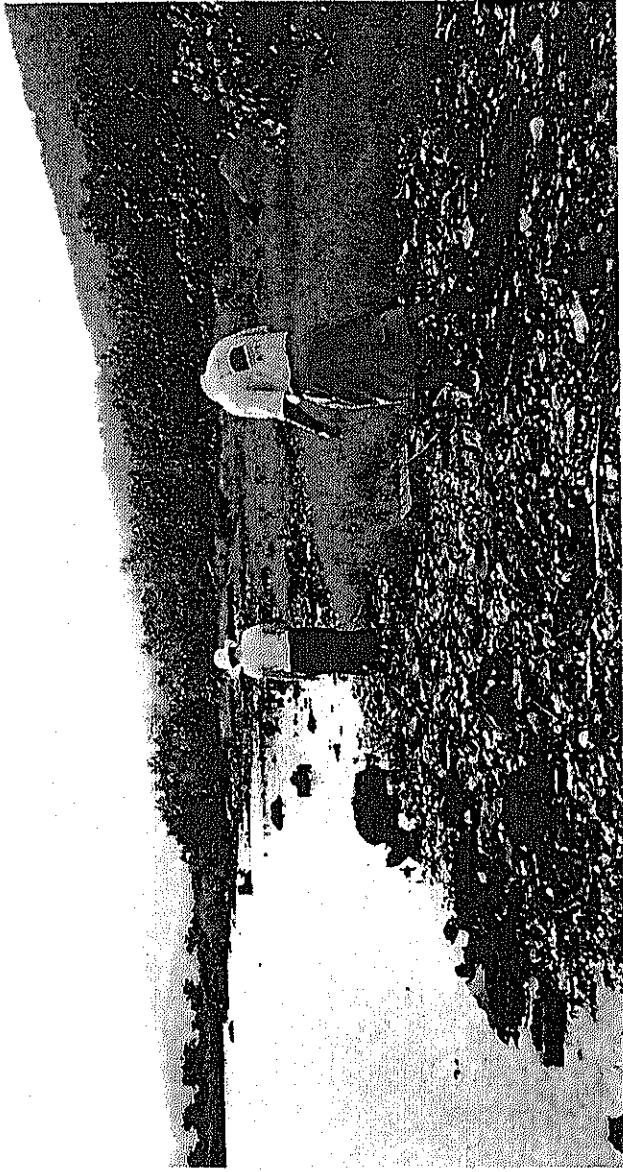


OLD WASTE DISPOSAL DEPOT AT VAITOLOA, ON VAIUSU BAY

PHOTO 10: OLD VAITOLOA WASTE DEPOT



OLD VAITOLOA WASTE DEPOT - SUBSTANTIAL REGROWTH

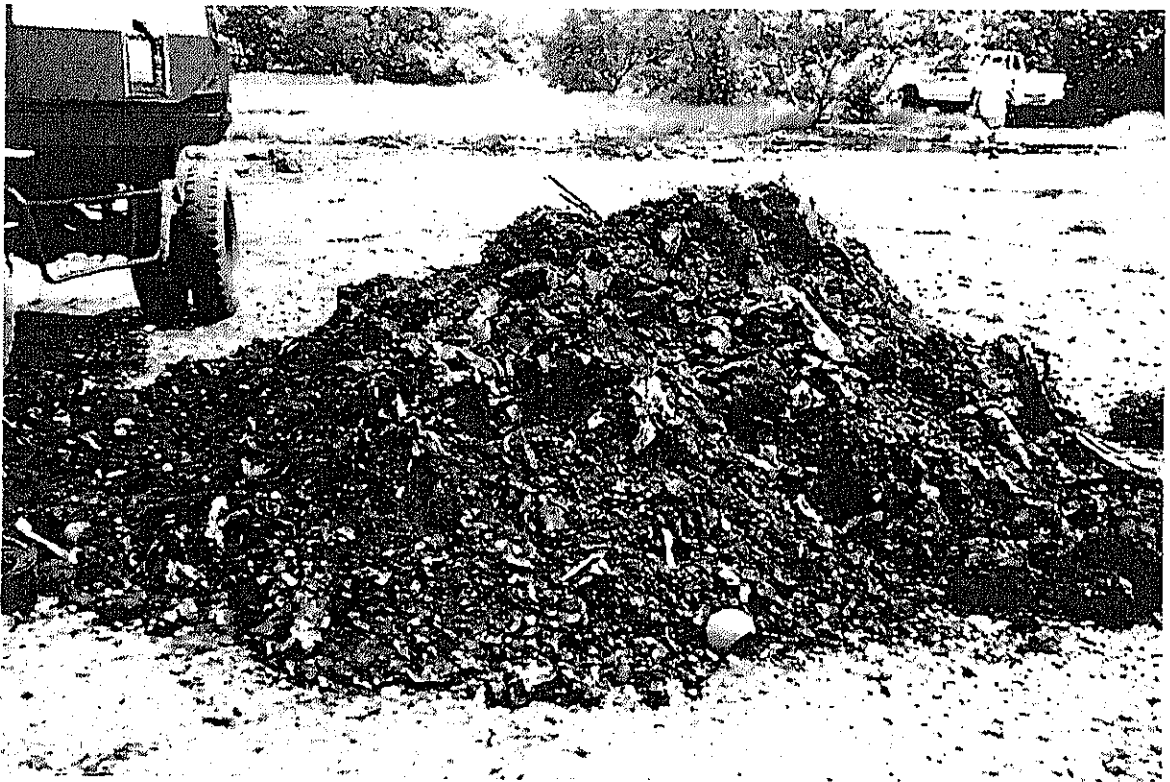


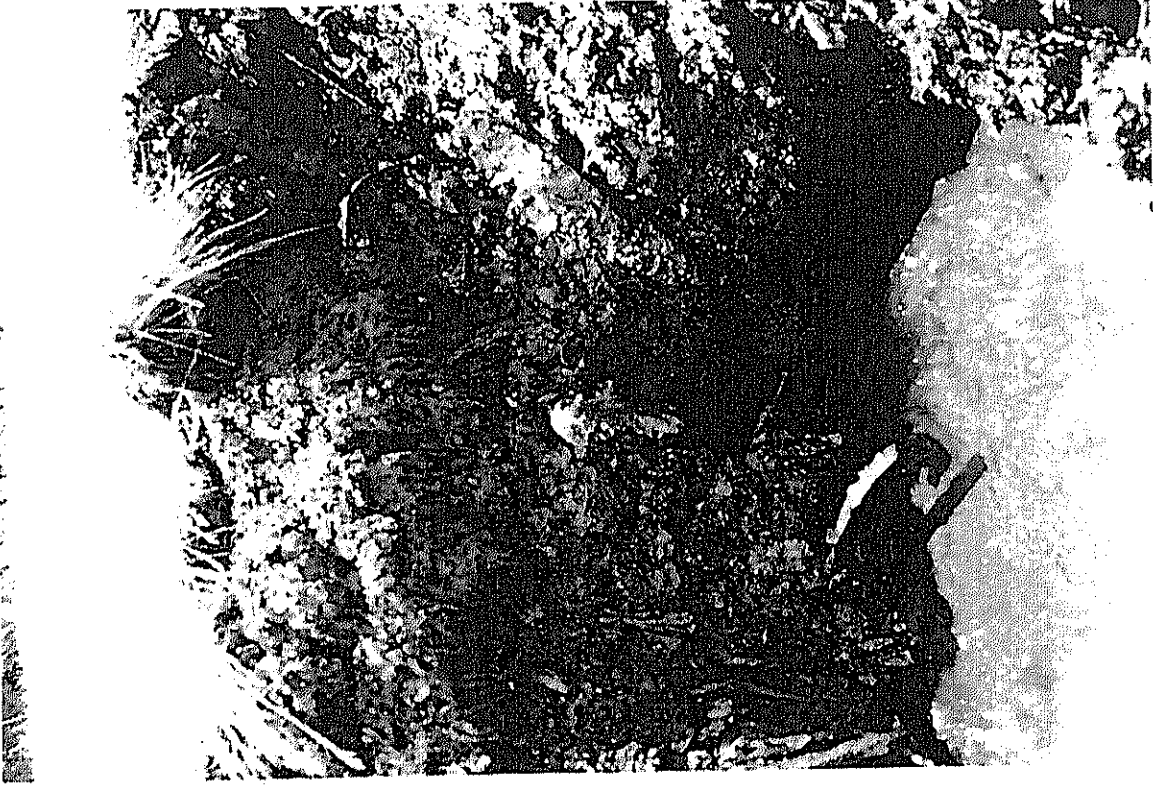
OLD WASTE DEPOT - SHORELINE
- STILL A LOT OF RUBBISH ON TOP





OLD VAITOLOA
DUMP
TEST PIT NO. 1





OLD VAITOLOA WASTE DUMP - TEST PIT NO. 2



SPOIL FROM TEST PIT NO. 2