

QUANG NGAI RURAL DEVELOPMENT PROGRAM (RUDEP) - PHASE 2

Operation and Maintenance Manual for Commune Infrastructure



VIETNAM-AUSTRALIA

Prepared for

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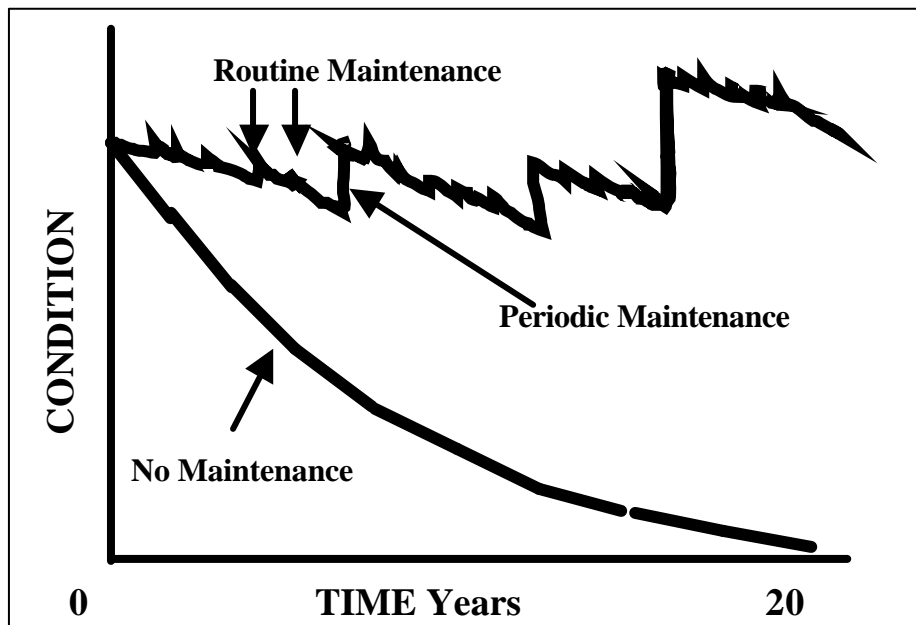
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1 Introduction

1.1 Role of Operation and Maintenance

The ability of assets to provide economic and social benefits over time depends on their condition. If the physical condition of assets deteriorate there will be a corresponding reduction in their economic and social benefit. The condition of infrastructure is protected through developing and implementing sound operational and maintenance procedures. While operational procedures should be applied consistently, maintenance of infrastructure involves a program of short term and long term activities. The short term maintenance tasks, commonly referred to as Routine Maintenance, involve performing minor tasks frequently. The long term maintenance tasks, commonly referred to as Periodic Maintenance, involve major tasks performed infrequently. The impact of routine, periodic and no maintenance on the condition of infrastructure is provided in Figure 1.

Figure 1: Impact of Maintenance on the Condition of Infrastructure



Maintenance of infrastructure involves three types of activities.

- Type 1: Routine maintenance

Type 1 maintenance is undertaken at frequent intervals of less than 6 months to 1 year. They normally involve performing simple tasks designed to maintain functional capacity.

- Type 2: Periodic maintenance

Type 2 maintenance is undertaken at intervals normally greater than two years. Type 2 maintenance involves rehabilitating elements of the asset that have deteriorated.

- Type 3: Emergency maintenance

Type 3 maintenance is undertaken on an as required basis in response to unforeseen circumstances.

1.2 Purpose of the Manual

The purpose of this manual is to improve the sustainability of existing community owned assets. The manual seeks to improve sustainability through developing and applying appropriate operational and maintenance programs, ensuring adequate resources and funds are available and relevant organisations are managed in a transparent manner.

1.3 Structure of the Manual

The manual provides guidance and tools to assist communities develop the organisations, procedures and skills to operate and maintain assets in an efficient manner.

The manual is subdivided into the following three parts.

Part 1: Organisation and Procedures

Part 2: Appendices

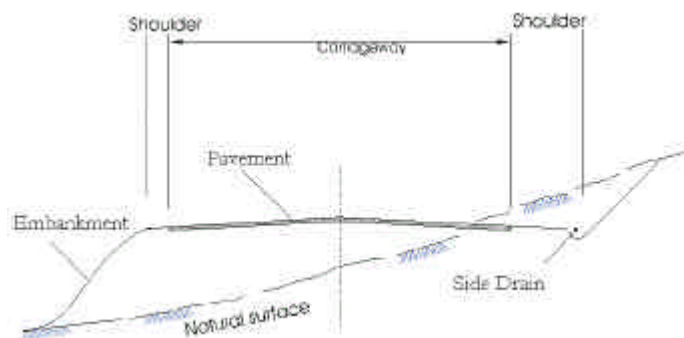
Part 3: Training modules

Part 1 provides background and general procedural information while Parts 2 and 3 provide detail information relating to operation and maintenance tasks and training respectively.

Descriptions of terms and phrases commonly used in this manual are provided below.

Carriageway -	The part of the road surface used by vehicular traffic.
Compaction -	The action of applying pressure to soil so it will not subside when walked or driven on.
Contract -	Legally enforceable agreement between parties that defines their respective roles and responsibilities.
Consumables -	Commodities needed to operate assets.
Culvert -	Opening under the road to allow the passage of water.
Drainage -	Those parts of the road designed to remove water from the road.
Embankments -	The banks formed by the placement or removal of soil.
Handrails -	Fence on bridges to stop passengers falling off.
Inlet Structure -	Structure located at the upstream side of a culvert.
Inventory -	Comprehensive list of assets.
Operator -	Organisation or individual responsible for the operation of an asset.
Outlet Channel -	Open channel downstream of a culvert.
Outlet Structure -	Structure located at the downstream side of a culvert.

Owner - Organisation responsible for the operational and maintenance of community owned assets.



Pavement - Soil placed on the carriageway. Pavement normally consists of hard granular material that provides a hard surface for vehicles. A road without pavement material is called a dirt road.

Resources - Personnel, equipment and systems needed to implement tasks.

Rip Rap - Large stones arranged in a regular pattern to protect soil surfaces from erosion.

Safety barriers - Strong fence to stop vehicles leaving the road at dangerous locations.

Scope of Work - Description of the operation or maintenance tasks to be undertaken.

Side drains - Drains located adjacent to the shoulder.

Shoulders - The part of the road located on the outside of the carriageway.

Skills - Knowledge and expertise required to implement tasks.

Specification - Details of the workmanship and material standards to be achieved for the scope of work.

Tender - Commercial offer to undertake maintenance tasks in accordance with an invitation from the owner.

Warranty - Undertaking from manufacturer provided when purchasing new assets to replace defective items.

Waterway - The area under a bridge through which water runs.

1.4 Use of the Manual

The manual provides guidance to owners or operators on the operation and maintenance of commune level assets resources. A central feature of the manual is the development and implementation of village-based operation and maintenance plan by the owner, based on local conditions.

The manual is intended for use by commune level organisations. Initially individual communes may not be comfortable with adopting the full scope of the manual. The requirement for an Owner to initially complete an asset inventory for all existing assets may be beyond their capacity. It is desirable that the procedures detailed in the manual are undertaken in stages and at a pace to suit the resources of the commune. It is better to introduce the manual slowing in stages than strain resources to introduce it in its entirety.

It is essential that all personnel involved in implementation are competent in the relevant skills before starting work. It is expected there will be considerable trial and error to identify the plan that is appropriate for an individual organisation.

2 Objectives and Strategies

2.1 Objectives

The objective of the manual is to assist commune level organizations to operate and maintain the condition of community owned infrastructure in a cost effective manner.

2.2 Strategies

The manual incorporates a number of strategies to achieve the objective stated in Section 2.1. The principal strategies incorporated in this manual are:

1. Resource allocation is undertaken to maximise economic impact. The ranking of the economic importance of infrastructure sectors from high to low is: irrigation, roads, education and health.
2. Routine maintenance should take priority over periodic maintenance.
3. User fees and charges should cover the full cost of maintaining infrastructure.
4. Maintenance should be planned in an objective manner considering relative needs and economic impact.
5. All responsibilities and roles should be clearly defined and allocated.
6. Processes should be transparent and information readily available to all stakeholders.
7. Maximum local resources should be developed and utilised through ongoing training.

3 Organisation

3.1 Structure

1. The structure of the organization should clearly define the various management and technical roles. Each position should have a duty statement and the roles and responsibilities for each position should be clearly defined.
2. The various roles in operating and maintaining assets are provided in Table 1.

Table 1: Operation and Maintenance Roles

Management	Technical	Training
<ul style="list-style-type: none"> • Preparing asset records • Record keeping • Life cycle costing • Budgeting • Managing procurement • Develop operational procedures • Procurement • Rostering • Financial accounting • Preparing reports 	<ul style="list-style-type: none"> • Condition surveys • Scheduling maintenance • Technical inspections • Operations 	<ul style="list-style-type: none"> • Training needs analysis • Managing training delivery

4 Procedures

4.1 Set Up and Establishment

4.1.1 General

1. All assets shall be recorded on the asset inventory and processed following the procedures provided in Sections 4.1.2 and 4.1.3.
2. Initially fees and charges will be levied to recover all operational and maintenance expenses for an asset. To assist owners set these initial fees and charges, unit operational and maintenance costs for common types of assets are provided in Annex 1. Once actual operational and maintenance costs for individual assets can be determined using historical records, the fees and charges may be amended to suit. Forms to assist in the calculation of the cost of maintenance tasks and lifecycle costs and operational costs are provided in Annex 2, 3 and 5 respectively.

4.1.2 Operational Set Up Procedures

1. Complete the asset record form provided in Annex 4.
2. Collect and file operational manuals, warranty documents and general information provided by the manufacturer.
3. Establish a file for each asset. Store all operational and maintenance documents for each asset in a separate file. Establish sub-files as considered necessary to ensure efficient access to important or frequently accessed information.
4. Collect and store spare parts in a secure place.
5. Identify the type and quantity of consumables needed to operate the asset correctly. Identify the most cost effective source of consumable items.
6. Develop Owner's operational procedures for individual assets.
7. Ensure operators are trained in accordance with the manufacturers instructions and owner's regulations.

4.1.3 Maintenance Set Up Procedures

1. Identify the maintenance tasks for each asset considering the recommendations provided in Annex 6.
2. Based on the availability of resources, identify the means by which the maintenance tasks will be performed. Owners should decide if there is potential for local community resources to complete individual maintenance tasks or if contractors with the appropriate skills should be employed.

4.2 Condition Surveys

1. Even though routine maintenance is scheduled to occur at regular intervals it is important that regular condition inspections are performed to identify deterioration and to plan maintenance programs. Condition surveys shall be performed on all assets at a frequency

determined by the Owner considering the recommendation provided in Table 2, priorities of the Owner, previous experience on the deterioration of the asset, the availability of skilled survey resources and the likelihood that any maintenance identified will be undertaken. Should maintenance not be performed on a regular basis then all assets should be inspected at least every six months to identify high priority maintenance tasks.

Table 2: Frequency for Performing Condition Surveys

Sector	Maximum period between condition surveys (Years)
Water Filter	One
Irrigation	Two
Roads/Bridges	Two
Buildings	Three
Electrical Reticulation	Three

2. It is desirable to remedy infrastructure deterioration as soon as possible. Information on the results of the inspections should be kept and consulted to identify modifications to the design of the infrastructure required to eliminate recurring problems.
3. Adequately skilled personnel should only perform condition surveys.
4. Condition survey forms for each asset developed to suit local requirements and considering the recommendations provided in Annex 8 shall be completed.
5. All condition survey forms shall be retained for future reference.

4.3 Scheduling Maintenance

1. Maintenance tasks for each asset will be determined considering the Maintenance Task List provided in Annex 6.
2. Scheduling of maintenance tasks will be based on the results of the Condition Survey described in Section 4.2. The scheduling of the maintenance tasks should consider the most desirable season in which the task should be undertaken and the availability of resources.
3. A program of maintenance activities will be prepared for the scheduled maintenance tasks (prepared in clause 2 above) and the resources and mechanisms (selected in Section 4.1.3). The program will identify the tasks to be completed by contractors and by commune-based resources.
4. Maintenance shall be prioritized to achieve the maximum economic impact. The ranking of sectors by economic impact, from high to low is, irrigation, roads/bridges, education and health.
5. A roster of commune resources to undertake the maintenance activities will be prepared for the following year.
6. A program of works to be undertaken by contractors will be prepared and used to manage the procurement of services.

4.4 Using Commune Resources

1. While it is expected that all operational tasks will be undertaken using personnel from within the commune it is possible a number of maintenance tasks may be done by external contractors.
2. The mix of internal and external resources used to undertake maintenance tasks will depend on the type assets involved, the income of the community and the skills available within the commune.
3. The basis of managing and paying for internal resources will be by agreement between the parties.
4. Internal resources used to undertake maintenance should be competent in performing the respective tasks.
5. If internal resources are used to undertake maintenance tasks compliance with technical specifications must be adhered to. A competent Technical Inspection Officer must inspect all works completed for compliance with the technical specifications.

5 Operational Tasks

5.1 Commissioning Assets

At the completion and handover of newly constructed assets the Owner shall ensure the following tasks are completed either as part of the handover procedure by the construction team or by operational personnel before the asset is used.

1. Final inspection.

The completed asset should be inspected for compliance with the technical specification of the works used during construction. Constructors shall remedy any defects in accordance with their contractual obligations.

2. Operational plan.

Details of the procedures to be adopted when operating assets, will be provided in an operational plan. The operational plan will be based on advice from suppliers, constructors and this manual and shall be prepared by either the Owner or a Contractor.

3. Operational training

The designated operators shall be trained to carry out their tasks in accordance with the Operational Plan. Training shall be provided and evaluated by either the supplier or constructor of the asset or a competent third party. The need to include training in the supply or construction contracts should be assessed before the contracts are awarded.

4. Establish procedures

Any action required to establish the procedures in the Operational Plan shall be completed. Action may relate to organisational changes, drafting and enacting regulations or setting up bank accounts.

5.2 Hygiene and Public Health

5.2.1 Water

Wells

Wells should be operated in a manner to maintain water quality and the condition of the asset. The rope and bucket should be kept clean and not contaminated in any way. Should the bucket become contaminated with any material that could affect water quality it should be thoroughly cleaned, or if it cannot be adequately cleaned replaced.

People should clean their hands before using the well. No cleaning or washing of clothes or objects should be undertaken on the ground immediately adjacent to the well.

Water filter

Refer to Figure 2: Schematic Arrangement of a Slow Sand Filter for schematic details of a slow sand filter.

Start up

Preparation of the filter takes several weeks, as the sand bed must be adequately prepared to act as a biological filter.

1. Step 1: Close all outlet valves in the filter system and add potable water carefully to the sand filter through Valve A. Continue adding water until the sand is completely covered.
2. Step 2: Allow water to flow slowly through the sand filter for two weeks. This will develop the biological film on the sand filter that purifies the water. During this time no water from the filter should be used for drinking or it should be boiled before drinking.
3. Step 3: For best operation there should be a constant flow of water through the sand filter. To achieve this, partly close Valve E so a constant rate of flow occurs.

Operation

During operation the following instructions must be followed at all times.

1. The sand filter should always be covered by water. The top layer of the filter should never dry out.
2. If algae starts to develop on the sand filter a cover should be placed over the chamber.
3. The rate of water flowing into the Inlet Chamber should approximately equal the rate of flow into the Potable Water Chamber so the time spent in the Sedimentation Chamber is maximised.

The following instructions should be followed for optimum operational performance.

1. A constant flow of water should occur through the sand filter. This can be achieved by regulating the flow into the Potable Water Chamber with a partly closed tap.
2. As sediment accumulates in the sand filter Valve E should be opened slightly to maintain an adequate flow rate through the filter. Once the tap is fully opened and the rate of flow is less than the rate required to meet demand the sand filter should be cleaned.

5.2.2 Sanitation

Latrines

The area surrounding latrines should be kept clean.

Solid waste disposal

Solid waste shall be classified into organic, non-organic and hazardous categories. Organic waste should be recycled by composting. Non-organic waste can be further subdivided into recyclable and non-recyclable items. Recyclable items include metal, some types of plastics and paper. Recyclable items should be stored and sold to waste recycling companies.

Non-recyclable items should be disposed of in a sealed land fill that is not located near to sources of drinking water. All hazardous waste shall be stored and disposed of in an appropriate manner. The preferred method of disposing of hazardous waste is to send it to a competent hazardous waste disposing organisation. Hazardous waste includes batteries, some medical waste, pesticide containers and unused paint.

5.2.3 Public Health

Health Centres

Health centres and their immediate area shall be kept clean. Health centres should not be used for any other purposes than providing health services. All waste shall be disposed of in an appropriate manner. See section 5.2.2 for information on disposing of solid waste.

Spare parts and consumables shall be maintained for all essential assets.

Markets

Markets shall be kept clean. Waste shall not be stockpile within the boundaries of the market. Vendors shall be regulated concerning the type of items being sold. Vendors shall be charged a fee to cover the full cost of operating and maintaining the market area.

5.3 Roads

1. The operation of a road mainly involves restricting its use to minimise damage.
2. The size and weight of vehicles using commune roads should be strictly enforced to protect the pavement material and culverts. Vehicles with an axle load greater than 7 tonnes should never be permitted to use commune roads when the pavement material is wet or soaked. Heavy vehicles, especially when the carriageway is wet, can cause deep rutting. This deep rutting leads to the further deterioration of the road to a point where it becomes unserviceable. Heavy vehicles may also damage the structural integrity of culvert pipes if the depth of cover is inadequate.
3. Should rutting occur from a single heavy vehicle emergency maintenance should be implemented as soon as possible to repair the damage.

5.4 Bridges

1. Similar to roads bridges can be damaged if the mass of a vehicle exceeds the ultimate design load used in the design of the bridge. The maximum allowable vehicle mass for each bridge should be obtained from the designer and clearly displayed on a sign next to the bridge.
2. The waterway of a bridge should not be restricted by other infrastructure that may increase the height of a flood and thus the risk of damage to the structure or nearby infrastructure.

5.5 Irrigation

1. To ensure irrigation systems are operated efficiently and equitably instructions for the operation of irrigation systems shall be prepared.

6 Maintenance Tasks

Description of maintenance tasks for common types of assets and the recommended average frequencies at which they should be performed are provided in Sections 6.1 to 6.6 inclusive.

6.1 Buildings

1. Gutters

	Description	Frequency
1	Check condition and repair gutters and downpipes including joints, mitres and fixings where visible especially for leaks, corrosion or damage.	Annual
2	Remove leaves and other matter from gutters and downpipes.	Six monthly

2. Roof

	Description	Frequency
1	Check roof for damage and corrosion to roofing material and fixings and repair as necessary.	Annual
2	Check all flashings for condition, integrity and fixings and repair as necessary.	Annual
3	Check all fascias for condition, integrity and fixings and repair as necessary.	Annual

3. Water Supply System

	Description	Frequency
1	Check all risers and tapware for condition and leaks and repair as necessary.	Annual
2	Check all accessible pipework for condition, leaks, corrosion, damage and fixings and repair as necessary.	Annual

4. Sewerage Pipes

	Description	Frequency
1	Check all inspection openings for breakages and damage.	Annual
2	Check all sewer pipes are adequately covered and not exposed.	Annual
3	Check all pipes for blockages and repair as necessary.	Annual
4	Check insect protection on vent pipes and repair as necessary.	Annual

5. Septic Tanks

	Description	Frequency
1	Check access cover on septic tank is accessible and can be removed.	Annual
2	Clean out contents of tank including all sludge and solids.	Three years.
3	Clear inlet and outlet junctions are in place and clear of obstructions.	Annual

6. Water Closets

	Description	Frequency
1	Check condition and operation of WC including pan, fixings and fittings, flushing device and pipework and repair as necessary.	Annual

7. Water storage tank

	Description	Frequency
1	Inspect tank and check condition of tank, base and surrounds, valves, pipework and level controls and repair as necessary.	Annual
2	Check and clean overflow pipe and check that overflow water is diverted away from the tank, buildings and other structures.	Annual
3	Check inside tank for foreign matter and sludge build up.	Three years
4	Check cover is fitted to inspection opening and inspect protection is sound on all openings.	Annual.
5	Desludge tank.	As required.

8. Lighting

	Description	Frequency
1	Check all luminaries and switches for correct operation and repair as necessary. Clean luminaries.	Six months.
2	Check for defects or damaged fittings, diffusers, lamp holders, ballast or capacitors and repair as necessary.	Three months
3	Check condition of time switches, light sensors on external lighting systems and repair as necessary.	Six monthly.

9. Yard maintenance

	Description	Frequency
1	Remove litter from yard and keep grass trimmed.	Month
2	Clean out drainage channels so they are free draining.	Six month

10. Pest infestation

	Description	Frequency
1	Protect the building from pest (termites, ants etc) infestation either by regular spraying with pesticide or ongoing cleaning.	Six month

11. Windows

	Description	Frequency
1	Replace broken windows and maintain window latches to ensure all windows are watertight.	Six month

12. Painting

	Description	Frequency
1	Rub down painted surfaces with wirebrush or metal spatula to remove loose paint and mortar.	Six years
2	Repair surface with matching material.	After 1
3	Wash surface with water to remove all dirt and grime.	After 2
4	Apply a suitable undercoat to match the surface and apply 1-2 coats of finishing paint.	After 3

6.2 Water filter

A schematic sketch of a slow sand filter is provided in Figure 2.

6.2.1 Cleaning the Filter

The sand filter should be cleaned when the flow rate is not adequate to meet demand. The following steps should be used when cleaning the filter.

Step 1: Lower the water level in the sand filter by carefully decanting using a cup to expose the top 2 centimetres of the sand.

Step 2: Carefully scrap off any accumulated silt and the top 2 centimetres of sand.

Step 3: Start the flow of water through the filter.

This process can be repeated as required until the depth of sand is reduced to 30 centimetres. Once the depth of sand is 30 centimetres the sand should be rehabilitated.

6.2.2 Rehabilitating the Filter

Once the depth of sand is 30 centimetres and the rate of flow is not adequate to meet demand the sand filter should be rehabilitated.

Step 1: Remove the top 2 centimetres of sand following Step 1 to 2 of Section 6.2.1 Cleaning the Filter.

Step 2: Remove the water in the sand filter to the top of the gravel layer.

Step 3: Carefully remove the next 10 centimetres of sand and store in a manner so it does not get contaminated with dirt.

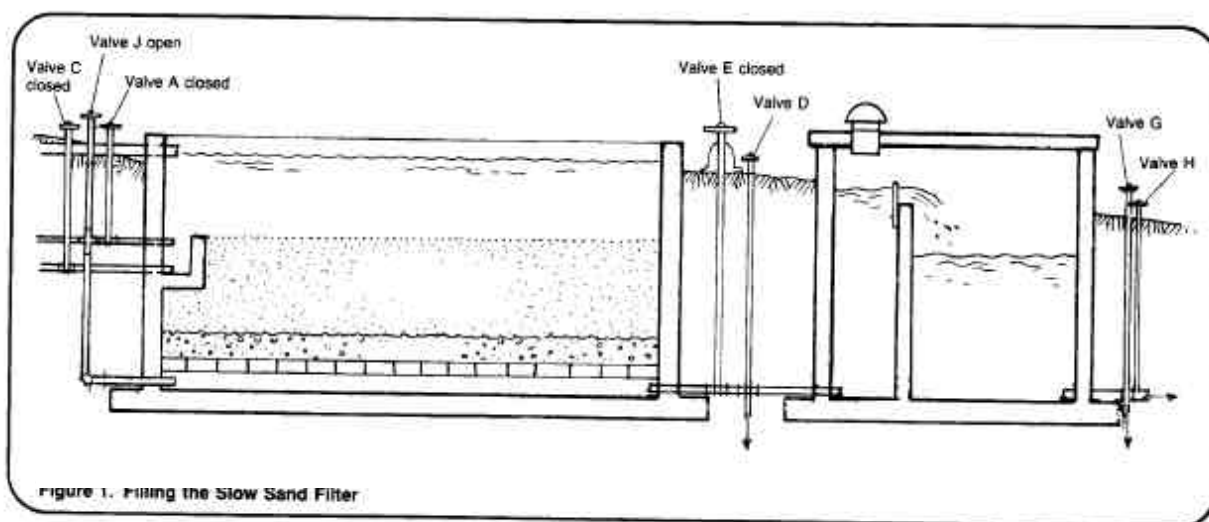
Step 4: Place a 10-centimetre layer of new clean sand and replace the 10 centimetres of sand previously removed from the sand filter.

Step 5: Fill the sand filter with water through Valve A. until the sand is completely covered.

Step 6: Provide a constant slow flow through the sand filter for 2-3 days.

Steps 1 to 5 should be undertaken as quickly as possible so the replaced sand is out of water for the shortest possible period.

Figure 2: Schematic Arrangement of a Slow Sand Filter



6.3 Electricity Reticulation

1. Poles

	Description	Frequency
1	Check the condition of all poles supporting cables and equipment and repair as necessary.	Two years
2	Check the structural integrity and soundness of the pole should be assessed. Undertake remedial works as necessary to ensure the pole performs as required.	Two years

2. Pole Foundations

	Description	Frequency
1	Check the condition of the foundation of all poles. The structural integrity of the foundation to support the pole should be assessed. Undertake remedial work as required.	Two years

3. Pole Insulators

	Description	Frequency
1	Check the condition of insulators. Clean insulators as necessary and replace cracked or damaged insulators.	Annual

4. Circuit Breakers

	Description	Frequency
1	Check the physical appearance. Check the presence of burning smells, conditions of seals and terminations.	Annual
2	Clean circuit breakers with particular attention to insulators.	Annual
3	Conduct insulation tests and replace faulty insulators as required. Conduct contact resistance (Milli-ohm) test.	Annual
4	Inspect mechanisms for wear and tear. Check condition of clusters, busbar/cable connections and terminations. If necessary lubricate following inspection.	Annual

5. Cables

	Description	Frequency
1	Check cable ends for any physical damage or deterioration in outer insulation, corona etc.	Two years

6. Transformer

	Description	Frequency
1	Check transformer for damage, evidence of overheating, adequate ventilation, audible discharge, pests, combustible material and cleanliness.	Annual
2	Check and repair oil leaks and oil level.	Annual
3	Check for hot spots using heat sensitive detector and repair as necessary.	Annual
4	Check, clean and recondition isolating contacts of withdrawal voltage transformers.	Annual
5	Check fuses for protection of primary windings.	Annual
6	Check all main and secondary connections for condition and tightness.	Annual
7	Clean and check condition of all exposed insulation especially for damage, cracks, signs of blistering and any defects.	Annual
8	Check all exposed earthing connections for signs of mechanical damage or corrosion.	Annual
9	Check condition and location of all safety signage.	Annual

7. Vegetation control.

	Description	Frequency
1	Trim trees and shrubs to reduce the risk of damage during storms. Ensure all vegetation is clear of cables and equipment.	Annual

6.4 Roads

1. Vegetation Control

	Description	Frequency
1	Remove all vegetation from the carriageway and shoulders of the road and neatly trim vegetation on embankments. All bushes and trees should be removed from embankments. Special care should be taken when trimming high fill embankments not to increase the risk of slips by steepening the embankment surface or removing scour protection afforded by grass.	Six months
2	Neatly trim vegetation and remove bushes and trees from embankments.	Six months

2. Drains

	Description	Frequency
1	Clean sediment and rubbish from side drains and regrade to maintain gradient.	Six months
2	Remove accumulated debris from culvert inlet structures, outlet structures and channels and pipes. All removed debris should be disposed of in a manner to reduce the risk of future contamination. While bushes and trees should be removed from channels it is important that grass should only be trimmed to protect against scouring.	Six months
3	Periodic Maintenance of Drainage Structures. Rehabilitate drainage structures by replacing or repairing damaged components. The mode of construction should match the existing structure. Where there is evidence the drainage structure is inadequately sized or placed inappropriately modifications to the design should be made to improve performance.	Five Years

3. Carriageway

	Description	Frequency
1	Fill potholes with suitable granular pavement material. Even if the carriageway has a dirt surface granular material should be used to fill potholes if possible as the development of a pothole may indicate a problem area and granular fill will mitigate the risk of a recurrence. Lightly dampen fill material before placing to aid compaction and compact using either mechanical compaction equipment or heavy stamping equipment.	Six months

2	<p>Periodic Maintenance of Pavement.</p> <p>If selected pavement material has been provided the original thickness of the pavement material should be reinstated. The material should be spread evenly and the surface shaped to provide a slope from the centre of the road to the side drains. The slope should be adequate to ensure water does not pond on the carriageway. Dampen the material and compact using the best available equipment.</p>	Five years
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4. Safety Devices

	Description	Frequency
1	Check the condition of all safety devices and make good as necessary. Safety devices includes safety barriers and signage.	Annual

6.5 Bridges

1. Waterway

	Description	Frequency
1	Clean the waterway in the vicinity of the bridge so the hydraulic capacity of the channel is maintained without removing vegetation scour protection.	Annual
2	Reinstate riprap that have been moved or replace riprap that has been lost.	Annual

2. Structure

	Description	Frequency
1	Replace damaged structural elements to maintain functional performance. Functional performance relates either to the structural capacity of the deck and foundations or the integrity of the scour protection works. Repair road furniture associated with bridge. Road furniture includes safety barriers, handrails and signage.	Annual

3. Road furniture

	Description	Frequency
1	Check and repair road furniture associated with bridge. Road furniture includes safety barriers, handrails and signage.	Annual

6.6 Irrigation

1. Vegetation Control

	Description	Frequency
1	Remove all vegetation from irrigation channels and neatly trim vegetation on embankments. Special care should be taken when trimming high fill embankments not to increase the risk of landslips by steepening the embankment surface or removing scour protection afforded by grass.	Annual

2. Channel

	Description	Frequency
1	Clean sediment and rubbish from irrigation channels and regrade to maintain gradient.	Six months
3	Rehabilitate drainage channels by repairing slumped walls and scouring. Place granular material in layers with thickness not exceeding 150 mm. Compact each layer before placing subsequent layers. The mode of construction should match the existing structure. Where there is evidence the drainage structure is inadequately sized or placed inappropriately modifications to the design should be made to improve performance.	Five Years

6.7 Emergency Maintenance

1. The Owner should be prepared to undertake emergency maintenance at short notice in response to unforeseen circumstances that damage assets.
2. Common causes of unforeseen damage to assets include extreme climatic conditions, like storms and floods and geological events, like landslips and earthquakes.
3. An event causing unforeseen damage requires an immediate response consistent with the level of damage and the importance of the asset affected.
4. The immediate response should be to cease using the asset and undertake immediate action to secure the condition of the asset.
5. A quick assessment should be made of the likelihood of the event occurring again and steps taken to protect maintenance personnel and the community.
6. If possible, advice from national emergency services agencies should be sought concerning minimising damage and protecting life.
7. If there is a history of unforeseen events that damage assets, emergency response plans should be prepared with assistance from national emergency services agencies. The design of assets should take into account events with a high probability of occurring during the life of the asset.

Annex 1

Indicative Fees and Charges

Annex 1: Indicative Fees and Charges

Asset Sector	Basis of Fees and Charges	Indicative Rate
Communal water filter	Fees and charges should be levied to individual households. The fees and charges should cover the full cost of supplying the water, operating and maintaining the filter.	VND## per household per annum.
Household water filter	Household water filters shall be operated and maintained by the householders therefore no communal based fees and charges are warranted.	Not applicable.
Road/Bridges	It is not feasible to levy fees and charges from individual users of commune level roads and bridges. Road and bridge maintenance funding should therefore be raised through commune-wide taxes.	Not applicable.
Irrigation	Individual Irrigators should be levied a fixed amount per hectare irrigated to cover the full life-cycle cost of the assets.	VND## per hectare under irrigation per annum.
Communal Building	A fixed fee per square metre should be levied equal to 3% of the construction cost.	VND## per square metre per annum.
Household buildings	Household buildings shall be operated and maintained by the householders therefore no communal based fees and charges are warranted.	
Electrical reticulation	Individual households should be levied a fixed amount per annum to cover the full cost of operating and maintaining the electrical reticulation. The O&M fee should be combined with the cost of supplying the electricity and be based on a fixed fee per household.	VND## per household per annum.

Annex 2

Form for Calculating the Cost of Maintenance Tasks

Annex 2: Form for Calculating the Cost of Maintenance Tasks

	Resource	Daily Cost (VND)	No required	Daily Amount (VND)
Description				
Labour Cost	Supervisor			
	Labourer			
Plant & Equipment				
Built in Items				
Sub-total				
Administration and Technical Inspection			5%	
Unit of production		Total Daily Cost		
Cost per Unit of Production				

Annex 3

Form for Calculating the Life-Cycle Cost of Maintaining Assets

Annex 3: Form for Calculating the Life-Cycle Cost of Maintaining Assets

Assumptions

1. The life of the asset will be 15 years.
2. Prices increase at an annual rate of 4%.
3. Maintenance costs and value of fees and charges have been calculated previously.
4. The fee and charges should equal the full cost of maintaining and operating the asset over its life.

Task	Year															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Total Operating & maintenance Cost																
Fees and charges																
Annual Surplus/deficit																

Methodology

1. List all the anticipated maintenance and operational tasks associated with the asset over its life of 15 years.
2. Place the Annual cost in the respective year column for each task. Take price increases into account by increasing the annual amount by 4% per year.
3. Place the expected annual fees and charges in each year column also increasing the amount by 4% each year.
4. Calculate the annual surplus/deficit by subtracting Total O&M Costs from Fees and charges for each year.
5. Calculate the total surplus/deficit over the 15 year life by adding the amounts on the bottom line.
6. The fees and charges are adequate if over the 15 years there is a surplus of fees and charges over costs.

Annex 4

Asset Record Form

Annex 4: Asset Record Form

Annex 4.1: Asset Record Form – Buildings

Description		
Sector		
Location		
Total Area: (sq m)		
Roof Type	Area (sq m):	Gutters:
Space Name:	Ceiling:	Windows:
Space Area:	Floor:	Door:
Ceiling Height:	Wall:	Lights:
Built In Items:	Power Outlets:	Plumbing:

Space Name:	Ceiling:	Windows:
Space Area:	Floor:	Door:
Ceiling Height:	Wall:	Lights:
Built In Items:	Power Outlets:	Plumbing:

Space Name:	Ceiling:	Windows:
Space Area:	Floor:	Door:
Ceiling Height:	Wall:	Lights:
Built In Items:	Power Outlets:	Plumbing:

Space Name:	Ceiling:	Windows:
Space Area:	Floor:	Door:
Ceiling Height:	Wall:	Lights:
Built In Items:	Power Outlets:	Plumbing:

Annex 4.2: Asset Record Form – Water Filter

Description	
Sector	Water
Location	
No of dwellings served	
Water source	
Type of process	
Construction material	

Annex 4.3: Asset Record Form – Electricity reticulation

Description		
Sector		
Location		
Total Length (m)		
No of Phases		
Poles	No:	Type:
Cables	Type	Area (sq mm)
Insulators	Type	
Circuit Breakers	Type	No.
Transformers	Type	No.

Annex 4.4: Asset record Form Roads

Description		
Sector		
Location		
Total Length (m)		
Max. Longitudinal Gradient: (%)		
No of Lanes		
Pavement	Type:	Thickness (mm):
Floodways	Size:	No:
Culverts	Size:	Length:
Road Furniture	Type	No.

Annex 4.5: Asset Record Form Bridges

Description		
Sector		
Location		
Total Length (m)		
Type of Construction		
Ultimate Design Load		
No of Lanes		
Scour protection	Type/Thickness:	Area (sq m):
Road Furniture	Type	No.

Annex 4.5: Asset Record Form Irrigation

Description		
Sector		
Location		
Water source	Type:	
Channel Lining:	Length (m)	Size:

Annex 5

Annual Operational Costs

Annex 5: Annual Operational Costs

	Resource	Unit	Unit Cost (VND)	Units per Annum	Annual Amount (VND)
Description					
Labour Cost	Supervisor				
	Labourer				
Plant & Equipment					
Consumable Items					
Sub-total					
Administration and Technical Overheads			5%		
Annual Cost					

Annex 6

Maintenance Task Lists

Annex 6: Maintenance Task Lists

Annex 6.1: Maintenance task list – Buildings

Major Task	Minor Task
Concrete maintenance	Repair concrete spalling
Metalwork maintenance	Removal of rust
	Select & apply metal primer & external finish
Roof, fascias & gutters	Clean gutters
	Repair damaged roof cladding
	Replace gutters
	Replace fascia boards
	Select & apply applied finishes
	Replace ridge capping & roof cladding
Floors, stairs & landings	Replace rotting floor boards
	Replace damaged stair structure (Timber/Metal)
	Select & apply external & internal applied finishes
Wall	Select external & internal cladding
	Select and apply external and internal applied finishes
	Repair wall structure
Windows/shutters	Replace damaged glazing
	Select and apply external & internal applied finishes to frames & security bars
	Select and install insect proof screen
	Select & install replacement frame
Doors	Select and install internal and external doors
Bathroom/Kitchen	Repair of cupboards
Security	Select and install domestic locks & latches
	Select and install cupboard locks and latches
Fire Services	Routine maintenance of fire alarms & hydrants
Ceilings	Repair damaged ceiling
Pipework inc joints	Unblocking sewers
	Disinfecting water mains
	Repairing damaged water and sewer pipes
Taps & fixtures	Repairing damaged seals
	Selecting & installing taps
Floor gullies	Repairing & cleaning floor gullies

Major Task	Minor Task
Grease traps	Cleaning & repairing grease traps
Vent pipes	Installation and repair of vent pipes
Water storage tanks	Repair of leaks on water tanks
Baths/Basins/Tubs	Cleaning blocked outlet drains
	Replacing baths/basins/tubs
W.C. suites/Urinals	Cleaning blocked outlet drains
	Repairing broken cisterns
Septic tanks	Sludge removal and disposal
Mains Connections	Routine maintenance of mains connections
Switchboards	Routine maintenance of switchboards
Light switches	Routine maintenance of light switches
Power outlets	Routine maintenance of power outlets
Light fittings	Routine maintenance of light fittings

Annex 6.2: Maintenance Task List-Water Filters

Major Task	Minor Task
Concrete maintenance	Repair concrete spalling
Water storage tanks	Repair of leaks in water tanks
Clean filter	Remove layer of sand to improve water flow rate
Rehabilitate filter	Replace sand filter material

Annex 6.3: Maintenance Task List-Electricity reticulation

Major Task	Minor Task
Mains Connections	Routine maintenance of mains connections
Power poles	Replace pole
	Repair damaged metal pole
	Repair damaged wooden pole
	Place pole vertical and repair damaged foundation
Pole Insulators	Clean pole insulators
	Replace damaged pole insulator
Circuit breakers	Repair defective seals and terminations
	Clean circuit breakers
	Replace faulty insulators after conducting insulation tests
	Replace worn clusters

Major Task	Minor Task
	Replace worn busbars
	Repair worn cable connections and terminations
Transformers	Clean transformer, remove flammable material and pest and vermin material
	Repair oil leaks
	Clean and recondition isolating contacts
	Replace primary winding protection fuses
	Repair damaged earthing connections
	Repair safety signage
Cables	Repair damaged cable ends and make good
Earthing conductors	Routine maintenance of earthing conductors
Vegetation	Trim trees and shrubs clear of infrastructure

Annex 6.4: Maintenance Task List-Roads

Major Task	Minor Task
Vegetation	Remove vegetation from shoulder and carriageway
	Trim vegetation on embankments
Culvert pipe	Cleaning culvert pipes
Outlet Channel	Clean outlet channel & cut grass
	Reinstate scoured drain
Culvert Headwall	Repair broken headwall- concrete/stone pitching
	Remove sediment and rubbish from inlet and outlet structures
Pavement	Fill potholes with pavement material and compact
	Repair of damaged bitumen seal
	Place 100 mm thick layer of pavement material and compact
Table drain	Clean table drain & cut grass
	Reinstate scoured drain
Open unlined drain	Clean open unlined drain & cut grass
	Reinstate scoured open unlined drain
Open lined drain	Cleaning open lined drain
	Repair damaged lining to open lined drain
Signage	Repair signs
Safety barriers	Repair damaged safety barriers and handrails

Annex 6.5: Maintenance Task List-Bridges

Major Task	Minor Task
Vegetation	Remove vegetation from waterway channels
	Trim vegetation on embankments
Waterway Channel	Repair scour holes adjacent to abutments
	Repair riprap adjacent to abutments
Concrete	Repair concrete spalling
Signage	Repair signs
Safety barriers	Repair damaged safety barriers and handrails

Annex 6.6: Maintenance Task List-Irrigation

Major Task	Minor Task
Vegetation	Remove vegetation from channels
	Trim vegetation on embankments
Headwall	Repair broken headwall- concrete/stone pitching
	Remove sediment and rubbish from inlet and outlet structures
Open unlined drain	Clean open unlined drain & cut grass
	Reinstate scoured open unlined drain
Open lined drain	Clean open lined drain
	Repair damaged lining to open lined drain

Annex 6.7: Maintenance Task List-Emergency Maintenance

Major Task	Minor Task
Emergency maintenance	Carry out emergency maintenance in response to climatic and geological events that damage infrastructure

Annex 7

Condition Survey Forms

Annex 7: Condition Survey Forms

Annex 7.1: Condition Survey Forms – Buildings

Infrastructure	Item	Location	Condition
Building Name:			
External areas			
Roof, facias & gutters	Gutters.		
	Roof cladding		
	Fascia boards		
	Ridge capping		
	Flashing		
Walls	Structure		
	Surface		
	Water proof		
	Protective coating		
Yard	Surface drainage		
	Pathways		
	Fencing		
	Lighting		
Internal spaces			
Flooring	Structural soundness		
	Surface		
	Drainage/dampness		

Infrastructure	Item	Location	Condition
Wall	Structure		
	Surface		
	Water ingress		
	Protecting coating		
Ceilings	Structure		
	Surface		
	Protective coating		
Windows/shutters	Frames.		
	Glazing		
	Security		
Doors	Structure		
	Surface		
	Protective finish		
	Hinges		
	Security		
Lights	Lumunaires		
	Switches		
	Globes/tubes		
Power	Power outlets		
Built in items	Cupboards		
	Taps/drains		
	Basins/sinks		

Infrastructure	Item	Location	Condition
	Others		
Septic tanks	Manholes/Openings		
	Inlet/Outlet junctions		
	Chamber		

Annex 7.2: Condition Survey Forms – Water Filter

Infrastructure	Item	Location	Condition
Name:			
Foundation	Structure		
	Ground condition		
	Flashing		
Walls	Structure		
	Surface		
	Water tightness		
	Protective coating		
Valves	Corrosion		
	Water tightness		
Sand	Contamination		
	Depth		
	Presence of algae		

Annex 7.3: Condition Survey Forms – Electricity reticulation

Infrastructure	Item	Location	Condition
Power poles	Structure		
	Foundation		
	Beams/connections		
Pole Insulators	Soundness		
	Cleanliness		
Circuit breakers	Seals and terminations		
	Circuit breakers		
	Insulators		
	Insulation test		
	Clusters		
	Busbars		
	Cable connections and terminations		
Transformers	Pests & vermin		
	Oil leaks		
	Isolating contacts		
	Primary winding protection fuses		
	Earthing connections		
	Safety signage		
Cables	Insulation		
	Terminations		
Vegetation	Dangerous trees		

Annex 7.4: Condition Survey Forms – Roads

Infrastructure	Item	Location	Condition
Carriageway	Surface condition		
	Thickness of pavement		
	Width of pavement		
Shoulder	Pothole & rutting		
	Surface condition		
	Scouring		
Embankments	Vegetation		
	Stability		
	Scouring		
Culvert pipe	Structure		
	Cleanliness		
Outlet Channel	Cleanliness		
	Scouring		
	Vegetation		
Culvert Headwall	Structure		
	Cleanliness		
Table drain	Cleanliness		
	Shape		
Signage	Structure		
	Missing signs		
	Legibility		
Safety barriers	Structure		

Annex 7.5: Condition Survey Forms – Bridges

Infrastructure	Item	Location	Condition
Waterway channel	Vegetation		
	Scouring		
Riprap	Condition		
Abutments	Structure		
	Foundation		
Deck	Structure		
Wingwalls	Structure		
	Foundation		
Signage	Condition		
	Legibility		
Safety barriers	Structure		

Annex 7.6: Condition Survey Forms – Irrigation

Infrastructure	Item	Location	Condition
Headwall	Structure		
	Cleanliness		
Open unlined drain	Wall stability		
	Scouring/sedimentation		
	Vegetation		
Open lined drain	Condition of lining		
	Cleanliness		

Limitations

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