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1. 現地調査日程表

第一次調査

	日付	曜日	活動内容	滞在地
1	1/22	月	<ul style="list-style-type: none"> 移動 (成田→マレ) 	マレ
2	1/23	火	<ul style="list-style-type: none"> MOFA_DER 協議 (Ms. Aishath AZEEMA) : 調査概要説明 MEEW_WES 協議 (Ms. Shaheeda ADAM・Mr. Ahmed WAHEED・Mr. Mohamed MUSTAFA) : 調査概要説明 英国赤十字協議 (Mr. Upagay) : 住宅建設工程確認 	マレ
3	1/24	水	<ul style="list-style-type: none"> 移動 (マレ→カドー→イシドー) 現場視察 	イシドー
4	1/25	木	<ul style="list-style-type: none"> アイランドチーフ協議 (Mr. Mohamed Ahamed) : 調査概要説明 イシドー初等中等学校協議 (Mr.Hassan, Mr. Emanuel) : 説明会についての打合せ 	イシドー
5	1/26	金	<ul style="list-style-type: none"> 移動 (イシドー→カドー→マレ) 新日本空調協議 : 水質検査 	マレ
6	1/27	土	<ul style="list-style-type: none"> 書類作成 	マレ
7	1/28	日	<ul style="list-style-type: none"> MOFA_DER 報告 (Ms. Aishath AZEEMA) : 調査結果概要説明 MEEW_WES 報告 (Ms. Shaheeda ADAM・Mr. Mohamed MUSTAFA) : 調査結果概要説明 JOCV 報告及び清算 	マレ
8	1/29	月	<ul style="list-style-type: none"> 移動 (マレ→コロンボ) JICA スリランカ事務所 : 活動報告 在スリランカ日本大使館 : 表敬、活動報告 	コロンボ
9	1/30	火	<ul style="list-style-type: none"> 移動 (コロンボ→シンガポール→成田) 	

第二次調査

	日付	曜日	活動内容	滞在地
1	3/7	水	<ul style="list-style-type: none"> 移動 (成田→シンガポール→マレ) 	マレ
2	3/8	木	<ul style="list-style-type: none"> SNK 協議 (長門氏・待鳥氏・Mr. Prasanna) : 先方負担分工事の進捗状況確認、BRC による新規住宅の接続問題、OJT 技術訓練生の能力・技量 MOFA_DER 協議 (Ms. Aishath AZEEMA) : 調査概要説明、他ドナーによる支援状況確認、JBIC 下水案件進捗状況 MEEW_WES 協議 (Ms. Shaheeda ADAM・Mr. Ahmed WAHEED・Mr. Mohamed MUSTAFA) : 調査概要説明、先方負担分工事の進捗報告、完工図書 (図面・マニュアル等) 作成状況、今後の技術支援に関する協議 	マレ

3	3/9	金	<ul style="list-style-type: none"> 移動 (マレ→イシドー) 下水処理施設サイト視察：家庭用浄化槽、第二浄化槽、土壌処理床、汚泥乾燥床、ポンプ盤 (一部バンダリズムによる破損、落書き) SNK 現場技術者 (Mr. ISHANE・Mr. PRASANNA) 及び OJT 訓練生 (Mr. JALEEL)への聴取り：訓練の内容・理解度の確認、対象地区における問題、住民の下水施設に対する意識の把握 	イシドー
4	3/10	土	<ul style="list-style-type: none"> OJT 訓練生と打合せ (Mr. RIZA, Mr. SHAREE, Mr. JALEEL, Mr. AFEEF, Mr. MOOSA, Mr. SAUDHU)：訓練参加の動機・勤労意欲・理解度の確認、維持管理における役割と責任の把握、組織運営に掛かる費用負担 診療所事務長への聴取り (Mr. Mohamed MUNAZ)：診療所の職員構成、予算確保の方法、対象地区における問題、組織運営のあり方 	イシドー
5	3/11	日	<ul style="list-style-type: none"> イシドー島事務所 (Mr. Abdul WAHEED)：住民の下水処理施設・料金徴収に関する認識、支払能力・支払意思、島事務所としての役割 カライドー島事務所 (Mr. Mohamed RAFEEU)：建設工事中に発生した諸問題、プロジェクトに関する情報不足、支払能力・支払意思、島事務所としての役割 アートル事務所 (Mr. Ali WAHEED)：維持管理体系の確立、料金徴収と費用負担、組合組織化に関する提案 	イシドー
			<ul style="list-style-type: none"> 高見沢移動 (イシドー→マレ) 	
6	3/12	月	<ul style="list-style-type: none"> MEEW_WES 協議 (Ms. Shaheeda ADAM・Mr. Ahmed WAHEED)：現地調査結果報告、現状分析、維持管理組織の形成、今後の技術支援に関する協議、他ドナー活動状況確認 	マレ 高見沢
			<ul style="list-style-type: none"> Isdhoo School 協議 (Mr. Emmanuel) Seminar の内容、日時、出席者等 Kalaidhoo School 協議 (Mr. Niman) Seminar の内容、日時、出席者等 	イシドー 堀米
7	3/13	火	<ul style="list-style-type: none"> MEEW：維持管理組織構造に関する検討 	マレ 高見沢
			<ul style="list-style-type: none"> Seminar 用リーフレット作成 必要工具リスト、スペアパーツリスト作成、SNK 長門所長に確認 両校長に挨拶、協力依頼 (Isdhoo-Mr. Rajan, Kalaidhoo-Mr. Asokan) 	イシドー 堀米
8	3/14	水	<ul style="list-style-type: none"> MEEW：維持管理費および料金徴収に関する検討 	マレ 高見沢
			<ul style="list-style-type: none"> 酵素材料集め Seminar 用リーフレット作成 リーフレット印刷 450 枚 	イシドー 堀米

9	3/15	木	<ul style="list-style-type: none"> UNICEF 協議 (Mr. David PROUDFOOT) : 実施中プロジェクトの仕様、進捗状況、維持管理に関する方針、住民教育活動 IFRC 協議 (Ms. Kathryn CLARKSON) : 実施中プロジェクトの仕様、進捗状況、維持管理に関する方針、操作員トレーニング、住民教育活動 	マレ 高見沢
			<ul style="list-style-type: none"> Seminar 原稿作成 リーフレット印刷 450 枚 	イシドー 堀米
10	3/16	金	<ul style="list-style-type: none"> 文書作成 	マレ 高見沢
			<ul style="list-style-type: none"> 9:00-10:30 Isdhoo School 子供向け Seminar 合計 135 人 2:00-3:00 Isdhoo School 大人向け Seminar 合計 7 人 4:00-5:30 Kalaidhoo School 大人向け Seminar 合計 39 人 	イシドー 堀米
11	3/17	土	<ul style="list-style-type: none"> 文書作成 	マレ
			<ul style="list-style-type: none"> 9:00-10:30 Kalaidhoo School 子供向け Seminar 合計 83 人 写真整理 	イシドー 堀米
12	3/18	日	<ul style="list-style-type: none"> MEEW_協議 (Mr. Abdul RASAAK) : 維持管理における役割と責任の把握、運営維持管理費の行政負担、維持管理組織の職員の雇用、維持管理組合の組織化について、下水施設維持管理に関する長期政策・方針 	マレ
			<ul style="list-style-type: none"> 水質検査用サンプリング 島事務所打ち合わせ、学校お礼の挨拶 堀米移動 (イシドー→マレ) 	イシドー 堀米
13	3/19	月	<ul style="list-style-type: none"> 国内打ち合わせ MOFA_DER 協議 (Ms. Aishath AZEEMA) : バングラジムの被害による追加修理・施設保護工事への見返資金の充当、BRC 住宅建設地の盛土の問題、維持管理職員の雇用 MEEW_WES 協議 (Ms. Shaheeda ADAM) : 維持管理体系の枠組み 	マレ
14	3/20	火	<ul style="list-style-type: none"> JICA 飯田所員と合流・打合せ 移動 (マレ→イシドー) イシドー島事務所表敬 (Mr. Abdul WAAHID) カライドー島事務所表敬 (Mr. Mohamed RAFEEU) OJT 訓練生への聴取り (Mr. RIZA, Mr. SHAREE, Mr. JALEEL, Mr. AFEEF, Mr. MOOSA, Mr. SAUDHU) : 訓練内容の充実度、組織成立後の勤務時間・勤務形態に関する検討、施設警護の方法 移動 (イシドー→マレ) 	マレ
15	3/21	水	<ul style="list-style-type: none"> MWSA 協議 (Mr. Abdul MOHAMED) : MWSA 家庭排水ガイドライン、モニタリング計画、水質分析項目 MEEW_WES 協議 (Mr. Ahmed WAHEED) : 維持管理体系の構築に関する長期方針、維持管理職員の雇用、運営維持管理費の行政負担、人材育 	マレ

			<p>成、モニタリング評価、住民参加促進のための活動</p> <ul style="list-style-type: none"> • MOFA_DER 協議 (Mr. Ali Nasser MOHAMED, Ms. Aishath AZEEMA) : 見返資金の充当、BRC 住宅建設地の盛土の問題、維持管理職員の雇用 • JOCV 協議 (齋藤調整員、岩重調整員) : 住民教育活動への JOCV 環境教育隊員の協力、組合関連法規の英訳 	
16	3/22	木	<ul style="list-style-type: none"> • MEEW 協議 (Mr. Waheed) お絵描き、植樹のフォローアップ • JOCV 報告及び清算 • 書類作成 	マレ
17	3/23	金	<ul style="list-style-type: none"> • 移動 (マレ→コロンボ) • JICA スリランカ事務所 : 活動報告 • 在スリランカ日本大使館 : 表敬、活動報告 	コロンボ
18	3/24	土	<ul style="list-style-type: none"> • 移動 (コロンボ→成田) 	

2. 主要面談者

Ministry of Foreign Affairs (MOFA)

Mr. Ali Nasser MOHAMED Assistant Director General
Ms. Aishath AZEEMA Assistant Director

Ministry of Environment, Energy and Water (MEEW)

Mr. Abdul RAZAAK Deputy Minister
Ms. Shaheeda ADAM Assistant Director General
Mr. Ahmed WAHEED Assistant Director
Mr. Mohamed MUSTAFA Environmental Analyst

Maldives Water and Sanitation Authority (MWSA)

Mr. Abdul ALEEM Senior Environmental Analyst

Laamu Atoll Office

Mr. Ali WAHEED Laamu Atoll Chief

Isdhoo Island Office

Mr. Abdul WAAHID Isdhoo Island Chief

Kalaidhoo Island Office

Mr. Mohamed RAFEEU Kalaidhoo Island Chief

Isdhoo/Kalaidhoo Island Health Centre

Mr. Mohamed MUNAZ Secretary

Isdhoo/Kalaidhoo Sewerage Construction Office

Mr. Ahmed RIZA Trainee
Mr. Ali SHAREE Trainee
Mr. Rasheed JALEEL Trainee
Mr. Hussain AFEEF Trainee
Mr. Ahmed MOOSA Trainee
Mr. Ibrahim SAUDHU Trainee

United Nations Children's Fund (UNICEF)

Mr. David PROUDFOOT Programme Officer (Water & Sanitation)

International Red Cross and Red Crescent Society (IFRC)

Ms. Kathryn CLARKSON Head of Delegation (Water & Sanitation)

3. 下水処理システム運営維持管理に係る提案書（英文）

O&M SYSTEM OF ISDHOO AND ISDHOO/KALAIIDHOO SWERAGE PROJECT

1. INTRODUCTION

a) Background

Most of the islands in the Maldives have been affected by the Indian Ocean Tsunami on 26 December 2004. Sewage from damaged sanitation facilities is one of the main reasons for groundwater deterioration. After the Tsunami, the Government of Japan represented by Japan International Cooperation Agency (JICA) has provided aid assistance to the Maldives. As one component of the emergency project, a sewerage system with treatment facilities has been constructed in L. Isdhoo and Isdhoo/Kalaidhoo. Construction of the facility is nearly completed; however, the appropriate O&M system has not been established. The systematic O&M structure is crucial for sustainability of the project. JICA, therefore, despatched a study mission in order to identify the needs and feasibility of further assistance from the Government of Japan to the Government of Maldives.

b) Current Issues

A field trip to Isdhoo and Isdhoo/Kalaidhoo was made by the study team (9-11 March 2007) to identify the current problems on site. The team found that, there are still some gaps to be filled for smooth start-up and sustainable operation and management of the sewerage system. The main issues to be discussed are listed below.

1. Financial arrangement

- Salary of O&M staff is not secured by MEEW/GOM.
- Annual budget and subsidy for the system is not planned.
- Fund for replacement cost of facilities should be saved.
- Fee collection mechanism is not yet established.

2. Institutional arrangement for O&M office

- Institutional structure is not clearly defined.
- Trainees' positions, job description and tasks shall be clearly identified
- Management and financial procedures and protocols shall be developed.
- Training programme for the staff must be prepared.

3. Vandalism

- Sense of ownership and responsibility is very low among the islanders.
- Community education and awareness about the system is relatively low.
- Part of cost for repair and replacement shall be covered by the community.

This paper is intended outline key issues regarding the sustainable operation and maintenance of the system and awareness of the beneficiaries on the importance of the system.

c) Definitions

Sustainability relies on the effective management of operation and maintenance activities. A service is sustainable when:

- It is functioning and being used,
- It is able to deliver an appropriate level of benefits,
- Its management is institutionalized,
- Its operation, maintenance, replacement and administrative costs are covered at local level,
- It can be operated and maintained at local level with appropriate and feasible external support,
- It doesn't have negative environment effect.

Operation deals with the actual running of a system for instance starting pumps, driving vacuum truck, or handling sludge. **Maintenance** deals with the activities that keep the system in proper working condition, including management, cost recovery, repairs and preventive maintenance.

- *Preventive maintenance*: regular activities undertaken in response to prescheduled systematic inspection, repair and replacement. This will lead to continuous service, O&M costs spread over time, extension of facilities' lifetime, user's satisfaction and willingness to pay.
- *Crisis maintenance*: maintenance undertaken only in response to breakdowns and/or public complaints. This will lead to poor service, high O&M costs, faster damage of equipment, and user's dissatisfaction. (Not recommended)

Management deals with the control and organization of a service and involves the following major functions:

- Development of a vision and strategy
- Planning
- Organization and mobilization of resources
- Administration
- Accounting
- Leadership, motivation of personnel
- Supervision, monitoring and evaluation
- Promotion of external relationships

d) Management of O&M

Operation and Maintenance are the key words towards improving performance and sustainability of the sewerage service. The implementation of **O&M is not just a technical matter**, but also includes social, community, institutional, financial, political, environmental aspects. Systematic O&M structure, therefore, should be planned and organized at both local and national levels. ***Management*** of O&M must be worked at the local level with appropriate technical, institutional and financial support from local and national authorities and other concerned parties including private sector.

e) Situation Analysis

There are several interrelated factors which affecting performance and effectiveness of O&M. The current situation was analyzed based on the following factors.

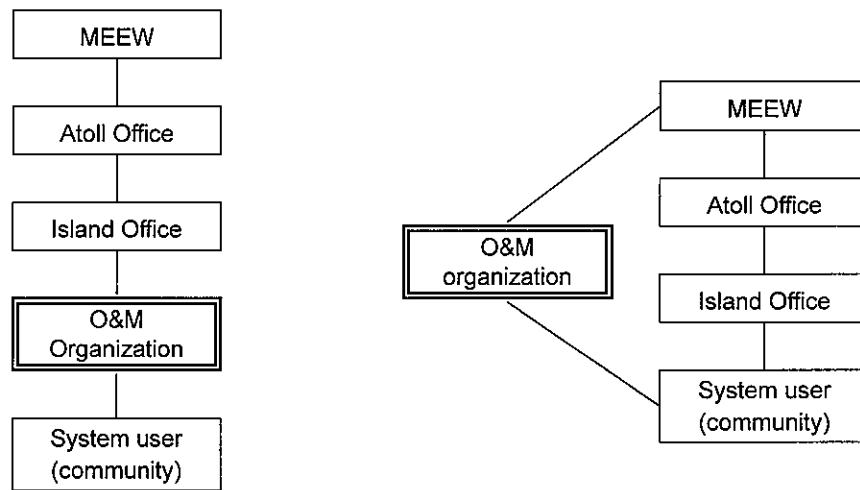
Factors	Situation	Action to be taken
Technical factors		
▪ Technology choice and its complexity	Advanced, complex	Training in technical skills, illustrating system diagram
▪ Its level of compliance to a demand	Complying the demand	
▪ Environmental impact	Low	
▪ Skills required for O&M	Medium level	Training in technical skills
▪ Spare parts availability and costs	Some are not available	Keeping list of suppliers, saving O&M fund
▪ Maintenance costs	Relatively high	Establishing cost recovery mechanism
Community factors		
▪ Availability of skills for O&M, minor & major repairs	Technical O&M training (OJT) conducted	Employing the trainees as O&M staff
▪ Willingness and ability to pay	Low willingness to pay	Raising user awareness
▪ Participation of all community groups	Low	Conducting meetings for community participation
▪ Financial & administrative management by legitimated community structure	Managerial skills are not available	Employing and training in management
▪ Felt need for an improved service	Low (vandalism)	Conducting meetings for community awareness
▪ Social and cultural aspects & behavior	Internal island matters	Cooperating with local authorities
▪ Level of ownership and responsibility	Low	Conducting meetings for community awareness
Legal and institutional framework		
▪ Clear policy & strategy towards O&M	Under preparation	Establishing regulations
▪ Technical assistance, training, monitoring	Not planned yet	Developing training and monitoring plan
▪ Setting up of alternative financial mechanisms	Not planned yet	Developing financial plan
▪ Financial arrangement for cost recovery	Under preparation	Establishing cost recovery mechanism
Environmental factors		
▪ Groundwater quality & quantity	Impact unknown	Monitoring water quality
▪ Island and marine environment	Impact unknown	Monitoring environment

As summarized above, it is urgent to plan and take action to strengthen the institutional frameworks and to improve the community issues.

2. INSTITUTIONAL ARRANGEMENT

a) Institutional structure

There are two basic options of the institutional structure, centralized and decentralized structure.



Option 1: centralized structure

Option 2: decentralized structure

The management of the O&M at local level is the long-term strategy of MEEW. It is recognized by the stakeholders that the O&M organization must be independent with the link to Atoll and Island offices. A proper management plan and protocols of the system must be developed. The proposed set-up is also important in the island with two communities and two administrations where social disputes are common. Therefore the decentralized structure is preferable option for the project sustainability.

b) Management Options

There are several management options for the sewerage system, in combination of ownership and responsibilities between the public, private and social (community organization) sectors. The options are summarized in Annex-1.

The suitable O&M management model must be selected with consideration of the several key issues such as: capacity of existing community organizations; community awareness and participation; complexity of technology; availability of spare parts; cost recovery mechanisms; willingness to pay; Regional economies; logistics/transportation; government leadership; strength of government staff; regional development; policies and legislation; communication/information sharing.

c) Establishing O&M Cooperative Society

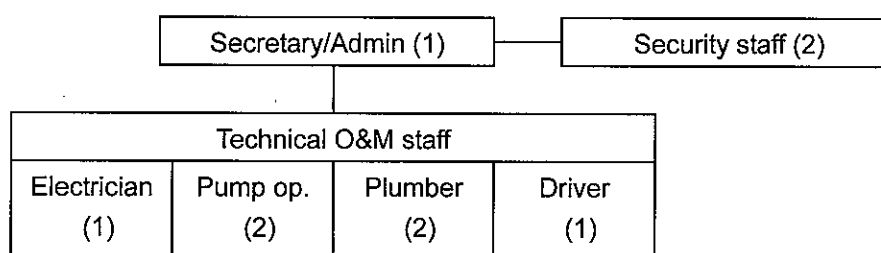
JICA study team recommend the MEEW to establish an O&M Cooperative for this sewerage system in Isdhoo/Kalaidhoo. The concept of cooperative societies is introduced by the loan project of ADB electrification project in the energy sector of MEEW. Currently the government of Maldives is working on legislation of 'the cooperative society law' to facilitate the establishment of cooperative societies in the islands. Therefore, if this option of cooperative is selected as the management model of the Isdhoo and Isdhoo/Kalaidhoo sewerage system, the organization should follow the legislation.

d) Staffing

The OJT has been conducted by the contractor to train 6 people selected from each island. All the trainees enhanced technical skills and knowledge of the sewerage system. As they are capable and willing to work for operation and maintenance of the system, they are nominated for the O&M staff. However, their managerial and financial capacity was never developed under the OJT. It is urgent to find the candidates for the manager and financial staff and train them for effective management of the O&M system.

The short-term and long-term organizational structures were proposed by MEEW.

(1) Initial (tentative) structure



Initial (tentative) structure

The above structure is tentative arrangement tailored to the available personnel: 6 technical staff, 1 secretary and 2 security staff. It is ideal to employ managerial and financial staff; however, currently such qualified persons are not available in the island. It is, therefore, proposed to engage one secretary as an administrative staff. The secretary and technical staff shall be trained in management skills, including human resource management, billing/finance and customer relations.

▪ Secretary/Administrator

The secretary is responsible for administrative works including maintaining financial records, issuing salaries, sending and collecting bills, liaison with customers and authorities.

▪ Technical O&M staff

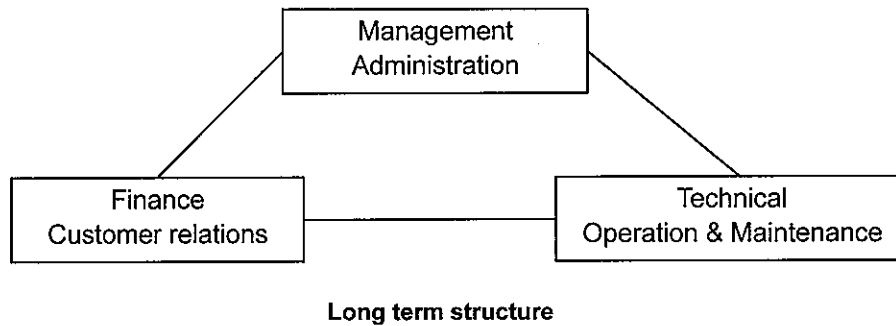
The technical staff is in charge of daily operation and preventive maintenance of the system. For the initial arrangement, the following positions will be recruited.

- Electrician: checking pump control panels, repairing pumps
- Pump operator: operating pumping system
- Plumber: patrol and monitoring of sewer pipes and treatment facilities
- Vacuum car operator: desludging, cleaning septic tanks

▪ Security officer

The security is in charge of patrolling and protecting the facilities against any damage or theft. They will have day and night shifts so that system components are under guard.

(2) Long-term structure



The O&M organisation will be reorganized into systematic structure after the business on truck. The organisation will consist of three sections, management, finance and technical. As the cooperative shall be independent from government support, the structure must strengthen the management and financial section.

The major roles of each section are as follows.

- **Management /Administration**

The manager is responsible for overall management and administrative works. The manager's tasks are long and short-term planning, human resource management, trouble shooting, and regular correspondence with the MEEW and other relevant authorities.

- **Finance/Customer relations**

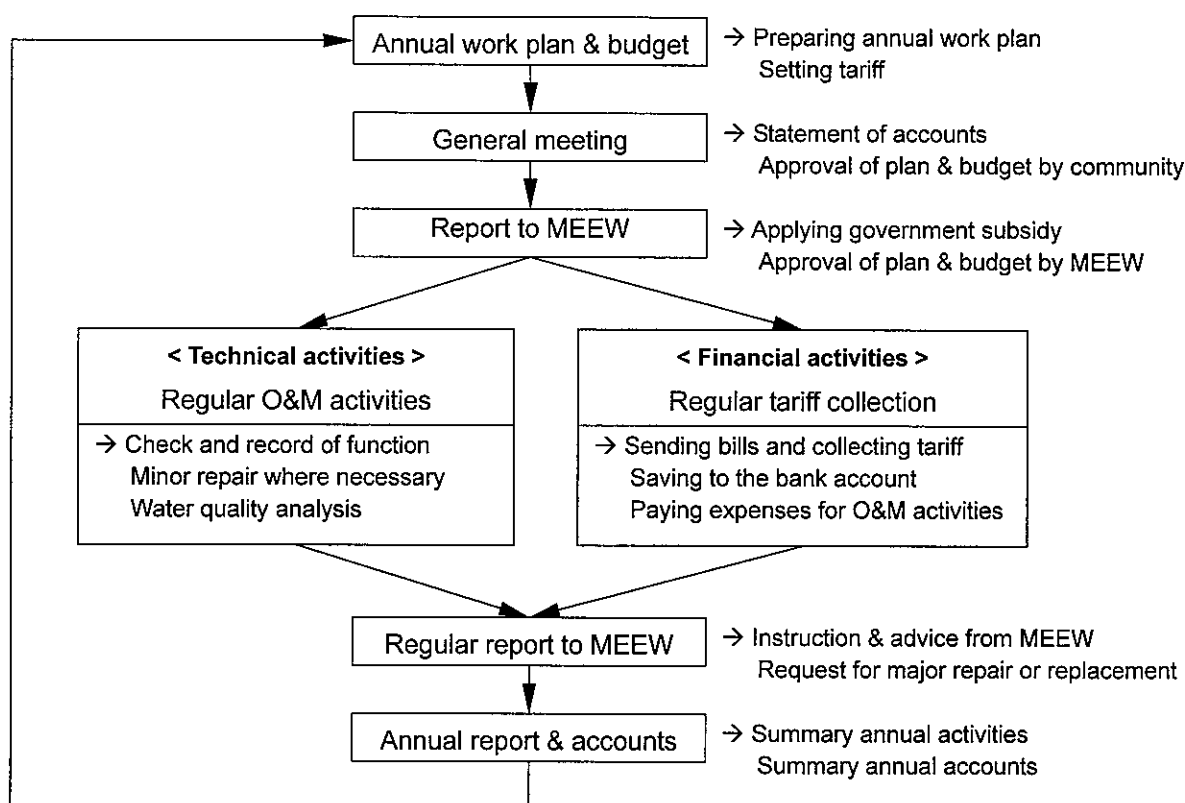
The financial manager or accountant is responsible for accounting, finance and procurement. The task includes maintaining all financial records, managing reserved fund, issuing salary, preparing bills and collecting tariff.

- **Technical O&M**

The personnel structure of the technical staff might be changed from the initial organisation. Even though the positions are changed, they are responsible for daily operation and preventive maintenance in order to provide continuous services to the community. The main activities are pump operation, patrol and monitoring of sewer pipes and treatment facilities, vacuum car operation and desludging, minor repairs, and any other technical works.

e) Activities

The routine of their activities is PLAN→APPROVE→DO→REPORT→REVIEW. Both technical and financial activities needs to be planned, approved, done, reported and reviewed. MEEW should always supervise their activities and give advice to improve their performance.



Documentation and reporting

Both technical and financial activities carrying out by the O&M staff need to be recorded and regularly checked by the service users and MEEW. The MEEW is responsible to facilitate the O&M office to carry out the systematic reporting and documentation.

The following documents are essential for carrying out and monitoring the O&M activities.

- System drawings & Operation manuals
- Business plan
- Annual work plan & budget
- Log book
- Daily/ weekly/ periodical reports
- Repair and replacement records

f) Roles and Responsibilities

For effective management of O&M, the roles and responsibilities of the government and community must be clearly defined. MEEW is ultimately responsible for providing the sustainable service as the implementing agency, supervising all the system operation, staffing and financial management. The monitoring of water quality is mandate of MWSA; therefore MEEW shall prepare the monitoring plan together with MWSA.

Local authorities may not be involved directly to the O&M management. The Atoll office, however,

plays an important role in coordinating the local politics. Therefore, the Atoll authority is expected to provide relevant support and instruction to the island community.

The proposed responsibilities for specific O&M tasks are listed below.

Government responsibility

Technical tasks

- Document all the drawings, design and operation manuals
 - Periodically check the report & record of O&M activities
 - Conduct monitoring of system performance, effluent and groundwater quality
 - Conduct major repairs, rehabilitation and extension of the system
-

Administrative & financial tasks

- Analyse the O&M activities for use in planning and budgeting
 - Select and recruit the O&M staff, allocate the budget for their salary
 - Develop and evaluate technical, financial and management training for O&M staff
 - Provide adequate technical, financial and management training to O&M staff
 - Develop information and material for community mobilization and awareness
-

Community (O&M staff) responsibility

Technical tasks

- Conduct daily pump operation and regular checks and adjustment of facilities
 - Monitor the septic tanks for filled-up, leaks, wear and tear, repair if needed
 - Regularly desludge the septic tanks and clean sewer pipes
 - Record and compile all daily & regular O&M activities
 - Manage stock of spare parts, tools and other supplies
-

Administrative & financial tasks

- Prepare annual budgets and long-term financial estimates
 - Collect tariffs and manage revenue
 - Make payments for purchase, loans and other obligations
 - Respond users complaints and improve customer relations
 - Organize and conduct general meetings for discussion
-

3. FINANCIAL MANAGEMENT

Financial management is the most important activity for sustainable system operation. The basic aspects of a financial management which has to be considered are summarised in Appendix-2.

a) Budgeting

In order to estimate monthly O&M expenditure, it is proposed to budget for the following items.

- Recurrent cost (electricity, fuel; maintenance of facilities, vehicle and motorbike)
- Replacement cost (reserved fund for future replacement of pumps, panels and vacuum truck)
- Personnel cost (allowance for staff, office expenses)

The following table shows the cost breakdown and estimation for in the sewerage system O&M.

Category	Item	Estimation
Operation cost	Electricity	Sewage 50lcd; population 1,800; pump capacity 14m ³ /h 50lit/day x 30days x 1800 = 2,700,000 lit = 2,700m ³ 2,700 / 14 m ³ /h x 0.7 kW x 3 Rf/kWh = 405 Rf/month
	Fuel for vehicle (diesel)	Running 45km weekly; mileage of 10km/lit 180 km/month / 10 km/lit x 9 Rf/lit = 162 Rf/month
	Fuel for motorbike (gasoline)	Running 60km weekly; mileage of 20km/lit; 4 motorbikes 240 km/month / 20 km/lit x 11 Rf/lit = 132 Rf /month/bike 4 bikes x 132 Rf/month = 528 Rf/month
	SUBTOTAL	405 + 162 + 528 = 1,095 Rf/m
Maintenance cost	Sewer pipes	Repair of clogged pipe, leakage etc = 100 Rf/month
	Treatment facilities	Cleaning and desludging activities = 100 Rf/month
	Vehicle & motorbike	Oil, battery, spare parts = 300 Rf/month
	SUBTOTAL	100 + 100 + 300 = 500 Rf/m
Replacement cost (reserved fund)	Sewage pump	Cost for pump USD300; 5years lifetime 300 x 12.75 Rf/\$ x 36 pumps = 137,700 Rf 137,700Rf / 5year / 12month = 2,295 Rf/month
	Control panel	Cost for panel USD1,000; 15years lifetime 1,000 x 12.75 Rf/\$ x 36 panels = 459,000 Rf 459,000Rf / 15year / 12month = 2,550 Rf/month
	Vacuum vehicle	Cost for vehicle Rf 360,000; 15years lifetime 360,000Rf / 15year / 12month = 2,000 Rf/month
	SUBTOTAL	2,295 + 2,550 + 2,000 = 6,845 Rf/m
Personnel cost	Allowance	Monthly allowance Rf2,300/person ; 7 staffs 2,300 Rf/pers x 7pers = 16,100 Rf/month
	Office expense	Bill for electricity, phone etc (lump-sum) = 1,000 Rf/month
	SUBTOTAL	16,100 + 1,000 = 17,100 Rf/m
TOTAL-A (recurrent cost only)		1,600 RF/month (5 Rf /hh: 340 households)
TOTAL-B (recurrent + replacement)		8,500 Rf/month (25 Rf/hh)
TOTAL-C (all costs)		25,600 Rf/month (75 Rf /hh)

Total monthly cost is estimated Rf25,600 (\$2,000; Rf75/hh), which is equivalent to Rf307,200 (\$24,000; Rf900/hh) annual. The recurrent cost will be Rf1,600 (\$126), and replacement cost will be Rf6,845 (\$537) per month. The estimated personnel cost is Rf17,100 (\$1,341), but it depends on the number of staff, thus this figure need to be adjusted to the structure of O&M management.

b) Source of Income

The major sources of income will be the user payments and government subsidy. The MEEW has stated that the personnel cost will be covered by the government. It was also announced that the O&M cost for the first year of operation will be fully subsidized by the central government. Therefore, planning for tariff collection system can be deliberated among the stakeholders during the first year of operation.

▪ *Government subsidy*

It is prerequisite for the O&M management to secure the source of income to cover the O&M cost for continuous operation. The current organization is very weak especially in financial management due to the lack of experience of all stakeholders to manage the sewerage system. It is, therefore, crucial for the government to provide appropriate technical and financial support to the O&M organization until their managerial and financial capacity is strengthened. As mentioned above, the government plan to employ the O&M staff as government officials but the staffing is still not finalised, so the personnel cost cannot be estimated yet. MEEW is responsible to organize the structure and secure the personnel cost at the earliest possible.

▪ *Monthly tariff*

Even though there are some other options to collect the money, monthly tariff collection is highly recommended for effective management. Tariff setting depends on the other source of income, such as government subsidy and cooperative funds. An example of tariff setting with step reduction in subsidy and rise in tariff is shown below.

Monthly income	Year 1	Year 2-5	Year 6-10	Year 11-after
Tariff collection	0	Rf 3,200	Rf 5,000	Rf 8,500
Govt. subsidy	Rf 25,600	Rf 22,400	Rf 20,600	Rf 17,100
Total	Rf 25,600	Rf 25,600	Rf 25,600	Rf 25,600
Tariff /household	0	Rf 10	Rf 15	Rf 25

A detailed financial analysis including depreciation of currency must be carried out, either when financial training is provided or before the tariff collection starts after a year. The tariff structure need to be approved by the MWSA.

- *Income generating activities*

The trainees of OJT have some idea of income generating activities such as planting crops to the treatment beds, charging septic tank cleaning service, and selling the composted sludge. Also, as the building has been used as the contractor's site office and will be handed over to the O&M organisation, there are couple of extra rooms which can be used for rent after renovation.

Such business mind can be encouraged to promote self-reliance. Good business model of such as MWSC need to be transferred to the O&M staff.

c) Tariff Collection

- *Willingness to pay*

Community have been informed the tariff collection since the design stage. However, paying for sewerage service is the first experience; without water service, some users may be reluctant to pay. Therefore, continuous community mobilisation activities are necessary to foster the sense of ownership and responsibility of the service users.

- *Tariff collection*

The mechanism for tariff collection can be considered; how to collect, who and when to collect, and where to save the collected money. If Isdhoo and Isdhoo/Kalaidhoo had one power supply system, then collecting money together with electricity bills might be the efficient option. However, there are two power houses operated by different island development committees in the island, it will be less effective. Sending monthly bills and collecting tariffs independently are recommended for this system. Either the administrative staff or technical staff of O&M organization can visit each household and collect bills.

d) Financial Administration and Monitoring

- *Bank account*

It is recommended that the O&M office opens a bank account and save the money collected from the community and subsidized by the government. The fund will be used to cover recurrent cost, minor repairs and reserved for replacement and future extension of the system. The bank account will be managed by the O&M administration staff. The movements of expenditures and incomes will be kept in a log book, and monitored by the Atoll authority periodically.

- *Control and monitoring*

Financial control and regular monitoring is important to maintain transparency of the financial management. The summary of annual accounts must be reported to the users. Regular auditing by the local auditor to review the accounts is recommended. It is also ideal if the financial statements will be analysed by the government to identify the financial status and take preventive measures where necessary.

4. MONITORING PROGRAMME

Two agencies are responsible for the monitoring namely MWSA and MEEW. MWSA is in charge of monitoring the impacts of the system to the water lens and aquifer. In this regard MWSA shall establish appropriate monitoring plan for the system. The monitoring plan can be developed in accordance with the Domestic Waste Water Guideline prepared by MWSA. Moreover, MEEW shall monitor the system performance and evaluate the overall project operation. This will help to measure and assess the performance, systematic data tracking and review the progress. It is advisable that MEEW shall facilitate the monitoring programme and ensure proper implementation. In this regard appropriate reporting mechanisms need to be developed and shared with the relevant agencies. Moreover, training and capacity building of the O&M staff shall be considered as an integral part of the monitoring programme.

Financial arrangements for conducting the monitoring programme shall be made available for MEEW, MWSA and other relevant stakeholders.

a) Water Quality Monitoring

MWSA has plans to develop the water quality database using GIS. It was also found that MWSA plans to prepare water quality monitoring programme and database for Isdhoo and Isdhoo/Kalaidhoo. This aims to monitor the long-term impacts on groundwater and the treatment performance of the facilities. The monitoring activities such as sampling, analysis and reporting can be carried out at the island level. Training in water sampling and analysis to the O&M staff, as well as selection of sampling points, will be organized by MWSA in coming weeks. The sampling points shall be 30, about 10% of household number. Sampling and on-site analysis of some items and sending the reports to MWSA monthly basis is planned. The framework for water quality monitoring is summarised as follows.

Items	Indicators	Data collection			Use of data		
		Source of information	Who collects?	When?	Information flow	Who analyses?	Who takes action?
Groundwater	pH, EC, salinity, bacteria, NO ₃ , PO ₃	Monitoring wells	O&M staff	monthly	Record in formats	O&M staff	MWSA
Treatment Effluent	BOD, COD, SS, bacteria, NO ₃ , PO ₃	Treatment facilities	O&M staff	monthly	Record in formats	O&M staff	MWSA

b) System Performance Monitoring

MEEW has already developed the Performance Indicators (PIs) for monitoring and evaluation (Refer to Appendix-4). Those PIs can be applied to use in motoring of this system. It is planned to mobilise the O&M staff to collected relevant data, however, establishment of the survey methods, preparing the monitoring format, and training of O&M staff have not been yet planned. The establishment of M&E system is one of urgent tasks of MEEW.

c) Other aspects of Monitoring

One of the main aims of the system is to provide better sanitation facilities for the community, and which will ultimately help to improve the health and well being of the people specially the children. The system will also have other socio-economic benefits for the target population i.e. creating job opportunities and enhance regional development after introducing better infrastructure in the island. The socio- economic benefits of the system shall also need to be monitored and appropriate mechanisms also need to be established in this regard.

Monitoring Items	Who collects?	When?	Evaluation Items	Who collects?	When?
Service level and user satisfaction	O&M staff	annually	Planning & design process	MEEW	After commission
Technical system performance	O&M staff	monthly	Tender and contract procedure	MEEW	After commission
Financial status	O&M staff	monthly	Implementation stage	MEEW	After commission
Institutional arrangement	O&M staff	monthly	Overall project quality	MEEW	After commission
Social, health, environment impacts	O&M staff	annually			

d) Project Evaluation

Each project must be evaluated its operation from the planning stage to the implementation. This Isdhoo and Isdhoo/Kalaidhoo sewerage system was implemented as one of the Tsunami recovery and reconstruction programme, therefore, project operation process have been irregular in some extent. However, whatever the type of the project, the lessons learned from the project operation can be applied to the next project. In order to improve the performance and quality of the constructed systems, MEEW is responsible to carry out the final evaluation of this project.

5. CONCLUSION AND RECOMMENDATION

It is the first experience for the local island in the Maldives to operate and maintain the sewerage system with treatment facilities. MEEW, as the implementing agency, is expected to facilitate the system operation and maintenance in effective and sustainable manner.

The paper outlines the possible alternatives and recommended options for the O&M structure. In preparation of this document, we have consulted with different levels of the stakeholders, especially with MEEW. So now the ball is in MEEW's court. Some important issues are still pending and the solutions must be clearly indicated by the responsible agency. The pending issues are listed below.

A. Institutional setup

- Selection of appropriate management option for establishment of Isdhoo and Isdhoo/Kalaidhoo (Cooperative Society?)
- Demarcation of roles and responsibilities (Who is the owner? service provider?)
- Handing-over process and preparation of MOU (When? To whom? What to be agreed?)

B. Financial assistance

- Recruitment of O&M staff and allocation of their salary (How many staff? How much?)
- Allocation of government subsidy (For what extent? How long?)
- Preparation of tariff mechanisms (How much? When? Who? How to collect?)

C. Community mobilisation

- Conducting of education and awareness activities by involving schools such as planting and painting (When? Who's in charge?)
- Conducting agricultural activities to generate the other source of income (How? When? Who?)
- Prevention of vandalism and promotion of proper use of facilities (How? When? Who?)

D. Monitoring and evaluation

- Establishment of M&E system (How to collect data, analyze and report? When? Who?)
- Conducting project evaluation for feedback to other project (What extent? When?)

One of the greatest challenges facing MEEW is the need of motivating and training all level of the stakeholders. This challenge is also made difficult by the social/political nature of the Isdhoo and Isdhoo/Kalaidhoo. Therefore, fostering positive atmosphere in the operation and maintenance activities is essential. It is highly recommended that MEEW should take the initiative in motivating all individuals and giving respects to those who are working in this project.

APPENDIX-1 LIST OF PERSON CONTACTED

Ministry of Foreign Affairs (MOFA)

Mr. Ali Nasser MOHAMED Assistant Director General
Ms. Aishath AZEEMA Assistant Director

Ministry of Environment, Energy and Water (MEEW)

Mr. Abdul RAZAAK Deputy Minister
Ms. Shaheeda ADAM Assistant Director General
Mr. Ahmed WAHEED Assistant Director
Mr. Mohamed MUSTAFA Environmental Analyst

Maldives Water and Sanitation Authority (MWSA)

Mr. Abdul ALEEM Senior Environmental Analyst

Laamu Atoll Office

Mr. Ali WAHEED Laamu Atoll Chief

Isdhoo Island Office

Mr. Abdul WAHEED Isdhoo Island Chief

Kalaidhoo Island Office

Mr. Mohamed RAFEEU Kalaidhoo Island Chief

Isdhoo/Kalaidhoo Island Health Centre

Mr. Mohamed MUNAZ Secretary

Isdhoo/Kalaidhoo Sewerage Construction Office

Mr. Ahmed RIZA Trainee
Mr. Ali SHAREE Trainee
Mr. Rasheed JALEEL Trainee
Mr. Hussain AFEEF Trainee
Mr. Ahmed MOOSA Trainee
Mr. Ibrahim SAUDHU Trainee

United Nations Children's Fund (UNICEF)

Mr. David PROUDFOOT Programme Officer (Water & Sanitation)

International Red Cross and Red Crescent Society (IFRC)

Ms. Kathryn CLARKSON Head of Delegation (Water & Sanitation)

APPENDIX-2 MANAGEMENT OPTIONS

a) Direct public management	
▪ Direct administration	Administration by the public service or government department, with no autonomous budget. Controlled by the local authority.
▪ Autonomous administration	Administration by the public service or government department, with autonomous budget and separate services.
b) Semi-direct public management	
▪ Inter-authority administration	Administration agreements between several authorities, with a coordination unit controlled by the government, for managing the system.
▪ Direct or autonomous admin. with some activities delegated to other firms	Administration by the public service, with activities delegated under a contractual service agreement to other firms for a specific task, and a limited period of time.
c) Delegated management	
▪ Management contract to a firm or individual	While the government remains responsible for the service in investment and tariff setting, it delegates their management to a firm or an individual, under a remuneration contract.
▪ Special management contract to a firm or an individual	Same as management contract described above, but with a remuneration based on a fixed agreement with the government and a percentage of the collected tariffs.
▪ Leasing/renting contractual arrangements with a firm	The government establishes a contract with a firm, which will not be responsible for the investments, but only for the operation and maintenance of the system, whose remuneration comes through collected tariffs.
▪ Public administration (Cooperative association)	Distinct legal status and financial autonomy. Controlled by the Assembly of Associates (where the local authority is a member among others), with the authorization of the government.
▪ Concession to community associations	Associations created by a General Assembly of users, with the authorization of the government. It manages and operates the system.
▪ Concession to a private firm or society	Under a contractual agreement between the firm and the government, the firm will fully manage, operate and maintain the system, with complete financial autonomy. The firm will invest with its own resources, at its own risks, but the government must approve them.
d) Private management	
▪ BOOT contractual agreement (Build-Own-Operate-Transfer). BOT (Build-Operate-Transfer); BOO (Build-Own-Operate); Inverse BOOT.	Under a contractual agreement, a private firm is totally responsible for the construction, operation and management of a system, but will transfer it to the government at the end of the contract, which is usually long term. For the inverse BOOT, the public authority builds, but the system becomes private at the end of the contract.
▪ Private management with public/private capital	Private company whose shares are public and private; some control is kept at the shareholders' assembly.
▪ Private management	Private company owns the system and is totally responsible.

(Adopted from IRC and WHO, 2000)

APPENDIX-3 FINANCIAL MANAGEMENT

Financial management is the most important activity for sustainable system operation. Based on the annual operation and maintenance activities, preparation of budget and summary of accounts have to be available annually, so that the users and other stakeholders can monitor the proper management. The basic aspects of a financial management which has to be considered re summarised as follows.

1. Budgeting

- What cost to budget for?
- What sources of income to use?

2. Arrangement of financial flows

- How to collect the money?
- When to collect the money?
- Who collects the money?
- Where to keep the money?

3. Financial administration

- How to register movements of expenditures and incomes?
- Who administers the funds?
- What are funds used for?
- Who orders payments?

4. Financial control and monitoring

- What type of financial control?
- How to monitor?
- What to do with bad payers?

The possible options for above questions are listed below.

1. Budgeting

Financial management issues	Possible options
What cost to budget for?	<ul style="list-style-type: none">▪ Administrative (personnel) cost▪ Fuel, power supply, etc.▪ Tools and spare parts▪ Minor repairs▪ All repairs▪ Extension, rehabilitation▪ Depreciation
What sources of income to use?	<ul style="list-style-type: none">▪ Regular user payments (monthly tariff)▪ Island funds▪ Voluntary contributions▪ Credit schemes▪ Government subsidy

2. Arrangement of financial flows

Financial management issues	Possible options
How to collect the money?	<ul style="list-style-type: none"> ▪ Billing ▪ Collection at desludging septic tank ▪ Fund-raising when breakdown ▪ Taking money from a fund
When to collect the money?	<ul style="list-style-type: none"> ▪ Monthly ▪ Per service provided ▪ Beginning of financial year
Who collects the money?	<ul style="list-style-type: none"> ▪ O&M administrative staff ▪ O&M technical staff ▪ Island Development Committee ▪ Island office
Where to keep the money?	<ul style="list-style-type: none"> ▪ In a safe ▪ In the island account ▪ In a bank account

3. Financial administration

Financial management issues	Possible options
How to register movements of expenditures and incomes?	<ul style="list-style-type: none"> ▪ Log book ▪ Book-keeping ▪ Bank statements
Who administers the funds?	<ul style="list-style-type: none"> ▪ O&M administrative staff ▪ A local accountant ▪ Bank accountant
What are funds used for?	<ul style="list-style-type: none"> ▪ Payment of expenditures related to O&M ▪ Generating bank interest ▪ Use for other development projects
Who orders payments?	<ul style="list-style-type: none"> ▪ O&M administrative staff ▪ O&M technical staff ▪ Island Development Committee ▪ Island chiefs ▪ Assembly of users

4. Financial control and monitoring

Financial management issues	Possible options
What type of financial control?	<ul style="list-style-type: none"> ▪ Receipts from book-keeping ▪ Regular meetings of O&M staff ▪ Double signature for disbursement of funds ▪ Feedback to users ▪ Checking with bank statements ▪ Registered auditors
How to monitor?	<ul style="list-style-type: none"> ▪ Use of log book ▪ Make a quarterly review and overview of the situation on expenditures, incomes, and % of people who do not pay
What to do with bad payers? (This problem is particularly crucial for "influential" members of society and public institutions)	<ul style="list-style-type: none"> ▪ Analysis of reasons for non-payment ▪ Improvement of service ▪ Improvement of relationship with the users ▪ Campaign on benefits of good payers ▪ Rescheduling of debt ▪ Sanctions

(Adopted from IRC and WHO, 2000)

APPENDIX-4 SUGGESTED PERFORMANCE INDICATORS

A. Monitoring Indicators

A-1. User Satisfaction

Indicators	Source	Formula
User Satisfaction	User survey	% of interviewees satisfied with service operation, classified by degree of satisfaction
Five main O&M problems	User survey	% of interviewees identifying each of the five most frequently listed problems
Care and use of facilities	User survey Evidence of facilities	Number of evidence with the facility misused or not being used

A-2. Service Level

Indicators	Source	Formula
Access to functioning sewerage system	User survey Project documents	Number of functioning facilities / total number in a defined locality
Cleanliness	User survey	% of interviewees satisfied with cleanliness, classified by degree of satisfaction
Reliability	Work logbooks	Functioning time during a particular period / duration of the period
Effluent quality	Water analysis result	Actual effluent quality (BOD, SS) / standard value

A-3. Institutional Arrangement

Indicators	Source	Formula
Work managed by users/ community	Minutes of meeting Work logbooks	Number of O&M activities carried out / duration of the period
Problems resolved by internal actions	Minutes of meeting Work logbooks	Number of problems resolved / duration of the period
Communication with institutions	Correspondence records	Number of successful outcomes / number of communication with institutions
Complaints dealt with	Correspondence records	Number of actions dealing with complaints / number of complaints logged in the period
Training O&M persons	Report on training	Number of days provided in training / duration of the period

A-4. Technical Status

Indicators	Source	Formula
Mean time to Repair (MTTR)	Work logbooks	Total time spent to repairs / number of repairs in the period
Mean time before failure (MTBF)	Work logbooks	Duration of the period / number of failures in the period
Leakage repair rate	Work logbooks	Number of leakages repaired / duration of the period
Desludging rate	Work logbooks	Number of cleaning pits or pipes / duration of the period
Outstanding repairs	Work logbooks	Number of repairs not carried out due to lack of spare parts
Accessibility	Work logbooks	Time elapsed between identifying the need for the

		repair and arrival of materials required
Support delivery time	Work logbooks	Time elapsed between placing request for support and receipt

A-5. Financial Status

Indicators	Source	Formula
Revenue collected efficiency	Bookkeeping Financial statements	Total collected tariff / total billed for sewerage
Billing efficiency	Financial statements	Total number billed for sewerage / number of connections required to pay charges
Informal sanitation cost	Financial statements	Average amount paid for use of sewerage system / household tariff rate
O&M costs per connection	Financial statements	Total O&M cost / number of connection
Revenue per connection	Financial statements	Total tariff revenue / number of connection
Cost-recovery ratio	Financial statements	(Total tariff revenue + subsidies, miscellaneous income) / total O&M cost

A-6. External Impacts

Indicators	Source	Formula
Water related diseases	Health records	Number of patients of water related diseases in the area
Groundwater quality	Water analysis result	Number of shallow wells bacteriological contamination detected / total number of wells
Sewer discharge rate	Work logbooks	Total amount of water pumped out to sea outfalls / total amount of sewage produced
School attendance	School attendance records	Number of children attended to school in the period / total number of children

B. Evaluation Indicators

B-1. Planning and design

Indicators	Source	Formula
Baseline survey	Project documents	%of household interviewed and assessed their needs
Consultation/ involvement	User survey	% of interviewees satisfied with consultation and dialogue, classified by degree of satisfaction
Demand responsiveness	User survey	% of interviewees identifying that DRA was applied during design stage
Technical feasibility	Project documents	Score on technical investigation and justification evaluated by PMU
Time growth for design	TOR for consultant	Final duration for design phase / initial contract duration
Design quality	TOR for consultant Project documents	Score on design quality evaluated by PMU

B-2. Tender and contract

Indicators	Source	Formula
Quality of tender documents	Tender documents	Score on the tender documents focusing on the technical specifications and drawings
Time taken for tendering stage	Contract documents	Number of days taken from approval of design to signing of contract
Cost proximity	Tender reports	Engineer's detailed estimated cost / contract price
Tendering process	Tender evaluation reports	Number of incidences when the bidding failed due to deviation of bidding price
Time for commencement	Tender reports	Number of days from contract signing to commencement of actual work at site

B-3. Implementation

Indicators	Source	Formula
Material control	Letters of approval Bills of quantity	% of materials/equipment approved by the owner/consultant
Tests & inspections	Inspection reports	Frequency of tests and inspections
Site supervision	Work plan Minutes of meeting	Frequency of site meeting
Quality management	Progress reports	Number of incidents of rejection on the work
Documentation	Progress reports Completion reports	Number of formal documents submitted the owner
Community involvement	Progress reports	Days of training for the community conducted / duration of the construction work

B-4. Overall project performance

Indicators	Source	Formula
Quality of facilities constructed	Completion inspection	Score on construction quality evaluated by PMU
Capacity of service provider	Completion inspection	Score on O&M system of the service provider evaluated by PMU
Time growth	Project documents	Overall project duration (design stage → end of construction) / initial planned duration
Time taken	Project documents	Overall project duration
Cost growth	Project documents	Overall project cost / initial planned cost
Cost proximity	Project documents	Overall project cost

APPENDIX-5 REQUEST FOR O&M ASSISTANCE PROGRAMME

MEEW seeks further assistance to JICA for establishing sustainable O&M structure. This programme targets the success of only the Isdhoo/Kalaidhoo sewerage project, however, the know-how which will be transferred to the Maldivian stakeholders through this programme is applicable to other sewerage projects to be implemented in the islands.

Aim

To provide a model of the O&M mechanism to be followed by other sewerage projects in the Maldives

Output

1. An appropriate O&M mechanism established in Isdhoo/Kalaidhoo

- Indicators

1a. Management staff of O&M organization (cooperative?) selected

1b. Rules and regulations of the organisation instituted

1c. Regular O&M activities carried out and reported

- Means of Verification

Member list, Rules & regulations, Minutes of meeting, Daily/weekly reports

- Assumption

Natural disasters do not destruct the project facilities and activities

2. A billing and tariff collection mechanism established

- Indicators

2a. Tariff structure developed and approved by the community and MWSA

2b. Annual budget for the first year compiled and approved

2c. Bank account of the O&M organization opened and fund saved

- Means of Verification

Business plan, Financial statement, Bankbook

- Assumption

Socio-economic and political situation do not get worse

3. Capacity of stakeholders (MEEW, O&M staff, community) developed

- Indicators

3a. Management staff of O&M trained in managerial and financial skills

3b. MEEW staff trained in institutional management skills

- Means of Verification

Training and workshop reports

- Assumption

Sufficient assistance received from local authority

4. Monitoring and Evaluation system established

- Indicators

- 4a. Long-term M&E programme developed by MEEW and MWSA
- 4b. Periodical monitoring conducted on water quality and system performance
- 4c. Evaluation on whole project operation conducted

- Means of Verification

M&E plan, Monitoring reports, Evaluation reports

- Assumption

Sufficient assistance received from local authority

Major activities

Proposed activities for achieving the above outputs are listed below:

- 1.1 Select appropriate and capable management staff of the O&M organization
- 1.2 Develop strategy, rules and regulation for the island-based O&M organization
- 1.3 Hold regular consultative meetings with the communities to promote their involvement to the O&M activities
- 1.4 Conduct community dialogs to facilitate the people's better understanding

- 2.1 Develop a business plan to state a clear tariff setting and billing system
- 2.2 Compile annual budget based on annual work plan and submit to MEEW for approval
- 2.3 Establish the billing and tariff collection procedures
- 2.4 Open a bank account and start saving of collected tariff

- 3.1 Identify capacity building needs of community, O&M management and central staff
- 3.2 Conduct community workshops and training programmes as per needs
- 3.3 Provide periodical supervision and technical expertise to the training programme
- 3.4 Monitor and evaluate trainees' performance and of the conducted training programme

- 4.1 Identify key items to be monitoring and indicators for each of them
- 4.2 Develop action plan for M&E indicating responsible persons and frequency
- 4.3 Provide training to involved persons
- 4.4 Collect data, analyse data, and take actions where necessary

Input

In order to carry out the activities proposed above, inputs required are categorized into three components: training programme, assignment of Japanese and local experts, and procurement of equipment.

a) Training programme

▪ MEEW Staff

The purpose of the training is to strengthen the institutional and managerial capacities of the counterpart staff. The experience of establishing an O&M structure will be replicated to other sewerage systems.

▪ O&M staff

Trainings in management and accountant are major object for the O&M staff. This can be facilitated via MWSC, as the firm has a stock of experience in providing water and sewerage services.

b) Experts

▪ Institutional expert (Japanese + local)

This expert shall assist MEEW in organising effective O&M system for Isdhoo and Isdhoo/Kalaidhoo sewerage system and managing human resources for long-term operation. The experts will also assist MEEW in development of its capacity in Institutional arrangements including establishment and implementation of M&E system.

▪ Financial expert (local)

Assisting to develop financial plan in the government level and develop tariff structure. The financial expert can also provide appropriate advices and assist capacity building of MEEW and the O&M staff in financial management.

▪ Water quality specialist (Japanese)

A water quality specialist will be providing periodical training in water analysis to the O&M staff in Isdhoo and Isdhoo/Kalaidhoo system. For effective and sustainable monitoring of groundwater quality and effluent quality, the process in sampling, analysing and reporting water quality shall be transferred to the island level.

▪ Community mobilisation officer (local)

As the community must be motivated to use the facility properly, the mobilisation officer will liaise with island people, community groups and schools and conduct community awareness and mobilisation activities. The officer also assists the O&M staff in planning and conducting activities such as plantation of fruits and vegetables and painting walls of treatment facilities.

c) Equipment

▪ Field water quality analysis kit (pH/EC, COD, NO₃, PO₃)

Those equipment are required for regular monitoring of environmental impact and system performance. The water quality monitoring plan shall be developed in consultation with MWSA. It is also better that, if a training component can be incorporated into the plan hence the local staffs can do the monitoring at island level and share the data with MWSA on regular basis. A frequent visit(bi-annual) of MWSA staff to shall be advisable.

4. モニタリング記録様式例 (英文)

MONITORING SHEET FOR ISDHOO/KALAI DHOO SEWERAGE SYSTEM

Name of Staff : _____

Month/Year: _____

Island Name : _____

Area Code: _____

Number of Households: _____

Number of Septic Tanks: _____

Number of Pumps: _____

Number of Control Panels : _____

A. Technical Status

	month 1	month 2	month 3
How many days did you work for O&M activities?			
How many days did you clean the facilities in this area?			
How many problems /complaints did you face?			
How many problems/complaints did you solve?			
How many septic tanks were cleaned in this area?			
How many repair works did you carry out?			
How many hours did you take for repair works?			
How many were there any clogging or leakage of pipes?			
How many outstanding repairs due to lack of spare parts?			
How many days/hours did it take from identifying the need of repair to arrival of required materials/person ?			

B. Financial Status

	month 1	month 2	month 3
How many bills were sent in this area?			
How many households paid their bills?			
How much money was collected in this area?			
How much money was expected to collect?			
Was there any expense for O&M of this area?			
How much did it cost for desludging works?			
How much did it cost for other O&M works?			

This monitoring form have been checked and submitted to the MEEW by the head of O&M technical staff.

Name: _____

Date: _____

Remarks:

Signature: _____

5. 技術協力プロジェクト PDM 案

プロジェクト名：モルディブ国 地方島下水処理システム運営改善計画
 対象地域：モルディブ国 インドー・カライドー島

協力期間：2007年9月～2008年6月
 対象グループ：実施機関・対象島住民

プロジェクトの要約	指標	指標データ入手手段	外部条件
上位目標 □ 全住民島において衛生的な下水サービスが提供される。			
プロジェクト目標 □ モ国で今後実施される下水案件のモデルとなる運営維持管理体系を確立する。	□ 建設された下水処理施設が島レベルの維持管理組織により運営される。	□ 事後評価報告書	
成果 1. インドー・カライドー島に適切な維持管理体制が構築される。 2. 料金体系・料金徴収システムが確立される。 3. 関係者の維持管理に係る能力が強化される。 4. モニタリング評価の体系が整備される。	1-1. 組織の法的基盤が確認される。 1-2. 維持管理組織の役員が選出される。 1-3. 行政・組織間の契約/合意書が整備される。 1-4. 規約が制定され、法的登記される。 1-5. 施設の運営・維持管理が行われ、その活動が定期的に報告される。 2-1. WTP/ATP および支払方法に係る意識が確認される。 2-2. 料金体系・事業計画書が整備され、利用者および MWSA から承認される。 2-3. 罰則が制定され、承認される。 2-4. 初年度予算案が作成され、承認される。 2-5. 維持管理組織名義の銀行口座が開設され、積立金が預金される。 3-1. 維持管理スタッフ・MEEW 職員に対するトレーニングが実施される。 3-2. 年間を通じて200日以上維持管理活動が実施される。 3-3. 維持管理活動計画・島住民に対する教育啓発活動計画が策定される。 4-1. 長期モニタリング計画が MEEW と MWSA により策定される。 4-2. 水質とシステム機能に関する定期的なモニタリングが実施される。 4-3. プロジェクト事後評価が実施される。	1-1. 協同組合法 1-2. 役員メンバー・リスト 1-3. 契約/合意書 1-4. 維持管理規約 1-5. 操業記録、日報・週報 2-1. 社会調査報告書 2-2. 事業計画書 2-3. 利用者規約 2-4. 年間予算報告書 2-5. 預金通帳 3-1. 評価記録、トレーニング報告書 3-2. 操業記録、日報・週報 3-3. 活動計画書 4-1. モニタリング計画書 4-2. モニタリング記録、分析結果 4-3. 事後評価報告書	□ 自然災害による施設破損や活動への障害がない。 □ 社会経済状況、政治情勢が悪化しない。 □ 地方行政からの十分な理解と協力が得られる。
活動 1-1. 関連法規（協同組合法・地方自治法）を調査する。 1-2. 維持管理組織の役員として適切な人材を選出し任命する。 1-3. 行政および維持管理組織間の契約/合意書が整備され署名される。 1-4. 島レベルの維持管理組織としての規約を制定し、法的登記を行う。 1-5. 関係者（ステイクホルダー）会合を開催し、当該施設運営に係る詳細な説明・協議を行い、協力を依頼する。 1-6. 初回島住民会合を開催し、利用者に対して、当該施設運営に係る詳細な説明・協議を行い、施設の適切な利用への理解を得る。 1-7. 定期的な住民会合を開催し、料金徴収に関する協力を呼びかける。 2-1. WTP/ATP 調査および支払方法に係る意識調査を実施する。 2-2. 料金体系と徴収システムを明確にした事業計画書を作成する。 2-3. 罰則を含めた利用者規約を制定し、MWSA の承認を得る。 2-4. 年間活動計画に基づいた年間予算案を編成し、MEEW の承認を得る。 2-5. 請求書送付・料金徴収方法について詳細な手順を検討する。 2-6. 銀行口座を開設し、施設更新費の積立を開始する。 3-1. 住民、維持管理スタッフ、MEEW 職員の能力とニーズを分析する。 3-2. 各々のニーズに基づいたワークショップ、トレーニングを開催する。 3-3. トレーニング参加者および内容の評価を実施する。 3-4. 関係者により現状問題分析を行い、維持管理活動計画および島住民に対する教育啓発活動計画を策定する。 4-1. モニタリングの項目と指標を決定する。 4-2. 責任者とモニタリング時期を明確にした活動計画を策定する。 4-3. 関係にたいするトレーニングを実施する。 4-4. データの収集と分析を行い、必要に応じて対策をとる。	投入 日本側投入 人材： 短期専門家 資金： 在外事業強化費 研修： (JICA 集団研修) モ国側投入 人材： 実施機関 (MEEW・MWSA) カウンターパート 資金： 技術協力プロジェクト以外で必要な事業実施費用	前提条件 □ 対象地域住民が施設利用料金の支払意思を維持する。 □ 実施機関の士気と主体性が持続する。	

Project Design Matrix (Log Frame)

Prepared: March 2007

Project: Management, O&M of Sewerage System in Isdhoo and Isdhoo/Kalaidhoo
Target Area: Laamu Atoll, Isdhoo and Isdhoo/Kalaidhoo Islands

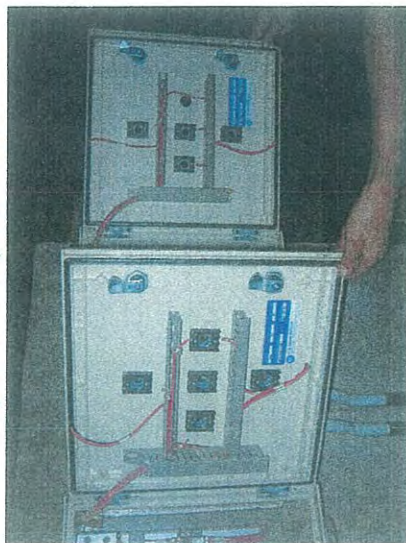
Period: September 2007 – June 2008
Target Group: MEEW, Island people

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Assumptions
AIM			
<ul style="list-style-type: none"> ▪ Provide improved sanitation services to all island population 			
OBJECTIVE			
<ul style="list-style-type: none"> ▪ Provide a model of O&M structure to be followed by other sewerage project in Maldives 	<ul style="list-style-type: none"> ▪ by the stakeholders 	<ul style="list-style-type: none"> ▪ Project Evaluation Report 	
OUTPUTS			
<p>5. An appropriate O&M organisation established in Isdhoo & Isdhoo/Kalaidhoo</p> <p>6. A billing & tariff collection mechanism established</p> <p>7. Capacity of stakeholders (MEEW, O&M staff, community) developed</p> <p>8. An effective Monitoring & Evaluation system established</p>	<p>1-6. Confirmed legal background</p> <p>1-7. Selected O&M staff</p> <p>1-8. Prepared contract/MOU between MEEW and O&M organisation</p> <p>1-9. Established rules & regulations, registered O&M organisation</p> <p>1-10. Regularly reported O&M activities</p> <p>2-6. Surveyed WTP/ATP and opinions on payment system</p> <p>2-7. Approved tariff mechanism and Business plan by users & MWSA</p> <p>2-8. Approved user conditions & penalty</p> <p>2-9. Approved 1st year annual budget</p> <p>2-10. Opened bank account</p> <p>3-4. Conducted training programmes to O&M staff and MEEW staff</p> <p>3-5. Carried out O&M activities 200 days annual</p> <p>3-6. Planned O&M activities, education & awareness activities</p> <p>4-4. Developed long-term monitoring plan by MEEW & MWSA</p> <p>4-5. Conducted regular water quality & system performance monitoring</p> <p>4-6. Conducted project evaluation</p>	<p>1-6. Cooperative society law</p> <p>1-7. Member list</p> <p>1-8. Contract/MOU</p> <p>1-9. Regulations</p> <p>1-10. Records, Daily/ weekly reports</p> <p>2-6. Survey report</p> <p>2-7. Business plan</p> <p>2-8. User conditions</p> <p>2-9. Financial statement</p> <p>2-10. Bankbook</p> <p>3-4. Training reports</p> <p>3-5. Records, Daily/ weekly reports</p> <p>3-6. Action plan</p> <p>4-4. Monitoring plan</p> <p>4-5. Monitoring report</p> <p>4-6. Evaluation report</p>	<ul style="list-style-type: none"> ▪ Natural disasters do not destruct the project facilities and activities ▪ Socio-economic and political situation do not get worse ▪ Sufficient assistance received from local authority
ACTIVITIES		INPUTS	PRE-CONDITIONS
<p>1-8. Study relevant laws & regulations (e.g. Cooperative society law)</p> <p>1-9. Select appropriate and capable management staff for O&M</p> <p>1-10. Prepare Contract/MOU between MEEW and O&M organisation prior to handing-over of facilities</p> <p>1-11. Develop rules & regulations for the island based organisation, register the organisation</p> <p>1-12. Conduct stakeholders meeting, discuss management issues, coordinate assistance from local authority</p> <p>1-13. Conduct initial (kick-off) users meeting, discuss O&M issues, make understand on proper use of the sewerage system</p> <p>1-14. Conduct regular meetings, promote cooperation to tariff collection</p> <p>2-1. Conduct survey on WTP/ATP and preferable payment method</p> <p>2-2. Develop business plan stipulating tariff mechanism</p> <p>2-3. Develop user conditions including penalties getting approval of MWSA</p> <p>2-4. Develop annual budget based on work plan getting approval of MEEW</p> <p>2-5. Establish an appropriate procedure in billing and tariff collection</p> <p>2-6. Open bank account and start fund saving for O&M</p> <p>3-5. Identify capacity building needs of stakeholders</p> <p>3-6. Conduct community workshops & trainings as per needs</p> <p>3-7. Monitor & evaluate trainees' performance and of the conducted training programme</p> <p>3-8. Identify current problem, develop O&M activities and education & awareness activities plans</p> <p>4-1. Select monitoring and evaluation items and indicators</p> <p>4-2. Develop monitoring plan indicating the persons in charge & period</p> <p>4-3. Provide training on monitoring process to stakeholders</p> <p>4-4. Collect & analyse data, take action where necessary</p>		<p><Japanese Inputs></p> <p>Personnel: Short-term experts</p> <p>Fund: Local Activities Cost</p> <p>Training: JICA group training programme</p> <p><Maldivian Inputs></p> <p>Personnel: MEEW/MWSA counterparts</p> <p>Fund: Implementation costs beyond the project scope</p>	<ul style="list-style-type: none"> ▪ Government policies remain supportive in providing financial assistance ▪ Users remain motivated to pay the tariff

Stop Vandalism

To your own system

It is something like to spit to the heaven
Spit turn to your face



Stupid Vandalism to control panel
It will increase maintenance cost



Cut down pipe header, it causes leakage.

We completed the sewerage system.
And then, important is operation.

How to operate the System by yourself?
Six New Sewerage Engineer trained
through JICA project will do.

Their name

Rasheed Jaleel, Hussain Afeef
Ahmed Riza, Ahmed Moosa
Ail Sharee, Ibrahim Saudhu



Supported by:



The Government of Maldives:

Ministry of Environment, Energy and Water

JICA (Japan International Cooperation Agency)

JICS (Japan International Cooperation System)

Consultants: Yachiyo Engineering Co., Ltd.

Contractor: Shin-Nippon Air Technology Co., Ltd.

You are The Owner of The System



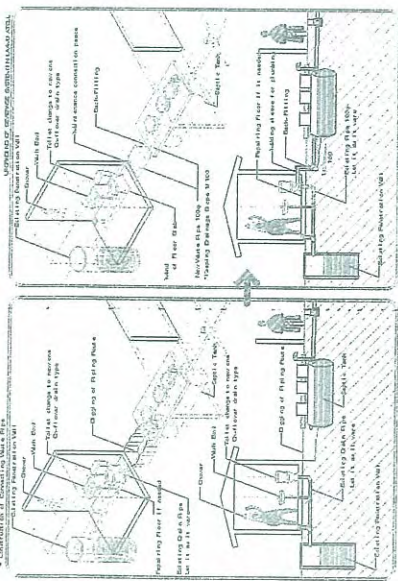
JAPAN
Office of Development Assistance

March 2007

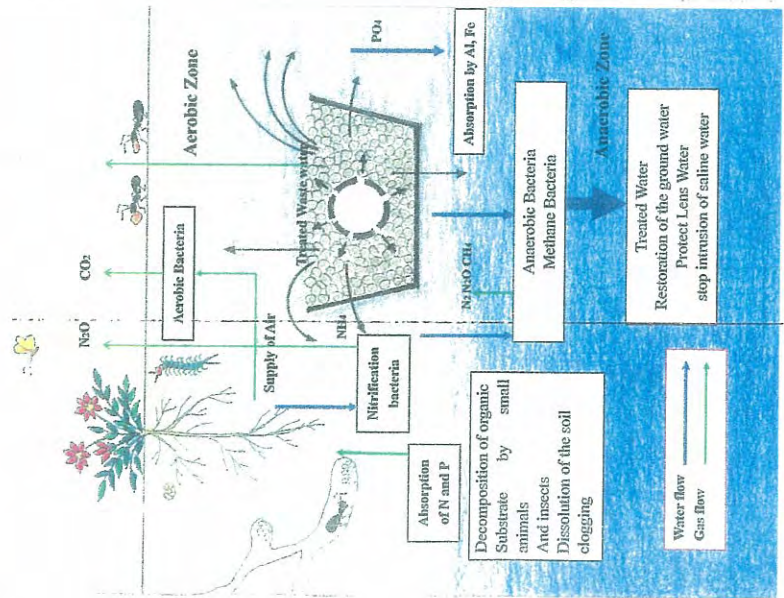
**Project for Upgrading Sewerage System
In Laam Atoll
(Isdhoo and Isdhoo/Kalaidhoo)
The study on Tsunami Recovery,
Rehabilitation and Development of Islands
in Maldives**

by
The Government of Japan

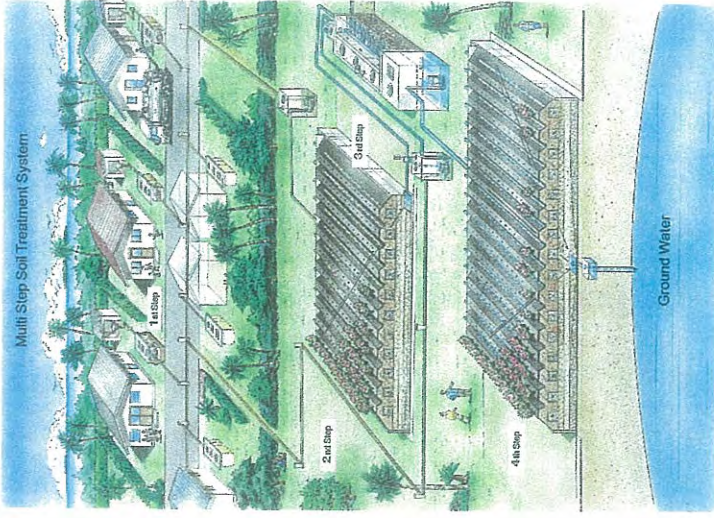
Connecting work from septic tank to the system



Black water be treated through soil treatment system



Multi step treatment system



Your Collaboration support New Organization

- 1. Planting Collabo. with Environmental Club**
To seek suitable to seed some plants and grow in and around the treatment system.
- 2. Painting Collaboration with School Children**
To familiar with the new treatment system to paint some picture on the wall of treatment facilities.
- 3. Maldives AI & Charcoal Collaboration**
To product charcoal from coconut shell and enzyme from dry-yeast, lactic-acid and Nattokinase.
- 4. Using Dry Sludge for Fertilizer**
- 5. Payment for Operation and Maintenance**
Step by step system still on discussion with MEEW

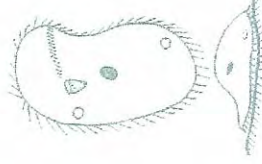


Protozoa Ciliates

Aspidiscus Costata

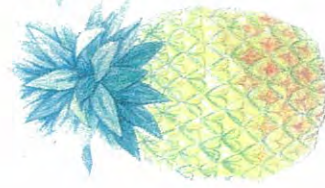


Characeum Polypodium



Chitodanella Ueicre

Microbes, Insects and Plants living in the soil consume nutrition of black water and turn it clear.



You can get many kinds of products from the system directly and indirectly.