



Training Program on Water and Road Management MM Approach



Held on the **28th – 30th of August 2023** at
The Water and Environment Centre
Sana'a University

Funded by the World Bank in partnership with the United Nations Office for Project Services, and implemented by MetaMeta, in cooperation with the Water and Environment Centre - Sana'a

Table of Contents

1	Introduction	1
2	Background on the courses	2
3	Overview	3
4	Task Information	4
5	The General Objective of the Training Program	4
	4.1 Detailed Objectives	4
	4.2 Participant Expectations	5
	4.3 Expected Outputs of the Training Course	5
6	Targeted Trainee	6
7	Challenges	6
8	Monitoring and Evaluation	6
9	Training Objectives	7
10	Expected outputs from the training program	7
11	Training Methodology	7
12	Method used in training	8
13	Facilities and auxiliary tools used in training Means	8
14	Methods Used to Evaluate Participants	9
15	Participants Names	9
16	Trainees Evaluation	10
17	Training Evaluation	12
18	Pre- and Post-Training Test Results	13
19	Results of Pre-Test Analysis	14
20	Results of Post-Test Analysis	14
21	Course Outputs	14
	21.1 General outputs from the participants:	16
	21.2 Steps to achieve outputs:	17
22	Results	18
23	Recommendations of trainees for water and road management:	18
24	Conclusion:	19
25	Annexes	20

1 Introduction

Training has become the focus of the development process in society, as it is the main instrument and means for those aiming towards a developed future and achieving standard, efficient work, especially in the current era of advanced technology and in which the world is developing rapidly with knowledge, capacities, and technologies. Training has become the tool to accommodate the pace of these rapid changes, face the technical and practical challenges encountered, and adapt to the vast growing needs of society. Training is a humanitarian process that creates opportunities for all individuals, empowering them to improve their living conditions. As international attention has been directed towards training, obtaining a degree has no longer been a necessity, as training does not only build the capacities within the frame of the work requirements but also meets international standards and accommodates the various practical work requirements.

Training is also the principal focus of responsible authorities in organizations, as it is an essential part of an integrated process aimed at developing the employee professionally, scientifically, and technically and providing him with new skills which he utilizes to control the various situations and challenges he might he faces in his work. In addition to the enormous developments and continuous discoveries, educational work has faced many challenges, intensifying the need to train working personnel to keep pace with various developments through acquiring new knowledge, skills, and experiences, raising the level of the entity's performance, and increasing their productivity.

Within the view of the importance of training, the project strives to have outputs that meet the various aspirations of the water and sanitation sector in the Republic of Yemen by finding a competitive goal for its services to meet the hopes and needs of society and the individual. It aims at creating added value to these services and maintaining the sustainability of its activities while adapting to the exceptional conditions of the country and the lack of available resources through utilizing the high skills and positive alteration of practice and directly investing the available resources in a professional manner that would raise the work efficiency, and reduce both costs and risks.

Aspiring to meet the vision of the program, a problem-solving approach has been adopted, in which the main goal is to mitigate and solve the major problems of the targeted entities, taking their hands towards providing better service quality, adapting to citizen's demands as well as those of funders, and following the newly developed sustainable development approaches.

2 Background on the courses

Yemen is classified among the five most water-scarce countries, and all efforts are required to preserve water resources in Yemen. There is a history of great creativity in water conservation in Yemen. This training aims to contribute to water conservation and provide additional water sources, especially in rural areas. This training also discusses harvesting water from various roads and storing or recharging groundwater from it - as well as benefiting from current investments in developing and rehabilitating roads to secure local water resources. He also discussed the vision of using roads for multiple purposes: While roads provide transportation, communications, and communication services, at the same time, they can contribute to securing water sources, facilitate flood control, and mitigate the effects of erosion and scour. In this way, the higher investment in link roads in Yemen can make them have a much wider impact on livelihoods and economic development.

Therefore, road development must consider the opportunities for harvesting water from the road through organized harvesting methods, adopting the cause to be “roads for water,” and combining investment in roads with water harvesting. Therefore, safe planning of the road accompanying water harvesting facilities near the road body will prevent structural damage to the roads.

The main benefits of creating water efficient roads are:

- Reducing damage to roads - Water is the main factor that causes damage to roads. These damages can take several forms, including: surface runoff (torrential rains) causing direct damage to the roads, erosion of slopes and lower slopes whose erosion affects the path of the road, or local residents may make adjustments to the roads in order to collect water, but this works my damage the roads. Therefore, understanding the behavior of surface runoff characteristics in accordance with the route of the road, road drainage facilities, spring water, subsurface runoff and land, and soil properties, can reduce road maintenance costs, and lead to fewer traffic interruptions.
- Preventing damage to agricultural land, especially reducing soil erosion and gully formation. Roads greatly disrupt natural drainage patterns and concentrate runoff by directing it through a limited number of culverts and other drainage facilities. If not implemented well, this may lead to scour and erosion of the road, especially in areas where the soil is relatively thick. The development of gullies may lead to the excavation of the natural earth and the depletion of soil moisture.
- Flood prevention: If water flowing from roads and local floods are not managed and controlled, these may affect the livelihood of people living near roads. However, the road embankment can divide the watersheds into independent parts and reduce flood damage. These fills can be used to change the flow patterns in the watershed, reduce its speed, and mitigate the flow of floods.

- The possibility of harvesting water from roads, and this process turns the threat into wealth. Water resulting from road drainage or from springs that are opened when constructing roads, or water and soil moisture retained by crossings or surface bridges, and road surfaces is considered a valuable water resource. Collecting road water to recharge groundwater can help with drinking water supplies, and local surface water storage in ponds and small dams helps in agriculture and livestock drinking, and this water also helps maintain soil moisture levels and control groundwater levels.
- It has been found that road water harvesting has been successfully introduced, and known in a number of places. Groundwater recharge or storage using excavation for borrowed backfill sites and borrowed filtration systems, such as deep trenches and percolation ponds that aim to increase groundwater recharge, as well as side drainage systems that are used for irrigation and sand collection, and earthen ponds on both sides of the road are some of the techniques, and already present in the country. At the same time, all these opportunities are being used sparsely, while there is a situation in which road development and water harvesting can be combined in an organized manner in Yemen.

The expected increase in investment in road infrastructure in Yemen presents essential opportunities to impact roads that help improve water provision significantly. During this training, both trends and processes in combining road development and water management were explained, as well as how water harvesting from roads can be enhanced through improved road designs and systematic placement of water harvesting infrastructure along roads. Currently, during the field visit, it was found that a number of these opportunities had been monitored and introduced to the engineers participating in the course and that they had been created by farmers and landowners along the roads on their initiative, but this could be done in a more organized way - as part of new road construction programs, and as part of the maintenance of existing roads.

Therefore, water and roads are the primary inputs for sustainable development, food, and social security. But at present, both programs are in critical condition: roads cause erosion, flooding, and unwarranted sedimentation, where water runoff is the major factor in road disruption. The main challenge is combining the development and maintenance of road infrastructure and water management in a mutually beneficial way. And with changing rainfall patterns and looming water scarcity in Yemen, the imperative to do so has become apparent.

In this training, different methods explained for harvesting water from roads, using it to recharge groundwater, and benefiting from the continued investment in developing and rehabilitating roads to secure local water resources. This calls for a multi-functional view of roads, where roads provide transportation and communication services. They can simultaneously contribute to water security, flood control, and erosion mitigation. In this way, significant investment in road connectivity in Yemen could have a much broader impact on livelihoods and economic development.

3 Overview

The report's structure has been prepared to reflect the extent of achievements and commitment to the progress of implementation of the training plan, as well as its impact and conformity with the desired benefits. It

clarifies the specific data for each program, as per the task. It also identifies the challenges, monitoring, and evaluation mechanisms, activities aimed at achieving the program's objectives, topics planned within the manual, and the applied methodologies. The report contains an overview of different training methods used in the program and the level of individual participation through pre-and post-tests. The report analyzes the trainee's evaluation and the program's various aspects. The report gradually builds up to reach the trainee's suggestions and recommendations and terminates in its final sections containing the outputs, results, and conclusion.

4 Task Information

The task requires the implementation of the training program for workers in the administrative field.

Project Name	Capacity building of Local Service Providers in Water, Road and Solid Waste Management	
Executing Entity	Water and Environment Centre – Sana'a University	
Executive Trainer	Dr. Sharafaddin Abdullah Ahmed Saleh	
Training Site	Water and Environment Center – Sana'a University	
Beneficiaries	Urban Water Supply and Sanitation Project Management Unit (PMU– Sana’a), The Road Maintenance Fund Implementation Unit (RMF-IU Sana’a), Rural Access Program-Central Management Office (RAPCMO).	
Training Start Date	28 Aug 2023	
Internship End Date	30 Aug 2023	
Total number of trainees	12	Twelve trainees
Training hours per program	21	Twenty-one training hours
Number of training days per program	3	Three training days

5 The General Objective of the Training Program

Provide participants with a better understanding of road and water management mythology, road water harvesting techniques and governance, and identifying opportunities to make roads more climate resilient and water positive in Yemen.

4.1 Detailed Objectives

1. Learn about the concept of financial management, its decisions, characteristics, and tasks.
2. Be able to describe what a budget is, how to prepare it, and use and monitor the effective implementation of budgets in their projects.

3. Learn about the accounting concept, its principles, importance, functions and objectives.
4. Giving a general idea of accounting systems, their types and objectives, the main components of accounting systems, and their basic elements and components.
5. Identify the accounting treatment of the most important financial operations.
6. Familiarity with the most important lists and financial reports and familiarity with the components of each.
7. Being able to acquire the skill of preparing financial statements.
8. Learn about the concept of financial analysis, its objectives, and its most important ratios and indicators.
9. Identify the concept of internal control and internal risk management, its importance, objectives, components and conditions that must be met to ensure the safety and protection of assets and the health and accuracy of internal operations in the entities.
10. Distinguishing between internal auditing and external auditing, and what must be provided and made available to auditors for them to carry out their work.

4.2 Participant Expectations

- 1 .Learn about water management in the path of roads and its harvesting techniques.
- 2 .Identify the possibility of mitigating the damage caused by water runoff on roads and their adjacent areas
- 3 .The ability to plan and implement road works and rehabilitation, including harvesting water from them in regular ways.
- 4 .The ability to activate the participation of local institutions and communities and encourage self-initiatives for water harvesting.
5. The ability to activate the afforestation of the road path and harvest water for irrigation and make the roads green areas and an recreation areas for the surrounding communities.

4.3 Expected Outputs of the Training Course

1. Enhance knowledge of effective road water management and water harvesting techniques and practices for participants.
2. Develop integrated interventions regarding (GR4W) water harvesting for the selected road route.
3. Develop an action plan that combines technical and institutional arrangements, including stakeholder involvement in implementing water harvesting interventions from roads.
4. Introduce the participants to maximizing the benefit of harvesting water from the roads and discharging the water in an organized way to prevent damage to the road and adjacent areas.

6 Targeted Trainee

This training is aimed to young, mid-career professionals and decision-makers in the water, environment, agriculture and roads sectors involved in and/or interested in the development and management of roads, water (GR4W) and road water harvesting for sustainable development. In addition to implementing partners from Urban Water Supply and Sanitation (UWSS-PMU), Road Maintenance Fund (RMF), and Rural Roads Program (RAP).

7 Challenges

- Most of the trainees participating in the training do not have any knowledge or experience in the field of financial management.
- The training period is very short despite the large number of basic training topics in the field of financial management.
- The levels of the trainees participating in the training varied.
- Diversity in levels of problems that are supposed to be addressed through training.
- Applying an unconventional and new methodology for the beneficiaries based on identifying the various problems of the entities and working to solve them through the design of different training programs.
- Provide trainers who can adapt to the new methodology.
- Achieving planned outputs.
- Preparing outputs and presenting them to beneficiaries to maximize benefits.

8 Monitoring and Evaluation

- The training program was designed according to a training need assessment of the beneficiaries.
- The training programs were designed to address the problems faced by the beneficiary institutions.
- The data and documents utilized during the training to help in address the problems are provided.
- Designing pre and post-tests to measure the progress of the participants.
- Developing forms for evaluating the trainees by the trainer
- Daily attendance statements.
- The final evaluation form for the program.
- Developing a model by the trainer to reflect the outputs of the trainees.

9 Training Objectives

To introduce the road water management methodology, water harvesting techniques, and governance to the participants, to identify opportunities to make roads more climate resilient and water positive in Yemen.

10 Expected outputs from the training program

- Enhance participants' knowledge of effective road water management and water harvesting techniques and practices.
- Develop integrated interventions related to (GR4W) water harvesting for selected roads.
- Develop an action plan that combines technical and institutional arrangements, including stakeholder engagement in implementing road water harvesting interventions.

11 Training Methodology

The training depends on the participatory training mechanism as a basis for training in the training process. So the current experiences of the participants determined first through a set of activities and the exchange of experiences among the target group through discussion of practical and realistic examples from the work environment of the participants in the training program (interactive training: group activities, evaluations or anything else that keeps participants active within the learning process).

Therefore, the training relied on participatory methods, where the participants exchanged their experiences in the field of training through group work activities, evaluations or anything else that keeps the participants active and their interventions. In addition to directing lectures as follows:

- Lectures explain practices, experiences, measures and stakeholder engagement to implement water harvesting interventions from roads to be Green Roads for Water (GR4W).
- A field visit to a road section to examine what was explained in the lectures in practice.
- Group work to exchange participants' experiences in the field of draining and harvesting water from roads and to identify the damage caused by water to the road body and its adjacent areas in the event that water is not managed and harvested in regular ways.

Group work to prepare action plans that combine technical and institutional arrangements, including stakeholder engagement to implement road water harvesting interventions and provide new water resources.

12 Method used in training

Because the number of participants is 12, from 3 utilities and with different specializations (road engineering, water and environmental engineering, road project officers), they were divided into three work groups, each group consisting of (2-6 engineers).

Group one: from Rural Road development Program

No	Participants Name	Department	Field of work	.Mobile No.
1	Salah Ahmed Moghalis	Environment and Community department	environment and community Officer	770608918
2	Jalal Mohammed Nasir Alaansi	Technical Administration	Design Engineer	777035239
3	Zaid Ali Yahya Almozagr	Technical Administration	Project officer	770705630
4	Omar Walied Saeed Hibat Allah	Technical Administration	Project officer	775015008

Group Two: Construction unit of Urban Cities Water and sanitation Project

No	Participants Name	Department	Description	.Mobile No.
1	Eng. Said Al-Tayeb	Construction Department	WASH Eng.	777282050
2	Eng. Amar Ahmed Al-Sageer	Construction and Study Department	Consultant	772030382

Group Three: Project Construction Unit – Road Maintenance Fund

No	Participants Name	Department	Description	Mobile .No.
1	Mahfodh AbdulAziz Al-Shamiri	Quality assurance	Quality assurance Officer	777952034
2	Ahmed Al-Husaini	Technical department	Technical manager	770838847
3	Mohammed Mohsen Al-Selwi	Environment department	Environment specialist	772544414
4	AbdulAziz Al-Moaed	Technical department	Project Officer	712098490
5	Mohammed AbdulKhaliq Ghailan	Technical department	Eng.	771221102
6	Yasmin Ali Humaid	Bridge department	Eng.	775285660

13 Facilities and auxiliary tools used in training Means

- Printed training material.
- data show.
- Flipchart board and papers.

14 Methods Used to Evaluate Participants

1. Pre and post-evaluation forms.
2. Actives participation.
3. Dealing with colleagues.
4. Participation in group work
5. Training outputs.

15 Participants Names

The names of the participants are shown in the table below

#	Participant's Name	Entity	Job
1	Salah Ahmed Hamid Mogalles	RAPCMO	Environment and community Officer
2	Jalal Mohammed Naser Al-Ansi	RAPCMO	Design Engineer
3	Zaid Ali Yahya Al-Muzaiqer	RAPCMO	Project officer
4	Amr Waleed Saeed Hebatallah	RAPCMO	Project officer
5	Saeed Abdulwahed Abdullah Al-Tayeb	PMU– Sana'a	WASH Eng.
6	Ammar Ahmad Abdulhameed Al-Sagheer	PMU– Sana'a	Consultant
7	Mahfouz Abdul-Aziz Rasam Al-Shamir	RMF-IU Sana'a	Quality assurance Officer
8	Ahmed Taher Mohammed Al-Husseini	RMF-IU Sana'a	Technical manager
9	Mohammed Mohsen Al-Selwi	RMF-IU Sana'a	Environment specialist
10	Abdulaziz Ahmed Ahmed Al-Moayed	RMF-IU Sana'a	Project Officer
11	Mohammed Abdo Alkhaliq Ghilan	RMF-IU Sana'a	Eng.
12	Yasmin Ali Saleh Humaid	RMF-IU Sana'a	Eng.

16 Trainees Evaluation

The trainees were evaluated by the trainers as in the table below:

#	Name	Trainer Evaluation			Attendance			Trainer Comments about the Participant
		Good	V. Good	Excellent	1	2	3	
1	Salah Ahmed Hamid Mogalles		√		Present	Present	Present	He committed to attending. He participates very well in the working groups, sections and discussions. He also clarifies the case of RAP irrigation pipes in one of projects under implementation through RAP.
2	Jalal Mohammed Naser Al-Ansi		√		Present	Present	Present	He committed to attending. He participates very well in the working groups, sections and discussion. He also clarifies one case presented during the PPT and was previously implemented through RAP.
3	Zaid Ali Yahya Al-Muzaiqer		√		Present	Present	Present	He committed to attending. He participates well in the working groups, sections and discussion. He also presents one case from RAP.
4	Amr Waleed Saeed Hebatallah			√	Present	Present	Present	He committed to attending. He participates well in the working groups, sections and discussion. He also presents one case from RAP. And present the plan of the RAP on behalf of his colleagues.
5	Saeed Abdulwahed Abdullah Al-Tayeb		√		Present	Present	Present	He committed to attending. He participates well in the working groups, sections and discussion. Despite his working experience which is not related to the course but his interest on the topic of the course are excellent.
6	Ammar Ahmad Abdulhameed Al-Sagheer		√		Present	Present	Present	He committed to attending. He participates well in the working groups, sections and discussion. He also presents one case from RMF. And present the plan of the UWSIU on behalf of his colleagues. Despite his working experience which is not related to the course but his interest on the topic of the course are excellent.

#	Name	Trainer Evaluation			Attendance			Trainer Comments about the Participant
		Good	V. Good	Excellent	1	2	3	
7	Mahfouz Abdul-Aziz Rasam Al-Shamir			√	Present	Present	Present	He committed to attending, and his participation was effective and he gave some examples from previous experience. His information on the course topics is very good, and his initiative to clarify some technical issues is very good.
8	Ahmed Taher Mohammed Al-Husseini		√		Present	Present	Present	He committed to attending, and his participation during the discussion, sections and working groups was fine.
9	Mohammed Mohsen Al-Selwi		√		Present	Present	Present	He committed to attending, and his participation during the discussion, sections and working groups was good.
10	Abdulaziz Ahmed Ahmed Al-Moayed		√		Present	Present	Present	He committed to attending. He participates well in the working groups, sections and discussion. He also presents one case from RMF. And present the plan of the RMF on behalf of his colleagues.
11	Mohammed Abdo Alkhaliq Ghilan		√		Present	Present	Present	He committed to attending, and his participation was good during the discussion, sections working groups and field visit.
12	Yasmin Ali Saleh Humaid		√		Present	Present	Present	She committed to attending. Her participation and interaction in discussion, sections and group work and sections were very good. She apology for attending the field visit.

17 Training Evaluation

#	Contents	Excellent	Very Good	Go-od	Fair	Poor	Total	Percentage
A .General Evaluation								
1	Time allocated for the program	0	1	1	5	6	13	35%
2	The extent of benefit gained from the program	4	6	2	1	0	13	80%
3	Theoretical content of the program	5	4	4	0	0	13	82%
4	Practical application in the program	6	1	6	0	0	13	80%
5	The level of training organization	3	7	3	0	0	13	80%
6	The utilized training tools and means	3	3	6	0	0	12	75%
7	Coffee break	5	3	4	0	0	12	82%
8	The training package	4	5	3	0	0	12	82%
	Total							%74
B .Trainers and Training Material Evaluation								
9	The trainer was well prepared.	7	4	1	0	0	12	90%
10	The trainer's commitment to the schedule	8	4	0	0	0	12	93%
11	The trainer's delivery of the training material	5	5	2	0	0	12	85%
12	The trainer encourages both participation and interaction	6	6	0	0	0	12	90%
13	The trainer uses the educational means efficiently	5	7	0	0	0	12	88%
14	The used visualization means were clear and efficient	5	3	4	0	0	12	82%
15	The content progression is easy to follow	3	6	3	0	0	12	80%
#	Total							%87
16	The trainer's voice is clear	4	9	0	0	0	13	86%
17	The trainer's ability to manage discussions and interventions	2	8	3	0	0	13	78%
18	The topics covered were relevant to my work and interest	7	5	1	0	0	13	89%
	Total							%89
C .Training Location Evaluation								
19	The training hall is suitable and well equipped	3	5		5	0	13	69%
20	The accessibility and closeness of the location	4	6	3	0	0	13	82%
	Total							75%
	Overall Evaluation							80%

18 Pre- and Post-Training Test Results

According to the results of the Pre-Exam and Post-Exam in the table the following results are achieved:

#	Participant's name	Entity	Job	Pre-test (100 grade)	Post-test (100 grade)
1	Salah Ahmed Hamid Mogalles	RAPCMO	Environment and community Officer	82	86
2	Jalal Mohammed Naser Al-Ansi	RAPCMO	Design Engineer	83	86
3	Zaid Ali Yahya Al-Muzaiqer	RAPCMO	Project officer	63	82
4	Amro Waleed Saeed Hebatallah	RAPCMO	Project officer	68	78
5	Saeed Abdulwahed Abdullah Al-Tayeb	PMU–Sana'a	WASH Eng.	81	83
6	Ammar Ahmad Abdulhameed Al-Sagheer	PMU–Sana'a	Consultant	74	83
7	Mahfouz Abdul-Aziz Rasam Al-Shamir	RMF-IU Sana'a	Quality assurance Officer	64	65
8	Ahmed Taher Mohammed Al-Husseini	RMF-IU Sana'a	Technical manager	69	87
9	Mohammed Mohsen Al-Selwi	RMF-IU Sana'a	Environment specialist	60	80
10	Abdulaziz Ahmed Ahmed Al-Moayed	RMF-IU Sana'a	Project Officer	75	82
11	Mohammed Abdo Alkhaliq Ghilan	RMF-IU Sana'a	Eng.	67	87
12	Yasmin Ali Saleh Humaid	RMF-IU Sana'a	Eng.	68	73

19 Results of Pre-Test Analysis

By analyzing the previous tables, we can reach the following results:

1. Pre-Exam average (71%) (good).
2. A number of (3) participants, representing 25%, obtained 62% of the grades at the “fair” level.
3. A number of (6) participants, representing 50%, obtained 70% of the grades at the level of (good).
4. A number of (3) participants, representing 25%, obtained an average percentage of 82% of grades at the level of (very good).

20 Results of Post-Test Analysis

From the previous table, the following results can be drawn:

1. A number of (1) participant, representing 8%, obtained 64% of the grades at the “good” level.
2. A number of (2) participants, representing 17%, obtained 76% of the grades at the level of (good, high).
3. A number of (8) participants, representing 75%, obtained an average percentage of 84% of grades at the level of (very good).
4. In total, the actual grades obtained were (971) grades, and when compared with the full grade (1200) grades, the overall achievement percentage was 81%, and accordingly, the general level of the post-test is (very good).
5. Post-test average (81%) (very good)

21 Course Outputs

Each utility participants presented and discussed a draft-specific plan with strategic and operational objectives. These plans revolved around achieving water and road management, draining and harvesting water from roads in organized methods to protect the road and neighboring areas from the damage of water flowing on them and benefiting from this water. (Participants updated and developed the plans that were presented, based on actual data, and submit them to the organization’s management and include them within the general plan of the utility.).

This plans mentioned in the flowing table below:

The plan with strategic and operational objectives		
No	Utility	Output
1	Rural Roads Development Program (RAP)	<p>Providing a specific plan with strategic objectives as flow:</p> <ol style="list-style-type: none"> 1- Knowledge Exchange with other countries that have success stories in managing roads and water and benefiting from them in water harvesting. 2-. Improving and raising current standards, whether design, environmental or social, for designing roads for water. 3. Building the capabilities of engineers in the utility, and attracting/using available expertise and requesting the provision of data from government agencies. 4. Making agricultural pipes to serve farm irrigation and introducing community contributions 5. Performing periodic maintenance on existing roads and taking into account rain harvesting facilities and water rights. 6. Creating a spillway or diverting the water flow at the culvert outlet to agricultural fields according to water rights.
2	Water and sanitation projects implementation unit for urban cities	<p>Providing a specific plan with strategic objectives: as flow:</p> <ol style="list-style-type: none"> 1. Design and implement of the rainwater drainage networks separate from wastewater networks to prevent the flowing of rainwater drainage in urban areas into sewage networks and connecting it to wastewater treatment plants. 2. Design and implement of structures for collecting, storing and distributing rainwater collected from the street to rainwater drainage network, and this water should be used for garden irrigation the cities. 3. Design and implement of structures for harvesting, storing and distributing rainwater harvested from road surfaces and structures, and utilizing it for irrigation and domestic and local uses.
3	Project Implementation Unit - Road Maintenance Fund	<p>Providing a specific plan with strategic objectives: as flow:</p> <ol style="list-style-type: none"> 1. Conducting training courses for engineers, including the concept of GR4W (Green Roads for Water) within the study materials in the University's College of Civil Engineering department. 2. Educating citizens about the concept of GR4W by involving citizens in the project during the study phase of the project. 3. Preparing in advance the proposal for targeted projects to request a convincing search for funding and including the budget for the concept of green roads for water (GR4W) (including water harvesting structures from road surfaces and adjacent areas within the funding to mitigate water damage to the body of roads and road drainage structures. And from its neighboring areas and benefit from the harvested water. 4. Introducing the necessary technical measures for draining and harvesting water through engineers educating the community during the study period and during the implementation phase. 5. Making special measures for the Beneficiaries Committee to play their role, as well as the relevant government agencies, to resolve disputes, if any.

		6. Intensifying the process of raising awareness among citizens about the project and the importance of following up on maintenance work for structures, with community participation as required.
--	--	--

21.1 General outputs from the participants:

1. Make a plan to take full advantage of rainwater captured from roads for irrigate agricultural crops and raise farmers' income
2. With taking advantage of harvesting rainwater from roads, to increase the possibility of obtaining a new source of water, and at the same time the road is protected from rainstorm damage.
3. Protecting the road from water damage by harvesting water, which reduces the cost of road maintenance.
4. Raising participants' competence, knowledge of environmental aspects, water harvesting and safe drainage, and identification of the types of water discharges from roads.
5. Learn new information about techniques for harvesting rainwater from roads and their construction, and understand the concept of green roads for water.
6. Increase knowledge about design errors in constructions the water drainage from roads and its treatments
7. Gain a general perception of the importance of including water rights for lands that benefit of harvested water from roads and its structures within road studies and design.
8. Conducting the design and implementation of the possibility of distributing water channels and drains from the roads to storage places and places to benefit from this water instead of harming the road and its surrounding areas.
9. Spreading awareness among the community and spreading the culture of harvesting water from roads and benefiting from it.
10. Attention should be paid to including facilities for harvesting water from roads and the environmental and social aspects of the planned roads
11. The possibility of constructing many water harvesting structures from roads, while paying attention to the environmental and social aspects in the upcoming roads planned for their implementation.
12. Know many aspects that were absent and were not taken into account when designing and implementing roads, even though they have great importance and serve the community and provide a source of water to support agriculture.
13. Obtain great and comprehensive knowledge about the issue of benefiting from water harvesting from roads by local communities, which will positively impact on their environmental and social aspects.
14. Identify the types of structures that can be used to harvest rainwater from roads, the relationship of roads with water and how to be use.
15. Identify environmental and societal considerations when designing the structures of harvesting rainwater from roads

16. Identify the types of problems faced the structures rain water harvesting from various types of roads (community, environmental, and service).
17. Identifying multiple cases of damage resulting from neglecting the drainage and harvesting of water from drainage structures and road bodies.
18. It is necessary to involve the community when conducting the study and design of any road to take into account the optimal drainage of water, with taking into account the water rights of the lands around the road. Best practices for harvesting rainwater from roads were also identified.
19. The field trip, which gave participants an opportunity to learn about the structures for drain water from roads and the possibility of harvesting water from them, in addition to the harms of poor drainage efficiency of this water.
20. Identify the idea of using roads to harvest rainwater and take it into account when designing the road and during the environmental and social studies of the roads.
21. Knowing the possibility of working and implementing safer, more stable and less maintenance cost for roads, if the water drainage from the road is well taken into account, and benefited from this water at the surrounding areas of the road.
22. The training course should have connected the roads and water in order to create an appropriate environment in the lives of the residents and their needs for water and to preserve the roads from water damage

21.2 Steps to achieve outputs:

The proposed steps to achieve the outputs of the training course by looking at the level of the participants in the training and the working conditions in their utilities entities can be as follows:

- Updating and developing plans that were presented based on actual data, and submitting them to their utilities management and including them within the general plan of the utilities.
- Adopting at least one implementable goal until the end of the current year, and setting an indicator to measure performance, for example adopting the management of roads, water, and water harvesting in organized ways in one of the roads for which it was decided to maintain. Achieving this goal will be considered a positive indicator for their utilities to adopt the plans and work to implement them.
- Activating a WhatsApp group to exchange experiences and information among participants.
- Implementing workshops on the concepts of road and water management, harvesting water from roads, and related systems and procedures in the region.

22 Results

There is no doubt in the plans that were presented and discussed at the end of the training program, which was for three days, are a clear preliminary vision to reach the achievement of the general purpose of the training and rehabilitation project, and it requires coordination and action by all parties (donors, targets) to achieve the goals covered by the plans. There are several results as follow:

1. Participants attended the training program, representing 3 utilities, and they have understanding and knowledge.
2. Plans were presented that focused on achieving road and water management and water harvesting from roads (Green Roads for Water (GR4W)).

Returns:

Participants have the ability to prepare and implement plans and procedures as required.

Impact:

Because most of the implemented roads did not take into account the harvesting of water from them and the drain of water in an organized manner, during this training program the participants were provided with information, knowledge, examples, exercises and a field visit to a road section to clarify the paramount importance of achieving green roads. So, that the utilities can provide a sustainable service to reach this goal that will have a significant positive impact for participants and their utilities as well.

23 Recommendations of trainees for water and road management:

1. Work on repeating such training
2. Raise awareness among citizens about water harvesting, utilization and exploitation.
3. Financing the relevant authorities for road maintenance and including water harvesting within the fund.
4. Giving the courses enough time to maximize their benefits (increasing the duration from 3 to 6 days)
5. Working on issuing a special manual for green roads (harvesting rainwater from roads) obliging the authorities designing roads to introduce standards for drainage and optimal harvesting of water from roads.
6. The field visit is very important and useful and confirms the course information by examining it in reality
7. It is important to monitor the impact of the course on the trainees after the end of the course and the extent to which what was learned in the course is applied
8. Conduct economic studies of the returns of these projects with the help of funding agencies and the state in implementing these projects

9. Conduct studies on the infrastructure for harvesting rainwater from roads, utilizing this water and distributing it according to water rights
10. Submit a request from the Water and Environment Center to the Rural Roads Program and the Road Maintenance Fund to include provisions for harvesting water from roads in future road projects, which will be approved by UNEPS.
11. With the interest of concerned parties in the environmental and social aspects, water drainage structures from roads, and water harvesting structure from roads, the should be include them in the items of support coming from the World Bank for rural roads.
12. Including the plan for harvesting water from roads in the road maintenance projects that will be launched soon with funding from UNEPS, and it will be an opportunity to apply what was studied in the training course.
13. Maximizing the role of community participation and increasing its effectiveness in the optimal use of water harvested from roads.
14. Adding the issue of draining rainwater from roads from city streets and using it to recharge groundwater and irrigate the central islands of streets and public parks, and creating green areas to improve the general view of the city, in addition to harvesting rainwater from streets and roads in cities will reduce irrigation expenses for road trees and gardens.
15. Work to spread the culture of green roads for water in engineering circles in government agencies to improve and develop models for water harvesting structures.
16. Work to spread awareness among members of society, especially rural agricultural communities, of the importance of the issue of water harvesting and the benefits that arise from it, so that they interact, respond, and take the initiative in making water traps, protecting agricultural land, and using this water in times of drought.
17. The state and local authorities must carry out maintenance measures for the established roads and take into account the harvesting of water from these roads in order to reduce the cost of maintenance in the future.

24 Conclusion:

The “Water and Roads Management” course was implemented during the period from August 28 - August 30, 2023 AD, for period of (3) days, in the Water and Environment Center Hall - Sana'a University, in coordination with UNOPS. Number of (12) participants from (3) parties participated in this course:

No	The entity
1	Rural Roads Development Program (RAP)
2	Water and sanitation projects implementation unit for urban cities
3	Project Implementation Unit - Road Maintenance Fund

The most prominent outcome of the training course was the presentation and discussion of (3) plans centered around achieving water harvesting from roads, managing water and roads to reach green roads for water.

Annex (1): Attendance Sheet

Cont No: 94 August

مشروع بناء قدرات المؤسسات الخدمية في قطاعات الطرق والمياه و المخلفات الصلبة
Capacity Building and Training Program of Local Institutions of Road, Water and Solid Waste Management Sectors
إدارة المياه والطرق - منهجية ميثاقاً - The MM Approach - Water and Road Management

2023 / 8 / 28 الاثنين الموافق

م	الاسم	الجهة	الوظيفة	التفون	حضور	التفون
1	صلاح احمد حميد عقلائ مفس	برنامج تنمية الطرق الريفية	ضابط السلامة البيئية والاجتماعية	770608918	Salah	770608918
2	جلال محمد ناصر العفسي	برنامج تنمية الطرق الريفية	مهندس تصاميم	777035239		777035239
3	زيد علي يحيى المزير	برنامج تنمية الطرق الريفية	ضابط مشاريع	770705630		770705630
4	عمرو وليد سعيد هبة الله	برنامج تنمية الطرق الريفية	ضابط مشاريع	775015008		775015008
5	سعيد عبدالواحد عبدالله الطيب	الوحدة التنفيذية لمشروع المياه والصرف الصحي بالمعدن الحضرية	مهندس مياه واصحاح بيئي	777282050		777282050
6	عمار احمد عبدالحميد الصغير	الوحدة التنفيذية لمشروع المياه والصرف الصحي بالمعدن الحضرية	مهندس استشاري	772030382		772030382
7	محفوظ عبدالعزيز رسام الشمعري	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	مهندس استشاري	737659574		737659574
8	احمد طاهر محمد الصنبي	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	المدير الفني	770838847		770838847
9	عبدالعزيز احمد المويد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	ضابط مشاريع	712098490		712098490
10	محمد عبدالوهد محسن الصلوي	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	اخصائي بيئي	772544414		772544414
11	محمد عبدالخالق غيلان سعيد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	مهندس تصاميم	771221102		771221102
12	ياسمين علي صالح حميد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	مهندس	775285660		775285660

المدرّب: د. شرف الدين عبدالله احمد



مشروع بناء قدرات المؤسسات الخدمية في قطاعات الطرق والمياه والمخلفات الصلبة

Capacity Building and Training Program of Local Institutions of Road, Water and Solid Waste Management Sectors
إدارة المياه والطرق - منهجية ميتامتا - Water and Road Management- The MM Approach - الثلاثاء الموافق 29 / 8 / 2023م

Cont No: 94

August

م	الاسم	الجهة	الوظيفة	التفون	حضور	انصراف
1	صلاح احمد عقلائ مفسن	برنامج تنمية الطرق الريفية	ضابط السلامة البيئية والاجتماعية	770608918		
2	جلال محمد ناصر العنسي	برنامج تنمية الطرق الريفية	مهندس تصاميم	777035239		
3	زيد علي يحيى علي المزيفر	برنامج تنمية الطرق الريفية	ضابط مشاريع	770705630		
4	عمرو وليد سعيد هبة الله	برنامج تنمية الطرق الريفية	ضابط مشاريع	775015008		
5	سعيد عبدالواحد عبدالله الطيب	الوحدة التنفيذية لمشروع المياه والصرف الصحي بالمدن الحضرية	مهندس مياه واصحاح بيئي	777282050		
6	عمار احمد عبد الحميد الصغير	الوحدة التنفيذية لمشروع المياه والصرف الصحي بالمدن الحضرية	مهندس استشاري	772030382		
7	محفوظ عبدالعزيز رسام الشميري	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	استشاري الجودة	737659574		
8	احمد طاهر محمد الحسيني	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	المدير الفني	770838847		
9	عبد العزيز احمد المويد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	ضابط مشاريع	712098490		
10	محمد عبدالودود محسن الصلوي	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	اخصائي بيئي	772544414		
11	محمد عبدالخالق غيلان سعيد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	مهندس تصميم	771221102		
12	باسمين علي صالح حميد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	مهندس	775285660		

المدرّب: د. شرف الدين عبدالله احمد



مشروع بناء قدرات المؤسسات الخدمية في قطاعات الطرق والمياه و المخلفات الصلبة

Capacity Building and Training Program of Local Institutions of Road, Water and Solid Waste Management Sectors
إدارة المياه والطرق - منهجية مياميتا - The MM Approach - إدارة المياه والطرق - منهجية مياميتا

2023 / 8 / 30م

cont No: 94

August

م	الاسم	الجهة	الوظيفة	التلفون	حضور	التصريف
1	صلاح أحمد حميد عقلائ مقلس	برنامج تنمية الطرق الريفية	ضابط السلامة البيئية والاجتماعية	770608918		
2	جلال محمد ناصر العنسي	برنامج تنمية الطرق الريفية	مهندس تصاميم	777035239		
3	زيد علي يحيى العزيفر	برنامج تنمية الطرق الريفية	ضابط مشاريع	7770705630		
4	عمرو وليد سعيد هبةالله	برنامج تنمية الطرق الريفية	ضابط مشاريع	775015008		
5	سعيد عبدالواحد عبدالله الطيب	الوحدة التنفيذية لمشروع المياه والصرف الصحي بالمدن الحضرية	مهندس مياه واصحاح بيئي	777282050		
6	عمار احمد عبدالحميد الصغير	الوحدة التنفيذية لمشروع المياه والصرف الصحي بالمدن الحضرية	مهندس استشاري	772030382		
7	محفوظ عبدالعزيز رسام الشمعيري	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	م. استشاري الجودة	737659574		
8	احمد طاهر محمد الحسيني	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	المدير الفني	770838847		
9	عبدالعزيز احمد المويد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	ضابط مشاريع	712098490		
10	محمد عبدالودود محسن الصلوي	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	اخصائي بيئي	772544414		
11	محمد عبدالخالق عجلان سعيد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	مهندس تصميم	771221102		
12	ياسمين علي صالح حميد	وحدة تنفيذ المشاريع بصندوق صيانة الطرق	مهندس	775285660		

المدرّب: د.شرف الدين عبدالله احمد

Annex (2)

Photos











