The United Republic of Tanzania

The Comprehensive Guidelines

for Irrigation Scheme Development

Volume 3 Operation and Maintenance

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National Irrigation Commission (NIRC)
P.O.Box 6668, Dar es Salaam,
Tanzania

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SECTION 5 GENERAL INFORMATION

SECTION 1 NTRODUCTION

Abbreviations

JICA	Japan International Cooperation Agency
A-CBG	Agricultural Capacity Building Grant
ASDP	Agricultural Sector Development Programme
ASDS	Agricultural Sector Development Strategy
ASPS	Agriculture Sector Programme Support
ASPS-IC	Agriculture Sector Programme Support – Irrigation Component
CDO	Community Development Officer
CBG	Capacity Building Grant
CBOs	Community Based Organizations
CMT	Council Management Team
DADG	District Agricultural Development Grant
DADP	District Agricultural Development Plan
DCT	District Core Team
DED	District Executive Director
D/D	Detailed Design
DDP	District Development Plan
DFT	District Facilitation Team
DIDF	District Irrigation Development Fund
DIMU	Data and Information Management Unit
DIDT	District Irrigation Development Team
DITS	Division of Irrigation and Technical Service
DPDT	District Project Development Team
DPLO	District Planning Officer
DIE	District Irrigation Engineer
EBG	Extension Block Grant
EC	Electric Conductivity
EIA	Environmental Impact Assessment
ESA	Environmental Sensitive Areas
ETo	Evapo -Transpiration
EIRR	Economic Internal Rate of Return
FAO	Food and Agriculture Organization (of the United Nations)
FIRR	Financial Internal Rate of Return
FPRWM	Farmers Participatory Repair Work Manual
F/S	Feasibility Study
GIS	Geographic Information System
GPS	Global Positioning System
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunity Deficiency Syndrome
ICB	International Competitive Bidding
ISD	Irrigation Scheme Development
IO	Irrigators' Organization
IRR	Internal Rate of Return
ISID	Institutional Support to Irrigation Development Project

LGA	Local Government Authority
LGCG	Local Government Capital Development Grant
LoU	Letter of Undertaking
MAFC	Ministry of Agriculture, Food Security and Cooperatives
MOWI	Ministry of Water and Irrigation
MS	Monitoring sheet
NCB	National Competitive Bidding
NEMC	National Environmental Management Council
NGO	Non-Government Organization
NIRC	National Irrigation Commission
NIMP	National Irrigation Master Plan
O&OD	Opportunities and Obstacles to Development
O&M	Operation and Maintenance
PADEP	Participatory Agricultural Development and Empowerment Project
PAP	Participatory Action Planning
PDS	Participatory Diagnostic Study
PFAC	Planning Financial and Administration Committee
PFC	Planning and Financial Committee
PO-RALG	President's Office - Regional Administration and Local Government
RBM-SIIP	River Basin Management and Smallholder Irrigation Improvement Project
RC	Regional Commissioner
RS	Regional Secretariat
SDPMA	Smallholder Development Programme for the Marginal Areas
SMS	Subject Matter Specialist
SWOT	Strength, Weakness, Opportunity and Threat
TDV	Tanzania Development Vision
TOR	Terms of Reference
TIP	Traditional Irrigation Improvement Programme
UTM	Universal Transverse Mercator
VADP	Village Agricultural Development Plan
VAEO	Village Agricultural Extension Officer
VEO	Village Executive Officer
WAEO	Ward Agricultural Extension Officer
WDC	Ward Development Committee
WDP	Ward Development Plan
WDM	Water Distribution Manual
WEO	Ward Executive Officer
WFT	Ward Facilitation Team
RIO	Regional Irrigation Office
ZIE	Zonal Irrigation Engineer
ZRC	Zonal Review Committee

Measurement Units

Extent

cm^2 = Square-centimeters (1.0 cm x 1.0 cm)
m^2 = Square-meters (1.0 m x 1.0 m)
km^2 = Square-kilometers (1.0 km x 1.0 km)
ha = Hectares (10,000 m2)
ac = Acres (4,046.8 m2 or 0.40468 ha.)

Length

mm = Millimeters
cm = Centimeters (cm = 10 mm)
m = Meters (m = 100 cm)
km = Kilometers (km = 1,000 m)

Currency

Tsh = Tanzanian Shillings

Volume

cm^3 = Cubic-centimeters
(1.0 cm x 1.0 cm x 1.0 cm or 1.0 m-lit.)
m^3 = Cubic-meters
(1.0 m x 1.0 m x 1.0 m or 1.0 k-lit.)
lit (l) = Liter (1,000 cm3)
MCM = Million Cubic Meter

Weight

gr = Grams
kg = Kilograms (1,000 gr.)
ton = Metric ton (1,000 kg)

Time

sec = Seconds
min = Minutes (60 sec.)
hr = Hours (60 min.)

Application of the Guidelines

1. What are described in the Guidelines?

The Guidelines focus on irrigation schemes development (gravity irrigation schemes, pump irrigation schemes for which the water source is a river, pond/lake, or water harvesting scheme) considering currently available budget for Irrigation Scheme Development (ISD) as well as current experience levels of the district staff. The Guidelines consist of four parts which are "Formulation Guidelines", "Implementation Guidelines", "Operation and Maintenance Guidelines" and "Training Guidelines". The Formulation Guidelines show a quick and practical way of formulating irrigation schemes in the ISD.

These Guidelines on the implementation stage describe how to proceed with each step of the implementation stage of irrigation scheme development (ISD).

The irrigation schemes formulated based on the Formulation Guidelines will be included in the ISD proposal through the procedure of ISD planning and approval within the district. After the ISD proposal is submitted to PO-RALG and the budget for ISD is approved and secured, the irrigation scheme development under ISD will proceed to the implementation stage to be promoted in accordance with the Implementation Guidelines, Operation & Maintenance Guidelines, and Training Guidelines respectively. More specifically, these Guidelines on the implementation stage describe a series of workflow including:

- Participatory action planning
- Registration of irrigators' organization (IO)
- Study and designing
- Tendering and contract awarding, including consulting services
- Construction work
- Operation and maintenance
- Capacity development for the community
- Monitoring and evaluation

In addition, these Guidelines help confirm necessary works and procedures in each step by means of flowcharts and checklists, and help proceed with each step of the implementation stage smoothly.

2. Why the Guidelines were prepared?

Preparation of DADP was launched in 2003 as one of the key activities presented in the Agricultural Sector Development Programme (ASDP) compiled in 2002. However, the ISD proposed by districts did not sufficiently present the appropriateness of their development plans, hence "Preparation of Guidelines for Irrigation Scheme Formulation for ISD" was selected as one of the priority supporting programmes in the National Irrigation Master Plan Study (NIMP) in 2002. In 2006, DADP Guidelines, superordinate guidelines to the Formulation Guidelines, were revised, and in accordance with its revision, the Formulation Guidelines were also revised through the applicability test conducted from March 2007 to June 2007.

This was coupled with a workshop and residential training sessions held from June 2007 to December 2007 on the actual operation of the revised Formulation Guidelines.

On the other hand, the guidelines which cover the implementation stage, including design, tendering and construction work, and O&M stage, operation, maintenance and farmers' organization, have been added.

The guidelines aim at:

- Defining necessary works and procedures to proceed smoothly with implementation, operation and maintenance after the ISD formulation and planning stage,
- Helping the Head Of Department dealing with Irrigation(HDI) and other district staff in charge of irrigation scheme development under the ISD to understand the activities to be practiced as government side persons, and
- Helping the Head of Department dealing with Irrigation and other district staff give community members and other stakeholders explanations and advice on necessary activities.

3. To whom the Guidelines were prepared?

The targets of these guidelines are the Head Of Department dealing with Irrigation, District Irrigation Engineer, Irrigation Technician, other district staff and farmers/community who are directly involved in formulation, implementation and O&M of irrigation scheme development. Zonal Irrigation Office/ Regional Irrigation Office (ZIO/RIO) staff are also a primary target of these guidelines because they are in charge of backstopping the districts, giving explanations and instructions on these guidelines to the district staff.

4. How the Guidelines were prepared?

A participatory approach was adopted for the preparation of these Guidelines. The Formulation Guidelines was revised through applicability tests activities in four model districts, the Guidelines were improved by District staff, ZIO/RIO staff and National Irrigation Commission (NIRC).These guidelines on the implementation stage, after being drafted, were improved, revised and finalized through discussions at workshops among district staff, ZIO/RIO staff and other stakeholders, and through the verification study in two model sites.

5. What is the special feature of the guidelines?

The most outstanding feature of these guidelines are: Quick, Systematic and Practical Irrigation Development Planning in ISD for the Formulation Guidelines, and Easy, Practical and Sustainable for the implementation of Irrigation Scheme Development for other Guidelines respectively.

Terminology for the Guidelines

In these guidelines, the following terms are defined as shown below.

1. Team and Committee	
District Irrigation Development Team (DIDT)	One team formed in the district to facilitate the irrigation scheme development (ISD). The team will be composed of Head Of Department dealing with Irrigation as chairperson, District Irrigation Engineer, Irrigation Technician, Agriculture extension officer, Community development Officer and other relevant staff of the District Office. Participation of Ward leaders, Village leaders, representative farmers, and other stakeholders as determined by district council and NGO will be desirable.
Zonal Review Committee (ZRC)	A ZRC will be formed in each Zonal Irrigation Office/Regional Irrigation office (ZIO/RIO) to assess and endorse the proposed irrigation scheme development (ISD) formulation prepared by DIDT. The team will consist of the Zonal Irrigation Engineer as chairperson and experts in various fields such as irrigation, agriculture, soil science, and environment.
District Council	Council consisting of members of District Assembly.
District Council	Superintending Board for Tendering approved by the District Council.
Tender Evaluation Team	Special Team for Tender Evaluation on District based Tendering consisting of members nominated by the District Council Authority.
Irrigators' Organization (IO)	Association or cooperative society consisting of irrigators in the projected irrigation scheme.
Irrigators' legal entity	Irrigators' organization which has been registered as a legal entity - irrigators' association under National Irrigation Act (NIA).

2. Survey and Planning	
Quick Site Inspection	The site survey to be conducted for all the irrigation schemes in the district to choose high potential scheme(s) for preliminary planning.
Field Survey	The site survey to be conducted for irrigation schemes selected through screening.
Preliminary Planning	The planning for irrigation schemes selected through screening.
Participatory Action Planning (PAP)	The participatory action planning is intended to give an opportunity to all stakeholders of the project to interact to discuss and jointly make a plan of action for preparing the project.

Participatory Diagnostic Study (PDS)	The participatory diagnostic study aims at diagnosis of the opportunities available to the stakeholders as well as the constraints blocking the exploitation of these opportunities to understand current situations which the stakeholders can observe surrounding the scheme and the village.
Participatory Design	The participatory design aims at coming up with the solutions to the problems identified by the irrigators' as a result of the participatory diagnostic study, to confirm their technical feasibility.
Feasibility Study (FS)	The feasibility study forms an integral part of a project proposal, examining the financial, social and environmental feasibility of the project, to enable the ISD financiers to make an investment decision.
Detailed Design /Tender Documentation	The detailed design and the tender documentation aim at defining the detailed specifications of the proposed intervention to permit a final timeframe and cost estimates to be prepared to proceed to the subsequent tendering and procurement procedure.

3. Reports and Documents	
Quick Site Inspection and Screening	The report to be prepared by DIDT describing the results of screening. The report should be submitted to ZRC for assessment and endorsement.
Screening Endorsement Letter	The letter to be prepared by ZRC to endorse the results of screening conducted by district.
Confirmation Letter on the Proposed Area	The letter to be prepared by the village government to confirm that villagers agreed on the selection of the proposed area (area to be considered in the preliminary planning).
Irrigation Scheme Formulation Plan Report	The report to be prepared by DIDT containing all the results of the field survey, preliminary planning, and prioritization of the selected schemes along with the district supporting programme. All completed data forms and maps of the selected schemes should be attached to the report.
Validation and Agreement Letter	The letter prepared by ZRC to validate and agree on the results of the irrigation development planning conducted by the district.
Feasibility Study Report	The report to be prepared by the district, or ZIO/RIO or a private consultant
Detailed Design Report	The report to be prepared by the district, or ZIO/RIO or a private consultant
Tender Documents	The document/forms to be prepared by the district, or ZIO/RIO or a private consultant entrusted by the district.

4. Map	
Village Resource Map	The map prepared by villagers showing resources of the village, such as river, agricultural land etc.
Present situation Map	The map prepared by DIDT based on the village resource map. It shows also resources, but their exact locations (coordinates) are measured by handheld GPS then plotted on the graph paper.
Scheme Development Map	The map prepared by DIDT based on the present situation map. It shows village resources but also the locations of any proposed intakes, canals, roads, etc.

5. Area	
Potential Area	Total area which is technically feasible, economically and financially profitable, socially viable, and environmentally acceptable that is irrigated or capable of being irrigated on the bases of water availability, land availability, and suitability.
Cultivated Area	The area currently cultivated in the potential area.
Present Irrigated Area	The area currently irrigated in the cultivated area.
Present Rainfed Area	The area currently not irrigated in the cultivated area.
Proposed Area	The area to be considered in preliminary planning. The area should be selected by villagers as the first priority area in the field survey meeting, and a confirmation letter on the proposed area shall be sent to the district office by the village government.
Irrigable Area in Rainy Season	The area that can be irrigated in the wet season.
Irrigable Area in Dry Season	The area that can be irrigated in the dry season.
Development Area	The area to be developed (area to be provided irrigation and drainage facilities).
Command Area of the Main Canal	The area irrigated from the main canal. Normally, it is the same as the development area, except when the proposed development is an extension of an existing canal. For an extension scheme, the command area of the main canal consists of the existing area plus the development area (extension area).

6. Irrigation System	
Irrigation Scheme	Any irrigation system that meets one of the following is recognized as a single irrigation scheme: 1) The irrigation system has several canals conveying water from one intake. 2) The irrigation system has several intakes but the canals from the intakes are connected. 3) The irrigation system has several intakes with scattered canals but the intakes and canals are situated within one or more village.
Traditional Irrigation Scheme	Irrigation schemes that have been initiated and operated by farmers themselves, with no intervention from external agencies.  Traditional Irrigation Scheme
Improved Traditional Irrigation Schemes	Irrigation schemes that have been initiated and operated by Semi-subsistence farmers themselves and on which there has subsequently been some intervention by an external agency in the form of construction of a new diversion structure.
Modern Irrigation Schemes	Formally planned, designed and fully developed smallholder scheme in which full irrigation facilities have been provided by external agencies with or without some contribution from the beneficiaries, and in which there is usually a strong element of management provided by the government or other external agency.
Water Harvesting Schemes	Irrigation schemes that subsistence farmers have themselves introduced using simple techniques to artificially control the availability of water to crops. Includes flood recession irrigation schemes.

7. Type of Irrigation Scheme

Gravity	An irrigation scheme in which water is supplied to agricultural land only with gravity force.
Pump (river)	The irrigation scheme for which the water source is a river and water is abstracted through pump.
Pump (lake/pond)	An irrigation scheme for which the water source is a lake/pond and water is abstracted through pump.
Rain water harvesting	An irrigation scheme that subsistence farmers have themselves introduced using simple techniques to artificially control the availability of water to crops. Includes flood recession irrigation schemes.
Groundwater	An irrigation scheme in which the water source is groundwater. Groundwater irrigation is not handled in the guidelines, since it needs special hydro-geological study. It is recommended that groundwater irrigation schemes be formulated in consultation with the ZIO/RIO.
Dam	An irrigation scheme in which a dam is the water source. Dam irrigation is not handled in the guidelines, since it requires special engineering studies. It is recommended that dam irrigation schemes be formulated in consultation with the ZIO/RIO.
Treadle pump	A treadle pump is a pump to lift water by pedal power. Treadle pump irrigation is not handled in the guidelines as it should be installed by farmers themselves, not the district government. However, promotion of treadle pumps can be emphasized and proposed in the ISD.

8. Required Works	
Rehabilitation	Works to recover the function of existing irrigation and drainage facilities up to the original level without changing irrigation system (not changing traditional or improved traditional system to a modern system).
Improvement	Works to enhance the function of existing irrigation and drainage facilities by changing the irrigation system (changing traditional or improved traditional system to modern system).
New Development	Works to develop a new irrigation and drainage system by providing new facilities (new irrigation and drainage facilities provision for a scheme where there are no existing facilities).
Extension	Works to extend the irrigation area from an existing upstream area to a non-developed downstream area.

Drainage	Works to improve the drainage condition of the scheme by providing new drainage facilities or improve existing drainage facilities without providing irrigation facilities (no irrigation works, only drainage works).

9. Interview Survey	
Household	A family unit managed under one financial control.
Anticipated negative impact	A bad influence that might occur because of a proposed irrigation development. Environmental problems not related to irrigation development (such as soil erosion under rainfed condition) are not "anticipated negative impact".
Water conflict within the scheme/village	Competition for limited water resources among villagers within the same scheme or village.
Water conflict between other schemes/village	Competition for limited water resources between different schemes or different villages.
Land conflict	Competition for limited land resources among villagers or between agriculturists and pastoralists.

10. Equipment	
Handheld Global Positioning System (GPS)	Equipment used to identify the geographical location of a point using satellite positioning. Horizontal measuring error of handheld type GPS is about 5-15 m, so while not suitable for measuring very small areas, handheld GPS is good enough for irrigation scheme formulation.  A Type of Handheld GPS

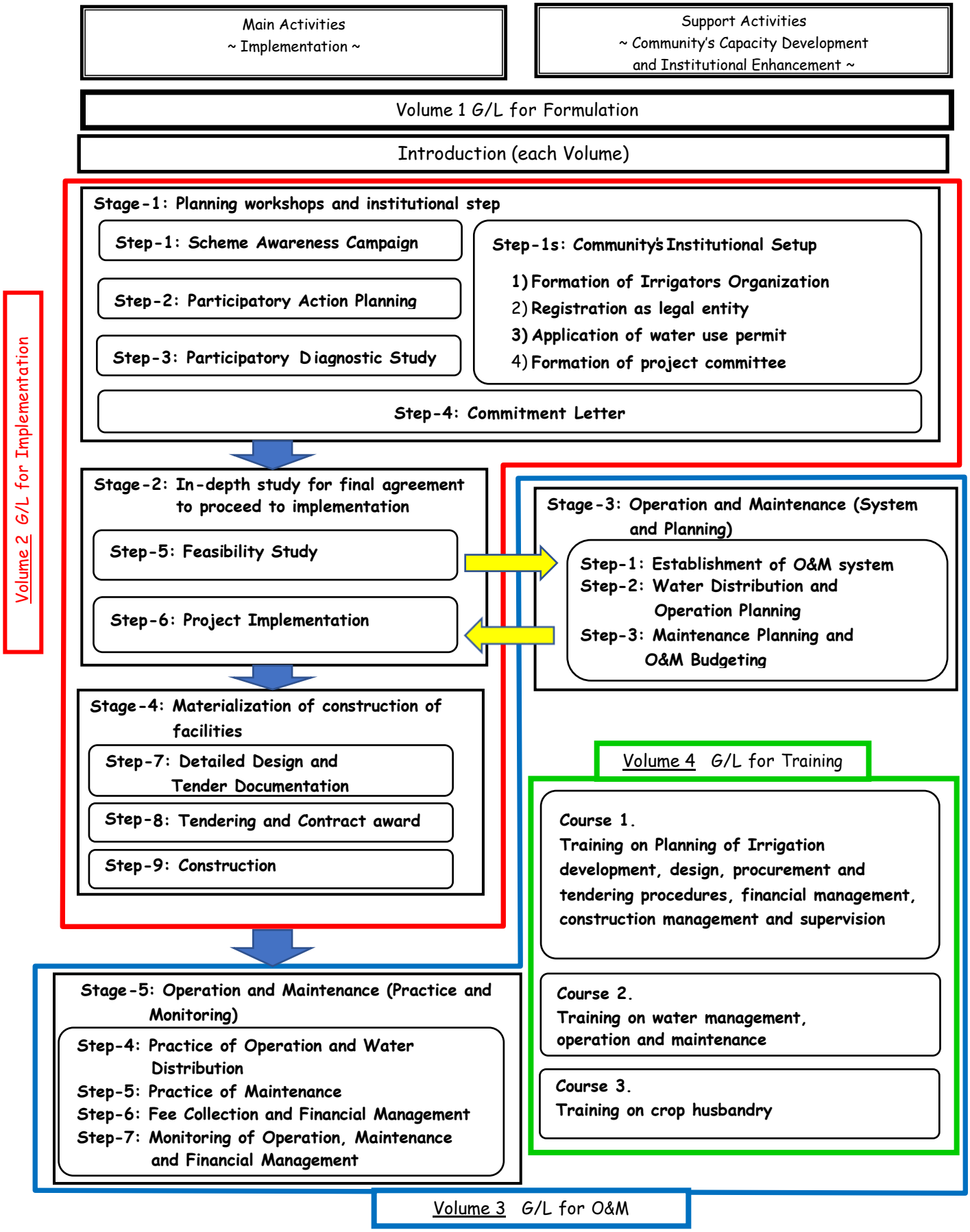
Handheld Electric Conductivity (EC) Meter	Equipment used to measure salinity, one of the major factors of water quality that must be checked. If salinity of the water is high, the EC meter shows a high value (high salt concentration).  A Type Handheld EC Meter

11. Database System	
National Irrigation Database	A database system that has been established in the National irrigation Commission (NIRC) for storing information about irrigation. It has four major functions: 1) Input data, 2) Output data, 3) Scheme maps an d 4) library. Data and information stored in the database can be provided to users of the guidelines upon request to the NIRC
Irrigation Geographic Information System (GIS)	A system established specifically for irrigation in the NIRC. It was prepared mainly using materials employed for the analysis of the potential Area for irrigation development. It consists of information on various types of general features (administration boundaries, rivers, and roads) along with more specific information such as agro-ecological zones, protected areas, land cover, land units and soil types. It can therefore be utilized for evaluating the irrigation potential of a proposed scheme. Data and information stored in the GIS can be provided to users of the guidelines upon request to the NIRC.

SECTION 2 STEPS

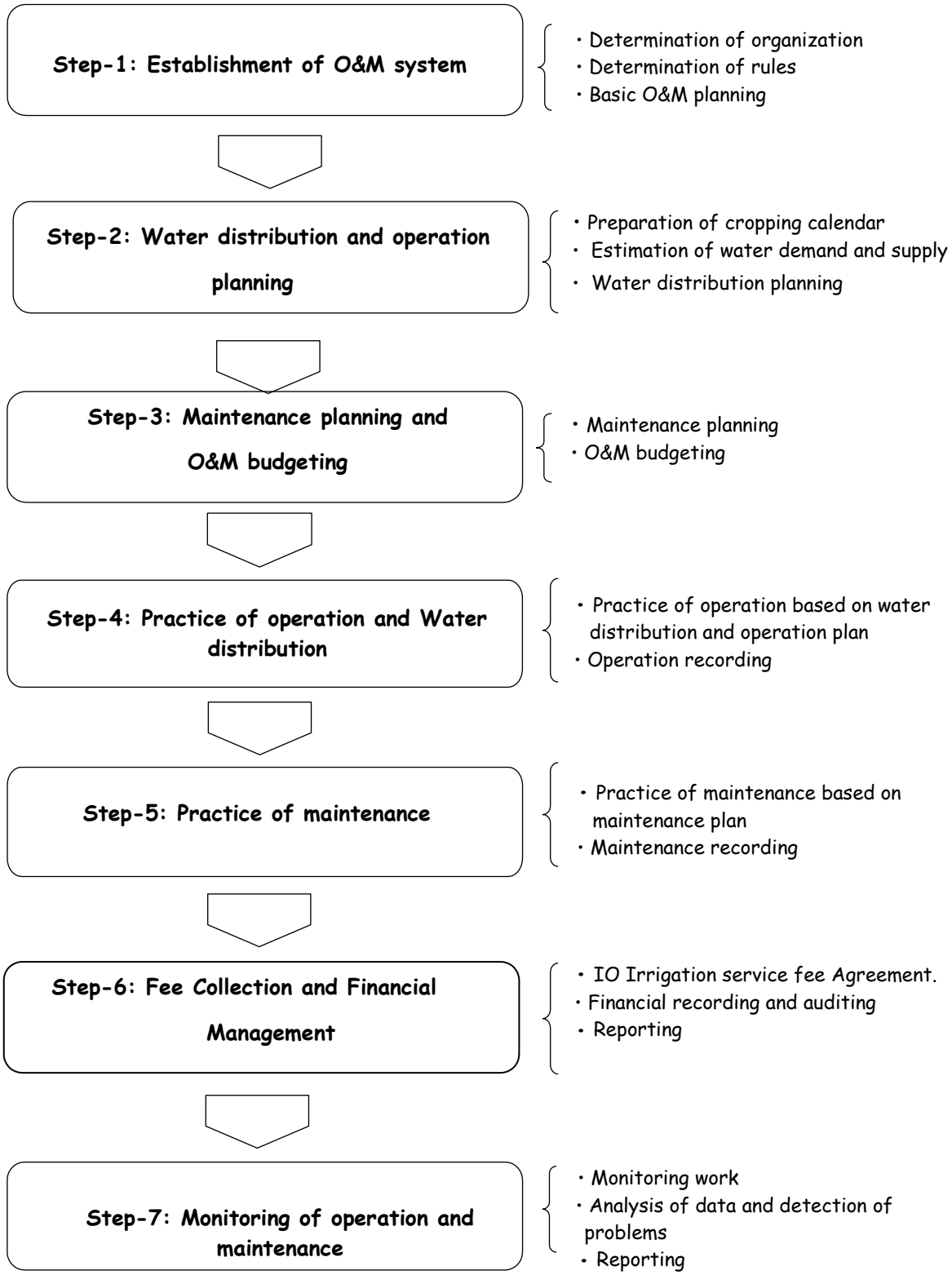
Outline of the steps – Step-1 to Step-9 and O&M

The main body of the guidelines is divided into four Volumes
– Formulation, Implementation, O&M and Training – as shown below:



Outline of the steps for operation and maintenance

The steps to be followed in the work of operation and maintenance are outlined in the flow chart below:



Step-1: Establishment of O&M System

Key Message

The irrigators' organization will make decisions on the basic structure for operating and maintaining irrigation facilities and other related facilities properly

Why is the work required?

Determining the basic structure for operation and maintenance activities will contribute to effective and efficient management of the irrigation facilities for the sustainability of the scheme

Key for the success of the work

The IO members understand the importance of establishing the basic O&M structure, and reaching an agreement on the basic operation and maintenance planning

Required inputs

1. Facilitator: District Irrigation Development Team (DIDT), RS, ZIO/RIO as required
2. Management Committee and other members of the irrigators' organization (IO)
3. Feasibility Study Report
4. Training material on water management, operation and maintenance, provided by DIDT in collaboration with ZIO/RIO and other related training Institutions
5. Flip chart, marker pens, masking tape, notebook, pencils, erasers, pencil sharpeners, triangular rule, straight rule and other stationery
6. O&M Training manual for scheme facilitators.
7. Basic operation plan (**Form-1**)
8. Water distribution diagram prepared at the Detailed Design (DD) stage
9. Basic maintenance plan (**Form-2**)
10. Operation and maintenance budgeting (**Form-3**)
11. Operation record (**Form-4**)
12. Maintenance record (**Form-5**)
13. Financial record (**Form-6**)
14. Reporting format (**Form-7**)
15. Water Distribution Manual (WDM)

How is the work carried out?

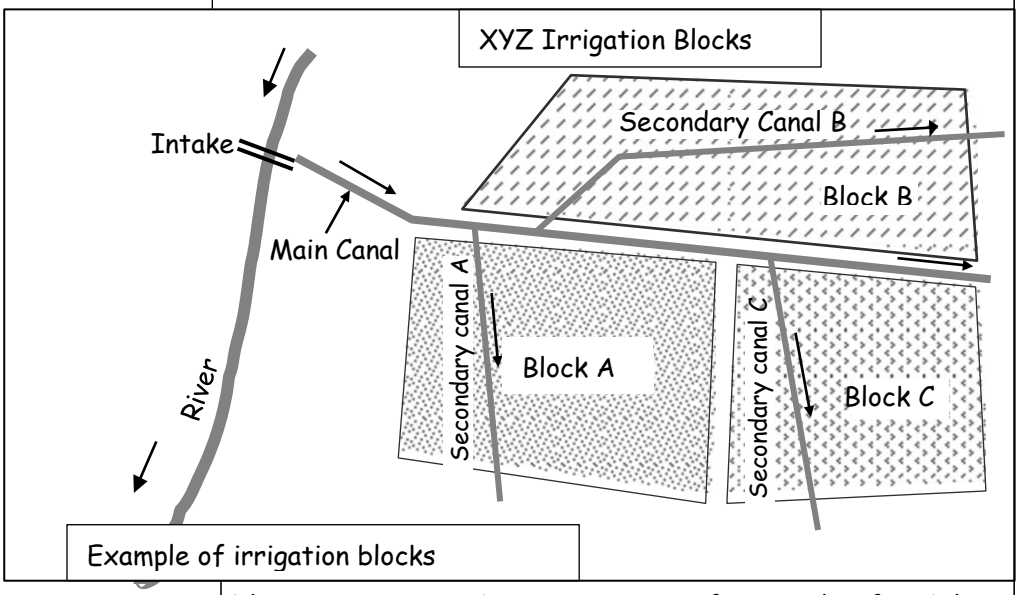
The District Irrigation Development Team (DIDT) in collaboration with RS and ZIO/RIO will organize the training session with the beneficiaries, and will facilitate and train the Management Committee and other members of the irrigators' organization (IO) so that the IO members can go through the following sub-steps by themselves.

The DIDT will provide necessary assistance in IO's activities upon request from the Management committee.

Also, the DIDT will receive the copies of the final outputs of Form-1 to Form-7 from the Management Committee so that the DIDT can provide support to the IO's activities of water management, operation and maintenance in the future when necessary.

Sub-step 1 prepare for a general meeting for operation and maintenance	The Management Committee will make arrangements for a general meeting for discussions on operation and maintenance system

	The agenda items for the general meeting will be: • Composition of IO - Organization chart - Election of subcommittee members, if necessary - Assignment of water master(s) • Rules of operation and maintenance - Concept of operation and maintenance system - Water distribution and operation planning - Maintenance planning - Operation and maintenance budgeting - Obligation of paying irrigation service fee of a minimum 5 percent of average yield in a scheme - Method of problem solving, decision making and conflict management - Method of financial management • Method of recording and reporting - Recording formats and methods of recording; operation record, maintenance record, and financial record - Reporting formats and methods of reporting when problems arise • Method of monitoring
Sub-step 2 Preparation for the general meeting (1) - Composition of IO and concept of O&M system	The Management Committee will prepare a proposed organization chart, following the instructions given in **Technical Guidance** (**Explanatory Note 1) and** O&M Training manual for scheme facilitators **(MAFC, 2013**,) with the assistance of DIDT members. Also, the Management Committee will have to explain the concept of operation and maintenance system to IO members at the general meeting. The Management Committee should read **Technical Guidance** (**Explanatory Note 1)**, and prepare for such explanation.

(2) - Basic operation planning	The Management Committee will prepare a proposal of the basic operation plan and modified water distribution diagram, using **Form-1**, and following the instruction given in **Technical Guidance(Explanatory Note 1),** O&M Training manual for scheme facilitators **(MAFC, 2013) and WDM (NIRC, 2017),** in collaboration with the some IO members. The irrigation blocks will be usually determined by secondary canals, groups of tertiary canals or tertiary canals.  The Management Committee can refer to the feasibility study report for basic operation planning.
(3) - Basic maintenance planning	The Management Committee will prepare a proposal of the basic maintenance plan, using **Form-2**, and following the instruction given in **Technical Guidance** (**Explanatory Note 1)**, with the assistance of DIDT members. The Management Committee can refer to the feasibility study report for basic maintenance planning
(4) - Operation and maintenance budgeting	The Management Committee will prepares a proposal of the operation and maintenance budget for one or two seasons, using Form-3, with the assistance of DIDT members. The O&M budget for one or two seasons shall be based on the basic operation plan and the basic maintenance plan prepared in Sub-step 3 and Sub-step 4. Management Committee will propose the appropriate costs of the Irrigation service fee **NIA (5), 2013** based on the estimated operation and maintenance cost. Management Committee can refer to the feasibility study report for operation and maintenance budgeting

(5) – Other issues	The management have to explain the methods of problem solving, decision making, conflict management, financial management, recording and reporting formats to IO members at the general meeting. The Management Committee should read **Technical Guidance** (**Explanatory Note 1)**, and prepare for such explanation. The responsible persons for keeping records using **Form-4** to **Form-6** are as follows: • **Form-4**: Operation record →persons in charge of managing operation – for example, water management subcommittee members and each of gate operators • **Form-5**: Maintenance record →persons in charge of managing maintenance – for example, maintenance subcommittee members • **Form-6**: Financial record →persons in charge of managing financing – for example, accountant (or treasurer) and finance subcommittee members Every IO member can use Form-7: Reporting format when problems arise and he/she would like to report about the problems to the management committee and/or the general meeting
(6) – Preparation for presentation at general meeting	For presentation at the general meeting, the management committee will prepare flip charts of the prepared forms, using triangular rules or straight rules, with the assistance of DIDT members Also, the management committee will review the training material on water management, operation and maintenance provided by the District Irrigation Development Team (DIDT), and prepare some flip charts if necessary, with the assistance of DIDT members.
Sub-step 3 Holding the general meeting – discussion and decision on operation and maintenance system	At the general meeting, the management committee will facilitate the discussion and decision on the following: • Composition of IO - Organization chart - Election of subcommittee members, if necessary - Assignment of gate operator(s) • Rules of operation and maintenance - Concept of operation and maintenance system - Water distribution and operation planning • Maintenance planning

	- Operation and maintenance budgeting - Obligation of paying O&M fees - Method of problem solving, decision making and conflict management - Method of financial management • Method of recording and reporting - Recording formats and methods of recording – operation record, maintenance record, and financial record - Reporting formats and methods of reporting when problems arise
Sub-step 4 Compilation of minutes and forms by the general meeting	The management committee will prepare a final version of the following on flip charts or a notebook, using triangular rules or straight rules, with the assistance of DIDT: • Organization chart and composition of subcommittees • **Form-1**: Basic operation plan • **Form-2**: Basic maintenance plan • **Form-3**: Operation and maintenance budgeting • **Form-4** to **Form-7**: Recording and reporting formats The management committee will keep the record of the general meeting
Sub-step 5 Submission of copies of final outputs of organization chart and Form-1 to Form-7 to the DIDT	The management committee will submit the finalized organization chart and Form-1 to Form-7 to the DIDT so that IO members can receive assistance of the DIDT when it is necessary.

Results

The basic structure of the organization and the Operation & Maintenance system are decided upon in order to ensure efficient and effective O&M activities in the future.

More specifically, the following are finalized for use in water management, operation and maintenance for the coming seasons:

- Organization chart of IO, and composition of subcommittees
- **Form-1**: Basic operation plan
- Modified water distribution diagram
- **Form-2**: Basic maintenance plan
- **Form-3**: Operation and maintenance budgeting
- **Form-4** to **Form-7**: Recording and reporting formats

Cited Reference

1. NIRC, (2017) Manual for Water Distribution in Irrigation Schemes (Version-1),
2. MAFC, (2013) Operation and Maintenance Training Manual for Scheme Facilitators,.
3. NIRC, (2013) The National Irrigation Act section five
4. NIRC ,(2015) National Irrigation regulation.
5. NIRC , (2018) National Irrigation Master plan.

Step-2: Water Distribution and Operation Planning

Key Message

The irrigators' organisation (IO) members will prepare the cropping calendar, gain their understanding for water demand and water supply, and prepare an irrigation schedule and a plan of water distribution

Why is the work required?

Proper irrigation scheduling and water distribution planning based on the agreed cropping calendar and the appropriate data of expected water demand and supply are the basis of the proper water management.
Also, proper water management based on appropriate data will provide useful data for future irrigation planning and water management.

Key for the success of the work

The IO members should understand the importance of cropping calendar, data of expected water demand and supply, and reach an agreement on the water distribution planning.

Required inputs

1. Facilitator: District Irrigation Development Team (DIDT), RS, ZIO/RIO as required
2. Management committee and other members of irrigators' organization (IO)
3. Feasibility study report
4. Past irrigation records, if any
5. Training material on water management, operation and maintenance, provided by the DIDT, RS, ZIO/RIO and other relevant training institutions
6. Flip chart, marker pens, masking tape, notebooks, pencils, erasers, pencil sharpeners, triangular ruler, straight ruler, calculator and other stationery
7. Basic operation plan (**Form-1**)
8. Modified water distribution diagram
9. Cropping calendar (**Form-8**)
10. Calculation sheet for water demand in each month (**Form-9**)
11. Estimation of water supply in the coming seasons (**Form-10**)
12. Irrigation schedule and water distribution plan (**Form-11**)
13. Water Distribution Manual
14. O&M Training Manual for scheme facilitators

How is the work carried out?

The District Irrigation Development Team (DIDT) in collaboration with RS &ZIO/RIO will organize the training session with the beneficiaries, and will facilitate and train Management committee members and other members of the irrigators' organization (IO) so that the IO members can go through the following sub-steps by themselves.

The DIDT will provide necessary assistance in IO's activities upon request from the Management committee.
Also, the DIDT will receive the copies of the final outputs of Form-1, Form-8 to Form-11 from the Management committee so that the DIDT can provide support to the IO's activities of water management, operation and maintenance in the future when necessary.

Sub-step 1 Preparation for the general meeting for water distribution and operation planning	The Management committee will make arrangements for the general meeting for discussions on water distribution and operation planning for a year and/or for a season. In the general meeting, the irrigation schedule and plan of water distribution will be discussed and decided for the coming one or two seasons. The agenda items for the general meeting are: • Division of the whole irrigation area into several irrigation blocks • Preparation of cropping calendar • Estimation of water demand and water supply • Irrigation scheduling and water distribution planning • Modified water distribution diagram Also, the Management committee will request the assistance of the District Irrigation Development Team (DIDT) if necessary.
Sub-step 2 Preparation for general meeting (1) – Review of basic operation plan	The Management committee will review, modify if necessary, and prepare a proposal of the basic operation plan, using **Form-1**, with the assistance of DIDT members.
(2) – Cropping calendar and pattern of planting	The Management committee will prepare a proposal of the cropping calendar and pattern of planting, using **Form-8** and following the instruction given in **Technical Guidance(Explanatory Note 2)**, O&M Training Manual for scheme facilitators (MAFC, 2013) and WDM (NIRC, 2017) with the assistance of DIDT members.
(3) – Estimation of water demand	The management committee will estimate the expected water demand of the whole irrigation area, using **Form-9** and following the instruction given in **Technical Guidance(Explanatory Note 3)**, WDM (NIRC, 2017) and with the assistance of DIDT members.
(4) – Estimation of water supply in the coming seasons	The management committee will estimate the expected water supply from the water source, using **Form-10** and following the instruction given in the footnote of **Form-10**, with the assistance of DIDT members.
(5) – Irrigation scheduling and water distribution planning	The management committee will prepare a proposal on irrigation scheduling and water distribution planning, using **Form-11** following the instruction given in the footnote of **Form-11**, O&M Training Manual for scheme facilitators (MAFC, 2013) and WDM (NIRC, 2017) with the assistance of DIDT members.
(6) – Preparation for presentation at general meeting	For presentation at the general meeting, the management committee will prepare flip charts of the prepared forms, using triangular rules or straight rules, with the assistance of DIDT members.

	Also, the management committee will review the training material on water management, operation and maintenance provided by the District Irrigation Development Team (DIDT), and prepare some flip charts if necessary, with the assistance of IO members
Sub-step 3 Holding a general meeting – Discussion and decision on water distribution and operation planning	At the general meeting, the management committee members will facilitate the discussion and the decision on the followings: ・Division of the irrigation area into irrigation blocks ・Cropping calendar ・Expected water demand and supply ・Irrigation schedule and plan of water distribution ・Modified water distribution diagram
Sub-step 4 Compilation of minutes and forms by the general meeting	The management committee will prepare a final version of the following on flip charts or a notebook, using triangular rules or straight rules, with the assistance of IO members: ・**Form-1**: Basic operation plan ・**Form-8**: Cropping calendar ・**Form-9**: Calculation sheet for water demand in each month ・**Form-10**: Estimation of water supply in the coming seasons ・**Form-11**: Irrigation schedule and water distribution plan The management committee will keep the record of the general meeting.
Sub-step 5 Submission of copies of final outputs of **Form-1**, **Form-8** to **Form-11** to DIDT	The management committee will submit the finalised**Form-1**, **Form-8** to **Form-11** to the DIDT so that the IO members can receive the assistance of the DIDT when it is necessary. .
<u>Results</u>	
The irrigation schedule and the plan of water distribution are decided for the coming one season or the coming two seasons at the general meeting of the irrigators' organization (IO). More specifically, the following are finalized for use in water management for the coming season(s): ・**Form-1**: Basic operation plan ・Finalized water distribution diagram ・**Form-8**: Cropping calendar ・**Form-9**: Calculation sheet for water demand in each month ・**Form-10**: Estimation of water supply in the coming seasons ・**Form-11**: Irrigation schedule and water distribution plan	

Cited Reference

NIRC, (2017) Manual for Water Distribution in Irrigation Schemes (Version-1).

MAFC, (2013) Operation and Maintenance Training Manual for Scheme Facilitators.

Step-3: Maintenance Planning and O&M Budgeting

Key Message

The IO will make a concrete plan of maintenance activities for one or two seasons, and prepare a budget plan for operation and maintenance

Why is the work required?

Effective maintenance work can be done through appropriate planning of activities as well as identification of necessary resources, including fund, materials and labour

Key for the success of the work

The IO members understand the importance of maintenance work, and express their intention to participate in the maintenance work.

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Required inputs

1. Facilitator: District Irrigation Development Team (DIDT), RS, ZIO/RIO as required
2. The Management committee and other members of irrigators' organization (IO)
3. Training material on water management, operation and maintenance, provided by DIDT, ZIO/RIO and other relevant training institutions
4. Flip chart, marker pens, masking tape, notebook, pencils, erasers, pencil sharpeners, triangular rule, straight rule, calculator and other stationery
5. Basic maintenance plan (**Form-2**)
6. Operation and maintenance budgeting (**Form-3**)
7. Maintenance plan (**Form-12**)
8. O&M Training Manual for Scheme Facilitators
9. Farmers Participatory Repair Work Manual (FPRWM)

How is the work carried out?

The District Irrigation Development Team (DIDT) in collaboration with RS & ZIO/RIO will organize the training session with the beneficiaries, and will facilitate and train management committee and other members of the irrigators' organization (IO) so that the IO members can go through the following sub-steps by themselves.

The DIDT will provide necessary assistance in IO's activities upon request from the management committee

Also, the DIDT will receive copies of final outputs of Form-2, Form-3 and Form-12 from the management committee so that the DIDT can provide support to the IO's activities of water management, operation and maintenance in the future when necessary.

Sub-step 1 Preparation for the general meeting for Maintenance Planning and O&M Budgeting	The management committee will make arrangements for the general meeting for discussions on maintenance planning for a year and/or for a season. The agenda items for the general meeting are: • Specific maintenance planning for one or two seasons • O&M budgeting for one or two seasons Also, the management committee will request the assistance of the **District Irrigation Development Team (DIDT) if** necessary.
Sub-step 2 Preparation for general meeting (1) – Basic maintenance planning	The management committee will review, modify if necessary, and prepare a proposal of the basic maintenance plan, using **Form-2**, with the assistance of DIDT in collaboration with IO members.
(2) – Specific maintenance planning	The management committee will prepare a proposal of the specific maintenance plan, using **Form-12** and following the instruction given in **Technical Guidance** (**Explanatory Note 4), O&M Training manual for scheme facilitators and FPRWM**, in collaboration with IO members and if necessary assistance of the DIDT.
(3) – O&M budgeting	The management committee will prepare a proposal of the operation and maintenance budgeting, using **Form-3 and O&M Training manual for scheme facilitators**, in collaboration with IO members and if necessary assistance of the DIDT.
(4) – Preparation for presentation at general meeting	For presentation at the general meeting, the management committee will prepare flip charts of the prepared forms, using triangular rules or straight rules, in collaboration with IO members and if necessary assistance of the DIDT. Also, the management committee will review the training material on water management, operation and maintenance provided by the District Irrigation Development Team (DIDT), and prepare some flip charts in collaboration with IO members.
Sub-step 3 Holding general meeting - Discussion and decision on Maintenance Planning and O&M Budgeting	At the general meeting, the management committee will facilitate the discussion and the decision on the following: • Specific maintenance planning for one or two seasons • O&M budgeting for one or two seasons

Sub-step 4 Compilation of minutes and forms by the general meeting	The management committee will prepare a final version of the following on flip charts or a notebook, using triangular rules or straight rules, in collaboration with IO members: • **Form-2**: Basic maintenance plan • **Form-3**: Operation and maintenance budgeting • **Form-12**: Maintenance plan The management committee will keep the record of the general meeting.
Sub-step 5 Submission of copies of final outputs of **Form-2**, **Form-3** and **Form-12** to **DIDT**	The management committee will submit the finalised**Form-2**, **Form-3**, **Form-12** to the DIDT so that IO members can receive the assistance of the DIDT when it is necessary.

Results

The maintenance plan is decided for the coming one season or the coming two seasons at the general meeting of the irrigators' organization (IO).

More specifically, the following are finalized for use in water management for the coming season(s):

- **Form-2**: Basic maintenance plan
- **Form-3**: Operation and maintenance budgeting
- **Form-12**: Maintenance plan

Step-4: Practice of Operation and Water Distribution

Key Message

The O&M subcommittee in charge of management of operation and gate operation operate the irrigation and other related facilities in accordance with the operation plan depending on the season

Why is the work required?

Effective and efficient water use can be achieved through organized O &M

Key for the success of the work

The irrigators follow the planned cropping calendar and irrigation schedule

Required inputs

1. Facilitator: District Irrigation Development Team (DIDT), RS, ZIO/RIO as required
2. ~~O&M Training Manual for scheme facilitators.~~
3. The management committee and other members of irrigators' organization (IO)
4. Basic operation plan (**Form-1**)
5. Cropping calendar (**Form-8**)
6. Irrigation schedule and water distribution plan (**Form-11**)
7. Operation record (**Form-4**)
8. O&M **Training** Manual **for scheme facilitators**
9. Water Distribution Manual

How is the work carried out?

The District Irrigation Development Team (DIDT) in collaboration with RS &ZIO/RIO will organize the training session with the beneficiaries, and will facilitate and train the management committee and other members of the irrigators' organization (IO) so that the IO members can go through the following sub-steps by themselves.

The DIDT, ZIO/RIO will provide necessary assistance in IO's activities upon request from the management committee.

Sub-step 1 Practice of operation	The O&M subcommittee will operate the irrigation and other related facilities in accordance with the following: ・Basic operation plan (**Form-1**) ・Cropping calendar (**Form-8**) ・Irrigation schedule and water distribution plan (**Form-11**) ・O&M **Training** Manual **for scheme facilitators** ・Water Distribution Manual
Sub-step 2 Operation recording	The O&M subcommittee will keep records of operation, using **Form-4**.

Result

Operation practice is organized in accordance with planned cropping calendar, water distribution and operation plan

Step-5: Practice of Maintenance

Key Message

The O&M subcommittee in charge of management of maintenance will make arrangements of maintenance work and implement maintenance work in accordance with the maintenance plan for one or two seasons.

Why is the work required?

Through organized maintenance work, facilities can be maintained well, and damaged facilities can be repaired without difficulties before the damage becomes severe.

Key for the success of the work

The irrigators participate in the planned and agreed maintenance activities

Required inputs

1. Facilitator:, District Irrigation Development Team (DIDT), ZIO/RIO as required
2. O&M Guidelines
3. The management committee and other members of irrigators' organization (IO)
4. Basic maintenance plan (**Form-2**)
5. Maintenance plan (**Form-12**)
6. Maintenance record (**Form-5**)
7. O&M Training Manual for Scheme Facilitators.
8. Farmers Participatory Repair Work Manual (FPRWM)

How is the work carried out?

The District Irrigation Development Team (DIDT) in collaboration with RS &ZIO/RIO will organize the training session with the beneficiaries, and will facilitate and train the management committee and other members of the irrigators' organization (IO) so that the IO members can go through the following sub-steps by themselves.

The DIDT will provide necessary assistance in IO's activities upon request from the management committee.

Sub-step 1 Practice of maintenance	The O&M subcommittee in charge of management of maintenance will make arrangements for maintenance work and implement the maintenance work in accordance with the following: ・Basic maintenance plan (**Form-2**) ・Maintenance plan (**Form-12**) ・O&M training manual for scheme facilitators and Farmers Participatory repair work manual (FPRWM)
Sub-step 2 maintenance recording	The O&M subcommittee in charge of management of maintenance will keep records of maintenance, using **Form-5**.

Result

Maintenance practice is organized in accordance with maintenance plan.

Step-6: Fee Collection and Financial Management

Key Message

The O&M subcommittee in charge of Administration Planning and Finance will make sure that Irrigation service fee collection is done according to IO member contract. Funds shall be managed by using cash and cheque books.

Why is the work required?

Through proper financial management, it facilitates transparency and accountability to IO members and other relevant stakeholders; it encourages their participation in O&M activities and the scheme implementation.

Key for the success of the work

The Irrigation service fee Agreement before season and IO finance to be managed by using Cash and cheque books.

Required inputs

1. Facilitator:, District Irrigation Development Team (DIDT), ZIO/RIO as required
2. O&M Training Manual for Scheme Facilitators.
3. IO Constitution
4. The management committee and other members of irrigators' organization (IO)
5. O&M Budgeting (**Form-3**)
6. Financial record (**Form-6**)
7. Irrigation service fee Agreement
8. Cash and cheque books

How is the work carried out?

The District Irrigation Development Team (DIDT) in collaboration with RS & ZIO/RIO will organize the training session with the beneficiaries, and will facilitate and train the management committee and other members of the irrigators' organization (IO) so that the IO members can go through the following sub-steps by themselves.

The DIDT will provide necessary assistance in IO's activities upon request from the management committee.

Sub-step 1 Signing IO Irrigation service Fee Agreement.	The O&M subcommittee in charge of Water, Operation & maintenance, and Administration Planning & Finance will make agreement between **Irrigators Organization and IO member on the Irrigation service Fee** collection in accordance with the following: • IO Constitution • IO Irrigation Fee Agreement. • NIA (5), 2013 • National Irrigation Regulation 2015

Sub-step 2 Fee Collection	The O&M subcommittee in charge of Administration Planning & Finance will issue bill to IO **member for service Fee** collection. IO member will pay to Treasurer whereby receipt will be issued. The fee collection will be done in accordance with the following: • O &M Budgeting **(Form- 3)** • Financial recording **(Form-6)** • Financial management module
Sub-step 3: Financial management.	Treasurer will collect the fee from IO members, record in (form No - 6, Cash and cheque Books). Collected fee will be deposited to IO Bank Account. Auditing (Internal & External) should be done regularly, Financial report to be shared to the General assembly according to IO constitution. Report sharing encourage transparency and accountability to IO members and other relevant stakeholders;
Result	
Fee Collection and Financial Management is organized in accordance with financial plan and supporting relevant documents.	

Step-7: Monitoring of Operation, Maintenance and Financial Management

Key Message

The O&M subcommittee will be responsible for monitoring of operation, maintenance and finance

Why is the work required

Through organized maintenance work, facilities can be maintained well, and damaged facilities can be repaired without difficulties before the damage becomes severe. Financial monitoring ensures transparency and accountability to the IO.

Also, the monitoring results can be utilized for future operation & maintenance planning and implementation. .

Key for the success of the work

When problems are seen, the sources of the problems are identified and necessary actions are taken

.

Required inputs

1. Facilitator:, District Irrigation Development Team (DIDT) &ZIO/RIO as required
2. O&M Manual
3. The management committee and other members of irrigators' organization (IO)
4. Basic operation plan (**Form-1**)
5. Basic maintenance plan (**Form-2**)
6. O&M Budgeting **(Form-3**)
7. Financial record (Form- 6)
8. Cropping calendar (**Form-8**)
9. Irrigation schedule and water distribution plan (**Form-11**)
10. Maintenance plan (**Form-12**)
11. Operation record (**Form-4**)
12. Maintenance record (**Form-5**)
13. Reporting format **(Form – 7)**
14. Monitoring sheet and Check form
15. Financial report

How is the work carried out?

The District Irrigation Development Team (DIDT) in collaboration with RS &ZIO/RIO will organize the training session with the beneficiaries, and will facilitate and train the management committee and other members of the irrigators' organization (IO) so that the IO members can go through the following sub-steps by themselves.

The DIDT will provide necessary assistance upon request from the management committee.

Sub-step 1 Monitoring work	The O&M subcommittee will monitor operation, maintenance and Financial management activities, following the instruction given in **Technical Guidance** (**Explanatory Note 1), O&M training manual for scheme facilitators (Cash & Cheque Books), O&M Monitoring sheet and O&M Check form**. For monitoring of operation, the following data can be used: ・Basic operation plan (**Form-1**) ・Cropping calendar (**Form-8**) ・Irrigation schedule and water distribution plan
	(**Form-11**) ・Operation record (**Form-4**) ・Observation of irrigation situations of fields, canals and structures ・Measured flow rate at different points For monitoring of maintenance, the following data can be used: ・Basic maintenance plan (**Form-2**) ・Maintenance plan (**Form-12**) ・Maintenance record (**Form-5**) ・Observation of irrigation situations of fields, canals and structures
Sub-step 2 Analysis of data, detection of problems and reporting	The O&M subcommittee will analyze the monitoring data, detect the problems and report the problems to the management committee, using **(Form – 7), Training report and progress report (Quarterly report).**
Result	
Operation and maintenance activities are monitored, and necessary actions are taken to solve detected problems	

SECTION 3 FORMS

Form-1 Basic operation plan

1) Irrigators organization (IO) member list

Scheme name: _____

District name: _____

Region name: _____

Zone name: _____

S/N	NAME	GENDER	VILLAGE	HAMLET	BLOCK NAME	ACREAGE	CROPS	IO ID NUMBER	PHONE NUMBER
1	PILI J. Masanja	F	Usoke	Yelayela	Braison	1	Paddy	034/1	0786000121

2) Division of irrigation area into several irrigation blocks

The proposed irrigation area will be divided into the following irrigation blocks. This will be a basis for water distribution planning.

Sketch of whole irrigation area divided into irrigation blocks

NOTE: Major structures, such as intake gates, head gates of secondary canals and major tertiary canals, major turnouts, and flow measuring devices, shall be drawn on this sketch.

Area of irrigation blocks

Name of irrigation block	Area (acre)	Area (ha)	Remarks
Total			

3) Basic method of operation

Location	Name of Infrastructure	In charge of Operation	Method of operation
Intake	Intake Gate	Block A O&M sub committee	Time sharing
Block A	DB1		

NOTE: In the column of "Method of operation," the following descriptions, for example, can be entered:

- In the case of gate facilities →"operating gate in the method of time sharing or flow sharing" (See **Technical Guidance** (**Explanatory Note 1**.)
- In the case of measuring facilities →"Checking flow rate every day or every week

Form-2 Basic maintenance plan

1) Routine maintenance and periodical maintenance – basic plan of activities for each element of the irrigation system

Irrigation facilities	Activities	Frequency of implementation	O&M Subcommittee of and any other support
Intake weirs and gates	Cleaning and removal of floating debris and foreign materials around weir bodies, trash racks, and scouring sluice gates	1/1/2009 1/2/09 1/3/09	
	Cleaning of the site around the intake		
	Lubrication – oiling or greasing – of gates		
	Anticorrosion treatment – painting – of metal works		
	Monitoring of water quality of the river	20/7/2009	Env.sub com. DIDT/ZI0/RIO
	Removal of solid deposition – silt and stones, if possible		
Irrigation network – lined canals	Repair of damaged joints, slabs and lining concrete with cracks		
	Weed control at joints and on surface of slabs		
	Removal of silt		
Irrigation network – unlined canals	Removal of silt		
	Cutting and removal of earth weeds and waterweeds on wetted parts of canal slopes, and floating waterweeds		
	Plugging small holes and replacement of porous soils to prevent seepage		
	Rebuilding of eroded banks		
Head gates, check gates and other structures	Removal of silt and obstructions		
	Lubrication – oiling or greasing – of gates		
	Anticorrosion treatment – painting – of mechanical		
Dams and reservoirs	Removal of waterweeds		
	Removal of foreign materials		
	Lubrication – oiling or greasing – of gates		
	Anticorrosion treatment – painting – of gates		
	Monitoring of water quality		

Irrigation facilities	Activities	Time of implementation	O&M Subcommittee of IO and any other support support
	Survey and removal, if possible, of solid deposition – silt and stones		
Drainage network	Weed control in the canal		
	Removal of silt		
	Repair and shaping of canal section		
Farm roads	Refilling of holes on road surface		
	Grading road surface		
	Repair of road shoulders eroded		
	Desilting and repair of side ditches and culverts		
	Provision of additional pavement materials for paved roads		
Flood dikes	Refilling of holes on dike surface		
	Grading dike surface		
	Repair of shoulders eroded		
Bunds in the fields	Weed control		
	Compaction		

2) Special maintenance

Measures in the case of damages by unforeseen disasters – what we shall do in case the irrigation facilities are damaged by unforeseen disasters, e.g. flood, heavy rainfall, earthquake and theft.

Plan of preventive actions – what we shall do to prevent or alleviate damages by unforeseen disasters:

Form-3 Operation and maintenance budgeting

The budget of operation and maintenance is planned for one or two seasons as follows:

Expected Revenue **Period:** **From Month/Year** **To Month/Year**

Description	Unit	Quantity	Unit Rate (Tshs.)	Amount (Tshs.)
O&M irrigation fees				
Others				
Subtotal				
Total				

Expected Expenditure **Period:** **From Month/Year** **To Month/Year**

Description	Unit	Quantity	Unit Rate (Tshs.)	Amount (Tshs.)
Water use permit fee				
Materials				
Subtotal				
Labour				
Subtotal				
Utility cost for office				
Subtotal				
Others				
Subtotal				
Total				

Form-4 Operation record (Water distribution records)

Recorded by _____

Date	Activities		Observations

NOTE: O&M subcommittee and each of the gate operators – shall keep the operation record using this format. The contents of work, place of work, etc., should be described in the column of "Activities". The situations of the fields, canals, gates and other facilities and location of observation measured flow rate and its location should be described in the column of "Observation".

Form-5 Maintenance record

Recorded by _____

ate	Activities	Cost	Observations

NOTE: O&M Subcommittee shall keep the maintenance record using this format.

The contents of work, place of work, materials purchased, amount of money spent, etc., should be described in the column of "Activities".

The situations of fields, canals, gates and other facilities and location of observation should be described in the column of "Observation".

Form-6 Financial record

1) Record of fee collection (Deterioration)/ (Maintenance)

Recorded by _____

Name of irrigator	Irrigation area (acre)	Amount Required		Amount Received	
		Deadline	Amount (Tshs.)	Date	Amount (Tshs.)
Isa Hasan	2	1/2/2009	8000/-	5/2/2009	2000/-
Isa hasan	2	1/2/2009	8000/-	6/4/2009	6000/-

2) Record of revenue and expenditure

Recorded by____________________

Date	Description	Revenue (Tshs.)	Expenditure (Tshs.)	Balance (Tshs.)
01/02/2009	O&M fee	1,000,000		1,000,000
03/03/2009	O&M fee	2,000,000		3,000,000
04/03/2009	Repair of Divison boxes		100,000	2,900,000
20/03/2009	Water use fee		300,000	2,600,000
1/4/2009	Grant from World vision	1,000,000		3,600,000
3/6/2009	Training at KATC		1,000,000	2,600,000

3) Record of Credit (Loan and Reimbursements)

Recorded by_____

Date	Description	Loan (Tshs.)	Reimbursement (Tshs.)	Outstanding Balance (Tshs.)	Remarks
01/02/2009	POWER TILLER	7,000,000/-		7,000,000/-	
03/03/2009	First Reimbursement – Power Tiller		5,000,000/=	2,000,000/-	

4) Financial statement

Date 30/3/2009

Balance in account

Recorded by Isa Athumani (Treasurer)

Description	Balance in account (Tshs.)
Balance brought forward (B/F)	
A/c No. 123456 NMB – Mbinga(O&M Fund)	2,690,250/-
A/C No. 23456 CRDB – Mbinga (Normal expenditure)	1,000.450/-
SACCOS	2,000,000/-
Total	5,690,700/-

Credit

Description	Outstanding balance (Tshs.)
Loan Power Tiller	2,000,000/-
Total	2,000,000/-

Revenue **Period: From Month/Year** **To Month/Year**

Description	Budget (Tshs.)	Actual amount (Tshs.)
O&M irrigation fees	12,000,000/-	9,000,000/-
Others	1,000,000/-	1,000,000/-
Subtotal	13,000,000/-	10,000,000/-
Total	13,000,000/-	10,000,000/-

Expenditure **Period: From Month/Year** **To Month/Year**

Description	Budget (Tshs.)	Actual amount (Tshs.)
Water use permit fee	300.000/-	300,000/-
Materials	9,000,000/-	7,000,000/-
Subtotal	9,300,000/-	7,300,000/-

Description	Budget (Tshs.)	Actual amount (Tshs.)
Labour		
Subtotal		
Utility cost for office		
Subtotal		
Others		
Subtotal		
Total		

Form-7 Reporting format

To the O&M Subcommittee

Date 12/07/2009

Reported by Athuman Njiapanda (Block leader)

Description of problem

Leakages at DB 12 Block A caused by damaged wall

Proposed measures, solutions and actions

Demolition of the damaged wall and construction of the new one. This is an emergency and needs a quick action

Form 8: Cropping calendar and patterns

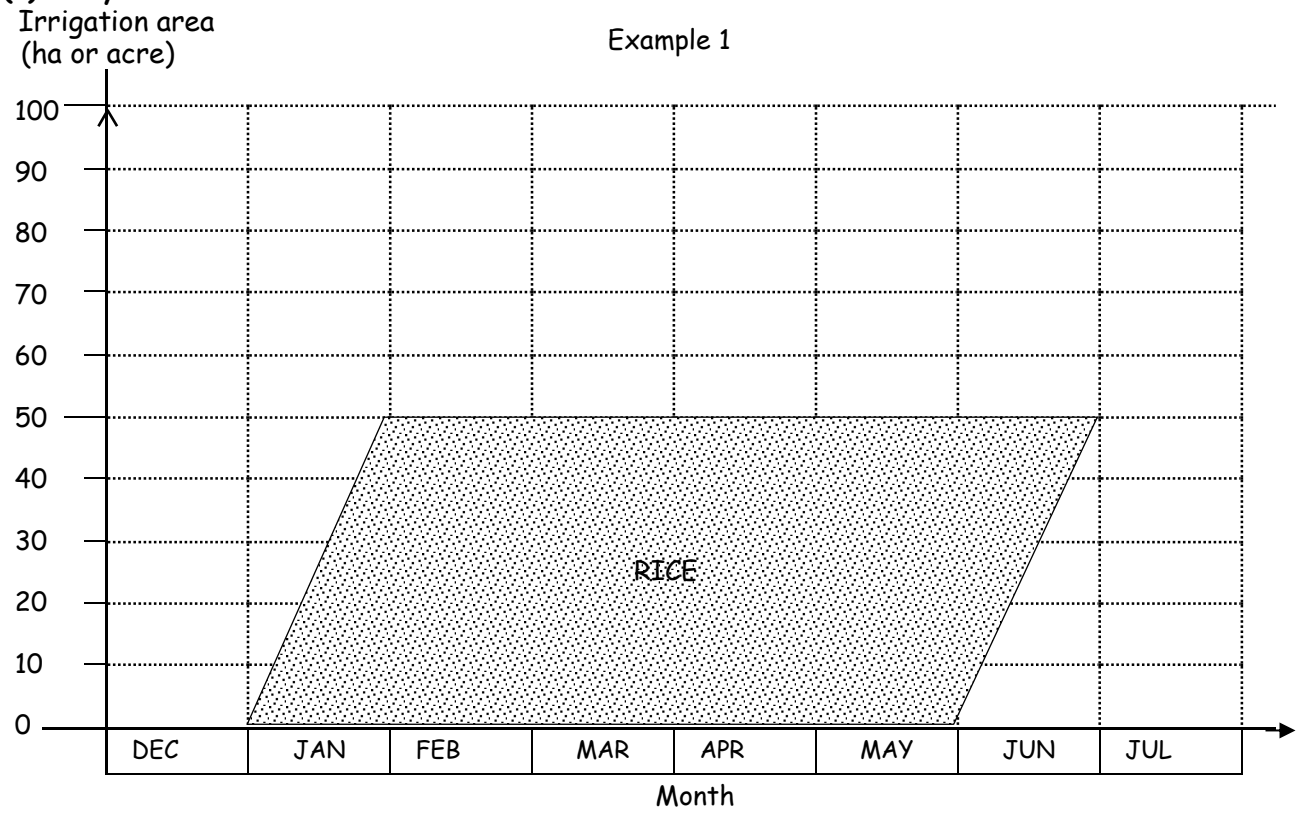
Form 8-1 Cropping Calendar

SN	ACTIVITIES	RAINY SEASON																						DRY SEASON																			
		JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEPT				OCT				NOV				DEC			
1	Ploughing																																											
2	Nursery preparations																																											
3	Seed sowing in the nursery																																											
4	Puddling																																											
5	Transplanting																																											
6	Weeding																																											
7	Pest and Disease management																																											
8	Fertilizer applications																																											
9	Bird scaring																																											
10	Harvesting																																											
11	Threshing																																											
12	Drying																																											
13	Storage																																											

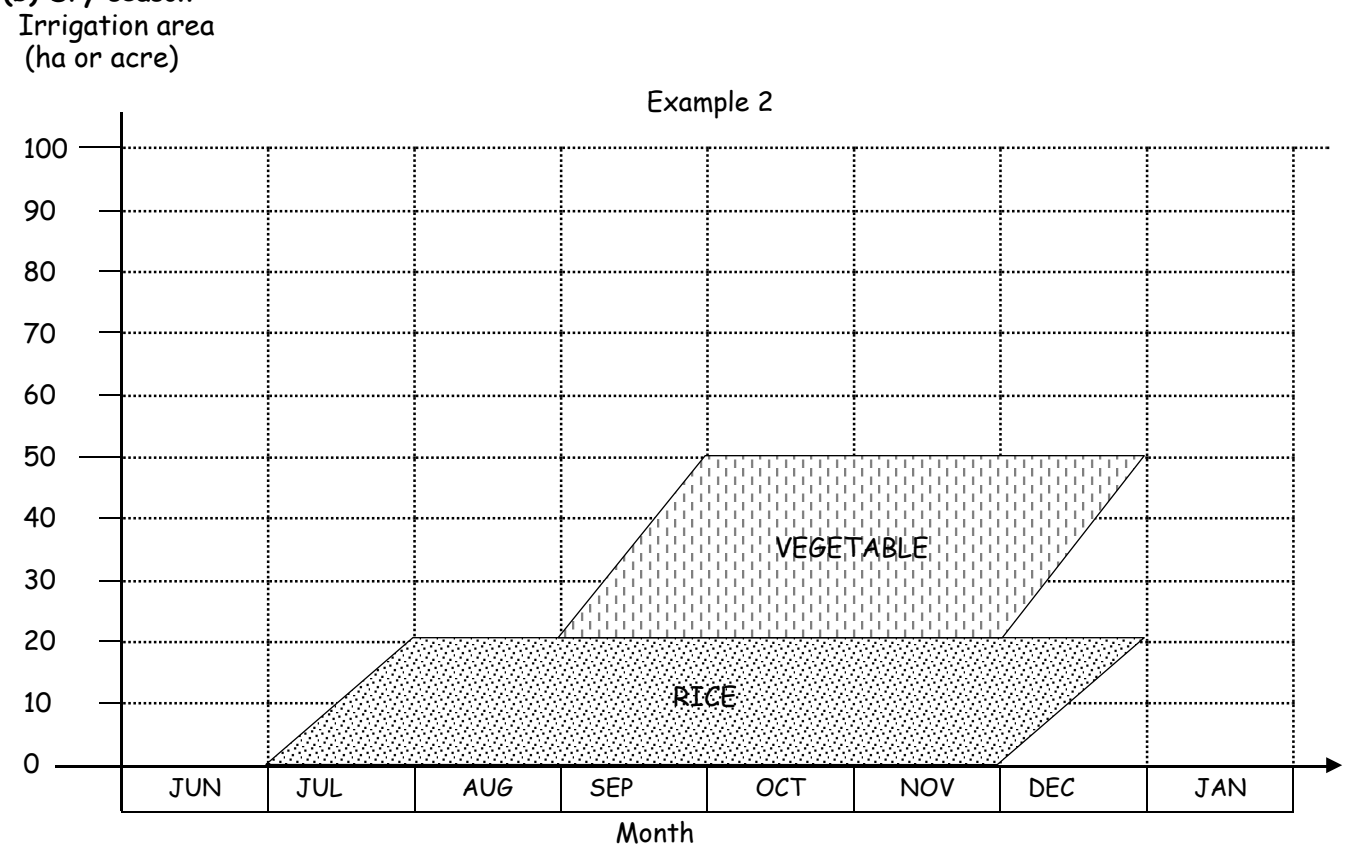
Note: Example of cropping calendar for two seasons of Rice crop

Form-8-2 Cropping pattern

(a) Rainy season



(b) Dry season



Form-9 Calculation sheet for water demand in each month

(a) Rainy season

		DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
Name of Block:	Gross unit water requirement (litre/sec/ha)	2	2.6	2.0	1.9	1.9	2.1		
	Area (ha)	100	150	300	300	250	200		
	Water demand (litre/sec)	200	390	600	570	475	420		
Name of Block:	Gross unit water requirement (litre/sec/ha)								
	Area (ha)								
	Water demand (litre/sec)								
Name of Block:	Gross unit water requirement (litre/sec/ha)								
	Area (ha)								
	Water demand (litre/sec)								
Name of Block:	Gross unit water requirement (litre/sec/ha)								
	Area (ha)								
	Water demand (litre/sec)								
Name of Block:	Gross unit water requirement (litre/sec/ha)								
	Area (ha)								
	Water demand (litre/sec)								
Total water demand (litre/sec)									

NOTE:

1) Try to fill out the above form, assuming that you will irrigate the whole proposed irrigation area from the month of starting irrigation to the month of finishing irrigation.
2) The data of gross unit water requirement will come from the table on Page 3-25, 26, 27 Formulation Guideline.
3) Water demand for each block will be calculated by the following formula:
   Water demand (litre/sec) = Gross unit water requirement (litre/sec/ha) X Area (ha)

(b) Dry season

		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
Name of Block:	Gross unit water requirement (litre/sec/ha)		6.53						
	Area (ha)		100						
	Water demand (litre/sec)		653 260						
Name of Block:	Gross unit water requirement (litre/sec/ha)								
	Area (ha)								
	Water demand (litre/sec)								
Name of Block:	Gross unit water requirement (litre/sec/ha)								
	Area (ha)								
	Water demand (litre/sec)								
Name of Block:	Gross unit water requirement (litre/sec/ha)								
	Area (ha)								
	Water demand (litre/sec)								
Name of Block:	Gross unit water requirement (litre/sec/ha)								
	Area (ha)								
	Water demand (litre/sec)								
Total water demand (litre/sec)									

NOTE:

1) Try to fill out the above form, assuming that you will irrigate the whole proposed irrigation area from the month of starting irrigation to the month of finishing irrigation.
2) The data of gross unit water requirement will come from the table on Page 3-25,26,27 Formulation Guideline.
3) Water demand for each block will be calculated by the following formula:

   Water demand (litre/sec) = Gross unit water requirement (litre/sec/ha) X Area (ha)

Form-9-1 Gross unit water requirement
(Summarized table of (a) and (b) of Form-9)

Unit: litre/sec/ha

		JAN	FEB	MAR	APR	MAY	JUN
Name of Block:	Gross unit water requirement						
	Adjusted						
Name of Block:	Gross unit water requirement						
	Adjusted						
Name of Block:	Gross unit water requirement						
	Adjusted						
Name of Block:	Gross unit water requirement						
	Adjusted						
Name of Block:	Gross unit water requirement						
	Adjusted						
		JUL	AUG	SEP	OCT	NOV	DEC
Name of Block:	Gross unit water requirement						
	Adjusted						
Name of Block:	Gross unit water requirement						
	Adjusted						
Name of Block:	Gross unit water requirement						
	Adjusted						
Name of Block:	Gross unit water requirement						
	Adjusted						
Name of Block:	Gross unit water requirement						
	Adjusted						

Form-10 Estimation of water supply in the coming seasons

		JAN	FEB	MAR	APR	MAY	JUN
Water availability (litre/sec)	Average year						
	Year of 80% dependability						
Proposed water supply (litre/sec)							
Expected water supply (litre/sec)							
		JUL	AUG	SEP	OCT	NOV	DEC
Water availability (litre/sec)	Average year						
	Year of 80% dependability						
Proposed water supply (litre/sec)							
Expected water supply (litre/sec)							

NOTE:

1) The data of water availability in each month in the average year and in the year of 80% dependability are given in the feasibility study report. Try to find out the data of water availability from the feasibility study report, and fill out the above form.

2) The data of proposed water supply, determined on the basis of the minimum irrigation area covered by the minimum water availability in the year of 80% dependability, are also given in the feasibility study. Try to find out the data of proposed water supply from the feasibility study report, and fill out the above form. (Proposed means proposed in F/S.)

3) The year of 80% dependability means a dry year which occurs at the rate of once in 5 years. The amount of water availability in the year of 80% dependability can cover the proposed irrigation area in 4 years out of 5 years. It means that you will run short of water in 1 year out of 5 years.

4) The water right will be acquired for the proposed water supply – the minimum water availability in the year of 80% dependability. Note that you cannot abstract more water even if the water source has much available water.

5) The expected water supply equals the proposed water supply in normal years. If you predict that the coming season will be a drier year than the year of 80% dependability according to the long-range weather forecast and your past experiences, the expected water supply only in dry season shall be 80% to 95% of the proposed water supply.

6) Information to be filled can also be obtained from the relevant water basin offices

Form-11 Irrigation schedule and water distribution plan

(a) Rainy season

		DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
Expected water demand (litre/sec)	Name of block:								
	( )								
	Name of block:								
	( )								
	Name of block:								
	( )								
	Name of block:								
	( )								
	Name of block:								
	( )								
	Total								
Expected water supply (litre/sec)									
Plan of water distribution (litre/sec)									
Date of starting irrigation and Date of finishing irrigation	Name of block: (A)	1/12/09 15/12/09							
	Name of block: (B)	10/12/09 31/12/09							
	Name of block: ( )								
	Name of block: ( )								
	Name of block: ( )								

NOTE:

1) The data of expected water demand comes from **Form-9**.
2) The data of expected water supply comes from **Form-10**.
3) The plan of water distribution will be determined by the following rule:
   In case expected water supply > or = expected water demand,
   plan of water distribution = expected water demand
   In case expected water supply < expected water demand,
   plan of water distribution = expected water supply
4) In case expected water supply < expected water demand, careful water management and particularly efficient water use will be needed.

(b) Dry season

		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
Expected water demand (litre/sec)	Name of block:								
	( )								
	Name of block:								
	( )								
	Name of block:								
	( )								
	Name of block:								
	( )								
	Name of block:								
	( )								
	Total								
Expected water supply (litre/sec)									
Plan of water distribution (litre/sec)									
Date of starting irrigation and Date of finishing irrigation	Name of block: (A)								
	Name of block: (B)								
	Name of block: ( )								
	Name of block: ( )								
	Name of block: ( )								

NOTE:

1) The data of expected water demand comes from **Form-9**.
2) The data of expected water supply comes from **Form-10**.
3) The plan of water distribution will be determined by the following rule:
   In case expected water supply > or = expected water demand,
   plan of water distribution = expected water demand
   In case expected water supply < expected water demand,
   plan of water distribution = expected water supply
4) In case expected water supply < expected water demand, careful water management and particularly efficient water use will be needed.

(c) Method of water distribution

1. Adopted method; ☐ **Flow sharing method**

☐ **Time sharing Method**

2. Irrigation schedule (in the case of time sharing method)

Day	Block to be irrigated
1st day	A (98HA)
2nd day	B
3rd day	C
4th day	D
5th day	A
6th day	B
7th day	C
8th day	D
9th day	A
10th day	B

Form-12 Maintenance plan – concrete planning of time and resources of maintenance activities planned in Form-2:

Month / year	Week	Plan of activities	Necessary resources
JAN /	1	(1) Intake weir and gates-cleaning and removal of floating debris and ……. (2)	
	2		
	3		
	4		
	5		
FEB /	1	1) Intake weir and gates-cleaning and removal of floating debris and …….	
	2		
	3		
	4		
	5		
MAR /	1	(1) Intake weir and gates-cleaning and removal of floating debris and …….	
	2		
	3		
	4		
	5		
APR /	1		
	2		
	3		
	4		
	5		
MAY /	1		
	2		
	3		
	4		
	5		

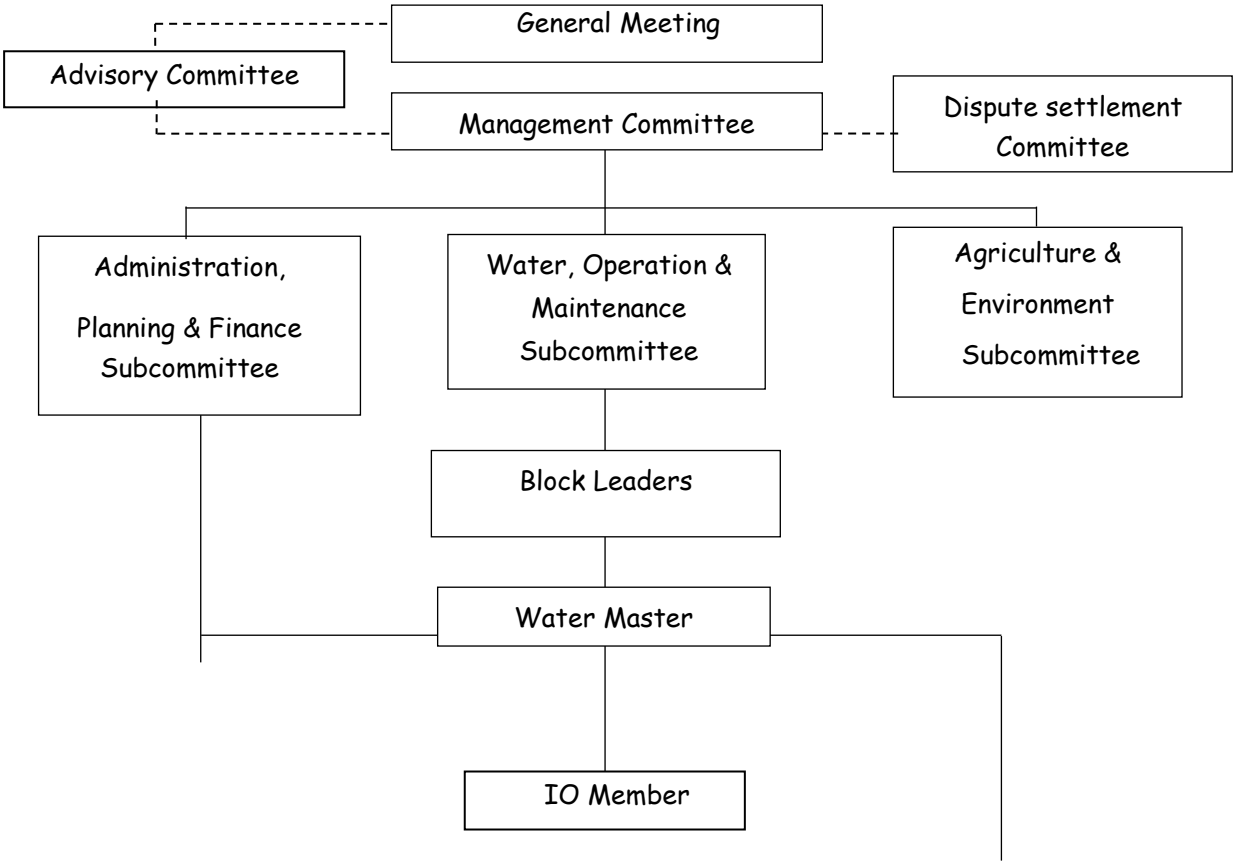
Month / year	Week	Plan of activities	Necessary resources
JUN /	1		
	2		
	3		
	4		
	5		
JUL /	1		
	2		
	3	Monitoring of water quality in the river	Env.sub com. **DIDT/ZIO/RIO, Fund,**
	4		
	5		
AUG /	1		
	2		
	3		
	4		
	5		
SEP /	1		
	2		
	3		
	4		
	5		
OCT /	1		
	2		
	3		
	4		
	5		
NOV /	1		
	2		
	3		
	4		
	5		
DEC /	1		
	2		
	3		
	4		
	5		

SECTION 4 TECHNICAL GUIDANCE

Section 4-1 Explanatory Notes

Explanatory Note 1: How to establish the operation and maintenance system Organization chart of the irrigators' organization

A sample organization chart of the irrigators' organization (IO) is shown below. The IO can organise several subcommittees in accordance with the IO members' intention and needs.

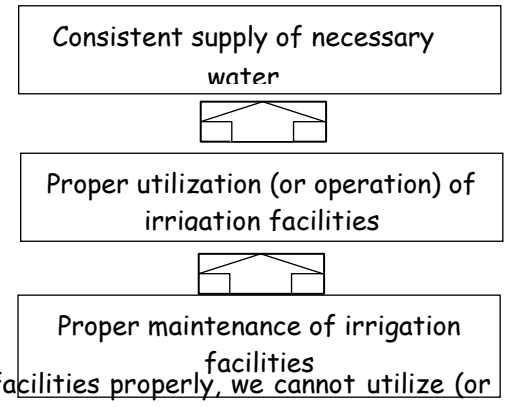


Concept of operation and maintenance system

The fundamental objective of the irrigation facilities is to supply necessary irrigation water consistently for the beneficiaries.

In order to supply necessary irrigation water consistently for beneficiaries, we need to utilize (or operate) the irrigation facilities properly.

In order to utilize (or operate) the irrigation facilities properly, we need to maintain the facilities.



On the other hand, if we do not maintain the irrigation facilities properly, we cannot utilize (or operate) the irrigation facilities properly.

Also, if we do not utilize (or operate) the irrigation facilities, necessary irrigation water cannot be supplied consistently for the beneficiaries.

The IO members should understand that establishment of the operation and maintenance system means to establish the operation and maintenance rules for the purpose of satisfying basic objective of the irrigation facilities.

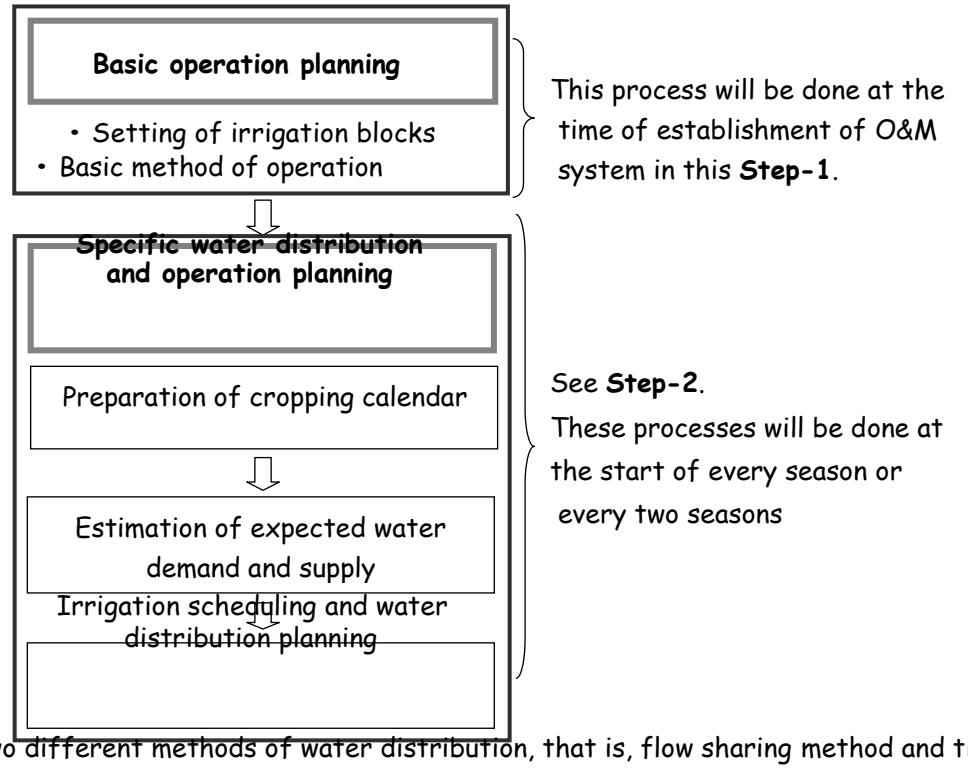
Water distribution and operation planning

Water distribution and operation planning will be done through the following processes.

An important issue in the basic operation plan is dividing the whole irrigation area into several irrigation blocks. The blocks will usually be determined by secondary canals. In case the blocks determined by secondary canals are too large, they can be divided into smaller blocks by groups of tertiary canals.

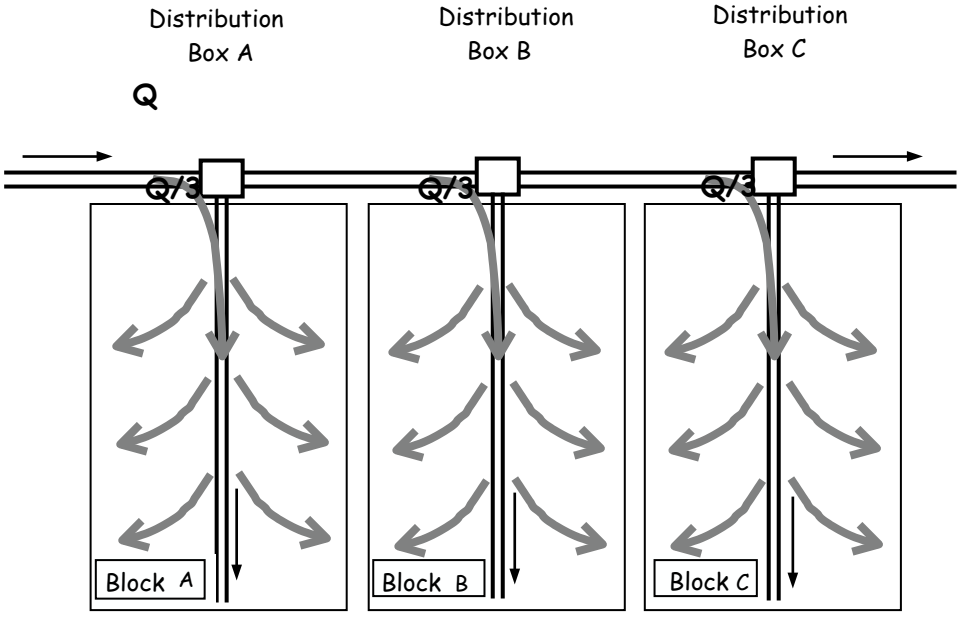
The water distribution diagram which was prepared during the Detailed Design stage shall be modified in accordance with the actual division of irrigation blocks and actual planting acreage.

An irrigation block is a practical unit for managing the operation.

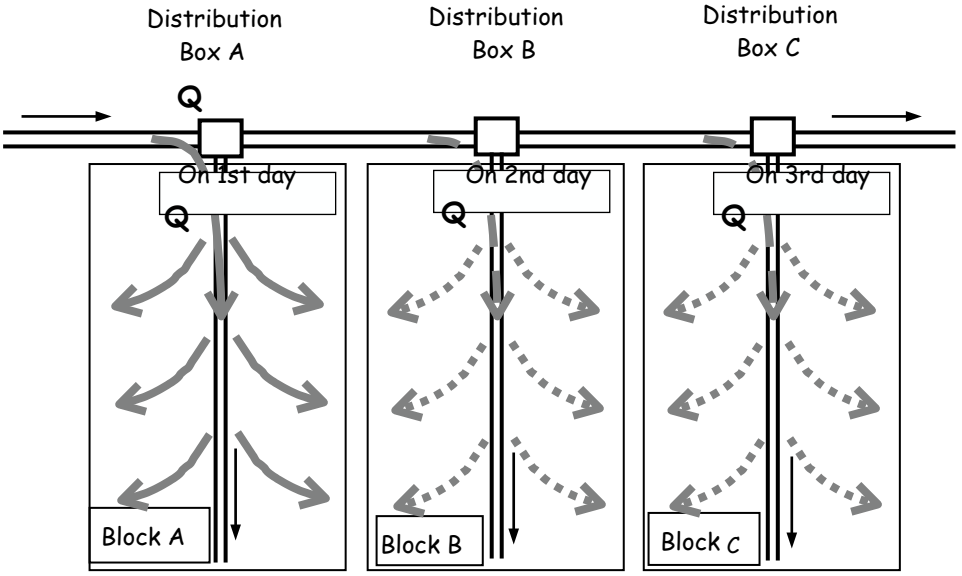


We have two different methods of water distribution, that is, flow sharing method and time sharing method.

(1) **Flow sharing method**: distributing water continuously to each irrigation block



(1) **Time sharing method**: distributing water by rotation



In the general meeting, the beneficiaries will discuss the following to determine the basic operation plan:

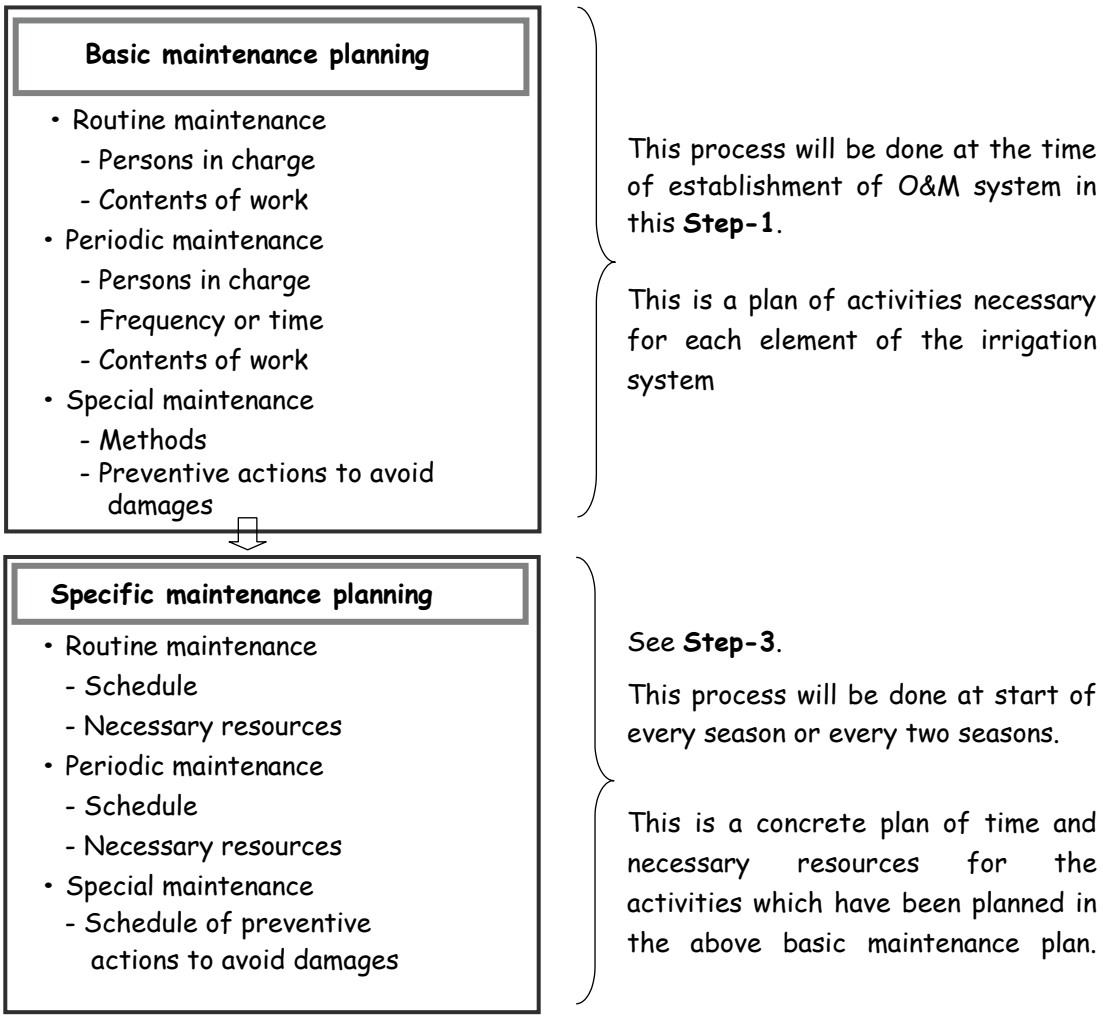
- How to divide irrigation blocks.
- Whether to adopt flow sharing method or time sharing method.
- How to coordinate the intention of farmers who have large farmland and farmers who have small farmland, farmers in upstream area and farmers in downstream area.

Maintenance planning

The maintenance work can be classified into the three types of work as follows:

Routine maintenance This is a responsibility of all IO members	~~Day-to-day maintenance work:~~ • Clearing silt at flow measuring devices • Removal of floating debris • Minor repair of canals and structures • Greasing or oiling of gates
Periodical maintenance The IO members will contribute labour for this work.	~~Works to be done at a certain interval:~~ • Strengthening of banks and structures • Desilting • Grass cutting • Repair of damaged structures • Painting of structures
Special maintenance The IO members will contribute labour for this work	~~Repair of damaged structures caused by~~ Unforeseen disaster, such as flood, heavy rainfall, earthquake, theft, etc

The maintenance planning will be done through the following processes:

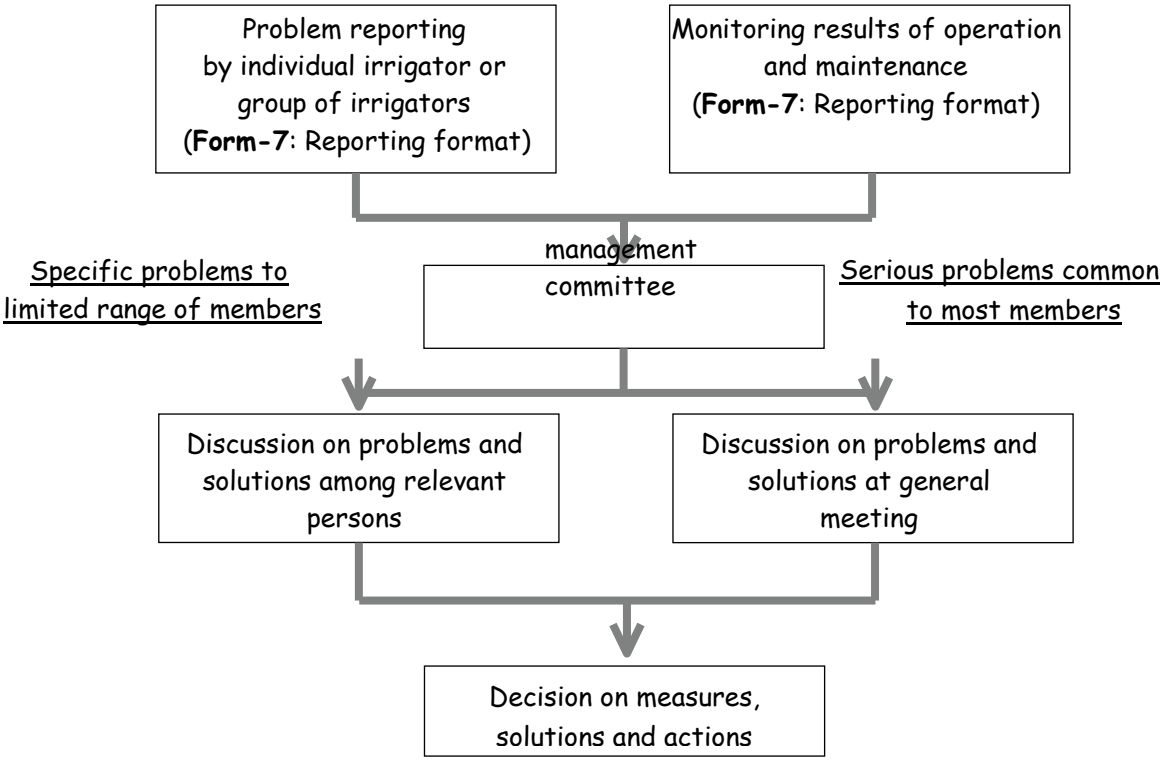


If the beneficiaries of the IO needs some assistance from the village government or the district in the maintenance activities, the IO shall specify in the maintenance plan the contents of the necessary assistance.

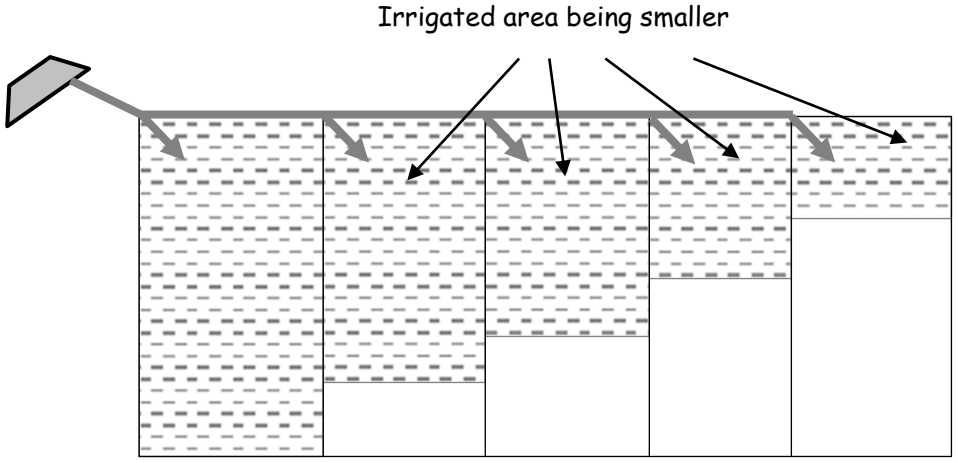
Furthermore, if the beneficiaries needs to hire a contractor for the maintenance activities, the IO shall specify in the maintenance plan the works which are supposed to be done by the contractor.

Method of problem solving, decision making and conflict management

When some problems arise, the following procedure usually will be followed:



A common problem on water distribution is illustrated below. In particular, in case water supply is limited, the situation of unequal water distribution will be seen. More specifically, upstream land plot receives more water and downstream land plot receives less water. Also, in a single land plot, more water is supplied at head end and less water is supplied at tail end.



Unequal water distribution

To minimize conflicts relating to water distribution, the following measures are possible:

- Strict implementation of the planned cropping calendar and pattern of planting.
- Strict implementation of the schedules of water delivery and distribution.
- Regular review of supply and use of irrigation water at different irrigation units.
- Immediate initiation of actions on inequity in water delivery and distribution

Method of financial management

Financial management has three components, namely:

- Financial planning – budget preparation
- Financial recording – maintenance of accounts
- Financial control – auditing

For financial planning or budgeting, the IO shall:

- .Identify and carry out assessment of sources of income – irrigation fee collected from the members is an important source of income for water management.
- Prepare estimates for expenditure over a specified period – usually, one or two seasons in a year.
- Agree on financial regulation.
- Develop a financial budget for the year to balance income and expenditure.

For financial recording – maintenance of accounts,

- For every income to the IO, an official receipt must be issued.
- For any expenditure by the IO, a cash sale must be obtained and recorded.
- A cashbook must be properly maintained.
- All accounts must be properly classified.
- Financial statements must be produced on a regular basis.

For financial controlling – auditing, it is recommended that the IO should:

- Procure a reputable agency to do auditing.
- Check legitimacy of expenditure and the procedure that was followed.
- Report anomalies for the purpose of making improvements.
- Take measures to implement the auditor's recommendations.

Method of monitoring operation

The purposes of the monitoring of operation are:

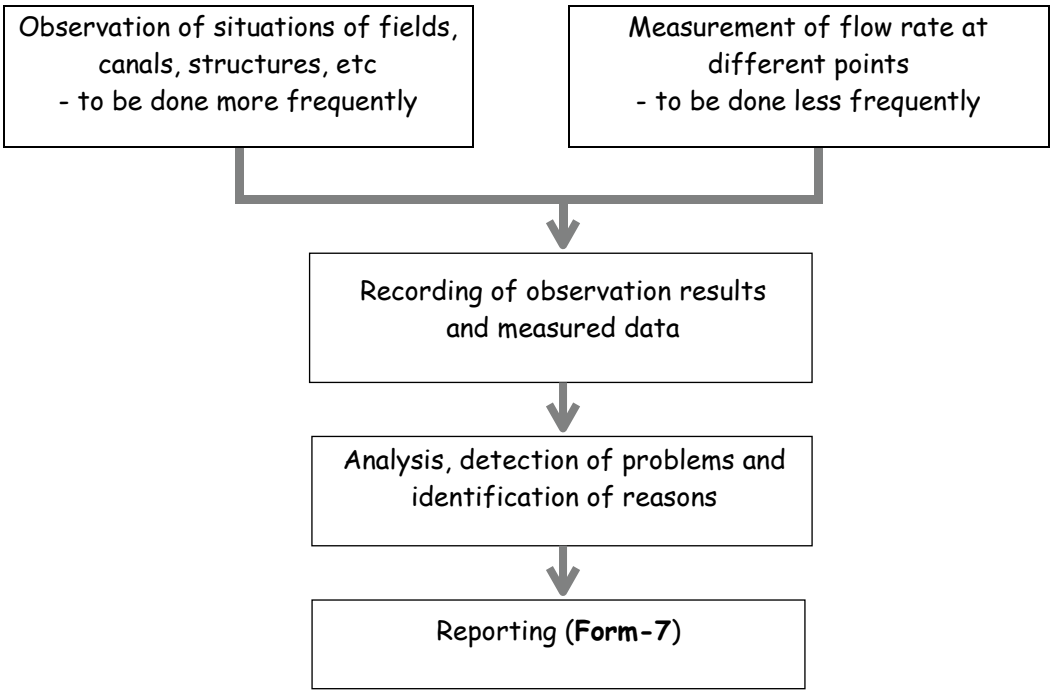
- Comparing the actual pattern of water distribution with the plan.
- Identifying the reasons for divergence of the actual pattern from the plan.
- Accumulating information on water demand, supply and performance as a guide to planning and implementation of water distribution for the forthcoming seasons.

During the irrigation period, some irrigation blocks or units sometimes receive more irrigation water than required, and some irrigation blocks or units sometimes receive less irrigation water than required. To minimize such situations, the periodical assessment of irrigation is needed.

The O&M subcommittee – shall be responsible for monitoring of operation. Also, it shall decide the method and the interval of monitoring.

Furthermore, in case some problems are observed from the monitoring activities, the persons in charge shall report the problems to the management committee, using the reporting format **Form-7**.

A common process of monitoring is shown below:



Regarding the measurement of flow rate, measuring devices are not installed at different points. In that case, we can use the following simple method as mentioned in the Formulation Guidelines.

1) Determine measurement point

Find a suitable point for measurement.

2) Estimate flow area

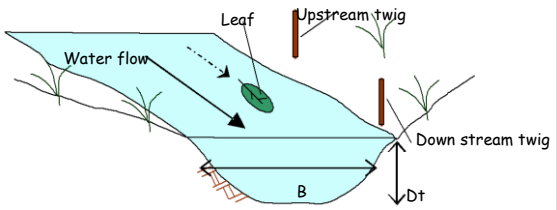
Measure canal width and water depth

B = ☐ m (canal width) Dt= ☐ m (water depth)

At= ☐ m^2 (flow area) (At = B x Dt)

3) Measure water flow velocity

a) Drive two twigs into the ground along the canal at a measured distance between the two twigs. b) Float a leaf on the water from the upstream twig to the downstream twig and measure the travel time. c) Calculate the flow velocity.



Ls = ☐ m (length between twigs) Tt= ☐ sec (travel time)

Vt = ☐ m/sec (V t = Ls/ Tt)

4) Calculate river discharge on the day of survey

Qt= ☐ m^3/sec (discharge) (Qt = At x Vt)

Method of monitoring maintenance

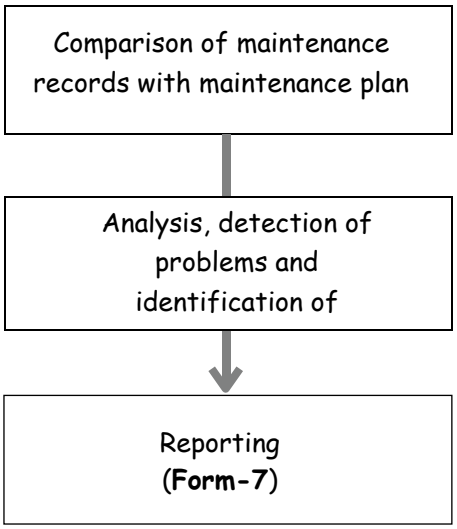
The purpose of the monitoring of maintenance is:

- Finding whether the planned maintenance is carried out as planned.

It is recommended that the persons who are NOT in charge of managing maintenance activities should be responsible for monitoring of maintenance. This is because the persons who are NOT in charge of managing maintenance can check the maintenance activities from a third person's standpoint.

The persons in charge of monitoring shall decide the method and the interval of monitoring. Furthermore, in case some problems are observed from the monitoring activities, the persons in charge shall report the problems to the management committee, using the reporting format in **Form-7**.

A common process for monitoring is shown below:



Explanatory Note 2: Cropping calendar and patterns

2-1: Cropping Calendar

What is cropping calendar?

The Cropping Calendar is a fundamental tool that provides sufficient information on crop production which enables enhancement of high yields. This tool supports farmers and agriculture extentionists across the world in taking appropriate decisions on crops and their sowing period, respecting the agro-ecological dimension.
It is a schedule of crop growing season from the fallow period and land preparation, to crop establishment and maintenance, to harvest and storage. It contains information on proper crop husbandry, harvesting and storage periods of locally adapted crops in specific agro-ecological zones.

The cropping calendar allows a farmer to:

- Plan for input purchase and use
- Plan for Water distribution to avoid water conflicts in irrigation scheme
- Determine labour requirements and plan for peak usage times
- Cultivate and produce crops in the same time
- Fetch good market prices for the produce
- Control pests (birds) and diseases for equal distribution of pests and diseases among farms of farmers
- Organize contractors for land preparation and harvesting
- Develop cash flow budget for year
- Determine credit needs and period required

HOW TO DEVELOP A CROPPING CALENDAR

1. Determine the best date to plant. This information can be gathered from local experience, agricultural advisors and leading farmers in the district.
2. Determine the time the variety takes from planting to harvest.
3. Mark on the calendar the date of planting/sowing and then when each other operation needs to be done (ploughing, weeding, fertilizing, and harvesting).
4. Then determine how much labour, equipment and finance will be required at each step during the growing period.
5. Pin the calendar in a prominent place to remind you when things need to be done.

2-2 Cropping pattern

What is cropping pattern?

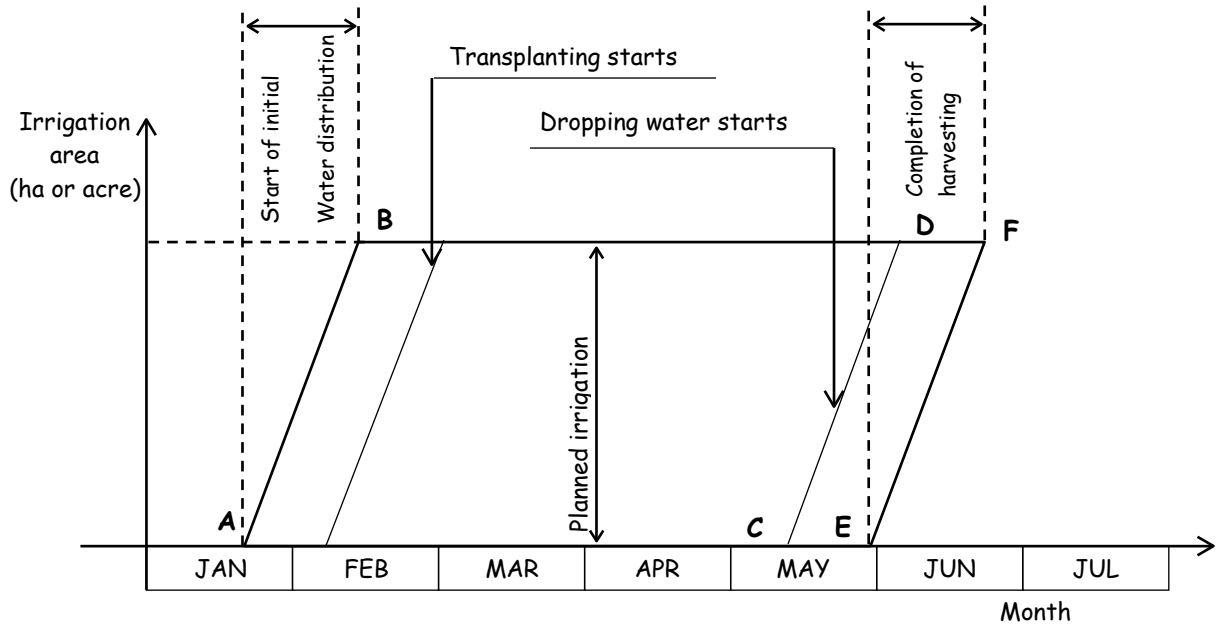
Cropping pattern means a diagram which shows when the crop will be planted, and when the crop will be harvested in a particular irrigation area, as shown below.

The horizontal axis represents the time which shows the growth stage of the crop, the time of farming activities and irrigation activities. On the other hand, the vertical axis represents the irrigation area in ha or acre.

In the diagram below, initial water distribution starts at point A, and has started in the whole area at point B. In a similar way, harvesting starts at point E, and has finished in the whole area at point F.

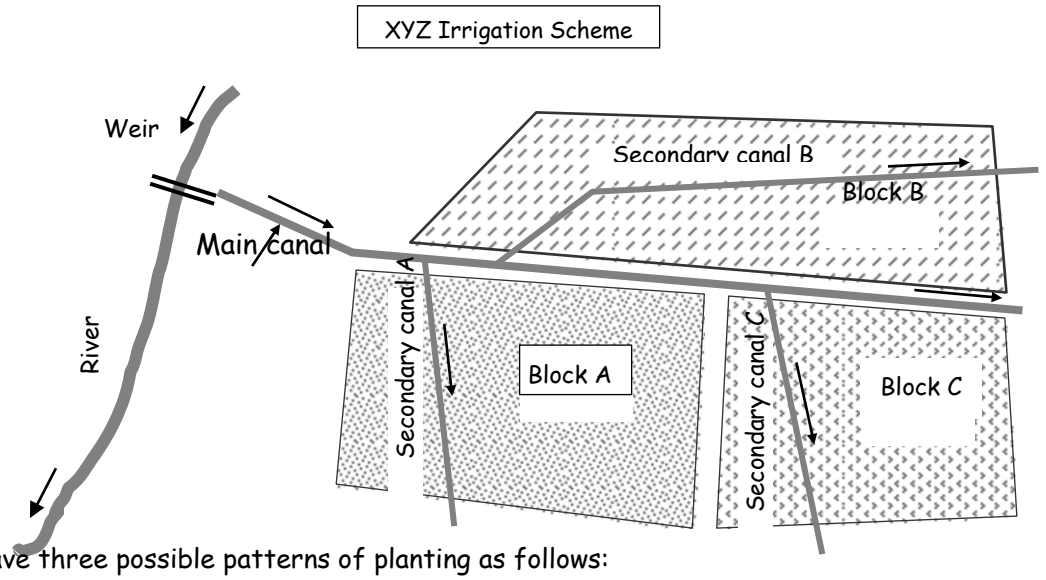
The irrigation area gradually increases in the period from A to B, is at a peak in the period from B to C, and gradually decreases in the period from C to D.

Also, the period from B to C shows full utilization of planned irrigation area with maximum water demand and maximum water utilization.



Example of pattern of planting

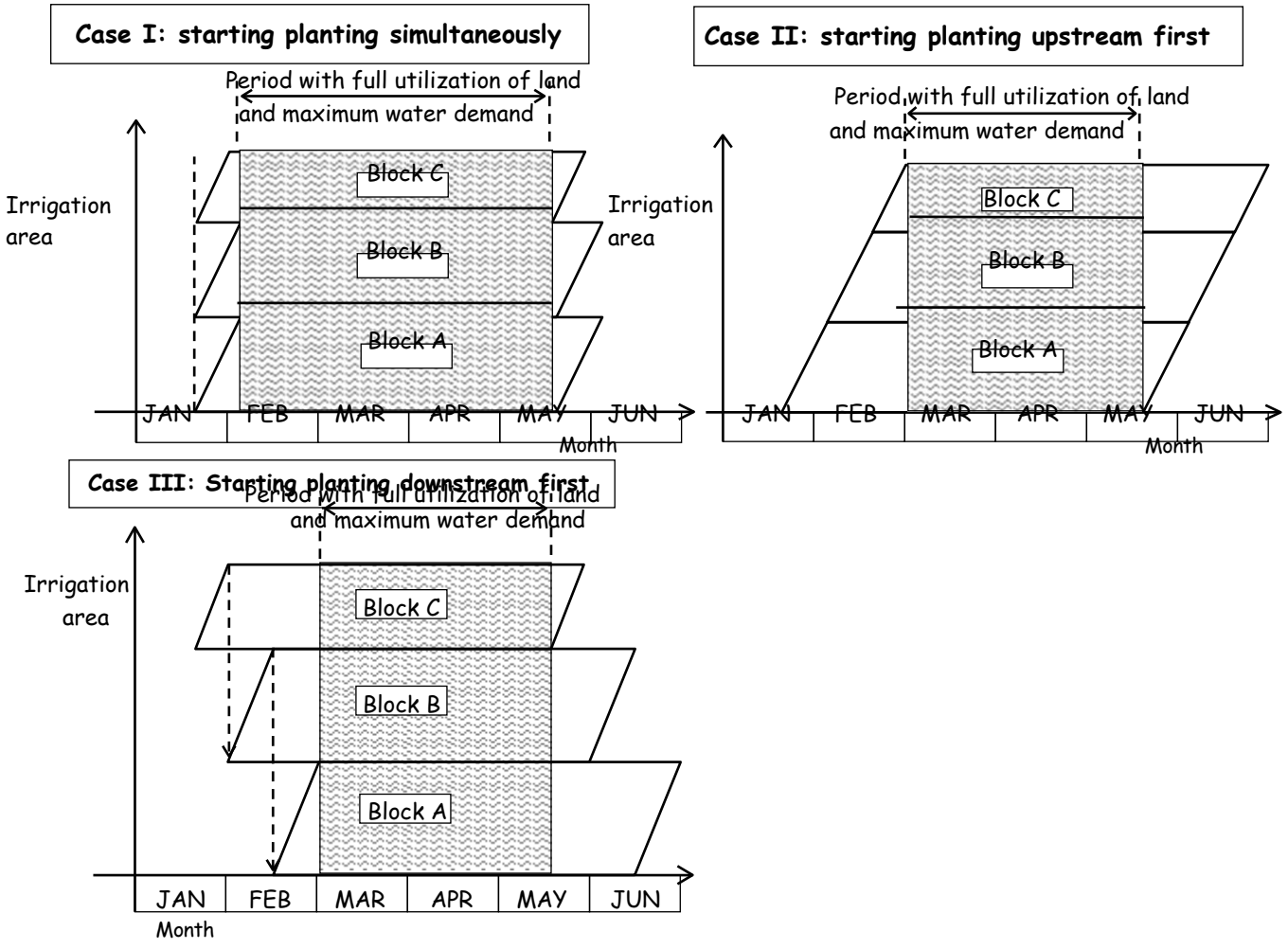
Now, let us take a more specific example which is closer to the actual situation to explain examples of pattern of planting. In the figure below, the irrigation area of the XYZ Irrigation Scheme is divided into three irrigation blocks – Block A, Block B and Block C – by the secondary canals, the groups of the tertiary canals or the tertiary canals.



We have three possible patterns of planting as follows:

- **Case I**: Starting planting simultaneously in the whole area regardless of irrigation blocks
- **Case II**: Starting planting upstream first – Block A first, then Block B and Block C
- **Case III**: Starting planting downstream first – Block C first, then Block B and Block A

The cropping calendar for each pattern of planting is shown below:



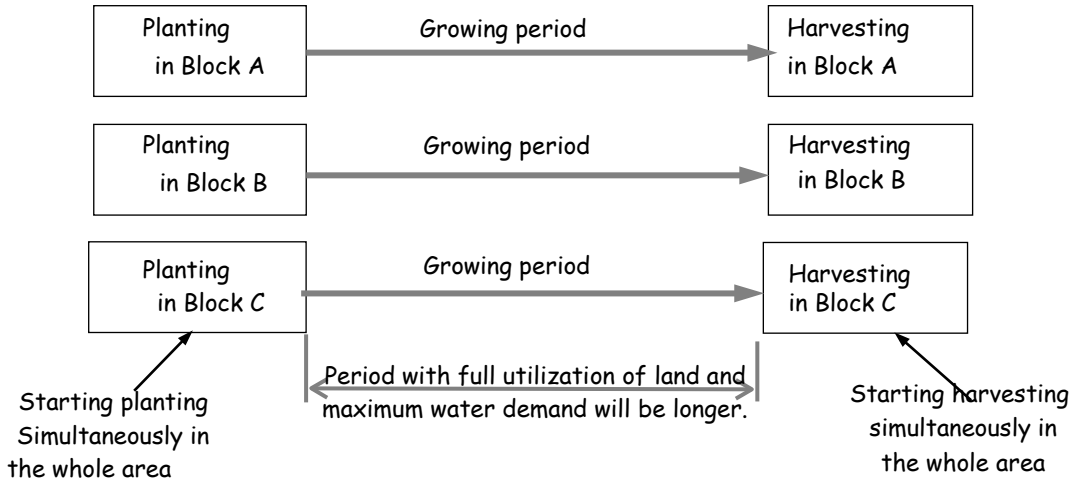
Relationship between pattern of planting and water demand variation within a season

As shown in the above diagrams, the period with full utilisation of land and maximum water demand is longer in the case of starting planting simultaneously in the whole area (Case I), and shorter in the case of starting planting upstream first or downstream first (Case II and III).

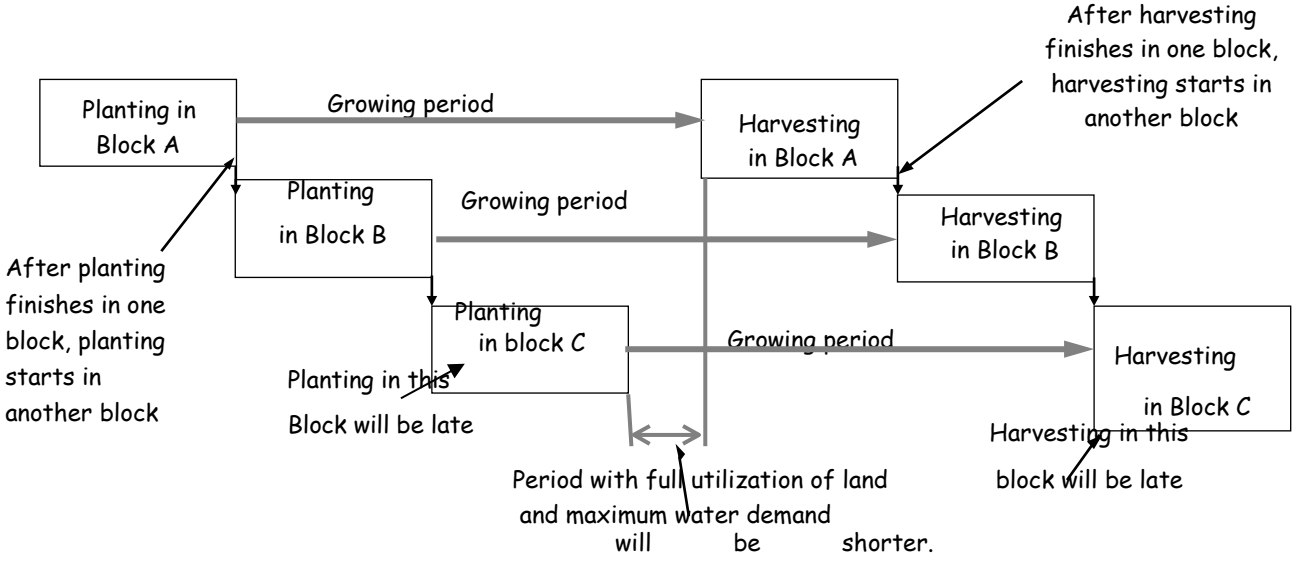
On the other hand, in the case of starting planting downstream first or upstream first (Case II and III), start of planting will be late in some irrigation block because, when planting finishes in one block, planting starts in another block. Also, start of harvesting will be late in some irrigation block.

These situations are illustrated below:

Case I: Starting planting simultaneously in the whole area regardless of irrigation blocks



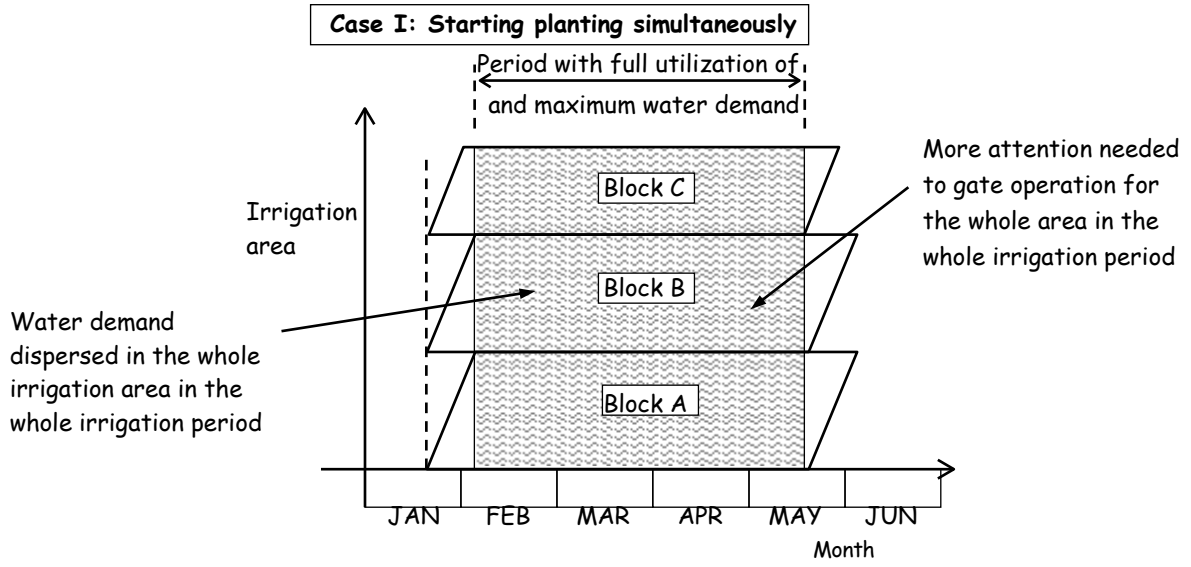
Cases II and III: Starting planting upstream first or downstream first
(Starting planting by rotation
- starting planting in one block, and after finishing it there, starting planting in another block)



Relationship between pattern of planting and activities of gate operation

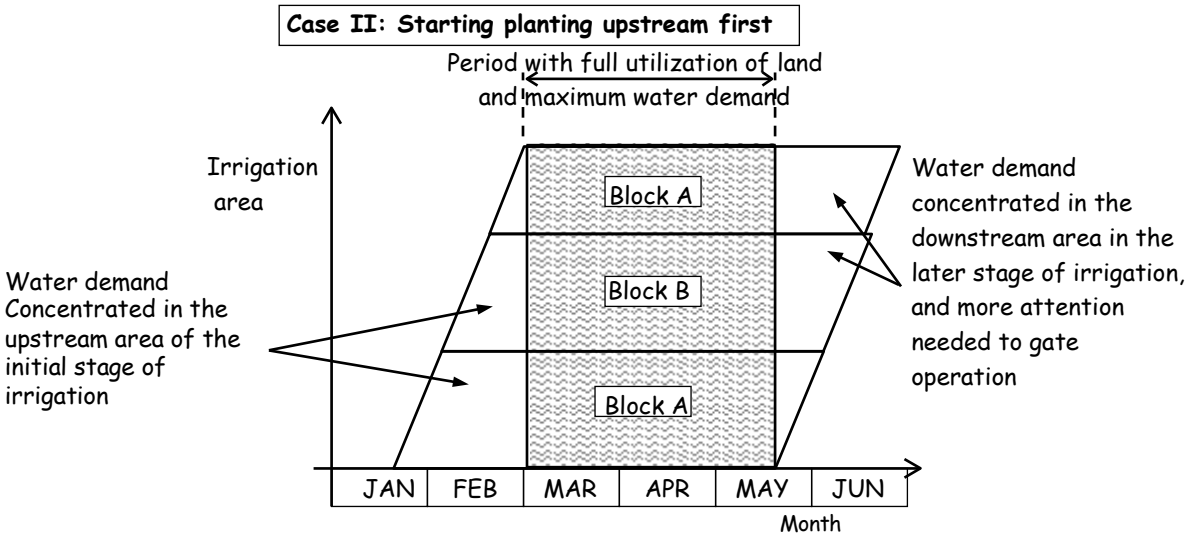
In the case of starting planting simultaneously in the whole area (Case I), water demand is dispersed in the whole irrigation area in the whole irrigation period. In this case, the entire canal network needs to have a larger volume of irrigation water in the whole irrigation period.

Therefore, more attention needs to be paid to gate operation for the whole irrigation area in the whole irrigation period.



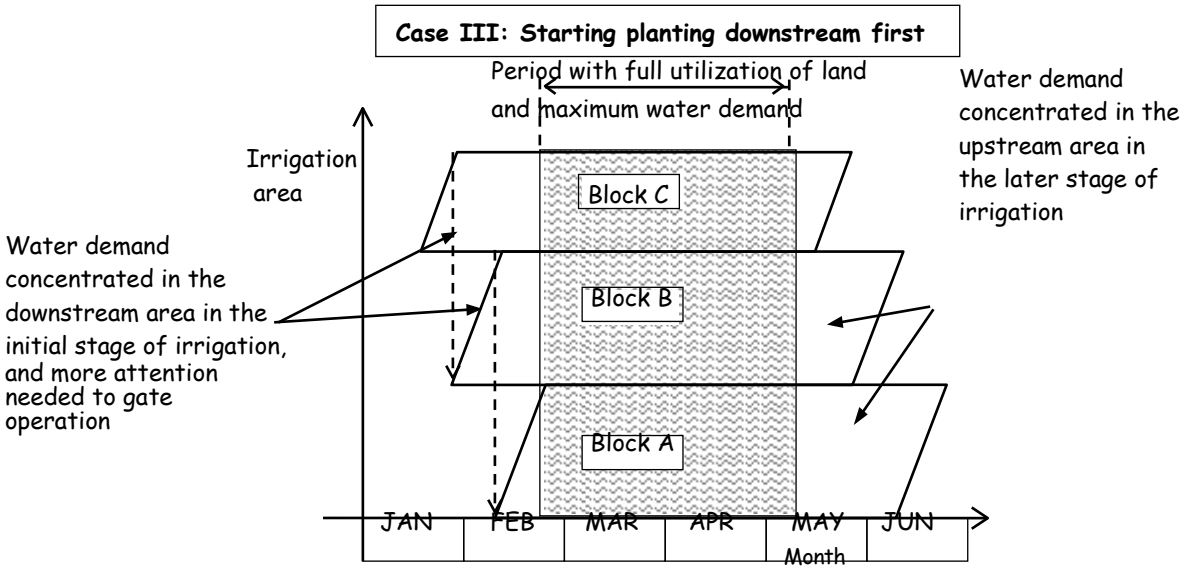
In the case of starting planting upstream first (Case II), water demand is concentrated in the upstream area in the initial stage of irrigation, and in the downstream area in the later stage of irrigation.

In case water demand is concentrated in the downstream area, a larger volume of water needs to be stored in the whole course of the main canal. Therefore, more attention needs to be paid to gate operation in the later stage than in the earlier stage of irrigation.



In the case of starting planting downstream first (Case III), water demand is concentrated in the downstream area in the initial stage of irrigation, and in the upstream area in the later stage of irrigation.

In case water demand is concentrated in the downstream area, a larger volume of water needs to be stored in the whole course of the main canal. Therefore, more attention needs to be paid to gate operation in the earlier stage than in the later stage of irrigation.



Which is better, Case I, Case II or Case III?
This shall be decided after taking the following into consideration:

a) Variation of water availability within a season

In order to make a water distribution plan properly, it is important to understand the variation of water availability within a season – how much water is available in the beginning stage, in the middle stage, and in the later stage of irrigation. This issue is quite important particularly in dry season when water availability is limited.

The organized irrigation of Case II or Case III – starting planting upstream first or downstream first – is recommended in terms of efficient distribution and use of a limited amount of water.

b) Easiness of operation activities, especially activities of gate operation

Regarding the easiness of gate operation, the unorganized irrigation of Case I – starting planting simultaneously in the whole area – makes gate operation more difficult than in the other cases. Case II or Case III would be recommended in terms of easiness of gate operation.

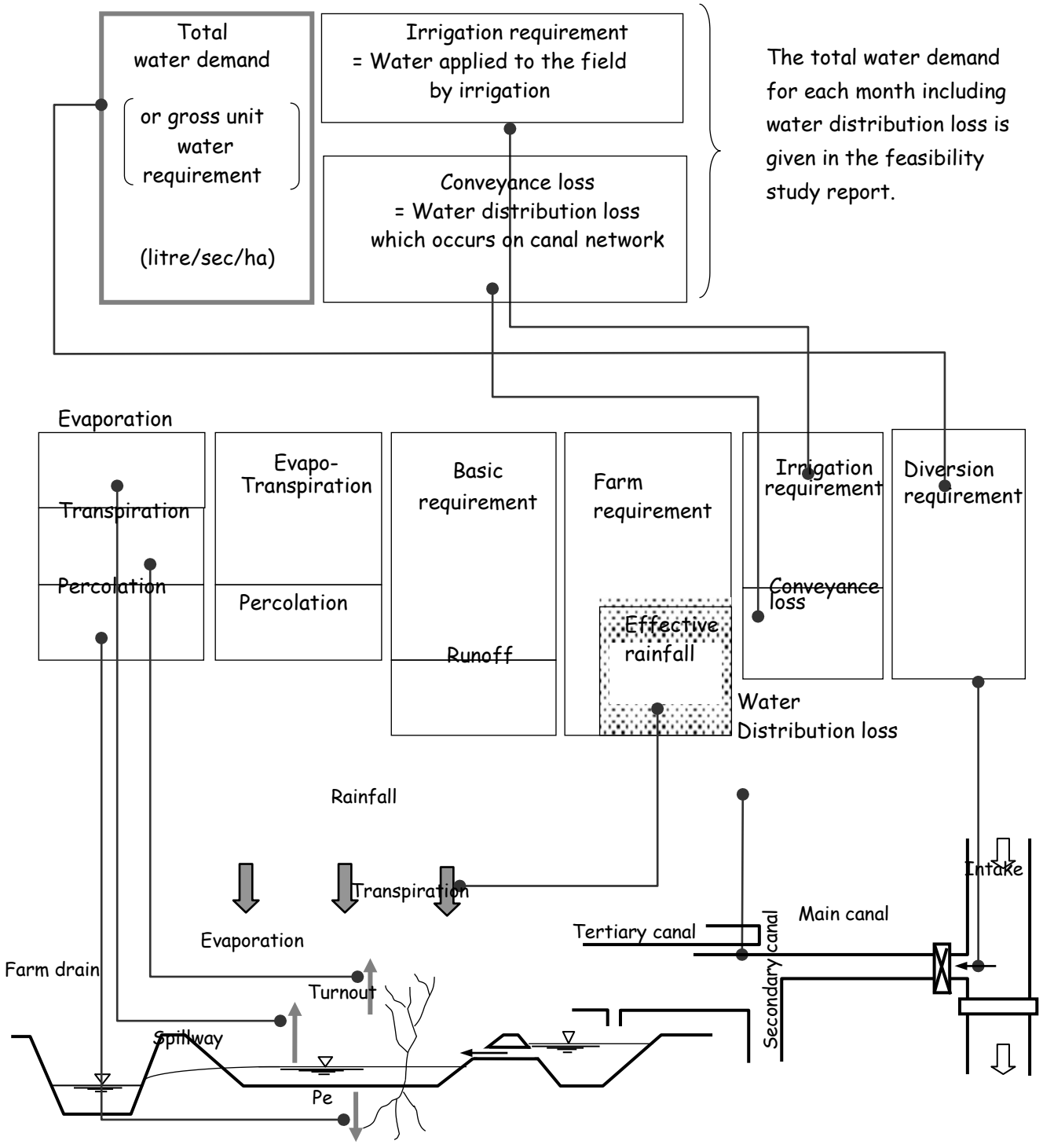
c) Irrigators' intention in each irrigation block

The irrigators' intention about when to start planting and when to start harvesting shall be coordinated in the general meeting facilitated by management committee.

Explanatory Note 3: Estimation of water demand

The irrigators need to understand the amount of water required in each month of the period with full utilization of land and maximum water demand. **Form-9** is the calculation sheet for water demand in each month.

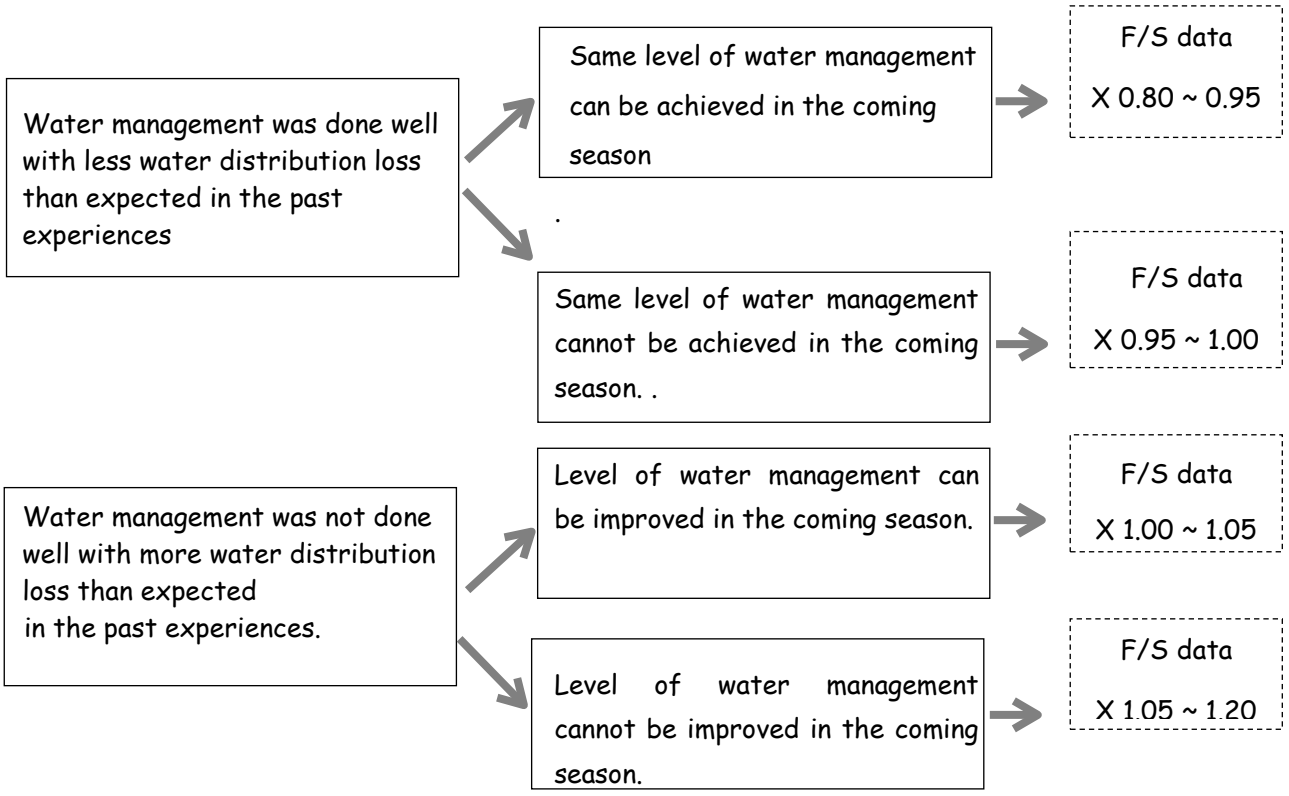
Water demand is the total amount of water required for irrigation of the whole irrigation area. It includes not only water for crops but also runoff and deep percolation from the field, and water distribution loss which occurs on the canal network.



Water demand including water distribution loss, expressed in litre/sec/ha, which is called 'gross unit water requirement,' is given in the feasibility study report.

The gross unit water requirement may differ by irrigation block. In that case, the unit water requirement for each irrigation block is also given in the feasibility study report.

Note that you can use the data of water requirement given in the feasibility study report without modification, or you may adjust the data given in the feasibility study report according to your past experiences. In case you adjust the data, refer to the following guide. Note that you can avoid overestimating or underestimating the water requirement using this guide.

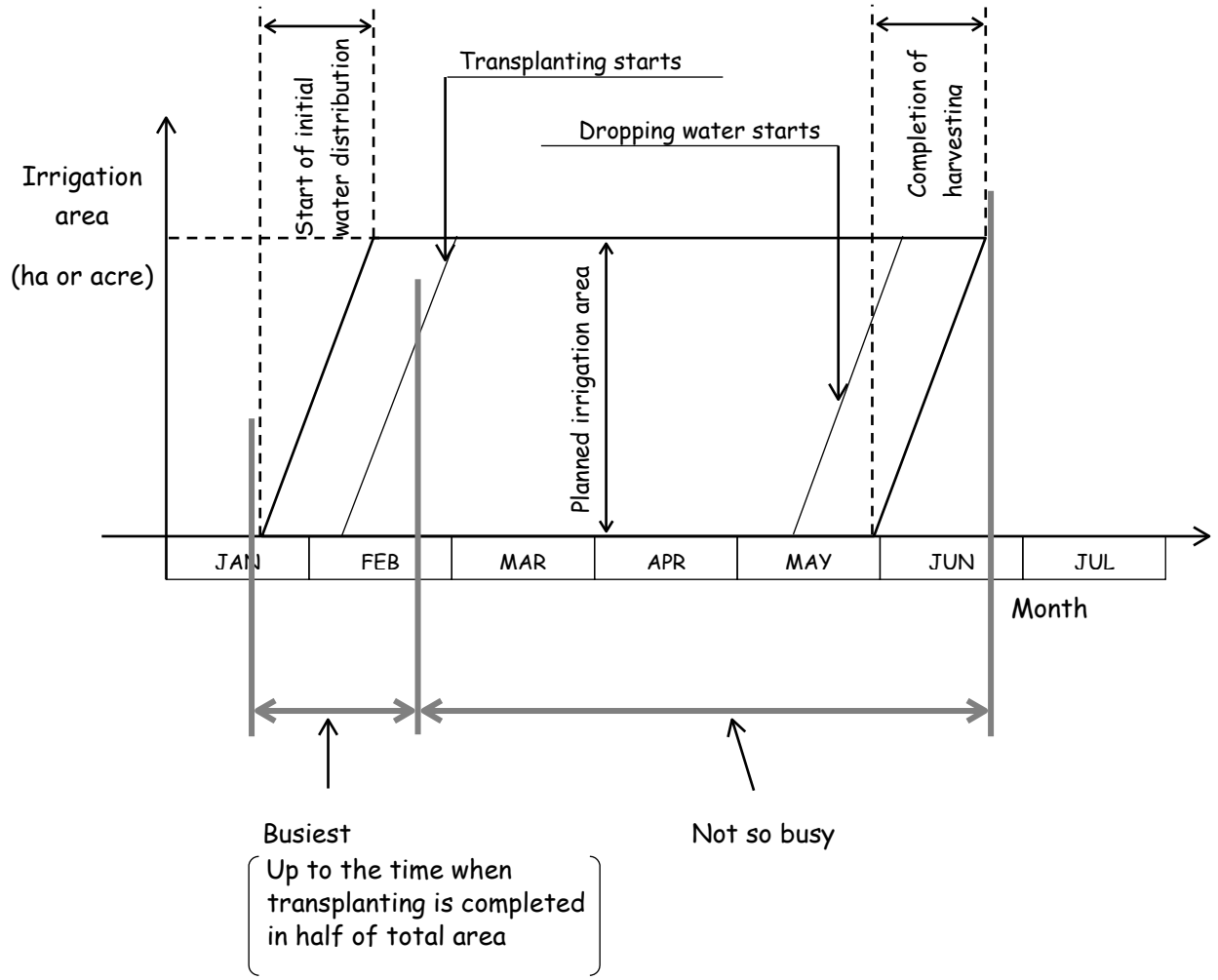


Try to find out the data of the water requirement from the feasibility study report, to fill out the following form, and if necessary and appropriate, to adjust the data.

Gross unit water requirement in litre/sec/ha, or in case it has been adjusted, adjusted water requirement in litre/sec/ha will be used in the calculation of water demand by **Form-9-1**.

Explanatory Note 4: Maintenance planning

Maintenance work for irrigation and other related facilities requires the labour of IO members. Therefore, maintenance activities shall be planned, taking into consideration whether farming practices are busy or not



Explanatory Note 5: How to maintain irrigation facilities

As shown below, maintenance activities can be grouped by major elements of an irrigation system.

- Intake weirs
- Irrigation network
- Dams and reservoirs
- Drainage network
- Roads and flood dikes
- Ancillary works

Major maintenance activities

Element of irrigation system	Major maintenance activities
Intake weirs	• Removal of large pieces of floating debris or dangerous materials especially large floating woods to protect trash racks, weir bodies and associated structures • Cleaning of the scouring sluice gates • Maintenance of the flow measuring facilities to obtain accurate records • Cleaning of all sites and areas adjacent to the facilities • Removal of weeds and any other foreign materials at the trash racks and the scouring sluice gates • Keeping all gates, accessories and metal works in workable conditions – lubrication (oiling or greasing) and anticorrosion treatment (painting) • Monitoring of water quality (pH, EC, salt content and biological standpoint) of the river • Removal of solid deposition – silt and stones
Irrigation network	**Concrete-lined canals** • Replacement of joints • Replacement of damaged slabs • Weed control at joints and on the surface of concrete slabs • Control and treatment of filters • Control and removal of silt • Repair of damaged lining concrete with cracks **Earth canal** a. <u>Silting</u> – mainly caused by defective design, inefficient maintenance, improper operation • Removal of silt by hand or machine, with attention to keeping canal section in correct shape, using a profile board • Preventive measures: - Controlling flow velocity – avoiding situations that water flows at low velocity and at small sectional area of flowing water - Avoiding abrupt operation of gates, which may cause rapid change in flow velocity, bank erosion near gates, and water flow with much silt carried

Element of irrigation system	Major maintenance activities
	b. Weed infestation • Cutting earth weeds and waterweeds growing on wetted parts of canal slopes, and removal of floating waterweeds • Excavation when silt is being removed, manually or by machine • Chemicals not recommended – because they are expensive, and because they may be harmful to people, animals and crops c. Water seepage – mainly caused by burrowing animals, rotting plants and roots, porous soils • Plugging of small holes with soil using spades and small hand compactors • Excavating out damaged sections of bank, and replacing them with new compacted soil • Trenching porous soils, burying plastic membrane or thick slurry made from excavated materials from canal banks, and backfilling of the trench with sand d. Erosion of banks – mainly caused by heavy rainfall, wind, improper operation, stock grazing and passage • Rebuilding of worn out banks, taking care of joints of old parts and new parts • Preventive measures: - Seeding grass on unwetted parts of canals - Fencing canals - Construction of water troughs for animals to drink
Dams and reservoirs	**Reservoir** • Controlling waterweeds • Removal of large floating debris (e.g. tree trunks) which may damage hydraulic works • Monitoring of water quality (pH, EC, salt content and biological standpoint) in order to detect possible sources • Survey, and removal if possible, of solid deposition at the bottom of the reservoir **Irrigation dam** • Lubrication – oiling or greasing – of gates • Anticorrosion treatment – painting – of gates • Cleaning of debris • Control of filters and some minor works • Weed control of the upstream slope of the dam • Monitoring of water quality (pH, EC, salt content and biological standpoint) in order to detect possible sources • Survey, and removal if possible, of solid deposition at the bottom of the reservoir

Element of irrigation system	Major maintenance activities
Drainage network	• Weed control in the canal section • Maintenance of flow gauges and other measuring devices • Removal of silt • Repair and shaping of canal sections
Roads and flood dikes	**Roads** • Refilling of pot holes on road surface • Grading road surface • Provision of additional pavement materials for paved roads • Repair of road shoulders eroded • Desilting and repair of side ditches and culverts **Flood dikes** • Refilling of holes on dike surface • Grading dike surface • Repair of eroded shoulders • Preventive measure: prohibition of traffic on dikes
Ancillary works	**Head gates, check gates, siphons, inlets, spillways, outlets, etc** • Removal of silt and obstructions • Antirust treatment – painting – of mechanical elements • Repair of field bunds

Section 4-2 Flow Chart and Check List

Step 1 : Detailed Flow Chart and Check List

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Arrangement for the general meeting	❑ Arrangement of general meeting ❑ Request of assistance of DIDT, if necessary		
Preparation (1) ~ Composition of IO and concept ~	❑ Preparation of organization chart ❑ Understanding of concept of O&M system	❑ Organization chart	
Preparation (2) ~ Basic operation planning ~	❑ Preparation of **Form-1**	❑ **Form-1**: Basic operation plan	
Preparation (3) ~ Basic maintenance planning ~	❑ Preparation of **Form-2**	❑ **Form-2**: Basic maintenance plan	
Preparation (4) ~ O&M budgeting ~	❑ Preparation of **Form-3**	❑ **Form-3**: O&M budgeting	
Preparation (5) ~ Other issues ~	❑ Understanding methods of problem solving, decision making, financial management and monitoring ❑ Preparation of recording and reporting format	❑ **Form-4** to **Form-7**: Recording and reporting formats	
Preparation (6) ~ Preparation for presentation	❑ Preparation of flip charts of **Form-1** to **Form-7** ❑ Review of training material ❑ Preparation of flip charts for explanation	❑ Flip charts of **Form-1** to **Form-7** ❑ Flip charts for explanation	

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Holding the general Meeting	❑ Discussion and decision on organization ❑ Discussion and decision on basic operation plan ❑ Discussion and decision on basic maintenance plan ❑ Discussion and decision on O&M budgeting ❑ Discussion and decision on other issues		
Compilation of general meeting results	❑ Preparation of finalized forms ❑ keeping the record of the general meeting	❑ Finalized **Form-1**: Basic operation plan ❑ Finalized **Form-2**: Basic maintenance plan ❑ Finalized **Form-3**: O&M budgeting ❑ Finalized **Form-4** to **Form-7**: Recording and reporting formats ❑ Record of the general meeting	
Submission of final outputs of organisation chart, Form-	❑ Submission of copies of organization chart, **Form-1** to **Form-7** to the DIDT		

<< References

1. Instructional Materials Development Unit (IMDU) / ASPS, "Technical Handbook No. 6: Irrigation Water Management," 2002.

Step 2 : Detailed Flow Chart and Check List

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Arrangements for the general meeting	❑ Arrangement for the general meeting ❑ Request of assistance of the DIDT, if necessary		
Preparation (1) ~ Review of basic operation plan ~	❑ Review and preparation of **Form-1**	❑ **Form-1**: Basic operation plan	
Preparation (2) ~ Cropping calendar ~	❑ Preparation of **Form-8**	❑ **Form-8**: Cropping calendar	
Preparation (3) ~ Calculation of water demand ~	❑ Preparation of **Form-9** ❑ Preparation of **Form-9-1**	❑ **Form-9**: Calculation sheet for water demand ❑ **Form-9-1**: Gross unit water requirement	
Preparation (4) ~ Estimation of water supply ~	❑ Preparation of**Form-10**	❑ **Form-10**: Estimation of water supply	
Preparation (5) ~ Irrigation scheduling and water distribution planning ~	❑ Preparation of **Form-11**	❑ **Form-11**: Irrigation schedule and water distribution plan	
Preparation (6) ~ Preparation for presentation	❑ Preparation of flip charts of **Form-1**, **Form-8** to **Form-11** ❑ Review of training material ❑ Preparation of flip charts for explanation	❑ Flip charts of **Form-1**, **Form-8** to **Form-11** ❑ Flip charts for explanation	
Holding the general meeting	❑ Discussion and decision on **Form-1** ❑ Discussion and decision on **Form-8** ❑ Discussion and decision on **Form-9** & **9-1**		

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
↓	❑ Discussion and decision on **Form-10** ❑ Discussion and decision on **Form-11**		
↓ Compilation of general meeting results	❑ Preparation of finalized forms	❑ Finalized **Form-1**: Basic operation Plan ❑ Finalized **Form-8**: Cropping calendar ❑ Finalized **Form-9**: Calculation sheet for water demand ❑ Finalized **Form-9-1**: Gross unit water requirement ❑ Finalized **Form-10**: Estimation of water supply ❑ Finalized **Form-11**: Irrigation schedule and water distribution plan	
	❑ keeping the record of the general meeting	❑ Record of the general meeting	
↓ Submission of final outputs of **Form-1**, **Form-8** to Form-11 to DIDT	❑ Submission of copies of **Form-1**, **Form-8** to 1		

<< Reference >>

1. Instructional Materials Development Unit (IMDU) / ASPS, "Technical Handbook No. 6: Irrigation Water Management," 2002.

Step 3 : Detailed Flow Chart and Check List

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Arrangement for the general meeting	❑ Arrangement for the general meeting ❑ Request for assistance of the **DIDT**, if necessary		
Preparation (1) ~ Basic maintenance plan ~	❑ Preparation of **Form-2**	❑ **Form-2**: Basic maintenance plan	
Preparation (2) ~ Specific maintenance plan ~	❑ Preparation of **Form-12**	❑ **Form-12**: Maintenance plan	
Preparation (3) ~ O&M budgeting ~	❑ Preparation of **Form-3**	❑ **Form-3**: Operation and maintenance budgeting	
Preparation (4) ~ Preparation for presentation	❑ Preparation of flip charts of **Form-2**, **Form-3** and **Form-12** ❑ Review of training material ❑ Preparation of flip charts for explanation	❑ Flip charts of **Form-2**, **Form-3** and **Form-12** ❑ Flip charts for explanation	
Holding the general meeting	❑ Discussion and decision on **Form-2**, **Form-3** and **Form-12**		
Compilation of general meeting results	❑ Preparation of finalized forms ❑ Keeping the record of the general meeting	❑ Finalized **Form-2**: Basic maintenance plan ❑ Finalized **Form-3**: Operation and maintenance budgeting ❑ Finalized **Form-12**: Maintenance plan ❑ Record of general meeting	

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Submission of final outputs of **Form-2**, **Form-3** and **Form-12** to the DIDT	❑ Submission of copies of **Form-2**, **Form-3** and **Form-12**		

<< References >>

1. Instructional Materials Development Unit (IMDU) / ASPS, "Technical Handbook No. 6: Irrigation Water Management," 2002.

Step 4 : Detailed Flow Chart and Check List

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Practice of operation	❑ Practice of operation		
Operation recording	❑ Operation recording	❑ **Form-4**: Operation record	

<< References>>

1. Instructional Materials Development Unit (IMDU) / ASPS, "Technical Handbook No. 6: Irrigation Water Management," 2002.

Step 5 : Detailed Flow Chart and Check List

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Practice of maintenance	❑ Practice of maintenance		
Maintenance recording	❑ Maintenance recording	❑ **Form-5**: Maintenance record	

<< References>>

1. Instructional Materials Development Unit (IMDU) / ASPS, "Technical Handbook No. 6: Irrigation Water Management," 2002.

Step 6 : Detailed Flow Chart and Check List

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Service fee agreement	❑ Irrigation service fee collection agreement		
Fee collection	❑ Fee collection practices		
Financial management	❑ Financial management	❑ **form-3** O&M Budgeting ❑ **Form-6**: Financial record	

<< References>>

1. Instructional Materials Development Unit (IMDU) / ASPS, "Technical Handbook No. 6: Irrigation Water Management," 2002.

Step 7 : Detailed Flow Chart and Check List

Work flow	Check List of Work Items	Paper/Report to be prepared/submitted	Result/Report to be obtained/received
Monitoring work	❑ Monitoring of O&M activities		
Analysis of data, detection of problems and reporting	❑ Analysis of data ❑ Detection of problems ❑ Reporting	❑ **Form-7**: Reporting format	

<< References >>

1. Instructional Materials Development Unit (IMDU) / ASPS, "Technical Handbook No. 6: Irrigation Water Management," 2002.

Additional Guidelines

1. For every scheme, an O&M manual should be prepared by the NIRC in collaboration with the DIDT. This should be prepared during design stage.

2. For every scheme, an O&M training manual should be prepared by NIRC in collaboration with relevant training institutions.

3. At the level of O&M, the DIDT should play the advisory role when required.

SECTION 5 GENERAL INFORMATION

Process of Irrigation Development after DADP Stage

(1) General

The irrigation schemes included in DADP will be developed based on the Guidelines for Participatory Improvement to Farmer Initiated and Managed Smallholder Irrigation Schemes, July 2003. The proposed process of irrigation scheme development after selecting an irrigation scheme, as presented in the guidelines, is outlined hereinafter (refer to the said guidelines for details).

(2) Process of Irrigation Scheme Development after Selection

After a scheme is selected for a DADP, the scheme will be developed with a participatory approach. The process is composed of the following nine stages:

1 Participatory Action Planning,

2 Registration as Legal Entity/Letter of Understanding,

3 Participatory Diagnostic Study,

4 Participatory Design/Feasibility Study,

5 Joint Investment Decision/ Financing Agreement,

6 Detailed Design/Tender Documentation,

7 Tendering/Contract Award,

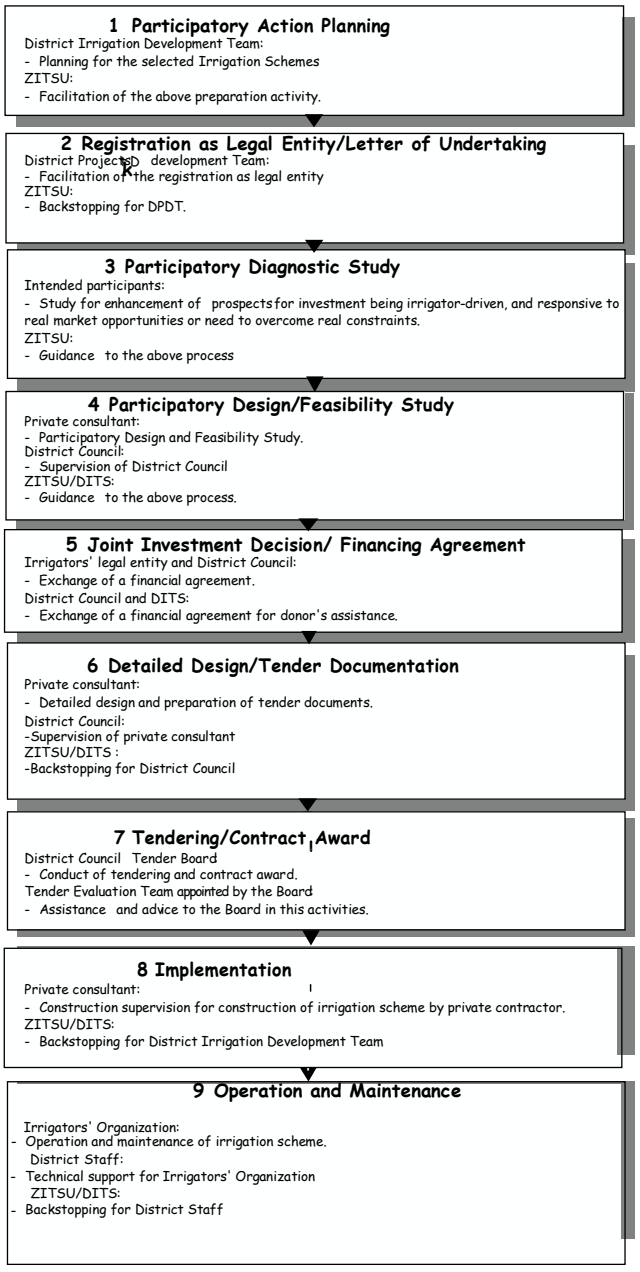
8 Implementation,

9 Operation and Maintenance.

The beneficial irrigators, as the main actors, will mostly take part in activities at these stages.

The Government agencies concerned at each stage are shown in the figure at right.

Process of Irrigation Scheme Development



The activities mentioned in the guidelines are re-iterated as follows:

Major Activities at each Stage

Stages	Major Activities
1 Participatory Action Planning	Series of short planning workshops: - to identify the nature of intervention intended by irrigators - to define allocation of responsibilities for meeting costs of the preparatory activities
2 Registration as Legal Entity/Letter of Undertaking	- Registration of the scheme as an organization/cooperative/ company as preferred by the membership under existing legislation/regulations - Preparation and signature of LoU from scheme to District Council
3 Participatory Diagnostic Study	- Participatory analysis of opportunities and constraints, construction of problem and objective trees - Collection of supporting baseline data
4 Participatory Design/Feasibility Study	- Joint study among the scheme members, other stakeholders and specialists - Submission of results to irrigators' entity for approval/veto
5 Joint Investment Decision/ Financing Agreement	- Consideration and acceptance of positive Feasibility Report by all financiers - Preparation and signature of agreements
6 Detailed Design/Tender Documentation	- Detailed sub project design and study
7 Tendering & Contract Award	- Selection and employment of consultants following District Council procedure/regulation - Procurement of goods and works following regulations or District Council procedure/regulation
8 Implementation	- Joint effort between various actors involved, including irrigators' entity
9 Operation and Maintenance	- To be defined through Participatory Diagnostic and Feasibility Study

Source: Guidelines for Participatory Improvement to Farmer Initiated and Managed Smallholder Irrigation Schemes, July 2003

In order to fulfill these activities successfully, the ZIO/RIO need to provide the district staff with support in close communication.

(3) Flexible Management to Development Process

The Guidelines show the timeframe for development. According to the timeframe, two years would be required for study, design and tendering before implementation. On the other hand, the development scales of irrigation schemes cover a large range of sizes: 10 ha to 500 ha for small-scaled irrigation schemes. In addition, each irrigation scheme has a different level of maturity. Considering these points, some stages mentioned above might be skipped or the time shortened depending on the conditions of the irrigation schemes. Flexible management is needed.