

## ***Module 4 – Operation & Maintenance of Minor Irrigation Project***

### **Topic**

Operation and Maintenance of Minor Irrigation schemes

### **Objective**

To gain technical knowledge and skill regarding regular operation and maintenance of minor irrigation scheme for its sustainability by the O & M subcommittee members of WUA

### **Expected out put**

- Maintenance of records regularly
- Holding regular meeting
- Repair & maintenance of electric pump / diesel pump
- Up-dating water charge demand, collection and balance details
- Raising of internal resources
- Regularity of financial audit
- Maintenance of pump efficiency, fuel efficiency

### **No of sessions**

- Three

### **Time required**

- 2 days

### **Material required**

- Flip chart
- LCD
- Chart paper
- Sketch pens
- Cello tape

### **Participants**

- Managing committee members, Operator, Works sub-committee, Members of WUA

### **Methodologies Used**

- Lecture
- Power point presentation
- Hands on/ practical demonstration
- Question-Answer session

## Session wise Plan

### Session No.1

**Topic:** What is good management, operation and maintenance of scheme

**Method:** Lecture

**Time:** 60 minutes

**Resource Person:** DPMU/ WRIDD staff, SO experts

**Support Material:** Chart paper, sketch pen, flip chart

**Tips for trainer:** Explain the procedures by using charts/flip chart, formats of different records

### Session No.2

**Topic:** Regular maintenance of the source and distribution network assets, quality standards, familiar with break down and causes, safety measures, cost control measures

**Method:** Lecture and demonstration

**Time:** 90 minutes

**Resource Person:** DPMU/ WRIDD staff, SO experts

**Support Material:** Chart paper, sketch pen, flip chart

**Tips for trainer:** Explain the procedures by using charts/flip chart, practical demonstration. Ask the participants to think about the water use efficiency systems and what should be done to control cost. Go on asking continuously till getting full information. Note down the information point wise, categorically. Consolidate them and add left over. Finally give conclusions and close the session

### Session No.3

**Topic:** Repair and maintenance of diesel pump/ electric pump

**Method:** Demonstration, question-answer session

**Time:** 90 minutes

**Resource Person:** DPMU/ WRIDD staff, SO experts

**Support Material:** Practical class

**Tips for trainer:** Explain different parts of the machine. Then explain procedure of repair and maintenance of pumps. Clear the doubts and sum up the session.

## Content

### **1.Low Capacity Deep Tube well or Light Duty Tube well (LDTW)**

These are capable of discharging 30 cubic meter per hour to irrigate an area of 4 to 6 hectares through open channels. These structures are installed in a cluster of 4 to 6 tube wells. It has been found that such structures can be managed very efficiently and economically by the users. It is possible to achieve a cropping intensity upto 300% due to availability of water through out the year.

After ratification by DLIC, DPMU send the SPMU along with the application signed by all of the WUA members to SPMU. SPMU analyses the plan on the basis of the indicators and forwards it to DPMU to start the bidding process.

- DPMU calls for bidding
- DPMU has to complete the bidding process with in stipulated period and select the contractor (generally lowest bidder)
- The selected contractor is being given the entire job of completing the scheme
- Contractor has to complete the job within stipulated time frame
- Place of construction and installation of scheme structure has to be identified in presence of responsible representative of DPMU, representative/s of contractor, and representative of WUA. Presence of SO representative is also desirable for that.
- Contractor has to purchase necessary materials and machineries. Purchased materials and machineries remain under the custodian and supervision of the WUA until the work is over.
- WUA has to be made aware by DPMU about the kinds, quantity and quality (brand) of materials and machineries required for construction and installation of scheme, as they have to play crucial role in monitoring and supervising the work. It is to be noted that till completion of the work all materials and machineries will remain under the custodian of WUA.

#### **List of materials required**

<b>Pipe</b>	<b>Motor</b>	<b>Electrical</b>
1. Filter	1. Submersible pump	1.Cable wire
2. Blank pipe		2.Pump controller
3. Housing pipe		
4. PVC pipes of several radius as mentioned in SDMP		

## **Steps to install Tube well**

- Drilling: Pilot
- Electro logging: Determining the water aquifer availability
- Enlarging Bore
- Lowering of pipe and setting pipe and filter prescribed for the sub project
- Gravel packing: Filling the gaps of the bore hole with gravels
- Development:
  1. Cleaning the tube well until requisite discharge is ensured as well as sand free water is available
  2. Perform some tests-
    - Vertically test/ to test whether alignment of installed tube well is ok
    - Discharge test/ to test discharge capacity
    - Sounding / to test the depth

**Attention: The upper most level of the tube well has to be at least, 2 feet above the surface of the land to avoid flowing of rainwater into the tube well.**

- Construction work of pump house begins after completion of installation of tube well.
- Electrical wiring within the pump house has to be done after construction
- Electricity department will examine the wiring of the pump house and fix the connection as per application
- Once the construction and installation of the scheme is complete, the scheme will be handed over to WUA

## **Operational instruction of LDTW driven by Electric**

Operational Instruction:

- A. Precaution to be taken before starting Motor:
  1. Pump room should be neat and clean. Otherwise Lizard, Rat or Termites may take shelter.
  2. All electrical fittings should be neat and clean.
  3. Starter or main switch should be opened in regular interval to examine existence of cockroach or lizard. Sometimes fuse may be off due to short circuit and may damage motor for their existence.

4. Check voltage range between 220 Volt by switching on the main switch installed in the Pump Room. It is not desirable to run motor below this range. There is a chance of burning of Motor if operated in low voltage.
5. Check-up right voltage in each phase of the three phases of main switch with the help of a test lamp or volt meter should be carried out. If there is any deviation of voltage, inform to WBSEB office.
6. If there is any defect in the Transformer, meter box or supply fuse, inform it to the local supply office of WBSEB.

B. Precautions to be taken after starting the Motor:

1. If supply voltage is within the range of 220 V then switch on the main and starter.
2. Contact local mechanic if the motor gets excessively heated.
3. Contact local mechanic or technician if there is excessive vibration or sound in the motor or fuse off frequently.
4. Motor should be kept on rest for an hour after continuous running for 4 hours. It should be recorded in the operators log book also.

C. Precautions to be taken after switching off the motor:

1. Press the red button of the starter to close the motor. If the motor does not stop close the main switch and inform to local office.
2. Keep all the log books, registers in proper place.
3. Close the windows before closing the Pump Room.
4. WUA should be consulted for next time distribution of water.

D. Other knowhow:

1. Trespassers are not allowed in the Pump Room excepting the operator.
2. Pump should be operated for 10-15 minutes during the off season or rainy season. Otherwise the Motor may Jam. Electric line may be damped.
3. It is the responsibility of the WUA to guard the materials of the Tube Well center.
4. Sufficient quantity of gravel in the Pump room attached to tube well should be checked.
5. If there is very low discharge from the pump, contact with the local office.
6. Switch off the motor If sand comes out along with the pumped water.
7. If electric consumption is abnormal, contact local office. For 17.5 H.P. motor consumption of electric is 12-13 unit and for 22.5 H.P motor 17-18 unit.
8. Ammeter will show deflection if the motor is overloaded. Motor should be closed in that case.

9. Important points to be recorded in the daily operators log book. Record in the log book If there is no demand of water in any day.
10. Water should not be released in absence of signature or finger print of the owner of the land/plot.
11. Irrigation Water should be distributed as per water scheduling of the registered WUA.
12. Motor should not be operated in absence of the operator. One stand by operate is preferable for a WUA
13. If any parts or machinery is stolen, immediately FIR has to be made at local Police Station and copy of FIR has to be kept with WUA
14. Screw of the Fuse grip of the main switch should be tightened intermittently to avoid loose connection. It prevents burning of electric line.
15. Correct ratings of fuse wire to be used.
16. Water should not be released in absence of water tax.If there is any defaulter it should be informed to the WUA. This local problem can be solved in the meeting conducted at the center by the WUA.
17. Sometimes there is sabotage in the pipe line. Local WUA should be cautious in this respect.

## **2.Medium Duty Tube wells (MDTW)**

The schemes are constructed for utilization of ground water resources in areas where irrigation is not covered through surface water resources and where water table is more than 7 meters below ground level and electrically operated submersible pump sets are required to be used for lifting water.

These are capable of discharging 100 cubic meters per hour to irrigate an area of 20 ha. through underground pipe lines emanating from an elevated distribution chamber. It is possible to have upto 300% cropping intensity.

After ratification by DLIC, DPMU send the SPMU along with the application signed by all of the WUA members to SPMU. SPMU analyses the plan on the basis of the indicators and forwards it to DPMU to start the bidding process.

- DPMU calls for bidding
- DPMU has to complete the bidding process with in stipulated period and select the contractor (generally lowest bidder)
- The selected contractor is being given the entire job of completing the scheme

- Contractor has to complete the job within stipulated time frame
- Place of construction and installation of scheme structure has to be identified in presence of responsible representative of DPMU, representative/s of contractor, and representative of WUA. Presence of SO representative is also desirable for that.
- Contractor has to purchase necessary materials and machineries. Purchased materials and machineries remain under the custodian and supervision of the WUA until the work is over.
- WUA has to be aware by DPMU about the kinds, quantity and quality (brand) of materials and machineries required for construction and installation of scheme, as they have to play crucial role in monitoring and supervising the work. It is to be noted that till completion of the work all materials and machineries will remain under the custodian of WUA.

#### **List of materials required**

<b>Pipe</b>	<b>Motor</b>	<b>Electrical</b>
1.Filter	1.Submersible pump	1.Cable wire
2. Blank pipe		2.Pump controller
3. Housing pipe		
4. PVC pipes of several radius as mentioned in SDMP		
5. Tripod		

#### **Steps to install Tube well**

- Drilling: Pilot
- Electro logging: Determining the water aquifer availability
- Enlarging Bore
- Lowering of pipe and setting pipe and filter prescribed for the scheme
- Gravel packing: Filling the gaps of the bore hole with gravels
- Development:
  3. Cleaning tube well until requisite discharge is ensured as well as sand free water is available.
  4. Perform some tests-
    - Vertically test/ to test whether alignment of installed tube well is ok
    - Discharge test/ to test discharge capacity
    - Sounding / to test the depth

**Attention: The upper most level of the tube well has to be at least, 2 feet above the surface of the land to avoid flowing of rainwater into the tube well.**

- Construction work of pump house begins after completion of installation of tube well. Subsequently work of laying the pipe line has to start.
- Electrical wiring within the pump house has to be done after construction
- Lowering of pump
- Electricity department will examine the wiring of the pump house and fix the connection as per application
- Once the construction and installation of the scheme is complete, the scheme will be handed over to WUA

### **Operational instruction of MDTW driven by Electric**

Operational Instruction:

- A. Precaution to be taken before starting Motor:
  1. Pump room should be neat and clean. Otherwise Lizard, Rat or Termites may take shelter.
  2. All electrical fittings should be neat and clean.
  3. Starter or main switch should be opened in regular interval to examine existence of cockroach or lizard. Sometimes fuse may be off due to short circuit and may damage motor for their existence.
  4. Check voltage range between 380-420 Volt by switching on the main switch installed in the Pump Room. It is not desirable to run motor below this range. There is a chance of burning of Motor if operated in low voltage.
  5. Check-up right voltage in each phase of the three phases of main switch with the help of a test lamp or volt meter should be carried out. If there is any deviation of voltage, inform to WBSEB office.
  6. If there is any defect in the Transformer, meter box or supply fuse, inform it to the local supply office of WBSEB.
  7. At least two nos NTP Valve/ Flap Valve of the distribution system should be opened before starting of the Motor. Assistance of the WUA of the scheme will be necessary to distribute water in a routine manner.
  8. Sluice Valve fitted within the Pump room should be closed before starting the motor.



B. Precautions to be taken after starting the Motor:

1. If supply voltage is within the range of 380-420 V then switch on the main and starter.
2. Initially hold the starter in Star Position for 8-9 seconds then change it to delta position. Presently semi-automatic or automatic starters are used in Agri-Irrigation. So operating instruction of the starter ( Kilburn, MEI,L&T etc.) should be consulted.
3. If the motor rotates in clock wise direction then inter change any of the two phase of the supply line in the Main Switch. Otherwise contact with the electrician of the local office.
4. Open the sluice valve of the pump room after starting the motor.
5. Contact local mechanic if the motor gets excessively heated.
6. Contact local mechanic or technician if there is excessive vibration or sound in the motor or fuse off frequently.
7. Motor should be kept on rest for an hour after continuous running for 4 hours. It should be recorded in the operators log book also.
8. Check supply voltage intermittently while the motor is in running condition.

C. Precautions to be taken after switching off the motor:

1. Close the sluice valve of the Pump room.
2. Press the red button of the starter to close the motor. If the motor does not stop close the main switch and inform to local office.
3. Keep all the log books, registers in proper place.
4. Close the windows before closing the Pump Room.
5. WUA should be consulted for next time distribution of water.

D. Other knowhow:

1. Trespassers are not allowed in the Pump Room excepting the operator.
2. Pump should be operated for 10-15 minutes during the off season or rainy season. Otherwise the Motor may Jam. Electric line may be damped.
3. It is the responsibility of the WUA to guard the materials of the Tube Well center.
4. Sufficient quantity of gravel in the Pump room attached to tube well should be checked.
5. If there is very low discharge from the pump, contact with the local office.
6. Switch off the motor If sand comes out along with the pumped water.
7. If electric consumption is abnormal, contact local office. For 17.5 H.P. motor consumption of electric is 12-13 unit and for 22.5 H.P motor 17-18 unit.
8. Ammeter will show deflection if the motor is overloaded. Motor should be closed in that case.

9. Important points to be recorded in the daily operators log book. Record in the log book If there is no demand of water in any day.
10. Water should not be released in absence of signature or finger print of the owner of the land/plot.
11. Irrigation Water should be distributed as per water scheduling of the registered WUA.
12. Motor should not be operated in absence of the operator. One stand by operate is preferable for a WUA
13. If any parts or machinery is stolen, immediately FIR has to be made at local Police Station and copy of FIR has to be kept with WUA
14. Screw of the Fuse grip of the main switch should be tightened intermittently to avoid loose connection. It prevents burning of electric line.
15. Correct ratings of fuse wire to be used.
16. Water should not be released in absence of water tax.If there is any defaulter it should be informed to the WUA. This local problem can be solved in the meeting conducted at the center by the WUA.
17. Sometimes there is sabotage in the pipe line. Local WUA should be cautious in this respect.

### **3.Shallow Tube well**

These structures are suitable for areas where water table is within 7 meters below ground level and water can be lifted with one centrifugal pump set run by electrical motor set or diesel engine and thereby dependence on electricity can be avoided. These structures are suitable for areas where water table is within suction limit. The tube wells are constructed for discharging 30 cubic meters per hour to irrigate 6 ha. of land through open channel. It is possible to achieve upto 300% cropping intensity.

### **4.Pump Dug Well**

Two hydro-geological conditions in West Bengal would require dug wells for exploitation of ground water resource for irrigation – the Laterite Zone of the hard rock areas and the areas of relatively thin deposits of highly permeable riverine alluvium. Each of these areas would require specific type of well design and construction technique. Dug wells are generally open masonry wells having low discharges. The diameters of open wells may vary from 2 to 9 m and they are generally less than 20 m in depth. The open wells may also be built using precast concrete rings.

### **5.Water Detention**

Areas having undulating terrains are suitable for constructing small detention structures or low height weirs across streams for storing surface water runoff. These are excellent tools for water

harvesting and effecting recharge of subsoil moisture. The arrest water will be useful for irrigation to the ruggedly barren areas adjoining Chhotonagpur range in western fringe of the state.

### **6.River Lift Irrigation (RLI)**

River lift irrigation schemes are installed where topography of land does not permit to construct storage or diversion works with gravity flow irrigation schemes. Water is lifted from the river, canals, beels etc. with the help of either by two diesel engines or two electric driven pumps-motor sets and delivered to field through underground pipe line network.

The schemes can be Midi or Medium and Mini or Small types. In the present project Mini scheme will be preferred.

Each of the two pump sets is capable of discharging 50(mini)/100(midi) cubic meter per hour i.e. total 100(mini)/ 200 (midi) cubic meter per hour to irrigate an area of 20(mini)/40(midi) ha. land. Water is distributed through underground pipe line emanating from two distribution chambers which may either be independently connected with the pump sets or may be interlinked depending upon shape and size of command area. Generally three pipe lines come out from the distribution chamber, from which water is distributed through 8 to 10 spout points. This system can achieve 300% cropping intensity.

After it gets ratification of DLIC, DPMU send the SPMU along with the application signed by all of the WUA members to SPMU. SPMU analyses the plan on the basis of the indicators and forwards it to DPMU to start the bidding process.

- DPMU calls for bidding
- DPMU has to complete the bidding process within stipulated period and select the contractor (generally lowest bidder)
- The selected contractor is being given the entire job of completing the scheme
- Contractor has to complete the job within stipulated time frame
- Place of construction and installation of scheme structure has to be identified in presence of responsible representative of DPMU, representative/s of contractor, and representative of WUA. Presence of SO representative is also desirable for that.
- Contractor has to purchase necessary materials and machineries. Purchased materials and machineries remain under the custodian and supervision of the WUA until the work is over.
- WUA has to be aware by DPMU about the kinds, quantity and quality (brand) of materials and machineries required for construction and installation of scheme, as they

have to play crucial role in monitoring and supervising the work. It is to be noted that till completion of the work all materials and machineries will remain under the custodian of WUA.

#### **List of materials required for Midi RLI**

<b>Pipe</b>	<b>Motor</b>	<b>Electrical</b>
1.Suction pipe	1.Motor/ engine	1.Cable wire
2. Delivery pipe		2.Pump controller
3. Quadry pod		

#### **List of materials required for Mini RLI**

<b>Pipe</b>	<b>Motor</b>	<b>Electrical</b>
1.PVC pipes of different diameters as mentioned in SDMP and PVC fittings	1.2 pump sets of discharging capacity of 50 cubic meter water per hour	1.Cable wire
2. Iron pipes of different diameters as mentioned in SDMP and iron fittings		2.Pump controller
3. Suction pipe		
4.Delivery pipe		
5.Sluice valve, flat valve, foot valve		
6.Rubber insertion of different diameters		

#### **Steps for Installation**

- Construction work of pump house , simultaneously laying the under ground pipe lines
- After completion of construction of pump house, electrical wiring of the pump house
- Engine/ motors to be installed on the specific platform
- Connection of suction and delivery pipes
- Electrification by the electrical department
- After completion of the construction work, electrification and motor starts operating, water comes out of the spouts , scheme is ready to be handed over to WUA

#### **Operational instruction of River Lift Irrigation Scheme driven by Electric / Diesel**

Operational Instruction:

A. Precaution to be taken before starting Motor:

1. Pump room should be neat and clean. Otherwise Lizard, Rat or Termites may take shelter.
2. All electrical fittings should be neat and clean.
3. Starter or main switch should be opened in regular interval to examine existence of cockroach or lizard. Sometimes fuse may be off due to short circuit and may damage motor for their existence.
4. Check voltage, by switching on the main switch installed in the Pump Room. The range should be between 380-420. It is not desirable to run motor below this range. There is a chance of burning of Motor if operated in low voltage.
5. Check-up right voltage in each phase of the three phases of main switch with the help of a test lamp or volt meter. If there is any deviation of voltage, inform to WBSEB office.
6. If there is any defect in the Transformer, meter box or supply fuse, inform it to the local supply office of WBSEB.
7. Suction pipe line should be filled up by pouring water through the priming bend.
8. At least two nos of NTP Valves / Flap Valves of the distribution system should be opened before starting of the Motor. Assistance of the WUA of the scheme will be necessary to distribute water in a routine manner.
9. Sluice Valve fitted within the Pump room should be closed before starting the motor.
10. In case of Diesel Engine check the fuel Tank and pour Diesel Oil if the tank is empty.
11. In case of Diesel Engine check the Mobil oil in the Mobil chamber through a dip stick (Mobil gauge) and pour Mobil upto the level as marked in the gauge.

B. Precautions to be taken after starting the Motor:

1. If supply voltage is within the range of 440 V then switch on the main and starter.
2. Initially hold the starter in Star Position for 8-9 seconds then change it to delta position. Presently semi-automatic or automatic starters are used. So operating instruction of the starter (Kilburn, MEI and L&T etc.) should be consulted.
3. If the motor rotates in clock wise direction then inter change any of the two phase of the supply line in the Main Switch. Otherwise contact with the electrician of the local office.
4. Open the sluice valve of the pump room after starting the motor.
5. Contact local mechanic if the motor gets excessively heated.
6. Contact local mechanic or technician if there is excessive vibration or sound in the motor or fuse off frequently.

7. Motor should be kept on rest for an hour after continuous running for 4 hours. It should be recorded in the operators log book also.
  8. Check supply voltage intermittently while the motor is in running condition.
- C. Precautions to be taken after switching off the motor:
1. Close the sluice valve of the Pump room.
  2. Press the red button of the starter to close the motor. If the motor does not stop close the main switch and inform to local office.
  3. Keep all the log books, registers in proper place.
  4. Close the windows before closing the Pump Room.
  5. WUA should be consulted for next time distribution of water.
- D. Others know how:
1. Trespassers are not allowed in the Pump Room excepting the operator.
  2. Pump should be operated for 10-15 minutes during the off season or rainy season. Otherwise the Motor may Jam. Electric line may be damped.
  3. It is the responsibility of the WUA to guard the materials of the Tube Well center.
  4. If there is very low discharge from the pump, contact with the local office.
  5. If electric consumption is abnormal, contact local office. For 8.0 H.P. motor Consumption of electric is 06-07unit and for 15.0 H.P motor 11-12 unit.
  6. Ammeter will show deflection if the motor is overloaded. Motor should be closed in that case.
  7. Important points to be recorded in the daily operators log book. Record in the log book If there is no demand of water in any day.
  8. Water should not be released in absence of signature or finger print of the owner of the land/plot.
  9. Irrigation Water should be distributed as per water scheduling of the registered WUA.
  10. Motor should not be operated in absence of the operator.
  11. Screw of the Fuse grip of the main switch should be tightened intermittently to avoid loose connection. It prevents burning of electric line.
  12. Correct ratings of fuse wire to be used.
  13. Water should not be released in absence of water tax. If there is any defaulter it should be informed to the WUA. This local problem can be solved in the meeting conducted at the center by the WUA.
  14. Sometimes there is sabotage in the pipe line. Local WUA should be cautious in this respect.