



Irrigation Modernization and Design of Pipe Distribution Networks

SYSTEM O&M



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System Operation

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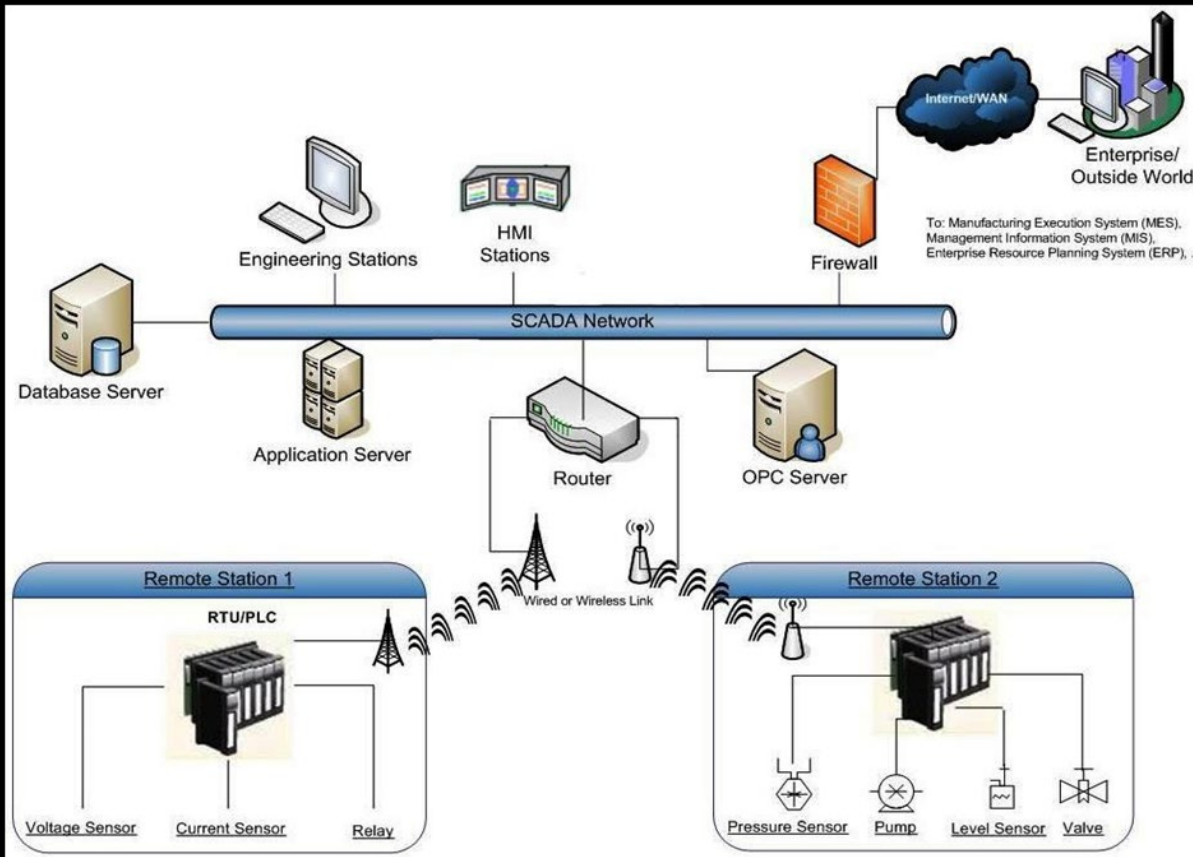
- Operation refers to timely and daily operation of the components of PDN systems such as the pumping system, rising mains/ gravity mains, distribution system, and so on.
- Operation should provide water according to the LoS adopted for the scheme, i.e. at pressures and flows at the outlets suited to farmer irrigators, and ideally on-demand.
- PDN systems are usually downstream control systems (i.e., controlled by releases from the Outlets), with flows and/ or pressures monitored, & gates, valves, pumps, adjusted as needed.



- Responsibility for Operations:
 - Upstream of the Outlets, operational control is generally with the System Operator.
 - Downstream of the Outlets, farmer irrigators distribute water to their fields.
- Most PDN systems adopt SCADA and other management systems to help with operations. The SCADA system, as a minimum allow real time remote monitoring of flows, pressures, and so on, but is likely to also include for remote operations.
- Modes of Operation include:
 - Fixed Schedule: high equity, suited to monocropping, easy for System Operator to manage.
 - Customized schedule – meets farmer demands, but more challenging for the Operator.
 - Informed Scheduling: real time data collected to inform irrigation scheduling, including crop type, stage of growth, weather, soil moisture, and so on.

SCADA System:

- Sensors and Actuators
- RTUs/ PLCs
- Data communication network (cellular, radio, cable, etc.)
- Base Unit and HMI



System Maintenance

System Maintenance

- Clear trash from screens and remove sediment from basins (sumps)
- Check and repair leaks
- Check and address vibrations
- Lubricate moving parts
- At the end of the season drain the pipe system, empty pumps of water and remove and store suction pipework.
- At the beginning of the season check pumps by rotating the impellers by hand to check they are not stuck. Check valves for functional operation.
- Replace broken devices (valves, meters, and so on).
- Buried pipes properly laid will last many (80+) years, but can be damaged by: (i) soil erosion, (ii) farm machinery, etc. Broken pipes need to be replaced. Valves which allow isolation of part of the pipe system allow maintenance with minimum disruption.

Dealing with Pipe Blockages

- If trash or high sediment loads enters the pipelines they may become blocked.
- Pipelines with low flow velocities are particularly vulnerable
- Trash usually accumulates at junctions/ bends
- To remove any sediment & biological slime, pipe jetting may be carried out.
- With trash, the pipeline will have to excavated, cut, obstruction removed, and re-laid.



Maintenance Store and Workshop

- Keep a stock of spare devices, pumps, and pipe fittings, maintain an inventory, and ensure spares are ordered to maintain the inventory.
- Tooled workshop to repair broken devices to extent this is practical

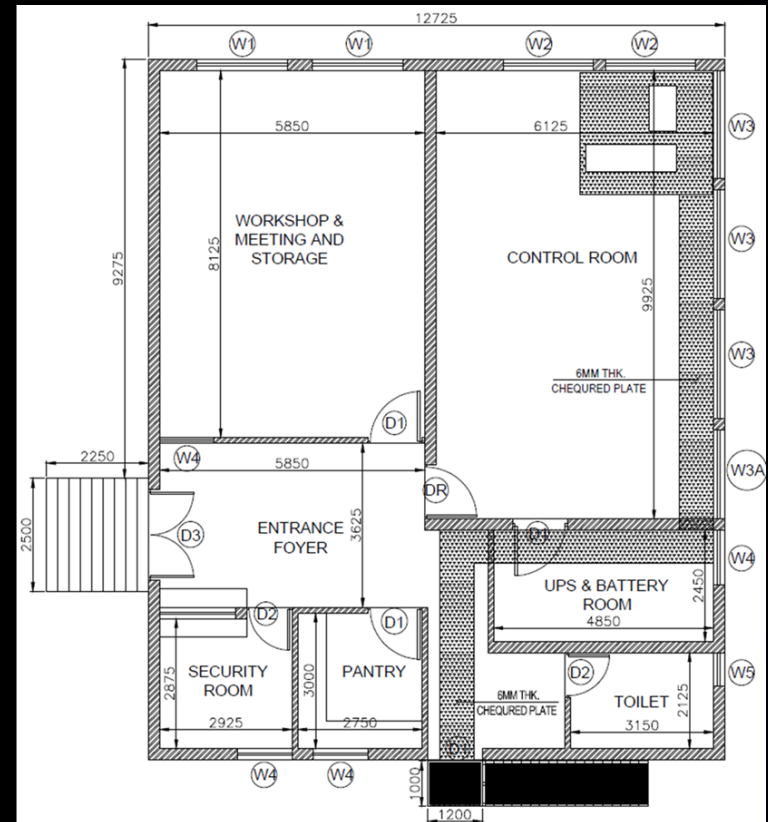


Stakeholders

Buildings, Facilities, Equipment, and Capacity Development

Stakeholders: buildings, facilities, equipment, and capacity development

- Stakeholders:
 - Public sector: WRD/ Irrigation Department, other concerned agencies (on-farm water management, agricultural extension, etc)
 - Private Sector
 - Farmers
- Buildings, facilities and equipment (computers, communications, etc)
- Capacity development
 - Awareness
 - Trainings



Cost Recovery

– Irrigation Service Charges

Charging for Irrigation Services

- With PDN systems accurate flow measurement and volumetric charging to individual/ small groups of farmers is possible.
- In case of non-payment by any one farmer, supply of irrigation can be cut off without affecting supply to others.
- If appropriate, pre-paid metering could be adopted, for example with a volumetric prepaid meter operated by farmer smart cards at the Outlets (distribution hubs)



Large caliber Prepaid IC card water meter

BMDA – prepaid metering system for small (~40 ha) pumped PDN systems

- Each farmer has a smart card
- When inserted into the pump controller the pump starts, and when removed the pump stops
- Credit on card is reduced according to time pump operates (~volume pumped)
- Recharge commission agents (selected farmers) recharge farmers smart cards and deposit collected cash into BMDA bank account
- The commission agent goes to the local BMDA office, shows the bank credit slip, and is then enabled to sell the same number of hours to dfarmers plus 10% (his commission)



Implementation

Implementation

- O&M is challenging immediately after construction as the irrigators will need time to adjust and build up trust.
- Turnkey (design-build-operate) contracts are recommended, where the contractor(s) who construct the modern (PDN – SCADA) system also manage O&M of the scheme for five years after commissioning.
- Performance-based payments suggested based on:
 - Outlet flows and pressures
 - Energy use
 - Recovery of irrigation service (water) charges
 - Trainings completed and quality
 - Numbers of farmers complaints
 - Hydraulic testing and working condition of the PDN and SCADA systems
 - Timeliness of repairs and maintenance
 - Completeness and quality of records and reports, and so on.

Thank you