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1.1 General

Water supply and sanitation is a state subject and the States are vested with the constitutional right on the planning, implementation, and cost recovery of water supply and sanitation projects. At the local level, the responsibility is entrusted by legislation to the Urban Local Bodies (ULBs) like Municipal Corporation, Municipality, Municipal Council, Notified Area Committee/Authority for towns, or on a State/Regional basis to specialized agencies.

The Urban Development Department or Public Health Engineering Department (PHED) is the principal agency at the State level for planning and implementation of water supply and sanitation programs. In a number of States, statutory Water Supply & Sanitation Boards (WSSBs) have taken over the functions of the PHEDs. The basic objectives for the creation of WSSBs have been to bring in the concept of commercialization in the water supply and sanitation sector management and more accountability with an increase in efficiency and for ease of getting funding from multilateral agencies. Such Boards have been set up in many states, and the metropolitan cities of Bangalore, Delhi, Hyderabad, Chennai, other cities and Odisha as a state have separate Statutory Boards.

The Ministry of Housing and Urban Affairs, Government of India, formulates policy guidelines in respect of the Urban Water Supply & Sanitation Sector and provides technical assistance to the States & Urban Local Bodies (ULBs) wherever needed. The expenditure on water supply and sanitation is met out of block loans and grants disbursed as Plan assistance to the States and out of loans from financial institutions like World Bank (WB), Japan International Cooperation Agency (JICA), Asian Development Bank (ADB), New Development Bank (NDB), Agence Française de Development (AFD), Housing and Urban Development Corporation (HUDCO), and other similar Agencies. The Central Government acts as an intermediary in mobilizing external assistance in the water supply and sanitation sectors and routes the assistance via the State plans. It also provides direct grant assistance to some extent for water supply and sanitation programs in urban areas such as Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Swachh Bharat Mission (SBM). Schemes are being developed to involve private participation in the form of Public Private Partnership (PPP). This will undertake capital investment in the sectors and bring new technologies and expertise in efficiently carrying out operation and maintenance and providing consumer-centric customer services with effective billing and collection systems.

The role of the Department is by and large confined in some States to mostly construction activities only e.g. Uttar Pradesh Jal Nigam, Uttarakhand Peyjal Sansadhan Vikas evam Nirmaan Nigam , Madhya Pradesh Jal Nigam, etc. while in some of the States/UTs e.g. Maharashtra Jeevan Pradikaran, Kerala Water Authority, Delhi Jal Board, etc. looks after the operation, maintenance, and cost recovery also. After commissioning schemes, the SBs usually hand over the projects to the ULBs for Operation & Maintenance or perform this function on their behalf. Thus, the pattern of commissioning and operation & maintenance of

schemes varies across different States.

The responsibility of operation, maintenance, and revenue collection is generally vested with the elected Urban Local Body. However, in some cases, specialized agencies such as the State Public Health Engineering Departments, Water Boards, Water Supply and Sewerage Boards, Jal Nigam, etc., are in charge of these functions and formulate the water tariff and implement the same with the approval of the Governments. For instance, in Delhi, right from planning up to O&M of Water Supply & Sewerage Schemes are being carried out by the Delhi Jal Board. The Local Bodies generally receive some grant assistance for capital works on water supply and sanitation from the State Government.

1.1.1 Objective of the Manual

The Manual is intended to serve as a guide to strengthen the technical, operational, and managerial capabilities required by the concerned personnel to operate and maintain water supply services as per acceptable norms of quantity, quality, sustainability, reliability, and cost for “Drink from Tap” (24x7) water supply system. This manual is intended primarily for the managers and technicians in charge of operating and maintaining the urban drinking water supply systems. This manual also includes guidelines for ensuring potability and promoting for Drink from Tap continuous water supply as discussed in Chapter 1: Introduction in Part A of this manual. By following the guidelines outlined in this manual, water supply agencies can ensure the availability of safe, reliable, and affordable drinking water to the public while promoting sustainable and environmentally friendly practices.

The procedures mentioned in the manual are intended to be guidelines for ensuring effective O&M of the water supply systems. This manual is not exhaustive but will serve as a reference volume for the agencies in-charge of the water supply systems to develop their O&M programs to suit their specific problems depending on the size of the system, type of agency, and location of the water supply system. Any agency desirous of formulating O&M programs should do so only on the basis of an exhaustive assessment of their existing water supply systems.

1.1.2 Objective of Operation and Maintenance

The objective of an efficient operation and maintenance of a water supply system is to manage and ensure “continuous (24X7) availability of ~~provide~~ safe and clean drinking water in adequate quantity and desired quality, at adequate pressure, at a convenient location and time, and as economically as possible on a sustainable basis and manage trouble free service delivery system.

In engineering parlance, operation refers to the timely and daily operation of the components of a water supply system such as headworks, treatment plant, Water Quality testing facility, machinery, and equipment, conveying mains, service reservoirs and distribution system, instrumentation, Supervisory Control and Data Acquisition (SCADA), Digital Twin, Information Technology Enabled Services (ITES) (Manual Part B-Chapter 10: Water Meters, Instrumentation, Telemetry & SCADA shall be referred for detail), communication systems, etc. effectively by various technical personnel, in conformance with the Operational Manual/

Guidelines, which is a routine function.

The term maintenance is defined as the art of keeping the structures, plants, machinery and equipment, and other facilities in an optimum working order. Maintenance includes planned maintenance/preventive maintenance, ~~or~~ corrective maintenance, mechanical/elctrical adjustments~~,~~ repairs~~,~~ corrective action, and reactive ~~planned~~ maintenance. However, replacements, correction of defects, etc., are considered as actions excluded from preventive maintenance. Preventive maintenance includes work that is carried out on a regular basis to maintain & keep the infrastructure in good condition. Corrective maintenance is replacing or repairing something that was done rather incorrectly, while reactive maintenance also called breakdown maintenance refers to maintenance tasks performed after an asset has broken down. The focus is on restoring assets to operating conditions as quickly as possible. It also includes a reaction to public complaints of ~~such as~~ malfunctioning & breakdown of equipment.

1.2 Operation and Maintenance Scenario

It has been observed that lack of attention to the important aspect of Operation & Maintenance (O&M) of water supply schemes in several towns often leads to deterioration of the useful life of the systems necessitating premature replacement of many system components. As such, even after creating such assets by investing millions of rupees, they are unable to provide the services effectively to the community for which they have been constructed, as they remain under-maintained, un-serviced hence becomes defunct or underutilized most of the time.

Initially a water supply scheme is generally designed and constructed for 24X7 continuous piped water supply, but in practice, it is operated ~~has to be resorted to~~ in intermittent mode because of many reasons. It brings in lot of stress on the system resulting lowering/ poor service delivery. Some of the key issues contributing to the poor Operation & Maintenance have been identified as follows:

i. Lack of as-built drawings of the existing network and unavailability of conditional assessment
ii. Contamination of Water
iii. Lack of Water Audit, improper metering, and High losses
iv. Inequitable Water Supply
v. Lack of cost recovery to sustain O&M
vi. Lack of inadequate data on Operation & Maintenance
vii. Inappropriate system design; and inadequate workmanship
viii. Multiplicity of agencies, overlapping responsibilities
ix. Inadequate skilled personnel and their training
x. Lesser attraction of maintenance jobs in career planning
xi. Lack of performance evaluation and regular monitoring
xii. Inadequate emphasis on preventive maintenance
xiii. Lack of Standard Operating Procedures (SOPs)
xiv. Lack of real time field data and information, etc.
xv. Lack of appreciation of the importance of facilities by the community

As a result, clear sector policies and legal frameworks, as well as a clear demarcation of responsibilities and mandates within the water supply sub-sector, are required. From the Indian experience, it has been observed that in the case of pumping schemes, by and large, about 20 to 40% of the total annual Operation & Maintenance cost goes towards the personnel (Operation & Maintenance Staff), 30 to 50% of the cost is incurred on power charges and the balance is utilized for consumables, repairs and replacement of parts and machinery and miscellaneous charges. In most of the cities in India, the tariffs are so low that they do not even cover the annual Operation & Maintenance cost. The necessary measures such as control of Unaccounted for Water (UFW), Non –revenue Water (NRW) and metering of the water connections may help to reduce the wastage of water and increase the revenue to the Local Body to the maximum extent.

1.2.1 Challenges in O&M of System

The operation and maintenance of water supply systems present several challenges, ranging from technical issues to financial constraints. Some of these are as follows:

1. Aging infrastructure, which requires constant repairs and maintenance to ensure its efficient functioning
2. Availability of skilled personnel to operate and maintain the complex water supply systems.
3. Financial sustainability.

Addressing these challenges requires a comprehensive approach that involves effective planning, adequate investment, and technically ~~a~~ trained and skilled ~~and~~ workforce, along with ~~the~~ adoption of sustainable practices to ensure long-term climate-resilient~~ce of the~~ water supply system. These have been discussed in Chapter 2: Operational Strategy in Part B of this manual.

1.2.2 Unaccounted For Water (UFW)

Unaccounted-for Water (UFW) is the difference between the quantity of water supplied to town's distribution system and the metered quantity of water used by the consumers. UFW has two components: (a) physical losses due to leakage from pipes, and (b) administrative losses due to illegal connections and under-registration of water meters. The reduction of UFW is a crucial step to improve the financial health of water utilities and to save scarce water resources. UFW in well-run water utilities is 15-20%, although the optimal level should vary depending on circumstances, such as particularly the cost of bulk water supply. The percentage of physical losses is influenced not only by the deterioration of the piped network, but also by the total amount of water used, system pressure, and the degree of supply continuity. The percentage of administrative losses depends on the degree of effort exerted in identifying illegal connections and in repairing meters.

1.2.3 Non-Revenue Water (NRW)

The non-revenue water (NRW) loss, is water that does not make from the source point of the water supply system to the consumer. It is because water gets lost along

the way due to leakage, wastage, or theft. These losses can be real/ physical losses (caused by leaks, breaks, spills, etc.) or only apparent losses that occur as a result of broken or tampered meters, poor meter readings, inaccurate records, or water theft. The leaks and breaks that allow water to escape can also allow impurities to enter the distribution system, impairing the quality of the water itself. Total non-revenue water loss is measured by the volume of the water lost in litres as a percentage of the total water supplied during the same time period. The rate of water loss can also be expressed as the volume of lost water per kilometre length of the pipes that makes the water distribution system. Chapter 11 “Water Audit and Leakage Control,” in Part B of this manual, deals with this aspect in detail.

To a large extent, the level of NRW is an indicator of how well a utility is managed. The terms non-revenue water loss and unaccounted-for water, are used interchangeably, but are different. Non-revenue water includes authorized but unbilled water use (such as for firefighting) while unaccounted-for water does not.

1.2.4 Metering

There are no two opinions that metering of water supply is desirable as well as essential to minimize wastage and to maintain economic pricing of water. Though most of the major towns have been provided with domestic and bulk water meters, over the years it has been observed that 20 to 50% of the installed meters remain defunct due to their poor quality. Sometimes tampering of the meters by the owners has also been noticed. Moreover, the infrastructure and repair facilities for water meters are not adequate in most of the Urban Local Bodies and Water Supply Boards, which inordinately delay their repairs and ~~early~~ reinstallation. In the absence of working meters, water bill ~~ing~~ (for water consumed during a period) is often estimated, either on average use-basis or on flat rate, as the case may be. It is necessary to get domestic and bulk water meters of the desired quality and precision indigeneously manufactured (within the country through technology transfer from developed countries for Indian market). It is perhaps worthwhile to explore the possibility of owning water meters by the respective Water Supply Agencies and Local Bodies themselves to ensure that the consumers do not have direct access to the meters so as to avoid possible tampering of the meters.

With the District Metering Area (DMA) approach for providing 24x7 water supply systems, bulk meters at the source, water treatment facility, pumping stations and meter at individual household level are required to estimate NRW including wastage of water, and calculate unit consumption, unit cost, etc. Maintenance of water meters refers to cleaning dirt–box or strainer from time to time, the replacement of gaskets upon their wear & tear, cleaning the chamber where the meter is installed & preventing water seepage in it. Chapter 10 “Water Meters, Instrumentation, Telemetry & SCADA,” of Part B of this Manual deals with this aspect in detail.

1.3 Need for Efficient and Effective O&M

The system developed with a huge capital investment requires to be operated and maintained to achieve desired Service Level Benchmarks (SLBs) during the design period. Generally, the ULBs tend to put emphasis on the construction/ development

of the system, and requirements of O&M are neglected, leading to the pre-mature deterioration of system components and services. Thus, the project designs ~~now are~~ have to be more concerned with the direct links between improved O&M practices and sustainability of water supply services, with improved customer satisfaction.

Various good practices have been tried & implemented by water authorities worldwide as explained in Table 1.1.

Table 1.1: Summary of Good Practices Drawn from City Case Studies

Good Practice	City or Utility
Fundamentals	
Having dynamic leadership at the top	Singapore, Phnom Penh, Bangkok, WATCO, Malkapur
Use of integrated water management policy	Shenzhen, Singapore
Corporatization of water utilities	Bangkok, Jamshedpur, WATCO
Regulating private sector participation effectively	Manila, Shenzhen
Service Delivery	
Increasing coverage and improving water availability	Bangkok, Colombo, MWCI, Phnom Penh, Singapore, Malkapur
Reducing non-revenue water	Jamshedpur, MWCI, Phnom Penh, Singapore, Malkapur
Securing clean, safe, and reliable water supplies	Bangkok, MWCI, Phnom Penh, Singapore, Malkapur
Improving service to the poor	Bangkok, Jamshedpur, MWCI, Phnom Penh, Singapore
Adopting the practice of demand-side management	Singapore
Monitoring and reporting effectively	Bangkok, Jamshedpur, Singapore
Financial and Human Resources Management	
Improving staff productivity	Bangkok, Jamshedpur, MWCI, Phnom Penh, Singapore
Pricing water for efficiency and sustainability	Jamshedpur, MWCI, Phnom Penh, Singapore, Malkapur
Improving revenue collection	Bangkok, Colombo, Jamshedpur, MWCI, Phnom Penh, Shenzhen, Singapore, Malkapur

Source: ADB: Good Practices in Urban Water Management: Decoding Good Practices for Successful Future (2012)

1.4 Organization of Maintenance

A proper organization has to be in place for efficient O&M. Chapter 3 “Institutional Strengthening and Capacity Building,” of Part C of this manual deals with this aspect in detail.

1.4.1 Key criteria of O & M Contract

A typical performance based operation and maintenance (O&M) contract should include, a definite time horizon of the service delivery, the extent of the services to be delivered, key performance indicators (KPIs), performance warranties, compensation and incentives, and liability ceilings including clear KPI measuring mechanism.

1.4.2 Policy Framework for Effective O & M

In the light of the 12th Schedule of the Indian Constituion (74th Amendment Act) 1992~~to the Constitution~~, which specify the powers, authority and responsibilities of Municipalities, the role and responsibilities of Urban Local Bodies have increased significantly to provide the basic facilities of water supply and sanitation to the community on a sustainable basis. The said amendment has enabled the Urban Local Bodies to become financially and technically sound to provide these basic civic amenities to the community. Though a certain degree of cross-subsidy is inevitable in respect of the economically weaker sections of the society, it is very necessary to run the water supply systems on commercial principles due to the fact that water is an economic good and, as such, it should no longer be considered as a free commodity. Therefore, the imposition of realistic tariffs for various beneficiaries and its effective realization is the key to the success of water supply sector performance, including that of operation and maintenance. Now, it has also been observed that all households are willing to pay user charges for such facilities, provided reliable service is ensured by the Water Supply Authorities and Urban Local Bodies.

Apart from providing minimum required quantity of drinking water to the people, the operation and maintenance authorities should always bear in mind that its quality is maintained at all times to safeguard the health of the community. City-level consumer forums may be set up to keep a vigil on the water sources to prevent possible contamination and make periodical reporting to the operation and maintenance agencies for appropriate action well in advance. At the same time, awareness programs on water conservation, wastage prevention, water quality, personal hygiene, etc., may have to be designed and implemented with the help of Non Governemntal Organizations (NGOs), Residential Welfare Associations, and the Neighbourhood Committees.

Consumer satisfaction should be the topmost priority of the operation and maintenance agencies, and an effective grievance redressal mechanism should be set up to enable the consumers to lodge complaints on aspects such as leakage and wastage of water, low pressure at consumer's end, contamination/poor quality of water, pilferage of system components, malfunctioning of water meters, problems related to meter reading, payment of bills, etc. and suggestions, if any, for better performance of the system. At the same time, all such complaints received by the operation and maintenance agencies should be attended to within a reasonable time frame, so as to win the confidence of the consumers.

Efforts should be made to maintain transparent accounting of income and expenditure and to realize the O&M cost on the basis of an affordable tariff through user charges.

Table 1.2 explains Checklist of O&M Best Practices as well as Critical Success Factors, which provide indicative strategies to implement Sustainable O&M.

Table 1.2: Checklist of O&M Best Practices/Critical Success Factors

Increase Utility of Facilities	**Maximize asset utilization**	**Enhance capacity of existing system.** e.g. Reducing NRW	**Apply demand management.** e.g. Introduction of telescopic water pricing	**Optimize availability/ reduce downtime** e.g. Scheduling short-duration maintenance tasks for off-peak hours.
	Enhance quality for users	**Adopt a customer-centric operating model.** e.g. Providing water as per SLBs.	**Enhance the end-to-end user experience** e.g. Ensuring grievance redressal in minimum time.	**Use smart technologies to refine performance** e.g. Use smart meter which will invoice as per consumption and reduce the cost of meter-reading.
Decrease total cost	**Reduce O&M costs**	**Implement lean and automated processes** e.g. Use of CMMS	**Optimize procurement costs and outsourcing** e.g. In areas where the requisite technology is discouragingly expensive or where specialist skills would be needed, operators can opt to outsource maintenance works or information technology (IT) services	**Right size management and support functions** e.g. Adjust their overheads and organizational structures by delayering, introducing shared services and optimizing the level of (de-centralization)
	Mitigate Externalities	**Arrange comprehensive sustainability** e.g. Water treatment plants can change from	**Embed sustainability** e.g., engaging the broader workforce on Environment,	**Co-operative with relevant stakeholders.** Operators should also take a multi-stakeholder

		being net energy consumers to net energy producers by installing Solar Cells on roof top.	health and safety aspects and not just creating a sustainability department	engagement approach, actively communicating with communities in outreach campaigns and collaborating with fellow operators and users to generate a greater positive impact across the infrastructure system.
Increase lifetime value	**Extend asset life**	**Invest in preventive and predictive maintenance**	**Control excessive asset consumption and stress** e.g., regulating the use of pumps only in operating range	**Enhance disaster resilience.** Effort should be made to incorporate more resilience into existing assets. Efforts should focus not only on structural measures, such as building protective barriers and retrofitting existing facilities, but also on cost-effective, non-structural measures, including the creation of natural buffer zones and the adaptation of more resilient design.
	Reinvest with a life cycle view	**Prioritize project options with whole life cycle Cost Benefit Analysis.** Before committing to major capital expenditure, it should first identify all possible project options and	**Select contracting mode for best value for money**. e.g., most efficient delivery mode – public sector, PPP or private sector – should be chosen on the basis of a	**Prepare for efficient project delivery**

		investigate more cost-effective solutions, such as optimization, loss reduction, demand-side measures, system wide capacity balancing.	value-for-money assessment, taking into account the potential quality of service and level of risk to the government budget	
Enable O&M best practice	**Ensure funding**	**Dedicate user taxes via maintenance funds**	**Apply inclusive user charges**	**Capture ancillary business opportunities.** e.g. Realizing revenue from advertisement of ESRs, parking, etc.
	Build capabilities	**Introduce asset management planning.** e.g. conduct regular assessments of the existing asset base, and create an infrastructure balance sheet to show how the stock of assets has evolved and to forecast the required maintenance funding. Proper digital and GIS Asset mapping has to be carried out as detailed in Advisory on GIS mapping of water supply and sewerage project. Conditional	**Apply data, benchmarks, and tools**. e.g., Infrastructure asset management processes and frameworks (such as ISO 55000) shall be introduced	**Conduct training and develop talent.** Increase formal O&M education and training in the various disciplines by academia, international financial institutions (IFIs), governments and the private sector, and to enhance other forms of knowledge exchange. Actually, the O&M phase itself is an excellent learning environment, as its stability and long-term orientation enable uninterrupted learning curves over a project's life cycle

		assessment and Retrofitting are also important aspects of Asset management which can be referred from Chapter 2 and chapter 12 in Part A of this manual.		
	Reform governance	**Corporatize and professionalize public agencies**. It often captures the advantages of a privately run company, including enhanced productivity, streamlined processes, commercial orientation and financial sustainability, while remaining accountable to the public and serving the public interest.	**Foster cooperation between agencies**. It involves cultivating a shared vision, mutual respect, and in-depth understanding of each other's roles.	**Consider private sector participation**

Source: Report of World Economic Forum on "Strategic Infrastructure - Steps to Operate and Maintain Infrastructure Efficiently and Effectively", 2014 (https://reports.weforum.org/strategic-infrastructure-2014/executive-summary/)

1.5 Public Private Participation

Public-Private Partnership (PPP) is being encouraged to bring in much-needed investments, as well as efficiencies in the utilization and management of resources.

It could be introduced in phases, either on Build, Operate and Own (BOO) or Build, Operate, Own and Transfer (BOOT) basis. Primarily, it is possible in two ways i.e. privatization of the existing water supply systems and secondly, privatization of systems in newly developed townships, municipal wards, housing colonies, business and commercial complexes, etc. However, it will require improvement in collection of recover the capital and operation and maintenance cost from the beneficiaries. .

Chapter 8 “Public Private Partner for Water Supply” of Part C of this manual deals with this aspect in detail

1.6 Content of Part B

The Part B of the Manual is organized as a set of 13 chapters. While the first two sets the context, the remaining eleven provide guidance on the operation and maintenance attributes of the Water Supply System.

1. **Introduction**
2. **Operational Strategy:** The chapter is to adopt a strategy toward providing safe and equitable drinking water from a reliable source to the end user through a proper system of a well-maintained train of treatment, transmission, and distribution network components, including efficient operations and maintenance of all tools and plants.
3. **Sources of Water Supply:** The chapter mainly discusses about the protection of the sources both in terms of quality and quantity. The sources of water supply are described in the following sections. To ensure sustainable water supply at source it is advisable to maintain all the functional and available sources, irrespective of their utilization.
4. **Transmission of Water:** The chapter discusses to evolve operation procedures to ensure that the system can operate satisfactorily, function efficiently and continuously, and last as long as possible at the lowest cost.
5. **Water Treatment Plant:** The chapter discuss O&M of various process/ units in a Water Treatment Plant.
6. **Raw Water and Clear Water Reservoirs:** The chapter discusses on the optimum use of the raw water and clear water reservoirs and their aspects of operation and maintenance.
7. **Distribution System:** The chapter discusses to ensure the system can be operated satisfactorily, and function efficiently & continuously and develop specific operational procedures are required for inspecting, monitoring, testing, repairing, and disinfecting the system.
8. **Drinking Water Quality Monitoring and Surveillance:** The chapter explains the aspects of water quality parameters, sampling, testing, laboratorial analysis, and outlines the standard procedures for various components of drinking water quality monitoring and surveillance, sanitary inspection activities to be undertaken
9. **Pumping Station and Machinery:** The chapter discusses on the O&M aspects of pumps and pump house and Troubleshooting for their issues.
10. **Automation of Water Supply System:** The chapter discuss on O&M of Water Meters, Instrumentation, Telemetry & SCADA
11. **Water Audit and Leakage Control:** The Chapter discuss on NRW, Water Audit and its procedure and techniques or leakage control.
12. **Energy Audit and Conservation of Energy:** The Chapter guide to carrying out energy Audit and factor for improving the energy efficiency in system.
13. **Safety Practices:** The Chapter discuss on Safety Practices in O&M of water supply system.

References:

- US EPA, (2013), “Water Audits and Water Loss Control for Public Water Systems”, https://www.epa.gov/sites/production/files/2015-04/documents/epa816f13002.pdf

Increase Utility of Facilities	Maximize asset utilization	Enhance capacity of existing system.	Apply demand management.	Optimize availability/ reduce downtime
	Enhance quality for users	Adopt a customer-centric operating model.	Enhance the end-to-end user experience	Use smart technologies to refine performance
Decrease total cost	Reduce O&M costs	Implement lean and automated processes	Optimize procurement costs and outsourcing	Right size management and support functions
	Mitigate Externalities	Arrange comprehensive sustainability	Embed sustainability	Co-operative with relevant stakeholders.
Increase lifetime value	Extend asset life	Invest in preventive and predictive maintenance	Control excessive asset consumption and stress	Enhance disaster resilience.
	Reinvest with a life cycle view	Prioritize project options with whole life cycle Cost Benefit Analysis.	Select contracting mode for best value for money.	Prepare for efficient project delivery
Enable O&M best practice	Ensure funding	Dedicate user taxes via maintenance funds	Apply inclusive user charges	Capture ancillary business opportunities.
	Build capabilities	Introduce asset management planning.	Apply data, benchmarks, and tools.	Conduct training and develop talent.
	Reform governance	Corporatize and professionalize public agencies.	Foster cooperation between agencies.	Consider private sector participation