# XI. MONITORING, LEARNING AND EVALUATION

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**Purpose of the NHP M&E system**

The purpose of the NHP M&E system is threefold:

- As a regular management tool - to help managers and stakeholders at all levels to track implementation progress, implementing agency performance and results, and so enable them to judge progress against agreed targets and to make improvements and corrections during implementation

- As an oversight tool - to show achievements and emerging issues to managers, decision makers and supervisors

- As a showcase – to demonstrate the value of the project to politicians and the general public

**Guiding principles for the NHP M&E system**

M&E is often the poor relation in project implementation, and too many projects arrive at the end of implementation with little to show in terms of clear demonstration of the results of the project. Frequently, the problem is that the M&E system proposed is too complicated and the information is difficult and expensive to collect. Many M&E systems do not answer the real information needs of managers, supervisors or decision makers. In many cases, too, managers are keen simply to get on with establishing facts on the ground and are reluctant to invest up front in defining the criteria of success or in establishing baselines – which has to be done at the start of the project.

In NHP, the following principles will guide M&E in order to avoid these common problems:

- Start early: Design the M&E system well before the start of the project and make sure that the staff and systems are in place to run the system

- Agree upfront on the results expected: Define and agree the results (outputs and outcomes) and the related targets upfront so that they are clear to all before implementation starts. The agreed results are set out in a NHP Results Framework (see below).

- Keep it simple: Choose only indicators that are important and relevant to judging implementation progress and results

- Make the indicators SMART: Ensure that all indicators are SMART: **S**pecific, **M**easurable, **A**ttributable, **R**elevant, **T**imebound

- Set the baseline: Collect the baseline information before implementation starts.

- Collect the information automatically from the MIS: When choosing the indicators and defining the source of information, make sure that all or almost all of the data can come automatically from the MIS in the ordinary course of data handling, so that the job of monitoring is essentially limited to validation, collation and reporting and the arduous and extensive collection of data is avoided.

**A four track results-based NHP M&E system**

Following the above principles and building on systems and experience under HP-I and HP-II, a results-based NHP monitoring and evaluation system will be set up prior to the start of project implementation. The system will work on four complementary tracks:

- Track 1: Monitoring implementation progress. This track will monitor implementation progress (activities and inputs) against the PIP and the agreed annual work programs. The parameters to be tracked would include: (a) activities and inputs delivered; (b) procurement progress; (3) financial progress; and (d) quick institutional performance indicators such as staffing against complement and training days. The information would be disaggregated at the level of each IA and state and aggregated at the national level for the project as a whole. The information would be used by IAs to monitor implementation progress at their level, and by decision makers, supervisors and other stakeholders to ensure timely and quality implementation and to allow corrections and trouble shooting.

- Track 2: Results monitoring. This track will monitor results against the agreed NHP Results Framework (see below) in order to measure overall results at national level for the project as a whole and disaggregated at the level of each IA and state. The information will be used by IAs, decision makers, supervisors and other stakeholders to follow overall project performance against agreed results on a regular basis during implementation and at completion.

- Track 3: Institutional performance monitoring. This track will monitor the performance of each IA and state, based on institutional performance against benchmarks (see ------ below) as well as progress towards the agreed results and on implementation progress. The information would be used to track the performance of each IA in order to (i) ensure adequate support and help in correcting anomalies and troubleshooting; and (ii) ensure that appropriate financial resources are allocated to each state program. The information would be used by IAs to monitor their own performance and identify needs for support, and by decision makers and supervisors and other stakeholders to identify needs for institutional strengthening as they arise. Performance would be monitored on a regular periodic basis (twice a year), with decisions on reallocation of project financial resources agreed and formally decided based on the two mid-term reviews.

- Track 4: Interim and final evaluations. This track will comprise three major assessments of project performance, results and emerging impacts, as inputs to two proposed mid-term reviews (year 3 and year 5) and to the implementation completion report at the end of the project implementation period (year 8). The assessments would summarize information from the three monitoring tracks described above, and add a fourth track which would assess: (a) emerging impacts based on user feedback and demonstrated benefits from changes in operations and planning resulting from the project (see ---- below) ; and (b) institutional performance and sustainability (see ---- below). The information would be used by IAs, decision makers and supervisors and other stakeholders to: (i) evaluate progress towards achievement of the project development objective based on the interim and final results; (ii) assess the efficiency of implementation; (iii) gauge the likely sustainability of outcomes; and (iv) assess performance of IAs, GoI and the Bank.

## Track 2: Results monitoring

Results monitoring follows the architecture of the project (see chart below):

- At the level of the project as a whole, M&E will measure how far the overall Project Development Objective is achieved
- At the level of each of the four components (A-D), M&E measures the Outcomes (the change or benefit as a result of the project)
- At the level of each of the eleven sub-components, M&E measures the Outputs (the products, services or facilities produced by the project)

For each outcome and each output, M&E monitors several parameters but just one *Lead Indicator* is selected as the indicator that quickly tells stakeholders whether the key results are being attained. For each indicator, a *baseline* and a *target are set.*The higher level indicators (at the level of PDO and component outcomes) are included in the World Bank Project Appraisal Document and are tracked systematically by the World Bank. For NHP, these higher level indicators are:

**Table 1: Project Development Objectives, outcomes and SMART indicators**

| **Project Development Objectives** | **SMART Indicator** |
|---|---|
| 1. Improve the **extent** of water resources information | Number of new Hydromet stations operational |
| 2. Improve the **reliability** of water resources information | Percentage of Hydromet stations that use modern technology |
| 3. Improve the **accessibility** of water resources information | Percentage of station data series nationwide that are integrated with on-line state and central databases |
| 4. Strengthen the **capacity** of water resources management institutions in India | Number of implementing agencies performing according to benchmark standards |
| **Component outcomes** | |
| 5. Extent and reliability of water resources data improved *(Component A)* | Number of sites with daily updates for: climate; streamflow; groundwater; water quality and surface water storage |
| 6. Strengthened communication and exchange of information amongst states, central government and other stakeholders (*Component B*) | Percentage of sub-national water resources information systems (WRIS) integrated with India-WRIS<br><br>Number of times water information accessed via website |
| 7. Water information and tools are used to improve water resources allocation and management (*Component C*) | Number of sub-basins with tools for seasonal water accounting<br><br>Number of streamflow forecasting stations with improved lead time |
| 8. Technical, planning and policy capacity for water resources management is built (*Component D*) | Number of implementing agencies performing according to benchmark standards |

For the higher level indicators, baseline and target values need to be set by the time of World Bank appraisal, as these form part of the Bank's commitment to its Board.

**Table 2: Indicators, baselines and targets**

| Indicator | Source | Baseline | Target |
|---|---|---|---|
| Number of new Hydromet stations operational | MIS | | |
| Percentage of Hydromet stations that use modern technology | MIS | | |
| Percentage of station data series nationwide that are integrated with on-line state and central databases | MIS | | |
| Number of implementing agencies performing according to benchmark standards | MIS | | |
| Number of sites with daily updates for: climate; streamflow; groundwater; water quality and surface water storage | MIS | | |
| Percentage of sub-national water resources information systems (WRIS) integrated with India-WRIS | MIS | | |
| Number of times water information accessed via website | MIS | | |
| Number of sub-basins with tools for seasonal water accounting | MIS | | |
| Number of streamflow forecasting stations with improved lead time | MIS | | |

## Implementing M&E

This results-based M&E system would be founded on: (a) the agreed results framework; (b) the parameters set out in the PIP and specified for each IA and for the project as a whole in the agreed annual work programs; (c) agreed areas of expected outcome and benefit as evaluated in the project economic analysis (i.e. reduced flood damage, increased hydropower generation, and increased water availability for irrigation and drinking water and industrial water supply); and (d) agreed institutional performance and sustainability criteria. Indicators and baseline data would be established for each parameter to be tracked.

Prior to the start of the project, an M&E Cell would be established in the National PMU and M&E Focal Points would be appointed in each central, river basin and state PMU (CPMUs, RPMUs and SPMUs). Support would be provided by the TMC team. Also prior to the start of the project, an M&E strategy and plan would be prepared and agreed specifying: final architecture of the results framework, indicators and targets; the information requirements; the tools and methodologies for data collection, analysis and reporting; the baseline data required; the roles and responsibilities for data collection, analysis and reporting; the staffing, capacity building and equipment and software requirements; and the M&E work plan for the first three years of implementation.

At the outset, the NPMU with the TMC team would conduct information and training of (i) managers to inform them of the system, its value and how to use the M&E reports in the course of implementation; and (ii) other staff responsible for MIS and M&E to ensure that data requirements and sources are understood.

The M&E system would build on systems and baseline data established under HP-I and HP-II, and would to the greatest extent possible (target 100%) be based on data being generated in the MIS in the normal course of project implementation. This would minimize the

requirement for IAs to gather and input extra data. All M&E data, information and outputs will be web-based and available via mobile devices.

The M&E system and its outputs will provide a rich fund of knowledge and an opportunity for learning. To take advantage of this, national and sub-national learning forums will be convened, together with webinars and virtual learning and knowledge-sharing events.

**Tracking emerging impacts**

Stakeholders expect that NHP will bring significant benefits throughout the Indian economy and for a broad section of society, especially for poor people through improved access to irrigation water, power and potable water arising from improved water management. Because there is no doubt that the project will contribute to these impacts, they have been considered in the assessment of benefits in the project economic analysis (q.v.). However, these impacts cannot be attributed solely to NHP and there are many intermediate steps which the project cannot influence. Therefore, these impacts are not tracked in the NHP Results Framework.

Nonetheless, evaluation of the project will include a rerun of the economic analysis, and for this the M&E system will collect information related to the four principal impacts foreseen:

- Reduced flood damage
- Increased hydropower generation
- Increased drinking or industrial water supplies
- Increased supplies for irrigation

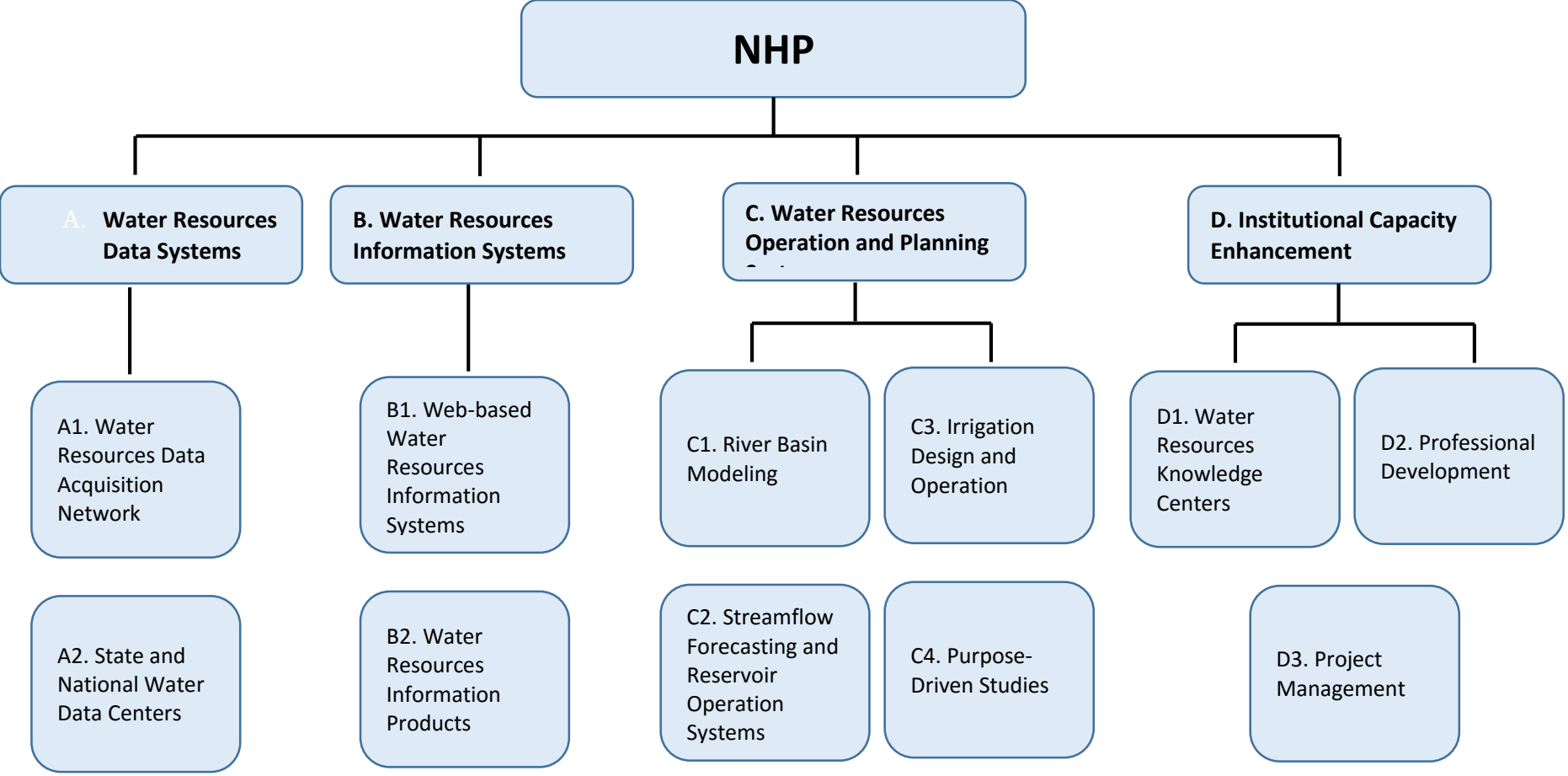
The data required will be collected on a sample basis through the MIS and will be analyzed in interim impact assessments at the two MTRs and at final completion of implementation (see above, *Track 4: Interim and final evaluations*).

**Collecting data for impact evaluation**

| Benefit | Data required for impact analysis |
|---|---|
| **Reduced flooding damages** | ▪ Past data on flow levels/releases and the corresponding flood losses<br>▪ Data on flow levels and releases for each reservoir<br>▪ Data on actual losses from floods |
| **Increased hydropower generation** | ▪ Estimates of the additional water that is available as a result of change in reservoir operations and the additional hydroelectricity generated as a result of this additional water<br>▪ Data on price at which this electricity is supplied. |
| **Increased drinking or industrial water supplies** | ▪ Estimates of the additional water that is available as a result of change in reservoir operations<br>▪ The allocation of this additional water for domestic or industrial uses<br>▪ Shadow price of water for domestic or industrial purposes |
| **Increased supplies for irrigation** | ▪ Estimates of the additional water that is available as a result of change in reservoir operations<br>▪ The allocation of this additional water for agricultural uses<br>▪ Shadow price of water for agricultural purposes to be used |

# NHP Results Monitoring

Objective, outcomes, outputs and indicators


NHP
A. Water Resources Data Systems
B. Water Resources Information Systems
C. Water Resources Operation and Planning
D. Institutional Capacity Enhancement
A1. Water Resources Data Acquisition Network
A2. State and National Water Data Centers
B1. Web-based Water Resources Information Systems
B2. Water Resources Information Products
C1. River Basin Modeling
C2. Streamflow Forecasting and Reservoir Operation Systems
C3. Irrigation Design and Operation
C4. Purpose-Driven Studies
D1. Water Resources Knowledge Centers
D2. Professional Development
D3. Project Management

| Project Development Objective |
|---|
| Objective: Improve the extent, reliability and accessibility of water resources information and to strengthen the capacity of water resources management institutions in India |

| Element of the PDO | SMART Indicator | Definitions | Source |
|---|---|---|---|
| • Improve the **extent** of water resources information | Number of new Hydromet stations operational | 'Operational' means data are transmitted at least 90% of the time | ***MIS***:<br>▪ RTDAS for surface water (A1.1)<br>▪ …for groundwater (A1.2)<br>▪ …for discharge (A1.3)<br>▪ …for water quality (A1.4)<br>▪ Manual observation equipment (A1.7) |
| • Improve the **reliability** of water resources information | Percentage of Hydromet stations that use modern technology | 'Modern technology' means : (i) automated telemetric systems; and (ii) improved manual systems using GPS time-stamped data | *As above* |
| • Improve the **accessibility** of water resources information | Percentage of station data series nationwide that are integrated with on-line state and central databases | 'Station' means all monitoring stations, including both manual and telemetric. 'Data series' means historical and current data series. 'Integrated' means digitized and made available on-line. | ***MIS***:<br>▪ Strengthening national and state WRIS (B1.1)<br>▪ Data digitization (B1.3) |
| • Strengthen the **capacity** of water resources management institutions in India | Number of implementing agencies performing according to benchmark standards | 'Benchmark standards' to be set during the first year of the project and to include measures of:<br>❖ Institutional autonomy (number of engineers, central and state financial commitments, own training program…)<br>❖ Modelling capability (modelling team, access to decision support system for river basins…)<br>❖ Quantity and quality of outputs (water balance models, water resources assessments, streamflow forecasts, irrigation scheme benchmarking…) | ***MIS***:<br>▪ Institutional autonomy (D2)<br>▪ Modeling capability (C1.1-2)<br>▪ Decision support systems for river basins (C1.1)<br>▪ Water balance modeling (C1.2)<br>▪ Flood forecasting systems (C2.1)<br>▪ Irrigation benchmarking (C3.1) |

**SMART** = Specific, measurable, attributable, relevant, time-bound

| Component A. Water Resources Data Systems |
|---|
| Outcome: Extent and reliability of water resources data improved<br><br>Outcome indicator: Daily updates for: climate (xxx sites); streamflow (xxx sites); groundwater (xxx sites); water quality (xxx sites) and surface water storage (xxx sites) [A1.1, A1.2, A1.3, A1.4, A1.7] |

**A1. Water Resources Data Acquisition Network**

Output: Number of Hydromet data acquisition networks established or upgraded

Output indicator: Number of Hydromet data acquisition systems operating as designed [A1.1]

Activity-level indicators: [*broken down into new and upgraded, and into: (a) real time (b) other automated; (c) mobile; and (d) other manual*]:

- Number of Real Time Data Acquisition Systems (RTDAS) *[A1.1, A1.2]*
- Number of weather recording stations [broken down between: (i) rain gauges; (ii) automatic weather stations] [A1.1]
- Number of water level monitoring facilities (rivers, dams/barrages, canals) *[A1.4]*
- Number of groundwater level monitoring facilities operating [A1.2]
- Number of reservoirs/barrages equipped with SCADA *[A1.10]*
- Number of water quality monitoring facilities operating *[A1.10, A1.4]*
- Number of discharge measurement stations [A1.3]
- Number of water quality laboratories operating, broken down between Level 1, Level 2, Level 2+, and between new and upgraded.

**A2. Establishment of State and National Water Data Centers**

Output: Facilities established or upgraded for automated data collection, collation and processing at state and national levels

Output indicator: Number of water data centers established and operating as designed [A2]

Activity-level indicators:

- Number of state or national data centers constructed or upgraded [A2.1, A2.2]
- Number of items of information technology equipment installed and operational, broken down between: computers; servers; VC facilities [A2.4]
- Central hydrologic instrumentation facility operational [A2.6]

| Component B. Water Resources Information Systems |
|---|
| Outcome: Strengthened communication and exchange of information amongst states, central government and other stakeholders<br><br>Outcome indicators: (1) Percentage of sub-national water resources information systems (WRIS) integrated with India-WRIS [B1.1]; (2) Number of times water information accessed via website (target year by year) [B1.1] |

**B1. Web-based Water Resource Information Systems**

Output: Web-based information systems developed or strengthened at central, regional, river basin and state levels

Output indicator: India-WRIS and regional, river basin and state level WRIS operating as designed [B1.1]

Activity-level indicators:

- Number of Implementing Agencies using standardized hydrological data acquisition and processing software e-SWIS [B1.1]
- Number of Implementing Agencies using national server [A2.4]
- Number of years of historical data per station digitized (measured in 'station years') [B1.3]

**B2. Water Resources Information Products**

Output: Knowledge products and inter-active products and services developed and available through portals and other media

Output indicator: Number of information products on-line (including: high-resolution topographic surveys, earth observation products, ensemble forecast products, web-based analytical tools) [B2.4]

Activity-level indicators: (*broken down between central, regional, river basin and state levels)*:

- Number of inter-active services available [B2.5]
- Number of registered users [B1]
- Number of times downloaded [B1]
- Volume of data downloaded (in gigabytes) [B1]
- Number of atlases [B2.1]
- Number of information brochures [B2.2]
- Number of mobile apps developed [B2.3]

| Component C. Water Resources Operation and Planning Systems |
|---|
| Outcome: Water information and tools are used to improve water resources allocation and management<br><br>Outcome indicators: (1) Number of sub-basins with tools for seasonal water accounting [C1.1]; and (2) Number of streamflow forecasting stations with improved lead time [C2.1] |

**C1. River Basin Modeling**

Output: Water resources assessments developed

Output indicator: Number of river basin models (with dynamic water resource assessments) developed [C1.2]

Activity-level indicators:

- Number of sub-basin models synchronized with centralized modelling framework [C1.2]
- Number of Decision Support Systems for river basins *[C1.1]*

**C2. Streamflow Forecasting and Reservoir Operations Systems**

Output: Models and DSS for streamflow forecasting are developed and in use

Output indicator: Number of streamflow forecasting stations with improved lead time [C2.1]

Activity-level indicators:

- Number of sub-basins with flood risk mapping [C2.1]
- Percentage of flood warning forecasts which are accurate [C2.1]
- Number of flood alert systems set up [A2]
- Number of studies for dam breach analysis [C2.3]

**C3. Irrigation Design and Operation**

Output: Modernization of irrigation design and smart operation of irrigation systems are supported

Output indicator: Number and hectares of irrigation schemes benchmarked [C3.1]

Activity-level indicators:

- Number and area of irrigation systems with improved scheduling and distribution [C3.1]
- Number of tools for improved irrigation design and management [C3.1-2]
- Number of WUAs and members supported in community-based water monitoring [C3.2]

**C4. Purpose-Driven Studies**

Output: Critical water resources knowledge gaps are filled

Output indicator: Number of studies and analytical tools published and disseminated [C4.1-4]

Activity-level indicators:

- Number of PDS for water quality [C4.1]
- Number of PDS for groundwater [C4.2]
- Number of PDS for surface water [C4.3]
- Number of PDS for surface/groundwater interaction [C4.4]
- Number of reservoir sedimentation assessments *[C4.3]*

| Component D. Institutional Capacity Enhancement |
|---|
| Outcome: Technical, planning and policy capacity for water resources management is built<br><br>Outcome indicator: Number of implementing agencies performing according to benchmark standards [D2.1-2.4] |

**D1. Water Resources Knowledge Centers**

Output: Water resources knowledge centers are developed and operational

Output indicator: Number of existing centers developed and new centers operational [D1.1-D1.3]

Activity-level indicators:

- Number of national water resources centers of excellence operational [D1.1-1.5]
- Number of sub-national centers operational at basin/regional level or state level D1.1-1.3]

**D2. Professional Development**

Output: Training is delivered and networking and knowledge exchange are facilitated

Output indicators: (1) Number of training days delivered; (2) % of respondents who found the program relevant ton them and their agency [D2.1-2.4]

Activity-level indicators:

- Number of Implementing Agency training needs assessments
- Number of Implementing agency training programs completed
- Number of people trained and participating in Hydromet development
- Number of people trained in use of models and tools developed under the project and applying them
- Number of people in community groups trained in local water management
- Number of partnerships with national and international institutes
- Number of people involved in professional development activities

**D3. Project Management**

Output: Project activities are managed and facilitated efficiently

Output indicator: Number of Implementing Agencies achieving benchmark levels for project delivery

Benchmark indicators for project delivery:

- Technical assistance team is in place and achieving results in line with expectation (YES/NO)
- PMU is set up and fully staffed
- Procurement plan and AWP satisfactorily prepared and on time
- AWP financial and physical targets achieved (%)
- Project disbursement is on schedule (% lag)
- Project procurement is on schedule (% lag)
- Audit reports signed off (number, %, lag from due date)
- Training programs for Implementing Agencies satisfactorily completed (number of trainees and % satisfaction)
- M&E reports complete and timely (number and %)
- Service standards on turnaround respected (% and lag)
- Hydromet network established and operational [A1]
- State WRIS operational [B1]