UNDERSTANDING THE WATER RESOURCES OF THE AYEYARWADY BASIN, MYANMAR

The Ayeyarwady River is Myanmar’s largest and most commercially important river but its water resources are not well understood.

With the support of the Australian Water Partnership, the Government of the Republic of the Union of Myanmar commissioned the first integrated assessment of the natural resources of the Ayeyarwady Basin. eWater lead the surface water assessment for the State of the Basin Assessment (SOBA).

The Ayeyarwady Basin

With an area of just over 675 000 km^2, the Republic of the Union of Myanmar is the second largest country in South-East Asia, after Indonesia.

The Ayeyarwady River starts in the Himalayas, flowing for approximately 2 000 km in a north-south direction through Central Myanmar. The river basin has a total area of 413,700 km^2 and covers about 61% of Myanmar. About 5% of the Basin extends into the neighbouring countries of India (to the west) and China (to the east).

The Ayeyarwady River Basin is dominated by a monsoonal rainfall regime, associated with the south-western Indian monsoon. It is also affected by convectional systems and cyclones from the Bay of Bengal. Groundwater flows to the streams and snowmelt from the northern regions are also important contributions to basin flows.

The Ayeyarwady River Basin is still a relatively undeveloped

basin. Like the majority of Myanmar, most of the Basin is characterized as rural, with agriculture the main use of water.

Ayeyarwady River, view from Bupaya bagan (credit: tuanjai62/ Adobe Stock)

Project overview

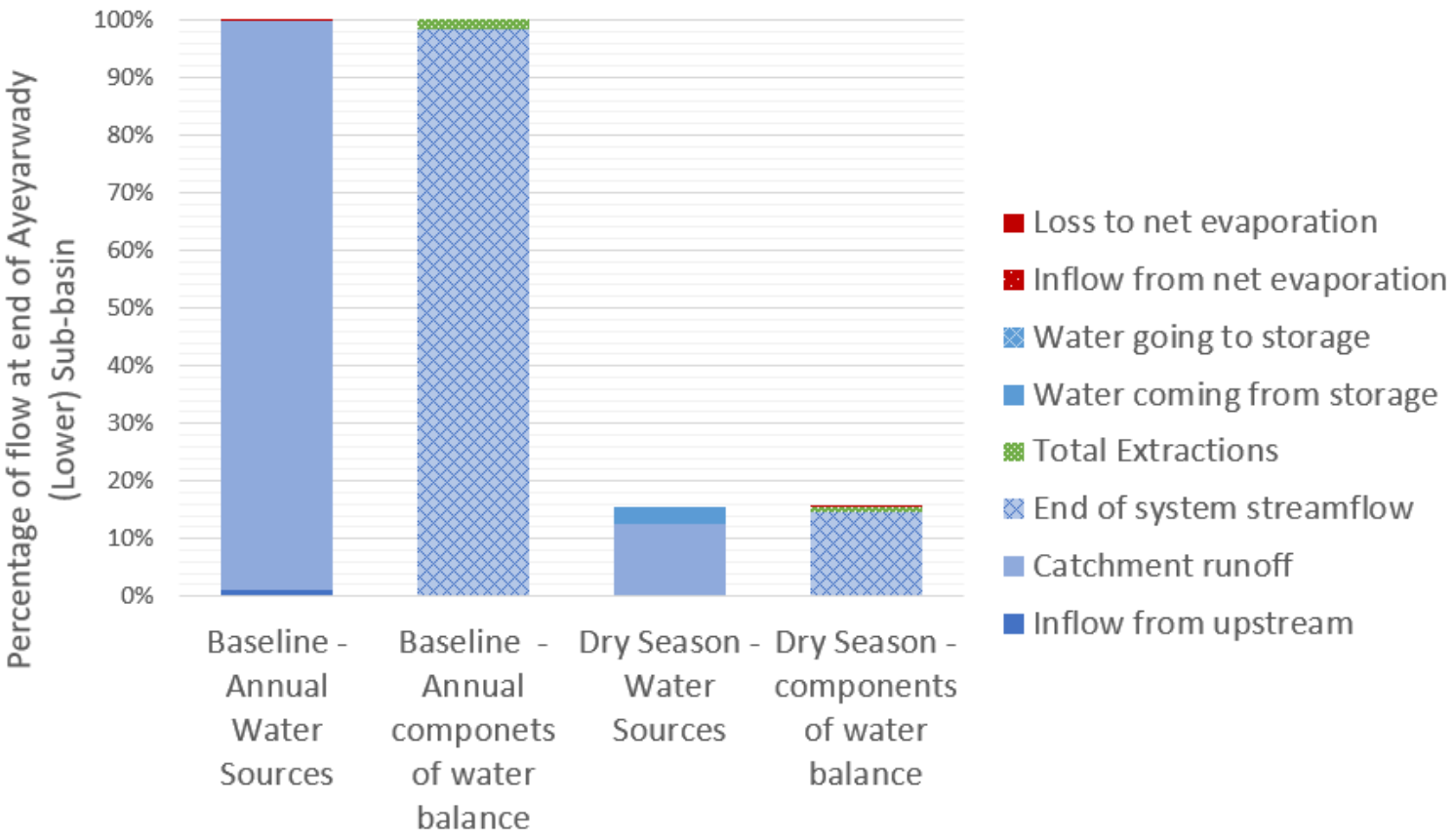
The SOBA provides a baseline assessment of the basin’s water

and other natural resources, from which future management options can be compared against.

eWater developed a preliminary baseline Source water system model for the Ayeyarwady Basin (north of the delta), from which a baseline assessment of the basin’s surface water resources was undertaken.

The model is run with historic climate data for 1982 to 2016, land use in 2014 and storage capacity in 2016. It represents agriculture, domestic, urban and hydropower water use.

For the first time, the baseline assessment gives water managers a description of the hydrology of the Ayeyarwady River Basin according to 5 Hydro-Ecological Zones and 13 sub-basins, significantly increasing the understanding of both water availability and water use in the basin. For example, in the figure below, we can see the different components that contribute to flow at the end of the system as an annual total and during the critical dry season, it shows how much water is provided by different sources and how much of this water is used or lost to evaporation.



Flow components at the end of the Ayeyarwady Basin, annually and in the dry season

The water system model is a first cut at drawing together the information required to adequately understand and simulate the complexities of the Ayeyarwady River Basin. The baseline model will be a key tool to support the future management of the basin's water resources, making it possible to:

> Combine outputs from the model together with observed values, to provide an overall assessment of water availability and uses across the Ayeyarwady River Basin.

Understand baseline water availability and use, to support the ongoing assessment of the Basin’s water resources and to examine possible future scenarios and possible implications, for example with climate change or increased agricultural use.
Simulate components of the hydrological cycle at locations where observed values are not available.
Identify information gaps and inform future data collection initiatives.

Scoping Study

Following the completion of the SOBA, eWater was engaged to undertake a scoping study of potential development options for the mainstream of the Ayeyarwady River and tributary flows. The study was also supported by the Australian Water Partnership.

The scoping study sought to demonstrate how water resource models can be used to assess management scenarios and provide valuable outputs to support stakeholder consultation.

The surface water system model was adapted to allow it to provide information on the likely changes in the Ayeyarwady mainstream and tributaries from different development scenarios. The scoping model can assess the likely flow changes from different development options, to consider the impact on water dependent outcomes such as irrigation, hydropower production, surface water flow heights and and flood magnitude. It is not intended to evaluate specific development proposals.

The scoping model was used to compare a High Development Scenario of hydropower on the tributaries and some irrigation development in the Central Dry Zone against a baseline scenario. The baseline scenario included ‘current’ irrigation demand and hydropower dams representing 2000 megawatts of hydropower, it does not include some 30 irrigation storages where data was not available.

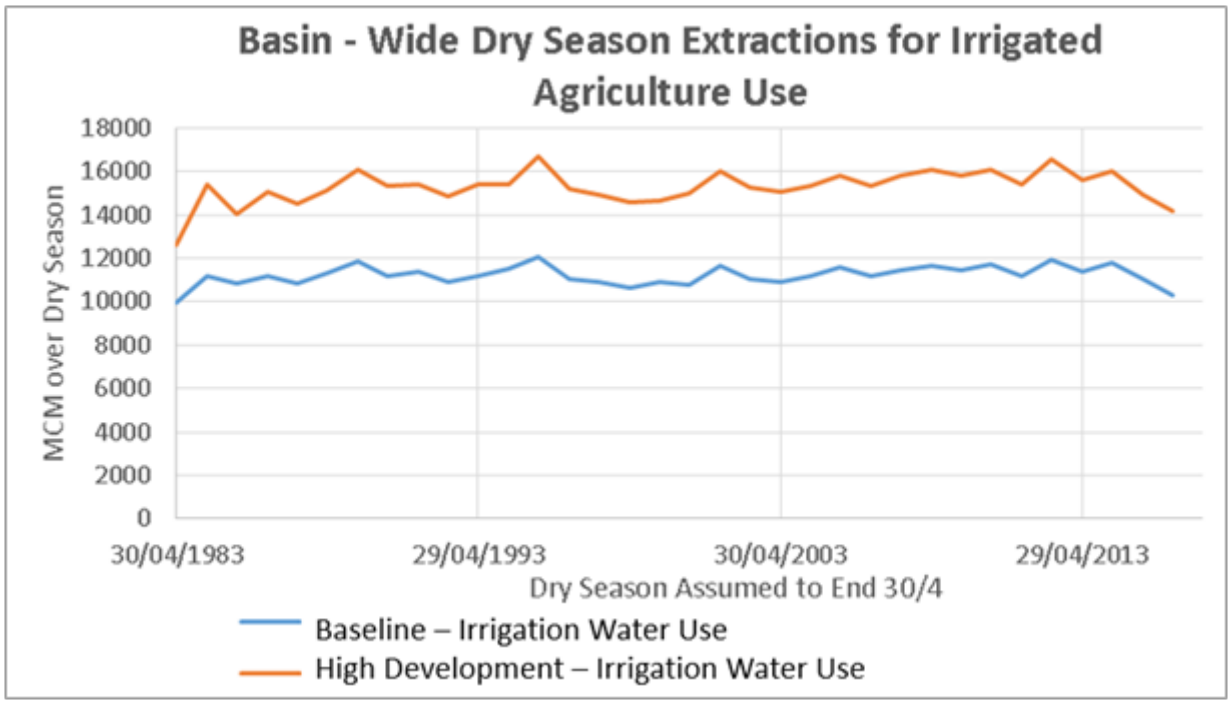
The results compared include:

- Change in hydropower generation on an annual and seasonal basis, inter-annual variability was also assessed.

Agriculture water use and availability assessed on an annu al and inter-annual basis.

An assessment of changes to hydrographs at Sagaing, Pyay and Monywa, including changes in flow volume as well as surface water level.

An example of the scoping model outputs is shown below. In this, dry season irrigation extraction under the baseline and high development scenarios are compared.



Dry season demand for water under the baseline and high development scenarios.

Capacity Building

eWater conducted face to face training programs to introduce water managers in Myanmar to the principles of hydrological modelling and the use of Source. The training used the new Ayeyarwady Source model, providing participants with hands-on experience in the use of the model.

eWater's Geoff Davis presenting Source training in Myanmar

RIVER BASIN MODELS AND WATER SHARING POLICY IN THE UPPER GODAVARI SUB-BASIN, MAHARASHTRA, INDIA

Resolving tension between farmers upstream and downstream over water allocations in the upper Godavari River in Maharashtra was the focus of a four year engagement in the west Indian State by

eWater.

The Maharashtra and New South Wales governments signed a Memorandum of Understanding for cooperation across a wide range of issues. Under the provisions of this MOU, the Government of Maharashtra in partnership with the NSW Department of Industry, Lands and Water (then) engaged eWater to provide training, technology transfer, and ongoing support in the use of Australian river modelling technology to Maharashtra.

eWater assisted the Maharashtra Department of Water Resources to develop a modelling framework to test water management options and to support the development of an integrated water resources management (IWRM) plan for the Upper Godavari sub-basin.

Basin overview

The Godavari River basin is India’s second largest river basin,

it covers 50% of the land area of Maharashtra state. It is a complex system, with 20 dams. Water use includes irrigated crops, industry and domestic use in urban and rural areas, including drinking water. Water availability and equitable distribution of water within the sub-basin are major public concerns that have resulted in legal challenges.

Within the sub-basin there is significant spatial and inter-annual variability in monsoon rainfall. Typically, runoff is generated in the high-rainfall, high-elevation areas of the sub-basin with little runoff generation in the area near the large Paithan irrigation dam at the outlet of the Upper Godavari.

Paithan Dam, after upstream monsoon rains.

Project outcomes

The project had two primary outputs, a calibrated Source model for the Upper Godavari Sub-Basin and building the capacity of the Maharashtra Department of Water Resources.

eWater, in collaboration with modellers from the Maharashtra Department of Water Resources set-up and calibrated a Source model for the Upper Godavari sub-basin. The model was used to evaluate water management options to improve equitable access to water across the sub-basin. Model outputs were used to inform the integrated water resource management plan

eWater and the NSW Department of Industry, Lands and Water used outputs from the river basin models to establish and focus communication and discussion with the Maharashtra Water Resources Department about improved water management policies and governance processes to implement the objectives of the Maharashtra State Water Policy. With a key focus being improving targeted communications to farmers in the basin.

eWater delivered a comprehensive training program in the use of Source, with customised training based on the Upper Godavari model. Training was held in India and Australia, both involved a combination of hands-on desktop learning and field visits to better understand the linkages between models and

on-ground water management.

More broadly, the project brought together water managers, academics and researchers in the Upper Godavari sub-basin to establish a community of practice that allows lessons and experiences to be shared across other sub-basins in Maharashtra.

Delegates learning about modern irrigation technology in the Murray-Darling Basin.

Award winning project

The success of the project was recognized at India Water Week 2019, when the national Minister for Jal Shakti (Water Resources) presented an award to the Maharashtra Water Resources Department (WRD) for using eWater Source modelling framework to achieve equitable distribution of water in the Upper Godavari Sub-basin.

Left to right: Mr Arun Ghate (IWRM team GMIDC), Mr Jasing Hire (IWRM team GMIDC), Mr Ajay Kohirkar (Executive Director GMIDC), Mr Dilip Tawar (Chief Engineer GMIDC), Mr Rajendra Pawar (Secretary Command Area Development, WRD), Ms. Sonali Nagargoje (IWRM team GMIDC), Mr. Avirat Chavan (IWRM team GMIDC)