

Irrigation Systems for Climate Change Adaptation in Viet Nam



An innovative project supported by the Asian Development Bank (ADB) will modernize irrigation systems in five drought-prone provinces in the south central coastal and central highland regions of Viet Nam.¹ The Water Efficiency Improvement in Drought-Affected Provinces (WEIDAP) Project embodies a conceptual shift toward irrigation modernization, integrating climate resilience measures and improved agricultural practices.²

From 2014 to 2016, these regions experienced the most severe drought in 40 years, which resulted in major crop losses affecting 60,000 hectares of agricultural land. As a long-term response to drought, the Ministry of Agriculture and Rural Development launched the WEIDAP Project. Vice-Minister Hoang Van Thang of the Ministry of Agriculture and Rural Development explained the project rationale during project preparation: “The south central coastal and highland provinces are extremely important for agricultural development. This is the land of high-value export crops like coffee, pepper, and fruit trees. Due to low rainfall and the impact of climate change, a project to ensure water supply for this region is vital.”

Transformation of Agriculture

The drought accelerated the transformation of agriculture already underway in the region as farmers switch from traditional crops to high-value crops that are more profitable and require less water. Farming in Binh Thuan Province is focused on dragon fruit, an exotic, high-value tropical fruit that needs less water. In the past, most farmers grew corn or rice, but now, dragon fruit is the leading crop, accounting for 40% of crop production value in Binh Thuan. To cope with increasing water scarcity and to reduce input costs, farmers are investing in high-technology irrigation systems like drip and sprinkler. Dragon fruit farmer Nguyen Tan Dan designed and built his own system. Using local components, the simple cost-effective technology has been adopted by other farmers in the area. Nguyen Tan Dan said, “I thought about changing technologies to save labor and operate more efficiently. The main advantage is better water application, and the design can be scaled up without much more investment.”

DRAGON FRUIT

- More profitable
- Uses less water
- 40% are grown in Binh Thuan



Improvised drip irrigation system.
Farmer Nguyen Tan Dan designed and built his own drip irrigation system for dragon fruit in Binh Thuan (photo by Dang Tran Thi, ADB).



Dragon fruit irrigation.
A buried polyvinyl chloride pipe system is used to facilitate irrigation of dragon fruit in Binh Thuan (photo from WEIDAP Project Report: Du Du-Tan Thanh Subproject).

In the upland area of Binh Thuan, farmer Dang Ngoc Cam installed a sprinkler system to irrigate his crop of black pepper, which is grown in the cooler highland terrain. The farmer says he will recoup his investment in the sprinklers (about \$1,000 per hectare) through reduced labor costs: “With a large farm, we need this kind of irrigation to be able to water all the trees on time. If we had to hire workers to water every day, the costs would be very high. And it is hard to find workers too.”

1 The project will modernize eight irrigation systems in the provinces of Binh Thuan, Dak Lak, Dak Nong, Khanh Hoa, and Ninh Thuan.

2 Although the south central coastal region is the driest area of Viet Nam, it is also affected by severe storms and floods such as Typhoon Damrey in November 2017.



Pepper farming.

Farmer Dang Ngoc Cam follows current standards in irrigation practice for pepper growing in Binh Thuan (photo by Steven Griffiths, ADB).



Sprinkler irrigation of pepper using polyvinyl chloride pipes.

Farmers in Binh Thuan find ways to adapt to increasing scarcity of water (photo by Steven Griffiths, ADB).

Farmers are already adapting to the increased scarcity of water. What they need from an irrigation system is the flexibility to access water as and when they need it. The WEIDAP Project will provide that level of service by introducing a climate-resilient pressurized piped irrigation system.

This will provide a flexible and more reliable water supply to farmers, improve water productivity, and promote diversification to higher-value crops. The innovation is in the higher level of service for farmers compared to an open canal irrigation system.



Mango orchards irrigated by the Cam Ranh Reservoir in Khanh Hoa Province.

In 2017, 60% of the harvest were lost due to droughts and insufficient water supply (photo by Hoang Anh Hai, ADB).

In Khanh Hoa Province, the Cam Ranh Reservoir used to supply water to flood fields for paddy rice. Today, most of the land has been converted to mango orchards. In 2017, there was enough water to produce a bumper harvest of mango, but the water supply was not stable. According to farmer Vuong Minh Hoa, “The drought caused big losses. The mangoes were too small for us to make any income. We lost about 60% of our crop.”

HIGHER LEVEL OF SERVICE

More and more farmers throughout the region are growing high-value crops in response to changing agro-ecological conditions and consumption patterns. The changes are driven by economics and by growing water scarcity due to drought and increasing demands on water itself. The need to improve the efficiency of agricultural water use has become a necessity. Government and irrigation companies need to understand and respond to these changes in agriculture by modernizing irrigation systems to provide a higher level of service.

—Sanath Ranawana

is a principal water resources specialist at ADB. He was the team leader in designing the Water Efficiency Improvement in Drought-Affected Provinces Project.

Viet Nam successfully developed its irrigated rice export industry and is now starting to expand to high-value agriculture. This requires a higher level of service compared to a canal-based irrigated rice system. Level of service means flow rate, ordering (that is, whether you have to order or it is accessed on demand), the pressure provided, the location, and the cost of the service.

—Rob Rendell

is an irrigation engineer and consultant for the Australian Water Partnership.

To implement modernization, we have to design activities to suit the situation in Viet Nam. It will be very challenging to provide the level of service that farmers need for high-value crops. Recent climate events, such as several droughts during 2014–2016, caused a lot of damage to our agriculture. At the end of 2016, in the same region, we had historical floods and heavy rainfall. Modern piped irrigation will help farmers adapt to this climate variability.

—Vu Ngoc Chau

is a senior project officer (agriculture and natural resources) at ADB. He was the Water Efficiency Improvement in Drought-Affected Provinces Project’s director at the Central Projects Office of Viet Nam’s Ministry of Agriculture and Rural Development.

Advantages of Piped Systems

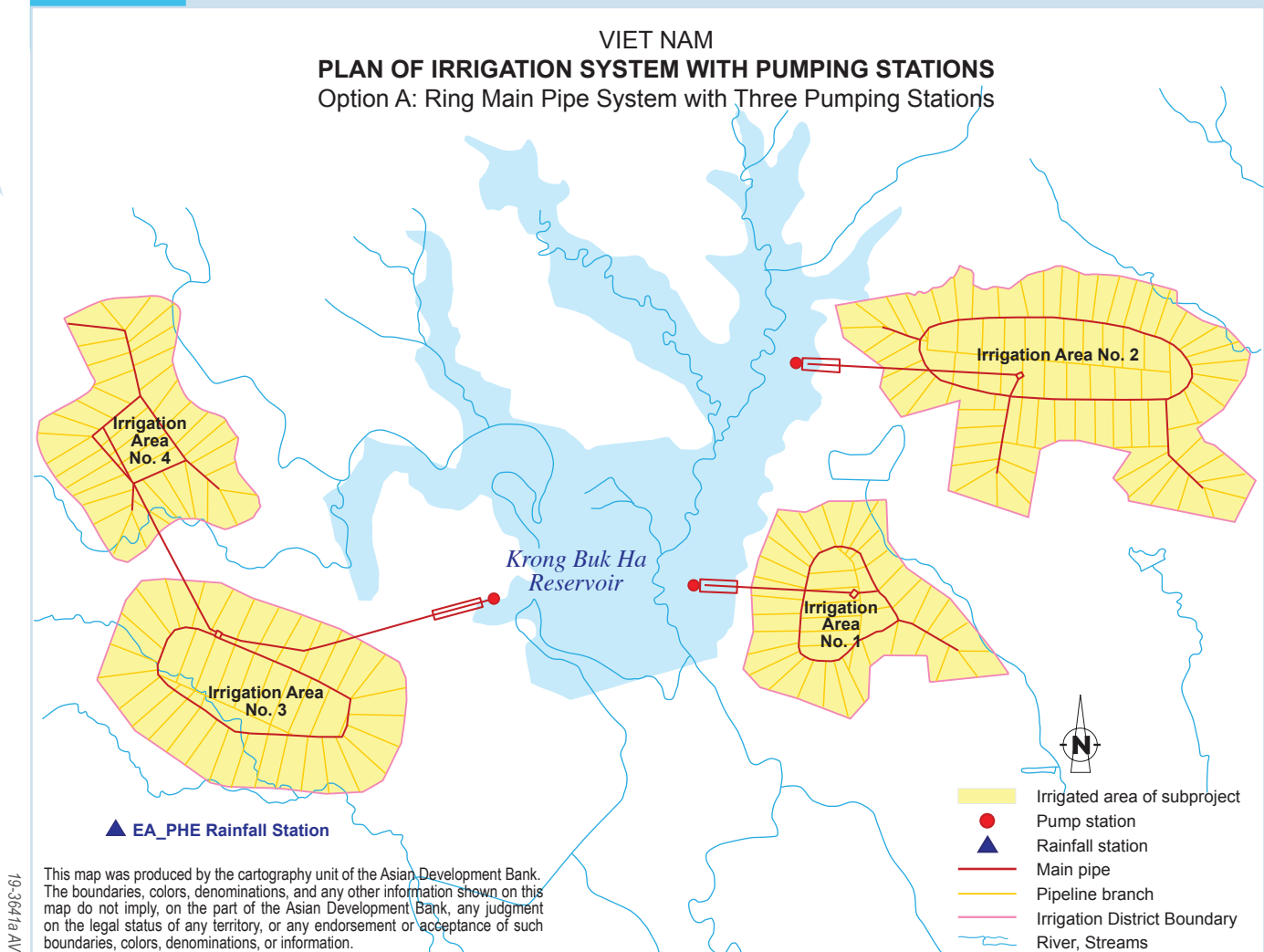
- Provide more efficient in-service delivery
- Support farmers to adopt on-farm water-efficient technologies
- Require less maintenance
- More resilient to extreme weather conditions
- More cost-efficient in the long term

In the past, water availability was not seen as a constraint for agriculture, but increasingly, water scarcity has become a major concern in Asian countries. Governments are looking for ways to reduce water use in agriculture—which consumes about 80% of all surface water—by promoting crop diversification and adopting more water-efficient technologies. In this context, piped systems offer a viable solution.

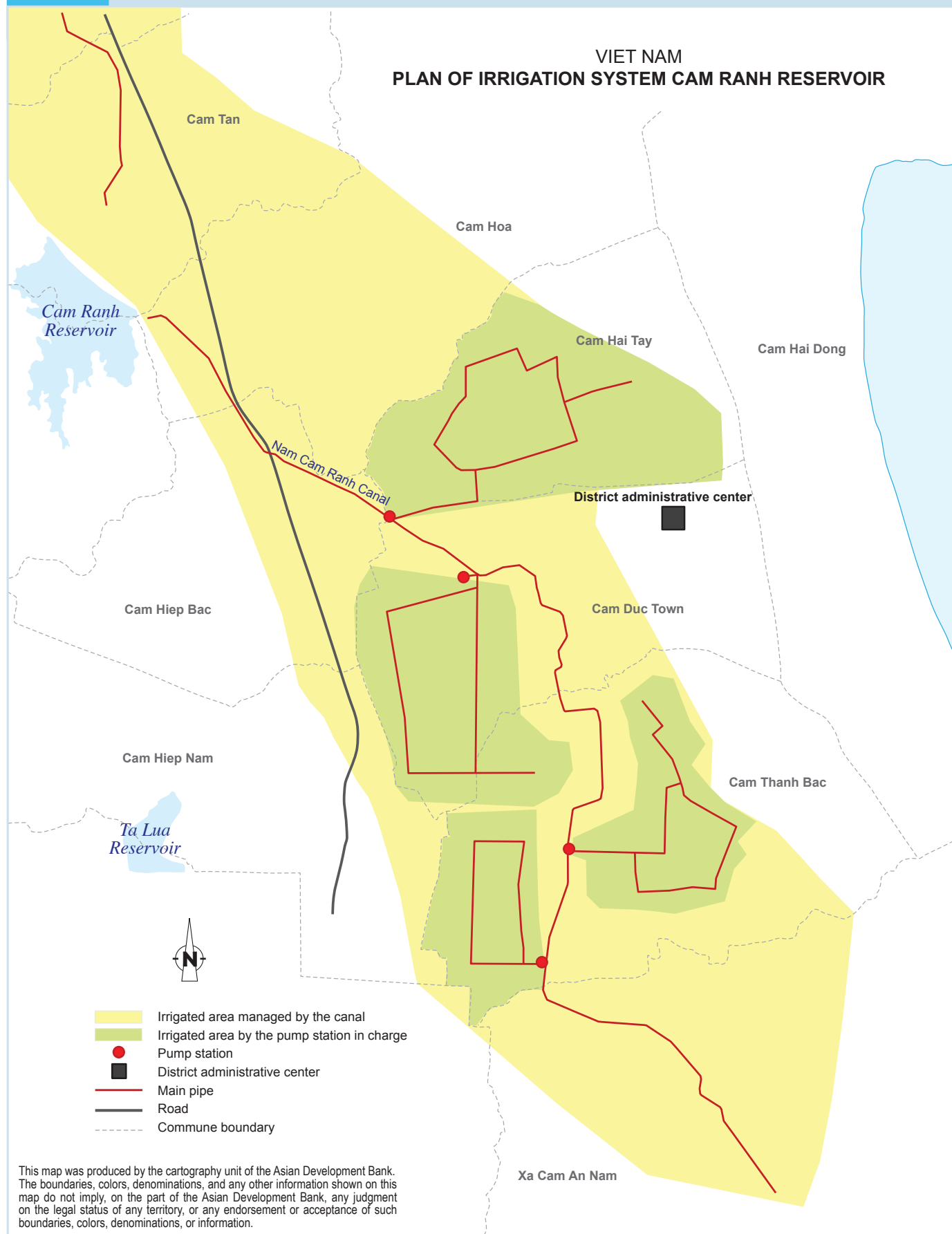
Traditional open canal flood irrigation systems were built to grow paddy rice, whereas piped irrigation provides farmers with a more flexible and precise water supply accessed on demand, which is more suitable for high-value crops. Piped systems provide more efficient in-service delivery, support farmers to adopt on-farm water-efficient technologies, require less maintenance, are more resilient to extreme weather conditions, and do not require water user groups to handle significant responsibilities to operate the distribution networks. As such, they are more cost-effective in the long term.

MAP 1

Proposed Scheme Layout for Krung Buk Ha Piped System, Dak Lak Province



Source: Central Office for Water Resources-Ministry of Agriculture and Rural Development. 2017.
Dak Lak Subproject Report. TA-9147: Water Efficiency Improvement in Drought-Affected Provinces Project. Ha Noi.



There is a provision in Viet Nam's Law on Hydraulic Works, 2017 to apply water pricing for the provision of irrigation services. Charges could, at a minimum, recover costs of operating and maintaining the irrigation schemes. This will be enabled by piped systems since water delivered can more easily be controlled and measured with meters. Farmers can be charged according to the volume of water they use.

This also creates conditions for private sector involvement in operation and maintenance. Viet Nam is close to reaching its ceiling of public debt. Increasingly, the government is looking at ways to share the cost of investment and operation and maintenance of infrastructure with the private sector and with service users.

Knowledge Partners

ADB's contribution is more than just financing; leveraging knowledge and advanced country experiences are equally important.

The Australian Water Partnership (AWP) brings vast experience in irrigation interventions and how water is managed in Australia. The AWP organized a study tour for Vietnamese irrigation officials to understand the Australian experience. In addition, the AWP provided several technical experts whose guidance was crucial to transform the WEIDAP Project from a conventional irrigation system rehabilitation to fully modernized, pressurized piped systems.

Through a partnership with IHE Delft Institute for Water Education, remote sensing technology was utilized to map crop water productivity in the area to be irrigated under the WEIDAP Project. This will help measure how much crop is produced with a unit of water.³ The information will be given to farmers along with advice on how to improve water productivity. A study by the International Food Policy Research Institute measured links between water and energy use in high-efficiency irrigation systems in the project area. The study helped to demonstrate the energy savings from adopting modernized irrigation systems.⁴

COST RECOVERY

Why would farmers pay to connect to a piped system? Farmers are already paying for water; they are paying the cost of pumping water from groundwater or other surface sources. In the project areas, farmers spend around \$90 per hectare a year in pumping costs. If a piped system can provide a reliable service on demand, and the cost is comparable to what farmers are now spending on pumping, then we expect many farmers will switch over.

—**Sanath Ranawana**,
principal water resources specialist
at ADB.

One challenge will be reforming the structure and management of the irrigation companies set up by the government. How to change these institutions to manage a modern irrigation system and implement cost recovery will be a difficult process. The assessment of options to introduce water charges supported by the Government of Australia will be very important to chart the way forward on cost recovery under the Water Efficiency Improvement in Drought-Affected Provinces Project.

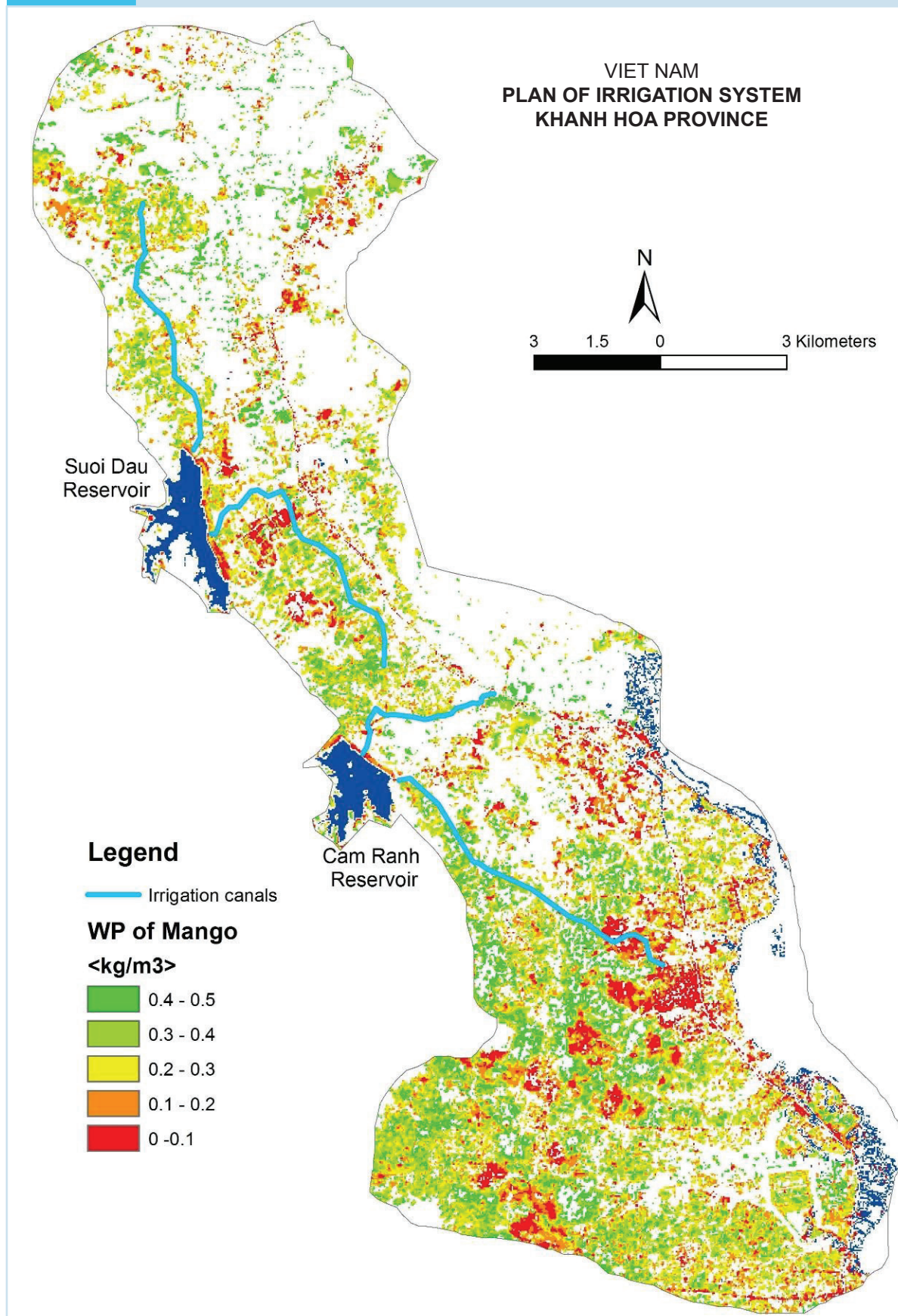
—**Vu Ngoc Chau**, senior project officer
(agriculture and natural resources)
at ADB.

3 X. Cai, W. Bastiaanssen, and Y. Siddiqi. 2016. *Water Productivity Assessment for Improved Irrigation Performance and Water Security in the Asia-Pacific Region: Viet Nam*. Delft, Netherlands: IHE Delft Institute for Water Education. Water productivity is a new way of measuring water use to improve efficiency of water use in irrigation. It is different from traditional ways of measuring irrigation efficiency, which are concerned with the supply of water to irrigate fields. Water productivity is a more holistic indicator of how much water is actually used per unit of crop produced.

4 ADB. 2017. *Quantifying Water and Energy Linkages in Irrigation: Experiences From Viet Nam*. Manila.

MAP 3

Assessing Water Scarcity Level through Water Productivity Mapping Using Satellite Remote Sensing



The WEIDAP Project is designed to provide a flexible and reliable irrigation service to farmers of high-value crops in conditions of water stress and climate variability. The project is about linking the right solution to the right problem in the right conditions. It points the way to irrigation modernization in Viet Nam.

THE FUTURE OF IRRIGATION IN VIET NAM

The Water Efficiency Improvement in Drought-Affected Provinces Project only covers a small area in five provinces. There is large potential to replicate piped irrigation systems in many other areas of Viet Nam that have similar agro-ecological conditions for growing high-value crops. The government's role should be to create the enabling conditions to foster the transformation of irrigation modernization. This means establishing the necessary financial incentives and policies for the provinces to scale up and replicate the Water Efficiency Improvement in Drought-Affected Provinces Project approach.

—Ryutaro Takaku

is a principal water resources specialist at ADB. He began administrating the Water Efficiency Improvement in Drought-Affected Provinces Project in 2019. He is also preparing ADB's Climate Adaptation through Irrigation Modernization Sector Project for Viet Nam.

I think Viet Nam is going to leapfrog what has been done to modernize irrigation technology and management in Australia and other western countries.

—Rob Rendell, irrigation engineer and consultant for the Australian Water Partnership.

The lessons I learned in Australia and the Netherlands are they don't mind investing a huge amount of money to modernize irrigation, with only one condition—the project must generate enough value to recover the investment. No matter how good the technology, we are not going to modernize irrigation in Viet Nam if we ignore this lesson.

—Vu Ngoc Chau, senior project officer (agriculture and natural resources) at ADB.

PROJECT HIGHLIGHTS

- **Cost:** \$124.26 million (estimated)
- **Financing:** \$100 million concessionary loan from the Asian Development Bank, plus grants from the Water Financing Partnership Facility (\$750,000) and the Climate Change Fund (\$300,000)
- **Impact:** Improved climate resilience and water productivity in agriculture
- **Outcome:** Climate-resilient and modernized irrigation systems in five provinces established
- **Main Features:** Improved agriculture practices through a conceptual shift in irrigation modernization, including the following:
 - (i) irrigation management services strengthened,
 - (ii) modern irrigation infrastructure developed, and
 - (iii) efficient on-farm water management practices adopted.

For more information, contact **Ryutaro Takaku** (rtakaku@adb.org), principal water resources specialist at the Asian Development Bank's Southeast Asia Department.

Notes:

In this publication, "\$" refers to United States dollars.

On the cover: In Viet Nam, pepper farming in Binh Thuan Province (left) and mango orchards in Khanh Hoa Province (right) benefit from irrigation systems (photos by ADB).



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