Water Balance study for INDORAMA farms in Uzbekistan

EXECUTIVE SUMMARY

APRIL 2020

This study focuses on a scientific-based approach to deliver climate-adaptive solutions for water resources management issues at Indorama's farms located in Kashkadarya (Nishon and Kasbi) and in Syrdarya (Oqoltyn and Sardoba). The study undertook a water balance assessment in order to identify the risks associated with the availability, the allocations and the management of the water used for irrigation and farming needs. The scope of this water balance assessment encompassed multiple geographic scales (e.g., transboundary, national, regional, district and farm levels). It has also analyzed the rules and regulations of water allocation as well as the methods of water distribution across Indorama's farmlands.

The irrigation water management issues were assessed applying water balance modeling methods, RS/GIS tools and field surveys with the aim to identify solutions for:

- **improving the conveyance of water and reducing water losses in the irrigation and drainage (I&D) systems;**
- **enhancing and increasing the efficiency of on-farm water management;**
- **improving the performance of the Water Consumers' Associations.**

The findings of the study showed that the water balance during the study years (2010-2018) was positive (surplus) for 88% of Indorama's farmlands and only 12% of Indorama's farmlands (1% in Kasbi and 11% in Nishon districts of Kashkadarya province) are located in areas which could periodically face the risk of water shortages, given the current state of the irrigation infrastructure. These areas are located in Hydromodule Zone III with the ground water deeper than 3 meters.

The analysis showed that improving the efficiency of the irrigation networks alone, from the current 70% up to 95%, allows to achieve a minimum of a 25% increase in the water availability (an improved water balance). Modern irrigation techniques, such as GPS-leveled fields with furrow irrigation using syphons and flumes, overhead pivot and overhead lateral irrigation methods being implemented by Indorama, will further enhance water availability to crops and will help to reverse negative water balances into positive water balances during years of water shortage.

In addition, institutional agreements on water sharing, allocations and water management as well as the water governance systems were analyzed at the regional and national levels.

Water allocations based upon the amounts requested by farmers on Indorama's farming areas vs the actual amounts of water supplied by the government were analyzed. The results showed that, during low water years, 100% of the farmland areas in Syrdarya and 74% of the farmlands in Kashkadarya received sufficient or excessive amounts of water.

Moreover, in order to assess the condition of the irrigation infrastructure, the consultants visited Kashkadarya and Syrdarya regions. During the field visits, meetings were organized with Indorama's Australian and local hydro technicians, as well as farmers in both project sites. The findings of the survey indicated that sediment is the main issue in the main canals and in the on-

farm canals in Kashkadarya region. The main canals are in relatively good condition in Syrdarya region, but the on-farm irrigation systems are in poor condition. The pre-cast parabolic canals are outdated and leak water, which results in significant water losses within the system. Indorama has contracted an Australian company, SMK Consultants Pty Ltd, to redevelop farm fields and irrigation systems with the aim to create a sustainable irrigated farming model which will ensure adequate water supplies in a timely manner.

Furthermore, CROPWAT 8.0 software (FAO, 1992, FAO, 2002), a decision support tool developed by the Land and Water Development Division of FAO, has been used to estimate the water volumes and the number of irrigations required for cotton and wheat in the project areas. The CROPWAT program predicts that, in total, 10 irrigations are needed for achieving the *maximum* cotton yield *potential* in the Kashkadarya steppe with irrigation rates during the growing season in the range of 8,717-8,802 m^3 /ha . The optimal irrigation rate for cotton, in Syrdarya province, is 5,580-7,086 m^3 ha . During years with high precipitation, six irrigations must be applied at a rate of 5,580 m^3 /ha . During the years with normal precipitation, seven irrigations must be applied at a rate of 6,343 m^3 /ha. During dry years, 8 irrigations are required at a rate of 7,086 m^3 /ha.

According to CROPWAT simulations, the optimal number of winter wheat irrigations in Kashkadarya province must be 5 times at an irrigation rate of 3,745 m^3 /ha during years with abundant precipitation, 3,510 m^3 /ha during years with normal precipitation and 4,619 m^3 /ha in dry periods.

According to CROPWAT simulations, the optimal number of winter wheat irrigations in the Syrdarya province would be 3-4 times at a rate of 2,004 m^3 /ha during years with abundant precipitation, 1,961 m^3 /ha during years with normal precipitation and 2,711 m^3 /ha during dry periods.

The study concluded that, in order to improve agricultural water productivity, there is a need to upgrade and desilt the main canals as well as the main drainage water collectors and to replace outdated on-farm irrigation and drainage infrastructure, implement efficient on-farm water management systems and to develop effective Water Consumers' Associations.

The water balance components indicated that there is a significant water losses and run-off under the current conventional furrow irrigation method. In order to address these issues, Indorama has undertaken a significant farm redevelopment project which includes land leveling, advanced irrigation practices, building water reservoirs, putting in the proper geometry of furrows and reuse of run-off water. The study determined that these measures will significantly increase the availability of water for irrigation at the field level, which will also improve the water balance.