Monitoring Water Sources and Water Use

R.R. Masumov

Monitoring water sources and water use is one of ways to improve water management efficiency. The efficiency of water resources use depends on well-handled impacts of specific IWRM instruments on behavior of water users [3] including the following tools:

- ***Building water knowledge*** (workshops, training seminars);
- ***Technological tools*** (water measurement devices);

The given section presents technological tools. Establishing the appropriate water measurement system on all water sources and arrangement of all available information in a common database are of top-priority value under water governance. At that, it is necessary to note that if this activity was earlier organized at top levels of water management hierarchy rather well, may be, without sufficient control, then at the level of water users (present WUAs) the status of the stream-gauging network, water measurement and accounting system including processing and analyzing data is quite low. The IWRM-Fergana Project may be presented as the good example of improving water use efficiency through employing monitoring tools.

Monitoring activity was initiated in 2002 by the field checkup of waterworks on pilot main canals resulting in the drawing up of the list of hydrometric equipment requiring replacement or partial modernization. Replacement of gauging rods (water-depth rods) was implemented at all gauging stations and posts on pilot canals. Modern flow-meters were procured to personnel of all hydro-operational sites under the Canal Administrations (CA). In addition, the IWRM-Fergana Project has held training seminars for CA staff and prepared the manual on water measurement and accounting for the specialists servicing the pilot main canals. On-the-job training in calibration of the gauging stations with using new propeller-type current meters (ISB-01) and a tube-type current meter (GTR-type) that are given in Figure 5.1 was held for the CA staff.

In the process of training, a great consideration was given to the accuracy of available information on flow rates. Participants of training seminars have selectively analyzed flow rate charts and tables for the balance and check gauging stations on the pilot irrigation canals. The analysis has shown that flow rate characteristics calculated for some head and balance gauging stations had impermissible inaccuracy (more than 5%) due to changes in the hydraulic regime at the gauging station resulting from side-slope erosion, sedimentation etc.

a) ISB-01

An action plan was developed to improve the situation related to an accuracy of flow rate measurements by means of elimination of above-mentioned causes. After rehabilitation of canal cross-sections in the vicinity of gauging stations, the Canal Administration has held on-the-job training for personnel covering the adjustment of a discharge rating curve at gauging stations and preparation of new equations and computational tables using the PC for calculating flow rates.

Putting the obligatory four-time measurements a day into practice of all the water-gauging divisions at all balance and check gauging stations on the pilot canals is another action for improving the accuracy

of water accounting practice. All these measures have also allowed entering reliable data on flow rates into the database of the on-line information system that can be used for designing the canal waterworks automation.

Figure 5.1 Instruments for Flow Rate Measurements

More precise definition of flow rates of pumping units withdrawing water for irrigation is also critical for improving the accuracy of water accounting. Ultrasonic flowmeters installed on discharge pipelines of the pumping stations in the end of 1990s have failed now due to the lack of proper O&M by the special service of manufacturers. At present, pumping stations' discharges are estimated using the design parameters of pump units. Taking into account that service life of many pump units exceeds 20 years it is possible to assume that the estimate of discharges using the design parameters of pump units can be rather inaccurate. In 2007, this fact was proved by the special measurements of flow rates at the alignment downstream of one pumping station withdrawing water from the SFC. Comparison of flow rates that were measured and computed using the design parameters of pump units has shown the discrepancy in about 30%. Thus, equipping of the pump units with modern flowmeters and updating the discharge rating curves of pump units by means of the traditional flow rate measurements are a topical task that allows improving the accuracy of water accounting on the pilot irrigation canals.

During the growing season of 2002, the field surveys of waterworks on secondary and tertiary canals were implemented under *the Component "WUAs."* These surveys have revealed that all off-takes into private farms and dekhkan farms were not equipped with water-measurement means and regulators. Water accounting and analyzing of water allocation among primary and secondary water users are not conducted within WUAs' areas. As a result of these surveys the needs in equipping all off-takes into private farms and dekhkan farms with water-measurement means were specified. All types of standard water-metering facilities and ancillary hydrometric equipment that allow operating them without special calibration were recommended for equipping off-takes (Table 5.2).

Table 5.2
Summary table of standard water-metering facilities and ancillary hydrometric equipment necessary for pilot WUAs (based on data of field surveys in 2002)

Water-metering facilities and ancillary hydrometric equipment	Pilot WUAs "Akbarabad"	Water-metering facilities and ancillary hydrometric equipment		
			"Akbarabad"	
Weir	7	Weir	7	Weir
Flow-measuring flume	35	Flow-measuring flume	35	Flow-measuring flume
Fixed channel	16	Fixed channel	16	Fixed channel
SANIIRI orifice	-	SANIIRI orifice	-	SANIIRI orifice
Water-depth rod	86	Water-depth rod	86	Water-depth rod
Hydrometric bridge	30	Hydrometric bridge	30	Hydrometric bridge

Necessary gauging equipment was manufactured by the special-purpose factory "Suvasbobuskunmash" in Tashkent (Uzbekistan) and delivered to the pilot WUAs in January 2003. Equipping of water users' off-takes with water-metering facilities was implemented in successive steps. First of all, the training seminars for WUAs' water users covering issues of construction and operation of water-metering facilities and their

calibration (preparing the passport of water-metering structures) were held. Constructing the gauging stations and posts equipped with different types of water-measuring devices was being implemented under direct supervising of the specialist in hydraulic measurements, and this allowed providing a good quality of works (Fig. 5.3).

a) WUA «Zarafshan»;

Constructing the gauging posts equipped with SANIIRI flow-measuring flumes "WLS" was conducted by two methods. The first method is the on-site manufacture of flumes using collapsible portable formwork for pouring concrete; and the second one is delivery and assembling pre-cast flumes (Figure 5.4).

b) WUA «Japalak»

Figure 5.3
Gauging posts equipped with Chipoletti weirs: where: 1 – Chipoletti weir; 2 – stiffening bar; 3 –gauging rod "RUG"

a) On-site manufacturing flumes using collapsible portable formwork

b) Assembling pre-cast flumes

Figure 5.4 Constructing gauging posts equipped with SANIIRI flow-measuring flumes "WLS"

A high quality of the gauging posts enabled the pilot WUAs' personnel to certify the ready-built gauging posts in timely manner and without any comments from the National Standardizing Authority. Equipping all off-takes with water-metering facilities was confidence-building measure of water users to water management organizations regarding water allocation. A special form for submitting applications for irrigation water was developed and introduced in the pilot WUAs for more active involving of water users in the process of water management and allocation. As a result, each water user could submit his application for irrigation water beforehand. WUA's personnel was reviewing the applications of each water user and establishing priorities of water distribution for next ten-day period. Introducing such an order enabled the WUA's personnel to establish the rigid schedule of water distribution in accordance with the daily water use plans drawn up beforehand and to supply irrigation water to all water users taking into consideration their real demands in fairer manner. It is necessary particularly to note that, first of all, an end user receives irrigation water according to the established schedule of irrigation water distribution and delivery (Figure 5.5). The so-called "publicity board" recommended by the project personnel and demonstrated in each WUA plays an important role in disseminating information on a sequence and rate of water delivery to each water user on the daily base.

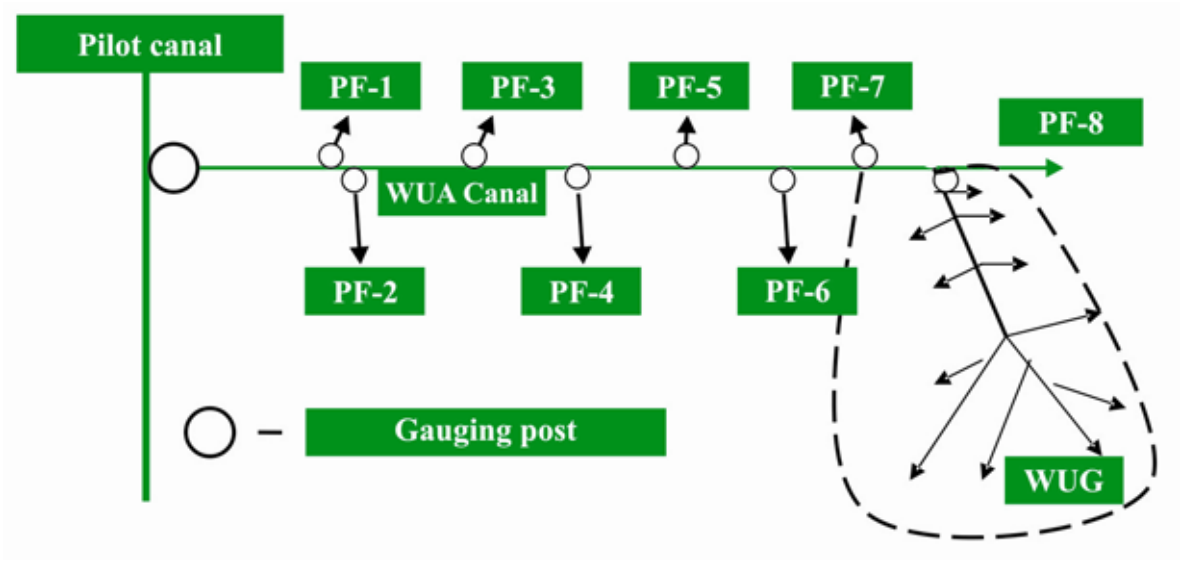

Figure 5.5 A Linear Network of the Secondary Canal in the WUA

In addition, the programs of training seminars included topics related to the water accounting in WUAs (daily three-time water measurements at the gauging posts with writing down into the register of an established format) along with on-the-job training of water users covering water measurements using water-metering devices and their maintenance. WUAs' personnel were completely procured with the methodological guidelines developed in the frame of the project (e.g. "Manual on Water Measurement and Accounting for WUAs' Specialists").

By the end of 2004, these measures allowed WUAs' personnel to solve their major task – equitable water distribution among WUAs' members resulting in lowering the level of social tension.

At present division of private and dekhkan farms is in progress within pilot WUAs in the project area. In 2007, according to survey data, the number of private and dekhkan farms in the WUA "Zarafshan" in Tajikistan and in the WUA "Akbarabad" in Uzbekistan has almost doubled in comparison with 2004, and their number in the WUA "Japalak" in Kyrgyzstan has increased up to five thousands. At the same time, in our opinion, the level of availability of water measurement facilities in WUAs has to be reasonable. The project consultants have therefore proposed grouping small farms (see Figure 5.5) into water user groups

(WUGs) with delegating their powers to an elected leader who will be responsible for water distribution. In this case, the right of each water user to have water-metering device at his off-take cannot be excluded. Hypothetically, in the process of fund accumulation, raising awareness of the need to support accurate irrigation water supply, and economic strengthening of WUAs, each farmer or another water user will hold an interest in installing water-metering device at his off-take to avoid excess payment and to have grounds for defending his water demands against the WUA.

One cannot be restricted only by activity related to equipping the canal network, WUAs, farms and other water users with water-metering facilities. It is also necessary to provide the methodology and means for specifying numerous indicators (e.g. volumes and quality of return water permissible for reuse) that are important not only for water management organizations and land reclamation agencies but also for water users themselves for successful water use and management, as well as for evaluating the water use efficiency and impacts (see Chapter 3).

It is necessary to establish the system of monitoring and evaluating return water that can be used for irrigation. In dry 2006 and 2007, when available water resources were limited, many WUAs in the SFC command area were forced to use drainage water from inter-farm collector-drains and tubewell drainage (TWD) for irrigation. In particular, drainage water was used for irrigating 300 ha in the WUA "Akbarabad" located in the command area of canal RP-1, raising water availability by 25-30%, on average. At the same time, in some places temporary cofferdams were arranged in collector-drain channels for diverting drainage water by gravity resulting in backwater and raising groundwater table on adjacent areas and, finally, in deteriorating the water and salt balance on lands of upstream WUAs. Therefore, drainage water use must be organized under supervision of the PHAE that is responsible for monitoring drainage water disposal through inter-farm collector-drains.

Climatic conditions essentially affect amount and timing of water applied. For example, rainy and belated spring, relatively cool summer and warm and dry autumn were observed in 2007. Therefore, rapid information on changes in the water and salt balance within the area where drainage water was used for irrigation and daily and long-term forecasts of the Hydro-Meteorological Service were very important. All this information should be promptly transferred to the WUA Council to develop appropriate measures aimed at adjustment of water consumption, lowering groundwater table and preventing soil salinization in the command areas of inter-farm collector-drains.