Developing Drainage Infrastructure in the Aral Sea Basin: the Past and Present

V.A. Dukhovny, H.I. Yakubov, P.D. Umarov

Intensive development of irrigation in the 20th century, especially, in its second half, including developing virgin lands in Golodnaya, Karshi, Jizak, and Sherabad steppes, in the command areas of Karakum and Kyzylkum irrigation canals, in Central Fergana, in the Asht Irrigation Scheme in Tajikistan made drainage issues especially topical in the region. Irrigation systems turned into irrigation and drainage systems that are the integrated ameliorative systems of irrigation and drainage, which only jointly allow to create conditions for sustainable agricultural production and to maintain land fertility. The rates of constructing these systems were really unique – up to 60,000 ha/year.

As a result of these works, by the beginning of the 1990s, 200,000 km of drainage networks were constructed, including 45,000 of inter-farm and main collector-drains, 155,000 km of on-farm drainage network (including 48,600 km of subsurface field drains), as well as 7,762 drainage tubewells covering the area of 836,600 ha. An area serviced by the horizontal drainage amounts to 4,750,860 ha.

However, if prior to 1990, the rates of constructing the drainage systems were really great, since 1990 they were practically suspended (Fig. 4.16).

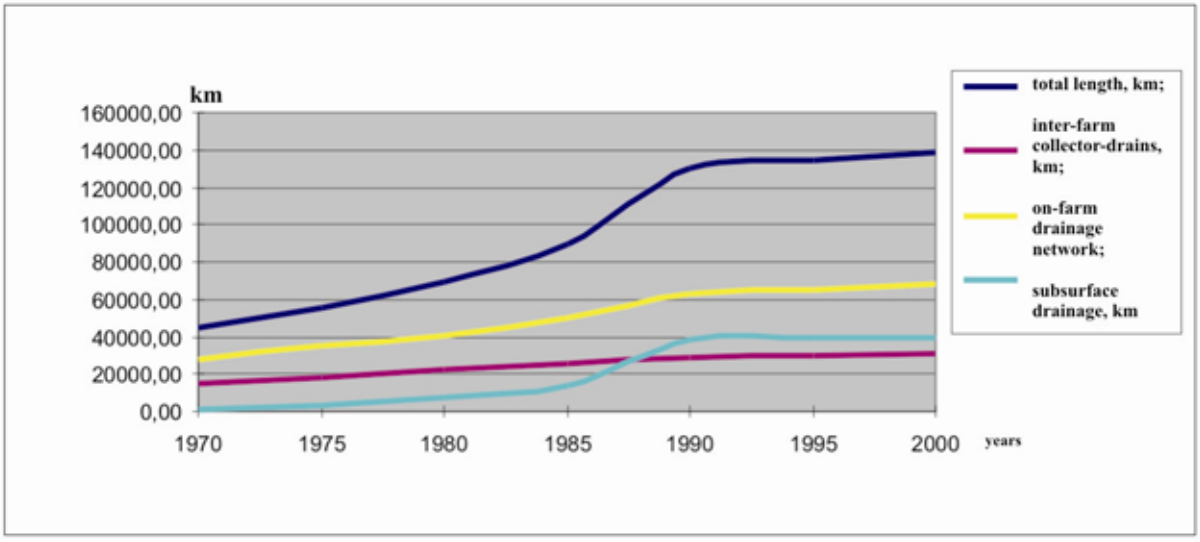

Figure 4.16 Trends of Drainage Development in Central Asia

At the same time, most of areas artificially drained are located in Uzbekistan where the advanced types of land drainage were introduced: subsurface field drains and drainage tubewells with the serviced areas of 550,000 ha and 450,000 ha respectively. Taking into consideration availability of drainage facilities, including the systems of drainage tubewells, per one hectare, irrigated lands in Kazakhstan, Tajikistan, and Uzbekistan can be classified as sufficiently man-made drained. In Turkmenistan, where a specific length of drainage makes up 14.7 m/ha, the irrigated lands can be referred to the category of insufficiently man-made drained. At that, irrigated lands of this country are located in the zone with more complicated hydro-geological and soil conditions.

At the same time, irrigated areas serviced by drainage tubewells (in 2000, this area amounted to 380,400 ha against 450,000 ha in 1990) have quite reduced during last years due to closedown of some tubewells.

Prior to 1991, in all Central Asian countries, main collector-drains, inter-farm collector-drains, drainage tubewells and partly subsurface drainage were on balance (in the books) of the state and were maintained by specialized organizations of the Republican Ministries of Land Reclamation and Water Resources, but on-farm open drainage network and most of subsurface drains were transferred from the books of the state to farms.

Therefore, the inter-farm collector-drains, drainage tubewells and part of subsurface drains were maintained by the Provincial Hydro-Geological & Ameliorative Expeditions or other specialized organizations such as National Drainage Network Administrations financed by the states. On-farm drainage systems were maintained by the farms using own funds.

Owing to economic weakening the water sector and transition of the agricultural sector towards market relations, the state water management organizations don't pay due attention to O&M of the inter-farm drainage systems; at the same time, on-farm drainage network of former collective farms and state farms is not maintained at all. As a result of funds shortage, the scopes of rehabilitation works, cleaning of collector-drains, and repairing and flushing of field drains were abrupt reduced resulting in the catastrophic technical state of drainage systems. Dynamics of two integrated indicators (a readiness factor and costs per unit) shows that consequences are the most adverse for the subsurface drainage systems and on-farm open drains (Table 4.5).

Table 4.5. Assessment of Horizontal Drainage Status in Uzbekistan

Type	Parameters	Prior to	1995	2000
Inter-farm open drainage network	Readiness factor	0.88	0.83	0.71
	Costs, USD/ha	5.4	2.64	2.86
On-farm open drainage network	Readiness factor	0.86	0.80	0.70
	Costs, USD/ha	7.1	2.7	3.0
Subsurface drainage	Readiness factor	0.89	0.78	0.63
	Costs, USD/ha	7.8	2.6	2.1

Much worse situation is observed for drainage tubewells, operation and maintain of which became extremely expensive and unprofitable under new conditions of transition towards the market (Table 4.6).

Table 4.6. Operational Indicators of Tubewell Drainage in the Republic of Uzbekistan (over the period of 1970 to 2002)

Indicator	Year						
	1970	1975	1980	1985	1990	1995	2002
Total number of drainage tubewells, pcs	543	939	1952	3137	4239	3908	3530 (2700)*
Drained area, 000' ha	174.45	198.65	310.62	406.83	447.51	447.86	380.4
Mean Annual OEC	0.47	0.67	0.64	0.58	0.57	0.33	0.24
Pumping-out, mln. m^3	568.01	1116.84	1577.47	2048.4	2203.35	810.2	925.18

Such a situation has resulted in abrupt deteriorating agricultural land conditions during last decade. The irrigated areas with a depth of groundwater table less than 2 m have increased on 21% in the Amu Darya basin and on 65% in the Syr Darya basin. At the same time, the areas with heavy and medium saline soils have increased on 57% and 78% in the basins of Amu Darya River and Syr Darya River respectively. Droughts observed during last decade also contributed to the intensification of soil salinization since water resources were insufficient for implementing proper leaching operations.

Thus, desalinization of soils within the irrigated schemes, which took place prior to 1990, gave way to salts accumulation gradually causing complete soil degradation.

In spite of their efficiency and capacity to provide conditions for establishing optimal water and salt regime of soils on irrigated lands and for reducing total production costs per unit of yield, advanced types of drainage systems (subsurface drainage, drainage tubewells, and horizontal drainage with booster-wells) were rather expensive and required due quality of O&M, permanent monitoring of land condition and water consumption.

Disintegration of the USSR was accompanied by destruction of all customary O&M norms and rules for the drainage systems; by economic and institutional weakening the water and agricultural sectors and decreasing the state economic potential as a whole. As a result, the rates of reconstruction and developing the drainage systems have reduced practically up to zero; O&M costs were decreased in a few times, and the capacity of land reclamation services has lowered in such degree that it resulted in soil salinization, waterlogging and loss of productivity of irrigated lands. Most surprising is that, when only 30-50% of drainage systems are operable, "cancerous tumor" of salinization did not affect all irrigation lands, although some similar processes are observed. Of course, in the past, under designing the drainage systems, some aspects such as additional drainage capacity of open collector-drains, introduction of water saving technologies, and methods of more rapid desalinization of saline soils were taken into consideration insufficiently. Moreover, excessive drainage capacity was accepted in the design and predictive estimates of drainage facilities density in order to provide more rapid rates of soil desalinization, not considering possible water deficit in the future.

Due to such a reserve capacity, if normal O&M will be provided the existing drainage systems in Central Asia can meet the requirements of management of water and salt balance on irrigated lands in most of regions under providing proper water delivery for leaching operations, excluding the irrigation schemes where drainage capacities are evidently insufficient. At present, practically in all regions of Central Asia, the technical state of existing drainage systems does not meet the requirements of ecological and land reclamation management.

Total economic losses related to soil salinization amount to US$ 354 million in the Amu Darya River basin and US$ 254 million in the Syr Darya River basin [6].