3.1 The pilot plots natural-economic conditions

3.1.1. Climatic conditions

The pilot plots climatic conditions are represented by number of indicators which are: effective temperature sum, precipitation, evaporation, etc. (table 3.1).

The pilot plots cover all basic rayons of Central Asia from Chui valley to SyrDarya lower reaches (Kizilkum massif) and AmuDarya river (Ashgabat and Tedjen rayons).
Climate is sharply continental. Average temperature in Fergana valley fluctuates within the limits 8,2-15 ^{0}C. Highest temperature is observed in Ashgabat oblast of Turkmenistan, it is 16 ^{0}C. Effective temperature sum is from 2200 (Chimkent oblast) to 5300 ^{0}C (Ashgabat oblast). Precipitation fluctuates within the limit of 76-400 mm/year under evaporation 800-1700 mm/year. Mellowing coefficient over the pilot plots is low: 0,084-0,45, i.e evaporation exceeds precipitation. Relative air humidity fluctuated from 49 to 70% , that characterizes this zone as dry and very dry.

3.1.2 Geomorphologic- hydrological conditions

On geomorphologic conditions areas of the pilot plots are presented by plane and slightly wavy valley with slopes from 0,0002 to 0,01 (table 3.2).

Lithological structure is presented by two- and multi-layer rocks. Fine-grained top soils permeability fluctuates within the limit from 0,1 to 30,0 m/days. Aquifer permeability is from 2 to 200 m/days.

In the most part of the pilot plots ground water table varies within 0,6-4,0 m, and on the plot in Kyrgyzstan ground water table is 4-6 m. In many pilot plots there is artesian water and its head exceeds ground water level.
Ground water upper layers salinity fluctuates from 0,8-2,0 g/l on old irrigated lands to 50 g/l and more on new developed salinizated areas. Ground water salinity usually low: from 0,5 to 1,0 g/l, but there are sites with high mineralization up to 30 g/l.

3.1.3 Soil-meliorative characteristics

Soils of the pilot plots varied on texture from sandy and sandy-loam (Turkmenistan) to loamy soils including light and heavy loam with relevant water-physical characteristics (table 3.3) .

Volumetric weight of dray soil fluctuated from 1,2 in sandy to 1,61 g/cm^3 in heavy loam, specific weight varied within the limits 2,4-2,73 g/cm^3. Water availability is 0,08-0,15.

Table 3.1.

Pilot plot location and climatic characteristics for in-contour drainage water use

Code of theme	Pilot project location	Sum of effective temperatures, C^0	Average annual precipitation, mm	Evaporativity, mm	Moistening coefficient, share of unit	Relative air humidity, %	Average annual air temperature, C^0
UZBEKISTAN							
03.1. Uz.	Djizak steppe	4600-4700	300	1200-1300	0,23-0,25	55-65	14,4-15,0
03.2. Uz	Golodnaya steppe	4600-4700	300	1100-1400	0,22-0,26	50-56	14,4-15,0
03.3. Uz	Fergana province, west part	4000	97-124	1000-1180	0,084-0,10	55-60	8,2-14,3
03.4. Uz	Fergana province, Altyaryk district	4000	76-133	1000-1180	0,11-0,22	55-65	13,0-15,6
03.5. Uz	Fergana province, Buvaida district	4000	76-133	1000-1180	0,11-0,22	55-65	13-15,6
03.6. Uz	Syrdarya province, Shuruzyak collector	4000-4100	250-350	1120-1280	0,19-0,27	55-60	12,5-13,0
03.7. Uz	Syrdarya province, Ilichevsk district	4000-4100	250-350	1300	0,19-0,27	55-60	12-13
TURKMENISTAN							
03.1.Tur.	Ashgabat province	5200-5300	245	1700	0,14	50	16,0
03.2.Tur.	Ashgabat province, Tedjen district		135-178	1700	0,08-0,10	49	16,2

Code of theme	Pilot project location	Sum of effective temperatures, C^0	Average annual precipitation, mm	Evaporativity, mm	Moistening coefficient, share of unit	Relative air humidity, %	Average annual air temperature, C^0
KAZAKHSTAN							
03.1.Kaz.	Chymkent province, Turkestan district	2400	160-200	1300-1400	0,11-0,15	55-60	15-16
03.2.Kaz.	Chymkent province, Kyzylkum massif	2200-2400	160-200	1200-1400	0,11-0,17	50-63	14-16
KYRGYZSTAN							
03.1.Kyr.	Chu valley, Sokuluk district		250-400	800-900	0,28-0,45	50-70	13,0

Table 3.2

Pilot projects' geomorphological- hydrogeological characteristics

Theme title, code	Geomorphology	Lithology	Permeability, m/day		Ground water table, m	Head, m		Salinity, g/l	
			top fine-grained deposits	aquifer		± Δh	± q	Co	Cr
UZBEKISTAN									
03.1. Uz.	Proluvial plane	Laboratorial work							
03.2. Uz.	Proluvial plane i=0,0003-0,0005	multi-layer	-	-	-	-	-	-	-
03.3. Uz.	Slightly corrugated Syrdarya plane i=0,0004	multi-layer	0,3-0,9	-	1,2-2,5	artesian	-	4,0-12,0	-
03.4. Uz.	Slope plane i=0,01-0,004	multi-layer	0,5-2,0	2-5	0,6-2,0	artesian	-	0,8-2,0	0,5-1,0
03.5. Uz.	Alluvial-proluvial plane i=0,0002-0,003	multi-layer	0,9	3-5	1,0-2,5	artesian		5,0-50,0	0,5-3,8
03.6. Uz.	Slightly corrugated plane i=0,0003-0,0005	two- and multi-layer	0,1-0,15	20-30	1,0-2,5	artesian	-	5-10 and more	-
03.7. Uz.	Alluvial-proluvial plane i=0,0003-0,0005	Multi-layer	0,15-0,23	20-25	2,0-4,0	Artesian	-	666-767	5-30
TURKMENISTAN									

Theme title, code	Geomorphology	Lithology	Permeability, m/day		Ground water table, m	Head, m		Salinity, g/l	
			top fine-grained deposits	aquifer		± Δh	± q	Co	Cr
02.03.1. Tur.	Slightly corrugated plane	-	6,5	-	2,0-2,5	-	-	2,8-5,0	-
02.03.2. Tur.	Alluvial plane i=0,0006-0,0007	two-layer	0,1-0,2	2-3	2,4-3,5	-	-	10-20	-
KAZAKHSTAN									
02.03.1. Kaz.	Slightly corrugated plane I=0,002-0,005	Multi-layer	0,2-0,5	2,5-150	1,0-4,0	-	-	1,8-3,0	0,5-1,5
02.03.2. Kaz.	Slightly corrugated plane i=0,0003-0,0005	Multi-layer	1,0-30,0	50-200	1,5-3,0	-	-	1,0-25,0	-
KYRGYZSTAN									
02.03.1.Kyr.	Slightly corrugated plane	two-layer	0,2-0,7 up to 10	-	6-10	-	-	2,5-35,0	2,5-3,5

Explanations:

±Δh - related to groundwater table, m;
±g - underground water exchange, m;
Co - groundwater salinity, g/l;
Cr - surface water salinity, g/l.

Table 3.3

Soil-reclamation characteristics of pilot plots on drainage water in-contour re-use

Theme title	Soil types on mechanical composition	Soil water-physical properties					Salinity					Soil-absorbing complex		
		γ	η	μ	δ	kt	salinity degree	salinity type	salt distribution	sum of salts within 0-100 cm layer	Cl^{1}	SAC	Ca^{++} %	Na^{+} %
UZBEKISTAN														
03.1.Uz.	loam	-	-	-	-	-	from slightly to strong	sulfate-chloride	superficial	0,3-1,2	-	-	-	5-10
03.2.Uz.	middle and heavy loam	1,4	2,7	-	-	-	slightly and strongly saline	sulfate-chloride	superficial	0,3-1,03	-	5,8-7,03	45-55	3,6-18,1
03.3.Uz.	loam, sandy loam, sand, clay	1,3-1,4	2,65-2,76	-	-	0,3	strongly saline	sulfate, sulfate-chloride	superficial	1,5-2,34	-	5,2-7,6	49-70	0,27-11,7
03.4.Uz.	light and middle loam	1,34	2,4	-	-	-	slightly saline	sulfate	superficial	0,3-1,0	-	7,1-9,8	41-70	0,27-11,7
03.5.Uz.	light and middle loam	1,42	2,72	0,12	-	0,23	middle and strongly saline	sulfate	superficial	1,34-2,4	0,077-1,10	6,16	53	5,1
03.6.Uz.	sandy	-	-	-	-	0,2	middle	sulfate-	superfici	0,7-1,5	-	-	-	-

Theme title	Soil types on mechanical composi-tion	Soil water-physical properties					Salinity					Soil-absorbing complex		
		γ	η	μ	δ	kt	salinity degree	salinity type	salt distribution	sum of salts within 0-100 cm layer	Cl^{1}	SAC	Ca^{++} %	Na^{+} %
	loam, loam						and strongly saline	chloride	al					
03.7.Uz.	light and middle loam	1,2-1,37	2,4-2,65	-	-	0,2	from slightly to strong	sulfate-chloride	superficial	0,3-1,6	0,006-0,029	-	-	
TURKMENISTAN														
02.03.1 Турк.	sandy	1,41-1,61	2,70-2,73	-	-	6,5	non-saline	-	-	0,170	0,008	5,8-7,8	48-79	1,04-10,0
02.03.2 Tur.	heavy loam	1,51	2.65	-	-	0,2	non-saline	-	-	0,100-0,250	-	-	-	-
KAZAKHSTAN														
02.03.1. Kaz.	middle and heavy loam	1,52	2,73	0,11-0,15	-	0,3	non- and middle saline	chloride-sulfate	-	0,06-0,162	-	10,9-27,1	40-76,0	1,8-10,4
02.03.2. Kaz.	loam, clay	-	-	-	-	up to 0,1	weakly and middle saline	chloride-sulfate	-	0,200-0,380	0,018-0,012	-	-	4,0-18,0
KYRGYZSTAN														
02.03.1. Kyr.	middle loam	1,2-1,48	2,6-2,72	-	-	1,3	non-saline	carbonate	-	0,17-0,196	-	5,25-11,5	30-88,0	3,-16,1

Explanations:

γ - soil volumetric mass, t/m^3 or g/cm^3;
η- specific mass, t/m^3 or g/cm^3 ; μ - water availability, share;
δ - salt availability coefficient;
kt - permeability coefficient, m/day;
SAC - soil-absorbing complex, mg-ekv/100 g of soil;
Ca^{++} - exchangeable calcium, % of SAC;
Na^{+} - exchangeable natrium, % of SAC.

On salinity degree the pilot plots soils are heterogeneous. The experiments were conducted as on non-saline lands (Kyrgyzstan), so on lands with slight and strong salinity. Salinization types are as follow: carbonate, chloride -sulfate, sulfate-chloride, sulfate.

Salts distribution over profile of soil horizon has, mainly, superficial character. Easy soluble salts content on dry residue in top 1m layer fluctuated from 0,06-0,160% on salinizated lands (South Kazakhstan, Turkmenistan and Chu valley of Kyrgyzstan) to 0,5-2,4% on medium and strongly salinizated lands of Hungry Steppe and Fergana valley (Uzbekistan). Chlorine- ion (CL^{1}) content fluctuated from 0,006 to 1,10%.

One of the main indicators of soils is exchangeable bases content (or absorbing soil complex (ASC)). Data show, that on most pilot plots absorption capacity is from 5,2 to 10 mg/ecv/100 g of soil, which is typical for soils of Central Asia poor with humus, excluding soils of South Kazakhstan (Chimkent oblast), where absorption capacity is higher: from 10 to 27 mg/ecv/100g. Content of absorbed Ca^{++} which constitutes from 40 to 88% of ASC sum was pointed out, which is good protecting indicator under drainage water use for irrigation. Although content of exchangeable Na^{+} fluctuates from 0,2 to 18% of ASC sum, but at the same time, over all pilot plots the physical signs of salinity are not found over soil profile.