



Other collaborators:  
years

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<b>F Funding agencies</b>		
	Full name or acronym	Percentage of project finance provided
1	Ministry for Land Reclamation and Water Management	100 %
2		%
3		%

<b>G Summary of research project (see instruction on page 1)</b>	
1	<p><i>Objective and technical fields:</i> Study of initial easy solvable salts stock formation within the upper thickness of quaternary sediments. <i>Objectives:</i> determination of salt stock formation active zone and its influence on soil desalinization process and drainage effluent composition .</p>
2	<p><i>Scientific and technical approach:</i> Prevention of irrigated land salinization on the base of the set of measures: irrigation and leaching regime improvement, land drainability increase, water-salt regime management. Study's meaning: Development of engineering reclamation methods for land and water productivity increase, drainage effluent chemical composition regulation.</p>
3	<p><i>Environment characteristics:</i> Average annual temperature is 12,5 - 13 °C. Annual evaporativity is 12 - 16 t.m<sup>3</sup>/ha. Humidity deficit is 9 - 13 th.m<sup>3</sup>/ha. Hydrothermal coefficient is 0,23 - 0,53. Lithology: quaternary sediments thickness is 100 - 500 m; cover loam thickness is 3 - 44 m. First permeable layer thickness is 10 - 150 m. Permeability coefficient are as follows: cover loam 0,02 - 3 m/day, aquifer 5 - 100 m/day; groundwater level in 1961 was 1 - 20 m depending on lands development stage. Difference between groundwater level and artesian water head was 0,05 - 5 m. Groundwater salinity varied within 5 and 18 - 36 g/l. Underground inflow is 300 - 3000 m<sup>3</sup>/ha/year; underground outflow is 350 - 4350 m<sup>3</sup>/ha/year. Soils are represented by sandy loam, light, middle and heavy loam; salt stock within 20 m thickness is 80 - 4800 t/ha (1960). Easy solvable salts content was from 0,3 % to 2,5 %. Solinity type was chloride - sulfate. According to H.Dimo within Golodnaya Steppe non-salinized groy soils were 623,3 th/ha (76,2 %); under deep groundwater level (5 - 7 m); slightly salinized soils 114,3 th/ha (14 %); strongly salinized soils 24,6 th/ha (3 %) and very strongly salinized 41.65 th/ha (5.1 %). Irrigation led to change of hydrogeological processes, broke equilibrium between water balance positive and negative elements and led to groundwater level increase. That is why soil secondary salinization processes developed. Its sources are easy solvable salts which are accumulated within the deep horizons and were not taken into account during design calculations.</p>

#### 4 Parameters of Pilot Projects and Technical Solutions:

Golodnaya Steppe total area is 666.08 th.ha. Water supply is performed by mains Dustlik and South - Golodnostepsky. Dustlik canal's length is 113 km, maximum capacity - 230 m<sup>3</sup>/sec, efficiency is 0,9 - 0,92. South - Golodnostepsky canals length is 127 km, maximum capacity 300 m<sup>3</sup>/sec, efficiency is 0,92 - 0,94.

The biggest collector is Central Golodnostepsky one. Its length is 85 km, depth 3 - 7 m, capacity - 90 m<sup>3</sup>/sec. It drives water to Arnasay sink. About 1450 vertical drainage wells were constructed within north - east and north - west part of the steppe with total discharge 66,9 m<sup>3</sup>/sec (1963).

Wells depth is 50 - 80 m. Within the south and south - west part close horizontal drainage was constructed. In - farm close drainage density is 4,5 - 5 m<sup>3</sup>/ha. Specific water duty within the old part of irrigated zone is 8,5 - 1,5 th.m<sup>3</sup>/ha, within the new zone 7,5 - 9 th.m<sup>3</sup>/ha.

#### 5 Methodology:

Organisation of regional investigations on determination of easy soluable salts composition and stock distribution within the upper 20 - 35 m thickness of soil and their influence on reclamation - ecological processes formation.

103 wells were drilled with soil and groundwater sampling within the different hydroclimatic, geomorphological and soil - reclamation zones all over the steppe.

Multicriterial analysis was used to explain the results of investigations.

#### 6. Results:

Salt regime and salt stock distribution within the upper thickness of quaternary sediments is a result of certain territory's water - salt balance. It is found that some types of salt profiles are formed:

1. Non - salinized within all thickness of quaternary sediments. It is typical for well drained lands (upper part of cones, premountain zone, rivers' upper reaches;

2. Non - salinized within upper soil layer up to depth 1 - 1,5 m with content increasing downward. Such salt profile is formed on flat weakly drainable territories under deep saline groundwater.

3. Strongly salinized from the surface to the depth of 3 - 4 m with sharp decrease of easy soluable salt content downward. It is formed where territory is weakly drained under close groundwater level (3 - 3,5 m) with overflow from artesian water (500 - 1000 m<sup>3</sup>/ha/year).

4. Regularly middle and strongly salinized within the upper 30 - thickness of quaternary sediments. It is formed within the zones and drainless lands which are represented by loam under close to surface groundwater level (3 - 3,5 m).

5. Strongly salinized within the upper horizons (to 1,5 - 2 m) with higher salt stock within the lower layers. It is typical for drainless flat territories under to close surface groundwater level (2 - 3 m) with heavy soils beneath.

6. Slightly salinized within the upper horizons (0,5 - 1,0 m) with sharp decrease of salt stock within the lower horizons. It is formed under conditions of weak underground outflow and inflow absence.

7. Alternation of strongly and middle salinized profiles with non - salinized and slightly salinized ones. Such type of profile is typical for weakly drained zones with schistous sediments.

On the base of field investigations 10 rayon's are singled out which differ by salt profiles of 20 - 30 m thickness and salts' composition.

*First rayon's* area is 58200 ha. it is located within the Syrdarya river second flood plain bottom and represented by light and middle loam with thickness 10 - 15 m. There are 6 types of salt profiles. Profile salinity is from slight to middle and downward salt content is negligible.

Total salt stock is 890 t/ha within the 20 m- thickness, including chloride - 45, sulfate - 408 t/ha type is chloride - sulfate to sulfate. Groundwater salinity is 1,2 - 59 g/l. Under irrigation drainage effluent salinity does not increase.

*Second rayon's* areas is 74800 ha. It is represented by 1 type profile and encompasses watershed of Djizak cone of removal, proluvial - alluvial valleys of Sansar and Zaaminsu rivers.

Soils are sandy loam or light loam with thickness 2 - 3 m. Groundwater level before irrigation was 10 -20 m and it did not take part in soil - formation process, soils are slightly salinized. Upper (1 - 2 m) thickness is salinized to 0,1 - 0,2 %, downward salinity is 0,5 - 0,7 5, salinity type is sulfate, seldom chloride - sulfate.

Groundwater salinity is 1,47 g/l (type is chloride - sulfate). Under irrigation unfavorable salt regime is observed only locally and does not require special drainage measures.

*Third rayon's* areas is 160800 ha. It is represented by 4 types of salt profile and encompasses wide watershed of the Syrdarya third flood plain bottom. Quaternary sediments' thickness is 10 - 30 m. Main salt is distributed to the depth 12 - 14 m regularly and varies within 0,5 - 0,6 % and 0,8 - 1,0 % on solid residue. Downward salt content sharply decreases.

Total salt stock within 20-m thickness is 1436 - 1498 t/ha in solid residue, 80 - 102 t/ ha on chlorine and 700 - 800 t/ha on sulfate. Salinity type is from chloride - sulfate to sulfate. Groundwater salinity is 2,5 - 14 g/l. Under irrigation soil salt regime is formed by salts stock within 20 - 30 m thickness.

*Fourth rayon's* areas is 34400 ha. There are 3 types of salt profile. It is located within Shuruzyak sink and constituted by 20 - 30 m thickness of loam (permeability coefficient is 0,07 - 0,1 m/day) which is underlaid by sand-gravel-pebble thickness. Groundwater salinity is 4 - 8 g/l within irrigated lands and 20 - 40 g/l within non - irrigated ones:

Salt stock within 5-m layer is 70 - 750 t/ha (55 %), while within all thickness it is 1300 t/ha.

Salinity type chloride - sulfate. Cover loam salt store participates in the process of water -salt regime formation.

*Fifth rayon's* area is 55280 ha and is located within the limits of Zaamin cone of removal. Lithology: proluvial - alluvial sediments which are represented by light and middle loam with thickness 10 - 45 m.

Specific feature of salinization is salt maximum within depths 0 - 5 m with solid residue 1,5 - 2 % and chlorine 0,06 - 0,12 %. Downward profile is desalinized due to leaching activity of groundwater going upward. Salinization type is sulfate and to the north chloride - sulfate. Salt stock within upper layer 0 - 5 m is 1025 t/ha and within all thickness 0 - 20 m is 1820 t/ha.

Groundwater salinity is 5 - 15 g/l. Under irrigation all quaternary sediments take part into the soil water - salt regime formation.

*Sixth rayon's* area is 31000 ha and it is located within transition zone between steppe and desert. Lithology: sandy loam (3 - 15 m), sand, clay. There are 6 types of salt profile. Maximum salt content coincides with capillary selvage on depth 0,5 - 1,0 m to 4 - 5, where salt sum changes from 0,8 - 1,2 to 2,5 % on solid residue and 0,05 - 0,12 % on chlorine, 0,6 - 1,4 % on sulfate.

Total salt stock within 20 m thickness is 1755 t/ha including 816 t/ha within layer 0 - 5 m. salinization type is sulfate within the upper horizon and chloride-sulfate within the lower one. Groundwater salinity is 5 - 30 g/l, salinization type is chloride-sulfate.

*Seventh rayon's* area is 135800 ha. There are 2 salt profiles which encompass central part of Golodnaya Steppe. Upper 0,8 m layer of soil is desalinized to 0,15 - 0,3 % on solid residue, downward salinization increases and within 20 m thickness equals to 0,8 - 1,8 %. Salinization type is sulfate, downward chloride-sulfate. Groundwater mineralisation is 18 - 36 g/l, type is chloride-sulfate.

*Eighth rayon's* area is 24329 ha and represented by 4 salt profiles and locates between Djizak and Zaamin cones of removal. Strong salinization is observed within all 20 - m thickness solid residue is 2 - 3 %, chlorine 0,2 - 0,8 %. Downward salinization decrease to 1,5 - 1,8 % and 0,2 - 0,4 % respectively.

Total salt stock within 0 - 20 thickness is 3705 t/ha. Groundwater salinity is 10 - 50 g/l, type is chloride-sulfate.

*Ninth rayon's* area is 88200 ha. There are 4 types of salt profile. It is located within Djetisay-

Sardoba and Kara-Karaiskaya sinks.

Lithology: alluvial-proluvial sediments, mostly loam and sandy loam soil salinity is very high: 2 - 4 % on solid residue, 0,4 - 0,6 % on chlorine, 0,8 - 1,0 % on sulfate.

Easy soluable salts stock is 4800 t/ha in central and south - east part and 2300 - 2500 t/ha in north - west one. Salinization type is chloride-sulfate. All salts, contained in cover loam, take part in water - salt regime formation.

*Tenth rayon's* area is 55080 ha. There are 2 types of salt profile. It is located on the Syrdarya first flood plain bottom and is represented by cover loam of 1 - 5 m thickness. Soil salinity is 0,8 - 1,7 %, type is chloride-sulfate. Within upper 2-m layer 63,8 % (30 t/ha) salts are contained, within lower one 30 -35 %.

<b>H Suggested key-words</b>			
1	Salt stock	4	Leaching
2	Soil salinization zoning	5	Salt removal
3	Groundwater level	6	Secondary salinization

<b>I Most recent publications (maximum 3)</b>			
1	Author(s): E. Djanaliyev, Kh. Yakubov		
	Title: Soil salt regime within the cover sediments		
	Publication details: Study of in initial salt stock formation regularity within the 0 - 2,5 m layer with determination of salt distribution along the profile, chemical composition and type of salinization was undertaken. Salt content change under irrigation is shown.		
	Year of publication:	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/> confidential <input type="checkbox"/>
1983			
2	Author(s):		
	Title:		
	Publication details:		
	Year of publication:	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/> confidential <input type="checkbox"/>
3	Author(s):		
	Title:		
	Publication details:		
	Year of publication:	free access <input checked="" type="checkbox"/>	restricted <input type="checkbox"/> confidential <input type="checkbox"/>