

**ARAL SEA
PROBLEMS:
REVIEW AND DECISIONS**

INTERSTATE COORDINATION WATER COMMISSION

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The problem of Aral Sea has become known as a famous example of antiquman & antinatural activities of state & society which contributed to the disappearance & desertification of one of the biggest fresh lakes in the world.

Beginning from 1974, the problem of water resources of the Aral sea basin had been intensively discussed in the former Soviet Union, when a special commission created to the decision of the Chairman of the Council of Ministers of the USSR had carefully studied this question & the water resources safety together with the improvement of its management from one part & donor feeding of rivers of the different sources (Ob, Irtysh, Volga) in the of volume 25 cub km per year had been stressed as the main decision of the water deficit in the interest of ecological & socio-economic prosperity. In this respect, the orientation of Planned & directive organs was aimed at the further development of the irrigated agriculture as on one of the main trends of the regional process under the necessary reduction dimensions of the Aral sea and the protectional measures on the Aral sea coast.

The planning based on the achieved results of the high past rates of irrigation rise, the powerfully built construction - development potential in the region and the scantiness of the allotted capital investments moved aside the ecological demands and possibilities of the water safety on the second plan and favoured the intensive removal of runoff in the process of irrigation development with the corresponding increase of the damage to the surroundings. All this was payed by the hope of the change of situation under the river runoff transference in the region, in the first place from the Siberia.

The beginning of the "perestroika" processes and the growth of "green" movement coincided with the wishes of the federal government to reduce the capital investments in the region and gradually led to the growth of attention to the problems of the basin, to the pressure of negative trends and ecological complications, in the first place, and to the degradation of the Aral Sea and Aral Sea coast.

The prognoses published in the past of the inevitability of

losses of the gross national income under the preservation of the available tendencies in the water economy have been noticed and have been marked by the change of reconstruction. Improvement of the available water consumption and water limitation in all branches of the national economy, specifically, in the irrigated agriculture. This line directed on the limitation was crowned with the definite success for the past decade permitting to reduce specific water-intakes on irrigation in the basin from 18,3 thous. cub. m. /ha of water in 1980 to 13,7 thous. cub. m. /ha in 1992.

The big victory was the acceptance of a special government decision for improvement of water consumption and ecological situation in the basin in 1986. As the result of it some principal measures were carried out:

- the creation of two basin inter-republican organization "Surdarya" & "Amudarya" with the subordination of Ministry of Water Resources of the USSR, aiming to the realization of a single water management in the basins of the both rivers;

- the Aral sea & Aral coast were recognized as direct water-consumers. The progressive increase of watersupply of them was projected to be from 9,0 cub km/year to 15 cub km/year in 2000 abreast to 2010;

- tasks for reduction of water consumption & gradually reduced limits of water consumption with regard for the increased demands of the sea were established for all republics as an aggregated water consumer.

At the same time it was projected & begun to realize the engineer decisions for drainage of collector-drainage of water from the industrial & communal-domestic runoffs into rivers. The works on the centralized municipal-drinking water supply of the Lower Surdarya & Amudarya were begun by the way of construction of specialized drinking structures & material waterpipes within the Tashayz, Khoresm, Kzyl-Orda regions & the Karakalpak ASSR.

The creation of the special department of the Aral sea in the part of the Committee for the extraordinary situations of the former USSR & also special inter-republic Consortium "Aral" favored the growth of works in these trends & considerable degree of attention at all local & republic institutions to the given questions.

The collapse of the USSR & its disintegration in 1991 had a considerable effect on the creation of the definite difficulties in the began work which remained without sources of financing & single leadership. In a such position it is

very important to give the real assessment to the modern situation & its connections. On its basis it is important to define the real way of solving socio-economic & ecological tasks which are very tightly connected with the limited natural & financial resources of five independent States.

1. The Aral sea & Aral sea basin.

The Aral Sea basin represented the area at a big scale of 690 thous. km on the territory of watershed of two main rivers: Surdarya & Amudarya. The average water resources of these two basins is 120 cub km per year including the surface & connected with it ground water, permitted for usage. The Aral is a big lake by which this closed basin is finished. For the last 300...400 years the surface of the lake was kept on the level of 50.5...53.0 with the common volume of approximately 1000 cub km & water surface 66000 sq km. The average evaporation of this lake was 60 cub km per year, which balanced with the inflow of two rivers, 47...51 cub km per year, underground inflow of 5...6 cub km. & precipitation of 5.5...6.5 cub km. per year.

The growth of the demand for water requirement & water consumption in the region as a result of demographic pressure couldn't leave this lake & the whole basin untouched. Thus, the changes in its environment had began naturally. The total volume of water income was decreased during for 30 years by 700 cub km of water. The desertification of former delta of two rivers & drying bottom of sea took place on an area of 2 mln ha. This disaster was accompanied by worsening of the quality of water in the river as a result of collector drain water in the river bed.

Naturally, in the 20th century the rise of population & its water demands were observed in many parts of the world: Ganga, Indus, Colorado, San Hoakin, Sacramento, Nile & many others are the consequences of the development of limited water resources. However, the difference between those & Aral sea is that they fall in open sea or ocean & the reduction of fresh water supply leads to the decrease fishery production, only but not of other natural conditions. In the Aral sea, as a closed river basin, the consequences of such hyper water consumption became more big & tragical. One similar example on American continent - is the lake Mono. The size & rate of its falling level is equal to Aral sea disaster.

The long history of Central Asia, more than six thous. years of it are connected with irrigation & water usage. "Water is the

life"- this old principal eastern of all nations of Central Asia & of other neighboring countries. The big rate of population & demographic pressure (table 1 & picture 1) in the second half of ongoing century after 1960 (year of beginning of natural disaster) received the "good decision" by point of view of the federal government. In this framework, to the Central Asian region was presented the role of raw appendage for industrial center of the Soviet Union. Only 6...8% of all raw transformed products were processed up to the final stage, others were transferred to metropolia in exchange of food (meat, milk, wheat) & industrial products. But such distribution of obligations transformed Central Asian Republics to "consuming" part of the country with the big expenses for natural resources on the unit of GNP & full dependence from the Federal government in receiving investments, direction & strategy for development. The former strong leaders of region such Rashidov, Kunaev, Rasulev were able to understand the situation, & further industrial development of republics step by step was increased and thus permitted the 30 year period of increase for the industry products (7.01). However, this industry wasn't oriented on self supply of the region, but most part on the industry for agricultural & agromachine productions, first cotton processing, water maintenance & water construction industry. The big growth of agricultural production on the basis of irrigation during 30 years constituted 2.5 times when irrigated area increase only by 45% allowed to support the improvement rate of welfare of population on the average level of USSR, but absolute value of national income per capita was twice less than in the Soviet Union. Moreover on the Aral Sea coast (Karakalpakistan, Kzyl Orda, & others) it was twice less than average level of the region. The old Russian proverb came true here: "too far from eyes, too far from hearts". It is now Central Asian bodies were related the Federal Government. The poor sanitary & epidemiological & social services, absence of modern hospitals, medical personnel medicine are the consequences of such government attention and of low living standards of local population, but not of the drying of Aral sea drying. However disaster of Aral sea coast & deterioration of water quality in low reaches of rivers contributes to the increase of the negative situation here. Thus the bad social situation met here with the worsening of natural conditions of living.

If until 1960s the water resources of the basin were distributed between the creation of national income (63 cub km

of water per 14,2 mln people) & waste of runoff of 57 cub km, including 47 for Aral, the socio-economic situation in 1990 changed the water distribution to 98 cub km for creation of national income for 35,6 mln people & remaining of part 21,5 including only 9 cub km for Aral sea.

Although the consumption of water per capita & per unit of the national income constantly decreased as gross irrigation rate, the saving of existed trend is not enough for solving the problem of the region in future.

Under the agricultural direction of economy in 1960-1985 the mentioned distribution of water resources promoted the growth of agricultural production & proper branches of agro-economic complex, which passed ahead of the population growth. Subsequent braking of water management & land-reclamation works with former tendencies, inadequate industrial development of the region led to the decrease of national income of Central Asian Republics and the drop in well-being of the population.

At the same time, Republics of the Central Asia did their best to decrease specific water expenditure (to 5.000 cub m/ha for ten years) and to intensify the rise of land productivity. However for the last 5 years the population growth were exceeding the results of these works, what led to the decline in the agricultural production, till area and water resources capacity per head.

The total volume of water income to Aral was decreased during 30 years by 700 cub km under natural decline in runoff, 165 cub km for 30 years and anthropogen withdrawal of 550 cub km for the same period. If the strict water limitation, accepted in 1982, would be in power since 1960, and all irrigation systems would be constructed as ones in Hungry Steppe and Surhansherabad with high capacity (0.789-0.80), then that would allow to economize 160 cub km of water for the sea. It wouldn't save the sea, but sea table would be 42-43 m., what is better than present one 36-37,0 m. As a consequence of level decrease the zone of former sea bed now presents a new desert of 2 mln ha area and the source of salt and dust-weathering. In coastal zone the climatic and hydrogeological conditions changed for the worse, and more than that, deltas and ecosystems were destroyed.

But itself the decline of Aral sea level couldn't change for the worse the ecology, medical, and epidemiological situation in the whole Aral region, including Karakalpakistan, Khorezm, Tashauz, Kizil-Orda district of Kazahstan. The sea level decline and further desertification emerged on the narrow strip of 250-400

Km from the former water front and on the area of former deltas. The reasons of deterioration of ecological situation of above-mentioned area are bound with the quantitative and qualitative changes of Amudarya and Surdarya river's runoff - from one hand, and the reconstruction of land-reclamation systems in these zones was behind the requirements to change land-reclamation regime with the purpose of adoption of the irrigation systems to conditions of low river level and poor water quality. As result, the mineral regime of soil changed for accumulative one, increasing the accumulation of pesticides and herbicides instead of useful substances (Potassium, calcium and etc.)

In the present view and demanding to decrease the loss of environment, some suggested decisions of the sea reserving on the present level are useless & inactive measures. The present reservoir of 37 m water table and 28-30 gr/l of mineralization cannot keep the stable ecosystem.

Under such water mineralization the sea fish-breeding will not be productive and algae and plankton have to change their composition; it's necessary to increase the annual income of surface water not less than 30-35 cub. Km/year to keep the stability of this reservoir. These steps will be unrealized ones, without bringing water from outside.

The levels 38-40, close to present ones, cannot recover deltas of both rivers with all natural structures; cannot decrease salt and dust-weathering from the dried sea bed. The present situation determined 2.0 mln. ha of former sea bed dried and becomes the source of salt and dust-weathering.

2. Perspectives for social and economic development of the region

The forecast of population growth in the region is defines the population in 2000 on the level of 48 mln. peoples & in 2010 - 68-72 mln. people. The needs of the population is the employment, the supply of food & comfortable living conditions are the top priority tasks for solving of social & economic problems of independent States, for protecting peace & silence in the region. In the main time the ecological requirements of Aral sea also must be satisfacted. The two tasks - socio-economic & ecological have to be solved only on the basis of single water supply - 120 cub km per year.

There is no acceptable concepts & proposals aimed to save

Aral Sea at any price, or at the expense of the well-being & future of people, up to the discrimination of the local population. The demand for employment, food and comfortable living conditions is the task of top priority for the solving of social & economic problems of the republic at the expense of its own forces.

According to the calculation, the problem of providing the population with foodstuffs (besides flour & meat) may be solved by fundamental improvement of irrigated lands using and encouraging farmers incentives, buying & developing advanced technologies of the crop-growing, seed-farming and irrigation.

In the best case, in year of 2000 these measures will give the opportunity to increase the productivity of the agriculture up to 34 mlrd. roubles in the Central Asia: 15 % at the expense of irrigated area rise & 33 % at the expense of the modern technology & the increase of farmers incentives.

Undoubtedly, the great results may be achieved in states of the Central Asia by the introduction of advanced technologies on the base of local irrigation methods (drip & underground irrigation), which allow to supply water to each plant & in proper quantity, & also to provide the optimal regime with dosage injection of fertilizers & nutrients.

The average expenditure of polyethelene to develop 1 ha land on drip irrigation of vineyards & orchards is 700 kg, clean tilled crops - about 1 t.

In this respect it is possible to double orchards & vineyards yield capacity, & to reach 50 % cotton growth with 50 % of waterflow decrease.

In 2010 use of this technology for plant-growing (about 5 mln. ha) becomes a significant investment of 42.5 mlrd roub., it's necessary to establish the industry of polymer materials with the output capacity of 800.000 t. per year from the available gas stock.

This direction must be the top priority. The intensive polymer production will also permit the agriculture to get film lining crop-growing in greenhouses and mulching, what will increase food production with the size of a farm.

Effective age of the agricultural potential requires local processing of raw materials & production of final goods: "cotton-yarn-fabric-clothes", "vegetables-tinned food", "peanut-sweets-oil", "cattle-skin-shoes & consumer goods" & etc.

Such reorientation of the agriculture would increase the

production capacity of agroindustrial complex, including the processing & growing of low-water-use & highly-effective crops up to 45...55 mlrd.roub. in 2000, & 85...120 mlrd. in 2010 - in the region (in price of 1984 years).

The great attention in the Aral Sea region must be paid to the not reconstruction of the sea, but of the deltas, especially Amudarya one. Filling of the delta with water, the establishment of number of controlled reservoirs, the practice of irrigation basin method & regular one, the use of irrigated pastures to increase the cattle-breeding, musquash-breeding & fishery will allow to the rise of employment, food production & thus living standarts.

The organization of fishery on watering area (200-250.000 ha of water surface) will exceed the present capacity of 150-200.000 t of fish. what will give products on 0,5 mlrd.roub. annually.

The rest of unemployed popilation have to work in the industry & service. In this view, industry will increase in 1,9 times in a year 2000, and 4 - in 2010, as compared with 1990.

To concentrate on home & foreign investments in industrial production, it is necessary to develop favourable & protected conditions by the reduction of tax on investments; producers, material provisions according to the state supply, hard prices, etc.

In the conditions of republic independence, sovereign rights, the rise of the states interest final goods such as cotton-fibre, silk, gas, minerals, vegetables and fruits will become the most profit canning products with the high-quality processing & the increase of specific cost of agricultural products up to world prices. On the basis of the compensation & barter, the concentration of foreign investments, the creation of Joint ventures well develop the production & advanced technology, probably come to the agreement with Russia to transfer some Siberian river runoff to Central Asia under equal exchange of "water-agricultural products".

By carrying out all construction works by the Central Asian Republics & water economy organizations, such decisions will promote the distribution of labour of the region & the prevention of further worsenning of the demograpgic situation. This transfer will provide 2 mln. people with jobs & will rise it up to 5-6 mln. people by developing low-water-use agroproduction.

Only the intensive solution of the employment problem will be effective in improvement of life & medic services. In this of

view, untill year of 1998 the Aral sea region have to provided will with drinking water, hospitals & dispensaries, special food supply for children. It's necessary to buy urgently 2-3 foreign plants for bottling of mountain water & to build such plants to provide all children of Aral region with drinking water free of charge. To improve the epidemiologic conditions the drainage water waste to Amudarya & Surdarya has to be stopped & the diversion of these watters also while we construct evaporation-lakes.

The versions of social-economic development where suggested, as a result of socio-economic, ecological approach & described analyzes in the region (table 1).

a/ conservation of existing condition of inertia in water supply to Aral sea according tgo previously agreed Government decision by the volume of 125 cub.km in 2000:22 cub per year in 2010;

b/ cutting the irrigated lands area in order supply water to Aral;

c/ similarly, but with making up the employment deficiency by additional working personnel in industry;

d/ realization of the procedures of radical improvement of agriculture on the basis of advanced techniques to 2010: practice of local methods of irrigation & intensive processing of agricultural crops;

e/ redistribution of river flow in the northern part of Central Asian region;

f/ Suberia water delivery and the action of item "DS".

The comparison of various variants of 2000 & 2010 predicts shows unsatisfactory regional socio-economic & ecological situation in any variants. No Variant a/, b/, or c/ are oriented on the support of Aral sea & keeping the tendencies of inertia development can prevent the growth of negative environmental tendencies both in the sea & in the whole region, especially near the Aral Sea. All these procedures are estimated to costg more than 100 mlrd.roub., but don't exclude great damages, which are keptt at the existing level for economics & environment. At the same time these variants don't provide the agricultural production in volume, remaining the supply of food at the level of 1990. No variants will let achieve the population employment of the conservantly, without high ccvaplotal investments. Most of all, all these variants decrease socio-economic indexes in comparison with 1960 or for 20...25 % against the existing level of huge waste for realisation

of the first two ones.

The variant "C" gives the possibility to increase the national income due to the high capital investments achieved by the reorientation of the whole republic's economy directed for industrial development. However in this case Central Asia becomes less provided by agricultural products per unit in comparison with 1960.

In conditions of independence & difficulties in interstate supply such orientation may lead the former republics to the famine.

The variant "D" - the improvement of irrigated agriculture together with the development of drip irrigation by the volume of 5 mln. ha & through processing & variant "E" - Syberian rivers transference will significantly improve the indices of socio-economic development of supply food employment for population & allow high water supply to Aral & Aral region, remaining the attachment of agricultural population to its places.

At the same time, at the level of 2000 these both variants are unreal in time & at the level of 2010 in will able lead to realization.

Therefore the states considers the necessity to use variant "D" for further work. It requires great efforts for the realization & leads not only to satisfaction of the regions requirements but to the solution of food problem using the natural & demografic potential of Central Asia.

In future with worsening of water delivery in Syberia, Ural & northen Kazakhstan & growth of unit tendencies for joint development. Central Asia states basing on water purenase & its barter for agricultural products, may use variant "F" - the improvement & partial delivery of Syberian rivers flow to Aral Sea basin.

III. The enviromental protection in Aral Region and the control of negative conscequences.

Great breaches of natural conditions and geographic position, also the decline in Aral Sea level may be summamarized as follows:

Aral Region:

- delta deserted, the degradation of vegetation, the loss of fishery capacity and musguash-breeding, the worsening of pastures, and dust-weathering from dried sea bed, the rise of climate aridity along the coast strip of 60-100km; the drop of

underground waters and the transition of gydromorphic sautomorphic ones, the water mineralization increase in the sea basin and underground waters are APPROXIWATELly 2 mln hd.

Lower reaches of river:

- the loss of natural waterings; the exceeding of total mineralization in ions; pesticide and herbicide water pollution; the ddecline of river sediments, therefore, the increase of canal losses and infiltration; the loss of natural fertility of lands.

The two special versions of calculations of the sea recovery to level 53 (table 3 and 4) in 2000 and 2010, demonstrate that annual water requirements are 111 and 73 cub. km/year, without taking into account deltas demands. Indeed, it's impossible to get such resources neither in the sea basin, nor anywhere (Siberia, Kaspiy) without any damage to the region and population.

Keeping the sea on the level 38, including delta demands, requires 28.0-30 cub. km. However, the reserving of the sea will not save us from worsening of the environment, moreover, it'll be increased under 39 sea level also.

Since year 1976, there were researching processes made of salt and dust-weathering, deserting of the area, salt accumulation and water dynamics in Aral region, the process of biological clearance of water from salts, pesticides, herbicides and etc. (picture N 3.4). On the basis of above stated researches it was suggested to reserve the rest of the sea basing on the level of the cultural zone, not on the lower hypsometric sea table, the purpose to recover deltas, to prevent deserting, to stop the climate aridity, salt and dust-weathering from the dried sea. There was made appeared a suggestion to create the entire avantdelta along the southern sea coast by Amudarya delta, to create Land-reclamation, irrigation basin method and the number of storages.

In 1989-90 the the fulfilment of the fixed program has begun with the participation of Aral sea region population. It demonstrated, that on the base of irrigation, and drainage water usage and their separate supply, it's possible to develop shallow lakes (55-60.000 ha area) of 3 m depth, where natural ecologic processes may be developed promoted the increase of fishery, musguash-breeding, growing of rush, reed and reed mace of 5-7 t/ha yield capacity.

Under the defined stream velocity, water vegetation is very active on the base of sorption of salt, pesticide and herbicide

absorption.

In coming across of salt-dust-weahtring with water surface, the sediments of hard aerosol increase in 10-20 - times and reaches 70-90% of initial intensity on 15-20 km distance. On the basis of our experimental works & modelling we prepared a suggestion about creation of a new environment profile of Aral Sea coast & part of the sea which permits us to use the real water resources to formulate a new ecological active area with the stable regime of the natural processes & productivity of this area more than initial productivity of the natural biosystem.

In the Aral sea region the great attention must be paid to the reconstruction not of the sea, but of the deltas, especially of Amudarya one.

The first stage of the filling delta with water includes the following steps: the construction of Mejdurechensk reservoir with volume of 500 mln cub m with syphon spillways, Muinaksky & Ribachy artificial basins, the stabilization of Sudochic lake on 53 level, the construction of 3 influent channels from Mejdurechensk reservoir to 3 ones of water intake to the polder system, the creation of irrigation basin systems on the distance between reservoir with in order to recover gydromorphic regime of delta & initial level of underground waters on 160.000 ha area of Amudarya region.

The second stage is a gradual progress of avant-deltas. Now it is suggested to make avan-deltas by the construction of mounting polder system, instead of the first version of the entire avant-delta along the southern sea coast because it's difficult to ensure the uniformity of water distribution & necessary regime of mineralization. In the shallow part of the polder there is a bioplateau made from reed, rush & reed mace for the sorption of pesticide, herbicide & salt. The water supply to the polder will be made in 3 points with 20-25 km interval between them. The central part of the polder (near Muinak) may be used as mother ponds; due to their great dissalinzation & stable depth regime, what is important for the wintering of fish; the most remote parts of the fresh water supply - as fattening ponds. The presence of these phenomenon permits to meet all demands in fish production - the running of water, the absence of slack zones necessary depth in summer of 1,5 m, the temperature of 15-20 C, the nitrate content of 40 mgg/l & less, the mineralization of 3-7 g/l - in the central polder; & 10 g/l - in the remote one.

The sea bed along the tail-water of polder dams have to be strengthened by phyto-land-reclamation method - some raws of the planting - 100-200 m width; also using contour ditch irrigation. The filtration along the tail-water of dikes will promote the moistering of raws & their good growth.

From this perspective it's suggested to make watering zone along the southern & some part of western coasts of 35-40 km which including zone of irrigation basin method, whjat will help to recover delta & to abolish deserted zone along the former sea coast.

According to the calculation, the evaporation of water surface near Muinak of area 600.000 ha (e.g. half of the whole deserted zone) will allow to decrease climate aridity at the expense of evaporation of 4-8 cub Km/year.

The rughtness of such idea was confirmed by the experience of 1989-92 when we fulfill 3 shallow lakes (55...60 th ha area) of 2...5 m in depth with the help of some temporary structures where natural ecological processes were formed and promoted by the increase of fishery, misquash-breeding, growing of rush, reed, & reed mace. The decrease of sediments of hard aerosol on coming across of salt-dust--weahtring with & under water surface increase in 10...20 times & reaches 70...80 % of initial intensity in 15...20 km distance. Taking into account the direction of north-eastern winds (61 %) & north-western 10...12 Km (Pic. 5). For the northern part of Aral sea ability to save the little sea is & all measure here must be directed for this goal.

4. Ways of water saving & increase of productivity of water.

1. WATER SAVING has to free necessary volume of water for the increase of industry production, Aral Sea & possibility of increase of water demand from some water users;

- improvement of activity of Interstate (former interrepublic) water basin organizations, improvement of management of water resources by this BWO decreased losses of runoff in the rivers by 1,5 cub Km/year & we are planning that introduction of II stage of automatization operation system of Syrdarya river & I stage of it in Amudarya will permit us to save some 1.5...2 cub Km/year. These two projects are now proposed to be financed by the World Bank & other sponsors;

- the complex measures by the control of providing of

losses of water in irrigation on the base of:

for year 2000 2010

a/ implementation of advanced methods of irrigatgion techniques (drip, surge, underground, basin irrigation) in the combination with land levelling	mln ha	2,0	5,0
b/ introduction of advanced methods of drainage for the redution of leaching requirement	mln ha	1,0	2,8
c/ rehabilitation of irrigation systems	mln ha	1,8	4,2
d/ lining of irrigation nets on the interfarming level	thouzand Km	28	84

- we expect good results from the advanced methods of irrigation. Our experience in the big scale of research-productive plot projects indicated that drip & surge multifrequence irrigation are allowing to save up to 50 % of water in the field, thus irrigation rate netto becomes 3500...4100 cub m/ha instead of 6500...8800 cub m/ha. The goal of distribution of these methods can be achived on the basis of creation of polyethylen production in the region & own production of drip irrigation system, which now is beginning by SPA SANIIRI;

- conjunctive water market & limiting system of water distribution between waterconsumers. The past 10 years when on the basis of constant administrative pressure & installation of the strict limit of water each year, we reduced the gross irrigation rate in the basin. It shows the necessity to develop a combination of straight administrative measures in the basin, state, district system level with economical mechanizm. The good experience of selffinancing & water payment in 14 districts of Uzbekistan demonstrated effective reduction of above planned water use in farms. We hope that implementation of agreement's relation between water organization & waterusers which will pay the proper part of their common productivity & penalty in big size for the extraouttake & worsening of water quality in sources would create the efficient instrument in water management;

- introduction of rotate waterusing including the increase of usage of drainage water in the place of their formation, the development of purification & demineralization of salt water.

2. INCREASE OF GNP - the most important task of development which has to be founded by the change of scenario of development of society in the industry direction with the final

production goods with the use of own raw & agrarian materials.

- effective use of the agricultural complex in rural areas by wide local processing & upgrading by chain lines;

- creation & introduction of the science full of watersaving highlabour technologies (device, equipment production; electronics; TV; automative & other industry);

- development of chemical production of polymer material on based on use of the natural products (oil, petroleum, gas & others);

- upgrading of mineral resources (gold, cuprum, rare materials, ets);

- the improvement of irrigated agriculture on the base of advanced world experience, introduction of new varieties of crops; expenditure of the programm "Land fertility & New Agriculture technologies", aimed at the cooperation of practical & scientific experiences in the crop-growing, involving the main reserves of irrigated fields by the following ways entire land reclamation; optimal crop selection; the differentiation of agrotechnical methods & the injection of fertilizers; ammendments & chimecals fov inhomogenhious soildependence from their passport clarifications; the improvement of plant selection to achive high yield capacity.

All these aspirations & expensive works must guarantee 16-18 cub.km per year on the level of 2000 year year, 22...25 cub Km per year in 2010 of water for Aral Sea & its coast & also to garantee a satisfactory increase of water consamption accovding to the interests of nonirrigated water users (industry, municipal, & fishfarmers) (table 5).

5. The institutional changes in management of Aral Sea basin improvement

After collapse of the USSR the understanding of the unity of the situated water resources in the basin & its common responsibility for the management & use of water in the region led five Ministries of water economy & irrigation of Central Asia states considered necessary not only to preserve the common management of water on the inter-state level as in the creation of two BVOs, but to develop & strengthen it on more higher conciliatory level on a part with five countries of the basin. With this goal in the begining of 1992 the thesis about common

Principles of use of was reclaimed water management resources. The management organ was organized Inter-state Coordination Water Commission. Both BVOs were turned into constantly acting functional organs of this Commission.

It is important to note that depending upon the earlier existed in the epoch of the USSR proposition when BVO were practically only operative functions of control & distribution of water resources in its way "key about water gate" that already in the first agreement were proclaimed the clear understanding of unity in planning as annual so & perspective of water resources use & development, in control not only for the quantity but for the quality of waters, in realization resources saving & nature protected activity on the improvement of the ecological situation in the basin, especially in the area of the Aral sea.

Proceeding from this ICWC starting from its first steps & conferences gave a great meaning to such questions as the working out a confirmation of the annual plans of water consumption & water distribution on the inter-state level, establishment of the hard limits as on the vegetative as well as on unvegetative season, search for the common technical solutions for all questions of the mutual interests as on rivers as well as on its main tributaries & on main interstate ways of collection & withdrawal of collector-drainage waters, and the further improvement & development of water resources use.

In contrast with the old practices, when water was distributed according to the master plans completely between the republics of the basin, in the present situation during three years water is practically divided between six aggregation water consumers, among which the sixth is the Aral & Aral Sea coast for which ICWC & BVO are strictly controlled for the fulfillment of water delivery into deltas & sea not less than the definite volumes of the annual plan. Such method did not slow down to reflect on the volumes of the ecological delivery & observance of the limits of water delivery to all states, during 1992 & 1993 under the deviation of water delivery to them in the range plus & minus 5% runoff in Aral & its coast with regard for the wateriness, which was 33,5 cub km in 1992 & 23,6 cub km in 1993.

Although the cascades of the reservoirs on the rivers are in different hands, the status of BVO as the distributor of all main structures on the water intakes from the river & tributaries permitted them simultaneously to put in order the water assessment & achieve the considerable reserves of water resources, earlier

hidden as "the channel losses & base removal". BVO "Surdarya" achieved a great success in this aspect due to the appropriate use of ASM system of the 1st part of the basin which worked out & introduced. In 1987-1988, the whole complex of structures, mathematical & program insurance. The perfect work of the operation staff succeeded to include in the account & use of more than 1,5 cub km of water resources of the surface waters.

This volume of safe justified at once all expenses for the creation of ASUB the Istage.

Simultaneously with the direct activity of the operation planning & management of water in the basin, ICWC gave considerable attention to the questions of the perspectives.

Exactly in this trend it is necessary to consider the efforts of ICWC on working out of the single strategy of management, on creation of "Concepts" & "Plan of the necessary measures" on decision of the problem of the Aral Sea basin with regard for its ecological & social-economic demands.

As it is known, these documents, prepared for 2 years by the experts of all 5 states by the initiative & active participation of ICWC, were in the base of the documents of two conferences of the Heads of states in Kazil-Orda & in Nukus in 1993 & 1994 approved these basic state positions & more over raised the action in the basin to the level of Inter-state Council of the Aral Sea basin & its Executive Committee.

Unquestionable achievement of ICWC is the understanding of the necessity of the joint scientific activity on the investigation & improvement of the ways of the optimum management of water in the basin, which was crowned with the creation of Scientific-information center ICWC as SPA SANIIRI as the main organization & 15 design & scientific-research Institutes coexecutors & also by the approval & work beginning from 1994 on a single program of works on water economy in ICWC system. The financing of all actions (BVO SIC ICWC & newly created its secretariate) is computed by all states on the basis of share participation, defined by the special decision, mainly, proportionally to the volume of water intake.

The program of SIC ICWC with the common volume of more than 3 mlrd roubles in the prices of the end of 1993 consists of 7 main tasks: the working out of a single regional water strategy in accordance with the national water policies; creation of a single information system of improvement of water-land resources use in coordination with the system of natural monitoring; the improvement of water quality in the rivers; creation of lawful

base of management of the water resources; creation of a natural protected complex in Aral Sea coast, deltas of both rivers, & on former dried bottom of sea; working out an introduction of ASUB of the 2nd turn of BVO "Surdarya" & ASUB of the 1st turn of BVO "Amudaryua"; the river straightening & river regulation works on the rivers & so on.

It is natural, that sufficiently complicated with situation financing of the independent states, the definite complications on the scope of all questions are necessary for the execution in the sphere of inter-state management of water resources. In particular extremely insufficient means are given for the direct realization of measures for improvement of the calculation system, capital investments on the reconstruction of facilities, channel regulation works, means for discharge of collector-drainage water channel, clearing & perfection of channel river below the Chardarya, direct works on Aral Sea coast.

In this respect a considerable help it is demanded & addition from the side of the Internal organization, in particular, UNDEP, World Bank & other sponsor & creditors. Unfortunately the members of different commissions & delegations who visited & studied our material on the Problem of the Aral Sea & its basin, made efforts that have the character of accumulation of experience of our achievement & mistakes rather than providing real assistance.

It is true that for the last time Mission of MBRR, during 1,5 months together with SIC ICWC on the instruction of Executive Committees of the Inter-state Council prepared TOR on 7 main projects & 12 subprojects for the transmission of financing to the international sponsors, the conference of which is planned for May-June 1994. Nevertheless there are only hopes, but in reality there is no confidence in their assistance.

Such attitude of the international associations is slightly incomprehensible. The complication & crisisness of the situation in the Aral Sea basin was proclaimed & recognized by everyone; it became a subject for hundreds of articles, publications & statements. If the Aral basin would be compared Mekong basin, it becomes clear that the situation in our region is more complicated. Nevertheless, if the international organizations under the pretence of grants & assistance, & credits give the Mekong basin hundreds of million of dollars per 1 year, the real assistance to our region amounts only 1 mln dollars in 1993.

Nevertheless, the deep understanding of these tasks, unity of efforts & means of the states of the Central Asia & , in the first place, workers involved in the sphere of ICWC, their support by the government raise hopes that the solution of the problem of management of water resources of the Aral Sea basin at all levels of its hierarchy will receive the further development in the interest of ecology & social progress of the region.

Prof. Victor Dukhovny
Director Central Asia Irrigation
Institute General director SPA SANIIRI

Fig.1. The dynamics of the distribution of the runoff expenditures between the Aral Sea, ecology & regional development (1960-2010)

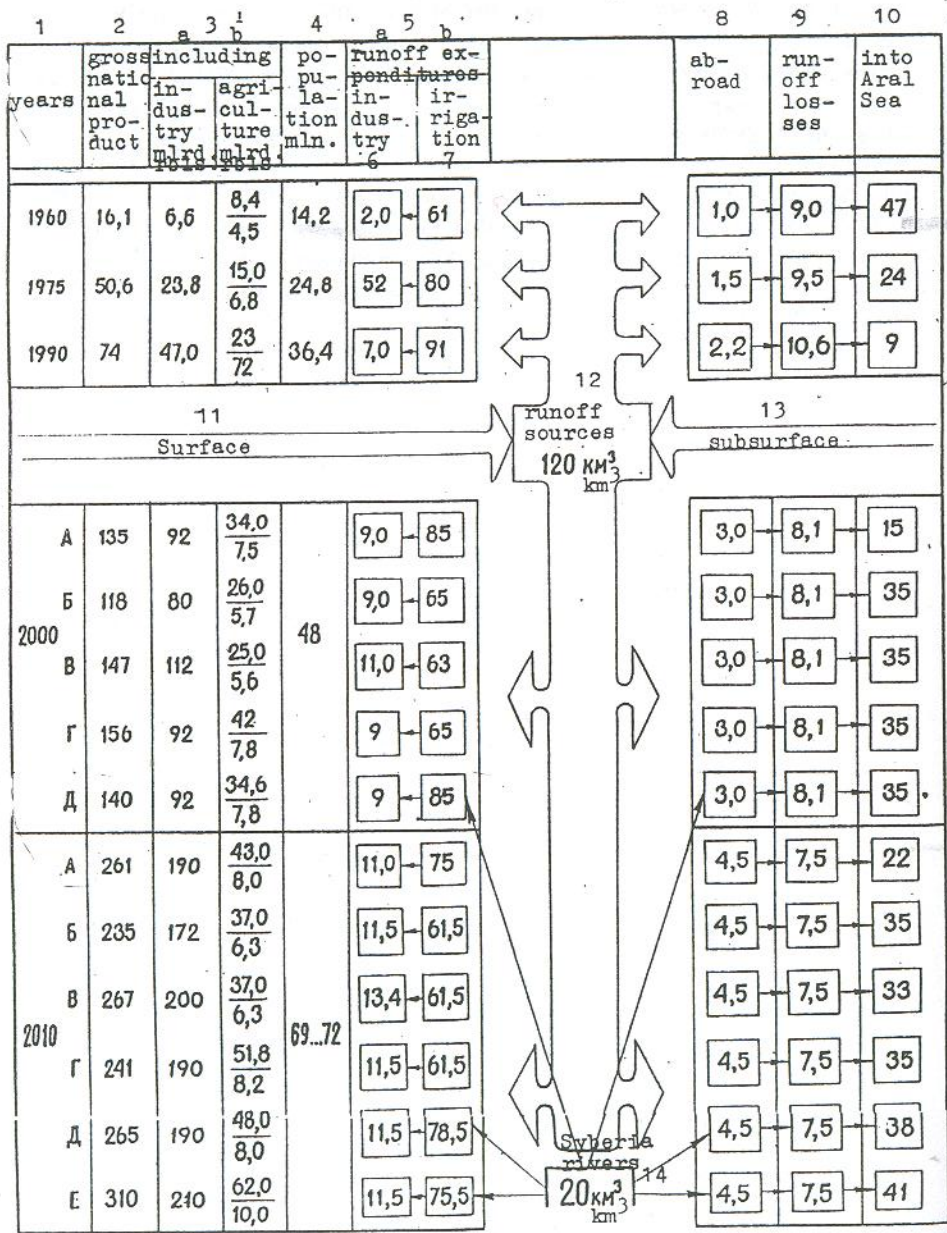


table 1

Dynamics of consumptive use dealing with social-economic developing of Central Asia

Year	Variant	GNP mlrd rbls	National income mlrd rbls	Agricultural production per head (per capita) rbls	National income per capita	Irrigable area per 1 person ha	Consumptive use per 1 person cub m/year	Necessary investments mlrd rbls *	Draw off and runoff per 1 person cub m/year	NOTE
1950		16,1	7,4	590	521	0,317	2460		4470	
1975		50,6	23,3	638	936	0,236	1920		3420	
1990		74	43	630	1105	0,2	1580		2550	
2000	A	135	73,5	708	1531	0,16	1370	152	1968	Aral support & keeping of employment of irrigation 5 mln ha Using the Syberia rivers
	B	118	64,2	541	1338	0,119	1100	126	1542	
	C	147	80,1	520	1668	0,117	1100	178	1542	
2010	D	156	85,0	875	1770	0,16	1100	168	1542	Aral support & keeping of employment of irrigation 5 mln ha Using the Syberia rivers
	E	140	75,2	720	1580	0,16	1370	152	1968	
	A	261	142	614	2030	0,114	965	349	1286	
	B	235	128	528	1828	0,09	782	331	1042	
	C	267	145	528	2062	0,09	805	422	1286	
2010	D	241	131	729	1872	0,117	782	404	1042	Drip irrigation 5 mln ha
	E	265	144	686	2057	0,114	965	379	1286	
	F	320	174	885	2483	0,153	965	458	1286	

* For agriculture & industry only with regard for the Aral problem

Table 2

The change of main features of Aral sea

Years	Level, m	Area sq. Km.	Volume cub. Km	Solt content g/l
1960	53,0	66,08	1061,6	10,0
1965	51,90	61,76	991,87	11,5
1970	50,94	58,01	993,2	13,0
1975	48,59	56,15	797,3	15,0
1980	47,18	54,08	719,5	16,6
1985	41,94	44,60	466,0	23,6
1990	38,29	36,40	323,0	34,0
1991	37,56	34,8	299,0	36,0
1993	36,94	33,31	277,5	39,6

Table 3

The balance of water for rehabilitation of Aral on the level 53 to 2000 year (in cub Km)

Years	Volume cub Km	Level m	Preci-pitation	Under-ground inflow	Evapora-tion	Flow from the river
1990	290,5	38,0				
1991	374,6	39,0	6,3	2,6	35,9	111,0
1992	155,9	41,5	7,1	2,3	39,0	111,0
1993	556,3	44,0	7,4	2,0	40,0	111,0
1994	615,5	45,5	7,5	1,7	41,0	111,0
1995	694,45	47,0	7,5	1,5	41,05	111,0
1996	771,65	48,5	7,9	1,4	43,1	111,0
1997	546,20	50,0	8,4	1,2	46,0	111,0
1998	920,35	51,0	8,7	1,2	46,8	111,0
1999	993,9	52,0	9,5	1,05	48,0	111,0
2000	1061,6	53,0	9,9	1,0	54,2	111,0

Table 4

The balance of water for rehabilitation of Aral on the level 53 to 2000 year (in cub km)

Years	Volume cub km	Level m	Precipitation	Under-ground in flow	Evaporation	Flow from the river
1990	302.6	38.0				
1991	349.6	38.0	6.3	2.7	35.0	73.0
1992	396.1	39.5	6.4	2.4	35.3	73.0
1993	440.2	34.0	6.7	2.25	37.9	73.0
1994	481.7	42.0	6.9	2.2	38.6	73.0
1995	525.0	43.0	7.0	2.1	38.8	73.0
1996	553.3	44.0	7.25	2.0	41.0	73.0
1997	594.4	44.5	7.35	2.0	41.2	73.0
1998	647.1	44.5	7.5	1.8	42.0	73.0
1999	687.1	46.0	7.7	1.6	42.9	73.0
2000	725.7	47.0	7.8	1.50	43.7	73.0
2001	764.6	48.5	8.0	1.40	44.5	73.0
2002	791.1	49.0	8.2	1.3	47.0	73.0
2003	838.3	49.5	8.4	1.2	47.4	73.0
2004	869.2	50.0	8.5	1.2	47.8	73.0
2005	904.2	50.5	8.5	1.2	47.8	73.0
2006	938.8	51.0	8.6	1.2	48.2	73.0
2007	972.0	51.5	9.0	1.2	50.0	73.0
2008	1000.5	52.0	9.3	1.1	51.9	73.0
2009	1031.9	52.5	9.75	1.05	53.4	73.0
2010	1061.6	53.0	9.9	1.0	54.2	73.0

Table 5
The growth of water consumption for industry municipal and fish farms, cub km.

NN	Region, river basin	Level routing(year)						
		1985	1990	1995	2000	2005	2010	2015
1	Amudarya back consumptive use	1,95	2,5	2,8	3,1	3,5	4,23	5,25
2	Sewage rivers back consumptive use	0,5	0,5	0,5	0,6	0,6	0,6	0,6
3	Syrdarya back consumptive use	1,8	1,8	2,2	2,8	3,3	3,88	4,6
4	Total on region	15,5	17,0	18,2	19,9	23,6	28	32,3
	income and usage of fresh water including:	10,0	10,2	10,2	10,2	12,5	15,2	17,6
	industry	4,1	5,2	6,3	7,8	9,3	11,0	12,9
	municipal farm	1,4	1,6	1,7	1,8	1,8	1,8	1,8
	fish farm	4,23	4,83	5,47	6,47	7,42	8,71	10,45
	back consumptive use including:	1,6	1,9	2,4	3,3	4,4	5,8	7,5
	industry	1,23	1,23	1,37	1,37	1,22	1,01	1,15
	municipal farm	1,4	1,6	1,7	1,8	1,8	1,8	1,8
	fish farm							

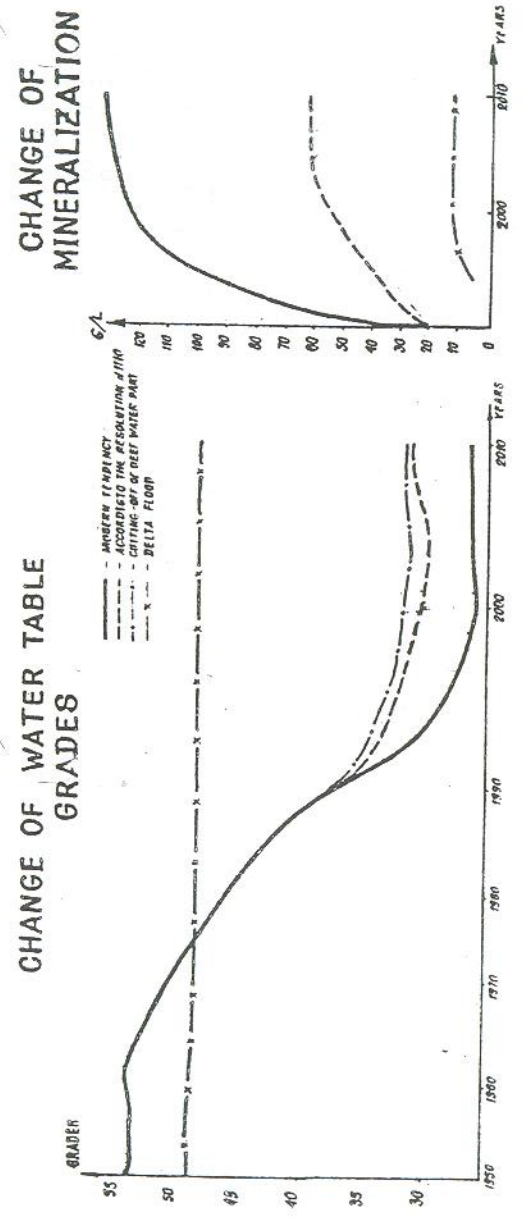


fig.2

fig.3
 ALLOCATION OF DRIED AEROZOLES ON THE SOUTH REGIONS ADJACENT TO ARAL SEA (T/HA PER YEAR)

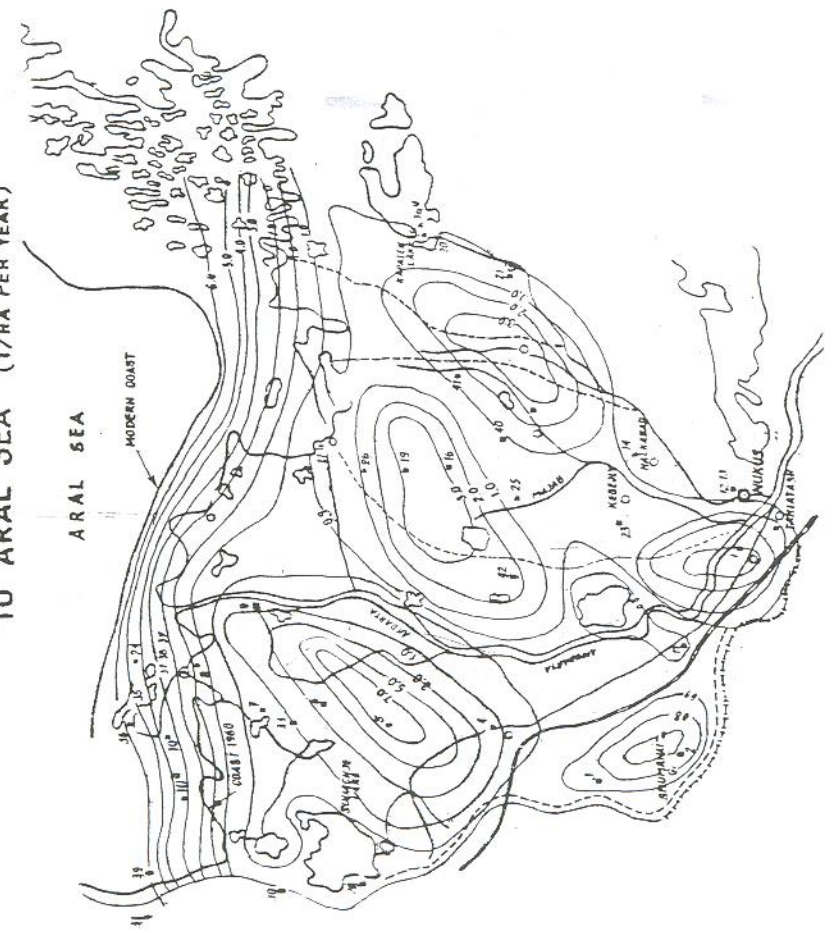
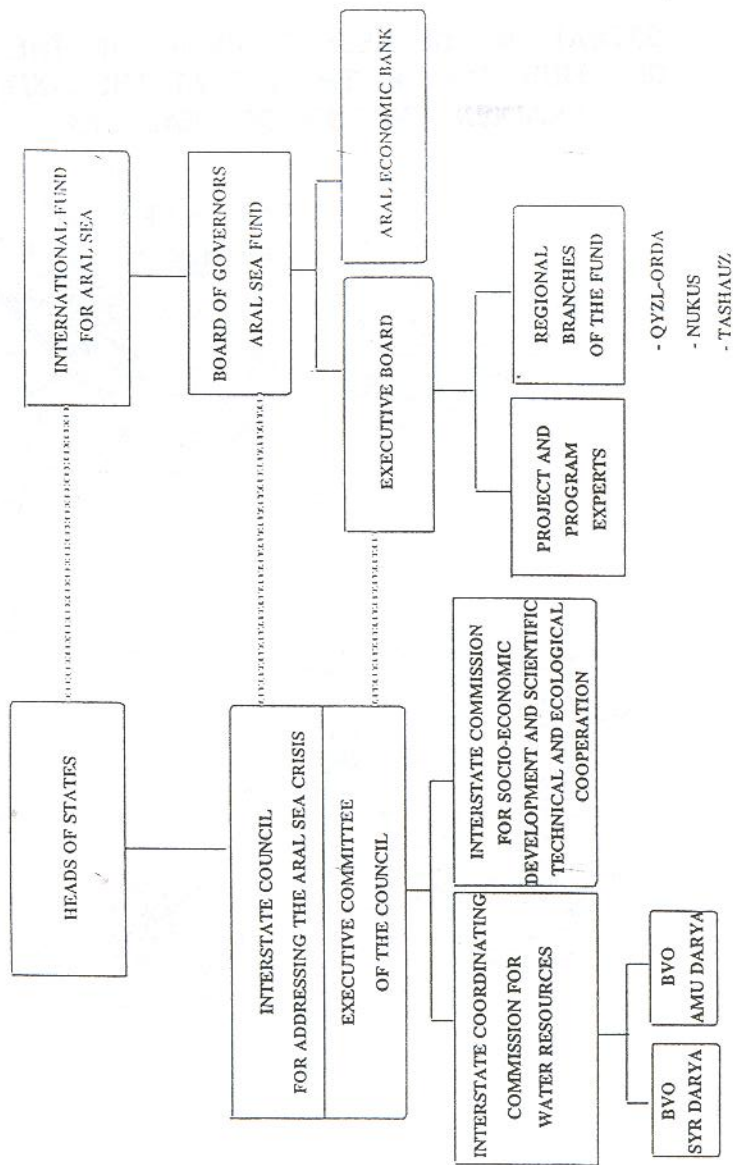


fig.6

The Structure of Interstate Organization for Addressing the Aral Sea Crisis



PRINCIPAL PROVISIONS CONCEPT

Concerning Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan on the Resolution of the problem of the Aral Sea Basin with allowance for Socioeconomic Development.

To the main text of the principle provisions of the subject Concept were laid the proposals of the representatives of Kazakhstan (1992), which has been largely worked out by the working team at the Cabinet of Ministers of Uzbekistan (1991 -1992). It also includes all other data of the project and research organizations of the Republic, the materials of the Ministry of Melioration and Water Management, of the State Committee on Environmental Protection, of the Academy of Sciences of Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan as well as materials of the World Bank Mission's presentation on the problem of Aral sea and a number of other documents.

The problem of the Aral Basin, of the Aral sea itself and the air balance around it are being associated in tense relationship with the peculiarities of the Central Asian Region, with its geographical and natural characteristics in consequence with the past, present and future socioeconomic development.

The established for the last decades agro-rural trend in the economy of the basin has brought this region into a very hard conditions in solving the most important tasks of the economy. Though the national income was growing per capita but it was always less than in other developed regions of the FSU. Cotton growing, first in the interest of cotton-independent country and then for the needs of export has occupied more than 50% of all irrigated lands and taken more than 50% of all water resources.

The strategy of the all-union labor distribution has made the Republic to import meat, milk, potato and other products and commodity goods.

In the arid climate conditions and of the isolated basin's nature, at the increasing growth of water demand there appeared the problem of Aral sea, as the result of long, careless and reckless exploration of basin's resources when there were used about 60% of all water resources of the region that is around 55-60 billion of cubic meters annually, that's the volume of water taken from the sea over its stable level before.

Before 1960 the general resources of surface and underground waters were feeding the Aral sea equally distributing between the creating of the national income - 65 cubic kilometers and of a inflow expenses - 57 cubic kilometers annually for filling in the sea. Together with it when on the basis of water and farming management there were created 55-60% of GNP and only 10-12% of end product and that might inevitably bring to socioeconomic crisis. Large scale irrigation and the low culture of the land development and as well slow industrial progress and the high growth of population brought to the reduction of the national income and of the life standard, slowing up to the public production and to more dependence on import. To slow up these negative processes the Central Asian Republics were increasing the efforts on decreasing the efficient consumption of water (for a decade they have decreased by 5 thousand cubic meters per hectare) and on the growth of the soil productivity. But for a lack of industrial development they couldn't stop the total fall of the efficient indications of the agricultural production of the rate of water supply per capita.

In the condition when all incomes from the main branch of agriculture were concentrated in other regions but the producers of agro production were financed through the "subsidies" these circumstances determined the low level of social and sanitary-epidemiological service and health care in the region.

That was reflected first of all in the poor supply of drinking water to the 50% of the population, in the shortage of hospitals and other medical clinics.

This situation was much worse in the Aral Sea Basin for the changing of hydrological regime and the destruction of the habitation medium, worsening of the quality of water in all the

region in all sources with the invasion of the deserts as a result of the level of Aral Sea.

The unfavorable socioeconomic and sanitary conditions and the uncontrolled usage of pesticides up to 20 - 25 kg per hectare have told negatively on public health in the Aral Sea Basin. During the medical control of the adult population in the Aral Sea Basin there were registered medical disorders at 63.5% of population in Karakalpakstan; 72.6% in Khorezm region of Uzbekistan, in Dashkhovuz and Lebakh viloyat (regions) of Turkmenistan. Children's disorders accounted consequently for 66% and 70%. The rate of medical failures in intestine infectious diseases in the region is three times more than that of other areas in the FSU. The situation is alike in Bukharam Dashkhovuz and Kzyl Orda regions.

In this connection this concept may not be examined separately of the problems in the region and of priorities of socioeconomic demands of the population living in this region on creating the satisfactory ecological situation.

The concept is coming out of the general decision of the socioeconomic problems of the region with a view of the growth of population by the 2000 at 1.5 times and by the year 2010 at 2 times.

The modern conditions as political as well as economic bring certain constraints to the solution of the critical issues of Aral Sea Basin. The breaking up of economic ties with the FSU republics, the inflation growth and the monopoly obstacles have turned this Central Asian zone into the extremely economically and ecologically poor area.

It's quite natural, that the Concept should be based as on general ideas, measures and tasks aimed to come out of the vexing situation of all interested states, as well as on peculiarities and definite goals of each of them.

Taking into consideration the specific aspects in economic, social and economic conditions of every country, the Concept nevertheless puts out an objective of working out the joint measures and outlooks on the formation of the specific and scientific ways of improving the socioeconomic, medico-biological and ecological situation in the Aral Sea Basin.

Considering this, the aims of the Concept are:

- definition of the main trends in region development, in order to provide the necessary level of the social-economic existence with limited water resources, primarily in Aral area and in economically backward regions of the basin considering new economic conditions;
- creation of the right solutions on preservation of ecological balance of the decreased basin of Aral Sea, and of the means for elimination of negative influence of ecological crisis in Aral area;
- improvement of the hygienic and health-care and biological conditions in Aral area ;
- definition of the reasonable means on water supply and water resources improvement considering possibilities of watering of Aral area and the economical reasons.

I. The definition of trends of social and economical development under circumstances of limited water resources.

The Concept had taken into consideration several variants of development for the region including existing water resources and external water resources.

As a result of study of possible results by 2000 and 2010, the variant, recommended by the Concept, includes radical changes in trends of social and economical development (Improvement of water supplied agriculture together with development of local water-supply systems up to 5 mln. ha. and with more complete utilization of agricultural resources).

The basis of the new way of development in current background is water saves, that is, the reduction of average water spending for one unit of product in all of the fields of national economy.

Under conditions of arid region, the total; economy of water becomes the primary responsibility of the society, because it influences the development and ecological improvement of the region.

These circumstances, considering demographical situation, define the primary trends of reasonable utilization of existing water resources:

- In irrigated agriculture- to ensure strict management of hydromelioration systems and to provide the keeping of water spending of end water-users within reasonable amounts, with further implementation of economic systems of irrigation and watering technologies, that requires investments;

- in consumer systems - to upgrade water supply systems and pipe works, implementation of proper equipment, definition of reasonable spending amounts in city areas and rural areas;

- in industry - to decrease average water spending by implementing the recycling systems, and further by development of non watery technologies.

The limitations of the water resources impact negatively whole social development and require:

- solution for the food supply problem and improvement of other fields of agricultural industry, basing on water-saving methods, by more complete implementation of existing resources;

- solution of the employment problem and in common- concerning the whole economy of the region- to make shift from water-demanding technologies rather to labor-demanding ones, try to decrease the amount of water spent in the industry by increasing the amount of labor spent, which will also improve the employment situation, especially this should be done in textile, light, food, mining, metallurgy, machinery-building and oil-gas industries;

- solution for the problem of ecological improvement of region, and primarily the Aral area, by providing the quality control for rivers, and by creating the artificial complexes that will simulate natural purifying of waters;

- the approval of contracts, laws and decrees on water usage, considering old agreements as well as changes in society and economy.

The utilization of water-saving methods and technologies in irrigated agriculture, melioration, other fields of economy will change rapidly the hydrological and economical parameters of watering systems and will decrease the maintenance expenses and increase the reliability of the investments.

Further development of agriculture and industry in Amudarya and Syrdarya rivers basins should be in accordance with requirements mentioned above, and should be conducted by each state within the limits and defined amounts to be able to fulfill the internal needs.

II. The investments

The states of the region have limited abilities for investments. To attract foreign and local investors for creation and improvement of labor-demanding but not water-demanding industry, it is recommended to ensure the creation of favorable conditions such as low taxes for investors and producers, the licence-free and tax-free export of goods, received as compensation for investments and so on.

In order to attract local and foreign private, cooperative and other free funds, it is supposed to be reasonable to promote in any ways the organization of the shared capital enterprises that will be dealing not only with development of watering system, but investing in common economical development of regions. The promotion will include the favorable conditions of credits and refund.

The implementation of resources of international organizations, banks, funds, for fulfillment of different programs concerning the improvement of watering system. This will be achieved successfully by cooperation of states of Central Asia.

III. The means of improvement of living conditions and health care

Considering the high ratio of rural population and climate conditions, it is considered most reasonable to solve the problems of employment and increasing of national product by creating in rural zones the factories of end processing of the product, and other labour-demanding small industries. The experience of certain areas on creation of small industries in rural zones is to be supported and developed by the means of enterprises with shared capital of the appropriate level and size. At the same time, pay the most attention to Aral area and other backward zones of the region and for this:

- to require the approval by Central Asian states of legal documents on social status and social aid for people suffered in ecological disasters;
- to provide the special attention and primary consideration for industry and agriculture on expenses of state investment funds.

By 1997, the supply of all the dwellings in Aral area with water should be completed, the hospitals and other health care institutions should be created as well as children institutions, and the special program "Ration" should be conducted. It could be reasonable to buy several lines on water bottling, in order to provide the population of Aral area for minimal price with the clean water, in zones where central watering system will not be introduced soon.

Aral area recovery is not possible without taking practical steps on stopping of pollution of rivers with mineralized post-irrigative drain flows. This is the reason to speed up the building of Left-Bank and Right-Bank tracks. To start working on stopping in nearest years the drain flows drop-in's to Amudarya and Syrdarya and other water arteries of the region, including drop-in's on a territory of bordering states. To locate and define the pollution sources in the basin and create a plan on their elimination, by building of the purifying systems and artificial plates. At the same time, at all levels, from state to single-farm, to create the program of decreasing the water spending per one product unit, thus decreasing the rivers pollutions. To improve and install the biological methods of plants protection, decreasing the usage of pesticides and herbicides, mineral fertilizers, and improve the usage of nitrofixation inhibitors in order to increase the strength of fertilizers.

Though the demineralization of post-irrigative drain waters is very expensive and energy spending, consider this to be the subject of primary interest, and develop this field.

Total medical registration and control over the population of the Aral area and location of most usual diseases in order to provide solution on this, assigning people suffered most to certain health care institutions for treatment and control.

Starting in 1994, begin the creation of special health care centers in Aral area.

Until dedicated staff will be trained, keep sending the personnel from other health institutions of state.

The creation of good living environment includes recovery of nature, water, air, improvement of food ration, communications and transport. The recovery of nature is the most important and others depend on it somehow. So the most attention now should be paid to this problem, using experience of Kazakhstan and Karakalpakistan, help of other countries, Russia and foreign sources.

IV. The solution of Aral problem and creation of system of area watering

The recovery of the sea up to the 53th mark requires yearly input of 65 square kilometers of water until 2010, without requirements of delta. It's too difficult by now. Keeping of the level at 38th mark is more possible and requires about 30-35 square kilometers a year. But simple to keep it still is not enough because of the natural processes of desertisation.

The researches and the actions conducted since 1989, have let to improve the climate and the condition of the dry bottom parts of sea, allowing even some breeding around.

The aim is to create stable ecological system, that will be improving total situation.

As expert researches showed, the creation of watered zones in deltas of both rivers will

let to decrease the aridity of the climate. The work on creation of artificial ecosystems in deltas and dry sea bottom are to be considered primary (on total Aral level) and should include the following actions:

- creation of the regulated system of basins for Amudarya and management of the part of Small Sea for Syrdarya;
- artificially irrigated landscape ecological systems on dry sea bottom and at deltas;
- phytomelioration on moving sands fixation;
- including drain flow waters into aguatoria through the sand areas.

At the same time the zones of salt balance should be defined and information obtained should be taken into account while planning.

V. Water resources change forecast used for further definition of resource usage

The forecast is created on information about total refilling resources of two basins, Amudarya and Syrdarya, including underground waters- 120 sq. km. yearly.

The population growth, water supply improvement in consumer field, will help in further development of new water system described above.

Under this conditions, spare water supply for Aral sea, delta and irrigation are by 2000, 100 thousand sq. km. and by 2010 - 97 thousand sq.km per year. Among these, the resource for Aral area should be averagely not less than 22.000 sq.km.per year. The amount of water supply exclusively for Aral area is defined yearly by Interstate commission, considering dryness of the year.

The cooperation is necessary with other states on utilization of external water sources in order to increase the amount up to 30 and more sq. km a year.

The first step should be the improvement of state level water management institutions. Certain structures created by the governments has already played positive role in situation improvement.

Further implementation of this interstate management system is necessary.

- Creation of legal documents on joint activity of the countries of basin, agreements and rules of participants;
- development of "Syrdarya II" project, implementation of " Amudarya I" project and introduction of the new methods of water purification.;
- creation inside of management institutions the division of control for underground water systems, quality control and management of appropriate delta areas, monitoring of region natural conditions.

- the improvement of water resources prediction including aerophotocontrol and glaciers control;

- the monitoring of natural events influencing or connecting with water resources, including the problem of Sarez lake;

- the creation of united policy of joint actions on water saving and constant reduction of average water spending that will free up water resources in region.—

The actions on reduction of water spending, drain systems repair and reconstruction and drain flow clearing at Aral area should be conducted in all the states simultaneously.

The priority should be given to the development of new irrigation technologies such as capillary, insoil, and high-precision irrigation, that should decrease average water spending by 50% and increase product quality.

During reconstruction of drain systems, inside of Aral basin, the priority should be given to low-tech technologies.

Together with this, the average water spending will be decreased by :

- changes in seed planning for the area;
- while seeding the preference of less water-demanding species;
- recycling systems implementation.

The important role could be played by improvement of conditions of mountain areas, their forestry, and natural flow system.

The coordinated utilization of these methods by all of the states of region will make economy of 10 - 11 mln. sq.m. of water considering the decrease of secondary waters.

VI. The Concept implementation system.

After approval of this document, the schedule is defined, that will include projects, described in Concept. The schedule is to consist of three main steps: urgent (3-5 years), primary (5-10 years), and secondary or long-term (10 years and more).

The definition of projects by these and also regional categories is to be conducted by Interstate Council, with its management institutions and through the governments of the countries.

All the construction works should be financed by and on expenses of states-participants, from funds dedicated to Aral problem by them and by other investors and from grants and credits of World Bank, and other investors.

Confirmed by the Nukus Conferense of Heads of 5 States of Central Asia with participation of vice-chairman Russian Federation on 11 January 1994.

Prof. Viktor Dukhovny
SANIIRI

The Concept

for the solution of Aral sea problem and measures of the 5 states for improvement of ecological situation in the basin.

The aspects of the Concept had gone through two years of elaboration by the group of experts, specialists & government representatives from the 5 Central Asia States. The final version of this work was confirmed on January 11 1994 at the Nukus conference by the Heads of Central Asian states: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan & Uzbekistan with the participation of deputy chairman of government of Russian Federation.

The following goals were crucial in the framework of the Concept for solution of Aral sea problem:

- the necessity to organize the implementation of the measures for improvement of ecological situation, that could stop complication & environment of Aral sea coast & drying bed of sea:

- besides, this main ecological aspiration is to enforce the technical & water actions for the reduction of negative consequences of water usage, the quality of water in rivers Syrdarya & Amudarya & ground waters;

- the joint approach to the improvement of Aral sea situation developed by the 5 states of Central Asia is taking into account the necessity to satisfy requirements of water, food, employment of population in the region, which is characterized by high birth rate. In other words - the improvement of Aral sea environment has to be accomplished with the creation opportunity for socio-economic progress of all 5 now independent States of Central Asia.

Due to the limited quantity of water in the basin and the need in assessment of the requirements of both sides (ecological and socio-economic) of the region it is necessary to take into attention the interests of each country of contemporary times. The Concept received (as a framework) impossibility to rehabilitate the Aral sea in its initial state and the necessity to form new ecologically stable profile of changed system of water-land protected landscape in the drying bed of aral sea.

On the basis of this framework the more detailed description is presented in the text of Concept, which is distributed

for the participants of section.

The decision of Heads of the 5 States confirmed the "Plan of Actions", which includes 7 main programs:

Program 1

"Preparation a general strategy of water usage and protection of water resources in the Aral sea Basin" - is a main programs, which stimulate the elaboration of single regional water, land and environment strategy for the future development of region, which will guarantee the creation of good conditions for economy, population, society and nature.

The especiality of this program is the right interrelations-between interstate and state strategies of each country: the coordination of international and national, interests for

common prosperity, the prevention of conflict's danger between them, between the economic and the nature, between upper and lower parts of basins, indeed between different branches of economic development of waterusers.

All this must be taken into account in the preparation of guidelines and optimal model of future measures, which will be planned in all programs of Aral sea Plan Actions in their interconnections and progress.

The program includes:

- the assesement of present situation in the basin of economic, ecological, social, legalislative and other sides;
- the assesement of ability to satisfy the national demands in water, land from the point of view of national interests and their coordination in the basin and the requirements of the environment;
- the definition and alternative selection of contents measures for the success development of Aral sea basin; the planning of these actions take into attention the priorities difference from them;
- the ellaboration of institutional, legal, information, technical, ecological measures for carrying out and providing this strategy.

The project will produce an approved regional strategy containing a set of water management action subprograms, recommendations in basin-wide legal and normative acts, capacity of development through training, institutional strengtheuing, ening technical and equipment assistance.

The total cost of project is expected about 5 mln USD, including preparatoryphase on 6 month - 375 th. USD.

Program 2

"The preparation and introduction aunified system of

water availability and consumption measurement; regional system of monitoring the environmental situation" - has task to create singlem high quality interactive regional information infrastructure which will served the necessity of all 5 States, international organizations and will give ability to supply them by real data and forecasts. It includes the delievery ans installation of the most modern hydrometereological data gathering, transmission, recieving, procesing and dissewination equipment; the electronic access to the global hydrometeredogical and climatological networks.

The system includes the process of building electronic data bases on some levels of ierarchy: "Basin - state - irrigation system (or water users assosiation) - wateruser (or field)". The principal objective of system is to facilitate the exchange of data and information about water, landuse, environment, socioeconomic consequenses between regional and national decision makers and managers.

The common cost of Programe is 30 mln USD including preparatory period 2,5 mln USD.

Program 3

The workins our principles of improving water quality and limiting pollution - has the next objectives:

- conduct an assesement of all significant sources of water pollutionin the basin;
- conduct Pilot Programs and develop action plan of priority investments for reducing pollution from irrigation;

- prepare the water quality arangement programs on the base comparison of alternative options: different scheme collection and removal of drainage and waste waters; reusage of mineralized and used water; reducing of quantaty and contents of salts in return flow, ets.

The cost of project 15 mln USD includes project preparation 415 th. USD.

Program 4

The preparation projects and creation artifically watered landscape ecosystems in the deltas of the Amu-Darya and Syr-Darya rivers and on the exposed Aral sea-bed - begins from the undertaking of research works and the carrying out the experemental projects directed by the decision of this program. The comparison of efforts from different versions of these measures will permit to select the common plan of protection actions for the deltas and sea.

There are some subjects of the program which differentiate:
- the North part of Aral sea (so called "Little sea") can

be saved as a dividing part of former sea and supported on the level 38 with the appropriate engineering work. If low part of river bed of Syr-Darya will be rehabilitated for the flow of needed discharge of water, these measures will permit to create joint landscape in the combination of Little sea and Syr-Darya delta:

- the creation of new ecological profile of south part of Aral sea as a complex of some zones of watering delta of Amu-Darya, chain of polders; a forestation of drying sea's bed and others;

- the ecological studies and assesment of ability saving and protection of proper part of "Big sea" with accoument of future usage of water in Aral sea basin;

- the forecast and plan protection of environment of Aral sea include the quality of water, control of salt and dust storms, biodiversity, cimmology and climate change.

The common cost of program is near 100 mln USD including preparation period- 1.7 mln USD.

Programm 5

Preparation and implementation of intergovernmental plan to clean water and health - is directed on the clean water guarantee for population of low lands of both rivers and Aral sea coast.

In its content the development of existing and ground water well field, new transmiion tubes for conducting of fresh water, the building of sewerage and sanitation systems for cities in the region. All measures are dividing on short term (one year), middle term (3...5 years), and longterm (more 10 years). If two first parts of programmes will begin immideteally; the last part would review to posibilidady and design of Planned works for the improvement quality of drinking water (Tryamuyn Reservoir, treatment plants, booster pumps) and alternative sources such as desalinization plants or pipelines from distant but highquality mountain scources.

The cost of all project is more than 100 mln USD, but first stage - 8.25 mln USD.

Programm 6

Integrated land and water management in upper watershed - must reflect the espeliaties water and agriculture activity in

Kyrgystan, Tadjikistan and part of Uzbekistan where begin the antropohenic influence on the changes of quality and quantaty of natural water recources and which definite the ability of reducing of those influence finaly. The objectives of project are to:

- assess existing conditions and impacts of water and land management activities on surface waters, groundwaters, soils and so;

- investigate assess, and implement on the Pilot Plots more appropriate methods of this management for the decrease of impact on the whole basin;

- predict and plan possible improvement in envirenmental quality in result of implementation of remedial actions.

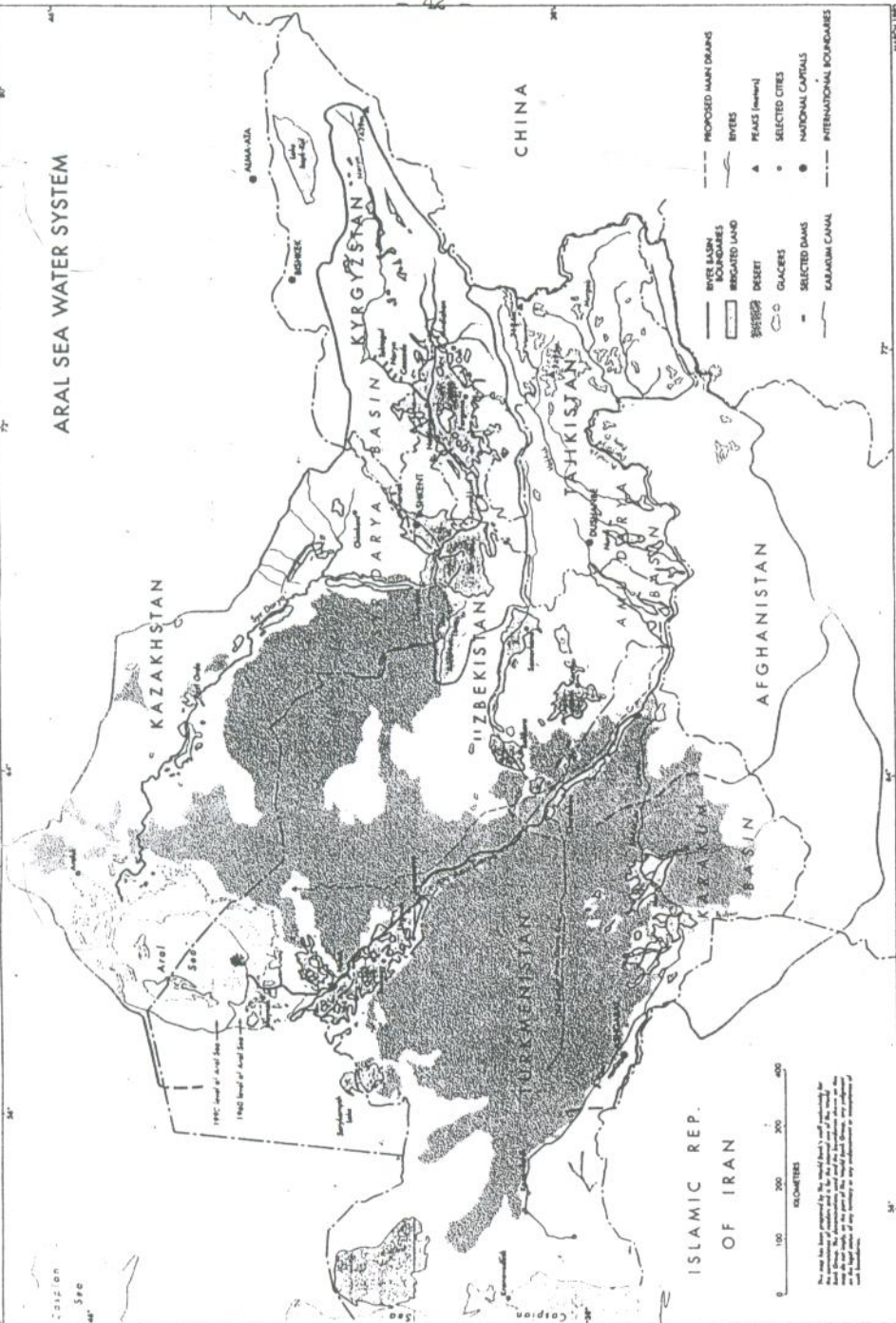
The total project costs are estimated to be 2 mln USD. Project puparation - 200 th USD.

Program 7

The creation of automatic control system for water management of Syrdarya & Amudarya rivers - is planned to provide real time automated regulation, covering all main structures in both rivers, capacity building for two basin water organizations & on base of this - to save near 2...3 mln cub m of annual water. As a base of this work the first stage of ASM Syrdarya, which was executed last 10 years would be used with improvement of modern computerized technology, including the monitoring & management of quality of water, connections with Aral sea and so.

The common cost of this two project is 150 mln USD for BWO Amudarya & 25 mln USD for BWO Syrdarya, first stage for both project approximately 4 mln USD.

ARAL SEA WATER SYSTEM



ISLAMIC REP.
OF IRAN



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- PROPOSED MAIN DAMS
- RIVERS
- ▭ IRRIGATED LAND
- ▨ DESERT
- DAMS
- SELECTED DAMS
- INTERNATIONAL BOUNDARIES
- ▲ PLACES (shown)
- SELECTED CITIES
- NATIONAL CAPITALS

CHINA

KAZAKHSTAN

KYRGYZSTAN

UZBEKISTAN

TAJIKISTAN

AFGHANISTAN

TURKMENISTAN

AMU DARYA BASIN

SYR DARYA BASIN

Scale
See