

A SURVEY ON SOCIAL ISSUES IN REPLACING EFFLUENT WITH AGRICULTURAL WATER RIGHTS (CASE STUDY : REPLACING MASHHAD EFFLUENT WITH WATER RIGHTS FROM KARDEH RIVER)

ENQUETE SUR LES QUESTIONS SOCIALES RELEVANT DU REMPLACEMENT DES DROITS DE L'EAU AGRICOLE PAR DES EAUX D'EFFLUENT (ETUDE DE CAS : REMPLACEMENT DES DROITS DE L'EAU DE LA RIVIERE KARDEH PAR DES EAUX D'EFFLUENT MASHHAD)

Papoli Yazdi (Dr.)¹

ABSTRACT

Over use of groundwater in Mashhad plain has resulted in a sharp decline of the water table. Because of draughts and increase of water consumption due to growing population pressure in Mashhad, one solution proposed by authorities was to compensate water scarcity by substituting the city effluent for a part of the water of Kardeh River that is now being used in agriculture in Mashhad. The project was approved and it is under execution now with cooperation from the Government, Executing agency and consulting companies. Olang and Parkandabad waste water treatment plants were constructed and transfer facilities to upload the effluents to the farmers' fields were made. There were many social problems in executing this project. So a survey on social problems associated with the replacing a part of the fresh river water by the treated waste water as well as the contract issues with farmers, was carried out by the Amayesh & Tose-e-Shargh Consulting Co. Some economic and social problems as well as some acceptable solutions in this project are discussed in this paper. Field study and dialog with farmers were the main method of investigation. The analyzed views show that the majority of people accept the change of

¹ Retired Professor of Tarbiat Modares University Tehran, Head of managing board, Amayesh & Tose-e-Shargh consulting Co., president of Amirkabir Research Institute, No 92, Sajjad BLVD, Mashhad, IRAN tel: 0511-7640040-44 fax: 7621658 e.mail : info@amayeshco.com or iramirkabir@gmail.com or papoli.mh@gmail.com

their right to fresh river water for agriculture with effluent, but they complain that the effluent quality is not acceptable and the quality and quantity of their agricultural produce were inferior to what they got when fresh river water was used. They believe that wastewater should be treated based on the world standards for agricultural irrigation.

Key words: effluent, agricultural water, Kardeh River, social result, social and economic problems.

RESUME ET CONCLUSIONS

Mashhad plaine dans la partie nord-est de l'Iran avec un climat semi-aride est l'une de la plaine les plus vulnérables contre la pénurie d'eau et la sécheresse. De nombreux siècles auparavant les seules sources d'eau pour la ville de Mashhad a été le métró, Qantas et les ressorts. Ces sources d'eau ont été assez seulement pour 100 colonies milliers. Mais aujourd'hui, la population de Mashhad est plus de 1,5 million et plus de 4 millions de pèlerins et de visiteurs viennent chaque année à Mashhad avec hébergement moyenne de 10 jours. Parce que de plus de retrait de la nappe phréatique au niveau de l'eau souterraine a chuté d'environ mètre à quelques centaines de mètres. Donc, le problème de pénurie d'eau à Mashhad est le plus grand obstacle pour le développement de cette ville. Il existe deux grands barrages près de Mashhad qui irriguent les terres agricoles du nord-est et le sud-ouest de Mashhad. Bien que certaines quantités d'eau à partir de deux barrages, Kardeh et Torogh, sont transférés à Mashhad ville pour l'utilisation résidentielle et industrielle, mais cela revient de l'eau ne suffit pas de pénurie d'eau Mashhad.

Une bonne solution proposée pour la compensation de la pénurie d'eau était de remplacer les droits d'eau des agriculteurs des deux barrages et les droits des propriétaires de puits d'eau avec un volume d'effluents Mashhad (eaux usées épurées). Le projet approuvé et un grand plan de système de collecte des eaux usées ville est sous-performance aujourd'hui. Certaines stations d'épuration ont été construites et les effluents de Parkandabad et Olang est maintenant transférée sur les terres des agriculteurs dans certaines parties de la zone du projet. Au cours de la prise de décision, l'étude économique et sociale du projet ainsi que la préparation du texte de l'accord pour un contrat avec contract titulaires de droits d'eau à partir des deux barrages et aussi avec de l'eau aux propriétaires de puits ont été remis à Amayesh Consulting Co. à Mashhad. Le résumé de l'étude sociale réalisée par la société de conseil est comme suit:

- A. *La zone du projet se compose de 17 villages à l'aval du barrage Kardeh, sept villages des usagers de l'eau du barrage Torogh, 16 puits d'eau du centre de recherche de Torogh, 7 puits d'eau de Shirin usine de sucre, 7 puits d'eau de Forest Torogh Park*
- B. *Sociales et économiques dans la zone d'enquête du projet ont été:*
- *Introduction à la situation actuelle*
 - *Sciences sociales et économiques de collecte de données et une enquête de la croissance de la population*
 - *Trouver et faire une liste des ayants droit à partir des deux barrages ainsi que la liste des propriétaires de puits et de leurs droits pour les prélèvements d'eau à la séparation des villages.*

- *Collections de vues de tous les propriétaires de droits d'eau et les droits de non-personnes de l'eau sur le sujet du projet (en remplacement des effluents des droits de l'eau)*
- *La collecte des données et l'analyse de la consommation d'eau à Mashhad et de l'eau agricole alloués pour les villages de la zone du projet*
- *Calcul du volume des effluents d'eau équivalent à des droits de tous les agriculteurs et les propriétaires de puits d'eau selon les conditions approuvées.*
- *Une enquête sur la quantité de terres agricoles et le nombre de bovins dans la région*
- *Sciences sociales et économiques d'enquête sur la société dans les villages à l'aval de Kardeh et Torogh Dam.*
- *Social et de l'évaluation économique des terres agricoles et de vergers appartenant au centre de recherche de Factory Torogh et Shirin et Forest Park de Torogh*

Selon le calcul total, les quantités d'effluents devraient être alloués à des villages en aval de la rémunération des droits de l'eau dans le barrage est Kardeh 15729750 mètres cubes, 8099360 m³ pour les ayants droit de l'eau dans les villages en aval du barrage Torogh, 3125607 m³ pour l'indemnisation des propriétaires de puits de Shirin Sugar Factory et 2229595 m³ pour effluents Torogh Forest Park. Au total, les effluents d'allocation pour la rémunération des agriculteurs droits sur l'eau et bien les droits des propriétaires de l'eau était de 30 millions de m³ d'effluents dans le changement de 20 millions de m³ d'eau pure à partir des barrages. Le résultat de l'étude sociale et l'analyse de spectacles interrogateur qu'aucune des personnes qui n'ont pas droit à l'eau sont intéressés à l'exécution du projet et seulement un peu de propriétaires de droits d'eau ont montré un intérêt pour le remplacement de leurs droits d'eau des barrages avec des effluents de la ville. La raison pour laquelle tourne le dos à une opinion que les effluents bien purifié, mais impure selon les règles religieuses. Bien que les agriculteurs ne sont pas d'accord avec le changement de l'eau pure pour les effluents, mais peu à peu par la formation, la propagande et les progrès en matière de gestion participative, ils activement associés au projet et ils utilisent désormais des effluents mélangés avec de l'eau pour l'irrigation.

Mots clés: *Effluent, eau agricole, rivière Kardeh, résultat social, problèmes sociaux économiques.*

(Traduction française telle que fournie par les auteurs)

1. INTRODUCTION

The most vital need of human being to live is water. One of the greatest issues being discussed among the decision makers and authorities in the world, particularly in dry and semi dry countries is to save water through optimal utilization. The authorities of Mashhad, a metropolitan city in the northeastern part of IRAN are also considering various options to supply adequate quantity of potable water for the citizens of Mashhad.

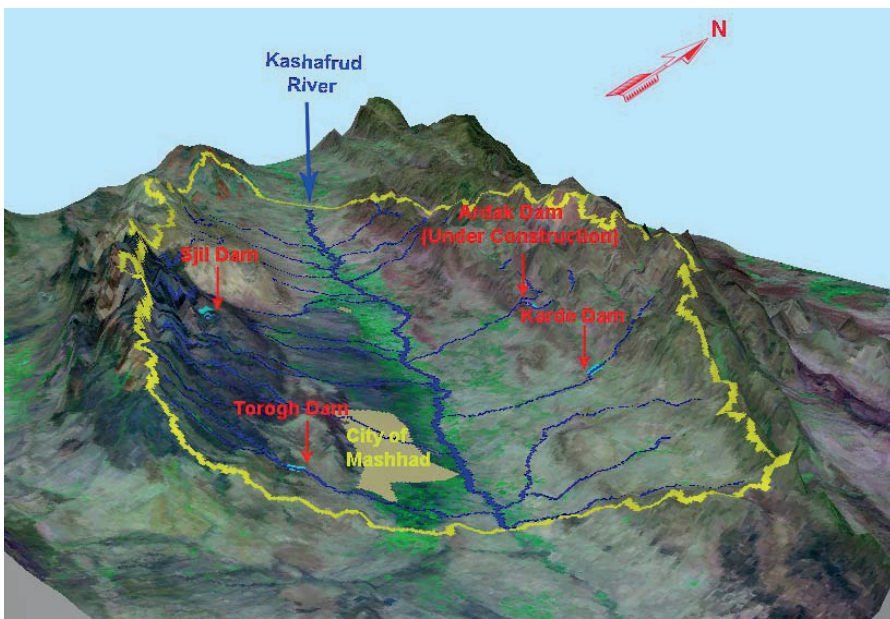
One of many plans for solution of water scarcity problem in Mashhad was to substitute the treated wastewater of the city for a part of the agricultural water allocated to farmers from Kardeh

and Torogh dams, recently constructed in suburb of Mashhad. This plan is being executed by the regional water company of Khorasan province. According to the approved plan, collection, transfer and treatment of wastewater has begun in the last decade and two treatment plants: Olang and Parkandabad wastewater treatment plants were constructed. The plan of substituting effluents (treated wastewater) for a part of the fresh water from the reservoirs of the two dams and well water wells for agricultural use was complicated and was carried out in Khorassan for the first time. Because of serious social issues and challenges involved, there was a need to study them in the plan area. This paper is the result of a survey on economic and social issues on the replacement of agricultural water with treated wastewater in the study area.

1. The main issue

Mashhad city is located in a semi arid climatic zone. Mashhad, before the construction of the dams on Karde and Torogh and before availability of water from the friendship dam on Harirud, was a city with 300 thousands inhabitants with only a few pilgrims. During that period water was supplied to Mashhad from groundwater (wells and springs) sources. With growth of Mashhad population and increase in the number of pilgrims (to visit the Tomb of Imam Reza in Mashhad), the main problem of Mashhad was to supply fresh water for the inhabitants and the pilgrims. Today the water allocated to Mashhad from Kardeh and Torogh or even the recent allocation from the Friendship dam is not enough to mitigate water scarcity of Mashhad .

One of the feasible solutions for Mashhad water scarcity problem is the utilization of treated wastewater for irrigation of green space and parks of Mashhad and also the utilization of effluent for cultivation of some agricultural products, which may not be harmful if consumed by humans or animals. The basin area and location of Karde and Torogh dam is shown in Fig. 1.



(Source : Mehdi Janparvar,Saeed Nairizi , Toos Ab Consulting eng. Co., Mashhad-Iran)

Fig. 1. Kashafrud River, its tributaries and Karde and Torogh dam location.

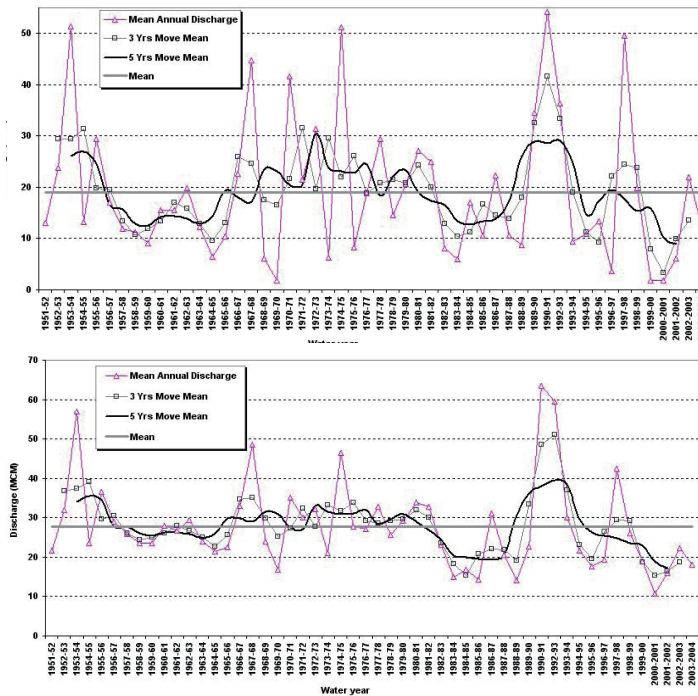
2. INHABITANTS IN THE STUDY AREA

The two groups of people living in the study area are :

- A. Real or legal individuals or institutes who have direct involvement in the project. These individuals are owner of water rights and well owners in the project area
- B. Individuals who are not directly involved in the project but their lives will be affected by the project, because of their dependence on drinking water availability. Besides, these people may be vulnerable to health risk in an environment where treated waste water may be used, even though they are not water or effluent users for agriculture.

3. METHOD OF INVESTIGATION

The effluent replacement project comprises research and execution of the plan mentioned earlier. The project should be commissioned with satisfaction of the farmers and water right owners who are required to sign a contract with the water authority in Mashhad foregoing their right to fresh river water in lieu of the treated waste water. Concerning the social issues the investigation could be carried out with selected individuals from population samples drawn from the project area. To ascertain the probable affected population due to the project, a comprehensive field study was first carried out.



(Source : Mehdi Janparvar, Saeed Nairizi, Toos Ab Consulting Eng. Co. , Mashhad – Iran)

Fig. 2. Mean, mean annual discharge and 3-5 yrs moving mean of Karde River (upper graph) and Mean, mean annual discharge and 3-5 yrs moving mean of Torogh dam (lower graph)

Based on the preliminary knowledge on society and its classification in the study area, the method of investigation and the statistical analysis method were determined.

3.1 Area of Study

The study area is divided into two sections :

3.1.1 The villages located at the down stream of Kardeh dam

This region comprises 16 villages in the northwestern part of Mashhad and at the downstream of Kardeh dam.

3.1.2 The villages located at the downstream of Torogh dam

This inhabited area lies below the Torogh dam, in the south east of Mashhad.

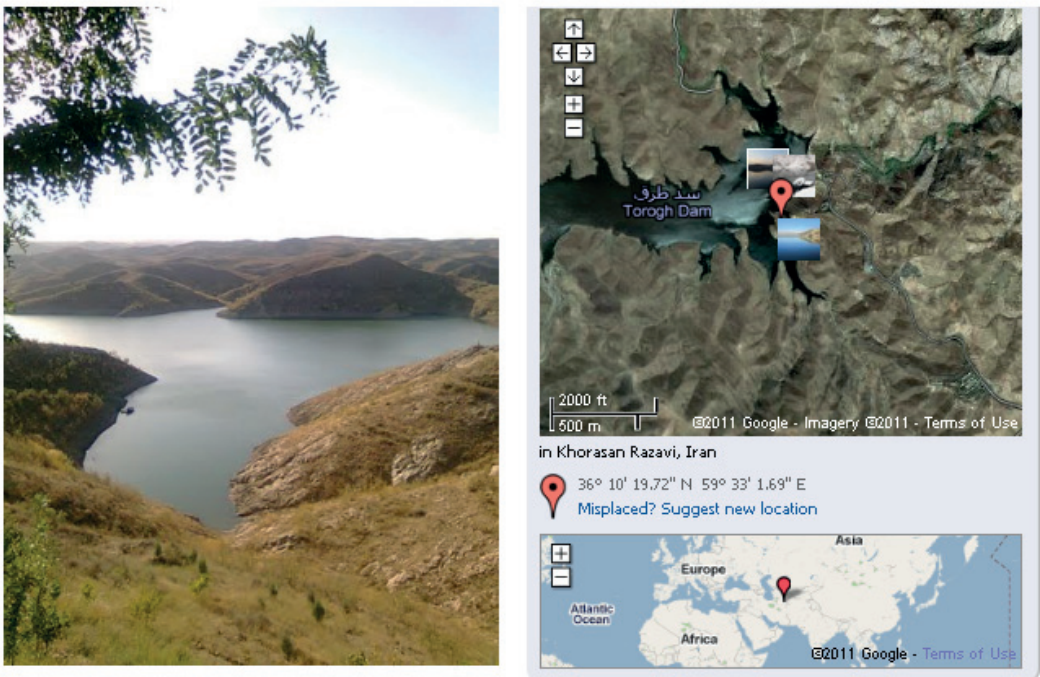
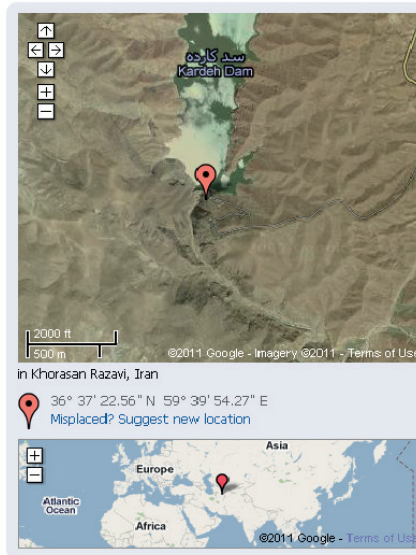


Fig. 3. Torogh dam located in the south eastern part of Mashhad plain.



Left Fig – Karde dam in Khorassan Razavi
 Right Fig -location of the Karde dam
 (Source: Google earth map)

Fig. 4. Karde Dam located 40 km from Mashhad city in the north eastern part of Iran

4. SOCIAL ISSUES AND POPULATION

4.1 language and religion

From the point of view of language, religion and ethnic condition, the society under investigation is homogeneous. People live in villages with a good road connectivity with Mashhad city, and so the citizenship of Mashhad are influenced by the social, cultural and economic features of the people living in these villages. Road and transportation facilities from these villages to Mashhad is so widespread and attractive that many people from far away distances such as Farnad and Farkhad, have migrated to these villages. Many inhabitants in these villages are the people from Mashhad who have selected the urban villages for settlement but their daily works are carried out in Mashhad. Being near a flourishing city of Mashhad, the villages also became small towns in practice located in the suburb of Mashhad. The low land price and housing in these big villages close to Mashhad is attractive for many migrants who come to Mashhad to find jobs. So some inhabitants of these villages who mostly are seasonal labors or workless people have created problems in Mashhad society because of their violation of laws such as dealings in liquor or drugs . Therefore the social investigation in these villages particularly, Farnad , Farkhad and Torogh villages are different from an usual rural study. In these villages, general specification of rural situation is mixed up with urban life specification . Although effluent substitution project is carried out for farmers from these villages who use dam water for irrigation, but other inhabitants who are affected by the project (landless and jobless people) were also involved in social investigation. To recognize and study the total classes of inhabitants of villages a special classification of people was carried out. From the Social view point, the villagers could be classified as described below :

4.2 Classification of individuals based on personal possession of land

4.2.1 Big owners

Before the land reform there were some big land owners in the basin area of Kardeh dam. According to the land law before the Islamic revolution, some part of lands was divided among the farmers and some remained in the possession of land owners. Some land owners bought their land from the farmers and began farming again.

After the Islamic revolution, two important features of land possession were:

- A. The farmers used the lands for cultivation but did not pay the land owner rights to any produce, which they themselves owned.
- B. Most land owners left the villages and traveled to Mashhad or other cities of Iran and some went abroad permanently. Some land owner died and the issue of land possession claim brought into the law court. At the present time (2010) about 18% of lands at the basin of Karde dam have a claim in Mashhad law court and there is a dispute on cultivation or water right or land possession between the farmers and the land owners.

4.2.2 Lands belonging to Astane Ghodse Razavi (AGR)

The ownership of most lands in Mashhad and its suburbs belongs to the Shrine of Imam Reza or as it is called "ASTANE GHODSE RAZAVI- AGR" (lands donated by people to the Shrine of Imam Reza). About 21.5% (287 Ha) in the Kardeh dam area belongs to ASTANE GHODSE RAZAVI (AGR). In addition, Akhengan village (705 ha.), Govareski (440 ha) , Gaz Rah (440 ha), Kardeh now (70 ha) all belong to AGR. Some part of Rezvan village (about 200 ha) and 532 hectares of other lands too, belong to Astane Ghodse Razavi.

Total of lands and water rights of Torogh village belong to AGR and farmers are tenants of AGR. From total lands of the study area, 3837 hectares (about 31.47%) belongs to AGR. Most of the farmers and other citizens in study area pay rental fees to AGR. Some other tenants of lands have not paid their dues since many years.

4.2.3 Lands of Owghaf (religious welfare)

Some parts of Rezvan village belongs to Owghaf charity office and farmers take lands on rent for cultivation.

4.2.4 Owners of small lands and water rights

About 68.5% of lands (about 8350 ha) in the study area are small pieces of lands that belong to small owners. The small land owners use their land in two ways: they themselves cultivate the land and work on their lands or they are tenants of land owners who have migrated to city or they have owned lands as successors of other land owners. All successors of an owner usually give right to one successor to cultivate land and give a part of his profit as rental share to other successors.

4.2.5 Illegal water right possessors

When the big land owners left the village, some farmers took over their lands and their water rights illegally. The land and water right seizers are divided into two groups: one who own lands or water rights and one who have seized the lands owned by Astan Ghods Razavi or Owghaf charity office or ones who had no lands but seized the lands from the owners.

4.2.6 Dry farming and animal husbandry

Some people in the study area have no water right and they are dry farmers. These people usually have some domestic animals such as sheep and cows and they too, are divided in two groups: Some are land owners of dry farming and some are tenants to these owners.

4.2.7 Landless people and laborers

In all the villages some people are not farmers but live in the villages. In 12 of the 17 villages, the number of non-farmers are more than the farmers. In Torogh village that is a part of Mashhad today, the number of non-farmers are more. In Kardeh basin the number of non-farmer are about 35% to 220% of water right owners in the village.

In the present condition the most effective persons in rural society are the small land owners who have more water and lands and they directly work on the land. The old land owners or the successors have migrated to cities and have no effect in village. Astane Ghodse Razavi and Owghaf have no direct work on lands.

Table 1. The types of agricultural land possession in the villages of the study area

item	Name of village	Type of possession			
		possession	Owner-tenant	Astane Ghodse Razavi	Owghaf Charity Office
1	Akhengan			*	
2	Govareshi			*	
3	Androkh	*	*		
4	Rezvan	*	*	*	*
5	Gozargah			*	
6	Hosenabad	*			
7	Kardehnou			*	
8	Farkhad	*			
9	Maryan	*			
10	Zak	*			
11	Jankoo	*			
12	Farmad	*			
13	Faz	*			
14	Khoshhava	*	*		
15	Moeinabad	*			
16	Khorgh	*			
17	Torogh			*	

5. REVIEW THE OPINIONS OF THE PEOPLE

According to the review and response of the people in the questionnaire at the beginning of the plan execution, the condition was as follows :

- 100 % of non-water right owners, residing in the villages, were opposed to effluent substitution in lieu of river water. The reason of opposition was that no benefit came from this plan to them but it probably could bring them damages.
- About 97.2 % of water right owners were opposed to the plan. Only 2.8% of the farmers who were aware of the result were in favor of the plan. The consenting persons were water right owners with the average age between 25 to 45 years and had a high water right (more than 10 hours in 12 rounds).
- All consenting persons were the settlers of Mashhad city. Their main reason to agree to the plan was the prospect of receiving fixed and continued allocated effluent during the year. That means that the consenting people living in city has had in view, only their financial benefits in the plan of substituting effluents in lieu of fresh water for irrigation.

6. THE EXISTING SOCIAL PROBLEMS IN RELATION TO PLAN EXECUTION AND THEIR SOLUTION

The social problems related to the execution of the water substitution plan in the region were studied. There are some problems common to most of the villages as follows:

- Since effluents replacement with agricultural water is planned and being executed for the first time in Khorassan, the farmers' conception of the project should be developed so that they easily accept the project.
- To change the tradition and introduce new concepts is always a difficult job and so the transition should be carried out step by step.
- One of the main social stigma in execution of the project is that water right owners do not believe in the governmental promises. The questionnaires responses show that more than 68% of villagers in the study area are not satisfied with the services of regional water companies. Most of distrust is created because the promises the government made to the people on allocation of dam's water when the dam was under construction were not fulfilled.
- Some villagers and water right owners have claimed that after 1988, the water received by them from the dam was not as promised and allocated before. In some cases they have brought their claim to the Mashhad court law where the claims are under consideration now.
- Majority of these water right owners in these villages have no valid documents to claim their right and they have received water from the dam in accordance with the local custom.
- in the time of plan execution there was no written documents of water rights and there was no signed list of water right owners confirmed by the village council.
- parts of water rights documents are in hand of successors and some are in hands of illegal custodians of water rights.

- in most cases the real water right owners have died or have left the village and there are a severe dispute for claiming water right now.
- There has been many purchases and sales of the water rights where no document has been issued or changed between the dealers.
- At the beginning of the replacement project, many people have been aware of water and effluent availability now and all have renewed their old dispute on water right from the dam.
- Some water right owners who were not using their right of water or have had sold their rights before, now are coming forward to claim for their rights to receive effluent.

7. PROPORTION OF WATER RIGHT OWNERS OF TOTAL POPULATION OF EACH VILLAGE

The total of population in Kardeh dam area are 2000 persons .The number of water right owners (WRO) in 15 villages near the dam are reported 596 persons.

Table 2. Per cent of WRO to total population of all villages.

Village name	Per cent of WROs
Akhengan	17.8
Jehankoob	-
Khorogh	5.4
Khoshhava	7
Rezvan	14
Zag	6.1
Faz	5.3
Kardeh now	-
Gozargah	2.2
Govareshki	9.8
Maryan	6.9
Moein abad	9.8

The total of WROs in Torogh village is 324 persons. Proportion of WROs to Torogh population is 1/6.

1. The villages located in upstream are Androkh, Rezvan, Akhengan, Govareshi and Moein abad where the two villages Anrokh and Rezvan are mountainous villages and the cultivation here are very different from the other villages. Most of products in these two villages are fruits. The villages located in the right bank of the river and in a smooth and productive plain contain : Zak , Maryan , Khorogh , Jankoob. In addition to water from the Kardeh dam, water from the deep and semi deep wells are also used for irrigation.

2. The villages on the downstream of river are located over a large area where there are fertile lands but without water. Because of the scarcity of water most of the lands are used in dry farming. Some of these villages such as Farkhod, Farmad and Faz are large and populated villages where in the recent years a large number of migrants have come from far away villages.

8. DETERMINATION THE AMOUNT OF AGRICULTURAL WATER RIGHTS OF THE VILLAGES BELOW THE KARDEH DAM AND ITS TIMELY DISTRIBUTION

The average annual agricultural water from Kardeh dam distributed among the villages is about 13.108 Mm³. The amount of 6 Mm³ of water from the Torogh dam is allocated for water rights of peasants with land share in Torogh village. The Torogh dam serves 324 farmers where every one has 5 hectares of land. Because of water scarcity, each farmer cultivates wheat in 2 to 2.5 hectares and 0.5 hectares is cultivated with summer products. The water allocated for domestic animal in the year is 0.24 Mm³.

9. CALCULATION METHOD OF THE FARE FOR WATER RIGHT AND EFFLUENT

The effluent allocated instead of agricultural water would be 20% more than the water right. The proportion of effluent volume of every WRO would be relative to his effluent to total effluent allocated to the village.

Table 3. Earlier average agricultural water allocation to the downstream villages of Kardeh dam and the maximum effluent now allocated instead.

Volume of water delivery during last 16 years			The amount of delivered effluent with 1.2 index	
Total of water volume (m ³)	Average per year (m ³)	l/s in 365 days	Average volume effluent	l/s in 365 days
209729999.8	13108125	415.7	15729750	498.8

Table 4. Average volume of agricultural water of Torogh Dam and maximum delivered effluent

Volume of total water delivered in 15 years			Volume of effluent delivered with index 1.2		
Total of water volume m ³	Average water volume m ³	l/s in 365 days	Average effluent volume m ³	l/s in 365 days	l/s in 270 days
101242000	6749466.67	214	8099360	256.8	347.2

10. CONCLUSIONS

According to the study results, at the beginning of the plan execution only a few people agreed to execution of the plan. The result of social investigation before the plan execution showed that non of the water right owner were in favor of the plan. In addition to the dissatisfaction of people because of health and environmental effects of the plan, the other important reason for people's opposition was the lack of awareness because they did not believe they could receive enough clean and healthy effluent instead of their right for agricultural water from the dam. So the people did not agree with an irrevocable contract. The best method to exchange effluent with agricultural water was the method of agreement called : "peaceful change contract". This contract method is not absolutely irrevocable and if all conditions mentioned in contract were not executed, the two sides had the right to cancel the contract.

Based on this understanding the contracts signed with farmers were in two categories:

- A. Contract for replacing agricultural water with effluent between Regional water Company and representatives of water right owners from a village based on the total water right of the village.
- B. Individual Contracts between the regional water Company and the individual water right owner based on the right of every single water user.

To satisfy all water right owners for execution of the plan, project managers decided to deliver 20 percent more effluent instead of water right equivalent.

REFERENCES

- Replacing a volume of Mashhad effluent with agricultural water right of the farmers, final report, Amayesh & Tose-e-Shargh consulting Co., 1382(2003), Mashhad. Iran
- Tabari, Masood et al., 2007. Reuse of city effluent, the potential of effluent in irrigation and production of forest trees in suburb of Tehran, The tenth national health environment, 8-10 Aban 1386 , Hamadan – IRAN
- Seham M. H. Hendy ,2006. Wastewater Management and Reuse in Egypt, Regional Workshop on Health Aspects of Wastewater Reuse in Agriculture.
- Yasser K. et.al., 2000., WASTEWATER REUSE LAW AND STANDARDS IN JORDAN, The Ministry of water and irrigation , Amman, Jordan
- Hyderabad , 2002. Reuse of Wastewater for Agriculture, The Hyderabad Declaration on Wastewater Use in Agriculture ,14 November 2002, Hyderabad, India
- IWMI, 2005. IWMI Projects on Reuse of Wastewater for Agriculture, Water Management, Environment, and Human Health Aspects of Wastewater Irrigation
- Cezar Tigno, 2009. Country Water Action: India Living on City Wastewater, Hyderabad (India), www.ruaf.org/node/507