

Studying the Environmental and Economical Effect of the Salty Water from Wells in Mazandaran

Jafar NAJIHAMMODI and Hussain KHADIR, Iran

Key words: environment, economic, water, well, Mazandaran.

SUMMARY

Because of the limited surface water resources man obligated to use fresh ground water, which is often has a lower quality than surface water.

Mazandaran Valley, south of the Caspian Sea, has an area of about 18 000 square kilometer through which few rivers flow (with a total capacity of 40 MM square meter). The valley is filled with a newly alluvial sediments, in which a few aquifers are located. Many wells were drilled in this valley into the aquifers since 1961 and in a greater number in 1981 and thereafter to supply the required amount of water. Because of the closely location of the aquifers to the sea and because of a heavily pumping of the water from the area, it caused an early intrusion of salt water into the surface aquifer and therefore many wells changed to be salt water producer (with an EC of 20 000 micro mhos per centimeter). These wells became a problem for the nearby environment through contaminating the soil around them and therefore limiting any good cultivation of the land. The preliminary damage estimation of the soil specially the SHALTOOT RICE production from any well was 50 acres. The SHALTOOT is very delicate to the amount of salt in the water and therefore the salty water cause about 20 percent damage for any acre. Hence, there was about \$ 14 000 economical lost from any well and a total of more than \$550 000 from the 40 wells in a year, which is ever increasing every year. Sustaining a healthy rural environment in MAZANDARAN is an urban demand that sought by urban society through omitting troublesome causes by maintaining a good interrelationship between them.

Studying the Environmental and Economical Effect of the Salty Water from Wells in Mazandaran

Jafar NAJIHAMMODI and Hussain KHADIR, Iran

1. INTRODUCTION

Fresh water is one of the important needs for the living on Earth. The great development in agriculture and industry and the ever increasing population cause a further demand on fresh water.

Water resources are in reality limited and can be surface as well as subsurface. Because of the limited amount of surface fresh water, human beings were obligated to use fresh ground water which is relatively and oftenly has a lower quality than fresh surface water.

2. MAZANDARAN VALLEY

Mazandaran Valley is a very thin and limited valley that is extended along the southern part of the Caspian Sea, with a total area of about 18 000 square kilometer(Figure1).

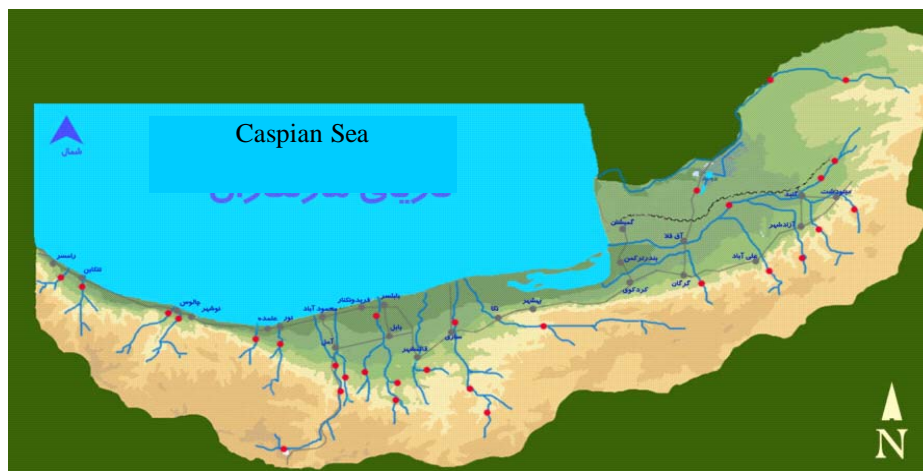


Figure 1: Mazandaran Valley

The valley is enclosed between two big faults namely Northern Alborz and Caspian that is filled with newly alluvial sediments. These faults are directed E-NE and W-SW. On the boundary of the valley there are different anticlines through which many rivers flow to bring a total amount of 40 MM cubic meter annually into the valley.

2.1 Aquifers in the Valley

There are two types of aquifers in the valley namely unconfined and confined in which wells were drilled (Figure2).

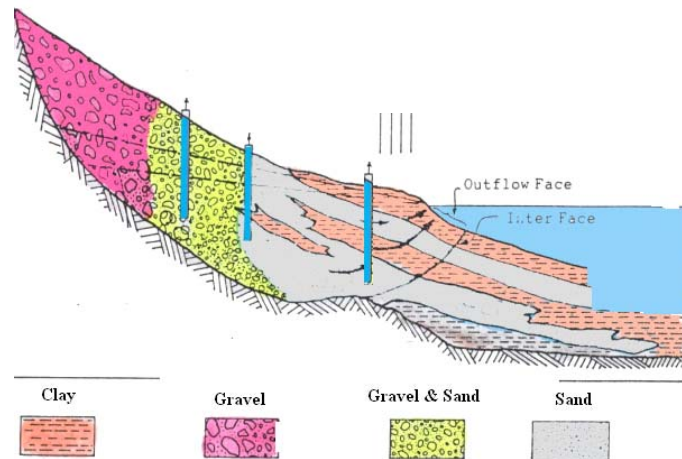


Figure 2: Aquifers in Mazandaran Valley

The unconfined aquifer has a small thickness subsurface layer, which has a fresh water. Because of a great production amount of water by the agriculture community that caused an early intrusion of sea water into the aquifer (this aquifer is contaminated also by surface sewage water to a minor extent) and therefore the wells started to produce salt water. Moreover, in the later few years the sea water level increased up to two meter which may due to springs eruption at the bottom of the sea and/ or tectonic movement in the bottom of the sea that cause more sea water intrusion into the surface aquifer. However, the confined deeper aquifer has a salty water, the water of which flows into the unconfined aquifer through the drilled wells (these wells were drilled down to 110 meter sub sea level) and because of the high pressure of the aquifer, the water also flows out of the wells and around them.

2.2 Wells in the Valley

Many wells were drilled in this valley since 1961 and in a greater number in 1981 and thereafter to supply the appropriated amount of water to the valley that maintain the valley to be evergreen with a very useful demanded agricultural products, where the rice is one of them (Figure3).



Figure 3: The evergreen valley in Mazandaran

2.3 Well Conditions

Most wells were drilled by native methods (specially in the unconfined aquifer) or improperly finished without considering scientific ways and after starting producing salt water, they were not properly closed (Figure 4).

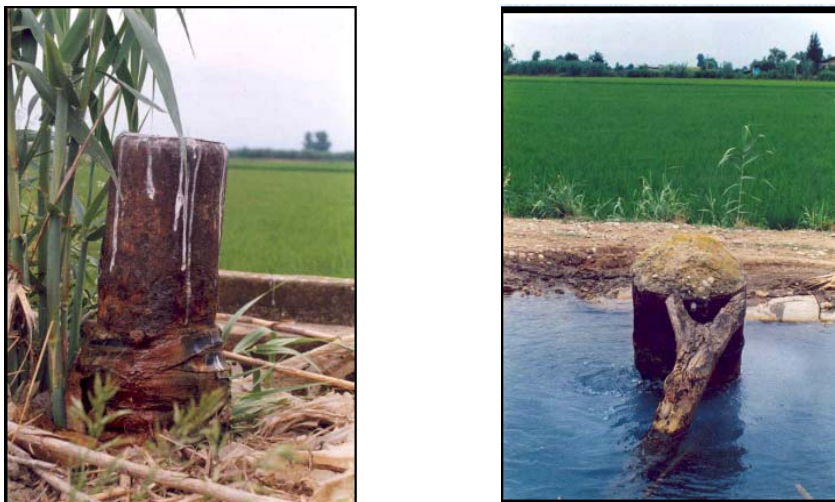


Figure 4: Salty Water producer wells

Therefore, there was always seepage of salt water from and around the wells. Some of these wells are producing salt water continuously that flows in the valley (Figures 5).



Figure 5: Salt water from wells flows into the valley

3. MAZANDARAN VALLEY AND ENVIRONMENT

Because of the close location of the valley to the sea and because of the heavily pumping of the (surface)aquifer's water caused it to be early invaded by the sea water. As a result, some of these wells changed to salt water producers and in due time the number of these wells increases to reach a total of 60 in 1964. The EC of these wells was averaged to be 20 000 micro mhos per centimeter. Using above water was inevitable because of a limited water resources from one side and from the other side the area around the eruptive wells started to be affected and began to show a negative signs on the soil and its products that is became in due time a problem to the valley environment through contaminating the land around the wells and around the flowing water, and *therefore, affecting the good* cultivation of the soil and changing the evergreen valley to a really bad spotted cultivation areas.

4. URBAN_RURAL INTERRELATIONSHIP AND ENVIRONMENT

The evergreen rural nature of Mazandaran Valley make a feeling that there is , here, a proper and wonderful environment of the area which make somebody happy and cheerful to enjoy nature that can be noticed markedly in the area to give the urban people a chance to enliven life(Figure 3).

Sustaining such healthy environment in the country life of Mazandaran and/ or else where in the world would be an interrelationship between urban and rural which must be sustained. Urban has an important and required duty to care for rural areas where it is the resources to maintain living products and the pleasurable sights. Rural has to keep its beautiful nature by using urban development and civilization.

5. SOIL DAMAGE

The soil of the valley area is very suitable for rice cultivation under the name of SHALTOOT. This rice is very sensitive to the amount of salt in the water. By continuous use of the water from the unconfined aquifer (even after contamination because of limited water resources) and the flow of uncontrollable water from the confined aquifer cause an ever decreasing of production of SHALTOOT RICE. However, the preliminary damage estimation of the soil from any one well can be extended up to a total of 50 acres and therefore, as a result there is a 20 per cent less rice production.

6. ECONOMIC DAMAGE

The seepage salt water from the wells was so great that the radius of effect extended a few tens of meters around the wells and along the flowing water. Thus, these wells had not only a negative effect upon the environment but also cause an agricultural products damage due to soil contamination by salt water. As mentioned above it was estimated that any one of these wells can cause a total effect upon land up to 50 acres with an over all damage of 20 percent on *Shaltoot rice*. Moreover, it was normally to produce 4 500 kilograms of Shaltoot from any acre in the valley. Whereas, the cost of one kilogram of Shaltoot Rice is \$0.35. Therefore, the estimated total damage from all 40 wells to be more than \$550 000 per year. The amount of damage sought to be increasing annually.

7. PLANS FOR THE WELLS

Relatively speaking, the wells which were drilled in the above mentioned aquifers are old and corroded. Therefore, they have to be abandoned and closed for ever. For this reason, a preliminary budget of about \$ 5 000 was allocated to close some of these wells. However, a total of \$ 100 000 is needed to close all the wells in the area. Moreover, at first stage, some 30 percent of the wells were closed for the period 1985 and 1989 and aiming to close the rest in the future.

8. CONCLUSIONS

- To keep Mazandaran Valley evergreen and environmentally healthy need to maintain a proper use of the water from the surface aquifer and to maintain the rest of water from other resources.
- Closing the eruptive wells as soon as possible to cut down upon flowing water and therefore to remedy the damage imposed upon the soil of the valley.
- Cut down upon water production (or at least control it) from the surface aquifer so that to keep it within the range of fresh water that would not affect the Shaltoot product and therefore, eliminating any damages.
- Sustaining a healthy rural in Mazandaran Valley is always a demand that sought by urban society to keep their products maintained and also to keep the pleasurable nature of the area.

9. REFERENCES

- AWRANG,R(1985),Closing The Salty Wells of Mazandaran,Interior Report,M.D.,Iran.
- KHADIR,H.(1999),Studying The Salty Water Wells In Mazandaran District,PWIT,Interior Report,Tehran,Iran.
- KHOLSHANI.M.(1999),Studying New Methods of Aquifer's Water Injection in Bishar Valley,PWIT-Thesis, Tehran, Iran.
- MUHAJERMILLANI,P.(1991),How to Make Optimum Agriculture Use of Salty Waters from Mazandaran District,M.D.,Iran.
- SAFIKANI,I.(1983),Planning to Close The Salty Artesian Wells In Mazandaran,National Drilling Company,M.D.,Iran.
- SEHRABI,K.(1992),Studying The Factors That Effecting The Intrusion of Different Coastal Aquifers of Mazandaran,M.D.,Iran.
- TALAGANI,G.(1991),Studying The Ways to Improve The Quality of The Salt water in Mazandara,M.D.,Iran.

BIOGRAPHICAL NOTES

Jafar Najihammodi was born in Iraq in 1942 where he finished the High School in 1961. Between 1962 and 1967 he was in USA where he got his BSc and MSc in engineering from LA TECH University. During the years 1967 and 1970 he was a Demonstrator at Baghdad University and in 1970 he became a lecturer. In 1974 started the work for the Dr.-Eng at Clausthal University in Germany where he got it in 1978. Since then he has been teaching and researching at different universities and countries.

Hussain Khadir was born in Kaimshahr,Iran in 1959. He got his BSc in engineering from Oromia University in 1992 and in 2002 obtained his MSc in engineering from PWIT. He is at the present time a director of the water office of Kaimshahr.

CONTACTS

Jafar Najihammodi and Hussain Khadir
Power Water Institute of Technology (PWIT)
Damawand Ave.,Iranabzar Ave., Ab Ave.
Tehran
IRAN
Tel. + 98 21 7313062
Fax + 98 21 7310425
Email: Naji_237@ Yahoo.com
Web site: www.pwit.ac.ir