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Study on rehabilitation and retehnologization of water household in Recaş locality, Timis county

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Abstract: The purpose of the study is to analyze the effectiveness of the operation of Water Treatment Plant from a deep source in the localities from west of the country. In this aim it studied the variation of raw water quality indicators at the entrance to the Water Treatment Plant and the values of these parameters from the process water treatment. Were performed laboratory determinations for both samples of raw water and treated water, during 2015, respectively May of 2016 after the rehabilitation and retehnologization of water household. Based on these laboratory determinations it was followed correction quality parameters of drinking water and water household yield refurbished in the system of water supply to villages in the west of the country. Water quality is analyzed comparing its values quality indicators with limits permitted by the legislation in the field (Drinking Water Law 458/2002 supplemented with law 311/2004).
Keywords: rehabilitation, treatment plant, water quality indicators

1. INTRODUCTION

Worldwide, one of the criteria that consider the degree of civilization of a country is water consumption per capita. In the current phase of economic and social development, characterized by dynamism requirements, on the one hand and limited character of natural resources, determined by pollution continues thereof, on the other hand, makes the WATER, one of important natural resources to be household judiciously to prevent WATER CRISIS, terms which occur frequently in studies forecast of various international bodies. The crisis of drinking water resources, it is more than obvious considering the fact that although 72% of Earth's surface is covered by water, more than 97% is salt water, however. The crisis of drinking water resources is determined by several factors, among them is the population explosion, rapid urbanization process that led to large population agglomerations, especially the increased demand for freshwater in industry and agriculture.

2. PRESENTATION OF EXISTING WATER HOUSEHOLD IN TIMIS COUNTY

2.1. DESCRIPTION OF THE CURRENT SITUATION

Water supply to consumers in this locality is currently conducting from a supply system that captures water from deep phreatic through 4 boreholes.

The water was transported through a pipeline network of existing water household composed of two tanks with a capacity of 300 cubic meters each, a water tower with a capacity of 300 cubic meters and a water pumping station in the distribution network.

Following the analysis of the water distributed, in the distribution network, were found exceedances of iron and manganese content above the limits stipulated by the legislation of water intended for drinking water. The entire water supply system was deprived of the basic element, Treatment Station.

In these circumstances, the system does not correspond to the existing rules on water treatment.

To correct these indicators is proposed to build one Water Treatment Plants in the vicinity of existing household water, in free space on construction.

2.3. DESCRIPTION OF EXISTING TREATMENT TECHNOLOGY

This locality is located in the center of Timis County, at a distance of 20 km from Timisoara it has an area of 5.2 km^2 and a number of 4891 inhabitants.

Until the Treatment Station, the locality had a water supply system composed of:

• Adduction, distribution network;

• Depth drilling, pumping water from boreholes being made in storage tanks;

• Water household consists of: two water storage tanks, pumping station that sends water into the existing water tower and gravity directly into the distribution network.

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3. WATER QUALITY MONITORING INTO AND OUT OF TREATMENT PLANT

Raw water captured from boreholes is pumped through submerged pumps at existing household water. The feed pipe has a length of 570 m.

Following the analysis of water samples taken from raw water, emerged the values shown in Table 1 and 2.

Table 1. Physical, chemical and microbiological parameters of raw water during the year 2015 (12 months)

Parameter	U.M.	RAW WATER PARAMETERS			Maximums values allowed in drinking water	Observations
		minimum values	averages	maximum values		
Oxidability - Permanganate Index	mgO2/l	0.54	1.19	2.66	5	Conf. Law 458/2002, Law 311/2004, OG11/2010 and OG1/2011
Ph		7.1	7.4	7.6	6.5 – 9.5	
Turbidity	NTU	0.4	-	-	max. 1	
Ammonium	mg/l	0.05	0.08	0.194	max. 0,5	
Calcium	mg/l	57	108	128		
Alkalinity	mval/l	6.1	7.4	8.6		
Acidity	mval/l	0.2	0.4	0.5		
Iron	mg/l	0.07	0.22	0.79	max.0,2	
Manganese	mg/l	0.01	0.09	0.27	max 0,05	
Total Filterable Residue	mg/l	594	701	875		
Total Hardness	grd. G	16.6	22.9	26.9	min.5	
Coliforms Bacteria	Nr./100 cmc.	0	0	27	0	
Enterococci	Nr./100 cmc.	0	0	17	0	
Escherichia Coli	Nr./100 cmc.	0	0	8	0	

From the analysis of raw water from boreholes field that supplies the water household resulting overcoming following qualitative parameters:

- **Iron - iron (dissolved),** which must be below 0.2 mg / l. The method for reducing the amount below 0.2 mg / l is iron oxidation through aeration, precipitation of this, in the form of iron oxide and retention in sandy filters under pressure;

- **Manganese - Mn (dissolved**) which must be below 0.05 mg / l. Method of reducing the value below 0.05 mg / l is the oxidation of manganese in the first phase by aeration in the aeration basin, and in

the second phase through oxidation and retention of manganese dioxide in pre manganese filtering layer of sand filters.

- **Coliforms Bacteria, Enterococci and Escherichia coli** from raw water can be eliminated by oxidation - disinfection with chlorine dissolved in filtered water (hypochlorous acid).

Table 2. Values of quality indicators analyzed in the period of May 2016

Parameter	U.M.	**RAW WATER PARAMETERS**			Maximums values allowed in drinking water	Observations
		minimum values	averages	maximum values		
Oxidability - Permanganate Index	mgO2/l	0.54	1.19	2.66	5	Conf. Law 458/2002, Law 311/2004, OG11/2010 and OG1/2011
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Ammonium	mg/l	0.05	0.08	0.194	max. 0,5	
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Alkalinity	mval/l	6.1	7.4	8.6		Conf. Law 458/2002, Law 311/2004, OG11/2010 and OG1/2011
Acidity	mval/l	0.2	0.4	0.5		
Iron	mg/l	0.07	0.15	0.22	max.0,2	
Manganese	mg/l	0.01	0.03	0.045	max 0,05	
Total Filterable Residue	mg/l	594	701	875		
Total Hardness	Grd. G	16.6	22.9	26.9	min.5	
Coliforms Bacteria	nr./100 cmc.	0	0	0	0	
Enterococci	nr./100 cmc.	0	0	0	0	
Escherichia Coli	nr./100 cmc.	0	0	0	0	

4. PROPOSAL FOR ACHIEVEMENT OF A WATER TREATMENT PLANTS IN THIS LOCALITY

Table 3. The flow for sizing a Treatment Station is:

type flow	Reference	Measurement units	Raw water flow
maximum daily	Qinput 1	mc/day	1260,48

Treatment process proposed for this source water includes:

- aeration (optional oxidation with hypochlorite water)
- rapid filtration under pressure with filtering sand
- rapid filtration under pressure with granular activated carbon
- disinfection
- wash water treatment of filters.

Treatment Plant proposed has the following structure design:

1. Capture;
2. Aeration and Reagents: Outdoor aeration basin, aeration blowers, household reagents;
3. Filtration: Influential SP / SP wash filters GAC, sand filters, GAC filters, blowers filters, wash filters SP;
4. Treatment of wash waters: Decanter sequentially, SP mud, sludge beds;
5. Disinfection;
6. Storage and distribution;
7. Treatment Station Building and land planning.

4.1. CAPTURE

Capturing is done from existing boreholes rehabilitated 4 pcs. The works contain PEID Dn 200mm feed pipe through which water from boreholes (raw water) is pumped (via submersible pumps) directly into existing storage tanks.

At the adduction entrance to the existing water household it was made a connection with a buried valve DN150mm representing the new route of raw water to the treatment plant.

4.2 AERATION AND REAGENTS

The presence of iron and manganese in water in concentrations that exceed allowable limits for drinking water, has some inconveniences. Aeration-oxidation process aims to improve the oxygen content of the water and correct the overall balance of Fe and Mn compounds so as to enable their subsequent detention by filtration. Also through aeration is done removal of free CO_2 (reducing the aggressiveness of the water), H_2S, NH_3, smell and unpleasant taste of the water and at the same time increasing the amount of dissolved oxygen, the aeration indirectly contribute to improving the biological degradation of the pollutants from the water.

On connection pipe, raw water from boreholes is pumped directly into the Treatment Station, respectively in the aeration basin.

Aeration tank has a volume of 52.5 cubic meters for a minimum contact time of 30 minutes and consists of 4 sections: intake basin, aeration basin, reagents basin and aspiration basin.

Related aeration tank there is a pumping station blowers that includes two blowers 1A + 1R, Q = 71 Nm^3/h on the blower, at a pressure of 700 mbar and Pn = 4 kW, driven variable speed, to regulate the air introduced in the aeration tank and for providing adjustment of a preset value of dissolved oxygen in aerated water (approximately 2 mg O_2/l).

Household reagents: If it will not be able to ensure the reduction of iron and manganese by aeration, oxidation with Cl_2 and retaining on sand filters, on the aeration pipe of aerated water there would be an injection solution of NaOH 20%, thereby ensuring a high pH of water of about 8.5. A high value of the pH is necessary to accelerate the oxidation of iron and manganese.

4.3 FILTRATION

Continued treatment line, filtering, represent in the technological line the step by which realized the separation process of the impurities from the water subjected to treatment. Through filtration are retained gravimetric and colloidal suspensions, organic and minerals matter, chemical compounds, microorganisms and bacteria.

Aerated raw water from the aeration basin is pumped using pumping station influential in sand filters. Influent pumping station consists of three centrifugal pumps (2A + 1R) that will convey a flow Q = 40,3mc / h each, at a height of pumping H 15,2Mca and power Pn = 3kW.

The role of influent pumping station is to perform washing GAC filters. The degree of water clarification is dependent on filtration rate, the size and concentration of particles in the suspension, the nature, grain size and filter layer thickness. GAC filters washing will be done with non-chlorinated water.

The filters are washed in countercurrent with filtered water and compressed air, water move the deposits from granules of coal and the compressed air contribute to blowing and washing the granules of coal.

Figure 1. Proposed Treatment Plant - influent pumps / wash filters

Filter sand: the filtration process with quartz sand are provided four fast filters under pressure, DN 2000 mm, made of carbon steel, with the purpose of retention of the compounds of Fe and Mn being sized so as to provide a specific speed of the filter 4.18 m/h in the case of filtration through all four filter units and 5.58 m/h in the case when one filter is in the filtration wash or maintenance.

GAC filters: in filtration process after rapid sand filters are provided two filtration units with granular activated carbon (GAC) under pressure, DN2000mm, made of carbon steel, sized to provide a specific filter speed of 8.36 m/h in case of filtration through two filtration units and 16.73 m/h when one filter is in wash.

Bellows filters sand and GAC: air needed during bubbling faze in washing process of sand filters and GAC filters is provided by a blower station consists of two blowers, S1 and S2 (1A + 1R), located in the new hall design

Figure 2. Treatment Plant proposed - sand filters + GAC filters

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4.4 WASH WATER TREATMENT

Water treatment process includes also recovery of wash water filters. Thus, the resulting dirty water from washing the filters will be decanted into a sequentially decanter of 25mc. After gravity sedimentation mud will be pump through the pumping group 2A + 1R Qp = 3 mc/h, H = 30 mCA, Pn = 1.5 kW, to drying beds (2x9mc) respectively to sewerage and decant water may be reintroduce in the treatment system without exceeding 10% of the nominal flow of the station.

Will be arranged 2 platforms for draining / drying / storage of the sludge with dimensions: L x l x h = 3 x 1.5 x 2 m. Platform for drying sludge must be able to take volume of water from the decanter in the event of emptying thereof. The concentrate sludge is pumped through a pipe located at half the width of the platform. The platform volume for drying sludge is 9 mc to 105 days storage / dehydration.

Figure 3. Sequentially decanter for waste water washing

Water from the sludge drainage will be collected by man-hole located on the end platforms and will be discharged from existing domestic sewage. In the front area of the platforms will fit a space that allows workers access and cleaning machinery and transport sludge.

To prevent moisture sludge due to rainfall proposed sludge drying beds covering with cellular polycarbonate plates.

To ensure the evaporation of water from sludge by convection effect, polycarbonate roof must ensure a free perimeter space to ensure natural ventilation.

4.5 DISINFECTION

To complete the treatment process will take into account the stage of disinfection by chlorination. Currently the treatment process is used pre-chlorination for faster oxidation of Fe and Mn compounds even NH4 (when needed). Chlorination is realized by 2 injections on treated water transmission pipelines, one before the storage of treated water and two after leaving the tanks representing the correction.

Chlorination of water takes place through three injection points chlorine, the chlorination station is provided with four chlorine dispensers and four chlorine ejectors.

All three injections of chlorine will be such as to maintain the residual chlorine concentration of water (maximum 0.5 mg / l).

4.6 STORAGE AND DISTRIBUTION

Storage tank and distribution pumping station existing were rehabilitated.

Equipment and instrumentation will be monitored and controlled by the SCADA system. With the help of process equipment ensures online monitoring, local display and signaling dispatcher operating parameters and water quality as follows: turbidity, temperature, pH and conductivity.

Figure 4. Rehabilitated tanks of 300 cubic meters capacity

4.7. TREATMENT STATION BUILDING AND ARRANGEMENT FIELD

Treatment Station building is a new construction, made from a metal structure with pillars profiles, beams (frames) and closed with sandwich panels.

5. CONCLUSIONS

The purpose of the study was to analyze the effectiveness of the operation of Water Treatment Plant from underground source of this locality in Timis County.

Treated water quality analysis at Treatment Plant was performed by comparing the measured values with the limits stipulated in Law no. 458/2002 completed with Law 311/2004 on drinking water quality.

Quality parameters of raw and treated water were: oxidisability, pH, turbidity, ammonium, calcium, alkalinity, acidity, iron, manganese, total filterable residue, total hardness, colifform bacteria, enterococci, Escherichia coli.

To existing water household resulted exceeded the indices of quality drinking water (iron, manganese, colifform bacteria, enterococci, Escherichia coli), hence requiring the design and execution of a potable water treatment plant.

After designing and execution of treatment plant, water quality indicators registered at the exit of the treatment station falls within the limits set in the Drinking Water Law.

In conclusion, with the rehabilitation and upgrading of water supply system and thus treatment plant for the Recaş locality will develop a secure system in terms of operation and in terms of the quality of water delivered to consumers.

6. REFERENCES

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