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MANAGEMENT OF WASTEWATER OF SETTLEMENT AREAS IN POTABLE WATER BASINS WITHIN TEKİRDAĞ PROVINCE

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ABSTRACT

Introduction

In total 13,22 hm3 potable and utilisation water is achieved from the surface water sources within Tekirdağ province, which are Şarköy puddle, Müstecep puddle, Yazır puddle, Türkmenli puddle and the Çokal dam that was completed in 2016. Due to the rapid population growth, intensive agricultural and industial activities in the province implementation of an integrated basin management has a big importance in protection, planning and managing of water sources. Within the scope with sustainable utilisation of water sources, prevention and improvement of water quality, it will be possible to bring large scale solutions to prevent possible devastations.Mainly, the general features of the available pottable water basins in the Tekirdağ province, within adjacent-near-mid and long distant protection areas researching spot and spreaded polution sources, available and possible threats for the basins were identified.

The aim of this case study
To plan and organize suitable cast out of domestics sewage which are located in areas near the under protection pottable water basins of Tekirdağ province.

Material and Methods
In this study, especially precautions to be taken for waste water coming from residental areas within or very near water basins are under consideration.**Conclusions:** İn the basins adverse impacts of domestic and industrial waste water which the most impartant elements of point-based pollution should be refuse using with appropriate treatment methods. For effective basin management industrial waste water must be removed from the basin even if it is refined.

Key words: potable water basin, surface water sources, domestic wastewater, wastewater treatment plant.

INTRODUCTION

Although the potential of surface water of Tekirdağ province is 713 hm^3/year, only 10% of the pottable and utilisation water demand from surface water resources. In this study potable water basins within the Tekirdağ province boundaries are under investigation, negative effects of the environmental pressure, especially precautions to be taken for waste water coming from residental areas within or very near water basins are under consideration.

MATERIAL AND METHODS

50 hm3 per year are supplied by Tekirdağ Water and Sewerage Administration from underground water sources, on the other hand together with the Çokal Potable Water Dam 2nd Division Şarköy Distribution Network, constuction of which was completed in year 2016, total 13 hm3 water is supplied from surface water sources. Dams and puddles supplying potable water within the Tekirdağ province are given in Table 1.

Table 1. Tekirdağ Surface Water Sources (TESKİ, 2015)

Surface Water Source	Settlement Where Potable Water is Supplied	Population (TÜİK 2015)	Water Content (hm^3/yıl)
Şarköy Pond	Şarköy District	30.982	1,53
Türkmenli Pond	Marmaraereğlisi District Yeniçiftlik Neighborhood	23.452 8.727	1,30
Yazır Pond	Barbaros Neighborhood Kumbağ Neighborhood	5.006 2.172	1,26 0,88
Müstecep Pond	Sağlamtaş Neighborhood	2.029	0,73
Çokal Dam Drinking Water 2nd Part-Şarköy Water Transmission	Şarköy District Malkara District	30.982 52.663	7,52
TOTAL			**13,22**

Together with the available surface water sources with the completion of ongoing dams and ponds in year 2017 the total volume of potable and usable water in Tekirdağ province will reach 24,65 hm3. In Table 2 are given surface water sources which are still under construction.

Table 2. Tekirdağ Province Surface Water Sources in Construction (DSİ, 2015)

Surface Water Resource	Settlement where potable water will supply	Population (TÜİK 2015)	Commissioning date	Water Content (hm^3/yıl)
Naipköy Dam	Süleymanpaşa District	187.727	2017	6,43
Saray Ayvacık Pond	Saray District	48.272	2017	5,00
TOPLAM				**11,43**

In complience with the law number 2560 of İstanbul Water and Sewerage Administration Head Office Institution and Duties articles 2/c and 20 and article 51 of Water Pollution Control Regulation the responsibility for protection and supervision of continetal surface water basins is given to Metropolitan Municipality Water and Sewerage Administration Head Offices. In Tekirdağ province to

prevent polution of potable and usable surface and undergroung water sources by wastewater of domestic, industial, agricultural and all type of stock farming, inorder to identify the juristic and technical measures for protection of regions just near, mid and long distant to water sources "Potable Water Basins Protection Regulation" is issued by Tekirdağ Water and Sewerage Administration Head Office. According to the provisions of the regulation, the possession of the surface and underground sources belongs to Tekirdağ Water and Sewerage Administration. According to the same regulations, within the boundaries of Tekirdağ province, any activity with potential to polute underground water sources are not allowed and its a must to carry out of the basin boundaries all sewage water. In case waste water is disposed by a sewer system made by TESKİ, the discharging enterprices are forced to comply with the parameter limits defined TESKİ Waste Sewage Discharge Regulations.

In TESKİ Potable Water Basin Protection Regulation General Rules article 5 clause 1; "It is not allowed to carry out any activity with potential to pollute Potable and utilisation water source and basin. Its a must that any waste water should be drained out of the basin area, there is a centence in Water Pollution Control Regulations Technical Regime Notification that within moderate or long distant protection areas only domestic waste water can be used for irrigation after refinition up to the stated criterias. According to the same article clause 13 "In case the disposion of the waste water is done by a sewerage network constucted by TESKİ, discharging enterprices should comply to the parameter limits defined in TESKİ Waste Water Sewerage Discharge Regulation. If an enterprice operating under the mentioned clause does not take countermeasures for its waste water, it is stated that this enterprice should be sentenced according to the regulation.

Additionally in the mentioned Regulation Short distant protection areas (300-1000 m) article 8 clause 11 "It is essential to take out of the border of the waste water of residental or industrial facilities located within Short distant protection areas that were available before the date that the area was taken under protection. Additionally moderate distant protection areas (1000-2000 m) article 9 clause 4 states "it is essential to take out of the boundaries any waste water comming from residental or industrial facilities that were available before the date that the area was taken under protection". In the same article clause 9 "In the existing settlement areas it is the responsibility of the related Chancellery to construct sewage network and carry the waste water out of the basin borders to a predefined by TESKİ suitable area. Waste water from residental areas can be used for irrigation after proper filtration.

The scope of law number 25687 dated 31.12.2004 titled Water Polution Control Directive is to protect the underground water sources of the country, inaddition to grant the best utilization of the water to prevent water pollution, in harmony with sustainable development goals to establish the necessary juristical and technical rudiments. The mentioned Directive covers clasification of water sources and usage objective, preservation of water quality and restrictions, rules of waste water dumping and permissions, regime and guidelines for sewage network facilities, tracking and supervision necessary to prevent pollution of water sources.

In clause 28 of Water Polution Control Directive Usage of Refined Waste Water for Irrigation "In regions with deficit irrigation water, Water Pollution Control Directives Tecnical Methods Notice the usage of refined waste water for irrigation purposes is stimulated. Precautions to be applied for this purpose and necessary inspections shall be carried out according to the Technical Procedures Notice. Complience of such kind of waste water is assessed by board formed by Governorship from Provincial Environment and Forestry Directorate, Provincial Agricultural Directorate and Regional Directorate of State Water Works.

Low number 27527 dated 20.03.2010 regarding Waste Water Refinement Facilities Technical Procedures Notice article 18 Refined Waste Water Usage Areas: "In the usage of refined waste water; agricultural, industial, supply to underground water sources, supply to areas used for repose purposes, indirect use as fire extinguishing water, use in toiletts and directly as potable water usage alternatives are available. The technology needed for refinement of waste water depend on the

purpose the refined water will be used. In case urban waste water is to be used in agriculture or irrigation of green areas, biological refinement technology that will grant sufficient degree of disinfection is needed. If direct or indirect recycling is under concideration, membrane technologies, active carbon and advanced oxydation like advanced alternatives are needed".

Indications

In the region of Tekirdağ Province currently available water basins are under two main negative environmental factors. These can be classified as spot located pollution sources and spread out pollution sources.

Main spot located basin threats are:

-Domestic waste water

-Industrial waste water

Spread out polution sources are:

-Uncontrolled use of fertilisers and agricultural chemicals

-Any waste difussed in the basin area

Investigating the potable water sources within the Tekirdağ Province, which are Türkmenli Puddle Basin, Yazır Puddle Basin, Şarköy Puddle Basin, Müstecep Puddle Basin and one of the new surface water sources Çokal Puddle, potential polution factors were identified. While there were not found any serious industrial polution sources, on the other hand there were no refinement facilities for domestic waste water. In the basin areas the agricultural activies consist mainly growing sunflower, corn, wheat and canola. Within the basin area boundaries citizens perform ovin breeding and stock farming. Potable Water Sources of Tekirdağ Province are shown in Figure 1.

Figure 1. Tekirdağ Drinking Water Basins

In Süleymanpaşa District, Yayabaşı, Karahisarlı, Aşağıkılıçlı and Yukarıkılıçlı quarters are situated in the Yazır Basin region. However, there is no any industrial waste water discharge within the basin. In total there are 425 livestock and 2.550 ovin available, 2.800 hectare area is used for planting sunflower, corn, wheat and canola. Domestic sewage is discharged to individual cesspits. Total population within the basin is 538, polution values due to settlement are; BOD_5 21,52 kg/day, Total Nitrogen 2,69 kg/day, Total Phosphorus 0,5 kg/day, AKM 18,83 kg/day.

Figure 2. Basin controls

Domestic sewage of quarters located within Marmaraereğlisi District Türkmenli Basin, Yakuplu, Türkmenli, Çeşmeli and Şahpaz are discharged inside the basin boundaries. In general individual septic tanks are used for domestic sewage, and there is no industrial sewage discharge. At the same time within the boundaries of the basin there are 828 livestock, 3.820 ovin in total there are 4.648 animals fed. There are also agricultural activities, which are mainly growing wheet, sunflower and corn. Total polution values of these four areas with population of 1.344 are; BOD_5 53,76kg/day, Total Nitrogen 6,72kg/day, Total Phospohorus 1,20kg/day, SSM 47,04 kg/day.

Quarter Vakfiığdemir is situated within Malkara District Müstecep Basin boundaries. With population 201 and main engagement agriculture and stock raising. There is no any industrial facility in the quarter, people do animal breeding individually. There are around 500 livestock and 1.000 ovin. In total 800 hectare people grow wheat, sunflower and in small quantities melone and water melone. Inaddition, around Müstecep Puddle people grow clover. To protect poluting the water basin, empty pesticide cans are collected in drums. Polution values due to 201 population are BOI5 8,04 kg/day, Total Nitrogen 1 kg/day, Total Phosphorus 0,18 kg/day, Suspended Solid Matter-SSM 7,04 kg/day.

Figure 3. Müstecep Neighborhood pesticide collection container

Within the Çokal Dam Basin, which is supplying portion of the potable water to Şarköy and Malkara Districts, there are 33 quartes with total population 10.851. Main agricultural products are sunflower, barley, wheat, clover and corn. Main farming output is around 21.305 livestock and 32.620 ovine. There is no Waste Water Treatment Plant in the basin region. Polution caused by 10.851 population is BOI5 434 kg/day, Total Nitrogen 54,26 kg/day, Total Phosporus 9,77 kg/day, AKM 18,83 kg/day. The waste water coming from a dairy farm located in the region is discharged in the basin after refined in a local Waste Water Treatment Plant.

(According to the Waste Water Treatment Plants Technical Methods Notice law number 27527 dated 20.03.2017, accepted percapita polution values are BOD_5: 40 gr/person.day, Total Nitrogen (TN): 5gr/person.day, Total Phosphorus (TP): 0,9gr/person.day, SSM: 35 gr/person.day)

Data related to settlement in the Tekirdağ Province are given in Figure 3. 70% of settlement areas within the basin fall in the precipitation area, 20% in moderate distant protection areas, 10% in short distant protection ares. Part of 286 populated Çınarlıdere Quarter is located in the adjacent protection area of the Çokal Basin, however there is no any industrial facility in the quarter.

Table 3. The Settlements in the Water Basins

Dam/Pond Name	Settlement (Neighborhood)	Population (2015)	Number of animals		Protection Area	Distance	Waste Water Disposal Method
			Cattle	Ovin			
TÜRKMENLİ POND (Marmaraereğlisi)	Yakuplu	244	28	620	Medium Area – Precipitation Area	1,17 km	Sewage ending with septic tank
	Türkmenli	313			Medium Area – Precipitation Area	2,31 km	Individual Septic Tank
	Çeşmeli	222			Precipitation Area	3,77 km	Individual Septic Tank
	Şahpaz	565	800	3.200	Precipitation Area	2,40 km	Individual Septic Tank
YAZIR POND (Süleymanpaşa)	Yayabaşı	88	60	100	Short Distance	654 m	Individual Septic Tank
	Karahisarlı	189	150	800	Medium Distance	1,48 km	Sewage ending with septic tank
	Aşağıkılıçlı	62	15	150	Precipitation Area	3,12 km	İndividual Septic Tank
	Yukarıkılıçlı	199	200	1500	Precipitation Area	4,27 km	Sewage
MÜSTECEP POND (Malkara)	Vakıfiğdemir	201	500	1.000	Precipitation Area	1,95 km	Sewage
ÇOKAL DAM (Şarköy)	Çınarlıdere (Malkara)	286	350	300	Closest Area- Short Distance	155 m	Sewage ending with septic tank
	Emirali (Malkara)	130	120	350	Short Distance	472 m	Sewage ending with septic tank
	Yayaağaç (Şarköy)	302	600	2.000	Short Distance – Medium Distance	736 m	Sewage ending with septic tank
	Sofuköy (Şarköy)	78	20		Medium Distance	1,65 km	sewage
	Gölcük (Şarköy)	361	60		Medium Distance – Precipitation Area	1,73 km	sewage
	Çimendere (Malkara)	307	1.200	4.500	Medium Distance	1,26 km	Sewage ending with septic tank

ÇOKAL DAM (Şarköy)	Aksakal (Malkara)	194	450	250	Medium Distance	1,43 km	Sewage ending with septic tank
	Sağlamtaş (Malkara)	2.029	3.000	3.000	Medium Distance – Precipitation Area	1,09 km	Sewage ending with septic tank
	Uluman (Şarköy)	281	450	1.200	Precipitation Area	2,76 km	İndividual Septic Tank
	İshaklı (Şarköy)	111	100	400	Precipitation Area	2,70 km	Sewage ending with septic tank
	Yeniköy (Şarköy)	692	2.050	5.000	Precipitation Area	3,26 km	Sewage ending with septic tank
	Kalaycı (Malkara)	70	155	-	Precipitation Area	3,41 km	Sewage ending with septic tank
	Balabancık (Malkara)	1.140	3.800	2.500	Precipitation Area	5,26 km	Sewage
	Ballı Mah. (Malkara)	588	900	600	Precipitation Area	4,54 km	Sewage ending with septic tank
	Müstecep (Malkara)	287			Precipitation Area	4,69 km	Individual Septic Tank
	Bulgur (Şarköy)	162	300	2.000	Precipitation Area	5,48 km	Individual Septic Tank
	Palamut (Şarköy)	47	50	50	Precipitation Area	6,18 km	Individual Septic Tank
	Esendik (Malkara)	70	200	500	Precipitation Area	6,66 km	Sewage ending with septic tank
	Elmalı (Malkara)	335	650	2.500	Precipitation Area	7,41 km	Sewage ending with septic tank
	Kavakçeşme (Malkara)	169	700	500	Precipitation Area	7,87 km	Sewage ending with septic tank
	Deliller (Malkara)	161	100	500	Precipitation Area	7,76 km	Sewage ending with septic tank
	Sırtbey (Malkara)	94			Precipitation Area	8,11 km	Individual Septic Tank
	Beyoğlu (Şarköy)	200	750	250	Precipitation Area	8,58 km	Sewage ending with septic tank

	Karacahalil (Malkara)	454	1.400	400	Precipitation Area	9,25 km	Sewage ending with septic tank
	Vakıfiğdemir (Malkara)	201	500	1.000	Precipitation Area	9,57 km	Sewage
	Alaybey (Malkara)	383	1.000	300	Precipitation Area	9,68 km	Sewage
	Yörgüç (Şarköy)	323			Precipitation Area	11,04 km	Individual Septic Tank
	Gözsüz (Malkara)	679	500	500	Precipitation Area	11,51 km	Sewage ending with septic tank
	Ormanlı (Süleymanpaşa)	170	600	3.000	Precipitation Area	11,40 km	Sewage ending with septic tank
	Yuva (Süleymanpaşa)	64	300	50	Precipitation Area	12,15 km	Individual Septic Tank
	Tatarlı (Hayrabolu)	270	800	900	Precipitation Area	12,38 km	Individual Septic Tank
	Araphacı (Süleymanpaşa)	98	200	70	Precipitation Area	15,42 km	Sewage ending with septic tank
	Yenice (Malkara)	115			Precipitation Area	16,40 km	Individual Septic Tank

According to "Notification of Technical Procedures For Wastewater Treatment Plants", after treatment domestic waste water in basin must be used in agriculture irrigation. Thus, watershed can be prevented of pollution with domestic wastewater.

Due to "The Project of Wastewater Collection and Wastewater Treatment Plants İmplementation-TESKİ" which is planned from Tekirdağ Water and Sewage Administration, domestic wastewater from settlements in basins will be purified. By protecting from TESKİ the settlements wastewater collection in basins, it had been planned leakproof septic tank+sewage truck as far as 250 person living in places, natural treatment plant between 250-750 person living in places and package treatment plant over 750 person living in places. In the Table 4, It is seen İmplementation Plan of Çokal Dam Basin neighborhoods and Türkmenli Pond Basin neighborhoods.

Table 4. Implementation Plan For Çokal and Türkmenli Basins Settlements

ÇOKAL DAM BASİN			
Neighborhood	**Population (2015)**	**Sewage Project**	**Planned**
Aksakal	194	will be done	Leakproof Septic tank + Sewage truck
Balabancık	1.140	will be done	Package Treatment Plant + Disinfection
Ballı	588	will be done	Leakproof Septic tank + Package Treatment Plant + Disinfection
Çimendere	307	will be done	Leakproof Septic tank+ Natural Treatment+ Disinfection
Çınarlıdere	286	will be done	Leakproof Septic tank+ Natural Treatment+ Disinfection
Emirali	130	will be done	Leakproof Septic tank + Sewage truck
Kalaycı	70	will be done	Leakproof Septic tank + Sewage truck
Müstecep	287	will be done	Leakproof Septic tank+ Natural Treatment+ Disinfection
Sağlamtaş	2.029	will be done	Package Treatment Plant + Disinfection
Gölcük	361	will be done	Leakproof Septic tank+ Natural Treatment+ Disinfection
İshaklı	111	will be done	Leakproof Septic tank + Sewage truck
Ulaman	281	will be done	Leakproof Septic tank+ Natural Treatment+ Disinfection
Yayaağaç	302	will be done	Leakproof Septic tank+ Natural Treatment+ Disinfection
TÜRKMENLİ POND BASİN			
Şahpaz	565	will be done	Leakproof Septic tank+ Natural Treatment+ Disinfection
Türkmenli	313	will be done	Leakproof Septic tank+ Natural Treatment+ Disinfection
Yakuplu	244	will be done	Leakproof Septic tank + Sewage truck

CONCLUSIONS

Potable water basin and surface water quality will be protected and domestic wastewater will be discharged out of the basin by ensuring that measures are taken for domestic wastewater from settlements in the basins. Furthermore, according to "Notification of Technical Procedures For Wastewater Treatment Plants", treated water can be reused as an alternative.

If local people participate in basin conservation activities, effective watershed management can be implemented. Especially waste water and other wastes must be controlled efectively and community must be awareness about issues.

İn the basins adverse impacts of domestic and industrial waste water which the most impartant elements of point-based pollution should be refuse using with appropriate treatment methods.

For effective basin management industrial waste water must be removed from the basin even if it is refined.

Under controlling all planned activities, periodic audits must be done regularly and emerging negotions must be resolved within the framework of legislation. By preventing spread of point-based and diffuse-based pollutants, hydrodynamic structure of surface water will be protected and quality of water resources will be renewal itself easily. Monitoring studies about quality classification of surface water resources protecting also needs to be maintained effectively.

In addition, nitrogen and phosphorus from agriculturel activities have important pollution potential on the fertile soil in the water basins. First of all, usage of fertilizer and agricultural pesticides must be reduced for reducing pollution convection to surface potable water resources. To prevent pollution convection to streams in the basins, agricultural activities must be implemented with ecological methods. Also, good farming practise must be spread.

Water saving, basin protection and studies of new water resources supply must be carried out together.

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