B−20 11th JSCE (Japan Society of Civil Engineering) Student Study Tour on the Danube River in Slovak and Austria Section

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1. Introduction

This paper is a report of 11th JSCE (Japan Society of Civil Engineering) Student Study Tour on the Danube River in Slovak and Austria Section (Fig.1), which has been carried out in 2-9 march 2010. The study tour, of which the member consists of Japanese university students, researchers and professors, was organized by JSCE environmental engineering committee on the overseas environmental education in association with Commenius university in Slovakia and Technical university of Vienna in Austria.

Fig.1 The map of the Danube

There are two main objectives in this JSCE study tour. The first one is to know the current problems of water and environment in the eastern part of Europe including the field excursions of 1) international conflict between Slovakia and Hungary at the Gabcikovo dam in the middle reaches of Danube River, 2) eco-restoration technology to revive fish-way at Freudenau dam on the main stream of Danube River in Austria section, and 3) water environment conservation measures such as wastewater treatment, groundwater pollution and treatment and solid waste treatment in the city of Vienna. The second objective is to exchange view and information on the environmental education among Japan, Slovakia and Austria through the small seminar at Commenius University and Technical university of Vienna (T-U Vienna).

2. The Gabcikovo dam and Inland Wetland

Construction of the Gabcikovo dam was completed in 1992, which is located at the middle reaches of the Danube River near the national border between Slovakia and Hungary (Fig.2), to change the water environment and eco-system of the inland wetland including the territory of Hungary. The main dam is constructed in the territory of Slovakia to divert Danube flow water by artificial canal system for stable navigation. The Gabcikovo hydro-power station with 8 Kaplan bulb turbines produces 2,600 GWh per annum of clean electricity to cover about 10% of electricity supply in Slovakia.

Hungary had once agreed on the joint promotion of Gabcikovo dam project in 1970 during the era of communist party controlled the politics of east Europe. The political paradigm was changed in 1989 by quitting from the joint agreement with Slovakia. Hungary claimed the flow diversion from Danube River by Slovakia to decrease 90 % of original base flow in the inland wetland of Hungarian territory. The international riparian question to divert the Danube flow was sent to

the international court of justice at Hague in 2002. After 10 years of joint monitoring of groundwater and eco-system in the wetland, the court proposed to compromise the conflict until both sides agree on the confident scientific monitoring result. The joint monitoring is still being continued to assess the environmental impact on the eco-system of inter-state wetland.

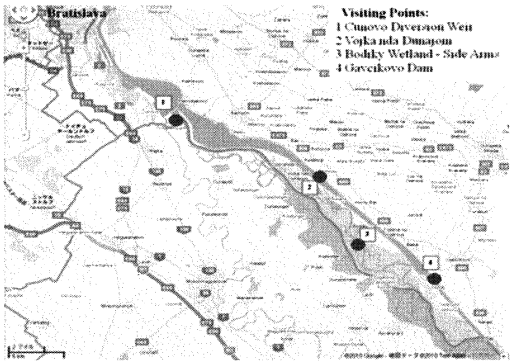

Fig.2 The map of the Gabcikovo

3. Freudenau Dam and Fish Bypass Channel

The Freudenau dam, of which the construction was started in 1992 and completed 1998, is one of the good example in the eastern part of Europe to compromise the conflict over hydro-electric power development and conservation of eco-system in wetland. A referendum was held in Vienna city in May 1991 to agree upon the Freudenau dam project with 73% of "yes". The Freudenau project comprises two main objectives to generate hydroelectricity of 1,052 GWh per annum and protect the floods in the lowest part of Vienna city along with the Danube River. Unique strategy of compromising the conflict over the nature conservation was restoration of fish bypass channel with pond-type fish pass (Fig.3).

Fig.3 The Freudenau Dam

Careful ecological monitoring was carried out in 2002 to confirm 41 species fish ascended through bypass channel (Umgehungsbach) and pond-type fish pass (Tümpelpass), which is about 72% of the potential 57 species in the Danube River at Vienna section.

4. Environmental Engineering Practices in Vienna City

In order to improve the life quality environment of Vienna city, some innovative technologies have been developed at wastewater treatment plant (EBS Wien), ground water purification plant (Moosburn), and solid waste treatment incineration plant (MVA Pfaffenau) in Vienna city.

4.1 EBS Wien Wastewater Treatment Plant

Vienna's wastewater treatment plant is located in the lowest area in the city of Vienna (Fig.4).

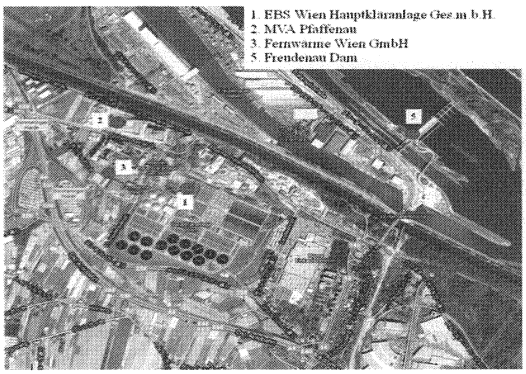

Fig.4 EBS Wien Wastewater Treatment Plant

It means all wastewater reach the plant by gravity. The advance treatment process to remove the nitrogen and phosphorus is innovated by removing more than 95% of carbon and 70% of nitrogen. After the secondary treatment by activated sludge method, approximately 85% of carbon and 30% of nitrogen are removed from the raw wastewater. The treated wastewater is then carried to the intermediate sedimentation tank to separate the muddy sludge. In the tertiary treatment process, especially nitrogen compounds, nitrogen and phosphorus are removed in the un-aerobic tanks of the stage 2. In the de-nitrification process, bacteria convert the ammonium (NH_4) into nitrate (NO_3), nitrification, and then microorganisms convert the nitrate (NO_3) into nitrogen gas (N_2). About 70% of nitrogen and 95% of carbon are removed in this process, finally, the sludge is removed from the final sedimentation tank, and then

the treated wastewater is discharged into the Danube River after water quality test.

4.2 Water Supply and Moosburn Water Purification Plant

Vienna's 95% of drinking water is dependent on the natural springs in the Lower Austrian-Styrian Alps. The spring water is sent to Vienna through two main pipelines. The drinking water is also supplied from groundwater in the alluvial fun deposit in the southern part of Vienna city, of which the purpose is emergency use including the case of repairing or replacing the two main pipeline systems (Fig.5). The groundwater aquifer was once polluted by heavy chemical industry to discharge the effluent with chlorinated hydrocarbons including tetrachloroethylene (C_2Cl_4) and trichloroethylene (C_2HCl_3) in 1940s. The concentration of the chlorinated hydrocarbons is different in places in the range from 25-30μg /l to 7-10μg /l. The chlorinated hydrocarbons are being removed using oxidation dosing ozone (O_3) and hydrogen peroxide (H_2O_2). The optimum ratio of dosing ozone and hydrogen peroxide was found to be 0.7g H_2O_2 per gram of O_3.This method enables to decrease the chlorinated hydrocarbons by 90% or more at least cost.

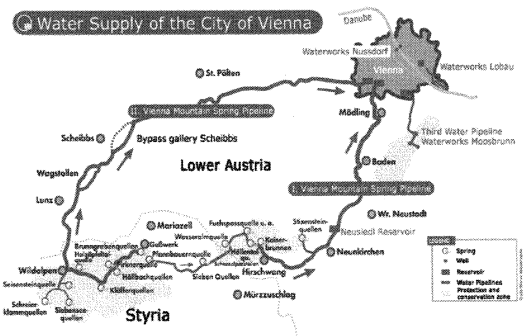

Fig.5 Water Supply of the City of Vienna

4.3 MVA Pfaffenau Solid Waste Incineration Plant

Vienna has 3 waste incineration plants including Flötzersteig, Spittelau and Pfaffenau. The incineration plants are directly connected to the Viennese district heating network to cover 30% of heat consumption. About 250,000 tons of solid waste is being burnt per year at the Pfaffenau waste incineration plant, supplying district heat as central heating for 50,000 Viennese households and electricity for 25,000 households.

5. International Academic Exchange Seminar

A series of seminar to exchange the view and information including the capacity development of university education system were held at Commenius University in Slovakia and T-U Vienna in Austria. Both universities would to make opportunities of foreign student admission within a few years. It means that Japanese students will be able to have a chance to study technology of the environmental engineering in eastern part of Europe.

6. Summary

It was a good opportunity for the undergraduate school student to attend the 11th JSCE student study tour in Slovakia and Austria. In this tour, I could study the advanced wastewater treatment technology with my eye. The Gabcikovo dam and Freudenau dam are impressive visiting points to know either conflict or compromise the development and environment conservation.

Many thanks are due to Dr. Hellumut Fleckseder and Prof. Helmut Croiss, and Prof.Libor Jansky for their kind cooperation and guidance with warm hospitality.

References

1) Libor Jansky, Masahiro Murakami, and Nevelina I. Pachova, 2004, The Danube: Environmental Monitoring of an International River, United nations University, ISBN: 92-808-1061-8