A REVIEW OF THE CENTRALIZED SEWERAGE SYSTEM FOR KUCHING CITY

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LIST OF ABBREVIATIONS

AN	Ammoniacal nitrogen
APHA	American Public Health Association
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DANCED	Danish Cooperation for Environment and Development
DBKU	Dewan Bandaraya Kuching Utara (Kuching North City Hall)
DID	Department of Irrigation and Drainage
DO	Dissolved Oxygen
DoE	Department of Environment
FCC	Feacal Coliform Count
INWQS	Interim National Water Quality Standards
MBKS	Kuching City South Council
NREB	Natural Resource and Environment Board
N_{tot}	Total Nitrogen
NTU	Nephelometric Turbidity Unit
PE	Population Equivalent
TSS	Total Suspended Solid
SSD	Sarawak Sewerage Service Department
SUB	Sustainable Urban Development
TCC	Total Coliform Count

WQI	Water Quality Index
WWTP	Wastewater Treatment Plant

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ABSTRACT

The centralized sewerage system for Kuching City currently under construction and this project is expected to be completed by October 2012. This system shall collect all the wastewater through sewer network to a centralized treatment plant and using the activated sludge system to treat the wastewater. The effluent after being discharged into a constructed wetland before finally flowing into Sarawak River is believed to comply with Standard A of the Environmental Quality Act requirement. Prior to this, Sarawak River and its tributaries within the study area are polluted. The main source of the pollution is raw and insufficiently treated sewage and wastewater, which is eventually drained to Sarawak River. The water quality of different point of the entire river system has been classified according to the Malaysian Interim National Water Quality Standards (NWQSM). The water quality in confluent of Sungai Bintangor, Sungai Sarawak, Holiday Inn, confluent of Sungai Padungan, confluent of Sungai Sekama, Sungai Sarawak, Bintawa Causeway and Bako Causeway is polluted and falls between the class III and class IV of the NWQSM. Very high concentrations of BOD and COD are observed in samples tested. The content of bacteria is extremely high and the water poses a health risk. The water quality in Sungai Sarawak, Satok Bridge, Upstream and Downstream Barrage are slightly polluted and falls between the class II and class III of the NWQSM.

ABSTRAK

Sistem pembetungan berpusat bagi Bandaraya Kuching sedang dalam pembinaan dan projek ini dijangka siap menjelang bulan Oktober 2012. Sistem ini akan mengumpul semua air kumbahan melalui rangkaian pembetung ke loji rawatan berpusat dan menggunakan sistem enapcemar teraktif untuk merawat air kumbahan. Efluen akan dilepaskan ke kawasan tanah basah dan kemudian dialirkan Sungai Sarawak dan dipercayai akan mematuhi Piawaian A keperluan Akta Kualiti Alam. Sungai Sarawak dan juga anak sungai dalam linkungan kajian ini menunjukkan bahawa sungai tersebut tercemar. Punca utama pencemaran tersebut adalah dari air kumbahan tidak terawat yang disalurkan terus ke Sungai Sarawak. Kualiti air dari tempat persampelan yang berbeza di sepanjang sungai telah dikelaskan mengikut "Malaysian Interim National Water Quality Standards (NWQSM)". Kualiti air di kuala Sungai Bintangor, Sungai Sarawak, Holiday Inn, kuala Sungai Padungan, kuala Sungai Sekama, Sungai Sarawak, tambak Bintawa dan tambak Bako adalah tercemar dan dikatagorikan antara kelas III dan kelas IV NWQSM. Dari keputusan kajian persampelan menunjukkan nilai "BOD" dan "COD" adalah sangat tinggi begitu juga kandungan bacteria yang menyebabkan pencemaran di dalam sungai tersebut. Kualiti air di Sungai Sarawak, Jabatan satok, di hulu dan di hilir "Barrage" juga agak tercemar dan dikatagorikan antara kelas II dan Kelas III NWQSM.

CHAPTER 1

INTRODUCTION

1.1 General Background

As early as 100AD, mankind had started to realize the important of sanitation system. During the Roman's era, they built splendid public toilets and bath area that linked to sophisticated water and waste delivery systems that still have the same similarity to the present ones. The system involved flushing and flowed into central channel of rock pipes that today we call it sewer line but of course with different material. Such material today is of verified Clay Pipe, Ductile Iron Pipe and high Density Polyethylene or all. This sewer water was then discharged to the nearest river or stream.

For the last 30 years, Malaysia wastewater treatment technologies used overhang latrines, pit privy, bucket system and pour flush system until the introduction of a more modern septic tank and Imhoff tank system. Only the last two decades, we saw the emergence of the new technologies in the form of oxidation ponds, aerated lagoons, package systems and a variety of mechanical plants. Even though with the growing changes in the wastewater treatment, sewage still remains as a current major pollutant of our inland waterway.

Over the years, water pollution has come out as major issues. The main pollutants include pathogen, organic matter, nutrients, heavy metals and toxic chemicals, sediment and suspended solids, silt and salt. In developing countries, the rivers in the urban areas are heavily polluted with domestic sewage, industrial effluents, chemical and solid wastes (UNEP, 2002).

In Kuching, housing estates still use septic tank as the most common domestic wastewater treatment system. From the survey outcome conducted by Drainage and Irrigation Department of Sarawak, it had recorded that there were about 74,000 septic tanks in Kuching (refer to Appendix 1). For area where larger population are involve, Imhoff tank system were usually used in single building while oxidation pond for hospital, airport, hotel and some institutions. Besides this two, there were a few local centres where their wastewater treatment using activated sludge system. The storm water drains and river acted as combined sewer receptors for all types of wastewater such as septic tank effluent, grey water from residential activities as well as liquid waste from industries.

1.2 Study Background

Kuching City is the capital of the State of Sarawak located on the island of Borneo and the city is located on the banks of the Sarawak River (refer to Figure 1.1). The population estimated more than half a million covering an area of approximately 431 square of kilometers, reaching out right to the South China Sea in the north.

Sungai Sarawak is the lifeblood of Kuching city. This river serves as a life-sustaining water source for the residents in Kuching City and the entire ecosystem surrounding in the areas. Besides, this river is also an important navigation channel that connected a few landmarks in Kuching City for river taxi. Water related sport activities are held in the river such as Sarawak Regatta and city celebration activity like decorated river float to boast Sarawak tourism industry.

Figure 1.1: Location of Kuching City
Source: Google Map

With rapid growth and urbanization, Kuching City is currently experiencing "growing pains" particularly in the areas of socio-economic and Municipal infrastructural demands bring this wastewater issue into a big subject of concern for the Government not to ignore. Increasing pollution discharges from the existing sewer systems into the rivers are beginning to worsen the water quality and threaten the well being of the streams and rivers, where this pollution has developed smell and killing the ecosystems in and around it.

As a responsible government, a Centralized Sewerage System to collect all the wastewater in Kuching city is introduced. This system shall collect all the wastewater through a network of underground pipes to a centralized treatment plant. From the plant, a process to treat the wastewater using the activated sludge system is believed to have treated effluents from the plant comply with Standard A of the Environmental Quality Act requirement (refer to Appendix 2). The effluent shall be discharged into a constructed wetland before finally flowing into Sarawak River.

The centralized sewerage system is currently under construction to reduce pollution level of the city's waterways due to insufficient treatment in septic / Inhoff tanks. The coverage study area of centralized sewerage system for Kuching City (Package 1) is as shown in Figure 1.2 which covers the commercial and densely-populated areas of the central business district. This project is expected to be completed by October 2012. For this project, three main components are involved. They are Wastewater Treatment Plant, Sewer Network

and Property Connections. It costs 530 million covering public sewer line of 64.1 km and a treatment plant design for 100,000PE expandable to 400,000PE.

A "Design and Construction" contract is awarded to a turnkey contractor Kumpulan Nishimatsu - Hock Seng Lee Consortium on 30th September 2008. The local consultant is Jurutera Jasa (Sarawak) Sdn Bhd in association with CH2M Hill USA. Sarawak Sewage Department is the government representative responsibled to manage and oversee the project. On project completion this organization shall also be the authority that responsible to manage and control the system for the Sarawak Government.

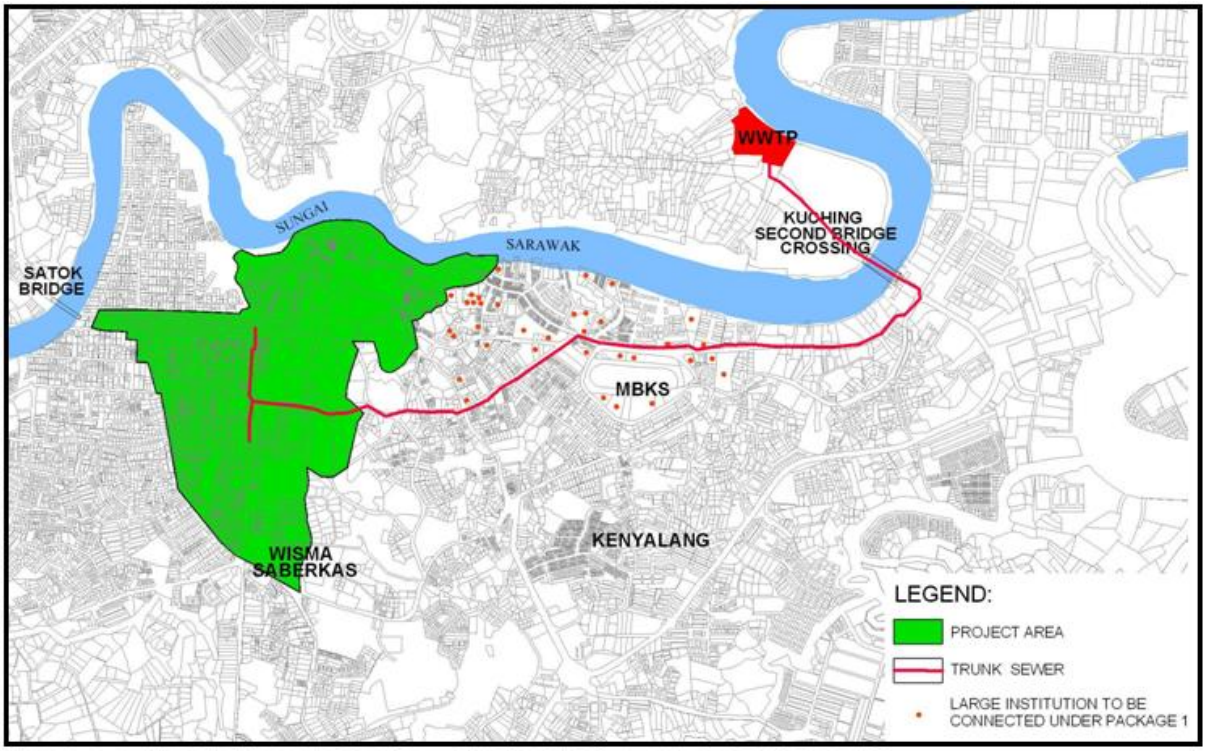

Figure 1.2: Study Area of Centralized Sewerage System for Kuching City (Package 1).
Source: Sewerage Service Department Sarawak.

1.3 Objectives

The objectives of this study are:

i. To study of the existing system and the proposed centralized sewerage system for Kuching City.

ii. To compare and analyze the existing influent and expected effluent for the proposed system.

iii. To evaluate the affected river water quality within the study area.

Furthermore, it provides the exposure on the application and performance of the theoretical knowledge thus enhance us the opportunity to develop new idea and approach in addressing the appropriateness of setting up a centralized sewerage system in Kuching city.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Sewerage refers to the collection, treatment and disposal of liquid wastes (McGhee, 1991). A sewage collection system consists of pipes network, pumping stations, channels, and appurtenances that convey wastewater to treatment plant, storage, or disposal. The wastewater may include domestic sewage, industrial sewage, storm sewage, or a mixture of the three.

Domestic sewage carries human wastes called black water (wastewater from toilet) and grey water from homes, public building, or commercial and industrial establishment. Industrial sewage is the wastewater from manufacturing processes, usually carrying a variety of chemical compounds. Storm sewage is the surface runoff caused by rainfall which carries organics, suspended and dissolved solids, and other substances picked up as it travels over the ground.

2.2 Wastewater Characteristics

Wastewater is characterized in terms of its physical, chemical, and biological compositions (Tchobangolous and Burton, 1991). Many of the parameter in physical, chemical and biological are interrelated. For example, temperature, a physical property, affects both the biological activity in the wastewater and the amounts of gases dissolved in the wastewater.

2.2.1 Physical Characteristics

The most important physical characteristic of wastewater is its total solids content, which is composed of floating matter, settles able matter, colloidal matter, and matter in solution (Tchobangolous and Burton, 1991). Other important physical characteristics include temperature, color odor, and turbidity. The principal physical properties of water are summarized in Table 2.1.

Table 2.1: Physical Characteristics of Wastewater

Characteristic	Description
Temperature	The temperature of wastewater is slightly higher than that of water supply. Temperature has effect upon microbial activity, solubility of gas, and viscosity. The temperature of wastewater varies slightly with the seasons, but is normally higher than air temperature during most of the year and lower only during the hot summer months.
Color	Fresh wastewater is light gray. Stale or septic wastewater is dark gray or black.
Odors	Fresh wastewater may have a soapy or oily odor, which is somewhat disagreeable. Stale water has putrid odors due to hydrogen sulphide, and other products of decomposition. Industrial wastes impart other typical odors. Because of odors associated with wastewater treatment facilities, area residents have often vigorously resisted and rejected wastewater treatment plant projects.
Turbidity	Turbidity in wastewater is caused by a wide variety of suspended solids. In general, stronger wastewaters have higher turbidity.

Source: Qasim, 1994