3D WATER QUALITY MODELING OF TASIK SRI SERDANG USING CENSIS APPLICATION

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1.0 INTRODUCTION

Reservoirs and lake are part of water resources and freshwater ecosystem besides river, sea and groundwater. Some of the reservoirs located near residential, industrial, recreational and commercial areas are usually being used as water supply source, detention ponds, recreational parks, fishing, habitat for aquatic life and as well as wastewater discharging sites. Tasik Sri Serdang is located at Taman Sri Serdang at the end of Anak Kuyoh River upstream. The catchment includes residential area, school, commercial area and institution. These activities can cause water quality problem to the pond. The pond location is very strategic and has a potential as a recreational park for various outdoors activities such as fishing and boating. This pond also can be a great habitat for various living organism if well maintained and the system framework principles can be applied at others reservoir identified. Therefore this study is all about providing the best approach in handling and maintains the water quality of Tasik Sri Serang. Coastal Environment Simulation System (CENSIS) is a powerful tool for environmental impact assessment, management of the environment and prediction for effect of practices to cope with quantitative assessment for current field, water quality/suspended solids and chemical substances, and gateway modules that help us to carry out numerical simulation (Chuden CTI Co., Ltd., 2005). CENSIS is using 3-Dimensional approach to carry out numerical simulation which is suitable for reservoirs, sea and estuarine application.

The objectives of this study are:

a) To determine water quality status of the pond
b) To develop 3D water quality modeling using CENSIS
c) To propose recommendation of remediation and management practices that will meet the desired condition of Tasik Sri Serdang.

2.0 LITERATURE REVIEW

Reservoir is influenced by flow, current and activity inside the pond. All aspect should be study to cope the overall assessment of changes, impact and for accurate simulation result. Factors that affect the ecological balance of reservoirs, lake or pond include its size and depth, the sun penetration, water temperature and movement, pollutants from runoff and point source and aquatics life in the ecosystem. According to Whitman et al., (2004), water quality approach is sensitive to the effect of the combined effects of the whole range of different discharges into a water body. Zalewski (2000) wrote that freshwater ecosystem processes regulate water, nutrient circulation and flow in two ways between the biota and hydrology. CENSIS software modules include hydrodynamic and water quality aspects and it using 3-Dimensional approach to carry out numerical simulation. The hydrodynamic model will describe the numerical approach developed of predicting hydrodynamic process in the system. Hydrodynamic environment of an estuary, sea and reservoir is affected by dynamic forcing variables such as tide, discharge, surface wind and other meteorological factors (Chuden CTI Co., Ltd., 2005). Nakata and Taguchi (1982), Nakata et al., (1983, 1985) and Taguchi and Nakata (1998) wrote that water quality numerical model developed a method to quantitatively evaluate physical-biological interaction in the ecosystem in terms of carbon, nitrogen, phosphorus and oxygen cycles. The model contains twelve state variables that include organic matter, intercellular nutrients of phytoplankton, nutrients, dissolved oxygen and chemical oxygen demand.

3.0 RESEARCH METHODOLOGY

This project required few types of data such as bathymetry, meteorological data, hydraulic and water quality data. Both primary and secondary data were collected. Data collection for this project comprises of three parts namely:

a) Field sampling either using portable or permanents sensor or bring back to laboratory for analysis
b) Laboratory work or data processing
c) Literature review and secondary data

3.1 Bathymetry Data

Bathymetry data provided by NAHRIM that being survey on 2007. The bathymetric map or chart usually shows floor relief or terrain as contour lines and may additionally provide surface navigational information. This data will be use to form model grid and generating model bathymetry by using 3D spline interpolation technique.

3.2 Meteorological Data

Primary data such as rainfall, temperature, relative humidity, evaporation, solar radiation, wind speed and wind direction provided from NAHRIM. Data collected since June 2008 until June 2009. The station located nearby (Lat: 3° 00' N and Long: 101° 42' E) at open space area to ensure that data collected is represent the real condition and to ensure no disruption by structure such as building, bridge, tree and etc that can cause error. Besides, there are 4 Meteorological Department stations identified as the closest station to the study area as shown in Table 1.

Table 1: Data from Meteorological Department

Station Name	Coordinate/Location	Period of Data	Parameter/Data
MARDI Serdang	Lat: 02° 59' N Long: 101° 40' E	1995-2004	Rainfall and Relative Humidity
Pusat Pertanian Serdang	Lat: 3° 00' N Long: 101° 42' E	1995-2007	Rainfall and Relative Humidity
Petaling Jaya	Lat: 3° 06' N Long: 101° 39' N	1995-2007	Wind speed, wind direction, cloud cover and evaporation.
Subang	Lat: 3° 07' N Long: 101° 33' E	1995-2007	Solar radiation, wind speed and wind direction.

3.3 Discharge, water quality and others data

Model development includes developing hydrodynamic (COSMOS) and water quality (EUTHROP) models. Data input to develop those models includes discharge, meteorological and water quality data. Details information on discharge and water quality data is as shown in Table 2. Data collected are use as an input and for calibration purposes. Therefore sampling frequency is subject to the aim to cover various storm and monsoon events.

Table 2: Discharge and water quality data

Types of Data	Parameter	Sampling Frequency/ Date	Methods of sampling	Details
Hydraulic	Discharge/Flow	27 Jun 2008, 3 and 31 July 2008, 28-29 Nov 2008, 27 Mac 2009, 1 July 2009.	Portable current meter and Aqua Dopp	Sampling at 7 sampling locations at the inlet, outlet and centre of the pond.
Water Quality	DO, Temperature, TSS, Salinity, Conductivity and Turbidity.	28-29 Nov 2008, 27 Mac 2009, 1 July 2009.	YSI Multiprobe (In-Situ)	
	BOD, COD, POC, DOC, PO4, Ammonium, NO2, NO3, TSS, Total Nitrogen, Phytoplankton, Zooplankton	28-29 Nov 2008, 27 Mac 2009, 1 July 2009.	Laboratory Analysis	

GIS information can be developed concurrently due to data availability such as land use map, topography map and satellite image.

4.0 RESULT AND DISCUSSION

Table 3 and 4 shows water flow rate during wet and dry season. Result shows volume of water that flow at the outlet is more than total volume of water that comes from the inlets. During wet season volume of water is obviously higher than dry season.

Table 3: Water flow rate at each sampling station in (m^3/hr) at 28-29 Sept 2008 (Wet Season)

Sampling Station	The Water Flow (m^3/hr) during sampling periods.								
	1st	2nd	3rd	4th	5th	6th	7th	8th	Avg.
SS2 (Inlet 1)	158.40	103.68	112.68	234.72	201.24	204.48	76.32	31.68	140.40
SS3 (Inlet 2)	64.44	52.56	213.12	74.52	40.68	190.08	66.60	45.00	93.38
SS4 (Inlet 3)	38.88	35.64	61.92	33.48	14.40	109.80	39.24	41.04	46.80
SS5 (Inlet 4)	70.56	62.28	86.40	121.32	29.52	97.20	49.32	44.28	70.11
Inlet (Total)	**332.28**	**254.16**	**474.12**	**464.04**	**285.84**	**601.56**	**231.48**	**162.00**	**350.69**
SS1 (outlet)	564.84	583.20	527.04	481.32	481.68	583.20	539.28	504.36	533.12

Table 4: Water flow rate at each sampling station in (m^3/hr) at 31 July 2008 and 1 July 2009 (Dry season)

Sampling Station	The Water Flow (m^3/hr) during sampling periods.			
	31 July 08	Time	1 July 2009	Time
SS2 (Inlet 1)	82.91	1.45 pm	82.25	9.45 am
SS3 (Inlet 2)	12.19	1.55 pm	9.98	10.00 am
SS4 (Inlet 3)	5.22	2.10 pm	2.85	10.30 am
SS5 (Inlet 4)	2.88	2.20 pm	4.94	10.40 am
Inlet (Total)	**103.20**		**100.02**	
SS1 (outlet)	111.63	1.00 pm	125.93	9.30 am

Meteorological data being processes to ensure the value is meet the requirement of CENSIS model. Water quality reading was calibrated by comparing it with secondary data from Department of Environment. From the analysis, result shows that the water quality status from each inlets and outlets is within class IV and V.

5.0 REFERENCE

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