

## **Methods of Evaluating the Semenyih River Basin Selangor, Malaysia**

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### **Abstract**

The Semenyih River Basin consists of 36 sub-basins with areas ranging from 1.37 to 35.57 km,<sup>2</sup> The basin comprises seven different major land uses such as forests; agricultural land; settlements; and industry; rubber and oil palm plantations; ex-mining land and water bodies. In order to classify the relative stability of each sub basin, the relationship between the seven land use categories, human activities and five physical parameters of the Semenyih Basin, i.e. a) water quality and water quality index, b) hydrological aspects such as surface compaction and drainage density, c) grade of weathering, d) landform or slope gradient, and e) population density were evaluated. The basin's stability classification results were concluded in four outcomes, namely (a) "Good", indicating that the whole area is covered by forests or parts are rubber plantation or characterized by water quality index Class I or IIA and considered to be stable. (b) "Fair", the land use in the area is mostly plantations such as rubber plantation or fruit trees or indicated by water quality index Class IIB. (c) "Slightly Disturbed", characterized by settlements and other mixed activities such as oil palm plantations, quarries or mine or indicated by water quality index Class III, and finally, (d) "Disturbed" sub basin, characterized by urban and industrial activities or indicated by water quality index Class III to V and considered to be least stable.

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## 1. Introduction

Definition of basin refers to part of the land area that drains water to a particular stream, river and or lake. The basin is regarded as a dynamic system where history and time can be important as the drainage basin passes through the various stages of its evolution (Chorley *et al.* 1984). The Semenyih Basin, which has a total area of 266.60 km<sup>2</sup> consists of 36 sub-catchments with areas ranging from 1.37 to 35.57 km<sup>2</sup>. It contains seven different land uses, five different lithologies and has a variety of landforms ranging from steep land to flatlands.

The Semenyih River Basin was evaluated in terms of the relationships between land use, human activities and five physical parameters, i.e. water quality, grade of weathering, slope gradient (geomorphology), surface compaction (hydrology) and human population within the basin. Two sectors of development; urbanization and industrialization have been identified as the main causes of environmental degradation in the study area (Jamaluddin Md..Jahi, 1999a and 1999b; Muhammad Barzani Gasim *et al.* 1999; 2002a; and 2002b).

## 2. Results and Discussion

### 2.1 Methods of sub-catchments evaluation

Evaluation of sub-catchments is carried out in the following ways; firstly, land use of the Semenyih Basin was divided into seven categories. Secondly, land use category and percentage of land use activity is identified in every sub-catchment, and the result show that every sub- catchment contains between one to five categories of land use with percentage from 15 to 100. Thirdly, qualitative relationships between land use and each of these stability indicator parameters viz., water quality, surface compaction, slope and population density were established for each sub-catchments. These relationships categorize the status of all sub-catchments into four levels of basin stability condition namely good, fair, slightly disturbed, and disturbed basins.

The seven categories of land use are: a) Forest; 2) Agriculture; 3) Rubber; 4) Oil Palm; 5) Urban and Industry; 6) Ex-Mining and 7) Water bodies

Description of each physical parameter is discussed as follows:

1. The scale for the Water Quality Index (WQI) is divided into four categories: a) Class I and IIA (for water supply without treatment or conventional treatment), b) Class IIB (recreational use with body contact), c) Class III (livestock drinking) and d) Class III to V (irrigation only). WQI classification is based on Interim National Water Quality Standard for Malaysia (DOE, 2001), in which for Class I (Clean) is  $\geq 80$ ; Class IIA and IIB (Slightly Polluted) range from 60 to 79 and Class III to V (Polluted) is  $\leq 59$ .

2. The scale for surface compaction refers to hydrological characteristics indicator that relate to the impact of existing land use. The categories of surface compaction are based on the distribution of vegetative cover and geological aspects. Surface compaction will be lesser in the forest areas or in the weathered rocks but high in the urban areas. The influence of surface compaction on runoff coefficient also depends on the pavement and surfaces and can be reflected from the drainage density. Four categories of surface compaction are: a) Land area with 30% or less compaction, b) Land area with 30 to 50% compaction, c) Land area with 50 to 70% compaction, and d) Land area with 70% or more compaction
3. Description of rock mass weathering grade is basically based on the IAEG expanse of man-made (1981) rating; fresh rock is Grade I, slightly weathered rock is Grade II, moderately weathered rock is Grade III, highly weathered material is Grade IV, completely weathered materials (Grade V) and residual soil (Grade VI). Weathered profile type B rock is most common in the forest areas and generally comprise of different grades, from I to VI. (Ibrahim Komoo, 1989).
4. The slope gradient or landform is a morphological pattern of the area and is very much influenced by rock hardness. The landform of the Semenyih Basin is basically divided into four slope categories: a) Slope less than  $10^0$  or flatland, b) Slope between 10 to  $20^0$  ranging from flat to rolling land, c) Slope between 20 to  $45^0$  ranging from rolling to steep land, and d) Slope of more than  $45^0$  or steep land.
5. The estimation of population density is based on total population per square km area. Population density reflects the level of human activity in certain places; generally, the higher the activity, the greater is the pollution level in the receiving water bodies. Urban and industrial areas usually are characterized by high population density, while forest is the lowest (DOS, 2000).

The result of the analysis of 36 sub-catchments of the Semenyih River Basin shows that twelve forested sub-catchments or 33% of the entire basin is classified as “Good”; six agricultural and forested sub-catchments or 17% of the basin is classified as “Fair”; ten agricultural and settlements sub-catchments or 28% of the basin is classified as “Slightly Disturbed” and eight urban sub-catchments or 22% of the basin is classified as “Disturbed” basin.

## **Conclusion**

Qualitative evaluation of the Semenyih River Basin based on existing category and activity of land uses and five physical parameters were carried out successfully. The results indicated that the basin is still healthy in term of land use coverage of forests (with more than 50%) and under protection and monitored by local authority. Dete-

rioration of the Semenyih Basin is limited to sub-catchments that are located within the urban and industrial areas and their vicinity.

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