



**UNIVERSITI PUTRA MALAYSIA**

**MODELING OF SALT WATER INTRUSIONS INTO LANGAT  
RIVER ESTUARY, MALAYSIA**

**NORHABINA ABD ARIS**

**FPAS 2012 19**



**MODELING OF SALT WATER INTRUSIONS INTO LANGAT RIVER  
ESTUARY, MALAYSIA**

By

**NORHABINA ABD ARIS**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfillment of the Requirements for the Degree of Master of Science**

**August 2012**

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

**MODELING OF SALT WATER INTRUSIONS INTO LANGAT RIVER ESTUARY, MALAYSIA**

By

**NORHABINA ABD ARIS**

**August 2012**

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This study used one-dimensional model approach to determine salt water intrusion of Langat River. The objective of the study is to produce a methodology for rapid assessment of the impact water abstraction on the saline intrusion in the Langat River. The first step is to produce a simple model of saline intrusion in estuaries and evaluate the impact of water abstraction from river, based on resulting salinity intrusion model.

The sampling measurement has been taken during intermediate, neap and spring tide at high and low water. These observation was then applied the one dimensional saline intrusion model which has been proposed by Ippen and Harleman (1961) to predict future saline intrusion length using best fit line analysis. The study found that saline water intruded further to the upstream up to 28.29 km during spring tide at high water compare to 13.85 km during intermediate at low water. The river water stratification layer has been determined using Ippen and Harleman (1961) approach. The study revealed that the Langat River behavior ranged from partially-mixed to well-mixed estuary. There are different values of diffusion coefficients,  $D_0$  for every tide conditions which ranged from 495 to 3219. Hydrological analysis such as return period and 7-days low flow also has been carried out in this study. From this study, one dimensional model has predicted saline will intrude further upstream up to 55 km with instantaneous salinity distribution,  $s/s_0=0.20$  on year 2020. This model was suitable to predict saline intrusion length during intermediate tide using best fit line analysis.

This study found that the amount water left in the river for year 2020 will be less than year 2004 due to higher water demand with 259% increase in population. Rise of water abstraction from the river may affect to saline water intrude to further to the upstream and affect the quality of drinking water. Therefore the rate of salt water intrusion should also be taken into account in decision-making, particularly for water resource of water supply.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sain

**MODEL PENCEROBOHAN AIR MASIN KE ATAS MUARA SUNGAI LANGAT, MALAYSIA**

Oleh

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Kajian ini telah menggunakan pendekatan model pencerobohan air masin 1-dimensi bagi Sungai Langat. Objektif kajian ini adalah untuk menghasilkan kaedah penilaian pantas ke atas impak pengambilan air terhadap pencerobohan air masin di Sungai Langat. Langkah pertama adalah untuk menghasilkan model pencerobohan air masin yang ringkas di muara dan menilai kesan impak pengambilan air dari sungai berdasarkan model pencerobohan air masin.

Perlaksanaan pensampelan dibuat semasa air pasang sederhana, air surut dan air pasang besar di peringkat kenaikan air tinggi dan air rendah. Data pensampelan diaplikasikan dalam model pencerobohan air masin 1-dimensi yang telah digunapakai oleh Ippen dan Harleman (1961) untuk meramal kemasukan pencerobohan air masin menggunakan analisis 'best fit line'. Kajian ini mendapati bahawa air masin telah menceroboh masuk paling jauh ke hulu semasa air pasang besar sejauh 28.29 km berbanding 13.85 km semasa air pasang sederhana. Penentuan lapisan strata saliniti air sungai telah dianalisis menggunakan kaedah pendekatan yang digunapakai oleh Ippen dan Harleman (1961). Ciri-ciri muara Sungai Langat adalah dikategorikan sebagai pencampuran separa dan pencampuran baik. Terdapat perbezaan bagi nilai pekali penyebaran,  $D_0$  dari julat 495 sehingga 3219. Bagi setiap air pasang yang dikaji, analisis hidrologi seperti 'return period' dan '7-days low flow' juga dilaksanakan dalam kajian ini. Dari kajian ini, model 1-dimensi dapat meramal pencerobohan air masin ke hulu di muara sejauh 55 km dengan menggunakan taburan saliniti,  $s/s_0=0.20$  bagi tahun 2020. Model ini adalah paling sesuai digunakan untuk meramal pencerobohan air masin semasa air pasang sederhana menggunakan analisis 'best fit line'.

Kajian mendapati jumlah minimum air dalam sungai bagi tahun 2020 akan berkurangan berbanding tahun 2004 berikutan peningkatan permintaan penggunaan air selari dengan peningkatan nisbah penduduk sebanyak 259%. Peningkatan pengambilan air dari sungai akan memberi kesan terhadap kemasukan air masin lebih jauh ke hulu dan memberi

kesan ke atas kualiti air minuman. Oleh yang demikian, kadar kemasukan air masin juga perlu diambilkira dalam membuat keputusan sumber air terutamanya untuk bekalan air.



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I certify that a Thesis Examination Committee met on 14 August 2012 to conduct the final examination of Norhabina Binti Abd Aris on her thesis entitled “Modeling of Salt Water Intrusions into Langat River Estuary, Malaysia” in accordance with the Universities and Universities Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master Science.

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