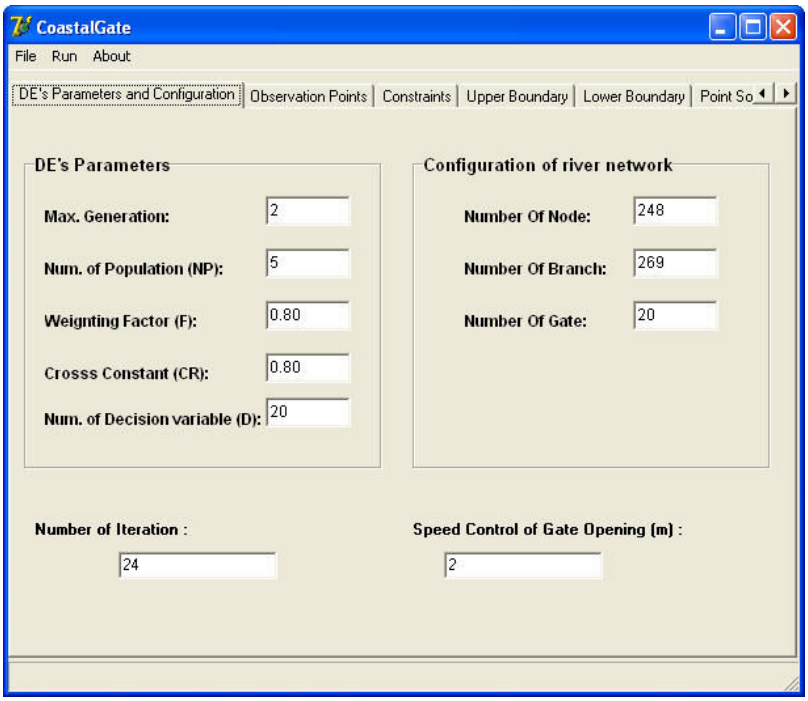
Appendix C
The configuration of CoastalGate model

The CoastalGate model developed was based on the theory of Differential Evolution (DE), which is stochastic optimization model, and by using River Operation Mode (ROM), which is the existing mathematical simulation model as described earlier. The Delphi computer programming language, an improved version of Pascal computer programming language, was used to develop such a coupling model. The input data requirement for CoastalGate model consists of those for three models, e.g. hydrodynamic, water quality, and optimization models. The detailed information of input data for each model is described as follows.

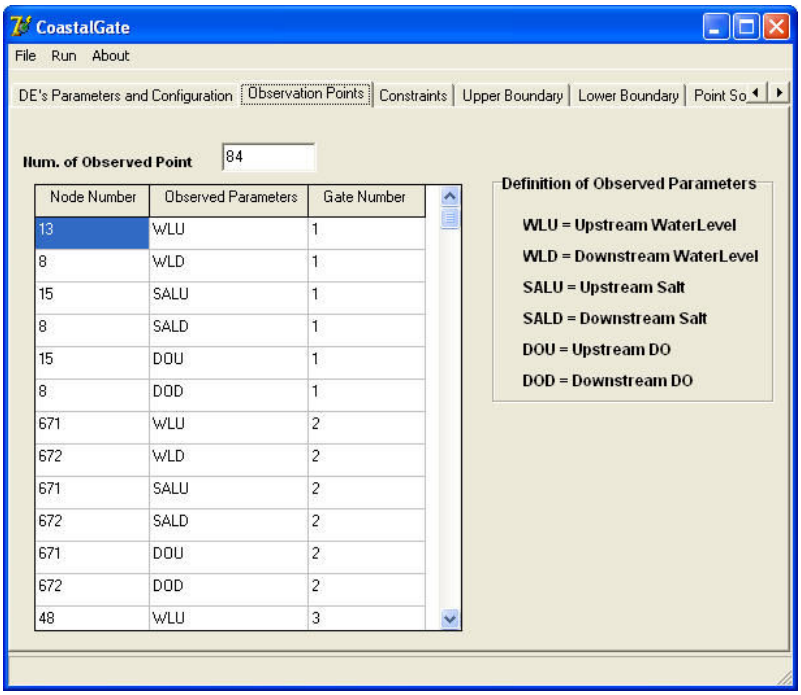
The input data which requires for optimization model comprises nine main parts which have to be inputted into nine input windows as follows. In the first window, the DE's parameters, namely the number of maximum generation, the number of population, weighting factor, crossover constant, the general information of river network: the number of nodes, branches, and gates, the criteria for controlling speed of gate opening, and the number of iteration (or planning time) are inputted to model (see Appendix Figure C1).



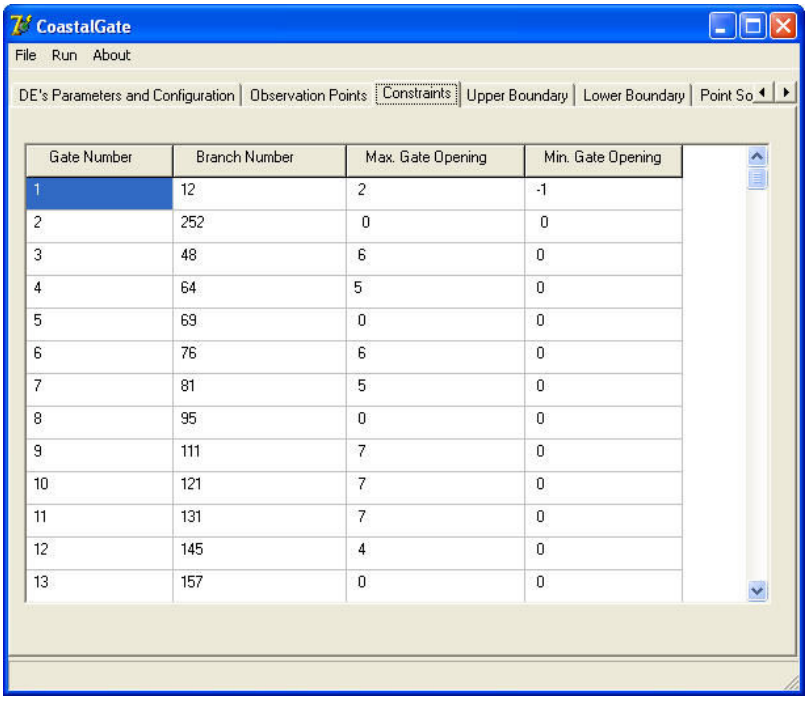
Appendix Figure C1 DE's parameters and configuration input window.

Appendix Figure C2 shows window for inputting data of observation point data. These input data are specified to use for collecting the information of interesting state variables (e.g. water levels, salinity concentrations and dissolved oxygen concentrations) at selected control points along the river obtained from running the CoastalGate model, and then these information are used for calculating satisfaction function as expressed in equation 33. The input data for this section include node number, observed parameters, and gate number,

The maximum and minimum allowable gate opening data are fed into constraints input window as shown in Appendix Figure C3. These input data contain details of gate number, branch number, allowable maximum and minimum gate opening. Indeed, the allowable maximum and minimum gate opening are the upper and lower limit of decision variables.

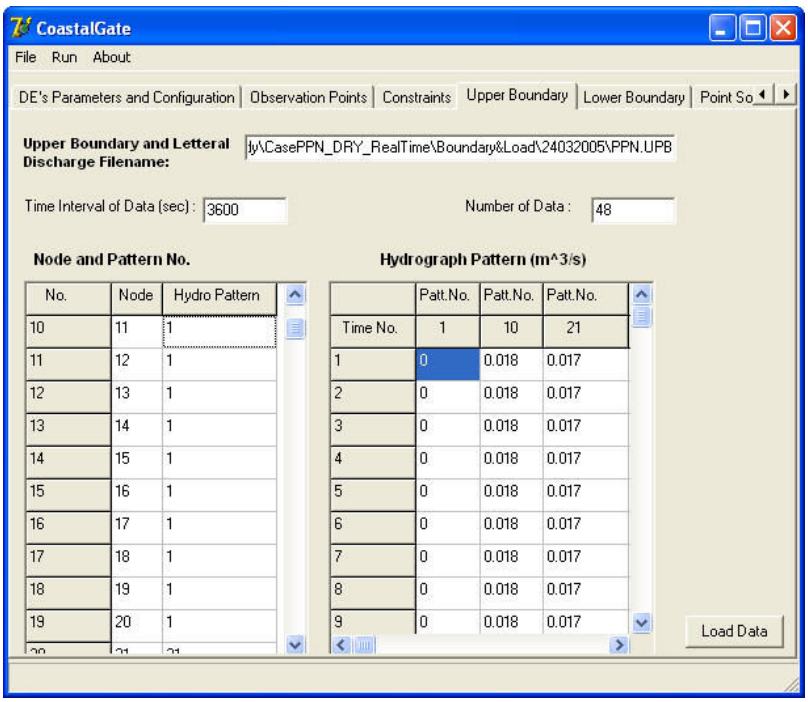


Appendix Figure C2 Observation points input window.



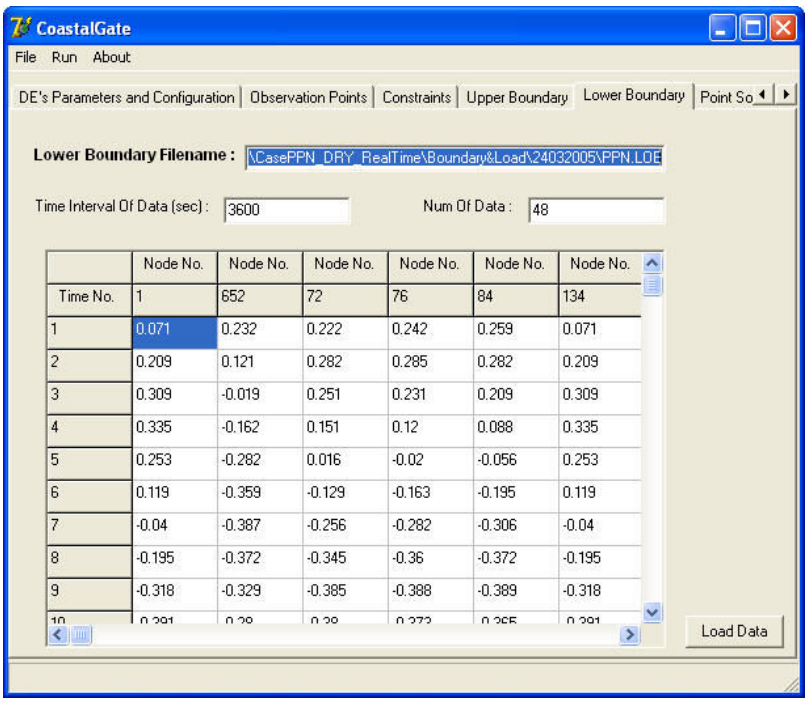
Appendix Figure C3 Constraints input window.

Appendix Figure C4 shows window for inputting data of upper boundary and lateral discharge. These input data contain details of time interval of data, the number of data, node number, hydrograph pattern, and the hydrograph information.



Appendix Figure C4 Upper boundary input window.

The lower boundary data is inputted into a lower boundary window as shown in Appendix Figure C5. These input data contain details of time interval of data, the number of data, node number, and the tide hydrograph information. For the purpose of planning coastal gate operations, the upper and lower boundary data are generated from two Forecasting Models: Auto Regressive & Updating Procedure Model (AR Model) and harmonic analysis model, respectively as described previously.

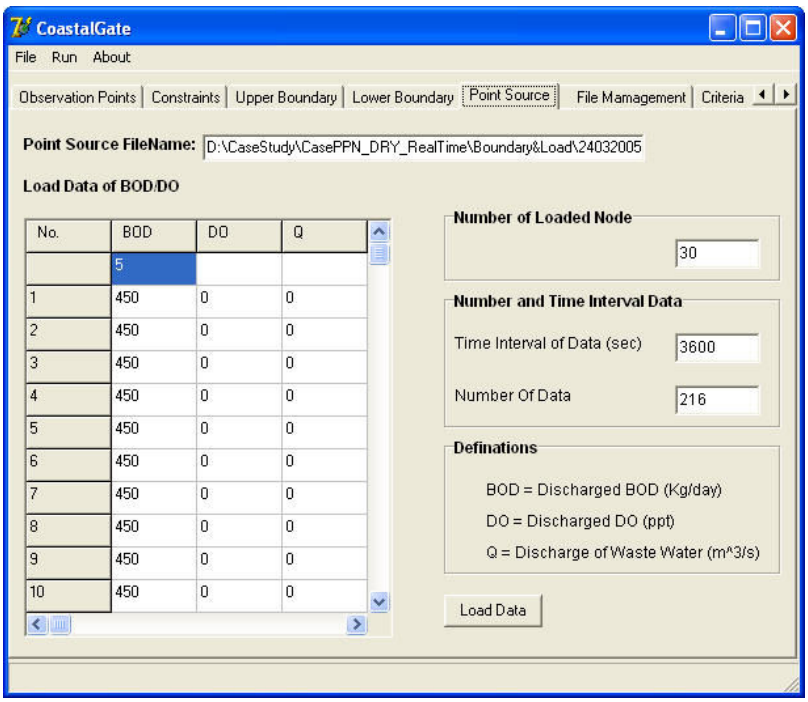


	Node No.	Node No.	Node No.	Node No.	Node No.	Node No.
Time No.	1	652	72	76	84	134
1	0.071	0.232	0.222	0.242	0.259	0.071
2	0.209	0.121	0.282	0.285	0.282	0.209
3	0.309	-0.019	0.251	0.231	0.209	0.309
4	0.335	-0.162	0.151	0.12	0.088	0.335
5	0.253	-0.282	0.016	-0.02	-0.056	0.253
6	0.119	-0.359	-0.129	-0.163	-0.195	0.119
7	-0.04	-0.387	-0.256	-0.282	-0.306	-0.04
8	-0.195	-0.372	-0.345	-0.36	-0.372	-0.195
9	-0.318	-0.329	-0.385	-0.388	-0.389	-0.318

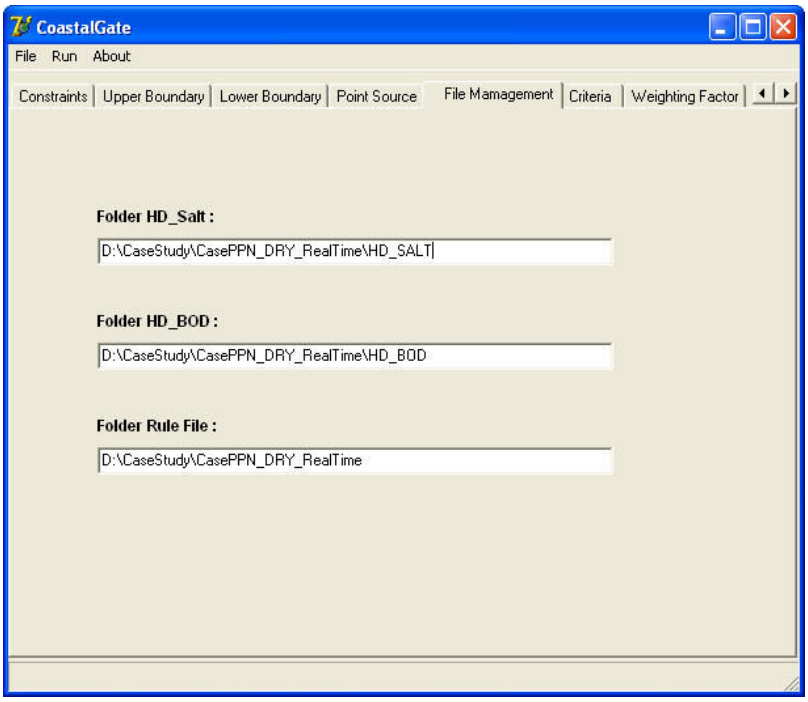
Appendix Figure C5 Lower boundary input window.

The point source data are inputted into a point source input window as shown in Appendix Figure C6. These input data contain details of number of loaded node, number and time interval data, discharged BOD, discharge DO, and discharge of waste water at loaded nodes.

The file information, which shows the path of folder for storing input data of hydrodynamic, salinity, BOD/DO models and also the path for storing output data file, are inputted into file management input window as presented in Appendix Figure C7.

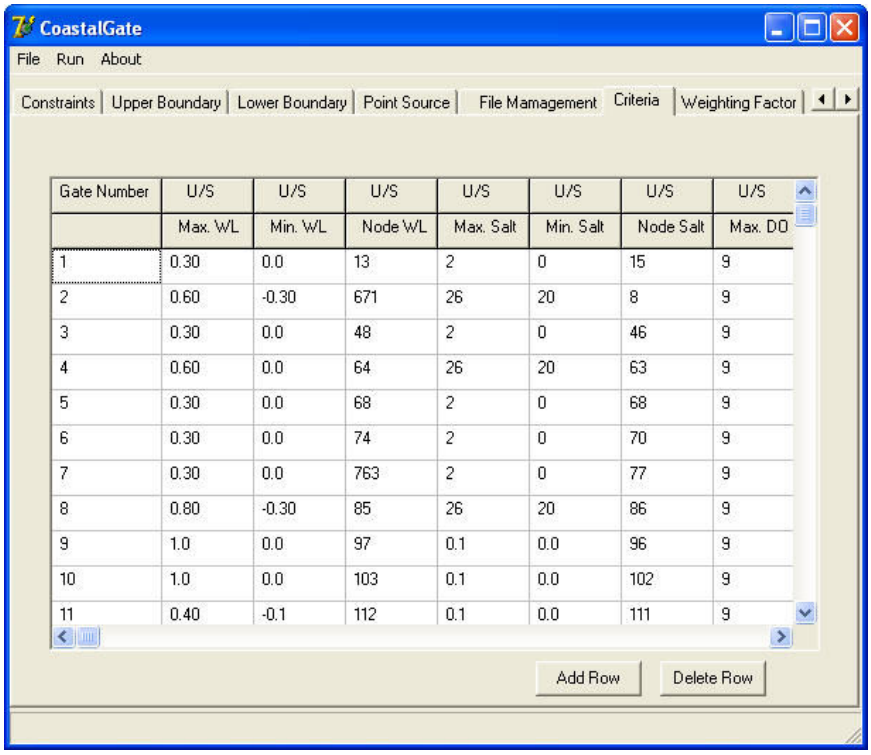


Appendix Figure C6 Point source input window.



Appendix Figure C7 File management input window.

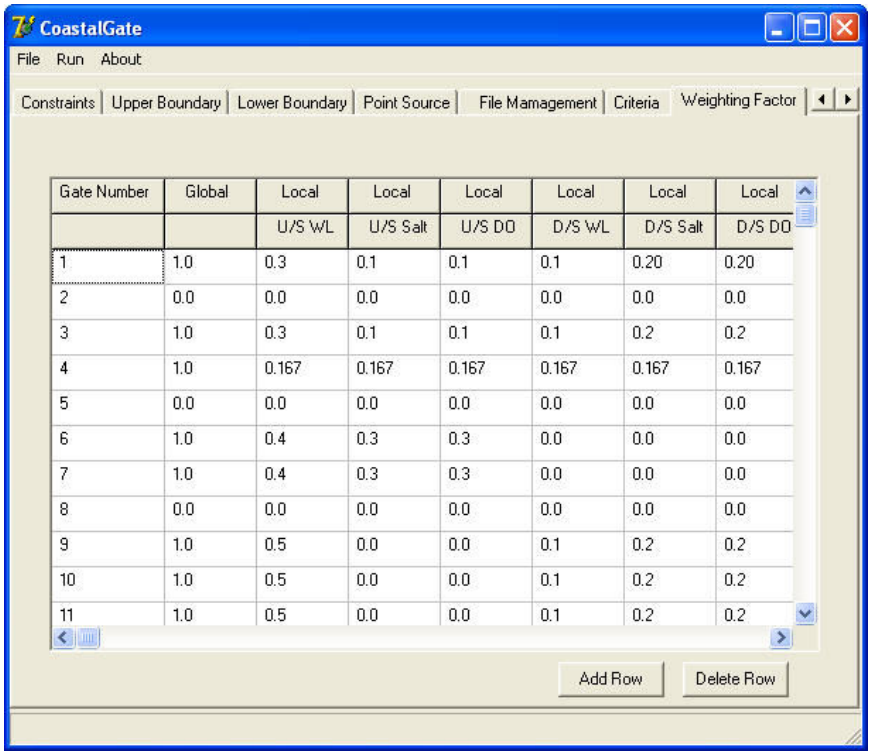
The desired criteria used for controlling water gate, which include the maximum and minimum values of water levels, salinity concentrations, and dissolved oxygen concentrations at selected control points are inputted into a criteria input window as presented in Appendix Figure C8.



Gate Number	U/S Max. WL	U/S Min. WL	U/S Node WL	U/S Max. Salt	U/S Min. Salt	U/S Node Salt	U/S Max. DO
1	0.30	0.0	13	2	0	15	9
2	0.60	-0.30	671	26	20	8	9
3	0.30	0.0	48	2	0	46	9
4	0.60	0.0	64	26	20	63	9
5	0.30	0.0	68	2	0	68	9
6	0.30	0.0	74	2	0	70	9
7	0.30	0.0	763	2	0	77	9
8	0.80	-0.30	85	26	20	86	9
9	1.0	0.0	97	0.1	0.0	96	9
10	1.0	0.0	103	0.1	0.0	102	9
11	0.40	-0.1	112	0.1	0.0	111	9

Appendix Figure C8 Criteria input window.

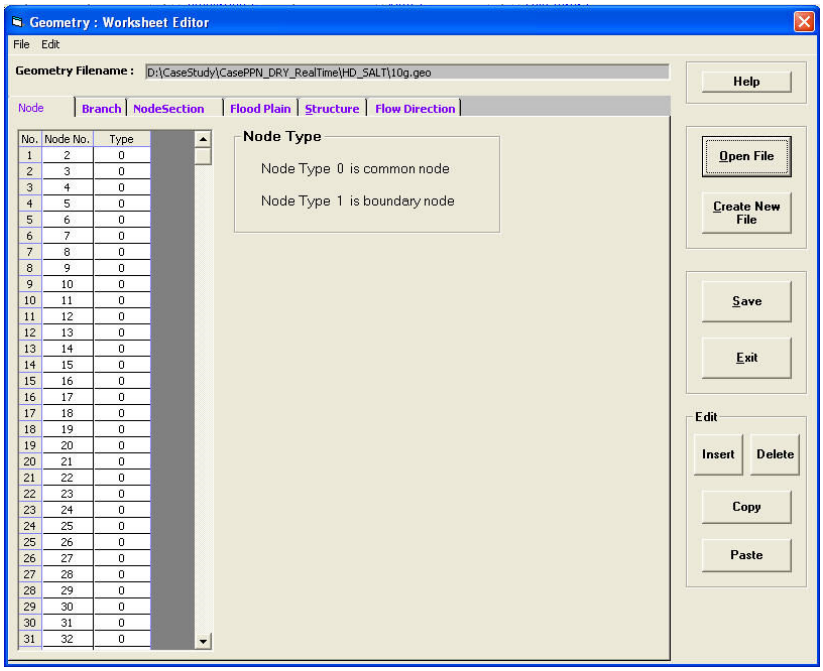
Finally, the data of weighting factor (WF) and relative importance of interesting parameter are inputted into a weighting factor input window (see Appendix Figure C9).



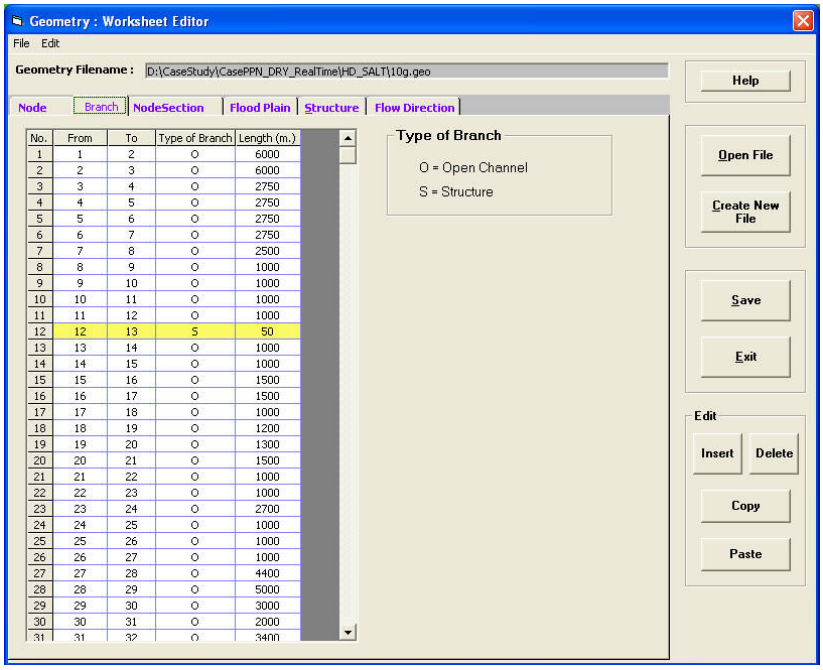
Gate Number	Global	Local U/S WL	Local U/S Salt	Local U/S DO	Local D/S WL	Local D/S Salt	Local D/S DO
1	1.0	0.3	0.1	0.1	0.1	0.20	0.20
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1.0	0.3	0.1	0.1	0.1	0.2	0.2
4	1.0	0.167	0.167	0.167	0.167	0.167	0.167
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1.0	0.4	0.3	0.3	0.0	0.0	0.0
7	1.0	0.4	0.3	0.3	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1.0	0.5	0.0	0.0	0.1	0.2	0.2
10	1.0	0.5	0.0	0.0	0.1	0.2	0.2
11	1.0	0.5	0.0	0.0	0.1	0.2	0.2

Appendix Figure C9 Weighting factor input window.

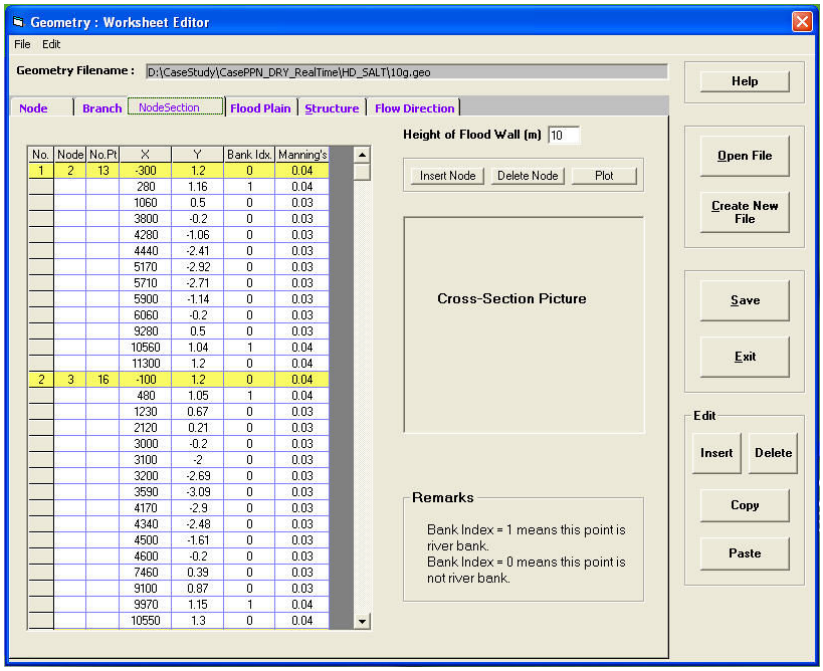
The input data for hydrodynamic model contain details of geometry, gate operation, upstream boundary, downstream boundary, flow direction, and initial values of discharge and water level. Appendix Figures C10 to C15 show inputting geometry data, which comprise data of node, branch, node section, floodplain, structure, flow direction. Appendix Figures C16 to C20 show inputting data of gate operation, upper boundary and lateral discharge, lower boundary, initial condition, and time, respectively. In fact, the upper boundary and lower data have already been inputted into optimization model; these data are input pattern which are required for River Operation Model only; they do not be used for running CoastalGate model.



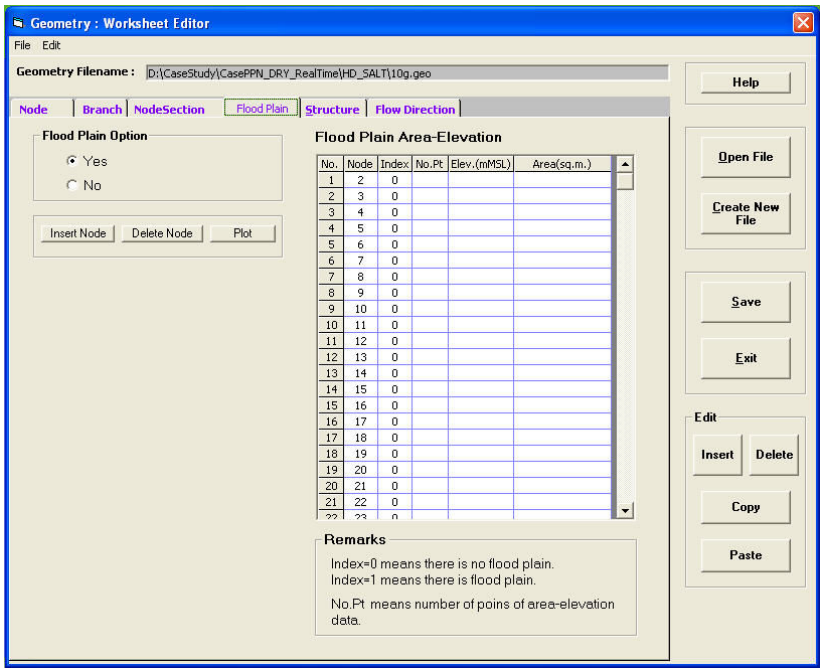
Appendix Figure C10 Node data input window.



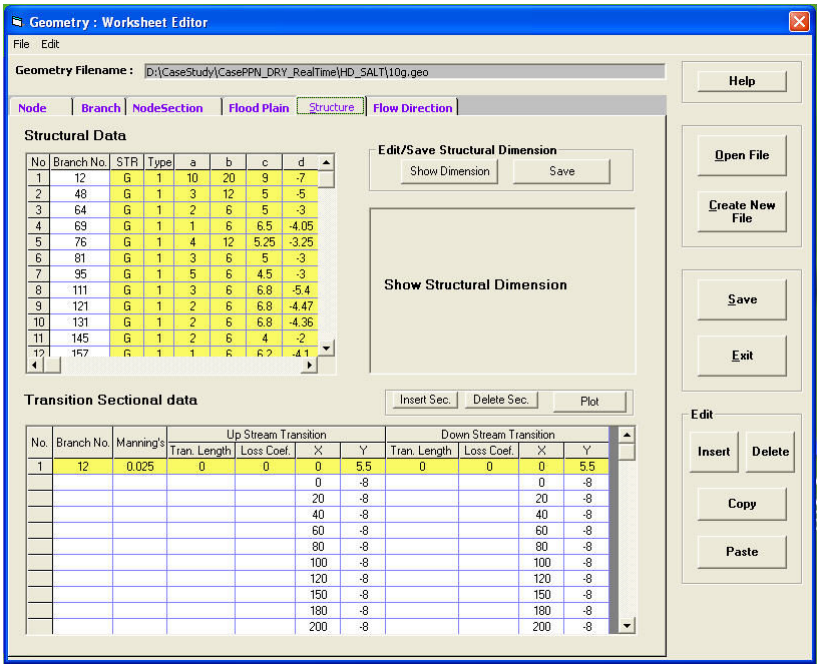
Appendix Figure C11 Branch data input window.



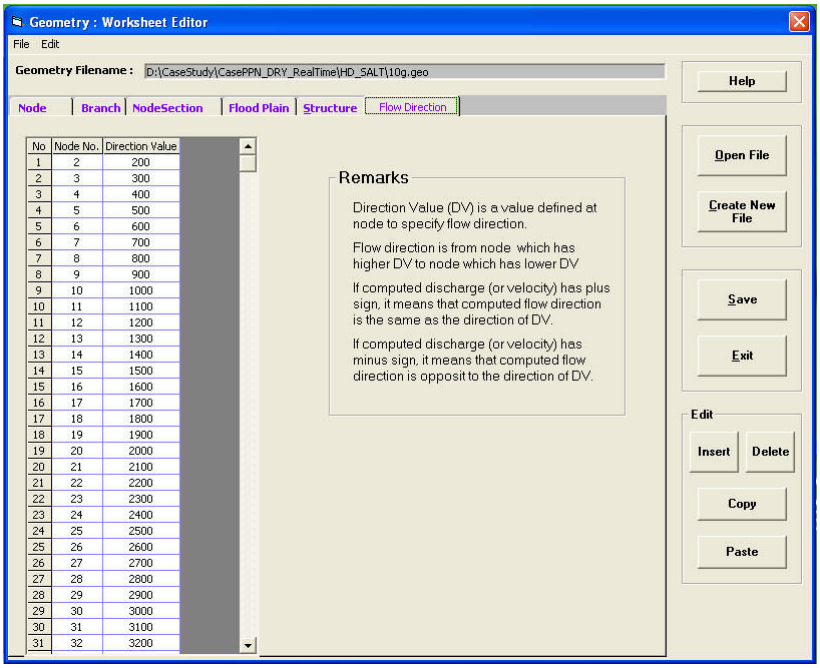
Appendix Figure C12 Node section data input window.



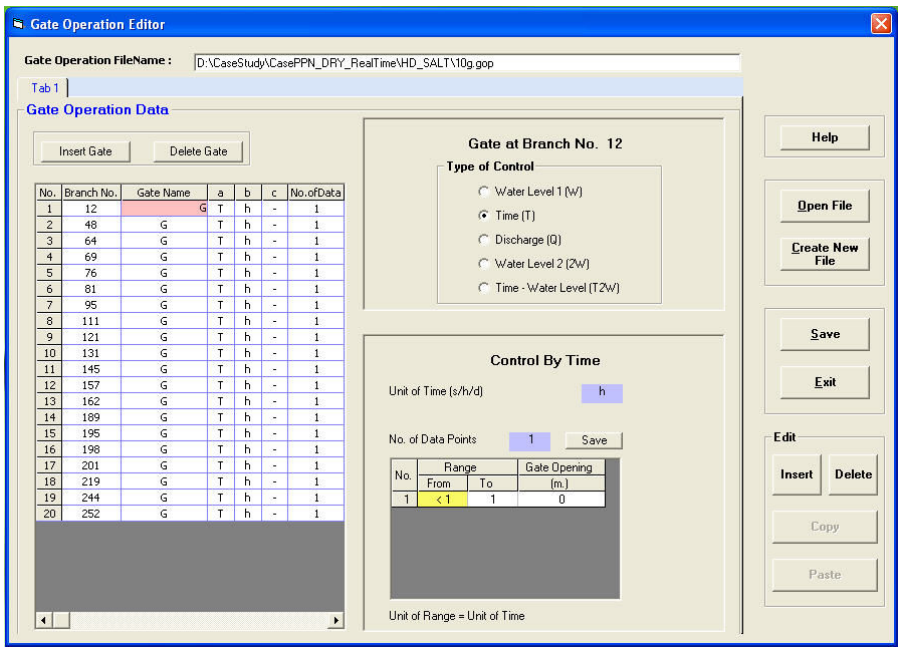
Appendix Figure C13 Floodplain data input window.



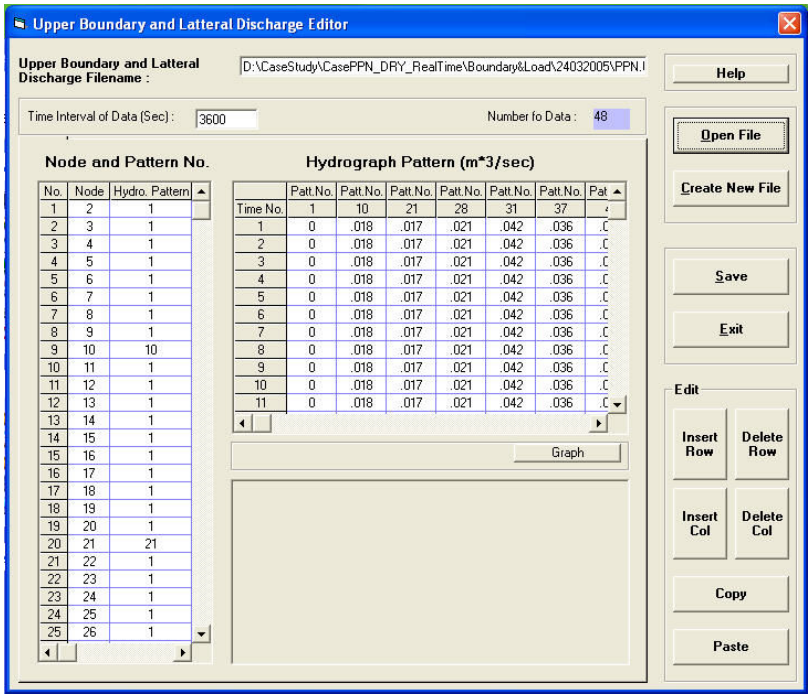
Appendix Figure C14 Structural data input window.



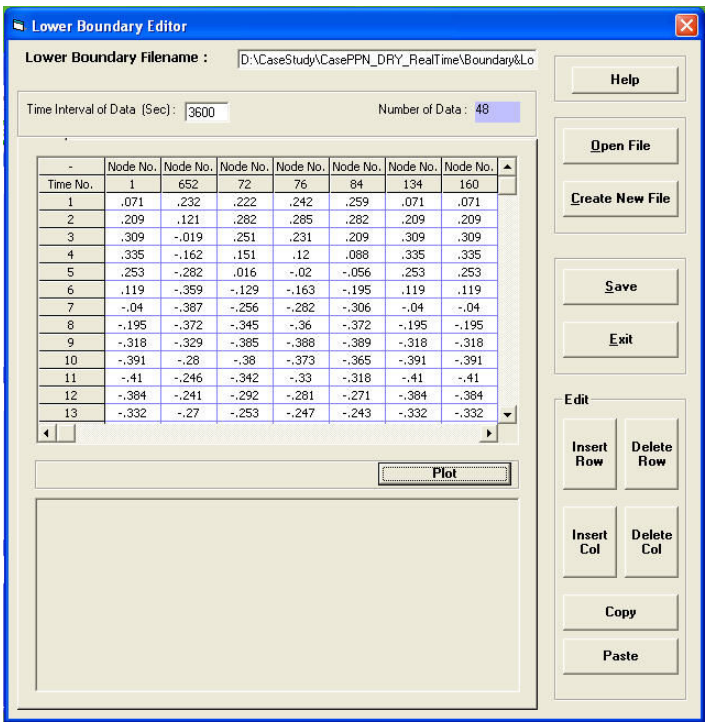
Appendix Figure C15 Flow direction data input window.



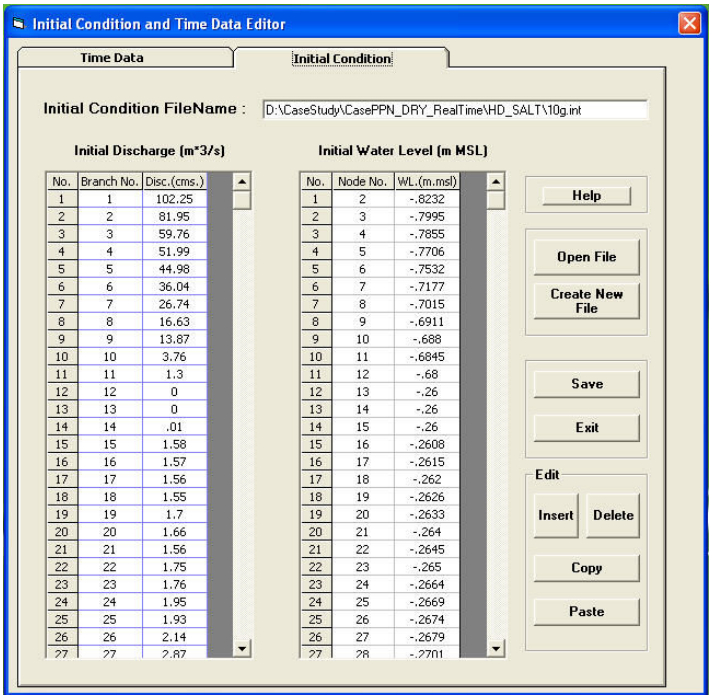
Appendix Figure C16 Gate operation data input window.



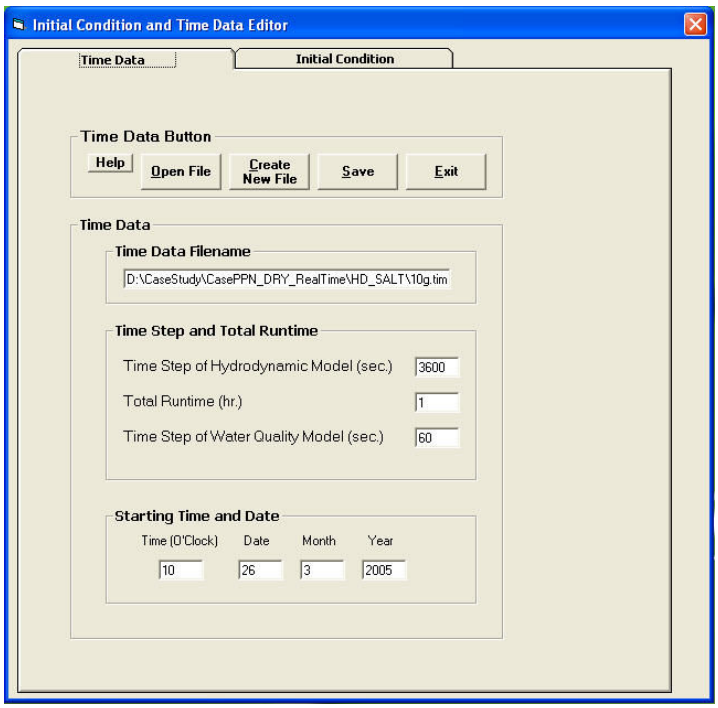
Appendix Figure C17 Upper boundary and lateral discharge data input window.



Appendix Figure C18 Lower boundary data input window.

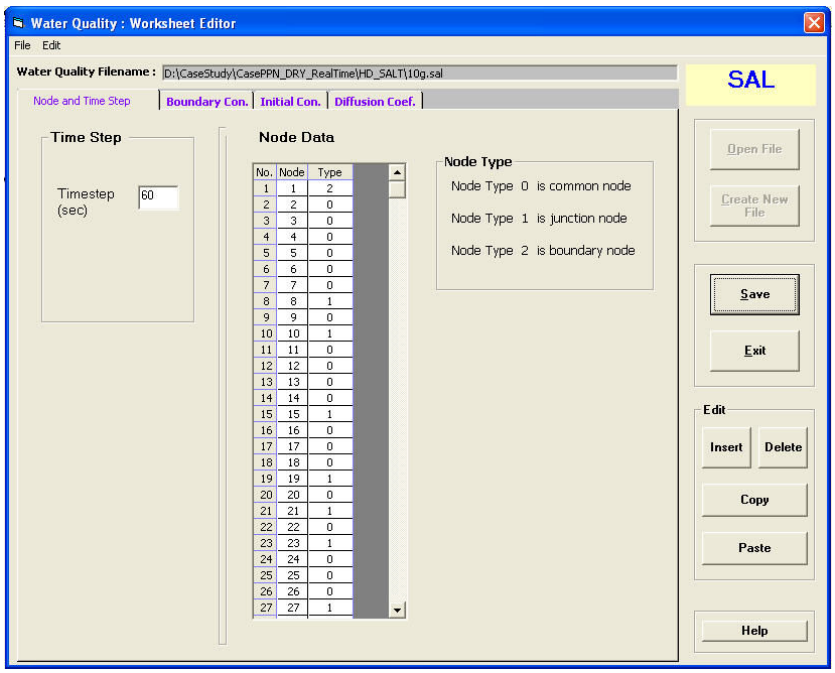


Appendix Figure C19 Initial condition data input window.

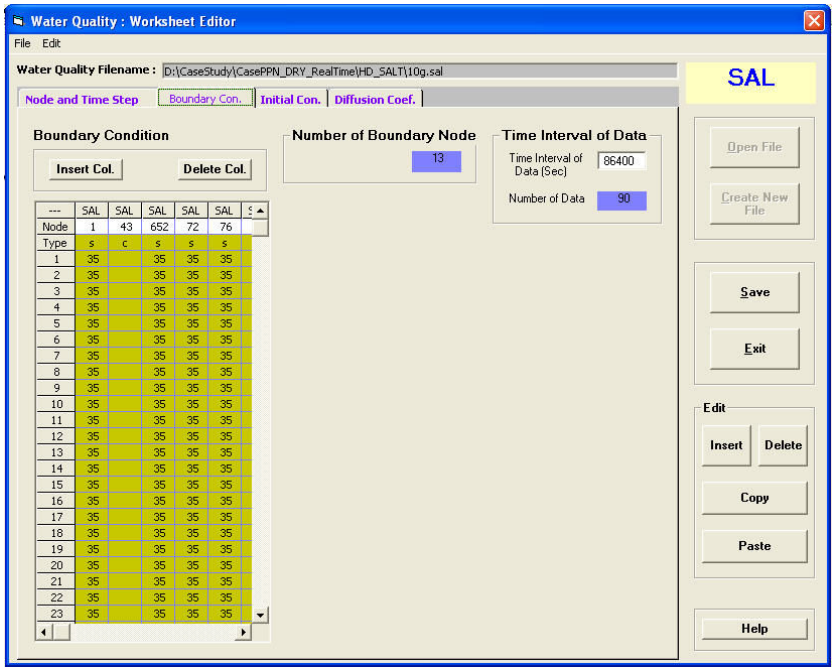


Appendix Figure C20 Time data input window.

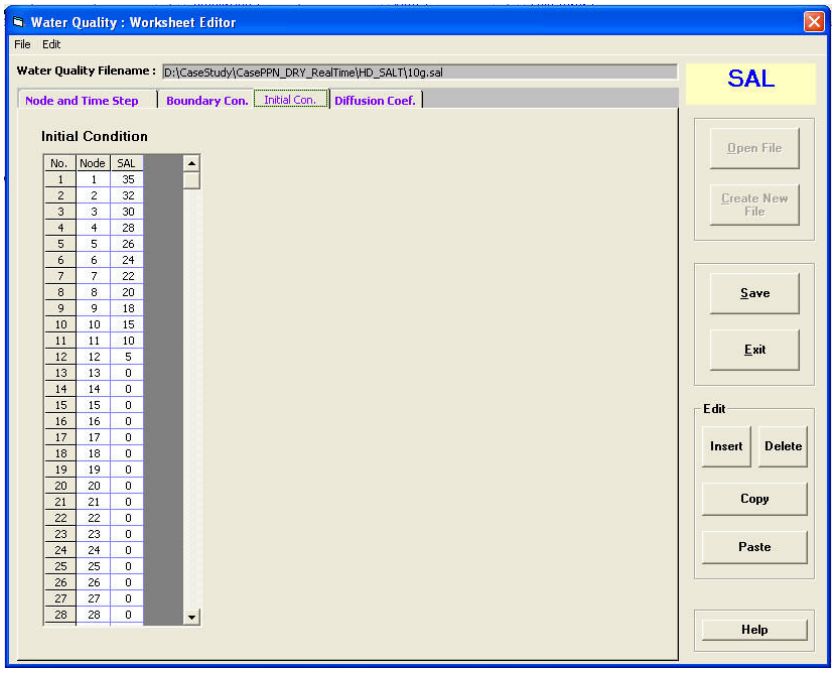
The input data requirement for salinity model contain details of node, time step, boundary condition, initial condition, and diffusion coefficient as shown in Appendix Figures C21 to C24. The input data requirement for BOD/DO model contain details of node, time step, boundary condition, initial condition, diffusion coefficient, waste load, and water quality parameters as shown in Appendix Figures C25 to C30.



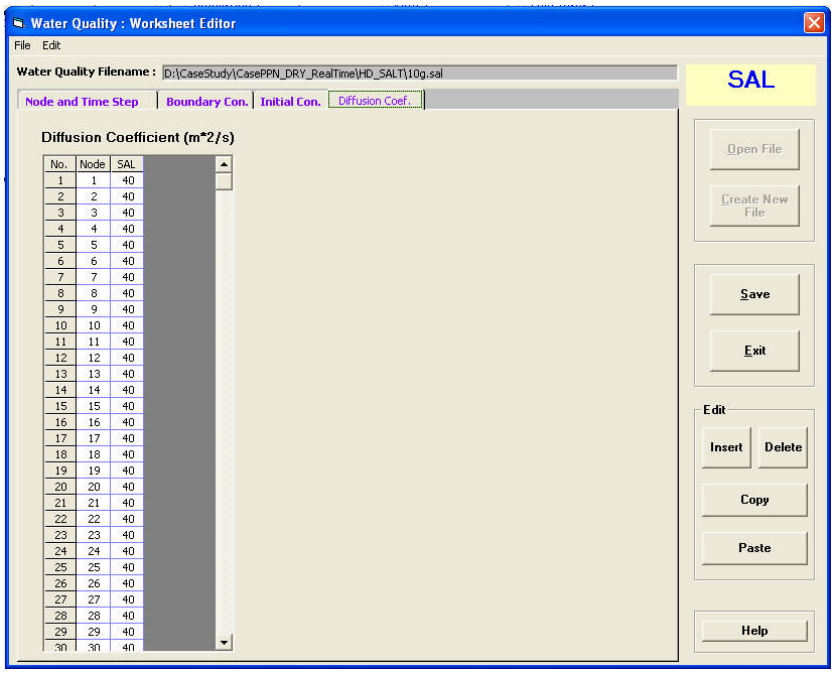
Appendix Figure C21 Node and time step data input window for salinity model.



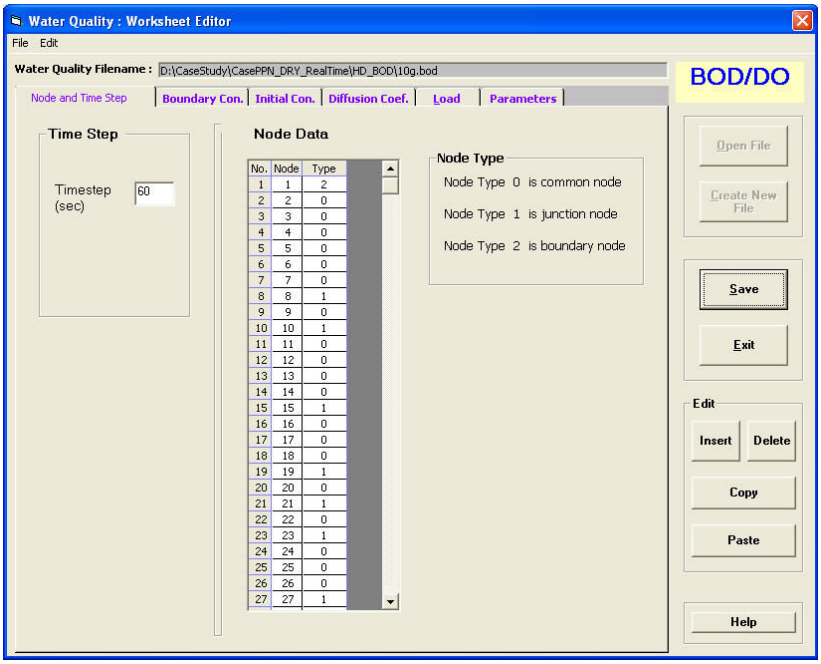
Appendix Figure C22 Boundary condition data input window for salinity model.



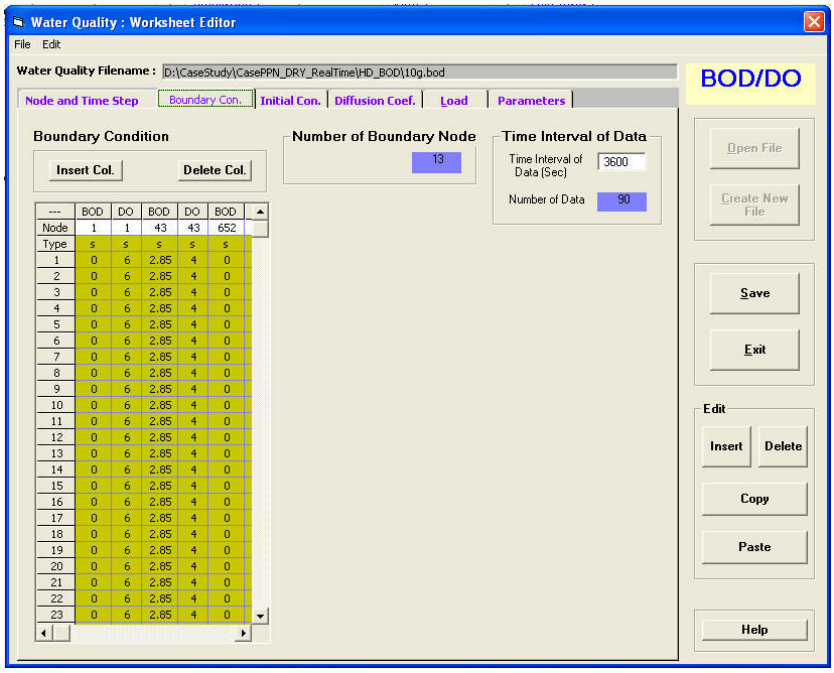
Appendix Figure C23 Initial condition data input window for salinity model.



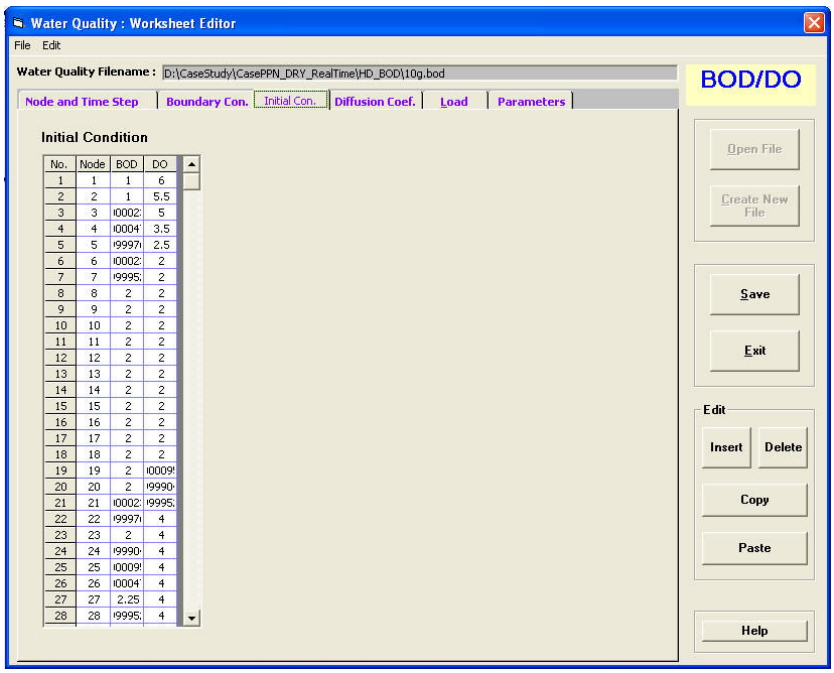
Appendix Figure C24 Diffusion coefficient data input window for salinity model.



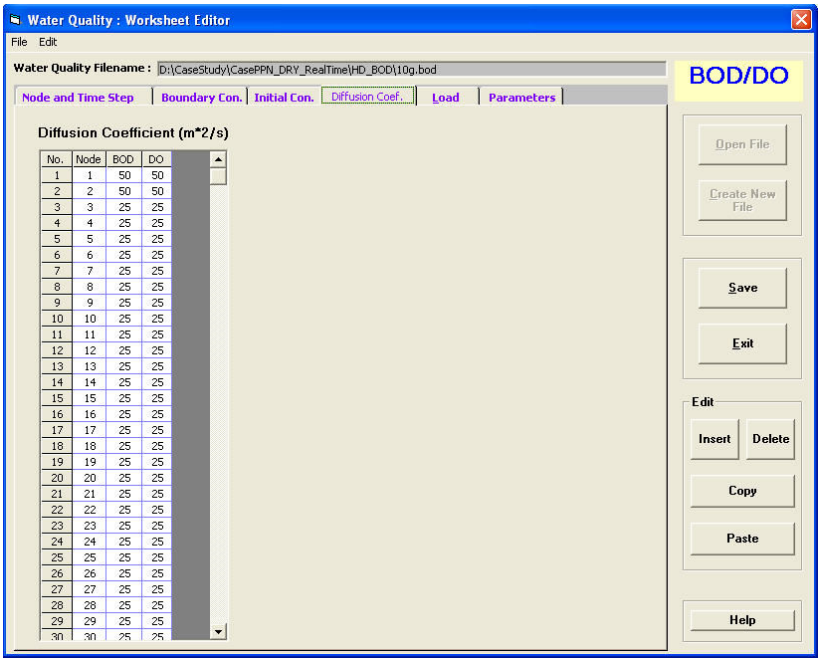
Appendix Figure C25 Node and time step data input window for BOD/DO model.



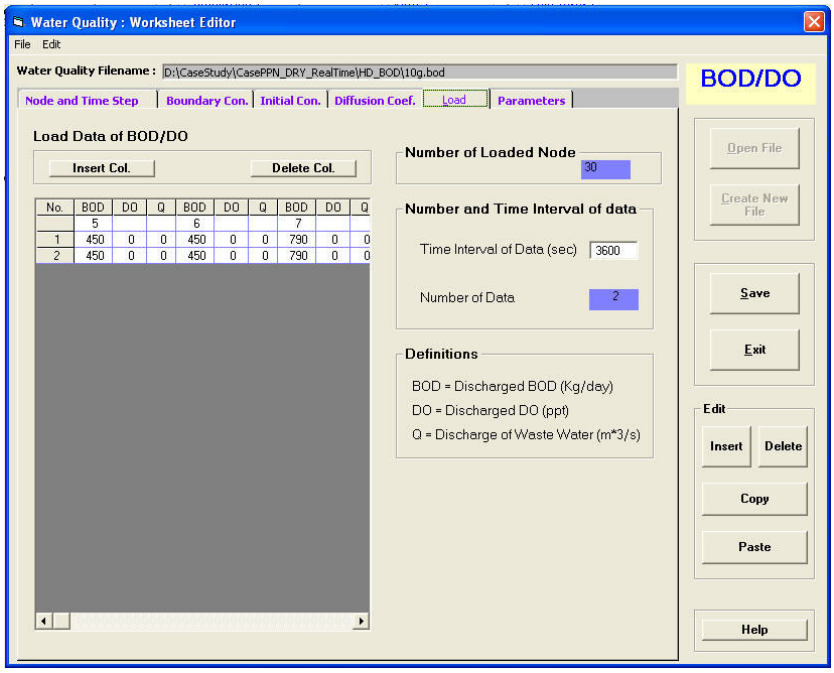
Appendix Figure C26 Boundary condition data input window for BOD/DO model.



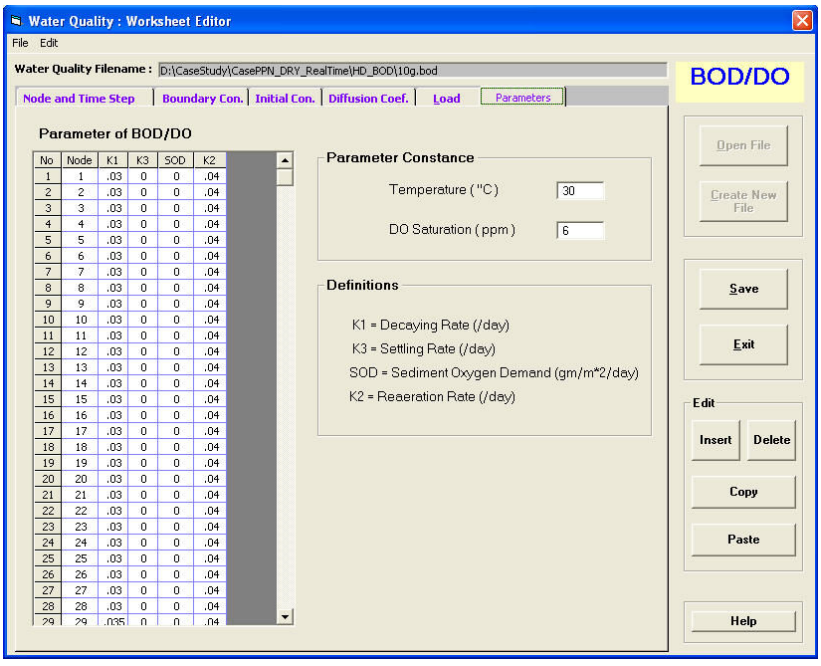
Appendix Figure C27 Initial condition data input window for BOD/DO model.



Appendix Figure C28 Diffusion coefficient data input window for BOD/DO model.



Appendix Figure C29 Waste load data input window for BOD/DO model.



Appendix Figure C30 Water quality's parameters data input window for BOD/DO model.

After feeding the several input data for hydrodynamic and water quality models (water quality model used herein are salinity and BOD/DO models), they are merged to became three files: *'Input.DAT'*, *'Input.SAL'*, *and 'Input.BOD*'. These three merged files are used as input files for hydrodynamic, salinity, and BOD/DO models, respectively. The output data of CoastalGate model are written in a text file (*Results.DAT*), which consist of data of DE' parameters, weighting factor, state variables, gate opening, satisfaction function value, and time taken.