

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).

DE's Parameters		Configuration of river network	
Max. Generation:	2	Number Of Node:	248
Num. of Population (NP):	5	Number Of Branch:	269
Weighting Factor (F):	0.80	Number Of Gate:	20
Crosss Constant (CR):	0.80		
Num. of Decision variable (D):	20		
Number of Iteration : 24		Speed Control of Gate Opening (m) : 2	

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.

CoastalGate
File Run About

DE's Parameters and Configuration | **Observation Points** | Constraints | Upper Boundary | Lower Boundary | Point So

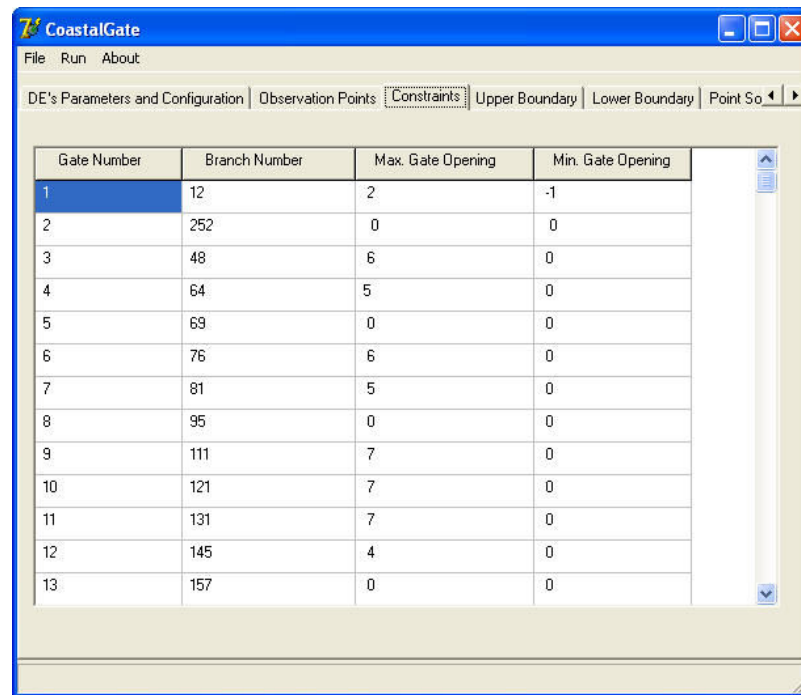
Num. of Observed Point: 84

Node Number	Observed Parameters	Gate Number
13	WLU	1
8	WLD	1
15	SALU	1
8	SALD	1
15	DOU	1
8	DOD	1
671	WLU	2
672	WLD	2
671	SALU	2
672	SALD	2
671	DOU	2
672	DOD	2
48	WLU	3

Definition of Observed Parameters

- WLU = Upstream WaterLevel
- WLD = Downstream WaterLevel
- SALU = Upstream Salt
- SALD = Downstream Salt
- DOU = Upstream DO
- DOD = Downstream DO

Appendix Figure C2 Observation points input window.



Gate Number	Branch Number	Max. Gate Opening	Min. Gate Opening
1	12	2	-1
2	252	0	0
3	48	6	0
4	64	5	0
5	69	0	0
6	76	6	0
7	81	5	0
8	95	0	0
9	111	7	0
10	121	7	0
11	131	7	0
12	145	4	0
13	157	0	0

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.

CoastalGate

File Run About

DE's Parameters and Configuration | Observation Points | Constraints | **Upper Boundary** | Lower Boundary | Point So

Upper Boundary and Letteral Discharge Filename: Jy\CasePPN_DRY_RealTime\Boundary&Load\24032005\PPN.UPB

Time Interval of Data (sec): 3600 Number of Data: 48

Node and Pattern No.

No.	Node	Hydro Pattern
10	11	1
11	12	1
12	13	1
13	14	1
14	15	1
15	16	1
16	17	1
17	18	1
18	19	1
19	20	1

Hydrograph Pattern (m³/s)

Time No.	Patt.No.	Patt.No.	Patt.No.
1	0	0.018	0.017
2	0	0.018	0.017
3	0	0.018	0.017
4	0	0.018	0.017
5	0	0.018	0.017
6	0	0.018	0.017
7	0	0.018	0.017
8	0	0.018	0.017
9	0	0.018	0.017

Load Data

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.

CoastalGate

File Run About

DE's Parameters and Configuration | Observation Points | Constraints | Upper Boundary | Lower Boundary | Point Source

Lower Boundary Filename : \CasePPN_DRY_RealTime\Boundary&Load\24032005\PPN_LOE

Time Interval Of Data (sec) : 3600 Num Of Data : 48

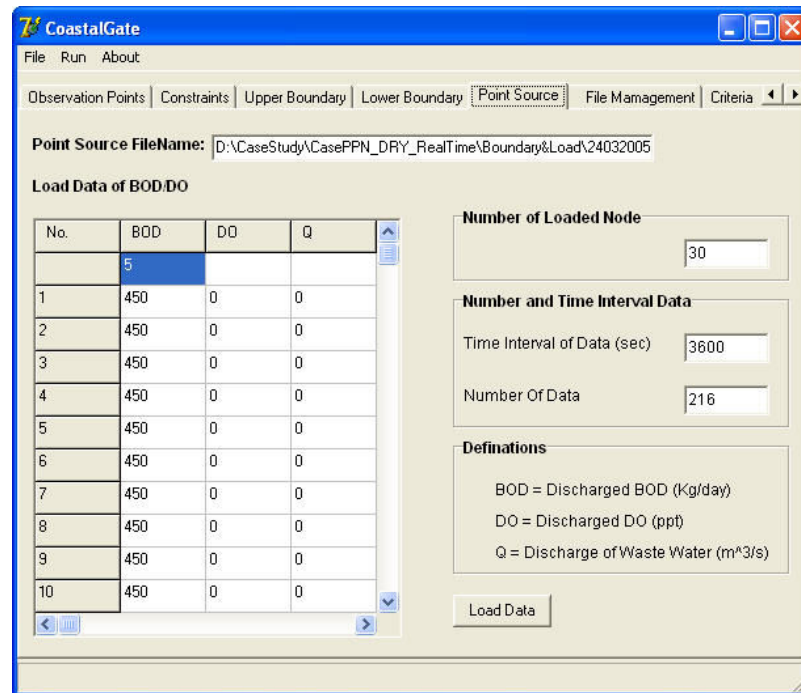
	Node No.	Node No.	Node No.	Node No.	Node No.	Node No.
Time No.	1	652	72	76	84	134
1	0.071	0.232	0.222	0.242	0.259	0.071
2	0.209	0.121	0.282	0.285	0.282	0.209
3	0.309	-0.019	0.251	0.231	0.209	0.309
4	0.335	-0.162	0.151	0.12	0.088	0.335
5	0.253	-0.282	0.016	-0.02	-0.056	0.253
6	0.119	-0.359	-0.129	-0.163	-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
10	-0.301	-0.30	-0.30	-0.373	-0.305	-0.301

Load Data

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.



CoastalGate

File Run About

Observation Points Constraints Upper Boundary Lower Boundary **Point Source** File Management Criteria

Point Source FileName: D:\CaseStudy\CasePPN_DRY_RealTime\Boundary&Load\24032005

Load Data of BOD/DO

No.	BOD	DO	Q
5			
1	450	0	0
2	450	0	0
3	450	0	0
4	450	0	0
5	450	0	0
6	450	0	0
7	450	0	0
8	450	0	0
9	450	0	0
10	450	0	0

Number of Loaded Node

30

Number and Time Interval Data

Time Interval of Data (sec) 3600

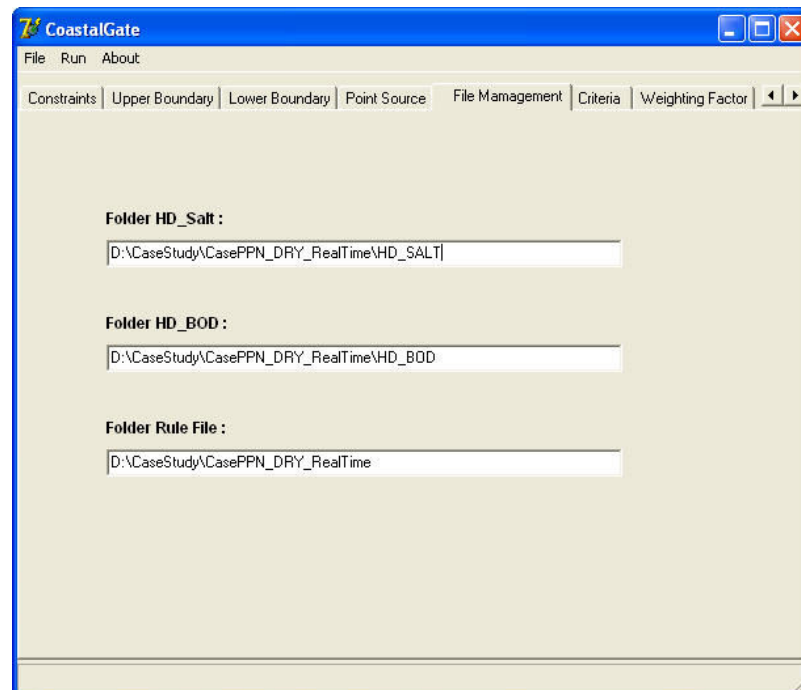
Number Of Data 216

Definations

BOD = Discharged BOD (Kg/day)
 DO = Discharged DO (ppt)
 Q = Discharge of Waste Water (m³/s)

Load Data

Appendix Figure C6 Point source input window.



CoastalGate

File Run About

Constraints Upper Boundary Lower Boundary Point Source **File Management** Criteria Weighting Factor

Folder HD_Salt :

D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT

Folder HD_BOD :

D:\CaseStudy\CasePPN_DRY_RealTime\HD_BOD

Folder Rule File :

D:\CaseStudy\CasePPN_DRY_RealTime

Appendix Figure C7 File management input window.

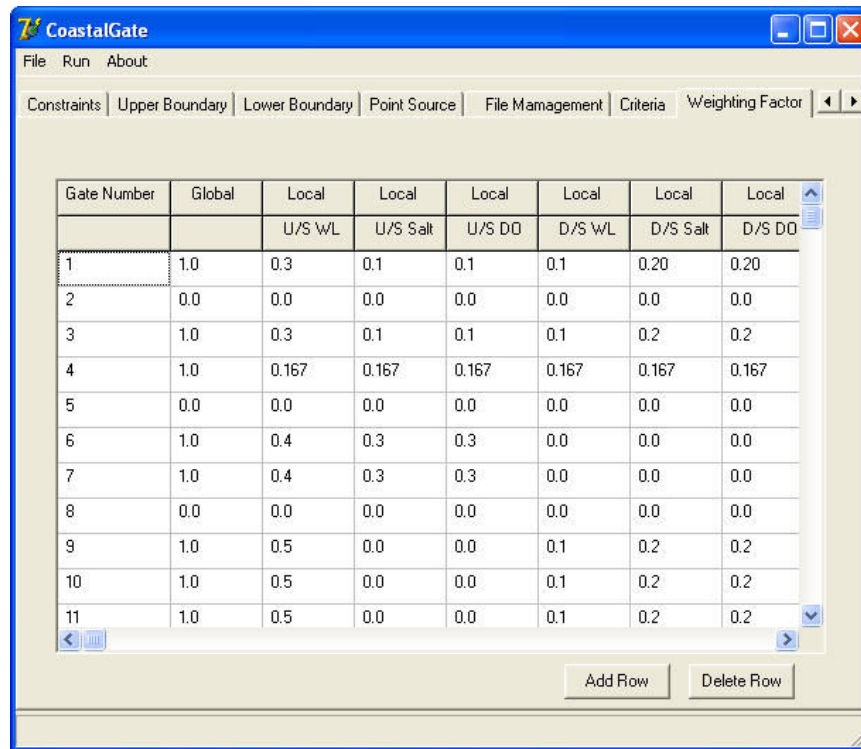
The desired criteria used for controlling water gate, which include the maximum and minimum values of water levels, salinity concentrations, and dissolved oxygen concentrations at selected control points are inputted into a criteria input window as presented in Appendix Figure C8.

Gate Number	U/S	U/S	U/S	U/S	U/S	U/S	U/S
	Max. WL	Min. WL	Node WL	Max. Salt	Min. Salt	Node Salt	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

Add Row Delete Row

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	Local	Local	Local	Local	Local
		U/S WL	U/S Salt	U/S DO	D/S WL	D/S Salt	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.

Geometry : Worksheet Editor

File Edit

Geometry Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.geo

Node Branch NodeSection Flood Plain Structure Flow Direction

No.	Node No.	Type
1	2	0
2	3	0
3	4	0
4	5	0
5	6	0
6	7	0
7	8	0
8	9	0
9	10	0
10	11	0
11	12	0
12	13	0
13	14	0
14	15	0
15	16	0
16	17	0
17	18	0
18	19	0
19	20	0
20	21	0
21	22	0
22	23	0
23	24	0
24	25	0
25	26	0
26	27	0
27	28	0
28	29	0
29	30	0
30	31	0
31	32	0

Node Type

Node Type 0 is common node
Node Type 1 is boundary node

Help

Open File

Create New File

Save

Exit

Edit

Insert Delete

Copy

Paste

Appendix Figure C10 Node data input window.

Geometry : Worksheet Editor

File Edit

Geometry Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.geo

Node Branch NodeSection Flood Plain Structure Flow Direction

No.	From	To	Type of Branch	Length (m.)
1	1	2	O	6000
2	2	3	O	6000
3	3	4	O	2750
4	4	5	O	2750
5	5	6	O	2750
6	6	7	O	2750
7	7	8	O	2500
8	8	9	O	1000
9	9	10	O	1000
10	10	11	O	1000
11	11	12	O	1000
12	12	13	S	50
13	13	14	O	1000
14	14	15	O	1000
15	15	16	O	1500
16	16	17	O	1500
17	17	18	O	1000
18	18	19	O	1200
19	19	20	O	1300
20	20	21	O	1500
21	21	22	O	1000
22	22	23	O	1000
23	23	24	O	2700
24	24	25	O	1000
25	25	26	O	1000
26	26	27	O	1000
27	27	28	O	4400
28	28	29	O	5000
29	29	30	O	3000
30	30	31	O	2000
31	31	32	O	3400

Type of Branch

O = Open Channel
S = Structure

Help

Open File

Create New File

Save

Exit

Edit

Insert Delete

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Appendix Figure C11 Branch data input window.

Geometry : Worksheet Editor

File Edit

Geometry Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.geo

Node Branch NodeSection Flood Plain Structure Flow Direction

Height of Flood Wall (m) 10

Insert Node Delete Node Plot

No.	Node	No.Pt	X	Y	Bank Idx	Manning's
1	2	13	-300	1.2	0	0.04
			280	1.16	1	0.04
			1060	0.5	0	0.03
			3800	-0.2	0	0.03
			4280	-1.06	0	0.03
			4440	-2.41	0	0.03
			5170	-2.92	0	0.03
			5710	-2.71	0	0.03
			5900	-1.14	0	0.03
			6060	-0.2	0	0.03
			9280	0.5	0	0.03
			10560	1.04	1	0.04
			11300	1.2	0	0.04
2	3	16	-100	1.2	0	0.04
			480	1.05	1	0.04
			1230	0.67	0	0.03
			2120	0.21	0	0.03
			3000	-0.2	0	0.03
			3100	-2	0	0.03
			3200	-2.69	0	0.03
			3590	-3.09	0	0.03
			4170	-2.9	0	0.03
			4340	-2.48	0	0.03
			4500	-1.61	0	0.03
			4600	-0.2	0	0.03
			7460	0.39	0	0.03
			9100	0.87	0	0.03
			9970	1.15	1	0.04
			10550	1.3	0	0.04

Cross-Section Picture

Remarks

Bank Index = 1 means this point is river bank.
Bank Index = 0 means this point is not river bank.

Help

Open File

Create New File

Save

Exit

Edit

Insert Delete

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Paste

Appendix Figure C12 Node section data input window.

Geometry : Worksheet Editor

File Edit

Geometry Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.geo

Node Branch NodeSection Flood Plain Structure Flow Direction

Flood Plain Option

☒ Yes

☐ No

Insert Node Delete Node Plot

Flood Plain Area-Elevation

No.	Node	Index	No.Pt	Elev.(mMSL)	Area(sq.m.)
1	2	0			
2	3	0			
3	4	0			
4	5	0			
5	6	0			
6	7	0			
7	8	0			
8	9	0			
9	10	0			
10	11	0			
11	12	0			
12	13	0			
13	14	0			
14	15	0			
15	16	0			
16	17	0			
17	18	0			
18	19	0			
19	20	0			
20	21	0			
21	22	0			
22	23	0			

Remarks

Index=0 means there is no flood plain.
Index=1 means there is flood plain.
No.Pt means number of points of area-elevation data.

Help

Open File

Create New File

Save

Exit

Edit

Insert Delete

Copy

Paste

Appendix Figure C13 Floodplain data input window.

Geometry : Worksheet Editor

File Edit

Geometry Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.geo

Node Branch NodeSection Flood Plain Structure Flow Direction

Structural Data

No	Branch No	STR	Type	a	b	c	d
1	12	G	1	10	20	9	-7
2	48	G	1	3	12	5	-5
3	64	G	1	2	6	5	-3
4	69	G	1	1	6	6.5	-4.05
5	76	G	1	4	12	5.25	-3.25
6	81	G	1	3	6	5	-3
7	95	G	1	5	6	4.5	-3
8	111	G	1	3	6	6.8	-5.4
9	121	G	1	2	6	6.8	-4.47
10	131	G	1	2	6	6.8	-4.36
11	145	G	1	2	6	4	-2
12	157	G	1	1	6	6.2	-4.1

Edit/Save Structural Dimension

Show Dimension Save

Show Structural Dimension

Insert Sec. Delete Sec. Plot

Transition Sectional data

No	Branch No	Manning's	Up Stream Transition				Down Stream Transition			
			Tran. Length	Loss Coef.	X	Y	Tran. Length	Loss Coef.	X	Y
1	12	0.025	0	0	0	5.5	0	0	0	5.5
					0	-8			0	-8
					20	-8			20	-8
					40	-8			40	-8
					60	-8			60	-8
					80	-8			80	-8
					100	-8			100	-8
					120	-8			120	-8
					150	-8			150	-8
					180	-8			180	-8
					200	-8			200	-8

Help

Open File

Create New File

Save

Exit

Edit

Insert Delete

Copy

Paste

Appendix Figure C14 Structural data input window.

Geometry : Worksheet Editor

File Edit

Geometry Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.geo

Node Branch NodeSection Flood Plain Structure Flow Direction

Flow Direction

No	Node No.	Direction Value
1	2	200
2	3	300
3	4	400
4	5	500
5	6	600
6	7	700
7	8	800
8	9	900
9	10	1000
10	11	1100
11	12	1200
12	13	1300
13	14	1400
14	15	1500
15	16	1600
16	17	1700
17	18	1800
18	19	1900
19	20	2000
20	21	2100
21	22	2200
22	23	2300
23	24	2400
24	25	2500
25	26	2600
26	27	2700
27	28	2800
28	29	2900
29	30	3000
30	31	3100
31	32	3200

Remarks

Direction Value (DV) is a value defined at node to specify flow direction.

Flow direction is from node which has higher DV to node which has lower DV

If computed discharge (or velocity) has plus sign, it means that computed flow direction is the same as the direction of DV.

If computed discharge (or velocity) has minus sign, it means that computed flow direction is opposite to the direction of DV.

Help

Open File

Create New File

Save

Exit

Edit

Insert Delete

Copy

Paste

Appendix Figure C15 Flow direction data input window.

Gate Operation Editor

Gate Operation FileName : D:\CaseStudy\CasePPN_DRY_RealTime\VD_SALT\10g.gop

Tab 1

Gate Operation Data

Insert Gate Delete Gate

No.	Branch No.	Gate Name	a	b	c	No. of Data
1	12	G	T	h	-	1
2	48	G	T	h	-	1
3	64	G	T	h	-	1
4	69	G	T	h	-	1
5	76	G	T	h	-	1
6	81	G	T	h	-	1
7	95	G	T	h	-	1
8	111	G	T	h	-	1
9	121	G	T	h	-	1
10	131	G	T	h	-	1
11	145	G	T	h	-	1
12	157	G	T	h	-	1
13	162	G	T	h	-	1
14	189	G	T	h	-	1
15	195	G	T	h	-	1
16	198	G	T	h	-	1
17	201	G	T	h	-	1
18	219	G	T	h	-	1
19	244	G	T	h	-	1
20	252	G	T	h	-	1

Gate at Branch No. 12

Type of Control

☐ Water Level 1 (W)
☒ Time (T)
☐ Discharge (Q)
☐ Water Level 2 (ZW)
☐ Time - Water Level (TZW)

Control By Time

Unit of Time (s/h/d)

No. of Data Points Save

No.	Range	Gate Opening (m.)
	From To	
1	< 1 1	0

Unit of Range = Unit of Time

Help

Open File

Create New File

Save

Exit

Edit

Insert Delete

Copy

Paste

Appendix Figure C16 Gate operation data input window.

Upper Boundary and Lateral Discharge Editor

Upper Boundary and Lateral Discharge Filename : D:\CaseStudy\CasePPN_DRY_RealTime\Boundary\Load\24032005\PPN.I

Time Interval of Data (Sec) : 3600 Number of Data : 48

Node and Pattern No.

No.	Node	Hydro. Pattern
1	2	1
2	3	1
3	4	1
4	5	1
5	6	1
6	7	1
7	8	1
8	9	1
9	10	10
10	11	1
11	12	1
12	13	1
13	14	1
14	15	1
15	16	1
16	17	1
17	18	1
18	19	1
19	20	1
20	21	21
21	22	1
22	23	1
23	24	1
24	25	1
25	26	1

Hydrograph Pattern (m³/sec)

Time No.	Pat. No.	Pat. No.	Pat. No.	Pat. No.	Pat. No.	Pat. No.	Pat. No.
	1	10	21	28	31	37	4
1	0	.018	.017	.021	.042	.036	.0
2	0	.018	.017	.021	.042	.036	.0
3	0	.018	.017	.021	.042	.036	.0
4	0	.018	.017	.021	.042	.036	.0
5	0	.018	.017	.021	.042	.036	.0
6	0	.018	.017	.021	.042	.036	.0
7	0	.018	.017	.021	.042	.036	.0
8	0	.018	.017	.021	.042	.036	.0
9	0	.018	.017	.021	.042	.036	.0
10	0	.018	.017	.021	.042	.036	.0
11	0	.018	.017	.021	.042	.036	.0

Graph

Help

Open File

Create New File

Save

Exit

Edit

Insert Row Delete Row

Insert Col Delete Col

Copy

Paste

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

Lower Boundary Editor

Lower Boundary Filename : D:\CaseStudy\CasePPN_DRY_RealTime\Boundary&Lo

Time Interval of Data (Sec) : 3600 Number of Data : 48

Time No.	Node No.	Node No.	Node No.	Node No.	Node No.	Node No.	Node No.
1	.071	.232	.222	.242	.259	.071	.071
2	.209	.121	.282	.285	.282	.209	.209
3	.309	-.019	.251	.231	.209	.309	.309
4	.335	-.162	.151	.12	.088	.335	.335
5	.253	-.282	.016	-.02	-.056	.253	.253
6	.119	-.359	-.129	-.163	-.195	.119	.119
7	-.04	-.387	-.256	-.282	-.306	-.04	-.04
8	-.195	-.372	-.345	-.36	-.372	-.195	-.195
9	-.318	-.329	-.385	-.388	-.389	-.318	-.318
10	-.391	-.28	-.38	-.373	-.365	-.391	-.391
11	-.41	-.246	-.342	-.33	-.318	-.41	-.41
12	-.384	-.241	-.292	-.281	-.271	-.384	-.384
13	-.332	-.27	-.253	-.247	-.243	-.332	-.332

Plot

Help

Open File

Create New File

Save

Exit

Edit

Insert Row

Delete Row

Insert Col

Delete Col

Copy

Paste

Appendix Figure C18 Lower boundary data input window.

Initial Condition and Time Data Editor

Initial Condition FileName : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.int

Initial Discharge (m³/s)

No.	Branch No.	Disc.(cms.)
1	1	102.25
2	2	81.95
3	3	59.76
4	4	51.99
5	5	44.98
6	6	36.04
7	7	26.74
8	8	16.63
9	9	13.87
10	10	3.76
11	11	1.3
12	12	0
13	13	0
14	14	.01
15	15	1.58
16	16	1.57
17	17	1.56
18	18	1.55
19	19	1.7
20	20	1.66
21	21	1.56
22	22	1.75
23	23	1.76
24	24	1.95
25	25	1.93
26	26	2.14
27	27	2.87

Initial Water Level (m MSL)

No.	Node No.	WL.(m.msl)
1	2	-.8232
2	3	-.7995
3	4	-.7855
4	5	-.7706
5	6	-.7532
6	7	-.7177
7	8	-.7015
8	9	-.6911
9	10	-.688
10	11	-.6845
11	12	-.68
12	13	-.26
13	14	-.26
14	15	-.26
15	16	-.2608
16	17	-.2615
17	18	-.262
18	19	-.2626
19	20	-.2633
20	21	-.264
21	22	-.2645
22	23	-.265
23	24	-.2664
24	25	-.2669
25	26	-.2674
26	27	-.2679
27	28	-.2701

Help

Open File

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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.

Water Quality : Worksheet Editor

File Edit

Water Quality Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.sal

Node and Time Step | Boundary Con. | Initial Con. | Diffusion Coef.

Time Step

Timestep (sec) 60

Node Data

No.	Node	Type
1	1	2
2	2	0
3	3	0
4	4	0
5	5	0
6	6	0
7	7	0
8	8	1
9	9	0
10	10	1
11	11	0
12	12	0
13	13	0
14	14	0
15	15	1
16	16	0
17	17	0
18	18	0
19	19	1
20	20	0
21	21	1
22	22	0
23	23	1
24	24	0
25	25	0
26	26	0
27	27	1

Node Type

Node Type 0 is common node
Node Type 1 is junction node
Node Type 2 is boundary node

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Help

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

Water Quality : Worksheet Editor

File Edit

Water Quality Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.sal

Node and Time Step | Boundary Con. | Initial Con. | Diffusion Coef.

Boundary Condition

Insert Col. Delete Col.

Number of Boundary Node 13

Time Interval of Data

Time Interval of Data (Sec) 86400
Number of Data 90

---	SAL	SAL	SAL	SAL	SAL	SAL	↑
Node	1	43	652	72	76		
Type	\$	€	\$	\$	\$		
1	35		35	35	35		
2	35		35	35	35		
3	35		35	35	35		
4	35		35	35	35		
5	35		35	35	35		
6	35		35	35	35		
7	35		35	35	35		
8	35		35	35	35		
9	35		35	35	35		
10	35		35	35	35		
11	35		35	35	35		
12	35		35	35	35		
13	35		35	35	35		
14	35		35	35	35		
15	35		35	35	35		
16	35		35	35	35		
17	35		35	35	35		
18	35		35	35	35		
19	35		35	35	35		
20	35		35	35	35		
21	35		35	35	35		
22	35		35	35	35		
23	35		35	35	35		

Open File
Create New File
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Help

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

Water Quality : Worksheet Editor

File Edit

Water Quality Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.sal

Node and Time Step Boundary Con. Initial Con. Diffusion Coef.

Initial Condition

No.	Node	SAL
1	1	35
2	2	32
3	3	30
4	4	28
5	5	26
6	6	24
7	7	22
8	8	20
9	9	18
10	10	15
11	11	10
12	12	5
13	13	0
14	14	0
15	15	0
16	16	0
17	17	0
18	18	0
19	19	0
20	20	0
21	21	0
22	22	0
23	23	0
24	24	0
25	25	0
26	26	0
27	27	0
28	28	0

Open File

Create New File

Save

Exit

Edit

Insert Delete

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Help

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

Water Quality : Worksheet Editor

File Edit

Water Quality Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_SALT\10g.sal

Node and Time Step Boundary Con. Initial Con. Diffusion Coef.

Diffusion Coefficient (m²/s)

No.	Node	SAL
1	1	40
2	2	40
3	3	40
4	4	40
5	5	40
6	6	40
7	7	40
8	8	40
9	9	40
10	10	40
11	11	40
12	12	40
13	13	40
14	14	40
15	15	40
16	16	40
17	17	40
18	18	40
19	19	40
20	20	40
21	21	40
22	22	40
23	23	40
24	24	40
25	25	40
26	26	40
27	27	40
28	28	40
29	29	40
30	30	40

Open File

Create New File

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Help

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

Water Quality : Worksheet Editor

File Edit

Water Quality Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_BOD\10g.bod

Node and Time Step | Boundary Con. | Initial Con. | Diffusion Coef. | Load | Parameters

Time Step

Timestep (sec) 60

Node Data

No.	Node	Type
1	1	2
2	2	0
3	3	0
4	4	0
5	5	0
6	6	0
7	7	0
8	8	1
9	9	0
10	10	1
11	11	0
12	12	0
13	13	0
14	14	0
15	15	1
16	16	0
17	17	0
18	18	0
19	19	1
20	20	0
21	21	1
22	22	0
23	23	1
24	24	0
25	25	0
26	26	0
27	27	1

Node Type

Node Type 0 is common node
Node Type 1 is junction node
Node Type 2 is boundary node

Open File
Create New File
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Insert Delete
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Help

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

Water Quality : Worksheet Editor

File Edit

Water Quality Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_BOD\10g.bod

Node and Time Step | Boundary Con. | Initial Con. | Diffusion Coef. | Load | Parameters

Boundary Condition

Insert Col. Delete Col.

Number of Boundary Node 13

Time Interval of Data

Time Interval of Data (Sec) 3600
Number of Data 90

---	BOD	DO	BOD	DO	BOD
Node	1	1	43	43	652
Type	s	s	s	s	s
1	0	6	2.85	4	0
2	0	6	2.85	4	0
3	0	6	2.85	4	0
4	0	6	2.85	4	0
5	0	6	2.85	4	0
6	0	6	2.85	4	0
7	0	6	2.85	4	0
8	0	6	2.85	4	0
9	0	6	2.85	4	0
10	0	6	2.85	4	0
11	0	6	2.85	4	0
12	0	6	2.85	4	0
13	0	6	2.85	4	0
14	0	6	2.85	4	0
15	0	6	2.85	4	0
16	0	6	2.85	4	0
17	0	6	2.85	4	0
18	0	6	2.85	4	0
19	0	6	2.85	4	0
20	0	6	2.85	4	0
21	0	6	2.85	4	0
22	0	6	2.85	4	0
23	0	6	2.85	4	0

Open File
Create New File
Save
Exit
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Insert Delete
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Help

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

Water Quality : Worksheet Editor

File Edit

Water Quality Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_BOD\10g.bod

Node and Time Step | Boundary Con. | Initial Con. | Diffusion Coef. | Load | Parameters

BOD/DO

Initial Condition

No.	Node	BOD	DO
1	1	1	6
2	2	1	5.5
3	3	10002	5
4	4	10004	3.5
5	5	19997	2.5
6	6	10002	2
7	7	19995	2
8	8	2	2
9	9	2	2
10	10	2	2
11	11	2	2
12	12	2	2
13	13	2	2
14	14	2	2
15	15	2	2
16	16	2	2
17	17	2	2
18	18	2	2
19	19	2	10009
20	20	2	19990
21	21	10002	19995
22	22	19997	4
23	23	2	4
24	24	19990	4
25	25	10009	4
26	26	10004	4
27	27	2.25	4
28	28	19995	4

Open File

Create New File

Save

Exit

Edit

Insert Delete

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Help

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

Water Quality : Worksheet Editor

File Edit

Water Quality Filename : D:\CaseStudy\CasePPN_DRY_RealTime\HD_BOD\10g.bod

Node and Time Step | Boundary Con. | Initial Con. | Diffusion Coef. | Load | Parameters

BOD/DO

Diffusion Coefficient (m²/s)

No.	Node	BOD	DO
1	1	50	50
2	2	50	50
3	3	25	25
4	4	25	25
5	5	25	25
6	6	25	25
7	7	25	25
8	8	25	25
9	9	25	25
10	10	25	25
11	11	25	25
12	12	25	25
13	13	25	25
14	14	25	25
15	15	25	25
16	16	25	25
17	17	25	25
18	18	25	25
19	19	25	25
20	20	25	25
21	21	25	25
22	22	25	25
23	23	25	25
24	24	25	25
25	25	25	25
26	26	25	25
27	27	25	25
28	28	25	25
29	29	25	25
30	30	25	25

Open File

Create New File

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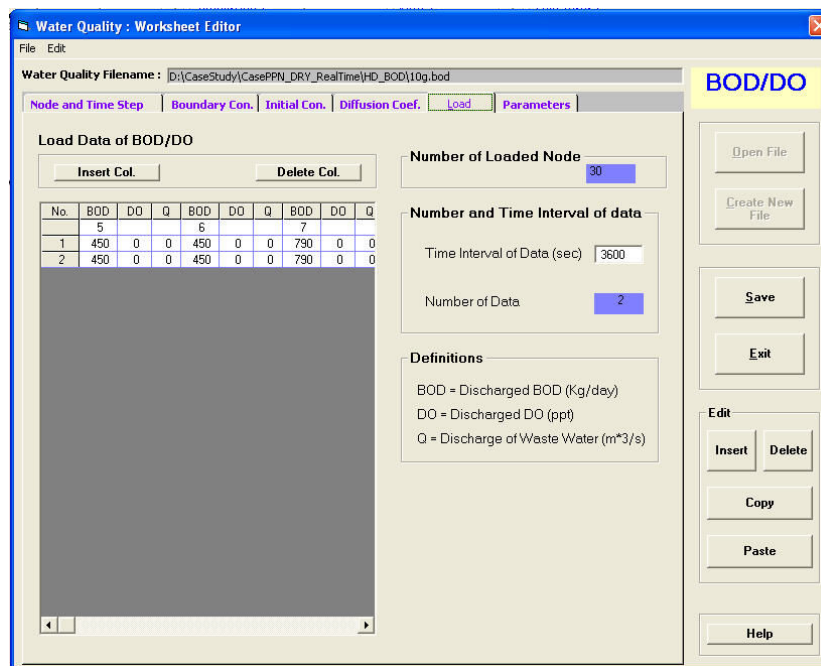
Insert Delete

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Help

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



Water Quality: Worksheet Editor

File Edit

Water Quality Filename: D:\CaseStudy\CasePPN_DRY_RealTime\HD_BOD\10g.bod

Node and Time Step | Boundary Con. | Initial Con. | Diffusion Coef. | Load | Parameters

Load Data of BOD/DO

Insert Col. Delete Col.

No.	BOD	DO	Q	BOD	DO	Q	BOD	DO	Q
1	450	0	0	450	0	0	790	0	0
2	450	0	0	450	0	0	790	0	0

Number of Loaded Node: 30

Number and Time Interval of data

Time Interval of Data (sec): 3600

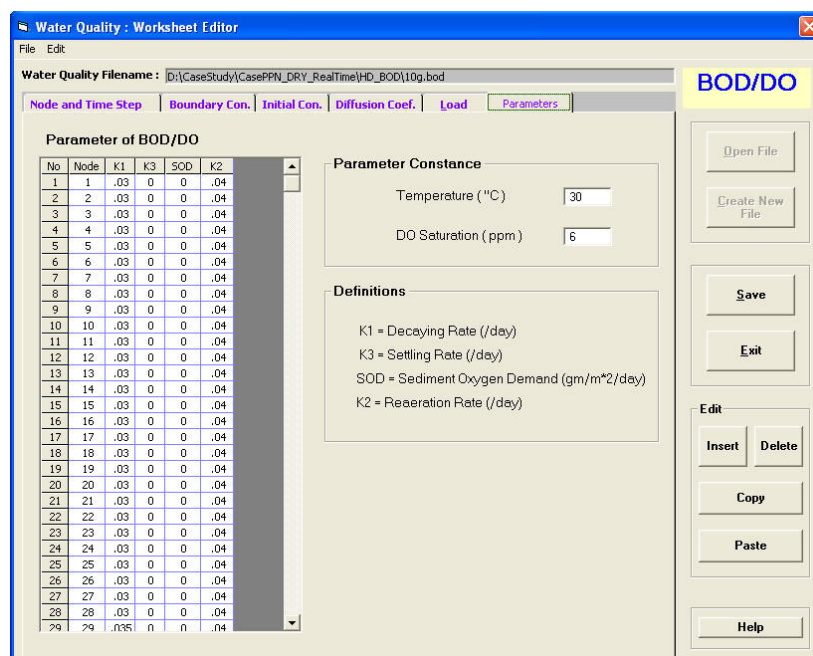
Number of Data: 2

Definitions

BOD = Discharged BOD (Kg/day)
 DO = Discharged DO (ppt)
 Q = Discharge of Waste Water (m³/s)

Open File
 Create New File
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 Exit
 Edit
 Insert Delete
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 Help

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



Water Quality: Worksheet Editor

File Edit

Water Quality Filename: D:\CaseStudy\CasePPN_DRY_RealTime\HD_BOD\10g.bod

Node and Time Step | Boundary Con. | Initial Con. | Diffusion Coef. | Load | Parameters

Parameter of BOD/DO

No.	Node	K1	K3	SOD	K2
1	1	.03	0	0	.04
2	2	.03	0	0	.04
3	3	.03	0	0	.04
4	4	.03	0	0	.04
5	5	.03	0	0	.04
6	6	.03	0	0	.04
7	7	.03	0	0	.04
8	8	.03	0	0	.04
9	9	.03	0	0	.04
10	10	.03	0	0	.04
11	11	.03	0	0	.04
12	12	.03	0	0	.04
13	13	.03	0	0	.04
14	14	.03	0	0	.04
15	15	.03	0	0	.04
16	16	.03	0	0	.04
17	17	.03	0	0	.04
18	18	.03	0	0	.04
19	19	.03	0	0	.04
20	20	.03	0	0	.04
21	21	.03	0	0	.04
22	22	.03	0	0	.04
23	23	.03	0	0	.04
24	24	.03	0	0	.04
25	25	.03	0	0	.04
26	26	.03	0	0	.04
27	27	.03	0	0	.04
28	28	.03	0	0	.04
29	29	.03	0	0	.04

Parameter Constance

Temperature (°C): 30

DO Saturation (ppm): 6

Definitions

K1 = Decaying Rate (/day)
 K3 = Settling Rate (/day)
 SOD = Sediment Oxygen Demand (gm/m²/day)
 K2 = Reaeration Rate (/day)

Open File
 Create New File
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 Help

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 become 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.