Preliminary results from a 2-D hydrodynamic transport model for the lower SJR in support of the Task 8 Linkage Study

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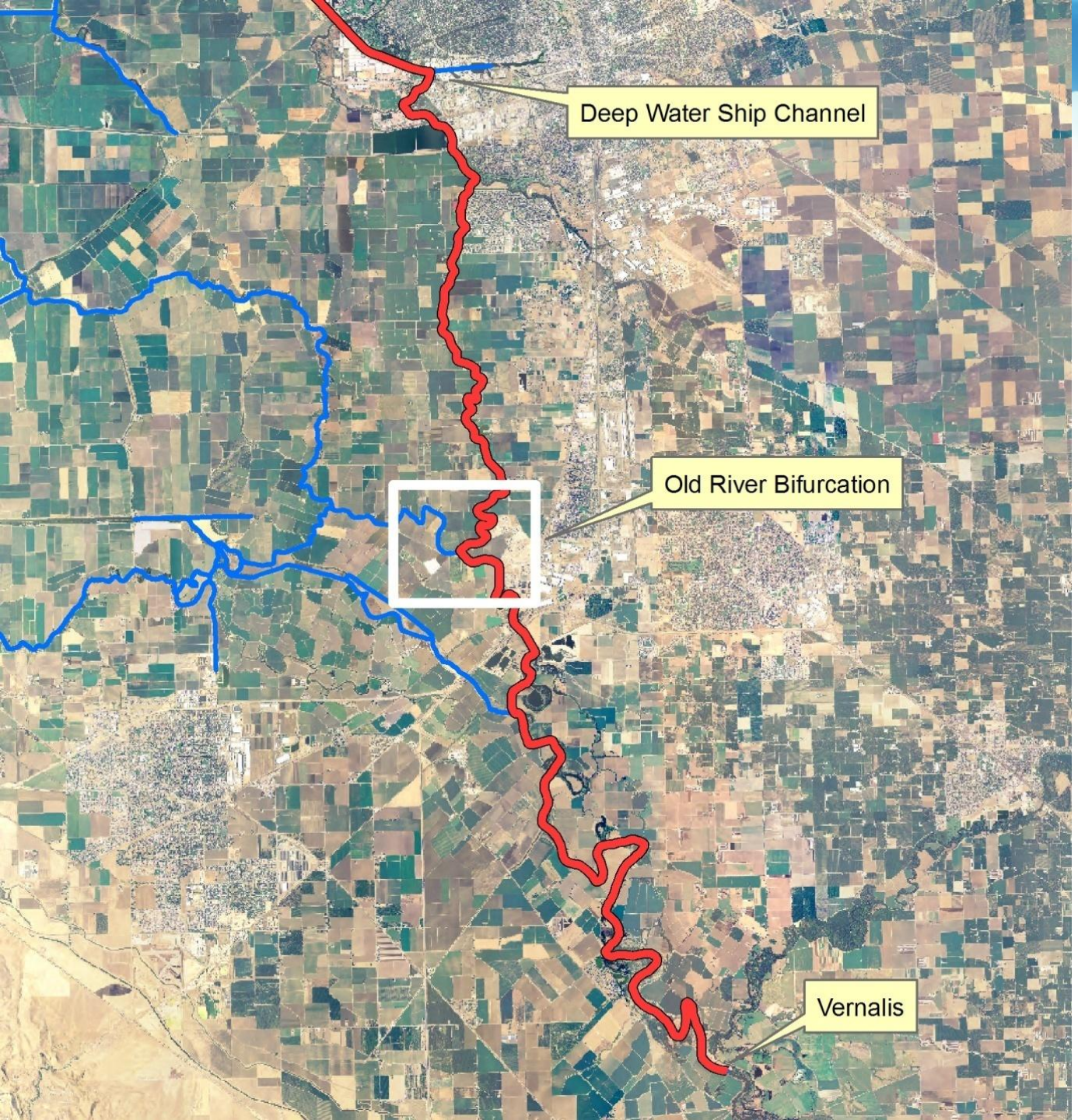
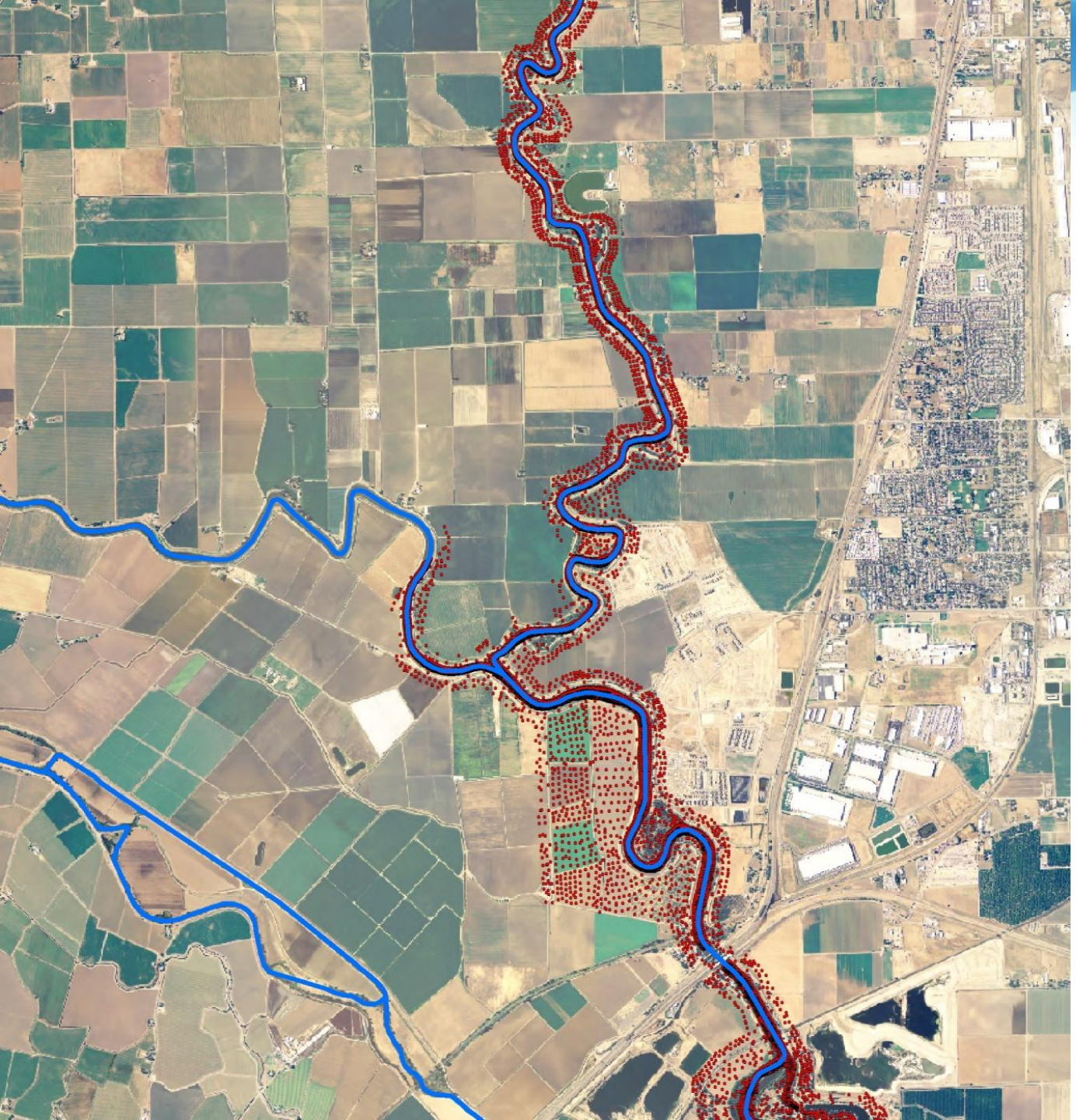
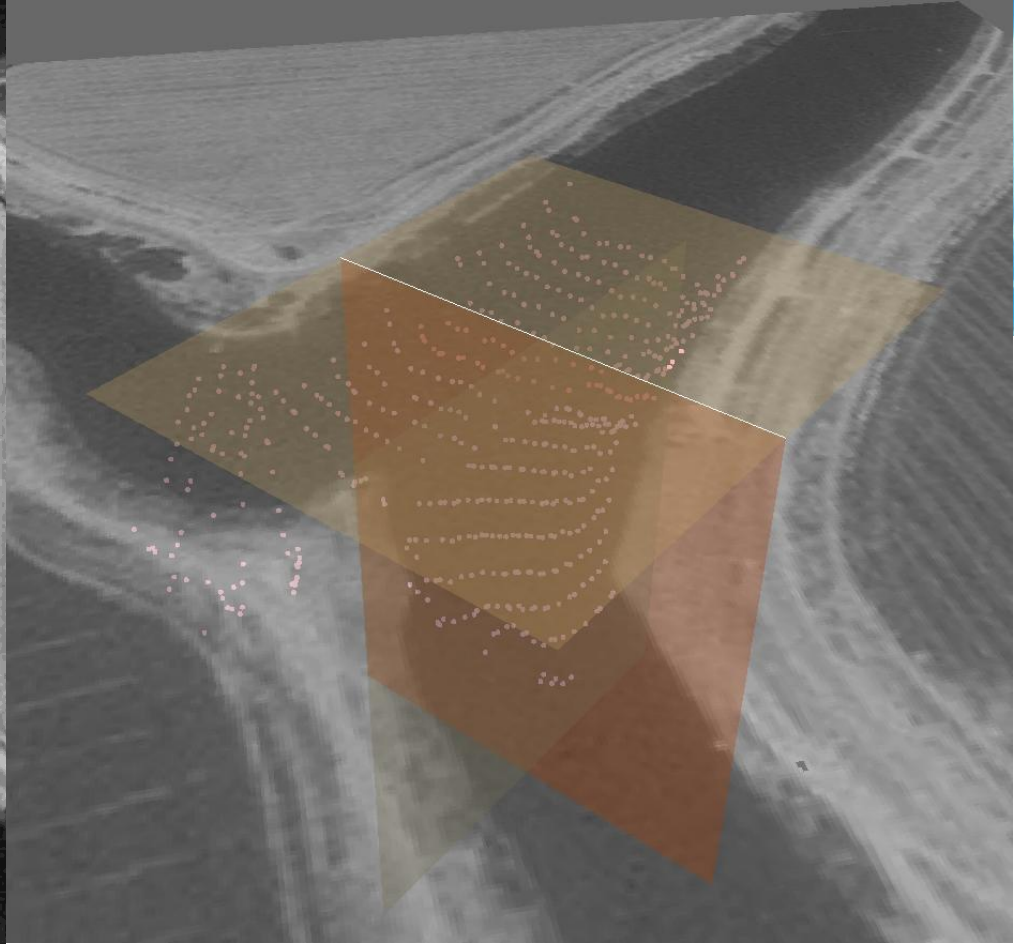
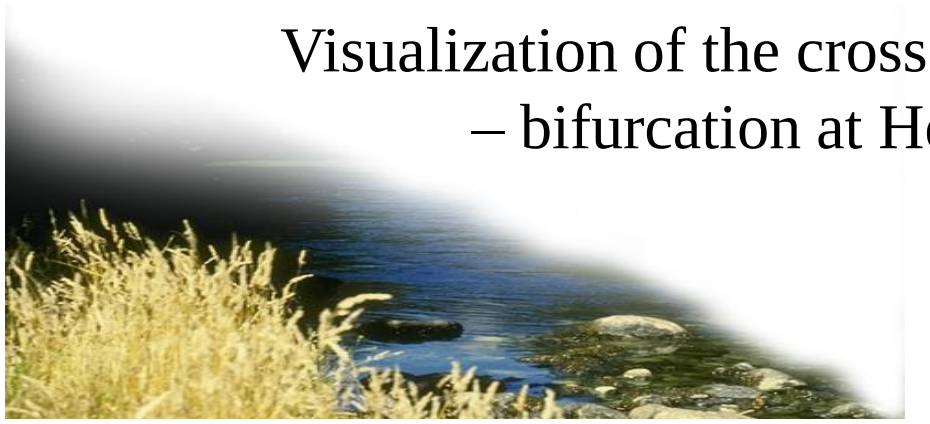


Model study reach – Vernalis to Rough and Ready monitoring station within the Stockton Deep Water Ship Canal



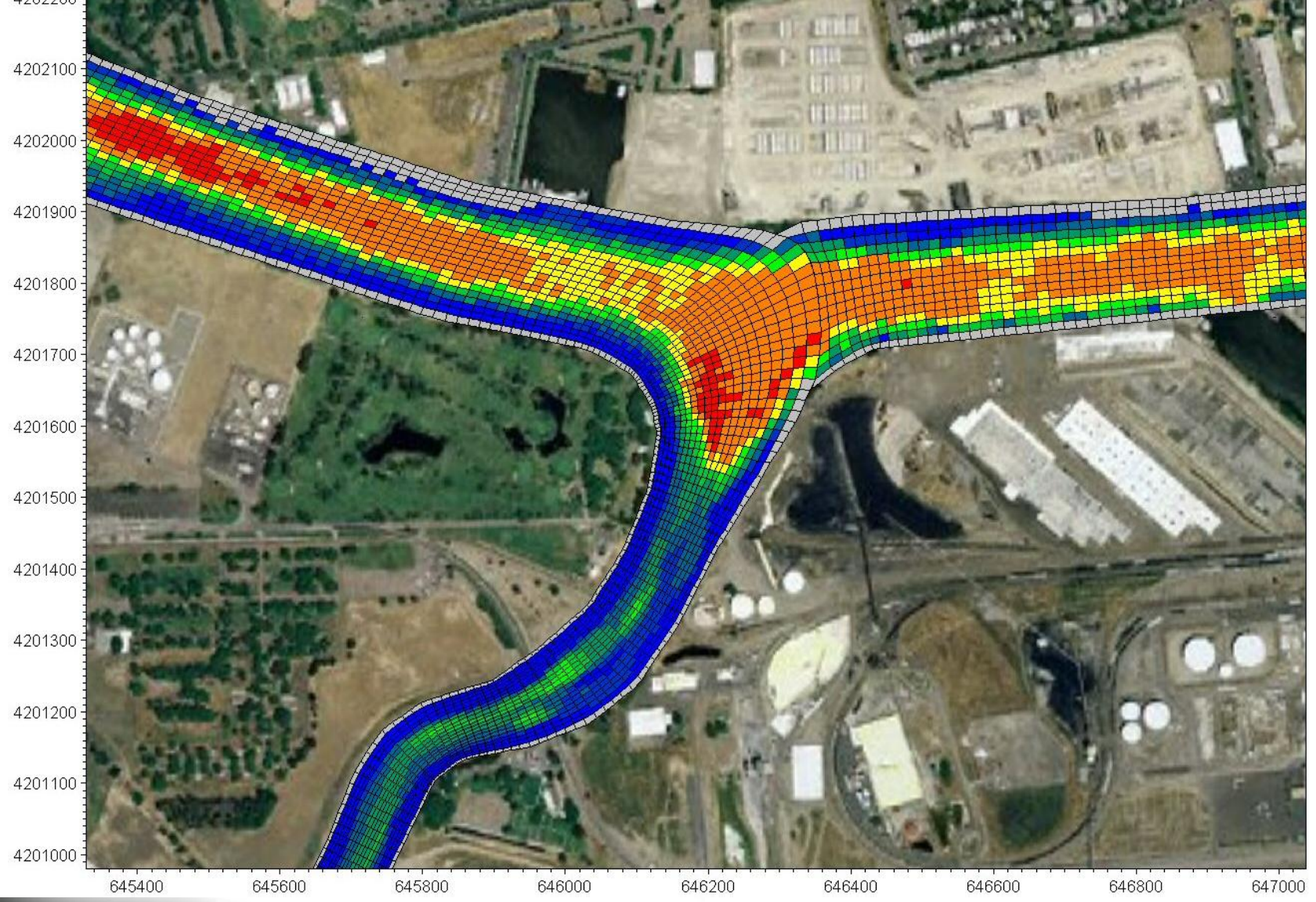
USCOE – cross section and bathymetry data for the 2002 San Joaquin River comprehensive study



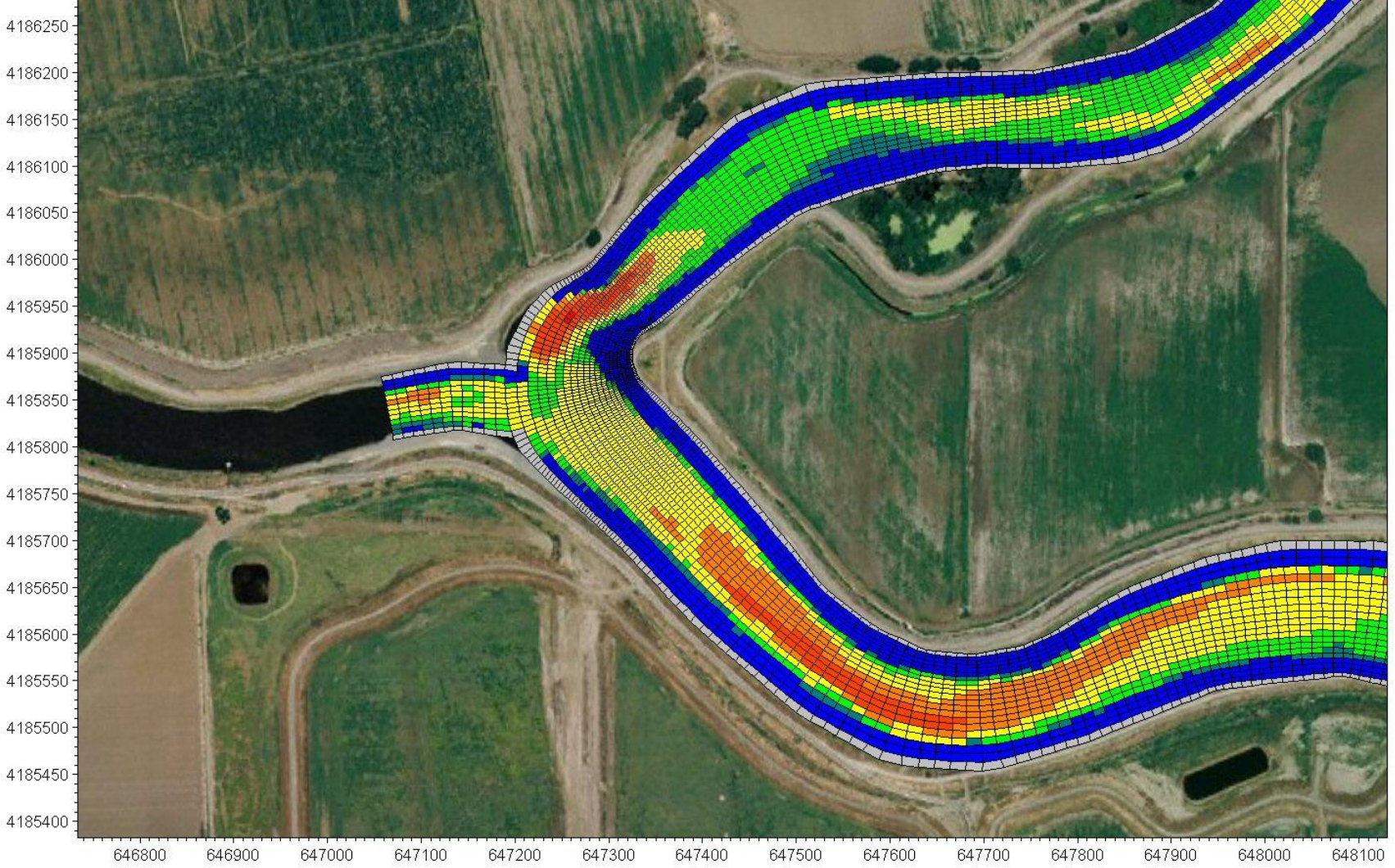


Visualization of the cross section and bathymetry data – bifurcation at Head of Old River (HOR)

Bathymetry map of San Joaquin River channel at point of entry to the Deep Water Ship Canal

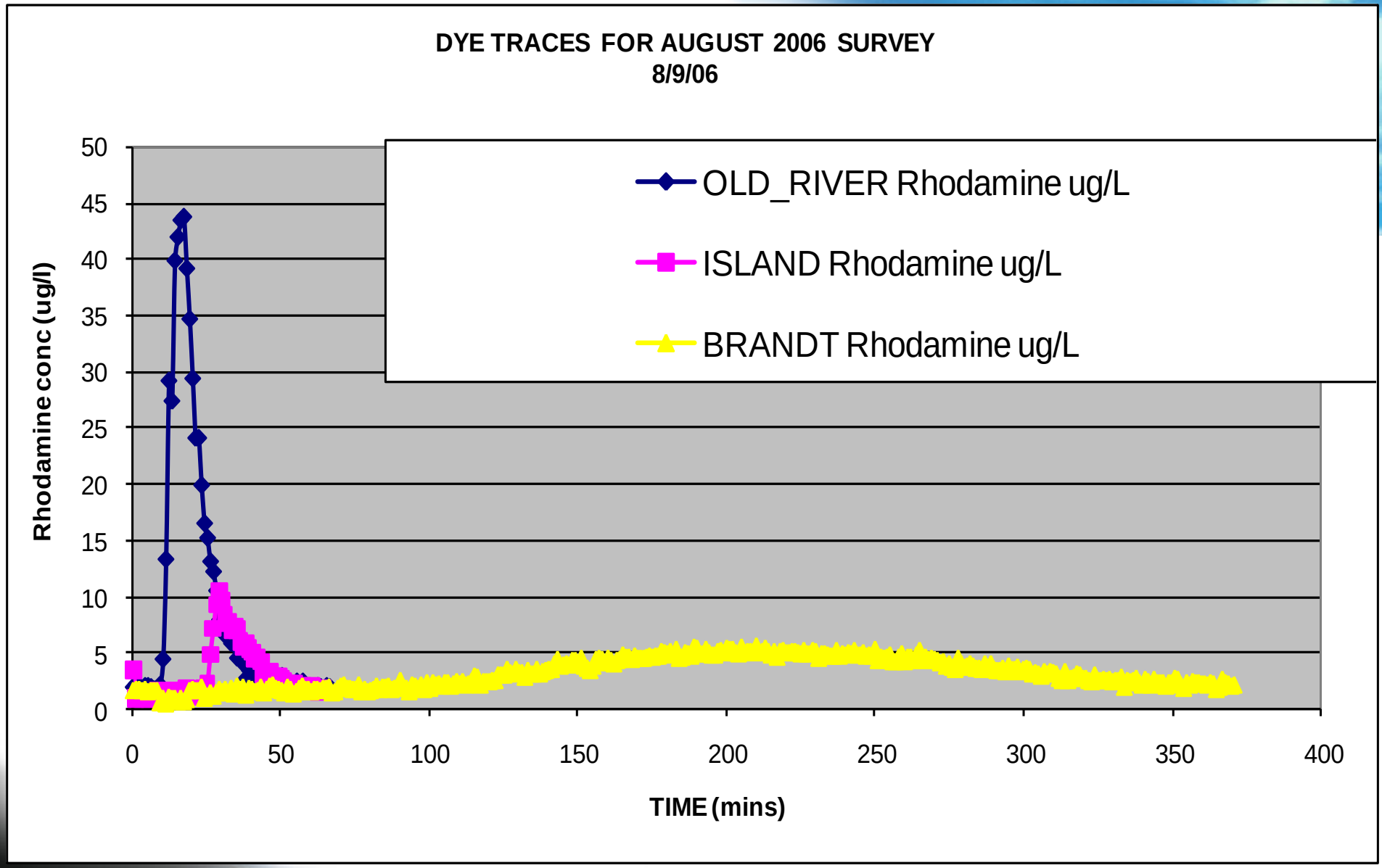


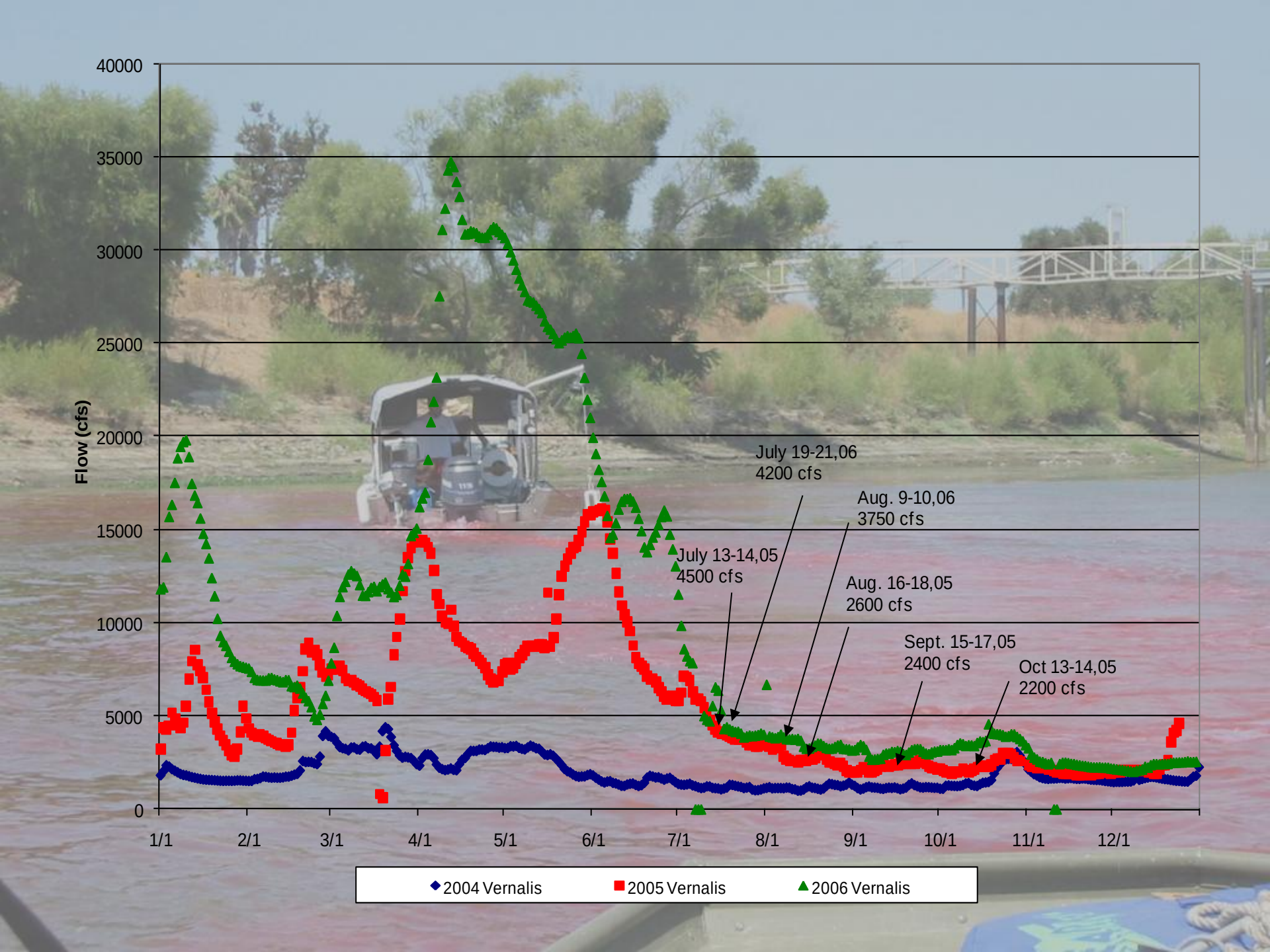
MIKE 21c curvilinear model cell discretization at entry to the Deep Water Ship Canal showing bathymetry



MIKE 21c curvilinear model cell discretization at flow bifurcation at Head of Old River (HOR) showing channel bathymetry

Rhodamine WT dye release by boat at Vernalis

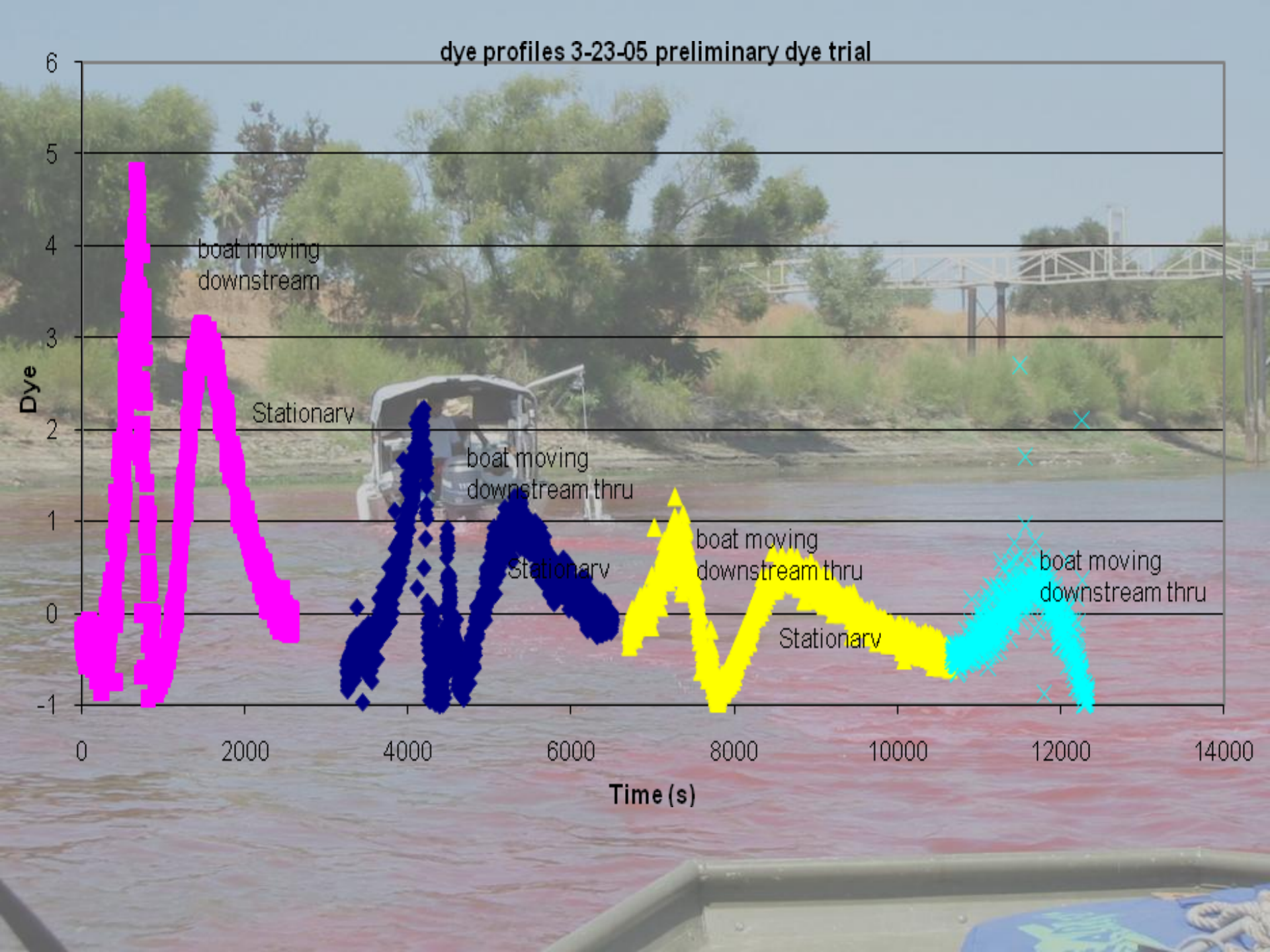

DYE TRACES FOR AUGUST 2006 SURVEY
8/9/06
Rhodamine conc (ug/l)
50
45
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
TIME (mins)
OLD_RIVER Rhodamine ug/L
ISLAND Rhodamine ug/L
BRANDT Rhodamine ug/L


40000
35000
30000
25000
20000
15000
10000
5000
0
Flow (cfs)
1/1
2/1
3/1
4/1
5/1
6/1
7/1
8/1
9/1
10/1
11/1
12/1
July 19-21,06
4200 cfs
Aug. 9-10,06
3750 cfs
July 13-14,05
4500 cfs
Aug. 16-18,05
2600 cfs
Sept. 15-17,05
2400 cfs
Oct 13-14,05
2200 cfs
2004 Vernalis
2005 Vernalis
2006 Vernalis

SIMULATION EXPERIMENT - 1

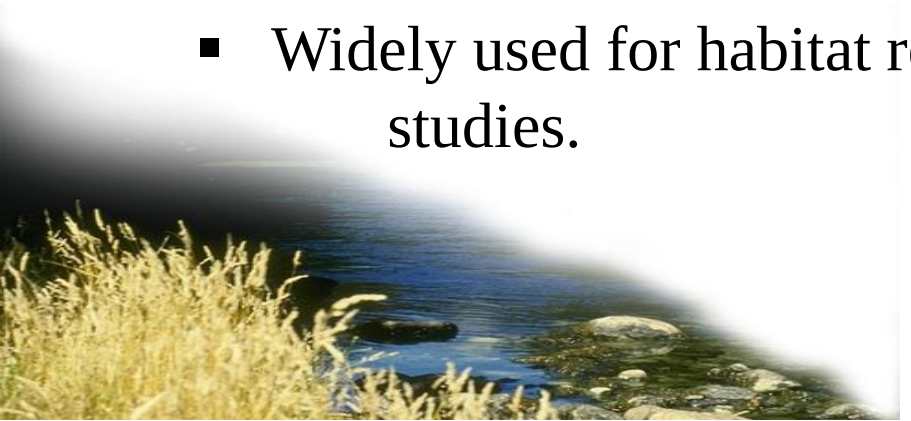
MARCH 23 – 27, 2005

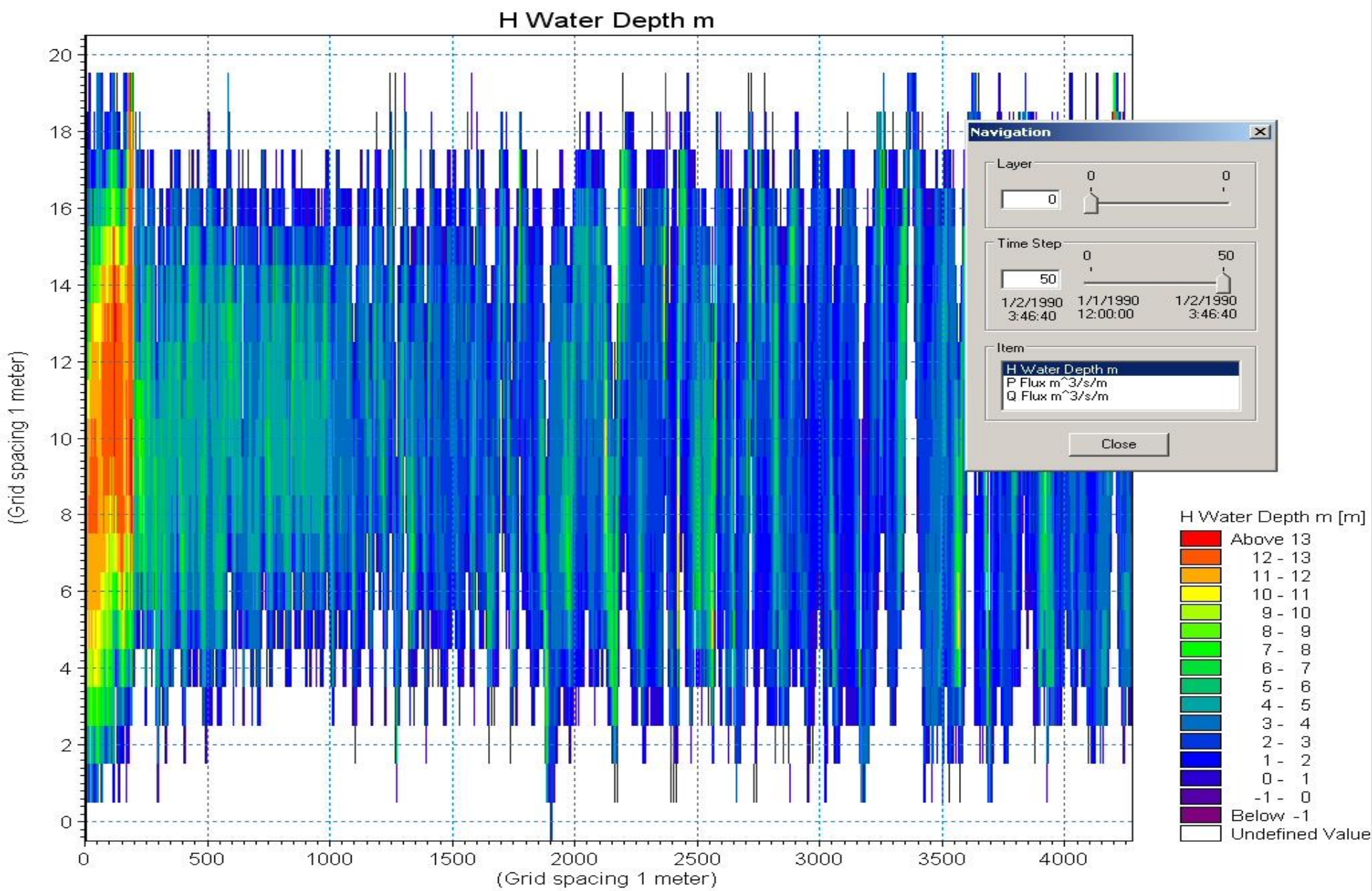
VERNALIS FLOW >5000 CFS


dye profiles 3-23-05 preliminary dye trial
6
5
4
3
2
1
0
-1
Dye
boat moving downstream
Stationary
boat moving downstream thru
Stationary
boat moving downstream thru
Stationary
boat moving downstream thru
0
2000
4000
6000
8000
10000
12000
14000
Time (s)

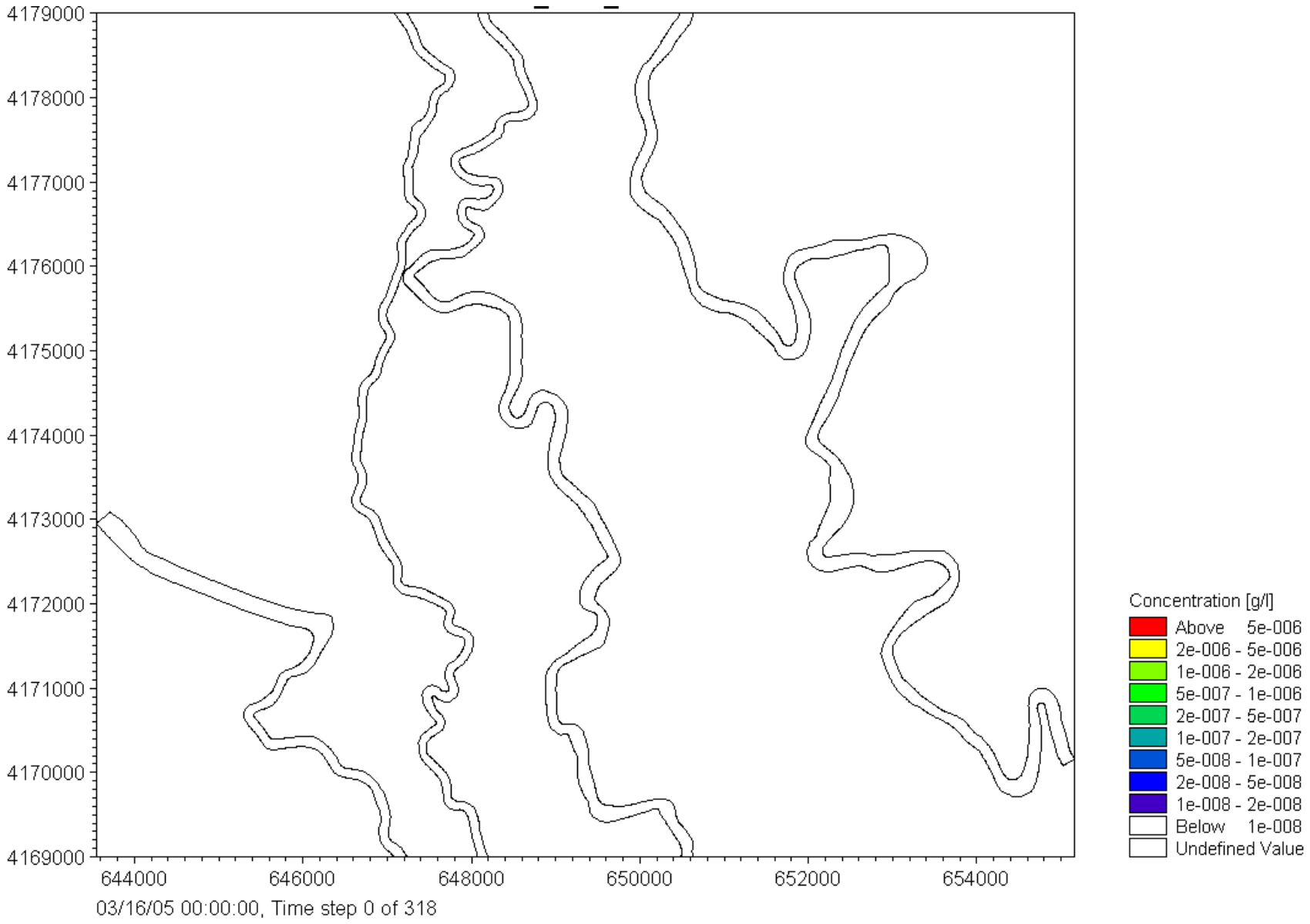
DHI - MIKE 21c
2-D Curvilinear Hydrodynamic Model

- Solves vertically-integrated St. Venant equations on a curvilinear finite difference grid
- Fully dynamic advection-dispersion model
- Contains helical flow model of 3-D secondary currents including time and phase lag
- Sediment model simulates bed scour and deposition, cohesive sediments and alluvial resistance
- Widely used for habitat restoration and morphological studies.





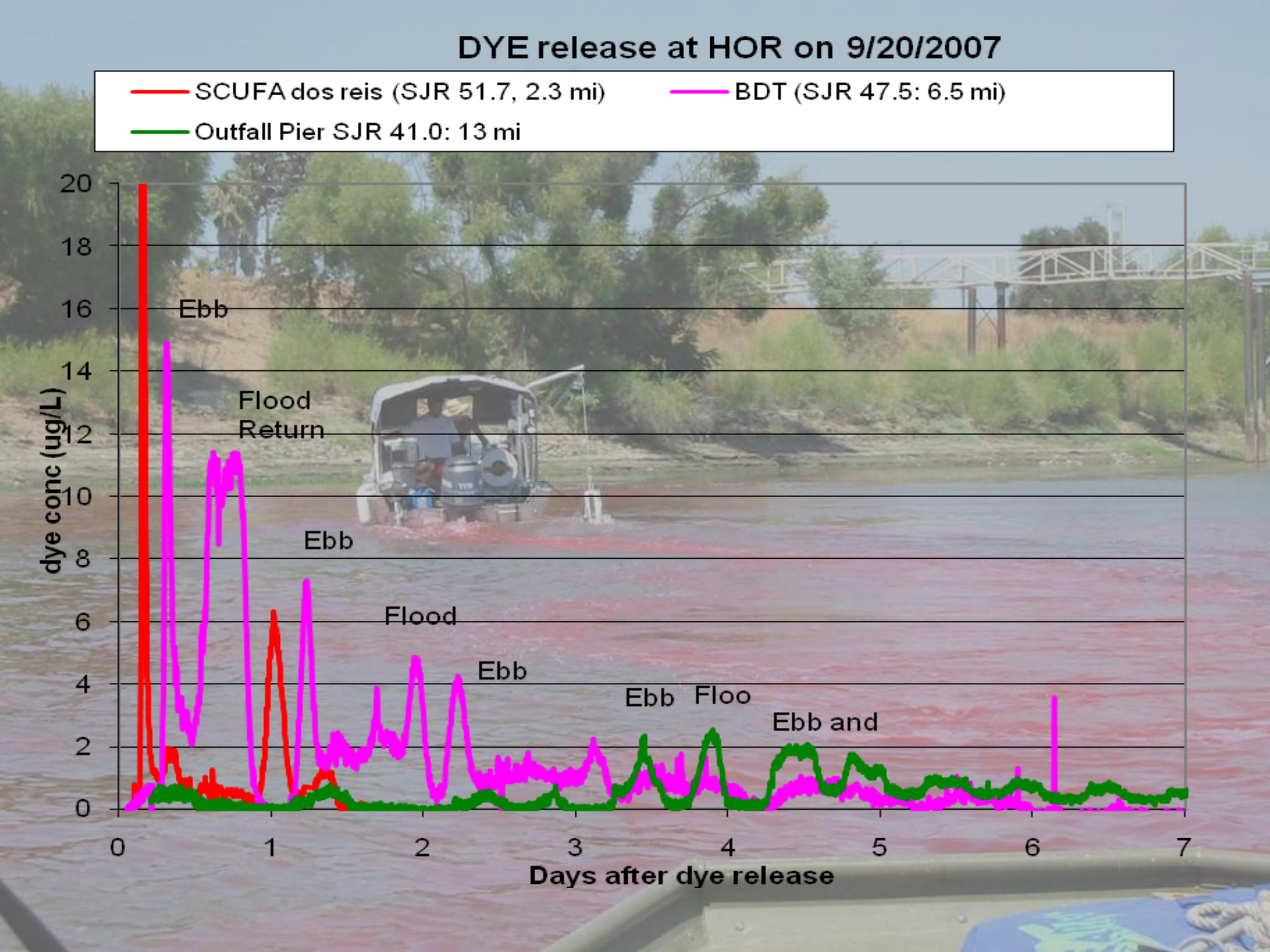
Developing a steady-state flow simulation with MIKE 21c

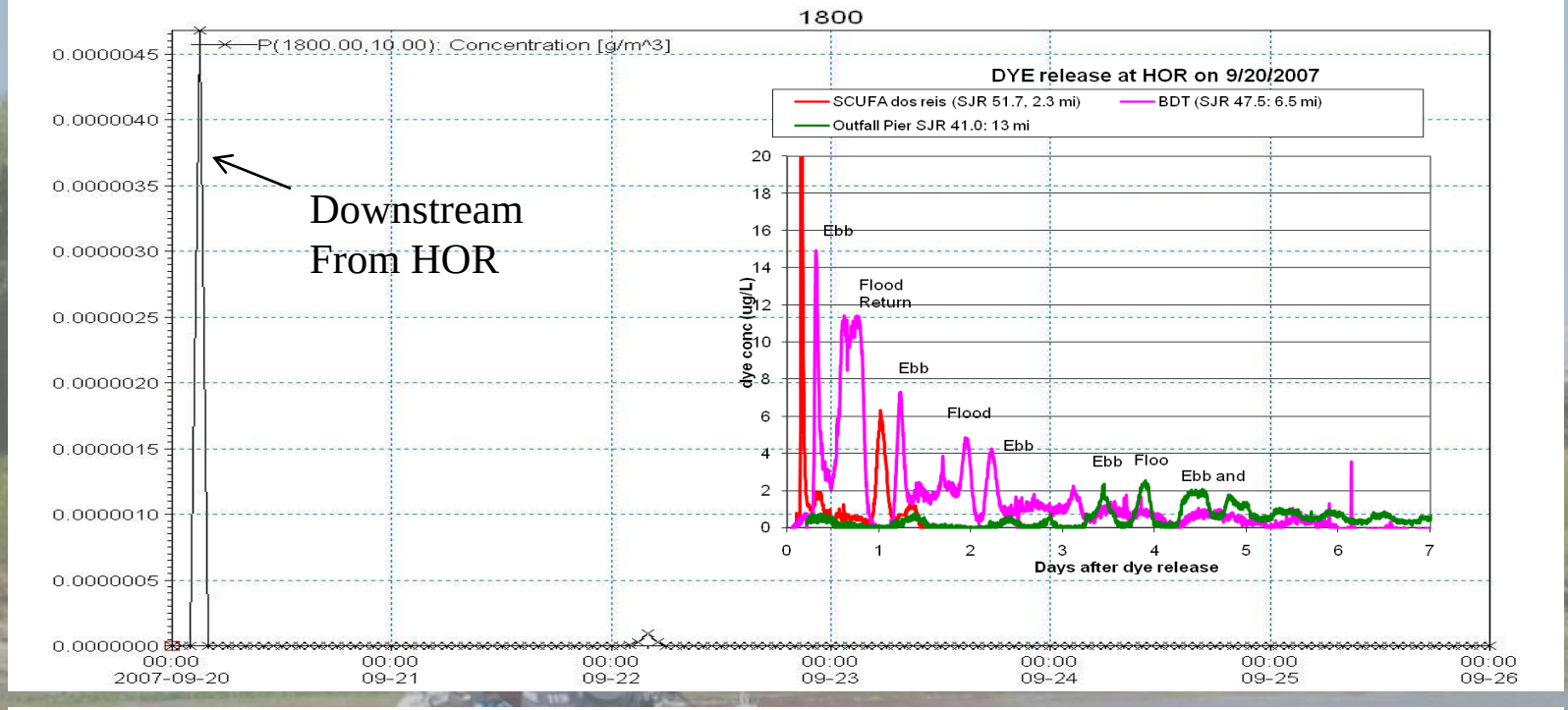

4179000
4178000
4177000
4176000
4175000
4174000
4173000
4172000
4171000
4170000
4169000
644000
646000
648000
650000
652000
654000
03/16/05 00:00:00, Time step 0 of 318
Concentration [g/l]
Above 5e-006
2e-006 - 5e-006
1e-006 - 2e-006
5e-007 - 1e-006
2e-007 - 5e-007
1e-007 - 2e-007
5e-008 - 1e-007
2e-008 - 5e-008
1e-008 - 2e-008
Below 1e-008
Undefined Value

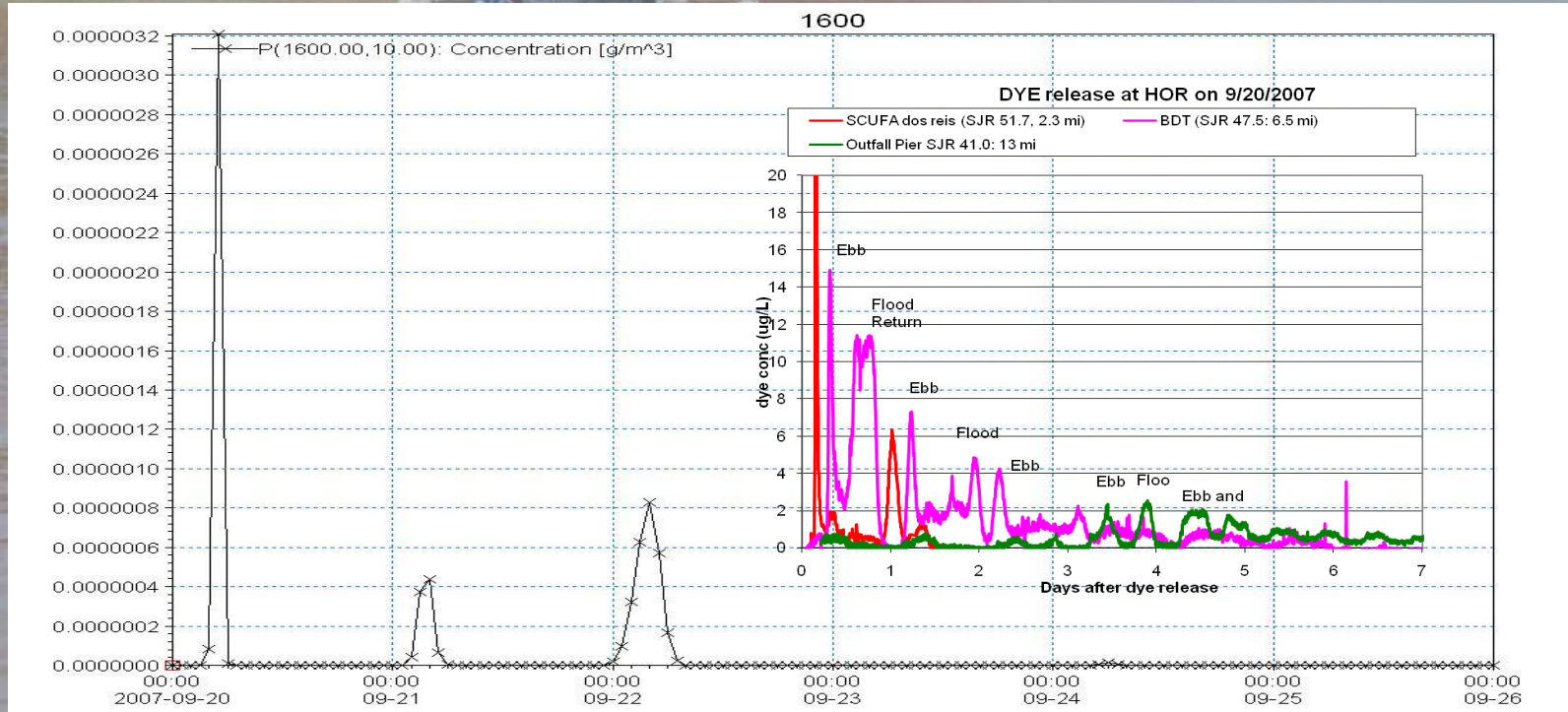
SIMULATION EXPERIMENT - 2

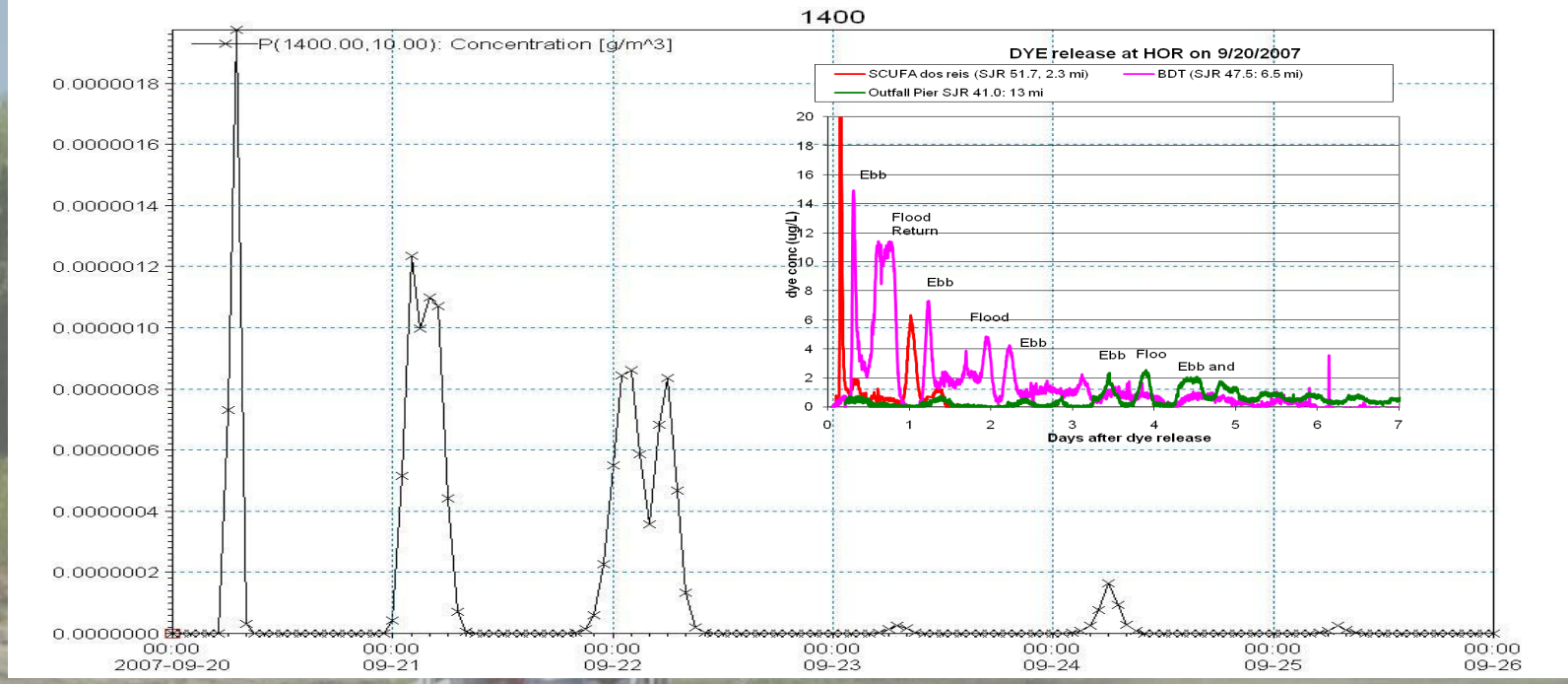
SEPTEMBER 20 – 27, 2007

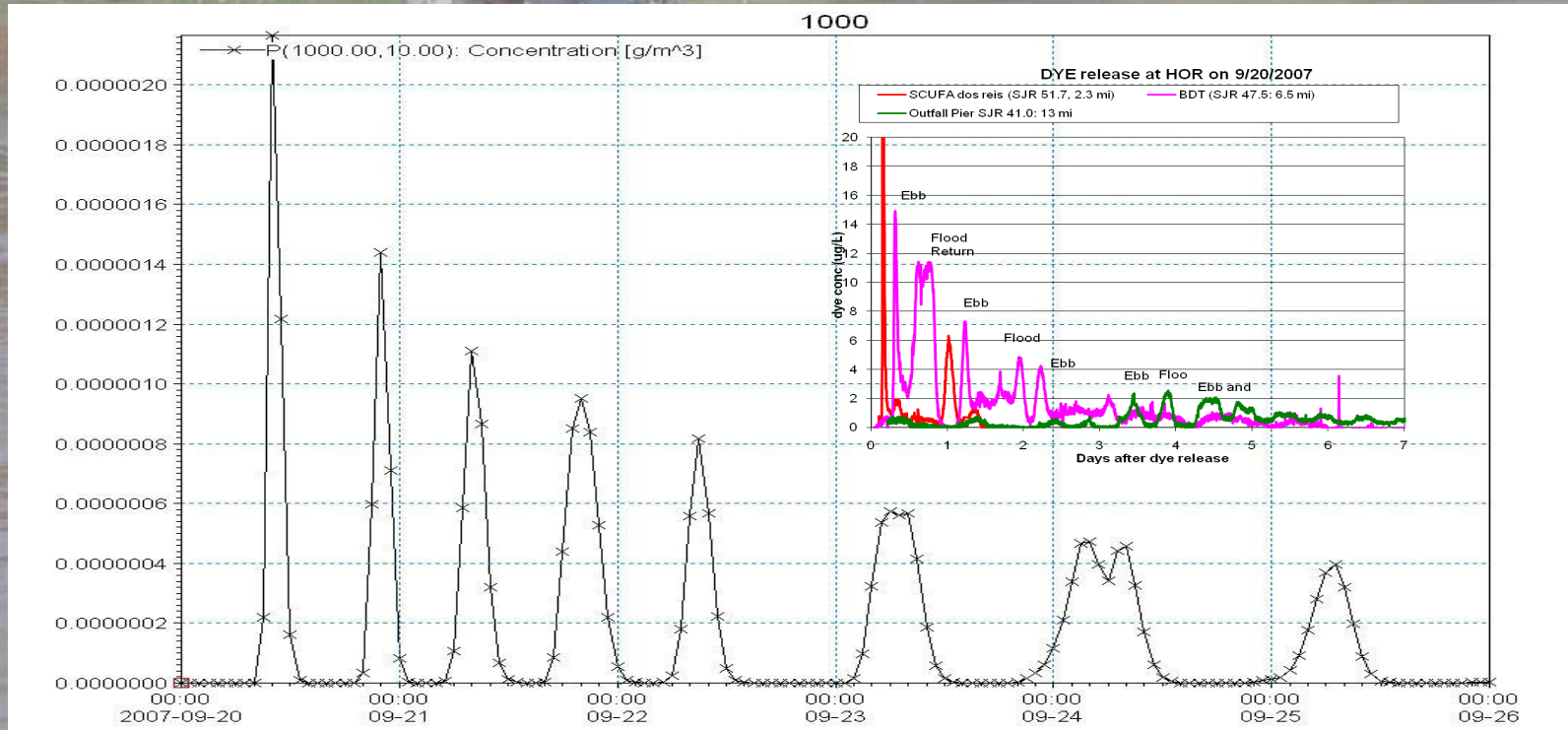
VERNALIS FLOW < 1000 CFS

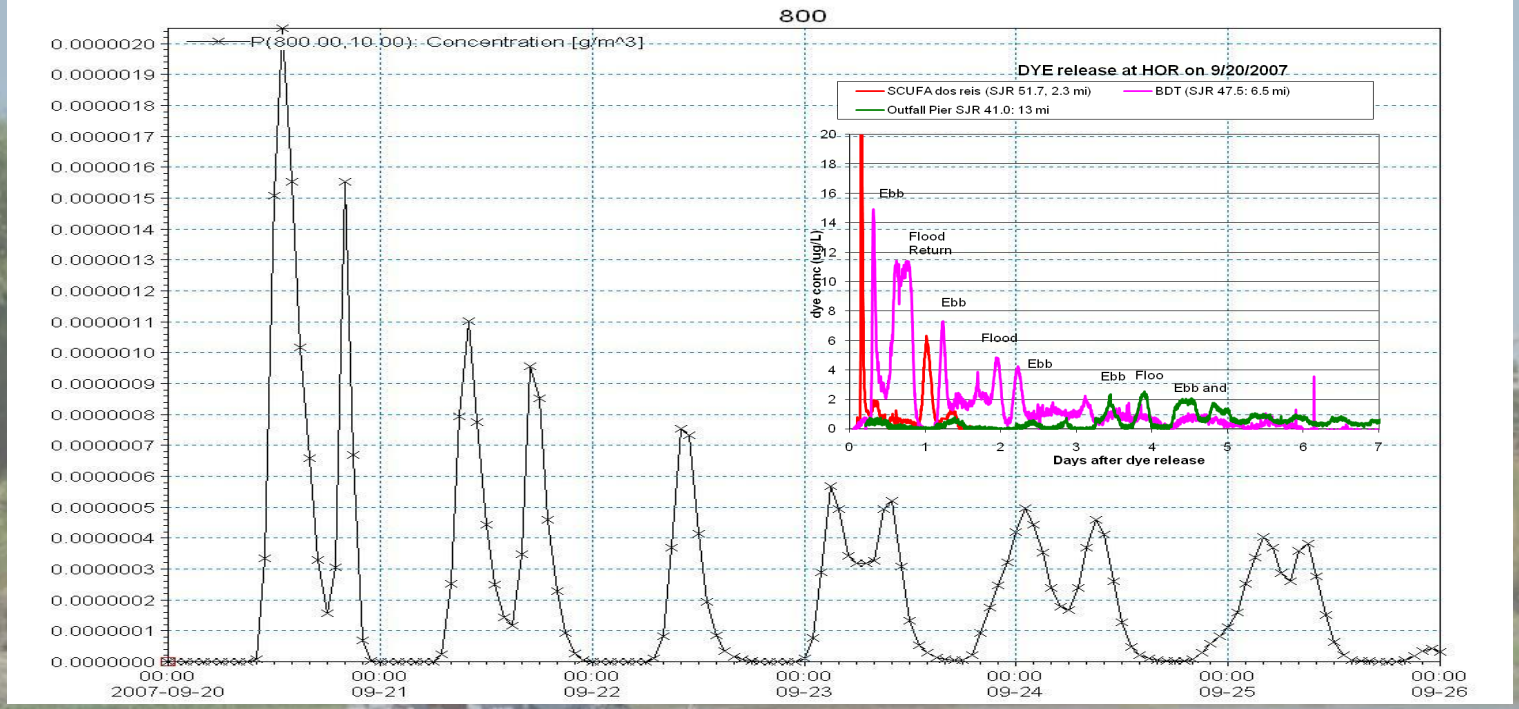

DYE release at HOR on 9/20/2007
SCUFA dos reis (SJR 51.7, 2.3 mi)
BDT (SJR 47.5: 6.5 mi)
Outfall Pier SJR 41.0: 13 mi
dye conc (ug/L)
20
18
16
14
12
10
8
6
4
2
0
Ebb
Flood
Return
Ebb
Flood
Ebb
Ebb
Floo
Ebb and
0
1
2
3
4
5
6
7
Days after dye release

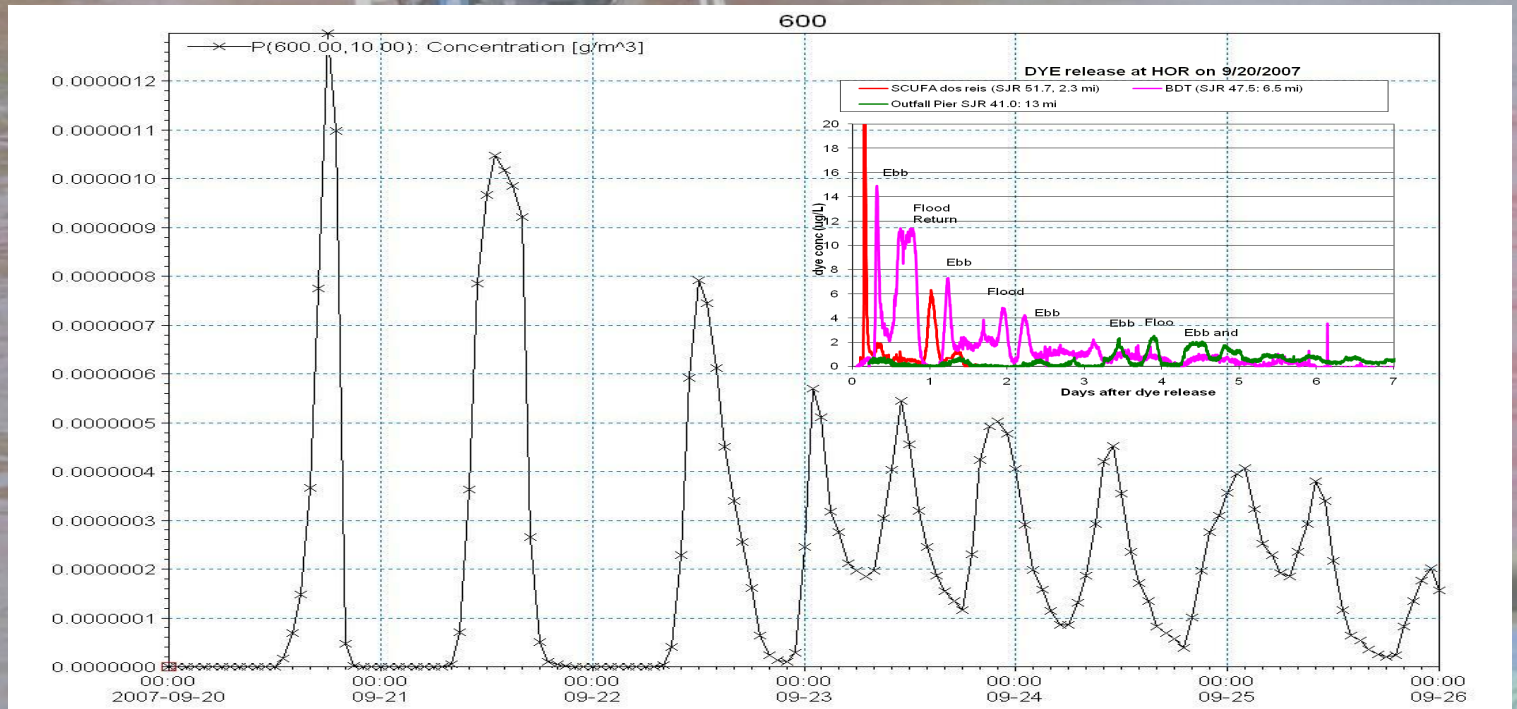

1800
P(1800.00,10.00): Concentration [g/m^3]
Downstream
From HOR
DYE release at HOR on 9/20/2007
SCUFA dos reis (SJR 51.7, 2.3 mi)
BDT (SJR 47.5: 6.5 mi)
Outfall Pier SJR 41.0: 13 mi
dye conc (ug/L)
Days after dye release
Ebb
Flood
Return
Ebb
Flood
Ebb
Ebb
Floo
Ebb and
0.0000045
0.0000040
0.0000035
0.0000030
0.0000025
0.0000020
0.0000015
0.0000010
0.0000005
0.0000000
00:00
2007-09-20
00:00
09-21
00:00
09-22
00:00
09-23
00:00
09-24
00:00
09-25
00:00
09-26

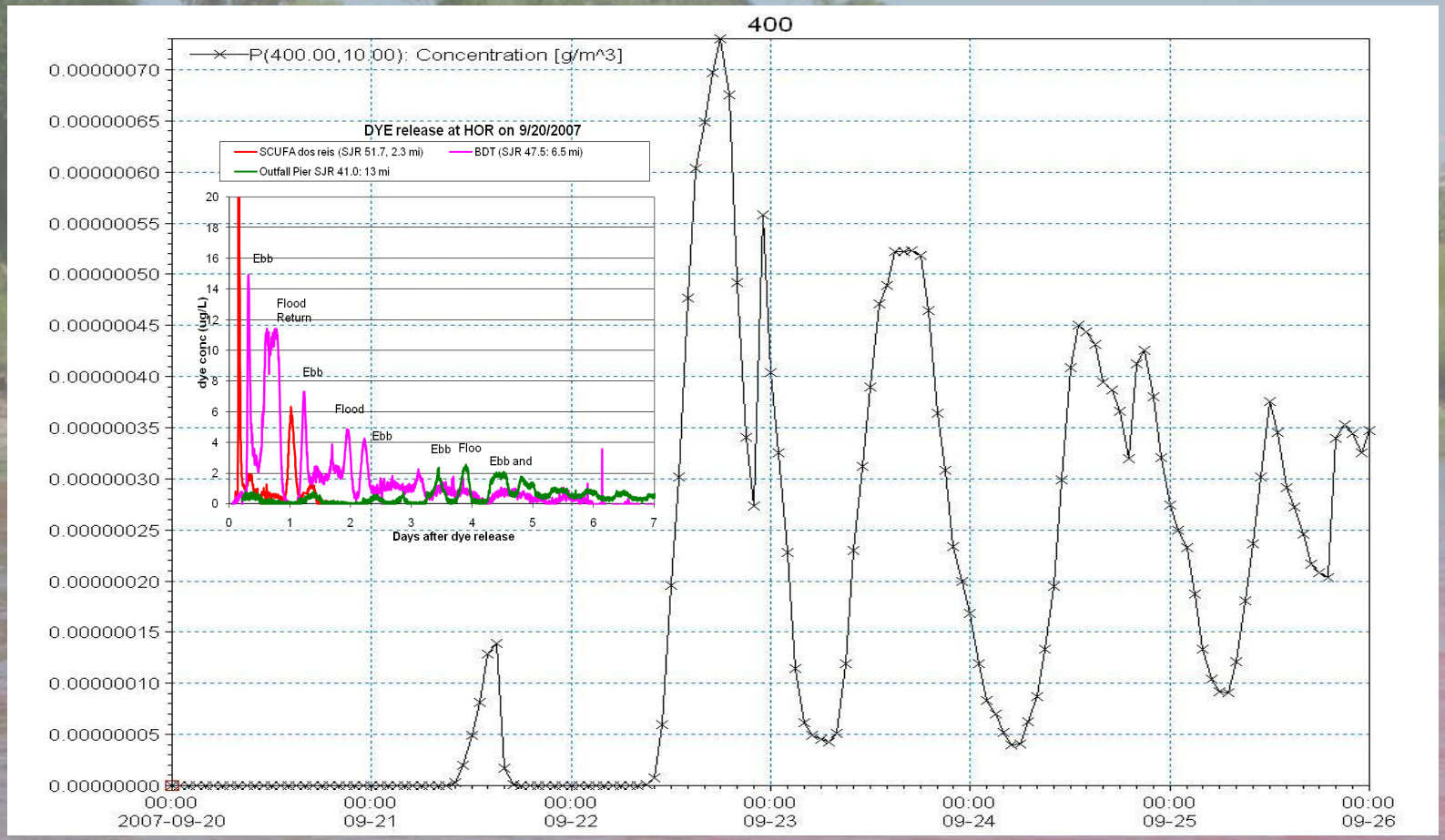

1600
P(1600.00,10.00): Concentration [g/m^3]
DYE release at HOR on 9/20/2007
SCUFA dos reis (SJR 51.7, 2.3 mi)
BDT (SJR 47.5: 6.5 mi)
Outfall Pier SJR 41.0: 13 mi
dye conc (ug/L)
Days after dye release
Ebb
Flood
Return
Ebb
Flood
Ebb
Ebb
Floo
Ebb and
0.0000032
0.0000030
0.0000028
0.0000026
0.0000024
0.0000022
0.0000020
0.0000018
0.0000016
0.0000014
0.0000012
0.0000010
0.0000008
0.0000006
0.0000004
0.0000002
0.0000000
00:00
2007-09-20
00:00
09-21
00:00
09-22
00:00
09-23
00:00
09-24
00:00
09-25
00:00
09-26


1400
P(1400.00,10.00): Concentration [g/m^3]
0.0000018
0.0000016
0.0000014
0.0000012
0.0000010
0.0000008
0.0000006
0.0000004
0.0000002
0.0000000
00:00 2007-09-20
00:00 09-21
00:00 09-22
00:00 09-23
00:00 09-24
00:00 09-25
00:00 09-26
DYE release at HOR on 9/20/2007
SCUFA dos reis (SJR 51.7, 2.3 mi)
BDT (SJR 47.5: 6.5 mi)
Outfall Pier SJR 41.0: 13 mi
dye conc (ug/L)
Ebb
Flood
Return
Ebb
Flood
Ebb
Ebb
Floo
Ebb and
Days after dye release


1000
P(1000.00,10.00): Concentration [g/m^3]
0.0000020
0.0000018
0.0000016
0.0000014
0.0000012
0.0000010
0.0000008
0.0000006
0.0000004
0.0000002
0.0000000
00:00 2007-09-20
00:00 09-21
00:00 09-22
00:00 09-23
00:00 09-24
00:00 09-25
00:00 09-26
DYE release at HOR on 9/20/2007
SCUFA dos reis (SJR 51.7, 2.3 mi)
BDT (SJR 47.5: 6.5 mi)
Outfall Pier SJR 41.0: 13 mi
dye conc (ug/L)
Ebb
Flood
Return
Ebb
Flood
Ebb
Ebb
Floo
Ebb and
Days after dye release


800
P(800.00,10.00): Concentration [g/m^3]
DYE release at HOR on 9/20/2007
SCUFA dos reis (SJR 51.7, 2.3 mi)
BDT (SJR 47.5: 6.5 mi)
Outfall Pier SJR 41.0: 13 mi
dye conc (ug/L)
Ebb
Flood
Return
Ebb
Flood
Ebb
Ebb
Floo
Ebb and
Days after dye release
0.0000020
0.0000019
0.0000018
0.0000017
0.0000016
0.0000015
0.0000014
0.0000013
0.0000012
0.0000011
0.0000010
0.0000009
0.0000008
0.0000007
0.0000006
0.0000005
0.0000004
0.0000003
0.0000002
0.0000001
0.0000000
00:00 2007-09-20
00:00 09-21
00:00 09-22
00:00 09-23
00:00 09-24
00:00 09-25
00:00 09-26


600
P(600.00,10.00): Concentration [g/m^3]
DYE release at HOR on 9/20/2007
SCUFA dos reis (SJR 51.7, 2.3 mi)
BDT (SJR 47.5: 6.5 mi)
Outfall Pier SJR 41.0: 13 mi
dye conc (ug/L)
Ebb
Flood
Return
Ebb
Flood
Ebb
Ebb
Floo
Ebb and
Days after dye release
0.0000012
0.0000011
0.0000010
0.0000009
0.0000008
0.0000007
0.0000006
0.0000005
0.0000004
0.0000003
0.0000002
0.0000001
0.0000000
00:00 2007-09-20
00:00 09-21
00:00 09-22
00:00 09-23
00:00 09-24
00:00 09-25
00:00 09-26


400
P(400.00,10.00): Concentration [g/m^3]
0.00000070
0.00000065
0.00000060
0.00000055
0.00000050
0.00000045
0.00000040
0.00000035
0.00000030
0.00000025
0.00000020
0.00000015
0.00000010
0.00000005
0.00000000
00:00 2007-09-20
00:00 09-21
00:00 09-22
00:00 09-23
00:00 09-24
00:00 09-25
00:00 09-26
DYE release at HOR on 9/20/2007
SCUFA dos reis (SJR 51.7, 2.3 mi)
BDT (SJR 47.5: 6.5 mi)
Outfall Pier SJR 41.0: 13 mi
dye conc (ug/L)
Ebb
Flood
Return
Ebb
Flood
Ebb
Ebb
Floo
Ebb and
Days after dye release

SUMMARY

- Model appears capable of simulating complex hydrodynamics of the lower San Joaquin River and Deep Water Ship Channel under low and high flow conditions
- Hydrodynamic dye trace animations reveal behaviors not readily apparent from analysis of data
- Existing model can be used to simulate algae growth, transport and decay using sediment analog