

CE-QUAL-W2: A Two-Dimensional, Laterally Averaged, Hydrodynamic and Water Quality Model, Version 4.5

User Manual: Part 5 – Model Utilities

Edited by

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Preface

This manual documents the two-dimensional, laterally averaged, hydrodynamic and water quality model CE-QUAL-W2. As in all complex models, there have been many contributors. This re-write of the User Manual was based on prior User Manuals: Environmental and Hydraulic Laboratories (1986), Cole and Buchak (1995) Version 2, and Cole and Wells (2000) Version 3.0 through Cole and Wells (2019) Version 4.1. Hence, one can think of the primary author as merely an editor of past documents, rather than reflecting one person's sole authorship. This updated User Manual contains numerous corrections, new figures, new sections, additional documentation, and improvements in organization and presentation of information compared to Cole and Wells (2019).

This section of the User Manual Part 5 documents the model utilities used in supporting the model, the model release notes and a detailed list of bug fixes.

The other sections of the User Manual are divided into multiple sections for ease of updating and editing:

- User Manual Part 1: Introduction to CE-QUAL-W2, Model download package, how to run the model, model versions, changes between model versions
- User Manual Part 2: Theoretical basis for CE-QUAL-W2: hydrodynamics and water quality, particle transport and numerical scheme
- User Manual Part 3: Model input and output file descriptions and input/output file examples
- User Manual Part 4: Model examples
- User Manual Part 5: Release notes, bug fixes, differences in model versions, history of bug fixes, and other user manuals such as for the GUI interface, the water balance algorithm, and other external codes.

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Or for a specific section:

Cole, Tom (2021) "Water Balance Utility," in "CE-QUAL-W2: A two-dimensional, laterally averaged, hydrodynamic and water quality model, version 4.5, user manual part 5, model utilities and release notes," ed. S. Wells, Department of Civil and Environmental Engineering, Portland State University, Portland, OR.

1. Introduction

Several useful CE-QUAL-W2 model utilities are available for editing the control file, post-processing model results, and setting up model input files. A description of these utilities is included in this part of the User Manual.

Also, this document shows model changes and bug fixes, model changes between versions, and a history of bug fixes in earlier versions.

Hence, this section of the User Manual includes the following sections:

- Model utilities
 - Water balance utility
 - Converter utility from w2_con.npt control file to Excel version
 - GUI control file editor and bathymetry viewer for Versions 3.7-4.22
 - Post-processor provided by DSI, Inc. including a bathymetry viewer
 - Excel macro utility for writing out input files for CE-QUAL-W2
- Model release notes
 - Current Bug fixes
 - Model Known Limitations
 - Model changes between versions
 - Model bug fixes between versions

2. Water Balance Utility

Primary author: Tom Cole

How to use the water balance utility GUI application

Running the water balance program

When the executable is run, a window appears that allows the following inputs (note that the executable runs under the Windows operating system only) as shown in Figure 1.

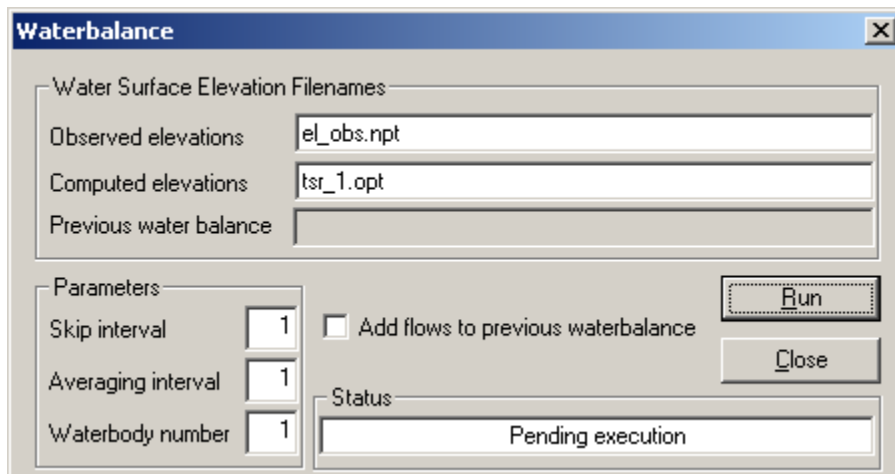


Figure 1. Dialog box for water balance utility.

:

When the dialog box first appears, default values populate the edit boxes. The user can then edit each one if the default values are not correct. Selecting Run will run the waterbalance utility to completion as shown in the following dialog box (Figure 2).

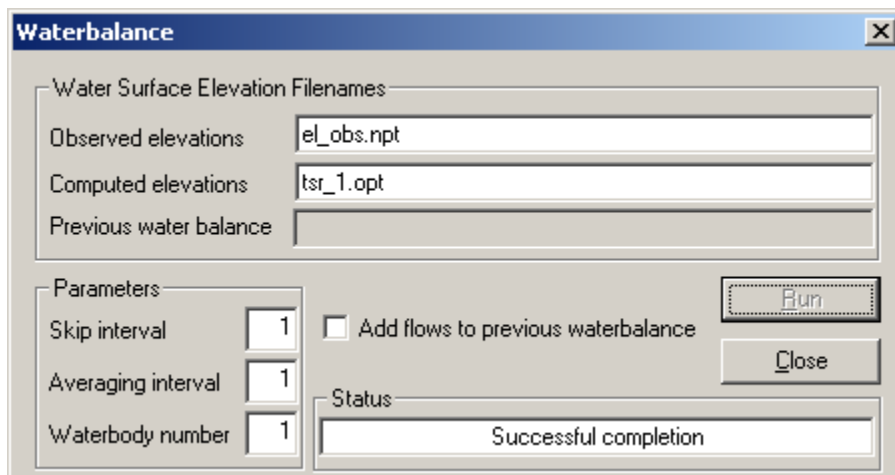


Figure 2. Dialog box for water balance utility if successful completion.

Observed elevations filename. This file consists of a Julian day and observed elevation as in the following example:

2000-2001 Oologah Reservoir observed water surface elevations

JDAY	ELO
90.792	195.453
90.833	195.456
90.875	195.459
90.917	195.441
90.958	195.444
91.000	195.450
91.042	195.441


```

91.083 195.441
91.125 195.447
91.167 195.441
91.208 195.444
91.250 195.438
91.292 195.432

```

This example skips the first 3 lines and is of a similar format to all other CE-QUAL-W2 time-varying inputs with a fixed format with eight columns each for the JDAY and ELO values. However, the utility will read in values using variable field lengths so long as the JDAY and ELO values are separated by a space. Data need not be at regular intervals that might cause a repeat of the same values. Sometimes better results have been obtained if the same values that repeat over a time interval are not included (such as the water surface elevation at day 91.083 above).

Also note that the degree of accuracy in the observed elevations can have an impact on the computed flows. It is up to the user to decide the necessary precision used in the observed water surface elevations.

Computed elevations filename. The following shows an example output file from a time series file (the columns to the right have not been shown):

JDAY,	DLT,	ELWS,
92.000,	456.39,	195.37,
93.000,	952.28,	195.28,
94.000,	494.28,	195.27,
95.000,	34.43,	195.17,
96.000,	170.88,	195.08,
97.000,	211.93,	194.99,
98.000,	255.11,	194.92,
99.000,	1459.08,	194.78,

The water balance utility reads in the [JDAY] and [ELWS] values and uses these in the water balance computations. The user must turn on time series output in the model control file and specify the segment at which the water surface elevation values are output (typically the segment next to the dam for reservoirs). Information on how to accomplish this is given in the User's Manual under the Time Series output file discussion.

Add to previous water balance . For various reasons, the water balance utility may not perfectly close the water balance the first time through the computations. Depending upon the discrepancies between computed and observed elevations, the utility may need to be used iteratively by rerunning the model using output from the first run of the water balance utility and then rerunning the water balance utility on the water surface elevations output in the new time series file. For a system with multiple branches, each iteration of the utility and the resulting output file can be saved as a separate file that is then incorporated as a distributed tributary for branch 2, then branch 3, etc. In the case of a system with only one branch, this approach cannot be used. Rather, the new flows generated at the second iteration need to be added to the previously computed flows and incorporated as an "improved" distributed tributary inflow file. This option allows the user to continue adding flows to the same inflow file.

The computed flows are contained in the "qwb.opt" file. For most simulations, these flows will generate water surface elevations sufficiently close to the observed elevations such that further refinement is unnecessary. However, as mentioned above, the solution may need to be iterated. Rarely, manual adjustment of the generated flows may be required. This is usually only needed when observed water surface elevations change significantly over a short time period.

Previous water balance filename. If the “Add to previous water balance” option is used, you must specify the existing water balance output file for the computed flows to be added to.

Skip interval. Some reservoirs have a lot of noise in the observed water surface elevation data, such as in peaking hydropower operations, and this option allows the user to specify how many observed elevations are ignored when computing the flows between observed elevations. For example, if water surface elevations are available on an hourly interval, the resulting flows generated by the water balance utility can have large + and – flows that are completely unrealistic as opposed to using observed elevations on a daily basis taken during periods of no hydropower generation. In order to smooth out the computed flows, a skip factor of 24 would result in computed flows being output on a daily basis with all of the “noise” generated by hydropower operations ignored over the 24-hour period.

Averaging interval. This option computes a running average of the water surface elevation based on the input value. This is an additional aid to smooth out water surface elevation “noise”. For example, consider the case in which there is no inflow/outflow to the system, but there is considerable wind seiching. The water balance utility would compute alternating inflows and outflows from the system that, depending on the amount of seiching, could be very large when in reality there should not be any flows added to or subtracted from the system. Using a running average alone or in combination with skipping over a number of observed elevations specified in (4) can help alleviate many of the problems caused by an automated water balance computation.

Waterbody number. In the case of multiple waterbodies each of which has a separate bathymetry input file, the user must specify which waterbody (and thus which bathymetry file) the water balance is being computed for. This capability is necessary for modeling systems with multiple reservoirs.

Incorporating the computed flows into the simulation

The water balance utility can be used for lakes and reservoirs in which water surface elevations are a function of inflows and controlled outflows from the system. The utility computes the flows necessary to match observed water surface elevations (typically taken at the dam) and outputs them to the “qwb.opt” file. This file is composed of a Julian date and an inflow ($\text{m}^3 \text{sec}^{-1}$). The flows can be either positive or negative. Temperatures and/or constituent concentrations must also be provided in the corresponding temperature and constituent concentration input files if the computed flows are incorporated as inflows to the system. ***The water balance utility does not provide this information***, but this information needs to be provided by the user depending upon how the computed flows are incorporated into the simulation. Considerable thought should go into how best to incorporate temperature and constituent concentrations and is discussed in more detail below.

Note that negative flows use temperatures/concentrations in the waterbody when calculating the impact on the system of these flows rather than the temperatures/concentrations in the corresponding inflow temperature and constituent concentration files. This ensures that negative flows generate no change in temperature or constituent concentrations. However, positive flows can impact simulation results and care must be taken as to how the flows are incorporated into the simulation.

The flows required to complete the water balance are computed as a step function. If they are incorporated into the model as an additional inflow or outflow whose current values are being linearly interpolated, such as a branch inflow, then the resulting water balance will not be correct. Typically, the flows in the qwb.opt file are first included as a distributed tributary inflow assigned to the mainstem branch and interpolation [DTRIC] is turned “OFF”. The corresponding distributed tributary inflow temperatures are

usually set to air temperatures in the qdt_br1.npt file. When running water quality, care must be taken as to what constituents should be included in the corresponding inflow constituent concentration file. Typically, only DO values are included if the distributed tributary option of incorporation is used, and they are set to saturated values corresponding to the observed air temperatures. Keep in mind that if the water balance flows are incorporated as branch inflows, then the mass loading of organic matter and nutrients will be increased as well.

The branch corresponding to the distributed tributary inflow is usually assigned to the mainstem branch of a reservoir. Using a distributed tributary minimizes the impact of the flow, temperature, and/or water quality associated with the distributed tributary by distributing the flow throughout all segments in a branch weighted by surface area. Be aware that large flows as a result of large errors in inflow/outflow measurements can and have had a significant impact on temperature and water quality calibration in the surface layers. Usually, this is not a problem, but sensitivity analyses should be conducted to see if the flow and associated temperature/constituent concentrations have an impact on the simulation results. If so, then the following discussion is of particular relevance.

As emphasized previously, a great deal of thought should go into how the flows generated from the water balance utility are incorporated into the simulation. As discussed previously, these are typically incorporated as distributed tributary inflows so as to minimize the impact of the flows on the simulation. However, this may not always be the best, most accurate, or most realistic method. For example, suppose that the water balance flows are consistently negative. This would indicate that either inflows are consistently overestimated or outflows are consistently underestimated. Obviously, incorporating the flows as a positive increase in the outflows as opposed to subtracting them from the inflows can potentially have a very significant impact on simulation results. In this case, sensitivity analyses should be conducted to determine which method improves the simulation results. If, say, hypolimnetic temperatures are consistently being underestimated, then incorporating the flows into a hypolimnetic outflow could improve the simulation results. Conversely, if hypolimnetic temperatures were being overpredicted, then the inflows should probably be reduced. The key point to keep in mind is that there are a number of different ways to incorporate the computed flows, and they generally should all be tested to determine the best way to incorporate the computed flows into the simulation.

As another example, consider the case in which the generated flows are consistently positive and a branch in which sometimes significant inflows are ungauged. In this case, a sensitivity analyses should be performed to determine if incorporating the flows or a portion of the flows into the ungauged branch inflow improves model results. Oftentimes, the model can be used as a guide as to how best to incorporate the computed flows into the simulation.

Example from Tom Cole

Walter F. George is a U.S. Army Corps of Engineer reservoir located on the Chattahoochee River in Alabama. The reservoir is operated as a peaking hydropower facility. During calibration, the model consistently underpredicted hypolimnetic temperatures by 0.5-1°C. Wind sheltering could be adjusted to increase hypolimnetic temperatures, but this adjustment always adversely impacted thermocline depth. After considerable thought, it was concluded that including possible seepage at the dam might improve hypolimnetic temperature predictions. A portion of the distributed tributary flows were incorporated as an additional outflow at the bottom of the dam. The final value used was $5 \text{ m}^3 \text{ sec}^{-1}$, which was less than 1% of the average outflows and brought hypolimnetic temperatures into almost exact agreement with observed temperatures. Further investigation of the outflows revealed that during times of no power generation, an additional flow of $5.1 \text{ m}^3 \text{ sec}^{-1}$ was specified in a file that was not originally sent as part of

the outflow data. Thus, the model pointed the way as to how best to incorporate the computed flows and was a surprisingly accurate indicator of what was occurring in the prototype.

How to use the water balance utility console application

A console application that reads an input file is also available to perform the waterbalance. This new console version of the water balance code provides the following updates:

1. This is not a windows dialog box driven code so it can easily be used in batch files.
2. There is now an input file for model parameters for the water balance utility and an output file for model errors.
3. There are several enhancements: one has more flexibility over file naming, the number of header lines to skip in input files, and the number of waterbodies to use in the analysis.

Input File: “WatBal.npt”

The new input file, “WatBal.npt” has the following format:

```
Water Balance input file for Console Application
"el_obs.npt"      , file for observations, time and water level time series in 2 columns
"tsr_8_seg36.opt" , tsr file for model predictions-assuming only one line skipped in
file header
"qwb1.npt"        , Output file name
1                , NSKIPS - number of skips of data
1                , NAV - averaging interval, number of data points to average
1,1             , waterbody to perform water balance: JW1:STARTWB,JW2:ENDWB:1,2=WB1&2;1,1==WB1
ONLY
3                , number of lines to skip in the header for the water level data file
0                , past water balance PWB file: Yes==1, No==0
"qwb.npt"        , Previous Water Balance file name
```

The explanations of each line are shown in the example file above. If performing over multiple waterbodies, keep in mind that all waterbodies must have the same grid (i.e., ELBOT and vertical spacing must be the same). Currently all the flow correction is given to only 1 water balance file. A later option will be for multiple WB files so that one can distribute them across several waterbodies.

Output File: “WatBal_Errors.opt”

If there are errors, any errors will be shown in this text file. If no errors, then this file will not be written to the disk.

An example of the error file output is shown below:

```
Could not open simulated elevations file tsr_8_seg39.opt
```

Output File: “el_stats.opt”

This output file displays model error statistics of the water level and average flow rate in the qwb output file. Typical output from this program are shown below:

N	Mean Error	Absolute ME	RMS Error
238	0.00	0.00	0.00

Average water balance flow correction = .00 m³/s for period covering Julian day 1.04 to 239.94

Output File from water balance

The main output file from the water balance utility is a time series of flows necessary to match the water level.

A typical output file is shown below:

Computed flow to complete water balance

1	1
JDAY	QWB
1.040	0.00
2.000	24.34
3.000	2.33
4.000	2.34
5.000	3.72
6.000	2.33
7.000	4.67
8.000	2.34
9.000	3.71
10.000	3.29
11.000	4.66
12.000	2.34
13.000	3.69
14.000	2.34
15.000	3.32
16.000	3.31
17.000	3.49

How to Run the Console Water Balance Utility

The water balance utility is run by executing the exe file for 32 (**WBconsole32.exe**) or 64 bit (**WBconsole64.exe**) Windows operating system. One also needs the input file **WatBal.npt** in the directory of the executable.

3. Control File Converter for CE-QUAL-W2

This section outlines the steps required to convert a legacy application control file, **w2_con.npt**, and its companion **graph.npt** file into the Excel version of the control file or to convert a w2_con.csv file from 4.1 or 4.22 to 4.5.

This is a relatively simple process that involves these steps:

1. Copy **ConverterControlFile.exe** into the directory of a legacy application or copy the three files read by the program (**w2_con.npt**, **graph.npt**, and the bathymetry file) into a directory with the executable. If you are just converting a 4.1 or 4.22 **w2_con.csv** file to the new format, just copy **w2_con.csv** and the bathymetry file into a new directory. After execution (double click the converter executable), the following files are written to the directory:
 - a. **w2_con45.csv** – this is a csv file format of the control file. This will then need to be copied into a Version 4.5 example **w2_con.xlsm** template.
 - b. A csv form of the bathymetry file (if the bathymetry file was not already in csv format). The output bathymetry file is named **bthX.csv**, where X is the waterbody number. This new format is much easier for editing and analysis than the older file format. The file name in the **w2_con.csv** is also changed to **bthX.csv**.
2. Copy **w2_con.csv** into an existing Version 4.5 example file ***.xlsm** from another application (you can use one from the W2 Model Examples) by following these steps:
 - a. Open the file **w2_con.xlsm** (or it may have a different descriptive name, such as **w2_con_DeGray.xlsm**) from an existing example problem supplied in the CE-QUAL-W2 example problems.

[illegible]

Figure 3. An example of an existing w2_con.xlsm file. Columns A and B are not used in the control file and we will be pasting the w2_con45.csv into column C1, not A1.

- i. The easiest option is to open the file **w2_con45.csv** from the converter utility in Excel. Select the columns and rows with data. Do not select the entire sheet

```

1 CE-QUAL-W2 Version 4.2.1
2 Control file version: 4.2.1 w2_con.txt
3 File reference: run 10 bin
4 "Version 1.7 Long Lake Model"
5 "Workshop water balance problem"
6
7
8
9
10
11 "Town Lake WES: Soot: PSU, Rnk / PSU, Crln: PSU"
12
13
14
15 NWB NBR RWX KMX NPROC CLOSEC
16 1 1 13 47 1 DM
17
18 NTR NST NWR NWD NDT NSP NFI NPU
19 1 1 1 0 0 0 0 0
20
21 NGC NSS NAL REP NROD NMC NSP
22 5 1 1 1 10 0 1
23
24 NDAY SELECTE HABSTATE ENVWPC AERATOC INTUWL
25 100 OFF OFF OFF OFF OFF
26
27 TMSTR1 TMEND YEAR
28 100 271 2000
29

```

- ii. Then Copy the selected cells from **w2_con45.csv** and paste to **w2_con.xlsxm** cell C1 using *Paste Values and Number Formatting* so that the colors and other formatting are preserved in the original document.
- b. The next step is to adjust rows for the number of constituents. The template file you used **w2_con.xlsxm** had an assumed number of water quality constituents that may be different from the number you will use. Go to approximately row 384 as shown below and delete or add cells **in only column A and B** only to match the specified number in the formula. So, if you need to add cells, then select the correct number of cells in column A and B, right click your mouse and choose 'Insert', then 'shift cells down.' If you need to delete cells, then select the correct number of cells in column A and B, right click your mouse, choose 'Delete', then select 'move cells up'. Now the information in column A and B should line up with what is written in Column C.

604	PARAMETER NAME	UNIT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	12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4. GUI Interface for CE-QUAL-W2 for Versions 3.7-4.20



Figure 10. About W2 Control GUI preprocessor.

Introduction

This section describes the GUI interface that is released with CE-QUAL-W2. This works with the old version of the control file, **w2_con.npt** (only up to Version 4.2) but does work with the Excel version of the control file (**w2_con.csv**). The w2_post program shown in the next section has a bathymetry viewer that can be used with the **w2_con.csv** control file.

The manual describes the uses of the GUI for editing the control file (**w2_con.npt**) and the bathymetry file (user-defined filename, typically called **bth.npt** or **bth.csv**). Please note that the model files can be edited using a text editor or in Excel, and the GUI is therefore not required to run the model. The GUI though may be very helpful for the new CE-QUAL-W2 user as is the Excel version of the control file. The bathymetry editor is very useful in viewing the model grid and making changes to the grid (e.g., grid refinement). The bathymetry editor though does not assist in setting up the bathymetry. The model user must have already developed the bathymetry file using other programs. The bathymetry editor only edits an existing bathymetry file. Often the bathymetry is developed using GIS software or programs like SURFER or other 3-D contour plotting software packages.

Installing the GUI Interface

After downloading the GUI interface setup files and unzipping them, from Windows Explorer double-click on 'setup.exe' to guide you in the set-up process.

Opening the GUI Interface

By double-clicking on the W2 icon from the Desktop or from Windows Explorer, the user is presented with the following screen:



Figure 11. Dialog box menu.

This interface is meant to be simple and uncomplicated.

Menus

The user has 3 menus: File, Window, and Help. The File menu controls which control file to open and to save. The user can only open a CE-QUAL-W2 control file – such as w2_con.npt. Opening any other file type will result in an error. The File save button and file open buttons and menu items only affect the control file and the associated files (bathymetry and graph files). Note that when you save a file, you overwrite the original file with which you started. The GUI program though copies the original output file to a similar name but with a number designator. This allows the user always to go back and track changes made over time to the control file or bathymetry files.

Button Bar

The buttons become active as the user opens the files that affect the buttons. For example, once the bathymetry file is opened, the 4 grid viewing options are then displayed (see more information below). The open file button opens the w2_con.npt file or another file that is in the format of the control file. The save button becomes active once a file is opened and changes are made. The print button prints the current screen (I would not use this since it is not a very useful print out. It is much more convenient to just print the text file directly from Notepad or other text editor.) The next buttons are described below.

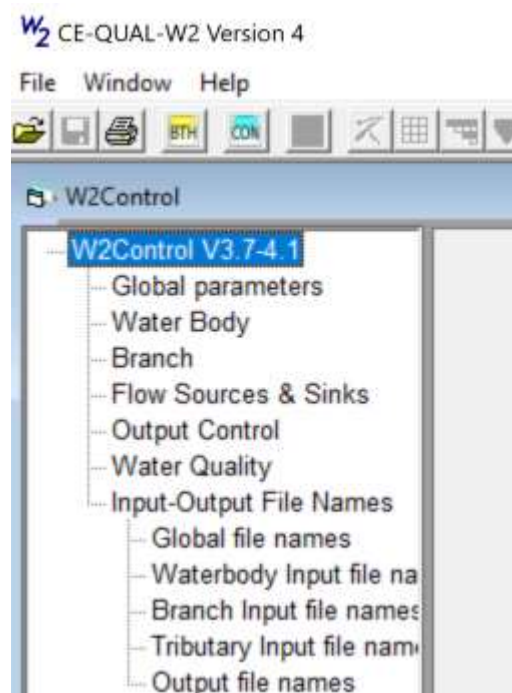


Figure 12. Menu of w2control.

Editing the Control File

Once you have chosen a control file to open (w2_con.npt), open it and adjust the window so that the window options are visible. If the file does not open there may be serious formatting errors in the file or you may have not chosen a CE-QUAL-W2 control file. Check the file for errors using the CE-QUAL-W2 preprocessor (a separate program released with W2).

You will notice that the BTH button is now active, meaning that you can also open the bathymetry file. The left pane now has 7 headings – each subheadings that can be shown by double-clicking on the main heading. For example, several of the subheadings have been expanded, as shown to your right.

By double-clicking on a subheading, the user can edit the information in a cell. Information about each model parameter is shown in Appendix C in the User Manual.

Once you have edited the cells (either by changing a number or changing a menu parameter), there are 2 buttons at the bottom of the page as shown below.

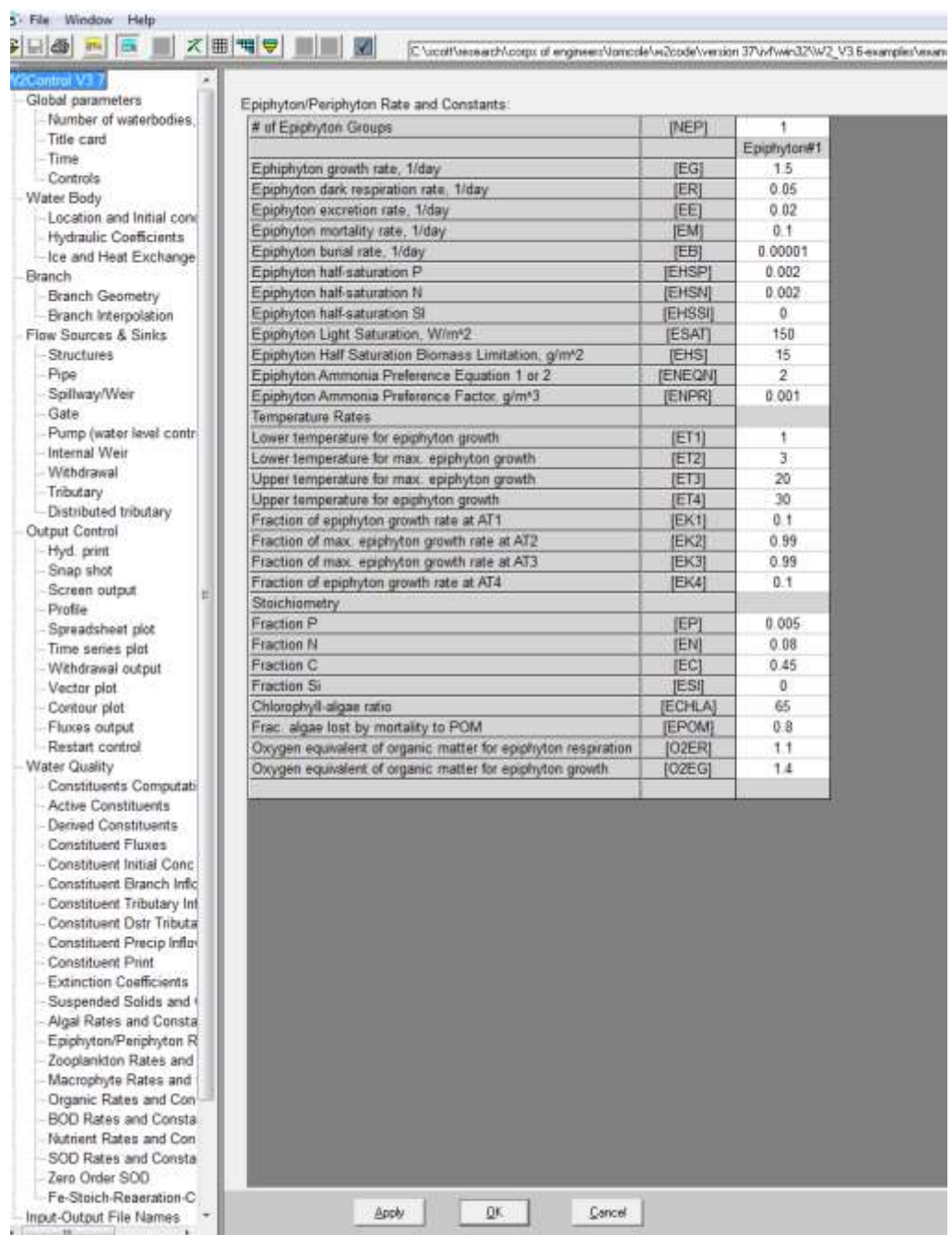


Figure 13. Example of w2control menu.

The Apply button is used to set the parameters of the table. For example above, the # of epiphyton groups is '1'. If one wanted to change this to "2". One would enter 2 in the cell for NEP and then press "Apply". The table will be re-drawn as shown below.

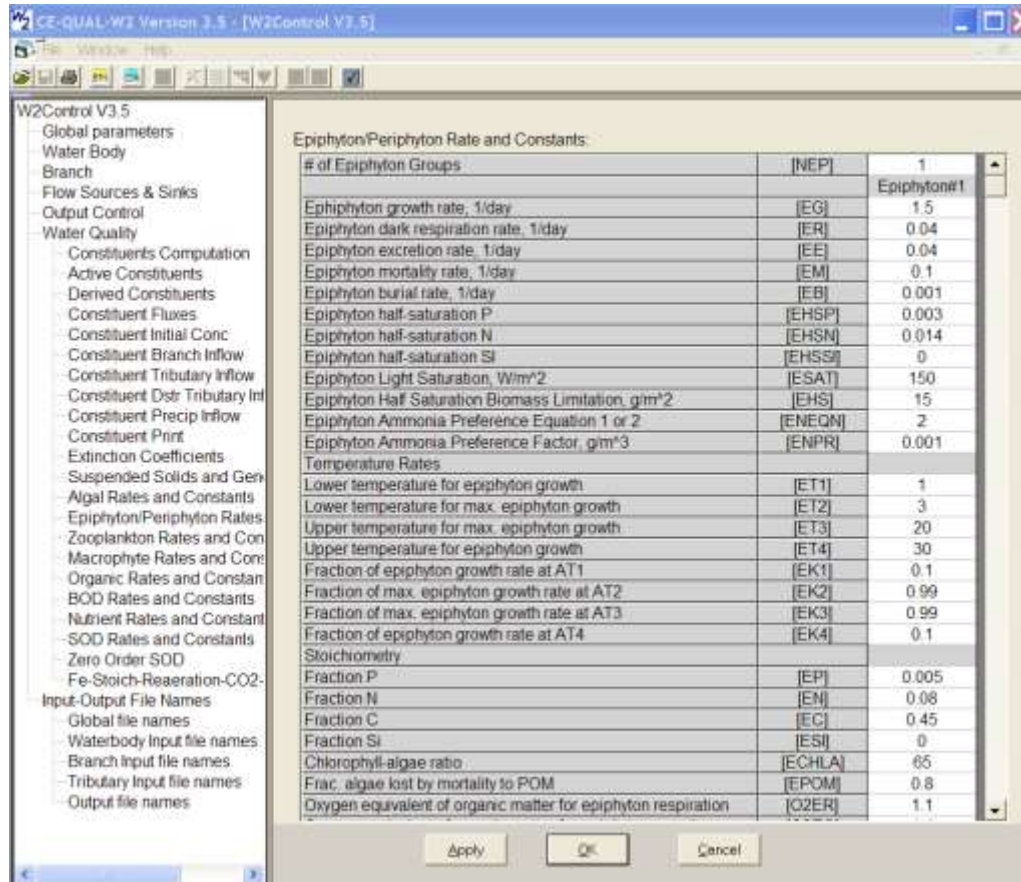


Figure 14. Dialog box example.

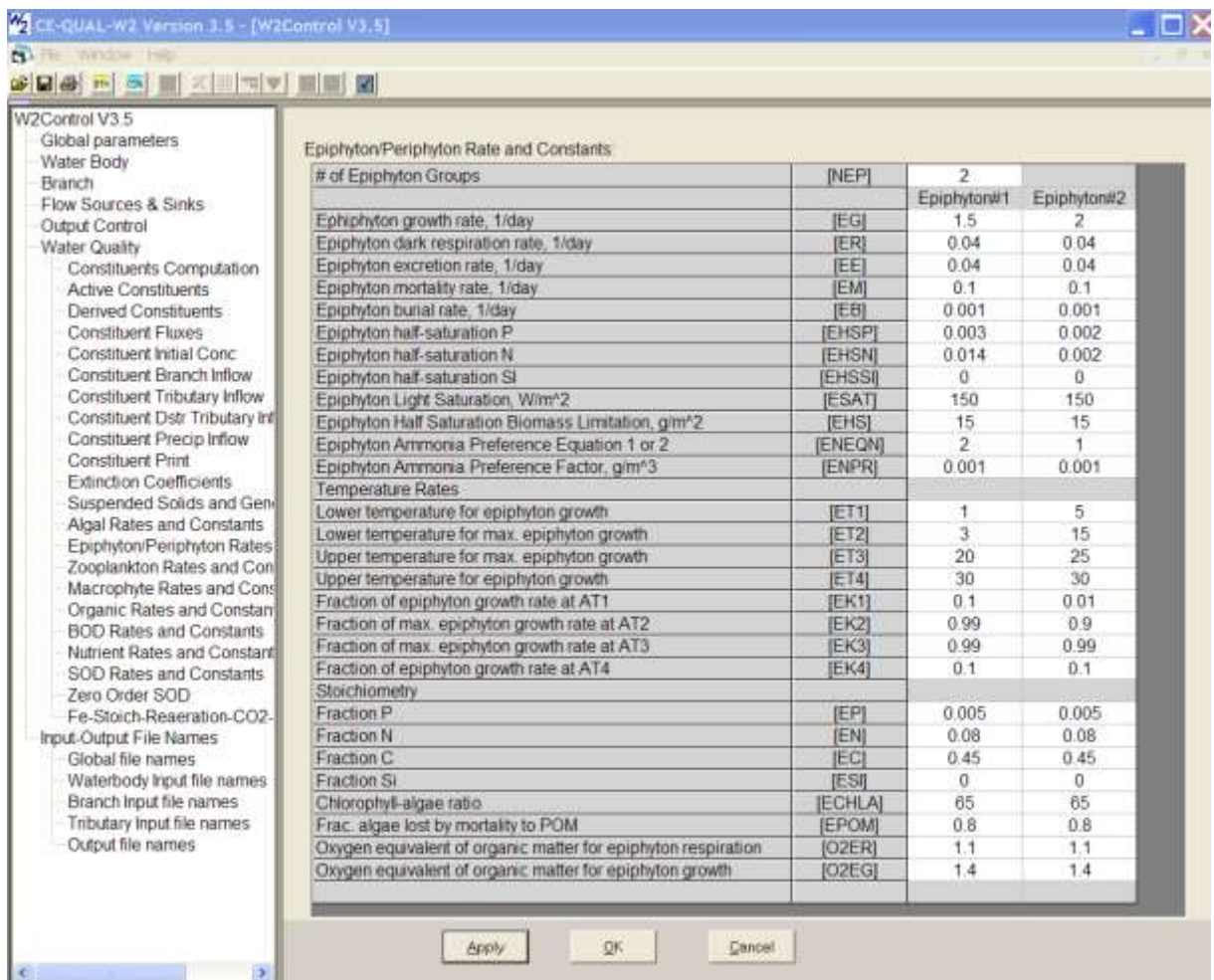


Figure 15. Dialog box example.

Then after making changes, the OK button MUST be pressed. But this does not SAVE the file to the hard disk. The User must also then press the SAVE button on the button bar above (or the menu FILE/SAVE file) to save these changes to the disk. The save button will be highlighted after a selection is changed.

Editing the Bathymetry File

After opening the control file, the bathymetry file can be opened by clicking the BTH button. Note that the bathymetry file name is under the 'INPUT-OUTPUT FILE NAMES' Menu and the submenu 'WATERBODY INPUT FILE NAMES'. At this point there are 4 views that become active: Side View, Top View, Data View, End View.

The buttons on the top allow one to toggle between the different bathymetric views. By expanding the Top View, one can enlarge the view by holding down the left mouse button and scrolling from right to left (see example below). To decrease the image size, hold down the left mouse button and scroll from right to left.

To change the active segment and layer, you must place the mouse cursor in the Data View at a segment and layer of interest and click the 'Refresh View' button. This affects the segment which is shown in the End View and which segment is highlighted in the Side View.

To edit the bathymetry, click on the variable and change its value. Then the user must click the 'OK' button to accept these changes. Using the SAVE button saves all the user files.

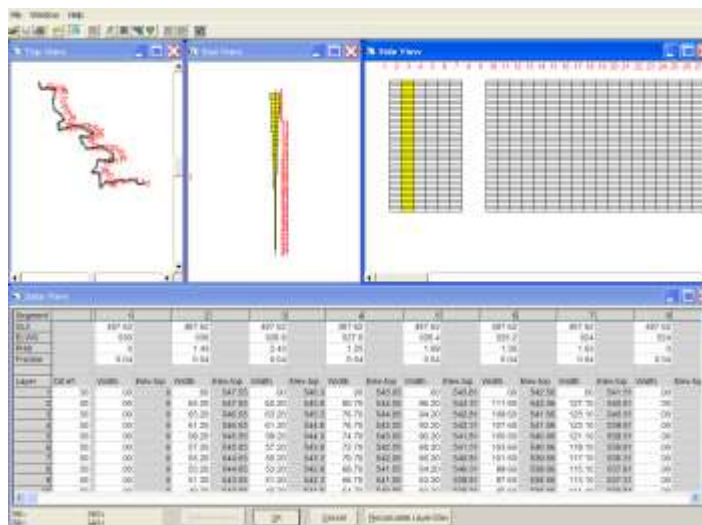


Figure 16. Bathymetry dialog box example.

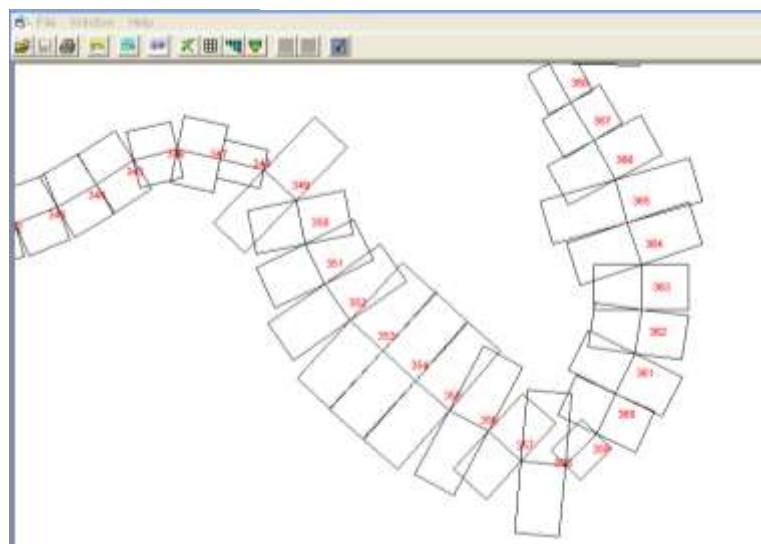


Figure 17. Segments of a model dialog box.

Merging or Splitting Segments or Layers

In order to perform this operation, open the Data View and select the range of layers and/or segments to merge or split by highlighting them with the mouse. You will notice in the left hand corner a box shows what segments and layers have been selected.

In the example below I have selected layers 5-14 and segments 2 and 3. You will also now notice that the layer and segment merge/split buttons are now active. To merge or split segments, click on the Merge/Split segment button. A small dialog box will come up with options for merging or splitting the segments (see below). You then have the option to merge the 2 segments or split them into many more segments. The control file (w2_con.npt) will automatically adjust segment numbers when using this option. But keep in

mind that the following files will need to be edited to adjust them for changes in the number of model segments: the wind sheltering coefficient file (wsc.npt) and the shading file (shade.npt).

A similar process is followed for merging or splitting layers.

5 - File Worksheet - P&S																			
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Figure 18. Splitting or merging layers example.

Note that in the bottom left corner of the above screen shot, the layers and segments that were selected is shown.

Merge/Split Segments

Starting Segment: 2

End Segment: 3

Current Number of Segments: 2

Total DLX: 500.4

Merge/Split into: 1 segments

Interpolation Style:

- ☐ Average
- ☐ Linear
- ☒ Piecewise Linear

OK Cancel Help

Figure 19. Merge/split dialog box.

Running the Preprocessor within the GUI

The preprocessor which checks all input files can be executed from within the GUI by clicking on the CHECK button. At which point a dialogue box will pop up with information about running the preprocessor. The preprocessor executable must be in the root directory with the input files.

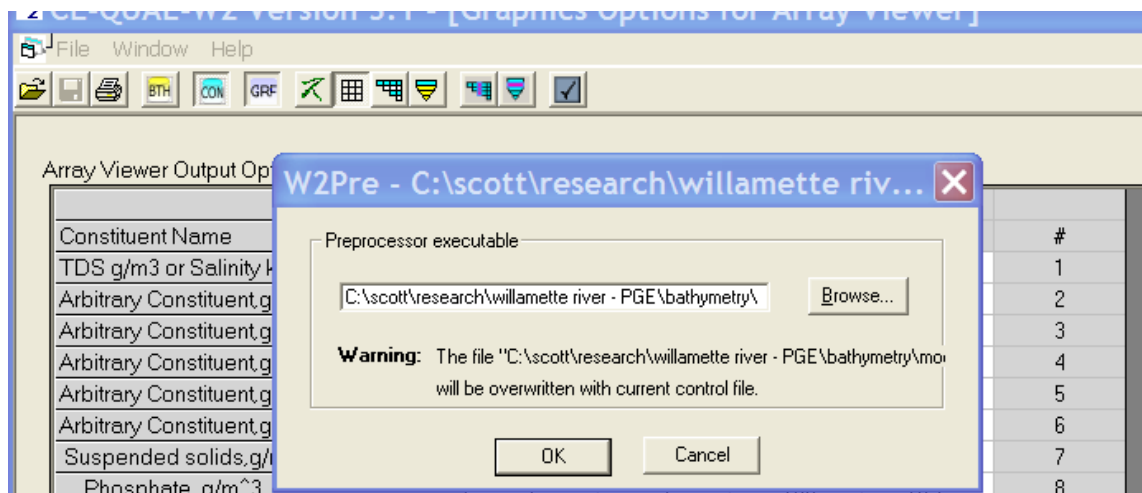


Figure 20. Running dialog box within w2control.

A Note on Saving Files

The GUI interface makes a backup copy of each file opened during a session. It will add an integer number to the files opened. This integer is based on whether previous backup files have been created or not. For example, the 1st time the GUI opens the files, w2_con.npt, graph.npt, and bth.npt; the program will write as backup copies of the unaltered original files: w2_con.npt2, graph.npt2, and bth.npt2. The next time the program opens these files, the files w2_con.npt3, graph.npt3, and bth.npt3 will be created (if you have already deleted the *.*2 files from your hard disk, the GUI will again use the integer '2' rather than '3').

Typical Errors with the GUI

Sometimes the GUI cannot read a control file because of the format of the text. UNIX/Linux systems often use a line-feed at the end of a line, while Windows text files include a carriage-return and a line-feed. You must convert the file to a Windows text file for the GUI to work properly. In a text editor you can view all the characters and verify you have the proper Windows format if the GUI is having problems reading the file. Many text editors automatically convert files from one type to the other (such as the text editor 'Notepad ++').

It is recommended that you use the W2 preprocessor to catch errors in the set-up files first before using the GUI. The W2 preprocessor though will not catch the line-feed error noted above and will read the files correctly whether in UNIX/Linux or Windows format.

Command Line Processing

The GUI also can be controlled by command line passing of the working directory and file. In a batch program or from the command line in a DOS box you can execute the GUI as follows:

```
"C:\scott\research\corps of engineers\tomcole\w2code\GUI36\w2control\w2control4.exe"  
C:\scott\w2workshop\2009 workshop\waterqual\problem1\w2_con.npt
```

The first string in quotes executes the GUI (this shows the path to the GUI – your path to the GUI will be different). The command line argument is NOT in quotes. This program was developed in VB6 and does not take quotes around the command line. Note that this is different than the FORTRAN command line argument. So the above command will open the GUI and load the control file automatically from the directory “C:\scott\w2workshop\2009 workshop\waterqual\problem1”.

Using the GUI W2Control on Touchscreen Laptops and Monitors

The software, W2Control, is a GUI preprocessor for the W2 model. It works fine on non-touch enabled monitors. But for touch screen monitors, like many of the latest laptops, the opening “treeview” menu does not work because of a software incompatibility with VB6, the source code. W2Control can though be used on a touch screen laptop by doing the following:

Go to Services by typing ‘Services’ in the command line or Cortana line. In the list choose ‘Touch keyboard and Handwriting Panel Service’. Right click your mouse and choose Properties and change ‘Automatic’ to ‘Disabled’. Then click STOP in the Service Status to stop the service. Click APPLY. The W2Control then works as expected.

5. Post-Processor for CE-QUAL-W2 by DSI, Inc.

Paul Craig at DSI, Inc. has generously provided a software system for evaluating model results. There is a short user’s manual produced by DSI that documents the software utility and this is a separate pdf file download. This post-processor currently works for Version 3.7 to the current version. This post-processor, as shown in Figure 21 and Figure 22, allows the user to look at model bathymetry, show time series, profile plots, contour plots, velocity vectors, and animations with up to 4 simultaneous state variables.

Quick Guide for the CE-QUAL-W2 Post Processor W2_Post

July 2012 Updates June 2016

W2_Post

A post-processor for CE-QUAL-W2 Version3/4 that provides the user with a broad range of visualization and analyses of the model results. W2_Post provides for rapid visualization and assessment of W2 model results. W2_Post uses a binary file generated by the CE-QUAL-W2 (i.e. the "W2I" file extension) for all of its model data analysis. No need to output multiple types of output from W2. The post-processor provides extensive model calibration / measured data comparison tools and statistics. The following are summaries of each major type of post-processing available.

Figure 21. Splash screen for W2_Post.

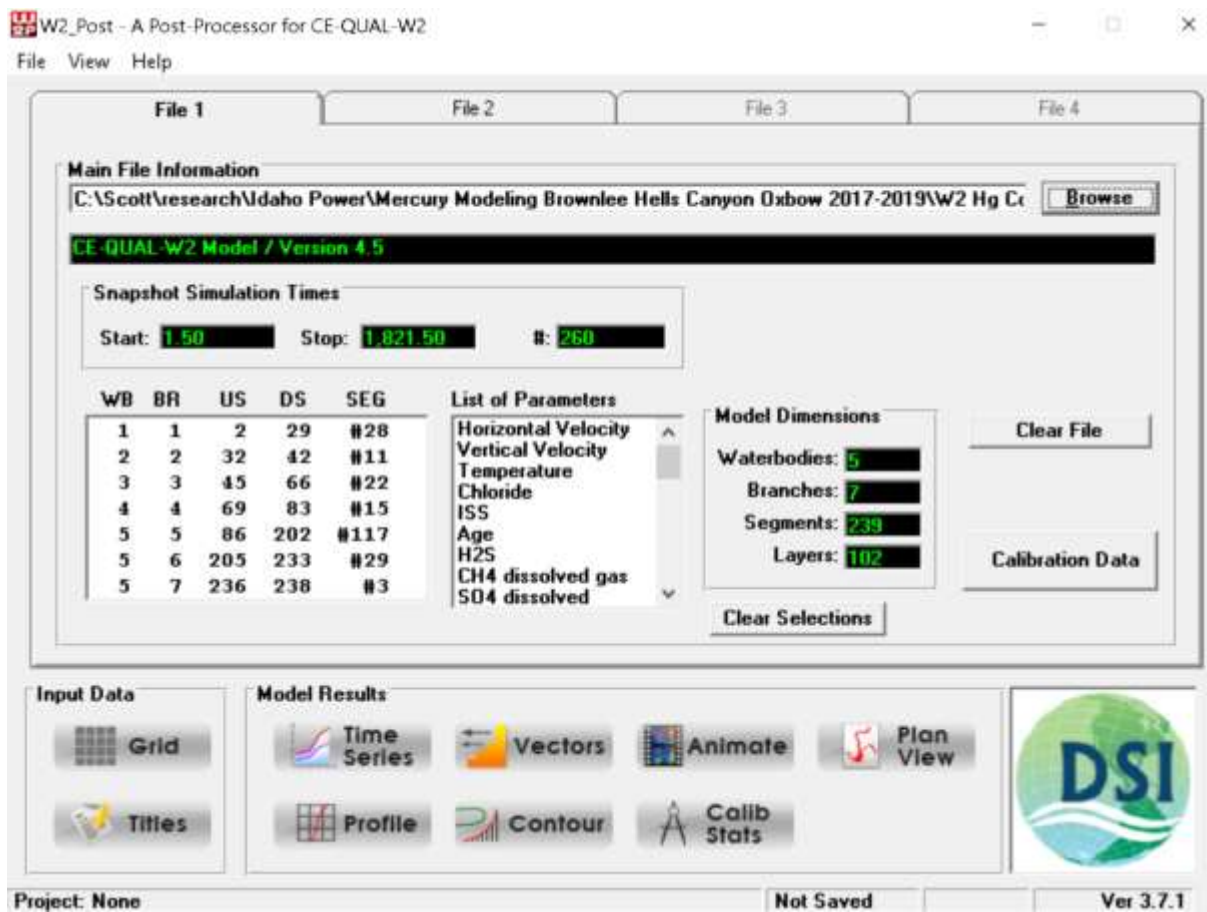


Figure 22. Menu for w2_post.exe post-processing tool from DSI.

6. Excel Macro Utility for CE-QUAL-W2

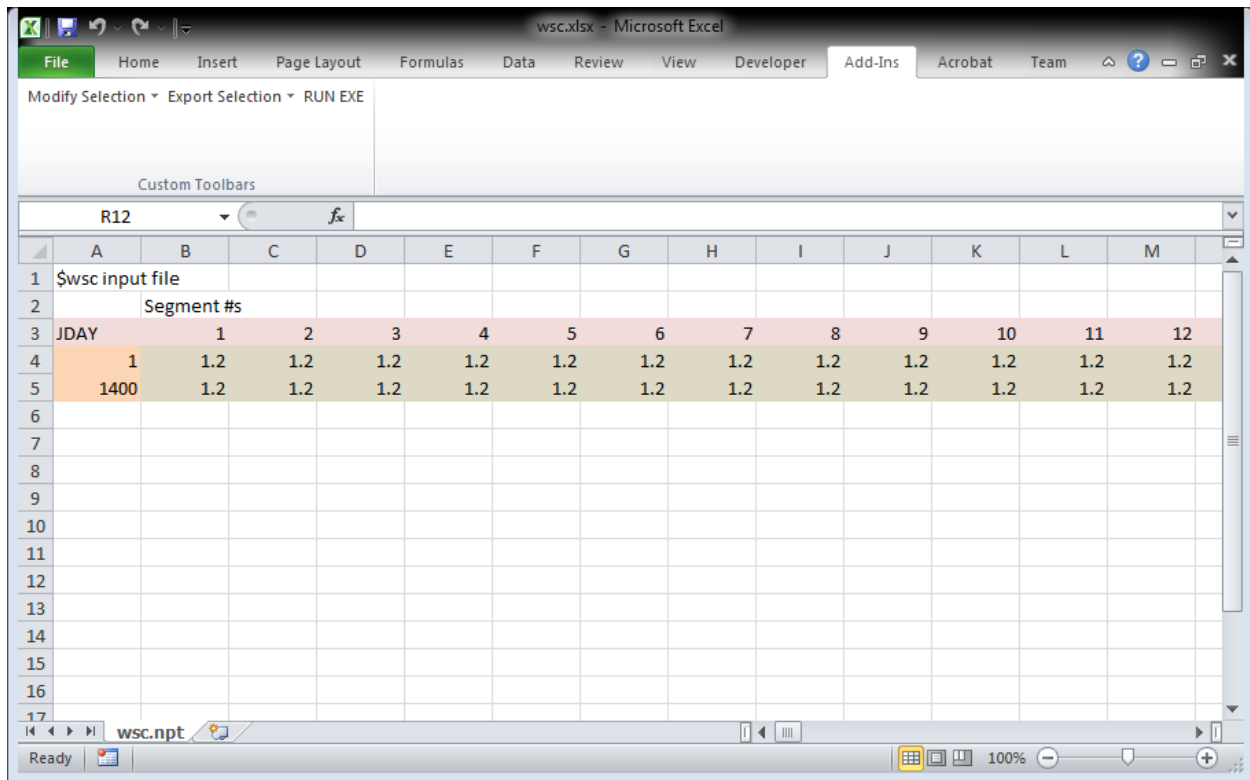
This Excel macro was written by Jeffrey Gregory, P.E., Civil Engineer, USACE, Nashville District and updated by Scott Wells, PSU.

The Excel macro, “w2tools_examples.xlsm”, can be used to develop and write out input files for the CE-QUAL-W2 model. This can be especially useful if the model user develops an Excel workbook with separate tabs for the different input files for the model.

For example, consider the input file for wind sheltering using the new free format (or csv) formatting option. You develop a workbook for this as shown below. The coloring in the workbook is optional and is just an aid to developing your work.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	\$wsc input file												
2	Segment #s												
3	JDAY	1	2	3	4	5	6	7	8	9	10	11	12
4	1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
5	1400	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
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Now one opens “w2tools_examples2.xlsm” and ‘Enables Macros’. Once this file is opened, the user will notice that the sheet now has a header termed “Add-Ins”. Clicking this header one obtains the following options as shown below: “Modify Selection”, “Export Selection”, or “Run EXE”.



The user then selects by highlighting the portion of the file to export or modify. By selecting “Export Selection” then “Any selection to csv format”. The file is written as a free-format csv file with the file name based on the worksheet name, i.e. in this case “wsc.npt”. There are many other export file formats that can be used that are compatible with CE-QUAL-W2. Also, the worksheets in the “w2tools_examples.xlsm” generally show how to use the different macro features. These sheets are only used to show examples of the use of the Add-In macros.

This set of tools also allow you to modify a selection by multiplying, adding, interpolating data gaps, rounding, and transposing. Select the area of the spreadsheet that you want to modify, then select Add-Ins, Modify Selection, and one of the tools, such as Interpolate (either the X column or the Y column of a 2 column selection).

7. W2 V4.5 Bug Fixes, Enhancements, and User Manual Changes

Table 1 shows a list of model bug fixes since the release of CE-QUAL-W2 Version 4.5.

**Table 1. List of bug fixes and enhancement code changes since CE-QUAL-W2 Version 4.5 was released.
Note that shaded areas toggle between release versions.**

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
1	W2/PREW2	Release	Initial code release	7/26/2021
2	W2/PREW2	Update	Re-release fixing minor read error in sediment diagenesis	7/30/2021
3	W2	Sediment diagenesis bug fix – critical fix	The sediment temperature for the aerobic layer and anaerobic layers were re-written. There were a couple mistakes in the earlier version since Version 4.0. These have been tested and are working fine now. Also 2 diagenesis files are now produced showing the model temperature in the aerobic layer and the anaerobic layers over time and segment.	8/30/2021
4	Converter	Bug fix	The converter utility output formats were adjusted to avoid character overflow in the output file and a bug in reading the w2_con.npt file was corrected in case epiphyton were set to zero.	8/30/2021
5	W2	Withdrawal.f90	A parentheses error was found by Stewart Rounds that has been corrected. Old code: IF ((WSEL-EL(KBOT,ID)-ELR) /= 0.0) THEN Updated code: IF (WSEL-(EL(KBOT,ID)-ELR) /= 0.0) THEN This code error would not have affected any simulation with zero slope which includes all lakes and reservoirs.	11/19/2021
6	W2	Sediment diagenesis	More output files were added to evaluate the computations within the sediment diagenesis model, these include porewater concentrations of NO3, NH3, PO4, and SO4 in both aerobic and anaerobic layers. The user manual was also updated.	11/19/2021
7	Converter	Bug fix	There was a bug fix for older bathymetry file formats. This has been fixed.	12/17/2021
8	W2	C vs Organic matter	The input variables when all organics are in terms of C basis was adjusted in the code to mimic the existing organic matter decay paths. Some of the additional functionality of this will be added in a subsequent release when the organic matter and C species are done similarly.	12/17/2021

8. W2 Known Code Limitations

Table 2 shows known bugs and issues with the current release of the code:

Table 2. Known bugs in code.

#	Item	Description
1	Water levels in a "bowl"	If water levels decrease in a waterbody shaped like a "bowl", the removal of model layers as the water level decreases will cause the model to bomb if an upstream segment dries up.
2	Pipes under high head	The pipes algorithm does not handle well high-head, high-speed, dynamic flow conditions in a pipe as a result of numerical stability.
3	Time step limitation in a complex system model	The time step for stability in a system model is governed by the lowest time step for numerical stability. If you have a very dynamic river with several reservoirs, the time step for the river will control. This can result in very long run times. One can still break apart the model and run the pieces separately using the WDOUT files to provide boundary conditions for downstream waterbodies.
4	Partitioning	The partitioning coefficient for sorption is currently constant for all organic and inorganic compartments
5	Internal weir at a Dam segment	Putting an internal weir at a Dam segment does not affect the outflow from the selective withdrawal structure. One must limit selective withdrawal rather than use an internal weir at the dam segment. Remember the internal weir works for the right-hand-face of a model layer.
6	W2 multiple file error check	If the model user accidentally enters duplicate file names for an input file, the w2 executable will "bomb" because it will try to read the file in more than once. The first use of the file will lock its availability for the second instance. The W2 error message that comes on the screen (traceback error) should mention the file name that has problems. The W2 preprocessor should catch this potential error.
7	Raising level of spillway/weir above grid	The preprocessor will say there is an error if the user raises the weir, spillway, gate, water level control or any other hydraulic element above the current top-of-the-grid. The w2 code will still run properly though. But more correctly, the model user should increase the DZ of the upper-most layer to a value that would eliminate this problem. Keep in mind that the segment widths from the top layer then extend upward at that same width.

#	Item	Description
8	Internal weirs	The internal weir algorithm does not work when all vertical layers of a segment are blocked by the weir.
9	Multiple dams into one downstream reach	Currently, the code will allow one dam inflow to a downstream branch by a user-specified outflow file. The code though does allow multiple dams inflowing to a common downstream branch if the outflow is specified as a hydraulic structure.
10	Problems reading file in GUI or in W2 pre-processor or in W2 model	<p>Sometimes the control file or bathymetry file or an input file cannot be read properly. This can be a result of the text editor used to produce the file or file conversions that occur when transferring files from workstations running Linux or from email. There may be a problem with the end of line character in the file. For Windows files, the standard end of line is a carriage return followed by a line feed: <CR><LF>. For UNIX systems it is usually only a Line Feed <LF>.</p> <p>To convert this from a UNIX system to a Windows system text file, use Notepad++ (a free windows text editor), go to EDIT/EOL Conversion and select Windows.</p> <p>Another issue common in reading text files is that the editor adds 'tabs'. All 'tabs' must be converted to 'spaces' for the file to be read properly.</p>

9. Appendix A: Differences between CE-QUAL-W2 Versions

Differences between Version 4.22 and 4.5

In a large departure from keeping the version form almost static, Version 4.5 has many differences in the fixed format text file and the Excel xlsx file that has the w2_con.csv version of the control file.

Below are the changes in the w2_con.npt file, but comparable ones are found in the Excel input file version. Only areas with new variables are highlighted:

MISCELL	NDAY	SELECTC	HABTATC	ENVIRPC	AERATEC	INITUWL	ORGCC	SEDIAG
	100	OFF	ON	ON	OFF	OFF	OFF	OFF

Eliminated the unused variables UQB and DQB:

BRANCH G	US	DS	UHS	DHS	NLMIN	SLOPE	SLOPEC
BR1	2	31	0	0	2	0.00000	0.000

TSR SEG	ITSR	ITSR	ITSR	ITSR	ITSR	ITSR	ITSR	ITSR	ITSR
	31								

TSR LAYE	ETSR	ETSR	ETSR	ETSR	ETSR	ETSR	ETSR	ETSR	ETSR
	0.00000								

WLOUT	WLC	WLFREQ
	ON	0.5

FLOWBAL	FLOWBC	FBFREQ
	ON	7.0

NPBAL	NPBALC	NPBFREQ
	ON	7.0

WITH OUT	WDOC	NWDO	NIWDO
	ON	1	1

RSO FREQ	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF
----------	------	------	------	------	------	------	------	------	------

CST COMP	CCC	LIMC	CUF	CO2PPM	CO2YRLY
	ON	ON	3	400.	ON

ATMDEP	ATMDPC	ATMDPIN
WB1	OFF	ON

CST ACTIVE	CAC
TDS	ON
Gen1	ON
Gen2	ON

CST ACTIVE	CAC
TDS	ON
Gen1	ON
Gen2	ON
Gen3	ON
ISS1	ON
WATERAGE	OFF
BACTERIA	OFF
DGP	OFF
N2	OFF
H2S	OFF
CH4	OFF
SO4	OFF
FEII	OFF
FEOOH	OFF
MNII	OFF
MNO2	OFF
PO4	ON
NH4	ON
NO3	ON
DSI	OFF
PSI	OFF
FE	ON
LDOM	ON
RDOM	ON
LPOM	ON
RPOM	OFF
ALG1	ON
DO	ON
TIC	ON
ALK	ON
ZOO1	OFF
LDOM_P	OFF
RDOM_P	OFF
LPOM_P	OFF
RPOM_P	OFF
LDOM_N	OFF
RDOM_N	OFF
LPOM_N	OFF
RPOM_N	OFF
MICROCY	OFF
CYLINDR	OFF
ANATOXIN	OFF
SAXITOXN	OFF

CST DERI	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC
DOC	OFF								
POC	OFF								
TOC	ON								
DON	OFF								
PON	OFF								
TON	OFF								
TKN	OFF								
TN	ON								
NH3	ON								
DOP	OFF								
POP	OFF								
TOP	OFF								
TP	OFF								
APR	OFF								
CHLA	OFF								
ATOT	OFF								
%DO	OFF								
TDG	ON								
TURBIDITY	OFF								
TSS	OFF								

TISS	OFF
CBOD	OFF
pH	OFF
CO2	OFF
HCO3	OFF
CO3	OFF
SECCHI	OFF

CST FLUX	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC
TISSIN	OFF								
TISSOUT	OFF								
PO4AR	OFF								
PO4AG	OFF								
PO4AP	OFF								
PO4ER	OFF								
PO4EG	OFF								
PO4EP	OFF								
PO4POM	OFF								
PO4DOM	OFF								
PO4OM	OFF								
PO4SED	OFF								
PO4SOD	OFF								
PO4SET	OFF								
NH4NITR	OFF								
NH4AR	OFF								
NH4AG	OFF								
NH4AP	OFF								
NH4ER	OFF								
NH4EG	OFF								
NH4EP	OFF								
NH4POM	OFF								
NH4DOM	OFF								
NH4OM	OFF								
NH4SED	OFF								
NH4SOD	OFF								
NH3GAS	ON								
NO3DEN	OFF								
NO3AG	OFF								
NO3EG	OFF								
NO3SED	OFF								
DSIAG	OFF								
DSIEG	OFF								
DSIPIS	OFF								
DSISED	OFF								
DSISOD	OFF								
DSISET	OFF								
PSIAM	OFF								
PSINET	OFF								
PSIDK	OFF								
LDOMDK	OFF								
LRDOM	OFF								
RDOMDK	OFF								
LDOMAP	OFF								
LDOME P	OFF								
LPOMDK	OFF								
LRPOM	OFF								
RPOMDK	OFF								
LPOMAP	OFF								
LPOME P	OFF								
LPOMSET	OFF								
RPOMSET	OFF								
CBODDK	OFF								
DOAP	OFF								
DOEP	OFF								
DOAR	OFF								
DOER	OFF								
DOPOM	OFF								
DODOM	OFF								

DOOM	OFF
DONITR	OFF
DOCBOD	OFF
DOREAR	ON
DOSED	ON
DOSOD	OFF
TICAG	OFF
TICEG	OFF
SEDDK	OFF
SEDAS	OFF
SEDLPOM	OFF
SEDSET	OFF
SODDK	OFF

CST	ICON	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB
TDS		51.0000							
Gen1		100.000							
Gen2		0.00000							
Gen3		10.0000							
ISS1		2.00000							

WATERAGE	0.0
BACTERIA	0.0
DGP	0.0
N2	0.0
H2S	0.0
CH4	0.0
SO4	0.0
FEII	0.0
FEOOH	0.0
MNII	0.0
MNO2	0.0

PO4	0.00100
NH4	0.00200
NO3	0.14000
DSI	0.00000
PSI	0.00000
LDOM	0.70000
RDOM	2.02200
LPOM	0.10000
RPOM	0.00000
ALG1	-1.0000
DO	-1.0000
TIC	11.9100
ALK	31.0000
ZOO1	0.1000
LDOM_P	0.0005
RDOM_P	0.0005
LPOM_P	0.0005
RPOM_P	0.0005
LDOM_N	0.0080
RDOM_N	0.0080
LPOM_N	0.0080
RPOM_N	0.0080

MICROCYS	0.0
CYLINDRO	0.0
ANATOXIN	0.0
SAXITOXN	0.0

CST	PRIN	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC
TDS		ON							
Gen1		ON							
Gen2		OFF							
Gen3		OFF							
ISS1		ON							
WATERAGE		OFF							
BACTERIA		OFF							
DGP		OFF							

N2	OFF
H2S	OFF
CH4	OFF
SO4	OFF
FEII	OFF
FEOOH	OFF
MNII	OFF
MNO2	OFF
PO4	ON
NH4	ON
NO3	ON
DSI	OFF
PSI	OFF
LDOM	ON
RDOM	ON
LPOM	ON
RPOM	OFF
ALG1	ON
DO	ON
TIC	OFF
ALK	OFF
ZOO1	OFF
LDOM_P	OFF
RDOM_P	OFF
LPOM_P	OFF
RPOM_P	OFF
LDOM_N	OFF
RDOM_N	OFF
LPOM_N	OFF
RPOM_N	OFF
MICROCYSTIN	OFF
CYLINDROSP	OFF
ANATOXIN	OFF
SAXITOXIN	OFF

CIN CON	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC
TDS	ON								
Gen1	ON								
Gen2	OFF								
Gen3	ON								
ISS1	ON								
WATERAGE	OFF								
BACTERIA	OFF								
DGP	OFF								
N2	OFF								
H2S	OFF								
CH4	OFF								
SO4	OFF								
FEII	OFF								
FEOOH	OFF								
MNII	OFF								
MNO2	OFF								
PO4	ON								
NH4	ON								
NO3	ON								
DSI	OFF								
PSI	OFF								
LDOM	ON								
RDOM	ON								
LPOM	ON								
RPOM	OFF								
ALG1	ON								
DO	ON								
TIC	ON								
ALK	ON								
ZOO1	OFF								
LDOM_P	OFF								
RDOM_P	OFF								

LPOM_P	OFF
RPOM_P	OFF
LDOM_N	OFF
RDOM_N	OFF
LPOM_N	OFF
RPOM_N	OFF
MICROCYSTIN	OFF
CYLINDROSP	OFF
ANATOXIN	OFF
SAXITOXIN	OFF

CTR CON	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC
TDS	ON	OFF								
Gen1	ON	OFF								
Gen2	OFF	OFF								
Gen3	ON	OFF								
ISS1	ON	OFF								
WATERAGE	OFF	OFF								
BACTERIA	OFF	OFF								
DGP	OFF	OFF								
N2	OFF	OFF								
H2S	OFF	OFF								
CH4	OFF	OFF								
SO4	OFF	OFF								
FEII	OFF	OFF								
FEOOH	OFF	OFF								
MNII	OFF	OFF								
MNO2	OFF	OFF								
PO4	ON	OFF								
NH4	ON	OFF								
NO3	ON	OFF								
DSI	OFF	OFF								
PSI	OFF	OFF								
LDOM	ON	OFF								
RDOM	ON	OFF								
LPOM	ON	OFF								
RPOM	OFF	OFF								
ALG1	ON	OFF								
DO	ON	OFF								
TIC	ON	OFF								
ALK	ON	OFF								
ZOO1	OFF	OFF								
LDOM_P	OFF	OFF								
RDOM_P	OFF	OFF								
LPOM_P	OFF	OFF								
RPOM_P	OFF	OFF								
LDOM_N	OFF	OFF								
RDOM_N	OFF	OFF								
LPOM_N	OFF	OFF								
RPOM_N	OFF	OFF								
MICROCYSTIN	OFF	OFF								
CYLINDROSP	OFF	OFF								
ANATOXIN	OFF	OFF								
SAXITOXIN	OFF	OFF								

CDT CON	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC
TDS	ON	OFF								
Gen1	ON	OFF								
Gen2	OFF	OFF								
Gen3	ON	OFF								
ISS1	ON	OFF								
WATERAGE	OFF	OFF								
BACTERIA	OFF	OFF								
DGP	OFF	OFF								
N2	OFF	OFF								
H2S	OFF	OFF								
CH4	OFF	OFF								

SO4	OFF	OFF
FEII	OFF	OFF
FEOOH	OFF	OFF
MNII	OFF	OFF
MNO2	OFF	OFF
PO4	ON	OFF
NH4	ON	OFF
NO3	ON	OFF
DSI	OFF	OFF
PSI	OFF	OFF
LDOM	ON	OFF
RDOM	ON	OFF
LPOM	ON	OFF
RPOM	OFF	OFF
ALG1	ON	OFF
DO	ON	OFF
TIC	ON	OFF
ALK	ON	OFF
ZOO1	OFF	OFF
LDOM_P	OFF	OFF
RDOM_P	OFF	OFF
LPOM_P	OFF	OFF
RPOM_P	OFF	OFF
LDOM_N	OFF	OFF
RDOM_N	OFF	OFF
LPOM_N	OFF	OFF
RPOM_N	OFF	OFF
MICROCYSTIN	OFF	OFF
CYLINDROSP	OFF	OFF
ANATOXIN	OFF	OFF
SAXITOXIN	OFF	OFF

CPR CON	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC
TDS	ON	ON								
Gen1	ON	OFF								
Gen2	OFF	OFF								
Gen3	ON	OFF								
ISS1	ON	OFF								
WATERAGE	OFF	OFF								
BACTERIA	OFF	OFF								
DGP	OFF	OFF								
N2	OFF	OFF								
H2S	OFF	OFF								
CH4	OFF	OFF								
SO4	OFF	OFF								
FEII	OFF	OFF								
FEOOH	OFF	OFF								
MNII	OFF	OFF								
MNO2	OFF	OFF								
PO4	ON	OFF								
NH4	ON	OFF								
NO3	ON	OFF								
DSI	OFF	OFF								
PSI	OFF	OFF								
LDOM	ON	OFF								
RDOM	ON	OFF								
LPOM	ON	OFF								
RPOM	OFF	OFF								
ALG1	ON	OFF								
DO	ON	OFF								
TIC	ON	OFF								
ALK	ON	OFF								
ZOO1	OFF	OFF								
LDOM_P	OFF	OFF								
RDOM_P	OFF	OFF								
LPOM_P	OFF	OFF								
RPOM_P	OFF	OFF								
LDOM_N	OFF	OFF								

RDOM_N	OFF	OFF							
LPOM_N	OFF	OFF							
RPOM_N	OFF	OFF							
MICROCYSTIN	OFF	OFF							
CYLINDROSP	OFF	OFF							
ANATOXIN	OFF	OFF							
SAXITOXIN	OFF	OFF							

GENERIC	CGQ10	CG0DK	CG1DK	CGS	CGLDK	CGKLF	CGCS	CGR
CG 1	0.00000	0.00000	0.00000	0.00000	0.0	0.0	0.0	0.0
CG 2	0.00000	-1.0000	0.00000	0.00000	0.0	0.0	0.0	0.0
CG 3	1.04000	0.00000	1.40000	0.00000	0.0	0.0	0.0	0.0

S SOLIDS	SSS	SEDRC	TAUCR	SSCS
SS# 1	1.00000	OFF	0.00000	0.0

BACTERIA	BACTQ10	BACT1DK	BACTS	BACTLDK
WB1	1.025	0.100	0.00	0.050

H2S	H2SR	H2SQ10	H2S1DK	SO4R
WB1	0.005	1.04	0.10	0.050

CH4	CH4R	CH4Q10	CH41DK
WB1	0.004	1.0400	0.05

FE	FEIIR	KFEOXID	KFERED	HalfSat	SetVel
WB1	0.004	1.0400	0.05	0.10	0.10

MN	MNIIR	KMNOXID	KMNRED	HalfSat	SetVel
WB1	0.004	1.0400	0.05	0.10	0.10

ALGAL RATE	AG	AR	AE	AM	AS	AHSP	AHSN	AHSSI	ASAT
ALG1	2.00000	0.04000	0.04000	0.10000	0.10000	0.00300	0.01400	0.00000	100.000

ALG STOI	ALGP	ALGN	ALGC	ALGSI	ACHLA	ALPOM	ANEQN	ANPR	AVERT_M
ALG1	0.00500	0.08000	0.45000	0.00000	0.06500	0.80000	1	0.00100	OFF

OM STOIC	ORGP	ORGN	ORGC	ORGS1
WB 1	0.00500	0.08000	0.45000	0.18000

OM RATE	OMT1	OMT2	OMK1	OMK2
WB 1	4.00000	30.0000	0.10000	0.99000

TURBSEC	COEFFA	COEFFB	SECCHI
WB1	1.10	0.05	1.5

CBOD	KBOD	TBOD	RBOD	CBODS
BOD 1	0.25000	1.01500	1.85000	0.0

REAERATION	TYPE	EQN#	COEF1	COEF2	COEF3	COEF4	DGPO2	MINKL
WB 1	LAKE	2	0.00000	0.00000	0.00000	0.00000	1.027	0.6

MET FILE.....METFN.....

WB 1 met.npt

EXT FILE.....EXTFN.....

WB 1 ext_1.npt

ATD FILE.....ATDFN.....

WB 1 atm_dep_wb1.csv

VPR FILE.....VPRFN.....

WB 1 vpr.npt

Differences between Version 4.2.2 and Version 4.2.1

RSO DATE	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD
RSO FREQ	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF
CST COMP	CCC ON	LIMC OFF	CUF 10							
CST ACTIVE	CAC									
TDS	ON									
Gen1	ON									
ISS1	ON									
ISS2	ON									

RSO DATE	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD	RSOD
RSO FREQ	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF	RSOF
CST COMP	CCC ON	LIMC ON	CUF 10	CO2PPM 400.	CO2YRLY ON					
CST ACTIVE	CAC									
TDS	ON									
Gen1	ON									
ISS1	ON									
ISS2	ON									

[illegible]

Differences between Version 4.2.1 and Version 4.2

Version 4.2.1 is file compatible except that the **multiple_wb.npt** format has changed. Also, a new input file, **w2_con.csv**, can be read by the model. This file is developed using the Excel file **w2_con.xslm**.

Differences between Version 4.2 and Version 4.1

Version 4.2 is file compatible with Version 4.1. There are no changes in the main control file. There are new control files though that control new processes: (1) Multiple processor simulation for cascade of waterbodies (**multiple_wb.npt**), (2) SYSTDG Total Dissolved Gas algorithm for spillways (**systdg.npt**).

Differences between Version 4.1 and Version 4.0

Version 4.1 is file compatible with Version 4.0. There are no changes in the main control file. There is only 1 new input file, '**particle.csv**', that serves as an input file to the particle tracking algorithm.

Differences between Version 4.0 and Version 3.72

Version 4 is file compatible with Version 3.72, even though there are new options in the main control file, **w2_con.npt**, and new input files whose presence or absence is detected by the model. For example, for ICEC control the options now include ON, ONWB, and OFF, where ONWB is a new option. New input files include a file for sediment diagenesis, '**W2_CEMA_Input.npt**', and a file for the dynamic alkalinity calculation, '**pH_buffering.npt**'

Control file differences are in the Generic Constituent Section of the Code where new variables were added to the control file to allow for phot-degradation and the new N2 state variable for TDG:

GENERIC	CGQ10	CG0DK	CG1DK	CGS	CGLDK	CGKLF	CGS	
CG 1	0.00000	0.00000	0.00000	0.00000	0.00000	1.03400	-1.0000	! TDG
CG 2	0.00000	-1.0000	0.00000	0.00000	0.00000	0.00000	0.00000	
CG 3	1.04000	0.00000	1.40000	0.00000	0.00000	0.00000	0.00000	

Differences between Version 3.72 and Version 3.71

These 2 codes are file compatible. Besides a few bug fixes since the last release of Version 3.71, Version 3.72 includes the USGS automatic port selection code. This can be activated by setting SELECTC='USGS' in the control file w2_con.npt. In Version 3.71, only 'ON' or 'OFF' were input variables for SELECTC. If one sets SELECTC='USGS', the format of the file w2_selective.npt is also changed from Version 3.71. Details of this and examples are provided in the User's Manual and on-line.

Differences between Version 3.71 and Version 3.7

There is only one change in the control file between Version 3.7 and 3.71. There is a new option for outlet structures – dynamic centerline elevation. In the control file, there is an ON/OFF option after declaring the # of structures for each branch:

```
EDDY VISC    AZC    AZSLC    AZMAX    FBC        E    ARODI STRCKLR BOUNDFR TKECAL
WB 1         TKE    IMP 1.00000    3 9.53500 0.43100 0.00000 0.00000    IMP

N STRUC      NSTR DYNELEV
BR1          17    ON
BR2           0    OFF
BR3           0    OFF

STR INT      STRIC  STRIC  STRIC  STRIC  STRIC  STRIC  STRIC  STRIC  STRIC
```

If these fields are missing the model will assume that DYNELEV=OFF.

Differences between Version 3.7 and Version 3.6

Even though there are some cases where a Version 3.7 executable will run Version 3.6 and Version 3.5 files fine, there are updates required to the w2_con.npt file that need to be made. The preprocessor will catch these errors.

Control file changes: w2_con.npt

The main changes to the W2 control file are additional flags to turn ON/OFF new control file options and the addition of new state variables for water quality, BOD-N and BOD-P for each BOD group.

Below is a list of changes in the control file with the card image header for each line changed (highlighted options are new in V3.7). Descriptions of these new features are in the W2 User's Manual.

1. MISCELL

```
MISCELL      NDAY SELECTC HABTATC ENVIRPC AERATEC INITUWL
            100    OFF      ON      ON      ON      OFF
```

Five new variables, SELECTC, HABTATC, ENVIRPC, AERATEC, and INITUWL, are 5 new control variables that turn ON/OFF the use of automatic selective withdrawal, fish habitat volumes, environmental performance criteria, artificial aeration, and the initial water surface and velocity computations, respectively. If

using an old Version 3.6 control file, all of these would default to 'OFF' if they were left blank. Also the model preprocessor would flag these are missing variables.

2. DLT CON

```
DLT CON      NDT  DLTMIN DLTINTR
              1  1.00000 OFF
```

where DLTINTR is a control for interpolating the the time step DLTMAX and DLTF rather than use as a step function

3. BRANCH G

```
BRANCH G      US      DS      UHS      DHS      UQB      DQB      NLMIN      SLOPE  SLOPEC
Br 1          2        59        0        0        0        0        1        0.0    0.0
```

where SLOPEC is the hydraulic equivalent slope for a river channel that affects the momentum equation.

4. GATE WEIR

```
GATE WEIR     GTA1     GTB1     GTA2     GTB2     DYNVAR     GTIC
Gate1         1.00000  1.50000  1.00000  1.50000     FLOW        ON
```

where GTIC is an interpolation control for the specified DYNVAR for the GATE-WEIR.

5. Dynamic pipe

```
PIPES         IUPI      IDPI      EUPI      EDPI      WPI      DLXPI      FPI      FMINPI  LATPIC  DYNPIPE
Pi 1          24        28        28.0      27.0      0.5      230.0    0.065    0.1     DOWN    ON
```

where DYNPIPE controls whether the pipe is controlled by time series of an ON/OFF or partially open gate

6. Dynamic pump

```
PUMPS 1       IUPU      IDPU      EPU      STRTPU     ENDPU     EONPU     EOFFPU     QPU      WTHLC  DYNPUMP
              111        0        440.      1.00      366.      441.0     435.0     1.0     DOWN    ON
```

where DYNPUMP controls the EPU, EONPU, EOFFPU, and QPU over time by reading in a time series file

7. INIT CND

```
INIT CND      TEMPI      ICEI      WTYPEC      GRIDC
WB 1          -1.0000  0.00000    FRESH      RECT
```

where GRIDC controls whether the grid is interpreted as rectangular in depth or trapezoidal.

8. CST ACTIVE [Note that this change only appears if NBOD>0]

```
CST ACTIVE     CAC
```

TDS	ON
Gen1	ON
Gen2	OFF
Gen3	OFF
Gen4	OFF
Gen5	OFF
ISS1	ON
PO4	ON
NH4	ON
NO3	ON
DSI	OFF
PSI	OFF
FE	OFF
LDOM	ON
RDOM	ON
LPOM	ON
RPOM	ON
1CBOD	ON
2CBOD	ON
3CBOD	ON
4CBOD	ON
5CBOD	ON
6CBOD	ON
7CBOD	ON
8CBOD	ON
9CBOD	ON
10CBOD	ON
1CBODP	ON
2CBODP	ON
3CBODP	ON
4CBODP	ON
5CBODP	ON
6CBODP	ON
7CBODP	ON
8CBODP	ON
9CBODP	ON
10CBODP	ON
1CBODN	ON
2CBODN	ON
3CBODN	ON
4CBODN	ON
5CBODN	ON
6CBODN	ON
7CBODN	ON
8CBODN	ON
9CBODN	ON
10CBODN	ON
ALG1	ON
ALG2	ON
ALG3	ON
DO	ON
TIC	ON
ALK	ON
ZOO1	OFF
LDOM_P	ON
RDOM_P	ON
LPOM_P	ON
RPOM_P	ON
LDOM_N	ON
RDOM_N	ON
LPOM_N	ON
RPOM_N	ON

9. CST ICON, CST PRIN, CIN CON,CTR CON, CDT CON and CPR CON

CST ICON	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB
----------	-------	-------	-------	-------	-------	-------	-------	-------	-------

CST PRIN	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC
TDS	ON								
AGE	ON								
TRACER	ON								

COL1	ON
Conduct	ON
Chlorine	ON
ISS1	ON
PO4	ON
NH4	ON
NOx	ON
DSi	OFF
PSi	OFF
TFe	OFF
LDOM	ON
RDOM	ON
LPOM	ON
RPOM	ON
1CBOD	ON
2CBOD	ON
3CBOD	ON
4CBOD	ON
5CBOD	ON
6CBOD	ON
7CBOD	ON
8CBOD	ON
9CBOD	ON
10CBOD	ON
1CBODP	ON
2CBODP	ON
3CBODP	ON
4CBODP	ON
5CBODP	ON
6CBODP	ON
7CBODP	ON
8CBODP	ON
9CBODP	ON
10CBODP	ON
1CBODN	ON
2CBODN	ON
3CBODN	ON
4CBODN	ON
5CBODN	ON
6CBODN	ON
7CBODN	ON
8CBODN	ON
9CBODN	ON
10CBODN	ON
ALG1	ON
ALG2	ON
ALG3	ON
DO	ON
TIC	ON
ALK	ON
ZOO1	OFF
LDOM_P	ON
RDOM_P	ON
LPOM_P	ON
RPOM_P	ON
LDOM_N	ON
RDOM_N	ON
LPOM_N	ON
RPOM_N	ON

CIN	CON	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC
TDS		ON	ON							
AGE		OFF	OFF							
TRACER		OFF	OFF							
COL1		OFF	OFF							
Conduct		ON	ON							
Chlorine		OFF	OFF							
ISS1		ON	ON							

PO4	ON	ON
NH4	ON	ON
NOx	ON	ON
DSi	OFF	OFF
PSi	OFF	OFF
TFe	OFF	OFF
LDOM	ON	ON
RDOM	ON	ON
LPOM	ON	ON
RPOM	ON	ON
1CBOD	ON	ON
2CBOD	ON	ON
3CBOD	ON	ON
4CBOD	ON	ON
5CBOD	ON	ON
6CBOD	ON	ON
7CBOD	ON	ON
8CBOD	ON	ON
9CBOD	ON	ON
10CBOD	ON	ON
1CBODP	ON	ON
2CBODP	ON	ON
3CBODP	ON	ON
4CBODP	ON	ON
5CBODP	ON	ON
6CBODP	ON	ON
7CBODP	ON	ON
8CBODP	ON	ON
9CBODP	ON	ON
10CBODP	ON	ON
1CBODN	ON	ON
2CBODN	ON	ON
3CBODN	ON	ON
4CBODN	ON	ON
5CBODN	ON	ON
6CBODN	ON	ON
7CBODN	ON	ON
8CBODN	ON	ON
9CBODN	ON	ON
10CBODN	ON	ON
ALG1	ON	ON
ALG2	ON	ON
ALG3	ON	ON
DO	ON	ON
TIC	ON	ON
ALK	ON	ON
ZOO1	OFF	OFF
LDOM_P	ON	ON
RDOM_P	ON	ON
LPOM_P	ON	ON
RPOM_P	ON	ON
LDOM_N	ON	ON
RDOM_N	ON	ON
LPOM_N	ON	ON
RPOM_N	ON	ON

CTR	CON	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC
TDS		ON	ON							
AGE		OFF	OFF							
TRACER		ON	ON							
COL1		ON	ON							
Conduct		ON	ON							
Chlorine		ON	ON							
ISS1		ON	ON							
PO4		ON	ON							
NH4		ON	ON							
NOx		ON	ON							

DSi	OFF	OFF							
PSi	OFF	OFF							
TFe	OFF	OFF							
LDOM	ON	ON							
RDOM	ON	ON							
LPOM	ON	ON							
RPOM	ON	ON							
1CBOD	ON	ON							
2CBOD	ON	ON							
3CBOD	ON	ON							
4CBOD	ON	ON							
5CBOD	ON	ON							
6CBOD	ON	ON							
7CBOD	ON	ON							
8CBOD	ON	ON							
9CBOD	ON	ON							
10CBOD	ON	ON							
1CBODP	ON	ON							
2CBODP	ON	ON							
3CBODP	ON	ON							
4CBODP	ON	ON							
5CBODP	ON	ON							
6CBODP	ON	ON							
7CBODP	ON	ON							
8CBODP	ON	ON							
9CBODP	ON	ON							
10CBODP	ON	ON							
1CBODN	ON	ON							
2CBODN	ON	ON							
3CBODN	ON	ON							
4CBODN	ON	ON							
5CBODN	ON	ON							
6CBODN	ON	ON							
7CBODN	ON	ON							
8CBODN	ON	ON							
9CBODN	ON	ON							
10CBODN	ON	ON							
ALG1	ON	ON							
ALG2	ON	ON							
ALG3	ON	ON							
DO	ON	ON							
TIC	ON	ON							
ALK	ON	ON							
ZOO1	OFF	OFF							
LDOM_P	ON	ON							
RDOM_P	ON	ON							
LPOM_P	ON	ON							
RPOM_P	ON	ON							
LDOM_N	ON	ON							
RDOM_N	ON	ON							
LPOM_N	ON	ON							
RPOM_N	ON	ON							
CDT CON	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC
TDS	ON	ON							
AGE	OFF	OFF							
TRACER	ON	ON							
COL1	ON	ON							
Conduct	ON	ON							
Chlorine	ON	ON							
ISS1	ON	ON							
PO4	ON	ON							
NH4	ON	ON							
NOx	ON	ON							
DSi	OFF	OFF							
PSi	OFF	OFF							
TFe	OFF	OFF							
LDOM	ON	ON							

RDOM	ON	ON								
LPOM	ON	ON								
RPOM	ON	ON								
1CBOD	ON	ON								
2CBOD	ON	ON								
3CBOD	ON	ON								
4CBOD	ON	ON								
5CBOD	ON	ON								
6CBOD	ON	ON								
7CBOD	ON	ON								
8CBOD	ON	ON								
9CBOD	ON	ON								
10CBOD	ON	ON								
1CBODP	ON	ON								
2CBODP	ON	ON								
3CBODP	ON	ON								
4CBODP	ON	ON								
5CBODP	ON	ON								
6CBODP	ON	ON								
7CBODP	ON	ON								
8CBODP	ON	ON								
9CBODP	ON	ON								
10CBODP	ON	ON								
1CBODN	ON	ON								
2CBODN	ON	ON								
3CBODN	ON	ON								
4CBODN	ON	ON								
5CBODN	ON	ON								
6CBODN	ON	ON								
7CBODN	ON	ON								
8CBODN	ON	ON								
9CBODN	ON	ON								
10CBODN	ON	ON								
ALG1	ON	ON								
ALG2	ON	ON								
ALG3	ON	ON								
DO	ON	ON								
TIC	ON	ON								
ALK	ON	ON								
ZOO1	OFF	OFF								
LDOM_P	ON	ON								
RDOM_P	ON	ON								
LPOM_P	ON	ON								
RPOM_P	ON	ON								
LDOM_N	ON	ON								
RDOM_N	ON	ON								
LPOM_N	ON	ON								
RPOM_N	ON	ON								
CPR CON	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC
TDS	ON	ON								
AGE	OFF	OFF								
TRACER	ON	ON								
COL1	ON	ON								
Conduct	ON	ON								
Chlorine	ON	ON								
ISS1	ON	ON								
PO4	ON	ON								
NH4	ON	ON								
NOx	ON	ON								
DSi	OFF	OFF								
PSi	OFF	OFF								
TFe	OFF	OFF								
LDOM	ON	ON								
RDOM	ON	ON								
LPOM	ON	ON								
RPOM	ON	ON								

1CBOD	ON	ON
2CBOD	ON	ON
3CBOD	ON	ON
4CBOD	ON	ON
5CBOD	ON	ON
6CBOD	ON	ON
7CBOD	ON	ON
8CBOD	ON	ON
9CBOD	ON	ON
10CBOD	ON	ON
1CBODP	ON	ON
2CBODP	ON	ON
3CBODP	ON	ON
4CBODP	ON	ON
5CBODP	ON	ON
6CBODP	ON	ON
7CBODP	ON	ON
8CBODP	ON	ON
9CBODP	ON	ON
10CBODP	ON	ON
1CBODN	ON	ON
2CBODN	ON	ON
3CBODN	ON	ON
4CBODN	ON	ON
5CBODN	ON	ON
6CBODN	ON	ON
7CBODN	ON	ON
8CBODN	ON	ON
9CBODN	ON	ON
10CBODN	ON	ON
ALG1	ON	ON
ALG2	ON	ON
ALG3	ON	ON
DO	ON	ON
TIC	ON	ON
ALK	ON	ON
ZOO1	OFF	OFF
LDM_P	ON	ON
RDM_P	ON	ON
LPOM_P	ON	ON
RPOM_P	ON	ON
LDM_N	ON	ON
RDM_N	ON	ON
LPOM_N	ON	ON
RPOM_N	ON	ON

New control files

Based on the options the user turns ON or OFF, new control files are required. These new control files are named:

1. w2_selective.npt – new variables controlling the selective withdrawal algorithm to select temperature targets
2. w2_habitat.npt – new variables controlling fish habitat limits for temperature and dissolved oxygen and surface and segment volume weighted eutrophication state variables
3. w2_envirpf.npt – new variables controlling setting environmental performance criteria
4. w2_aerate.npt – variables describing use of dissolved oxygen addition to enhance dissolved oxygen levels through diffusers

Details of these new control files are in the CE-QUAL-W2 User Manual.

Differences between Version 3.6 and Version 3.5

Version 3.6 can be run without changing any of the input files, even though the preprocessor will identify errors in the control file because of missing variables. Below is a highlighted list of locations in the file w2_con.npt where additional variables have been added. There are no other changes in the input files for Version 3.6.

The TKE algorithm has been updated with new algorithms that match experimental tank data for kinetic energy and dissipation. This is based on a Master's degree project by Sam Gould at Portland State University. A new user option is the TKE1 algorithm, in add addition to the legacy algorithm TKE. This results in several new input variables on the following line of the w2_con.npt file that are only active if TKE1 is chosen for AZC:

EDDY VISC	AZC	AZSLC	AZMAX	FBC	E	ARODI	STRCKLR	BOUNDFR	TKECAL
WB 1	W2	IMP	1.00000	3	9.535	0.430	24.0	10.00	IMP

The roughness height of the water for correction of the vertical velocity wind profile is now a user-defined input, z_0 . Prior to this the model had hardwired the value of $z_0=0.003$ m for wind speed correction at 2m (for evaporation where wind height at 2 m is typical) and $z_0=0.01$ m for wind at 10 m (for shear stress calculations where wind height of 10 m is typical). For consistency, both conversions now use the same value of roughness height. If the user does not specify the value of z_0 (for example if he/she leaves the spaces blank for z_0 using a V3.5 control file), the code uses 0.001 m.

HYD COEF	AX	DX	CBHE	TSED	FI	TSEDF	FRICC	Z0
WB 1	1.00000	1.00000	0.30000	11.5000	0.01000	1.00000	MANN	0.001

A new option for output is in the format required for TECPLOT. For TECPLOT animation there is only a flag in the CPL output line. This allows for easy model animation of the variables U, W, T, RHO, and all active constituents at the frequency specified by the CPL file as a function of distance and elevation.

CPL PLOT	CPLC	NCPL	TECPLOT
WB 1	ON	1	ON

A new variable for determining the fraction of NO₃-N that is diffused into the sediments that becomes organic matter, or SED-N was introduced. According to one study, only about 37% of NO₃-N that diffuses into the sediments becomes incorporated into organic matter in the sediments. The rest is denitrified.

NITRATE	NO3DK	NO3S	FNO3SED
Wb 1	0.05	0.0	0.37
Wb 2	0.05	0.0	0.37

In V3.5 the model computed an average decay coefficient of the sediments based on what was deposited. The user now has the option to dynamically compute that decay rate or to have it fixed and controlled by the model user. A new variable was introduced called DYNSEDK which is either ON/OFF to allow or not allow dynamic computation of the sediment decay rate.

SEDIMENT	SEDC	PRNSC	SEDCI	SEDK	SEDS	FSOD	FSED	SEDBR	DYNSEDK
----------	------	-------	-------	------	------	------	------	-------	---------

Wb 1	ON	ON	0.0	0.1	0.0	1.0	1.0	0.001	OFF
Wb 2	ON	ON	0.0	0.1	0.0	1.0	1.0	0.001	OFF

The User can now specify the # of processors to use on the host computer. Most users find that setting NPROC=2 gets the best results. Sometimes setting this greater than 2 results in slower model performance. Also, the CLOSEC control closes the windows dialog box after the model completes its simulation. This is useful in using the windows version of the release code in batch simulations. These are specified in the control file as follows:

GRID	NWB	NBR	IMX	KMX	NPROC	CLOSEC
	1	4	66	117	2	ON

Differences between Version 3.2 and Version 3.5

The differences in V3.5 and V3.2 input files are found in the control file: **w2_con.npt** and in the **graph.npt** file. All other files are the same between the 2 versions.

w2_con.npt

Below is an example of parts of the control file from V3.5 where all new variables are highlighted. Most of these changes have to do with the new zooplankton, macrophyte, and new state variables added to the model. See the User Manual for a list of changes between V3.2 and V 3.5 in the version history. Also there were some deletions from the V3.2 w2_con.npt file. These are shown below.

New variables added to the control file are highlighted

```
.
.
IN/OUTFL      NTR      NST      NIW      NWD      NGT      NSP      NPI      NPU
              1        1        0        0        0        0        0        0

CONSTITU      NGC      NSS      NAL      NEP      NBOD      NMC      NZP
              5        1        1        1        5        0        1

MISCELL      NDAY
              100

.
.
CST COMP      CCC      LIMC      CUF
              ON      ON      10

CST ACTIVE    CAC
TDS           OFF
Gen1          ON
Gen2          OFF
Gen3          OFF
Gen4          OFF
Gen5          OFF
ISS1          OFF
PO4           OFF
NH4           OFF
NO3           OFF
DSI           OFF
PSI           OFF
FE            OFF
LDOM          OFF
RDOM          OFF
LPOM          OFF
RPOM          OFF
BOD1          OFF
BOD2          OFF
BOD3          OFF
BOD4          OFF
BOD5          OFF
ALG1          OFF
DO            OFF
TIC           OFF
ALK           OFF
ZOO1          OFF
LDOM_P        OFF
```

RDOM_P	OFF
LPOM_P	OFF
RPOM_P	OFF
LDOM_N	OFF
RDOM_N	OFF
LPOM_N	OFF
RPOM_N	OFF

CST DERI	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC	CDWBC
DOC	OFF								
POC	OFF								
TOC	OFF								
DON	OFF								
PON	OFF								
TON	OFF								
TKN	OFF								
TN	OFF								
DOP	OFF								
POP	OFF								
TOP	OFF								
TP	OFF								
APR	OFF								
CHLA	OFF								
ATOT	OFF								
%DO	OFF								
TSS	OFF								
TISS	OFF								
CBOD	OFF								
pH	OFF								
CO2	OFF								
HCO3	OFF								
CO3	OFF								

CST FLUX	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC	CFWBC
TISSIN	OFF								
TISSOUT	OFF								
PO4AR	OFF								
PO4AG	OFF								
PO4AP	OFF								
PO4ER	OFF								
PO4EG	OFF								
PO4EP	OFF								
PO4POM	OFF								
PO4DOM	OFF								
PO4OM	OFF								
PO4SED	OFF								
PO4SOD	OFF								
PO4SET	OFF								
NH4NITR	OFF								
NH4AR	OFF								
NH4AG	OFF								
NH4AP	OFF								
NH4ER	OFF								
NH4EG	OFF								
NH4EP	OFF								
NH4POM	OFF								
NH4DOM	OFF								
NH4OM	OFF								
NH4SED	OFF								
NH4SOD	OFF								
NO3DEN	OFF								
NO3AG	OFF								
NO3EG	OFF								
NO3SED	OFF								
DSIAG	OFF								
DSIEG	OFF								
DSIPIS	OFF								
DSISED	OFF								

DSISOD	OFF
DSISET	OFF
PSIAM	OFF
PSINET	OFF
PSIDK	OFF
FESET	OFF
FESED	OFF
LDOMDK	OFF
LRDOM	OFF
RDOMDK	OFF
LDOMAP	OFF
LDOMEF	OFF
LPOMDK	OFF
LRPOM	OFF
RPOMDK	OFF
LPOMAP	OFF
LPOMEF	OFF
LPOMSET	OFF
RPOMSET	OFF
CBODDK	OFF
DOAP	OFF
DOAR	OFF
DOEP	OFF
DOER	OFF
DOPOM	OFF
DODOM	OFF
DOOM	OFF
DONITR	OFF
DOCBOD	OFF
DOREAR	OFF
DOSED	OFF
DOSOD	OFF
TICAG	OFF
TICEG	OFF
SEDDK	OFF
SEDAS	OFF
SEDLPOM	OFF
SEDSET	OFF
SODDK	OFF

CST	ICON	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB	C2IWB
TDS		0.00000								
Gen1		0.00000								
Gen2		0.00000								
Gen3		0.00000								
Gen4		0.00000								
Gen5		0.00000								
ISS1		0.00000								
PO4		0.03000								
NH4		0.01000								
NO3		0.30000								
DSI		0.00000								
PSI		0.00000								
FE		0.00000								
LDOM		0.10000								
RDOM		0.10000								
LPOM		0.10000								
RPOM		0.10000								
BOD1		0.00000								
BOD2		0.00000								
BOD3		0.00000								
BOD4		0.00000								
BOD5		0.00000								
ALG1		0.10000								
DO		12.0000								
TIC		5.00000								
ALK		19.8000								

ZOO1	0.1000
LDOM_P	0.0005
RDOM_P	0.0005
LPOM_P	0.0005
RPOM_P	0.0005
LDOM_N	0.0080
RDOM_N	0.0080
LPOM_N	0.0080
RPOM_N	0.0080

CST PRIN	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC	CPRWBC
TDS	OFF									
Gen1	ON									
Gen2	OFF									
Gen3	OFF									
Gen4	OFF									
Gen5	OFF									
ISS1	OFF									
PO4	OFF									
NH4	OFF									
NO3	OFF									
DSI	OFF									
PSI	OFF									
FE	OFF									
LDOM	OFF									
RDOM	OFF									
LPOM	OFF									
RPOM	OFF									
BOD1	OFF									
BOD2	OFF									
BOD3	OFF									
BOD4	OFF									
BOD5	OFF									
ALG1	OFF									
DO	OFF									
TIC	OFF									
ALK	OFF									
ZOO1	OFF									
LDOM_P	OFF									
RDOM_P	OFF									
LPOM_P	OFF									
RPOM_P	OFF									
LDOM_N	OFF									
RDOM_N	OFF									
LPOM_N	OFF									
RPOM_N	OFF									

CIN CON	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC	CINBRC
TDS	ON									
Gen1	OFF									
Gen2	ON									
Gen3	ON									
Gen4	ON									
Gen5	ON									
ISS1	ON									
PO4	ON									
NH4	ON									
NO3	ON									
DSI	OFF									
PSI	OFF									
FE	OFF									
LDOM	ON									
RDOM	ON									
LPOM	ON									
RPOM	ON									
BOD1	ON									
BOD2	ON									
BOD3	ON									

BOD4	ON
BOD5	ON
ALG1	ON
DO	ON
TIC	ON
ALK	ON

ZOO1	OFF
LDOM_P	OFF
RDOM_P	OFF
LPOM_P	OFF
RPOM_P	OFF
LDOM_N	OFF
RDOM_N	OFF
LPOM_N	OFF
RPOM_N	OFF

CTR CON	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC	CTRTRC
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

TDS	ON	ON
Gen1	OFF	OFF
Gen2	ON	ON
Gen3	ON	ON
Gen4	ON	ON
Gen5	ON	ON
ISS1	ON	ON
PO4	ON	ON
NH4	ON	ON
NO3	ON	ON
DSI	OFF	OFF
PSI	OFF	OFF
FE	OFF	OFF
LDOM	ON	ON
RDOM	ON	ON
LPOM	ON	ON
RPOM	ON	ON
BOD1	ON	ON
BOD2	ON	ON
BOD3	ON	ON
BOD4	ON	ON
BOD5	ON	ON
ALG1	ON	ON
DO	ON	ON
TIC	ON	ON
ALK	ON	ON

ZOO1	OFF	OFF
LDOM_P	OFF	OFF
RDOM_P	OFF	OFF
LPOM_P	OFF	OFF
RPOM_P	OFF	OFF
LDOM_N	OFF	OFF
RDOM_N	OFF	OFF
LPOM_N	OFF	OFF
RPOM_N	OFF	OFF

CDT CON	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC	CDTBRC
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

TDS	ON
Gen1	OFF
Gen2	ON
Gen3	ON
Gen4	ON
Gen5	ON
ISS1	ON
PO4	ON
NH4	ON
NO3	ON
DSI	OFF
PSI	OFF
FE	OFF

LDOM	ON
RDOM	ON
LPOM	ON
RPOM	ON
BOD1	ON
BOD2	ON
BOD3	ON
BOD4	ON
BOD5	ON
ALG1	ON
DO	ON
TIC	ON
ALK	ON
ZOO1	OFF
LDOM_P	OFF
RDOM_P	OFF
LPOM_P	OFF
RPOM_P	OFF
LDOM_N	OFF
RDOM_N	OFF
LPOM_N	OFF
RPOM_N	OFF

CPR CON	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC	CPRBRC
TDS	ON										
Gen1	OFF										
Gen2	ON										
Gen3	ON										
Gen4	ON										
Gen5	ON										
ISS1	ON										
PO4	ON										
NH4	ON										
NO3	ON										
DSI	OFF										
PSI	OFF										
FE	OFF										
LDOM	ON										
RDOM	ON										
LPOM	ON										
RPOM	ON										
BOD1	ON										
BOD2	ON										
BOD3	ON										
BOD4	ON										
BOD5	ON										
ALG1	ON										
DO	ON										
TIC	ON										
ALK	ON										
ZOO1	OFF										
LDOM_P	OFF										
RDOM_P	OFF										
LPOM_P	OFF										
RPOM_P	OFF										
LDOM_N	OFF										
RDOM_N	OFF										
LPOM_N	OFF										
RPOM_N	OFF										

EX COEF	EXH2O	EXSS	EXOM	BETA	EXC	EXIC
WB 1	0.45000	0.01000	0.40000	0.45000	OFF	OFF
ALG EX	EXA	EXA	EXA	EXA	EXA	EXA
	0.10000					
ZOO EX	EXZ	EXZ	EXZ	EXZ	EXZ	EXZ
	0.2	0.2	0.2			

MACRO	EX	EXM	EXM	EXM	EXM	EXM	EXM	EXM	EXM	
		0.0100								
GENERIC		CGQ10	CG0DK	CG1DK	CGS					
CG 1		0.00000	-1.0000	0.00000	0.00000					
CG 2		0.00000	0.00000	0.00000	0.00000					
CG 3		1.04000	0.00000	0.50000	0.00000					
CG 4		0.00000	0.00000	0.00000	0.00000					
CG 5		0.00000	0.00000	0.00000	0.00000					
S SOLIDS		SSS	SEDRC	TAUCR						
SSI		1.50000	OFF	0.00						
ALGAL RATE		AG	AR	AE	AM	AS	AHSP	AHSN	AHSSI	ASAT
ALG1		2.00000	0.12000	0.02000	0.05000	0.04000	0.00500	0.00500	0.00000	50.0000
ALGAL TEMP		AT1	AT2	AT3	AT4	AK1	AK2	AK3	AK4	
ALG1		5.00000	12.0000	20.0000	30.0000	0.10000	0.99000	0.99000	0.10000	
ALG STOI		ALGP	ALGN	ALGC	ALGSI	ACHLA	ALPOM	ANEQN	ANPR	
ALG1		0.00500	0.08000	0.45000	0.00000	65.0000	0.80000	1	0.00100	
EPIPHYTE		EPIC	EPIC	EPIC	EPIC	EPIC	EPIC	EPIC	EPIC	EPIC
EPI1		OFF								
EPI PRIN		EPRC	EPRC	EPRC	EPRC	EPRC	EPRC	EPRC	EPRC	EPRC
EPI1		OFF								
EPI INIT		EPICI	EPICI	EPICI	EPICI	EPICI	EPICI	EPICI	EPICI	EPICI
EPI1		10.0000								
EPI RATE		EG	ER	EE	EM	EB	EHSP	EHSN	EHSSI	
EPI1		2.00000	0.05000	0.02000	0.05000	0.01000	0.00200	0.00200	0.00000	
EPI HALF		ESAT	EHS	ENEQN	ENPR					
EPI1		50.0000	40.0000	2	0.00200					
EPI TEMP		ET1	ET2	ET3	ET4	EK1	EK2	EK3	EK4	
EPI1		2.00000	5.00000	20.0000	30.0000	0.10000	0.99000	0.99000	0.10000	
EPI STOI		EP	EN	EC	ESI	ECHLA	EPOM			
EPI1		0.00500	0.08000	0.45000	0.00000	65.0000	0.80000			
ZOOP RATE		ZG	ZR	ZM	ZEFF	PREFP	ZOOMIN	ZS2P		
Zoo1		1.50	0.10	0.010	0.50	0.50	0.0100	0.30		
ZOOP ALGP		PREFA	PREFA	PREFA	PREFA	PREFA	PREFA	PREFA	PREFA	PREFA
Zoo1		1.00	0.50	0.50						
ZOOP ZOOP		PREFZ	PREFZ	PREFZ	PREFZ	PREFZ	PREFZ	PREFZ	PREFZ	PREFZ
Zoo1		0.00	0.00	0.00						
ZOOP TEMP		ZT1	ZT2	ZT3	ZT4	ZK1	ZK2	ZK3	ZK4	
		0.0	15.0	20.0	36.0	0.1	0.9	0.98	0.100	
ZOOP STOI		ZP	ZN	ZC						
		0.01500	0.08000	0.45000						
MACROPHYT	MACWBC	MACWBC	MACWBC	MACWBC	MACWBC	MACWBC	MACWBC	MACWBC	MACWBC	MACWBC
Mac1	ON	OFF	OFF							
MAC PRINT	MPRWBC	MPRWBC	MPRWBC	MPRWBC	MPRWBC	MPRWBC	MPRWBC	MPRWBC	MPRWBC	MPRWBC
Mac1	ON	OFF	OFF							
MAC INI	MACWBCI	MACWBCI	MACWBCI	MACWBCI	MACWBCI	MACWBCI	MACWBCI	MACWBCI	MACWBCI	MACWBCI
Mac1	0.00000	0.1	0.5							

MAC RATE	MG	MR	MM	MSAT	MHSP	MHSN	MHSC	MPOM	LRPMAC
Mac 1	0.30	0.05	0.05	30.0	0.0	0.0	0.0	0.9	0.2

MAC SED	PSED	NSED
Mac 1	0.5	0.5

MAC DIST	MBMP	MMAK
Mac 1	40.0	500.0

MAC DRAG	CDSTEM	DWV	DMSA	ANORM
Mac 1	2.0	7e4	8.00	0.80

MAC TEMP	MT1	MT2	MT3	MT4	MK1	MK2	MK3	MK4
Mac 1	7.0	15.0	24.0	34.0	0.1	0.99	0.99	0.01

MAC STOICH	MP	MN	MC
Mac 1	0.005	0.08	0.45

DOM	LDOMDK	RDOMDK	LRDDK
WB 1	0.10000	0.00100	0.00100

POM	LPOMDK	RPOMDK	LRPDK	POMS
WB 1	0.08000	0.00100	0.00100	0.10000

OM STOIC	ORGP	ORGN	ORGC	ORCSI
WB 1	0.00500	0.08000	0.45000	0.18000

OM RATE	OMT1	OMT2	OMK1	OMK2
WB 1	4.00000	30.0000	0.10000	0.99000

CBOD	KBOD	TBOD	RBOD	CBODS
BOD 1	0.04180	1.01470	1.00000	0.0
BOD 2	0.13020	1.01470	1.00000	0.0
BOD 3	0.04690	1.01470	1.00000	0.0
BOD 4	0.08800	1.01470	1.00000	0.0
BOD 5	0.05000	1.01470	1.00000	0.0

CBOD STOIC	BODP	BODN	BODC
BOD 1	0.00500	0.08000	0.45000
BOD 2	0.00500	0.08000	0.45000
BOD 3	0.00500	0.08000	0.45000
BOD 4	0.00500	0.08000	0.45000
BOD 5	0.00500	0.08000	0.45000

PHOSPHOR	PO4R	PARTP
WB 1	0.00100	0.00000

AMMONIUM	NH4R	NH4DK
WB 1	0.00100	0.50000

NH4 RATE	NH4T1	NH4T2	NH4K1	NH4K2
WB 1	5.00000	25.0000	0.10000	0.99000

NITRATE	NO3DK	NO3S
WB 1	0.05000	0.00000

NO3 RATE	NO3T1	NO3T2	NO3K1	NO3K2
WB 1	5.00000	25.0000	0.10000	0.99000

SILICA	DSIR	PSIS	PSIDK	PARTSI
WB 1	0.10000	0.00000	0.30000	0.20000

IRON	FER	FES
WB 1	0.10000	0.00000

SED CO2	CO2R
WB 1	0.10000

STOICH 1 O2NH4 O2OM
WB 1 4.57000 1.40000

STOICH 2 O2AR O2AG
ALG1 1.10000 1.40000

STOICH 3 O2ER O2EG
EPI1 1.10000 1.40000

STOICH 4 O2ZR
ZOO1 1.10000

STOICH 5 O2MR O2MG
MAC1 1.1 1.4

O2 LIMIT KDO
0.10000

SEDIMENT	SEDC	SEDCPRC	SEDCI	SEDK	SEDS	FSOD	FSED	SEDBR
WB 1	ON	ON	0.00000	0.10000	0.1	1.00000	1.00000	0.2

SOD RATE	SODT1	SODT2	SODK1	SODK2
WB 1	4.00000	30.0000	0.10000	0.99000

S DEMAND	SOD	SOD	SOD	SOD	SOD	SOD	SOD	SOD	SOD
	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	0.6								

REAERATION	TYPE	EQN#	COEF1	COEF2	COEF3	COEF4
WB1	LAKE	6				

Lines removed from the V3.2 control file: These are a result of eliminating the pumpback and line printer settings.

Here is the part of the V3.2 control file that was deleted:

DST TRIB DTRC
Br 1 ON
Br 2 ON
Br 3 OFF
Br 4 OFF
Br 5 OFF

PUMPBACK JBG KTG KBG JBP KTP KBP
0

PRINTER LJC
IV

HYD PRINT	HPRWBC	HPRWBC	HPRWBC	HPRWBC	HPRWBC	HPRWBC	HPRWBC	HPRWBC	HPRWBC
NVIOL	OFF	OFF							
U	ON	ON							

Graph.npt file changes. These changes are a result of the new state variables in W2 and are highlighted below.

Hydrodynamic, constituent, and derived constituent names, formats, multipliers, and array viewer controls

.....HNAME.....	FMTH	HMULT	HMIN	HMAX	HPLTC
#					

Timestep violations [NVIOL]	(I10)	1.0	-1.0	1.0	OFF
1					
Horizontal velocity [U], m/s	(1PE10.1)	1.0	-.1000	0.15	OFF
2					
Vertical velocity [W], m/s	(1PE10.1)	1.0	-.1E-6	-0.01	OFF
3					
Temperature [T1], <o/>C	(F10.2)	1.0	-10.0	-26.0	ON
4					
Density [RHO], g/m^3	(F10.3)	1.0	997.0	1005.0	OFF
5					
Vertical eddy viscosity [AZ], m^2/s	(F10.3)	1.0	-1E-08	0.01	OFF
6					
Velocity shear stress [SHEAR], 1/s^2	(F10.3)	1.0	-1E-08	0.01	OFF
7					
Internal shear [ST], m^3/s	(F10.3)	1.0	-1E-08	0.01	OFF
8					
Bottom shear [SB], m^3/s	(F10.3)	1.0	-1E-08	0.01	OFF
9					
Longitudinal momentum [ADMX], m^3/s	(F10.3)	1.0	-1E-08	0.01	OFF
10					
Longitudinal momentum [DM], m^3/s	(F10.3)	1.0	-1E-08	0.01	OFF
11					
Horizontal density gradient [HDG], m^3/s	(F10.3)	1.0	-1E-08	0.01	OFF
12					
Vertical momentum [ADMZ], m^3/s	(F10.3)	1.0	-1E-08	0.01	OFF
13					
Horizontal pressure gradient [HPG], m^3/s	(F10.3)	1.0	-1E-08	10.0	OFF
14					
Gravity term channel slope [GRAV], m^3/s	(F10.3)	1.0	0.0	0.0	OFF
15					
.....CNAME.....	FMTC	CMULT	CMIN	CMAX	CPLTC
#					
TDS, g/m^3	(F10.3)	1.0	-1.0	200.0	OFF
1					
Age, days	(F10.3)	1.0	-1.0	-200.0	ON
2					
Tracer, g/m^3	(F10.3)	1.0	-20.000	100.0	OFF
3					
Bacteria, col/100ml	(F10.3)	1.0	-20.000	100.0	OFF
4					
Conductivity, mhos	(F10.3)	1.0	-20.000	100.0	OFF
5					
Chloride, mg/l	(F10.3)	1.0	-20.000	100.0	OFF
6					
ISS, g/m^3	(F10.3)	1.0	-20.000	100.0	OFF
7					
Phosphate, g/m^3	(F10.3)	1000.0	-1.0	500.0	OFF
8					
Ammonium, g/m^3	(F10.3)	1000.0	-0.1000	300.0	OFF
9					
Nitrate-Nitrite, g/m^3	(F10.3)	1.0	-0.1000	5.0	OFF
10					
Dissolved silica, g/m^3	(F10.3)	1.0	-1.0	10.0	OFF
11					
Particulate silica, g/m^3	(F10.3)	1.0	-0.2000	15.0	OFF
12					
Total iron, g/m^3	(F10.3)	1.0	-0.1000	2.0	OFF
13					
Labile DOM, g/m^3	(F10.3)	1.0	-0.1000	-3.0	OFF
14					
Refractory DOM, g/m^3	(F10.3)	1.0	-0.1000	-4.0	OFF
15					
Labile POM, g/m^3	(F10.3)	1.0	-0.1000	-3.0	OFF
16					
Refractory POM, g/m^3	(F10.3)	1.0	-0.1000	-4.0	OFF
17					

CBOD1, g/m^3	(F10.3)	1.0	-0.0100	3.0	OFF
18					
CBOD2, g/m^3	(F10.3)	1.0	-0.0100	3.0	OFF
19					
CBOD3, g/m^3	(F10.3)	1.0	-0.0100	3.0	OFF
20					
CBOD4, g/m^3	(F10.3)	1.0	-0.0100	3.0	OFF
21					
CBOD5, g/m^3	(F10.3)	1.0	-0.0100	3.0	OFF
22					
Algae, g/m^3	(F10.3)	1.0	-0.0100	3.0	OFF
23					
Dissolved oxygen, g/m^3	(F10.3)	1.0	-0.0100	-1.0	OFF
24					
Inorganic carbon, g/m^3	(F10.3)	1.0	-0.0100	3.0	OFF
25					
Alkalinity, g/m^3	(F10.3)	1.0	-0.0100	3.0	OFF
26					
zooplankton1, mg/m^3	(g10.3)	1000.0	-0.0100	1.0	OFF
27					
LDOM P, mg/m^3	(g10.3)	1000.0	0.0	1.0	OFF
28					
RDOM P, mg/m^3	(g10.3)	1000.0	0.0	1.0	OFF
29					
LPOM P, mg/m^3	(g10.3)	1000.0	0.0	1.0	OFF
30					
RPOM P, mg/m^3	(g10.3)	1000.0	0.0	1.0	OFF
31					
LDOM N, mg/m^3	(g10.3)	1000.0	0.0	1.0	OFF
32					
RDOM N, mg/m^3	(g10.3)	1000.0	0.0	1.0	OFF
33					
LPOM N, mg/m^3	(g10.3)	1000.0	0.0	1.0	OFF
34					
RPOM N, mg/m^3	(g10.3)	1000.0	0.0	1.0	OFF
35					
.....CDNAME.....					
#	FMTCD	CDMULT	CDMIN	CDMAX	CDPLTC
Dissolved organic carbon, g/m^3	(F10.3)	1.0	-1.0	25.0	OFF
1					
Particulate organic carbon, g/m^3	(F10.3)	1.0	-1.0	50.0	OFF
2					
Total organic carbon, g/m^3	(F10.3)	1.0	-1.0	25.0	OFF
3					
Dissolved organic nitrogen, g/m^3	(F10.3)	1.0	-1.0	25.0	OFF
4					
Particulate organic nitrogen, g/m^3	(F10.3)	1.0	-1.0	25.0	OFF
5					
Total organic nitrogen, g/m^3	(F10.3)	1.0	-1.0	50.0	OFF
6					
Total Kheldahl Nitrogen, g/m^3	(F10.3)	1.0	-1.0	15.0	OFF
7					
Total nitrogen, g/m^3	(F10.3)	1.0	-1.0	15.0	OFF
8					
Dissolved organic phosphorus, mg/m^3	(F10.3)	1000.0	-1.0	25.0	OFF
9					
Particulate organic phosphorus, mg/m^3	(F10.3)	1000.0	-1.0	-1.0	OFF
10					
Total organic phosphorus, mg/m^3	(F10.3)	1000.0	-1.0	5.0	OFF
11					
Total phosphorus, mg/m^3	(F10.3)	1000.0	-1.0	20.0	OFF
12					
Algal production, g/m^2/day	(F10.3)	1.0	-1.0	5.0	OFF
13					
Chlorophyll a, mg/m^3	(F10.3)	1.0	-5.0	145.0	OFF
14					

Total algae, g/m ³	(F10.3)	1.0	-1.0	60.0	OFF
15					
Oxygen % Gas Saturation	(F10.3)	1.0	-1.0	50.0	OFF
16					
Total suspended Solids, g/m ³	(F10.3)	1.0	-1.0	5.0	OFF
17					
Total Inorganic Suspended Solids,g/m ³	(F10.3)	1.0	-1.0	20.0	OFF
18					
Carbonaceous Ultimate BOD, g/m ³	(F10.3)	1.0	5.0	9.0	OFF
19					
pH	(F10.3)	1.0	-1.0	10.0	OFF
20					
CO2	(F10.3)	1.0	-1.0	10.0	OFF
21					
HCO3	(F10.3)	1.0	-1.0	10.0	OFF
22					
CO3	(F10.3)	0.0	0.0	0.0	OFF
23					

Differences between Version 3.1 and Version 3.2

There are minor differences in 2 input files between the 2 versions: **w2_con.npt** and the **graph.npt** file. All other files are the same between the 2 versions.

w2_con.npt

The only section where there is a slight difference in the control file is in the section where the inorganic suspended solids group settling velocities are entered. In Version 3.1, this section looks like this:

```

ALG EX      EXA      EXA      EXA      EXA      EXA      EXA
      0.10000

GENERIC      CGQ10    CG0DK    CG1DK      CGS
CG 1      0.00000 -1.0000 0.00000 0.00000
CG 2      0.00000 0.00000 0.00000 0.00000
CG 3      1.04000 0.00000 0.50000 0.00000
CG 4      0.00000 0.00000 0.00000 0.00000
CG 5      0.00000 0.00000 0.00000 0.00000

S SOLIDS      SSS      SSS      SSS      SSS      SSS      SSS      SSS      SSS      SSS
      1.50000

ALGAL RATE      AG      AR      AE      AM      AS      AHSP      AHSN      AHSSI      ASAT
ALG1      2.00000 0.12000 0.02000 0.05000 0.04000 0.00500 0.00500 0.00000 50.0000
  
```

In Version 3.2, there is now a sediment resuspension capability for wind driven resuspension along the shores of lakes and reservoirs. The Version 3.2 control file has the following lines in this same section of the control file:

```

ALG EX      EXA      EXA      EXA      EXA      EXA      EXA
      0.10000

GENERIC      CGQ10    CG0DK    CG1DK      CGS
CG 1      0.00000 -1.0000 0.00000 0.00000
CG 2      0.00000 0.00000 0.00000 0.00000
CG 3      1.04000 0.00000 0.50000 0.00000
CG 4      0.00000 0.00000 0.00000 0.00000
CG 5      0.00000 0.00000 0.00000 0.00000

S SOLIDS      SSS      SEDRC      TAUCR
SS1      1.50000      OFF      0.00

ALGAL RATE      AG      AR      AE      AM      AS      AHSP      AHSN      AHSSI      ASAT
ALG1      2.00000 0.12000 0.02000 0.05000 0.04000 0.00500 0.00500 0.00000 50.0000
  
```

For Version 3.2, SSS is the settling velocity for particle group 1, SEDRC is the control which turns ON or OFF sediment resuspension, and TAUCR is the critical shear stress at which resuspension occurs. For Version 3.2, each line represents 1 SS group, while in Version 3.1, each group settling velocity is in the next 8 columns moving across the page.

graph.npt

The graph file controls output formatting and the graphing parameters used in Array Viewer (only for the PC platform). The files have been rearranged significantly. A Version 3.1 graph file is shown below:

Constituent, hydrodynamic, and derived constituent names, formats, multipliers, and array viewer controls

.....CNAME.....	CMULT	CMIN	CMAX	CPLTC	#
TDS g/m^3 or Salinity kg/m^3	1.00000	-1.0000	200.000	OFF	1
Generic Constituent,g/m^3, #1	1.00000	-1.0000	-200.00	ON	2
Generic Constituent,g/m^3, #2	1.00000	-1.0000	1000.00	OFF	3
Generic Constituent,g/m^3, #3	1.00000	-1.0000	5.00000	OFF	4
Generic Constituent,g/m^3, #4	1.00000	-1.0000	-300.00	OFF	5
Generic Constituent,g/m^3, #5	1.00000	-1.0000	-3.0000	OFF	6
Suspended solids,g/m^3, #1	1.00000	-1.0000	15.0000	OFF	7
Phosphate, g/m^3	1000.00	-1.0000	-50.000	OFF	8
Ammonium, g/m^3	1000.00	-0.1000	-300.00	OFF	9
Nitrate-Nitrite, g/m^3	1.00000	-0.1000	-5.0000	OFF	10
Dissolved silica, g/m^3	1.00000	-1.0000	10.0000	OFF	11
Particulate silica, g/m^3	1.00000	-0.2000	15.0000	OFF	12
Total iron, g/m^3	1.00000	-0.1000	2.00000	OFF	13
Labile DOM, g/m^3	1.00000	-0.1000	-3.0000	OFF	14
Refractory DOM, g/m^3	1.00000	-0.1000	4.00000	OFF	15
Labile POM, g/m^3	1.00000	-0.1000	3.00000	OFF	16
Refractory POM, g/m^3	1.00000	-0.1000	4.00000	OFF	17
CBOD, g/m^3, #1	1.00000	-0.1000	10.0000	OFF	18
CBOD, g/m^3, #2	1.00000	-0.1000	10.0000	OFF	19
CBOD, g/m^3, #3	1.00000	-0.1000	10.0000	OFF	20
CBOD, g/m^3, #4	1.00000	-0.1000	10.0000	OFF	21
CBOD, g/m^3, #5	1.00000	-0.1000	10.0000	OFF	22
Algae, g/m^3, #1	1.00000	-0.0100	-3.0000	OFF	23
Dissolved oxygen, g/m^3	1.00000	-2.0000	15.0000	OFF	24
Inorganic carbon, g/m^3	1.00000	-1.0000	10.0000	OFF	25
Alkalinity, g/m^3	1.00000	-1.0000	200.000	OFF	26
.....HNAME.....	HFMT	HMIN	HMAX	HPLTC	#
Timestep violations [NVIOL]	(F10.0)	-1.0000	100000	OFF	1
Horizontal velocity [U], m/s	(1PE10.1)	-0.0100	0.10000	ON	2
Vertical velocity [W], m/s	(1PE10.1)	-.10E-06	0.01000	OFF	3
Temperature [T1], <o/>C	(F10.2)	-2.0000	-30.000	ON	4
Density [RHO], g/m^3	(F10.2)	997.000	1005.00	OFF	5
Vertical eddy viscosity [AZ], m^2/s	(1PE10.1)	-1E-08	0.00100	OFF	6
Velocity shear stress [SHEAR], 1/s^2	(1PE10.1)	-1E-08	0.01000	OFF	7
Internal shear [ST], m^3/s	(1PE10.1)	-1E-08	0.01000	OFF	8
Bottom shear [SB], m^3/s	(1PE10.1)	-1E-08	0.01000	OFF	9
Longitudinal momentum [ADMX], m^3/s	(1PE10.1)	-1E-08	0.01000	OFF	10
Longitudinal momentum [DM], m^3/s	(1PE10.1)	-1E-08	0.01000	OFF	11
Horizontal density gradient [HDG], m^3/s	(1PE10.1)	-1E-08	0.01000	OFF	12
Vertical momentum [ADMZ], m^3/s	(1PE10.1)	-1E-08	0.01000	OFF	13
Horizontal pressure gradient [HPG], m^3/s	(1PE10.1)	-1E-08	0.01000	OFF	14
Gravity term channel slope [GRAV], m^3/s	(1PE10.1)	-1E-08	10.0000	OFF	15
.....CDNAME.....	CDMULT	CDMIN	CDMAX	CDPLTC	#
Dissolved organic carbon, g/m^3	1.00000	-1.0000	3.00000	OFF	1
Particulate organic carbon, g/m^3	1.00000	-1.0000	25.0000	OFF	2
Total organic carbon, g/m^3	1.00000	-1.0000	50.0000	OFF	3
Dissolved organic nitrogen, g/m^3	1.00000	-1.0000	25.0000	OFF	4
Particulate organic nitrogen, g/m^3	1.00000	-1.0000	25.0000	OFF	5
Total organic nitrogen, g/m^3	1.00000	-1.0000	25.0000	OFF	6
Total Kheldahl Nitrogen, g/m^3	1.00000	-1.0000	5.00000	OFF	7
Total nitrogen, g/m^3	1.00000	-1.0000	50.0000	OFF	8
Dissolved organic phosphorus, mg/m^3	1000.00	-1.0000	15.0000	OFF	9
Particulate organic phosphorus, mg/m^3	1000.00	-1.0000	15.0000	OFF	10
Total organic phosphorus, mg/m^3	1000.00	-1.0000	25.0000	OFF	11
Total phosphorus, mg/m^3	1000.00	-1.0000	-1.0000	OFF	12
Algal production, g/m^2/day	1.00000	-1.0000	5.00000	OFF	13

Chlorophyll a, mg/m ³	1000.00	-1.0000	-70.000	OFF	14
Total algae, g/m ³	1.00000	-1.0000	5.00000	OFF	15
Oxygen % Gas Saturation	1.00000	-5.0000	145.000	OFF	16
Total suspended Solids, g/m ³	1.00000	-1.0000	60.0000	OFF	17
Total Inorganic Suspended Solids, g/m ³	1.00000	-1.0000	50.0000	OFF	18
Carbonaceous Ultimate BOD, g/m ³	1.00000	-1.0000	20.0000	OFF	19
pH	1.00000	6.00000	9.00000	OFF	20
CO2	1.00000	-1.0000	10.0000	OFF	21
HCO3	1.00000	-1.0000	10.0000	OFF	22
CO3	1.00000	-1.0000	10.0000	OFF	23

An example of the same graph file but for Version 3.2 is shown below:

Hydrodynamic, constituent, and derived constituent names, formats, multipliers, and array viewer controls

.....HNAME.....	FMTH	HMULT	HMIN	HMAX	HPLTC
#					
Timestep violations [NVIOL]	(I10)	1.0	-1.0	1.0	OFF
1					
Horizontal velocity [U], m/s	(Z10.8)	1.0	-1.000	0.15	ON
2					
Vertical velocity [W], m/s	(Z10.8)	1.0	-1E-6	-0.01	OFF
3					
Temperature [T1], <o/>C	(Z10.8)	1.0	-10.0	-26.0	ON
4					
Density [RHO], g/m ³	(Z10.8)	1.0	997.0	1005.0	OFF
5					
Vertical eddy viscosity [AZ], m ² /s	(Z10.8)	1.0	-1E-08	0.01	OFF
6					
Velocity shear stress [SHEAR], 1/s ²	(Z10.8)	1.0	-1E-08	0.01	OFF
7					
Internal shear [ST], m ³ /s	(Z10.8)	1.0	-1E-08	0.01	OFF
8					
Bottom shear [SB], m ³ /s	(Z10.8)	1.0	-1E-08	0.01	OFF
9					
Longitudinal momentum [ADMX], m ³ /s	(Z10.8)	1.0	-1E-08	0.01	OFF
10					
Longitudinal momentum [DM], m ³ /s	(Z10.8)	1.0	-1E-08	0.01	OFF
11					
Horizontal density gradient [HDG], m ³ /s	(Z10.8)	1.0	-1E-08	0.01	OFF
12					
Vertical momentum [ADMZ], m ³ /s	(Z10.8)	1.0	-1E-08	0.01	OFF
13					
Horizontal pressure gradient [HPG], m ³ /s	(Z10.8)	1.0	-1E-08	10.0	OFF
14					
Gravity term channel slope [GRAV], m ³ /s	(Z10.8)	1.0	0.0	0.0	OFF
15					
.....CNAME.....	FMTC	CMULT	CMIN	CMAX	CPLTC
#					
TDS, g/m ³	(Z10.8)	1.0	-1.0	200.0	OFF
1					
Age, days	(Z10.8)	1.0	-1.0	-200.0	ON
2					
Tracer, g/m ³	(Z10.8)	1.0	-20.000	100.0	OFF
3					
Bacteria, col/100ml	(Z10.8)	1.0	-20.000	100.0	OFF
4					
Conductivity, mhos	(Z10.8)	1.0	-20.000	100.0	OFF
5					
Chloride, mg/l	(Z10.8)	1.0	-20.000	100.0	OFF
6					
ISS, g/m ³	(Z10.8)	1.0	-20.000	100.0	OFF
7					

Phosphate, g/m ³	(Z10.8)	1000.0	-1.0	500.0	OFF
8					
Ammonium, g/m ³	(Z10.8)	1000.0	-0.1000	300.0	OFF
9					
Nitrate-Nitrite, g/m ³	(Z10.8)	1.0	-0.1000	5.0	OFF
10					
Dissolved silica, g/m ³	(Z10.8)	1.0	-1.0	10.0	OFF
11					
Particulate silica, g/m ³	(Z10.8)	1.0	-0.2000	15.0	OFF
12					
Total iron, g/m ³	(Z10.8)	1.0	-0.1000	2.0	OFF
13					
Labile DOM, g/m ³	(Z10.8)	1.0	-0.1000	-3.0	OFF
14					
Refractory DOM, g/m ³	(Z10.8)	1.0	-0.1000	-4.0	OFF
15					
Labile POM, g/m ³	(Z10.8)	1.0	-0.1000	-3.0	OFF
16					
Refractory POM, g/m ³	(Z10.8)	1.0	-0.1000	-4.0	OFF
17					
CBOD1, g/m ³	(Z10.8)	1.0	-0.0100	3.0	OFF
18					
CBOD2, g/m ³	(Z10.8)	1.0	-0.0100	3.0	OFF
19					
CBOD3, g/m ³	(Z10.8)	1.0	-0.0100	3.0	OFF
20					
CBOD4, g/m ³	(Z10.8)	1.0	-0.0100	3.0	OFF
21					
CBOD5, g/m ³	(Z10.8)	1.0	-0.0100	3.0	OFF
22					
Algae, g/m ³	(Z10.8)	1.0	-0.0100	3.0	OFF
23					
Dissolved oxygen, g/m ³	(Z10.8)	1.0	-0.0100	-1.0	OFF
24					
Inorganic carbon, g/m ³	(Z10.8)	1.0	-0.0100	3.0	OFF
25					
Alkalinity, g/m ³	(Z10.8)	1.0	-0.0100	3.0	OFF
26					
.....CDNAME.....	FMTCD	CDMULT	CDMIN	CDMAX	CDPLTC
#					
Dissolved organic carbon, g/m ³	(F10.3)	1.0	-1.0	25.0	OFF
1					
Particulate organic carbon, g/m ³	(F10.3)	1.0	-1.0	50.0	OFF
2					
Total organic carbon, g/m ³	(F10.3)	1.0	-1.0	25.0	OFF
3					
Dissolved organic nitrogen, g/m ³	(F10.3)	1.0	-1.0	25.0	OFF
4					
Particulate organic nitrogen, g/m ³	(F10.3)	1.0	-1.0	25.0	OFF
5					
Total organic nitrogen, g/m ³	(F10.3)	1.0	-1.0	50.0	OFF
6					
Total Kheldahl Nitrogen, g/m ³	(F10.3)	1.0	-1.0	15.0	OFF
7					
Total nitrogen, g/m ³	(F10.3)	1.0	-1.0	15.0	OFF
8					
Dissolved organic phosphorus, mg/m ³	(F10.3)	1000.0	-1.0	25.0	OFF
9					
Particulate organic phosphorus, mg/m ³	(F10.3)	1000.0	-1.0	-1.0	OFF
10					
Total organic phosphorus, mg/m ³	(F10.3)	1000.0	-1.0	5.0	OFF
11					
Total phosphorus, mg/m ³	(F10.3)	1000.0	-1.0	20.0	OFF
12					
Algal production, g/m ² /day	(F10.3)	1.0	-1.0	5.0	OFF
13					

Chlorophyll a, mg/m ³	(F10.3)	1.0	-5.0	145.0	OFF
14					
Total algae, g/m ³	(F10.3)	1.0	-1.0	60.0	OFF
15					
Oxygen % Gas Saturation	(F10.3)	1.0	-1.0	50.0	OFF
16					
Total suspended Solids, g/m ³	(F10.3)	1.0	-1.0	5.0	OFF
17					
Total Inorganic Suspended Solids, g/m ³	(F10.3)	1.0	-1.0	20.0	OFF
18					
Carbonaceous Ultimate BOD, g/m ³	(F10.3)	1.0	5.0	9.0	OFF
19					
pH	(F10.3)	1.0	-1.0	10.0	OFF
20					
CO ₂	(F10.3)	1.0	-1.0	10.0	OFF
21					
HCO ₃	(F10.3)	1.0	-1.0	10.0	OFF
22					
CO ₃	(F10.3)	0.0	0.0	0.0	OFF
23					

In Version 3.2, the user has format control of all output variables, as well as MULT control (see User Manual). In Version 3.1, some groups had one but not the other. Also, in Version 3.2, the groups (HNAME, CNAME, CDNAME) were reordered.

10. Appendix B: BUG FIXES AND ENHANCEMENTS BETWEEN VERSIONS

There have been many updates and bug fixes between model versions. Even though some model updates have not been documented, we have tried to be diligent in outlining code updates since Version 3.7 between model versions. We have included below a series of tables with code fixes for multiple versions of CE-QUAL-W2 as a reference to earlier versions.

W2 V4.2 Bug Fixes, Enhancements, and User Manual Changes

Table 3 shows a list of model bug fixes since the prior release of CE-QUAL-W2 Version 4.1. Note that some of these fixes were documented before the first release of Version 4.2.

Table 3. List of bug fixes and enhancement code changes since CE-QUAL-W2 Version 4.2 was released. Note that shaded areas toggle between release versions.

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
1	W2	Particle tracking	Fixed a bug when a particle was in the “air” above the water surface when in a river a ‘deep slot’ was added to the river bathymetry to keep it hydrated. Also, fixed a reflection error off the surface for vertical movement of the particle.	12/26/2018
2	W2	Particle tracking	For file output for finalparticle.csv, adjusted header so that it would be general for any number of monitoring stations. Previously the header was hard-wired to write only 3 monitoring locations in the title. This does not affect prior model output information only the title header.	1/3/2019
3	PREW2	Pipe invert	The preprocessor gave a ‘false’ error for an invert elevation being below the grid in some rare cases. This has been fixed. The model was not affected.	1/21/2019
4	W2	TN	There was a bug in the calculation of TN when large concentrations of zooplankton were present. If zooplankton were not simulated or they were a small population, there would be no impact of this TN bug. Bug fixed.	1/29/2019

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
5	W2	Epiphyton periphyton burial and conversion to LPOM and sediments	The User Manual showed that the epiphyton parameter EB, burial rate, was in units of m/day. The model implemented this and also computed the cell layer burial rate as $EB \cdot EC$ (concentration of biomass per cell volume) * Surface area/Volume of a cell or $EB \cdot EC/H$ where H is the layer thickness. In reality though it should be the thickness of the periphyton layer. But that layer thickness is not predicted by the model. Hence, the decision was to change the burial rate to units of 1/day such that the loss of epiphyton by burial would follow a first order decay process (similar to the first order sediment model) as $EB \cdot EC$. Hence, this burial rate is no longer a function of the grid. Also, there was the conversion of organic matter and nutrients at death to the sediment P, N and C compartments whereas they should go directly to LPOM first. Hence only burial goes directly into the sediment compartments.	3/5/2019
6	W2	Output files	Code was written to print the initial condition in output files at time $t=0$ at the start of the simulation.	3/5/2019
7	W2	Restart with Sediment Diagenesis	Prior to this date, the restart option did not work with sediment diagenesis turned ON. This enhancement has been coded and debugged and is now working.	7/1/2019
8	W2	Dynamic loading	This is a new feature in CE-QUAL-W2 and applies to linear waterbodies in series. For example, if one has a river system with 9 waterbodies, the model user can break the model into 9 separate models and run them all in parallel where the downstream model dynamically updates its boundary conditions as the upstream model moves forward in time. This has resulted in significant time savings for model runs (90%).	7/1/2019
9	W2	Sediment Diagenesis	Output files were updated to write csv files that can be plotted easily in Excel. The older output files for sediment diagenesis were hard to graph formatted text output files. All internal writes for warnings are now written to the W2 warning file, w2.wrn, and all errors are written to the w2.err output file.	7/1/2019
10	W2	Sediment Diagenesis	Bug fixes were made to the scour section of the model. The code had several errors based on the documentation from CEMA. These have been fixed and synchronized with the description in the CEMA sediment diagenesis report. Thanks to Lindsay Bearup at the USBR! Also, the scour model was not set-up for both Chezy and Manning's friction factors. This code was generalized.	7/1/2019
11	W2	Output files	Output files were not initialized properly for w2.wrn during a restart. This was fixed allowing the w2.wrn file to be appended to rather than over-written.	7/1/2019

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
12	W2	Code updates	Pointers were allocated memory in the ALLOCATE command. This was non-standard Fortran usage and was fixed. There were extra calls to Kinetic_Rates and Temperature_Rates subroutines that were unnecessary during layer addition and in the INIT subroutine.	7/1/2019
13	W2	TDG	A new algorithm for TDG production at spillways, SYSTDG, was implemented in Version 4.2. This is a more detailed TDG correlation equation compared with the existing algorithms in Version 4.1 and before. The primary application was for the Columbia and Snake River dams. A separate technical memo is included with the User Manual on this new process.	7/1/2019
14	W2	opt to csv	Flux output files were changed from a file type opt to csv to facilitate graphing in Excel. Structure output files for the auto port selection were changed from opt to csv.	7/1/2019
15	W2	Contour output	The Tecplot and regular Contour output was not working for cases when branches went inactive. This has been fixed.	7/1/2019
16	W2	Sediment diagenesis	The input file for sediment diagenesis has been changed from w2_CEMA_input.npt to w2_diagenesis.npt for clarity of naming files. All output files have also been changed to include 'Diagenesis' as the first word and eliminating 'CEMA'. For example the file CEMALogFile.opt was changed to DiagenesisLog-File.opt.	7/1/2019
17	W2	Withdrawal	In the withdrawal subroutine, the kt index needed to be defined twice. Below is an example of the fix in 2 places: (1) <pre> ELR = SINA(JB)*DLX(ID)*0.5 ! CB 10/14/11 WSEL = ELWS(ID)-ELR ! CB 10/14/11 kt=ktwb(jw) ! cb 07/24/19 CALL DOWNSTREAM_WITHDRAWAL_ESTIMATE(JSTSPLT(J,1),TEMPTOP,EST R(JSTSPLT(J,1),TSPLTJB(J))) </pre> (2) <pre> WSEL = ELWS(IWD(JWD))-ELR ! CB 10/14/11 I=IWD(JWD) kt=ktwb(jjw) ! cb 07/24/19 CALL LATERAL_WITHDRAWAL_ESTIMATE(JSTSPLT(J,1),TEMPTOP,EWD(JS TSPLT(J,1))) </pre>	8/1/2019
18	W2	Branch inactive	The BR_INACTIVE flag that skips output in a branch that was inactive was dimensioned with the wrong variable for the CPL output (Tecplot output). This has been corrected.	8/27/2019
19	W2	Tecplot Branch	There is a new input file to specify what branches the user wants for Tecplot output, called TecplotBr.csv. This allows the user to only pick some of the branches rather than all of them for Tecplot output.	8/27/2019

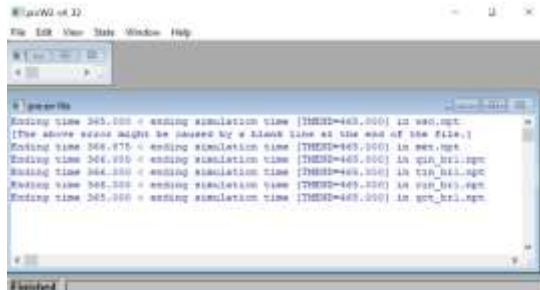
#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
20	Prew2	False warning	A false warning was sometimes activated for pipes for DYNPIPE when in fact was ON or OFF as required. This was fixed. Below is final code fix: <pre> IF ((DYNPIPE(JP) /= 'ON') .AND. (DYNPIPE(JP) /= 'OFF')) THEN CALL ERRORS WRITE (ERR,FMTI) 'Pipe DYNAMIC PIPE control [DYNPIPE='//DYNPIPE(JP)(4:8)//'] must be either "ON" or "OFF" for pipe </pre>	8/27/2019
21	W2	str_brX.opt	Structure output file, str_brX.opt, for automatic port selection was changed from a text delimited *.opt file to a comma delimited *.csv file	8/28/2019
22	W2	Auto Port Selection	The split algorithm for the auto port selection based on temperature now can read an input file of dynamic temperatures rather than relying on multiple rules with different fixed temperatures.	8/30/2019
23	W2	Tecplot	Tecplot output under the CPL output was not set up for restart properly. Tecplot output files now should work for cases where there are model restarts.	9/4/2019
24	W2	Water age	The code below for water age correction as a result of evaporation (a very minor adjustment) was incorrect: The old code was <pre> IF(AERATEC == "ON")CALL AERATEMASS IF (EVAPORATION(JW) .AND. WATER_AGE_ACTIVE)THEN ! CORRECT WATER AGE FOR EVAPORATION SR 7/27/2017 DO I=IU,ID JC=NGCS+JG_AGE-1 CSSB(KT,I,JC)=CSSB(KT,I,JC)-EV(I)*CG(KT,I,JC) ENDDO ENDIF </pre> The updated code is <pre> IF(AERATEC == "ON")CALL AERATEMASS IF (EVAPORATION(JW) .AND. WATER_AGE_ACTIVE)THEN ! CORRECT WATER AGE FOR EVAPORATION SR 7/27/2017 DO I=IU,ID JC=NGCS+JG_AGE-1 CSSB(KT,I,JC)=CSSB(KT,I,JC)- EV(I)*CG(KT,I,JG_AGE) ENDDO ENDIF </pre>	10/17/2019
25	W2	Pipe algorithm	The pipe algorithm was revised to reduce issues with pipe algorithm instabilities. There is error trapping to reduce the prevalence of growing instabilities from a water surface slope that becomes unstable.	11/1/2019

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
26	W2	W2 fixes	Small fixes that do not affect the model user: Eliminated the unused variable PHISSET and changed INTEGER*8 variables in the SYSTDG algorithm to INTEGER*4. Thanks to Stewart Rounds USGS for noting these items.	11/13/2019
27	W2	Turbidity	<p>Turbidity can be used through the sediment diagenesis model as a derived variable. This will shortly be moved to a derived constituent in W2 and taken out of the sediment diagenesis subroutine. There was a coding error in the turbidity routine that was fixed:</p> <pre> !CellTSSValue = C1(K,SegNumI,6) !CellTSSValue = TOTSS(K,SegNumI) !SW 11/15/2019 C1(K,SegNumI,nturb) ! cb 2/18/13 !C1(K,SegNumI,6) = exp(CoeffA_Turb*log(CellTSSValue) + CoeffB_Turb) !C2(K,SegNumI,6) = exp(CoeffA_Turb*log(CellTSSValue) + CoeffB_Turb) !C1(K,SegNumI,nturb) = exp(CoeffA_Turb*log(CellTSSValue) + CoeffB_Turb) ! cb 2/18/13 !C2(K,SegNumI,nturb) = exp(CoeffA_Turb*log(CellTSSValue) + CoeffB_Turb) C1(K,SegNumI,nturb) = exp(CoeffA_Turb*log(TOTSS(K,SegNumI)) + CoeffB_Turb) ! cb 2/18/13 C2(K,SegNumI,nturb) = C1(K,SegNumI,nturb) !exp(CoeffA_Turb*log(CellTSSValue) + CoeffB_Turb) </pre>	11/15/2019
28	W2	Examples and User Manual	The kinetic flux output order for DOEP and DOAR was reversed in a couple of the input files in the model example files (in w2_con.npt) and in one place in the User Manual. These were corrected.	11/15/2019

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
29	W2	Branch Active	<p>In the process of setting inflows to upstream inactive branches to branches that were still active, the following code was updated for complex, multi-waterbody systems: [Chris Berger]</p> <pre> IF (BR_INACTIVE(JB)) THEN ! CONVERT INFLOWS TO TRIBS SET TO THE CUS(1) LOCATION JTT=JTT+1 ! ITR(JTT)=CUS(1) ! HARDWIRED TO FIRST BRANCH ITR(JTT)=CUS(jbdn(jw)) ! changed HARDWIRE TO JBDN BRANCH ! cb 11/20/19 QTR(JTT) = QIN(JB) ... ! including tributary flows for inactive branches DO JW=1,NWB ! cb 11/20/19 KT = KTWB(JW) DO JB=BS(JW),BE(JW) IF (BR_INACTIVE(JB)) then IU = CUS(JB) ID = DS(JB) IF (TRIBUTARIES) THEN DO JT=1,JTT !***** Inflow fractions IF (JB == JBTR(JT)) THEN I = cus(jbdn(jw)) ! plac- ing tributary flows in upstream end of main branch QTRF(KT:KB(I),JT) = 0.0 KTTR(JT) = KT KBTR(JT) = KB(I) KTTR(JT) = MAX(KT,KTTR(JT)) KBTR(JT) = MIN(KB(I),KBTR(JT)) IF (KBTR(JT) < KTTR(JT)) KBTR(JT) = KTTR(JT) BHSUM = 0.0 DO K=KTTR(JT),KBTR(JT) BHSUM = BHSUM+BH2(K,I) END DO DO K=KTTR(JT),KBTR(JT) QTRF(K,JT) = BH2(K,I)/BHSUM END DO DO K=KTTR(JT),KBTR(JT) QSS(K,I) = QSS(K,I)+QTR(JT)*QTRF(K,JT) END DO END IF END DO END IF end if end do end do </pre>	11/22/2019

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
30	W2	WRN output	<p>The warning output format was improved when there were volume balance errors – thanks to Stewart Rounds, who defies retirement to provide model improvements!!</p> <p>In the subroutine, balances.f90, the new code is shown below:</p> <pre> IF (VOLUME_WARNING) THEN WRITE (WRN, '(A,F0.4,/A,I0,A,I0,A,I0,3(:/A,E15.8, A))') & 'COMPUTATIONAL WARNING AT JULIAN DAY = ',JDAY, & 'WATERBODY=', JW, ', BRANCH=', JB, ', KT=', KT, & 'SPATIAL CHANGE =', VOLSBR(JB), ' M^3', & 'TEMPORAL CHANGE =', VOLTBR(JB), ' M^3', & 'VOLUME ERROR =', VOLSBR(JB)-VOLTBR(JB), ' M^3' !SR 11/16/19 WRITE (WRN,*) 'LAYER CHANGE:', LAYERCHANGE(JW) WRITE (WRN,*) 'SZ', SZ(CUS(JB):DS(JB)), 'Z', Z(CUS(JB):DS(JB)), 'H2KT', H2(KT,CUS(JB):DS(JB)), & 'H1KT', H1(KT,CUS(JB):DS(JB)), 'WSE', ELWS(CUS(JB):DS(JB)), 'Q', Q(CUS(JB):DS(JB)), & 'QC', QC(CUS(JB):DS(JB)), 'T1', T1(KT,CUS(JB):DS(JB)), 'T2', T2(KT,CUS(JB):DS(JB)), & 'SUKT', SU(KT,CUS(JB):DS(JB)), 'UKT', U(KT,CUS(JB):DS(JB)), 'QIN', QINSUM(JB), & 'QTR', QTR, 'QWD', QWD !SR 11/16/19 WARNING_OPEN = .TRUE. </pre>	12/2/2019

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
31	W2	W2 Error Dump	<p>The W2ErrorDump.opt file output format was changed to be easier to analyze. The file was changed to W2ErrorDump.csv to facilitate opening in Excel and for general plotting. The new code is from Stewart Rounds and is found in endsimulation.f90.</p> <p>Old code:</p> <pre>!OPEN(W2ERR,FILE='W2Errordump.opt',status='unknown') !WRITE(w2err,*) 'JDAY',jday,'SZ',sz,'Z',z,'H2KT',h2(kt,1:imx),'H1KT',h1(kt,1:imx),'BHR1',bhr1(kt,1:imx),'BHR2',bhr2(kt,1:imx),'WSE',elws,'Q',q,'QC',qc,'QERR',qerr,'T1',t1(kt,1:imx),'T2',t2(kt,1:imx),'SUKT',su(kt,1:imx),& ! 'UKT',u(kt,1:imx),'QIN',qin,'QTR',qtr,'QWD',qwd</pre> <p>New Code:</p> <pre>OPEN (W2ERR,FILE='W2Errordump.csv',status='unknown') WRITE (W2ERR,*) 'JDAY = ', JDAY WRITE (W2ERR,'(A,1000(" ",F0.6))') 'QIN:', (QIN(J),J=1,NBR) WRITE (W2ERR,'(A,1000(" ",F0.6))') 'QTR:', (QTR(J),J=1,NTRT) WRITE (W2ERR,'(A,1000(" ",F0.6))') 'QDT:', (QDTR(J),J=1,NBR) WRITE (W2ERR,'(A,1000(" ",F0.6))') 'QWD:', (QWD(J),J=1,NWDT) WRITE (W2ERR,'(/A)') 'SEG,BRANCH,KT,WSE,SZ,Z,Q,QC,QERR,H2KT,H1KT,BHR1,BHR2,T1,T2,SUKT,UKT' DO JW=1,NWB KT = KTWB(JW) DO JB=BS(JW),BE(JW) DO I=US(JB)-1,DS(JB)+1 WRITE (W2ERR,'(I0," ",I0," ",I0,14(" ",F0.6))') I, JB, KT, ELWS(I), SZ(I), Z(I), Q(I), QC(I), QERR(I), H2(KT,I), H1(KT,I), BHR1(KT,I), BHR2(KT,I), T1(KT,I), T2(KT,I), SU(KT,I), U(KT,I) END DO END DO END DO</pre>	12/30/2019
32	W2	Multiple Waterbody	<p>Stewart Rounds improved on the code presented in Version 4.2. Instead of writing and reading restart files, the code waited for the updates before proceeding. This led to code changes in many subroutines. Also, the downstream model can now wait for input from multiple upstream files rather than just one. This update is described in the User Manual and is part of the Version 4.2.1 model update because of a new input file format for the multiple waterbody input file.</p>	1/2/2020

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
33	PREW2	Preprocessor	<p>A new feature was added to the preprocessor – a new windows pops up with errors if they are present. This avoids having to open the pre.err file in a word processor in case there were errors.</p> 	3/15/2020
34	W2	Pump	<p>Added features were added to the pump algorithm. This allows for the flow through a pump to be controlled by the downstream water level, rather than just the upstream level. If this is the case, then a negative downstream segment number is used. This also changes the logic of ELON and ELOFF. This has been updated in the User Manual also.</p>	3/15/2020
35	W2/PREW2	Control file	<p>A new control file option was created in Excel using a comma delimited control file, w2_con.csv. This control file is a lot simpler to use than the text file w2_con.npt because (1) strict formatting by spaces is not required, (2) easier to cut and paste large sections withing Excel, (3) variable explanations are available in Column A, (4) the graph.npt file is no longer required and is incorporated into the Excel based input file, and (5) there is a one-button function to write the input file into csv format for reading into the W2 code.</p> <p>This file also has many other advantages in setting up output and more intuitive variable placement (i.e., the order of the old w2_con.npt is not strictly followed.) The only negative is that it breaks the GUI W2_Control which is not necessary other than the nice visualization bathymetry tools. But many of those are in the w2Tools post-processor. There is currently not a converter from the old format to the new one. But the model executable and preprocessor work with either control file.</p>	4/16/2020
36	W2	TSR	<p>TSR model output headers were improved. The P, N, and Light limitation for algae headers (APLIM, ANLIM, ALLIM) now show the algae group number rather than a generic header, such as PLIM_ALG1.</p>	5/3/2020
37	Converter	Control file	<p>A control file converter utility and description was added to the download package. This utility converts the control file (w2_con.npt) to a format using Excel.</p>	5/22/2020
39	PreW2	More checks	<p>Several additional model checks were added to the preprocessor to improve its skill set.</p>	5/22/2020 6/15/2020

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
40	W2	Tecplot output	A new input file Tecplotbr.csv is now used to specify which branches are output to the Tecplot contour map. Before, all model branch information was output to the Tecplot file. Now the user can control this more precisely to eliminate a lot of post-processing of the data file. This is described in the User Manual.	5/22/2020
41	W2	CO2 in atmosphere	As the basis for Version 4.2.2, the CO2 gas saturation was redone. See User Manual Part 2 under TIC.	8/10/2020
42	Converter		Fixed a bug in writing out the csv format for the control file in case there were more than 1 withdrawals.	8/27/2020
43	W2	SPR ONV	Whenever the SPR was set equal to ONV for a w2_con.csv file, this output was not implemented correctly. For the input file w2_con.npt this worked as expected.	10/8/2020
44	Converter		Fixed a bug when NTR was exactly 9 (this bug also affected cases where NWB=9 or NBR=9). Also fixed some of the output formatting.	11/27/2020
45	W2	Pipe	A dimensioning bug was found when there were no pipes. This did not affect model results with the executable but did show up using the debugger in the Intel environment. This has been fixed. Many thanks to Jun Ma for noticing that!!	12/20/2020
46	W2/Pre/Converter	Csv input	When converting to the Excel macro utility for the control file and when modeling a system with no tributaries, the columns read for distributed inflows and precipitation may have been read incorrectly. This was adjusted by fixing the converter utility, the preprocessor and W2 code.	2/17/2021
47	W2	Kinetic Flux	<p>When there are layer subtractions, the Kinetic flux in the surface layer terms can not account for the mass. This did not affect the mass balance of the constituents, just the flux variables used for output. Many thanks for Taylor Adams of Hydros for finding that error.</p> <p>In layeraddsubtract.f90:</p> <pre> KF(KT,I,KFCN(1:NAF(JW),JW)) = (KF(KT-1,I,KFCN(1:NAF(JW),JW))*VOL(KT-1,I)+ KF(KT,I,KFCN(1:NAF(JW),JW))*VOL(KT,I))/(VOL(KT-1,I)+VOL(KT,I)) ! SW Fix suggested by Taylor Adams Hydros 25Feb2021 ! KF is in units of g/m3/s KFS(KT,I,KFCN(1:NAF(JW),JW)) = KFS(KT-1,I,KFCN(1:NAF(JW),JW))+KFS(KT,I,KFCN(1:NAF(JW),JW)) ! SW Fix suggested by Taylor Adams Hydros 25Feb2021 ! KFS is in units of g KFS=KF*VOL*DT C1(KT-1,I,CN(1:NAC)) = 0.0 </pre>	2/25/2021

W2 V4.1 Bug Fixes, Enhancements, and User Manual Changes

Table 4. Bug fixes and enhancements for Version 4.1.

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
1	PREW2	Additional checks	Additional checks were added to the preprocessor for sediment decay temperature coefficients and stoichiometric coefficients. Concentration summaries in downstream and upstream head boundary conditions were added to the pre.opt file.	5/19/2017
2	W2	DO Saturation	<p>The equation for computing dissolved oxygen saturation was a function of elevation and temperature. If the user set the water body type to SALT, the TDS or salinity was used to correct the dissolved oxygen saturation. The TDS correction for dissolved oxygen saturation was added to the fresh water computation also.</p> <p>The new code is highlighted below:</p> <pre> SATO = EXP(7.7117- 1.31403*(LOG(T+45.93)))*P IF (SALT_WATER) THEN SATO = EXP(LOG(SATO) - SAL*(1.7674E-2- 1.0754E1/(T+273.15)+2.1407E3/(T+273.15)** 2)) ! SAL is in ppt ELSEIF (SAL > 100.) THEN SATO = EXP(LOG(SATO) - (SAL/1000.)*(1.7674E-2- 1.0754E1/(T+273.15)+2.1407E3/(T+273.15)** 2)) ! SAL is in mg/l ENDIF </pre>	5/21/2017
3	W2	Sediment diagenesis output	Another line was added to the sediment diagenesis input file for the frequency of output. Prior to this it used the TSR output frequency and wrote out duplicate results if there was more than 1 waterbody.	5/25/2017
4	W2	Initialize variables	DLVOL, VOLTBR, EVBR, and QSUM were added to the initialized variables in INIT.F90. This only affects the Fortran compiler when it is in debug model. In the release executable all variables are initialized to zero even if not explicitly set to zero.	7/24/2017

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
5	W2	Sediment diagenesis code updates	<p>We have deleted unused variables and array initializations. This has improved the speed of running the model with sediment diagenesis. These code areas are:</p> <pre> !SP CEMA if(sediment_diagenesis)then If(CEMARElatedCode .and. IncludeBedConsolidation)Call ComputeCEMARElatedSourceSinks ! If(CEMARElatedCode .and. IncludeCEMASedDiagenesis)Call ComputeCEMADIagenesisSourceSinks SW 6/27/2017 end if !End SP CEMA !SP CEMA !if(sediment_diagenesis)then ! If(CEMARElatedCode .and. IncludeBedConsolidation)TSS = 0.0 ! SW 7/27/2017 !end if !End SP CEMA !SP CEMA !if(sediment_diagenesis)then ! CEMATSSCopy = TSS !end if !End SP CEMA </pre>	7/24/2017
6	PREW2	Sediment diagenesis	Additional error checking for the sediment diagenesis model was added to the preprocessor. In this case, whenever SOD was not set to zero, an error is displayed.	7/24/2017
7	W2	Assorted code improvements	Stewart Rounds of the USGS suggested a few minor updates: eliminated extra right-parentheses in a format description for time series output (the Intel compiler allowed them!), added WARNING_OPEN and ERROR_OPEN = .TRUE. in several cases where output is written to these files, and eliminated a situation where the derived output file at a withdrawal point was not written out if the file is empty. Also, for water age, evaporation should not concentrate the 'age'. Hence code was added to recognize water age and to eliminate the effect of evaporation on water age.	7/27/2017
8	W2	Branch active or inactive	In the W2 model, if a model branch became dehydrated, the model would not continue running. In order to allow for wide varieties of water levels, users would often have to add numerous deep fictitious layers to keep a branch hydrated. Now the model can handle branches becoming active or inactive automatically. Code was added to allow branches to become active as they fill up or to become inactive if they lose their water. Also, any branch inflows or tributaries entering inactive branches are automatically moved to the current active segment of the nearest hydrated branch.	7/27/2017

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
9	W2	RPOMN	<p>Stewart Rounds, USGS, found this one. The if test below used NRPOMP rather than NRPOMN. Usually both NRPOMN and NRPOMP are both 'ON', so for most applications this should not affect the model user.</p> <p>OLD Code:</p> <pre>IF(CAC(NRPOMP) == ' ON')THEN IF(RPOM(K,I).GT.0.0)THEN ORGNRP(K,I)=RPOMN(K,I)/RPOM(K,I)</pre> <p>NEW Code:</p> <pre>IF(CAC(NRPOMN) == ' ON')THEN IF(RPOM(K,I).GT.0.0)THEN ORGNRP(K,I)=RPOMN(K,I)/RPOM(K,I)</pre>	8/2/2017
10	W2	Screen Dialog Box	Under some unique conditions, exiting the W2 dialog box reinitializes some of the output files. Added code was inserted to STOP program execution after closing the dialog box.	8/23/2017
11	W2	Sediment Diagenesis	Flux rates for P, NH3, and NO3 were added to the MASSBAL output file from sediment diagenesis so that a complete N and P balance can be evaluated for a waterbody.	8/31/2017
12	W2	Particle Tracking	Particle tracking algorithm has been added and documentation in a separate report added to the model release	8/31/2017
13	W2	Opt to csv file	Changed flowbal.opt and massbal.opt to flowbal.csv and massbal.csv in order to facilitate opening in Excel.	8/31/2017
14	W2	Gate file	The gate file was inadvertently not converted over to a csv format in the earlier Version 4.0 code. The 4.1 code was updated to include csv gate files.	9/26/2017

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
15	W2	Shading	<p>Added code to allow for a canopy shading in addition to dynamic shading. The DYNOSH in the shade input file can now be a negative number between -1 and 0. This will activate dynamic shading and taking the absolute value of this number will reduce the short wave solar radiation by a fixed fraction as if some of the channel has a canopy. Of course canopy cover is more complex than this small correction since it also affects long-wave radiation transfer. New code is highlighted below:</p> <pre> SN = MIN (HT*ABS (SIN (ABS (PHI0(I)- AZ00))) / TAN (A0)-EDGE, BI(KT,I)) SFACT = SRED*SN/BI(KT,I) 100 CONTINUE SHADE(I) = MAX (0.0, 1-SFACT) SHADE(I) = MIN(ABS(SHADEI(I)), SHADE(I)) ! SW 10/2/2017 Allows for fixed canopy cover over ! top of channel - only used if shade is less than ! shadei only valid for -0.99 and 0.0 </pre> <p>Hence if DYNOSH (or SHADEI) in the code were -0.9 and the dynamic shading algorithm computed the shade factor as 0.95 (which is a 5% reduction in short wave solar), the code would use 0.9 or a 10% reduction in short-wave solar. If the dynamic shade algorithm computes a shade greater than the fixed rate, the minimum of these is used.</p>	10/3/2017
16	W2	Sediment Diagenesis	<p>Changed back to the original segment width at the bottom for sediment diagenesis so that this algorithm replicates the original CEMA sediment diagenesis algorithm. Pulled out the CellArea as a dimensioned variable computed only once rather than for each cell at each time step. Also, added a control variable to turn ON/OFF Bubbles calculation. This saves much computational time and until the Bubbles subroutine is vetted we do not recommend its use. Also several code fixes were made in the sediment diagenesis module for mistakes in the original algorithm.</p>	10/3/2017, 10/22/2017
17	W2	User Manual	<p>The User Manual was updated fixing minor errors and typos and adding discussion of new features of Version 4.1. This is Revision 1 of the 4.1 Manual but includes updates and fixed typos from the Version 4.0 Manual and explanations of new features.</p>	10/3/2017
18	W2	Kinetic fluxes for ADD Layer	<p>A bug was corrected in the Kinetic Flux layer addition code as shown below:</p> <pre> KFS(KT,I,KFCN(1:NAF(JW),JW)) = KFS(KT+1,I,KFCN(1:NAF(JW),JW)) !KF(KT+1,I,KFCN(1:NAF(JW),JW)) CODE ERROR FIX SW 10/24/2017 </pre> <p>This does not affect fluxes in the TSR file, only the cumulative fluxes (KFS) during an add layer event for the surface layer only.</p>	10/24/2017

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
19	W2	Header	Changed header for flux for DO reaeration from just source to source/sink which can occur during super-saturation. KFNAME(64) = 'DO reaeration - source/sink, kg/day'	10/24/2017
20	W2	Fluxes	In the file, kfl_wbX.opt where X is the waterbody number, the fluxes are presented in the same format as a snapshot file. The headers showed fluxes in kg/d but they were in kg. This has been corrected. The fluxes in kg/d in the file kflux_wbX.opt were already in the correct units of kg/d. Also, added the following code since KT would have been from the prior waterbody rather than the current waterbody: <pre> DO JW=1,NWB KT = KTWB(JW) ! SW 10/25/2017 IF (FLUX(JW)) CALL KINETIC_FLUXES END DO </pre>	10/24/2017
21	W2	Pumps	Changed some of the logic for pumps to avoid settings for older values influencing the current settings. The following code was added to hydroinout.f90: <pre> ILAT = 0 JWW = NWD withdrawals = jww > 0 if(nwdt>nwd)qwd(nwd+1:nwdt)=0.0 ! SW 10/30/2017 JTT = NTR tributaries = jtt > 0 if(ntrt>ntr)qtr(ntr+1:ntrt)=0.0 ! SW 10/30/2017 JSS = NSTR </pre>	10/30/2017

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
22	W2	TDG at spillway	<p>Since the new implementation of the TDG algorithm, the withdrawal.f90 algorithm at spillways had not been updated properly. This fix applies to the computation of TDG at spillways and gates. The old and new code are shown below:</p> <pre> !if(tdgon)then ! cb 11/6/17 !cdavg(js,jb,16) = (cavg(js,jb,ndo)/exp(7.7117- 1.31403*(log(tavg(js,jb)+45.93))))*palt(id))*1 00.0 dosat=exp(7.7117- 1.31403*(log(tavg(js,jb)+45.93))))*palt(id) cdavg(js,jb,16)=(cavg(js,jb,ndo)/dosat)*100.0 IF(ngctdg /= 0)THEN EA = DEXP(2.3026D0*(7.5D0*TDEW(JW)/(TDEW(JW)+237.3 D0)+0.6609D0))*0.001316 ! in mm Hg 0.0098692atm=7.5006151mmHg !cdavg(js,jb,NDC) = (cavg(js,jb,NGN2)/(1.5568D06*0.79*(PALT(ID)- EA)*(1.8816D-5 - 4.116D-7 * Tavg(js,jb) + 4.6D-9 * Tavg(js,jb)**2)))*100.0 ! SW 10/27/15 n2sat=1.5568D06*0.79*(PALT(ID)- EA)*(1.8816D-5 - 4.116D-7 * Tavg(js,jb) + 4.6D-9 * Tavg(js,jb)**2) cdavg(js,jb,NDC) = 100.*(0.79*(cavg(js,jb,NGN2)/n2sat) + 0.21*(cavg(js,jb,ndo)/dosat)) ENDIF !end if </pre>	11/8/2017
23	W2 Control	Updated GUI	<p>A new version of W2Control has been made to account for a large number of small refinements in the control file to bring it up to Version 4.1. Otherwise, some of these changes had to be implemented by editing the text file, w2_con.npt. Also, guidance was added to the release notes how to use the GUI with a touch-screen laptop or desktop in cases where the touch screen does not work with the GUI.</p>	3/10/2018

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
24	W2	Csv file input for shade file	<p>Updated reading in csv file for shade file to be compatible with preprocessor. Sometimes one needs to add an extra column of commas in a csv input file.</p> <p>New code:</p> <pre> IF (INFORMAT=='\$') THEN READ (SHD, '(/)') DO I=1, IMX READ (SHD, *) J, SHADEI(I) ! SW 3/14/2018 ADDED TO BE COMPATIBLE WITH PREPROCESSOR IF (SHADEI(I) < 0.0) THEN BACKSPACE (SHD) READ (SHD, *) J, SHADEI(I), TTLB(I), TTRB(I), CLLB(I), CLRB(I), SRLB1(I), SRLB2(I), SRRB1(I), SRRB2(I), (TOPO(I, J), J=1, IANG), SRFJD1(I), SRFJD2(I) ENDIF ENDDO </pre>	3/14/2018
25	W2	TSR file output	<p>When the model user sets the elevation as a negative value, the model outputs variables at that layer only. When the water level went below that layer, the output was fixed at the old value of the variable until the water level rose into the layer. To eliminate issues with misinterpreting or having to edit out constant values, whenever the water level is below the layer, now a -99 is written out showing that there is no water in the layer specified.</p>	4/5/2018
26	PREW2	More checks	<p>Added checks for NaN in input files for meteorological files and flow, temperature and concentration files for inflows, distributed tributaries, precipitation, and tributaries. Previously, the preprocessor read input files even with NaN without reporting an error since this is a proper numerical value.</p>	4/10/2018
27	W2	WDO output	<p>The Withdrawal files are often used for downstream models. The withdrawal output frequency is in days. In order to make this more precise numerically, the output frequency can also be entered in hours and seconds. The problem was that 1 hour is 0.04167 days and due to round off error for long term runs of many years, the hourly frequency output would not be at the same hour. The variable WDOC now can be ON/OFF/ONS/ONH where ONS means the output frequency is in sec and ONH means the output frequency is in hours. The User Manual, GUI, and Preprocessor have been updated.</p>	4/10/2018
28	Water-balance	Water-balance	<p>A new waterbalance utility was released that is a console application and can be used in batch file processing. It also has more features than the old water balance utility allowing the use of multiple waterbodies in the calculation of flows. There is a new file directory for this application in the download section as well as executables and a User Manual for this utility.</p>	4/10/2018

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
29	PREW2	More checks	Several more preprocessor enhancements were added to the preprocessor to check for Unix file type where an EOL is a <CR> and not the windows <CR><LF>. Also a few more descriptions were added to the error output to clarify where a problem may be.	4/18/2018
30	Water-balance	Water-balance	Some refinements to the water balance utility console application were made.	6/5/2018
31	W2	Sediment Resuspension	<p>The sediment resuspension algorithm computed sediment resuspension in all model layers except the surface layer. The fix below adds resuspension for the surface layer (highlighted code is new).</p> <pre> IF (SEDIMENT_RESUSPENSION(J)) THEN FETCH = FETCHD(I,J) IF (COS(PHI(JW)-PHI(I)) < 0.0) FETCH = FETCHU(I,J) FETCH = MAX(FETCH,BI(KT,I),DLX(I)) U2 = WIND(JW)*WSC(I)*WIND(JW)*WSC(I)+NONZERO COEF1 = 0.53 *(G*DEPTHB(KT,I)/U2)**0.75 COEF2 = 0.0125*(G*FETCH/U2)**0.42 COEF3 = 0.833* (G*DEPTHB(KT,I)/U2)**0.375 COEF4 = 0.077* (G*FETCH/U2)**0.25 HS = 0.283 *U2/G*0.283*TANH(COEF1)*TANH(COEF2/TANH(COEF1)) ITS = 2.0*PI*U2/G*1.2* TANH(COEF3)*TANH(COEF4/TANH(COEF3)) TS = 2.0*PI*sqrt(U2)/G*1.2* TANH(COEF3)*TANH(COEF4/TANH(COEF3)) ! cb 7/15/14 L0 = G*TS*TS/(2.0*PI) L1 = L0 ! SW 6/28/2018 Allow for resuspension of surface layer L = L0*TANH(2.0*PI*DEPTHB(KT,I)/L1) DO WHILE (ABS(L-L1) > 0.001) L1 = L L = L0*TANH(2.0*PI*DEPTHB(KT,I)/L1) END DO COEF = MIN(710.0,2.0*PI*DEPTHB(KT,I)/L) UORB = PI*HS/TS*100.0/SINH(COEF) TAU = 0.003*UORB*UORB IF (TAU-TAUCR(J) > 0.0) EPSILON = MAX(0.0,0.008/49.0*(TAU-TAUCR(J))*3*10000.0/DLT) SSR = EPSILON*DLX(I)*(BI(KT,I)- BI(KT+1,I))/VOL(KT,I) END IF SSSS(KT,I,J) = - SSS(J)*SS(KT,I,J)*BI(KT,I)/BH2(KT,I)+SSR </pre>	6/28/2018
32	W2	Sediment Flux	<p>Added 'RECURSIVE' to the subroutine definition as it calls itself and recent updates to the Intel compiler flagged this as an error.</p> <pre> RECURSIVE Subroutine CEMASedimentDiagenesis Use MAIN Use GLOBAL Use GEOMC Use SCREENC </pre>	6/28/2018
33	PREW2	Added checks	Assorted minor updates to error checks	7/1/2018

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
34	PREW2	Consolidation	Update to checking code in sediment diagenesis for consolidation. New code: <pre> Read(5000,*)MessageTemp, LayerAddThkFrac Read(5000,*)MessageTemp, NumConsolidRegs if(IncludeBedConsolidation .and. NumConsolidRegs == 0)then ! CB 7/9/2018 changed .or. to .and. CALL ERRORS </pre>	7/9/2018
35	W2	Sediment	The sediment model allows for first order sediment decay in the layers above the bottom layer. If a modeler set as an initial condition a finite value for the initial concentration of sediment, then the amount in layer kb would be there and not transfer eventually to the sediment diagenesis layer as downward sloughing occurs. Hence, if the model user sets an initial concentration of the first order sediment model and has turned on sediment diagenesis, then the code sets the value of sediment in layer kb to zero. The code fix for SED is shown below: <pre> SED(KT,I) = SED(KT,I)/H2(KT,I) If(CEMARElatedCode .and. IncludeCEMASedDiagenesis)then ! cb 07/23/18 SED(KT+1:KB(I)-1,I) = SED(KT+1:KB(I)-1,I)/H2(KT+1:KB(I)-1,I) sed(kb(i),i)=0.0 else SED(KT+1:KB(I),I) = SED(KT+1:KB(I),I)/H2(KT+1:KB(I),I) end if END DO </pre> Similar code fixes were applied to SEDP, SEDC and SEDN.	7/23/2018
36	W2	TSR output	When a branch goes inactive, the TSR output file continued to write output information even though the segment was not hydrated. Logic was added to skip output for a TSR file if the segment was inactive or if the fixed layer was above the surface layer. <pre> DO J=1,NIKTSR I = ITSR(J) ! find out if segment is inactive OR cell is inactive for fixed layer - do not write out tsr file ! SW 7/24/2018 IF(BR_INACTIVE(JBTSR(J)))CYCLE IF(CUS(JBTSR(J)) > I)CYCLE DO JW=1,NWB IF (I >= US(BS(JW))-1 .AND. I <= DS(BE(JW))+1) EXIT END DO IF(ETSR(J) < 0)THEN ! SW 7/24/2018 IF(INT(ABS(ETSR(J))) < KTWB(JW))CYCLE ENDIF </pre>	7/24/2018

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
37	W2	WRN	When a branch becomes ACTIVE, it is now written out to the WRN file (this was previously written out to the SNP file and only when INACTIVE to the WRN file).	7/24/2018
38	W2	SO4 in Sediment	The code was updated to compute SO4 in both the aerobic and anaerobic layers and to allow diffusion from the water column to the sediment. This was previously not implemented. Also, updates were made to the bed consolidation routine in the sediment diagenesis model.	8/1/2018
39	W2, PREW2	Constriction	<p>This is a model enhancement: The model user can specify a maximum width between segments by specifying that in a new input file called 'constriction.csv'. This does not affect the volume of the segments – it only affects the right hand side face width. Whereas an internal weir blocks all the flow, this allows for a reduced area and eliminates the need to insert a short segment of small width that can cause stability and lowered time step issues.</p> <p>The new input file is 'constiction.csv' and has the following format: Line 1: Comment Line 2: # of constrictions Line 3: Comment Line 4: [Repeated by # of constrictions] Segment # of constriction, Maximum width in m of constriction</p> <p># of Constrictions 1 Seg # Max width, m 10 115</p> <p>The W2 code looks for 'constriction.csv' – if it is found, then it reads the file and applies this to the right hand side width between 2 segments.</p> <p>Updates were made to the User Manual, Preprocessor and W2 Executables</p>	8/3/2018
40	W2	Restart	If there were WDO output files, the RESTART option may not have worked properly. A code fix was implemented for a RESTART with WDO output files.	8/3/2018
41	W2	Envir Perf	The environmental performance output was updated to include the descriptive terms: 'Sum of fractions' and 'Average'. The User Manual was updated.	8/6/2018
42	W2	Particle Transport	Tracking the time history of temperature, velocity and depth of particles was added to the particle transport algorithm. The file 'particle.csv' now includes information on histogram output for each particle released into the waterbody. The User Manual and Preprocessor were also updated for this new feature.	8/6/2018

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
43	W2	Layer subtract	<p>When the W2 model adds a deep slot in shallow rivers, the variable AVHR in layeraddsub.f90 was defined for an inactive segment incorrectly. This code was cleaned up. New code is shown below:</p> <pre> DEPTHM(KTWB(JW),I)=(H1(KTWB(JW),I)- (EL(KBI(I)+1,I)-EL(KB(I)+1,I)))*0.5 ! SW 1/23/06 IF(I<=DS(JB))THEN ! SW 8/6/2018 AVHR(KT,I)=(H1(KT,I)- (EL(KBI(I)+1,I)-EL(KB(I)+1,I)))+(H1(KT,I+1)- (EL(KBI(I)+1,I+1)-EL(KB(I)+1,I+1))& -H1(KT,I)+(EL(KBI(I)+1,I)- EL(KB(I)+1,I)))/(0.5*(DLX(I)+DLX(I+1)))*0.5*DLX(I) ELSE AVHR(KT,I)=AVHR(KT,I-1) ENDIF </pre>	8/6/2018
44	W2	Input bathymetry	<p>If the model user in the bathymetry input file gives the water surface (or FRIC, or PHI0, or DLX) of inactive segments a '0', the code in the first time step may set the KT layer incorrectly because of using ELWS of an inactive segment. The code though fixes it on the 2nd time step. This does not really affect the model run as it gets started other than an unnecessary change in the surface layer designation. If the model user gave the inactive segments the same values as the active ones, the code ran normally from the first time step. In order to standardize this and allow the model user to keep inactive segment ELWS, DLX, FRIC, and PHI0 set to zero, these values are initialized with the neighboring segment value.</p> <pre> READ (BTH(JW),'/(10F8.0)') (DLX(I), I=US(BS(JW))-1,DS(BE(JW))+1) READ (BTH(JW),'/(10F8.0)') (ELWS(I), I=US(BS(JW))-1,DS(BE(JW))+1) READ (BTH(JW),'/(10F8.0)') (PHI0(I), I=US(BS(JW))-1,DS(BE(JW))+1) READ (BTH(JW),'/(10F8.0)') (FRIC(I), I=US(BS(JW))-1,DS(BE(JW))+1) READ (BTH(JW),'/(10F8.0)') (H(K,JW), K=1,KMX) DO I=US(BS(JW))-1,DS(BE(JW))+1 READ (BTH(JW),'/(10F8.0)') (B(K,I), K=1,KMX) H2(:,I) = H(:,JW) END DO endif ! Set water surface of inactive segments to those active cells next to them SW 8/6/2018 DO JB=BS(JW),BE(JW) ELWS(US(JB)-1)=ELWS(US(JB)) ELWS(DS(JB)+1)=ELWS(DS(JB)) DLX(US(JB)-1)=DLX(US(JB)) DLX(DS(JB)+1)=DLX(DS(JB)) PHI0(US(JB)-1)=PHI0(US(JB)) PHI0(DS(JB)+1)=PHI0(DS(JB)) FRIC(US(JB)-1)=FRIC(US(JB)) FRIC(DS(JB)+1)=FRIC(DS(JB)) END DO </pre>	8/6/2018
45	W2	Particle	<p>Added the ability of particles to be passed to other branches by connections of gates, pumps or spillways between upstream and downstream branches aligned linearly along a river.</p>	8/7/2018

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
46	W2	Flow Balance Output	<p>The flow balance output file, flowbalance.csv, output was affected by Branches becoming active or inactive. Code was revised in balances.f90 to allow for the flow balances to properly account for cumulative flow sources/sinks.</p> <pre> IF (VOLUME_BALANCE(JW)) THEN DO JB=BS(JW),BE(JW) IF(.NOT.BR_INACTIVE(JB))THEN ! SW 8/8/2018 VOLSBR(JB) = VOLSBR(JB)+DLVOL(JB) VOLTBR(JB) = VOLLEV(JB)+VOLPR(JB)+VOLTRB(JB)+VOLDT(JB)+VOLWD(JB)+V OLUH(JB)+VOLDH(JB)+VOLIN(JB)+VLOUT(JB)+VOLICE(JB) if(sediment_diagenesis)then If(CEMARElatedCode .and. IncludeBedCon- solidation)Then VOLTBR(JB) = VOLTBR(JB)+ VOLCEMA(JB) End If ENDIF IF (ENERGY_BALANCE(JW)) THEN ESR(JW) = 0.0 ETR(JW) = 0.0 DO JB=BS(JW),BE(JW) IF(BR_INACTIVE(JB))CYCLE ! SW 8/8/2018 IF (MASS_BALANCE(JW)) THEN DO JB=BS(JW),BE(JW) IF(BR_INACTIVE(JB))CYCLE ! SW 8/8/2018 DO JC=1,NAC </pre>	8/8/2018
47	W2	Particle Transport	<p>In the particle tracking algorithm, the depth statistics of are now based on the particle depth. Before this, the depth statistics of a particle were based on water depth not particle depth.</p>	8/24/2018

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
48	W2	Long Profile Output	<p>The volume weighted temperature was added to the longitudinal profile output. The User Manual was also updated.</p> <pre> WRITE(NUNIT, '(1000(A, ", ")))' 'Seg#', 'ElevWaterSurf(m) ', 'Q(m3/s)', 'SurfaceT- emp(oC)', 'Depth(m)', 'Width(m)', 'VolWeighTemp(oC)' , (CNAME2(CN(JC)), JC=1, NAC), (CDNAME2(CDN(JD, JW)), JD=1 , NACD(JW)) ELSE WRITE(NUNIT, '(1000(A, ", ")))' 'Seg#', 'ElevWaterSurf(m) ', 'Q(m3/s)', 'SurfaceT- emp(oC)', 'Depth(m)', 'Width(m)', 'VolWeighTemp(oC)' ENDIF DO JJ=1, NWB K=KTWB(JJ) DO JB=BS(JJ), BE(JJ) DO I=CUS(JB), DS(JB) ! TEMP VOL WEIGHTED AVERAGE SW 8/30/2018 TVOLAVG=0.0 ! SW 8/30/2018 VOLTOT=0.0 DO KK=KTWB(JW), KB(I) VOLTOT=VOLTOT+VOL(KK, I) TVOLAVG=TVOLAVG+T1(KK, I)*VOL(KK, I) ENDDO IF(KB(I)>=KTWB(JW)) tvolavg=tvolavg/voltot IF(CONSTITUENTS) THEN WRITE(NUNIT, '(I5, ", ", 100(F12.3, ", ")))' I, ELWS(I), QC(I), T2(K, I), DEPTHB(KB(I), I), B(KTI(I), I), TVOLAVG, (C2(K, I, CN(JAC))*CMULT(CN(JAC)), JAC=1, NAC), (CD(K, I, CDN(JD, JW))*CDMULT(CDN(JD, JW)), JD=1, NACD(JW)) ELSE WRITE(NUNIT, '(I5, ", ", 100(F12.3, ", ")))' I, ELWS(I), QC(I), T2(K, I), DEPTHB(KB(I), I), B(KTI(I), I), TVOLAVG </pre>	8/30/2018
49	W2	SPR output	<p>The spreadsheet output file now has an option to output volume weighted values at the locations and times specified. If the user enters 'ONV' in the control file in the following line:</p> <pre> SPR PLOT SPRC NSPR NISPR WB 1 ONV 1 2 </pre> <p>the output will include the regular SPR output and a separate file with the suffix '_volw.csv' for the volume weighted output. The User Manual has also been updated with the new feature.</p>	9/28/2018
50	W2	User Manual	Updated the LPOM, LPOM-P, and LPOM-N source sink equations and the LPOM source sink stencil to be in agreement with the model code. These were old and did not reflect the addition of zooplankton ingestion and excretion/mortality.	10/9/2018
51	W2	Particle Tracking	Added an enhancement to add monitoring segments that record when the particle goes by the monitor or sensor. This would be useful for comparing to a dye study in a river for example.	11/14/2018
52	W2	SPR output	A volume weighted output bug for item 49 was fixed.	11/14/2018
53	W2	TSR flux output units	If flux output was ON, the instantaneous flux values for TSR output were in the incorrect units. These units were corrected to kg/day. Thanks to Binglei Gong at Anchor! All other flux files units were not affected.	12/10/2018

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
54	W2	Volume balance	The volume balance when segments were added and subtracted because of a shallow location in the grid, caused the code to incorrectly compute the volume balance (if VBC is ON). This was corrected.	12/18/2018
55	W2	Internal solar radiation and angle of sun for shading	The internal solar radiation algorithm had a bug that if one used reference years many years from your simulation or made a simulation over 20 years, the solar maximum each year drifts. If you read in solar radiation, there are no issues or if one makes runs from 1-10 years – the drift is probably minimal. This mainly affects those who use a reference year far from the start date or run simulations over 20 years or longer while using the internal short wave solar algorithm. Fix from Dan Turner at USACE and Stewart Rounds USGS – many kudos!!	12/18/2018
56	W2	Energy and mass balance	For a simulation with an initial BRANCH INACTIVE, the energy and mass balance if ON (EBC and MBC set to ON) starts off incorrectly. The layer subtraction algorithm when segments were subtracted in some cases where there were deeper holes followed by shallows incorrectly computed the energy and constituent mass balance. Also, a couple changes were made for the heat balance and mass balance for constituents when branches were changed from active to inactive.	12/18/2018
57	W2	Particle tracking	Fixed a bug when a particle was in the “air” above the water surface when in a river a ‘deep slot’ was added to the river bathymetry to keep it hydrated. Also, fixed a reflection error off the surface for vertical movement of the particle.	12/26/2018
58	W2	Particle tracking	For file output for finalparticle.csv, adjusted header so that it would be general for any number of monitoring stations. Previously the header was hard-wired to write only 3 monitoring locations in the title. This does not affect prior model output information only the title header.	1/3/2019
59	PREW2	Pipe invert	The preprocessor gave a ‘false’ error for an invert elevation being below the grid in some rare cases. This has been fixed. The model was not affected.	1/21/2019
60	W2	TN	There was a bug in the calculation of TN when large concentrations of zooplankton were present. If zooplankton were not simulated or they were a small population, there would be no impact of this TN bug. Bug fixed.	1/29/2019

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
61	W2	Epiphyton periphyton burial and conversion to LPOM and sediments	The User Manual showed that the epiphyton parameter EB, burial rate, was in units of m/day. The model implemented this and also computed the cell layer burial rate as $EB \cdot EC$ (concentration of biomass per cell volume) * Surface area/Volume of a cell or $EB \cdot EC/H$ where H is the layer thickness. In reality though it should be the thickness of the periphyton layer. But that layer thickness is not predicted by the model. Hence, the decision was to change the burial rate to units of 1/day such that the loss of epiphyton by burial would follow a first order decay process (similar to the first order sediment model) as $EB \cdot EC$. Hence, this burial rate is no longer a function of the grid. Also, there was the conversion of organic matter and nutrients at death to the sediment P, N and C compartments whereas they should go directly to LPOM first. Hence only burial goes directly into the sediment compartments.	3/5/2019
62	W2	Output files	Code was written to print the initial condition in output files at time $t=0$ at the start of the simulation.	3/5/2019
63	W2	Restart with Sediment Diagenesis	Prior to this date, the restart option did not work with sediment diagenesis turned ON. This enhancement has been coded and debugged and is now working.	3/5/2019
64	W2	Dynamic loading	This is a new feature in CE-QUAL-W2 and applies to linear waterbodies in series. For example, if one has a river system with 9 waterbodies, the model user can break the model into 9 separate models and run them all in parallel where the downstream model dynamically updates its boundary conditions as the upstream model moves forward in time. This has resulted in significant time savings for model runs (90%). Documentation for this will be provided shortly.	3/5/2019
65	W2	User Manual	The existing User Manual will be frozen in its current version until a newly updated user manual will be released in the next couple months. Hence, the dynamic loading described above will be described in the new User Manual.	3/5/2019

W2 V4.0 Bug Fixes, Enhancements, and User Manual Changes

Table 5. Bug fixes and enhancements for Version 4.0.

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
1	PREW2	Additional model checks	Additional model checks were added for Profile and Spreadsheet output model segments	6/7/16
2	User Manual	Updated	User Manual Rev 6 was released with many minor updates and better explanatory text	6/7/16
3	W2	Restart	Fixed restart to work for epiphyton and macrophytes. This was broken in case a model user used RESTART. Fixed restart for mass balance for nutrients output in the file mass-bal.opt.	6/7/16
4	W2	Location of compiler info file	Fixed location of W2 compiler information in case of using command line aware directory. File was written to the location of the model executable rather than the command line aware directory.	6/7/16
5	Waterbalance	Update for Version 4	The waterbalance utility uses a model tsr file for reading in water level over time. Since the Version 4 file format was updated with comma delimited output files, the waterbalance utility has been updated. This utility is not compatible with earlier versions.	6/10/16
6	W2	Sediment Diagenesis	Initialized the sediment width (sedcellwidth) in subroutine CEMASedimentDiagenesis.	6/11/16
7	W2	Screen output	The text fields in the Windows dialog box may 'overflow' if you have more than 160 tributaries. The field size was increased to avoid this possibility. Old code: CHARACTER(1000) :: TEXT1 New code: CHARACTER(1700) :: TEXT1	6/24/16
8	W2	Profile output	The longitudinal profile output added depth at a segment as part of the longitudinal output. User Manual updated also.	7/11/2016
9	W2	Profile output	Changed file name of longitudinal file output from integer of the Julian day to Julian day in F8.2 format in case of multiple outputs on one day	7/16/2016

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added																																																																						
10	W2	TSR output	Changed TSR file so that the first 11 lines of header are eliminated to facilitate graphing. Also, the name of the filetype in the control file is now read and used for the output file. Hence, using the TSR FILENAME of 'tsr.csv' will produce csv files that are immediately opened in Excel for viewing again making it easier for post-processing.	8/1/2016																																																																						
11	PRE	Met file checks	<p>The preprocessor has been enhanced with more model file checks. This program now has summaries of meteorological data (min, max, average) for each waterbody in the pre.opt file as well as further logical checks on values of these averages. These summaries are another check on the correctness of the input met data file. A typical result in pre.opt is shown below:</p> <table> <tr> <th colspan="5">Meteorological Data Input Summary</th></tr> <tr> <th>Parameter</th><th>Waterbody</th><th>Average Value</th><th>Maximum</th><th>Minimum</th></tr> <tr> <td>TAIR (C)</td><td>1</td><td>10.553</td><td>37.780</td><td>-11.940</td></tr> <tr> <td>TDEW (C)</td><td>1</td><td>6.935</td><td>19.500</td><td>-17.670</td></tr> <tr> <td>WIND (m/s)</td><td>1</td><td>1.337</td><td>12.440</td><td>0.000</td></tr> <tr> <td>PHI (rad)</td><td>1</td><td>3.426</td><td>6.280</td><td>0.000</td></tr> <tr> <td>CLOUD (0-10)</td><td>1</td><td>7.367</td><td>9.720</td><td>0.000</td></tr> <tr> <td>SRO (W/m2)</td><td>1</td><td>0.000</td><td>0.000</td><td>0.000</td></tr> <tr> <td>TAIR (C)</td><td>2</td><td>10.553</td><td>37.780</td><td>-11.940</td></tr> <tr> <td>TDEW (C)</td><td>2</td><td>6.935</td><td>19.500</td><td>-17.670</td></tr> <tr> <td>WIND (m/s)</td><td>2</td><td>1.337</td><td>12.440</td><td>0.000</td></tr> <tr> <td>PHI (rad)</td><td>2</td><td>3.426</td><td>6.280</td><td>0.000</td></tr> <tr> <td>CLOUD (0-10)</td><td>2</td><td>7.367</td><td>9.720</td><td>0.000</td></tr> <tr> <td>SRO (W/m2)</td><td>2</td><td>0.000</td><td>0.000</td><td>0.000</td></tr> </table>	Meteorological Data Input Summary					Parameter	Waterbody	Average Value	Maximum	Minimum	TAIR (C)	1	10.553	37.780	-11.940	TDEW (C)	1	6.935	19.500	-17.670	WIND (m/s)	1	1.337	12.440	0.000	PHI (rad)	1	3.426	6.280	0.000	CLOUD (0-10)	1	7.367	9.720	0.000	SRO (W/m2)	1	0.000	0.000	0.000	TAIR (C)	2	10.553	37.780	-11.940	TDEW (C)	2	6.935	19.500	-17.670	WIND (m/s)	2	1.337	12.440	0.000	PHI (rad)	2	3.426	6.280	0.000	CLOUD (0-10)	2	7.367	9.720	0.000	SRO (W/m2)	2	0.000	0.000	0.000	10/30/16
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12	PRE	Distributed concentration checks	Added checks for average, min, and max inflow concentrations for all distributed tributaries. These are written out to the pre.opt file	11/1/16																																																																						
13	PRE	LPR input	For LPR file inputs for temperature, the preprocessor reports an error when using LPR input. The code incorrectly used KT rather than KTWB(JW). [This also affects V3.7 preprocessor.]	11/9/2016																																																																						
14	W2	Model update	The model executables were updated from Intel Fortran Compiler # 14 to Intel Fortran compiler # 17. Also, the flag to initialize all variables to zero was enforced. There are many variables in the new sediment diagenesis model that need to be explicitly set to zero. These initializations will be made in the code in the future so that setting this flag will be unnecessary.	11/17/2016																																																																						
15	W2 and PRE	Code updates	A couple code updates were made as a result of using the Intel Fortran Version 17 compiler. The new compiler did not like some of the older implementations. These were minor updates.	11/22/2016																																																																						
16	W2	Output	Improved clarity of output headers for flux outputs, including units of kg/d in all header titles	11/28/2016																																																																						

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
17	W2	Output header	The order of the flux headings in the file 'kflux_jwX.opt' were switched. The header showed DOAP, DOAR, DOEP, DOER but it should have been DOAP, DOEP, DOAR, DOER. This is determined from the order in the example problem control files and the User Manual. The example problems and User Manual have all been updated.	11/28/2016
18	W2	Example problems	Updated example problems using FIX #10 above where tsr.opt filename was changed to tsr.csv allowing tsr files to open directly in Excel.	11/28/2016
19	W2	Algae-Si	The flux of Si from dying algae was incorrectly computed. This bug has existed since Version 3.0 when the algorithm was first added to W2. Below is the code fix: <pre> ENTRY PARTICULATE_SILICA PSIAM(:,IU:ID) = 0.0 DO I=IU,ID DO K=KT,KB(I) DO JA=1,NAL IF (ALG_CALC(JA)) THEN PSIAM(K,I) = PSIAM(K,I)+AMR(K,I,JA)*ALG(K,I,JA)*ASI(JA) ! PSI(K,I) HA-Z 12/2016 ENDIF </pre>	12/5/2016
20	W2	WDO output	Enhancement: The Withdrawal output file name WDOFN was unused in the main program. Now the model reads this file and uses the file type for all WDO output files. Previously this was hard-wired to 'opt' output. Now if the user sets WDOFN to 'wdo.csv' all the files will be written with the 'csv' file type facilitating opening in Excel. The files are already in comma delimited format.	12/8/2016
21	W2	DLT INTER	There was a problem computing the interpolated value of DLTMAX and DLTF when the first value of DLTD was earlier than the start date of the model. This bug was fixed.	12/9/2016
22	User Manual	Updates	Assorted typos fixed, better explanatory text added, and added definitions and units of model parameters. This is REV8.	1/6/2017, 2/10/2017
23	W2	Output format	Output format changed for Bioenergetics output file	1/6/2017
24	W2	TECPLOT output	Added derived variables to TECPLOT output files (See Contour Plot in User Manual). User Manual updated.	1/17/2017
25	PREW2	ENVIRPC	Checks were added for the ENVIRPC input file in the preprocessor.	2/16/2017
25	W2	ENVIRPC	Fixed several minor bugs in the ENVIRPC subroutine and added an enhancement to perform a histogram analysis of water depth. The User Manual was updated to reflect this new enhancement as well as the new csv output format and file names. The example problems were updated with new w2_envirprf.npt files.	2/16/2017

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Fixed or Enhancement added
26	W2	Head BC input files	For head boundary condition input files (both upstream and downstream), the W2 code was updated to include new file formats for these boundary conditions (BCs). They include the older format, a new csv format and a new csv format in case conditions are not stratified at the BC. The User Manual was updated to show these new file formats.	3/3/2017
27	PREW2	Head BC checks	With the new file format for head BCs in #26 above, the preprocessor was updated to check these new input file formats. Also, additional checks were added to the head BCs.	3/3/2017
28	Water-balance	Bug fixes/updates	The water balance utility was updated because of the new input format of TSR output files. See fix #10. Also, a bug was fixed in this code that affected cases when the water level was above the top of the grid.	3/17/2017
29	W2	CPL Tecplot	The CPL Tecplot output sometimes did not update the month in the contour plot text files. This has been fixed – thanks to Jung Ma, Hubei University of Technology in Wuhan, for finding it!	4/4/2017
30	Water-balance	Waterbalance manual	The waterbalance manual was updated for Version 4.	4/14/2017
31	W2	TSR output	Refined the TSR output so that flux terms that were not specified are no longer written out. This cleans up the TSR output and reduces the active number of flux variables when sediment diagenesis is not on.	4/15/2017
32	W2	Derived variables	Fixed a code regression for derived variable TDG when the user stopped the code and pressed restart	4/15/2017
33	W2	Withdrawal output	When a user pressed restart and he/she specified withdrawal output files, the restarted files ignored the filetype of the WDO specification in the control file and used 'opt'.	4/15/2017

W2 V3.7 Bug Fixes, Enhancements and User Manual Changes

Table 6. Bug fixes and enhancements for Version 3.7.

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
1	W2	Fish habitat limits	<p>Changed temperature and DO criteria from <code>t2(k,i)<fisht-emph(ii).and.t2(k,i)>fishtempl(ii).and.o2(k,i)>fishdo(ii)</code></p> <p>to <code>t2(k,i)<=fisht-emph(ii).and.t2(k,i)>fishtempl(ii).and.o2(k,i)>=fishdo(ii)</code></p> <p>This update is reflected in the manual. Hence the high temperature limit and the dissolved oxygen minimum is less than or equal to given value rather than less than.</p>	8/7/2012
2	W2	Structure, gate, pump, pipe, withdrawal output files	<p>Added code to ensure that if flow is '0' in an outlet structure, that the corresponding temperature and concentration in the outlet file is written as '-99.0'. Previously this was not fully implemented in the code. Code such as this was inserted in several places in the subroutine outputa2.f90:</p> <pre> IF (QGT(JS)==0.0) THEN TAVGW(JWD)=-99.0 CAVGW(JWD, :)=-99.0 CDAVGW(JWD, :)=- 99.0 ENDIF </pre>	8/13/2012
3	PREW2	Format updates	Several output updates were made for warnings and errors	8/16/2012
4	Resource files for W2	Compiling files	Updated some corrupted resource files that were used to compile the source code. Also, zipped up source code and compiler settings together so that file locations are correct for using the Intel compiler.	9/12/2012

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
5	W2 and PREW2	Read csv files	By inserting the character '\$' as the first character of the first line, the following files can now be read in free-format or csv format: met, lpr, vpr, wsc, met, cin, ctr, cdtr, cpre, qot, and qwd. This is described in a Word document that accompanies the download package. The preprocessor has also been updated for file checks. This is part of the Version 3.71 update.	9/12/2012
6	W2	Read input file	<p>An input format bug was fixed for a system with more than 9 waterbodies.</p> <pre> DO JD=1,NDC !READ (CON, '(A8, (:9A8)) ') CDNAME2 (JD), (CDWBC (JD, JW), JW=1, NWB) READ (CON, '(A8, (:9A8) :/ (8X, (:9A8))) ') CDNAME2 (JD), (CDWBC (JD, JW), JW=1, NWB) !cb 9/13/12 END DO READ (CON, ' (/) ') ! DO JF=1,NFL do jf=1,73 ! Fix this later !READ (CON, '(A8, (:9A8)) ') KFNAME2 (JF), (KFWBC (JF, JW), JW=1, NWB) READ (CON, '(A8, (:9A8) :/ (8X, (:9A8))) ') KFNAME2 (JF), (KFWBC (JF, JW), JW=1, NWB) !cb 9/13/12 END DO </pre> <p>This had the effect of turning OFF output for derived constituents for waterbody 10.</p>	9/13/2012
7	GUI	Time series elevation	The GUI read in values of ETSR as integers rather than real numbers. This was fixed.	10/30/12
8	W2	Spillways Lateral	Lateral spillways when connected to other model segments were sometimes not connecting as a tributary to the downstream segment. This has been fixed.	10/30/12
9	W2	W2Tools output	In place of the Vector Plot Output (VPL), a new output was added that allows use of the W2Tools post-processing package. This is part of the Version 3.71 update.	10/30/12
10	W2	User Manual	The User Manual has been updated with the new model features as shown in 5 and 9 above. In addition a separate user manual file shows how to use the w2tools post-processor. This is in the directory for W2tools. This is the version 3.71 update.	10/30/12

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
11	W2	Water quality and temperature	A new calculation technique was added that eliminates calling the Tri-diagonal subroutine. These were built into the temperature and water quality subroutines. This change results in improvements in computational speed of from less than 5% to over 20% for water quality models with lots of water quality state variables.	10/30/2012
12	PREW2	More checks	Added more error trapping for input files. This is an effort for the error trapping to occur before the code bombs. Fixed a couple of regression errors as a result of this fix.	11/2/2012, 11/5/2012
13	Excel macro utility		Added an Excel macro utility to aid in writing out input files to CE-QUAL-W2	11/5/2012

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
14	W2	Withdrawal subroutine	<p>Fixed an IF test that used the wrong variable in the dynamic port allocation algorithm. Also added code to allow the code to test for temperatures at the outlet levels specified.</p> <p>Deleted line of code is underlined followed by the fix.</p> <pre> DO J=1,NUMTSPLT !REORDERING OUTLETS SO THAT HIGHEST ELEVATION STRUCTURE ON TOP (ASSUMING 2 SPLIT OUTLETS) ! <u>IF (TCNTR(J) == 'ST') THEN</u> IF (TSPLTCNTR(J) == 'ST') THEN ! cb 11/11/12 IF (ESTR(JSTSPLTT(J,1),TSPLTJB(J)) < ESTR(JSTSPLTT(J,2),TSPLTJB(J))) THEN JSTSPLT(J,1)=JSTSPLTT(J,2) JSTSPLT(J,2)=JSTSPLTT(J,1) END IF ! <u>ELSE IF (TCNTR(J) == 'WD') THEN</u> ELSE IF (TSPLTCNTR(J) == 'WD') THEN ! cb 11/11/12 IF (EWD(JSTSPLTT(J,1)) < EWD(JSTSPLTT(J,2))) THEN ... IF (TSPLTJB(J) == JB .AND. TSPLTCNTR(J) == ' ST') THEN QALL=0.0 DO JJ=1,NOUTS(J) QALL=QALL+QSTR(JSTSPLT(J,JJ),TSPLTJB(J)) ! SUM UP ALL THE FLOWS ELR = SINA(JB)*DLX(DS(JB))*0.5 DO K=KTWB(JW),KB(DS(JB)) IF (EL(K,DS(JB))-ELR < ESTR(JSTSPLT(J,JJ),TSPLTJB(J))) EXIT !SW 10/17/01 END DO KSTR = K-1 KSTRSPLT(JJ) = MIN(KSTR,KB(DS(JB))) ENDDO DO JJ=1,NOUTS(J) ! cb 11/11/12 dividing total flow between outlets for temperature test QSTR(JSTSPLT(J,JJ),TSPLTJB(J)) = qall/real(nouts(j)) ENDDO </pre>	11/13/12

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
15	W2	Reading in names of WQ variables	<p>In case a user does not enter the units in graph.npt, the code improperly parses the WQ variable name. In this case the output name is a blank. To avoid this issue, extra code was added to preserve the variable name even if no units were added to the graph.npt list.</p> <pre> L1 = SCAN (CNAME(JC),',')+2 IF(L1 == 2)L1=43 ! SW 12/3/2012 Implies no comma found L2 = SCAN (CNAME(JC)(L1:43), ')'+L1 IF(L2 > 43)L2=43 ! SW 12/3/2012 CUNIT(JC) = CNAME(JC)(L1:L2) CNAME1(JC) = CNAME(JC)(1:L1-3) CNAME3(JC) = CNAME1(JC) DO WHILE (L3 < L1-3) </pre>	12/3/2012
16	PREW2	SEDS and SEDK	<p>The variable names were switched in reading the control file in the preprocessor perhaps leading to incorrect warnings/errors being tagged.</p> <p>The proper order was restored:</p> <pre> !READ (CON, '(/A8/(8X,2A8,6F8.0,A8))', ERR=400) AID, (SEDC(JW), PRNSC(JW), SEDCI(JW), seds(jw), SEDDK(JW), FSOD(JW), ! FSOD(JW), sedbr(jw), DYNSEDK(JW), JW=1,NWB) ! SW 6/1/07 READ (CON, '(/A8/(8X,2A8,6F8.0,A8))', ERR=400) AID, (SEDC(JW), PRNSC(JW), SEDCI(JW), SEDDK(JW), seds(jw), FSOD(JW), & FSOD(JW), sedbr(jw), DYNSEDK(JW), JW=1,NWB) ! cb 12/30/12 </pre>	12/30/12
17	Excel macro utility w2tool	Integer/Long variables	Some loose ends were corrected in the Visual Basic code built into the Excel macros.	1/2/2013
18	W2	TDG output	A series of code changes were made to fix some issues that arose for computing the impact of a structure on downstream TDG. These fixes were made in subroutines Withdrawal, outputa2w2tools, w2modules, and hydroinout. These affected calculation of output of dissolved gas concentration for output files for spillways or gates that had dissolved gas equation.	1/23/2013

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
19	W2	Reading in dynamic extinction coefficient	<p>For temperature only studies, the model did not update the dynamic light extinction coefficient correctly. This has been fixed by the added code below:</p> <pre> DO JW=1,NWB IF (READ_EXTINCTION(JW)) GAMMA(: ,US(BS(JW)):D S(BE(JW))) = EXH2O(JW) ! SW 1/28/13 KT = KTWB(JW) IF (.NOT. NO_HEAT(JW)) THEN </pre>	1/28/2013
20	W2	Input format when 9 WBs	<p>A specific input read error occurred when 9 waterbodies were present as a result of an earlier bug fix: The new read statements occur in 2 places:</p> <pre> READ (CON,'(A8,9A8,/(:8X,9A8)))') CDNAME2(JD),(CDWBC(JD,JW), JW=1,NWB) !cb 9/13/12 sw 2/18/13 READ (CON,'(A8,9A8,/(:8X,9A8)))') KFNAME2(JF),(KFWBC(JF,JW), JW=1,NWB) !cb 9/13/12 sw2/18/13 </pre>	2/18/13
21	PREW2	More checks added	Additional checks were added to warn users of gaps in meteorological data when interpolation may be inappropriate.	2/20/2013
22	W2 User Manual	Updated	Updated User Manual – many small additions and edits – REV3.	2/20/2013
23	PREW2	Improved an error check	Updated an error check for choosing inactive segments for ISNP output	3/21/2013
24	PREW2	More checks added	Added checks for inflow temperature and tributary temperatures	3/28/2013

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
25	W2	Initial WL Calculation	<p>Changed SLOPE to SLOPEC in init—u-elws.f90 routine since the normal depth should be based on SLOPEC.</p> <pre> END IF FUNCVALUE=FLOW- XAREA*HRAD**0.6667*SLOPEC(JB)**0.5/FMANN ! SW 4/5/2013 RETURN END SUBROUTINE MANNINGS_EQN </pre> <p>Also changed KB(I)-1 to KB(I)+1 for ELWS:</p> <pre> IF (ABS(DX).LT.XACC .OR. FMID.EQ.0.) THEN ELWS(I)=RTBIS+EL(KB(I)+1,I) ! SW 4/5/13 RETURN </pre> <p>Also changed KTOP from REAL to an INTEGER:</p> <pre> REAL :: XAREA, WSURF ! 4/5/13 SW INTEGER :: KTOP ! 4/5/13 SW </pre>	4/5/2013
25	W2	Output for pumps, spillways, gates	If the LAT option was chosen, the output files index for JWD was incorrect. This may have affected output temperatures and concentrations.	5/17/2013
26	PRE-W2	Mass loading calculation	There were cases where the preprocessor bombed while calculating the mass loading for output to the pre.opt file. This error has been fixed.	6/21./2013
27	W2	Assorted code updates	<p>Minor format errors (that were ignored by compiler), update to code comments, and faster code initializations to speed up model performance were performed in several subroutines: input_PAR.f90, temperature_PAR.f90, transport_PAR.f90, update.f90, and w2_37_win.f90.</p> <p>An example of an initialization code speed up from temperature_PAR.f90:</p> <p>New code:</p> <pre> DO K=KT,KB(I) AT(K,I) = 0.0D0; CT(K,I) = 0.0D0; VT(K,I) = 0.0D0 ! SW CODE SPEEDUP 6/15/13 ENDDO </pre> <p>Old code</p> <pre> AT(:,I) = 0.0D0; CT(:,I) = 0.0D0; VT(:,I) = 0.0D0 </pre>	6/21/2013
28	W2 tools Excel macro	Update	More robust tools release	6/21/2013
29	PRE-W2	Label error	A label error for one spillway error was fixed. It mistakenly used 'gate'.	7/2/2013

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
30	W2	CPL output	<p>A slight change in output format for the 'raw' cpl output file format was made. No change was made in the tecplot output format.</p> <pre> DO I=CUS(JB),DS(JB) WRITE (CPL(JW),'(A38/(9(F10.3,2X)))') CDNAME(CDN(JD,JW)),(CD(K,I,CDN(JD,JW))*CDMULT(C DN(JD,JW)),K=KTWB(JW),KB(I)) ! cb 6/28/13 end do !WRITE (CPL(JW),'(A38/(9(F10.3,2X)))') CDNAME(CDN(JD,JW)),(CD(K,I,CDN(JD,JW))*CDMULT(C DN(JD,JW)),& ! SW 8/12/06 !K=KTWB(JW),KB(I)),I=CUS(JB),DS(JB)) ! CB 1/03/05 </pre>	7/31/13
31	W2	Read input file	<p>A regression error that cropped up when there were 9 or greater than 10 waterbodies has been fixed. This had to do with reading in derived and flux variables in the control file.</p> <pre> DO JD=1,NDC If (nwb < 10) READ (CON,'(A8,(:9A8))') CDNAME2(JD),(CDWBC(JD,JW), JW=1,NWB) If (nwb >= 10) READ (CON,'(A8,9A8,/(:8X,9A8))') CDNAME2(JD),(CDWBC(JD,JW), JW=1,NWB) !cb 9/13/12 sw 2/18/13 6/16/13 END DO READ (CON,'(/)') ! DO JF=1,NFL do jf=1,73 ! Fix this later If (nwb < 10) READ (CON,'(A8,(:9A8))') KFNAME2(JF),(KFWBC(JF,JW), JW=1,NWB) If (nwb >= 10) READ (CON,'(A8,9A8,/(:8X,9A8))') KFNAME2(JF),(KFWBC(JF,JW), JW=1,NWB) !cb 9/13/12 sw2/18/13 6/16/13 </pre>	8/13/13
32	W2	New compiler	Upgraded to the Intel XE 13.1.3.198 compiler. New W2 executables for 32 bit and 64 bit.	8/13/13
33	W2	INIT WL	<p>An error was fixed in the initial water level computation program for rivers. The code below should have the subscript JB instead of J.</p> <pre> DO JJW=1,NWB DO JJB=BS(JJW),BE(JJW) IF (DHS(JB) > US(JJB) .AND. DHS(J) < DS(JJB)) THEN JBD=JJB END IF END DO </pre>	8/20/13

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
34	W2	INIT WL	<p>There was an index error with gates in the initial water level computation. The old code is shown below:</p> <pre> IF (ELWS (ID) < WSUP) THEN IF (ELWS (IDSP (JS)) > WSUP) WSUP = ELWS (IDSP (JS)) ! CHECKING TO SEE IF DOWNSTREAM WS ELEVATION ISN'T ALREADY 'HIGH' ELWS (ID) = WSUP </pre> <p>The new code is</p> <pre> IF (ELWS (IDGT (JG)) > WSUP) WSUP = ELWS (IDGT (JG)) ! CHECKING TO SEE IF DOWNSTREAM WS ELEVATION ISN'T ALREADY 'HIGH' WX 8/21/13 </pre>	8/21/2013
35	W2	GATE	<p>Cleaning up some code in the gate algorithm.</p> <p>Old code:</p> <pre> IF (A2GT (JG) /= 0.0 .AND. IDGT (JG) /= 0.0) THEN </pre> <p>New code:</p> <pre> IF (A2GT (JG) /= 0.0 .AND. IDGT (JG) /= 0) THEN </pre>	8/21/2013
36	W2	TSS computation	<p>Updated the computation for the derived variable TSS to include zooplankton and the particulate form of CBOD. A formula was added to the User Manual reflecting this change. New code includes</p> <pre> IF (CBODS (IBOD) > 0.0) TOTSS (K, I) = TOTSS (K, I) + CBOD (K, I, IBOD) / O2OM (JW) ! SW 9/5/13 Added particulate CBOD to TSS computation TOTSS (K, I) = TOTSS (K, I) + ZOO (K, I, JZ) ! SW 9/5/13 Added zooplankton to TSS computa- tion </pre>	9/6/2013
37	W2	Spillway-LAT	<p>When a spillway was defined with IDSP=0 and LAT, a tributary was defined incorrectly. The new code is shown below:</p> <pre> IF (IDSP (JS) /= 0) then ! cb 9/11/13 JTT = JTT + 1 QTR (JTT) = QSP (JS) ITR (JTT) = IDSP (JS) PLACE_QTR (JTT) = PDSPC (JS) == ' DENSITY' SPECIFY_QTR (JTT) = PDSPC (JS) == ' SPECIFY' IF (SPECIFY_QTR (JTT)) THEN ELTRT (JTT) = ETDSP (JS) ELTRB (JTT) = EBDSP (JS) END IF JBTR (JTT) = JBD end if ! cb 9/11/13 </pre>	9/11/2013

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
38	W2	32 bit exe on XP	Recompiled with new settings from Visual Studio 2012 to (hopefully) run on XP systems with 32 bit OS	9/11/2013
39	W2	End Simulation	<p>Added new close open files in the end_simulation subroutine. This is merely cleaning up the code to be consistent in closing all open files when a 'Stop' is executed. This should have no effect on the end user. Part of this new code is shown below:</p> <pre> IF(SELECTC == ' ON')then ! SW 9/25/13 New Section on closing files ifile=1949 do jb=1,nbr if(nstr(jb) > 0)then ifile=ifile+1 close(ifile) endif enddo if(nwd > 0)then ifile=ifile+1 close(ifile) endif endif IF (DOWNSTREAM_OUTFLOW) THEN JFILE=0 DO JWD=1,NIWDO CLOSE(WDO(JWD,1)) CLOSE(WDO(JWD,2)) IF (CONSTITUENTS) THEN CLOSE (WDO(JWD,3)) END IF IF (DERIVED_CALC) THEN CLOSE(WDO(JWD,4)) END IF </pre>	9/25/13

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
40	W2	Pumps – Lateral	<p>Fixed several sections of code in the PUMP algorithm in the hydroinout.f90 routine. Under some conditions such as specifying “Lateral”, the PUMP algorithm may not have moved the water from the upstream to the downstream segment correctly. This has been fixed and tested. Part of the code changes are shown below:</p> <pre> IF (LATERAL_PUMP(JP)) THEN ELW = EL(KTWB(JWU),IUPU(JP))- Z(IUPU(JP))*COSA(JBU) ! JWU = JWU+1 ! SW 9/25/13 ! JBD(JWU) = JBU ! IWD(JWU) = IUPU(JP) ELSE ELW = EL(KTWB(JWU),IUPU(JP))- Z(IUPU(JP))*COSA(JBU)- SINA(JBU)*DLX(IUPU(JP))*0.5 ! JSS(JBU) = JSS(JBU)+1 ! SW 9/25/13 END IF ... IF (PUMPON(JP)) THEN IF (LATERAL_PUMP(JP)) THEN JLAT = 1 JWU = JWU+1 ! SW 9/25/13 ... CALL LATERAL_WITHDRAWAL ! (JWU) DO K=KTW(JWU),KBW(JWU) QSS(K,I) = QSS(K,I)-QSW(K,JWU) END DO IF (IDPU(JP) /= 0) THEN ! MOVED CODE SW 9/25/13 JTT = JTT+1 ... ELSE JSS(JBU) = JSS(JBU)+1 ! SW 9/25/13 KTSW(JSS(JBU),JBU) = KTPU(JP) ... </pre>	9/25/13

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
41	W2	Clean up memory issues	<p>A series of minor memory issues were cleaned up. This should have no impacts on current model runs. These were usually uninitialized memory. Code changes made include:</p> <pre> READ (CON,'(/') KFNAM2=' ' ! SW 9/27/13 INITIALIZE ENTIRE ARRAY KFWBC = ' ' ! SW 9/27/13 INITIALIZE ENTIRE ARRAY READ (CON,'(//(:8X,9I8))') (KBWD(JW), JW=1,NWD); TRC= ' ' ! SW 9/27/13 INITIALIZATION SINCE ALLOCATION IS TO NTRT READ (CON,'(//(:8X,9A8))') (TRC(JT), JT=1,NTR) EHSN(JE), EHSSI(JE), JE=1,NEPT) !JE=1,NEP) SW 9/27/13 READ (CON,'(//(:8X,2F8.0,I8,F8.0))') (ESAT(JE), EHS(JE), ENEQN(JE), ENPR(JE), JE=1,NEPT) !JE=1,NEP) SW 9/27/13 READ (CON,'(//(:8X,8F8.0))') (ET1(JE), ET2(JE), ET3(JE), ET4(JE), EK1(JE), EK2(JE), & EK3(JE), EK4(JE), JE=1,NEPT) !JE=1,NEP) SW 9/27/13 READ (CON,'(//(:8X,6F8.0))') (EP(JE), EN(JE), EC(JE), ESI(JE), ECHLA(JE), EPOM(JE), JE=1,NEPT) !JE=1,NEP) SW 9/27/13 READ (CON,'(//8X,A8,I8,A8)') RSOC, NRSO, RSIC; RSOD=0.0 ! SW 9/27/13 INITIALIZE SINCE ALLOCATED AS NOD BUT ONLY NRSO USED READ (CON,'(//(:8X,9F8.0))') (RSOD(J), J=1,NRSO) READ (CON,'(//8X,I8,F8.0,a8)') NDLT, DLTMIN, DLTINTER; DLTD=0.0 ! SW 9/28/13 INITIALIZE ARRAY TO NOD SINCE ONLY NDLT ASSIGNED READ (CON,'(//(:8X,9F8.0))') (DLTD(J), J =1,NDLT) SINKC(1:NSTR(JB),JB) = SINKCT(1:NSTR(JB),JB) POINT_SINK(1:NSTR(JB),JB) = SINKC(1:NSTR(JB),JB) == ' POINT' ! SW 9/27/13 END DO ! POINT_SINK = SINKC == ' POINT' COLDEP=ELWS(I)-COLB ! MACT(J,KT,I)=MACT(J,KT+1,I) IF(MACROPHYTE_ON)MACT(J,KT,I)=MACT(J,KT+1,I) ! SW 9/28/13 ! SDKV(:,US(JB):DS(JB))=SDK(JW) SDKV(:,US(JB)-1:DS(JB)+1)=SDK(JW) ! SW 9/28/13 </pre>	9/27/13

42	W2	CPL output	<p>Code was added to eliminate writing out the habitat index to the CPL file for Tecplot when HABITATC is OFF.</p> <pre> IF(I /= DS(JB)+1)THEN IF(HABTATC == ' ON')THEN WRITE (CPL(JW),9999) X1(I),ELWS(I),U(K,I),- W(K,I),T1(K,I),RHO(K,I),HAB(K,I),(C2(K,I,CN(JC)) ,JC=1,NAC) ELSE WRITE (CPL(JW),9999) X1(I),ELWS(I),U(K,I),- W(K,I),T1(K,I),RHO(K,I),(C2(K,I,CN(JC)),JC=1,NAC) ENDIF ELSE XDUM=-99.0 WRITE (CPL(JW),9999) X1(I),ELWS(I),XDUM,XDUM,XDUM,XDUM,XDUM,(XDUM, JJ=1,NAC) ENDIF DO K=KTWB(JW),KMX-1 IF(I /= DS(JB)+1 .AND. K <= KB(I))THEN IF(HABTATC == ' ON')THEN WRITE (CPL(JW),9999) X1(I),ELWS(I)-DEPTHM(K,I),U(K,I),- W(K,I),T1(K,I),RHO(K,I),HAB(K,I),(C2(K,I,CN(JC)) ,JC=1,NAC) ELSE WRITE (CPL(JW),9999) X1(I),ELWS(I)-DEPTHM(K,I),U(K,I),- W(K,I),T1(K,I),RHO(K,I),(C2(K,I,CN(JC)),JC=1,NAC) ENDIF IF(K == KB(I))THEN IF(HABTATC == ' ON')THEN WRITE (CPL(JW),9999) X1(I),ELWS(I)-DEPTHB(K,I),U(K,I),- W(K,I),T1(K,I),RHO(K,I),HAB(K,I),(C2(K,I,CN(JC)) ,JC=1,NAC) ELSE WRITE (CPL(JW),9999) X1(I),ELWS(I)-DEPTHB(K,I),U(K,I),- W(K,I),T1(K,I),RHO(K,I),(C2(K,I,CN(JC)),JC=1,NAC) ENDIF WRITE (CPL(JW),*)'TITLE="CE-QUAL-W2"' IF(HABTATC == ' ON')THEN WRITE (CPL(JW),19233)(CNAME2(CN(JN)),JN=1,NAC) ELSE WRITE (CPL(JW),19234)(CNAME2(CN(JN)),JN=1,NAC) ENDIF ! sw 9/28/13 19233 FORMAT('VARIABLES="Distance, m","Elevation, m","U","W","T","RHO", "HABITAT" ',<NAC>('','',A8,'')) 19234 FORMAT('VARIABLES="Distance, m","Elevation, m","U","W","T","RHO" ',<NAC>('','',A8,'')) ! sw 9/28/13 </pre>	9/28/13
43	W2	SPECIFY TRIB	<p>In specifying the elevation between top and bottom for an inflow tributary, the code put the inflow 1 layer</p>	10/3/2013

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
			<p>below it should have been in many cases. This has been fixed by the additional code shown below:</p> <pre> IF (SPECIFY_QTR(JT)) THEN KTTR(JT) = 2 ! DO WHILE (EL(KTTR(JT),I) > ELTRT(JT)) DO WHILE (EL(KTTR(JT),I) > ELTRT(JT) .and. EL(KTTR(JT)+1,I) > ELTRT(JT)) ! SW 10/3/13 KTTR(JT) = KTTR(JT)+1 END DO </pre>	
44	W2	CWO or CWDO output	<p>Fixed a format overflow in writing out concentrations in a withdrawal output file.</p> <pre> IF (QWDO(J) /= 0.0) CWDO(CN(JC),J) = CWDO(CN(JC),J)/QWDO(J) WRITE (CWDOC(CN(JC)), '(F8.3)') CWDO(CN(JC),J) ! SW 9/23/13 Changed format from G8.3 to F8.3 to avoid format overflow CWDOC(CN(JC)) = ADJUSTR(CWDOC(CN(JC))) IF (QWDO(J) /= 0.0) CDWDO(CDN(JD,JW),J) = CDWDO(CDN(JD,JW),J)/QWDO(J) WRITE (CDWDOC(CDN(JD,JW)), '(F8.3)') CDWDO(CDN(JD,JW),J) ! SW 9/23/13 Changed format from G8.3 to F8.3 to avoid format overflow CDWDOC(CDN(JD,JW)) = ADJUSTR(CDWDOC(CDN(JD,JW))) </pre>	10/4/2013
45	W2 and PREW2	Inflow, Tributary, Distributary and Shade inputs	<p>Added csv file format as a new file input format for flow and temperature files for inflows, tributaries and distributed tributaries. Also, the shade file is now in csv file format. This enhancement includes updates to the preprocessor and W2 codes. Also several minor bug fixes were made on the Preprocessor.</p>	7/15/14
46	W2	Resuspension of inorganic solids	<p>A resuspension formula was corrected. See the code change below:</p> <pre> HS = 0.283 *U2/G*0.283*TANH(COEF1)*TANH(COEF2/TANH(COEF1)) !TS = 2.0*PI*U2/G*1.2* TANH(COEF3)*TANH(COEF4/TANH(COEF3)) TS = 2.0*PI*sqrt(U2)/G*1.2* TANH(COEF3)*TANH(COEF4/TANH(COEF3)) ! cb 5/9/14 </pre>	7/15/14
47	W2	Tecplot output	<p>When the user sets CPL output for Tecplot, the output format when HABITAC=OFF was incorrect. This has been fixed.</p>	7/15/14

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
48	PREW2	Warnings	Fixed a name inconsistency for developing warnings for input concentrations <pre>! IF (NAME /= 'Residence time' .AND. NAME /= 'Water age') THEN IF (NAME /= 'Residence time' .AND. NAME /= 'AGE') THEN ! SW 7/15/14 CALL WARNINGS</pre>	7/15/14
49	W2	TSR filename	The filename in w2_con.npt for TSR is used for the output filenames. In order to account for complex paths that include more than one '.', the following change was made with the BACK=.TRUE. command which checks from the right-hand-side rather than left-hand-side of the character string <pre>! L1 = SCAN(TSRFN, '.') L1 = SCAN(TSRFN, '.', BACK=.TRUE.)</pre>	8/22/14
50	PREW2	Hydraulic structure warnings	Added many new hydraulic structure warnings (gates, spillways, pumps, pipes, internal weirs) for cases where KBSTR was less than KB and fixed a few error messages for these structure checks.	9/10/14
51	W2	TSR output	The time series file has added the surface heat flux terms (net, short wave solar net, long wave radiation net, back radiation heat flux, evaporation heat flux, conductive heat flux) to the output. The manual was also updated.	1/15/15
52	W2	Interpolation of wind direction	In some cases, the wind direction interpolation was incorrect. Code was added to reduce the wind direction angle to less than 2π before the interpolation is performed and to consider another possible interpolation case. Thanks to Wenwei Xu for pointing this out. New code is shown below: <pre>! CONVERT PHIO AND PHINX TO LESS THAN 2*PI SW 2/13/15 DO WHILE (PHIO(JW) > 2.*PI) PHIO(JW) = PHIO(JW) - 2.*PI ENDDO DO WHILE (PHINX(JW) > 2.*PI) PHINX(JW) = PHINX(JW) - 2.*PI ENDDO IF (PHIO(JW) - PHINX(JW) > PI) THEN PHI(JW) = (1.0 - RATIO)*(PHINX(JW)+2.0*PI)+RATIO*PHIO(JW) ELSEIF (PHIO(JW) - PHINX(JW) < -PI) THEN ! WX 2/13/15 PHI(JW) = (1.0 - RATIO)*PHINX(JW)+RATIO*(PHIO(JW) +2.0*PI) ! WX 2/13/15 ELSE PHI(JW) = (1.0 - RATIO)*PHINX(JW)+RATIO*PHIO(JW) END IF</pre>	2/13/15

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
53	W2	Withdrawal	Stewart Rounds: Extra check to avoid divide by zero in withdrawal algorithm (this or similar code occurs in 4 subroutines in withdrawal.f90) IF ((ELSTR-HSWB) > EL(KBOT+1,ID)) THEN DLRHOB = ABS(RHO(KSTR,ID)-RHO(KBOT,ID)) ELSE IF ((EL(KBOT+1,ID)-ELR) == ELSTR) THEN !SR 03/24/13 DLRHOB = NONZERO !SR 03/24/13 ELSE DLRHOB = ABS(RHO(KSTR,ID)- RHO(KBOT,ID))*HSWB/(ELSTR-(EL(KBOT+1,ID)-ELR))	4/9/2015
54	W2	SELECTC	The USGS has developed a new automatic port selection algorithm. In the control file, w2_con.npt, one can use the new algorithm by setting SELECTC='USGS'. The old algorithm is used when this is set to SELECTC='ON'. There is new documentation in the User Manual for this new algorithm.	4/9/2015
55	W2	Restart output	Added code to write out a restart file (rso.opt) at the end of a run if restart_output is ON.	4/9/15
56	W2 Examples	Added example problems	Added new example problem for the Spokane River using new csv file inputs and 4 example problems for using the USGS auto-port algorithm	4/9/15
57	W2	Restart for file volume_wbX.opt	The file handler was not closed properly for volume_wbX.opt. Fixed it with additional code in endsimulation.f90: <pre> if(nwd > 0)then ifile=ifile+1 close(ifile) endif do jw=1,nwb ! sw 4/20/15 ifile=ifile+1 ! sw 4/20/15 close(ifile) ! sw 4/20/15 enddo ! sw 4/20/15 </pre>	4/20/15
58	W2	W2selective.npt	Changed input format for critical temperatures for the output file volume_wbX.opt from a maximum of 10 waterbodies to 100. <pre> READ(1010,'(8X,100F8.0)')(TEMPCRIT(JW, J),JW=1,NWB) ! NOTE MAX OF 100 WATERBODIES sw 4/20/15 </pre>	4/20/15
59	W2	Resuspension of SS	Changed DO loop index in suspended solids resuspension in water_quality.f90 from DO K=KT-1,KB(I)-1 to DO K=KT+1,KB(I)-1 ! cb 9/29/14	5/14/2015

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
60	W2	Wind at 2 m	<p>The W2 model computes the wind at a 2 m height based on the used defined measurement height of the wind for evaporation computations. The formula for computing this variable was using a step function of the wind data rather than interpolation of the wind data when the user chose to interpolate meteorological data. For meteorological input data at short time intervals this is a very minor change. For meteorological data at large time intervals (like a day), this could affect the amount of evaporation. Hence, the calculation below was moved from the TVDS routine to the main routine so that the interpolated wind would be used.</p> <p>WIND2(I)=WIND(JW)*WSC(I)*DLOG(2.0D0/Z0(JW))/DLOG(WINDH(JW)/Z0(JW))</p>	5/21/15
61	W2	TSR output	<p>The TSR file output now also includes a volume weighted vertical average temperature for the segment that the TSR file is located. The manual has been updated also.</p>	6/1/15
62	W2	Writing over output files	<p>In some intermittent cases, when the dialog box closes, the model reinitializes some of the output files (effectively deleting the output). The following line of code was adding at the beginning of the main W2 code to prevent this:</p> <pre> ! ** Task 1: Inputs ** ! ***** ***** ***** INTEGER(4) length, istatus character*255 dirc ! call omp_set_num_threads(4) ! set # of processors to NPROC Moved to INPUT subroutine IF(END_RUN)STOP ! SW 6/26/15 Added code to prevent a thread from reinitializing output files as dialog box is closing...intermittant error </pre>	6/26/15
63	W2	Output order for kinetic fluxes	<p>The output columns for DOAR and DOER were switched in the output file kflux_jw*.opt. The model code was changed to fix this.</p> <pre> ! DOAR => KF(:,56); DOEP => KF(:,57); DOER => KF(:,58); DOPOM => KF(:,59); DODOM => KF(:,60) DOEP => KF(:,56); DOAR => KF(:,57); DOER => KF(:,58); DOPOM => KF(:,59); DODOM => KF(:,60) ! cb 9/16/2015 </pre>	9/16/15

W2 V3.6 Bug Fixes, Enhancements, and User Manual Changes

Table 7. Bug fixes and enhancements for Version 3.6.

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
1	W2	TKE1 model	The variable STRICK was incorrectly allocated as an INTEGER rather than REAL.	10/11/2008
2	W2	PIPE	Code was streamlined in the subroutine ZBRENT where calls were made directly to CDFUNC rather than through the dummy function FUNC	10/11/2008
3	W2 Manual	Z0	The User Manual had Z0 in an incorrect line in the control file (w2_con.npt). The write up and example control file in the User Manual were corrected.	10/28/2008
4	W2	Longitudinal profile input	The W2 program did not read initial constituent concentrations in the longitudinal profile file when CCC was 'OFF'. This has been fixed.	12/4/2008
5	W2	TECPLOT output	When using TECPLOT output for multiple waterbodies, the output format did not allow loading the information into TECPLOT. Fixed.	1/26/2009
6	W2	Epiphyton input	For entering vertical profile data for periphyton, there was an index error: OLD CODE: IF (VERT_EPIPHYTON(JW,JE)) EPD(:,I,JE) = EPIVP(K,JW,JE) NEW CODE: IF (VERT_EPIPHYTON(JW,JE)) EPD(:,I,JE) = EPIVP(:,JW,JE)	5/21/2009
7	PreW2	Constituent loads	An enhancement was added to the Preprocessor to compute loads in kg/day for all inflow, tributary and distributed tributaries. Also, these are summed up for the model application. These are shown in the file "pre.opt". These are approximate loads since the concentration data are used to set the frequency of loading update. Flow rates at the time of the concentration input data are used to compute load.	5/21/2009

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
8	W2	Gas transfer at spillways	<p>A couple code fixes in the hydroinout.f90 subroutine:</p> <p>(1) CGAS needed to be initialized in some cases to CGAS=C2(K,ID,CN(JC)) prior to calling the subroutine TOTAL DISSOLVED GAS for use in the Butts and Evans (1983) equation: NEW CODE: CGAS=C2 (K, ID, CN (JC)) ! MM 5/21/2009</p> <p>(2) Change logic in several lines from IF(CAC(NDO) == ' ON' to IF(CAC(NDO) == ' ON' .and. CN(JC)==NDO NEW CODE: IF (CN (JC) ==NDO .AND. CAC (NDO) == ' ON' .AND. GASSPC (JS) == ' ON' .AND. QSP (JS) > 0.0) THEN ! MM 5/21/2009</p>	5/21/2009
9	W2	Reaeration from dams	<p>An error was found in the formulae from Butts and Evans (1983). OLD CODE: DB = SAT-C DA = DB* (1.0+0.38*AGASGT (N) *BGASGT (N) *CGASGT (N)) * (1.0-0.11*CGASGT (N)) * (1.0+0.046*T)) C = SAT-DA NEW CODE: DA = SAT-C ! MM 5/21/2009 DA: Deficit upstream DB = DA/ (1.0+0.38*AGASSP (N) *BGASSP (N) *CGASSP (N)) * (1.0-0.11*CGASSP (N)) * (1.0+0.046*T)) ! DB: deficit downstream C = SAT-DB</p>	5/21/2009

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
10	W2	Order of flux parameters	<p>The order of flux parameters in the User Manual and output were incorrect. The control file has them in this order:</p> <pre> RPOMSET CBODDK DOAP DOAR DOEP DOER DOPOM DODOM DOOM </pre> <p>whereas the code assumed they were in this order:</p> <pre> RPOMSET CBODDK DOAP DOEP DOAR DOER DOPOM DODOM DOOM </pre> <p>This has been corrected. The User Manual and control file order is now reflected in the W2 code.</p>	6/2/2009
11	Pre	False errors for inflow location	<p>The preprocessor sometimes gave false errors in the pre.err for tributary, internal weirs, pipes, and other hydraulic features saying that the pipe or tributary was below the elevation of the bottom of the segment. The W2 model ran fine even with this error message given in the preprocessor. This has been fixed.</p> <p>Example of OLD CODE:</p> <pre> IF (EBTR(JT) < EL(KB(ITR(JT)+1), ITR(JT))) THEN CALL ERRORS WRITE (ERR,FMTFI) 'Inflow placement bottom elevation [EBTR=',EBTR(JT),'] < bottom active cell elevation for tributary ',JT </pre> <p>New CODE:</p> <pre> IF (EBTR(JT) < EL(KB(ITR(JT))+1, ITR(JT))) THEN CALL ERRORS WRITE (ERR,FMTFI) 'Inflow placement bottom elevation [EBTR=',EBTR(JT),'] < bottom active cell elevation for tributary ',JT </pre>	6/18/09

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
12	Pre	Additional error checking	Additional error checking was added to help debug an error in the bathymetry file when the problem was in the branch connectivity specifically BS and BE. Also, a false error was given when the temperature had an isothermal initial condition, constituents were OFF, and an initial concentration was set to "-2". This was fixed.	6/22/09
13	Pre	Command line processing and working directory displayed for windows	<p>In the windows version of the preprocessor, the user can now supply a command line argument that sets the working directory of the code. Hence, one does not need to copy the preprocessor into every directory. In a batch file, for example, one can execute the following command:</p> <pre>preW2_ivf.exe "C:\scott\w2workshop\2009 workshop\waterqual\problem3"</pre> <p>The preprocessor now uses the supplied directory (in double quotes) as the working directory for all the files. The command line argument has one blank space between the end of the executable and the first quote. Also, the working directory is now displayed at the top of the window.</p> <p>Additional checks were also added for checking the grid linkage.</p>	9/12/09
14	W2	# of processors	<p>The model user can now control the # of physical processors the model uses. At this point, dual-processor model runs have shown an improvement of about 20% over a single processor. But, QUAD processors usually are slower. It is recommended that NPROC be set to 2 in the control file. The user can experiment on his/her own system. If this is not set by the user or is left blank, the model still runs but sets it to 2 processors.</p> <pre> GRID NWB NBR IMX KMX NPROC CLOSEC 1 1 23 22 2 ON </pre>	9/12/09

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
15	W2	Command line processing for windows	<p>In the windows version of the w2 model, the user can now supply a command line argument that sets the working directory of the code. Hence, one does not need to copy the model executable into every directory. In a batch file, for example, one can execute the following command:</p> <pre>W2_ivf.exe "C:\scott\w2workshop\2009 workshop\waterqual\problem3"</pre> <p>The w2 model now uses the supplied directory (in double quotes) as the working directory for all the files. The command line argument has one blank space between the end of the executable and the first quote. The working directory is displayed in a text box in the window.</p>	9/12/09
16	W2	W2 window closed at end of successful execution	<p>At the end of a windows run, the windows dialog box waits for the user to press 'close' to exit the window. This allows the user to examine the final run parameters. In the w2_con.npt file there is now an option to close this window when the run has completed. If this option is not set, then the dialog box will stay until the user clicks 'close'.</p> <p>This allows for efficient batch processing of the model, especially if user in conjunction with command line processing mentioned in #15.</p> <pre>GRID NWB NBR IMX KMX NPROC CLOSEC 1 1 23 22 0 ON</pre> <p>When CLOSEC is set to ON, then the dialog box will disappear once the run finishes. If it is set to OFF, then the dialog box will remain until the user clicks 'close'.</p>	9/12/09
17	User Manual	Updates	Updates and changes to the control file (#13-#16) were reflected in an updated User Manual.	9/12/09

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
18	GUI	Updates	<p>The GUI was updated with the following:</p> <ol style="list-style-type: none"> (1) new control file parameters NPROC and CLOSEC were added (see #14 and 16). There is also a SELECTC that will be used in V3.7 that has been included – ignore it for now. (2) The GUI also can be controlled by command line passing of the working directory and file. In a batch program or from the command line in a DOS box you can execute the GUI as follows: <pre>"C:\scott\research\corps of engi- neers\tomcole\w2code\GUI36\w2control\w2co ntrol36.exe" C:\scott\w2workshop\2009 workshop\waterqual\problem1\w2_con.npt</pre> <p>The first string in quotes executes the GUI. The command line argument is NOT in quotes. This program was developed in VB6 and does not take quotes around the command line. Note that this is different than the FORTRAN command line argument. So the above command will open the GUI and load the control file automatically.</p> <ol style="list-style-type: none"> (3) A text box now shows the file path and name of the file that you are working on (4) In file open, earlier all *.npt files were shown. Since only "w2_con.npt" files are loaded into the GUI, only the "w2_con.npt" file was shown for opening. 	9/12/09

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
19	W2	Gates, spillways, pipes	<p>Whenever DOWN was specified for a gate, spillway or pump, the model estimated the water level at the end of the segment, rather than using the branch center water level. This is important in sloping river systems where a long segment may have a water surface elevation drop between the segment center and the edge. In the past this was computed assuming the slope of the channel. This was updated to estimate the water surface elevation using linear interpolation rather than the grid slope. Below is an example of the code fix – in this case for GATES:</p> <p>OLD CODE: <code>ELIU=ELWS (IUGT (JG)) - SINA (JBUGT (JG)) *DLX (IUGT (JG)) *0.5</code></p> <p>NEW CODE: <code>ELIU= ELWS (IUGT (JG)) + (ELWS (IUGT (JG)) - ELWS (IUGT (JG) - 1)) / (0.5 * (DLX (IUGT (JG)) +DLX (IUGT (JG) - 1))) *DLX (IUGT (JG)) *0.5</code></p>	9/25/09
20	W2	New executable	A new executable was made using a new release of Intel Version 11 compiler that corrected problems with Windows 7 applications.	9/25/09

21	W2	ICE cover algorithm	<p>There were a couple logic errors in the ice cover algorithm. These were corrected below:</p> <pre> !***** Ice thickness ICETH(I) = ICETH(I)+ICETHU+ICETH1+ICETH2 IF (ICETH(I) < ICE_TOL) ICETH(I) = 0.0 IF (WINTER .AND. (.NOT. ICE_IN(JB))) THEN IF (.NOT. ALLOW_ICE(I)) ICETH(I) = 0.0 END IF ICE(I) = ICETH(I) > 0.0 IF (ICE(I)) THEN ! 3/27/08 SW ICESW(I) = 0.0 ELSE ICESW(I) = 1.0 ENDIF ICETHU = 0.0 ICETH1 = 0.0 ICETH2 = 0.0 IF (ICETH(I) < ICE_TOL .AND. ICETH(I) > 0.0) ICETH(I) = ICE_TOL ELSE IF (TERM_BY_TERM(JW)) CALL EQUILIBRIUM_TEMPERATURE ! SW 10/20/09 Must call this first otherwise ET and CSHE are 0 HIA = 0.2367*CSHE(I)/5.65E-8 ! JM 11/08 convert SI units of m/s to English (btu/ft2/d/F) and then back to SI W/m2/C ! ICETH(I) = MAX(0.0,ICETH(I)+DLT*((RIMT- ET(I))/(ICETH(I)/RK1+1.0/HIA)-(T2(KT,I)- RIMT))/RHOIRL1) ! OLD CODE ICETH(I) = MAX(0.0,ICETH(I)+DLT*((RIMT- ET(I))/(ICETH(I)/RK1+1.0/HIA)- HWI(JW)*(T2(KT,I)-RIMT))/RHOIRL1) ! SW 10/20/09 Revised missing HWI(JW) ICE(I) = ICETH(I) > 0.0 ICESW(I) = 1.0 IF (ICE(I)) THEN ! TFLUX = 2.392E- 7*(RIMT-T2(KT,I))*BI(KT,I)*DLX(I) ! OLD CODE TFLUX = 2.392E- 7*HWI(JW)*(RIMT-T2(KT,I))*BI(KT,I)*DLX(I) ! SW 10/20/09 Revised missing HWI(JW) TSS(KT,I) = TSS(KT,I) +TFLUX TSSICE(JB) = TSSICE(JB)+TFLUX*DLT ICESW(I) = 0.0 END IF END IF END DO END IF END IF END IF </pre>	10/20/09
22	W2	Gates output in QWD file	<p>The following bug was found in defining which branch a gate was located. This affected the output for the</p>	3/24/10

#	Code: W2 or PREW2 or GUI	Fix or En- hancement Type	Description of Bug/Enhancement	Date Bug Fixed or En- hancement added
			<p>withdrawals at a location where there were gates that were not tied to other branches.</p> <p>Old code:</p> <pre> JWUGT(JG) = JW IF (IDGT(JG) > 0) THEN DO JB=1,NBR IF (IDGT(JG) >= US(JB) .AND. IDGT(JG) <= DS(JB)) EXIT END DO JBDGT(JG) = JB DO JW=1,NWB IF (JB >= BS(JW) .AND. JB <= BE(JW)) EXIT END DO JWDGT(JG) = JW else ! BUG FIX 9/27/07 jbdgt(jp)=1 jwdgt(jp)=1 END IF </pre> <p>New code:</p> <pre> JWUGT(JG) = JW IF (IDGT(JG) > 0) THEN DO JB=1,NBR IF (IDGT(JG) >= US(JB) .AND. IDGT(JG) <= DS(JB)) EXIT END DO JBDGT(JG) = JB DO JW=1,NWB IF (JB >= BS(JW) .AND. JB <= BE(JW)) EXIT END DO JWDGT(JG) = JW else ! BUG FIX 9/27/07 jbdgt(jg)=1 ! SW 3/24/10 jwdgt(jg)=1 ! SW 3/24/10 END IF </pre>	

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
23	PreW2	Reading of WSC	<p>Reading in of the WSC file was limited to only 100 dates in the preprocessor. This limitation was fixed by the code shown below:</p> <pre> ! DO J=1,100 28995 continue ! cb 3/26/10 READ (NPT, '(10F8.0/(8X,9F8.0))',END=29000) SDAY, (WSC(I),I=1,IMX) IF (SDAY <= SDAYO) THEN CALL ERRORS WRITE (ERR, '(3(A,F0.3))') 'Julian date ',SDAY, ' <= previous date of ',SDAYO, ' in '//WSCFN END IF DO I=1,IMX IF (WSC(I) <= 0.0) THEN CALL ERRORS WRITE (ERR, '(A,F0.3,A,I4,A)') 'Julian date ',SDAY, ': WSC AT SEG(I)=',I, ' <= 0.0 in '//WSCFN ENDIF IF (WSC(I) > 2.0) THEN CALL WARNINGS WRITE (WRN, '(A,F0.3,A,I4,A)') 'Julian day ',SDAY, ': WSC(I) AT SEG(I)=',I, ' > 2.0 in '//WSCFN END IF IF (WSC(I) > 0.0 .and. wsc(i) < 0.5) THEN CALL WARNINGS WRITE (WRN, '(A,F0.3,A,I4,A)') 'Julian day ',SDAY, ': WSC(I) AT SEG(I)=',I, ' < 0.5 in '//WSCFN END IF ENDDO SDAYO=SDAY ! ENDDO go to 28995 ! cb 3/26/10 </pre>	3/26/10
24	PreW2	Check on LAT or DOWN	<p>Added an enhancement to do a check in case a spillway, pipe, pump, or gate was specified as 'DOWN'. In all cases where 'DOWN' is specified, the segment that the hydraulic structure originates must be at the end of a branch. Additional logic was added to check for this in all the hydraulic structures.</p>	3/26/10
25	W2 Manual	Light extinction, ice	<p>Added more text to the section on computation of light extinction and inserted a missing reference. Revised an equation for clarity in ICE algorithm and added more explanation on how to estimate HICE.</p>	4/13/2010
26	W2 Manual	Precipitation input file	<p>The units of precipitation are in m/s. The example precipitation input file was changed to more realistic values.</p>	4/14/2010

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
27	W2	ICE	<p>Added code to account for the need to compute long wave radiation in case user chose the equilibrium temperature approach. Fixed subscript error in ice melt computation. Also, made the variable TICE double precision since it is assumed double precision in the call to Surface_terms.</p> <p>New code:</p> <pre> IF (ICE(I)) THEN TICE = TAIR(JW) DEL = 2.0 J = 1 if(tair(jw).ge.5.0)then ! SW 4/19/10 RANLW(JW) = 5.31E- 13*(273.15+TAIR(JW))**6*(1.0+0.0017*CLOUD (JW)**2)*0.97 else RANLW(JW) = 5.62E- 8*(273.15+TAIR(JW))**4*(1.-0.261*exp(- 7.77E- 4*TAIR(JW)**2))*(1.0+0.0017*CLOUD(JW)**2) *0.97 endif RN1=SRON(JW)/(REFL*RHOWCP)*SHADE(I)*(1.0- ALBEDO(JW))*BETAI(JW)+RANLW(JW) ! SW 4/19/10 DO WHILE (DEL > 1.0 .AND. J < 500) CALL SURFACE_TERMS (TICE) RN(I) = RN1-RB(I)- RE(I)-RC(I) ! 4/19/10 ! RN(I) = SRON(JW)/(REFL*RHOWCP)*SHADE(I)*(1.0- ALBEDO(JW))*BETAI(JW)+RANLW(JW)-RB(I)- RE(JW)-RC(I) ! OLD CODE DEL = RN(I)+RK1*(RIMT-TICE)/ICETH(I) IF (ABS(DEL) > 1.0) TICE = TICE+DEL/500.0 J = J+1 END DO </pre>	4/19/10
28	W2	Evaporation	<p>Units for EV in the SNP file were given in m/s but were actually m^3/s</p>	4/21/10

#	Code: W2 or PREW2 or GUI	Fix or En- hancement Type	Description of Bug/Enhancement	Date Bug Fixed or En- hancement added
29	W2	Ice	<p>In the ice melt algorithm, SRON should not have been divided by RHOCP in computing RN1 and DEL in the DO WHILE loop should have been ABS(DEL) rather than DEL:</p> <pre> RN1=SRON(JW)/REFL*SHADE(I)*(1.0- ALBEDO(JW))*BETAI(JW)+RANLW(JW) ! SW 4/19/10 eliminate spurious division of SRO by RHOCP DO WHILE (ABS(DEL) > 1.0 .AND. J < 500) ! SW 4/21/10 Should have been ABS of DEL CALL SURFACE_TERMS (TICE) </pre>	4/21/2010
30	PRE	Constituent loading	<p>The output from the preprocessor in the pre.opt file for constituent loading was in kg rather than the output header of kg/day. The output was updated to kg/day by adding the following lines of code:</p> <pre> cdtload(incdt(1:NACdt(Jb),Jb),jb)=cdtload(incdt(1:NACdt(Jb),Jb),jb)/(jday-tstart) ! CB 5/10/10 Change units to kg/day ctrload(trcn(1:NACtr(Jt),Jt),jt)=ctrload(trcn(1:NACtr(Jt),Jt),jt)/(JDAY-TSTART) !CB 5/11/10 convert to units of kg/day </pre>	5/10/10

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
31	W2	Gate, spillways, pipes	<p>In the case where the user has specified that the flow is DOWN, in the case of reverse flow, the model did not assign the flow correctly if the user had no other tributaries or withdrawals specified in the control file. For this rare event, additional code was written to account for this fact. Also, a logic error was discovered in reverse flow for spillways and gates. This was corrected.</p> <p>New code added to hydroinout.f90:</p> <pre> JWW = NWD withdrawals = jww > 0 ! 6/4/10 SW JTT = NTR tributaries = jtt > 0 ! 6/4/10 SW JSS = NSTR IF (SPILLWAY) THEN ... END IF tributaries = jtt > 0 ! 6/4/10 SW withdrawals = jww > 0 ! 6/4/10 SW DO JW=1,NWB KT = KTWB(JW) DO JB=BS(JW),BE(JW) </pre> <p>New code in gate-spill-pipe.f90:</p> <p>For spillway:</p> <pre> IF (ISUB == 0) THEN DLEL = ELIU-ESP(JS) IF (ELID > ESP(JS)) DLEL = ELIU-ELID ! SW 6/7/10 IF (DLEL < 0.0) THEN DLEL = -DLEL </pre> <p>For gates:</p> <pre> IF (A2GT(JG) == 0.0 .AND. G2GT(JG) /= 0.0) DLEL = ELIU-G2GT(JG) IF (ELID > EGT(JG)) DLEL = ELIU-ELID ! SW 6/7/10 IF (DLEL < 0.0) THEN </pre>	6/4/10

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement added
32	W2	Branch intersections with multiple waterbodies	<p>In cases where there are branch intersections between waterbodies, it was possible that the variable KBI and KB were incorrectly set. Here is the fix: Move the statement defining KBI in the subroutine init-geom.f90 to the place shown below (delete the earlier reference):</p> <pre> IF (B(K, ID+1) == 0.0) B(K, ID+1) = B(K-1, ID+1) IF (IEXIT == 1) EXIT END IF END IF END IF END DO END DO ! SW 1/23/06 END DO ! SW 1/23/06 bnew=b ! SW 1/23/06 KBI = KB ! SW 10/30/2010 !**** Upstream active segment and single layer ! 1/23/06 entire section moved SW DO JW=1, NWB KT = KTWB(JW) DO JB=BS(JW), BE(JW) </pre>	10/30/2010
33	W2	SS resuspension	<p>The code index was incorrect in the loop for computing resuspension. This led in some compilers to an infinite loop.</p> <p>The corrected code is shown below:</p> <pre> SSSS(KT, I, J) = - SSS(J) * SS(KT, I, J) * BI(KT, I) / BH2(KT, I) + SSR ! DO K=KT-1, KB(I)-1 ! DO K=KT, KB(I)-1 ! JP 2/3/12 IF (SEDIMENT_RESUSPENSION(J)) THEN </pre> <p>Thanks to James Pasley for this bug report/fix.</p>	2/3/2012

W2 V3.5 Bug Fixes, Enhancements, and User Manual Changes

Table 8. Bug fixes and enhancements for Version 3.5.

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
1	W2	Zooplankton-algae	Sign error in the zooplankton grazing on algae term	8/23/06
2	W2	Input/output	Format for I/O was changed to allow better decimal precision of output	8/23/06
3	W2	Sediment settling rate	<p>The sediment settling rate was accidentally used for POM settling. This was fixed. The old and new code lines are shown below:</p> <p>OLD:</p> <pre>sedsum = sedsum+seds(JW)*(LPOM(K,I)*lpomdk(jw)+RPO M(K,I)*rpomdk(jw))*BI(K,I)/BH2(K,I)*(1 .0-BI(K+1,I)/BI(K,I))</pre> <p>NEW:</p> <pre>sedsum = sedsum+poms(JW)*(LPOM(K,I)*lpomdk(jw)+RPO M(K,I)*rpomdk(jw))*BI(K,I)/BH2(K,I)*(1 .0-BI(K+1,I)/BI(K,I)) ! cb 10/22/06</pre> <p>This was an issue in the SEDIMENT, SEDIMENT C, SEDIMENT P, SEDIMENT N, and SEDIMENT DECAY RATE subroutines.</p>	10/26/06
4	W2	Sediment burial	<p>An algorithm was added for sediment burial. This is now a new parameter in the sediment part of the control file. An updated user manual description is forthcoming. The sediment burial rate SEDB (day⁻¹) can be specified in the “SEDIMENT” card section of the control file. A different burial rate can be specified for each water body.</p> <p>OLD/NEW line (example):</p> <pre>! SED(K,I) = MAX(SED(K,I)+(LPOMEP(K,I)+SEDAS(K,I)+S EDOMS(K,I)+SEDNS(K,I)- SEDD(K,I))*DLT,0.0) SED(K,I) = MAX(SED(K,I)+(sedem+SEDAS(K,I)+sedcb(k ,i)+SEDOMS(K,I)+SEDNS(K,I)-SEDD(K,I)- sedbr(k,i))*DLT,0.0) ! cb 11/30/06</pre>	11/30/06

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
5	Control File	Add burial rate for sediment model	<p>This is the change in #4 above implemented in the control file. The new variable SEDBR is added in f8 format after the FSED variable. SEDBR: sediment burial rate in units of per day.</p> <pre> SEDIMENT SEDC SEDPRC SEDCI SEDK SEDS FSOD FSED SEDBR WB 1 ON ON 0.00000 0.10000 0.1 1.00000 1.00000 1.0 </pre>	
6	W2	Sediment heating and sediment processes	<p>If a model added and subtracted layers that resulted in segment addition and subtraction, there was the possibility that sediment fluxes were incorrectly computed.</p> <p>In the NO3 subroutine: Old code:</p> <pre> NO3SED(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I) -BI(K+1,I))/BH2(K,I) </pre> <p>New code:</p> <pre> if(k == kb(i)) then NO3SED(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I))/BH2(K,I) else NO3SED(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I)- BI(K+1,I))/BH2(K,I) endif </pre> <p>New code added in sediment routine:</p> <pre> if(k == kb(i)) then ! SW 4/18/07 SODD(K,I) = SOD(I)/BH2(K,I)*SODTRM(K,I)*BI(K,I) else SODD(K,I) = SOD(I)/BH2(K,I)*SODTRM(K,I)*(BI(K,I)- BI(K+1,I)) Endif </pre> <p>New code added in suspended solids routine:</p> <pre> if(k == kb(i)) then SSR = EPSILON*DLX(I)*BI(K,I)/VOL(K,I) else SSR = EPSILON*DLX(I)*(BI(K,I)- BI(K+1,I))/VOL(K,I) Endif </pre>	4/18/07

#	Code: W2 or PREW2 or GUI	Fix or En- hance-ment Type	Description of Bug/Enhancement	Date Bug Fixed or Enhance- ment Added
6	W2	(see above)	<p>New code added for heat flux to channel bottom:</p> <pre> if (kt == kb(i)) then ! SW 4/18/07 SROSED = SROOUT*TSEDF(JW) else SROSED = SROOUT*(1.0- BI(KT+1,I)/BI(KT,I))*TSEDF(JW) Endif if (k==kb(i)) then ! SW 4/18/07 TFLUX = CBHE(JW)/RHOWCP*(TSED(JW)- T2(K,I))*BI(K,I)*DLX(I) else TFLUX = CBHE(JW)/RHOWCP*(TSED(JW)- T2(K,I))*(BI(K,I)-BI(K+1,I))*DLX(I) endif </pre> <p>New code added for sediment subrou- tine:</p> <pre> if (k == kb(i)) then ! SW 4/18/07 SEDAS(K,I) = SEDAS(K,I)+MAX(AS(JA),0.0)*ALG(K,I,JA) *BI(K,I)/BH2(K,I)*(1.0- BI(K+1,I)/BI(K,I)) else SEDAS(K,I) = SEDAS(K,I)+MAX(AS(JA),0.0)*ALG(K,I,JA) *BI(K,I)/BH2(K,I)*(1.0- BI(K+1,I)/BI(K,I)) endif if (k == kb(i)) then ! SW 4/18/07 SEDOMS(K,I) = POMS(JW)*(LPOM(K,I)+RPOM(K,I))*BI(K,I) /BH2(K,I) SEDSO = POMS(JW)*SED(K,I)*BI(K+1,I)/BH2(K,I) else SEDOMS(K,I) = POMS(JW)*(LPOM(K,I)+RPOM(K,I))*BI(K,I) /BH2(K,I)*(1.0-BI(K+1,I)/BI(K,I)) SEDSO = POMS(JW)*SED(K,I)*BI(K+1,I)/BH2(K,I)*(1.0-BI(K+1,I)/BI(K,I)) endif </pre>	4/18/07

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
7	W2	Zoo-plankton fixes	<p>Several fixes in the zooplankton routine were made. Many thanks to Dr. Kellie Vache, Institute for Landscape Ecology and Resources Management (ILR) Justus-Liebig-University Giessen Heinrich-Buff-Ring 26 35392 Giessen, Germany, for finding these which are documented below:</p> <pre> DO K=KT,KB(I) do jz = 1, nzp zgztot=0.0 !kv 5/9/2007 do jjz = 1,nzp ! zooss(k,i,jz)= (zmu(k,i,jz)*zeff(jz)-zrt(k,i,jz)- zmt(k,i,jz))*zoo(k,i,jz) - zgztot ! omnivorous zooplankton zgztot=zgztot+zgztot+zgztot*(k,i,jz,jz)*zoo(k,i,jz) !kv 5/9/2007 end do zooss(k,i,jz)= (zmu(k,i,jz)*zeff(jz)-zrt(k,i,jz)- zmt(k,i,jz))*zoo(k,i,jz) - zgztot ! kv 5/9/2007 end do do jjz = 1, nzp ! tgraze(k,i,jz) = tgraze(k,i,jz) + prefz(jz,jjz)*zoo(k,i,jjz) tgraze(k,i,jz) = tgraze(k,i,jz) + prefz(jjz,jz)*zoo(k,i,jjz) !cb 5/17/2007 end do do jjz = 1,nzp ! omnivorous zooplankton ! ZGZ(k,i,jjz,jz) = Zmu(K,I,jz)*ZOO(K,I,jz)*prefZ(jz,jjz)/ tgraze(K,I,jz) ZGZ(k,i,jjz,jz) = Zmu(K,I,jz)*ZOO(K,I,jz)*prefZ(jjz,jz)/ tgraze(K,I,jz) !kv 5/9/2007 end do </pre>	5/21/07
8	PRE	More checks	<p>Added checks for Sediment burial rate and some further checks on grid geometry; added output on SEDS and SEDBR to the pre.opt file; fixed condition where NZP had to equal 1 to work.</p>	6/2/2007

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
9	W2	Array deallocation	The deallocate command on line 7557 was commented out to avoid a deallocation error when the 'STOP' button is pushed during execution on a PC. ! deallocate (sedbr,sedbrp,sedbrn,sedbrc) ! SW 6/4/07 No need to deallocate pointers	6/4/2007
10	W2	Initialization of IUT	For code setting up an external head BC, the variable IUT was not initialized before it was used. This was fixed below: !**** Boundary bottom layers ! IF (UH_EXTERNAL(JB)) KB(IUT-1) = KB(IUT) IF (UH_EXTERNAL(JB)) KB(IU-1) = KB(IU) !cb 6/12/07 IF (UH_INTERNAL(JB)) THEN IF (JBUH(JB) >= BS(JW) .AND. JBUH(JB) <= BE(JW)) THEN ! KB(IUT-1) = MIN(KB(UHS(JB)),KB(IUT)) KB(IU-1) = MIN(KB(UHS(JB)),KB(IU)) !cb 6/12/07 ELSE ! IF (EL(KB(IUT),IUT) >= EL(KB(UHS(JB)),UHS(JB))) THEN IF (EL(KB(IU),IU) >= EL(KB(UHS(JB)),UHS(JB))) THEN !cb 6/12/07 ! KB(IUT-1) = KB(IUT) KB(IU-1) = KB(IU) ELSE ! DO K=KT,KB(IUT) ! IF (EL(KB(UHS(JB)),UHS(JB)) >= EL(K,IUT)) THEN ! KB(IUT-1) = K; EXIT DO K=KT,KB(IU) !cb 6/12/07 IF (EL(KB(UHS(JB)),UHS(JB)) >= EL(K,IU)) THEN !cb 6/12/07 KB(IU-1) = K; EXIT !cb 6/12/07 END IF	6/17/2007
11	W2	CBOD settling	The CBOD settling rate earlier was not converted from m/d in the control file to m/s in the code. Added code: cbods = cbods/day !cb 7/23/07	7/23/07

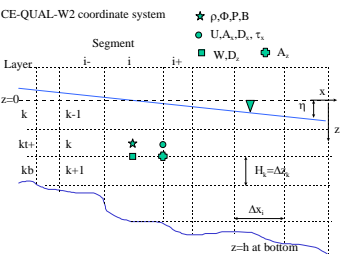
#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
12	W2	TSR output	The surface width was not correctly being output. Changed BI(KT) to BI(KTWB(JW)). FIX: BI (KTWB (JW) , I) , SHADE (I) , ICETH (I) , (ADJUSTR (C2CH (JAC)) , JAC=1 , NAC) , & ! CB 7/26/07	7/26/07
13	PREW2	Pumps	The pump control for DOWN or LAT was not being checked properly, also a check on IUPUC was incorrect. Fixed.	8/14/07
14	W2	Algae	The logic for negative settling velocities for algae had an error. Old code: ! ASR (K, I, JA) = - AS (JA) * (ALG (K+1, I, JA) * B (K+1, I) / (B (K, I) * H2 (K, I)) - ALG (K, I, JA)) * BI (K, I) / BH2 (K, I) New code: ASR (K, I, JA) = - AS (JA) * (ALG (K+1, I, JA) * BI (K+1, I) / BH2 (K, I) - ALG (K, I, JA) * BI (K, I) / BH2 (K, I)) ! SP 8/27/07 Shwet Prakash	8/27/07
15	GUI	NZOOP	When # of zooplankton was set equal to zero, there was an array dimensioning error that caused the writing of the control file to only proceed part way. Fixed.	9/17/07

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
16	W2	Open channel flow	<p>Variable passed between subroutines had inconsistent declaration between routines.</p> <pre> ! REAL, ALLOCATABLE, DIMENSION(:) :: Y, D, B, V, CAREA, TOPW, BELEV, Q, VOLD, YOLD REAL, ALLOCATABLE, DIMENSION(:) :: Y, B, V, CAREA, TOPW, BELEV, Q, VOLD, YOLD ! cb 10/1/07 ! ALLOCATE (Y(NN), V(NN), CAREA(NN), TOPW(NN), BELEV(NN), Q(NN), VOLD(NN), YOLD(NN), D(NN), B(NN)) ALLOCATE (Y(NN), V(NN), CAREA(NN), TOPW(NN), BELEV(NN), Q(NN), VOLD(NN), YOLD(NN), B(NN)) ! cb 10/1/07 ! DEALLOCATE (Y, V, CAREA, TOPW, BELEV, Q, VOLD, YOLD, D, B, YT, VT, VPR, YPR, TAREA, TOPWT, RT, INDX, AL, DAA) DEALLOCATE (Y, V, CAREA, TOPW, BELEV, Q, VOLD, YOLD, B, YT, VT, VPR, YPR, TAREA, TOPWT, RT, INDX, AL, DAA) ! cb 10/1/07 </pre>	10/4/07
17	W2	TKE model	<p>The TKE algorithm had several bugs that have been fixed, these included making the loop over layers go to KBMIN (rather than KB), the original code overwrote the boundary conditions when using the Thomas algorithm, the original code overwrote vertical eddy viscosity at the bed during the averaging process, Δz_k changed to $\Delta z_{k+1/2}$, TKE array was initialized to zero, TKE was implemented in add/sub layers like AZ. Many of these fixes are a result of the work of Sam Gould (Gould, 2006) who wrote an MS project report at PSU entitled “k-e Turbulence Model.” Further recommendations by Gould (2006) will be incorporated into the next version of CE-QUAL-W2.</p>	10/4/07

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
			<p>The old code is shown below as a reference to the new code in the release version.</p> <p>OLD CODE</p> <pre> ENTRY CALCULATE_TKE USTAR = SQRT (1.25*CZ (I) *WIND10 (I) **2/RHO (KT,I)) IF (MANNINGS_N (JW)) THEN HRAD = BHR1 (KT,I) / (BR (KTI (I), I) - BR (KT+1,I) +2.*AVH1 (KT,I)) if (macrophyte_on.and.mannings_n (jw)) then call macrophyte_friction (hrad, fric (i), effric, kt, i) gc2=g*effric*effric/hrad**0.33333333 else if (.not.macrophyte_on.and.mannings_n (j w)) then gc2=g*fric (i) *fric (i) /hrad**0.33333333 end if ELSE GC2 = 0.0 IF (FRIC (I) /= 0.0) GC2 = G/ (FRIC (I) *FRIC (I)) END IF USTARB = SQRT (GC2) *ABS (0.5* (U (KT,I) +U (KT,I-1))) TKE (KT,I,1) = 0.5* (3.33* (USTAR*USTAR+USTARB*USTARB) + TKE (KT,I,1)) * (BH2 (KT,I) /BH1 (KT,I)) TKE (KT,I,2) = 0.5* (USTAR*USTAR*USTAR+USTARB*USTARB*U STARB*5.0/H1 (KT,I) +TKE (KT,I,2)) * (BH2 (K T,I) /BH1 (KT,I)) DO K=KT+1, KB (I) -1 BOUK = MAX (AZ (K,I) *G* (RHO (K+1,I) - RHO (K,I)) / (H (K,JW) *RHOW), 0.0) PRDK = AZ (K,I) * (0.5* (U (K,I) +U (K,I- 1) -U (K+1,I) -U (K+1,I-1)) /H (K,JW)) **2.0 PRHE = 10.0*GC2**1.25*ABS (0.5* (U (K,I) +U (K,I- 1))) **4.0/ (0.5*B (K,I)) **2.0 IF (MANNINGS_N (JW)) THEN ! v3.5 start HRAD = BHR (K,I) / (BR (K,I) - BR (K+1,I) +2.0*H (K,JW)) ! GC2 = G*FRIC (I) *FRIC (I) /HRAD**0.333 if (macrophyte_on.and.mannings_n (jw)) then call macrophyte_friction (hrad, fric (i), effric, k, i) gc2=g*effric*effric/hrad**0.33333333 </pre>	

#	Code: W2 or PREW2 or GUI	Fix or En- hance-ment Type	Description of Bug/Enhancement	Date Bug Fixed or Enhance- ment Added
			<pre> else if (not.macrophyte_on.and.mannings_n(jw))then gc2=g*fric(i)*fric(i)/hrad**0.33333333 end if ! v3.5 end END IF PRHK = GC2/(0.5*B(K,I))*ABS(0.5*(U(K,I)+U(K,I -1)))*3.0 UNST = PRDK-TKE(K,I,2) UNSE = 1.44*TKE(K,I,2)/TKE(K,I,1)*PRDK- 1.92*(TKE(K,I,2)/TKE(K,I,1)*TKE(K,I,2)) TKE(K,I,1) = TKE(K,I,1)+DLT*(UNST+PRHK-BOUK) TKE(K,I,2) = TKE(K,I,2)+DLT*(UNSE+PRHE) END DO USTARB = SQRT(GC2)*ABS(0.5*(U(KB(I),I)+U(KB(I), I-1))) TKE(KB(I),I,1) = 0.5*(3.33*USTARB*USTARB+TKE(KB(I),I,1)) TKE(KB(I),I,2) = 0.5*(USTARB*USTARB*USTARB*5.0/H(KB(I), JW)+TKE(KB(I),I,2)) AT = 0.0; CT = 0.0; VT = 0.0; DT = 0.0 DO J=1,2 DO K=KT,KB(I) AT(K,I) = -DLT/BH1(K,I)*BB(K- 1,I)/SIG(J)*AZ(K-1,I)/AVH1(K-1,I) CT(K,I) = - DLT/BH1(K,I)*BB(K,I)/SIG(J)*AZ(K,I)/AV H1(K,I) VT(K,I) = 1.0-AT(K,I)-CT(K,I) DT(K,I) = TKE(K,I,J) END DO CALL TRIDIAG(AT(:,I),VT(:,I),CT(:,I),DT(:,I),KT,KB(I),KMX,TKE(:,I,J)) END DO DO K=KT,KB(I) TKE(K,I,1) = MAX(TKE(K,I,1),TKEMIN1) TKE(K,I,2) = MAX(TKE(K,I,2),TKEMIN2) AZ(K,I) = 0.09*TKE(K,I,1)*TKE(K,I,1)/TKE(K,I,2) END DO ! Center at cell faces DO K=KT,KB(I)-1 AZ(K,I) = 0.5*(AZ(K,I)+AZ(K+1,I)) AZ(K,I) = MAX(AZMIN,AZ(K,I)) AZ(K,I) = MIN(AZMAX(JW),AZ(K,I)) DZ(K,I) = MAX(DZMIN,FRAZDZ*AZ(K,I)) END DO </pre>	

#	Code: W2 or PREW2 or GUI	Fix or En- hance-ment Type	Description of Bug/Enhancement	Date Bug Fixed or Enhance- ment Added
18	W2	Restart	Added TKE to restart variables written out and read in.	10/5/07
19	GUI	ET	The equilibrium temperature option in the drop down menu was 'EQT' rather than 'ET'. Fixed.	10/9/07
20	W2	Sediment	The SEDIMENT subroutine did not have any computational mistakes, just an error in assigning all array variables to the value at K,I. This resulted in excessive computational time. The fix is shown below: OLD sedbr = sedb(jw)*sed(k,i) NEW sedbr(K,I) = sedb(jw)*sed(k,i)	10/15/07

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
21	W2	TKE	<p>Turbulence model had an improper averaging between layers. A new temporary variable was defined to temporarily store the values for AZ prior to averaging to the bottom/top of the layers and the horizontal layers. This also affected the computation of DZ. Fixed.</p> <p>New code defined AZT and allocated memory for it, such that</p> $AZT(K, I) = 0.09 * TKE(K, I, 1) * TKE(K, I, 1) / TKE(K, I, 2)$ <p>and</p> $AZ(K, I) = 0.5 * (AZT(K, I) + AZT(K+1, I))$ <p>Similarly for the horizontal averaging and for DZ. Also, the values of DZ were fixed to be at the bottom of a cell and AZ was fixed to be at the bottom right-hand edge of a cell as shown below:</p> 	12/17/07

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
22	W2	SS settling	<p>The incorrect cell width was used for SSSO. BI(KT,I) was changed to BI(K,I).</p> <p>OLD CODE:</p> <pre> SSSO (K, I) = (TOTSS0+FES (JW) *FPFE (K, I)) *B I (KT, I) /BH2 (K, I) *DO1 (K, I) FPSS (K, I) = FPSS (K, I) *TISS (K, I) NEW CODE: SSSO (K, I) = (TOTSS0+FES (JW) *FPFE (K, I)) *B I (K, I) /BH2 (K, I) *DO1 (K, I) FPSS (K, I) = FPSS (K, I) *TISS (K, I) </pre>	12/17/07
23	W2	Initial-ization of one-layer	<p>The definition of KBMIN was not updated if the model started out in some segments with only one_layer. This has been fixed.</p> <p>Added code highlighted:</p> <pre> DO I=IU, ID IF (KB(I)-KT < NL(JB)-1) IUT = I+1 ONE_LAYER(I) = KT == KB(I) END DO CUS(JB) = IUT ! reinitialize KBMIN DO I=IU-1, ID KBMIN(I) = MIN(KB(I), KB(I+1)) END DO KBMIN(ID+1) = KBMIN(ID) !**** Areas and bottom widths IF (.NOT. TRAPEZOIDAL (JW)) THEN </pre>	12/17/07

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
24	W2	Bottom processes	<p>This is a couple more fixes related to bug fix #6 above. The Denitrification rate and epiphyton burial rates could be affected based on unique combinations of adding/subtracting segments that left the value of BI in an inactive layer below KB defined incorrectly. In order to prevent the possibility of problems, the following fixes were made:</p> <p>Old Code:</p> <pre> sedNO3(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I) -BI(K+1,I))/BH2(K,I) EPM(K,I,J) = EPD(K,I,J)*(BI(K,I)- BI(K+1,I)+2.0*H1(K,I))*DLX(I) </pre> <p>New code:</p> <pre> if(k == kb(i)) then ! SW 12/16/07 sedNO3(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I))/BH2(K,I) else sedNO3(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I) -BI(K+1,I))/BH2(K,I) endif if(k == kb(i)) then ! SW 12/16/07 EPM(K,I,J) = EPD(K,I,J)*(BI(K,I)+2.0*H1(K,I))*DLX(I) else EPM(K,I,J) = EPD(K,I,J)*(BI(K,I)- BI(K+1,I)+2.0*H1(K,I))*DLX(I) endif </pre>	12/17/2007

#	Code: W2 or PREW2 or GUI	Fix or En- hance-ment Type	Description of Bug/Enhancement	Date Bug Fixed or Enhance- ment Added
25	W2	CBODS	<p>If the user defined particulate CBOD that settles to the bottom and had SED turned ON, the conversion from oxygen to organic matter was missing in the accumulation on the channel bottom or sides.</p> <p>OLD</p> <pre> do jd=1,nbod SEDcb(K,I) = SEDcb(K,I)+MAX(cbods(jd),0.0)*cbod (K,I,Jd)*BI(K,I)/BH2(K,I)*(1.0- BI(K+1,I)/BI(K,I)) end do </pre> <p>NEW</p> <pre> do jd=1,nbod SEDcb(K,I) = SEDcb(K,I)+MAX(cbods(jd),0.0)*(cbo d(K,I,Jd)/O2OM(JW))*BI(K,I)/BH2(K, I)*(1.0-BI(K+1,I)/BI(K,I)) ! 1/16/08 end do </pre>	1/18/08
26	W2	SEDBR	<p>Eliminated a redundant definition of SEDBR in the Sediment routine since it is already defined in the Kinetic rates sub-routine.</p>	1/18/08

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
27	W2	SEDDK	<p>The first order sediment decay rate is an average of the decay rates of all the influxes of organic matter and their respective decay rates. There was an error in computing this average decay rate for CBOD treated as particulate. Code fix is shown below:</p> <p>OLD</p> <pre> do jd=1,nbod sedsum = sed- sum+MAX(cbods(jd),0.0)*cbod(K,I,Jd)) *BI(K,I)/BH2(K,I) * (1.0- BI(K+1,I)/BI(K,I)) end do </pre> <p>NEW</p> <pre> do jd=1,nbod sedsum = sed- sum+MAX(cbods(jd),0.0)*cbod(K,I,Jd)) *BI(K,I)/BH2(K,I) * (1.0- BI(K+1,I)/BI(K,I)) *RBOD(JD) *CBODD(K,I,JD)/O2OM(JW) end do </pre>	1/18/08
28	W2	SRO	<p>There are some cases when segments were added/subtracted that the value of BI was not correctly initialized. This code is a fix to prevent such occurrences:</p> <p>OLD CODE:</p> <pre> SRONET = SROIN-SROOUT SROSED = SROOUT*(1.0- BI(K+1,I)/BI(K,I)) *TSEDF(JW) </pre> <p>NEW CODE:</p> <pre> SRONET = SROIN-SROOUT if(k /= kb(i)) then ! SW 1/18/08 SROSED = SROOUT*(1.0- BI(K+1,I)/BI(K,I)) *TSEDF(JW) else SROSED = SROOUT*TSEDF(JW) endif </pre>	1/18/2008

#	Code: W2 or PREW2 or GUI	Fix or En- hance-ment Type	Description of Bug/Enhancement	Date Bug Fixed or Enhance- ment Added
29	W2	Water Qual- ity	<p>Added several calls to prevent computation of kinetic variables if epiphyton are defined in the control file with NEP=1 or more but is not ACTIVE or turned ON. If the kinetic expressions are non-zero and the initial concentration is given, then this could add source/sink terms to the oxygen balance.</p> <p>This is typical of the code changes – since several of this type were made:</p> <p>OLD CODE:</p> <pre>DO JE=1,NEP PO4EG(K,I) = PO4EG(K,I)+EGR(K,I,JE)*EPC(K,I,JE)*EP(JE) PO4ER(K,I) = PO4ER(K,I)+ERR(K,I,JE)*EPC(K,I,JE)*EP(JE) END DO</pre> <p>NEW CODE:</p> <pre>IF (EPIPHYTON_CALC(JW,JE))then ! SW 1/18/2008 PO4EG(K,I) = PO4EG(K,I)+EGR(K,I,JE)*EPC(K,I,JE)*EP(JE) PO4ER(K,I) = PO4ER(K,I)+ERR(K,I,JE)*EPC(K,I,JE)*EP(JE) endif</pre>	1/18/2008

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
30	W2	Bottom processes	<p>Continuation of bug fix #24 in such places as</p> <p>New code:</p> <pre> IF (K == KB(I)) THEN xdum=BI(K,I)/BH2(K,I) ! SW 1/18/08 ELSE xdum=BI(K,I)/BH2(K,I)*(1.0- BI(K+1,I)/BI(K,I)) ENDIF SEDAS(K,I) = SEDAS(K,I)+MAX(AS(JA),0.0)*ALG(K,I,JA) *x dum ! SW 1/18/08 SEDOMS(K,I) = pomS(JW)*(LPOM(K,I)+RPOM(K,I))*xdum !sw 1/18/08 cb 10/22/06 IF (K==KB(I)) THEN ! SW 1/18/08 SEDSO = 0.0 ELSE SEDSO = sedS(JW)*SED(K,I)*BI(K+1,I)/BH2(K,I)*(1.0-BI(K+1,I)/BI(K,I)) Endif DO K=KT,KB(I) IF (K == KB(I)) THEN xdum=BI(K,I)/BH2(K,I) ! SW 1/18/08 ELSE xdum=BI(K,I)/BH2(K,I)*(1.0- BI(K+1,I)/BI(K,I)) ENDIF DO JA=1,NAL SEDASp(K,I) = SEDASp(K,I)+MAX(AS(JA),0.0)*ap(ja)*ALG (K,I,JA)*xdum ! SW 1/18/08 END DO DO JE=1,NEP IF (EPIPHYTON_CALC(JW,JE)) LPOMEpP(K,I) = LPOMEpP(K,I)+EPOM(JE)*ep(je)*(EMR(K,I, JE)*EPC(K,I,JE)) END DO do jd=1,nbod </pre> <p>This code is repeated similarly in many of the sediment routines.</p>	1/18/2008

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
31	W2	Add segment initial-ization	<p>The DEPTHM and DEPTHB were not initialized correctly when a segment was added – this does not affect internal computations, just output for SPR and SNP files.</p> <p>OLD CODE:</p> $\begin{aligned} \text{BKT(I)} &= \text{BH1(KT,I)}/\text{H1(KT,I)} \\ \text{DEPTHB(K,I)} &= \text{H1(KT,I)} & ! \\ \text{DEPTHM(K,I)} &= \text{H1(KT,I)}*0.5 \end{aligned}$ <p>NEW CODE:</p> $\begin{aligned} \text{BKT(I)} &= \text{BH1(KT,I)}/\text{H1(KT,I)} \\ \text{DEPTHB(KT,I)} &= \text{H1(KT,I)} & ! \end{aligned}$ <p>SW 1/27/08</p> $\text{DEPTHM(KT,I)} = \text{H1(KT,I)}*0.5$ <p>! SW 1/27/08</p>	1/27/08

W2 V3.2 Bug Fixes, Enhancements, and User Manual Changes

Table 9. Bug fixes and enhancements for Version 3.2.

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
1	W2	Waterbody-waterbody connection	When there was negative velocities at a waterbody-waterbody connection, there was a possibility (dependent on the bathymetry of the connection at the waterbody-waterbody intersection) that there could be temperature or concentration anomalies.	8/31/04

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
2	W2	Lateral withdrawal	Added limit to the DLRHOMAX function: Old code: DLRHOMAX=MAX(DLRHOT,DLRHOB) New code: DLRHOMAX=MAX(DLRHOT,DLRHOB,1.0E-10)	1/25/05
3	W2	Branch connectivity	Logic in branch connectivity set-up was fixed Old code: IF(UHS(JB) == DS(JJB))EXIT New code: IF(abs(UHS(JB)) == DS(JJB))EXIT	1/25/05
4	W2	Pumpback	Pumpback logic was corrected – this is legacy code that will probably be removed from later versions of W2 Old code: DO JB=1,NBR IF (JB == JBP) JWBP = JW END DO New code: DO JW=1,NWB DO JB=BS(JW),BE(JW) IF(JB == JBP) JWBP = JW END DO END DO	1/25/05
5	W2	CPL write	Switched order of implied DO loop on CPL write statement for output of constituents	1/25/05
6	W2	PRF write	Changed output format for PRF output for constituents from f10.2 to e13.6	1/25/05

#	Code: W2 or PREW2 or GUI	Fix or En- hance-ment Type	Description of Bug/Enhancement	Date Bug Fixed or Enhance- ment Added
7	W2	Heat balance	<p>Added the Idso and Jackson long wave radiation equation when air temperatures are below 5C. The Swinbank model underpredicts long wave incoming radiation at low air temperatures by as much as 10%.</p> <p>The computation of long wave atmospheric radiation is done using the approach of Swinbank (1963) unless air temperatures are less than 5°C, when the Idso and Jackson (1969) formula is used (Wells, et al., 1982).</p> <p>The Swinbank formula for clear sky long wave atmospheric radiation is</p> $\phi_{ac} = 5.31E - 13(T_a + 273)^6$ <p>where units are W/m², °C at 2 m height.</p> <p>Below 40°F (5°C) the formula of Idso and Jackson is recommended (above 10°C both equations are almost identical):</p> $\phi_{ac} = \sigma(T_a + 273)^4(1 - 0.261\exp(-7.77E - 4T_a^2))$ <p>where units are W/m² and T_a is in units of °C. The Stefan-Boltzmann constant = 5.62E-8 W/m²/(°K)⁴.</p>	1/25/05

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
7	W2	Layer addition algorithm	<p>Mistyped subscript K instead of I: Old code:</p> <pre> IF (KB(I) > KBI(I)) THEN B(KB(K),I) = 0.0 DX(KB(I),I) = 0.0 KB(I) = KB(I)-1 IF (I /= DS(JB)+1) KBMIN(I) = MIN(KB(K),KB(I+1)) IF (I /= US(JB)-1) KBMIN(I-1) = MIN(KB(I-1),KB(I)) </pre> <p>New Code:</p> <pre> IF (KB(I) > KBI(I)) THEN B(KB(I),I) = 0.0 ! SW 3/2/05 DX(KB(I),I) = 0.0 KB(I) = KB(I)-1 IF (I /= DS(JB)+1) KBMIN(I) = MIN(KB(I),KB(I+1)) ! SW 3/2/05 IF (I /= US(JB)-1) KBMIN(I-1) = MIN(KB(I-1),KB(I)) </pre>	3/2/05
8	W2	Variable initialization	<p>In some cases when there was a layer subtraction and a time step violation immediately afterward, the variable SW was not initialized properly. This caused problems in the Tomas Algorithm for the water surface computation. The following line of code was added to the SUB layer algorithm:</p> <pre> SW(KT-1,IU-1:ID+1) = 0.0 !TC 3/9/05 </pre> <p>Also, the variable AVHR was defined in the Update variables for DS+1. The following new code was added:</p> <pre> AVHR(KT,DS(JB)+1)=H1(KT,DS(JB)+1) !SW 03/08/05 </pre>	3/9/05

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
9	W2	Interpolation multipliers	<p>Possible index error if there are multiple waterbodies.</p> <p>Old code:</p> <pre> RATZ (K, JW) = AVH2 (K-1, I) / AVH2 (K, I) CURZ1 (K, JW) = 2.0 * H (K, JW) ** 2 / (AVH2 (K-1, I) + AVH2 (K, I)) / AVH2 (K-1, I) CURZ2 (K, JW) = - 2.0 * H (K, JW) ** 2 / (AVH2 (K-1, I) * AVH2 (K, I)) CURZ3 (K, JW) = 2.0 * H (K, JW) ** 2 / (AVH2 (K-1, I) + AVH2 (K, I)) / AVH2 (K, I) END DO </pre> <p>New code:</p> <pre> RATZ (K, JW) = AVH2 (K-1, DS (BE (JW))) / AVH2 (K, DS (BE (JW))) CURZ1 (K, JW) = 2.0 * H (K, JW) ** 2 / (AVH2 (K-1, DS (BE (JW))) + AVH2 (K, DS (BE (JW)))) / AVH2 (K-1, DS (BE (JW))) CURZ2 (K, JW) = - 2.0 * H (K, JW) ** 2 / (AVH2 (K-1, DS (BE (JW))) * AVH2 (K, DS (BE (JW)))) CURZ3 (K, JW) = 2.0 * H (K, JW) ** 2 / (AVH2 (K-1, DS (BE (JW))) + AVH2 (K, DS (BE (JW)))) / AVH2 (K, DS (BE (JW))) </pre>	5/10/05
10	W2	Spillway and Gates	<p>Older code in order to check if it was submerged or not used the elevation difference relative to the channel bed on either side of the weir, rather than the weir crest. Also removed code line:</p> <pre>IF (ELDN > ESP (JS)) DH + ELUP - ELDN</pre>	5/10/05
11	W2	Reaeration	<p>Corrected formula errors in Thackston and Krenkel formula:</p> <p>Old code:</p> <pre> USTAR = SQRT (ADEPTH * SLOPE (JB) * 32.2) ** 0.5 REAER (I) = 24.88 * (1.0 + SQRT (0.176 * UAVG / SQRT (ADEPTH))) * USTAR </pre> <p>New code:</p> <pre> USTAR = SQRT (ADEPTH * SLOPE (JB) * 32.2) REAER (I) = 24.88 * (1.0 + SQRT (0.176 * UAVG / SQRT (ADEPTH))) * USTAR / ADEPTH </pre> <p>Similar changes were made to the updated Thackston model (Eqn 10)</p>	5/10/05
12	W2	Violations NV	The variable BI and VOL was not initialized properly during a time-step violation.	8/25/05

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
13	W2	ADD a layer	The variable BI was not initialized properly during an ADD layer.	8/25/05
14	W2	TRIDIAG sub-routine	<u>Insert Deallocate Statement in Tridiag</u> <pre> SUBROUTINE TRIDIAG (A,V,C,D,S,E,N,U) USE PREC INTEGER, IN TENT (IN) :: S, E, N REAL (R8), DIMENSION (:), INTENT (IN) :: A (E), V (E), C (E), D (E) REAL, DIMENSION (:), INTENT (OUT) :: U (N) REAL (R8), ALLOCATABLE, DIMENSION (:), :: BTA, GMA ALLOCATE (BTA (N), GMA (N)) BTA (S) = V (S) GMA (S) = D (S) DO I=S+1,E BTA (I) = V (I)-A (I) /BTA (I-1) *C (I-1) GMA (I) = D (I)-A (I) /BTA (I-1) *GMA (I-1) END DO U (E) = GMA (E) /BTA (E) DO I=E-1,S,-1 U (I) = (GMA (I)-C (I) *U (I+1)) /BTA (I) END DO Deallocate (BTA, GMA) <----- - ! SW 10/17/05 END SUBROUTINE TRIDIAG </pre>	10/17/05
15	W2	SUB layer	<u>In SUB Layer/Sub Seg - eliminate parentheses which caused a sign error</u> <pre> IF (.NOT. TRAPEZOIDAL (JW)) THEN BI (KT, IU-1) = B (KTI (IU-1), I) H1 (KT, IU-1) = H (KT, JW) - Z (IU-1) BH1 (KT, IU-1) = B (KTI (IU-1), IU-1) * (EL (KT, IU-1) -EL (KTI (IU-1)+1, IU-1) -Z (IU-1) *COSA (JB)) /COSA (JB) <----- -- ! SR 10/17/05 IF (KT >= KB (IU-1)) BH1 (KT, IU-1) = B (KT, IU-1) *H1 (KT, IU-1) DO K=KTI (IU-1)+1, KT BH1 (KT, IU-1) = BH1 (KT, IU-1) +BH1 (K, IU-1) END DO ELSE </pre>	10/17/05

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
16	W2	SUB layer for shallow systems	<p><u>Layer SUB - improve model running in shallow segments</u></p> <pre> ! ** Water surface minimum thickness DO JW=1,NWB KT = KTWB(JW) ZMIN(JW) = -1000.0 KTMAX = 2 <----- ! SR 10/17/05 DO JB=BS(JW),BE(JW) DO I=CUS(JB),DS(JB) IF (KB(I) > KTMAX) KTMAX = KB(I) <----- ! SR 10/17/05 IF (Z(I) > ZMIN(JW)) THEN IZMIN(JW) = I JBIZ = JB END IF ZMIN(JW) = MAX(ZMIN(JW),Z(I)) END DO END DO ADD_LAYER = ZMIN(JW) < -0.85*H(KT-1,JW) .AND. KT /= 2 SUB_LAYER = ZMIN(JW) > 0.60*H(KT,JW) .AND. KT < KTMAX <-- ----- ! SR 10/17/05 !***** Upstream active segment IUT = US(JB) IF (SLOPE(JB) /= 0.0) THEN DO I=US(JB)-1,DS(JB)+1 IF (KB(I) < KT) THEN <----- ----- ! SR 10/17/05 KB(I) = KT B(KB(I),I) = 0.000001 DX(KB(I),I) = DXI(JW) ... !***** Additional layer subtractions ZMIN(JW) = -1000.0 DO JB=BS(JW),BE(JW) DO I=CUS(JB),DS(JB) ZMIN(JW) = MAX(ZMIN(JW),Z(I)) END DO END DO SUB_LAYER = ZMIN(JW) > 0.60*H(KT,JW) .AND. KT < KTMAX <----- - ! SR 10/17/05 END DO END DO <u>Also done for the initial set-up of the branch geometry:</u> !**** Upstream active segment and single layer IF (SLOPE(JB) /= 0.0) THEN DO I=US(JB)-1,DS(JB)+1 IF (KB(I) < KT) THEN <----- ! .AND. I /= IZMIN(JW) SW 10/17/05 B(KT,I) = 0.000001 </pre>	10/17/05

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
17	W2	Shade algorithm	<p>No errors just an improvement in computational efficiency.</p> <p><u>Delete this from the SHADING subroutine:</u> !*** Set the angles for which topographic shade data are available DO II=1, IANG ANG(II)=((II-1)* (360.0/FLOAT(IANG))) *PI/180.0 END DO GAMMA = (2*PI)/IANG</p> <p>and change the 2 occurrences of gamma to gama (only in shading subroutine): ANG2 = (TOPO(I,J+1)-TOPO(I,J))/GAMA <---- ! SW 10/17/05 TOPOANG = TOPO(I,J)+ANG2*ANG1 ENDIF END DO IF (AZ00 > ANG(IANG) .AND. AZ00 <= 2*PI) THEN ANG1 = AZ00-ANG(IANG) ANG2 = (TOPO(I,1)-TOPO(I,IANG))/GAMA <----! SW 10/17/05</p> <p>ADD a line to the module SHADEC: MODULE SHADEC PARAMETER (IANG=18) REAL, PARAMETER :: GAMA=(3.1415926*2.)/REAL(IANG) <--- ! SW 10/17/05 REAL, DIMENSION(IANG):: ANG <----! SW 10/17/05 REAL, ALLOCATABLE, DIMENSION(:) :: A00, DECL, HH, TTLB, TTRB, CLLB, CLRB <----- ! SW 10/17/05 REAL, ALLOCATABLE, DIMENSION(:) :: SRLB1, SRRB1, SRLB2, SRRB2, SRFJD1, SRFJD2, SHADEI REAL, ALLOCATABLE, DIMENSION(:,:) :: TOPO LOGICAL, ALLOCATABLE, DIMENSION(:) :: DYNAMIC SHADE DATA ANG /0.00000, 0.34907, 0.69813, 1.04720, 1.39626, 1.74533, 2.09440, 2.44346,& 2.79253, 3.14159, 3.49066, 3.83972, 4.18879, 4.53786, 4.88692, 5.23599, 5.58505, 5.93412/ <----- ! SW10/17/05 END MODULE SHADEC</p> <p>Delete allocation statement for ang: ALLOCATE (SRLB1(IMX), SRRB1(IMX), SRLB2(IMX), SRRB2(IMX), SRFJD1(IMX), SHADEI(IMX), SRFJD2(IMX)) ALLOCATE (TOPO(IMX,IANG)) <--- - !SW10/17/05 ALLOCATE (QSW(KMX,NWDT), CTR(NCT,NTRT), HPRWBC(NHY,NWB))</p> <p>Delete ang from the deallocate statement: DEALLOCATE(TTLB, TTRB, CLLB, CLRB, SRLB1, SRRB1, SRLB2, SRRB2, SRFJD1, SHADEI, SRFJD2, TOPO, QSW, CTR) <--- ---! SW 10/17/05</p>	10/17/05

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
18	W2	Epiphyton algorithm	Several changes were made that corrected errors in shallow systems where adding and subtracting layers did not reinitialize macrophyte layers when the current KT was below KB; the epiphyton burial rate was greater than specified in the control file; epiphyton that are buried become part of the 1 st order organic sediment (as before); epiphyton mortality now becomes part of the LPOM pool (based on the EPOM fraction) and is settled and transported downstream rather than going into the organic 1 st order sediment model directly. Currently this is non-photosynthesizing – but we will change in the next version.	5/26/06
19	W2	ADD/SUB layers	There was a bug in addition and subtraction of layers that led to water quality variables not being initialized correctly during riverine shallow flow	5/26/06
20	User Manual	Typos corrected	The manual had a few typos that were corrected.	6/11/2006
21	W2	Waterbody-waterbody connection	The subroutine Upstream_velocity under specific conditions did not maintain flow continuity across a waterbody-waterbody connection	6/29/2006
22	W2	SNP output	The algal limiting nutrient SNP output had a bug under specific conditions in writing out the information.	6/30/2006

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
23	W2	Sediment heating and sediment processes	<p>If a model added and subtracted layers that resulted in segment addition and subtraction, there was the possibility that sediment fluxes were incorrectly computed.</p> <p>In the NO3 subroutine: Old code:</p> <pre> NO3SED(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I) -BI(K+1,I))/BH2(K,I) </pre> <p>New code:</p> <pre> if(k == kb(i)) then NO3SED(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I))/BH2(K,I) else NO3SED(K,I) = NO3(K,I)*NO3S(JW)*NO3TRM(K,I)*(BI(K,I)- BI(K+1,I))/BH2(K,I) endif </pre> <p>New code added in sediment routine:</p> <pre> if(k == kb(i)) then ! SW 4/18/07 SODD(K,I) = SOD(I)/BH2(K,I)*SODTRM(K,I)*BI(K,I) else SODD(K,I) = SOD(I)/BH2(K,I)*SODTRM(K,I)*(BI(K,I)- BI(K+1,I)) Endif </pre> <p>New code added in suspended solids routine:</p> <pre> if(k == kb(i)) then SSR = EPSILON*DLX(I)*BI(K,I)/VOL(K,I) else SSR = EPSILON*DLX(I)*(BI(K,I)- BI(K+1,I))/VOL(K,I) Endif </pre>	4/18/07

#	Code: W2 or PREW2 or GUI	Fix or En- hance-ment Type	Description of Bug/Enhancement	Date Bug Fixed or Enhance- ment Added
23	W2	(see above)	<p>New code added for heat flux to channel bottom:</p> <pre> if (kt == kb(i)) then ! SW 4/18/07 SROSED = SROOUT*TSEDF(JW) else SROSED = SROOUT*(1.0- BI(KT+1,I)/BI(KT,I))*TSEDF(JW) Endif if (k==kb(i)) then ! SW 4/18/07 TFLUX = CBHE(JW)/RHOWCP*(TSED(JW)- T2(K,I))*BI(K,I)*DLX(I) else TFLUX = CBHE(JW)/RHOWCP*(TSED(JW)- T2(K,I))*(BI(K,I)-BI(K+1,I))*DLX(I) endif </pre> <p>New code added for sediment subrou- tine:</p> <pre> if (k == kb(i)) then ! SW 4/18/07 SEDAS(K,I) = SEDAS(K,I)+MAX(AS(JA),0.0)*ALG(K,I,JA) *BI(K,I)/BH2(K,I)*(1.0- BI(K+1,I)/BI(K,I)) else SEDAS(K,I) = SEDAS(K,I)+MAX(AS(JA),0.0)*ALG(K,I,JA) *BI(K,I)/BH2(K,I)*(1.0- BI(K+1,I)/BI(K,I)) endif if (k == kb(i)) then ! SW 4/18/07 SEDOMS(K,I) = POMS(JW)*(LPOM(K,I)+RPOM(K,I))*BI(K,I) /BH2(K,I) SEDSO = POMS(JW)*SED(K,I)*BI(K+1,I)/BH2(K,I) else SEDOMS(K,I) = POMS(JW)*(LPOM(K,I)+RPOM(K,I))*BI(K,I) /BH2(K,I)*(1.0-BI(K+1,I)/BI(K,I)) SEDSO = POMS(JW)*SED(K,I)*BI(K+1,I)/BH2(K,I)*(1.0-BI(K+1,I)/BI(K,I)) endif </pre>	4/18/07

#	Code: W2 or PREW2 or GUI	Fix or Enhancement Type	Description of Bug/Enhancement	Date Bug Fixed or Enhancement Added
24	W2	Algae	<p>The logic for negative settling velocities for algae had an error.</p> <p>Old code:</p> <pre>! ASR(K,I,JA) = - AS(JA)*(ALG(K+1,I,JA)*B(K+1,I)/(B(K,I) *H2(K,I))- ALG(K,I,JA))*BI(K,I)/BH2(K,I)</pre> <p>New code:</p> <pre>ASR(K,I,JA) = - AS(JA)*(ALG(K+1,I,JA)*BI(K+1,I)/BH2(K, I)-ALG(K,I,JA)*BI(K,I)/BH2(K,I))</pre> <p>!SP 8/27/07</p> <p>Shwet Prakash</p>	8/27/07