

Linking LSPC to WASP Spreadsheet Utility

Harpeth River water quality model

J. Davis 03/04/2021







• Single LSPC subbasin may encompass multiple WASP segments

• Single WASP segment may span several LSPC subbasins

• WASP segments also have to capture point source discharges

- LSPC subbasins are manually mapped to WASP segments
 - Flows
 - Boundaries/loads



Any exchange of water from:

1. Outside model network into the model (e.g., LSPC runoff; point source)

2. Inside model network to the outside (e.g., water withdrawal; outlet)



EPA Region 4 Harpeth model training 2021 LSPC flow outputs: RO vs. PERO







- LSPC generates two flow types for each subbasin:
 - PERO terrestrial sheetflow for a given subbasin
 - acre-in/day
 - RO cumulative instream flow
 - ft³/s
 - Sum of terrestrial sheetflow for that subbasin AND instream flows from upstream subbasin(s)



SEPA Region 4 Harpeth model training 2021 Linking LSPC to WASP: RO vs. PERO



- Headwater ROs typically routed to most upstream WASP segment in that subbasin
- PEROs typically routed to midpoint WASP segment in that subbasin
 - Calibration stations or PS may affect this

- Can use RO instead of PERO if need to merge two LSPC headwaters
 - Too few WASP segments
 - Improve model run times



Processing LSPC output

EPA Region 4 Harpeth model training 2021 LSPC to WASP: Standard .OUT format

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H	TT Designed and maintained by: 6 TT ···· Tetra Tech, <u>Inc</u> .	LSPC outp	outs an .OUT file for each subbasin
	7 TT 10306 Eaton Place, Suite 340 8 TT Fairfax, VA 22030		
1	9 TT ···· (703) · 385-6000 0 TT		
1	TT This output file was created at 10:29:19am on 02/22/2018 TT Time interval: 60 min Output option: day	Raw LSPC .OUT	files difficult to read due to formatting
1	4 TI-lebel 5 TT-PRECprecipitation (rain + snow) volume (in-acre/day)]	6
	7 TT IFWO interflow outflow volume (in-acre/day) 8 TT AGWO groundwater outflow volume (in-acre/day)		
1	9 TT PERO total outflow rate volume (in-acre/day) 0 TT DEP stream depth (ft)	First 6 columns	are year, month, day, hour, minutes, and
2	1 II AVDEP····stream average depth (st.) 2 TT TAU·····bed-shear·stress (kg/m*2) 3 TT R0·····total rate of outflow flow RCHRES (cfc)		
2	4 TT SOSED sediments load from lane (english tons/day) 5 TT SSEDUT1 suspended sediment concentration in outflow from the RCHR	RES (mg/1)	seconds [blank]
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- 3	1 TT POQUAL3 total flux of QUAL from the PLS_TP (lb/day) 2 TT CONC1 BOD5 dissolved concentration (average) in RCHRES (mg/l)	LSPC calibration b	ased on hourly time step, but export daily
3	 TT CONC2 TN dissolved concentration (average) in RCHRES (mg/l) TT CONC3 TP dissolved concentration (average) in RCHRES (mg/l) TT CONC3 TP dissolved concentration (average) in RCHRES (mg/l) 	aver	age values when link to WASP
- 3	TT-DOXMIN dissolved oxygen instream minimum concentration (mg/1) TT-DOXMIX dissolved oxygen instream miximum concentration (mg/1)		
- 3	8 TT DOXAV dissolved oxygen instream a erage concentration (mg/l) 9 TT BOD biochemical oxygen demand instream concentration (mg/l)		(i.e., standard format)
4	 IIIIEMP_MIN ··· minimum reach temperature degree C) TT TEMP_MAX ··· maximum reach temperature degree C) TT TEMP ···· reach temperature degree C) 		· ·
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LSPC WQ parameters linked into WASP as boundary concentrations
Nutrients, DO, CBOD, inorganic sediment, and water temperature

Linking LSPC to WASP: Subspecies partitioning

- Typically, only output TN and TP from LSPC
- WASP needs NH₃, NO₂/NO₃, OrgN, PO₄, and OrgP

Can partition LSPC TN and TP based on assumptions

- Use ambient monitoring data to calculate subspecies composition of LSPC runoff
- Use WRDB and Excel to calculate subspecies composition



- Need to convert units when linking LSPC output to WASP
- Units of LSPC flows:
 - RO cubic feet per second
 - PERO acre-in per day
- WASP needs flows in cubic meter per second
- WASP needs concentrations in mg/L and temperature in degree Celsius
 - RO concentrations directly reported in LSPC .OUT (mg/L)
 - PERO concentrations calculated from LSPC loads (lbs/day) and PERO flows (acre-in per day)

EPA Region 4 Harpeth model training 2021 LSPC to WASP: Excel spreadsheet

Total Nitrogen (RO Total Nitrogen (PE

BOD1 (RO) BOD1 (PERO BOD2 (RO)

BOD2 (PER BOD3 (RO)

BOD3 (PERO) Dissolved Ox NH3 (RO)

NH3 (PERC

NO3 (RO) NO3(PERO) DON (RO) DON (PERO PON (RO) PON (PERO

DIP (RO)

DIP (PERO

DOP (RO)

DOP (PERC

POP (PERO

POP (RO)

CHLA-1 CHLA-2 CHLA-3

Solid-1

Solid-2 Solid-3 Reach Flow PERO Flow

Total Phosphorus (RC

- Excel utility can preprocess LSPC .OUT files for WASP
- Already preconfigured for Harpeth
 - Only need to update 'Path to LSPC' filepath argument
- Utility will
 - Extract parameters required by WASP
 - Partition TN and TP into subspecies
 - Apply appropriate unit conversions
 Including RO vs PERO
 - Export WRDB-ready .csv files



Name

Harpeth_WQ_Model_2020-11 > Model_Utils

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EPA Region 4 LSPC to WASP: Excel spreadsheet



EPA Region 4 Harpeth model training 2021 LSPC to WASP: LSPC Output tab

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2	2 1	L01.out	RO	LSPC101RO					138	
3	3 1	L02.out	RO	LSPC102RO					21	
4	4 1	L03.out	RO	LSPC103RO					23	
5	5 1	L04.out	RO	LSPC104RO					136	
6	5 1	L05.out	RO	LSPC105RO		_			16	
7	7 1	L06.out	RO	LSPC106RO					19	
8	3	L07.out	RO	LSPC107RO					134	
9) :	L08.out	RO	LSPC108RO					13	
1	0	L09.out	RO	LSPC109RO					14	
1	1 :	L10.out	RO	LSPC110RO					99	
11	2:	l11.out	RO	LSPC111RO					149	
1	3 :	L12.out	RO	LSPC112RO					148	
/	4:	L13.out	RO	LSPC113RO					98	
1	5 :	L14.out	RO	LSPC114RO					118	
1	6	L15.out	RO	LSI C115RO					119	
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subbasin to extract			1	for that subbasir	- 1	to na	ime data ir	WRDB	for subbasir	n flow boundary

EPA Region 4 Harpeth model training 2021 LSPC to WASP: Segment names tab

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3	2	LSPC203PERO	LSPC203PERO						
4	3	HarpethRiver3	HarpethRiver3						
5	4	JonesCreek4	JonesCreek4						
6	5	JonesCreek5	JonesCreek5						
7	6	JonesCreek6	JonesCreek6						
8	7	LSPC175PERO	LSPC175PERO						
9	8	LSPC165PERO	LSPC165PERO						
10	9	LSPC164PERO	LSPC164PERO						
11	10	JonesCreek10	JonesCreek10						
12	11	JonesCreek11	JonesCreek11						
13	12	TN0066958	TN0066958						
14	13	LSPC108RO	LSPC108RO						
15	14	LSPC109RO	LSPC109RO						
16	15	LSPC161PERO	LSPC161PERO						
17	16	LSPC105RO	LSPC105RO						
18	17	LittleJonesCreek17	LittleJonesCreek17						
19	18	LittleJonesCreek18	LittleJonesCreek18						
20	19	LSPC106RO	LSPC106RO						
21	20	LSPC177PERO	LSPC177PERO						
22	21	LSPC102RO	LSPC102RO						
23	22	SulphurForkCreek22	SulphurForkCreek22						
24	23	LSPC103RO	LSPC103RO						
25	24	Harpeth24	Harpeth24						
-	> Main	LSPC Output Segment Names (+)							

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	132	LSPC162RO			Surface			
	133	LSPC178PER	0		Surface			
	134	LSPC107RO			Surface			
	135	Harpeth135			Surface			
	136	LSPC104RO			Surface			
	137	LSPC202PERO			Surface			
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 Can review LSPC to WASP segment mapping by viewing 'Segments' & 'Flows' screen

EPA Region 4 Harpeth model training 2021 LSPC to WASP: Processing workflow

Run LSPC and export .OUT files



Link WASP .WIF to WRDB





Feature The balance area will contain training modules and iterat aspects of using WASP e a will be required that and in the application of the model. The first feature will be published shortly.





Preprocess LSPC .OUT files w/ Excel utility



Import preprocessed files into WRDB

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Linking LSPC .AIR file to WASP

EPA Region 4 Harpeth model training 2021 Processing weather .AIR files

- Only a single weather station mapped to WASP
 - X304Y089_X304Y089_X304Y08
 - Hourly time step
- Use .AIR file generated by LSPC plug-in
 - Imported into WRDB
 - Applied English to metric unit conversion
- WASP requires
 - Solar (Harpeth WASP model calculates based on Lat/Long)
 - Air temperature
 - Dew point
 - Wind speed
 - Cloud cover

Parameter	LSPC Units	WASP Units	LSPC to WASP conversion
Solar Radiation	Langley / hour	Watts / m ²	11.63
Solar Radiation	Langley / day	Watts / m ²	0.484583
Dew Point	degF	degC	degF to degC conversion
Air Temperature	degF	degC	degF to degC conversion
Wind Speed	miles / hr	meter / second	0.447
Cloud Cover	Range 1-10	Range 0-1	0.10



Questions?