

Introduction to WRDB

Harpeth River water quality model

C. York 02/25/2021



- General overview of WRDB
- Elements of a WRDB project
 - Station table
 - PCode table
 - Results table
 - CCode / RCode validation tables

- Summary of WRDB utilities
 - Export data
 - Report generation
 - Graphing
 - GIS utility



- Designed to process and manage ambient monitoring data for model development
- WASP v8 designed to store input data in WRDB
- Possess add-ins that facilitate calibration
 - e.g., WRDB-Graph
- LSPC input data are stored in MS Access database, not WRDB

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🖨 EPA Enterprise Authen 🐔	Files - OneDrive 👲 RAMS Welcomes you! 🜐 People Plus 🛭 🕏 SESD Region 4 Intranet 🜌 USGS Gage N. Oconee 🚯 SharePoint 🜐 Sign in DataCamp
🞆 Wa	ter Resources Database 6.1
	Introduction
Wab Seroen Shuts WRDB Manual Non Technical Overview WRDB Graph Manual	In 1993, the <u>Georgia Environmental Protection Division</u> (EPD) initiated design of the Water Resources Database (WRDB) to address the imposing data management challenges presented by the Chattahoochee River Modeling Project. These challenges included a vast amount of data to be handled, a wide variety of data types to be accommodated, and a diversity of information sources each providing important data often in incompatible formats. These circumstances were further complicated by factors like: insufficient in-house expertise in the technical aspects of database design; a general lack of success with the effective use of existing national databases; and, the fact that expected WRDB users possessed an assortment of professional specialties and a variety of software skill levels.
	As software development progressed, it soon became clear that the WRDB could easily serve a host of general data management needs beyond those of this particular modeling project. Accordingly, the WRDB was recast as a general-purpose instrument for addressing a variety of everyday data management problems typically faced by environmental practitioners. The U.S. Environmental Protection Agency (Region IV) provided funds to support its development as a general-purpose tool. Beginning in 2009, the Panama Canal Authority also began supporting WRDB enhancements including those which ultimately lead to the development of WRDB 6.0.
Links WRDB Fact Sheet	WRDB is a Microsoft Windows application utilizing the .Net Framework. It consists of low-level libraries used by a variety of applications (WRDB, Graph, GIS, etc.) and both a Windows client or Web user interface. WRDB supports many popular database backends including Access, SQLite, Oracle, SQL Server, and MySQL and can be used by individuals, work groups, or enterprises.
	This web site was developed to introduce WRDB concepts and provide a convenient location for downloading the latest version of the software and documentation. The software was developed by Dr. Lloyd Chris Wilson, P.E., of <u>Wilson Engineering</u> in St. Louis, Missouri. If you are not associated with Georgia EPD, Region IV EPA, or the Panama Canal Authority, please contact Dr. Wilson for information on software development and support options.
	Acknowledgements:
	With his unique understanding of EPD's data needs, Dr. Burke provided significant guidance throughout the design of the computational code and user interface. His valuable contributions are acknowledged. In addition, Mr. Paul Lamarre of EPD is acknowledged as the contract administrator for many of the projects, and for his careful testing of the software.
	Region IV EPA supported much of the development of this software either directly or through grants to GaEPD. Mr. Jim Greenfield and Mr. Tim Wool provided helpful direction and feedback.
	Tetra Tech, Inc., has been a strong proponent and contributor to the overall development of WRDB. Mr. Brian Watson and many other staff members are gratefully acknowledged.
	The Autoridad del Canal de Panamá (Panama Canal Authorty) provided valuable financial support for WRDB versions 5.1 and 6.0. Mr. Iván Domínguez was the project manager and also directed development of enterprise features added in WRDB 6.0; his contributions as well as those of his staff and management are gratefully acknowledged.
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	http://www.wurdh.com/



How we use WRDB for watershed modeling

- Repository for WASP input data
 - LSPC input data are stored in MS Access database
 - LSPC output data are stored in WRDB
- Repository for WASP calibration data
- WASP input and calibration data can be stored in separate WRDB files
 - Minimizes file size
 - Faster data queries
- WASP input database has three separate working tables
 - WASP weather (only need a subset of stations used in LSPC)
 - LSPC model output (preprocessed with Excel macro)
 - Point source data (facilities, springs, w. withdrawals, etc)

WRDB 6.1 - FFrk_WASP_Input in WRDB Project Workspace

Open Prefs Explr New Work Mstr Alt Supt ExtData Entry Del Impt SB19 Dwn

File Edit Select Output Window Help

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- Working Tables: A single project can have multiple working tables
- Master Tables: We typically do not use them
- Support Tables:

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- Station table: Includes metadata for sampling locations
- Parameter table (PCode): Includes parameter metadata (units & names)

Station PCodes Branches Groups Validation Criteria Tracking Journal Station ID Station Name Station Type Data Freq Latitude Longitude Elevation HUC Branch ID River Mile Re ID D r Area Ag 0987 KENTUCKY SOLITE CORP WITHDRAWAL 38.03551 -85.71773 <null> 0 USPC-101-R0 01/ 1020 PERSIMMON RIDGE GOLF CLUB WITHDRAWAL 38.298064 -85.438068 <null> 0 Help E E Help E <</null></null>																		
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LSPC-101-RO	01/01/2006 00:00	TN									0.99390		
LSPC-101-RO	01/01/2006 00:00	NH3									0.03677		
LSPC-101-RO	01/01/2006 00:00	NO3									0.61		
LSPC-101-RO	01/01/2006 00:00	DON									0.35		
LSPC-101-RO	01/01/2006 00:00	TP_LOAD									2,348.97		
LSPC-101-RO	01/01/2006 00:00	TP									0.91832		
LSPC-101-RO	01/01/2006 00:00	DIP									0.43		
LSPC-101-RO	01/01/2006 00:00	DOP									0.49		
LSPC-101-RO	01/01/2006 00:00	BOD1									1.02		
LSPC-101-RO	01/01/2006 00:00	DO									8.61686		
LSPC-101-RO	01/01/2006 00:00	SOLID1									24.98		
LSPC-101-RO	01/01/2006 00:00	FLOW									29.60		
LSPC-101-RO	01/01/2006 00:00	TEMP									13.28		
LSPC-101-RO	01/02/2006 00:00	TN_LOAD									2,863.48		
LSPC-101-RO	01/02/2006 00:00	TN									1.08490		
LSPC-101-RO	01/02/2006 00:00	NH3									0.04014		
LSPC-101-RO	01/02/2006 00:00	NO3									0.66		
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	BOD1	Biochemical Oxygen Demand	mg/L		0	2	<null></null>	<null></null>	<null></null>	<null></null>	07/12/2017 09:26
	CBOD5	BOD 5-day carbonaceous 20deg C	mg/L		0	5	<null></null>	<null></null>	<null></null>	<null></null>	07/12/2017 09:20
	CHLA	Chlorophyll-a	mg/L		0	5	<null></null>	<null></null>	<null></null>	<null></null>	07/12/2017 09:20
	CLOUD COVE	CLOUD COVER	proportion		0	2	<null></null>	<null></null>	<null></null>	<null></null>	07/13/2017 09:12
	DEW POINT	DEW POINT	deg C		0	2	<null></null>	<null></null>	<null></null>	<null></null>	07/13/2017 09:10
	DIP	Dissolved Inorganic Phosphorus	mg/L		0	2	<null></null>	<null></null>	<null></null>	<null></null>	07/12/2017 09:26

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Validation support tables

- Accessed in 'Validation' tab dropdown
- Remark Code table (RCode): Used to indicate flagged data points
 - e.g., J, U, etc
- CCodes: R4 modelers typically use to indicate backcalculated PCodes
 - e.g, ORGN = TKN NH_3
- RCode table has option to exclude flagged records from Calibration graphs and summary statistics
- Allows flagged data to be included in database, but not used in calibration

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Stations PCodes Branches Groups Validation Criteria Tracking Journal

CCod	les - Com	positing co	les associated with data records				~						
CCod	CCodes - Compositing codes associated with data records RCodes - Result codes associated with data records												
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LCode	es - Locat	tion codes a	sociated with data records										
QCod	QCodes - Quality codes associated with Working tables, imported files, and data records												
Ageno	Agencies - Valid agencies associated with Station IDs and data records												
FIPS C	FIPS Codes - Standard numeric codes associated with states and counties for Stations												
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	Potential Issue		Solutions
•	Similar to GIS-databases, moving an existing project file requires a remapping of filepath	•	Avoid moving an existing WRDB project
•	Certain actions in WRDB cannot be undone (e.g., deleting working tables)	•	Keep a back-up copy of any projects until you are more familiar with the program
•	WRDB has lots of pop-up confirmation screens	•	Enable 'Expert Mode' through 'Project Preferences' to minimize pop-up screens



- Restoring the Harpeth River Modeling SQL Lite database (.sdb)
- Loading database as New Project
- Browse / Query / Plot
- Exporting data to other formats

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→	Harpeth_Ri	ver_Modeling.sdb	SDB	File	658,440 KB	

Building new WRDB project from an existing .sdb

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File	Window Help			
-	Select Project Workspace	🛄 Project Preferences: Harpeth_Data	?	×
1	New Project	Project Database Project Options Application Options		
8	New Project X	Database Type: 3 SQLite	7	~
	entered below. The name must not be the same as an existing Project. After	Database Name: 4 C:\Desktop\Harpeth_WQ_Model\WASP\Harpeth_River_Modeling\Harpeth_River_Modeling.sdb	Brow	se
► M	your database connection information on the first tab, and additional Project	Password:		
2	and Application preferences on the second and third tabs.	Master Table Name: 5 Master ~	Creat	te
-1	Project Name: Harpeth_Data	Command Timeout (sec): 30		
	Description:	Note: SQLite tables are all stored inside a single database file. The Username and Password entries are optional and will norm be used for this data provider.	ally not	
		Test C	onnectic	on
		Project Security Supervisor Password (blank to disable security):		7
	2 OK Cancel			
		 Ø Неір ОК 	Cane	cel

DB type = SQLite database (.sdb)

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- DB name = filepath for existing "Harpeth_River_Modeling.sdb"
- Master Table is required by WRDB (select "Master"), but note, this is not used

Accessing support tables

🛄 WI	Ĵ WRDB 6.0 - FFrk_WASP_Input in WRDB Project Workspace File Edit Select Ou <u>tput Window</u> Help																									
File	Edit	Sel	ect Output	Window	He	lp																				
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 Working and support tables can be accessed via the ribbon

 CCode and RCode tables accessed via the 'Validation' tab in pop-up



🚊 WRDB	6.0 - FFrk_V	VASP_Ir	nput in WRDB Pr	Summarize by Station & Parameter Cut-Sintr+R Parameter Parameter Cut-Sintr+R Parameter Par																		
File E	e Edit Select Output Window Help																					
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	KY002	0001 0	3/31/2000 00:00	CBOD5						K10020001		T LOW		CM3	605	0.03296	0.01/53	0.10673	01/01/2000 00.00	12/31/2010 00.00		
	KY002	0001 0	4/01/2000 00:00	CBOD5				7.00000		KY0020001	La Grange STP	NH3	Nitrogen ammonia total [as N]	mg/L	605	0.47031	0.14000	10.50000	01/01/2000 00:00	12/31/2010 00:00		
	KY002	0001 0	4/30/2000 00:00	CBOD5					7.00000		KY0020001	La Grange STP	NOX	Nitrite plus Nitrate	mg/L	605	15.13158	2.11361	25.57333	01/01/2000 00:00	12/31/2010 00:00	
	KY002	0001 0	5/01/2000 00:00	CBOD5					6.00000		KY0020001	La Grange STP	TN	Nitrogen Total [as N]	mg/L	605	17.49334	2.52781	29.01000	01/01/2000 00:00	12/31/2010 00:00	
	KY002	0001 0	5/31/2000 00:00	CBOD5					6.00000	~	KY0025194	Jeffersontown WQTC MSD	FLOW	Flow in conduit CMS	CMS	1,545	0.15732	0.06527	0.78325	01/01/2000 00:00	12/31/2010 00:00	
	🙆 He	elp	Options	Show fi	rst 100	0 records 🗸			C	lose	KY0025194	Jeffersontown WQTC MSD	NH3	Nitrogen ammonia total [as N]	mg/L	1,545	0.90229	0.05000	14.90000	01/01/2000 00:00	12/31/2010 00:00	
											KY0025194	Jeffersontown WQTC MSD	NOX	Nitrite plus Nitrate	mg/L	1,545	8.18503	0.20267	19.66000	01/01/2000 00:00	12/31/2010 00:00	
											KY0025194	Jeffersontown WQTC MSD	TN	Nitrogen Total [as N]	mg/L	1,545	9.59920	0.28800	20.00000	01/01/2000 00:00	12/31/2010 00:00	
											KY0029416	McNeely Lake WQTC MSD	FLOW	Flow in conduit CMS	CMS	1,032	0.00434	0.00039	0.03767	01/01/2000 00:00	12/31/2010 00:00	
											KY0029416	McNeely Lake WQTC MSD	NH3	Nitrogen ammonia total [as N]	mg/L	1,032	0.60995	0.00600	7.00000	01/01/2000 00:00	12/31/2010 00:00	
										KY0029416	McNeely Lake WQTC MSD	NOX	Nitrite plus Nitrate	mg/L	1,032	15.61340	0.21965	24.92020	01/01/2000 00:00	12/31/2010 00:00		
											KY0029416	McNeely Lake WQTC MSD	TN	Nitrogen Total [as N]	mg/L	1,032	20.22678	0.28198	32.00000	01/01/2000 00:00	12/31/2010 00:00	

- Summary reports can be generated based on working table or queried data
- Provides basic summary statistics

EPA Region 4 Harpeth model training 2021 Data availability reports



Can also generate data availability (inventory) reports to quickly identify data gaps

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Mpdes [Working Table]	Advanced Query ? ×	Bata gaonoo
Station ID Date/Time PCode LEW Depth Acy CCode S L Q R Result Val Trk ID A	Station ID: IN ('KY0020001', 'KY0025194', 'KY0029416')	
KY0020001 01/01/2000 00:00 CEOD5 12.000000 12.000000 12.000000 12.000000 12.000000 12.000000 12.000000 12.000000 12.000000 12.000000 12.0000000 12.0000000000	Date-time: ALL Assist	
KY0020001 02/01/2000 00:00 CBOD5 8.0000 C	PCode: IN ('FLOW', 'NH3', 'NOX', 'TN') Assist	
KY0020001 02/29/2000 00:00 CBOD5		
KY0020001 03/31/2000 CBOD5 6.00000 0		
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KY0020001 05/31/2000 00:00 CBOD5		
Ø Help B Options Show first 1000 records Close Clo	WKDB b.0 - FFIK_WASP_Input in WRDB Project Workspace Save Show SC File Edit Select Output Window Help	

- Data queries can be initiated on the ribbon
- Copy records to Excel by clicking 'Options' → 'Copy Selected Records'

WRDB 6.0 - FFrk_WASP_Input in WRDB Project Workspace

 Don't use 'Ctrl-C' in window; can truncate significant digits

Npdes [Working Table]														
Station ID	Date/Time	PCode	LEW	Depth	Acy	CCode	s	L	Q	R	Result	Val	Trk ID	^
KY0020001	01/01/2000 00:00	CBOD 5									12.00000			
KY0020001	01/31/2000 00:00	CBOD5									12.00000			
KY0020001	02/01/2000 00:00	CBOD5									8.00000			
KY0020001	02/29/2000 00:00	CBOD5									8.00000			
KY0020001	03/01/2000 00:00	CBOD5									6.00000			
KY0020001	03/31/2000 00:00	CBOD5									6.00000			
KY0020001	04/01/2000 00:00	CBOD5									7.00000			
KY0020001	04/30/2000 00:00	CBOD5									7.00000			
KY0020001	05/01/2000 00:00	CBOD5									6.00000			
KY0020001	05/31/2000 00:00	CBOD5									6.00000			v
😧 Help	Options	Show f	irst 100	0 record	ls v								Close	

Station ID	Date/Time	PCode	LEW	Depth	Acy	CCode	S	L	Q	R	Result	Val	Trk ID
Y0020001	01/01/2000 00:00	FLOW									0.03098		
Y0020001	01/31/2000 00:00	FLOW									0.03098		
Y0020001	02/01/2000 00:00	FLOW									0.03483		
Y0020001	02/29/2000 00:00	FLOW									0.03483		
Y0020001	03/01/2000 00:00	FLOW									0.03251		
Y0020001	03/31/2000 00:00	FLOW									0.03251		
Y0020001	04/01/2000 00:00	FLOW									0.02817		
Y0020001	04/30/2000 00:00	FLOW									0.02817		
Y0020001	05/01/2000 00:00	FLOW									0.02484		
Y0020001	05/31/2000 00:00	FLOW									0.02484		
Y0020001	06/01/2000 00:00	FLOW									0.02493		
Y0020001	06/30/2000 00:00	FLOW									0.02493		
Y0020001	07/01/2000 00:00	FLOW									0.02208		
Y0020001	07/31/2000 00:00	FLOW									0.02208		
Y0020001	08/01/2000 00:00	FLOW									0.02055		
Y0020001	08/31/2000 00:00	FLOW									0.02055		
Y0020001	09/01/2000 00:00	FLOW									0.02129		
Y0020001	09/30/2000 00:00	FLOW									0.02129		
Y0020001	10/01/2000 00:00	FLOW									0.01906		
WHERE D AND Dta AND (Dt	Ita.Station_ID IN ('H a.PCode IN ('FLOW a.Owner='JMD' O	KY002000 /', 'NH3', R Dta.Ow	(IEG_B) 1', 'KY 'NOX' vner IS	0025194 , 'TN') NULL)	; 'KY0	029416')							
			10			Curr 2			_	_		_	
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	2↓ ⊑⊒	Sort Copy Sel	ected I	Records									

Edit Table Info...
 Display Record Count



- Can export working tables or data subsets
 - Output \rightarrow Export
- Export as single file, or multiple files by PCode
- Multiple file formats available

	WRDR 6.1 EFeb Calibration in WRDR Devices Westerness														
WRDB 6.1 - FFrk_Calibration in WRDB Project Workspace															
File Edit Select Output Window Help															
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	R Data Frame (*.txt)														

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EFFFF0	01	06/29	/2006	13:38	TKN			MSD					1.50	\checkmark	3	3	
EFFFF0	01	09/26	/2006	08:39	NH3			MSD				Α	0.05	\checkmark	3	3	
EFFFF0	01	09/26	/2006	08:39	NO3			MSD					0.97	\checkmark	3	3	
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FFrk_Calibration in WRDB Project Workspace Edit Select Output Window Help Image: Select Output Window Help Image: Select Graphs Image: Select Image: Select

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Accessing graph functions

EPA Region 4

Harpeth model training 2021



AIR TEMP at 93821_UO



Based upon open source GIS Tool

- MapWindow/DotSpatial
- Same tools in EPA's BASINS
- Can use files from:
 - ArcMap
 - BASINS
 - Other standard GIS files







- Integrates WRDB data w/ spatial data
 - Assess ambient data by location
 - Thematic mapping
 - Number of observations
 - Mean / median / geomean / percentiles
 - Aggregate data across time
 - Day / month
 - Growing season
 - Annual
 - Create animations to show parameter changes through space and time