TETRA TECH

Soil Attenuation of Nutrients during Onsite Wastewater Treatment Expert Review Panel - Update to WWTWG

November 7, 2014

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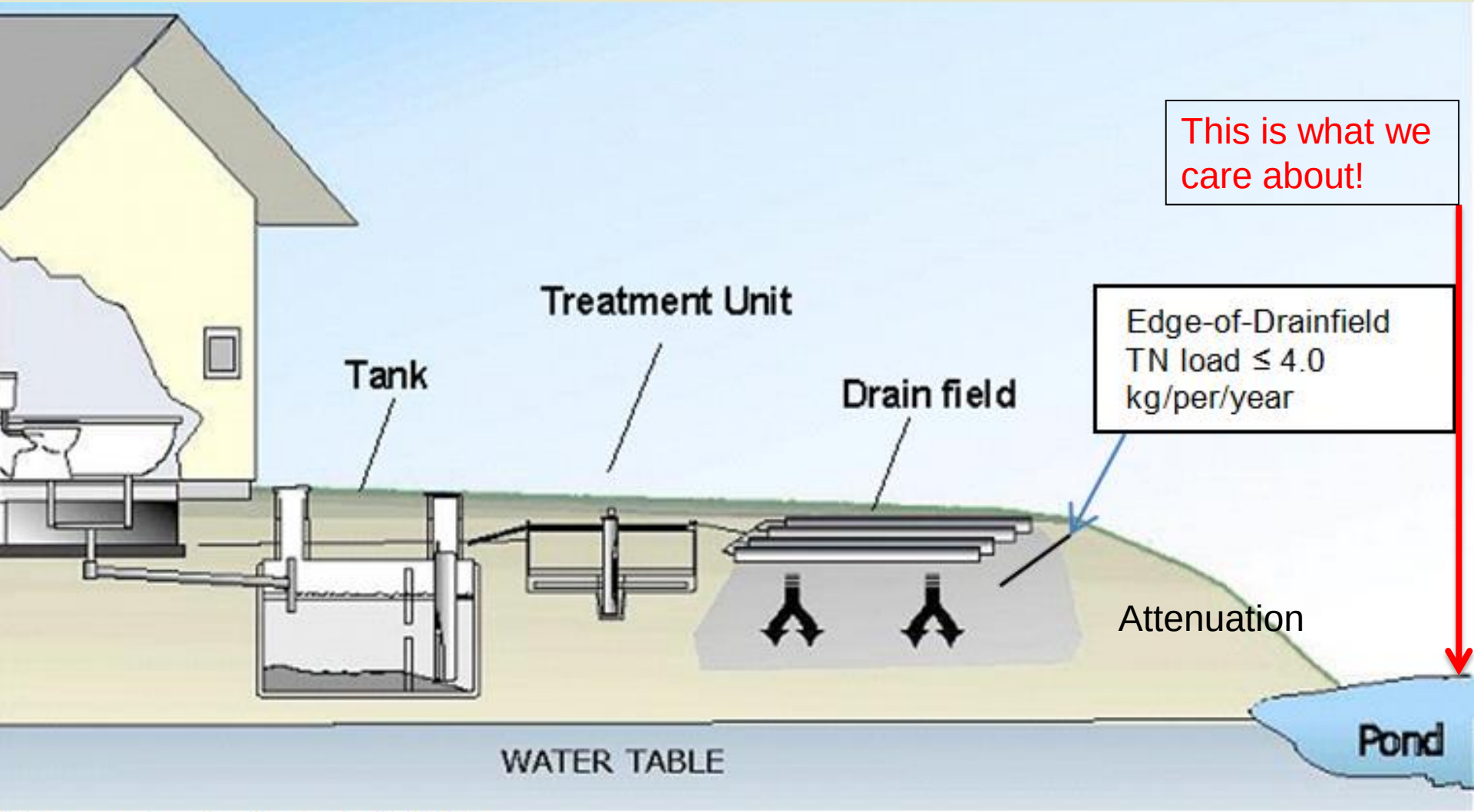
Agenda

- Charge
- Members
  - Chair
- Activities to date
- Current status
- Future activities and schedule

Attenuation Panel Charge



Source: Joubert et al. (2005)

Attenuation Panel Charge

- **Review science on how to factor attenuation of N and P into TMDL onsite system load estimates.**
  - Can model can be improved by using attenuation rates that vary?
  - Is 100% removal of total phosphorus (TP) from onsite wastewater system effluents warranted?
  - Recommend a methodology and specific attenuation rates to be used in different contexts.
- Also:
  - Document data needs.
  - Recommend procedures for reporting, tracking and verifying.
  - Critically analyze any unintended consequences.

Member Classification




Name	Organization	Alternates	Member Type	Org. Type
Jason Baumgartner	Delaware	Derek Caruthers, Jack Hayes	Voting	ChesBay State Government
Jay Prager	Maryland DEP	Barry Glotfelty	Voting	ChesBay State Government
Tom Boekeloo	New York DEP		Voting	ChesBay State Government
John Diehl	PA DEP	Nick Hong	Voting	ChesBay State Government
Marcia Degen	Virginia DOH	Eric Aschenbach, Jay Conta	Voting	ChesBay State Government
Dave Montali	West Virginia	Rick Hertges	Voting	ChesBay State Government
Robert Siegrist	Colorado School of Mines		Voting	Academia
Michael O'Driscoll	East Carolina University	Charlie Humphreys	Voting	Academia
David Lindbo	North Carolina State U		Voting	Academia
Jim Anderson	University of Minnesota		Voting	Academia
Randy Miles	University of Missouri		Voting	Academia
Carol Ptacek	University of Waterloo		Voting	Academia
John Galbraith	Virginia Tech		Voting	Academia
Durrelle Scott	Virginia Tech		Voting	Academia
Kang Xia	Virginia Tech		Voting	Academia
Eberhard Roeder	Florida DOH	Elke Ursin	Voting	State Government (other)
A.J. Maupin	Idaho DEQ		Voting	State Government (other)
Sushama Pradhan	NC Onsite Water Protection	Steven Berkowitz	Voting	State Government (other)
Joyce Hudson	US EPA - OWM	Maureen Tooke	Voting	EPA
Robert Goo	US EPA - OWOW		Voting	EPA
Rob Adler	US EPA - Region 1		Voting	EPA
Paul Finnell	USDA		Voting	Federal Government (other)
Judy Denver	USGS		Voting	Federal Government (other)
George Heufelder	Barnstable County DHE		Voting	County Government (other)
David Sample	Virginia Tech		Advisory	Academia, representative from the STAC
Rich Piluk	Anne Arundel Co. HD		Advisory	ChesBay Local Government
Jeff Moeller	WERF		Guest	Research Foundation
Lewis Linker	Bay Program Office		Advisory	EPA, representative from the CBP modeling team
Ning Zhou	Bay Program Office		Advisory	CBPO, representative from the WWTWG
David Wood	Bay Program Office		Supporting	CBPO
Victor D'Amato	Tetra Tech		Supporting	Consultant
Jim Kreissl	Tetra Tech		Supporting	Consultant

Appointing a Chair

- Multiple nominees (most declined)
- **Chair: Dr. David Lindbo**
  - NC State University Soil Science/Exension
  - Specialty: Soil-Environment Relations

- Responsibilities:
  - Leader of panel
  - Point of contact with Coordinator
  - Help Coordinate
    - Assign responsibilities
    - Manage comment process
    - Brief WWTWG
    - Respond to comments
    - Resolve issues

Activities to Date

- Administration and orientation
- White paper development/background discussions
- Literature collection/dissemination
- Six conference calls
  - Lew Linker presentation on Bay model
  - Bob Siegrist presentation on STUMOD
- Developed draft report outline
  - Use to assign/synthesize/summarize literature
  - Start writing based on calls, etc.

Attenuation Panel Considerations/Issues

- Variable as a function of soil characteristics
  - Soil type
  - Soil depth
  - Soil geochemistry (redox conditions, labile carbon)
- Variable as a function of topography
  - Setback distance
  - Riparian areas or wetlands in flow path
- Variable as a function of effluent characteristics
  - STE versus pre-treated

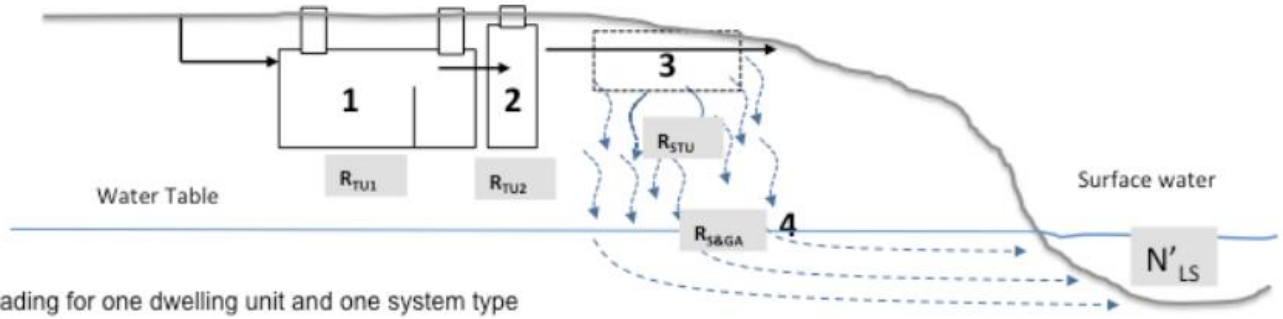
Attenuation Panel Considerations/Issues

- What kind of recommendations will panel provide?
  - Average attenuation rates across watershed
  - Variable attenuation based on spatial data
  - Variable attenuation based on site-specific data
- Nitrogen and phosphorus or just nitrogen?

White Paper - Attenuation Accounting Methodologies

- **Watershed Constant**: single, average attenuation rate is used across the entire Bay watershed.
- **Subwatershed Constant**: Different average attenuation rates assigned to different subwatersheds.
- **Spatially Variable**: Attenuation rates assigned to different areas based on their spatial characteristics.
- **Site-Specific**: Attenuation rates customized for individual systems, based on characteristics and location.

System components and estimating nutrient loading



Loading for one dwelling unit and one system type

$$N'_{LS} = N_S\left(1-R_{TU1}\right)\left(1-R_{TU2}\right)\left(1-R_{STU}\right)\left(1-R_{S\&GA}\right)$$

$$e = \left(1-R_{TU1}\right)\left(1-R_{TU2}\right)\left(1-R_{STU}\right)\left(1-R_{S\&GA}\right)$$

e= a combined export coefficient for all compartment for one dwelling unit reflecting factors affecting removal in each compartment

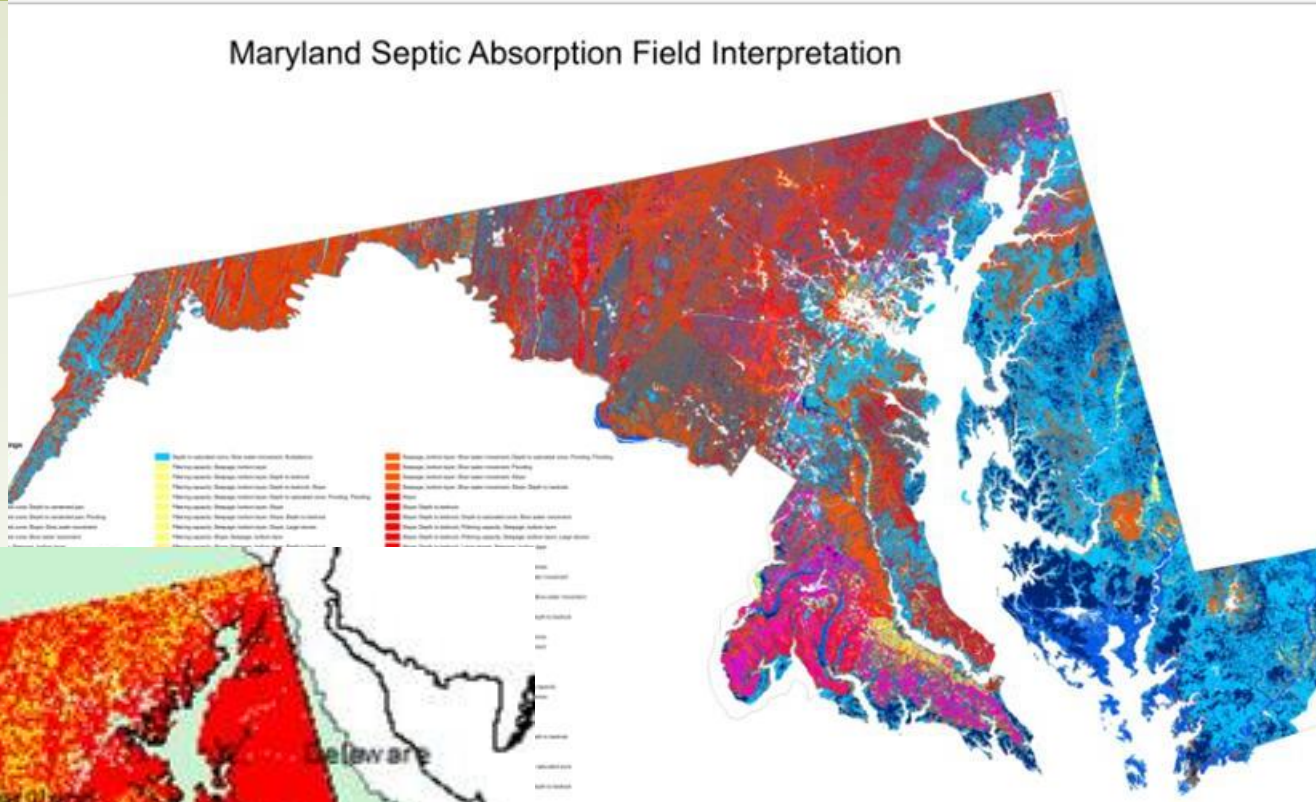
Loading from multiple dwelling unit, multiple system types

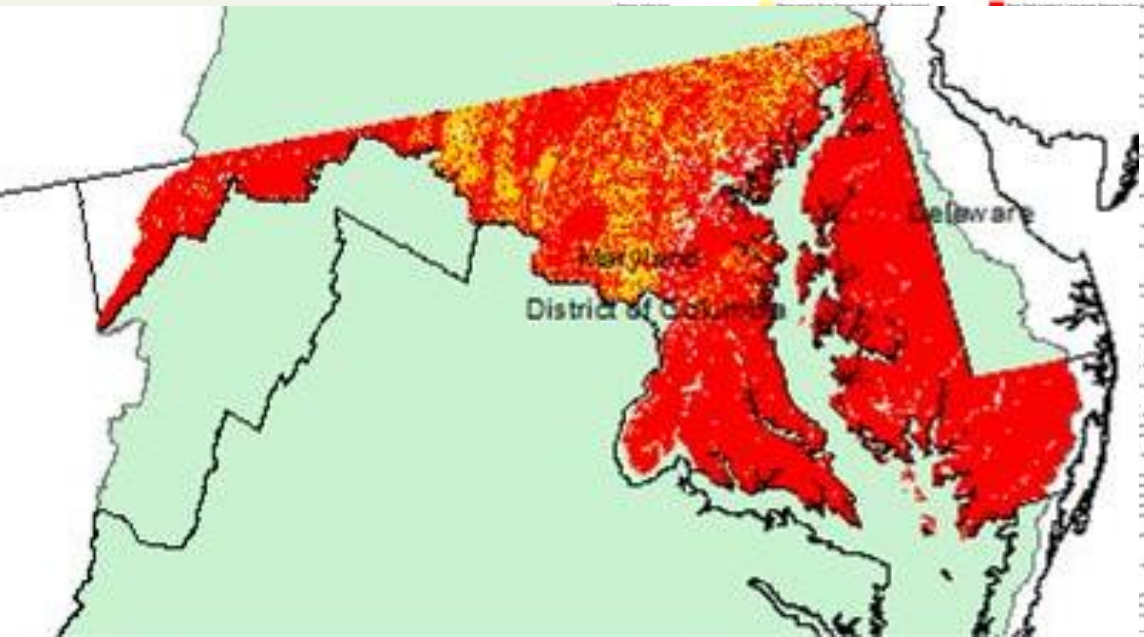
$$N_{LS} = \sum_{i=1}^{ST}\left\{\sum_{j=1}^{DU}\left[\left(N_S\right)\left(1-R_{TU1}\right)\left(1-R_{TU2}\right)\left(1-R_{STU}\right)\left(1-R_{S\&GA}\right)\right]\right\}$$

Component	Parameter	Comment
1. Treatment unit 1 (e.g., septic tank)	R_{TU1}	Literature data is available on removal efficiencies of many confined unit operations
2. Treatment unit 2 (e.g., intermittent sand filter)	R_{TU2}	
3. Soil-based treatment unit (e.g., infiltration trenches)	R_{STU}	STUMOD estimates transformation and removal in an unsaturated soil profile
4. Deeper vadose zone and groundwater	$R_{S\&GA}$	HPS combined with STUMOD estimates removal in the vadose zone and groundwater

Maryland Maps – from Paul Finnell (USDA)





Report Outline

- **Introduction**
  - Historical approach
  - Maryland (and others) approach
  - Proposed geomorphic approach
  - Challenges
- **Methods**
  - Describe weight of evidence approach
  - Literature
  - Modeling
  - Hydrogeomorphology
- **Results and Discussion**
  - Coastal Plain
  - Piedmont
  - Ridge and Valley
  - Appalachian Highlands
- **Conclusions and Recommendations**

Future Presentations to Support Report

- David Radcliffe (UGA)
  - TN, TP versus watershed onsite density in GA; prediction of denite rates
- Steven Berkowitz (North Carolina)
  - TN, TP in onsite dominated NC Piedmont watersheds; storm/baseflow; malfunctioning systems
- Eberhard Roeder (Florida)
  - TN, TP in Florida watersheds; treatment approaches
- Mike O'Driscoll, Charlie Humphrey (ECU)
  - TN, TP in septic dominated NC Coastal Plain watersheds; plume tracking
- Randy Miles (Mizzou)
  - Predicting TN, TP delivery in different soils and topographies
- Judy Denver (USGS)
  - SPARROW model
- AJ Maupin (Idaho)
  - TP delivery; treatment; regulation
- Center for Watershed Protection
  - Attenuation in higher order streams
- Cape Cod modelers
- Others?

Future Activities

- Refine draft outline (Nov-Dec)
- Assign/review literature (Nov-Feb)
- Internal draft report (Feb-Apr)
- Draft report to WWTWG (Apr-May)
- Additional review/revision