Evaluating Risks in a Source Water Protection Area - Modernized Methodologies

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Operator Training Committee of Ohio, Inc.
Class III/IV Workshop
August 2, 2017

Outline

* City of Dayton Source Water Protection Area
* Recent Updates to the City of Dayton Source Water Protection Program
* US EPA's Priority Setting Approach (PSA) for Managing Groundwater Contamination Sources in Wellhead (Source Water) Protection Areas
* Modernizing PSA Methodology
* Conclusions

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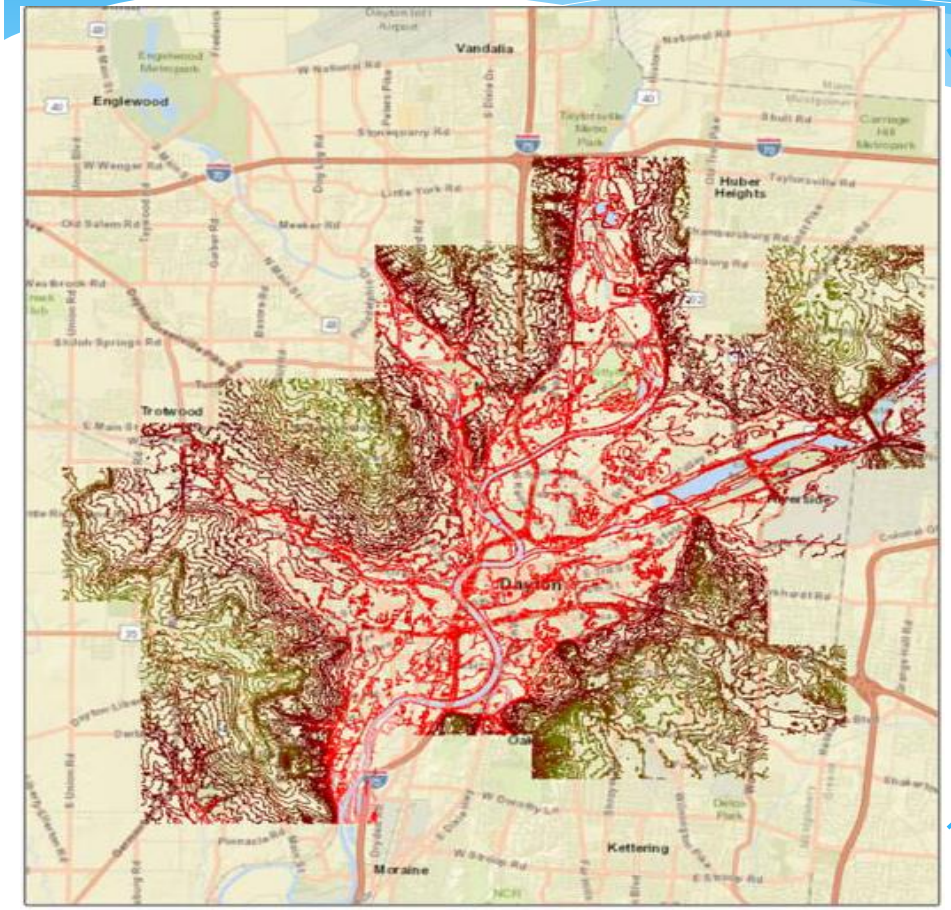
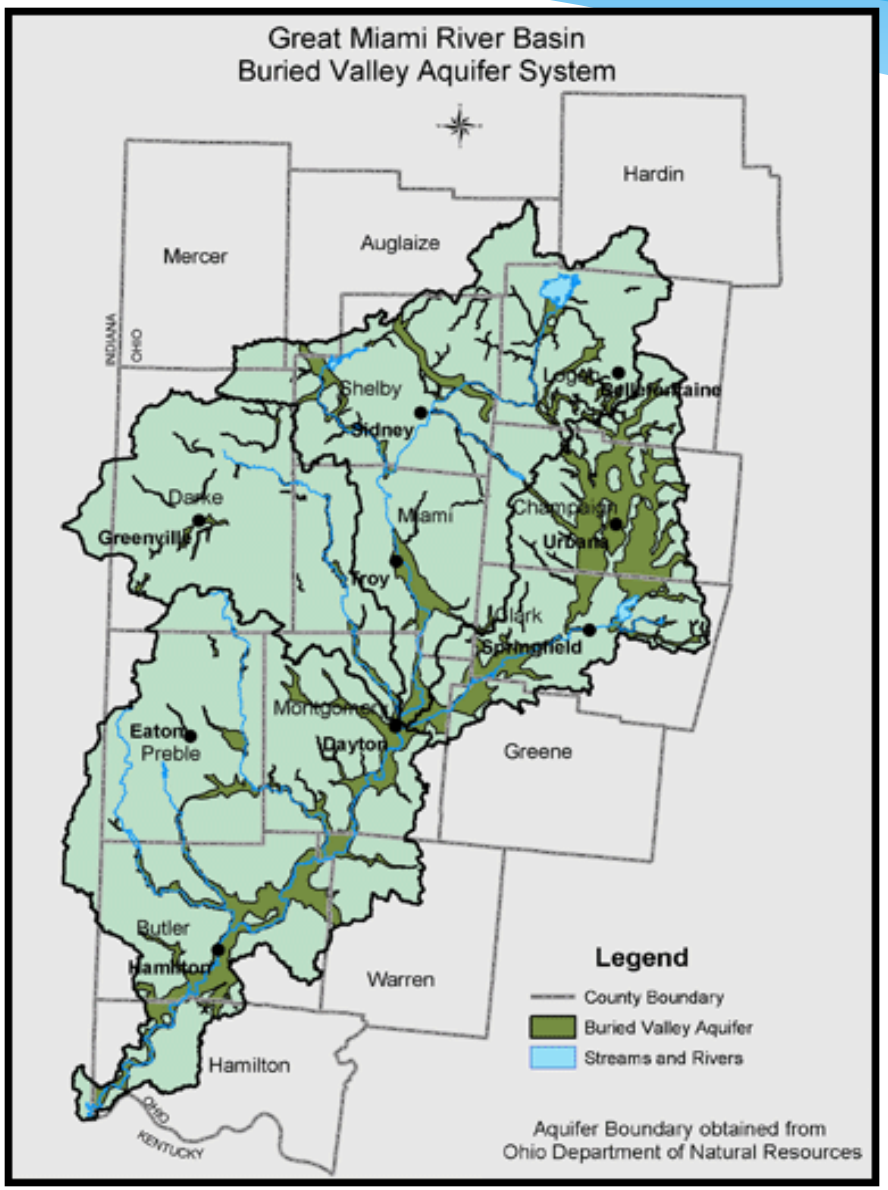
City of Dayton, Ohio

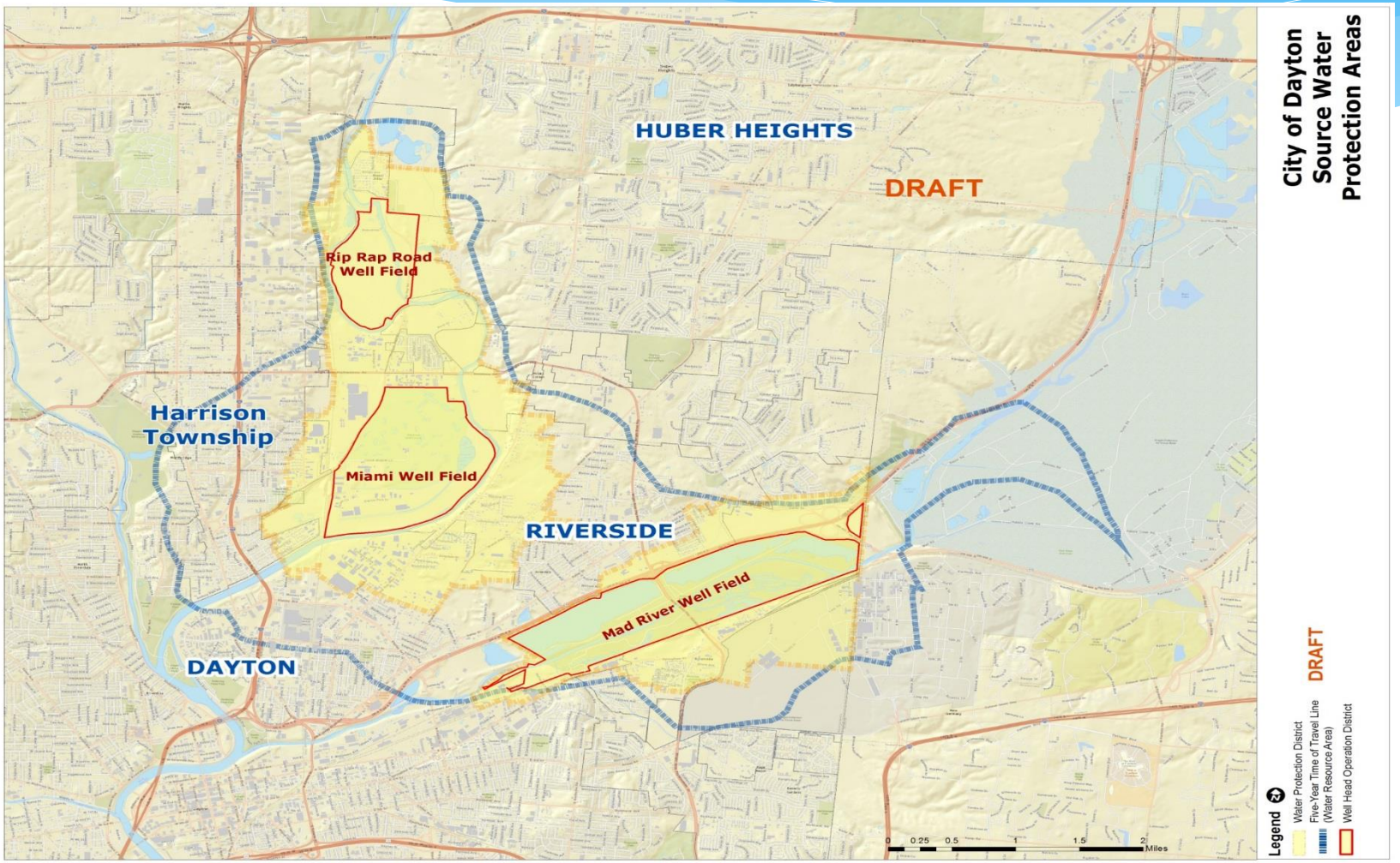


Great Miami Buried Valley Aquifer



- Sustainable Asset
- Phenomenal Recharge
- Sole Source Aquifer
- ~1.5 Trillion Gallons
- Principal Water Source For 1.6 Million People
- Dayton Water provides drinking water to more than 400,000 customers
- Producing 60 MGD

Wellfields and Source Water Protection Area



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Reasons for Updating SWPP

- Timeframe 25+ years
- Water usage decrease
- More and better hydrogeological data
- Need to model the 5 year Time Of Travel (TOT) boundary

Reasons for Updating SWPP Cont

- Time for a re-evaluation of the Source Water Protection Program
- Reconnect with the businesses operating in the 1 year TOT
- Begin to understand businesses operating in the 5 year TOT

Reasons for Updating SWPP Cont.

- Used new delineation and the risks posed within the 5 year TOT
- Large number of businesses and the need for a quantitative risk ranking system
- End goal of the risk ranking system is to prioritize limited SWPP funding and resources for the highest risks

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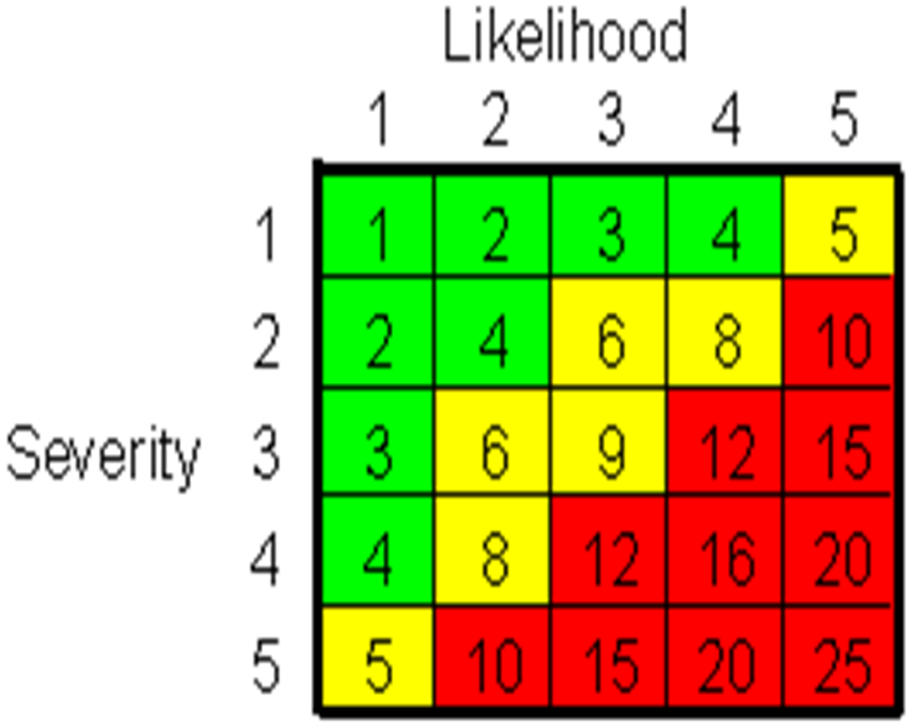
Priority Setting Approach (PSA)

- What is the PSA?
  - Method developed by the US EPA in the early 1990s
  - Risk screening tool to enable assessment of risks posed by potential sources of contaminants
  - Scores and ranks risk posed by sources of contaminants

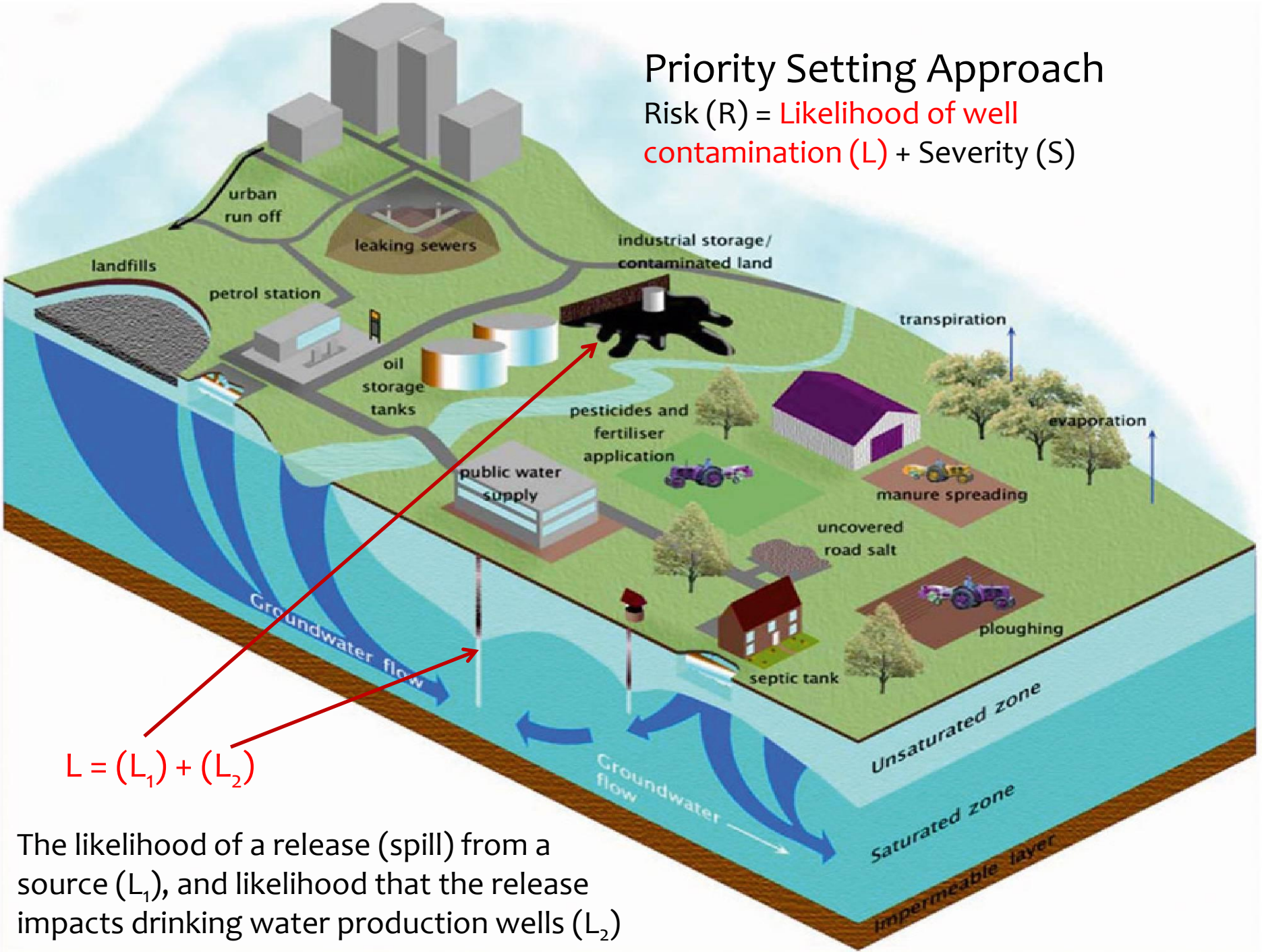
Priority Setting Approach
R = L + S

- What is the PSA?
  - PSA is based on conventional risk assessment
  - Risk = Likelihood x Severity
  - R = L x S



Priority Setting Approach

Risk (R) = Likelihood of well contamination (L) + Severity (S)



$L = (L_1) + (L_2)$

The likelihood of a release (spill) from a source (L_1), and likelihood that the release impacts drinking water production wells (L_2)

Example Potential Sources of Contamination in the Dayton SWPA

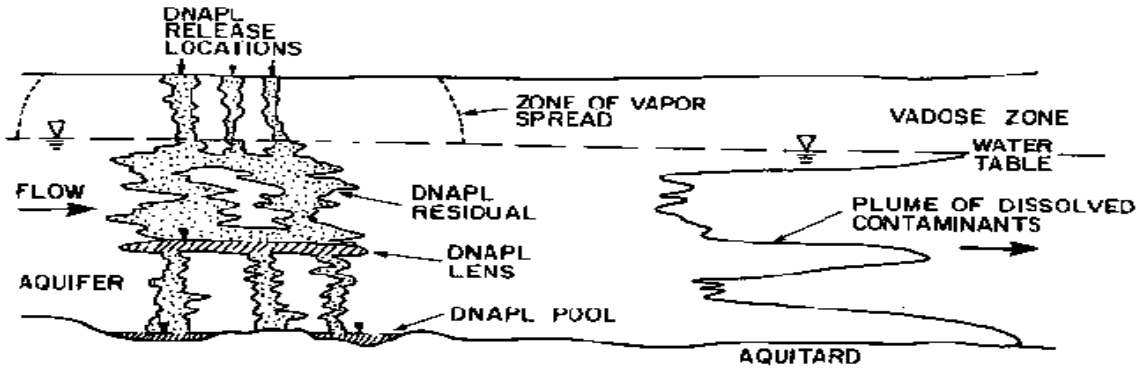
- Container Storage and Material Transfer
- Storage Piles
- Tanks
- Overland Material Transport
- Landfills
- Shallow (Class V) Dry Wells
- Agrichemical Applications
- Pipelines

Priority Setting Approach

R = L + S

S reflects the potential health hazard

S = Q+A+T



Quantity Released (Q)

Attenuation due to transport (A) through buried valley aquifer deposits

Toxicity of the contaminant (T)

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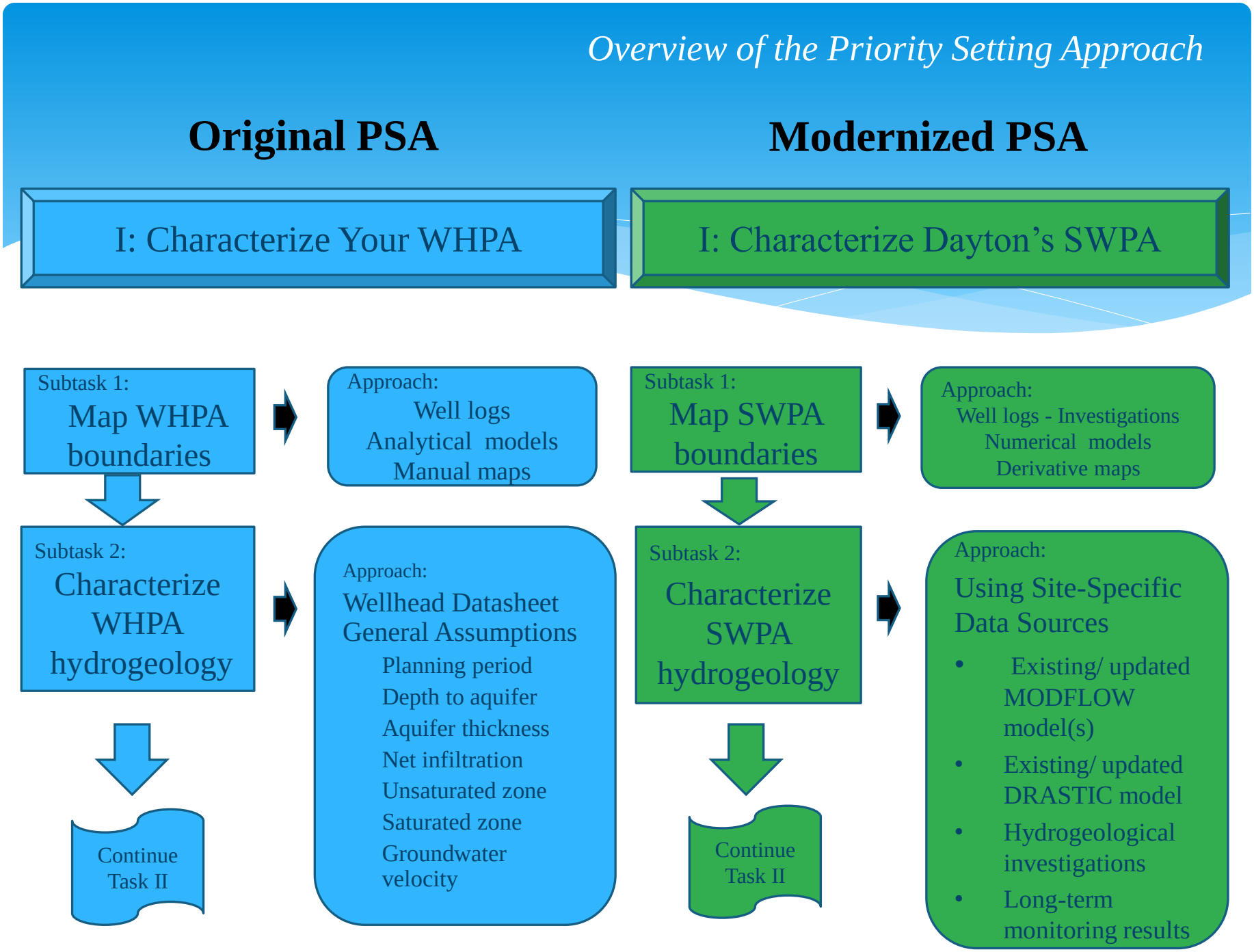
Modernization of the PSA

- USEPA PSA method required modernization for use by the City of Dayton
- Over 25 years of SWPA- specific information available
- Incorporation of results from numerous hydrogeological investigations

Modernizing PSA Method Cont.

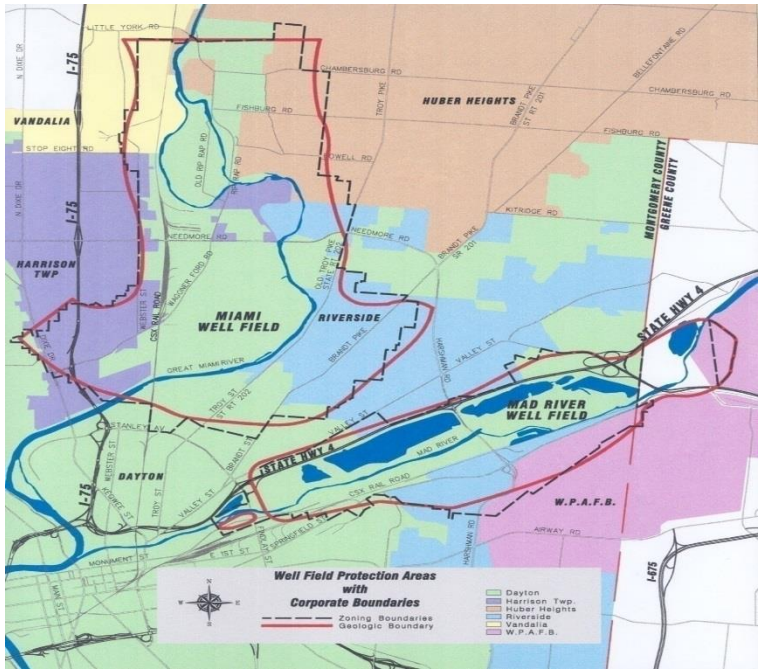
- Standardization of potential contaminant's environmental characteristics and how they persist in the subsurface
- Inclusion of new contaminants of concern in the PSA evaluation process
- Needed to implement PSA calculations in a computer model format to permit quick and standardized assessments

Overview of the Priority Setting Approach

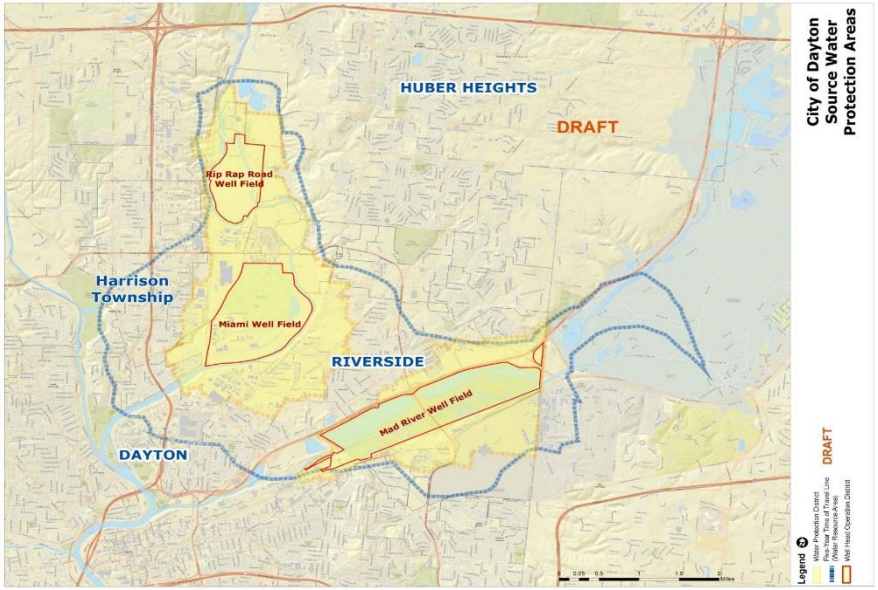


Previously Defined WHPA vs Current SWPA Delineation

Dayton WHPA (circa 1988)



Current Dayton SWPA



Overview of the Priority Setting Approach

Original PSA

II: Potential Sources of Well Contamination

Subtask 3: Identify & Locate All Sources

→ **Approach:** Surveys; Field studies; Manual maps

Subtask 4: List all sources by category & name

→ **Approach:** Manually complete Block I Master Scoresheet

Subtask 5: Contaminant source characterization

→ **Approach:** Source Datasheet General Assumptions; Non-standard inputs estimated based on source type

Continue Task III

Modernized PSA

II: Potential Sources of Well Contamination

Subtask 3: Identify & Locate All Sources

→ **Approach:** Site inventories (historical & new); Existing databases

Subtask 4: List all sources by category & name

→ **Approach:** Develop standardized category & name database

Subtask 5: Contaminant source characterization

→ **Approach:** Develop standardized database for potential contamination for all sources

Continue Task III

Overview of the Priority Setting Approach

Original PSA

III: Perform Source Calculations

Subtask 6:
Assess Contaminant Source Releases

Approach:
Use Source Datasheet and manually calculate:
- Likelihood of release (L_1), Quantity of release (Q), Toxicity (T) scores

Subtask 7:
Scoring Results Transfer Master Scoresheet

Approach:
Manually complete Block II Master Scoresheet

Continue Task IV

Modernized PSA

III: Perform Source Calculations

Subtask 6:
Assess Contaminant Source Releases

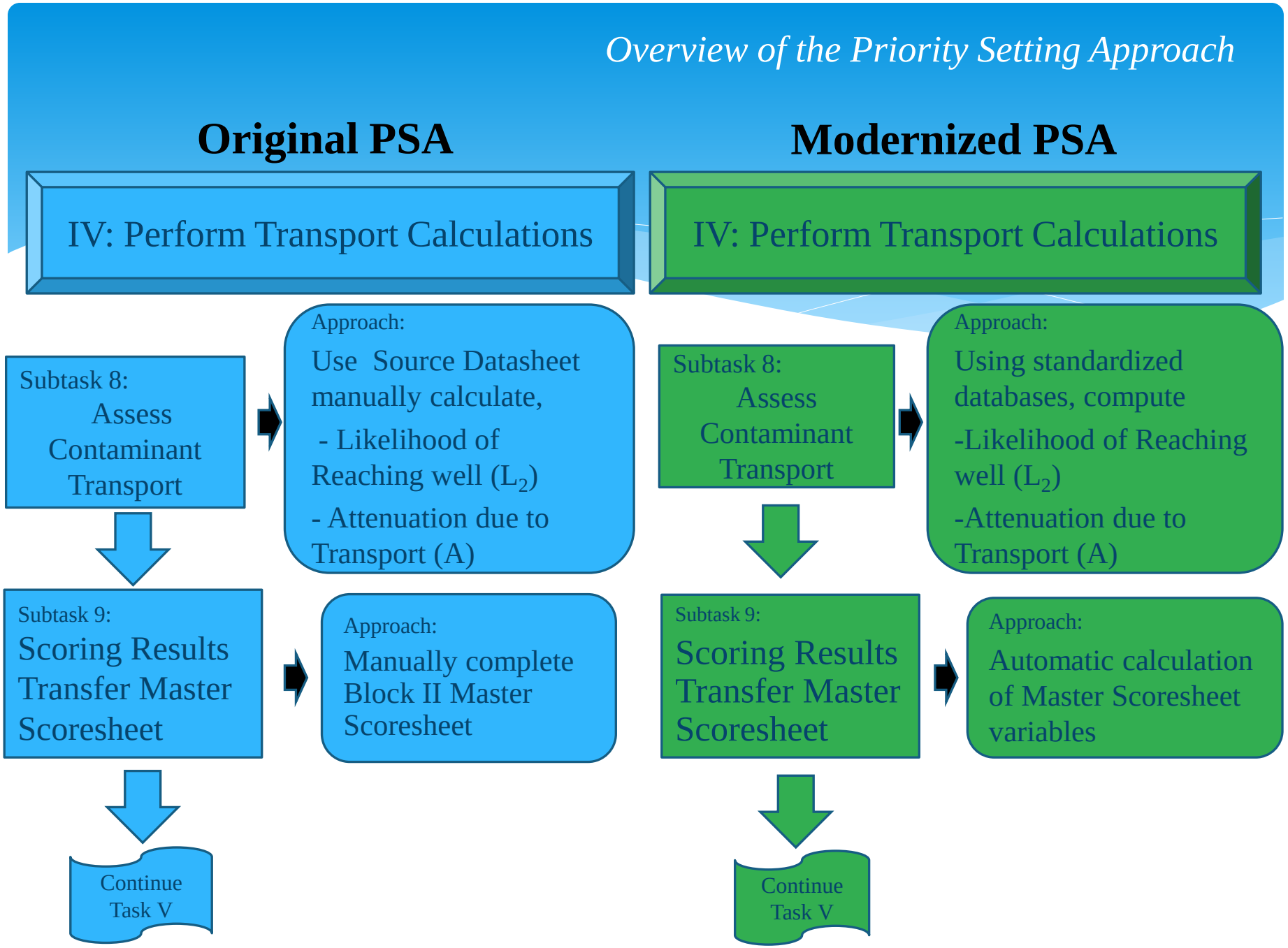
Approach:
Using standardized databases and compute:
- Likelihood of release (L_1), Quantity of release (Q), Toxicity (T) scores

Subtask 7:
Scoring Results Transfer Master Scoresheet

Approach:
Automatic calculation of Master Scoresheet variables

Continue Task IV

Overview of the Priority Setting Approach



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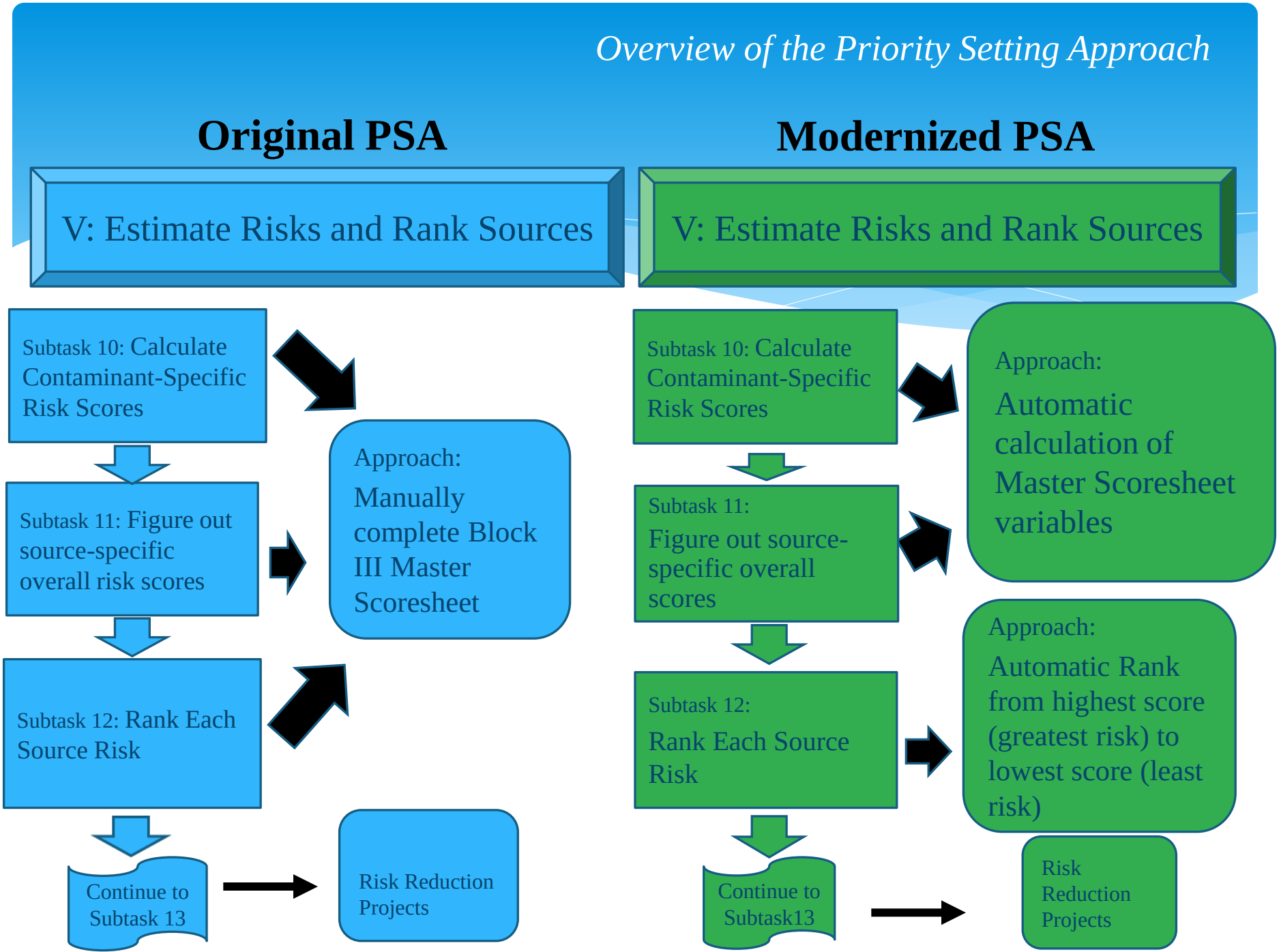

Overview of the Priority Setting Approach

Original PSA

Subtask 13: Risk Reduction Projects

Approach:
More regulatory with some incentives including purchasing chemical rights

Modernized PSA

Subtask 13: Risk Reduction Projects

Approach:

- More incentive focus and target greatest risks
- Developing Drinking Water Protection Partnerships
- Social media to create awareness plus promoting the business
- Offering more useful incentives such as use of consultant and funding for engineering controls
- Purchasing chemical rights

Overview of the Dayton's Priority Setting Approach Spreadsheet Based Platform

Source #																																								
Source Name																																							
Location																																							
Author																																							
Date																																							
State Plane X (US Survey Ft) [LINK]	1502280																																						
State Plane Y (US Survey Ft) [LINK]	666612																																						
	Current Source Type:							Landfills																															
	WD1	WD2	WD3	WD4	WD5	WD6	WD7	SD1	SD2	SD4	SD5	SD6	SD7	SD3			T			L1		Q						Lu	Ls	L2	Au	As	A	L	S		
Source Type	Planning Period (yrs)	Depth to Aquifer Score	Aquifer Thickness Score	Net Infiltration (in)	Unsaturated Zone Hydraulic Conductivity Score	Saturated Zone Material	Groundwater Velocity Score	Landfill Design (list) [LINK]	Landfill Status (list)	Age of Landfill (yrs)	Area of Landfill (acres)	Distance Score (list)	Direct Transport to Well? (Y/N)	Default Assumptions (Y/N)	Reset Contaminant Data	Concentration Score [LINK]	Toxicity Score	Mobility Score	Persistance Score	Likelihood of Release Score	Release, Volume and/or Area Score	Quantity Score	Timeframe	Adjusted Hydraulic Conductivity Score	Adjusted Velocity Score	Unsaturated Zone TOT Category	Saturated Zone TOT Category	Likelihood Unsaturated	Likelihood Saturated	Likelihood Reaching Well	Unsaturated Attenuation	Saturated Attenuation	Attenuation due to Transport	Likelihood of Well Contamination	Severity of Well Contamination	Risk Score	Risk Level
Agrichemical Application	10	0.3	1.5	9	4	Gravel	4	35	500	--	--	2	No	--	2,4-D	3	0.5	M	L	0.0	2.3	5.3	45	3	3	A	B	0.0	0.0	0.0	-0.2	-47.8	-48.0	0.0	-42.2	-42.2	Low
Container Storage and Material Transpor	10	0.3	1.5	9	4	Gravel	4	5	H	Unpadded	30	2	No	--	Hazardous Material/Products	-2.7	2.0	M	L	-1.3	2.3	-0.4	40	3	3	A	B	0.0	0.0	0.0	-0.2	-47.8	-48.0	-1.3	-46.4	-47.7	Low
Shallow Injection Wells (Class V)	10	0.3	1.5	9	4	Gravel	4	7	1	--	--	2	No	--	Industrial Process Water Disp	-1.3	0.5	M	M	0.0	3.4	2.1	17	3	3	A	B	0.0	0.0	0.0	0.0	-2.5	-2.5	0.0	0.1	0.1	High
Land Treatment	10	0.3	1.5	9	4	Gravel	4	15	50	2	--	2	No	--	Inorganic Chemicals - Land Tr	-0.9	0.8	H	H	0.0	4.7	3.8	25	4	4	A	A	0.0	0.0	0.0	0.0	-4.4	-4.4	0.0	0.2	0.2	High
Landfills	10	0.3	1.5	9	4	Gravel	4	1	2	8	100	2	No	No	Arsenic(Subtitle C/Hazardous	-1	3.7	H	H	0.0	4.9	3.9	18	4	4	A	A	0.0	0.0	0.0	0.0	-4.4	-4.4	0.0	3.2	3.2	High
Material Transport	10	0.3	1.5	9	4	Gravel	4	H	H	100	--	2	No	--	RCRA Permitted Storage (X50	2	2.0	M	L	-1.0	1.1	3.1	110	3	3	A	B	0.0	0.0	0.0	-0.2	-47.8	-48.0	-1.0	-42.9	-43.9	Low
Pipelines	10	0.3	1.5	9	4	Gravel	4	Other	25	30	15	2	No	--	RCRA Permitted Storage (X50	2.4	-0.4	H	L	0.0	3.1	5.5	35	4	4	A	A	0.0	0.0	0.0	0.0	-4.9	-4.9	0.0	0.2	0.2	High
Septic Tank Systems	10	0.3	1.5	9	4	Gravel	4	30	10	--	--	2	No	--	Sewer - Chloroform	-4.8	1.2	H	M	0.0	1.5	-3.3	40	4	4	A	A	0.0	0.0	0.0	0.0	-4.4	-4.4	0.0	-6.5	-6.5	Low
Storage Piles	10	0.3	1.5	9	4	Gravel	4	Heap Lead	1	1	4	2	No	--	Heap Leaching Piles - Metals M	-0.3	-0.8	H	H	0.0	3.0	2.7	14	4	4	A	A	0.0	0.0	0.0	0.0	-4.4	-4.4	0.0	-2.5	-2.5	Medium
Surface Impoundments	10	0.3	1.5	9	4	Gravel	4	1	1	10	--	2	No	--	Urban Stormwater Retention	2	0.2	M	H	0.0	-0.2	1.8	20	3	3	A	B	0.0	0.0	0.0	0.0	-2.4	-2.4	0.0	-0.4	-0.4	Medium
Tanks	10	0.3	1.5	9	4	Gravel	4	2-5	S	1	20	2	No	--	Product Storage (Paint Dryer:	2.9	2.0	M	L	-0.6	0.2	3.1	30	3	3	A	B	0.0	0.0	0.0	-0.2	-47.8	-48.0	-0.6	-42.9	-43.5	Low

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Conclusions In Dayton's SWPA

- Many business operations may not pose a great risk to groundwater
- Many businesses already diligently provide BMPs further protecting groundwater
  - Just in time ordering of needed chemicals
  - Less toxic or benign substitutes
  - Secondary containment and engineering controls
  - Spill response and safety training

Conclusions In Dayton's SWPA

- Some businesses do pose significant risks
  - Large quantities of toxic and persistent chemicals with high mobility in soil and groundwater
  - BMPs needed or improvements needed
- Not so common anymore but chlorinated ethenes used as degreasers, or in dry cleaning
- Emerging contaminants: Poly & Perfluoroalkyl Substances (PFAS), and 1, 4 Dioxane

Conclusions In Dayton's SWPA

* Modernization of the Priority Setting Approach (PSA) algorithm provides a realistic method
* Screening and ranking of risks for source water protection programs
* Comprehensive approach that can seem overwhelming because it is realistic

Conclusions In Dayton's SWPA

* The PSA provides objective ranking of risks to drinking water resources of businesses and other sources operating and located within the SWPA
* The PSA can be updated with data from emerging contaminants of concern
* Effective tool for Source Water Protection Programs

Conclusions In Dayton's SWPA

Based on risk screening using Dayton's PSA, locate monitoring equipment/ wells in areas of greatest risk

Prioritization of limited resources to address greatest risks

Thank You!

Contributors and Acknowledgments

* City of Dayton Dept. of Water
  * Michele Simmons, Jim Shoemaker, Gayle Galbraith, and Environmental Management staff
* Amec Foster Wheeler Dayton Office
  * Paul Stork and staff
* Terran Corp.
  * Brent Huntsman and staff
* OTCO, Inc.

OTCO, Inc.