

# Paducah Land Acquisition Study

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Director, Kentucky Research  
Consortium for Energy and  
Environment



# Background

**The study was conducted in accordance with a Congressional Directive to DOE in the 2006 Energy and Water Development Appropriations Act.**

*“Within the funds provided the Department shall undertake a study of the potential purchase of property or options to purchase property that is located above the plume of contaminated groundwater near the facility site. The study shall evaluate the adequate protection of human health and environment from exposure to contaminated groundwater and consider whether such purchase, when taking into account the cost of remediation, long-term surveillance, and maintenance, is in the best interest of taxpayers.”*

*Energy and Water Development Appropriation Bill, 2006 (Senate Report 109-084)*



# Timetable

- May 16, 2006
  - Contract with KRCEE
- June 15, 2006
  - Presentation to Paducah Citizens Advisory Board
- June 29, 2009
  - Public Presentation
- September 20, 2006
  - First draft of report provided for review by KRCEE (PPPO review)
- September 21, 2006
  - Presentation to Paducah Citizens Advisory Board
- February 2, 2007
  - The second draft of the report provided for review by KRCEE (DOE-HQ review)
- March 12, 2007
  - The third draft of the report provided for review by KRCEE (public review)
- March 20, 2006
  - Public Presentation
- April 16, 2007
  - Final report was submitted to Congress



# Report

- The report provides information regarding land acquisitions options under various cleanup scenarios.
- The report is not a decision document.
- The information in the report may be used in future decision documents.



# Project Tasks

- **Identified property that is over or could be over contaminated groundwater.**
- Delineated ways to purchase property or interests in property.
- Developed general cost estimates for property or interests in property.
- Summarized assumptions for potential remedial actions that could address contaminated groundwater and sources.
- Modeled where contaminated groundwater might migrate to in the future and identified potentially impacted properties.
- Identified conditions that make property acquisition cost-effective while ensuring protection for human health and the environment.
- Completed an economic analysis.



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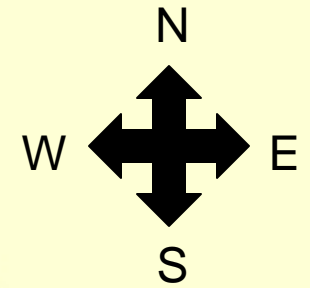
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# TCE Plume - 2004

## Legend

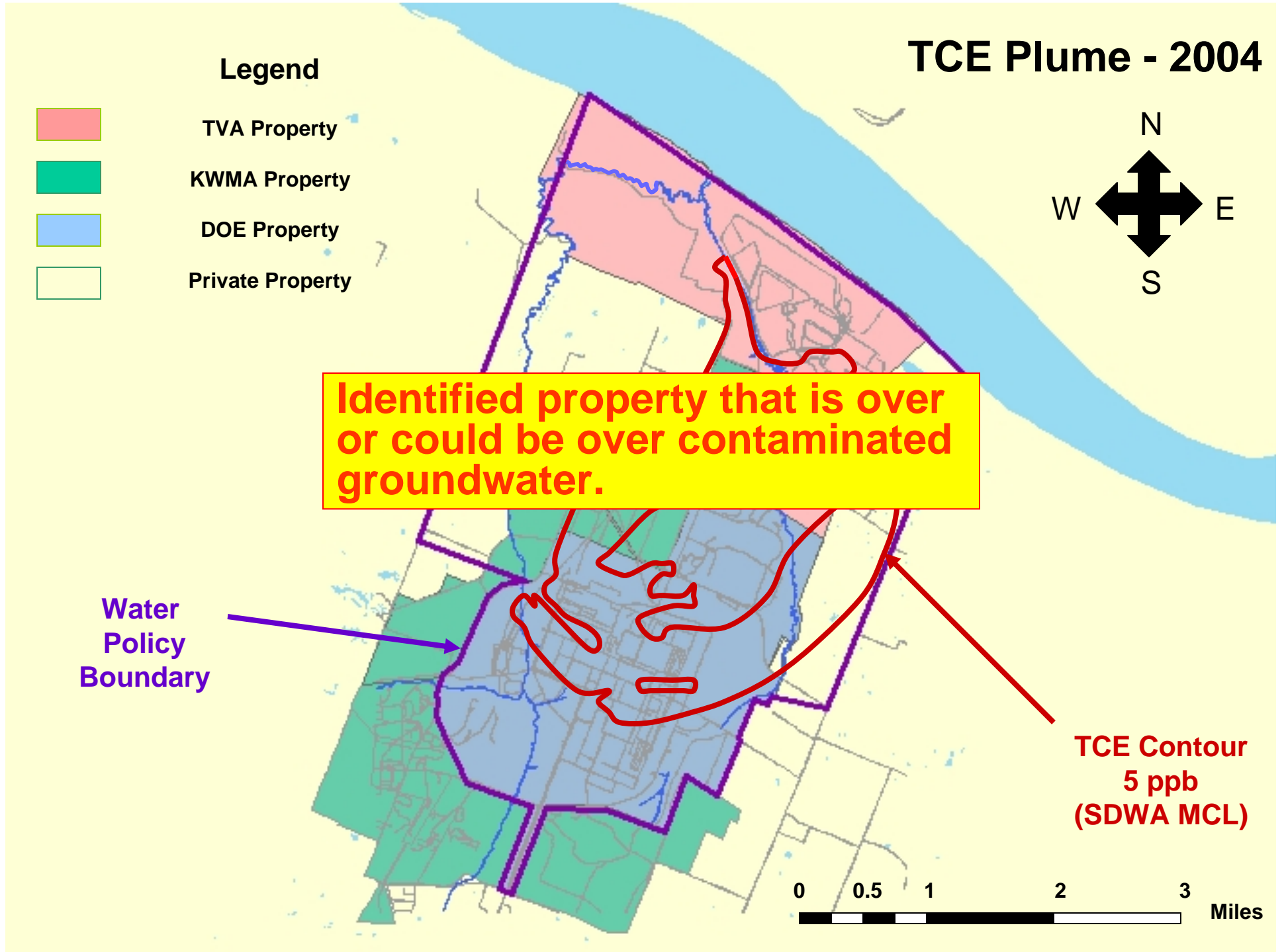
-  TVA Property
-  KWMA Property
-  DOE Property
-  Private Property



**Identified property that is over or could be over contaminated groundwater.**

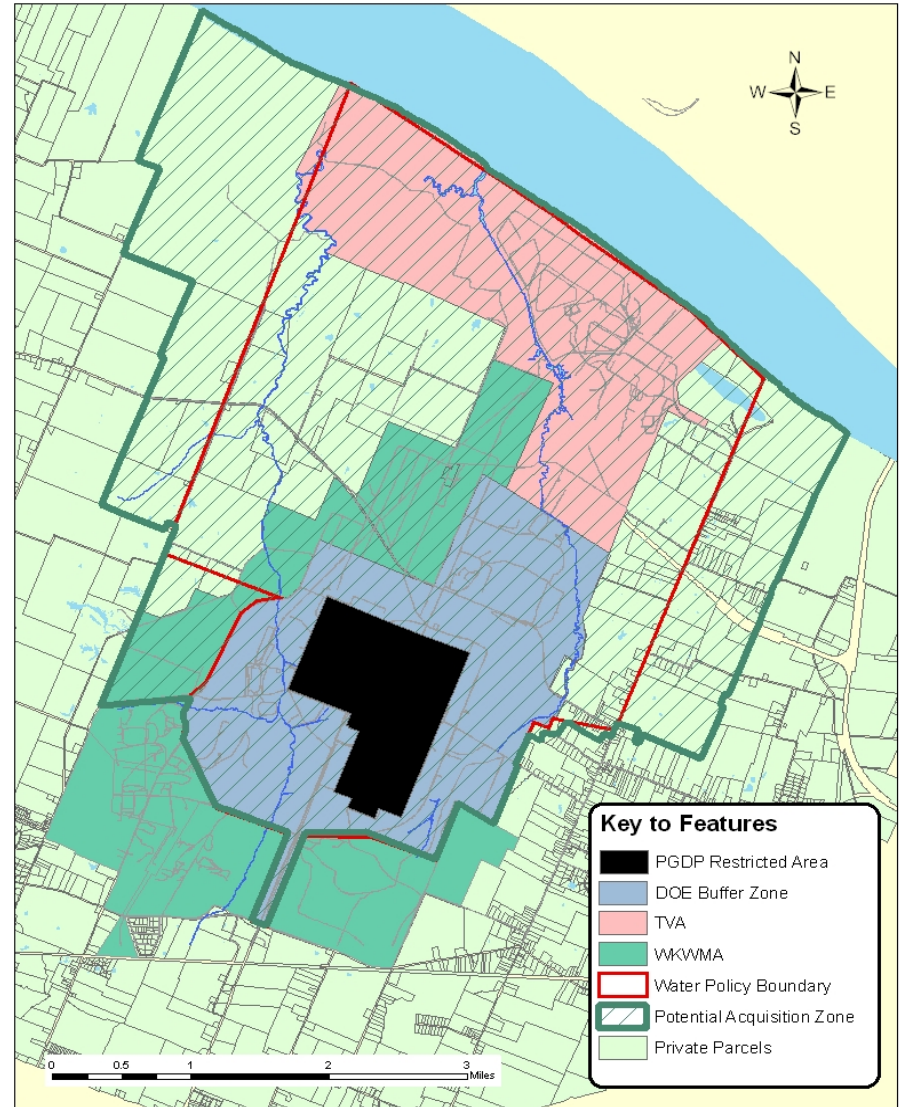
**Water Policy Boundary**

**TCE Contour  
5 ppb  
(SDWA MCL)**



# Identified property that is over or could be over contaminated groundwater

Ownership Characteristics in the Area Impacted or Potentially Impacted by Contaminated Groundwater		
Ownership	Number of Parcels	Area (Acres)
DOE	1	3,556
TVA (Shawnee Power Plant)	1	2,669
Kentucky (West Kentucky Wildlife Mgt. Area)	2	1,290
<b>Private Property</b>	165	6,054
Farm	64	5,783
Rural Residential	101	271
<b>Total</b>	169	13,568



# Delineated ways to purchase property or interests in property

Property Acquisition Matrix				
Interest	Parcels Not DOE-owned			
	Monitoring Easement	Limited Scope Easement	Expanded Scope Easement	Title Clearing
Fee Simple	No	Yes	Yes	Yes
Life Estate	No	No	No	Yes
Leasehold	No	Yes	Yes	Yes
Concurrent Estates	No	No	No	Yes
Nonpossessory Future Interests	No	No	No	Yes
Purchase Option	No	No	No	Yes
License	No	No	No	Yes
Easement	Yes	Yes	Yes	Yes
Real Covenants / Equitable Servitudes	Yes	Yes	Yes	Yes



# Developed general cost estimates for property or interests in property

Range of Estimated Per Unit Acquisition Costs for <b>Fee Simple Purchase of Properties</b>			
Study Area Properties	Units	Estimated Range of Acquisition Costs Per Parcel or Per Acre	
		Upper Estimate	Lower Estimate
Residential	Per Parcel	\$138,301	\$120,293
Farm:			
Fair Market Value	Per acre	\$3,099	\$2,788
Development Value	Per acre	\$7,583	\$6,524



# Developed general cost estimates for property or interests in property

Estimated Range of Acquisition <b>Costs for Easements</b> on a Per Parcel or Per Acre Basis		
Easement	Upper Estimate	Lower Estimate
<b>Limited scope easement includes restrictions on the use of groundwater underlying a property or the surface water running through the property.</b>		
	<b>Farm Parcels: Estimated Acquisition Cost Per Acre</b>	
<b><u>Limited Scope Restrictions</u></b>		
Upper Estimate	\$17,330	\$872
Lower Estimate	\$4,001	\$472
<b><u>Expanded Scope Restrictions</u></b>		
Upper Estimate	\$38,325	\$2,789
Lower Estimate	\$16,529	\$2,589





# Developed general cost estimates for property or interests in property

Estimated Range of Acquisition <b>Costs for Easements</b>		
	<p><b>Expanded scope easement includes restrictions on the use of groundwater underlying a property or the surface water running through the property <i>and</i>, potentially, a prohibition on the construction of subsurface structures (i.e., swimming pools, septic systems, ponds and the like).</b></p>	
<u>Limited</u>		
<u>Expanded Scope Restrictions</u>		
Upper Estimate	\$38,325	\$2,789
Lower Estimate	\$16,529	\$2,589



# Summarized assumptions for potential remedial actions that could address contaminated groundwater and sources





- P&T
  - Continuation of existing pump and treat action
- C-400
  - Source building
- URD
  - Source and
- URD-PTZ
  - Source reduction for all sources, treatment of Southwest Plume, and plume containment

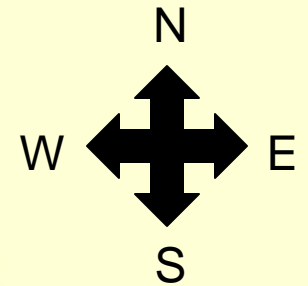
**These four scenarios are examples used to examine plume migration and develop example cost estimates for property acquisition options.**



# TCE Plume - 2004

## Legend

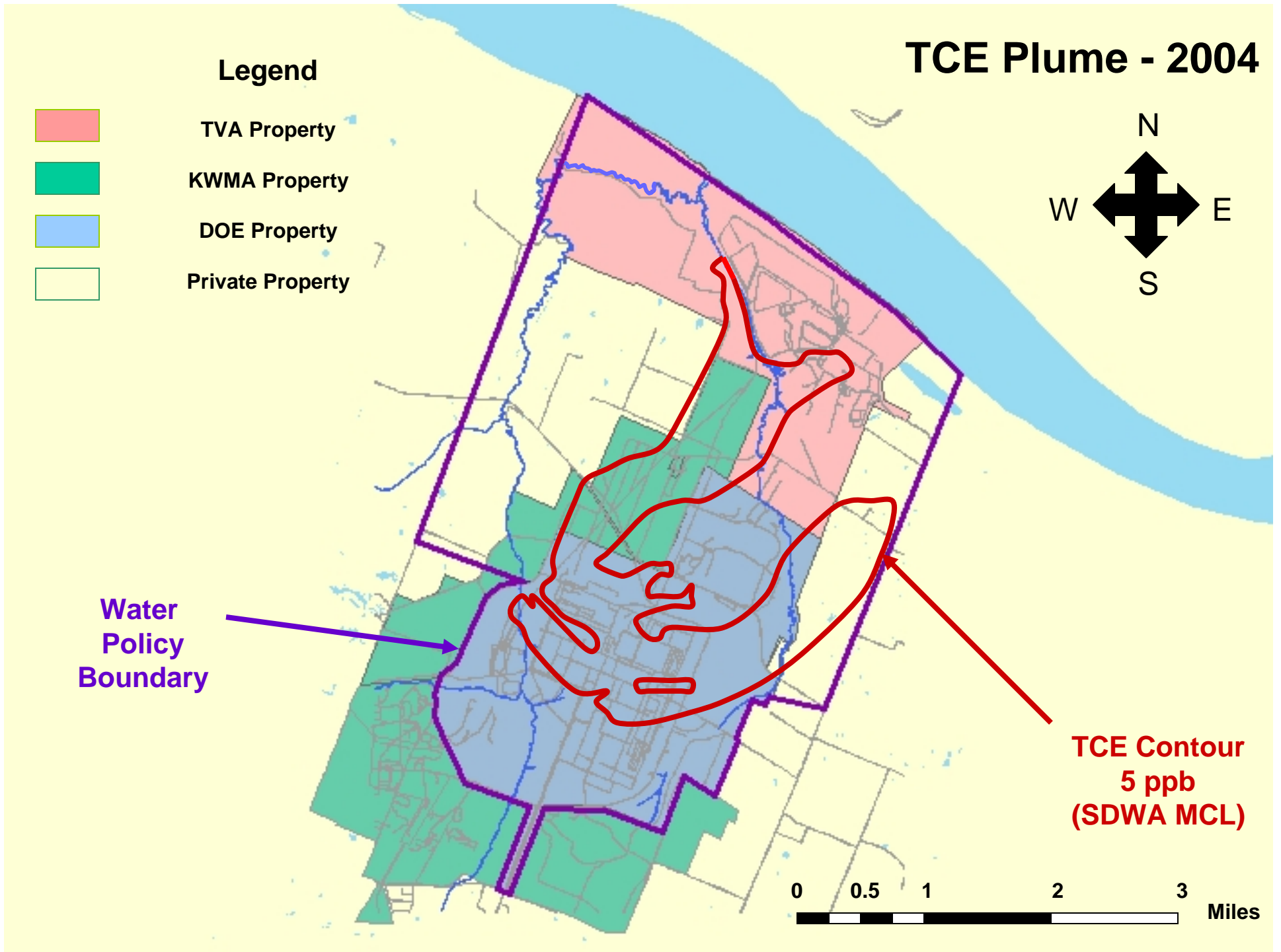
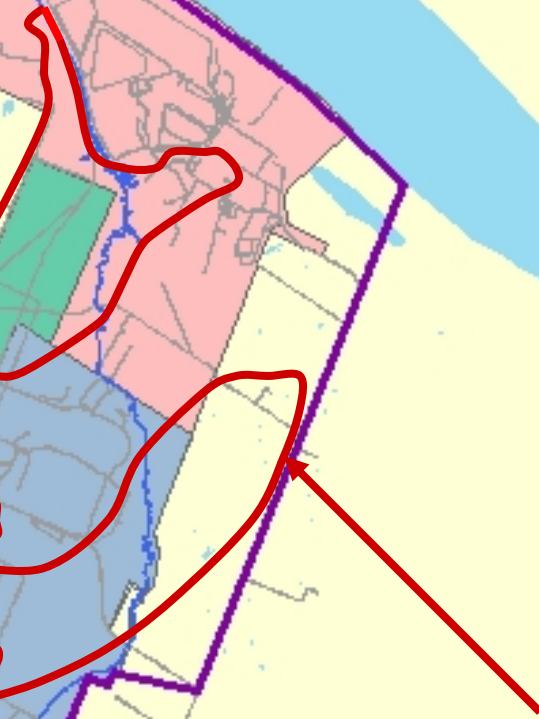
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**Water  
Policy  
Boundary**

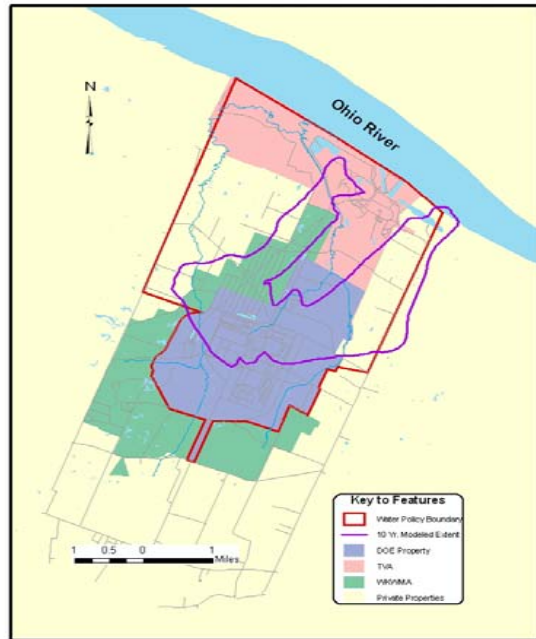


**TCE Contour  
5 ppb  
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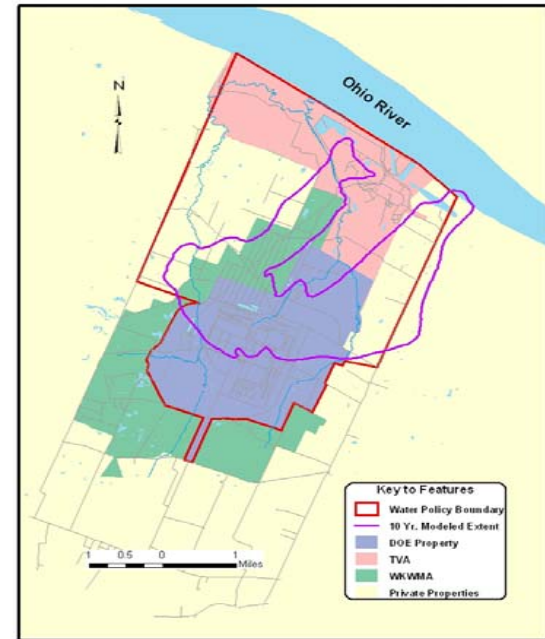


# 10 yr

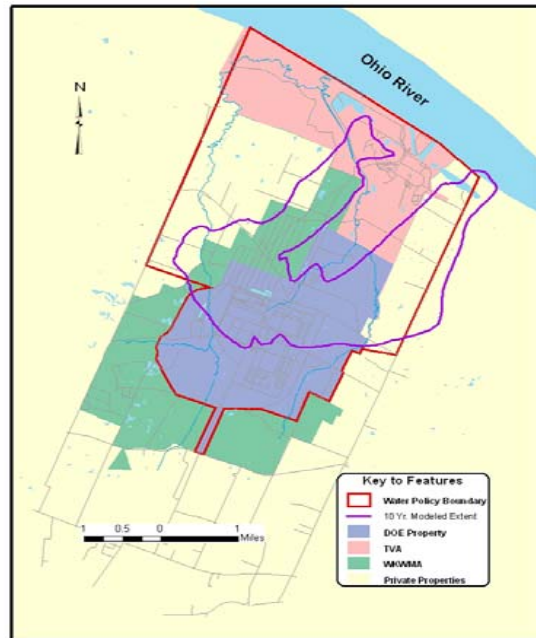
P&T



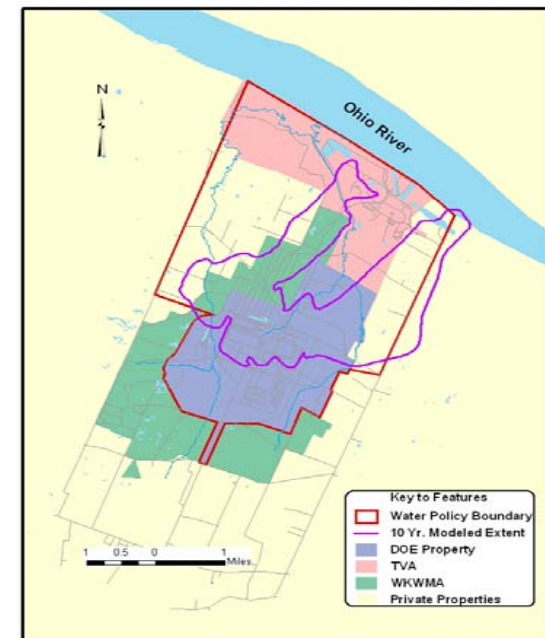
Source  
Reduction  
(URD)



C-400

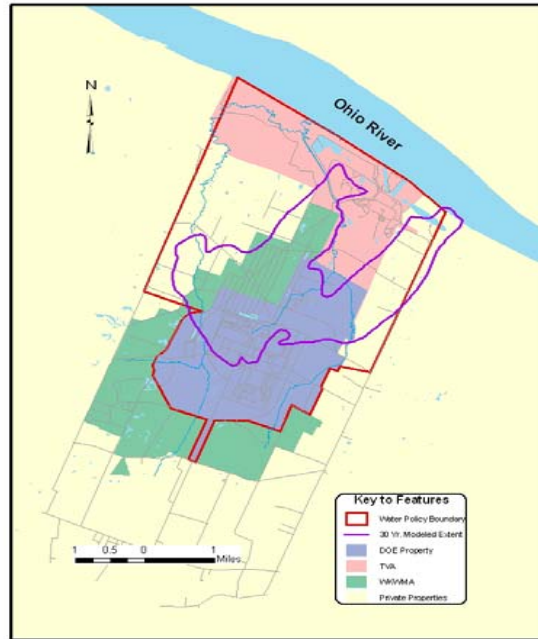


Source  
Reduction  
and  
Fenceline  
(URD-PTZ)

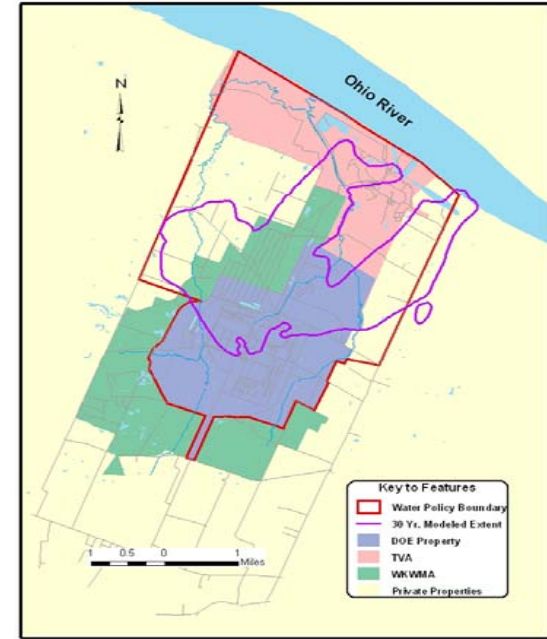


# 30 yr

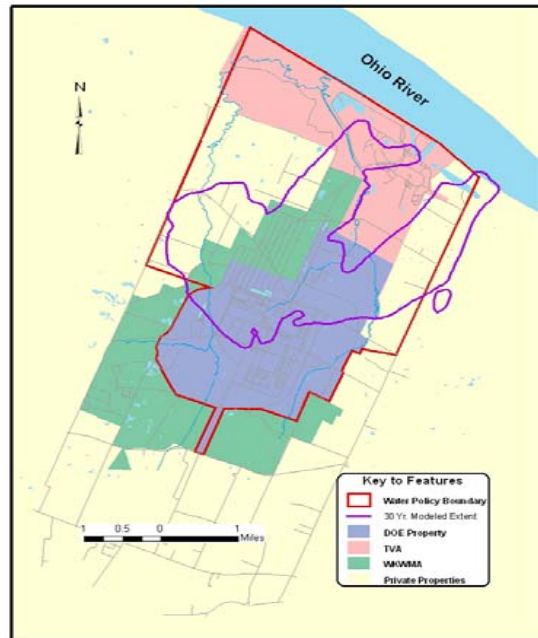
## P&T



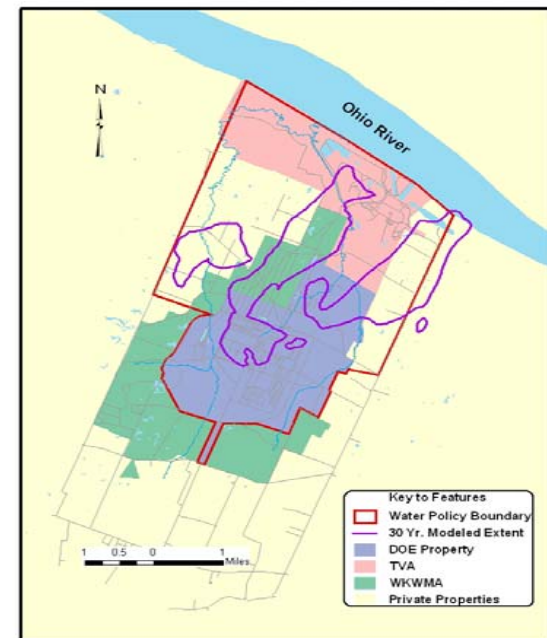
## Source Reduction (URD)



## C-400



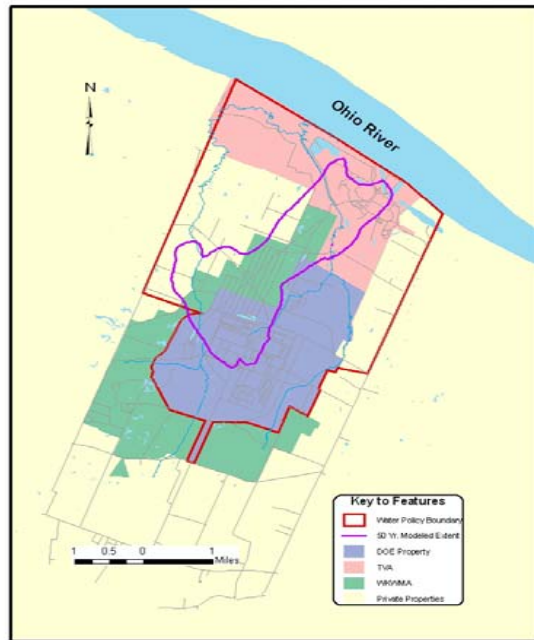
## Source Reduction and Fenceline (URD-PTZ)



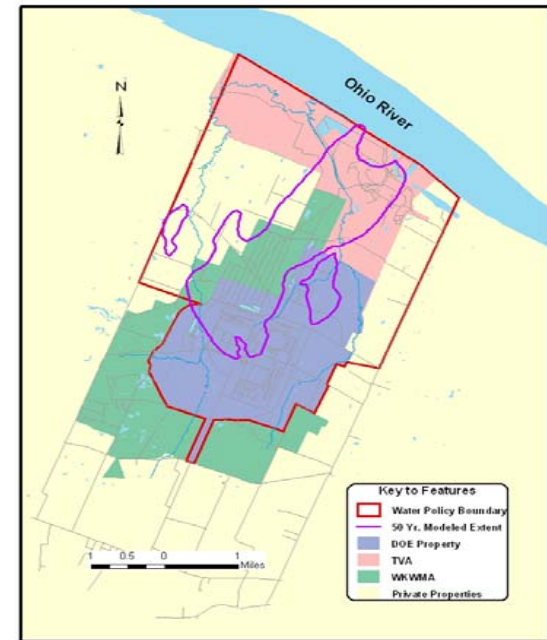


# 50 yr

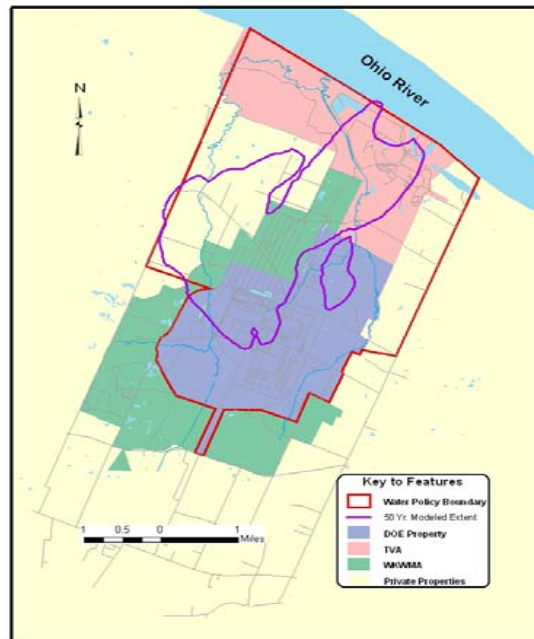
## P&T



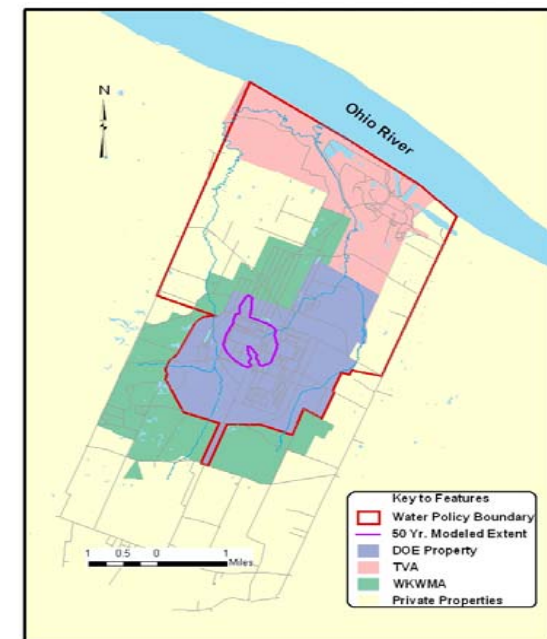
## Source Reduction (URD)



## C-400

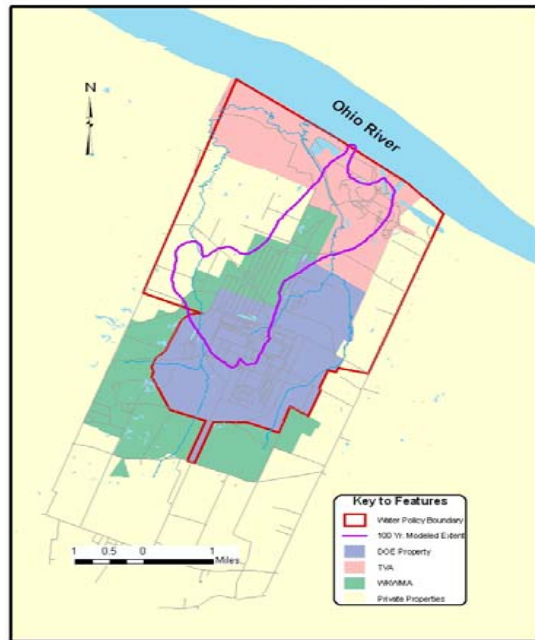


## Source Reduction and Fenceline (URD-PTZ)

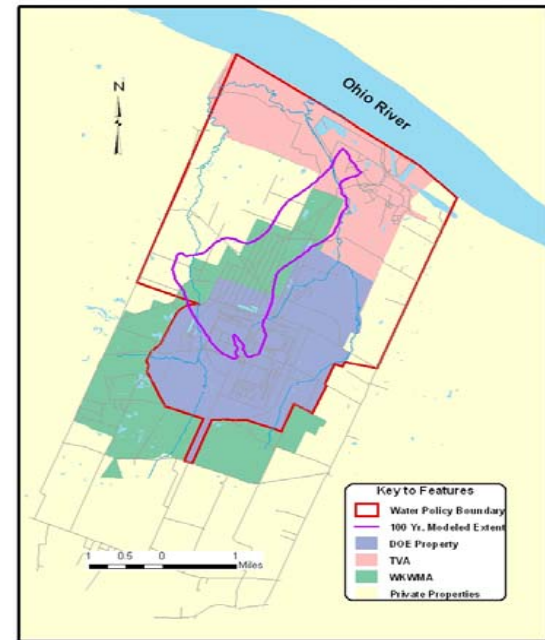


# 100 yr

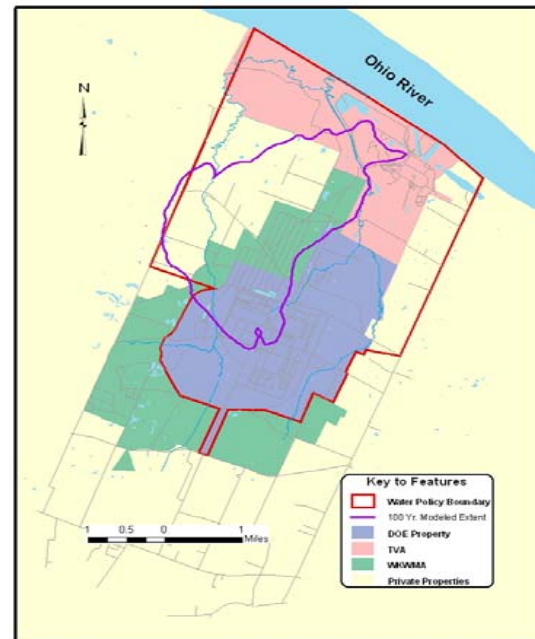
P&T



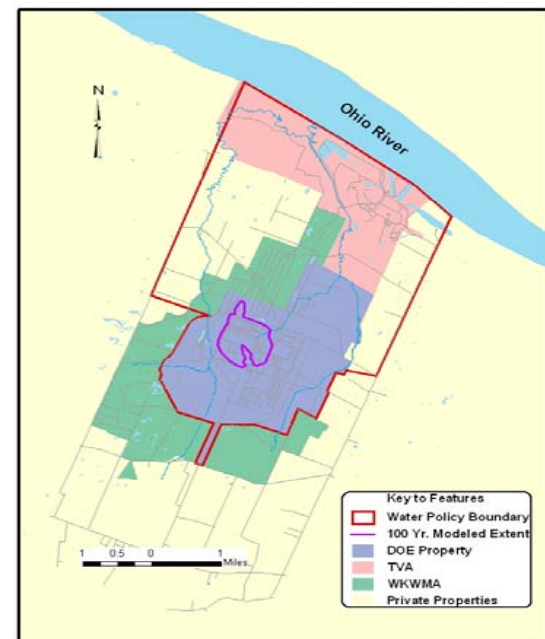
Source  
Reduction  
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C-400



Source  
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# Modeled where contaminated groundwater might migrate and identified potentially impacted properties

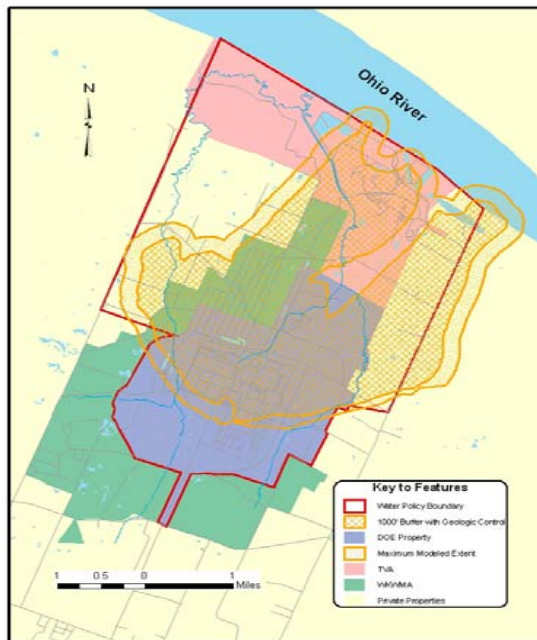
<b>Total Number of Impacted Properties for Each Potential Response Action</b>				
<b>Year</b>	<b>P&amp;T</b>	<b>C-400</b>	<b>URD</b>	<b>URD-PTZ</b>
<b>2007</b>	74	74	74	74
<b>2012</b>	82	89	89	89
<b>2017</b>	88	97	97	96
<b>2022</b>	85	98	98	96
<b>2037</b>	66	82	79	75
<b>2057</b>	12	26	15	0
<b>2107</b>	12	30	10	0



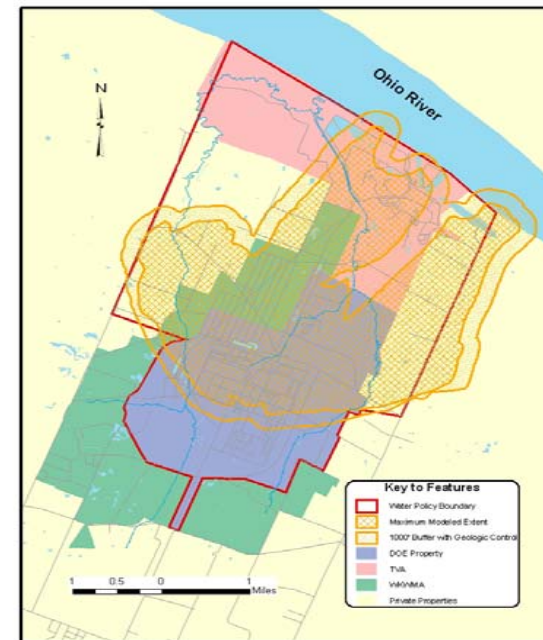


# Maximum Extent

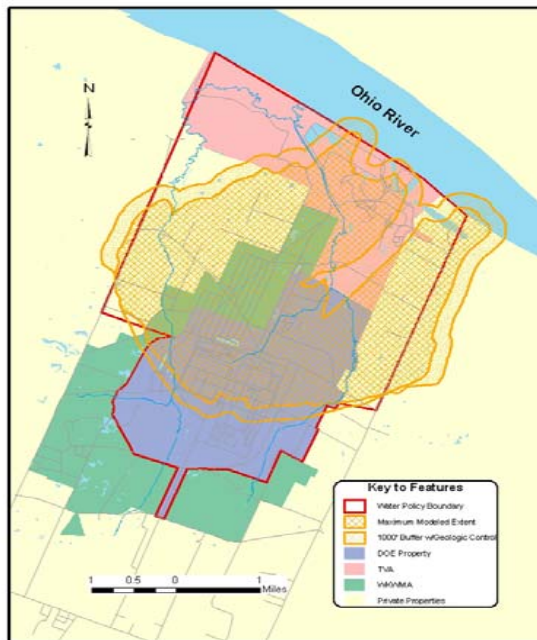
P&T



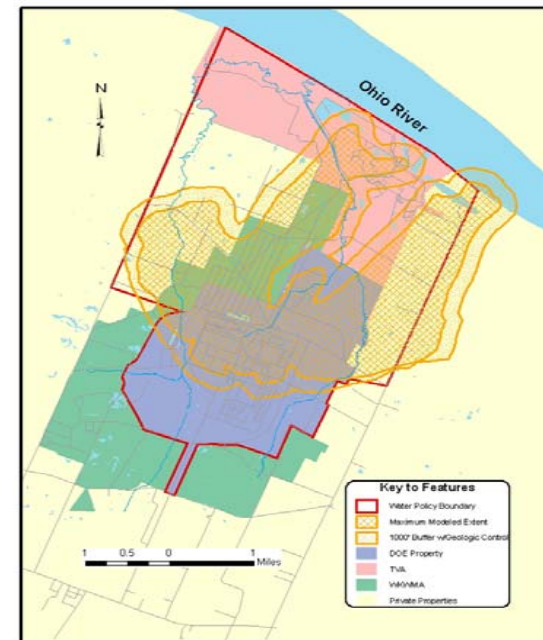
Source Reduction (URD)



C-400



Source Reduction and Fenceline (URD-PTZ)



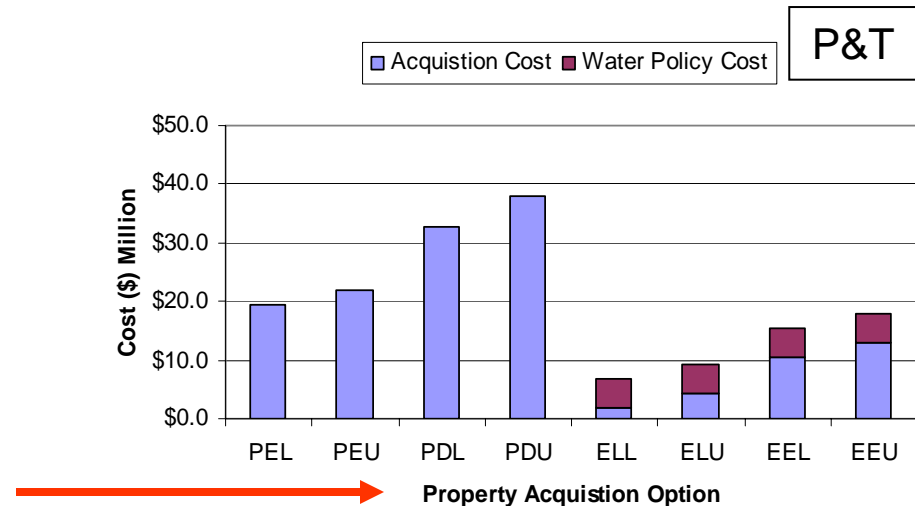
# Modeled where contaminated groundwater might migrate and identified potentially impacted properties

<b>Maximum Potential Property Impact for Each Potential Response Action (over 100-years modeled)</b>			
<b>Scenario</b>	<b>ID</b>	<b>Agricultural Parcels (acres)</b>	<b>Residential Parcels (number)</b>
<b>1</b>	<b>P&amp;T</b>	3531	80
<b>2</b>	<b>C-400</b>	4370	85
<b>3</b>	<b>URD</b>	4102	85
<b>4</b>	<b>URD-PTZ</b>	4049	84

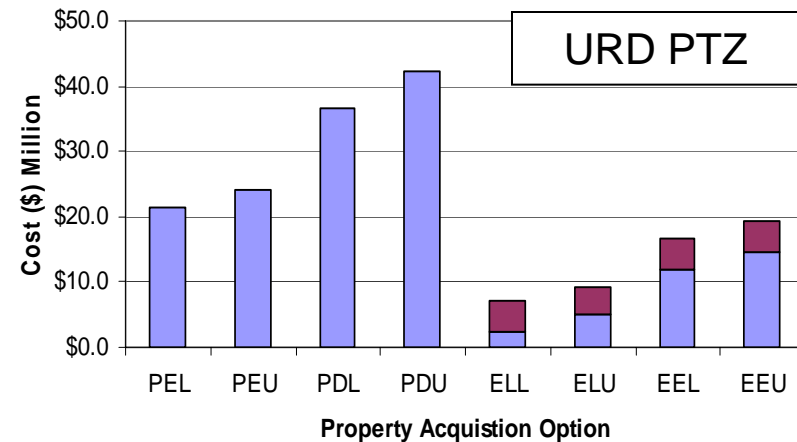
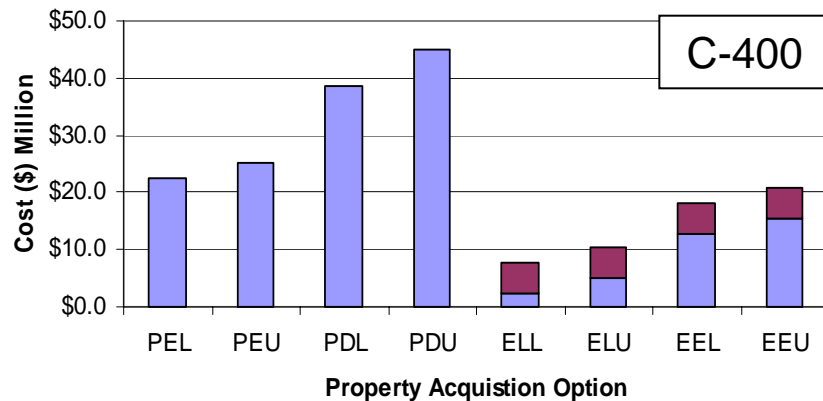
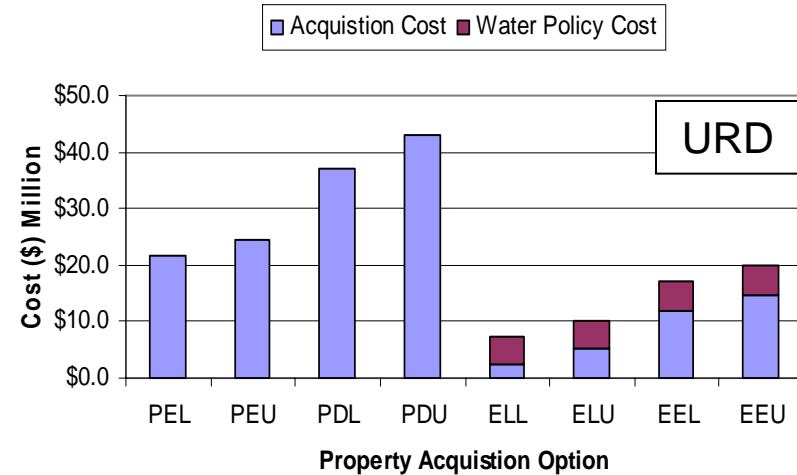
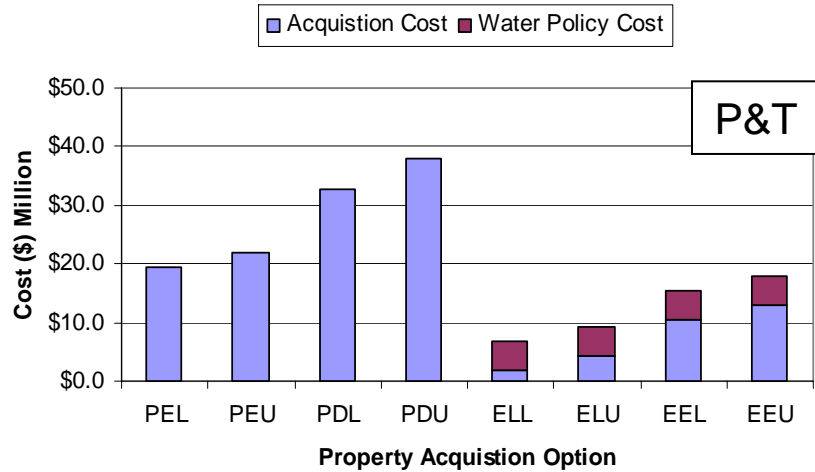


# Completed an economic analysis (8 property acquisition cost options)

Key	Acquisition Option	Basis	Cost Range
PEL	Purchase	Existing	Lower
PEU	Purchase	Existing	Higher
PDL	Purchase	Development	Lower
PDU	Purchase	Development	Higher
ELL	Easement	Limited	Lower
ELU	Easement	Limited	Higher
EEL	Easement	Expanded	Lower
EEU	Easement	Expanded	Higher



# Completed an economic analysis (4 remediation options)



# General Observations

- The property purchase is significantly more expensive than the combined cost of the Water Policy with a restrictive easement.
- When compared between example actions, the costs for property acquisition (purchase or easement) are essentially equal.
  - This suggests mitigating potential exposure by property acquisition is independent of the effectiveness of the response action modeled.



# Acknowledgements

- Project Team

- Kentucky Research Consortium for Energy and Environment
- Kentucky Water Resources Research Institute
- University of Kentucky College of Engineering
- University of Kentucky College of Agriculture
- University of Kentucky College of Law
- Partnership for Agricultural Economic Analysis
- Surface Mining Institute, LLC
- John Volpe, LCC

