



U.S. DEPARTMENT OF
ENERGY

OFFICE OF
**ENVIRONMENTAL
MANAGEMENT**

OAK RIDGE RESERVATION GROUNDWATER STRATEGY STATUS

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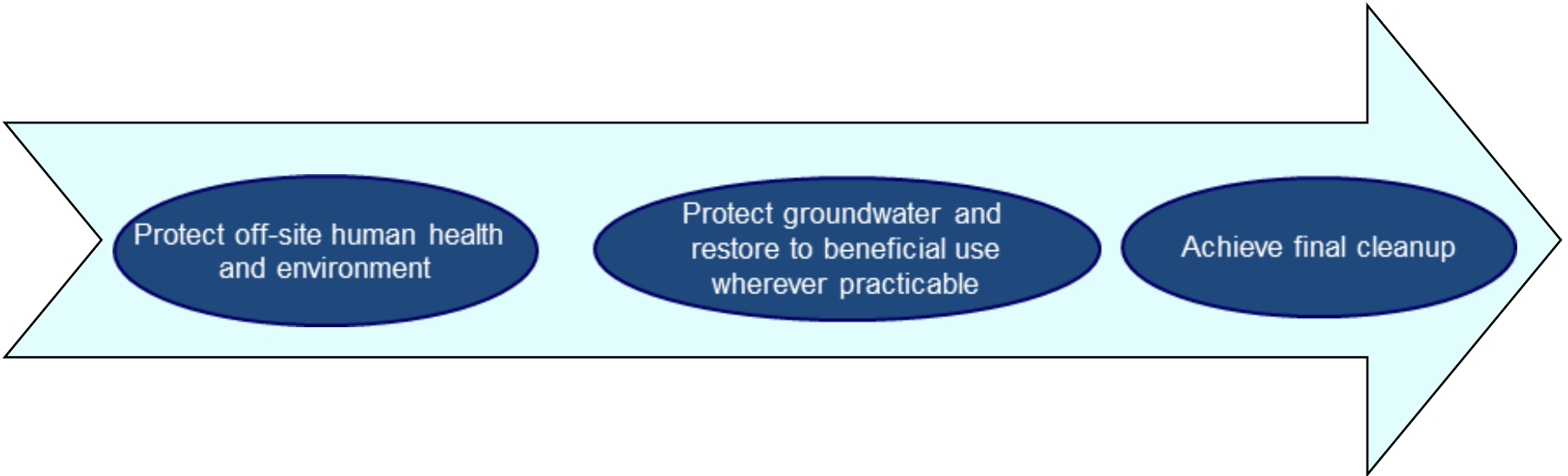
June 10, 2015

AGENDA:

- **Groundwater Strategy overview**
- **Groundwater Strategy implementation status**
 - Groundwater Program
 - Off-site Groundwater Assessment
 - ORR Regional flow model
- **Next priorities**
- **Long-term implementation**



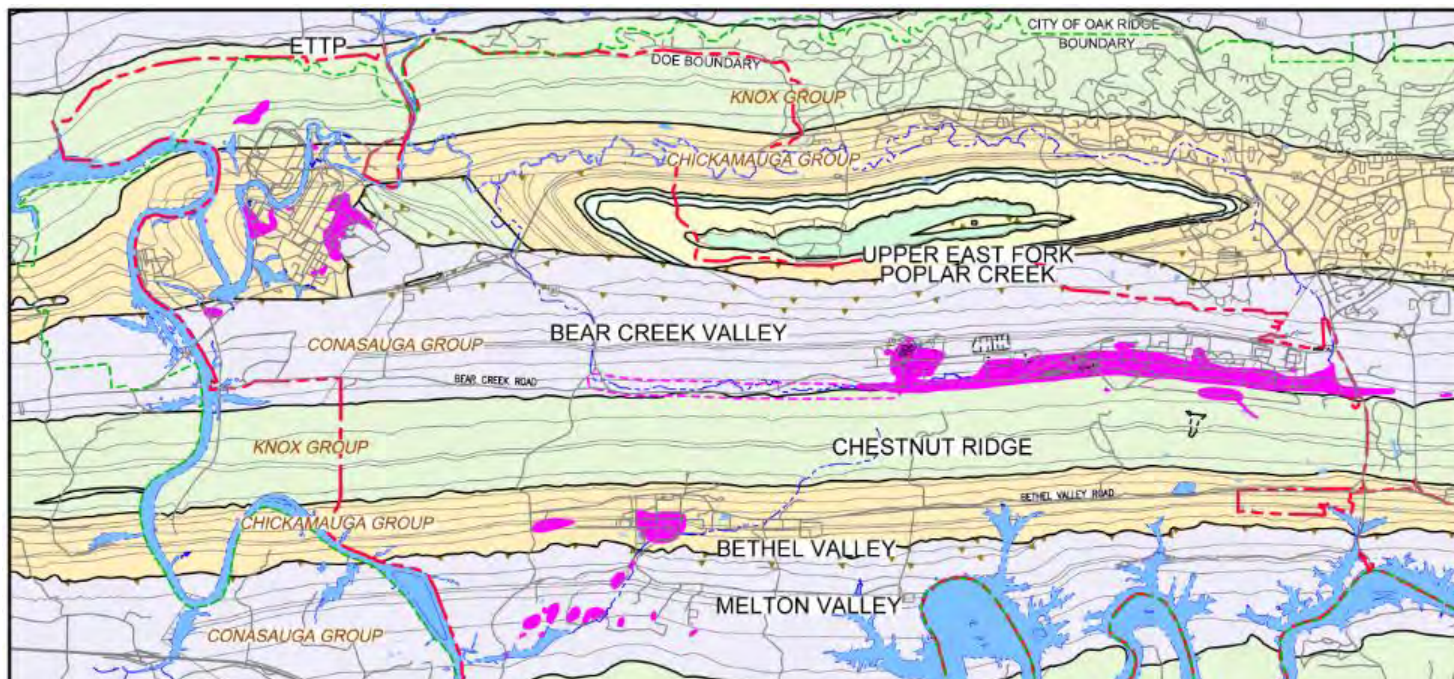
- **Groundwater Strategy**
 - workshops held with regulators in 2013 identified and ranked plumes and projects
 - DOE/EPA/TDEC agreement on Groundwater Strategy document in 2014
- **Purpose:** Document a path forward for managing legacy groundwater challenges
- **Objectives:** Support decision-making and identify actions to:



Protect off-site human health and environment

Protect groundwater and restore to beneficial use wherever practicable

Achieve final cleanup



35 “plumes” defined

- major constituents of potential concern: tritium, strontium-90, technetium-99, uranium, nitrate, VOCs, and mercury
- shallow (<100 ft), intermediate, and deep (>400 ft) contamination
- data gaps and uncertainties



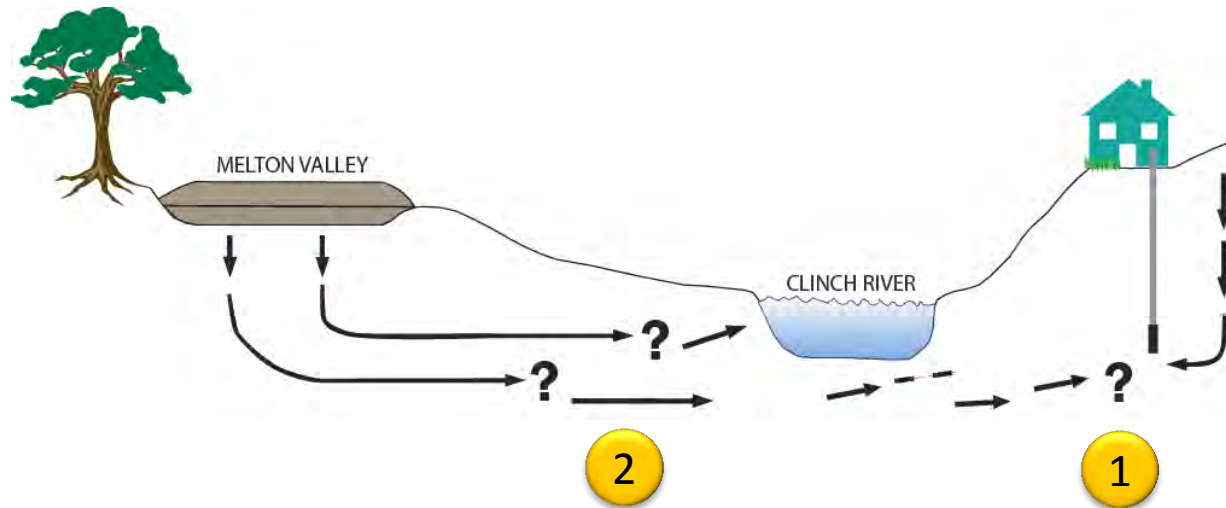
36 candidate projects

- projects address one or more plumes
- investigations
- early actions
- other projects to be identified based on findings

- **Set up a Groundwater Program to implement the strategy**
 - systematically prioritize and investigate plumes and data gaps
 - identify actions that may be warranted
 - support CERCLA decisions
- **Perform Off-site Groundwater Assessment**
 - *first priority project to address potential off-site risk*
- **Develop and maintain an ORR regional flow model**
 - help predict flowpaths
 - optimize investigations and preparedness for remediation and decisionmaking
 - provide framework for site-specific models

First groundwater strategy priority is:


- potential off-site migration
- protection of off-site human health and environment
- **top-ranked plume:** *Melton Valley exit pathway from undetermined sources*




1 top-ranked project: *Off-site Groundwater Assessment (2014)*

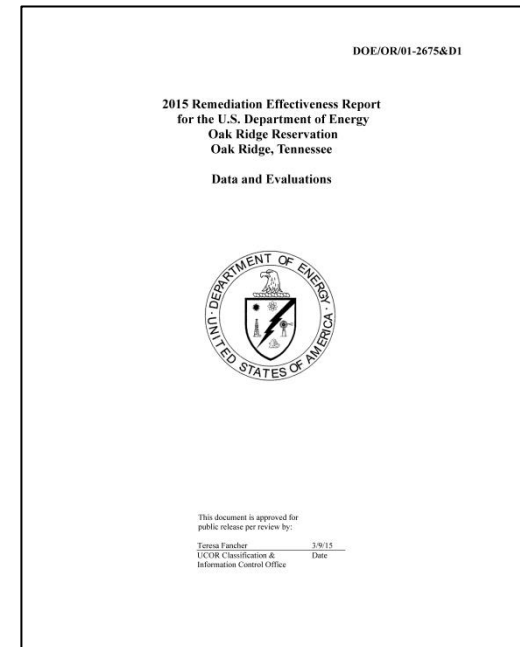
2 next projects: increase understanding of contaminant movement

GROUNDWATER STRATEGY Implementation Status

	FISCAL YEAR																							
	13				14				15				16				17				18			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
GROUNDWATER STRATEGY																								
Charter																								
Workshops																								
Groundwater Strategy (D1 and D2)																								
STRATEGY RECOMMENDATIONS																								
Groundwater Program																								
Base program	Ongoing Strategy Implementation 																							
Off-site Groundwater Assessment																								
Gather data/DQO																								
D1 RSE Work Plan																								
Sampling and analysis																								
RSE Report (D1 and D2)																								
ORR Regional Flow Model																								
Gather data/establish TAG																								
Test Case Model (Y-12 area)																								
Draft Regional Model																								
Maintain Regional Model																								
FUTURE PROJECTS (TBD)																								
RI Work Plan																								
Construct site-specific models																								
Other																								

 ORR Groundwater Milestone

- **Groundwater Program was initiated in 2014**
 - part of the existing Water Resources Restoration Program (WRRP)
 - full-time senior hydrogeologist, technical support
 - limited well development and sampling
 - groundwater modeling
- **Summary of progress in annual Remediation Effectiveness Report**

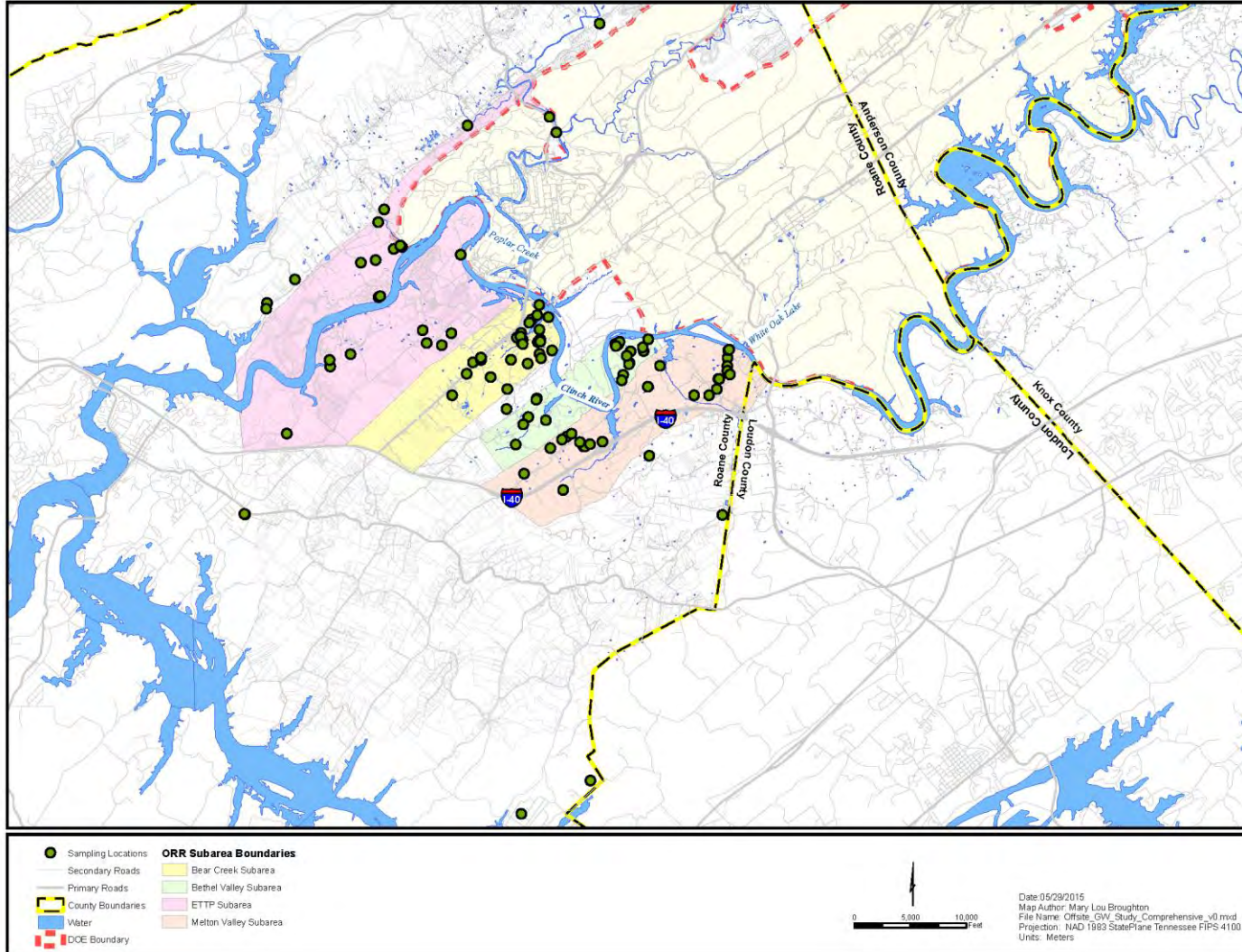


- **Remedial Site Evaluation (RSE) Work Plan approved in 2014**
 - tri-party effort followed DQO process
 - TDEC co-sampling at select locations

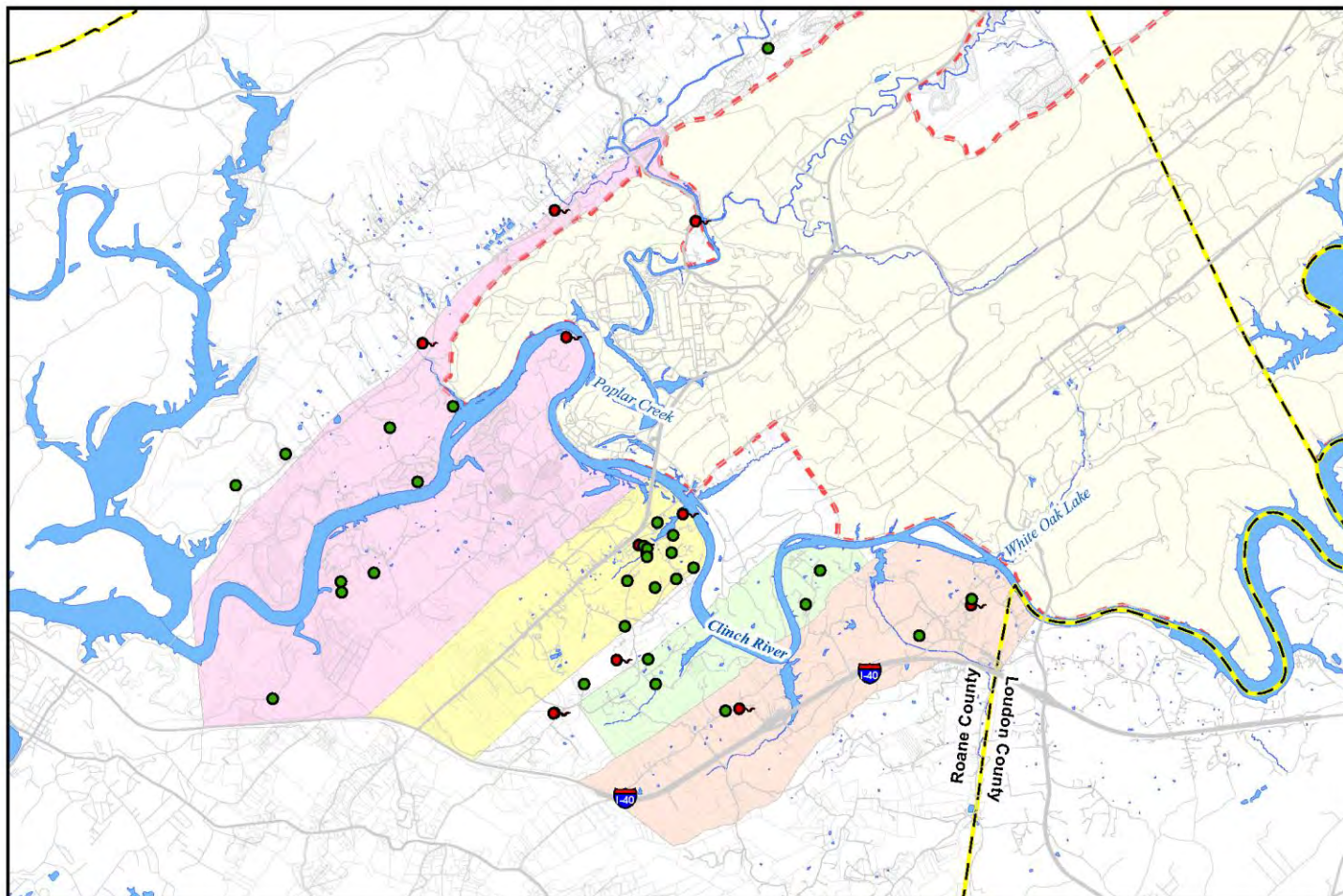


- conducted site visits and obtained access agreements
- *first sampling event in FY 2015 Q2 was successfully completed*
- second sampling event in FY 2015 Q4
- confirmatory sampling as needed in FY 2016
- RSE report of results in November 2016

Off-site Groundwater Assessment Potential sampling locations



Properties
evaluated as
possible sampling
locations



Locations:	
Well	32
Spring	11
Total	43

Offsite Groundwater Study Well/Spring Locations

● Sampling Locations
 County Boundaries
● Springs
 Bear Creek Subarea
 Water
 Secondary Roads
 Bethel Valley Subarea
 DOE Boundary
 Primary Roads
 ETPF Subarea
 Melton Valley Subarea

Date: 04/15/2016
 Map Author: Mary Lou Broughton
 File Name: Offsite_GW_Study_WellsSpring_Loc_v1.mxd
 Projection: NAD 1983 StatePlane Tennessee FIPS 4100
 Units: Meters

- **Initial screening of results from the first sampling event shows exceedances of U.S. EPA National Primary Drinking Water Standards at 3 of 43 locations sampled**
- **Exceedances are for lead (at one location); lead and gross alpha activity (at another location); and combined radium-226 and radium-228 activity (at another location)**
- **Review of the results is ongoing and includes evaluation of probable naturally-occurring causes:**
 - elevated turbidity and suspended solids
 - naturally-occurring radon

Communication matrix outlines how information is to be exchanged, used for decision-making, and communicated

- flowchart developed jointly by DOE and State of Tennessee (Tennessee Department of Environment and Conservation [TDEC] and Tennessee Department of Health [TDH])
- data collection, data interpretation, and decision-making phases
 - sample results compared to human health and ecological screening levels
 - data sharing and information exchange among DOE, TDEC, and TDH
 - DOE to send letters summarizing results to property owners
 - TDH to communicate with property owners for locations with exceedances of health based screening levels
 - July 2015 meeting to confirm evaluation results from the FY15 Q2 sampling event and determine if confirmatory sampling is needed

Multi-year effort began in FY 2014 to develop model for the ORR and surrounding area

- **Purpose:**

- tool to be used and refined to support future groundwater decisionmaking on the ORR
- describe likely regional groundwater flow boundary conditions and help predict regional flowpaths
- support future development of more detailed models in specific areas (e.g., remedial action sites, deep flow)
- support “what if” scenario evaluations to better understand groundwater flow
- help identify data gaps and guide well placement

- **A Technical Advisory Group (TAG) formed in 2014:**
 - DOE, EPA, and TDEC representatives and industry experts
 - TAG member from the USGS serves as an interface between the TAG and the ORSSAB
- Model areal extent has been tentatively identified
- EarthVision[®] software was selected for development of geologic model
- USGS code MODFLOW-USG was selected for development of numeric flow model pending Test Case results
 - software is being tested using a Test Case Model (Y-12 area)

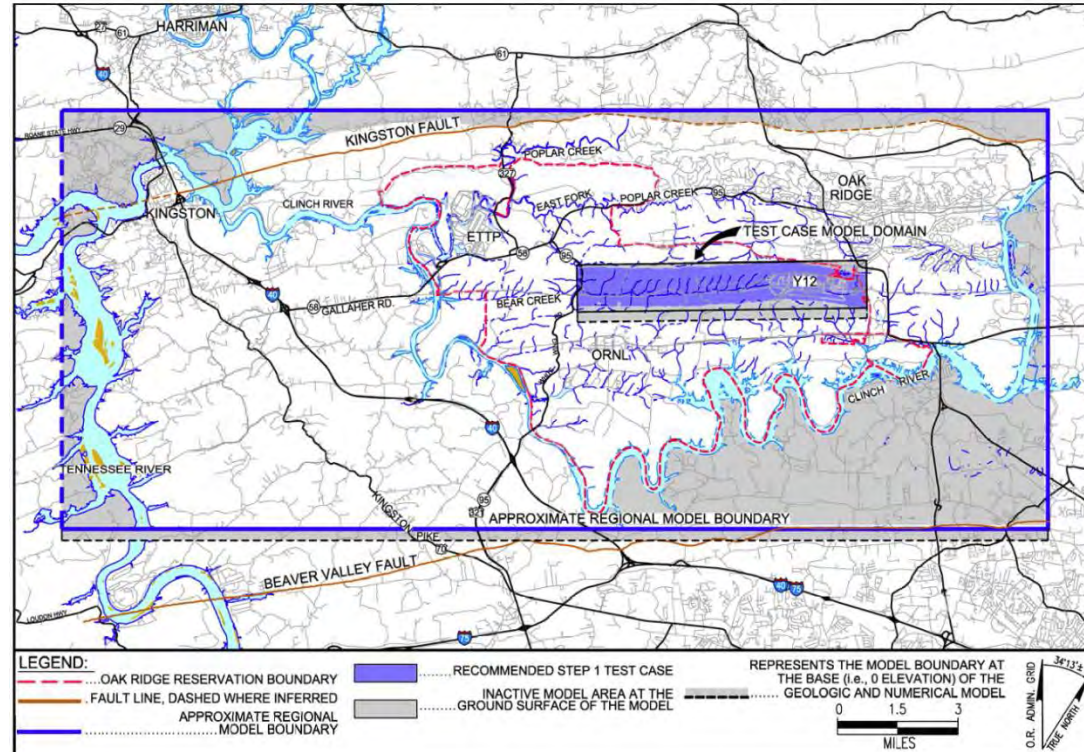
Areal extent of models

Regional model

- area is ~ 25 x 10 miles, or ~250 square miles
- depth is to sea level (~1000 ft)

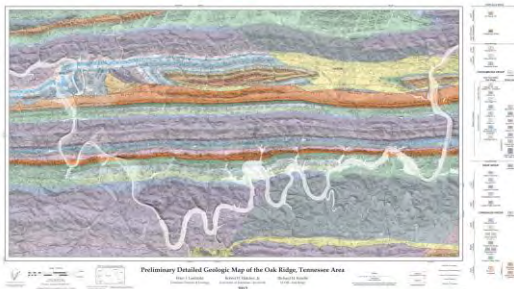
Test Case model (blue shaded area)

- Y-12 area was selected due to the large amount of available data and presence of representative geologic formations
- geologic model area is ~42 square miles
- flow model area is ~ 8 square miles
- depth is to sea level (~1000 ft)



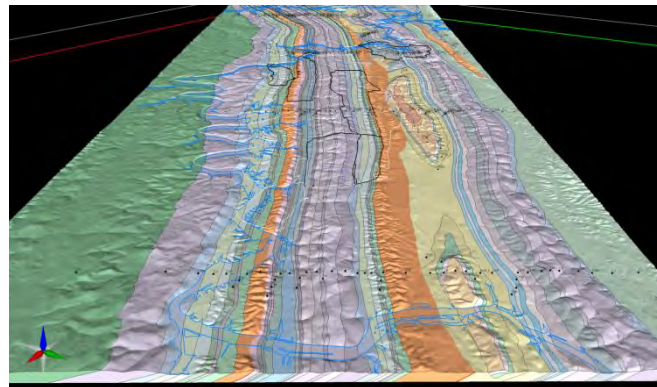
Collect data

- surface, subsurface, and hydrology data collected from multiple sources



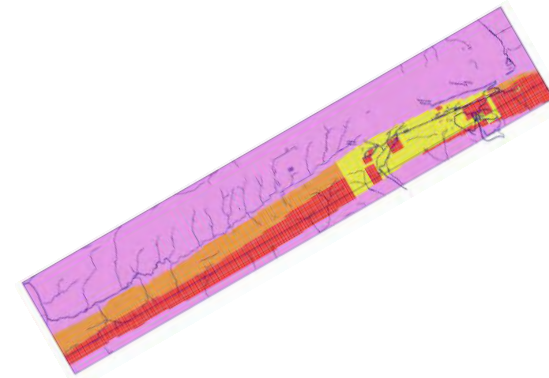
Develop geologic model (EarthVision®)

- 3-D representation of geology
- exists primarily to provide input to numeric flow model (MODFLOW-USG)
- attempts to honor the geologic configuration without being overly complex



Develop and use numeric flow model (MODFLOW-USG)

- USGS software MODFLOW-USG
- conduit flow capability
- calibrate model using available data
- use model to evaluate groundwater flow and identify data gaps

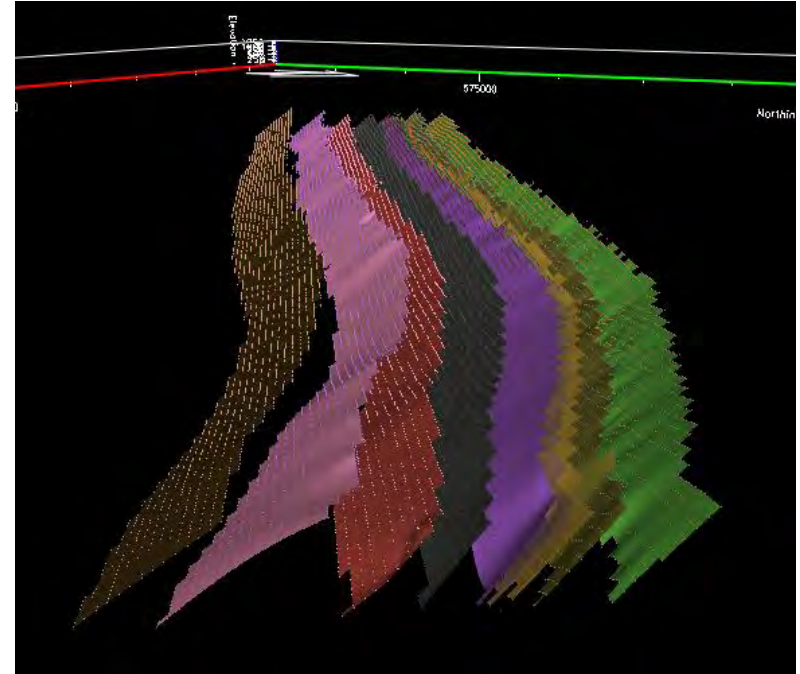


- **Test Case model**

- activities to evaluate workflow processes and software capabilities are nearing completion
- Test Case lessons learned are being captured for inclusion and application in the regional scale model

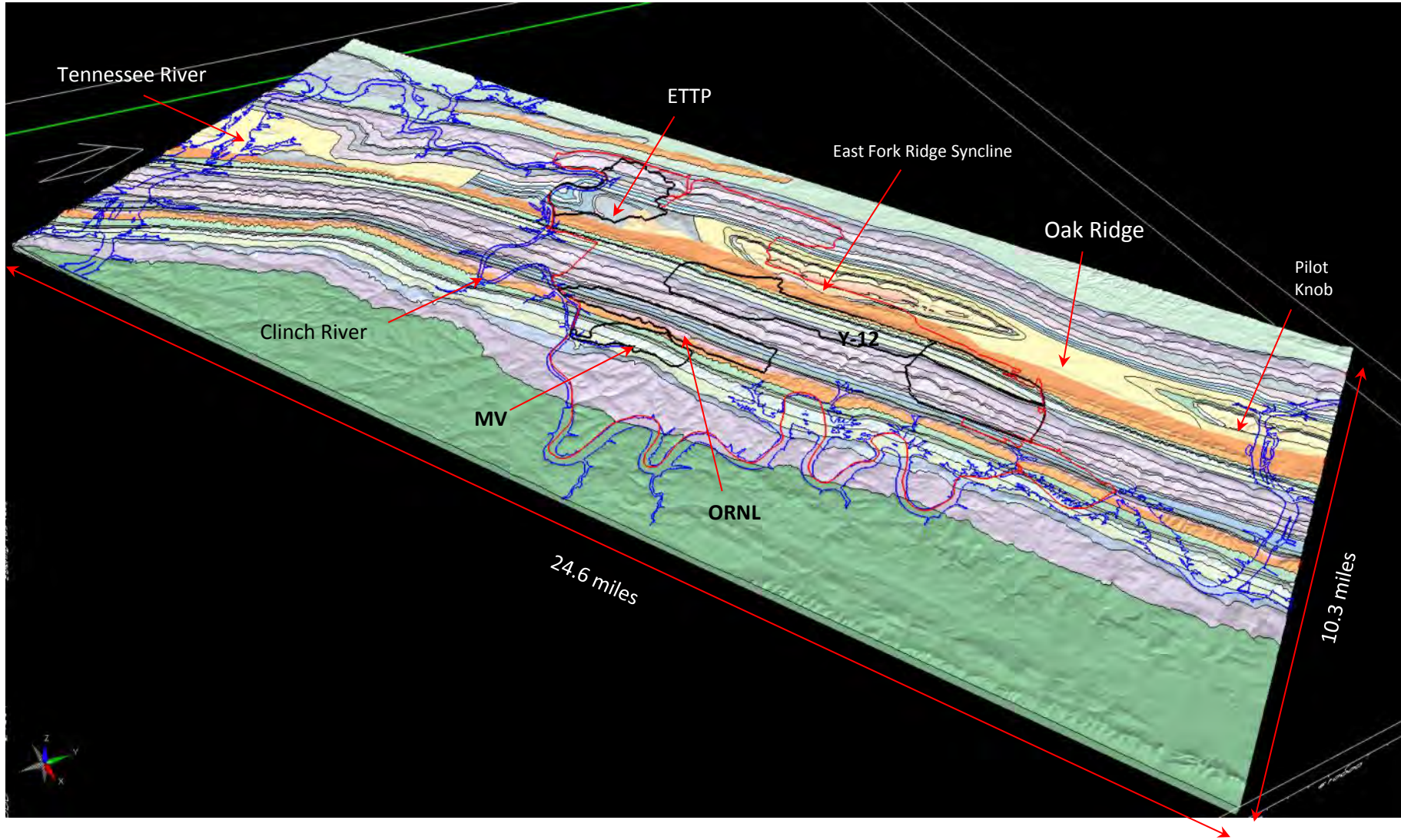
- **Regional model**

- construction has been completed in segments to create a unified, regional scale geologic model
- next steps:
 - export regional geologic model data (EarthVision®) to numeric flow model (MODFLOW-USG)
 - build out and calibrate the regional numeric flow model



Exporting from EarthVision® of Text Case model data of dipping geologic formation surfaces for use in MODFLOW-USG.

ORR Regional geologic model





- **FY 2018 milestone for Remedial Investigation Work Plan**
 - placeholder for next priority groundwater project, such as:
 - project to install/sample wells in Melton Valley or Bear Creek Valley area to increase understanding of contaminant plumes and reduce data gaps
 - selection will be guided by off-site results and plume ranking
- **Groundwater Program**
 - full-time hydrogeologist, technical support, etc., integrated with WRRP
 - continue work on regional model/site-specific models
- **Other candidate projects include:**
 - determine an approach for addressing Melton Valley hydrofracture issues (top-ranked project for interior plumes)
 - remediation projects
 - ETTP Sitewide Treatability Study
 - Bethel Valley 7000 area remediation

Prepare for and reach final groundwater decisions.

- Most final RODs are scheduled in the last 10 - 15 years of ORR cleanup
- Groundwater Strategy recommends an ongoing Groundwater Program with integrated monitoring and pre-Remedial Investigation efforts to help prepare for complex CERCLA decisions

	FISCAL YEAR																																						
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47						
ETTP																																							
ETTP Sitewide ROD																																							
Y-12																																							
Bear Creek Burial Ground ROD																																							
Bear Creek Valley Final ROD																																							
UEFPC Final ROD																																							
Chestnut Ridge ROD																																							
ORNL																																							
Melton Valley Final ROD																																							
Bethel Valley Final ROD																																							

 Groundwater Contamination Source Area ROD
 Final Groundwater Decision ROD