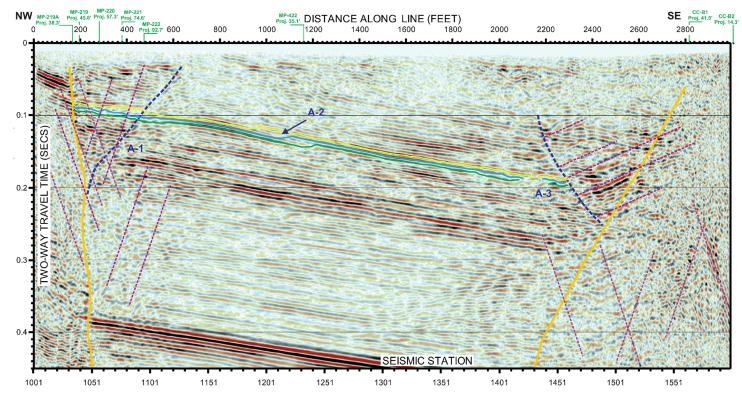


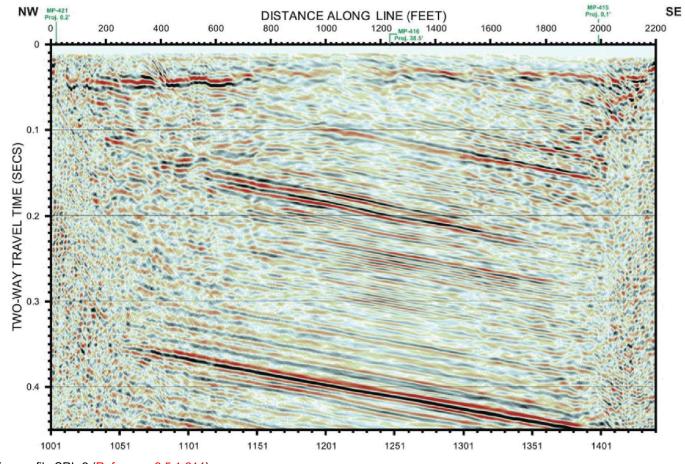
Notes: Seismic reflection profile SRL-1 (Reference 2.5.1-214).





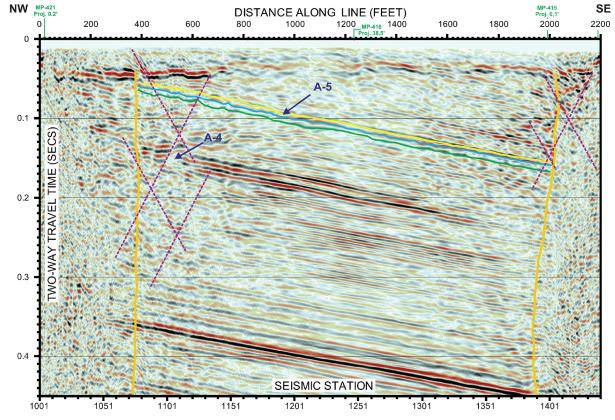
Notes: Seismic reflection profile SRL-1 (Reference 2.5.1-214).





Note: Seismic reflection profile SRL-2 (Reference 2.5.1-214).

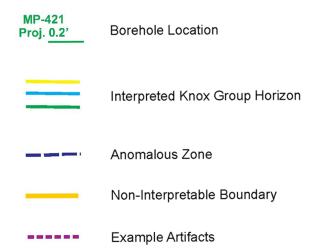
Figure 2.5.1-36. (Sheet 3 of 5) Seismic Reflection SRL-2—Without Interpretation



Note: Seismic reflection profile SRL-2 (Reference 2.5.1-214).



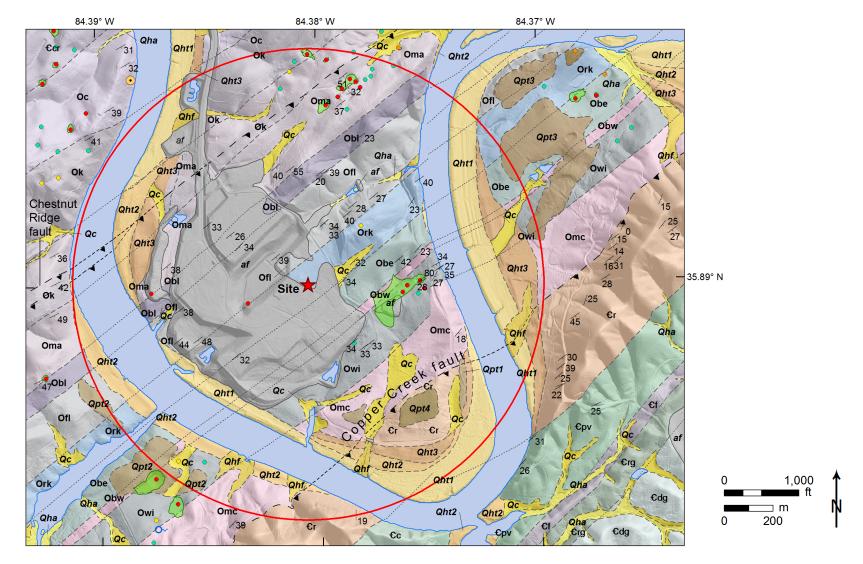
## **Explanation for Annotated Seismic Reflection Lines**



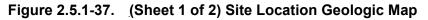
Notes:

Borehole locations are presented if projected less than 100 ft from the line unless noted. Explanation for seismic reflection lines (Reference 2.5.1-214)

## Figure 2.5.1-36. (Sheet 5 of 5) Explanation for Seismic Line Figures



Note: Simplified geologic map of the Clinch River Nuclear site area.



Quaternary Units	Ве	edrock Units
af Artificial Fill		Chickamauga Group
Qha Alluvium		Omc Moccasin Fm. siltstone with limestone interbeds
<mark>Qc</mark> Colluvium		Owi Witten Fm. limestone with shale interbeds
Qhf Alluvial Fan Qht Qht2 Holocene Clinc River Terraces	le cian	Obw Bowen Fm. siltstone with limestone interbeds
Image: Generation of the sector of the sec	y Middle Ordovician	Obe Benbolt Fm. limestone with siltstone interbeds
Qpt1Qpt2Pleistocene CliQpt3Qpt4River Terraces	nch	Ork Rockdell Fm. limestone with siltstone interbeds
Qpt5		Of Fleanor Shale mbr. of the Lincolnshire Fm. shale and siltstone with limestone
Geologic Structures		Obl Blackford Fm. (includes Eidsen mbr.) limestone and siltstone
•		Knox Group
Thrust Fault dashed where approximate, dotted where concealed	d	Oma Mascot Dolomite dolomite with chert, limestone and sandstone
Contact     dashed where approximate, dotted	e Lower Ordovician	Ok Kingsport Fm. dolomite with chert, limestone and sandstone
28 where concealed 28 Bedding Strike and Dip	Lov Ordov	Olv Longview Dolomite dolomite and chert
Karst Features		Oc Chepultepec Dolomite dolomite with chert, limestone and sandstone
• Cave	ian	Copper Ridge Dolomite dolomite with chert, limestone and sandstone
<ul> <li>Closed depression          <u>2</u> ft deep and 100 sq ft area</li> </ul>	Upper Cambrian	Conasauga Group
<ul> <li>Three-sided depression</li> </ul>	0	€c Conasauga Group - undivided
<ul> <li>Two-sided depression</li> </ul>		€dg Dismal Gap Fm. (Maryville Ls.)
<ul> <li>Shallow closed depression</li> <li>&lt; 2 ft deep</li> </ul>	Middle Cambrian	shale and limestone with dolomite and siltstone Crg Rogersville Shale
o∽ Spring	Mid	shale with mudstone and siltstone interbeds
Closed depression $\geq 2$ ft deep	0	Cf Friendship Fm. (Rutledge Ls.) limestone, dolomite, siltstone and shale
and 2000 sq ft area		€pv Pumpkin Valley Shale shale with mudstone and siltstone interbeds
Rome Formation		
	Lower Cambrian	Cr Rome Fm undivided sandstone, shale and siltstone with interbeds of dolomite

# Figure 2.5.1-37. (Sheet 2 of 2) Site Location Geologic Map

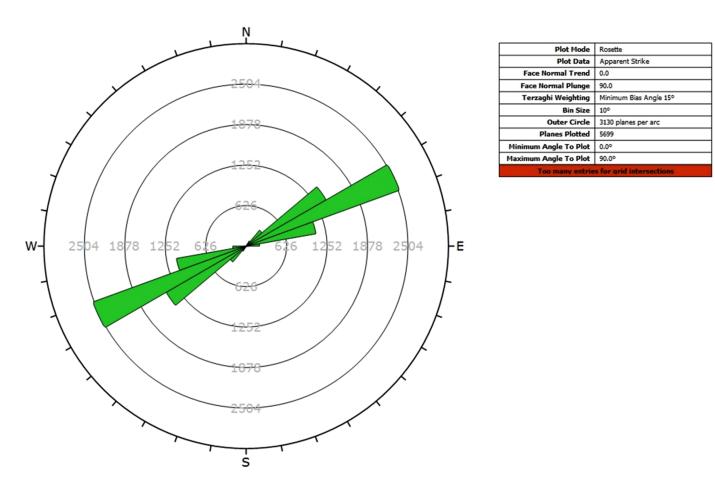


Figure 2.5.1-38. (Sheet 1 of 11) Acoustic Televiewer Data and Outcrop Mapping—Strike of Bedding

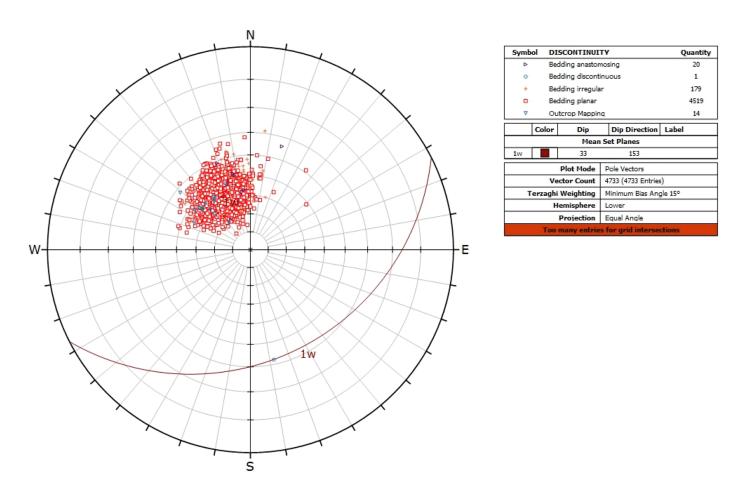
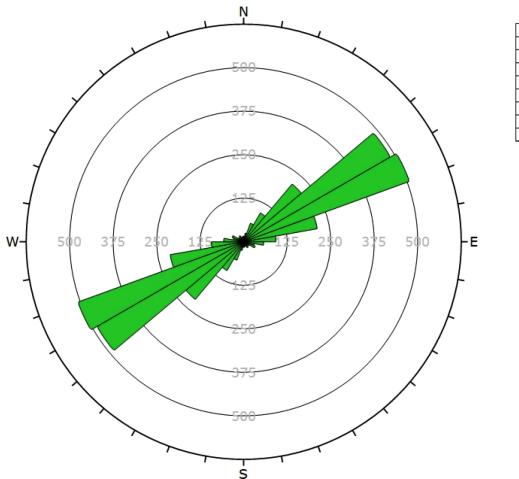


Figure 2.5.1-38. (Sheet 2 of 11) Acoustic Televiewer Data and Outcrop Mapping—Strike and Dip of Bedding Planes



Plot Mode	Rosette
Plot Data	Apparent Strike
Face Normal Trend	0.0
Face Normal Plunge	90.0
Bin Size	10°
Outer Circle	625 planes per arc
Planes Plotted	1916
Minimum Angle To Plot	0.0°
Maximum Angle To Plot	90.0°

Figure 2.5.1-38. (Sheet 3 of 11) Acoustic Televiewer Data and Outcrop Mapping—Strike of Fractures

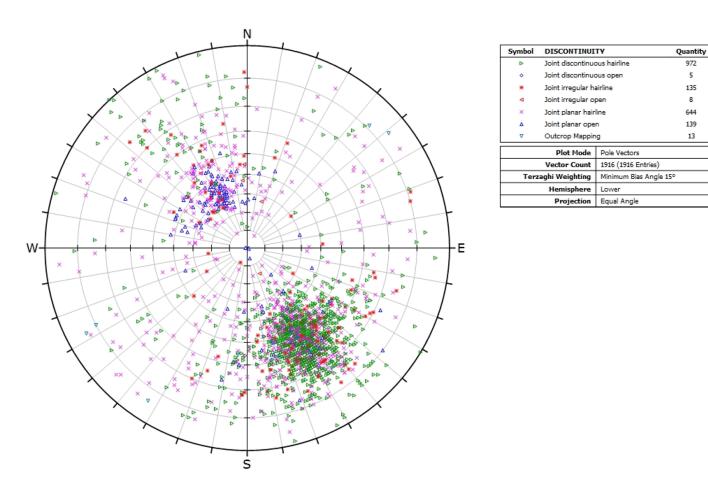


Figure 2.5.1-38. (Sheet 4 of 11) Acoustic Televiewer Data and Outcrop Mapping—Orientation of all Fractures

972

5

135 8

644 139

13

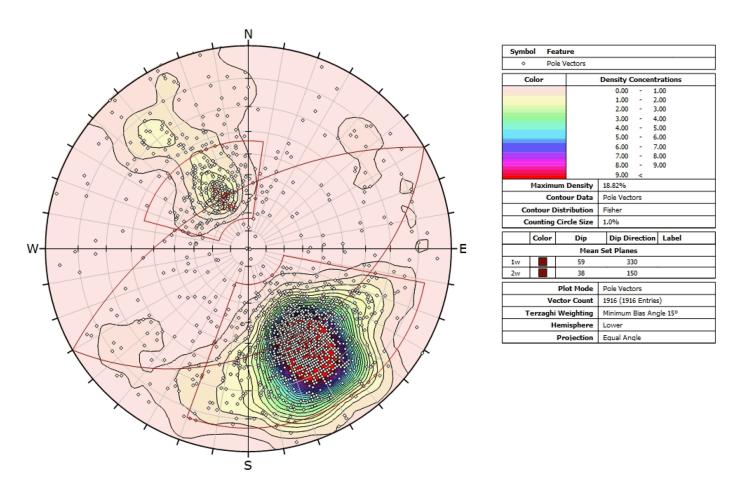


Figure 2.5.1-38. (Sheet 5 of 11) Acoustic Televiewer Data and Outcrop Mapping—Strike and Dip of Primary Fracture Sets

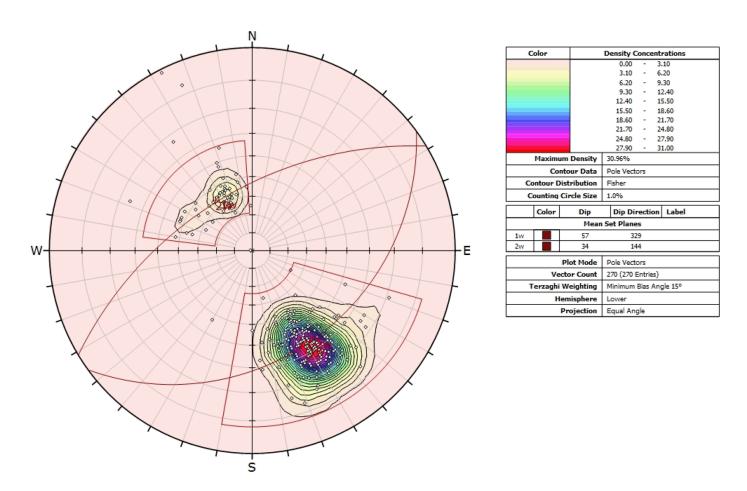


Figure 2.5.1-38. (Sheet 6 of 11) Acoustic Televiewer Data and Outcrop Mapping—Orientation of Fractures in the Benbolt Formation

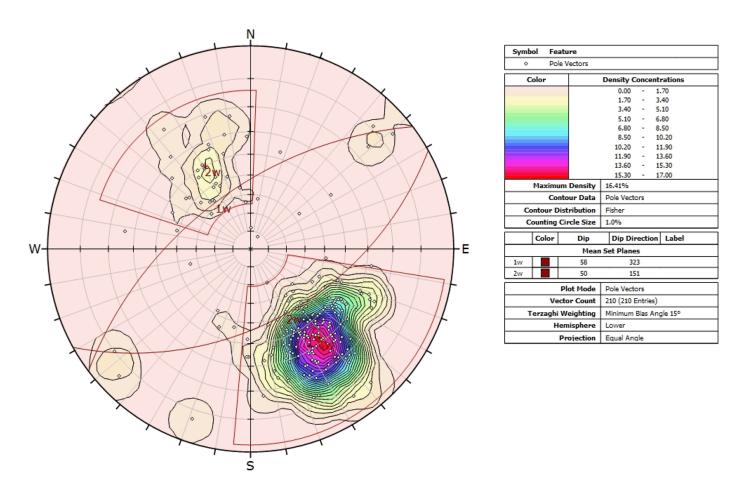


Figure 2.5.1-38. (Sheet 7 of 11) Acoustic Televiewer and Outcrop Mapping—Orientation of Fractures in the Blackford Formation

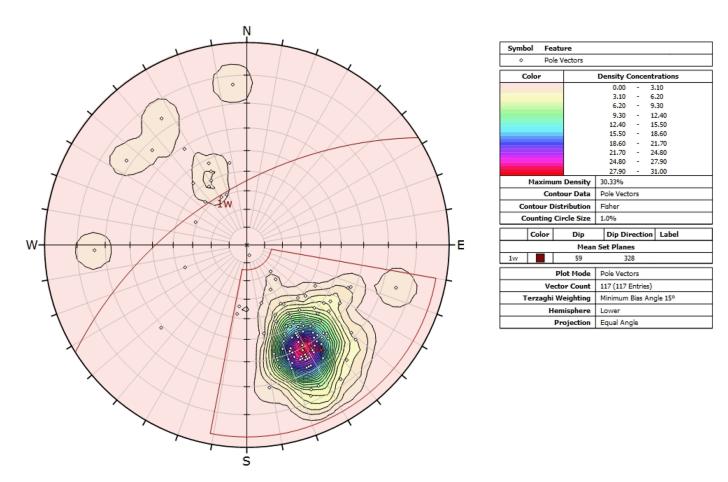


Figure 2.5.1-38. (Sheet 8 of 11) Acoustic Televiewer Data and Outcrop Mapping—Orientation of Fractures in the Eidson Formation

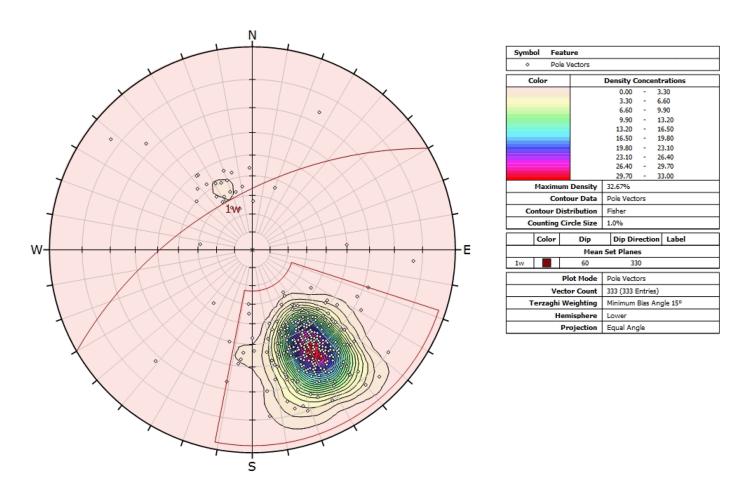


Figure 2.5.1-38. (Sheet 9 of 11) Acoustic Televiewer Data and Outcrop Mapping—Orientation of Fractures in the Fleanor Shale

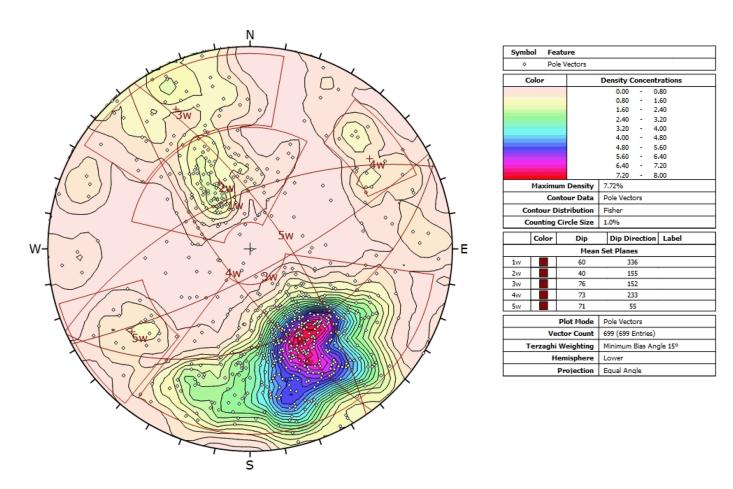


Figure 2.5.1-38. (Sheet 10 of 11) Acoustic Televiewer Data and Outcrop Mapping—Orientation of Fractures in the Newala Limestone

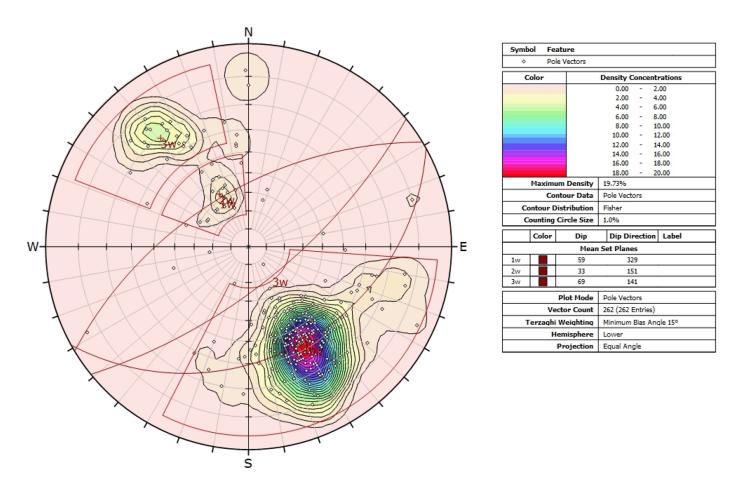


Figure 2.5.1-38. (Sheet 11 of 11) Acoustic Televiewer Data and Outcrop Mapping—Orientation of Fractures in the Rockdell Formation

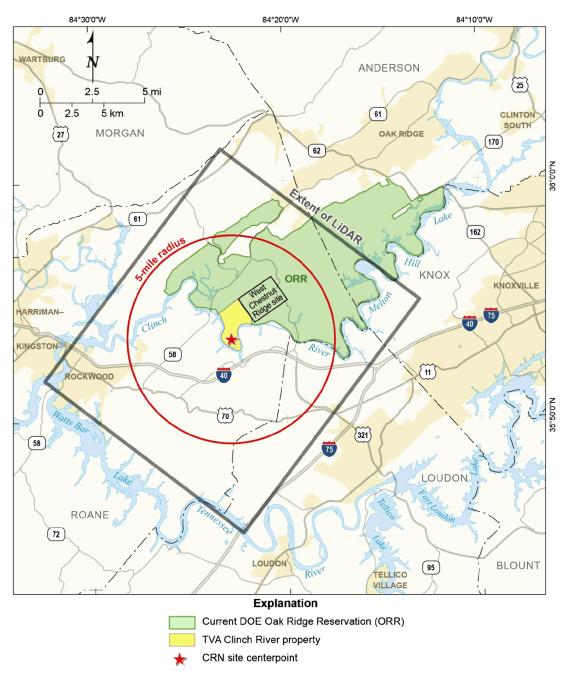
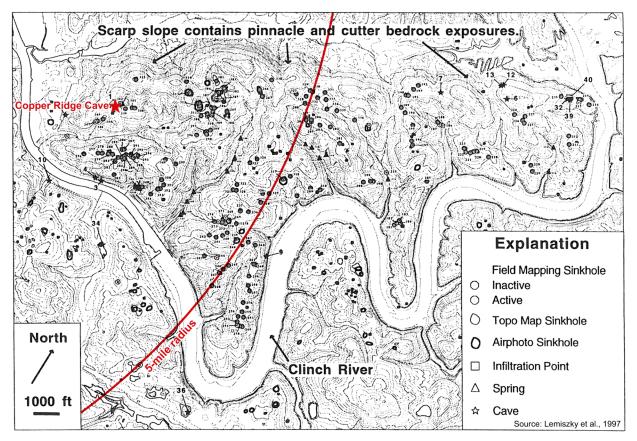
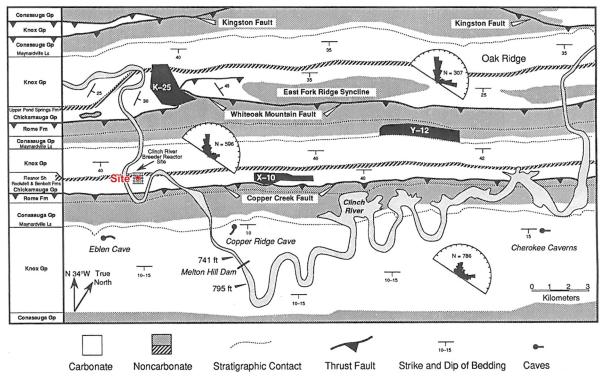


Figure 2.5.1-39. Site Area Map



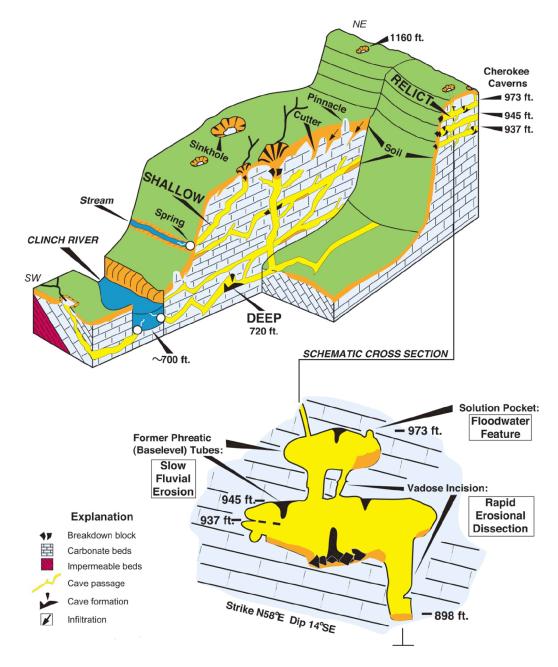
Source: Reference 2.5.1-239

Figure 2.5.1-40. Karst Features near Copper Ridge Cave



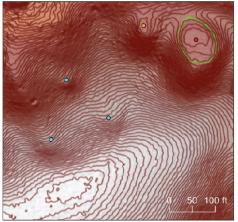
Source: Reference 2.5.1-240

Figure 2.5.1-41. Generalized Geologic Map of the Oak Ridge Area

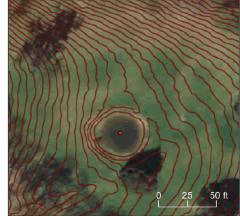


Source: Reference 2.5.1-240

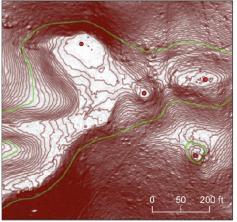
Figure 2.5.1-42. Conceptual Model for Karst Systems in the Oak Ridge Area



A. Karst depressions on a hillside with 1-foot contours and color ramp DEM



B. Water-filled sinkhole in an open field with 1-foot contours on 2013 aerial photography



C. Multiple sinks within a larger closed depression with 1-foot contours

D. Depressions on ridge top, hillshade DEM

#### Explanation

- Center of closed depressions 2-foot depth and 100-square-foot area • Two-sided depression
- Extent of closed depression
- Three-sided depression
- Shallow depression

Figure 2.5.1-43. Examples of Karst Depressions Mapped from LiDAR Data

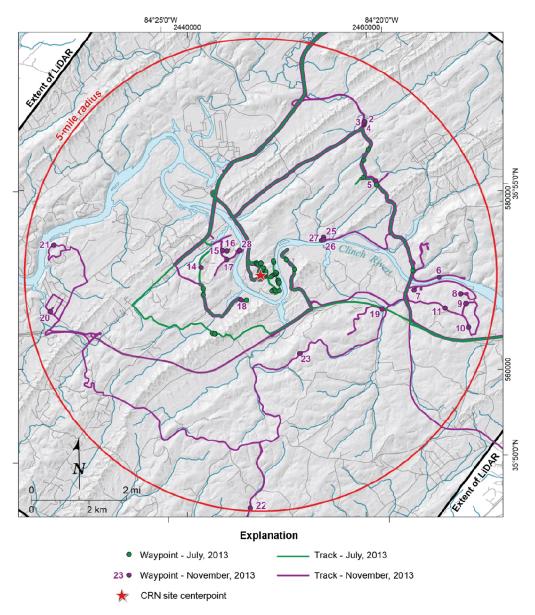


Figure 2.5.1-44. Location of Karst Field Reconnaissance



A. Pond in depression, Knox Group



B. Gentle depression, Knox Group



C. Active swallet, Witten Formation



D. Flat floor of depression, Witten Formation

# Figure 2.5.1-45. Field Photographs of Karst Depressions

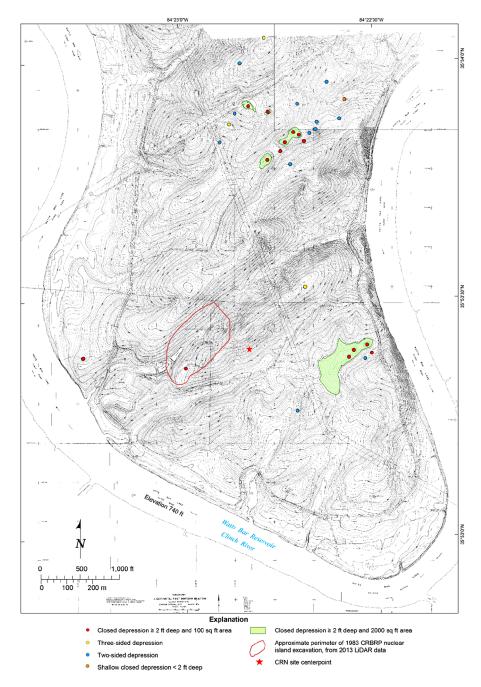


Figure 2.5.1-46. Surface Karst Features and Site Topography Associated with CRBRP Investigations (1973)

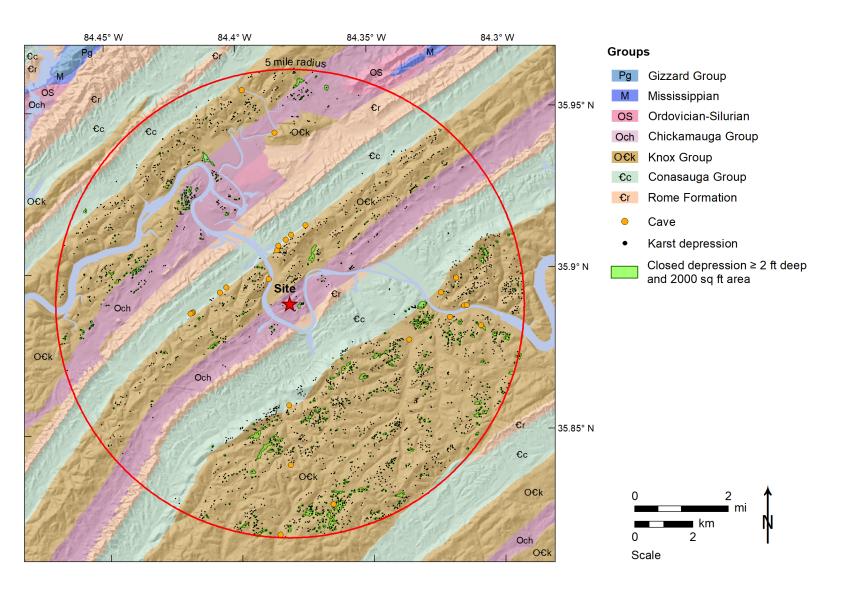


Figure 2.5.1-47. Distribution of Mapped Karst Features in the Site Area



A. Small stream passage, 3 ft-high, with alluvial deposits on floor



B. Large stream passage, 16 ft-wide, following bedding dip



C. Solution enlargement at the intersection of joint and bedding plane



D. Ceiling collapse along bedding plane.

Figure 2.5.1-48. Field Photographs of Cave Features

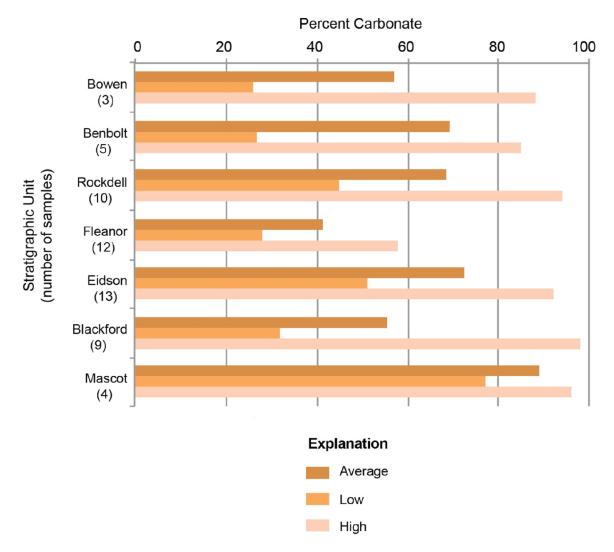
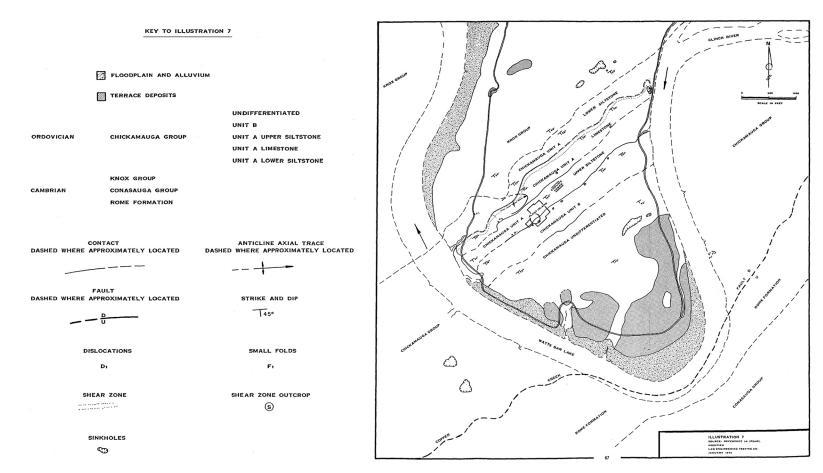
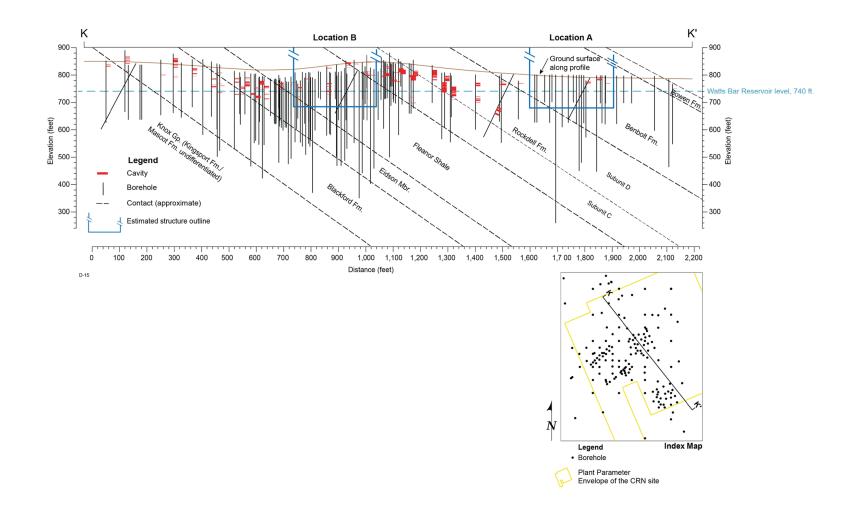


Figure 2.5.1-49. Carbonate Content of Rock Core Samples by Stratigraphic Unit



Source: Page 216 of Reference 2.5.1-238

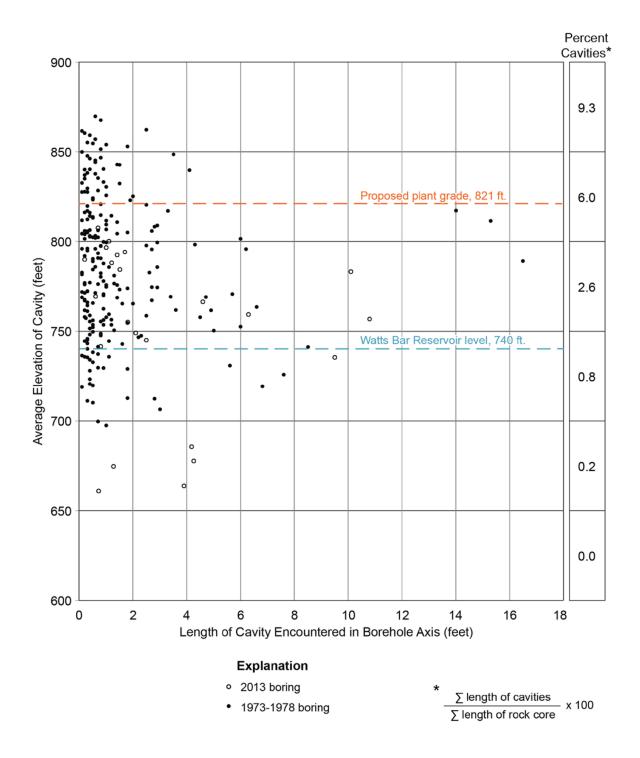




#### Notes:

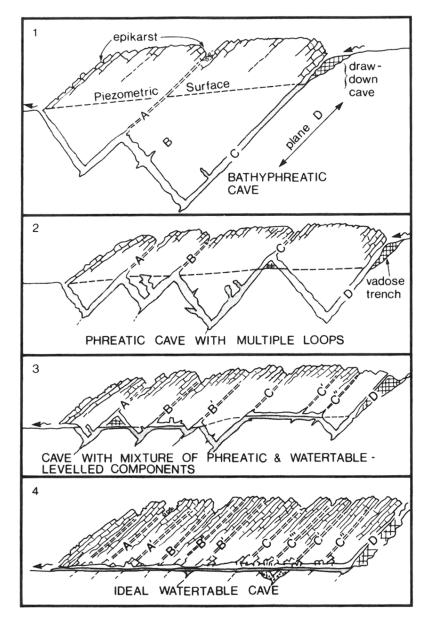
- 1. Boreholes are projected on to a vertical plane oriented perpendicular to bedding strike of N52°E.
- 2. Borehole data are compiled from the CRBRP (Reference 2.5.1-100) and the CRN investigation (Reference 2.5.1-214).

## Figure 2.5.1-51. Cross-Section Distribution of Cavities in Rock Core



Sources: Reference 2.5.1-100, Reference 2.5.1-214

Figure 2.5.1-52. Cavity Size and Elevation in Borings







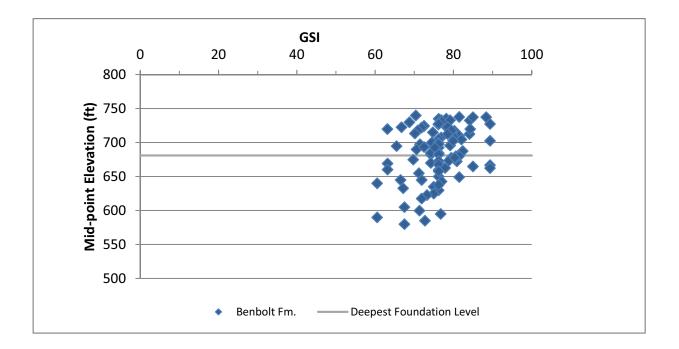


Source: Reference 2.5.1-246 Oblique view south.

# Figure 2.5.1-54. Photograph of Completed Clinch River Breeder Reactor Project Excavation, 1983



Figure 2.5.1-55. Dissolution of Limestone Interbeds in the Blackford Formation



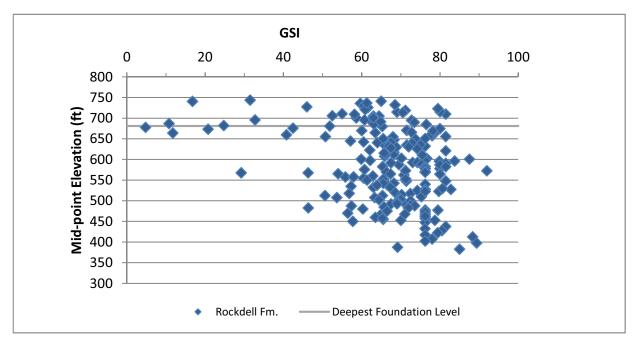
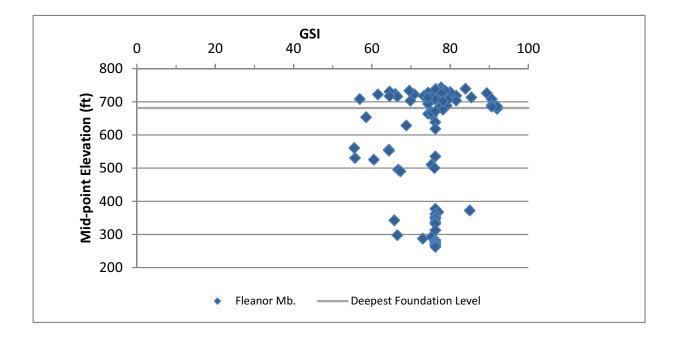


Figure 2.5.1-56. (Sheet 1 of 3) Scatter Plots of Geological Strength Index per Bedrock Unit



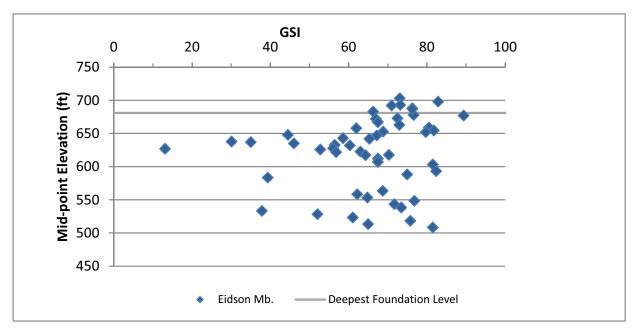
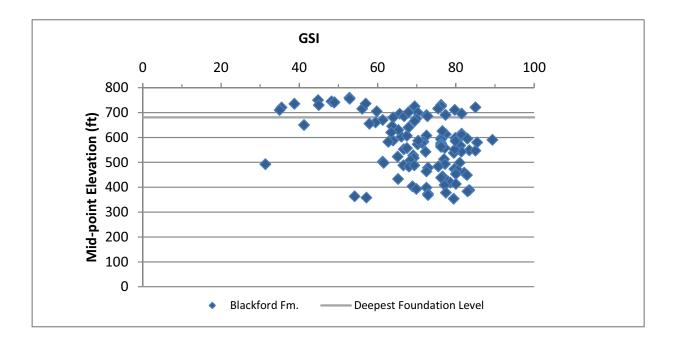


Figure 2.5.1-56. (Sheet 2 of 3) Scatter plots of Geological Strenth Index per Bedrock Unit



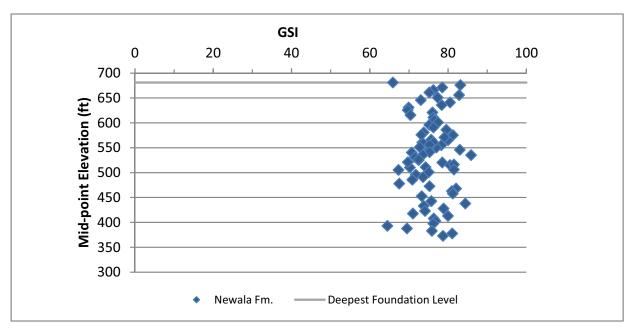
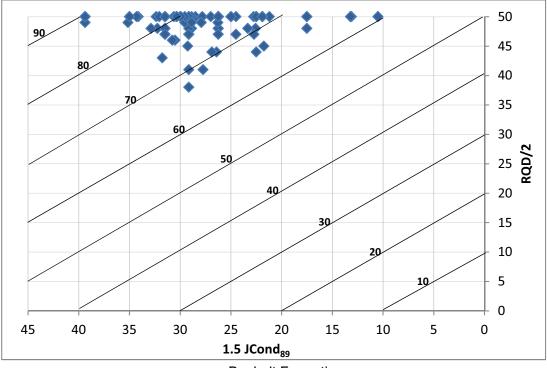
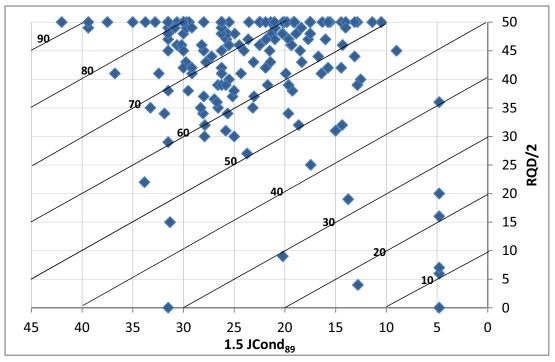


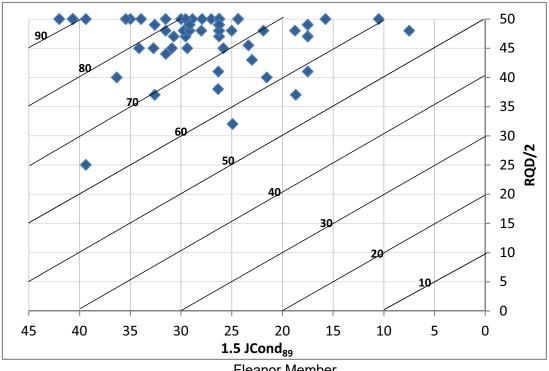
Figure 2.5.1-56. (Sheet 3 of 3) Scatter Plots of Geological Strength Index per Bedrock Unit



**Benbolt Formation** 



Rockdell Formation Note: JCond<sub>89</sub> = Joint Condition Rating; GSI = Geological Strength Index; RQD = Rock Quality Designation **Figure 2.5.1-57.** (Sheet 1 of 3) Portion of GSI Chart Showing 1.5 JCond<sub>89</sub> Against RQD/2 and GSI per Bedrock Unit (Extended to Show RQD/2 > 40)



Fleanor Member

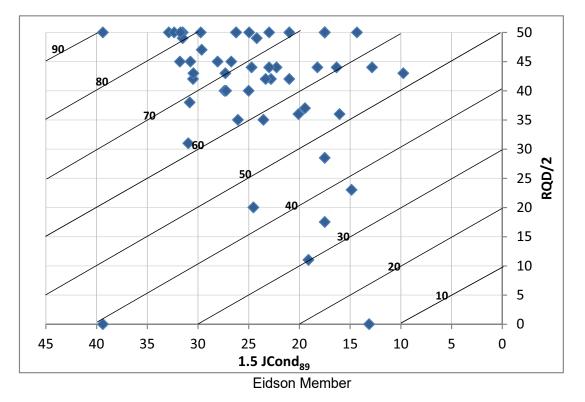
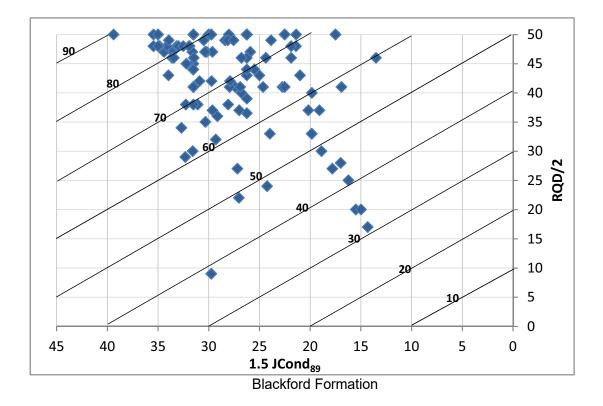


Figure 2.5.1-57. (Sheet 2 of 3) Portion of GSI Chart Showing 1.5 JCond<sub>89</sub> Against RQD/2 and GSI per Bedrock Unit (Extended to Show RQD/2 > 40)



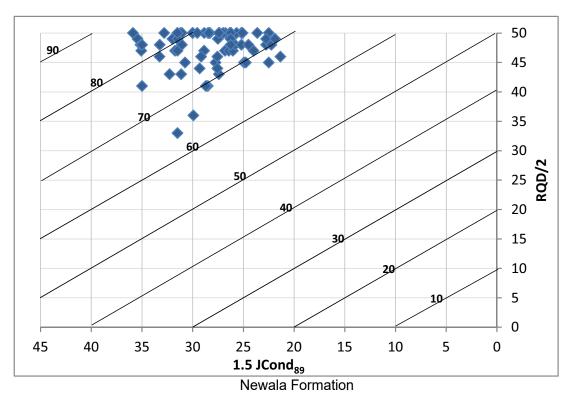
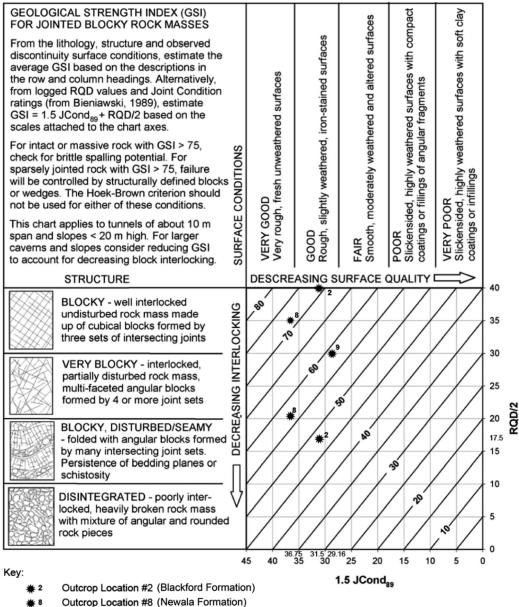


Figure 2.5.1-57. (Sheet 3 of 3) Portion of GSI Chart Showing 1.5 JCond<sub>89</sub> Against RQD/2 and GSI per Bedrock Unit (Extended to Show RQD/2 > 40)

### **Clinch River Nuclear Site** Early Site Permit Application Part 2, Site Safety Analysis Report



- Outcrop Location #9 (Rockdell Formation)

Note: JCond<sub>89</sub> = Joint Condition Rating; RQD = Rock Quality Designation Source: Reference 2.5.1-265

Figure 2.5.1-58. Estimates of Geological Strength Index at Outcrop Locations 2, 8, and 9

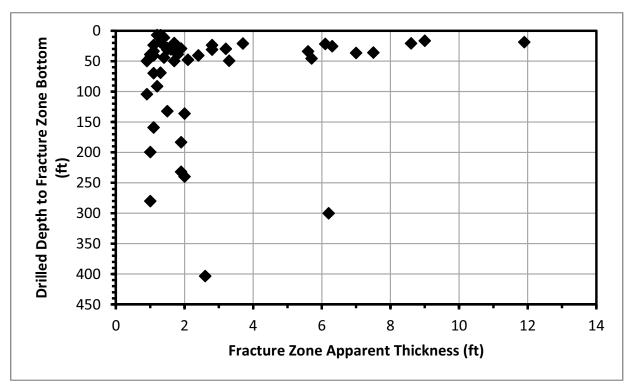


Figure 2.5.1-59. (Sheet 1 of 2) Scatter Plot of Fracture Zone Apparent Thickness—Against Drilled Depth to Fracture Zone Bottom (Using the 100- and 200-Series Borings)

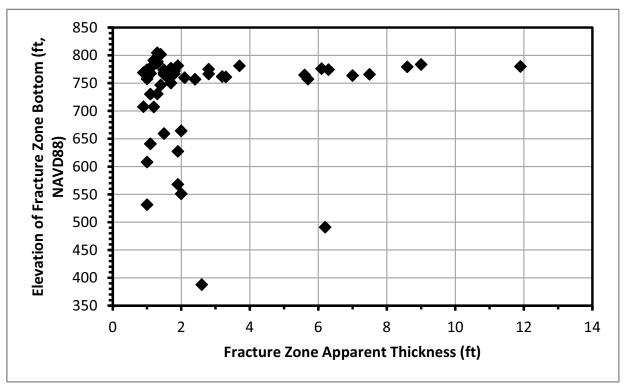


Figure 2.5.1-59. (Sheet 2 of 2) Scatter Plot of Fracture Zone Apparent Thickness—Against Elevation of Fracture Zone Bottom (Using the 100- and 200-Series Borings)

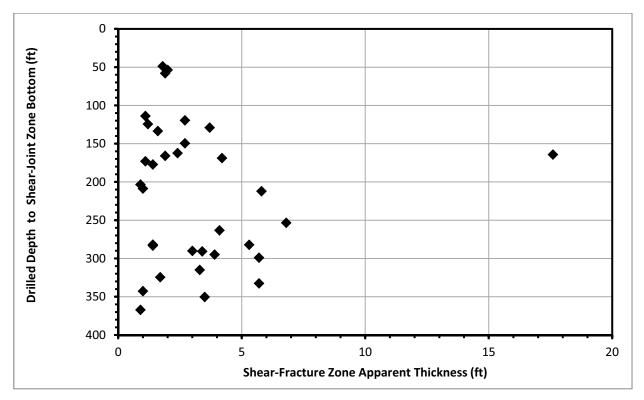


Figure 2.5.1-60. (Sheet 1 of 2) Scatter Plot of Shear-Fracture Zone Apparent Thickness—Against Drilled Depth to Shear-Fracture Zone Bottom (Using 100- and 200-Series Borings)

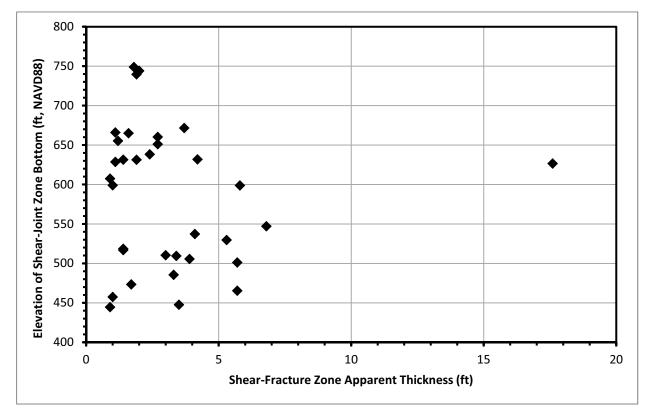
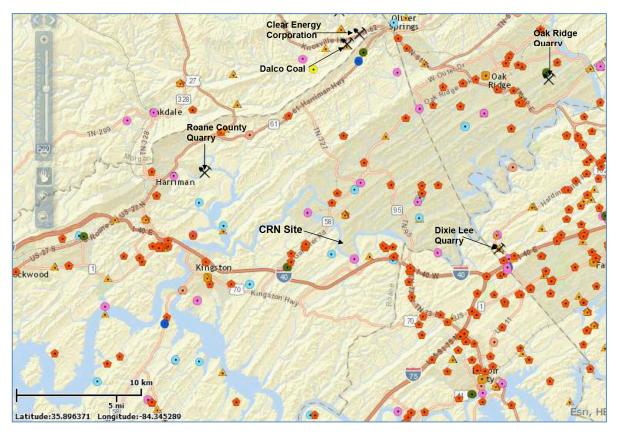


Figure 2.5.1-60. (Sheet 2 of 2) Scatter Plot of Shear-Fracture Zone Apparent Thickness—Against Elevation of Shear-Fracture Zone Bottom (Using 100- and 200-Series Borings)



#### Notes: Source: Reference 2.5.1-273.

The symbols shown on this map represent water resource permits for various applications such as construction, water treatment plants, individual wells, hydrostatic purposes etc. See the legend to this figure on the next sheet.

Mine locations are shown as 🛠 and include the following on the map: <u>Roane County Quarry:</u> Crushed and Broken Limestone

Dixie Lee Quarry: Crushed and Broken Limestone

Oak Ridge Quarry: Crushed and Broken Limestone

Clear Energy Corporation (formerly Dalco of Tennessee LLC.): Bituminous Coal and Lignite, Surface.

Dalco Coal of Tennessee, LLC. Bituminous Coal and Lignite, Underground.

## Figure 2.5.1-61. (Sheet 1 of 2) Map showing the Water Resource Permit Application Sites Within Approximately 10 Miles of the Clinch River Nuclear Site

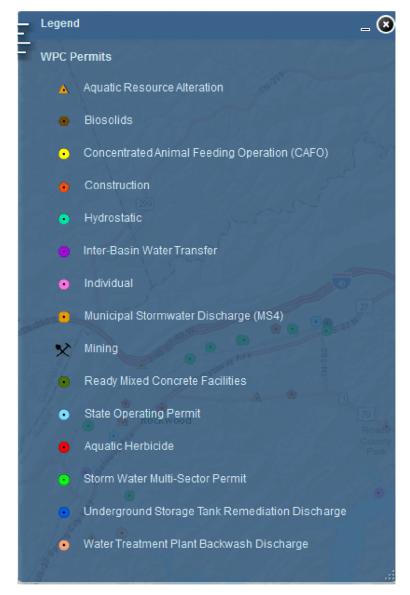




Figure 2.5.1-61. (Sheet 2 of 2) Map Showing the Water Resource Permit Application Sites Within Approximately 10 Miles of the Clinch River Nuclear Site

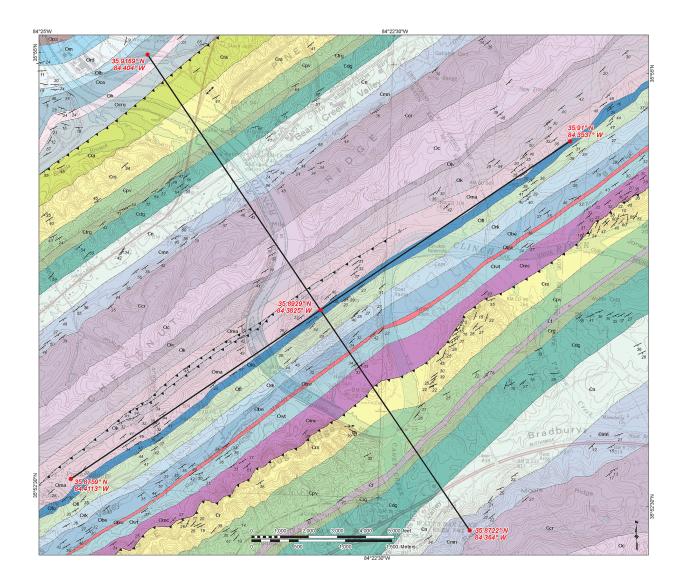
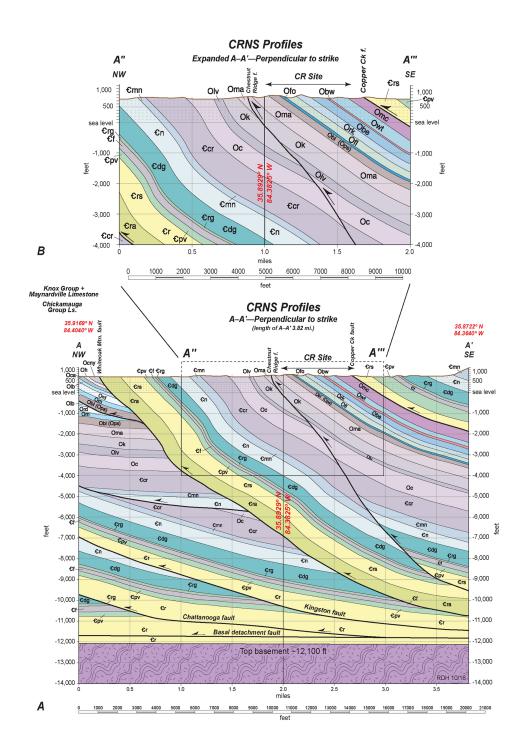


Figure 2.5.1-62. Map Showing the Location of Geologic Cross-Section A-A' to Basement

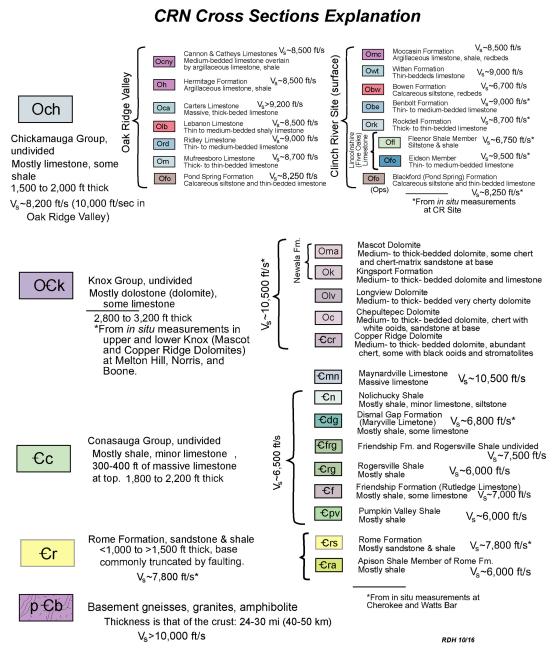


Note:

A. Across-strike geologic cross-section A-A' with an expanded section, the location of which is indicated in the rectangle in the center of the diagram.
B. Upper part of Figure A with additional detail. Location of section line is indicated in the geologic map on

B. Upper part of Figure A with additional detail. Location of section line is indicated in the geologic map on Figure 2.5.1-62.

# Figure 2.5.1-63. (Sheet 1 of 2) Geologic Cross-Section A-A' Ground Surface to Basement



Note: Explanation of symbols used to identify the different geologic units in Figures 2.5.1-62 and 2.5.1-63.

# Figure 2.5.1-63. (Sheet 2 of 2) Geologic Cross-Section A-A' Ground Surface to Basement