

# 2012 Southeastern Transportation Geotechnical Engineering Conference

## Development and Performance of **Geotechnical Documents for the US 460 Connector Phase I Design-Build Project**

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- Project Orientation
- Project Geology and Geotechnical Challenges
- D-B-B to D-B: Phase I Project Elements
- D-B Risk Assessment/Considerations
- Pre-Award Strategies
  - Short- and Long-Term
  - Contractor Team and VDOT Team
  - RFP Documents
- Post-Award Strategies
  - Scope Validation Period
  - Design and Construction QA/QC Plan
- Concluding Comments



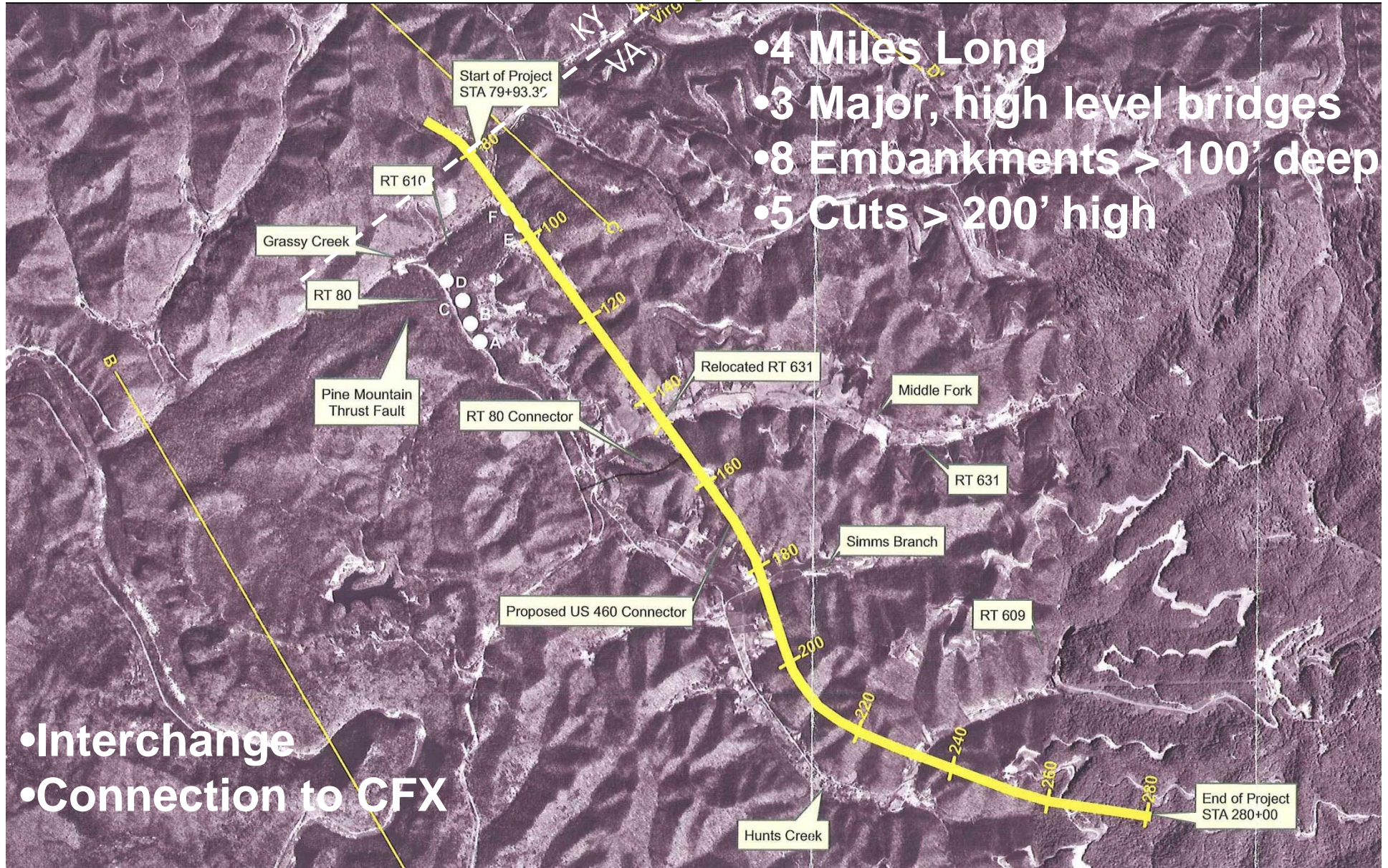


# US 460 Connector



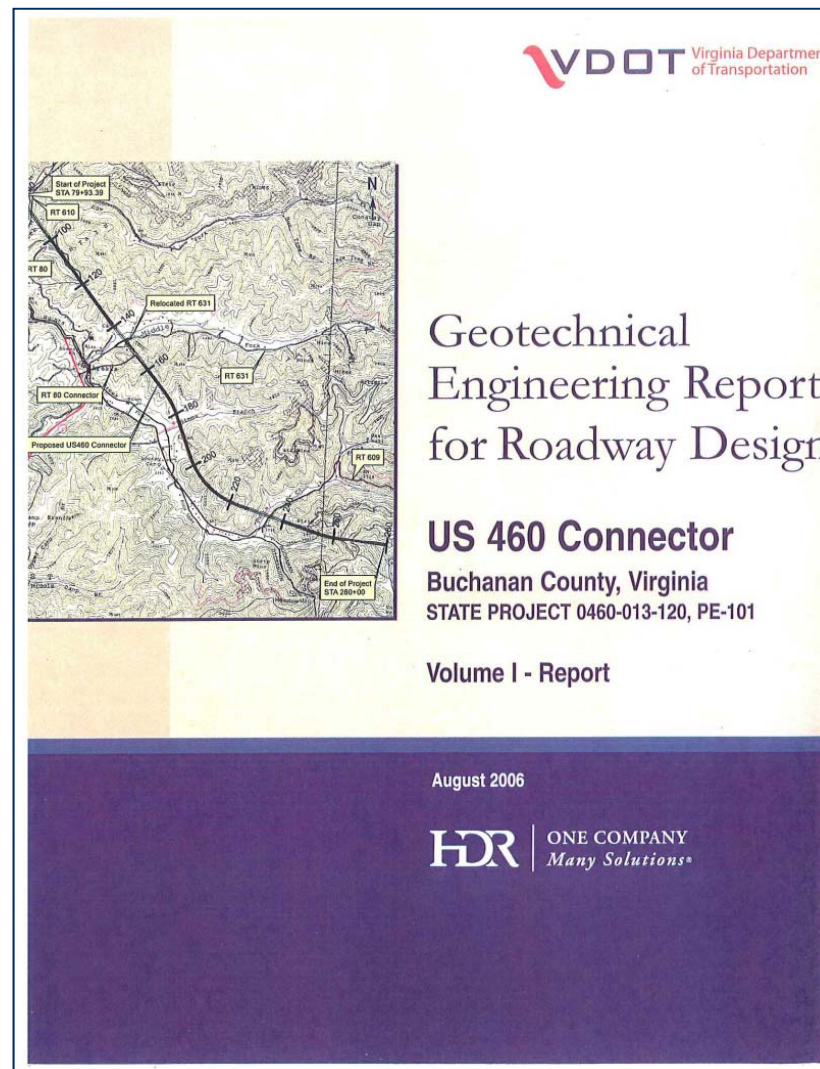
2012 STGEC

## 2004-2006 DBB Project





# Geotechnical Engineering Report



## Project Shift from DBB to DB

- 2007
- Project Subdivided into Phases I and II
- Phase I – Link Kentucky with Virginia Route 80
- Phase II – Link Phase I with CFX
- Reasons for using DB on Phase I
  - Expedite Project Delivery by 3 Years to Meet Scheduled Completion of Kentucky Segment
  - Meet 2009 Commitment for Appalachian Funding
  - Allow For Possible Innovation in Design/Construction

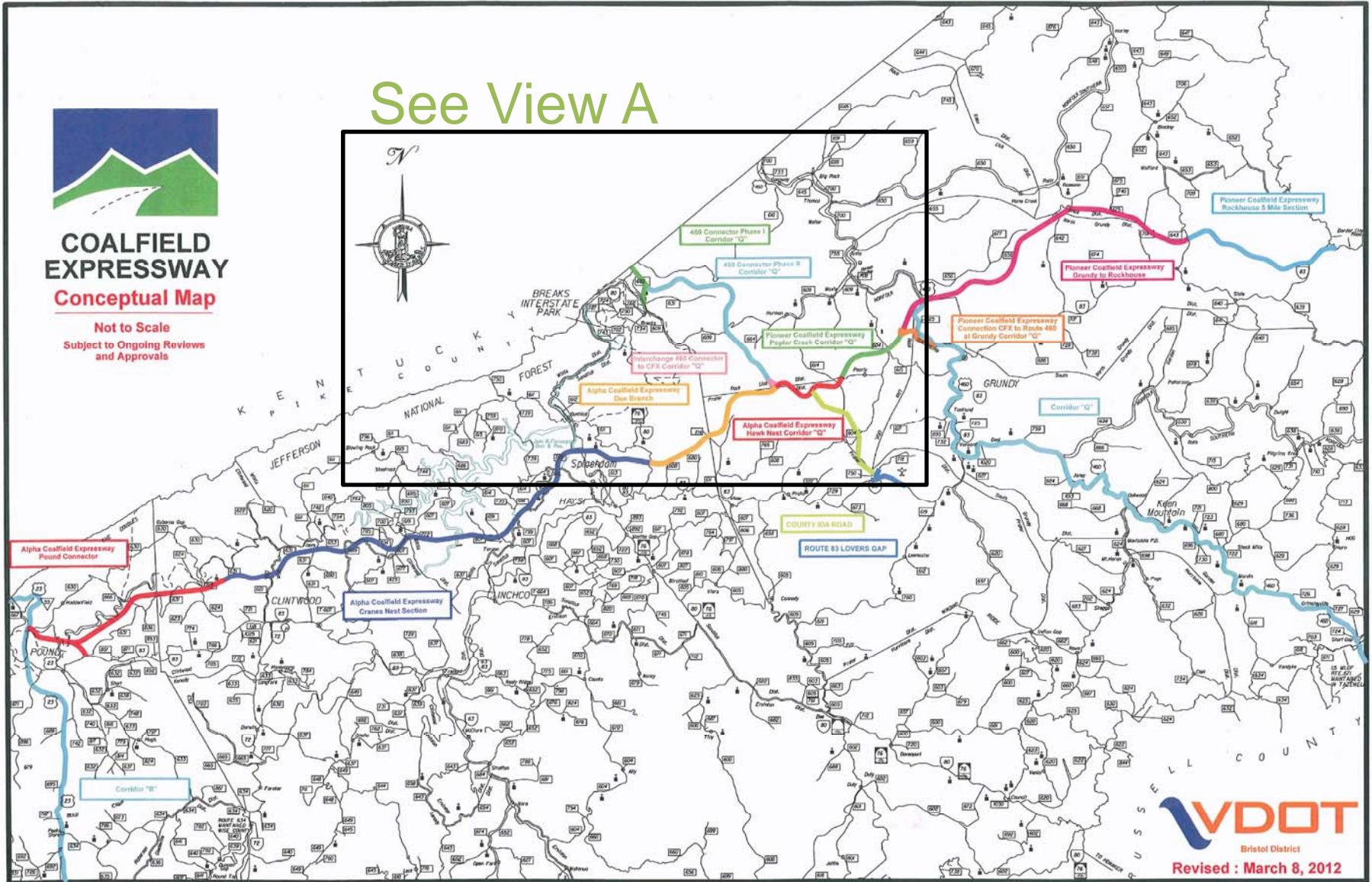


See View A

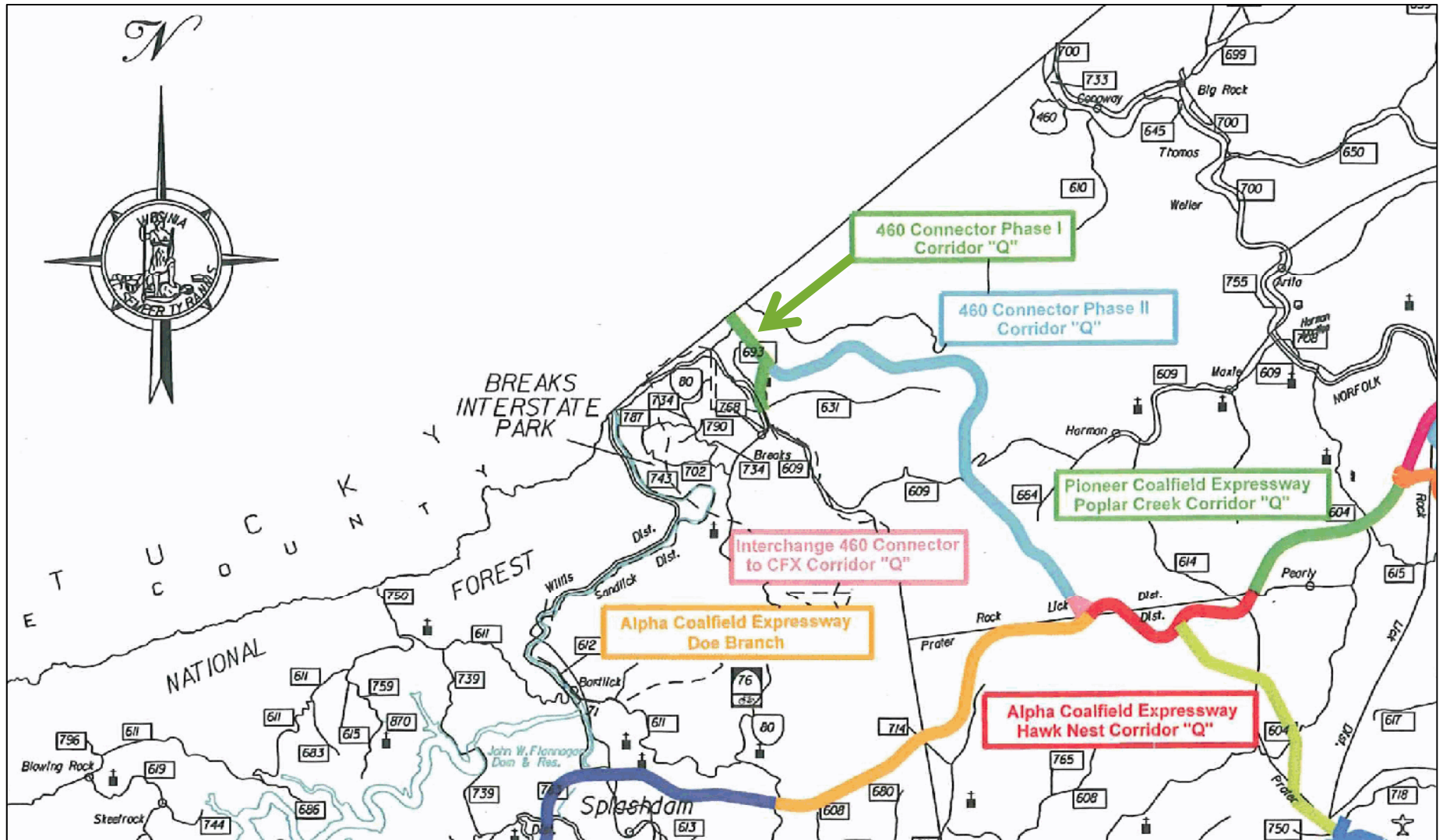


# COALFIELD EXPRESSWAY Conceptual Map

Not to Scale  
Subject to Ongoing Reviews  
and Approvals



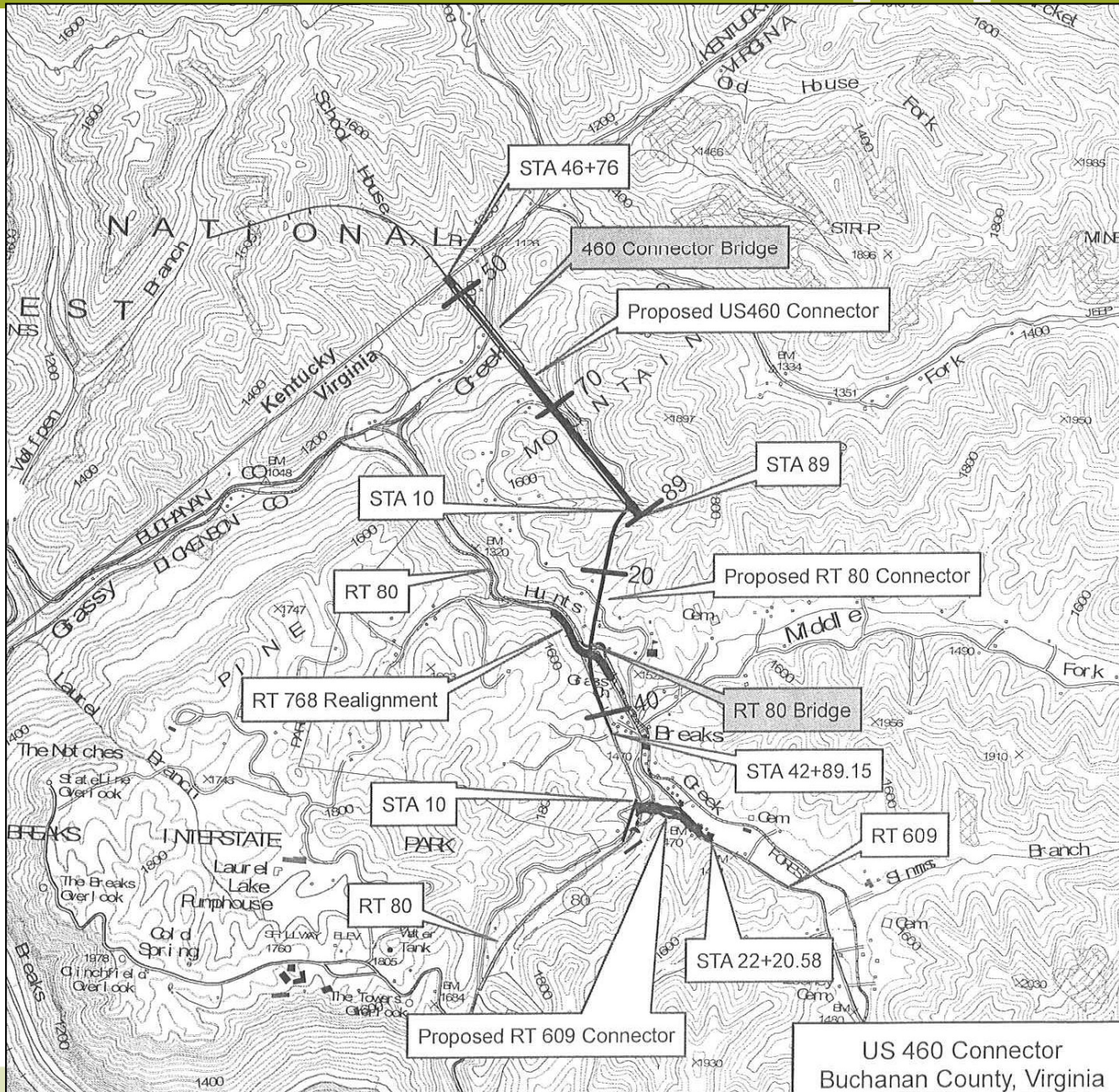
# View A





# US 460 Connector Phase I [DB]

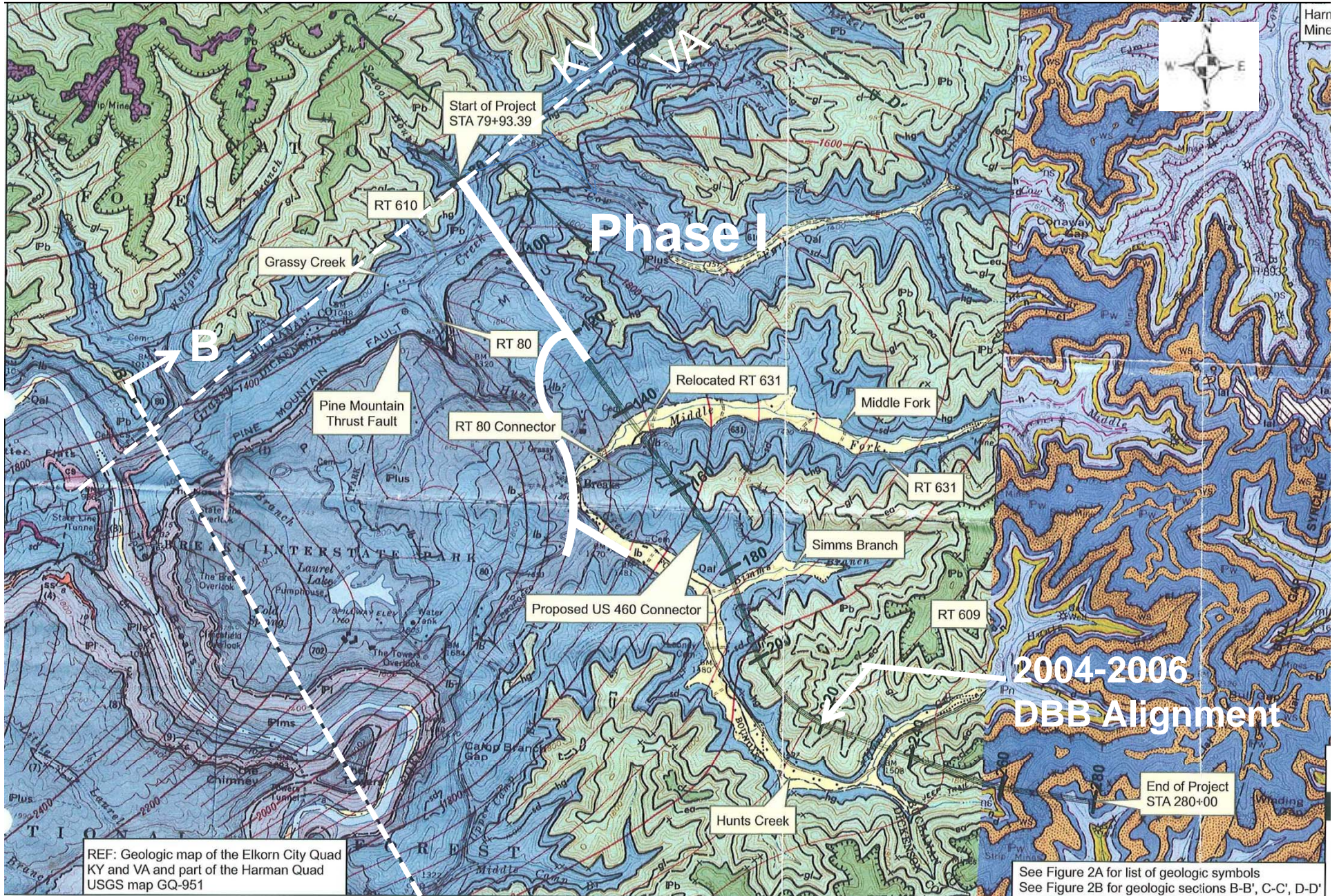
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# US 460 Connector - Geologic Map

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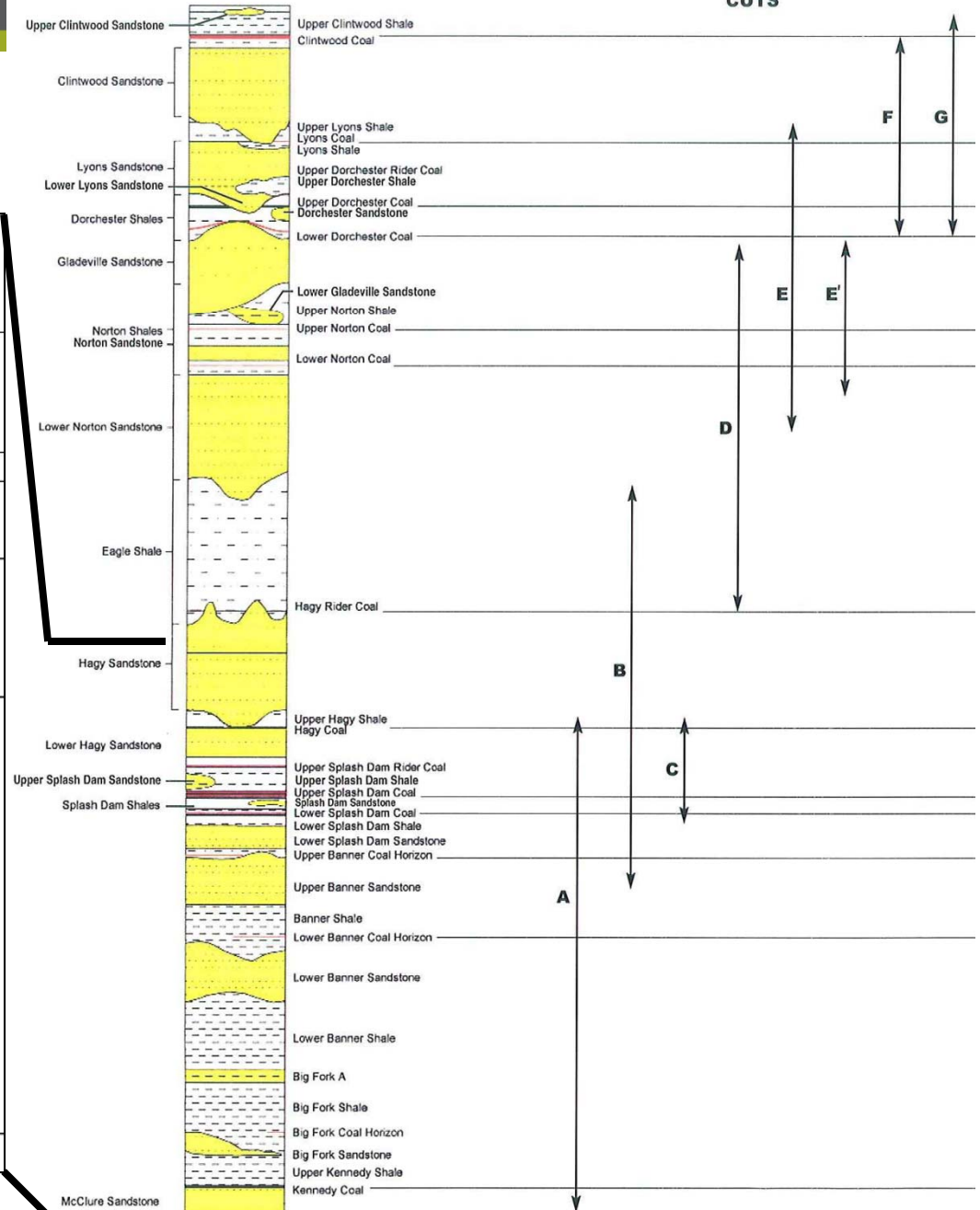
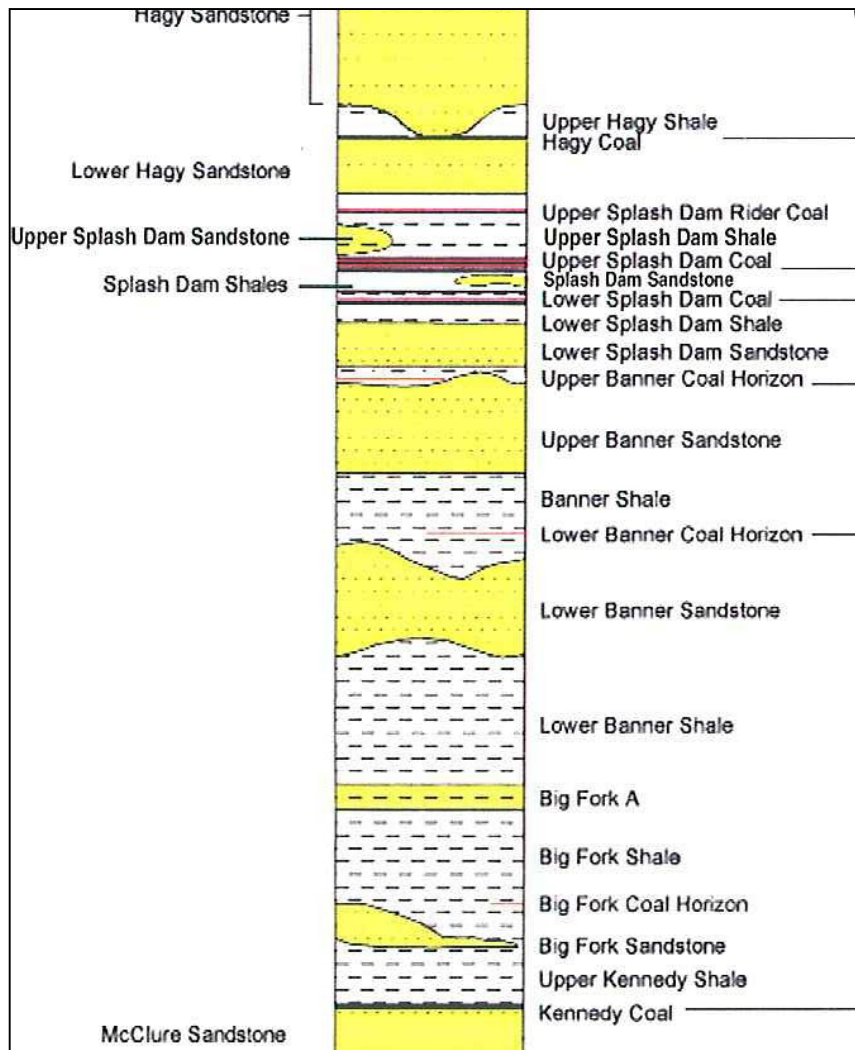






# Geologic Stratigraphic Column

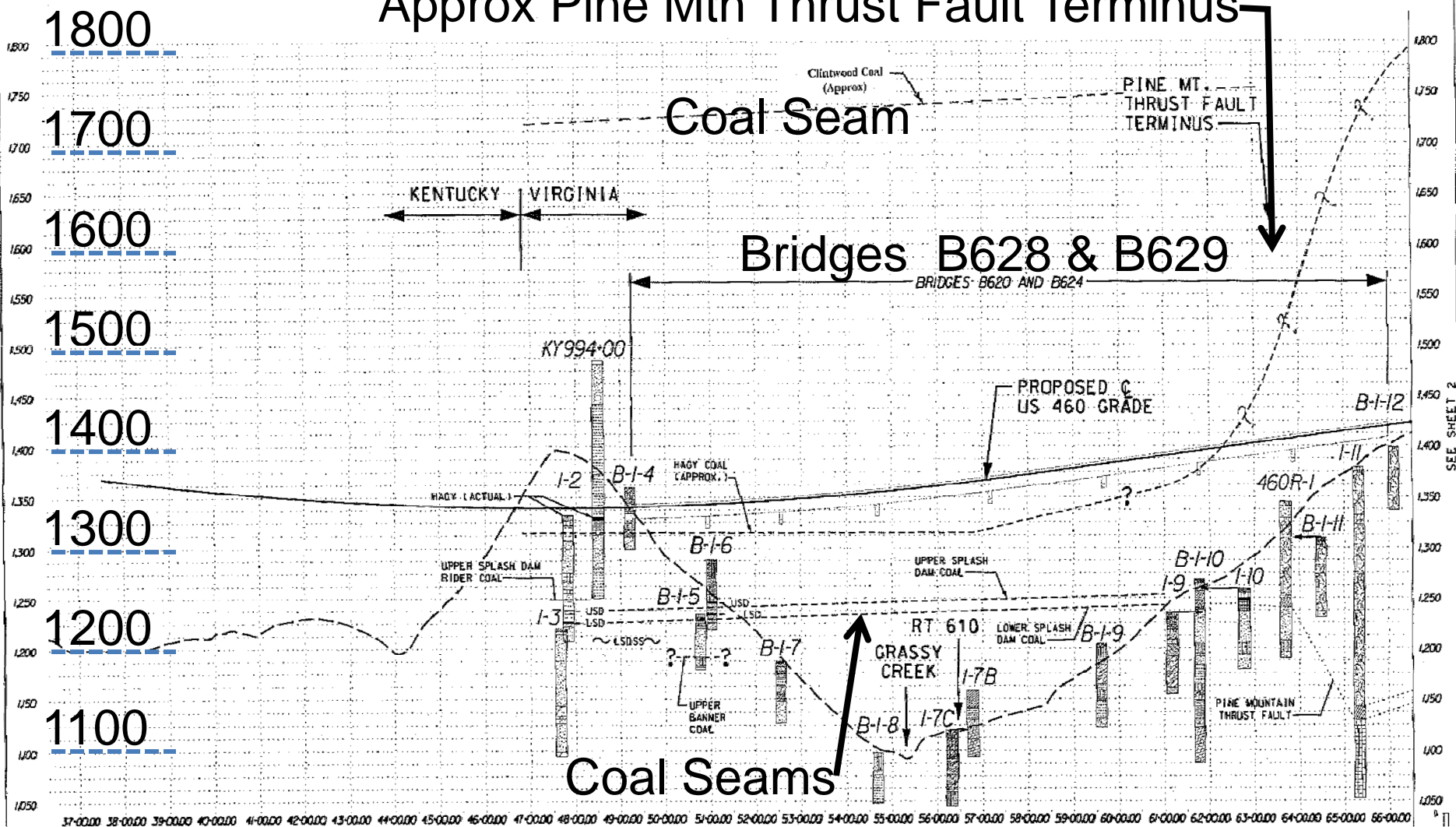
## Phase I





REVISED	FEDERAL AID PROJECT	STATE PROJECT	SHEET NO.
	1A	VVV	6

# Approx Pine Mtn Thrust Fault Terminus



## Subsurface Profile - US 460 Connector Phase I

COAL ASSESSMENT STUDY  
 US 460 CONNECTOR  
 GEOLOGIC PROFILE

SCALE:  
 VERTICAL 1"=100'  
 HORIZONTAL 1"=200'

NOTE:  
 COAL PROFILES ARE APPROXIMATE AND ARE PROJECTED ON CENTERLINE.  
 THE PROFILE MAY NOT LINE UP WITH THE COAL SEAM IN BORING DUE TO DIP.

PLAN NO.	PROJECT	FILE NO.	SHEET NO.
			6

## Key Design Components

- US 460 Connector
  - 0.8 mile – 4 lanes ,divided – new alignment
  - Twin, high-level bridges ~ 1700 feet long
  - Two cuts with overall heights of ~ 70 to 170 feet
  - Fills with maximum heights of ~ 50 feet
  - Turning lane at Route 80



## Key Design Components

- Route 80 Connector
  - ~0.6 mile – 2 lanes – new alignment
  - Multi-span 630-foot bridge over Hunts Creek and Route 768
  - Major cut with lesser cuts and fills
  
- Route 609 Connector
  - ~0.2 mile – 2 lanes – new alignment
  - Minor cuts and fills

## Key Design Components

- Route 768 Realignment
  - ~0.3 mile – 2 lane improvements
  - At grade with minor cuts and fills
  
- Storm Water Management Basins
  - 5 Locations for consideration
  
- Surplus Materials Area
  - Designated by VDOT for future Maintenance Facility
  - Possible fill depths of 100 feet plus
  - Old Mine Spoil Area



## Pre-Award Phase

```
graph TD; A[Pre-Award Phase] --> B[Selection]; B --> C[Post-Award Phase]; C --> D[Scope Validation Period]; D --> E[Design and Construction QA/QC Plan];
```

Selection

## Post-Award Phase

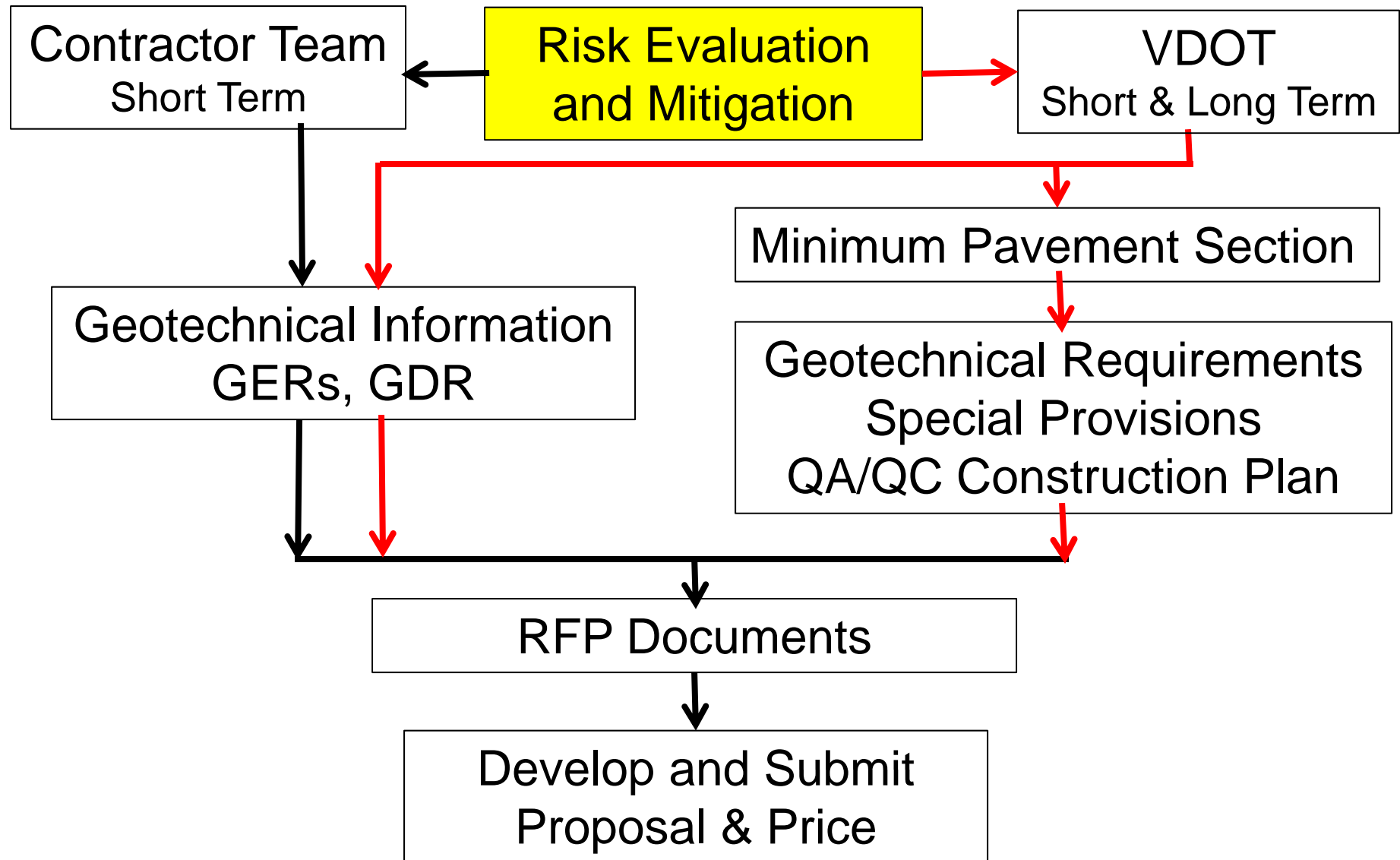
Scope Validation Period

Design and Construction  
QA/QC Plan

# Risk Assessment for Design-Build

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## Pre-Award Phase



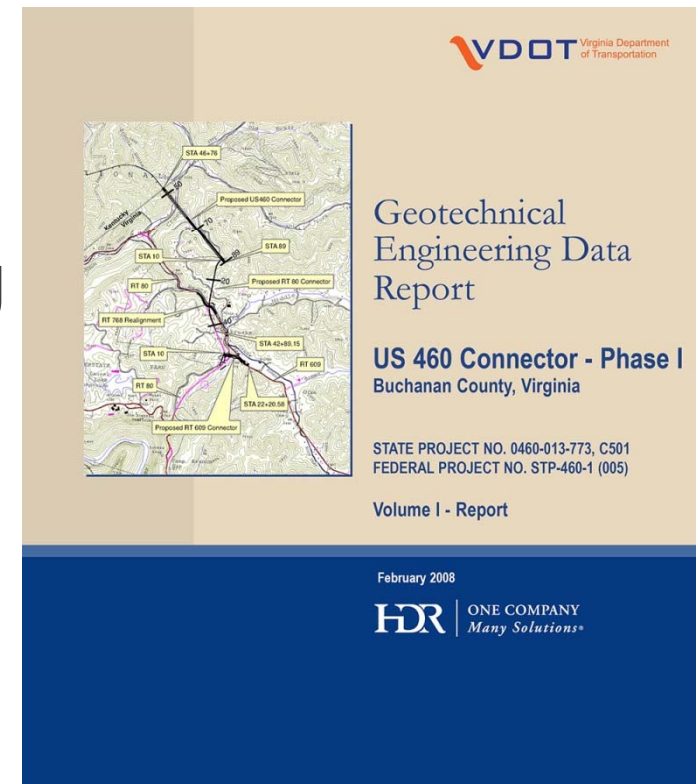


## Geotechnical Design/Risk Considerations

- Pine Mountain Thrust Fault
- Coal Seams and Mining
- Embankments [in Steep Terrain]
- Long Term Durability of Rock in Cut Slopes and Fills
- Overburden – Colluvial or Residual Soil, Coal Waste
- Bridge and Wall Foundations
- Control of Ground Water Impacts
- Pavement Design and Subgrade Quality
- Settlement Control

## Geotechnical Data Report (GDR)

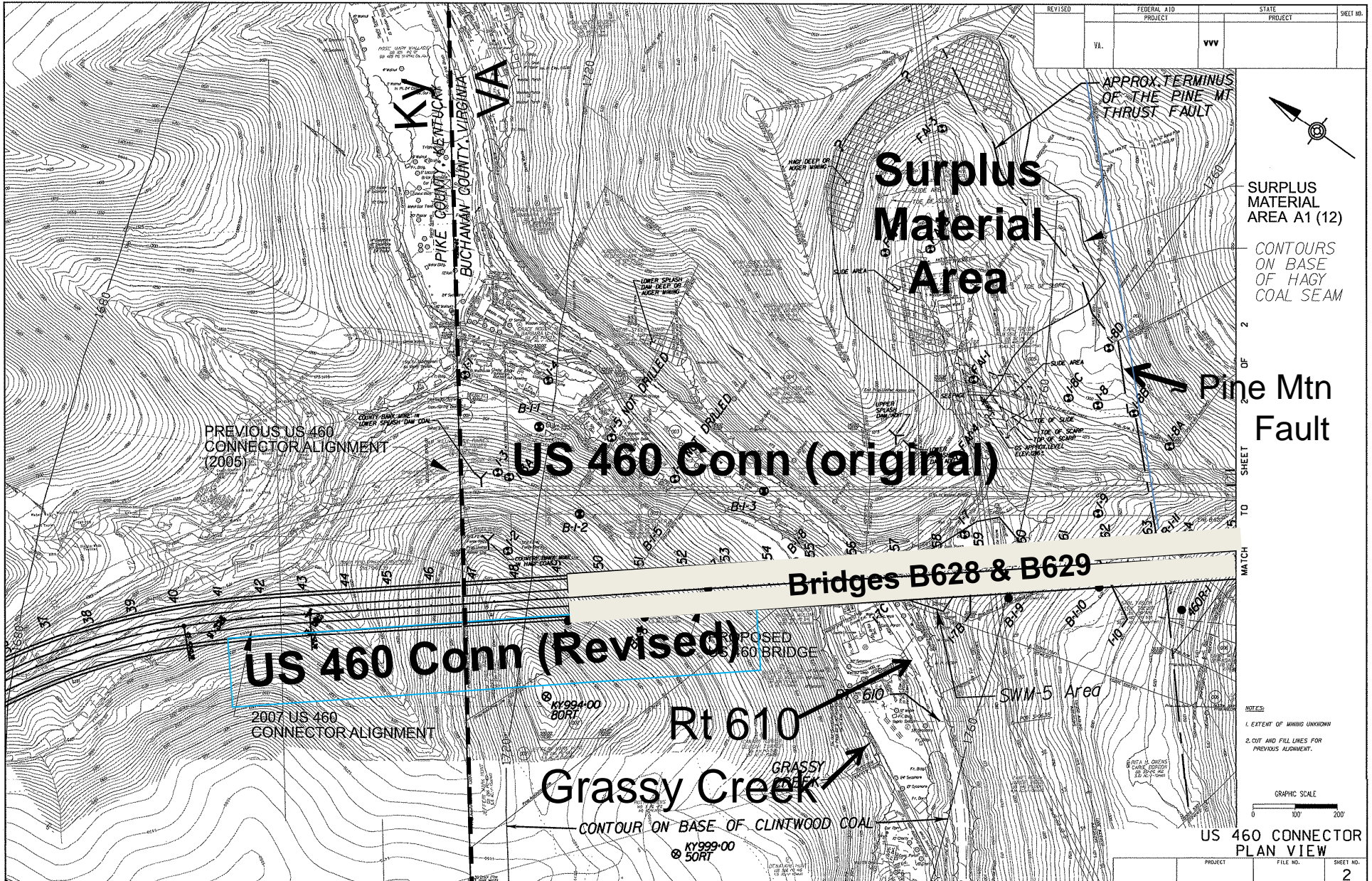
- Supplemental Borings for:
  - Revised US 460 Connector Alignment
  - Borings for New Route 80 Connector
  - Route 609 Connector
  - Route 768 Realignment
- Supplemental Laboratory Testing





# US 460 Connector Phase I

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# US 460 Connector Phase I

2012 STGEC





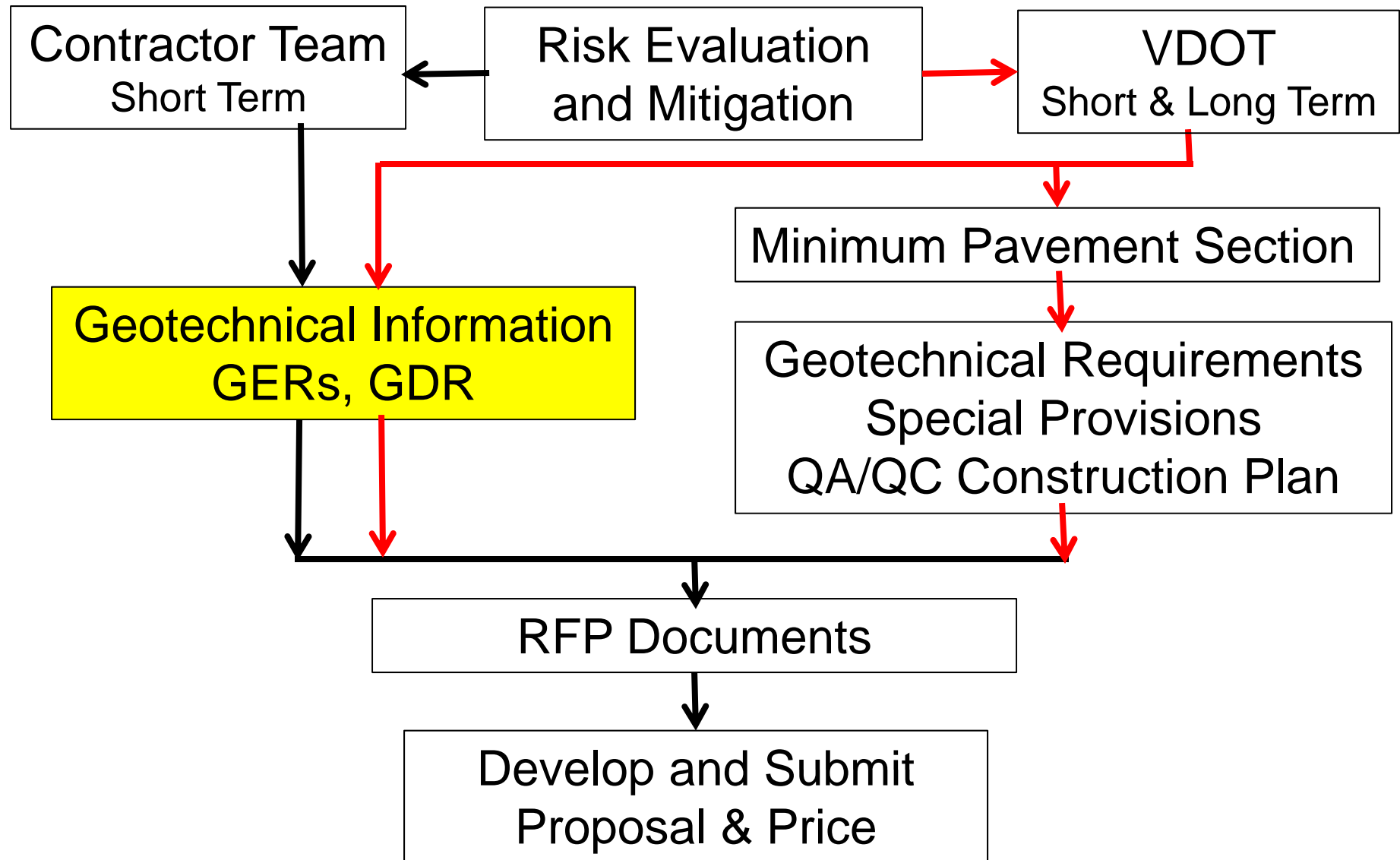


Pre-Award Phase  
**RFP Documents**

# Risk Assessment for Design-Build

2012 STGEC

## Pre-Award Phase







## Section 2.0 Technical Information and Requirements

- *Section 2.6 – Geotechnical Work*
  - Geotechnical Reports - US 460 Connector:
    - Phase I GDR
    - GERs for Concept Studies at Two Phase I Bridges \*
    - GER for US 460 Connector (2006) \*
    - Coal Assessment Report for Phase I \*

\*For information only. Recommendations in Reports not to be relied on for DB Team final design

# Project Geotechnical Information

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**Geotechnical Engineering Report for Roadway Design**

**US 460 Connector**  
Buchanan County, Virginia  
STATE PROJECT 0460-013-120, PE-101

Volume I - Report

August 2006

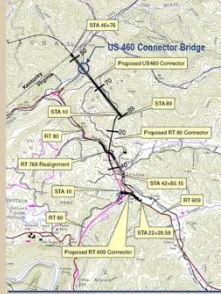




**Geotechnical Engineering Report for Concept Study**

**US 460 Connector - Phase I**  
Buchanan County, Virginia

Route 80 Connector Bridge over Route 768 and Hunts Creek  
STATE PROJECT NO. 0460-013-773, B630  
FEDERAL PROJECT NO. STP-460-1 (005)

February 2008

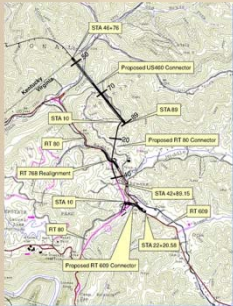




**Geotechnical Engineering Report for Concept Study**

**US 460 Connector - Phase I**  
Buchanan County, Virginia

US 460 Connector Bridge over Grassy Creek and Route 610  
STATE PROJECT NO. 0460-013-773, B628, B629  
FEDERAL PROJECT NO. STP-460-1 (005)

February 2008



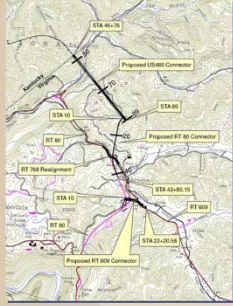


**Geotechnical Engineering Data Report**

**US 460 Connector - Phase I**  
Buchanan County, Virginia

STATE PROJECT NO. 0460-013-773, C501  
FEDERAL PROJECT NO. STP-460-1 (005)

Volume I - Report

February 2008




**Coal Assessment Report**

**US 460 Connector - Phase I**  
Buchanan County, Virginia

STATE PROJECT NO. 0460-013-773, C501  
FEDERAL PROJECT NO. STP-460-1 (005)

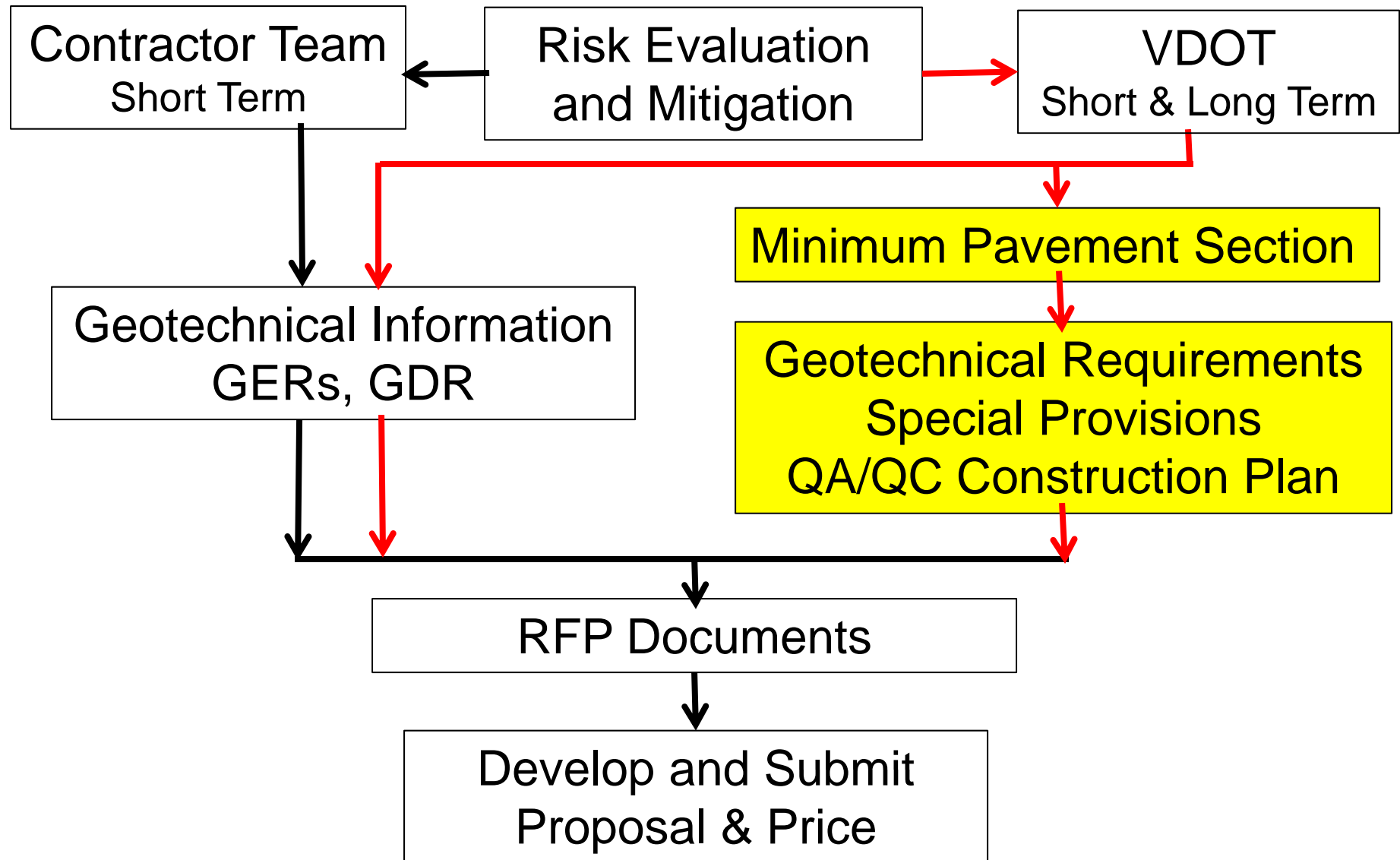
March 2008



# Risk Assessment for Design-Build

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## Pre-Award Phase





# Request For Proposal (RFP) Documents 2012 STGEC

## Section 2.0 Technical Information and Requirements

- Section 2.1 – Special Provisions
- Section 2.6.1 - Minimum Pavement Sections
- Section 2.6.2 – Geotechnical Requirements
  - Long Term Differential Settlement
    - Pavements, subgrades and embankments
    - Foundations (Per AASHTO or Designer)
  - Stability of Cut and Embankment Slopes
  - Minimum Geotechnical Requirements \*\*\*
  - Settlement and Stability of Surplus Disposal Area

## \*\*\*Minimum Geotechnical Requirements

- Access Roads
- Bridge Foundations
- Coal Undercut
- Corrosion Protection for Foundations
- Embankments
- Grouting of Deep Mines
- Mine Opening Backfill
- Soil Cut and Fill Slopes
- Soil-Rock Transition Subgrades
- Surplus Disposal Area
- Retaining Walls
- Rock Cut Slopes & Minimum Slope Design Criteria
- Storm Water Management Basins
- Termini for the US 460 Connector Bridges

## Ex. MGR - Corrosion Protection for Foundations

**Design and construction of structure foundations shall consider potential corrosion impacts by applying the following minimum criteria:**

- Use Type II cement for all structure foundations ... unless test results indicate otherwise to the satisfaction of the Department.
- Coat and seal the surface of coal and carbonaceous shale seams encountered in excavations for foundations ... before backfilling.
- Design shoring and anchor systems ... which will remain after construction, for lifetime corrosion losses ...[ per] AASHTO and the RFP.



# Request For Proposal (RFP) Documents 2012 STGEC

## Section 2.0 Technical Information and Requirements

- Section 2.11.3 – Geotechnical Coordination and QA/QC
  - DB's Geotechnical Engineer (GE) integral to Design and Construction Team;
  - GE Experienced with Similar Conditions;
  - GE Reviews Drawings and Verify Recommendations are Incorporated into Plans;
  - GE Reviews Modifications and Recommendations, if necessary;
  - GE Makes Frequent Site Visits to Verify Work;
  - Documentation of GE Activities Included in QA/QC Plan

## Two Phase Selection Process

- 1<sup>st</sup> Phase - RFQ
  - Statement of Qualifications
  - Shortlisting of 3 Firms
  
- 2<sup>nd</sup> Phase – RFP (and Invitation to Bid)
  - Pre-Proposal Meeting
  - Q & A
  - Proprietary Meeting
  - Basis of Award – Best Value
    - Technical Proposal (Max Score 30)
    - Price Proposal (Max Score 70)

# Post Award



## Pre-Award Phase

```
graph TD; A[Pre-Award Phase] --> B[Selection]; B --> C[Post-Award Phase]; C --> D[Scope Validation Period]; D --> E[Design and Construction QA/QC Plan];
```

Selection

## Post-Award Phase

Scope Validation Period

Design and Construction  
QA/QC Plan

- Intended to Address DSC Clause
- SVP Time Is Specified in Contract (120 Days)
  - Issues Brought Up Early, Not Over Full Project Length
- Provides Validation of GDR information

## Pre-Award Phase



Selection



## Post-Award Phase



Scope Validation Period



Design and Construction  
QA/QC Plan



- Design QA/QC – [Geotechnical Reports & Plans]
  - Reviewed per FHWA Checklist
  - RFP Section 2.0 Technical Requirements
  - Geotechnical Recommendations Included in Plans and Construction QA/QC Program
  
- Construction – QA/QC Documents
  - Checklists
  - RFIs (including Geotechnical Engineer Recs)

## Use of Checklists

- Design
  - FHWA Checklist and Guidelines for Geotechnical Reports and Preliminary Plans and Specifications
  - MGR Checklists
  - Geotechnical Recommendations included in plans and QA/QC program
  
- Construction
  - QA/QC Forms – Geotechnical Recommendations

# Design

## QA Checklist for Corrosion Protection For Foundations

### Minimum Geotechnical Requirements for Corrosion Protection for Foundations Checklist

Project: \_\_\_\_\_

Location: \_\_\_\_\_

Prepared by: \_\_\_\_\_

Date: \_\_\_\_\_

Check Appropriate Box

Yes   No   Not Applicable

Design and construction of structure foundations shall consider potential corrosion impacts by applying the following minimum criteria:

- |  |   |
|--|---|
| <p>1. Will Type II Cement be used for all structure foundations and coat exterior surfaces buried below the finished ground surface?<br/>Comments: _____</p>   | <p><input type="checkbox"/>   <input type="checkbox"/>   <input type="checkbox"/></p> |
| <p>2. Will an approved mastic be used in accordance with the applicable ASTM Method, unless test results indicate otherwise to the satisfaction of the Department?<br/>Comments: _____</p>                           | <p><input type="checkbox"/>   <input type="checkbox"/>   <input type="checkbox"/></p> |
| <p>3. Will the surface of coal and carbonaceous shale seams encountered in excavations for foundations be coated and sealed with an approved liquid asphalt before backfilling?<br/>Comments: _____</p>              | <p><input type="checkbox"/>   <input type="checkbox"/>   <input type="checkbox"/></p> |
| <p>4. Were shoring and anchor systems used for excavation support (which will remain in place after construction) designed for lifetime corrosion losses consistent with AASHTO and the RFP?<br/>Comments: _____</p> | <p><input type="checkbox"/>   <input type="checkbox"/>   <input type="checkbox"/></p> |



# Construction QA Checklist for Drilled Shaft Foundations

## Construction Quality Assurance

Drilled Shaft Special Provision (10-2-2007)  
Deep Foundation Systems (5-5-2007)

Date:  Time:  Project:

Work Package:  Activity ID:  Location:

Select	Question
<b>Preparatory</b>	
<input type="checkbox"/>	Preparatory inspection meeting was conducted
<input type="checkbox"/>	Verify Drilled Shaft Installation Plan (DSIP) approved; DSIP details procedures and method for rock socket clean out.
<input type="checkbox"/>	Verify that design documents are approved
<input type="checkbox"/>	Verify approved erosion and sediment controls installed per DSIP
<input type="checkbox"/>	Verify mix design approved; Mix design meets low permeability concrete requirements per Special Provision for Drilled Shafts (Article VI (A) Materials)
<input type="checkbox"/>	Verify that the trial batches for low permeability concrete cast by Contractor and tested by an independent testing laboratory at least one month before field application per Special Provision for Low Permeability Concretes
<input type="checkbox"/>	Verify that the Load Test Plan is approved and Contractor has a VDOT approved company performing the load testing on the demonstration shaft.
<input type="checkbox"/>	If slurry is proposed; verify that the Slurry Management Plan is approved
<input type="checkbox"/>	Verify that VDOT approved Cross hole Sonic Logging (CSL) Company is on board
<input type="checkbox"/>	Verify equipment approved including use of concrete pump truck and the drilling equipment meets criteria in the DSIP document
<input type="checkbox"/>	Verify workers have required OSHA certification for confined space entry; Contractor has all equipment required for confined space entry on project
<input type="checkbox"/>	Verify Plan for Concrete Placement is approved
<b>Intermediate</b>	
<input type="checkbox"/>	Check that all erosion and sediment controls are installed in accordance with the DSIP and other contract requirements
<input type="checkbox"/>	Verify that the demonstration shaft installed according to the plans and special provisions
<input type="checkbox"/>	Review and observe the contractor's construction methods to confirm that they are following the approved procedures in the DSIP
<input type="checkbox"/>	Drilled shaft superintendent on the project during all drill shaft work activities
<input type="checkbox"/>	Review and inspect the the contractor's construction method log during shaft excavation; Is all required information being recorded on the VDOT Excavation Form?
<input type="checkbox"/>	Observe the Contractor's work to confirm he is using the proper methods for disposal of: spoil excavation, slurry waste, waste concrete, and drilled shaft cutoffs-offs; Is he following the approved procedures for disposal outlined in the DSIP?

- Geotechnical information provided (GDRs, GERs, etc), held up to review during SVP with no approved claims.
- MGRs were valuable and were heavily relied on to define and obtain quality for long term performance.
- Verification that the geotechnical recommendations were incorporated into plans was difficult but Section 2.0 provided the requirement for that action and the QA/QC Plan was the tool used to meet this requirement.
- Requirement for coordination with Geotechnical Engineer and for field visits during construction to confirm conditions and adequacy of design has been valuable including responses to RFIs.

Thank You  
Questions