RECLAMATION

Managing Water in the West

Kingston Generating Facility Flyash Impoundment Failure.

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Bureau of Reclamation

Presentation Outline

- Site History
- Failure Event and Consequences
- Cleanup – Time Critical Removal Action
- Failure Root Cause Analysis
- Failure Modes Analysis for Remainder of the Site
- Dike C Buttress
- Remedial Action - Seismic Retrofit

Kingston Generating Facility

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Site History

Located 30 miles west of Knoxville, Tennesee

Electric power plant built in the 1950's

World's largest coal fired electric plant when built

Produces about 1,200 tons per day of flyash residue

Stores flyash in wet impoundments

Flyash storage evolved over time as original pond filled new ones were developed.

Site Features

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Impoundment Failure

December 22, 2008

Failure occurred after midnight

5.4 million cubic yards of flyash were released

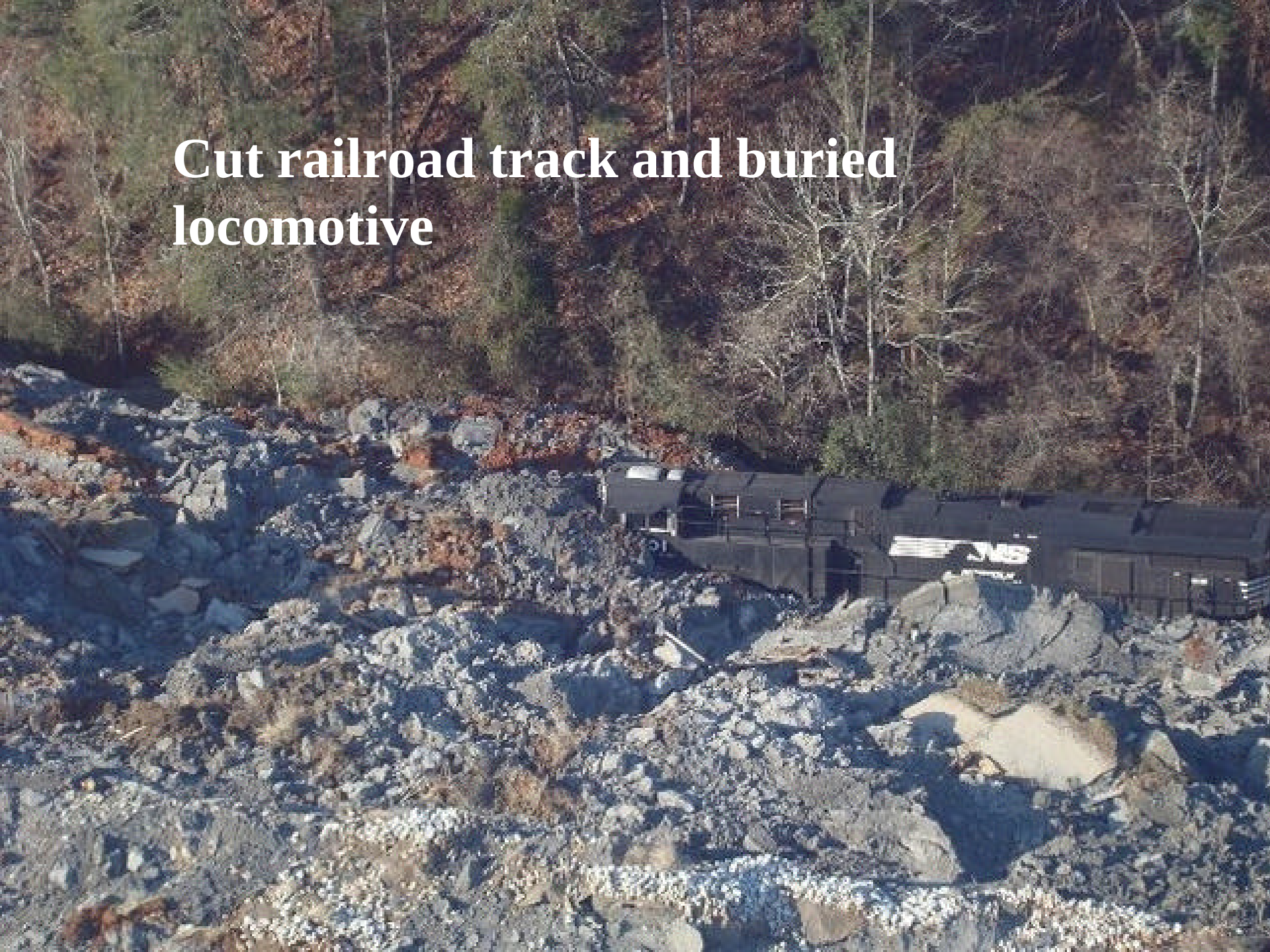
300 acres of land and water covered in ash

Response started after alert given by telephone call to 911 from a man trapped in home

Everyone responded


FILLS IN
SWAN POND
SLOUGH
FILLS IN
EMORY RIVER
WEST SLOUGH
EMPTIES INTO
EMORY RIVER
MAIN CHANNEL

TVA purchased over 100 properties for about $65 million.


Cut railroad track and buried locomotive

Road, power line, water and sewer lines disrupted.

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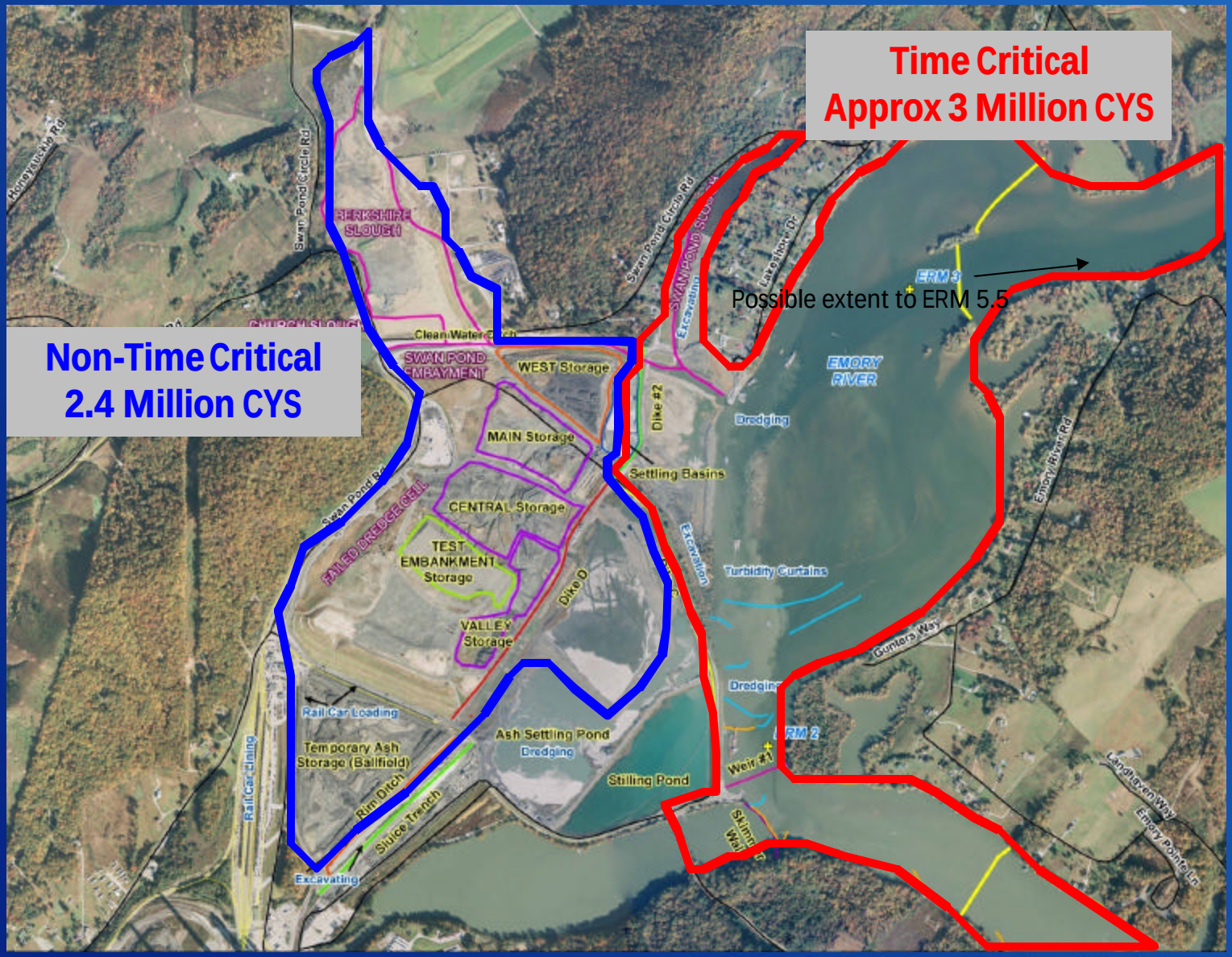
Cleanup Time Critical Removal Action



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Cleanup

Removing ash using excavators and dredges

Up to 22,000 cubic yards per day removed

Shipping 8,000 tons per day by rail to Alabama

Estimated cost $800 million to cleanup

Largest industrial spill in the United States


KOBELCO
VOLVO
28
KOMATSU
27


KOMATSU
PC
600
LC


03/20/2010


CAT


03/19/2010

Failure Root Cause Analysis

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Cell Configuration 4/5/2005

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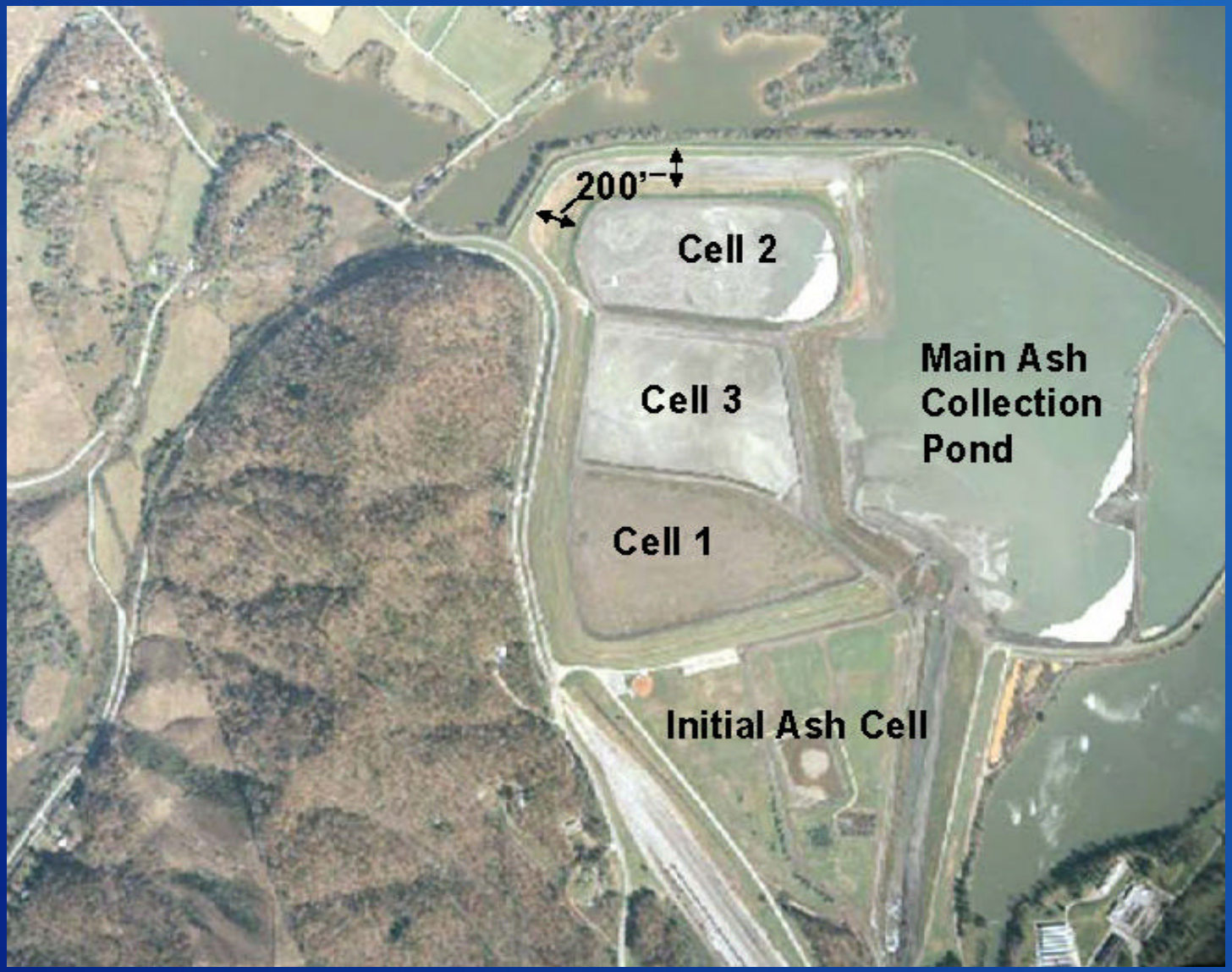
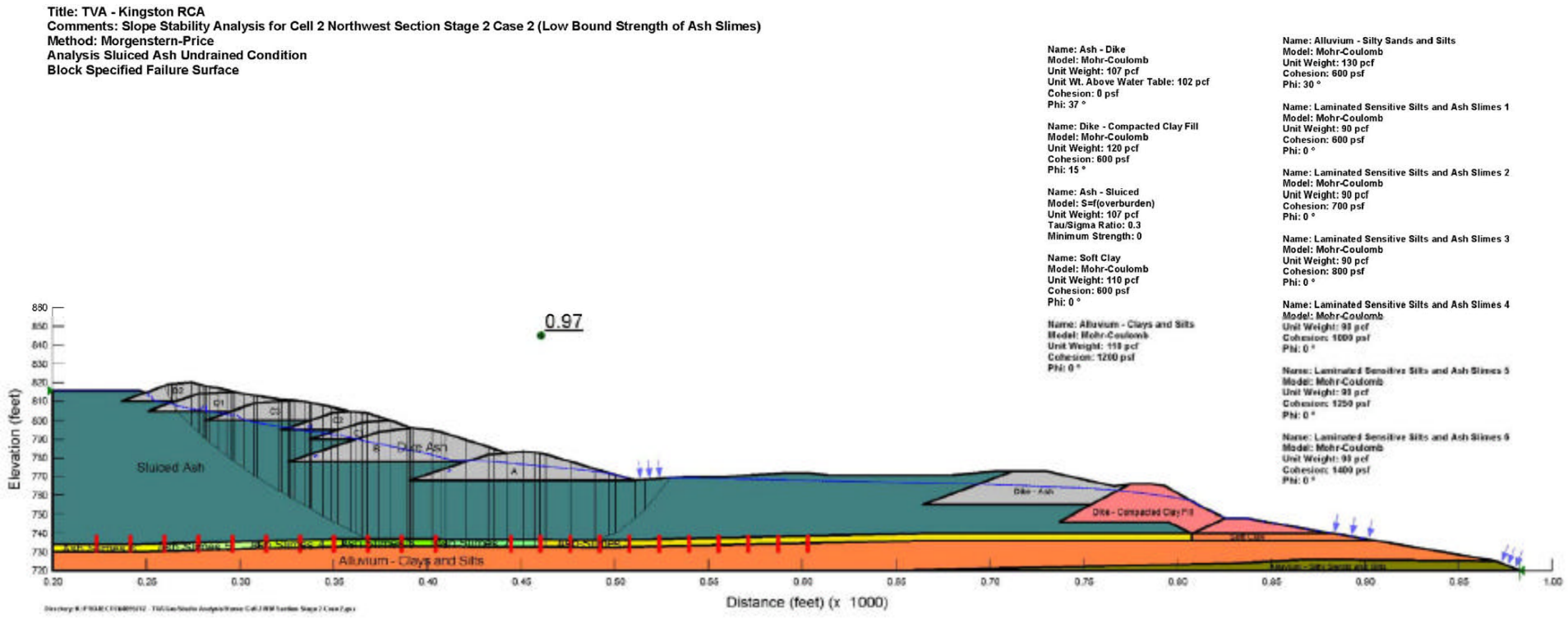
Cell Configuration 11/3/1996



Failure Root Cause Analysis



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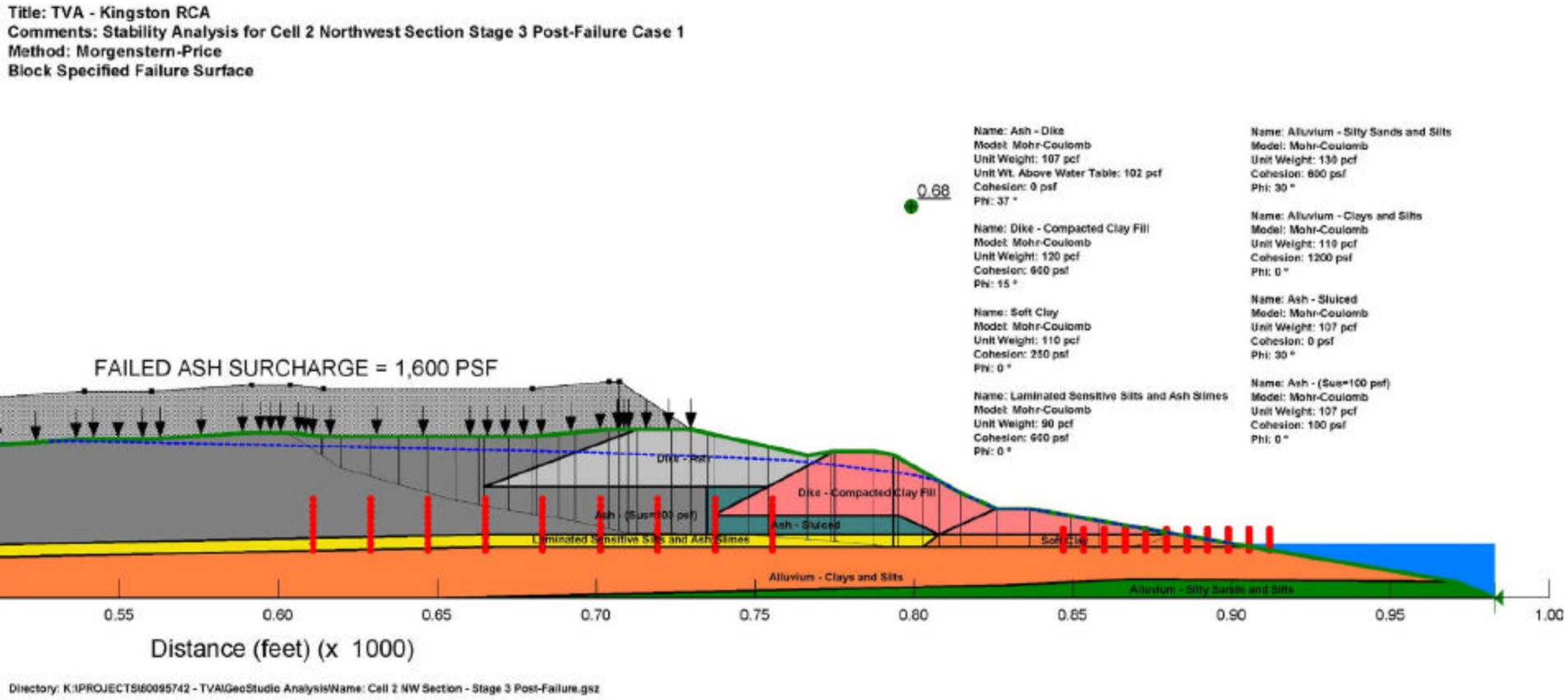
Failure Root Cause Analysis



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Failure Modes Analysis for Remainder of the Site

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Dike C Buttress

TVA management review concerning failure concluded that TVA needs to change from a reactive manager of problems to a proactive manager who anticipates problems and takes action to reduce risks.

Management wanted to act now!

Consultants said cut down the trees.

Reclamation said no, its too risky. Rich Kramer (consultant to State of TN also said no)

Dike C Buttress

TVA pressed for limited tree removal in one area

Reclamation allowed it with controls:

1. **Must have at least one truck load of road base (mixture of silt, sand , gravel) stockpiled at dike.**
2. **Stantec engineer present to observe the work.**
3. **Install road base material in the stump holes.**
4. **Place road base over any seeps that occur.**
5. **Locate and monitor seeps.**

Dike C Buttress

Seeps showed up at several of the tree holes.

We required daily inspections of each seep.

They finally got serious about doing the failure modes analysis we had been asking for. Two months later:

Dike C slope stability Factors of Safety as low as 1.16

Dike C seepage heave Factors of Safety as low as 1.4

Seismic analysis not done but looking bad.

Later admitted that seismic failure is likely due to weak sand underneath the 10 feet of clay foundation.

Dike C Buttress

TVA management then wanted Dike C fixed in 2 months time.

It took that long to design the buttress which is filter sand, fine gravel, coarse gravel, and riprap.

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Dike C Buttress

Dike C Buttress First Panel


01/22/2010

Remedial Action - Seismic Retrofit

The failed cell will be converted to a landfill.

Plant will be modified to stop wet removal of ash.

Dry ash will be produced which is a saleable product

Nationwide about 45% of flyash is sold for use in concrete and other purposes.

Questions