Development of a Compacted Cover System to Minimize Net Percolation and Selenium Transport

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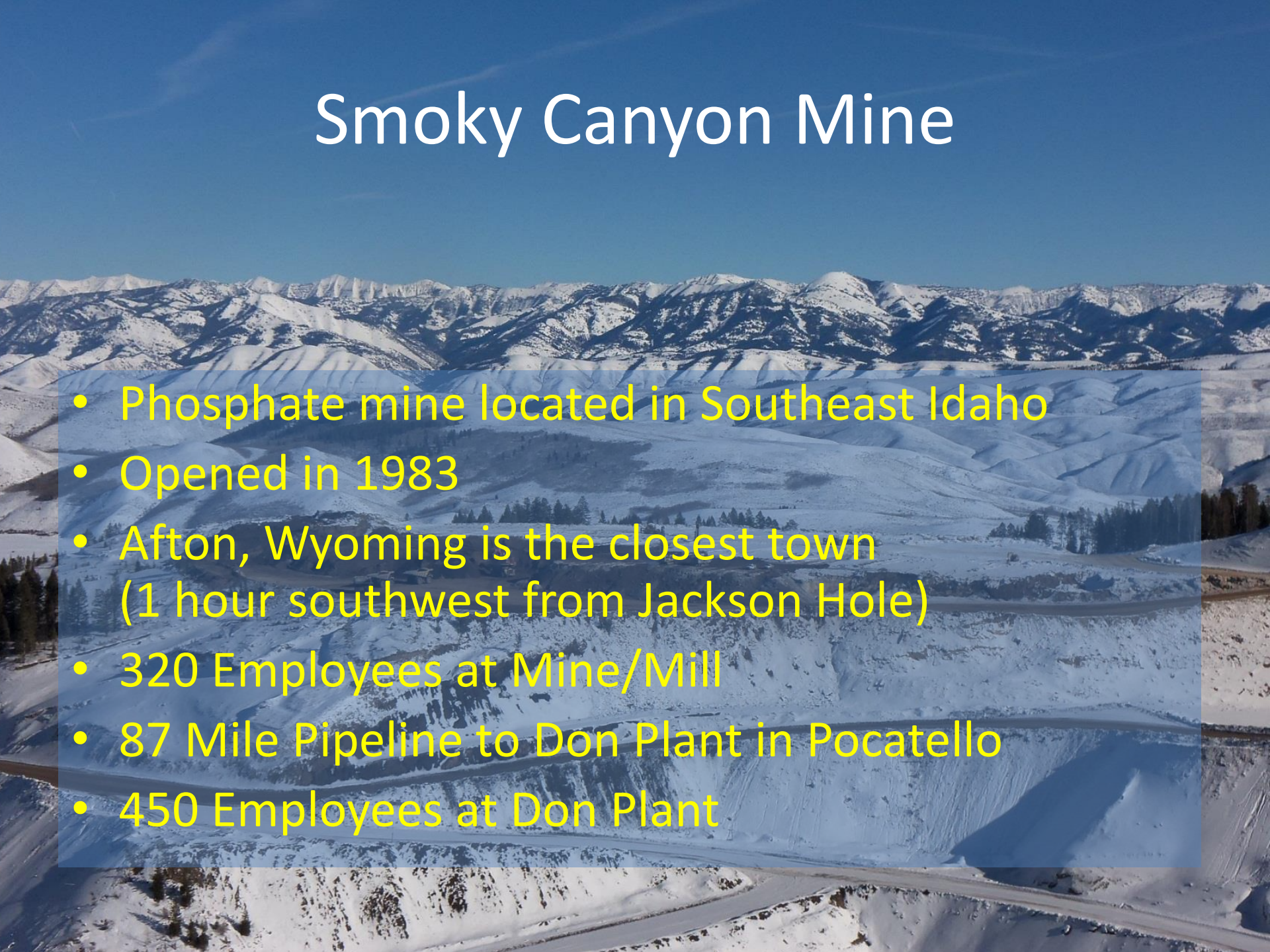
Smoky Canyon Phosphate Resources

Presentation Outline

- Smoky Canyon Mine Background
- Deep Dinwoody Cover System Design
- Compaction Field Testing
- Cover System Study Area Construction

Smoky Canyon Mine



- Phosphate mine located in Southeast Idaho
- Opened in 1983
- Afton, Wyoming is the closest town (1 hour southwest from Jackson Hole)
- 320 Employees at Mine/Mill
- 87 Mile Pipeline to Don Plant in Pocatello
- 450 Employees at Don Plant

Smoky Canyon Mine

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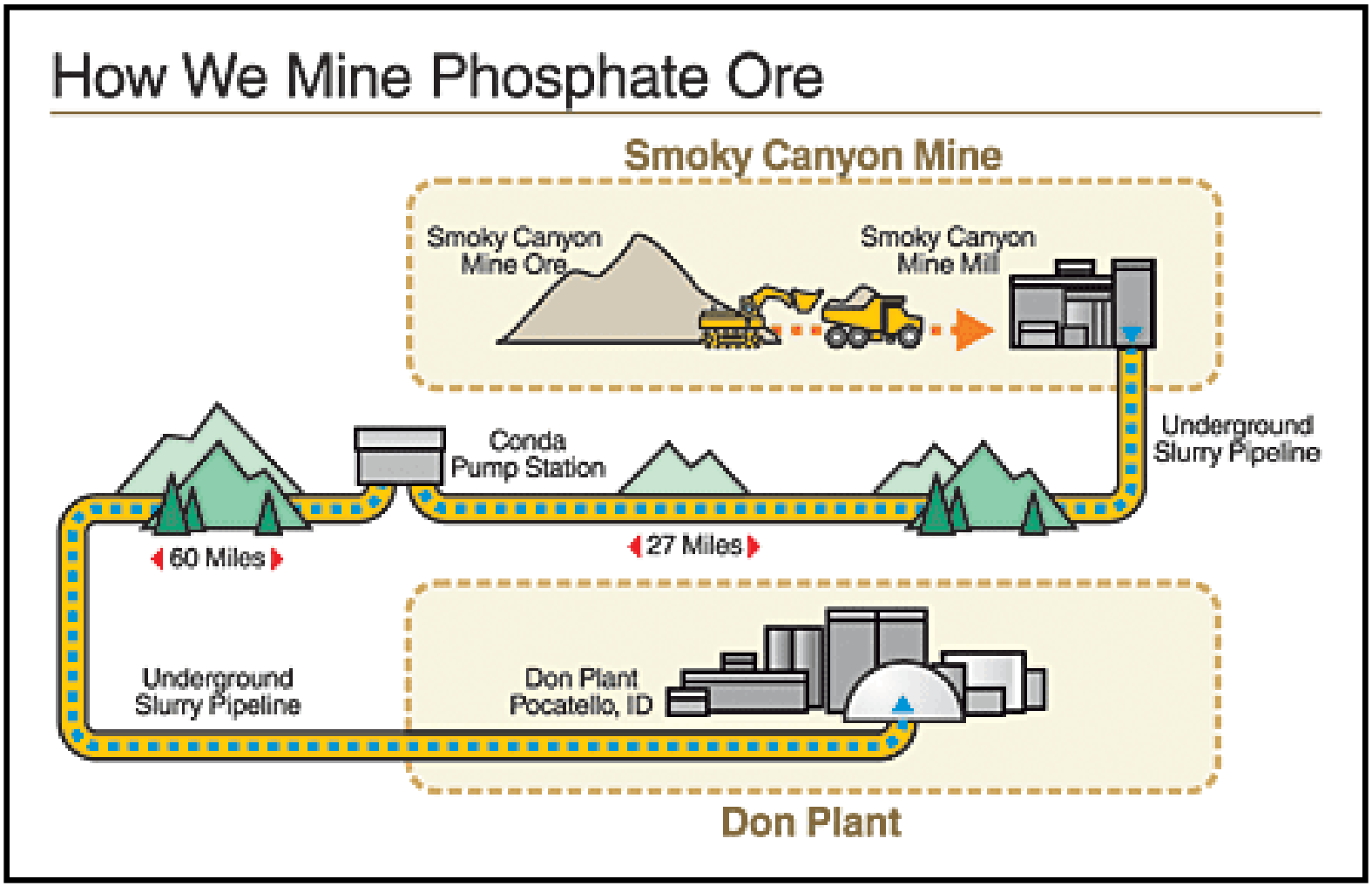
Smoky Canyon Mine



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Smoky Canyon Mine

- +/- 3 MT of Ore mined per year
- 9:1 Strip Ratio (tons:tons)
- 8 Mile Ore Haul (will be 16 soon)
- Current Operations, Future Permitting, CERCLA Site all in one!

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Mill/ Shop

Pole Canyon

Sage Creek

South Fork
Sage Creek

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We have some Critical Environmental Issues

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Deep Dinwoody Cover System

→ **Required by Record of Decision to minimize water infiltrating, picking up Selenium in waste dumps, and increasing concentrations of Selenium in Springs.**

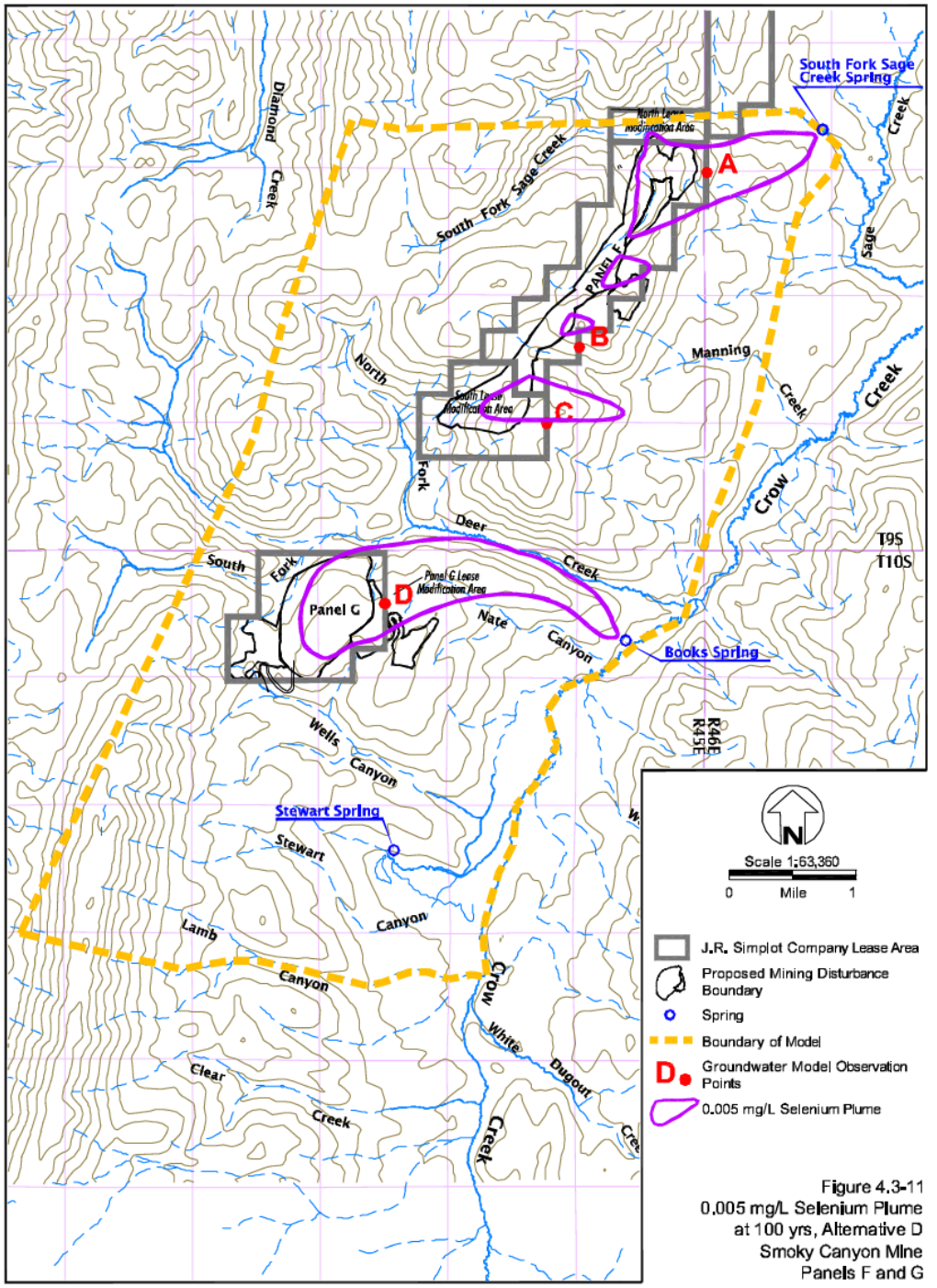

Figure 4.3-11
0.005 mg/L Selenium Plume
at 100 yrs, Alternative D
Smoky Canyon Mine
Panels F and G

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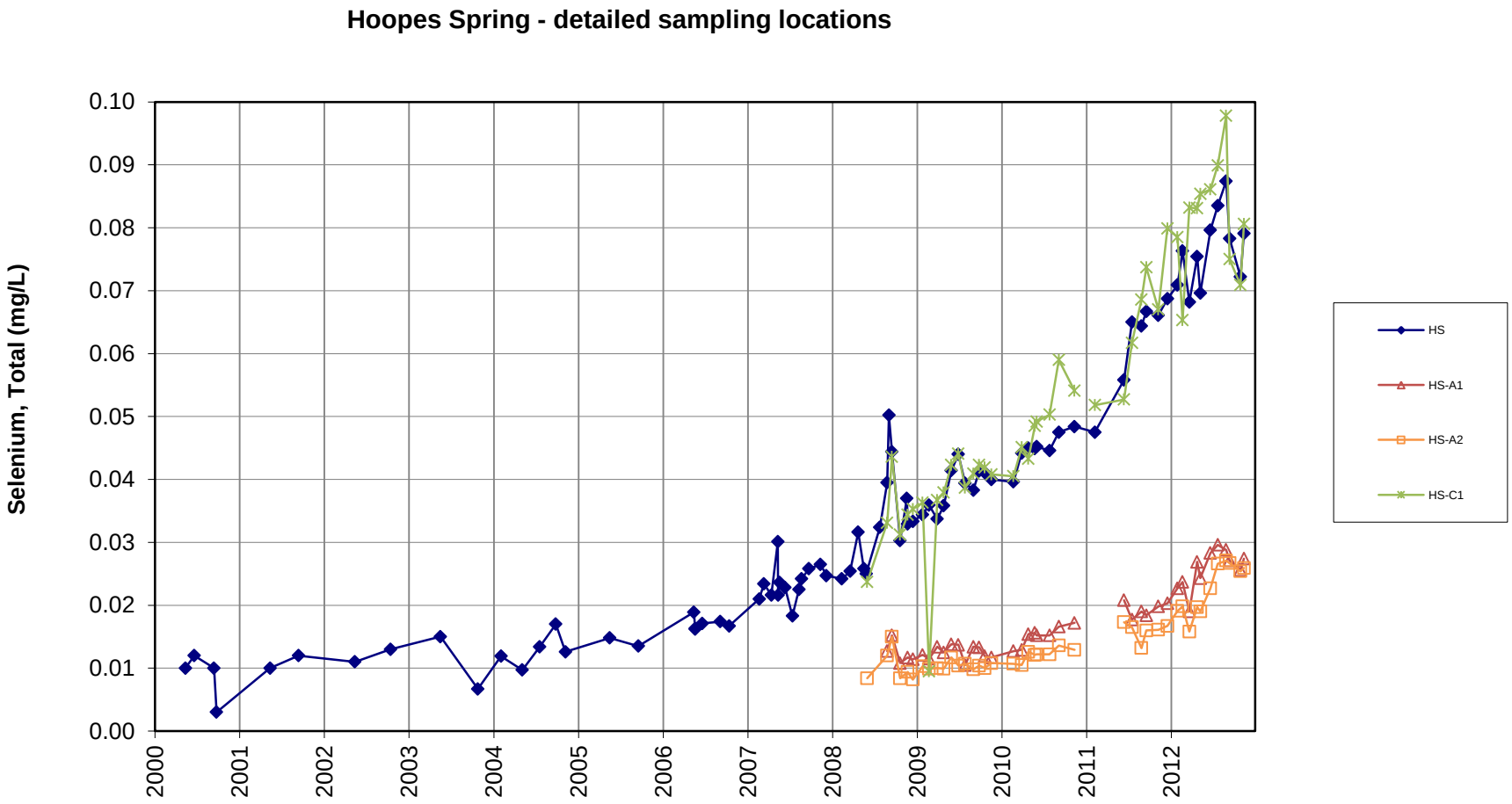
Why is this Deep Dinwoody Cap So Important?



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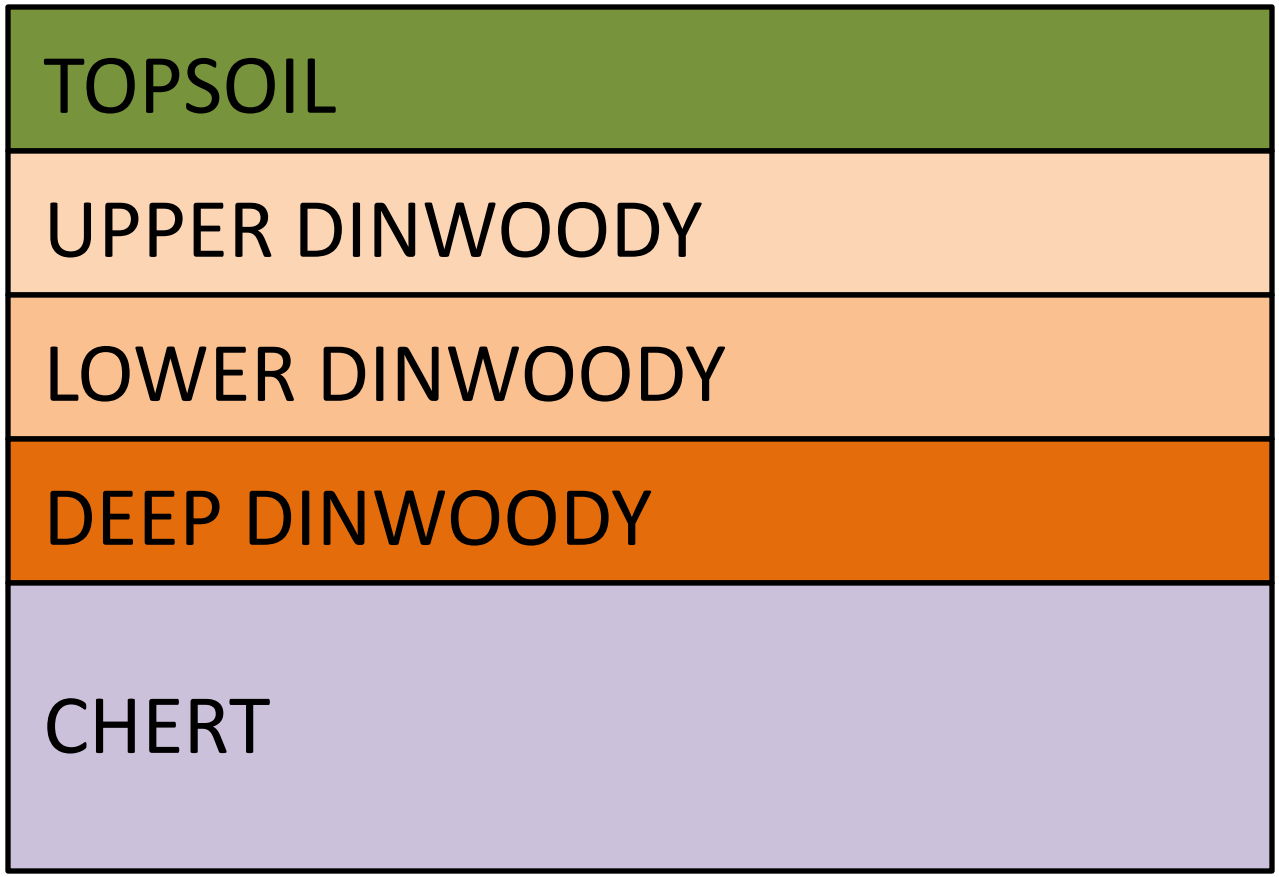
Deep Dinwoody Cover System Design



Deep Dinwoody Cover System Design

- Average NP of less than 1 inch/yr predicted
- Deep Dinwoody cover system approved
  - Performance to be demonstrated
- Dinwoody to be installed with an average ksat of $1x10^{-6}$ cm/s or less

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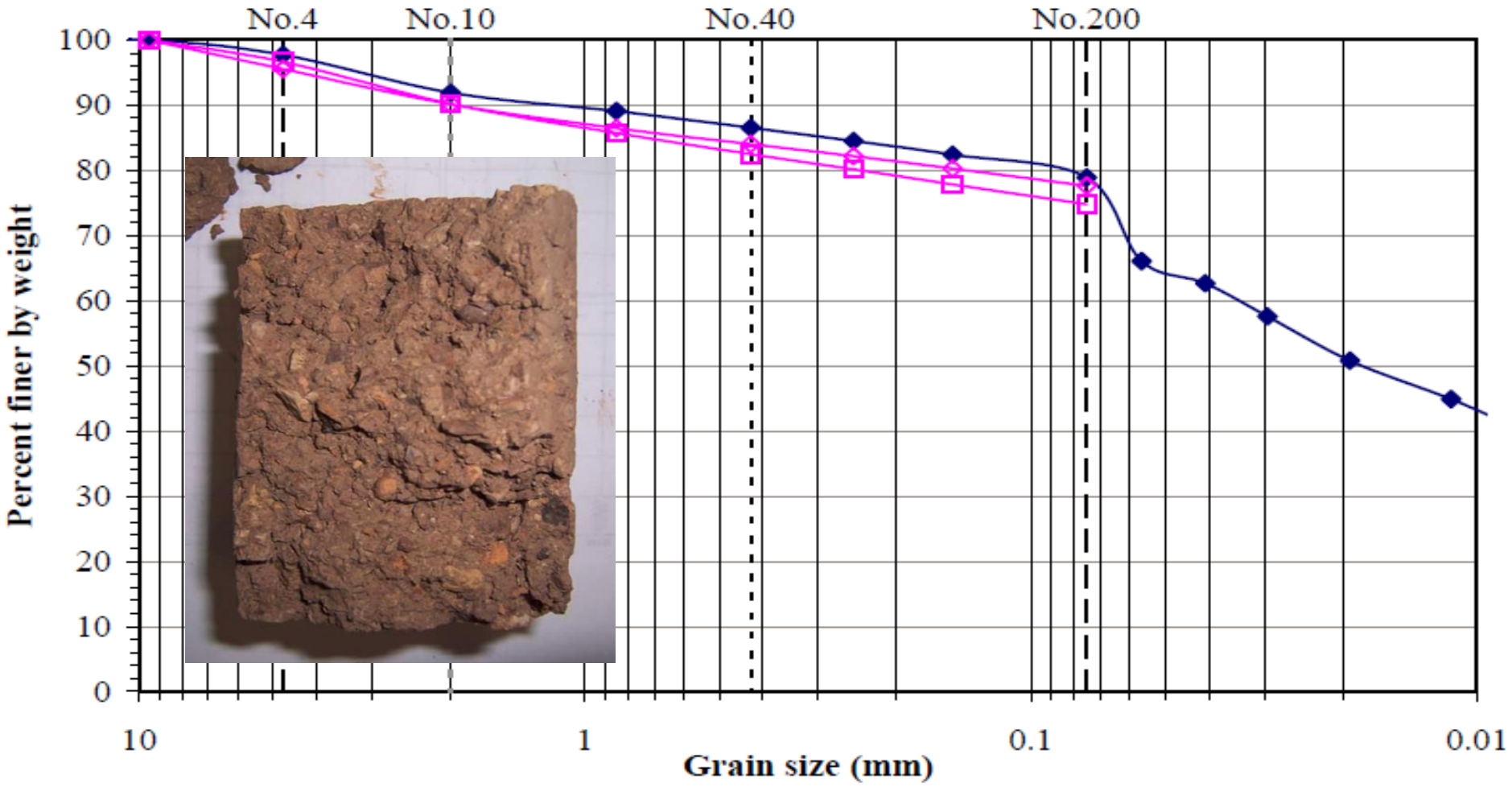
Dinwoody Cover Material



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Deep Dinwoody Cover System Design

- Vadose/W Model
- 100 year weather database
- Net Percolation based on hydrogeology and contaminant transport
- Dinwoody → Deep Dinwoody

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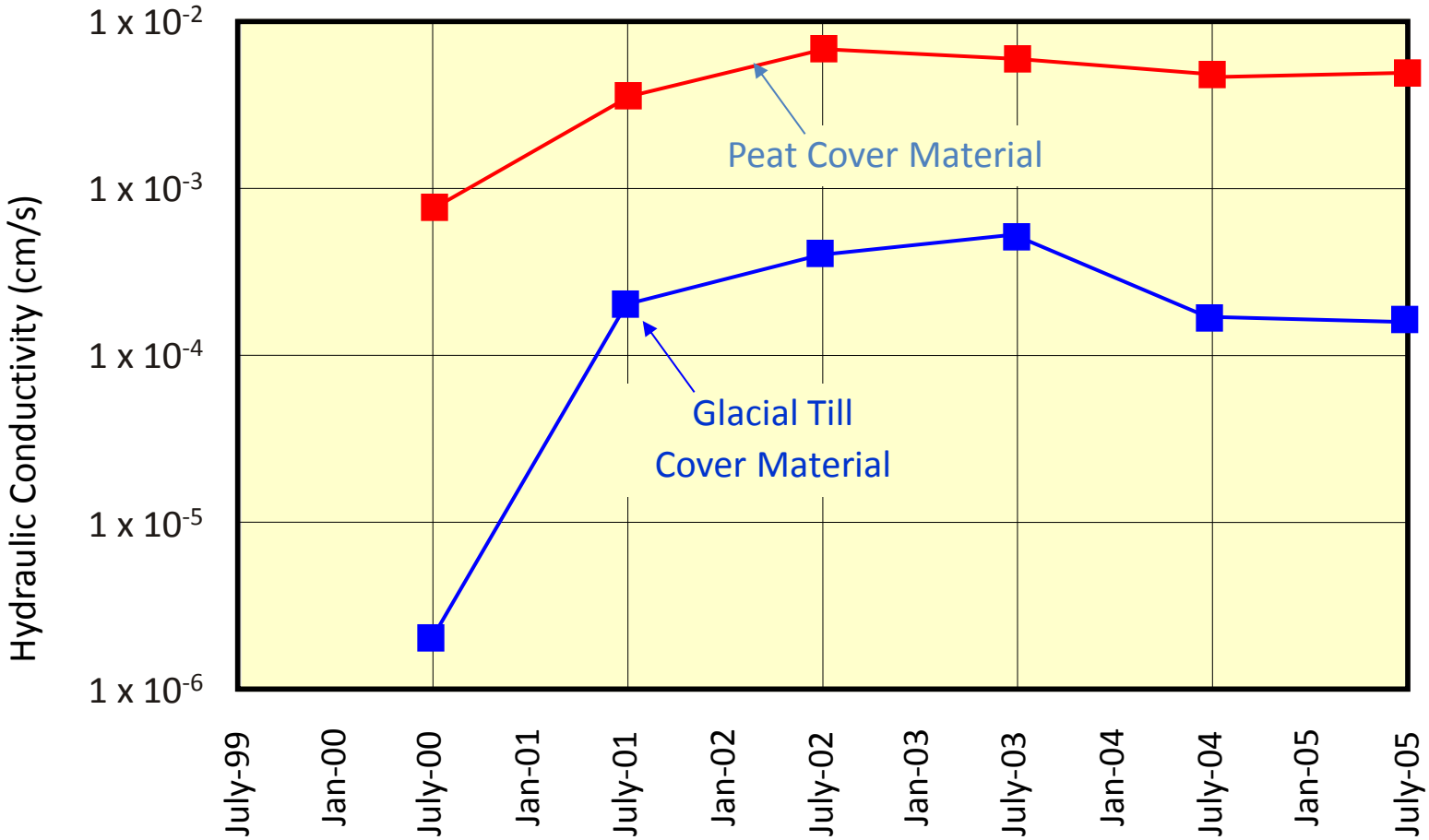
Field Properties: Change in k_{fs}

Hydraulic Conductivity – Cover Material



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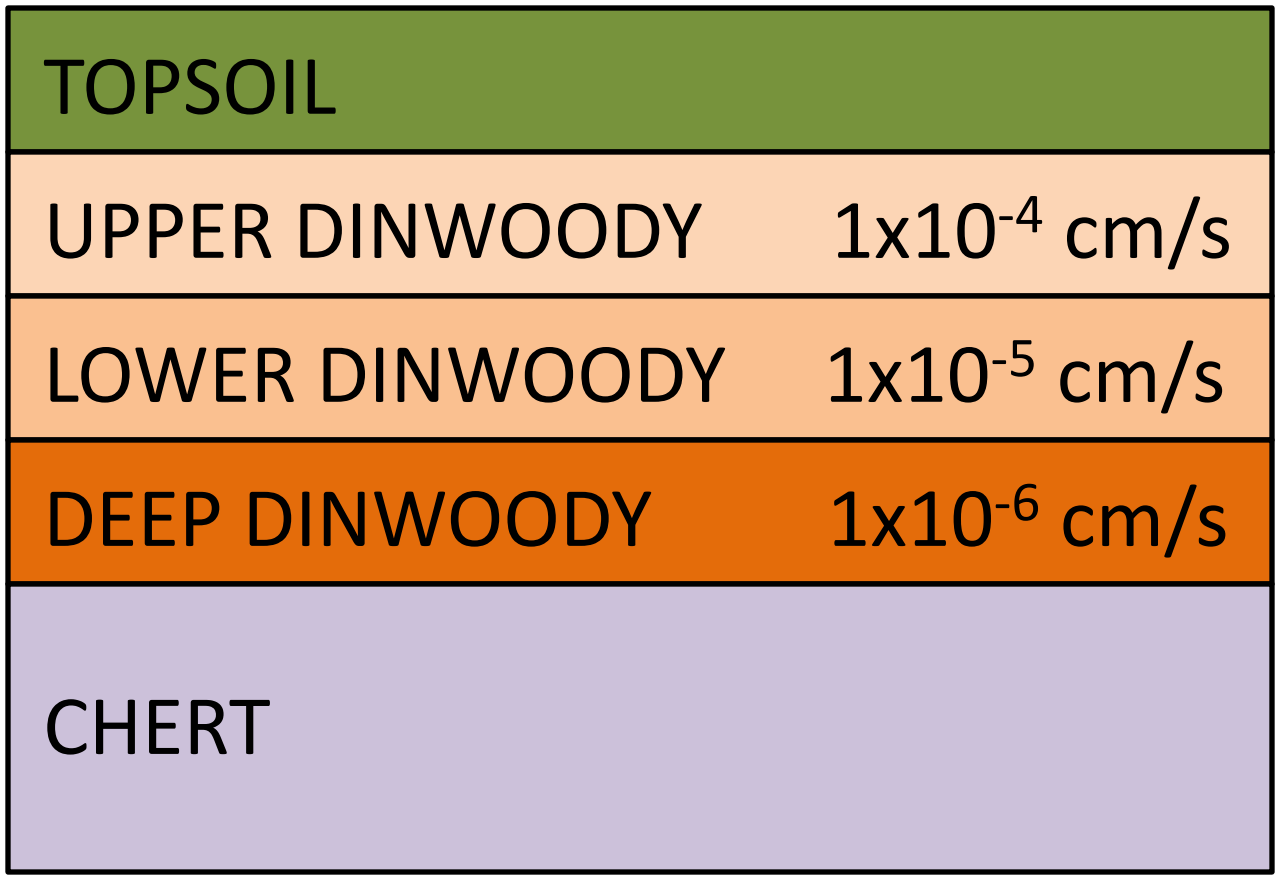
Deep Dinwoody Cover System Design

- Dinwoody lifts evolve with time.



Field Trials

- Mining showed complexities of Dinwoody material

Field Trials

- Coarse rock difficult to identify
- Bottom Dinwoody unweathered and blocky

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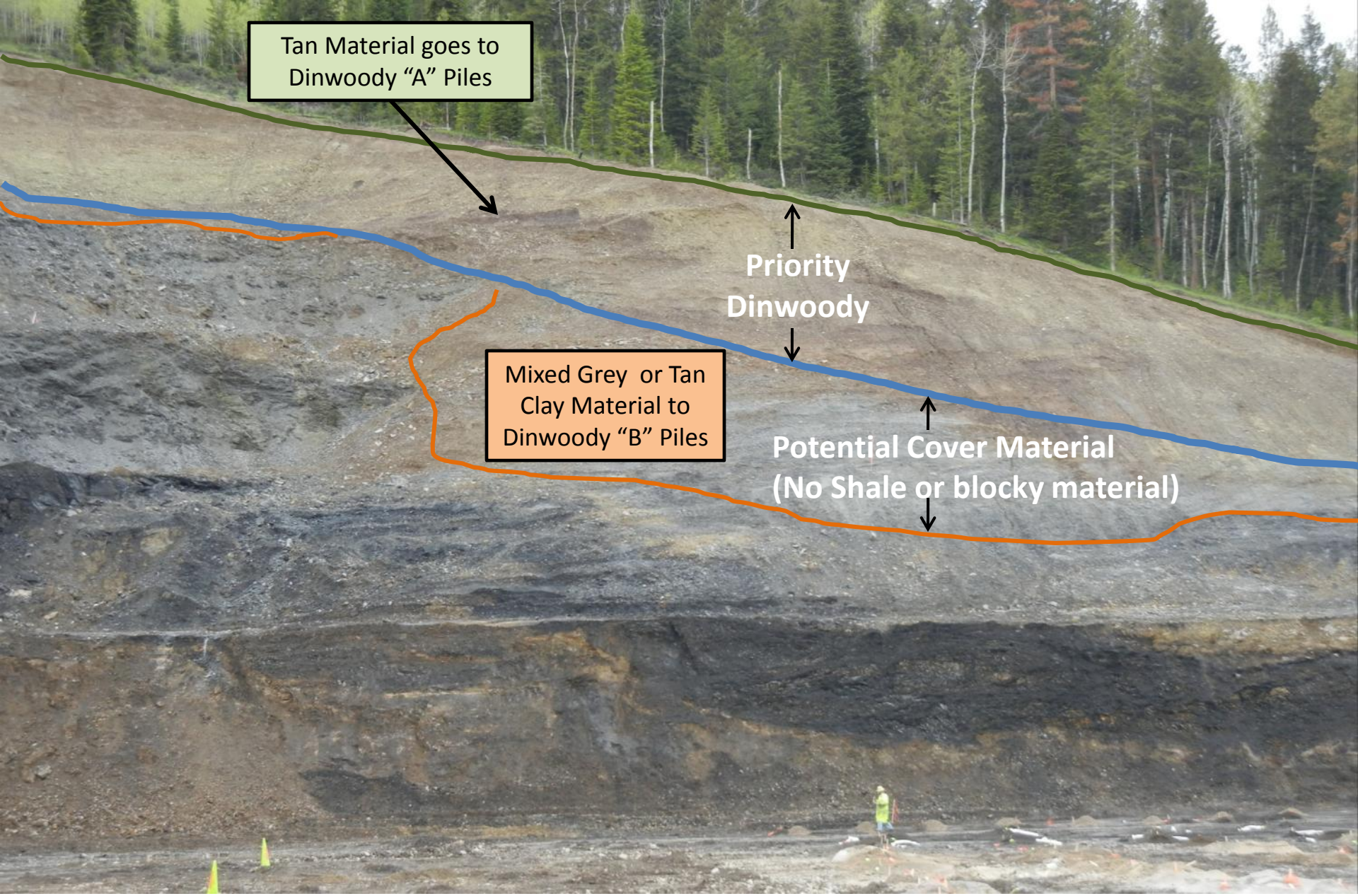

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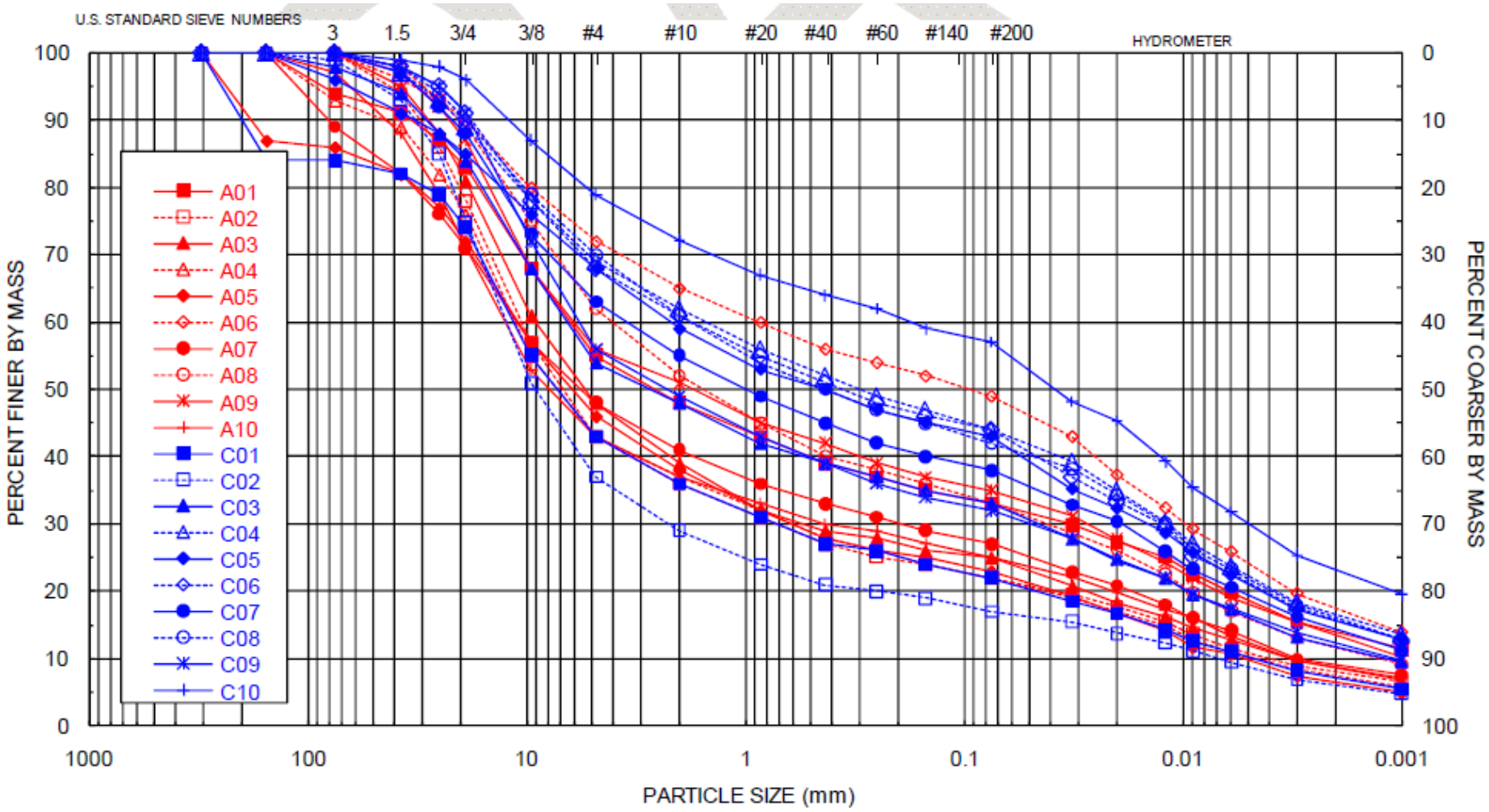
Field Trials

- Compaction methods: scraper, sheepsfoot, pneumatic roller



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY			
		Coarse	Fine	Coarse	Medium	Fine				
USDA	COBBLES	GRAVEL		SAND				SILT	CLAY	
				Very coarse	Coarse	Medium	Fine	Very fine		

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Field Trials

- Attempt to discover surrogate test
- PSD, Atterberg, borehole permeameter, density
- Material selection, compaction method, BP confirmation


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Field Trials

- Pneumatic roller, 4 passes chosen.
  - Geometric mean
    $K_{sat} = 5x10^{-7}$ cm/s

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Borehole Permeameters

Borehole Permeameters

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Field Construction

- Stockpiled moisture content satisfactory
- Moisture conditioning is slow

Construction QC

- Visual inspection
- Atterberg
- Moisture content (5/ac)
- Density (5/ac)
- PSD (1/ac)
- Borehole permeameter (1/ac)
- Survey Controls (5/ac)

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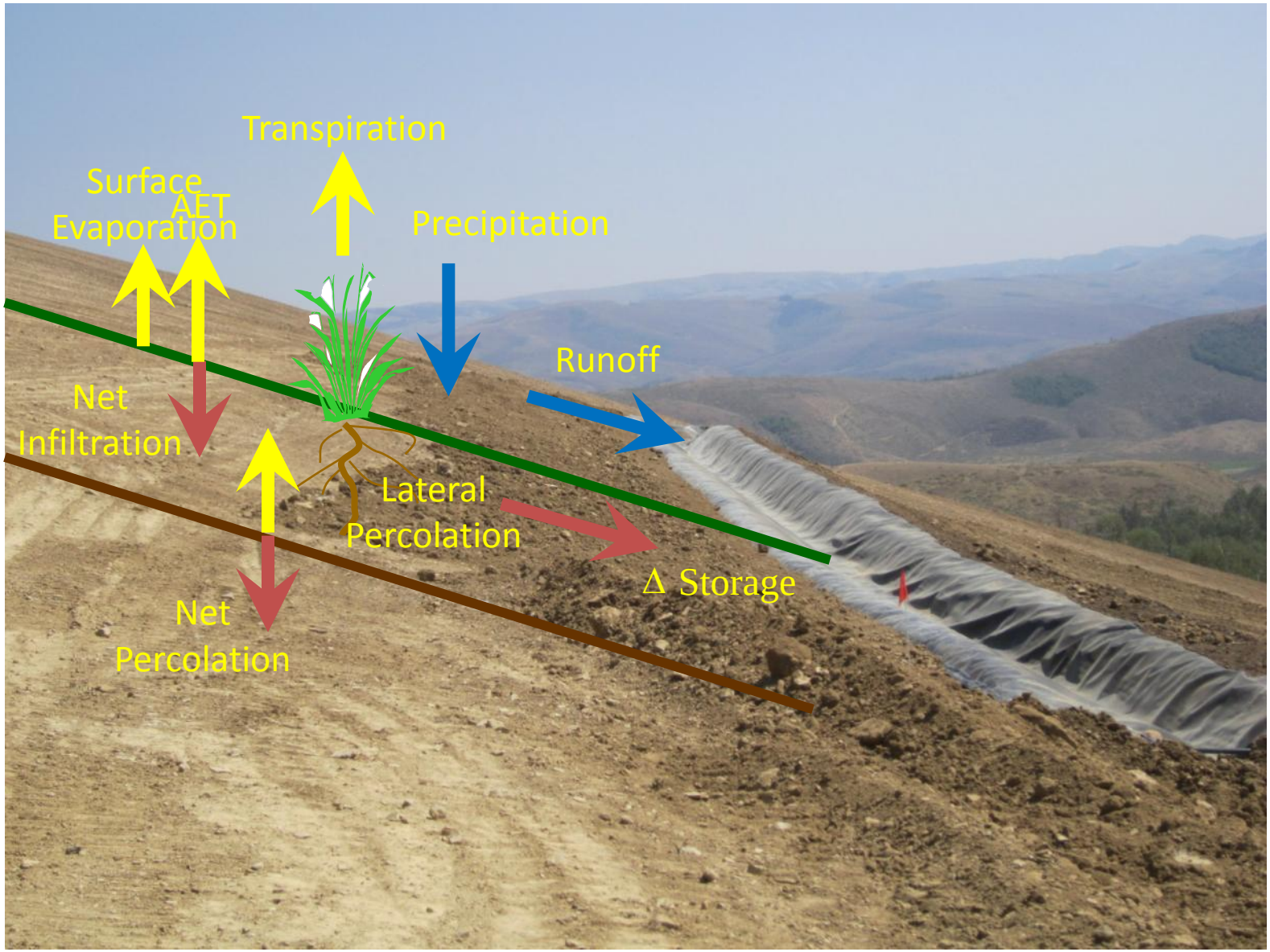
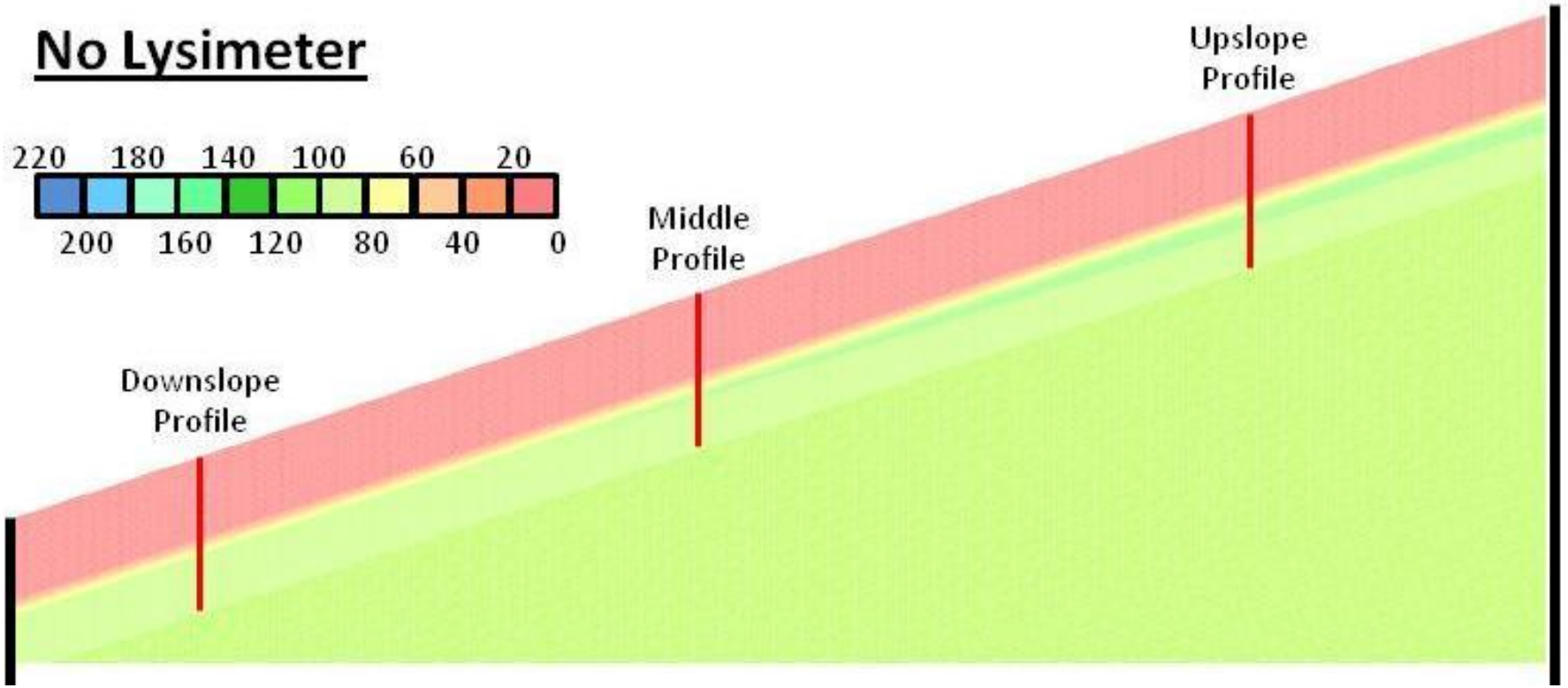
Water Balance



Lysimeter Areal Extent

- Small areal extent of lysimeter (e.g. ~ 0.3m): expect high variability
- Increase number of lysimeters: better understanding of variability
- Increase areal extent (e.g. ~ 2.5m irrigation tank): reduced variability
- Increase areal extent further: “capture” spatial variability
  - Full-scale cover construction equipment
  - Obtain “bulk” net percolation rate
  - Site-specific as to whether spatial variability captured
  - In general, a qualitative assessment of where we are “comfortable”

Lysimeter Design



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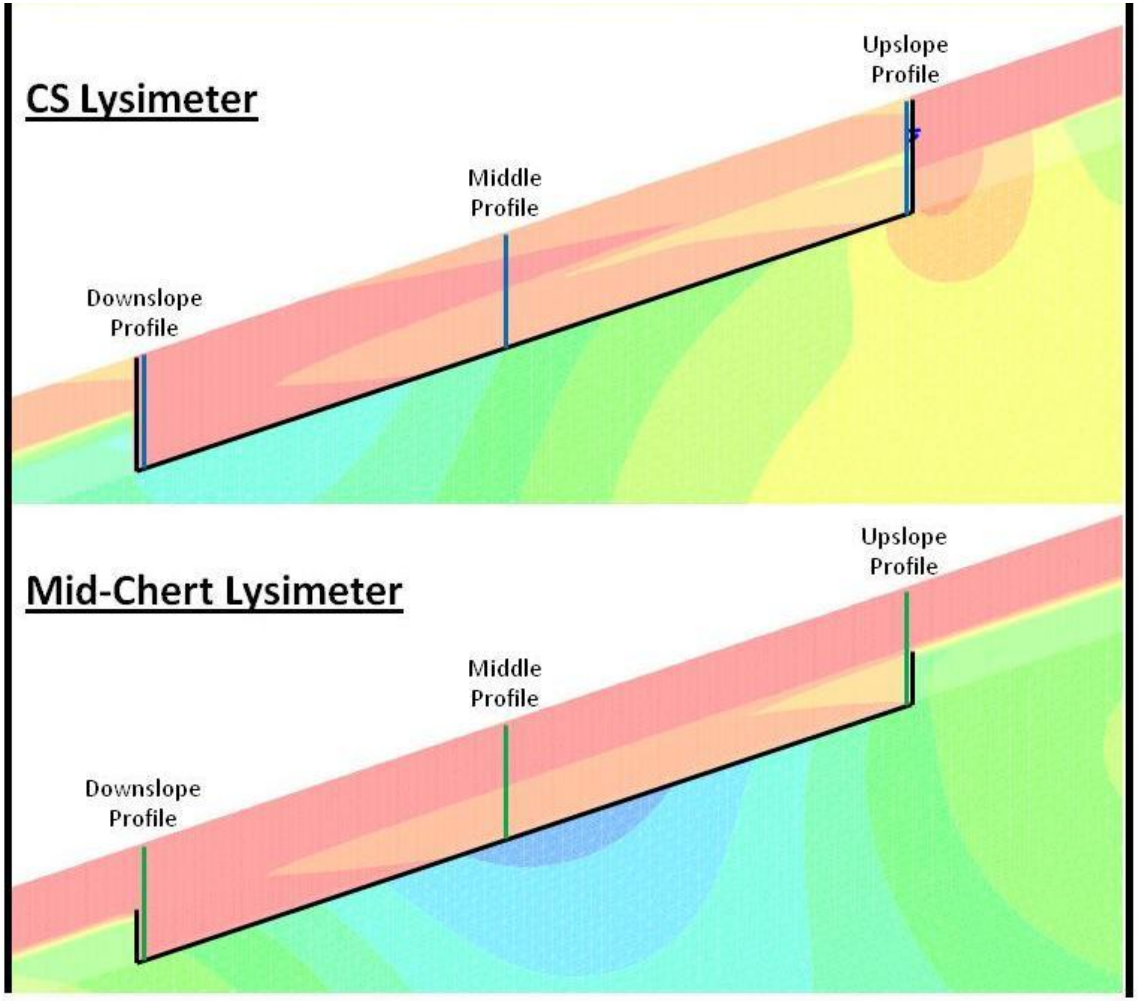
Lysimeter Design



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Performance Demonstration

- Photo of Interflow collections

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Summary

- Deep Dinwoody cover system designed to minimize net percolation
- Field trials were vital to developing experience and Construction QA/QC standards
- Demonstration site in first year of performance demonstration

Thank you

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