

Coal Mine Remediation Methods, Closure Technologies

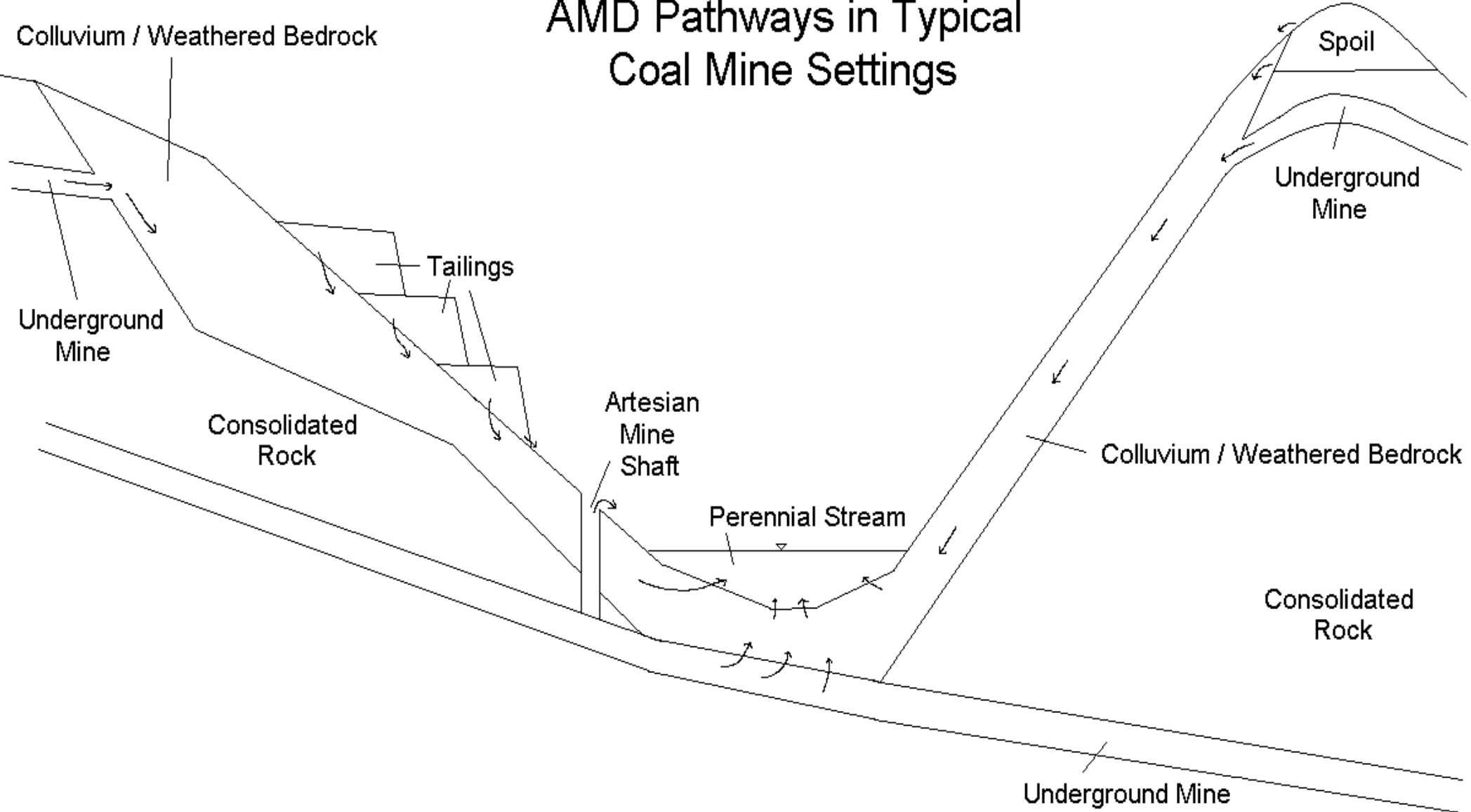
Paul F. Ziemkiewicz, Ph.D.

Director

National Mine Land Reclamation Center

West Virginia University

AMD Pathways in Typical Coal Mine Settings



Treatment Methods

- Direct acid neutralization methods
- Indirect treatment
- Engineered barriers/covers







Coal Refuse

Kempston Glider

Remnant of Special
State Minerals

Abandoned Temple

Art. Deep
Vertical Shaft

Industrial/Residential Waste

North Branch Potomac River

Georges Creek Stream Sealing Project



Ocean Coal Refuse Stabilization Project



Vindex Coal Waste Stabilization Project



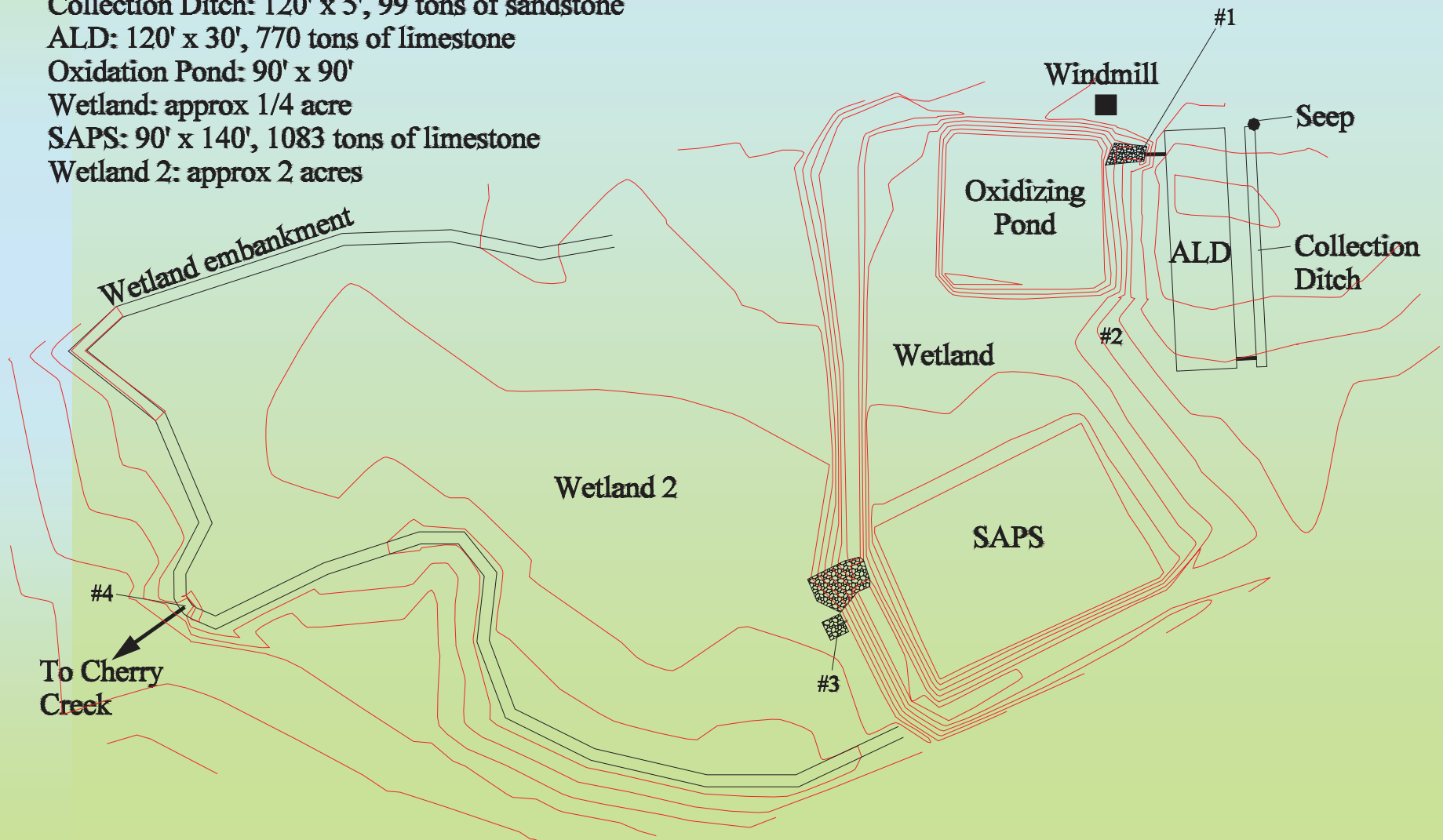


Glotfelty - Before Reclamation



Glutfelty Reclamation Plan

Collection Ditch: 120' x 5', 99 tons of sandstone
ALD: 120' x 30', 770 tons of limestone
Oxidation Pond: 90' x 90'
Wetland: approx 1/4 acre
SAPS: 90' x 140', 1083 tons of limestone
Wetland 2: approx 2 acres



- Water Quality Sample Location



Post-Construction



Constructed Wetland, Alabama



Open Limestone Channel



Freshwater Limestone Leach bed



Results of Limestone Leach beds

pH was 4.2; now 7.1

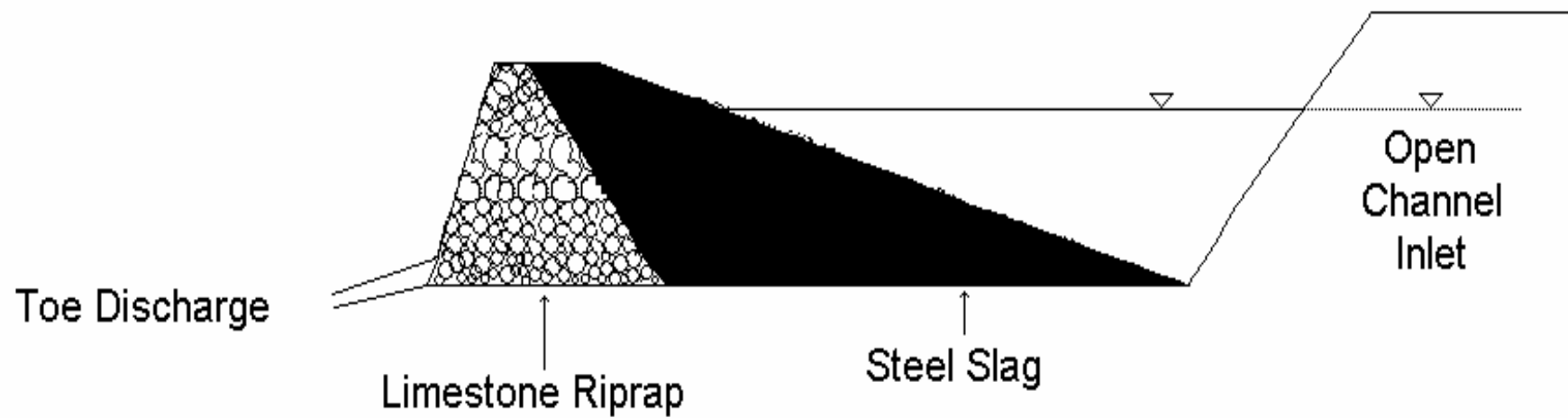


Steel Slag



Steel Slag Leach Bed

Conditions: No Iron, Aluminum or Manganese



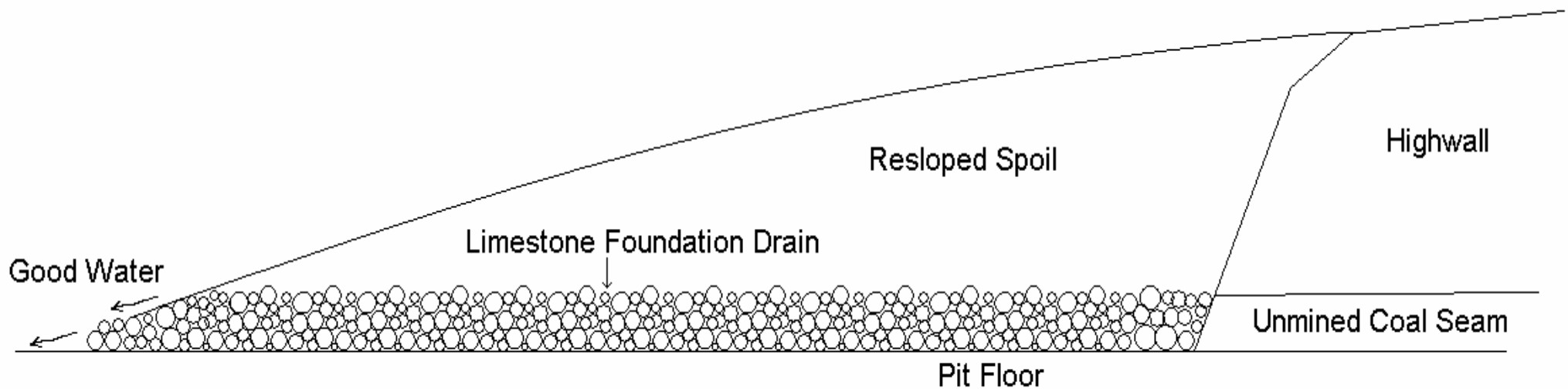
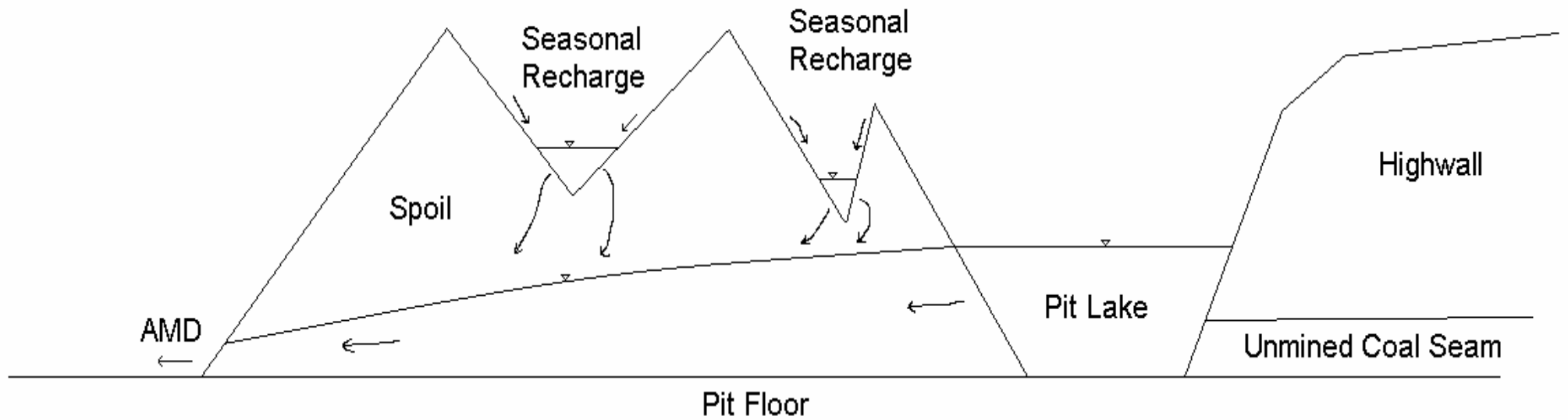
Steel Slag Leachbed at McCarty Highwall site



Weir 11 discharge on Casselman River, 1995



Effect of Reclamation on AMD Formation



Limestone Foundation Drain



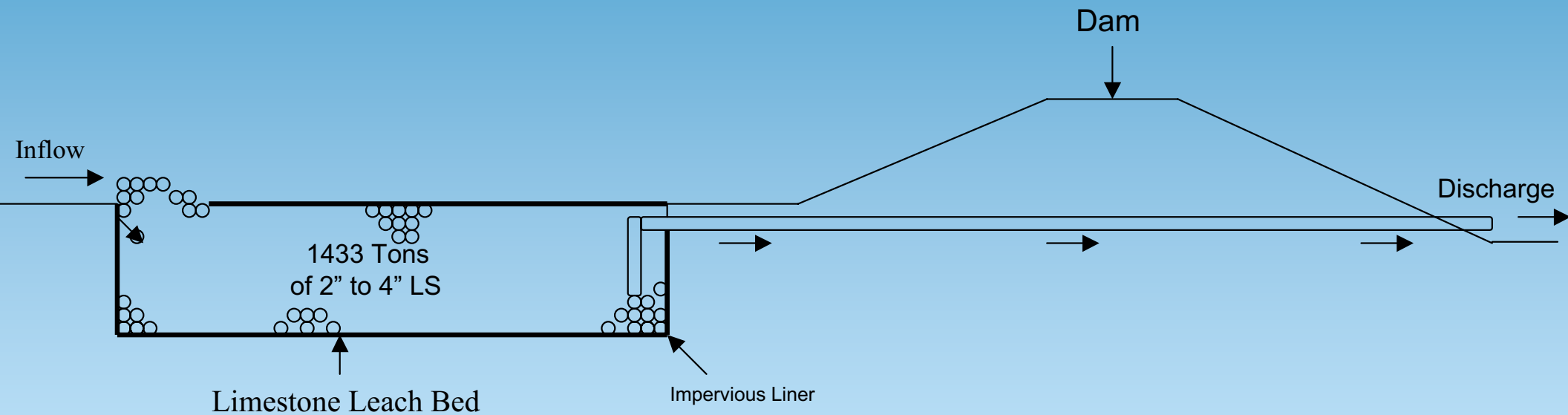
Weir 11 discharge, 1996



Limestone Leachbed Acmar, AL Site Prior to Reclamation



Diagram of Treatment System at Acmar, AL Limestone Leach Bed



Acmar Internal Leachbed



Catchment pond below steel slag capped refuse pile in compliance



Steel Slag cap on Refuse Pile

Soil



Steel slag

Refuse

Pit Floor and Highwall Barrier – FBC Ash



FBC Ash being delivered to pit floor



Lime Dosers



Boxholm



Pumpkonsult



Aquafix

Return of Life



TREE SURVIVAL ON A MOUNTAINTOP SURFACE MINE IN WEST VIRGINIA



Samples Mine Complex





Second Year Growth, Samples Mine

Acid Lake: Gorbi Mine, Singrauli, U.P.

