

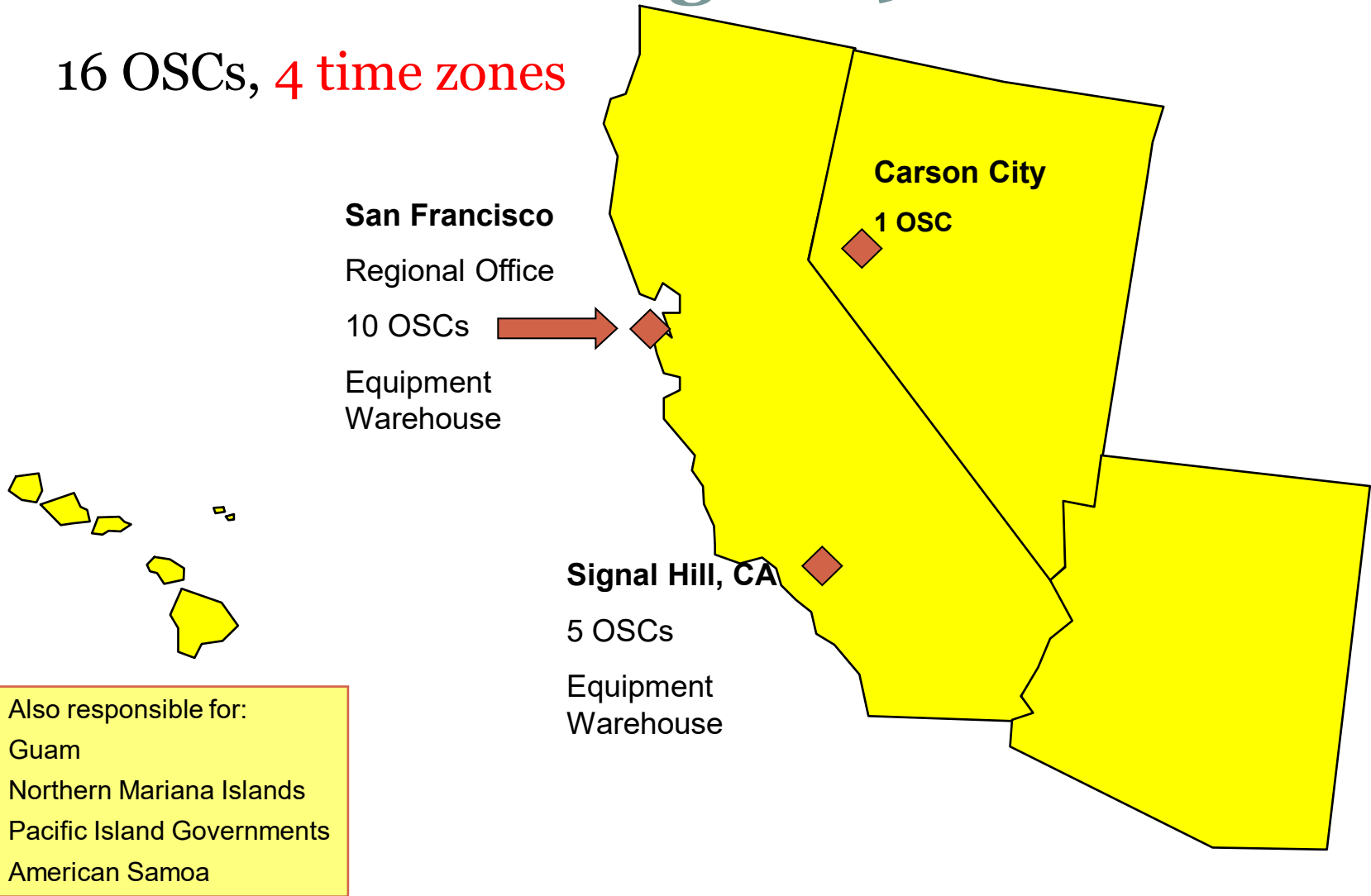
EPA Region 9 and Use of Biosolids for Contaminated Soils Management

PACIFIC SOUTHWEST REGION
SUPERFUND DIVISION
EMERGENCY RESPONSE PREPAREDNESS
AND PREVENTION BRANCH



Emergency Response-Removal in Region 9

16 OSCs, 4 time zones



Why we need contam. soils management skills?



- Estimated 3rd of our work is on contaminated soils sites.
- Highest cost sites to remediate – often other agencies and stakeholders request assistance.
- Often high toxicity and direct exposure – commonly residential sites.
- Interventions should preserve water quality – on-site techniques allay monetary and environmental costs.

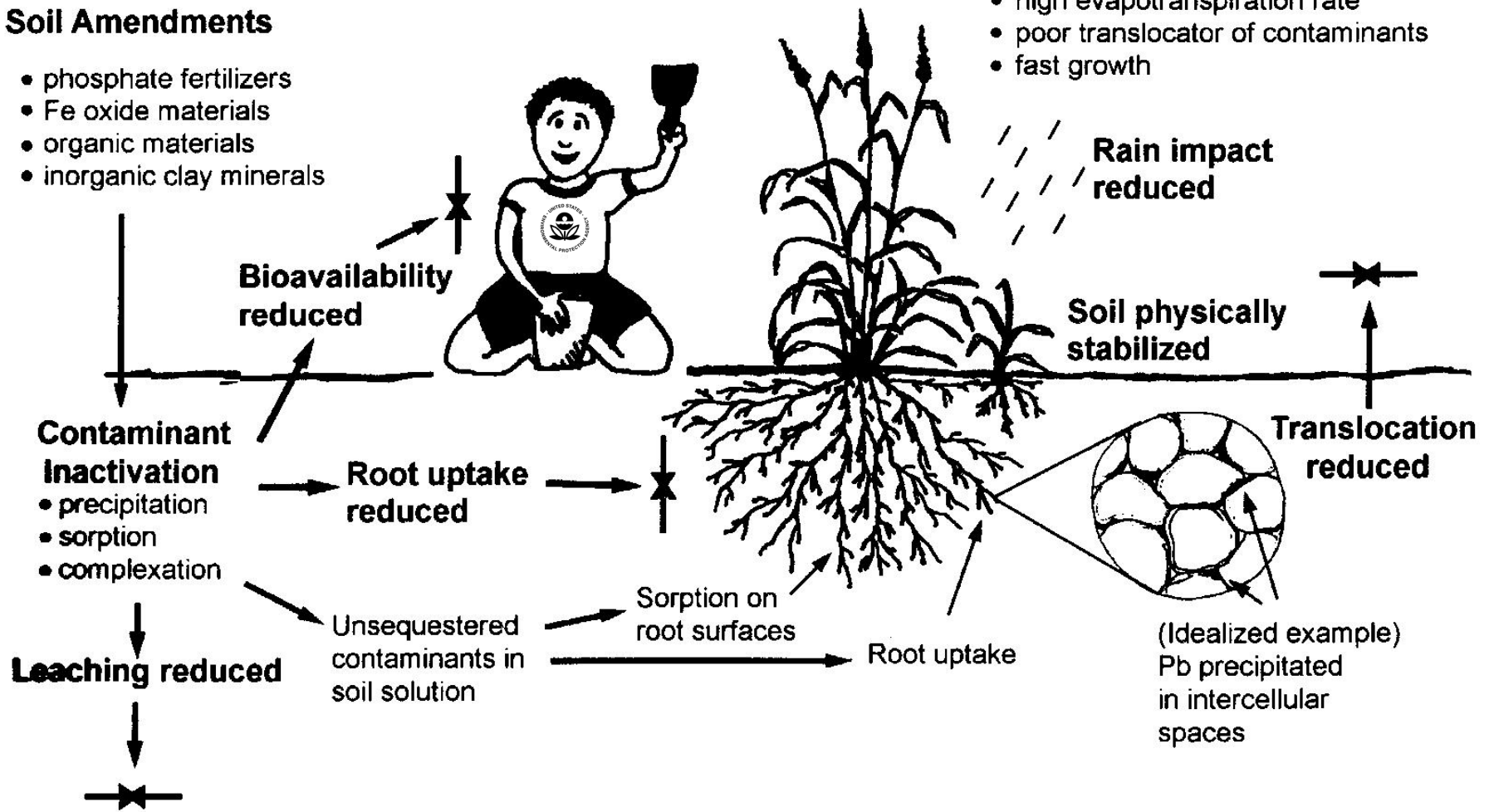
Superfund Perspective

Plant Characteristics

- quick and easy establishment
- excellent soil cover
- high evapotranspiration rate
- poor translocator of contaminants
- fast growth

Soil Amendments

- phosphate fertilizers
- Fe oxide materials
- organic materials
- inorganic clay minerals



Reconsidering Cleanup Goals



- **Bioavailability in risk assessment**
 - Removal objectives use Preliminary Remediation Goals (PRGs) for decision making in the “risk range” of contaminant concentrations
 - PRGs may not be an appropriate measure of risk at a mine site
 - ✦ Total metals may not be bioavailable
 - ✦ Risk assessment modeling traditionally assumes 80 to 100% absorption
- **Reactive cover construction is a practical remediation solution.**

An Example: Iron King Mine Site



- Humboldt, AZ
- Runoff and erosion from the mine contaminated neighboring residences with arsenic
- Arsenic naturally high in the region



Bioavailability in Risk Analysis

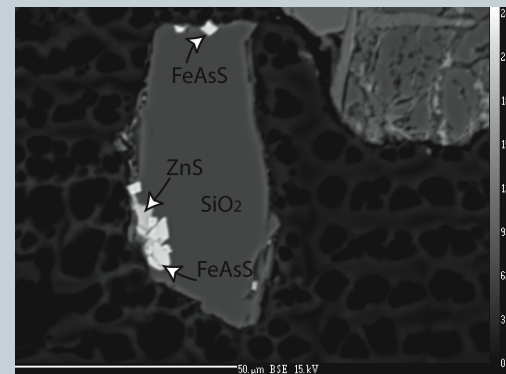
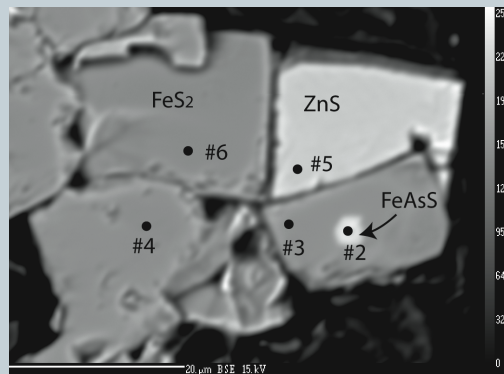


- EPA found that all residences in the study exceeded PRGs (22 ppm – Reg 9 PRG)
- Background concentrations (35 ppm) exceeded PRGs
- Considered bioavailability of arsenic as a means of reconsidering protective level
 - Based on lines of evidence EPA selected a bioavailability default of 50% (departure from 80-100% typically used)

Electron Microprobe Analysis



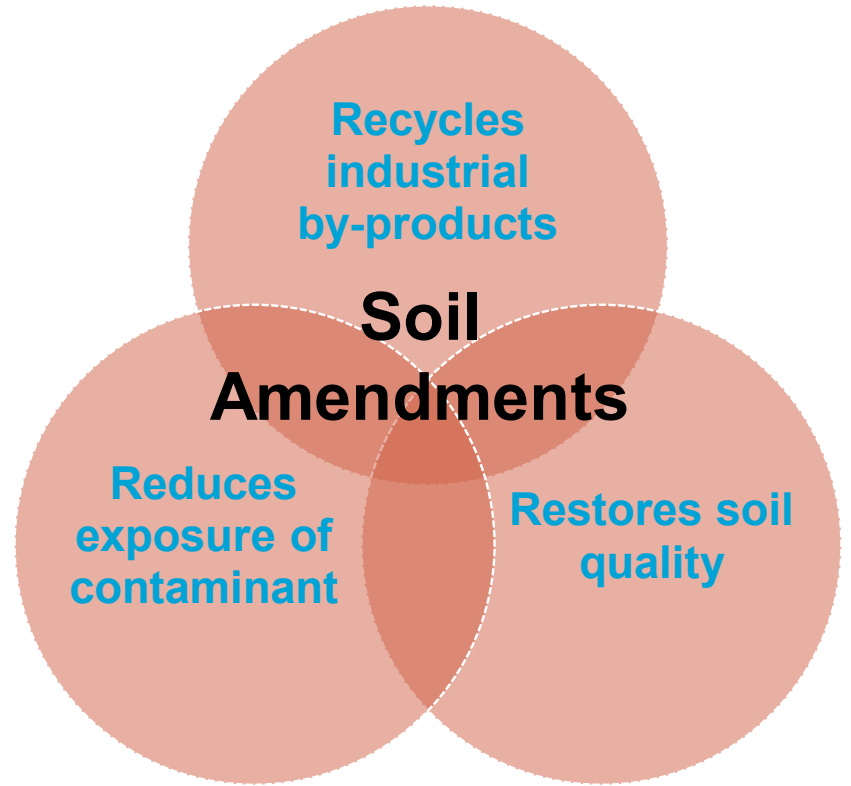
- Conducted speciation of As using an electron microprobe
 - Determined that As was present as arsenopyrite – a low bioavailability form of As
- Analysis provided confirmation that primary species in soil samples is in fact arsenopyrite.



Create a “Reactive Cover”



- Various substances can be used to decrease bioavailability *in-situ*
 - Biosolids and Water Treatment Residuals (other OM?)
 - Amendments
 - ✦ Limestone, use for arsenic, lead, zinc, cadmium
 - ✦ Phosphate, use for lead sites
 - Basis provided by bioavailability & ecotoxicity tests



Biosolids



- Produced by all municipalities
- Use regulated under 40 CFR 503
- 70% of biosolids are now land applied
- Cost - "subsidized" by municipality

Courtesy of H. Compton, EPA & Dr. S. Brown, U. Wash.

McCleure & Sheldon Tailings Site



- The McCleure & Sheldon Sites are abandoned mines with high arsenic and lead concentrations in soil
 - Estimated bioavailability before and after treatment with biosolids, limestone and phosphate.
 - Demonstrated a reduction in bioavailability and leachability
 - Demonstrated that the sites could be revegetated for erosion control

Cleanup Goals

- Reduce contaminated surface runoff and impacts to groundwater.
 - Improve site drainage to route run-on around sources.
- Prevent fugitive dust emissions
 - Construct vegetative cover (wood mulch, soil, and biosolids compost) and hydroseed w/native plants & grasses
- Coordinate activities with Federal and State authorities, consider National Historic Preservation Act.

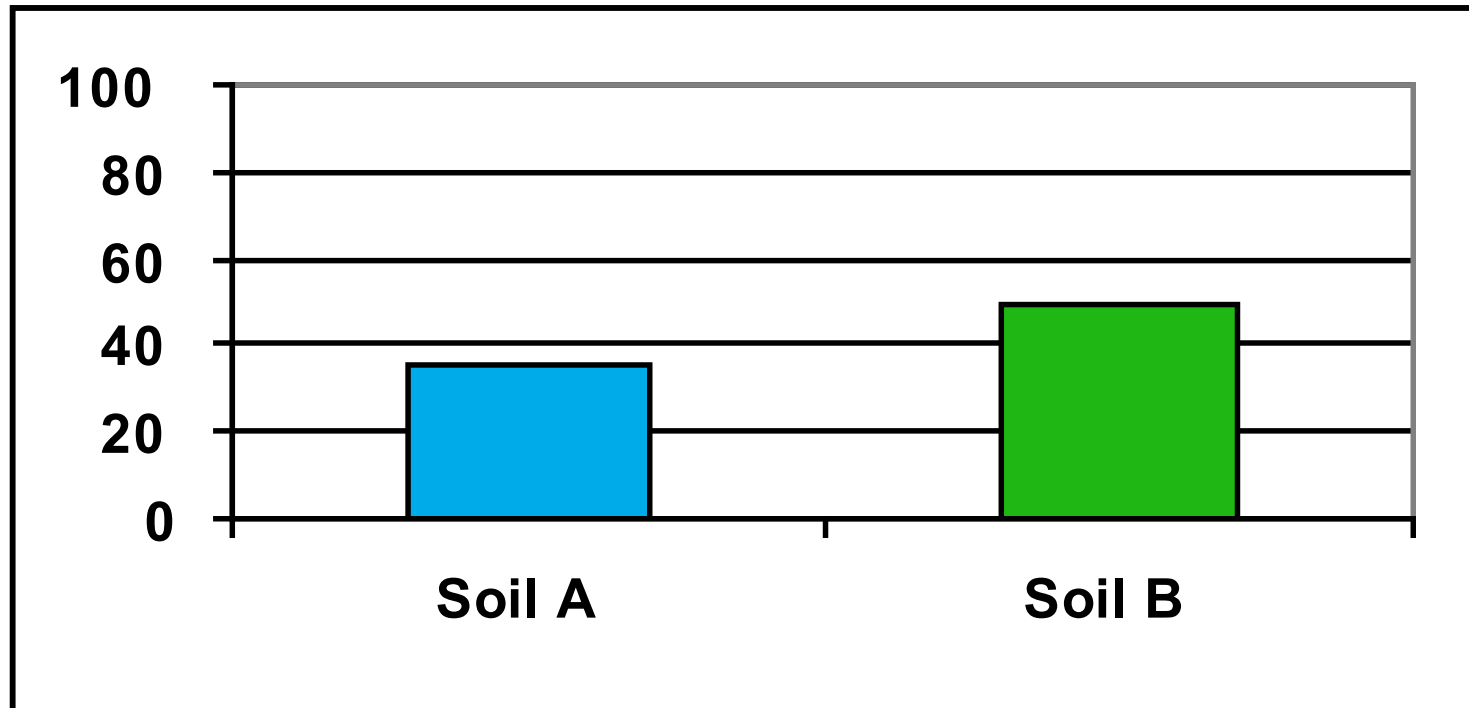
Tailings Soil Characteristics

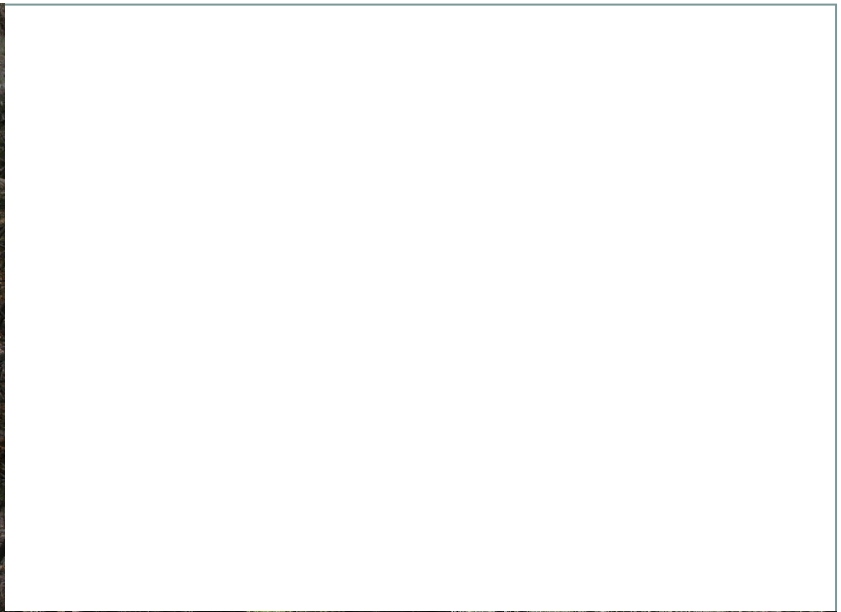


- Tailings A
- Total Lead 3%,
30,000 ppm
- Total Arsenic 300 ppm
- pH 2.3

- Tailings B
- Total Lead 0.2%,
2,000 ppm
- Total Arsenic 200 ppm
- pH 2.7

Reduction in Lead Bioaccessability





McCleure Tailings Before & After



Sheldon Tailings Pile



The Problem

- Fugitive dust and direct contact result in As & Pb exposures to wildlife and the public posing risks
- Contaminated runoff enters receiving waters and groundwater
- Increased exposure of pyritic (high iron and sulfide) mine waste to oxygen and water.
 - Metal sulfide minerals are oxidized and dissolve into water.
 - Microbially mediated acid generation occurs resulting in increased metal mobility.

Drainage Ditch Filled with Sediment & Tailings



Acid Mine Drainage at Toe of Tailings Pile



Cleanup Plan



- **Site Drainage Improvements**
 - Grading
 - French drain system to route run-on around tailings
- **Excavation and removal of contaminated sediments in stream channel**
- **Reactive Cap Construction**
 - Vegetative barrier to direct exposure and fugitive dust
 - Reduction of storm water infiltration to minimize Acid Mine Drainage (AMD)

Erosion Control



- Revegetation of cap reduces sheet erosion during heavy rainfall.
- Install fiber rolls around culverts and across all vegetated slopes.

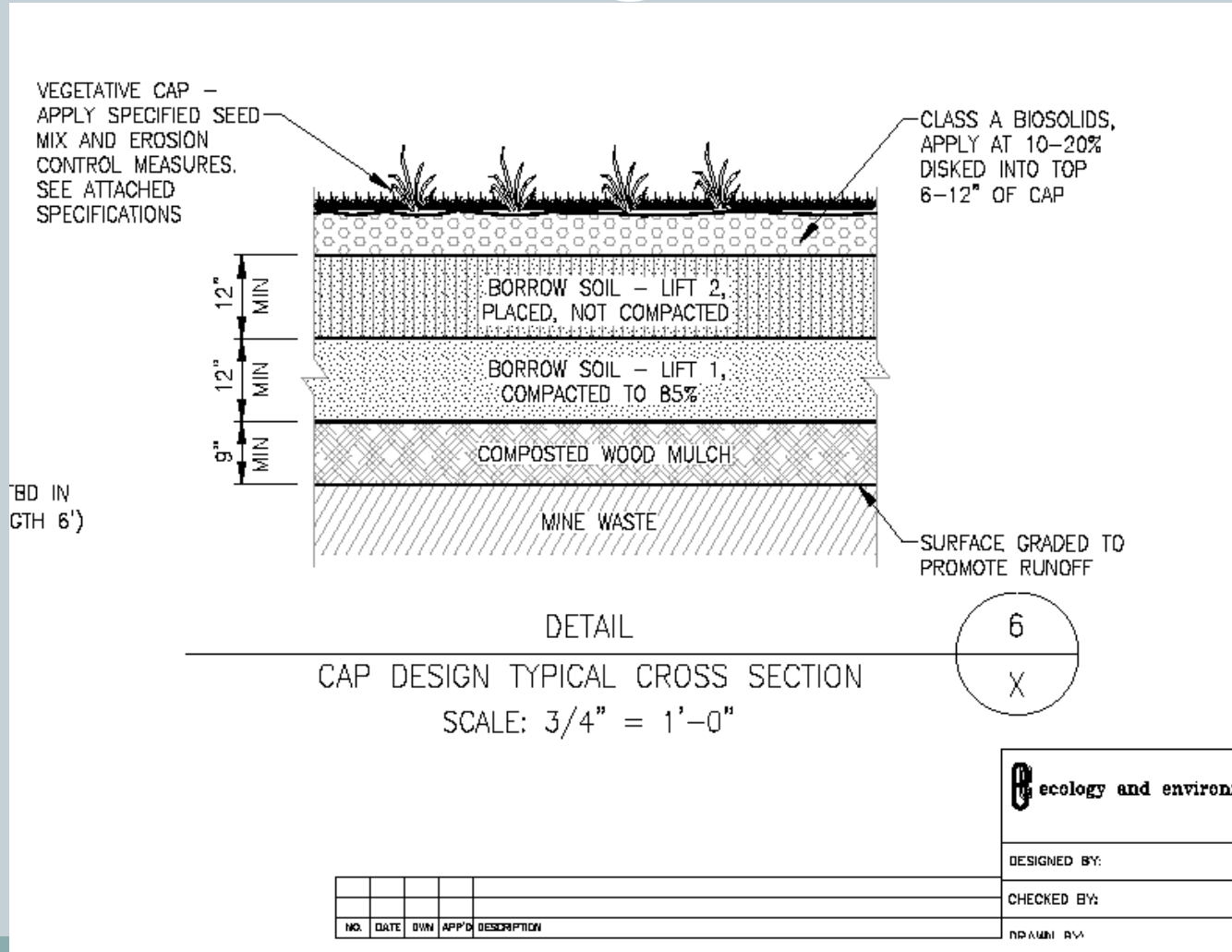
Workers Installing Drainage



Reactive Cap

- Organic mulch lower layer that isolates contaminated mine waste, slowly releases N and P, holds water, and helps plants grow long-term
- Upper vegetated layer that acts as a sponge
 - ✦ Use local source of borrow soil and Biosolids
 - ✦ Good growth media for establishing plants
 - ✦ Plant uptake, transpiration and evaporation help prevent water infiltration into tailings
- Multiple layers work together to seal in waste, store water, prevent erosion, and stem AMD generation

Reactive Cap



Import Quantities



- Approximately 4,390 cubic yards (cys) of Borrow Soil available at no cost from USFS. Located ~6 miles from the site off of Walker Road
- Approximately 1,200 cys of composted wood mulch available at no cost from Sun Dog Ranch Road Transfer Station
- Approximately 364 cys (225 tons) of Exceptional Quality Class A sterile biosolid compost

Workers Spreading Biosolids



Tractor Disking in Biosolids



Hydroseeding



Biosolids Amendment



- Class A Biosolids are essentially free of pathogens prior to land application
- Exceptional Quality Biosolids have lower metals requirements than Class A or Class B Biosolids; same pathogen level as Class A Biosolids
- Synagro's Arizona Soils Composting Facility used the windrow process and composted biosolids with green waste

Current Opportunities



- New partnership with CASA
- EPA currently has sites in NV, AZ, and CA that could benefit biosolids for land reclamation
 - Jackson, CA (Argonaut Mine Superfund Site)
 - San Benito County, CA (New Idria Mine Superfund Site)
 - Eureka, Ft McDermitt, NV
 - Navajo Nation, AZ & NM
 - Partnership with San Francisco PUC

