FRAC SAND MINING and RECLAMATION in WISCONSIN

Dr. Tom Hunt, Director of Science
Applied Ecological Services, Inc.
Professor Emeritus
University of Wisconsin - Platteville
Frac Sand Mining in Wisconsin

- Wisconsin has abundant high-quality sand resources
- Sand typically processed (washed and separated) locally, then shipped out of state
- Mining requires a valid permit ch. NR 135, Wis. Adm. Code; typically locally administered
- Substantial rise in permit requests to mine
- Local regulatory authorities did not anticipate level and scale of activity
Tourism, Recreation, Property Values

PROPERTY VALUE GUARANTY

Upon the execution of the attached Agreement ("Effective Date") and until ("Termination Date"), ABC Resources, Inc. will provide property value Guaranty to the owners of parcels of land, identified on the attached Exhibit X.
Where the Gas is Located
HYDROFRACKING A WELL

Fluid pressure fractures the rock, sand grains keep the fractures open
Best Frac Sand Locations (red)
Alluvial – Bedrock aka Cransand
Industrial Sand Mine Locations in Wisconsin

Planning mining operations tailored toward the approved post mining land use to avoid 11th hour calamities

NR 135.03 (14) land use specified in approved nonmetallic mining reclamation plan

- removal or reuse of nonmetallic mining refuse
- grading of the nonmetallic mining site
- removal, storage and replacement of topsoil
- stabilization of soil conditions
- reestablishment of vegetative cover
- control of surface water and groundwater
- prevention of environmental pollution
- restoration of plant, fish and wildlife habitat
Seamless integration of the four Rs – the right materials at the right time in the right amount in the right place ensure successful reclamation

- **AESTHETICS**
- **FISH & WILDLIFE HABITAT**
- **ACCELERATE SUCCESSIONAL TRAJECTORY**
- **CREATE RESILIENT SYSTEMS** (biodiversity)
- **SOIL HEALTH** (building/rebuilding soil)
- **PHYTOREMEDIATION**
- **EROSION CONTROL**
- **LEGAL REQUIREMENT**
- **GEOMORPHIC FUNCTION & STABILITY** (hydrology & materials)
- **ECOSYSTEM SERVICES** (O₂, pollinators, temperature modulation, water purification…)}
Residential/Commercial
Agriculture/Forestry

POOP & STOMP
Site analysis/resource inventory realizes reclamation possibilities; hydrology is a principal consideration

- Climate
  - Weather patterns, hardiness zones, microclimate

- Hydrology
  - Resilient reclamation = water, water, water

- Geomorphic Features
  - Topography, slope, aspect, relief, erosivity, shaping

- Soils
  - Characteristics, topsoil, subsoil, distribution, handling

- Made structures
  - Roads, highways, rail, ports

- Biota
  - T&E species
  - Habitat

- Extensional landscape compatibility
High Quality Imagery is Necessity
Topographic Mapping and Volume Estimating
Slope and Topographic Position Index (TPI)
Hydrology: Watershed/Catchment
appropriate hydrologic unit of analysis

Portion of watershed showing process of rainfall, interception, evaporation, transpiration, infiltration, percolation, groundwater flow, overland flow, subsurface flow, surface storage, detention storage, and channel precipitation.

Depicts series of storage and flow processes: boxes are storage, arrows are flow: illustrates terms and simple mathematical modeling.
Establish Drainage Density

- Sub Watershed Collected in Channel
- Split the Peaks
- Reverse Drainage
- Switchback design
- Inlet to Channel
N 21%
NE 12%
E 3%
SE 4%
S 30%
SW 9%
W 5%
NW 16%
N 5%
NE 4%
E 5%
SE 0%
S 24%
SW 9%

LAND ASPECT: DIVERSE vs MONOTYPIC

NATURAL LANDFORM
Creates Landscape Resilience

CONVENTIONAL LANDFORM
Geomorphic Drainage Swale
Zone Planting Technique
Biota – Resilient Habitat Design

Establish baseline information

Develop bio-criteria for assessment of ecosystem health

Establishing habitat goals and objectives aimed at reclaiming an ecosystem

Determining if current and future reclamation efforts are promoting a "more natural" or "unnatural" assemblage of plant and animal communities
Soil Density
Nuclear Density Probe

Soil Prep
Vibratory Ripper
Mulch Stockpile, Research Plots & Tree Nursery
Hydric Soil Storage

Experimental Wetland
Revegetation Techniques
Drilling & Mulching
Revegetation Techniques
Tree Spade & Whips/Tree Guards
Revegetation Techniques

Plugging Hydric Species
Reclamation Monitoring:
long-term quality control
Assessing Revegetation Success
NR 135.13 (4) determined by:

(a) Comparison to reference area
(b) Comparison to baseline data
(c) Comparison to a technical standard.

(5) Revegetation using a variety of plants indigenous to the area is favored.
NR 135.13 Assessing success

(3) post mining land use specifies return of the mining site to a pre-mining condition, the operator shall obtain baseline data on the existing plant community for use in the evaluation of reclamation success.
Habitat Restoration

NR 135.06 (4). When the land use requires plant, fish or wildlife habitat, it shall be restored.

Goals describe the habitat

Objectives describe the parameters and life cycle of target species

Design criteria describe look and feel of the habitat
Criteria for Ruffed Grouse Habitat

- Expand aspen stands.
- Target three age classes: <5 yrs for brood; 6-25 yrs for nesting, cover, and wintering adults; and >25 yrs for winter food and brood cover.
- Develop dense vertical thickets of hazelnut, sumac, black berries, and young oaks.
- Consider conifers for winter cover.
- Intersperse stands.
Landscape Context & Compatibility
Auburn Mine Chippewa County Wisconsin

Dr. Holly Dolliver UWRF w permission Superior Silica Sands
Mining: A Transitional Land Use