

WESTERN WISCONSIN SAND MINING

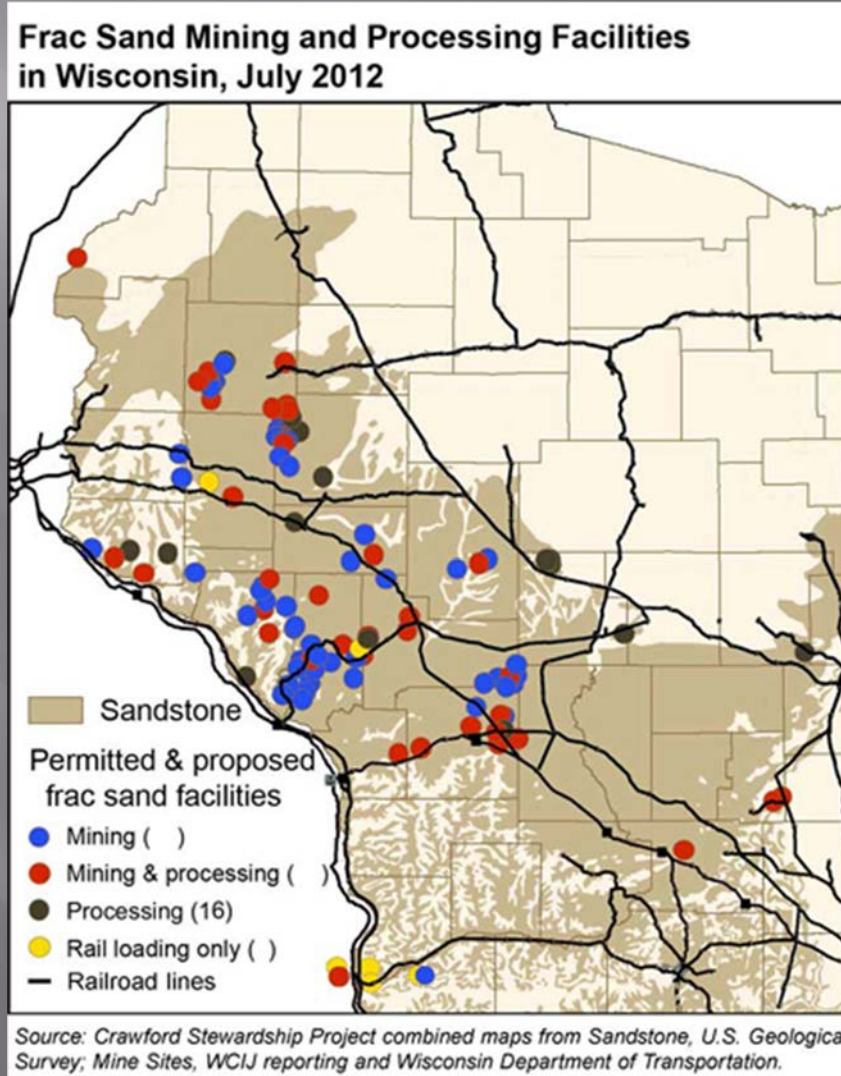
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Sand Type

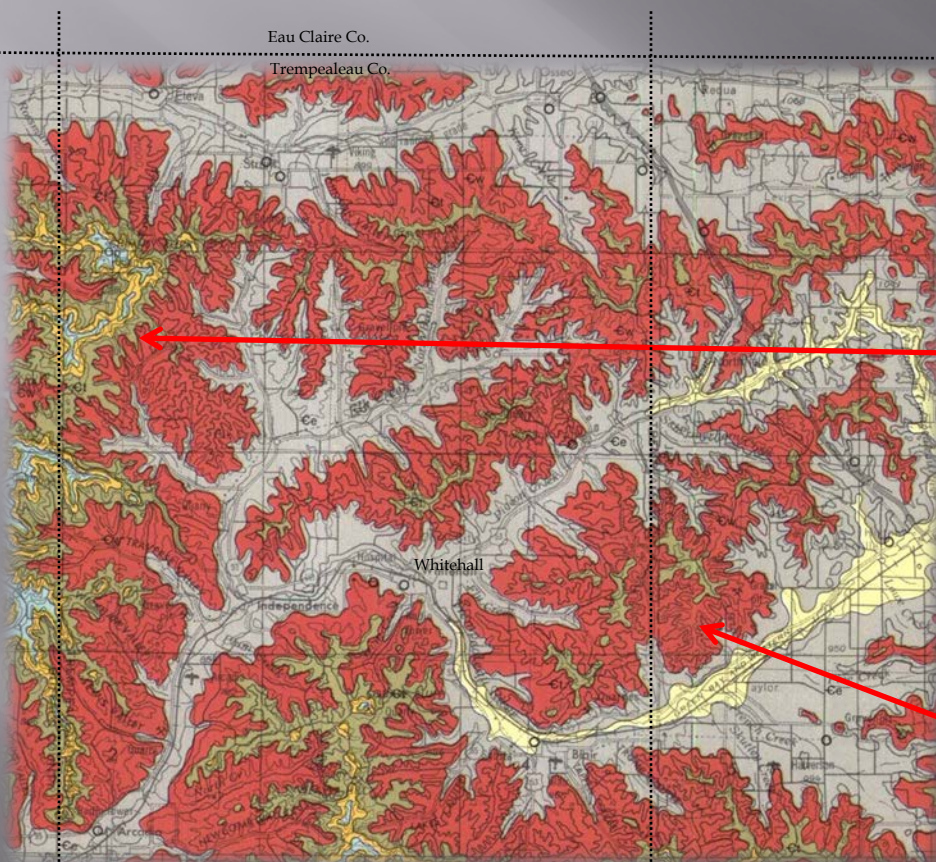


- ▣ API Fracture sand specifications, considerations include:
 - ▣ Size, sphericity, roundness, mineralogy, crush resistance
- ▣ Sand of interest is super strong, almost pure quartz(>90%) (SiO_2)
- ▣ Sand Size +140
 - Larger size more valuable +70
 - Size sought (20-40, 40-70, 70-140)
- ▣ Contaminants reduce strength(glaucanite, iron, manganese, etc.)

Where is the Sand?



West Central Sand Formations



DESCRIPTION OF MAP UNITS

- Os Platteville Formation.** Dolomite, light brown, beds less than 1 m thick, fractured; about 4 m maximum thickness in this area.
- Oa Ancell Group.** Sandstone, quartzose, white to pale yellow, fine grained, rounded, moderately sorted; 25 m thick.
- Op Prairie du Chien Group.** Dolomite and sandy dolomite. Consists of three recognizable units, from top to bottom: **Shakopee Formation**, **Willow River Member**-dolomite, gray to brown, medium grained, thin-bedded; contains rounded flat pebbles of buff, fine-grained dolomite; 15 to 18 m thick. **Shakopee Formation**, **New Richmond Member**-sandstone and siltstone, brown to gray, fine grained, dolomitic, lenticular-bedded; contains coarse rounded and frosted quartz grains; 2 to 5 m thick. **Oneota Dolomite**-dolomite, gray, thick-bedded, crystalline; with much chert in discrete beds or in irregular masses throughout; with white to light gray oolite beds up to 60 cm thick in lower part; 27 m thick.
- ⓐ Jordan and St. Lawrence Formations.** Sandstone, quartzose, sandy dolomite, dolomite, and siltstone. Consists of four recognizable units, from top to bottom: **Jordan Formation**, **Coon Valley Member**-dolomite, yellow to tan or brown, sandy; 6 to 14 m thick. **Jordan Formation**, **Van Osler Member**-sandstone, quartzose, white to brown to yellow or orange, fine to medium grained, poorly sorted, medium- to thin-bedded, cross-bedded; with calcite-cemented nodules, iron-cemented in places; may be locally interbedded with underlying unit; 9 to 15 m thick. **Jordan Formation**, **Norwalk Member**-sandstone, quartzose, white, fine grained, rounded, and moderately sorted quartz sand grains, medium-bedded; trace of garnet; 15 to 18 m thick. **St. Lawrence Formation**, **Lodi Member**-siltstone, light brown to blue-brown, and very fine-grained dolomite, thick-bedded; less than 3 m thick.
- ⓐ Tunnel City Group.** Sandstone, 30 to 56 m thick. Consists of five recognizable, interbedded units: **Mazomanie Formation**, **lithology 1**-sandstone, quartzose, yellow to white, fine grained, well sorted, cross-bedded; less than 5 percent glauconite. **Mazomanie Formation**, **lithology 2**-sandstone, quartzose, mica-bearing, light gray to yellow, fine to very fine grained, thin-bedded; similar to Tomah Member but containing no shale; **Lone Rock Formation**, **Reno Member**-sandstone, quartzose, glauconite-bearing, fine and very fine grained; small-scale cross-bedding. **Lone Rock Formation**, **Tomah Member**-sandstone, quartzose, mica-bearing, light gray to yellow, very fine grained, thin-bedded; beds separated by laminae and partings of gray-green siltstone. **Lone Rock Formation**, **Birkmose Member**-sandstone, quartzose, glauconite-bearing, green, fine grained, commonly cross-bedded; includes burrowed beds and flat-pebble conglomerate.
- ⓐ Woneowoc Formation.** Sandstone. Consists of two recognizable units, from top to bottom: **Ironton Member**-sandstone, quartzose, white to brown with iron staining, medium to coarse grained, subrounded, poorly sorted, wavy-bedded, vertical burrows present; calcite-cemented; 5 to 18 m thick; individual bedding units 1 to 2 m thick with thin, intervening claystone beds. **Galesville Member**-sandstone, quartzose, white, fine to medium grained, rounded to subrounded, well sorted, thick-bedded, cross-bedded, poorly cemented; 5 to 18 m thick; individual bedding units 3 to 5 m thick.

Buffalo Co.

Trempealeau Co.

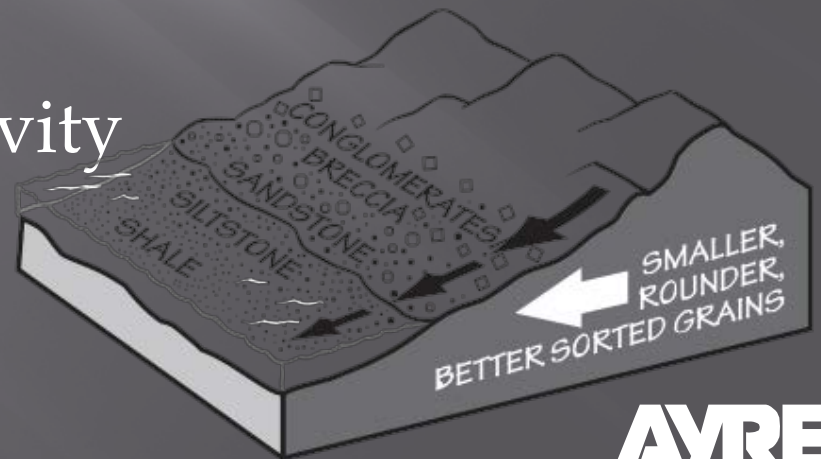
Jackson Co.

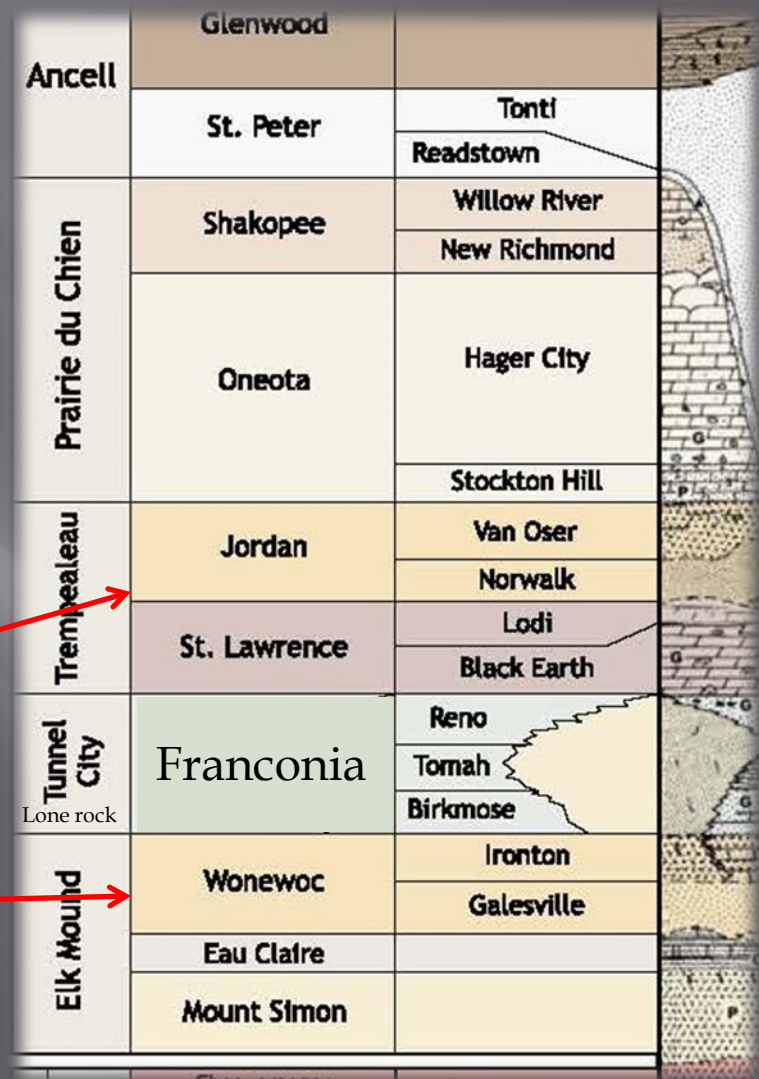
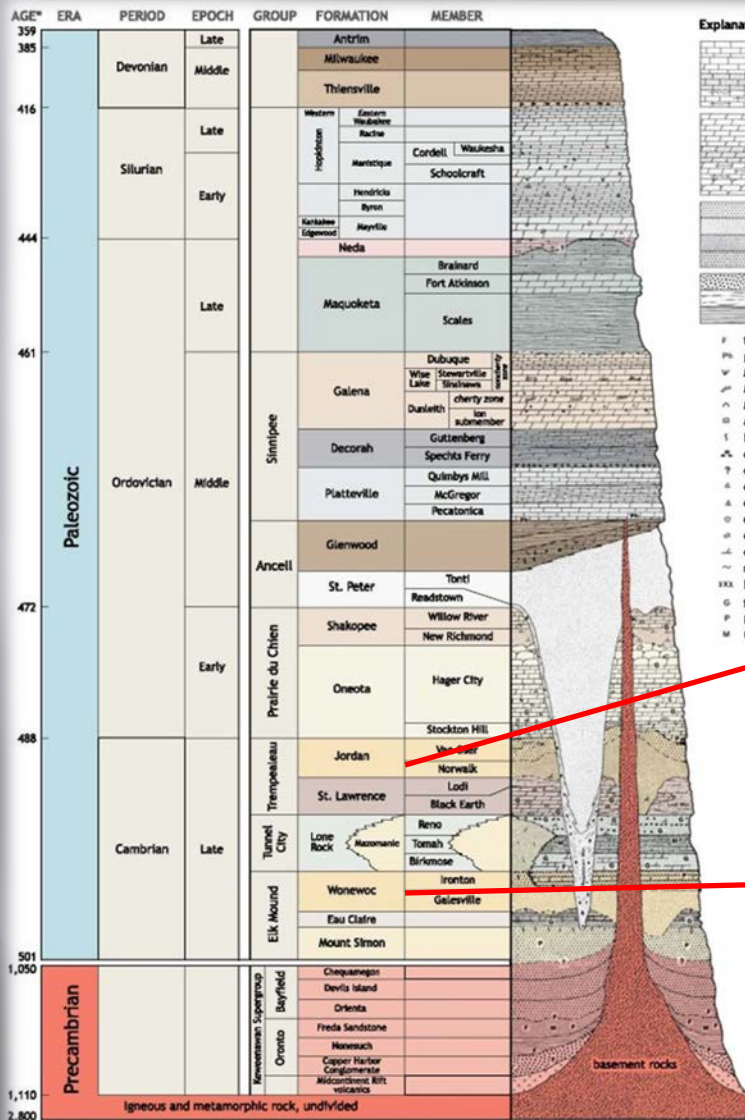
Source: UWEX WGNHS

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Why is the Sand Here?

- ▣ Cambrian Period Inland Sea
- ▣ Transgressive/Regressive Deposition
- ▣ Sandstone Layers - Deposition during high energy (shallow sea)
- ▣ Limestone Layers - Deposition during low energy (deep sea)
- ▣ Exposed by Glacial Activity





* Absolute age dates in million years are based on the Geological Society of America Geologic Time Scale, 2009.

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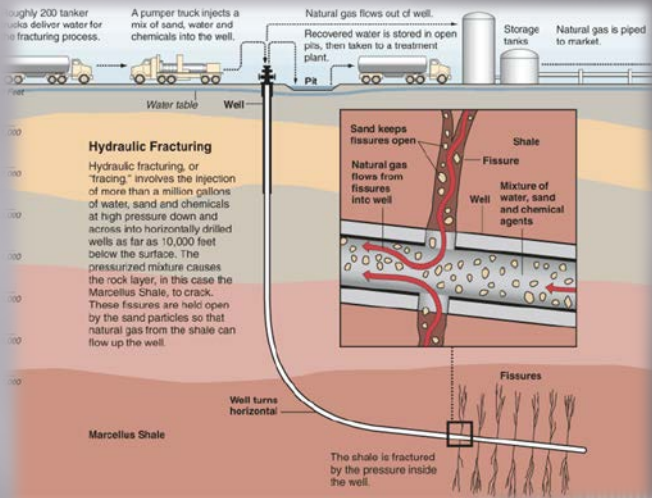
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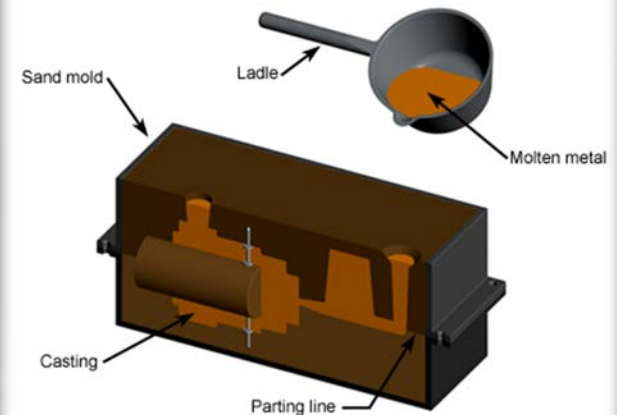
Glass Making Video

Hydraulic Fracturing Video

What is the sand used for?



Hydro-fracking



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Sand Casting
(foundry sand)



Sand Blasting

Pool Filtration
Play Sand
Golf Courses
Water Filtration
Hot Mix Asphalt
Glass

Sand Mining (Deposit Selection)

- ▣ Literature research to find possible sources
- ▣ Outcrop samples
- ▣ Soil borings
- ▣ Grain Size & Crush Test



Sand Mining (Mine Selection)

- ▣ Deposit Thickness & Depth
- ▣ Contiguous Property Size
- ▣ Groundwater Elevation
- ▣ Surface Water & Wetland Proximity
- ▣ Residential Proximity
- ▣ Governmental Climate
- ▣ Processing & Shipping Facility Proximity



Image Source: Google Earth

Processes at the Mine

- ▣ Site Preparation
- ▣ Sand Excavation
 - Mechanical only or Mechanical w/blasting
- ▣ Stormwater Controls
- ▣ Stockpiles (conveyors, equipment, scalping screen)
- ▣ Crushing (mine specific)(3" minus)
- ▣ Washing (mine specific)
- ▣ Hauling



Image Source: Google Earth

Processes at the Mine



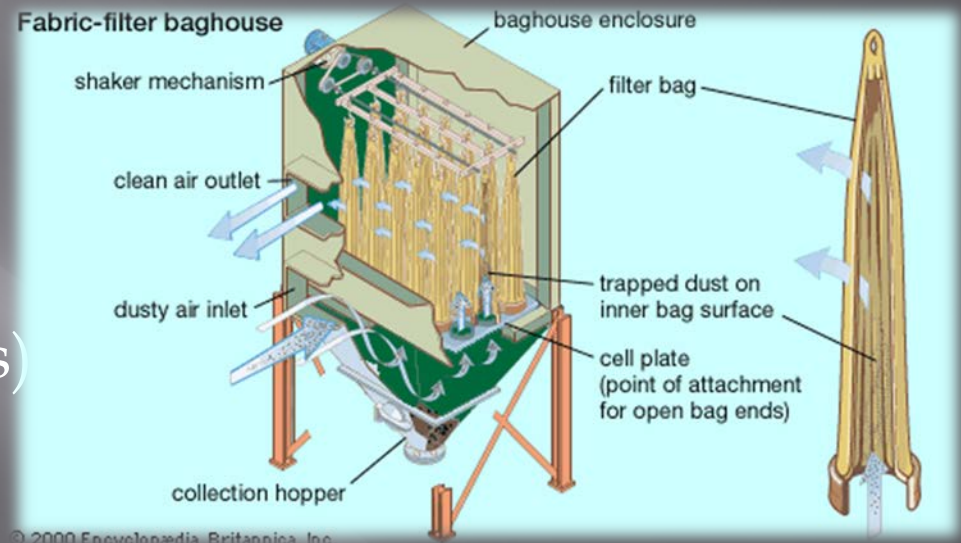
Sand Mining (Plant Selection)

- ▣ Rail Access
- ▣ Water Supply
- ▣ Roadway Access
- ▣ Fuel Supply
- ▣ Sand Supply
- ▣ Governmental Climate



Processes at the Sand Plant

- ▣ Raw Stockpiling
- ▣ Crushing
- ▣ Washing
 - Wet Stockpile
 - Clarifier (Flocculants)
 - 6,000-10,000 gpm
- ▣ Drying
 - 200-400 tph
- ▣ Screening
- ▣ On-site Storage
- ▣ Shipping
- ▣ Dust Control

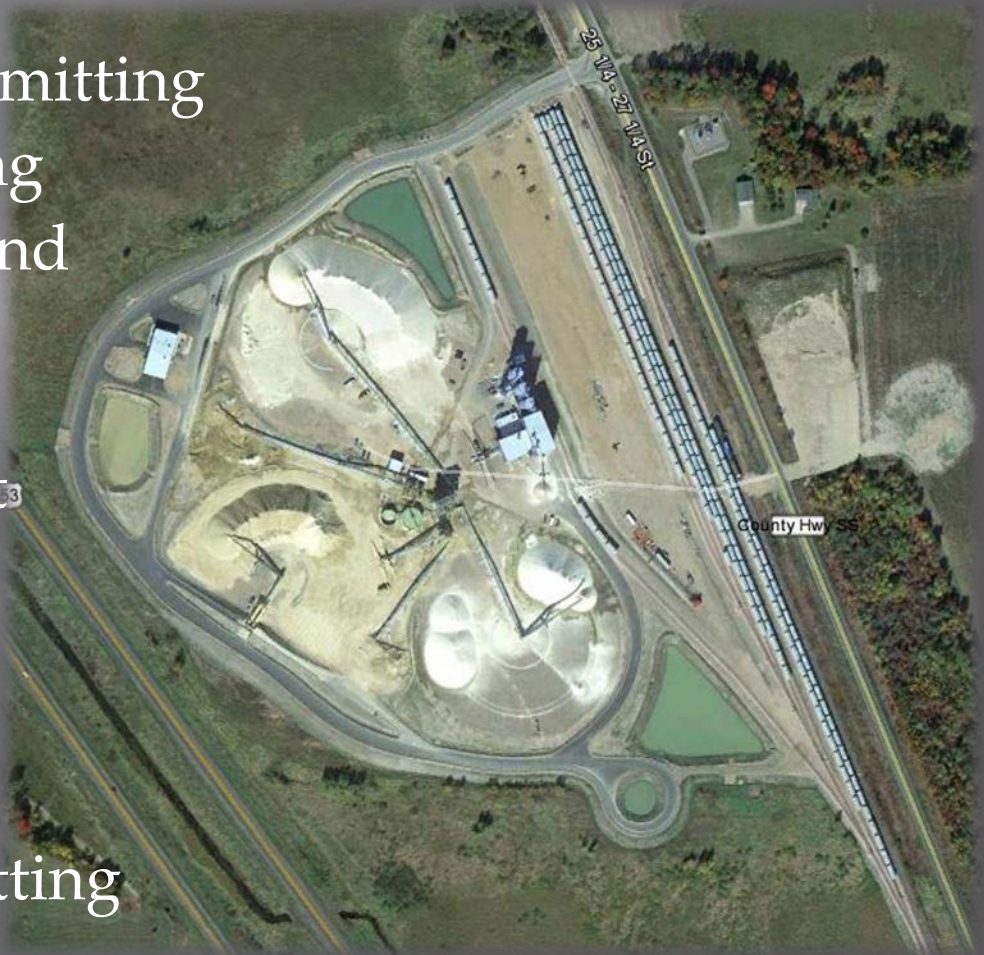


Sand Processing Plants



Mine & Plant Permitting

- ▣ Reclamation Plan Permitting
- ▣ Stormwater Permitting
- ▣ Surface Water/Wetland Impact Permitting
- ▣ Air Permitting
- ▣ Industrial By-Product Permitting
- ▣ High Capacity Well Permitting
- ▣ Driveway Permitting
- ▣ Building Code Permitting



Monitoring & Enforcement



Monitoring Well



Storm Water Monitoring



Air Monitoring Station



Water Supply Well

Industry Regulations

- ▣ Local Regulation (County and/or Municipality)
 - Reclamation, Zoning, Land Use, Licensing, Conditional Use Permits, Shoreland, Driveway, Road Use, Sanitary, Building
- ▣ State Regulations (WDNR, WDOT)
 - Water Supply, Air, Stormwater, Wetlands, Surface Water, Archaeological, Historical, Endangered Resources, Highway Access
- ▣ Federal Regulations (EPA, MSHA, FAA, USACE, CWA, NIOSH)



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Industry Regulations

- ▣ WDNR – Air Emissions Standards
 - Fugitive Dust Control Plan
 - Air Monitoring Plan
 - Malfunction Prevention & Abatement Plan
 - Stack Compliance Testing
- ▣ NIOSH – Occupational Safety
 - Occupational Silica Dust Exposure Limits
 - ▣ TWA_{10} exposure limit 0.05 mg/m^3
- ▣ MSHA – Workplace Safety
 - Miner Noise Exposure Limits
 - ▣ “action level” – TWA_8 sound level 85 dBA
 - ▣ “dual hearing protection level” – TWA_8 sound level 105 dBA

Decibel Chart

| Commercial | Industrial | Residential | dB Level |
|------------------------|------------------|-------------------------|----------|
| Threshold For Hearing | | | 0 |
| Good Recording Studio | | Breathing | 10 |
| | | Rustling Leaves | 15 |
| | | Whisper, Mosquito | 20 |
| Library | | Living / Dining Room | 30 |
| Refrigerator Hum | | Kitchen / Bathroom | 40 |
| Quiet Office | Power Lawn Mower | Home Office | 50 |
| | | Birds at 10' | 55 |
| Conversational Speech | | | 60 |
| Piano Practice | | Electric Shaver | 60 |
| Business Office | | Piano Practice | 65 |
| Noisy Restaurant | Inplant Office | Street Traffic | 70 |
| Chamber Music | | Barking Dog | 75 |
| Classroom | | Alarm Clock | 75 |
| | | Television / Dishwasher | 75 |
| Airplane at 1 mile | Manual Machines | Vacuum Cleaner | 80 |
| Reception / Lobby Area | Handsaw | Garbage Disposal | 85 |
| Motor Bus | | Telephone Dial Tone | 85 |
| Applause in Auditorium | | Lawn Mower | 85 |

Decibel Chart (cont.)

| | | | |
|---|-----------------------|--------------------|-----|
| OSHA Required Hearing Protection in Factory | | | 85 |
| Teleconference Room | | Train at 100' | 90 |
| Subway | Farm Tractor | Teenage Stereo | 90 |
| Sustained Exposure May Cause Hearing Loss | | | 90 |
| Music Practice Room | Electric Drill | Walkman at 5/10 | 94 |
| French Horn | Average Factory Noise | Blender | 100 |
| Orchestra | Diesel Truck | Motorcycle | 105 |
| Computer Room | Printing Press | Train | 105 |
| Bass Drum | Heavy Truck | Power Saw | 110 |
| Dog Kennel | Power Mower | Baby Crying | 110 |
| Symphony Orchestra | Punch Press | Squeaky Toy to Ear | 110 |
| Pain Begins | | | 120 |
| Disco | Sandblasting | Shot Gun | 120 |
| Cymbal Crash | Pneumatic Clipper | Air Raid Siren | 130 |
| Dragcar Racing | Military Jet | Shotgun | 140 |
| Rock Concert | Aircraft Carrier Deck | Jet Takeoff | 140 |
| Chest Wall Begins to Vibrate | | | 150 |
| Ear Drum Breaks Instantly | | | 160 |
| Death of Hearing Tissue | | | 180 |
| Loudest Possible Sound | | | 194 |

Local Concerns

- ▣ State Statute Enforcement
- ▣ Zoning Impacts (Traffic, noise, light, vibration, etc.)
- ▣ Rail Crossings
- ▣ Air Impacts
- ▣ Groundwater Impacts
 - Direct – Mining below water table
 - Indirect – Industrial by-products
- ▣ Surface Water/Wetland Impacts
- ▣ Aesthetics

Questions?

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