Bad River Band Line 5 Reroute

Clean Water Act Section 401(a)(2) Hearing

May 13-14, 2025

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LimnoTech

Qualifications

John F. Bratton, Ph.D., P.G.

Senior Science Officer at LimnoTech, Ann Arbor, MI

Ph.D. in Geology, University of California – Berkeley
Sc. B. in Geology-Chemistry, Brown University

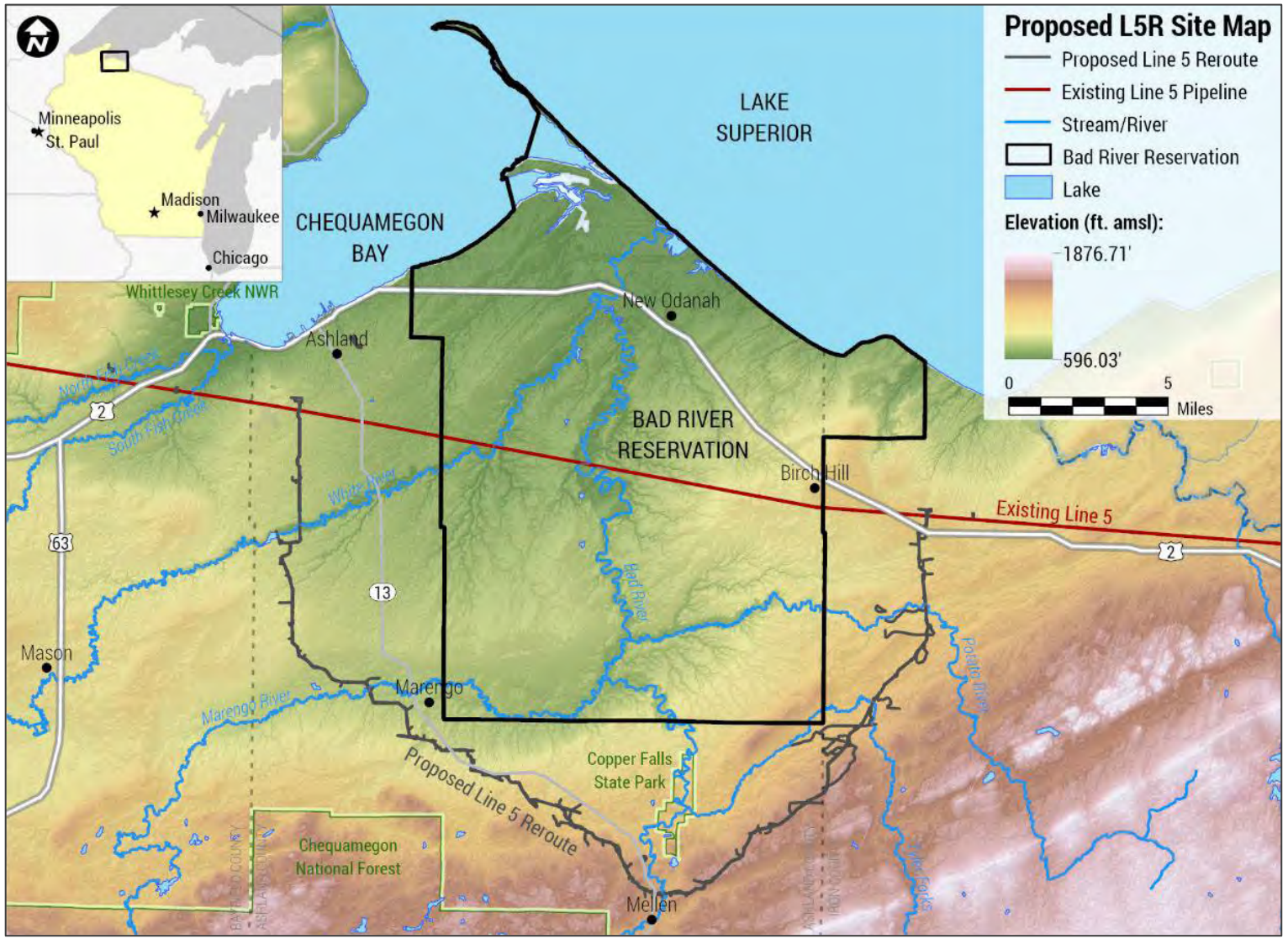
Licensed Professional Geologist in California, Utah, Alabama, Florida

37 years of experience in hydrogeology including drinking water supply, contaminated site groundwater characterization and remediation, geochemistry, glacial geology

Adjunct faculty teaching experience at graduate and undergraduate levels at seven institutions including current appointments at Wayne State University (Detroit) and Madonna University (Livonia, MI)

Former supervisory research geologist at U.S. Geological Survey and Deputy Laboratory Director at the Great Lakes Environmental Research Laboratory of the National Oceanic and Atmospheric Administration's

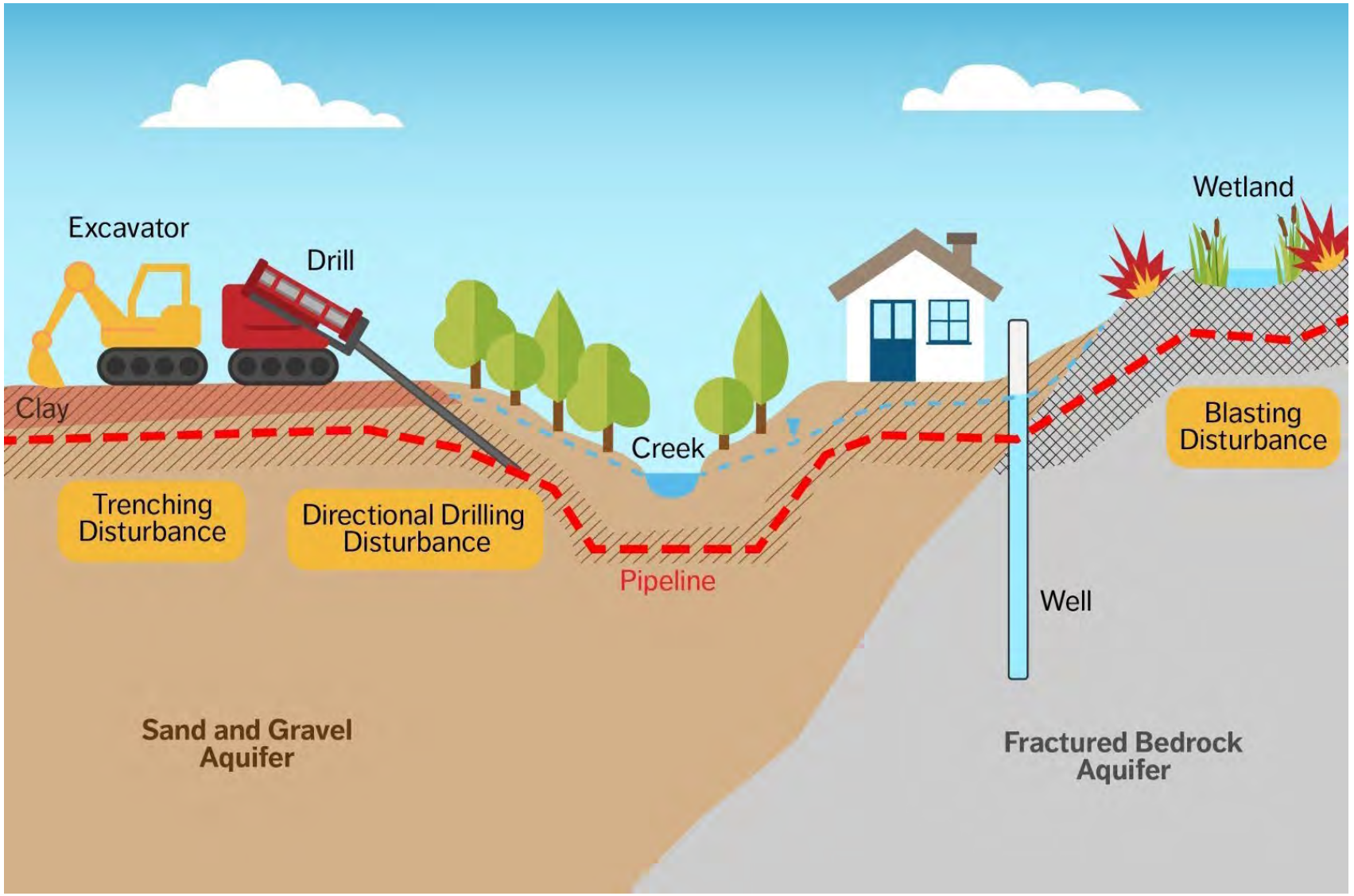
Location Map



Trenching

Directional Drilling

Blasting



Enbridge Flanagan South Pipeline construction, Illinois (2014)

Assessed impacts on Tribal groundwater and related resources of Line 5 Reroute Project (L5R) construction activities, including the following:

Hydrogeology – impacts on groundwater recharge, groundwater flow, groundwater quality, drinking water wells, and groundwater discharge to surface water, including seeps, springs, streams, rivers, and wetlands

Horizontal Directional Drilling (HDD) – impacts on groundwater flow, quality, and related resources of HDD methods for advancing pipeline segments beneath streams, rivers, and other features along the reroute corridor, especially from drilling fluid

Blasting – fracturing impacts on groundwater flow, quality, and related resources of blasting to allow pipeline segments to be buried where normal trenching is not possible due to shallow bedrock along the reroute corridor

https://dykonblasting.com/industries-served/

Hydrogeological Impacts

Enbridge Line 5 pipeline exposure within the Denomie Creek subwatershed. (MNRD, 10/31/19)

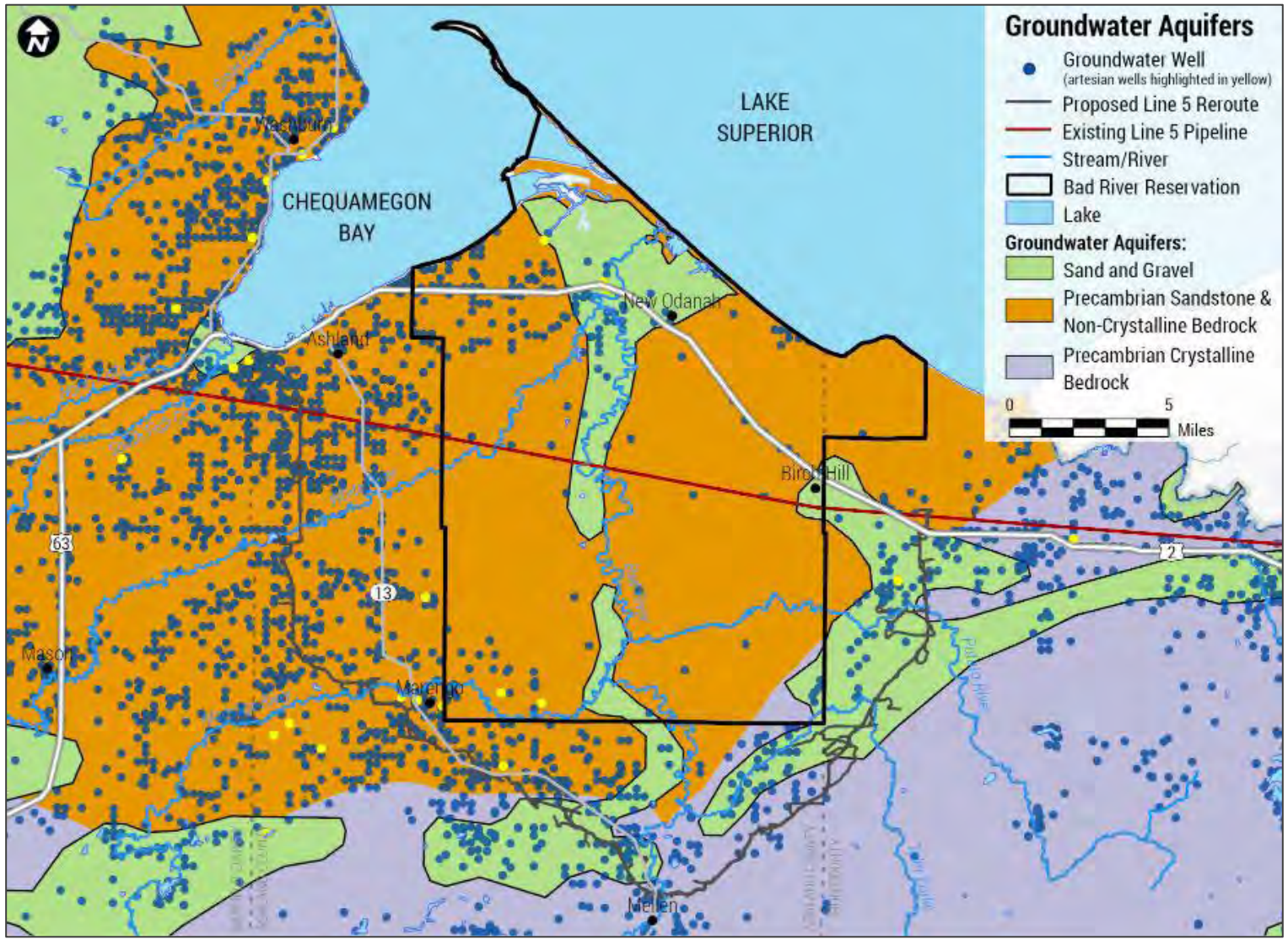
Hydrogeological Impacts

Impacts relevant to 401(a)(2) and the Bad River Reservation:

The glacial and bedrock aquifers underlying the Reservation and surrounding areas serve as drinking water supplies and feed cold-water trout streams, wetlands, and springs.

The L5R project will impact groundwater recharge areas and aquifer properties upgradient from wells and springs that are likely to be degraded by pipeline construction activities.

Aquifers and Wells



Information & Sources Reviewed

Beyond information provided by Enbridge and the Environmental Impact Statement, approximately 20 additional data sources were reviewed, and then maps were constructed for analysis by combining geospatial data with L5R project corridor information. Sources included:

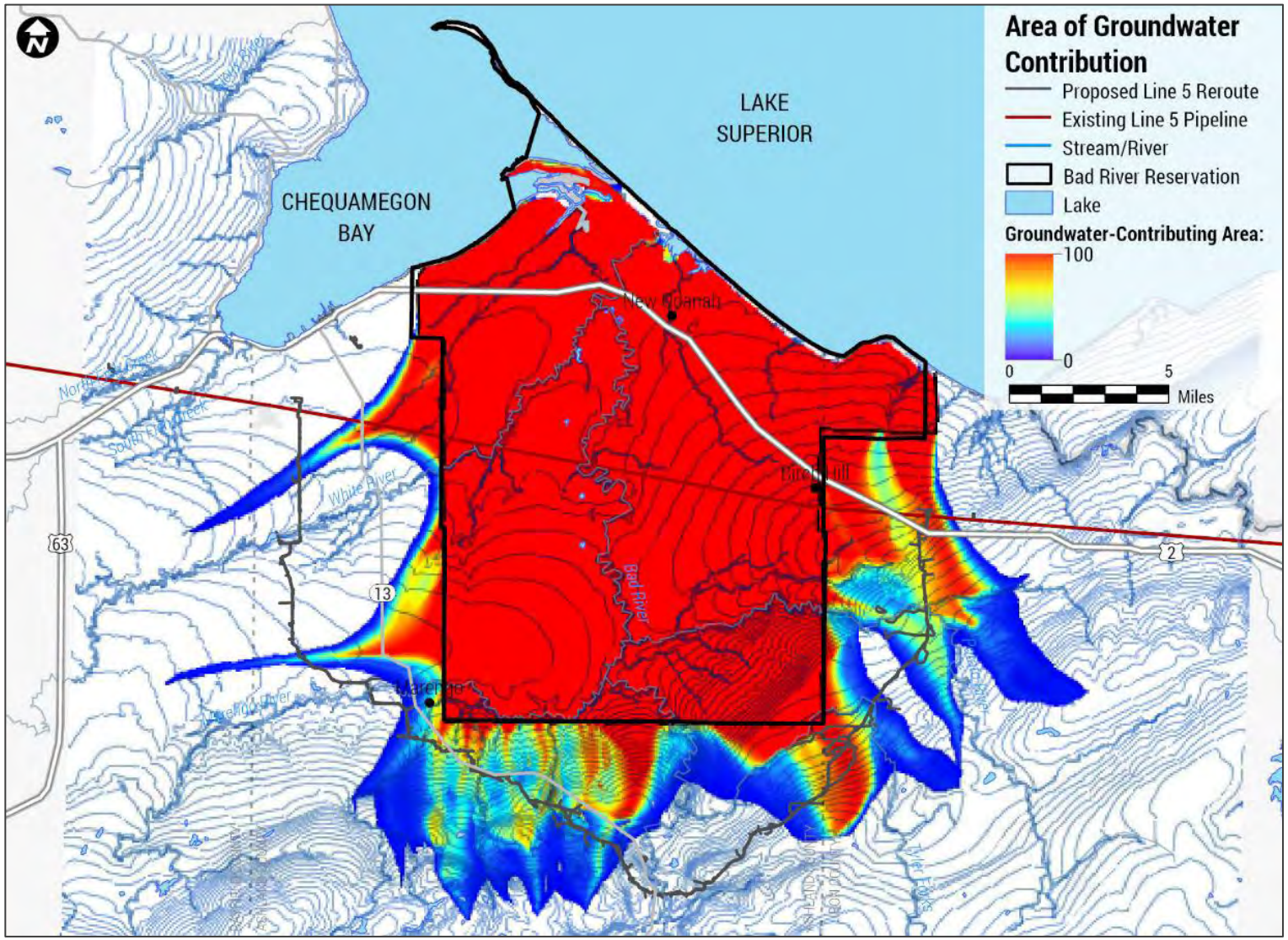
- U.S. Geological Survey studies
- Wisconsin DNR and Natural History studies and databases
- Peer-reviewed journal articles
- Doctoral dissertations
- Scientific conference proceedings volumes
- Technical reports and agency guidance documents

Groundwater Impacts to the Reservation

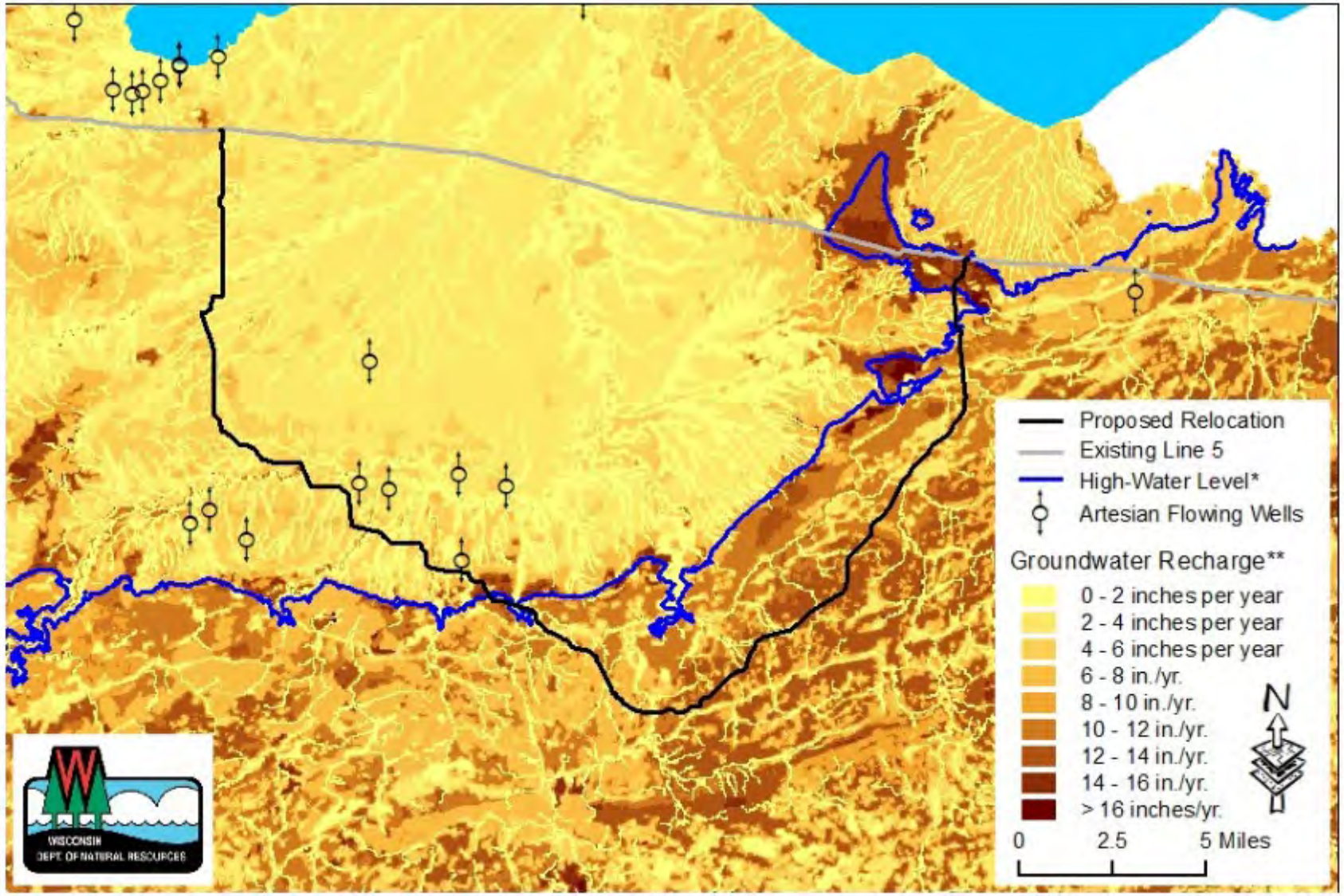
Based on prior numerical modeling of groundwater flow by the U.S. Geological Survey, the L5R project corridor will impact:

- Recharge areas, confined aquifers, springs, and groundwater-surface water interactions in the Reservation's headwaters area.
- There will be downgradient/downstream negative impacts on groundwater flows, well yields, groundwater quality, and surface water properties on the Reservation.

Area of Groundwater Contribution



Groundwater Recharge



Groundwater Impacts to Reservation Streams

Groundwater and surface water are linked as a single resource so groundwater impacts of L5R project will degrade surface water on the Reservation. There is a high likelihood of confined aquifer breaching during pipeline trenching and sheet pile driving, resulting in:

- uncontrolled flow of groundwater to surface water,
- increasing stream flow rates,
- increasing erosion, and
- changing downstream water quality parameters such as temperature and turbidity that can negatively impact stream-dwelling beings and life stages.

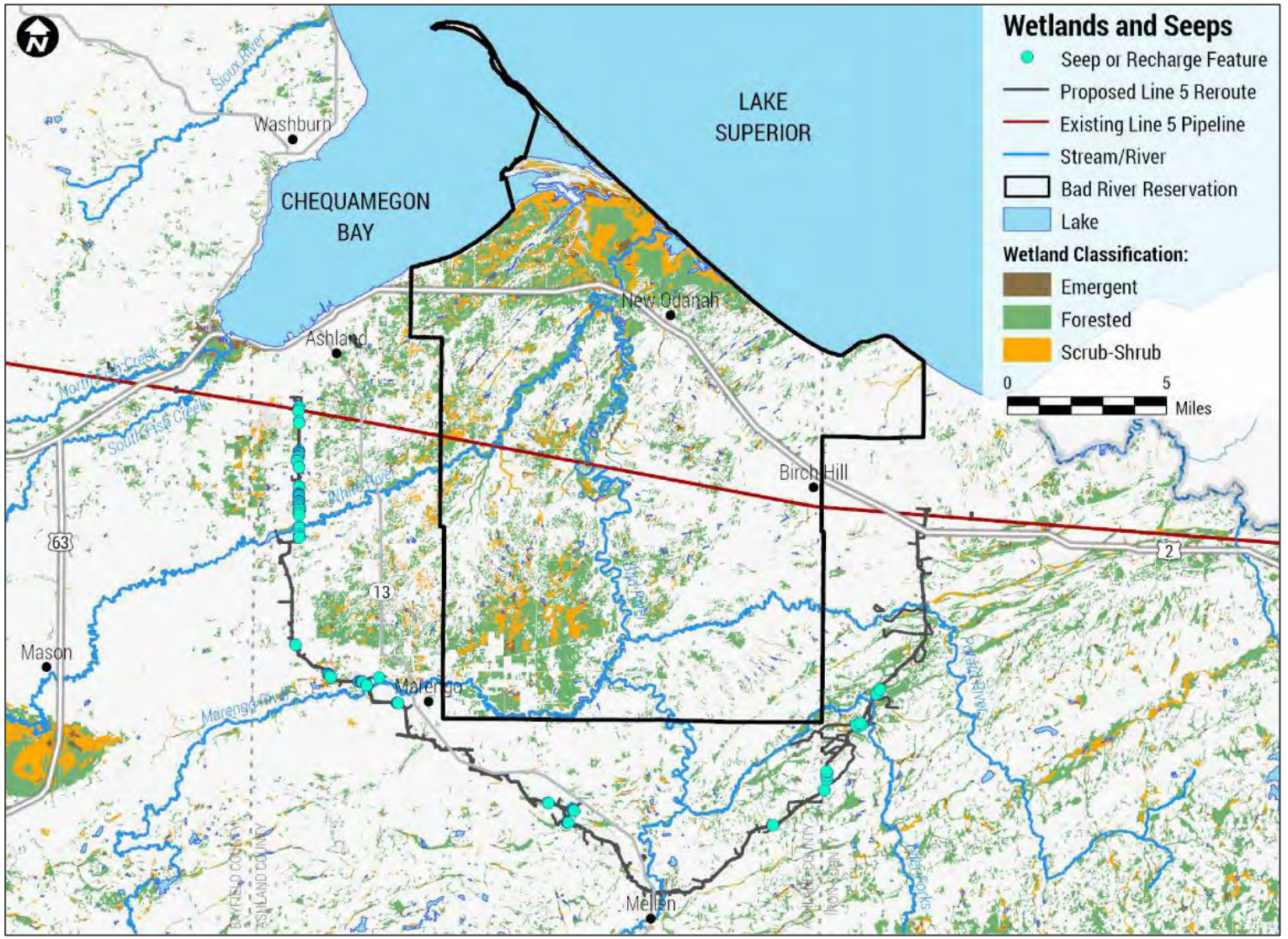
Example: January 2021, Enbridge Line 3 construction breached an artesian aquifer near Clearbrook, Minnesota, that discharged over 25 million gallons before being mitigated a year later in January 2022.

Groundwater Impacts to Reservation Streams

Pipeline construction can decrease groundwater discharge by changing the permeability of glacial aquifer sediments and changing fracture patterns in bedrock. This can result in:

- decreased or stopped flow of groundwater to surface water in streambeds and springs,
- decreased stream flow rates and water levels in wetlands,
- seasonal drying up of first-order streams and permanent dessication of wetlands (90 seeps and groundwater-influenced wetlands noted along L5R corridor), and
- increased downstream water temperatures that can negatively impact stream-dwelling beings.

Wetlands and Seeps



Species that depend on water quality and groundwater discharge sites (e.g., freshwater mussels, waterfowl, overwintering turtles, spawning fish, aquatic plants).

Groundwater Impacts to Reservation Streams – Listed Species


Freshwater mussels


Whooping cranes


Wood turtles


Lake sturgeon

401(a)(2) and Bad River Standards

Tribal Water Quality Standard:

- E.3.i - Lowering of Water Quality: “A lowering of water quality is defined as: the projected or observed diminished chemical, biological, or physical integrity of Reservation surface waters, ***including changes to water flow or water level*** [emphasis added]…”.

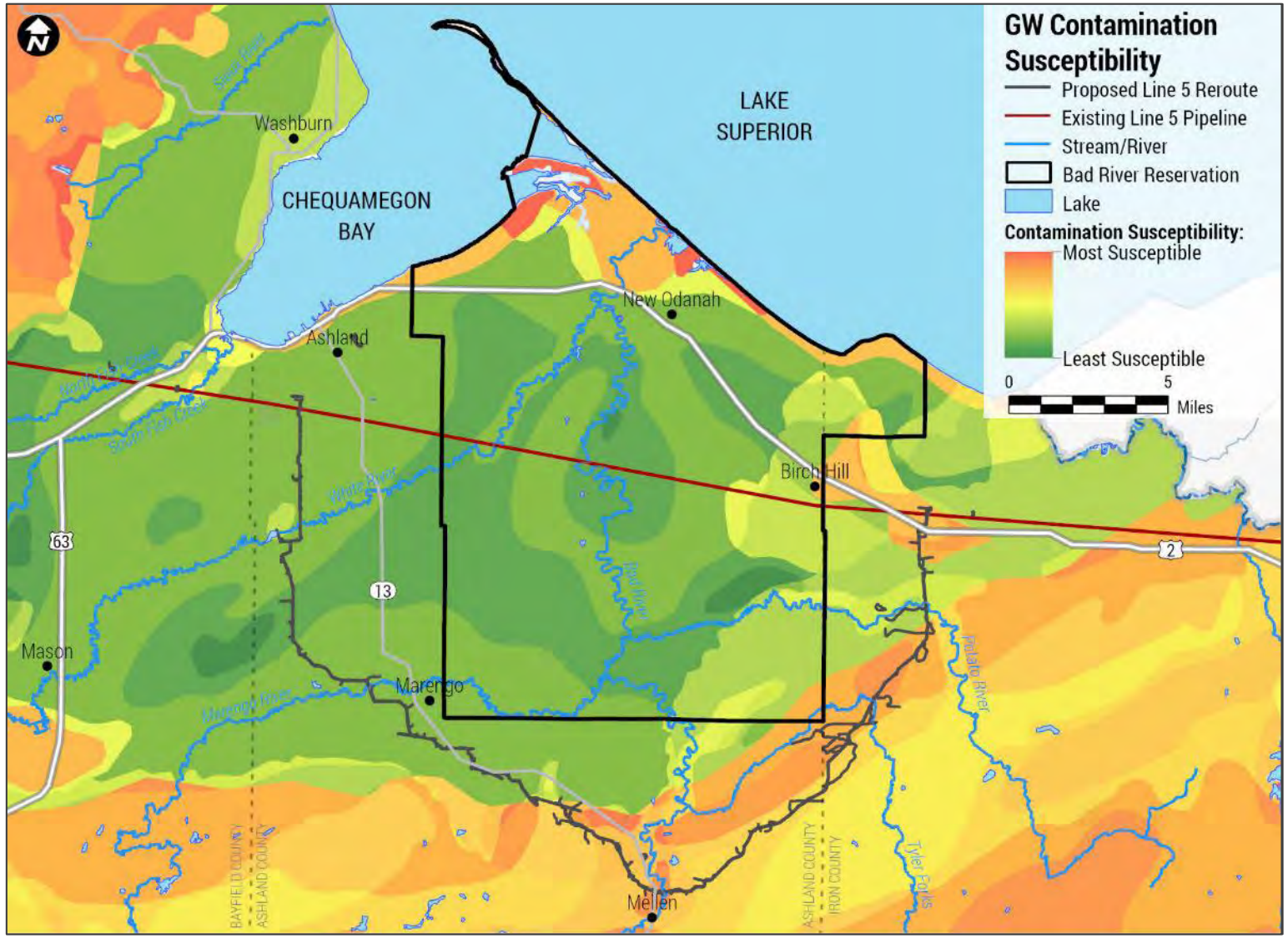
The creation or alteration of groundwater conduits would alter groundwater levels and surface water flows, which would negatively impact the designated uses of the Tribe’s surface water resources.

401(a)(2) and Bad River Standards

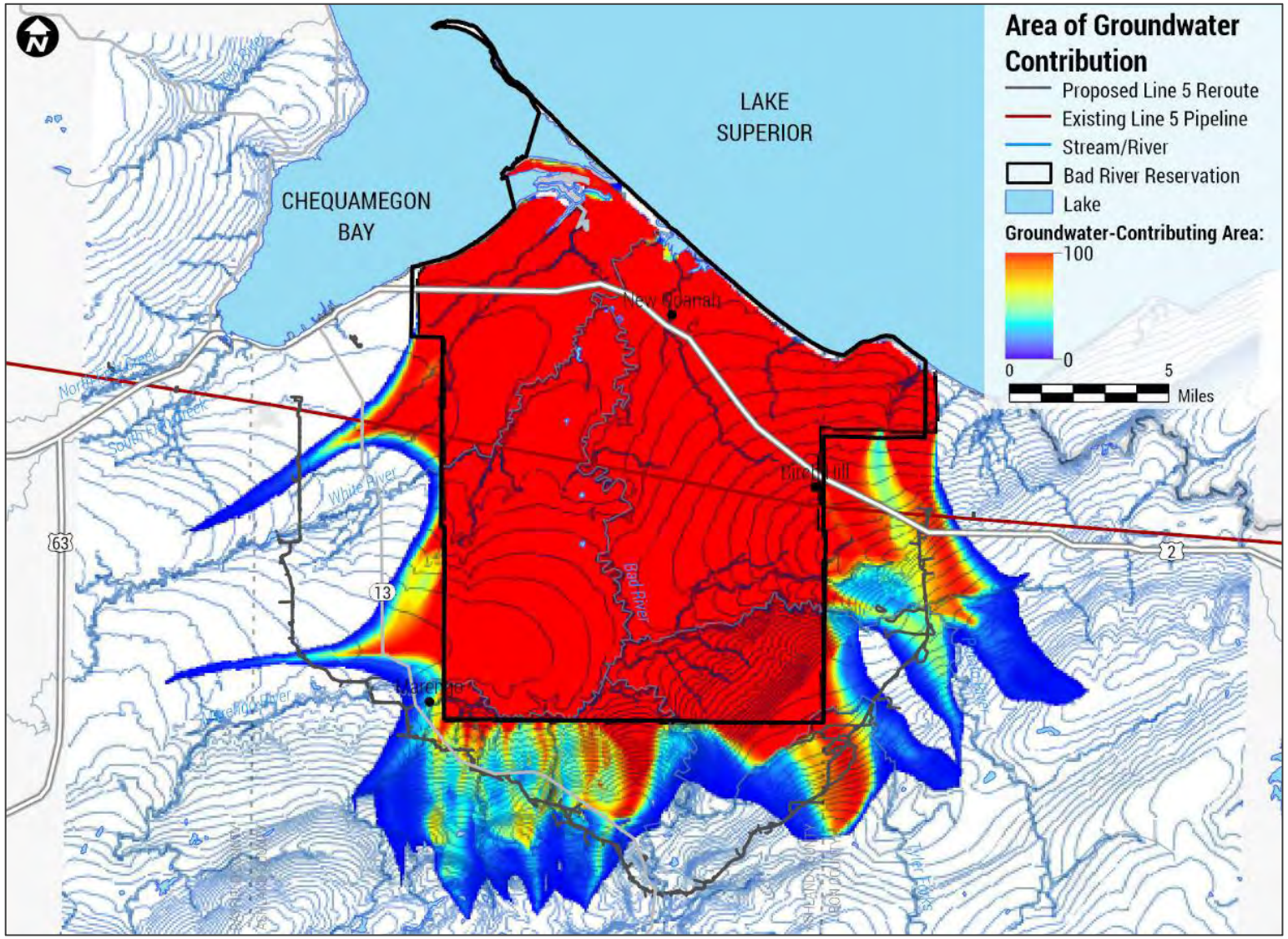
Pipeline construction will alter flow paths and introduce contaminants to groundwater such as spilled lubricants, fuel, and hydraulic fluids; drilling mud and additives; and mobilized natural minerals that are present in bedrock.

The western part of the Reservation upgradient from the Birch Hill community wells and the southeastern corner of the Reservation are most susceptible to L5R impacts.

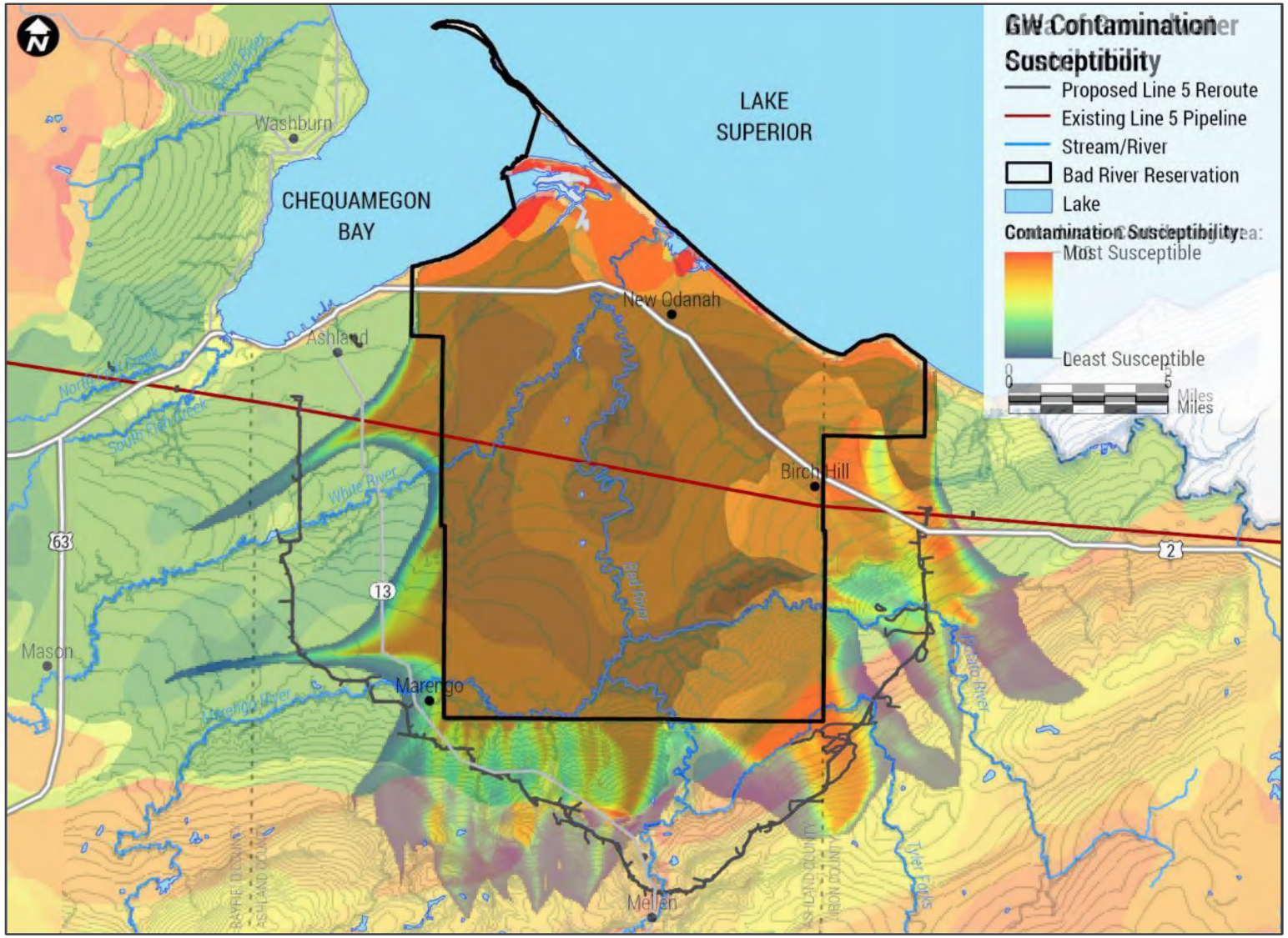
Groundwater Contamination Susceptibility

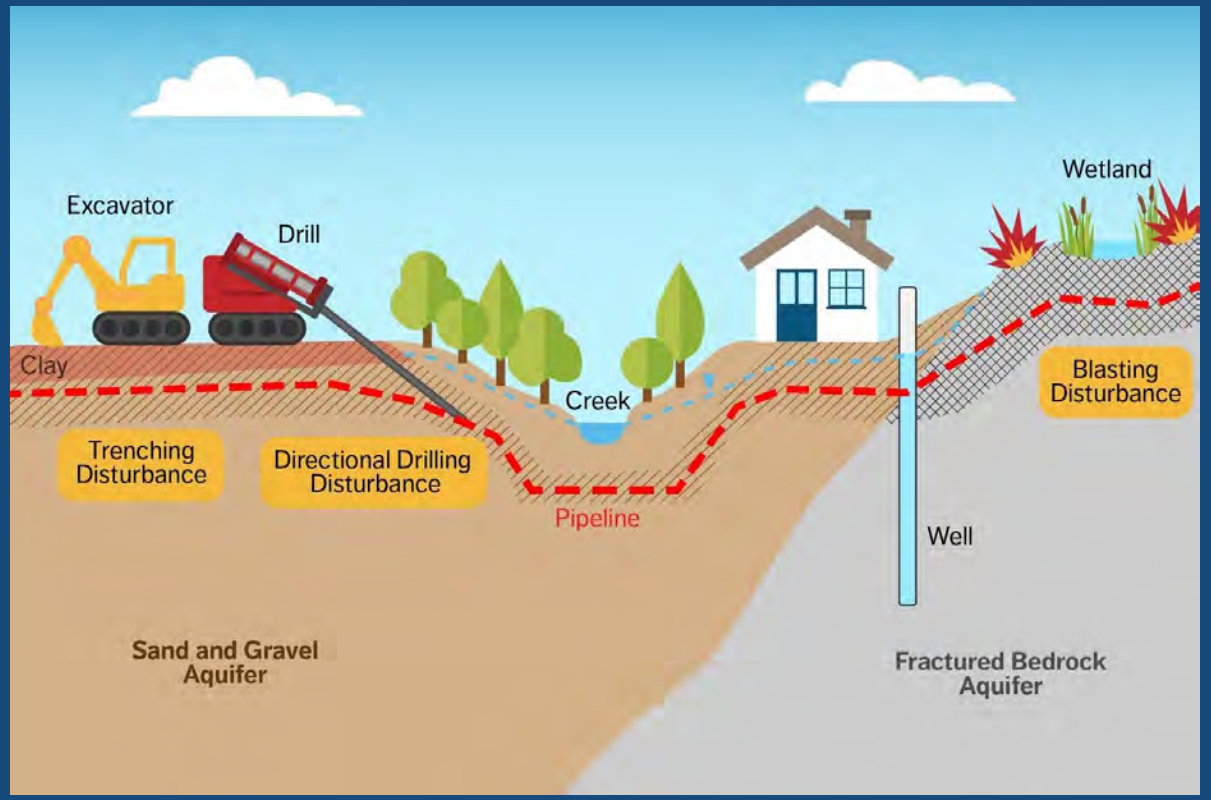


Area of Groundwater Contribution



Groundwater Contamination Susceptibility + Contributing Area




Excavator
Drill
Wetland
Clay
Creek
Blasting Disturbance
Trenching Disturbance
Directional Drilling Disturbance
Pipeline
Well
Sand and Gravel Aquifer
Fractured Bedrock Aquifer

HDD Impacts

Drilling Fluid Releases

The HDD approach (12 crossings) includes low-angle drilling of a small-diameter pilot hole, pilot hole enlargement, and pipe installation. Pressurized drilling fluid is used during all phases. Because there is uncertainty about drill bit positioning, subsurface geology, and confining pressure, drilling fluid release to the surface is unavoidable.

The “direct pipe” method (one crossing) uses a steerable microtunnel boring machine (MTBM) with drilling mud that pulls the pipe along behind it as it advances.

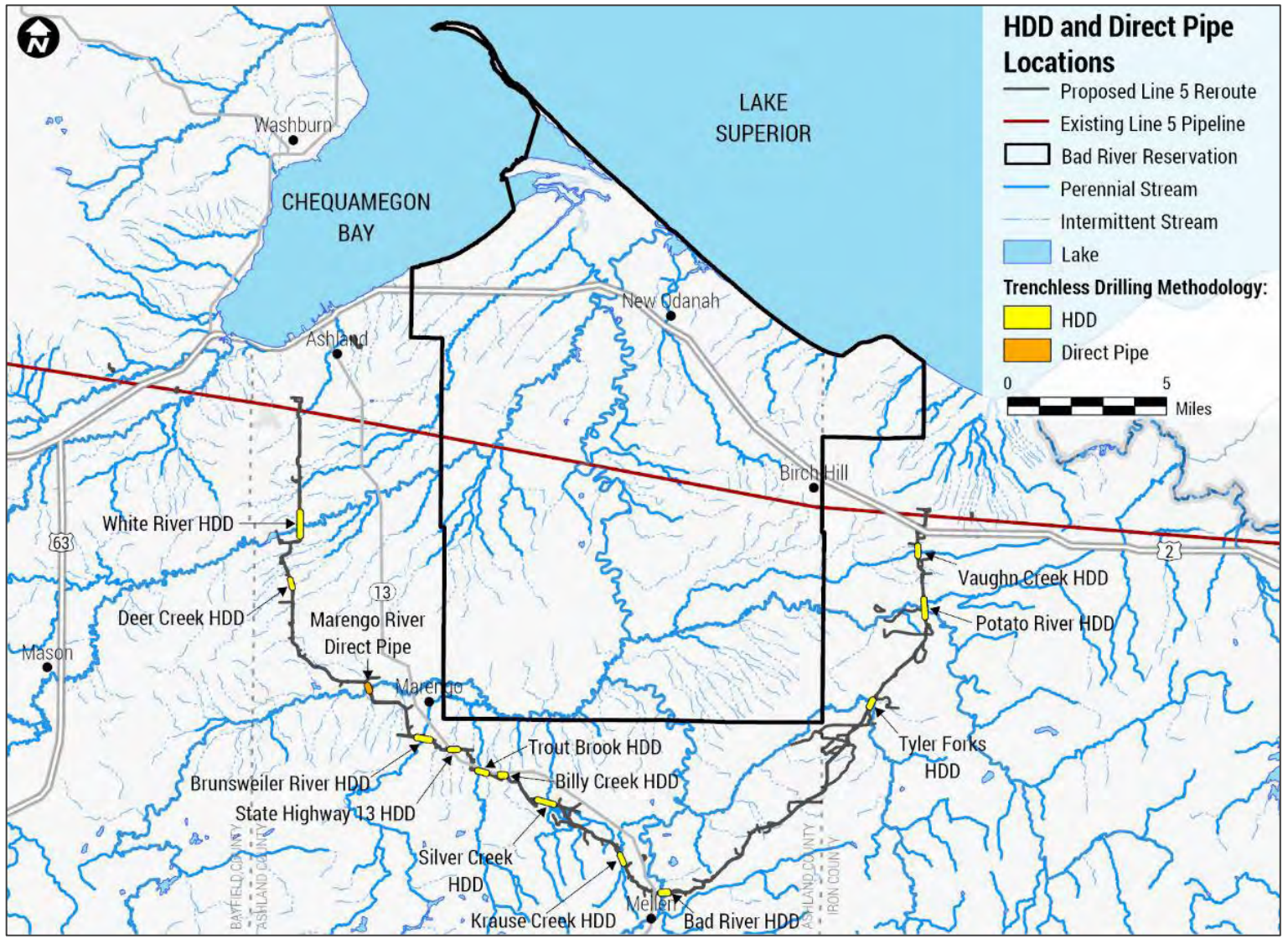
Line 3 pipeline construction in Minnesota resulted in 28 drilling fluid release incidents (“frac-outs” or hydrofractures). Multiple similar incidents would be expected during the L5R project.

Higher risks of fluid loss are associated with longer and deeper HDD runs:

- White River (milepost 4),
- Brunsweiler River (milepost 14),
- Silver Creek (milepost 19), and
- Potato River (milepost 38) and nearby tributaries (Vaughn Creek, Winks Creek).

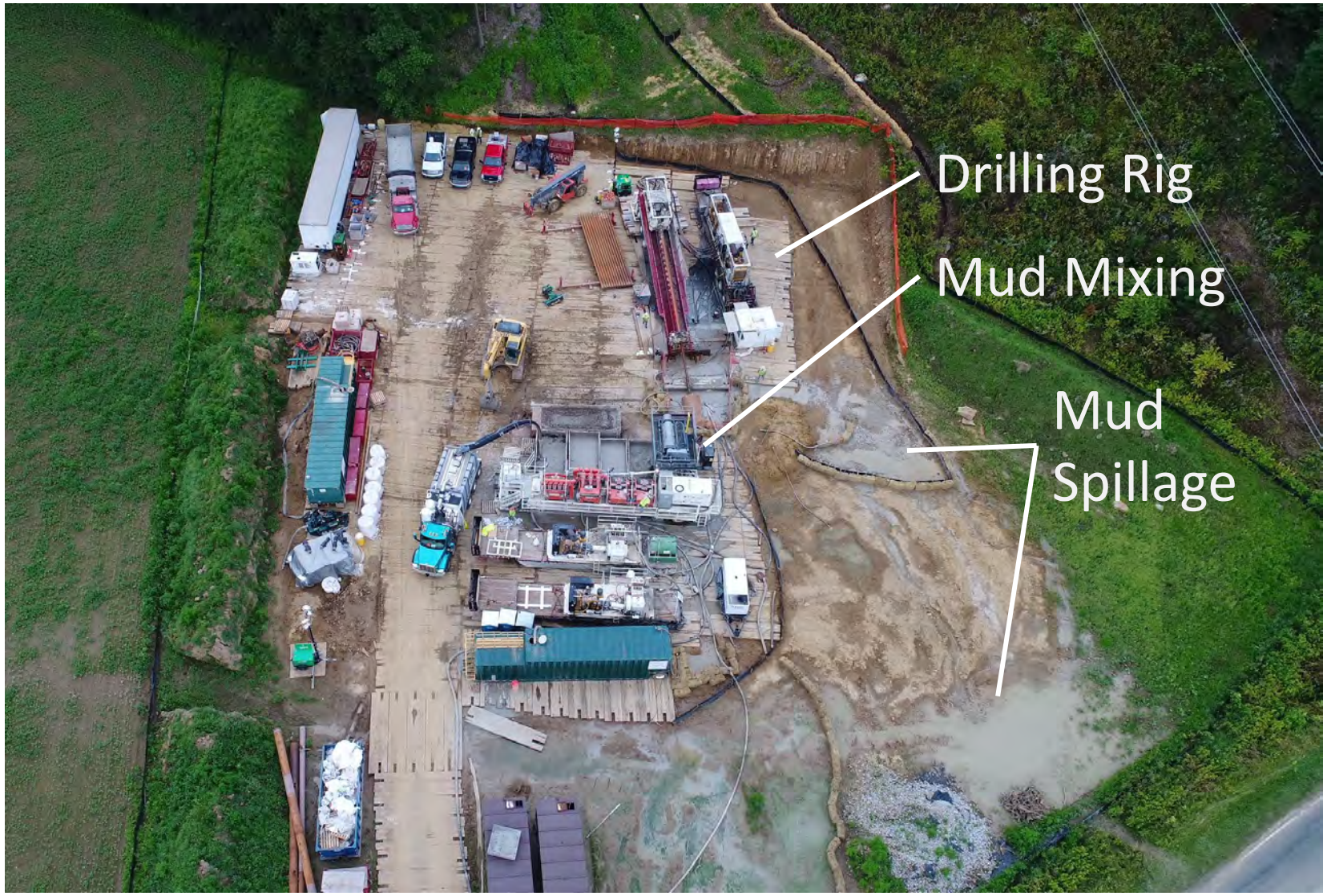
There is potential for HDD fluid to contain PFAS and other chemicals, as many additives are proprietary.

HDD and Direct Pipe Locations



HDD Layout

Typical large HDD rig and layout area setup.



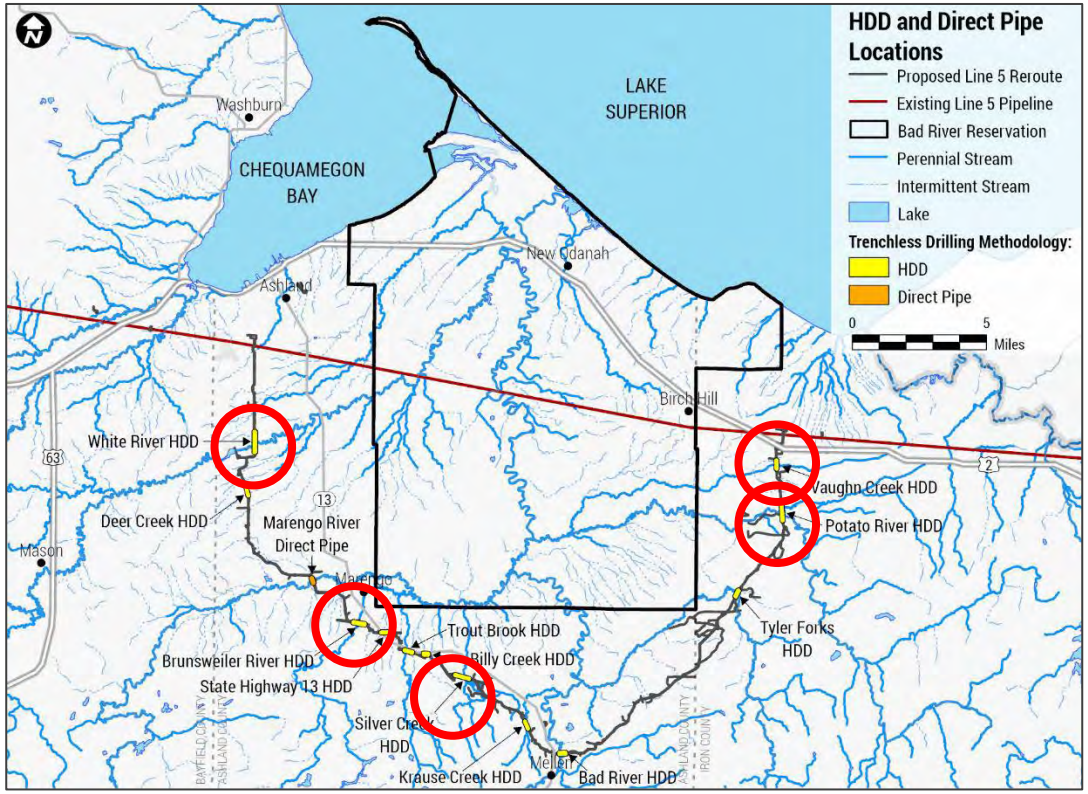
HDD Subsurface Impacts

Pressurized drilling fluid is used during all phases of HDD, so fluid is lost to the formation during drilling, potentially degrading groundwater quality and sealing flow paths to wells, seeps, springs, and streambeds.

One challenge with low-angle drilling is transitioning from unconsolidated glacial material (cobbles, gravel, sand, clay) into bedrock:

- Drill bit can “skip” off the bedrock surface, creating a large cavity in the unconsolidated material.
- Difficult to maintain the cavity due to balancing mud pressure and cavity wall collapse.
- Increasing mud pressure and moving the drill string in and out to deal with this increases the chance of inadvertent release, hole failure, or stream slope failure.

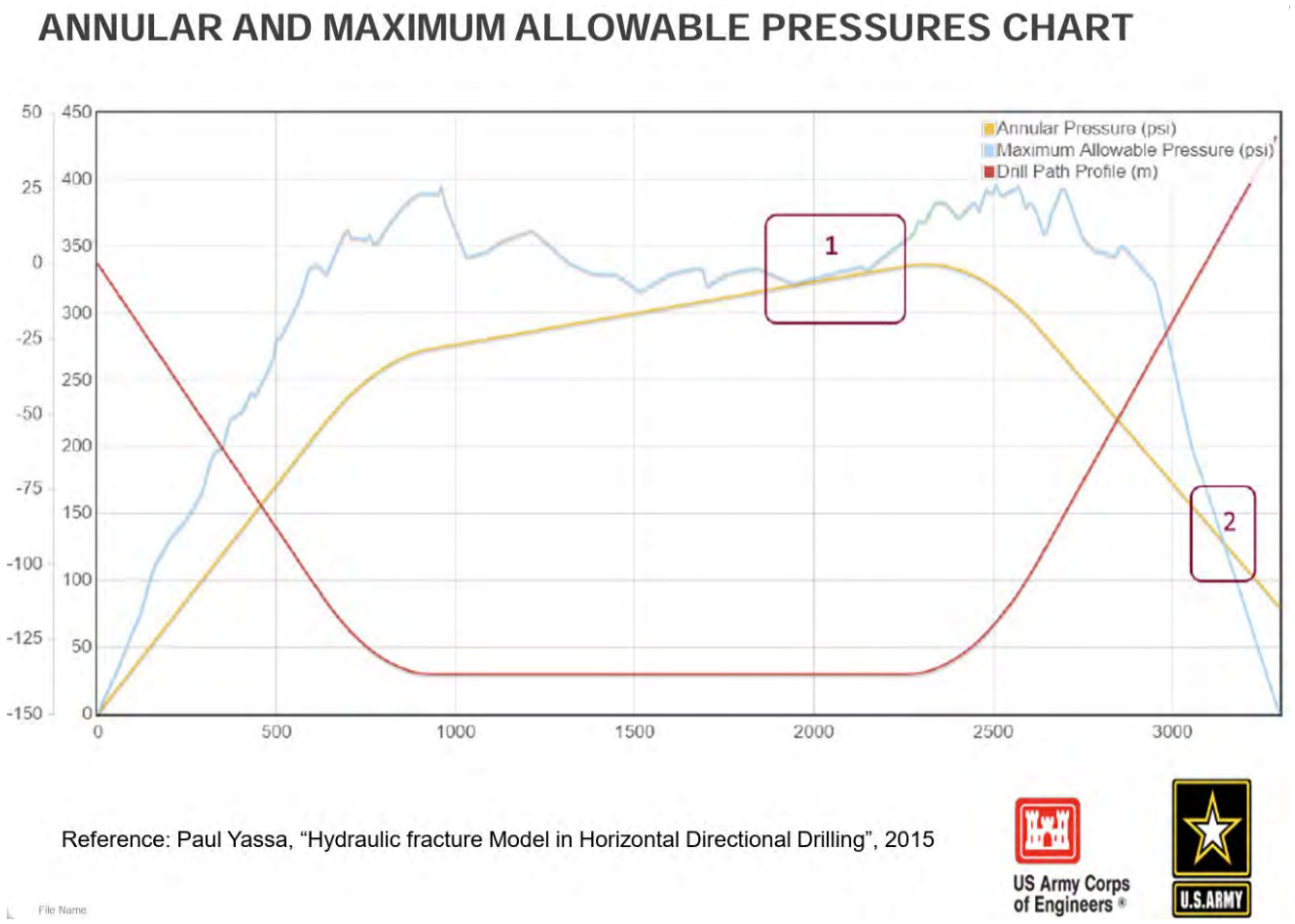
Problematic HDD Crossings



Contractors identified the White River Crossing and the Silver Creek Crossing to be "**significant and challenging**." Additionally, a known artesian spring area (from milepost 14.0 to 14.3) associated with the Brunsweiler River Crossing was acknowledged in the initial design reports. Contingency plans fail to address both the significant and challenging aspects of these HDD crossings, and the plans do not account for artesian conditions. These are only a subset of the crossings with known issues.

Enbridge HDD Release Evaluation

Enbridge contractors used the Delft equation to evaluate the potential for inadvertent fracturing of the subsurface during drilling and associated release of drilling fluid.



Adequacy of Enbridge HDD Release Evaluation

My concerns mirror those of the consultant retained by USEPA (RESPEC) to evaluate the calculations reported for the Milepost 4 site, however they extend to other sites as well. Key points of uncertainty (adapted):

1a. Unclear how Pmax was determined, including the cohesive strength of soil.

1b. Inadequate consideration of the layering of soils and associated soil properties.

1c. Inadequate consideration of potential for elevated groundwater pressure in spring.

1d. Method for determining site-specific range of earth stresses unclear.

1e. Radius of the damage zone/plastic zone unclear.

1f. Hydrofractured plastic zone growth in the vicinity of geotechnical boreholes is unclear (concern about the release of drilling fluid along the filled borehole pathway, or concern about lateral vs. vertical anisotropy?).

1g. How the groundwater pressure was determined in specifying shear modulus was unclear. [Besides the loss of drilling fluid, slope failure could also be a concern here; see Eigenbrod, 2003.]

2. The Hydrofracture Curve Analysis should have a factor of safety based on local, specific conditions.

3. The information used to develop the blue line on the figures that shows the pressure at which inadvertent drilling fluid returns are likely is not fully presented.

Blasting Impacts

https://www.youtube.com/watch?v=lrKlPjEn_S8
Dykon Blasting, 2017, pipeline work in Arkansas

Blasting Impacts to Water Resources

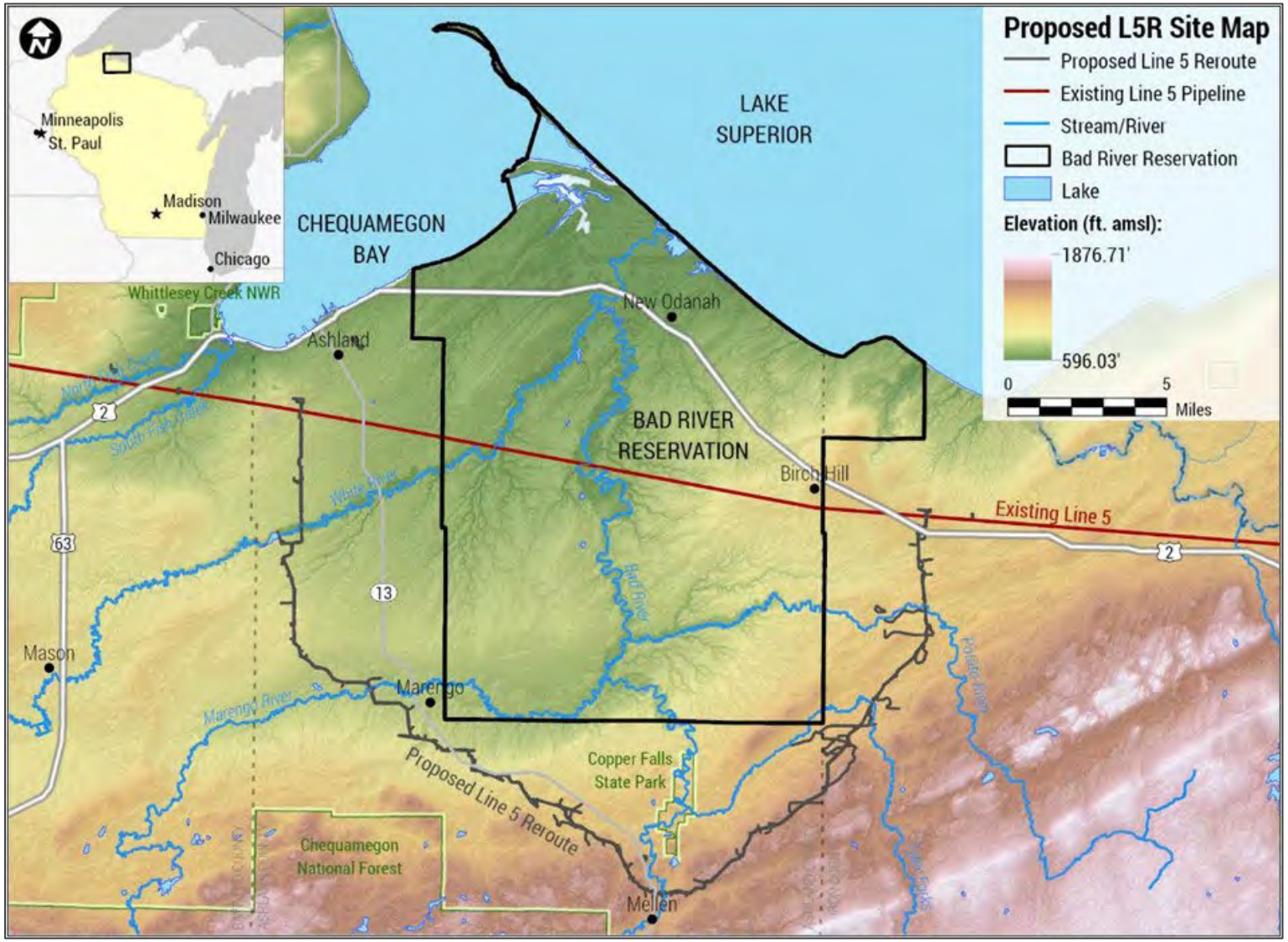
Blasting uses explosives for the excavation of rock. Explosive residues and fractures that extend beyond the trench area may be left behind during this process.

Near-surface bedrock (<60 inches deep) exists over 2 percent of the pipeline route, covering a total length of 10,753 linear feet (>2 miles).

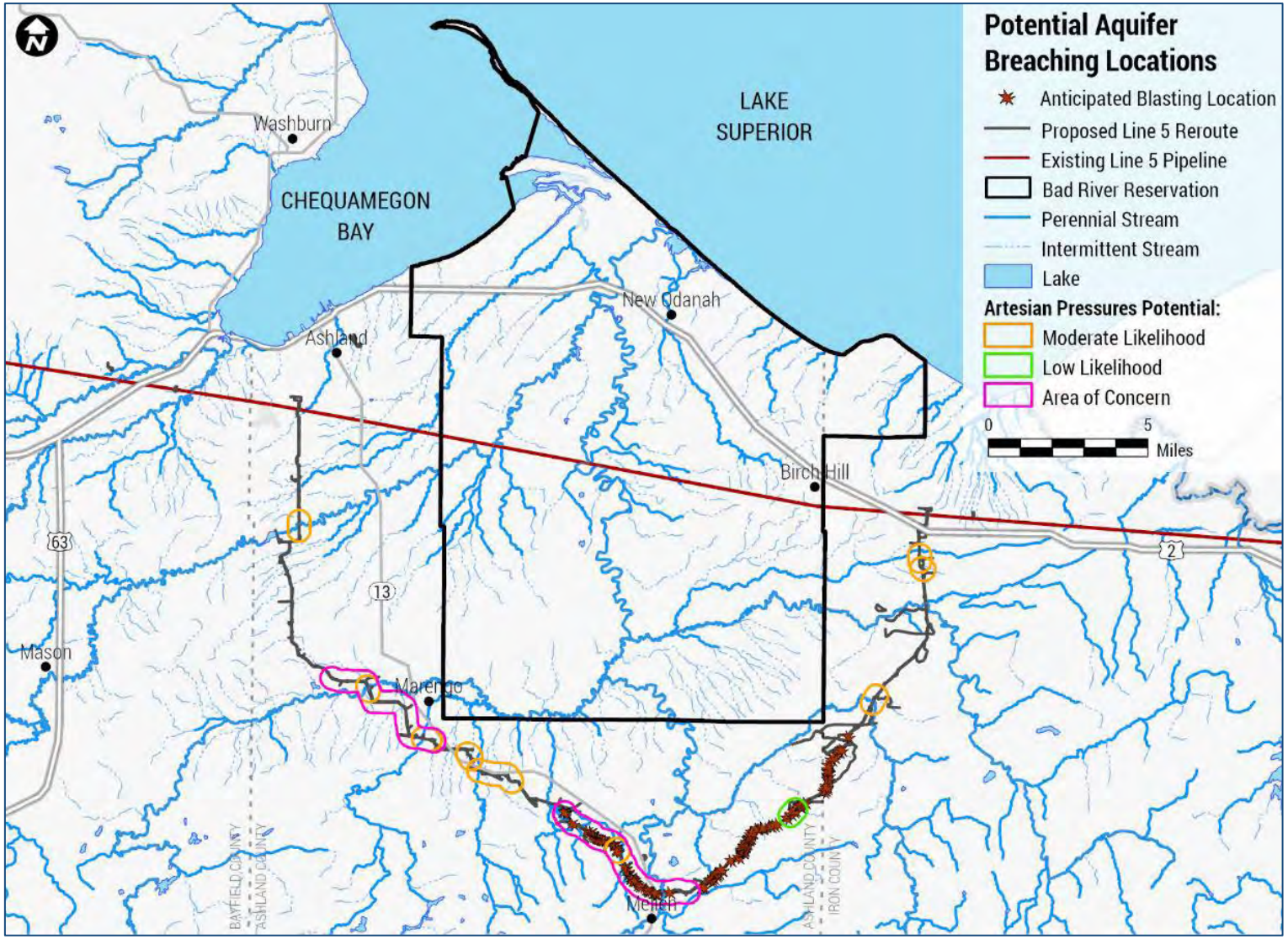
Blasting will permanently alter the fractured bedrock aquifers along the corridor, resulting in:

- Redirection of groundwater flow paths along impacted existing rock fractures and new rock fractures.
- Introduction of explosive constituents and other construction-related contaminants to groundwater.
- Excess flow or reduced/eliminated flow and discharge of groundwater.
- Degraded drinking water wells and springs, and dried up or flooded wetlands and streams in blasting areas.

Topographic Map



Potential Aquifer Breaching and Blasting Locations



Inadequacy of Mitigation

The Enbridge *Wetland and Waterbody Restoration and Post-construction Monitoring Plan* addresses blasting-related mitigation. On page 23, the plan states:

"Examples of topography or hydrology-related issues that may require additional restoration include: unexpected ponding, unexpected drainage, and/or disruptions to flow patterns causing changes in pre-construction wetland hydrology. Corrective actions, such as ***regrading or recontouring*** [emphasis added], *will be implemented if crowning, subsidence, or the restored grade is determined to be interfering with the goal of re-establishing vegetative communities according to the local ecotype, or pre-construction wetland hydrology."*

The plan acknowledges the potential for hydrologic disruption, but:

- Only surficial remedies are proposed.
- Subsurface issues created by permanent alteration of groundwater flow paths and modified seepage into or out of fractured bedrock cannot be addressed in this way.
- Subsurface remedies such as grout injection, re-excavation, and sealing of fractures from blasting, or subsurface rerouting of flow are not considered.
- Blasting impacts are assumed to be minimal, and the corrective actions described are unlikely to be effective.

Problematic Blasting Locations

The eastern portion of the proposed L5R corridor goes through areas underlain by the Copper Falls Aquifer. Dozens of blasting locations proposed along this route are in a groundwater area that the WDNR identifies as more susceptible to contamination. Additionally, blasting is proposed to occur within an area contributing to aquifer recharge that flows onto the Reservation and may impact private or community wells in Birch Hill and elsewhere.

Wetlands occur at various elevations as perched depressions in higher elevation areas or on floodplains that interact with streams under high water conditions or that are fed by groundwater during lower river stages. Wetlands in such settings are fragile and subject to irreversible alteration by construction activities such as blasting that modify their hydrogeologic settings by changing their interaction with groundwater.

Contamination from Bedrock Minerals

Excess rock from blasting (a.k.a., “muck”) is planned to be re-used as pipeline trench fill material. Bedrock could contain constituents that may degrade water quality and pose health risks:

- Blasting agent residues
  - Nitrates, fuel oil, perchlorate, mercury, RDX, HMX, and PETN
- Natural toxic or harmful elements released from bedrock:
  - Arsenic, radon, selenium, uranium, lead, boron, cadmium, molybdenum, phosphorus, vanadium, and other metals.
  - Asbestiform minerals identified in the Penokee Range near the proposed project area, and known to be present in the Tyler Forks River basin.
  - Phosphorus.
  - Sulfur-bearing minerals (e.g., iron sulfides) that, on exposure to atmospheric oxygen, moisture, and acidophilic iron-oxidizing bacteria, can result in the formation of sulfuric acid, dissolved iron, precipitation of ferric hydroxide, and pipeline degradation.

Mobilized toxic compounds and acidic water can impact groundwater and surface water long after construction is complete, and can potentially compromise pipeline integrity. Bedrock mineralogy along the blasting segments of the L5R corridor has not been well characterized.

Mercury Contamination

A concern with modification of wetland hydrology is the mobilization of mercury and methylmercury from wetland soils due to changes in saturation and redox conditions from L5R construction activities. Multiple Lake Superior watersheds have mercury impairments linked to upland wetland sources.

Related Federal Agency Concerns

A March 2022 letter from USEPA that consisted of 27 pages of comments on the Line 5 Environmental Impact Statement included the following concerns:

- "potential bedrock fractures from blasting and associated impacts to the migration of waters" (p. 16),
- well contamination by blasting agents (p. 16),
- creation of "French drain type conditions" (p. 17), and
- "disturbed groundwater and surface water interactions and instream flow dynamics" at stream crossings (p. 17).

Potential impacts on aquatic fish and invertebrates (e.g., freshwater mussels) are mentioned on p. 13, which would include impacts of "changes in water quality, temperature, and nutrients" (p. 17).

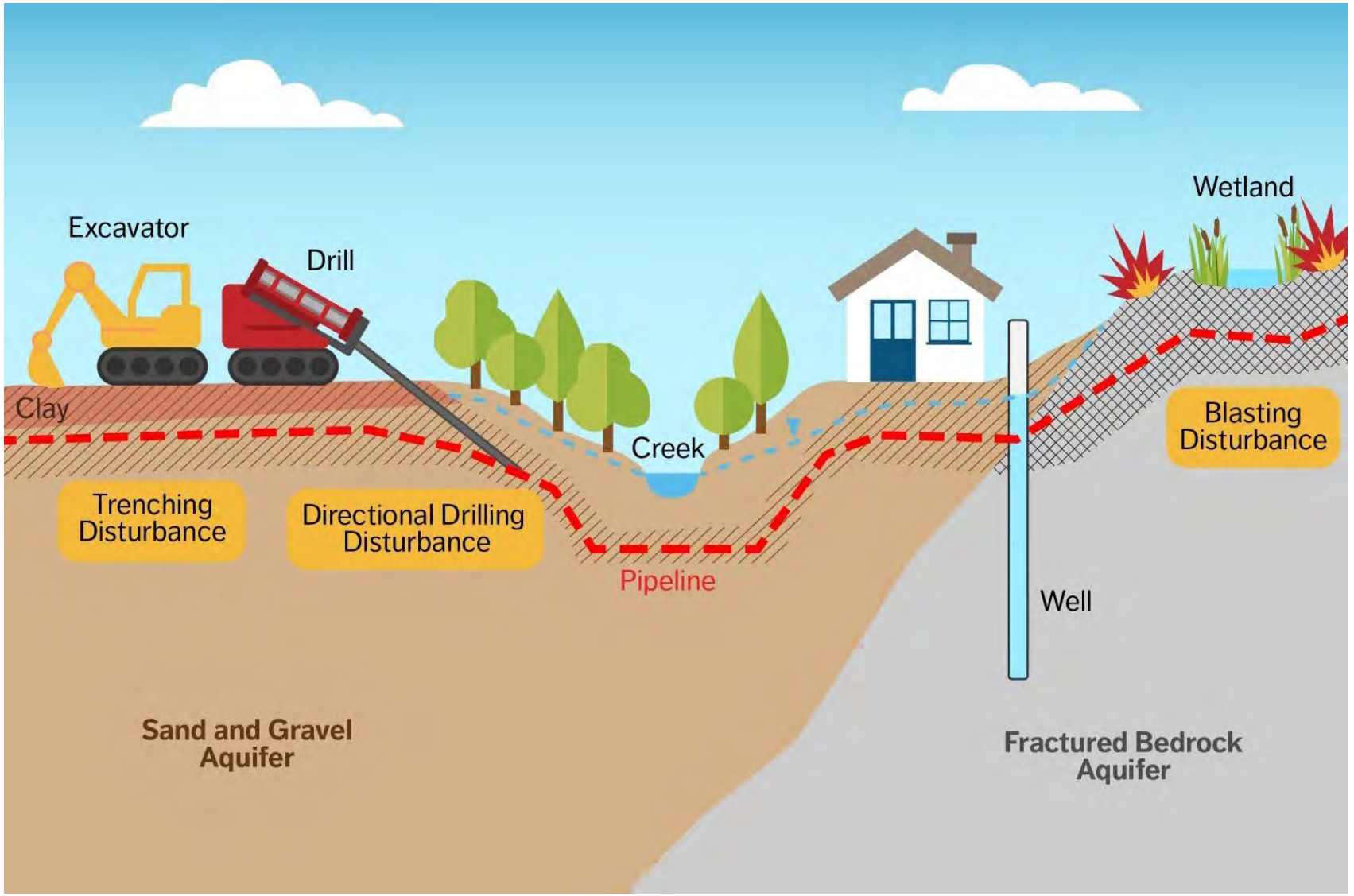
EPA Comment 16 (repeated as Comment 34) states:

"In areas where wetlands occur in thin soils over impermeable bedrock, blasting can generate new preferential soil moisture movement and/or groundwater flow paths that can result in changes to wetland hydrology or even dewatering of wetland."

Summary

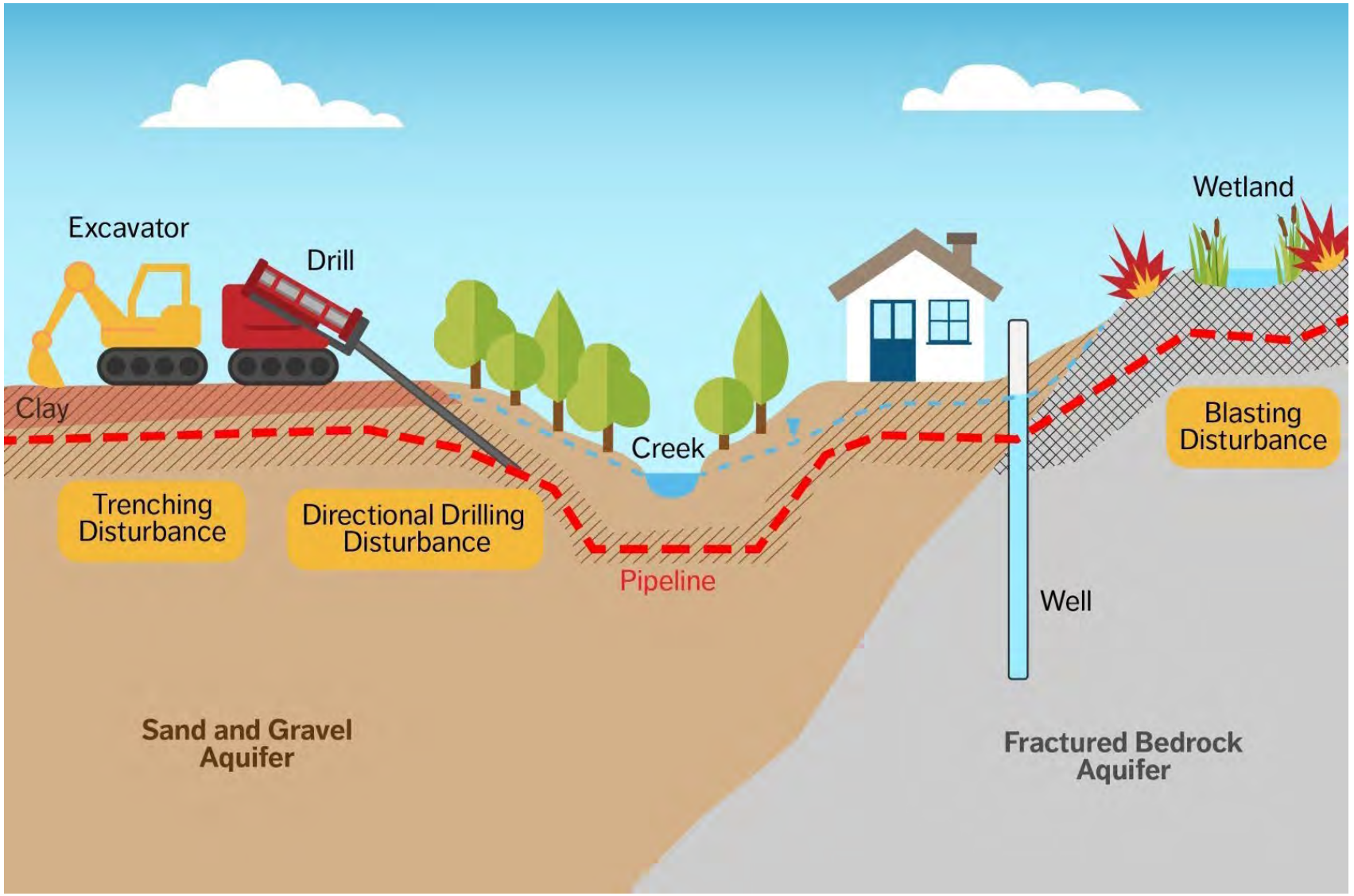
Expert Opinion:

The proposed Enbridge Line 5 Reroute Project will cause impacts that will violate Tribal water quality and flow alteration standards (Sect. E.3.i.).



Expert Opinion:

The L5R Project will create temporary and permanent negative impacts to groundwater quantity, quality, and related natural resources and beings on the Bad River Reservation and on lands and waters covered by the Tribe's retained treaty rights.



Expert Opinion:

L5R Project construction, including over 10,000 linear feet of blasting and substantial excavation in areas of artesian groundwater pressure, will negatively affect natural resources and beings on the Bad River Reservation and adjacent lands such that permit conditions cannot be established to prevent harm.