

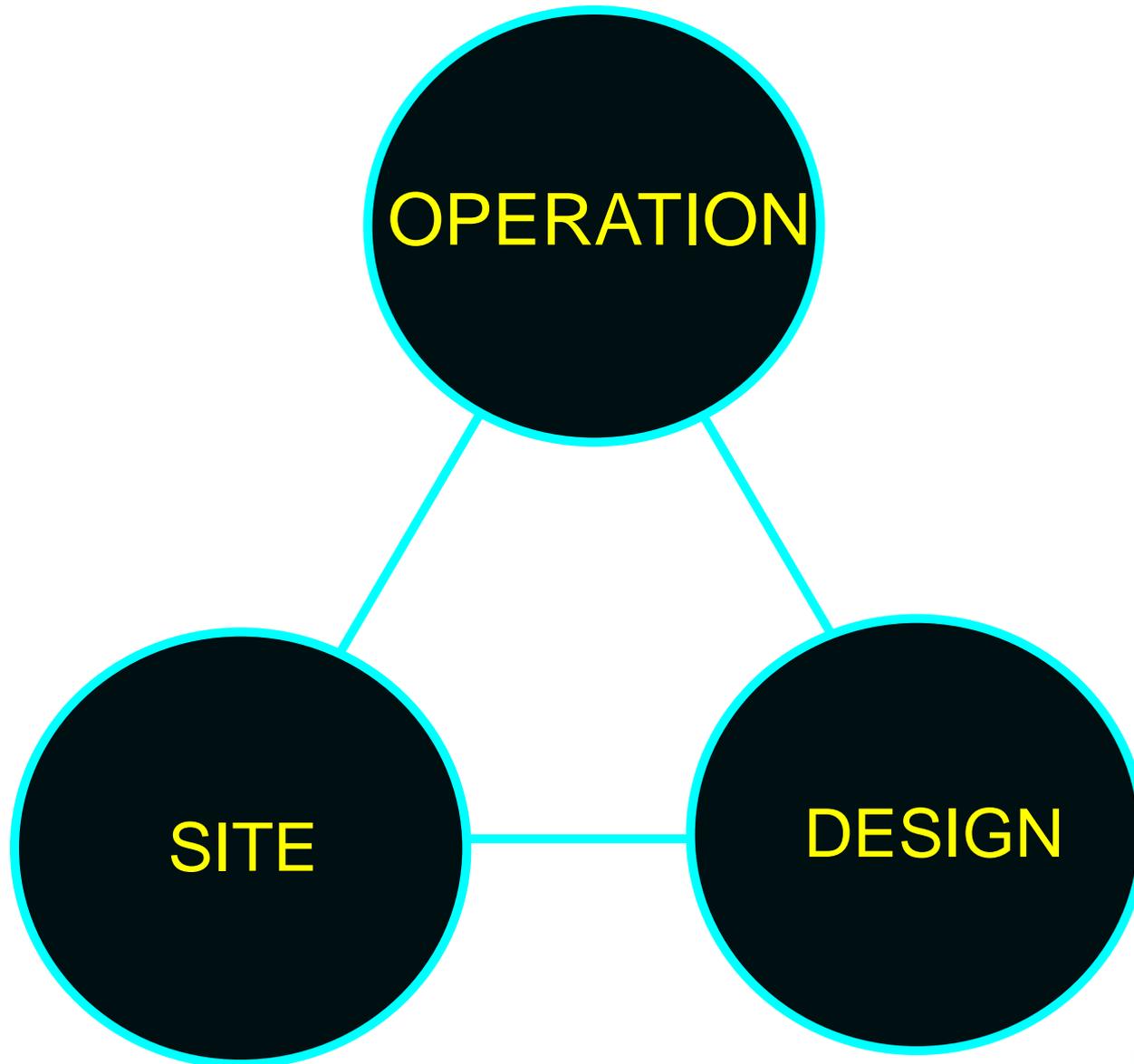
North Dakota Oilfield Solid Waste Update

February 11, 2014

Bismarck, ND

Dave Glatt, Section Chief
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Three Landfill Factors



"UNBREAKABLE LINKS"

NDDH Solid Waste Facility Permit Process

Pre-Application Review

- **Preliminary facility description** (size, type of waste, amount, design, etc.);
- **Available information on site** geology, hydrogeology, topography, soils, and hydrology.
- **Acceptable to Local Zoning;**
- **Proponent has Legal Access to Property;**
- **Department consults with the State Geologist and State Engineer;**
- Full application may be filed **only after approval of the pre-application.**

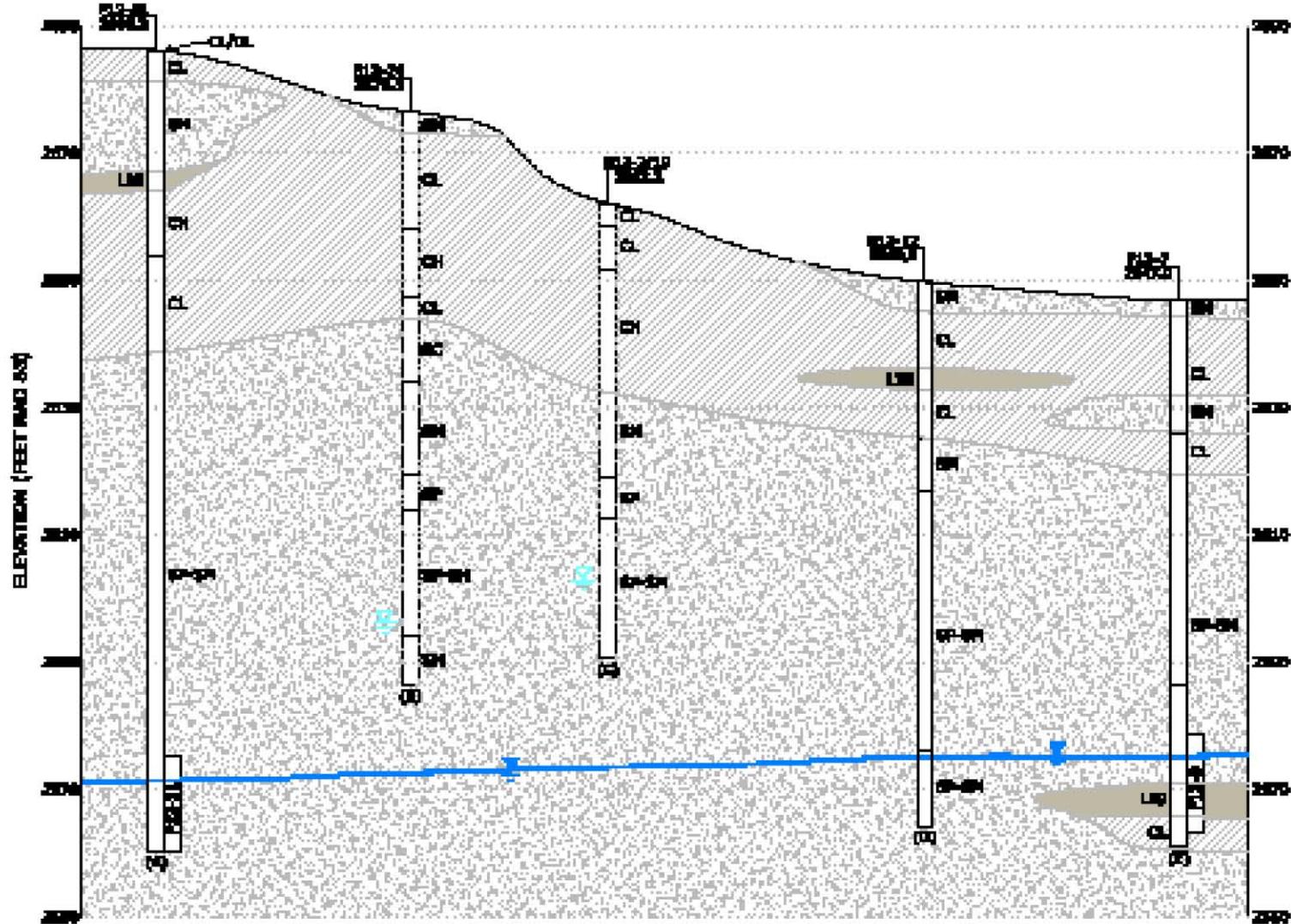
NDDH Solid Waste Facility Permit Process

Application Must Address

- Applicant publishes two public notices in the county newspaper;
- Site Characterization and Soil Survey;
- Facility Design - Engineering Specifications;
- Plan of Operation – including operation, training, record keeping and reporting;
- Waste Acceptance (types and amounts) and Waste Rejection Procedures;

SOUTHWEST
1'

NORTHEAST
1'



- | | | | |
|----------|------------------------|----------|-------------------------------------|
| [Symbol] | SOIL CLASSIFICATION | [Symbol] | LEAN OR FAT CLAY |
| [Symbol] | WATER TABLE | [Symbol] | SAND, SILTY WITH SILT OR SILTY SAND |
| [Symbol] | PERCHED WATER | [Symbol] | LENTIC |
| [Symbol] | POTENTIOMETRIC SURFACE | | |

NDDH Solid Waste Facility Permit Process

Application Review

- Ground Water Monitoring and Corrective Action;
- Construction Quality Assurance and Quality Control;
- Closure and Post Closure Care (30 years);
- Financial Assurance.

NDDH Solid Waste Facility Permit Process

If Application is Complete

- NDDH prepares a review and draft permit;
- Public Review and Comment on Draft Permit;
- Department publishes a notice in the county newspaper and a daily newspaper of general circulation;
- Interested persons may submit written comments within thirty days;
- NDDH may hold a hearing if there is significant public interest;
- All written comments will be considered.

NDDH Solid Waste Facility Permit Process

Before Issuance of a Solid Waste Facility Permit:

- NDDH notifies county commissioners...of the Department's intention to issue a permit.
- County Commissioners may call a special election to...approve or disapprove of the facility based on public interest and impact on the environment.
- If a majority...vote to disapprove of the facility, the NDDH may not issue the permit and the facility may not be located in that county.

Location Requirements for MSW, Special Waste and Industrial Waste Landfills

General location standards (NDAC 33-20-04.1-01)

1. Avoid unsuitable areas with unfavorable topography, geology, hydrology, or soils.
 2. Minimize, control or prevent the movement of waste or waste constituents with geologic conditions and engineered improvements.
- Sites should be underlain by (clay-rich) materials with low permeability to provide a barrier to contaminant migration.

Location Requirements for MSW, Special Waste and Industrial Waste Landfills

Areas or conditions excluded:

- (1) Within an aquifer;
- (2) Within a public water supply designated wellhead protection area;
- (3) Within a one hundred-year floodplain;
- (4) Area susceptible to differential settlement including underground mines

Location Requirements for MSW, Special Waste and Industrial Waste Landfills

Areas or conditions excluded (cont'd):

(5) channels, ravines, or steep topography

(6) Within woody draws; or

(7) Areas designated as critical habitats for endangered or threatened species of plant, fish, or wildlife.

Location Requirements for MSW, Special Waste and Industrial Waste Landfills

Areas or conditions may not be approved unless there are no reasonable alternatives:

- (1) Principal glacial drift aquifers;
- (2) Closer than one thousand feet to a down gradient drinking water supply well;
- (3) Two hundred feet from surface water or wetland;
- (4) Within final cuts of surface mines; or
- (5) Closer than one thousand feet to any state or national park.

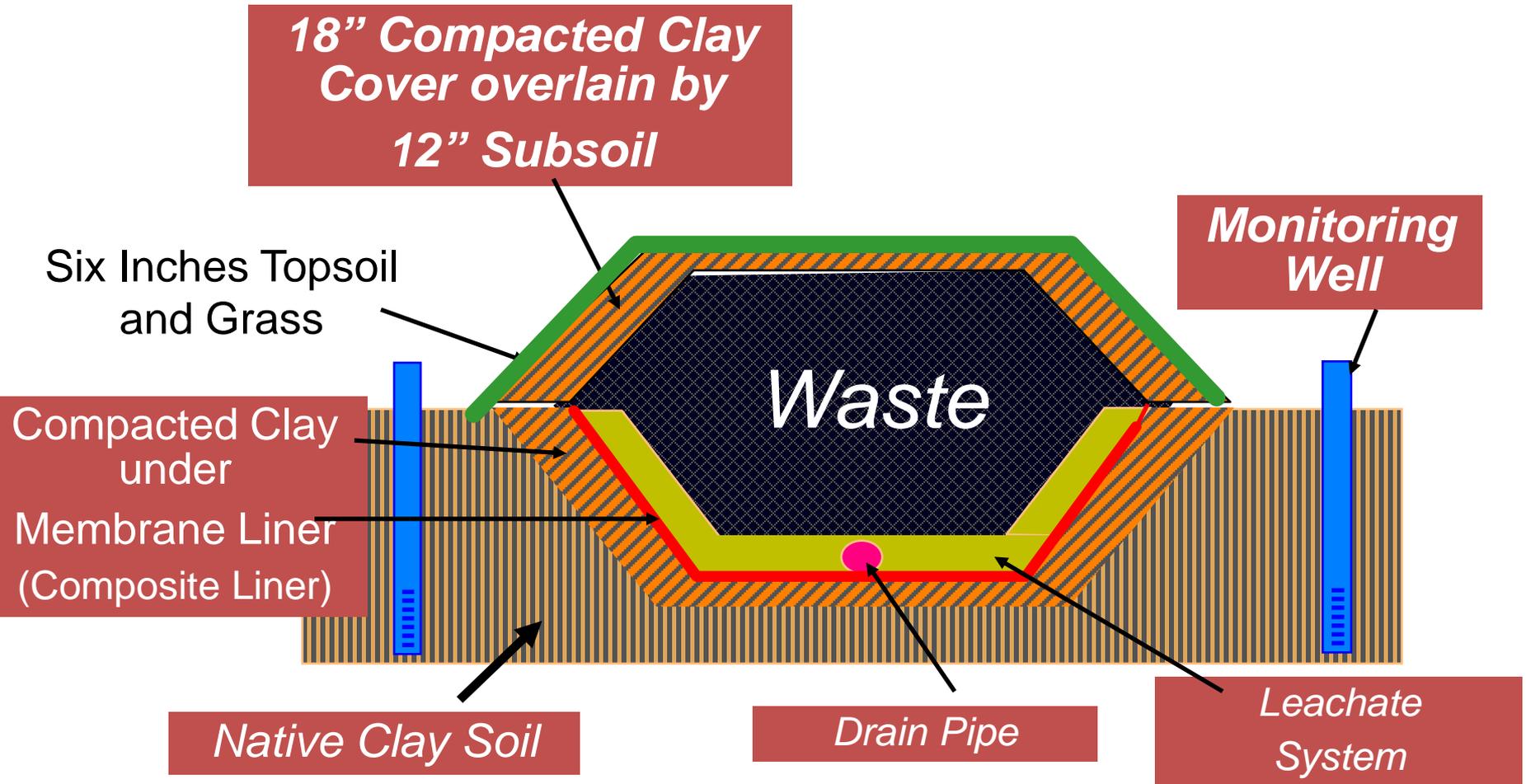
Location Requirements for MSW, Special Waste and Industrial Waste Landfills

The Department may establish alternative criteria based on specific site conditions.

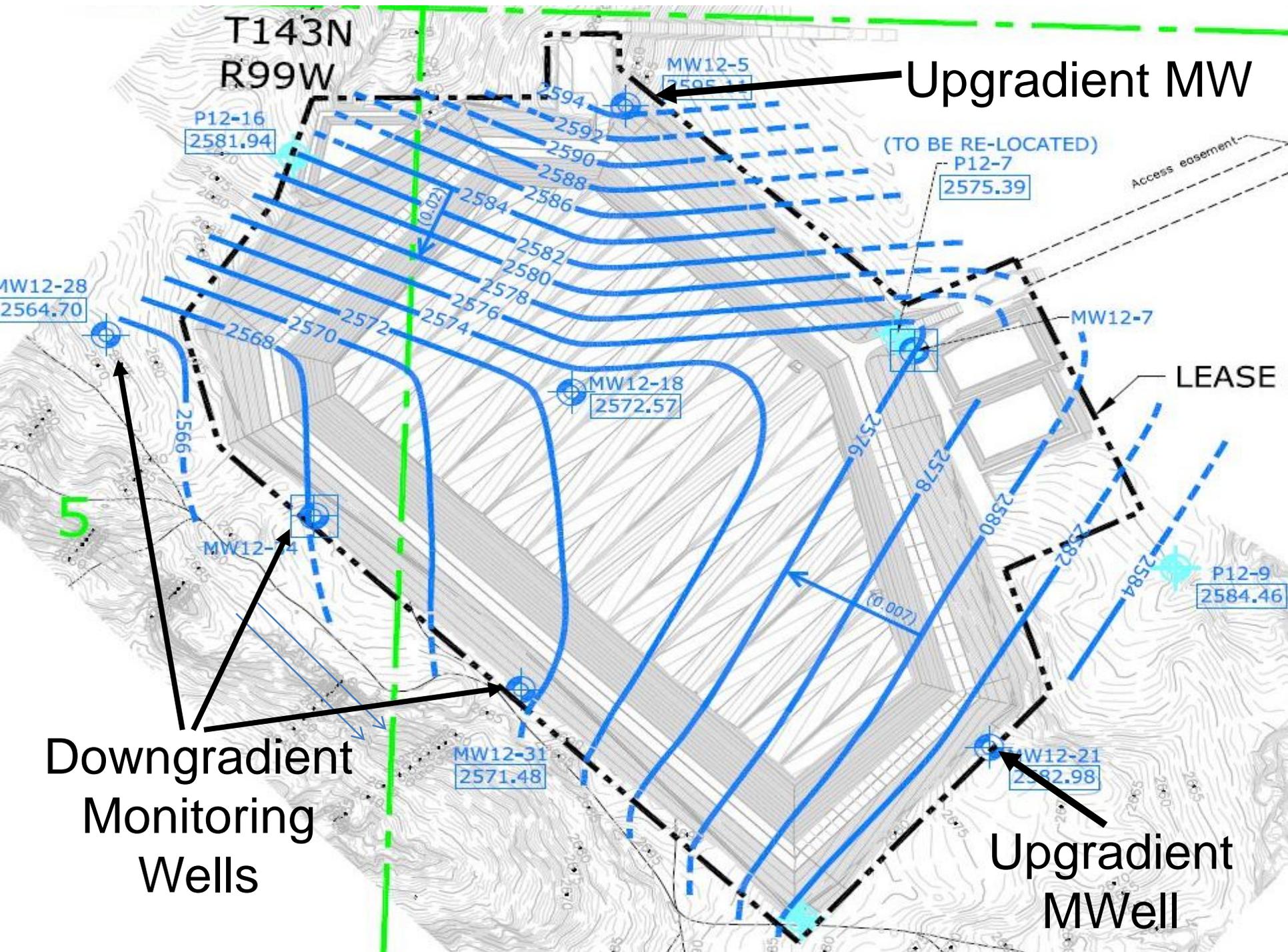
Municipal waste landfills have setback requirements for airport runways (FAA – Bird Attractant Requirements)

Twenty-five foot setback from pipelines or transmission lines.

Anatomy of MSW and Oilfield Special Waste Landfills



MSW Landfill has 2 foot Composite Liner,
Oilfield Special Landfill has 3 foot Composite Liner



T143N
R99W

Upgradient MW

(TO BE RE-LOCATED)
P12-7

Access easement

LEASE

Downgradient
Monitoring
Wells

Upgradient
MWell

5

P12-16
2581.94

MW12-5
2595.11

P12-7
2575.39

MW12-7

MW12-18
2572.57

P12-9
2584.46

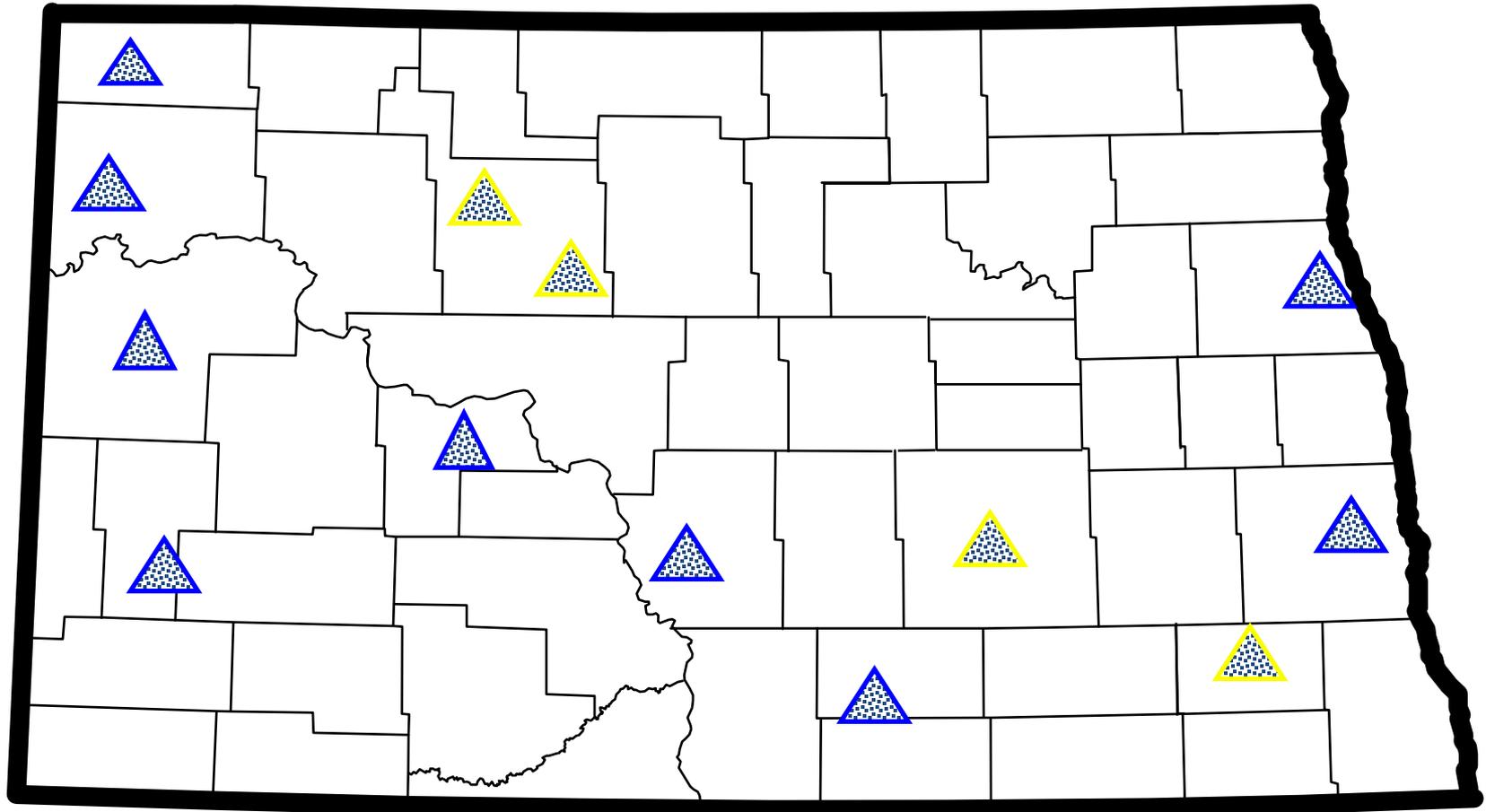
MW12-24

MW12-31
2571.48

MW12-21
2582.98

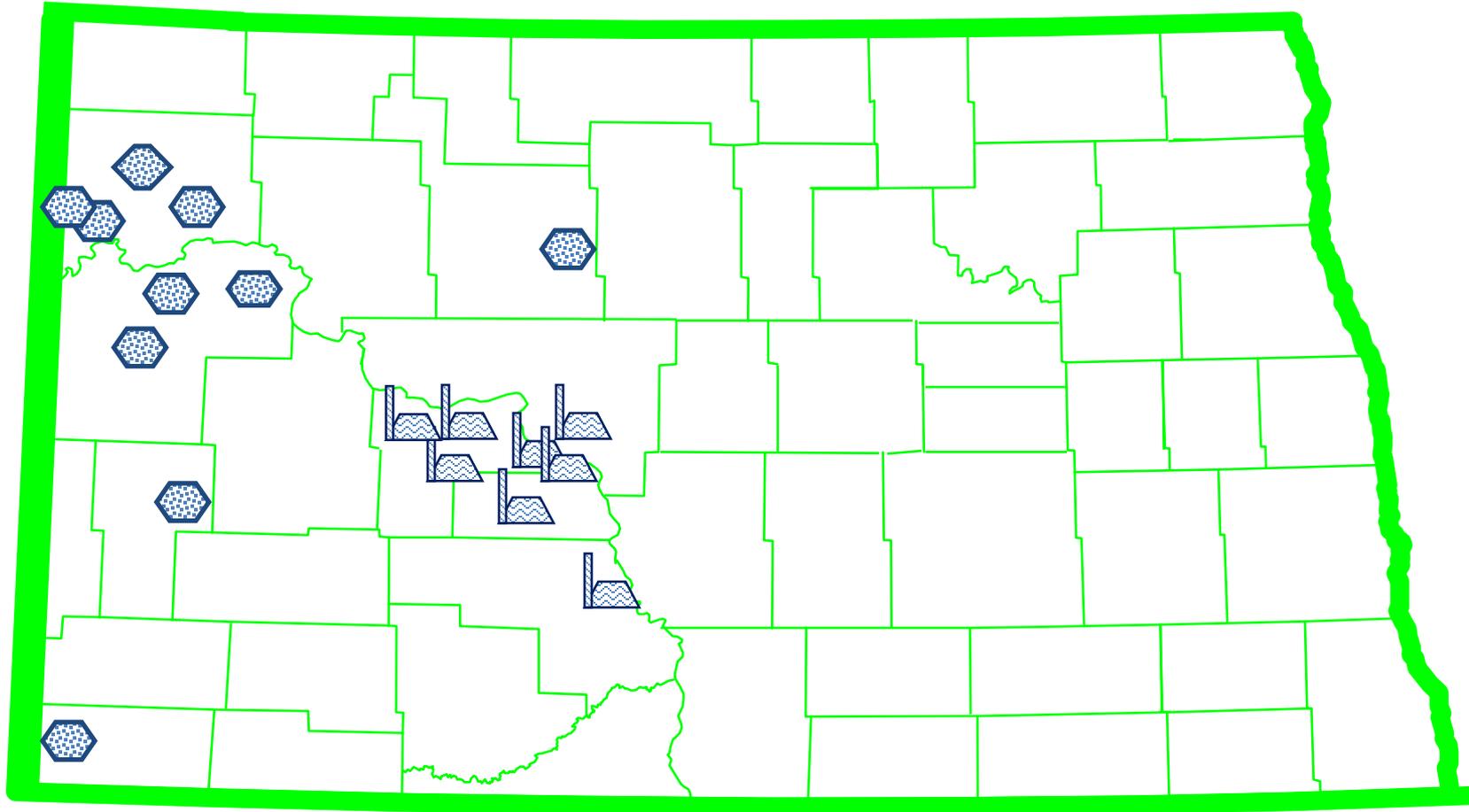
MW12-28
2564.70

13 Municipal Solid Waste (MSW) Landfills



Permitted Special Waste Landfills

February 2014



 - Oilfield Special Waste

 - Coal Ash Facilities

OILFIELD WASTE DISPOSAL FACILITIES - 2014

- Chimney Butte Environmental, LLC
- Dishon Disposal, Inc. (DDI)
- Ideal Oilfield Disposal, LLC
- IHD Solids Management, LLC. (IHD)
- Little Missouri Special (LMI)
- Marquis Alliance Energy Group Inc.
- Prairie Disposal, LLC/R360(PDI)
- Sawyer Disposal Services, Inc (SDS)- Industrial & Special
- Tervita, LLC –Blue Buttes

Approved for Construction: Wisco Oilfield Services

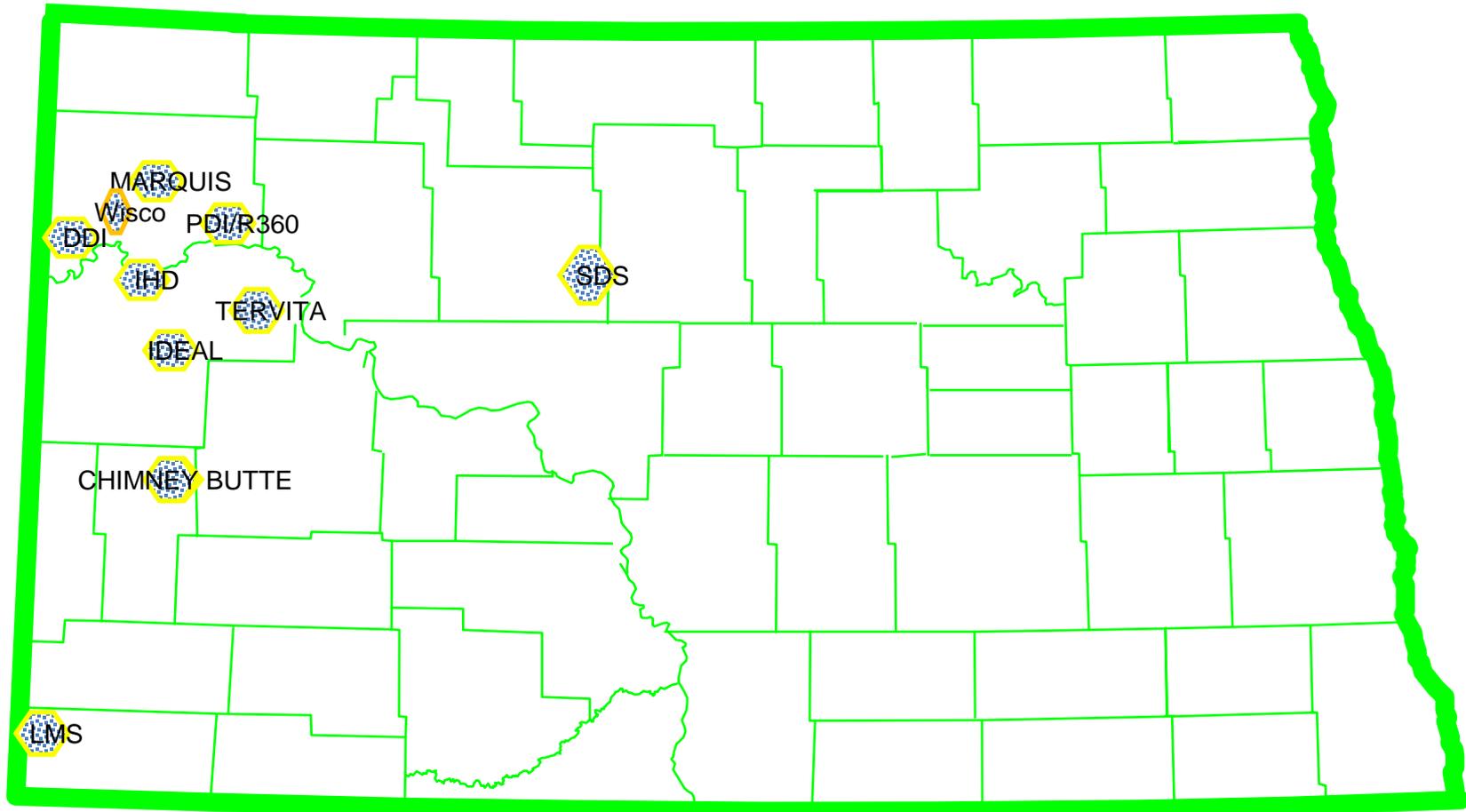
Four more under consideration

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10 Solid Waste Landfills for Oilfield Waste

Feb 2014

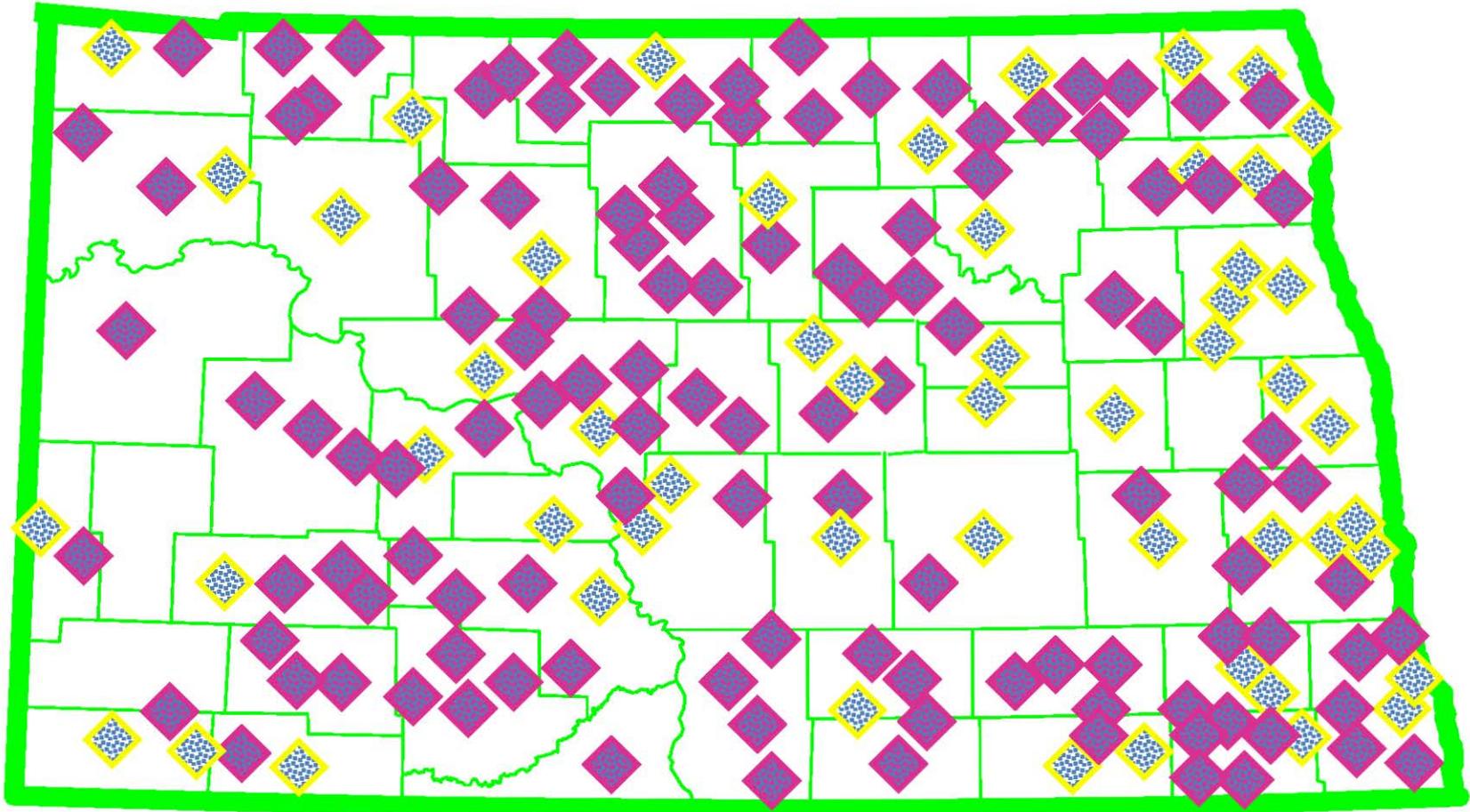


Note: Wisco is under construction.

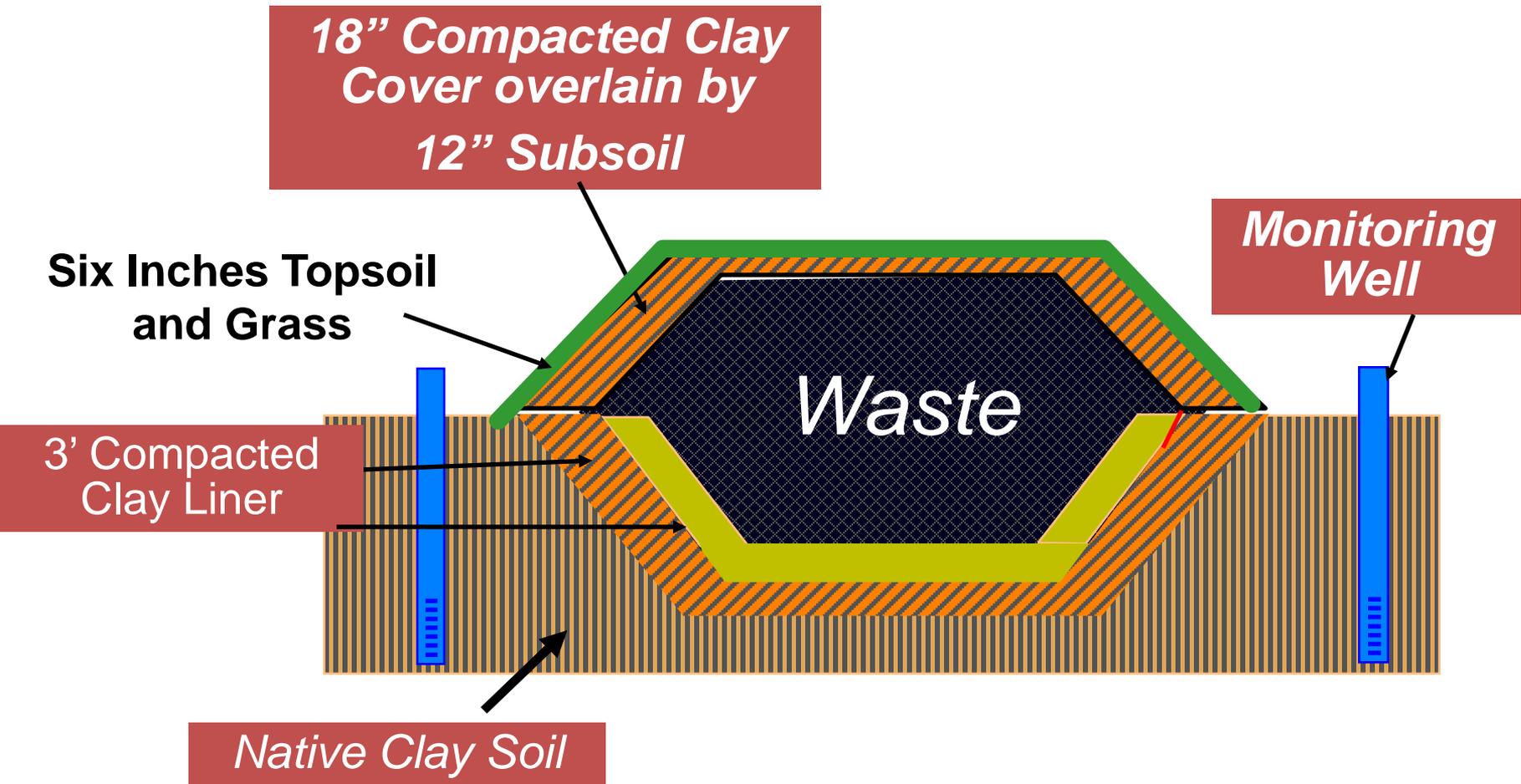
Inert Waste Landfills

◆ Permitted

◆ Small - Permit-by-Rule



Typical Anatomy of Coal Ash Special Waste and Small Industrial Waste Landfills



Coal Combustion Special Waste Landfill
Typically has 3 Foot Compacted Clay Liner

Anatomy of Large Industrial Waste Landfills

8 Foot Cover System: 2' Clay Over Waste, Synthetic (HDPE) Liner and Drainage Layer, 5.5' Clay & Subsoil, 6" Topsoil and Grass

Monitoring Well

Monitoring Well

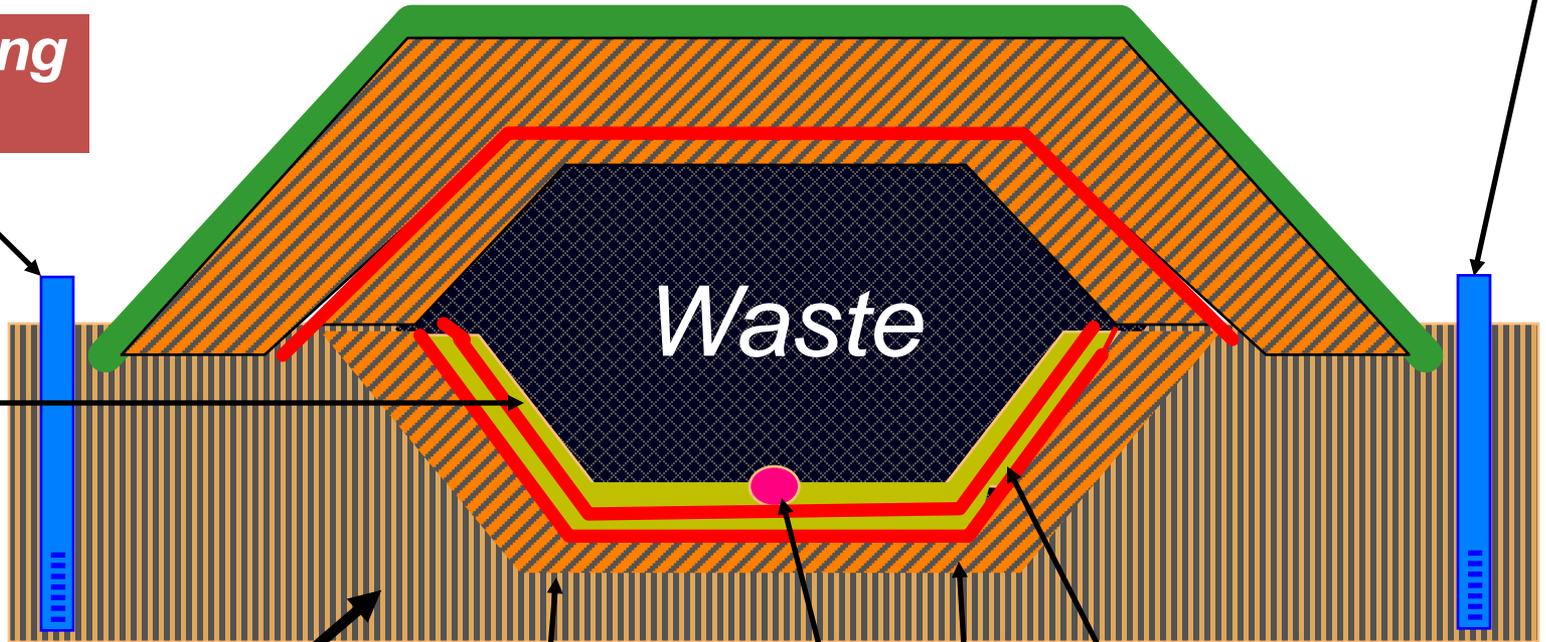
12' LCS

Waste

Native Clay Soil

Drain Pipe

Double Liner/Double Leachate Collection System:
3' Composite Liner (3' compacted clay + 60 mil HDPE), Drainage layer, Second HDPE liner, 12' Leachate Collection Sand



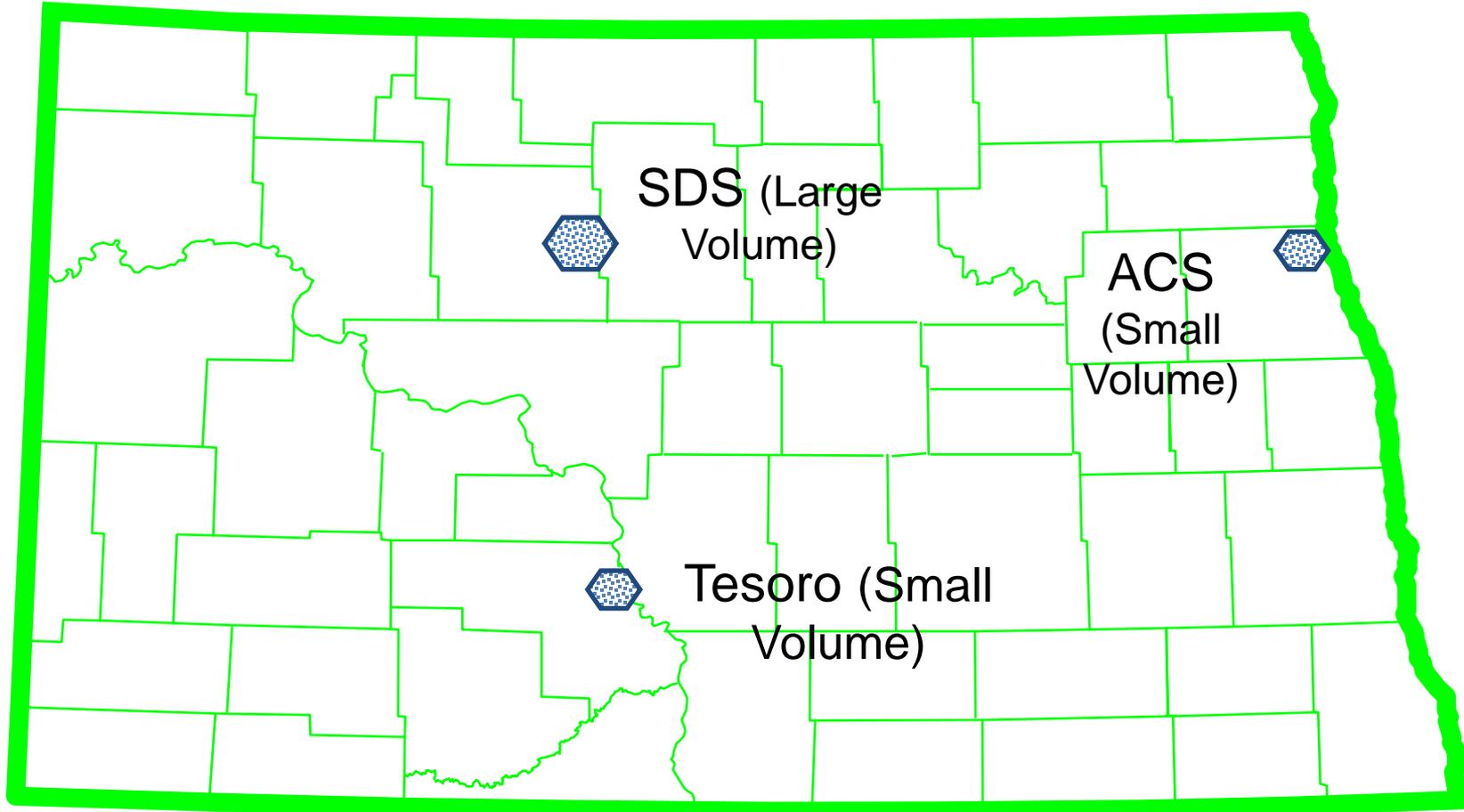
Anatomy of Inert Waste Landfills

*18" Compacted Clay Cover or
42" Uncompacted Clay Cover
overlain by 6" Topsoil and
Grass*



Native Clay Soil

Industrial Waste Landfills



LEACHATE

FORMED BY LIQUIDS PASSING
THROUGH WASTE

LEACHATE CONTAINS DISSOLVED SOLIDS
AND SUSPENDED PARTICLES
DERIVED FROM WASTE

COMPARE LEACHATE TO COFFEE AND TEA?

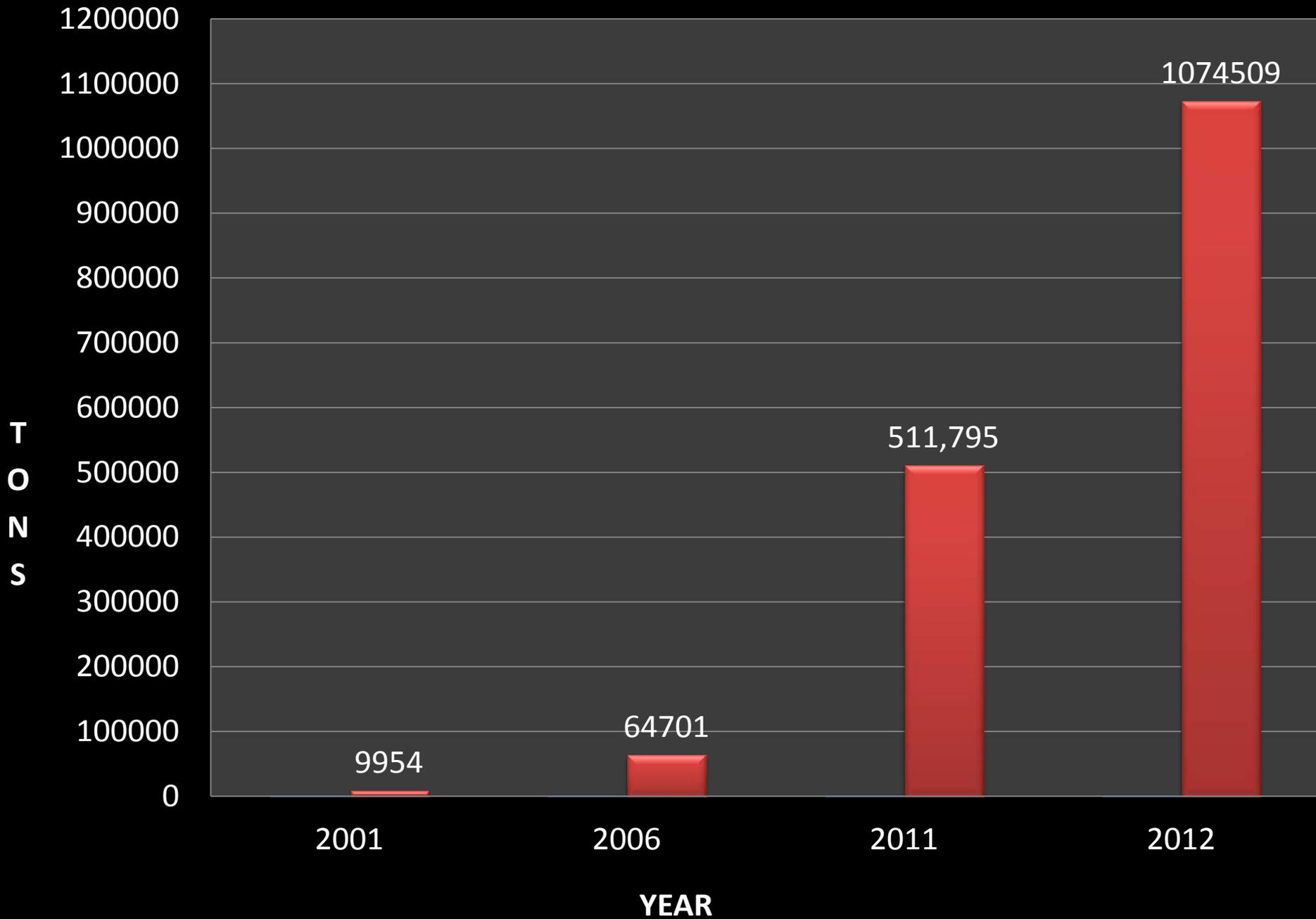




North Dakota Inert Waste Definition

- **Inert Waste will not generally contaminate water or form a contaminated leachate.**
- **Inert waste does not serve as food for vectors.**
- **Inert waste includes construction and demolition wood, bricks, masonry, concrete;**
- **incidental metal; tree branches;**
- **Also bottom ash from coal fired boilers and waste coal fines.**

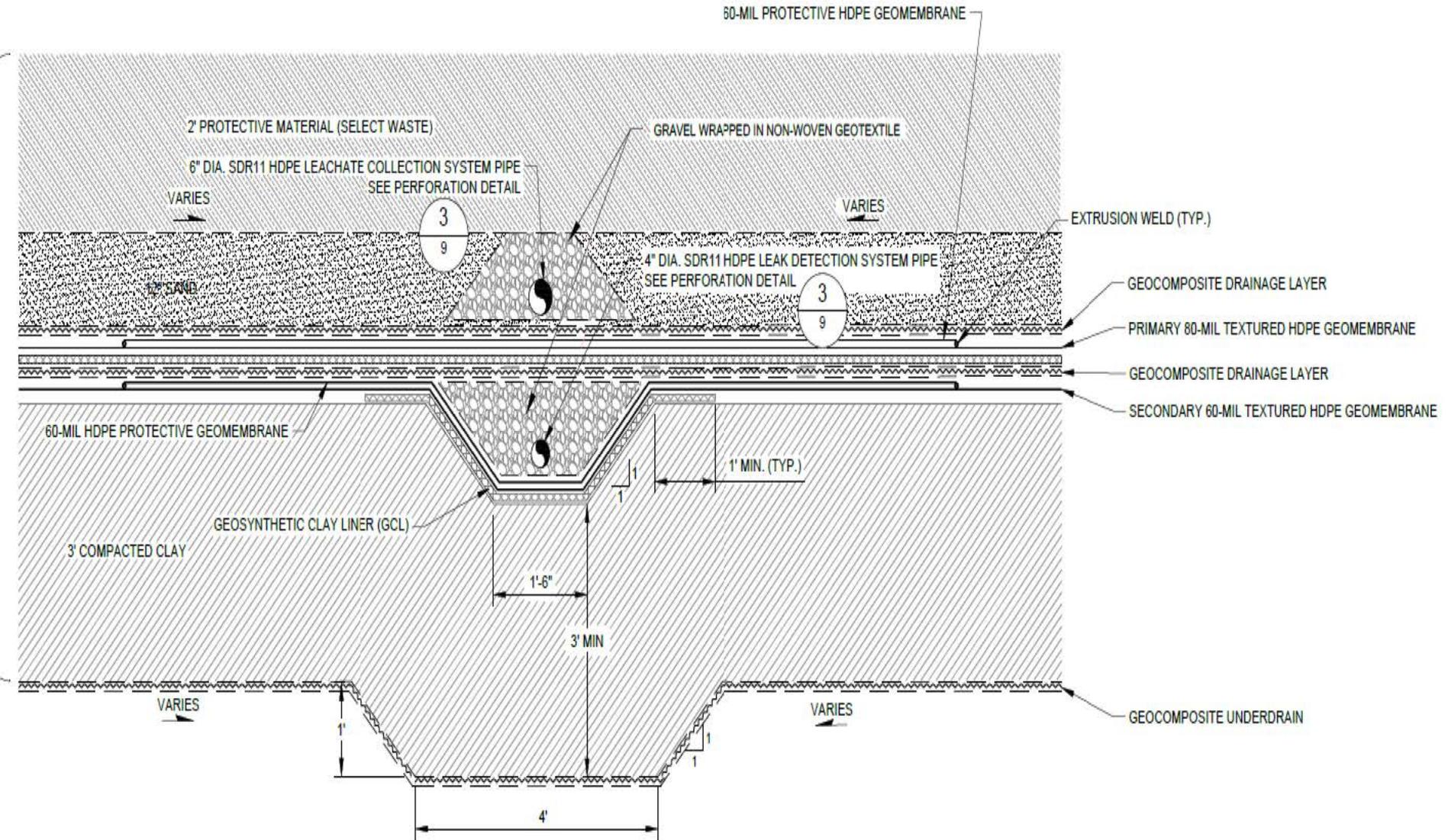
OILFIELD SPECIAL WASTE LANDFILLED IN NORTH DAKOTA



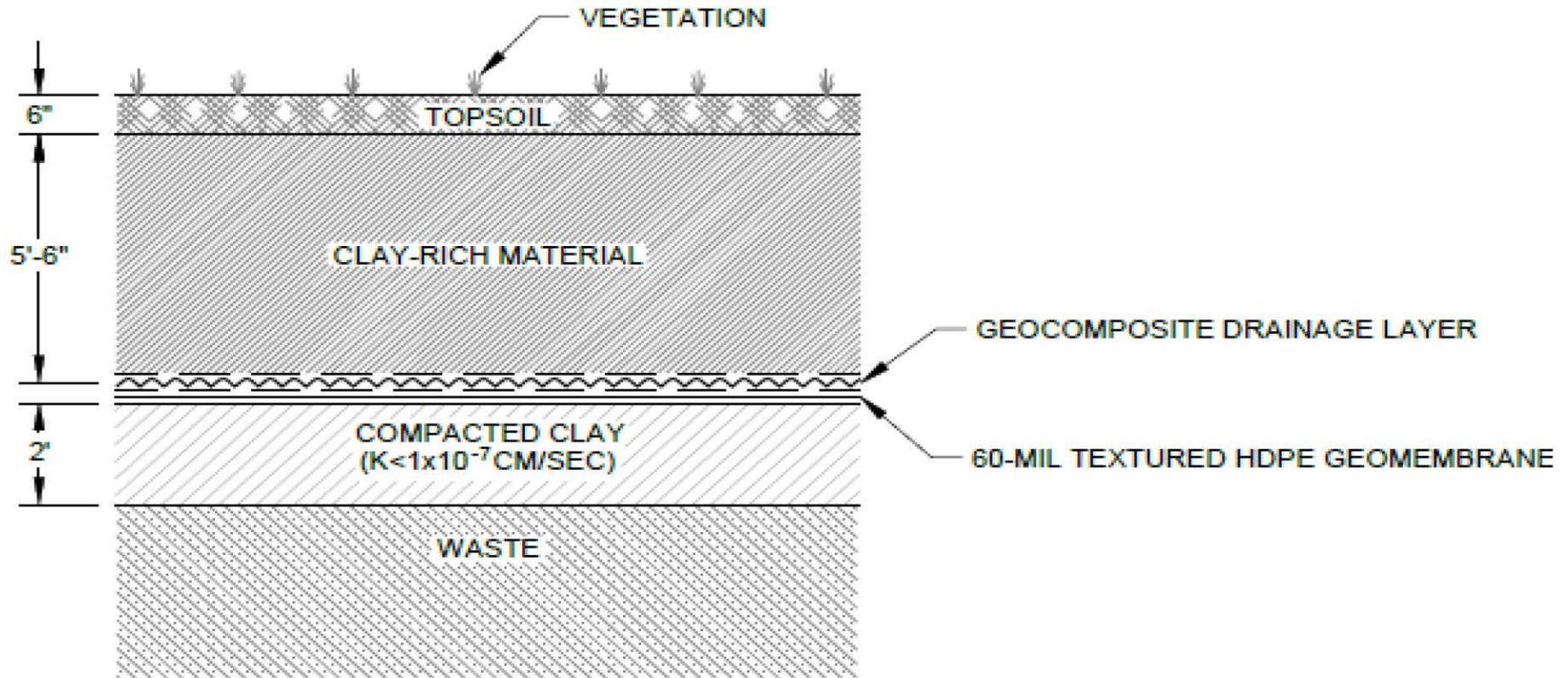
Oilfield Solid Waste - 2012

- **About 450 Tons Solid Waste per well**
- **2000 wells per year**
- **9 million tons cuttings and mud per year**
- **About 1.1 million tons disposed in Oilfield Special Waste Landfills in 2012**
- **Remainder disposed on well site**

Large Industrial Waste Landfill Liner/Leachate Collection System Design

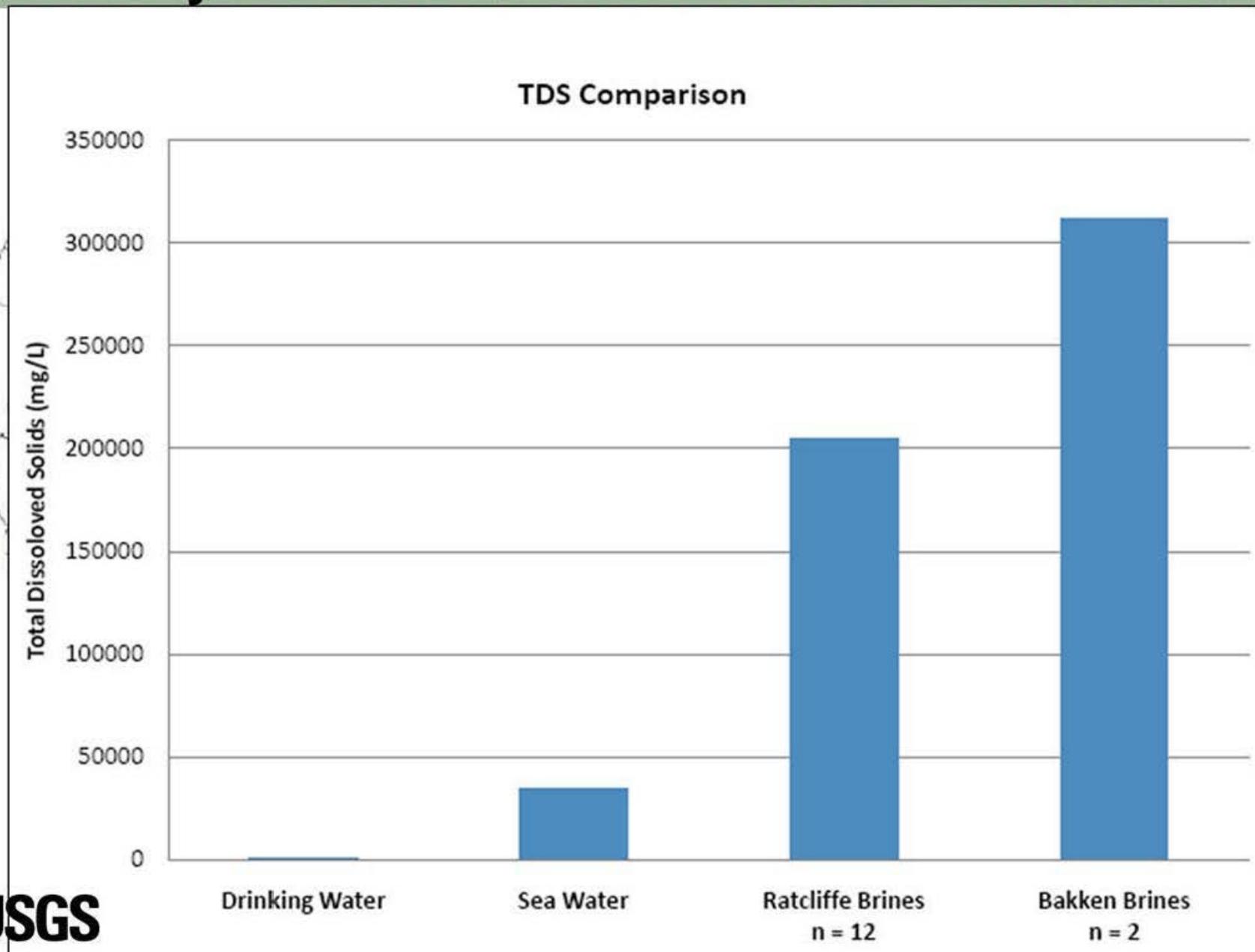


Large Industrial Waste Landfill Cover Design



2 FINAL COVER SYSTEM DETAIL
7 NTS

Chemistry of Co-Produced Waters in the United States



OILFIELD WASTE LEACHATE

Leachate: Liquid That Has Percolated Through Solid Wastes and Extracted Dissolved or Suspended Materials;

- **Leachate can contaminate surface water and ground water;**
- **Can severely damage soils and vegetation;**
- **Leachate is contained within a lined landfill and collected in the leachate collection system;**
- **Oilfield Waste Landfill Leachate is commonly evaporated or disposed in a disposal well.**

OILFIELD WASTE LANDFILL LEACHATE CHARACTERISTICS

Constituent	Range
Total Dissolved Solids	19,200 – 63,900 ppm
Conductivity	28,089 – 88,240 umhos/cm
Sodium	5,460 – 18,800 ppm
Calcium	2,410 – 5,280 ppm
Chloride	17,800 – 36,800 ppm
Ammonia-Nitrite as N	0.92 – 116 ppm
Sulfate	1,240 – 1,460 ppm

Common Organic Compounds in ND Oilfield Landfill Leachate

Compound	Concentration
Benzene	0.077 - 24.7 ppb
Ethyl benzene	0.079 - 9.3 ppb
Toluene	0.21 – 23.8 ppb
Xylenes	0.79 – 90.8 ppb
Gasoline Range Organics	1.036 – 5.54 ppm
Diesel Range Organics	2.3 – 1,400 ppm

08.04.2011

**Dead Vegetation and Damaged Soil
From Salt- Water/Brine Release**



NORTH DAKOTA
DEPARTMENT *of* HEALTH



**Brine Impacted Soils and Vegetation at
Charbonneau Creek – near Alexander**

08.01.2011

INERT WASTE FACILITY SITE REQUIREMENTS

33-20-04.1-01. General location standards.

- **1. No solid waste management facility may be located in areas which result in impacts to human health or environmental resources or in an area which is unsuitable because of reasons of topography, geology, hydrology, or soils.**
 - **Generally clay-rich soils away from steep areas, wetlands, floodplains, gravel pits, high water table, and other poorly suited areas.**

Prohibited or Restricted Wastes for Permitted Landfills

- **Regulated Hazardous Waste**
- **Unrinsed Pesticide Containers**
- **PCB waste**
- **Lead acid batteries**
- **Major Appliances and Recyclable Scrap metal**
- **Used Oil**
- **Liquids** (in excess of household amounts)
- **Ignitable Waste**
- **Regulated Infectious Waste**
- **Radioactive Waste**
- **Municipal Waste Incinerator Ash** (unless approved)
- **Industrial or Special Waste** not addressed in waste acceptance plan and permit



Hazardous Waste

- **Characteristic Hazardous Wastes**
 - Ignitable
 - Corrosive
 - Reactive
 - Toxic
- **Listed Hazardous Wastes**
- **Regulated under the Hazardous Waste Rules if a business generates >200 lbs/month**
- **Oilfield Exploration and Production Waste is Exempt from Federal and State Hazardous Waste Rules**



Oilfield Exploration and Production Wastes

Subject to ND Solid Waste Rules (exempt from HW Rules)

- Produced water
- Drilling fluids and drill cuttings
- Rigwash
- Well completion, treatment, and stimulation fluids
- Workover wastes
- Basic sediment and water and other tank bottom sludge from storage facilities that hold product and exempt waste
- Accumulated materials such as hydrocarbons, solids, sand, and emulsion from production separators, fluid treating vessels, and production impoundments
- Pit sludges and contaminated bottoms from storage or disposal exempt wastes
- Gas plant dehydration wastes, including glycol-based compounds, glycol filters, filter media, backwash, and molecular sieves
- Gas plant sweetening wastes for sulfur removal, including amine, amine filters, amine filter media, backwash, precipitated amine sludge, iron sponge, and hydrogen sulfide scrubber liquid and sludge
- Cooling tower blowdown
- Spent filters, filter media, and backwash (assuming the filter itself is not hazardous and the residue)
- Packing fluids
- Produced sand
- Pipe scale, hydrocarbon solids, hydrates, and other deposits removed from piping and equipment prior to transportation
- Hydrocarbon-bearing soil
- Pigging wastes from gathering lines
- Wastes from subsurface gas storage and retrieval, except for the listed nonexempt wastes
- Constituents removed from produced water before it is injected or otherwise disposed of
- Liquid hydrocarbons removed from the production stream but not from oil refining
- Gases removed from the production stream, such as hydrogen sulfide and carbon dioxide, and volatilized hydrocarbons
- Materials ejected from a producing well during blowdown
- Waste crude oil from primary field operations and production
- Light organics volatilized from exempt wastes in reserve pits or impoundments or production equipment

Hydraulic Fracturing

- Composition of Frac solutions
 - 98 % Water & Sand
 - 2 % additives and gels
 - Acids (hydrochloric acid, acetic acid) - **Corrosive**
 - Sodium hydroxide, Potassium Hydroxide, Ammonium Hydroxide - **Corrosive**
 - Acrylamide – **Listed U Hazardous Waste**
 - Sodium Chloride
 - Methanol, isopropanol, petroleum distillate, kerosene isobutanol - **Ignitable**