

Plentywood •

SHERIDAN COUNTY

MONTANA

The Clear Lake Aquifer

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Reiten

1. Sheridan County Conservation District 2. Montana Bureau of Mines and
Geology

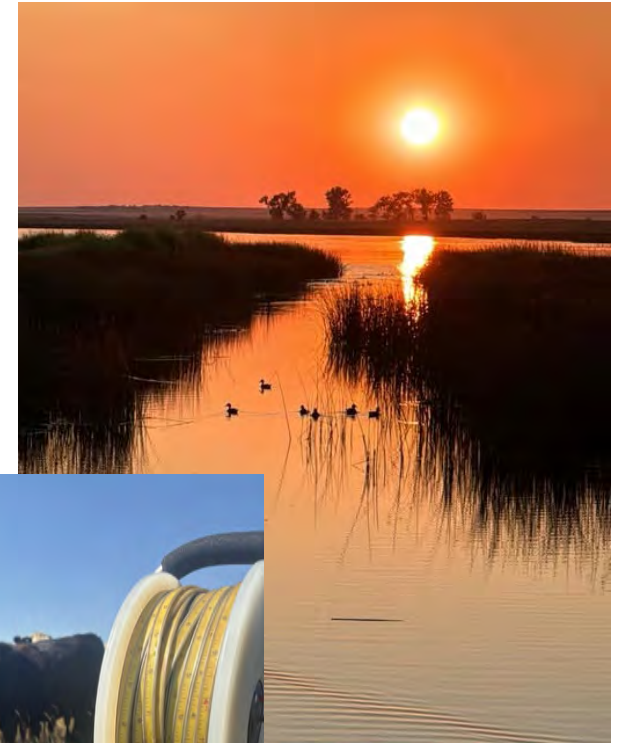
October 2025



Sheridan County
Conservation District

What is special about the Clear Lake Aquifer?

- Supports agricultural irrigation, livestock, and domestic water
- Ecological / habitat support
- Critical during drought periods



Origins: Geologic & Hydrologic

- Deposits from the ancestral Missouri River
- Glacial meltwater & sedimentation
- Sand, gravel, coarse sediment — good permeability

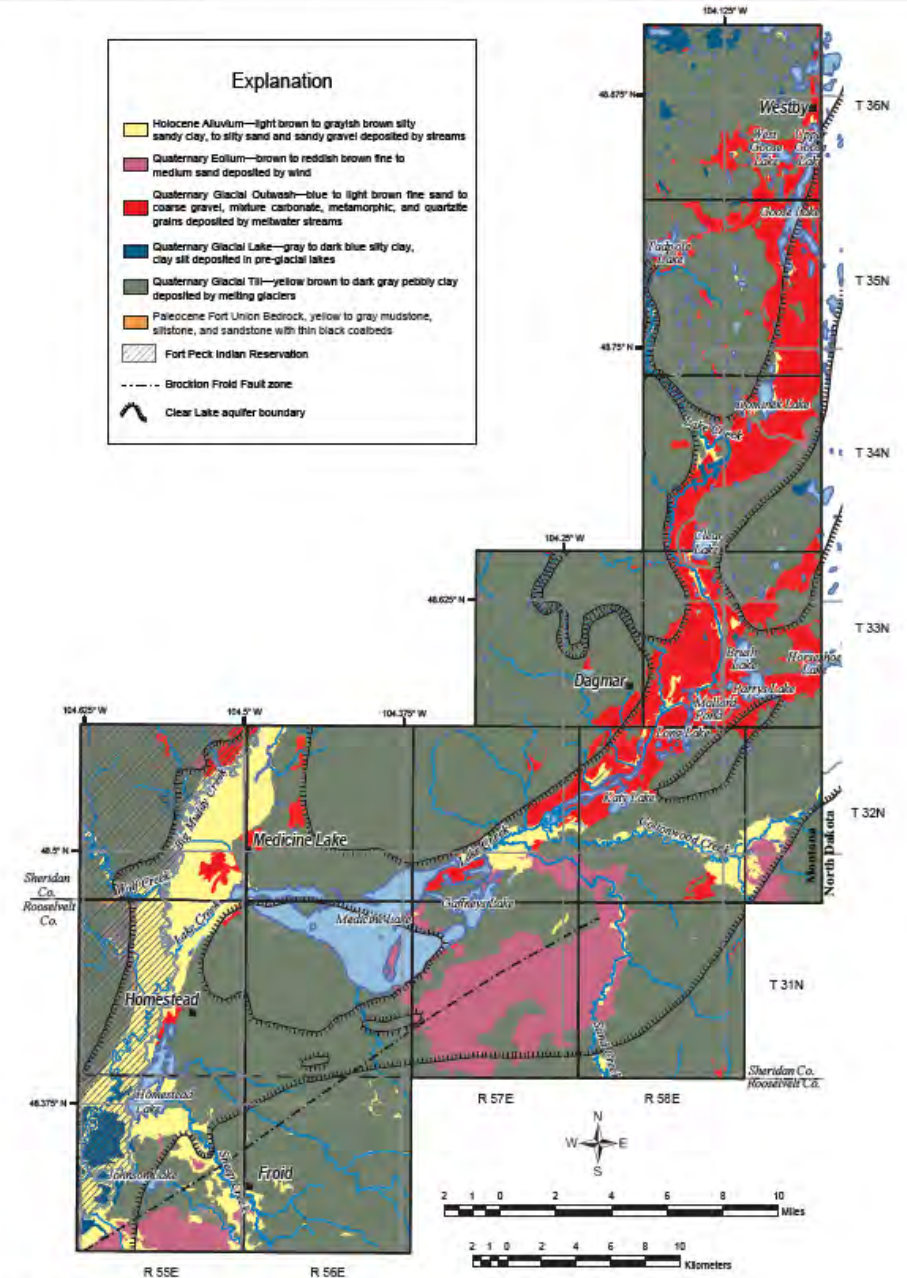


Figure 8. Surficial geology of the Clear Lake aquifer.

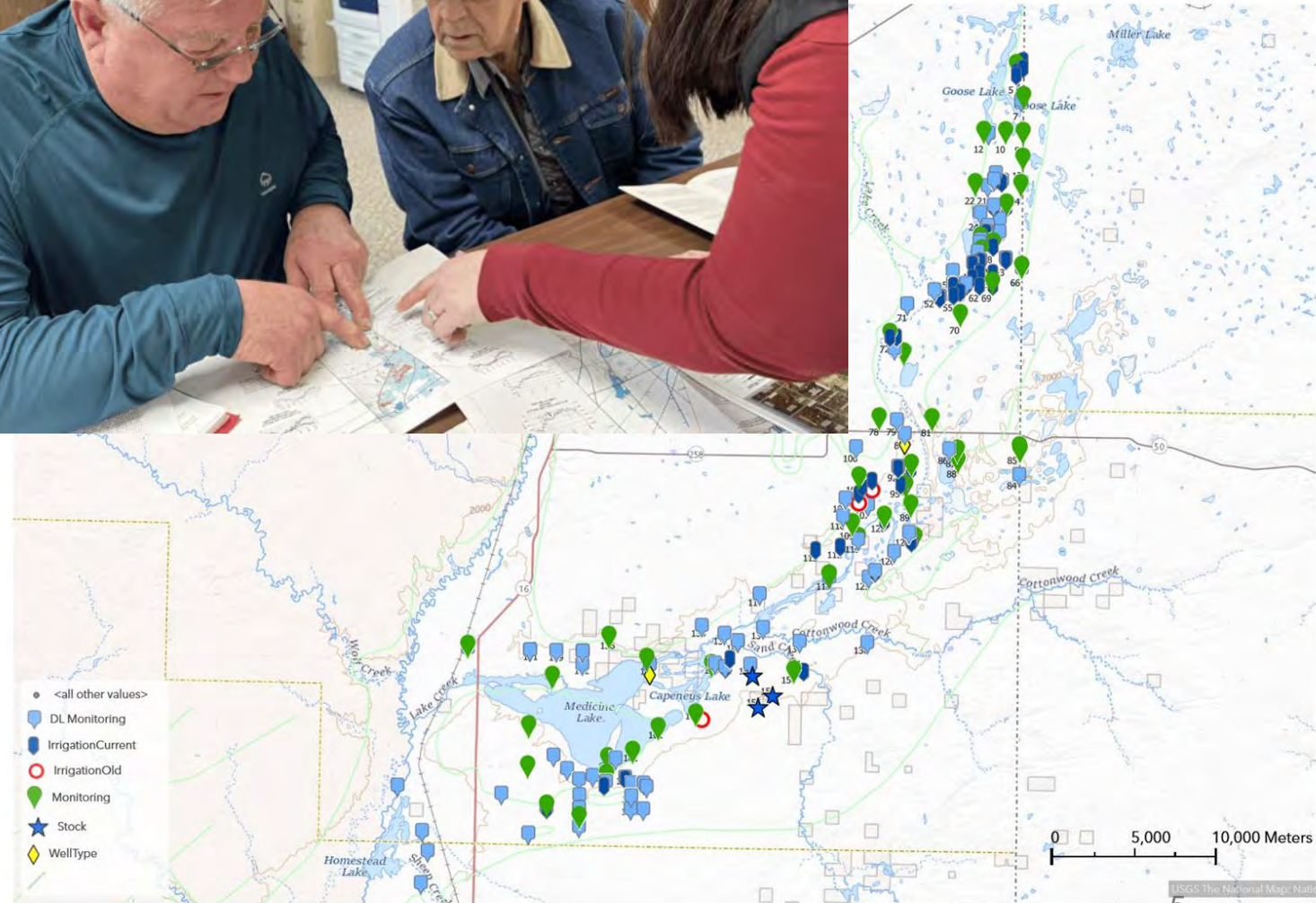
Historical Exploration

- Surficial Geologic mapping (MBMG and USGS)
- Detailed Hydrogeology data and Interpretation
 - Donovan and Bergantino (1987)
 - Donovan (1988)
- Ground Water Information Center (GWIC)
- Reiten (2002)



Early Wells

- 1974: Marlowe Onstad's first production well
- 2025: 56 production wells



Spatial Extent & Physical Dimensions

- The aquifer spans from Westby to Homestead, MT
- Width: ~1 to 6 miles
- Depth: 10 - 200+ feet in many areas

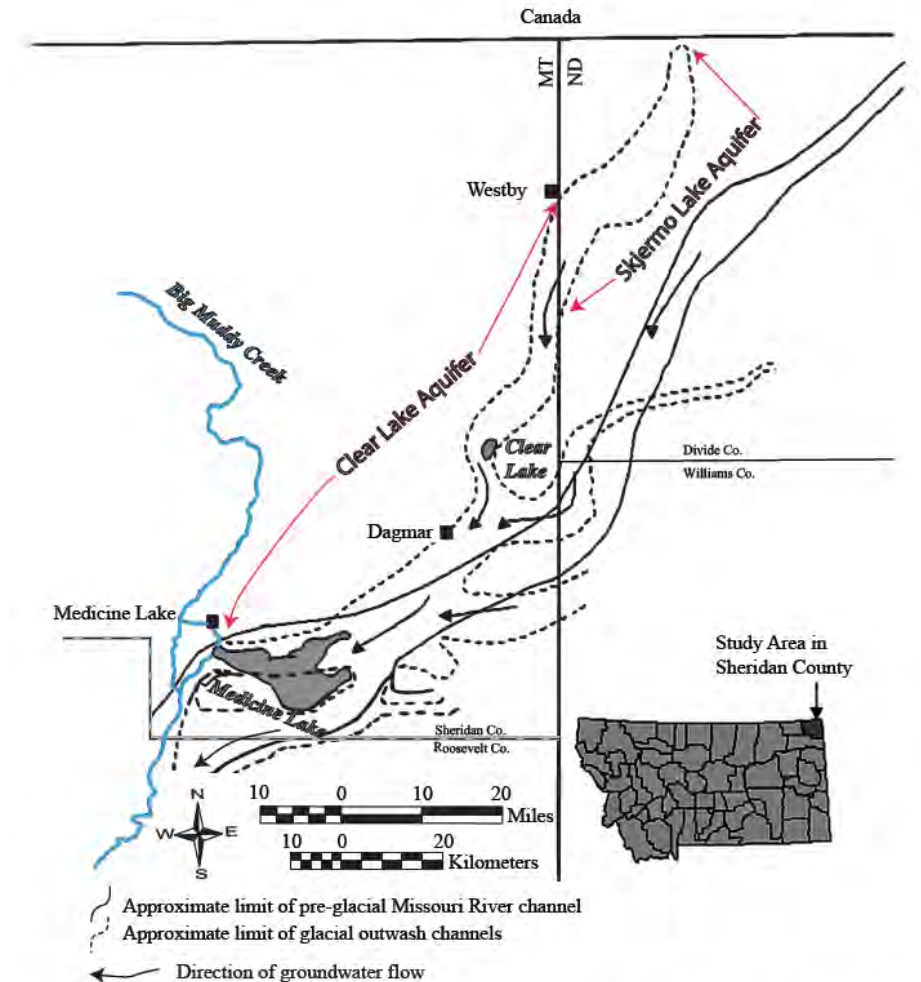


Figure 1. Sand and gravel deposits in buried valleys of the ancestral Missouri River and glacial outwash channels form the Clear Lake aquifer in Montana. The outwash part of the aquifer is called the Skjermo Lake aquifer in North Dakota (modified from Donovan, 1988).

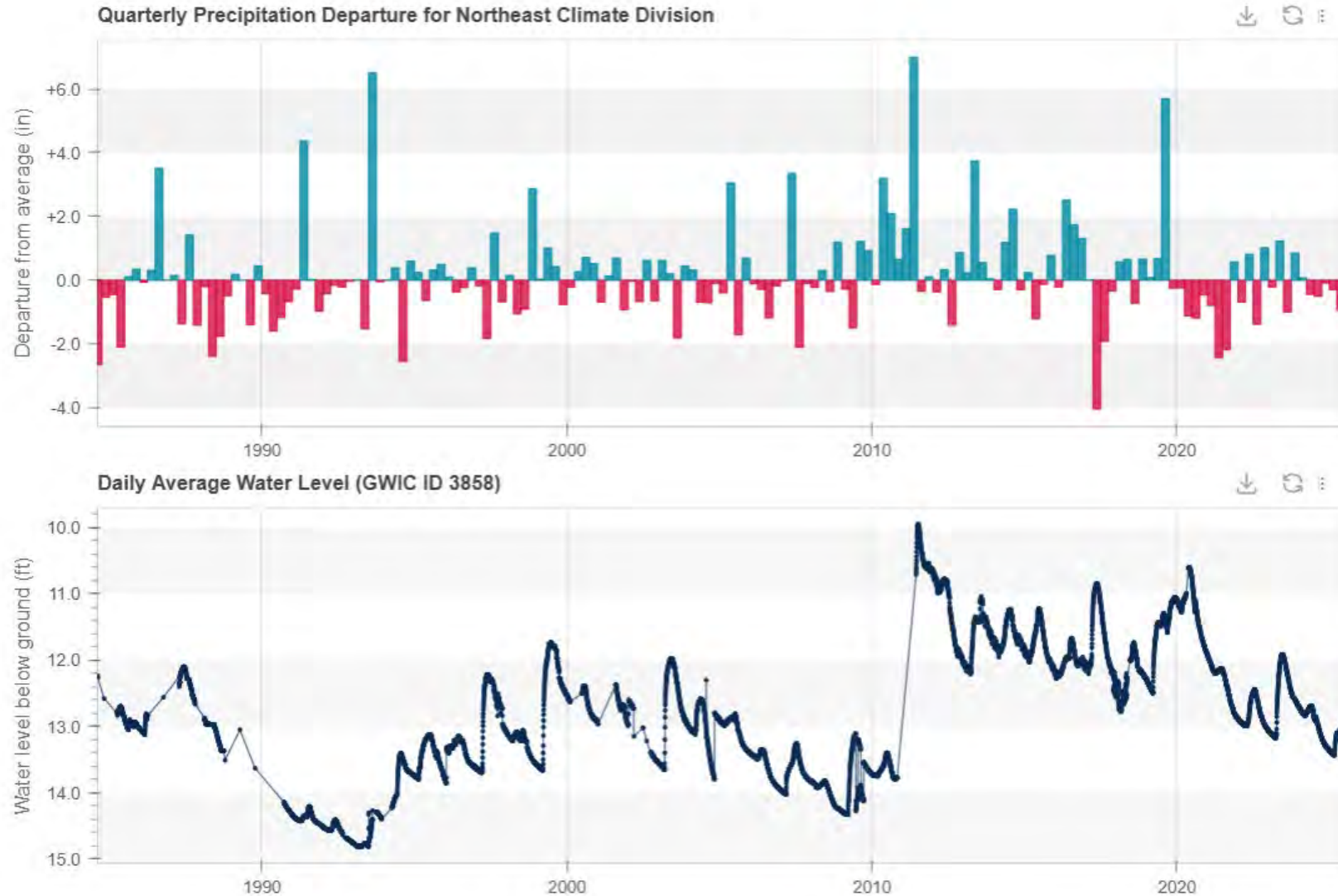
Agricultural & Community

- Irrigation of alfalfa, wheat, pulses, and forage
- Livestock watering
- Domestic wells tapping the system
- Reduces dependence on rainfall



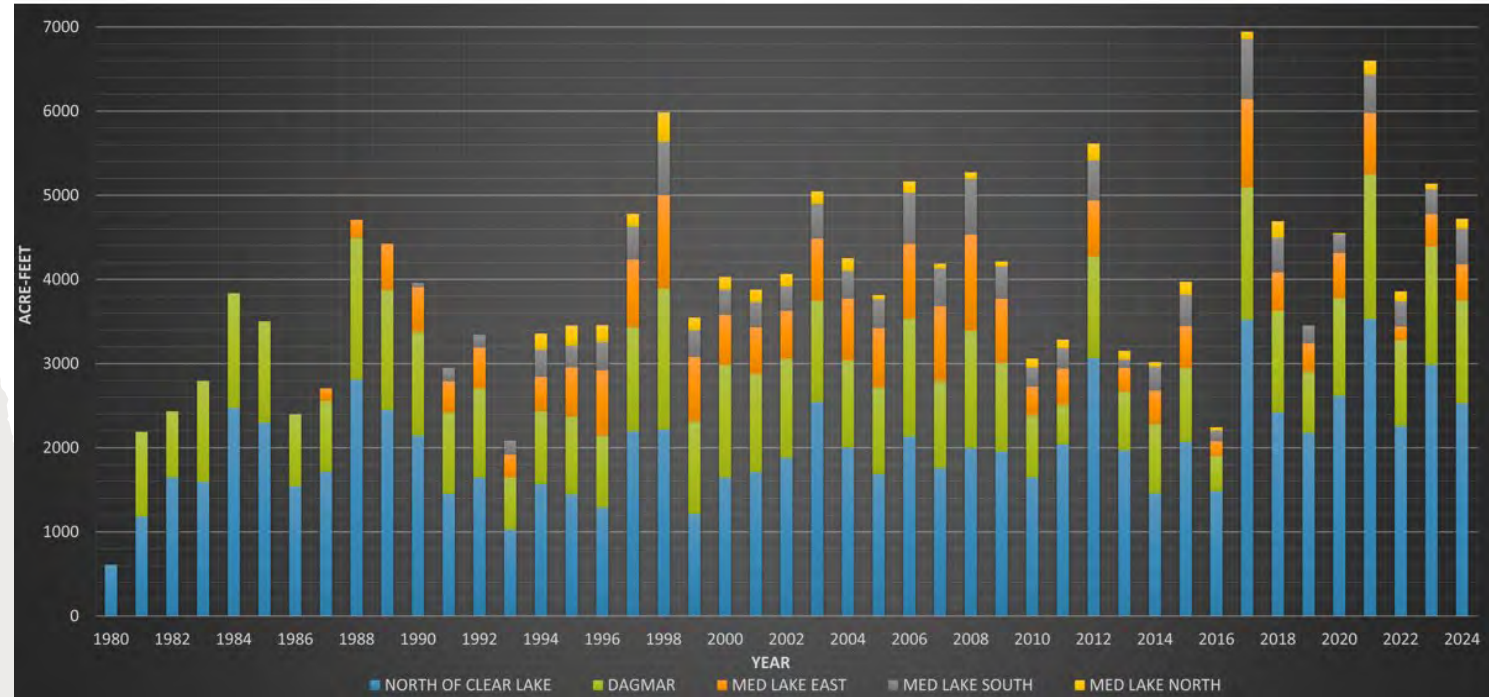
Historic Droughts

- Historical droughts (1930s, 1980s, recent)
- Increased drawdowns during dry periods



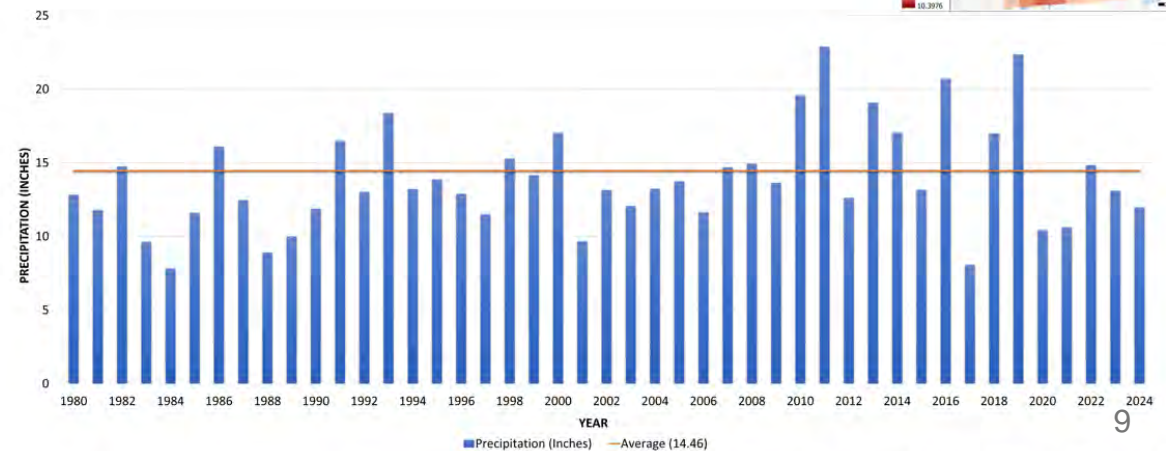
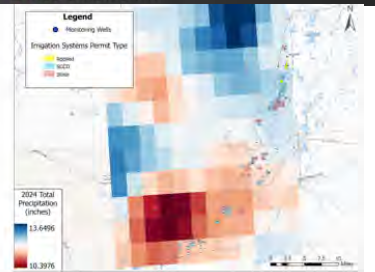
Historic Recharge

- Historical recharge is relatively stable
- Sensitivity to precipitation, temperature, and recharge variability



Precipitation

- Sheridan County 2024 Total Precipitation= 11.99 inches
- 2.47 inches below 30 year average
- 1.12 inches less than 2023



Managing the Resource

Technical Advisory Committee (TAC)

- Local city/county planner
- U.S. Fish & Wildlife Service (USFW)
- U.S. Geological Survey (USGS)
- Montana Bureau of Mines and Geology (MBMG)
- USDA Natural Resources Conservation Service (NRCS)
- Montana Department of Natural Resources and Conservation (DNRC)
- Assiniboine & Sioux Fort Peck Tribes - Water Resources



Form 113 RESERVED WATER USE APPLICATION EVALUATION CHECKLIST 2/76

For District Use Only
Application No. _____ Date Technical Input Requested _____
Date Evaluation Completed _____

1. Has the site for irrigation authorizations been met?
Yes No

2. Is the location completed?
Yes No

3. Does the applicant own or have possessory interest in the land?
Yes No

4. Does the proposed use meet the objectives of the reservation?
Yes No

Is it a beneficial use?
Yes No

5. Is reserved water available at the intended point of diversion?
Yes No

Consider the following:

A. Test Well Data
1. Aquifer thickness
2. Aquifer materials (from well log)
3. Static water levels
4. Presence of confining conditions
5. Pump test data, i.e. flow rate, pumping water level

B. Area Aquifer Conditions
1. Aquifer boundaries
2. Water level trends
3. Historic fluctuations in aquifer levels
4. Aquifer hydraulic properties
5. Transmissivity
6. Storage coefficient

Form 113 RESERVED WATER USE APPLICATION EVALUATION CHECKLIST 2/76

6. Will senior water rights be adversely affected?
Yes No

Consider the following:

A. Distance of proposed well from existing wells
B. Likely draw-down cone of proposed well
C. Draw-down cones of existing wells
D. Water level trends in the area

7. Is the proposed project system adequate?
Yes No

Consider the following:

A. Well depth
B. Well diameter
C. Pump size
D. Sprinkler type

8. Are the soils at the site suitable for irrigation?
Yes No

Consider the following:

A. Texture and structure of the soil from surface to 5 feet depth
B. Profile restrictions (hardpan, calicheon layers, etc)
C. Moisture holding capacity
D. Soil chemistry, i.e. SAR, EC, and pH

9. Is the quality of the water suitable for irrigation?
Yes No

Consider the following:

A. Total Dissolved Solids (TDS)
B. Sulfate Absorption Ratio (SAR)
C. Electrical Conductivity (EC)
D. Compatibility of water with soil types
E. Potential effects irrigation may have on water quality
F. Potential from pumping to induce poorer quality water from other aquifer zones

Form 113 RESERVED WATER USE APPLICATION EVALUATION CHECKLIST 2/76

10. Will adequate soil and water conservation measures be used?
Yes No

11. Are adverse effects to wetlands likely to occur?
Yes No

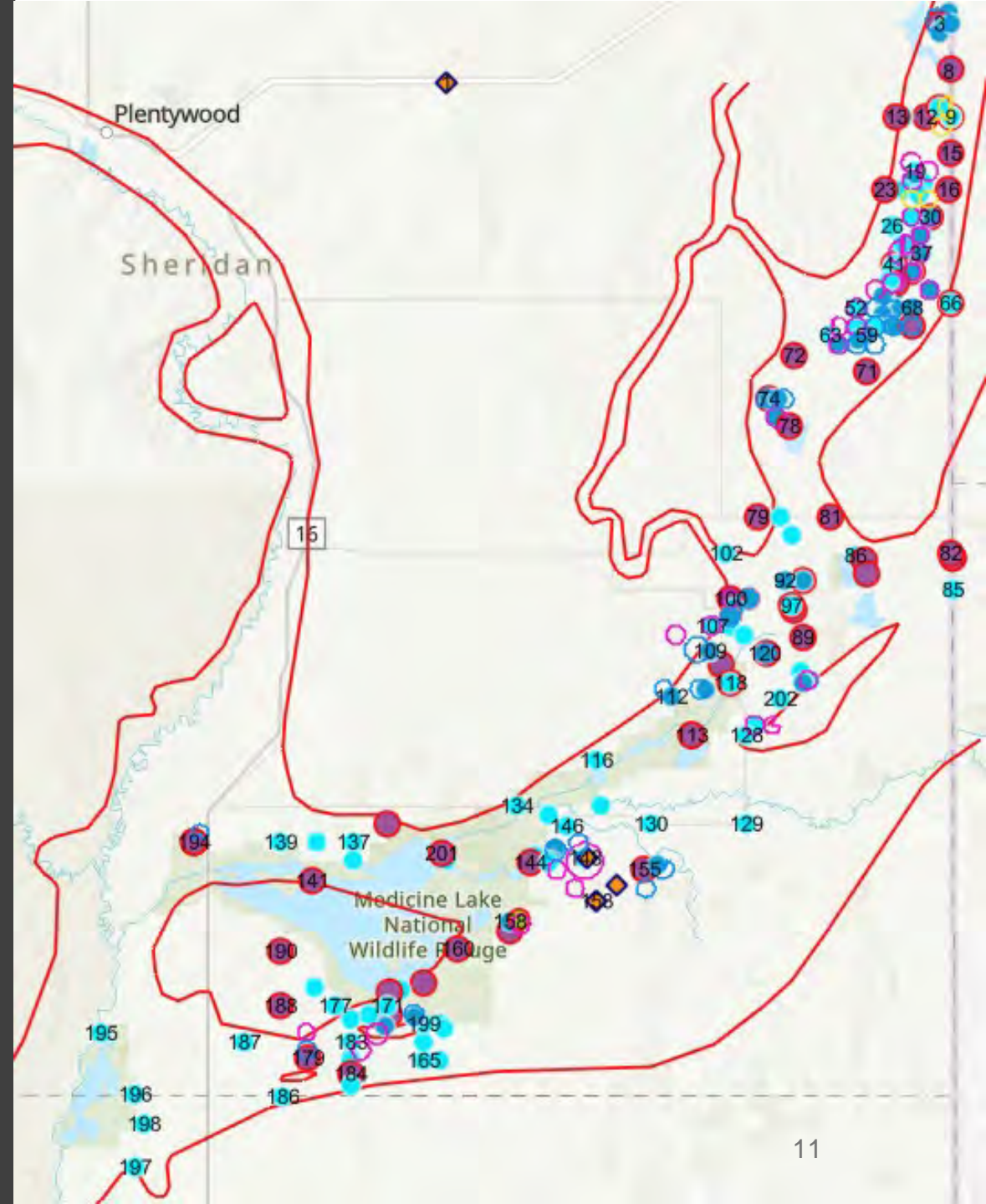
Consider the following:

A. Proximity of proposed well to wetlands
B. Wetland type and relative importance
C. Degree of connection between wetland and aquifer where use is proposed
D. Likely extent of the cone of depression for the proposed well
E. Presence of aquifer boundaries and confining layers
F. Results of pump test data
G. Area trends in wetland levels

District Representative _____ Date _____

To Meet Regulatory Guidelines

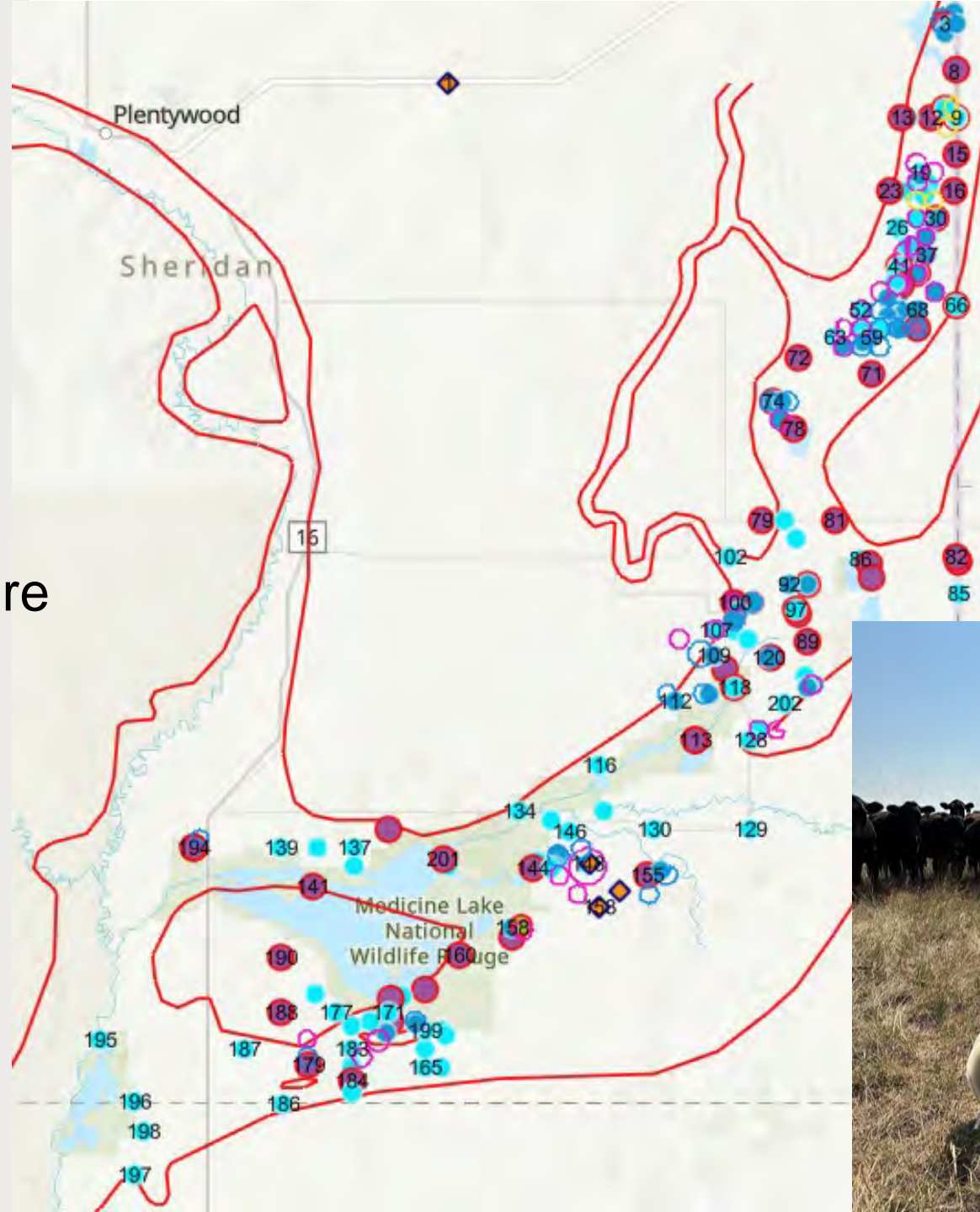
- Managed by Sheridan County Conservation District
- Tracked metrics: water depth, water quality, usage trends
- Purpose: inform allocation and sustainability decisions





Starts with Monitoring

- 79 monitor wells + 5 lakes monitored hourly (using pressure transducers)
- 66 wells manually measured
- Data collected monthly
- 65 additional wells manually measured semiannually



Challenges & Uncertainties

- Recharge limitations and slow refilling
- Cumulative drawdowns and well interference
- Parameter sensitivity
- Conflicts between agricultural use and ecological / wetland demands
- Climate change reducing precipitation or altering timing



Data is used to ensure sustainable use, as the resource is allocated.

- The State set the water reservation at 15,549 acre-feet annually
- The SCCD holds the authority to distribute 10,000 acre-feet
- Currently, 9,418 acre-feet are allocated
- Increases are allowed only if monitoring shows aquifer capacity is not compromised



Resource Allocation is Controlled

- All new production wells require application & review
- Required steps: aquifer test, water sampling, impact evaluation
- Reviewed by Technical Advisory Committee (TAC)



Future Directions & Sustainability

- Enhanced groundwater modeling and scenario testing.
- Adaptive management: periodic review of allocation rules.
- Public outreach, stakeholder engagement, and conservation incentives.

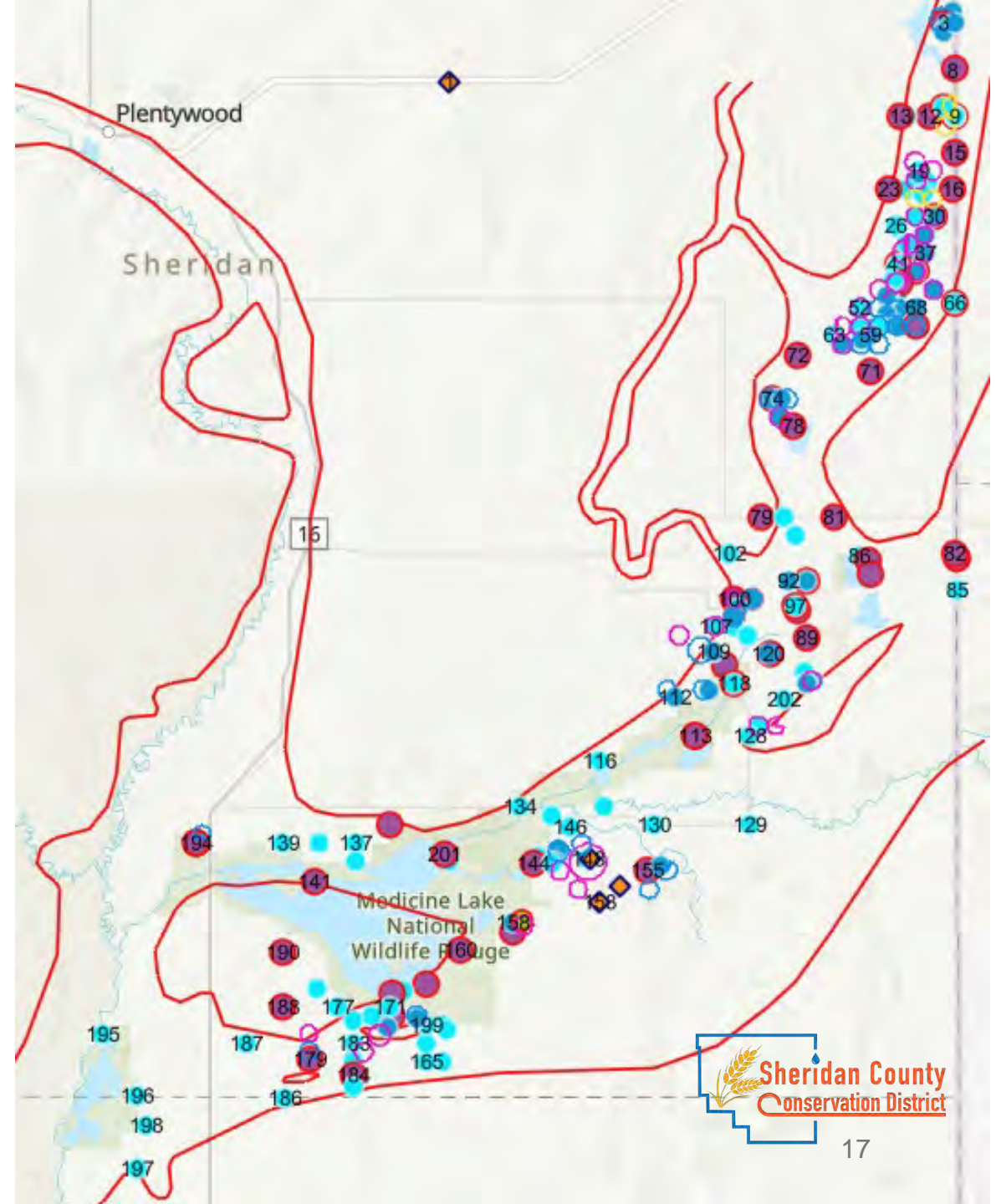


- Utilize buffers or conservative thresholds to protect against surprises.
- Continue expanding and maintaining the monitoring network.



Key Takeaways

1. The Clear Lake Aquifer is foundational to Sheridan County's water security.
1. Its geologic origin is tied to the ancestral Missouri River and continental glaciation.
1. Agricultural, domestic, and ecological uses rely heavily on it.
1. A layered monitoring program gives insight into its dynamics.
1. Institutional rules, TAC review, and the Sheridan County Conservation District support managed development.
1. Challenges include recharge limits, drawdowns, model uncertainty, ecological trade offs, and climate change.



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Thank you!

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