POTABLE WATER MASTERPLAN

Camp Courageous

December 8, 2021

IOWA™
CIVIL & ENVIRONMENTAL ENGINEERING

THE TEAM:

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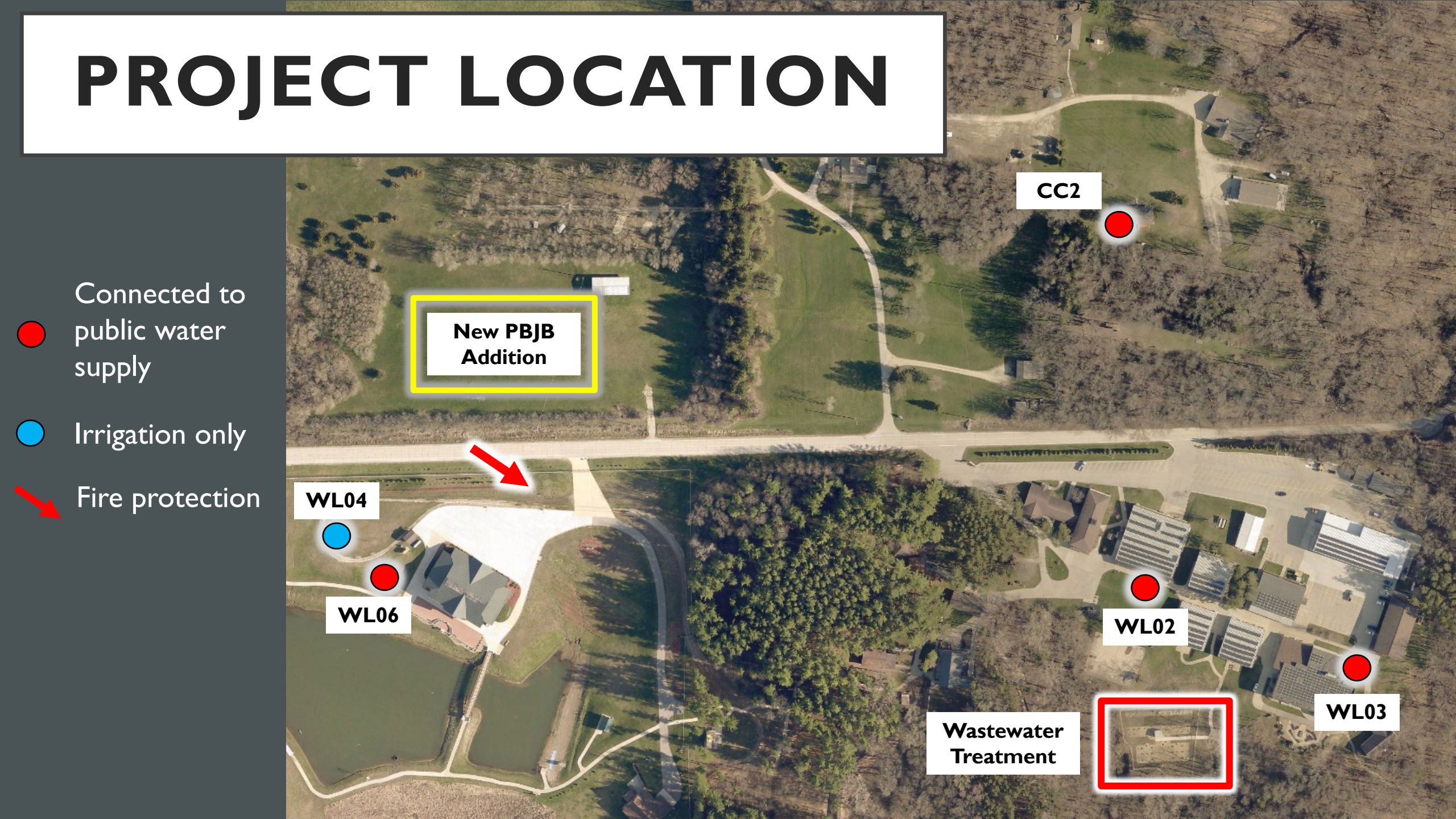
Project Background
Research and
Data Analysis
Masterplan
Recommendations

CAMP COURAGEOUS

- 25,000 gallons/day on average
- 4 active wells
- 2 different aquifers
- Growing water concerns
- Challenging aquifers

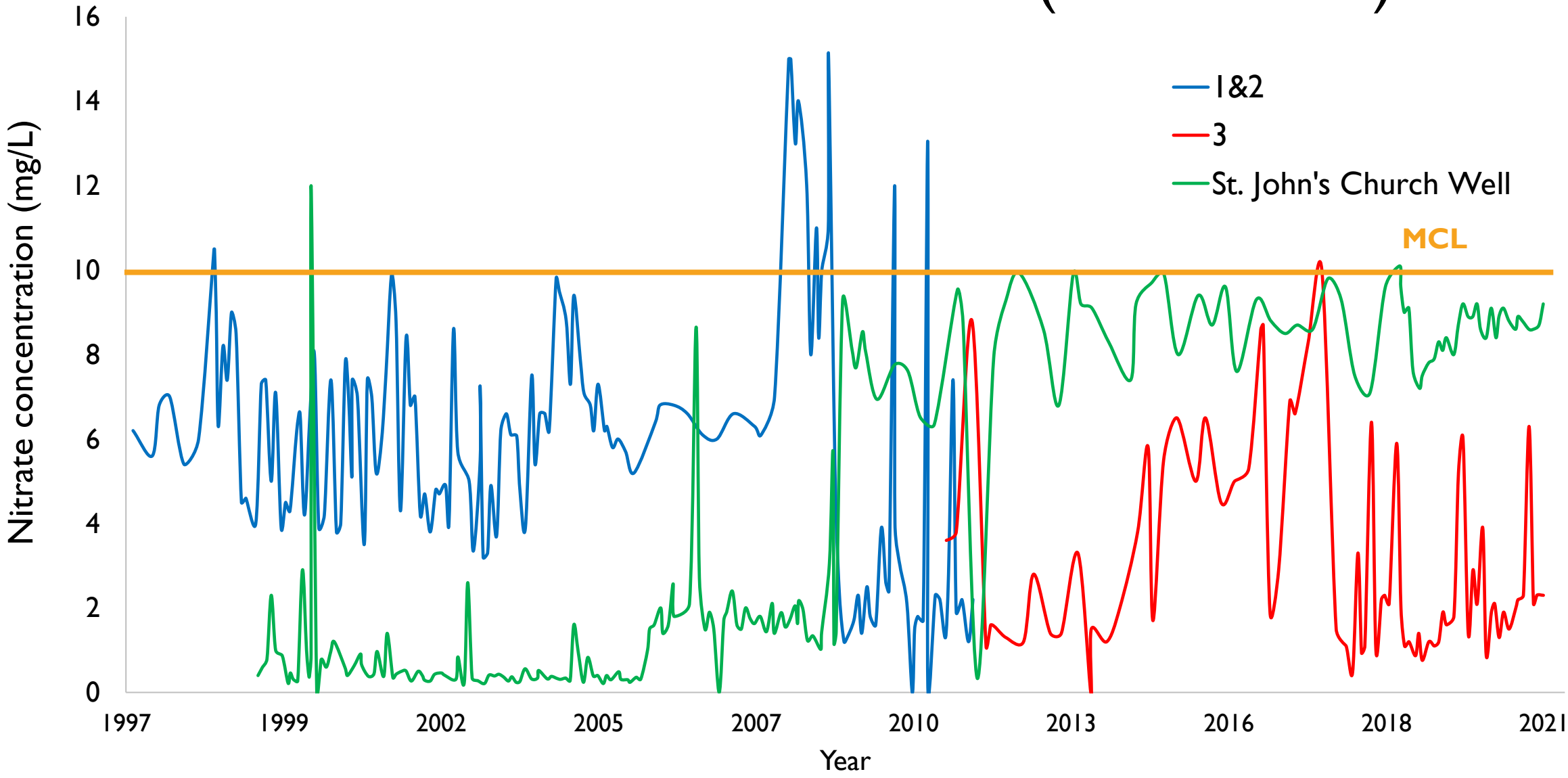
PROJECT LOCATION



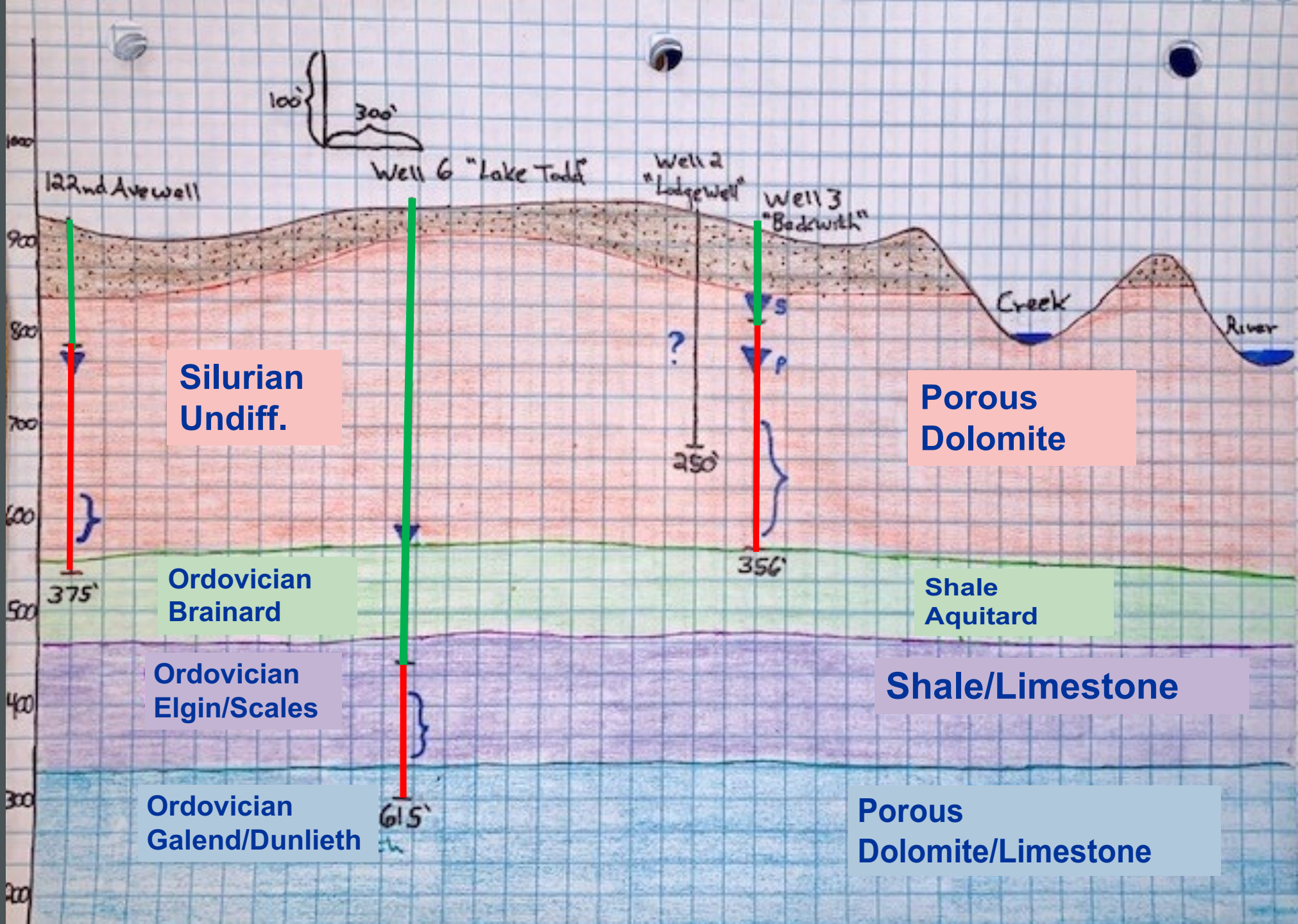
PROJECT OBJECTIVES

- Obtain an understanding of the aquifers, stratigraphy and composition of the Camp Courageous water sources
- Develop a Masterplan to assure that Camp Courageous has a safe, ample and enjoyable water supply.

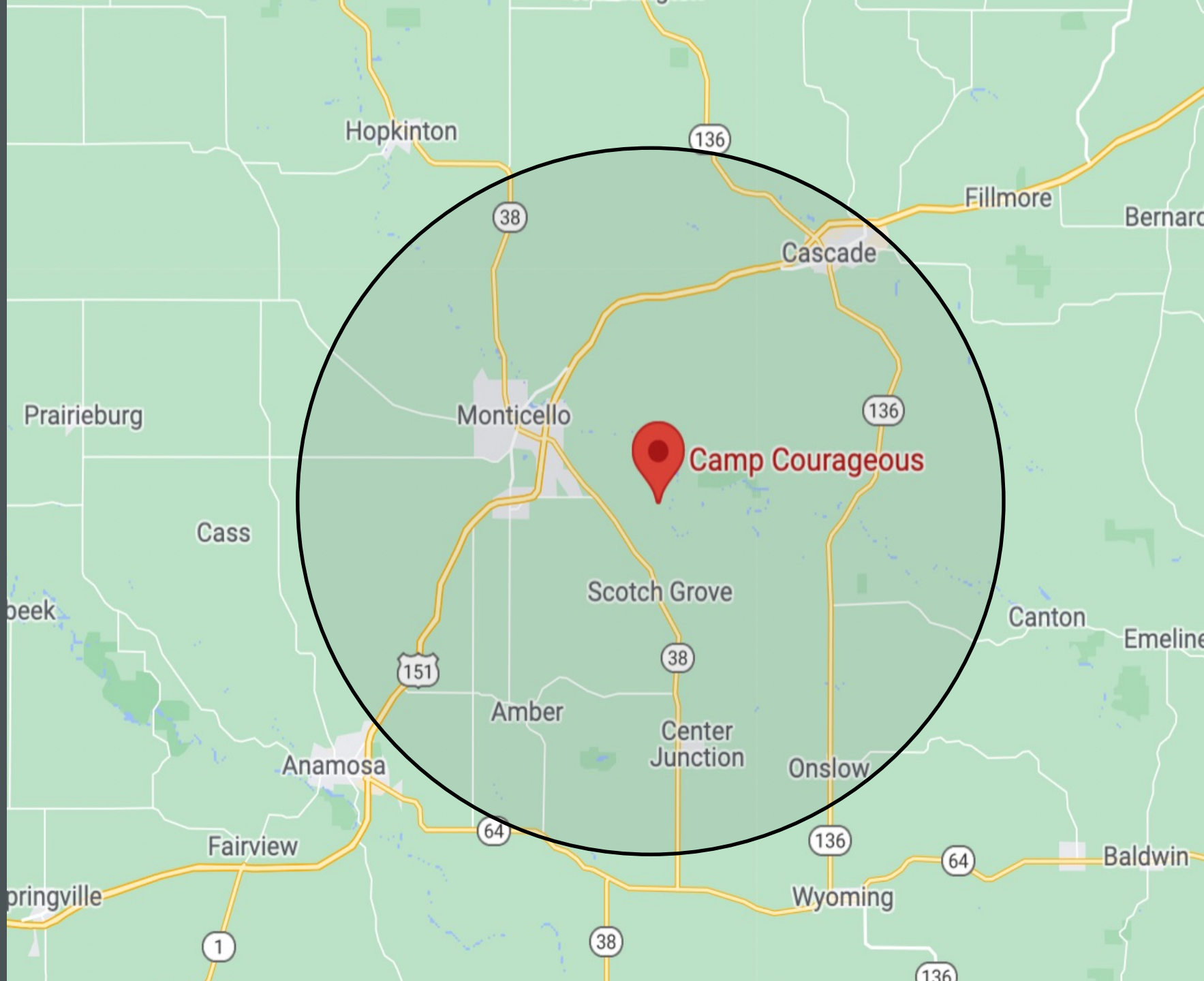
Well Nitrate Concentration (1997 - 2021)



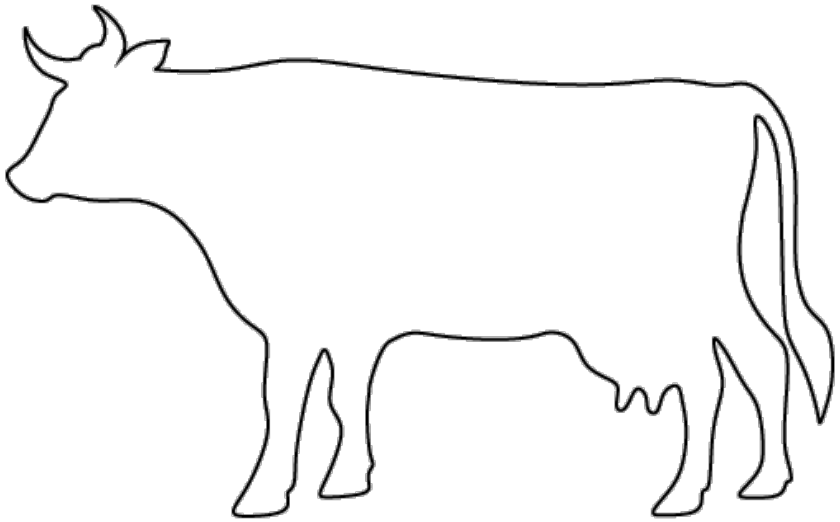
AREA STRATIGRAPHY

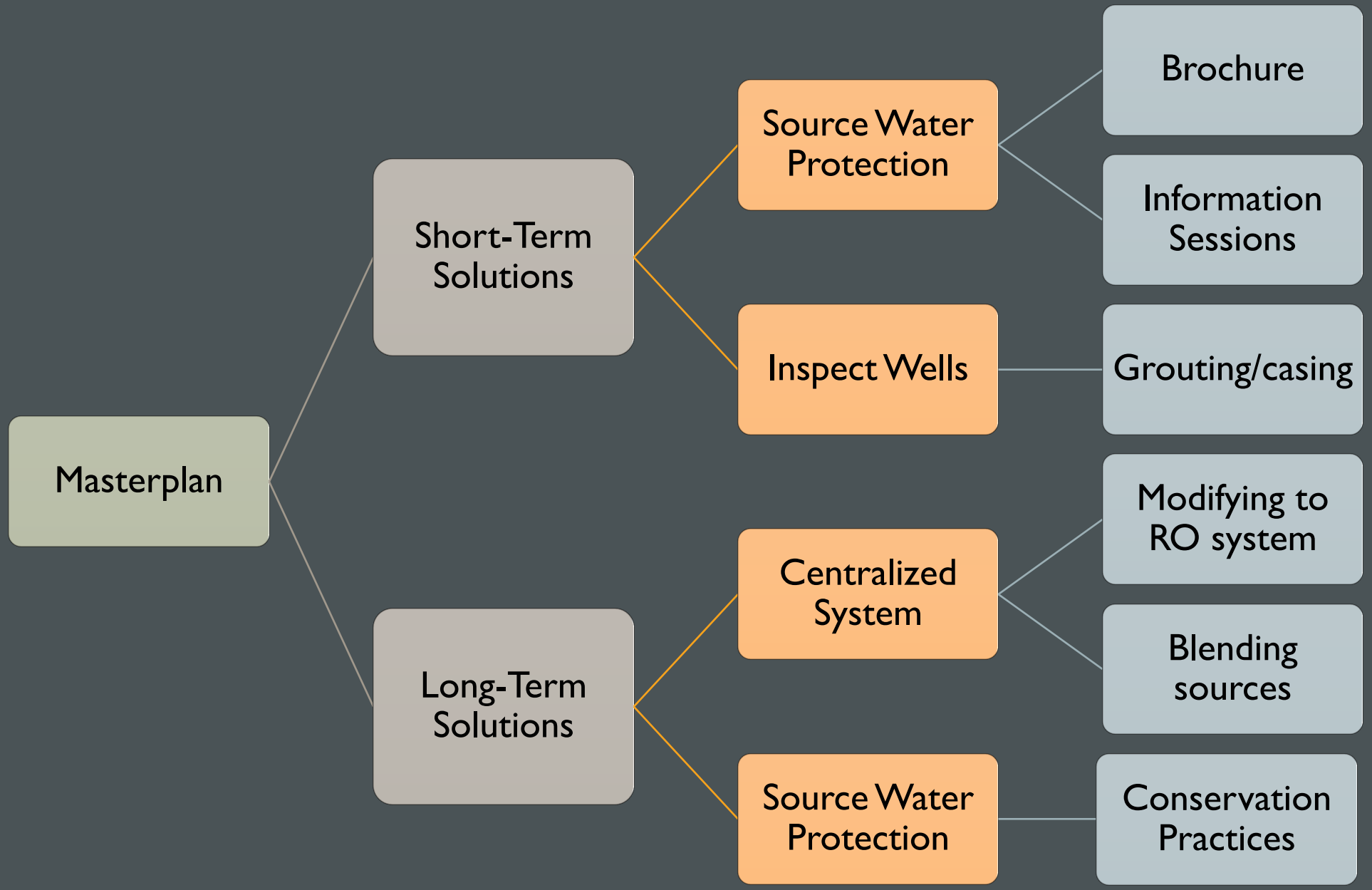


POTENTIAL RECHARGE AREA



ISOTOPE SAMPLING DATA




Masterplan
Short-Term Solutions
Long-Term Solutions
Source Water Protection
Inspect Wells
Centralized System
Source Water Protection
Brochure
Information Sessions
Grouting/casing
Modifying to RO system
Blending sources
Conservation Practices

SHORT-TERM SOLUTIONS

- Source Water Protection
- Well Inspection
- Backwash Storage Tanks
- Continue Current Water Treatment

SHORT-TERM SOURCE WATER PROTECTION SOLUTIONS

Filter Strip

About Conservation Agriculture

What is Conservation Agriculture?

Conservation Agriculture (CA) is a sustainable approach to agricultural production which aims to protect soil from erosion and degradation, improve its quality and biodiversity, contribute to the preservation of natural resources like water and air, while optimizing yields.

Why Conservation Agriculture?

Conservation practices can decrease the levels of water contaminants such as Nitrate, and improve soil, groundwater, and cops.

Nitrates are natural chemicals that are found soil, air, and water. Nitrate levels has been increasing over the past few decades and this is concerning. Excess Nitrates can stem from fertilizer, pesticides, and manure. Nitrates can seep into the groundwater supply and cause health problems in people's well water.

Soil erosion, caused by water and wind detaching and removing topsoil, can lead to infertile lands for crops, water quality issues, and more. CA has the capability of reducing soil erosion and promoting a biodiversity in your soil where your crop will thrive.

Prescribed Grazing of Cover Crops

Conservation Practices and Descriptions

Cover Crops

Crops, including grasses, legumes, and forbs, for seasonal cover and other conservation purposes. Planted prior to grain crop harvest or immediately after harvest, cover crops can reduce erosion, provide winter grazing for livestock, and reduce nutrient loss.

Residue and Tillage Management, No-till/Strip-till/Direct Seed

Managing the amount, orientation and distribution of crop and other plant residue on the soil surface throughout the year, including tillage, nutrient applications and harvesting of residue.

Denitrifying Bioreactor

Denitrifying bioreactors are underground structures filled with wood chips that intercept and treat tile water. They help reduce nitrate levels in water leaving agricultural land

Filter Strips

A strip of dense herbaceous vegetation such as grass, trees or shrubs that filters runoff and removes contaminants before they reach water bodies or water sources, such as wells.

Additional Choices, not limited to:
Field Borders, Wetlands, Prairies, Contour Farming, Ponds, Wetlands, Riparian Forest Buffers, Crop Rotation, Nutrient Management, and more

Benefits of Conservation

Landowner and farm operator decisions can implement CA practices which would benefit them and their soundings.

Better Soil

The importance of soil:

- allows both water and air to move through and get to roots,
- carries a diverse population of microorganisms
- contain an abundance of readily available nutrients

Implementing conservation practices that cause less disturbance to soil through erosion control, reducing compaction, and more, can be seen to improve soil health through the availability of water and maintenance of soil nutrients.

Better Water

Water is essential to our way of life. From drinking, eating, showering, and more. Implementing conservation practices can help filter and reduce contaminants in the groundwater where wells draw water from. Cleaner water can also improve the environment of bio life in and around rivers and streams.

Better Crop

With CA, better soil, and water infiltration lead to a thriving crop with a flourishing ecosystem among its roots. A thriving crop can lead to great yields and more capital in the pocket of the farmer.

More Profit

Aside from the profit of better crop yield, incorporating a practice such as cover crops can show an increase in profits from cost-share payments, crop insurance discounts, reduced labor for those who feed cattle, and more.

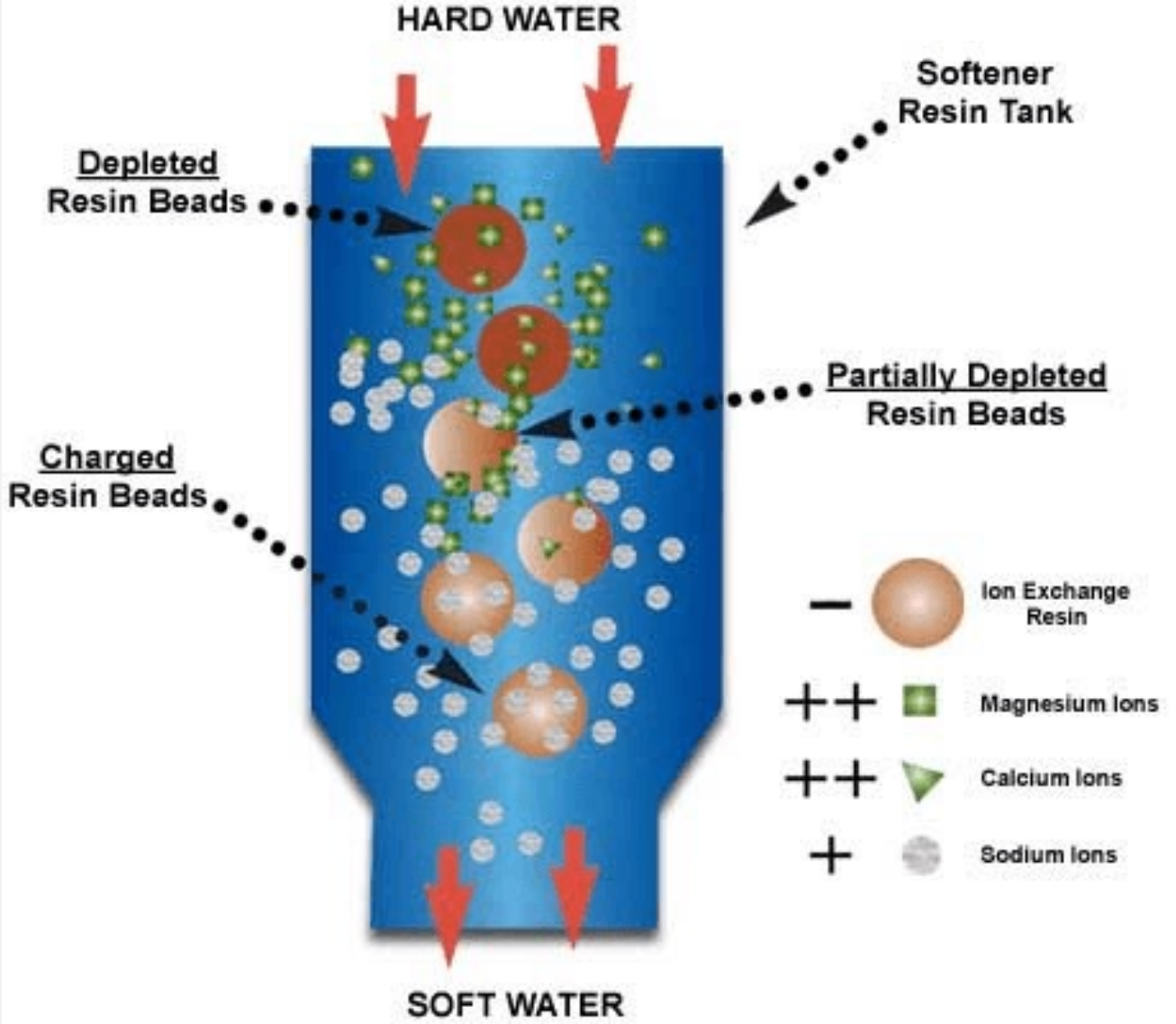
Brochure

Public Information Sessions

Source: Practical Farmers of Iowa

BACKWASH STORAGE TANKS

- Backwash is a byproduct of regenerating the resin beads
- Backwash can contribute to high chlorides in the wastewater
- Installation of backwater tanks may become necessary if the chlorides cause the wastewater to exceed the maximum daily limit
- Some may be recycled through settling and used for deicing

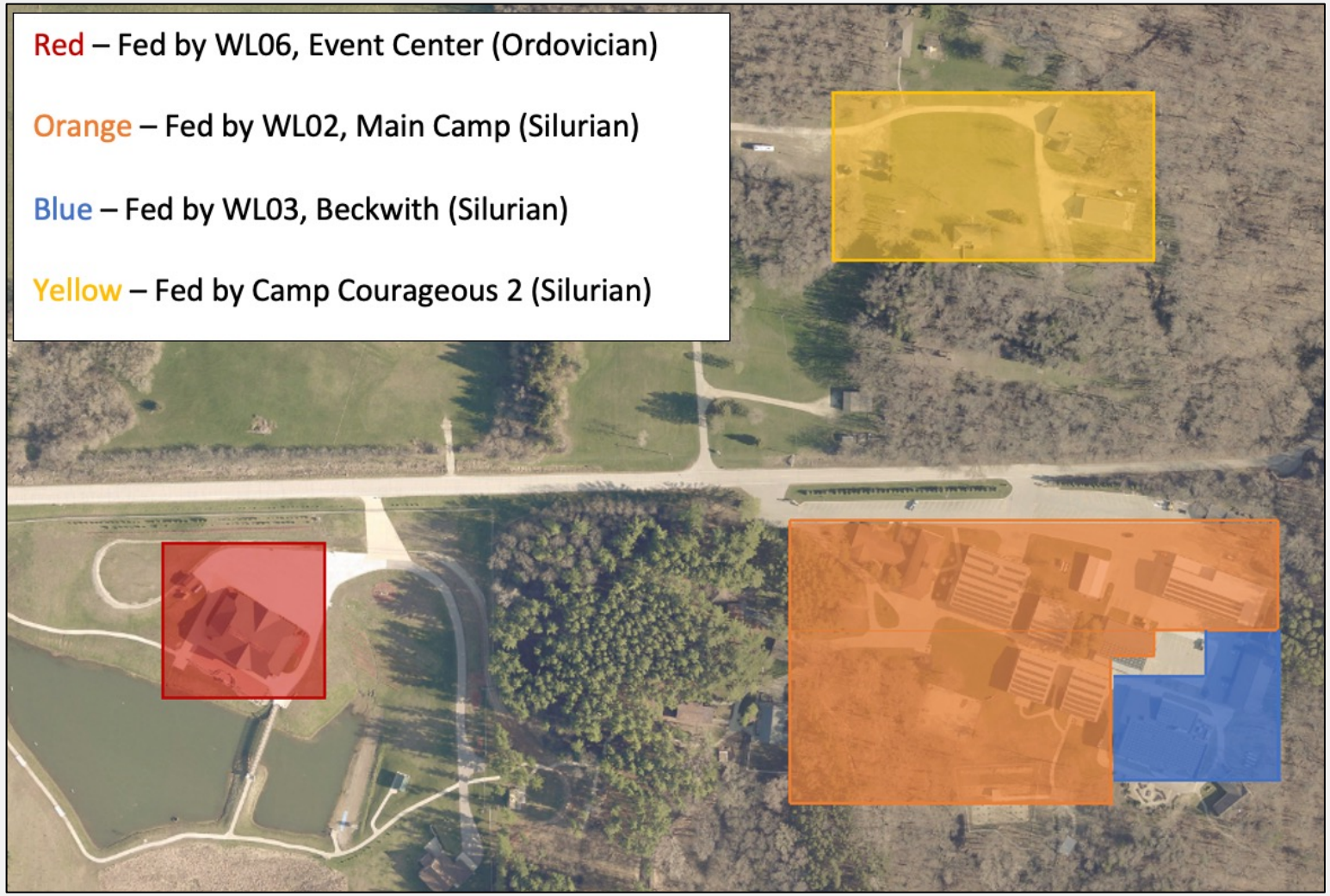


WELL INSPECTION

- Midway Well Service can conduct initial and in-depth well inspections
- Check for damage to casings that might allow contaminants from surface water to enter the well water

CURRENT WELL TREATMENT AND SERVICE MAP

- WL02 and Camp Courageous 2 treated with Ion Exchange
- WL03 and WL06 softened and chlorinated



LONG-TERM SOLUTIONS

- Centralized Water Treatment System
- Conservation Practices

CENTRALIZED SYSTEM

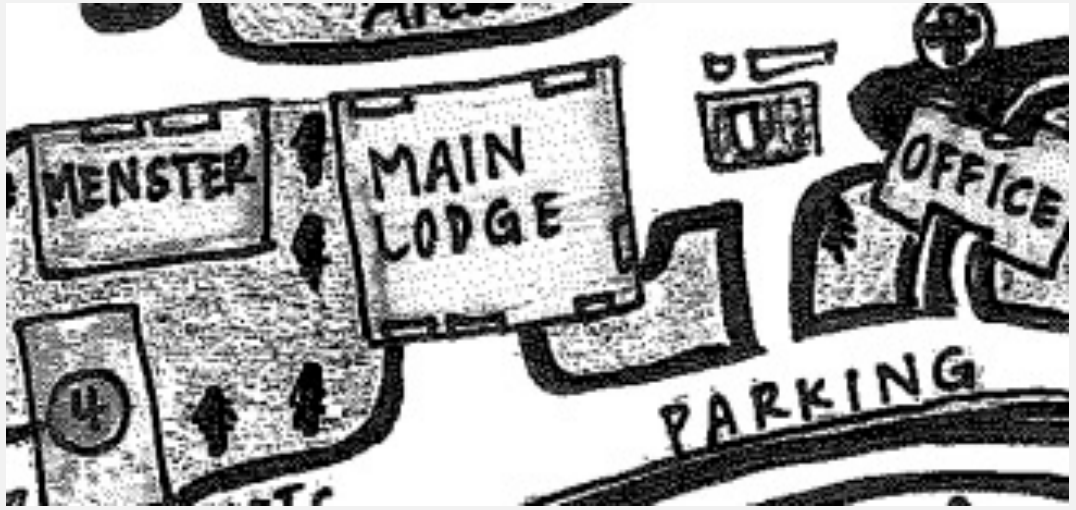
- Could be triggered by increased levels of existing contaminates, or identification of new contaminates.

Location

Reverse Osmosis

CENTRALIZED SYSTEM

- Potential Location: main lodge basement



CENTRALIZED SYSTEM

- Potential Location: main lodge basement
- Installation required for RO:
  - Sediment Pre-Filter
  - Carbon Pre-Filter
  - RO Membrane
  - Post Carbon Filter

CONSERVATION PRACTICES

- Land and water stewardship for long term payback.
- Meaningful improvements will require participation on a regional scale.

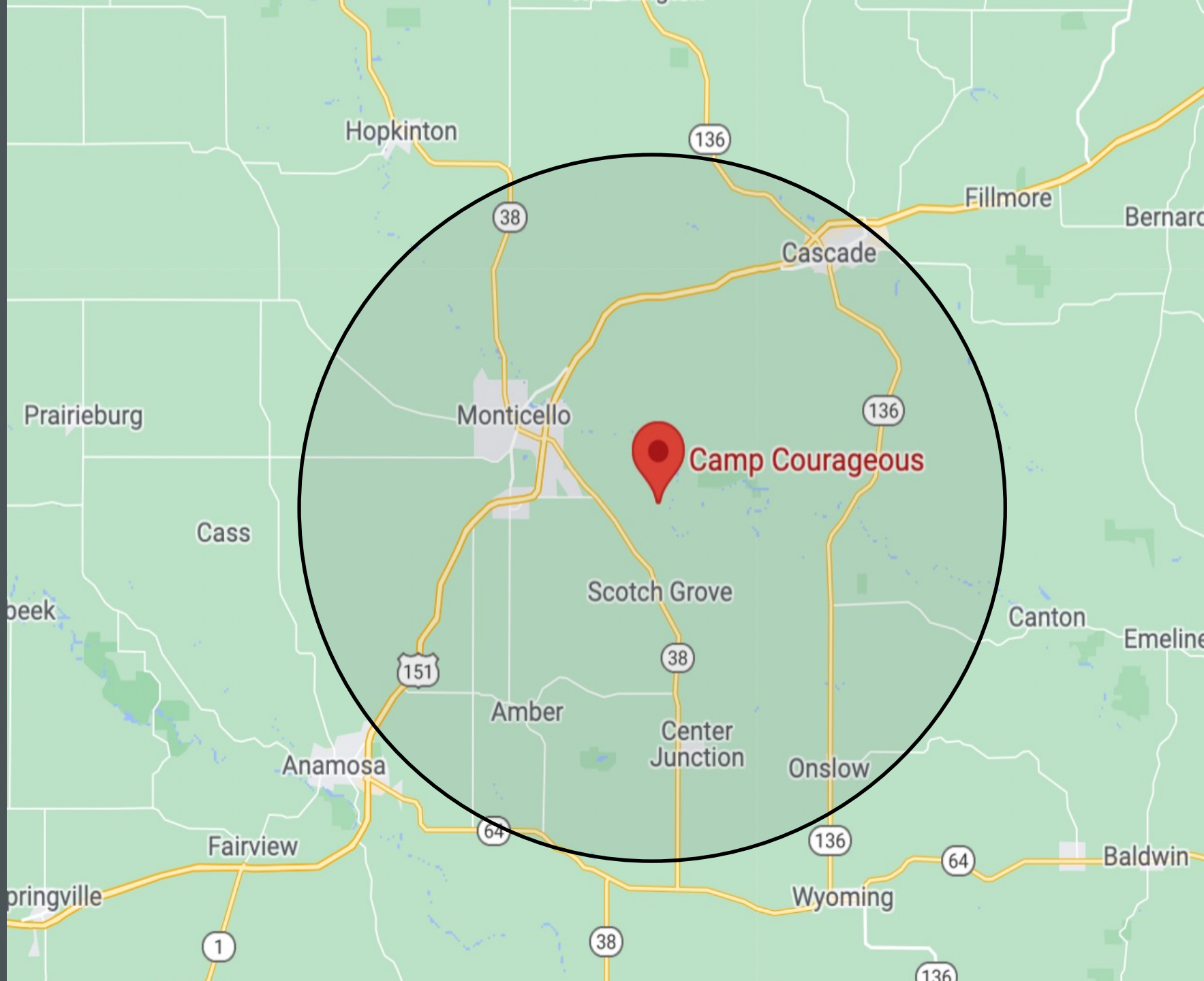
Denitrifying Bioreactor

Cover Crops

Perennial Vegetation

Saturated Buffers

10-MILE RADIUS



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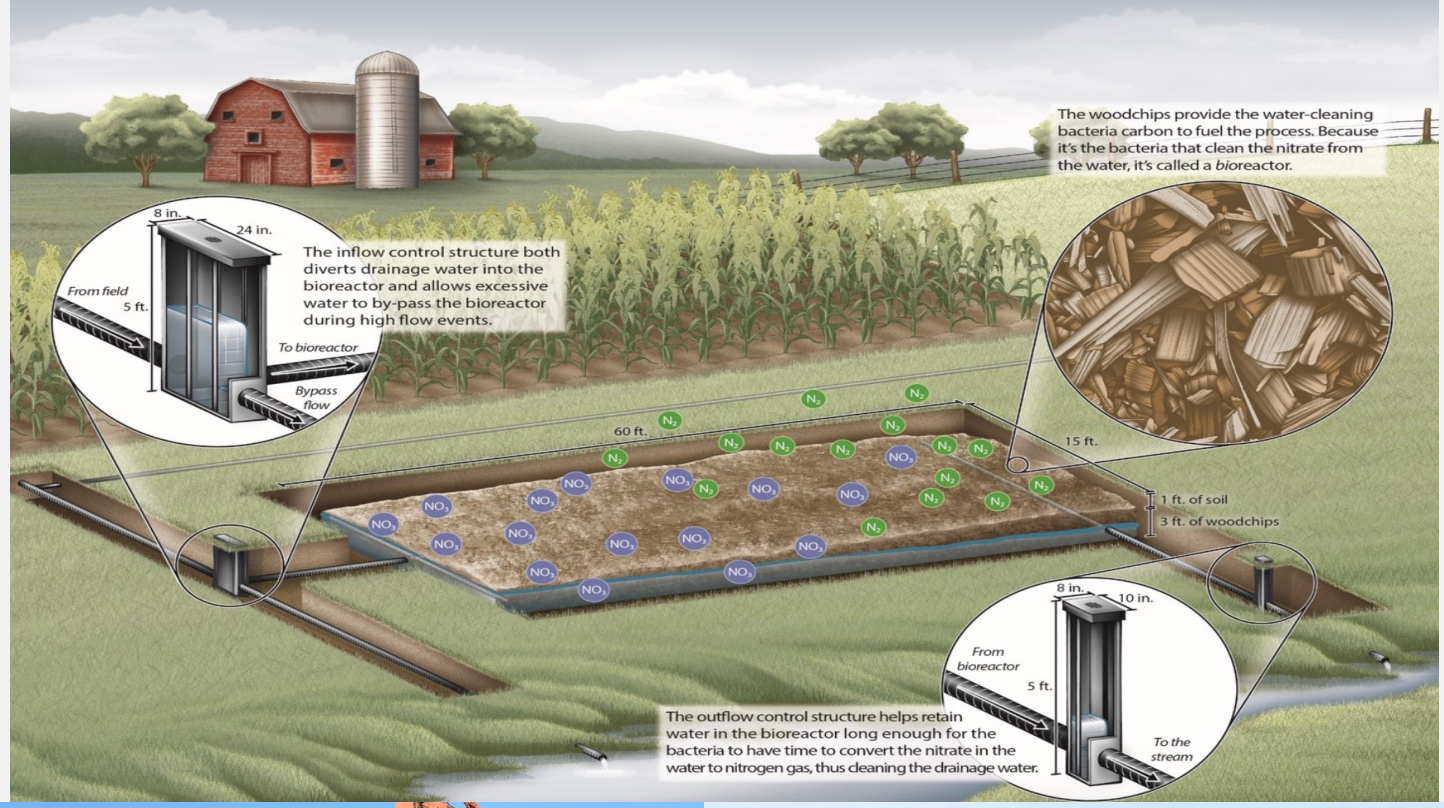

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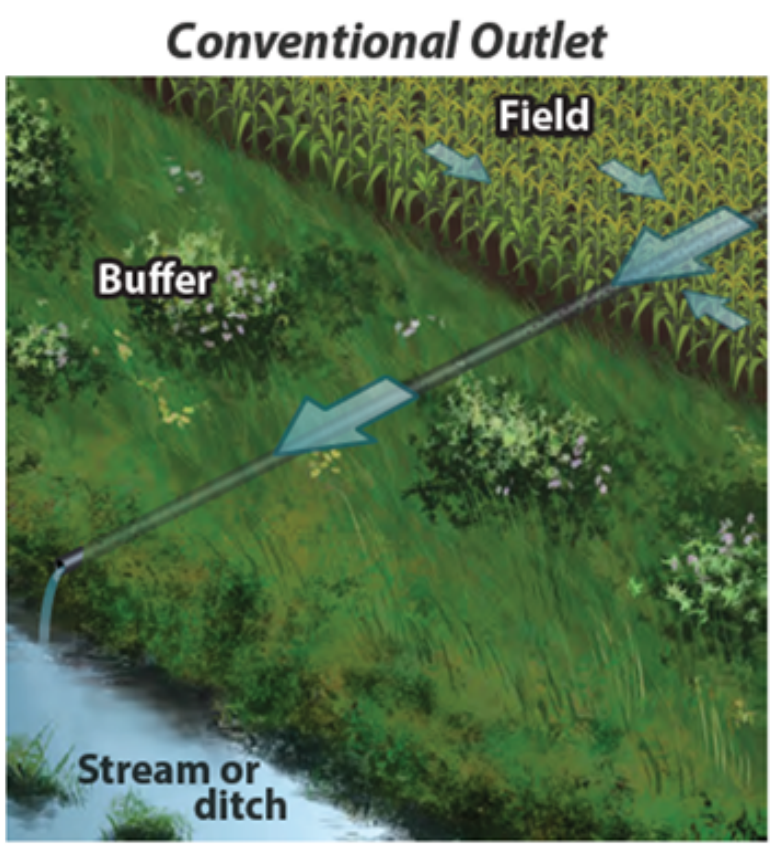

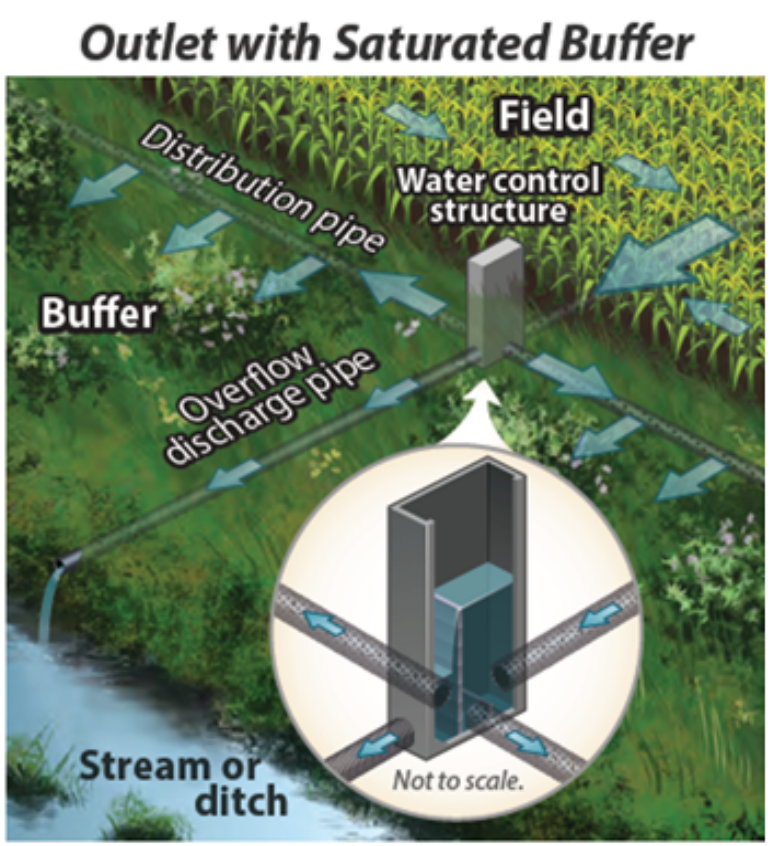

COST OF PROJECT

Approaches	Relative Cost
Flyers/ Information Sessions	$ > $100
Well Inspection	$$ > 1,000
Conservation Practices*	$$$ > 5,000
Backwash Storage Tanks	$$$ > 5,000
Centralized System	$$$$$$ > 100,000

* Subsidies can reduce expense if eligible

IN CONCLUSION


THANK YOU!
QUESTIONS?
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