

---

**SOURCE WATER DELINEATION AND ASSESSMENT REPORT  
FOR TREGO SCHOOL DISTRICT No. 53**

---

**PWSID # MT0001170**

*Trego, Montana*

Prepared for:

**Trego School District No. 53**  
P.O. Box 10  
Trego, MT 59934

Prepared by:

**Land & Water Consulting, Inc.**  
P.O. Box 8027  
Kalispell, MT 59904

June 2001

LWC Project No.: 210167

# TABLE OF CONTENTS

Page

## INTRODUCTION

Purpose

Limitations

## CHAPTER 1

### BACKGROUND

The School District

Geographic Setting

General Description of the Source Water

The Public Water Supply

Water Quality

## CHAPTER 2

### DELINEATION

Hydrogeologic Conditions

Well Information

Methods and Criteria

Model Input

Delineation Results

Limiting Factors

## CHAPTER 3

### INVENTORY

Inventory Method

Inventory Results/Control Zone

Inventory Results/Special Projection Zone

Inventory Results/Protection Zone

Inventory Update

Inventory Limitations

## CHAPTER 4

### SUSCEPTIBILITY ASSESSMENT

## **LIST OF TABLES, FIGURES & APPENDICES**

### **List of Tables**

[Table 1. Geologic or Hydrogeologic Investigations in the Area](#)

[Table 2. List of Geologic or Hydrogeologic Maps Available for the Area](#)

[Table 3. Source Well Information for Trego School District 53](#)

[Table 4. Input Parameters Used to Delineate the Source Water Protection Area](#)

[Table 5. Significant Potential Contaminant Sources](#)

[Table 6. Relative Susceptibility to Specific Contaminant Sources as Determined by Hazard and the Presence of Barriers](#)

[Table 7. Susceptibility Assessment for Significant Potential Contaminant Sources in the Control Zone and Inventory Region](#)

### **List of Figures**

[Figure 1. Vicinity Map](#)

[Figure 2. Surficial Geology Map](#)

[Figure 3. Special Protection Zone](#)

[Figure 4. Protection Zone](#)

### **List of Appendices**

Appendix A. Well Log

Appendix B. Pump House Layout

Appendix C. Uniform-Flow Equation and Time-of-Travel Calculation

Appendix D. GUDISW Form

## **INTRODUCTION**

This Source Water Delineation and Assessment Report was prepared by Land and Water Consulting (LWC) under contract to Trego School District 53 (PWSID #01170) located in Lincoln County, Montana. This Source Water Delineation and Assessment Report (SWDAR) has been prepared specifically for the Trego School District supply well in compliance with PWS-6 as required for new public water supply wells. This SWDAR was completed with assistance from Mr. Leroy Mee, PWS Operator, and Mrs. Margaret Mee, Secretary/District Clerk of Trego School District 53.

### **Purpose**

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Trego School District's new Water Supply Well as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is "delineation and assessment". Delineation is a process of mapping source water protection areas, which contribute water used for drinking. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The primary purpose of this source water delineation and assessment report is to provide information that helps the Trego School District complete a source water protection plan to protect its drinking water source.

### **Limitations**

This report was prepared to assess threats to the Trego School District Supply Well and is based on published information, data obtained during the drilling and construction of the well, and the Trego School District's PWS Operator. The terms "drinking water supply" or "drinking water source" refer specifically to the supply well. Only potential sources of contamination in areas that contribute water to these drinking water sources are considered.

The terms "contaminant" and "toxin" are used in this report to refer to constituents for which maximum concentration levels (MCLs) have been specified under the national primary drinking water standards, and to certain constituents that do not have MCLs but are considered to be significant health threats.

# CHAPTER 1

## BACKGROUND

### **The School District**

The Trego School District 53 serves approximately 80 persons, which include the students and staff. In addition, the school facilities also serve as a community center for the residents of Trego. The City of Trego is an unincorporated community. The sparsely populated town relies on septic systems for sewage treatment. In addition, there is not a storm water collection system. [Figure 1](#) is a site vicinity map displaying local features.

### **Geographic Setting**

Trego is located within the Salish Mountains adjacent to the Kootenai National Forest. The School is built on a north-facing slope that ranges in elevation between 3,169 and 3,192 feet above mean sea level (amsl). Average annual precipitation in the Trego area generally ranges from 18 to 22 inches. Most of the precipitation falls in the months of November, December, and January. The average annual temperature in the Trego area is 42° F.

### **General Description of the Source Water**

The Trego School District's well obtains water from a buried alluvial aquifer. The aquifer thickness is at least 35 feet and occurs under confined conditions. Pumping-test analyses indicate the aquifer is capable of producing in excess of 50 gpm. A copy of the Driller's Log for the well is included in Appendix A.

### **The Public Water Supply**

The Trego School District's water distribution system serves approximately 80 people during the school year and has 3 connections. The School District is entirely reliant on groundwater for their water supply. The well is located on a hill approximately 50 feet southwest of the School. The well pumps water into two 86-gallon pressure tanks located within the lower level of the School. Disinfection is provided through the injection of chlorine. A schematic showing the layout of the pump house is included in Appendix B.

### **Water Quality**

Water-quality samples had not been collected as of the writing of this report.

## CHAPTER 2

### DELINEATION

The source water protection area, the land area that contributes water to the well for Trego School District PWS #01170 is identified in this chapter. Three management areas are identified within the source water protection area. These three regions are the Control Zone, Special Protection Zone (inventory region) and Protection Region (recharge region). The control zone, also known as the exclusion zone, is an area of at least 100-foot radius around the well. The inventory region represents the zone of contribution of the well, which approximates a three-year groundwater time-of-travel. Analytical equations describing ground water flow using estimates of pumping and aquifer characteristics were used to calculate groundwater time-of-travel distance. The recharge region represents the entire portion of the aquifer that contributes water to this well.

#### Hydrogeologic Conditions

As shown on [Figure 2](#), the area near the Trego School is geologically mapped as Quaternary lake-bottom deposits and till (Coffin and others, 1971). As can be seen on the drilling log in Appendix A, the lake deposits and till at the well location are approximately 173 feet thick. Underlying the lake deposits and till is a confined buried alluvial deposit that is at least 35 feet thick. Recharge to the alluvial aquifer occurs from infiltration of snowmelt and rainfall in areas of more permeable materials such as outwash and alluvium. The general groundwater flow direction in the vicinity of the Trego School is towards the north-northeast.

A summary of the published and unpublished sources of information, which were used in this assessment, is presented in the following Tables 1 and 2.

<b>Table 1 – Geologic or Hydrogeological Investigations in the Area</b>			
<b>Title of Project</b>	<b>Period of Project</b>	<b>Area Covered</b>	<b>Project Purpose</b>
Surficial Geology and Water Resources of the Tobacco and Upper Stillwater River Valleys, Northwestern Montana, MBMG, Bulletin 81, 1971, Coffin, D.L., Brietkrietz, A. and McMurtrey, R.G.			
Geology and Mineral Deposits of Lincoln and Flathead Counties, Montana, MBMG, Bulletin 79, by Willis M. Johns.			

<b>Table 2 – List of Geologic or Hydrogeologic Maps Available for the Area</b>			
<b>Title or Description</b>	<b>Date</b>	<b>Area Covered</b>	<b>Reference</b>
Geologic and Structure Maps of the Kalispell 1° x 2° Quadrangle, Montana, USGS Map I-2267 by Harrison and others.			

Based on the hydrogeologic information, the Trego School District well would be considered to have Low Source Water Sensitivity as categorized using the table below.

<b>Source Water Sensitivity</b>
<b>High Source Water Sensitivity</b> Surface water and GWUDISW Unconsolidated Alluvium (unconfined) Fluvial-Glacial Gravel Terrace and Pediment Gravel Shallow Fractured or Carbonate Bedrock
<b>Moderate Source Water Sensitivity</b> Semi-consolidated Valley Fill sediments Unconsolidated Alluvium (semi-confined)
<b>Low Source Water Sensitivity</b> Consolidated Sandstone Bedrock Deep Fractured or Carbonate Bedrock <b>Semi-consolidated Valley Fill Sediments (confined)</b>

## Well Information

A summary of the well construction and testing specifications are presented in Table 3. A copy of the Driller's Well Log is contained in Appendix A.

<b>Table 3 Source Well Information for Trego School District 53</b>	
<b>Information</b>	<b>Well</b>
<b>PWS Source Code</b>	Not yet assigned
<b>Well Location (T, R, Sec or lat, long)</b>	SW1/4 SE1/4 of Sec. 18, T34N, R25W
<b>MBMG #</b>	187878
<b>Water Right #</b>	Not yet assigned
<b>Date Well was Completed</b>	10/29/00
<b>Total Depth (feet)</b>	208
<b>Screened Interval</b>	190 - 200
<b>Static Water Level (feet)</b>	156
<b>Pumping Water Level (feet)</b>	171
<b>Drawdown (feet)</b>	15
<b>Test Pumping Rate (gpm)</b>	56.70
<b>Specific Capacity (gpm/ftΔs)</b>	3.78

## Methods and Criteria

The Source Water Protection Area (SWPA) for the Trego School District Well was determined using the methods contained in the Montana Source Water Protection Technical Guidance Manual. More specifically, the Control Zone was set at a fixed radius of 100 feet from the wellhead, the Special Protection Zone was determined using the uniform flow equations, and the Protection Region was set at a fixed radius of 1 mile.

## Model Input

Model Input values of variables, such as transmissivity, used to delineate the inventory region is based on an empirical formula adapted from the Jacob modified nonequilibrium equation, transmissivity can be estimated for a confined aquifer using the following

equation:  $Q/S = T/2000$  (Driscoll, 1995). Where  $Q/S$  = specific capacity and  $T$  = transmissivity of the well in gallons per day per foot (gpd/ft). Based on this equation a transmissivity value was calculated to be 7,560 gpd/ft or 1,011 ft<sup>2</sup>/day. The specific capacity of the well was calculated using actual site-specific information derived from the Well Drilling Log, aquifer pumping test, and other physical measurements made on the well. A summary of the hydrogeologic characteristics for the Trego School District 53 well is presented in Table 4. The perforated interval of the well casing (10 feet) was used to calculate the hydraulic conductivity and varies from the actual aquifer thickness.

<b>Input Parameter</b>	<b>Well</b>
<b>PWS Source Code</b>	Not yet assigned
<b>Transmissivity (ft<sup>2</sup>/day)</b>	1,011
<b>Thickness (ft)</b>	10
<b>Hydraulic Conductivity (ft/day)</b>	101.1
<b>Hydraulic Gradient</b>	0.001
<b>Flow Direction</b>	North-Northeast
<b>Effective Porosity</b>	0.20
<b>Pumping Rate (gpm)</b>	20
<b>1-Year TOT</b>	605 ft.
<b>3-Year TOT</b>	1,223 ft.
<b>10-Year TOT</b>	2,912 ft.

### **Delineation Results**

The results of the delineation for the Special Protection Zone are schematically presented on [Figure 3](#). A copy of the uniform-flow equation and time-of-travel calculation are presented in Appendix C.

### **Limiting Factors**

The EPA analytical method assumes that the aquifer is homogeneous, isotropic, and of infinite areal extent. The major assumptions of such methods are that flow in the aquifer is along a uniform gradient and horizontal. In addition, withdrawal rates are assumed to be constant over time.

Limitations to this delineation include the spatial variability in aquifer properties and the possibility of errors regarding the estimates of parameters such as transmissivity and porosity. Variability within the alluvial aquifer also exists and includes, but is not limited to, aquifer thickness and areal extent. Groundwater flow within an aquifer is generally not uniform or strictly two-dimensional. Therefore, the aquifer is not homogeneous or isotropic, and withdrawals may vary over time.

The delineation shown on [Figure 3](#), represents the estimated capture zone based on a maximum daily pumping rate along a uniform gradient over the length of a three year flowpath.

## **CHAPTER 3**

### **INVENTORY**

Potential sources of contamination were inventoried to assess the susceptibility of the Trego School District 53 drinking water source to contamination. Nitrate and pathogens derived from septic drainfields were the most common potential contaminants identified in Trego School District 53 source water protection area. In addition, one underground storage tank containing gasoline was identified.

#### **Inventory Method**

A representative of the Trego School District conducted a visual survey of the inventory area that was spatially defined by the Special Protection Zone and the upgradient area extending into the Protection Region.

#### **Inventory Results/Control Zone**

The land contained within the control zone for the well is owned and administered by the Trego School District. A parking area for school buses is located approximately 40 feet to the east of the well location. As such, there are no significant potential hazards within the control zone.

#### **Inventory Results/Special Protection Zone**

As previously mentioned, a representative of the Trego School District, to ascertain and identify the potential contaminant sources, completed an inventory of the Special Protection Zone. The results of the inventory are shown below in Table 5. The land within the special protection zone is predominantly undeveloped property and has three structures sparsely located around the well. Three drainfield were inventoried and mapped within the Special Protection Zone. There are no other types of improvements within the area, as such; there is no formal collection and/or disposal system for stormwater run-off. The land use within the inventory region is classified predominantly as unsewered residential (UR), agricultural-dryland pasture (DP) and forest (F), with an area near the well classified as road right-of-way (ROW).

<b>Table 5 Significant Potential Contaminant Sources</b>		
<b>Source</b>	<b>Contaminants</b>	<b>Description</b>
UST	Gasoline	None
Animal Feeding Operation	Pathogens and Nitrates	None
Storm Sewer Outfall	Various organic chemicals	None
Sanitary Sewer Main	Pathogens and Nitrates	None
Septic Systems	Pathogens and Nitrates	3
Class V Injection Well	Various organic chemicals	None

### **Inventory Results/Protection Zone**

The recharge region is defined as a 1-mile radius around the well and is depicted on [Figure 4](#). Potential contamination sources located within the protection zone include septic systems associated with individual homes and an underground storage tank containing gasoline located approximately ½-mile to the northeast within the town of Trego. Other sources of contamination include the potential for spills along the railroad right-of-way and road right-of way that transect the protection zone.

### **Inventory Update**

The certified operator will update the inventory every year. Changes in land use or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to the Montana Department of Environmental Quality (MDEQ) every five years to ensure re-certification of the source water delineation and assessment report.

### **Inventory Limitations**

The inventory area is located within a sparsely populated and forested area around Trego. As such, the inventories for the Control Zone and Special Protection Zone and Protection Zone could be completed without limitations.

## CHAPTER 4

### SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contamination by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential sources for management actions by local entities, in this case the Trego School District 53 well.

The goal of the Source Water Management is to protect the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the Inventory Region, and 3) ensuring that land use activities in the Recharge Region pose minimal threat to the source water. Management priorities within the Inventory Region are determined by ranking the significant potential sources identified in the previous chapter according to susceptibility.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood the contaminated water will flow to the well (see Table 5). Hazard is rated by the proximity of a potential contaminant source to the well. Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (see Table 6). The susceptibility of the well to each potential contaminant source is assessed separately.

<b>Table 6</b>			
<b>Relative Susceptibility to Specific Contaminant Sources as Determined by Hazard and the Presence of Barriers</b>			
	<b>High Hazard</b>	<b>Moderate Hazard</b>	<b>Low Hazard</b>
<b>No Barriers</b>	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
<b>One Barrier</b>	High Susceptibility	Moderate Susceptibility	Low Susceptibility
<b>Multiple Barriers</b>	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

The results of the susceptibility assessment for the Trego School District 53 are summarized in Table 7. The following are brief descriptions regarding the susceptibility assessments for each potential contaminant source.

Septic System – Hazard is ranked moderate because there are more than 50 septic systems within one square mile of the site. Susceptibility is ranked low due to the thick sequence of clay above the water producing zone and the depth of the well intake.

UST Site – Hazard is ranked moderate for the UST site located within the inventory region. Compliance with DEQ leak detection and/or leak prevention requirements constitutes an engineered barrier. Susceptibility is ranked low due to multiple barriers.

<b>Table 7</b>						
<b>Susceptibility Assessment for Significant Potential Contaminant Sources in the Control Zone and Inventory Region</b>						
<b>Source</b>	<b>Contaminant</b>	<b>Hazard</b>	<b>Hazard Rating</b>	<b>Barriers</b>	<b>Susceptibility</b>	<b>Management</b>
<b>Septic</b>	Pathogens and Nitrate	Leaching	Moderate	Thick clay rich soil, Depth to intake	Low	Monitoring
<b>UST</b>	Gasoline	Spills and Leaks	Moderate	Thick clay rich soil, Depth to intake	Low	Leak monitoring, spill prevention

## **Appendix A**

---

### **WELL LOG**

---

*SOURCE WATER DELINEATION AND ASSESSMENT REPORT FOR  
Trego School District No. 53  
Trego, Montana*

## **Appendix B**

---

### **PUMP HOUSE LAYOUT**

---

*SOURCE WATER DELINEATION AND ASSESSMENT REPORT FOR  
Trego School District No. 53  
Trego, Montana*

## **Appendix C**

---

### **UNIFORM-FLOW EQUATION AND TIME-OF-TRAVEL CALCULATION**

---

*SOURCE WATER DELINEATION AND ASSESSMENT REPORT FOR  
Trego School District No. 53  
Trego, Montana*

Trego School District 53  
 Source Water Protection Plan  
 EPA Analytical Method

Parameters:  $Q = 20 \text{ gpm} = 3850.20 \text{ ft}^3/\text{day}$   
 $b = 10 \text{ feet}$   
 $i = 0.001$   
 $K = 101.1 \text{ ft/day}$   
 $n = 0.20$

**Distance to Stagnation Point ( $X_L$ )**

Equations:  $X_L = Q/2\pi Kbi$

$$X_L = \frac{3850.20 \text{ ft}^3/\text{day}}{2\pi(101.1 \text{ ft/day})(10 \text{ feet})(0.001)}$$

$$X_L = - 606.11 \text{ Feet}$$

**Boundary Limit ( $Y_L$ )**

$Y_L = Q/2Kbi$

$$Y_L = \frac{3850.2 \text{ ft}^3/\text{day}}{2(101.1 \text{ ft/day})(10 \text{ feet})(0.001)}$$

$$Y_L = 1904.15 \text{ Feet}$$

**Time-of-Travel Calculations**

Equation:  $T_x = \frac{n}{Ki} \left[ X_L - \frac{Q}{2\pi Kbi} \ln \left( 1 + \frac{2\pi Kbi}{Q} X_L \right) \right]$

Where:  $T_x$  = travel time from point x to the pumping well  
 $X_L$  = distance from pumping well over which groundwater travel in  $T_x$  (time)  
 $n$  = aquifer porosity (percent) = 20%  
 $Q$  = pumping rate of well ( $\text{ft}^3/\text{yr}$ ) = 20 gpm = 3,850.2  $\text{ft}^3/\text{day}$   
 $K$  = hydraulic conductivity = 101.1 ft/day  
 $b$  = aquifer thickness = 10 ft.  
 $i$  = hydraulic gradient = 0.001 ft/ft

Calculated travel times are:

$T_x$ (years)	$X_L$ (feet)	$XL$ (mile)
1.74	1000	0.19
1	605	0.11
3	1,223	0.23
5	1,745	0.33
10	2,912	0.55

## **Appendix D**

---

### **GUDISW FORM**

---

*SOURCE WATER DELINEATION AND ASSESSMENT REPORT FOR  
Trego School District No. 53  
Trego, Montana*

**GUDISW FORM – Preliminary Assessment**  
 DEPARTMENT OF ENVIRONMENTAL QUALITY  
 METCALF BUILDING  
 P.O. Box 200901  
 Helena, Mt 59601-0901

**Preliminary Assessment of Ground-Water Sources that may be under the Direct Influence of Surface Water**

SYSTEM NAME Trego School District 53 PWS ID# 01170  
 SOURCE NAME Well #1 COUNTY Lincoln  
 DATE June 21, 2001 NC NTNC C POPULATION 75

**Index Points**

**A. TYPE OF STRUCTURE (CIRCLE ONE)**

Well GO TO SECTION B  
 \_\_\_\_\_  
 Spring \_\_\_\_\_ 40  
 Infiltration Gallery \_\_\_\_\_ 40

**B. HISTORICAL PATHOGENIC ORGANISM CONTAMINATION**

History or suspected outbreak of *Giardia*, or other pathogenic organisms associated with surface water, with current system configuration \_\_\_\_\_ 40  
 No history or suspected outbreak of *Giardia*.  \_\_\_\_\_ 0

**C. HISTORICAL MICROBIOLOGICAL CONTAMINATION (Circle all that apply)**

Record of acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)  \_\_\_\_\_ 0  
 No violations \_\_\_\_\_ 0  
 One violation \_\_\_\_\_ 5  
 Two violations \_\_\_\_\_ 10  
 Three violations \_\_\_\_\_ 15  
 Record of non-acute MCL violations of the total Coliform Rule over the last 3 years (circle the one that applies)  \_\_\_\_\_ 0  
 One violation or less \_\_\_\_\_ 0  
 Two violations \_\_\_\_\_ 5  
 Three violations \_\_\_\_\_ 10  
 DEQ-verified complaints about turbidity \_\_\_\_\_ 5

**D. HYDROGEOLOGICAL FEATURES (Circle all that apply)**

Horizontal distance between a surface water and the source:  \_\_\_\_\_ 0  
 greater than 500 feet \_\_\_\_\_ 0  
 250-500 feet \_\_\_\_\_ 5  
 100-250 feet \_\_\_\_\_ 10  
 less than 100 feet \_\_\_\_\_ 15

**E. WATER WELL CONSTRUCTION (Circle all that apply)**

Unknown well construction \_\_\_\_\_ 30  
 Poorly constructed well (uncased, or casing not sealed to depth of at least 18 feet below land surface, or casing construction is unknown) \_\_\_\_\_ 15  
 In wells tapping unconfined or semi-confined aquifers, depth below land surface to top of perforated interval or screen:  \_\_\_\_\_ 0  
 greater than 100 feet \_\_\_\_\_ 0  
 50-100 ft \_\_\_\_\_ 5  
 25-50 ft \_\_\_\_\_ 10  
 0-25 ft \_\_\_\_\_ 15  
 unknown \_\_\_\_\_ 15

**F. WELL INTAKE CONSTRUCTION**

Unknown intake construction \_\_\_\_\_ 25  
 In wells tapping unconfined or semi-confined aquifers, depth to static water level below land surface:  \_\_\_\_\_ 0  
 greater than 100 feet \_\_\_\_\_ 0  
 50-100 ft \_\_\_\_\_ 5

0-50 ft	_____	10
unknown	_____	10
Poor sanitary seal, seal without acceptable material, or unknown seal type	_____	15

ANALYST Carlo Arendt / Land and Water Consulting, Inc. TOTAL \_\_\_\_\_ 0

**PERLIMINARY ASSESSMENT DETERMINATION (circle the one that applies)**

- I) **PASS:** Well is classified as groundwater.
- II) **FAIL:** Well must undergo further GUDISW determination.
- III) **FAIL:** Spring or infiltration gallery; must undergo further GWUDISW determination.
- IV) **FAIL:** Well will PASS if intake construction deficiencies (section F) are repaired.
- V) **FAIL:** Well may PASS if well construction details (section E) become available.

**COMMENTS** New well is not classified as GUDISW

---



---



---



---