Pablo – Lake County Water and Sewer District

Pablo Public Water System

PWSID # MT0001917

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

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GLOSSARY*

Acute Health Effect. A negative health effect in which symptoms develop rapidly.

Alkalinity. The capacity of water to neutralize acids.

Aquifer. A water-bearing layer of rock or sediment that will yield water in usable quantity to a well or spring.

Barrier. A physical feature or management plan that reduces the likelihood of contamination of a water source from a potential contaminant source

Best Management Practices (BMPs). Methods for various activities that have been determined to be the most effective, practical means of preventing or reducing pollution.

Biennial Reporting System (BRS). An EPA database that contains information on hazardous waste sites. The data can be accessed through the EPA Envirofacts website.

Chronic Health Effect. A negative health effect in which symptoms develop over an extended period of time.

Class V Injection Well. Any pit or conduit into the subsurface for disposal of waste waters. The receiving unit for an injection well typically represents the aquifer, or water bearing interval.

Coliform Bacteria. A general type of bacteria found in the intestinal tracts of animals and humans, and also in soils, vegetation and water. Their presence in water is used as an indicator of pollution and possible contamination by pathogens.

Community. A town, neighborhood or area where people live and prosper.

Confined Animal Feeding Operation (CAFO). Any agricultural operation that feeds animals within specific areas, not on rangeland. Certain CAFOs require permits for operation.

Confined Aquifer. A fully saturated aquifer overlain by a confining unit such as a clay layer. The static water level in a well in a confined aquifer is at an elevation that is equal to or higher than the base of the overlying confining unit.

Confining Unit. A geologic formation present above a confined aquifer that does not allow the flow of water, maintaining the pressure of the ground water in the aquifer. The physical properties of a confining unit may range from a five-feet thick clay layer to a shale that is hundreds of feet thick.

Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Passed in 1989 by the Montana State Legislature, CECRA provides the mechanism and responsibility to clean up hazardous waste sites in Montana.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Enacted in 1980. CERCLA provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through the Act, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup. The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) provides information about specific sites through the EPA Envirofacts website.

Delineation. The process of determining and mapping source water protection areas.

Geographic Information Systems (GIS). A computerized database management and mapping system that allows for analysis and presentation of geographic data.

Hardness. Characteristic of water caused by presence of various calcium and magnesium salts. Hard water may interfere with some industrial processes and prevent soap from lathering.

Hazard. A relative measure of the potential of a contaminant from a facility or associated with a land use to reach the water source for a public water supply. The location, quantity and toxicity of significant potential contaminant sources determine hazard.

Hydraulic Conductivity. A constant number, or coefficient of proportionality, that describes the rate water can move through an aquifer material.

Hydrology. The study of water and how it flows in the ground and on the surface.

Hydrogeology. The study of geologic formations and how they effect ground water flow systems.

Inventory Region. A source water management area for ground water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three year ground water travel time.

Leaking Underground Storage Tank (LUST). A release from a UST and/or associated piping into the subsurface.

Maximum Contaminant Level (MCL). Maximum concentration of a substance in water that is permitted to be delivered to the users of a public water supply. Set by EPA under authority of the Safe Drinking Water Act to establish concentrations of contaminants in drinking water that are protective of human health.

Montana Bureau of Mines and Geology – Ground Water Information Center (MBMG/GWIC). The database of information on all wells drilled in Montana, including stratigraphic data and well construction data, when available.

Montana Pollutant Discharge Elimination System (MPDES). Database system to track entities that discharge wastewater of any type into waters of the State of Montana.

National Pollutant Discharge Elimination System (NPDES). A national database system to track entities that discharge wastewater.

Nitrate. An important plant nutrient and type of inorganic fertilizer that can be a potential contaminant in water at high concentrations. In water the major sources of nitrates are wastewater treatment effluent, septic tanks, feed lots and fertilizers.

Nonpoint-Source Pollution. Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of chemicals into surface and/or ground waters at increased levels that may exceed MCLs.

Pathogens. A microorganism typically found in the intestinal tracts of mammals, capable of producing disease.

Point-Source. A stationary location or fixed facility from which pollutants are discharged.

Permit Compliance System (PCS). An EPA database that provides information on the status of required permits for specific activities for specific facilities. The data can be accessed through the EPA Envirofacts website.

Public Water System. A system that provides water for human consumption through at least 15 service connections or regularly serves 25 individuals.

Pumping Water Level. Water level elevation in a well when the pump is operating.

Recharge Region. A source water management region that is generally the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.

Resource Conservation and Recovery Act (RCRA). Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner. The Resource Conservation and Recovery Information System (RCRIS) provides information about specific sites through the EPA Envirofacts website.

Secondary Maximum Contaminant Levels (SMCL). The maximum concentration of a substance in water that is recommended to be delivered to users of a public water supply, based on aesthetic qualities. SMCLs are non-enforceable guidelines for public water supplies, set by EPA under authority of the Safe Drinking Water Act. Compounds with SMCLs may occur naturally in certain areas, limiting the ability of the public water supply to treat for them.

Section Seven Tracking System (SSTS). SSTS is an automated system EPA uses to track pesticide producing establishments and the amount of pesticides they produce.

Source Water. Any surface water, spring, or ground water source that provides water to a public water supply.

Source Water Assessment Report. A report for a public water supply that delineates source water protection areas, performs an inventory of potential contaminant sources within the delineated areas, and evaluates the relative susceptibility of the source water to contamination from the potential contaminant sources under "worst-case" conditions.

Source Water Protection Areas. For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply. For ground water sources, the area within a fixed radius or three-year travel time from a well, and the land area where the aquifer is recharged.

Spill Response Region. A source water management area for surface water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified four-hour water travel time in a stream or river.

Static Water Level (SWL). Water level elevation in a well when the pump is not operating.

Susceptibility (of a PWS). The relative potential for a PWS to draw water contaminated at concentrations that would pose concern. Susceptibility is evaluated at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system.

Synthetic Organic Compounds (SOC). Man made organic chemical compounds (e.g. herbicides and pesticides).

Total Dissolved Solids (TDS). The dissolved solids collected after a sample of a known volume of water is passed through a very fine mesh filter.

Toxic Release Inventory (TRI). An EPA database that compiles information about permitted industrial releases of chemicals to air and water. Information about specific sites can be obtained through the EPA Envirofacts website.

Transmissivity. A number that describes the ability of an aquifer to transmit water. The transmissivity is determined by multiplying the hydraulic conductivity time the aquifer thickness.

Unconfined Aquifer. An aquifer containing water that is not under pressure. The water table is the top surface of an unconfined aquifer.

Underground Storage Tanks (UST). A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals, and the associated plumbing system.

Volatile Organic Compounds (VOC). Chemicals such as petroleum hydrocarbons and solvents or other organic chemicals which evaporates readily to the atmosphere.

Definitions adapted from EPA's Glossary of Selected Terms and Abbreviations (http://www.epa.gov/ceisweb1/ceishome/ceisdocs/glossary/glossary.html)

INTRODUCTION

This Delineation and Assessment Report was completed by James Swierc with the DEQ Source Water Protection Program, with assistance from Clay Sloan, Operator for the Pablo PWS (ID# 1917). The unincorporated town of Pablo is located in Lake County, on the Flathead Indian Reservation, home of the Confederated Salish and Kootenai Tribes (CSKT).

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Pablo PWS as required by the Montana Source Water Protection Program and the federal Safe Drinking Water Act (SDWA).

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is termed delineation and assessment. The emphasis of this delineation and assessment report is identifying significant potential contaminant threats to public drinking water sources and providing the information needed to develop a source water protection plan for Pablo.

Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

Delineation and assessment is the foundation of source water protection plans, the mechanism Pablo can use to protect their drinking water source. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate the Pablo operator and the local community to complete a source water protection plan that meets their specific needs.

Limitations

This report was prepared to assess threats to the Pablo public water supply, and is based on published information and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of the Pablo public water supply and not any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the area of the Pablo public water supply are identified. Only potential sources of contamination in areas that contribute water to its drinking water source 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 Community

The unincorporated community of Pablo is located in the north-central part of the Mission Valley, within the boundaries of the Flathead Indian Reservation (Figure 1). Pablo has a population estimated at 1,298 people in 1990. Salish-Kootenai College, a four-year tribal college, and the government complex for the Confederated Salish and Kootenai Tribes are located in Pablo. The local economy relies on agriculture and businesses in the area. The major highway in the area is U.S. Highway 93 which runs in a north-south direction through both the town and the Mission Valley, and connects Pablo with Ronan to the south and Polson to the north.

Wastewater from the community is collected in a sanitary sewer system. The sewer system discharges to treatment ponds located southwest of the town (Figure 2). Water from the treatment lagoons is land applied to the area southwest of the lagoons.

Geographic setting

Pablo is located in the north-central part of the Mission Valley. The elevation of the town is approximately 3100 feet above sea level. The Mission Mountains, with peaks as high as 8,600 feet above sea level, represent the eastern boundary to the valley. The mountains that form the western valley boundary are as high as 7,400 feet above sea level. The Mission Valley is drained by the Flathead River, which flows generally southward from Flathead Lake to a position near Dixon, where the flow direction changes to west. The Pablo National Wildlife Refuge, a lake with wetlands providing habitat for birds, is located several miles northwest of Pablo. Surface drainage in Pablo generally flows south, and diverts towards several small creeks that follow the regional surface drainage pattern towards the southwest (Figure 2). Several irrigation ditches that flow in a general northeast-southwest direction are also present in the area.

The climate in the area is typical for this part of Western Montana. Weather data is reported for Polson, a town located approximately 6 miles north of Pablo. Polson receives an average of 15.43 inches of precipitation annually, with the wettest months in May and June averaging 1.93 and 2.25 inches. The driest months are February and March, with respective averages of 0.86 and 0.95 inches per month. The temperature ranges from an average high of 81.9° F in July (minimum July average of 52.9° F) to an average of 31.2° F in January (minimum January average of 18.9° F).

General description of the Source Water

The Pablo PWS obtains water from four wells installed into a relatively deep aquifer comprised of glacial outwash deposits covered by several hundred feet of clay-rich glacial tills. The wells are located in a north-south trending line on the southwest side of the town (Figure 2). The wells draw water from an approximate depth of 400 feet below the ground surface, with one well at a total depth of almost 600 feet. Ground water in the source aquifer for the wells in the Pablo area flows in an estimated general west to southwestern direction.

The Public Water Supply

The Pablo PWS currently serves an estimated resident population of 950 and a non-resident population of 1,000. There are currently 405 active service connections. The system has four wells located in the southwest part of town, as shown in Figure 2. The oldest well, Block 42 Well 1 (DEQ Source Code 002), was installed in 1972 to a depth of 595 feet and has a yield of 160 gpm. The third well, Block 31Well 2 (Source 003), was installed in 1979 to a depth of 408 feet and has a yield of 100 gpm. The second well, Block 1 Well 3 (Source 004) was installed in 1973 to a depth of 390 feet, and has a yield of 170 gpm. The fourth well, Well 4 (Source 005) was installed in 1989 to a depth of 454 feet with a yield of 200 gpm. The water from the wells is piped into the main distribution system, which covers the area as depicted in the general plan shown in Appendix A. A copy of the most recent sanitary survey for the system and the DNRC well logs for the PWS wells is included in Appendix B. The water does not receive any treatment prior to distribution to the consumers.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring constituents include coliforms and other signs of pathogenic organism, nitrates, metals and for multiple chemicals. The monitoring schedule depends on many factors such as the size and source water for a PWS, the number of sources (e.g. wells), and the population served. Each PWS has a specific monitoring program tailored to their system that follows the general protocols for operation of a PWS defined by DEQ. A review of the DEQ PWS database indicates that monitoring results for the Pablo PWS show no violations or exceedences of any drinking water quality standards.

The ground water in the Pablo area is a calcium bicarbonate type, with generally low concentrations of dissolved constituents (Slagle, 1988). This water is generally acceptable for all uses, including use as a drinking water supply source. The data listed in Table 1 are taken from a well in the Pablo area, northeast of the area where the source wells for the Pablo PWS wells are located. This data is considered representative of background water quality for the local water source aquifer.

Table 1 – Background Water Quality in Pablo

	Cond	PH	Temp	TDS	Hardness	Ca	Mg	Na	K	HCO_3	CO_3	SO_4	Cl	F	SiO_2	NO_3
Sample	--	--	--	--	**As $CaCO_3$**	--	--	--	--	--	--	--	--	--	--	--
Date	**μ S/cm**	**SU**	**° C**	**mg/L**	**mg/L**	**mg/L**	**Mg/L**	**Mg/L**	**mg/L**	**Mg/L**	**mg/L**	**Mg/L**	**Mg/L**	**mg/L**	**mg/L**	**mg/L**
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8/26/75	160	6.0	13.0	--	67	13	8.3	0.7	0.9	--	--	3.1	0.5	0.2	16	0.14
6/2/83	165	7.6	13.0	--	60	14	6	0.7	0.7	99	0	3.7	0.5	0.4	19	0.14

Source well listed is from Township 21 North, Range 20 West, Section 11acc, in the Pablo Town area

Data from Slagle (1988).

CHAPTER 2

DELINEATION

The source water protection area, the land area that contributes water to the Pablo PWS, is identified in this chapter. Three management areas are identified within the source water protection area. These three regions are the control zone, inventory region, and recharge region. The control zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The inventory region for the confined aquifer represents an area of a 1,000 feet radius around each wellhead. The recharge region represents the area where the aquifer is replenished.

For the Pablo area, a shallow ground water system is present across the area to the north and east of town, including the eastern part of town. The shallow system is utilized for small private wells, and is monitored by the operator for the Pablo PWS. The area within the boundaries of the Pablo Water and Sewer District is identified as a Special Protection Region to help the community maintain the integrity of the shallow ground water system. The Special Protection Region represents an expansion of the inventory zone.

<u>Hydrogeologic Conditions</u>

Geologic and hydrogeologic studies of the Mission Valley and Pablo area are listed in Table 2, with a summary of maps listed in Table 3. The hydrogeologic system in the Mission Valley, including the Pablo area, is described in detail by Slagle (1988) and Boettcher (1983). The following description of the local hydrogeology is adapted from these sources. Within the Mission Valley, the major geologic units include a thick sequence of glacial deposits of clay-rich tills with small outwash seams overlying a thicker sequence of more continuous sand and gravel outwash deposits that can serve as productive local aquifers. These sediments were deposited by the advancing glacier over Tertiary basin-fill sediments as it advanced southward into the Mission Valley. Pablo is located at a general midpoint between glacial terminal moraine deposits near Polson and Charlo. The terminal moraine deposits are comprised of large amounts of sand and gravel deposited when the advancing glaciers stopped at this position.

The surficial material near Pablo is primarily clay-rich strata with intermixed sand and gravel. Some alluvium comprising sand, gravel, boulders and some clay are present on the surface in some areas, with the thickest deposits of alluvium located adjacent to the Mission Mountains. The shallow ground water system is present in the area east and northeast of central Pablo, and the aquifer is comprised of alluvial deposits, glacial deposits, or a mixture of both.

The aquifer material for the Pablo PWS is interpreted as comprised of glacial outwash sediments covered with clay-rich glacial tills. The tills represent a confining layer for the coarser deposits of sand and gravel that produce water. Silt deposits of glacial Lake

Missoula are present in some areas overlying the glacial tills. A limited number of thin, discontinuous sand and gravel outwash lenses in the till may produce small amounts of water, but none of these have been developed to supply any community systems. The glacial deposits cover the entire central part of the Mission Valley. A geologic map depicting the surface geology of the area around Pablo is present in Figure 3. A generalized ground water flow map for the glacial aquifer that is the source for the Pablo PWS is depicted in Figure 4.

The glacial outwash sediments representing the source aquifer for Pablo can be considered to have boundaries where PreCambrian Belt Supergroup rocks outcrop along the margins of the valley. Due to the depth of the outwash deposits below the surface, and the nature of glacial deposits in general, the exact configuration of the aquifer is not known. However, the aquifer does represent a water source developed by communities across the central part of the Mission Valley. Based on interpretation of the well logs for the PWS wells (Appendix B), the glacial outwash deposits comprising the aquifer for the Pablo PWS occur in discontinuous sand and/or gravel seems ranging in thickness from several feet up to 30 feet or more. These outwash seams cannot be correlated over large distances, as is common in glacial strata. However, the occurrence of these seams significantly increases at an approximate depth of 350 feet below the surface. In addition, the high density of these seams and consistent yield demonstrate that they are in communication, and can be considered as a single aquifer unit. This is supported by various studies mapping the potentiometric surface in them as a single unit (Table 3). The overlying clay-rich tills that represent the confining aquitard to the deeper outwash seams are generally present from an estimated depth of 50 feet to 350 feet below the surface. Small water bearing seams may be present within these tills; however, they occur as small discontinuous lenses that do not appear to be in hydraulic communication with other water bearing intervals. As a result, these seams do not provide sufficient yield for development as a water source with no PWS in the Mission Valley utilizing them as a source. The geologic cross-section in Figure 5 depicts the relationship of the different types of glacial deposits in the Pablo area to the margins of the Mission Valley.

The static water level of the deep glacial aquifer is near the surface, and may result in flowing artesian wells in parts of the Mission Valley west of Pablo. However, an area of approximately 50 square miles located west of Ronan does not have any usable quantities of ground water, reflecting the variability of the type of deposits that represent the source for the glacial aquifer. Based on the hydrogeologic setting as a confined aquifer with a thick sequence of overlying clays, the aquifer is classified as having a low source water sensitivity to contamination.

Table 2. List of geologic or hydrogeologic investigations near the Pablo and Mission Valley area.

Title of Project	Reference Information	Area Covered	Project Purpose
Physiography and Glacial Geology of Western Montana and adjacent areas	Alden, W.C., 1953 U.S. Geological Survey Professional Paper 231	Western Montana including the Mission Valley, and the Idaho Panhandle	Document the regional glacial history and related deposits.
Ground-Water Resources in the Central Part of the Flathead Indian Reservation, Northwestern Montana	Boettcher, A.J., 1982 Montana Bureau of Mines and Geology Memoir 48	Mission Valley and Little Bitterroot Valley	Document hydrogeology, ground water quality, and potential for development of ground water in the study area
Geohydrology of the Flathead Indian Reservation, Northwestern Montana	Slagle, S.E., 1988 U.S. Geological Survey Water-Resources Investigations Report 88-4142	Flathead Indian Reservation, including Mission Valley	Update Boettcher with a more comprehensive study covering the entire Flathead Reservation

Table 3. List of geologic or hydrogeologic maps available for the Pablo area.

Title or Description	Date	Area Covered	Reference
Map showing generalized geology and depth to the top of Belt Supergroup; and Map showing altitude and configuration of the water surface of the valley-fill aquifers	1988	Flathead Reservation	Ground-Water Resources in the Central Part of the Flathead Indian Reservation, Northwestern Montana; Boettcher, A.J., 1982; Montana Bureau of Mines and Geology Memoir 48
Generalized geohydrologic map of the central part of he Flathead Indian Reservation; AndMap showing potentiometric surface, well locations and low-flow measurement sites in the central part of the Flathead Indian Reservation	1982	Mission Valley and Little Bitterroot Valley	Geohydrology of the Flathead Indian Reservation, Northwestern Montana; Slagle, S.E., 1988; U.S. Geological Survey Water-Resources Investigations Report 88-4142

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. For the Pablo area, the ground water occurs in glacial outwash beds that are recharged by surface water infiltration into alluvium and other surficial material along the margins of the Mission Mountains, including the Polson Terminal Moraine deposits. In this area, mountain glacial deposits are intermixed with the valley glaciers, and the tills are not present as a continuous confining layer. Additional recharge from infiltration of precipitation and stream loss may occur in limited quantities. Water flows from the recharge area vertically downwards to the aquifer beds, then horizontally towards the central part of the Mission Valley beneath the thick clay-rich tills. In the Pablo area, any flowpath for water from the surface to the deep glacial aquifer would be convoluted through any shallow water bearing seams in the surficial deposits. From its recharge area adjacent to the mountains, water flows in the deeper glacial aquifer in a general southwestern direction towards the Flathead River, which acts as a discharge point. This relationship is depicted in the cross-section in Figure 5.

Well(s) Information

The source wells for the Pablo PWS are located in the southwestern part of town as depicted in Figure 2. Copies of the drillers well logs are included in Appendix B. Well information is summarized in Table 4. The wells are cased to depth with steel casing to the total depth of the well. Two of the wells are completed with open casing to depth, and two wells have perforations at varying intervals as listed in Table 4.

Table 4. Source well information for Pablo.

Information	Well #1	Well #3	Well #2	Well #4
PWS Source Code	002	004	003	005
Well Location (T, R, Sec or lat, long)	T21N, R20W Sec 11 ACC	T21N, R20W Sec 11 ACBD	T21N, R20W Sec 11 ACC	T21N, R20W Sec 11 ACBA
MBMG #	75987	75978	6134	75998
Water Right #	W034232	P040917	P040918	P067825
Date Well was Completed	8/1/72	12/10/79	8/16/73	11/30/89
Total Depth	595 feet	408 feet	390 feet	454 feet
Perforated Interval	Casing to 578 feet	388' – 402'	Casing to 385 feet	380' – 392' 415' – 440'

Static Water Level	1 foot	--	16 feet	9 feet
Pumping Water Level	126 feet	85 feet	215 feet	294 feet
Drawdown	125 feet	--	199 feet	--
Test Pumping Rate	80 gpm	110 feet	220 feet	--
Specific Capacity	0.64 gpm/ft	--	1.1 gpm/ft	--

Methods and Criteria

The methods and criteria used to delineate the source water protection zones for the Pablo water system are specified in the Montana Department of Environmental Quality Source Water Protection Program (DEQ, 1999). For the Pablo system, the criteria for confined systems was followed for the wells. This incorporates using a fixed radius to identify the control and inventory zones around each well. The inventory zones for the Pablo wells defined by this criteria, a 100 foot radius for the control zone and a 1,000 foot radius for the inventory zone, are depicted in Figure 6. The recharge area was identified using available geologic maps (Boettcher, 1983; Slagle, 1988) and is shown in Figure 7.

The Special Protection Region that represents the limits of the Pablo Water and Sewer District as an expanded inventory zone is present in the area northeast of the standard confined aquifer inventory zones for the PWS wells. The Special Protection Region represents an area where a shallow ground water system is present that is utilized for private wells in certain areas. This area is upgradient from the PWS wells, and older deep wells within the area may provide conduits for communication of the shallow water with the deeper source aquifer for the Pablo PWS. Shallow ground water within the Special Protection Region may potentially be impacted as a result of nutrient loading from areas with a high density of septic systems.

Ground Water Flow Rates and Time of Travel

Time of travel calculations were completed using the uniform flow equation (EPA, 1993) for both the deep glacial aquifer supplying the Pablo PWS and the shallow ground water system. Conservative estimates for aquifer properties were made using available data from published reports. The flow rate estimates are made to evaluate the time of travel distance from the recharge area along the front of the Mission Mountains, and to assess the impacts to the PWS from potential contaminant sources in the inventory zone.

Model Input - Deep Ground Water System

The values selected for the calculation of time of travel for the deep aquifer supplying the Pablo PWS wells represent conservative assumptions made to evaluate ground water flow rates upgradient from the Pablo area. The values for these estimates are generally based on the information reported for the area in Boettcher (1982) and Slagle (1988). However, these reports did not include any results from aquifer testing for any wells within several miles of the Pablo wells. As a result, aquifer properties were obtained using the initial well testing data for Well 3 of the Pablo water supply system. The values for aquifer properties reported in the following discussion are consistent with regional aquifer properties, as reported in Boettcher (1982) and Slagle (1988). The criteria for selection of each value used for the ground water flow estimates is summarized in the following discussions:

Transmissivity: The transmissivity value is calculated from the specific yield of Well 3 using the method described in Driscoll (1980) for confined aquifers, where:

Q/s = T/2000; or T = 2000 Q/s

Q = pumping rate, gpm – 220 gpm

s = drawdown, in feet - 199 feet note: Q/s = specific capacity

T = Transmissivity, in gpd/ft

The estimated value for Transmissivity is 2,211 gpd/ft, which equals 296.3 ft^2/day

- ***Thickness***: The value for the thickness of the aquifer is estimated at 20 feet, which is a composite average of the water bearing intervals for the four PWS wells interpreted from the well logs (Appendix B)

- ***Hydraulic Conductivity***: A value for hydraulic conductivity is estimated using the basic relationship

T = Kb, where T = transmissivity – 296.3 ft2/day

b = aquifer thickness – 20 feet

The estimated value for the hydraulic conductivity (K) is 14.8 ft/day. A rounded value of 15 ft/day is used for this assessment.

- ***Hydraulic Gradient***: The hydraulic gradient was measured from two potentiometric surface maps published in different studies. The local gradient calculated from a flow map in Boettcher (1983) shows an approximate change of 75 feet over a mile, for an estimated gradient of 0.014. The local gradient calculated from a flow map in Slagle (1988) shows an approximate change of 100 feet over a distance of 5 miles, for an estimated gradient of 0.0037. A value of 0.01 was used for this study as a modified average value biased towards the Boettcher study results; which evaluates the aquifer in more detail in the Pablo area, and this gradient reflects wells proximal to Pablo. This data is also presented in Slagle, who presents a more regional review of ground water conditions (Figure 4).

- ***Flow Direction***: The flow direction from Boettcher (1983) indicates a northwestern flow direction. Slagle (1988) indicates a more general western flow direction. The estimated flow direction for this study is considered as due west (270 degrees) to reflect the regional flow system. Water level elevations in wells northeast of Pablo indicate that a gradient may exist from this direction; however there is not sufficient data to evaluate the flow gradient and direction in detail.

- ***Porosity***: The value for effective porosity is estimated from (Todd, 1980) at 20%. The estimated value is considered representative of gravel intermixed with finer grained material, such as a glacial till.

- ***Pumping Rate***: The pumping rate for the wells was estimated at 200 gpm, reflecting the needs of the system.

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Model Input - Shallow Ground Water System

The values used to estimate the shallow ground water flow condition upgradient from Pablo reflect Boettcher (1982) and Slagle (1988); however, there is little information that characterizes the properties of the shallow flow system in the Pablo area. As a result, the values for hydrogeologic parameters used to estimate the ground water flow properties are generally estimated considering representative ground water flow properties presented in hydrogeology references (Todd, 1980; Heath, 1983; Fetter, 1988). Specific information on the geologic characteristics of the flow system are obtained from wells obtained from the Ground Water Information Center (GWIC) database at the Montana Bureau of Mines. Copies of the well logs and other information obtained from GWIC for the Pablo area are included in Appendix C. The criteria for selection of each value used for the ground water flow estimates is summarized in the following discussions. Note that transmissivity is not a required value for estimates using the uniform flow equation.

- ***Thickness***: The value for the thickness of the aquifer is estimated at 15 feet, which represents the saturated thickness of the aquifer. This value is obtained from GWIC information reported for a well in Township 21 North, Range 20 West, Section 1 BBD located northeast of Pablo.

- ***Hydraulic Conductivity***: The estimated value for the hydraulic conductivity (K) is 50 ft/day. This value is obtained from the listed references as representative of a medium to coarse sand; or of a glacial unit comprised predominantly of sand and gravel.

- ***Hydraulic Gradient***: The local hydraulic gradient was estimated at 0.02 as a conservative estimate of shallow flow conditions for the area. The published ground water flow maps in Boettcher (1982) and Slagle (1983) present regional assessments with no information on the shallow, local ground water conditions.

- ***Flow Direction***: The flow direction for the shallow unit is estimated at southwest based on the LUST site investigation report for Joe's Jiffy Stop due east of the PWS wells (see Chapter 3, Inventory, for further discussion and the specific location of this site). This ground water flow direction is reasonable for a shallow water table aquifer, reflecting topography and the regional surface drainage direction.

- ***Porosity***: The value for effective porosity is estimated from (Todd, 1980) at 20%. The estimated value is considered representative of gravel intermixed with finer grained material.

- ***Pumping Rate***: The pumping rate for the wells was estimated at 50 gpm as a conservative estimate.

<u>Ground Water Flow Rate Calculation Results</u>

Summary spreadsheets of the results of the time of travel calculations for both the deep and shallow aquifers are included in Appendix D. For the deep aquifer, the results of the calculations indicate an estimated distance of 1,250 feet for a one-year time of travel (TOT), and a distance of 2,415 feet for a three-year TOT. The results for the shallow aquifer indicate an estimated distance of 2,010 feet for a one-year TOT, and a distance of 5,725 feet for a three-year TOT. These results are depicted on Figure 8 with the inventory zones for the Pablo PWS wells.

<u>Limiting Factors</u>

The ground water flow rate calculations use values that are considered representative of actual conditions. This approach reflects the uncertainties in the data used in the modeling process, with estimates reflecting conservative, or worst-case conditions. The assumed values are consistent with published data on the ground water system in the Mission Valley and Pablo study area (Table 2). While the inventory zones are delineated using criteria for confined aquifers, ground water flow rates were estimated to demonstrate the general properties of the ground water flow system for assessments on a more regional scale. In addition, the assessment of flow conditions in the shallow aquifer primarily reflect assumed or estimated values as there is little available information on this unit. As a result, the calculations of flow rates for both the deep and shallow aquifers are considered as estimates. Further refinement of the hydrogeologic conceptual model and time of travel flow calculations would require collection of additional data.

Additional limitations result from the use of the Uniform Flow Equation for analysis of flow rates, which does not account for pumping from multiple wells. Uncertainty in flow conditions for the shallow unit reflect the relationship between surface water and the unit, and the density and frequency of pumping from wells installed at various locations across the study area. An additional limitation on this assessment reflects the nature of glacial strata, where deposit types reflect variable shapes, and can exhibit rapid changes in hydraulic properties over very short distances.

CHAPTER 3

INVENTORY

An inventory of potential sources of contamination was conducted for the Pablo PWS within the control, inventory and special protection regions. Potential sources of all primary drinking water contaminants, including pathogens, were identified. However, only significant potential contaminant sources were selected for detailed inventory. The significant potential contaminants in the Pablo PWS inventory region include nitrates and pathogens from sanitary sewers, septic systems and agriculture; and herbicides and pesticides from cropped agricultural land.

The inventory for the Pablo PWS focuses on all activities in the control zone, certain sites or land use activities in the inventory and special protection regions, and general land uses and large facilities in the recharge region. The inventory results from the following steps are summarized in Table 5.

Inventory Method

The primary inventory method represents a "windshield survey" and a business directory search of the delineated inventory zone and special protection region in the Pablo area. This assessment was completed as a method of checking on the information provided from available databases, and to identify any sites, facilities or land uses that may not have been included with the database searches.

The available databases were initially searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. The following steps were followed:

Step 1: Urban and agricultural land uses were identified using data from the GAP program implemented at the University of Montana. The GAP program classified the state at 90 meter pixels for approximately 50 land use and vegetation types. This information was obtained in electronic format from the Montana State Library NRIS website.

- Urban and agricultural land use for the area is depicted in Figure 9.

Sewered and unsewered residential land use were identified from boundaries of sewer coverage obtained from municipal wastewater utilities. Storm water management and discharge points were identified with the help of the PWS Operator. Septic system density outside of the sewered area was evaluated using census block population data, reflecting a septic system density of 2.6 persons per septic system.

- This information is depicted in Figure 10.

Step 2: EPA's Envirofacts System was queried to identify EPA regulated facilities located in the Inventory Region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

► The only facility identified with this query is the Plum Creek facility north of Pablo, identified as a conditionally exempt small quantity generator. The permit for the facility reflects air emissions.

Step 3: The Permit Compliance System (PCS) was queried using Envirofacts to identify Concentrated Animal Feeding Operations with MPDES permits. The water system operator or other local official familiar with the area included in the inventory region identified animal feeding operations that are not required to obtain a permit.

► No facilities in the Pablo area were identified with this query.

Step 4: DEQ databases were queried to identify the following in the inventory region: Underground Storage Tanks (UST), hazardous waste contaminated sites, landfills, abandoned mines, and active mines including gravel pits. Any information on past releases and present compliance status was noted.

► The following UST Sites were identified. The location of these sites is shown in Figure 11.

Pablo Area Active Underground Storage Tanks

Name	*Address*	*Facility ID*	*Number USTs*	*Comments*
Joe's Jiffy Stop	51356 Highway 93 N	24-07562	3	Gas Station and Convenience Store
Mission Valley Concrete	Old Highway 93	24-13438	3	Two Diesel and One Gasoline tanks
Pablo Elementary School	608 4th Ave	24-04823	1	School
Quicksilver Express	52001 Highway 93 N	24-11124	3	Gas Station and Convenience Store
Two Eagle River School	Highway 93	24-12096	1	School

- The following Leaking UST Sites were identified. The location of these sites is shown in Figure 11.

Pablo Area Leaking Underground Storage Tank Sites

Name	*Address*	*Facility ID*	*Leak #*	*Confirmed Release Date*	*Cleanup Completion Date*	*Ground Water Impacts / Comments*
Joe's Jiffy Stop	51356 Highway 93 N	24-07562	413	10/9/90	6/7/95	Leak from product dispensing lines. Soils remediated with a SVE systems, 6 monitoring wells detected no impacts to ground water
Plum Creek Manufacturing Co.	121 Light Road	24-03719	3196	7/10/97	--	Leak discovered during tank removal and closure, no impacts to ground water
Tollefson's Garage	25 3rd Ave East	24-00652	798	6/28/91	12/7/92	Leak discovered during tank removal and closure, no impacts to ground water detected in monitoring wells

- There are no hazardous waste contaminated sites (CECRA Sites) in the DEQ database for the Pablo area.

- There are no landfills, either active or closed, in the DEQ database for the Pablo area. Solid waste is taken to a landfill north of Pablo, near Polson.

- There are no inactive mines in the Pablo area. The only active mines in the area are gravel pits operated by Mission Valley Concrete in the Pablo area. The location of these mines is depicted in Figure 11.

  Step 5: A business phone directory was queried to identify businesses that generate, use, or store chemicals in the inventory region. Equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were targeted by SIC code.

- The SIC code search identified the following businesses for Pablo:

Pablo Area SIC Code Search Results

Name	***SIC Code***	***Business Type***	***Address***
Allred Paint & Supply	5198	Paints, Varnishes & Supplies	52166 Highway 93
Char-Koosta News	2759	Commercial Printing	51396 Highway 93 N
Confederated Salish Trbl Cmplx	2759	Commercial Printing	Highway 93 W
H&L Welding	7692	Welding Repair	404 3rd Ave E
Frank's Meats	2011	Meat Packing Plant	204 4th Ave E
Mike's Transmission	7538	General Automotive Repair	118 7th St N
Pablo Econo Repair	7538	General Automotive Repair	306 3rd Ave E
Quick Silver Express	5541	Service Station – Gasoline and Oil	52001 Highway 93 N
Vern Frisk Trucking	4213	Trucking – Motor Freight (non-local)	10 Division Street
Vic Stinger Auto Repair	7538	General Automotive Repair	506 3rd Ave E
Whispering Pines Mini Storage	4225	Storage – Household and Commercial	Clairmont Rd

Note – Some businesses may be identified by multiple SIC codes.

Step 6: Major road and rail transportation routes were identified throughout the inventory region.

▶ The major transportation route is US 93, which runs in a north-south direction through Pablo. A railroad line is also present in a general parallel direction to US 93. The locations of these, and other minor transportation routes, are identified on Figure 10.

Step 7: All land uses and facilities that generate, store, or use large quantities of potentially hazardous materials were identified within the recharge region and identified on the base map. This information reflects the results of the inventory process outlined in the previous steps.

▶ All of the inventoried facilities that represent significant potential contaminant sources are identified on the base map in Figure 11.

Step 8: All wells located within the inventory region were identified and well logs were obtained when available.

▶ There are three wells located in the Pablo area operated by the Confederated Salish and Kootenai Tribes. The wells are located at the Mission Valley Power facility, at the Tribal Offices, and at Salish-Kootenai College. There is no documentation of these wells available from MBMG-GWIC. The estimated location of these wells is depicted in Figure 11.

▶ The wells located from MBMG – GWIC are summarized in the following table, with additional information in Appendix C. The approximate locations of the wells are shown in Figure 11.

Pablo PWS Inventory Zone Area Deep Wells

GWIC Id	*DNRC Water Right*	*Site Name*	*Township*	*Range*	*Section*	*Tract*	*Total Depth*	*Completion Date*
75969	--	Pablo School District #28	21N	20W	11	--	370	11/10/1955
75972	--	Steilen, Robert	21N	20W	11	--	520	08/10/1961
75979	--	Stokes, John	21N	20W	11	--	204	05/07/1973
75985	--	Steilen, Robert	21N	20W	11	AB	520	08/10/1961
75988	65637	Rodriguez, Frank	21N	20W	11	BCB	428	04/17/1985
75989	65554	Geurtin, Gerald	21N	20W	11	BDD	400	02/27/1987
75992	72494	Taber, Vernon	21N	20W	11	CDD	380	07/25/1989
75995	--	Church of the Nazarene	21N	20W	11	DB	343	11/20/1970
132368	--	Martinson, Curtis & Karla	21N	20W	11	DCAD	379	10/21/1992

The results of the "windshield survey" were consistent with the results from database searches, and did not indicate any additional facilities to review. There were several above ground heating oil tanks present at residences and businesses in the area. However, individually these are not considered to be signficant potential contaminant sources.

The following summarizes the results of the inventory for the Pablo area. The potential contaminants are listed, with a description of the potential release mechanism for the site. In all cases, releases may occur due to unavoidable conditions such as flooding, lightning or fire. The sites where this is the primary potential release mechanism are identified as concerns resulting from such a disaster. For other sites where other release mechanisms may be more common, the potential for a release from such a disaster is assumed.

The Montana source water protection program identifies specific types of potential contaminant sources as significant, for further evaluation of the susceptibility of the water source to these sources (Chapter 4). In general, potential contaminant sources are designated as significant if they fall into one of the following categories:

1. Large quantity hazardous waste generators.
2. Landfills.
3. Underground storage tanks.
4. Known groundwater contamination (including open or closed hazardous waste sites, state or federal superfund sites, and UST leak sites).
5. Underground injection wells.
6. Major roads or rail transportation routes.
7. Cultivated cropland greater than 20 % of the inventory region.
8. Animal feeding operations.
9. Wastewater treatment facilities, sludge handling sites, or land application areas.
10. Septic systems.
11. Sewer mains.
12. Storm sewer outflows.
13. Abandoned or active mines.

Table 5. Summary of Inventory Results for Pablo PWS.

ID#	*Source*	*Potential Contaminants*	*Description/Concern*
1	*Sanitary Sewer System*	*Pathogens and Nitrates*	*Leakage from sewer lines*
2	*Wastewater Treatment Lagoons*	*Pathogens and Nitrates*	*Leakage from lagoon bottom*
3	*Plum Creek Pablo*	*Petroleum Hydrocarbons*	*Spill of Stored Chemicals*
4	*USTs – Joe's Jiffy Stop*	*Petroleum Hydrocarbons*	*Leak from UST*
5	*USTs – Mission Valley Concrete*	*Petroleum Hydrocarbons*	*Leak from UST*
6	*USTs – Pablo Elementary School*	*Petroleum Hydrocarbons*	*Leak from UST*
7	*USTs – Quicksilver Express*	*Petroleum Hydrocarbons*	*Leak from UST*
8	*USTs – Two Eagle River School*	*Petroleum Hydrocarbons*	*Leak from UST*
9	*LUST Site – Joe's Jiffy Stop*	*Petroleum Hydrocarbons*	*Residual contamination after site closure*
10	*LUST Site – Plum Creek Manufacturing Co*	*Petroleum Hydrocarbons*	*Residual contamination after site closure*
11	*LUST Site – Tollefson's Garage*	*Petroleum Hydrocarbons*	*Residual contamination after site closure*
12	*Gravel Quarry – Mission Valley*	*Spills of fuels, lubricants, and other*	*Quarry provides direct conduit for contamination to*

	Concrete	*chemicals*	*shallow ground water system*
13	*Allred Paint & Supply*	*Paints*	*Natural Disaster – spill/release of stored paints*
14	*Char-Koosta News*	*Inks (Volatile Organic Chemicals)*	*Natural Disaster – spill/release of inks*
15	*Confederated Salish Trbl Cmplx*	*Inks (Volatile Organic Chemicals)*	*Natural Disaster – spill/release of inks*
16	*Eaton Welding*	*Cleaning Solvents*	*Disaster – spill/release of stored chemicals*
17	*Frank's Meats*	*Animal Waste*	*Natural Disaster – spill/release of animal wastes that can release pathogens*
18	*Mike's Transmission*	*Petroleum Hydrocarbons, Cleaning Solvents, Antifreeze*	*Natural Disaster – spill/release of chemicals and fuels stored on site*
19	*Pablo Econo Repair*	*Petroleum Hydrocarbons, Cleaning Solvents, Antifreeze*	*Natural Disaster – spill/release of chemicals and fuels stored on site*
20	*Vern Frisk Trucking*	*Petroleum Hydrocarbon, unknown transported materials*	*Natural Disaster – spill/release of chemicals and fuels stored on site*
21	*Vic Stinger Auto Repair*	*Petroleum Hydrocarbons, Cleaning Solvents, Antifreeze*	*Natural Disaster – spill/release of chemicals and fuels stored on site*
22	*Whispering Pines Mini Storage*	*Commercial Storage of unknown chemicals*	*Natural Disaster – spill/release of chemicals and fuels stored on site*

23	*US Highway 93*	*Spills of various chemicals*	*Disaster – spill/release of chemicals and fuels transported on Highway*
24	*Railroad Lines*	*Spills of various chemicals*	*Disaster – spill/release of chemicals and fuels transported on railroad line*
25	*Urban Land Use*	*Spills of various chemicals*	*Non-point source pollution, small spills of household chemicals*
26	*Agricultural Land Use*	*Pathogens and Nitrates; Pesticides and Herbicides*	*Non-point source pollution, concentration of fertilizers/chemicals in surface/ground water*
27	*Septic Systems*	*Pathogens and Nitrates*	*Non-point source pollution, loading o f ground water system with effluent*
28	*Storm Water Outfalls*	*Spills of various chemicals*	*Point source to non-point source releases from urban land use*
29	*Class V Injection Wells*	*Various organic chemicals*	*Direct discharge of chemical to shallow ground water system*
30	*Heating Oil Tanks*	*Petroleum Hydrocarbons*	*Disaster or accidental spill of fuels*

Inventory Results/Control Zone

The control zone represents the most critical point to protecting the integrity of the wellhead for ground water sources. The land around the control zones for the wells is predominantly urban residential. The area around Wells 1, 2 and 3 is connected to the local sewer system. The area around Well 4 is not connected to the sewer, and is located near a trailer park and other homes with a high density of septic systems. Inventory sheets for all properties in the Control Zones are included in Appendix E. The significant potential contaminant sources are listed in Table 6, with the locations shown on Figure 11.

Inventory Results/Inventory Region

The inventory region for the Pablo wells is defined as the area within a 1,000 foot radius of each wellhead. Land use in this area is predominantly urban, with a small amount of dryland agriculture (Figure 9). The identified potential contaminant sources include the Railroad Tracks, the sewer system, wastewater treatment lagoons, septic tanks, and the UST and Gravel Pit at Mission Valley concrete. The results of the inventory of significant potential contaminant sources are listed in Table 6, with the locations shown on Figure 11. Completed inventory summary sheets for the significant potential contaminant sources located in the inventory zone are included in Appendix F.

Table 6. Significant potential contaminant sources for Pablo PWS.

Source	Contaminants	Description
USTs	*Petroleum Hydrocarbons*	*Mission Valley Concrete – two diesel USTs and one for gasoline*
Waste Water Treatment Lagoons	*Pathogens and Nitrates*	*Line lagoons, dispose water by land application southwest of lagoons*
Sanitary Sewer Main	*Pathogens and Nitrates*	*Runs parallel to railroad tracks, on opposite side from PWS wells*
Railroad Lines	*Spills of various chemicals*	*Run adjacent to the location of PWS wells*
Agricultural Land Use	*Pathogens and Nitrates; Pesticides and Herbicides*	*Small amount of dryland agriculture in southeast part of inventory zone*
Septic Systems	*Pathogens and Nitrates*	*High density in area southeast of wells, particularly adjacent to Well 4*
Gravel Pit	*Various organic chemicals*	*Mission Valley Concrete – provides a conduit to the shallow ground water system for any spilled chemicals*

Inventory Results/Special Protection Region

The significant potential contaminant sources located within the Special Protection Region include USTs, several Leaking UST sites, and gravel pits. The sewer system has been extended to facilitate hookups through this region; however, there are still many residences that have not connected to this system and are still using septic systems. There is a small amount of irrigated agriculture located in the eastern part of this area.

Inventory Results/Recharge Region

The land use in the recharge region is primarily irrigated agriculture. There are no significant potential contaminant sources that were identified for this area. General land use for the area is depicted in Figure 9.

Inventory Update

The certified operator for the Pablo PWS will update the inventory every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

Inventory Limitations

The inventory is limited by the accuracy of information in databases used for the assessment. The windshield survey provides a level of quality assurance that the information presented reflects current conditions at the time of preparation of this report. The location of Class V injection wells is not complete at this time, and is currently being compiled by EPA for the area.

The location of Pablo on the Flathead Reservation may limit the completeness of the databases used. Leaking UST sites under the direction of CS&KT staff may not have any information reported to the DEQ database. In other cases, wells may be installed with no record to any Montana state databases. In these and other cases, this report relies on the local knowledge of the operator.

CHAPTER 4

SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case the Pablo PWS.

The goal of 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 Special Protection Region, and 3) ensuring that land use activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the Pablo PWS to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the Pablo PWS wells (Table 7). Hazard for confined aquifers is low if all wells in the inventory region are constructed to current state standards. Hazard is high if the PWS well is not sealed into the confining layer and moderate of only other wells are not properly constructed. Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 8). The susceptibility of each well to each potential contaminant source is assessed separately. Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to Pablo PWS wells (Table 8).

Table 7. Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

Presence Of Barriers	Hazard		
	High	Moderate	Low
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

A query of the MBMG-GWIC database indicated a total of six wells installed to depths similar to the Pablo PWS wells potentially present in the inventory zone (Appendix C). An additional three wells operated by CS&KT are located within the Special Protection Region. There is no information available for these wells from MBMG-GWIC. The location of these wells is depicted in Figure 11. For purposes of the susceptibility assessment, the PWS wells for the Pablo system are considered to be properly constructed with adequate seals. With limited information available, there is a potential that one or more of the additional wells in the inventory zone may not have proper seals to shallow ground water; therefore the relative hazard assigned for all of the potential contaminant sources in the inventory zone is ***moderate***. All potential contaminant sources located in the Special Protection Region, and outside of the inventory zone, are assigned a relative hazard of ***low***.

Table 8. Susceptibility assessment for significant potential contaminant sources in the Control Zone and Inventory Region**.**

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
USTs	Petroleum Hydrocarbons	Spill, leak	Moderate	Compliance with 1998 upgrades; clay rich soils	Low	Monitor compliance results
Wastewater Treatment Lagoons	Pathogens and Nitrates	Spill, leak	Moderate	Clay-rich soils	Moderate	Monitor operation of lagoons and disposal of wastewater
Sanitary Sewer Main	Pathogens and Nitrates	Leak	Moderate	Clay-rich soils	Moderate	Monitor integrity of sewer lines
Railroad Lines	Various	Spill	Moderate	None	High	Develop emergency response procedures
Agricultural Land Use	Pesticides and herbicides; Nitrates	Non-point source, concentration	Low	Clay-rich soils	Low	Educate community of BMPs for agriculture
Septic Systems	Pathogens and Nitrates	Leak	Moderate	Clay-rich soils	Moderate	Connect to sanitary sewer system
Gravel Pit	Various	Small spills	Moderate	Clay-rich soils	Moderate	Monitor use of chemicals near gravel pit

The results of the susceptibility assessment indicate that the Pablo PWS wells are generally well protected from contamination. The primary threats are considered to result from the septic systems, the sewer mains and wastewater collection and treatment system, and from spills from an accident on the railroad lines.

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