

WELLHEAD PROTECTION PROGRAM
POWELL TOWNSHIP PUBLIC WATER SUPPLY SYSTEM
POWELL TOWNSHIP, MICHIGAN

PREPARED FOR:

Powell Township
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PREPARED BY:

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1.0 INTRODUCTION

Powell Township supplies public water to residents in Powell Township and the community of Big Bay. Included, as **Figure 1**, is a location map of the well field and water supply service area. The public water supply system (PWSS) utilizes four wells located within two Powell Township well fields. Wells #1 and #2 are located within the northern wellfield and have capacities of 145 gpm. Wells #3 and #4 are located within the southern wellfield and have capacities of 550 gpm and 250 gpm respectively. **Figure 2** shows both well fields used for the PWSS along with their respective Wellhead Protection Areas (WHPAs). The original WHPA for the northern well field is shown in **Figure 3** and the new WHPA for the southern well field is shown on **Figure 4**. Water Well and Pump Records for the PWSS wells are included in **Appendix A**.

The goal of the Wellhead Protection Program is to help ensure the safe supply of drinking water for the residents of Powell Township and the community of Big Bay. The purpose of this Wellhead Protection Plan (WHPP) is to delineate the areas that supply water to the public water supply wells, identify potential contaminant sources, establish management strategies to protect the source water, construct a framework to respond to water supply emergencies, and develop public education material. The water supply service area (**Figure 1**) encompasses most of the community of Big Bay. There are a total of 114 customers that are serviced by the Powell Township Public Water Supply System, based upon the water billing database. The public water supply service area is primarily characterized by residential, commercial, and recreational customers. Of the 114 customers, there are approximately 19 commercial and 95 residential customers. Commercial customers include a gasoline service station, hotel, bar/restaurant, county park/campground (Perkins Park), youth health camp (Bay Cliff), county garage, church, school, county refuge harbor, and other small commercial businesses.

The community of Big Bay has a large transient population as a result of a primarily tourism-driven economy. Peak usage of the system is during the summer months when Bay Cliff Health Camp is in full operation and Perkins Park is at its peak usage. Other periods of high usage are related to the school year, as a result of the Powell Township School operations (grades K-8), and winter sport activities (i.e., primarily snowmobiling). Lake Independence provides an abundance of year-round recreational activities, including fishing, swimming, and camping at Perkins Park. Special events also contribute to peak system demand, including Summer and Winter fishing tournaments and Summer and Fall softball tournaments. Semi-annual hydrant flushing also contributes to peak system demand.

All four PWSS wells are completed in an overburden aquifer. There does not appear to be a significant confining unit between the ground surface and the aquifer interval from which the PWSS wells are producing. The producing water-bearing formation is considered an unconfined aquifer. Groundwater produced from these wells is potentially vulnerable to contamination from sources such as chemical spills and leaking storage tanks. Powell Township realizes that there is the potential for contamination of the groundwater aquifer supplying the water to the four public water supply wells.

Being a proactive community, Powell Township was awarded multiple Wellhead Protection Grants through the Michigan Department of Environmental Quality - Drinking Water and Municipal Assistance Division (MDEQ-DWMAD). Funds from these grants were used to develop a Wellhead Protection Program for Powell Township's public water supply wells.

Elements of this Wellhead Protection Program include the following:

- Wellhead Protection Team
- Wellhead Protection Area Delineation
- Contaminant Source Inventory
- Management Strategies
- Contingency Plan
- Potential New Well Locations
- Public Education and Participation

The greatest risk to the Township's public water supply system is from contamination entering the ground from surface or underground storage tank releases and traveling down through the soil to the aquifer. Most of the effort in developing this Wellhead Protection Program was focused on two activities: Wellhead Protection Area Delineation and Contaminant Source Inventory.

2.0 ROLES AND RESPONSIBILITIES – WELLHEAD PROTECTION TEAM

Prior to applying for a Wellhead Protection Grant, Powell Township created a local wellhead protection team. The members of the team and the group they are representing are listed below.

Local Team Representative	Name	Representing	Role
Municipality	Darlene Turner	Powell Township, Supervisor	Team Lead; Liaison with the Township Board
Local Water System	Daryl Wilcox, Peter TenEyck	Powell Township Water Department	Provide system monitoring and maintenance; Liaison with Powell Township
Local Fire Department	Michael Thoma	Powell Township Fire Department	Provide technical input to the team regarding hazardous substance safety and Best Management Practices (BMPs) based on Community Right-to-Know reporting
School Board	Holly DeWitt	Powell Township School Board	Liaison to the community and the education system; aide in disseminating WHPP concepts to students
General Public	Samantha Morin	Public	Provide input to the Team from the at-large community related to the WHPA and its impact on the community
Local Business	Joe Cram	Business Community	Provide input to the Team from the at-large business community related to the WHPA and its impact on the local businesses
Planning	Paul Beauchaine	Powell Township Planning Commission	Provide technical input to the team regarding the WHPA and its impact on future projects within the community

Copies of the Participation Agreements for each of the above listed members are included in **Appendix B**. As new members are added or deleted, the Wellhead Protection Team directory will be updated and revised on an as needed basis.

The Township Supervisor and Water System Operator will be responsible for ensuring that this Wellhead Protection Program is updated in a timely manner. An annual review of this Wellhead Protection Program will be completed to determine if there are any areas that need to be updated. These two individuals will work in cooperation with their consultant, U.P. Engineers & Architects, Inc. of Ishpeming, Michigan, to ensure that the Wellhead Protection Program is regularly updated.

3.0 WELLHEAD PROTECTION AREA DELINEATION

This wellhead protection plan has been prepared to incorporate the new well field that Powell Township has developed in Section 28, Township 51N, Range 27W. Powell Township identified and delineated the source of groundwater produced by the Township's well field based on a model for the ten-year time of travel delineation area. The Wellhead Protection Area (WHPA) delineation effort involved several tasks, which are summarized herein.

3.1 2010 and 2017 Pump Testing performed on TW-3 and TW-4

72-hour and stepped-rate tests were performed on TW-3 in 2010 and TW-4 in 2017 to determine aquifer hydrogeological parameters and to project drawdown in the wells at various pumping rates and durations. Additionally, a dual pumping well test was conducted in 2017 to evaluate the effect of TW-3 and TW-4 pumping simultaneously on the aquifer. Results of the tests were reviewed by UPEA and MDEQ's Source Water Unit (SWU) to determine capacities of the wells (550 gpm for TW-3, and 250 gpm for TW-4).

3.2 Piezometric surface map development which included the groundwater flow direction and hydraulic gradient

Groundwater flows primarily to the east towards Lake Independence. The hydraulic gradient ranges from 0.045 to 0.085 in the study area.

3.3 Conceptual model of the aquifer

A conceptual model of the aquifer was developed to establish hydrogeological parameters and boundary conditions of aquifer, in support of wellhead protection area delineation modeling effort. UPEA selected the model that was used for subsequent delineation modeling the aquifer as an unconfined sand and gravel aquifer, underlain by a confining clay layer. The model selected was the two-dimensional semi-analytical GPTRAC module found as part of the WHPA code.

3.4 Determination of the final 10 year Time-of-Travel (TOT) delineation area by the MDEQ Source Water Protection Unit using the Michigan Groundwater Management Tool (MGMT)

As input, this method uses municipal and private water well logs on file in the Michigan water well log database. Information available from this source includes strata lithology, phreatic surface depth, GIS well location and well collar elevation. Well location and production rates for the two existing test wells in the new Powell Township well field (Test Wells #3 and #4, which are approved for equipping as municipal production wells) were also input to the MGMT as the aquifer production wells. Details

of the MGMT calculations are not understood to be generally available in publication form at the present time.

The MGMT delineation output data was used by ArcGIS to overlay the 10 year delineation on useful base maps. The final wellhead protect area (WHPA) recommended by the Powell Township Wellhead Protection team and accepted by the Powell Township Board of Commissioners was determined by defining an area that encompasses the MGMT-determined delineation area and utilizes quarter-quarter section boundaries for the practical ease of establishing the protected wellhead area by land owners and stakeholders. This resulting WHPA is shown in **Figure 4**.

4.0 CONTAMINANT SOURCE INVENTORY

A review of environmental records for the site was conducted to identify existing potential sources of contamination, including known and potential sites of environmental contamination identified in various state programs. The location of these sites has been verified by the community and maps identifying their locations in relation to the wellhead protection area are included as attachments. No potential contaminant sources were identified within one mile of the south WHPA by a federal and state database search, and no potential contaminant sources were identified within the north WHPA; however there are several sites located less than one mile from the north WHPA in Big Bay. Federal and state database search results are included as **Appendix C**.

National Priority List (NPL)

The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. The results of the search identified no adjacent properties as an active NPL site. There were no de-listed NPL sites that lie within a one mile radius of the WHPAs (**Appendix C**).

Superfund Enterprise Management System (SEMS), Comprehensive Environmental Response Compensation and Liability Information List (CERCLIS)

SEMS (formerly CERCLIS) contains data on potentially hazardous waste sites that have been reported to the EPA by states, municipalities, private companies, and private persons, and contains the same data and content as CERCLIS. Results of the search identified no adjacent properties as being active SEMS sites. There were no other SEMS or CERCLIS sites within a one mile radius of the south WHPA, and there was one active SEMS site located less than one mile from the north WHPA in Big Bay. The Powell Township Landfill archived SEMS site is located approximately 0.219 miles north and down gradient of the north WHPA (**Appendix C**).

Resource Conservation and Recovery Act (RCRA)

The Resource Conservation and Recovery Information System (RCRIS) database includes information on sites that generate, transport, store, treat, and/or dispose of hazardous wastes, as defined by RCRA. No archived RCRA transport, storage and disposal (TSD) facilities were identified within one mile of the WHPAs. No RCRA Large Quantity Generator (LQG) or RCRA Small Quantity Generator (SQG) were identified within one mile of the WHPAs and one RCRA Conditionally Exempt Small Quantity Generators (CESQGs) site was identified within one mile of the north WHPA. A site qualifies as a RCRA-CESQG if the company generates less than 220 pounds of hazardous waste or spill residue per month. The Powell Township School site is located approximately 0.645 miles northeast and down gradient of the north WHPA (**Appendix C**).

Resource Conservation and Recovery Act (RCRA) CORRACTS

CORRACTS is a list of handlers with RCRA Corrective Action Activity. Results of the database search revealed no CORRACTS sites within a 1.0 mile radius of the WHPAs.

Federal Institutional Control/Engineering Control

No federal institutional control/engineering control (FIC/EC) registries were found within one mile of the WHPAs. (Appendix C).

Emergency Response Notification System (ERNS)

The WHPA and adjoining properties are not reported as ERNS sites (Appendix C).

State and Tribal Equivalents CERCLIS

The State Hazardous Waste Sites (SHWS) records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. A review of the SHWS list has revealed that no SHWS sites are located within one mile of the WHPAs (Appendix C).

Solid Waste Disposal Site List (SWF/LF) (WDS)

The Solid Waste Facilities/Landfill Sites records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. The data comes from the MDEQ list of Solid Waste Facilities. There are no known solid waste disposal or landfill facility (SWF/LF) sites within one mile of the WHPAs listed with the State of Michigan. The WHPAs are not identified as a waste disposal site (WDS) (Appendix C).

Part 201 (Environmental Remediation) of Michigan's Natural Resources and Environmental Protection Act (NREPA), Public Act 451 of 1994, as Amended

MDEQ's Remediation and Redevelopment Division has developed a list of all environmental contamination facilities (i.e., state hazardous waste sites) in Michigan, which are not leaking underground storage tanks (LUST) facilities. There were no Part 201 facilities identified within the WHPAs, and there was one Part 201 site (Powell Township Landfill) which was located 0.219 miles north and down gradient of the north WHPA (Appendix C).

Deleted Part 201 sites no longer exceed applicable cleanup criteria. There were no sites classified as DEL Part 201 sites.

Leaking Underground Storage Tank (LUST) Facilities (Part 213 of Act 451 of 1994, as Amended)

The MDEQ's Remediation and Redevelopment Division regulates all LUST Part 213 facilities in Michigan and has developed a list of open and closed LUST sites. An Indian LUST is a leaking underground storage tank on Indian property. A search of these databases indicated there were no Part 213 LUST facilities within the WHPAs. No Indian LUST sites were found within one mile of the WHPAs. Two LUST sites were located in Big Bay, less than one mile from the north WHPA, but down gradient. The Giannunzio Oil site is located approximately 0.323 miles northeast of the north WHPA, and the Big Bay District Garage is located approximately 0.583 miles northeast of the north WHPA.

Michigan Underground Storage Tank Regulations (Part 211 of Act 451 of 1994, as Amended)

MDEQ's Waste and Hazardous Materials Division regulates active Underground Storage Tank (UST) facilities with registered USTs and Aboveground Storage Tanks (ASTs). It also publishes a list of all UST sites, which are not Leaking Underground Storage Tank (LUST) facilities. An Indian UST is a listing of underground storage tank locations on Indian Land. The WHPAs do not contain any UST sites. Two active and two closed UST sites are located less than one mile from the north WHPA in Big Bay (Appendix C).

<u>Site</u>	<u>Status</u>	<u>Distance/Direction</u>	<u>Relative Elevation</u>
Giannunzio Oil	Active	0.323mi/NE	Lower
Big Bay Outpost and Deli	Active	0.490mi/NE	Lower
Big Bay District Garage	Closed	0.583mi/NE	Lower
Powell Twp School District	Closed	0.645mi/NE	Lower

State Voluntary Cleanup Sites

No known state voluntary cleanup sites are located within one mile of the WHPAs (**Appendix C**).

State Brownfield and BEA Sites

No Brownfield sites were registered with the EPA within one mile of the WHPAs, and no BEA sites were identified within one mile of the WHPAs (**Appendix C**).

Manufactured Gas Plants

Manufactured gas sites were used in the United States from the 1800s to the 1950s to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, oil and water that also produced a significant amount of waste. Many byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludge, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from the process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination. There were no former Manufactured Gas Plants (MGP) identified within one mile of the WHPAs.

Indian Reservation

An online review and analysis has revealed that there are no Indian Reservation sites within one mile of the WHPAs.

Historic Landfills

A review of a list of historic Michigan landfill list revealed no former landfill within one mile of the WHPAs.

Oil and Gas Permit Locations

There are no known oil and gas permit locations within or near Powell Township's WHPAs.

Other Potential Contaminant Sources Within and Adjacent to the WHPA

Additional potential contaminant source locations were identified upon knowledge of the Township and information provided by members of the Wellhead Protection Team. These potential contaminant source locations are not within the WHPAs. Development within the north WHPA is limited to one camp owned by Mr. Tom Abbot, which has one private water well. Development in the south WHPA is limited to four residences along County Road 550, several primitive roads, and the well house. The following potential contaminant sources, which are all outside the WHPAs, are listed in order of increasing distance from the WHPAs.

A. 550 Snowmobile Club

The 550 Snowmobile Club headquarters are located down gradient of the north WHPA and adjacent to the property containing the Powell Township Well Field. One confirmed Aboveground Storage Tanks (AST) is located adjacent to the outbuildings on the property used by the 550 Snowmobile

Club. The north WHPA does extend onto the property owned and utilized by the 550 Snowmobile Club, but it appears from the WHPA map that the AST is located at a minimum of 20 feet outside and down gradient of the WHPA. The AST is used for diesel fuel for the groomers. There are no reported contaminated sites located on the property owned by the 550 Snowmobile Club.

B. Maintenance Garage

An automotive maintenance garage is located on Hungry Hollow Road. The maintenance building is located approximately 0.5 miles south of the north WHPA and 0.25 miles to the north of the south WHPA. This property currently contains a 250 gallon diesel above ground storage tank with secondary containment. There have been no signs or reports of leakage from the tank, or any equipment stored on the property.

C. Automobile Salvage Yard on Hungry Hollow Road

An automobile salvage yard is located approximately 0.6 miles south of the north WHPA and 0.25 miles north of the south WHPA. There are no reported contamination sites located on the property containing the salvage yard. It is unknown if the salvage yard is currently active. There are also two inactive 250 gallon above ground storage tanks located on the subject property. Potential sources of contamination from the salvage yard include automobile fluids (oil, gasoline, diesel, transmission fluid, power steering fluid, antifreeze, etc.) as well as potential historical, unreported leakage from the above ground storage tanks. There are no known or reported releases on the subject property.

5.0 MANAGEMENT STRATEGIES

5.1. Abandoned Wells

There are no known abandoned wells located within the delineated WHPA.

As part of the Wellhead Protection Program for Powell Township, one of the most critical elements for this community is the identification and management of abandoned wells within the WHPA. Abandoned wells represent a potential threat to the drinking water supply of Powell Township, particularly if they are located near a potential contaminant source.

5.2. Abandoned Well Inventory – General Description

To complete the Abandoned Well Program, an abandoned well inventory was performed. Areas that currently have access to the Township municipal water supply and are located within or near the WHPA were the focus of the abandoned well inventory activities. Most of the activities were targeted towards the residential or commercial buildings with a water supply that was present prior to construction of the Township water system (i.e., initial construction and water main repairs and extensions). These properties are the most likely to have an abandoned well present.

Available Water Well and Pump Records were reviewed to determine which properties have had their abandoned wells properly plugged and which properties have a well record on file but are currently connected to the Village Water System or are located in the WHPA. Water Well and Pump Records within the WPHAs were reviewed.

The records review was followed by a windshield survey throughout the Township's water system limits to identify known or probably abandoned well locations. UPEA conducted this windshield survey with Peter TenEyck. Peter TenEyck is on the Township Water Department and on the Township's Wellhead Protection Team. Additionally, aerial photographs covering sections 16, 17, 20, and 21 were reviewed for abandoned homesteads or previously developed areas that may contain an abandoned well.

These abandoned well search activities resulted in the finding of no abandoned wells within the WHPAs at this time.

5.3. Results of Water Well and Pump Records Review

A search utilizing the MDEQ Wellogis Database and the MDEQ GeoWebFace Database was conducted to identify water wells located within the WHPAs. One private water well (Haupt, #52000003884) was identified utilizing the databases to be within the south WHPA. In addition, one private water well was identified in developing the initial WHPP and is not recorded in the MDEQ databases. Owner information, location, and well identification number of the water well in the WHPAs is listed below. Water Well and Pump Records for the well identified in the WHPAs is included in **Appendix D**.

<u>Owner</u>	<u>Location</u>	<u>Township</u>	<u>Well ID</u>
Abbott	T51N, R27W, Section 20	Powell	Not Available
Haupt	T51N, R27W, Section 22	Powell	52000003884

Additionally, longtime residents of the Powell Township area who are knowledgeable about the Powell Township area and are also on the Wellhead Protection Team did not have knowledge of any additional water wells located within the WHPAs other than the two drinking water wells identified above.

5.4. Properties with Active Wells Also Connected to the Township Water Supply

There are no known properties within the WHPAs that have private wells and are also connected to the Powell Township Water Supply.

5.5. Monitoring Wells

There are two known properties within the WHPAs containing four monitoring wells. All of the monitoring wells are located within both of the Powell Township Well Fields and are currently in use. There are no other known monitoring wells located within the delineated WHPAs. In summary, there are no known monitoring wells in the delineated WHPA that need to be sealed.

5.6. Abandoned Well Sealing Priorities

The greatest risk for Powell Township is the presence of unsealed abandoned wells near an existing or potential site of environmental contamination. There were no locations identified within the WHPAs that contained abandoned wells or potential contaminant sources.

5.7. Future Abandoned Well Activities

Managing abandoned wells with the WHPAs is an ongoing activity. The Township intends to continue to watch for abandoned wells in the WHPAs. If unsealed abandoned wells are identified in the future they will be added to a database of unsealed abandoned wells. Information regarding the exact location, well depth, diameter, and condition of the identified unsealed abandoned wells will be added to the database as the information becomes available. After an abandoned well is properly sealed, it will be deleted from the database.

There are two properties located within the WHPAs that have an active drinking well. Only one property is located near the area serviced by the municipal water supply system. If that residence does connect to the Township water system or the Township increases its water service area, the wells should be appropriately abandoned and plugged.

Powell Township is in the process of transferring the source of the drinking water supply from the north well field to the south well field. Once the transition is complete, wells in the north well field may be potential candidates for abandonment if Powell Township decides to no longer utilize the north wells or maintain them for contingency purposes.

5.8. Zoning

Section 401 Part P of Powell Township's Zoning Ordinance

Powell Township previously established a Wellhead Protection Zone in their zoning ordinance (Section 401(P)) which restricts activities within a one-thousand (1,000) foot radius of the township's PWSS wells. Powell Township, in addition to the Wellhead Protection Zone, also established two delineated Wellhead Protection Areas: the first as part of the Wellhead Protection Plan developed in 2003, and the second as part of this plan developed in 2018. This section of the ordinance limits zoning districts within the Wellhead Protection Zone to Residential, Rural Residential, and Timber Production Districts. In addition, above-ground liquid storage tanks (including home heating oil tanks and gasoline storage tanks) are required to have concrete secondary containment. A copy of this section of the zoning ordinance has been included in **Appendix E**.

5.9. Zoning Map

Powell Township, with the assistance of the Central Upper Peninsula Planning and Development (CUPPAD) Regional Commission, has a zoning map. This map was developed utilizing Geographical Information System (GIS) software and databases. The delineated WHPA will be added to the zoning map as soon as possible to reflect the new WHPA for the south well field. The update is expected to be completed by the end of 2018 and a copy of this updated zoning map and amended ordinance will be submitted to the MDEQ. A copy of the Zoning Map with a draft outline of the northern WHPA is included in **Appendix F** of this report. The Zoning Administrator is responsible for ensuring that the zoning map is updated in a timely manner.

5.10. Current Zoning Status – Wellhead Protection Area

Included as **Appendix F** is the current zoning map for Powell Township. As noted on the attached zoning map, properties within the WHPAs fall within the following zoning districts.

- Timber Production (TP-40)

- Rural Residential (RR-5)
- Town Development (TD)
- Wellhead Protection Zone

Included in **Appendix E** are the restrictions and schedule of regulations for these zoning districts.

5.11. WHPA information page on the Powell Township Website

As part of the Wellhead Protection Program for Powell Township, one of the most accessible ways to disseminate information to the community is through the creation of a WHPA information page on the township's website. The page will serve as a dynamic educational tool which encourages proper storage, handling, and use of hazardous materials, as well as good on-site wastewater disposal practices throughout the township. A map of the WHPAs and emergency information will be included on the page. The Powell Township homepage can be found at <http://www.powelltownship.org/>.

5.12. Windshield Survey – General Description

As part of the ongoing care and evaluation of the WHPAs a yearly windshield survey of the WHPAs and surrounding areas will be performed. The survey will be conducted by a Wellhead Protection Team Member and will observe and identify potential contamination sources on or around the WHPAs. Specifically, the survey will attempt to identify locations of potentially abandoned wells, areas of hazardous waste usage or storage, and unauthorized dumping sites on and around the WHPAs. Results of the survey will be reported to and discussed by the Wellhead Protection Team. Identified hazards will be remedied as seen fit by the team.

5.13. Implementation Table

Included below is an implementation table for new management strategies to be completed by the Wellhead Protection Team. The team will use the included table as a guide to implement new management strategies, and will be able to track completion of the items listed.

**POWELL TOWNSHIP WELLHEAD PROTECTION PLAN
WELLHEAD PROTECTION TEAM MANAGEMENT STRATEGIES IMPLEMENTATION TABLE**

MANAGEMENT STRATEGY	TARGET COMPLETION DATE	ACTUAL COMPLETION DATE
1. Create a WHPA information page on the Powell Township Website.		
a. Present groundwater concepts and wellhead protection to Powell Township website visitors through creation of a webpage. Encourage proper storage, handling and use of all hazardous materials and good on-site wastewater disposal practices throughout the township.	2018 grant year	
2. Conduct a windshield survey of the WHPA and surrounding area.		
b. A member of the wellhead protection team will annually observe as much of the WHPAs and surrounding areas as feasible. The team member will observe and identify any potential contamination sources.	Annually review WHPA for new potential sources.	
3. Overlay Zoning Ordinance		
a. Establish a Wellhead Protection Zone restricting activities within a 1,000 foot radius of the Township's PWSS wells.	2018 grant year	
b. Develop a Zoning Map and submit to MDEQ. Update the map as needed.	2018 grant year	

6.0 CONTINGENCY PLAN

A water supply emergency would be defined as either a chemical spill in the vicinity of one of the public water Supply wells or a mechanical / electrical plumbing failure that results in interruption of the water system operations.

In the event of a water supply emergency, the following personnel would be notified (in order of notification). All of these personnel are also on the Township's Wellhead Protection Team.

1. Daryl Wilcox, Powell Township Water System Operator
P.O. Box 141, Big Bay, Michigan 49808
(906) 458-1775
Representing: Powell Township Water Department
2. Peter K. TenEyck, Powell Township Custodian
P.O. Box 113, Big Bay, Michigan 49808
(906) 345-9345 Ext 13 360-9552
Representing: Powell Township Maintenance Department
3. Darlene Turner, Township Supervisor
P.O. Box 319, Big Bay, Michigan 49808
(906) 345-9345 Ext 14 345-9467
4. Eric Bradfish
Environmental Engineer, U.P. Engineers and Architects, Inc.
100 Portage Street, Houghton, Michigan 49931
(906) 482-4810 Ext 17

Required testing equipment would depend upon the nature of the water emergency. If a chemical spill were to occur, samples of the water would be collected directly from the impacted PWSS well and could be analyzed at an approved analytical laboratory for the chemicals of concern. The township has access to all of the sampling equipment and supplies necessary to collect a sample for laboratory analysis through U.P. Engineers and Architects, Inc.

For mechanical, electrical, and plumbing failures, the Township has their own equipment and several local contractors that it relies upon for regular maintenance or emergency repairs. These include:

Excavation:

Powell Township (Backhoe)

Plumbing:

Swailles Plumbing & Heating
120 Co Rd Sands Township (906) 249-5016

Electrical:

Code Electrical, Dan Audette, 1301 Division, Marquette, Michigan (906) 225-0325

Well Drilling:

Kleiman Pump & Well Drilling 1-800-672-7201

These contractors have all of the testing equipment necessary to diagnose potential problems and perform the necessary repairs. They are familiar with the operations of the Township public water supply system and are a valuable resource in the event of a water supply emergency.

Response protocol in the event of an emergency includes the following:

- Contact Daryl Wilcox, Water System Operator, via phone (906) 458-1775 or Pat DeWitt, Water System Operator, via phone (715) 817-5126
If no immediate contact is made contact Pete K. TenEyck, Powell Township Maintenance Custodian, via phone (906) 360-9552;
- If Daryl Wilcox, Pat DeWitt, and Pete TenEyck are not available, contact Darlene Turner, Township Supervisor, via phone (906) 345-9467;
- Contact the Michigan Department of Environmental Quality Water Division – Upper Peninsula District Office to inform them of the water supply emergency, via telephone (906) 228- 4853.
- In the event of a plumbing, electrical, or mechanical equipment failure, contact one of the above listed to schedule and emergency repair.
- In event of a chemical spill, contact Eric Bradfish, U.P. Engineers & Architects, Inc. (906) 482-4810 Ext 17
- Once the emergency has been diagnosed, immediately proceed with corrective measures;
- Prepare a public notice following completion of corrective measures and place notice of corrective measures at the Township Hall. Submit a copy of the notice to the Michigan Department of Environmental Quality – Drinking Water and Municipal Assistance Division.

If one of the water supply wells becomes contaminated, the system would rely solely upon the other PWSS wells on a temporary basis. Arrangements would be made with a water supply company for water to be trucked into the community as a backup source to the secondary wells. Culligan Water Conditioning of Iron Mountain, Michigan (906) 774-2700) is a local bulk water supply company. In the event there is no answer at the office, call Noah Saber (906) 399-7302.

Another alternative for a temporary water supply would be bottled water. However, this would be a last resort due to the inefficiency of supplying 114 services with bottled water. The local water supply companies that provide bottled water include:

- Culligan Upper Peninsula Bottled Water Service, Iron Mountain, Michigan (906) 774-2700
- Hancock Bottling Company, Inc Hancock, Michigan (906) 482-3701
- Jilbert Dairy, Inc. Marquette, Michigan (906) 225-1363
- Norway Springs, Norway, Michigan 800-928-3704

If treatment of the water supply were necessary, an emergency packaged water treatment plant would be evaluated. If it is determined that one of these systems is feasible, it would be installed on a long term temporary basis or permanent bases. Some of the potential water treatment systems include micro-filtration, reverse osmosis, air sparing, granular activated carbon, and others.

If necessary, a new production well would be considered to replace a contaminated water supply well. The township would likely install an additional deep well (i.e. greater than 100 feet deep) in order to obtain water from an uncontaminated ground water aquifer. Potential locations discussed at the Wellhead Protection Team meeting on May 25, 2017 include:

- Property located near the current Powell Township Well Field; within the 400 acres owned by Powell Township.
- Property where the north Powell Township Well Field is located
- Marquette County Road Commission property located west of old well field
- Property on which Powell Township Hall is currently located
- Property at Squaw Beach/Burns Landing
- Property on which the Township cemetery and ball field are currently located.

If a water supply emergency were experienced, the public would be notified through one or more of the following procedures:

- Notice provided in a monthly water bill to all water system users or as a separate mailing or door-to-door notification (if necessary);
- Public Notice at the Township Hall
- Notification in the local newspaper (The Mining Journal);
- Notification through a local radio station (WDMJ);
- Notification to the Marquette County Health Department;
- Notification to the Michigan Department of Environmental Quality – Drinking Water and Municipal Assistance Division.

7.0 NEW WELLS

A new well may be installed, either to address a water supply expansion, an increase in water demand, or susceptibility of an existing well to contamination. Any new wells that are constructed will be incorporated into the Wellhead Protection Program. Currently, two new wells were drilled and are in the process of being installed into the system and one additional well is scheduled to be drilled in 2018. The wells are located in Section 28 and have been incorporated into this Wellhead Protection Plan.

To incorporate new wells into the Wellhead Protection Program, the following steps would be followed:

1. A GPS position would be taken of the new well and the information noted on the updated WHPA map. The Wellhead Protection Area Map would be updated to include the new water supply well. A new 10-year time of travel model would be performed to determine the WHPA around the new well. The WHPA would be expanded to include a 10-year time of travel area that includes the new production well.
2. A contaminant source inventory would be conducted within the revised WHPA. Based on the results of the current contaminant source inventory, it is unlikely that any registered facilities (on either a state or federal database) would be found. All of the state and federal environmental databases that were reviewed as part of the current contaminant source inventory did not show any additional facilities (i.e., other than those already listed as potential contaminant sources) within the Big Bay area.

3. All abandoned wells within the new well's WHPA would be inventoried and included on a map of abandoned wells. The most efficient way to perform this inventory would be to contact the Water System Operator, and perform a windshield survey of the new well's WHPA.

8.0 PUBLIC EDUCATION AND PARTICIPATION

The following activities were completed as part of the original wellhead protection program and will be again for the updated program:

- Display the WHPA map at the Powell Township Hall in Big Bay;
- Display the educational brochure illustrating the delineated WHPA and pertinent aspects of the WHP Program development;

Included is the educational brochure that has been developed to educate the public in the Powell Township area regarding the delineated WHPA and important aspects of the WHP Program. Also included on this brochure are practical suggestions on how residents can help to protect their public water supply to prevent the groundwater from becoming contaminated.

The following public education and participation activities will be conducted on an on-going basis:

- Provide the public with wellhead protection program literature, available at the Powell Township Hall in Big Bay and on the Powell Township website.
- Summarize the findings of the wellhead protection program at one or more Township Council meetings each year.
- Conduct Wellhead Protection Team annual meetings along with team meetings on an as-needed basis.
- Display the WHPA map at the Township Hall in Big Bay, MI.
- Distribute information in monthly water bills or other appropriate methods, providing information on findings of current wellhead protection program activities and updating users in the future on any new activities happening as part of the wellhead protection program.
- Present wellhead protection program information at the Powell Township School as it fits in with teaching plans.

Information that will be presented to the public includes the educational brochure (**Appendix G**) and an educational document produced by the Michigan Department of Environmental Quality (**Appendix H**).

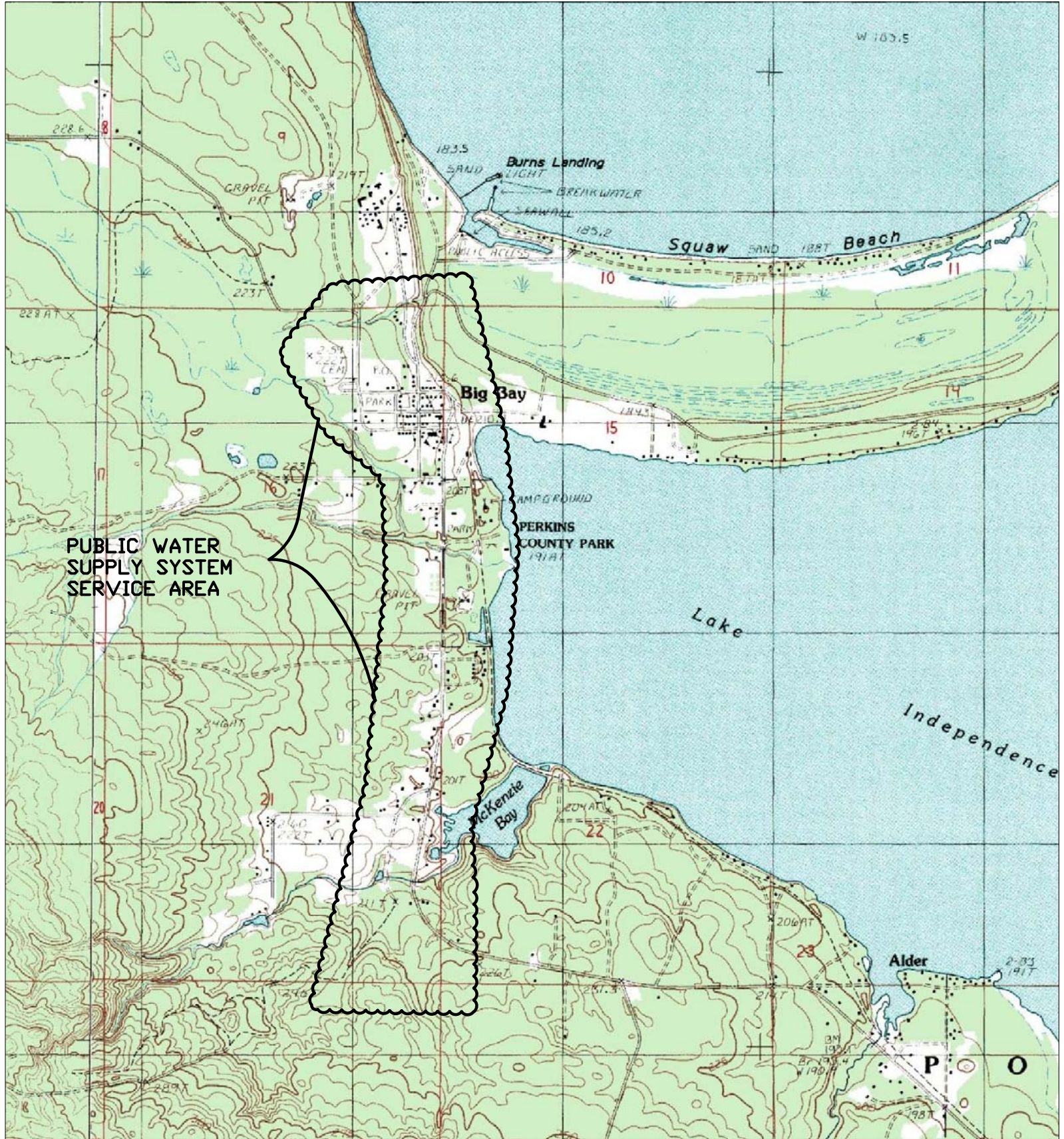



FIGURE 1
POWELL TOWNSHIP WATER SUPPLY
SYSTEM SERVICE AREA
POWELL TOWNSHIP, MICHIGAN

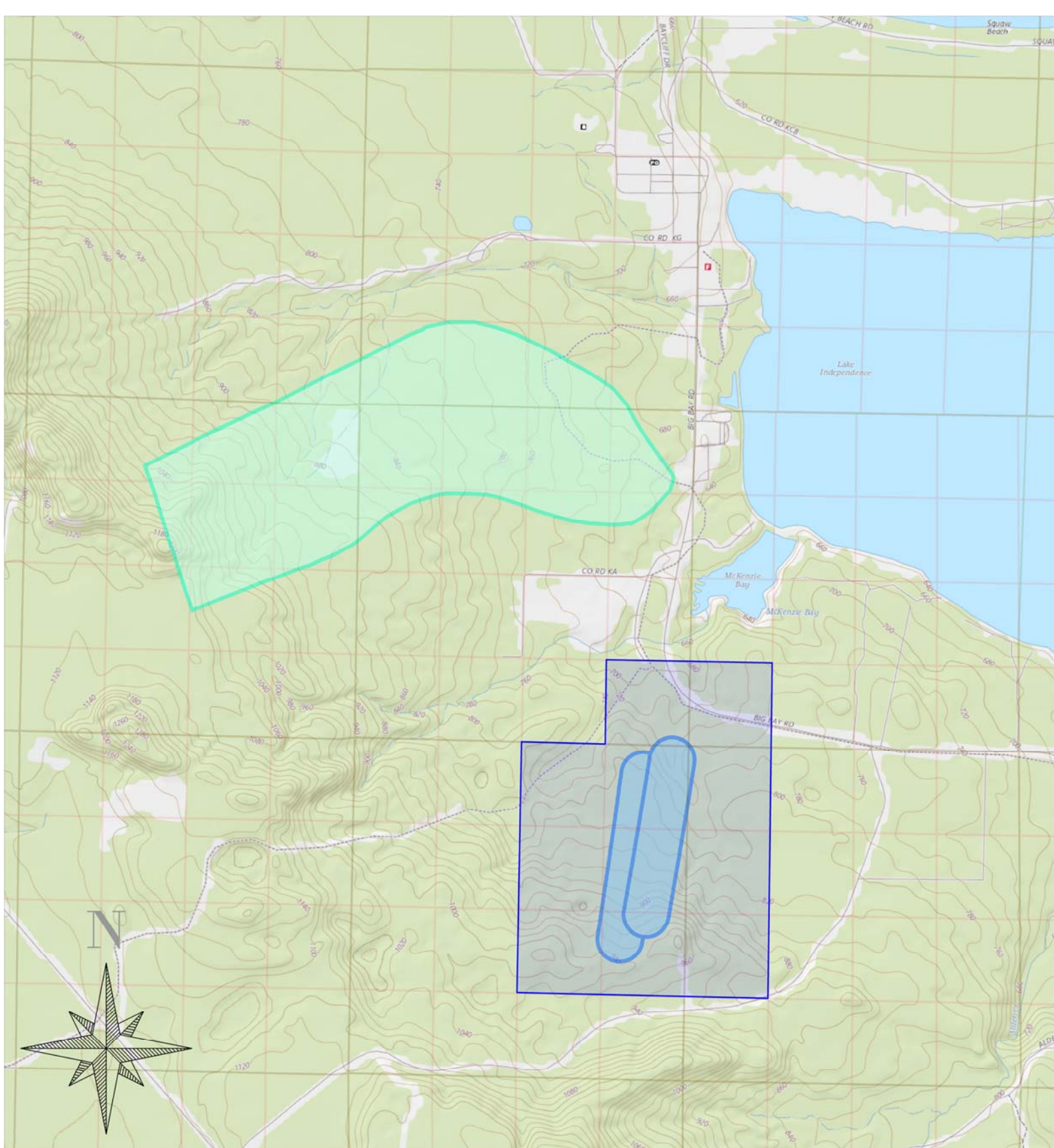


U.P.E.A.
ENGINEERS & ARCHITECTS




**U.P. ENGINEERS &
ARCHITECTS, INC.**

Houghton Iron Mountain Ishpeming Sault Ste. Marie Marinette

DRAWN: CJK	SCALE: 1" = 2,000'	DATE: 01/23/2018	DESIGNED: WFG	JOB No.: P05-17158
------------	--------------------	------------------	---------------	--------------------



LEGEND

-  10 YEAR TIME OF TRAVEL
-  SOUTHERN (NEW) WHPA
-  NORTHERN (OLD) WHPA

0 2,000 4,000
FEET

FIGURE 2
NORTHERN (OLD) AND SOUTHERN (NEW)
WELLHEAD PROTECTION AREAS
POWELL TOWNSHIP, MICHIGAN



**U.P. ENGINEERS &
ARCHITECTS, INC.**

Houghton Iron Mountain Ishpeming Sault Ste. Marie Marinette

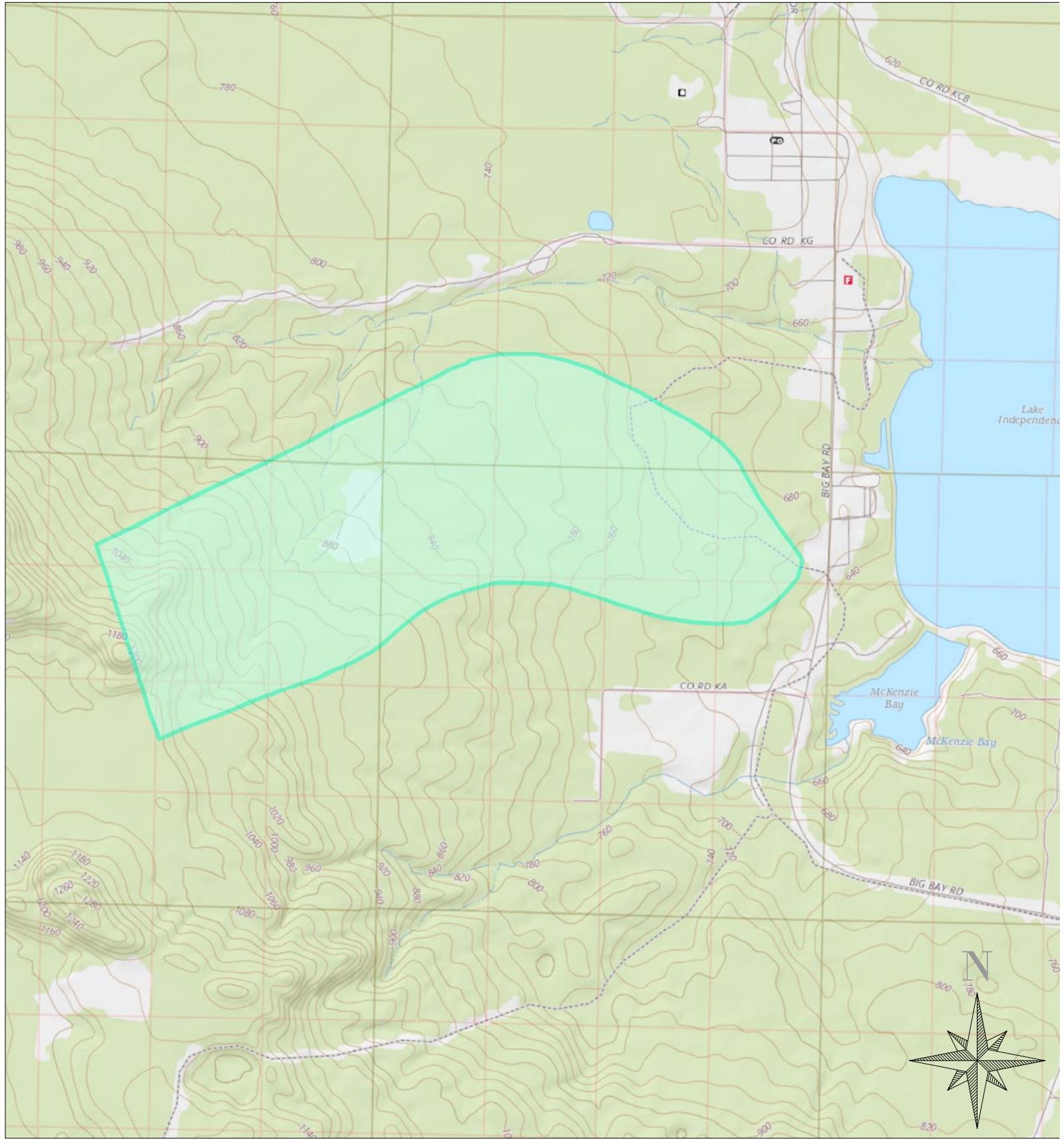
DRAWN: CJK

SCALE: 1" = 2,000'

DATE: 01/23/2018

DESIGNED: WFG


JOB No.: P05-17158

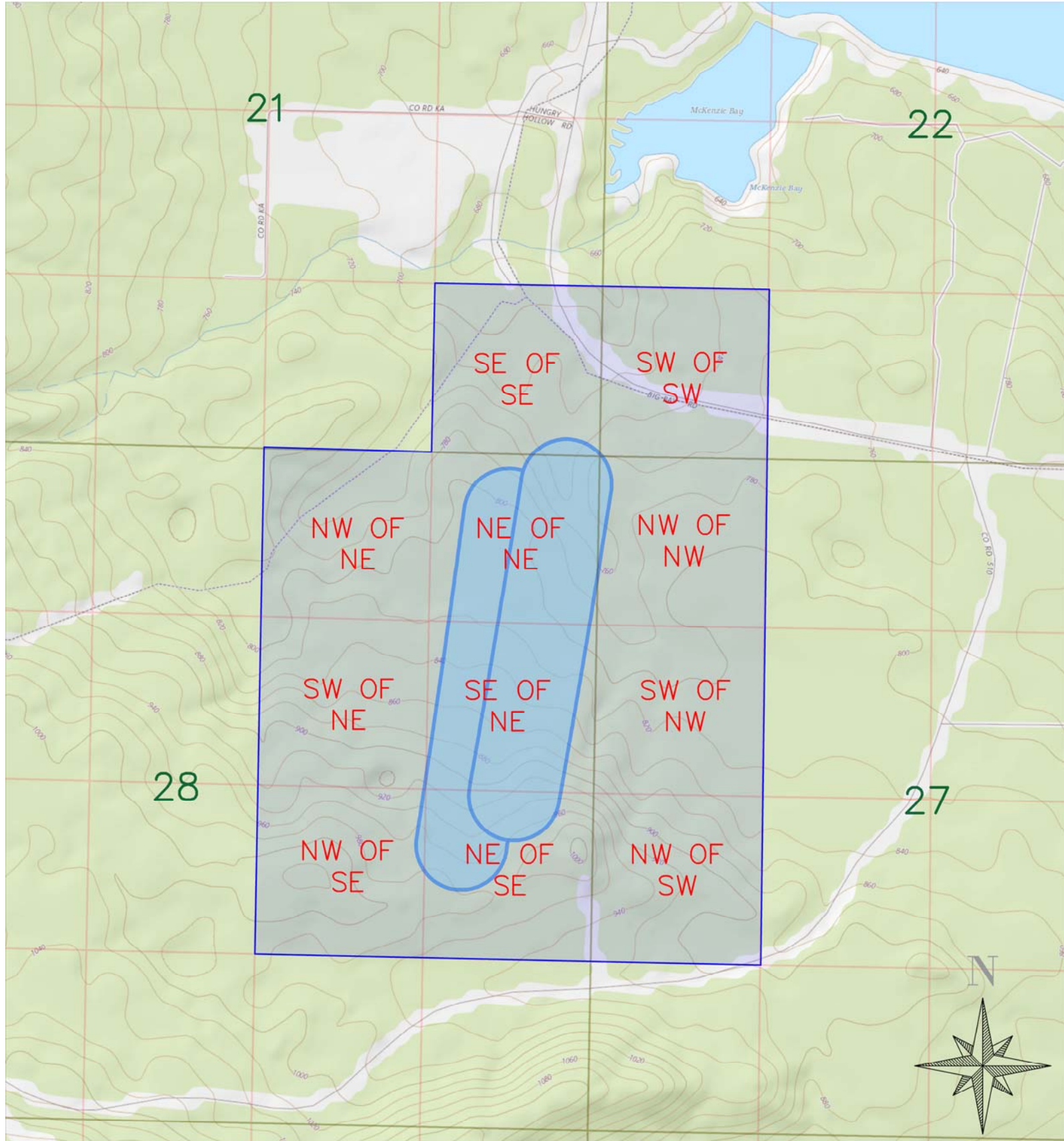


LEGEND

 NORTHERN (OLD) WHPA



<p>FIGURE 3 NORTHERN (OLD) WELL FIELD WHPA POWELL TOWNSHIP, MICHIGAN</p>				
		<p>U.P. ENGINEERS & ARCHITECTS, INC.</p>		
<p>Houghton Iron Mountain Ishpeming Sault Ste. Marie Marinette</p>				
<p>DRAWN: CJK</p>	<p>SCALE: 1" = 1,500'</p>	<p>DATE: 01/24/2018</p>	<p>DESIGNED: WFG</p>	<p>JOB No.: P05-17158</p>



LEGEND

 10 YEAR TIME OF TRAVEL

 SOUTHERN (NEW) WHPA

28 SECTION IDENTIFIER

SE OF SE QUARTER-QUARTER SECTION IDENTIFIER

0 1,000 2,000
FEET

FIGURE 4
SOUTHERN (NEW) WELL FIELD
TEN-YEAR TIME OF TRAVEL AND WHPA
POWELL TOWNSHIP, MICHIGAN



**U.P. ENGINEERS &
ARCHITECTS, INC.**

Houghton Iron Mountain Ishpeming Sault Ste. Marie Marinette

DRAWN: CJK

SCALE: 1" = 1,000'

DATE: 01/24/2018

DESIGNED: WFG

JOB No.: P05-17158

APPENDIX A

WATER WELL AND PUMP RECORDS – PUBLIC WATER SUPPLY SYSTEM WELLS, POWELL TOWNSHIP, MICHIGAN

DRILLING LOG

Owner Big Bay #1 Phone 7/11/83
 Address Coastal Hwy Test well

Drilling Record				Type of Formation Remarks
Day	Date	Time Start	Time Finish	
				0-50 - sandy clay
				50-55 - sandy clay
				55-60 - sandy clay
				60-75 - sandy clay

80-100 - clay, coarse

Water Data	
Gals/min	102-104
Recom. Pumping Depth	85 +
Recom. Pump Size	15-15 1/2" long
Bottom Well Diam.	6" screen
Screen Size	#15-15 1/2" long

Drilling Data	
Driller	
Helper	
OK'd by	

Station 43' from surface

HAKALA
 WELL & PUMP SERVICE
 Negaunee Michigan 49866



Courtesy of
 GEN SPACE CORPORATION

DRILLING LOG

Owner Big Bay #2 Phone 7/21/83
 Address Coastal Hwy Test well

Drilling Record				Type of Formation Remarks
Day	Date	Time Start	Time Finish	
				0-35 - sandy clay
				35-45 - gravel
				45-70 - sandy clay
				70-75 - clay, fine sand

75-85 - coarse #12-15"

Water Data	
Gals/min	85 +
Recom. Pumping Depth	
Recom. Pump Size	
Bottom Well Diam.	6" screen
Screen Size	#15-15 1/2" long

Drilling Data	
Driller	Yoon
Helper	
OK'd by	

Station 44'8" TOC

7/18/83

85-98 - coarse, dense clay
 98-107 - fine sandy clay



Courtesy of
 GEN SPACE CORPORATION



Water Well And Pump Record



Completion is required under authority of Part 127 Act 368 PA 1978.

Failure to comply is a misdemeanor.

Import ID: 52512721311

Tax No:	Permit No:	County: Marquette	Township: Powell
Well ID: 52000003873 Elevation: 757.02 ft. Latitude: 46.8054151 Longitude: -87.7308117 Method of Collection: GPS Std Positioning Svc SA Off		Town/Range: 51N 27W	Section: 21
		Well Status: Active	WSSN: 700
		Source ID/Well No: POWELL TWP WEL	
		Distance and Direction from Road Intersection: WSSN #00700	
		Well Owner: POWELL TOWNSHIP	
Well Address: POWELL TWP WELL #1 BIG BAY, MI 49808		Owner Address: P.O. Box 39 BIG BAY, MI 49808	

Drilling Method: Unknown Well Depth: 100.00 ft. Well Type: New Casing Type: Steel - black Casing Joint: Threaded & coupled Casing Fitting: Drive shoe Diameter: 6.00 in. to 89.50 ft. depth Borehole: 6.00 in. to 102.00 ft. depth		Pump Installed: No Pressure Tank Installed: No Pressure Relief Valve Installed: No																																														
Well Use: Type I public Date Completed: 7/18/1983 Height:																																																
Static Water Level: 43.00 ft. Below Grade Well Yield Test:		<table border="1"> <thead> <tr> <th>Formation Description</th> <th>Thickness</th> <th>Depth to Bottom</th> </tr> </thead> <tbody> <tr><td>Clay & Sand</td><td>50.00</td><td>50.00</td></tr> <tr><td>Clay Gravel Sand</td><td>5.00</td><td>55.00</td></tr> <tr><td>Sand</td><td>5.00</td><td>60.00</td></tr> <tr><td>Sand Coarse</td><td>20.00</td><td>80.00</td></tr> <tr><td>Lithology Unknown Coarse</td><td>22.00</td><td>102.00</td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </tbody> </table>		Formation Description	Thickness	Depth to Bottom	Clay & Sand	50.00	50.00	Clay Gravel Sand	5.00	55.00	Sand	5.00	60.00	Sand Coarse	20.00	80.00	Lithology Unknown Coarse	22.00	102.00																											
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Lithology Unknown Coarse	22.00	102.00																																														
Screen Installed: Yes Screen Diameter: 6.00 in. Screen Material Type: Unknown Slot Length Set Between 15.00 15.00 ft. 85.00 ft. and 100.00 ft. Fittings: Unknown		Filter Packed: No Blank: 0.00 ft.																																														
Well Grouted: No		Geology Remarks:																																														
Wellhead Completion: Unknown																																																
Nearest Source of Possible Contamination: <table border="1"> <thead> <tr> <th>Type</th> <th>Distance</th> <th>Direction</th> </tr> </thead> <tbody> <tr> <td>Unknown</td> <td>0 ft.</td> <td></td> </tr> </tbody> </table>		Type	Distance	Direction	Unknown	0 ft.		Drilling Machine Operator Name: Employment: Unknown Contractor Type: Unknown Reg No: Business Name: Business Address:																																								
Type	Distance	Direction																																														
Unknown	0 ft.																																															
		Water Well Contractor's Certification This well was drilled under my supervision and this report is true to the best of my knowledge and belief. Signature of Registered Contractor Date																																														
General Remarks:																																																
Other Remarks:																																																



Water Well And Pump Record



Completion is required under authority of Part 127 Act 368 PA 1978.

Failure to comply is a misdemeanor.

Import ID: 52512721312

Tax No:	Permit No:	County: Marquette	Township: Powell			
Well ID: 52000003874 Elevation: 656.65 ft. Latitude: 46.805453 Longitude: -87.7311354 Method of Collection: GPS Std Positioning Svc SA Off		Town/Range: 51N 27W	Section: 21	Well Status: Active	WSSN: 700	Source ID/Well No: POWELL TWP WEL
		Distance and Direction from Road Intersection: WSSN #00700;				
		Well Owner: POWELL TOWNSHIP				
		Well Address: POWELL TWP WELL #2 BIG BAY, MI 49808		Owner Address: P.O. Box 39 BIG BAY, MI 49808		

Drilling Method: Unknown Well Depth: 95.00 ft. Well Type: New Casing Type: Steel - black Casing Joint: Threaded & coupled Casing Fitting: Drive shoe Diameter: 6.00 in. to 83.00 ft. depth Borehole: 6.00 in. to 107.00 ft. depth	Well Use: Type I public Date Completed: 7/21/1983 Height: Pump Installed: No Pressure Tank Installed: No Pressure Relief Valve Installed: No
Static Water Level: 44.75 ft. Below Grade Well Yield Test:	Yield Test Method: Unknown
Screen Installed: Yes Screen Diameter: 6.00 in. Screen Material Type: Unknown Slot Length Set Between 15.00 15.00 ft. 82.00 ft. and 95.00 ft. Fittings: Unknown	Filter Packed: No Blank: 0.00 ft.
Well Grouted: No	
Wellhead Completion: Unknown	
Nearest Source of Possible Contamination: Type Distance Direction Unknown 0 ft.	
	Drilling Machine Operator Name: Employment: Unknown
	Contractor Type: Unknown Reg No:
	Business Name: Business Address:
	Water Well Contractor's Certification This well was drilled under my supervision and this report is true to the best of my knowledge and belief.
	Signature of Registered Contractor Date
General Remarks:	
Other Remarks:	



Water Well And Pump Record

Completion is required under authority of Part 127 Act 368 PA 1978.



Import ID:

Failure to comply is a misdemeanor.

Tax No:	Permit No:	County: Marquette	Township: Powell			
Well ID: 52000006675 Elevation: Latitude: 46.79347 Longitude: -87.72947 Method of Collection: GPS Std Positioning Svc SA Off		Town/Range: 51N 27W	Section: 28	Well Status: Inactive	WSSN: 700	Source ID/Well No: TEST WELL 3
		Distance and Direction from Road Intersection:				
		Well Owner: POWELL TOWNSHIP				
		Well Address: MI		Owner Address: P.O. BOX 39 BIG BAY, MI 49808		

Drilling Method: Rotary Well Depth: 221.00 ft. Well Type: New Casing Type: Steel - black Casing Joint: Welded Casing Fitting: Diameter: 10.00 in. to 166.00 ft. depth Borehole: 14.50 in. to 166.00 ft. depth 10.00 in. to 221.00 ft. depth		Pump Installed: No Pressure Tank Installed: No Pressure Relief Valve Installed: No																																											
Well Use: Test well Date Completed: 10/28/2010 Height: 2.00 ft. above grade Static Water Level: 60.00 ft. Below Grade Well Yield Test: Yield Test Method: Unknown		<table border="1"> <thead> <tr> <th>Formation Description</th> <th>Thickness</th> <th>Depth to Bottom</th> </tr> </thead> <tbody> <tr><td>Sand & Silt Very Fine</td><td>20.00</td><td>20.00</td></tr> <tr><td>Sand Fine</td><td>15.00</td><td>35.00</td></tr> <tr><td>Sand & Gravel</td><td>10.00</td><td>45.00</td></tr> <tr><td>Sand Fine</td><td>20.00</td><td>65.00</td></tr> <tr><td>Sand & Gravel Clayey</td><td>25.00</td><td>90.00</td></tr> <tr><td>Sand Fine</td><td>20.00</td><td>110.00</td></tr> <tr><td>Sand & Gravel Coarse</td><td>8.00</td><td>118.00</td></tr> <tr><td>Gravel & Cobbles</td><td>4.00</td><td>122.00</td></tr> <tr><td>Sand & Silt Fine</td><td>16.00</td><td>138.00</td></tr> <tr><td>Sand Fine</td><td>83.00</td><td>221.00</td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>		Formation Description	Thickness	Depth to Bottom	Sand & Silt Very Fine	20.00	20.00	Sand Fine	15.00	35.00	Sand & Gravel	10.00	45.00	Sand Fine	20.00	65.00	Sand & Gravel Clayey	25.00	90.00	Sand Fine	20.00	110.00	Sand & Gravel Coarse	8.00	118.00	Gravel & Cobbles	4.00	122.00	Sand & Silt Fine	16.00	138.00	Sand Fine	83.00	221.00									
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Gravel & Cobbles	4.00	122.00																																											
Sand & Silt Fine	16.00	138.00																																											
Sand Fine	83.00	221.00																																											
Screen Installed: Yes Screen Diameter: 10.00 in. Screen Material Type: Stainless steel-slotted Slot Length Set Between: 10.00 55.00 ft. 166.00 ft. and 221.00 ft. Fittings: Neoprene packer		Filter Packed: No Blank: Well Grouted: Yes Grouting Method: Grout pipe outside casing Grouting Material: Neat cement Bags: 88.00 Additives: None Depth: 0.00 ft. to 166.00 ft.																																											
Wellhead Completion: 12 inches above grade		Geology Remarks:																																											
Nearest Source of Possible Contamination: Type: Unknown Distance: Direction:		Drilling Machine Operator Name: DEAN NEUENS Employment: Employee Contractor Type: Water Well Drilling Contractor Reg No: 22-2431 Business Name: KLEIMAN PUMP & WELL DRILLING Business Address: P.O. BOX 704, IRON MOUNTAIN, MI, 49801																																											
		Water Well Contractor's Certification This well/pump was constructed under my supervision and I hereby certify that the work complies with Part 127 Act 368 PA 1978 and the well code. Signature of Registered Contractor Date																																											
General Remarks: TW-3 TEST PRODUCTION WELL, SCREEN DEVELOPED FOR 27 HOURS																																													
Other Remarks:																																													

APPENDIX B

WELLHEAD PROTECTION PROGRAM TEAM PARTICIPATION AGREEMENTS



Wellhead Protection Team
Participation Agreement

I agree to actively participate as part of the team in developing and implementing the Wellhead Protection Program for the

Powell Township

Water Supply. I agree to attend the minimum required quarterly meetings during the contract period October 1, 2017 to September 30, 2018.

Signature: Paul Beauchaine Date: 02-06-18

PLEASE, ORIGINAL SIGNATURES ONLY. NO PHOTOCOPIES ACCEPTED.

Name: PAUL BEAUCHAINE

Title: CHAIR - PLANNING COMMISSION

Representing: PLANNING COMMISSION

Address: _____

Phone #: _____





Wellhead Protection Team
Participation Agreement

I agree to actively participate as part of the team in developing and implementing the Wellhead Protection Program for the

Powell Township

Water Supply. I agree to attend the minimum required quarterly meetings during the contract period October 1, 2017 to September 30, 2018.

Signature: _____

Date: 1/29/17

PLEASE, ORIGINAL SIGNATURES ONLY. NO PHOTOCOPIES ACCEPTED.

Name: _____

Holly Dewitt

Title: _____

Representing: _____

Powell Township School

Address: _____

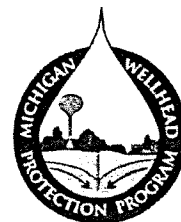
PO Box 260

Big Bay MI

49808

Phone #: _____

715-817-5127



Wellhead Protection Team
Participation Agreement

I agree to actively participate as part of the team in developing and implementing the Wellhead Protection Program for the

Powell Township

Water Supply. I agree to attend the minimum required quarterly meetings during the contract period October 1, 2017 to September 30, 2018.

Signature: Peter Teneyck Date: 1/29/2018

PLEASE, ORIGINAL SIGNATURES ONLY. NO PHOTOCOPIES ACCEPTED.

Name: PETER TENEYCK
Title: MAINTENANCE DEPT
Representing: POWELL TOWNSHIP GOV
Address: P.O. BOX 113
Big Bay MI 49808

Phone #: 906-360-9552



Wellhead Protection Team
Participation Agreement

I agree to actively participate as part of the team in developing and implementing the Wellhead Protection Program for the

Powell Township

Water Supply. I agree to attend the minimum required quarterly meetings during the contract period October 1, 2017 to September 30, 2018.

Signature: Michael Thomas Date: 11-30-17

PLEASE, ORIGINAL SIGNATURES ONLY. NO PHOTOCOPIES ACCEPTED.

Name: Mike Thoma

Title: Fire Chief

Representing: Powell Township

Address: _____

Phone #: 906 345-9400



Wellhead Protection Team
Participation Agreement

I agree to actively participate as part of the team in developing and implementing the Wellhead Protection Program for the

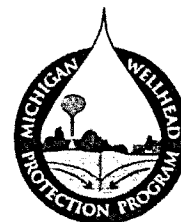
Powell Township

Water Supply. I agree to attend the minimum required quarterly meetings during the contract period October 1, 2017 to September 30, 2018.

Signature: Darlene Turner Date: 11-30-17

PLEASE, ORIGINAL SIGNATURES ONLY. NO PHOTOCOPIES ACCEPTED.

Name: DARLENE TURNER
Title: SUPERVISOR
Representing: POWELL TOWNSHIP
Address: 101 BESSINGER
PO BOX 319
BIG BAY MI 49808
Phone #: 906-345-9345 Ext 14



Wellhead Protection Team
Participation Agreement

I agree to actively participate as part of the team in developing and implementing the Wellhead Protection Program for the

Powell Township

Water Supply. I agree to attend the minimum required quarterly meetings during the contract period October 1, 2017 to September 30, 2018.

Signature: Daryl Wilcox Date: 11/30/17

PLEASE, ORIGINAL SIGNATURES ONLY. NO PHOTOCOPIES ACCEPTED.

Name: Daryl Wilcox

Title: Water Operator

Representing: Powell Township

Address: PO Box 319

Big Bay, MI 49808

Phone #: (906) 458-1775



Wellhead Protection Team
Participation Agreement

I agree to actively participate as part of the team in developing and implementing the Wellhead Protection Program for the

Powell Township

Water Supply. I agree to attend the minimum required quarterly meetings during the contract period October 1, 2017 to September 30, 2018.

Signature:  Date: 11/30/17

PLEASE, ORIGINAL SIGNATURES ONLY. NO PHOTOCOPIES ACCEPTED.

Name: Samantha Morin

Title: Deputy Clerk / Utility Billing Clerk

Representing: Powell Township

Address: _____

Phone #: 906-370-2190



Wellhead Protection Team

Participation Agreement

I agree to actively participate as part of the team in developing and implementing the Wellhead Protection Program for the

Powell Township

Water Supply. I agree to attend the minimum required quarterly meetings during the contract period October 1, 2017 to September 30, 2018.

Signature: _____

Date: _____

PLEASE, ORIGINAL SIGNATURES ONLY. NO PHOTOCOPIES ACCEPTED.

Name: _____

Title: _____

Representing: _____

Address: _____

Phone #: _____

APPENDIX C

ENVIRONMENTAL DATABASE REVIEW, COMPLETED DECEMBER 28, 2017

CONTENTS

Superfund Site Search Results.....	1
Acitve.....	1
Archived.....	2
EPA Facility Database Search Map.....	3
MDEQ Facility Database Search Map.....	4
MDEQ Inventory of Facilities: Big Bay/Powell.....	8
Waste Data System Search Results: Big Bay.....	9

Superfund Site Search Results

Disclaimer:

The CERCLIS Public Access Database, which contained a selected set of publicly releasable Superfund program data, has been retired. The EPA is transitioning to the Superfund Enterprise Management System, or SEMS. SEMS includes the same data and content as CERCLIS. As SEMS is made operational, nightly data refresh routines will be reestablished. This webpage will be updated to reflect the status of data updates.

Search Results

Search Criteria:

Active vs. Archived:

Active What are active and archived sites?

County:

MARQUETTE

State(s):

Michigan

Found **5** site(s) that match your search criteria listed above.

To conduct another search, return to the [Search Superfund Site Information](#) page.

[Save results in Excel format](#)

**No Active SEMS sites
within 1 mile of
Wellhead Protection
Areas.**

Displaying sites 1 through 5

EPA ID	Site Name	City	County	ST	Non-NPL Status	Non-NPL Status Date	NPL Status
MID980608970	CLIFF/DOW DUMP	MARQUETTE	MARQUETTE	MI	[Blank Code]	[Blank Date]	Deleted NPL
MIN000510488	HUMBOLDT MILL HISTORIC ORE PROCESSING FACILITY	CHAMPION	MARQUETTE	MI	OS	02/26/2015	Not NPL
MIN000508651	PELLESTAR	NEQAUNEE TOWNSHIP	MARQUETTE	MI	RR	09/04/2009	Not NPL
MI0571924760	US AIR FORCE K I SAWYER AFB	GWINN	MARQUETTE	MI	OF	04/06/2004	Not NPL
MIN000510857	USCG OLD STATION MARQUETTE	MARQUETTE	MARQUETTE	MI	NF	03/16/2016	Not NPL

Displaying sites 1 through 5



Superfund Site Search Results

Disclaimer:

The CERCLIS Public Access Database, which contained a selected set of publicly releasable Superfund program data, has been retired. The EPA is transitioning to the Superfund Enterprise Management System, or SEMS. SEMS includes the same data and content as CERCLIS. As SEMS is made operational, nightly data refresh routines will be reestablished. This webpage will be updated to reflect the status of data updates.

Search Results

Search Criteria:

Active vs. Archived:

Archived *What are active and archived sites?*

City:

BIG BAY

Found **1** site(s) that match your search criteria listed above.

To conduct another search, return to the [Search Superfund Site Information](#) page.

Save results in Excel format

Displaying sites 1 through 1

EPA ID	Site Name	City	County	ST	Non-NPL Status	Non-NPL Status Date	NPL Status
MID980993398	<u>POWELL TWP LDFL</u>	BIG BAY	MARQUETTE	MI	NF	02/07/1990	Not NPL

Displaying sites 1 through 1

**ONE Archived SEMS site within 1 mile of
OLD Wellhead Protection Area.**

DECEMBER 20, 2017



Envirofacts Search Results

Search Results for:
Map Recentered

ONE RCRA site within 1 mile of OLD Wellhead Protection Area.



Envirofacts Links

- [EF Overview](#)
- [Search](#)
- [Model](#)
- [Data Update](#)
- [Multisystem Search User Guide](#)
- [Contact Us](#)

[Report an Error](#)

The facility list below is based upon the facilities that are visible with the map above. To refine your search to a more targeted area of interest, please visit the [Envirofacts Multisystem Search Form](#). To search Envirofacts via an interactive map, please view your results in [EnviroMapper for Envirofacts](#).

List of EPA-Regulated Facilities in Envirofacts

[Copy](#) [CSV](#) [Excel](#) [PDF](#) [Print](#)

Showing 1 to 1 of 1 entries

Show 10 entries

Search:

[First](#) [Previous](#) [Next](#) [Last](#)

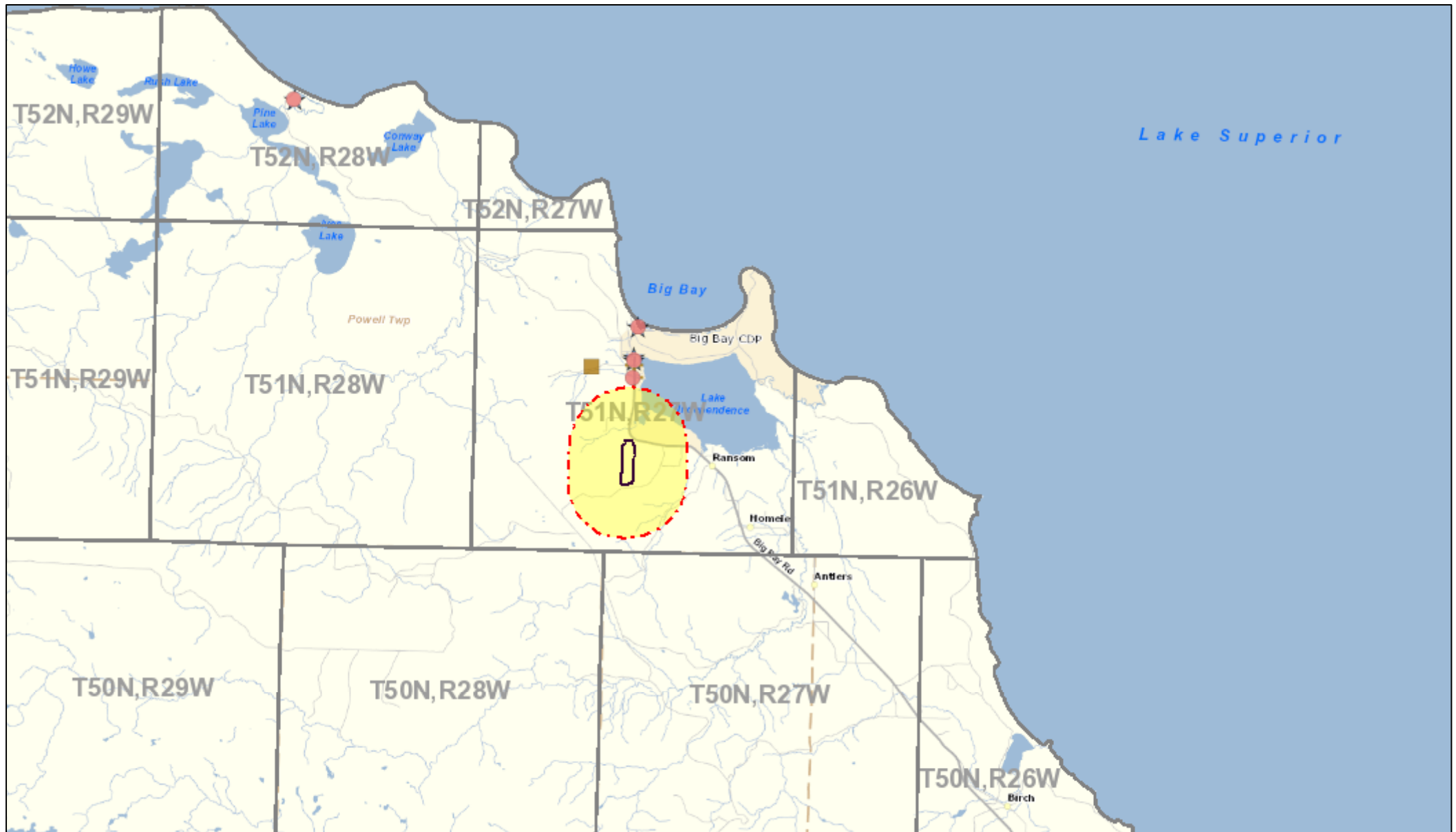
FACILITY INFORMATION	AFS ⓘ	ACRES ⓘ	BR ⓘ	SEMS ⓘ	GHG ⓘ	PCS/ICIS ⓘ	RADInfo ⓘ	RCRAInfo ⓘ	TRI ⓘ	TSCA ⓘ	
TOWNSHIP OF POWELL SCHOOLS 101 DEUTSCH AVE							View Report				
FACILITY INFORMATION					AFS ⓘ	ACRES ⓘ	BR ⓘ	SEMS ⓘ	GHG ⓘ	PCS/ICIS ⓘ	RAD ⓘ
Longitude: -87.72836											
Summary Report											
Facility Report											
Compliance Report											

Showing 1 to 1 of 1 entries

Show 10 entries

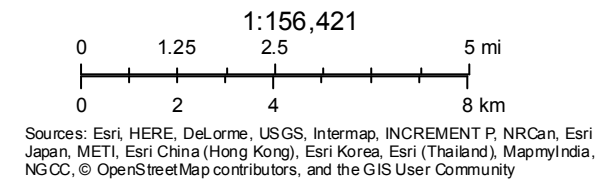
Search:

Environmental Mapper

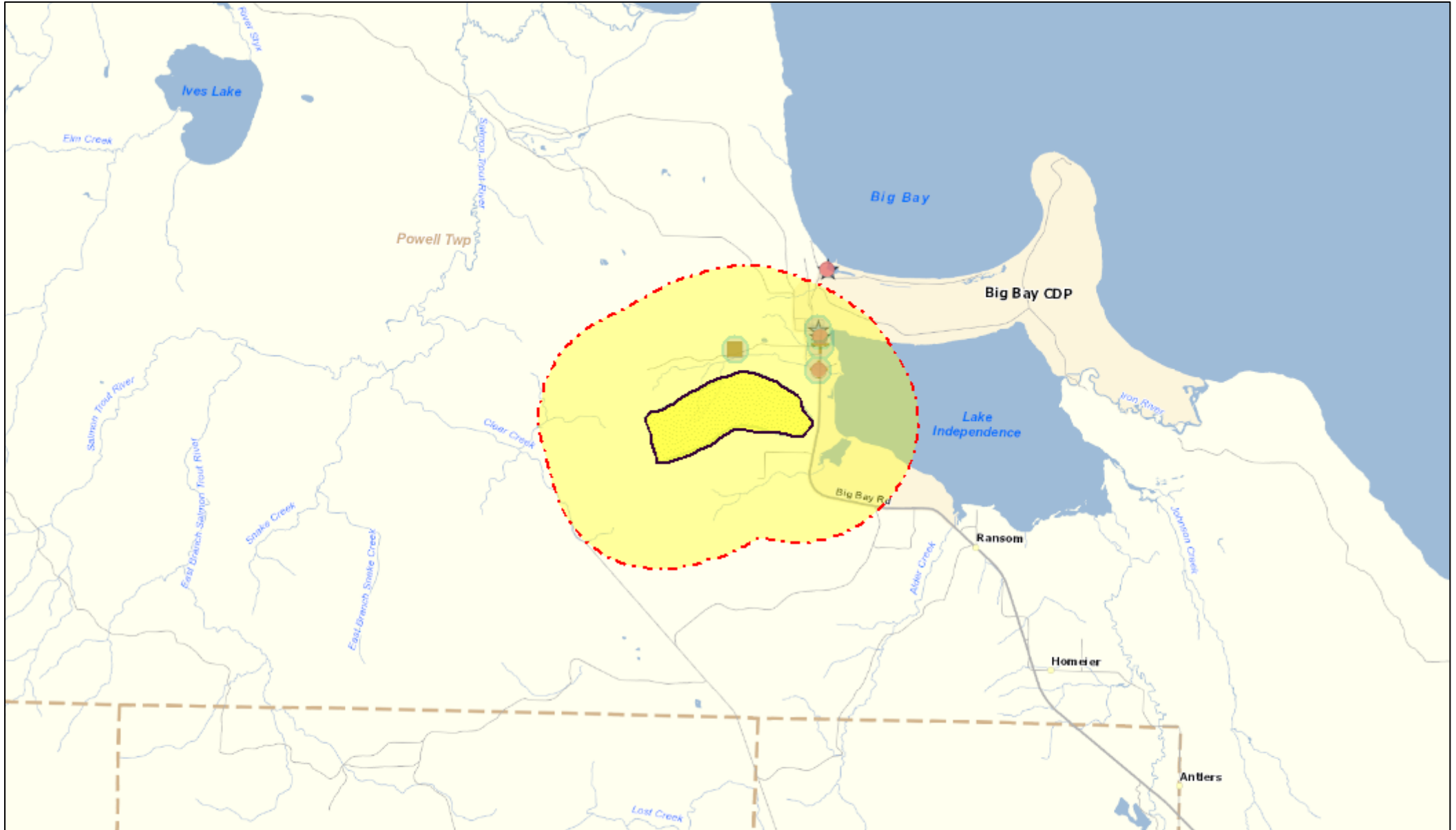


December 21, 2017

No Part 201, 211, 213; BEA; Brownfield; Land Use Restriction sites registered with MDEQ within 1 mile of NEW Wellhead Protection Area.

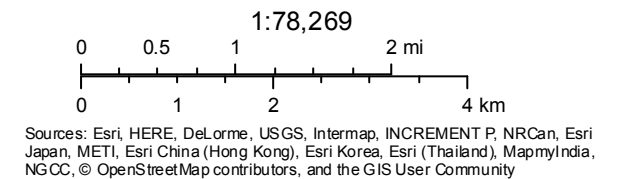


Environmental Mapper



January 23, 2018

ONE Part 201, TWO Part 213, FOUR Part 211 sites located within 1 mile of OLD WHPA. NO BEA sites within 1 mile of OLD WHPA.



Storage Tank Facilities

Facility ID	Facility Name	Address	City	Zip Code	County	District	Latitude	Longitude	Method of Collection	Date of Collection	Accuracy Value	Accuracy Value Unit	Source	Horizontal Datum	Description Category	Point Line Area
00002055	Giannunzio Oil	98 Bensinger	Big Bay	49808	Marquette	Upper Peninsula	46.812477	-87.728903	GPS Code Meas. Standard Positioning Service SA Off	2003-10-21 00:00:00	10	METERS	State of MI	NAD83	Plant Entrance (Freight)	POINT
00010231	Big Bay District Garage	COUNTY ROAD 550	BIG BAY	49808	Marquette	Upper Peninsula	46.81709	-87.728615	GPS Code Meas. Standard Positioning Service SA Off	2004-06-10 00:00:00	100	FEET	State of MI	NAD83	Plant Entrance (Freight)	POINT
00002055	Giannunzio Oil	98 Bensinger	Big Bay	49808	Marquette	Upper Peninsula	46.812477	-87.728903	GPS Code Meas. Standard Positioning Service SA Off	2003-10-21 00:00:00	10	METERS	State of MI	NAD83	Plant Entrance (Freight)	POINT
00036970	Big Bay Outpost and Deli Inc	300 Bensinger	Big Bay	49808	Marquette	Upper Peninsula	46.81584	-87.728635	GPS Code Meas. Standard Positioning Service SA Off	2004-06-10 00:00:00	100	FEET	State of MI	NAD83	Plant Entrance (Freight)	POINT

00010231	Big Bay District Garage	COUNTY ROAD 550	BIG BAY	49808	Marquette	Upper Peninsula	46.81709	-87.728615	GPS Code Meas. Standard Positioning Service SA Off	2004-06-10 00:00:00	100	FEET	State of MI	NAD83	Plant Entrance (Freight)	POINT
----------	-------------------------	-----------------	---------	-------	-----------	-----------------	----------	------------	--	---------------------	-----	------	-------------	-------	--------------------------	-------

Show rows:

Results: 1 – 5 of 6



Open Part 201 Site

Site ID	Site Name	Address	City	Zip Code	County	Source	Pollutants	Latitude	Longitude	Horizontal Collection Method	Horizontal Reference Datum	Horizontal Accuracy in Meters	Reference Point	Source Map Scale
52000020	Powell Twp LF	POWELL TWP HALL	Big Bay	49808	Marquette	Refuse Systems	Domestic comm	46.815037	-87.745422	The geographic coordinate determination method based on interpolation-map.	North American Datum of 1983	15	Center of a facility or station.	24,000

Show rows: ▼

Results: 1 – 1 of 1





Department of Environmental Quality

Inventory of Facilities Search Results

District	Facility ID	BEA Number	Facility Name	Address	County	Township	City	Zip	Latitude	Longitude	Data Source
Upper Peninsula	00010231		Big Bay District Garage	COUNTY ROAD 550	Marquette		BIG BAY	49808	46.81709	-87.72862	Part 213
Upper Peninsula	00005272		Big Bay Harbor	COUNTY ROAD KF	Marquette		BIG BAY	49808	46.82611	-87.72746	Part 213
Upper Peninsula		199800073UP	Big Bay IGA	100 Besinger Road	Marquette	Big Bay					BEA
Upper Peninsula	00002055		Giannunzio Oil	98 Bensinger	Marquette		Big Bay	49808	46.81248	-87.72890	Part 213
Upper Peninsula	00016257		Huron Mountain Club	COUNTY ROAD KK	Marquette		BIG BAY	49808	46.88552	-87.86494	Part 213
Upper Peninsula		200500331UP	Lot #4	Bensinger Street (County Road 550)	Marquette	Big Bay		49808			BEA
Upper Peninsula	52000020		Powell Twp LF	POWELL TWP HALL	Marquette	temptownship	Big Bay	49808	46.81504	-87.74542	Part 201
Upper Peninsula		201400575UP	Property	Peep O Day Road	Marquette	Big Bay		49808			BEA

ONE Part 201, TWO Part 213, FOUR Part 211 sites located within 1 mile of OLD WHPA. NO BEA sites within 1 mile of OLD WHPA.

NO Part 201, Part 213, Part 211, or BEA sites within 1 mile of NEW WHPA.

Advanced Search

 ▼ ▼

Clear

Run Query

Search Criteria**Search Results**

Results Summary: Results count = 14 Matching Sites(s)

Criteria Summary: Search Site ID History = No; Search WDS ID History = No; City = big bay; Search Address History = No;

Display Options:

Site Name Options...



Show Site Legal Name



Show Site Specific Name

 ▼☐ Address☐ City☐ State☐ Zip☐ County☐ Contact Name☐ Contact Phone☐ Contact Email

Export List to CSV (Excel)

Site ID	WDS ID	Site Legal Name
MID985623578	406168	TOWNSHIP OF POWELL SCHOOLS
MIR000016956	410911	US DEPT/HOMELAND SECURITY
MIR000016964	410912	US DEPT/HOMELAND SECURITY
MIR000041103	413260	BIG BAY HARBOR OF REFUGE
MIG000039871	443452	PENINSULAR SANITATION
	465515	POWELL TOWNSHIP TRANSFER STATION
	466381	TOWNSHIP OF POWELL
	472533	BAY CLIFF HEALTH CAMP
	472538	CRAM'S GENERAL STORE - LAUNDROMAT
	472539	TOWNSHIP OF POWELL
	476877	BIG BAY 550 SNOWMOBILE CLUB

477135	TOWNSHIP OF POWELL
477141	LIGHTHOUSE THREE INC
MIK939585485	480892 LIGHTHOUSE THREE INC

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Version 1.2.0.4075-P

No WDS sites within 1 mile of the Wellhead Protection Areas.

APPENDIX D

WATER WELL AND PUMP RECORDS –PRIVATE WATER WELLS WITHIN WELLHEAD PROTECTION AREA

Water Well And Pump Record

Completion is required under authority of Part 127 Act 368 PA 1978.



Import ID: 52512722010

Failure to comply is a misdemeanor.

Tax No: 1117201800		Permit No:		County: Marquette		Township: Powell	
<div style="font-size: 2em; font-weight: bold; margin-bottom: 10px;">Well ID: 52000003884</div> <div> Elevation: 728.35 ft. Latitude: 46.7955136662 Longitude: -87.7275081463 Method of Collection: Interpolation-Map </div>				Town/Range: 51N 27W	Section: 22	Well Status:	WSSN:
				Source ID/Well No:			
				Distance and Direction from Road Intersection:			
Well Owner: MICHAEL HAUPT							
Well Address: CO RD 550 CITY, MI 48901						Owner Address: 230 W. ARCH ST. MARQUETTE, MI 49855	

Drilling Method: Rotary Well Depth: 103.00 ft. Well Type: New	Well Use: Household Date Completed:	Pump Installed: No Pressure Tank Installed: No Pressure Relief Valve Installed: No
Casing Type: Steel - black Casing Joint: Welded Casing Fitting: Drive shoe Diameter: 5.00 in. to 100.00 ft. depth Borehole:	Height:	

Static Water Level: 75.00 ft. Below Grade Well Yield Test: Pumping level 95.00 ft. after 1.00 hrs. at 12 GPM	Yield Test Method: Unknown		Formation Description	Thickness	Depth to Bottom
			Sand Fine	60.00	60.00
			Sand & Clay Fine	15.00	75.00
			Clay	5.00	80.00
Screen Installed: Yes	Filter Packed: No		Clay & Boulders	10.00	90.00
Screen Diameter: 5.00 in.	Blank: 0.00 ft. Above		Sand Fine To Medium	13.00	103.00
Screen Material Type:					
Slot	Length	Set Between			
12.00	3.00 ft.	100.00 ft. and 103.00 ft.			
Fittings: Neoprene packer					
Well Grouted: No					

	Geology Remarks:
Wellhead Completion: Other, 12 inches above grade	

Nearest Source of Possible Contamination: Type None	Distance 	Direction 	Drilling Machine Operator Name: JIM HAKALA Employment: Unknown
			Contractor Type: Unknown Business Name: Business Address:
			Reg No: 52-0206
			Water Well Contractor's Certification This well was drilled under my supervision and this report is true to the best of my knowledge and belief.
			Signature of Registered Contractor
			Date

General Remarks:
Other Remarks: Wellhead Completion:12 inch Above Grade

APPENDIX E

WELLHEAD PROTECTION ZONE, SECTION 401 – PART P; ZONING
REGULATIONS, ZONING DISTRICTS WITHIN WELLHEAD PROTECTION
AREA, POWELL TOWNSHIP ZONING ORDINANCE

ARTICLE IV, SECTION 401 – PART P; ZONING REGULATIONS, ZONING DISTRICTS WITHIN WELLHEAD PROTECTION AREA, POWELL TOWNSHIP ZONING ORDINANCE

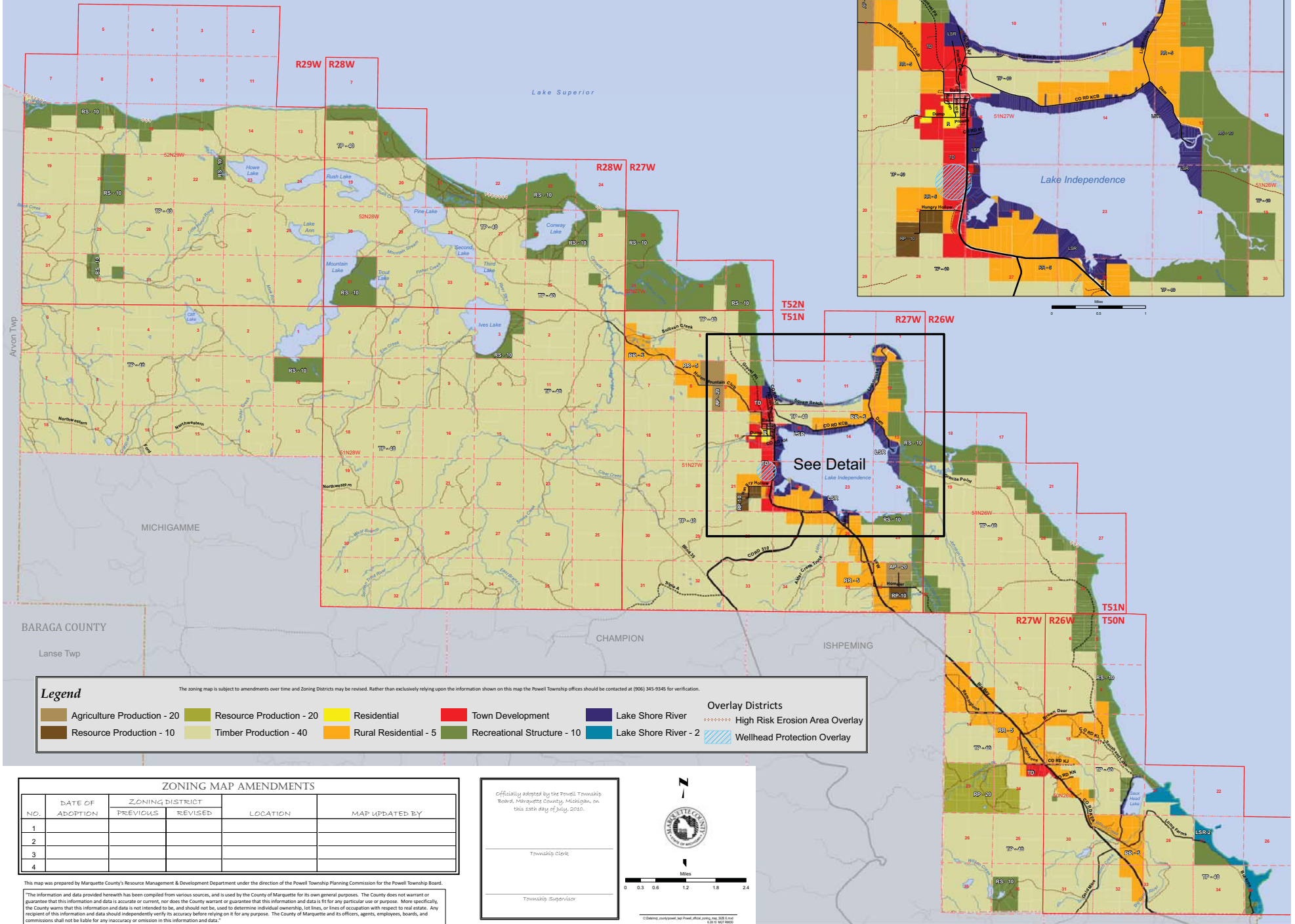
(P). Wellhead Protection Zone and Wellhead Protection Area: All zoning districts within a one thousand (1,000) foot radius of the township municipal water supply and within the township's delineated - Wellhead Protection Area are restricted to Residential, Rural Residential, and Timber Production Districts in order to provide maximum protection against groundwater contamination. All liquid above-ground petroleum and chemical storage tanks within this zone shall be placed above ground level with a concrete catch basin with a minimum three (3) inch lip around its base to collect any leakage from the storage tank. This is to include home heating oil tanks, gasoline storage tanks, and any other tanks containing possible pollutants to the groundwater system.

APPENDIX F

ZONING MAP OF POWELL TOWNSHIP, MICHIGAN, PREPARED BY CUPPAD

Powell Township Official Zoning Map

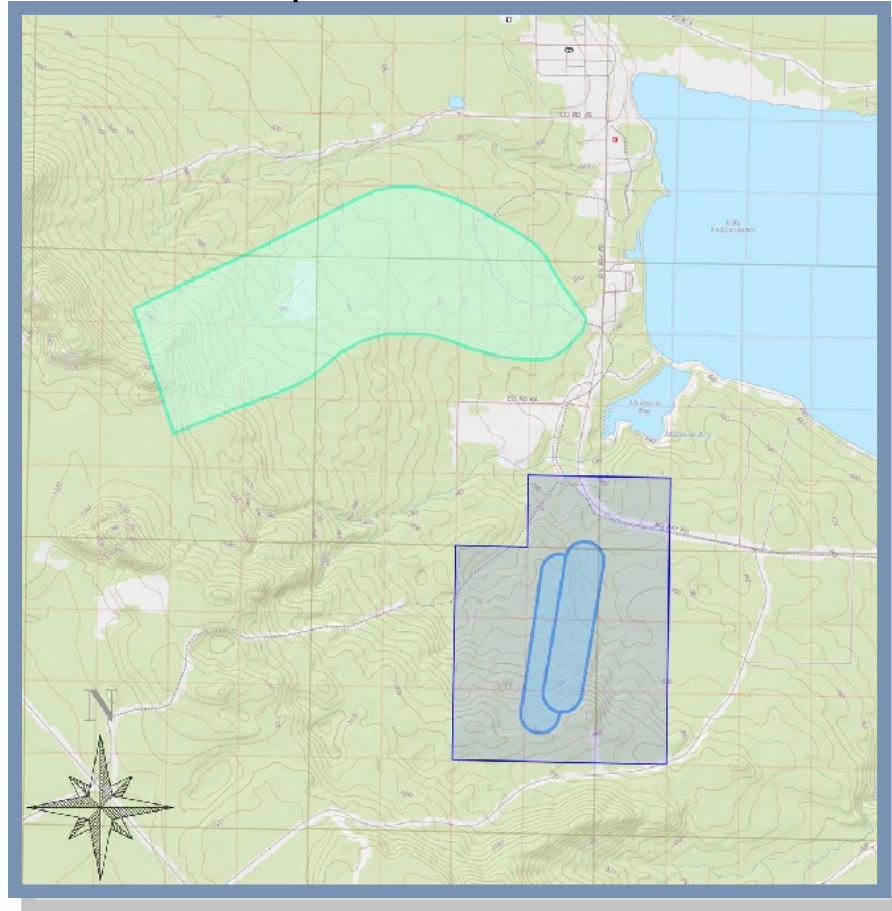
Marquette County, MI



APPENDIX G

EDUCATIONAL BROCHURE, POWELL TOWNSHIP WELLHEAD PROTECTION
AREA

Powell Township Wellhead Protection Areas



Michigan's Wellhead Protection History

The purpose of Michigan's Wellhead Protection Program (WHPP) is to protect public water supply systems (PWSS), which use groundwater, from potential sources of contamination. Protection is provided by identifying the area which contributes groundwater to PWSS wells, identifying sources of contamination within the area, and developing methods to cooperatively manage the area and minimize the threat to the PWSS.

Michigan's WHPP was developed in response to 1986 amendments to the federal Safe Drinking Water Act (SDWA). Unlike many programs throughout the country, wellhead protection is a voluntary program which is implemented on a local level through activities coordinated by local, county, regional, and state agencies. Guidelines for the program were developed by the MDEQ. Although the program is voluntary, PWSSs who choose to participate in wellhead protection must develop a local WHPP consistent with the guidelines established by the state. Local WHPPs must specifically address seven elements which include the establishment of roles and duties, wellhead protection area (WHPA) delineation, identification of sources of contamination within the WHPA, the development of mechanisms to manage the WHPA and minimize threats to the PWSS, the development of contingency plans for water supply emergencies, identification of procedures for the development of new well sites and incorporate them into the local WHPP, and provide opportunities for public participation. Various state and local regulations are integrated into the local WHPP and provide legal authority for a broad range of activities which help to support local wellhead protection efforts.

Powell Township - History

Powell Township began their efforts in development of a WHPP in 1996, with the adoption of procedures for protecting their groundwater supply. A wellhead protection team formed, which consisted of a cross-section of the local community, including representatives from the township water system, fire department, school, business community, county park manager, and local residents. The Township secured multiple matching fund grants, from the MDEQ, from 1999 through 2003, which provided financial assistance to offset costs for development of the WHPP. Additional updates were conducted in 2014 and 2018.

Common Sources of Groundwater Contamination - Causes and Prevention

Underground Storage Tanks

Contamination Evidence

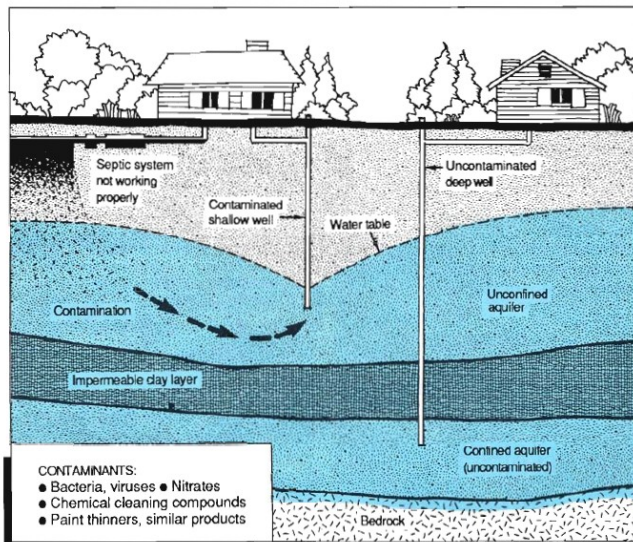
- Petroleum odor in wells or basement
- Tank inventory losses
- Spills
- Detection of leaks

Causes

- Corroded tanks
- Poor installation and/or maintenance
- Deterioration of abandoned tanks
- Poor Inventory control
- No leak detection

Prevention

- Proper installation, maintenance, leak testing, and inventory control
- Permit compliance
- Leak containment
- Removal of abandoned tanks



Failing or Poorly Located Septic Systems

Contamination Evidence

- Wastewater vents to ground surface
- Detection of excessive bacteria or chemicals in well water tests

Causes

- Poor installation and/or maintenance
- Disposal of household chemicals, such as paint thinners
- Overloading the system with a garbage disposal unit
- Use of septic cleaning additives
- Too many closely spaced septic systems in a limited area

Prevention

- Proper installation and maintenance
- Inspection and cleaning by septic cleaning service every 2-4 years, annually if garbage disposal is used
- Do not dispose of household chemicals into septic systems

Source: Groundwater Contamination, Lyle S Raymond Jr., November 1988

Improper Disposal of Contaminants

Contamination Evidence

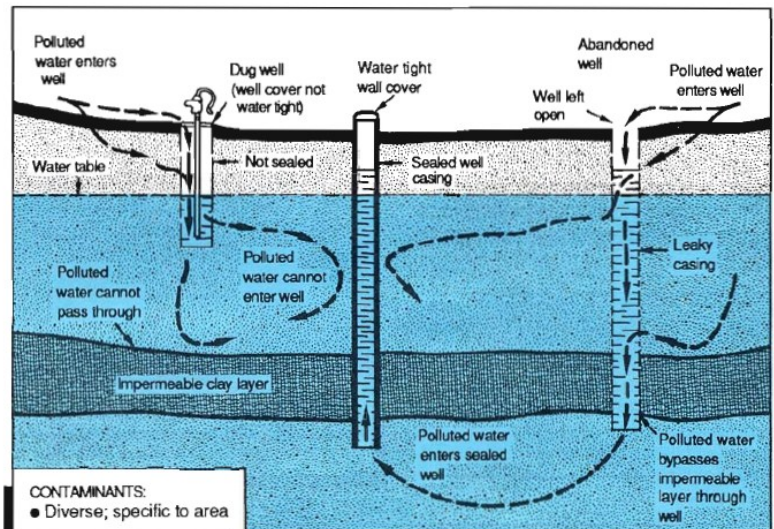
- Petroleum odor in well water
- Other chemical odors
- Detection of chemicals in water tests

Causes

- Improper disposal of chemicals, oil, pesticides, other wastes and used containers
- Lack of disposal facilities for small amounts of hazardous waste

Prevention

- Public information & education
- Disposal facilities for small hazardous waste generators
- Enforcement against improper waste disposal
- Recycle used motor oil



Abandoned Wells

Contamination Evidence

- Detection of high bacteria levels in well water tests
- Well water turbidity
- Detection of other contaminants in well water

Causes

- Old well casing or leaky casing
- Well cover not watertight
- Improperly abandoned wells
- Groundwater movement from abandoned wells to contaminated wells

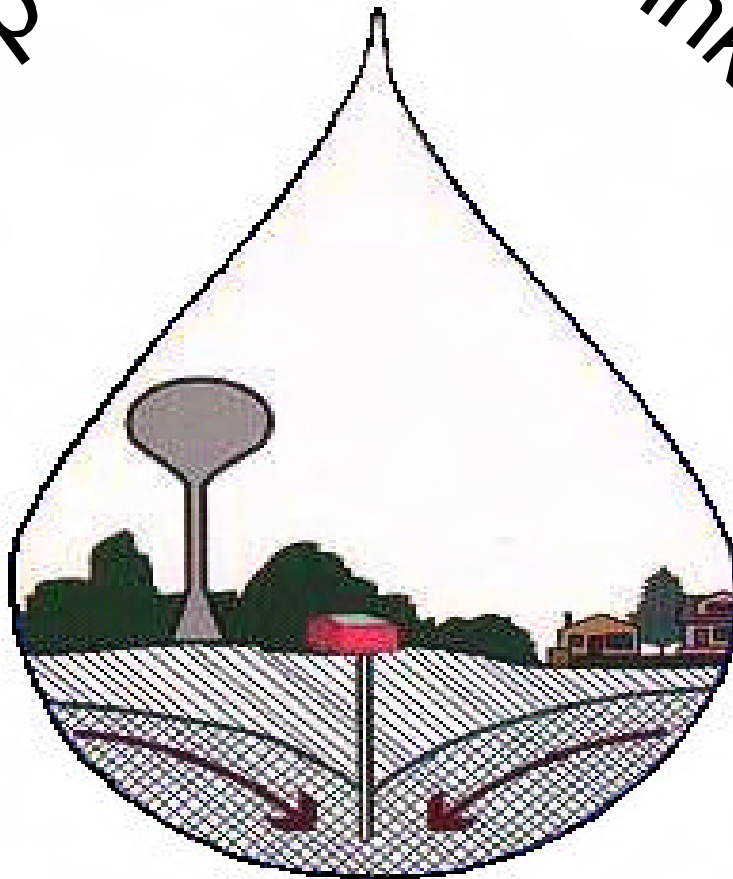
Prevention

- Watertight well cover
- Tight well casing
- Tight plumbing connections
- Identify and seal open abandoned wells

APPENDIX H

THE MICHIGAN WELLHEAD PROTECTION PROGRAM GUIDE, MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY, FEBRUARY 2006

Teaming Up for Quality Drinking Water



The Michigan Wellhead Protection Program Guide

Michigan Department of Environmental Quality
Drinking Water & Environmental Health Section
February 2006

A Guide to Protecting Your Community's Drinking Water

This guidebook is intended for local government staff, leaders, and community volunteers who have an interest in community development, environmental protection, and drinking water quality. Information on basic groundwater principles and the importance of participating in the Michigan Wellhead Protection Program (WHPP) are provided.

The WHPP involves activities and management practices for protecting public groundwater supply systems from contamination. Wellhead protection is an ongoing process that will help your community have control over its future environment. Your involvement and commitment to helping ensure a safe and reliable source of drinking water is vital. By participating in the Michigan WHPP, your community will effectively manage and thus protect your public drinking water source.

The Michigan Wellhead Protection Program

Participating in Wellhead Protection

- Clean drinking water is vital to sustain a community
- Develop a set of guidelines that will protect your community drinking water supplies
- Utilize more stringent state regulations in WHPAs
- Develop a management area that is approved by the State of Michigan.
- Provide a higher level of environmental review in the state permitting process.
- Financial assistance available in the development of management practices in the WHPA.

Michigan's groundwater is used for drinking water by nearly half of the state's population. In addition, it is used for irrigation and industrial purposes and contributes to the economy and unique quality of life in our Great Lakes State. In an effort to safeguard public water supply systems (PWSS) from contamination, the federal Safe Drinking Water Act (SDWA), 1976 PA 399, was amended in 1986 to include wellhead protection. Through these amendments Michigan implemented a voluntary, statewide WHPP. Michigan's WHPP is composed of a set of guidelines that help communities protect their drinking water by identifying the area that contributes groundwater to PWSS wells, identifying sources of contamination within that area, and developing methods to cooperatively manage the area and minimize the threat to the PWSS.

Unlike many programs, wellhead protection is voluntary and implemented at the local level through the coordination of activities by local, county, regional, and state agencies. Although the program is voluntary, communities who choose to develop a state approved WHPP, must develop a local WHPP consistent with the guidelines established by the state. Local WHPPs specifically address seven elements, which include:

1. **Roles and Responsibilities**—identify individuals responsible for the development, implementation, and long-term maintenance of the local WHPP.
2. **Wellhead Protection Area Delineation**—determine that area which contributes groundwater to a PWSS well.
3. **Potential Sources of Contamination**—identify known and potential sites of contamination within the Wellhead Protection Area (WHPA) and include in a contaminant inventory list.
4. **Wellhead Protection Area Management**—provide mechanisms which will reduce the risk of existing and potential sources of contamination from reaching the public water supply well or wellfield.
5. **Contingency Plan**—develop an effective contingency plan in case of a water supply emergency.
6. **New Wells**—provide information on existing groundwater availability, the ability of the PWSS to meet present and future demands, and the vulnerability of the existing wells to contamination.
7. **Public Education and Outreach**—generate community awareness in wellhead protection by focusing on public education and the dissemination of wellhead protection information.

The Michigan Wellhead Protection Grant Program



Funding for WHPP activities is available through a state grant program and is designed to assist communities in the development and implementation of WHPPs. Within the grant program, the state funds 50 percent of eligible grant activities while the other 50 percent is matched with local funds. Grant money is awarded each year to PWSSs *based on a scoring system that ranks communities of similar size.*

*Note: Unless otherwise credited, all graphics in this document were used with permission from:
Michigan State University Extension, Water Quality Publications
WQ 34 & 35.*

Groundwater Basics

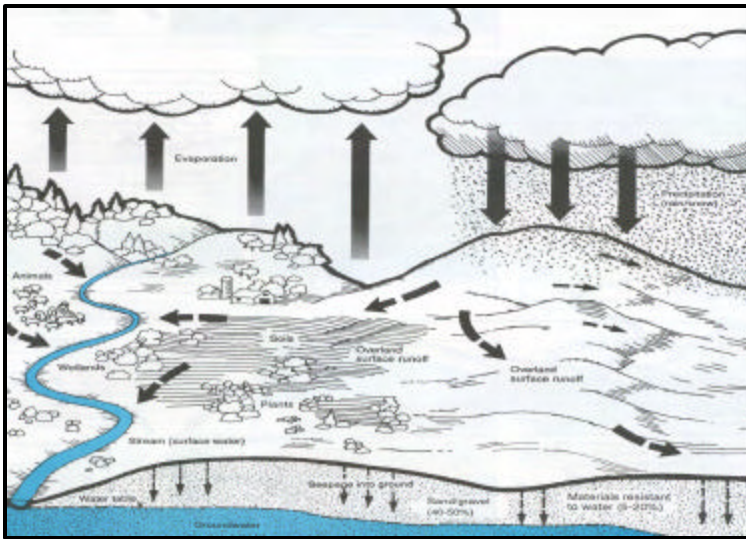
Before going into detail about the WHPP, it is important to understand the mechanics of groundwater. This section will give you the basic information you need to understand why you should participate in the WHPP.

Ground water myth #1

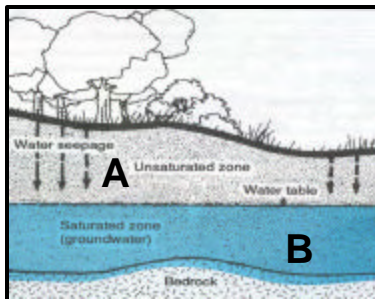
Groundwater is a large underground lake or river.

Reality: Groundwater is stored in small spaces between rock or soil particles.

The Water Cycle



Groundwater begins with rain and snowmelt that seeps or infiltrates into the ground as gravity pulls it downward. The type of land surface determines how much water will infiltrate into the ground. The amount of water that infiltrates into the ground varies from 5 percent to 50 percent, with the remaining water running off the land surface into streams, rivers, and lakes or returning to the atmosphere by evaporation.

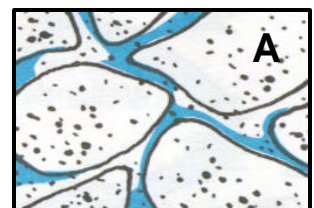


Saturated and Unsaturated Zones

Subsurface Water

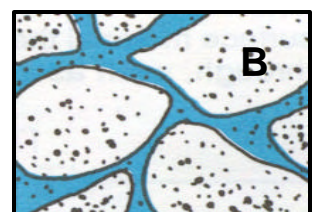
Groundwater is present in geological formations below the land surface (subsurface). The subsurface can be divided into two zones, the unsaturated zone and the saturated zone. As water infiltrates into the ground it will travel through material that has open spaces between particles called pore spaces. Pore spaces are small to microscopic in size.

The first zone that infiltrating water intercepts is the unsaturated zone (A). In the unsaturated zone the pore spaces are filled with both water and air. Plant roots can capture moisture moving through this zone but it does not contain enough water to supply a well. The movement of water through this zone is vertical.



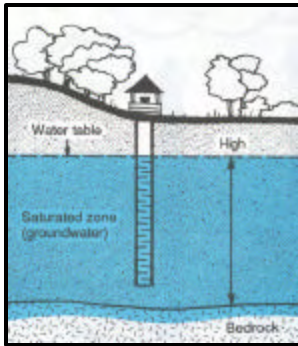
Unsaturated pore spaces

As the water infiltrates through this material it will eventually begin to build up, filling the pore spaces completely with water. The zone where pore spaces contain only water is called the saturated zone (B). Water flows both horizontally and vertically in the saturated zone. It is from the saturated zone that we can withdraw groundwater for our use.



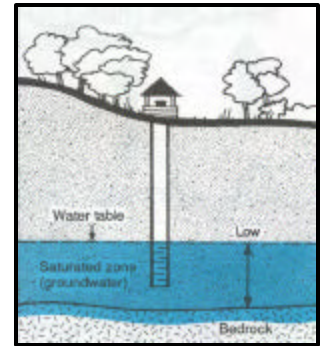
Saturated pore spaces

The Water Table



Seasonal high water table

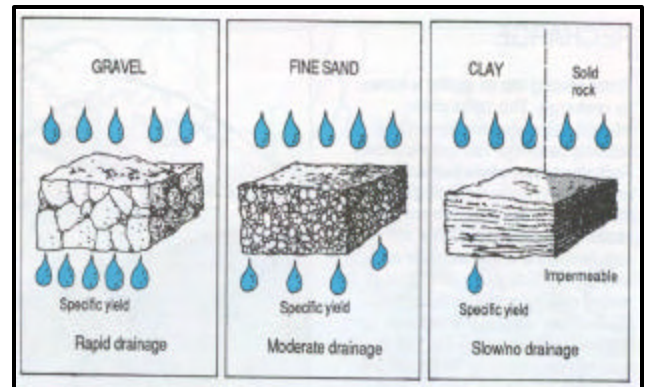
The boundary between the unsaturated and the saturated zone is called the water table. The water table is not a flat surface but a surface with high and low spots that generally follow the features of the land. The water table rises and falls according to the season of the year. Typically the water table is higher in the early spring and lower in late summer.



Seasonal low water table

Aquifers

Aquifer is the term that is used to describe a formation that stores groundwater in a usable and sustainable quantity. Drinking water comes from groundwater that is extracted from an aquifer. The aquifer can be made of a wide range of materials and may be at any depth. An aquifer's size and areal extent can vary widely. Some aquifers are found only locally where others are found throughout a region. In Michigan, aquifers are classified as confined or unconfined. The material that overlays the aquifer determines the type of aquifer.



Water travel through different materials: gravel, fine sand and clay.

Confined Aquifers

Groundwater does not move easily through layers of material that have very small, unconnected pore spaces. This layer is called an impermeable layer. When there is a thick impermeable layer it becomes a confining layer. When found between the land surface and your drinking water aquifer, it acts as a barrier that adds a natural layer of protection to your aquifer. The confining layer slows the travel of contamination from activities on the land surface to your aquifer. While the confining layer provides extra protection, contamination can still travel into your aquifer via fractures and abandoned wells.

Unconfined Aquifers

Unconfined aquifers are aquifers that do not have an impermeable layer between the land surface and the aquifer. When a confining layer is not present there is no barrier to slow the travel of contamination between the surface and your aquifer. Unconfined aquifers are very sensitive to activities on the surface and are at a high risk of contamination.

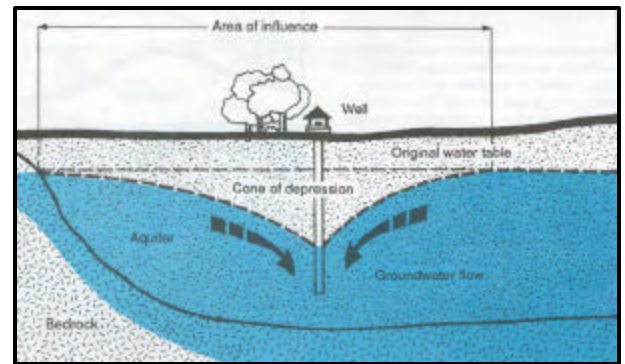
Ground water myth #2

Groundwater does not move or groundwater moves very fast.

Reality: Groundwater moves very slowly from a few inches to a few feet per day.

The Cone of Depression

When water is pumped out of an aquifer, the water table will dip down around the well. This is called the cone of depression. Because water is being pumped out of the aquifer the speed of the water begins to increase as it approaches the pumping well. As you get farther away from the well the flow begins to decrease back to the natural flow rate.



The cone of depression

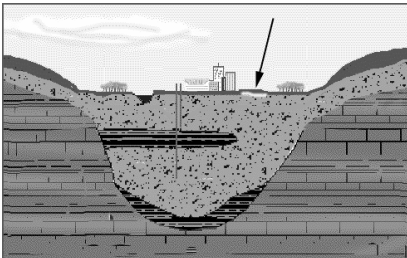
Ground water myth #3

*There is a lot of groundwater.
reality: Groundwater is about 0.7
percent of all the water on earth
and not all of that is good for, or
available for, drinking water.*

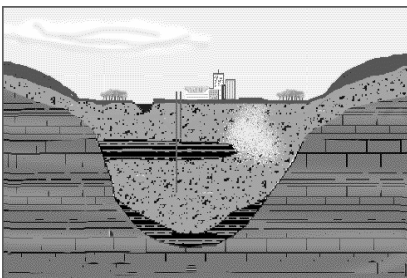
Aquifers are a complex system with many factors that influence the groundwater quality. Once an aquifer is contaminated it is very difficult and expensive to clean up and virtually impossible to return it to its original state.

Example of a Contamination Event

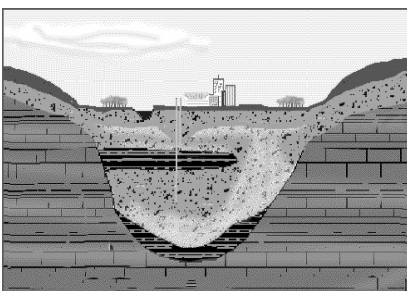
The following example will give you a visualization of how surface activities can contaminate your drinking water supply.



- 1) The picture is a representation of an aquifer with an incomplete confining layer (dark black bands). There are two wells, a shallow well above the partial confining layer and a deep well below the partial confining layer. The arrow points to a chemical spill that occurred on the surface.



- 2) One of the unique properties of water is that it can dissolve and carry many kinds of material. Because of this, chemical spills on the surface (solid or liquid) can be carried into the aquifer when water comes in contact with them. Once the contamination mixes with the water it becomes very mobile and will travel with the groundwater.



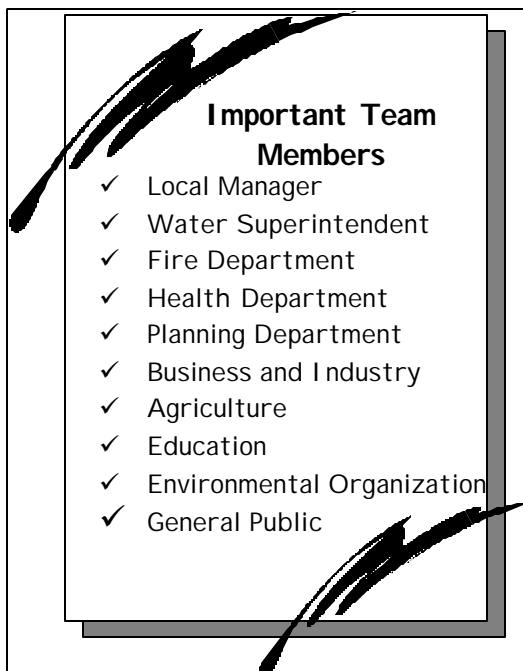
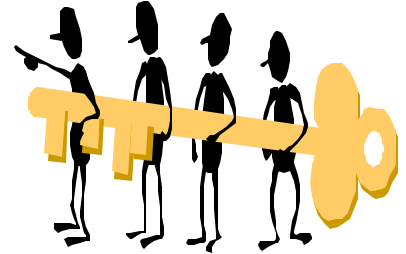
- 3) Once the contamination reaches the groundwater it spreads through the aquifer. Because withdrawing groundwater increases its flow or movement, it may actually cause the contamination to move more rapidly towards your drinking water well. The final outcome may be contamination being pulled into the drinking water well and ultimately into the public water supply system.

Now that you have a basic understanding of what you are protecting, we will continue on to the elements of the WHPP and show you how they will help you protect your drinking water supply.

The Seven Elements of Wellhead Protection

1) Roles and Responsibilities

The first step in developing a successful WHPP is to build a team of people that want to play an important role in protecting your public water supply. When building a team, you want to include participants that have a variety of experiences. A great team will consist representatives from your local municipality, fire department, and health department along with others involved in area businesses, schools, environmental organizations, planning agencies, and citizens (within your community and those residing in adjacent communities).



Being a part of the wellhead protection team will give you an opportunity to participate in protecting your drinking water supply as well as give you the chance to share information with your peers about the program, hopefully getting them interested in wellhead protection. By now, you are probably asking..."Why should I be a wellhead protection team member?" Well, being a part of the team allows you to gain valuable knowledge about your drinking water and more importantly, you have the opportunity to make decisions that can keep your drinking water free of contamination and safe for you and your family. Building an effective wellhead protection team will also help to ensure your program's continuation and success.

The next step of team development is determining, within your local government, who will be responsible for what aspects of the program. For instance, who will be the community contact for questions about the program? Who will keep the program updated? Who will organize wellhead protection events in your community? What will be the responsibilities of each of the groups represented on the team? There are outside organizations that can help with your wellhead protection efforts and can also be listed and used as a resource for your community.



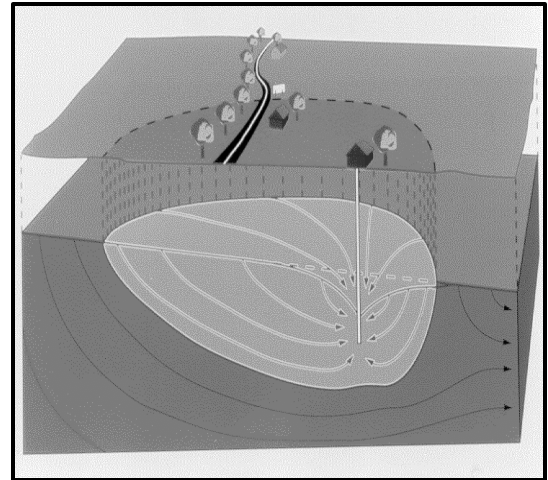
2) Determining the Wellhead Protection Area (WHPA)

Q: What is a WHPA?

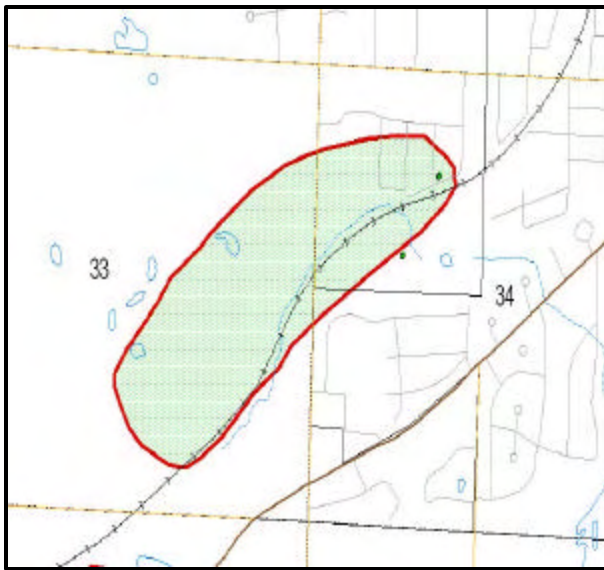
A: The surface area that overlies the aquifer that is directly contributing water to your well.

The WHPA is the physical area your program is going to manage. Determining the WHPA is done through a scientific process that takes into account the characteristics of the aquifer from which you withdraw your drinking water.

The WHPA is determined by pumping the well for 24 or 72 hours to determine how much water is available and the speed at which it is moving. The groundwater flow direction in the area is determined by taking static water elevations in surrounding wells. Collecting static water elevations will tell you at what level the water table is found and will help determine the natural slope of that three dimensional surface. Once these two things have been completed, the information is entered into a computer modeling program that scientifically determines the 10-year time of travel.



3-D Wellhead Protection Area



Wellhead Protection Area Map
Source: DEQ

The 10-year time of travel boundary marks the time it will take a particle of water to travel through the WHPA and into the well. Ten years is the time period selected by Michigan because it provides a reasonable length of time for responding to environmental problems within a WHPA that is of a size that can be reasonably managed.

The WHPA is determined and is submitted to the Michigan Department of Environmental Quality (DEQ) for approval. Once approved, the WHPA receives a higher level of environmental monitoring at the state level for certain activities which are permitted through the state. For example, an underground storage tank must have an extra layer of protection around the tank (secondary containment), or businesses with groundwater discharge permits may need to perform more frequent monitoring. As stated previously, the WHPP does not exclude any businesses or activities from your WHPA.

3) Contaminant Source Inventory

Once the Wellhead Protection Area has been completed and approved by the DEQ, the next step in the program is to identify sites within the WHPA that may have the potential of contaminating your drinking water supply. Because both surface and subsurface activities can impact the drinking water supply, it is important to know what activities are occurring in your wellhead protection area. The inventory will provide a basis for a management plan that will address current issues in your WHPA.

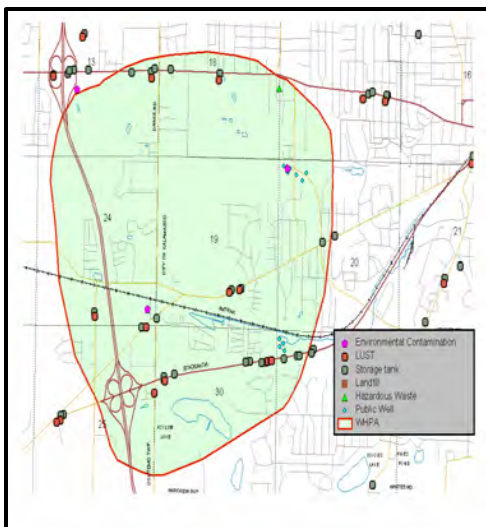
Creating a list and map of all potential and known sites of environmental contamination within your WHPA is one such way to protect your drinking water supply. Existing and known sites of environmental contamination may include:

- ✓ Leaking Storage Tanks
- ✓ Superfund Sites
- ✓ Part 201 (contamination) sites of Act 451—
- ✓ Oil and Gas Spills
- ✓ Others

In addition, potential sites of environmental contamination may include:

- | | |
|-------------------------------|---|
| ✓ Registered Storage Tanks | ✓ Commercial Facilities |
| ✓ Hazardous Waste Generators | ✓ Manufacturing and Industrial Facilities |
| ✓ Ground Water Discharges | ✓ Institutional Facilities |
| ✓ Agricultural Operations | ✓ Utility Companies |
| ✓ Septic Systems or Dry Wells | ✓ Abandoned Wells |

Proper management of hazardous materials can effectively reduce the threat to your drinking water supply.



Source: DEQ

Once these sites are identified and mapped, you will have the basis for deciding how the management portion of your WHPP should be designed. In addition, your contaminant source inventory will provide you with a list of businesses to include as part of your WHPP team.

It is important to educate facilities which handle and store hazardous materials so they are aware of the location of their business or facility in relation to the drinking water supply. They may be unaware that they are located directly over the area that contributes to the water they drink. As part of the wellhead protection team, business leaders feel included in the process, offer ideas, and bring a new perspective to the table. Businesses will gain valuable information for improving management of hazardous materials and protecting the water they drink.

The proper management of hazardous materials can effectively reduce the threat of contamination to the drinking water supply.

4) Wellhead Protection Area Management

In order for a WHPP to protect your community's drinking water it is important to set up management practices that will allow for the development of your community without jeopardizing water quality.

Management strategies are developed entirely by the community to fit the community's needs. Strategies such as site plan review, zoning, ordinances, land use planning, and the incorporation of wellhead protection into the Master Plan or Comprehensive Plan are tools that communities can develop and use to insure the future quality of their drinking water supply.

Community leaders and businesses need to work together towards one central goal—protecting your public water supply.



It is important that staff involved in the planning aspect of the community participate in the wellhead protection efforts, since they will be responsible for making sure that the management strategies for wellhead protection are followed during the planning process.

In addition to setting up management strategies on a planning level, management techniques should be made available for businesses handling and storing hazardous materials. There are many free or low cost programs available through the DEQ Environmental Assistance Division that will actually help business become more environmentally safe and add cost savings as well. These programs are not regulatory programs.

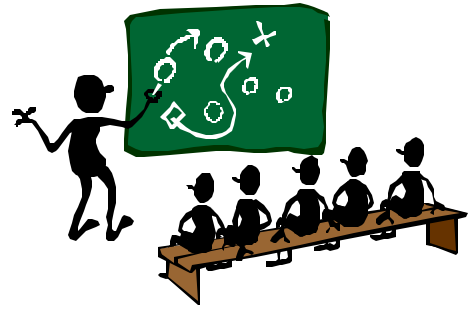
Management of your WHPA also needs to occur at the residential level. Educating residents about the proper use and application of common household chemicals and hosting a household hazardous waste collection day are two examples of residential management.



Because the WHPP is voluntary, it is important to establish good working relationships. Community leaders, community residents, agricultural producers, and businesses need to work together toward one central goal—protecting your public water supply.

5) Contingency Plan

A contingency plan will help safeguard your community in the event of a water supply emergency. The plan will include personnel, testing equipment, procedures, and materials that are necessary and identify where they are located in order to quickly and effectively correct the water supply emergency. A response protocol, notification procedures, and methods that can be used in handling emergencies based upon the nature of the threat to the PWSS are also included. These elements are important and necessary during a water supply emergency because you will be prepared and ready for action.



Should your well be impacted by contamination, the contingency plan will provide a course of action that identifies the procedure for containing or isolating the impacted well within the water supply. Once a well is impacted, a community must have a quick response time. An alternative water supply and/or an external source of water such as bulk or bottled water are identified in the contingency plan. The plan will also include how the community will be notified of an emergency and who will be in charge of notifying others. The plan is intended to have response protocol, personnel, and equipment in place prior to a contamination event so the community can react quickly.

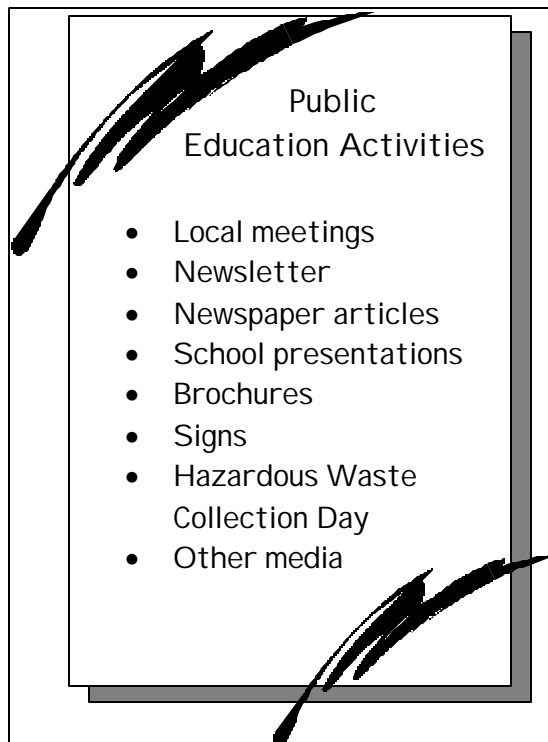
6) New Wells

Your wellhead protection activities provide an excellent assessment of your public water supply system by collecting information on existing groundwater availability, the ability of your well(s) to meet present demands, and the vulnerability of your existing wells to contamination. If your community has had a water supply expansion, an increase in water use, or if existing wells are highly vulnerable to contamination, you will consider a plan that focuses on the future development of wells. A plan will be created that describes why your community has decided to expand production, how you plan to expand (e.g., location of additional well(s), proposed depth, capacity) and a timetable for when you plan to delineate any newly installed wells.



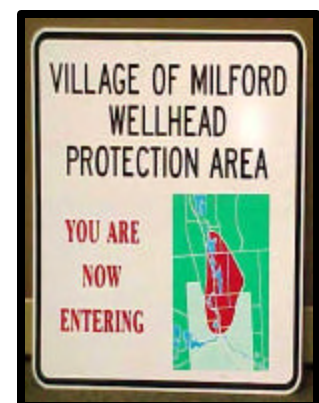
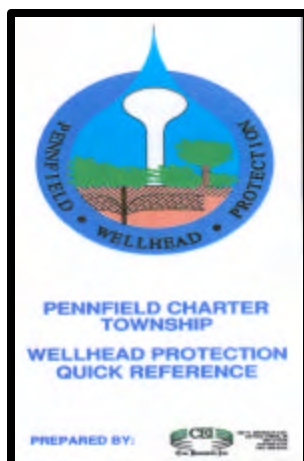
If new municipal wells are constructed within your community, it is strongly recommended that you integrate them into the WHPP. At the time of construction, the WHPP is easier and less costly to delineate. In addition, wellhead protection can be used to evaluate the availability of groundwater at a particular site.

7) Public Education and Participation



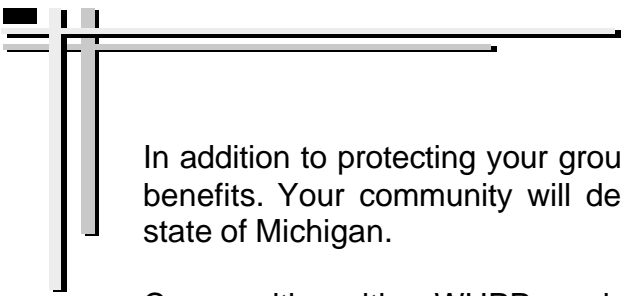
Educating your community members and encouraging them to participate in your drinking water protection efforts is essential. Why should you educate your community on the importance of wellhead protection? First, having the support of those who live, work and own businesses in your WHPA will ensure the program's success and longevity. Second, a successful program equals a better managed public water supply system which lessens the likelihood of drinking water contamination. Third, in the event of an emergency, your community will be better prepared and equipped to deal with the contamination problem. Therefore, it is critical to gather support and interest from all within your community.

To generate interest in wellhead protection, your community may wish to focus on public education and distribute wellhead protection information. Presentations can be made at your local meetings, before your boards and commissions, and at your schools. Sending out wellhead protection newsletters and brochures, hosting radio and cable television spots, posting signs in your WHPA, organizing a hazardous waste collection day, writing an article for your local newspaper, or setting up a WHPP booth at the local fair are other ideas. In addition, distributing WHPP mugs, hats, placemats, shirts, coloring books, and other advertising paraphernalia are also effective. Educating those who live within and around your WHPA is a vital step in the protection of your water supply.



Examples of Wellhead Protection Outreach Products (Source: DEQ)

Benefits of Wellhead Protection



In addition to protecting your groundwater, the WHPP also provides a number of other benefits. Your community will develop a management area that is approved by the state of Michigan.

Communities with a WHPP receive a higher level of environmental review in the state permitting process. In addition, permitting for underground and aboveground storage tanks, spillage of polluting materials, and discharging to groundwater include more stringent requirements within WHPAs. Consequently, communities that have designated WHPAs are able to better safeguard their groundwater from contamination. Financial assistance is also available for the development of management practices (e.g., planning and zoning) and the searching and plugging of abandoned wells within the WHPA.

The state WHPP does not dictate what businesses can or cannot locate within the wellhead protection area, nor does it prevent the use or storage of hazardous materials in the wellhead protection area. It is the responsibility of the local unit of government to determine how to protect the water supply through planning, zoning, and proper management techniques. These techniques need to be developed by your community and designed to fit your community's needs. Implementing and enforcing these higher level management techniques will provide your community with the power to protect your public water supply systems.

Summary

A safe and reliable source of drinking water is essential for life. Because our water supply is limited, it needs to be properly managed. The proper management of public water supplies is an ongoing process that requires future planning. Implementing a WHPP is a cost-effective way for communities to protect the health of their citizens and the natural resources of Michigan.

For further information, please contact:

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Water Bureau
Drinking Water and Environmental Health Section
Source Water Protection Unit
P.O. Box 30273
Lansing, MI 48909
Telephone: 517-241-1355**

