REPORT ON KNOWN STATUS OF SELENIUM IN WATER WELLS AT AND AROUND THE EMPIRE AND TILDEN MINES

Introduction

Selenium, a naturally occurring substance has recently become a contaminant of concern due to its ability to interfere with aquatic organism reproduction. And, there is some evidence that the iron mining activity in Central Marquette County may be contributing to the release of excess selenium into nearby surface waters. The Michigan Department of Environmental Quality (MDEQ) Water Bureau (WB) has been working independently and with Cliffs Natural Resources (CNR) to identify surface waters impacted by selenium discharges and specific potential source areas. A selenium maximum contaminant level (MCL) of 50 micrograms per liter (ug/l) was established in 1991 for public water supplies. The toxicity level for aquatic reproduction interference is likely much lower, and the current water quality standard is 5 ug/l.

This report documents research into selenium monitoring of drinking water wells. Drinking water wells located within one mile of CNR activity sites associated with the Empire and Tilden mines where either paper or electronic well construction logs exist are identified. Activity sites include active mining and processing sites, waste rock storage piles, tailings basins, and re-use water ponds associated with the Empire and Tilden Mines.

Recommendations for future action are offered.

General Geographic and Geologic Setting

The active CNR areas cover approximately 100 square miles of central Marquette County, Michigan, including areas in Richmond, Negaunee, and Tilden Townships. The region is a diverse combination of upland wooded, wetlands, rural residential areas, and natural resource production zones, and is bisected with many small and medium sized streams. Except for a small section near the central northern boundary of the CNR active areas, the surface drainage in the CNR active areas is generally to the south and east and within the Escanaba River watershed, which flows to Lake Michigan. Surface drainage in a small area in the north central part of the CNR active areas flows north towards the Carp River watershed, which flows to Lake Superior.

The geology of the area is extremely complex. The Huronian Series PreCambrian aged bedrock underlying the active CNR areas are generally metamorphic slate, graywacke, schist, iron formation, and quartzite. The formations exist in a large extremely faulted and folded structure called the Marquette Synclinorium. A major thrust fault, the Palmer Fault moved a section of the synclinorium southward forming the feature where the iron formations extracted at the Empire and Tilden Mines are located. Surrounding the

By: Chuck Thomas, Ground Water Engineer
MDEQ-Water Bureau
November 4, 2009

synclinorium formations are older granite, gneiss, schist, and peridotite of the Laurentian and Keewatin Series of PreCambrian basement rock. The entire region experienced multiple periods of Pleistocene era glaciations, resulting in a thin to thick mantling of glacial and alluvial unconsolidated deposits over the much older bedrock. The glacial deposits are highly variable and are thicker over areas where bedrock valleys exist and thin to absent at locations where bedrock highs are present.

Analysis Results for Selenium in Drinking Water Wells

Since the water supplies at both the Empire and Tilden Mines are classified as nontransient-noncommunity public water supplies, monitoring for heavy metals including selenium is required by Michigan's Safe Drinking Water Act. Table 1, found in Appendix A details monitoring results for the wells located at the Empire Mine for samples analyzed at both a private lab, White Water Associates and the state laboratory in Lansing. Analysis results for selenium in the Empire Mine water wells range from not being detected to 114 ug/l. One well at the Empire Mine, Well C regularly contained elevated amounts of selenium, including multiple samples with concentrations above 50 ug/l. The use of this well for drinking water was discontinued in 1998. Memorandum copies detailing those actions taken by CNR are also attached in Appendix A. Water samples from three other Empire Mine wells had selenium concentrations exceeding 5 ug/l. The wells are not currently potable water wells and are designated as Well E, Well N, and Well OW-3.

Selenium analysis results for the well at the Tilden Mine range from not detected to 3 ug/l. The results are summarized in Table 2, also located in Appendix A.

Even though the two mines are located adjacent to each other, there are geology and mineralogy differences in both the source rocks and ore bodies between the Empire and Tilden Mines. A more detailed study of the mineralogy of the formations mined may help determine the high selenium zones and help CNR improve control of selenium releases.

A query was requested and made of the state laboratory database for selenium analysis results for all wells located in Marquette County. The lab database contains electronic records from 1983 to the present. A summary of the results is attached as Appendix B. In that time span, 304 samples from Marquette County wells were analyzed for selenium content. Prior to 2001, the laboratory method reporting limit was 5 ug/l. From 2001 to the present the reporting limit has been 1 ug/l.

During the period 1983 through 2000, there were 210 samples analyzed. Seventeen samples contained selenium, some at levels below the reporting limit. The results ranged from 1 ug/l to 114 ug/l. The mean of the results is 19 ug/l, and the median is 2 ug/l. Nine of the 17 samples with reportable selenium levels were from wells at the

Empire Mine, two samples were from the Tilden Mine, 5 samples were from other public water supplies, and one was from a private well. The detected selenium concentrations in all samples collected from wells not owned by CNR, including the other public water supplies were less than 5 ug/l, which is also less than 10% of the public water supply MCL. The private well is located more than 1 mile north of the mining activity areas, and had a selenium content of 1 ug/l.

During the period 2001 to the present, 94 samples from Marquette County have been analyzed for selenium at the state laboratory. Fifteen of the 94 samples contained selenium at or above the reporting limit. The analysis results ranged from 1 ug/l to 4 ug/l. The mean and median for both sample results sets is 2 ug/l. The highest selenium content during this period, 4 ug/l was in a sample from the Empire Mine. Of the 15 samples with reportable selenium content, 4 came from the mines, 7 came from other public water supplies, and 4 came from private wells. The selenium concentrations in the samples from the other public water supply wells were all below 5 ug/l, which is less than 10% of the MCL. None of the private wells sampled are located near the mining activity areas.

Overall, in 26 years of sampling and analysis work, 11% of the Marquette County samples contained detectable selenium. Of the 11% with selenium, 47% of those were samples collected from wells owned by CNR. One CNR well has contained selenium at levels above 50 ug/l, and three wells have had samples with selenium concentrations above 5 ug/l. Nine other CNR wells that have been sampled have always had selenium concentrations below 5 ug/l.

Well Construction

An attempt has not been made to correlate well construction details such as casing depth, grouting, and formations of completion to selenium content. This is because the well logs available for the high selenium content wells at the Empire Mine do not provide the necessary detail to make those assessments. The available well logs for past and present water wells at both mines area are attached in Appendix A. The locations of many identified Empire Mine wells are shown on two diagrams provided by CNR, which are included in Appendix A. Additional well construction details are needed in order to better assess why some wells contain high levels of selenium and other nearby wells do not contain selenium at elevated concentrations.

Based on the available well construction and location information, it does appear that Well C, the well at the Empire Mine with the consistently high selenium content is located within an area of known high selenium content in runoff water. The well is very near a water retention pond. The available well construction information suggests the well has an un-grouted annular space, which may provide a conduit for downward migration of surface water to the aquifer. This possibility will be further investigated.

Private Wells Located Near Mining Activity Areas

Using available data sources, an attempt was made to identify all private wells located within a one mile radial area around active mining locations, tailings basins, and waste rock storage piles. The locations of wells were obtained using the Michigan Water Well Viewer database located at http://wellviewer.rsgis.msu.edu/, electronic well logs located at http://www.deq.state.mi.us/wellogic/main.html, and non-electronic well logs located in the WB paper well log files. The map views of the active CNR areas and the ¼, ½, and 1-mile halos around the active areas are included as Figures 1 through 3, found in Appendix C. The base figures showing the active CNR areas were prepared and provided by staff from the MDEQ, Office of Geologic Survey using GIS shape files obtained from CNR.

In Figures 1 through 3, the mine activity areas are detailed as both solid and lined areas. Around each active CNR area are ¼, ½, and 1-mile radial distance halos depicted with cross-hatched lines. A table of all wells indentified within the 1-mile radial distance is attached as Table 4 and is located in Appendix C. Also included in Table 4 is the well owner name, the well depth, the year the well was constructed, the approximate radial distance from a mine activity area, and the Wellogic ID number if one exists. Blanks in Table 4 mean the information does not exist in the databases and files that were researched. The distance range entry means the well is within that radial distance, but does not represent the actual distance between an active mine area and the well. For example, a well with a range of 1 means the well is located at least ½ mile away, but not more than 1 mile away. The entry of "0" in this column means the well is located with an active CNR area.

The number of identified wells located less than ¼ mile from an active area is 24. The number of wells possibly located more than ¼ mile away, but less than ½ mile away is 37. The number of wells located greater than ½ mile away, but less than 1 mile from an active area is 88. There are 19 wells owned by CNR and 2 old United States Geologic Survey (USGS) wells that appear to be within an active area. The USGS wells were likely abandoned and their former locations are now within a tailings basin area.

Recommendations

Sampling of some private wells near active facilities may be an appropriate course of action, but is probably premature until more is known about the wells located at the Tilden and Empire Mines and the area hydrogeology. In particular, we need to know relative locations of wells to known areas at the surface where elevated selenium in runoff waters has been documented. The construction details of wells with elevated selenium need to be verified to ascertain if surface runoff could enter the well bore or aquifer at the well locations. If CNR geologists have mineralogy information on the

various rock formations and have identified selenium-rich mineral zones, this could help us better understand the selenium source.

Since it appears that selenium is more prevalent at the Empire than at the Tilden, concentrating future private well sampling east, south, and southwest of the Empire Mine may be a prudent first step instead of looking at all listed wells.

If CNR has done any ground water modeling, a review of that work would immensely aid our understanding of what may or may not be happening with selenium migration. If regional ground water investigation and modeling work has not been done, it may become necessary as efforts to understand and track selenium movement in and around the active CNR areas move forward. In particular, ground water gradient information, particle tracking modeling, aquifer characteristics, ground water draw down in response to mine dewatering, and selenium migration modeling would all be extremely valuable components to a thorough understanding of the ground water environment around the mine areas.

If private well monitoring is determined to be needed, field verification of wells located within the selected radial distance will be necessary. There are likely many existing wells that were not listed in the researched sources identified herein, and some of the wells that have been identified are only roughly located by the quarter section designations contained in their well logs.

This report is an initial attempt to identify existing information, gather it in a single cohesive reference, and suggest needs for more information. Also, recommendations for future work are presented for consideration.

APPENDIX A

Table 1: Empire Mine Wells – Analysis Results

Table 2: Tilden Mine Wells – Analysis Results

CNR Memorandum Regarding Well C

Well Logs for CNR Water Wells

Site Diagram 1 – Empire Mine Well Locations

Site Diagram 2 – More Empire Mine Well Locations

APPENDIX B

Table 3: Selenium Analysis Results from Marquette County Wells - 1983 to the Present

APPENDIX C

Figure 1: 1- Mile Halo Around Active CNR Areas

Figure 2: ½ - Mile Halo Around Active CNR Areas

Figure 3: ¼ - Mile Halo Around Active CNR Areas

Table 4: Wells Identified Within 1- Mile Halos

SAMPLE ANALYSIS RESULTS FOR EMPIRE MINE POTABLE WATER WELLS

LAB	SAMPLE DATE	WELL	ANALYSIS RESULTS for SELECTED METALS in milligrams per liter										
			Selenium	Mercury	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
Lan	05-Nov-07	001	0.002	nd	nd	nd	nd	nd	nd	nd	nd	0.01	nd
Lan	31-Jan-05	001	x	x	x	nd	x	x	x	x	x	x	x
Lan	27-Jul-04	001	x	nd	x	x	x	x	x	x	x	x	0.0001
Lan	28-Aug-95	001	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
WWA	07-Jul-04	A	0.003	nd	nd	nd	nd	nd	nd	nd	0.002	0.02	nd
WWA	13-Sep-02	A	nd	nd	nd	nd	0.04	nd	nd	nd	nd	nd	nd
WWA	22-Aug-01	A	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
WWA	20-Jul-00	A	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.03	nd
WWA	09-Jul-99	A	0.002	nd	nd	nd	0.01	nd	nd	nd	nd	nd	nd
Lan	04-Feb-98	A	0.001	x	x	x	x	x	x	x	0.001	x	x
Lan	29-Oct-97	A	0.002	nd	nd	0.0004	0.004	nd	nd	0.004	0.0011	0.007	nd
Lan	03-Dec-96	A	nd	nd	nd	nd	nd	nd	nd	0.002	0.002	nd	nd
Lan	16-Oct-95	A	nd	nd	nd	0.0007	nd	nd	nd	nd	nd	nd	nd
Lan	13-Oct-95	A	nd	nd	nd	0.001	nd	nd	nd	nd	0.003	nd	nd
Lan	16-Sep-94	A	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Lan	29-Mar-90	A	nd	nd	x	nd	nd	x	nd	nd	nd	x	x
WWA	07-Jul-04	B	0.004	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
WWA	13-Sep-02	B	nd	nd	nd	nd	0.04	nd	nd	nd	nd	nd	nd
WWA	22-Aug-01	B	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
WWA	20-Jul-00	B	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
WWA	09-Jul-99	B	0.001	nd	nd	0.002	0.01	nd	nd	nd	0.009	nd	nd
WWA	20-Jul-00	C	0.044	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
WWA	09-Jul-99	C	0.091	nd	nd	nd	0.01	nd	nd	nd	0.001	nd	nd
Lan	04-Feb-98	C	0.114	x	x	x	x	x	x	x	0.002	x	x
Lan	04-Dec-97	C	0.060	x	x	x	x	x	x	x	0.002	x	x
Lan	29-Oct-97	C	0.055	nd	nd	nd	0.004	nd	nd	0.003	0.0013	0.009	nd
Lan	03-Dec-96	C	0.044	nd	nd	nd	nd	nd	nd	0.003	nd	nd	nd
Lan	16-Oct-95	C	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Lan	16-Sep-94	C	0.014	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Lan	29-Mar-90	C	0.014	nd	x	nd	nd	x	nd	nd	0.006	x	x

Empire Mine
Selected Metals
Analysis Results

By: Chuck Thomas
MDEQ-Water Bureau
September 10, 2009

LAB	SAMPLE DATE	WELL	ANALYSIS RESULTS for SELECTED METALS in milligrams per liter										
			Selenium	Mercury	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
WWA	20-Jul-00	E	0.050	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
WWA	09-Jul-99	E	0.031	nd	nd	nd	0.01	nd	nd	nd	nd	nd	nd
WWA	09-Jul-99	M	0.001	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
WWA	09-Jul-99	N	0.006	nd	nd	nd	0.01	nd	nd	nd	nd	nd	nd
WWA	09-Jul-99	OW-1	0.002	nd	nd	0.001	0.02	nd	nd	nd	nd	nd	nd
WWA	09-Jul-99	OW-3	0.007	nd	0.002	nd	0.02	nd	nd	nd	nd	nd	nd
WWA	09-Jul-99	Sec	0.004	nd	nd	nd	0.01	nd	nd	nd	nd	nd	nd
Lan	16-Oct-95	Sec	nd	nd	nd	0.0005	nd	nd	nd	nd	nd	nd	nd
Lan	16-Sep-94	Sec	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Lan	16-Oct-95	Trn	nd	nd	nd	nd	nd	nd	nd	nd	0.007	nd	nd
Lan	16-Sep-94	Trn	nd	nd	nd	0.0003	nd	nd	nd	nd	nd	nd	nd
Lan	16-Oct-95	Poc	nd	nd	nd	0.0003	nd	nd	nd	nd	nd	nd	nd
Lan	16-Sep-94	Poc	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Lan	29-Mar-90	Poc	nd	nd	x	nd	nd	x	nd	nd	nd	x	x
Lan	16-Sep-94	Pit	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

NOTES:

1. Well 001 samples could be either well A or well B
2. Wells A & B are active Type II wells
3. Well C use has been discontinued
4. Wells Trn, Poc, Sec are type III wells still in use
5. Trn = training center
6. Sec = Security well - at guard shack
7. Poc = "pocket well"
8. nd means not detected above reporting limit
9. x means analysis not performed
10. WWA = White Water Associates laboratory
11. Lan = State laboratory in Lansing

Empire Mine
Selected Metals
Analysis Results

By: Chuck Thomas
MDEQ-Water Bureau
September 10, 2009

Table 2

SAMPLE ANALYSIS RESULTS FOR TILDEN MINE POTABLE WATER WELL

LAB	SAMPLE DATE	WELL	ANALYSIS RESULTS for SELECTED METALS in milligrams per liter										
			Selenium	Mercury	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
Lan	21-Mar-05	001	0.003	nd	nd	0.001	nd	nd	nd	nd	0.001	nd	nd
Lan	27-Nov-00	001	0.003	nd	nd	nd	0.003	nd	nd	nd	nd	0.005	nd
Lan	29-Mar-00	001	nd	nd	x	nd	nd	x	nd	nd	nd	x	x
Lan	09-Dec-97	001	nd	0.00003	nd	0.0003	0.005	nd	nd	0.002	0.0002	0.003	nd
Lan	18-Sep-95	001	nd	nd	nd	0.0003	nd	nd	nd	nd	nd	nd	nd

NOTES:
1. nd means not detected above reporting limit
2. x means analysis not performed
3. Lan = State laboratory in Lansing

Tilden Mine
Selected Metals
Analysis Results

By: Chuck Thomas
MDEQ-Water Bureau
September 14, 2009

Empire Iron Mining Partnership

...For Generations to Come

Inter-Office Memo

To: J. M. Johnson

From: D. J. Ahola

Subject: Drinking Water Selenium

Date: February 3, 1998

Drinking water sampling recently resulted in a slight exceedance of the selenium Maximum Contamination Level (MCL) in "C" Well. A few days after the last sample was taken, the pump in "C" Well failed. An evaluation of all the water testing and pump failures was conducted to determine if there was any correlation between pump failure and selenium contamination (see attached spreadsheet).

A direct correlation cannot be made, however, the manufacturer will evaluate whether pump wear or other materials could leach into the well water. I will re-sample "C" Well to see if the selenium concentration was affected by the installation of the new pump.

In the meantime "C" Well will remain locked-out until the selenium concentration falls below the MCL. We continue to supply drinking water for the plant from "A" Well which shows non-detection for selenium.

cc: TSP, RHB
Ed O'Brien
Harry Klieman
BRYAN STIEMSMA

Empire Iron Mining Partnership

...For Generations to Come

Inter-Office Memo

To: Empire Mine Employees

From: D. J. Ahola

Subject: Drinking Water Advisement

Date: February 4, 1998

Under the provisions of the Safe Drinking Water Act, Act 399 P.A. 1976 and Rules as amended, the Maximum Contaminant Level (MCL) for Selenium in drinking water has been set at 0.05 parts per million (ppm). Recent water sampling from "C" Well has indicated that the standard has been slightly exceeded. Samples taken on 10/29/97 and 12/4/97 had selenium concentrations of 0.055 and 0.060 respectively.

On advisement from the Marquette County Health Dept. we have locked-out "C" Well until the selenium level tests below the standard. "A" & "C" Wells supply the plant and pit service buildings with potable water. Only "A" Well, which is below the detection limit for selenium, and which is safe to drink, will continue to supply drinking water for the mine, while the problem with "C" Well is being evaluated in association with the health department. "A" Well has been in use for over 30 years and was usually run during day shift. "C" Well was put into service about 10 years ago as a backup to "A" Well, and was used during afternoon and night shift.

The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that selenium is a health concern at certain high levels of exposure. Selenium is also an essential nutrient at low levels of exposure. This inorganic chemical is found naturally in food and soils and is used in electronics, photocopy operations, the manufacture of glass, chemicals, drugs, and as a fungicide and a feed additive. In humans, exposure to high levels of selenium over a long period of time has resulted in a number of adverse health effects, including a loss of feeling and control in the arms and legs. EPA has set the drinking water standard for selenium at 0.05 ppm to protect against the risk of these adverse health effects. Drinking water that meets the EPA standard is associated with little to none of this risk and is considered safe with respect to selenium.

Additional assistance is available if you have questions by calling either the Environmental Division of the Marquette County Health Department at 475-4195, or myself at 475-3724.

Empire Iron Mining Partnership

Dear fellow employees,

February 6, 1998

As you may be aware, we have our own potable water supply at the Empire Mine which is used for drinking and showering. This water is provided from "A" and "C" wells for the plant and pit service buildings, and is tested annually for all potential drinking water contaminants. "A" Well has been in use for over 30 years and was usually run during day shift. "C" Well was put into service about 10 years ago as a backup to "A" Well, and was used during afternoon and night shift.

Recently and for the first time, as a result of our years of sampling, the metallic element selenium was detected in our back-up "C" well in a concentration slightly above the safe drinking water standard. The Safe Drinking Water Act sets the Maximum Contaminant Level (MCL) for Selenium in drinking water at 0.05 parts per million (ppm). Samples taken on 10/29/97 and 12/4/97 had selenium concentrations of 0.055 and 0.060 respectively.

On advisement from the Marquette County Health Dept. we have locked-out "C" Well until the selenium level is determined to be back below the standard. Only "A" Well, which is below the detection limit for selenium, and which is absolutely safe to drink, will continue to supply drinking water for the mine. The problem with "C" Well is being evaluated, the water re-tested, and hopefully will be solved in association with the health department.

The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that selenium is a health concern at certain high levels of exposure. Selenium is also an essential nutrient at low levels of exposure. This inorganic chemical is found naturally in food and soils and is used in electronics, photocopy operations, the manufacture of glass, chemicals, drugs, and as a fungicide and a feed additive. In humans, exposure to high levels of selenium over a long period of time has resulted in a number of adverse health effects, including a loss of feeling and control in the arms and legs. EPA has set the drinking water standard for selenium at 0.05 ppm to protect against the risk of these adverse health effects. Drinking water that meets the EPA standard is associated with little to none of this risk and is considered safe with respect to selenium.

This precautionary action will insure safe drinking water for your consumption. Additional assistance is available if you have questions by calling either the Environmental Division of the Marquette County Health Department at 475-4195, or myself at 475-3724.

Sincerely,

Donald J. Ahola

Donald J. Ahola
Sr. Environmental Engineer

WATER WELL AND PUMP RECORD

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

Failure to comply is a misdemeanor.

Well B

Well ID: 52000005038

Tax No:	Permit No:	County: Marquette	Township: Richmond

Fraction:	Section:	Town/Range:	WSSN:	Source ID/Well No:
NE¼ SE¼ SE¼	30	47N 26W	2007252	002

Well ID: 52000005038

Elevation: 1302 ft

Latitude: 46.44254

Longitude: -87.5954

Distance and Direction from Road Intersection:

Well Owner: Empire Mine

Well Address:
Empire Mine Rd
Palmer MI 49871

Owner Address:
P.O. Box 38
Palmer MI 49871

Drilling Method: Rotary
Well Depth: ft.
Well Use: Type II public
Well Type: New
Date Completed: 11/11/1967
Casing Type:
Casing Joint:
Diameter: 14.00 in. to

Bore Diameter 1:
Bore Diameter 2:
Bore Diameter 3:
Height:
Casing Fitting:

Pump Installed: No
Pump Installation only:
Pump Installation date:
HP:
Manufacturer:
Pump Type:
Model Number:
Pump Capacity:
Length of Drop Pipe:
Id of Well:
Diameter of Drop Pipe:
Draw Down Seal Used:

Pressure Tank Installed: No
Pressure Tank Type:
Manufacturer:
Model Number :
Tank Capacity : Gallons
Pressure Relief Valve Installed : No

Static Water Level:
Yield Test Method:
Measurement Taken During Pump Test:

Abandoned Well Plugged: No
Reason for not plugging Well:
Abandoned well ID:

Formation Description	Thickness	Depth to Bottom

Screen Installed: No
Well Intake:
Filter Packed:
Screen Diameter:
Length:
Screen Material Type:
Slot:
Blank:
Fittings:

Well Grouted: No
Grouting Method:
No. of Bags:
Additives:
Grouting Materials:

Well Head Completion: 12 inches above grade, Other

Geology Remarks:

Nearest source of possible contamination:
Type
Distance
Direction

Contractor Type:
Registration Number:
Business Name:
Business Address:

Drilling Machine Operator Name: KLEIMAN

Employment:

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
Well Head Completion:

EQP 2017C (2/2000)

ATTENTION WELL OWNER: FILE WITH DEED

2/17/2004 10:47

WATER WELL AND PUMP RECORD

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

Well A

Well ID: 52000005037

Failure to comply is a misdemeanor.

Tax No:	Permit No:	County: Marquette	Township: Richmond

Fraction:	Section:	Town/Range:	WSSN:	Source ID/Well No:
NE¼ SE¼ SE¼	30	47N 26W	2007252	001

Well ID: 52000005037

Elevation: 1302 ft

Latitude: 46.44267

Longitude: -87.59526

Distance and Direction from Road Intersection:

Well Owner: Empire Mine

Well Address:
Empire Ine Rd
Palmer MI 49871

Owner Address:
P.O. Box 38
Palmer MI 49871

Drilling Method: Unknown

Well Depth: 49.00 ft. | Well Use: Type II public

Well Type: New | Date Completed: 11/11/1962

Casing Type:
Casing Joint:
Diameter: 12.00 in. to

Bore Diameter 1:
Bore Diameter 2:
Bore Diameter 3:
Height:
Casing Fitting:

Pump Installed: No
Pump Installation date:
Manufacturer:
Model Number:
Length of Drop Pipe:
Diameter of Drop Pipe:
Draw Down Seal Used:

Pump Installation only:
HP:
Pump Type:
Pump Capacity:
id of Well:

Pressure Tank Installed: No
Pressure Tank Type:
Manufacturer:
Model Number :
Tank Capacity : Gallons
Pressure Relief Valve Installed : No

Static Water Level:
Yield Test Method:
Measurement Taken During Pump Test:

Abandoned Well Plugged: No
Reason for not plugging Well:

Abandoned well ID:

Formation Description	Thickness	Depth to Bottom

Screen Installed: No | Well Intake:
Filter Packed:
Screen Diameter: | Length:
Screen Material Type:
Slot:
Blank:
Fittings:

Well Grouted: No | Grouting Method:
No. of Bags: | Additives:
Grouting Materials:

Well Head Completion: 12 inches above grade, Other

Geology Remarks:

Nearest source of possible contamination:
Type | Distance | Direction

Contractor Type:
Registration Number:
Business Name:
Business Address:

Drilling Machine Operator Name: HAKALA

Employment:

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.

HAKALA

Signature of Registered Contractor | Date

General Remarks:

OTHER REMARKS Well Head Completion:

EQP 2017C (2/2000)

ATTENTION WELL OWNER: FILE WITH DEED

2/17/2004 10:47

EMPIRE WELLHEAD 76-057

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

WATER WELL AND PUMP RECORD

GEOLOGICAL SURVEY NO.

PERMIT NUMBER

1 LOCATION OF WELL

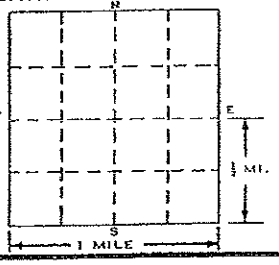
County	Township Name	Fraction	Section Number	Town Number	Range Number
Marquette	Richmond	¼ ¼ ¼		N/S	E/W

Distance And Direction From Road Intersection: "C" Well

Street Address & City of Well Location

Locate with "X" in Section Below

Sketch Map:



2 FORMATION DESCRIPTION

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Dirty silty gravel & boulders	20	20
Gravel, sand, clay lenses	10	30
Gravel, boulders, red clay lenses	16	46
Clean gravel & boulders	30	76

USE A 2ND SHEET IF NEEDED

3 OWNER OF WELL:

Address: Empire Mine, The Cleveland-Cliffs Iron Co., Negaunee, MI

Address Same As Well Location? [X] Yes [ ] No

4 WELL DEPTH:

76 FT. Date Completed: MO. 10 DAY ___ YEAR 79 [X] New Well [ ] Replacement Well

5

[ ] Cable tool [X] Rotary [ ] Driven [ ] Dug
[ ] Hollow rod [ ] Auger [ ] Jetted [ ] ___

6 USE:

[X] Domestic [ ] Type I Public [ ] Type III Public
[ ] Irrigation [ ] Type IIa Public [ ] Heat pump
[ ] Test Well [ ] Type IIb Public [ ] ___

7 CASING:

Diameter [X] Steel [ ] Threaded
[ ] Plastic [X] Welded

14 in. to 46 ft. depth
___ in. to ___ ft. depth

Grouted Drill Hole Diameter
___ in. to ___ ft. depth
___ in. to ___ ft. depth

Height: Above/Below
Surface 2 ft.
Weight 63.37 lbs./ft

Drive Shoe [ ] Yes [X] No

8 SCREEN:

[ ] Not Installed

Type #304 SS Diameter 14"
Slot/Gauze 150 Length 30'
Set between 46 ft and 76 ft

FITTINGS: [X] K-Packer [ ] Lead Packer [ ] Bremer Check
[ ] Blank above screen ___ ft. Other ___

9 STATIC WATER LEVEL:

15'-5" ft. below land surface [ ] Flow

10 PUMPING LEVEL: below land surface

30 ft. after 2 hrs. pumping at 403 G.P.M.
___ ft. after ___ hrs. pumping at ___ G.P.M.

11 WELL HEAD COMPLETION:

[ ] Pitless adapter [X] 12" above grade
[ ] Basement offset [ ] Approved pit

12 WELL GROUTED?

[X] No [ ] Yes From ___ to ___ ft

[ ] Neat cement [ ] Bentonite [ ] Other ___

No. of bags of cement ___ Additives ___

13 Nearest source of possible contamination

Type ___ Distance ___ ft. Direction ___

Well disinfected upon completion? [ ] Yes [ ] No

Was old well plugged? [ ] Yes [ ] No

14 PUMP:

[ ] Not Installed [ ] Pump Installation Only

Manufacturer's name Pleuger

Model number PN82-50 HP 60 Volts 460

Length of Drop Pipe 63'-4" ft. capacity ___ G.P.M.

TYPE: [X] Submersible [ ] Jet

PRESSURE TANK:

Manufacturer's name ___

Model number ___ Capacity ___ Gallons

15. Remarks, elevation, source of data, etc.

16 WATER WELL CONTRACTOR'S CERTIFICATION:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Kleiman Pump & Well Drilling, Inc. 057
REGISTERED BUSINESS NAME REGISTRATION NO.

Address P.O. Box 1704, Iron Mountain, MI

Signed ___ Date
AUTHORIZED REPRESENTATIVE

Authority:

17. Rig Operator's Name:

Dean Neuens

D67d 2/89

TAX NO:

MICHIGAN DEPARTMENT OF PUBLIC HEALTH
WATER WELL AND PUMP RECORD

PERMIT NO:

1. LOCATION OF WELL

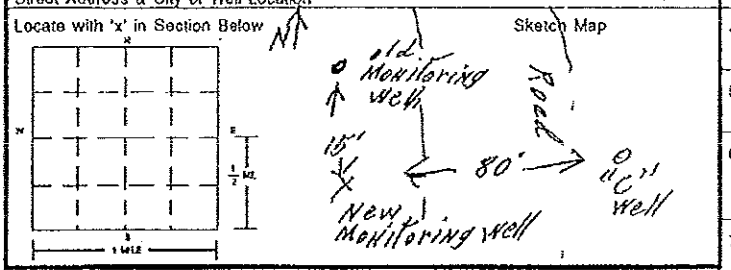
County	Township Name	Fraction	Section No.	Town No.	Range No.
Marquette	Richmond	1/4 1/4 1/4			

Distance and Direction from Road Intersection: "O" Well

Street Address & City of Well Location

Locate with 'x' in Section Below

Sketch Map



3. OWNER OF WELL Empire Iron Mine
Address P.O. Box 38
Palmer MI. 49871
Address Same as Well Location ☒ Yes ☐ No

4. WELL DEPTH: 66' ft. Date Completed 9/3/98 ☒ New Well ☐ Replacement Well

5. ☐ Cable Tool ☒ Rotary ☐ Driven ☐ Dug ☐ Hollow Rod ☐ Auger/Bored ☐ Jetted ☐ ____

6. USE: ☐ Household ☐ Type I Public ☐ Type III Public ☐ Irrigation ☐ Type IIa Public ☐ Heat Pump ☐ Test Well ☐ Type IIb Public ☐ Monitoring

7. CASING: ☒ Steel ☐ Threaded ☒ Plastic ☐ Welded ☐ Other ____
Steel Diameter: 6" in. to 6 ft. depth
Plastic 2" in. to 46 ft. depth
BORE HOLE: Diameter: 6" in. to 60 ft. depth; 6 in. to 70 ft. depth
Height: Above/Below Surface: 1-6 ft. Steel; 1 PVC
Weight: ____ lbs./ft.
☐ Drive Shoe ☐ Shale Packer

8. SCREEN: ☐ Not Installed ☒ Gravel-Packed
Type PVC Diameter 2"
Slot/Gauze 10 Slot Length: 20'
Set Between 46 ft. and 66 ft.
FITTINGS: ☐ K-Packer ☐ Bremer Check
☒ Blank Above Screen 46 ft. Other ____

9. STATIC WATER LEVEL: 17 ft. Below Land Surface ☐ Flowing

10. PUMPING LEVEL: Below Land Surface 40 ft. After 1 hrs. Pumping at 5 G.P.M.
☐ Plunger ☐ Bailer ☒ Air ☐ Test Pump

11. WELL HEAD COMPLETION: ☐ Pitless Adapter ☒ 12" Above Grade ☐ Basement Offset ☐ Well House

12. WELL GROUTED? ☐ No ☒ Yes From 0 to 41 ft.
☒ Neat Cement ☐ Bentonite ☐ Other ____
No. of Bags 8 Additives ____

13. NEAREST SOURCE OF POSSIBLE CONTAMINATION:
Type ____ Distance ____ ft. Direction ____
Type ____ Distance ____ ft. Direction ____

14. PUMP: ☐ Not Installed ☐ Pump Installation Only
Manufacturer's Name ____
Model Number ____ HP ____ Volts ____
Length of Drop Pipe ____ ft. Capacity ____ G.P.M.
TYPE: ☐ Submersible ☐ Jet ☐ Other ____
PRESSURE TANK:
Manufacturer's Name ____
Model Number ____ Capacity ____ Gallons ____

2. FORMATION DESCRIPTION

	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Boulders	4'	4'
Silty Gravel	26	30
Red clay Gravel	15'	45
Course sand & Gravel	15'	60'
Broken Gray Rock	5'	65'
Gray Iron Ore	7'	72'

USE A 2ND SHEET IF NEEDED

15. ABANDONED WELL PLUGGED? ☐ Yes ☐ No
Casing Diameter ____ in. Depth ____ ft.
PLUGGING MATERIAL: ☐ Neat Cement ☐ Bentonite Slurry ☐ Cement/Bentonite Slurry ☐ Concrete Grout ☐ Bentonite Chips
No. of Bags ____ Casing Removed? ☐ Yes ☐ No

16. REMARKS: (Elevation, Source of Data, etc.)

17. DRILLING MACHINE OPERATOR:
☒ Employee ☐ Subcontractor
Name William Bredeson

15. WATER WELL CONTRACTOR'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Kleiman Pump & Well Drilling INC 2020
REGISTERED BUSINESS NAME REGISTRATION NO
Address P.O. Box 704 Iron Mtn. MI 49801
Signed William Bredeson Date 9-4-98
AUTHORIZED REPRESENTATIVE

GW-2-228 9/93

IMPORTANT: File with deed.

WELL OWNER COPY

Authority: Act 368 PA 1978 Completion: Required
Penalty: Conviction of a violation of any provision is a misdemeanor.

WATER WELL AND PUMP RECORD

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

Failure to comply is a misdemeanor.

Well ID: 52000002655 **Import ID:** 52472630004

Tax No:	Permit No:	County: Marquette	Township: Richmond

Fraction:	Section:	Town/Range:	WSSN:	Source ID/Well No:
SW¼ NE¼ NE¼	30	47N 26W		

Well ID: 52000002655

Elevation: 1300 ft

Latitude: 46.4448466821

Longitude: -87.5968155211

Distance and Direction from Road Intersection:

Well Owner: Empire Mine

Well Address:
PALMER MI 49871

Owner Address:
P.O. BOX 38
PALMER MI 49871

Drilling Method: Rotary
Well Depth: 102.00 ft. **Well Use:** Unknown
Well Type: Replacement **Date Completed:** 1/21/1981
Casing Type: Unknown
Casing Joint: Welded
Diameter: 6.00 in. to 40.10 ft. depth

Bore Diameter 1:
Bore Diameter 2:
Bore Diameter 3:
Height: 1.60 ft. above grade
Casing Fitting: Drive shoe

Pump Installed: Yes **Pump Installation only:** No
Pump Installation date: **HP:**
Manufacturer: Grundfos **Pump Type:** Submersible
Model Number: **Pump Capacity:** 0.00 GPM
Length of Drop Pipe: 98.00 ft. **Id of Well:**
Diameter of Drop Pipe:
Draw Down Seal Used: No

Pressure Tank Installed: No
Pressure Tank Type:
Manufacturer:
Model Number : **Tank Capacity :** Gallons
Pressure Relief Valve Installed : No

Static Water Level: 32.00 ft. Below Grade(Not Flowing)
Yield Test Method: Unknown
Measurement Taken During Pump Test:
100.00 ft. after 1.00 hrs. pumping at 1.00 GPM

Abandoned Well Plugged: No
Reason for not plugging Well:
Abandoned well ID:

Formation Description	Thickness	Depth to Bottom
Lithology Unknown Fill	40.00	40.00
Slate	62.00	102.00

Screen Installed: No **Well Intake:** Unknown
Filter Packed:
Screen Diameter: **Length:**
Screen Material Type:
Slot:
Blank:
Fittings:

Geology Remarks: 1. [FILL] [40] [40] 2. [SLATE] [102] [62]

Well Grouted: No **Grouting Method:**
No. of Bags: **Additives:**
Grouting Materials:

Well Head Completion: 12 inches above grade, Other

Nearest source of possible contamination:

Type	Distance	Direction
None		

Contractor Type: Unknown
Registration Number: 575
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**

Drilling Machine Operator Name:

Employment: Unknown

General Remarks:
OTHER REMARKS **Well Head Completion:** 12 inch Above Grade

EQP 2017C (2/2000)

ATTENTION WELL OWNER: FILE WITH DEED

2/18/2000 03:50

WATER WELL AND PUMP RECORD

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

Well ID: 52000002656 — Failure to comply is a misdemeanor. — **Import ID:** 52472630005

Tax No:	Permit No:	County: Marquette	Township: Richmond

Fraction:	Section:	Town/Range:	WSSN:	Source ID/Well No:
SE¼ SW¼ NE¼	30	47N 26W		

Well ID: 52000002656

Elevation: 1300 ft

Latitude: 46.4430918728

Longitude: -87.5984400787

Distance and Direction from Road Intersection:

Well Owner: Empire Mine

Well Address: PALMER MI 49871

Owner Address: P.O.BOX 38 PALMER MI 49871

Drilling Method: Rotary
Well Depth: 353.00 ft. **Well Use:** Household
Well Type: Replacement **Date Completed:** 2/28/1989

Casing Type: Steel - black
Casing Joint: Welded
Diameter: 4.00 in. to 182.00 ft. depth

Bore Diameter 1: 6.00 in. to 200.00 ft. depth
Bore Diameter 2:
Bore Diameter 3:
Height: 1.00 ft. above grade
Casing Fitting: None

Pump Installed: No
Pump Installation date:
Manufacturer:
Model Number:
Length of Drop Pipe:
Diameter of Drop Pipe:
Draw Down Seal Used:
Pump Installation only:
HP:
Pump Type:
Pump Capacity:
Id of Well:

Pressure Tank Installed: No
Pressure Tank Type:
Manufacturer:
Model Number :
Tank Capacity : Gallons
Pressure Relief Valve Installed : No

Static Water Level: 27.00 ft. Below Grade(Not Flowing)
Yield Test Method: Unknown
Measurement Taken During Pump Test:
350.00 ft. after 1.00 hrs. pumping at 8.00 GPM

Abandoned Well Plugged: No
Reason for not plugging Well:

Abandoned well ID:

Formation Description	Thickness	Depth to Bottom
Interval Not Sampled	102.00	102.00
Gray Slate Soft	18.00	120.00
Greenstone Hard	88.00	208.00
Gray Slate Soft	22.00	230.00
Red Iron Formation	25.00	255.00
Greenstone Hard	25.00	280.00
Red Iron Formation	10.00	290.00
Greenstone Hard	40.00	330.00
Red Iron Formation	23.00	353.00

Screen Installed: No **Well Intake:** Unknown
Filter Packed:
Screen Diameter: **Length:**
Screen Material Type:
Slot:
Blank:
Fittings:

Well Grouted: Yes **Grouting Method:** Unknown
No. of Bags: **Additives:** None
Grouting Materials:
Neat cement From 18.00 ft. to 200.00 ft.

Well Head Completion: Unknown

Geology Remarks: 1. [STARTED DRILLING] [102] [102] 2. [SOFT GRAY SLATE] [120] [18] 3. [HARD GREENSTONE] [208] [88] 4. [SOFT GRAY SLATE] [230] [22] 5. [RED IRON ORE] [255] [25] 6. [HARD GREENSTONE] [280] [25] 7. [RED IRON ORE] [290] [10] 8. [HARD GREENSTONE] [330] [40] 9. [RED ORE] [353] [23]

Nearest source of possible contamination:

Type	Distance	Direction
None		

Contractor Type: Unknown
Registration Number: 575
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**

Drilling Machine Operator Name: WILLIAM BROEDERS/MARK SUVENSKI
Employment: Unknown

General Remarks: OLD WELL WAS HIGH IN IRON WE CEMENTED IN A LINER AND DRILLED ON DOWN

OTHER REMARKS

EQP 2017C (2/2000)

ATTENTION WELL OWNER: FILE WITH DEED

2/18/2000 03:50

WATER WELL AND PUMP RECORD

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

Well ID: 52000002657 — Failure to comply is a misdemeanor. — **Import ID:** 52472630006

Tax No:	Permit No:	County: Marquette	Township: Richmond

Well ID: 52000002657

Elevation: 1300 ft

Latitude: 46.4426684368

Longitude: -87.6009632574

Fraction:	Section:	Town/Range:	WSSN:	Source ID/Well No:
SW¼ SW¼ NE¼	30	47N 26W		

Distance and Direction from Road Intersection:

Well Owner: Empire Mine

Well Address: PALMER MI 49871

Owner Address: P.O.BOX 38, PALMER MI 49871

Drilling Method: Rotary
Well Depth: 123.00 ft. **Well Use:** Unknown
Well Type: Replacement **Date Completed:** 3/29/1979
Casing Type: Unknown
Casing Joint: Welded
Diameter: 6.00 in. to 49.80 ft. depth

Bore Diameter 1:
Bore Diameter 2:
Bore Diameter 3:
Height: 1.00 ft. above grade
Casing Fitting: Drive shoe

Pump Installed: Yes **Pump Installation only:** No
Pump Installation date: **HP:**
Manufacturer: Other **Pump Type:** Submersible
Model Number: **Pump Capacity:** 0.00 GPM
Length of Drop Pipe: 120.00 ft. **Id of Well:**
Diameter of Drop Pipe:
Draw Down Seal Used: No

Pressure Tank Installed: No
Pressure Tank Type:
Manufacturer:
Model Number : **Tank Capacity :** Gallons
Pressure Relief Valve Installed : No

Static Water Level: 25.00 ft. Below Grade(Not Flowing)
Yield Test Method: Unknown
Measurement Taken During Pump Test:
100.00 ft. after 24.00 hrs. pumping at 6.00 GPM

Abandoned Well Plugged: No
Reason for not plugging Well:
Abandoned well ID:

Formation Description	Thickness	Depth to Bottom
Unidentified Consolidated Fm Fill	28.00	28.00
Hardpan W/Gravel W/Boulders	15.00	43.00
Red See Comments Fractured	40.00	83.00
Iron Formation	22.00	105.00
Blue Iron Formation	18.00	123.00

Screen Installed: No **Well Intake:** Unknown
Filter Packed:
Screen Diameter: **Length:**
Screen Material Type:
Slot:
Blank:
Fittings:

Well Grouted: No **Grouting Method:**
No. of Bags: **Additives:**
Grouting Materials:

Well Head Completion: Pitless adapter

Geology Remarks: 1. [ROCK FILL AND DIRT] [28] [28] 2. [GRAVEL HARPAN, BOULDERS] [43] [15] 3. [RED HEMATIE-FRACTURED TIGHT RED AND BLUE HEMATIE] [83] [40] 4. [IRON FROM] [105] [22] 5. [BLUE IRON FROM] [123] [18]

Nearest source of possible contamination:

Type	Distance	Direction
None		

Contractor Type: Unknown
Registration Number: 575
Business Name:
Business Address:

Drilling Machine Operator Name:

Employment: Unknown

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.

Kleiman

Signature of Registered Contractor **Date**

General Remarks:
OTHER REMARKS **Pump Manufacturer:** REDA

EQP 2017C (2/2000)

ATTENTION WELL OWNER: FILE WITH DEED

2/18/2000 03:50

WATER WELL AND PUMP RECORD

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

Failure to comply is a misdemeanor.

Well ID: 52000005039

Tax No:	Permit No: 710061	County: Marquette	Township: Tilden

Fraction:	Section:	Town/Range:	WSSN:	Source ID/Well No:
SE¼ SW¼ NW¼	26	47N 27W	2007452	001

Well ID: 52000005039

Elevation: 1385 ft

Latitude: 46.43694

Longitude: -87.64241

Distance and Direction from Road Intersection:

Well Owner: Cleveland Cliffs Iron Company

Well Address:
TILDEN MINE
NATIONAL MINE MI

Owner Address:
500 DIVISION STREET
ISHPEMING MI 49849

Drilling Method: Cable Tool
Well Depth: 69.00 ft. Well Use: Type II public
Well Type: New Date Completed: 12/13/1971
Casing Type: Steel - black
Casing Joint: Threaded & coupled
Diameter: 6.00 in. to 57.00 ft. depth

Bore Diameter 1:
Bore Diameter 2:
Bore Diameter 3:
Height: 3.00 ft. above grade
Casing Fitting: Drive shoe

Pump Installed: No
Pump Installation date:
Manufacturer:
Model Number:
Length of Drop Pipe:
Diameter of Drop Pipe:
Draw Down Seal Used:
Pump Installation only:
HP:
Pump Type:
Pump Capacity:
Id of Well:

Pressure Tank Installed: No
Pressure Tank Type:
Manufacturer:
Model Number :
Tank Capacity : Gallons
Pressure Relief Valve Installed : No

Static Water Level: 6.60 ft. Below Grade(Not Flowing)
Yield Test Method: Unknown
Measurement Taken During Pump Test:
41.50 ft. after 6.00 hrs. pumping at 190.00 GPM

Abandoned Well Plugged: No
Reason for not plugging Well:

Abandoned well ID:

Screen Installed: Yes Well Intake:
Filter Packed: No
Screen Diameter: 6.00 in. Length: 13.00 ft.
Screen Material Type: Stainless steel-wire wrapped
Slot: 16.00 in. Set Between 57.00 ft. and 69.40 ft.
Blank:
Fittings:
Other

Well Grouted: No Grouting Method:
No. of Bags: Additives:
Grouting Materials:

Well Head Completion: 12 inches above grade, Other

Nearest source of possible contamination:

Type	Distance	Direction
Unknown		
Unknown		

Drilling Machine Operator Name: KLEIMAN

Employment: Employee

Formation Description	Thickness	Depth to Bottom
See Comments	6.00	6.00
Gravel Sandy	7.00	13.00
Sand Silty	4.00	17.00
Red Sand	2.00	19.00
Red Sand W/Gravel	1.00	20.00
Sand Coarse	2.50	22.50
Sand W/Gravel	5.00	27.50
Sand Medium	2.50	30.00
Tan Sand W/Gravel	2.00	32.00
Sand Fine	2.00	34.00
Red Sand Fine	7.90	41.90
Tan Sand Fine	3.10	45.00
Red Sand Fine	8.00	53.00
Red Sand Coarse	3.00	56.00
Sand Coarse	1.00	57.00
Sand	6.00	63.00
Sand Fine	4.00	67.00
Sand Coarse W/Stones	2.30	69.30
Sand Fine	4.10	73.40
Red Sand Fine	4.30	77.70
Red Sand Fine W/Clay	3.00	80.70
See Comments	3.40	84.10

(Continued on Page 2)

EQP 2017C (2/2000)

ATTENTION WELL OWNER: FILE WITH DEED

2/17/2004 10:47

WATER WELL AND PUMP RECORD

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

Failure to comply is a misdemeanor.

Well ID: 52000005039

Tax No:	Permit No: 710061	County: Marquette	Township: Tilden

Fraction:	Section:	Town/Range:	WSSN:	Source ID/Well No:
SE¼ SW¼ NW¼	26	47N 27W	2007452	001

Well ID: 52000005039

Elevation: 1385 ft

Latitude: 46.43694

Longitude: -87.64241

Distance and Direction from Road Intersection:

Well Owner: Cleveland Cliffs Iron Company

Well Address:
TILDEN MINE
NATIONAL MINE MI

Owner Address:
500 DIVISION STREET
ISHPEMING MI 49849

(Continued from Page 1)

Formation Description	Thickness	Depth to Bottom

Geology Remarks: [1] TILL [6] 0.0180"-00.020" [7] 0.010" [8] 0.012", PRESSURE [9] 0.016" [10] 0.014", PRESSURE [12] 0.0080" - 0.010" [15] BECOMING CLEANER, 0.020" - 0.024" [16] VERY CLEAN, 0.018" - 0.050" [17] VERY CLEAN, FINER, 0.014" - 0.016' [18] VERY CLEAN, 0.020" - 0.024' [19] DIRTIER, 0.018" [20] FINER DIRTIER SAND, SLOW, 0.008" [22] RED HEMATITIE WITH CLAY SMEARS

Contractor Type: Water well drilling contractor
Registration Number: 575
Business Name: KLEIMAN PUMP & WELL DRILLING
Business Address: P.O. BOX 704, IRON MOUNTAIN, MI

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: EXCELLANT WATER QULAITY SEE 12/13/71 POWERS LAB ANALAYSIS REUSLTS

OTHER REMARKS **Screen Fittings:** SCREWED WITH LEAD PACKER **Well Head Completion:**

EQP 2017C (2/2000)

ATTENTION WELL OWNER: FILE WITH DEED

2/17/2004 10:47

WATER WELL AND PUMP RECORD

Completion is required under authority of Part 127 Act 368 PA 1978.
Failure to comply is a misdemeanor.

Well ID: 52000005040

Tax No:	Permit No: 790110	County: Marquette	Township: Tilden

Fraction:	Section:	Town/Range:	WSSN:	Source ID/Well No:
SE¼ SW¼ NW¼	26	47N 27W	2007452	002

Well ID: 52000005040

Elevation: 1385 ft

Latitude: 46.43671

Longitude: -87.64209

Distance and Direction from Road Intersection:

Well Owner: Cleveland Cliffs Iron Company

Well Address:
TILDEN MINE
NATIONAL MINE MI

Owner Address:
500 DIVISION STREET
ISHPEMING MI 49849

Drilling Method: Cable Tool
Well Depth: 108.50 ft. Well Use: Type II public
Well Type: New Date Completed: 3/1/1979
Casing Type: Steel - black
Casing Joint: Welded
Diameter: 12.00 in. to 75.60 ft. depth

Bore Diameter 1: 12.00 in. to 108.50 ft. depth
Bore Diameter 2:
Bore Diameter 3:
Height: 2.00 ft. above grade
Casing Fitting: Drive shoe

Pump Installed: Yes
Pump Installation date:
Manufacturer:
Model Number: PN63-11
Length of Drop Pipe: 93.00 ft.
Diameter of Drop Pipe:
Draw Down Seal Used: No

Pump Installation only: No
HP: 20.00
Pump Type: Submersible
Pump Capacity: 200.00 GPM
Id of Well:

Pressure Tank Installed: No
Pressure Tank Type:
Manufacturer:
Model Number :
Tank Capacity : Gallons
Pressure Relief Valve Installed : No

Static Water Level: 37.00 ft. Below Grade(Not Flowing)
Yield Test Method: Unknown
Measurement Taken During Pump Test:
73.60 ft. after 2.50 hrs. pumping at 410.00 GPM

Abandoned Well Plugged: No
Reason for not plugging Well:
Abandoned well ID:

Formation Description	Thickness	Depth to Bottom
See Comments	20.00	20.00
Sand W/Clay Fine	25.00	45.00
Sand W/Silt	5.00	50.00
Sand Clayey Fine	23.00	73.00
Sand Coarse	2.00	75.00
Red Sand Fine	2.00	77.00
Sand Medium	18.00	95.00
Sand Medium W/Gravel	5.00	100.00
Clay & Gravel Silty	4.00	104.00
No Lithology Information	4.50	108.50

Screen Installed: Yes Well Intake:
Filter Packed: No
Screen Diameter: 12.00 in. Length: 35.00 ft.
Screen Material Type: Stainless steel-wire wrapped
Slot: 10.00 in. Set Between 73.50 ft. and 108.50 ft.
Blank:
Fittings:
Other

Geology Remarks: [1] FILL DIRT [5] CLEAN [7] FAIRLY CLEAN, 14-16 SLOT

Well Grouted: No Grouting Method:
No. of Bags: Additives.
Grouting Materials:

Well Head Completion: 12 inches above grade, Other, Pitless adapter

Nearest source of possible contamination:
Type Distance Direction
None

Contractor Type: Water well drilling contractor
Registration Number: 575
Business Name: KLEIMAN PUMP & WELL DRILLING
Business Address: P.O. BOX 704, IRON MOUNTAIN, MI

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

Drilling Machine Operator Name: KLEIMAN
Employment: Unknown

General Remarks: #304 STAINLESS STEEL SCREEN IS MULTI-SLOT: 10, 12, & 14 SLOT

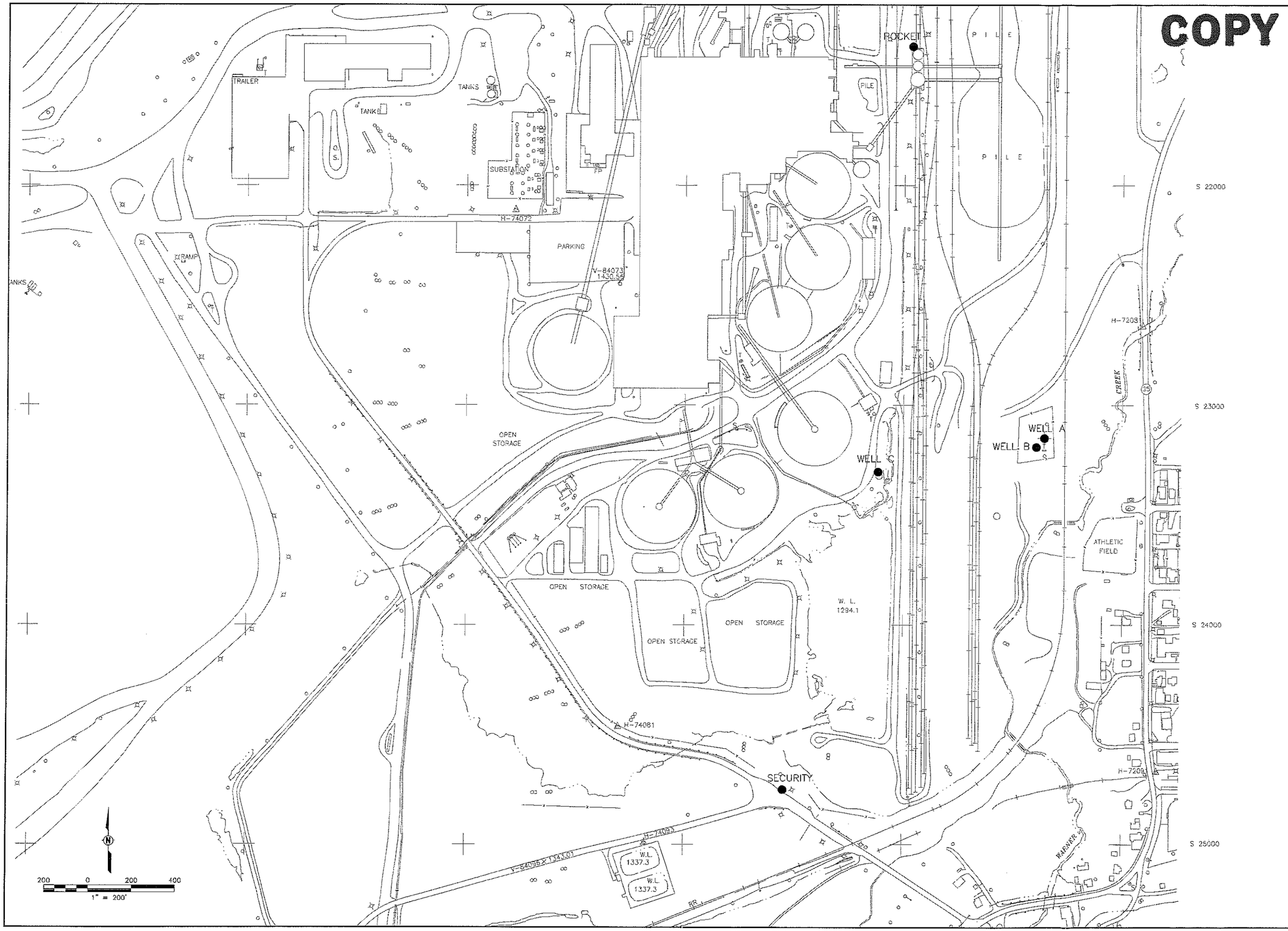
OTHER REMARKS Screen Fittings: FIGURE K PACKER, BAIL BUTT Well Head Completion:

EQP 2017C (2/2000)

ATTENTION WELL OWNER: FILE WITH DEED

2/17/2004 10:47

Chuck Thomas



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EMPIRE MINE SITE PLAN

Issued

Rev	Date	Description

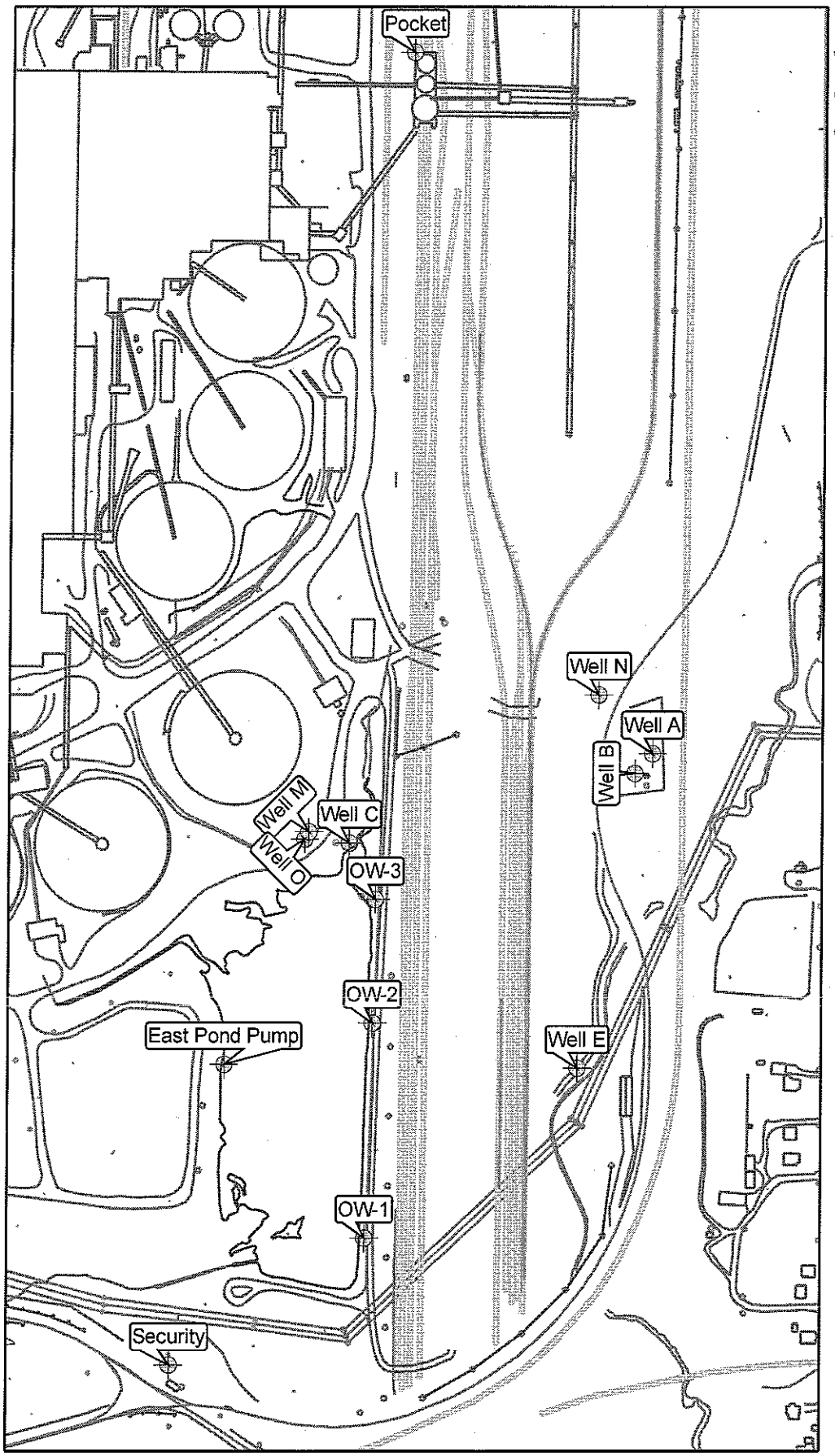
Designed: -
Drawn: -
Checked: -
Approved: -

PROJECT NUMBER
1

SHEET REFERENCE NUMBER
1

From Brent Kitenbuger, CNR 9/09
9/25/09

X:\projects\200700372\CAD\Empire_Mine_Site_Plan.dwg; 9/10/2009 12:06:34 PM; PARKINSON, ANTHONY; STS.stb



EMPIRE WELLHEADS, OBSERVATION WELLS, & EAST POND PUMP

0 125 250 500 750 1,000 Feet

scale approximate

Received from CNR via email 11/3/2009 CGT

EMPIRE MINE
PALMER, MI

Drawn By: RB
Checked by: CG
Date: 11/3/09

APPENDIX B

Table 3: Selenium Analysis Results from Marquette County Wells - 1983 to the Present

TABLE 3: SELENIUM ANALYSIS RESULTS IN MARQUETTE COUNTY SINCE 1983

collectDate	township	section	wellNo	owner	street	city	result	detect
13-Nov-01	Sands		001	Reinhart Foods	881 County Road 480	Marquette	0.001	0.001
07-Feb-01	Richmond	30	5	Richmond Township		Palmer	0.001	0.001
20-Sep-99				REPUBLIC TWP WATER DEPT	Plant Tap	Republic	0.001	0.005
22-Apr-97			1	Ishpeming Township	Poplar Street	Ishpeming Twp	0.001	0.005
6-Oct-00	Negaunee		NEW	TAMMY LIUPAKKA	488 M-35 East	Negaunee	0.001	0.005
28-Feb-00	Water Plant			AUTH	1800 North Road	Ishpeming	0.001	0.005
20-Apr-01	Marquette			WAYNE MORSE	99 Co Road 550	Marquette	0.001	0.001
14-Oct-97	Chocolay		3	MANGUM PRISON FARM	Basil Road	Marquette	0.001	0.005
01-May-01	Marquette			MARK CAMERER	99 A Co Road 550	Marquette	0.001	0.001
29-Jan-04			4	Richmond Township	M-35 South	Palmer	0.001	0.001
20-Dec-99	Chocolay			Ojibwa Housing Authority	103 Keweenaw Trail	Harvey	0.001	0.005
29-Sep-04			2	Richmond Township	Co Road M B M-35	Palmer	0.001	0.001
04-Feb-98	Richmond	30	A	Empire IRON Mine PARTNERSHIP	Empire Mine Road	Palmer	0.001	0.005
21-Jun-05	CHOCOLAY				105 ACRE TRL	MARQUETTE	0.001	0.001
29-Oct-97	Richmond	30	A	EMPIRE MINING PARTNERSHIP	Empire Mine Road	Palmer	0.002	0.005
22-Jun-04					3145 Co Road P6	Ishpeming	0.002	0.001
09-Dec-97	Tilden	26	001	TILDEN MINE	Located 2 Mi South of	Ishpeming	0.002	0.005
05-Nov-07	RICHMOND	30	001	PARTNERSHIP	EMPIRE MINE ROAD	PALMER	0.002	0.001
22-Mar-01	Richmond	30	5B	Richmond Township		Palmer	0.002	0.001
07-Jun-04	Chocolay	28		BILL FETTERHOFF	304 Brookwood	Marquette	0.002	0.001
20-Dec-00	Chocolay			OJIBWA HOUSING AUTH.	102 Ojibwa Trail	Harvey	0.003	0.005
21-Mar-05	Tilden	26	001	TILDEN MINE	Located 2 Miles South of	Ishpeming	0.003	0.001
14-Jan-03	Tilden	21	2	TILDEN TOWNSHIP			0.003	0.001
27-Nov-00	Tilden	26	001	TILDEN MINE	Located 2 Miles South of	Ishpeming	0.003	0.005
28-May-04			001	EMPIRE MINE	EMPIRE MINE ROAD	PALMER	0.003	
28-May-04			001	EMPIRE MINE	EMPIRE MINE ROAD	PALMER	0.004	
16-Sep-94	RICHMOND	30	C	EMPIRE IRON MINING PARNERSHIP	EMPIRE MINE	PALMER	0.014	0.005
29-Mar-90			001	EMPIRE MINE	WELL C		0.014	0.005
03-Dec-96	RICHMOND	30	C	EMPIRE MINE	EMPIRE MINE RD.	PALMER	0.044	0.005
29-Oct-97	Richmond		C	PARTNERSHIP	Empire Mine Road	Palmer	0.055	0.005
04-Dec-97	Richmond	30	C	Roberts	Empire Mine Road	Palmer	0.060	0.005
04-Feb-98	Richmond	30	C	PARTNERSHIP	Empire Mine Road	Palmer	0.114	0.005

Prepared by: Chuck Thomas
MDEQ - Water Bureau

October 26, 2009

TABLE 3: SELENIUM ANALYSIS RESULTS IN MARQUETTE COUNTY SINCE 1983

collectDate	township	section	wellNo	owner	street	city	result	detect
20-Jan-84				ACOCKS MED. CARE FACILITY	ACOCKS DR.	MARQUETTE	<0.002	0.002
24-Jul-83				CITY OF NEGAUNEE	TW-7[CCI PROPERTY]	NEGAUNEE	<0.002	0.002
18-Sep-83				CITY OF NEGAUNEE	TW 7C	NEGAUNEE	<0.002	0.002
14-Jun-84				FORSYTH TWP.	WELL #3 HOUSE #4	GWINN	<0.002	0.002
27-Sep-83				GASPAR	US-41	HARVEY	<0.002	0.002
15-Mar-83				GWINN	TWP HALL	FORSYTH	<0.002	0.002
27-Sep-83				HLINAK	US-41 SILVER CR. RD.	HARVEY	<0.002	0.002
14-Jun-84				K I SAWYER AFB	BLDG. 531		<0.002	0.002
22-Aug-84				MARQUETTE	1951 US-41 W.	MARQUETTE	<0.002	0.002
27-Jun-83				NEGAUNEE	SEWAGE PLANT	NEGAUNEE	<0.002	0.002
22-Jul-83				POWELL TOWNSHIP	COUNTY RD. 550 S.	BIG BAY	<0.002	0.002
20-Jun-84				US FOREST SERVICE	DUKES EXP. STA.	SKANDIA	<0.002	0.002
09-Jan-85				BARRY-SANDS MHP	CO.RD. 553	SANDS	<0.004	0.004
09-Jan-85				BIARCHI-4 KORNERS MHP	CO.RD. 553	GWINN	<0.004	0.004
18-Apr-85				BLAKE	71 BROOKWOOD LN.	MARQUETTE	<0.004	0.004
07-Sep-85				CITY OF NEGAUNEE	JACKSON ST	NEGAUNEE	<0.004	0.004
14-Oct-84				CITY OF NEGAUNEE-3RD	WELL #18	NEGAUNEE	<0.004	0.004
09-Jan-85				DAHLSTROM-LAKE HAVEN MHP	M-35	LITTLE LAKE	<0.004	0.004
27-Aug-85				NEGAUNEE TWP	WELL 2	NEGAUNEE	<0.004	0.004
25-Oct-84				SCANDIA-21 HRS.	FIRE STATION NEW WELL		<0.004	0.004
05-Oct-84				TILDEN TWP.	WELL #1	MINE	<0.004	0.004
09-Jan-85				WIRKULA-553 MOBILE ESTATES	CO.RD. 553	MARQUETTE	<0.004	0.004
29-Apr-87				BEACON WATER ASSN	ROUTE 1 BOX 13B	CHAMPION	<0.005	0.005
13-Aug-86				BIDE-A-WHILE MHP	232 SILVER CREEK RD	MARQUETTE	<0.005	0.005
25-Mar-87				CITY OF ISHPEMING	TW #4	ISHPEMING	<0.005	0.005
09-Nov-87				CITY OF ISHPEMING	TEST WELL #7	ISHPEMING	<0.005	0.005
14-Jan-86				DALE MERCURE	604 DALTON RD	SKANDIA	<0.005	0.005
29-Jun-89				DIORITE	27865 DIORITE LOCATION		<0.005	0.005
03-Aug-87				DONALD WUSSOW	553	GWINN	<0.005	0.005
28-Jun-88				ELY TWP	TWP HALL	GREENWOOD	<0.005	0.005
29-Mar-90			001	EMPIRE MINE	WELL A		<0.005	0.005
29-Mar-90			001	EMPIRE MINE	POCKET WELL		<0.005	0.005
15-Feb-89				FORSYTH TWP	TWP HALL	GWINN	<0.005	0.005
14-Jan-85				GARY MCMASTER	143 MCMASTER RD	SKANDIA	<0.005	0.005

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October 26, 2009

TABLE 3: SELENIUM ANALYSIS RESULTS IN MARQUETTE COUNTY SINCE 1983

collectDate	township	section	wellNo	owner	street	city	result	detect
18-May-88				HAGANS/SAWYER PARK INN	CR 553 & SOUTHGATE DR	GWINN	<0.005	0.005
18-May-88				HAGANS/SAWYER PARK INN	CR 553 & SOUTHGATE DR	GWINN	<0.005	0.005
08-Jun-87				INDIAN HEALTH SERVICE	CTY RD 492-WELL 3	MARQUETTE	<0.005	0.005
08-Jun-87				INDIAN HEALTH SERVICE	CTY. RD. 492	MARQUETTE	<0.005	0.005
05-Jun-86				ISHPEMING	CLIFFS SHAFT-MINE WELL		<0.005	0.005
19-Dec-86				ISHPEMING	TW #4	ISHPEMING	<0.005	0.005
22-Oct-87				KI SAWYER AFB	TW 9		<0.005	0.005
23-Jun-88				KI SAWYER AFB	WELL 9		<0.005	0.005
23-Jun-88				KI SAWYER AFB	WELL 9		<0.005	0.005
30-Jun-88				KI SAWYER AFB MI	WELL #10		<0.005	0.005
01-Jul-88				KI SAWYER AFB MI	WELL #10		<0.005	0.005
27-Feb-90				LARRY STERZIK	1956 M28 EAST	MARQUETTE	<0.005	0.005
05-Dec-86				LYLE TROMBLY	590 LAKEWOOD LANE	MARQUETTE	<0.005	0.005
10-Mar-88			001	CREEK	219 SILVER CREEK RD.	MARQUETTE	<0.005	0.005
15-Feb-89				MCNABB MARKETING	M35	GWINN	<0.005	0.005
28-Feb-90				AUTHORITY	NCRPW89-2-A		<0.005	0.005
09-Sep-88				AUTHO	ETW-3	PALMER	<0.005	0.005
13-Dec-89				NEGAUNEE TOWNSHIP	OBS. WELL #4		<0.005	0.005
13-Dec-89				NEGAUNEE TOWNSHIP	PRODUCTION WELL #1		<0.005	0.005
13-Dec-89				NEGAUNEE TOWNSHIP	PRODUCTION WELL #1		<0.005	0.005
13-Dec-89				NEGAUNEE TOWNSHIP	OBS. WELL #5		<0.005	0.005
13-Dec-89				NEGAUNEE TOWNSHIP	PRODUCTION WELL #2		<0.005	0.005
29-Jun-89				NEGAUNEE TWP.	COMMUNITY BLDG.		<0.005	0.005
22-Feb-90				AUTHORITY	NCRPW89-1-6		<0.005	0.005
04-Mar-90				AUTHORITY	NCRPW89-2-B		<0.005	0.005
07-Mar-90				AUTHORITY	NCRPW89-2-C		<0.005	0.005
07-Sep-88				AUTHO	ETW-4	PALMER	<0.005	0.005
07-Sep-88				AUTHO	ETW-4	PALMER	<0.005	0.005
07-Sep-88				AUTHO	ETW-4	PALMER	<0.005	0.005
09-Sep-88				AUTHO	ETW-3	PALMER	<0.005	0.005
09-Sep-88				AUTHO	ETW-3	PALMER	<0.005	0.005
14-Sep-88				NEGAUNEE/ISHPEMINS	SANDS PLAIN		<0.005	0.005
14-Sep-88				NEGAUNEE/ISHPEMINS	SANDS PLAIN		<0.005	0.005
14-Sep-88				NEGAUNEE/ISHPEMINS	SANDS PLAIN		<0.005	0.005

Prepared by: Chuck Thomas
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TABLE 3: SELENIUM ANALYSIS RESULTS IN MARQUETTE COUNTY SINCE 1983

collectDate	township	section	wellNo	owner	street	city	result	detect
14-Apr-89				AUTHORITY	BIRTG	ISHPEMING	<0.005	0.005
23-Sep-88				AUTHO	SANDS PLAIN-ETW-5	PALMER	<0.005	0.005
23-Sep-88				AUTHO	SANDS PLAIN-ETW-5	PALMER	<0.005	0.005
23-Sep-88				AUTHO	SANDS PLAIN-ETW-5	PALMER	<0.005	0.005
26-Sep-88				AUTHO	SANDS PLAIN-ETW-6	PALMER	<0.005	0.005
26-Sep-88				AUTHO	SANDS PLAIN-ETW-6	PALMER	<0.005	0.005
26-Sep-88				AUTHO	SANDS PLAIN-ETW-6	PALMER	<0.005	0.005
17-Mar-87				NICE COMM.SCHOOL	CHAMPION MIDDLE SCHOOL	CHAMPION	<0.005	0.005
06-Jan-88			001	NIZE COMMUNITY SCHOOLS	BOX 68	CHAMPION	<0.005	0.005
29-Jun-89				PALMER	RICHMOND TWP. HALL		<0.005	0.005
13-Aug-86				PINE ACRES	265 LAKEWOOD ROUTE 2	MARQUETTE	<0.005	0.005
19-Oct-88				PLIMPTON	NORTHERNAIN MHP	GWINN	<0.005	0.005
08-Sep-87				POWELL TWP	SCHOOL	BIG BAY	<0.005	0.005
14-Jun-89				POWELL TWP.	LAUNDRANMAT		<0.005	0.005
31-Aug-88				SANDS PLAIN		POST	<0.005	0.005
31-Aug-88				SANDS PLAIN		POST	<0.005	0.005
31-Aug-88				SANDS PLAIN		POST	<0.005	0.005
17-Dec-87			001	SCHOOL-WELLS TWP.	CO.RD. 426	ARNOLD	<0.005	0.005
15-Feb-89				SKANDIA	LAHTI RES-9697 US 41	SKANDIA	<0.005	0.005
07-Aug-86				SKANDIA WEST BRANCH TWP	WELL FIELD-SCHOOL RD	SKANDIA	<0.005	0.005
01-Aug-86				WATE	WELL SITE #2	SKANDIA	<0.005	0.005
11-Jul-88				SUPERIOR FAMILY CARE CLINIC	425 CORNING ST	MARQUETTE	<0.005	0.005
29-Mar-90				TILDEN MINE	WELL 1		<0.005	0.005
29-Mar-90			001	TILDEN MINE	WELL 2		<0.005	0.005
14-Jun-89				TILDEN TWP.	DOBSON RES.		<0.005	0.005
14-Dec-98	Sands				Laundromat	Gwinn	ND	0.005
04-Feb-99	Chocolay		001		219 Silver Creek Road		ND	0.005
05-Nov-03	Forsyth		5		Well #5	Gwinn	ND	0.001
24-Aug-09	RICHMOND				110 E CO RD MA	NEGAUNEE	ND	0.001
05-Dec-95	SANDS TWP			553 MOBILE ESTATES	553 MOBILE ESTATES	GWINN	ND	0.005
06-May-02	Sands			ALLAN WIRKULA	Laundromat	Gwinn	ND	0.001
18-Jul-06				ATT: LARRY	150 M-28	MARQUETTE	ND	0.001
02-Nov-99	Ishpeming	06	1	BETH HEIKKINEN	101 Appleridge Drive	Ishpeming	ND	0.005
03-Oct-00			NEW	BETH HEIKKINEN	101 Appleridge Drive	Ishpeming	ND	0.005

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October 26, 2009

TABLE 3: SELENIUM ANALYSIS RESULTS IN MARQUETTE COUNTY SINCE 1983

collectDate	township	section	wellNo	owner	street	city	result	detect
08-Jul-97	Chocolay	07	1	Bide - A - Wile M H Park	232 Silver Creek Road	Marquette	ND	0.005
26-Mar-01	Marquette			BRIAN BLACK	98 Co Road 550	Marquette	ND	0.001
03-Oct-96	CHOCOLAY6		NEW	BRIAN CARRIERE	128 W FAIRBANKS	MARQUETTE	ND	0.005
07-May-01	Sands			Carolyn L Myers	140 Flodin Road	Gwinn	ND	0.001
21-Jul-03	Chocolay			CHARLES SCHWENNER	204 Timber Lane Harvey	Marquette	ND	0.001
06-Dec-04	Chocolay		001	CHOCOLAY CHILD CTR	197 Terrace	Marquette	ND	0.001
14-Nov-94	CHOCOLAY		001	CHOCOLAY CHILDREN'S CENTER	197 TERRACE ST	MARQUETTE	ND	0.005
12-Nov-07	CHOCOLAY		001	BERA	197 TERRACE	MARQUETTE	ND	0.001
29-Nov-93	CHOCOLAY	10	#1	CONDOMINIUMS		HARVEY	ND	0.005
08-Dec-00	Chocolay			CHOCOLAY SHORES	203 Hotel Place	Marquette	ND	0.005
26-Sep-06	CHOCOLAY			CHOCOLAY SHORES	203 HOTEL PLACE	MARQUETTE	ND	0.001
03-Oct-03	Chocolay			CHOCOLAY SHORES APTS	203 Hotel Place	Marquette	ND	0.001
19-Jul-95			1	CITY OF ISHPEMING	US-41	ISHPEMING	ND	0.005
23-Aug-94				CITY OF MARQUETT	320 N LAKESHORE BLVD	MARQUETTE	ND	0.005
01-Nov-93				CITY OF MARQUETTE	320 LAKESHORE BLVD	MARQUETTE	ND	0.005
02-Sep-03				City of Marquette	325 Lakeshore Blvd	Marquette	ND	0.001
11-Sep-08	CHOCOLAY		001	ACADEMY	219 SILVER CR RD	MARQUETTE	ND	0.001
06-Jul-99			001	DARLENE KIMBALL	197 Terrace	Marquette	ND	0.005
06-Nov-01	Chocolay	06	001	DARLENE KIMBALL	197 Terrace	Marquette	ND	0.001
06-Oct-03	Sands	11		David Cowell	205 Taylor Road	Gwinn	ND	0.001
08-Oct-96	CHOCOLAY	6	NEW	DENNIS MAGADAUZ	155 W MAIN	MARQUETTE	ND	0.005
06-Aug-03	Negaunee	28		DONALD JOHNSTON	137 Heritage Drive	Negaunee	ND	0.001
23-Apr-02	Forsyth			Edwin L Buck	1175 West Shag Lakes Road	Gwinn	ND	0.001
19-Jul-04	Ely		4	Ely Township	Pumphouse	Greenwood	ND	0.001
25-Jan-05	Ely		2	Ely Township	Pumphouse	Diorite	ND	0.001
20-Sep-93	ELY 48-28	32	2	ELY TWP	PUMP HOUSE	ISHPEMING	ND	0.005
21-Jun-95	ELY		2	ELY TWP - GREENWOOD WATER	PUMP HOUSE	ISHPEMING	ND	0.005
19-Mar-02			2	ELY TWP.	Pumphouse	Diorite	ND	0.001
16-Sep-94	RICHMOND	30	T	EMPIRE IRON INING PARTNERSHIP	EMPIRE MINE	PALMER	ND	0.005
16-Sep-94	RICHMOND	30	P	PARTNERSHIP	EMPIRE MINE	PALMER	ND	0.005
16-Sep-94	RICHMOND	30	S	PARTNERSHIP	EMPIRE MINE	PALMER	ND	0.005
16-Sep-94	RICHOMOND	30	PIT	PARTNERSHIP	EMPIRE MINE	PALMER	ND	0.005
16-Sep-94	RICHMOND	30	A	PARTNERSHIP	EMPIRE MINE	PALMER	ND	0.005
28-Aug-95	RICHMOND	30	001	EMPIRE MINE	EMPIRE MINE	PALMER	ND	0.005

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October 26, 2009

collectDate	township	section	wellNo	owner	street	city	result	detect
13-Oct-95	RICHMOND	30	A	EMPIRE MINE	EMPIRE MINE RD	PALMER	ND	0.005
16-Oct-95	RICHMOND	30	SEC	EMPIRE MINE	EMPIRE MINE RD	PALMER	ND	0.005
16-Oct-95	RICHMOND	30	POC	EMPIRE MINE	EMPIRE MINE RD	PALMER	ND	0.005
16-Oct-95	RICHMOND	30	C	EMPIRE MINE	EMPIRE MINE RD	PALMER	ND	0.005
16-Oct-95	RICHMOND	30	A	EMPIRE MINE	EMPIRE MINE RD	PALMER	ND	0.005
16-Oct-95	RICHMOND	30	TRN	EMPIRE MINE	EMPIRE MINE RD	PALMER	ND	0.005
03-Dec-96	RICHMOND	30	A	EMPIRE MINE	EMPIRE MINE RD.	PALMER	ND	0.005
08-Oct-96	CHOCOLAY	6	NEW	EUGENE GREENLEAF	117 W WRIGHT PLACE	MARQUETTE	ND	0.005
01-Oct-96	CHOCOLAY	6	NEW	FORREST LIBBEY	136 W MAIN	MARQUETTE	ND	0.005
14-Sep-93	FORSYTH		#1	FORSYTH TOWNSHIP	WELL # 1 (KIDDER WELL)	GWINN	ND	0.005
13-Mar-96	T45N,R25W	28		FORSYTH TOWNSHIP	ROAD	GWINN	ND	0.005
29-Sep-97	Forsyth		MON	Forsyth Township	Gwinn Ball Field	Gwinn	ND	0.005
13-Mar-00	Forsyth		6	Forsyth Township	Well 6	Gwinn	ND	0.005
12-Mar-02	Forsyth		1	Forsyth Township	Well #1	Gwinn	ND	0.001
22-Jul-03			5	Forsyth Township	Well #5	New Swanzy	ND	0.001
27-Jul-03				Forsyth Township	Well #6	Gwinn	ND	0.001
20-Jul-94	FORSYTH		#5	FORSYTH TWP	WELL #5	SWANZY	ND	0.005
01-Oct-96	CHOCOLAY	6	NEW	GARY DIONNE	155 W FAIRBANKS	MARQUETTE	ND	0.005
19-Sep-94	CHOCOLAY	7	1	GEORGE SCHMIDT	232 SILVER CREEK	MARQUETTE	ND	0.005
16-Dec-96	NEGAUNEE	28		HERITAGE DR APTS	137 HERITAGE DR	NEGAUNEE	ND	0.005
18-Feb-97	NEGAUNEE	28		HERITAGE DR. APTS.	137 HERITAGE DRIVE	NEGAUNEE	ND	0.005
04-Nov-97	Chocolay	06	169	HOMEOWNER PRIVATE WELL	119 Lakewood Lane	Marquette	ND	0.005
23-Sep-08	SANDS			HWY M553 MOBILE ESTATES LLC	160 S M553	GWINN	ND	0.001
31-Aug-94	NEGAUNEE	35		ING RAILROAD CO. LK SUPERIOR	311 M 35	NEGAUNEE	ND	0.005
17-Apr-09			4	ISH TWP	JAMES ST	ISH TWP	ND	0.001
21-Mar-06			1	ISH TWP.	POPLAR ST	ISHPEMING	ND	0.001
27-Mar-00		08	4	Ishpeming Township	James Street	Ishpeming	ND	0.005
27-Mar-00		08	5	Ishpeming Township	M-28	Ishpeming	ND	0.005
17-Apr-09			5	ISHPEMING TOWNSHIP	S NORTH LAKE DR	ISH TWP	ND	0.001
24-Oct-94			#1	ISHPEMING TWP	POPLAR ST	TWP	ND	0.005
21-Mar-01	Marquette			JILL ORMSON	92 Co. Road 550	Marquette	ND	0.001
26-May-93	FORSYTH		2	JIM MOWAK	710 HORSESHOE LAKE DR	GWINN	ND	0.005
03-Oct-96	CHOCOLAY	6	NEW	JMAES PATOVISTI	168 W MAIN	MARQUETTE	ND	0.005
28-Jul-05	CHOCOLAY			JOHN ENGLISH	ROAD IN WOODS	MARQUETTE	ND	0.001

TABLE 3: SELENIUM ANALYSIS RESULTS IN MARQUETTE COUNTY SINCE 1983

collectDate	township	section	wellNo	owner	street	city	result	detect
01-Jun-09	CHOCODAY			JOHN OKONKOWSKI	1879 E M-28	MARQUETTE	ND	0.001
07-Oct-02	Negaunee	35	001	Co	311 M-35		ND	0.001
23-Apr-07	CHOCOLAY			LEIDHOLT	196 BROOKSIDE DRIVE	MARQUETTE	ND	0.001
19-Sep-94	CHOCOLAY		1	LSS MANOR CHOCOLAY	201 CHERRY CREEK RD	MARQUETTE	ND	0.005
03-Jun-97	Chocolay		2	LSS MANOR CHOCOLAY	201 Cherry Creek Road	Marquette	ND	0.005
26-Sep-06	CHOCOLAY			LSS MANOR CHOCOLAY	201 CHERRY CREEK RD	MARQUETTE	ND	0.001
07-Apr-05	Sands			M-553 Mobile Estates Inc	Pump House	Gwinn	ND	0.001
13-Dec-93	CHOCOLAY		1	MANGUM PRISON FARM	BASAL RD	MARQUETTE	ND	0.005
14-Dec-93	CHOCOLAY		2	MANGUM PRISON FARM	BASAL RD	MARQUETTE	ND	0.005
20-Jun-94	CHOCOLAY		3	MANGUM PRISON FARM	BASAL RD	MARQUETTE	ND	0.005
28-Oct-96	TWP.		2	MANGUM PRISON FARM	BASIL ROAD	MARQUETTE	ND	0.005
28-Oct-96	TWP.		1	MANGUM PRISON FARM	BASIL ROAD	MARQUETTE	ND	0.005
14-Sep-99	Chocolay	15	2	MANGUM PRISON FARM	Basil Road	Marquette	ND	0.005
14-Sep-99	Chocolay	15	1	MANGUM PRISON FARM	Basil Road	Marquette	ND	0.005
21-Jul-03	Chocolay			MARNIE WETING	212 Timber Lane Harvey	Marquette	ND	0.001
17-Mar-98			001	SCHOOL	1111 Ortman Rd.	Marquette	ND	0.005
04-Feb-99	Chocolay			MARQUETTE PUBLIC SCHOOLS	219 Silver Creek Road		ND	0.005
04-Mar-02	Chocolay		001	MARQUETTE PUBLIC SCHOOLS	1111 Ortman Rd.	Marquette	ND	0.001
24-Jan-05	Chocolay		001	MARQUETTE PUBLIC SCHOOLS	1111 Ortman Road	Marquette	ND	0.001
26-Nov-07	CHOCOLAY		001	MARQUETTE PUBLIC SCHOOLS	1111 ORTMAN RD	MARQUETTE	ND	0.001
22-Jul-04	Marquette			Marquette Township		Marquette	ND	0.001
10-Sep-07	MARQUETTE			MARQUETTE TOWNSHIP	STREET	MARQUETTE	ND	0.001
13-Feb-08	MQT		1	MARQUETTE TOWNSHIP	1	MARQUETTE	ND	0.001
27-Mar-03	Township Hall			MICHIGAMME TOWNSHIP	200 Main Street	Michigamme	ND	0.001
07-May-03				MICHIGAMME TOWNSHIP	Township Hall	Michigame	ND	0.001
09-Feb-95	NEGAUNEE		001	MICHIGAN GAS CO	34 US-41 HWY EAST	NEGAUNEE	ND	0.005
30-Nov-07	NEGAUNEE	27		NATHAN LYTIKAINEN	44 FORGE RD		ND	0.001
02-May-95		35		NEGAUNEE TOWNSHIP	PUMP HOUSE #1	NEGAUNEE	ND	0.005
29-Jun-98		35		Negaunee Township	Well #1	Negaunee	ND	0.005
19-Aug-03		36	3	Negaunee Township	Pumphouse Road Test Well #3	Negaunee	ND	0.001
04-Nov-03			6	Negaunee Township	Well Field	Negaunee	ND	0.001
06-Nov-03			5	NEGAUNEE TOWNSHIP	Well Field	Negaunee	ND	0.001
10-Nov-03			4	Negaunee Township	Well Field	Negaunee	ND	0.001
14-Aug-06	NEGAUNEE	35	ONE	NEGAUNEE TOWNSHIP	PUMPHOUSE RD	NEGAUNEE	ND	0.001

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TABLE 3: SELENIUM ANALYSIS RESULTS IN MARQUETTE COUNTY SINCE 1983

collectDate	township	section	wellNo	owner	street	city	result	detect
25-Feb-08	NEGAUNEE		1	NEGAUNEE TOWNSHIP	WELL HOUSE #1	NEGAUNEE	ND	0.001
24-Mar-97				AUTH	FACILITY	ISHPEMING	ND	0.005
17-Mar-09				AUTH	1800 NORTH RD	ISHPEMING	ND	0.001
04-Aug-94	PLANT			AUTH.	1800 NORTH RD	ISHPEMING	ND	0.005
13-Feb-07	T47N/R27W	4	TW2	AUTHORITY	SUNSET DRIVE	ISHPEMING	ND	0.001
08-Oct-96	CHOCOLAY	6	NEW	NELSON MILLER	153 W TERRLUE	MARQUETTE	ND	0.005
21-Jul-03	Chocolay			NORMAN PESONEN	209 Timber Lane Harvey	Marquette	ND	0.001
25-Sep-95	CHOCOLAY			OJIBWA HOUSING AUTHORITY	124 KEWEENAW TRAIL	HARVEY	ND	0.005
08-Dec-03	Chocalay		001	Ojibwa I I Casino	105 Acre Trail	Marquette	ND	0.001
21-Mar-01	Marquette			PATRICK & JOAN FURGESON	97 Co. Road 550	Marquette	ND	0.001
01-Oct-96	CHOCOLAY	6	NEW	PEDONE/BETZ	140 W MAIN	MARQUETTE	ND	0.005
01-Oct-96	CHOCOLAY	6	NEW	PETE BERSINGER	161 W MAIN	MARQUETTE	ND	0.005
08-Oct-96	CHOCOLAY	6	NEW	PETE LARUE	426 CORNING AVE	MARQUETTE	ND	0.005
29-Aug-00	Chocolay			PINE ACRES MHP	3000 US 41 South	Marquette	ND	0.005
22-Jul-03	Chocolay		2	PINE ACRES MHP	3000 US 41 South	Marquette	ND	0.001
06-Jun-95	CHOCOLAY			PINE ACRES MOBILE HOME PARK	3000 US-41 SO	MARQUETTE	ND	0.005
28-Jun-06	CHOCOLAY		2	PINE ACRES MOBILE HOME PARK	3000 US HWY 41 S	MARQUETTE	ND	0.001
04-Aug-97	Chocolay			PINE ACRES MOBILE HOME PK	3000 U. South . 41 South	Marquette	ND	0.005
	POWELL #1		1	POWELL TOWNSHIP	WELL #1 BIG BAY	BIG BAY	ND	0.005
06-Aug-02	Powell		1	Powell Township Water Dept	Twp. Pump House C R 550	Big Bay	ND	0.001
06-Oct-98	Negaunee	35	001	ISHPEMING	311 M-35		ND	0.005
21-Mar-01	Marquette			RANDY & VICKI BULLOCK	99 B Co. Road 550	Marquette	ND	0.001
02-Apr-02	Sands		001	Reinhart Food SERVICE	881 County Road 480	Marquette	ND	0.001
17-Dec-07	SANDS		001	REINHART FOOD SERVICE	881 COUNTY ROAD 480	MARQUETTE	ND	0.001
17-Jan-96	SANDS		001	REINHART FOODS	881 COUNTY RD 480	MARQUETTE	ND	0.005
28-Feb-94	SANDS		001	REINHART FOODS INC	881 CR 480	MARQUETTE	ND	0.005
10-Sep-08	REPUBLIC			DEPT	9485 WILLOW DRIVE	REPUBLIC	ND	0.001
31-May-95	TWP		#2	DEPT	WELL #2	PALMER	ND	0.005
31-May-95	TWP		#1	DEPT	WELL #1	PALMER	ND	0.005
25-Aug-09	FORSYTHE			RILEY AUSTIN	156 ALBATROSS	GWINN	ND	0.001
21-Mar-01	Marquette			RITA FORTIN	100 Co. Road 550	Marquette	ND	0.001
08-Oct-96	CHOCOLAY	6	NEW	ROBERT STEEMAN	161 W FAIRBANKS	MARQUETTE	ND	0.005
12-Aug-09	RICHMOND			SALLYANN J KIVISTO	320 GOOSE LK RD	NEGAUNEE	ND	0.001
07-Jun-95	SANDS			SANDS TRAILER COURT	COUNTY RD 553	GWINN	ND	0.005

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TABLE 3: SELENIUM ANALYSIS RESULTS IN MARQUETTE COUNTY SINCE 1983

collectDate	township	section	wellNo	owner	street	city	result	detect
29-Dec-98	Sand			SANDS TRAILOR COURT	110 South Co Road 553	Gwinn	ND	0.005
27-Aug-03	Forsyth		9	Sawyer Business Center	Well #9	Gwinn	ND	0.001
23-Jun-08	CHOCOLAY		977	SCOTT EMERSON	119 LAKEWOOD LANE	MARQUETTE	ND	0.001
08-Jul-98	Negaunee		001	Semco Energy Gas Co.	34 U. S. 41, East	Negaunee	ND	0.005
08-Oct-96	CHOCOLAY	6	NEW	SHANE PLACE	170 W FAIRBANKS	MARQUETTE	ND	0.005
21-Aug-00	Skandia		3	SKANDIA WEST BRANCH WATER	Pump House	Skandia	ND	0.005
02-Sep-02	Ishpeming			SUNNYSIDE ESTATES	43 Sunnyside Estates	Ishpeming	ND	0.001
05-Jun-95	SKANDIA		#1	SWBWA	WELL SITE	SKANDIA	ND	0.005
17-Dec-97	Marquette		1	TBM - CHOCOLAY SHORES	203 Hotel Place	Marquette	ND	0.005
22-Nov-04	Sands	11	001	Teaching Family Homes	1000 Silver Creek Road	Marquette	ND	0.001
25-Oct-05	SANDS	11	001	TEACHING FAMILY HOMES	1000 SILVER CREEK ROAD	MARQUETTE	ND	0.001
12-Dec-07	SANDS	11	001	TEACHING FAMILY HOMES	1000 SILVER CR RD	MARQUETTE	ND	0.001
17-Jun-02	Marquette	33		Thomas K. RAY	250 Partridge Bay Trail	Marquette	ND	0.001
18-Sep-95	TILDEN	26	001	TILDEN MINE	OF ISHPE	ISHPEMING	ND	0.005
25-Jul-95	TILDEN	21	1	TILDEN TOWNSHIP	PUMP HOUSE	ISHPEMING	ND	0.005
20-Nov-97	Forsyth			Tim Edge	Office	Little Lake	ND	0.005
04-Oct-94	FORSYTH			TIMOTHY EDGE	OFFICE	LITTLE LK	ND	0.005
01-May-00	Forsyth		1	TOM MC NABB	661 East M 35	Gwinn	ND	0.005
03-May-02	Forsyth		1	TOM MC NABB	661 East M 35	Gwinn	ND	0.001
21-Sep-93	FORSYTH		1	TOM MCNABB	661 E M-35	GWINN	ND	0.005
03-Oct-97	Forsyth		1	TOM MCNABB	661 East M 35	Gwinn	ND	0.005
02-Jan-00				unknown	unknown		ND	0.001
22-Jan-96				unknown	unknown		ND	0.005
15-May-95	CHOCOLAY		001	WAHLSTROM RESTAURANT	5043 US 41 S	MARQUETTE	ND	0.005
05-Sep-01	Marquette			WAYNE F MORSE	99 Co Road 550	Marquette	ND	0.001
14-Nov-00	Marquette		TWO	WAYNE MORSE	99 Co Road 550	Marquette	ND	0.005
14-Nov-00	Marquette		ONE	WAYNE MORSE	99 Co Road 550	Marquette	ND	0.005
15-Dec-00	Marquette		TWO	WAYNE MORSE	99 Co Road 550	Marquette	ND	0.001
20-Apr-01	Marquette			WAYNE MORSE	99 Co Road 550	Marquette	ND	0.001
12-Dec-94	WELLS TWP		1	WELLS TOWNSHIP SCHOOL	CO RD 426	ARNOLD	ND	0.005
16-Jun-98	Wells		001	Wells Township School	Co Road 426	Arnold	ND	0.005
25-Mar-02	Wells		001	Wells Township School	38211 Co Road 426	Arnold	ND	0.001
22-Oct-07	WELLS		001	WELLS TOWNSHIP SCHOOL	38211 CO RD 426	ARNOLD	ND	0.001
20-Jul-93	WELLS	7	001	EDUCATION	426 COUNTY RD	ARNOLD	ND	0.005

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APPENDIX C

Figure 1: 1- Mile Halo Around Active CNR Areas

Figure 2: ½ - Mile Halo Around Active CNR Areas

Figure 3: ¼ - Mile Halo Around Active CNR Areas

Table 4: Wells Identified Within 1- Mile Halos

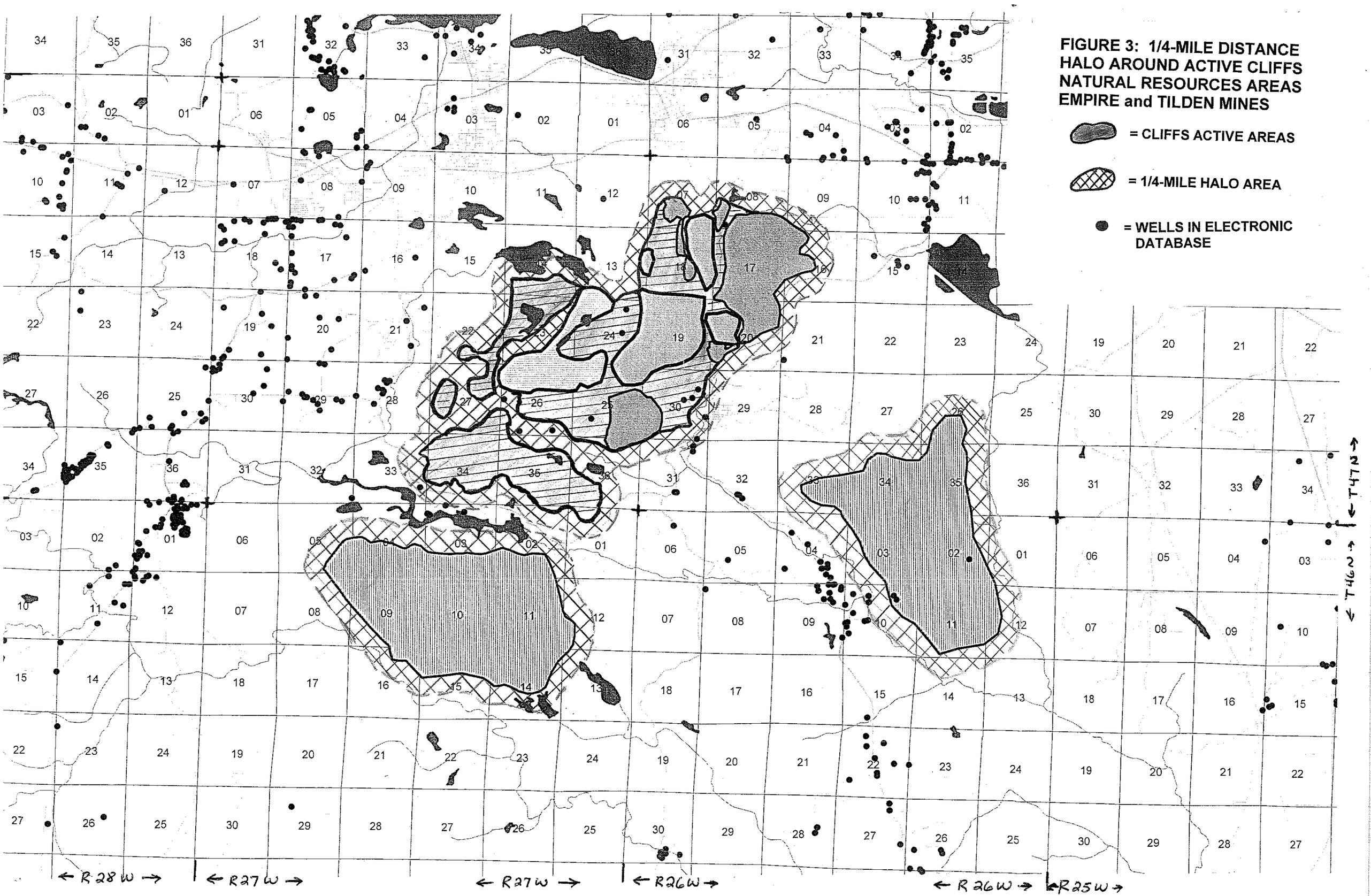

FIGURE 3: 1/4-MILE DISTANCE HALO AROUND ACTIVE CLIFFS NATURAL RESOURCES AREAS EMPIRE and TILDEN MINES

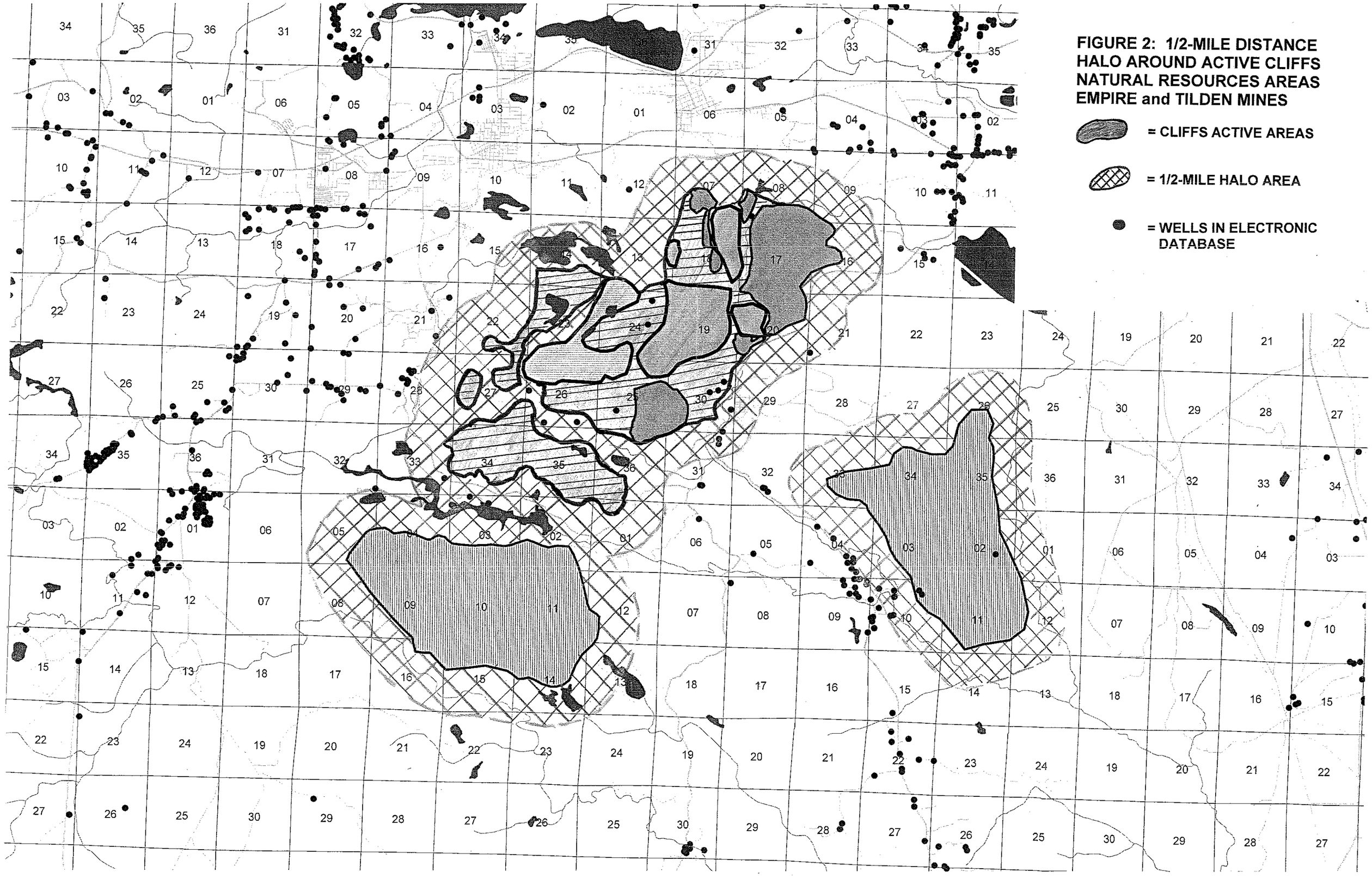

FIGURE 2: 1/2-MILE DISTANCE HALO AROUND ACTIVE CLIFFS NATURAL RESOURCES AREAS EMPIRE and TILDEN MINES

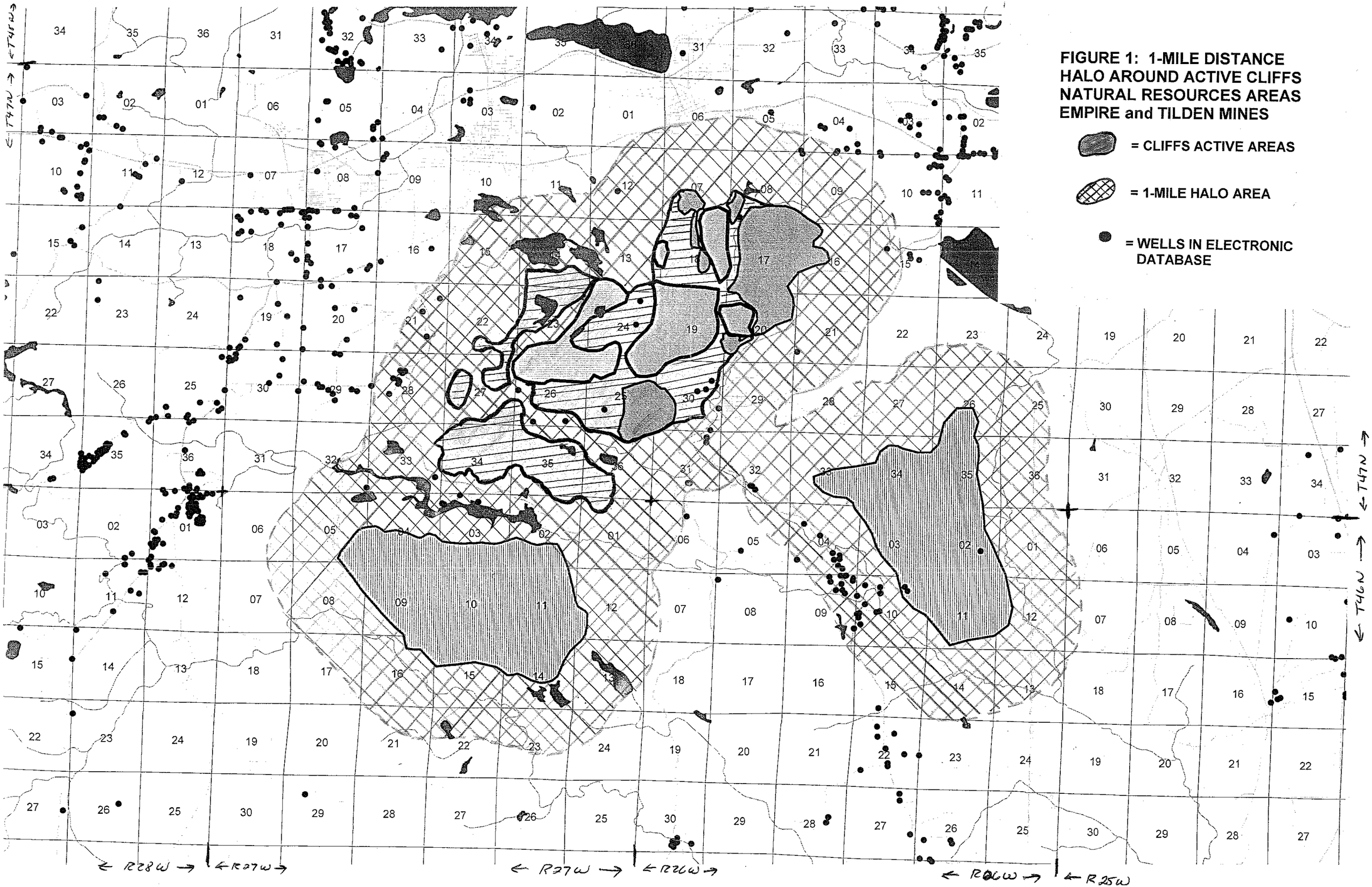

FIGURE 1: 1-MILE DISTANCE HALO AROUND ACTIVE CLIFFS NATURAL RESOURCES AREAS EMPIRE and TILDEN MINES

= CLIFFS ACTIVE AREAS

= 1-MILE HALO AREA

= WELLS IN ELECTRONIC DATABASE

LIST OF WELLS AROUND ACTIVE CNR MINING AREAS

TABLE 4

Town	Range	Section	1/4 sec	Distance Range	Owner Name	Year	Depth	Wellogic ID#
46N	26W	2	NE	0	Tilden Mine	1989	57	
46N	26W	2	SE	0	CCI	1989	57	52000000986
46N	26W	10	NE	0	Tilden Magnetic Partners	1973	25	52000001022
46N	26W	2	SW	0	USGS	1963	47	
47N	26W	20	NW	0	Empire Mine - Lindberg	1997	480	
47N	26W	30		0	Empire Mine	1981	102	52000002655
47N	26W	30		0	Empire Mine	1989	353	52000002656
47N	26W	30		0	Empire Mine	1979	123	52000002657
47N	26W	30		0	Empire Mine - T2	1962	49	52000005037
47N	26W	30		0	Empire Mine - T2	1967		52000005038
47N	27W	24	SE	0	Empire Mine - South Well #119	1987	750	52000002757
47N	27W	24	NE	0	Empire Mine - North Well #120	1987	750	52000002758
47N	27W	25	SW	0	CCI - Bacco	1975	27	52000002759
47N	27W	26	SE	0	CCI - Tilden	1981	104	52000002761
47N	27W	26	SE	0	CCI - Tilden - T2	1971	69	52000005039
47N	27W	26	SE	0	CCI - Tilden - T2	1979	108	52000005040
47N	27W	26	SW	0	CCI - Tilden	1971	71	52000002762
47N	27W	26	NW	0	CCI - Tilden - Guard Shack	1996	150	
47N	27W	26	NW	0	CCI - Bechtel	1975	40	52000002760
47N	27W	27		0	CCI - Tilden	1992	677	
47N	27W	36	NW	0	USGS	1964	87	
46N	26W	4	SW	1/4	Floyd & Denise Jeske	1977	58	52000000993
46N	26W	4	SE	1/4	Patrick Kennedy	1973	62	52000000989
46N	26W	4	SE	1/4	Robert Hewitt		45	52000000992
46N	26W	10	NW	1/4	Gilbert Liquie	1988	42	52000001020
46N	26W	10	NE	1/4	Jefferey S. Hiironen	1983	27	52000001023
46N	26W	12	SE	1/4	USGS	1963	60	
46N	27W	3	NE	1/4	Robert Homeier	1990	59	52000001057
47N	26W	7	SE	1/4	Heliste Clifford	1993	202	
47N	26W	8	SW	1/4	Edward Johns	2000	35	52000004344
47N	26W	26	SE	1/4	USGS	1979	130	
47N	26W	26	SE	1/4	USGS	1963	92	
47N	26W	29	SW	1/4	Richmond Twp - #1			52000002650
47N	26W	29	SW	1/4	Richmond Twp - #2			52000002651
47N	26W	29	SW	1/4	Paul & Tekla Numikoski	1987	32	52000002652
47N	26W	30	SE	1/4	Richmond Twp	1980	60	52000002653
47N	26W	30		1/4	Richmond Twp - #4	1980	60	52000002658
47N	26W	30		1/4	Richmond Twp - #5	2001	55	52000004208
47N	26W	31	NE	1/4	Stephen Kemper	1986	252	52000002662
47N	27W	33	SE	1/4	Craig Helsten	1976	56	52000002798
47N	27W	33	SE	1/4	Matt Kitto	1998	38	
47N	27W	34	NE	1/4	Guy Miller	2003	202	52000004904
47N	27W	34	SW	1/4	Leonard Bancroft	1997	43.5	
47N	27W	34	SW	1/4	Dennis Pellinen	1996	79	
47N	27W	34	SW	1/4	Douglas Potila	1998	82	
46N	26W	4	SW	1/2	Buryl B Smith		46	52000000987
46N	26W	4	NE	1/2	Gordon LaMere	2002	33	52000004556
46N	26W	4	SE	1/2	Patrick Kennedy	1960	53	52000000991
46N	26W	4	SE	1/2	Howard Wendt		58	52000000990
46N	26W	4	SE	1/2	Valdomero Suarez	1994	48	

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LIST OF WELLS AROUND ACTIVE CNR MINING AREAS

TABLE 4

Town	Range	Section	1/4 sec	Distance Range	Owner Name	Year	Depth	Wellogic ID#
46N	26W	4	NW	1/2	John Kirkpatrick	1978	51	
46N	26W	4	SE	1/2	Arnold Carlson	1989	50	52000000988
46N	26W	10	NE	1/2	Richard Brintlinger	1987	253	52000001012
46N	26W	10	NW	1/2	Reino Hiisala	1980	63	52000001013
46N	26W	10	NW	1/2	Daryl & Carol St Aubin	1968	74	52000001017
46N	26W	10	NW	1/2	James Solomon	1973	68	52000001018
46N	26W	10	NW	1/2	Ross Kemp	1984	28	52000001019
46N	26W	10	SW	1/2	Little Dallas	1993	48	52000001024
46N	26W	10	NW	1/2	Allan Lewis	1979	253	
46N	26W	10	NW	1/2	David Carlson	1980	97	
46N	27W	3	NW	1/2	Elmer Juntila	1991	59	52000001053
46N	27W	3	NW	1/2	Donald Kiiskila	1976	63	52000001054
47N	26W	9	NW	1/2	Richard Kallionen	1994	43	
47N	26W	21	SW	1/2	William Anderson	1979	143	
47N	26W	21	SW	1/2	Kathyrn Regan	1979	143	52000002648
47N	26W	25	SW	1/2	USGS	1963	59	
47N	26W	27	SW	1/2	Stephen Kemper	1986	252	
47N	26W	31	SE	1/2	Richmond Twp	1983	47	52000002659
47N	26W	31	SE	1/2	Richmond Twp	1983	56	52000002660
47N	26W	31	SW	1/2	Westley Carlstrom	1982	45	52000002663
47N	26W	36	NW	1/2	USGS	1963	71	
47N	26W	36	NW	1/2	USGS	1964	65	
47N	26W	36	NW	1/2	USGS	1964	73	
47N	26W	36	SW	1/2	USGS	1964	125	
47N	26W	36	NW	1/2	USGS	1964	59	
47N	27W	21	SE	1/2	Tilden Twp	1979	58	52000002754
47N	27W	21	SE	1/2	Tilden Twp	2003	57	52000004728
47N	27W	21	SE	1/2	CCI 68-9	1968	30	
47N	27W	21	SE	1/2	CCI #9	1966	57	
47N	27W	21	SE	1/2	CCI #10	1966	52	
47N	27W	21	SE	1/2	William Tonge	1998	163	
47N	27W	32	SE	1/2	Robert Jacobson	2002	264	52000004482
46N	26W	4	NE	1	John & Margaret Larson		29	52000001003
46N	26W	4	NW	1	Lance Yunk	2006	160	52000005819
46N	26W	4	NW	1	Kurt & Donna Williams		51	52000000997
46N	26W	4	NW	1	Gerald Maki	1992	122	52000000996
46N	26W	4	SE	1	John Ark	1976	53	
46N	26W	4	SW	1	Larry Birmingham	1993	30	
46N	26W	4	SE	1	Alan Wernholm	1995	34	
46N	26W	4	SE	1	Lee Richardson	1977	58	
46N	26W	4	NW	1	Richmond Twp Club	1992	205	
46N	26W	4	SW	1	Gilbert Liquie	1997	44	
46N	26W	4	SW	1	Paula Conners	1999	104	52000003984
46N	26W	9	NE	1	Susan Larson		31	52000001001
46N	26W	9	NE	1	Lyle Larson	2003	103	52000005106
46N	26W	9	NE	1	Wiel Crook	2006	31	52000005882
46N	26W	9	NE	1	Lyle Larson	1987	55	52000001007
46N	26W	9	NE	1	Stephen J Mattson		30	52000001006
46N	26W	9	NE	1	Urpo Vuorinen	1987	128	52000001004
46N	26W	9	NE	1	George V Miljour	1987	203	52000001005

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TABLE 4

Town	Range	Section	1/4 sec	Distance Range	Owner Name	Year	Depth	Wellogic ID#
46N	26W	9	NE	1	Robert Gero	1982	35	52000001009
46N	26W	9	SW	1	Donald A Harju	1975	28	52000001015
46N	26W	9	SW	1	Kenneth Asher	1975	100	52000001016
46N	26W	9	SW	1	Robert Beams	2002	30	52000004554
46N	26W	9	NE	1	Bruce & Zita Anderson	1982	83	52000001002
46N	26W	9	NE	1	Les Korpi	1985	328	52000001008
46N	26W	9	NE	1	Dean Larson	1974	31	
46N	26W	9	NE	1	John Larson	1987	29	
46N	26W	9	NE	1	Gary M Hill	1975	30	52000001010
46N	26W	9	NE	1	Roberrt Miller	1988	94	52000001011
46N	26W	9	SE	1	Everett Koskinen	1976	100	
46N	26W	9	SE	1	Tilden Mining	1997	35	
46N	26W	10	SW	1	Jonathan Pietila	2007	38	52000006060
46N	26W	10	SW	1	Peggy Kangas	1983	27	
46N	26W	10	SW	1	Ricky Eckloff	1992	123	
46N	26W	10	SW	1	Sulo Harju	1968	74	
46N	26W	10	SW	1	Victor Orr	1986	34	52000001014
46N	26W	15	SW	1	Bruce Warden		80	52000001025
46N	26W	18	NW	1	Shawn Shanks	1996	113	
47N	26W	4	SW	1	Kevin Koch	1987	142	52000002602
47N	26W	4	SW	1	Duane Plattenberg	2005	242	52000005766
47N	26W	5	SE	1	John G Roberts	1977	125	52000002606
47N	26W	5	NE	1	Michael & Virginia King	1990	123	52000002605
47N	26W	5	SE	1	James Wickstrom	1977	103	
47N	26W	5	SW	1	CCI	1949	180	
47N	26W	5	SW	1	CCI	1941	86.5	
47N	26W	5	SE	1	Mikko Hakkame	1977	105	
47N	26W	6	SW	1	CCI #5	1901	251	
47N	26W	6	SW	1	CCI #7	1901	225	
47N	26W	7	NW	1	Steven Laine	1977	39	
47N	26W	8	NE	1	Werner Manninen	1977	105	52000002607
47N	26W	8		1	John Nardi	2008	43	52000006210
47N	26W	9	NE	1	Alan Baldasari	1993	102	
47N	26W	9	NW	1	George Kellan	1987	125	52000002608
47N	26W	9	NW	1	Melvin Anderson	1980	120	
47N	26W	9	NW	1	Werner Manninen	1977	105	
47N	26W	9	NE	1	Marvin Korpi	2006	202	52000005877
47N	26W	10	SW	1	Ed Venus Hammell	1989	80	52000002636
47N	26W	15	NW	1	Paul Hill	1973	52	
47N	26W	15	SW	1	Michael Ruesing	2003	143	52000004659
47N	26W	15	SW	1	Larry Rasmussen	2003	304	52000004963
47N	26W	15	NW	1	Paul Hill	1973	52	52000002647
47N	26W	25	SW	1	USGS	1964	202	
47N	26W	27	NW	1	CCI #14	1966	30	
47N	26W	27	NW	1	CCI #13	1966	37	
47N	26W	27	NW	1	CCI #16	1966	33	
47N	26W	29	SE	1	U.S. Steel	1966	46	
47N	26W	32	SW	1	Bruce Kemp	1982	43	52000002664
47N	26W	32	SW	1	William Turner	1973	36	52000002665
47N	26W	32	SW	1	Daniel Turner	1978	43	52000002666
47N	26W	36	SW	1	USGS	1979	104	

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LIST OF WELLS AROUND ACTIVE CNR MINING AREAS

TABLE 4

Town	Range	Section	1/4 sec	Distance Range	Owner Name	Year	Depth	Wellogic ID#
47N	27W	12	SW	1	Suicide Ski Hill	1990	62	52000002696
47N	27W	21	NE	1	Ernest Peitila	1979	283	
47N	27W	21	NE	1	Dale Helsten	1986	102	
47N	27W	21	NE	1	Dale Helsten	2002	84	52000004502
47N	27W	21	NE	1	Dale Helsten		102	52000002755
47N	27W	21	NE	1	Ted Smith	1992	130	52000002753
47N	27W	28	NW	1	Gerald Kippola	1971	32	52000002764
47N	27W	28	NW	1	Art Hytinen	1979	125	52000002765
47N	27W	28	NW	1	Arthur Hytinen		125	52000002766
47N	27W	28	NW	1	Mike Hytinen	1978	105	52000002768
47N	27W	28	NW	1	Donald Maki	1979	125	52000002769
47N	27W	28	NW	1	Sally Maki	1979	125	52000002770
47N	27W	28	NW	1	Robert Kennedy	1998	242	
47N	27W	28	NW	1	Elvira Kippola	1978	123	52000002767
47N	27W	28	NW	1	Ernest Pietila	1978	283	52000002771
47N	27W	28	SW	1	David Lawrence	1968	36	52000002772
47N	27W	28	SW	1	William Morcom	1992	275	52000002773
47N	27W	28	SW	1	Carl Hytinen		143	52000004948
47N	27W	32	SW	1	Ellsworth Robare	1976	32	

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