APPENDIX A

DEFINITIONS

COMMUNITY PUBLIC WATER SUPPLY - A water supply that provides year round service to not fewer than 15 living units or not fewer than 25 residents.

DELINEATED AREA -The capture zone for a drinking water source. For groundwater, the area is defined through modeling for wellhead protection or fixed radius approach for an assessment. Surface water sources are delineated by a watershed or subwatershed basis.

KARST HYDROLOGIC SYSTEM - A continuum of vertical and horizontal conduits formed by dissolution of geologic materials (limestone, dolomite, gypsum halite, sylvite, and other soluble rocks and minerals), in which groundwater flow is typically much faster than groundwater flow in porous media. Vertical conduits usually are closely spaced joint sets and open fractures (sometimes faults), and horizontal conduits are usually bedding plane partings or openings, all of which are hydrologically enhanced by dissolution of soluble rocks and minerals.

NONCOMMUNITY PUBLIC WATER SUPPLY - a water supply that has not less than 15 service connections or that serves not less than 25 individuals on an average daily basis for not less than 60 days per year.

SENSITIVITY - Relative ease at which a contaminant can migrate to a water supply source. Measures inability of natural materials or hydrologic conditions to protect the source. For groundwater, a function of intrinsic characteristics of the geologic materials that compose the land surface and the saturated and unsaturated zones. Independent of land use or contaminant characteristics.

SUSCEPTIBILITY -Likelihood of a contaminant impacting a source of drinking water considering source water protection area and sensitivity. Determines if a contaminant could reach the source at concentrations that could affect the system's ability to meet all regulatory requirements. Also includes consideration of well construction and abandoned wells for groundwater sources and intake construction for surface water sources.

WELLKEY - A Software Program that stored well drilling record information and provided for the automated entry, storage, and retrieval of data. This program was not year 2000 compliant and was replaced by Wellogic.

Wellogic - Software Program that allows well drilling record information for the automated entry, storage, and retrieval of well information. The program allows data to be recorded over the internet and stores data in an SQL database. This program replaced WELLKEY.

APPENDIX B

Source Water Assessments for
NONCOMMUNITY PUBLIC WATER SUPPLY SYSTEMS

Table of Contents

Section	Page
Introduction	1
GPS Locations and Water Well Records	1
Global Positioning System (GPS)	1
Well Records and ***Wellogic***	1
Geographic Information System (GIS)	2
Overview of Source Water Assessment Scores	2
Source Water Assessment Score (SWAS) System	2
Geologic Sensitivity - $SWAS_G$	2
Well Construction - $SWAS_W$	3
Well Grouting	3
Well Age	4
Casing Depth	4
Pumping Rate	4
Water Chemistry and Isotope Data - $SWAS_C$	5
Nitrates and Nitrites	5
Presence of Organic Chemicals	5
Tritium	5
Isolation from Sources of Contamination - $SWAS_S$	6

January 1, 2000 Version

INTRODUCTION

Source water assessments are to be performed on approximately 10,500 NCPWS throughout the state. The source water assessments will be completed in accordance with the provisions described herein and have, as objectives, the following:

- Accurately establish through the use of a GPS and GIS the location of NCPWS wells.
- Provide for the entry of water well and pump records into an electronic data management system.
- Identify the location and proximity of sources of contamination located within 800 feet of NCPWS wells.
- Establish a SWAS that reflects the "inherent vulnerability" of the NCPWS well and source water.

GLOBAL POSITIONING SYSTEM LOCATIONS AND WATER WELL DRILLING RECORDS

Obtaining accurate location information and water well drilling record information for NCPWS wells is an essential first step in the state SWAP. The location and well record information will be entered into the Statewide Groundwater Data Base (SGDB). The collection of location and well record information will be built upon the technical expertise and networking developed by the Kellogg Foundation, GEM grant program. Training of county staff and the compilation of data will be done by GEM regional centers located at major universities around the state. The effort will be coordinated by the Institute of Water Research, MSU, as they were the coordinators for the original GEM grant.

Global Positioning System

Location information will be collected for each NCPWS well using a GPS. The ultimate goal is to obtain accurate GPS locations on all NCPWS wells for entry into the SGDB. Local health departments, at their option, will be contracted for site visits to obtain GPS locations on all NCPSW wells. The GPS locations must be "corrected" to provide accurate well locations before the locations are entered in the SGDB. Corrected locations may be obtained through the "real time" acquisition of accurate locations, or postprocessing of the collected location information to provide accurate locations.

Local health departments will be offered additional funds for corrected and accurate well locations. The supplemental funds may be used to purchase new GPS units or upgrade existing GPS capabilities, provided the local health department provides corrected and accurate GPS locations for entry into the SGDB. Local health departments collecting GPS locations but not providing corrected and accurate GPS locations for entry into the SGDB will be loaned GPS units. The state has purchased 12 Trimble Geo Explorer II GPS units with a differential accuracy of 2 to 5 meters that will be rotated between counties. Local health departments accepting additional funds for providing accurate location will not be eligible for the use of loaner GPS units. The Institute of Water Research will be responsible for correcting location information obtained from counties not taking the supplemental funds.

Well Drilling Records and *Wellogic*

Information from well drilling records is critical to the SWAP. As part of SWAP, available well records for NCPWS wells will be compiled. The SGDB contains location verified well information compiled from well drilling records to which the information for NCPWS wells will be added. ***Wellogic*** is the software program that allows well drilling record information to be stored in a data base format and provides for the automated entry, storage, and retrieval of well information. Local health departments, at their option, will be contracted to enter the well drilling record information for NCPWS wells in ***Wellogic***. Local health departments, which do not enter well drilling record information into ***Wellogic*** will locate well drilling records for NCPWS wells as part of the source water assessment procedure. Well drilling records that are not entered into ***Wellogic*** shall be forwarded to a GEM center for entry into ***Wellogic*** and inclusion in the SGDB.

Geographic Information System

The use of GIS for analysis and display of location and well record information is necessary in the state SWAP. ArcInfo coverage is the MDEQ standard for GIS applications. ArcView and ArcInfo are the standard software packages for departmental information analysis and applications.

To the extent staffing and contract activities allow, the SWAP will provide maps to LHDs that include the following information:

- Maps showing the locations of wells derived by address matching using the Type II data base and base maps developed from the Michigan Information System.
- County vulnerability maps based upon a statewide vulnerability map to be developed by Dr. Dave Lusch, MSU.
- Potential sites for contaminant sources based upon state lists.

The GPS location and well drilling record information obtained by the counties will be compiled and incorporated into the statewide GIS for use in the analysis of information and the presentation to the public. Through GIS the results can be used in protection efforts for public water supplies and also be used to focus groundwater protection efforts for private water supply wells.

OVERVIEW OF SOURCE WATER ASSESSMENT SCORES

In addition to the GPS/GIS phases of the source water assessment, the vulnerability of NCPWS wells will be evaluated by determining a SWAS. Ideally a source water assessment would entail a critique of the rate at which groundwater moves both horizontally and vertically in the subsurface. Unfortunately, hydrogeologic studies that document the rate of groundwater movement are scarce, difficult to conduct, and expensive. The SWAS has been created as a numeric system that assigns points for situations that represent a “perceived risk” based upon the evaluation of four criteria. The evaluation criteria provide a “qualitative assessment” of groundwater movement and the potential for movement of contaminants into the subsurface. The SWAS is based upon evaluation of the following:

1. The geologic sensitivity of the NCPWS well.
2. The construction, maintenance, and use of the NCPWS well.
3. Chemistry and/or isotope data from the NCPWS well water.
4. Isolation of the NCPWS well from sources of contamination.

The criteria are evaluated in a manner such that a higher SWAS is equated to a greater perceived risk for the NCPWS source water.

Establishing a SWAS provides a rationale for identifying NCPWSs that should receive a priority in the NCPWS program. The SWAS system has been developed cooperatively with the Noncommunity Unit, Groundwater Section, Water Division, MDEQ. The Noncommunity Unit may utilize the SWAS to assign monitoring requirements and identify NCPWSs that should receive priority in the performance of sanitary surveys.

SOURCE WATER ASSESSMENT SCORE SYSTEM

The SWAS system is based upon the accumulation of points for situations that represent a perceived risk to the NCPWS source water. The SWAS is derived from a sum of a geologic sensitivity score ($SWAS_G$); a well construction score ($SWAS_W$); a score for chemistry and isotope data ($SWAS_C$); and an isolation from sources of contamination score ($SWAS_S$).

Geologic Sensitivity - $SWAS_G$

The $SWAS_G$ is factored into the SWAS based on the total thickness of CCM such as clay, clay-rich till or shale, penetrated in construction of the NCPWS well; or the total thickness of CPCM such as a mixture of sand and clay or sandstone and shale. The total thickness of CCM and CPCM should be determined from the well drilling record for the NCPWS well. Where a well drilling record is not

available, well drilling records from adjacent wells or test hole borings may be used. Geologic maps (i.e., lithologic cross-sections) may also be used if they provide adequate coverage of the area in which the NCPWS well is located.

Thirty points (30) are initially assigned to the $SWAS_G$ to represent a well lithology with an associated "high geologic sensitivity." From the thirty points, three points are then deducted from the $SWAS_G$ for each **5 feet of CCM** or **10 feet of CPCM** indicated on the well drilling record. The greater the amount of CCM or CPCM, the greater the intrinsic geologic protection provided the NCPWS well, the greater the number of points deducted, and the lower the resulting $SWAS_G$. The following table provides a breakdown of geologic sensitivity, feet of CCM, feet of CPCM, and the points deducted from the 30 points to provide the resultant $SWAS_G$:

Geologic Sensitivity, CCM, CPCM, and Points Deducted

Geologic Sensitivity	**High Sensitivity**		**Moderate Sensitivity**						**Low Sensitivity**		
Amount of CCM (feet)	0	5	10	15	20	25	30	35	40	45	50 or greater
Amount of CPCM	0	10	20	30	40	50	60	70	80	90	100 or greater
Points Deducted	0	3	6	9	12	15	18	21	24	27	30

It is important to note the CCM and/or CPCM must be equal to or greater than 5 feet and 10 feet, respectively, to provide a deduction in the $SWAS_G$. The CCM and/or CPCM less than 5 feet and 10 feet, respectively, shall not be summed to provide a deduction to the $SWAS_G$. Further, where the amount of CCM and/or CPCM indicated on the well drilling record results in a deduction of more than 30 points, the $SWAS_G$ shall be assigned a score of zero (0).

Well Construction - $SWAS_W$

The design, physical condition, and operation of a NCPWS well may allow the entrance of contaminants into the well despite a high level of intrinsic geologic protection. To account for this possibility, the SWAS is assigned points through the $SWAS_W$ based upon four criteria related to the construction and use of the NCPWS wells. The $SWAS_W$ is assessed points based upon well grouting, the age of the well, the casing depth, and the pumping rate of the well.

Well Grouting - The well grouting criteria provides an evaluation of the condition of the well relative to current requirements set forth in the Groundwater Quality Control Act, Part 127, 1978 PA 368, as amended and rules, 1994 Revision (Act 368), for sealing the annular space of a water well. Points are added to the $SWAS_W$ in accordance with the following:

0 pts. - The well record indicates the casing has been sealed from bottom to top in accordance with R 325.1634a, Construction of wells; grouting rotary-bored and augered wells, Rule 134a of Act 368.

5 pts. - The well drilling record indicates the casing has been sealed to an unknown depth or to a depth of 25 feet, in accordance with R 325.1635, Construction of wells; grouting driven casing wells, Rule 135, of Act 368.

10 pts. - The well record indicates the well was grouted, but the date of construction precedes the 1994 revisions to Act 368, and available evidence suggests the well is not in compliance with current grouting requirements.

15 pts. - The well drilling record indicates the well was not grouted, no well drilling record is available, or other information suggests the well was ineffectively grouted.

Well Age - The age of a well provides an overall indication of probable conformity to current code requirements for the construction of a well, and an indication of the probable integrity of the well due to deterioration of materials used in the construction of the well. The $SWAS_W$ is assessed a greater number of points as the age of the well increases in accordance with the following criteria:

0 pts. - A well drilling record is available that indicates the well was constructed after the 1994 revisions to Act 368, or a well record is available that indicates the well was constructed in accordance with the 1994 requirements.

5 pts. - A well drilling record is available that indicates the well was constructed prior to 1994 and after 1976, the year the state of Michigan, SDWA was adopted as the standard for the regulation of public water supply systems.

10 pts. - A well drilling record is available that indicates the well was constructed prior to 1976 but after 1967, the year Act 368, was originally adopted as the standard for the construction of wells.

15 pts. - A well drilling record is not available, the age of the well is unknown or it is determined that the construction of the well precedes the 1967 inception of Act 368.

Casing Depth - The depth to which a well is cased is a factor in determining the amount of earth material available to provide for natural attenuation of potential contaminants. The $SWAS_W$ is assessed a greater number of points as the casing depth is decreased in accordance with the following criteria:

0 pts. - The well drilling record, or a physical determination of the casing depth, indicates the well is cased to a depth of 200 feet or greater.

5 pts. - The well drilling record, or a physical determination of the casing depth, indicates the well is cased to a depth between 100 and 199 feet.

10 pts. - The well drilling record, or a physical determination of the casing depth, indicates the well is cased to a depth between 25 and 99 feet.

15 pts. - The well drilling record, or a physical determination of the casing depth, indicates the well is cased less than 25 feet, the casing terminates below grade, or the casing depth is not known.

Pumping Rate - The pumping rate has considerable impact on the “cone of depression” and “area of influence” of a well. In generalized terms, the area of influence is greater at higher pumping rates, thereby, increasing the potential for contamination of a NCPWS well. Accordingly, the $SWAS_W$ is assessed additional points based upon the following criteria for the pumping rate of the permanent pump:

0 pts. - The well drilling record, or a physical determination of the pumping rate of the permanent pump, indicates the well is pumped at less than or equal to 20 gallons per minute (gpm).

5 pts. - The well drilling record, or a physical determination of the pumping rate of the permanent pump, indicates the well is pumped at a rate of 21 to 50 gpm.

10 pts. - The well drilling record, or a physical determination of the pumping rate of the permanent pump, indicates the well is pumped at a rate of 51 to 100 gpm.

15 pts. - The well drilling record, or a physical determination of the pumping rate of the permanent pump, indicates the well is pumped at a rate greater than 100 gpm.

Water Chemistry and Isotope Data - $SWAS_C$

Water chemistry data provides a refinement to the SWAS through the $SWAS_C$ that may increase or decrease the SWAS. As examples, the presence of nitrates, nitrites, volatile organic compounds, or synthetic organic compounds, even at low levels, is an indicator of source water vulnerability and increases the SWAS; the absence of tritium in the source water indicates the source water is old and not vulnerable, thereby decreasing the SWAS.

Nitrates and Nitrites - Water chemistry data that indicates nitrate-nitrogen (NO_3-N) or nitrite-nitrogen (NO_2-N) concentrations are present in the well water are an indication of vulnerability and result in points being added to the $SWAS_C$. The NO_3-N and NO_2-N data should be evaluated and points assigned the $SWAS_C$ based upon the most recent sample results. Water chemistry data for NO_3-N or NO_2-N concentrations in the well water shall result in the assignment of points to the $SWAS_C$ in accordance with the following:

0 pts. - NO_3-N and NO_2-N not detected in the well water.

10 pts. - NO_3-N or NO_2-N detected in the well water at a concentration that is less than one-half the drinking water standard.

20 pts. - NO_3-N or NO_2-N detected in the well water at a concentration that is less than the drinking water standard, but the concentration is one-half or more than one-half the drinking water standard.

50 pts. - NO_3-N or NO_2-N detected in the well water at a concentration that exceeds the drinking water standard.

Presence of Organic Chemicals - The presence of a VOC or SOC is a clear sign of source water vulnerability. Points will be added to the $SWAS_C$ if water chemistry data indicates the presence, with confirmation, of a VOC or SOC in accordance with the following:

0 pts. - No VOC or SOC has been detected in the well water.

5 pts. - VOC or SOC sample has never been collected.

20 pts. - VOC or SOC has been detected in the well water at a concentration that is less than the drinking water standard, or no drinking water standard has been established for the VOC or SOC in question.

50 pts. - VOC or SOC has been detected in the well water at a concentration that exceeds a drinking water standard.

Tritium - The analysis of NCPWS well water that indicates no tritium is present indicates the source water is not vulnerable and results in a negative assignment of points to the $SWAS_C$:

-30 pts. - Added to the $SWAS_C$ where isotope data indicates the tritium concentration in the source water is less than 1.0 tritium units.

+30 pts. - Added to the $SWAS_C$ where isotope data indicates the tritium concentration in the source water exceeds 10 tritium units.

Isolation from Sources of Contamination - $SWAS_S$

The isolation of a NCPWS well from sources of contamination is an important criteria in the source water assessment. The maintenance of isolation distances can significantly reduce the perceived risk associated with the use of a well. The $SWAS_S$ is assessed points for failure to maintain adequate isolation between "potential" sources of contamination and "known" sources of contamination. Known sources of contamination include those sources where the groundwater has been impacted as a leaking underground storage tank or other sites of environmental contamination. The $SWAS_S$ is assessed points based upon isolation as follows:

10 pts. - Each "standard source" of potential contamination within 75 feet of the NCPWS well.

10 pts. - Each "major source" of potential contamination located from 75 to 800 feet of the NCPWS well.

20 pts. - Each "major source" of potential contamination located within 75 feet of the NCPWS well.

25 pts. - Each "known" source of contamination located within 800 feet of the NCPWS well.

APPENDIX C

Source Water Assessment Worksheet - Noncommunity

Data collection to complete the source water assessment worksheet is an extension of the Sanitary Survey conducted as part of the Noncommunity Public Water Supply Program. Please complete the following as appropriate.

Name of Supply: _____ **WSSN:** _____

Address: _____ **County:** _____

Well Log and Location

Well Record Available	☐ Yes	☐ No
Well Record Entered in ***Wellogic***	☐ Yes	☐ No (If No, attach copy)
If Well Record Entered in ***Wellogic***	***Wellogic*** # _____,	
GPS Location Obtained for Well(s)	☐ Yes	☐ No

Geologic Sensitivity - $SWAS_G$

Geologic sensitivity is determined based upon the total thickness of Continuous Confining Material (CCM) or Continuous Partially Confining Material (CPCM). Beginning with a $SWAS_G$ of 30 points, 3 points are deducted for each 5 feet of CCM or 10 feet of CPCM. The CCM must be reported on the well record as 5 feet of continuous material and the CPCM 10 feet of continuous material to provide for a deduction. The summing of CCM layers thinner than 5 feet or CPCM layers thinner than 10 feet is not allowed. Where the point deduction exceeds 30 points, the $SWAS_G$ shall be assigned zero (0) points.

CCM Table: Utilize where well log reports just "clay" or "shale"

CCM (feet)	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 or greater	**CCM Pts. Deducted**
Pts. Deducted	0	3	6	9	12	15	18	21	24	27	30	

CPCM Table: Utilize where well log reports mixture of "sand/clay" or "sandstone/shale"

CPCM (feet)	0 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 79	80 to 89	90 to 99	100 or greater	**CPCM Pts. Deducted**
Pts. Deducted	0	3	6	9	12	15	18	21	24	27	30	

30 Points minus the CCM pts. deducted and the CPCM pts. deducted - **$SWAS_G$**	

Version: January 1, 2000

Well Construction, Maintenance and Use - $SWAS_W$

This portion of the source water assessment score provides an evaluation of the NCPWS relative to the grouting, age, casing depth and pumping rate for the well.

Well Grouting

Casing sealed entire length in accordance w/1994 Revisions	Casing sealed by driven casing method - 1994 Revisions	Casing sealed in accordance with 1967 code	Casing not sealed or status unknown	Enter Points Below
0 pts.	5 pts.	10 pts.	15 pts.	

Well Age

Constructed 1994 or after	Constructed 1976 - 1993	Constructed 1967 - 1975	Constructed 1966 or before	Enter Points Below
0 pts.	5 pts.	10 pts.	15 pts.	

Casing Depth

Well cased 200 feet or greater	Well cased from 100 – 199 feet	Well cased from 25 - 99 feet	Well cased <25 feet or not known	Enter Points Below
0 pts.	5 pts.	10 pts.	15 pts.	

Pumping Rate

20 gpm or less	21 – 50 gpm	51 - 100 gpm	Greater than 100 gpm	Enter Points Below
0 pts.	5 pts.	10 pts.	15 pts.	

Sum of pts. from grouting, age, casing depth, and pumping rate - **$SWAS_W$**	

Water Chemistry and Isotope Data - $SWAS_C$

This portion of the source water assessment score provides an evaluation of the NCPWS relative to the presence of nitrates and nitrites, organic chemicals and tritium.

Nitrate and Nitrites

Not Detected	Detected Less than ½ MCL	Detected ½ MCL to <MCL	Detected Exceeds the MCL	Enter Points Below
0 pts.	10 pts.	20 pts	50 pts.	

VOCs and SOCs

Not Detected	Not Sampled	Detected @ less than MCL	Detected Exceeds the MCL	Enter Points Below
0 pts.	5 pts.	20 pts	50 pts.	

Tritium Results

No Test	Tritium @ < 1 TU	Tritium @ > 10 TU	Enter Points Below
0 pts.	-30 pts.	30 pts.	

Sum of pts. from nitrate/nitrite, organic chemicals and tritium result- **$SWAS_C$**	

Isolation from Sources of Contamination - $SWAS_S$

This portion of the source water assessment score provides an evaluation of the NCPWS relative to the wells isolation from "major" and "standard" sources of contamination. Sources of contamination are also evaluated dependent upon whether they are "potential" or "known" sources of contamination.

"Potential" Major Sources of Contamination from 75 to 800 feet

Source of Contamination	**Number of Sources**	**Distance from Well (feet)**	
Large Scale Waste Disposal			
Land Application of Sanitary Wastewater or Sludge			
Landfill			
Bulk Chemical or Chemical Waste Storage			
Underground Storage Tank			
Other			**Enter Points Below**
Number of Major Sources from 75 to 800 feet		**x 10**	

"Potential" Major Sources of Contamination within 75 feet

Number of Major Sources within 75 feet		**x 20**	

"Potential" Standard Sources of Contamination within 75 feet

Source of Contamination	**Number of Sources**	**Distance from Well (feet)**	
Storm or Sanitary Sewers			
Pipe Lines			
Septic Tank or Septic Drain Field			
Cesspools, Seepage Pits, or Dry Wells			
Leaching Beds			
Barnyards			
Surface Water			
Other			**Enter Points Below**
Number of Standard Sources within 75 feet		**x 10**	

"Known" Sources of Contamination within 800 feet

Source of Contamination	**Number of Sources**	**Distance from Well (feet)**	
Act 201 Sites (formerly 307 sites)			
Superfund Sites			
Leaking Underground Storage Tanks			**Enter Points Below**
Number of Known Sources within 800 feet		**x 25**	

Sum of pts. from sources of contamination - **$SWAS_S$**	

<u>Source Water Assessment Score</u> - SWAS

Sum of $SWAS_G$, $SWAS_W$, $SWAS_C$ and $SWAS_S$ = **SWAS**	

NONCOMMUNITY, PUBLIC WATER SUPPLY SOURCE WATER ASSESSMENT REPORT FOR

LAKE POINTE MANOR **2004247**

What is SWAS? - The Source Water Assessment Score (SWAS) is a process that factors geologic and water well attributes, water chemistry, and potential contaminant sources for each drinking water source into a ranking system to determine the relative potential for contamination. Sources with low scores are considered to be less susceptible to contamination than those with high scores. This assessment is required by the Michigan Source Water Assessment Program under the provisions of the 1996 amendments to the Federal Safe Drinking Water Act.

WSSN: 2004247 **Well No.** 1
System:
Name: LAKE POINTE MANOR
Address: 5768 E. GRAND RIVER
City: HOWELL MI 48843
Owner:
Name: LAKE POINTE MANOR/PETER KOSM
Address: 5768 E. GRAND RIVER
City: HOWELL MI 48843

Well Log and Location - A well log is a legal document describing the well location, construction, depth, soil formations penetrated, and capacity. It has been required to be completed by the drilling contractors and copies submitted to the owner, local health department and State since 1967. ***The lack of information from a well log will increase the SWAS.*** If the worksheet indicates no well log was available for this assessment, it is recommended you contact the well drilling contractor to locate a copy. Wellogic is an electronic database for well logs. GPS stands for global positioning system. Eventually, all noncommunity, public water supply wells will have their locations determined by GPS.

Well Log and Location

Well log is available	Y
Well log entered in Wellogic	Y

Geologic Sensitivity - This score represents the degree of natural protection afforded by the soil materials above the drinking water supply. Lower scores indicate more protection. Points are deducted based on the thickness and type of geologic material that overlies the source of water. Surface contaminants migrate downward at varying rates dependent on geologic material and thickness. CCM stands for continuous confining material (eg. clay). CPCM indicates continuous partially confining material (eg. mixture of sand and clay). More points are deducted for a thick clay layer than a thick sand layer, or a thinner clay layer. Point Range 0-30. ***Sensitivity increases one level if well construction or water chemistry reflects an adverse condition.***

Geologic Sensitivity – SWAS (G)

CCM Pts. Deducted:	12
CPCM Pts. Deducted:	9
Total SWAS(G) Points:	**9**

Geologic Sensitivity Rating – Moderate

Well Construction - Points are minimized when a well has features that help protect the water supply from contamination. These include whether the well was grouted (sealing the annulus that is created between the casing and the soil formations during construction); the well age, how deep the casing extends into the ground, and how much water the well pumps since larger volumes can pull contaminants from greater distances. Point Range 0-15 (each category) Lower scores indicate better well construction.

Well Construction

Well Grouting Points:	10	
Well Age Points:	5	
Casing Depth Points	10	
Pumping Rate:	5	
Total SWAS(W) Points:		**30**

APPENDIX D

SOURCE WATER ASSESSMENT REPORT for WSSN 2004247 (Continued)

Water Chemistry and Isotope Data – Points are added if water sample results indicate nitrates, or detectable levels of volatile organic chemicals (solvents, fuel components) or synthetic organic chemicals (pesticides or herbicides). Points are also added if these analyses have never been completed. Tritium monitoring is a voluntary means of age dating the water. Generally, the older the water the more protected the source. Point Range 0-50 (each category). ***Susceptibility is very high if contaminants at or above Maximum Contaminant Level (MCL).***	**Water Chemistry and Isotope Data – SWAS(C)** Nitrate and Nitrites Points: 0 VOCs and SOCs: 5 Tritium Results: 0 **Total SWAS(C) Points: 5**
Isolation From Sources of Contamination – Points are added based on the number and type of potential contaminant sources within the regulated distance (75 feet from standard or 800 feet from major contaminant sources). Examples of the 75 foot distance are septic tanks, sewer lines, storm sewers, etc. The 800 foot distance is for chemical waste or storage such as fuel tanks, landfills, lagoons, or known plumes of groundwater contamination. Point Range – indefinite. ***Susceptibility increased an additional level if standard source within 75' or major source within 800' and two levels if major source within 75' or known source within 800'.***	**Isolation from Contamination – SWAS (S)** Major sources from 75 to 800 feet: 0 x 10 = 0 Major sources within 75 feet: 0 x 20 = 0 Standard sources within 75 feet 0 x 10 = 0 Known sources within 800 feet: 0 x 25 = 0 **Sum of points from sources of contamination: 0**
Source Water Assessment Score – The total SWAS factored with the Geologic Sensitivity are used to determine the overall Susceptibility.	**Source Water Assessment Score – SWAS** **SWAS(G)+SWAS(W)+SWAS(C)+SWAS(S)=SWAS** 9 30 5 0 **44**
Susceptibility Determination – Susceptibility is a means to identify the relative potential of contamination for public water supply sources.	**Susceptibility Determination** Based on the above compilation of source geology, well construction, water chemistry and potential contaminant sources for this public source of drinking water, this assessment determines its: ***Susceptibility is*** ***Moderate***

LIVINGSTON COUNTY
DEPARTMENT OF PUBLIC HEALTH

2300 East Grand River Avenue, Suite 102, Howell, Michigan 48843-7578

www.lchd.org

LAKE POINTE MANOR/PETER KOSMAS
5768 E. GRAND RIVER
HOWELL, MI 48843

Dear Public Water System Owner/Operator:

This is your notification of the result of the assessment of **LAKE POINTE MANOR, WSSN# 2004247,** with regard to susceptibility to contamination. This assessment is required under the Michigan Safe Drinking Water Act, 1976 PA 399, as amended. Michigan has over 11,000 noncommunity public water systems drawing their water from wells. Conducting Source Water Assessments (SWAs) on each well provides a means to broadly characterize sources with respect to the relative risk of contamination. This initial assessment was conducted by your local health department (LHD) in cooperation with the Department of Environmental Quality. It is intended to assist owners and regulatory agencies in making decisions affecting their drinking water system, future sampling, and ground water protection efforts.

Source Water Assessment Results

- The Geologic Sensitivity rating for your well is **Moderate**.
- The overall Susceptibility rating for your well is **Moderate**.

Enclosed is the report for your source indicating how it was assessed. This process is structured to evaluate the degree of natural protection afforded by the permeability of geologic material like sands, gravels, clays, silts, or rock that overlay the source of water. This is called the Geologic Sensitivity. The Sensitivity categories go from low to very high.

Factors considered in addition to the natural features of the site have to do with how the location has been affected by human activities. This includes the well attributes such as depth, grouting, age, pumping rate, historic water quality results, and proximity to various sources of potential contamination such as septic systems, sewer lines, fuel storage tanks, or actual groundwater contamination sites. These factors combined with the Geologic Sensitivity determine the overall Susceptibility. If you have more than one well, your system is rated on the most susceptible one.

What does this mean?

These terms are a means of categorizing thousands of drinking water sources for better long-term management of this valuable resource. Typically, there is little that can be done to improve a Geologic Sensitivity to afford more protection. However, it may be possible to decrease Susceptibility (lessen the potential for contamination) over time by

certain actions. Generally, this might mean installing a new deeper or grouted well, properly abandoning an unused well, or eliminating a potential source of contamination such as fuel storage tank, sewer line, or a septic system. Any effort to improve the protection of your water supply should be based on site specific information and consultation with your LHD.

What should I do now?
You are not required to take a specific action at this time as a result of this notification. The purpose of this notification is to inform you of this assessment. Please maintain this notice on file with your water sample results, sanitary survey report, and other required water system documents. Thank you for your assistance in protecting and maintaining a safe drinking water supply.

If you wish to discuss the raw scoring for your source or if you have any questions regarding your water system, please contact me at (517) 546-9858.

Sincerely,

Amy Hiipakka
Non-Community Public Water Supply
Program Coordinator

Enclosures
cc: DEQ Noncommunity File

APPENDIX E

Source Water Assessments
For
Community Public Water Supply Systems
On Groundwater Sources

Table of Contents

Section	Page
Introduction	1
GPS Locations and Water Well Records	1
Global Positioning System	1
Well Records and WELLOGIC	1
Geographic Information System	1
Overview of Source Water Assessment Scores	2
Source Water Assessment Score System	2
Geologic Sensitivity - $SWAS_G$	2
Well Construction - $SWAS_W$	3
Well Grouting	3
Well Age	3
Casing Depth	4
Pumping Rate	4
Water Chemistry and Isotope Data - $SWAS_C$	4
Nitrates and Nitrites	4
Presence of Organic Chemicals	5
Inorganic Contaminants	5
Radionuclides	5
Tritium	5
Isolation from Sources of Contamination - $SWAS_S$	6
Control of Isolation Area	6

INTRODUCTION

Source water assessments are to be performed on CPWS throughout the state that do not participate in wellhead protection. The source water assessments will be completed in accordance with the provisions described herein and have, as objectives, the following:

- Accurately establish through the use of a GPS and GIS the location of CPWS wells.
- Provide for the entry of water well drilling records into an electronic data management system.
- Identify the location and proximity of sources of contamination located within 2,000 feet of CPWS wells.
- Establish a SWAS that reflects the "inherent vulnerability" of the CPWS well and source water.

GLOBAL POSITIONING SYSTEM LOCATIONS AND WATER WELL DRILLING RECORDS

Obtaining accurate location information and water well drilling record information for CPWS wells is an essential first step in the state SWAP. The location and well drilling record information will be entered into the Statewide Groundwater Data Base (SGDB).

Global Positioning System

Location information will be collected for each CPWS well using a GPS. The ultimate goal is to obtain accurate GPS locations on all CPWS wells for entry into the SGDB. The GPS locations must be "corrected" to provide accurate well locations before the locations are entered in the SGDB. Corrected locations may be obtained through the "real time" acquisition of accurate locations or postprocessing of the collected location information to provide accurate locations.

Well Records and *Wellogic*

Information from well drilling records is critical to the SWAP. As part of SWAP, available well drilling records for CPWS wells will be compiled. The SGDB contains location verified well information compiled from well drilling records to which the well drilling record information for CPWS wells will be added. Wellogic is the software program that allows well record information to be stored in a data base format and provides for the automated entry, storage, and retrieval of well information.

Geographic Information System

The use of GIS for analysis and display of location and well drilling record information is necessary in the state SWAP. ArcInfo coverage is the MDEQ standard for GIS applications. ArcView and ArcInfo are the standard software packages for departmental information analysis and applications.

To the extent staffing and contract activities allow, the SWAP will provide maps to district offices that include the following information:

- Maps showing the locations of wells derived by address matching using the Type I data base and base maps developed from the Michigan Information System.
- County vulnerability maps based upon a statewide vulnerability map to be developed by Dr. Dave Lusch, MSU.
- Potential sites for contaminant sources based upon state lists.

The GPS location and well drilling record information will be compiled and incorporated into the statewide GIS for use in the analysis of information and the presentation to the public. Through GIS the results can be used in protection efforts for public water supplies and also be used to focus groundwater protection efforts for private water supply wells.

OVERVIEW of SOURCE WATER ASSESSMENT SCORES

In addition to the GPS/GIS phases of the source water assessment, the vulnerability of CPWS wells will be evaluated by determining a SWAS. Ideally a source water assessment would entail a critique of the rate at which groundwater moves both horizontally and vertically in the subsurface. Unfortunately, hydrogeologic studies that document the rate of ground water movement are scarce, difficult to conduct, and expensive. The SWAS has been created as a numeric system that assigns points for situations that represent a "perceived risk" based upon the evaluation of four criteria. The evaluation criteria provide a "qualitative assessment" of groundwater movement and the potential for movement of contaminants into the subsurface. The SWAS is based upon evaluation of the following:

1. The geologic sensitivity of the CPWS well.
2. The construction, maintenance, and use of the CPWS well.
3. Chemistry and/or isotope data from the CPWS well water.
4. Isolation and control of the CPWS well from sources of contamination.

The criteria are evaluated in a manner such that a higher SWAS is equated to a greater perceived risk for the CPWS source water.

The SWAS system has been developed cooperatively with the Environmental Health and Field Operations Sections in the Water Division, MDEQ. Staff from these sections may utilize the SWAS to assign monitoring requirements and identify CPWSs that should receive follow-up activities.

Source Water Assessment Score System

The SWAS system is based upon the accumulation of points for situations that represent a perceived risk to the CPWS source water. The SWAS is derived from a sum of a geologic sensitivity score ($SWAS_G$); a well construction score ($SWAS_W$); a score for chemistry and isotope data ($SWAS_C$); and isolation and control from sources of contamination score ($SWAS_S$).

Geologic Sensitivity - $SWAS_G$

The $SWAS_G$ is factored into the SWAS based on the total thickness of CCM such as clay, clay-rich till, or shale, penetrated in construction of the CPWS well; or the total thickness of CPCM such as a mixture of sand and clay or sandstone and shale. The total thickness of CCM and CPCM should be determined from the well drilling record for the CPWS well. Where a well drilling record is not available, well drilling records from adjacent wells or test hole borings may be used. Geologic maps (i.e., lithologic cross-sections) may also be used if they provide adequate coverage of the area in which the CPWS well is located.

Thirty points (30) are initially assigned to the $SWAS_G$ to represent a well lithology with an associated "high geologic sensitivity." From the thirty points, three points are then deducted from the $SWAS_G$ for each 5 feet of CCM or 10 feet of CPCM indicated on the well drilling record. The greater the amount of CCM or CPCM, the greater the intrinsic geologic protection provided the CPWS well, the greater the number of points deducted, and the lower the resulting $SWAS_G$. The following table provides a breakdown of geologic sensitivity, feet of CCM, feet of CPCM, and the points deducted from the 30 points to provide the resultant $SWAS_G$:

Geologic Sensitivity, CCM, CPCM, and Points Deducted

Geologic Sensitivity	High Sensitivity		Moderate Sensitivity						Low Sensitivity		
Amount of CCM (feet)	0	5	10	15	20	25	30	35	40	45	50 or greater
Amount of CPCM	0	10	20	30	40	50	60	70	80	90	100 greater
Points Deducted	0	3	6	9	12	15	18	21	24	27	30

It is important to note the CCM and/or CPCM must be equal to or greater than 5 feet and 10 feet, respectively, to provide a deduction in the $SWAS_G$. The CCM and/or CPCM less than 5 feet and 10 feet, respectively, shall not be summed to provide a deduction to the $SWAS_G$. Further, where the amount of CCM and/or CPCM indicated on the well drilling record results in a deduction of more than 30 points, the $SWAS_G$ shall be assigned a score of zero (0).

Well Construction - $SWAS_W$

The design, physical condition, and operation of a CPWS well may allow the entrance of contaminants into the well despite a high level of intrinsic geologic protection. To account for this possibility, the SWAS is assigned points through the $SWAS_W$ based upon four criteria related to the construction and use of the CPWS wells. The $SWAS_W$ is assessed points based upon well grouting, the age of the well, the casing depth, and the pumping rate of the well.

Well Grouting - The well grouting criteria provides an evaluation of the condition of the well relative to current requirements set forth in the Groundwater Quality Control Act, Part 127, 1978 PA 368, as amended and rules, 1994 Revision (Act 368), for sealing the annular space of a water well. Points are added to the $SWAS_W$ in accordance with the following:

0 pts. - The well drilling record indicates the casing has been sealed from bottom to top in accordance with R 325.1634a, Construction of wells; grouting rotary-bored and augered wells, Rule 134a of Act 368.

5 pts. - The well drilling record indicates the casing has been sealed to an unknown depth or to a depth of 25 feet, in accordance with R 325.1635, Construction of wells; grouting driven casing wells, Rule 135, of Act 368.

10 pts. - The well drilling record indicates the well was grouted, but the date of construction precedes the 1994 revisions to Act 368, and available evidence suggests the well is not in compliance with current grouting requirements.

15 pts. - The well drilling record indicates the well was not grouted, no well drilling record is available, or other information suggests the well was ineffectively grouted.

Well Age - The age of a well provides an overall indication of probable conformity to current code requirements for the construction of a well, and an indication of the probable integrity of the well due to deterioration of materials used in the construction of the well. The $SWAS_W$ is assessed a greater number of points as the age of the well increases in accordance with the following criteria:

0 pts. - A well drilling record is available that indicates the well was constructed after the 1994 revisions Act 368, or a well drilling record is available that indicates the well was constructed in accordance with the 1994 requirements.

5 pts. - A well drilling record is available that indicates the well was constructed prior to 1994 and after 1976, the year the state of Michigan, SDWA was adopted as the standard for the regulation of public water supply systems.

10 pts. - A well drilling record is available that indicates the well was constructed prior to 1976 but after 1967, the year Act 368, was originally adopted as the standard for the construction of wells.

15 pts. - A well drilling record is not available, the age of the well is unknown, or it is determined that the construction of the well precedes the 1967 inception of Act 368.

Casing Depth - The depth to which a well is cased is a factor in determining the amount of earth material available to provide for natural attenuation of potential contaminants. The $SWAS_W$ is assessed a greater number of points as the casing depth is decreased in accordance with the following criteria:

0 pts. - The well drilling record, or a physical determination of the casing depth, indicates the well is cased to a depth of 200 feet or greater.

5 pts. - The well drilling record, or a physical determination of the casing depth, indicates the well is cased to a depth between 100 and 199 feet.

10 pts. - The well drilling record, or a physical determination of the casing depth, indicates the well is cased to a depth between 25 and 99 feet.

15 pts. - The well drilling record, or a physical determination of the casing depth, indicates the well is cased less than 25 feet, the casing terminates below grade, or the casing depth is not known.

Pumping Rate - The pumping rate has considerable impact on the "cone of depression" and "area of influence" of a well. In generalized terms, the area of influence is greater at higher pumping rates, thereby, increasing the potential for contamination of a CPWS well. Accordingly, the $SWAS_W$ is assessed additional points based upon the following criteria for the pumping rate of the permanent pump:

0 pts. - The well drilling record, or a physical determination of the pumping rate of the permanent pump, indicates the well is pumped at a rate of less than 200 gpm.

5 pts. - The well drilling record, or a physical determination of the pumping rate of the permanent pump, indicates the well is pumped at a rate of 200 to less than 500 gpm.

10 pts. - The well drilling record, or a physical determination of the pumping rate of the permanent pump, indicates the well is pumped at a rate of 500 to less than 1,000 gpm.

15 pts. - The well drilling record, or a physical determination of the pumping rate of the permanent pump, indicates the well is pumped at a rate greater than 1,000 gpm.

Water Chemistry and Isotope Data - $SWAS_C$

Water chemistry data provides a refinement to the SWAS through the $SWAS_C$, which may increase or decrease the SWAS. As examples, the presence of nitrates; nitrites; volatile organic compounds or synthetic organic compounds, even at low levels; regulated inorganic chemicals; and regulated radionuclides are indicators of source water vulnerability and increase the SWAS; the absence of tritium in the source water indicates the source water is old and not vulnerable, thereby decreasing the SWAS. Review of chemical monitoring records should go back 5 years or more if appropriate. $SWAS_C$ cannot be less than 0 when tritium is less than 1 tritium unit.

Nitrates and Nitrites - Water chemistry data that indicates nitrate-nitrogen (NO_3-N) or nitrite-nitrogen (NO_2-N) concentrations are present in the well water are an indication of vulnerability and result in points being added to the $SWAS_C$. The NO_3-N and NO_2-N data should be evaluated and points assigned the $SWAS_C$ based upon the most recent sample results or historical trends. Water chemistry data for NO_3-N or NO_2-N concentrations in the well water shall result in the assignment of points to the $SWAS_C$ in accordance with the following:

0 pts. - NO_3-N and NO_2-N not detected in the well water.

10 pts. - NO_3-N or NO_2-N detected in the well water at a concentration that is less than one-half the MCL.

20 pts. - NO_3-N or NO_2-N detected in the well water at a concentration that is less than the drinking water standard, but the concentration is one-half or more than one-half the MCL.

50 pts. - NO_3-N or NO_2-N detected in the well water at a concentration that exceeds the MCL.

Presence of Organic Chemicals - The presence of a volatile organic compound (VOC) or synthetic organic compound (SOC) is a clear sign of source water vulnerability. Points will be added to the $SWAS_C$ if water chemistry data indicates the presence, with confirmation, of a VOC or SOC in accordance with the following:

0 pts. - No VOC or SOC has been detected in the well water.

10 pts. - VOC or SOC detected in the well water at a concentration that is less than one-half the MCL.

20 pts. - VOC or SOC detected in the well water at a concentration that is less than the MCL, but the concentration is one-half or more than one-half the MCL.

50 pts. - VOC or SOC detected in the well water at a concentration that exceeds the MCL.

Inorganic Chemicals - Water chemistry data which detects the presence of regulated inorganic chemical contaminants in the well water from man made or natural sources indicates either a vulnerable source and/or the sources possible inability to meet maximum contaminant levels (MCL). Fluoride is exempt from this scoring unless natural concentrations exceed ½ the MCL or 2 mg/l. Points will be added to the $SWAS_C$ if water chemistry data indicates the presence, with confirmation, of a inorganic contaminants in accordance with the following:

0 pts. - Regulated inorganic contaminants not detected in the well water.

10 pts. - Regulated inorganic contaminants detected in the well water at a concentration that is less than one-half the MCL.

20 pts. - Regulated inorganic contaminants detected in the well water at a concentration that is less than the drinking water standard, but the concentration is one-half or more than one-half the MCL.

50 pts. - Regulated inorganic contaminants detected in the well water at a concentration that exceeds the MCL.

Radionuclides - The presence of regulated radionuclides indicates the well is susceptible to natural or manmade contaminants that may effect the supply's ability to meet drinking water standards. Points will be added to the $SWAS_C$ if water chemistry data indicates the presence, with confirmation, of a regulated radionuclide in accordance with the following:

0 pts. - Regulated radionuclides not detected in the well water.

10 pts. - Regulated radionuclides detected in the well water at a concentration that is less than one-half the MCL.

20 pts. - Regulated radionuclides detected in the well water at a concentration that is less than the drinking water standard, but the concentration is one-half or more than one-half the MCL.

50 pts. - Regulated radionuclides detected in the well water at a concentration that exceeds the MCL.

Tritium - The analysis of CPWS well water that indicates no tritium is present indicates the source water is not vulnerable and results in a negative assignment of points to the $SWAS_C$: Sources with tritium levels between 1.0 and 10 tritium units are of questionable vulnerability and receive no points.

-30 pts. - Added to the $SWAS_C$ where isotope data indicates the tritium concentration in the source water is less than 1.0 tritium units.

+30 pts. - Added to the $SWAS_C$ where isotope data indicates the tritium concentration in the source water exceeds 10 tritium units.

Isolation from Sources of Contamination - $SWAS_S$

Isolation from Standard and Major Sources - The isolation of a CPWS well from sources of contamination is an important criteria in the source water assessment. The maintenance and control of isolation distances can significantly reduce the perceived risk associated with the use of a well. The $SWAS_S$ is assessed points for failure to maintain and/or control adequate isolation between "potential" sources of contamination and "known" sources of contamination. Known sources of contamination include those sources where the groundwater has been impacted as a leaking underground storage tank or other sites of environmental contamination. The $SWAS_S$ is assessed points based upon isolation as follows:

10 pts. - Each "standard source" of potential contamination within 200 feet of the CPWS well.

10 pts. - Each "major source" of potential contamination located from 200 to 2,000 feet of the CPWS well.

20 pts. - Each "major source" of potential contamination located within 200 feet of the CPWS well.

25 pts. - Each "known" source of contamination located within 2,000 feet of the CPWS well.

Control of Standard Isolation Area - The Michigan SDWA requires a CPWS to own or control, through a lease or easement, the defined isolation area around each well. Failure to own or properly control this area effects the future vulnerability of the well. Additional points will be added to the $SWAS_S$ based on the following schedule:

0 pts. - CPWS owns or controls the entire isolation area.

10 pts. - CPWS owns or controls one-half or more of the isolation area.

20 pts. - CPWS owns or controls less than one-half the isolation area.

NOTE: Comments, maps, and well drilling records included with or attached to the score sheet will benefit the review of this assessment and future source water assessment related activities.