



MARQUETTE COUNTY HEALTH DEPARTMENT,  
TECHNICAL GUIDANCE MANUAL  
TO THE  
MARQUETTE COUNTY  
SUPERIOR ENVIRONMENTAL HEALTH CODE

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## **INTRODUCTION**

The Superior Environmental Health Code was adopted to promote public health, safety, and welfare of the people of the Upper Peninsula of Michigan. Within the Code are the specifications for construction of sewage and water supply systems. Due to the dynamic and complex nature of on-site sewage and water systems governed by the Code, an on-going technical guidance document is necessary. This Technical Guidance Manual has been prepared to provide guidelines, specifications, and standard practices used to implement the Code.

## **ARTICLE 3.0 LICENSING AND REGISTRATION**

### **SEWAGE SYSTEM INSTALLER LICENSING PROCEDURES**

Reference: Section 3.1, 3.2 of the Superior Environmental Health Code

1. Applicant shall complete a written exam proctored by an environmental health representative of the local health department.
2. The exam may be taken at any of the local health department jurisdictions.
3. Upon satisfactory completion of the exam, the results will be reviewed and incorrect answers discussed with the applicant.
4. A passing score is 70%. A retest can be scheduled at contractor's discretion.
5. A separate license will be required for each local health department.
6. The license will be valid for three (3) years, starting with the calendar year in which the license is first issued. The license shall expire on December 31.

## **ARTICLE 5.0 SEWAGE**

### **100 YEAR FLOOD PLAIN RESTRICTIONS**

Reference: 5.7.1.1.G Minimum Site Requirements/100 Year Floodplain

This section of the code states that all sewage systems shall not be located in a floodplain of less than one hundred (100) years, or in an area subject to seasonal flooding or ponding of surface waters. Historically there has been much debate statewide regarding the interpretation of, "the site shall not be located in a floodplain".

Flood plain delineation is currently the responsibility of the Michigan Department of Natural Resources, Water Resource Division and is subject to change. Flood plain information can be obtained by contacting the appropriate State agency.

For the purpose of flood plain enforcement through the Superior Environmental Health Code, the flood plain boundary will be defined as follows:

“The first point in the landscape between the proposed septic system or well installation area, where the 100 year flood level, as determined by the appropriate State agency, intersects the land.”

All proposed septic system and well locations must be outside of this boundary as defined.

Permit applications for parcels, which cannot meet this requirement, shall be denied in accordance with department policy, and must pursue a variance to move forward.

Systems installed by variance must be installed so that the entire septic system, including the 4 feet of soil beneath the aggregate and soil interface, are elevated above the 100-year flood level as determined by the appropriate State agency.

Wells, which are installed within the 100 yr flood plain by variance or deviation, must have elevated casings, which raise the wellhead and screened vents above the 100 yr flood level.

Note: Permits from MDNRE, Water Resource Division, or appropriate State agency, may be required prior to placing fill for a conventional sewage system below or in a 100-year floodplain elevation.

## **SEWAGE SYSTEM ABANDONMENT**

Reference: Section 5.7.1.1.G

This section is provided to guide industry and regulators in the proper abandonment of a septic tank and/or absorption system. Regardless of the abandonment method chosen, a potential safety hazard must not be created.

### Septic Tank

Abandonment shall not proceed until the septic tank is pumped and the contents properly disposed of by a licensed septage waste hauler. Alternative methods of septage and tank disposal may be approved in writing by the health officer. Proper abandonment of a septic tank shall consist of one of the following methods:

1. Collapse tank when feasible; otherwise completely fill it with material approved by the health officer. Provide compaction during the filling process to eliminate the potential to develop a sinkhole or any other safety hazard.

### Absorption System

When it is practical to do so, the absorption system should be left in place. When the area is needed for other purposes, the absorption system may be removed.

The disposal method to be used shall be one of the following:

1. Remove and haul the contaminated material to a licensed Type II landfill. Containment of the contaminated material must be provided during transport to avoid creation of a nuisance or environmental health hazard.
2. A property owner may choose to bury the abandoned absorption system on his or her own parcel, or the parcel of another with owner's consent. All components of the system shall be buried in a manner that does not create an environmental health hazard.

## **AGGREGATE/FILTER MATERIAL**

Reference: 5.10.1

Aggregate/filter material shall be washed stone or other material approved by the Health Officer that complies with all of the following specifications:

1. One hundred percent (100%) passing through a two and one-half inch sieve.
2. No material shall pass a one-half inch sieve except for fines. Fines are material that will pass through a number two hundred sieve.
3. The total fines content passing through a number 200 sieve, as determined by loss by wash method, shall not exceed one-half percent.

Stone aggregate may be field evaluated for hardness acceptability by determining whether it can scratch a copper penny without leaving any rock residue.

Aggregate shall be transported, stockpiled, and/or otherwise manipulated in a manner, which will not contaminate it with fines exceeding one-half percent loss, by wash method.

Slag, chipped rubber, synthetics, concrete pavement, and other alternative aggregate may be approved in writing by the Health Officer.

## **SEPTIC TANKS**

Reference: 5.12(1)

This section states:

“Septic tanks shall be watertight and constructed of concrete or other materials approved by the Health Officer.”

1. In order to provide technical guidance to meet this standard, the following specifications have been established:
  - a) Pre-cast concrete tanks shall have a minimum wall, compartment and bottom thickness of two and one-half inches and shall be adequately reinforced. The top shall be at least four inches thick and able to withstand the load for which it was intended.

- b) Concrete block tanks are not permissible.
  - c) A cast in place concrete tank shall be approved by the Health Officer prior to construction and comply with all specifications listed in part (a).
  - d) The use of polyethylene septic tanks or tanks manufactured with materials other than concrete shall be limited to sites when use of a concrete tank is not feasible. Written approval from the Health Officer is required prior to permitting a septic tank constructed of any material other than concrete.
2. The liquid capacity of all prefabricated septic tanks shall be permanently marked on the uppermost tank surface.
  3. Manufacturers shall demonstrate, upon request of the Health Officer, that the septic tanks, which they manufacturer, are watertight.
  4. Multiple compartment tanks shall comply with the following:
    - a) As measured from the invert elevation of the outlet, the first compartment shall have at least two-thirds of the total required liquid capacity.
    - b) Each compartment within a tank shall have an inspection port situated above the outlet baffle.
  5. The minimum liquid depth of any compartment shall be thirty-eight inches (38"). Liquid depths greater than seventy-eight inches (78") shall not be considered in determining the working liquid capacity.
  6. When a high water table is present, septic tanks shall be weighted to prevent floating or shifting.
  7. Access ports shall be provided for maintenance. They shall be a minimum of twelve inches by twelve inches (12"x12"), twelve inches (12") in diameter, or a maximum of twenty inches by twenty inches (20"x20") in diameter. Each access port cover shall be provided with a corrosion resistant strap or handle to facilitate removal.
  8. Inspection ports instead of access ports will not be accepted.
  9. The access port for cleaning and maintenance purposes shall extend to ground surface by a secure riser. Access port covers shall be adequately secured to prevent unauthorized access. Existing tanks, which will be in continued use for a replacement system, will be required to be retrofitted with an approved riser.
  10. A tank shall be located to assure accessibility for inspection and cleaning. No other construction or landscaping shall impede the tank's accessibility.
  11. The tank shall be located on the same side of a building that the sewer line exits the foundation wall. The building sewer shall be at least five feet long, but as short as possible, and contain not more than two (2) forty-five degree (45<sup>0</sup>) degree bends, or one long sweeping ninety degree (90<sup>0</sup>) bend.
  12. The inlet and outlet specifications are as follows:
    - a) Have a minimum diameter of four inches (4").
    - b) Be placed on opposite ends of the tank, unless otherwise specified by the Health Officer.

- c) The invert elevation of the inlet shall be at least two inches (2") higher than the invert elevation of the outlet.
  - d) The outlet shall be equipped with an effluent filter extending below the tank's liquid level a distance equal to but not less than thirty-five percent (35%) or greater than fifty percent (50%) of the liquid level.
  - e) The tank inlet and outlet shall be installed with a rubber or neoprene gasket to provide watertight connections. The Health Officer may approve in writing other watertight connections.
13. Tank ventilation shall be provided by means of a minimum of eight inches (8") of air space between the underside of the top of the tank and the top of the 'T' fitting.
  14. A multiple compartment tank shall have a four-inch (4") minimum diameter 'T' or an effluent filter, placed in the common wall; utilizing the same specifications as established for the effluent filter in section 12.
  15. Septic tanks shall be set level side to side and front to back.
  16. Tanks shall be installed with the outlet closest to the drainfield as designed by the manufacturer.

## **EFFLUENT FILTERS/LINES**

Reference: Section 5.12

1. An effluent filter is required in all new and/or replacement septic system installations. This will at times require effluent filters to be retrofitted to existing tanks. The filter shall be installed and used in accordance with the manufacturer's recommendations.
2. An effluent filter shall meet the following specifications:
  - a) Be constructed of durable and corrosion-resistant materials.
  - b) Be designed to prevent the escape of suspended solids during normal operation or malfunction.
  - c) Retain all particles greater than one-eighth inch (1/8") in size.
  - d) Be designed to accommodate the effluent discharge for the system it serves.
3. Effluent lines shall be 4" diameter schedule 40 PVC, or equivalent, piping with glued joints for the entire length of line between the filter outlet and the drainfield.
4. Effluent lines serving systems that require pumping from the septic tank to the drainfield must be connected to the drainfield header at an angle of 45 degrees or greater. This configuration is to prevent the backflow of effluent from the drainfield to the tank when the pump cycles off.

## **ABSORPTION SYSTEM**

Reference: Section 5.7, 5.10.4

### **Trench Designs**

The following shall be used to design trench absorption systems.

1. Thirty-six inch (36") wide trenches shall be spaced seven feet (7') on center, which would leave approximately four feet (4') of undisturbed soil between trenches.
2. Thirty inch (30") wide trenches shall be spaced at least six feet (6') on center.
3. Twenty-four inch (24") wide trenches shall be spaced at least five feet (5') on center.
4. Eighteen inch (18") wide trenches shall be spaced at least four feet (4') on center.
5. A common header shall be installed (footers not required).
6. Rock and pipe trench systems must be constructed of State approved perforated pipe, placed with holes facing downward within the trench, and solid schedule 40 PVC pipe in the header and effluent line.
7. Rock aggregate must be approved aggregate installed at a thickness of six inches (6") below the perforated pipe and extending to two inches (2") above the perforated pipe.
8. Chamber systems may be used for trench installations without gravel, must be installed in accordance with manufacturer's recommendations and will be sized in accordance with current State guidance regarding chamber sizing.

### **Chamber System Installation**

1. Chamber systems can be installed as a bed configuration or a trench configuration.
2. Sizing for chamber systems will be determined by the current State guidance. At the time of this revision, the State has provided a comparison chart in Microsoft XL format.
3. Bed configuration: Number of chambers required is determined by the make and model of the specific chamber used compared to the required number of chambers per 100 ft<sup>2</sup> of bed without sidewall.
4. Trench configuration: Number of chambers required is determined by the make and model of the specific chamber used compared to the required number of chambers per 100 ft<sup>2</sup> of bed with sidewall infiltration allowed.
5. Chambers shall be installed in accordance with manufacturer's recommendations on leveled and raked trench bottoms on soil, which has not been compacted or smeared.
6. The effluent line and the header must be constructed of solid schedule 40 PVC piping with glued joints. Headers must be set level. Footers are not required.
7. Observation ports shall be installed in the fittings provided by the manufacturer in the end of each row of chambers.
8. Chambers shall be back filled with clean permeable soil, which is free of rocks, cobbles and boulders, to avoid damage or offset to the chambers.
9. A minimum of 12 inches of soil cover shall be placed over the chambers after final installation.

### **Mound Site Preparation Procedure**

1. Check the moisture content of the soil to a depth of eight inches (8"). Smearing and compacting of wet soil will result in reducing the infiltration capacity of the soil. Proper soil moisture content can be determined by rolling a soil sample between the hands. If it rolls into a one-fourth inch (1/4") wire, the site is too wet to prepare. If it crumbles, site preparation can proceed. If the site is too wet to prepare, do not proceed until it dries.
2. Lay out the fill area on the site so that the distribution cell runs perpendicular to the direction of the slope whenever possible.
3. Standard Mound Installation: Cut trees flush to the ground and leave stumps, remove surface boulders that can be easily removed, remove vegetation over six inches (6") long by mowing and removing cut vegetation. Prepare the site by breaking up, perpendicular to the slope, the top six inches (6") to eliminate any surface mat that could impede the vertical flow of liquid into the in situ soil. Chisel type plowing is highly recommended especially in fine textured soils. Rototilling or other means that pulverize the soil is not acceptable. The important point is that a rough, unsmear surface be left. The sand fill will intermingle between the clods of soil, which improves the infiltration rate into the natural soil. Immediate application of at least 6 inches of fill material is required after tilling. All vehicular traffic is prohibited on the tilled area. For sites where the effluent may move laterally, vehicle traffic is also prohibited for fifteen feet (15'), down slope and ten feet (10') on both sides of level sites. If it rains after the tilling is completed, wait until the soil dries out before continuing construction.
4. Deep Cut/Cut and Fill Mound Installation: If more permeable soils are available lower in the profile, a deep cut excavation may be made. Deep cut excavations shall not be greater than six feet (6') in depth unless approved by the Health Officer. Deep cut and fill installations will only be permissible where strata that are more permeable are located in the soil profile, which are determined to be of consistent thickness of no less than twenty-four inches (24") and are not affected by water table. The excavation must expose the permeable layer without contamination.
5. Place the fill material, which has been properly selected, around the edge of the tilled or excavated, area. Work from the end and up slope sides. This will avoid compacting the soils on the down slope side, which, if compacted, affects lateral movement away from the fill and could cause surface seepage at the toe of the fill on slowly permeable soils. Move the fill material into place using a small track type tractor with a blade or a large backhoe that has sufficient reach to prevent compaction of the broken up area. Do not use a tractor/backhoe having tires. Always keep a minimum of six inches (6") of fill material beneath tracks to prevent compaction of the in situ soil.
6. Place the fill material to the required depth.

### **Fill Material**

1. Clean medium sand with little or no fines is to be used to form a sand base to the elevation that is required on the permit and/or site evaluation. Sand fill shall be added from the upslope side or ends to reduce site disturbance whenever possible.
2. When constructing a mound system, a five-foot (5') sand extension around the bed is required. This sand extension prevents effluent from leaching out of the toe of slope.
3. In addition to the five foot (5') sand extension, a minimum 3:1 slope to natural grade is recommended. Steeper slopes can be approved by the Health Officer on a site-specific

basis. It is recommended that a sand-based soil be used for this slope. The edge of the aggregate bed must be placed a minimum of ten feet (10') from property lines. In no case shall slope fill cross property lines without direct consent of the owner of the impacted parcel.

### **Observation Ports**

1. Observation ports shall extend to the ground surface and remain visible after installation.
2. The inspection port shall be constructed of non-perforated PVC, which is four inches (4") in diameter, and be equipped with a removable cap.
3. Inspection ports shall be installed 1 foot from the corner of the footer, on each outside lateral of the system using a ninety degree (90<sup>0</sup>) 'T' fitting oriented upward vertically. The inspection port shall be glued into the 'T' fitting for permanent installation."

### **Aggregate Cover**

Reference: Section 5.10.5

- 1) Straw/Hay is an approved material for covering the aggregate. This straw/hay must be of sufficient thickness that fines cannot filter through and clog the drainfield (enough so that no aggregate can be seen when covered).
- 2) Soils used to cover the drainfield should not be clay-based soils in order to maximize evapo-transpiration. A minimum of 12 inches and a maximum of 30 inches of soil cover are required.
- 3) The field area shall be seeded and mulched to provide grass growth and prevent erosion of the field. The area around the field shall be landscaped to drain surface runoff away from the field area. Trees should not be grown on or near the field area as the roots will eventually plug the laterals. Grass is the best cover for your drainfield.
- 4) To avoid compaction and breakage of drainfield materials, the drainfield should not have structures built upon it and vehicle traffic should not be allowed.

### **Privies**

Privies/outhouses can only be permitted to be installed on parcels, which meet the Michigan Department of Consumer and Industry Services' 2003 Technical Bulletin "Requirements for Plumbing Fixtures in Remote Cabins"

Prior to being granted a privy permit, the applicant must provide written proof of a plumbing permit exemption from the Marquette County Construction Code Authority.

Issuance of a privy permit will also require application for and issuance of a grey water permit if a structure with a sink or primitive bathing facility will be constructed.

Privy Construction requirements are governed by Act 273 PA 1939 and the rules promulgated there under titled “Department of Environmental Quality, Division of Water and Radiological Protection, Outhouses” including Rule 325.421 through Rule 325.426.

Privies shall be constructed as follows:

- 1) A soil test hole must be evaluated for the primary privy location and a reserve replacement area.
- 2) Soil conditions must be known, and must meet suitability requirements, for a minimum vertical distance of four feet (4') below the intended bottom of the pit for an earth pit privy. This will require a test hole of minimum eight and one-half feet (8.5') depth.
- 3) The constructed earth pit shall have a depth minimum of four and one-half feet (4.5') and a depth maximum of six feet (6'). These depth requirements may require mounding if water table or bedrock is encountered. The minimum volume of the pit shall be fifty cubic feet (50 ft<sup>3</sup>) per seat.
- 4) Sills shall be provided to support the outhouse structure.
- 5) Pit curbing shall be installed to support the excavation from collapse and shall extend the depth of the pit. Pit curbing shall not be use to support the outhouse structure or sills.
- 6) Pit mounds shall be of well tamped earth installed in thin layers and shall extend outward on the level a minimum of eighteen inches (18") beyond the edge of the sills. Slopes on mound edges shall not be steeper than 3:1, and shall be seeded or covered with sod to prevent erosion.
- 7) The floor and seat riser shall be constructed of impervious material or tongue and groove lumber, and in a manner to exclude insects. The seat riser shall be bonded to the floor to prevent seepage, and shall be provided with a seat with a hinge lid.
- 8) The pit shall be ventilated from the riser to a point outside of the structure by a flue or vent having a cross-sectional area of a minimum twelve square inches (12 in<sup>2</sup>). The joints of the vent shall be tight and the opening screened with 16-mesh screening
- 9) The privy structure shall be fully enclosed and fly tight.

Vaulted privies can be constructed by using an approved septic tank, or concrete privy vault, in substitution of a pit and meeting all criteria stated above. Vaulted privies shall be placed where they are accessible to a septic pumping truck.

### **Grey Water Systems**

Grey water only systems can only be permitted to be installed on parcels, which meet the Michigan Department of Consumer and Industry Services' 2003 Technical Bulletin "Requirements for Plumbing Fixtures in Remote Cabins"

Grey water systems can only be installed for structures, which do not have pressurized plumbing, and rely on carried water only. For the purposes of this technical manual, pressurized plumbing includes plumbing under gravity pressure from a storage tank, or plumbing, which relies on temporary connections to surface water or storage tank pumps.

Prior to being granted a grey water system permit, the applicant must provide written proof of a plumbing permit exemption from the Marquette County Construction Code Authority.

**Frequently, grey water installations are requested for sauna installations. If power is available per MDCIS Remote Cabin definition, all sauna drains must be sumped and pumped to a septic tank connected to an absorption system located on the parcel.**

Issuance of a grey water system permit will also require issuance of a privy permit to serve the remote structure.

It is important to note that grey water has been scientifically shown to convey pathogens and contain significant nutrients. As such, grey water is a potential threat to ground and surface water resources.

Grey water systems shall be permitted and constructed as follows:

- 1) A test hole must be provided in the intended location of the grey water drain, and in a suitable replacement area, to determine soil suitability.
- 2) Grey water installations shall meet all isolation distance requirements specified for drainfield absorption beds in the Superior Environmental Health Code.
- 3) The grey water infiltration system shall be installed to allow forty-eight inches (48") of suitable soil beneath the drain system/soil interface and any evidence of water table or bedrock.

- 4) The sewer line connecting the source to the grey water drain shall be a Schedule 40 PVC sewer line with glued joints.
- 5) The infiltration system shall be constructed in accordance with the requirements for construction of absorption fields specified by current code and shall be of adequate size to handle the projected flow rate of the source. Alternatively, a drywell can be constructed as an infiltration system using approved aggregate and cribbing which allows for the transfer of wastewater to the soil interface. Drums, which have been used to contain toxic materials such as petroleum products, shall not be modified for use as dry well cribs due to potential groundwater and soil contamination issues. Minimum drywell sizing shall be twenty-four inches (24") in diameter by twenty-four inches (24") in depth. Vertical isolation from the bottom of the drywell to water table, bedrock or other soil restrictions shall be maintained at forty-eight (48").

### **Final Inspections**

Reference: 5.15.1

- 1) Final Inspection notification shall occur at least one (1) department working day prior to the completion of the system. The department shall inspect the installation within three working days to determine if it complies with the code. The department shall reserve the right to extend the notification period for weekends and legal holidays.
- 2) For purposes of this code, the minimum components of a sewage system that must be installed for a full final inspection are as follows: septic tank, aggregate, sand fill (if required), drainfield piping network (header and footer connections), and five foot (5') sand extensions (if required). Approved aggregate cover should be on-site for verification if not installed.
- 3) If any of the components of the sewage system are missing or there are deficiencies in construction, the system will be "red tagged" as not meeting permit/code requirements. Systems not approved will require corrections to be made in accordance with Article 7 (Enforcement) of the code. Proof of correction will be required, most likely by a re-inspection from a sanitarian with a follow up fee charged to the installer.
- 4) Privies and grey water drains also require final inspection and approval.

## **ARTICLE 6.0**

## **WATER SUPPLIES**

### **Geothermal Borings**

The Superior Environmental Health Code's definition of a "well" includes the following in regards to geothermal exchange: An opening in the surface of the earth for utilizing the geothermal properties of earth formations, including, but not limited to a heat exchange well used for the purpose of utilizing the geothermal properties of the earth formations for heating or air conditioning. This includes both supply and return wells and the vertical boreholes for closed

loop systems. The Sanitary Code authorizes the health department to develop and adopt a Technical Manual.

**Vertical Closed Loop Systems- shall be constructed in accordance with current MDEQ guidance/best practices**

Vertical Closed Loop Systems are any installations vertical or horizontally directionally bored which are at a depth of fifteen feet (15') or greater.

Vertical closed loop systems require a permit from the local health department.

One permit is required for single and two family residential sites or systems.

One permit is required per twenty-five (25) boreholes on a commercial site or system.

Permit application shall include a site diagram, the number of proposed boreholes, and proposed heat transfer fluids to be used. A permit application must be submitted to the local health department fourteen (14) days prior to installation.

**Construction Permit Requirements:**

1. Geothermal boreholes must be constructed (drilled and grouted) by a Michigan licensed water well driller or individuals authorized under the Administrative Rules, as amended, of the Michigan Public Health Code, 1978 PA 368, Part 127.
2. All hydronic piping installation must abide by the rules set forth in the 2006 International Mechanical Code.
3. A preliminary site evaluation shall be conducted by the health department and a construction permit issued prior to any drilling or installation.
4. Geothermal boreholes must be constructed and grouted in accordance with Part 127.
5. Grouting of boreholes shall be completed within 24 hours of borehole completion.
6. One record representing the formation must be submitted for each geothermal permit. The formation information, as-built drawing, and all other requested information must be recorded on the DEQ Geothermal Closed –Loop Construction Notice and submitted to the health department within 60 days of completion of the boreholes.
7. Vertical loops shall be isolated in accordance with the following isolation distances:
  - Household drinking water well - fifty feet (50')
  - Type IIb or Type III public water well - seventy-five feet (75')
  - Type I or IIa public water well - two-hundred feet (200')
  - Residential on-site sewage system - twenty-five feet (25')
  - Buried water service line or sewer line - ten feet (10')
  - Property line - ten feet (10')

Note: Marquette County Health Department shall have the authority to grant variances to or increase the isolation distance listed above.

8. Heat transfer fluids shall be food-grade propylene glycol, methanol, or ethanol (20 percent) or other nontoxic compounds that meet IGSHPA Closed Loop/Geothermal Heat Pump Systems, Design and Installation Standards, 2007 Edition, Section 3B and 3C, and are compatible with manufactures' specifications. Flammable liquids shall not be used.
9. All underground piping must be a minimum of 160-psi pressure rated high-density polyethylene.
10. All joints in piping must be heat fused by butt, socket, sidewall or electro fusion in accordance with the pipe manufacture's procedures and in compliance with the 2006 International Mechanical Code.
11. Pressure testing must be conducted prior to transfer fluids being installed. Pressure testing must be at 100 psi for thirty (30) minutes in compliance with the International Mechanical Code.
12. A leakage detected shall be immediately excavated and repaired or the loop shall be permanently abandoned in accordance with Part 127.
13. A tag listing contractor's name, chemicals used for heat transfer fluids, and chemical concentrations must be installed on the heat exchanger unit.
14. All buried geothermal piping must have continuous locator tape attached.
15. All vertical boreholes that are to be abandoned must be abandoned in accordance with Part 127. If the loop cannot be removed, the loop shall be permanently sealed by pumping high solids bentonite grout into the loop and completely filling the loop with grout.

### **Vertical Open Loop Systems**

Vertical Open Loops Systems utilize a water well to supply ground water to a heat pump. All open loop wells are regulated under Part 127, require a water well permit from the local health department, and shall be constructed by a Michigan licensed well driller. Wells that are part of a groundwater thermal exchange system may not serve another function, except water may be supplied to the domestic water system if the domestic water system is protected by an air gap or backflow prevention device in accordance with Michigan's Plumbing Code.

### **Horizontal Closed Loop Systems**

Horizontal closed loop systems are regulated by Mechanical Code Authorities.

### **Hand Pump Wells**

Hand pump well permits will only be granted for parcels, which meet the requirements of the Michigan Department of Consumer and Industry Services' 2003 Technical Bulletin "Requirements for Plumbing Fixtures in Remote Cabins".

Prior to being granted a hand pump well permit, the applicant must provide written proof of a plumbing permit exemption from the Marquette County Construction Code Authority.

For remote structures, a privy permit and potentially a grey water permit must also accompany a hand pump well permit.