	OFFICE OF DRINKING WATER AND MUNICIPAL ASSISTANCE POLICY AND PROCEDURE	DEPARTMENT OF ENVIRONMENTAL QUALITY
Original Effective Date: October 10, 1996 Revised Date: Reformatted Date: April 3, 2013	Subject: Hydraulic Fracturing of Water Wells Division/Office and Program Names: ODWMA-Well Construction Program Number: ODWMA-368-127-005 Page: 1 of 3	Category: <input type="checkbox"/> Internal/Administrative <input type="checkbox"/> External/Noninterpretive <input checked="" type="checkbox"/> External/Interpretive

A Department of Environmental Quality (DEQ) Policy and Procedure cannot establish regulatory requirements for parties outside of the DEQ. This document provides direction to DEQ staff regarding the implementation of rules and laws administered by the DEQ. It is merely explanatory; does not affect the rights of, or procedures and practices available to, the public; and does not have the force and effect of law.

INTRODUCTION, PURPOSE, OR ISSUE:

Hydraulic Fracturing (also known as “hydrofracturing” or “hydrofracking”) is a process where liquids or gases are pressurized within a confined area of a water well borehole to open existing bedrock fractures or part of the bedrock matrix to increase permeability.

The use of improper methods or performing hydraulic fracturing in certain geologic settings may result in well contamination or aquifer impairment. R 325.1637 of the Groundwater Quality Control Rules states “Hydraulic fracturing of bedrock is not permitted without the prior written approval of the health officer.” Since the rule does not include specifics on how the local health department (LHD) Health Officer can assess if hydraulic fracturing should be approved, this policy and procedure and the accompanying technical manual provide a basis for issuing permits for hydraulic fracturing of water wells.

AUTHORITY:

R 325.1637, Rule 137(3), of the Groundwater Quality Control Rules, R 325.1601 *et seq.*, adopted under authority of Part 127, Water Supply and Sewer Systems, of the Public Health Code, 1978 PA 368, as amended, the Michigan Water Well Construction and Pump Installation Code, being MCL 333.12701 *et seq.* (Code).

STAKEHOLDER INVOLVEMENT:

The technical manual associated with this policy and procedure was developed by a stakeholder group that met nine times from late 1994 through early 1996. The stakeholder working group consisted of a well drilling contractor experienced in hydraulic fracturing, a consultant Geologist, the District Geologist for the Michigan Department of Natural Resources, an Environmental Health Sanitarian from the Michigan Department of Public Health, an Environmental Engineer from the Michigan Department of Public Health, and the Division of Environmental Health Supervisor and an Environmental Health Sanitarian from the Marquette County Health Department.

During this policy and procedure development, stakeholder involvement was expanded beyond the working group. Early in the process, a survey was sent to all well drilling contractors

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operating in the Upper Peninsula of Michigan eliciting data and opinion relevant to the policy and procedure and technical manual development. Once prepared, the draft policy and procedure and technical manual were sent for peer review by a select group of well drilling contractors and LHD Environmental Health Supervisors. The final version was supported by the Ground Water Advisory Committee.

DEFINITIONS: Contained in the policy technical manual.

POLICY:

When a well regulated under Part 127 and/or under a local sanitary code is proposed to be hydraulically fractured, the request for approval shall be directed to the LHD Health Officer.

When a Type I public well is proposed to be hydraulically fractured, written approval shall be obtained from the DEQ, Office of Drinking Water and Municipal Assistance's (ODWMA) district engineer who is responsible for issuing the permit under the Safe Drinking Water Act, 1976 PA 399, as amended. The district engineer shall consult with the LHD and ODWMA, Well Construction Program, staff before granting written permission.

The ***Hydraulic Fracturing Request Review Policy***, otherwise known as the technical manual, shall be used by the reviewing agency (LHD or DEQ) to process the hydraulic fracturing request. The reviewing agency's approval or denial for hydraulic fracturing may be transmitted to the well owner or well drilling contractor using the ***Hydraulic Fracturing Request Approval/Denial Form***, which is included in the ***Hydraulic Fracturing Request Review Policy***.

PROCEDURES:

WHO	DOES WHAT
Water well drilling contractor or well owner	Submits application to LHD to hydraulically fracture water well for all well types except Type I public wells. Applications to hydraulically fracture Type I public wells shall be submitted to the DEQ.
LHD Health Officer or DEQ District Engineer	Reviews application in accordance with policy.
LHD Health Officer	If minimum isolation distances as defined in the policy technical manual are not met, the LHD Health Officer requests review by ODWMA, Well Construction Program, staff.
DEQ District Engineer	Consults with Well Construction Program staff and with LHD.
Well Construction Program staff	When consulted, provides recommendations regarding hydraulic fracturing of the well to the LHD Health Officer and/or DEQ District Engineer.
LHD Health Officer or DEQ District Engineer	Issues permit/authorization or denial to hydraulically fracture a well.

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REFERENCE:

Hydraulic Fracturing Request Review Policy, otherwise known as the technical manual

OFFICE CHIEF APPROVAL:



Liane J. Shekter Smith, P.E., Chief
Office of Drinking Water and Municipal Assistance

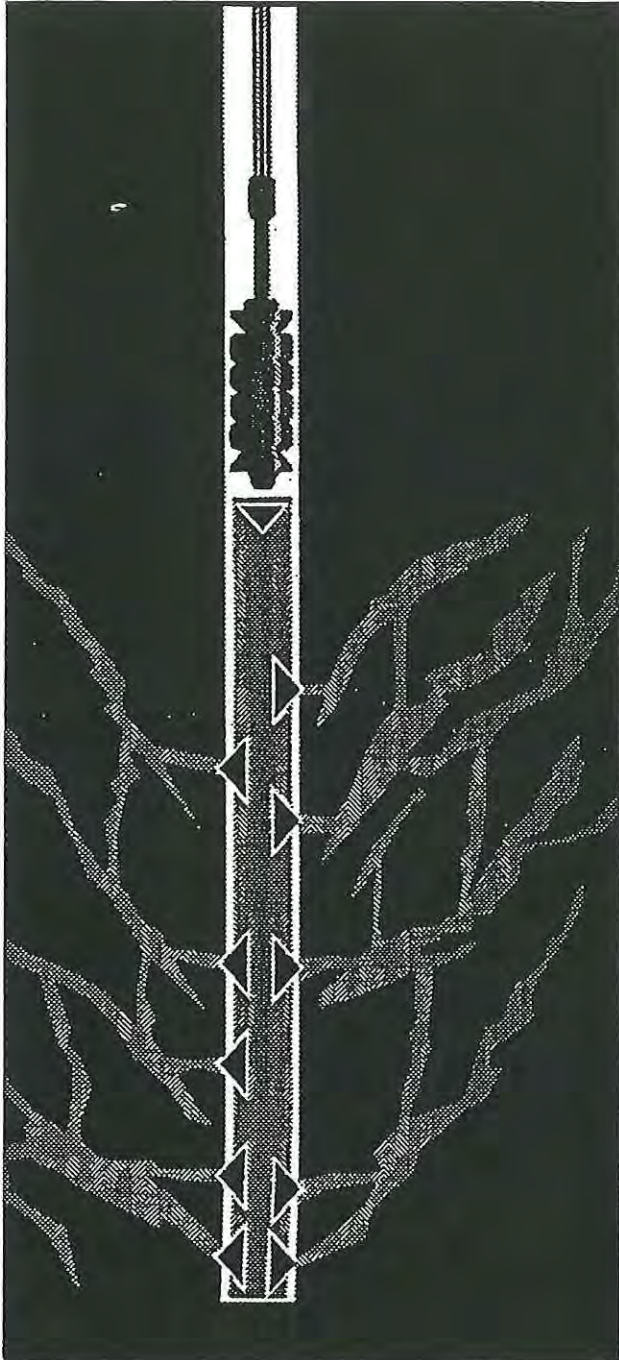
3/15/2013
Date

DEPUTY DIRECTOR APPROVAL:



Jim Sygo, Deputy Director

4/3/2013
Date



Hydraulic Fracturing Request Review Policy

HYDRAULIC FRACTURING REQUEST REVIEW POLICY

HYDRAULIC FRACTURING COMMITTEE MEMBERS:

Fred Benzie -	Committee Chairperson Registered Sanitarian, Supervisor Division of Environmental Health Marquette County Health Department
Frank Chenier -	Geologist Michigan Department of Natural Resources
Harry Kleiman -	Engineer, Registered Well Driller Owner: Kleiman Pump and Well Drilling
Mack McDonald -	Registered Sanitarian Drinking Water and Radiological Protection Division Michigan Department of Environmental Quality
Jane Surrell -	Committee Recording Secretary Registered Sanitarian Division of Environmental Health Marquette County Health Department
Chuck Thomas -	Geologist and Ground Water Engineer Drinking Water and Radiological Protection Division Michigan Department of Environmental Quality
Jack VanAlstine -	Ret. Assistant State Geologist Geological Survey Division Michigan Department of Natural Resources Sanitarian Division of Environmental Health Marquette County Health Department

* Hydraulic fracturing cover art courtesy of Flatwater Fleet Inc.

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HYDRAULIC FRACTURING REQUEST REVIEW POLICY

Part I. PURPOSE AND SCOPE

The Hydraulic Fracturing Request Review Policy was drafted for use by local health department staff for reviewing well drillers' requests to hydraulically fracture drinking water wells.

Section A. Background Information:

Subsection 1: Description of Procedure

Hydraulic fracturing (HF) was developed by the oil industry in the 1940's for opening up tight reservoir rocks to improve product recovery. It consists of injecting fluid (usually water) into the well under such pressure that the formation is actually parted, or fractured. The pressures required are generally 1 psi or less for every foot of depth. Sand or plastic additives (proppants) are sometimes used to maintain the fractures. The fractures produced are generally only a few millimeters wide, but may extend for hundreds of feet and may be either horizontal or vertical depending on the path of least resistance.

HF was first used in the drinking water well industry in the early 1960's. Since then, the procedure has become popular with water well drillers, particularly in the "hard rock" crystalline bedrock areas of the United States. HF has also been in used in limestone and sandstone water wells with success.

Some concerns with HF of water wells have been expressed by the environmental health sector. While HF procedures in the oil industry are completed at greater depths, water wells are generally shallow and therefore are hydraulically fractured closer to the surface. In areas where the bedrock is found with little or no overburden, hydraulic fracturing could create channels near or at the surface thus allowing contamination to enter the well. There are also concerns of fracturing and obtaining water of aesthetically undesirable quality such as high chlorides, or of negatively impacting the water quality or quantity of neighboring wells.

HF is a well stimulation procedure which can enhance water production but is generally a method of last resort. It allows property owners the opportunity to increase water production from wells which would not otherwise produce enough water for their needs. Geologic and hydrologic data and other subsurface conditions are rarely, if ever, known with precise accuracy on a proposed HF site. Therefore, this policy was developed to minimize the potential for on-site problems or damage during the HF procedure and to provide as much protection as reasonably possible for adjacent property owners.

Subsection 2: Legal Foundation for Developing an HF Policy

In April of 1994, Part 127, 1978 P.A. 368 was amended to address hydraulic fracturing of water wells. R 325.1606 (4) (g) defines hydrofracturing as constituting well drilling. R 325.1637 (3) states, "Hydraulic fracturing of bedrock is not permitted without the prior written approval of the health officer". A definition for what constitutes hydrofracturing or hydraulic fracturing however, was not included in Part 127, nor were policies provided by rule for reviewing requests or issuing approvals; A policy to review and approve hydraulic fracturing as required by R 325.1637 (3) of Part 127, 1978 P.A. 368 needed to be developed.

Section B. Definitions:

Subsection 1: Department

The department is the local health department having jurisdiction.

Subsection 2: Formation Packer

A formation packer is a device designed to isolate sections of a borehole.

Subsection 3: Health Officer

The Health Officer is the administrative officer in charge of the local health department having jurisdiction, or his/her authorized representative.

Subsection 4: Hydraulic Fracturing

The definition of hydraulic fracturing for the purpose of this policy is as follows. 'Hydrofracturing' and 'hydraulic fracturing' mean the same.

Hydraulic Fracturing: Is the application of liquids or gases exceeding 250 pounds per square inch via confinement in a predetermined portion of borehole for the purpose of parting the rock matrix or opening existing rock fractures to increase permeability. The pressure is pump pressure, measured at the ground surface.

Subsection 5: HF

Hydraulic fracturing and HF mean the same.

Subsection 6: HF Packer

An HF packer is a device designed to isolate and contain pressure within the borehole.

Subsection 7: New Well

A new well is a well where construction has commenced within 20 days of an HF request.

Subsection 8. Proppants

Proppants are clean, chlorinated, inert materials used to maintain rock fractures that should not adversely affect the aquifer or water pumped from the well.

Subsection 9: Structure

A structure is a building or dwelling where people either work or live, a garage, or a building built upon a foundation.

Subsection 10: Target Well

A target well is the well that is proposed for hydraulic fracturing.

Subsection 11. Transmission Main

A transmission main is a underground pipe line, other than a residential utility line, utilized for the distribution of a product that would be considered a ground water contaminant should it be released into the ground water, or gases or liquids that could be a threat to public safety.

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Section C. Purpose and Use of the Hydraulic Fracturing Request Review Policy:

In accordance with Part 127, 1978 P.A. 368, a person wishing to hydraulically fracture a water well must submit their request to the local health department having jurisdiction for written approval. Upon receipt of an HF request, health department staff will use this policy and procedures described in Part II, Section D, Subsection 1, to determine whether written approval may be granted.

Part II. HYDRAULIC FRACTURING APPROVAL**Section A. Application:**Subsection 1: Timely Submittal

- (1)(a) The request for approval to hydraulically fracture an existing well must be submitted to the Health Officer at least seven (7) full business days prior to the scheduled work.
- (1)(b) The request for approval to hydraulically fracture a new well must be submitted to the Health Officer at least two (2) full business days prior to the scheduled work.

Subsection 2: Use of Approved Application for HF Approval Form

- (2)(a) A hydraulic fracturing request submittal must include the Application for HF Approval form completed by the licensed well driller. The form may be obtained from the Health Officer.
- (2)(b) All sections of the form must be completed except where the information is not available. A sketch of the site must be provided that shows the relative location of the target well to all other wells within 250 feet. The sketch must detail the distance from the target well and location of rock outcrops, structures, potential contaminant sources, roads, water bodies, transmission mains, and property boundaries within 250 feet.
- (2)(c) Potential contaminant sources include septic systems, underground and above ground fuel and chemical storage vessels, sewers, barnyards, manure pits, abandoned wells, waste storage

or disposal units, or any other source that could possibly impart a biological or chemical contaminant into the ground water environment.

Section B. Review of the Application for HF Approval Form by Health Officer:

The information given on the Application for HF Approval form will be reviewed by the Health Officer to determine whether an approval can be made.

Subsection 1: Application and Criteria for Denial

A department receiving an Application for HF Approval form shall review the form for completeness including the signature of the registered driller who will be responsible for hydraulically fracturing the well. The department may return an application without action, or it may be denied, if it has been determined that any of the following exist:

- a) pertinent information is missing,
- b) inaccurate information has been provided,
- c) the requirements of this policy and/or applicable state laws and regulations cannot be met.

Subsection 2: Review of Application Information for HF Approval

(2)(a) The reviewing department shall use the Criteria for Hydraulic Fracturing flow charts to determine the minimum HF packer setting depth below the bottom of the casing if the target well meets the isolation distances as specified in Part II, B., Subsection 3, unless site conditions and/or target well construction warrants otherwise.

(2)(b) If the target well does not meet the isolation distances as specified in Part II, B., Subsection 3., the department shall consult with appropriate recognized State agencies to determine whether approval to hydraulically fracture may be issued and what, if any, special requirements should be included.

Subsection 3: Use of Criteria for HF Flow Charts in Evaluation of HF Request by Health Officer

The Health Officer shall use the Criteria for Hydraulic Fracturing flow

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charts to determine the minimum HF packer setting depth below the bottom of the casing and for issuing an approval to hydraulically fracture a well, if the following isolation conditions are met:

- (3)(a) **Nearest Well:**
The target well is more than 200 feet away from the closest neighboring well.
- (3)(b) **Nearest Bedrock Outcrop:**
The nearest bedrock outcrop is more than 200 feet from the target well.
- (3)(c) **Distance from Contamination Source:**
- (3)(c) i. The target well is isolated from potential sources of contamination in accordance with Part 127, 1978 P.A. 368 or Act 399, P.A. 1976, as applicable to type of contaminant source.
- (3)(c) ii. The target well is more than 800 feet from an Act 451, Section 201 site (or Act 307 site) or any other known site(s) of ground water contamination.
- (3)(d) **Isolation from Surface Water:**
The target well is more than 100 feet from surface water.

If the target well is within 100 feet of surface water, that being a stream, river, lake, bog, or intermittent stream, the HF packer shall be placed below the casing at a depth at least 75 feet below the surface elevation of the surface water, or the depth as determined by the use of the Criteria for HF flow charts, whichever depth is greater.

Subsection 4: Target Well Information for Use with the Criteria for HF Flow Charts.

- (4)(a) **Grouting:** For the purpose of using the Criteria for HF flow charts, a well shall only be considered grouted if the casing is grouted the entire length from the bottom of the casing up to the pitless adaptor with neat cement, concrete, or a

mixture of neat cement and bentonite where the bentonite component is no more than five percent by weight.

If the well to be fractured is grouted with a material that is not listed in the preceding paragraph, the "Not Grouted" side of the Criteria for HF flow chart shall be used when determining the depth of the packer setting.

If the well is not proven to be grouted, the HF packer setting shall be determined from the 'not grouted' portions of the Criteria for HF flow charts except as provided in Part II, B., Subsection (4)(d).

- (4)(b) **Casing Length:** The casing length shall be the actual length of approved steel or plastic casing installed in the well from the ground surface to the bottom of the casing. If a well with a buried wellhead is to be hydraulically fractured, the casing must be extended in an approved manner in accordance with Rule 325.1642(1), Part 127, 1978 P.A. 368.
- (4)(c) **Casing Type:** A well can not be hydraulically fractured unless it is constructed with approved steel or plastic casing. HF packer settings shall be at least 5 feet below the bottom of the casing.
- (4)(d) **Grouted Liner Present:** If a liner of approved material has been installed in the well, the length of grouted liner beyond the outer casing may be added to the casing length, and this total length used with the 'grouted' side of the Criteria for HF flow charts providing the following conditions are met:
- 1) There is five feet or more of grouted liner in place inside the outer casing;
 - 2) There is five feet or more of grouted liner past the end of the outer casing;
 - 3) And there is 20 feet or more of grouted liner installed.

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The 'grouted' side of the Criteria for HF flow charts may be used if the foregoing conditions are met even if the outer well casing is not grouted.

The HF packer setting must be at least 10 feet below the bottom of the liner pipe.

- (4)(e). **UngROUTed Liner Present:** If a liner pipe of approved material is present but is not grouted in place, then the depth and grout condition of the outer casing shall be used with the Criteria for HF flow charts to determine the packer setting.
- (4)(f) **Formation Packer:** If a formation packer is installed in the target well, the Health Officer may require special conditions for the HF procedure.
- (4)(g) **Well Depth:** The well depth shall be the actual drilled hole depth from the ground surface that is free of debris and other obstructions. The portion drilled through unconsolidated materials above bedrock shall be considered the overburden depth.
- (4)(h) **Well Log:** If an approved log of the target well is available, a copy shall be included with the application form.

If an approved log of the target well is not available, the contractor must, using generally acceptable methods, determine and provide the following information to the Health Officer: well diameter; casing type, length and integrity; static water level; depth of overburden; bedrock type to be hydraulically fractured and whether the well is grouted as defined by this HF policy. In absence of adequate information for the target well, the Health Officer may deny the HF application or may require a more conservative HF approach.

- (4)(i) **Static Water Level:** The static water level shall be measured before and after HF. A change in static water level after fracturing may be indicative of unwanted interconnections between aquifers, formations, and/or

surface features. (eg. fracture opened to ground surface at a hillside outcrop)

- (4)(j) **Distance to Underground Transmission Main Pipeline:**
If underground transmission main pipelines are located within 200 feet of the target well, the well driller performing the HF must contact Miss Dig or any non-participating owners of the pipelines 72 hours before HF.

Section C. Site Review:

Subsection 1: Evaluation of Hydraulic Fracturing Sites

- (1)(a) The relative location of the target well to all other wells, including abandoned wells and pits, all structures, sources of potential contamination, and outcrops within 250 feet must be accurately located on the site sketch and confirmed by the Health Officer. If the site visit reveals the information provided is not accurate and representative of actual site conditions, the HF approval shall not be issued and the Application for HF Approval form returned to the applicant with an explanation.
- (1)(b) If there are questions concerning the data provided on the well records and/or well permits they must be resolved prior to issuing the HF approval.

Subsection 2: Requiring Site Visits

- (2)(a) **Existing Wells:** A site visit shall be required for existing wells before HF approval is considered. The purpose of the site visit is twofold. First, to review and confirm that the information provided is accurate and reasonably represents actual site conditions. Second, to determine that no pertinent information or conditions regarding the site were overlooked.
- (2)(b) **Newly Constructed Wells:** A site visit may be required for newly constructed wells prior to HF approval when the Health Officer determines there is a need for additional

information or if the information provided on the HF application is in question.

Section D. Issuing HF Approval:

Subsection 1: Issuing Written Approval

- (1)(a) The Health Officer shall review the application and information available including site visit information, utilize the HF Request Review Policy and Criteria for HF flow charts, and may consult with State agencies in approving HF requests. Approval shall be provided in writing on forms provided by the department. The HF approval shall specify a minimum HF packer setting depth below the end of the casing and may include special requirements. The approval may require the collection of water samples prior to HF and/or after HF as specified in a written agreement between the department and the well owner. The collection of additional data on the target well may be required as part of the HF approval, including but not limited to, static water level measurements or production capacity.
- (1)(b) A target well which has been determined by the health officer to be contaminated, may be approved for HF if the target well is reconstructed to isolate the contamination source before the well is hydraulically fractured.
- (1)(c) HF approvals shall expire 60 days from the date of issuance and are contingent upon no new wells or other construction occurring within 200 feet of the target well.

Subsection 2: Issuing Written Denial

- (2)(a) The Health Officer may deny an application for HF when incomplete, inaccurate or false information has been supplied, or when (s)he determines the requirements of this policy and/or applicable State Statutes have not or can not be met. The reasons for denial shall be furnished to the applicant in writing.
- (2)(b) An HF request shall be denied when the aquifer(s) to be hydraulically fractured has been determined by the health officer

to be chemically and/or bacteriologically contaminated, except as allowed by Part II, D, Subsection (1)(b).

Section E. General Construction Requirements:

Subsection 1: Chlorination

The target well shall be disinfected by a method approved by the department prior to HF. All water used in the HF process shall comply with Rule 325.1639 (8), Part 127, 1978 P.A. 368 as amended.

Subsection 2: HF Packers

If plastic outer casing or liners are installed, the HF packers used must be of a design that will not damage the casing during installation or removal.

Subsection 3: Injection Fluids

Water used as an injection fluid shall comply with R 325.1639 (8), Part 127, 1978 P.A. 368., All other injection fluids, if used, shall comply with R 325.1640 (2), Part 127, 1978 P.A. 368, and/or Department of Environmental Quality, Drinking Water and Radiological Protection Division policy.

Subsection 4: Proppants

Proppants used shall be clean, chlorinated, inert materials that do not adversely affect the aquifer or water pumped from the well and shall not support microbiologic growth. Following proppant use, the well shall be pumped to waste to prevent any residual or harmful effects from their use.

III. FOLLOW UP REQUIRED ON HF WELLS

Section A. Follow up Activities:

Follow up activities to be performed after the HF procedure may be specified

as part of the written HF approval and may include water sample collection, static water table measurement, well pumping capacity measurement or other requirements that may be deemed necessary by the Health Officer.

Section B. Hydraulic Fracturing Report Form:

The Health Officer shall require the driller who hydraulically fractured the target well to complete an HF Report form and submit it to the department as part of the written HF approval.

APPENDIX 1.

APPLICATION FOR HYDRAULIC FRACTURING APPROVAL

This form must be completed by the well drilling contractor before a well may be hydraulically fractured.

Application Date: _____ Well ID Number: _____

Well Permit Number: _____

1) CONTRACTOR INFORMATION

CALL MISS DIG: 1-800-428-7171

Company Name: _____

Registration #: _____

Address: _____

Phone Number: _____

Rig Operator: _____

2) WELL OWNER & LOCATION INFORMATION

Owner Name: _____

Well Site Legal Description:

Mailing Address: _____

____ 1/4 ____ 1/4 ____ 1/4 Sec. ____ T ____ R ____

State Plane Coordinates:

Phone Number: _____

X: _____ Y: _____

Well Site Address: _____

Tax ID Number: _____

Miss Dig Ticket #: _____

3) SITE INFORMATION

Rock Type to be Fractured: _____

Hydrofractured Well Distance From:

Distance to nearest outcrop: _____ ft.

1) nearest well: _____ ft.

2) nearest structure: _____ ft.

Sketch the site in the space provided on page two. Show the relative location of the items listed in the right side column to the well to be hydraulically fractured and show all wells and buildings within 250 feet of the site.

3) surface water: _____ ft.

4) transmission pipeline: _____ ft.

5) contaminant source: _____ ft.

What is nearest contaminant source?

4) WELL INFORMATION

ATTACH WELL LOG. IF WELL LOG NOT AVAILABLE, THEN PROVIDE THE INFORMATION REQUESTED IN THIS SECTION.

Well Depth: _____ ft.

Casing Type: _____

Static Water Level: _____ ft.

Casing Depth: _____ ft.

Estimated Overburden Thickness: _____ ft.

Grout Type: _____

Liner or Formation Packer Used? Yes or No

Grouted Interval: from _____ ft. to _____ ft.

HF APPLICATION: PAGE TWO

5) WATER INFORMATION PRIOR TO FRACTURING (Required for existing production wells and wells near known contamination areas)

Quantity of Water Available Prior to Fracturing: _____ gallons per minute.
Pump must be run until it breaks suction and a true capacity must be measured by throttling with a valve. A minimum of one (1) hour of pumping must be done beyond removing standing water volume in the well.

Is Water Quality Information Available? Attach copy of laboratory analysis report or provide information requested below if report not available.

Laboratory providing analyses: _____

Nitrates: _____ mg/l

Iron: _____ mg/l

Date of Analysis: _____

Chlorides: _____ mg/l

Bacteriological: (Circle one)

Hardness: _____ mg/l

Positive Negative

SITE SKETCH (Show distances)

↑
N

CERTIFICATION

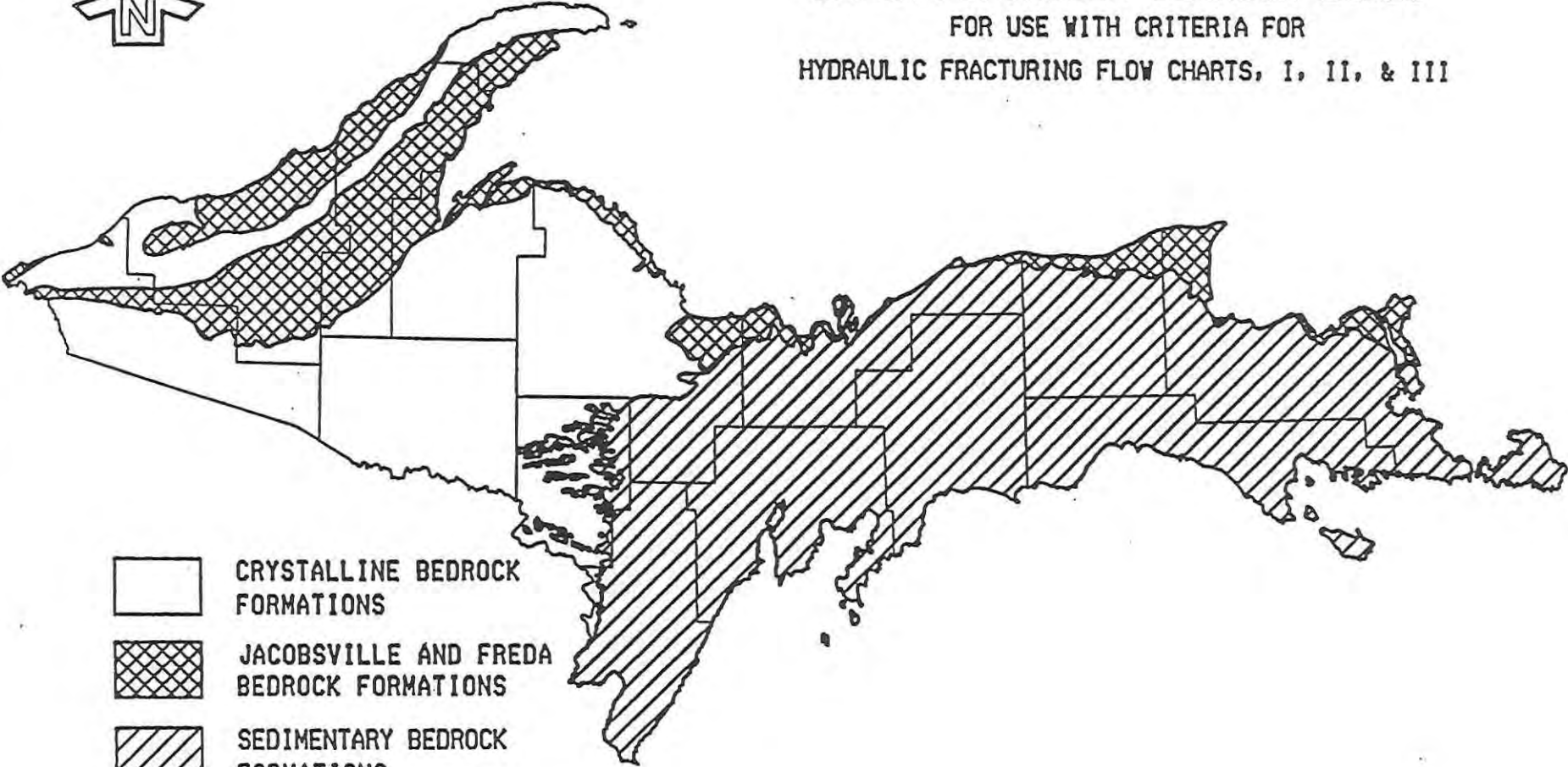
I attest that the information provided in this application is true and accurate.

WELL DRILLER'S SIGNATURE: _____

PROVIDING FALSE INFORMATION ON THE APPLICATION FORM VOIDS THE HEALTH OFFICER'S APPROVAL TO HYDRAULICALLY FRACTURE THE WELL.

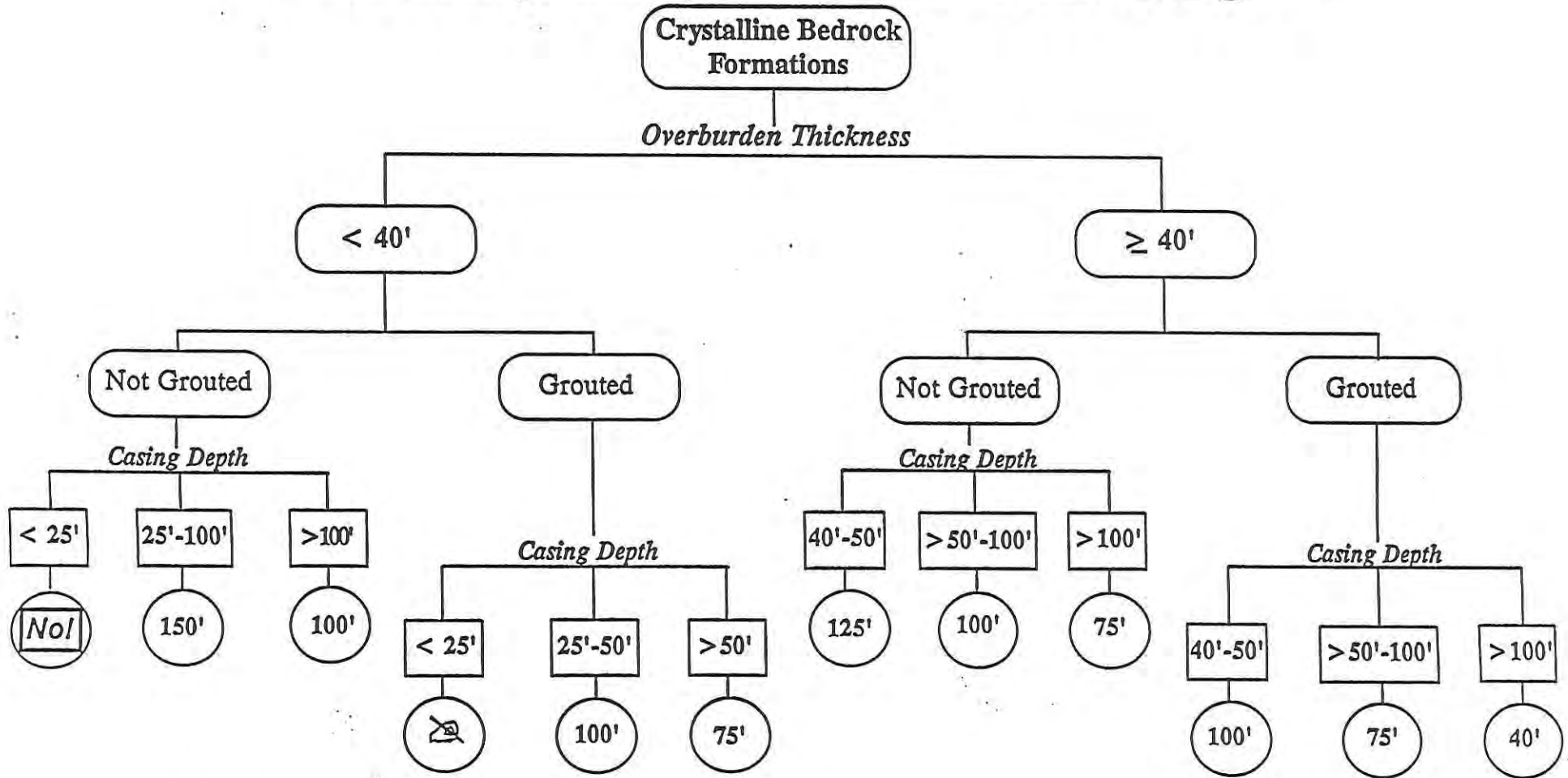
APPENDIX 2.

UPPER PENINSULA BEDROCK ZONES
FOR USE WITH CRITERIA FOR
HYDRAULIC FRACTURING FLOW CHARTS, I, II, & III



APPENDIX 3.

Criteria for Hydraulic Fracturing I



Legend



Indicates depth of packer below the bottom of the casing.



Hydraulic Fracturing not permitted.

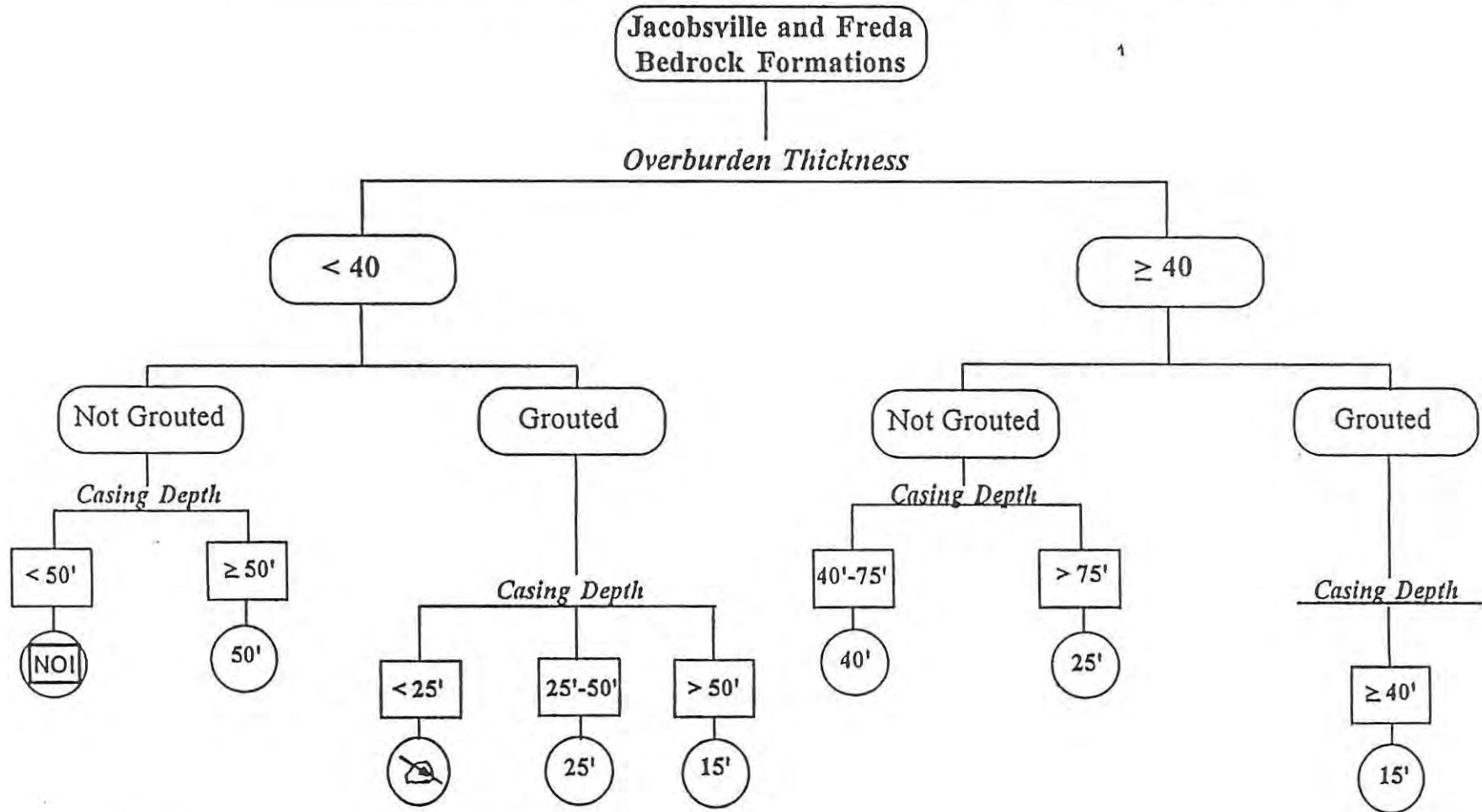


Hydraulic Fracturing may be permitted with special considerations.

'GROUTED' See Hydraulic Fracturing Policy for definition of accepted grout types.

Approved by HF Committee 5/2/95
 R 6/7/95
 R 9/27/95

Criteria for Hydraulic Fracturing II



Legend



Indicates depth of packer below the bottom of casing.



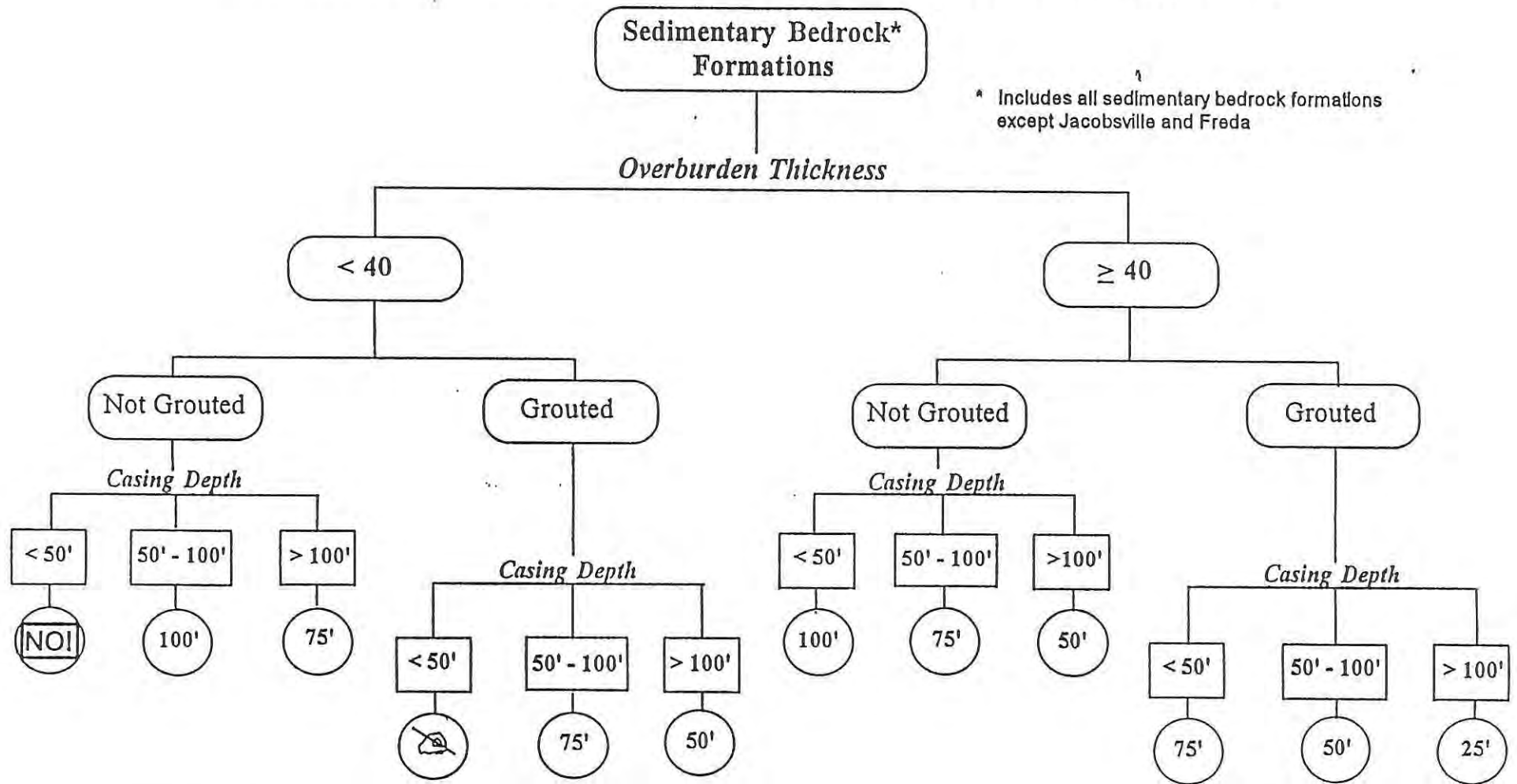
Hydraulic Fracturing not permitted.



Hydraulic Fracturing may be permitted with special considerations.

'Grouted' See Hydraulic Fracturing Policy for definition of accepted grout types.

Criteria for Hydraulic Fracturing III



Legend

○ Indicates depth of packer below the bottom of casing.

NOI Hydraulic Fracturing not permitted.

Hand Hydraulic Fracturing may be permitted with special considerations.

'Grouted' See Hydraulic Fracturing Policy for definition of accepted grout types.

APPENDIX 4.

HYDRAULIC FRACTURING REQUEST APPROVAL/DENIAL FORM

Information regarding a request to hydraulically fracture the below identified target well has been received and reviewed by an authorized representative of the Health Officer.

Well I.D. _____ Application Date _____

Well Permit # _____ Property Tax I.D. 52- _____

Street Name and Address _____

Township Name _____, _____ 1/4, _____ 1/4, _____ 1/4,

Section _____, T _____ N, R _____ W

In accordance with R 325.1637, Rule 137 (3), of "Groundwater Quality Control, Part 127, 1978 P.A. 368, as amended, and rules, the request to hydraulically fracture a water well at the above identified location is hereby:

APPROVED

For Michigan Licensed Well Driller _____ Registration No. _____

And contingent upon the following special construction practices or conditions:

The attached Hydrofracturing Report Form shall be completed by the driller performing the hydraulic fracturing and submitted to the Marquette County Health Department, Environmental Health Division within 60 days after hydraulically fracturing the well.

DENIED

Based on the following reasons:

It shall be understood that the use of HF techniques have inherent risks which require that a driller use discretion to avoid possible negative consequences. HF approvals expire 60 days from date of issuance and contingent upon no new wells or construction occurring within 200 feet.

Health Officer Representative

Date

Approved by HF Committee on 9/28/95

APPENDIX 5.

(Company Name)
Hydrofracturing Report

Date: _____		Information Prior to Fracturing	
Job # _____	Owner _____	Well Diameter _____	Casing Length _____
St. Location _____	City _____	Well Depth _____ from top of casing	which is _____ ft. above/below grade
State _____ Zip _____	Legal Description: 1/4 1/4 1/4 Sec. T R	SWL _____	Before _____ After _____
State Plane: X- _____ Y- _____	Lat. _____ Lon. _____	CAPACITY _____	(Pump must be run until breaking suction and a true capacity be measured by throttling with a valve. Minimum of 1 hour of pumping must be done beyond removing standing volume in well.)
Name of Driller _____	Year Drilled _____	Comments: _____	_____
Water Chemistry: Before After	pH _____	_____	_____
Iron _____	Nitrates _____	_____	_____
Bacti Sample Date: _____ Lab. # _____	Observed Physical Characteristics:	_____	_____
Cloudy _____	Sandy Sediments _____	_____	_____
Odor _____	Date: _____	_____	_____

Date: _____		Information During/After Fracturing				
Test Pump Mfg. _____	Test Pump Model # _____	Packer Mfg. _____	Comments: _____			
Test Pump Setting _____	Test Pump Drop Pipe Size _____	Packer Type _____	_____			
Source of Hydrofracture Water _____	Chlorinate Yes No _____	Packer Dia. _____	_____			
_____	_____	Packer Length _____	_____			
_____	_____	Element Length _____	_____			
_____	_____	Injection Tubing Dia. _____	_____			
_____	_____	_____	_____			
Pump Test:						
Time	GPM	Pumping Level	Color	Odor	Sediment Qty. Type	
1/2 Hour						
1 Hour						
2 Hour						
3 Hour						
4 Hour						
Packer Setting	Gauge Pressure	Volume Pumped	Length of Time Pumped	Flowback Yes or No	Flowback Color	Comments
1 Ft	psi	Gal.				
2 Ft						
3 Ft						
4 Ft						
5 Ft						
6 Ft						
7 Ft						
8 Ft						
9 Ft						
10 Ft						

Witnesses: _____ _____ _____	I attest the above is correct to the best of my ability:	
	Signature of Hydrofracturing Technician _____	Date _____
	Signature of Well Driller _____ Regist. # _____	Date _____

*Chain of Custody does not use U.S. Mail Service