Groundwater Protection Stakeholder Workgroup: Water Wells

Alaska Best Management Practices

MAINTAINING OR DECOMMISSIONING WATER WELLS AND BOREHOLES

Prepared by private and public stakeholders in conjunction with the authorities of the Alaska Department of Environmental Conservation, the Alaska Department of Natural Resources, and the Alaska Water Well Association.

January 23, 2017

MEMORANDUM

State of Alaska

Department of Environmental Conservation
Division of Environmental Health

TO: All Drinking Water Program staff

DATE: July 8, 2016
FILE NO:
PHONE NO: 269-7645

FROM: Christina Carpenter, EH Director

SUBJECT: Directive for accepting the "Alaska Best Management Practices for Maintaining or Decommissioning Water Wells and Boreholes"

Effective immediately, the Drinking Water (DW) Program shall accept the "Alaska Best Management Practices for Maintaining or Decommissioning Water Wells and Boreholes" (BMPs) as an approved alternate method, as described in 18 AAC 80.015(e)(2).

The purpose of this Memorandum is to act as an internal directive for the DW Program to accept the BMPs, which were developed by the Groundwater Protection and Water Wells stakeholder workgroup (workgroup). The workgroup consisted of members of the Alaska Water Well Association (water well drillers and pump installers), hydrologists, engineers, public water system owner/operators, water testing lab professionals, private citizens, and agency staff (DEC and DNR). The workgroup thoughtfully developed the BMPs taking into account Alaska's unique remoteness and natural conditions and by balancing the protection of groundwater and public health with practices that are economically sustainable and can be applied statewide.

Current DW Program regulations require methods for decommissioning water wells in 18 AAC 80.015(e). In practice, exception to the regulatory coverage are monitoring wells that are installed, maintained, or decommissioned in accordance with a work plan approved by the Division of Spill Prevention and Response or the EH/Solid Waste Program. Additionally, DW Program regulations are referenced by DNR as the requirements for permanently abandoned wells and well decommissioning methods, in 11 AAC 93.140(d) & (f). The BMPs are intended to provide easy access to, and clarify, acceptable methods as they apply to 18 AAC 80.015(e).

Thank you for your cooperation in implementing the BMPs.

Attachment: "Alaska Best Management Practices for Maintaining or Decommissioning Water Wells and Boreholes"

cc: Cindy Christian, Program Manager, EH/Drinking Water Program

MAINTAINING/DECOMMISSIONING WELLS/BOREHOLES

ALASKA BEST MANAGEMENT PRACTICES FOR MAINTAINING OR DECOMMISSIONING WATER WELLS AND BOREHOLES

Foreword

Dear Reader,

As a stakeholder of Alaska's groundwater, we have a responsibility to be good stewards of this shared natural resource. These Best Management Practices (BMPs) were designed for Alaskans who use, provide access to, or otherwise have a vested interest in Alaska's groundwater quality and quantity, with the intent of protecting our shared resource through proper construction, maintenance, and decommissioning of groundwater wells.

In 2012 the DEC began facilitating meetings with participation from representatives of different stakeholder groups to identify and address issues and concerns related to groundwater protection in Alaska. This stakeholder workgroup consisted of water well drillers, pump installers, hydrologists, engineers, state agency (i.e., DEC and DNR) staff, public water system owner/operators, water testing lab professionals, as well as private citizens. Meetings were held on a roughly monthly basis during the relatively slow off season. Minutes and results from the meetings were regularly shared with a broader group through email and a meeting web page.

The stakeholder workgroup thoughtfully developed BMPs over the course of approximately three (3) years taking into account Alaska's unique remoteness and natural conditions. These BMPs are intended to be applied to the construction of all non-public water wells and the maintenance or decommissioning of all wells and boreholes (public and non-public). The BMPs balance protecting groundwater and public health with practices that are economically sustainable and can be applied statewide. An additional outcome of the stakeholder workgroup meetings was a web site containing information compiled from across the state and nation as it relates to private drinking water wells, found at http://dec.alaska.gov/eh/dw/DWP/DWP_PrivateWells.html.

The BMPs for maintaining or decommissioning all wells are intended to provide easy access to, and clarify, methods as they apply to Alaska, by serving as an alternate DEC-approved method as described in 18 AAC 80.

Adequate protection of our groundwater resources relies on Alaskans recognizing its importance and can be accomplished through voluntary application of these BMPs.

Sincerely,

The Groundwater Protection and Water Wells Stakeholder Workgroup

MAINTAINING/DECOMMISSIONING WELLS/BOREHOLES

ALASKA BEST MANAGEMENT PRACTICES FOR MAINTAINING OR DECOMMISSIONING WATER WELLS AND BOREHOLES

Table of Contents

MAINTAINING/DECOMMISSIONING WELLS/BOREHOLES

1 Purpose

To provide best management practices that ensure water wells and boreholes within the state of Alaska, whose use has been or will be discontinued, are decommissioned or maintained in such a manner as to prevent the contamination of the aquifers penetrated by those water wells or boreholes.

2 Disclaimer

Following these practices does not relieve the person responsible for the work from compliance with any state, federal, or local authorizations which are required for the project. All necessary authorizations/permits should be obtained before proceeding with the project.

3 Scope

These practices apply to decommissioning all water wells and boreholes which penetrate aquifers that are, or could be, sources of potable water within the state of Alaska, except for monitoring wells that are installed, maintained, and decommissioned in accordance with a work plan approved by the ADEC Division of Spill Prevention and Response or the ADEC Solid Waste Program. Water wells and boreholes decommissioned prior to the date of establishment of these Best Management Practices should not be reviewed based on the omission of, or failure to perform or meet, any of the recommended practices contained herein, unless, at that time, those practices were stated and established in local or State of Alaska regulations.

4 Updates and Alterations

Future changes to this document should be done after review and approval by a committee (similar to the original Groundwater Protection and Water Wells Stakeholder Workgroup) composed of representatives from the public, industry groundwater professionals, and appropriate state agency staffs.

5 Definitions

The words, terms and phrases, used herein have the meanings given to them in "Definitions for 'ALASKA BEST MANAGEMENT PRACTICES FOR MAINTAINING OR DECOMMISSIONING WATER WELLS AND BOREHOLES' and 'ALASKA BEST MANAGEMENT PRACTICES FOR THE CONSTRUCTION OF NON-PUBLIC WATER WELLS'", except where the context clearly indicates a different meaning.

6 Best Practices

A water well or borehole should be either properly maintained or decommissioned. Proper maintenance is defined as using the practices described under 6.1 Proper Maintenance. If the conditions under 6.1 Proper Maintenance are not present, the water well should be decommissioned using the practices described in 6.2 Decommissioning.

Observation or test wells used in the investigation or management of usable sources of groundwater are not considered "abandoned" so long as they are maintained for these purposes.

The guiding principle for proper maintenance and decommissioning of a well/borehole is to ensure that no contamination of the aquifer occurs because of the well/borehole.

6 (Continued)

6.1 Proper Maintenance

Proper well maintenance should include the following elements.

A. If it is a public water system (PWS) well, requirements found in 18 AAC 80 must be met.

B. A properly installed sanitary well cap, or if the well is subject to periodic flooding, a properly installed watertight well seal.

C. Positive grading of low-permeability soil to direct the drainage of surface water or contaminants away from the well, or a sanitary ground seal of adequate depth to prevent the downward migration of water or contaminants in the annular space of the well.

D. Potential sources of contamination, such as, but not limited to, chemicals, domestic animals or equipment, should be kept away from the well.

6.2 Decommissioning

Well/borehole decommissioning work should be completed by, in consultation with, or under the guidance of, a groundwater professional in accordance with the following practices.

A. Before backfilling

1. As much as possible, remove all internal well and pump parts, wiring, accessories (excluding pitless adapters), and other obstructions in the well/borehole.

2. When a liner is present, attempt to remove it before backfilling.

B. Open annular space

An open annular space presents a potential pathway for the vertical migration of water or contaminants to an aquifer or between aquifers. An open annular space that spans different aquifers may also disturb natural aquifer water levels. When an open annular space is known or suspected, the following should be done:

1. The services of a groundwater professional experienced in such matters should be enlisted to assess whether the open annular space may be problematic. Examples of a problematic open annular space may include:

   a. The formation is noncaving, noncollapsing, or would not be expected to otherwise naturally seal the annular space; or

   b. Known or suspected contamination is on the property or adjacent property; or

6.2.B.1 (Continued)

c. Known or suspected contamination is in the aquifer(s); or

d. Known or suspected variations in the water levels of the aquifer(s) exist and are not caused by natural processes, pumping or other uses; or

e. A public water system is within 500 feet.

2. If the groundwater professional determines that the open annular space is potentially problematic, the open annular space should be sealed by removing the casing or liner, or by using the following practices:

   a. *Casing left in place*:

      i. As a minimum, break, perforate or slot from 20 feet to 40 feet below the ground surface. It should be recognized that this minimum is due to the reality of equipment availability, site access and the cost thereof. The true BMP is to perforate and pressure grout from the bottom up.

      ii. From the bottom up to 40 feet BGS, backfill per the appropriate practices in Sections 6.2.D through 6.2.E.

      iii. From 40 feet BGS up to the uppermost section (15 feet or more below ground surface), backfill by placing bentonite grout slurry from the bottom up and then pressurizing the bentonite grout slurry.

      iv. Complete the uppermost section of the well/borehole as described in Section 6.2.F.

   b. *Liner left in place*:

      i. It is a fair assumption that the liner was perforated during installation, therefore the liner should be backfilled by placing a bentonite grout slurry from the bottom up to the uppermost section (15 feet or more below ground surface) and then pressurizing the bentonite grout slurry.

      ii. Complete the uppermost section of the well/borehole as described in Section 6.2.F.

3. Where a liner exists but the open annulus is not deemed by a groundwater professional to be problematic, the following practices should be followed:

6.2.B.3 (Continued)

a. Bentonite grout slurry should be placed from the bottom up filling the hole up to the uppermost section (15 feet or more below ground surface).

b. Complete the uppermost section of the well/borehole as described in Section 6.2.F.

4. Variations from the above practices should be reviewed by the regulating authority in consultation with a groundwater professional.

C. Aquifer—flowing artesian

1. When a flowing artesian condition is present in the well, or if there is artesian leakage up around the well casing, the services of a groundwater professional experienced in such matters should be enlisted to design a procedure using inert substances and/or downhole equipment (such as a packer) that will result in the complete stoppage of water flow to the surface.

D. Aquifer—unconsolidated

1. **Backfilling Option 1 – all bentonite**: Backfill the well/borehole with bentonite as described below. Complete the uppermost section of the well/borehole as described in Section 6.2.F.

a. *Producing zones*: Backfill using bentonite chips or pellets, slowly poured in a bridge-free manner, as determined by periodically monitoring the fill level while pouring.

b. *Non-producing zones*: Backfill using either bentonite chips or pellets, slowly poured in a bridge-free manner, as determined by periodically monitoring the fill level while pouring, or bentonite grout slurry pumped in through a tremie from the bottom up.

2. **Backfilling Option 2 – combination bentonite/other backfill sequence:** Backfill with a combination of bentonite and other backfill in sequence, as described below. Complete the uppermost section of the well/borehole as described in Section 6.2.F.

a. *Bentonite*: Install a minimum eight (8)-foot thick plug of bentonite chips or pellets (i.e., two sacks of chips for a 6-inch diameter well, and 3 sacks of chips for an 8-inch diameter well), slowly poured in a bridge-free manner, as determined by periodically monitoring the fill level while pouring, immediately above the producing zones, at intervals no more than one hundred (100) feet apart, and immediately above any other identified open interval (e.g., well perforation, well screen, slotted casing, etc.).

6.2.D.2.a (Continued)

i. For wells shallower than one-hundred (100) feet below ground surface (BGS), install at least one (1) intermediate eight (8)-foot thick plug of bentonite chips or pellets, slowly poured in a bridge-free manner, as determined by periodically monitoring the fill level while pouring.

b. *Other backfill:* Backfill with clean sand, gravel, and/or local drill cuttings, disinfected with a minimum fifty (50) parts per million (ppm) chlorine water solution slowly poured on the backfill material as it is slowly placed in the well.

E. Aquifer—consolidated (i.e. "bedrock")

1. Backfill the portion of the well within the consolidated aquifer as described in Section 6.2.D, up to fifteen (15) feet below the surface casing drive shoe. If the producing zones are unknown, backfill with no more than one-hundred (100)-foot intervals of other backfill, separated by eight (8)-foot thick plugs of bentonite chips or pellets, slowly poured in a bridge-free manner, as determined by periodically monitoring the fill level while pouring.

2. From fifteen (15) feet below the surface casing drive shoe, install a plug of bentonite chips or pellets, slowly poured in a bridge-free manner, as determined by periodically monitoring the fill level while pouring, to five (5) feet above the surface casing drive shoe, and then continue to backfill following the practices described above.

3. Complete the uppermost section of the well/borehole as described in Section 6.2.F.

F. Uppermost section of well/borehole

1. At a point fifteen (15) or more feet BGS, install a plug of bentonite chips or pellets, slowly poured in a bridge-free manner, as determined by periodically monitoring the fill level while pouring, up to the depth where the casing is to be cut off and capped.

a. Cut off the well casing at least two (2) feet BGS and seal with either of the following:

i. A 0.250-inch thick plate welded to the casing completely around its circumference; or

ii. A watertight well seal that is compression bolted onto the casing.

6.2.F.1 (Continued)

b. Pour at least one fifty-pound (50-lb) sack of bentonite granules around and over the sealed casing. This helps seal the annular space near the surface and can act as an early indicator of subsurface casing during potential future excavation.

c. Finish with local soil or fill at the surface.

G. Records

1. Record of Decommissioning ("well decommissioning log"). The person completing the work should provide, in the form of a written report or completed form, a well decommissioning log to the owner within thirty (30) days of completion of the work. The well decommissioning log should include an accurate account of the procedures, as well as materials and their associated amounts, used to perform the work. The well decommissioning log is an important record that should be carefully filed and kept with other important property documents. To assist, a form is available from the ADNR, http://dnr.alaska.gov/, 907-269-8400.

7 References (the most recent version should be referenced)

Alaska Administrative Code 11 AAC 93, *Water Management*.

Alaska Administrative Code 18 AAC 80, *Drinking Water*.

Alaska Department of Environmental Conservation (ADEC), Division of Spill Prevention and Response, Contaminated Sites Program, *Monitoring Well Guidance*.

Alaska Statute, 46.15 *Water Use Act*.

ANSI/AWWA A100, Water Wells, and Appendix to ANSI/AWWA Standard A100 (*Decommissioning of Test Holes, Partially Completed Wells, and Abandoned Completed Wells*).

Great Lakes – Upper Mississippi River Board (GLUMRB) of State and Provincial Public Health and Environmental Managers, Ten States Standards, *Recommended Standards for Water Works*.

Municipality of Anchorage (MOA), Water and Wastewater System Codes, Chapter 15.55 *Water Wells*.

National Ground Water Association (NGWA), May 2014, ANSI/NGWA-01-14, *Water Well Construction Standard*.

7 (Continued)

Private Drinking Water Wells & Systems, http://dec.alaska.gov/eh/dw/DWP/DWP_PrivateWells.html, web site hosted by Alaska Department of Environmental Conservation (ADEC).

Sterrett, Robert. J., 2007, *Groundwater and Wells*, 3rd ed., Johnson Screens, New Brighton, Minnesota, 812 pp.

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD), Home Ownership Center (HOC), *Appraisal & Property Requirements, Water Systems*.

U.S. DEPARTMENT OF VETERANS AFFAIRS (VA), *Minimum Property Requirements (MPRs), Water Supply and Sanitation Facilities*.

MAINTAINING/DECOMMISSIONING WELLS/BOREHOLES

Appendix

A. Definitions

See “Definitions for ‘ALASKA BEST MANAGEMENT PRACTICES FOR MAINTAINING OR DECOMMISSIONING WATER WELLS AND BOREHOLES’ and ‘ALASKA BEST MANAGEMENT PRACTICES FOR THE CONSTRUCTION OF NON-PUBLIC WATER WELLS’”

BMP DEFINITIONS

Definitions for
"ALASKA BEST MANAGEMENT PRACTICES FOR MAINTAINING OR DECOMMISSIONING WATER WELLS AND BOREHOLES"
and
"ALASKA BEST MANAGEMENT PRACTICES FOR THE CONSTRUCTION OF NON-PUBLIC WATER WELLS"

1 Purpose

To provide definitions to words, terms, and phrases used in the best management practices in which this document is referenced.

2 Updates and Alterations

Future changes to this document should be done after review and approval by a committee (similar to the original Groundwater Protection and Water Wells Stakeholder Workgroup) composed of representatives from the public, industry groundwater professionals, and appropriate state agency staffs.

3 Definitions

The following words, terms, and phrases have the meanings given to them in this document, except where the context clearly indicates a different meaning.

AAC—Alaska Administrative Code.

Abandoned—a water well or borehole whose use has been discontinued and that has not been properly decommissioned or maintained in accordance with "Alaska Best Management Practices for Maintaining or Decommissioning Water Wells and Boreholes."

ADEC—Alaska Department of Environmental Conservation.

ADNR—Alaska Department of Natural Resources.

Air lift ("airlift")—the use of compressed air to remove (lift) a fluid or material from a borehole or excavation.

Animal containment area—any outdoor enclosure or group of enclosures containing one (1) or more horse, mule, cow, lama, or similar sized animal; four (4) or more dogs, sheep, goats, or swine, or similar sized animals; ten (10) or more rabbits, fowl, ferrets, or other domesticated small animals.

Annular space ("annulus")—the void space between the outside of the well casing and the side wall of the drilled borehole, between two casings or between a casing and a liner.

Annulus ("annular space")—the void space between the outside of the well casing and the side wall of the drilled borehole, between two casings or between a casing and a liner.

ANSI—American National Standards Institute.

BMP DEFINITIONS

Arsenic—a metallic element (heavy metal) that even at low levels over a relatively long period of time can have long-term (chronic) health effects. Arsenic occurs naturally in rocks and soil, but other sources may be from industrial and agricultural uses.

ASTM—American Society for Testing and Materials.

Aquifer—a formation, a group of formations, or part of a formation that is sufficiently saturated and permeable to yield significant quantities of water to wells and springs.

Aquifer—unconfined ("unconfined aquifer")—a condition of the aquifer in which atmospheric pressure is freely communicated to the aquifer and where the aquifer has no upper confining layer. The static water level within the aquifer is at atmospheric pressure and does not rise above the aquifer's upper limit.

Aquifer—unconsolidated ("unconsolidated aquifer")—a type of aquifer that is primarily composed of loose grains of sediment (e.g., silt, sand, gravel, or combinations).

Aquifer—confined ("artesian")—a condition of the aquifer in which it is isolated from the atmosphere by a confining layer or group of confining layers. The static water level in a confined aquifer is generally subject to pressure greater than atmospheric and rises to a level above the aquifer's upper limit.

Aquifer—consolidated ("bedrock")—a type of aquifer that is primarily composed of solidified groups of grains of sediment (e.g., siltstone, sandstone, conglomerate, or combinations), or solid crystalline rock with fractures, cracks, or voids (e.g., limestone, volcanic rock, etc.).

Aquitard ("confining layer")—a layer in the subsurface that may store water but is not permeable, which may include permafrost; and therefore, does not yield water to a well or spring.

Artesian—a confined aquifer condition in which the static water level in a well or borehole is above the aquifer's upper limit; to be differentiated from *flowing* artesian (see definition for "flowing artesian").

Bacteria (*singular*: bacterium)—a microorganism that comes in a variety of shapes. Some bacteria in drinking water can cause short-term (acute) health effects. See also definitions for "coliform bacteria", "fecal coliform", and "total coliform".

Bailing—the use of a cylindrical pipe device (with a bottom valve) suspended on a line to remove fluid or material from a borehole or excavation.

Bentonite—a naturally occurring montmorillonite aluminum silicate clay. As a commercial product bentonite comes in the form of powder, granules (8- to 20-mesh size), chips (¼ inch to ¾ inch size), or pellets (¼ inch to ½ inch size) approved by NSF/ANSI for use as grout in water wells.

BMP DEFINITIONS

Bentonite grout slurry—a high-solids mixture of bentonite particles and water with a consistency of 18 percent to 30 percent solids.

Best Management Practices—Those practices proven effective through research and field applications in Alaska.

BGS—below ground surface; "BLS" is also used, which means "below land surface."

BMP—Best Management Practice.

Borehole ("wellbore")—a hole bored into the ground and intended to be constructed for extraction of water, for water exploration, for cathodic protection, for geotechnical holes and wells, or for a ground source heat pump installation.

Bridge-free—the manner by which sealing materials are placed in a well or borehole, such that individual particles are allowed to settle to the full intended depth without prematurely clumping or sticking.

Casing ("pipe")—pipe made of material herein specified as ASTM A-53 Grade B (ASTM A-53B) steel or NSF/ANSI approved PVC or HDPE installed in a well borehole to prevent sidewall caving, to provide access to an aquifer, and to provide protection from up-hole or surface contamination of the aquifer.

Caving ("sloughing")—to fall or collapse into a borehole.

Certified laboratory—a laboratory certified by the State of Alaska.

Coliform bacteria—a set of bacteria that are found in the digestive systems of warm-blooded animals, in soil, on plants, and in surface water. Some coliform bacteria in drinking water can cause short-term (acute) health effects. See also definitions for "bacteria", "fecal coliform", and "total coliform".

Confined aquifer ("aquifer—confined"; "artesian")—a condition of the aquifer in which it is isolated from the atmosphere by a confining layer or group of confining layers. The static water level in a confined aquifer is generally subject to pressure greater than atmospheric and rises to a level above the aquifer's upper limit.

Confining layer ("aquitard")—a layer in the subsurface that may store water but is not permeable, which may include permafrost; and therefore, does not yield water to a well or spring.

Consolidated aquifer ("aquifer—consolidated"; "bedrock")—a type of aquifer that is primarily composed of solidified groups of grains of sediment (e.g., siltstone, sandstone, conglomerate, or combinations), or solid crystalline rock with fractures, cracks, or voids (e.g., limestone, volcanic rock, etc.).

BMP DEFINITIONS

Contaminant—a physical, chemical, biological, or radiological substance or material in water that, in sufficient quantity, makes water unfit for human consumption.

Contamination—the presence of a contaminant, or group of contaminants.

Cross-connection—joining of two or more zones, areas, or systems.

Cross-contamination—a cross-connection with a contaminated substance.

Cuttings ("drill cuttings")—the loose material derived from the original (in place) material by the drilling process.

DD—drawdown.

Decommission—to fill or plug a well so that it is rendered unproductive and does not produce water or serve as a channel for water movement or for the movement of contaminants.

Discharge—a release, emission, or pouring forth of fluid or material.

Disinfection—a process that inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

Domestic use—water not used for a public water system.

Drawdown (DD)—the distance between the static water level and the pumping water level in a well or an aquifer; will vary with the pumping rate.

Drill cuttings ("cuttings")—the loose material derived from the original (in place) material by the drilling process.

Drilling fluid—a freshwater or air based liquid used during the drilling operation to circulate materials (cuttings) from the borehole.

Drive-point (also called "sand-point"; "well-point") water well—a shallow (usually less than 50 feet deep) small-diameter water well (1-1/4-inch to 2-inch nominal inside diameter) consisting of coupling-connected pipe fitted with a perforated or screened section and a steel point at the end, and driven into the ground.

Drive shoe—a forged or tempered steel collar with a cutting edge, attached to the lower end of a casing string by threading or welding, to protect the bottom end of the casing as it is driven, rotated, or otherwise forced into the borehole.

Dry grout method—the method of grouting the annular space outside of the casing by keeping bentonite granules (NSF/ANSI approved) pooled around the casing in a cone-shaped depression so they follow the casing as it is driven.

BMP DEFINITIONS

Engineer ("groundwater professional")—a licensed professional civil, mechanical, or environmental engineer registered pursuant to Alaska Statue 8.08. Considered here as a "groundwater professional" when has demonstrated work experience and/or educational background in groundwater issues and construction.

EPA ("USEPA")—United States Environmental Protection Agency.

Fecal coliform—a type of coliform bacteria included in total coliform that originates in feces from warm-blooded animals. Some fecal coliform in drinking water can cause short-term (acute) health effects, such as Escherichia coli (E. coli), and may also be an indicator of the presence of other pathogens. See also definitions for "bacteria", "coliform bacteria", and "total coliform".

FHA—Federal Housing Administration.

Filter pack ("sand pack"; "gravel pack")—the development of a well by the addition of sand or gravel, in the annulus outside of a well screen or a slotted liner, to stop or slow the production of finer material from the aquifer and/or to improve the well production by allowing the use of a larger screen or liner slot size; sometimes placed inside the well casing or liner to stop or slow the production of finer material from the aquifer.

Flowing artesian—a confined aquifer condition in which the static water level in a well or borehole is above the ground surface or the top of well casing; to be differentiated from an artesian condition that is not *flowing* (see definition for "artesian").

Formation—a layer, or group of layers, of sediment or rock within the subsurface that can be unconsolidated, consolidated, or a combination.

Formation packer—a device which prevents water flow within the annular space between the surrounding formation and the well casing or liner.

Free chlorine—a chlorine by itself; as a separate element; not bound with other elements in a compound.

Free chlorine residual—that chlorine remaining after part of the original amount has been removed by the process.

GPD—gallons per day.

GPH—gallons per hour.

GPM—gallons per minute.

Gravel pack ("filter pack")—a type of filter pack.

BMP DEFINITIONS

Groundwater—any water, except capillary moisture, beneath the land surface or beneath the bed of a stream, lake, reservoir, or other body of surface water, regardless of the formation in which the water stands, flows, percolates, or otherwise moves.

Groundwater professional—well drillers, pump installers, hydrogeologists, geologists, and engineers with demonstrated work experience and/or educational background in groundwater issues and water well construction.

Grout—a stable bentonite clay material that is NSF/ANSI approved, in a slurry or granular form impervious to and capable of preventing the vertical movement or migration of water.

Grouting or grouted—the act of installing grout.

Hazardous substance—those substances that, because of quantity, concentration, or physical/chemical/infectious characteristics, may pose a threat to human health or to the environment when treated, handled, stored and transported, and/or disposed of. Hazardous substances include those defined as hazardous under federal, state and municipal laws.

Holding tank—a watertight covered receptacle designed and built to receive and store domestic wastewater for disposal at another location.

Human consumption—the use of water for drinking, bathing, showering, cooking, dishwashing, maintaining oral hygiene, and other similar uses.

Hydrogeologist ("groundwater professional")—a professional geologist, certified and licensed by the State of Alaska pursuant to Alaska Statute 08.02.011, who practices groundwater science.

Intake—opening in a well or pump into which water enters or is drawn.

Liner—casing, of a smaller size, installed inside another casing; may be slotted or perforated adjacent to the water producing zone(s).

Manure/animal excreta—solid waste from domesticated animals, and for the purposes of these practices, shall also mean bedding or other materials contaminated by animal liquid or solid wastes.

Manure/animal excreta storage area—any area where such material is being stored, temporarily or permanently, or being composted.

Microorganism ("microbe")—a small (often microscopic) life form such as bacteria, algae, diatoms, parasites, plankton, and fungi. Some may cause disease.

Monitoring well ("observation well")—an existing or abandoned water well, or a newly cased excavation or opening into the ground constructed by digging, boring, drilling, driving, jetting or other methods for the purpose of determining the physical, chemical, biological, or radiological properties of groundwater.

BMP DEFINITIONS

Nitrate—a chemical compound that, for very young children, taking in high levels in drinking water over a relatively short period of time can cause serious health effects. Sources of nitrates may be natural, but may also include fertilizers, animal feed lots, manures, sewage, septic systems, industrial wastewater, sanitary landfills, and garbage dumps.

Non-public water [system] well—a water well that does not meet the definition given for a "public water system well". This includes wells used for the following purposes: private or domestic water supply; livestock or irrigation; recreational purposes; ground source heat pump return, injection, or vertical loops; industrial process water, or machine or process cooling water; dewatering wells; or dam or levee relief wells.

NSF—National Sanitation Foundation.

Observation well ("monitoring well")—an existing or abandoned water well, or a newly cased excavation or opening into the ground constructed by digging, boring, drilling, driving, jetting or other methods for the purpose of determining the physical, chemical, biological, or radiological properties of groundwater.

On-site wastewater disposal system—any wastewater storage, treatment, or disposal system that serves a facility located on a lot which is not connected to a public sewer.

Pathogen—an infectious biological agent, such as a virus or bacterium, that causes disease or illness.

PPM—parts per million.

Pipe ("casing")—the steel pipe made of material herein specified as ASTM A-53 Grade B (ASTM A-53B) and NSF/ANSI approved PVC or HDPE installed in a well borehole to prevent sidewall caving, to provide access to an aquifer, and to provide protection from up-hole or surface contamination of the aquifer.

Pitless adapter—an NSF/ANSI approved device attached to the well casing, constructed to permit the flow of water from the well casing.

Permafrost—a thick subsurface layer of soil that remains frozen throughout the year.

Permeable—describes the ability for fluids to pass through an aquifer or soils.

Permeability—a measure of a rock or soil's ability to transmit fluid which is a function of porosity, surface area and tortuosity or connectedness of pore space(s).

Potable water—water suitable for human consumption.

Producing zone ("water zone")—the zone of the aquifer that yields water to the well, and is an interval which is usually open to the aquifer (e.g., uncased, screened, perforated, slotted, etc.).

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Production (producing) rate—the volume per unit of time (usually GPM) at which a water well gives/yields/produces water.

Protective well radius ("setback"; "separation distance")—a set of prescribed horizontal distances around a water well in which there should be no potential sources of contamination; separation distances may vary depending on the potential source of contamination.

Public sewer system—a sewer system as defined in Alaska Statute 46.03.900, and operated by a public utility as defined in Alaska Statute 42.05.990.

Public water system (PWS)—a water system as defined by ADEC regulations 18 AAC 80, and does not include a private or domestic (non-public) water system.

Public water system (PWS) well—a water well constructed for the purpose of providing water to a "public water system".

Pump ("well pump")—a mechanical device used to recover water from a well or water collection system.

Pump install log ("Record of Commissioning")—a written report or completed form showing all pertinent information and data on pump installation, replacement, repair, or service as specified herein; see ADNR for suggested format.

Pump installer ("groundwater professional")—a contractor, licensed as a construction contractor pursuant to Alaska Statues, or an employee thereof, who works on well pump installation and service; may also be a well driller. Considered here as a "groundwater professional" when has demonstrated work experience and/or educational background in groundwater issues and construction.

Record of Decommissioning ("well decommissioning log")—a written report or completed form showing all pertinent information and data on the decommissioning of the well or borehole as specified herein; see ADNR for suggested format.

Record of Commissioning ("pump install log")—a written report or completed form showing all pertinent information and data on pump installation, replacement, repair, or service as specified herein; see ADNR for suggested format.

Record of Construction ("well log")—a written report or completed form showing pertinent information and data relative to the drilling and completion of the well as specified herein; see ADNR for suggested format.

Recovery—the ability of the water in a well to return to its static level after being drawn down during a period of pumping.

BMP DEFINITIONS

Riser ("riser pipe")—the pipe extending from the well pump to the point of discharge from the well casing.

Sand pack ("filter pack")—a type of filter pack.

Sand pumping—the movement of sand from a formation into the wellbore during water production/flow or well development.

Sanitary ground seal—a subsurface grout seal between the well casing and the borehole wall or surrounding material.

Sanitary well cap ("well seal")—a securely fastened and vented well cap with a gasket, attached to the top of a well casing or pipe sleeve, that prevents insects, dirt, or incidental water or other liquid from entering the well under normal conditions, that allows air to flow in and out of the well, and that is NSF/ANSI approved.

Sealing or sealed—the act of providing a watertight seal between the casing and the borehole, or surrounding material, by means of installing an impervious grout material.

Septic disposal field—an absorption bed, deep or shallow absorption trench, seepage pit, or mound system.

Septic tank—the water tight receptacle designed to receive domestic wastewater and allow the clarified liquids to be discharged into a subsurface soil absorption system.

Separation distance ("setback"; "protective well radius")—a set of prescribed horizontal distances around a water well in which there should be no potential sources of contamination; separation distances may vary depending on the potential source of contamination.

Setback ("separation distance"; "protective well radius")—a set of prescribed horizontal distances around a water well in which there should be no potential sources of contamination; separation distances may vary depending on the potential source of contamination.

Sloughing ("caving")—to fall or collapse into a borehole.

Static water level (SWL)—the level relative to a measuring point (i.e. the top of well casing or ground surface) at which the water stands in or above the well when no pumping or flow is occurring, or has recently occurred.

Stick up—the portion of a well's casing extending above the surface of the ground or floor.

Submersible pump—a complete well pump and motor assembly placed under the water level to pump water up the well to the discharge point.

Surface water—any persistent natural or man-made source of water that is not directly attributable to a single rainfall or snowmelt event. Surface waters include all lakes, ponds,

streams, springs, intermittent or seasonal flows, natural and artificial bodies of water and all of the water of the State of Alaska as defined in Alaska Statue 46.03.900.

SWL—static water level.

Test well—a well constructed for the purpose of testing the viability of an aquifer, such as yield, specific capacity, and quality, to be used for water supply. A test well may be converted to a water well.

TOC—top of casing.

Total coliform—a measure of the presence of coliform bacteria that is used as an indicator of the possible presence of harmful coliform bacteria, such as fecal coliform. See also definitions for "bacteria", "coliform bacteria", and "fecal coliform".

Total dynamic head—the head (pressure) produced by a well pump usually described in feet.

Tremie—

1. (*noun*) A three-part equipment assemblage consisting of a hopper, pipe, and lifting apparatus used for the purpose of installing material such as filter pack, backfill, or grout into an excavated space, borehole, well, or annular space;
2. (*verb*) To install material through a tremie pipe.

Unconfined aquifer ("aquifer—unconfined")—a condition of the aquifer in which atmospheric pressure is freely communicated to the aquifer and where the aquifer has no upper confining layer. The static water level within the aquifer is at atmospheric pressure and does not rise above the aquifer's upper limit.

Unconsolidated aquifer ("aquifer—unconsolidated")—a type of aquifer that is primarily composed of loose grains of sediment (e.g., silt, sand, gravel, or combinations).

USEPA ("EPA")—United States Environmental Protection Agency.

VA—United States Department of Veteran's Affairs.

Wastewater—water containing human excreta, food waste, wash water and other wastes commonly discharged into a water-carried sewage disposal system, and such diluting water as may have entered the waste disposal system. Wastewater does not mean liquids containing hazardous wastes as defined by federal, state, or municipal law.

Water storage facilities—includes water storage tank(s), pumps and piping used in the storage of potable water.

Water storage tank—a watertight covered receptacle designed and built to receive and store clean and/or potable water.

BMP DEFINITIONS

Water table—a groundwater surface within an unconfined aquifer where the water pressure is equal to atmospheric pressure.

Water well ("well")—an excavation, opening, shaft, or hole constructed for the purpose of water extraction.

Water well driller ("well driller"; "groundwater professional")—a contractor, licensed as a construction contractor per Alaska Statutes, or an employee thereof, who works on the construction of water wells; may also perform pump installation and service work.

Water zone ("producing zone")—the zone of the aquifer that yields water to the well, and is an interval which is usually open to the aquifer (e.g., uncased, screened, perforated, slotted, etc.).

Watertight well seal ("well seal")—a device that is securely attached to the top of a well casing or pipe sleeve that prevents the entrance of water even when submerged, such as by flood water.

Well ("water well")—an excavation, opening, shaft, or hole constructed for the purpose of water extraction.

Well cable—the electrical cable extending from the submerged well pump that passes through the well seal and is attached to the surface electrical source.

Well decommissioning log ("Record of Decommissioning")—a written report or completed form showing all pertinent information and data on the decommissioning of the well or borehole as specified herein; see ADNR form for suggested format.

Well depth—the depth of the completed well as measured from the top of casing, unless specified otherwise.

Well driller ("water well driller"; "groundwater professional")—a contractor, licensed as a construction contractor per Alaska Statutes, or an employee thereof, who works on the construction of water wells; may also perform pump installation and service work.

Well fracturing—a water well stimulation technique used to improve the flow of water into a low-yield well by injecting potable water under pressure into the well (also called "hydraulic fracturing", "hydrofracturing", "hydrofracking, or "fracking"), or using explosives in a well (also called "explosive fracturing", "explofracturing", "explofracking", "well shooting", or "well blasting"), to open fractures in the surrounding bedrock aquifer.

Well log ("Record of Construction")—a written report or completed form showing all pertinent information and data relative to the drilling and completion of the well as specified herein; see ADNR for suggested format.

Well packer—a device attached to a liner, drop pipe, or well screen riser to prevent flow within the annular space.

BMP DEFINITIONS

Well perforation(s) (casing, pipe or liner perforation)—a slot(s) cut into the casing to allow water to move through the well, or to allow seal material to fill the annular space; before-wellbore-installation slot cutting methods include gas torch, plasma arc, and machine milling; after-wellbore-installation slot cutting methods include using a downhole perforation tool and explosive perforation charges.

Well pit—an excavation, opening, shaft or hole surrounding a well.

Well pump ("pump")—a mechanical device used to recover water from a well or water collection system.

Well redevelopment—subsurface well work designed to improve well yield; example procedures include: surging (air or mechanical surge block), over-pumping ("rawhiding"); back-flush/rawhide cycling, jetting (air or water), chemical treatments, and well fracking.

Well rehabilitation—subsurface well work designed to repair, improve and/or rejuvenate the physical features of a well; examples include: perforations, lining, swaging, re-drilling, scraping and cleanouts, install screens, pull and reinstall screens, install and filter-pack smaller screens inside existing screens or perforations, chemical treatments and well fracking.

Well screen(s)—a filtering device(s) installed in a well to prevent excess sediment from entering and allow water to move through the well while keeping out most sand and gravel; most commonly used types are V-wire wrapped continuous slot, pipebased, and shutter screens.

Well seal—a "watertight well seal" or "sanitary well cap".

Well yield test ("pump test")—a test to determine the producing capability of the well, drawdown and recovery rate/time of the well.

Well yield—the producing rate of a well on a given date as determined by a well test; often described as a rate in gallons per minute (GPM) with the amount of drawdown (DD) at that rate.

Wellbore ("borehole")—a hole bored into the ground and intended to be constructed for extraction of water, for water exploration, for cathodic protection, for geotechnical holes and wells, or for a ground source heat pump installation.