

Lummi Administrative Regulation

Well Construction Standards for Wellhead Protection



Lummi Indian Business Council
Natural Resources Department
Water Resources Division

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17 LAR 04.010 Introduction

- (a) The purpose of this administrative regulation is to establish minimum standards for construction, operation, and decommissioning of water wells. The following excavations are excluded from this regulation:
 - (1) Any excavation that is not intended to withdraw ground water for agricultural, aquaculture, municipal, industrial, domestic, or commercial use;
 - (2) Any excavation for the purpose of obtaining or prospecting for oil, natural gas, minerals, products of mining, quarrying, inserting media to repressure oil or natural gas bearing formations, storing petroleum, natural gas, or other products;
 - (3) Injection wells regulated under provisions of the Safe Drinking Water Act;
 - (4) Infiltration or exfiltration galleries, trenches, ponds, pits, and sumps.
- (b) Those excavations excluded in subsection (a)(1) through (4) of this section shall be constructed, maintained, and decommissioned to ensure protection of the ground water resource and to prevent the contamination and waste of that resource as described in Lummi Code of Laws (LCL) Title 17 and associated regulations.
- (c) It is the responsibility and liability of the water well operator who constructs the well, the property owner, and the water well contractor, to take whatever measures are necessary to guard against waste and contamination of the ground water resources. It is necessary in some cases to construct and decommission wells with additional requirements beyond the minimum standards. Additional requirements may be necessary when the well is constructed or decommissioned in, or adjacent to, a known or potential source of contamination. Nothing in these regulations limits the Water Resources Manager to approve comparable alternative specifications for well construction as technology in the industry develops, or new and comparable methods of construction become known to the Water Resources Manager.
- (d) When strict compliance with the requirements and minimum standards for construction of water wells are not practicable, any person may request a variance issued by the Water Resources Manager from one or more of the provisions of the minimum standards of well construction. The application for a variance must propose a comparable alternative specification that will provide equal or greater human health and resource protection than the minimum standards. Application for a variance shall be made in writing and approved prior to the construction or decommissioning of the well. The variance application shall

contain at least the following information:

- (1) Name, address, and phone number of the person(s) requesting the variance;
 - (2) Address of well site; and/or location to the quarter, quarter, section township range using the public lands survey system;
 - (3) The specific regulation(s) that cannot be followed, the comparable alternative specification, and justification for the request.
- (e) The Water Resources Manger will evaluate the variance application and a response will be given within fourteen business days. In a public health emergency or other exceptional circumstance, verbal notification for a variance may be given. An emergency usually consists of a well failure resulting in a dry well or an unusable well. Driller convenience does not constitute an emergency. The emergency variance recipient must immediately follow up with a written notification to the Water Resources Manager so that a permanent written record is made of the variance.
- (f) Pursuant to the Lummi Code of Laws (LCL) Title 17.02.030(j), the Water Resources Manager is responsible for recommending to the Executive Director the imposition of fines and issuance of orders, including both emergency restraining orders and cease and desist orders as may be necessary to enforce the minimum standards for construction of water wells.
- (g) These regulations apply to all lands on the Lummi Indian Reservation and any other lands that are owed by the Nation or held in trust for the Nation by the United States throughout the usual and accustomed grounds and stations and Traditional Areas of the Lummi Nation.

17 LAR 04.020 Definitions

The following definitions are not already listed in LCL Title 17 and are intended to facilitate the use of these regulations.

"Abandoned well" means a well that is unused, unmaintained, or is in such disrepair as to be unusable for five or more years.

"Access port" is a 1/2- to 2-inch tapped hole or tube equipped with a screw cap, which provides access to the inner casing, for measurement of the depth to water surface. An access port also means a removable cap.

"Annular space" is the space between the surface or outer casing and the inner casing, or the space between the wall of the drilled hole and the casing.

"Artesian well" is a well obtaining water from an aquifer bounded above and below by confining or impermeable rock or soil layers, or rock or soil layers of distinctly lower permeability than the aquifer itself. The water will rise in the well above the point of initial penetration (above the bottom of the confining or impermeable layer overlying the aquifer). This term includes both flowing and non-flowing wells.

"Artificial gravel pack" is a mixture of gravel or sand placed in the annular space around the liner, perforated pipe, or well screen. A gravel pack is used to reduce the movement of finer material into the well and provide lateral support to the screen in unstable formations.

"Artificial recharge" is the addition of water to an aquifer by activities of man, such as irrigation or induced infiltration from streams, or injection through wells, trenches, pits, and ponds.

"Bentonite" is a mixture of swelling clay minerals, predominantly sodium montmorillonite.

"Capped well" is a well that is not in use and has a watertight seal or cap installed on top of the casing.

"Casing" is a pipe, generally made of metal or plastic, which is installed in the borehole to maintain the opening.

"Consolidated formation" means any geologic formation in which the earth materials have become firm and cohesive through natural rock forming processes. Such rocks commonly found in Washington include basalt, granite, sandstone, shale, conglomerate, and limestone. An uncased borehole will normally remain open in these formations.

"Constructing a well" or **"construct a well"** means: boring, digging, drilling, or excavating a well; installing casing, sheeting, lining, or well screens, in a well; or drilling a geotechnical soil boring. "Constructing a well" or "construct a well" includes the alteration of an existing well.

"Curbing" is a liner or pipe made of concrete, precast tile, or steel installed in dug wells to provide an annular space between the well bore and the liner or pipe for sealing.

"Decommissioning" means to fill or plug a well so that it will not produce water, serve as a channel for movement of water or pollution, or allow the entry of pollutants into the well or

aquifer(s).

"Dewatering well" means a cased or lined excavation or boring that is intended to withdraw or divert ground water for the purpose of facilitating construction, stabilizing a land slide, or protecting an aquifer.

"Disinfection" or **"disinfecting"** is the use of chlorine, or other disinfecting agent or process approved by the Water Resources Manager, in sufficient concentration and contact time adequate to inactivate coliform or other indicator organisms.

"Domestic water supply" is any water supply that serves a family residence(s).

"Draw down" is the measured difference between the static ground water level and the ground water level induced by pumping.

"Drilled well" is a well in which the hole is usually excavated by mechanical means such as rotary, cable tool, or auger drilling equipment.

"Driven well" is a well constructed by joining a "drive point" to a length of pipe, then driving the assembly into the ground.

"Dug well" is a well generally excavated with hand tools or by mechanical methods. The sidewalls may be supported by material other than standard weight steel casing.

"Filter pack" means clean, well rounded, smooth, uniform, sand or gravel, which is placed in the annulus of the well between the bore hole wall and the liner, perforated pipe, or well screen to prevent formation material from entering the well.

"Formation" means an assemblage of earth materials grouped together into a unit that is convenient for description or mapping.

"Grout" is a fluid mixture of cement, bentonite, and water used to seal the annular space around or between well casings, or to decommission wells.

"Impermeable" is a descriptive term for earth materials which have a texture or structure that does not permit fluids to perceptibly move into or through its pores or interstices.

"Liner" means any device inserted into a larger casing, screen, or bore hole as a means of maintaining the structural integrity of the well.

"Lummi Code of Laws (LCL)" means the latest edition of the Lummi Nation Code of

Laws. The Water Resources Protection Code is LCL Title 17.

“Operator” means any party associated with a well construction, reconstruction-alteration, or decommission project that has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or has day-to-day operational control of those activities at a project site that are necessary to ensure compliance with well construction, reconstruction-alteration, or decommission standards for the project or other permit conditions.

"Permeability" is a measure of the ease of which liquids or gas move through a porous material. For water, this is usually expressed in units of centimeters per second or feet per day. Hydraulic conductivity is a term for water permeability. Soils and synthetic liners with water permeability of 1×10^{-7} cm/sec or less may be considered impermeable.

"Pressure grouting" is a method of forcing grout into specific portions of a well for sealing purposes.

"PTFE" means polytetrafluoroethylene casing materials such as teflon. The use of the term teflon is not an endorsement for any specific PTFE product.

"Public water supply" is any water supply intended or used for human consumption or other domestic uses, including source, treatment, storage, transmission and distribution facilities where water is furnished to any community, collection or number of individuals, available to the public for human consumption or domestic use, excluding water supplies serving one single-family residence.

"Public water system" means a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has a least 15 service connections or regularly serves at least twenty-five individuals.

"PVC" means polyvinyl chloride, a type of thermoplastic casing.

"Static water level" is the vertical distance from the surface of the ground to the water level in a well when the water level is not affected by withdrawal of ground water.

"Temporary surface casing" is a length of casing (at least four inches larger in diameter than the nominal size of the permanent casing), which is temporarily installed during well construction to maintain the annular space.

"Test well" is a well (either cased or uncased), constructed to determine the quantity and/or quality of water available for beneficial uses, identifying underlying rock formations

(lithology), and/or to locate optimum zones to be screened or perforated. If a test well is constructed with the intent to withdraw water for beneficial use, it must be constructed in accordance with the minimum standards for water supply wells. Otherwise a test well shall be constructed in accordance with the minimum standards for resource protection wells. A water right permit, preliminary permit, or temporary permit shall be obtained prior to constructing a test well. A "test well" is a type of "water well."

"Tremie tube" is a small diameter pipe used to place grout, filter pack material, or other well construction materials in a well.

"Turbidity" is a measure of the clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

"Unconsolidated formation" means any naturally occurring, loosely cemented, or poorly consolidated earth material including such materials as uncompacted gravel, sand, silt, and clay. Alluvium, soil, and overburden are terms frequently used to describe such formations.

"Water well" means any excavation that is constructed and which the intended use is for the location, diversion, artificial recharge, observation, monitoring, dewatering or withdrawal of ground water for agricultural, municipal, industrial, domestic, or commercial use.

"Water well contractor" means any person, firm, partnership, co-partnership, corporation, association, or other entity, licensed and bonded to engage in the business of constructing water wells.

"Well alteration(s)" include(s): deepening, hydrofracturing, or other operations intended to increase well yields, or change the characteristics of the well. Well alteration does not include general maintenance, cleaning, sanitation, and pump replacement.

"Well completion" means that construction has progressed to a point at which the drilling equipment has been removed from the site, or a point at which the well can be put to its intended use.

"Well driller(s)" or "driller(s)" is synonymous with "operator(s)."

"Well" means water wells, resource protection wells, instrumentation wells, dewatering wells, and geotechnical soil borings. Well does not mean an excavation made for the purpose of obtaining or prospecting for oil or natural gas, geothermal resources, minerals, or products of mining, or quarrying, or for inserting media to re-pressure oil or natural gas bearing formations, or for storing petroleum, natural gas, or other products.

17 LAR 04.030 Well Construction Permits

- (a) Unless otherwise authorized under the terms of the settlement agreement for *United States, Lummi Nation v. Washington State Department of Ecology, et al.*, Civil Action No. C01-0047Z (U.S. District Court, Western District of Washington), any person proposing a new well or expansion of an existing well must obtain a permit from the Lummi Nation authorizing the drilling of the well. The Water Resources Manager must comply with LCL 17.03 when evaluating well construction permit applications. The requirements for wells are provisions of LCL 17.04.080. The Water Resources Manager must be satisfied that the following requirements are met:
- (1) The licensed operator must have a copy of the water right permit, certificate, or well registration on site at all times. Every well shall be constructed to meet the provisions of the permit, certificate, or well registration. Provisions may include: limitations on zones of completion, special sealing requirements, special casing and liner requirements, and other specific construction and testing detail.
 - (2) Any person who constructs or alters a well is required to submit a complete well drilling report as shown in 17 LAR 04.040 to the Water Resources Manager within thirty days after completion of a well, or after the drilling equipment has left the site. Such record must include the following information:
 - (A) Owner name, operator/trainee name, operator/trainee license number, contractor registration number, drilling company name, tax parcel number;
 - (B) Well location street address and to at least quarter, quarter section or smallest legal subdivision;
 - (C) Unique well identification tag number, construction date, number, and intended use of well;
 - (D) Method of drilling and stratum information including depth, thickness, and type;
 - (E) Water information including static water level, the tested capacity of the well, chloride levels, shut in pressure, and any other water quality information; and
 - (F) Type and length of well casing and screen; seal material, location and type of placement used; filter pack location and material used.

- (b) The property owner, owner's agent, or water well operator shall notify the Water Resources Manager of their intent to begin well construction, reconstruction-alteration, or decommissioning procedures at least seventy-two business hours before starting work. The notice of intent must contain, the well owner's name, operator/trainee name and license number, contractor registration number, drilling company name, well location, proposed use, and approximate start and completion dates. In an emergency, the Water Resources Manager may allow verbal notification, with a written notification within twenty-four hours. An emergency situation may consist of a failing well or water quality issues which could result in a public health or safety concern.

WATER WELL CONSTRUCTION/ALTERATION REPORT
Lummi Indian Business Council - Lummi Water Resources Division

Main report form containing sections for well identification, use of well, type of work, dimensions, construction details, perforations, static water levels, well test results, and certification. Includes a table for construction/alteration procedure materials.

The Lummi Indian Business Council does NOT warrant the Data and/or Information in this Well Construction/Alteration Report.

17 LAR 04.050 Location of Well Sites

- (a) Every well must be planned and constructed so that it is (1) adapted to those geologic and ground water conditions known to exist at the well site to ensure utilization of any natural protection available; (2) not a conduit for contaminating the ground water nor a means of wasting water; and (3) capable of yielding, where obtainable, the quantity of water necessary to satisfy the requirements the user has stated are needed and for which the well water is intended to be used.

- (b) The requirements for the location of the well site and access to the well are the following:
 - (1) The proposed water well shall be located on high ground within a subject parcel;
 - (2) The well shall be protected from a one hundred year flood and from any surface or subsurface drainage capable of impairing the quality of the ground water supply;
 - (3) All wells shall not be located within certain minimum distances of known or potential sources of contamination. The Sanitary Control Area is specified in LCL 17.04.030;
 - (4) When a well is located in an area of known or potential contamination the water well casing and seal shall be impervious to the contaminants;
 - (5) Minimum setback distances for water wells other than for public water supply are:
 - (A) Five feet from any building projection. Water wells shall not be located in garages or inhabited dwellings;
 - (B) Fifty-feet from a septic tank, septic holding tank, septic containment vessel, septic pump chamber, and septic distribution box;
 - (C) Fifty feet from building sewers, collection, and nonperforated distribution lines;
 - (D) One hundred feet from the edge of a drainfield, proposed drainfield that has been approved by a health authority, and reserve drainfield areas;
 - (E) One hundred feet from all other sources or potential sources of contamination except for solid waste landfill.
 - (6) One thousand feet from the property boundary of a solid waste landfill.

- (c) In sitting a well, the driller shall consider:
 - (1) All Lummi Nation water well construction regulations, policies, and ordinances as well as any restrictions based on the settlement agreement of *United States, Lummi Nation v. Washington State Department of Ecology, et al.*, Civil Action No. C01-0047Z (U.S. District Court, Western District of Washington);
 - (2) Permeability of the soil or rock;
 - (3) Adjacent land uses;
 - (4) Local ground water conditions; and
 - (5) End use of the well.
- (d) Before construction, the water well operator should strongly emphasize to the well owner the importance of retaining good accessibility to the well to permit future inspection, maintenance, supplementary construction, and decommissioning.
- (e) In constructing a water well, care shall be taken to preserve the natural barriers to ground water movement between aquifers.
 - (1) Care shall be taken to seal aquifers or strata penetrated during drilling operations, which might impair water quality or result in cascading water.
 - (2) Water wells may not interconnect aquifers.
 - (3) All sealing must be permanent and prevent movement of surface or ground water into the annular space between the permanent casing and the borehole.
 - (4) Sealing shall prevent the upward movement of artesian waters within the annular space around the well casing and prevent the contamination or wasting of ground water.
 - (5) Sealing shall prevent the movement of ground water either upward or downward from zones that were cased off.

17 LAR 04.060 General Well Design and Construction

- (a) Wells may be completed with screens, perforated liners or pipe, or open bottom completion. The well driller or designer shall advise the owner or the owner's

representative of the most appropriate method of completion.

- (b) All well components must be of sufficient strength to withstand the normal forces to which they are subjected during and after installation for the designed life of the well.
- (c) Water wells must be completed in a manner that prevents the production of untreatable amounts of sand, silt, or turbid water, which would render the well unusable.
- (d) Open bottom completion is appropriate where the withdrawn waters are essentially free of sand, silt, and turbidity.
- (e) Perforated pipe completion is suitable for a coarse-grained, permeable aquifer where the withdrawn waters are free of sand, silt, or turbidity. Perforations above the static water level are not permitted. In place perforations with Star, Mills knife, or similar type perforators are acceptable. Perforated pipe liners, either saw cut, torch cut, mill slotted, or punched are acceptable.
- (f) The use of perforated casing for working casing as the hole is being drilled is prohibited, except in those cases where the well driller can, through personal experience in the particular area of drilling, attest to the sufficiency of the pre-perforated casing in all respects for the specific well being constructed.
- (g) Pipe liners may be of steel, plastic, or other suitable corrosion resistant material. All liners must be of sufficient strength to withstand normal forces exerted upon the liner material during installation and operation for the designed life of the well. Liners may be used in a natural development or gravel packed type construction. The installation of a liner without a gravel pack is prohibited when conditions exist that will result in excessively turbid water.
- (h) Well screens and well points must be constructed of compatible corrosion resistant material. A neoprene, or grout seal shall be fitted to the top of the well screen assembly, if necessary. The bottom of the well screen shall be plugged or capped. The use of lead packers is prohibited.
- (i) The alignment of the permanent casing or liner shall be sufficiently plumb and straight to allow the installation of screens, liners, pumps, and pump columns without binding or having adverse affects on the operation of the installed pumping equipment. Alignment of the well casing or bore hole shall not deviate from an alignment that would allow a twenty foot test section of pipe to be inserted to the bottom of the well without binding. The diameter of the test section of pipe shall be per Table 1. For testing alignment in casing reductions, each section shall be tested separately.

17 LAR 04.070 Casing and Liner Requirements

(a) Proper casing must be installed in all water supply wells. The casing shall withstand normal forces, which act upon it during and after installation for the designed life of the well. It shall be resistant to the corrosive effects of the surrounding formations, earth, and water. All plastic casing for use in potable water supply wells must be manufactured to conform to National Sanitation Foundation (NSF) Standard 14-84, or the most recent revision. Unless prior approval is obtained from the Water Resources Manager, materials for well casings must be either steel casings as shown in Table 1 or plastic casing as shown in Table 2. Minimum specifications for steel casing and pipe for water wells are shown in Table 1. Steel casing larger than twenty inches shall have a minimum wall thickness of 0.375 inches.

(1) Steel Casing

- (A) All steel casing materials must be new or, in like new condition, and be structurally sound.
- (B) Casing that has been exposed to a contaminant shall not be used in well construction unless the contamination can be and has been entirely removed.
- (C) When casing lengths are joined together, they must be connected by watertight weld or screw coupled joints.
 - (i) Welded joints must be at least as thick as the wall thickness of the well casing and be fully penetrating.
 - (ii) All steel well casings shall meet or exceed the minimum American Society for Testing and Materials (ASTM) A-53 A or B specification for steel pipe.

Table 1. Minimum Specification for Steel Casing and Pipe.

Nominal Size (in)	Outside Diameter (in)	Wall Thickness (in)	Weight per Foot (pounds)	Test Section Outside Diameter (inches)
1.25	1.660	0.140	2.270	0.50
1.5	1.900	0.145	2.72	0.75
2.0	2.375	0.154	3.65	1.00
2.5	2.875	0.203	5.79	1.50
3.0	3.500	0.216	7.58	2.00
3.5	4.000	0.226	9.11	2.50
4.0	4.500	0.237	10.79	3.00
5.0	5.563	0.258	14.62	3.50
6.0	6.625	0.250	17.02	4.00
8.0	8.625	0.250	22.36	6.00
10	10.750	0.250	28.04	8.00
12	12.750	0.250	33.38	10.00
14	14.000	0.312	45.61	11.00
16	16.000	0.344	57.52	14.00
18	18.000	0.375	70.59	16.00
20	20.000	0.375	78.60	18.00
24	24.000	0.375	94.62	20.00
30	30.000	0.375	118.65	24.00

(2) Plastic Casing

- (A) Plastic, fiberglass, PVC, SR, ABS, or other type of nonmetallic well casing must be manufactured and installed to conform to ANSI/ASTM F 480-81, Standard Dimension Ratio (SDR) 21 or the most recent revision.
 - (i) SDR is calculated by dividing the outside diameter of the pipe by the wall thickness.
 - (ii) SDR 21 is the minimum requirement; higher pressure rated pipe may be used.
- (B) All plastic casing must be installed only in an oversized drill hole without driving. The oversized hole must be a diameter of at least 4 inches larger than the outside diameter of the plastic casing or coupling hubs, or

whichever is larger.

- (C) All plastic casing must be new or in like new condition and clearly marked by the manufacturer showing nominal size, type of plastic material, SDR, ASTM designation, and have a National Sanitation Foundation (NSF) seal of approval for use in potable water supplies.
- (D) Casing that has been exposed to a contaminant shall not be used in well construction unless the contamination can be and has been entirely removed.
- (E) Plastic casing joints must be watertight
 - (i) Either "bell" type, threaded joints, or coupling hubs are approved.
 - (ii) Hub couplings must be of materials meeting the specifications for plastic casings as stipulated in subsection (2) of this section.
 - (iii) If joints are secured with solvent cement, it must be done in accordance with manufacturer's directions.
- (F) The manufacturer's recommendations for minimum specifications for plastic casings.

Table 2. Minimum Specifications for Plastic Casing

Nominal Casing Diameter (inches)	Minimum Thickness (inches)	SDR
2.0	0.13321	21
2.5	0.13721	21
3.0	0.16721	21
3.5	0.19021	21
4.0	0.21421	21
4.5	0.23621	21
5.0	0.26521	21
6.0	0.31621	21
8.0	0.41021	21
10.0	0.51121	21
12.0	0.60621	21

(b) Liner pipe requirements:

- (1) Liner pipe must consist of steel, in new or like new condition, free of pits or breaks or polyvinyl chloride (PVC), CPVC, type 1120, with SDR 21 (Class 200) or greater wall thickness. All PVC must be clearly marked to identify the type, class, and SDR.
- (2) Liner pipe must be of sufficient strength to withstand breakage or collapse when the well is pumped and meet ASTM potable water standards.
- (3) When installed, liner pipe shall extend or telescope at least two feet into the lower end of the well casing. If more than one string of liner pipe is installed, each string shall extend or telescope at least eight feet into the adjacent larger diameter liner pipe.
- (4) Liner pipe may not be permanently fixed to a well casing below land surface.

(c) Concrete Curbing requirements:

- (1) The concrete used to make curbing must consist of clean, hard and durable aggregate with not less than five sacks (ninety-four pounds per sack) of Portland cement per cubic yard of concrete;
- (2) The maximum diameter of aggregate particles may not exceed 1 1/2 inches, but in any case may not exceed 1/5 the minimum width of the casing thickness;
- (3) The ratio of coarse aggregate to fine aggregate (passing No. 4 U.S. Standard Sieve) must be approximately 1 1/2 to 1 by volume, but in any case, may not exceed 2 to 1 nor be less than 1 to 2;
- (4) The curbing shall be at least six inches thick and free of voids. The walls shall be poured in one continuous operation;
- (5) When concrete tile is used to line a well, the combined total wall thickness and seal shall be a minimum of six inches.

17 LAR 04.080 Recommended Well Diameters

(a) Recommended well diameters.

Anticipated Well Yield (gpm)	Nominal Size of Pump Bowls (inches)	Optimum Size of Well Casing (inches)
Less than 100	4	6 ID
75 to 175	5	8 ID
150 to 350	6	10 ID
300 to 700	8	12 ID
500 to 1,000	10	14 OD
800 to 1,800	12	16 OD
1,200 to 3,000	14	20 OD
2,000 to 2,800	16	24 OD
3,000 to 6,000	20	30 OD

17 LAR 04.090 Sealant Requirements

(a) Bentonite sealant:

- (1) Bentonite used to prepare slurries for sealing or decommissioning shall be specifically designed for this purpose. At no time shall grout slurry contain materials that are toxic, polluting, develop odor, change color, or serve as a micro-bacterial nutrient. All bentonite slurries shall be prepared and installed according to the manufacturer's instructions. A recognized certification authority, such as the National Sanitation Foundation, must certify all additives. Active solids content (bentonite) shall be twenty percent by weight or greater in all bentonite slurries. The active solids shall be checked by using the following formula:

$$\text{Weight of bentonite (lbs)} \times 100 = \% \text{ solids}$$

$$\text{Weight of bentonite (lbs)} + (\text{gallons of water} \times 8.33 \text{ lbs/gal})$$

Example:

STEP 1	STEP 2
$\frac{105 \text{ lbs of bentonite}}{105 \text{ lbs of bentonite} + (50 \text{ gal of water} \times 8.33 \text{ lbs/gal})}$	$\times 100 = 20\% \text{ solids}$

- (2) Unhydrated bentonite-pelletized, granulated, powder, or chip bentonite may be used in the construction of seals or in decommissioning of wells. The bentonite material shall be specifically designed for sealing or decommissioning wells and must be within the industry tolerances for dry western sodium bentonite. Polymer additives must be designed and manufactured to meet industry standards to be nondegrading and must not act as a medium which will promote growth of microorganisms. All unhydrated bentonite used for sealing or decommissioning must be free of organic polymers. Placement of bentonite shall conform to the manufacturer's specifications and result in a seal free of voids or bridges.

(b) Cement sealants:

- (1) Neat cement consists of either Portland cement types I, II, III, or high-alumina cement mixed with not more than six gallons of potable water per sack of cement (ninety-four pounds per sack).
- (2) Neat cement grout consists of neat cement with up to five percent bentonite clay added, by dry weight of the bentonite. Bentonite is added to improve flow qualities and compensate for shrinkage.
- (3) Concrete sealants consist of clean, hard, and durable aggregate with not less than five sacks (ninety-four pounds per sack) of Portland cement per cubic yard of concrete sealant.
 - (A) The maximum diameter of aggregate particles may not exceed 1 1/2 inches, but in any case may not exceed 1/5 the minimum width of the casing thickness.
 - (B) The ratio of coarse aggregate to fine aggregate (passing No. 4 U.S. Standard Sieve) must be approximately 1 1/2 to 1 by volume, but in any case, may not exceed 2 to 1 nor be less than 1 to 2.
 - (C) Expanding agents, such as aluminum powder, may be used at a rate not exceeding 0.075 ounce (1 level teaspoon) per sack (ninety-four pounds per sack) of dry cement. The powder may not contain polishing agents. High-alumina cement and Portland cement of any type must not be mixed together.

(c) Sealing methods:

- (1) When neat cement or neat cement grout is used in sealing, it shall be placed

seventy-two hours before additional drilling takes place, unless special additives are mixed with the neat cement or neat cement grout that cause it to set in a shorter period of time.

- (2) All hydrated sealing materials shall be placed by tremming the mixture from the bottom of the annular space to the surface in one continuous operation.
- (d) This section may not preclude the use of new sealant materials, which have been approved by the Water Resources Manager.
- (e) Standards for surface seals
- (1) All water wells constructed shall have a surface seal, which seals the annular space between the borehole and the permanent surface casing.
 - (2) The seal shall be constructed to prevent surface contaminants from reaching the ground water.
 - (3) The surface seal must have a minimum diameter of four inches larger than the nominal size of the surface casing, to include the outside diameter of the bell, in bell and hub couplings.
 - (4) The surface seal must extend from land surface to a minimum depth of eighteen feet, except, when the minimum surface seal requirements for driven, jetted, and some dug wells are less than eighteen feet. See the appropriate section of this regulation for these wells for a detailed description of their sealing requirements.
 - (5) The completed surface seal must fully surround the permanent casing, must be evenly distributed, free of voids, and extend to undisturbed or recompacted soil.
 - (6) After the permanent casing has been set in final position, the annular space shall be filled to land surface with bentonite or cement grout or neat cement. Leaving voids for future installation of equipment such as a pitless adapter is prohibited.
 - (7) A temporary casing with a minimum length of eighteen feet and a minimum nominal diameter of four inches greater than the permanent casing shall be used in all unconsolidated formations such as in gravels, sands, or other unstable conditions when the use of drilling fluid or other means of keeping the bore hole open are not employed.
 - (8) Whenever reconstruction involves permanent surface casing movement; or the

existing surface seal is damaged; or a surface seal never existed; the driller shall repair, replace, or install a minimum of eighteen feet of surface seal around the permanent casing.

(f) Formation sealing requirements:

- (1) Unconsolidated formation sealing - without significant clay beds or other confining formations: drilled wells that penetrate an aquifer overlain by unconsolidated formations such as sand and gravel without significant clay beds (at least six feet thick) or other confining formations shall be sealed in accordance with the surface sealing requirements of the previous section and shown in Figure 1.
- (2) Unconsolidated formation sealing - with significant clay beds or other significant confining formations: drilled wells that penetrate an aquifer overlain by clay or other confining formations that are at least six feet thick, shall be sealed to prevent movement of water or contamination in the annular space between the permanent casing and the clay or other confining formation(s). One of the following methods shall be used to seal the annular space:
 - (A) A drill hole at least four inches greater in diameter than the nominal size of the permanent well casing shall extend from the land surface into the clay bed or other confining formation located directly above the aquifer to be developed. The annular space shall be filled with bentonite (slurry or unhydrated), cement grout, or neat cement to form a watertight seal between the casing and all significant confining formations encountered during drilling.
 - (B) If bentonite slurry, cement grout, or neat cement is used to seal the annular space it must be placed by either pumping or tremmying the seal material from the lowest clay bed or other confining formation of significance encountered, to land surface. The drill hole shall be kept open through the use of a temporary casing or any other drilling method that stabilizes the borehole wall. See Figure 1.
 - (C) An upper drill hole at least four inches greater in diameter than the nominal size of the permanent well casing shall extend to a minimum of eighteen feet from land surface. A temporary casing or other means of maintaining an open borehole shall be utilized. All temporary casing will have an outside diameter of a minimum of four inches larger than the permanent casing (for example, a ten-inch temporary casing for a six-inch permanent casing). The upper drill hole shall always contain a minimum of nine feet

of sealant throughout the advancement of the permanent casing. Except, if the temporary casing is removed or not utilized, the upper drill hole shall be kept full of sealant. See Figure 1.

- (3) Consolidated formations - in drilled wells that penetrate an aquifer, either within or overlain by a consolidated formation, sealing of the casing shall conform to one of the following procedures.
 - (A) Procedure One: An upper drill hole at least four inches greater in diameter than the nominal size of the permanent well casing shall extend from land surface into a sound, unfractured, consolidated formation. Unperforated permanent casing shall be installed to extend to this same depth, and the lower part of the casing shall be driven and sealed into the consolidated formation to establish a watertight seal between the formation and the casing. The remainder of the annular space to land surface shall be filled with cement grout, neat cement, or bentonite.
 - (i) If the consolidated formation is encountered at a depth less than eighteen feet from land surface, the upper drill hole and permanent casing shall extend to a minimum of eighteen feet from land surface. See Figure 2.
 - (ii) If cement grout, neat cement, or bentonite slurry is placed by pumping to seal the entire annulus from the bottom up to land surface, the upper drill hole may be a minimum of two inches larger than the outside diameter of the permanent casing.
 - (B) Procedure Two: An upper drill hole at least four inches greater in diameter than the nominal size of the permanent casing extends from land surface to a depth of at least eighteen feet. An unperforated permanent casing shall be driven into the consolidated formation and sealed in a manner that establishes a watertight seal between the formation and the casing. Throughout the driving of the well casing to the consolidated formation, the annular space between the upper drill hole and the permanent casing shall be kept at least one-half full with unhydrated bentonite, or bentonite slurry. The remainder of the annular space to land surface shall be filled with cement grout, neat cement, or bentonite. See Figure 2.
 - (C) If temporary surface casing is used in either procedure (A) or (B) of this subsection; the casing must be a minimum of eighteen feet long and at least four inches larger in diameter than the permanent casing. If a consolidated

formation is encountered within the first eighteen feet, the temporary casing may terminate at the interface of the consolidated formation. Withdrawal of the temporary casing must take place simultaneously with proper sealing of the annular space to land surface.

(g) Sealing standards for artesian wells.

- (1) When flowing artesian conditions are known or suspected, the operator shall have a written sealing plan prepared prior to initiation of construction. The plan shall identify the type of sealing material that will be used and the method for sealing. The plan shall also contain at least one alternative construction method for sealing and an emergency contingency section that will identify steps to be taken if the ground water flow cannot be controlled
- (2) When artesian water is encountered in the well, an unperforated well casing shall extend into the confining stratum overlying the artesian zone. The casing shall be sealed into the confining stratum to prevent surface and subsurface leakage from the artesian zone. If the well flows at land surface, it must be equipped with a control valve so that flow can be completely stopped.
- (3) The well shall be completed with seals, packers, or grout that eliminates leakage around the well casing. The driller shall not move the drilling rig from the well site until leakage is completely stopped, unless the Water Resources Manager grants authority for temporary removal, or when loss of life or property is imminent.

(h) The surface seal of all dug wells shall be constructed to effectively seal the annular space between the undisturbed native material of the upper well hole and the well curbing, which may consist of concrete tile, steel pipe, or liner. The seal depth shall be at least eighteen feet below land surface or to within three feet of the bottom in dug wells that are less than twenty-one feet in depth. Dug wells may be sealed with cement, neat cement, bentonite, or cement grout. A cap shall be placed on all dug wells. Except during maintenance, the cap shall remain in place. The cap shall prevent entry of pollutants, insects, and mammals into the well. See Figure 3.

(i) Sealing standards for driven wells and jetted wells.

- (1) Driven well: An upper hole at least four inches greater in diameter than the permanent casing shall extend a minimum of six feet below land surface. The annular space between the upper oversized drill hole and the permanent casing must be kept at least one-half full with bentonite or bentonite slurry throughout all driving of the pipe. The remaining annular space to land surface shall be filled with

cement grout, neat cement, or bentonite. See Figure 4.

- (2) Jetted well: The surface seal in a jetted well shall be constructed to seal the annular space between the permanent casing and undisturbed native soil. An upper hole at least four inches greater in diameter than the permanent casing shall extend a minimum of six feet below land surface.

17 LAR 04.100 General Well Construction Information

- (a) Construction standards for artificial gravel-packed wells: In gravel-packed wells, the gravel mixture shall be placed around the screen so that bridging or size separation does not occur. The gravel pack must be clean and chemically stable. All gravel and water used must be disinfected with at least fifty parts per million (ppm) chlorine for a contact time of at least thirty minutes. Rinse water containing chlorine is a pollutant. Chlorine in the rinse water must be allowed to dissipate and the water must be discharged in a safe manner consistent with the intent of the LCL Title 17.
- (b) Standards for the upper terminal of water wells:
 - (1) The watertight casing or curbing of any well shall extend at least six inches above the ground surface. Pit completion is prohibited.
 - (2) Where the site is subject to flooding, the top of the casing must be at least two feet above the estimated water level of a one hundred-year frequency flood.
 - (3) All wells shall be equipped with an access port that allows for the measurement of the depth to water surface, or with a pressure gage that indicates the shut-in pressure of a flowing artesian well. See Figure 6. The access ports and pressure gauges or other openings in the cover must be sealed or capped to prevent entrance of surface water or foreign material into the well.
 - (4) Any vent opening, observation ports, or air-line equipment shall extend from the upper end of the well by watertight piping to a point at least six inches above land surface. The terminals of these facilities shall be shielded or sealed to prevent entrance of foreign matter or pollutants.
 - (5) A pitless adapter, or similar device is permitted on water wells if it is made with fittings approved by the Indian Health Board. The connection must be above static water level. Any person who removes any part of a surface seal to install a pitless adapter shall repair the seal in a timely manner so that it is brought up to land surface.

- (c) Temporary capping requirements: All wells which are not in use, or are temporarily out of service, must be securely capped so that no contamination can enter the well. Capping must be affixed by solid welds or equal seal to prevent unauthorized access to the well. Temporary capping alone will not satisfy the decommissioning requirements described in section 17 LAR 04.130.

- (d) Well Tagging Requirements:
 - (1) It shall be the operator's responsibility to place a well identification tag with a unique identification number on every well that they construct, alter, or reconstruct;
 - (2) The alpha-numeric number shall be recorded on the drilling report in the space provided;
 - (3) The operator shall remove the well identification tag on all wells they decommission and shall attach the tag to the decommissioning well report;
 - (4) It shall be the well owner's responsibility to place a well identification tag with a unique identification number on every well they own;
 - (5) Upon request, the Water Resources Manager shall furnish the well owner with a well tag and tagging instructions;
 - (6) The well owner shall tag their well(s) and submit a completed tagging report to the Water Resources Manager;
 - (7) The well tag shall be permanently attached to the outer well casing or other prominent well feature and be visible above land surface;
 - (8) It is unlawful for a person to tamper with or remove a well identification tag except during well alteration.

- (e) Preventing water well and equipment contamination.
 - (1) All tools, drilling equipment, and materials shall be free of contaminants prior to beginning well construction. Contaminants include lubricants, fuel, bacteria, and any other item(s) that will be harmful to public health and/or the resource, reduce the well efficiency, or reduce the life of the water well.

- (2) Every new or reconditioned water well, after completion of construction or repair, and before being placed in service, shall be cleared of all foreign materials and free of contamination.
 - (3) The well casing shall be swabbed and cleaned to remove oil, grease, or joint dope.
 - (4) All pumping equipment, sand, or gravel used in sand-packed or gravel-packed water wells and the well casing shall be thoroughly sluiced with clean water and disinfected. The disinfecting agent shall be safe and not impair the potability of the ground water. All disinfectants shall be used in accordance with manufacturer's recommendations.
 - (5) Before the well is put to use, the standing water in the well shall be disinfected and flushed to remove all traces of disinfectant. A water sample shall then be taken and tested for coliform bacteria or other items deemed necessary by the tribal health authorities. Examples of other test items may include: chloride, arsenic, nitrates, dissolved solids, sodium, iron, pH, manganese, conductivity, hardness, and turbidity. If testing indicates a presence of coliform bacteria, tribal health authorities may require more stringent disinfecting methods.
 - (6) If chlorine is used to disinfect the well water, sufficient chlorine will be added to the standing water to give a residual of fifty ppm free chlorine. The chlorine shall remain in the well for a period of at least twenty-four hours. After twenty-four hours, a minimum of one ppm free chlorine residual shall remain in the water before the well is flushed free of chlorine and a sample taken. Other disinfectants placed in the ground water shall be used in quantities that are safe, nonpolluting, and that are not a detriment to the potability of the ground water. All disinfectants used in ground water shall be used in accordance with manufacturer's recommendations.
 - (7) Chlorine and other disinfectants can pollute. The chlorine or other disinfectants in the rinse water must be allowed to dissipate before discharging the water to surface water. This water shall be discharged in a safe manner consistent with the LCL Title 17.
- (f) All water introduced into a well for drilling purposes and for mixing sealing materials shall be obtained from a potable water source and have a chlorine residual of not more than one ppm free chlorine.
 - (g) All pumps and pumping equipment and materials must be free of contamination and shall be installed in a manner consistent with the intent and purposes of these regulations.

- (h) The use of detergents, chlorine, acids, or other chemicals in wells for the purpose of increasing or restoring yield, shall be used according to manufacturer's recommendations. Except for routine maintenance and cleaning, a valid Washington State well drilling license is required for all chemical conditioning that alters the condition of the water well.

17 LAR 04.110 Well Construction Illustrations.

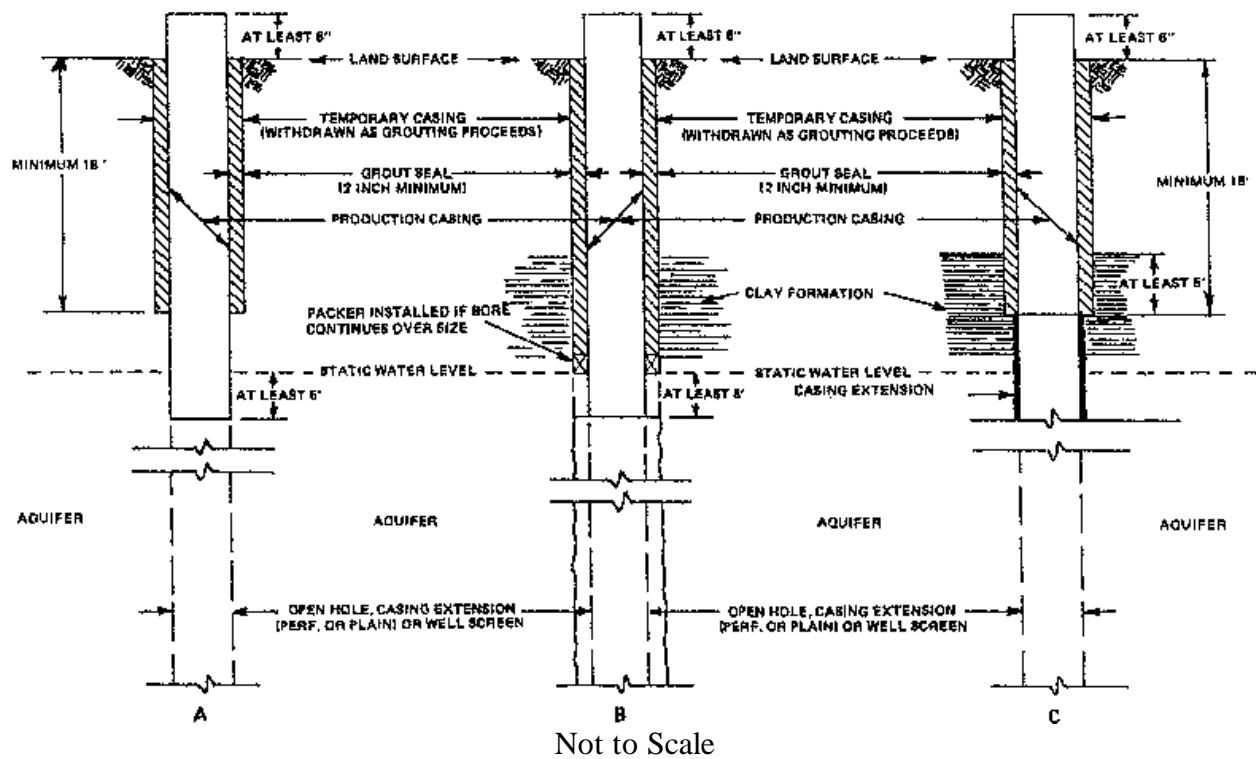
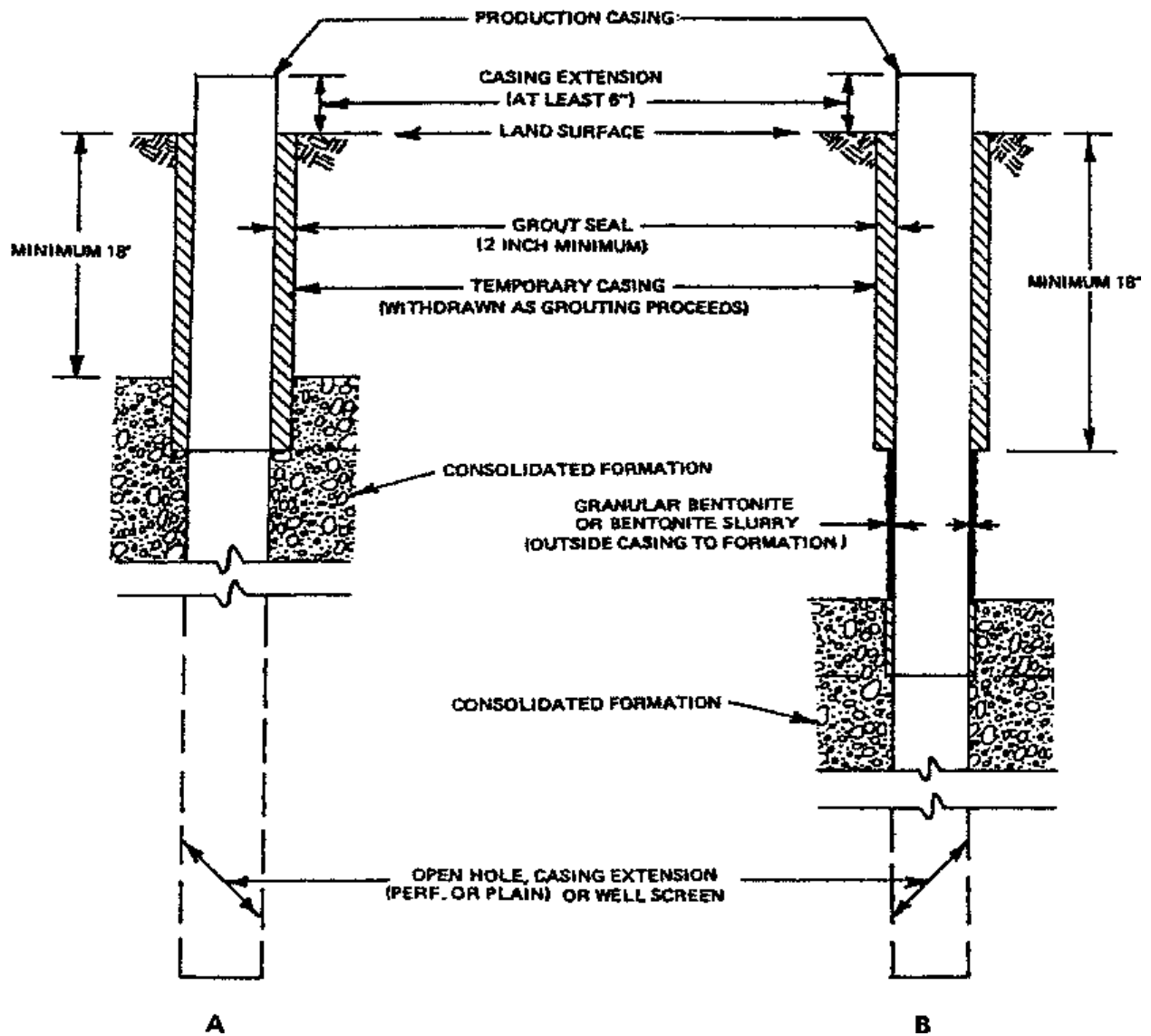
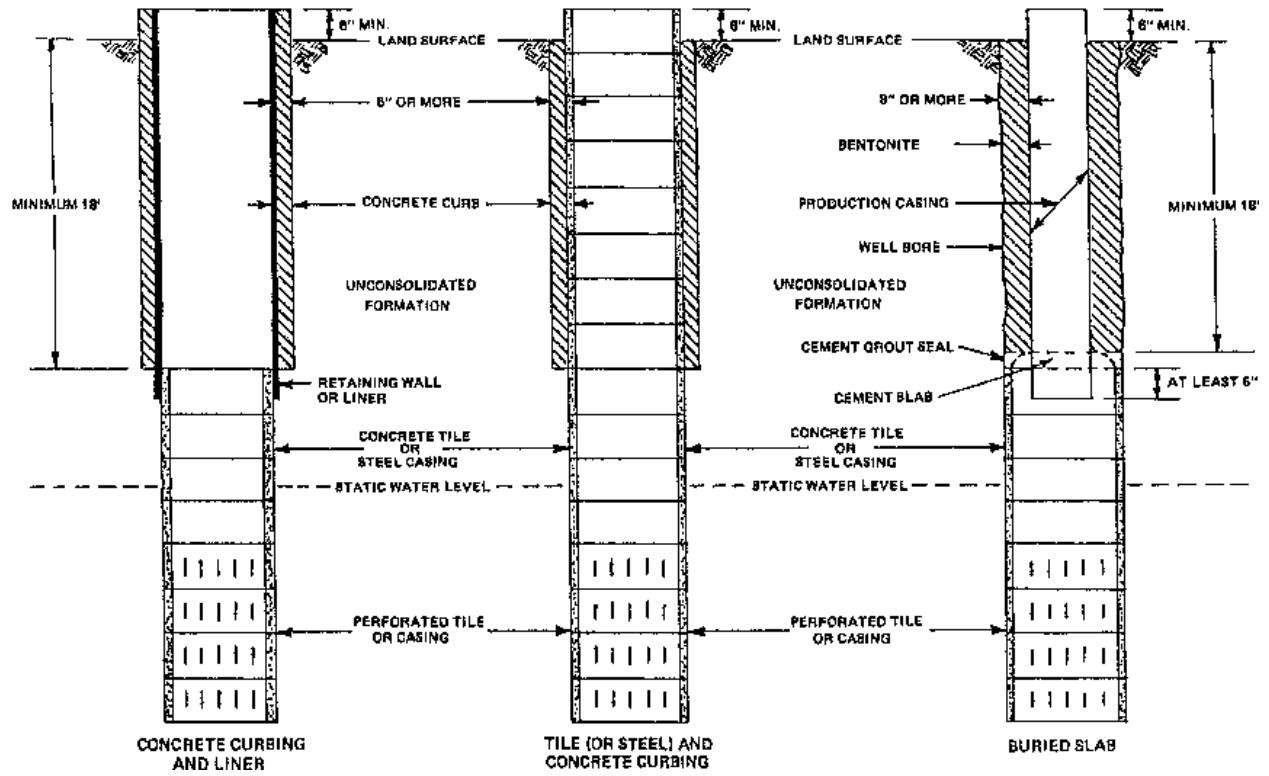


Figure 1. Sealing of unconsolidated formations.



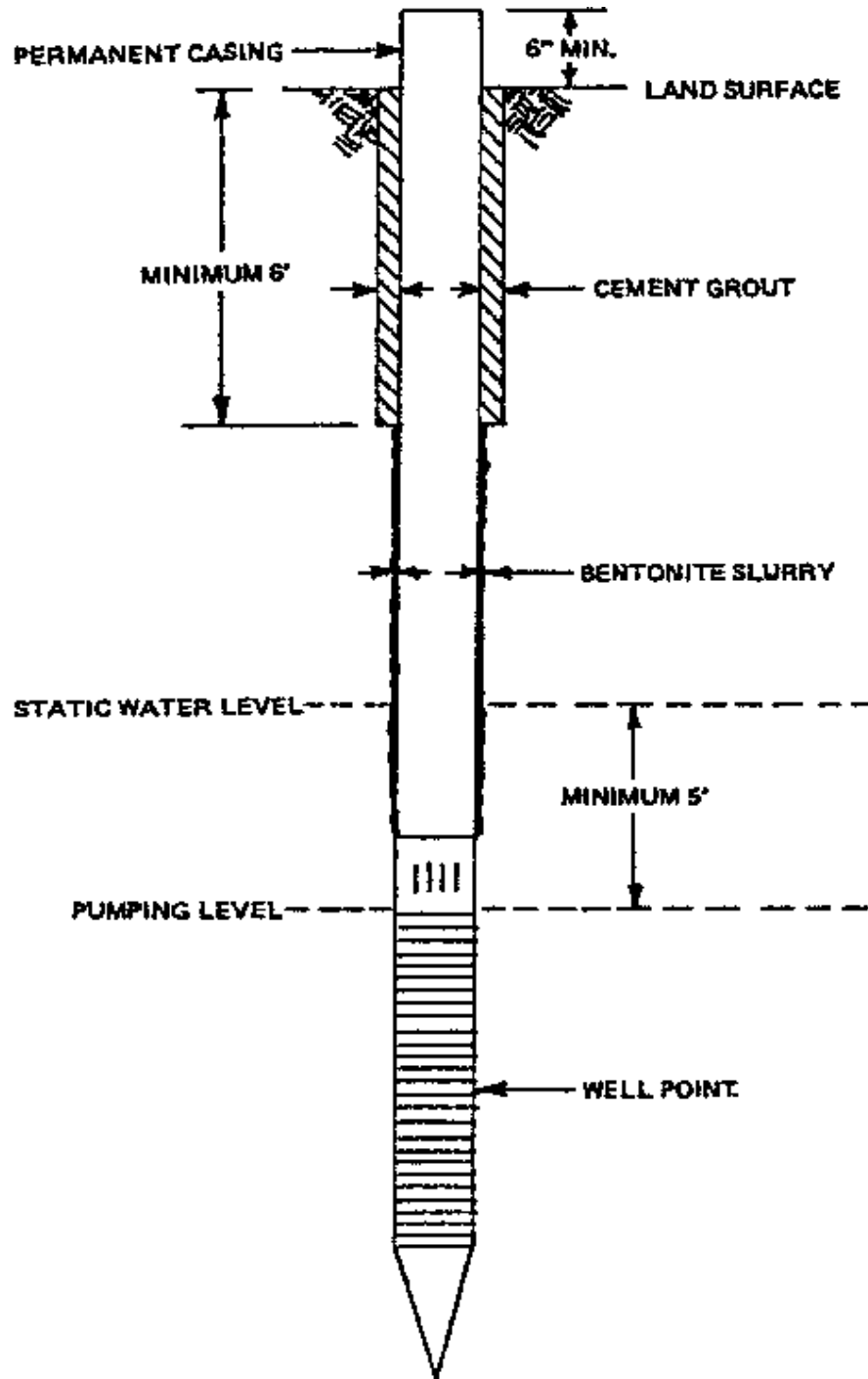
Not to Scale

Figure 2. Sealing of consolidated formations



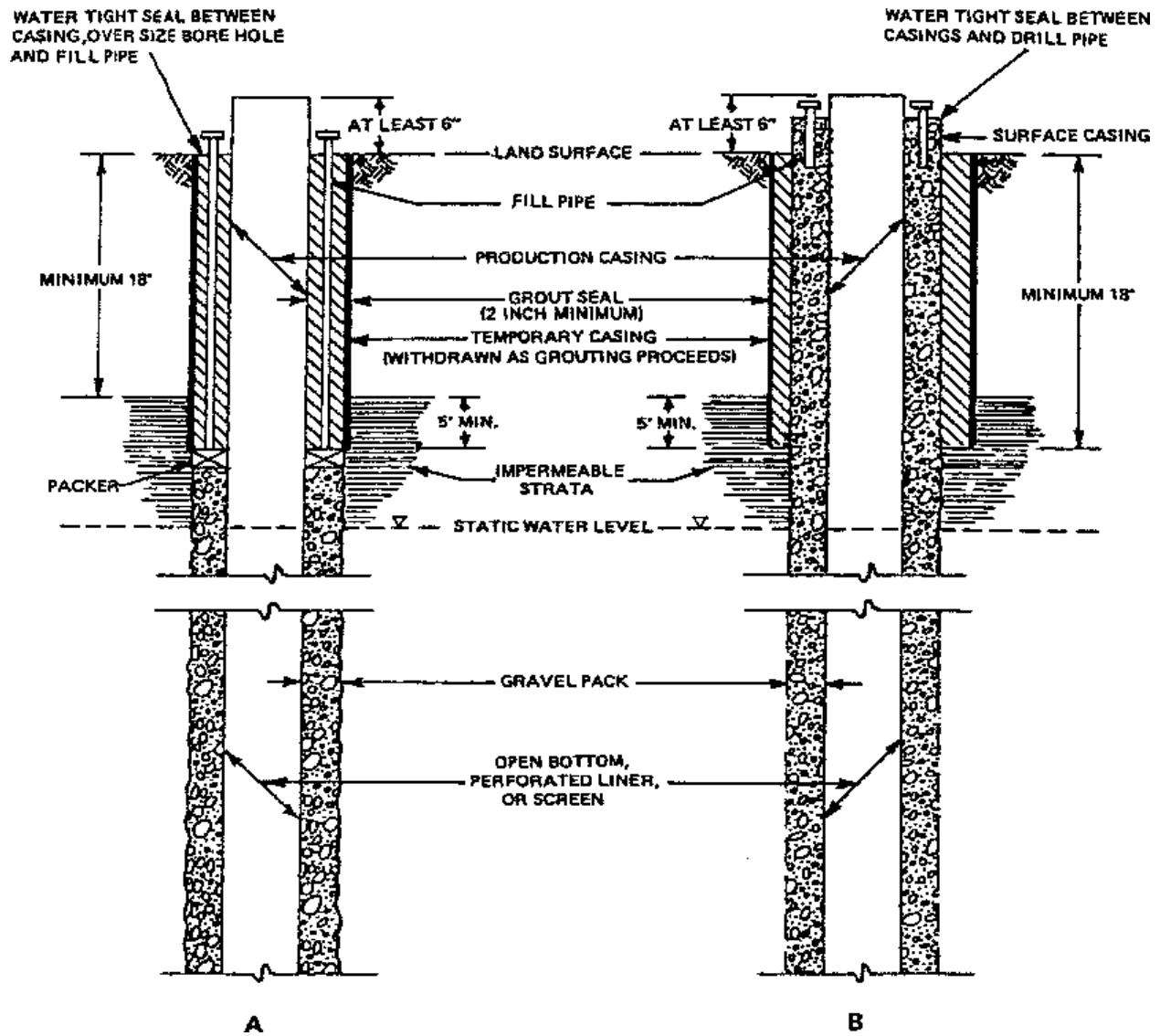
Not to Scale

Figure 3. Sealing of dug wells.



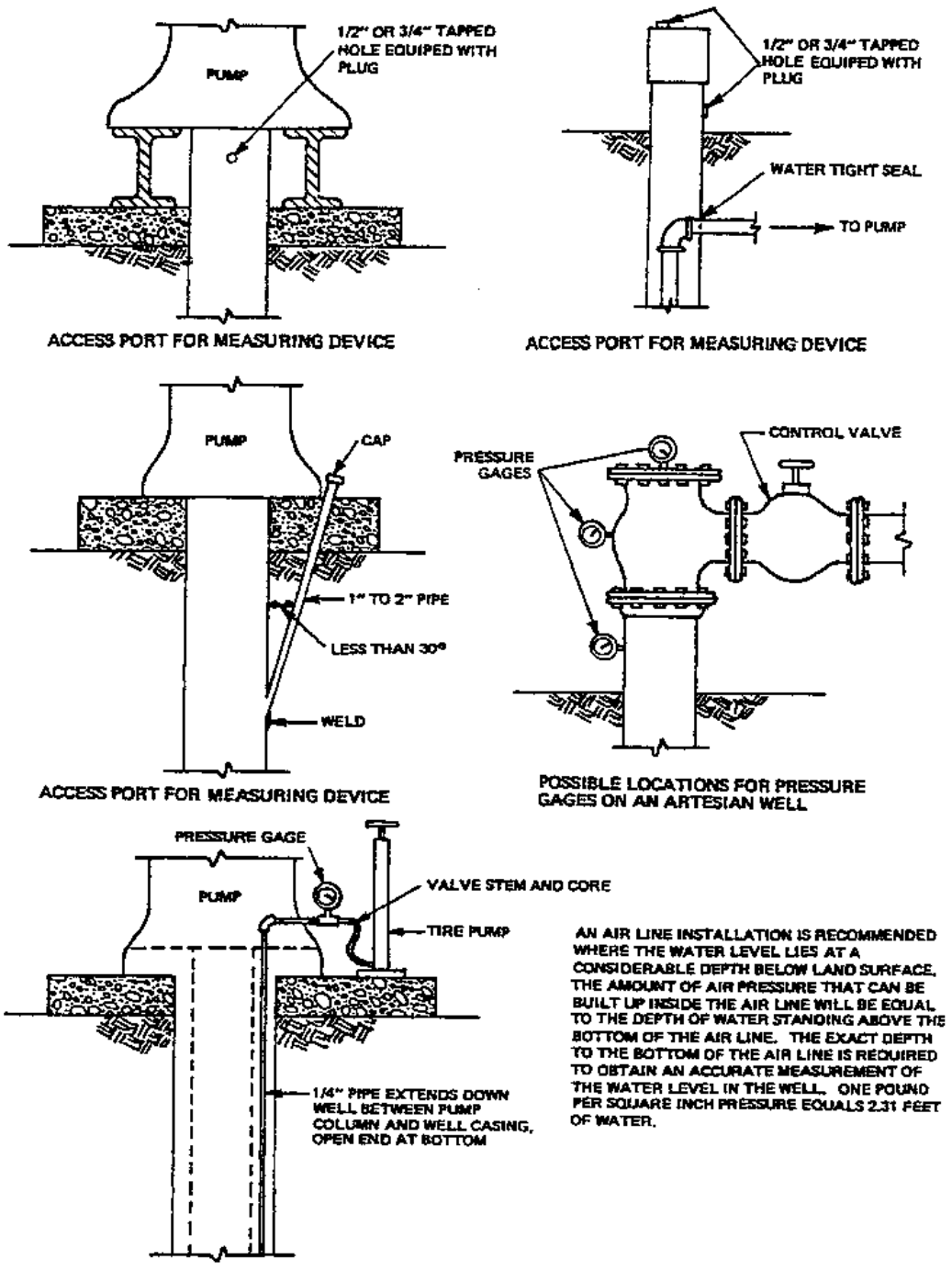
Not to Scale

Figure 4. Sealing of driven and jetted wells.



Not to Scale

Figure 5. Sealing of sand or gravel packed wells: (A) –well constructed with temporary surface casing and (B) – well constructed with permanent surface casing.



Not to Scale

Figure 6. Suggested methods for installing pressure gages and air-lines for measuring water levels in a well.

17 LAR 04.120 Requirements For Measuring Water Use

- (a) A measuring device is required for all wells subject to authority under these regulations.
- (b) General requirements for measuring devices:
 - (1) No withdrawal of water shall be made unless the measuring devices and facilities are in proper operating condition, except when:
 - (A) A measuring device or facility is being repaired according to the requirements of subsection (2) or (3) of this section; and
 - (B) The well owner uses a substitute measuring device or other method to measure the withdrawal or to provide a reasonable estimate thereof.
 - (2) Upon discovery of a malfunctioning measuring device or facility, the well owner shall repair the device or facility and make them operable as soon as possible;
 - (3) If a well owner does not repair a malfunctioning measuring device or facility and make them operable as soon as possible, the Water Resources Manager may order that a measuring device or facility be repaired or replaced within a specified time period;
 - (4) Measuring devices and facilities must be registered and calibrated for the full range of discharge from the withdrawal for which they are to be used;
 - (5) There shall be no turnouts or diversions between the source of water and the measuring devices and facilities, except for faucets or other small outlets that have a de minimis effect on the diversion or withdrawal;
 - (6) In the case of intermittent artesian wells, the meter shall be installed in a manner that will measure both pumped and flowing discharge.
- (c) Pressure system meters
 - (1) Pressure system meter requirements:
 - (A) At any flow rate measured by the meter, the meter itself shall be rated by the manufacturer to register not less than ninety-five percent, nor more than one hundred five percent, of the water actually passing through the meter.

- (B) At any flow rate measured by the measuring system (i.e., meter plus any secondary equipment such as data recorders) the system shall not register less than ninety percent, nor more than one hundred ten percent, of the water actually passing through the system.
 - (C) The meter shall have a visual totalizer or the facility shall be capable of totalizing the flow. The totalizer shall contain sufficient recording digits to ensure that "roll over" to zero does not occur before the next recording period.
 - (D) The Water Resources Manager may require that the measuring device be capable of indicating flow rate as well as totalized flow.
 - (E) For other conditions necessary to ensure accurate and precise measurement data, the selection, installation, and maintenance of measuring devices by water users shall be guided by generally accepted industry standards, such as the American Water Works Association standards and information from the manufacturer. These standards also shall be used by the Water Resources Manager in making decisions as to the appropriate selection, installation, operation, and maintenance of measuring devices acceptable under this regulation.
- (2) Meters shall meet the following installation requirements:
- (A) The meter shall be installed in accordance with manufacturer specifications.
 - (B) There shall be a full pipe of water in the meter at all times when water is being withdrawn.
 - (C) The meter shall not be installed in a manner that creates an uneven velocity profile. Straight sections of pipe before and after the meter, straightening vanes or other flow conditioning devices shall be used to provide even flow through the meter as necessary.
- (3) The operation and maintenance requirements for meters on pressure systems:
- (A) Meters shall be inspected and maintained as specified by the manufacturer.
 - (B) Meters shall be field or shop calibrated, as specified by the manufacturer. Meters also shall be field or shop calibrated and/or repaired if they are over

or under registering. System diagnostics may substitute for physical calibration of nonmechanical meters.

17 LAR 04.130 Well Decommissioning

- (a) Any well that is unusable, abandoned, or whose use has been permanently discontinued, or which is in such disrepair that its continued use is not practical or is an environmental, safety or public health hazard shall be decommissioned.
- (b) The following information must be recorded and reported to the Water Resources Manager for decommissioning of a well:
 - (1) Well log and other information about construction (if available), depth, casing type and diameter. Also include street address of the well, township, range, and quarter/quarter section, tax parcel number, and identification tag number at time of decommissioning.
 - (2) Provide reasons that the well is being decommissioned.
 - (A) Water level and well depth information (collected before well is decommissioned) including the elevation above ground surface for the water level measuring point.
 - (B) A non-pumping water level measurement must be taken and recorded prior to decommissioning the well, and the water level at the time of measurement shall not be significantly affected by pumping of that or nearby wells.
 - (C) A measurement of well depth must be taken and recorded prior to decommissioning of the well.
 - (3) Precise location of the well using a Global Positioning System (GPS) and/or a high-resolution aerial photograph (which can be obtained from the Water Resources Manager).
 - (4) Disposition of well tag (if any).
 - (5) Documentation of the method of well decommissioning, method(s) of placement of the sealing material, sealing materials used, the quantity of those materials, location of placement of sealing materials in the well, location and resolution of obstructions that could not be removed, and mix specifications for the sealing

material, including the type and viscosity of bentonite grouts. This also includes calculation of the volume of sealing material needed for each interval and the resolution of any discrepancies between the amount of sealing material needed and the amount of sealing material used for each interval.

- (6) Documentation and certification by the well driller of how the well was decommissioned and that it was decommissioned properly. Include the name of the company; registration number of the company, person(s) that performed the work, and the date(s) that decommissioning occurred. This documentation shall be recorded on a form provided by the Water Resources Manager as shown in 17 LAR 04.140.
- (c) Cased water wells shall be decommissioned in one of the following ways:
- (1) Perforate the casing from the bottom to within five feet of the land surface and pressure grout the casing.
 - (A) Perforations shall be at least four equidistant cuts per row, and one row per foot. Each cut shall be at least one and one-half inches long.
 - (B) Apply enough pressure to force the sealing material through the perforations, filling any voids on the outside of the casing.
 - (C) The remainder of the casing shall be filled with cement grout, neat cement, or bentonite slurry.
 - (D) Place a watertight secure cover on top of the casing.
 - (2) Withdraw the casing and fill the bore hole with cement grout, neat cement, or bentonite as the casing is being withdrawn.
 - (3) If it can be verified through a field examination and review of the drilling report that a water well was constructed in accordance with this regulation, and it is not being decommissioned to allow the siting of potential sources of contamination within one hundred feet of the well, it shall be decommissioned by the casing removal, or casing perforation methods described above or by:
 - (A) Filling the casing from bottom to within five feet of land surface with bentonite, cement grout, or neat cement;
 - (B) The casing may be cut off at a maximum of five feet below land surface.

- (d) Uncased wells shall be backfilled with concrete, cement grout, neat cement, or bentonite.
- (e) To decommission dug wells remove all debris and obstructions that impede decommissioning or that may contaminate the aquifer from within the dug well. Install clean chlorinated sand or pea gravel to a point two feet above static water level. Fill the remainder of the well with concrete or bentonite to the land surface. Dug wells with static levels below twenty feet from land surface, may be decommissioned by placing chlorinated sand or pea gravel to the static level and then placing alternating layers of sealing material and chlorinated sand or pea gravel to within twenty feet of land surface. The alternating layers of sand or pea gravel must be a maximum of five feet thick. The minimum thickness of the sealing material layers must be five feet. The remainder of the dug well to a maximum of two feet below land surface shall be filled with bentonite, neat cement, cement grout, or concrete. Bentonite slurry shall not be used to decommission dug wells.
- (f) Sealing material placed below the static water level shall be piped directly to the point of application or placed by means of a dump bailer or tremie tube. If cement, cement grout, or neat cement is used to seal below the static water level in the well, the material shall be placed from the bottom up by methods that avoid segregation or dilution of the material. When used to place grout, the discharge end of the tremie tube shall be submerged in the grout to avoid breaking the seal while filling the annular space. Sealing material may be hand poured above the static water level, provided the material does not dilute or segregate, and the resulting seal is free of voids.

