

**DELAWARE
REGULATIONS GOVERNING
THE CONSTRUCTION
AND USE OF WELLS**

ADOPTED: FEBRUARY 6, 1997

EFFECTIVE: APRIL 6, 1997

TABLE OF CONTENTS

SECTION 1 - GENERAL PROVISIONS	1
1.01 Statutory Authority.....	1
1.02 Scope and Applicability.....	1
1.03 Enforcement and Penalties.....	2
SECTION 2 - DEFINITIONS	3
SECTION 3 - GENERAL REQUIREMENTS AND PROCEDURES	9
3.01 Permit Required.....	9
3.02 Well Repair.....	9
3.03 License Required.....	9
3.04 Permit Applicants.....	9
3.05 Permit Application Procedures.....	9
3.06 Dewatering Well Application Procedures.....	10
3.07 Closed Loop Heat Pump Application Procedures.....	11
3.08 Monitor and Observation Well Application Procedures.....	11
3.09 Application Procedures for Permits to use Existing Wells.....	11
3.10 Permit Issuance Procedures.....	12
3.11 Emergency Circumstances.....	14
3.12 Relocation During Construction.....	14
3.13 Water Well Contractor and Well Driller Responsibilities.....	15
3.14 Property Owner's Responsibilities.....	15
3.15 Pump Installer Contractor Responsibilities.....	16
3.16 Temporary Wells for Construction Water.....	16
3.17 Permit Transfer.....	16
3.18 Cancellation of Permits.....	16
3.19 Permit Duration.....	16
3.20 Approval for Use.....	17
3.21 Changing Well Classification.....	17
3.22 Water Service Piping.....	17

TABLE OF CONTENTS

SECTION 4 - WELL CONSTRUCTION STANDARDS	18
4.01 Siting Criteria.....	18
4.02 Sanitary Protection During Well Construction.....	20
4.03 Water for Well Construction.....	21
4.04 Well Casing.....	22
4.05 Well Screens.....	25
4.06 Gravel Packed Wells.....	26
4.07 Well Grouting.....	26
4.08 Well Development.....	29
4.09 Pitless Well Adapters, Pitless Well Units, and Plumbing "Tees"	29
4.10 Well Caps and Upper Terminus of Wells.....	30
4.11 Water Level Access Ports and Tubes.....	31
4.12 Meters, Pumping Equipment, and Vents.....	32
SECTION 5 - SPECIAL CONSTRUCTION REQUIREMENTS	34
5.01 Monitor and Observation Well Construction.....	34
5.02 Coastal Well Construction.....	34
5.03 Public, Miscellaneous Public and Industrial Well Construction.....	35
5.04 Heat Pump Recharge Well Construction.....	35
5.05 Heat Pump Closed Loop Well Construction.....	36
SECTION 6 - WELL DISINFECTION	37
6.01 General Requirements.....	37
6.02 Required Disinfection Procedure.....	37
SECTION 7 - WELL COMPLETION REPORTS	40
7.01 General Requirements.....	40
7.02 Required Information.....	40
SECTION 8 - WELL MAINTENANCE AND REPAIR	42

TABLE OF CONTENTS

SECTION 9 - WELL ABANDONMENT	43
9.01 General Requirements.....	43
9.02 Sealing and Fill Materials.....	44
9.03 Abandonment Procedures.....	44
SECTION 10 - WELL IDENTIFICATION TAG	46
SECTION 11 - VARIANCES	47
11.01 Applicable Delaware Law.....	47
11.02 Application Procedures.....	47
SECTION 12 - PUBLIC HEARINGS AND APPEALS.....	49

SECTION 1 - GENERAL PROVISIONS

1.01 Statutory Authority

The Department of Natural Resources and Environmental Control establishes and adopts the following Regulations pursuant to the authority granted by §6010(a) of the Delaware Environmental Protection Act, 7 Del. C., Chapter 60.

1.02 Scope and Applicability

- A. Minimum requirements are hereby prescribed governing the location, design, installation, use, disinfection, modification, repair, and abandonment of all wells and associated pumping equipment as well as certain requirements for the protection of potable water supply wells. These Regulations supersede all other well construction Regulations.
- B. No person shall conduct any activity contrary to the provisions of these Regulations. All such activities which are contracted for shall be carried out only by those persons having a valid license pursuant to the provisions of the "Regulations for Licensing Water Well Contractors, Pump Installer Contractors, Well Drillers, Well Drivers and Pump Installers."
- C. These Regulations apply to well construction activities from the initial penetration or excavation of the ground through development, equipment installation, disinfection and abandonment. Set up of construction equipment before actual penetration or excavation is not considered part of construction.
- D. The installation of any well, as defined in Section 2.61 of these Regulations, including any well installed for the purpose of obtaining geologic or hydrologic information shall receive the prior approval of the Department in the form of a well permit.
- E. If any part of these Regulations or the application of any part thereof is held invalid or unconstitutional, the application of such part to other persons or circumstances and the remainder of these Regulations shall not be affected thereby and shall be deemed valid and effective.
- F. The DNREC shall have the right to require that the well permit and permit conditions be recorded with the Recorder of Deeds office in the county where the well is located.
- G. These Regulations, being necessary for the protection and conservation of the water resources of the State, shall be liberally construed in order to preserve the land, surface water and ground water resources of the State of Delaware.
- H. The Department shall have the right to enter at reasonable times upon any private or public property for the purpose of inspecting and investigating conditions relative to the

enforcement of these Regulations; upon given verbal notice and after presenting official identification to the owner, occupant, custodian, or agent of the property.

1.03 Enforcement and Penalties

The provisions of these Regulations shall be enforced by the Department as provided in 7 Del. C., Chapter 60. Such enforcement may include revocation of any permit for cause. The failure of the Department to enforce any of the provisions of this Regulation shall not constitute a waiver by the Department of any such provisions.

SECTION 2 - DEFINITIONS

The following words or phrases, when used in these Regulations, shall have the meaning ascribed to them in this Section unless the text clearly indicates otherwise:

- 2.01 **Abandoned Well:** A well which has been permanently filled or sealed.
- 2.02 **Agricultural Well:** A well used for the watering of livestock, poultry, aquaculture uses, or solely for the watering of household yards and gardens or for other purposes related to farming in general but not including the irrigation of lands or crops. Water is not used for human consumption or to service a dwelling.
- 2.03 **Annular Space:** The space between two cylindrical objects, one of which surrounds the other, such as the space between a drill hole and a casing pipe or between two well casings.
- 2.04 **Applicant:** The owner(s) of the property or the legally authorized agent of the owner(s) as evidenced by sufficient written documentation.
- 2.05 **Aquifer:** A part of a formation, a formation, or a group of formations that contains sufficient saturated permeable material to yield economically useful quantities of water to wells and springs.
- 2.06 **Beneficial Use:** Any use of water which is necessary to the applicant, non-wasteful, reasonably non-damaging to other users, and in the best interest of the public.
- 2.07 **Community Water System:** A public water system which serves at least fifteen (15) service connections used by year-round residents or regularly serves at least twenty-five (25) year-round residents.
- 2.08 **Confined Aquifer:** An aquifer bounded above and below by impermeable beds or by beds of distinctly lower permeability than that of the aquifer itself and containing ground water which is everywhere at a pressure greater than atmospheric and from which water in a well will rise to a level above the top of the aquifer.
- 2.09 **Confining Layer:** A body of impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.
- 2.10 **Consolidated:** Geologic material that is firm and rigid due to the interlocking or cementation of its mineral components or both.
- 2.11 **Contaminant:** Any substance, either man-made or natural, which is concentrated enough to degrade water quality to a degree which renders such water harmful to public health and safety, or to the environment.
- 2.12 **Contamination:** The presence of a contaminant.
- 2.13 **Department:** The Department of Natural Resources and Environmental Control (DNREC).
- 2.14 **Dewatering Well:** A well used to remove ground water for construction of footings, sewer lines, building foundations, elevator shafts, etc.

- 2.15 Disinfection:** The inactivation of pathogenic organisms in water by chemical oxidants or equivalent agents.
- 2.16 Disposal Area:** The entire area used for underground dispersion of the liquid portion of sewage.
- 2.17 Domestic Well:** A well primarily used for potable non-public water supply purposes and which may be used for non-potable purposes, excluding heat pump supply.
- 2.18 Drawdown:** The extent of lowering of the static water level in a well and of the water table or potentiometric surface adjacent to a well, resulting from the discharge of water from a well by pumping or natural flow.
- 2.19 Drilled Well:** A well that is excavated wholly or in part by means of a drill such as auger(percussion or rotary) which operates by cutting, abrasion or by use of air pressure or a water jet.
- 2.20 Drive Shoe:** A device fastened to the bottom of a length of casing to aid in driving the well casing.
- 2.21 Driven Well:** A well that is constructed by driving a casing, at the end of which there is a drive point and screen.
- 2.22 Dug Well:** A well that is constructed in an excavation created by the use of picks, shovels, or other hand tools, or by means of a power shovel.
- 2.23 Gravel Pack:** Gravel or coarse sand placed opposite a well screen to limit the entrance of fine particles and improve well yield.
- 2.24 Ground Water:** Any water naturally found under the surface of the earth.
- 2.25 Grout or Grouting Material:** A stable and impervious bonding material, reasonably free of shrinkage, which is capable of providing a watertight seal in the annular spaces of a well.
- 2.26 Heat Pump Closed Loop Well:** A sealed and pressurized loop of pipe containing a heat exchange solution which is circulated below the earth's surface and utilizes groundwater for the purpose of heat transfer.

- 2.27 Heat Pump Recharge Well:** A well constructed and primarily used for injecting ground water source heat pump effluent back into an aquifer, and which may be used for other non-potable water supply purposes provided prior written approval is obtained from the Department.
- 2.28 Heat Pump Supply Well:** A well constructed primarily to obtain ground water as a source for heat pump supply purposes and which may be used for other purposes, including domestic water supply, provided prior written approval is obtained from the Department.
- 2.29 Industrial Well:** A well which is used in the processing, washing, packaging, or manufacturing of a product excluding food and beverages.
- 2.30 Injection Well:** A well used to inject fluid into the subsurface as regulated in the "Regulations Governing Underground Injection Control."
- 2.31 Irrigation Well:** A well which is used for the watering of lands or crops other than household lawns and gardens.
- 2.32 Miscellaneous Public Well:** A well which supplies water for potable and other beneficial uses to service stations, stores, small offices, businesses, etc. with less than twenty-five (25) employees; and from which the water is not used in the manufacture or preparation of food or beverages for sale to or use by the public in general.
- 2.33 Monitor Well:** A well installed for the sole purpose of the determination of subsurface conditions and collecting ground water samples.
- 2.34 Multiple Screening:** The placing (in a single well) of more than one screen in different or separated water-bearing units, or of a continuous screen connecting two or more water-bearing units.
- 2.35 Observation Well:** A well used for the sole purpose of determining ground water levels.
- 2.36 Person:** Any individual, firm, association, organization, partnership, business trust, corporation, company, contractor, supplier, installer, user, or owner, or any Federal, State or local governmental agency or public district or any officer or employee thereof.
- 2.37 Piezometer:** A small diameter non-pumping well with a short screen that is used to measure elevation of the water table or potentiometric surface.

- 2.38 Pitless Well Adapter:** A device designed for attachment to one or more openings through a well casing, provided with a pitless well cap, and so constructed as to prevent the entry of contamination into the well. The adapter is used to conduct water to or from the well, protect the water from freezing temperatures and provide access to the well and water system components within the well.
- 2.39 Pitless Well Unit:** A pre-assembled device which extends the upper end of a well casing to above grade, provided with a pitless well cap, and so constructed as to prevent the entry of contamination into the well or potable water. The unit is used to conduct water to or from the well, protect the water from freezing temperatures and provide access to the well and to the water system components within the well.
- 2.40 Pitless Well Cap:** A sanitary device that covers and encloses the upper termination of the well casing above a pitless well adapter or unit and provides for connections for electrical power lines and a screened well vent.
- 2.41 Potable Water:** Any water which is in compliance with all the primary health related drinking water standards specified in the Delaware Regulations Governing Public Drinking Water Systems and the US EPA Safe Drinking Water Act, and is acceptable for human consumption.
- 2.42 Potential Source of Contamination:** Anything that may introduce contaminants so as to cause a violation of applicable water standards or otherwise interfere with water uses. Examples may include, but are not limited to, underground storage tanks for petroleum products, wastewater disposal areas, landfills, and confined animal feed lot operations.
- 2.43 Pressure Grouting:** The emplacement of grout materials under positive pressure.
- 2.44 Public Well:** A well which is used to supply water to more than three dwelling units; twenty-five (25) or more employees; in the manufacture of ice, foods, or beverages; to the public in food washing, processing, or preparation in a plant, restaurant, or other facility.
- 2.45 Pump Installer:** Any person licensed by the State of Delaware to act in responsible charge of all on-site work in the installation, modification, and repair of water pumps and related equipment.
- 2.46 Pump Installer Contractor:** Any person licensed by the State of Delaware to engage in the business of contracting for the installation, modification, and repair of water well pumps and related equipment.

- 2.47 Pump Pit:** A hole or depression in the ground in which the well and external pumping equipment is contained, and which is not protected from freezing.
- 2.48 Recovery Well:** A well used to withdraw contaminated ground water.
- 2.49 Secretary:** The Secretary of the Department of Natural Resources and Environmental Control or his duly authorized designee.
- 2.50 Septic Tank:** A watertight receptacle which receives the discharge of sanitary sewage and is designed and constructed so as to permit settling of settleable solids from the liquid, digestion of the organic matter by detention, and discharge of the liquid portion into a disposal area.
- 2.51 Service Connection:** A water line from a public water supply system to a dwelling or building.
- 2.52 Soil Boring:** An uncased excavation done for the purpose of determining the physical or chemical characteristics of soil.
- 2.53 Source of Contamination:** Anything that introduces contaminants so as to cause a violation of applicable water standards or otherwise interfere with water uses. Examples may include but are not limited to underground storage tanks for petroleum products, wastewater disposal areas, landfills, and confined animal feed lot operations.
- 2.54 Static Water Level:** The elevation of water in a well not under the influence of pumping.
- 2.55 Suction Line:** A pipe which conveys water from a well to a pump under vacuum conditions.
- 2.56 Temporary Well:** A well used to supply water for well construction.
- 2.57 Test Well:** A well installed to ascertain the lithology and water transmission properties of an aquifer or geologic materials and which may be used to determine water quality; a well which is not used on a permanent basis.
- 2.58 Unconfined Aquifer:** An aquifer in which no relatively impermeable layer exists between the water table and the ground surface and an aquifer in which the water surface is at atmospheric pressure.
- 2.59 Unconsolidated:** Geologic material that is loosely arranged and whose particles are not cemented together.
- 2.60 Water Well Contractor:** Any person licensed by the State of Delaware to engage in the business of contracting for the construction of wells or the installation or repair of pumping equipment in or for wells, or both.
- 2.61 Well:** Any excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed when the intended use of such excavation is for the location, testing, acquisition, use, for extracting water from, or for the artificial recharge of subsurface fluids, and where the depth is greater than the diameter or width. For the purpose of this regulation this definition does not include

geotechnical test; soil, telephone, and construction piling borings; fence posts, test pits, or horizontal closed loop heat pump circulation systems constructed within twenty (20) feet of the ground surface.

- 2.62 Well Casing:** The pipe installed in a well to give unobstructed access to a water-bearing unit, to provide protection during and after installation, or both.
- 2.63 Well Driller:** Any person licensed by the State of Delaware to act in responsible charge of all on-site work relating to the drilling, construction, development, and testing of wells; well alteration and repair, test boring and coring; and the installation, modification, and repair of well pumps and related equipment.
- 2.64 Well Driver:** Any person licensed by the State of Delaware to act in responsible charge for all on-site work relating to the driving, construction, development, and testing of driven wells; alteration and repair of driven wells; and the installation, modification and repair of water well pumps and related equipment ordinarily used in driven wells.
- 2.65 Well Pit:** A hole or depression in the ground surface around a well casing in which the well head is capped below grade and which does not contain pumping equipment.
- 2.66 Well Screen:** A structural device which supports the well excavation, allows entrance of sub-surface fluids into a well or exit from a recharge well, and which acts as a filter to keep sediment from entering a well.
- 2.67 Wick Drain:** A prefabricated drainage strip which is driven into the ground for the removal of pore water from the soil, therefore consolidating compressible soils. The wick drain design allows for escaping water to follow gravitational forces and to drain downwards or upwards into granular drainage layers or to the ground surface.

SECTION 3 - GENERAL REQUIREMENTS AND PROCEDURES

3.01 Permit Required

- A. A well may not be constructed until the Department has issued a well permit to the applicant, unless otherwise authorized under Section 3.11 of these Regulations. A well permit is not required for the construction of piezometers with a hand auger or hand operated driver or for the construction of wick drains in the unconfined aquifer.
- B. A permit is required for the use of all wells.

3.02 Well Repair

A well permit is not required if an existing well requires only repair or rehabilitation (the restoration of a well's original yield, to the best extent possible) and the location and physical dimensions of the well are not changed. A change in physical dimensions, such as deepening, making more shallow, enlarging, or reducing the length or diameter of either the screen or well casing shall require an application for a well permit as set forth in the remainder of this Section. The Department may consider the approval of additional repair procedures on a case-by-case basis.

3.03 License Required

The construction, repair, modification, or abandonment of wells and the installation of pumps and pumping equipment in and for water wells shall be performed by or under the direct on-site supervision of an individual licensed pursuant to the requirements of 7 Del. C., §6023 and the requirements of the "Regulations for Licensing Water Well Contractors, Pump Installer Contractors, Well Drillers, Well Drivers, and Pump Installers."

3.04 Permit Preparers

All well permit applications shall be prepared by a water well contractor.

3.05 Permit Application Procedures

- A. Applications for well permits shall be made on forms provided by the Department.

- B. All applications shall be legible and complete. An illegible or incomplete application shall be returned to the preparer with a statement of the reason for rejection.
- C. All applications shall be signed by the proper applicant or their duly designated agent.
- D. All well applications shall be signed by the permit preparer as stated in Section 3.04 of these Regulations.
- E. All applications shall be accompanied by an application fee if applicable.
- F. Wells shall only be used for their designated use as defined in Section 2 of these Regulations.
- G. The Department shall not consider the issuance of a new well permit for a potable water supply well on a previously undeveloped property until after the wastewater disposal system construction permit for the property has been issued, or it is demonstrated that central sewer service is available to the property.
- H. All well permit applications shall contain the tax map, block, and parcel number for the property on which the well is to be constructed. For wells which will be constructed in areas where no tax map numbers are assigned, some evidence to that fact must be submitted with the well permit application in lieu of the tax map, block and parcel number.

3.06 Dewatering Well Application Procedures

- A. Permit applications for dewatering wells shall include:
 - (1) Duration of project.
 - (2) Location of water discharge.
 - (3) Project location including site map and well point layout noting the estimated number of dewatering wells/points for the project.
 - (4) Quantity of water to be pumped.
- B. Permits are valid for the duration of the project as described in the application. The construction authorized by the permit shall commence prior to the expiration date of the permit.

- C. The Department may require additional information concerning the operation prior to issuance of any dewatering permit.
- D. Withdrawals from dewatering facilities are subject to the requirements of Section 3.10(K) of these Regulations.
- E. Water quality tests may be required as part of the application, at the discretion of the Department, where the Department has reason to believe that ground water contamination may exist in or near the proposed construction site.

3.07 Closed Loop Heat Pump Application Procedures

- A. Permit Applications shall show the total number of vertical loops for one system on one application form.
- B. One application fee shall be assessed for each application form submitted.

3.08 Monitor and Observation Well Application Procedures

- A. Applications for monitor and observation wells shall be submitted on special forms provided by the Department.
- B. Applications for a maximum of ten (10) monitor or observation wells may be submitted on a single form provided:
 - (1) all wells are proposed with similar construction, and
 - (2) are located on the same tax map parcel number and associated with one project, and
 - (3) are screened in the same aquifer.
- C. Monitor and Observation well applications shall be accompanied by the appropriate fee if applicable. Monitor well applications require one fee per project for any number of wells submitted for review at one time.
- D. Completion reports for monitor wells shall adhere to the requirements of Section 7 of these Regulations.

3.09 Application Procedures for Permits to Use Existing Wells

- A. Applications for permits to use existing wells shall contain information similar to that required in an application for a well permit.
- B. Existing wells for which a use permit application is submitted must meet the criteria contained in these Regulations.
- C. The Department may impose special use conditions which may include but are not limited to the conditions contained in the original well permit.

3.10 Permit Issuance Procedures

- A. Advertising Requirements

- (1) Any permit application or combination of applications received for a well(s) located on a tract of land owned by the same person, where the total estimated withdrawal is greater than fifty thousand (50,000) gallons per day shall be advertised in newspapers of local and statewide circulation with a comment period of fifteen (15) days before issuance of the well permit(s).
 - (2) A second advertisement will not be required if all of the following conditions are met:
 - (a) the well was never installed,
 - (b) the requested usage rate and well construction details have not changed.
- B. The Department, in considering applications and granting permits, shall take into account the geology, hydrology and hydraulics of the area of interest, population density and water use, character of surface and subsurface, water quality, depletion rate of the water resources, sources of contamination, and other factors as may be relevant to the protection of the water resources and water supply.
- C. The Department may place special conditions on the well permit such as, but not limited to, a requirement for double casing, special grouting requirements, special use restrictions, depth restrictions, notification of installation date, and special material requirements to protect the water resources, water supply, and the public health, safety and welfare.
- D. Where an approved public water supply system is legally and reasonably available to the site to be served, the Department shall deny an application for a well permit for a potable water well. A public water supply system is deemed legally

available when a Certificate of Public Convenience and Necessity has been granted to a water utility for the site. A public water supply system is deemed reasonably available when a public water distribution line is located within two hundred (200) feet of the structure or building to be served. However, a public water supply system shall not be considered reasonably available by the Department if topographic or manmade features make connection physically impractical. The Department shall not deny a well permit for a non-potable well solely on the basis of the availability of a public water supply system.

- E. When proposed wells, with the exception of monitor, observation, and recovery wells, are to be located within the jurisdiction or service area of a municipality serving public water, the applicant shall submit a written statement of approval from said municipality with the well permit application.
- F. The Department may require, as a permit condition, that certain tests be done such as, but not limited to, the performance of a geophysical log on the well, the determination of water quality parameters, and the taking of formation samples.
- G. The Department may require aquifer tests as a condition of any well permit. These tests may require the construction and use of one or more observation or monitor wells.
- H. A well permit number may be given verbally over the telephone in emergency circumstances in accordance with Section 3.11 of these Regulations, or when the application has been approved and is or should be in transit to the applicant.
- I. An application which is denied shall be returned to the applicant accompanied by an explanation of the reasons for rejection.
- J. All water wells constructed for production purposes shall be put to beneficial use.
- K. All wells and dewatering facilities are subject to 7 Del. C., §6031 and §6037, which set forth responsibilities as it concerns remedying the depletion, exhaustion, or water quality degradation of any existing use of water caused as a result of any operation authorized under the approved permit.

3.11 Emergency Circumstances

- A. An emergency circumstance is deemed to exist where a well will replace an existing well and where the Department determines that the lack of water or delay in obtaining water poses an immediate and significant danger to the health or welfare of persons or their property or where the Department has determined that other exceptional circumstances exist.
- B. A permit number may be given verbally for the installation of a well where an emergency circumstance exists.
- C. Within seventy-two (72) hours after the verbal issuance of a permit number under emergency circumstances, the applicant shall submit to the Department a well permit application and well completion report, which shall include the permit number.
- D. In instances where an emergency circumstance exists at times when State offices are closed, a well may be constructed providing that it replaces an existing well and that the Department is notified verbally on the first working day following such action. A well permit application (including the well permit number), the appropriate application fee, and a well completion report shall be submitted within seventy-two (72) hours after notification.
- E. All wells constructed under emergency circumstances shall be constructed in conformance with these Regulations and all officially established policies.

3.12 Relocation During Construction

If it is necessary to relocate a proposed well or a newly constructed well in order to obtain sufficient yield, potable water, overcome a well construction problem, avoid power lines or underground utilities, to meet a distance requirement; or in the case of monitor wells, to react to field conditions determined during geophysical surveys, test pits or prior drilling, the well driller may relocate the well construction site under authority of the original permit provided that:

- A. Any new site meets the requirements of these Regulations.
- B. The new well location is situated on the same tax parcel number listed on the permit.

- C. The unsuccessful well, cased or uncased, shall be abandoned in accordance with the requirements of Section 9 of these Regulations before the drilling equipment is removed from the site.
- D. Monitor, observation, or recovery wells shall not be relocated beyond the limits of the site as described on the well permit application(s).

3.13 Water Well Contractor and Well Driller Responsibilities

- A. The water well contractor and well driller or well driver are responsible for construction of the well in accordance with the conditions of the permit and applicable laws and Regulations.
- B. The well driller or well driver is required to have at the drilling site a copy of the signed well permit or, in the case of verbal permits, the permit number.
- C. A well driller or well driver shall physically be present to conduct or supervise the actual on-site work of constructing a water well.
- D. Upon completion of the well, the water well contractor shall submit to the Department a legible well completion report as set forth in Section 7 of these Regulations.

3.14 Property Owner's Responsibilities

- A. The property owner is responsible for maintaining the well in accordance with these Regulations and in compliance with all applicable well permit conditions including but not limited to maintenance of the upper terminus and well tag.
- B. The property owner is responsible for having any damage to the well repaired by a well driller.
- C. It is the responsibility of the property owner to have a failed well properly abandoned and sealed by a well driller within sixty (60) days of construction of a replacement well. If the well is not abandoned and sealed at the end of this period the Department may have the well abandoned and sealed at the well owner's expense, unless specific written approval for maintaining the replaced well is granted by the Department.

3.15 Pump Installer Contractor Responsibilities

When it is necessary for a pump installer contractor or their licensed employee to open a well for any reason, the pump installer contractor is responsible for maintaining the well, while the well is open, in accordance with these Regulations and in compliance with all applicable well permit conditions including but not limited to maintenance of the upper terminus, well tag, well cap, and disinfection of the well.

3.16 Temporary Wells for Construction Water

- A. Upon application, the Department may issue a permit for a temporary well to supply drilling water for a new well installation. In acting on the application for a temporary well, consideration will be given to area geology and ground water quality. To the extent practicable, the application for a temporary well should be submitted in conjunction with the application for the new well or wells.
- B. All temporary wells shall be abandoned and sealed in accordance with Section 9 of the Regulations, or converted to another use in accordance with Section 3.21 of these Regulations, within thirty (30) days of completion of the new well(s), unless an extension is granted in writing by the Department.

3.17 Permit Transfer

A well permit is transferable by the property owner, by providing a copy of the well permit in its entirety, including the well permit conditions, to the subsequent property owner.

3.18 Cancellation of Permits

The Department shall have the right to cancel any permit for a well that has not yet been constructed or is not in the process of being constructed.

3.19 Permit Duration

A permit shall be valid for a period of one (1) year from the date of issuance by the Department, except as noted in Section 3.06(B) of these Regulations.

3.20 Approval for Use

- A. Well permits are issued for construction and use, except as noted in Section 3.20(B) and 3.20(C) of these Regulations.
- B. Any well permit or combination of well permits issued for well(s), with the exception of non-potable wells constructed and used for fire protection purposes only, located on a tract of land owned by the same person where the total estimated yield or use is greater than fifty-thousand (50,000) gallons per day are authorized for construction and testing only. Prior to putting the well(s) into service the owner shall apply for and receive a Water Allocation Permit as set forth in the "Regulations Governing the Allocation of Water."
- C. Approval for use shall be obtained from the Division of Public Health for all miscellaneous public, industrial, and public wells prior to their use.

3.21 Changing Well Classification

Upon receipt of a complete application and the appropriate fee, the Department may consider approving a request to change an existing well from one classification to another, such as in the changing of a test well to a public water well.

3.22 Water Service Piping

Water service piping from the well to the structure(s) shall be installed in accordance with the requirements of the "State of Delaware Regulations Governing a Detailed Plumbing Code", administered by the Department of Health and Social Services, Division of Public Health.

SECTION 4 - WELL CONSTRUCTION STANDARDS

4.01 Siting Criteria

- A. All wells, except for monitor, recovery, dewatering, and observation wells shall satisfy the following minimum horizontal separation distance requirements:
- (1) Ten (10) feet from a property line (except as required in Section 4.01(J) of these Regulations) to allow access to the well without encroaching on adjoining properties. Wells may be constructed less than ten (10) feet from a property line if prior approval is granted by the Department for the purpose of maximizing other horizontal separation distances as required by this Section.
 - (2) For any parcel, lot, or subdivision created or recorded within fifty (50) feet of, or within the boundaries of, an Agricultural Lands Preservation District (as defined in Title 3, Del. C., Chapter 9); all wells constructed on such parcels shall be located a minimum of fifty (50) feet from any boundary of the Agricultural Lands Preservation District. This requirement does not apply to parcels recorded prior to the implementation date of these Regulations. However, it is recommended that all wells be placed the maximum distance possible from lands which are or have been used for the production of crops which have been subjected to the application of land applied federally regulated chemicals.
 - (3) Wells shall not be permitted within any dedicated State of Delaware right-of-way unless written permission is obtained from the right-of-way holder and is submitted for review with the application, unless otherwise approved by the Department.
 - (4) One hundred (100) feet from identifiable potential or existing sources of contamination, except that public and industrial water wells shall have a minimum separation of one hundred fifty (150) feet. Heat pump closed loop and heat pump recharge wells may be as close as fifty (50) feet to identifiable potential or existing sources of contamination, as stated in Sections 5.04(B) and 5.05(A) of these Regulations. The Department may consider approval of a lesser isolation distance from agricultural and irrigation wells on a case-by-case basis.

- (5) Fifty (50) feet from approved septic tanks, diversion valves or boxes, dosing chambers, holding tanks and grease traps, with the exception of public and industrial water wells where the minimum separation distance shall be one hundred fifty (150) feet.
- (6) Fifty (50) feet from any underground sewage force main. The isolation distance may be decreased to no less than ten (10) feet when the section of the sewer line within fifty (50) feet of the proposed well is double cased with watertight joints; or when the well is constructed into a confined aquifer.
- (7) Fifty (50) feet from any gravity sewer line. The minimum separation distance shall be decreased to ten (10) feet when the sewer line is constructed of SDR 35 polyvinyl chloride (PVC) pipe and the joints are watertight slip joints with rubber gaskets.
- (8) Unless otherwise approved by the Department, no industrial or public water well may be constructed within one hundred fifty (150) feet of any identifiable potential or existing source(s) of contamination as defined by these Regulations.

B. When any well, with the exception of industrial and public water wells, cannot be physically placed the required isolation distance from identifiable potential or existing sources of contamination as specified in this section, the isolation distance may be decreased to no less than fifty (50) feet, but kept to a maximum possible distance, provided the well is screened in a confined aquifer and pressure grouted, as described in Section 4.07(K)(3) of these Regulations, from at least ten (10) feet into the confining layer immediately above the source aquifer. Where the confining layer is less than ten (10) feet in thickness, the well shall be pressure grouted entirely through the confining layer. In areas where a confined aquifer does not exist within one hundred fifty (150) feet of the natural ground surface, the depth of the casing shall be at least one hundred (100) feet and the casing shall be grouted in accordance with the requirements of Section 4.07(K)(4) of these Regulations. The final grout height in all cases shall be in accordance with the requirements of Section 4.07(K)(7) of these Regulations.

- C. A well may not be constructed within or under any building other than a separate structure constructed specifically for the housing of pumping equipment, unless otherwise approved in writing by the Department. Such structures shall be properly marked to indicate the classification of and the well permit number of the well contained therein.
- D. Suction lines from wells shall be at least ten (10) feet from all identifiable potential or existing sources of contamination. However, if high water table conditions may submerge the suction pipe during any portion of the year, the suction pipe shall be at least fifty (50) feet from all identifiable potential or existing sources of contamination unless the suction line is double cased from the well to the pump.
- E. Any subsurface pressure water supply line shall be at least ten (10) feet removed from any subsurface wastewater disposal area.
- F. All wells shall be located so as to be accessible for cleaning, treatment, repair, testing, inspection, and any other such work as may be necessary.
- G. All wells shall be protected from surface water run-off and flooding, as stated in Section 4.10 of these Regulations.
- H. The Department may require special location and depth requirements for a proposed water supply well to minimize its exposure to potential or existing sources of contamination or interference with other water supply wells. Such requirements may include, but may not be limited to, the submission of drawdown data and capture zone analyses.
- I. Wells subject to flooding, as defined in Section 5.02(A) of these Regulations, are subject to the additional siting requirements contained in Section 5.02(B) of these Regulations.
- J. All public water wells within a housing development, subdivision, or strip development recorded on or after the implementation date of these Regulations shall be located at least one hundred fifty (150) feet within the subdivision or development's outermost property lines.

4.02 Sanitary Protection During Well Construction

- A. During well construction, the well and any water bearing formation shall be protected against contamination by any cause, including surface water drainage.

- B. Whenever construction stops before the well is grouted and pumping equipment is installed, the open annular space shall be covered and protected from surface water drainage, and the well casing capped in accordance with the requirements of Section 4.10(D) of these Regulations.
- C. In the event that contaminants are encountered during the drilling process, the well driller shall ensure that adequate precautions are taken to decontaminate the drilling and related apparatus to prevent the transfer of contaminants from the site.
- D. Whenever contamination is observed during the drilling process, and the contamination was not anticipated or evaluated during the permit application and approval process, the well driller shall cease work and notify the Department immediately.

4.03 Water for Well Construction

- A. Water used during the construction of any potable well shall be obtained from sources listed in Section 4.03(C)(1)(2) or (3) of these Regulations.
- B. Water used during construction of any non-potable well shall be secured from the best and closest source available. For purposes of this Section, the closest source may be considered from one (1) to five (5) miles depending on road conditions and the quality of water required.
- C. The best water source for construction purposes in order of preference shall be:
 - (1) A public water supply system meeting the requirements of the "Delaware Regulations Governing Public Drinking Water Systems." If the water is transported to the site in a receptacle, it shall be disinfected in accordance with Section 4.03(F) of these Regulations prior to use.
 - (2) Any other potable water supply. If the water is transported to the site in a receptacle, it shall be disinfected in accordance with Section 4.03(F) of these Regulations prior to use.
 - (3) Other non-potable water supply wells such as wells used for irrigation, fire fighting, or well construction. If the water is transported to the site in a receptacle, it shall be disinfected in accordance with Section 4.03(F) of these Regulations prior to use.

- D. Water from sources other than those listed in Section 4.03(C) shall not be used for well construction.
- E. Construction water used in mixing drilling fluids and grout need not be disinfected prior to use.
- F. Disinfection of water used for well construction shall be accomplished as follows:
 - (1) For water from an existing potable drinking water source, a chlorine compound shall be added to the water to produce a free residual chlorine of one (1) milligrams per liter (mg/L).
 - (2) For water from a non-potable well, disinfection shall be accomplished by mixing one (1) gallon of sodium hypochlorite (or an equivalent amount of calcium hypochlorite) to each one thousand (1000) gallons of drilling water. At least thirty (30) minutes contact time shall lapse between addition of the disinfectant and use of the water as drilling fluid. NOTE: Sodium hypochlorite in the form of laundry bleach contains 5.25 percent available chlorine. One and seven tenths (1.7) gallons of laundry bleach is equivalent to one (1) pound of dry calcium hypochlorite.

4.04 Well Casing

- A. All types of casing used for well construction shall be approved by the National Sanitation Foundation, The American Society for Testing and Materials, or by the Department for use as well casing. Well casing shall be strong enough to resist the forces imposed on it during and after installation.
- B. Any well casing materials which cause the delivered water to be toxic or violate state or federal drinking water standards are not permitted.
- C. Well casing other than thermoplastic or steel shall only be used with the written approval of the Department.
- D. All thermoplastic well casing used in the construction of wells shall have a strength rating which is equal to or greater than Schedule 40 in the same diameter, unless otherwise approved by the Department. For wells with a

diameter greater than six (6) inches it is the responsibility of the water well contractor to take into account special conditions that may require heavier weight well casing (i.e., installation depth, cementation of sediments, water quality, etc.).

- E. Steel well casing shall be used in wells constructed in crystalline rocks.
- F. Steel well casing up to and including a nominal size of six (6) inches shall be at least Schedule 40. For wells larger than six (6) inches in diameter the minimum wall thickness is 0.280 inches unless prior written approval is granted by the Department.
- G. Other sizes of well casing may be approved by the Department upon receipt of a written request from the water well contractor.
- H. Well Casing Lengths
 - (1) Less than twenty (20) feet of casing shall not be used in any well. Monitor, observation, recovery, wick drains, dewatering, and large diameter bored wells are excluded from this requirement. Required casing heights above ground surface are specified in Section 4.10 of these Regulations.
 - (2) Wells (except wick drains, monitor, observation and recovery wells) constructed on parcels less than one-half acre in size and on which an on-site wastewater disposal system is or will be utilized, shall be cased to a minimum depth of forty-two (42) feet.
 - (3) For wells constructed in unconsolidated sand and gravel deposits, the casing shall extend to the top of or into the aquifer used.
 - (4) For wells constructed in crystalline rock the casing shall extend through the weathered zone and be seated at least ten (10) feet into bedrock.
 - (5) When SDR (standard dimensional ratio) thermoplastic casing is used, the wall thickness should be at least equal to or greater than the wall thickness of schedule 40 thermoplastic casing in the same diameter. The following table is intended as a guide in the selection of thermoplastic casing.

THERMOPLASTIC CASING SELECTION GUIDE

Diameter Inches	Recommended Maximum Depth (Feet)					
	Sch. 40	Sch. 80	SDR 21	SDR 19	SDR 17	SDR 13.5
2	875	1500	*	*	*	1325
3	675	1500	*	*	*	1325
4	450	1050	*	450	625	1325
4.5	375	950	*	450	625	1325
5	300	875	325	450	625	1325
6	225	700	325	450	625	1325

* Not Recommended in diameter indicated

NOTE: SDR (standard dimensional ratio) = casing outside diameter ÷ wall thickness.

I. Other Well Casing Requirements

- (1) Joints for all well casing shall be water tight and joined in accordance with the manufacturer's recommendations. Joints for steel well casing may be electrically welded or threaded. Joints for thermoplastic well casing may be threaded or coupled with solvent welding. Solvent-weld joints for thermoplastic well casing shall be allowed to set to attain sufficient structural strength before the casing is installed in the bore hole.
- (2) Temporary well casing and liners shall be of such minimum thickness as required to withstand the structural load imposed by conditions inside and outside the well.
- (3) No well casing shall be cut off or cut below ground except:
 - (a) to install a pitless unit or pitless adapter, or
 - (b) to install a standard plumbing "Tee", or

- (c) to install an outer casing to terminate just below a pitless adapter or standard plumbing "Tee" connection, which is on the inner casing, or
 - (d) for abandonment purposes.
- (4) In crystalline rock where steel well casing is required, the well casing shall be equipped with a "drive shoe" which shall be firmly seated by driving it into the rock prior to continuation of drilling or grouting.

4.05 Well Screens

- A. All wells which obtain water from unconsolidated aquifers shall be equipped with a well screen that will limit the entrance of sediment material into the well following development and completion.
- B. Wells finished in consolidated aquifers where the bottom of the well casing is at a depth where the formation will not collapse because of pumping, are not required to be screened.
- C. Well screens shall have sufficient structural strength to accomplish the purpose for which they are installed.
- D. The well screen openings (slots) shall provide, so far as is practicable, the maximum amount of open area, consistent with the strength of the screen material and sediment grain size (gradings) of the water-bearing formation to permit maximum transmission without clogging.
- E. Only machine manufactured well screens shall be used in the construction of a well, unless otherwise approved by the Department.
- F. Well screens shall be provided with fittings necessary to seal the well screen to the well casing. Lead packers and lead swedges are prohibited.
- G. A fitting shall be provided to close the bottom of the well screen.
- H. Screening of more than one aquifer shall not be allowed in any well. The Department may consider an exception to this requirement in the case of wick drain construction, on a case-by-case basis.

4.06 Gravel Packed Wells

- A. Gravel which is packed in annular spaces shall be washed with water and free of clay, silt, and organic material.
- B. The gravel pack shall not contain iron or manganese in concentrations that will adversely affect the quality of water withdrawn from the well.
- C. It is recommended that gravel stored at the drilling site be stored on a clean plastic or other clean surface to prevent mixing with soil materials.
- D. The gravel pack may be emplaced by simply placing gravel down the annulus, by placing a water-gravel mix down the annulus or by using a tremie pipe where a water-gravel mix is emplaced at the bottom of the annulus and by slowly raising the tremie pipe.
- E. Gravel packs may not connect different aquifers.

4.07 Well Grouting

- A. All wells having annular spaces shall be grouted unless specifically exempted in this Section or otherwise approved by the Department.
- B. The annular space of all wells to be grouted shall be a minimum of one and one half (1.5) inches wide (diameter of bore hole = outside diameter of casing plus three (3) inches).
- C. All wells shall be grouted as soon as possible, but not later than twenty four (24) hours after the well casing has been set in place and all construction operations have been completed.
- D. All wells having annular spaces (with the exception of monitor, observation, and dewatering wells with casing depths of twenty (20) feet or less, and temporary wells for well construction) shall be pressure grouted.
- E. Monitor and observation wells and temporary wells for well construction may be grouted by pouring grout down the well annulus, if pressure grouting is impractical.
- F. Dewatering wells with casing depths less than twenty (20) feet which are constructed by either washing or driving the casing, need not be grouted.
- G. The water well contractor may be required to notify the Department in advance of grouting wells to provide the Department the opportunity to observe the procedure. Such condition shall be specified on the well permit. The well driller is not required to stop work to wait for Department staff unless the permit states otherwise.
- H. After grouting is completed cement grout shall be allowed to cure in accordance with manufacturer's recommendations

before well construction activity, including development, can be resumed.

I. The Department shall have the right to require special conditions pertaining to the grouting of any well. These requirements shall be specified on the well permit.

J. Grouting Materials

(1) Cement - the annular space may be filled with neat Portland or quick setting (hi-early) cement in a ratio of not over six (6) gallons of water per ninety-four (94) pound sack of cement or as otherwise permitted by the Department following a written request and justification. A sodium based bentonite clay may be added to the cement grout in an amount not to exceed five (5) pounds per ninety-four (94) pound sack of cement. When adding bentonite clay to portland cement grout, additional water shall be allowed at a rate of one (1) to two (2) gallons of water to one (1) pound of bentonite.

(2) Bentonite Clay - A sodium based bentonite clay may be used to fill the annular space in both the confined and unconfined unconsolidated sand and gravel aquifers in a ratio of not less than one and one-half (1.5) pounds of bentonite clay per gallon of water, or according to the manufacturer's specifications. It is recommended that a ratio of at least two (2) pounds of bentonite per gallon of water be used. It is also recommended that bentonite clay not be used where it comes in contact with ground waters with a pH below five (5.0) or having a total dissolved solids content greater than one thousand (1,000) milligrams per liter (mg/L), or according to the manufacturer's specifications.

(3) If rapid loss of grout material occurs during emplacement, clean coarse fill material such as sand, gravel, crushed stone, or dry cement may be used in the zone or zones in which the loss is occurring.

K. Standards for Grouting

- (1) Well grouting shall be performed to provide a water tight seal through the annular spaces of a well to prevent fluid migration through the annulus.
- (2) The annular spaces of all wells, except for the wells exempted in Section 4.07(D) of these Regulations, shall be pressure grouted to a depth of at least eighteen (18) feet. Monitor, observation, recovery, and large diameter bored wells may be grouted to a lesser depth depending on the length of the casing. The Department may require grouting to a greater depth. All wells constructed on a parcel less than one-half acre in size and which is or will utilize an on-site wastewater disposal system shall be grouted to a minimum depth of forty (40) feet.
- (3) For wells penetrating confined, unconsolidated sand and gravel aquifers, the annular space shall be pressure grouted from at least ten (10) feet into the confining layer, immediately above the source aquifer. Where the confining layer is less than ten (10) feet in thickness, the well shall be pressure grouted entirely through the confining layer. The final grout height shall be in accordance with the requirements of Section 4.07(K)(7) of these Regulations.
- (4) Wells installed with a minimum casing depth of one hundred (100) feet, as provided for in Section 4.01(B) of these Regulations, shall be grouted from a minimum of five (5) feet above the screen to a point on the casing in accordance with the requirements of Section 4.07(K)(7) of these Regulations.
- (5) If the annular space cannot be grouted in accordance with these Regulations, the well shall be abandoned in accordance with Section 9 of these Regulations.
- (6) Deviation from the grouting standards may be approved by the Department for unusual conditions which prevent conformance to these standards. This permission shall be in writing from the Department and secured prior to grouting.

- (7) The final grout height shall be between ground surface and a point on the casing corresponding to the base of the pitless adapter, pitless unit, or plumbing "Tee". The grout may be extended at the time of grouting to ground surface and allowed to settle to, but not below, the base of the pitless adapter, pitless unit, or plumbing "Tee", or grout may be placed to the base of the pitless adapter, pitless unit, or plumbing "Tee", and more grout added to maintain the required minimum height until settling ceases.
- (8) Monitor and observation wells shall be grouted in accordance with Section 5.01 of these Regulations or according to special permit conditions as stipulated on the permit.

4.08 Well Development

- A. Well development shall consist of cyclic or intermittent pumping, surging, or both, either mechanically or by using water or air under pressure. Development shall continue until formation cuttings, mud, drilling fluids and additives are removed from the well. All wells shall be developed to remove the fine sands, silts, clays and rock particles from the aquifer surrounding the well screen or intake interval such that the water pumped from the well meets the following requirements:
 - (1) Contains less than five (5) milligrams of sand or larger particles per liter of water. Particles with a diameter between 0.0625 and 2.0 millimeters shall be considered sands.
 - (2) Have a turbidity of less than ten (10) NTU (Nephelometric Turbidity Units), except that when the turbidity is due to the oxidation of dissolved iron or manganese naturally occurring in the water. The well may be put into service if it is not reasonably possible to produce water from another aquifer and treatment is not legally or technically possible.
- B. Monitor and observation wells shall be developed as specified in Section 4.08(A) of these Regulations, unless otherwise approved by the Department.

4.09 Pitless Well Adapters, Pitless Well Units, and Plumbing "Tees"

- A. Pitless well adapters or pitless well units shall be installed on all wells having a submersible or deep well ejector pump which utilizes an underground discharge.

- B. For suction lift systems where the well casing is used as a suction line and for heat pump recharge wells, a standard plumbing "Tee" connector and extension pipe with cap may be used in place of a pitless well adapter or pitless well unit, providing the extension meets the requirements of Section 4.10 of these Regulations.
- C. All pitless well adapters or pitless well units shall be of a type approved by the National Sanitation Foundation, the Water Systems Council, or the Department.
- D. Connections of the pitless well adapter, pitless well unit, or plumbing "Tee" to the well casing and lateral connections of piping shall be watertight. To assure a watertight connection between the well casing and the pitless well adapter or pitless well unit, care shall be exercised in cutting the hole in the well casing. It is recommended that a metal cutting hole saw and template be used. After the use of a metal cutting hole saw, all burrs resulting from the cutting operation shall be removed. If an acetylene torch is used in the cutting operation, all slag shall be removed, and both inside and outside surfaces of that portion of casing surrounding the hole shall be smooth.
- E. A pitless well adapter, pitless well unit or plumbing "Tee" shall be installed in conformance with depth of water service piping requirements referenced in Section 3.22 of these Regulations.

4.10 Well Caps and Upper Terminus of Wells

- A. The well casing, pitless well adapter or pitless well unit may not terminate less than eight (8) inches above the finished ground surface or pump house floor for domestic, miscellaneous public, and agricultural wells unless otherwise approved by the Department.
- B. All other wells, with the exception of monitor, observation and closed loop heat pump wells and piping systems, shall terminate not less than twelve (12) inches above the finished ground surface. Monitor and observation wells may be excluded from this requirement with the written approval of the Department. Wells constructed in coastal or flood prone areas as defined in Section 5.02(A), shall be completed in accordance with Section 5.02(C) of these Regulations. Alternative construction methods may be approved by the Department.

- C. Closed loop heat pump well piping systems shall be connected to the dwelling in accordance with manufacturer's recommendations and all local building and plumbing codes. Closed loop heat pump well systems are not required to terminate above the finished ground surface.
- D. All wells shall be covered with a secure well cap. Vented capping devices shall be screened so as to be insect and vermin proof. The well cap shall be locked or incapable of being removed without the use of tools. The Department may consider approval of alternative methods for capping irrigation and agricultural wells while mobile pumping equipment is in use. When the mobile pumping equipment is removed, the well shall conform to the requirements of these Regulations.
- E. Use of buried well seals, well pits, or other devices, including buried "sanitary well seals" to cap wells below ground surface and provide access for electrical cable and water pipe are prohibited unless prior written approval has been granted by the Department.
- F. Pump pits, as defined in Section 2.47 of these Regulations, are prohibited.
- G. Any time an existing well which does not meet the requirements of this Section is accessed for any reason, the upper terminus shall be brought into compliance with the requirements of this Section, unless otherwise approved by the Department.

4.11 Water Level Access Ports and Tubes

- A. All wells with a pumping capacity greater than fifty thousand (50,000) gallons per day shall be constructed with a port and access tube. Irrigation wells are not required to be equipped with an access tube.
- B. All public wells which supply a community water system and are completed in a confined aquifer, and all industrial wells completed in a confined aquifer shall have an access port equipped with a removable cap or plug and tube through which a water level measurement can be made.
- C. If the pump motor is not installed directly over the well, the access port shall be located directly on top of the well.

- D. If the pump motor is installed directly over the well, an access port pipe shall be installed through the pump base or outside the well casing at some accessible point below the base of the pump.
- E. The access port and tube shall have a minimum inside diameter of one half (0.5) inch, so that the position of the water level may be determined by measurement with a steel or electric tape. The access port and tube shall be equipped with a removable cap or plug.
- F. The access port shall be installed and plugged in a manner which prevents the entrance of water, dust, insects, or other foreign material, and permits ready access for water level measurements.
- G. Air line gauges are not acceptable water level measurement devices.

4.12 Meters, Pumping Equipment, and Vents

- A. All wells with a design capacity greater than fifty thousand (50,000) gallons per day shall be permanently equipped with a meter(s) capable of acquiring instantaneous flow rate and totalized flow measurements accurate to within plus/minus five percent (+/- 5%) of actual flow rate, unless otherwise approved by the Department. Flow rate indicators may consist of any combination of test dials and direct reading indicators. Elapsed timers are not acceptable flow metering devices except as noted in Section 4.12(B) of these Regulations.
- B. Irrigation wells, agricultural wells, and non-potable wells constructed and used for fire protection purposes only and which have a design capacity greater than fifty thousand (50,000) gallons per day shall be equipped with an elapsed time meter, readable in hours or minutes, equipped on the well's drive engine or motor to measure actual hours of operation.
- C. A backflow protection device shall be installed in a pumping system where the pumping equipment is used to apply wastewater, fertilizers, or chemicals, and where the pumping equipment is also connected to a water well.
- D. The pump capacity shall be consistent with the intended use and yield characteristics of the well.
- E. Installation of the pump shall be in accordance with manufacturer's instructions.

- F. Well vents shall be screened and positioned to prevent the entrance of surface water, dust, insects, or other foreign material.
- G. Upon completion of installation, the person installing the pump shall disinfect the well and pump in accordance with Section 6 of these Regulations.

SECTION 5 - SPECIAL CONSTRUCTION REQUIREMENTS

5.01 Monitor and Observation Well Construction

- A. Unless otherwise approved by the Department, monitor and observation wells shall conform to standard well construction requirements and other general requirements as specified in these Regulations.
- B. In circumstances where special monitor and observation well construction specifications are necessary to protect the public health, safety, or environment, the Department may require additional specifications for monitor and observation well construction.
- C. Monitor wells shall be constructed by a method which allows for the determination of characteristics of the geologic materials under the site unless otherwise approved by the Department.
- D. Unless otherwise approved by the Department, the annular spaces of monitor and observation wells with casing depths exceeding twenty (20) feet below ground surface shall be pressure grouted from the top of the gravel pack to the ground surface. Other grouting methods capable of completely sealing the annular space are acceptable for wells with casing depths less than or equal to twenty (20) feet below the ground surface.
- E. The Department has prepared monitor well construction guidelines, which are available upon request, to assist in planning monitor wells and completing the monitor well permit application.

5.02 Coastal Well Construction

- A. Special construction standards as set forth in this section are for wells in areas prone to wave action or flooding. These coastal areas are shown on Flood Insurance Rate Maps published by the Federal Emergency Management Agency and are designated as "A" or "V" zones.
- B. Wells described in 5.02(A) above and constructed on waterfront properties shall be constructed on the landward side of the property, if possible.
- C. Wells shall be finished at least two (2) feet above ground surface.

5.03 Public, Miscellaneous Public and Industrial Well Construction

- A. All miscellaneous public, industrial, and public water wells as defined in Section 2 of these Regulations, shall be installed by such a method that will allow proper construction and grouting of the well according to applicable Regulations contained herein.
- B. Test wells may be converted for public, miscellaneous public or industrial production well purposes, in accordance with Section 3.21 of these Regulations. The Department reserves the right to add additional requirements to the permit if it is converted to permanent status.
- C. Department personnel shall be notified at least twenty-four (24) hours prior to the construction of any public, miscellaneous public or industrial well. The well driller is not required to stop work or to wait for Department staff prior to commencing work unless the permit states otherwise. Failure to notify the Department may result in the issuance of an order to abandon the well and/or other action by the Department.
- D. The outside of all structures that house a public or industrial well, such as a pump house, shall be marked in such a manner so as to indicate that a public or industrial well is contained within the structure.

5.04 Heat Pump Recharge Well Construction

- A. All water obtained from wells for the operation of a heat pump system shall be injected into the aquifer from which it came. Exemptions from this requirement may be considered where the requirements of Sections 5.04(D) and (E) of these Regulations have been met and:
 - (1) the seasonal high static water level in the aquifer from which the withdrawal occurs is within five (5) feet of the land surface, or
 - (2) the confined aquifer will not accept the water from the supply well
- B. No heat pump recharge well may be constructed within fifty (50) feet of any identifiable potential or existing source of contamination, including but not limited to septic tanks, tile fields, and manure piles.

- C. No corrosion inhibitors, water softening, or other additives shall be added to the water that will eventually be returned into the ground.
- D. The diameter and screen length of all heat pump recharge wells shall be equal to or greater than the diameter and screen length of the heat pump supply well, unless otherwise approved by the Department.
- E. Where a heat pump recharge well meets the requirements of 5.04(D) and all other requirements of these Regulations, and the receiving aquifer will not readily accept the return flow, another well will be required of the owner. In such cases it is the well owner's responsibility to provide for the additional well. An exception to the requirement of another well may be considered upon written request.
- F. Heat pump recharge wells shall be capped in accordance with the requirements of Section 4.10(B) of these Regulations.

5.05 Heat Pump Closed Loop Well Construction

- A. No heat pump closed loop well shall be constructed within fifty (50) feet of any identifiable potential or existing source of contamination, including but not limited to septic tanks, tile fields, and manure piles.
- B. The solution contained in the heat pump closed loop well piping system shall not contain any toxic substances.
- C. The heat pump closed loop well piping system shall comply with the requirements of Section 4.10(C) of these Regulations.
- D. All buried pipe shall be marked with underground warning tape at a depth of twenty-four (24) inches.
- E. All closed loop heat pump system piping shall be capped and protected until the manifold piping is ready to be connected.
- F. Pressure testing of the closed loop heat pump system network shall be conducted prior to putting the system into operation.

SECTION 6 - WELL DISINFECTION

6.01 General Requirements

- A. Disinfection of all wells in accordance with Section 6.02 is required, except as noted in Section 6.01(D) and (E) of these Regulations. Bacteriological sampling and testing of the well is recommended as the final act of well construction or repair.
- B. After any repair or maintenance operation to the well, pumping equipment or piping, or other system components, those system components shall be disinfected. For domestic wells, the entire system shall be disinfected.
- C. Calcium hypochlorite shall be used for disinfection of the well and appurtenances, such as the pump, piping and distribution system, unless otherwise approved by the Department.
- D. No monitor well shall be disinfected without prior written approval of the Department.
- E. No dewatering wells need be disinfected unless specifically required as a condition of the well permit.
- F. The Department shall have the right to require special disinfection procedures.

6.02 Required Disinfection Procedure

- A. The following procedures shall be followed when disinfecting wells, unless otherwise approved by the Department. Other methods may be considered provided it can be demonstrated that they will yield comparable results.
- B. Calcium hypochlorite tablets sufficient for a dosage of at least one hundred (100) milligrams per liter (mg/L) free available chlorine shall be dropped into the well before any pump or pumping equipment are installed. As a general guideline, it is recommended that the dosage calculation be based on two hundred (200) milligrams per liter (mg/L) free available chlorine to account for chlorine demand.
- C. After the pump or pumping equipment has been installed, the pump shall be started and water pumped to waste through a discharge line until chlorine is detected. If the concentration is less than one hundred (100) milligrams per

liter (mg/L), more calcium hypochlorite shall be added until the concentration is at least one hundred (100) milligrams per liter (mg/L).

- D. The internal surface of the well casing above the static water level shall be rinsed with the chlorine solution from the discharge line in a manner sufficient to thoroughly rinse the well casing, or for fifteen (15) minutes, whichever is less.
- E. If it is not practicable to discharge the pumped water back into the well (as described above), fractured calcium hypochlorite tablets (tablets broken into varying sizes ranging from half tablets to a granular size) shall be added to the well. The entire surface of the well casing shall then be rinsed with at least ten (10) gallons of a one hundred (100) milligrams per liter (mg/L) chlorine solution made by dissolving calcium hypochlorite (pulverized tablets or granular) in water.
- F. If the well is connected to a distribution system, the chlorinated water shall be drawn through the entire system until a strong odor of chlorine is detected at each tap, unless otherwise approved by the Department.
- G. The well and distribution system shall be allowed to stand for at least twelve (12) hours, twenty-four (24) hours is recommended.
- H. If the free chlorine residual is less than five (5) milligrams per liter (mg/L) after twelve (12) hours (using a DPD test kit), the above procedure shall be repeated. When the free chlorine residual is at least five (5) milligrams per liter (mg/L) after twelve (12) hours, the well and distribution system shall be pumped to waste.
- I. Should the well fail to be acceptably disinfected as determined by the Department; the Department may require other measures such as re-disinfection, repair, or abandonment; to be determined on a case-by-case basis.
- J. The amount of calcium hypochlorite needed to produce a dosage of one hundred (100) milligrams per liter (mg/L) free available chlorine per one hundred (100) feet of water column is given in the following table:

**Calcium Hypochlorite Needed
to Dose 100 Feet of Water at 100 mg/L**

Casing Diameter (Inches)	Volume 100 Feet (Gallons)	* Calcium Hypochlorite
2	16.3	1/2 oz.
4	65.3	2 oz.
6	146.9	4 oz.
8	261.1	6 oz.
10	408.0	8 oz.
12	587.5	12 oz.
16	1,044.5	20 oz.
20	1,632.0	2 lb.
24	2,350.1	3 lb.

**65 percent available chlorine*

K. Notes

- (1) READ THE CALCIUM HYPOCHLORITE LABEL CAREFULLY AND FOLLOW ALL SAFETY AND STORAGE INSTRUCTIONS. CALCIUM HYPOCHLORITE SHOULD ALWAYS BE ADDED TO WATER. NEVER ADD WATER TO CALCIUM HYPOCHLORITE.
- (2) Prior to closing the well, the interior metal surfaces of the well casing above the static water level should be inspected for fragments of calcium hypochlorite. Any fragments should be removed, as they may corrode the steel well casing and other metal surfaces in the well.

SECTION 7 - WELL COMPLETION REPORTS

7.01 General Requirements

- A. A well completion report shall be submitted to the Department on forms provided by the Department, not later than thirty (30) days after the construction of any well, except as required in Section 3.11(C) of these Regulations.
- B. Each completion report shall be signed by the well driller or well driver in direct on-site supervision of the well construction, unless otherwise approved by the Department, certifying that all information contained on the report is true and correct.
- C. A separate well completion report shall not be required providing all pertinent information is supplied on a well abandonment report for the same well.
- D. Failure to submit well completion reports as required by this Section shall result in the denial of additional well permits, following written notification to the responsible water well contractor.

7.02 Required Information

- A. All items on the well completion report shall be completed, making sure to note if a particular item is not applicable (N/A).
- B. If the actual well site is at all different than that proposed on the well permit, a new site plan shall be included on the well completion report. If a site adjustment is made after permit issuance, the well driller or well driver is required to see that the well complies with these Regulations.
- C. For wells constructed in unconsolidated sand and gravel aquifers, the well description log shall include notation of the sediments grain size (such as gravel, coarse, medium and fine sand, silt, clay, etc.), color, thickness, and depth of individual layers or lenses, and any characteristics of the sediments that appear different or outstanding.

- D. For wells constructed in crystalline rock, the well description log shall include the predominant color of the rock, whether or not it breaks easily, whether the rock is veined with stringers of different material or color and any characteristics of the rock that appear different or outstanding. Depth, interval and estimation of flow rate of all water-bearing zones as encountered during drilling shall be specified.

SECTION 8 - WELL MAINTENANCE AND REPAIR

- A. All materials used in the maintenance, replacement, modification, or repair of any well shall meet the requirements for new installation. Broken, punctured or otherwise defective or unserviceable well casing, well screen, fixtures, seals, or any part of the well head shall be repaired and replaced, or the well shall be properly abandoned and sealed as specified in Section 9 of these Regulations.
- B. Repair of any well having a well head terminating below ground shall include the extending of the well casing above the finished ground surface as specified in Section 4.10 of these Regulations, unless otherwise approved by the Department.
- C. The repair of any industrial or public water supply well shall include the installation of a water level access port and tube as required in Section 4.11 of these Regulations, if applicable.

SECTION 9 - WELL ABANDONMENT

9.01 General Requirements

- A. The objective of the requirements described in this Section is to seal the well to limit its potential as a pathway for vertical migration of fluids between different aquifers.
- B. All wells to be abandoned shall be sealed only by a well driller.
- C. Within thirty (30) days of abandonment of a well the water well contractor shall submit a well abandonment report to the Department, on a form provided by the Department. The report shall be completely filled out and signed by the well driller or well driver in charge of on-site supervision.
- D. The Department may require any well owner to have a well abandoned if the Department determines that any of the following conditions apply:
 - (1) the well has no beneficial use,
 - (2) the well is causing or is a potential source of contamination to waters of the state,
 - (3) the well is producing water that is contaminated,
 - (4) the operation of the well causes diminishment in the quantity or quality of any neighboring wells or surface waters,
 - (5) the well is deemed a potential safety hazard to the lives and welfare of humans or animals,
 - (6) the well is not constructed in accordance with the permit conditions or these Regulations.
- E. A well penetrating several aquifers or formations shall be filled and sealed in such a way as to prevent the vertical movement of water from one aquifer to another within the well.
- F. The Department shall have the right to require special abandonment procedures be followed to avoid or mitigate water quality or water quantity problems.

- G. All wells for which a replacement well permit has been issued and which are accessible shall be abandoned within sixty (60) days of completion of the replacement well. The well(s) shall be abandoned as set forth in these Regulations unless specific written approval for maintaining the replaced well is granted by the Department.
- H. Wells that are unsuitable for their intended use shall be abandoned or converted to another classification in accordance with Section 3.21 of these Regulations.

9.02 Sealing and Fill Materials

- A. Concrete, Portland cement grout, sodium-based bentonite clay grout, or combinations of these materials or other materials approved by the Department are considered sealing material and shall be used to abandon a well in accordance with Section 9.03 of these Regulations.
- B. Drill cuttings, clay, silt, sand, gravel, and crusher run are herein considered fill material and may only be used in the abandonment of a well in accordance with Section 9.03 of these Regulations.
- C. Portland cement grout and sodium-based bentonite clay grout shall meet the requirements of Section 4.07(J)(1) and (2) of these Regulations.

9.03 Abandonment Procedures

- A. Prior to abandonment, all wells shall be investigated to determine their condition, the details of construction, and whether or not any obstructions exist that will interfere with the filling and sealing process. Any obstructions shall, if possible, be removed by cleaning out the hole or redrilling.
- B. Where the annular space may provide a significant avenue for ground-water contamination or otherwise endanger public health or safety, the Department may require that the well casing be ripped, perforated, or removed entirely to assure that the well casing and annular space or voids are filled with sealing or fill materials. Alternate abandonment procedures may also be approved by the Department.
- C. All wells shall be filled with the appropriate sealing or fill materials starting from the bottom of the well upward to the ground surface, except as noted in Sections 9.03 (F), (G), and (H), or unless otherwise approved by the Department.

- D. When Portland cement grout or concrete is used as a sealing material, it shall be placed in one continuous operation.
- E. Sealing material shall be placed in the interval or intervals to be sealed by methods that prevent free fall, dilution, or separation of aggregates from cementing materials.
- F. A dug well larger than twenty-four (24) inches in diameter shall be filled and sealed by placing fill material in the well to a level approximately five (5) feet below land surface, and placing a three (3) foot plug of sealing material above the fill. The sealing material for the upper portion of the well shall be allowed to spill over into the excavation to form a cap. The remainder of the well shall be backfilled with native soil.
- G. For wells penetrating fractured or cavernous rock, coarse fill materials may be used opposite the cavernous or creviced rock portions of the well. Sealing material shall extend to the surface from the bottom of the casing or from a depth of twenty (20) feet, whichever is greater.
- H. Dewatering wells less than twenty four (24) feet deep and two (2) inches or less in diameter shall have the entire casing removed unless otherwise approved by the Department. After removal of the casing, the wells may be abandoned with natural fill materials.

SECTION 10 - WELL IDENTIFICATION TAG

- A. Upon completion of the well and before leaving the site, the well driller, well driver, or pump installer shall be responsible for the attachment of the well identification tag issued by the Department. In cases where the well driller will be returning at a later date to hook-up the well, the tag may be secured with a temporary piece of wire or clamping device until after the hook-up has been completed. The tag shall be permanently fastened to the well casing above finished grade by means of a one half (1/2) or three-eighths (3/8) inch stainless steel band or other device or method approved by the Department. Tags for flush mount installations should be mounted to the sides of the road boxes or by any method which will permanently display the well permit number.
- B. Tags for well permits issued via fax or under emergency circumstances shall be affixed to the well casing within five (5) working days of the well driller's receipt of the tag.
- C. Well tags shall be returned to the Department within thirty (30) days of cancellation or expiration of an unused permit, or the abandonment of a tagged well.

SECTION 11 - VARIANCES

Applications for variances to any section of these Regulations except those which concern a source of water for three or fewer families shall be advertised in newspapers of local and statewide circulation with a comment period of fifteen (15) days. A public hearing will be held if a meritorious request is received within the fifteen (15) day period. A public hearing request shall be deemed meritorious if it exhibits a familiarity with the application and a reasonable statement of the variance's probable impact.

11.01 Applicable Delaware Law

No variance may be granted unless the Secretary, hearing officer or the Environmental Appeals Board finds that the following have been satisfied pursuant to the requirements of 7 Del. C., §6011.

- A. Good faith efforts have been made to comply with the requirements of 7 Del. C., Chapter 60.
- B. The applicant is unable to comply with the requirements of 7 Del. C., Chapter 60 and these Regulations because the necessary technology or other alternative methods are not or have not been available for a sufficient period of time or the financial cost of compliance by using available technology is disproportionally high with respect to the benefits which continued operation would bestow on the lives, health, safety and welfare of the occupants of this State and the effects of the variance would not substantially and adversely affect the policy and purposes of this chapter;
- C. Any available alternative is being or will be used to reduce the impact of the granting of the subject variance on the lives, safety, or welfare of the occupants of this State; and
- D. The continuing operation of the proposed well is necessary to national security or to the lives, health, safety or welfare of the occupants of this State.

11.02 Application Procedures

A separate application shall be made to the Department for each individual well permit desired. Each variance application shall consist of:

- A. A complete well permit application;

- B. A separate scaled plot plan of the area depicting distances from all potential or existing sources of contamination as defined in Section 2.42 and 2.53 of these Regulations, within a one hundred fifty (150) foot radius of all proposed public and industrial wells, and within a one hundred (100) foot radius of all other proposed wells. The plot plan shall also include all buildings and property lines, and all other physically limiting barriers such as overhead power lines;
- C. The appropriate fee, if applicable;
- D. Written documentation showing compliance with Section 11.01 of these Regulations.
- E. The property owner's signature on a written request which specifies the Section(s) of these Regulations for which the variance is requested.

SECTION 12 - PUBLIC HEARINGS AND APPEALS

- A. Public hearings shall be held in conformance with the requirements of 7 Del. C., §6006.
- B. Decisions of the Secretary may be appealed to the Environmental Appeals Board pursuant to 7 Del. C., §6008.

