INSPECTIONS AND EVALUATIONS

Introduction

A Final Inspection is an on-site assessment of a newly completed water well/pump system to determine if the water well location and visible components of the well and water supply system comply with the State Well Code and local water well permit conditions and any abandoned wells have been plugged.

Local Health Departments (LHD) are required as part of their Minimum Program Requirements to conduct a final inspection on not less than 10% of new well installations. Most LHDs achieve a much higher percentage of final inspections, and some even achieve 100%. The state average is approximately 50%.

A Predrilling Site Review or Random Construction Inspection (made during well construction) are not Final Inspections because they occur before the water system is completed.

The ***minimum*** items checked and activities performed during a Final Inspection are:

- ✓ Water well location to ensure adequate separation from contamination sources.
- ✓ Casing termination method (pitless adapter, well house, basement offset) and well cap.
- ✓ Visual check of sealing of annular space surrounding the water well casing.
- ✓ Water system component materials (water well casing, water service line, etc.).
- ✓ Pump installation (pump, pressure tank, piping, sample tap, valves, and controls).
- ✓ Collection of bacteriological water sample (by owner or owner's authorized representative) and nitrate/partial chemical analysis is recommended.
- ✓ Plugging abandoned water wells at replacement water well sites.

If code violations are frequently observed while performing Final Inspections, increasing the rate of Final Inspections can bring about improved compliance. Sanitarians should complete the *Water Supply Final Inspection Checklist (see enclosed)*, or an equivalent, for each Final Inspection.

As part of the final inspection of the water supply, the LHD will typically make an as-built sketch of property which is located either on the well permit or the final inspection form. The LHD will note items such as the correct water well location and any sources of contamination (e.g. septic tanks and drainfields, fuel tanks, animal yards, etc.).

Approval

If the well construction meets code, the well record is satisfactory, and the water samples are satisfactory, the LHD will usually provide the well owner with a written approval. This may be in the form of a letter, inspection tag, finalized permit, or other document. This ensures the well owner that the newly completed water system is suitable for the intended use.

WATER SUPPLY FINAL INSPECTION CHECKLIST

Owner_____ Site Address _____

Permit Number _____

A. Water Well Location Approved? ☐ YES ☐ NO

1. Same location as approved on permit? ☐ YES ☐ NO
(If "No," make drawing showing location)

2. Properly isolated from contamination sources (standard and major)? ☐ YES ☐ NO

3. Accessible for maintenance/repair? ☐ YES ☐ NO

B. Wellhead/Casing Termination Approved? ☐ YES ☐ NO

1. Method:

Pitless adapter ____ Well house ____ Basement offset ____ Other _____

2. Wellhead

a. 12 inches above grade? ☐ YES ☐ NO

b. Approved well cap/seal? ☐ YES ☐ NO

c. Approved conduit (grey Schedule 40 PVC or galvanized pipe)? ☐ YES ☐ NO ☐ NA

d. Caving of soil or open annulus around casing? ☐ YES ☐ NO

C. Grouting Approved? ☐ YES ☐ NO

1. Verified on water well record review? ☐ YES ☐ NO

2. Field observation of grouting? ☐ YES ☐ NO

D. Pump Installation Approved? ☐ YES ☐ NO

1. Location? In well ____ On top of well ____ Basement offset ____ Well house _____
Other _____

2. Type? Submersible ____Deep well jet ____ Shallow well jet ____Constant Pressure ____
Other _____

E. Piping Between Well and House Approved? ☐ YES ☐ NO

1. Material? Plastic: PVC _____ PE _____Other _____
NSF-pw marking ☐ YES ☐ NO

Minimum 160 psi pressure rating ☐ YES ☐ NO

2. Diameter _____ inches

3. Protected suction line? ☐ YES ☐ NO ☐ NA

4. For submersible pump installations, is check valve installed within well casing? ☐ YES ☐ NO ☐ NA

F. Pressure Tank Installation Approved? ☐ YES ☐ NO

1. Type: Captive air ____ Galvanized ____ Buried ____

2. Number of tanks _____

3. Pressure relief valve installed? ☐ YES ☐ NO

G. Sampling Tap Approved? ☐ YES ☐ NO

H. Water Samples Collected? ☐ YES ☐ NO

1. Type: Bacteriological _____Partial Chemical _____Nitrate/nitrite _____
VOC ____ Other _____

2. Sample(s) collected by: LHD _____Owner _____Water Well driller _____
Other _____

Comments:_____

_____

_____

_____

_____

Inspected by _____ Date: _____ Reinspection Date: _____

Have the permit conditions been met? ☐ YES ☐ NO

Is the water well record accurate and complete? ☐ YES ☐ NO

Does the system comply with the State Well Code? ☐ YES ☐ NO

Is there a safe coliform bacteria sample? ☐ YES ☐ NO

Does any other water sampling meet acceptable levels? ☐ YES ☐ NO ☐ NA

The water well system is approved ☐ ***YES*** ☐ ***NO***

Reviewed by_____ Date _____

HOW TO CONDUCT AN INVESTIGATION ON AN EXISTING WATER SUPPLY

This outline was prepared to aid the Local Health Department (LHD) in conducting a complete evaluation of an existing water supply. Properties going through refinancing or wells with water quality issues may prompt the LHD to conduct such an investigation.

Office Investigation

1. Identify exact location of well on county map or plat book.
2. Geological study of the area (well records, groundwater database information, geological maps, hydrogeological studies, etc.)
3. Locate well record for well in question.
4. Review facility file.
5. Review bacti and partial chemistry history of the water supply.
6. Contact well driller(s) for well construction details for area wells if no well records are available for immediate vicinity.
7. Contact owner to make arrangements for investigation. This may include removal of pump or exposure of pitiess adapter (by the owner). If investigation involves temporary shutdown of pumping equipment, owner should be notified so arrangement for an alternate water supply can be made,
8. Prepare materials used for field evaluation such as a grout probe, flashlight, tape measure and evaluation forms.

Field Investigation

1. Determine number of wells located on property. Ask owner if there are any abandoned wells at the site.

2. Review any records the owner may have or record information from the owner regarding the water supply (drilling contractors billing invoice, repair bills, well record, etc.)

3. Survey the well site and prepare a sketch on the survey form, including:
   - Location of potential contamination sources, such as septic systems, sewer lines, fuel tanks, animal feedlots, etc.
   - Location of buildings, roads and driveways.
   - Location of well(s) and isolation distances from contamination sources.
   - Water service line location.
   - Utility line locations (buried or abovegrade)
   - Property lines.
   - Surface water (ponds, lakes, rivers, ditches).
   - Prominent topographic features (hills, knolls, gentle sloping, etc.).

4. Pump details
   - Type of pump (submersible, deep well jet, shallow well jet, hand pump).
   - Brand name, model number and horsepower
   - Rated pumping capacity

5. Pump installation
   - Location of pump.

- Pump setting or drop pipe length.
- Check valve locations.
- Piping materials (type and specification markings).
- Protection around buried suction lines.
- Electrical wiring installation.

6. Pressure tank
   - Number & Type of pressure tank (galvanized steel, bladder, diaphragm).
   - System operating range (from pressure gauge or look at pressure switch for operating range).
   - Brand name and model number.
   - Total tank capacity and tank drawdown (available from manufacturers sizing charts, if brand and model are known).
   - Record measured tank dimensions, if brand and model are not available.
   - Note if pressure tank is waterlogged.
   - Location of tank.
   - Piping layout.
   - Pressure switch & pressure gauge (is it functioning?)
   - Pressure relief valve.
   - Sampling tap near tank (high enough to permit sampling?)

7. Distribution system
   - Water service line and distribution piping material (copper, galvanized steel, PVC, PB) - ASTM markings - pressure ratings - NSF-pw (potable water) certification.
   - Check for leaks, corrosion and other maintenance problems.
   - Cross-connection survey (submerged inlets, unapproved yard hydrants, boiler feed lines, hosebibbs, water closets, etc.)

8. Water treatment devices
   - What type of treatment, if any, is present? softening, iron removal, aeration/fitration, reverse osmosis, distillation, chlorination, ultraviolet disinfection, carbon filtration).
   - Are the treatment devices adequately maintained and functioning properly?
   - Were the treatment devices installed to treat aesthetic water quality problems or bacteriological, nitrates, volatile organic compounds or other compounds of public health concern?
   - Record the brand and model name of any treatment equipment.

9. Pitless adapter installation
   - Determine type (weld-on adapter, clamp-on adapter, thread-on unit).
   - Determine brand name and model. Since pitless adapters and well caps are sold together, this can usually be determined by checking well cap for manufacturer's name. Becoming familiar with the various makes and models available will help the sanitarian evaluate pitless adapters.
   - If trench is open, inspect the connection to the casing for leaks. For weld-on adapters, carefully check integrity of welds for watertightness.

10. Well caps and seals
    - Is cap or seal intact and free of cracks or severe corrosion?

- Check well cap for presence of screened vent and proper vent construction, where required.
- Check to see if vent is unobstructed and functioning. (This can be done by running pump and checking for inward air movement during pumping and outward air movement during well recovery).
- Check caps and sanitary seals to see if they are securely attached to casing.
- If vent is unscreened (e.g., old-style overlapping cap), remove cap and check for evidence of insects on underside of cap or in well casing.
- Check for secure attachment between well cap and protective electrical conduit.

11. Well casing
    - Examine the outside of the casing to determine if there are any cracks, corrosion, etc.
    - Examine interior of casing with flashlight or mirror when well cap is removed.
    - Determine casing material (black steel, galvanized steel, or SDR 21 or SDR 17 PVC).
    - Note any casing markings that may be visible (ASTM specifications, weight per foot, wall thickness, manufacturer or supplier name).

12. Well diameter
    - Measure with tape - common well casing sizes are noted by inside pipe diameter. The measurement of outside diameter will be slightly larger - e.g , 4- inch well casing is 4.026 in. I.D. and 4.5 in. O.D.)
    - Upper casing size on thread-on pitless units will be 1- inch larger than nominal casing size (e.g., a 2- inch well will have a 3-inch upper casing.)

13. Well Depth
    - Can be measured with weighted drop string or tape after pump and drop pipe have been removed from well.

      WARNING: Do not put anything into well unless all internal components (drop pipe, pump) have been removed.
    - Usually measured only during problem investigations.
    - Downhole cameras can be used to determine well depth and casing depth.

14. Casing depth (bedrock wells only)
    - For steel casing, an electromagnet can be used after pump and drop pipe have been removed from well.
    - Usually measured only during problem investigations.

15. Grouting
    - Grouting is best evaluated during actual grouting operation. This allows the sanitarian to determine if grout is being placed from bottom up to surface and the total depth of grouting. Evaluation after well is complete is best done while the excavation to install the pitless adapter is still open or immediately upon completion of the well. Grout from the surface to 5 foot below grade is usually removed during pitless adapter installation.
    - In high bedrock areas, it may be necessary to have the homeowner excavate to the top of the bedrock to evaluate grouting. This allows evaluation of the seal at the bedrock/overburden interface.

- Check material around the casing below the pitless unit. If evaluation is done prior to pitless adapter installation, there will often be grouting material visible on the ground surface around the well casing.
  - Neat Cement - If grouting material is neat cement, a shovel may be used to expose a few feet of the grout, but generally the total depth of grouting cannot be determined. Neat cement will appear as a hard, rock-like material, gray to greenish-gray in color.
  - Bentonite grout- An acceptable bentonite grout will appear as a pliable clay with a peanut butter or gelatin consistency, gray to brownish-gray in color. If granular or coarse grade bentonite were used, the individual particle configuration maybe recognized. An unacceptable bentonite drilling mud slurry will appear as a watery clay mixture, tan to gray in color. A shovel or soil probe can be used to evaluate bentonite grouts.
  - Evaluation using soil probe - This process is discussed in the Grouting chapter of this manual.
- For wells in high bedrock areas, where the casing length is relatively short 25-35 feet, or where it is suspected to be less than 25 feet, examination inside the well may determine if there is a leakage problem due to leak of grouting. Look down the casing using a flashlight or mirror to determine if any water is cascading off the end of the well casing. It may be necessary to operate the pump to lower the water level a few feet below the casing. If water is cascading off the end of the casing, grouting is either not present or considered inadequate. This evaluation procedure may not be possible in all wells due to variations in pitless adapter design and casing diameter.
- A tracer dye may be placed in an excavation around a well to detect leakage in the annular space. Place powdered fluorescein dye around the well and flood the excavation. Pump the well for an extended period of time and keep the excavation flooded. The presence of visible dye in the well water indicates a defective seal around the casing. If no dye is visible, a sample should be collected in a partial chemical bottle and submitted to the Michigan Department of Environmental Quality lab for fluorescein dye analysis. The inability to detect fluorescein dye does not mean that the annular space is adequately sealed, since many factors (e.g. well depth, pumping length, well efficiency, interactions of dye with solid, etc.) influence the effectiveness of this method. Success is more likely in fractured, high bedrock areas.

16. Note any unusual features such as flow of water around casing (loss of confining formation on flowing well), open annulus space or depression around well casing.

17. Disinfect the water supply if pump or drop pipe were removed or if any equipment was placed into the well during the investigation.

18. Collect bacteriological and partial chemical samples where appropriate.

PROCEDURES FOR FIELD EVALUATION OF PUMP CAPACITY

Introduction

Simple field procedures may be utilized to estimate well production and evaluate pressure tank function. This information is essential for determining if a water supply will adequately meet demands within the facility. Determination of pump capacity should become a routine part of water supply evaluations, especially for mortgage evaluations and wells serving public facilities where pump capacity is critical.

Pump Capacity Evaluation

1. Open the sampling tap near the pressure tank and drain water from the tank until pressure drops to the pump cut-in pressure, (Make sure no other water is being used in the building during the test.) On a submersible pump installation, it is often necessary to listen for a "click" in the pressure switch in order to signal the starting of the pump. Observe the pressure gauge and note the pump cut-in and cut-out pressures.

2. When the pump starts, immediately close the sampling tap and measure the length of time required for the pump to fill the pressure tank and shut off. The length of time between the pump cut-in pressure and cutout pressure is the *pump running time.*

3. After the pump stops, open the sampling tap and using a 5 gallon container measure the volume of water that can be drained from the tank before the pump cut-in pressure is reached. When the pump starts, immediately close the tap and discontinue volume measurement. The volume of water measured is the *usable tank volume.*

4. Divide the usable tank volume by the pump running time to determine pump capacity.

   EXAMPLE
   Pump running time = 30 seconds or 0.5 minutes
   Usable tank capacity = 6.2 gallons
   Pump capacity = 6.2 gallons / 0.5 minutes = 12.4 gallons per minute

Pressure Tank Evaluation

By comparing the observed usable tank volume to the manufacturer's specifications for a particular model pressure tank, one can also determine if the pressure tank is functioning properly.

EXAMPLE
6.2 gallons of water were drawn from a 20 gal. hydropneumatic bladder type tank at an operating pressure of 30-50 psi. (Note: usable tank volume is inversely related to the operating pressure, i.e., if the operating pressure of the system is increased from 30-50 psi to 40-60 psi the usable tank volume will decrease.) By checking the manufacturer's data, we find that the total tank volume is 20 gallons and at a 30-50 psi setting, the tank should yield about 0.31 or 31 percent of its total volume as usable tank capacity. 20 gallons x 0.31 = 6.2 gallons. Since 6.2 gallons were withdrawn during the field test, it appears that the pressure tank is functioning in accordance with the manufacturer's specifications.