ENVIRONMENTAL Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Sand and Sediment in Water Supply Wells

This fact sheet covers the origins of sand and sediment in water supply wells and options to address them. When used here, the term "sediment" means material that is visible, but too small to be felt when rubbed between the fingers. The term "sand" means material that can be both seen and felt.

There are three common explanations for sand and sediment in drinking water wells.

1. Rock cuttings or loose soils remaining from the installation of a new well. When a well is newly constructed, particles remaining from the construction can be removed from the well by pumping water to waste, sometimes for an extended period of time. This flushing procedure is discussed in the fact sheets WD-DWGB-1-2, "Bedrock (Artesian, Drilled) Well Design," and WD-DWGB-1-6, "Point Well Design." (Please note that all of the Drinking Water and Groundwater Bureau fact sheets can be found at http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm.) This material will give the water a cloudy or muddy appearance and, if found in a bedrock (artesian) well, may include particles with sharp edges.

2. Precipitates from certain dissolved minerals in the water. Minerals, including iron or manganese (Fe/Mn), can be present in well water in New Hampshire. Methods for removing Fe/Mn from well water are discussed in the fact sheets WD-DWGB-3-7 (Technical Version) and WD-DWGB-3-8 (Summary). Other common minerals that could cause sediment in water are calcium and magnesium, also known as hardness. A hardness precipitate would have a white or yellow color. Hardness removal is discussed in fact sheet WD-DWGB-3-6. Fe/Mn precipitates typically are loose orange-brown sediments that are too small to be felt between the fingers. Hardness precipitates typically attach to the surface of a sink, bathtub, or toilet. In addition, fine sand-size grains of mineral precipitates have also been observed.

3. Continuous entry of fine clay or sand particles from the soil or from poor quality bedrock. This condition could exist if a well defect or an unstable naturally-occurring soil condition exists above the bedrock fractures, allowing fine sand or sediment to enter a well. This material generally would have a gritty feel.

Origin of Sediment

In dug wells (those approximately 3 feet in diameter and 10-15 feet deep), sediment entry can occur if the soil backfill passes through the joints between the sections of well casing or through the perforations typically present in the lowest well casing. In fieldstone wells, soils can migrate into the well throughout the entire casing circumference and height. See fact sheet WD-DWGB-1-4 for information about proper dug well construction. Sand could also migrate through the crushed stone around the bottom of a dug well casing and into the well.

In bedrock wells, sediments can enter the well from either the interface between the casing and bedrock or from the unstable soil above the top end of a rock fault (see the diagram on page 4). These areas are described in more detail below.

Sediment entry can occur at the overlap between the steel well casing and the socket that has been drilled into the bedrock. This would be considered a construction defect. In this case, the sand entry may possibly be stopped by setting up the well drilling equipment and pounding the steel casing back into the socket. A more assured method is to install a mechanical seal inside the well hole. See below for more details about mechanical seals and review the fact sheet WD-DWGB-1-9, "Secondary Well Seals and Liners."

Sand entry can occur into the top of any of the bedrock fractures that the well has encountered. In this case, the sand originates at the upper end of the rock fracture that is covered by loose soil. In this situation, there is no manmade defect in the well but rather the sand entry is an unfortunate aspect of the location's geology. This situation could also occur if the surface of the rock fault consists of highly weathered bedrock.

Identifying Sand Entry Location in Bedrock Wells
In bedrock wells it is very difficult to determine which of the possibilities introduced above is the origin of the sand problem.

In some cases, a camera can be lowered into the well to inspect the tightness of the bottom of the drive shoe and steel casing or to view each intersected rock fracture. The pump must be pulled to make room for the camera.

Another investigatory method is to install a temporary packer (a device to close off certain vertical intervals of the well) so that each segment can be pumped individually. The water pumped from each level can then be evaluated for the presence of sand.

In either case, there is only a moderate probability of identifying the entry location of the sand by these methods.

Corrective Action

1. In-The-Well Solution for Dug Wells
In dug wells the entry point(s) of the sand should be sealed. However, this may not be easily accomplished. When impractical, the situation could be allowed to continue and the pump suction line moved up. In the longer term, the accumulated sand in the bottom of a dug well can be removed by a "mud-sucker" construction pump or by clamshell bucket. Please note that by raising the suction line you increase the well's susceptibility to drought conditions.

Where substantial sand is entering a dug well, bacteria contamination can occur. Soil surrounding the well casing will settle. When soil is lost, the ability of the remaining soil to filter bacteria may be lessened. Therefore backfill will then need to be added around the top of the well to replace the soil being lost.

2. In-The-Well Solutions for Bedrock Wells
Devices are available to seal off leakage at either the well casing/bedrock socket overlap or lower fractures in the well hole. The best known device of this type is a Jaswell seal. This type of device is shown in the diagram on page 4. Installing such a seal may reduce the well's safe yield. A variation on this approach would be to permanently seal the level of the well that has the problem using cement grout. Once the cement has hardened, a well rig would drill through the sealed area reestablishing a clear well hole. This approach will

also reduce the well's safe yield.

More recently, a mechanical system has been developed that can be added to the intake of your pump to remove sand before it enters the pump. This system is also costly and requires pulling the pump for retrofit installation. If large amounts of sand are entering the well, the material must be periodically removed or it will accumulate and will be pulled into the well pump.

3. In-The-Home Solutions

Because it is often difficult to pin down the location of the sand entry and expensive to install a Jaswell seal, some homeowners conclude that it is more cost effective to leave the well as is and remove the sand when the water and sand mixture reaches the home.

Two in-home treatment options are discussed below. The in-home choice is possible only if the amount of sand entering the well is small. When the in-home option is chosen, it should be recognized that the sand will cause excessive wear to the well pump and shorten its life expectancy.

Centrifuge Sand Removal Device

This device removes sand by spinning the water within the housing of the device. Sand has a greater density than water, and thus accumulates around the perimeter of the device and is periodically bled off. A disadvantage is that clay-sized particles, which are smaller than sand, may not be totally removed. There is some pressure loss with this device.

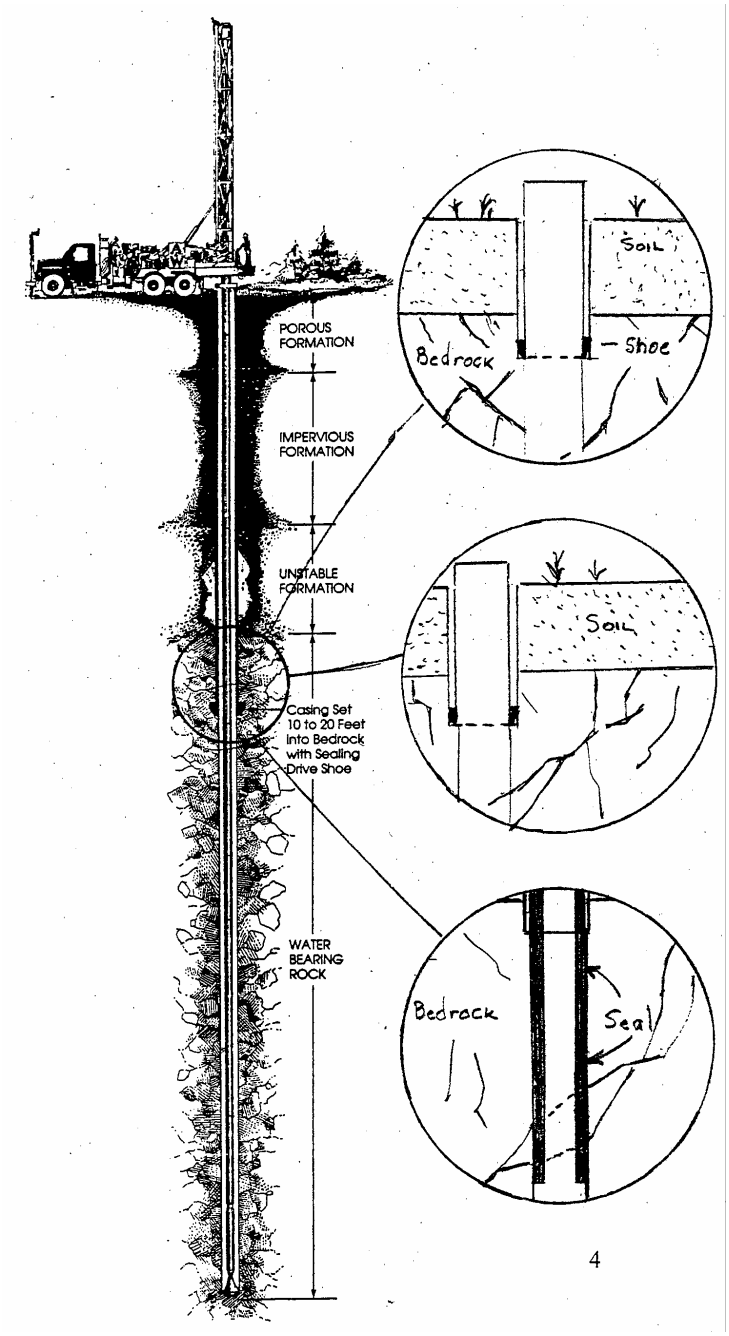
Sand Filter Removal Device

This option consists of installing a back-washable filter to strain out sand particles. The device must be periodically cleaned by backwashing.

For More Information

Please contact the Drinking Water and Groundwater Bureau and the New Hampshire Water Well Board at (603) 271-2513 or visit our website at http://des.nh.gov/organization/divisions/water/dwgb/index.htm. All of the bureau's fact sheets are on-line at http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm.

CROSS SECTION THROUGH A BEDROCK WELL



SEDIMENT ENTRY

Sediment enters a bedrock well at the interface between the drive shoe of the steel casing and the socket drilled into the bedrock. Before the drive shoe requirement, the cylindrical steel casing may have deformed during placement. A deformed casing would be a construction defect. Drive shoes are not required on plastic well casing or where the cable tool method of construction is used.

Sediment enters the bedrock well through one or more of the faults that the well hole has encountered. The entry level of the sediment is lower down in the well. The other end of that particular fault is covered with soil which is not stable and the sediment condition will continue until larger particles create a bridge across the upper end of the fault.

JASWELL SEAL

A "Jaswell seal" or similar device seals off a portion of the well hole. The resultant diameter within the Jaswell device is approximately 4 inches. The well hole diameter is generally 6 inches. The Jaswell can seal off just the level of concern or can seal off the entire area from the top to the concern area.