Maine Geologic Facts and Localities
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Maine's Highest Yielding Well

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Introduction

The State of Maine is blessed with abundant ground water resources. If you happen to live in a rural setting, your water supply is likely to be a dug, driven-point, drilled gravel, or most commonly, drilled bedrock well. If your home is served by a municipal or public water supply, there is also a very good chance that your water may come from a large-capacity drilled gravel-packed or naturally developed well installed in sand and gravel. Although there are some very high yielding drilled bedrock wells in Maine, they are not as common or as high yielding as those installed in sand and gravel deposits. July's Site of the Month focuses on what likely is Maine's highest yielding gravel well or well field. The well, which is owned and operated by a major water district, occurs along a large river in the mid-coast area of Maine.
Wells and Rivers

This water district well and many high capacity gravel wells like it are sited along large rivers and streams to increase the potential recharge. When a gravel well adjacent to a river is pumped, the cone of depression or the surface expression of this cone known as the *area of influence* typically would extend out to the river (Figure 1).

**Figure 1.** Pumping well adjacent to a stream. Reversal of the ground-water flow gradient causes water to flow from the stream to the well.
Wells and Rivers

In some cases depending upon site conditions, this cone of depression may even extend to the opposite side of the river from the well (Figure 2). When a well is pumped and recharged in this way, the condition is known as *induced infiltration* or *induced recharge*. In some settings, low permeability sediments such as clay may isolate or partially isolate the well from the river. Therefore, the hydraulic connection between a well and the river is largely dependent upon the permeability, thickness, and continuity of the underlying sediments.

**Figure 2.** Pumping well adjacent to a stream. Increased pumping over time causes drawdown on the opposite side of the stream and an increased cone of depression.
Wells and Rivers

Figure 3 is a generalized site map showing the well locations relative to the river as well as two associated geologic cross-sections.

Figure 3. Generalized site map showing well locations relative to the river. Subsurface geology is shown by Cross-section A-A’ and Cross-section B-B’ (Figure 4).
Wells and Rivers

As is evident from the cross-sections, the area is underlain by significant thicknesses of clay, sand, and gravel. Based upon this subsurface information, the aquifer is only partially confined by the clay in the sense that there are areas where shallow and deep coarse materials are continuous.

**Figure 4.** (Left) Hydrogeologic cross-section A-A'. [Higher resolution PDF image (1.7mb)](https://example.com)  
(Right) Hydrogeologic cross-section B-B'. [Higher resolution PDF image (0.7mb)](https://example.com)
Wells and Rivers

These "windows" allow water to be filtered though the sand and gravel from the river bed to the well as a seemingly infinite supply of recharge. This connection to the river is clearly seen when the downstream river hydrograph is compared to the hydrographs of the production well and a monitoring well immediately adjacent to the river (and west of the production well) (Figure 5).

**Figure 5.** River/aquifer response data, downstream on the east side of the river.
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The original well at the site was drilled in 1956 using cable tool drive and wash methods. The completed well was drilled to a total depth of 138 feet (depth of bedrock surface) with 12-inch diameter casing and 25 feet of screen with variable slot openings sized according to the grain size of the material (Figure 6).

Figure 6. 1956 drill log and well construction diagram.
Yield at the time was determined to be 2910 gallons per minute (gpm). Subsequent pumping tests have revealed that this yield is very conservative and that theoretical potential yields based upon constant rate pumping test results for the well are likely to be in the range of 5900 to 8800 gpm. Since the original well was approaching 50 years in age and there were some concerns about the screen's long-term integrity, it was decided to replace this well. In December 2004, a 24-inch diameter naturally developed gravel well was installed immediately adjacent to the original 12-inch well with a total depth of 140 feet, a screen length of 29.5 feet, and a total theoretical yield based upon a 2500 gpm constant rate pumping test of 11,000 gpm (Figure 7).
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This well would not likely be operated at this rate because of the very high approach and entrance velocities. Larger diameter wells would likely need to be installed in this well field to realize this tremendous yield.

Figure 7. 2004 drill log and well construction diagram.
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The following photographs (Figures 8-13) show the new well being drilled and developed as well as views of the site in general.

Figure 8. View of drilling rig as replacement 24-inch well was drilled. Figure 9 is a close view.
**Figure 9.** Close-up view of the casings. The uppermost casing is the 24-inch well.
Figure 10. View of wrapped stainless steel screen for 24-inch well.
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Figure 11. Development of 24-inch well. Note construction of temporary settlement pond for collection of fine material.
Figure 12. Attachment of pitless adaptor and piping to 24-inch well.
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Figure 13. Completed 24-inch well with older, 12-inch well in foreground.
References and Additional Information


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