Managing Your Groundwater Supply

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All About Irrigation Workshop
Tidewater Agricultural Research
and Extension Center
Suffolk, VA

Presented by:
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Summary Recommendations:

- **Pick your best aquifer (for new wells or for adding wells):**
  - Consider alternatives, such as Columbia (surficial) aquifer;
  - Coordinate planning with the VA DEQ to gain insights and avoid hitting regulatory walls.

- **Well interference – space wells and spread pumping:**
  - Well driller may have a feel for sufficient spacing (for given aquifer and drawdowns);
  - Increase spacing in central area of well field or line of wells;
  - If only pump some wells at the same time, spread which wells are pumping simultaneously.

- **Well efficiency – is your pumping level falling? If yes, is it falling more inside the well than outside the well?**
Transmissivity and Storativity ("T and S") (key hydraulic properties for how drawdown impacts extend out from a pumping well):

- Unique for each different aquifer (distance-drawdown impacts differ);
- Vary within the same aquifer for different locations/directions.
Distance-Drawdown plot (Jacob method) at 48 hours elapsed pumping time

Distance representing 1/2 of Well #2 casing diameter (6-in).

Well A-1

Well #1

Well #2

well loss

\( r_0 = 2.550 \text{ ft} \)

\( \Delta s = 5.05 \text{ ft} \)

**Transmissivity (T)**

\[ T = \frac{Q}{\Delta s} \]

\[ T = \frac{70 \text{ (gpm)}}{5.05 \text{ ft}} \]

\[ T = 13.87 \text{ ft}^2/\text{day} \]

**Storativity (S)**

\[ S = \frac{T \cdot t}{640 \cdot r_0^2} \]

\[ S = \frac{13.87 \text{ ft}^2/\text{day} \cdot 8 \text{ hr}}{640 \cdot (2.550 \text{ ft})^2} \]

\[ S = 4.94 \times 10^{-4} \]
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Well A-1

\[ r_0 = 2,550 \text{ ft} \]

Well #1

\[ \Delta s = 5.05 \text{ ft} \]

Well #2

Well loss

Transmissivity (T)

\[ T = \frac{Q}{\Delta s} \]

\[ = \frac{70 \text{ (gpm)}}{5.05 \text{ ft}} \]

\[ = 714 \text{ ft}^2/\text{day} \]

Storativity (S)

\[ S = \frac{T}{640 r_0^2} \]

\[ = \frac{714 \text{ ft}^2/\text{day}}{640 \text{ ft}^2} \]

\[ = 4.94 \times 10^{-4} \]
Well Loss (well efficiency):

- No way to easily measure (short of aquifer testing, and no good way to do it short of multiple observation wells),

BUT...

- If you can measure water levels in your well, you can monitor changes/trends in performance.
### Yield versus Specific Capacity

<table>
<thead>
<tr>
<th>“100 gallon-per-minute well”</th>
<th>“100 gallon-per-minute well”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static water-level depth = 70 feet</td>
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</tr>
<tr>
<td>Pumping water-level depth = 120 ft</td>
<td>Pumping water-level depth = 80 ft</td>
</tr>
<tr>
<td>(after say, 2 hours)</td>
<td>(after say, 2 hours)</td>
</tr>
</tbody>
</table>

**Specific Capacity of well**

"100 gallon-per-minute well"

- Static water-level depth = 70 feet
- Pumping water-level depth = 120 ft

- Specific Capacity of well
  - \[= \frac{100 \text{ gpm}}{(120-70 \text{ ft})}]_{2-\text{Hr}}\]
  - \[= \frac{100 \text{ gpm}}{(50 \text{ ft})}]_{2-\text{Hr}}\]
  - \[= (2 \text{ gpm/ft})_{2-\text{Hr}}\]

"100 gallon-per-minute well"

- Static water-level depth = 70 feet
- Pumping water-level depth = 80 ft

- Specific Capacity of well
  - \[= \frac{100 \text{ gpm}}{(80-70 \text{ ft})}]_{2-\text{Hr}}\]
  - \[= \frac{100 \text{ gpm}}{(10 \text{ ft})}]_{2-\text{Hr}}\]
  - \[= (10 \text{ gpm/ft})_{2-\text{Hr}}\]
Well #4 6" well
140' Deep 14" screen
60' Water Level
8' Drawdown at 9 gpm
6.8' 9 gpm at 40 lbs. Pres.

Pump 120