WRITTEN TESTIMONY OF

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Introduction

Thank you Chairman Kucinich, and members of the Subcommittee, for inviting me to testify today. My name is David Hyndman, and I am an associate professor at Michigan State University in Groundwater Hydrology. My main areas of scientific research are: 1) evaluating the impacts of changes in climate and land use on water quality and quantity, and 2) developing novel methods to characterize subsurface properties that control the movement and fate of water and associated contaminants.

I have participated as an expert witness in several legal cases involving groundwater and surface water, including several concerned with the impacts associated with the bottled water industry. In all cases involving this industry to date, I have been retained by interests opposed to bottled water. I am here today on my own behalf, and am providing my scientific opinions, not those of my university or any other organization.

Today, I have been asked to provide some general testimony related to the impacts of the bottled water industry on groundwater, surface water, and riparian areas. I will also briefly discuss where these bottled water wells and plants are being located, and the relationship of the resulting environmental impacts to the Food and Drug Administration (FDA) definition of *Spring Water*.

Definition of Spring Water

I have highlighted the most relevant portions of the FDA definition of Spring Water in [21CFR165 (110)] as:

> *The name of water* **derived from an underground formation from which water flows naturally to the surface** of the earth may be **"spring water."** *Spring water shall be* **collected only at the spring or through a bore hole tapping the underground formation feeding the spring**.
>
> *There shall be a natural force causing the water to flow to the surface through a natural orifice. The location of the spring shall be identified. Spring water collected with the use of an external force shall be from the same underground stratum as the spring, as shown by a* **measurable hydraulic connection** *using a hydrogeologically valid method* **between the bore hole and the natural spring**, **and shall have all the physical properties**, *before treatment,* **and be of the same composition and quality, as the water that flows naturally to the surface** *of the earth.*
>
> *If spring water is collected with the use of an external force, water* **must continue to flow naturally to the surface of the earth through the spring's natural orifice**. *Plants shall demonstrate, on request, to appropriate regulatory officials, using a hydrogeologically valid method, that an appropriate hydraulic connection exists between the natural orifice of the spring and the bore hole.*

In my opinion, there are several issues with this definition.

1) There is little in this definition to distinguish "spring water" from slow groundwater seepage across broad areas to surface water bodies.
2) The nature of the required hydraulic connection test for pumping encourages placement of these "spring water" extraction wells in areas where the environmental consequences of such extraction is likely the most significant.

3) Groundwater flow through sediments is generally a diffuse process, and areas that are being tapped as “springs” are often simply areas in the subsurface with coarse grained material that causes water to flow more rapidly to the surface.

Common Locations for Spring Water Wells

Pumping facilities for spring water are often placed in the headwaters of streams, where the groundwater level reaches the surface, because it is easier to show the reduction of streamflow in these locations during forced pumping. Unfortunately, these also tend to be environmentally sensitive ecosystems.

The water sold as “spring water” in some cases contains shallow groundwater that would not have otherwise flowed to a spring's *“natural orifice*".

Groundwater Impacts

When water is extracted from the shallow subsurface using wells, the elevation of the water table (defined by the water level in surrounding wells) will decline in what is called a “cone of depression”. The decline is largest adjacent to the extraction well, but this cone of depression can encompass a large region. If individuals have drinking water wells in the cone of depression, their water supply can be affected by the reduction in levels.

Surface Water Impacts

Streamflow and Level

Groundwater is the main source of streamflow in most humid areas, such as the Midwestern United States. In these areas, there is essentially a one to one relationship between pumping of shallow groundwater and the resulting reduction of outflow to surface water. In other words, for every gallon of water pumped out of groundwater, there is one gallon of water lost to streams in the watershed. High capacity bottled water extraction in headwater locations can cause large percentage reductions in the flow of streams. For example if the natural flow of a stream was 1000 gallons per minute, and 500 gallons per minute were extracted to be bottled as “spring water”, the flow of the stream which would capture the extracted water would be reduced by 50 %.

When the flow of a stream is reduced by significant groundwater extraction, the level of the stream is also reduced. The more familiar example is the opposite case; stream levels rise when streamflow increases after a large storm event. Concerns associated with reductions in level include reduced navigability, degraded aesthetic quality, and impairment of the stream for aquatic organisms such as fish.

In addition changes in flow and level can also alter the water temperature relative to an unaltered system. In turn, this can have significant consequences for organisms that live on those water bodies.

Wetland and Lake Levels

If pumping reduces the groundwater level below lakes or connected wetlands, the level of these surface water bodies will generally drop by a similar amount. In addition, riparian wetlands exist on the margins of many stream systems. As a result, reduction of the levels of a stream would also reduce the water level in adjoining wetlands.

Seasonal Impacts

In locations, such as Michigan, our research has demonstrated that there is very little recharge to groundwater during the growing season, because most of the precipitation that falls during this period evaporates or is transpired (used) by vegetation. Streamflow during the growing season thus relies almost entirely on the slow outflow of groundwater, which is reduced by large groundwater extractions in the vicinity of those streams. The largest impacts would occur when large volume extractions continue during drought periods, because the impacts of pumping exacerbate already low streamflows during such periods.

Necessary Information for Informed Decisions

Decisions about the location and capacity of high capacity pumping are facilitated by hydrologic research and mapping. Specifically, there is a need for detailed mapping of subsurface properties, including the geometry of the shallow aquifer systems, the storage and transmission properties of subsurface materials, and the detailed nature of connections between surface water bodies and groundwater. This information, along with detailed climate data, can drive emerging numerical models that can predict the local and regional influences of large volume groundwater extractions under current and future conditions.

Summary

Large groundwater extractions for “spring water” bottling have significant impacts including:

- reductions in the flow and level of regional streams,
- declines in groundwater level, which reduce the level of lakes and some wetlands,
- changes in the temperature of surface water bodies, and
- alteration of the habitat for fish and other species that live in lakes, streams, and wetlands.

These impacts are most significant during dry portions of the year, especially during droughts.

The FDA definition of spring water encourages placement of “spring water” extraction wells in environmentally sensitive headwaters of stream systems.

Additional research is needed in the hydrologic sciences to address these concerns.