Board Approves Rule Changes

Following notice and a public hearing, the Board adopted several rules changes during the April 5, 2005 meeting. The changes affect District rules 6.1, 6.2 and 8.3. Section 6 of the District's rules addresses deposits for well registrations and well permits. The changes here now require that a $250 deposit be submitted for each permit or registration. Also, language was added which specifies that a deposit is **not** refundable if drilling begins before the permit or registration is issued.

Additionally, the approved changes to Section 8.3 concern the fee which is required for an application for exception to well spacing. Previously the fee was $250, but has changed to $500.

If you need copies of the District's rules, come by the office or visit our web site www.spuwcd.org.

Calendar of Events

May 30	*Memorial Day Office Closed*
June 7	*Board Meeting 1:30 pm District office*
July 4	*Independence Day Office Closed*
July 5	*Board Meeting 1:30 pm District office*
August 2	*Board Meeting 1:30 pm District office*

SOUTH PLAINS GROUNDWATER NEWS is published by the SOUTH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT, PO Box 986, 802 Tahoka Road, Brownfield, TX 79316. Directors: Dan Day, Doyle Moss, Scott Hamm, Matt Hogue, Larry Yowell; General Manager: Jason Coleman; Administrative Assistant: Lindy Harris. Subscriptions are free upon request.

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SOUTH PLAINS GROUNDWATER NEWS

MAY 2005 **VOLUME 12, NUMBER 3**

Understanding the Ogallala
Part 4–Aquifer Recharge

Note: This is the fourth article of the series entitled "Understanding the Ogallala".

Due to the exceptional 2004 precipitation, the District has received a number of questions concerning groundwater recharge. The results of recent District water level measurements provide some data used for local recharge studies. Outside agencies have also conducted research and specialized studies over the years, which adds to our understanding of this process. However, a local understanding must also include a regional perspective of the Ogallala. Recall the unique features of the southern Ogallala; it is isolated from the original source water and materials. Also, remember that groundwater generally moves quite slowly within the District, commonly 50 feet or less a year. Consequently, the main influence for aquifer recharge is the sum of local conditions. **The aquifer does not receive recharge from snowmelt in the Rocky Mountains.**

Three related topics are presented here concerning our understanding of Ogallala recharge. These topics include the variables affecting recharge, methods of quantifying recharge and local recharge studies.

Variables which affect recharge include soil type, depth to water, land use, and precipitation. For this article, recharge is defined as precipitation that infiltrates to the water table of the aquifer. Using this definition, the other variables are better understood. For example, certain soil types facilitate deep percolation of water better than others. A coarse sand has a higher infiltration rate than a clay soil. However, deep cracks in a clay soil may allow rapid infiltration until the clay swells and the cracks are closed. Also, if the unsaturated material is thin, then water must move downward only a short distance before it reaches the water table, or saturated zone. Recent studies suggest that land use also influences recharge rates. Specifically, these findings indicate tilled crop land facilitates recharge more readily than do native pastures or conservation program grasses. In fact, a 2001 recharge study conducted near the Muleshoe National Wildlife Refuge shows that recharge is negligible for this type of land. As a result, it is assumed that recharge rates have increased since crop land development on the Southern High Plains. Another study which confirms that land use and land cover are factors affecting recharge is the Southern Ogallala Groundwater Availability Model (GAM). Here, modelers used different recharge rates for specific time periods. For example, before significant agricultural land development, recharge figures of 0.02 in/yr and less were estimated for the District. However, for the time period since, the model includes recharge rates of 1.0 in/yr and greater for the same area.

Ogallala...Continued on page 2

Ogallala Formation

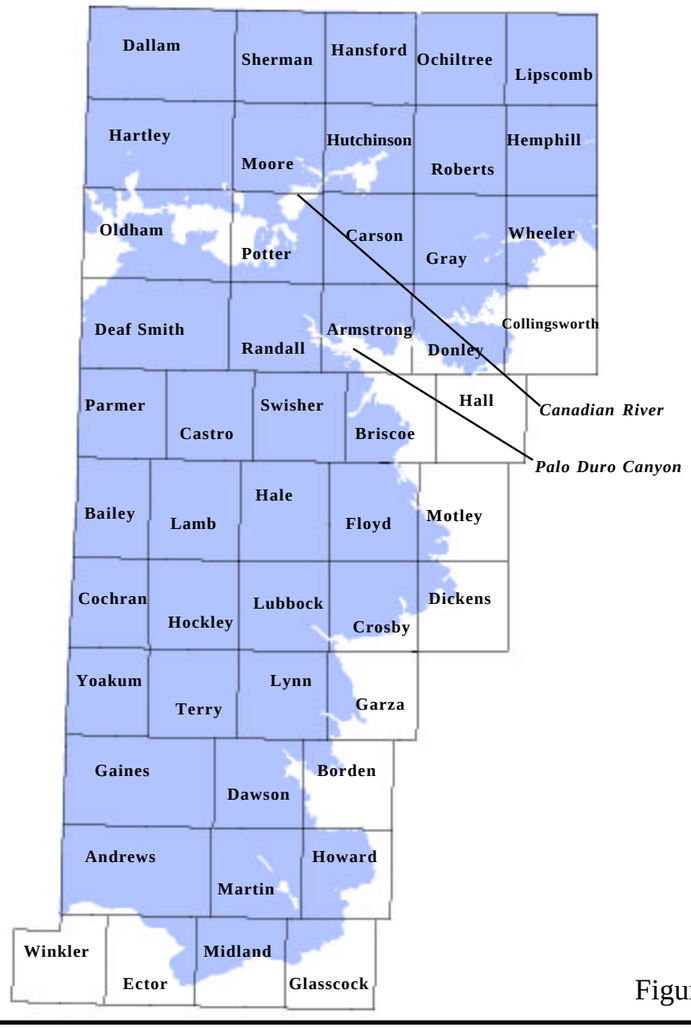

Figure 1

Ogallala...Continued from page 1

Precipitation may become recharge when it infiltrates the soil profile and when it collects as runoff. The timing, frequency and severity of precipitation are several variables which influence its effects as recharge. For example, a rainfall event during the summer may quickly evaporate and be used by actively growing plants. Conversely, fall and winter precipitation may occur when conditions are favorable for deep percolation. Accumulation of precipitation runoff in low spots and playa lakes is common when an intense rain event occurs during a short time. This runoff allows deep percolation when conditions are favorable.

There are a variety of methods which are used for studying and quantifying recharge. Several of these involve using a "tracer", which may be chloride, nitrate, or tritium. These parameters are observed at certain concentrations at different depths within the profile. Analyzing these chemical concentrations helps reveal the depth to which water has infiltrated over time.

When chloride is the tracer, the process involves a mass balance where chloride inputs are estimated from rainfall. Long term chloride concentrations in precipitation are multiplied by mean annual precipitation, and then compared to groundwater chloride concentrations. This operation is utilized for both irrigated and non-irrigated sites, although some adjustments are made for irrigated land sites due to irrigation return flow. Irrigation return flow is that water which was once applied for irrigation, but lost to deep percolation. A similar approach is utilized when nitrate is the tracer.

Tritium occurs naturally in the atmosphere and enters the subsurface mainly through precipitation. However, tritium fallout increased during the 1950s due to atmospheric nuclear testing. Today, the distribution of tritium within an unsaturated profile is used when determining the velocity of the soil water. A corresponding recharge rate is then calculated by multiplying the velocity by the average water content in this unsaturated zone. Using a recent study, recharge rates for non-irrigated areas were about 0.32 in/yr using the chloride method. For irrigated areas, the same study indicates a range of 0.7-1.3 in/yr using the tritium method.

The District has conducted recharge studies for the past five years. After considering the numerous issues presented above, it is evident that recharge is affected by highly variable parameters. Many of these parameters are variable within a fairly small area, so recharge rates also vary a bit within the District. However, rather than quantify these different rates, the District's approach has been broadened to quantify the total volume of yearly recharge using several other measured variables. This is the water balance.

One variable includes water level measurements, which provide data for calculating both areas of increasing groundwater storage and areas of declining groundwater storage. The second variable concerns estimated groundwater usage. From a network of meter cooperators, the District calculates the estimated total usage for each year. Using this data, the water balance is then calculated. For example, suppose the estimated usage for a year is 120,000 ac-ft and water level measurement data indicates a decline in storage of 90,000 ac-ft. The estimated recharge volume is then 30,000 ac-ft. Using this process, a five year average recharge of about 73,000 ac-ft/yr has been calculated for the District. If this volume was spread evenly throughout the District, the resulting rate is about 1.5 in/yr. This rate is given for example only; it has already been documented here that recharge rates vary widely over the District's area. It is always useful to examine other studies as a check when performing these calculations. For comparison, the Southern Ogallala GAM results from simulations during 2003-2014 indicate the District's recharge is about 72,000 ac-ft/yr. Past studies from the Texas Water Development Board contain recharge figures of about 44,000 ac-ft/yr. The District's five year study includes results from individual years that span this range of values.

A future goal of the District's recharge study includes a more site-specific quantification of varying recharge rates. For now, common sense supplies much of the local understanding of aquifer recharge, although specific questions still linger. For example, it is understood that much of last season's documented recharge occurred in non-irrigated areas with shallow depths to groundwater. Much of the irrigated area has not yet experienced such significant water level increases as those documented in some non-irrigated areas. Unfortunately, many irrigated areas of the District may experience a much greater time lag in recharge because of greater depths to groundwater there.

In conclusion, the variables which affect groundwater recharge include the properties of both the underlying strata, and local precipitation. Land use also influences recharge rates on the Southern High Plains. Tracer studies using chloride, nitrate and tritium have provided a range of recharge rates for both irrigated and non-irrigated areas. Local recharge studies have quantified the District's annual volume of recharge using a water balance. Results of this five year study include a range of values also found in other studies. Generally, recharge is a slow process within the District and is currently lower than the average usage, resulting in water table declines.

Legislative Update

The 79th Legislative session ends May 30, 2005. During the current session, District staff have monitored many bills which affect our land owners and the District's operation. A recurring theme found in numerous bills concerns groundwater conservation districts conducting joint planning and similar management schemes over an aquifer.

It is unknown at this time which of these bills will be signed by the Governor. Visit our web site link "*News Articles of Interest*" for further updates as additional news stories are published.

2005 Decline Maps are now available