Nebraska Resources Newsletter

Published Quarterly by the Nebraska Department of Natural Resources
301 Centennial Mall South / P.O. Box 94676 / Lincoln, NE 68509-4676

Inside this Issue:

Issue 43, April 2012

- Seepage Runs/cover and page 2
- How much can it possibly rain?/ cover and page 4
- Platte Basin Water Management Action Initiative/page 3
- Republican River Basin Study/ page 4
- 2011 Water Well Registrations/ pages 5 and 6

Agency Numbers to Remember

Agency address:
Nebraska
Department of Natural Resources
301 Centennial Mall South
Fourth Floor
P.O. Box 94676
Lincoln, Nebraska 68509-4676
Agency phone number:
(402) 471-2363
Agency fax number:
(402) 471-2900
Agency homepage address:
http://www.dnr.ne.gov

Editor's Note:
A full color electronic version of this newsletter can be found on the Department's web site along with back issues at **http://www.dnr.ne.gov/dnrnews/newsarchive2.html**.

Seepage Runs

By: James Gilbert and Tom O'Connor

A seepage run consists of making multiple stream flow discharge measurements along a specific portion of a stream or river to determine the exchange between groundwater and surface water. Specifically, seepage runs provide a detailed picture of the gaining or losing reaches in a stream and the extent of groundwater connection to the stream (*please see graphic on page 2*). The connection between groundwater and stream flow is important for understanding the surface water–aquifer interactions of a reach or watershed and can be used to guide projects such as perennial stream delineation, water table mapping, and groundwater modeling. Because maintaining a gaging network can be expensive, seepage runs can provide information that helps fill in data gaps resulting from a stream segment or watershed having few or no permanent gaging stations.

Seepage runs are usually done when the stream is at a baseflow condition; that is when groundwater is contributing all or most of the flow to the stream. Baseflow conditions occur when there have been no recent rains, no

Continued on p. 2

How much can it possibly rain?

By: Tim Gokie, P.E. and Pat Diederich, P.E.

There seems to be a general misunderstanding about how much it can rain and how frequently such rainstorms occur. You hear things like, *"I live outside the 100-year floodplain, I don't need flood insurance, I will never get flooded,"* or *"I have lived here for over 50 years and the highest the water has ever gotten is to that tree over there."* A common saying we hear from dam owners, *"That spillway will never run, this dam has been here for 20 years and the water has never gotten close to that auxiliary spillway."*

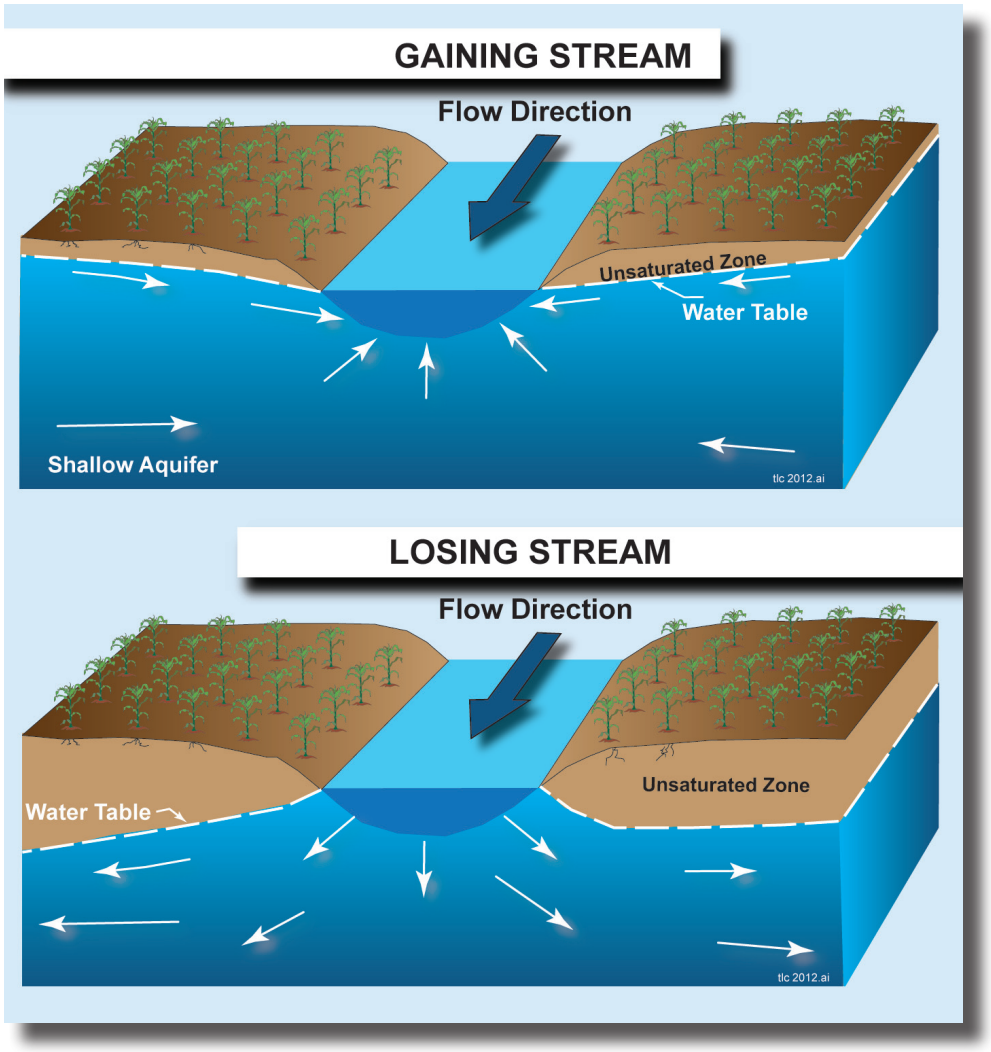
If the natural disasters that have happened over the past year have not taught us anything else, **we should at least acknowledge that when it comes to nature, personal experience is extremely unreliable in predicting future events**. The morning of March 11, 2011, no one living on the northeastern coast of Japan had experienced a tsunami of the magnitude they would experience later that day. The August 2011 Mineral, Virginia, Earthquake that caused over $70 million in damages was the strongest earthquake to hit eastern Virginia in recorded history going back to 1774. Closer to home, last year's volume of runoff from the Upper Missouri River far exceeded what had been witnessed in 114 years of record.

Continued on p. 4

Seepage Runs continued from p. 1

recent snow or ice melt, and little or no evapotranspiration from actively growing plants or leafing trees. In Nebraska, baseflow conditions typically occur during early spring or late fall.

During a seepage run, discharge measurements are made on the main stem and all tributaries and diversions within the designated reach. Access to remote tributaries can be problematic and before starting a seepage run, detailed maps of planned measurement locations must be prepared. The location where flow begins on each tributary (ephemeral to perennial stream) is also identified on a map. During a seepage run, speed is of the essence and the discharge measurements are generally completed within a short period of time. Where the stream or river can be safely crossed (generally less than 3 ft. in depth), wading measurements are typically made with a top-set rod and current meter. At bridge locations where the stream cannot be safely waded, a meter is lowered into the stream from a railing using a crane or bridge board. Where the river is too deep to wade and there is no bridge, an Acoustical Doppler Current Profiler (ADCP) 'sled' can be towed across the stream.



If baseflow conditions exist, then the change in discharge between two measuring points, plus all diversions and/or minus all tributaries can be attributed to groundwater seepage. A net positive change is attributed to groundwater contributing to streamflow (gaining stream); a net negative change is attributed to streamflow loss to groundwater (losing stream). It is important to note, that a seepage run provides information only at one point in time – a "snapshot." Seepage runs repeated over months, years, or even decades can provide further information on how the stream-groundwater interaction changes in response to intervening stresses (e.g. shifts in land-use, irrigation, channel degradation, etc).

Seepage run data can be used with a groundwater model to determine model boundaries and to calibrate the exchange between groundwater and streamflow. For example, the location where a stream becomes perennial is an excellent way to help determine the boundary conditions of the model. The point on a stream where flow ceases under baseflow conditions is assumed to be the point where the stream-aquifer interaction diminishes toward zero – this can be used as evidence to exclude the remainder of the reach from the model. Although limited to a "snapshot" in time, seepage run data can also be applied to various hydrologic studies and projects, including groundwater model construction and calibration. By comparing the direction or magnitude of flow within a specific reach with the net simulated flow from groundwater model results, seepage run data can be used as a general target for model calibration.

The Nebraska Department of Natural Resources field offices have completed numerous seepage runs throughout the state, including segments of the Blue, Nemaha, Loup, Platte, Elkhorn, and Niobrara River Basins. Many of these seepage runs have been conducted in cooperation with federal agencies such as the U.S. Geological Survey and the U.S. Bureau of Reclamation. The Department's Lincoln Field Office is planning a Fall 2012 seepage run on segments of the Big Blue River.

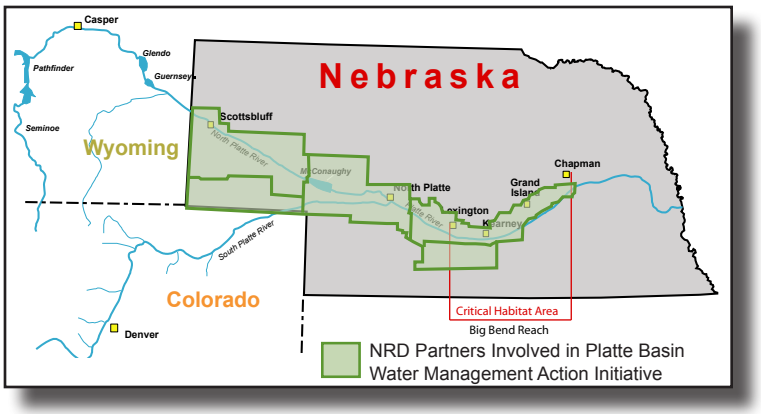
Platte Basin Water Management Action Initiative

By Jennifer Schellpeper

The Nebraska Department of Natural Resources and the Central Platte, North Platte, Twin Platte, South Platte and Tri-Basin Natural Resources Districts (NRDs) are working to implement the Platte Basin Water Management Action Initiative (Initiative). **The Initiative was developed to study, design and implement water management projects in the Platte Basin for the purposes of reducing the consumptive uses of water, enhance streamflows, recharge groundwater and/or support wildlife habitat.** The Initiative is funded via the water resources cash fund and the Nebraska Environmental Trust (Trust). The Trust made its decision to fund the Initiative at a board meeting on April 5, 2012. One of the major benefits of the Initiative is that it is expected to help meet Nebraska's requirements for complying with the currently implemented integrated management plans (IMPs) in the Platte Basin as well as the Nebraska New Depletion Plan (NNDP) portion of the Platte River Recovery Implementation Program (PRRIP). That program is a basin-wide effort undertaken by the U.S. Department of the Interior (DOI) and the states of Colorado, Nebraska and Wyoming to secure defined benefits for the endangered interior least tern, whooping crane, and pallid sturgeon, and the threatened piping plover.

Multiple projects are being pursued as part of the Initiative. A number of projects are also being coordinated with PRRIP. One particular project is currently in the final stage of the feasibility study, the J-2 re-regulating reservoir. This project would capture water in newly constructed facilities associated with Central Nebraska Public Power and Irrigation District's (CNPPID) system during periods of excess flows. Water would then be released during periods of shortages to target flows.

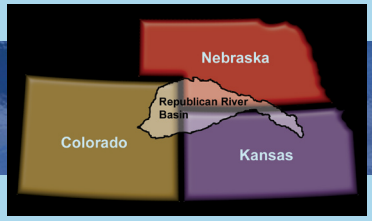
Several projects involve the use of excess stream flows to recharge groundwater reservoirs in Nebraska. The Initiative will develop some of these projects and will coordinate with the PRRIP on others. These projects involve diverting surface water from the Platte River during times of excess flow into irrigation canals during the non-irrigation season or within excess canal capacity during the irrigation season. Excess flows could also be diverted using alluvial wells located close to the Platte River. The Platte River Recovery Implementation Program has conducted reconnaissance-level and preliminary feasibility studies of groundwater recharge. Currently, more in-depth studies are being conducted on Phelps, Dawson and Gothenburg Canals. The Initiative partners carried out a demonstration recharge project in the spring and fall of 2011 working in cooperation with more than 20 surface water canals across the Platte Basin from Kearney to Scottsbluff. The project concept is that seepage will percolate into the alluvium and recharge the groundwater aquifer. Excess water that is not recharged would be returned to the river via spillways within the same month. Return flows that result from canal and reservoir seepage would accrue to the river for some duration after the recharge event.



Other potential projects involve changing the use of existing surface water appropriations or groundwater certified uses. A voluntary temporary leasing program would provide incentives to farmers to annually or long-term (e.g., 30 years) lease water supplies that would otherwise have been used for irrigation. This type of project could include various water management incentives consisting of programs resulting in consumptive use reductions. The reduction in consumptive use could be added to the Lake McConaughy environmental account (EA) when storage space is available and released during times of shortage.

The Initiative is expected to result in more efficient and effective water management and will optimize a spectrum of water uses including irrigation, hydropower production, environmental and endangered species needs. Optimizing flow levels will benefit local NRD efforts to reach a sustainable balance of water supplies and water uses and will provide additional options to irrigators seeking to maximize the value of water used. Other beneficiaries of the project include the Platte River ecosystem, which will have additional flow available during what would otherwise be periods of lowflow. This in turn will be beneficial to endangered species and other species of concern along the Platte River. The state of Nebraska and the partner NRDs will benefit in that the Initiative will assist in meeting Nebraska's responsibilities under the IMPs and the NNDP of PRRIP.

Republican River Basin Study



By Doug Hallum, P.G.

The states of Colorado, Kansas and Nebraska will receive a $413,000 grant from the Bureau of Reclamation's (BOR) Basin Study Program to study water management options in the Republican River Basin. The Basin Study Program is part of the WaterSMART (Sustain and Manage America's Resources for Tomorrow) program, with the purpose of studying western water basins to develop sustainable management strategies. Seventeen western states are eligible for funding through the program. The Republican River Basin study is one of five projects funded by the Basin Study Program in 2012. The study will include state, local, and federal interests to develop management strategies or options that best suit the needs of water users within the Republican River Basin.

The purpose of the Republican River Basin Study is to model the hydrologic (surface-groundwater interactions) and economic effects of various water management strategies, through variable water supply and climatic conditions, with the goal of providing water management options that optimize use of both surface and groundwater resources. Evaluation of management options will include impacts to both the water supply and the economy of the region. The study will advance the knowledge of basin hydrology, aquifer characteristics, and surface-groundwater interactions by adding to and expanding on studies that the Nebraska Department of Natural Resources and the Natural Resources Districts have initiated previously. Analyzing both the hydrologic and economic impacts of various management options allows for water managers to choose conjunctive water management strategies that best fit the water management goals and objectives of the region.

The study region will include about 23,000 square miles of the Republican River Basin from its headwaters in Colorado to the Clay Center streamgaging station in north-central Kansas. A formal agreement between the states and the BOR is in development; once the agreement is formalized, project completion is expected in two years.

How much can it possibly rain? continued from p. 1

The critical question that must be answered for the design or evaluation of high hazard potential dams in the state is how much can it possibly rain? This is **because the consequences of failure for these dams are so high that everything that can reasonably be done must be done to assure that a dam breach never happens**.

In 2008, Applied Weather Associates based in Monument, Colorado, was hired to provide an answer to the question, "How much can it possibly rain?" The study was funded by the Lower Platte North, Lower Platte South, Papio-Missouri River, Lower Elkhorn and Central Platte Natural Resources Districts along with the U.S. Army Corps of Engineers, Central Nebraska Public Power and Irrigation District and the Nebraska Department of Natural Resources. In meteorological terms, "How much can it possibly rain?" is known as the probable maximum precipitation (PMP). The exact definition of the PMP is the theoretical, greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographic location at a certain time of year. Applied Weather Associates used a standard methodology that consists of finding the largest rainfalls that have occurred during the period of record in areas that have similar weather characteristics as Nebraska, namely, the western Midwest and the northern Great Plains. These extremely large storms were then idealized to maximum rain producing conditions, sometimes increasing their severity by more than 40%.

A handful of freak thunderstorms across the Midwest were the driving storms for the study. These storms included the June 24, 1963, David City, Nebraska, Storm that dropped 16.5 inches of rain over six hours; the May 30, 1935, Hale, Colorado, Storm that dropped 18 inches in six hours; the September 17, 1926, Boyden, Iowa, Storm that produced 24 inches of rain in 24 hours; the June 10, 1944, Stanton, Nebraska, Storm that dropped 15.8 inches in 24 hours; and the July 17, 1996, Aurora College, Illinois, Storm that resulted in 18.2 inches of rain in 24 hours.

So how much can it possibly rain? The answer depends on where you live. In Scottsbluff, the probable maximum precipitation amount was determined to be 18.9 inches in 24 hours. In Hastings, it is 22.8 inches and in Norfolk, it's 23.0 inches. The highest amount for Nebraska is near Falls City with 24.8 inches in 24 hours. These totals are three to five times the 4.3-inch to 7.2-inch rainfall amounts that our 100-year floodplains are based on. Applied Weather Associate's final PMP Study can be found on the Department's website at http://dnr.ne.gov/docs/damsafety.html.

2011 Water Well Registrations

During the past year (January 1, 2011-December 31, 2011) over **6,800 water wells were registered with the Nebraska Department of Natural Resources** (DNR). These water wells are utilized for a variety of purposes ranging from livestock watering to municipal water needs.

Current Nebraska laws require that **all water wells be registered with DNR**. Exceptions to the law include test holes in existence for ten days or less, dewatering wells with intended use of less than 90 days, and domestic and livestock wells completed prior to September 9, 1993.

Water well contractors are responsible for filing the well registration information on newly constructed water wells with DNR within 60 days of the well completion date. Water well owners are responsible for registering existing wells that have not been previously registered with the state. Registration forms and information are available at DNR's main office in Lincoln, its five field offices (see field office information box) and online at http://www.dnr.ne.gov/ in the groundwater section. Failure to register water wells is a Class IV misdemeanor under Nebraska law. If you have any questions about well registration please contact DNR's main office or any of its five field offices.

The electronic address for searching DNR's well registration information is:
http://dnrdata.dnr.ne.gov/wellssql/

DNR Forms are available at:
http://dnr.ne.gov/docs/wellforms.html

Natural Resources Districts	2011 Registered Irrigation Wells Including Replacement Wells	2011 Total Registered Wells All Types
1. Central Platte	131	455
2. Lewis & Clark	66	118
3. Little Blue	150	269
4. Lower Big Blue	57	133
5. Lower Elkhorn	88	342
6. Lower Loup	109	428
7. Lower Niobrara	76	127
8. Lower Platte North	64	336
9. Lower Platte South	10	283
10. Lower Republican	9	73
11. Middle Niobrara	9	98
12. Middle Republican	5	111
13. Nemaha	26	155
14. North Platte	12	196
15. Papio-Missouri River	8	365
16. South Platte	0	94
17. Tri-Basin	63	138
18. Twin Platte	29	234
19. Upper Big Blue	150	336
20. Upper Elkhorn	84	215
21. Upper Loup	13	141
22. Upper Niobrara-White	9	145
23. Upper Republican	7	42
Totals	**1,175**	**6,845**

as of December 24, 2011

A **cumulative total of 108,125 irrigation wells** have been registered from 1930-December 2011. This figure includes replacement wells.

Additional information on available well registration handouts from DNR can be found on page 6 of this newsletter.

Field Office Information

Bridgeport Field Office
729 Main Street
P.O. Box 787
Bridgeport, Nebraska 69336-0787
Phone: 308-262-1930
Fax: 308-262-1939

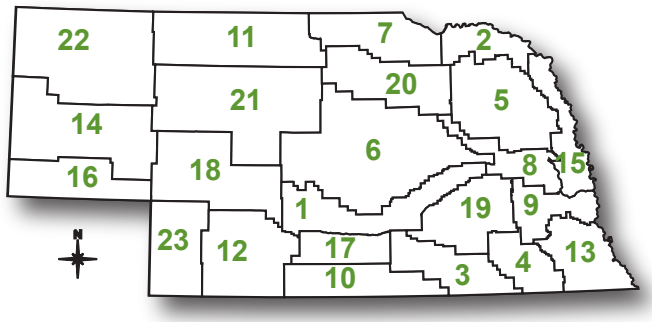
Cambridge Field Office
622 Patterson
P.O. Box 426
Cambridge, Nebraska 69022
Phone: 308-697-3730
Fax: 308-697-3200

Norfolk Field Office
601 East Benjamin Ave., Suite 101
P.O. Box 1451
Norfolk, Nebraska 68701
Phone: 402-370-3377
Fax: 402-371-0653

Ord Field Office
North Highway 11
P.O. Box 251
Ord, Nebraska 68862
Phone: 308-728-3325
Fax: 308-728-9967

Lincoln Field Office
301 Centennial Mall South
P.O. Box 94676
Lincoln, Nebraska 68509-4676
Phone: 402-471-0589
Fax: 402-471-6598

Nebraska Natural Resources Districts



Nebraska Resources

Nebraska Department of Natural Resources
301 Centennial Mall South, 4th Floor
P.O. Box 94676
Lincoln, Nebraska 68509-4676

Return Service Requested

State of Nebraska
Dave Heineman, Governor

Nebraska
Department of Natural Resources
Brian P. Dunnigan P.E., Director

The *Nebraska Resources* is a quarterly publication of the Nebraska Department of Natural Resources. We welcome your comments and suggestions.

Printed with Soy Ink

Additional Well Registration Information

Additional information on registered water wells from 1930 to 2011 can be found at http://dnr.ne.gov/docs/DNR_BrochureList.html under the heading:

Registered Irrigation Wells Brochures

Cumulative Total of Irrigation Wells Registered in Nebraska (1930-2011)
Registered Wells Per Year (1993-2011)
New Irrigation Wells Per Year (1993-2011)
Registered Irrigation Wells 2011 by NRD
Registered Irrigation Wells Between 1972 and 2011 by NRD
Registered Irrigation Wells Between the Years 1972-2011 by NRD

Nebraska Department of Natural Resources....
....dedicated to the sustainable use and proper management of the State's natural resources.