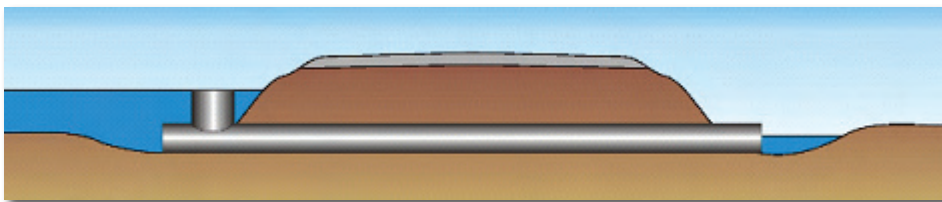


Successful Completion of First Waffle Field Trial

During spring 2004, the initial Waffle field trial was conducted on one complete section of agricultural land near Shelly, Minnesota. The goal of the Waffle demonstration is to verify the downstream reduction in flooding as a result of upstream storage in Waffle sections and to determine the effects of extended springtime water storage on the land. Although the actual field demonstration occurred in the spring of 2004, initial research activities began the previous summer and fall.



Side View of Diagram of Culvert with Standpipe

One of the first steps of the field trial was to survey the land in the fall of 2003. The detailed data from the elevation survey helped EERC researchers determine the potential volume of water storage and ensure that the drainage of neighboring sections would not be altered.

The next phase of the field trial was to implement the structural modifications needed to store water. The existing culverts were extended to allow for the addition of canal gates and overflow devices known as standpipes to allow for water storage. The standpipe inlet was set at an elevation designed to maximize storage while ensuring that the road had sufficient protection from potential erosion and heavy rain. Soil moisture and temperature sensors were also installed to collect data at various levels within the soil.

The newly gated culverts were closed in anticipation of the spring melt. The water that was stored on the section was a combination of snowmelt from precipitation that landed on the site as well as water originating upstream of the site. The water reached the maximum storage volume of 175 acre-feet (or the equivalent of 1 foot of water stored over 175 acres) on March 26, after which it was stored on the section for 14 days and then released. Water release started on April 8 and was performed in a controlled fashion; the section was completely drained in about 42 hours.

Prior to water storage, a water flow and routing model was utilized to investigate how much additional water could be added to the site from a significant rainstorm without causing the water to overtop the roads. It was determined that the site could withstand a 3-inch rainfall event without overtopping the surrounding roads. The model was also used to determine the rate at which water could be drained from the site without causing erosion or significantly impacting downstream ditch volumes. During the field trial, a variety of flowmeters and transducers collected data to compare predicted versus actual water flow and total storage volumes.

Continued on page 4

Crop Yield Results from Field Trial Demonstration

Soybeans, sunflowers, and corn were the crops planted on the trial field. During visual inspections of the crops in early fall, the crops revealed no difference in height or robustness between the flooded and nonflooded areas or between the flooded areas and neighboring fields with identical crops. The planting dates of the crops on the trial site were about 5 days later than neighboring fields. This delay was expected to have minimal impacts on yields and associated farming operations.

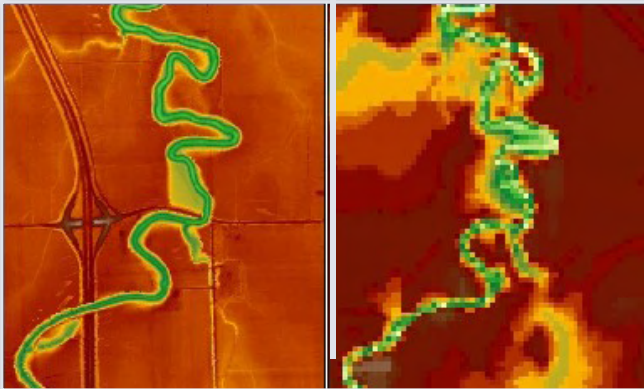


Yields were estimated for the corn and sunflower crops on October 5, 2004, according to a method developed by the North Dakota State University Extension Service.¹ The crop yield results comparing the flooded and nonflooded areas are shown in Figures 1 and 2 on page 3. Soybean yields were not calculated because that portion of the section, the extreme northeast 40 acres, did not have water stored on it. The Waffle storage site yields averaged 139 bushels per acre, just slightly higher than the 136 bushels per acre estimated on a neighboring nonflooded field. This minimal difference in yield suggests that the short delay in

Continued on page 3

Elevation Data Collection Under Way in the Forest River Watershed

Elevation data within the Red River Basin are needed to calculate water storage potential in order to evaluate the Waffle concept. The National Elevation Data (NED) data set is publicly available from the U.S. Geological Survey; however, the vertical accuracy of the data can range from plus or minus 3 to 9 feet. In an area as flat as the Red River Basin, errors that large could make a significant difference in calculating water storage potential. Therefore, the EERC is collecting LIDAR (light detection and ranging) digital elevation data in selected areas, which, with vertical accuracies of plus or minus 6 inches, provide much greater accuracy than the NED data. Elevation data from LIDAR are collected from an instrument mounted on a small airplane that flies in swaths across the designated area. The lower the aircraft flies, the more accurate the elevation data, but the longer it takes to conduct the survey.



LIDAR

NED

Example of Resolution of Digital Elevation Data Types

The EERC contracted Sanborn Mapping Inc. to collect detailed elevation data using LIDAR for 1627 square miles in northeastern North Dakota, comprising the Forest River Watershed and Walsh County. This will allow the EERC to calculate storage volumes and conduct hydrologic modeling for an entire subwatershed for comparison with the same techniques using NED.

Data collection occurred over the summer, with the cost shared by the Waffle project and the Natural Resources Conservation Service National Cartography and Geospatial Center in Texas. A sample data set was delivered in mid-August, and the final products were delivered at the end of October. The LIDAR data were validated with over 100 global positioning system (GPS) data points collected by EERC researchers, helping to ensure the accuracy of the data.

Heith Dokken Returns from Service in Iraq

EERC Research Engineer Heith Dokken returned to the EERC after serving 15 months in Iraq with the Army National Guard 957th Multirole Bridge Company, which is based out of Bismarck. He received 10 weeks of training at Fort Leonard, Missouri, before flying into Kuwait. From there, he went to Iraq, where he served with various military groups working as a medic.



Loaded down with 60 pounds of gear, Dokken was prepared for guard duty in Fallujah.

Heith's first mission was attached to the 130th Engineering Brigade in Balad, Iraq, an Iraqi Air Base about 60 miles north of Baghdad in the middle of the Suni Triangle. "We set up camp, pulled perimeter security, hauled supplies, and helped move the rest of the company up to Balad," said Heith. He indicated a newly discovered respect for Army engineers after seeing how hard they work.

Later, Heith moved 60 miles west of Baghdad to Ar Ramadi, where he served with the river patrol of the Euphrates River. Heith regularly put in 18- to 20-hour days while he served in Iraq. Because he was the only medic serving this engineering unit, he worked on many shifts, sometimes only sleeping 1 or 2 hours a night or not at all.

Last November, Heith was serving with the 82nd Airborne and 3rd Armored Cavalry putting in a bridge by the Syrian border. They were attacked and hit with approximately 76 mortars in 3 days on the bridge site. While running to check on a fellow soldier, Heith tore the meniscus in his knee. He waited until he returned to the United States to have surgery to repair the injury.

When asked what might happen next in his military service, Heith says he doesn't know if he will be activated in the future, but he is "ready to go again where he is needed at any time." Heith also served in Desert Storm as a Hospital Corpsman for the Navy.

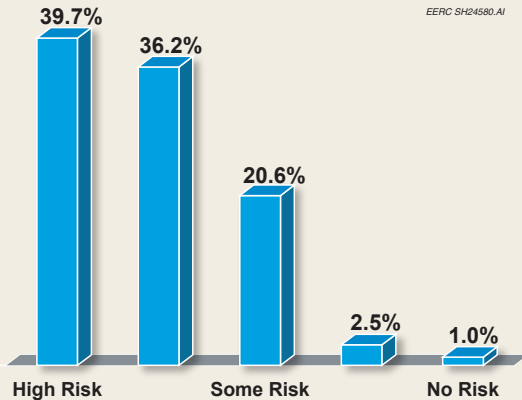
Heith said, "This country has given me so much. I've been able to do so much and see so much." He shows a genuine appreciation for America and has visited 48 states through his military career.

Now that Heith is back, he will continue to work on geographic information system (GIS)-related aspects of the Waffle. Welcome back, Heith!

Landowner Survey Results

EERC Marketing Research Manager Sheila Hanson presented the results of the Wild Rice Watershed Landowner Survey at the Soil & Water Conservation Meeting in July in St. Paul, Minnesota. From the more than 4500 surveys mailed to landowners in the Wild Rice Watershed, 542 were returned. The overall response rate was 11.8%.

Perceived Risk of Future Flooding



The landowner survey was intended to gather opinions regarding existing flood management practices. Participants were landowners in Norman, Mahnomen, Clearwater, Clay, and Becker Counties in Minnesota. The Waffle study was not mentioned until the end of the survey, and no background information on the Waffle was provided to the survey recipients. In the pilot sample, 63% of respondents indicated that they would like to learn more about the Waffle concept.

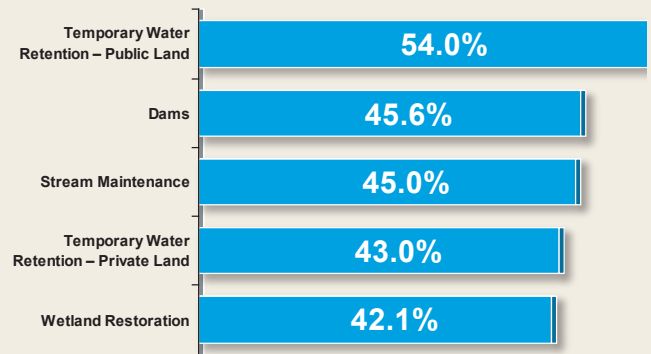
About 70% of respondents had directly experienced problems with flooding. Survey respondents were asked to select the level

of risk that they believe exists for a significant spring flooding event to occur in the Red River Basin in the next 50 years.

Some of the factors that were found to relate to respondents' interest in participation in temporary water storage are higher perceived risk of future flooding, participation in the Conservation Reserve Program (CRP), or if the respondent had ever held back water in the past for any reason.

When respondents were asked to choose useful solutions to spring flooding, the top five answers included temporary water storage on public land, stream maintenance, dams, temporary water storage on private lands, and wetland restoration. Most respondents chose multiple so-

Top Five Flood Mitigation Techniques



lutions to flood mitigation. One common theme that arose in the open-ended responses on the survey is the need to work together on flood mitigation efforts.

Hanson indicated, "We are pleased with the response rate. The results of this pilot survey will help drive the direction of the basinwide landowner survey this winter."

Crop Yield Results (continued from front page)

planting resulting from water storage did not adversely affect yields.

Sunflower yield estimates were identical between the flooded and nonflooded areas of the field at approximately 1191 lb per acre, providing further evidence that the stored water had no significant impact on crop production. There were no comparisons with neighboring fields because no sunflowers were planted there.

Watch for the next newsletter, where we will discuss the findings on water quality, soil nutrients, soil moisture and temperature, and water infiltration and evaporation.

Figure 1

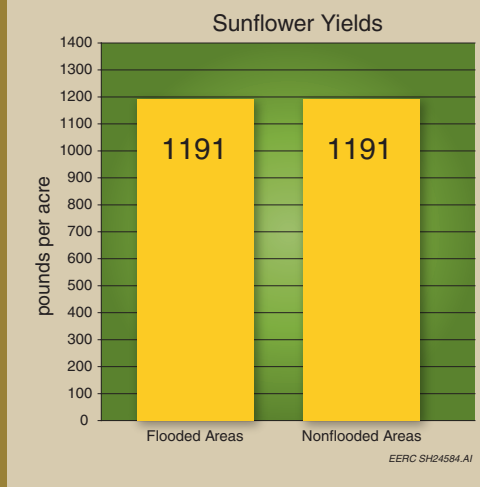
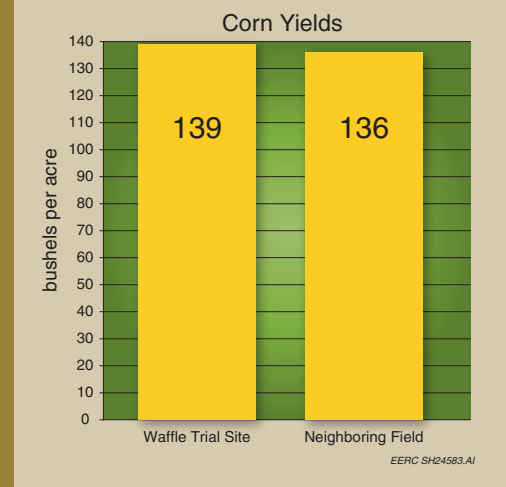


Figure 2



¹NDSU Extension Service, 1999, Estimating crop yields, 1999 ProCrop Index, North Dakota State University, Fargo: www.ag.ndsu.nodak.edu/aginfo/procrop/ (accessed October 2004).

Did you know?

- On average, nearly a third of the water that flows down the Red River each year comes during April (EERC progress report).
- The Waffle team has given presentations at 130 gatherings this year, including township board meetings, soil and water conservation meetings, and service clubs. If you know of a group that would like to learn more about the Waffle concept, please call us at (701) 777-5050.

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Waffle Field Trial (continued from front page)

In addition to potential for water storage, the Waffle team is researching other potential effects on the soil and groundwater. Data from a meteorological station on the site were also used to look at wind speed and direction, temperature, and humidity. From that information, researchers are able to calculate estimates of evaporative losses. Results of a water quality evaluation will be reported in the next newsletter.

Discussions with several landowners concerning the field trial for the spring of 2005 are being conducted in both Minnesota and North Dakota. The intent is to expand the size of the 2004 demonstration and conduct the field trial on a scale large enough to include several sections in 2005.



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