IOWA'S WATER
Ambient Monitoring Program

Assessment of Impervious Surfaces
in an Urban Watershed

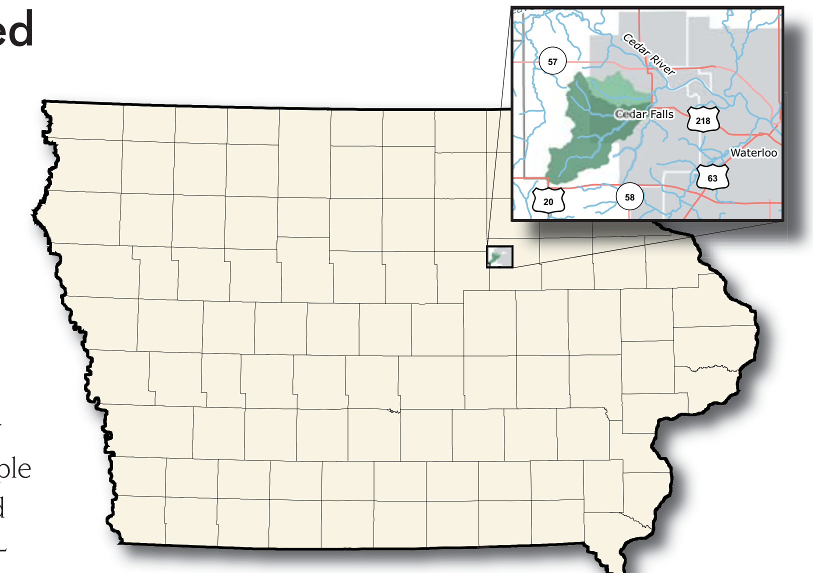

Figure 1. *Location of the two study sub-watersheds in Cedar Falls, Iowa – University Branch (light green) and Southwest Branch (dark green).*

An assessment of watershed condition is an important step in helping to determine the best actions to address water quality or quantity issues. While these assessments have traditionally been conducted by driving the watershed and recording observations, new technologies and tools have emerged that enhance the process – particularly within urbanized watersheds. An example of one new tool is the Urban Watershed Management Assistance (UWMA) application developed by the GeoInformatics Training, Research, Education and Extension (GeoTREE) Center at the University of Northern Iowa (UNI). The goal of this student-led project was to develop basic data sets that the City of Cedar Falls and the University of Northern Iowa could use for watershed-based planning and management.

The UWMA application consists of two tools: the Watershed Delineation tool and the Watershed Management Assistance tool. Watershed Delineation helps the user define the boundaries of the watershed of interest, while the Watershed Management Assistance Tool creates visual depictions or maps of physical characteristics within a watershed based on modeling of specific criteria such as soil type, landforms, or sensitive species. Based on the mapped output of the models, the user can identify high and low priority areas for watershed conservation or management activities.

The UWMA tool also helps to customize watershed assessments to the features of the urban landscape. Currently, urban watersheds are assessed with respect to basic physical data (such as land use, steeply sloping areas, and erodibility) that are also collected in rural areas. While these data are critical data, the impervious surface areas and storm drain information helps to predict the flow pathways from the urban landscape to streams, which can then be used to target best management practices (BMPs) to reduce peak storm runoff and delivery of pollutants to the stream.

Currently the City of Cedar Falls is testing the UWMA tool to generate preliminary data for their city-wide watershed assessment, a requirement of their MS4 (municipal separate storm sewer system) permit with the State of Iowa. By setting specific priorities and modeling accordingly, the city will be able to target areas on a micro-watershed scale for stormwater management practices, including retrofits of existing urban areas. In the future, this tool may be modified or expanded for use in other areas.

For More Information

The UWMA application tool can be downloaded from the web at www.faculty.sfasu.edu/zhangy2/download.htm (UWMA.zip) and also available from the GeoTREE Center at the University of Northern Iowa and the City of Cedar Falls. Data are available with the UWMA application, but are intended for software demonstration and tutorial purposes only. However, customized data sets can be generated for additional urban areas interested in using the UWMA tool. This project was intended to serve as a prototype and proof of concept to test the tool and analyze performance for urban watershed assessment and management.

Acknowledgements
Dr. Ramanathan Sugumaran, GeoTREE Center director, and Dr. Yanli Zhang serve as primary contacts for product development at the University of Northern Iowa. Khaledur Rahman served as the graduate research assistant for this project at the GeoTREE Center. Dr. Zhang with Stephen F. Austin State University developed the extension for the UWMA.

Funding
Water monitoring activities of the Iowa Department of Natural Resources are funded by Iowa Infrastructure – Environment First Fund appropriations, as well as grants provided by the U.S. Environmental Protection Agency from Sections 106 and 319 of the Clean Water Act and the Regional Environmental Monitoring and Assessment Program. Funding for this project was provided by the City of Cedar Falls and the University of Northern Iowa. The Iowa Department of Natural Resources provided in-kind technical support.

Iowa Watershed Monitoring and Assessment Program Web Site – www.igsb.uiowa.edu/wqm/

Prepared by
Iowa Department of Natural Resources, Geological and Water Survey
109 Trowbridge Hall, Iowa City, IA 52242-1319

Printed on Recycled Paper

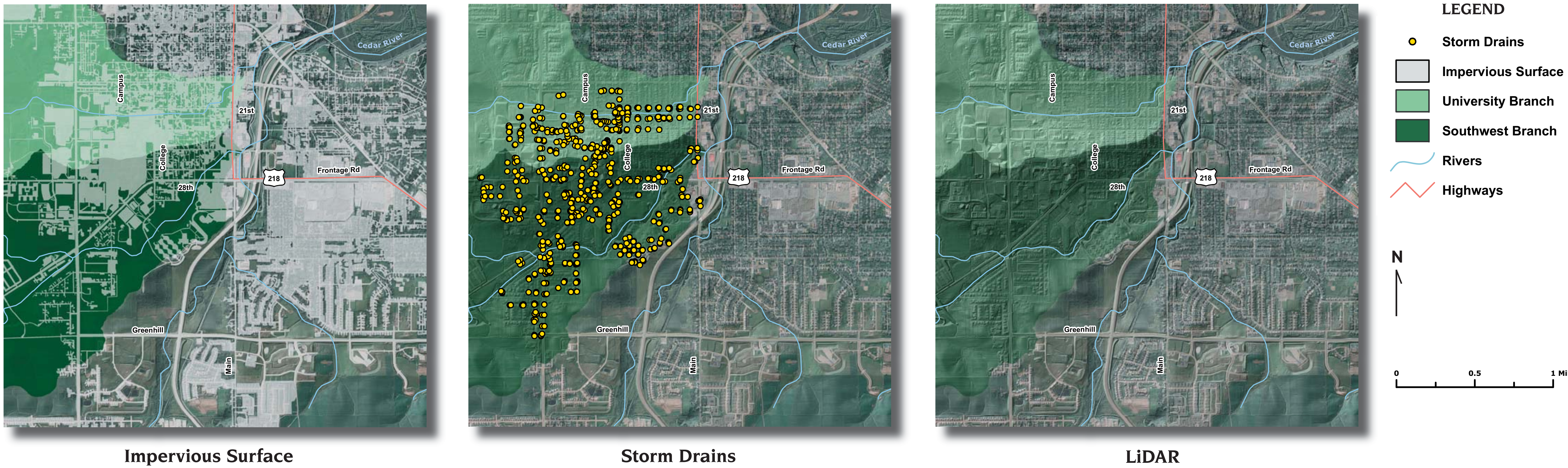

Figure 2. *Maps showing the University Branch and the Southwest Branch of the Dry Run Creek Watershed in Cedar Falls, Iowa.* **Impervious Surface** *shows buildings, roads, and parking lots (gray areas) present in the study area.* **Storm Drains** *map includes inlets from streets and parking lots and storm drain outfalls which drain to the creek (yellow circles).* **LiDAR** *shows detailed topography of the study area.*

to have, there are also details in urban watersheds that often go overlooked when applying traditional methods of assessment. Impervious surfaces (areas where rainfall can not infiltrate into the ground) shed water to artificially created storm drains, which is quickly delivered to creeks and streams creating potential issues with both water quantity and quality. These uniquely urban characteristics need to be identified and integrated with other physical data to determine the status and impact of land within urban watersheds.

Sub-Watershed Assessment and Mapping

To test the UWMA tool, priority subwatersheds in the Dry Run Creek watershed were identified for assessment and mapping activities. The Dry Run Creek watershed comprises more than 15,000 acres, including most of the City of Cedar Falls. An assessment of the entire watershed would prove too costly and time consuming for a student project. Instead, two priority sub-watersheds were chosen for this project: the University Branch (2.50 mi^2) and Southwest Branch (9.69 mi^2) of the Dry Run Creek watershed (Figure 1).

Elevation data and topography are important physical characteristics in understanding how water moves in landscapes. These data are particularly important in urban environments where the natural hydrology has been altered. To improve the assessment for the Dry Run Creek watershed, elevation data were gathered through LiDAR (Light Detection and Ranging). LiDAR uses lasers to scan the Earth's surface from an aircraft to determine highly accurate elevation data. When LiDAR information is combined with other data for the City of Cedar Falls and the University of Northern Iowa, maps depicting critical drainage conditions can be created (Figure 2).

Impervious Surface and Storm Drain Data

Satellite photographs were used to identify impervious areas (buildings, roads, and parking lots) within the City of Cedar Falls and refined for the Dry Run Creek watershed with a special emphasis on the southern portion of the watershed, including the Cedar Falls Industrial Park and the University of Northern Iowa campus.

To further enhance the understanding of storm drainage in the Dry Run Creek watershed, storm drain inlets and outlets were identified and mapped within two sub-watersheds in the City of Cedar Falls (Figure 2). Six hundred thirty-three data points were collected during the month of July 2009. Points collected included storm drain inlets from streets and parking lots, storm drain outfalls draining to the creek, as well as "beehive" drains located in vegetated areas (Figure 2). Together with the LiDAR