



The influence of
**LANDSCAPE
FACTORS**
on transportation systems

prepared by Iowa State University

Overview



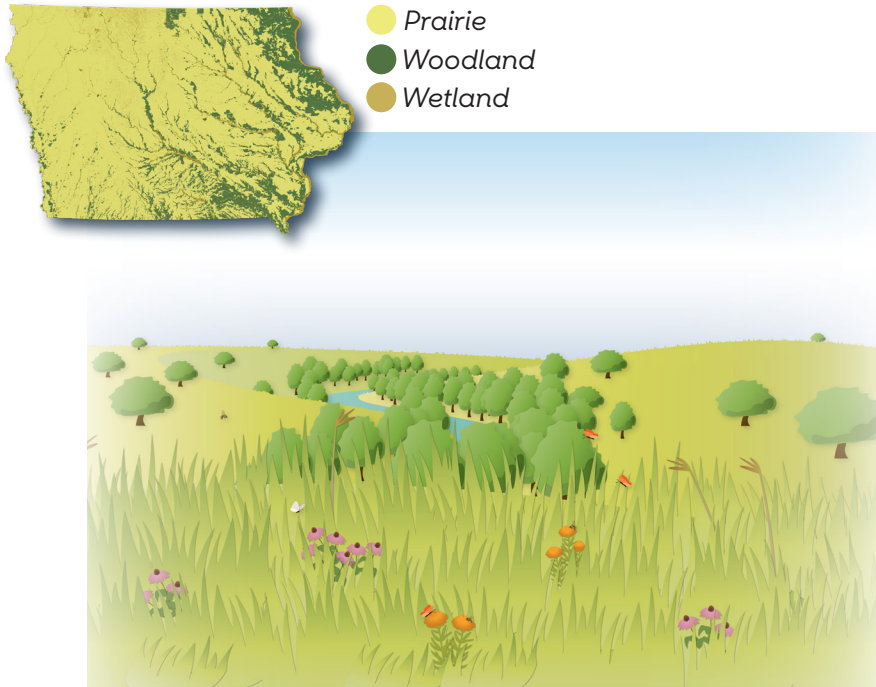
This presentation explores the relationship between the landscape and built systems in your community. Specifically, we will examine:

- The development of transportation systems and community land use over time
- How surface water and topography affect where communities and transportation systems develop
- The impact of groundwater (when present) on transportation and land use
- Benefits of trees and other vegetation and how trees in towns fit with transportation networks, main streets, and neighborhoods

Burt is a town of approximately 600 residents just east of Highway 169 in Kossuth County in North Central Iowa. Located west of the East Fork Des Moines River, Burt was settled in 1881 at the time when the Northwestern Railroad was under construction. The community was named after Horace G. Burt, who was president of the Union Pacific Railroad from 1898 to 1904.

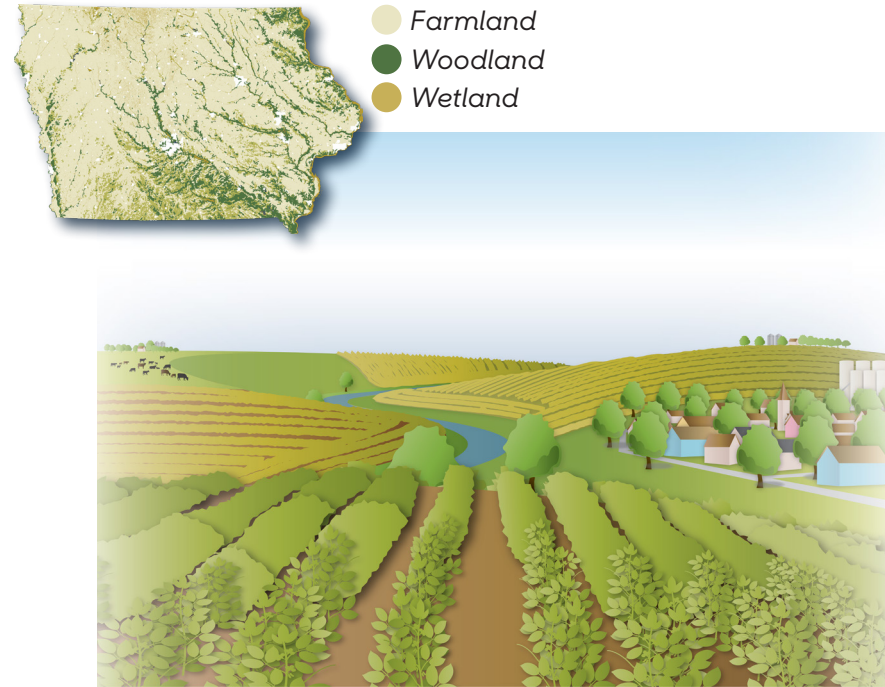
Burt is situated within the Des Moines Lobe ecoregion, so most of the surrounding area consisted mainly of tallgrass prairie that has been converted to agricultural use. Burt lies in a relatively flat part of the state with subtle changes in topography. This landscape type is often known as drum and kettle because of its characteristic small mounds and depressions.

Land Cover Changes Over Time



Historical Landscape

The historical landscape of Iowa was dominated by prairie and savannas. Tree canopy was typically found in valleys along river corridors adjacent to scattered savannas, because the fires that maintained the prairies could not spread as easily in those places. Native plants such as switchgrass, little bluestem, coneflower, and milkweed are some of the more recognizable plants found in the diverse prairie landscape.



19th Century Landscape

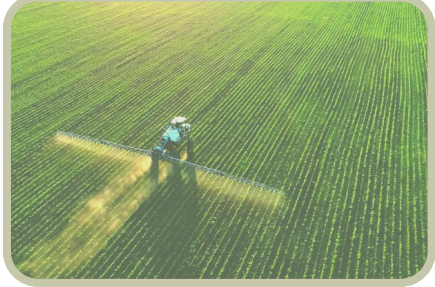
The once-dominant prairie has been replaced by agricultural fields, pasture lands, and small towns in the post-settlement Iowa landscape. Fire suppression and development have allowed for greater growth of wooded areas among the rural landscape and in town. At the same time, many wooded river corridors have narrowed to make more room for cropland.

Current Land Cover

Impervious Surfaces



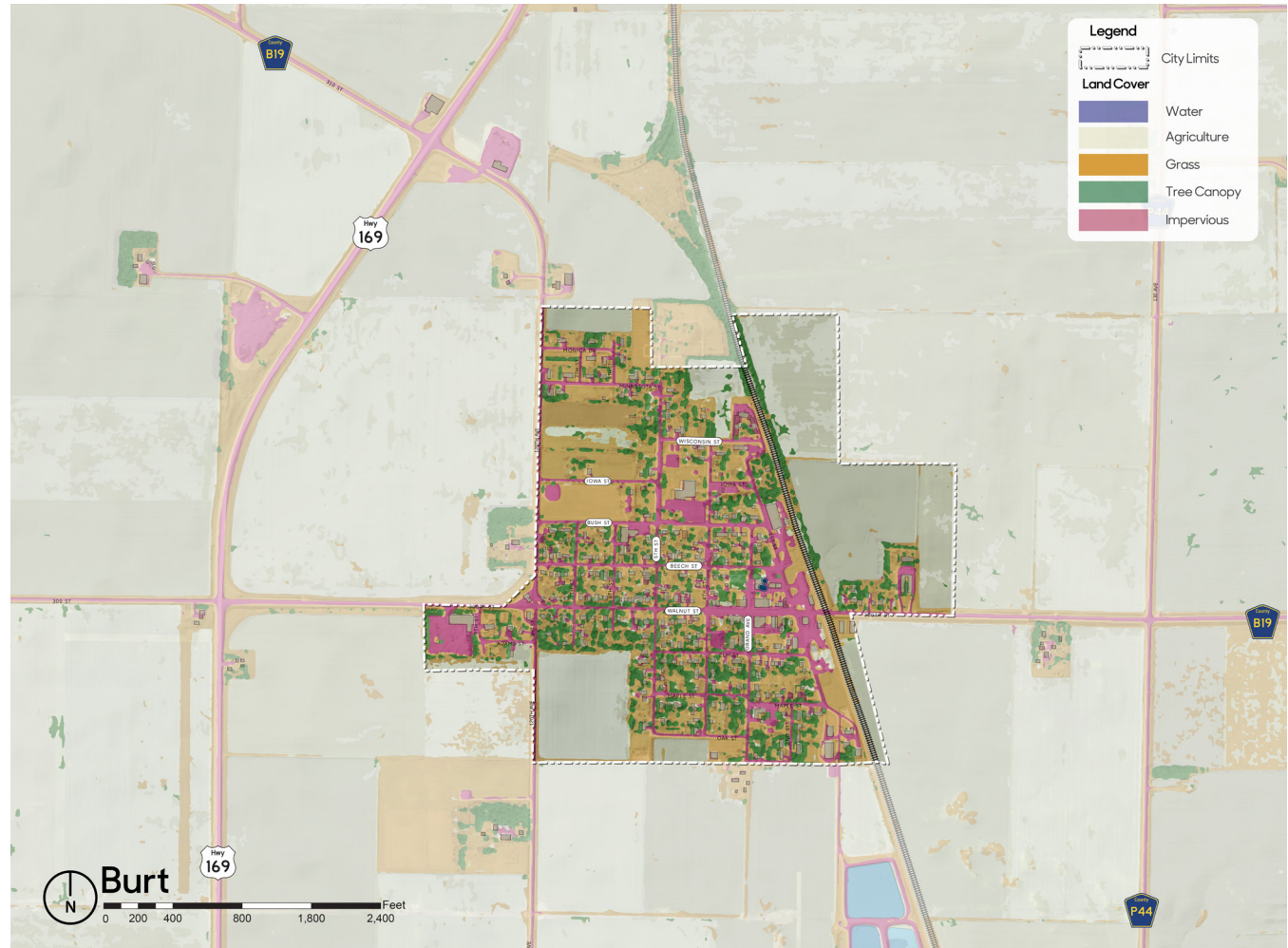
Agricultural Land



Grassland/Lawn

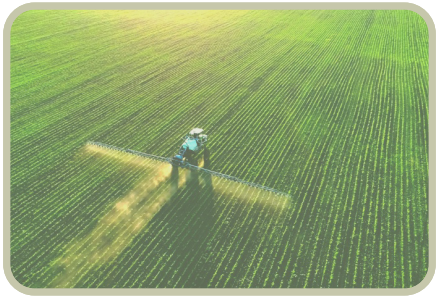


Tree Canopy



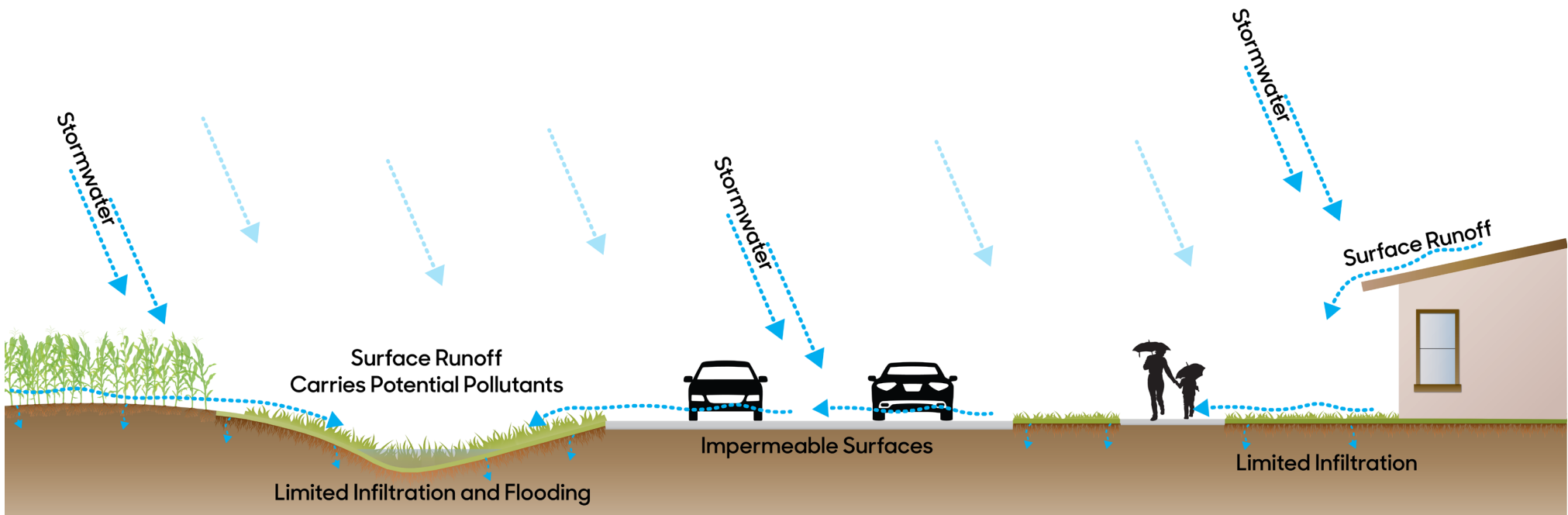
The land cover in most of Iowa's small towns today is a mix of residential lawns or neighborhood spaces dotted by trees. Streets and parking are paved and are sometimes flanked by sidewalks. Commercial and industrial zones are typically dominated by impervious surfaces.

The land cover in Burt consists primarily of lawns and scattered trees in residential areas, and impervious surfaces in the business district and along the railroad tracks.



Impervious Surfaces, Agricultural Land, & Lawns

Impervious surfaces limit or prevent stormwater from infiltrating the ground and, in expansive areas, can create heat-island effects through stored and reflected heat. Agricultural land that is in annual crops and tilled provides limited infiltration, which can contribute to local flooding. Lawns can also limit infiltration, especially over compacted soil. All of these factors contribute to stormwater runoff and localized flooding, especially during intense rainfall.



Groundwater Concerns

The depth to the water table refers to the distance from the surface that groundwater fully saturates soil. In places with a high water table (zero or only a few feet below the surface), groundwater can well up and cause localized flooding. Rivers and natural lakes are generally areas where the water table is above the ground. These rivers and lakes receive most of their water from groundwater with some surface-water runoff from rain or snowmelt. This is why rivers can still be seen even if it hasn't rained in a while.

High water tables can have effects beyond just surface pooling, such as in the case of "frost boils." Frost boils result from groundwater freezing during winter and forming bubbles of ice called "ice lenses" that expand and push up from the ground. When the ice thaws, the frost boils collapse, leaving a divot in the surface. With certain kinds of flexible pavement, such as asphalt or gravel, these frost boils form potholes.

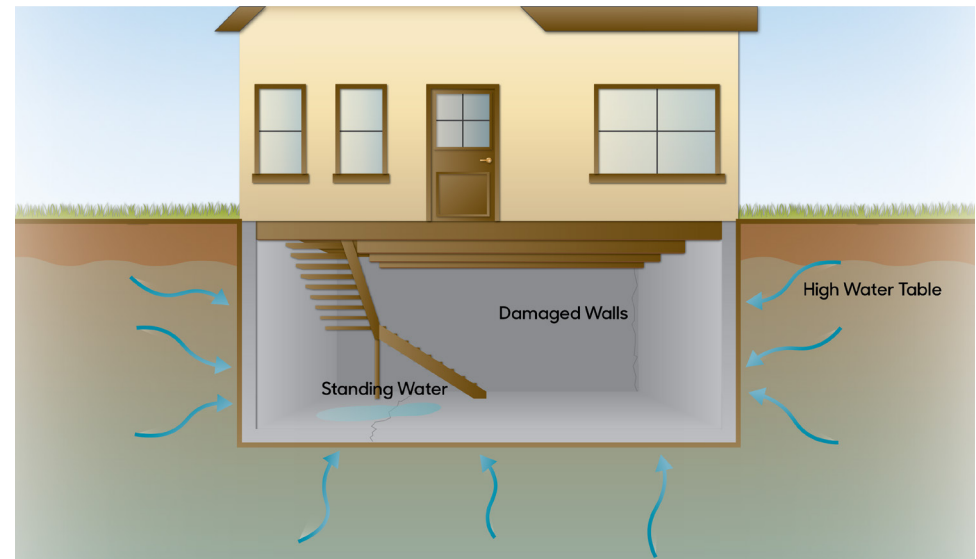
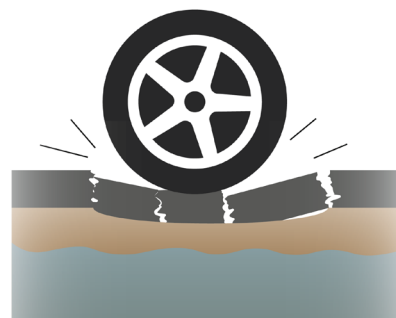
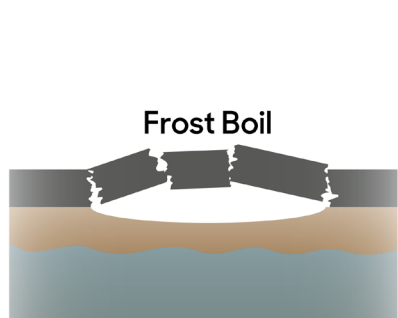
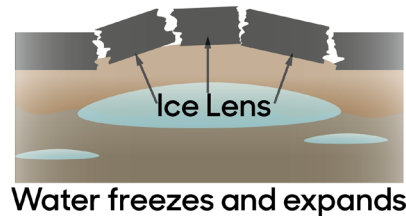
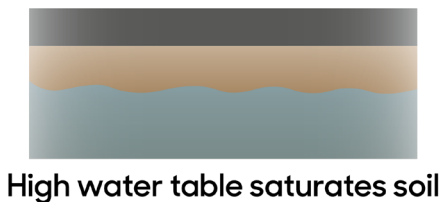


Diagram of the effects of a high water table on foundations and basements.

High groundwater tables can also have detrimental effects on one's home. Houses with basements surrounded by a high water table develop cracks or damaged walls due to water pressure. Typically a tile drain mitigates some of these effects, but wet foundations can require "dewatering," which can be expensive. Developing landscapes with high water tables requires more expensive maintenance, construction, and paving. Creating public spaces or parks in these areas makes good sense.



Ice thaws and saturated soil collapses

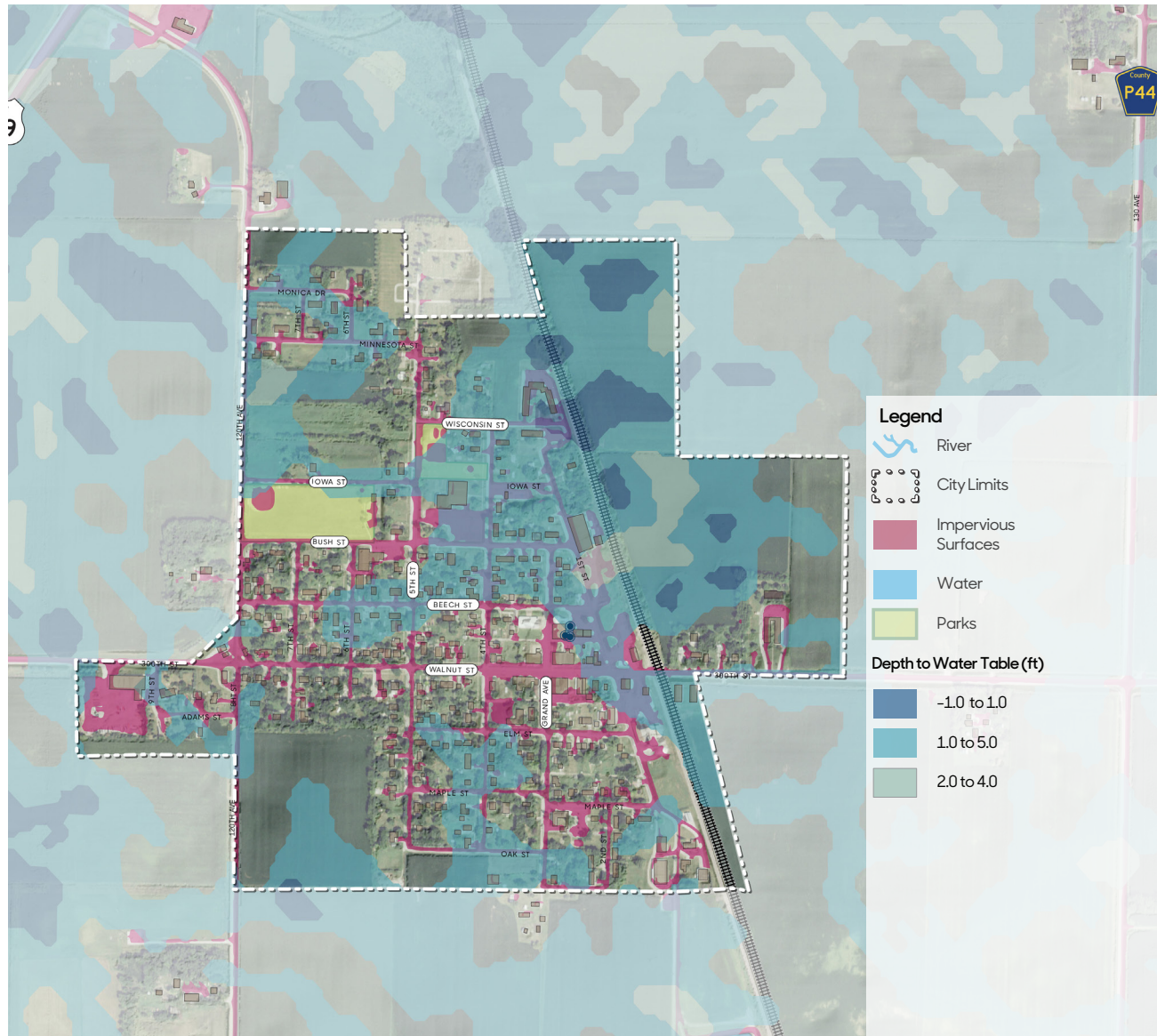
Traffic breaks bubble and wears surface

Diagram of the process by which frost boils affect roadways.

Example Community



Emmetsburg's high water table has caused repeated damage on streets and parking lots. The highway shows signs of continual repairs.



Groundwater and impervious surface map of Burt, IA

Most of the residential areas of the community have a groundwater depth from 1 to 5 feet or deeper. Scattered throughout the community are patches that could have exposed water during the wet season.

Looking at your town map, are there areas where the high water table and impervious surfaces overlap? Next time you are in this part of town, note local pavement conditions. Do you see signs of cracks or buckling? Has the surface been patched multiple times?

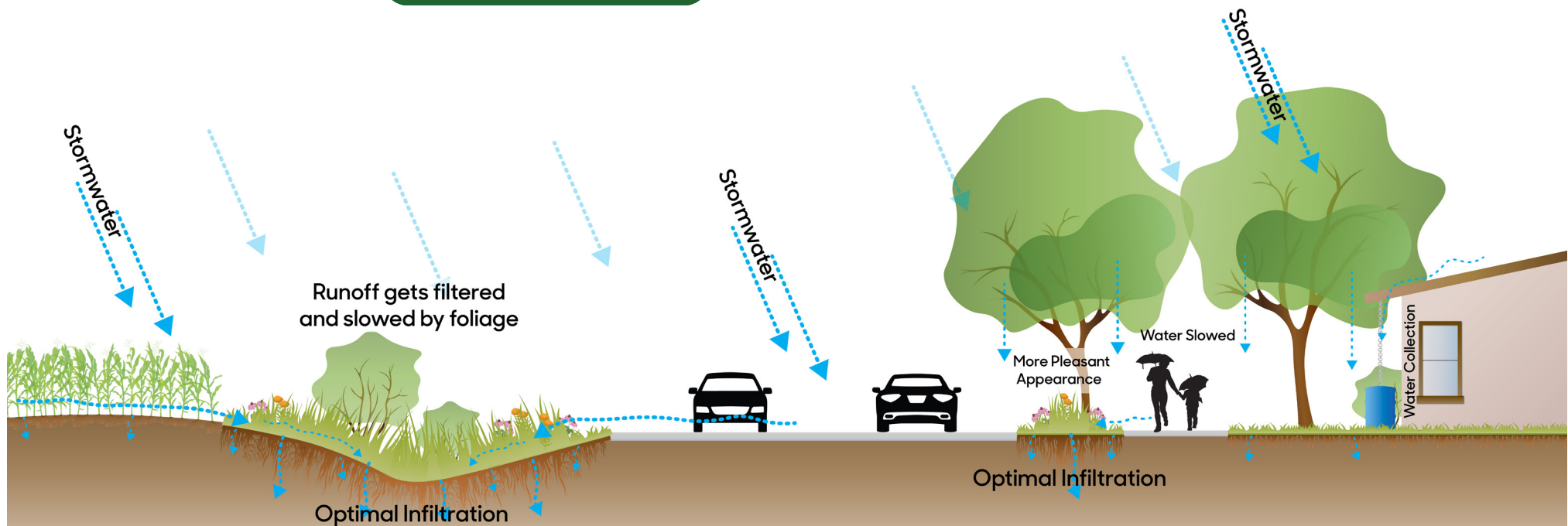
Vegetation Benefits



Grasslands & Tree Canopy

Native grasslands with deep-rooted plants aid in infiltrating stormwater, while dense foliage slows and filters stormwater from other areas. Practices such as bioswales and natural roadsides capitalize on these benefits to improve water quality.

Trees offer many advantages. They clean the air, create shade, and cool the atmosphere. They intercept rainfall, which helps mitigate stormwater runoff and flooding. They consume groundwater, which lowers the water table and makes space for water storage below ground. Carefully chosen and placed trees create community identity and make spaces comfortable for residents. Grasslands and trees provide habitat for pollinators and birds, which provides enjoyment for residents.

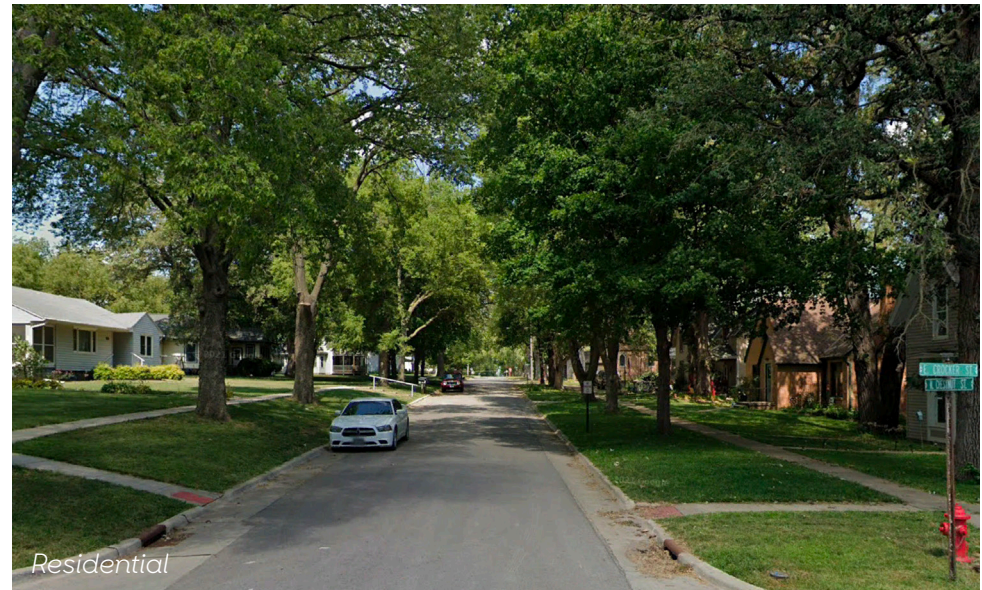




Example Streetscapes with Minimal Vegetation



Example of Vegetated Streetscapes



Lack of street trees creates uncomfortable spaces that feel unwelcoming and exposed to the elements.

Street trees, shrubs, and planters along a roadway offer shade and protection from the elements, while also enhancing the experience of the street.

Vegetation Benefits



Land Use Map of Burt, IA

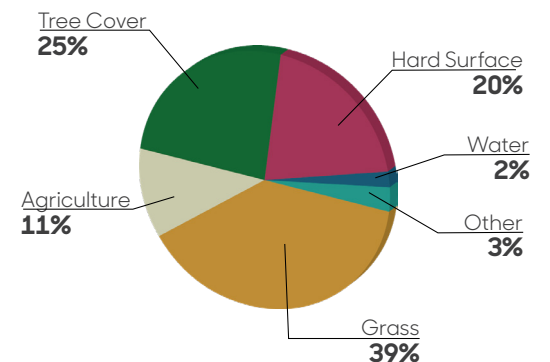
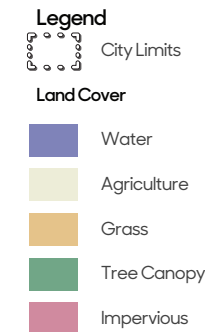
Much of the impervious surfaces in Burt are situated adjacent to the railroad tracks and throughout the downtown, while residential areas are dominated by lawns with some tree canopy.

Looking at the heart of your community, does your downtown core have trees?

How does this change as you move from the downtown into residential areas of town?

Reflecting on your own experiences, where do you feel most comfortable on a hot summer day?

How do you think visitors see this space?





*Aerial photograph of Burt, IA
The less vegetated locations in Burt are exposed to sunlight, particularly in the downtown area, which consists mainly of impervious surfaces.*

Next time you are out in town, note what it feels like to be in areas where there are more trees and vegetated areas.

How does it feel to be in areas mostly dominated by impervious surfaces with minimal vegetation?

Do you notice a difference in how many people pause or gather in those spaces?

Surface Water Conditions

A watershed is an area defined by elevated boundaries that separate water flowing toward different rivers and creeks. These basins show the extent of a drainage area flowing to a single outlet point.

Where a community is located within its watershed(s) determines how much water flows into or through it. Location also influences the town's capacity to manage flooding issues. For example, a community located near the end of a watershed (close to the outlet point) will have little capacity for reducing the amount of water draining toward it from upland areas, and will receive greater volumes of water during flooding seasons than other communities located higher in the same watershed.

Development of channelized waterways, drainage tiles, and impervious surfaces also leads to increased quantities and speed of the water headed downstream; while a community located near the top of its watershed may not experience flooding, managing water will have a greater effect on neighboring communities downstream.

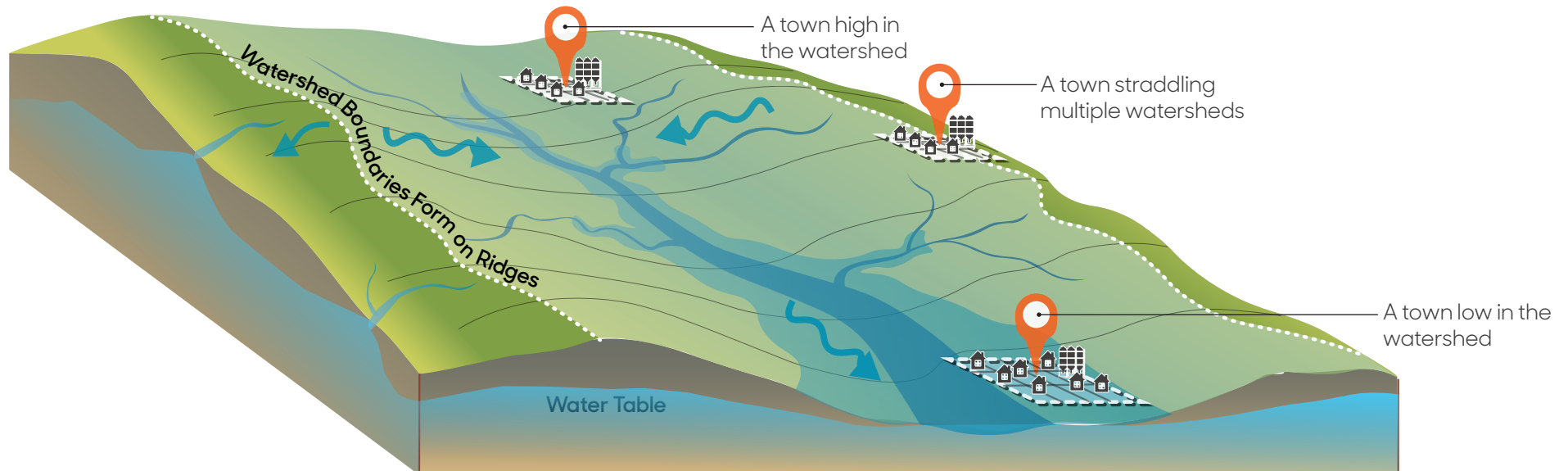
The map on the following page highlights your community within its surrounding watershed(s).

Where is your community located within the watershed(s)? Is water flowing to your community or away from it?

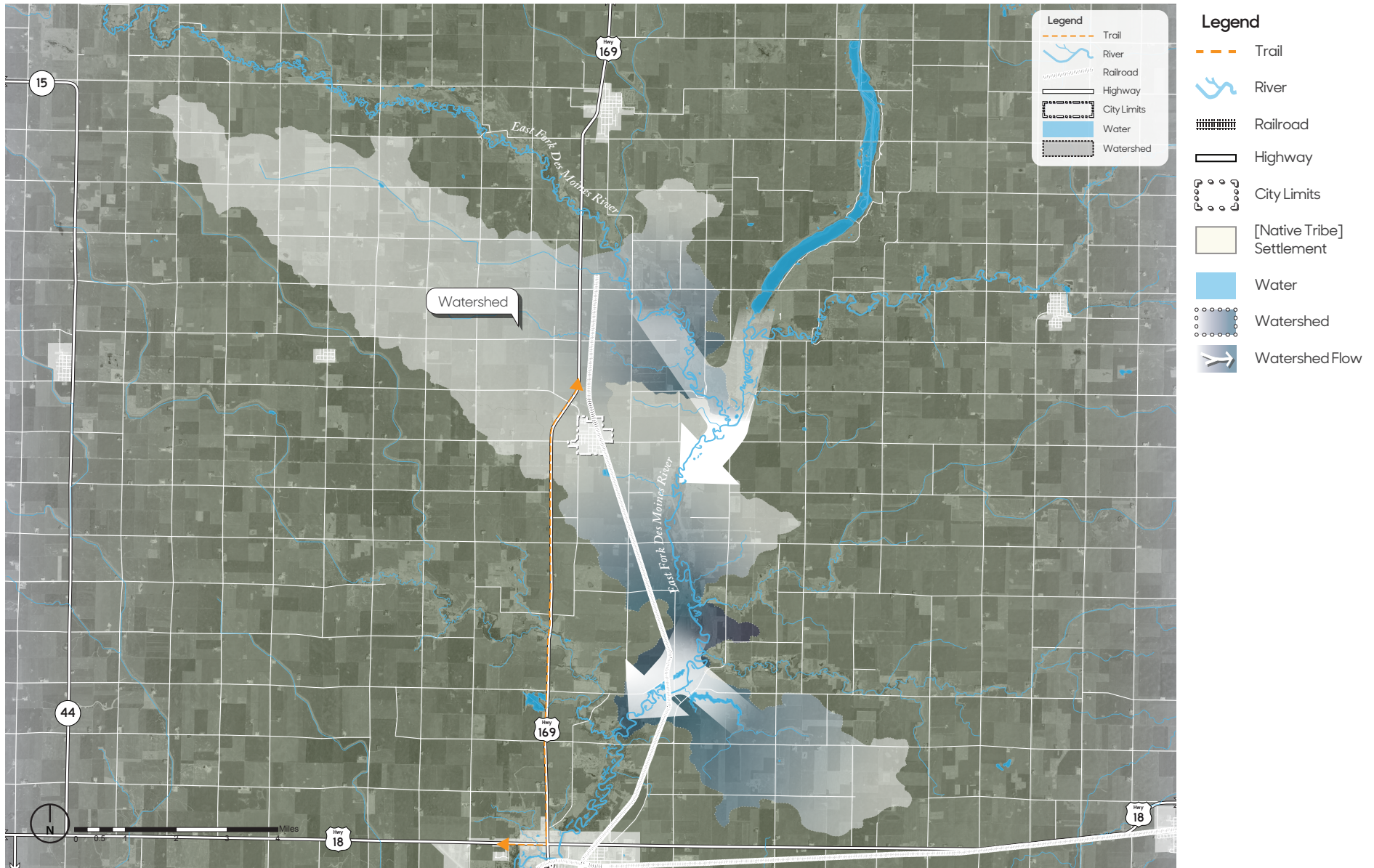
Is flooding an issue in your community?

How big is the watershed above your town? What conditions might increase or reduce flooding?

Are there conditions or practices happening in your community that could be creating risk for communities downstream from you?



Axonometric diagram of the physical characteristics of a watershed.



Watershed map of Burt, IA

Burt is higher up in the watershed, which means that water will flow away from town to the river. The flatness of the region limits water outside of the community from flowing through. In this drum-and-kettle landscape, water tends to settle in subtle depressions in the land. Burt's location relative to the nearest river is outside of any floodplains.

Settlement Patterns

The elevation and flow map displays topographic differences in elevation using a combination of contour lines and the color gradient depicted in the legend.

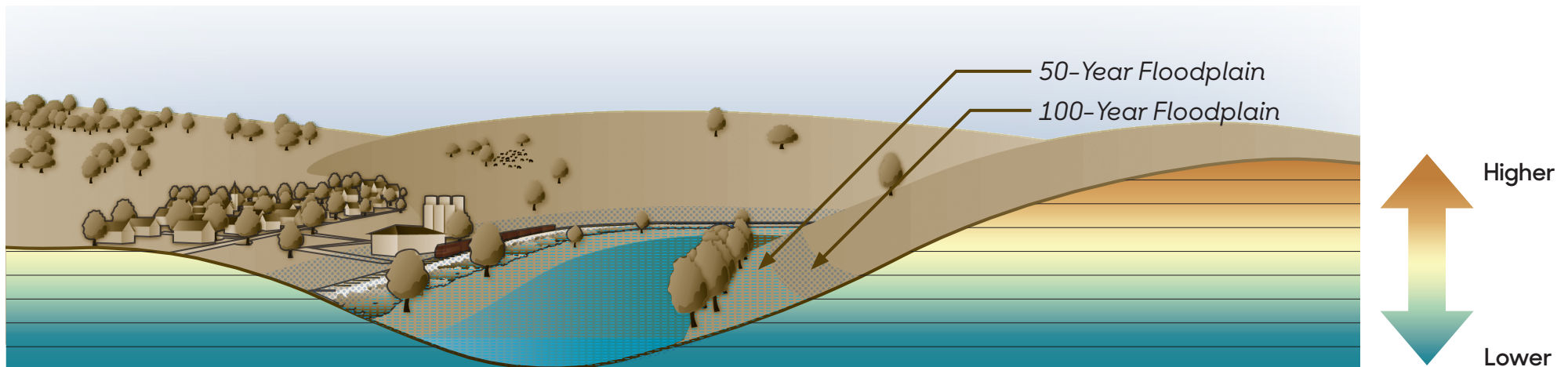
The north central region of the state is known for relatively flat and fertile soil that provided great opportunities for agricultural development. The flatness of the landscape also would have made it easy for creating transportation corridors. However, the potential for high groundwater can create structural challenges for that infrastructure. With no creeks or rivers immediately nearby, Burt is out of the floodplain.

Note the relationship of your community to the surrounding elevation: is it located in a valley, on high ground, or is it split between the two?

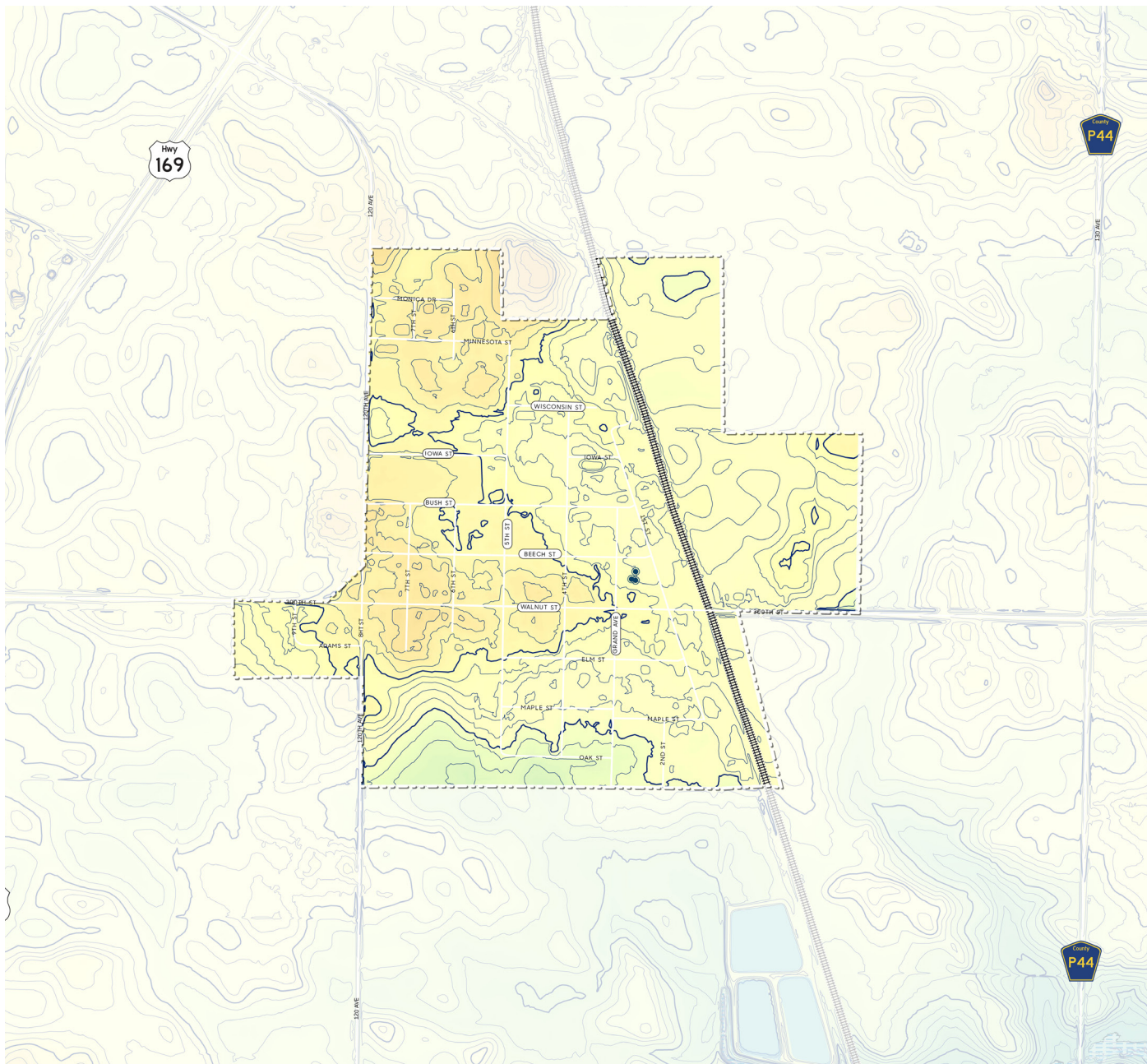
Which parts of the community are low or high in the landscape?

Why might this be the case?









What landform conditions might have driven development decisions?



Sectional diagram depicting the scale of elevation in relation to topographic features and development patterns.



Legend

-  River
-  City Limits
-  Road
-  Railroad
-  Water
-  2ft Contours
-  Water Well
-  Higher Elevation
↓
Lower Elevation

Elevation and flow map of Burt, IA

Burt is located in an area that is relatively flat, making it an ideal stop along the railroad. The flatness of the area also allowed for undisrupted outward development for residential and agricultural use.

