# $3 \mid \text{Watershed Characteristics}$

Photo: A wintry mix of precipitation falls on the English River. Photo courtesy of Dan Ehl.



# 3.1 Land Use

#### Historic Land Use

The Government Land Office (GLO) conducted the original public land survey of Iowa between 1832 to 1859. Surveyors and their assistants produced both field notes and township maps that briefly described the land and its natural resources (vegetation, water, soil, landform, etc.) at the time of the survey. These maps and survey notes are one of the few data sources about vegetation distribution before much of Iowa changed to a landscape driven by intensive agriculture. The data presented in Figure 3 represents the observed vegetation by the deputy surveyors when laying out the public land surveys. At the time, the English River watershed was classified as 83 percent prairie, 16 percent timber, and 1 percent other.<sup>1</sup>



Figure 3. Historical Vegetation in the English River Watershed (1832 - 1859)

#### Current Land Use

Data from the 2013 United States Department of Agriculture (USDA) land cover survey suggests that soybean and corn acres comprised 57 percent of the landscape in the English River watershed (Table 2).<sup>2</sup> Grassland and pasture areas made up 25 percent of the watershed landscape, and developed areas (including open space and high to low intensity development) comprised slightly over 12 percent (Figure 4). In comparison to state averages, the English River watershed had a higher proportion of soybean acres than state averages, as well as a higher proportion of pasture/grassland areas. The same data suggests that the English River watershed had a smaller proportion of corn acres and urban development than average.

The vast majority of the watershed is privately owned; however, in addition to road right-of-ways, approximately 2,165 acres in the watershed are publically owned.



#### Corn Suitability Rating

Figure 5 displays the corn suitability rating (CSR) for land located within the English River watershed. CSR provides a relative ranking of soils mapped in the state based on their potential to be utilized for intensive row crop production. The CSR is an index that can be used to rank one soil area's yield potential against another. Ratings range from 100 for soils that have no physical limitations, occur on minimal slopes, and can be continuously row cropped to as low as 5 for soils with severe limitations for row crops. The ratings assume a) adequate management, b) natural weather conditions, c) artificial drainage where required, d) that soils lower on the landscape are not affected by frequent floods, and e) no land-leveling or terracing.



Above: Figure 5. Corn suitability rating in the English River Watershed. Below: Figure 6. Mean corn suitability rating in the English River Watershed on the subwatershed level



The mean CSR rating for the ERW, including urban land and waterways, is 49.8. Of the 20 subwatersheds in the English River watershed, the Ramsey Creek subwatershed has the highest mean CSR value of 61.9. The Devils Run subwatershed has the lowest mean CSR value of 37.7. In general, higher mean CSR values are observed in subwatersheds located in the eastern and northwestern portions of the ERW, while lower mean CSR values are found in subwatersheds located in the central portion of the ERW (Figure 6).

English River Watershed Improvement & Resiliency Plan

#### Crop Productivity

The number of watershed acres used for raising corn has remained relatively steady in the last 11 years, between 120,000 and 140,000 acres (Figure 7). The number of acres used for raising soybeans has fluctuated slightly during the same time period, between approximately 80,000 and 110,000 acres.



Figure 7. English River Watershed Corn / Soy Acres (2002 - 2013)

#### Livestock Productivity

As of 2014, there were 135 permitted animal feeding operations (AFOs) in the English River watershed.<sup>3</sup> Of these, 42 facilities are located within the Washington County area of the watershed, 34 facilities were within the Poweshiek County area in the watershed, 25 within Iowa County, 18 in Keokuk County, 12 in Johnson County, and 1 in Mahaska County. Combined, these permitted facilities housed approximately 124,045 animals. Approximately 91.5 percent of the livestock accounted for in these facilities were swine; 5.5 percent were poultry, 2.3 percent beef cattle, and less than 1 percent dairy cattle.

## Land Tenure

Farmland owners in Iowa are aging, as is the general population. Land tenure trends in Iowa, captured every five years in a survey by Mike Duffy of Iowa State University Extension. In 2012, almost one third of Iowa farmland was owned by someone over the age of 75 in 2012. The percentage of land owned by people in this age category has been increasing since 1982, when only 12 percent of the land was owned by someone over the age of 75.<sup>4</sup>

Using property data, an analysis of the land tenure was conducted for English River watershed properties. The analysis showed that 73 percent of watershed properties are owned by individuals who live within 5 miles of the property. Another 10 percent of land is owned by landowners living between 5 and 50 miles of the property, and 5.5 percent of the land is owned by landowners living more than 50 miles away. Figure 8 on the following page shows the mailing address zip code locations for property owners in the English River watershed. These findings show impacts of the recent boom in land values.<sup>4</sup>

#### 3.2 Soils

The English River watershed lies in the "Loess Ridges/Glacial Till" soil region of Iowa, which is characterized by soil developed in loess on broad, convex ridgetops and upper sideslopes. The Ladoga, Otley, Clinton, Colo and Gara soil associations comprise over half of the watershed area. The vast majority of soils in the English River watershed are categorized as hydrologic group B or C. Hydrologic groups are used to estimate runoff from precipitation. The hydrologic groups are categories of soils based on their intake of water when saturated and then receive additional precipitation from long-duration storms.

Hydrologic group B soils have a moderate infiltration rate; they consist mainly of moderately deep to well drained soils that have moderately fine to coarse texture.<sup>5</sup> Hydrologic group C soils have a slow infiltration rate because they typically have a layer that impedes the downward movement of water, these soils have a higher runoff potential than B or A soils.

Figure 9 shows where highly erodible land (HEL) is located within the English River watershed. HEL is any land that can erode at excessive rates because of its soil properties. Approximately 45 percent, or 184,156 acres of the watershed, is considered HEL or potentially HEL. The 2014 Iowa Farm Bill requirements specify that producers who participate in any programs offered by FSA, NRCS, or RMA (i.e. federal crop insurance premium subsidies, conservation subsidies, loans and disaster payments) are required to have an approved Natural Resource Conservation Service (NRCS) conservation plan to substantially reduce soil loss before planting on HEL; these provisions do not apply to those farming non-HEL land.<sup>6</sup> The same requirements apply to producers who grow crops on highly erodible land with no crop history prior to 1985, (known as "sod-busting").<sup>7</sup>

## Elevation and Slope

The English River watershed is dominated by rolling terrain and valleys intersected by rivers and streams. LiDAR (Light Detection and Ranging) data indicates that the highest elevation in the watershed is 1,019 feet above sea level, and the lowest elevation within the watershed is 604 feet above sea level.

Table 3. Slopes in the English River Watershed <sup>8</sup>				
Slope Classification	Range	Acres	Description	% of Total
А	0-2%	78,598	Level, or nearly level	19.2
В	2 - 5%	86,132	Gently sloping	21.0
С	5 - 9%	109,851	Moderately sloping	26.8
D	9 - 14%	84,417	Strongly sloping	20.6
Е	14 - 18%	26,985	Moderately steep	6.6
F	18 - 25%	15,592	Steep	3.8
G	25-40%	7,649	Very Steep	1.9

The slope classification data provided in Table 3 was derived from a LiDAR elevation dataset for the watershed. The data suggests that the majority of land in the English River watershed can be classified as slope types A, B, C, or D. Less than 13 percent of the landscape has slopes exceeding 14 percent grade (steep) or higher.



Figure 8. Land Tenure of English River Watershed properties



Figure 9. Highly erodible lands in the English River Watershed

## 3.3 Geology

#### Landform Regions

The English River Watershed (ERW) lies almost entirely within the Southern Iowa Drift Plain (SIDP), which is the largest of Iowa's seven distinct landform regions (Landform Regions of Iowa, Prior, J.C., 1991). The SIDP is typified by an undulating landscape with tabular uplands and a complex dendritic network of incised river and stream valleys. Mature soil development results from a generally thick cover of wind-blown glacial loess covering a thick package of Pre-Illinoisan till.



Figure 10. Map of the landform regions, modified from <u>Landform Regions of Iowa</u> (Prior, 1991) and showing the location of the English River Watershed (in red)

#### Bedrock

The bedrock geology of the ERW is highly variable and complex. The initial bedrock units within the ERW are Pennsylvanian, Mississippian, and Devonian in age, from youngest to oldest (Figure 11). General descriptions of the major bedrock units are listed below. The topography of the bedrock surface is just as dynamic as the surface, ranging in depth from at or near the surface to more than 450 deep (Figure 12).

The influence of bedrock geology varies greatly on local and regional scales. Generally speaking, at locations where bedrock is close to the surface there can be a direct communication between surface water and the groundwater held in bedrock aquifers, which is where the majority of potable water is sourced. In the ERW there are few places where bedrock is at or near the surface, mostly where rivers have cut down to the bedrock surface. From a ground-water quality perspective, the greater likelihood of this communication tends to increase the chances of negatively impacting the aquifer from surface contaminants (i.e. petroleum, fertilizers, pesticides, etc.). Where there is a thick cover of glacial till, or perhaps a shale layer, these bedrock aquifers are considered to be protected from surface contaminants, thus leading to improved water quality to those who use its water. In general, the ERW has enough cover to allow for the major bedrock aquifer units to be protected.

#### Pennsylvanian System

• *Lower Cherokee Group* – Primarily consists of shale and sandstone with minor limestone lenses. The sand stones can be iron-rich and yield low to moderate quantities of water with typically poor quality. These are generally less than 100 feet thick within the English River Watershed.

#### Mississippian System

• *Pella/St. Louis Formations* – Primarily consists of dolomite and limestone with minor sand stone, shale, and chert. Part of the regional Mississippian aquifer system. Thickness varies from 45 to 130 feet.

• *Augusta Group* – Primarily consists of dolomite and fossiliferous limestone with minor cherty units and shale. Part of the regional Mississippian aquifer system. Has a maximum thickness of 200 feet.

• *Kinderhookian* – Primarily consists of dolomite, siltstone, and limestone with lesser amounts of shale, fossiliferous limestone, and chert. Part of the regional Mississippian aquifer system. These have a maximum thickness of 130 feet.

#### **Devonian System**

• *Fammenian* – Primarily consists of shale and siltstone with minor argillaceous limestone. These are generally considered to be a regional aquitard. These may reach thicknesses of up 300 feet.

• *Lime Creek Formation* – Primarily consists of shale and dolomite with minor amounts of argillaceous dolomite/limestone and siltstone. These are generally considered to be a re gional aquitard. They have a maximum thickness of 160 feet.





#### 3.4 Surface Water

The English River watershed is an interconnected series of tributaries and rivers totaling 1,447 miles in length, which is noted in Table 4. Around 409,000 acres of southeastern Iowa drain into it.

Table 4. General Wate	Table 4. General Watershed Data – English River (Waterbody ID Code IA02-IOW-0100)				
Location	Iowa, Johnson, Keokuk, Mahaska, Poweshiek, and Washington counties				
Waterbody Type River					
Watershed Area 409,236 acres					
Total River and Stream length	1,447 mi.				
Dominant Land Use	Row Crop Agriculture				
HUC 12 Watersheds	20 HUC-12 subwatersheds (ID Codes: Refer to Table 6)				
HUC 10 Watershed	4 HUC-10 watersheds				
HUC 8 Watershed	Part of the Lower Iowa (ID Code 07080209)				

The English River begins as a series of tributary streams, originating in Poweshiek and Iowa counties. These tributary streams converge into the North English, Deep River, Middle English Rivers, and Deer Creek (Figure 13). The South English River begins in southeastern Poweshiek County. All of these rivers merge with the South English River in northwest Washington County to form the English River. The English River then flows east through Washington County before merging with the Iowa River, just east of Riverside.



Figure 13. Rivers of the English River Watershed

#### Stream Order

A well-connected stream and river network is found within the English River watershed. The National Hydrography Dataset lists 568 miles of 1st order streams, 162 miles of 2nd order streams, 54 miles of 3rd order streams, 69 miles of 4th order streams, and 36 miles of 5th order streams in the watershed (Figure 14).



Figure 14. Stream order in the English River Watershed

#### Lakes

Lake Iowa is an 84 acre constructed lake in the north central region of the English River watershed. It is the only significant waterbody in the watershed besides the North, Middle and South English Rivers, Deer Creek, and Deep River. Lake Iowa is utilized primary for recreational uses, such as swimming and fishing. The lake's designated uses are Class A1 - primary contact recreation, Class B (LW) – aquatic life, and Class HH – human health (fish consumption). Lake Iowa was placed on the impaired waters list in 2008 by the Iowa Department of Natural Resources for impairments including algal blooms, mercury levels found in the fish, and pathogens (E. coli).<sup>9</sup>

A draft Total Maximum Daily Load (TMDL) has been developed by IDNR to address the nuisance algal blooms in Lake Iowa, and at the time of writing, the TMDL was open for public comment. The TMDL attributes the algal blooms, which cause the impairment of the primary contact recreation designated use, to excess total phosphorus loads. The total phosphorus is derived from non-point sources such as fertilizer and manure from row crops, sheet and rill erosion, and atmospheric deposition. A 79% reduction in total phosphorus loads is required in order to meet the TMDL. The final Lake Iowa Watershed Improvement Plan is anticipated to be available by the end of 2015.<sup>10</sup>

#### Wetlands

Currently, there are approximately 11,250 acres of wetland in the English River watershed (Table 5). Wetland inventory data suggests that of these, over half of the areas (61%) are wet due to temporary flooding. Almost 12 percent of additional wetland areas are intermittently exposed, and less than 5 percent of wetland areas are water-inundated year-round.

Table 5. English River Wetland Inventory				
Wetland Type	Acres	Percent (%)		
Temporarily Flooded	6,908	61.4		
Intermittently Exposed	1,298	11.5		
Seasonally Flooded	1,257	11.2		
Semi-permanently Flooded	665	5.9		
Permanently Flooded	499	4.4		
Intermittently Flooded	418	3.7		
Unclassified Wetland	129	1.1		
Artificially Flooded	76	0.7		
Total	11,250	100%		

Figure 15 shows areas containing identified wetlands in the English River watershed according to the National Wetland Inventory (NWI), a dataset developed by the U.S. Fish and Wildlife Service. The wetland locations were derived from aerial photo interpretation. The NWI maps do not show all wetlands, as the maps were derived from aerial photography with varying limitations due to scale, photo quality, inventory techniques, and other factors. Consequently, the maps tend to show wetlands that are interpreted through readily-accessible photos, with consideration given to photo quality and map scale.



Figure 15. Inventory of wetlands in the English River Watershed

## Watersheds

Watersheds in the United States are nested within one another and classified using Hydrologic Unit Codes (HUCs) based on their scope and size. Watersheds are divided into regional watersheds (HUC - 2) at the large end of the scale, and subdivided into watershed units as small as HUC - 12s. The Upper Mississippi Regional watershed (picured in blue) covers approximately 75 percent of Iowa (Figure 16). The entire area drains into the Mississippi River.

Regional watersheds can be divided into HUC – 8 watersheds. The English River watershed is part of the Lower Iowa Watershed, pictured in green (Figure 16).



Figure 16. HUC - 8 watersheds, including the Lower Iowa watershed

## Subwatersheds

The Lower Iowa Watershed can be broken down further into additional, smaller watersheds called HUC -10s (Figure 17). Four of these HUC -10 watersheds comprise the English River watershed. The HUC -10 watersheds that make up the English River watershed are the North, Middle, and South English, and the English River subwatershed.

There are 20 subwatersheds (or HUC – 12s) that comprise the English River watershed. The Dugout Creek watershed is also known as the headwaters of the North English River, and is the largest HUC – 12 in the ERW with an area of 36,000 acres. In comparison, the smallest HUC – 12 in the ERW is a creek with no official name (known by the U.S. Geological Survey as the "Town of Tilton" subwatershed). Table 6 shows each HUC – 12 and their relative size in acres and square miles.



Figure 17. English River Watershed area and the other HUC - 10 subwatersheds of Iowa, including HUC - 12 wastersheds

Table 6. HUC – 12s of the English River Watershed				
HUC – 12 ID	USGS HUC – 12 Name	IGS HU – 12 Name	Acres	Sq. Miles
070802090401	Headwaters North English River	English River-Dugout Creek	36,075	56.3
070802090302	Middle English River	Middle English River	29,845	46.6
070802090503	Middle South English River	Middle South English River	27,397	42.8
070802090603	Deer Creek	Deer Creek-English River	26,571	41.5
070802090403	Deep River	Deep River	26,535	41.4
070802090601	Lime Creek	Lime Creek-English River	26,208	40.9
070802090504	Lower South English River	Lower South English River	25,728	40.2
070802090606	English River	English River-Bulger's Run	25,425	39.7
070802090602	Birch Creek-English River	English River-Birch Creek	21,928	34.2
070802090404	Jordan Creek-North English River	English River-Jordan Creek	19,540	30.5
070802090402	Upper North English River	Upper English River	19,076	29.8
070802090502 Uooer South English River		Upper South English River	18,411	28.7
070802090605	Ramsey Creek-English River	English River-Ramsey Creek	15,438	24.1
070802090301	Gritter Creek	Gritter Creek	14,836	23.2
070802090408	Outlet North English River	English River-Middle English River	14,193	22.2
070802090405	Devils Run	Devils Run	13,007	20.3
070802090406	Middle North English River	English River-Deep River	12,841	20.1
070802090604	Camp Creek	Camp Creek-English River	12,818	20.0
070802090407	Lower North English River	English River-Devils Run	12,611	19.7
070802090501	Town of Tilton	Unnamed Creek-South English River	11,016	17.2

#### 3.5 Groundwater

Aquifers

Wells in the English River watershed typically serve one of three purposes: public or private drinking water sources, agricultural / livestock use. Water resources are tapped through shallow or deep wells, depending upon the aquifers readily available for the community or individual to access. The vast majority of available geologic and hydrogeologic data is collected when drilling water wells. The following are the types of aquifers in the English River Watershed:

- *Alluvial* Unconsolidated sediments found within a natural river or stream floodplain. The average depth of the 12 alluvial wells in the ERW is 50 feet.
- *Buried Sand and Gravel* Unconsolidated sand and gravel units found within the glacial till package. The average depth of the 30 buried sand and gravel wells in the ERW is 150 feet.
- *Cambrian Ordovician –* Bedrock aquifer of Cambrian Ordovician age, generally carbonate and sandstone. Depths of public wells in the ERW using the Cambrian - Ordovician aquifer range from about 1,700 feet to 1,950 feet.
- *Devonian* Bedrock aquifer of Devonian age, generally carbonate. Depths of public wells in the ERW using the Devonian aquifer range from about 120 feet to 425 feet.
- *Mississippian* Bedrock aquifer of Mississippian age, generally limestone and dolomite (carbonate). Depths of public wells in the ERW using the Mississippian aquifer range from about 100 feet to 400 feet.
- *Silurian* Bedrock aquifer of Silurian age, generally carbonate. Depths of public wells in the ERW using the Silurian aquifer range from 640 feet to 825 feet.

## Drinking Water Sources

There are approximately 3,076<sup>11</sup> wells in the English River watershed that are documented by the Iowa Department of Natural Resources (IDNR). Based on the Iowa Geological Survey (IGS) online geologic sampling database GEOSAM<sup>12</sup>, there is data for 845 of the wells in the watershed. Among those are public water supply wells that serve the public. Table 7 shows the breakdown of aquifers being tapped by public wells in the watershed.

	Table 7. Aquifer Use by Public Wells in the English River Watershed						
Well Status	# of wells	Alluvial	Buried Sand & Gravel	Mississippian	Devonian	Silurian	Cambrian / Ordovician
Active	29	7	14	2	1	-	3
Not Used	32	3	15	6	3	3	1
Stand By	3	2	1	-	-	-	-
TOTAL	64	12	30	8	4	3	4

Some public water supplies in the watershed utilize *alluvial* aquifers, or shallow sand and gravel deposits associated with streams and rivers directly in their vicinity. Because of the shallow nature of these ground water sources, they are particularly vulnerable to contamination through surface level runoff, leaching of improperly stored chemicals, leaky storage tanks, or agricultural runoff.

The public water utilities in the watershed that are currently listed as having "Highly Susceptible Systems" are the Cities of Kalona, Riverside, the Shiloh residential development, and the regional water utility- Poweshiek Water Association. Poweshiek Water Association provides four communities in the English River watershed with drinking water: Barnes City, Gibson, Guernsey, and Millersburg. Communities with "Highly Susceptible Systems" have the option to develop and implement a Source Water Protection Plan. The Iowa Department of Natural Resources' Source Water Protection program helps participating communities identify ways to protect their drinking water resources from contamination before it is treated and distributed to consumers. The program offers assistance with planning to achieve this goal. The program's Phase 1 planning results in a more detailed analysis of drinking water resources, threats, and action steps for protecting drinking water at its source. The following English River watershed communities have completed Phase 1 Source Water Protection Assessments: Deep River, Grinnell, Kalona, Montezuma, North English, Parnell, Riverside, Webster, and Wellman. In addition to Phase 1 completion, the following communities have utilized the program to develop Phase 2 assessments: Grinnell, Montezuma, Riverside, and Wellman.

The majority of public drinking water sources in the watershed come from *buried sand and gravel aquifers*. These sources are deeper and as a result, better protected from surface contaminants or leaching.

Sandstone and limestone sources (such as the *Cambrian-Ordovician*, *Devonian*, and *Mississippian* aquifers) are utilized by a few public water suppliers in the watershed. These aquifers are deeper bedrock-level aquifers that are well protected from contamination. These drinking water resources are at risk of contamination in areas where sinkholes are more frequent (such as in the northeastern part of the state), however.

## Agricultural Drainage Wells

Agricultural drainage wells are deep pits that collect drainage from large agricultural tiling systems. Agricultural drainage wells pose a risk to the safety of drinking water supplies; because of their depths they can allow field drainage to come into contact with, or leach into water aquifers used for drinking water by others. The IDNR estimates that approximately 350 agricultural drainage wells were in use before legislation passed in 1997 to protect groundwater sources and closed all but around 60 of these wells.<sup>13</sup> There are no reported agricultural drainage wells in the English River watershed.<sup>14</sup> Most agricultural drainage wells in Iowa exist primarily in north central Iowa, where the landscape is flat, and many of these have since been closed.

#### 3.6 Climate & Precipitation

Climate data from the City of Williamsburg, approximately five miles north of the watershed, showed an average area precipitation of 36 inches per year between 1951 and 2013 (Figure 18). Year to year precipitation totals vary widely, however. During that 62 year time frame, a high of nearly 60 inches was recorded in 1993, and lows of 20 inches or less were recorded in 1953 and 1988.<sup>15</sup> These observations were consistent with historic state-wide weather events across Iowa, such as the floods of 1993 and a severe drought in 1988.

Monthly temperature data from the same period of time (1951 to 2013) suggest that on average, July and August are the hottest months of the year (Figure 19).<sup>15</sup> Not surprisingly, the data shows that December, January, and February are typically the coldest months of the year.



Figure 18. Yearly precipitation around the English River Watershed (1951 - 2013)



Figure 19. Average monthly temperatures in the English River Watershed (1951 - 2013) in Williamsburg, Iowa

## 3.7 Demographics

#### Population

Township population data from the 2010 Decennial Census analyzed with GIS (Geographic Information Systems) apportioning tools suggest that approximately that 21,699 people live in the English River watershed. This equates to approximately 33.9 people per square mile. The headwaters of the English River watershed begin in the south-eastern end of the City of Grinnell, but technically, this community is not in the English River Watershed. As the data in Table 8 shows, the largest community in the English River watershed is actually Kalona (pop. 2,363) followed by Montezuma (pop. 1,462). The smallest communities in the watershed are Guernsey (pop. 63) and Gibson (pop. 61).

## Urban/Rural

Of the approximately 21,699 people who reside within the watershed, about 40 percent, or 8,605 people, live in "urban" areas; within the corporate city limits of the watershed's 14 incorporated cities and towns (Table 8). Population density (or persons per square mile) in the watershed is actually greatest at the southeastern end. Although communities like Wellman and Riverside are smaller than Kalona or Montezuma, higher density is created by the presence of rural housing developments combined with the urban areas in these locations.

Table 8. Population in ERW Commu	nities <sup>16</sup>
Incorporated Cities and Towns	2010 Population
Kalona	2,363
Montezuma	1,462
Wellman	1,408
North English	1,041
Riverside	993
Deep River	279
Keswick	246
Parnell	193
Barnes City	176
Millersburg	159
Webster	88
Kinross	73
Guernsey	63
Gibson	61
TOTAL	8,605

#### Recent Population Changes

Portions of 30 county townships overlap with the English River watershed area. Decennial Census data from 2000 and 2010 suggest that 14 of these townships experienced growth during this decade, while 16 townships experienced a population decline (refer to Figure 20).

Areas with the greatest gains are in the southeastern portion of the watershed: Iowa (26%) and Jackson Townships (23%); and in the central portion: Fillmore (20%) and Troy Townships (13%). The greatest population losses occurred in the southwestern area of the watershed, such as Pleasant Grove (-16%), Dayton (-18.5%), Adams (-19%) and Prairie (-20%) Townships.



Figure 20. Population changes in townships within the watershed (2000 - 2010)

## Age

Data from the 2010 Decennial Census, suggest that (in the watershed's townships) the average median age of watershed residents is 42 years (refer to Figure 20 for township boundaries). As the data in Table 9 indicates, Sharon Township in southwestern Johnson County has the lowest median age (27.5) and Dayton Township has the highest (47.7 years).

# Diversity

On average, 98 percent of watershed residents identified themselves as "White" in the 2010 U.S. Census (Table 10). Warren Township (Poweshiek County) is the most diverse township in the watershed, with 4.4 percent of residents identifying with a racial or ethnic group other than "White."



Figure 21. Population density in the English River watershed (2010)

Grant Township's diversity is likely heightened by students and staff affiliated with nearby Grinnell College. Deep River Township (Poweshiek County) is the only area in the watershed where 100 percent of residents identify as being "White."

Warren and Bear Creek Townships (Poweshiek County) have the highest proportion of residents identifying as either "Hispanic" or "Latino" (4.7%) than any other townships in the watershed. Some areas, such as Adams (Keokuk County) and Deep River (Poweshiek County) Townships, did not have any residents who identified as being either Hispanic or Latino in the 2010 Census (Table 10). It is possible that there may be residents who are Hispanic / Latino living in these areas, but they were overlooked or declined to participate in the Census.

Table 9. Median Age in English River Watershed Townships			
Township	County	Total Population	Median Age
Dayton	Iowa	202	47.7
Malcom	Poweshiek	580	47.4
Pilot	Iowa	335	45.8
Adams	Keokuk	421	45.1
Lincoln	Poweshiek	285	45.1
Pleasant	Poweshiek	289	44.8
Prairie	Keokuk	351	44.8
Deep River	Poweshiek	473	44.4
Scott	Poweshiek	257	43.9
English	Iowa	1615	43.8
Cedar	Washington	288	43.6
Jackson	Poweshiek	1838	43.6
Pleasant Grove	Mahaska	297	43.6
Washington	Poweshiek	451	43.4
Warren	Poweshiek	430	43.3
Grant	Poweshiek	522	42.8
Hartford	Iowa	1294	42.4
Liberty	Keokuk	344	42.3
English River	Keokuk	584	42.2
Greene	Iowa	522	41.5
English River	Washington	3924	41.3
Filmore	Iowa	743	41.2
Lime Creek	Washington	2203	41.0
Troy	Iowa	3437	39.6
Lincoln	Iowa	243	39.5
Iowa	Washington	2262	39.3
Jackson	Washington	488	38.1
Bear Creek	Poweshiek	1820	37.6
Washington	Johnson	1200	34.2
Sharon	Johnson	1291	27.5

	Table 10. Racial and Ethnic Diversity in the English River Watershed				hed
Township	County	Total Population	White	Biracial	Hispanic/Latino
Deep River	Poweshiek	473	100.0%	0.0%	0.0%
Lincoln	Iowa	243	99.6%	0.0%	0.4%
Jackson	Washington	488	99.4%	0.4%	2.0%
Prairie	Keokuk	351	99.4%	0.0%	1.7%
Lincoln	Poweshiek	285	99.3%	0.4%	0.7%
English	Iowa	1615	98.9%	0.5%	1.0%
Washington	Poweshiek	451	98.9%	0.4%	0.2%
Pilot	Iowa	335	98.8%	0.9%	0.3%
Sharon	Johnson	1291	98.5%	1.2%	1.6%
Troy	Iowa	3437	98.4%	0.8%	1.3%
Adams	Keokuk	421	98.3%	1.0%	0.0%
Jackson	Poweshiek	1838	98.3%	0.7%	1.1%
Liberty	Keokuk	344	98.3%	0.6%	1.5%
Malcom	Poweshiek	580	98.3%	0.9%	2.4%
Pleasant	Poweshiek	289	98.3%	1.0%	1.7%
Iowa	Washington	2262	98.1%	0.8%	0.9%
Hartford	Iowa	1294	98.0%	0.3%	0.9%
Scott	Poweshiek	257	97.7%	0.0%	2.7%
Cedar	Washington	288	97.6%	0.3%	1.4%
English River	Keokuk	584	97.6%	1.2%	2.1%
English River	Washington	3924	97.5%	0.9%	1.6%
Filmore	Iowa	743	97.3%	0.5%	2.6%
Greene	Iowa	522	97.3%	0.8%	2.9%
Lime Creek	Washington	2203	97.3%	1.3%	1.6%
Pleasant Grove	Mahaska	297	97.3%	0.0%	1.0%
Washington	Johnson	1200	97.2%	1.5%	0.5%
Grant	Poweshiek	522	96.7%	1.0%	0.4%
Dayton	Iowa	202	96.5%	1.5%	2.5%
Bear Creek	Poweshiek	1820	96.0%	0.9%	4.3%
Warren	Poweshiek	430	95.6%	1.2%	4.7%
AVERAGE		966.3	98.0%	0.7%	1.5%

## Household Size

Average household size in watershed townships is 2.56 persons per household. Sharon and Washington Townships in southwestern Johnson County observe the largest average household sizes of 3.68 and 3.23 persons per household respectively. Average family household size may be a little larger in these areas because of the Amish community there. The Amish families tend to have larger families, and multigenerational households are more common. Pleasant Grove Township (Mahaska County) and Adams Township (Keokuk County) average the smallest households; 2.15 and 2.3 persons, respectively.

## Education

Using estimates provided by the American Community Survey (2013), an average of 91 percent of watershed township residents have completed a high school education or the equivalent. Graduation rates are highest (at or near 100%) in Pilot and Lincoln Townships (Iowa County) and in Cedar Township (Washington County). Graduation rates were considerably lower (61%) in Sharon and Washington Townships (Johnson County) and Washington Township (80%) in Poweshiek County. The lower rates of high school completion in the Johnson County townships may be influenced by the large Amish community present; whose youth traditionally complete their formal education at 8th grade.

An average of 17 percent of residents in watershed townships have attained a Bachelor's degree or higher. Troy and Pilot Townships (Iowa County) average the largest percentage of 4-year degree earners at 29.2 and 28.1 percent respectively. An average of 28 percent of Iowa Township (Washington County) residents attain a 4-year degree or beyond. Townships on average with the fewest 4-year (or higher) degree earners are Dayton (Iowa County), Pleasant Grove (Mahaska County), and Lincoln (Poweshiek County), at rates of 10.9, 5.0, and 2.1 percent, respectively.

# Household Income

Median annual earnings for employed watershed residents are \$33,458 annually, per estimates provided by the American Community Survey. These salaries were adjusted for inflation. Median earnings were highest in Jackson (Washington County), Greene (Iowa County) and Washington Townships (Johnson County): \$40,000 – \$50,000. The lowest median earnings were in Pleasant and Scott Townships (Poweshiek County) and Pleasant Grove (Mahaska County): \$16,000 – \$20,000.

Median earnings among men were highest in Jackson and Iowa Townships in Washington County, and Washington Township in Johnson County: \$51,000 – \$78,000. They were lowest in Pilot (Iowa County), Pleasant (Poweshiek County), and Pleasant Grove (Mahaska County): \$12,000 – \$26,000. Median earnings of women were highest in Jackson (Washington County), Pilot (Iowa County), and Liberty Townships (Keokuk County) \$35,000 – \$36,000. They were lowest in Washington (Johnson County), Scott (Poweshiek County), and Pleasant Grove (Mahaska County); \$13,000 – \$15,000.

# 3.8 Watershed Habitat & Conservation

# Fish & Wildlife Habitat

At one time, Iowa's landscape was characterized by abundant prairies, dense woodlands, and wetlands that provided habitat for diverse biological systems. Due to human impacts on the landscape from clearing, draining, plowing, hunting, and development, Iowa has lost over 75 percent of original forest and woodland areas, over 95 percent of its wetlands, and all but 1 percent of original prairie.<sup>17</sup> There are direct and indirect impacts of development on habitat. Humans impact habitat directly when they remove forests, pave roads, and build cities. Humans also indirectly impact remaining habitat when they allow sediment or chemicals to leach into aquatic environments, intentionally or unintentionally introduce invasive species into ecosystems, by overhunt, or fragment habitat areas. Iowa has several native species of birds, mammals, reptiles, and other animals that are currently threatened or endangered. Species that are "endangered" are facing extinction, and as a result, are protected by law from hunting and removal of known habitat.<sup>17</sup> Species that are "threatened" have been projected to become endangered at some future point in time and are also protected by law.<sup>18</sup> Table 11 provides a list of species known to inhabit areas in the English River watershed that are currently classified as "endangered" in the state of Iowa. Some species are on federal registries as well.

	Table 11. Endangered Species in English River Watershed Counties					
		IOWA	JOHNSON	KEOKUK	POWESHIEK	WASHINGTON
	RIDDS	Barn Owl	Barn Owl	Barn Owl	Barn Owl	Barn Owl
	BIRDS		King Rail		Piping Plover*	
			Northern Harrier		Red-shouldered Hawk	
	ΜΛΛΛΛΛΙς	Indiana Bat**	Spotted Skunk	Indiana Bat**	Indiana Bat**	Indiana Bat**
	MANNALS				Spotted Skunk	Spotted Skunk
-		Eastern Prairie Fringed Orchid	Eastern Prairie Fringed Orchid*			
e		Ground Pine	Ground Pine			
er	PLANTS		Pale Green Orchid			
ы В С			Ricebutton Aster			
lai			Waxleaf Meadowrue			
u C	REPTILES	Wood Turtle	Eastern Massasauga			Wood Turtle
ш	FISH		Freckled Madtom			Freckled Madtom
			Higgin's-eye Pearly Mussel**	Pistolgrip		Pistolgrip
	FRESHWATER MUSSELS		Pistolgrip			
			Round Pigtoe			
			Sheepnose			
			Yellow Sandshell			
	INSECTS		Byssus Skipper		Dakota Skipper	
	AMPHIBIANS					Blue-spotted Salamander

\*Federal register of "Threatened" species \*\*Federal register of "Endangered" species



Photo: Endangered Barn Owl.

- The *Barn Owl*, endangered in every English River watershed county, relies on savanna habitat for nesting and hunting, and often roost in tree cavities or old barns or abandoned buildings near these savannas. The greatest threats to the Barn Owl are the loss of grassland areas they rely on for hunting, from poisoning due to use of rodenticides, and the removal of dead trees and old barns they utilize for nesting.
- The *Indiana Bat* relies on large trees with loose bark for roosting. They often choose trees close to water, because the water attracts the insects they feed on. Primary threats to this bat species are their colonial lifestyle that hastens the transmission of colony-wide infections, a loss of timber areas they rely on for nesting due to logging and development, poisoning from insecticides, and contaminated surface waters.
- The *Eastern Prairie Fringed Orchid* is native to tallgrass prairies and sedge meadows. Populations of this rare orchid have been greatly reduced by the conversion of prairie habitat to rowcrops, pressure created by invasive plant species, livestock overgrazing in grassland areas, and herbicide drift.
- The *Ground Pine* is a shady woodland tree that is sometimes found by roadsides. The population of this tree has been adversely impacted by urban development, the conversion of woodlands to cropland, and invasive species.

• The *Wood Turtle* and the *Pistolgrip Mussel* both rely on sandy or rocky-river-bottom habitat. Wood Turtles tend to nest in grassland buffers along streams and rivers. The Wood Turtle is greatly threatened by habitat fragmentation, loss of grasslands, and traffic from farm machinery and automobiles. The Pistolgrip Mussel is endangered because of sedimentation from dredging and gravel mining, and water pollution from residential and industrial discharges, herbicides and fertilizer runoff.



Photo: Endangered Wood Turtle. *Photo courtesy of Colin Osborn/USFWS*.

Table 12 provides a list of numerous plant, animals, and reptilian species that may become endangered in the future unless action is taken to restore habitat, reduce poaching, and remove invasive species responsible for their decline.

		Ta	able 12. Threatened Species i	n English River Water	shed Counties	
		IOWA	JOHNSON	KEOKUK	POWESHIEK	WASHINGTON
	BIRDS	Henslow's Sparrow		Henslow's Sparrow		Henslow's Sparrow
ened	FISH	Topeka Shiner**				
		Pink Milkwort*	Oak Fern	Slender Ladies'- tresses	Golden Corydalis	Downy Woodmint
	PLANTS	Slender Ladies'-tresses Western Prairie Fringed Orchid	Pinesap Pink Milkwort		Slender Ladies'-tresses	Slender Ladies'-tresses
		Woodland Horsetail	Showy Lady's Slipper Slender Ladies'-tresses Slim-leaved Panic Grass			Winged Monkey Flower
rea	MAMMALS		woory winkweed	Southern Bog Lemming		
Ļ	REPTILES	Ornate Box Turtle	Blanding's Turtle Common Musk Turtle Ornate Box Turtle			Blanding's Turtle
	FISH		Orangethroat Darter			
	FRESHWATER MUSSELS		Butterfly Creeper Fat Pocketbook** Purple Wartyback			Creeper
	INSECTS				Powesheik Skipperling	
	AMPHIBIANS					Central Newt

\*Federal register of "Threatened" species \*\*Federal register of "Endangered" species

# Conservation and Recreational Areas

The English River watershed contains roughly 3,900 combined acres of conservation and recreational areas (Table 13). Of these, approximately 2,738 acres can be classified as wildlife or wildlife management areas. These areas are maintained primarily for providing wildlife habitat with some recreational benefits for people such as wildlife viewing, hiking, and seasonal hunting or trapping. Typically motorized vehicles or boats, camping, and other activities that leave more of a human footprint are not allowed. Some of these areas are created through the Iowa Habitat Access Program (IHAP). Seasonal hunting on these properties may be permitted at times, but they are not generally open to the public. There are approximately 580 acres of IHAP in the English River Watershed. The Iowa Department of Natural Resources also maintains an additional 638 acre grassland area in Iowa County (Indiangrass Hills Easement) with limited public access.

There are 4 county parks in the watershed providing 1,123 acres of recreational options such as picnicking, fishing, camping, canoeing, hiking, or swimming. These areas are maintained by County Conservation Boards and designed for the purpose of creating both habitat and recreational areas. Iowa Township Park in northeastern Washington County is the only urban park amongst these recreational places managed on a county level.

There are three public river access points to the English River in the watershed. One is located just east of the tri-county English River Wildlife Area; there is one in Riverside and one east of Riverside, near the junction of the English and Iowa Rivers. The distance between the canoe access points at the English River Wildlife area and at the English – Iowa River junction is an approximately a 30-mile paddling trail (water-level permitting).

Table 13. Recreational & Wildlife Areas in the English River Watershed				
Name	Туре	Approx. Size	Unit	
Indiangrass Hills Easement	Conservation Area	638	acres	
Lake Iowa Park	County Park	441	acres	
Coffman Woods Preserve	County Park	4	acres	
Deep River Recreational Area	County Park	4	acres	
Foster Woods	County Park	36	acres	
English River Paddling Route	Paddling Route	30.2	miles	
Iowa Habitat Access Program Tract	Private Wildlife Area	6	acres	
Iowa Habitat Access Program Tract	Private Wildlife Area	574	acres	
Canoe Access	Public River Access	0.5	acres	
Riverside Access	Public River Access	0.5	acres	
Iowa Township Park	Urban Park	25.38	acres	
Butler Timber Wildlife Area	Wildlife Area	2	acres	
Lantz Wildlife Preserve	Wildlife Area	35	acres	
Berstler Woods	Wildlife Area	124	acres	
English River Wildlife Area	Wildlife Area	1,434	acres	
Lincoln Wildlife Management Area	Wildlife Area	4	acres	
Cecil Rivers Timbers	Wildlife Area	89	acres	
Deep River Timber Wildlife Area	Wildlife Area	396	acres	
English River Access	Wildlife Area	25	acres	
Pheasant Ridge	Wildlife Management Area	49	acres	

#### 3.9 Current Best Management Practices in the Watershed

Numerous farmers across the watershed have already installed or are in the process of implementing best management practices on their land. Currently, there are about 640 total miles of terraced-land in the English River Watershed. Additionally, there are 1,341 farm ponds that provide erosion control and other agricultural benefits on properties within the watershed, as shown in Table 14. Other non-structural best mangement practices such as buffers, cover crops, and no-till agriculture are difficult to identify because they cannot be delineated through aerial imagery.

Table 14. Best Management Practices in the Watershed		
Practice	Total	
Terraces	640.14 miles	
Farm Ponds	1,341	