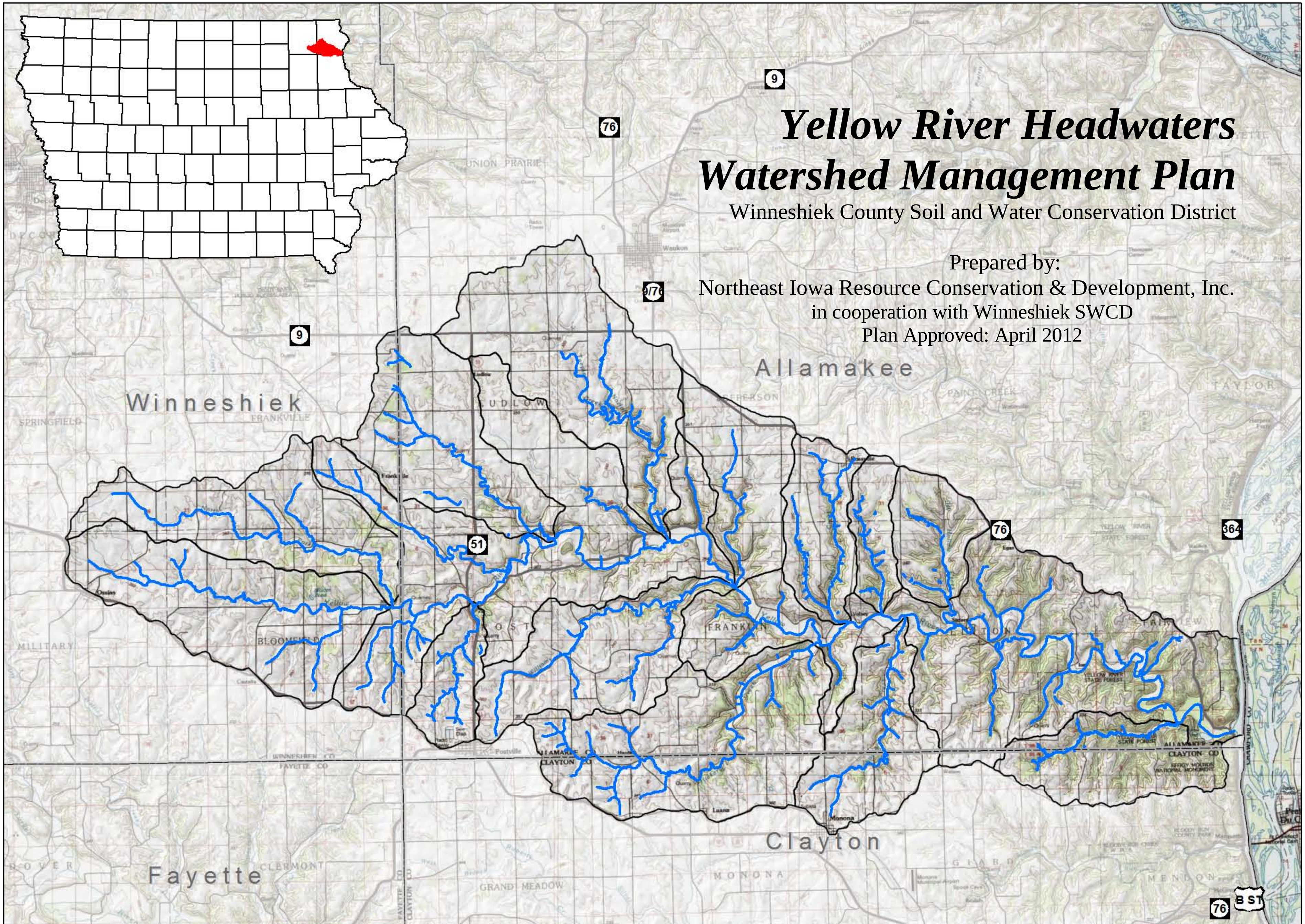
Yellow River Headwaters Watershed Management Plan

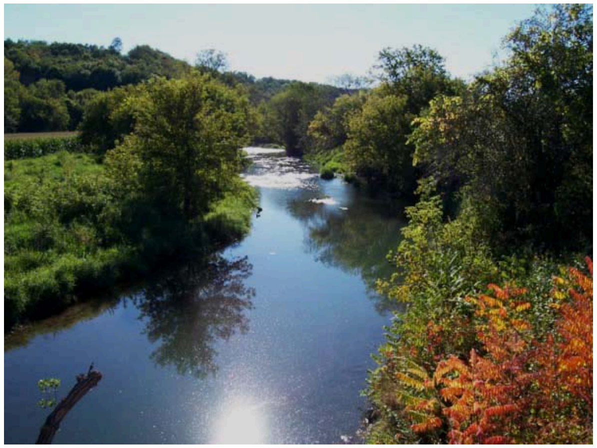
Winneshiek County Soil and Water Conservation District

Prepared by:
Northeast Iowa Resource Conservation & Development, Inc.
in cooperation with Winneshiek SWCD
Plan Approved: April 2012



Yellow River Watershed: Winneshiek & Allamakee Counties, Iowa

YELLOW RIVER HEADWATERS MANAGEMENT PLAN
Winneshiek County SWCD



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Part I: Executive Summary

The Yellow River Headwaters Watershed (YRHW) encompasses 26,119 acres in Northeast Iowa and is composed of two main stream branches, the North Fork Yellow River and Yellow River. The two branches join near the base of the YRHW to form the Yellow River, which downstream becomes the State of Iowa's largest coldwater trout stream and a High Quality Resource Water. Sections of the two branches of the YRHW and the Yellow River downstream from their confluence are listed on the State of Iowa's 303(d) List of Impaired Waters as impaired due to primary contact use and aquatic life impairments.

The primary contact use impairment in both Yellow River segments and the North Fork segment was caused by bacteria identified by IDNR-UHL monitoring from 2006-2008 where the sample geometric mean exceeded the water quality criterion of 126 CFU/100mL. The draft TMDL developed by Iowa DNR identifies the likely sources of bacteria causing the impairment to be cattle in the stream, run-off from field applied manure and pastures, open feedlot run-off, non-functioning septic systems and wildlife. The rationale for the aquatic life impairment in the Yellow River and North Fork was caused by low dissolved oxygen (DO) as identified by >10% of samples from IDNR/UHL/SWCD monitoring violating the WQ criteria for DO. In addition, the Yellow River segment was identified for low biotic index. While the exact causes of the low DO and low biotic indices was listed as unknown, IDNR personnel indicate that multiple sources including sediment loading, nutrient run-off, habitat alterations and large levels of organic matter entering the stream are likely culprits of the reduced biota and low DO.

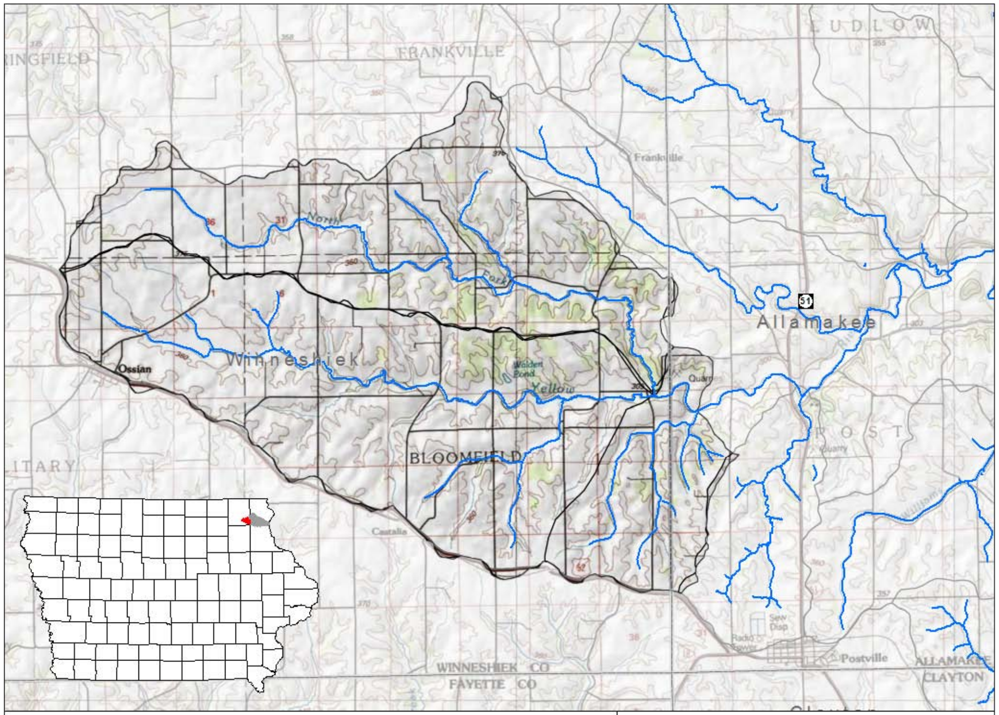
The primary focus of this watershed management plan is to develop a strategy to address the bacteria impairment in the YRHW streams. The plan outlines a goal to reduce bacteria delivery to the streams in the YRHW by 90% over the next 10 years. The proposed strategies will result in the reduction of greater than 7.70E+14 CFU of bacteria per day delivered to the YRHW streams or more than 2.81E+17 CFU annually. These reductions will bring the streams in line with allowable limits for indicator bacteria and potentially lead to removal from the Section 303(d) List. The watershed management plan also secondarily addresses sediment and nutrient delivery to the YRHW streams by identifying targeted areas and Best Management Practices to slow the flow of water off of the land and allow for increased time for bacteria inactivation and nutrient and sediment capture. The strategies proposed in the plan will result in sediment delivery reductions of 50% from watershed land areas and 15% from streambank erosion, totaling more than 17,450 tons per year in annual sediment delivery reductions.

This watershed management plan provides Winneshiek SWCD and their partners with a strategic guide to addressing water quality impairments in the YRHW and improving overall water quality in one of Iowa's most treasured aquatic resources, the Yellow River.

Part II: Vision & Purpose Statement

Vision Statement
We envision the Yellow River Headwaters as a healthy working watershed where soil and nutrients are retained on the land, livestock nutrients are managed and the streams, the river and the riparian areas provide quality fish and wildlife habitat.

Purpose Statement
To provide a plan justification for targeted technical and financial assistance that will accelerate the adoption of conservation practices in the Yellow River Headwaters and result in the removal of the Yellow River from Iowa's list of impaired waters



Yellow River Headwaters: Winneshiek & Allamakee Counties, Iowa

Part III: Watershed Characteristics

of the Yellow River Watershed and Yellow River Headwaters Watershed

The Yellow River Watershed (YRW) encompasses approximately 154,500 acres in Allamakee, Clayton and Winneshiek Counties in the far northeast corner of Iowa. In its entirety, the Yellow River and its tributaries are 360 miles in length with steep elevation changes for an Iowa watershed, 612 feet at the mouth to 1310 feet along the uppermost boundary of the watershed. The Yellow River is designated as a *High Quality Resource Water* by the State of Iowa but is more well known as the largest cold water trout stream in the State.

The Yellow River Water Trail is one of the State's most remote Iowa Water Trails, used by recreationists including those canoeing, tubing, kayaking, camping and fishing that want to be in a more "wild" or remote setting. The forested hillsides, topography, rural nature and rugged limestone outcroppings in the eastern two thirds of the watershed isolate river users from people and noise. Wildlife and fish populations are abundant; fishermen from around the region pursue rainbow, brown and brook trout, as well as smallmouth bass in the Yellow River. Iowa DNR Fisheries personnel report that the river supports healthy populations of naturally reproducing trout that grow to become some of the largest trout in the state. The Yellow River Watershed also encompasses significant public natural areas including portions of Iowa's largest state forest, Yellow River State Forest, and Iowa's only National Monument, Effigy Mounds National Monument, before emptying into the Upper Mississippi National Fish and Wildlife Refuge.

Surveys conducted by local tourism groups show visitors are drawn to the natural resource in Northeast Iowa including the water and land resources found in the YRW. The Iowa Tourism Association reports that Allamakee and Winneshiek County tourism expenditures for 2010 exceeded $58 million. Although the expenditures are much less than those of urban counties with large tourism venues, when considered on a per capita basis they are comparable to the counties in Iowa that lead the list of tourism expenditures such as Polk, which has tourism expenditures exceeding $1.4 billion annually. By comparison Allamakee County tourism expenditures, which are directly tied to their natural resources, were $2,300 per capita in 2010 compared to Polk County's $2567 per capita and Black Hawk County's $2,226 per capita. Allamakee County Economic Development has even recognized the value of the Yellow River to their tourism industry by placing a kiosk about the Yellow River Water Trail at their County Tourism and Chamber offices in Waukon, the county seat.

The YRHW, which is the focus of this project, is the subset of the YRW within Winneshiek County and a very small portion of Allamakee. The YRHW encompasses approximately 26,119 acres or 16.8% of the overall area of the Yellow River Watershed. Locally, there are two identified stream stretches in the YRHW, the North Fork of the Yellow River and the Yellow River. As its name implies, the YRHW is the headwaters of the Yellow River and as such plays an important role in the water quality of the Yellow River and the economic development of the region. The geology, topography and land use in the YRHW are vastly different from the rest of the YRW. Agriculture rather than forest dominate the YRHW and more tile drainages than coldwater springs feed the river.

The YRHW has a record of impairment and a history of fish kills that has placed it on the State of Iowa's 303(d) Impaired Waters List. The pollutants causing the listed impairments are a threat not just to the ecological health of the YRHW but to the ecological health and economic productivity potential of the YRW as a whole. Improving water quality in the headwaters of the system is imperative for three reasons given its position at the head of the system and its influence on the water quality and environmental health of the entire river. It is also a substantial contributor to the impairment of the Yellow River even though it is only one sixth of the Yellow River's 154,500 acres. The YRHW is also a valuable natural resource assets of its own as the stream corridor of the watershed provides habitat to a great diversity of life forms including several valuable game species as well as bird and insect species beneficial for their control of agricultural crop pests. The stream corridor also serves as important connectors to allow animal movement between the blocks of habitat found within the watershed. The following pages provide basic information regarding the geology, soils, topography and land use that are important to understanding the YRHW and making decisions.

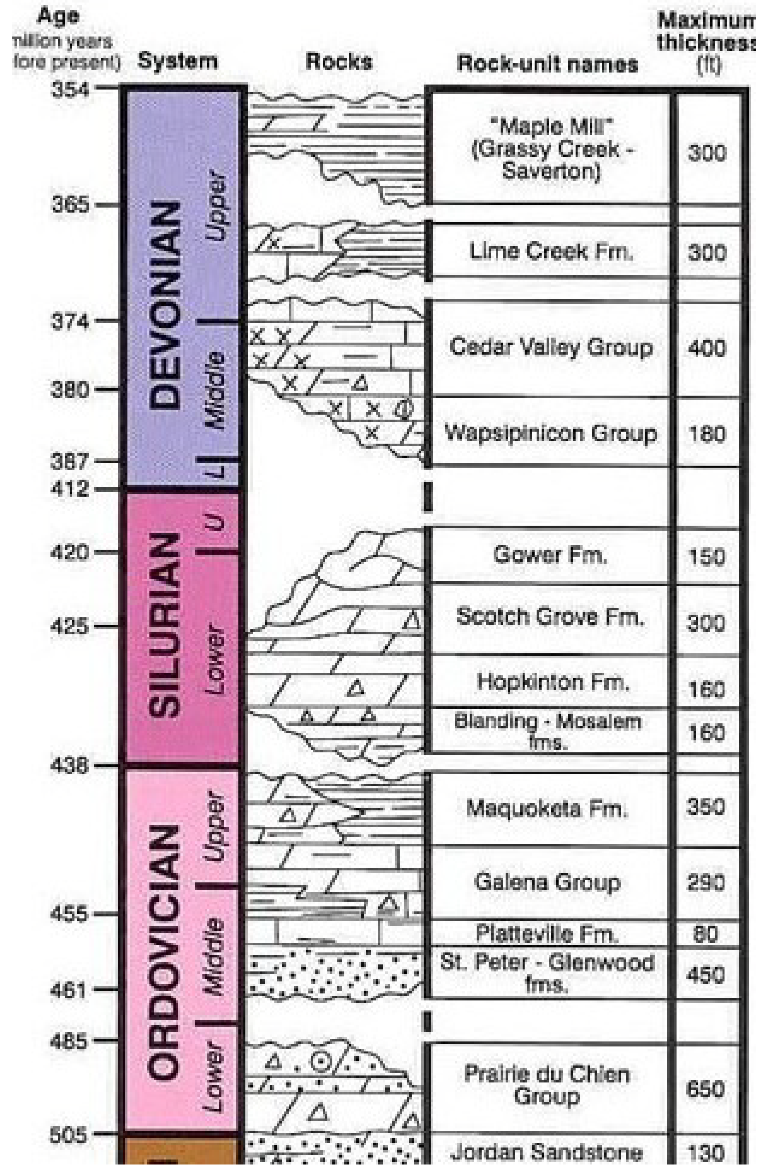
Geology

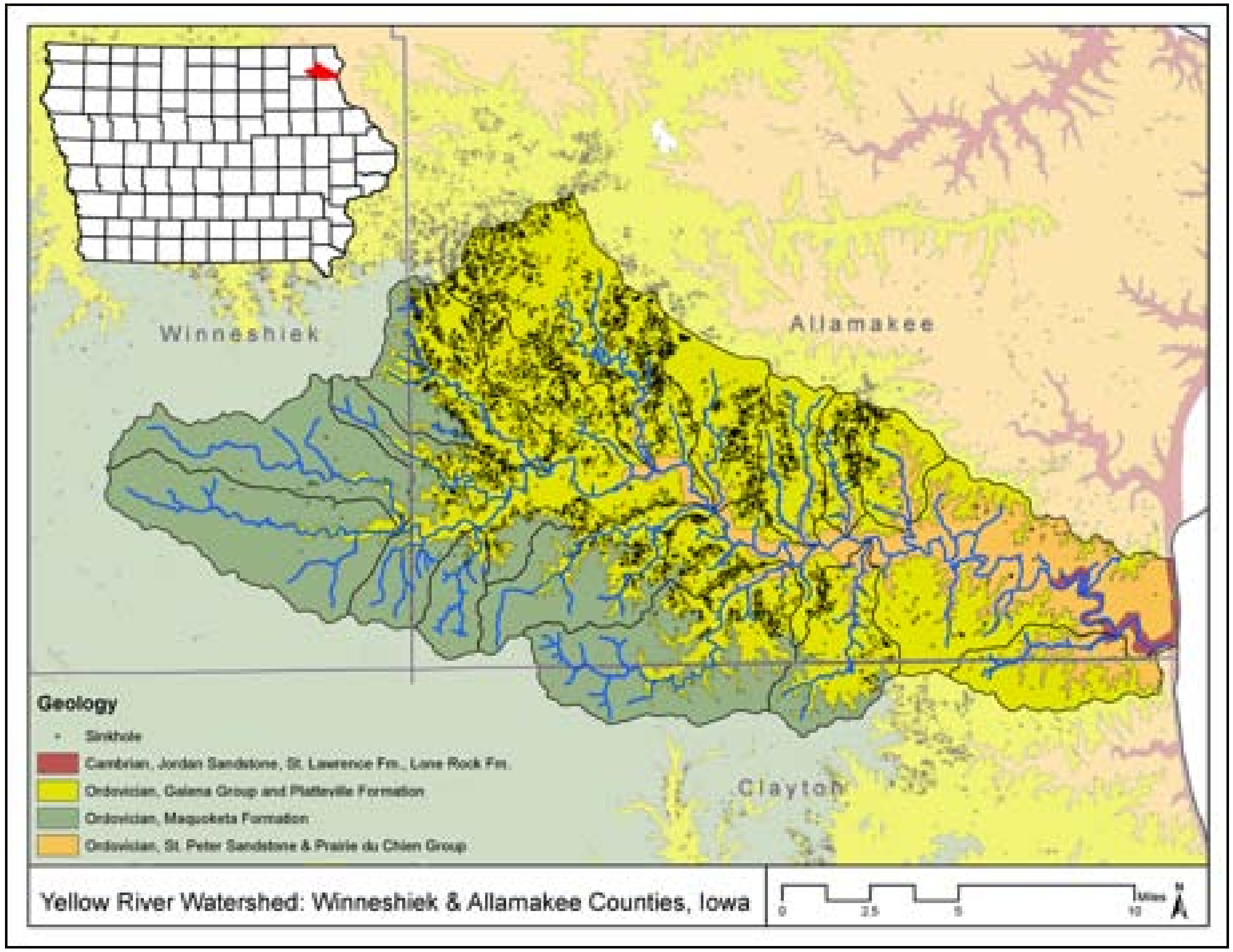
The Geologic information in this Plan has been developed with assistance from the Iowa Geologic and Water Survey.

The YRW is in the Paleozoic Plateau landform region of Iowa, and is characterized by shallow bedrock with a typically thin cover of glacial deposits. Bedrock in the YRW consists mainly of Ordovician age strata. The Cambrian age Jordan Sandstone underlies the Ordovician strata and is the uppermost rock below the Yellow River valley near it's confluence with the Mississippi River. The stratigraphic column to the right shows the rock sequence below the watershed (Devonian and Silurian rocks are not present in the YRW, but occur further west).

Surficial deposits from the Quaternary period (Glacial Age) are thin, and typically less than 25 feet in depth throughout most of the watershed, increasing to greater than 50 feet in depth in isolated areas along the watershed divide. Only minor amounts of glacial till are present, and most of the surficial deposits are loess, which consists of wind-deposited silt.

Bedrock in the YRHW proper is mainly the Maquoketa Formation, which consists of shaley limestones and shales. The Galena Group rocks are uppermost rock below the Yellow River Valley in the far downstream end of the YRHW. All of the bedrock units other than the shales in the Maquoketa Formation and the lowermost Galena Group (Decorah Shale) are aquifers, and are used by local residents for water supplies. The Maquoketa and Decorah shales are aquitards and barriers to groundwater movement. The shallow cover of mainly loess over these bedrock aquifers makes the groundwater very vulnerable to contamination from land surface activities.





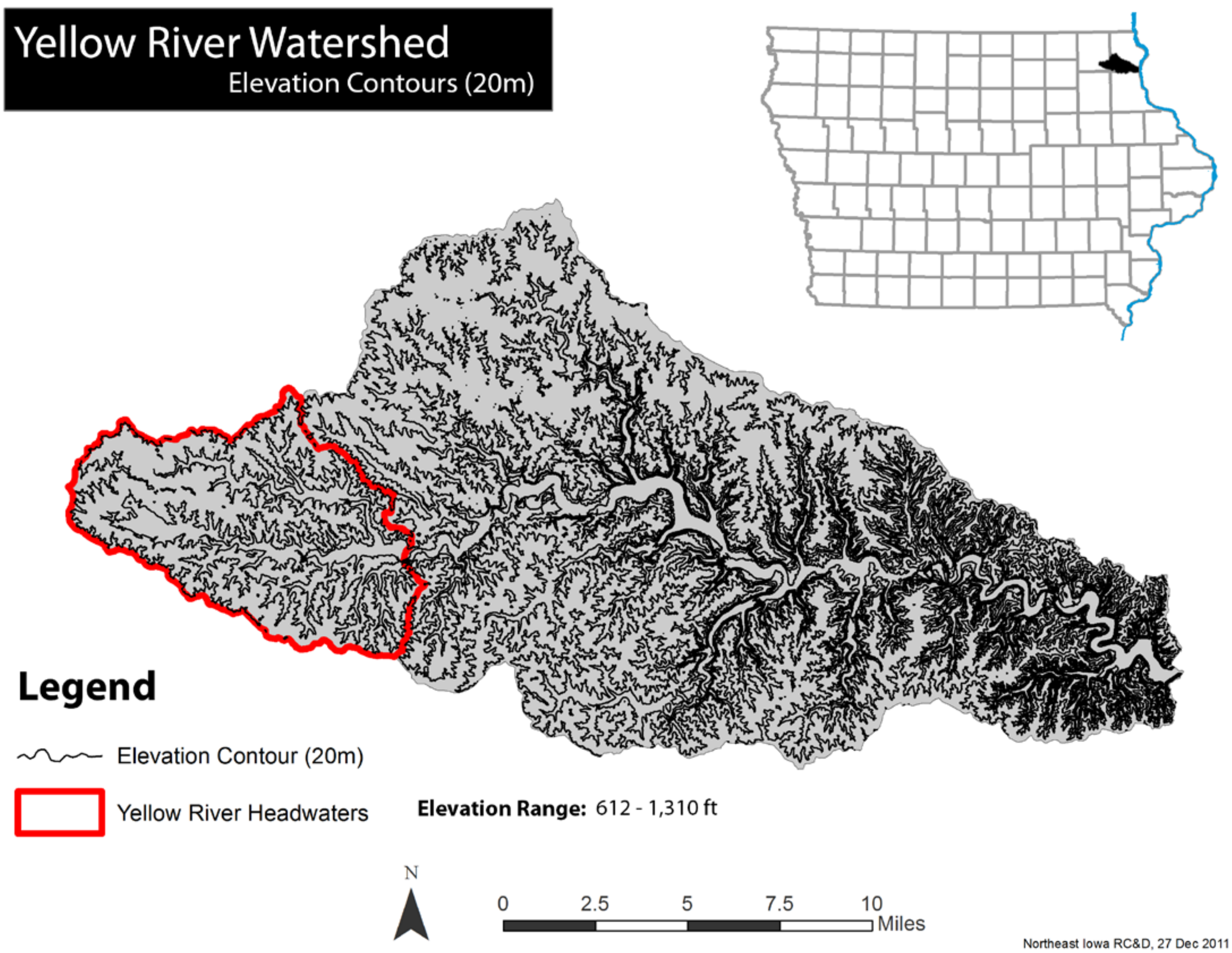
Sinkholes and losing streams add to groundwater vulnerability in the Yellow River Watershed by allowing direct inputs of surface runoff into aquifers. Mapping from soil surveys, historical photography, and LiDAR show there are almost 3,000 sinkholes in the YRW. The vast majority formed where the Galena Group is the uppermost bedrock. Where the Galena is the uppermost rock, sinkholes, losing streams, and large springs are common, and often the subsurface plumbing system allows groundwater to cross watershed boundaries.

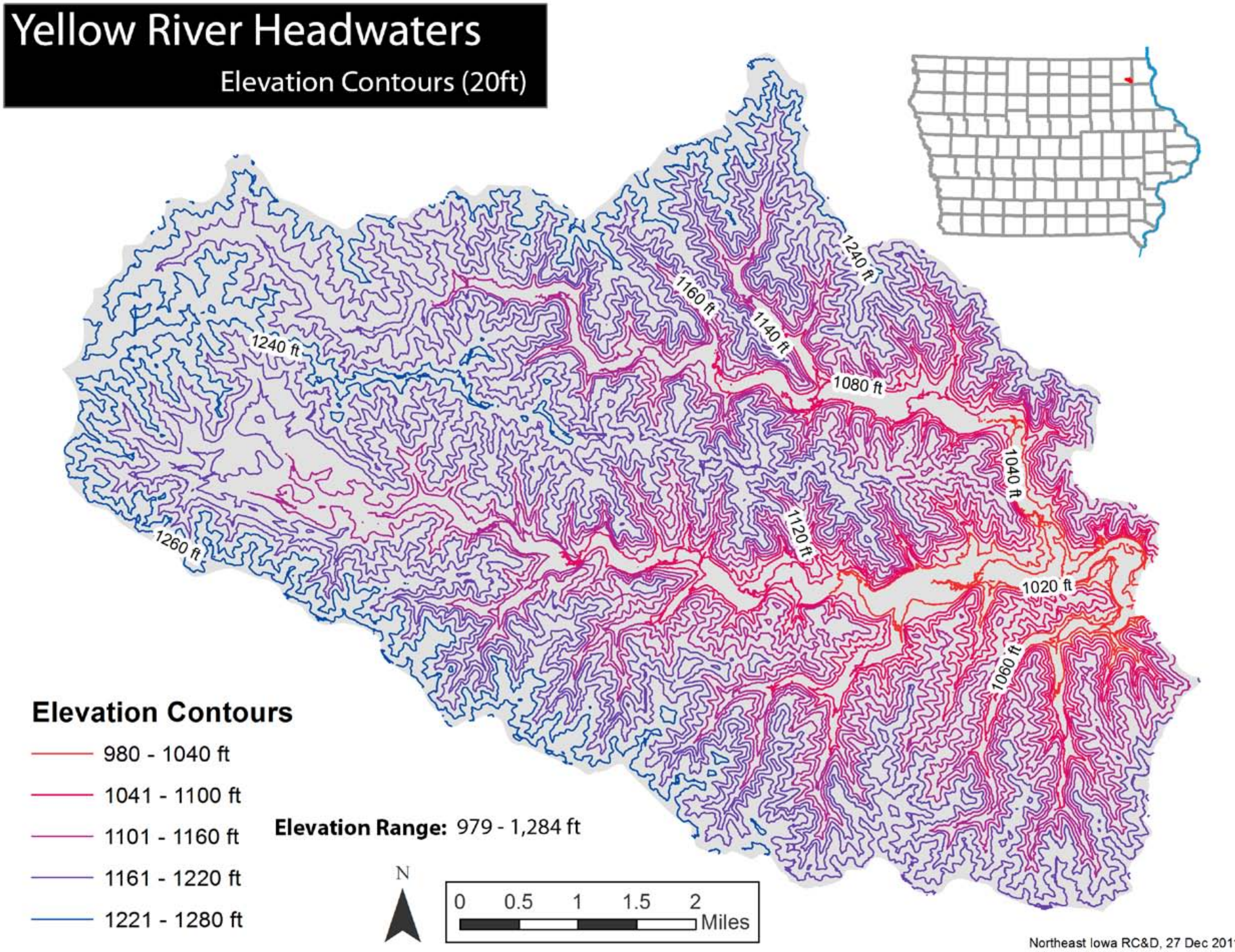
Large sections of the Yellow River in the eastern portions of the YRW, downstream of the YRHW, lose water into underground aquifers, creating a dynamic example of karst geology and hydrology. Although sinkholes and losing streams obfuscate water quality issues in downstream sections of the YRW, they do have as much influence in the YRHW. The YRHW, which is in the Maquoketa Formation, has only a handful of sinkholes, and there are no losing sections of stream or river present. As a result, conservation planning and implementation in the YRHW may have a more direct and measurable impact on water quality in the Yellow River than conservation in other areas of the YRW. The Geology map shows the differences in geology between the YRHW and the rest of the YRW.

Note – Additional Sinkhole-depth to rock mapping at: *ftp://ftp.igsb.uiowa.edu/igspubs/pdf/ofm-2010-07.pdf*

Elevation Changes

Although the elevation of the Yellow River Basin ranges 612 feet at the mouth to 1,310 along the uppermost boundary of the watershed, elevations in the YRHW are less dramatic changing from 979 at the mouth to 1,284 at the highest most point.

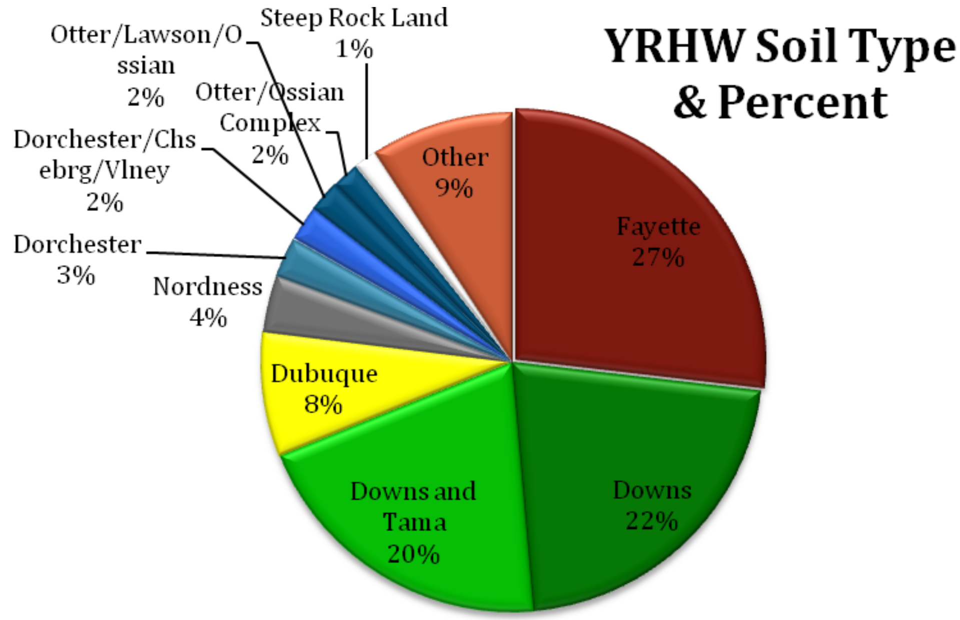


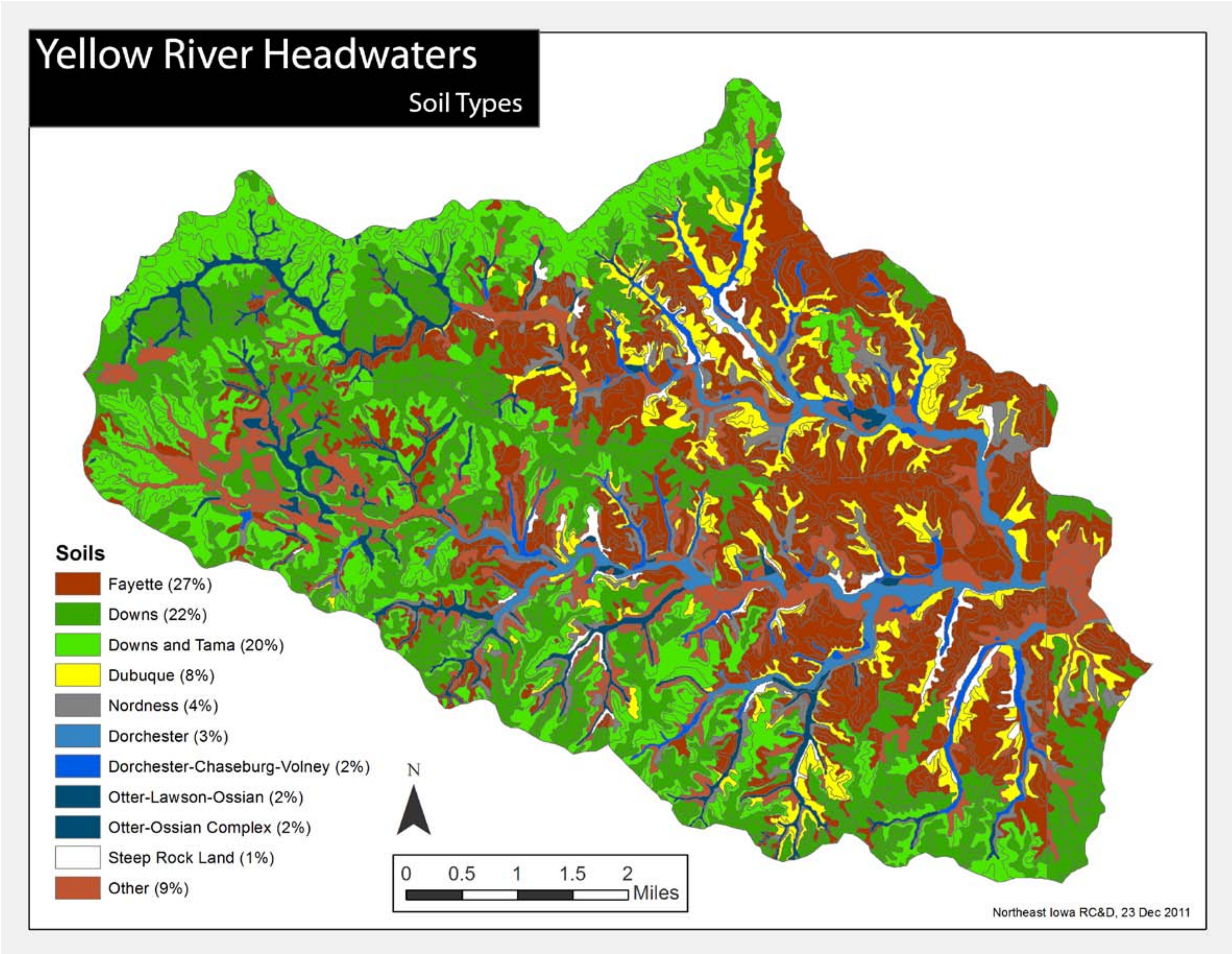

Yellow River Headwaters
Elevation Contours (20ft)
1240 ft
1160 ft
1140 ft
1240 ft
1080 ft
1040 ft
1120 ft
1260 ft
1020 ft
1060 ft
Elevation Contours
980 - 1040 ft
1041 - 1100 ft
1101 - 1160 ft
1161 - 1220 ft
1221 - 1280 ft
Elevation Range: 979 - 1,284 ft
N
0 0.5 1 1.5 2 Miles
Northeast Iowa RC&D, 27 Dec 2011

Soils

The major soil series found within the YRW are Fayette (34%), Downs (24.5%), Nordness (8.4%), and Dubuque (7.1%). There is a shift in predominance of soils in the YRHW with more Downs and Downs and Tama (42%) and less Nordness (4%). The dominant soils in the YRHW are all alfisols- soils that developed under forest covers in humid midlatitudes.

- The **Fayette** series consists of very deep, well-drained, fine silty alfisol formed in loess. Slopes range from 0-60 percent. These are well-drained soils; saturation does not occur within a depth of six feet during the wettest periods of the normal year. Surface runoff potential is negligible to high depending on the slope. Fayette soils occur throughout the steeper portion of the Yellow River drainage basin along the Yellow River itself.
- The **Downs** series consists of very deep, well-drained, fine silty alfisol formed in loess. Slopes range from 0-25 percent. These are well-drained soils; saturation does not occur within a depth of six feet during the wettest periods of normal years. Surface runoff potential is negligible to high. These soils occur in the uplands of the tributaries and the upper reaches of the watershed.
- The **Nordness** series consists of shallow, well-drained, loamy alfisol formed in loamy or silty material and a paleosol over limestone rock. Slopes range from 2-40 percent. These are well-drained soils. Saturation does not occur within a depth of six feet during the wettest period of most years. Surface runoff potential is low to high. These soils are found in the tributary valleys.
- The **Dubuque** series consists of moderately deep, well-drained, fine silty alfisol formed in 18 to 36 inches of loess and a thin layer of residuum from limestone bedrock or reddish paleosol high in clay overlying limestone bedrock. Slopes range from 2-60percent. These are well-drained soils; saturation does not occur within a depth of six feet during the wettest period of most years. Surface runoff potential is low to high. These soils are found along the steep edges of the lower watershed valleys and the upper watershed valleys.




Yellow River Headwaters
Soil Types
Soils
Fayette (27%)
Downs (22%)
Downs and Tama (20%)
Dubuque (8%)
Nordness (4%)
Dorchester (3%)
Dorchester-Chaseburg-Volney (2%)
Otter-Lawson-Ossian (2%)
Otter-Ossian Complex (2%)
Steep Rock Land (1%)
Other (9%)
N
0 0.5 1 1.5 2
Miles
Northeast Iowa RC&D, 23 Dec 2011

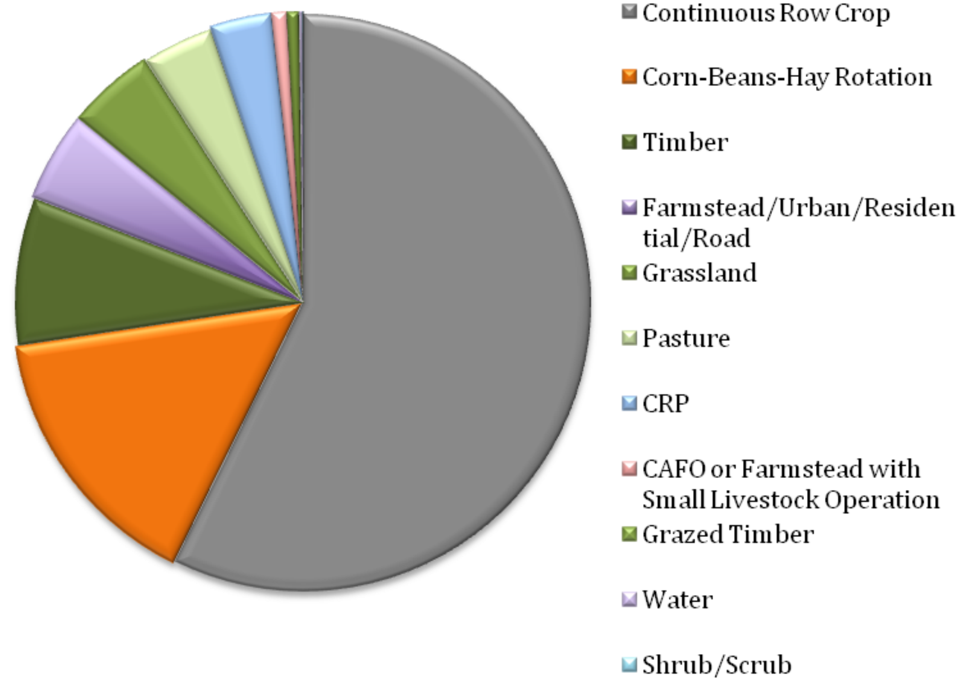
Land Use

The YRHW is the most intensively farmed sub-watershed in the Yellow River Watershed. Land use assessments were conducted in 2007 and 2011. In 2007, the land use watershed assessment identified over 72% of the YRHW in row crop agriculture. The 2007 assessment also found 11% timber, 6% grassy areas and 6% pasture, with most of these perennially vegetated areas adjacent to or in stream corridors. The remaining 5% was primarily made up of farmstead, residential areas and portions of two small towns (Ossian and Castalia comprise 2.2%). There is very little CRP in this watershed, only 4% in 2007 and as in most Iowa watersheds there was less in 2011 at 3.4%. The 2011 survey found 71.9% row crop, 8.7% timber, 8.3% grass and 3.9% pasture.

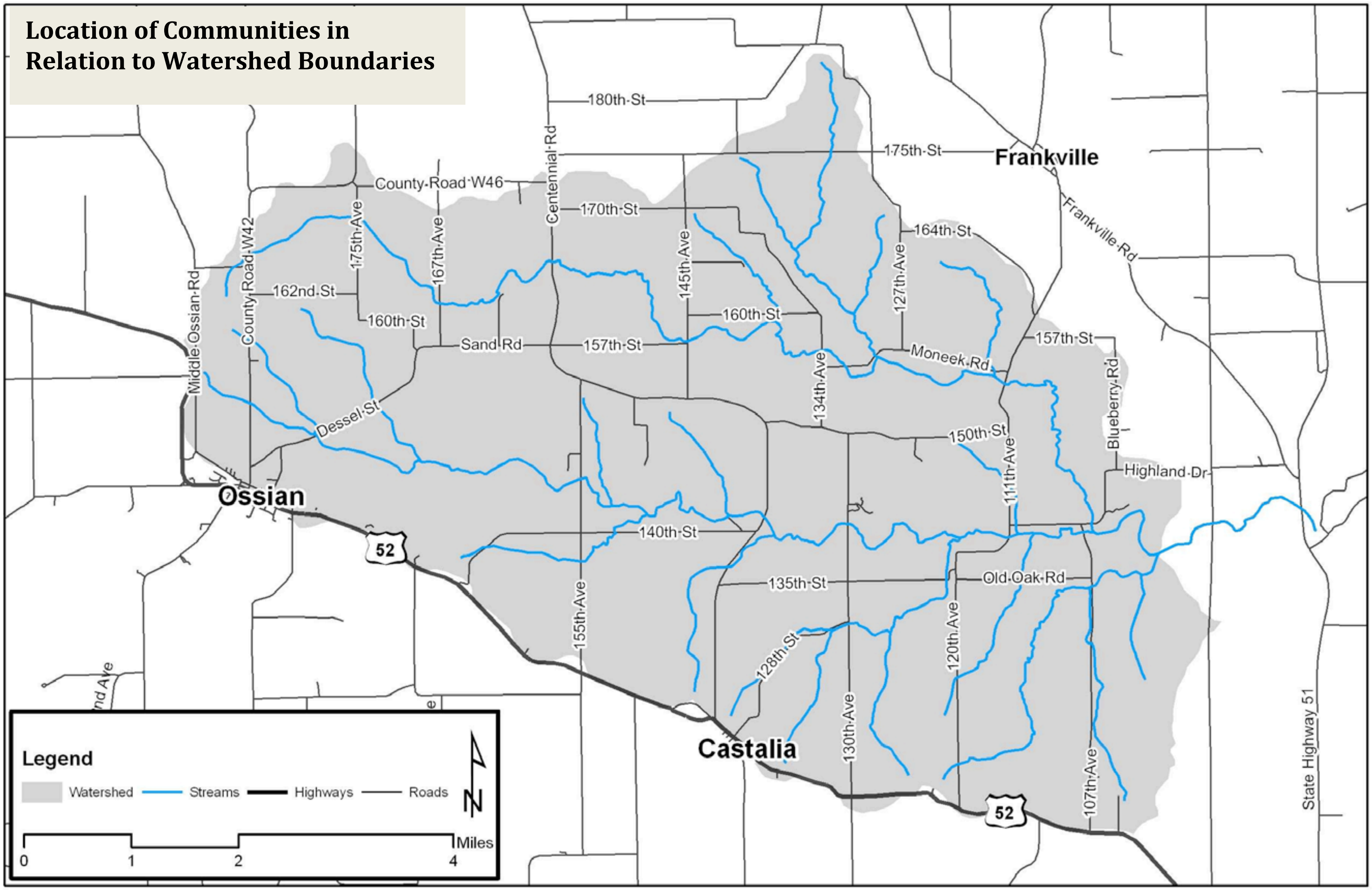
Table 1: Yellow River Headwaters Watershed
2011 Land Use

Land Use	Acres	Percentage
Continuous Row Crop	14803	56.7
Corn-Beans-Hay Rotation	3957	15.2
Timber	2126	8.1
Farmstead/Urban/Residential/Road	1306	5.0
Grassland	1269	4.9
Pasture	1023	3.9
CRP	894	3.4
CAFO or Farmstead with Small Livestock Operation	225	0.9
Grazed Timber	169	0.6
Water	41	0.2
Shrub/Scrub	13	0.048
Total	26116.9235	

The 2007 assessment also evaluated the stream corridor. Covering roughly twenty-three miles of stream, the stream survey found that livestock had free access to over eleven miles of the stream and that erosion was generally more severe where livestock access was not managed. A 2007 livestock survey found that there are fifty-four livestock operations in the YRHW with dairy, beef, sheep, hogs, and chickens all represented. There were eleven confinement buildings in the watershed at that time and several proposed for construction in the near future. The other forty-three operations were smaller family operations with fewer than 300 animal units that did not meet the definition of a Confined Animal Feeding Operation (CAFO) under the current Clean Water Act. The 2011 livestock survey identified fifty-one livestock operations with dairy, beef, sheep, hogs, horses and chickens for a total of 6894 animal units in the watershed. Nine of those operations met the definition for CAFO.



The 2011 livestock survey, as well as a 2011 RASCAL survey, identified pasture locations, commonly finding in-stream pasturing and near stream feedlots in the valleys of the watershed, especially in relation to the forty-two operations that were not CAFOs.
Small livestock producers in the YRHW face a number of challenges including; limited access to water, limited pasture, limited feedlot locations and limited funding for high cost feedlot fixes to reduce bacteria delivery. Typical feedlot runoff solutions are not required by law and are too expensive for the majority of the producers to implement and traditional methods of restricting livestock from surface waters are complicated by the flash flooding that occurs in the valley pastures. Because of the karst topography, landowners are typically required to implement concrete basins or storage facilities when containing livestock waste, which can escalate the costs and deter the producer from implementing such practices.

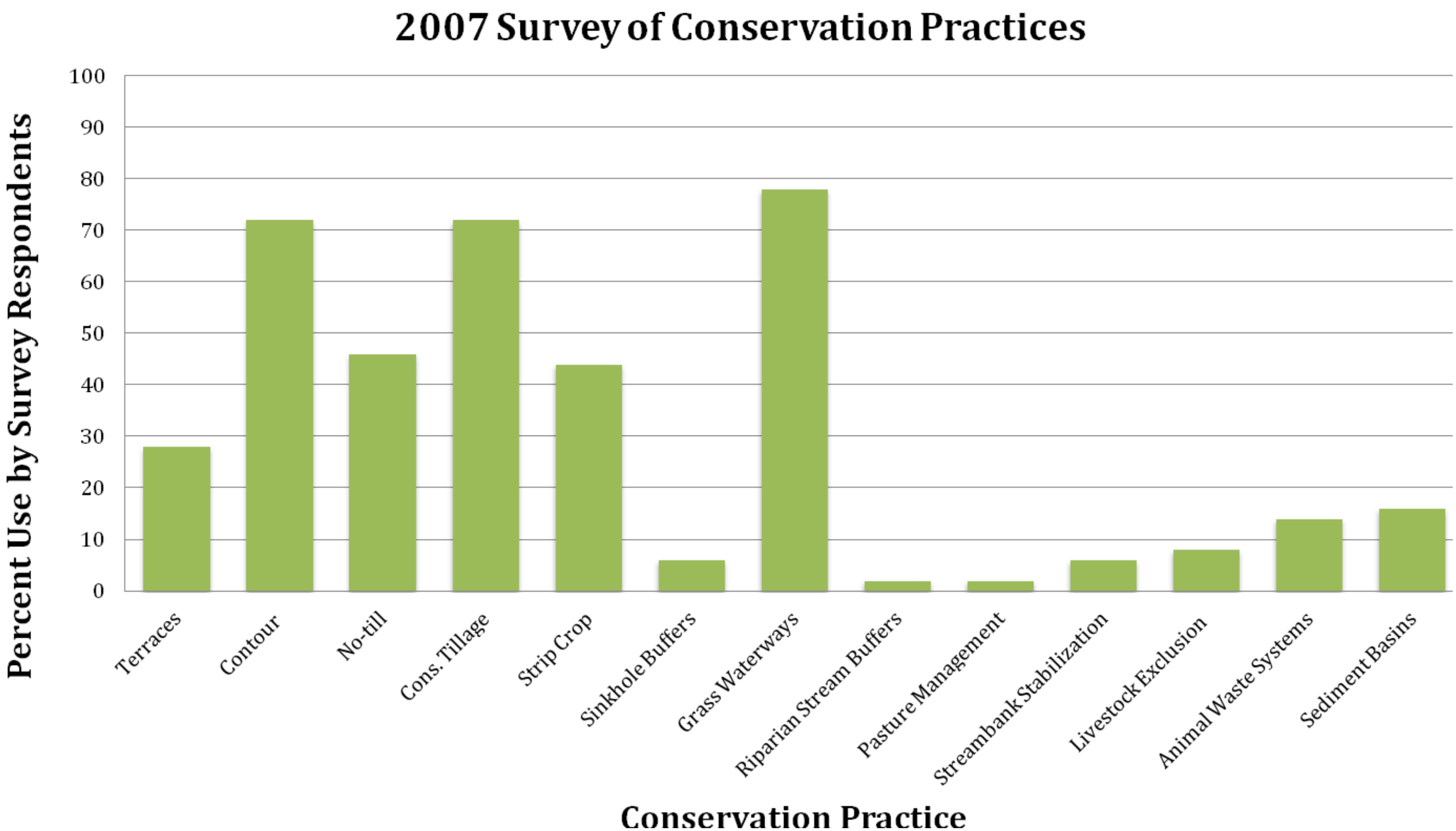


As can be seen in the previous map, two communities, Ossian and Castalia, are dissected by the YRHW boundary. The total percent of the YRHW within the city limits of these two communities is 2.2%. Ossian's sewage treatment plant drains into a different watershed, the Turkey River Watershed, but Castalia's sewage treatment plant, which is a lagoon cell treatment system, drains into the YRHW. Both communities direct storm water runoff into the YRHW tributaries. Surveys of private rural landowner found that more than 50% of the rural septic systems in the watershed are 25 years old or more, indicating a large number of potentially non-functioning or outdated systems. Additional information concerning land-use is detailed in the Watershed Research and Analysis section of this Plan.

Part IV: Community Based Planning & Public Outreach

Formal community based planning occurred in 2007 and 2011. The 2007 activities were paid for through a Watershed Planning Grant by Iowa Department of Ag and Land Stewardship, and directed and implemented by the Winneshiek County SWCD with assistance from Northeast Iowa RC&D. The 2011 activities were paid for by an Iowa DNR USEPA Section 319 Planning Grant and conducted by Iowa Learning Farms in preparation for development of this plan. During both of these efforts local, regional and state partners conducted public meetings, distributed and compiled community surveys and held one-on-one conversations with landowners. The surveys varied in both content and distribution, collecting very different but useful information that complemented other planning efforts. Between 2007 and 2011 the Winneshiek SWCD, and through contract with the Winneshiek SWCD, Northeast Iowa RC&D, conducted more deliberate one-on-one outreach and completed additional verbal and technical surveys. More detailed information about each of these efforts follows.

The 2007 survey was directed toward rural landowners and specifically technical in nature. Thirty-eight percent of watershed landowners responded to this survey and the results of this survey provided good insight into land use in the YRHW, the rural landowner's interest in a watershed project and opinions regarding specific conservation practices. The information in these surveys was confirmed through public meetings, which also gathered further information including the fact that producers in the watershed noted they would be far more likely to implement animal waste BMPs if 75% cost share were available.


2007 Survey of Conservation Practices
Percent Use by Survey Respondents
100
90
80
70
60
50
40
30
20
10
0
Terraces
Contour
No-till
Cons. Tillage
Strip Crop
Sinkhole Buffers
Grass Waterways
Riparian Stream Buffers
Pasture Management
Streambank Stabilization
Livestock Exclusion
Animal Waste Systems
Sediment Basins
Conservation Practice

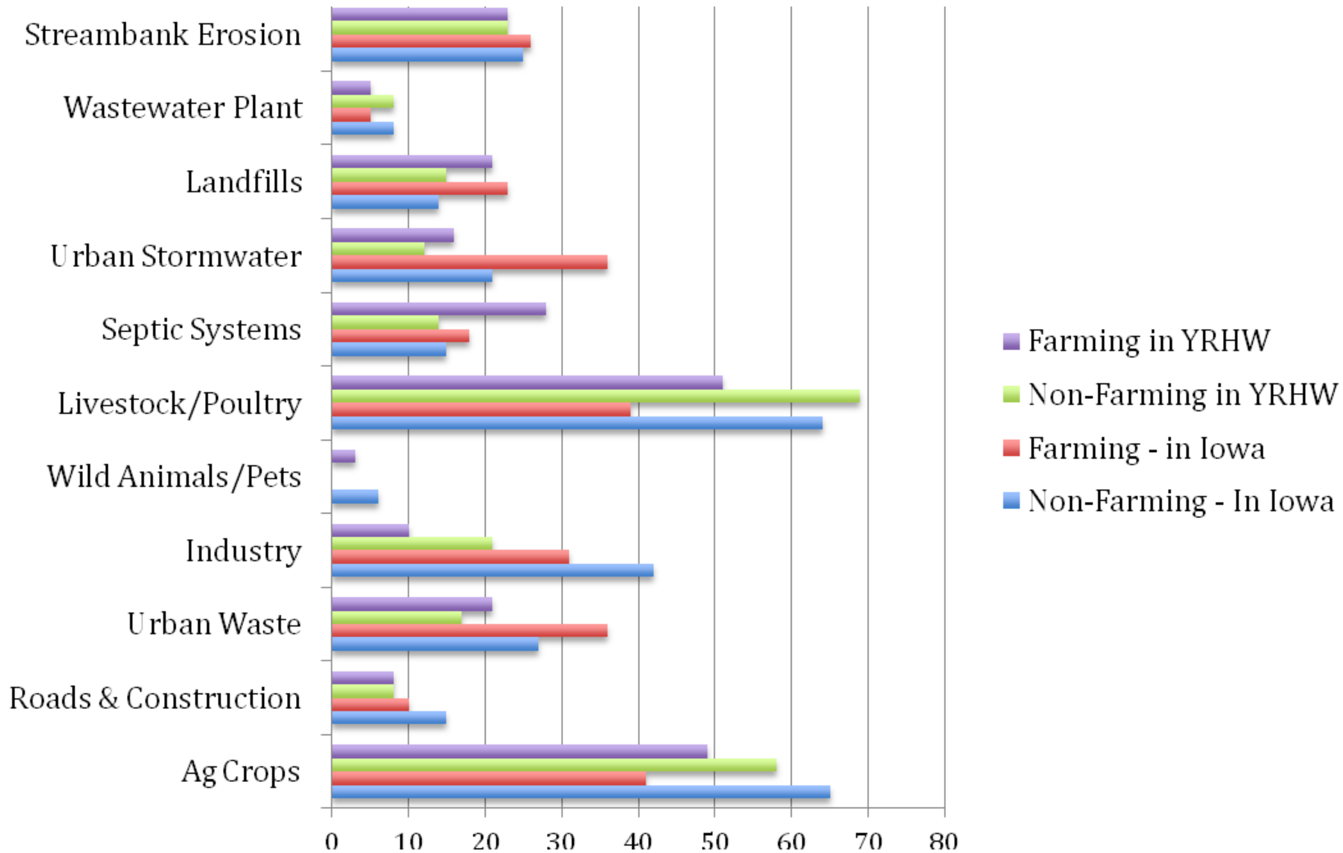
Some other notable survey responses include those associated with the use of conservation practices, which provides input into why the water quality in the Yellow River may be impaired.

- Generally stream management including riparian stream buffers, livestock exclusion and stream bank stabilization appear to be minimal. Livestock survey of the watershed make these numbers even more critical given the low pasture management reported is usually associated with livestock access to the streams or river in the watershed.
- The survey also found that the more costly conservation practices including the animal waste systems and sediment basins were less likely to be currently in use. Although 48% of the respondents owned livestock, only 14% reported having an animal waste system and only 16% reported having sediment basins. This trend was found to be reversible based on the discussions with landowners that noted the percent cost share was a factor.
- Results from a landowner survey indicated that more than 50% of the private septic systems in the YRHW are more than 25 years old, indicating a large number of potentially non-functioning or outdated systems. These septic systems are most likely contributing to the bacteria levels found in the YRH.

The survey as well as a watershed meeting provided input regarding the likelihood of success of a targeted watershed improvement project.

- The vast majority (94%) of landowners surveyed indicated that they believed the water quality in the YRHW was in need of improvement and felt that changes in agricultural practices and rural land use were the biggest factors contributing to water quality impairments.
- The survey found that 80% of respondents were in favor of a watershed project and 74% would participate in a watershed project.
- At a well-attended pre-watershed project meeting held in the Ossian Community Center, landowners in the watershed expressed they were eager to participate in a watershed project and would implement one or more conservation practices.
- Eighty-two percent of survey respondents as well as meeting attendees indicated that they would prefer to receive information regarding the watershed project through newsletters from the SWCD.

The 2011 survey was mailed to 327 watershed residents in June. Ninety-one, or 30% were completed and returned. The survey was intended to help the partners better understand the watershed resident's perceptions of water quality issues as well as to provide a basis for outreach and education recommendations. The report of results was presented to the SWCD and is included in this document as part of Section VIII, which details the Public Outreach Plan. It is titled, "*Yellow River Headwaters Watershed 2011 Perceptions Regarding Water Quality in Iowa and in the YRHW from Farming and Non-Farming Survey Respondents*



Citizen Awareness Campaign". The results and findings of this report provide insight into the social and cultural influences that impact the watershed. The report, which provides input from "Non-farming" and "Farming" land-owning residents, reveals the differences in perceptions with regard to these two watershed resident groups. Fifty-seven percent of respondents were not engaged in farming. It is important to note that nearly 98% of the watershed is dedicated to agricultural production.
The document also details recommendations for the partners regarding everything from the logo to suggested outreach topics. A time frame for outreach is also provided in the report.

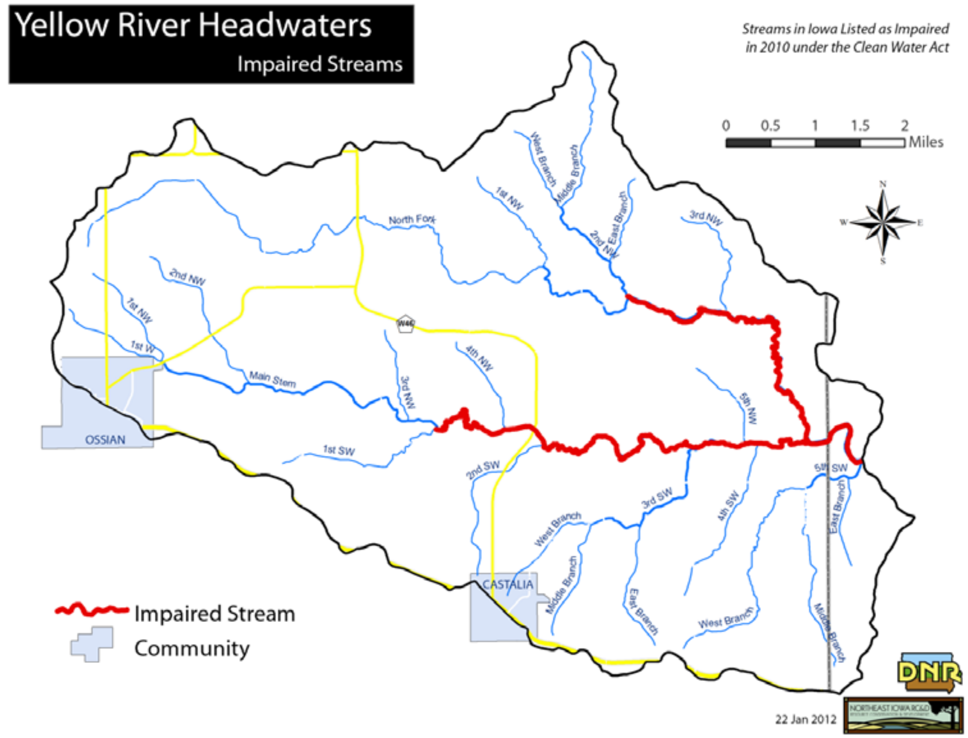
Notable findings include the following. Although half of respondents felt the quality of the groundwater in their area was good (the highest response) the positive Farming responses (66%) were much higher than the positive Non-Farming responses (40%). The majority of both respondent groups felt that the quality of surface waters where they live was "fair" as opposed to good. This perception provides an opportunity for outreach and education.

Sixty-five percent of Non-Farming respondents felt that Agricultural crop production was most responsible for existing pollution problems in Iowa. Sixty-four percent felt livestock and poultry operations were most responsible for existing pollution problems in Iowa. This was compared to respectively 41% and 39% of Farming respondents. When the question was changed to provide input regarding the Yellow River Headwaters, fewer Non-Farming (58%) and more Farming (49%) respondents blamed agricultural crop production. This may indicate recognition by farming respondents of conservation opportunities in the watershed. More of both blamed livestock and/or poultry for pollution problems in the YRHW, 69% Non-Farming and 51% Farming respondents providing opportunities for outreach and conservation related to the bacteria impairment. Although the Yellow River is impaired for bacteria, only 16% of all respondents said they “know” there are high bacteria counts and 41% suspect. This also provides opportunities for outreach and education.

Thirty-six percent of Farming respondents felt that urban storm water runoff was most responsible for existing pollution problems as compared to 21% of Non-Farming respondents. The majority of the respondents, 92% felt that they had “none” or only “A little” soil erosion on their property.

The survey asked how different groups were fulfilling their responsibility for protecting water quality in their community. The Soil and Water Conservation District (SWCD) ranked highest with the landowners second highest. This perception indicates a high level of confidence in the Winneshiek SWCD.

Part V: Causes & Sources of Impairment



Iowa's 2008 Impaired Waters List identifies three stretches of stream within the YRHW as impaired. The same waterbodies are identified on Iowa's 2010 Impaired Waters Draft list as well. The listings are required as part of the Clean Water Act Section 303(d) listing of impaired waters. The three segments; the Yellow River from the Old Highway 51 crossing to the confluence with the North Fork, the North Fork from the mouth at the confluence with the Yellow River to confluence with unnamed (2^{nd} NW) tributary, and the Yellow River from North Fork Yellow River confluence to confluence with unnamed tributary (1^{st} SW) are all identified as impaired due to aquatic life and primary contact use impairments.

Aquatic Life Impairment - The rationale for the aquatic life impairment in the Yellow River was caused by low dissolved oxygen (DO) as identified by >10% of samples from IDNR/UHL/SWCD monitoring violating the WQ criteria for DO as well as low biotic index identified by biological sampling by IDNR in 2002 and biological (REMAP) sampling in 2004. The aquatic life impairment in the North Fork segment was also caused by low DO as identified by >10% of samples from IDNR/UHL/SWCD monitoring violating the WQ criteria for DO. While the exact causes of the low DO and low biotic indices was listed as unknown, IDNR personnel indicate that multiple sources including sediment loading, nutrient run-off, habitat alterations and large levels of organic matter entering the stream are likely culprits of the reduced biota and low DO.

Primary Contact Recreation Impairment – The primary contact use impairment in both Yellow River segments and the North Fork segment was caused by bacteria identified by IDNR-UHL monitoring from 2006-2008 where the sample geometric mean exceeded the water quality criterion of 126 CFU/100mL. The likely sources of bacteria in the stream are highlighted in the TMDL developed by the Iowa DNR that can be found in Part V.

Part VI: Watershed Research & Analysis

The Yellow River and its watershed has been the target of water monitoring since 2004. Some of that monitoring was tied to controversy in the watershed related to point source pollution downstream of the YRHW. However, the majority was related to the Iowa DNR and Winneshiek and Allamakee County SWCD's desire to gain a better understanding of the Yellow River and the Yellow River Watershed system because they are such important resources for the State of Iowa.

In 2004, the Iowa DNR and Allamakee Soil and Water Conservation District, with help from Northeast Iowa Resource Conservation and Development Inc. began water quality monitoring, dye tracing, calculating soil loss and monitoring flow in the YRW. Through their efforts, the partners completed monitoring of the tributaries, including those found in the YRHW and at points along the main stem of the Yellow River. This effort continued through 2007 and provided good baseline information for the YRHW Project. Since that time, the partners have worked together to conduct additional research and complete more extensive analysis in the YRHW including RASCAL assessment, land-use tablet assessment, and water monitoring. A description of the historic work is provided in the *Causes and Sources of Impairment* section of this document. The more recent research is detailed in this section.

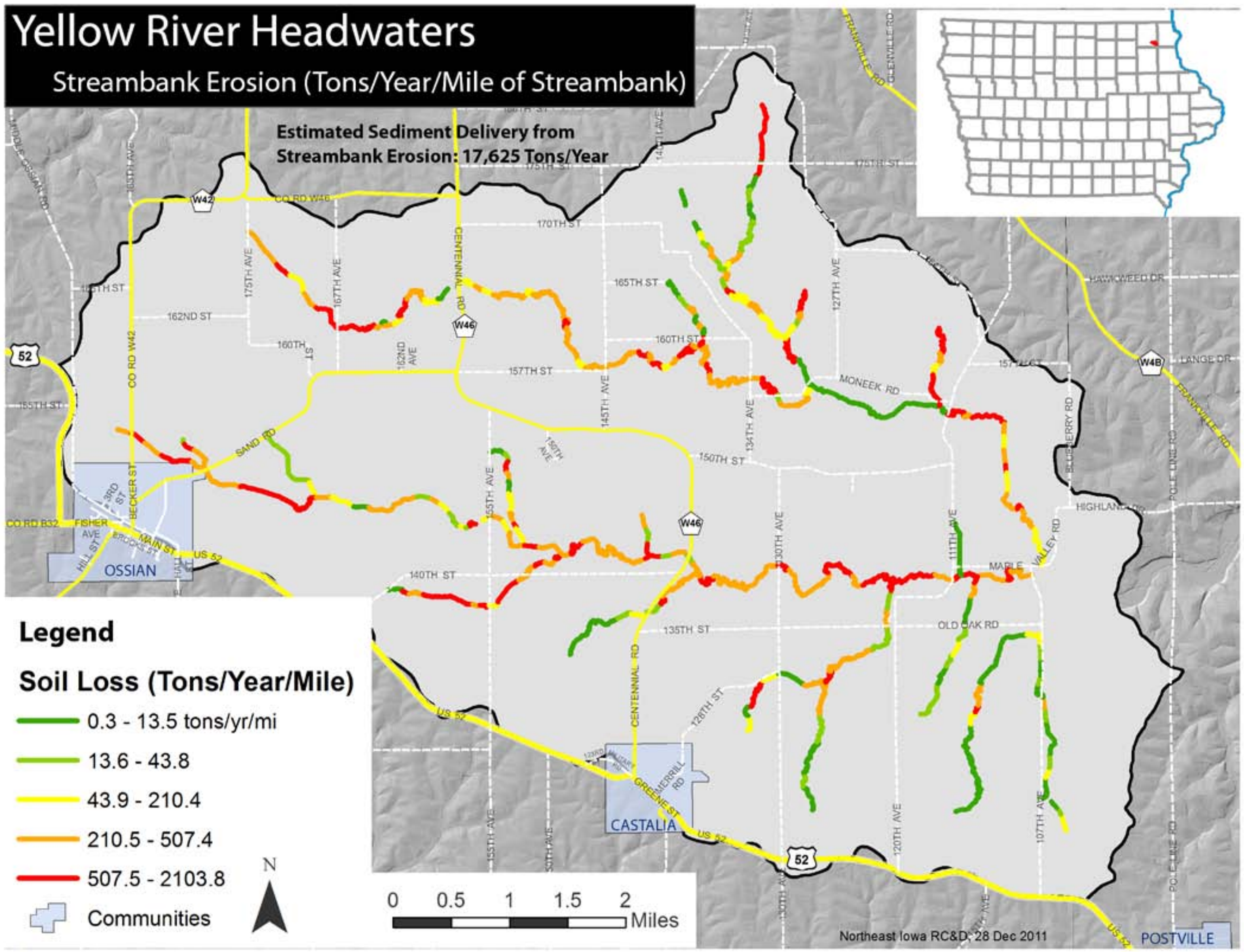
RASCAL

Two RASCAL (Rapid Assessment of Stream Conditions Along Length) assessments were completed in the YRHW, the first in 2007 and the second in 2011. The 2007 RASCAL was completed on the two main streams in the YRHW, the Main Stem of the Yellow River and the North Fork of the Yellow, but no other flowing waters. The 2011 analysis was more in depth, providing information on the main tributaries and all other flowing water in the YRHW. Only one landowner did not allow access for the assessment. Although there are notable differences between data sets it is important to recognize that different people gathered the data in 2007 and 2011. Since the RASCAL assessment relies on the judgment of the person doing the survey, only conservative conclusions have been drawn regarding the differences between the 2007 and 2011 assessments.

Several sets of data and numerous maps developed from the assessment are included as attachments with this plan. They are helpful as baseline information and also allowed for GIS analysis of the system. Significant findings from the 2011 RASCAL include the following.

- In 2011, there were 14 springs and 28 seeps in the stream channels of the YRHW.
- In 2011, there were 19 animal crossings and 44 machinery crossings.
- There were 65 sites with concrete/rock waste in 2011.
- There were 156 tile outlets marked in 2011.
- There were 20 fences across streams in 2011.
- Although the lower portions of the Yellow River has losing sections, there is no visible flow loss in any stream or stream segment in the YRHW.
- There were no visible changes in the *Channel Pattern* from 2007 to 2011.
- *Observed Water Clarity* is “Clear” with two notable exceptions.
- The *Channel Condition* shows limited past alteration that could be attributed to the fact that much of the corridor is pasture rather than row crop.
- *Adjacent Land Use* was dominated by crop in 2007 (95%) but the 2011 assessment documented an increase in “grass” and “pasture.” In 2011, approximately 70% of land use in the Riparian Zone is pasture grass and another 20% is trees or CRP/trees.
- The *Riparian Zone Width* in 2011 shows 45% of the perennial vegetation extends greater than 60 feet.
- Minimal Canopy Cover exists along the flowing water in the YRHW (0 to 10%), which has fewer trees in the riparian than in the YRW.
- The width of the Riparian Zone generally decreases further up the channel and in smaller tributaries with an increase in <10 feet and 10-30 feet riparian zones.
- Where grass is found beyond the riparian area, the banks (with one exception in the North Fork) more stable than where adjacent land use is not grass.
- *Bank material* is soil/silt
- Gullies in the watershed correspond directly with severe erosion on both sides of the bank.
- Bank Height >6 feet (6’-10’ and 10’-15’) overlapped with Bank Stability being reported as unstable or moderately unstable when livestock have access to these areas.

An estimate of stream bank soil loss in the YRHW was calculated based on conservative assumptions. Understanding a conservative loss of 17,626 tons/year is helpful and the mapping of degree of soil loss is useful for understanding the extent of the soil erosion from the stream bank and where future work might be targeted. The United States Department of Agriculture NRCS Stream Bank Erosion Estimator, as detailed in the NRCS Field Office Technical Guide, was used in combination with RASCAL information on *Bank Stability, Bank Height, Bank Erosion, and Bank Material* or Soil Type to develop the map below shows tons of soil eroded/year/mile of stream bank.

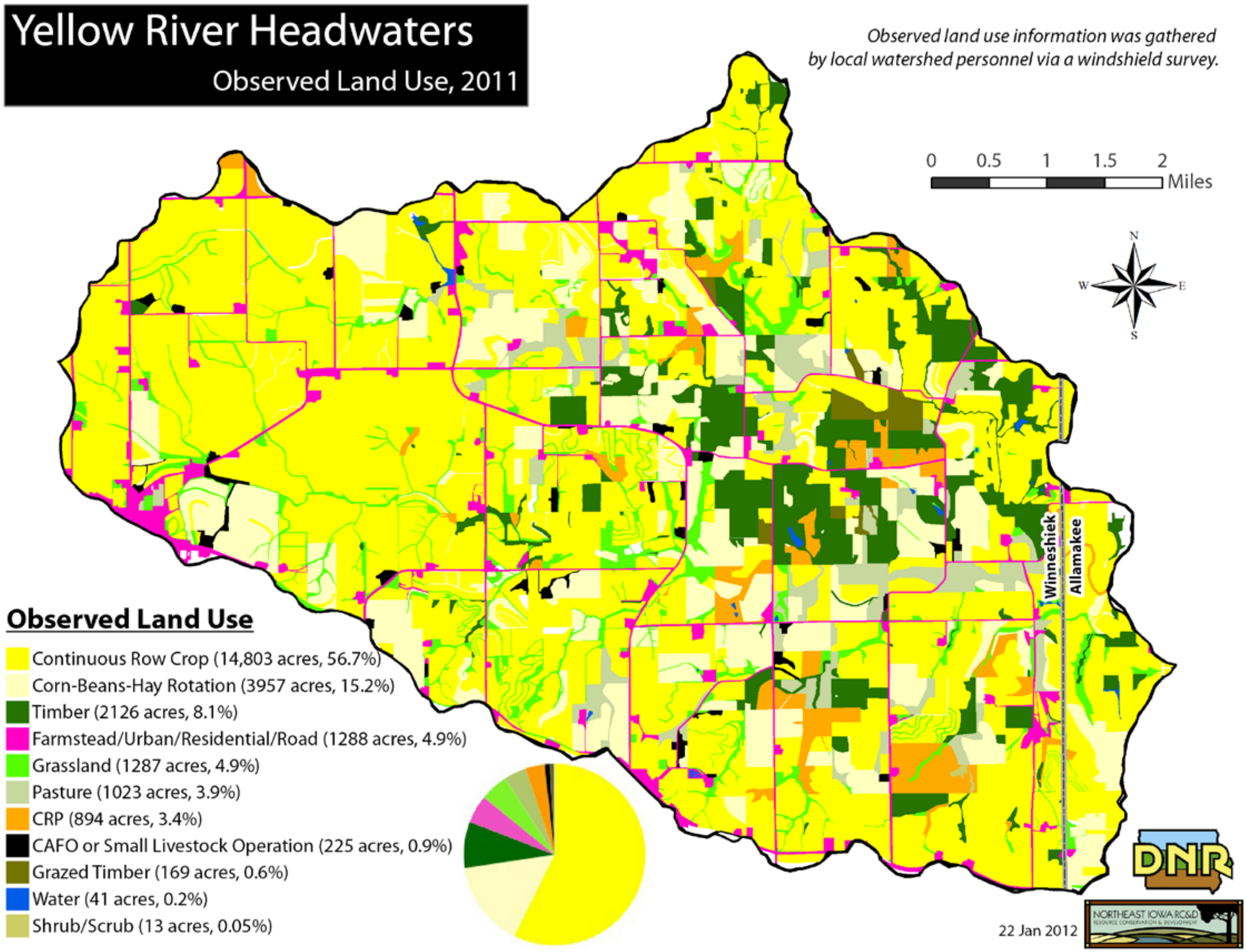


Land-use Tablet Assessment

A Land-use Tablet Assessment was completed in the YRHW in 2007 and again in Spring 2011. Results of the more recent 2011 assessment highlight land uses in the YRHW and the resulting sediment delivery to those streams from the corresponding land uses.

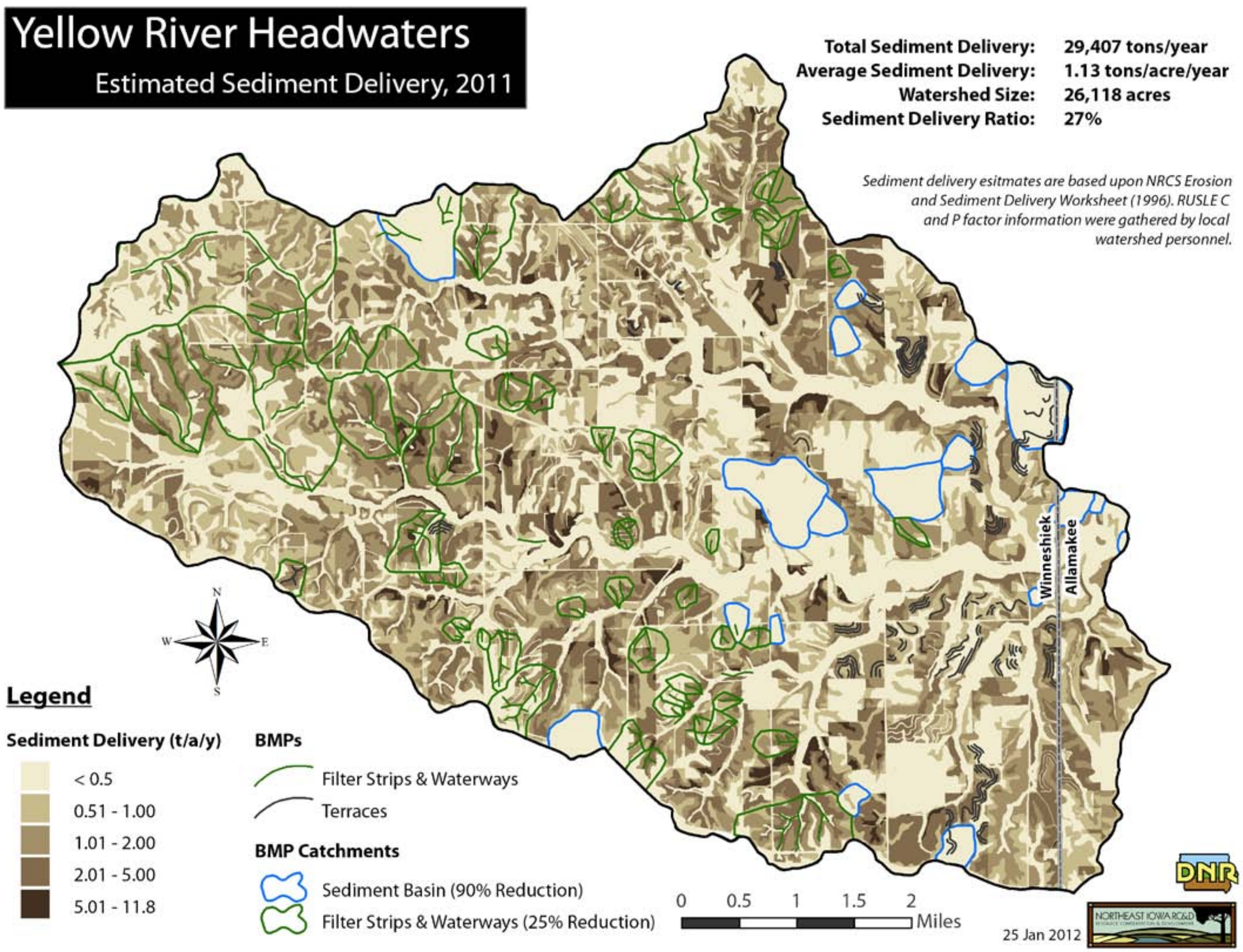
Nearly 72% of the land in the watershed is dedicated to row crop agriculture with only 15% of that area incorporating hay or alfalfa into the cropping rotation. Over 1,000 acres in the watershed is dedicated to pasturing livestock with a majority of that area lying within stream corridors.

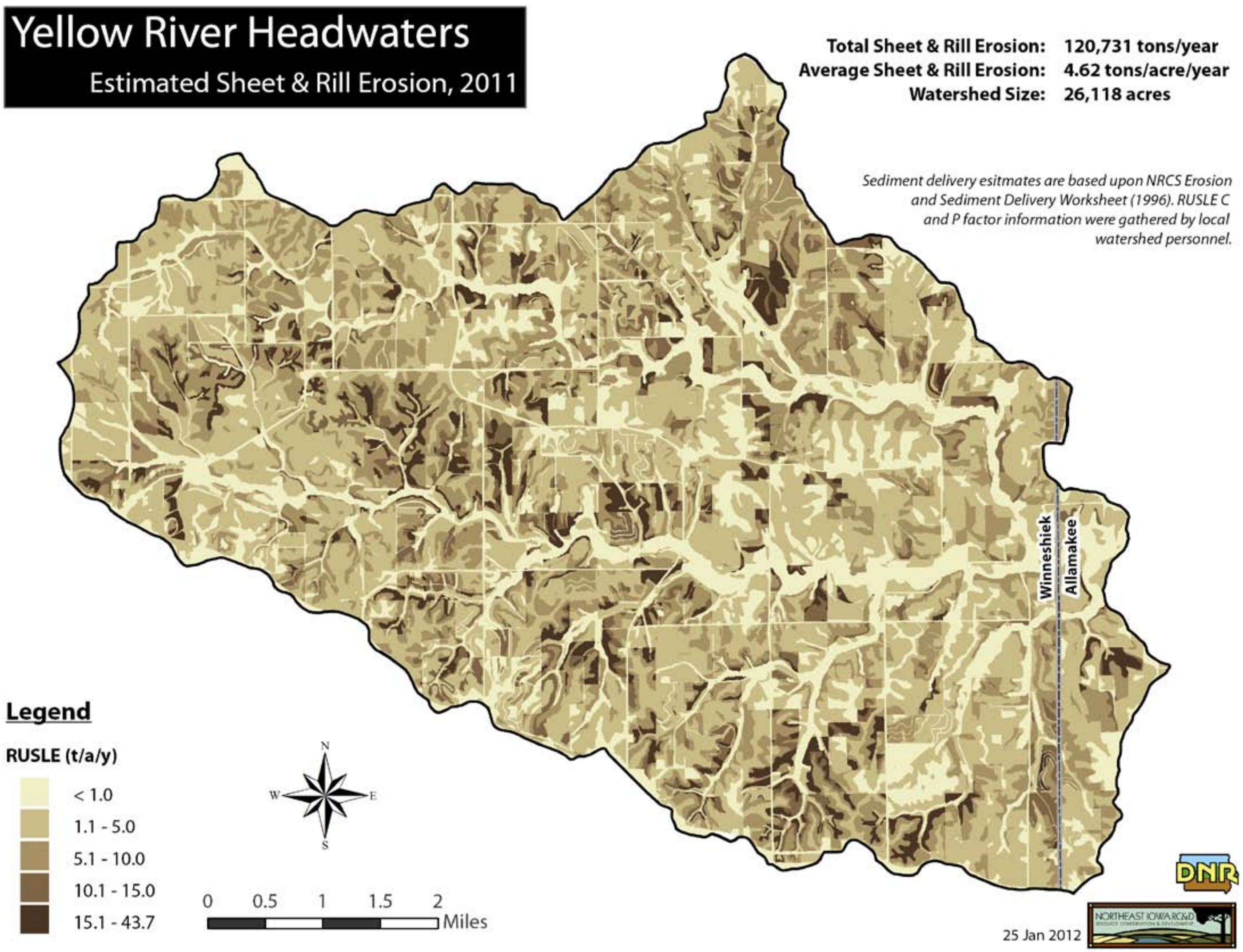
Slightly over 8% of the watershed is in timber and another 8% is dedicated to CRP and grassland, which includes grassed waterways and buffers. A complete breakdown can be found on the below map.


Yellow River Headwaters
Observed Land Use, 2011
Observed land use information was gathered by local watershed personnel via a windshield survey.
0 0.5 1 1.5 2 Miles
N
S
E
W
Winneshiek
Allamakee
Observed Land Use
Continuous Row Crop (14,803 acres, 56.7%)
Corn-Beans-Hay Rotation (3957 acres, 15.2%)
Timber (2126 acres, 8.1%)
Farmstead/Urban/Residential/Road (1288 acres, 4.9%)
Grassland (1287 acres, 4.9%)
Pasture (1023 acres, 3.9%)
CRP (894 acres, 3.4%)
CAFO or Small Livestock Operation (225 acres, 0.9%)
Grazed Timber (169 acres, 0.6%)
Water (41 acres, 0.2%)
Shrub/Scrub (13 acres, 0.05%)
DNR
NORTHEAST IOWA RC&D
22 Jan 2012

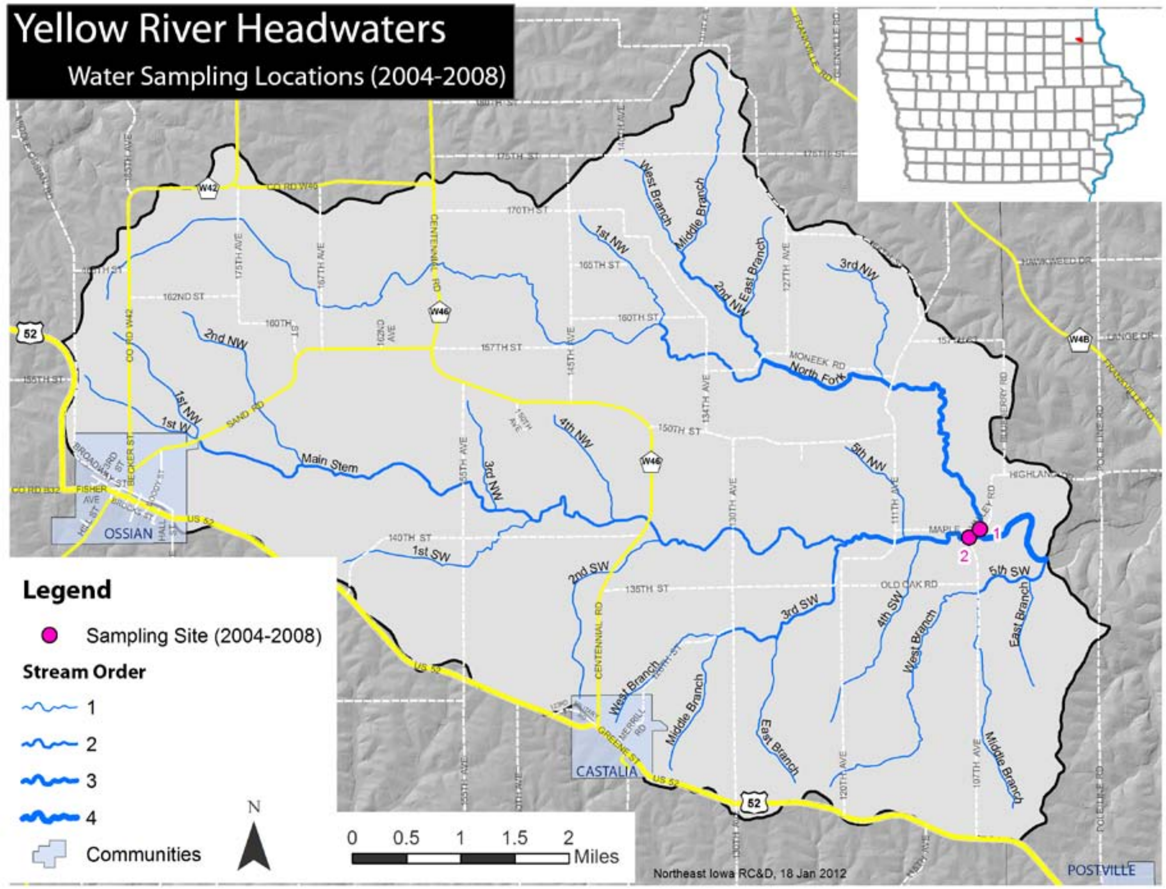
Sheet and Rill Erosion and Sediment Delivery

Utilizing information from the Land-use Tablet Assessment relating to agricultural land use, field management and tillage practices and presence or absence of conservation practices, along with slope and soil type data, Iowa DNR and Northeast Iowa RC&D staff were able to generate estimates of sheet and rill erosion and sediment delivery to the stream in the YRHW. The sheet and rill ersoion map does not take into account existing soil conservation practices, whereas the sediment delivery map accounts for estimated actual sediment reaching the stream. Based on these estimates, there are approximately 29,407 tons per year of sediment being delivered to the stream in the YRHW, a figure that correponds to more than 1.13 tons per acre per year throughout the watershed.




Yellow River Headwaters
Estimated Sheet & Rill Erosion, 2011
Total Sheet & Rill Erosion: 120,731 tons/year
Average Sheet & Rill Erosion: 4.62 tons/acre/year
Watershed Size: 26,118 acres
Sediment delivery esitmates are based upon NRCS Erosion and Sediment Delivery Worksheet (1996). RUSLE C and P factor information were gathered by local watershed personnel.
Winneshiek
Allamakee
Legend
RUSLE (t/a/y)
< 1.0
1.1 - 5.0
5.1 - 10.0
10.1 - 15.0
15.1 - 43.7
N
W
E
S
0 0.5 1 1.5 2 Miles
25 Jan 2012
DNR
NORTHEAST IOWA RC&D

Water Monitoring 2004-2008

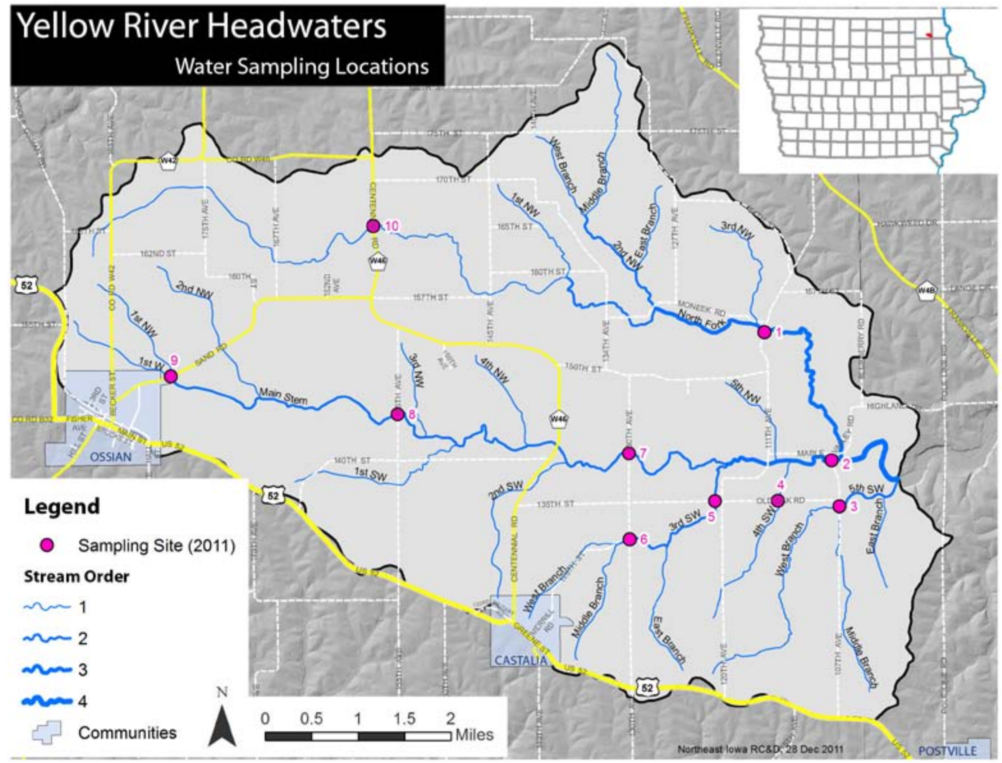


The Allamakee County SWD partnered with the Iowa DNR/ UHL to monitor water quality in the entire Yellow River Watershed between 2004 and 2008. From 2004 to 2006, weekly sampling occurred from May through October with monthly samples collected from November through April. In 2007, bi-weekly samples were collected from June through November with monthly samples collected throughout the rest of the year and in from January through September 2008, monthly samples were collected. Water samples were collected at two locations in the YRHW during this time, one site on the Yellow River sub and one on the North Fork of the Yellow River just before it joined the Yellow River Sub (see map).

Water monitoring results at these two locations throughout the period identified periodic and/or consistent levels of contaminants consistent with the causes of impairment. Monitoring data displayed elevated levels of ammonia N, *E. coli* bacteria, phosphate as P, nitrate + nitrite as N, turbidity and total suspended solids (TSS). Monitoring data showed consistently high *E. coli* levels with extreme spikes in bacteria numbers after certain heavy rainfalls. In the Yellow River Sub (Site #2 on map), 90.5 % of all of the samples collected between 2004 and 2008 had *E. coli* levels above the 235 CFU/100ml one time sample maximum level and the only samples that fell below that level were collected during the winter season between the months of November and March. The highest level recorded at the site was 830,000 CFU/100ml with a total of 9 samples between 2004 and 2008 indicating *E. coli* levels above 100,000 CFU/100ml. Results from the North Fork of the Yellow River were similar in terms of bacteria levels with 87.5% of all samples collected between 2004 and 2008 displaying *E. coli* levels above 235 CFU/100ml, with the only samples not exceeding that level collected during the winter. One sample collected at the North Fork site contained 820,000 CFU/100ml, while another 4 samples had levels above 100,000 CFU/100ml.

Water Monitoring 2011

Northeast Iowa RC&D conducted water monitoring at 10 locations throughout the YRHW between April and November of 2011. Samples were collected twice monthly at each location. A map of the locations is included. Samples were analyzed by the (University of Iowa Hygienic Lab (UHL) for Total Phosphate as P, *E. coli* bacteria, Ammonia Nitrogen and Nitrate +Nitrite as N. Field analysis also gathered pH, water temperature, chloride, dissolved oxygen and turbidity data at each site. Additional information on the parameters, sampling and analysis procedures and techniques is included in the Yellow River Headwaters Watershed Quality Assurance Project Plan found in Part XI of this plan.



Water monitoring results from the 2011 monitoring indicate continued elevated levels of bacteria throughout the YRHW. Eighty-two percent of all samples collected exceeded the one-time standard for primary contact recreation waters of 235CFU/100mL standard. In addition, the geometric mean bacteria level for all 10 sites was above the standard. Nitrate + Nitrate Nitrogen as N levels in the watershed were also elevated with arithmetic mean levels above 10mg/L at 5 of the 10 sampling sites and only one site (site 4) with a mean level below 7.5 mg/L. The table below shows a summary of 2011 water monitoring results.

2011 Water Monitoring Results Summary

Site ID	pH	Chloride (mg/L)*	Temp ˚C	Temp ˚F	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Total Phosphate as P (mg/L)*	Nitrate + Nitrite Nitrogen as N	E.coli (MPN/100mL)**	Ammonia Nitrogen as N (mg/L)*
1	8.4	<33	13.8	56.8	85.5	8.3	0.18	9.2	7097	0.08
2	8.4	<33	14.7	58.4	51	8.4	0.17	8.4	2386	0.07
3	8.6	<33	11.9	53.5	17.1	9.4	0.07	7.5	298	<0.05
4	8.6	<33	11.8	53.3	18.5	9.1	0.15	5.7	1168	0.06
5	8.6	<33	12.2	53.9	27.2	9.1	0.11	8.3	820	<0.05
6	8.7	<33	12.1	53.8	19.5	9.4	0.12	10.4	698	<0.05
7	8.6	<33	14.3	57.7	26.7	9	0.13	10.6	1010	<0.05
8	8.6	<33	13.4	56.1	10.9	10.2	0.09	13	684	<0.05
9	8.6	<33	13.7	56.7	9.6	9.5	0.14	11.7	983	<0.05
10	8.4	<33	14	57.2	29.6	9.4	0.12	13.1	1266	0.08

* In calculating means, values above or below the detection limit are assumed to be 20% less than or greater than the detection limit (e.g., A chloride value of <33mg/L is assumed to be 26.4mg/L (= 33*0.8) for purposes of calcuating the mean)

**E.Coli means are a Geometric Mean, all others are arithmetic

TMDL for Bacteria for Yellow River Sub Section and North Fork Yellow River

Yellow River 1 is the monitoring location associated with the impaired segment IA 01 YEL 0080_3. It runs 5.8 miles from its confluence with the North Fork Yellow River (S13, T96N, R7W, Allamakee County) to its confluence with an unnamed tributary (SE 1/4, S8, T96N, R7W, Winneshiek County). This segment receives flow from the Yellow River Headwaters HUC 12. There are not any impaired tributaries that flow into this segment.

North Fork Yellow River (IA 01-YEL-0160_0) is the ninth impaired Yellow River tributary upstream from the Yellow River confluence with the

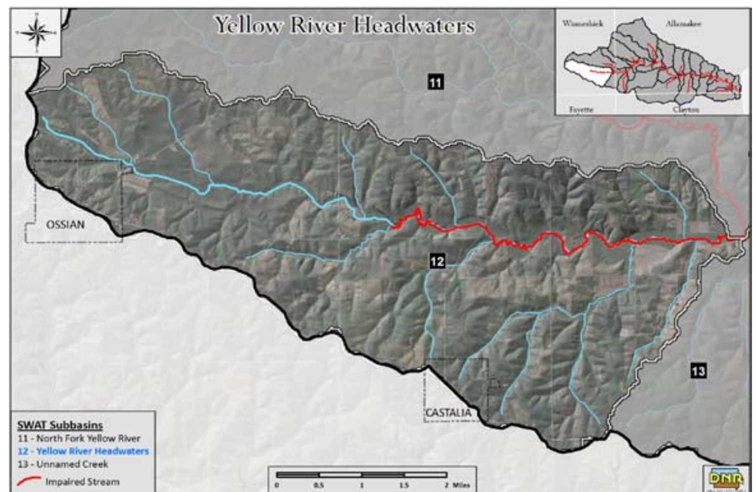


Figure 7-1 Yellow River 1 (0080_3) – Yellow River Headwaters. The impaired segment is shown in red.

Mississippi. The classified segment runs northwest 3.7 miles upstream from its confluence with the Yellow River (S13, T96N, R7W, Winneshiek County).
There is one municipal wastewater treatment facility for the City of Castalia that discharges to a tributary of the Yellow River Sub segment. This facility is a controlled discharge lagoon that releases effluent at higher flows twice per year in the spring and fall. The stream flow used in the development of the TMDL for these segments is derived from the area ratio flow based on the Ion USGS gage data. A SWAT watershed model developed for the Yellow River watershed labels the headwaters segment Subbasin 12 and the North fork Yellow River segment Subbasin 11.

Water body pollutant loading capacity (TMDL)

The *E. coli* organism load capacity is the number of organisms that can be in a volume and meet the water quality criteria. The loading capacity for each of the five flow conditions is calculated by multiplying the midpoint flow and *E. coli* criteria concentrations. Table 7-2 shows the median, maximum, and minimum flows for the five recurrence intervals.

Table 7-2 Yellow River 1 maximum, minimum and median flows

Flow description	Recurrence interval range (mid %)	Midpoint of flow range, cfs	Maximum of flow range, cfs	Minimum of flow range, cfs
High flow	0 to 10% (5)	55.5	592.4	35.7
Moist conditions	10% to 40% (25)	17.5	35.7	11.0
Mid-range	40% to 60% (50)	8.7	11.0	7.3
Dry conditions	60% to 90% (75)	5.9	7.3	4.7
Low flow	90% to 100% (95)	3.9	4.7	1.7

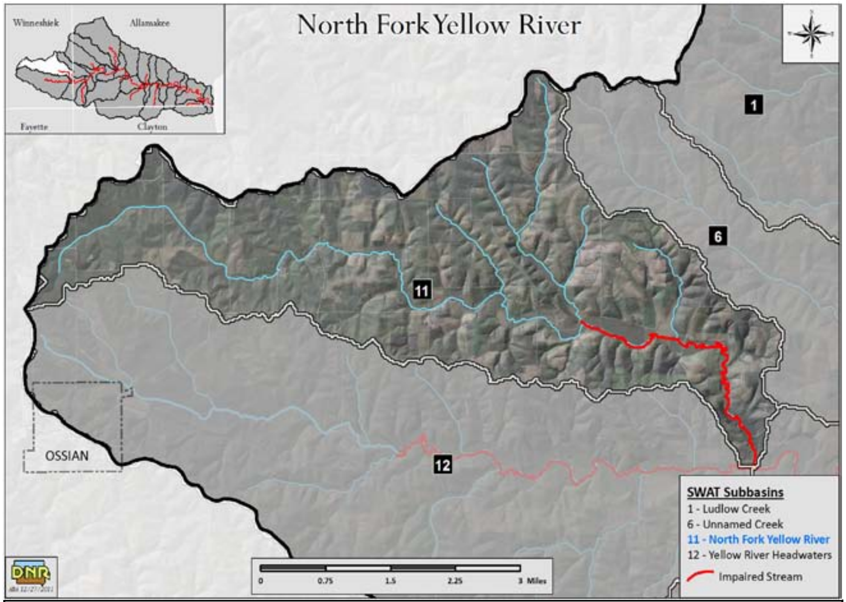


Figure 16-1 North Fork Yellow River (0160_0). The impaired Section is shown in red.

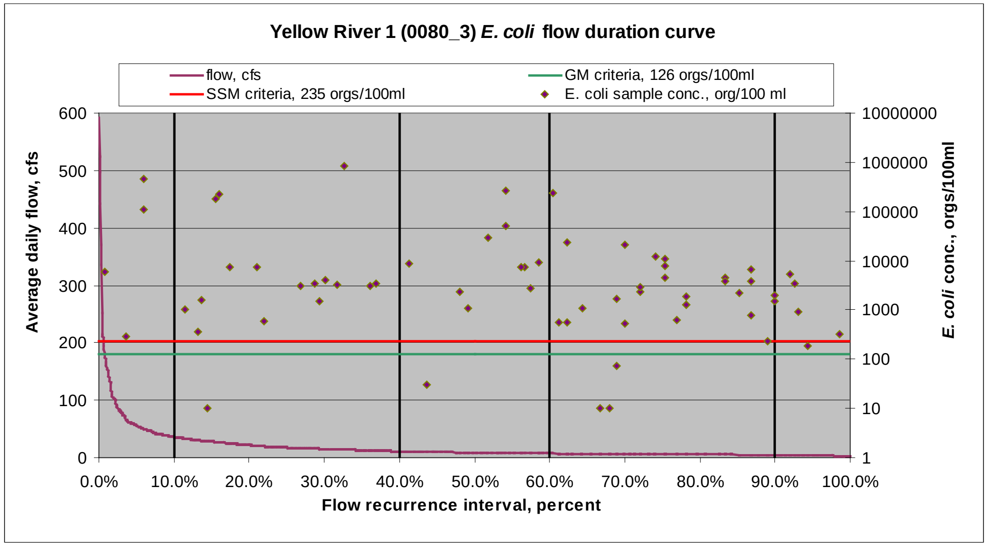
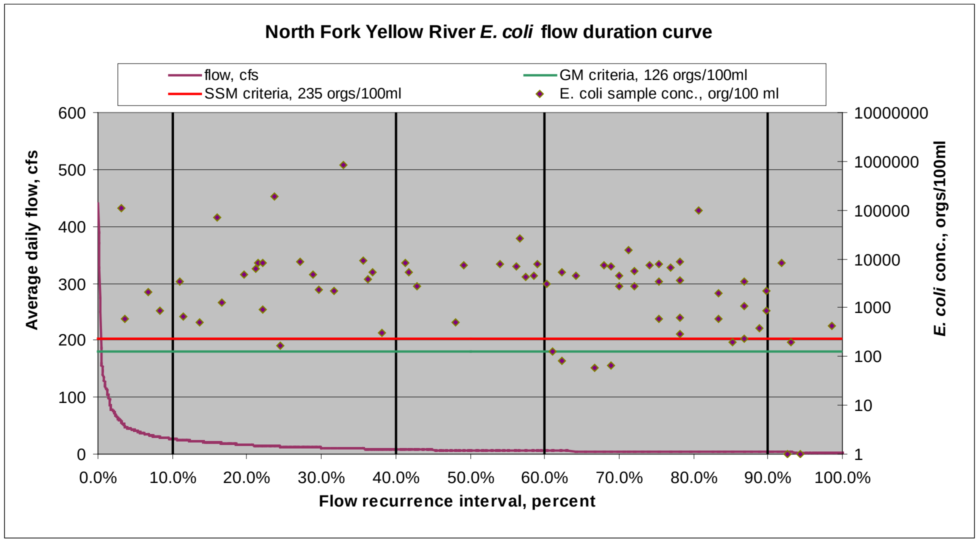


Figure 7-2 Yellow River 1 Flow Duration Curve



Flow and load duration curves were used to establish the occurrence of water quality standards violations, to establish compliance targets, and to set pollutant allocations and margins of safety. Duration curves are derived from flows plotted as a percentage of their recurrence.

E. coli loads are calculated from *E. coli* concentrations and flow volume at the time the sample was collected. To construct the flow duration curves, the bacteria monitoring data and the Water Quality Standard (WQS) sample max (235 *E. coli* organisms/100 ml) were plotted with the flow duration percentile.

Figure 7-2 shows the data that exceeds the WQS criteria at each of the five flow conditions. High flow violations indicate that the problem occurs during run-off conditions when bacteria are washing off from nonpoint sources.

Criteria exceeded during low or base flow, when little or no runoff is occurring, indicate that continuous sources such as septic tanks, livestock in the stream, riparian wildlife, and wastewater treatment plants are the problem.

Figure 1

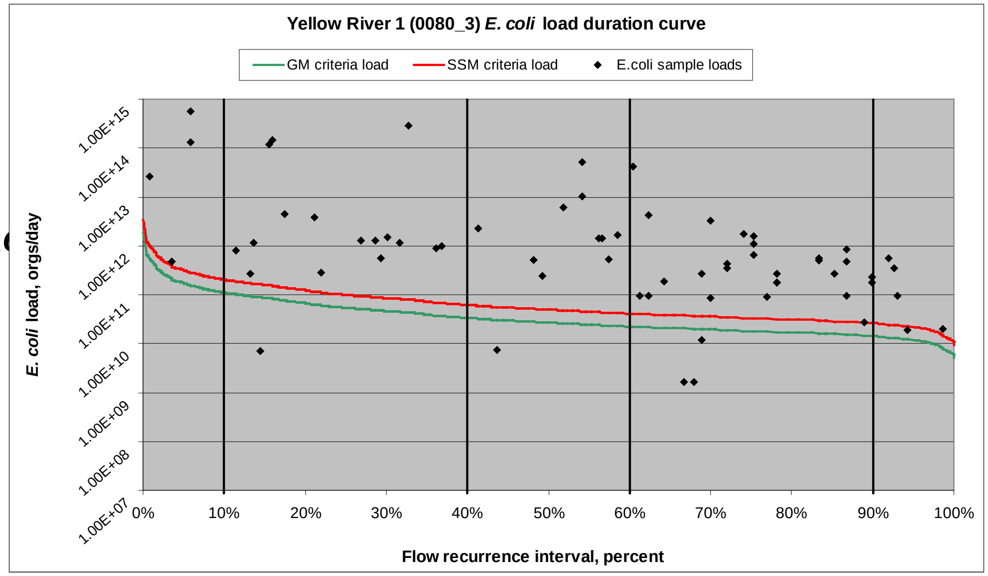


Figure 7-3 Yellow River 1 Load Duration Curve

Load duration curves were used to evaluate the five flow conditions for this Yellow River segment. The load duration curve is shown in Figure 7-3. In the figure, the lower curve shows the maximum *E. coli* count for the geometric mean (GM) criteria and the upper curve shows the maximum *E. coli* count for the single sample maximum (SSM) criteria at a continuum of flow recurrence percentage. The individual points are the observed (monitored) *E. coli* concentrations converted to loads based on daily flow for the day they were collected. Points above the load duration curves are violations of the WQS criteria and exceed the loading capacity.

Existing load.

The existing loads are derived from the sampling data collected for Yellow River Sub and North Fork Yellow River. These data are the sample values shown in the flow and load duration curves. The *E. coli* concentrations are multiplied by the simulated daily flow to get the daily loads. The daily loads are plotted with the load duration curves. The allowable loads for a given flow equal the flow multiplied by the WQS limits for the geometric mean or single sample maximum. Monitored data that exceed the limits are above the criteria curves. The maximum existing loads occur during major rains when runoff and bacteria concentrations are highest. Concentrations exceed the criteria during these high flow events. Other conditions leading to criteria violations occur during dry low flow periods when continuous loads from livestock in the stream, local wildlife, septic tanks, and wastewater treatment plants can cause bacteria problems. The assessment standard used to evaluate streams is the *E. coli* geometric mean criteria. Since the load duration approach precludes the calculation of a geometric mean, the 90th percentile of observed concentrations within each flow condition is multiplied by the median flow to estimate existing loads. This procedure has been used to

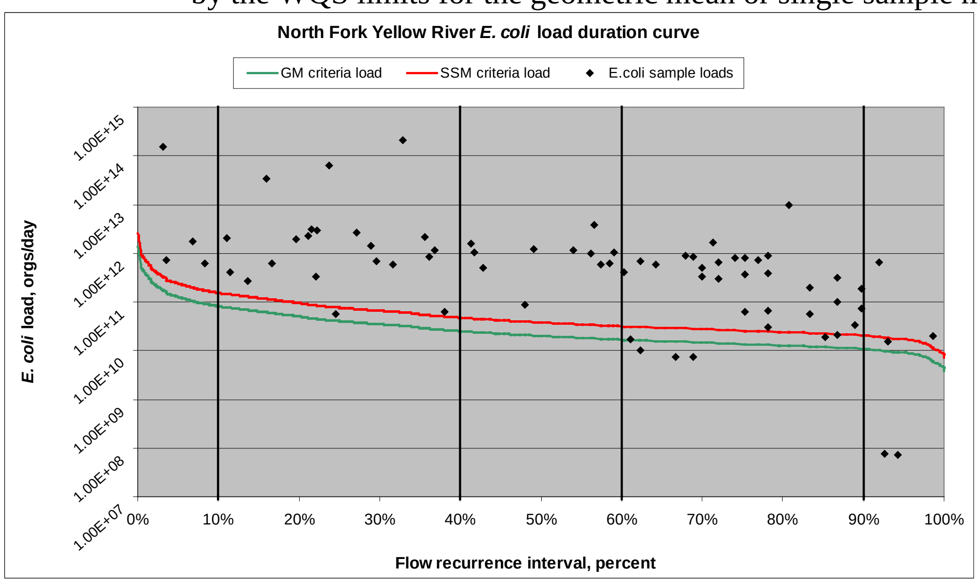


Figure 16-3 North Fork Yellow River Flow Load Duration Curve

evaluate impaired segments. Table 7-5 and 16-5 show the existing loads for each flow condition.

Table 7-5 Yellow River 1, existing loads

Flow condition, percent recurrence	Recurrence interval range (mid %)	Associated median flow, cfs	Existing 90th percentile *E. coli* conc., org/100ml	Estimated existing load, *E. coli* org/day
High flows	**0 to 10% (5)**	55.5	348000	4.73E+14
Moist conditions	**10% to 40% (25)**	17.5	196000	8.39E+13
Mid-range	**40% to 60% (50)**	8.7	52000	1.11E+13
Dry conditions	**60% to 90% (75)**	5.9	12900	1.85E+12
Low flow	**90% to 100% (95)**	3.9	4540	4.34E+11

Table 16-5 North Fork Yellow River existing loads

Flow condition, percent recurrence	Recurrence interval range (mid %)	Associated median flow, cfs	Existing 90th percentile *E. coli* conc., org/100ml	Estimated existing load, *E. coli* org/day
High flows	**0 to 10% (5)**	41.0	77630	7.79E+13
Moist conditions	**10% to 40% (25)**	13.0	70000	2.23E+13
Mid-range	**40% to 60% (50)**	6.5	8300	1.32E+12
Dry conditions	**60% to 90% (75)**	4.3	7680	8.17E+11
Low flow	**90% to 100% (95)**	2.9	5032	3.57E+11

Identification of pollutant sources.

The sources of bacteria in the Yellow River headwaters subbasin (SWAT subbasin 12) and North Fork Yellow River subbasin (SWAT Subbasin11) are nonpoint sources including failed septic tank systems, cattle in stream, pastured cattle, wildlife, and manure applied to fields from animal confinement operations. The loads from these sources are incorporated into the SWAT watershed model and appear in Tables 7-6 to 7-10 and 16-6 to 16-10.

Non-functional septic tank systems. There are about 95 onsite septic tank systems in the Yellow River subbasin (2.5 persons/household) and an estimated 69 onsite septic tank systems in the North Fork yellow River subbasin (2.5 persons/household). IDNR estimates that 50 percent are not functioning properly. It is assumed that these are continuous year round discharges. Septic tank loads have been put into the SWAT model as a continuous point source by subbasin.

Table 7-6 Yellow River 1 headwaters septic tank system E. coli orgs/day

Population of Yellow River headwaters	237
Total initial E.coli, orgs/day [1]	2.99E+11
Septic tank flow, m^3/day [2]	62.8
E. coli delivered to stream, orgs/day [3]	**3.14E+09**

Table 16-6 North Fork Yellow River septic tank system E. coli orgs/day

Population of N. F. Yellow River subbasin	172
Total initial E.coli, orgs/day [1]	2.17E+11
Septic tank flow, m^3/day [2]	45.58
E. coli delivered to stream, orgs/day [3]	**2.28E+09**

1. Assumes 1.26E+09 E. coli orgs/day per capita
2. Assumes 70 gallons/day/capita
3. Assumes septic system discharge concentration reaching stream is 1000 orgs/100 ml

Cattle in stream. Of the 680 cattle in pastures in the Yellow River headwaters subbasin and the 512 cattle in pastures in the North Fork Yellow River subbasin, one to six percent of those are assumed to be in the stream on a given day. The number on pasture and the fraction in the stream varies by month. Cattle in the stream have a high potential to deliver bacteria since bacteria are deposited directly in the stream with or without rainfall. Subbasin cattle in the stream bacteria have been input in the SWAT model as a continuous point source varying by month.

Table 7-7 Yellow River 1 cattle in the stream E. coli orgs/day[1]

Pasture area, acres	871
Number of cattle in stream/day[2]	41
Dry manure, kg/day[3]	126
E. coli load, orgs/day[4]	**1.67E+12**

Table 16-7 North Fork Yellow River Cattle in the stream E. coli orgs/day[1]

Pasture area, acres	657
Number of cattle in stream/day[2]	31
Dry manure, kg/day[3]	95
E. coli load, orgs/day[4]	**1.26E+12**

1. The number of cattle in the subbasin is estimated from the area of the pastured landuse – 0.78 cattle/ha.
2. It is estimated that cattle spend 6% of their time in streams in July and August, 3% in June and September, and 1% in May and October. The loads shown in this table are for July and August. The loads for the other 4 months when cattle are in streams have been incorporated into the SWAT modeling.
3. Cattle generate 3.1 kg/head/day of dry manure.
4. Manure has 1.32E+07 E. coli orgs/gram dry manure.

Grazing livestock. The number of cattle in the Yellow River headwaters subbasin is estimated to be 680 and 512 in the North Fork Yellow River subbasin and it is assumed that the cattle are on pasture from May to November and that 94 percent are on pasture at any given time. The potential for the delivery of bacteria to the stream occurs with precipitation causing runoff. Manure available for washoff is put in the SWAT model at 6 kg/ha in the pasture HRU's.

Table 7-8 Yellow River 1 manure from pastured cattle, maximum E. coli available for washoff, orgs/day[1]

Pasture area, acres	871
Number of cattle on pasture[2]	639
Dry manure, kg[3]	1980
Maximum E. coli load, orgs/day[4]	2.61E+13
Maximum E. coli available for washoff, orgs[5]	**4.71E+13**

Table 16-8 North Fork Yellow River manure from pastured cattle, maximum E. coli available for washoff, orgs/day[1]

Pasture area, acres	657
Number of cattle on pasture[2]	481
Dry manure, kg[3]	1493
Maximum E. coli load, orgs/day[4]	1.97E+13
Maximum E. coli available for washoff, orgs[5]	**3.55E+13**

1. The number of pastured cattle is 94% of the total.
2. Cattle generate 3.1 kg/head/day of dry manure.
3. Manure has 1.32E+07 E. coli orgs/gram dry manure
4. The load available for washoff is the daily load times 1.8.

Wildlife manure. The number of deer in Allamakee County is about 9,000 located primarily in forested land adjacent to streams. Another 1,000 have been added to account for other wildlife such as raccoons and waterfowl for a total estimate of 10,000. This works out to 0.024 deer per acre. The area of the Yellow River headwater subbasin is 13,023 acres for a total of 313 deer. In the subbasin the deer are assumed to be concentrated in the ungrazed grassland and are in the subbasin year round.

Table 7-9 Yellow River 1 wildlife manure loads available for washoff

Number of deer[1]	Grassland area, ha	SWAT manure loading rate, kg/ha/day[2]	E. coli available for washoff, orgs[3]
313	305	1.48	9.22E+08

Table 16-9 North Fork Yellow River watershed wildlife manure loads available for washoff

Number of deer[1]	Forested area, ha	SWAT manure loading rate, kg/ha/day[2]	E. coli available for washoff, orgs[3]
233	420	0.799	4.99E+08

1. Deer numbers are 0.059 deer/ha (2.47 acre per ha) for the entire subbasin concentrated to 1.025 deer/ha in the forest land use. All wildlife loads are applied to the forest landuse in the SWAT model. The county deer numbers have been increased by 10% to account for other wildlife in the subbasin.
2. Assumes 1.44 kg/deer/day.
3. Assumes that the maximum E. coli available for washoff is 1.8 times the daily load.

Field applications of CAFO manure.
There are about 4,000 swine in confinement in the Yellow River headwaters subbasin and about 2,400 hogs and 250,000 chickens in confinement in the North Fork Yellow River subbasin. The manure from these is stored and land applied to cropland. The manure has been distributed to the fields in the subbasin in the fall after soybean harvest and in the spring prior to corn planting in year 2 of a two year rotation. The relatively brief fall and spring timing of manure application and incorporation in the soil significantly reduces the E. coli organisms from these sources. Manure application has been entered in the SWAT model by subbasin as a load available at the end of October and the beginning of April.

Table 7-10 Yellow River 1 confined livestock manure applications

Livestock type	Swine	Chickens	Dairy cows
Number of animals	4,000	0	0
Manure applied, kg/application[1]	1,649,800	0	0
Area applied to, acres[2]	194	0	0
Manure applied, kg/ha/day[3]	2,127	0	0
Subbasin E. coli, orgs/day	4.41E+14	0	0
Subbasin E. coli available for washoff, orgs/day[4]	7.94E+14	0	0

Table 16-10 North Fork Yellow River watershed confined livestock manure applications

Livestock type	Swine	Chickens	Dairy cows
Number of animals	2,400	52,200	0
Manure applied, kg/application[1]	989,880	2,734,763	0
Area applied to, acres[2]	116	259	0
Manure applied, kg/ha/day[3]	2,127	2,326	0
Subbasin E. coli, orgs/day	2.65E+14	1.44E+14	0
Subbasin E. coli available for washoff, orgs/day[4]	4.76E+14	2.59E+14	0

1. Manure is calculated based on number of animals * dry manure (kg/animal/day)*365 days/year.
2. The area the manure is applied to is based on the manure's nitrogen content. Manure is applied at a rate equivalent to 201.6 kg N/ha/yr. Swine manure is applied at 2127 kg/ha, dairy manure at 2631 kg/ha and chicken manure at 2326.
3. Manure is assumed to be applied to fields twice a year over 5 days on October 30 and April 1. It is incorporated in the soil and it is assumed that only 10% of bacteria are viable and available after storage and incorporation.

4. Maximum *E. coli* available for washoff are 1.8 times the daily maximum available load.

Seasonal effect of different sources.

The relative impacts of the bacteria sources are shown in Figures 7-4 and 7-5. Figure 7-4 shows the relative loads delivered by the "continuous" sources, those sources present with or without rainfall and runoff. These are the failed septics that are assumed to be a problem every day of the year and the loads from cattle in the stream that vary by month from May to October. It can be seen in this figure that the impacts from cattle in the stream are much more significant than those from failed septic tank systems.

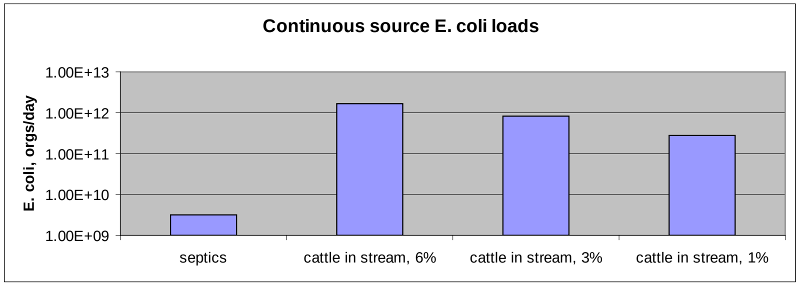


Figure 7-4 E. coli loads from "continuous" sources Yellow Sub

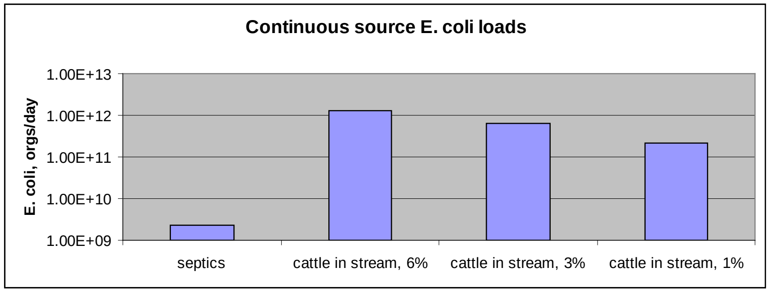


Figure 16-4 E. coli loads from "continuous" sources North Fork Sub

The three general washoff sources of bacteria in the subbasin are shown in Figure 7-5 and 16-5. The wildlife source consists primarily of deer and smaller animals such as raccoons and waterfowl. These are year round sources. Pastured cattle consist of grazing cattle and small poorly managed feedlot-like operations. The grazing season is modeled as lasting 168 days starting May 1. Manure from confined animal feeding operations (CAFO) is applied to cropland twice a year for a relatively brief time assumed to be a few days. Most field applied manure is assumed to be incorporated into the soil and most bacteria in it are not available. Confinement animals are swine, chickens and dairy cattle.

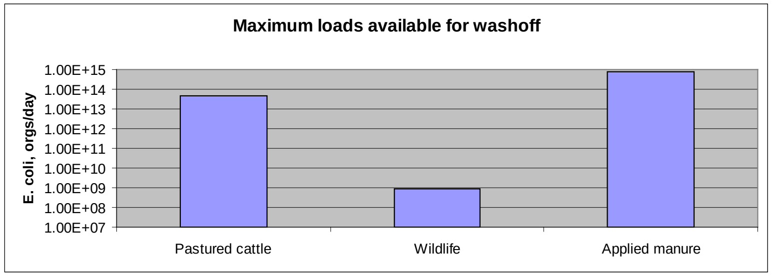


Figure 7-5 Maximum E. coli loads available for washoff Yellow Sub

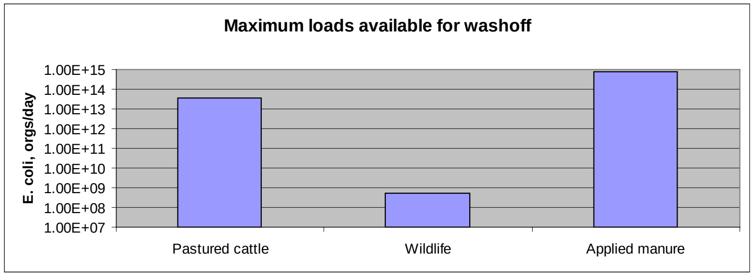


Figure 16-5 Maximum E. coli loads available for washoff North Fork

The maximum bacteria load to the stream occurs when the continuous source load plus the precipitation driven washoff load are combined. In general, the more rainfall the higher the flow rate and the more elevated the concentration. High flow rate and elevated concentration equal peak loads.

Flow interval load source analysis. Based on the load duration curve analysis the maximum existing load occurring during the zero to forty percent recurrence interval runoff conditions in the Yellow River Headwaters subbasin, is 1.18E+14 orgs/day and the total available load based on the potential sources is 8.41E+14 orgs/day and the maximum existing load occurring during the zero to forty percent recurrence interval runoff conditions in the North Fork Yellow River subbasin is 3.77E+13 orgs/day and the total available load based on the potential sources is 7.71E+14 orgs/day. Generally the maximum load in the stream, delivered in April when runoff is occurring, is approximately fourteen percent of the bacteria available for washoff. At the zero to ten percent maximum existing load of 4.73E+14 in the Yellow River Headwaters subbasin and 7.79E+13 in the North Fork Yellow River subbasin and the same load available for washoff, the stream load is fifty-six percent of the available load in the Yellow River subbasin and ten percent of the available load in the North Fork Yellow River subbasin.

Departure from load capacity.

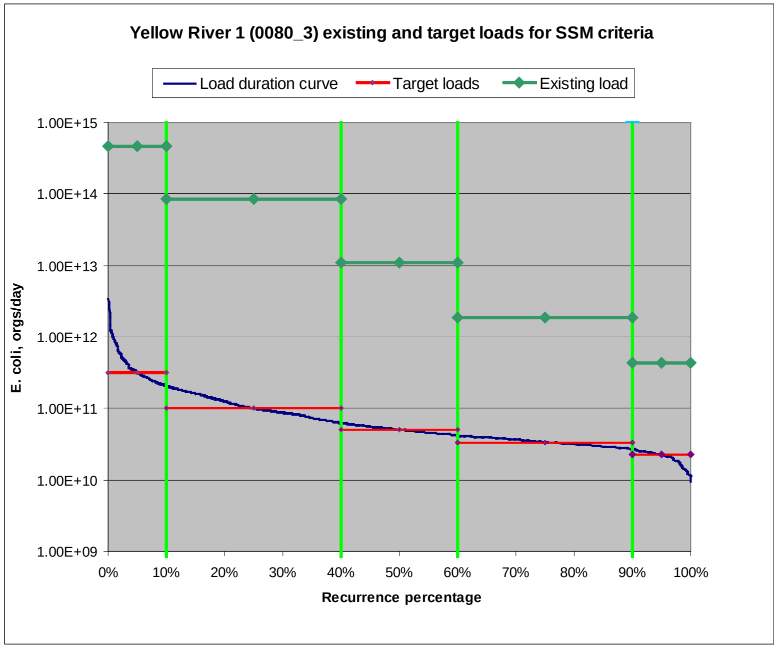
The departure from load capacity is the difference between the existing load and the load capacity. This varies for each of the five flow conditions. Table 7-11 and 16-11 show this difference. The existing and target loads for the five flow conditions are shown graphically in Figure 7-6 and Figure 16-6.

Table 7-11 Yellow River 1, departure from load capacity

Design flow condition, percent recurrence	Recurrence interval range (mid %)	Existing *E. coli* orgs/day	Load capacity, orgs/day	Departure from capacity, orgs/day
High flow	**0 to 10% (5)**	4.73E+14	3.2E+11	4.72E+14
Moist conditions	**10% to 40% (25)**	8.39E+13	1.0E+11	8.38E+13
Mid-range flow	**40% to 60% (50)**	1.11E+13	5.0E+10	1.11E+13
Dry conditions	**60% to 90% (75)**	1.85E+12	3.4E+10	1.82E+12
Low flow	**90% to 100% (95)**	4.34E+11	2.2E+10	4.11E+11

Table 16-11 North Fork Yellow River departure from load capacity

Design flow condition, percent recurrence	Recurrence interval range (mid %)	Existing *E. coli* orgs/day	Load capacity, orgs/day	Departure from capacity, orgs/day
High flow	**0 to 10% (5)**	7.79E+13	2.4E+11	7.76E+13
Moist conditions	**10% to 40% (25)**	2.23E+13	7.5E+10	2.23E+13
Mid-range flow	**40% to 60% (50)**	1.32E+12	3.7E+10	1.28E+12
Dry conditions	**60% to 90% (75)**	8.17E+11	2.5E+10	7.92E+11
Low flow	**90% to 100% (95)**	3.57E+11	1.7E+10	3.40E+11



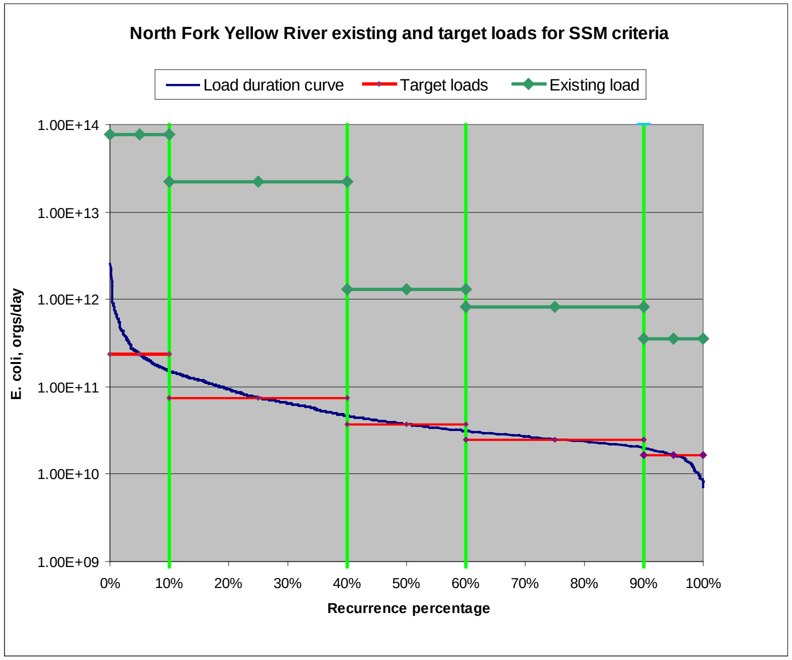


Figure 7-6 and 11-6. Difference between existing and target loads in Yellow River Sub and North Fork Yellow River

Pollutant Allocations

Wasteload allocations.
The wasteload allocations for the Castalia municipal wastewater treatment facility that discharges to an unnamed tributary to the Yellow River are shown in Tables 7-12 and 7-13 which show the geometric mean (GM) and single sample maximum (SSM) TMDL calculations. It is currently assumed that all of the wastewater treatment plants in the watershed discharge to a Class A1 stream. The wasteload allocations for the discharges are the Class A1 *E. coli* water quality standards, a GM of 126-organisms/100 ml and a SSM of 235-organisms/100 ml. These concentration criteria have been multiplied by the 180day average wet weather (AWW) flow divided by ten to mimic the episodic and controlled discharge. There are no permitted discharge sites in the North Fork Yellow River subbasin.

Load allocation.
The load allocations for *E. coli* TMDLs are the load capacity less an explicit 10 percent margin of safety (MOS) less the total WLA for the flow condition for the GM or SSM. There is a separate load allocation set for each of the target recurrence intervals. The load allocations are shown in Tables 7-12 and 7-13.

Table 7-12 Yellow River IA 01-YEL-0080-3 GM *E. coli* load allocations

Flow condition, percent recurrence	GM target (TMDL) *E. Coli*, orgs/day	GM MOS *E. Coli*, orgs/day	Total WLA GM *E. coli*, orgs/day	LA GM *E. coli*, orgs/day
High flows	1.7E+11	1.7E+10	1.56E+09	1.5E+11
Moist conditions	5.4E+10	5.4E+09	1.56E+09	4.7E+10
Mid-range flow	2.7E+10	2.7E+09	1.56E+09	2.3E+10
Dry conditions	1.8E+10	1.8E+09	1.56E+09	1.5E+10
Low flow	1.2E+10	1.2E+09	1.56E+09	9.3E+09

1. Based on geometric mean standard of 126 *E. coli* organisms/100 ml

Table 7-13 Yellow River IA 01-YEL-0080-3 SSM *E. coli* load allocations

Flow condition, percent recurrence	SSM target (TMDL) *E. Coli*, orgs/day	SSM MOS *E. Coli*, orgs/day	Total WLA SSM *E. coli*, orgs/day	LA SSM *E. coli*, orgs/day
High flow	3.2E+11	3.2E+10	2.91E+09	2.8E+11
Moist conditions	1.0E+11	1.0E+10	2.91E+09	8.8E+10
Mid-range flow	5.0E+10	5.0E+09	2.91E+09	4.2E+10
Dry conditions	3.4E+10	3.4E+09	2.91E+09	2.7E+10
Low flow	2.2E+10	2.2E+09	2.91E+09	1.7E+10

1. Based on single sample maximum standard of 235 *E. coli* organisms/100 ml

Margin of safety.
The margin of safety for *E. coli* is an explicit 10 percent of the load capacity at each of the design recurrence intervals as shown in Tables 7-12 and 7-13.

TMDL Summary
The following equation shows the total maximum daily load (TMDL) and its components for the impaired IA 01-YEL-0080-3 segment of the Yellow River.

Total Maximum Daily Load = Σ Load Allocations + Σ Wasteload Allocations +MOS

A Total Maximum Daily Load calculation has been made at design flow conditions for the GM and SSM of this segment and these are shown in Figures 7-7, 16-6 and 7-8 and 16-7.

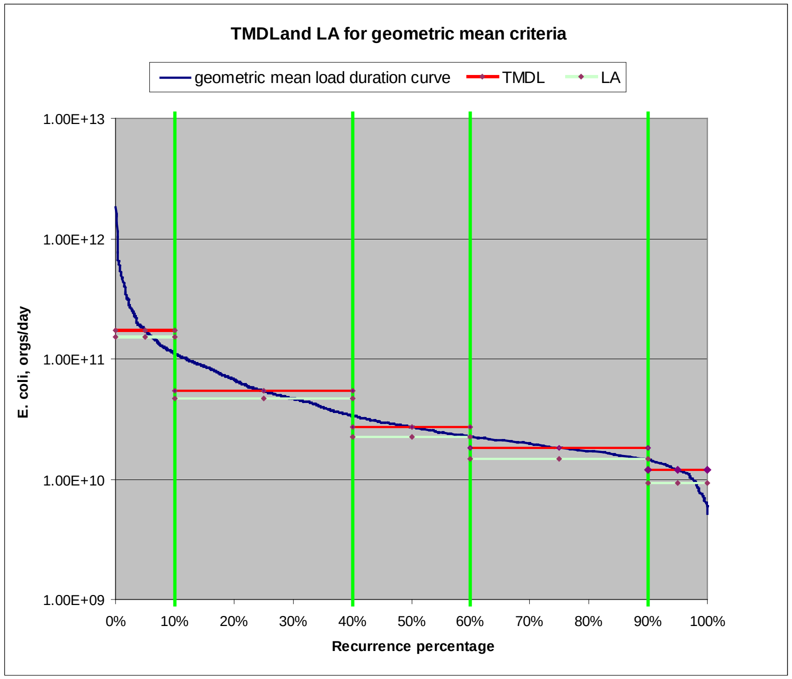


Figure 7-7 GM TMDL at WQS of 126 orgs/100 ml for the five flow Conditions for Yellow River subbasin

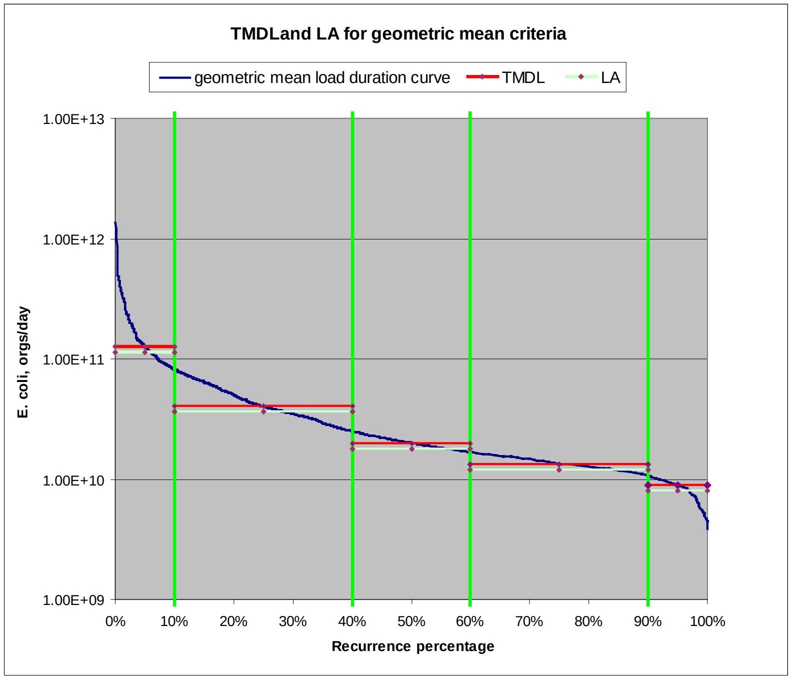


Figure 16-6 GM TMDL at WQS of 126 orgs/100 ml for North Fork

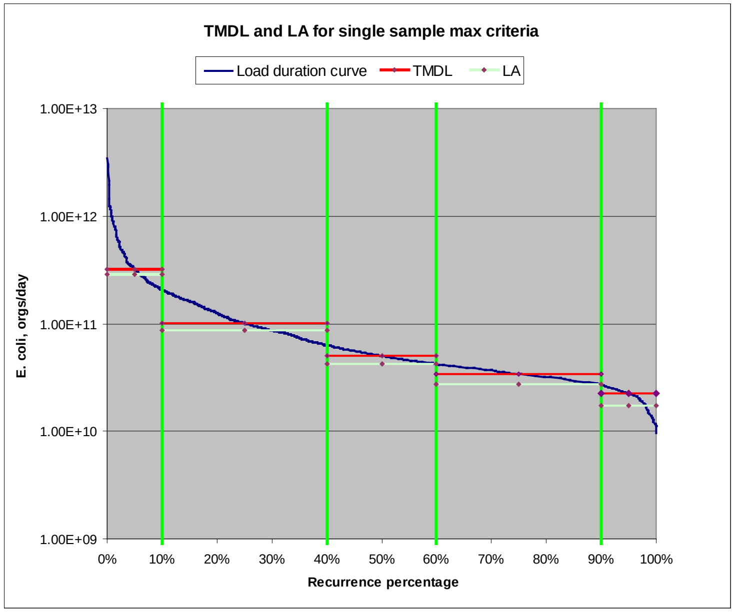


Figure 7-8 SSM TMDL at the WQS of 235 orgs/100 ml for the Yellow River Headwaters subbasin for the five flow conditions

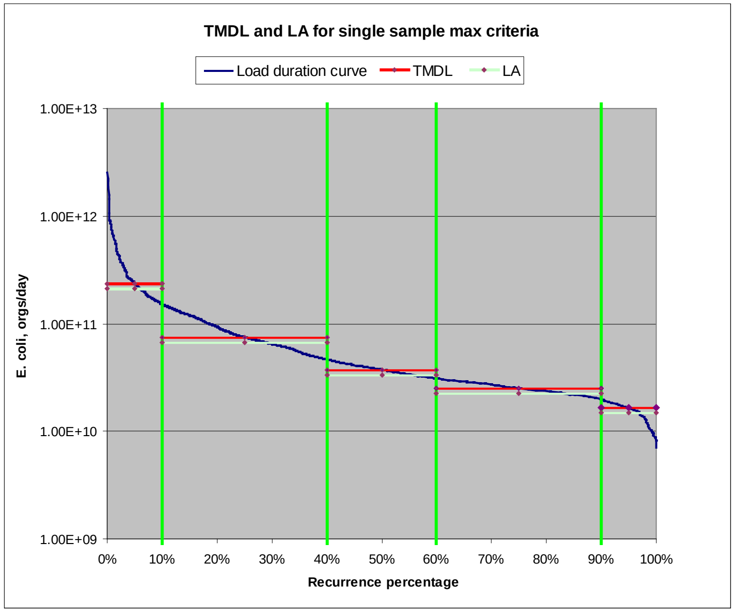


Figure 16-7 SSM TMDL at WQS of 235 orgs/100 ml for the North Fork

TMDL for Sediment Delivery

At this time there is no TMDL developed for sediment delivery in the YRHW. Based on estimates from sediment delivery calculations and stream bank delivery sources it is estimated that current sediment loading to the YRHW is 47,032 tons per year with 29,407 tons annually from surface erosion and 17,625 tons annually from stream bank erosion.

VII: Proposed Management Measures & Expected Load Reductions

The following proposed management measures and strategies will result in significant reductions in bacteria, sediment, and nutrient delivery to the YRHW once implemented. The proposed measures target watershed areas that are contributing the greatest amount to the impairments and allow for maximum return on investment of conservation dollars.

Project Goals and Objectives

<u>Goal 1: Reduce bacteria delivery to the YRHW streams by 90%</u>

Objective 1: Eliminate cattle in the stream (unrestricted access) on the entire YRHW and North Fork Yellow River stream corridors
Objective 2: Reduce available manure for wash-off from confinement operations by 50%
Objective 3: Reduce bacteria delivery from open feedlot operations in close proximity to the YRHW

<u>Goal 2: Reduce sediment delivery to the YRHW streams from watershed land area by 50% (17,450 t/y)</u>

Objective 1: Install 21 targeted sediment and water control basins to reduce sediment and bacteria delivery to the YRHW streams
Objective 2: Implement targeted BMPs to achieve 50% reduction in sediment delivery on the remaining 10% of land contributing the highest sediment delivery and 15% reduction in sediment delivery on all remaining acres

<u>Goal 3: Reduce sediment delivery to the YRHW streams from stream bank erosion by 15%</u>

Objective 1: Target streambank stabilization to banks contributing in excess of 1,000 t/mile/y of sediment to the YRHW

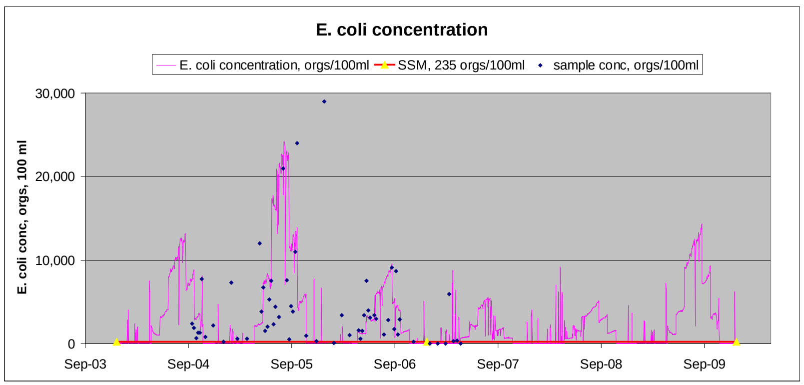
<u>Goal 4: Reduce municipal and residential bacteria, sediment and nutrient delivery from septic and stormwater run-off.</u>

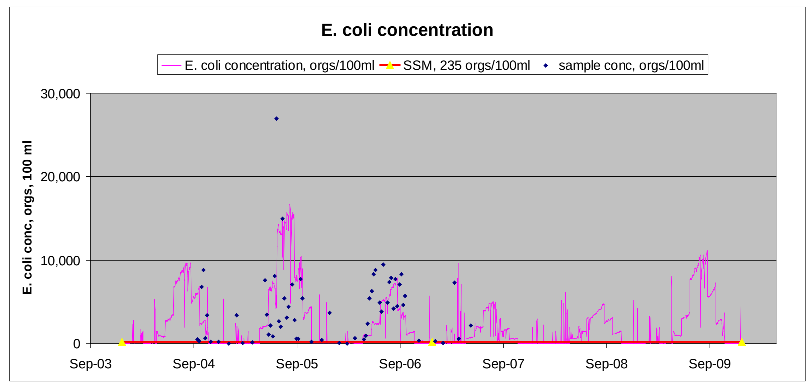
Objective 1: Reduce the delivery of bacteria from non-functioning or poorly functioning septic systems
Objective 2: Reduce the delivery of bacteria, sediment and nutrients from municipal sources in the YRHW

Bacteria

The TMDL developed by IDNR for bacteria in the YRHW indicates that reduction of bacteria delivery to the stream could be most effectively accomplished through addressing the most significant contributors of bacteria, cattle in the stream and field applied manure from CAFOs. The following graphs represent SWAT analysis of load reductions based on several simulations for the Yellow River Sub and North Fork Yellow River subbasins that make up the YRHW. All data between quotes below is taken from the TMDL developed by William Graham with Iowa DNR.

"The modeled systematic reduction of the loads by source provides the initial evaluation of proposed implementation plans for the subbasin. The SWAT model has been run in five scenarios in which loads have been reduced for the most significant sources. The source analysis identified the primary source of bacteria and as cattle in the stream and field applied manure from CAFOs. Figure 7-9 show the SWAT model output concentrations for the stream with monitored concentrations also plotted on the chart. The target concentration of 235 E. coli orgs/100 ml day is frequently exceeded by both monitored data and SWAT simulated values.





The second scenario removes half of the cattle in the stream from the subbasin. This generates concentrations that are much lower, but that are still very high compared to the SSM standard.

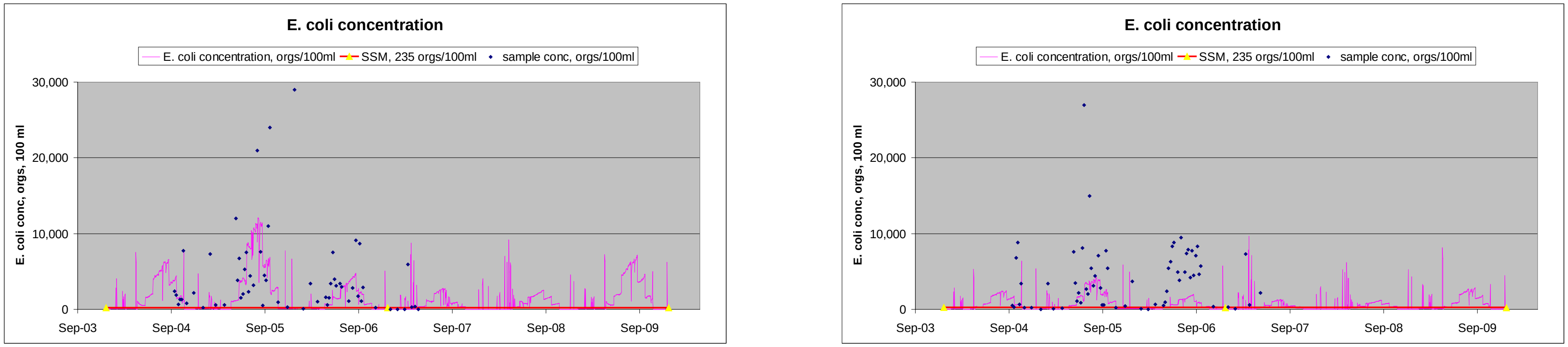


Figure 7-10 SWAT Scenario 2 output for half reduction of CIS E. coli concentrations: Yellow River subbasin on left, North Fork Yellow River subbasin on right.

The third scenario, shown in Figure 7-11, eliminates cattle in stream (CIS) altogether as a source. This drops the concentration during the grazing season but there remain quite a few instances of high bacteria concentration from runoff. Much of this is associated with field application of manure from CAFOs and the assumption that it is often done in the spring when it rains harder and more often.

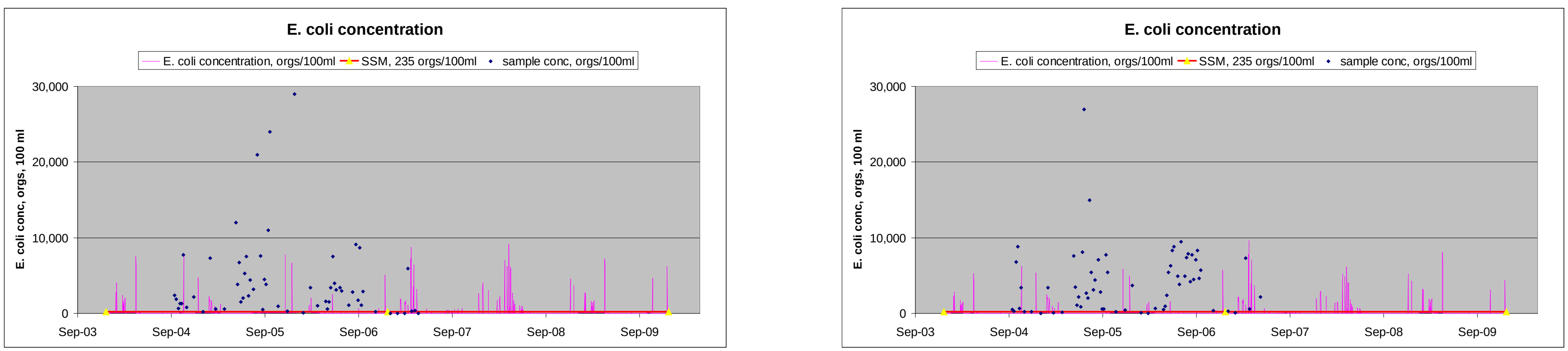


Figure 7-11 SWAT Scenario 2 output for complete reduction of CIS: Yellow River subbasin on left, North Fork Yellow River subbasin on right.

The fourth scenario, shown in Figure 7-12, assumes that the field applications of manure are cut in half. This brings bacteria concentrations down from these applications down quite a bit but they still exceed the target.

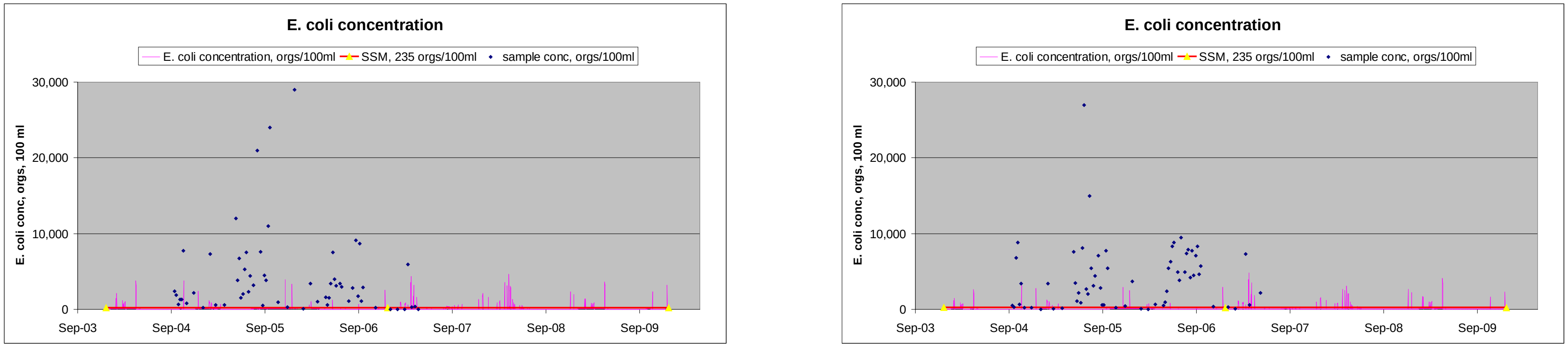


Figure 7-12 SWAT output for complete reduction of CIS E. coli and half of applied manure from CAFOs: Yellow River subbasin on left, North Fork Yellow River subbasin on right.

The fifth scenario, shown in Figure 7-13, in addition to the previous reductions, reduces the manure from cattle on pasture by two thirds. This pasture manure reduction showed less than a one percent decrease in bacteria concentration in the stream.

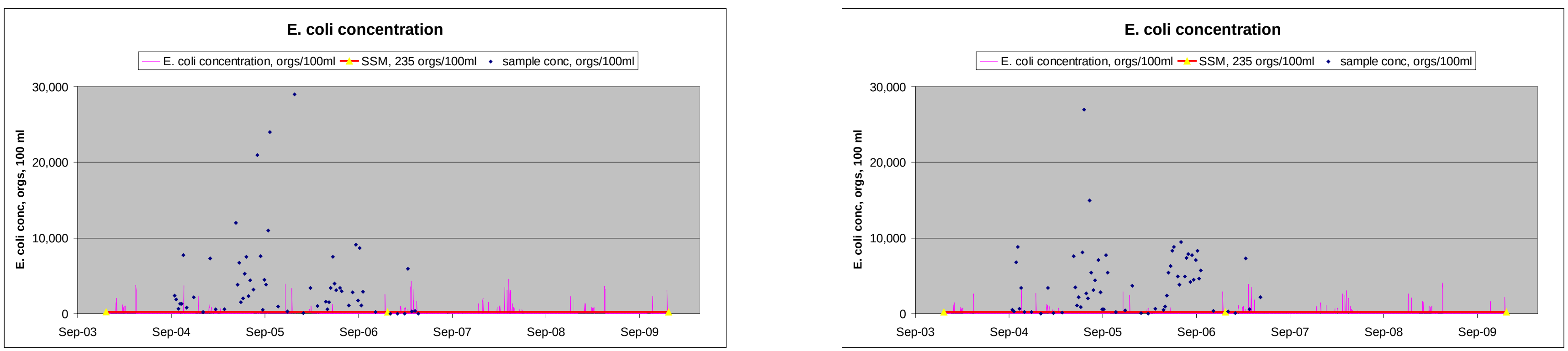


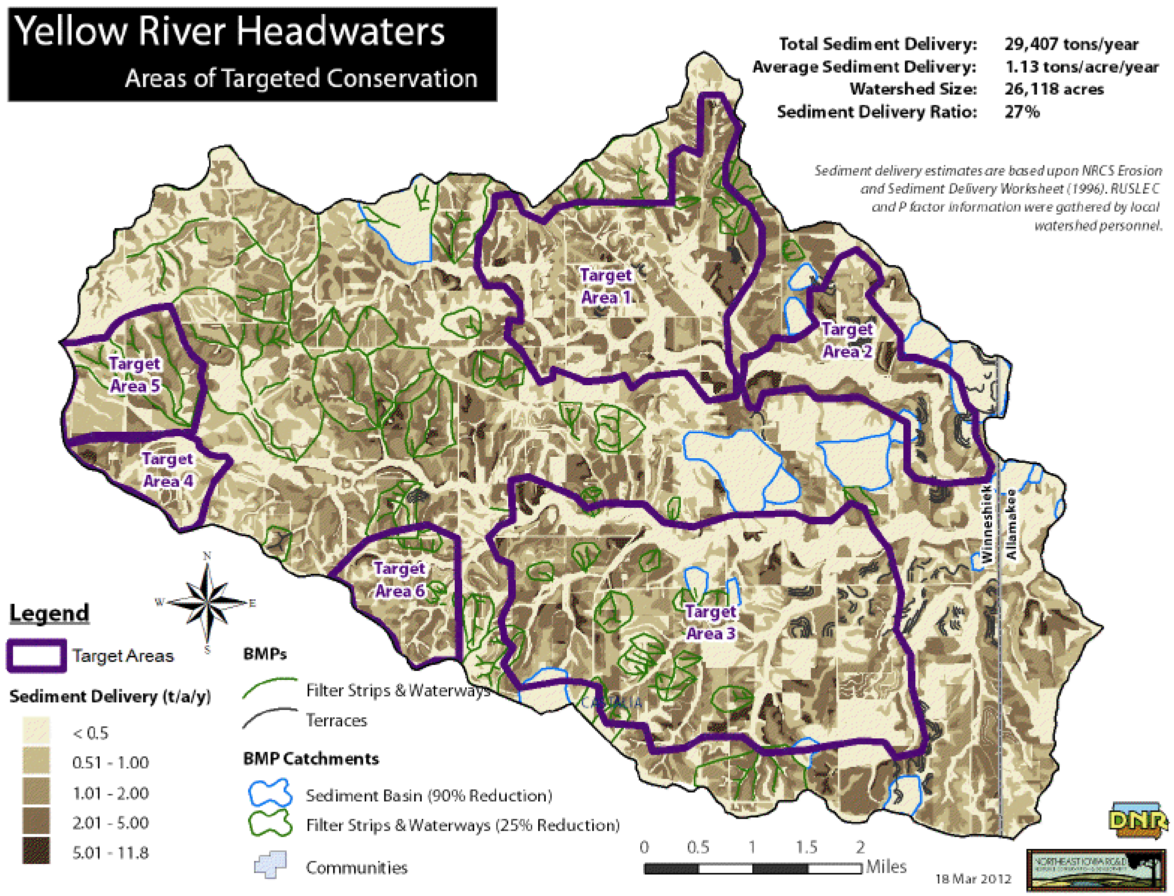
Figure 7-13 SWAT output for complete reduction of CIS E. coli and half of applied manure from CAFOs and a two thirds reduction of manure from cattle on pasture: Yellow River subbasin on left, North Fork Yellow River subbasin on right.

There are several combinations of source reductions that can be simulated. The five scenarios described here reduce bacteria loads from the sources that have been modeled to have the greatest impact on stream outlet bacteria concentrations. It is worth noting that sources that are not reduced in these scenarios may have important episodic or local effect on *E. coli* organism numbers."

The largest contributors to bacteria loading in the YRHW are livestock with direct access to the stream and wash off from manure spreading of CAFO manure on surface land in the YRHW. The fifth scenario in the TMDL SWAT model involves removing two-thirds of the cattle from pasture in the watershed, which is not a feasible option and only would result in a 1% decrease in the amount of bacteria reaching the stream. Therefore, the proposed management measures in this WMP specifically focus on those two sources to obtain maximum reduction of bacteria entering the stream. Fencing for livestock exclusion, livestock watering systems, watering pipeline, and livestock watering ponds all offer landowners the ability to eliminate livestock access to the stream. In cases where complete removal from the stream is not possible, heavy use protection, stream crossings and flash grazing and management intensive grazing allow for managed access to the stream and protection of the stream bank. Feedlot runoff control measures provide for more proper handling of manure on the lot, filtering of runoff and diversion of clean water away from concentrated manure stockpiles which all will help to reduce bacteria delivery, organic matter and ammonia from reaching the stream, particularly during episodic heavy rain or snowmelt events. To address the contributions of bacteria to the stream available for wash off from CAFO manure spreading to fields in the watershed, landowners will be assisted with developing comprehensive nutrient management plans (CNMPs). In addition, filed practices, such as water and sediment control basins, filter strips and riparian buffers will all reduce runoff and bacteria delivery from fields, as well as allow for ultraviolet inactivation of bacteria.

Sediment

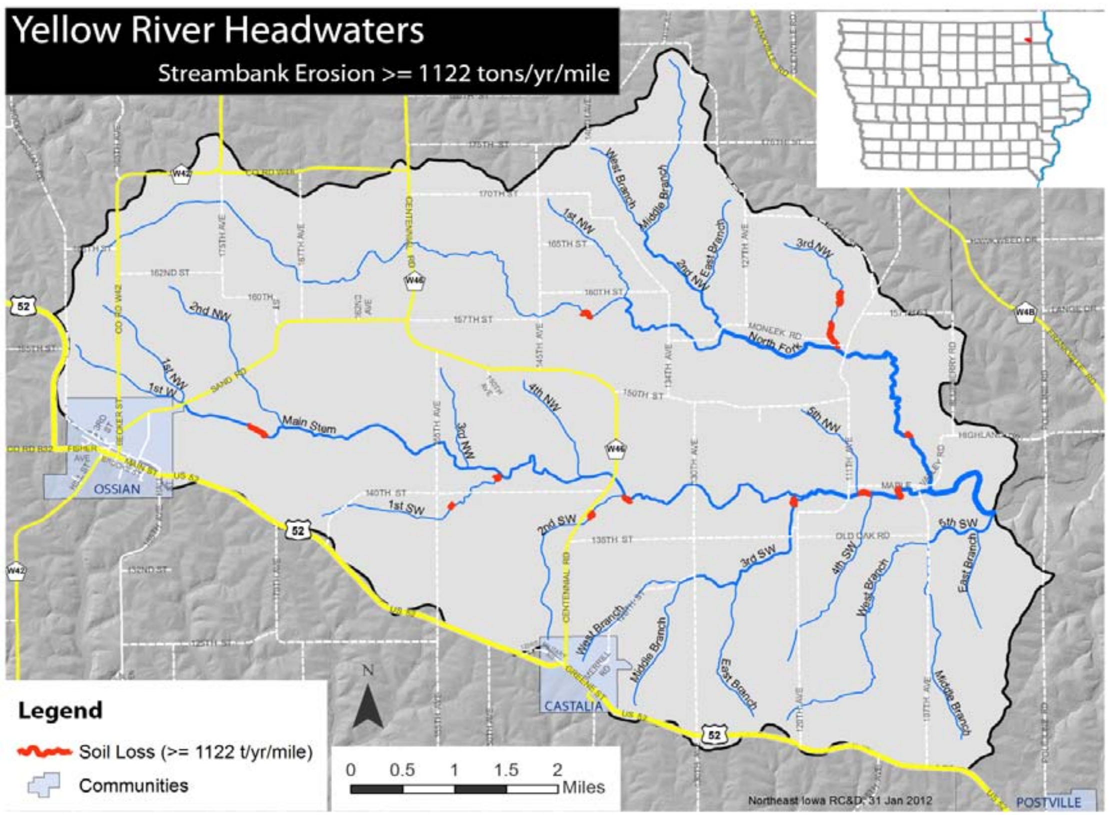
The primary focus of the YRHW WMP is to reduce bacteria. By implementing BMPs typically utilized to reduce sediment delivery, the Winneshiek SWCD and landowners will not only address a secondary goal of reducing sediment delivery, but also the primary goal of reducing bacteria. Research conducted by the US EPA has shown that BMPs that slow the rate of stormwater and in field run-off effectively serve to reduce the amount of bacteria reaching the ultimate receiving water through time, light and temperature inactivation of the bacteria. According to several studies, "BMPs were originally designed to control runoff volumes and rates by attenuating the flow. The attenuation increases the time between the rainfall-generated runoff and the water reaching the receiving water. The time lag serves to reduce the concentration of these indicator organisms. Structural BMPs then can be effective in reducing indicator bacteria concentrations contained in stormwater runoff."[1] The report also states, "factors such as temperature and light intensity have been shown to be as, or more important to, indicator bacteria inactivation rates. This would suggest that when attempting to mitigate bacteria in runoff, watershed managers should construct BMPs to maximize the temperature increase from solar exposure. Similarly, the added effects of light, even at constant temperature, can increase inactivation



rates, improving BMP performance."[1] Lake Darling in Iowa has also seen significant reductions in bacteria and bacteria related beach closings as a result of sediment basins and water retention structures in the upland that have capture 73% of the sediment and water runoff prior to reaching the lake. Eric O'Brien with Iowa DNR indicates that bacteria often binds with sediment and is transported with sediment runoff. By reducing the sediment delivery, bacteria delivery is also reduced.

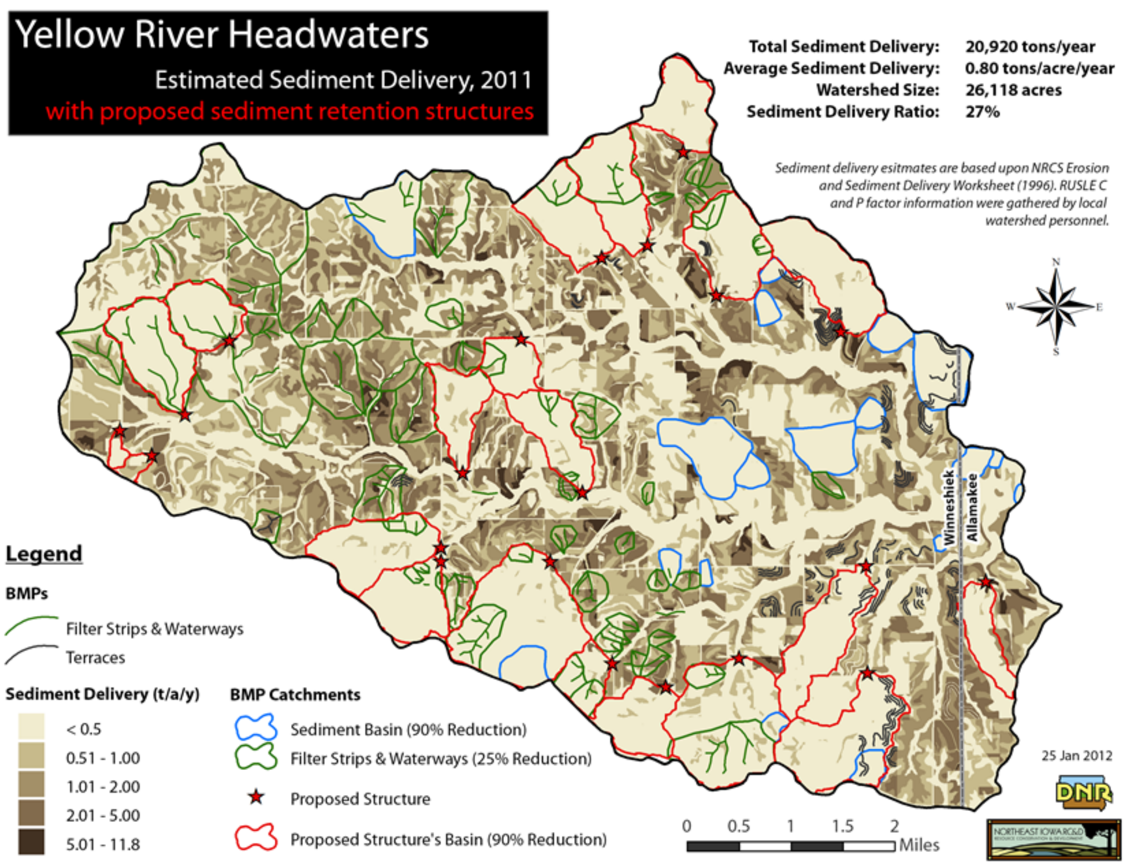
[1]Source: Struck, S.D., A. Selvakumar, M. Borst. 2006. Performance of Stormwater Retention Ponds and Constructed Wetlands in Reducing Microbial Concentrations. EPA/600/R-06/102. Office of Research and Development, US Environmental Protection Agency, Cincinnati, OH.

The YRHW WMP proposes and targets BMPs that not only will slow the rate of runoff and reduce bacteria delivery, but will also result in a 50% reduction in the amount of sediment delivered to the stream from the land surface in the watershed and will result in a 15% reduction in the amount of sediment delivered from eroding stream banks, resulting in an overall reduction of 37% of the sediment currently delivered to the YRHW on an annual basis. The total reductions achieved through proposed BMPs would eliminate 17,450 tons of sediment annually from reaching streams in the YRHW. In addition to reduction of sediment, the BMPs would also reduce nutrient input into the stream, particularly phosphorus which often binds with sediment. The non-livestock BMPs, especially buffer strips and sediment basins will also assist to reduce bacteria, nitrates and nitrogen and organic matter delivered to the stream. Targeted areas for conservation BMPs have been identified and will guide conservation practice implementation to achieve maximum results with limited financial cost-share assistance. Reduction of sediment is also valuable in reducing active bacteria levels because of the ability of light to cause indicator bacteria inactivation. The reductions will improve overall water quality, including dissolved oxygen levels



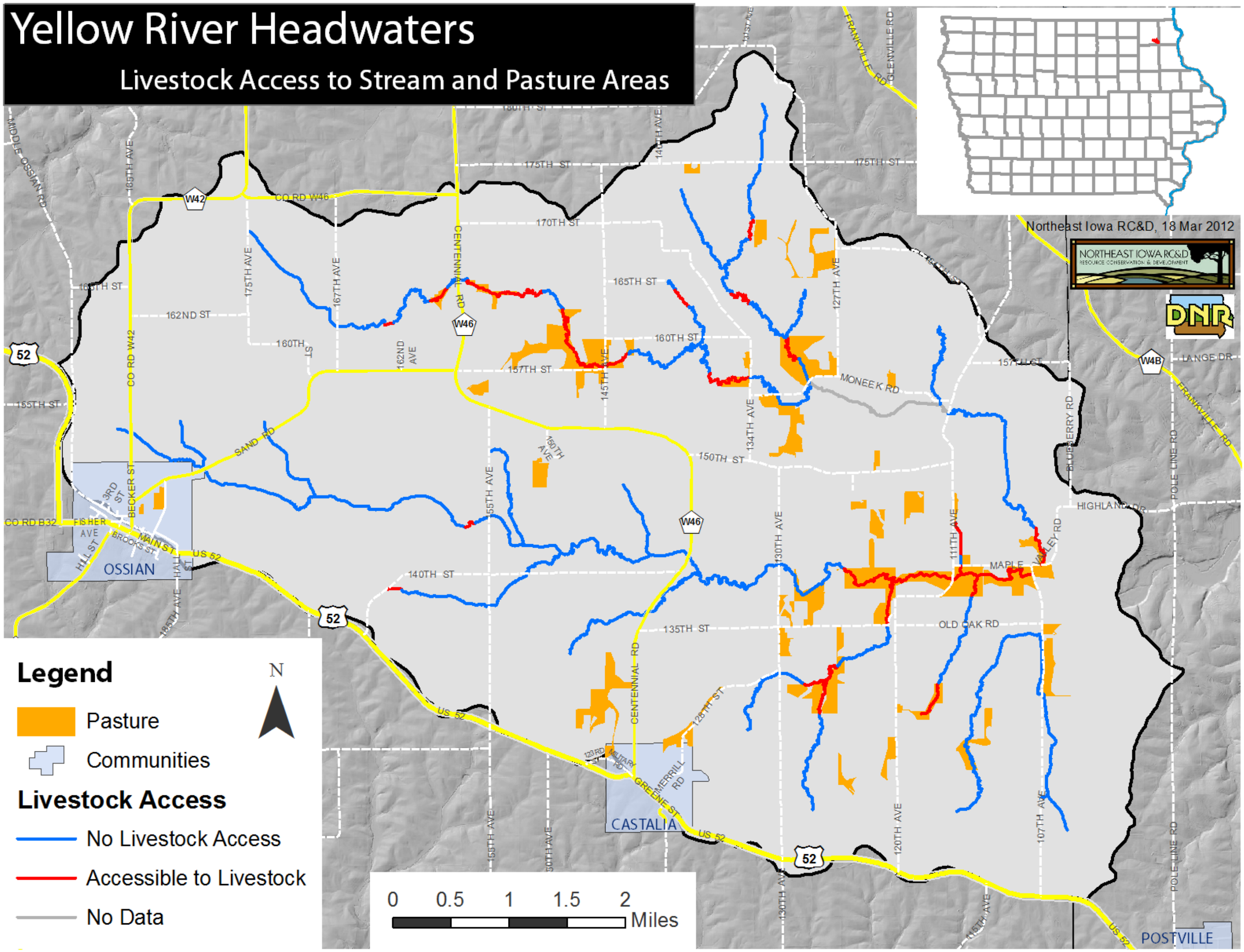
that contribute to the impairment listing in the YRHW.

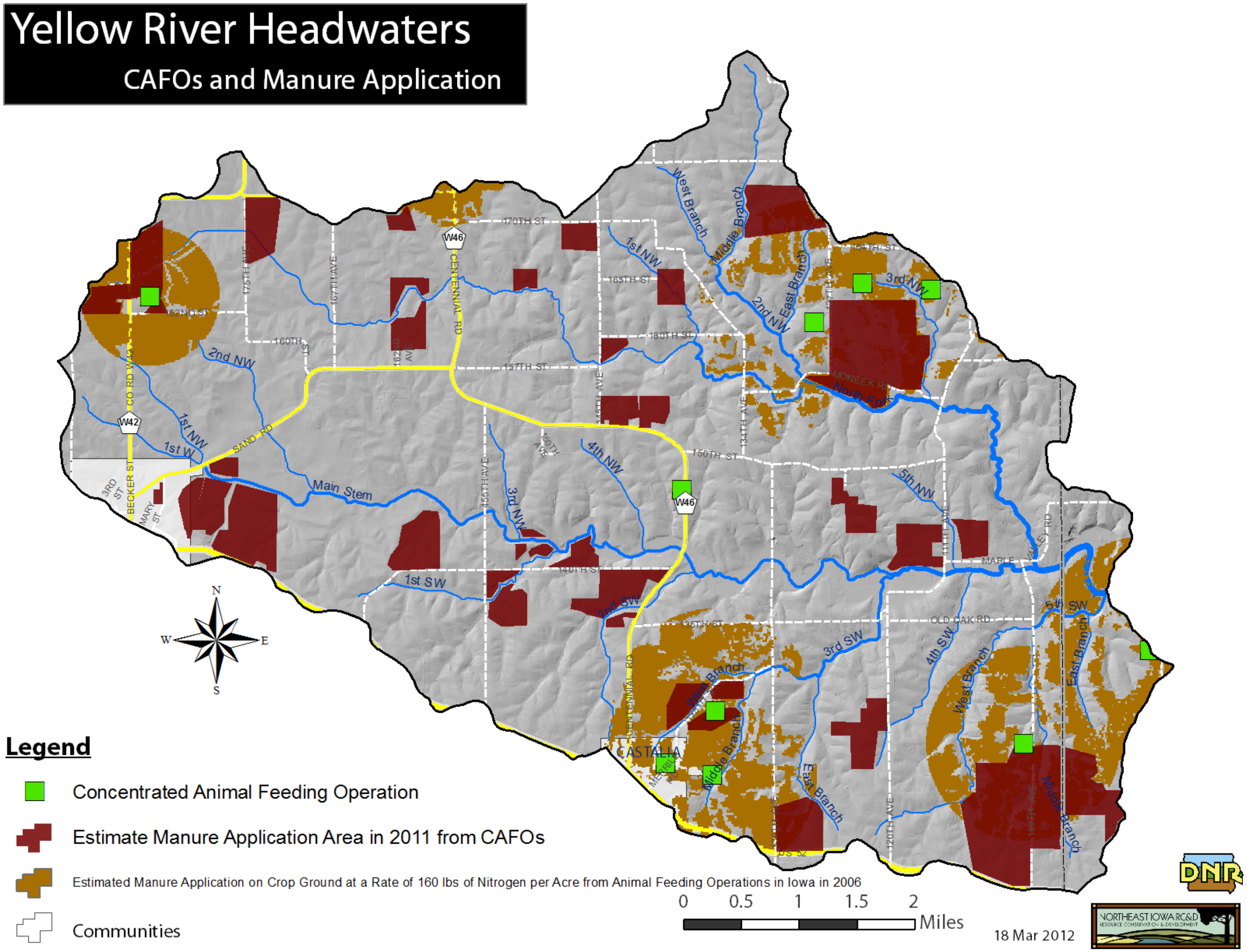
Erosion from stream banks currently contributes 17,625 tons of sediment to streams in the YRHW each year. The YRHW WMP proposes the implementation of stream bank stabilization practices on stream bank segments that have delivery rates of greater than 1100 tons/mile/year. There are currently slightly over 10,000 feet of stream bank in the YRHW with erosion rates exceeding 1000 tons/mile/year. These areas are highlighted in the adjacent map. Stabilization of these banks would eliminate over 15% of all sediment delivery from eroding banks resulting in annual delivery reductions of more than 2,667 tons per year. In combination with physical stabilization of the most severely eroding cut banks, the removal of livestock from the stream described previously will allow less severely eroding banks to re-vegetate and heal naturally resulting in further reduction of sediment delivered from eroding stream banks. The construction of sediment basins and installation of other BMPs such as terraces, filter strips, buffers strips and grassed waterways will also increase retention time and reduce flash flows of water that exacerbate eroding stream banks, thereby further reducing sediment delivery from stream banks.



Sediment delivery will also be reduced through targeted upland BMP implementation throughout the watershed. Installation of BMPs and proposed practices would result in a 50% reduction in surface delivered sediment in the YHRW, a total of more than 14,780 tons per year. One of the most efficient BMPs to combat sediment delivery and slow the flow of water is the installation of water and sediment basins. The WMP targets 21 sites for installation of these basins that would result in annual sediment reductions of 8,487 tons per year. The adjacent map identifies the proposed locations and land areas that would be treated by the basin. In addition to reducing sediment

and nutrient delivery, the basins also would hold water to reduce flow and allow UV radiation from the sun to kill bacteria that are carried to the basins from feedlots, pastured livestock and wash off from surface applied manure.
Land use analysis indicates that of the watershed area not treated by existing or proposed basins, 10% of the remaining acres contribute more than 43% of the remaining sediment delivery to the YRHW streams. Those land areas will be aggressively targeted with BMPs including terraces, grassed waterways, filter strips, buffer strips, grade stabilization structures and no-till farming to achieve 50% reductions in sediment delivery of 50% from those areas totaling 4507 tons per year. Public outreach, improvements in farming practices, pressure from neighbors and an increased sense of ownership and pride in the watershed will be assumed to result in BMPs installed on the remaining areas reducing sediment delivery of 15% on those acres. The resulting annual reductions in sediment delivery would be 1789 tons per year. In total, it is anticipated that sediment delivery reductions by the end of the 10 year project would be 17,450 tons per year resulting in improved stream habitat, less bacteria and nutrient delivery, and increased dissolved oxygen levels in the streams. A complete list of BMPs proposed is included in Part VII of this plan.


Yellow River Headwaters
Livestock Access to Stream and Pasture Areas
Northeast Iowa RC&D, 18 Mar 2012
Legend
Pasture
Communities
Livestock Access
No Livestock Access
Accessible to Livestock
No Data
N
0 0.5 1 1.5 2 Miles
OSSIAN
CASTALIA
POSTVILLE


Yellow River Headwaters
CAFOs and Manure Application
Legend
Concentrated Animal Feeding Operation
Estimate Manure Application Area in 2011 from CAFOs
Estimated Manure Application on Crop Ground at a Rate of 160 lbs of Nitrogen per Acre from Animal Feeding Operations in Iowa in 2006
Communities
0 0.5 1 1.5 2 Miles
18 Mar 2012
N
S
E
W
Main Stem
North Fork
West Branch
Middle Branch
East Branch
CASTALIA
170TH ST
150TH ST
OLD OAK RD
CENTENNIAL RD
SAND RD
W46
W42

Part VIII: Technical/Financial Assistance Background & Need

The vast majority of the YRHW is in Winneshiek County, which is one of the most active counties in the state in terms of conservation practice adoption and implementation. The level of conservation success in the county is in part due to the need for conservation practices; the steep topography, karst geology and fragile soils in the county are inherently prone to erosion. The county encompasses portions of two Major Land Resource Areas, 104 and 105; it is where hillside prairies historically met forested bluffs. Agricultural demands on the land at this interface have created an inherent need for conservation as producers first replaced forests with pasture and then pasture with corn and beans, replacing perennial vegetation with annual crops, moving further and further onto the steep hills and forest formed soils, relying on conservation practices to keep them in compliance with federal programs.

Adoption of conservation practices in the county is also influenced by a strong conservation ethic, a proven landowner interest in conservation and a consistently strong Soil and Water Conservation District. Results from landowner surveys conducted in the YRHW and the Upper Iowa River Watershed prove that Winneshiek County SWCD is well known and respected by producers throughout the county. The Winneshiek County SWCD (WSWCD) is also well known by other SWCDs, Iowa NRCS, Iowa DNR and other partner and peer entities for their ability to put conservation on the ground. Current staff members in the Winneshiek NRCS/SWCD include the NRCS District Conservationist, NRCS Soil Conservationist, Secretary; District Technician; State Soil Conservation Technician; Watershed Project Coordinator; Civil Engineering Technician; Soil Conservation Technician and a Soil Conservation Aid.

A 2011 Iowa NRCS report identified Winneshiek County as number one in the state in the CSP program as well as the number one county in the state in utilization of the EQIP Organic Initiative. From fiscal year 2003 through fiscal year 2010 they were second in the state in overall EQIP dollars allocated to the county, approximately $4.7 million, even though they were not targeted for Mississippi River Basin Initiative dollars. They have also seen a significant participation in other conservation programs including EWP, CRP, stream bank stabilization and forestry programs. Staff actively analyze state and federal programs, evaluate the need for those programs and then utilize and implement them throughout the county. Winneshiek County currently has six active water quality projects, the most in Iowa. WSWCD considers outreach, promotion and recognition a priority for these projects. They work diligently to deliver conservation assistance for the watershed projects and complex state and federal programs through quality engineering, management and implementation. Implementation of the Yellow River Watershed Headwaters Plan will not only require assistance from the team of employees that the county already relies on, it will also demand additional personnel that are able to prioritize dedicated time to the tasks outlined in the plan. The continuous desire by producers to enroll lands into conservation programs or apply best management practices to their lands have led to the need for a State Soil Conservation Technician to be placed in the WSSCD field office that could aid in the survey, design, layout and construction oversight to ensure timely placement and development of practices. Current stewardship practice workload makes it extremely difficult to respond efficiently and produce in a timely manner a product to producers that is satisfactory to design standards and the producer's expectations. The additional personnel will ensure that the proposed work can be successfully accomplished in a timely manner. Financial assistance for producers that implement the proposed conservation will complement existing programs and be crucial to the successful implementation of the YRHW Plan as well as the district's ability to document the success of the plan implementation.

Technical and Financial Assistance Needs.

BMP	Amount	Estimated Cost in Dollars	Expected Fund Sources
Livestock & Manure			
Feedlot Runoff Control Measures (i.e. Manure storage structures, gutters, settling basins, clean water diversions, filter channel, total confinement)	12 Sites	960,000	EQIP, WSPF, 319, WIRB
Fencing for Livestock Exclusion	4,000 Feet	10,000	EQIP, WHIP, 319, REAP
Livestock Watering System	6 Systems	12,000	CCRP, EQIP, WHIP, 319
Stream Crossing	6 Crossings	15,000	EQIP, 319,WSPF
Heavy Use Protection	12 Sites	36,000	EQIP, 319,WSPF
Pipeline	5000 Feet	7,500	EQIP, 319, WSPF
Prescribed Grazing	250 Acres	7,500	EQIP, 319, WSPF

Pasture/Hayland Planting	150 Acres	7,500	EQIP 319, WSPF
CNMP	12 Plans	45,000	EQIP
Livestock Exclusion Incentive	50 Acres	50,000	319, WSPF
BMP	**Amount**	**Estimated Cost in Dollars**	**Expected Fund Sources**
Cropland & Municipal			
Water & Sediment Control Basins	21 Sites	210,000	EQIP, 319,WSPF
Streambank Stabilization	10,000 Feet	400,000	EQIP, WHIP
Filter Strips with crop history	75 Acres	250,000	CCRP
Filter Strip with no crop history	50 Acres	37,500	319, WSPF
Marginal Pasture Riparian Buffer	100 Acres	300,000	CCRP
Grade Stabilization Structures	14 EA	1,050,000	WSPF, EQIP, 319, WIRB
Waterways	40,000 Feet	100,000	CCRP, WSPF, EQIP, 319
No-Till/Strip-Till	750 Acres	56,250	EQIP, 319, WSPF
Contour Buffer Strips	75 Acres	37,500	CCRP, 319
Terraces	30,000 Feet	120,000	WSPF, EQIP, 319, WIRB
Stormwater Wetlands	6 Sites	90,000	319, EQIP
Rain gardens	10 Sites	10,000	319, REAP
Bio-swales	5 Sites	10,000	319, REAP
Bio-Reactors	5 Sites	20,000	319
Rural Farmstead/Acreage			
Septic System Voucher for Inspection and/or clean out	60 @ $100 each	6,000	319

Total BMP Cost		3,847,750	
Administrative	**Amount**	**Estimated Cost in Dollars**	**Expected Fund Sources**
Local FTE Project Coordination, Outreach and Education	10 YR	750,000	WSPF, 319
Local PTE Technical Layout, Design and Construction Oversight	10 YR	400,000	319, IDALS
Travel, Training and Supplies		20,000	319, WSPF
MinnFARMS Evaluation	40 sites	25,000	319
Water Monitoring	11 sites	150,000	319
Information and Education	1500/year	15,000	WSPF, 319
Other Contractual Services		12,000	NRCS
Total Administrative Costs		1,372,000	
Total Administrative + BMPs Estimated Costs		**$5,219,750**	319, WSPF, IDALS, REAP, WHIP, WIRB, EQIP, CCRP

IX: Public Outreach Plan

The primary goal of the Yellow River Headwaters Watershed Project is to reduce bacteria loading and sedimentation in the Yellow River through education and outreach, landowner and watershed citizen engagement, proactive conservation, and professional implementation of BMPs.

The *Yellow River Headwaters Watershed Citizen Awareness Campaign* funded by the Winneshiek SWCD and the Iowa Department of Natural Resources USEPA Section 319 in cooperation with Iowa Learning Farms – Building a Culture of Conservation, provides suggestions for public outreach in the YRHW. The WSWCD will use many of these suggestions as well as additional outreach techniques that have been successful in other Winneshiek County watershed project areas to reach the populace in the YRHW. These techniques may also be utilized to educate an engage citizens and businesses from outside the watershed that could influence public opinion about participation in the practices outlined in this Plan.

Unless otherwise indicated, the following Goals and Strategies are taken from the Yellow River Headwaters Watershed Citizen Awareness Campaign.

Goals/Strategies

The Winneshiek Soil and Water Conservation District has been carrying out watershed work for twenty years, and began a water quality improvement project specifically for the Yellow River Headwaters watershed in 2009. Their project goals include reducing livestock access to the stream by 75% and decreasing bacteria loading by 35%. This outreach campaign will work in harmony with these goals, building a culture of conservation among the residents of Yellow River Headwaters watershed (see http://www.winneshiekswcd.org/Watershed_Projects.html).

Survey results indicate that watershed residents are generally aware of what is contributing to the poor water quality within their watershed; however, this campaign seeks to educate all residents--not just landowners--about the importance of water quality and to inspire them to care for Yellow River. This will ultimately require changes in habits and practices. The changes made can eventually remove Yellow River Headwaters from the Iowa Department of Natural Resources 303(d) list of impaired water bodies and ensure the health of the largest trout stream in Iowa.

Overarching goals of this outreach campaign include the following: increase awareness of poor water quality of Yellow River Headwaters watershed, inform area residents of necessary improvements within the watershed and inspire residents to feel greater ownership in the river's water quality.

After visiting with watershed residents (particularly in Ossian and Castalia), Winneshiek SWCD Commissioners, Yellow River Headwaters watershed coordinator and team members, it is suggested that Calmar and Postville be included in this campaign, even though these communities are geographically located outside the Yellow River Headwaters watershed. Many Yellow River Headwaters watershed residents travel to Calmar and Postville for various social and athletic activities. South Winneshiek Elementary and Middle School are in Ossian. South Winneshiek High School and Northeast Iowa Community College are located in Calmar. While these communities exist outside of the geographic watershed boundaries, the "humanshed" is indeed larger and certainly includes not only Ossian and Castalia, but also the surrounding communities of Calmar, Postville, and in some aspects, Decorah.

The suggested outreach tools, outlined in the following pages, will function together to communicate the messages of this watershed improvement project. These tools should act as a means to unite and empower the *community* so that they can make change happen as a *watershed community* to restore the water quality in Yellow River.

Watershed Leadership Team

The existing Yellow River Headwaters watershed advisory board guides the watershed improvement project, striving towards its goals of improving water quality and building a culture of conservation. With twenty years of background in watershed project work, the Winneshiek Soil and Water Conservation District brings valuable experience to the table for the Yellow River Headwaters watershed project. Combined with watershed coordinator Corey Meyer's extensive experience and technical expertise, this group has a strong leadership base. The Yellow River Headwaters' November 2011 newsletter states, "Remember we are looking for folks that are interested in being on the advisory board." To make this advisory board as well rounded and representative as possible, it is recommended that new members include at least one non-farmer resident and one female resident. Furthermore, it is strongly recommended to invite the county sanitarian and local or regional economic development personnel to sit on this advisory board. Clean water builds positive economic growth, and these individuals would bring a unique perspective to the watershed advisory board. We also suggest inviting a member of the Winneshiek County Cattlemen to the board since one of the goals is to reduce livestock access to streams. Finally, the Department of Natural Resources Fisheries Biologist, Bill Kalishek, should be a part of the advisory board.

Branding Elements

Core branding elements for the watershed awareness campaign should be created to support this plan.

Logo: The existing logo for the Yellow River Headwaters project was developed in 2009. The logo is graphically interesting, and ties together many recognizable local features, including the oak savannas, the Yellow River water body and the rolling hills of northeast Iowa. (INSERT – This logo was developed by the Iowa DNR with input from WSWCD. The WSWCD has already received positive public feedback and recognition so although variations of the logo were suggested by the Iowa Learning Center, the existing logo, shown to the right, will be retained throughout the project. A gray scale of this logo may be used in newspaper or other black and white print. Additional modified logos of the project name may be used as seen below.)

Modified logos shown in full color and grayscale -- provide options that can be used in different places based upon varying printing capabilities. For instance, a grayscale logo may be most appropriate for a newspaper story or advertisement. Road signage may call for varying sizes of logos – some signs may be better suited to a vertical layout while a horizontal layout may be more appropriate for others. These logos are intended to simply provide the watershed project team with options to fit the needs that may arise in print and publication, and to complement the existing watershed logo that has been in use and is highly recognizable in the area.

- Campaign Slogan: **"Improving water quality now and for the future"** or **"A Healthy River Begins with Us."**

The slogan can be included on all of the components of the campaign in conjunction with one of the watershed identification logos.

Marketing Materials

Several different marketing media will be utilized in the campaign to align with what survey respondents indicated they would use.

One survey question asked, "*Of the learning opportunities available, which would you be most likely to take advantage of for water quality issues?*" The highest response was the use of printed fact sheets or brochures (56%, n=51), followed by "looking at a demonstration or display" (32%, n=29) and a website (30%, n=27). The campaign will incorporate all three of these learning opportunities to help educate watershed residents. (INSERT – Unfortunately the survey question did not allow the respondent to select "Yellow River Headwaters Watershed Newsletter from the SWCD." A previous survey found that the Yellow River Headwaters Watershed Newsletter was the primary way that producers preferred to receive information regarding the project and water quality issues. Therefore the WSWCD will continue to utilize the newsletter to reach watershed residents.)

Another survey question asked, "Have you ever changed your mind about an environmental issue as a result of…". The highest responses indicated were "firsthand observation" (52%, n=47), "concern about the future for your children/grandchildren" (41%, n=36) and "conversations with other people" (39%, n=35). This campaign takes these responses into account as well, offering a targeted campaign to educate citizens and promote water quality in ways that will be most effective to local residents.

Support Resources

An informational brochure will be developed to generate interest about the watershed, the project and its goals. The language and images used in the brochure, and all appropriate materials, will emphasize the importance of water quality for residents, and their children and grandchildren—the future. This brochure will be available at Winneshiek Co. and Allamakee Co. SWCD/NRCS and Extension offices, Postville and Decorah Chamber of Commerce offices, and in brochure racks and at local retail sites. Public libraries in Ossian, Calmar and Postville are another great avenue for distributing print materials and promoting the watershed project in general.

Regular press releases will continue to be sent to area newspapers, including the *Ossian Bee, Calmar Courier, Postville Herald* and *Decorah Journal/Public Opinion.* These press releases will feature the voices of watershed coordinator Corey Meyer, Winneshiek SWCD commissioners, watershed residents and Northeast Iowa RC&D personnel, and will support all of the materials and events surrounding the Yellow River Headwaters watershed project. The press releases will not only contain information about events, activities and resources, but will also have the occasional human-interest story. Ideas for the human-interest stories will include personal stories about the Headwaters usage or a feature concerning a landowner who has changed their practices and are making a difference. The more multi-generational the stories, the more effective they will be in inspiring others to care and change.

Website

A Yellow River Headwaters campaign website should be created which will be easy to edit and update so people involved in the project can make necessary changes to any information, such as water quality testing and findings, as the project advances.

The website will contain general information about the watershed, what can be done to improve water quality, and where residents can find more information. Topics to include on the website: benefits of no-till/strip-tillage crop management, cover crops, streambank erosion mitigation, water quality benefits of fencing area cattle to keep them out of local streams, and how to build a rain barrel or construct a rain garden at home.

The website will also contain a page specifically for kids, where they can access activities such as easy-to-create hands-on experiments to do at home, pages to print and color, and a crossword puzzle about water quality. This will provide an opportunity for the next generation to get involved and be engaged in local water quality issues.

Fact Sheets/Utility Bill Inserts

A series of fact sheets will be created and mailed to the entire watershed every three months as an insert with their utility bill. The Yellow River Headwaters watershed project currently publishes a quarterly newsletter that is four pages long. The newsletter seems to be an effective means of communicating with landowners about opportunities available to them for increasing conservation on their land. The fact sheets are not meant to replace the newsletter. The fact sheets will be only two pages (front and back) and will be geared toward all residents of the watershed and not just landowners.

The fact sheet inserts should contain information about the project, progress updates and information about project challenges and proposed solutions. The fact sheets will direct community members to the website and offer contact information for an expert who can answer questions or offer insight on utilizing best management practices. The inserts should discuss seasonal trends in water quality and how practices contribute differently during different times of the year. They should also include short profiles of watershed residents making changes to their land for future generations.

Survey respondents indicated that they would be likely to utilize printed fact sheets and/or brochures as a way to learn about water quality issues. By placing the fact sheet in a utility bill, there is more opportunity that it will be read and create a connection between their water bill and water quality. These fact sheets will focus on the community aspect of the Yellow River Headwaters project, featuring a local resident in each issue. In addition, the fact sheets will target the variety of water quality impairments in the Yellow River Headwaters, educating residents about possible causes and solutions, connecting water quality with land management decisions within the watershed.

Suggested topics for the quarterly fact sheets include:

Quarter 1:

- Yellow River Headwaters Watershed Improvement Project involvement opportunities
    - Attend public watershed events
    - Assist in planning the public watershed events/volunteer time to speak about water quality experiences
- Possibilities for conservation practices on residents' land
- Long term goals for the project
- Resident feature/profile

Quarter 2:

- Nutrient Management and Bacteria
    - Nutrient management from urban and rural perspectives
    - Details on bacteria effects on human and animal health
    - Sources of bacteria (urban and rural contributions) within the watershed and proposed solutions
- Watershed project goals
- Resident feature/profile

Quarter 3:

- Managing Soil Erosion
    - Streambank erosion within the watershed and proposed solutions
    - Erosion from farmland in the watershed and proposed solutions
    - Environmental impacts of sediment in Yellow River Headwaters
    - Economic value of soil
- Progress made thus far and watershed project goals
- Resident feature/profile

Quarter 4:

- Urban Storm Water
    - What is the physical pathway of storm water in the watershed? Where do storm sewers lead?
    - Impairments resulting from urban storm water and proposed solutions (large scale)
    - Urban conservation practices and how they can be utilized – reinforce existing rain barrel program and expand on other opportunities
- Resident feature/profile
- Overview of watershed project goals which have been met
- Goals for the future of the Yellow River Headwaters watershed project

Golf Course Scorecards

The Silver Springs Golf Club, located in Ossian, is a popular social spot, particularly for the younger residents of the watershed. As part of the watershed outreach campaign, a special scorecard may be created in place of the traditional scorecards used on the golf course. This new scorecard may be slightly larger to include facts about the watershed project, the challenges that are being addressed, the project logo and the website address for the project.

These scorecards could be made more unique by numbering them and offering a daily drawing for a prize. The player with the corresponding number could win a complimentary beverage or other prize funded by the watershed project. The intent of the raffle is to encourage people to read the information more closely. Additional options for the scorecards could be to include a coupon as part of the scorecard, or to present their completed scorecard to receive a logo'd golf ball or pack of custom golf tees with the project information on it.

Additionally, the golf course should be encouraged to implement some appropriate conservation practices so that it can be recognized as being an environmental leader in the area.

Watershed Signage

Watershed Boundary Signs

In addition to the sequential road signs, additional signage may be placed on roads as people enter and exit the watershed, which read: "Now entering/exiting Yellow River Headwaters Watershed." These would mark the boundaries, as they exist on the landscape. It could offer a different view of the area for those who are familiar with the concept of watersheds and introduce the concept to those who are not, creating conversation pieces for those living in the watershed as well as those visiting. The signs will include the project logo, slogan and website.

Road Signs

Small signs may be placed along highways that travel through the Yellow River Headwaters watershed. (Note: The photographs included in this report are for example only, not actual or recommended locations for signage.) The signs will be reminiscent of the old Burma-Shave advertising road signs placed in groups. The first three or four signs will contain a sequential series of short phrases, with the last containing the logo and slogan for the watershed project. Each set of signs will be different, to engage people and generate curiosity about the project. (INSERT – If signage is used it will meet all state and federal regulations regarding outdoor advertising.)

Because of the range of impairments in this watershed, signs could contain information about general water quality issues such as bacteria, excess nutrients, and also specific issues to the area, such as the effects on trout fishing.

An example of a sign series could be:

1. Want a nice green lawn?
2. Think of the river...
3. All that Phosphorus
4. Is gonna make the fish quiver!
5. Yellow River Headwaters: Improving water quality now and for the future.

Yard Signs

As community members become aware of and involved with the project, they should be acknowledged for any positive changes that they make in their land management practices. Signs will be created for people to put in their yards so that they can be recognized as good conservationists.

The signs can read:

> I installed (conservation practice) to restore Yellow River.
>
> Improving water quality now and for the future.
>
> Find out more at *website.com*

These signs will be brief so that the message is transferred as travelers pass by. The goal is to motivate people to practice conservation on their land, and in turn, receive recognition for their good work. In addition to their yard sign, they will be recognized on the website, which will include their contact information (with their permission) so that community members can easily ask questions or exchange information with someone who has installed conservation practices on their own land. This will encourage residents to network with one another and strengthen community awareness of the watershed improvement project.

Watershed Resident Involvement

Commodity or Conservation Groups

Twenty-three percent of survey respondents said they get information from commodity groups. These groups can often provide additional funding that is more flexible than state/federal funds and could fund some of the more unique promotional and outreach activities. Local farmers trust the commodity group leadership who can serve as a great tool for reaching more farmers often times those with larger farming operations. The same is true with the conservation groups. For instance, Pheasants Forever is popular in northeast Iowa and watershed project leaders should explore partnering with the Winneshiek County chapter.

Area Churches and Service Groups

Fifty-two percent of survey respondents indicated that they are very active within their local church. People often use their church for idea exchange and discussion on a variety of topics, religious and nonreligious. Clean water is a human right and discussing within the church community why and how to clean up local waters would be appropriate. Water quality activities could be part of social justice activities on the part of local churches. Watershed project leaders should approach church members who are also farmers/residents in the watershed to see if they would speak to the issue at a church event.

The utility fact sheets will be adapted for inserting into church bulletins in the following area churches: Ossian Lutheran Church, Stavenger Lutheran Church (Ossian), St. Frances De Sales Catholic Church (Calmar), Zion Lutheran Church (Castalia), Calmar Lutheran Church, Trinity Lutheran Church (Calmar), St. Aloysius Catholic Church (Calmar), Calmar United Methodist Church, Calmar Bible Fellowship, St. Paul Lutheran Church (Postville), St. Bridget Catholic Church (Postville), Postville Community Presbyterian Church, Bethlehem Presbyterian Church, and Postville Lubavitch Synagogue/Jewish Resource Center.

Involving youth groups such as Boy Scouts, Girl Scouts or 4-H clubs in the watershed project helps bring awareness to the issues involving the Yellow River Headwaters to new, younger audiences. This will help engage the next generation who will be taking care of the water quality. The groups can participate in service projects that help the watershed such as trash pick up days, painting picnic tables or restrooms in an area park, etc. Furthermore, these service-oriented groups can also help with door-to-door promotion and distribution of print materials within the watershed.

Another opportunity for youth involvement would be possible through a partnership with one or more teachers at South Winneshiek and/or Postville High Schools. Design and creation of the Yellow River Headwaters watershed website could become a class project for high school students, in which the watershed coordinator and/or advisory board would serve as the client and consult with the teacher(s) and student group(s) regularly. In addition to raising students' awareness of local environmental issues, this partnership would be a great learning opportunity for the students and would benefit the watershed project by utilizing students' computer and design skills.

High School/Community Sporting Events

Seventy-seven percent of survey respondents indicated that they sometimes or always attend local sporting events. The Yellow River Headwaters watershed project could increase its presence in the local community and generate renewed interest in project efforts through sponsorship at local sporting events. This could include booster club sponsorship at South Winneshiek and Postville High Schools, or sponsorship of local youth athletics (e.g. Little League softball/baseball or soccer leagues).

Town Festivals and County Fairs

Annual town festivals (e.g. Castalia Tractor Day, Calmar Farmers Day, Nordic Fest [Decorah], Winneshiek County Fair) provide a unique opportunity for education and promotion of the Yellow River Headwaters watershed project. These town festivals already center around pride in the local community, so expanding that sentiment to include pride in local water bodies would be very appropriate. The Yellow River Headwaters watershed project could participate through numerous means, including event sponsorship and/or setting up a booth to distribute print materials and visit with local residents.

Community Events and Field Day

Survey respondents indicated "firsthand observation" and "conversations with other people" as key motivators to changing their minds about an environmental issue. This campaign will utilize these responses by planning multiple community events to offer opportunities for watershed residents to gather together and discuss the challenges with the area's water quality issues, as well as observe conservation practices in place in their local area.

- A general awareness "kick off" event will be held to publicly launch this new phase of the Yellow River Headwaters watershed awareness campaign and watershed improvement plan. This event will be held at a convenient location within the watershed, and will be hosted by watershed coordinator Corey Meyer and other local community members who are well known and respected by area residents.

- An Iowa Learning Farms field day will be held on a watershed resident's farm who is demonstrating conservation practices that help to reduce erosion and lessen sediment entering into water bodies. The field day can offer simultaneous tracks addressing no-till/strip-till, cover crops, nutrient and manure management, rain barrels, organic gardening, etc. so that there are topics for both urban and rural residents.

- A “closing” event for the campaign should be held to celebrate the progress made within the watershed. This could be a simple ceremony to award certificates of recognition to those who changed their practices, installed conservation structures, or contributed their time to help with the campaign.

- A community hog roast could help raise awareness of the Yellow River Headwaters project, celebrate project successes and raise funds that could help further project goals. This event could be held in conjunction with any one of the recommended events described above.

All of these events provide opportunities for watershed residents to network, learn from one another and unite as a watershed community.

The Iowa Learning Farms Conservation Station could be included at one or more of the scheduled community events. The Conservation Station is an effective tool for demonstrating how conservation land practices benefit water and soil quality and for bringing people together around conservation issues. The rainfall simulator component of the Conservation Station has an effective visual display, which demonstrates how different land practices (urban and rural) affect surface and subsurface water quality. The Conservation Station also contains a learning lab with various interchangeable lessons, allowing the conservation message to be targeted for each specific event and audience. A specific educational module tailored to the issues and challenges faced in the Yellow River Headwaters watershed could be created and displayed at one or more of these events.

Youth Outdoor Classroom

Iowa Learning Farms will coordinate and host a youth outdoor classroom day for the 4th and 5th grade students of South Winneshiek Elementary and Postville’s Cora B. Darling Elementary School and Torah Education Program. A park or nature area within the Yellow River Headwaters watershed would be a good location for such an event. Alternatively, a landowner in the watershed could also host the youth on his/her property. Ideally, the event would be held in a location adjacent to the Yellow River Headwaters, to allow students to see and experience the water body in an up-close setting.

The Conservation Station will be a key component of this youth outdoor classroom day. Through fun, engaging hands-on activities, students will experience educational lessons on topics including watersheds and the impacts of land management choices on soil and water quality. This event will utilize the educational materials developed for Yellow River Headwaters, raising an appreciation for the watershed and local communities, while also raising awareness as to the water quality challenges faced in the watershed.

There would be five or six different learning stations, each with its own presenter or team of presenters. Iowa Learning Farms will work with watershed coordinator Corey Meyer to identify conservation-minded individuals or groups to lead other learning stations/group sessions during the day-long event. Examples of such partners may include Winneshiek and/or Allamakee Co. Conservation Boards, local ISU Extension and Outreach personnel, local DNR/NRCS staff, local SWCD commissioners and local Farm Bureau personnel. Students would be divided into groups to experience the many different learning stations at the outdoor classroom. Student groups would rotate to each of the different learning stations, spending approximately 40 minutes at each stop and participating in such activities as nature hikes/scavenger hunts, fish species identification, birds and furs, geocaching, and water quality monitoring.

Outreach Time Frame

First Quarter Activities	• Create website • General project information brochure • Utility bill/church bulletin fact sheet #1 • Golf course scorecards designed and printed • Sponsorship of high school/youth athletic events
Spring/Summer Quarter Activities	• Kick-off event for residents • Watershed boundary signs • Sequential roadside signs • Golf course scorecards • Town festivals • Utility bill/church bulletin fact sheet
Summer Quarter Activities	• Iowa Learning Farms field day • Yard signs • Town festivals

	• Utility bill/church bulletin fact sheet
Fall/Winter Quarter Activities	• Yard signs • Youth Outdoor Classroom (Oct) • Utility bill/church bulletin fact sheet • Closing event for residents

X: Outreach Schedule

YEAR	QUARTER	ACTION ITEM
2013	First (Winter)	• Create website • Develop general project information brochure • Work with churches and utility company on fact sheet insert • Develop golf course scorecard design and print • Sponsor school athletic events • Watershed Newsletter • Press Release • BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second (Spring)	• Watershed event for residents • Develop watershed boundary signs • Develop roadside signs • Place golf course scorecards • Participate in town festivals • Utility bill/church bulletin utility fact sheet implementation • Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring
	Third (Summer)	• Field day • Golf Course Score Cards • Place yard signs

		• Place roadside signs • Participate in town festivals • Utility bill/church bulletin watershed fact sheet implementation • Watershed Newsletter • BMP Installation • MinnFARM • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth (Fall)	• Place yard signs • Golf Course Score Cards • Hold youth outdoor classroom • Utility bill/church bulletin watershed fact sheet • Watershed Newsletter • BMP Installation • Water Monitoring
2014	First	• Update website • Press Release • Watershed Newsletter • BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring
	Third	• Field day • Watershed Newsletter • Golf Course Score Cards

		• MinnFARM • BMP Installation • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Hold youth outdoor classroom • Golf Course Score Cards • Watershed Newsletter • BMP Installation • Water Monitoring
2015	First	• Update website • Press Release • Watershed Newsletter • BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring
	Third	• Field day • Watershed Newsletter • Golf Course Score Cards • MinnFARM • BMP Installation • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Hold youth outdoor classroom • Golf Course Score Cards

		• Watershed Newsletter • BMP Installation • Water Monitoring
2016	First	• Update website • Press Release • Watershed Newsletter • BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring
	Third	• Field day • Watershed Newsletter • Golf Course Score Cards • MinnFARM • BMP Installation • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Hold youth outdoor classroom • Golf Course Score Cards • Watershed Newsletter • BMP Installation • Water Monitoring
2017	First	• Update website • Press Release • Watershed Newsletter

		• BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring
	Third	• Field day • Watershed Newsletter • Golf Course Score Cards • MinnFARM • BMP Installation • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Hold youth outdoor classroom • Golf Course Score Cards • Watershed Newsletter • BMP Installation • Water Monitoring
2018	First	• Update website • Press Release • Watershed Newsletter • BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design

		• BMP Installation • Water Monitoring
	Third	• Field day • Watershed Newsletter • Golf Course Score Cards • MinnFARM • BMP Installation • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Hold youth outdoor classroom • Golf Course Score Cards • Watershed Newsletter • BMP Installation • Water Monitoring • Follow-up landowner survey
2019	First	• Update website • Press Release • Watershed Newsletter • BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring
	Third	• Field day • Watershed Newsletter • Golf Course Score Cards

		• MinnFARM • BMP Installation • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Hold youth outdoor classroom • Golf Course Score Cards • BMP Installation • Watershed Newsletter • Water Monitoring
2020	First	• Update website • Press Release • Watershed Newsletter • BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring
	Third	• Field day • Watershed Newsletter • Golf Course Score Cards • MinnFARM • BMP Installation • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Hold youth outdoor classroom • Golf Course Score Cards

		• Watershed Newsletter • BMP Installation • Water Monitoring
2021	First	• Update website • Press Release • Watershed Newsletter • BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring
	Third	• Field day • Watershed Newsletter • Golf Course Score Cards • MinnFARM • BMP Installation • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Hold youth outdoor classroom • Golf Course Score Cards • Watershed Newsletter • BMP Installation • Water Monitoring
2022	First	• Update website • Press Release • Watershed Newsletter

		• BMP Promotion • BMP Design • Water Monitoring • Meet with YRHW Advisory Committee
	Second	• Watershed Newsletter • BMP Design • BMP Installation • Water Monitoring • Landowner survey (final follow-up)
	Third	• Celebration and Wrap-up Event • Watershed Newsletter • Golf Course Score Cards • MinnFARM • BMP Installation • Press Release about overall project success • Water Monitoring • Meet with YRHW Advisory Committee
	Fourth	• Water Monitoring • Project Wrap up and Final Report

XI: Practice Implementation & Outcome Schedule

Goal 1: Reduce bacteria delivery to the YRHW streams by 90%

Goal 1, Objective 1: Eliminate cattle in the stream (unrestricted access) on the entire YRHW and North Fork Yellow River stream corridors

	Phase 1			Phase 2			Phase 3				
Practice	**2013 SFY**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Project Total**
Fencing for Livestock Exclusion	250 ft	500	250	400	400	500	500	400	400	400	**4000 ft**
Livestock Watering Systems	1 site	0	1	1	1	0	1	0	1	0	**6 sites**
Stream Crossing	1 site	0	1	0	1	0	1	0	1	0	**6 sites**
Heavy Use Protection	1 site	1	1	2	2	1	1	1	1	1	**12 sites**
Pipeline	500 ft	500	500	500	500	500	500	500	500	500	**5000 ft**
Prescribed Grazing	25 ac.	25	25	25	25	25	25	25	25	25	**250 ac.**
Pasture/Hayland Planting	10 ac.	10	20	10	10	20	10	20	20	10	**150 ac**
Livestock Exclusion Incentive	5 ac.	0	5	5	10	10	5	10	0	0	**50 ac.**
Resulting bacteria delivery reductions	7.33E+11 CFU daily			9.54E+11 CFU daily			1.25E+12 CFU daily				**2.93E+12 CFU daily delivery reductions**

- The previously listed practices will result in the complete removal of livestock from the stream other than at protected crossings to move livestock from one prescribed grazing paddock to another

Goal 1, Objective 2: Reduce available manure for wash-off from confinement operations by 50%

	Phase 1			Phase 2			Phase 3				
Practice	**2013 SFY**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Project Total**
CNMP	1 plan	2	2	1	1	1	1	1	1	1	**12 plans**
Filter Strip with Crop History	5 ac.	5	5	10	5	10	10	10	10	5	**75 ac.**
Filter Strip with No Crop History	5 ac.	5	5	5	5	10	10	5	0	0	**50 ac.**
Marginal Pasture Riparian Buffer	10 ac.	10	5	10	20	5	10	10	10	10	**100 ac.**
Resulting bacteria delivery reductions	3.02E+14 CFU daily			2.17E+14 CFU daily			2.48E+14 CFU daily				**7.67E+14 CFU daily delivery reductions**

- CNMPs will address manure management on over 4,000 acres resulting in a 50% reduction in available manure for daily washoff from fields. Filter strips and buffers will slow water and filter bacteria prior to reaching the stream.

Goal 1, Objective 3: Reduce bacteria delivery from open feedlot operations in close proximity to the YRHW

	Phase 1			Phase 2			Phase 3				
Practice	**2013 SFY**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Project Total**
Feedlot Runoff Control BMPs: manure storage, gutters, settling basins, clean water diversions, filter channel, total confinement	1 site	2	2	1	1	1	1	1	1	1	**12 sites**
Resulting bacteria delivery reductions	TBD by MNFARMS			TBD by MNFARMS			TBD by MNFARMS				**TBD by MNFARMS**

- Open feedlots will be improved to reduce bacteria run-off. MNFARMS will determine actual bacteria reductions

Goal 2: Reduce sediment delivery to the YRHW streams from watershed land area by 50% (17,450 t/y)

Goal 2, Objective 1: Install 21 targeted sediment and water control basins to reduce sediment and bacteria delivery to the YRHW streams

	Phase 1			Phase 2			Phase 3				
Practice	**2013 SFY**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Project Total**
Water & Sediment Control Basins	2 sites	3	2	3	2	1	2	2	2	2	**21 sites**
Resulting sediment delivery reductions	2,978 tons/year			2,246 tons/year			3,263 tons/year				**8,487 tons/year**

Goal 2, Objective 2: Implement targeted BMPs to achieve 50% reduction in sediment delivery on the remaining 10% of land contributing the highest sediment delivery and 15% reduction on all remaining acres

	Phase 1			Phase 2			Phase 3				
Practice	**2013 SFY**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Project Total**
Filter Strip w/ Crop History	5 ac.	5	5	10	5	10	10	10	10	5	**75 ac.**
Filter Strip w/o Crop History	5 ac.	5	5	5	5	10	10	5	0	0	**50 ac.**
Marginal Pasture Riparian Buffer	10 ac.	10	5	10	20	5	10	10	10	10	**100 ac.**
Grade Stabilization	1 ea.	1	1	2	2	2	2	1	1	1	**14 ea.**
Grassed Waterways	2500ft	2500	5000	5000	5000	5000	5000	5000	2500	2500	**40,000 ft**
No-Till/Strip Till	25 ac.	25	25	25	75	75	125	125	125	125	**750 ac.**
Contour Buffer Strips	5 ac.	5	5	10	10	10	10	10	10	0	**75 ac.**
Terraces	2000ft	2500	3000	4000	4000	3500	2500	2500	3000	3000	**30,000 ft.**
Resulting sediment	1,788 tons/year			2,451 tons/year			2,057 tons/year				**6,296 tons/year**

delivery reductions				

- In addition to sediment delivery reductions, these practices will reduce bacteria delivery from field applied manure.

Goal 3: Reduce sediment delivery to the YRHW streams from stream bank erosion by 15%

Goal 3, Objective 1: Target streambank stabilization to banks contributing in excess of 1,000 t/mile/y of sediment to the YRHW

	Phase 1			Phase 2			Phase 3				
Practice	**2013 SFY**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Project Total**
Streambank Stabilization	500 ft.	500	500	500	1000	1000	2000	2000	1000	1000	**10,000 ft.**
Resulting sediment delivery reductions	405 tons/year			682 tons/year			1,580 tons/year				**2,667 tons/year**

Goal 4: Reduce municipal and residential bacteria, sediment and nutrient delivery from septic and stormwater run-off.

Goal 4, Objective 1: Reduce the delivery of bacteria from non-functioning or poorly functioning septic systems

	Phase 1			Phase 2			Phase 3				
Practice	**2013 SFY**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Project Total**
Septic System Voucher for Inspection	2 ea.	5	5	10	10	8	5	5	10	0	**60 ea.**
Resulting bacteria delivery reductions	1.08E+9 CFU daily			2.54E+9 daily			1.80E+9 daily				**5.42E+9 CFU daily delivery reductions**

Goal 4, Objective 2: Reduce the delivery of bacteria, sediment and nutrients from municipal sources in the YRHW

	Phase 1			Phase 2			Phase 3				
Practice	**2013 SFY**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Project Total**
Stormwater Wetlands	0 sites	0	1	1	1	1	1	1	0	0	**6 sites**
Rain Gardens	1 site	1	1	1	2	1	2	1	0	0	**10 sites**
Bio-Swales	0 sites	1	1	0	0	1	1	1	0	0	**100 ac.**
Bio-Reactors	0 sites	0	1	3	1	0	0	0	0	0	**5 sites**

- These practices will result in reduction in bacteria, sediment and nutrient delivery from municipal sources and reduction in flash flows in the YRHW during rain events. Water monitoring has indicated elevated bacteria levels from the municipal areas of Ossian and Castalia. These practices will address those sources. The bio-reactors will reduce nitrate delivery by 50% from tile line outlets at the developed sites and will serve as a watershed awareness and promotion tool to encourage a comprehensive watershed approach to conservation.

***Project milestones will be reviewed annually to monitor progress and are subject to change due to unforeseen situations**

XII: Load Reduction Evaluation & Project Accountability

Load reductions achieved through the implementation of recommended practices will be calculated and documented to demonstrate project success. Sediment and nutrient reductions will be estimated using the sediment delivery calculator for all completed practices. Bacteria loading reductions from installed practices on open feedlots will be estimated utilizing the MinnFARM model.

Water monitoring will be continued to document changes in water quality over the life of the project and project staff will work with Iowa DNR personnel to conduct aquatic life/biotic sampling in the YRHW several times during the project life as well. The project activities proposed in this WMP are expected to significantly reduce bacteria delivery and result in water quality improvements when implemented. It is anticipated that as a result of practice implementation, monthly bacteria readings will be under the State of Iowa standard. Periodic exceedences are likely to still occur dependent on rainfall, landuse changes not anticipated and other variable conditions.

Project staff will annually review actual progress with milestones identified in the WMP to provide project accountability and make adjustments in targets where necessary. Success of the project will be measured by acres not only load reductions and water quality improvements, but also by practices installed, acres impacted, outreach contacts completed, and by an increase in overall participation in watershed project activities.

A follow-up survey of landowners and watershed residents will be completed during year 5 and year 10 of the project to evaluate changes in attitudes and perceptions towards water quality, participation in the Yellow River Headwaters Watershed Project and overall awareness of water quality and watershed health. The results of the follow-up surveys will be compared to results of the pre-plan survey to determine changes over time.

Part XIII: QAPP – Water Quality Monitoring Plan

(This QAPP was developed by personnel from the Watershed Monitoring and Assessment Section of the Iowa Department of Natural Resources with input from personnel from Northeast Iowa RC&D Inc. Signed copies of this document are available from the Winneshiek Soil and Water Conservation District)

Quality Assurance Project Plan
Iowa's Project 319 Watershed Improvement Grants
Yellow River Headwaters

Northeast Iowa RC&D
Postville, IA 52162

September 2011
Updated January 2012
QA/WM/23-01

Yellow River Project Manager Winneshiek County SWCD Chairperson	Wilbur Stoen	Date
Iowa Department of Natural Resources Project Coordinators	Lisa Fascher/Mary Skopec	Date
University Hygienic Laboratory SHL Project Officer:	Mike Schueller	Date
Plan Approved By DNR Quality Assurance Officer	Lynette Seigley	Date

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PROJECT/TASK ORGANIZATION

Figure 1 shows the project organization, lines of responsibility, and lines of communication for this project. The Winneshiek County Soil and Water Conservation District is responsible for the overall management of the Yellow River Headwaters project. This project is funded by U.S. EPA Section 319 dollars administered through the Iowa Department of Natural Resources 319 program. The Yellow River Project Coordinator is responsible for implementation of the project, sample collection, and management of the water quality data collected. The DNR Project Coordinators are responsible for designing a suitable water monitoring plan and coordinating with the State Hygienic Laboratory for the shipment of coolers, bottles, and paperwork to complete the monitoring. The DNR Quality Assurance officer is responsible for carrying out the quality control/quality assurance exercises and data management as outlined in the QAPP. The DNR Quality Assurance officer is responsible for receival of data from the laboratory for eventual upload into AWQMS. The State Hygienic Laboratory (SHL) is contracted to analyze water samples collected as part of the Yellow River Headwaters Project.

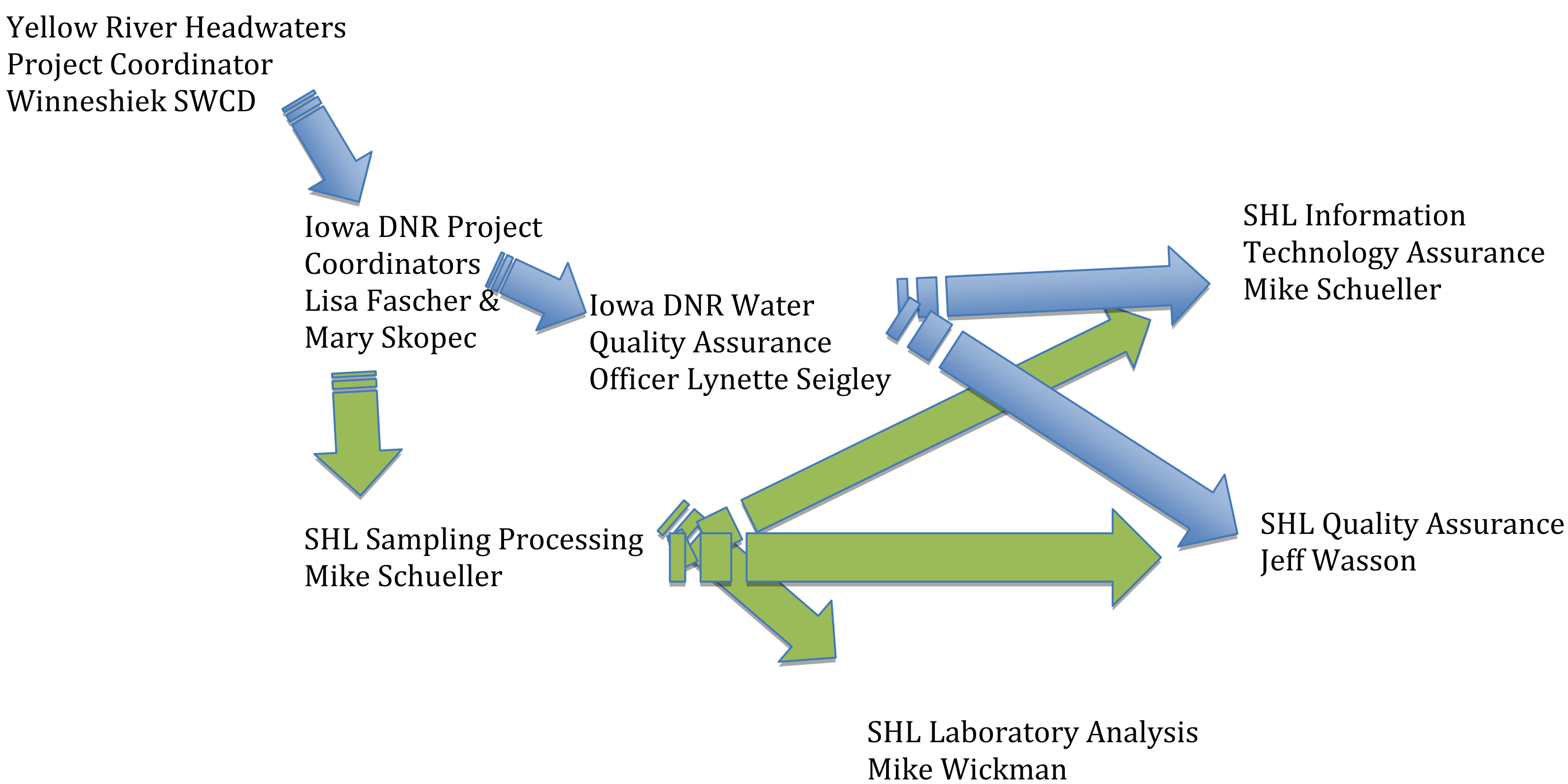


Figure 1. Flow diagram for the project organization, lines of responsibility, and lines of communication for the Yellow River Headwaters project.

PROBLEM DEFINITION/BACKGROUND

The Yellow River Headwaters Watershed (YRHW) has a record of impairment and a history of fish kills that has placed it on the State of Iowa's 303(d) Impaired Waters List. The pollutants causing the listed impairments are a threat not just to the ecological health of the YRHW but to the ecological health and economic productivity potential of the larger Yellow River Watershed (YRW) as a whole.

The YRW is extremely important to the region and to the state because of its economic value and its exceptional natural resource assets. Improving water quality in the headwaters of the system is imperative for three reasons.

One, from its position at the head of the system, the YRHW influences the water quality and environmental health of the entire river. Two, though it is only one sixth of the YRW's 154,500 acres, the YRHW has a history of significant contribution to water quality impairment in the Yellow River and it has been designated by the State of Iowa as a 303(d) impaired watershed. Three, protecting the water quality of the headwaters should be done for more reasons than to protect the value of the river below it. The YRHW has valuable natural resource assets of its own. The stream corridor of the watershed provides habitat to a great diversity of life forms including several valuable game species as well as bird and insect species beneficial for their control of agricultural crop pests. The stream corridor also serves as important connectors to allow animal movement between the blocks of habitat found within the watershed.

The Iowa section 303(d) Impaired Waters List for 2010 identifies watershed impairments as Aquatic Life and Primary Contact Recreation. The causes/stressors for Aquatic life impairment are low dissolved oxygen (DO) as indicated by water sampling and Biological-Unknown, as indicated by a low biotic index. The cause /stressor for Primary Contact Recreation is listed as indicator bacteria.

Non-point source pollution inputs, specifically nutrient enrichment, sediment delivery, and bacterial loading are caused by run-off from agricultural land. In addition, the large number of tile outlets identified by the RASCAL (Rapid Assessment of Stream Conditions Along Length) assessment also suggests these discharges as an additional source of nitrogen, and possibly phosphorus enrichment. Point source loadings are contributed by one municipal wastewater plant (City of Castalia), which discharges to the watershed. These loadings are a matter of public record and are available from the city's plant operator or Iowa DNR field Site #1 in Manchester.

Habitat alterations caused by sedimentation and erosion can be attributed to two factors: one, a higher percentage of land in row crop production and two, by stream corridor degradation caused by livestock with free access to the stream. Since 2000 there have been two fish kills: one in 2002 and one on 6/21/2011.

The YRHW also contributes to the impairment of a downstream section of the Yellow River designated for Primary Body Contact that is listed as impaired due to elevated levels of indictor bacteria/pathogens (i.e., *E. coli* bacteria). Water monitoring samples taken in the YRHW have exceeded 100,000 CFU/I00mL fourteen times since 2004. These high levels, including two peak occurrences of over 800,000 CFU/I00mL, suggest the existence of significant bacteria sources within the watershed.

According to Iowa DNR Environmental Protection Division (EPD) personnel, the large number of animal feedlots distributed along the stream corridors of the watershed suggests the possibility of improperly managed manure stockpiles as sources of high bacterial loadings and of the ammonia responsible for fish kills. Manure stockpiles are capable of generating large amounts of ammonia within hours after contact with water and continue to generate ammonia as bacteria further metabolize organic nitrogen in the manure. Ammonia is the dominant toxic agent in records of fish kills in Iowa. In the opinion of Iowa DNR EPD personnel investigating the fish kill of 6/21/2011, ammonia was the suspected but unconfirmed cause of the fish kill. Episodic flushes of ammonia caused by precipitation events and /or chronic flows of ammonia may explain the absence or periodic absence of fish populations in some stream segments. Fish kills have very serious consequences both for fish populations and for the liable party or parties. Loss of aquatic populations from low dissolved oxygen, reduction in macroinvertebrate habitat and fish spawning habitat from sedimentation, and the risk to public health from elevated bacteria levels all have the potential to significantly degrade water quality, quality of life, and economic development in the Yellow River Watershed.

PROJECT DESCRIPTION

Continued water quality monitoring in the YRHW is necessary to achieve goals and objectives. Eleven sites geographically spread throughout the watershed including two historical monitoring sites upstream of the confluence of the two forks of the YRHW: the Yellow River Sub (IA 01-YEL-0160-0) and the North Fork Yellow River (IA 01-YEL-0080-3). Previous monitoring was completed by the Allamakee SWCD/ DNR/ Northeast Iowa RC&D Inc. / UHL (2004-2006) and by DNR (TMDL data gathered 2009).

GOALS/OBJECTIVES

- To complement and augment baseline sampling data from sites on the North Fork and Yellow River Subs.
- To locate impairment hotspots along with their likely source(s). Monitoring sites are strategically located on tributaries and on stream segments in order to isolate the discrete contributions each segment or tributary makes to system impairment
- To document water quality improvements to the impaired river segments and tributaries in order to gauge the relative effectiveness of BMPs. Water quality managers will be able to evaluate the efficacy of the projects and make adjustments to plans for future projects.
- Water monitoring will determine if water quality" standards" are being met and if BMPs are meeting goals in reducing impairments.
- RASCAL stream bank and gully erosion assessment will be repeated after BMP installation in order to quantify reduction in sediment delivery from stream corridors.

DATA QUALITY OBJECTIVES

The main objectives of the YRHW 319 monitoring program are to develop a monitoring network that can isolate impairment hotspots within the watershed and to track the performance of (BMPs) designed to improve water quality in the YRHW. The YRHW 319 monitoring network is designed to monitor pre-project and post-project conditions in the tributaries and river segments of the YRHW.

In order to determine the difference between pre- and post-project conditions, the sample collection, preservation, and analytical techniques are generally constant from one year to the next. The only exceptions are those changes needed to be consistent with revised USEPA approved methods and those changes that occur based on location and design of BMPs. Local project staff will conduct all sampling, providing consistency throughout the sampling effort. The data collected for this monitoring represent conditions in the watershed. The measurements made include those for which standards or USEPA criteria may be used to judge water quality. Quantitation limits specified in Table 1 are sufficient to meet the data quality objectives for each analyte. Appendices 1 through 3 are included to provide information on the analytical procedures used, sample container, sample preservation methods, maximum holding times, and data quality requirements.

TRAINING REQUIREMENTS/CERTIFICATION

There are no special training requirements associated with this project. A certified drinking water laboratory performs laboratory analyses. Field sampling completed by the local project staff is conducted according to DNR SOP (2002) for surface water monitoring. Local project staff is trained by DNR staff in the proper sample collection procedures, calibration and use of the field meters, collection of lab samples and processing of samples and completion of paperwork for shipment of samples to the lab, and completion of the field form.

Table 1. Water quality criteria for analytes monitored as part of the Yellow River Headwaters 319 Monitoring Program (source: Iowa Administrative Code, Chapter 61, p. 13-22). Only analytes with standards are listed.

Parameter	***Iowa Water Quality Standard***	***Applicable Designated Use Classification(s)***	***Parameter Quantitation Limit***
Ammonia Nitrogen	** (depends on pH and temperature of water)	B	0.05 mg/L
Dissolved Oxygen	7.0 mg/L (5.0 mg/L)[1] 5.0 mg/L (5.0 mg/L)[1] 5.0 mg/L (4.0 mg/L)[1] 5.0 mg/L (5.0 mg/L)[1]	BCW BWW BLR BLW	0.1 mg/L
Escherichia coli Bacteria	30- day geometric mean 126 organisms/100 ml** 30-day geometric mean 630 organisms/100 ml** single-sample maximum 235 organisms/100 ml** single-sample maximum 2880 organisms/100 ml**	A1, A3 A2 A1, A3 A2	10 organisms/100 ml
pH	Minimum 6.5; maximum 9.0	A, B	0.1 unit
Temperature	Max. increase = 3°C not to exceed 32°C BWW	BLW, BLR	0.5°C
Total phosphorus as phosphorus	None	None	0.02 mg/L

[1] Minimum value for at least 16 hours of every 24-hour period (minimum value at any time during every 24-hour period)
"B" includes all of the following designated uses: BLW, BCW, BWW, BLR
"A" includes all of the following designated uses: A1, A2, A3

DOCUMENTATION AND RECORDS

The State Hygienic Lab (SHL) will report the data from the chemical/physical monitoring of samples submitted as part of the Yellow River Headwaters project to the YRHW Project Coordinator and to the Iowa Department of Natural Resources. Data are available electronically from SHL through their lab information management system. The data will also be made available to the Iowa DNR in an AWQMS-compatible format for eventual upload to the Iowa DNR and EPA's water quality databases. The data will include the AWQMS station identification number, which will be provided by the DNR for all station locations. SHL will make available completed monitoring results to the YRHW Project Coordinator not later than fifteen (15) calendar days after the end of each month or as soon as possible following completion of all analytical determinations requested. Extra time for analysis is allowed in cases when the analytical work warrants. A notification to the submitter that analytical results from a sample will be delayed and the reason for the delay will be made within fifteen (15) calendar days of receipt of the sample if extra time is required for analysis.

Data collected as part of this project will be summarized by site. Results will be presented as part of DNR technical reports, fact sheets, and at project meetings as requested by the YRHW Project Coordinator. Information will also be presented at state and national meetings, and disseminated through the Ambient Water Monitoring Program web site (www.igsb.uiowa.edu/wqm) and press releases.

SAMPLING DESIGN AND COLLECTION METHODS

Local project staff will perform sample collection. The sampling protocol will be conducted in accordance with the DNR SOP for surface water monitoring (2002).

- Sample containers will be provided by SHL.
- Samples will be collected and will be shipped to the SHL via an overnight courier.
- Samples will be collected from ten sites on tributaries and river sections distributed throughout the watershed. Table 2 and Figure 2 identify the location of the monitoring sites.
- All samples collected as part of this activity will be coded as **YELLHEAD.**
- Field measurements will be recorded on an appropriate field data sheet and then transferred to electronic format. An example field data sheet is located in Appendix 4.
- Appropriate chain of custody paperwork will be delivered with the water samples to the laboratory. An example of the SHL chain of custody is located in Appendix 5.

Sampling site locations, analytical parameters, and sampling frequency may be modified through written agreement between the DNR and SHL and the 319 project coordinator.
The YRHW 319 water monitoring project has been designed to address the goals and objectives addressed above.
Locations of monitoring sites were chosen to meet the following general criteria

- To complement and augment pre-existing sampling data from two primary sites on the North Fork and Yellow River Sub.
- To refine the search for impairment sources by achieving the geographical spread necessary to locate higher contributory subwatersheds within the watershed.
- Sites are located so as to subdivide the project watershed into subwatersheds that are likely to demonstrate a measureable change in water quality during the life of the project.
- To make best use of funds available for analysis.

Local project staff will collect and analyze stream grab samples bimonthly from the fixed locations listed in Table 2 (Figure 2). Sampling is to occur on Tuesdays or Wednesdays during the bimonthly period. This allows for a consistent sampling interval and allows the data from all sites to be directly compared. SHL will analyze these samples for the lab parameters listed in Table 3 and watershed staff will use field meters and field kits to directly measure the other parameters. Sampling site locations, analytical parameters, and sampling frequency may be modified through written agreement between the Department and SHL and the DNR project coordinators. All samples collected as part of this activity will be coded as **YELLHEAD.**

TRAINING REQUIREMENTS/CERTIFICATION

There are no special training requirements associated with this project. A certified drinking water laboratory performs laboratory analyses. Field sampling completed by the local project staff is conducted according to DNR SOP (2002) for surface water monitoring. Local project staff is trained by DNR staff in the proper sample collection procedures, calibration and use of the field meters, collection of lab samples and processing of samples and completion of paperwork for shipment of samples.

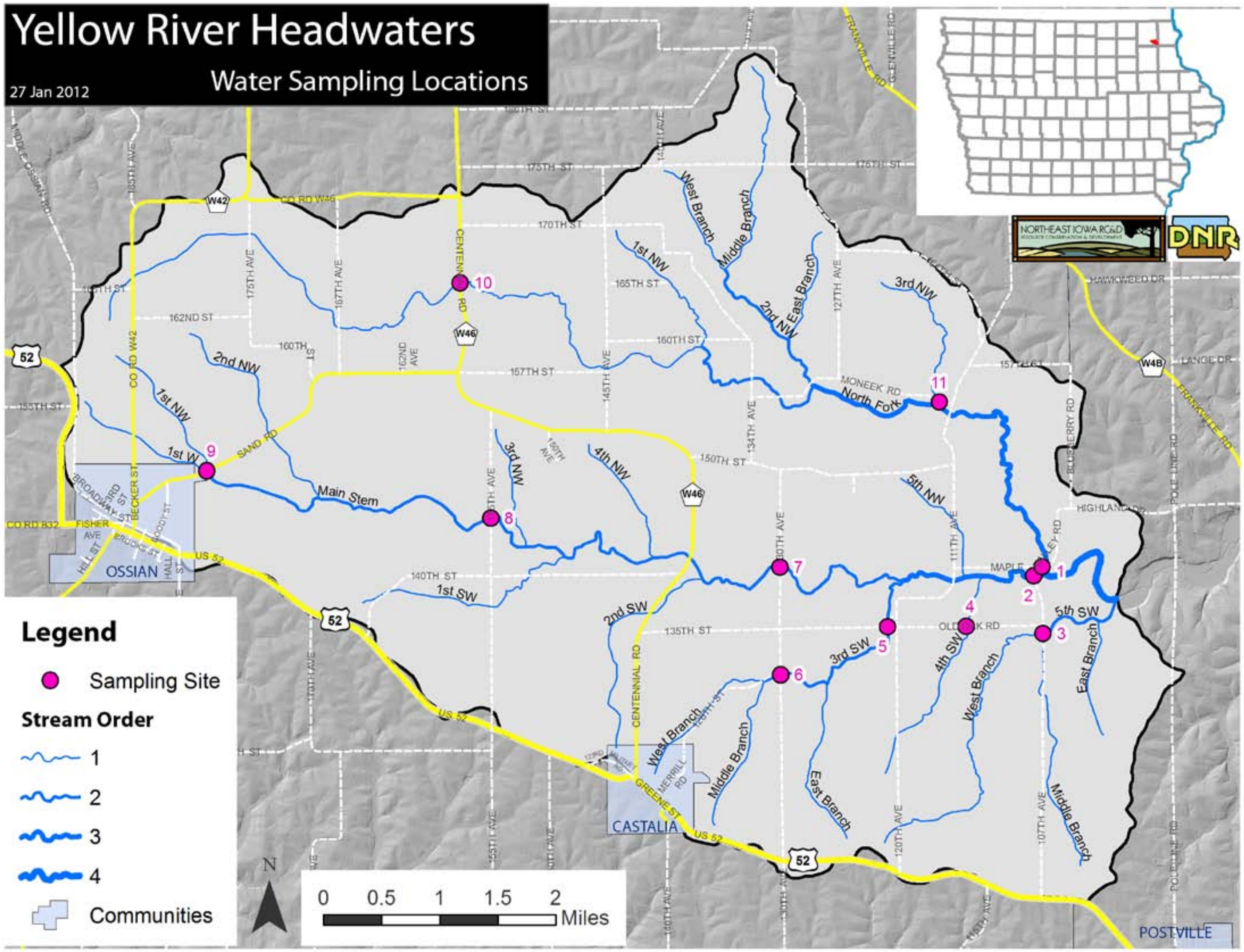
Table 2. Location for sites monitored as part of the Yellow River Headwaters project.

Site Name	*County*	*Street Location*	*X (meters)*	*Y (meters)*
1	Winneshiek	111th Ave	611767	4779364
2	Winneshiek	107th Ave	612937	4777144
3	Winneshiek	107th Ave	613069	4776347
4	Winneshiek	Old Oak Rd	612001	4776445
5	Winneshiek	135th St	610916	4776437
6	Winneshiek	130th Ave	609430	4775775
7	Winneshiek	130th Ave	609421	4777264
8	Winneshiek	155th Ave	605413	4777942
9	Winneshiek	Sand Rd	601482	4778601
10	Winneshiek	Centennial Rd	604990	4781205

Table 3. Parameters monitored for the Yellow River Headwaters 319 Monitoring Program.
All Stations Parameters – Bimonthly Sampling, April through November

Ammonia–Nitrogen (lab)	pH (field)
E. coli Bacteria (lab)	Temperature (field)
Total Phosphate (lab)	Turbidity (field)
Chloride (field)	Dissolved Oxygen (field)

Figure 2. Map of monitoring sites for the YRHW 319 water quality monitoring project.



SAMPLE METHOD REQUIREMENTS

Local project staff will perform sample collection. A representative grab sample will be collected from each sampling location as outlined in the DNR SOP (2002) for chemical/physical water quality monitoring of Iowa's streams and rivers. Grab samples will be preserved according to the requirements of SHL and packaged for shipment by the collector to the laboratory for analysis. Local project staff will follow the specimen handling procedures documented in the DNR SOP (2002) for the Ambient Water Monitoring Program. Field measurements will be done by local staff and performed as specified in the SOP.

Samples will be collected on a bi-monthly basis. Collection days will be on Tuesdays or Wednesdays. Collection will begin in April and continue through November. Each month, one of the two sampling kits will contain an extra set of bottles, quality assurance (QA), to allow for control samples to be taken. The control samples will be rotated through the set of ten sites and will be marked with a Capital A, as in 1A, 2A, etc. Bi-monthly sampling was chosen because it is less costly than weekly sampling and still meets the State of Iowa requirements for determining inclusion on the EPA's Section 303(d) impaired waters list. Water samples will be collected and analyzed for *E. coli* bacteria, ammonia nitrogen and total phosphates. Field parameters will be taken for temperature, dissolved oxygen, turbidity, pH, and chloride.

To aid in the determination of the source(s) of *E. coli* bacteria, a set of samples collected during the fall under low-flow conditions will be analyzed for optical brighteners and *E. coli* bacteria. One of the quickest, easiest, and least expensive Bacterial Source Tracking methods to identify human fecal contamination is fluorometry, a chemical "BST" method. The fluorometer detects optical brighteners from laundry detergents, most dishwashing detergents, and toilet papers, which fluoresce when exposed to UV light. Fluorometry when combined with counts of fecal bacteria can be an inexpensive method to detect human waste in fresh and marine waters.

All parameters, other than the field parameters of temperature, dissolved oxygen, turbidity, pH and chloride, will be analyzed by the State Hygienic Laboratory (SHL) as listed in Appendix 2. All parameters sampled for will be considered critical to the projects goals.

The SHL will provide bottles, labels, forms, packaging, and shipping materials (if necessary). Local project staff will label, preserve, and package the samples. Local project staff will ensure overnight delivery of the samples that they collect to the SHL in Ankeny. Sample bottle preparation and preservation methods are documented in Appendices 2 and 3. Samples collected by local project staff will be received at the Ankeny Laboratory Sample Receiving Section and processed according to the SHL-Des Moines Support

Services SOP (SHL, 1997c). Sample chain of custody will be documented according to the Limnology Section SOP and the Limnology Section QASP (SHL 1997a; SHL 2000).

All samples submitted to SHL will be coded as **YELLHEAD** and will include a chain of custody form that includes site names, date and time samples were collected, and analyses to be performed (see Appendix 5 for chain of custody form). SHL log-in procedures will accommodate this code. In a format agreed upon by the DNR, a monthly report will be provided to the DNR from computer printouts of logged-in samples. Any deviation from normal sampling procedures, such as a change in sampling location, omission of samples for analysis, etc., will be identified to DNR in writing prior to transmittal of analytical results.

FIELD SAMPLING EQUIPMENT

The following equipment is used to measure field parameters as part of the Yellow River Headwaters project: Eutech pH Testr 10, HACH 2100Q turbidity meter, YSI Model 55 Handheld Dissolved Oxygen and Temperature System, chloride test strips, plastic beakers. All equipment supplied by the Iowa DNR.

Eutech pH Testr 10

Calibration: The Testr is calibrated using two pH buffer solution standards: a pH 7 buffer and a pH 10 buffer. Before calibration, the Testr is conditioned by immersing the electrode in tap water for 30 minutes. After conditioning, the Testr is ready for calibration. A sufficient volume of buffer to cover the Testr's electrode when immersed is poured into two 100-ml plastic beakers; one beaker for each standard. The Testr is then switched on (**Step 1)** and immersed about 2 to 3 cm into the first pH standard buffer solution (**Step 2)**. The calibration (CAL) button is pressed (**Step 3)** and the 'CAL' indicator will be shown. The upper display will show the measured reading based on the last calibration while the lower display will indicate the pH standard buffer solution**. (Step 4)** The Testr is given about 2 minutes to stabilize its reading and the HOLD/ENT button is pressed to confirm the first calibration point. The upper display will be calibrated to the pH standard buffer solution and the lower display will then toggle in between readings of the next ph standard buffer solution. Repeat Steps 1 through 4 with the second pH standard buffer solution.

Measurement: The Testr is turned on and the electrode is immersed in undisturbed flowing water at the monitoring site. Sufficient time (at least a minute) is allowed for the reading to stabilize. The reading is recorded on the field data sheet and the Testr turned off.

HACH 2100Q turbidity meter

The turbidity meter measures turbidity in Nephelometric Turbidity Units (NTU) by ratio turbidimetric determination using a primary nephelometric light scatter signal 90 degrees to the transmitted light scatter signal. The model 2100Q meets EPA Method 180.1. The manual is User Manual 01/2010, Edition 1.

Calibration: The turbidity meter is calibrated using the calibration process described in the User Manual on pages 9 and 10 and the calibration verification process described on page 16.

Measurement: At each monitoring site, the turbidimeter is placed on a level, stationary surface. A sample is collected from the stream and measured by strict adherence to the techniques and procedures described in the Users Manual on pages 10 and 11.

YSI Model 55 Handheld Dissolved Oxygen and Temperature System

The YSI model 55 meter measures in water by measuring the passage of oxygen across the membrane of the instrument's probe. The thin permeable membrane isolates the positive and negative electrodes of the probe from the environment while allowing gases to enter. When a polarizing voltage is applied to the sensor electrodes, oxygen which has passed through the membrane reacts and is consumed at the cathode causing a current to flow. The membrane passes oxygen at a rate proportional to the pressure difference across it. Because oxygen is rapidly consumed at the cathode, it can be assumed that the oxygen pressure inside the membrane is zero. Therefore, the force causing oxygen diffusion through the membrane is proportional to the partial pressure of oxygen outside the membrane. As oxygen partial pressure (DO) varies so does its diffusion across the membrane causing the probe current to change proportionately. **Because dissolved oxygen is consumed during the test it is essential that the sample be continuously stirred at the sensor tip or that the sensor is immersed in flowing water. For this and other quality control reasons, dissolved oxygen is measured streamside in flowing water segments.**

Calibration: Calibration is done according to the user's manual.

1. Remove probe from the calibration chamber and inspect both probe and chamber visually to confirm the integrity of the probe membrane and that the chamber is moist. Reinsert the probe in the chamber.
2. Turn the instrument on and give it about 15 minutes to stabilize readings.
3. To calibrate, depress and release the UP ARROW and DOWN ARROW keys simultaneously.
4. The LCD should then display the local altitude in thousands of feet. For this watershed the altitude is eleven hundred feet.

Measurement: In order to give the instrument adequate time to stabilize its measurements, it is the **first instrument deployed** at each monitoring site. At the monitoring site the carrying case is opened and placed on a level surface. The probe is removed from its chamber and by use of a notched dowel gripping the cord, is suspended over moving water, entirely immersing the membrane in the flow but not touching the stream substrate.

HACH Chloride Titrators

Because of the time required for complete reaction of the titrator, chloride sampling is the **first process deployed**. A 100 ml plastic beaker is rinsed three times according to IOWATER QAPP (2010) protocol, approximately one half inch of sample is collected, the beaker is placed on a level surface, a titrator inserted, and the reaction process begins. By the time all other sampling has been completed, the reaction is complete and the result is recorded on the Field Data Sheet. Titrators are stored and used according to product container instructions. Used titrator strips are collected and disposed of according to the IOWATER QAPP (2010).

SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The SHL will provide bottles, labels, forms, packaging, and shipping materials for all lab samples collected as part of the Yellow River Headwaters project. Local project staff will label, preserve, and package the samples for overnight shipment to SHL. Sample bottle preparation and preservation methods are documented in Appendix 2. Samples collected by local project staff will be received at the Ankeny Laboratory Sample Receiving Section and processed according to the SHL-Des Moines Support Services SOP (SHL, 1997c). Sample chain of custody will be documented according to the Limnology Section SOP and the Limnology Section QASP (SHL 1997a; SHL 2000). All samples submitted to SHL will be coded to the project code **YELLHEAD**.

ANALYTICAL METHODS REQUIREMENTS

The State Hygienic Laboratory in Iowa City and Ankeny does analyses of water samples. Samples collected as part of the Yellow River Headwaters project will be analyzed in the Ankeny lab. Appendices 2 and 3 list the analytical procedures, maximum holding times, sample preservation methods for field and lab measurements, and laboratory methods. Samples will be disposed of via the sanitary sewer system; acidified samples will be neutralized before disposal. Analyses of samples with QA parameters outside acceptable limits will require reanalysis and, if deemed necessary by the QA Officer, corrective action to be undertaken. The SHL Sample Operations and Quality Assurance Officer are responsible for insuring that corrective action is taken and will report the corrective action to the DNR QA Officer. Individuals responsible for corrective action and corrective action procedures are described in the SHL's QA documents.

QUALITY CONTROL REQUIREMENTS

The SHL is a state agency under the Iowa Board of Regents. The Iowa General Assembly created the Laboratory in 1904 to meet the needs of the citizens of Iowa as the "state public health and environmental laboratory." The statute placed the Laboratory as a "permanent part of the University of Iowa." The SHL is well known for its high quality analytical performance. Since 1973, the Laboratory has had a cooperative agreement with the Iowa Department of Natural Resources to support many aspects of IDNR's statewide environmental programs. Particular to monitoring related to Iowa's 319 Program, the SHL conducts field and analytical efforts in support of this program. The program activities mainly include sample collection and analysis.

The SHL follows very strict Quality Assurance and Quality Control (QA/QC) guidelines to maintain a high degree of precision and accuracy. The Quality Assurance Program Plan of the State Hygienic Laboratory (SHL, 1997d) includes protocols for sample custody, holding and extraction times, and detection limits. Other procedures include: daily instrument calibration, interference checks, verification standards, assessment of extraction and sampling efficiencies. Confirmation studies are performed routinely. In general, at least one duplicate and one spike sample are prepared for each set of ten to fifteen samples. A minimum of one reagent blank is prepared and analyzed for each complete set of samples. Trip blanks are used for field sampling programs.

As part of its QA effort, SHL participates in numerous inter-agency and inter-laboratory proficiency testing and performance evaluation programs, including: U.S. EPA, Water Supply Series, Water Pollution Series, Office of Enforcement and Compliance Assurance series for the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and Solid Waste Series; the U.S. Geological Survey Standard Reference Sample Program; and American Industrial Hygiene Association programs. In addition, the SHL has participated in the U.S. EPA Contract Laboratory Program, one of the most rigorous quality assured analytical programs for environmental laboratories.

EQUIPMENT TESTING, INSPECTION AND MAINTENANCE REQUIREMENTS

Field equipment calibration and preventive maintenance procedures are outlined in the DNR SOP (2002) for chemical/physical water quality monitoring of Iowa's streams and rivers. The field meters used as part of this project will be maintained and calibrated according to the user manual. Details are described on page 9 of this document.

The laboratory equipment will be calibrated and maintained according to SHL's standard operating procedures for the laboratory.

DATA MANAGEMENT

Samples collected will be logged into the SHL mainframe system (ELIS). Once analyses are completed, results are entered into ELIS by the analyst, and then released by another analyst.

SHL will report the data from 319 water monitoring stations to the Yellow River Headwaters project coordinator on a monthly basis in an electronic format that is AWQMS compatible. SHL will submit completed monitoring results to the Yellow River Headwaters project coordinator not later than fifteen (15) calendar days after the end of each month.

For analytical results that are below the quantitation limit (including pesticides and metals), the quantitation limit of the test will be reported with a "less than" designation.

ASSESSMENT AND RESPONSE ACTION

The data collected through the 319 Water Monitoring Program are used in analyzing trends and describing water quality conditions for the impaired waterbody of interest and any other requested or required assessments. The data also provide a source of water quality information for other governmental agencies, industry, and the general public.

The data will also be used to report on the program effectiveness of the implementation of best management practices used as part of the Nonpoint Source program of the Iowa DNR.

REPORTS

The Yellow River Headwaters project coordinator will provide a periodic update to the Yellow River project director of the field and lab data being collected as part of this project and report any deviation from normal sampling procedures, such as a change in sampling location, omission of samples for analysis, etc. An annual summary will also be provided to the Iowa DNR 319 program.

DATA REVIEW, VALIDATION AND VERIFICATION REQUIREMENTS

Data associated with QA controls outside of the acceptance limits will be rejected by the SHL Section Chief or reviewing manager. Rejected data problems will be reported to the QA officer. Data verification will be conducted in accordance with data processing's SOP for ELIS. Rejected data is reported on the rejected data report to the analytical section chief and the SHL Sample Operations and Quality Assurance Officer. Data review, validation and verification criteria are discussed in the Limnology Section QASP (SHL, 1997b), and other SHL QA documents. The data validation and verification process is discussed in the Limnology Section QASP (SHL, 1997b) and other SHL QA documents.

INFORMATION TECHNOLOGY

SHL lab analyses will be available to the Yellow River Headwaters project coordinator via the lab's laboratory information management system. SHL will transfer 319 water quality surface water data to the DNR – Iowa Geological and Water Survey via the Survey's FTP site. The Yellow River Headwaters project coordinator will provide the field data results to the DNR – Iowa Geological and Water Survey in an Excel format. Field and lab data will be uploaded into AWQMS.

REFERENCES

- Guidance for Quality Assurance Project Plans, February 1998, U.S. Environmental Protection Agency, EPA/600/R-98/018, 131 p.
- Iowa Administrative Code, Chapter 61, Water Quality Standards.
- Iowa Department of Natural Resources, 2002, SOP for Surface Water Quality Monitoring, Iowa City, IA.
- Iowa Department of Natural Resources, 2010, Quality Assurance Project Plan for IOWATER, QA/WM/01-02, 90 p.
- University Hygienic Laboratory, 1997a, Limnology Section Standard Operating Procedures Manual, the University of Iowa Hygienic Laboratory, Iowa City, IA.
- University Hygienic Laboratory, 1997b, Limnology Section Quality Assurance Section Plan, the University of Iowa Hygienic Laboratory, Iowa City, IA.
- University Hygienic Laboratory, 1997c, University Hygienic Laboratory Des Moines Support Services Standard Operating Procedures, The University of Iowa Hygienic Laboratory, Iowa City, IA.
- University Hygienic Laboratory, 1997d, Quality Assurance Program Plan of the University Hygienic Laboratory, The University of Iowa Hygienic Laboratory, Iowa City, IA.
- University Hygienic Laboratory, 1999, University Hygienic Laboratory Iowa City Central Services Standard Operating Procedures, The University of Iowa Hygienic Laboratory, Iowa City, IA.
- University Hygienic Laboratory, 2000, Limnology Quality Assurance Section Plan, the University of Iowa Hygienic Laboratory, Iowa City, IA.

Appendix 1. Analytical procedures, maximum holding times, and sample preservation methods for field measurements.

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES				
Analyte	***Container***	***Preservative***	***Maximum Holding Time***	***Method***
Chloride	None required	None required	Analyze immediately	IOWATER QAPP 2010
Dissolved Oxygen	None required	None required	Analyze immediately	SM 4500-0-G
pH, Field	None required	None required	Analyze immediately	SM17 4500 H
Temperature, Field	None required	None required	Analyze immediately	SM17 2550
Turbidity	None required	None required	Analyze immediately	USEPA 180.1

Appendix 2. Analytical procedures, maximum holding times, and sample preservation methods for laboratory measurements.

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES				
Analyte	***Container***	***Preservative***	***Maximum Holding Time***	***Method***
Ammonia Nitrogen	250 ml plastic	Cool, 4°C H_2SO_4 to pH<2	28 days	LAC10-107-06-1J
E. coli Bacteria	120 ml clear plastic	0.008% NA2S2O3; Cool to 4 ◦C	<24 hours, <10°C for surface water	EPA 1603 (modified mTEC)
Phosphorus, Total	250 ml plastic	Cool, 4°C H_2SO_4 to pH<2	28 days	LAC10-115-01-1D

Appendix 3. Data quality requirements and assessments for the Yellow River Headwaters water quality monitoring.

Analyte	**Matrix**	**Method Detection Limit**	**Estimated Accuracy of True Value**	**Accuracy Protocol**	**Estimated Precision (Relative % Difference)**
Ammonia Nitrogen as N	Water	0.05 mg/L	+ 14%	Recovery on spikes	RDP < 20%
E. coli Bacteria	Water	10 CFU	NA	NA	Three-year Average = 0.21
Phosphate, Total	Water	0.02 mg/L	±5%	Recovery on spikes	RPD <20%

mg/L – milligrams per liter; NA – not applicable; RPD - Relative % Difference

Appendix 4. Yellow River Headwaters field form.

Yellow River Headwaters Field Form Date: ________ Sampled by: __________________________

1 *Time:*	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH

2 *Time:*	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH

3 *Time:*	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH

4 *Time:*	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH

5 *Time:*	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH

6 *Time:*	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH

Yellow River Headwaters Field Form Date: ________ Sampled by: ____________________________

7	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH
Time:					

8	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH
Time:					

9	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH
Time:					

10	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH
Time:					

Duplicate Sample

Site:	Water Temp (°C)	D.O. (mg/L)	Turbidity (NTU)	Chloride (mg/L)	pH
Time:					

Appendix 5. YRHW Chain of Custody Form

Iowa Geological and Water Survey Sample Tracking Form

ReportTo: SAME AS BILL TO				Analysis Requested					Bill To: Winneshiek County SWCD, 2296 Oil Well Rd, Decorah, IA 52101, (563)382-8777, Contact (John Beard)	Project Name/Client Reference: Yellow River Headwaters
SHL Order Number		Sample Matrix Codes: SW = Surface Water; DW = Drinking Water, WW=Wastewater; S = Soil/Sed; F= Foliage; O=Other		SM21 9223	LAC10-107-06-1J	LAC10-115-01-1D			Project Code: YELLHEAD	Collector's Phone #: 563-864-7112
										Print Collector's Name
										Collector's Signature
Sample ID/Description	Date (mm/dd/yy)	Time (military)	Sample Matrix - Use codes	E. coli Bacteria	Ammonia-N	Total Phosphate			Sample Labels - SHL USE ONLY	Collector Comments
1			SW							
2			SW							
3			SW							
4			SW							
5			SW							
6			SW							
7			SW							
8			SW							
Relinquished by			Date	Time			Comments			
Sample receiving custodian			Date	Time			Sample Intact Yes No			

State Hygienic Laboratory
Research Park - Coralville
Iowa City, IA 52242-5002
319-335-4500

State Hygienic Laboratory
2220 S. Ankeny Blvd.
Ankeny, IA 50021
515-725-1600

Lakeside Lab
1838 Hwy 86
Milford, IA 51351
712-337-3669 ext. 6

Iowa Geological and Water Survey
109 Trowbridge Hall
Iowa City, IA 52242-1319
319-335-1575

Iowa Geological and Water Survey Sample Tracking Form

ReportTo:				Analysis Requested						Project Name/Client Reference
SAME AS BILL TO				SM21 9223	LAC10-107-06-1J	LAC10-115-01-1D			**Bill To:** Winneshiek County SWCD 2296 Oil Well Rd Decorah, IA 52101 (563)382-8777 Contact (John Beard)	Yellow River Headwaters
SHL Order Number		Sample Matrix Codes								Collector's Phone #
		SW = Surface Water; DW = Drinking Water; WW=Wastewater; S = Soil/Sed; F= Foliage; O=Other								563-864-7112
										Print Collector's Name
										Collector's Signature
									Project Code: YELLHEAD	
Sample ID/Description	Date (mm/dd/yy)	Time (military)	Sample Matrix - Use codes	E. coli Bacteria	Ammonia-N	Total Phosphate			Sample Labels - SHL USE ONLY	Collector Comments
9			SW							
10			SW							
			SW							
			SW							
			SW							
			SW							
			SW							
			SW							

Relinquished by	Date	Time	Comments	
Sample receiving custodian	Date	Time	Sample Intact	
			Yes No	

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Iowa City, IA 52242-5002
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712-337-3669 ext. 6

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