Walnut Creek Watershed Management Plan—Overview

**Assessment**
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- Chapter 2: Watershed Geography
- Chapter 3: Climate and Streamflow
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- Chapter 5: Character of Streams
- Chapter 6: Key Pollutants and Sources

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- Chapter 12: Measures and Milestones
- Chapter 13: Resource Requirements
- Chapter 14: Evaluation and Amendments
- Chapter 15: Best Management Practices Toolkit
Assessment
Process Overview

**Walnut Creek WMA**
- Board Meetings
- Executive Committee

**Public Interaction**
- Open House Events
- Stakeholder Meetings
- Individual Discussions

**Plan Development**

**Boots on the Ground**
- Windshield Survey
- Stream Assessment Walks
- Quadcopter Video Collection
- Water Quality Monitoring

**Desktop Assessments**
- GIS Analysis
- Computer Modeling & Simulation

**Process throughout 2015**
- Executive Committee Meetings
- Monthly Walnut Creek Watershed Management Authority (WMA) Meetings
- Open Houses
  - Windsor Heights (April)
  - Clive (October)
- Heartland Co-op Meetings
Process Overview

Watershed Geography

VISION:
Engaged stakeholders working across boundaries to create and sustain a healthy watershed

MISSION:
Through collaboration, education and research, implement science-based policies and practices to deliver flood mitigation, water quality improvements, natural resources protection, recreation and to support economic vitality

What is a WMA?
The WMA is formed by an agreement (Chapter 28E) between two or more eligible political subdivisions within a specific watershed. A board of directors governs the WMA. WMAs may:
- Assess and reduce flood risk
- Assess and improve water quality
- Monitor federal flood risk planning and activities
- Educate residents of the watershed regarding flood risks and water quality
- Allocate moneys made available to the WMA for water quality and flood mitigation

Requirements of a WMA include:
- Iowa Code Chapter 466B Subchapter II
- All cities, counties and SWCDs of the watershed must be invited to participate in the WMA
- A Chapter 28E agreement that includes a map of the watershed must be filed with the Secretary of State
- Must be governed by a Board of Directors
- WMAs may not acquire land through eminent domain and do not have taxing authority

Benefits of forming a WMA:
- To conduct planning on a watershed scale, which has greater benefits for water quality improvement and flood risk reduction
- To foster partnerships and cooperation
- To leverage resources such as funding and technical expertise
- To facilitate stakeholder involvement in watershed management

Information about forming a WMA:
In 2010, Iowa lawmakers authorized forming Watershed Management Authorities. A Watershed Management Authority (WMA) is a mechanism for cities, counties, Soil and Water Conservation Districts (SWCDs) and stakeholders to cooperatively engage in watershed planning and management.
Watershed Geography

Plan Understanding

Local Topography & Terrain
82.8 square miles
drains through Walnut Creek and its tributaries to the Raccoon River.

Past & Current Land Uses
During a recent 10-year period, 6.7 square miles were developed into urban land use.
Currently, the watershed is nearly evenly split between urban and agricultural land uses.

Soil Conditions
The slopes of soils, their ability to absorb water and their resistance to erosion are key features to consider in watershed planning.

- Topography and Terrain
- Soil Qualities
- Changes in Land Use
Watershed Geography

Topography and Terrain
- Landforms
- Slopes

Soil Qualities
- Hydric Soils (Wetlands)
- Infiltration / Percolation Rates
- Soil Erodibility

Changes in Land Use
- Pre-pioneer Settlement
- Agriculture
- Urban

Slope Map
Watershed Geography

Landscape Change

1970s
- Interstate highway system influences development
- Westward movement starts to accelerate
- Merle Hay Mall and Valley West Mall have been constructed

1990s
- Floods of 1993 force West Des Moines City Hall offices to relocate
- Development extends across most areas east and south of I-35/I-80, and begins to expand beyond that limit near I-235 interchange

2014
- Urban footprint nearly doubles since the 1990's
- Grimes and Johnston extend development into the Walnut Creek Watershed
<table>
<thead>
<tr>
<th>Land Use</th>
<th>2001</th>
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<tr>
<td></td>
<td>area</td>
<td>% of watershed</td>
<td>area</td>
<td>% of watershed</td>
<td>% change</td>
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<tr>
<td>Open Water</td>
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<td>0.3%</td>
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<td>Urban</td>
<td>18663</td>
<td>35.3%</td>
<td>22936</td>
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<tr>
<td>Forest</td>
<td>1650</td>
<td>3.1%</td>
<td>1446</td>
<td>2.7%</td>
<td>-0.4%</td>
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<tr>
<td>Grasslands /Wetlands</td>
<td>1209</td>
<td>2.3%</td>
<td>1135</td>
<td>2.1%</td>
<td>-0.1%</td>
</tr>
<tr>
<td>Pastureland</td>
<td>3530</td>
<td>6.7%</td>
<td>2147</td>
<td>4.1%</td>
<td>-2.6%</td>
</tr>
<tr>
<td>Cropland</td>
<td>27626</td>
<td>52.3%</td>
<td>25013</td>
<td>47.4%</td>
<td>-4.9%</td>
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<tr>
<td><strong>Total</strong></td>
<td>52825</td>
<td></td>
<td>52825</td>
<td></td>
<td></td>
</tr>
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</table>
Climate and Streamflow

**Climate - Recent Trends**

- Normal Annual Precipitation:
  - 1972: 30.51”
  - 2014: 35.2”

- Normal Annual Temperature:
  - 1972: 49.3°F
  - 2014: 50.8°F

- Highest Monthly Precipitation:
  - June: 4.87”
  - May: 4.67”
  - Aug: 4.27”
  - Jul: 4.12”
  - Apr: 4.09”

- Highest Monthly Temperatures:
  - July: 85.9°F
  - Aug: 83.8°F
  - June: 81.7°F
  - Sept: 76.4°F
  - May: 72.8°F

90% of all rainfall events in central Iowa are less than 1.25 inches in depth.

*1985-2014

**Streamflow - Recent Trends**

- Annual Flow:
  - 1972: 1.9
  - 2014: 2.6
  - 2010: 5.6

- 37% increase

- Highest flows typically from May - June

- 5.6 billion cubic feet of water would fill 21,000 water towers

- 2mil gal x 21,000

**Temperature**

**Precipitation**

**Streamflow**
Downstream waterbodies are:
1. Des Moines River
2. Lake Red Rock
3. Mississippi River
4. Gulf of Mexico

**Walnut Creek**
- Currently considered an impaired waterbody due to high levels of bacteria.
- Flows into the Raccoon River which is impaired due to high levels of bacteria and nitrate.

Elevated levels of nutrients such as nitrogen and phosphorus have created a 5,840 square mile dead zone in the Gulf of Mexico (10% of the size of the entire State of Iowa).

**Des Moines Water Works** collects water from the Raccoon River for drinking water use. This water must be disinfected and nitrates removed through a special process when concentrations are above a certain level.

**Past Studies**
- Water Quality Improvement Plan for Raccoon River
- Raccoon River Watershed Water Quality Master Plan
- Iowa’s Nutrient Reduction Strategy

**Iowa’s Nutrient Reduction Strategy**
Created to reduce the amount of nutrient load sent from Iowa to the Gulf of Mexico.
Character of Streams

57% of all field assessed streams had moderate to severe erosion

239 miles of streams reviewed as part of the development of this plan

4-10x how much wider streams are now than they were prior to pioneer settlement

71% of streams (1st order and above) are incised or deeply incised meaning they have downcut or become lower over time

48% of smaller streams (0 or 1st order) have no stream buffer or have a buffer that is less than 50 feet in total width

Field Assessments
- 2014-2015
- 41 miles

GIS / Desktop Assessments
- Horizontal / Vertical Character
- Stream Buffer Type and Width

What is a buffer? Buffers slow and filter runoff before it enters the stream.
1%*

*Less than 1% of the streams assessed within the urbanized areas of the watershed are stable.
Key Pollutants and Sources

**Water Quality Monitoring Samples**
- Collected by Iowa Soybean Association/Clean Water Alliance and IOWATER volunteers
- Collected at two sites along Walnut Creek, every other week, throughout spring and summer
- IOWATER completed sampling at over 30 locations within the watershed, but more infrequently

<table>
<thead>
<tr>
<th>Pollutant Sources By Land Use</th>
<th>N</th>
<th>P</th>
<th>BOD</th>
<th>Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>13.61%</td>
<td>26.14%</td>
<td>51.51%</td>
<td>6.89%</td>
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<tr>
<td>Cropland</td>
<td>80.59%</td>
<td>49.12%</td>
<td>33.76%</td>
<td>10.24%</td>
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<tr>
<td>Pastureland</td>
<td>1.91%</td>
<td>2.02%</td>
<td>5.09%</td>
<td>0.29%</td>
</tr>
<tr>
<td>Forest</td>
<td>0.14%</td>
<td>0.66%</td>
<td>0.25%</td>
<td>0.44%</td>
</tr>
<tr>
<td>Grasslands</td>
<td>0.04%</td>
<td>0.16%</td>
<td>0.06%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Gully</td>
<td>0.81%</td>
<td>4.79%</td>
<td>2.05%</td>
<td>18.97%</td>
</tr>
<tr>
<td>Streambank</td>
<td>16.3%</td>
<td>9.58%</td>
<td>4.10%</td>
<td>37.95%</td>
</tr>
<tr>
<td>Construction Site</td>
<td>1.27%</td>
<td>7.53%</td>
<td>3.20%</td>
<td>25.19%</td>
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</tbody>
</table>

8 loading reduction goals are outlined within this chapter.

**Key Pollutants of Concern**
- Nitrogen
- Phosphorus
- Sediment
- Pathogens (bacteria and viruses)
- Runoff rates and volumes

**Agricultural Areas**
Nitrogen and phosphorus compounds have been measured higher levels.

**Urban Areas**
Levels of bacteria have been at higher concentrations.

**Pollutants of Concern**

**Nitrates**
Highest measured concentration

**22.9 mg/L**
More than twice the Raccoon River Total Maximum Daily Load (TMDL) standard of 9.5 mg/L.

**77,010 MPN/100mL**
was observed to be the maximum level of E.coli (indicator bacteria), which is more than 330 times the state's allowable average concentration of 235 MPN/100mL.

**Monitoring**
- Iowa Soybean Association
- IOWATER

**Modeling**
- Calibrated using monitoring data
- Watershed wide and case-studies
Key Pollutants and Sources

Source: "Monitoring Data from Iowa Soybean Association, IDNR Snapshot and Iowater"
# Key Pollutants and Sources

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Total Load (pounds)</th>
<th>Total Load (tons)</th>
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<tr>
<td>Nitrogen</td>
<td>941,600</td>
<td>471</td>
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<tr>
<td>Phosphorus</td>
<td>61,500</td>
<td>31</td>
</tr>
<tr>
<td>Sediment</td>
<td>59,360,000</td>
<td>29,700</td>
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</table>
### Key Pollutants and Sources

#### Pollutant Loads By Source – Entire Watershed

<table>
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<td>38.0%</td>
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<td>25.2%</td>
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### TOTAL NITROGEN BY SOURCE

- Urban: 80.59%
- Cropland: 0.14%
- Pastureland: 0.81%
- Forest: 1.63%
- Grasslands: 1.27%
- Gully: 3.71%
- Streambank: 1.91%
- Construction Site: 0.04%

### TOTAL SEDIMENT BY SOURCE

- Urban: 26.14%
- Cropland: 49.12%
- Pastureland: 18.97%
- Forest: 6.89%
- Grasslands: 10.24%
- Gully: 25.12%
- Streambank: 6.98%
- Construction Site: 1.32%

### TOTAL PHOSPHORUS BY SOURCE

- Urban: 7.53%
- Cropland: 4.79%
- Pastureland: 9.58%
- Forest: 0.66%
- Grasslands: 0.03%
- Gully: 0.16%
- Streambank: 2.02%
- Construction Site: 49.12%
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Key Pollutants and Sources

Watershed – Sources of Nitrogen Loading (Annual Rate per Acre)

Note: Does not include Construction Site Loading
Key Pollutants and Sources

Watershed - Sources of Phosphorus Loading (Annual Rate per Acre)

Source Loading (pounds per acre per year)

Note: Does not include Construction Site Loading
Key Pollutants and Sources

Watershed – Sources of Sediment Loading (Annual Rate per Acre)

Note: Does not include Construction Site Loading
ONE
Reduce flooding through improved stormwater management and soil health.

TWO
Improve water quality, with an emphasis on sediment, nitrate, phosphorous and e-coli reductions.

THREE
Enhance recreation and public health through improved water quality, habitat restoration, stream accesses, improved connectivity to parks/trails and cultural opportunities.

FOUR
Deliver enriched conservation education and programming with emphasis on water quality/quantity management, wildlife/habitat, urban and agricultural needs within the watershed.

FIVE
Support community vitality and maintain economic health through implementing multi-purpose projects producing benefits in public, natural resources and economic health that can be documented.

SIX
Develop ongoing means for collaboration and implementation of effective policies and practices, taking a consistent watershed and/or regional scale approach as much as practical.

Vision
“Engaged residents working across political and property boundaries to create and sustain a healthy watershed.”

Mission
“Through collaboration, education and research, implement science-based policies and practices for flood mitigation, water quality improvements, natural resources protection and improved recreation while maintaining economic health.”

Goals
Case Study: Subwatershed Strategic Plans

Why Study Subwatersheds?
- More precise information can be gathered for a smaller study area
- Can model practices at the scale of an individual field or site
- As projects are implemented, measurable improvements can be seen through monitoring
- At the scale of the entire watershed, many more improvements would be needed to notice changes
- Not all improvements will be in the priority areas, but by focusing work in those areas, lessons can be learned that can be applied to future improvements throughout the watershed
- Opportunities to ask: “Are we getting the expected results from our efforts?” “What changes should be made for future work?”

Why were these subwatersheds selected as priority areas?

- Rural—Walnut Creek Headwaters
  - Features both prairie pothole and steeper terrain
  - Samples many of the different characteristics of the larger watershed
  - Some conservation practices are in place—signals landowner interest
  - Has both confined feeding operations and pastures, which some other areas lack
  - Opportunities to slow or treat runoff higher in the watershed

- Urban—South Walnut Creek (Country Club Lake)
  - Opportunities to modify outlets on large ponds to better manage smaller storms
  - Variety of land uses (office, retail, residential, parks, golf courses)
  - Includes three communities (West Des Moines, Waukee and Clive)

- Developing—Lower Little Walnut Creek
  - Area ready to develop over next 5-10 years
  - Steeper terrain—in the past, similar areas have had urban stream stability issues after development
  - Includes three communities (Waukee, Clive and Urbandale)

- Gather more detailed info for modeling
- Target more improvements in a smaller area
- Test results (monitoring)
- Apply lessons learned to other watersheds
Case Study: Subwatershed Strategic Plans

**Key Lessons Learned**

**Rural (411)**
- Cropland is expected to be the largest source of nitrogen and phosphorus loads.
- Gully and streambank erosion is expected to be a large source of sediment load.

**Developing (602)**
- Runoff volume increase in suburban residential areas compared to pre-settlement conditions during a one-year storm event (2.67” in 24 hrs): 7x
- Rate of flow increase for same conditions: 43x
- Reduction in peak outflow rates from developing areas for the one-year event, using new stormwater design methods outlined in the Iowa Stormwater Management Manual (compared to current methods): 97%
- Restoring healthy topsoil layers to open space areas can reduce stormwater runoff by 1/2.

**Urban (213)**
From 2001-2011, construction sites made up 2-3% of this subwatershed. This small portion of this landscape is estimated to contribute:
- 61% Sediment load
- 17% Nitrogen
- 26% Phosphorus

**25%**
Construction sites likely contribute more than 25% of the total sediment load.

- Pollutant Sources
- Construction Site Pollution Prevention
- Increases in flow in developing areas
- New methods better manage small storms
- Importance of healthy topsoil

Modifying key pond outlet structures to manage small storms could reduce:
- One-year outflow rates for the area served by more than 40%
- Phosphorus and sediment loads downstream by 10%
Policy Recommendations

**Concerns**
- Elevated pollutant concentrations
- Long-term cost to repair eroded stream corridors ($2-3 million/mile)
- 25% of sediment load to Walnut Creek may be attributed to construction site runoff
- Flood damage to buildings and structures
- Lack of access for maintenance or repairs
- Damage to habitat and loss of resources

**Policies**
- Use new stormwater management guidelines in developing areas
- Reserve open spaces for flood plains and stream buffers
- Make improvements on points of emphasis for sediment and erosion control practices
- Protect or restore healthy topsoil layers on open spaces in developing areas
- Rural management strategies

**Outcomes**
- Where implemented, runoff is captured, filtered, and reduced for more than 90% of all storm events
- Reduction in rapid bounce in water levels in small tributaries
- Establish a more natural pattern of flow in developing areas
- Lower the potential for costly stream bank and channel erosion
- Sediment loading related to construction sites and streambank erosion minimized
- Reserved spaces for access and improvements
- Limit placement of new structures or restrictions within the flood plain

**Urban**
- Policies
- Points of Emphasis

**Rural**
- In Development
Policy Recommendations

Urban
- Stormwater Management
- Flood Plain Protection
- Stream Buffer Protection
- Construction Site Pollution Prevention
- Soil Quality Restoration

Rural
- Developing Recommendations
- Recent Meetings with Farmers / Landowners

Draft Recommendations—Policy

Stromwater Management
- Major policies such as the State’s Stormwater Management Manual and the Local Stormwater Management Plan shall be in place and implemented by 2025.

Flood Plain Protection
- Local policies and requirements should be adopted or amended to protect floodplains in the future.

Stream Buffer Protection
- Stream buffers should be established to create a buffer zone between developed areas and natural water bodies.

Construction Site Pollution Prevention
- Construction sites should be properly managed to prevent pollution.

Soil Quality Restoration
- Measures should be taken to improve and restore soil quality.

Draft Recommendations—Best Practices

Preserve topsoil
- Preserve topsoil layers during construction activities.

Manage the water quality volume using green infrastructure
- Use green infrastructure such as rain gardens and bioswales to manage stormwater.

Modify existing detention basins to manage 90% of all storm events
- Modify existing detention basins to manage a larger proportion of storm events.

Increase the use of green infrastructure
- Increase the use of green infrastructure to manage stormwater.

Improve stormwater management training
- Improve training for stormwater management professionals.

Enhance stormwater management policies
- Enhance policies related to stormwater management.
Projects and Priorities

Ten-Year Implementation Plan

- Case Study Areas
- CIP Programs
- Other Watershed Wide Project Recommendations

Case Study Subwatersheds
- Rural (411)
- Urban (213)
- Developing (602)

Scheduled
Capital
Improvement
Projects

Other
Recommended
Projects
Throughout the
Watershed
Implementation
Education and Collaboration Plan

- How does the message about the plan get to those who can help implement it?
- How do groups work together?
Measures and Milestones

Timeline

- 10-year initial plan
- Full watershed plan will take decades
- First order of business:
  - Establish monitoring program
  - Begin education and outreach
  - Review and amend local policies
- Next steps:
  - Implement projects as funding is acquired or allocated
  - Evaluate progress annually
  - Report results
  - Plan updates
Implementation

- Resource Requirements
  - Financial
  - Technical
  - Staffing
- Evaluation and Amendments
- Best Management Practices Toolkit