WALNUT CREEK WATERSHED

management plan update

PLAN IN PROGRESS
January 8, 2016

January 2016

RDg PLANNING • DESIGN

DES MOINES AREA MPO METROPOLITAN PLANNING ORGANIZATION

SNYDER & ASSOCIATES Engineers and Planners

Polk Soil & Water CONSERVATION DISTRICT

Walnut Creek Watershed Management Plan—Overview

Assessment

Action

Implementation

Assessment

Process Overview

Walnut Creek WMA

- Board Meetings
- Executive Committee

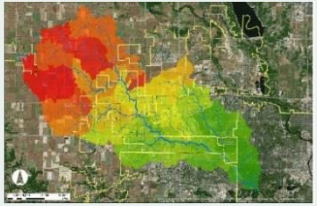
Public Interaction

- Open House Events
- Stakeholder Meetings
- Individual Discussions

Plan Development

- Windshield Survey
- Stream Assessment Walks
- Quadcopter Video Collection
- Water Quality Monitoring

Boots on the Ground



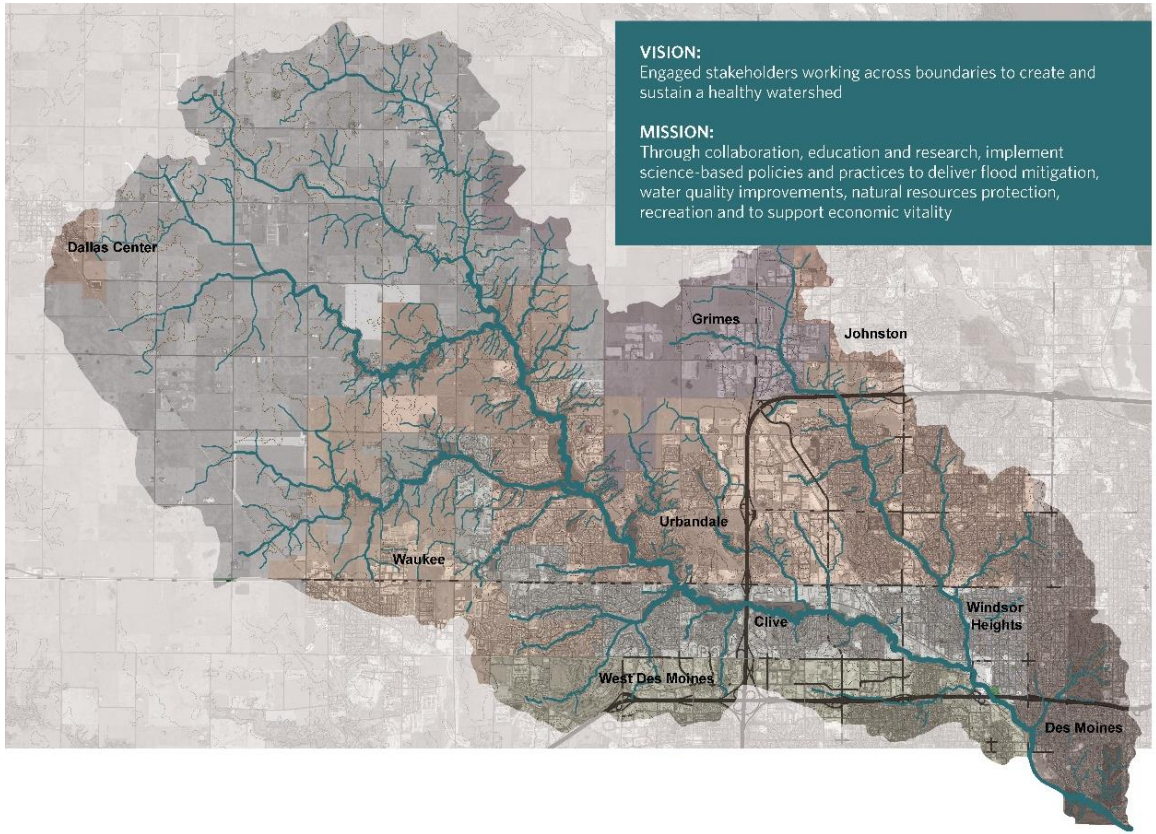
- GIS Analysis
- Computer Modeling & Simulation

Desktop Assessments

- 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:

per 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

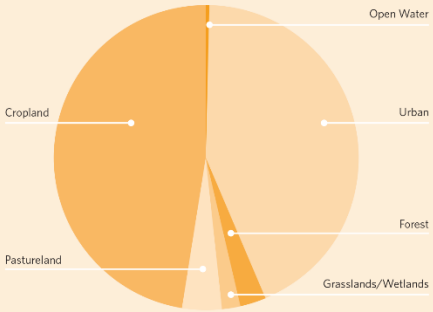
Local Topography & Terrain

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

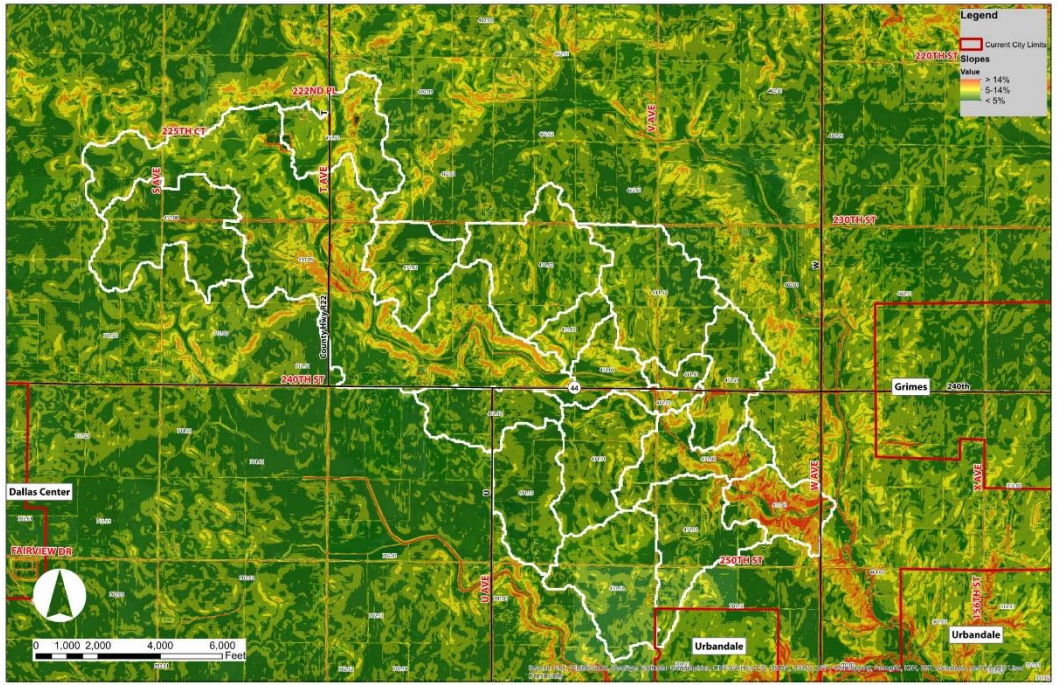
- Landforms
- Slopes

Soil Qualities

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

Changes in Land Use

- Pre-pioneer Settlement
- Agriculture
- Urban

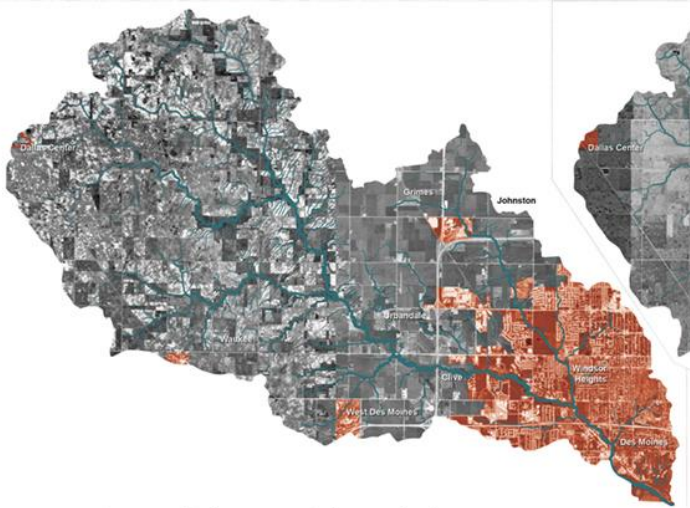


Slope Map

Watershed Geography

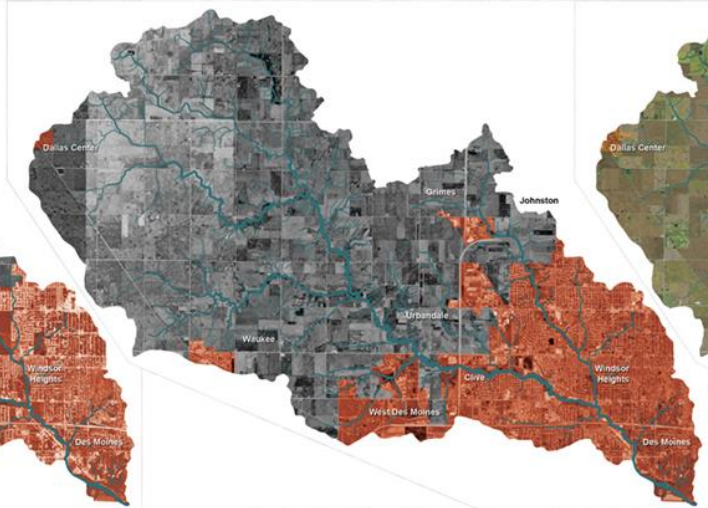
Landscape Change

1970s



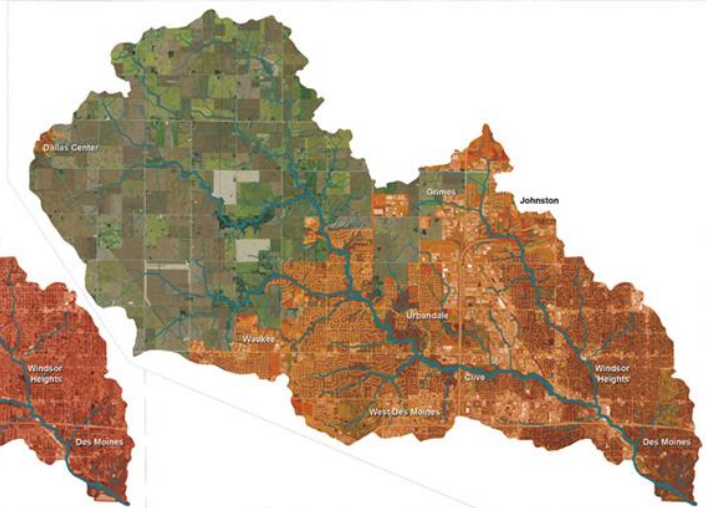
- Interstate highway system influences development
- Westward movement starts to accelerate
- Merle Hay Mall and Valley West Mall have been constructed

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

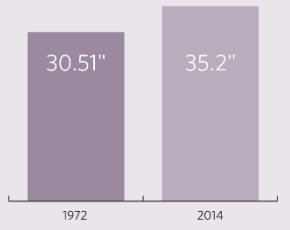
Watershed Geography

Land Use	2001		2011		2001-11
	area (in acres)	% of watershed	area (in acres)	% of watershed	% change
Open Water	146	0.3%	147	0.3%	0.0%
Urban	18663	35.3%	22936	43.4%	8.1%
Forest	1650	3.1%	1446	2.7%	-0.4%
Grasslands /Wetlands	1209	2.3%	1135	2.1%	-0.1%
Pastureland	3530	6.7%	2147	4.1%	-2.6%
Cropland	27626	52.3%	25013	47.4%	-4.9%
Total	**52825**		**52825**		

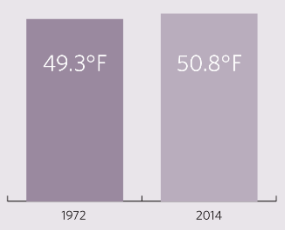
Climate and Streamflow

Climate - Recent Trends

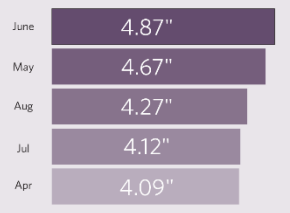
Normal Annual Precipitation



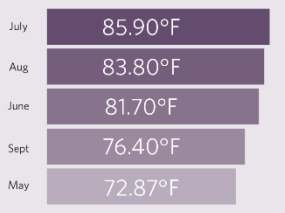
Normal Annual Temperature



Highest Monthly Precipitation*



Highest Monthly Temperatures*

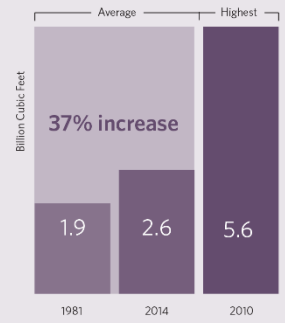


90% of all rainfall events in central Iowa are less than 1.25 inches in depth.

*1985-2014

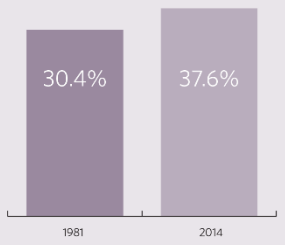
Streamflow - Recent Trends

Annual Flow



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

The portion of rainfall converted to runoff has increased recently.



Highest flows typically from May - June

2mil gal x 21,000

- Temperature
- Precipitation
- Streamflow

Background Studies

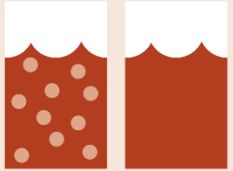
Downstream waterbodies are:

1. Des Moines River
2. Lake Red Rock
3. Mississippi River
4. Gulf of Mexico

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)

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.



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.

Iowa's Nutrient Reduction Strategy

Created to reduce the amount of nutrient load sent from Iowa to the Gulf of Mexico.

Past Studies

- Water Quality Improvement Plan for Raccoon River
- Raccoon River Watershed Water Quality Master Plan
- Iowa's Nutrient Reduction Strategy

Character of Streams

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

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

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

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

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

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

Field Assessments

- 2014-2015
- 41 miles

GIS / Desktop Assessments

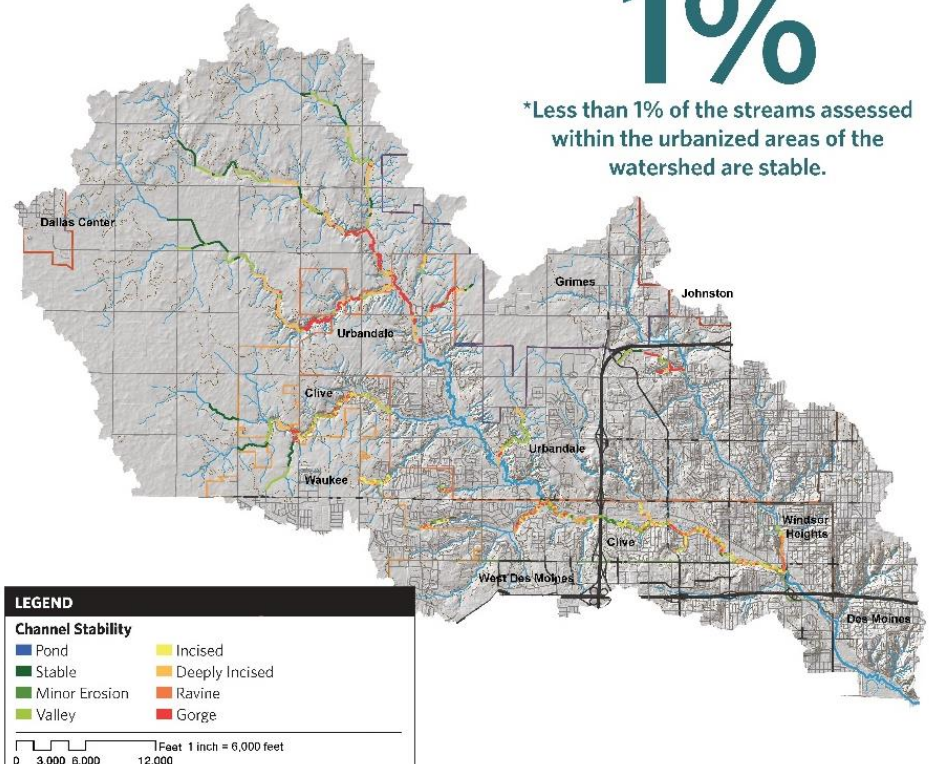
- Horizontal / Vertical Character
- Stream Buffer Type and Width

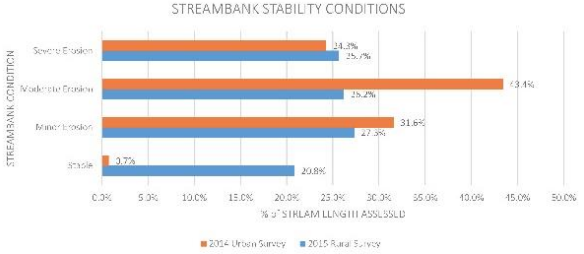
Character of Streams

Channel Stability

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

Pollutant Sources By Land Use				
	N	P	BOD	Sediment
Urban	13.61%	26.14%	51.51%	6.89%
Cropland	80.59%	49.12%	33.76%	10.24%
Pastureland	1.91%	2.02%	5.09%	0.29%
Forest	0.14%	0.66%	0.25%	0.44%
Grasslands	0.04%	0.16%	0.06%	0.03%
Gully	0.81%	4.79%	2.05%	18.97%
Streambank	1.63%	9.58%	4.10%	37.95%
Construction Site	1.27%	7.53%	3.20%	25.19%

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

8 loading reduction goals are outlined within this chapter.

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.

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

Urban Areas
Levels of bacteria have been at higher concentrations.

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

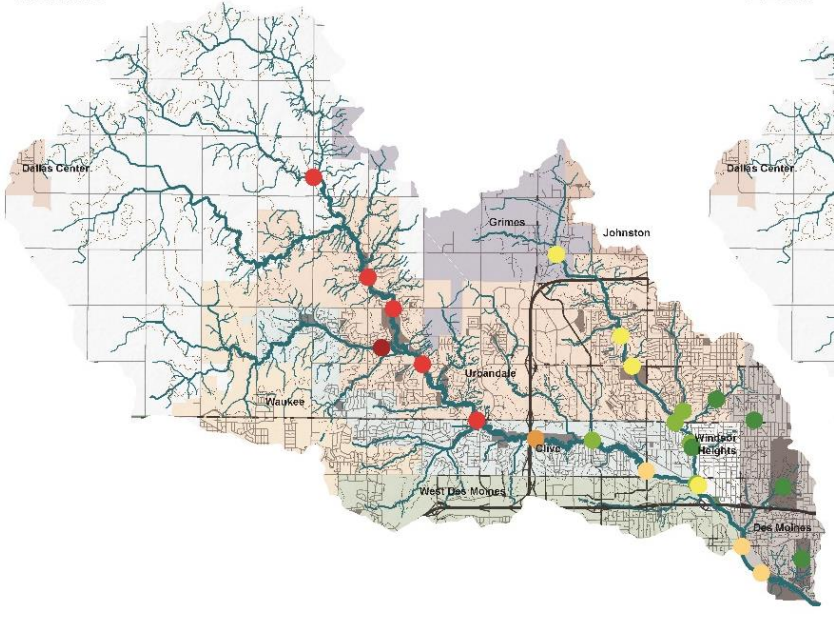
Modeling

- Calibrated using monitoring data
- Watershed wide and case-studies

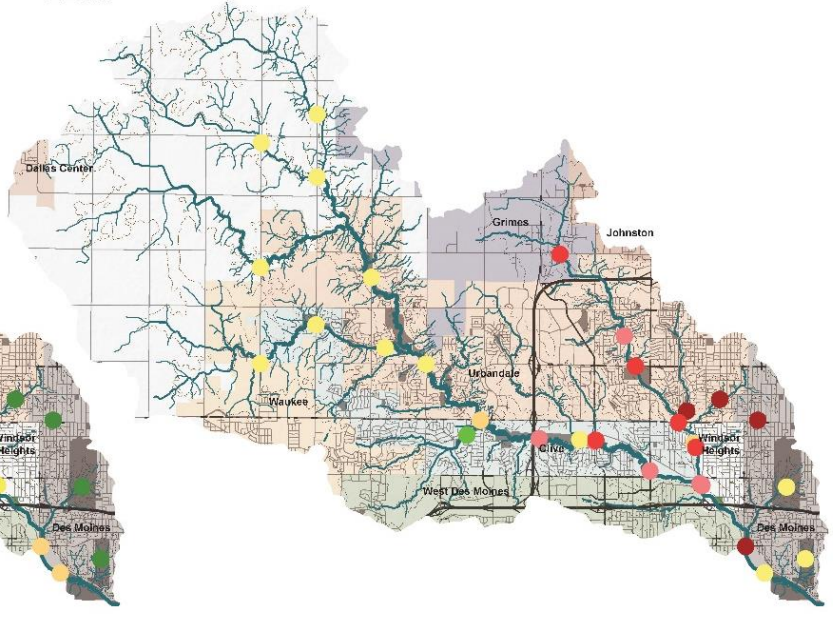
Pollutants of Concern

Key Pollutants and Sources

Nitrates



E-Coli



Source "Monitoring Data from Iowa Soybean Association, IDNR Snapshot and Iowater"

LEGEND

Nitrate (mg/l)		E-Coli	
0.0 - 0.1	15.1 - 17.0	240	10001 - 30000
0.2 - 5.0	17.1 - 18.0	241 - 5000	30001 - 80000
5.1 - 10.0	18.1 - 23.9	5001 - 7500	
10.1 - 15.0	24.0 - 35.0	7501 - 10000	

0 3,000 6,000 12,000 Feet 1 inch = 6,000 feet

Key Pollutants and Sources

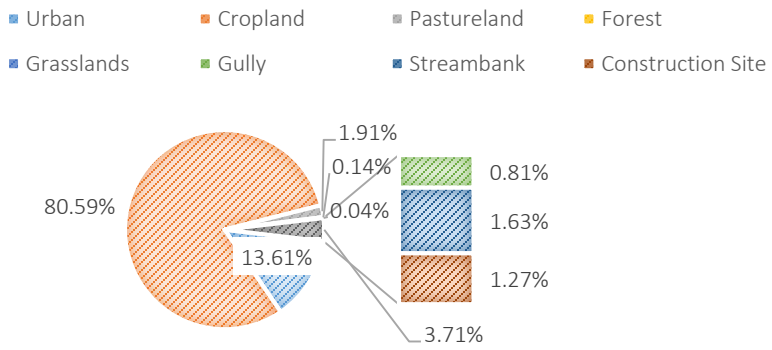
Estimated Average Watershed Loading		
Pollutant	**Total Load (pounds)**	**Total Load (tons)**
Nitrogen	941,600	471
Phosphorus	61,500	31
Sediment	59,360,000	29,700

Key Pollutants and Sources

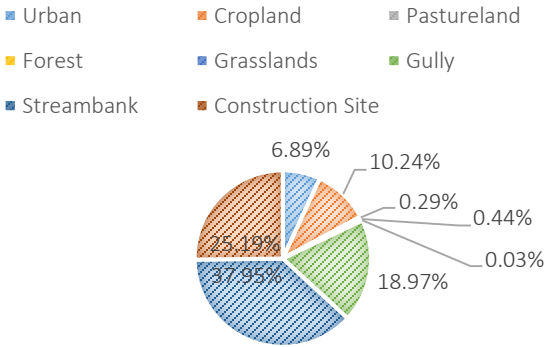
Pollutant Loads By Source – Entire Watershed

	N	P	Sediment
Urban	13.6%	26.1%	6.9%
Cropland	80.6%	49.1%	10.2%
Pastureland	1.9%	2.0%	0.3%
Forest	0.1%	0.7%	0.4%
Grasslands	0.0%	0.2%	0.0%
Gully	0.8%	4.8%	19.0%
Streambank	1.6%	9.6%	38.0%
Construction Site	1.3%	7.5%	25.2%

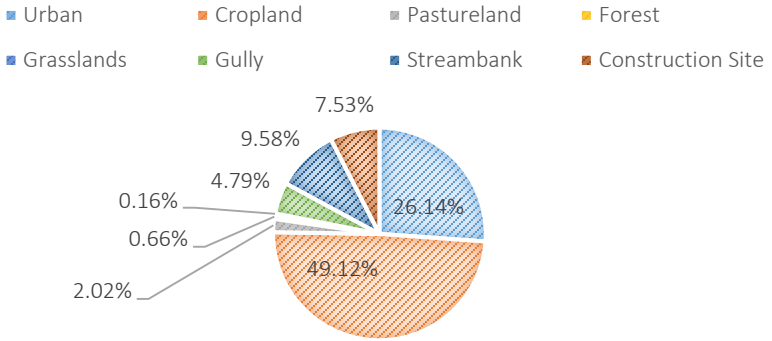
TOTAL NITROGEN BY SOURCE



TOTAL SEDIMENT BY SOURCE



TOTAL PHOSPHORUS BY SOURCE



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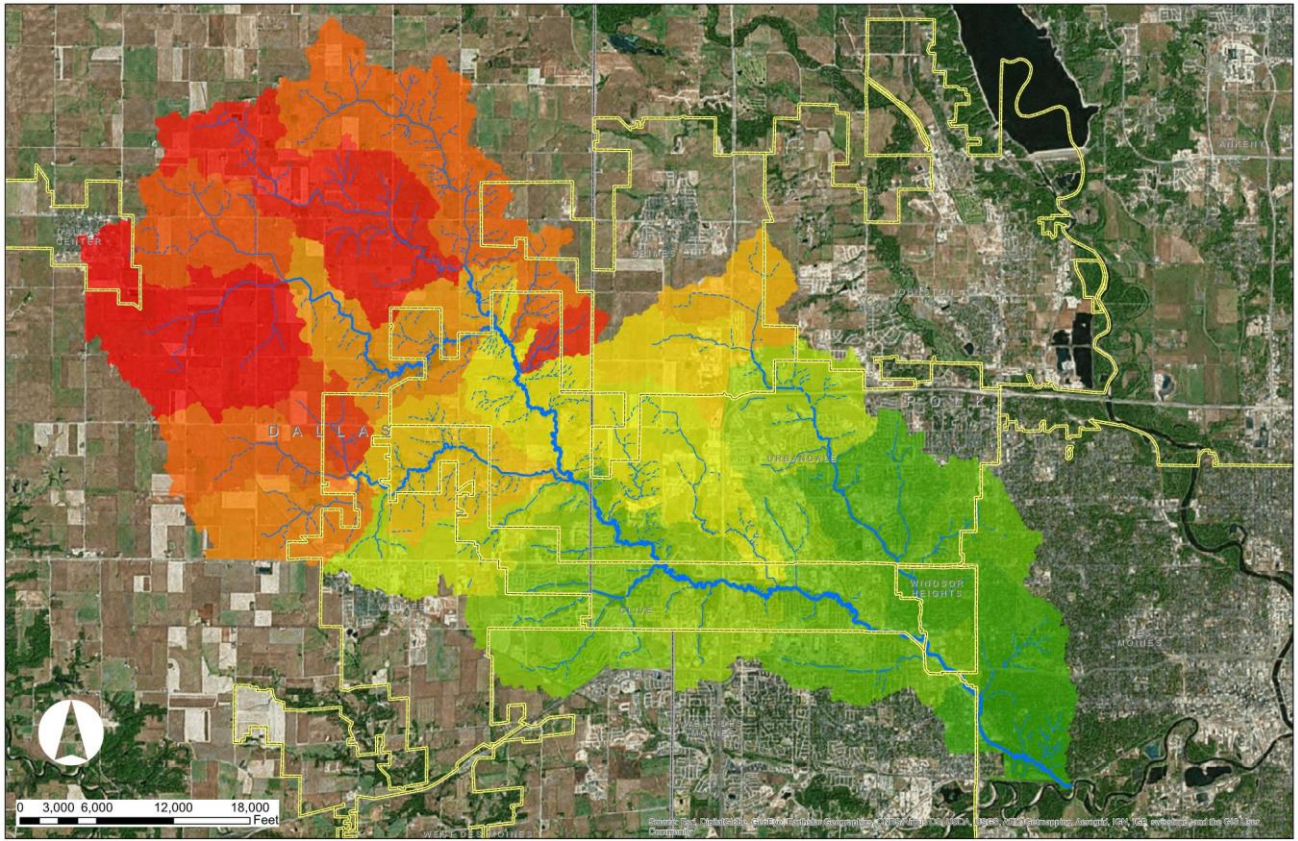
Key Pollutants and Sources

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

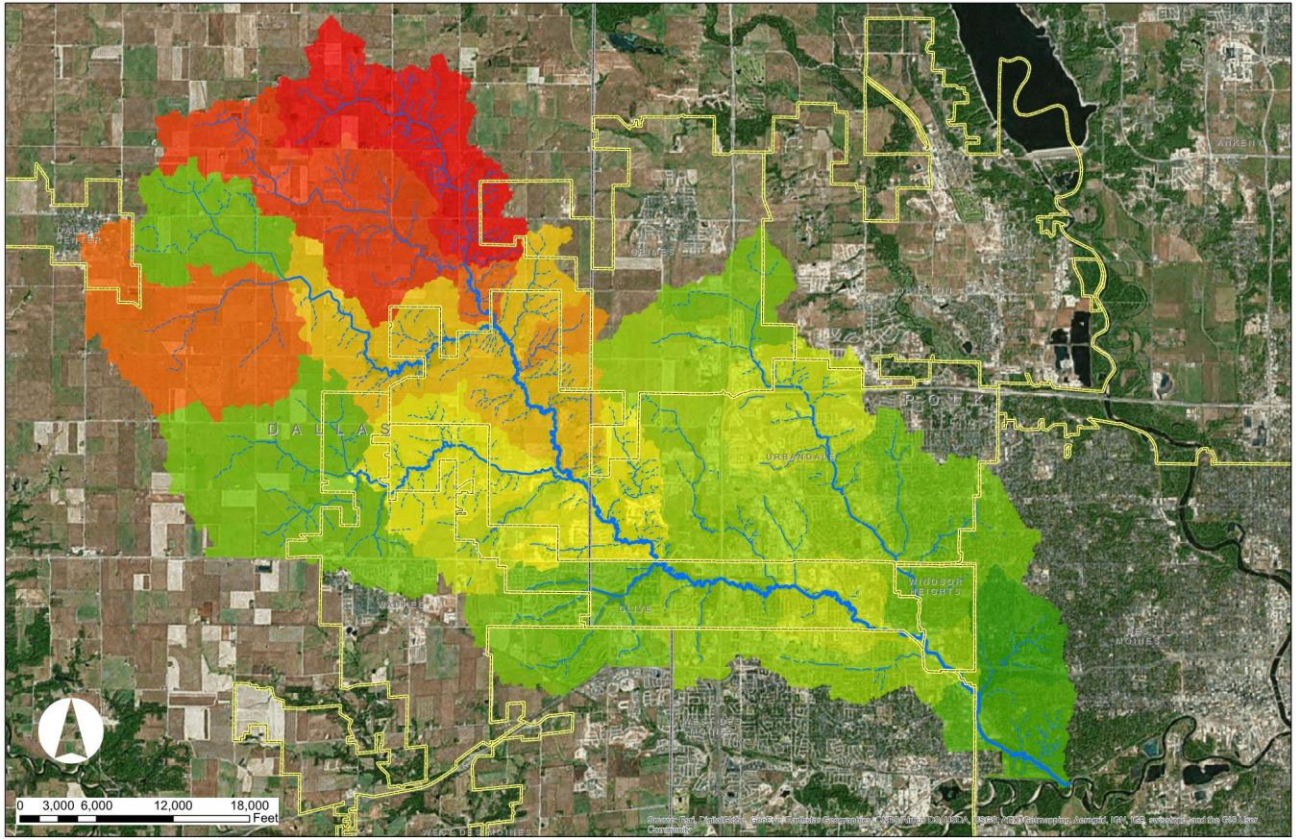


Source Loading (pounds per acre per year)

Note: Does not include Construction Site Loading

Key Pollutants and Sources

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

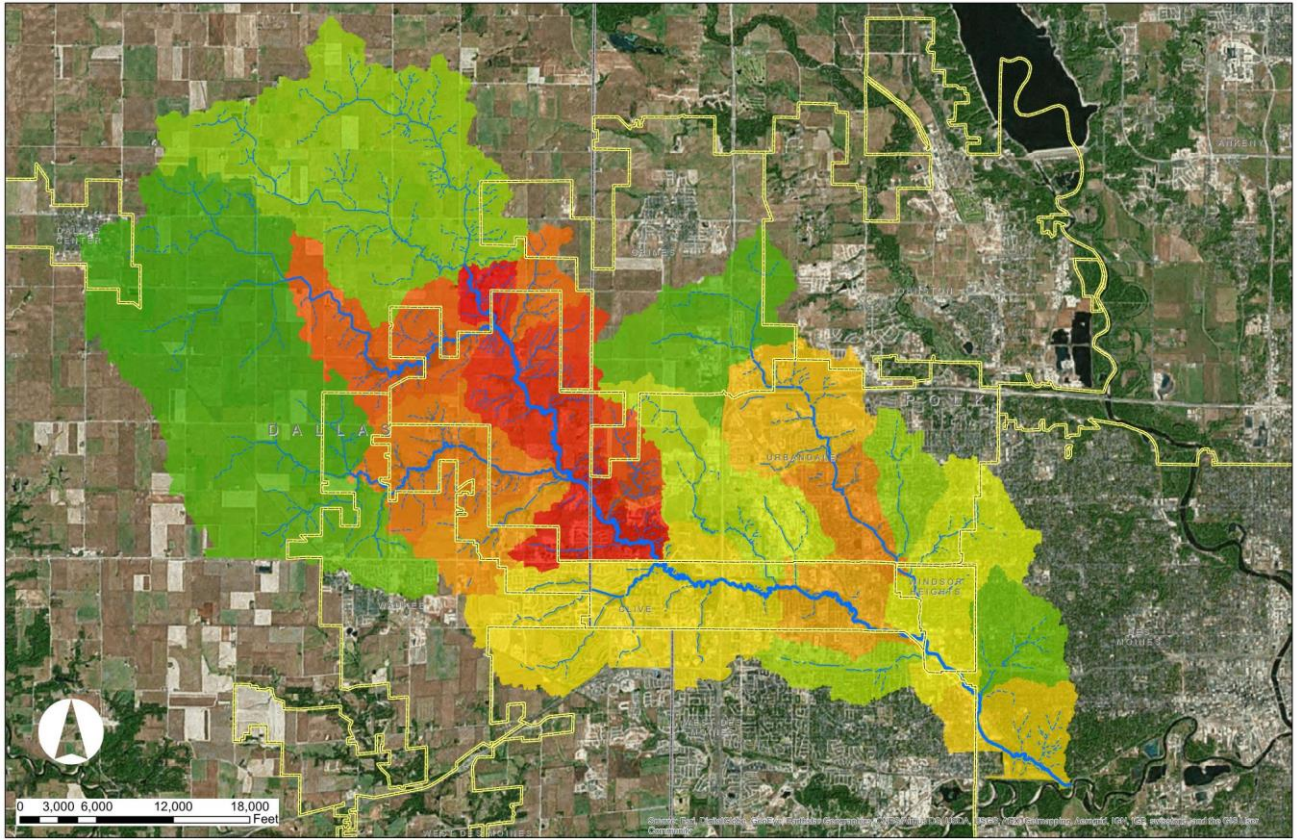


Source Loading (pounds per acre per year)

Note: Does not include Construction Site Loading

Key Pollutants and Sources

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



Source Loading
(TONS per acre per year)

Note: Does not include Construction Site Loading

Action

Strategic Framework

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

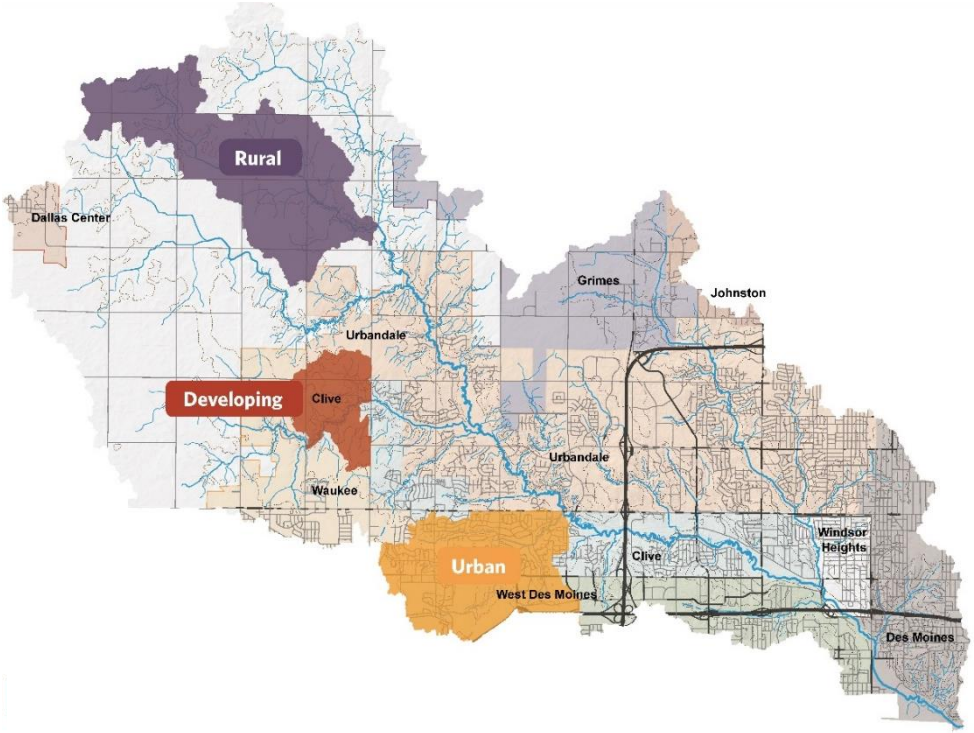
"Engaged residents working across political and property boundaries to create and sustain a healthy watershed."

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 these 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 land owner 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.

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.

Developing (602)

7x	Runoff volume increase in suburban residential areas compared to pre-settlement conditions during a one-year storm event (2.67" in 24 hrs)
43x	Rate of flow increase for same conditions
97%	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)
1/2	Restoring healthy topsoil layers to open space areas can reduce stormwater runoff by 1/2.

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%

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

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 maintenanceor 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, filitered 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

1 Stormwater Management

Adopt policies such as the Unified Sizing Criteria with the Iowa Stormwater Management Manual which call for management of both small and large storm events:

- Water Quality Volume: Capture and treat runoff expected to be generated by a 24-hour, 1.25" event. Over 90% of all precipitation in Central Iowa can be attributed to these types of events.
- Channel Protection Volume: Provide extended detention of the 1-year storm, with allowance over a period of between 24 and 48 hours.
- or large storm events: Release runoff at rates similar to what would have existed prior to pioneer settlement.

2 Flood Plain Protection

Local policies and ordinances should be adopted or amended to protect flood plains in the following ways:

- Reduce property losses during major flood events by preventing construction of new privately owned building structures within the limits of the 100-year flood plain
- Maintain flood storage capacity by limiting grading or placement of fill materials within the flood plain.
- Identify areas of active stream movement and reserve areas as open space where future stream movement or flood plain inundation is expected.
- Consider higher rainfall rates from NOAA Atlas 14 data when establishing flood protection elevations

3 Stream Buffer Protection

Stream buffers should be established—either by public land acquisition or through preservation as permanent easements—as public or private open space. Local policies and ordinances should be adopted or amended to establish protected stream buffers. Stream buffers should be wide enough to serve the following functions:

- Include the entirety of the regulatory 100-year flood plain or areas expected to be inundated by a 24-hour 100-year storm event.
- Allow for expected stream migration, based on recent movement patterns of historic stream channel locations.
- Provide enough width for future stream bank improvements.
- Include room for reserved paths for maintenance or permanent multi-purpose trails that can be used for access.
- Include a minimum building setback standard from all stream banks, trails and access paths.

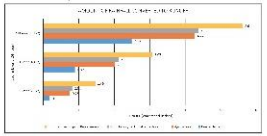
4 Construction Site Pollution Prevention

Construction site runoff has been identified as one of the largest sources of sediment loading within the urban environment. Key improvements to address this include:

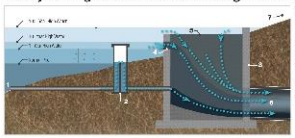
- Consider stormwater management early in the site design process, look for ways to minimize the footprint of disturbed areas, lessen grading volumes and reduce impervious surfaces.
- Develop and implement a Site Management Plan (SMP), with the goal of providing healthy soils across all open space areas on developed landscapes, before construction has been completed.
- Increase the use of temporary seeding, mulches, rolled erosion control products (RECPs) and turf reinforcement mats (TRMs).
- Prior to commencing land disturbing activities, install perimeter site controls.
- Don't overload control s. Refer to design guidelines for sizing and design.
- Check silt site controls on a weekly basis and before rainfall is expected to make sure they are in good working order.
- Routine y check sites to ensure that construction sites are in compliance with state and local standards.
- Inspection personnel should respond promptly when pollutant site runoff or off-site tracking is observed, or if there complaints are received.
- When necessary, "stop-work orders" or other methods should be used to force sites back into compliance before work on other construction items can proceed

Draft Recommendations—Best Practices

Preserve topsoil



Modify existing detention basins to manage 98% of all storm events



Manage the water quality volume using green infrastructure

Projects and Priorities

Ten-Year Implementation Plan

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

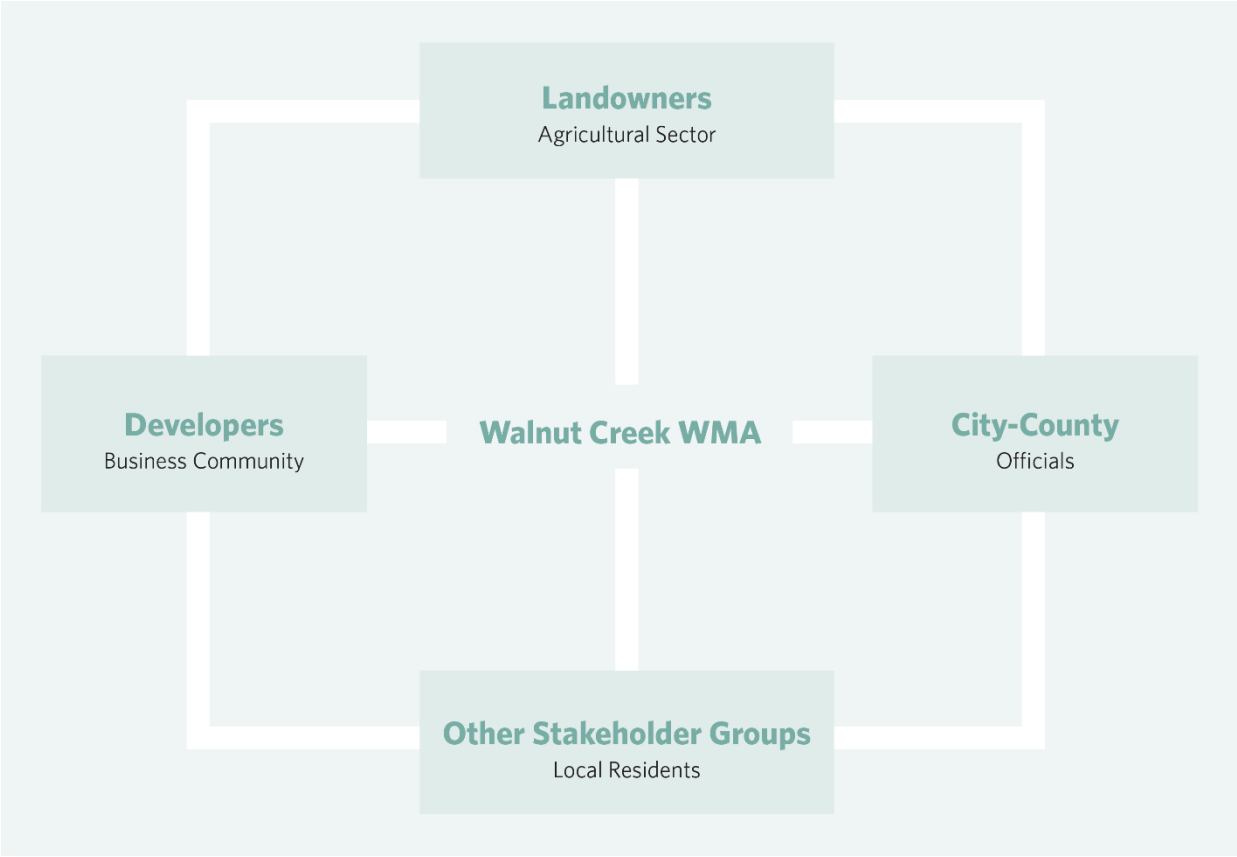
Scheduled Capital Improvement Projects

Other Recommended Projects Throughout the Watershed

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

Implementation

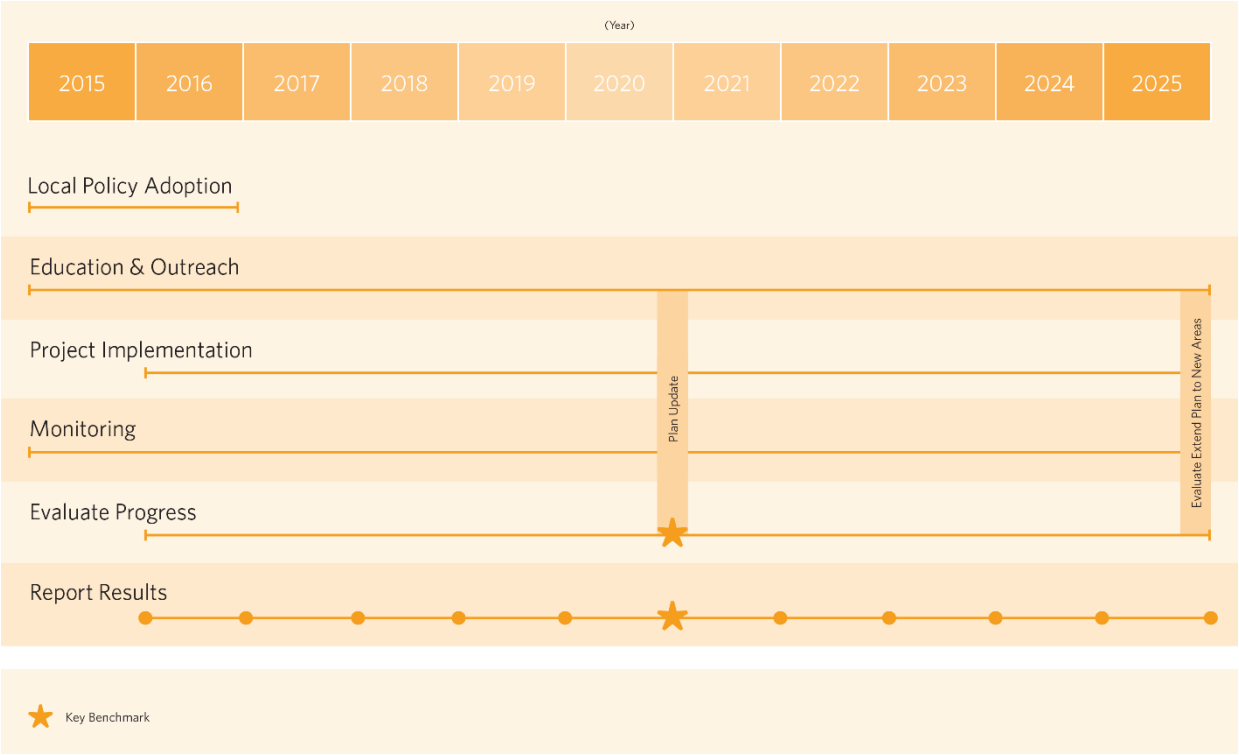
Education and Collaboration Plan



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

Measures and Milestones

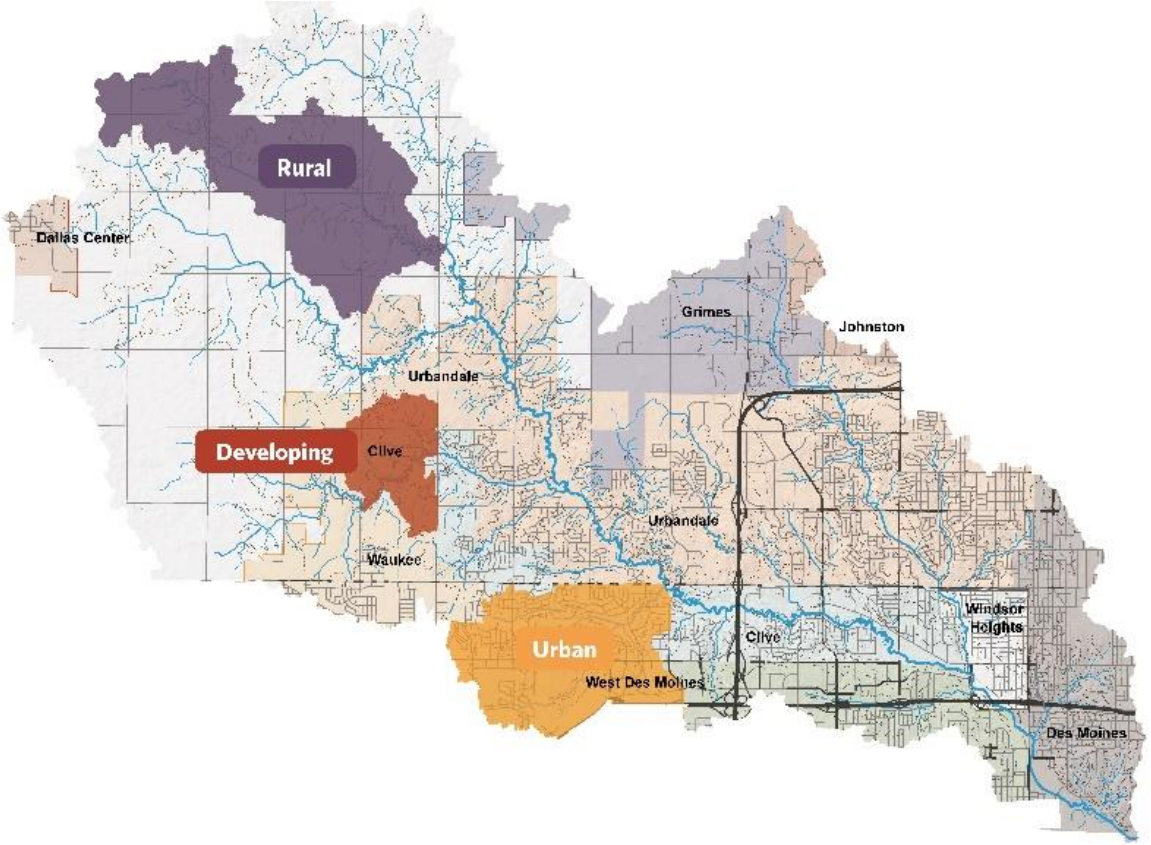
Timeline



- 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



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PLANNING • DESIGN

DES MOINES AREA
MPO
METROPOLITAN PLANNING ORGANIZATION

SNYDER & ASSOCIATES
Engineers and Planners

Polk Soil & Water
CONSERVATION DISTRICT