



WATER

Sioux City's Ravine Park Watershed-Scale Stormwater Improvements with Innovative Funding

Bio

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- Farm Boy

- Carpenter

- Contractor

- Engineer

- Stream Nerd



BIG PICTURE -LOCATION

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Sioux City,
Iowa

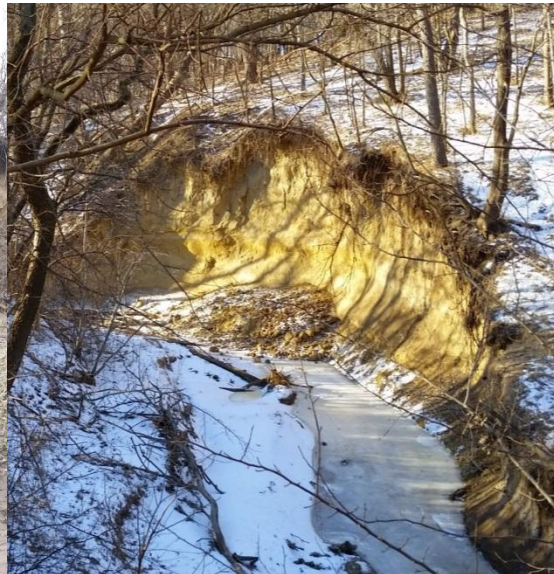


Image courtesy of <http://www.keyword-suggestions.com>

BIG PICTURE -SYMPTOMS

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- Urban stream seems to be eating its banks
- Trees and storm pipes are washing downstream
- Banks are moving toward roads, infrastructure, etc.
- Property owners are losing yards, fences, sheds



Project Motivation

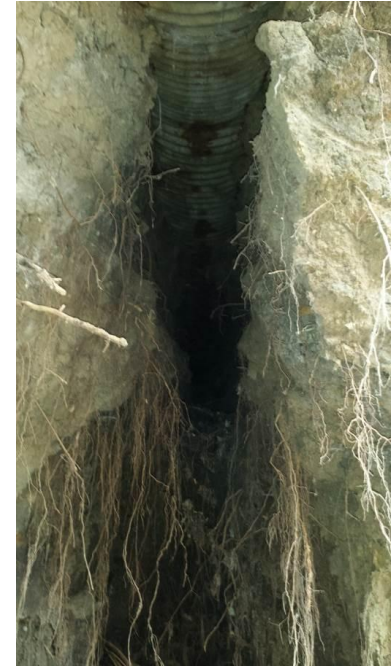
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- Risk to Infrastructure
 - Storm Outfalls
 - Roads
 - Sanitary Mains
- Water Quality Impacts
 - Sediment
 - Embedded Nutrients
 - Other...



BIG PICTURE -LOESS

- Wind-blown glacier dust
- Dry loess = concrete
- Wet loess = pudding



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Ravine Park
Drainage Study

Current Land Use

Legend

- Watershed
- Stream

Missouri River

0 125 250 Feet
1 inch = 1,000 feet

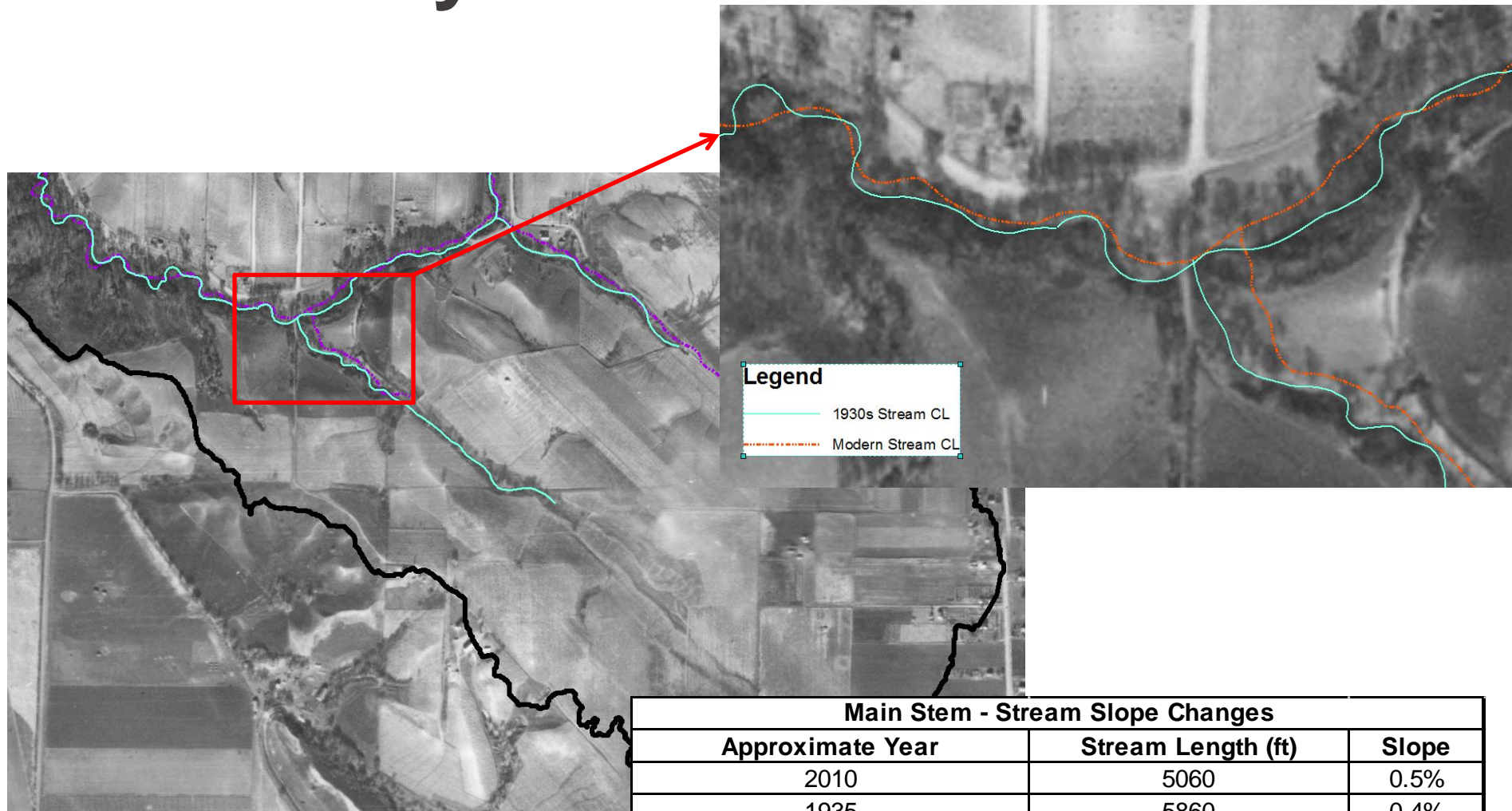
Data Source:
Projected Coordinate System:
NA D83 HARN StatePlane Iowa North Feet
Projection: Lambert Conformal Conic
Map Published:
Author: ALG

Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, USGS, Airphoto, Navteq, USDA, AeroGRID, IGN, and the U.S. Department of Agriculture

HRCreen

Summary of Provenance

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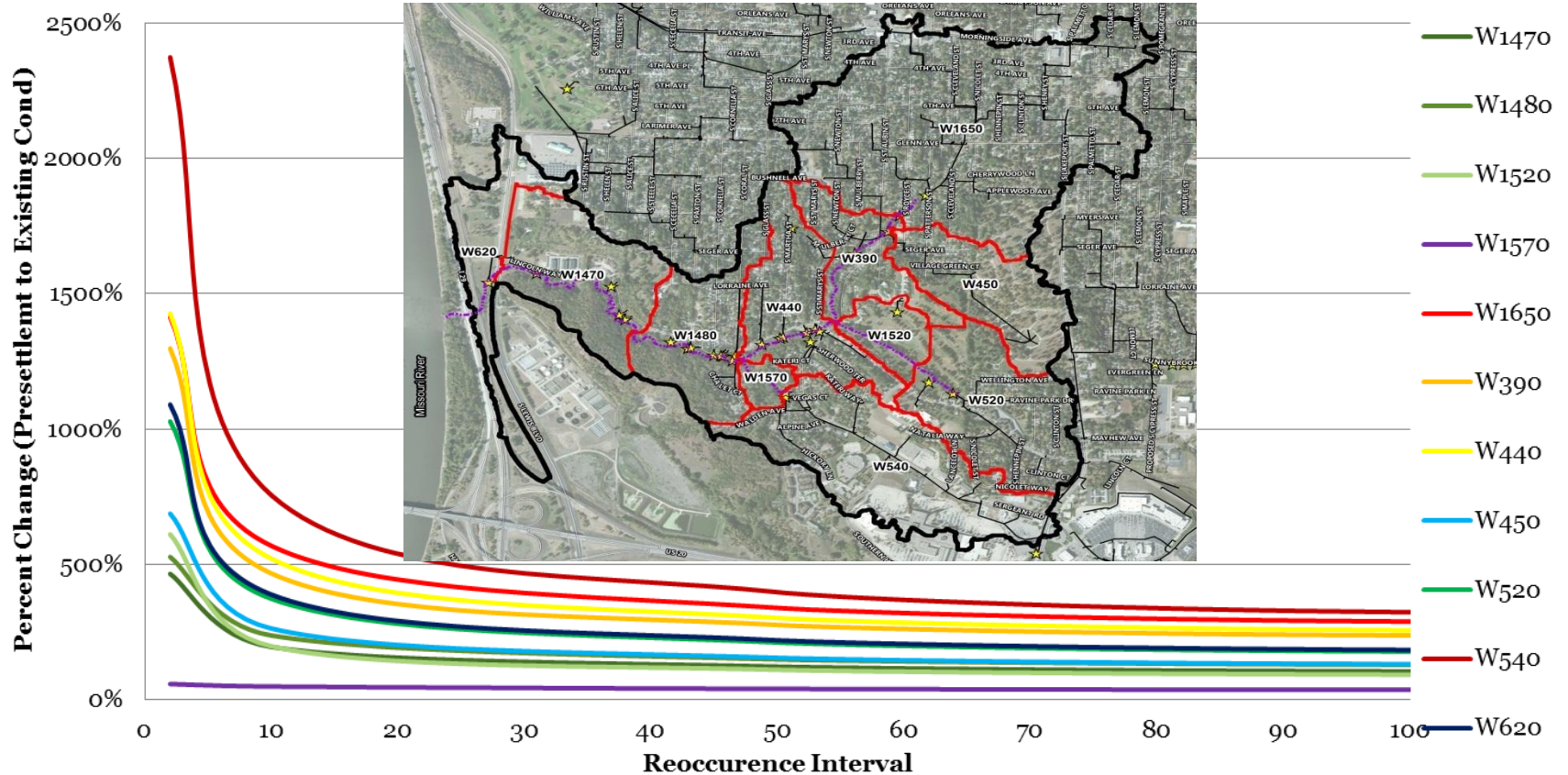
1930's Aerial

Main Stem - Stream Slope Changes		
Approximate Year	Stream Length (ft)	Slope
2010	5060	0.5%
1935	5860	0.4%
Difference	- 800 ft	+ 25%

Summary of Provenance

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Peak Flow - Percent Change



Solutions

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PHASE 1 - Restore Natural Hydrology

- Ecosystem Restoration Began 2014
 - Continuing in 2017

PHASE 2 - Prevent Imminent Damage

- 2016-17 Stream Stabilization

PHASE 3 – Continue Restoring Hydrology

- 2017 Watershed improvements

(Seek Simple Improvements with Multiple Benefits)

Solutions – Phase 1

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Phase I – Prairie and Oak Savanna Restoration

Conservation Corps of Iowa (17 kids with chainsaws)

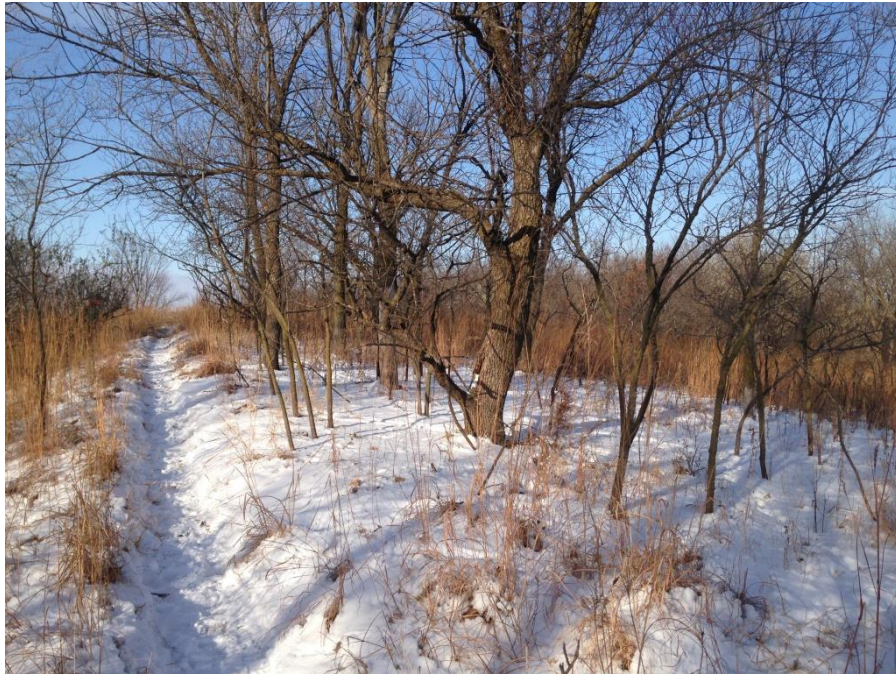


Ravine Park Watershed Improvements | Sioux City, Iowa

Solutions – Phase 1

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Phase I – Prairie and Oak Savanna Restoration



Solutions – Phase 1

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AFTER 20 YEARS OF ANNUAL, PATCHWORK BURNING AT TIMBERHILL:

- ✓ OVER 450 PLANT SPECIES HAVE RETURNED (WITHOUT RE-SEEDING!)
- ✓ ERODED GULLIES ARE HEALING
- ✓ 80 NESTING BIRD SPECIES, INCLUDING MULTIPLE T&E SPECIES
- ✓ NEW SPRINGS HAVE FORMED AT BASE OF HILLS
- ✓ MANY EXTREMELY RARE FUNGI HAVE APPEARED
- ✓ DECLARED THE “MOST BIOLOGICALLY DIVERSE PLACE IN IOWA”

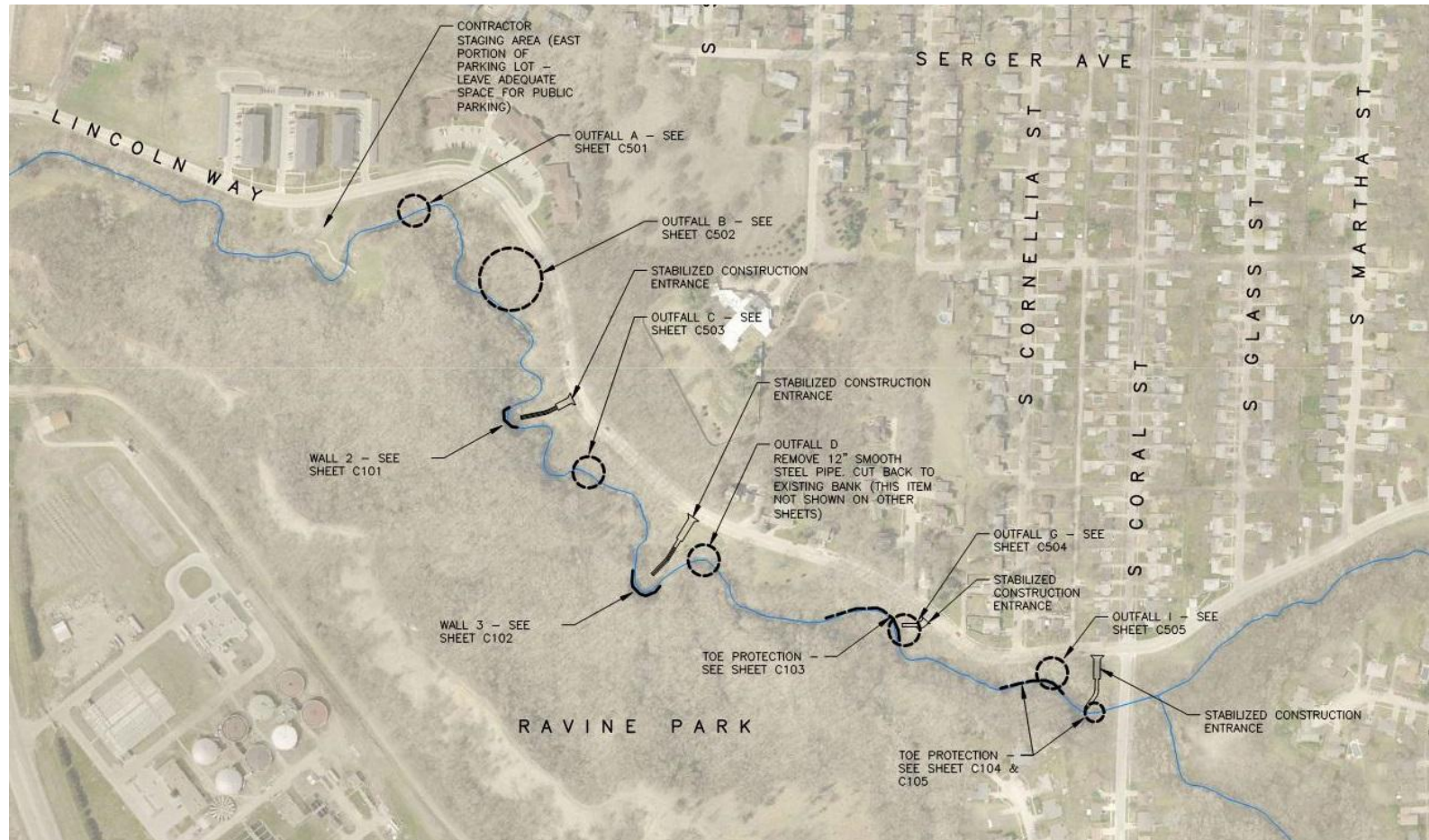
• www.timberhilloaksavanna.com



Solutions – Phase 2

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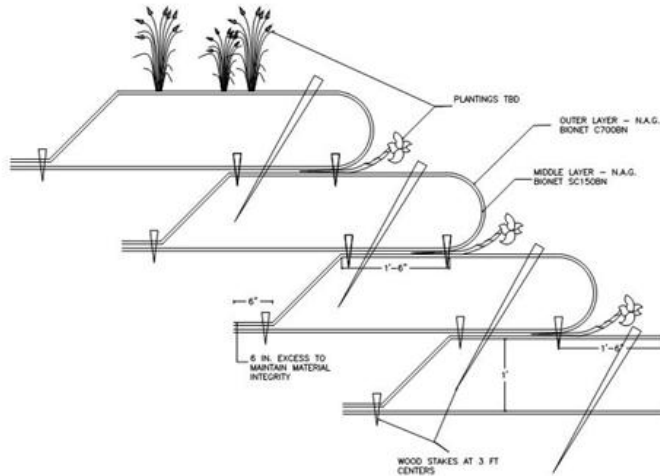
In-Stream Improvements



Solutions – Phase 2

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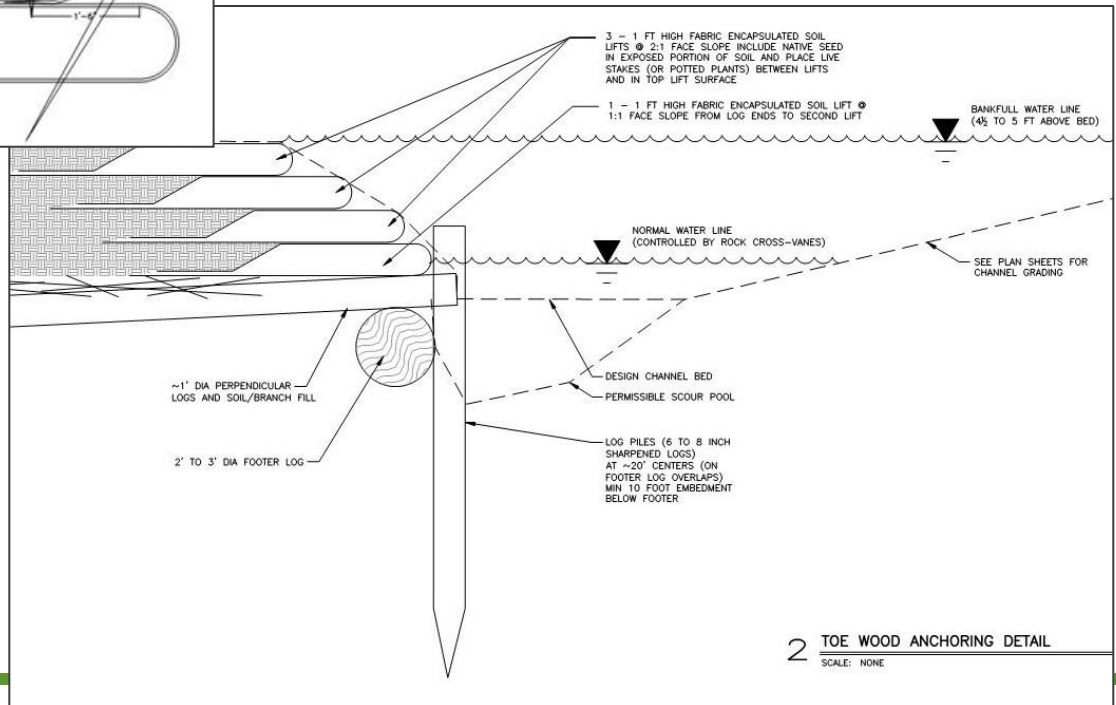
1 FABRIC ENCAPSULATED SOIL LIFT DETAILS
SCALE: 1:10



Protection of 3 Critical Banks with Toe-Wood Sod Mats



PROPOSED
THALWEG
EXISTING
THALWEG



2 TOE WOOD ANCHORING DETAIL
SCALE: NONE

Improvements | Sioux City, Iowa

Perpendicular Woody Fill

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2nd Lift and Tie-in to Existing Bench

17



Dormant Plantings and Native Seeding

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Post Construction

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Solutions – Phase 3

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Upland Commercial Area BMP Retrofits – Underway



Solutions – FUNDING?

How about some free money?

Seriously...

Iowa DNR State Revolving Fund (with a twist)

Solutions – FUNDING?

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- Prior to 2009, wastewater utility revenues could only be used for construction and improvements of the wastewater system



- 2009 Iowa legislation allows wastewater utility revenues to finance a new category of projects

“Water Resource Restoration Sponsored Projects”

- Locally directed
- Watershed-based
- Address water quality problem



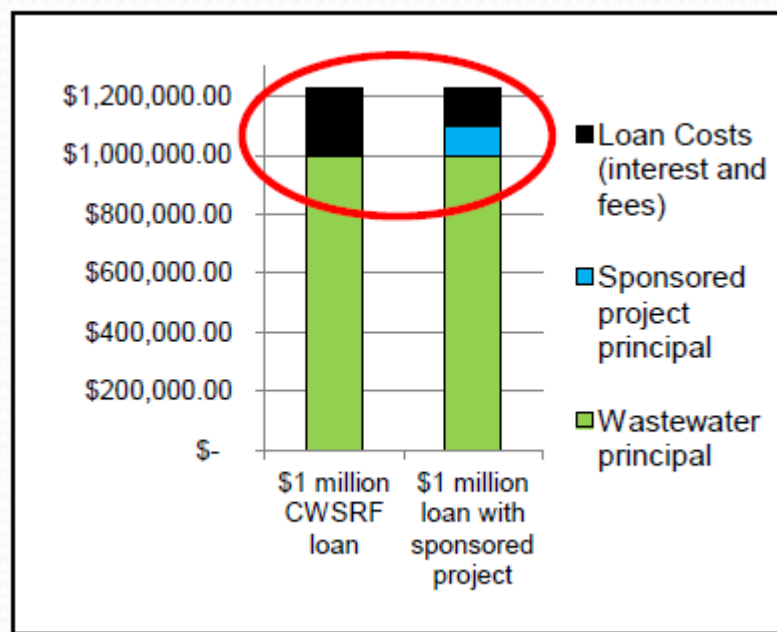
Solutions – FUNDING?

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Iowa DNR - Clean Water State Revolving Fund

Water Resource Restoration Sponsored Projects Program

Typical Loan
Utility borrows principal for wastewater infrastructure and repays principal plus interest and fees



Loan with SP
Utility borrows principal for both wastewater infrastructure and sponsored project, but interest rate is reduced

Utility is able to finance **TWO** water quality projects for the cost of **ONE**

Solutions – FUNDING?

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Iowa DNR - Clean Water State Revolving Fund

Water Resource Restoration Sponsored Projects Program

- Must include “Watershed Based Approach”
 - Stormwater BMPs
 - Soil Quality Restoration
 - Stream Corridor Restoration (Stabilization?)
 - ONLY if watershed initiatives included as well

Questions?

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Additional Slides – Supporting Material

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BIG PICTURE -OBSERVATIONS

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- Watershed is completely built out (minus cemetery and park)
- Development predates “detention era”
- Adjacent woodland park is overgrown and impenetrable
- Loess soils are really amazing! (and a pain in the @\$\$!)



SO... WHAT TO DO?

➤ Armor the channel more?



(maybe re-think
this one)

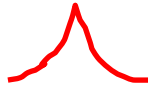


SO...

WHAT TO DO?

SYMPTOM!

STREAM ~~PROBLEM?~~

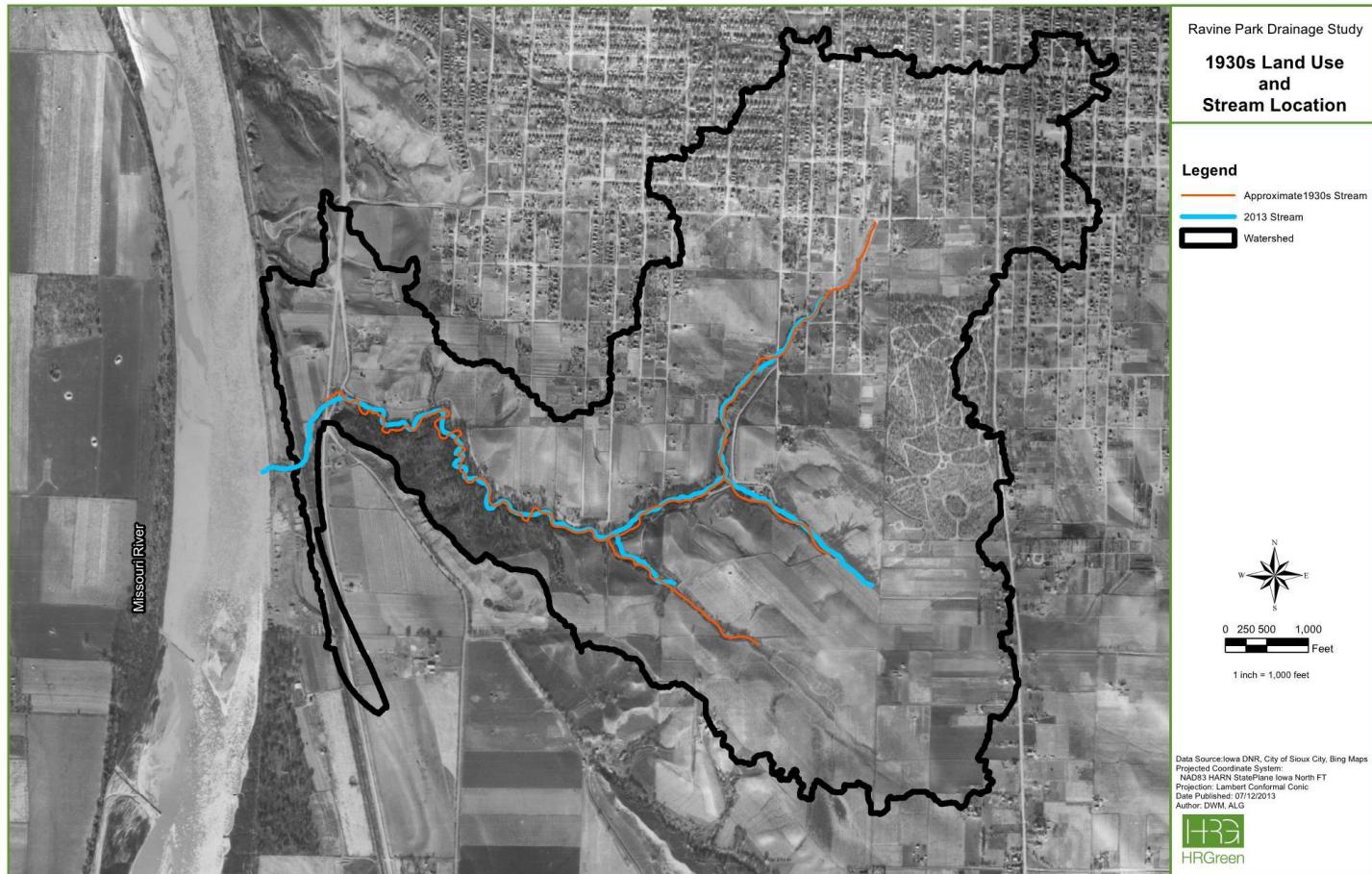


Well, how'd we get here?

Any Changes Over Time?

30

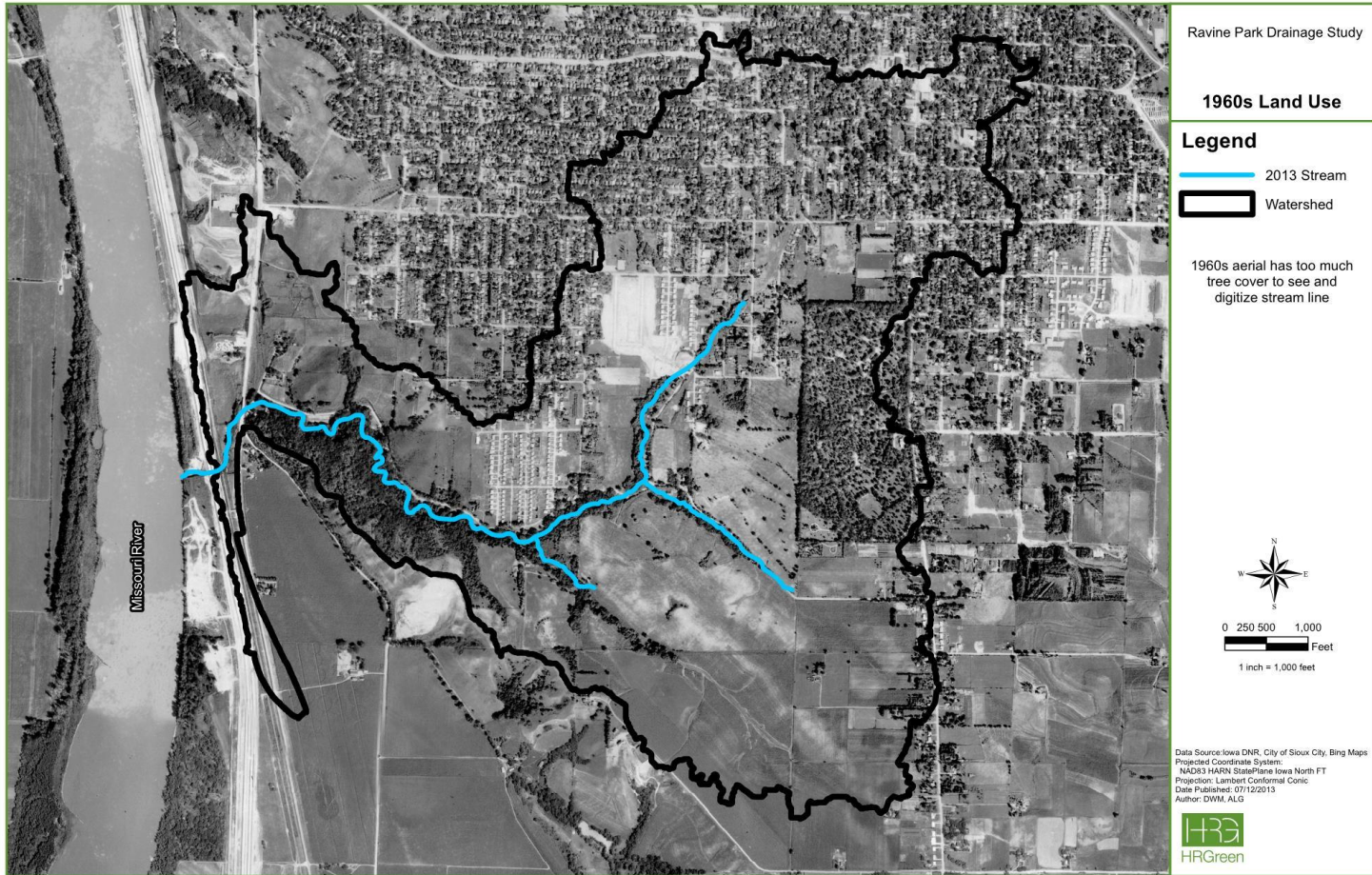
1930's



Any Changes Over Time?

31

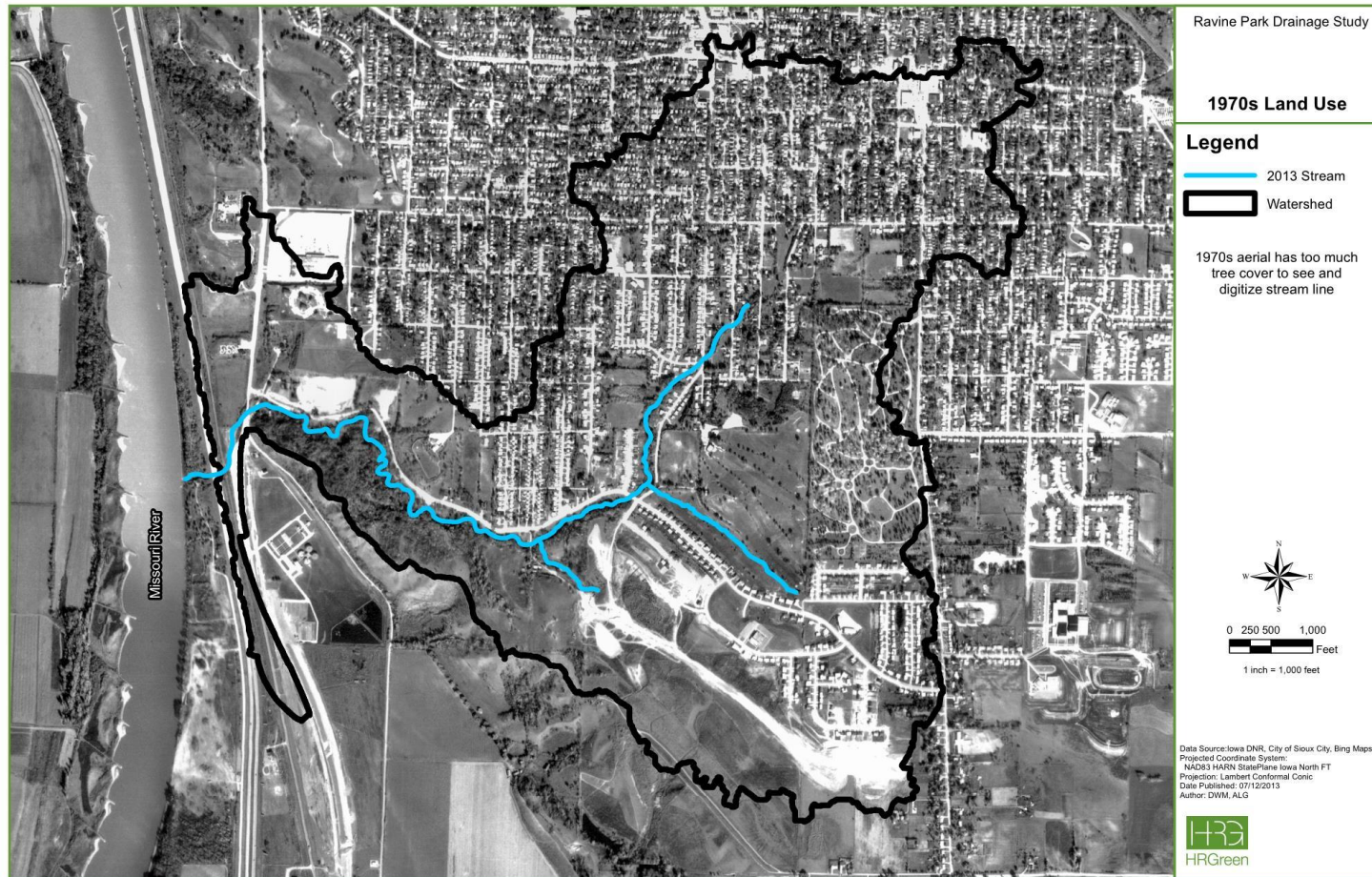
1960's



Any Changes Over Time?

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1970's



Summary of Provenance

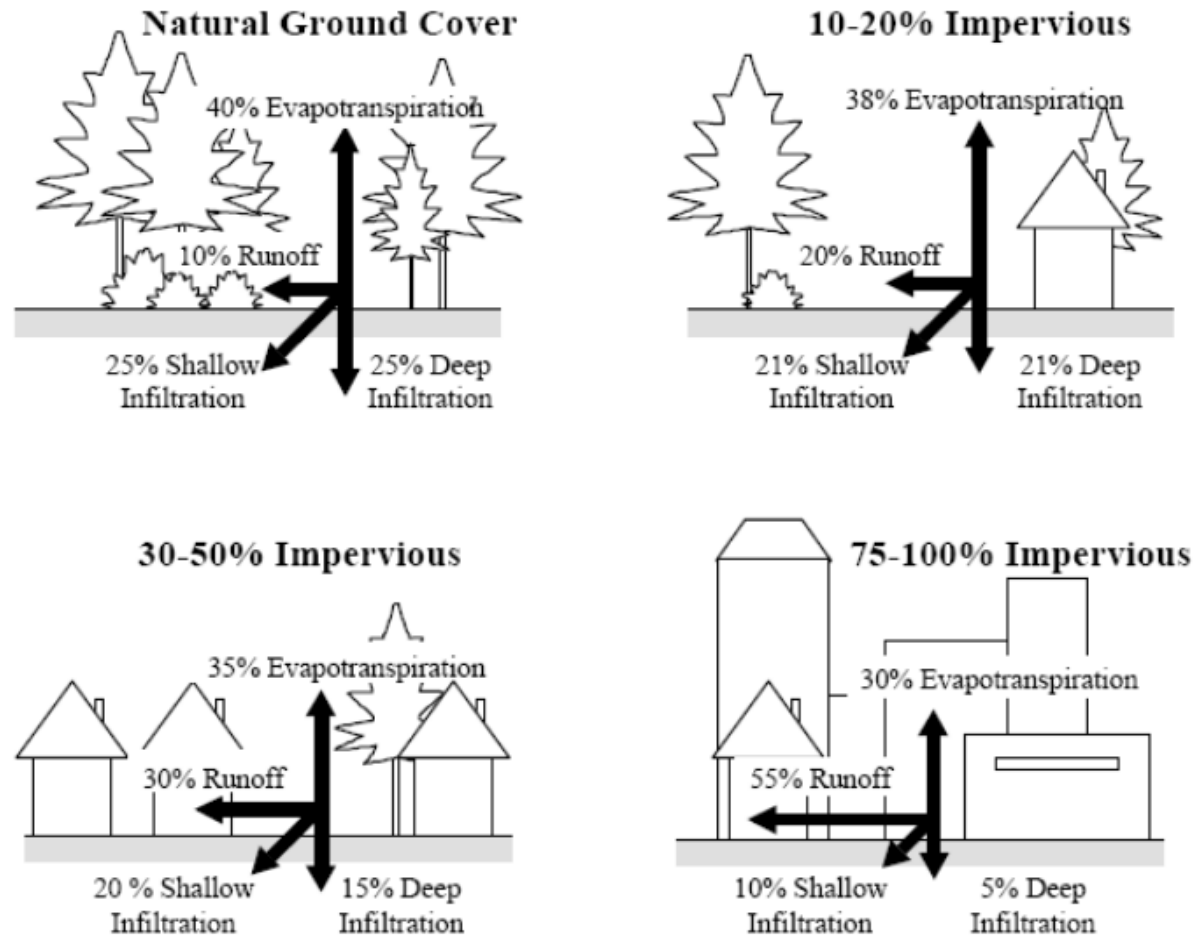
- Hydrologic Modification
 - Development of Watershed
 - Increased Imperviousness
 - Storm Pipe Outfalls (hydrology concentrators)
 - Fire Prevention
 - Invasive Species
 - Less species

“Iowa used to be a sponge, now it’s a countertop”

- Chad Graeve, Pottawattamie County Conservation

Summary of Provenance

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Source: Adapted from Arnold and Gibbons, 1996

So....

Now what?

Historical Clues...

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- Arrested head cuts

Historical Clues...

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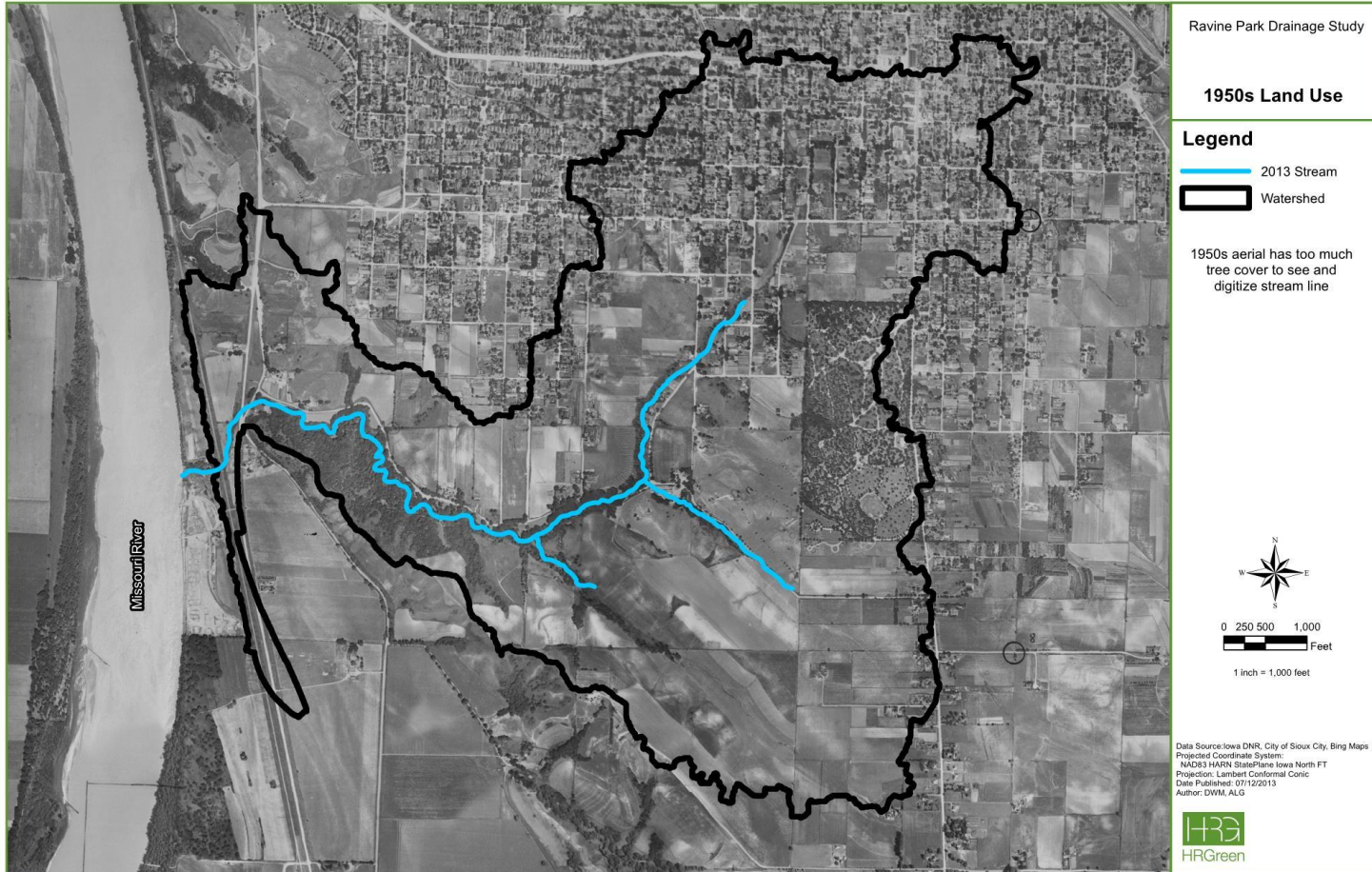


- Critter depositional stratigraphy analysis

Any Changes Over Time?

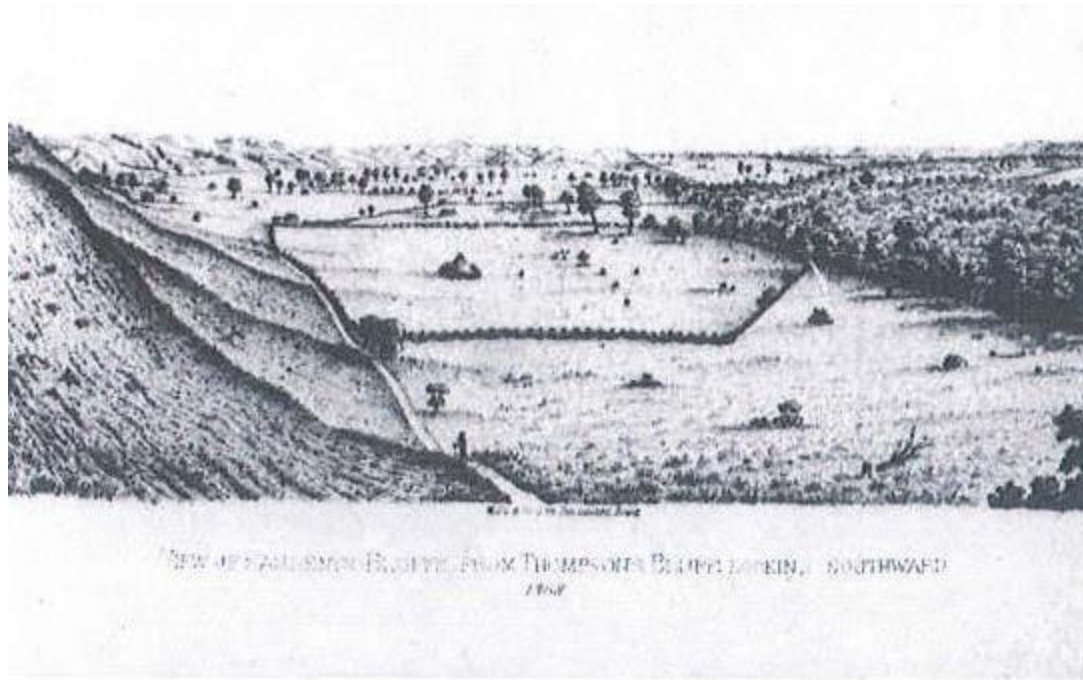
38

1950's



Any Changes Over Time?

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- 1868 – Orestes StJohn – “A thrifty growth of young forest trees is now springing up everywhere in [the loess hills], and rapidly encroaching upon it’s hillsides and prairies whenever they are by any means protected from the annual prairie fires”

Solutions – Phase 1

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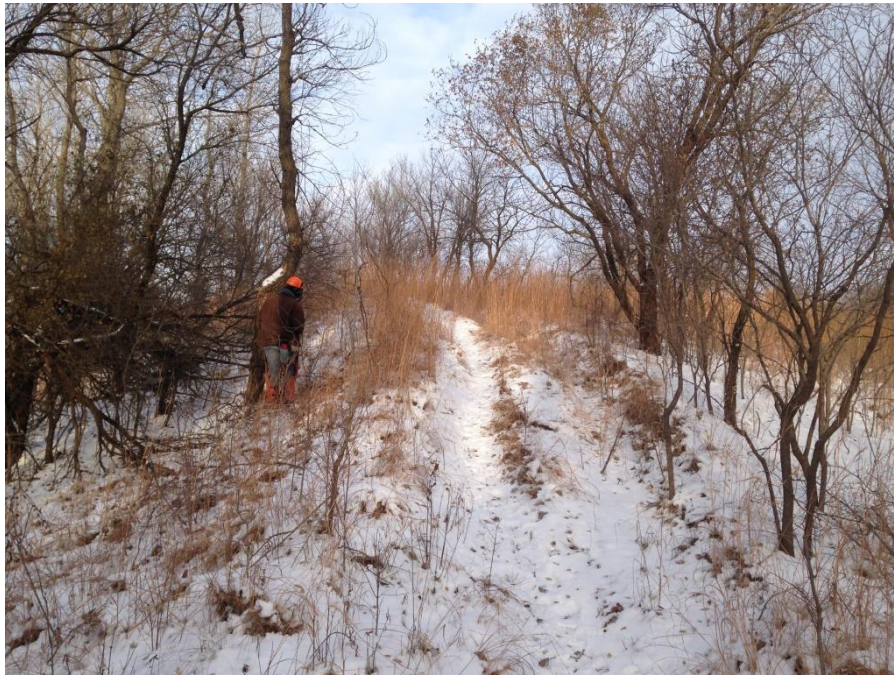
Phase I – Prairie and Oak Savanna Restoration



Solutions – Phase 1

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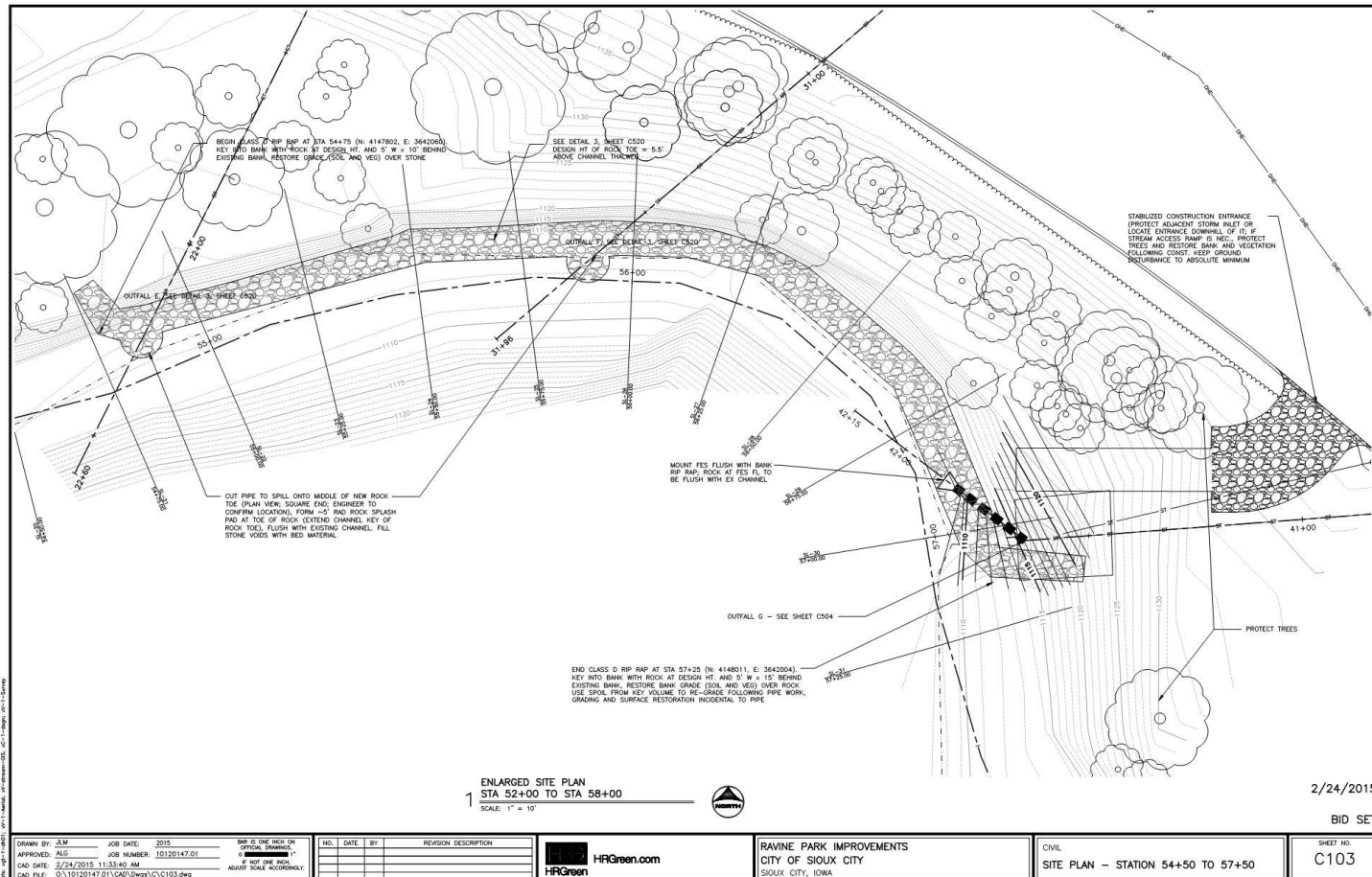
Phase I – Prairie and Oak Savanna Restoration



Solutions – Phase 2

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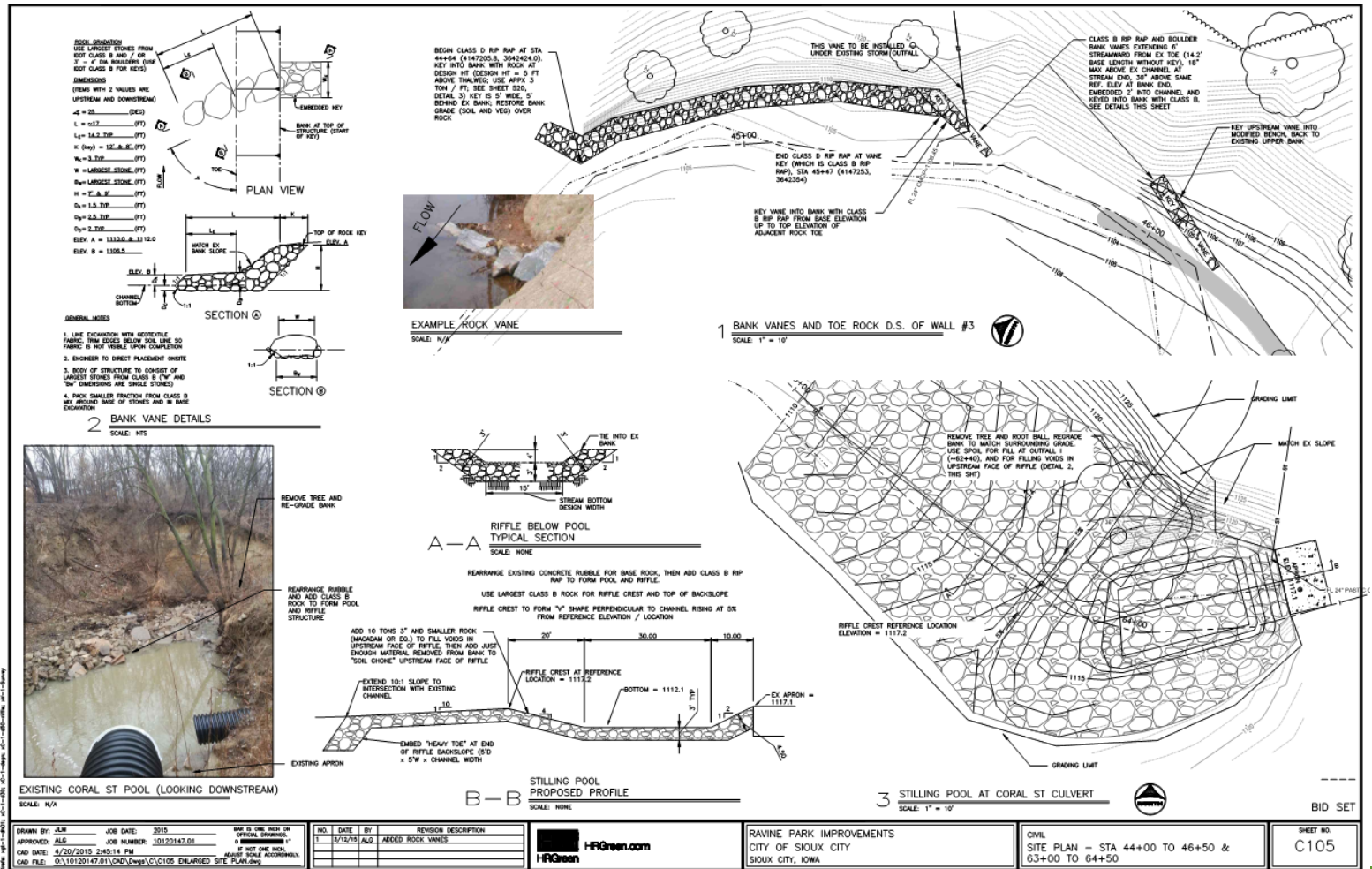
Rock toes and outfall protection



Ravine Park Waterford Improvements, Sioux City, Iowa

Solutions – Phase 2

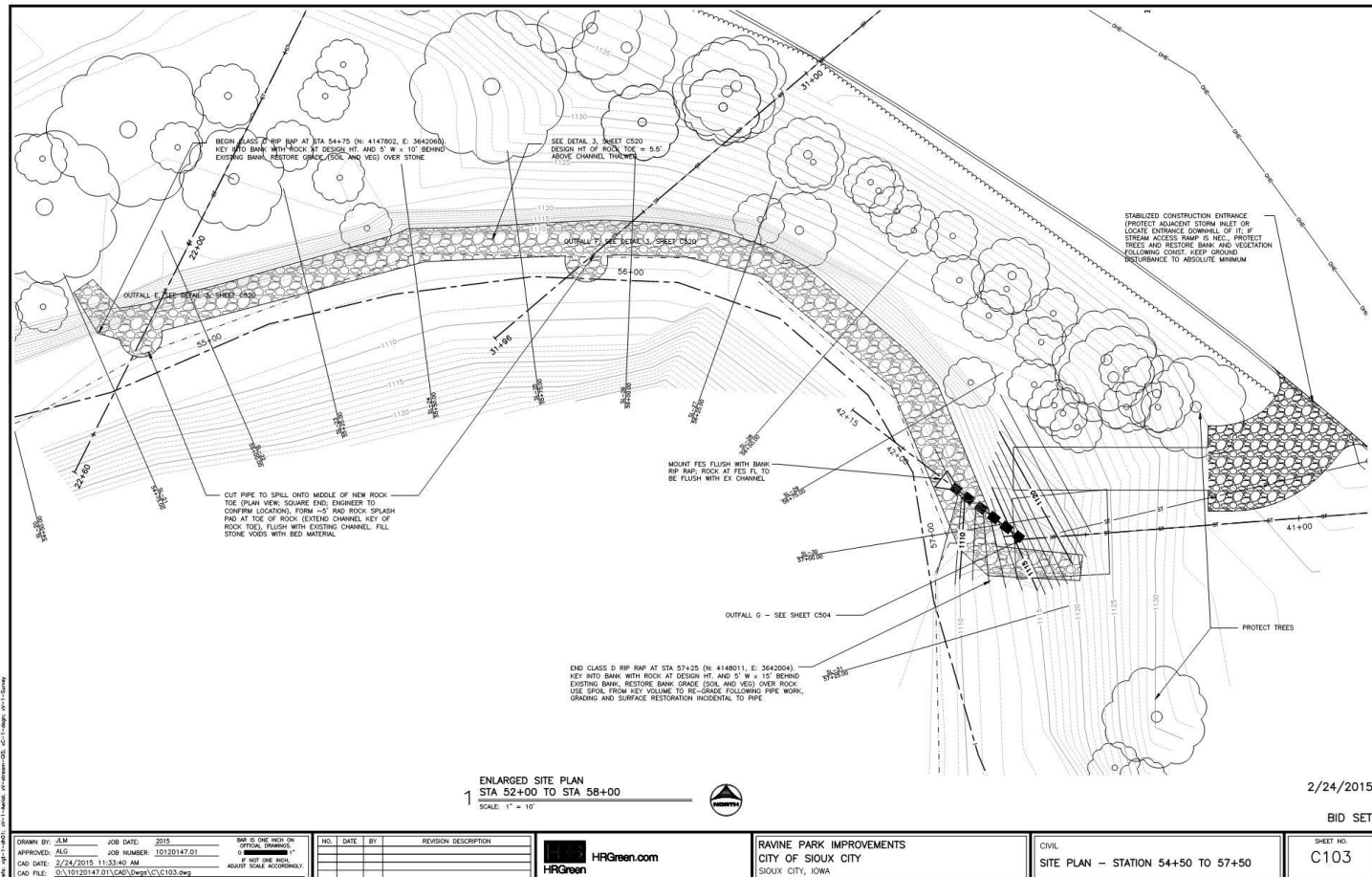
More Rocks – Riffles, weirs, and vanes, oh my!



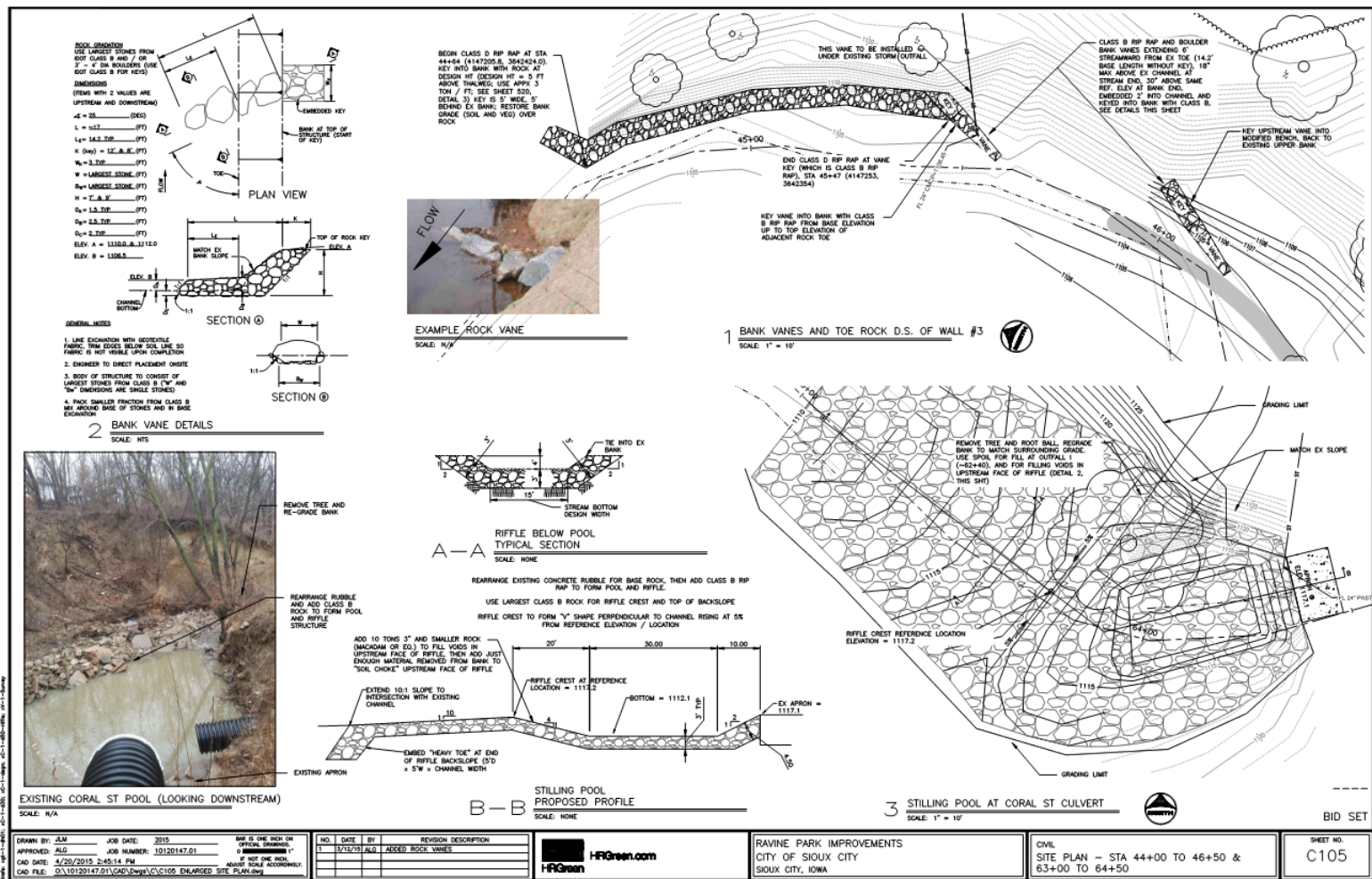
Solutions – Phase 2

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Rock toes and outfall protection



More Rocks – Riffles, weirs, and vanes, oh my!



Solutions – Phase 3

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Upland Commercial Area BMP Retrofits

