****AMENDED****
**AGENDA**
**SPECIAL MEETING OF THE AMES CITY COUNCIL**
**COUNCIL CHAMBERS - CITY HALL**
**APRIL 16, 2013**

**CALL TO ORDER:** 7:00 p.m.

**CONSENT AGENDA:** All items listed under the consent agenda will be enacted by one motion. There will be no separate discussion of these items unless a request is made prior to the time the Council members vote on the motion.

1. Resolution approving Change Order No. 2 ~~and 3~~ to NAES Corporation of Houston, Texas, for Steam Turbine No. 8 Overhaul
2. Resolution waiving City's purchasing policy and awarding contract for Power Plant Motor Repair to Electrical Engineering and Equipment Company of Des Moines, Iowa
3. Resolution authorizing an amount not to exceed $1,500 for additional litigation expense in Iowa League of Cities v. EPA case

****Additional Item:** Resolution approving closure of parking spaces on Chamberlain Street between Welch Avenue and Fire Station #2 driveway and Chamberlain Lot Y on April 19 - 21 to facilitate staging of law enforcement vehicles and related equipment

**WORKSHOP:**

4. Council Workshop on Flood Mitigation Study:*
   a. Final presentation by consulting engineers
   b. City Council questions/answers

**COUNCIL COMMENTS:**

**CLOSED SESSION:**

5. Motion to hold Closed Session, as provided by Section 21.5(1), *Code of Iowa*, to discuss appointment of City Attorney

**ADJOURNMENT:**

***The Consultant will present the Council with a summary of all public input that has previously been received. This workshop is for the consultant's presentation to the City Council. Council will seek additional public input before final decisions are made.**

**ITEM # 1**
**DATE: 04-16-13**

# COUNCIL ACTION FORM

**SUBJECT: POWER PLANT STEAM TURBINE NO. 8 OVERHAUL – CHANGE ORDER #2**

## BACKGROUND:

This project is required to replace worn parts discovered after the opening and inspection of the Power Plant's Unit No. 8 turbine and generator for repairs that may be needed to avoid more serious damage. Repairs and replacement of worn parts are completed as the inspection progresses and work is defined. **It is important to understand that large change orders are a normal and expected part of a major turbine-generator overhaul, due to the fact that many repair needs are unknown until the unit is opened and inspected.**

On January 22, 2013, City Council awarded a contract to NAES Corporation, Houston, TX, for Steam Turbine No. 8 Overhaul in the amount of $807,800. This original amount included the following elements:

- $443,800 for the lump sum base bid contract portion.
- $91,500 for the time and material based "not to exceed" contract portion.
- $272,500 for the estimated time and material based contract portion.

On April 9, 2013, City Council approved Change Order #1 in an amount of $171,482 for additional work on the steam turbine section.

Council authorization for a second change order containing the following five elements is now needed.

## Item 1

**Description:** When the steam path diaphragms were removed for shipment to the Century Turbine shop for cleaning, inspection and repair, the diaphragm to shell fit which was hidden from view was found to be severely eroded. The shell metal was cut by leaking steam bypassing the steam path. Failure to repair now will result in accelerated erosion and ultimate loosening of the diaphragm and turbine failure and shutdown.

**Cost:** The not-to-exceed cost for Item 1 is $16,500.

**Item 2**

**Description:** The hydrogen seal housing and seals were discovered to be damaged upon disassembly. No cause was determined, but repair is necessary before operation resumes to prevent hydrogen from escaping and potentially creating an explosive environment.

**Cost:** The not-to-exceed cost to repair is $34,841.95

**Item 3**

**Description:** General Electric recommends a new type of sealing system for the generator end shields. Modifications are required for the new system. Approval of this work will potentially reduce hydrogen leakage and assist with the acceptance of the pre-start air leakage test.

**Cost:** The not-to-exceed cost to modify and seal the shields is $6,665.

**Item 4**

**Description:** Inspection of control valve number 4 identified a seat crack. This crack must be replaced, since if it breaks the metal will flow through the turbine and wreck steam path components as it goes. The City will procure the part, and under this change order NAES will provide the labor to remove the damaged seat, install the new control valve seat and lap it.

**Cost:** The not-to-exceed cost is $11,550.

**Item 5**

**Description:** Upon disassembly of the valve rack shaft, damage was found that needs to be repaired to allow smooth valve operation. If this is not repaired, operation can be jerky which leads to unstable turbine operation. It is recommended that this item be authorized so that NAES can complete the necessary work before the rotor returns to Ames from the repair shop for reinstallation.

**Cost:** The not-to-exceed cost to return to spec is $5,720.

**The total cost of all five items in Change Order No. 2 is $75,276.95.**

**PROJECT COST HISTORY**

As was noted above, one change order has already been approved for this contract. Change Order No. 1, for $171,482, increased funds to cover costs associated with turbine repairs that were more extensive then what was included in the base bid.

**This change order will increase this portion of the Steam Turbine No. 8 Overhaul project cost by an additional $75,276.95. As a result, this would bring costs for this portion of the project to $1,054,558.95. Overall, the <u>total</u> project dollar amount committed to date (inclusive of Change Order No. 2) is $1,837,515.85.**

**The engineer's estimate to perform the overhaul work with the original work scope and a reasonable amount of repair was $1,830,000.** The approved FY 2012/13 Budget and Capital Improvements Plan includes $3,500,000 for the turbine generator overhaul. That amount includes parts, professional technical assistance, and contractor services.

To date, the project budget has the following items encumbered:

| | | |
|---|---|---|
| 1. | $526,086.90* | Actual cost for Unit #8 Steam Turbine Parts (This total did not include freight) |
| 2. | $807,800.00 | Actual cost of Base Bid, plus cost-not-to-exceed Options for Steam Turbine No. 8 Overhaul |
| 3. | $171,482.00 | Contract Change Order No. 1 to Steam Turbine No. 8 Overhaul (Approved by City Council on April 9, 2013) |
| **4.** | **$ 75,276.95** | **Contract Change Order No. 2 to Steam Turbine No. 8 Overhaul (this item)** |
| 5. | $256,870.00 | Cost-not-to-exceed time and materials for GE representative to provide technical direction for this overhaul |
| | **$1,837,515.85** | **Total committed to date** |

**<u>ALTERNATIVES</u>:**

1. Approve contract Change Order No. 2, including Items 1 through 5 above, to NAES Corporation of Houston, TX, in the amount of $75,276.95 for the Steam Turbine No. 8 Overhaul.

2. Reject contract Change Order No. 2.

**<u>MANAGER'S RECOMMENDED ACTION</u>:**

The Unit No. 8 Turbine-Generator is currently down for a major overhaul. These overhauls are typically performed in the industry about every five years to restore unit efficiency and to maintain good unit life and reliability. We are now into our 8$^{th}$ year since the last overhaul, which has contributed to the number and cost of repairs identified after the turbine and generator are disassembled. This change order, along with others that will be identified in coming weeks, is necessary to restore the steam turbine back to good working order and allow the unit to run until the next major

overhaul in 5+ years.

Therefore, it is the recommendation of the City Manager that the City Council adopt Alternative No. 1 as stated above.

**It is important to note that another major change order may be needed in short order.** Inspection of the turbine's stator has determined that wedges used to hold the coils "firm" have been working loose. The wedges can be replaced during this outage, but that could cause a delay in the project completion date by 2-3 weeks. An alternative may be to reassemble the generator and plan the stator repair for this fall or next spring. The risk of problems developing in the interim is small, but additional cost will be incurred for re-opening the turbine, pulling the rotor and reassembly. **If staff ultimately determines that this work should be performed now, a special City Council meeting will probably be requested in order to keep the outage duration to a minimum.**

**ITEM # 2**
**DATE: 04-16-13**

**COUNCIL ACTION FORM**

**SUBJECT: WAIVER OF PURCHASING POLICY FOR POWER PLANT MOTOR REPAIRS**

**BACKGROUND:**

This project is for the repair of five motors during the Unit #8 Overhaul. These motors are located in the basement and sub-basement of the Power Plant and are critical to the operation of the Unit #8 Boiler. The repair of these motors is not directly related to the Unit #8 overhaul project. However, the motor repairs were scheduled to be done during the overhaul project in order to minimize downtime for Unit #8.

These motors were removed and sent to Electrical Engineering & Equipment Company (3E), of Des Moines, Iowa for maintenance. This company was chosen for their close proximity to the plant, ability for a quick turn-around, reputation, cost, past experience, and motor manufacturer's certification. The maintenance work was estimated to cost $15,000, and consisted of opening, inspecting and cleaning the motors. If anything was found in the inspection to warrant a repair, the facility would then send the City an estimate for consideration.

After inspection, 3E found that two of the motors need significant repair work. Their estimate (inclusive of all costs for maintenance on all five motors and recommended repairs on two of the motors) is as follows:

| | |
|---|---|
| 1. 800 hp maintenance: | $ 3,942.43 |
| 2. 200 hp maintenance: | $ 5,801.04 |
| 3. 100 hp maintenance: | $ 1,792.59 |
| 4. 300 hp maintenance and repair: | $ 15,734.00 |
| 5. 800 hp maintenance and repair: | $ 32,000.00 |
| **Total:** | **$ 59,270.06** |

Staff did not anticipate encountering such expensive repairs when the motors were sent out to 3E for maintenance. Since the repair work was not competitively bid, staff subsequently contacted two comparable large motor repair facilities in order to check 3E's repair quote for Item #5 for reasonableness. These other two firms also have the

capabilities and manufacturer certifications to repair these motors. Those quotes for Item 5, based on an expedited repair schedule, were as follows:

| | |
|---|---|
| JANDA Motor Service, Davenport, IA | $ 34,000.00 |
| Hupp Electric Motors, Cedar Rapids, IA | $ 32,713.00 |

Given the time frame available to complete these repairs, it is apparent that the original 3E quote for Item 5 is competitive.

Section 6.04 D of the City purchasing policies requires that competitive written bids or proposals be solicited for the purchase of materials, equipment, and services having a total cost of $50,000 or more.

Going out for bids on these motor repairs is not a viable option, since the timing on these repairs is critical to coincide with completion of the Unit #8 Overhaul. Staff is thus requesting that Council waive Section 6.04 D of the City's purchasing policies, based on the following factors:

1) The motors must be repaired, returned to the Power Plant, and installed in order to keep the Unit #8 Overhaul on schedule.

2) Staff would need to obtain estimates on each of the repairs for Items 1-4 from other repair facilities. The other two companies' cost estimates are based on the repair scope descriptions provided by 3E. Therefore, there is a risk that the estimated repair costs from another repair facility could change once they receive the motors and open up and inspect them for needed repairs.

3) The motors are currently disassembled at Electrical Engineering & Equipment Company, so there would be added costs and a risk of delays associated with reassembling and shipping them to another firm.

4) Electrical Engineering and Equipment Company is the closest certified large motor maintenance/repair shop to the Ames plant, which reduces travel time and exposure.

5) Some of the parts needed for the repair of these motors are considered long lead time parts. That means they must be ordered immediately in order get the motors repaired, returned, and installed in the Power Plant by the required date in order to keep the overhaul on schedule.

The Power Plant Operations & Maintenance budget for Unit #8 Auxiliary Electrical Equipment currently contains $63,000 to cover the cost of this work.

**ALTERNATIVES:**

1. Waive Purchasing Policy bidding requirements and award this motor maintenance and repair work to Electrical Engineering & Equipment Company, Des Moines, IA in the amount of $59,270.06.

2. Do not waive Purchasing Policy bidding requirements and direct staff to competitively bid the maintenance and repair work. This option could increase the risk of delaying the outage.

**MANAGER'S RECOMMENDED ACTION:**

These motors are critical for the operation of the Unit 8 Boiler. By having Electrical Engineering & Equipment Company continue to work on these motors, the motors will be repaired at a competitive cost and in the shortest time possible in order to have them returned before the end of the Unit #8 Overhaul.

Therefore, it is the recommendation of the City Manager that the City Council adopt Alternative No. 1, thereby waiving the Purchasing Policy bidding requirements and awarding this work to Electrical Engineering & Equipment Company of Des Moines, IA in the amount of $59,270.06.

# Memo

**Legal Department**

TO: Mayor Campbell and Members of the Ames City Council

FROM: Judy K. Parks, Acting City Attorney

RE: Iowa League of Cities v. Environmental Protection Agency litigation funding

DATE: April 11, 2013

You may recall that in the Fall of 2010, the City of Ames joined other Iowa cities and the Iowa League of Cities in this litigation which challenged the U.S. EPA's informal revision of the interpretation of several Clean Water Act provisions. You may also recall that in late March of this year, the Court ruled for the Iowa League in a very favorable opinion that vacated the EPA's illegally promulgated rules.

At the beginning of this project, a joint litigation agreement amongst the cities and League was executed that provided for the Hall and Associates law firm of Washington, D. C., to represent the interests of all members of the joint litigation group with cost sharing on a pro rata basis. The cost sharing arrangement was approved by your resolution on September 14, 2010 with the City's contribution in an amount not to exceed $25,000. Those funds have been expended.

Now that a ruling has come down, additional work will need to be done by retained counsel to ensure that the decision is properly implemented. The firm estimates that $1500.00 per entity would be needed for those activities, and WPC Director John Dunn has advised me that this amount could be paid for from uncommitted funds that department has available for miscellaneous outside professional services.

Since the implementation of the ruling is necessary to attain the benefits of the court's ruling, I am recommending your approval of this additional funding.

**ITEM # Additional Item**
**DATE: 04-16-13**

# COUNCIL ACTION FORM

**SUBJECT: CLOSURE OF PARKING SPACES ON CHAMBERLAIN STREET AND LOT Y DURING VEISHEA**

## BACKGROUND:

In conjunction with this year's VEISHEA celebration, the Police Department has requested the closure of parking spaces on both sides of Chamberlain Street from Welch Avenue east to the Fire Station #2 driveway as well as Chamberlain Lot Y. The closure of these spaces would occur from 4:00 pm on Friday evening, April 19, until 6:00 am on Saturday morning April 20. Parking would again be prohibited in these spaces from 4:00 pm on Saturday evening until 6:00 am Sunday morning. Closure of these spaces will allow for the parking of law enforcement vehicles and other City equipment as may be necessary. Lost meter revenue is estimated at less than $5.00.

## ALTERNATIVES:

1. The City Council can approve the closure of parking spaces on Chamberlain Street between Welch Avenue and the Fire Department Station #2 driveway and Chamberlain Lot Y as requested on April 19-21 during VEISHEA.

2. The City Council may deny the request.

## MANAGER'S RECOMMENDED ACTION:

This closure is needed in order to facilitate staging of law enforcement vehicles and related equipment during VEISHEA. The street will remain open the entire time.

Therefore, it is the recommendation of the City Manager that the City Council approve Alternative #1 and allow for the closure of parking spaces as requested.

Memo

**4**

To: Mayor and Council

From: John Dunn

Date: April 12, 2013

Subject: Flood Mitigation Study Workshop

HRD Engineers, the firm that conducted the City's community-wide flood mitigation study, has just presented its final update to the public, and will now give that same presentation to the City Council. At the April 16, 2013 Council workshop, HDR will provide Council with a brief overview of the scope of the study, a description of the extensive public involvement efforts, and a summary of the public input and feedback received. The majority of the presentation will focus on the results of the mitigation alternatives that were evaluated.

The presentation portion of the workshop is expected to take about an hour. Following that, staff and the consulting team will welcome questions and discussion with Council. There will not be public input at this workshop, and Council will not be asked to make any final decisions.

Throughout the progress of the study, staff members from Iowa State University, Story County and the Iowa Department of Transportation actively participated and provided key input. Because many of the alternatives would involve these neighboring bodies, invitations have been extended to senior leaders from each of these three organizations to attend the April 16 workshop.

To aid in your preparation for the workshop, a copy of the presentation materials is attached. Materials from the various public meetings, including the most recent meetings on April 10, are available on a website hosted by the consulting team. These can be reached by clicking the Flood Study link in the upper right corner of the City's home page.

Following Tuesday's workshop, HDR will finalize the written report, incorporating any additional feedback or direction from Council. The draft report is anticipated to be ready for staff review by mid-May, with the final report brought to Council in late June for acceptance. Staff will then look for guidance from Council at some point this summer or fall regarding follow up actions. This could include projects Council desires to consider as part of the next Capital Improvements Plan, any changes in floodplain regulations that Council may wish to consider, or any other types of actions to mitigate flooding in the future.

Water and Pollution Control Department
**Administrative Division**

515.239.5150 *main*
515.239.5251 *fax*

300 E 5th Street, Bldg #1
P.O. Box 811
Ames, IA 50010
www.CityofAmes.org/Water

# Council Workshop 3

City of Ames

Flood Mitigation Study

April 16, 2013

# Welcome

The purpose of this update is to:

- Present the detailed screening evaluation of flood mitigation alternatives and strategies for the Ames Community to the City Council
- Present feedback on the strategies to the City Council.

# The Study

## Method

Collect public input, develop and analyze alternatives and strategies, summarize impacts.

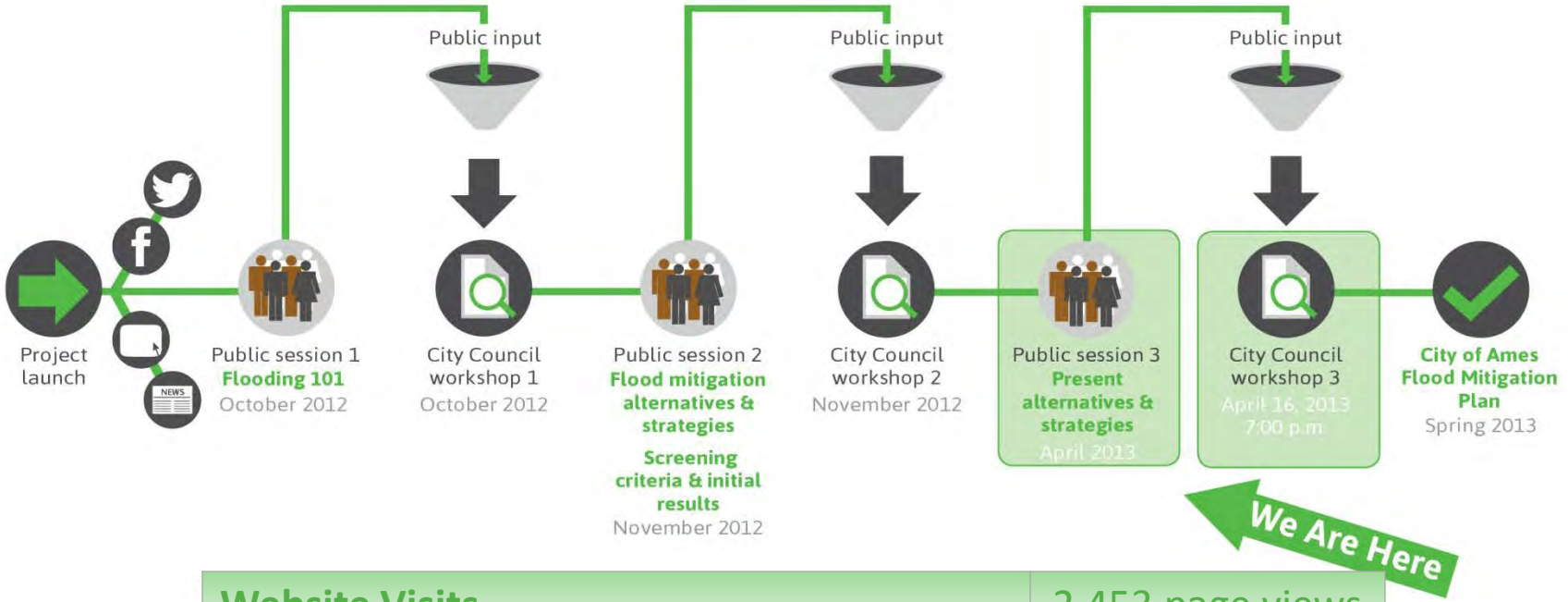
## Focus

Determine impacts – positive and negative – of flood mitigation alternatives and strategies.

## Goal

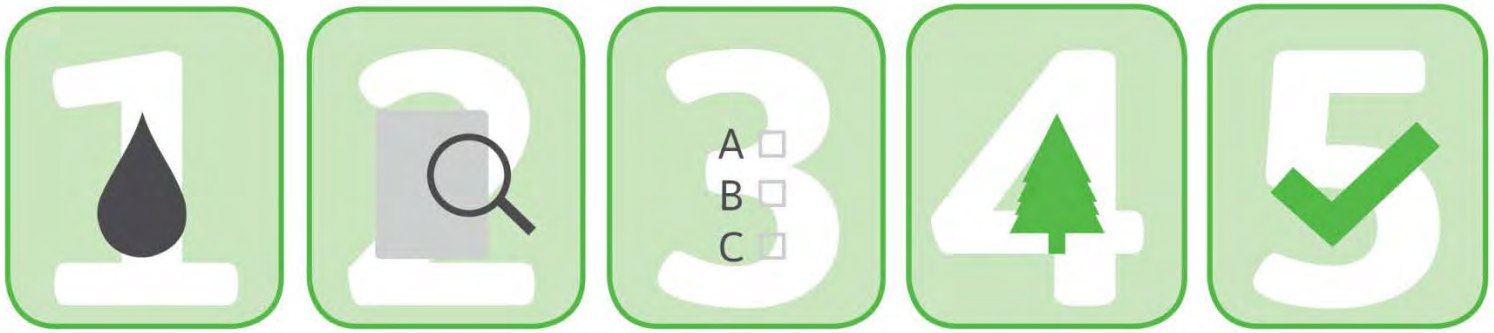
Present the best alternatives and strategies to City Council.

# Community Involvement




| | |
|---|---|
| **Website Visits** | 2,453 page views |
| **Online Meeting Participation** | 645 page views |
| **Public Session 1 Meeting Attendance** | 98 attendees |
| **Public Session 2 Meeting Attendance** | 58 attendees |
| **Public Session 3 Meeting Attendance** | 112 attendees |
| **Comments Received** | 181 comments |

# Evaluation Process




Since we last met in November, we conducted the Detailed Screening Process of Flood Mitigation Alternatives and Strategies. Criteria included:

- Level of Protection Provided
- Project Cost
- Environmental Impacts
- Benefit Cost Analysis

# Flood Hydrology

The study team updated flood magnitudes and frequencies by engineering and statistical calculations and reviewed and updated flood maps.

| USGS Gage | Source | Annual flood-probability discharge (cfs) | | | |
|---|---|---|---|---|---|
| | | 10-percent | 2-percent | 1-percent | 0.2-percent |
| South Skunk River near Ames, IA | Updated FFA | 6,800 | 10,200 | 11,600 | 14,900 |
| | FEMA Effective Flows | 6,280 | 9,000 | 10,100 | 12,600 |
| Squaw Creek at Ames, IA | Updated FFA | 8,260 | 15,800 | 20,000 | 32,600 |
| | FEMA Effective Flows | 7,570 | 13,700 | 17,000 | 26,300 |
| South Skunk River below Squaw Creek near Ames, IA | Updated FFA | 14,500 | 24,100 | 28,900 | 41,800 |
| | FEMA Effective Flows | 12,700 | 19,700 | 23,000 | 31,400 |

# Transposed Rainstorms

- **Upper Iowa River, Iowa, June 7-8, 2008**
  10.5 inches in 30 hours
- **Ames, Iowa, August 8-11, 2010**
  10 inches
- **Lake Delhi, Iowa, Dam Failure Event, July 24, 2010**
  13 inches in 48 hours
- **Ames, Iowa, August 8-11, 2010**
  *with transposed 2nd Night of Rainfall*
  20% more rainfall
- **Dubuque, Iowa (Galena, Illinois), July 27-28, 2011**
  11+ inches of rain in 13 hours, 0.1% annual chance rainfall (1,000 year rainfall)

**Upper Iowa**
(77,000 acre-ft of runoff)

**Ames**
(69,000 acre-ft of runoff)

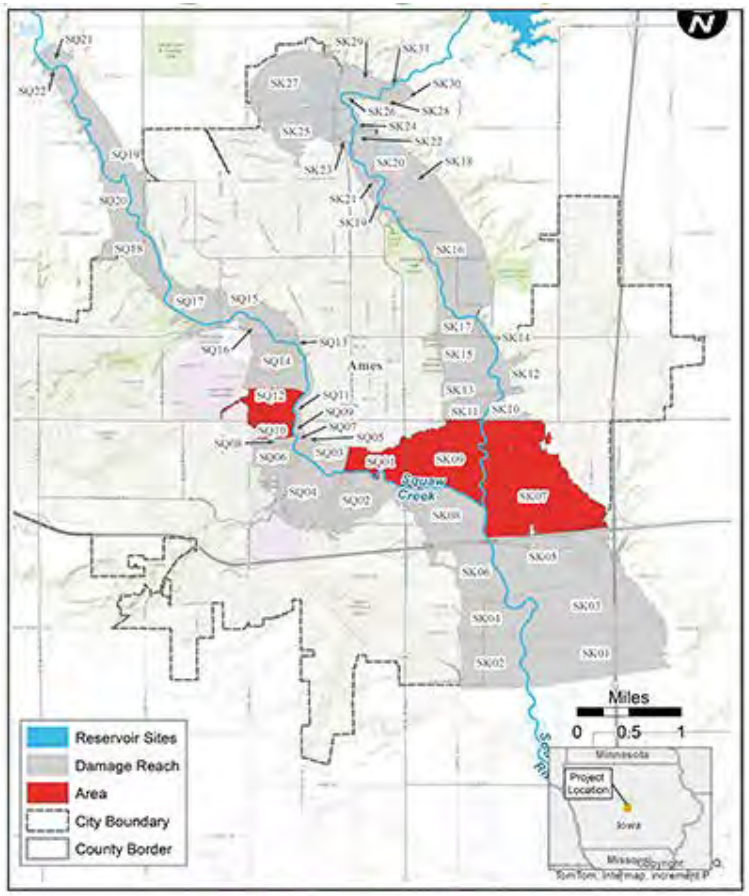
**Lake Delhi Storm**
(120,000 acre-ft of runoff)

**Ames – Transposed**
(187,000 acre-ft of runoff)

**Dubuque**
(103,000 acre-ft of runoff)

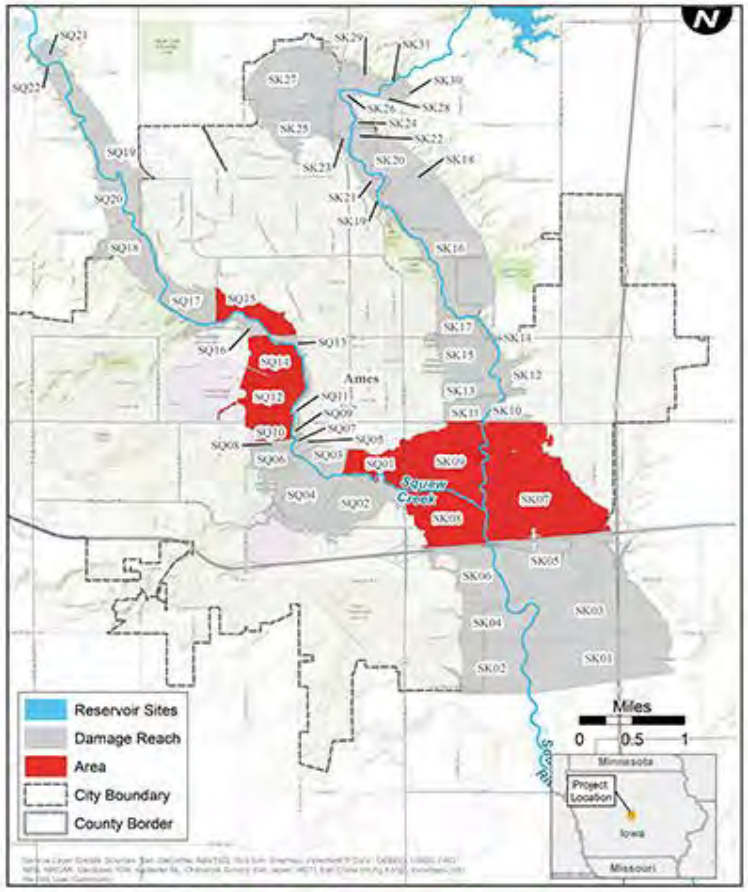
# Flood Damage Areas

## (Red = High $ Damage Area)




100-Year Flood Event

40% of total Structures and 99% of total Property Value




500-Year Flood Event

60% of total Structures and 99% of total Property Value

# Flood Mitigation Alternatives & Strategies

| Storage | Protection | Non-Structural |
| --- | --- | --- |
| • Centralized Flood Storage<br>• Regional Flood Storage<br>• Floodplain Storage<br>• Conservation Measures in Watershed | • Flood Water Diversion<br>• Conveyance Improvements<br>• Levee along Skunk River<br>• Levee along Squaw Creek | • Do Nothing<br>• Property Buyouts<br>• Flood Plain Ordinance Modification |

# Flood Mitigation Alternatives & Strategies


Floodwall


Levee with Roadway

Floodwall

Levee with Roadway

Diversion

Dry Reservoir

Wetlands Restoration

Reservoir

# Screening Criteria

The following criteria were used to evaluate flood mitigation alternatives and strategies.

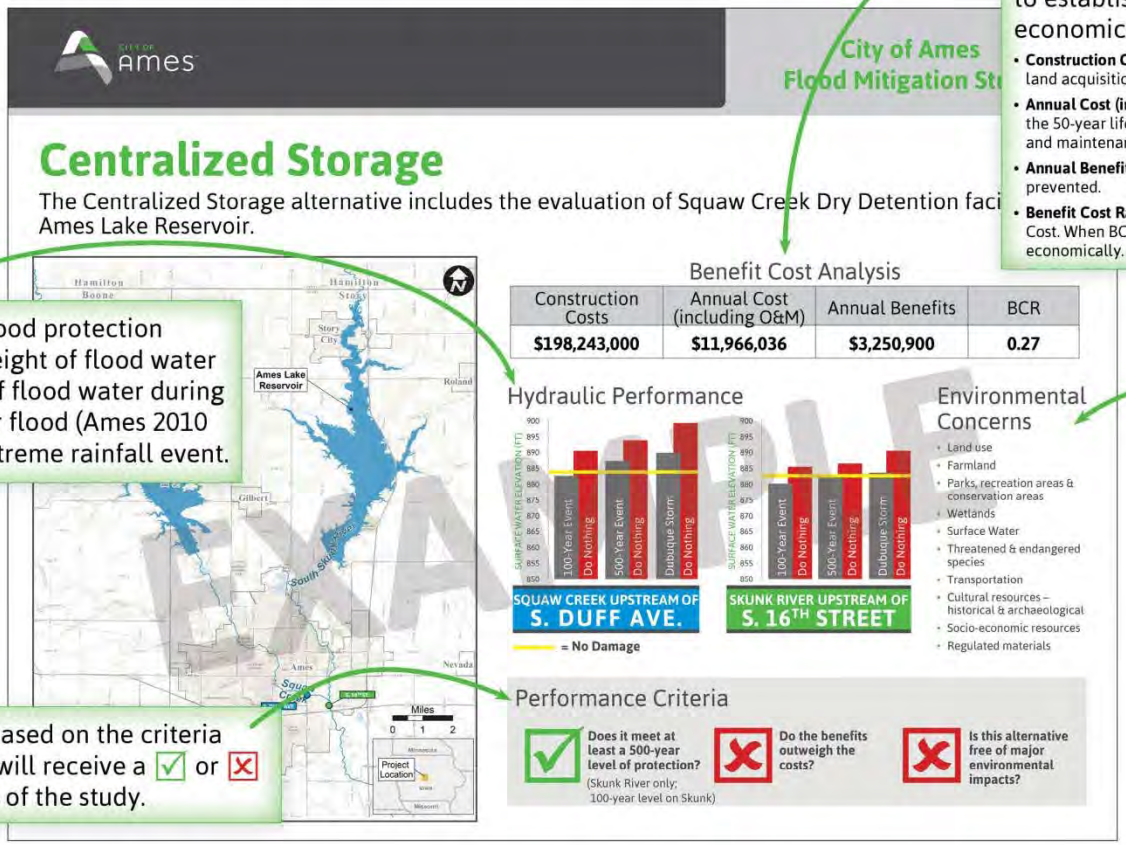
**Benefit Cost Analysis** – Estimates and totals the equivalent dollar value of the benefits and costs to the community to establish whether projects are economically worthwhile.

- **Construction Costs** – Final project cost including construction, land acquisition, and transportation relocations.
- **Annual Cost (including O&M)**– Annual cost of the project over the 50-year life of the project including capital costs, operation and maintenance costs.
- **Annual Benefits** – Annual dollar value of property damage prevented.
- **Benefit Cost Ratio (BCR)** – Annual Benefits divided by Annual Cost. When BCR is greater than 1, the project is justified economically.

**Hydraulic Performance** – Flood protection achieved by lowering the height of flood water and reducing the quantity of flood water during the 100-year flood, 500-year flood (Ames 2010 Flood), and the Dubuque extreme rainfall event.

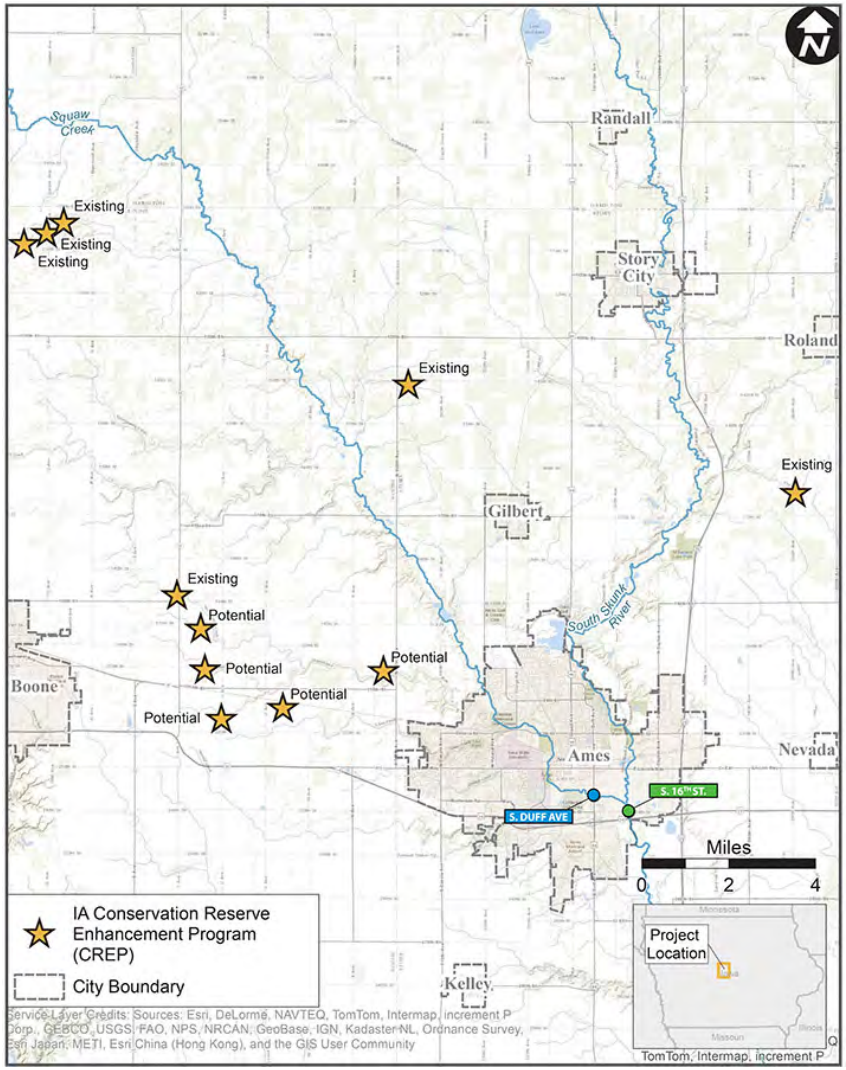
**Performance Criteria** – Based on the criteria above, each alternative will receive a ☑ or ☒ if it meets the objectives of the study.

**Environmental Concerns** – Identifies the main environmental impacts of each alternative or strategy.



# Conservation Measures in Watershed

The Conservation Measures in the Watershed alternative evaluates small detention sites that could contribute to flood reduction, and the construction of wetlands administered under the Iowa Department of Agriculture and Land Stewardship Conservation Reserve Enhancement Program.



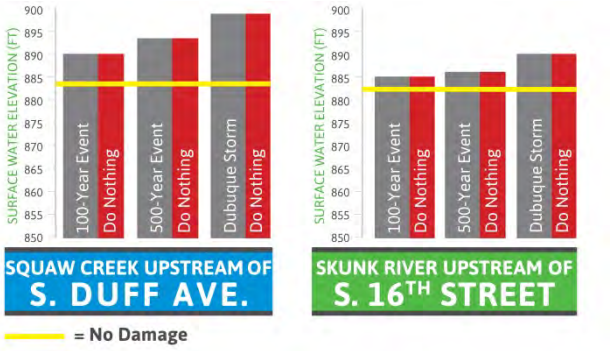

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$2,025,000** | **$122,230** | **$0** | **0.00** |

# Conservation Measures in Watershed

The Conservation Measures in the Watershed alternative evaluates small detention sites that could contribute to flood reduction, and the construction of wetlands administered under the Iowa Department of Agriculture and Land Stewardship Conservation Reserve Enhancement Program.

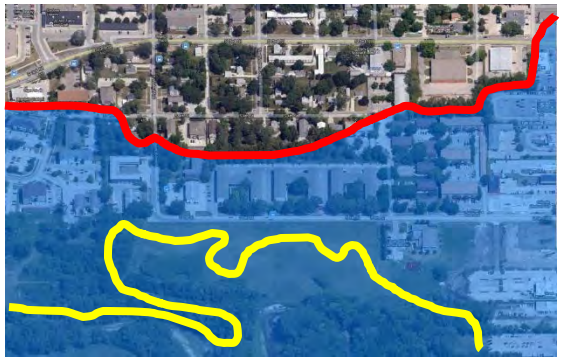
## Hydraulic Performance




## 500-Year Event

## 100-Year Event

## Dubuque Storm



## Environmental Concerns

| | | | |
|---|---|---|---|
| Land Use | Impacts to Agricultural land. (1,326 acres) | | |
| Farmland | Impacted. | | |
| Parks, Recreation & Conservation Areas | No impact. | | |
| Wetlands | Would increase existing wetland conservation areas in partnership with the Iowa Department of Agriculture and Land Stewardship. | | |
| Surface Water | No impact. | | |
| Threatened & Endangered Species | No impact. | | |
| Cultural Resources – Historical & Archaeological | No impact. | | |
| Socio-Economic Resources | No impact. | | |
| Environmental Justice | No impact. | | |
| Transportation | No impact. | | |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. | | |
| Regulated Materials | No impact. | | |
| Air Quality | No impact. | | |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (Provide no flood level of reduction.) | Do the benefits outweigh the costs? ☒ | Is this alternative free of major environmental impacts? ☑ |

## Conservation Measures in Watershed

**Limited Flood Protection Value for the City of Ames**

**Limited number of sites available**

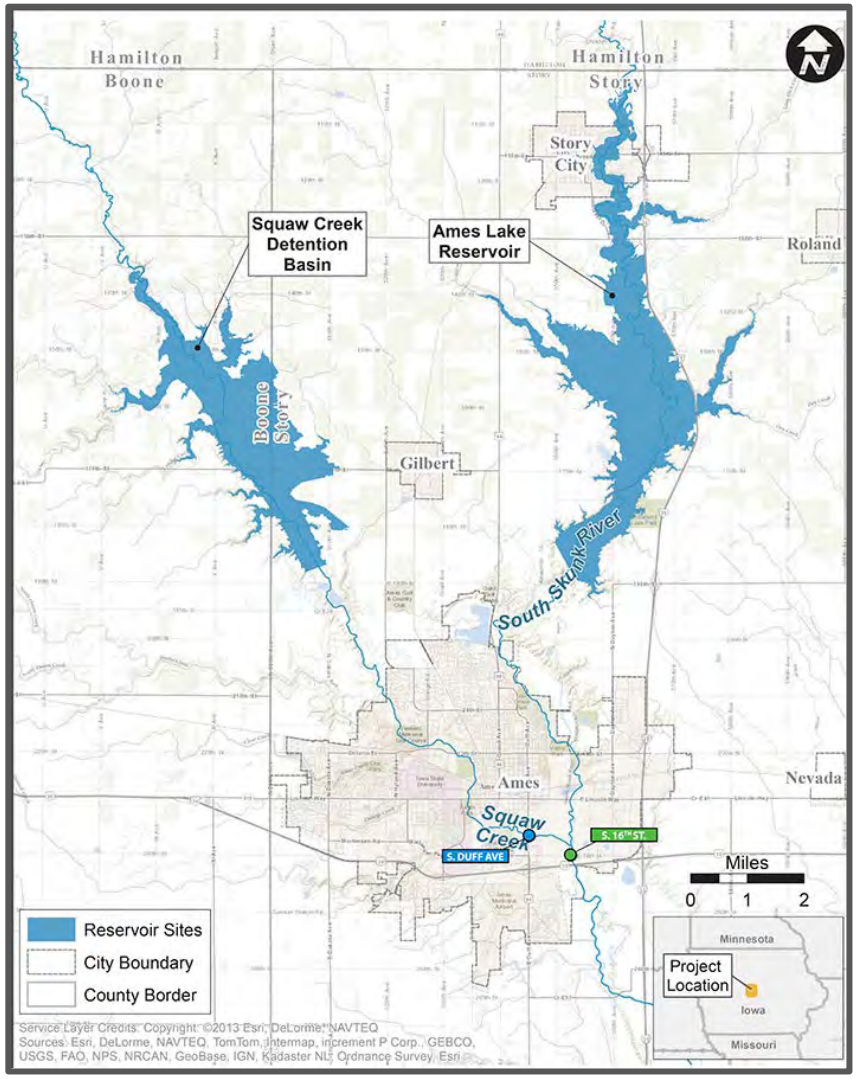
**Partnering opportunities with State of Iowa and Counties in Watershed**

# Centralized Storage

The Centralized Storage alternative includes the evaluation of Squaw Creek Dry Detention facility and Ames Lake Reservoir.

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$198,243,000** | **$11,966,036** | **$3,250,900** | **0.27** |



# Centralized Storage

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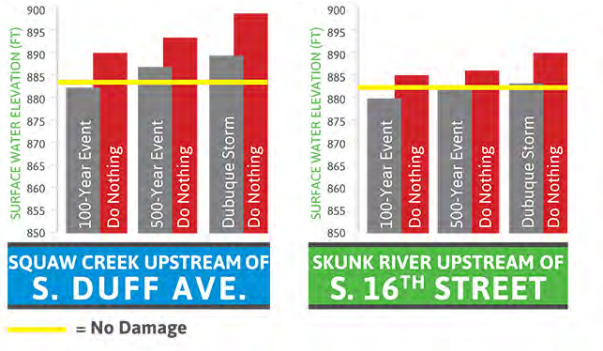
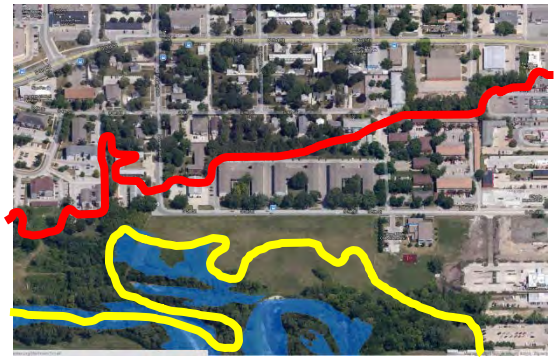
## Hydraulic Performance




## 500-Year Event

## 100-Year Event



## Dubuque Storm

## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to residential & agricultural land uses NW of Ames. Residential, agricultural and Public Lands NE of Ames & Story City. Housing developments in Western Story County and Eastern Boone County. Scattered farm residences in both counties. (10,660 acres) |
| Farmland | Impacted. |
| Parks, Recreation & Conservation Areas | Impacts to Story City Park, River Bend Municipal Golf Course, 12 conservation and recreation areas between Ames and Story City. |
| Wetlands | Impacts to approximately 840 acres. |
| Surface Water | Impacts to approximately 15 miles of Skunk River and approximately 7.5 miles of Squaw Creek. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 93 archaeological sites and 17 historic structures with the construction of SR-1, and 17 archaeological sites and 46 historical structures with the construction of SC-1. |
| Socio-Economic Resources | Impacts to approximately 150 residences from construction of SR-1 and 75 residences from construction of SC-1. Construction of SR-1 and SC-1 would preclude further development in and near affected areas. Construction of SR-1 would also affect Story City's wastewater treatment plant, a school and associated athletic facilities, and 2-3 businesses in Story City. |
| Environmental Justice | Impacts to minorities, low-income, elderly and LEP populations. |
| Transportation | Impacts to US 69, Broad Street in Story City, 130th, 150th, 170th, 180th, and 190th Streets, as well as local roads with the construction of SR-1. Construction of SC-1 would affect 140th, 150th, 160th, 170th, and 180th Streets. Potential impacts to airspace at the Ames Municipal Airport. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 15 leaking UST's within 1 mile of SR-1. 1 leaking UST is within the proposed footprint of SR-1. |
| Air Quality | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☑ (Skunk River only; 100 –year level on Squaw.) | Do the benefits outweigh the costs? ☒ | Is this alternative free of major environmental impacts? ☒ |

## Centralized Storage

**Not free of major environmental impacts**

**Cost prohibitive**

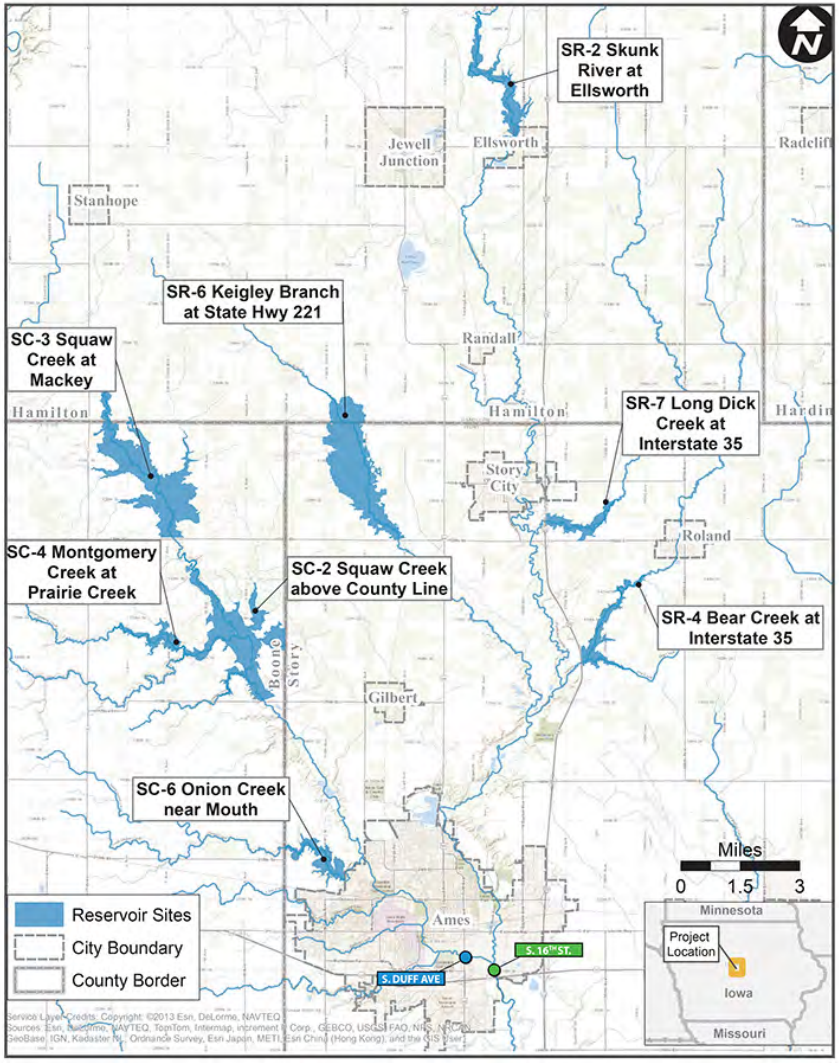
**Does provide 450-year level of flood protection on both skunk river and squaw creek**

# Regional Flood Storage

The Regional Flood Storage alternative includes the evaluation of 14 storage sites.

## Benefit Cost Analysis

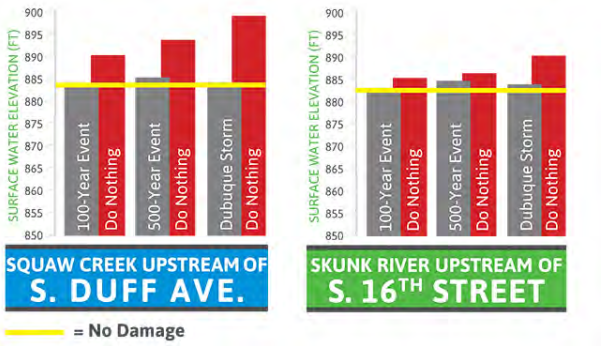
| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$145,339,000** | **$8,772,727** | **$3,217,700** | **0.37** |



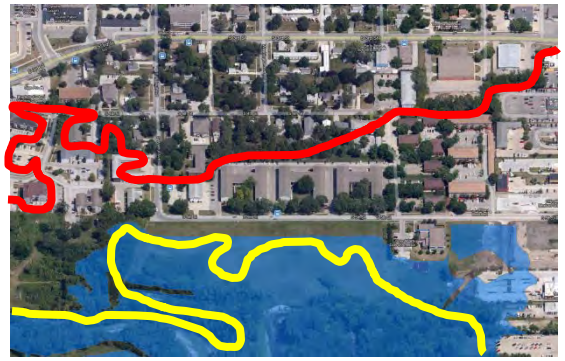
# Regional Flood Storage

The Regional Flood Storage alternative includes the evaluation of 14 storage sites.

## Hydraulic Performance

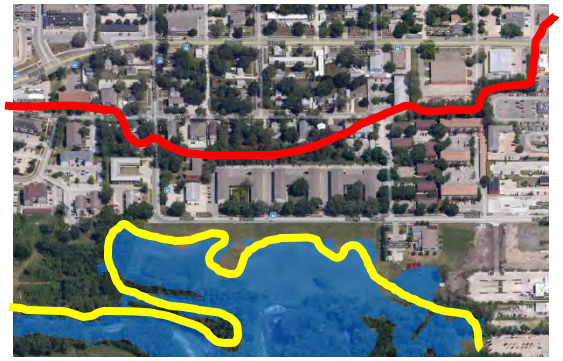



## 500-Year Event



## 100-Year Event

## Dubuque Storm



## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to residential developments, cemeteries, and agricultural land. (7,355 acres) |
| Farmland | Impacted. |
| Parks, Recreation & Conservation Areas | Impacts to the Bob Pyle Marsh WMA. |
| Wetlands | Impacts to approximately 800 acres. |
| Surface Water | Impacts to approximately 5.5 miles of Skunk River; approximately 5.3 miles of the Keigley Branch of the Skunk River; approximately 3.0 miles of Bear Creek, and approximately 2.8 miles of Long Dick Creek. This alternative would also flood approximately 10.5 miles of Squaw Creek, approximately 2.7 miles of Montgomery Creek, and approximately 2.6 miles of Onion Creek. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 18 archaeological sites and 22 historic structures. |
| Socio-Economic Resources | Impacts to approximately 110 residences, farms, and acreages. |
| Environmental Justice | No impacts. |
| Transportation | Impacts to 100th, 110th, 120th, 130th, 140th, 150th, and 160th Streets, as well as local roads. Potential impacts to airspace at the Ames Municipal Airport. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 15 leaking UST's, 1 Iowa contaminated site and 1 non-NPL Superfund site. |
| Air Quality | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (100-year level on Squaw; 100-year level on Skunk) Do the benefits outweigh the costs? ☒ Is this alternative free of major environmental impacts? ☒ |

## Regional Flood Storage

**Not free of major environmental impacts**

**Cost prohibitive**

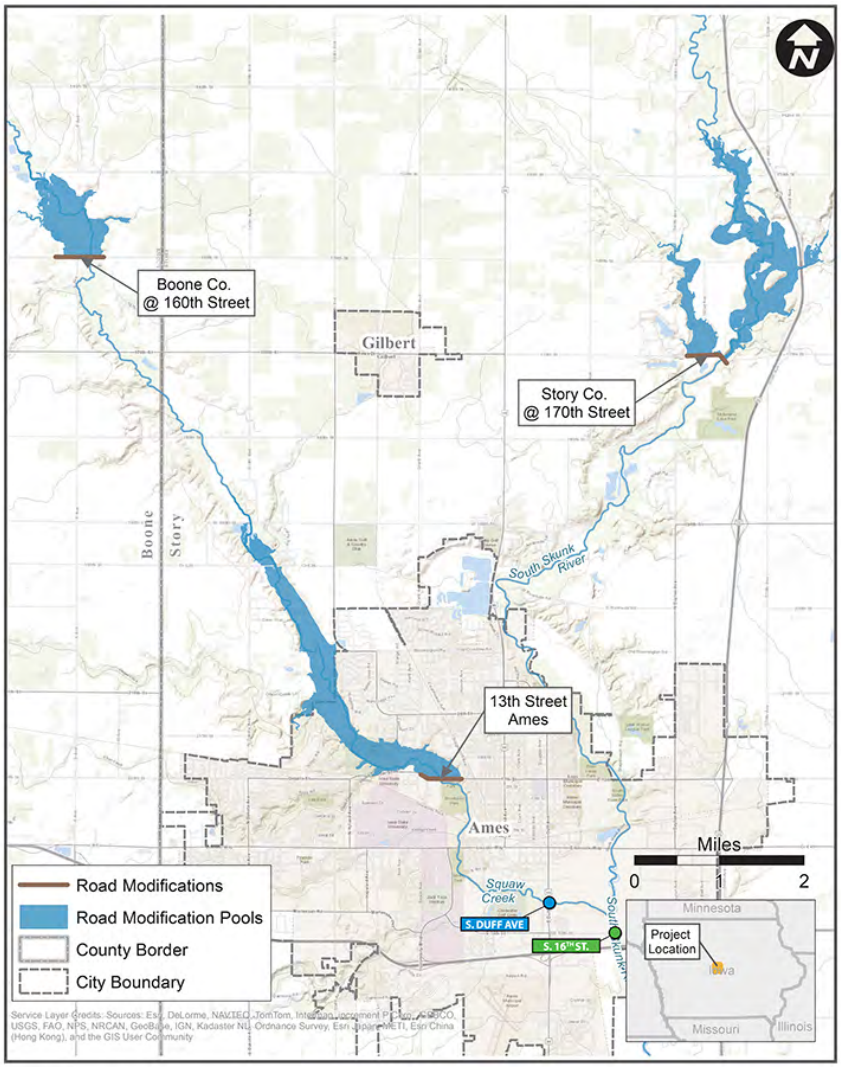
**It does provide 450-year level of flood protection on both skunk river and squaw creek**

# Floodplain Storage

The Floodplain Storage alternative achieves additional floodplain storage by raising 3 roads by 5 feet, and modifying 3 bridges/culverts.

## Benefit Cost Analysis

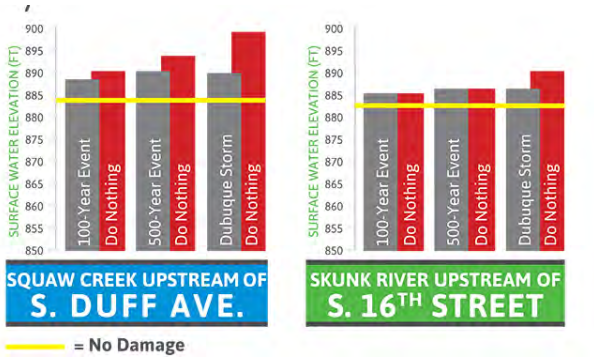
| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$41,000,000** | **$2,474,778** | **$2,786,900** | **1.13** |



# Floodplain Storage

The Floodplain Storage alternative achieves additional floodplain storage by raising 3 roads by 5 feet, and modifying 3 bridges/culverts.

## Hydraulic Performance




## 500-Year Event

## 100-Year Event

## Dubuque Storm

## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to residential area (ISU housing), recreation land, parks and conservation land, and agricultural land uses. (709 acres) |
| Farmland | Impacted. |
| Parks, Recreation & Conservation Areas | Impacts to Skunk River Greenbelt WMA, Crooked Bend WMA, Bear Creek Area, and Soper's Mill County Park, Veenker Memorial Golf Course, part of the Ames High Prairie State Preserve, the Furman Aquatic Park in Ames, and the ISU Stable Run Disc Golf Course. |
| Wetlands | Impacts to approximately 540 acres. |
| Surface Water | Impacts to approximately 6.5 miles of Squaw Creek and approximately 2.5 miles of Skunk River. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 66 archaeological sites and 5 historic structures. |
| Socio-Economic Resources | Impacts to part of the ISU housing area, approximately 25 residences, 2 businesses, a golf course, and a water park. |
| Environmental Justice | Impacts to minorities, low-income, elderly and LEP populations. |
| Transportation | Impacts to 150th, 160th, 170th, and 190th Streets. Would also require raising the following roads 5 feet and modifying bridges/culverts at these locations: Boone County Road 160 at Squaw Creek, Story County Road 170 at the Skunk River, and 13th Street in Ames at Squaw Creek. Potential impacts to airspace at the Ames Municipal Airport. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 10 leaking UST sites, 1 non-NPL Superfund site, and 1 Iowa contaminated site within 1 mile of the 13th Avenue site in Ames. |
| Air Quality | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (Reduced 100-year flood height of 2-ft on Squaw.) Do the benefits outweigh the costs? ☑ Is this alternative free of major environmental impacts? ☒ |

## Floodplain Storage

**Positive Cost Benefit Ratio**

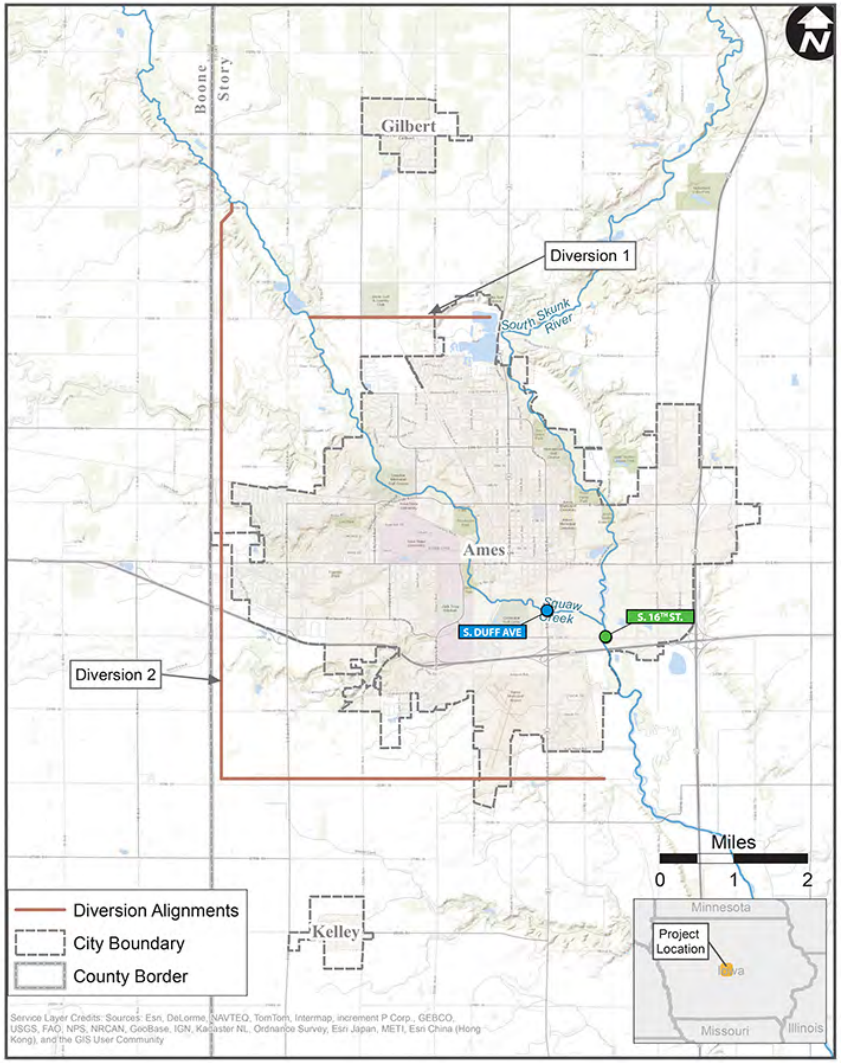
**Would require coordination with the county**

**Not free of major environmental impacts**

**Reduces the flood levels at the 100-year flood 2-ft on Squaw Creek**

# Diversion 1

The Diversion 1 alternative includes diverting flood waters around Ames by diverting Squaw Creek at Cameron School Road to the Skunk River via the Ada Hayden Reservoir.



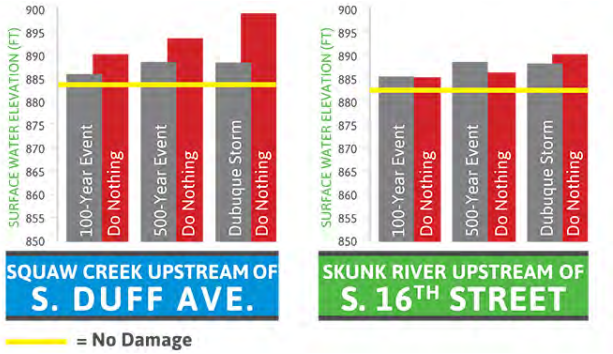

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$49,243,000** | **$2,972,329** | **$3,042,700** | **1.02** |

# Diversion 1

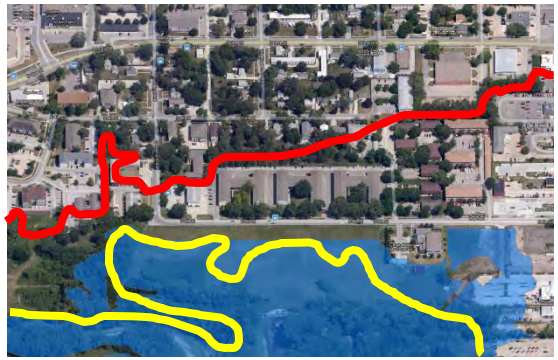
The Diversion 1 alternative includes diverting flood waters around Ames by diverting Squaw Creek at Cameron School Road to the Skunk River via the Ada Hayden Reservoir.

## Hydraulic Performance




## 500-Year Event

## 100-Year Event



## Dubuque Storm

## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to small areas of residential and commercial, southern edge of Ames Municipal Airport, recreation, conservation, and agricultural land. (1,370 acres) |
| Farmland | Impacted. |
| Parks, Recreation & Conservation Areas | Would divide the Ames Golf and Country Club and the Ada Hayden Heritage Park by creating a channel through these areas. |
| Wetlands | Impacts to approximately 10 acres. |
| Surface Water | No impacts to existing streams; however construction of these diversions would create a total of 17 miles of new stream channel. Construction of these diversions would affect flow in both the Skunk River and Squaw Creek. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 9 archaeological sites and 7 historic structures. |
| Socio-Economic Resources | Impacts to approximately 60 residences, a 25-residence trailer park, approximately 5 businesses, and the approach lighting in the clear zone of the Ames Municipal Airport. |
| Environmental Justice | Impacts to minorities, low-income, elderly and LEP populations. |
| Transportation | Would cut across several roads in Ames, including US 30, Lincoln Way, South Duff Avenue, George Washington Carver Avenue, 180th Street, 520th Avenue, and 530th Avenue. Bridges would need to be constructed, or in some cases, reconstructed. Potential impacts to the UPRR tracks and airspace at the Ames Municipal Airport. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 5 leaking USTs within 1 mile. |
| Air Quality | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (Reduced 100-year flood height of 5-ft on Squaw.) Do the benefits outweigh the costs? ☑ Is this alternative free of major environmental impacts? ☒ |

## Diversion 1

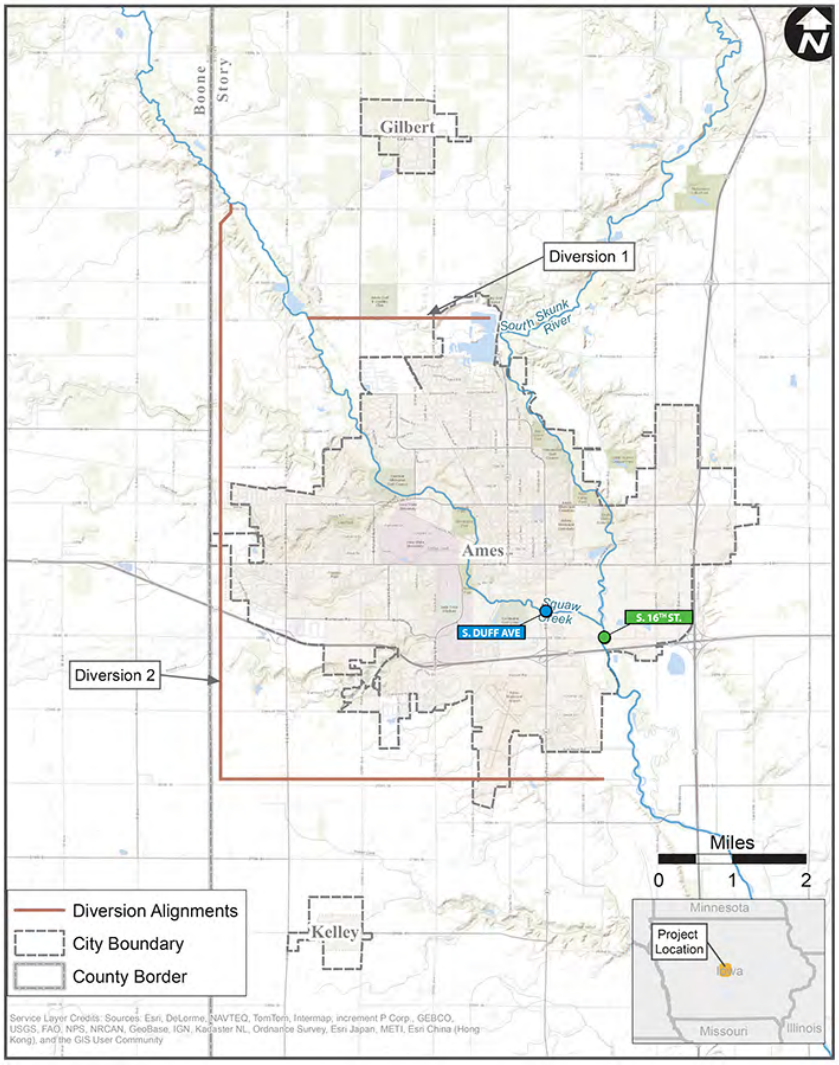
**Reduces 100-year flood 5-ft on squaw creek**

**Benefits outweigh the costs**

**Not free of major environmental impacts**

# Diversion 2

The Diversion 2 alternative includes diverting flood waters around Ames by diverting Squaw Creek upstream from Cameron School Road, to the Skunk River downstream from the Ames Municipal Airport.



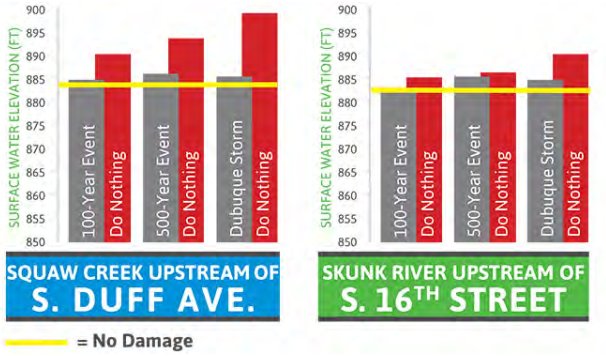

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| $1,095,000,000 | $66,094,687 | $3,192,300 | 0.05 |

# Diversion 2

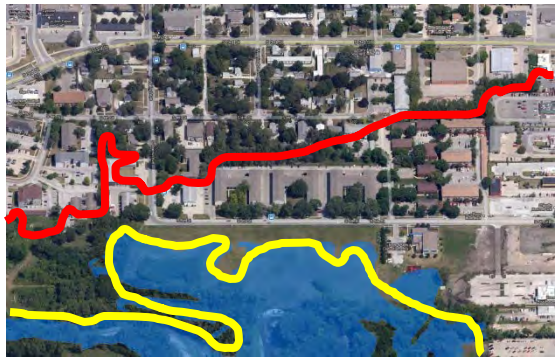
The Diversion 2 alternative includes diverting flood waters around Ames by diverting Squaw Creek upstream from Cameron School Road, to the Skunk River downstream from the Ames Municipal Airport.

## Hydraulic Performance




## 500-Year Event

## 100-Year Event



## Dubuque Storm

## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to small areas of residential and commercial, southern edge of Ames Municipal Airport, recreation, conservation, and agricultural land. (1,370 acres) |
| Farmland | Impacted. |
| Parks, Recreation & Conservation Areas | Would divide the Ames Golf and Country Club and the Ada Hayden Heritage Park by creating a channel through these areas. |
| Wetlands | Impacts to approximately 10 acres. |
| Surface Water | No impacts to existing streams; however construction of these diversions would create a total of 17 miles of new stream channel. Construction of these diversions would affect flow in both the Skunk River and Squaw Creek. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 9 archaeological sites and 7 historic structures. |
| Socio-Economic Resources | Impacts to approximately 60 residences, a 25-residence trailer park, approximately 5 businesses, and the approach lighting in the clear zone of the Ames Municipal Airport. |
| Environmental Justice | Impacts to minorities, low-income, elderly and LEP populations. |
| Transportation | Would cut across several roads in Ames, including US 30, Lincoln Way, South Duff Avenue, George Washington Carver Avenue, 180th Street, 520th Avenue, and 530th Avenue. Bridges would need to be constructed, or in some cases, reconstructed. Potential impacts to the UPRR tracks and airspace at the Ames Municipal Airport. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 5 leaking USTs within 1 mile. |
| Air Quality | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (Reduced 100-year flood height of 5-ft on Squaw; 100-year protection on Skunk.) / Do the benefits outweigh the costs? ☒ / Is this alternative free of major environmental impacts? ☑ |

## Diversion 2

**Reduces 100-year flood 5-ft on squaw creek**

**Cost Prohibitive**

**Not free of major environmental impacts**

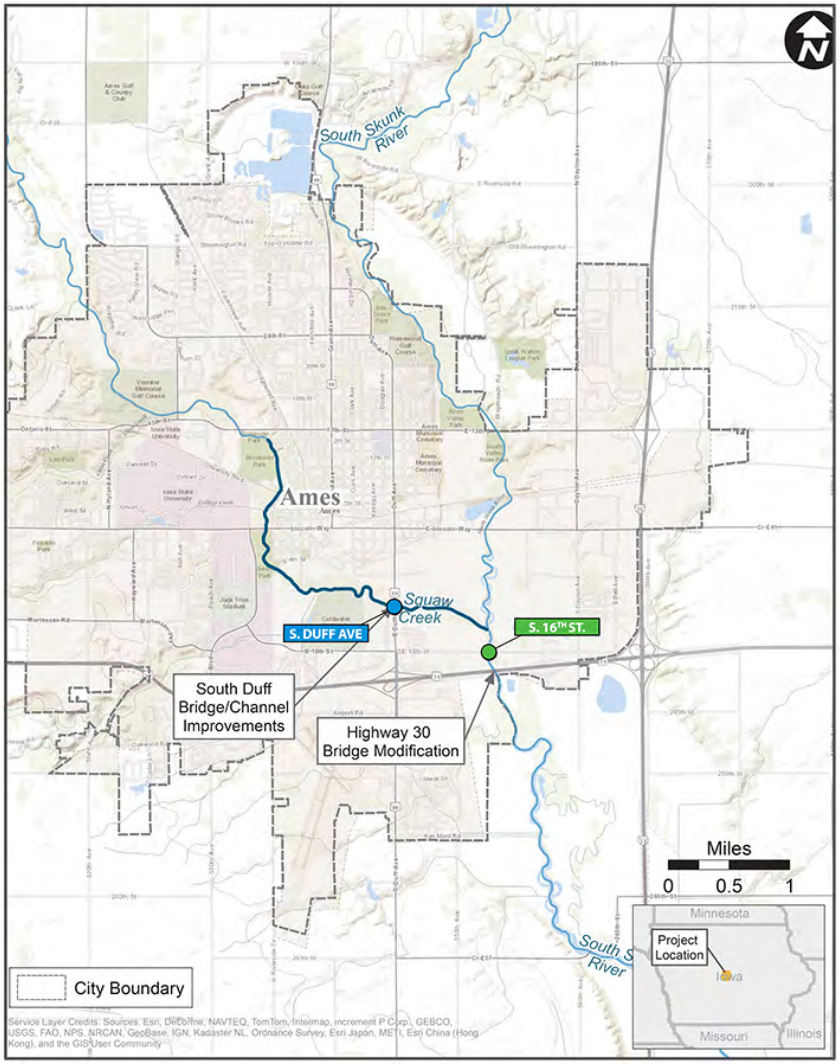
# Conveyance Improvements

## (Clear Channel)

The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.

### Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$2,943,000** | **$177,641** | **$2,436,700** | **13.72** |



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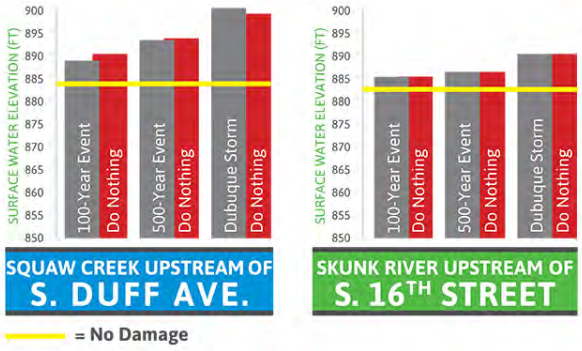
The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.

## Hydraulic Performance




## 500-Year Event

## 100-Year Event

## Dubuque Storm

## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to small areas of commercial land adjacent to South Duff Road Bridge, open space, agricultural land adjacent to US 30 bridge. (70 acres) |
| Farmland | Impacted. |
| Parks, Recreation & Conservation Areas | No impact. |
| Wetlands | No impact. |
| Surface Water | Impacts to short stretches of stream channel near the South Duff Bridge and the Highway 30 Bridge during construction. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 3 archaeological sites and 2 historic structures. |
| Socio-Economic Resources | Impacts to businesses adjacent to the South Duff Road bridge and open space and agricultural land adjacent to the US 30 bridge. |
| Environmental Justice | No impact. |
| Transportation | Temporary impacts to roads within the Project Area. Would also require the lengthening of Hwy 30 Bridge over the Skunk River and the South Duff Bridge over Squaw Creek. Impacts to the approach lighting at the southern end of the runway at Ames Municipal Airport and potential impacts to the airspace. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 31 leaking UST sites, 2 non-NPL Superfund site, and 6 no leaking USTs within the proposed footprints are within 1 mile. |
| Air Quality | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (Reduced 100-year flood height of 1-ft on Squaw.) Do the benefits outweigh the costs? ☑ Is this alternative free of major environmental impacts? ☒ |

## Conveyance Improvements (Clear Channel)

**Reduces 100-year flood 1-ft on squaw creek**

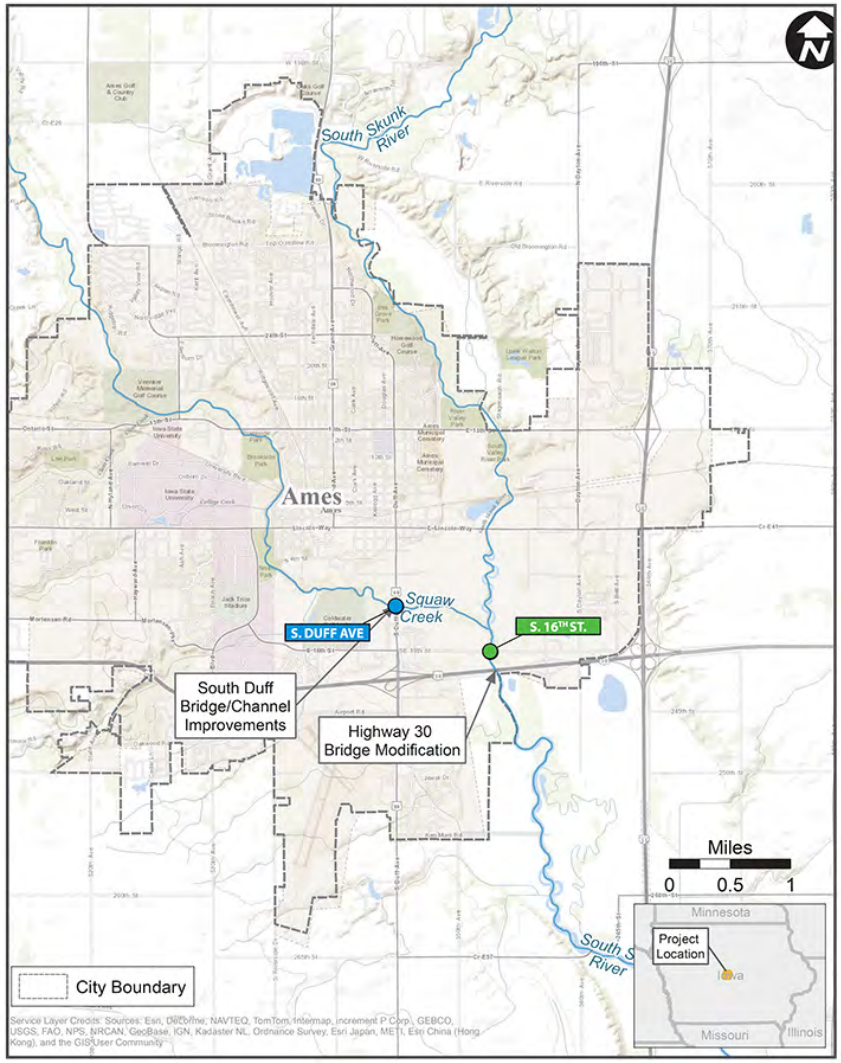
**Benefits outweigh Costs**

**Not free of major environmental impacts**

# Conveyance Improvements

## (US Hwy 30 Bridge Improvement)

The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.




### Benefit Cost Analysis

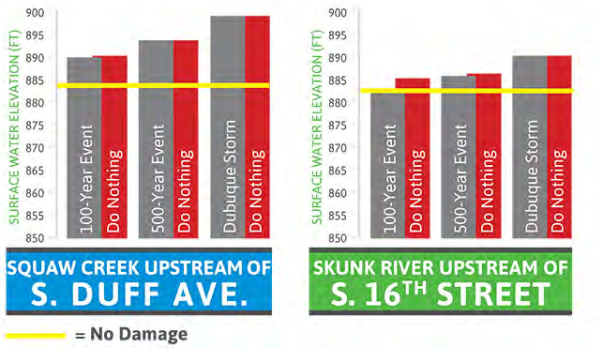
| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$7,740,000** | **$467,190** | **$2,097,300** | **4.49** |

# Conveyance Improvements

## (US Hwy 30 Bridge Improvement)

The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.

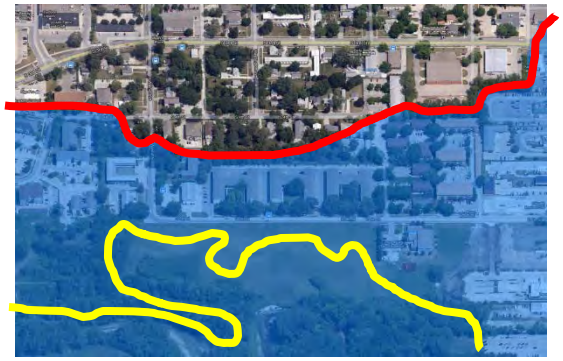
### Hydraulic Performance




### 500-Year Event

### 100-Year Event

### Dubuque Storm



## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to small areas of commercial land adjacent to South Duff Road Bridge, open space, agricultural land adjacent to US 30 bridge. (70 acres) |
| Farmland | Impacted. |
| Parks, Recreation & Conservation Areas | No impact. |
| Wetlands | No impact. |
| Surface Water | Impacts to short stretches of stream channel near the South Duff Bridge and the Highway 30 Bridge during construction. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 3 archaeological sites and 2 historic structures. |
| Socio-Economic Resources | Impacts to businesses adjacent to the South Duff Road bridge and open space and agricultural land adjacent to the US 30 bridge. |
| Environmental Justice | No impact. |
| Transportation | Temporary impacts to roads within the Project Area. Would also require the lengthening of Hwy 30 Bridge over the Skunk River and the South Duff Bridge over Squaw Creek. Impacts to the approach lighting at the southern end of the runway at Ames Municipal Airport and potential impacts to the airspace. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 31 leaking UST sites, 2 non-NPL Superfund site, and 6 no leaking USTs within the proposed footprints are within 1 mile. |
| Air Quality | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (Reduced 100-year flood height of 2.5-ft on Skunk.) Do the benefits outweigh the costs? ☑ Is this alternative free of major environmental impacts? ☑ |

## Conveyance Improvements (US Hwy 30 Bridge Improvement)

**Reduces 100-year flood 2.5-ft on skunk river**

**Benefits outweigh Costs**

**Free of major environmental impacts**

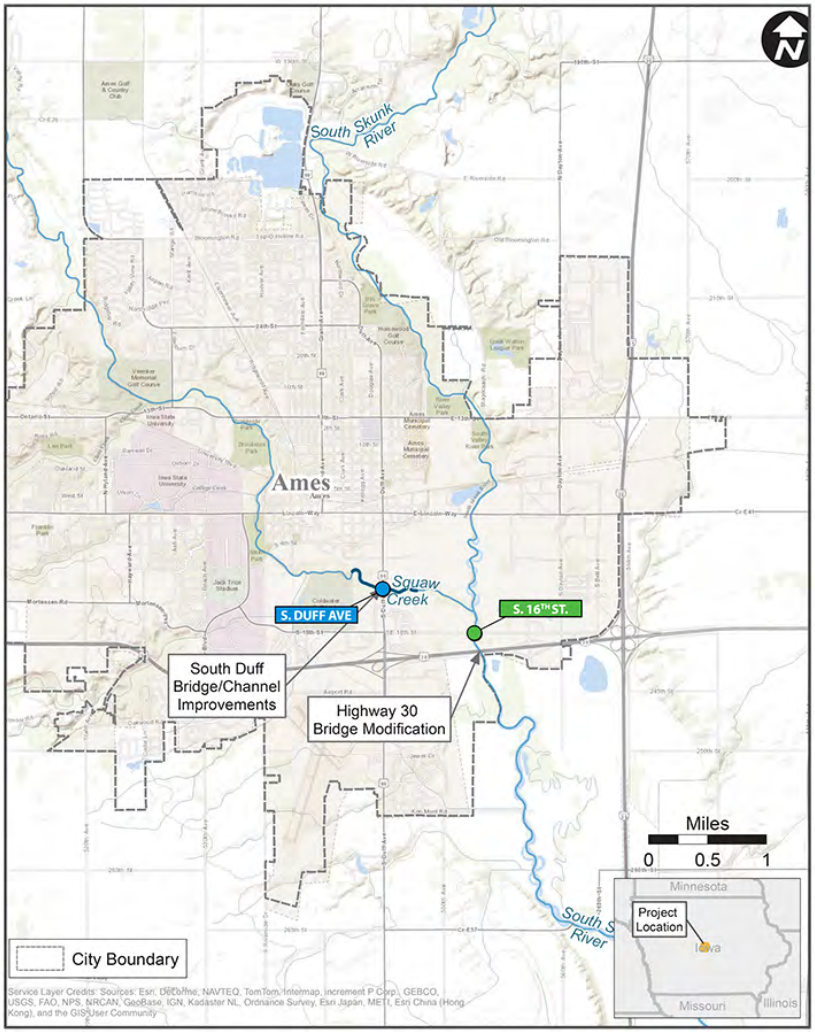
# Conveyance Improvements

## (South Duff Bridge Improvement & Clear Channel)

The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.

### Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$4,715,000** | **$284,599** | **$2,086,900** | **7.33** |

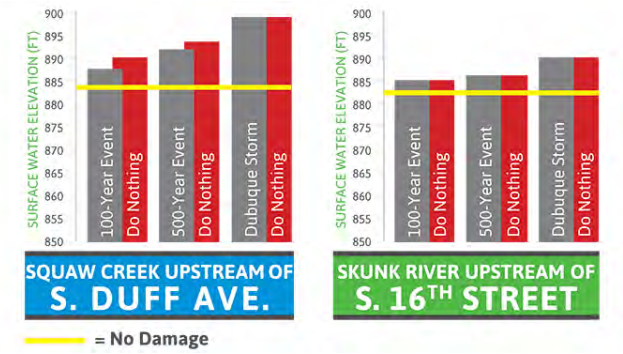


# Conveyance Improvements

## (South Duff Bridge Improvement & Clear Channel)

The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.

### Hydraulic Performance




### 500-Year Event

### 100-Year Event

### Dubuque Storm

## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to small areas of commercial land adjacent to South Duff Road Bridge, open space, agricultural land adjacent to US 30 bridge. (70 acres) |
| Farmland | Impacted. |
| Parks, Recreation & Conservation Areas | No impact. |
| Wetlands | No impact. |
| Surface Water | Impacts to short stretches of stream channel near the South Duff Bridge and the Highway 30 Bridge during construction. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 3 archaeological sites and 2 historic structures. |
| Socio-Economic Resources | Impacts to businesses adjacent to the South Duff Road bridge and open space and agricultural land adjacent to the US 30 bridge. |
| Environmental Justice | No impact. |
| Transportation | Temporary impacts to roads within the Project Area. Would also require the lengthening of Hwy 30 Bridge over the Skunk River and the South Duff Bridge over Squaw Creek. Impacts to the approach lighting at the southern end of the runway at Ames Municipal Airport and potential impacts to the airspace. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 31 leaking UST sites, 2 non-NPL Superfund site, and 6 no leaking USTs within the proposed footprints are within 1 mile. |
| Air Quality | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (Reduced 100-year flood height of 2-ft on Squaw.) Do the benefits outweigh the costs? ☑ Is this alternative free of major environmental impacts? ☑ |

## Conveyance Improvements (US Hwy 30 Bridge Improvement)

**Reduces 100-year flood 2-ft on squaw creek**

**Benefits outweigh Costs**

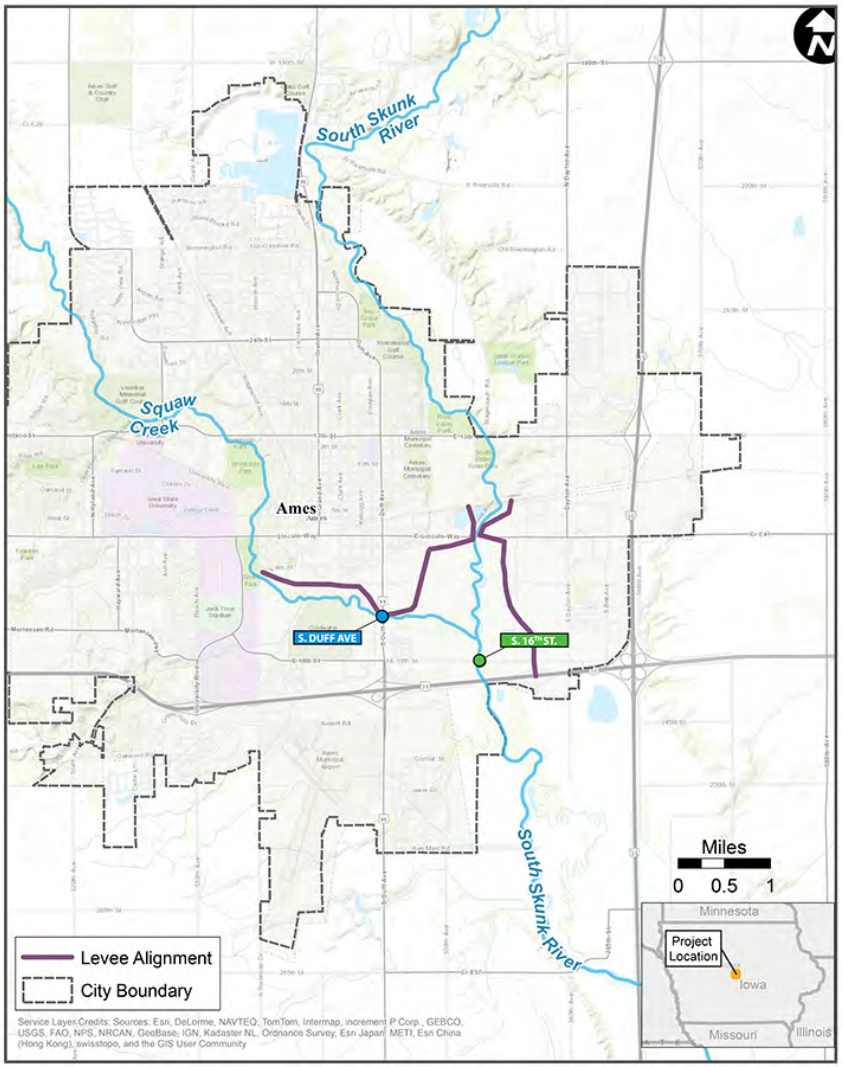
**Free of major environmental impacts**

# Levee Protection to 100-Year

The Levees alternatives evaluates protection to the 100-year flood level protecting property areas along Skunk River and Squaw Creek by constructing a levee (berm/floodwall) combination.

## Benefit Cost Analysis

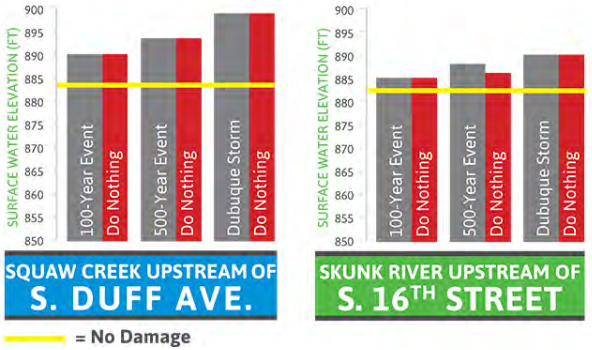
| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **Skunk River $4,818,000** | **Skunk River $290,817** | **Skunk River $121,400** | **Skunk River 0.42** |
| **Squaw Creek $6,079,000** | **Squaw Creek $366,931** | **Squaw Creek $174,600** | **Squaw Creek 0.48** |



# Levee Protection to 100-Year

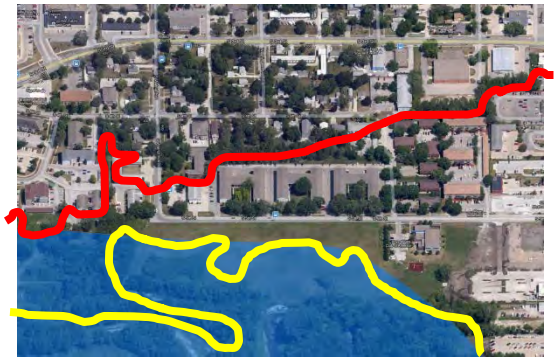
The Levees alternatives evaluates protection to the 100-year flood level protecting property areas along Skunk River and Squaw Creek by constructing a levee (berm/floodwall) combination.

## Hydraulic Performance

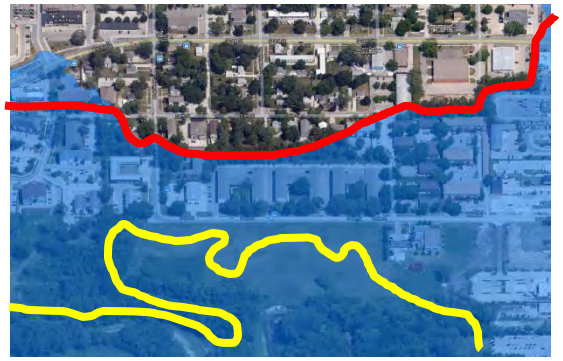



## 500-Year Event

## 100-Year Event



## Dubuque Storm



## Environmental Concerns

| | |
|---|---|
| Land Use | Impacts to commercial and agricultural land. (10 acres) |
| Farmland | No impact. |
| Parks, Recreation & Conservation Areas | No impact. |
| Wetlands | No impact. |
| Surface Water | No impact. |
| Threatened & Endangered Species | Potential impacts. |
| Cultural Resources – Historical & Archaeological | Impacts to 3 archaeological sites and 24 historic structures. |
| Socio-Economic Resources | Impacts to approximately 10 to 15 businesses. |
| Environmental Justice | Impacts to minorities, low-income, elderly and LEP populations. |
| Transportation | Temporary impacts to roads within the Project Area. Potential impacts to the UPRR tracks and airspace at the Ames Municipal Airport. |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. |
| Regulated Materials | 45 leaking UST sites, 6 non-NPL Superfund sites, and 6 Iowa contaminated sites are within 1 mile. 1 leaking UST is located within the footprint of the Squaw Creek levee. |
| Air Quality | No impacts. |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☒ (The alternative meets the 100-year protection on Squaw & Skunk.) |
| | Do the benefits outweigh the costs? ☒ |
| | Is this alternative free of major environmental impacts? ☑ |

## Levee Protection to 100-Year

**Protects to 100-year level**

**Benefits do not outweigh costs**

**Free of major environmental impacts**

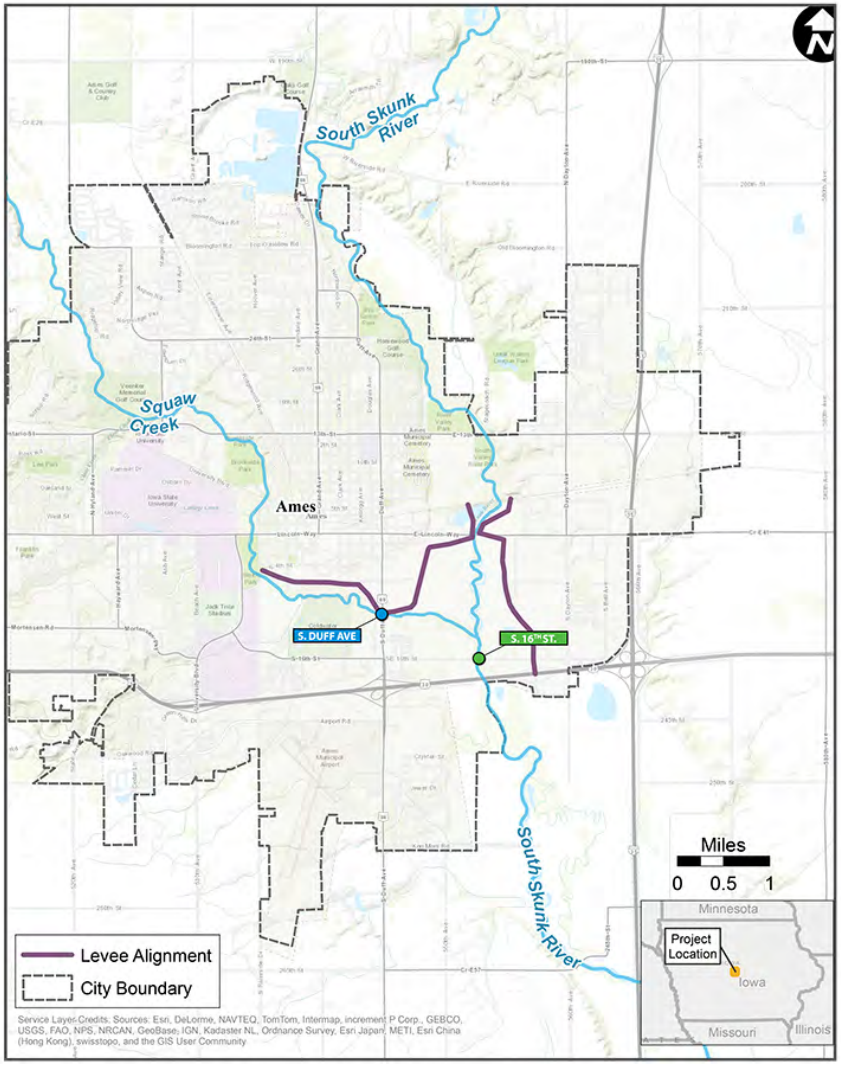
**Opportunities for combination with conveyance improvements**

# Levee Protection to 500-Year

The Levees alternatives evaluates protection to the 500-year flood level protecting property areas along Skunk River and Squaw Creek by constructing a levee (berm/floodwall) combination.

## Benefit Cost Analysis

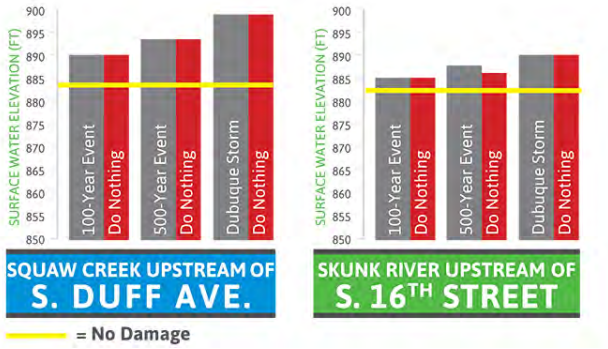
| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **Skunk River $5,333,000** | **Skunk River $321,902** | **Skunk River $198,100** | **Skunk River 0.62** |
| **Squaw Creek $7,688,000** | **Squaw Creek $462,844** | **Squaw Creek $174,600** | **Squaw Creek 0.38** |



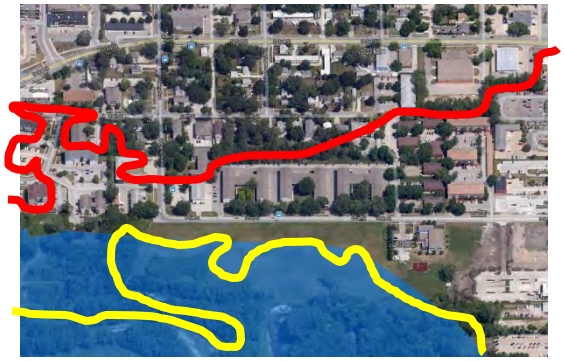
# Levee Protection to 500-Year

The Levees alternatives evaluates protection to the 500-year flood level protecting property areas along Skunk River and Squaw Creek by constructing a levee (berm/floodwall) combination.

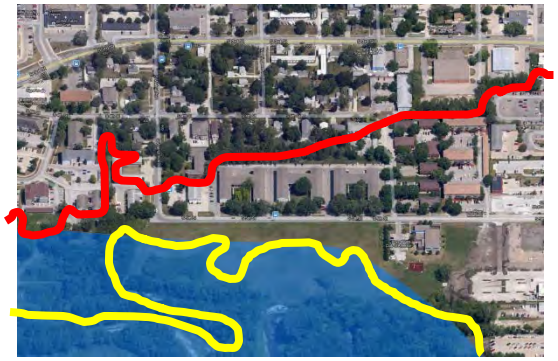
## Hydraulic Performance



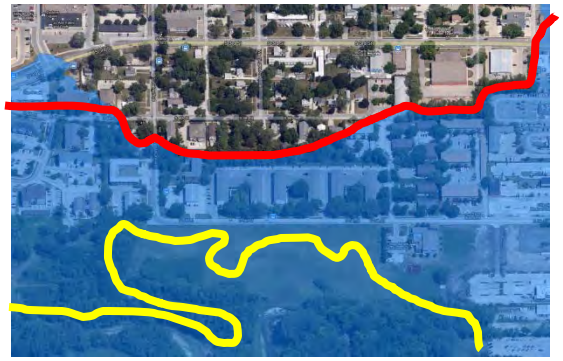

## 500-Year Event



## 100-Year Event



## Dubuque Storm



## Environmental Concerns

| | | | |
|---|---|---|---|
| Land Use | Impacts to commercial and agricultural land. (10 acres) | | |
| Farmland | No impact. | | |
| Parks, Recreation & Conservation Areas | No impact. | | |
| Wetlands | No impact. | | |
| Surface Water | No impact. | | |
| Threatened & Endangered Species | Potential impacts. | | |
| Cultural Resources – Historical & Archaeological | Impacts to 3 archaeological sites and 24 historic structures. | | |
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| Environmental Justice | Impacts to minorities, low-income, elderly and LEP populations. | | |
| Transportation | Temporary impacts to roads within the Project Area. Potential impacts to the UPRR tracks and airspace at the Ames Municipal Airport. | | |
| Noise | Construction of any alternative selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. | | |
| Regulated Materials | 45 leaking UST sites, 6 non-NPL Superfund sites, and 6 Iowa contaminated sites are within 1 mile. 1 leaking UST is located within the footprint of the Squaw Creek levee. | | |
| Air Quality | No impacts. | | |
| Performance Criteria | Does it meet at least a 500-year level of protection? ☑ | Do the benefits outweigh the costs? ☒ | Is this alternative free of major environmental impacts? ☑ |

## Levee Protection to 500-Year

**Protects to 500-year level**

**Benefits do not outweigh costs**

**Free of major environmental impacts**

# Three Questions – Three Answers

**Question 1.** Could rain barrels prevent the flooding in Ames? If every citizen of Ames had two 50 gallon rain barrels, wouldn't it prevent flooding on the Skunk and Squaw?

**Answer 1.** No it would not. This is the equivalent of 30 seconds of flow at the South Skunk River at Highway 30.

**Question 2.** Do the bridges cause the flooding in Ames?

**Answer 2.** No. If every single bridge and embankment was removed through the City of Ames, it would only result in water surface elevations at South Duff that are 0.5-ft lower during 100-year event and 1.7-ft lower during the 500-year event.

**Question 3.** Does continued development in floodplain cause the flooding in Ames?

**Answer 3.** If every piece of land in the floodway fringe was developed it leads to 1-ft higher water surface elevations (100-year) and 3-ft higher water surface elevations (500-year). That is what is behind Ames floodplain policy.

# Next Steps and Path Forward

**Combination of three alternatives:**

- Channel Improvements near South Duff, Hwy 30 Improvements, and Levees along Squaw Creek and Skunk River
- Lower water surface elevations reduce levee height, material from channel used in levee or interior drainage storage area (2-3-ft on sq.; 0.8-ft on sk; 100-year)
- Stand Alone – Annual Benefits ($4.5 million), Annual Costs ($1.5 million)
- Phasing – HWY 30 Improvements 5-10 Years
  - 100-year levee -> ~200-year
  - 500-year levee -> ~700-year

# Next Steps and Path Forward

**Modification of Floodplain Ordinance:**

- At South Duff the FEMA 100-year water surface elevation is 888.5 ft. Development must be built to 3-ft above, or 891.5 ft. The FEMA 500-year water surface elevation is 891.0-ft, or less than the development standard.
- Consider adopting a 2D hydraulic model for quantifying impacts of development beyond the scope of this study (the impact of removal of a single building on flood plain water surface elevations)

# Public Involvement Summary

The following is a summary of public participation for the City of Ames Flood Mitigation Study from September 2012 to April 2013.

**Participation To Date (Website, Online Public Meeting, In-person Public Sessions & Comments)**

| Participation Method | Quantity |
|---|---|
| Website | 2,453 page views |
| Online Open House | 645 page views |
| Public Session 1 Meeting Attendance (4 meetings) | 98 attendees |
| Public Session 2 Meeting Attendance (2 meetings) | 58 attendees |
| Public Session 3 Meeting Attendance (2 meetings) | 112 attendees |
| Comments Received | 181 comments |

## Outreach Tools & Techniques

The following outreach was used to promote awareness of the Study and attendance at the meetings. Multiple methods of outreach were developed to ensure identified stakeholder groups and the general public was made aware of the opportunities to participate in the study process.

**Postcard**

8,599 postcard invitations were mailed to landowners in the 100-year and 500-year floodplain; postcards were mailed two weeks prior to each Public Meeting. The purpose of the postcard invitation was to invite the public to the public meetings and provide them with the Study information and opportunities to comment.

**Door Hanger**

An 11-inch x 3-inch door hanger was placed in 1000 mobile home and multi-family units. They were placed on the front doors of homes located in the Homestead Colony Mobile Home Park and several other specified neighborhood community. The door hangers invited

the public to participate in the Public Meetings and online public open house meetings. The door hanger provided the resident a direction to the City website for more information and was only used to promote Public Session 1.

**Social Media Alerts & Share Links**

Three weeks prior to the Public Meetings, Social Media Alerts (2 per week) were posted on both the Facebook and Twitter sites of the City of Ames. Each week leading up to the Public Meetings, two alerts were posted. The purpose of the alerts was to encourage participation in the Public Meeting, either traditional or online format. In order to take advantage of online networking opportunities, social media share links will be embedded in the project website and online public meeting.

**Neighborhood Association Email**

Along with the quarterly Neighborhood Associations newsletter included mention of the Study and the upcoming Public Session meetings. The purpose of the email was to encourage participation in the public engagement process, describe the methods by which they will be informed of upcoming events, and find more information at the City of Ames website.

**Email Invitation**

An html formatted email invitation was mailed to all identified stakeholders and participants who provided email contact information at the Public Meetings or on the City of Ames Email Notification distribution list. The email invitations were distributed two weeks prior to each Public Meeting and were used to introduce the public to the project and to invite participation in the Public Meetings and online public open house meeting. The email will provide a link to the online open house public meeting. A reminder email was also sent out prior to every Public Meeting.

**City Newsletter**

Multiple articles were published in the City of Ames Newsletter, City Side. The article ran in October 2012, January 2013 and March 2013. The purpose of the newsletter article was to promote the upcoming Public Meetings and encourage City residents to participate and provide input.

**Website, Online Meeting & Comment Form**

Information regarding the City of Ames flood mitigation planning was provided on the City of Ames home page. A link directly from the City of Ames website guided the reader to the online meeting.

The online meeting served as an online portal for all interested parties to find information about the project, updates on different milestones reached throughout the planning process, and opportunities to participate and provide input and feedback on the project planning. The same information presented at each of the Public Meetings was presented in an online, self-directed open house meeting. As of April 11, 2013, the City of Ames Flood Mitigation Study website had 1,229 unique visitors, generating 2,435 hits, 645 online meeting views and 181 comments.

## Comments

In order to provide mitigation solutions to the City of Ames, three questions were asked of the public during Public Session 1. Responses are listed below.

1. How have you been impacted by flooding?
    - Sewer backup
    - Access to roads
    - Repairs and maintenance
    - Flooding from the municipal airport
    - Flooded homes and apartments
    - High water approximately 100-150 feet away from house
    - Damage to mobile homes
    - Lack of emergency response
    - Taxpayer impacts
    - Lack of drinking water
    - Loss of business revenue

2. What do you think are the flooding issues impacting the greater Ames community?
    - Older businesses on South Duff Avenue
    - Mobile Home Court
    - Restricted water flow by bridges and small river channel
    - Watersheds above Ames
    - Fill along South Duff
    - Loss of property
    - Displacement from homes
    - Cost of clean-up and repairs
    - Building in the floodplain
    - Flooding to the east of the airport
    - Too much development on flood plains
    - Too much development on College Creek on either side of S. Dakota Ave
    - Hwy 30 across the Skunk River
    - Amount and speed of rainwater to the north of Ames needs to be controlled

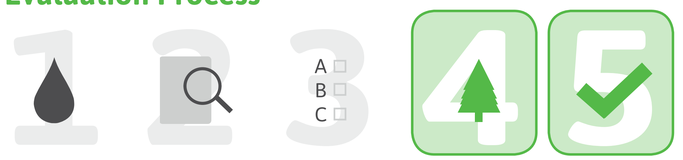
3. How do you think these flooding issues should be solved?
    - Promote businesses on Airport Road
    - Restrict development on South Duff
    - Build reservoir
    - Prevent fill
    - Buyout businesses in the floodplain
    - Watershed-wide solutions
    - Limit building in the floodplain
    - Stop promoting urban sprawl

- 500-year plain and ordinances to prevent building on the flood plain
- Re-using old buildings rather than building new ones
- Provide a statewide solution
- A dam on South Skunk and/or Squaw Creek
- Enlarge Squaw Creek channel
- Have businesses construct water holding ponds
- Watershed management
- Build water outlet in the highway
- Put water pumps into buildings
- Using engineering judgments
- Make plans using a higher standard
- Provide information regarding FEMA programs
- Better storm water management
- Dayton Road conveyance

Additional public input was solicited in order to provide feedback on the alternatives and strategies to the study team. A summary of public input is listed below:

- 100-year flood data is ineffective
- Consider environmental impacts
- Consider dredging creeks while dry
- Consider upstream containment structures
- Consider conservation measures
- Consider floodplain ordinance modifications for all alternatives and strategies
- Better emergency management
- Listen to impacted parties
- Consider stopping and or limiting development in the floodplain
- Upstream and downstream impacts should be considered
- The whole watershed should be addressed, not just Ames
- The City should consider property buy-outs
- Environmental impacts should be quantified

Evaluation Process

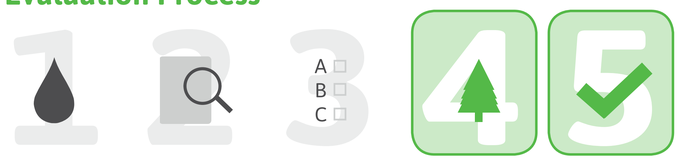



# Welcome!

The purpose of this meeting is to:

- Present the detailed screening evaluation of flood mitigation alternatives and strategies for the Ames Community.
- Gather feedback on the strategies to present to the City Council.

Evaluation Process



# The Study

## Method

Collect public input, develop and analyze alternatives and strategies, summarize impacts.

## Focus

Determine impacts—positive and negative—of flood mitigation alternatives and strategies.

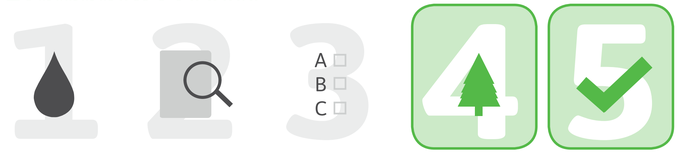
## Goal

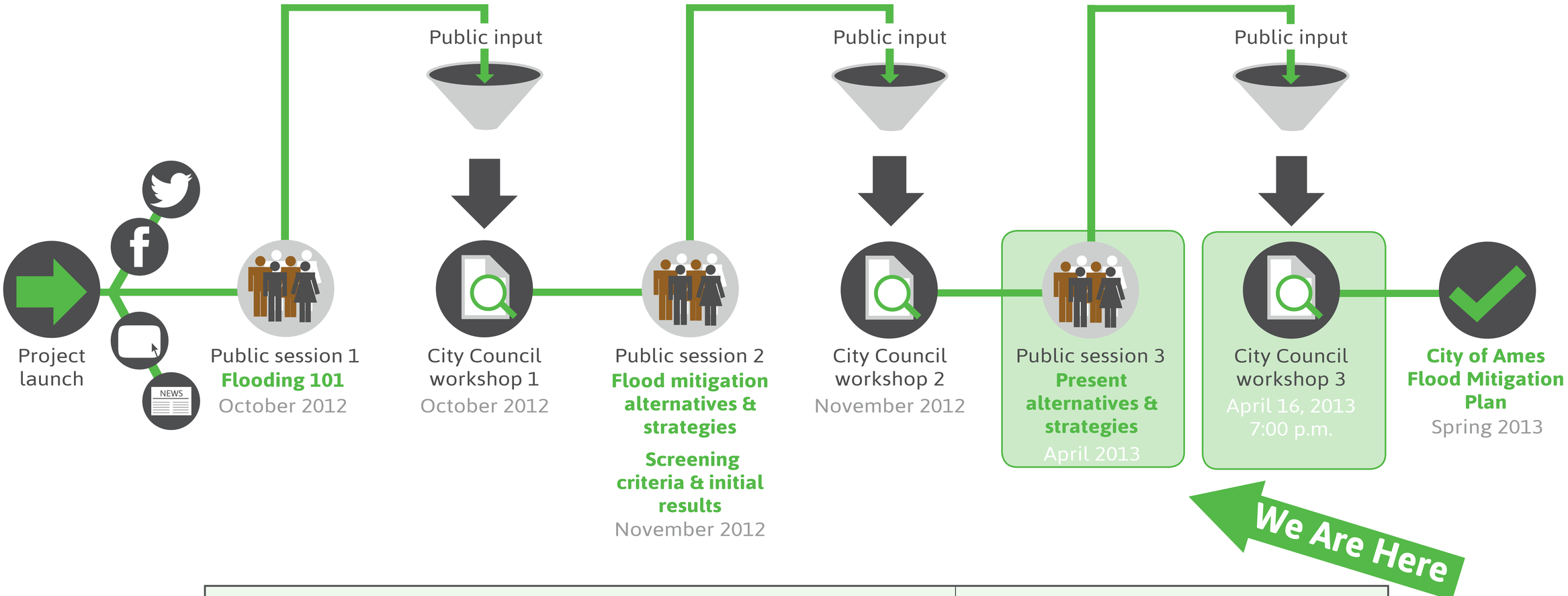
Present the best alternatives and strategies to City Council.

# City of Ames Flood Mitigation Study

## Community Involvement

Evaluation Process




| | |
|---|---|
| **Website Visits** | 2,151 page views |
| **Online Meeting Participation** | 540 visits |
| **Public Session 1 Meeting Attendance** | 98 attendees |
| **Public Session 2 Meeting Attendance** | 58 attendees |
| **Comments Received** | 173 comments |

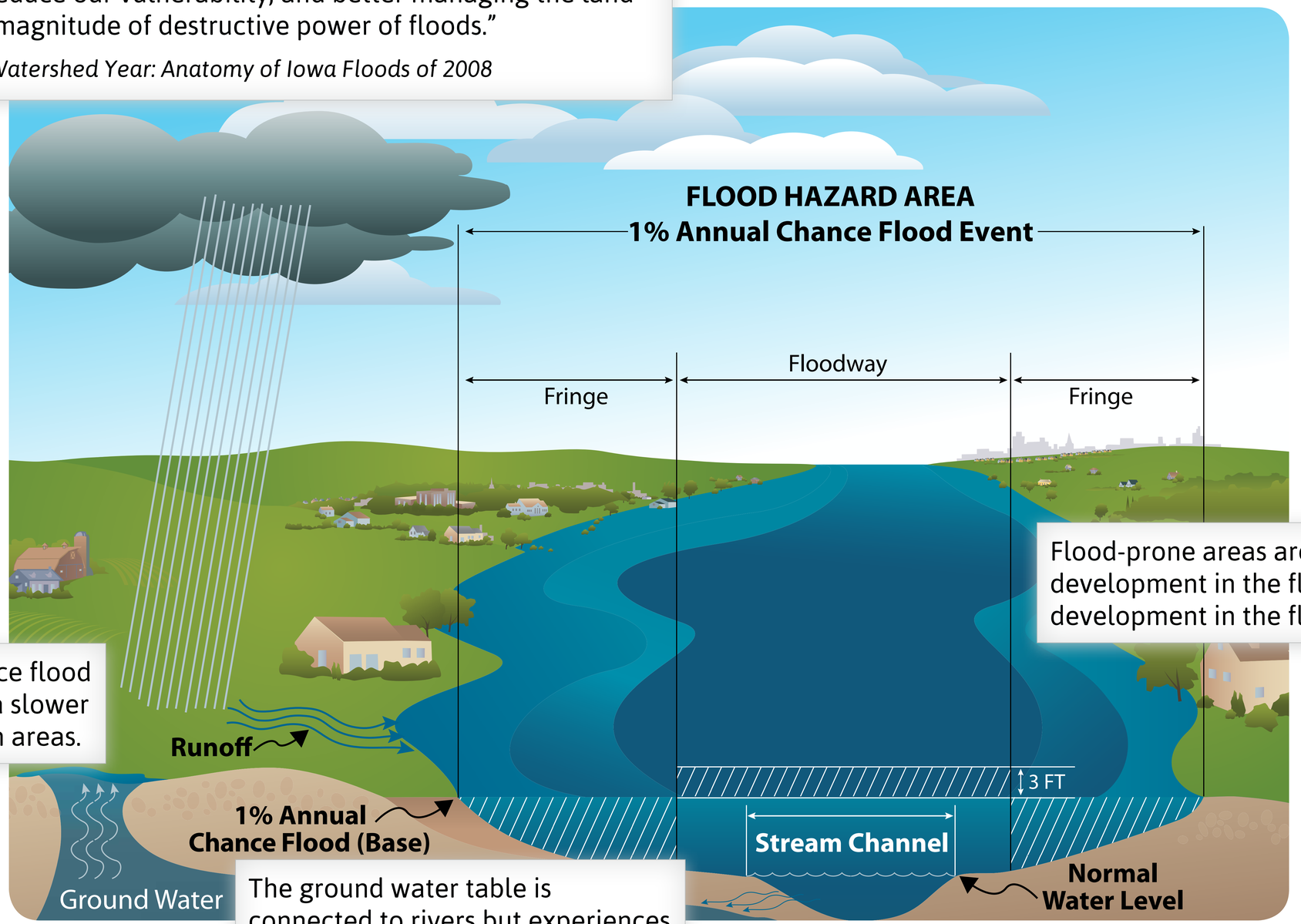
Evaluation Process

1 2 3 4 5

# Flooding 101

"Living with floods involves two broad activities: better managing the risks and taking steps to reduce our vulnerability, and better managing the landscape to reduce the magnitude of destructive power of floods."

--Connie Mutel, *A Watershed Year: Anatomy of Iowa Floods of 2008*



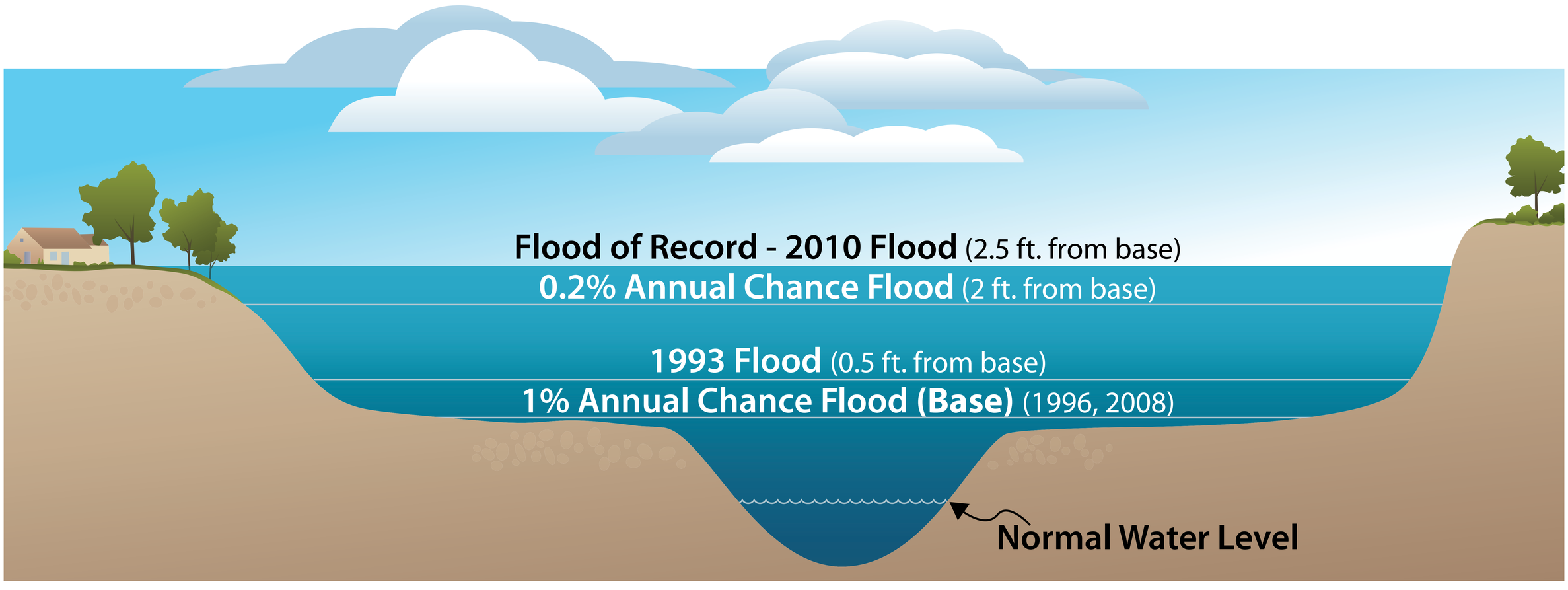

Rural areas produce flood causing runoff at a slower rate than do urban areas.

Flood-prone areas are managed by restricting development in the floodway, but allowing development in the floodway fringe.

The ground water table is connected to rivers but experiences a delayed response to flood waters. Ground water rises in a flood event.

# Flooding 101

Evaluation Process




**River Cross Section at Skunk River (below confluence with Squaw Creek)**

Evaluation Process

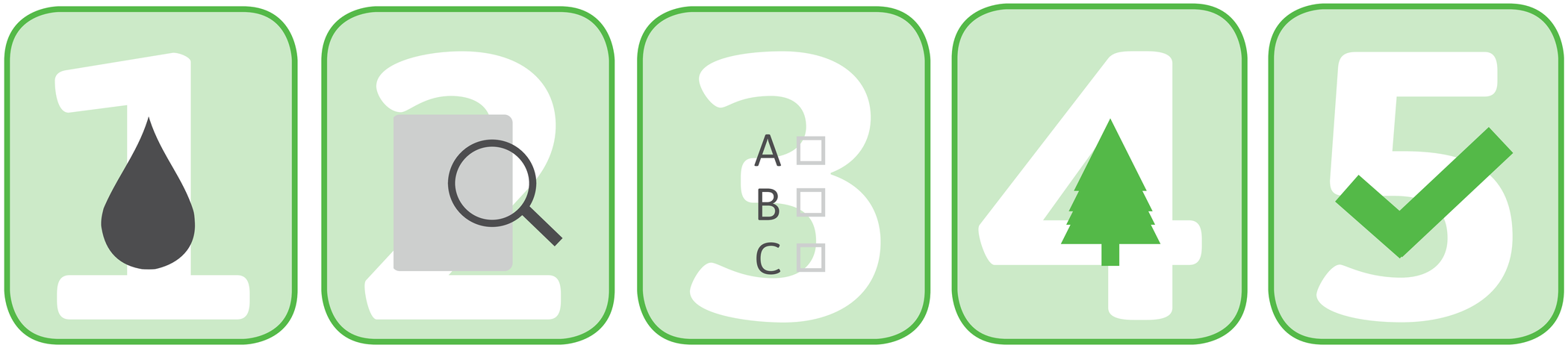
1 2 3 4 5

# Flood Hydrology

The study team updated flood magnitudes and frequencies by engineering and statistical calculations and reviewed and updated flood maps.

| USGS Gage | Source | Annual flood-probability discharge (cfs) | | | |
|---|---|---|---|---|---|
| | | 10-percent | 2-percent | 1-percent | 0.2-percent |
| South Skunk River near Ames, IA | Updated FFA | 6,800 | 10,200 | 11,600 | 14,900 |
| | FEMA Effective Flows | 6,280 | 9,000 | 10,100 | 12,600 |
| Squaw Creek at Ames, IA | Updated FFA | 8,260 | 15,800 | 20,000 | 32,600 |
| | FEMA Effective Flows | 7,570 | 13,700 | 17,000 | 26,300 |
| South Skunk River below Squaw Creek near Ames, IA | Updated FFA | 14,500 | 24,100 | 28,900 | 41,800 |
| | FEMA Effective Flows | 12,700 | 19,700 | 23,000 | 31,400 |

# Evaluation Process



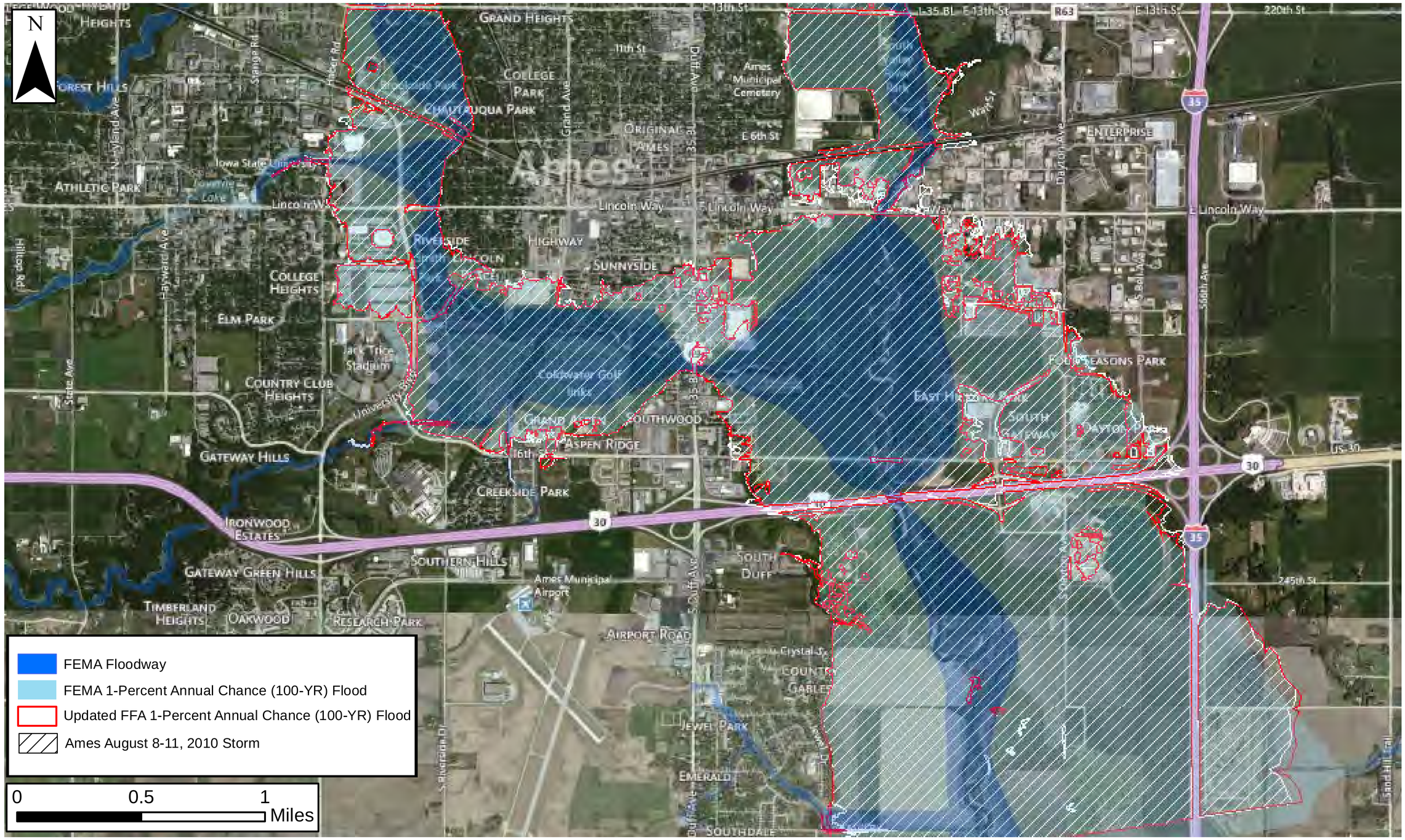

Since we last met in November, we conducted the Detailed Screening Process of Flood Mitigation Alternatives and Strategies. Criteria included:

- Level of Protection Provided
- Project Cost
- Environmental Impacts
- Benefit Cost Analysis

CITY OF Ames™

# City of Ames
# Flood Mitigation Study

## 1% Annual Chance FEMA Floodplain, 1% Annual Chance Updated FFA Floodplain and Ames August 8-11, 2010 Flood Extent




## Confluence of Squaw Creek and Skunk River

* Approximate boundaries based on modeled inundation not actual inundation from the 2012 flood event

Evaluation Process

1 2 3 4 5

# Transposed Rainstorms

- **Upper Iowa River, Iowa, June 7-8, 2008**
  10.5 inches in 30 hours
- **Ames, Iowa, August 8-11, 2010**
  10 inches
- **Lake Delhi, Iowa, Dam Failure Event, July 24, 2010**
  13 inches in 48 hours
- **Ames, Iowa, August 8-11, 2010**
  *with Transposed 2nd Night of Rainfall*
  20% more rainfall
- **Dubuque, Iowa (Galena, Illinois), July 27-28, 2011**
  11+ inches of rain in 13 hours, 0.1% annual chance rainfall (1,000 year rainfall)

**Upper Iowa**
(77,000 acre-ft of runoff )

**Ames**
(69,000 acre-ft of runoff )

**Lake Delhi Storm**
(120,000 acre-ft of runoff )

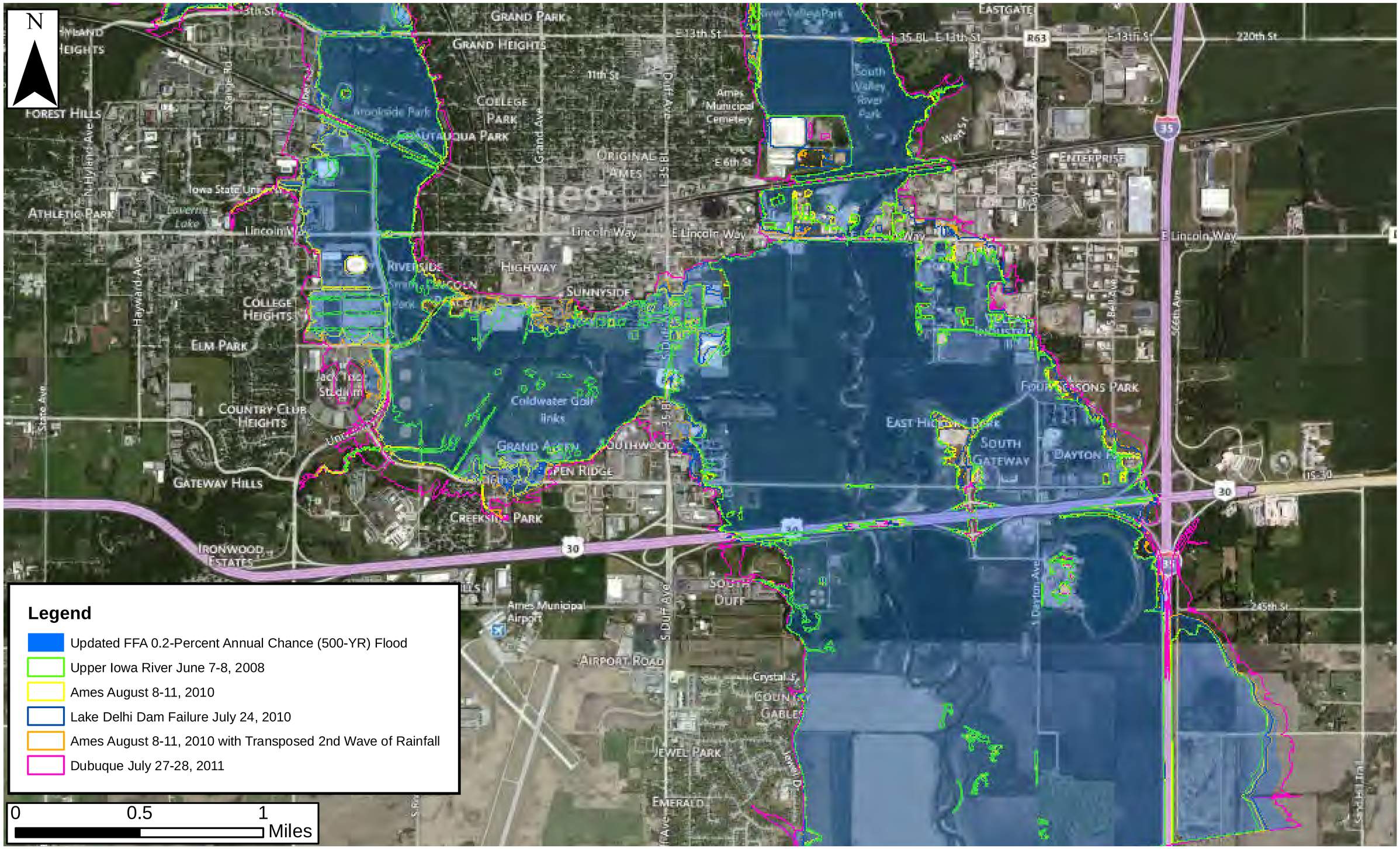
**Ames - Transposed**
(187,000 acre-ft of runoff )

**Dubuque**
(103,000 acre-ft of runoff )

CITY OF ames™

# City of Ames
# Flood Mitigation Study

## Flood Boundaries from Transposed Rainstorms




## Confluence of Squaw Creek and Skunk River

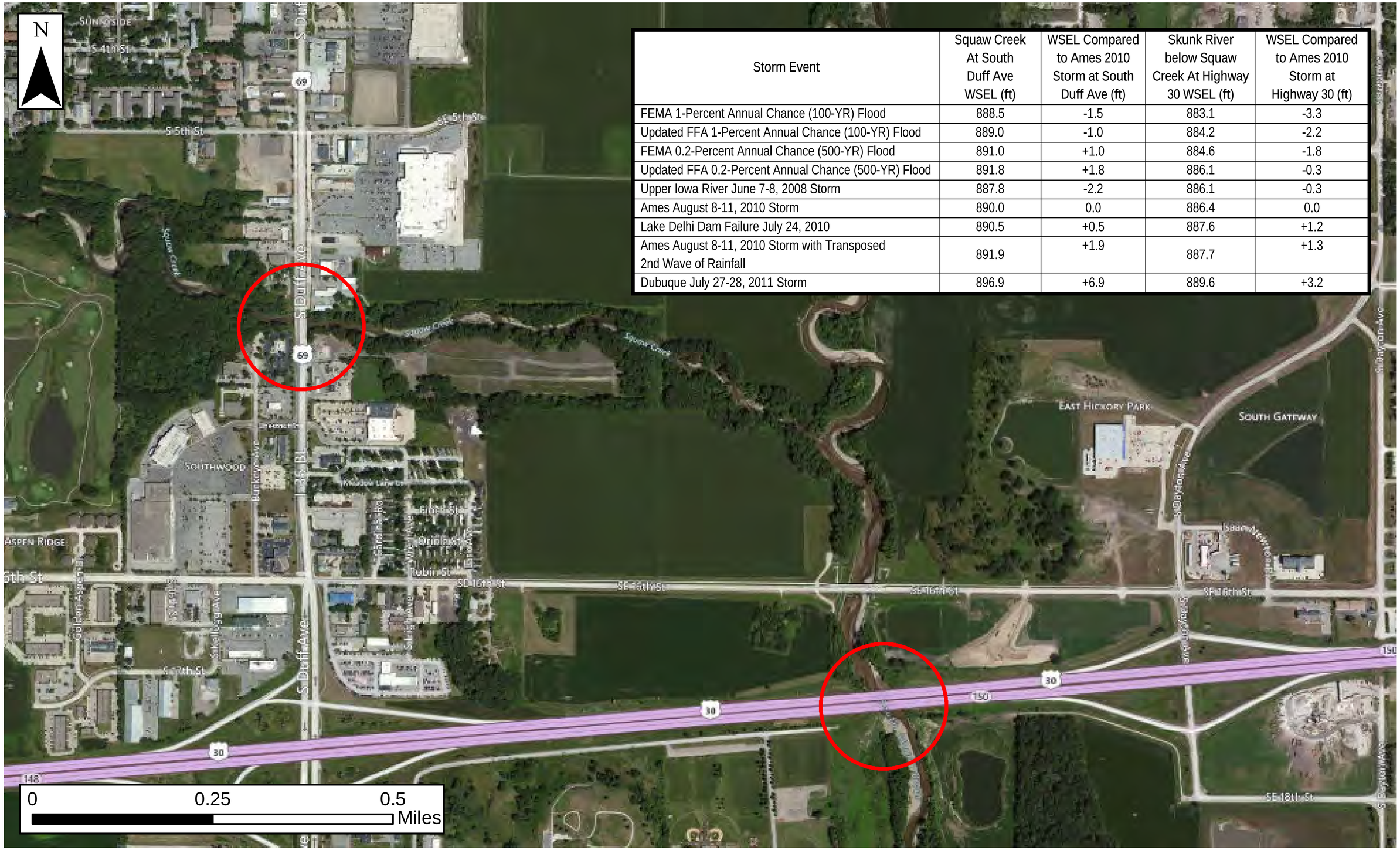
* Approximate boundaries based on modeled inundation

CITY OF ames™

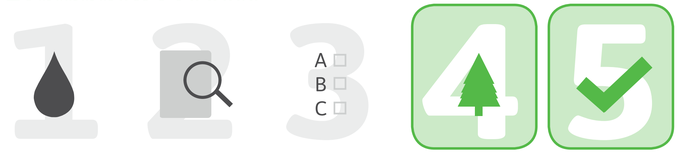
# City of Ames
# Flood Mitigation Study

## Water Surface Elevation Comparison

| Storm Event | Squaw Creek At South Duff Ave WSEL (ft) | WSEL Compared to Ames 2010 Storm at South Duff Ave (ft) | Skunk River below Squaw Creek At Highway 30 WSEL (ft) | WSEL Compared to Ames 2010 Storm at Highway 30 (ft) |
|---|---|---|---|---|
| FEMA 1-Percent Annual Chance (100-YR) Flood | 888.5 | -1.5 | 883.1 | -3.3 |
| Updated FFA 1-Percent Annual Chance (100-YR) Flood | 889.0 | -1.0 | 884.2 | -2.2 |
| FEMA 0.2-Percent Annual Chance (500-YR) Flood | 891.0 | +1.0 | 884.6 | -1.8 |
| Updated FFA 0.2-Percent Annual Chance (500-YR) Flood | 891.8 | +1.8 | 886.1 | -0.3 |
| Upper Iowa River June 7-8, 2008 Storm | 887.8 | -2.2 | 886.1 | -0.3 |
| Ames August 8-11, 2010 Storm | 890.0 | 0.0 | 886.4 | 0.0 |
| Lake Delhi Dam Failure July 24, 2010 | 890.5 | +0.5 | 887.6 | +1.2 |
| Ames August 8-11, 2010 Storm with Transposed 2nd Wave of Rainfall | 891.9 | +1.9 | 887.7 | +1.3 |
| Dubuque July 27-28, 2011 Storm | 896.9 | +6.9 | 889.6 | +3.2 |



Evaluation Process




# Flood Mitigation Alternatives & Strategies

## Storage

- Centralized Flood Storage
- Regional Flood Storage
- Floodplain Storage
- Conservation Measures in Watershed

## Protection

- Flood Water Diversion
- Conveyance Improvements
- Levee along Skunk River
- Levee along Squaw Creek

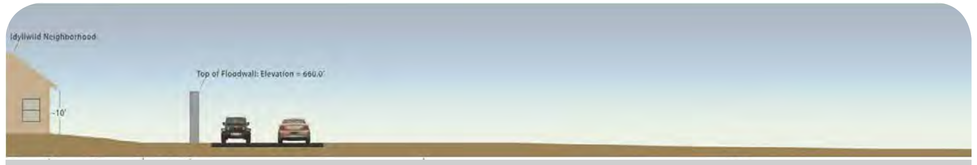
## Non-Structural

- Do Nothing
- Property Buyouts
- Flood Plain Ordinance Modification

Evaluation Process

1 2 3 4 5

# Flood Mitigation Alternatives & Strategies

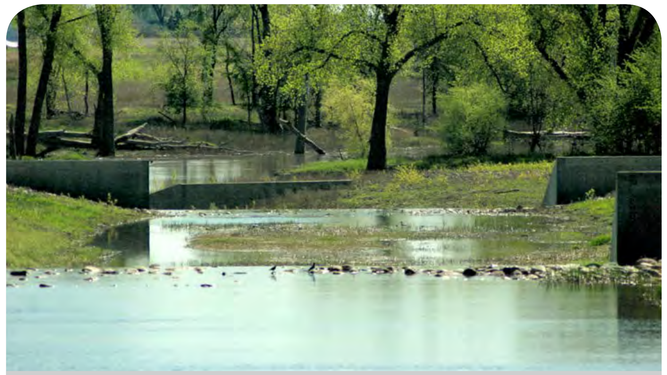



Floodwall


Levee with Roadway

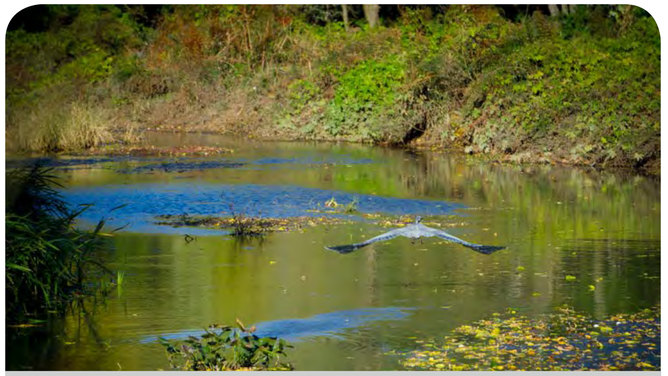
Floodwall

Levee with Roadway



Diversion

Dry Reservoir



Wetlands Restoration

Reservoir

Evaluation Process

# Screening Criteria

The following criteria were used to evaluate flood mitigation alternatives and strategies.

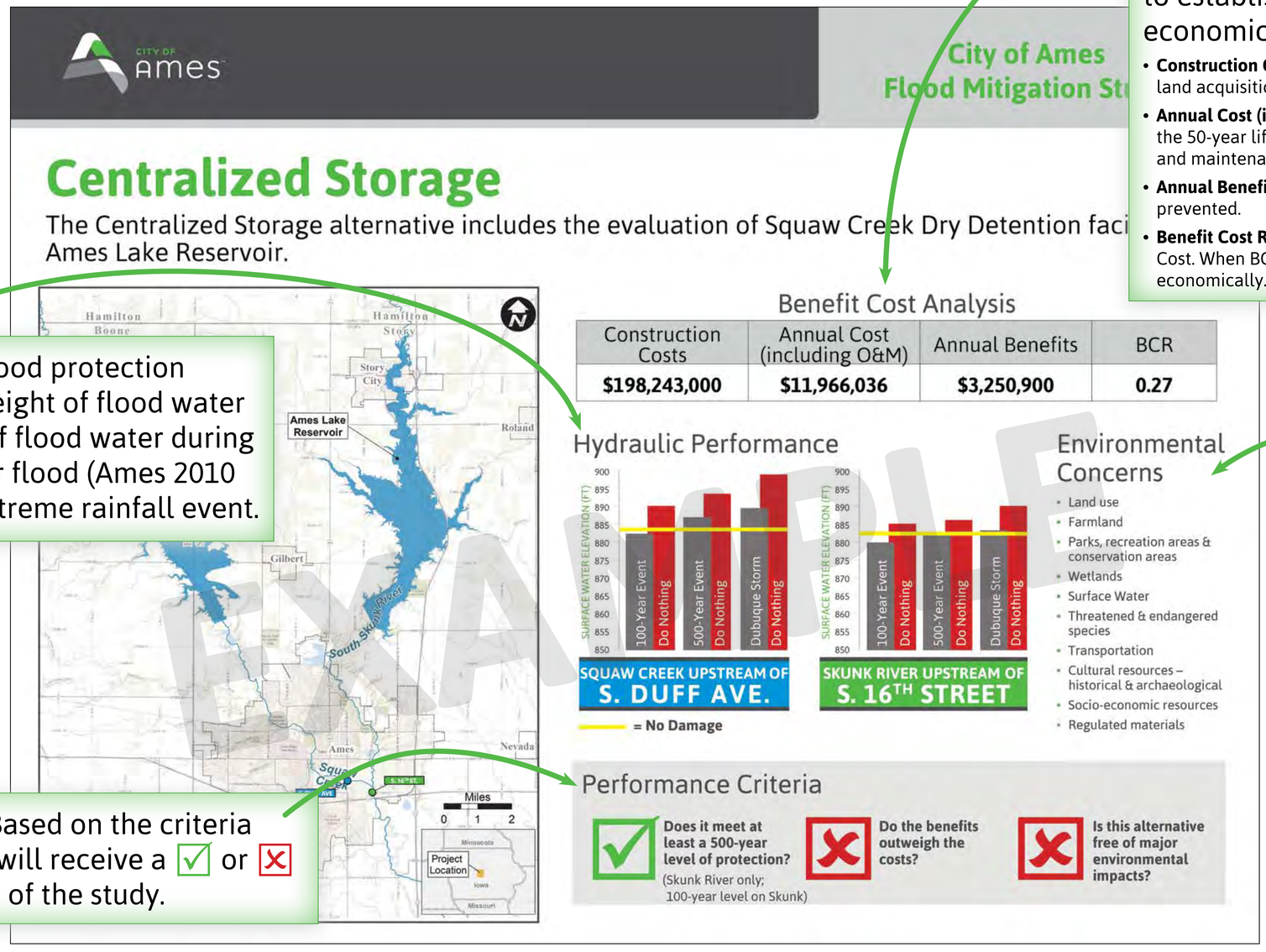
**Benefit Cost Analysis –** Estimates and totals the equivalent dollar value of the benefits and costs to the community to establish whether projects are economically worthwhile.

- **Construction Costs** – Final project cost including construction, land acquisition, and transportation relocations.
- **Annual Cost (including O&M)**– Annual cost of the project over the 50-year life of the project including capital costs, operation and maintenance costs.
- **Annual Benefits** – Annual dollar value of property damage prevented.
- **Benefit Cost Ratio (BCR)** – Annual Benefits divided by Annual Cost. When BCR is greater than 1, the project is justified economically.

**Hydraulic Performance –** Flood protection achieved by lowering the height of flood water and reducing the quantity of flood water during the 100-year flood, 500-year flood (Ames 2010 Flood), and the Dubuque extreme rainfall event.

**Performance Criteria –** Based on the criteria above, each alternative will receive a ☑ or ☒ if it meets the objectives of the study.

**Environmental Concerns –** Identifies the main environmental impacts of each alternative or strategy.



CITY OF ames™

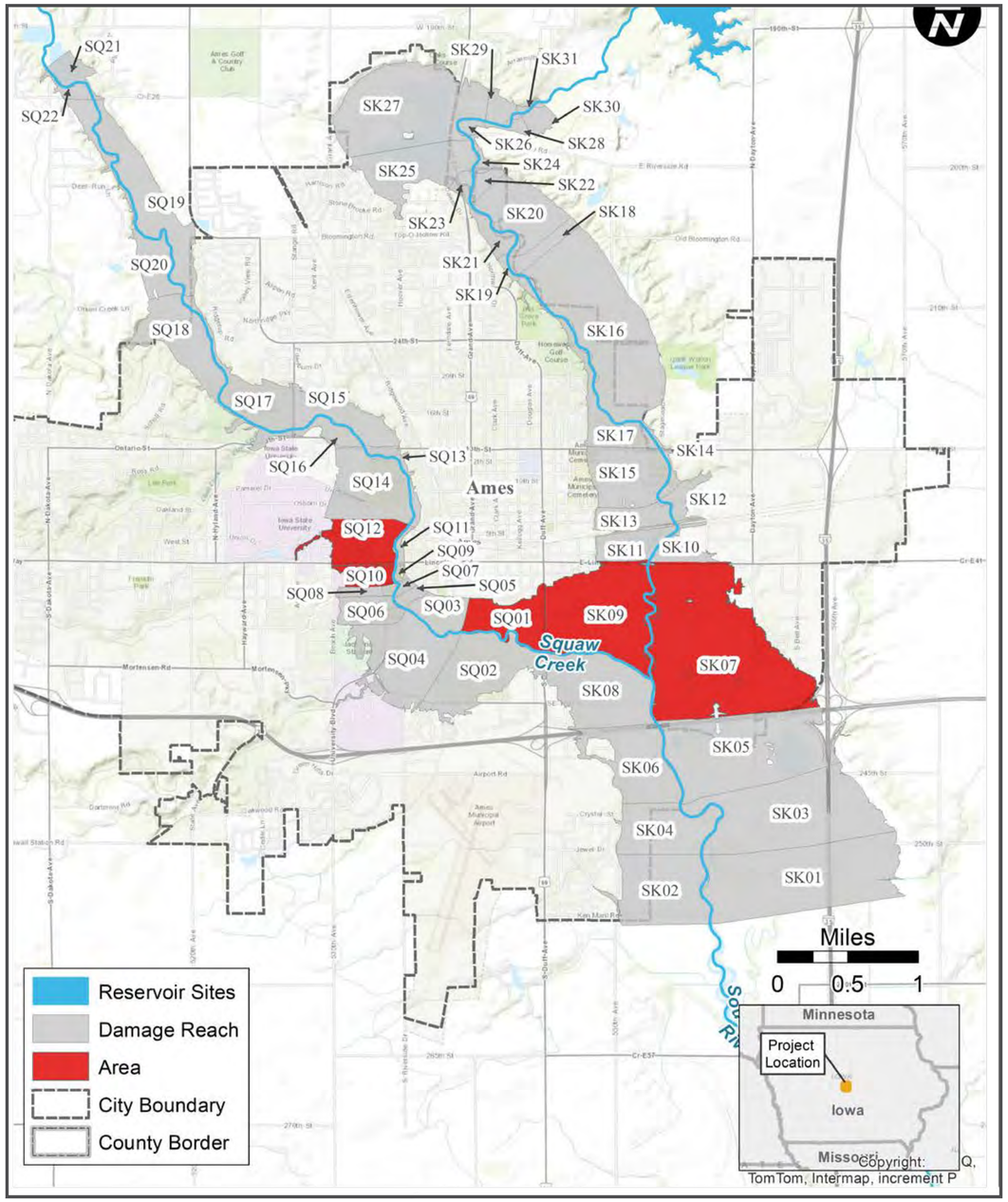
# City of Ames
# Flood Mitigation Study

## Evaluation Process

1 2 3 4 5

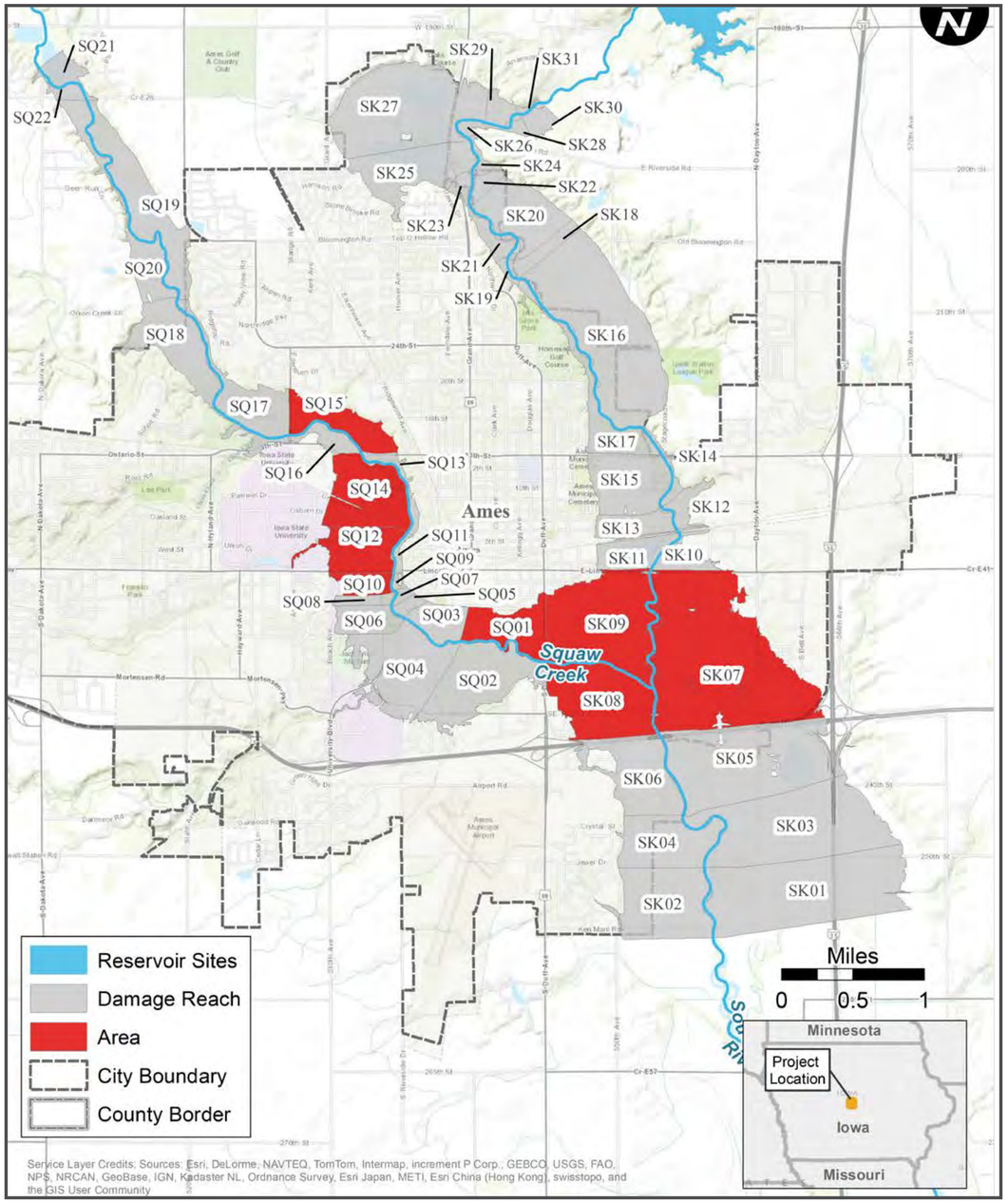
A
B
C

# Flood Damage Areas
## (Red = High $ Damage Area)




## 100-Year Flood Event

**40% of total Structures and 99% of total Property Value**

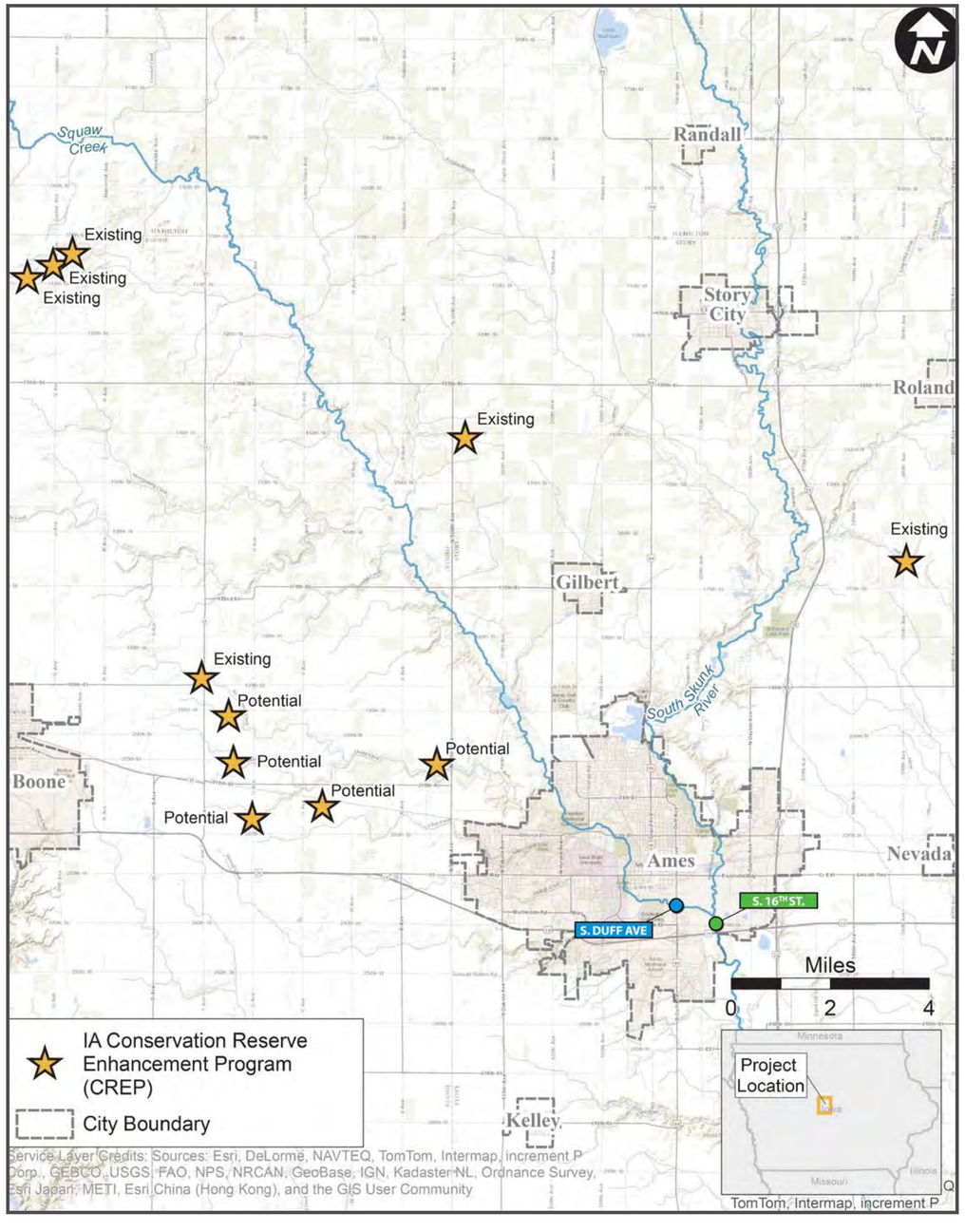



## 500-Year Flood Event

**60% of total Structures and 99% of total Property Value**

# Conservation Measures in Watershed

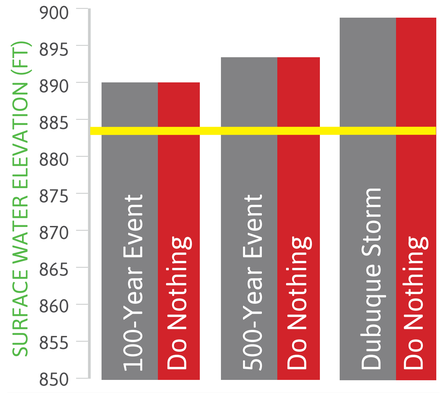
The Conservation Measures in the Watershed alternative evaluates small detention sites that could contribute to flood reduction, and the construction of wetlands administered under the Iowa Department of Agriculture and Land Stewardship Conservation Reserve Enhancement Program.



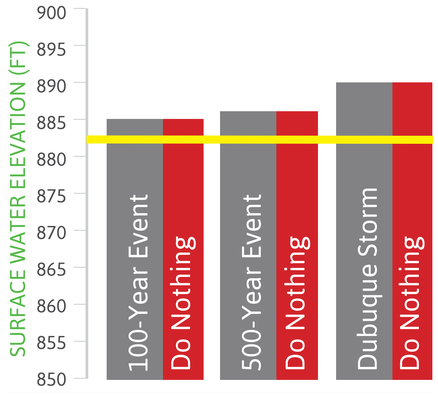

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$2,025,000** | **$122,230** | **$0** | **0.00** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland

## Performance Criteria

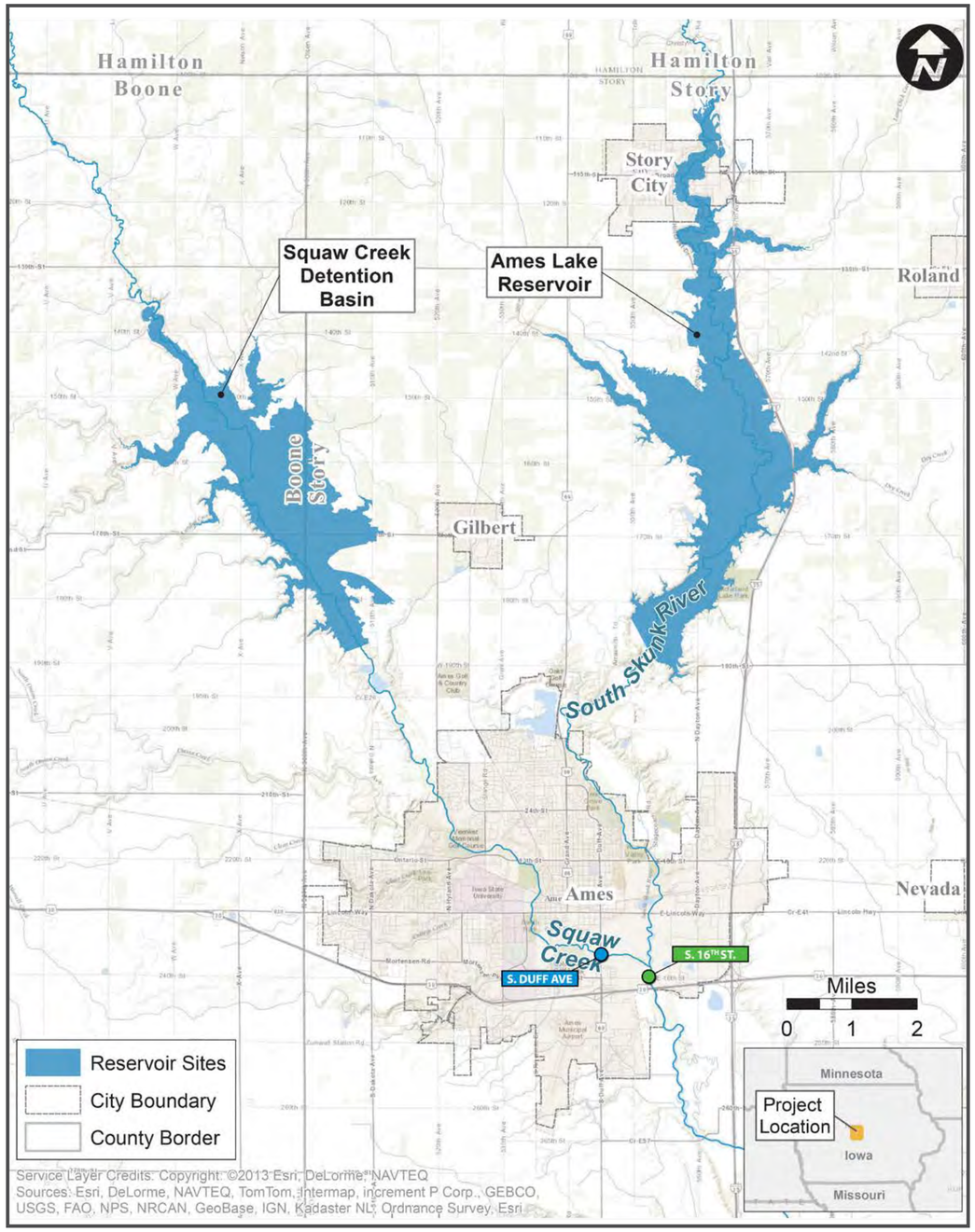
**Does it meet at least a 500-year level of protection?**
(Provide no flood level of reduction)

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Centralized Storage

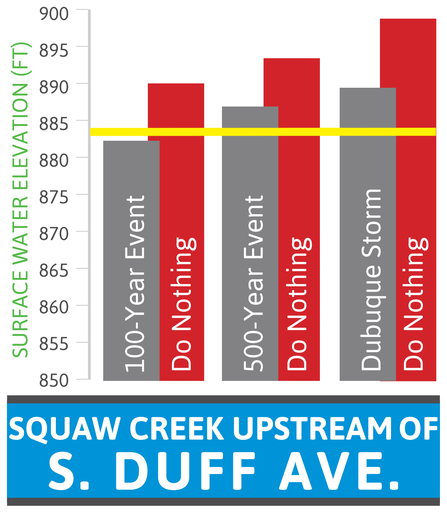
The Centralized Storage alternative includes the evaluation of Squaw Creek Dry Detention facility and Ames Lake Reservoir.



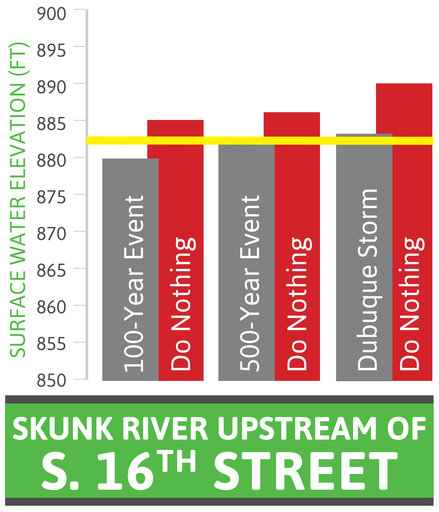

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$198,243,000** | **$11,966,036** | **$3,250,900** | **0.27** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland
- Parks, recreation areas & conservation areas
- Wetlands
- Surface Water
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials

## Performance Criteria

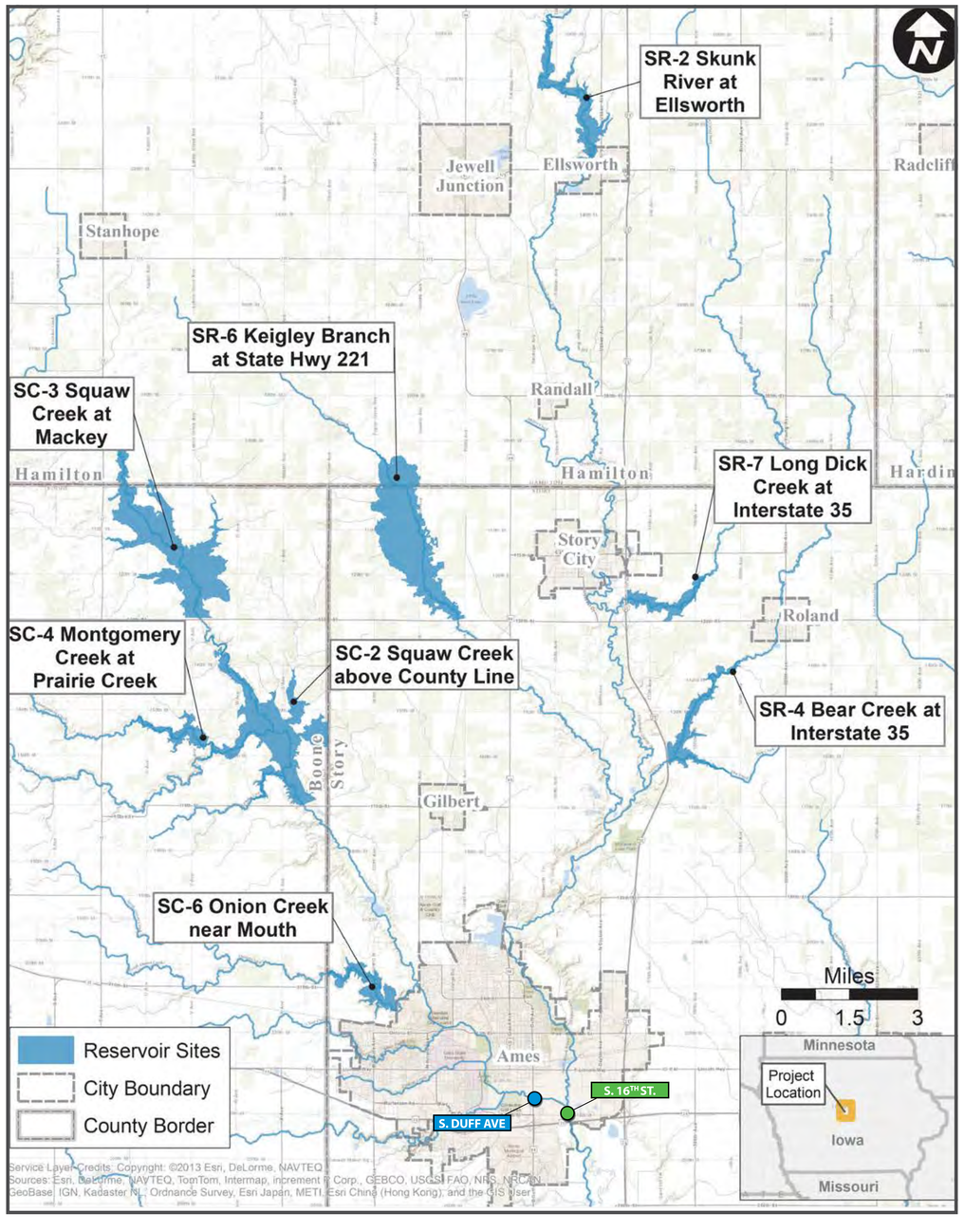
**Does it meet at least a 500-year level of protection?**
(Skunk River only; 100-year level on Squaw)

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Regional Flood Storage

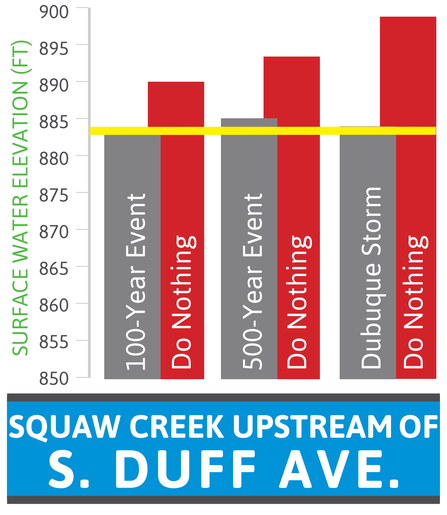
The Regional Flood Storage alternative includes the evaluation of 14 storage sites.



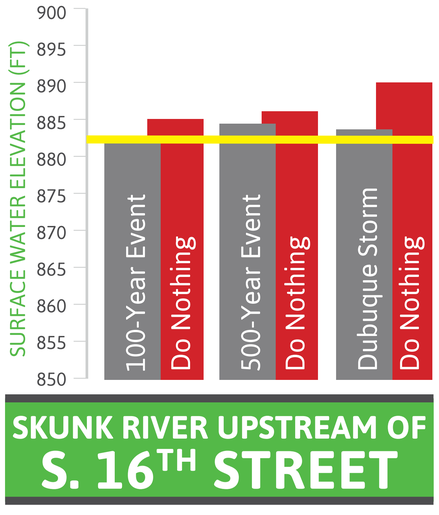

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$145,339,000** | **$8,772,727** | **$3,217,700** | **0.37** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland
- Parks, recreation areas & conservation areas
- Wetlands
- Surface Water
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials

## Performance Criteria

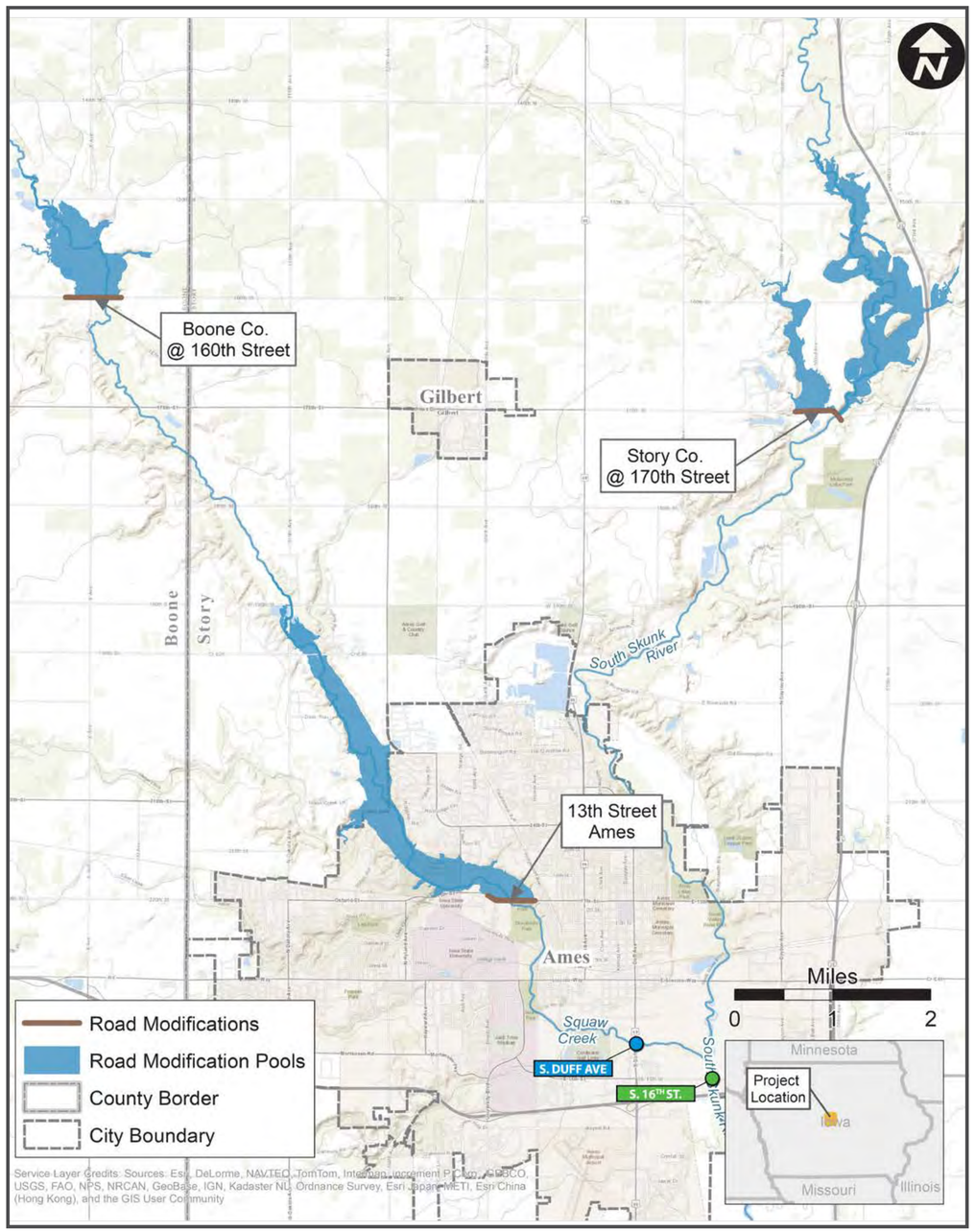
**Does it meet at least a 500-year level of protection?**
(100-year level on Squaw; 100-year level on Skunk )

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Floodplain Storage

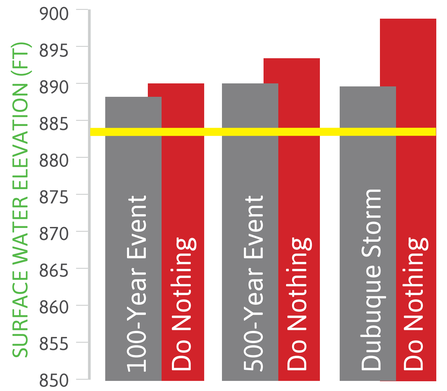
The Floodplain Storage alternative achieves additional floodplain storage by raising 3 roads by 5 feet, and modifying 3 bridges/culverts.



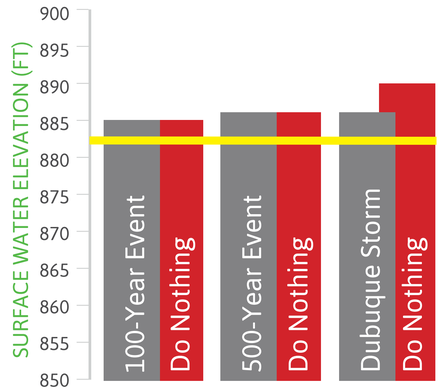

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$41,000,000** | **$2,474,778** | **$2,786,900** | **1.13** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland
- Parks, recreation areas & conservation areas
- Wetlands
- Surface Water
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials
- Environmental justice

## Performance Criteria

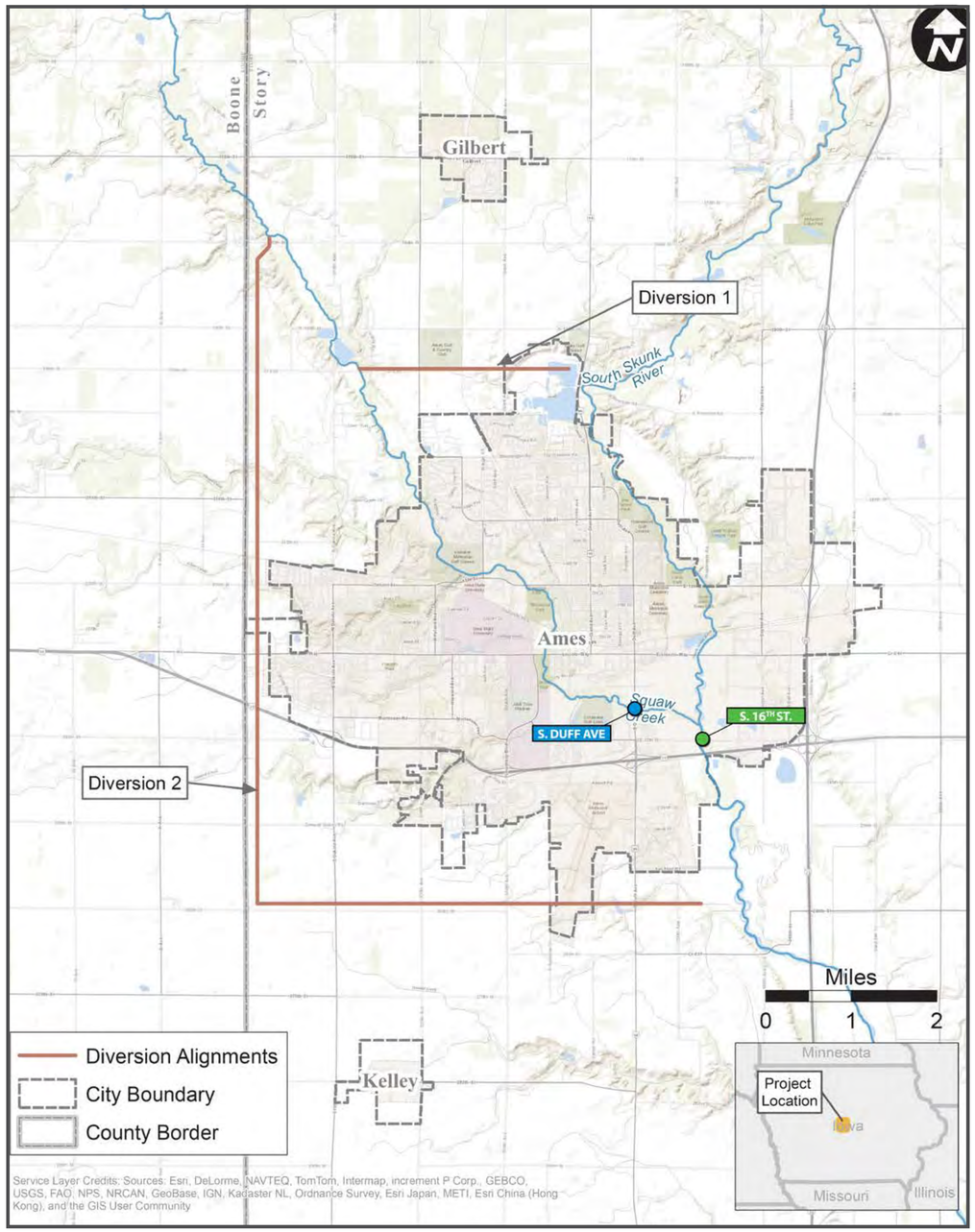
**Does it meet at least a 500-year level of protection?**
(Reduced 100-year flood height of 2-ft. on Squaw)

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Diversion 1

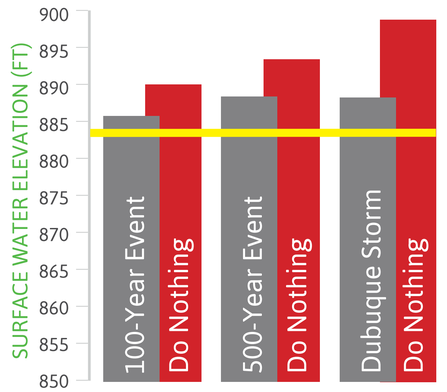
The Diversion 1 alternative includes diverting flood waters around Ames by diverting Squaw Creek at Cameron School Road to the Skunk River via the Ada Hayden Reservoir.



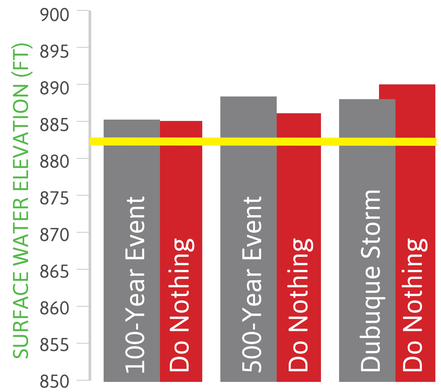

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$49,243,000** | **$2,972,329** | **$3,042,700** | **1.02** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland
- Parks, recreation areas & conservation areas
- Wetlands
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials
- Environmental justice

## Performance Criteria

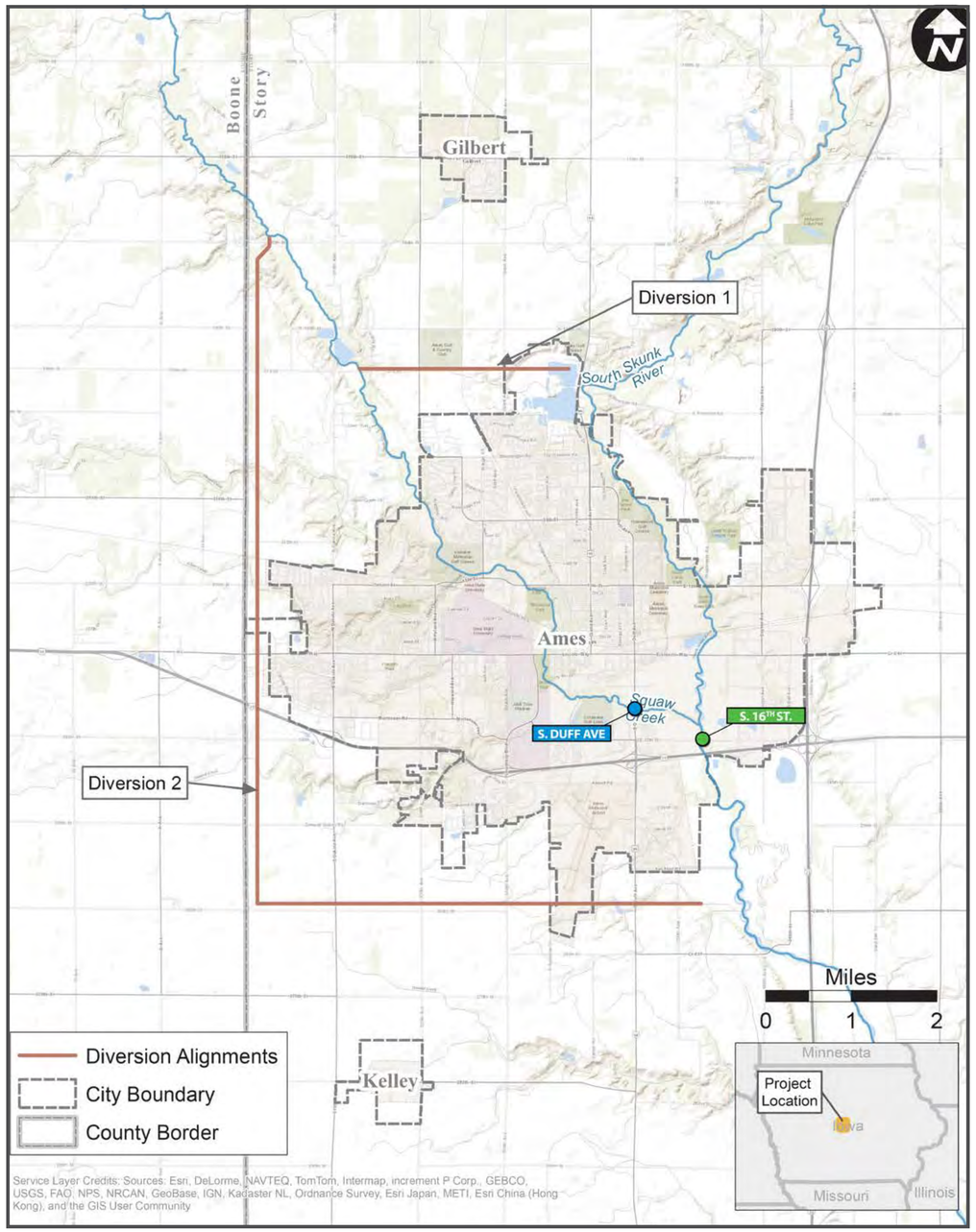
**Does it meet at least a 500-year level of protection?**
(Reduced 100-year flood height of 5-ft on Squaw)

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Diversion 2

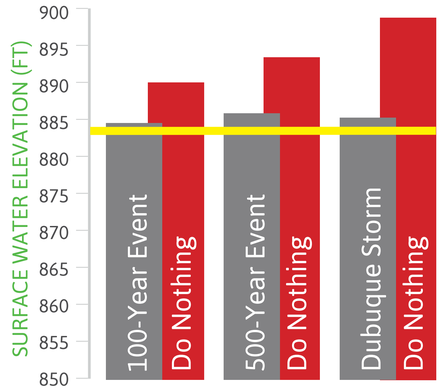
The Diversion 2 alternative includes diverting flood waters around Ames by diverting Squaw Creek upstream from Cameron School Road, to the Skunk River downstream from the Ames Municipal Airport.



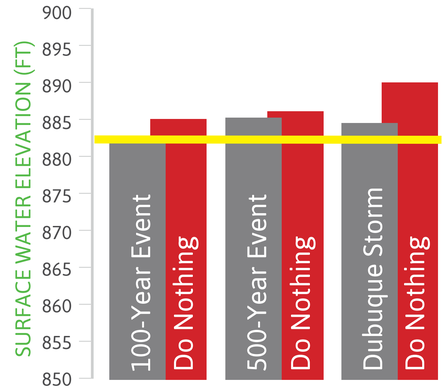

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$1,095,000,000** | **$66,094,687** | **$3,192,300** | **0.05** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland
- Parks, recreation areas & conservation areas
- Wetlands
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials
- Environmental justice

## Performance Criteria

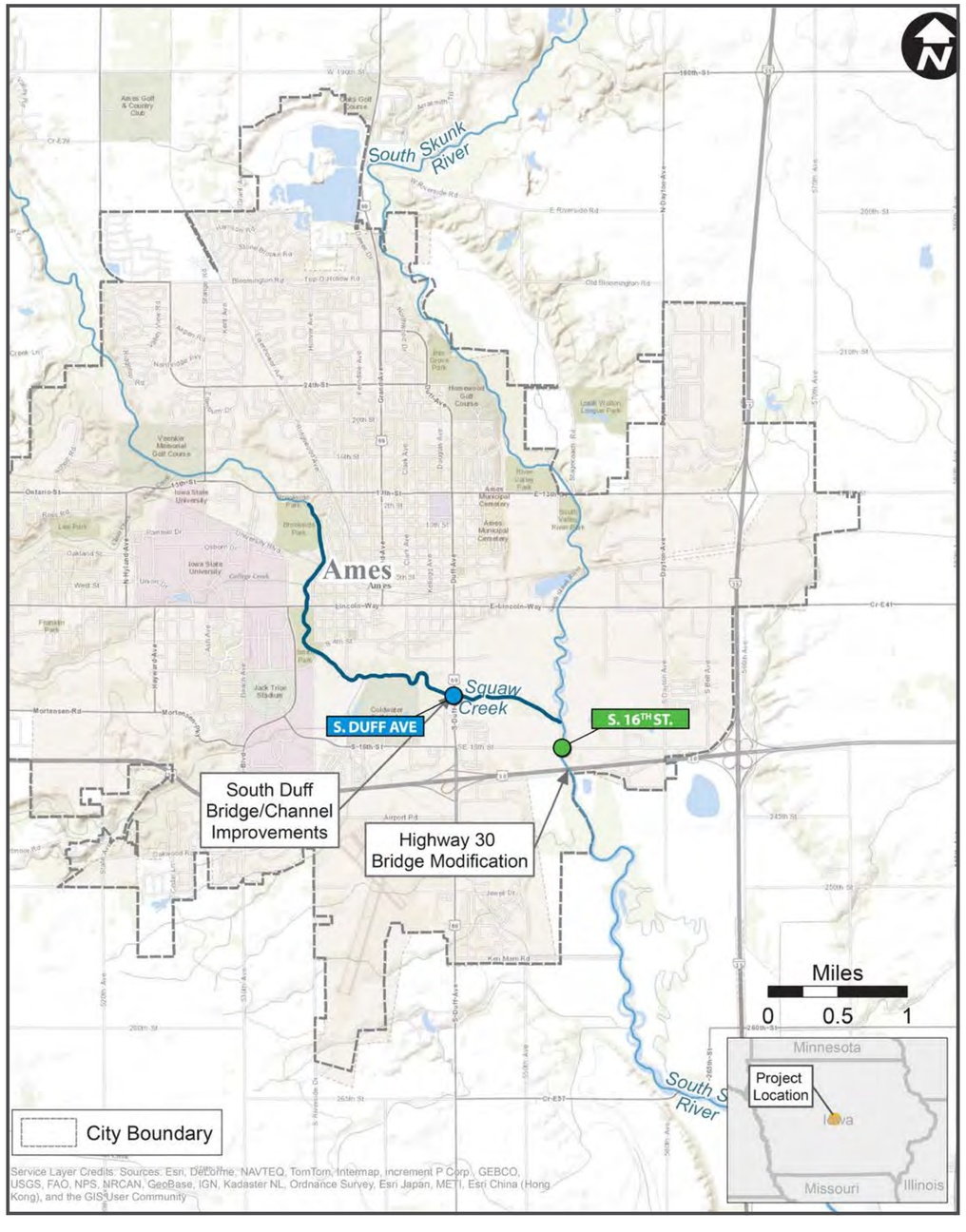
**Does it meet at least a 500-year level of protection?**
(Reduced 100-year flood height of 5-ft on Squaw; 100-year protection on Skunk)

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Conveyance Improvements (Clear Channel)

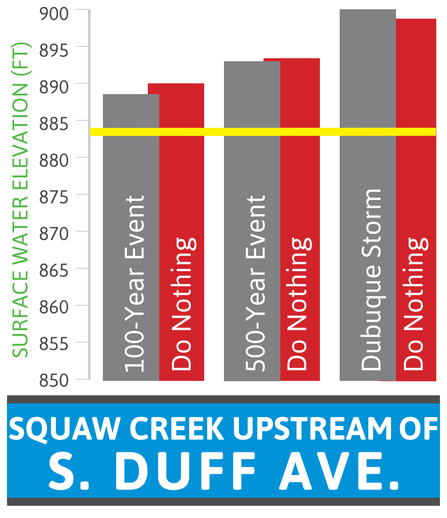
The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.



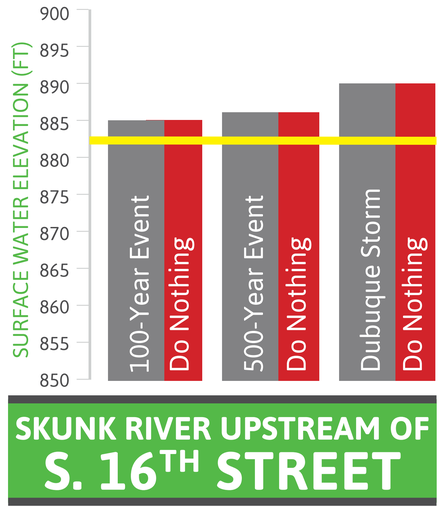

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$2,943,000** | **$177,641** | **$2,436,700** | **13.72** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland
- Surface water
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials

## Performance Criteria

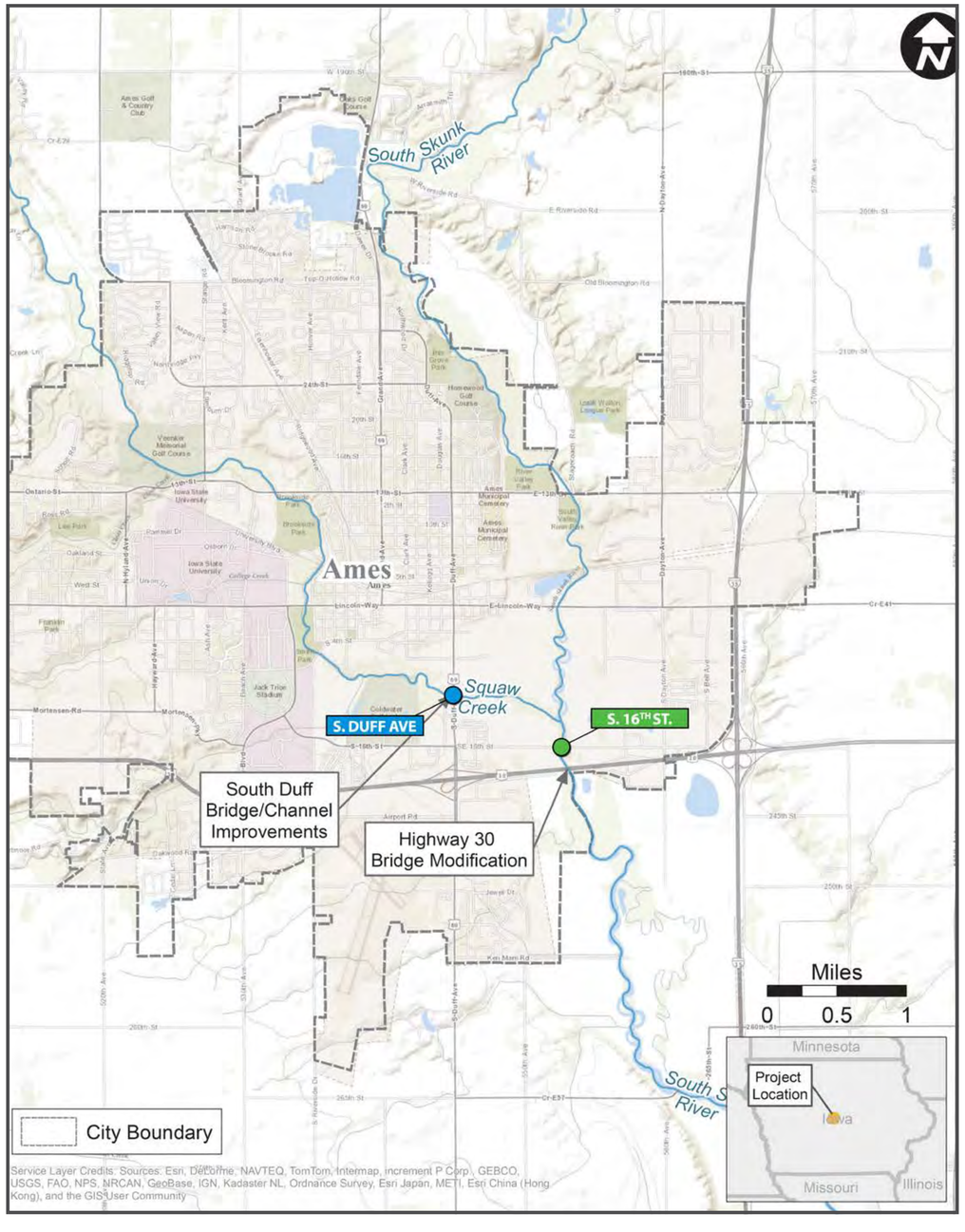
**Does it meet at least a 500-year level of protection?**
(Reduced 100-year flood height of 1-ft. on Squaw)

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Conveyance Improvements (US Hwy 30 Bridge Improvement)

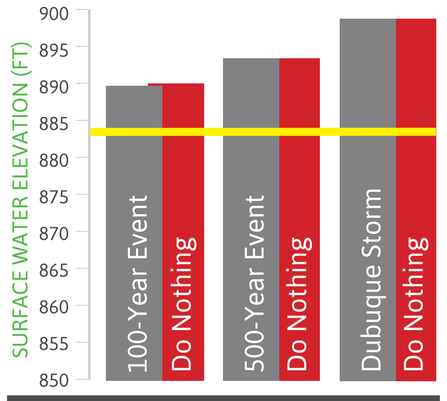
The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.



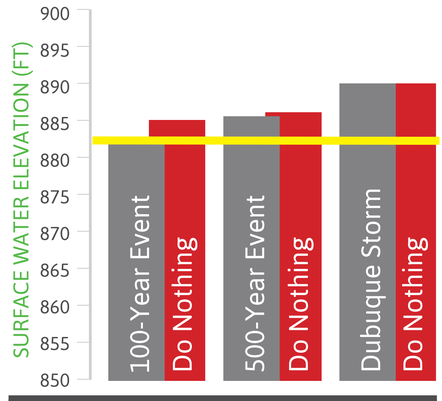

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$7,740,000** | **$467,190** | **$2,097,300** | **4.49** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland
- Surface water
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials

## Performance Criteria

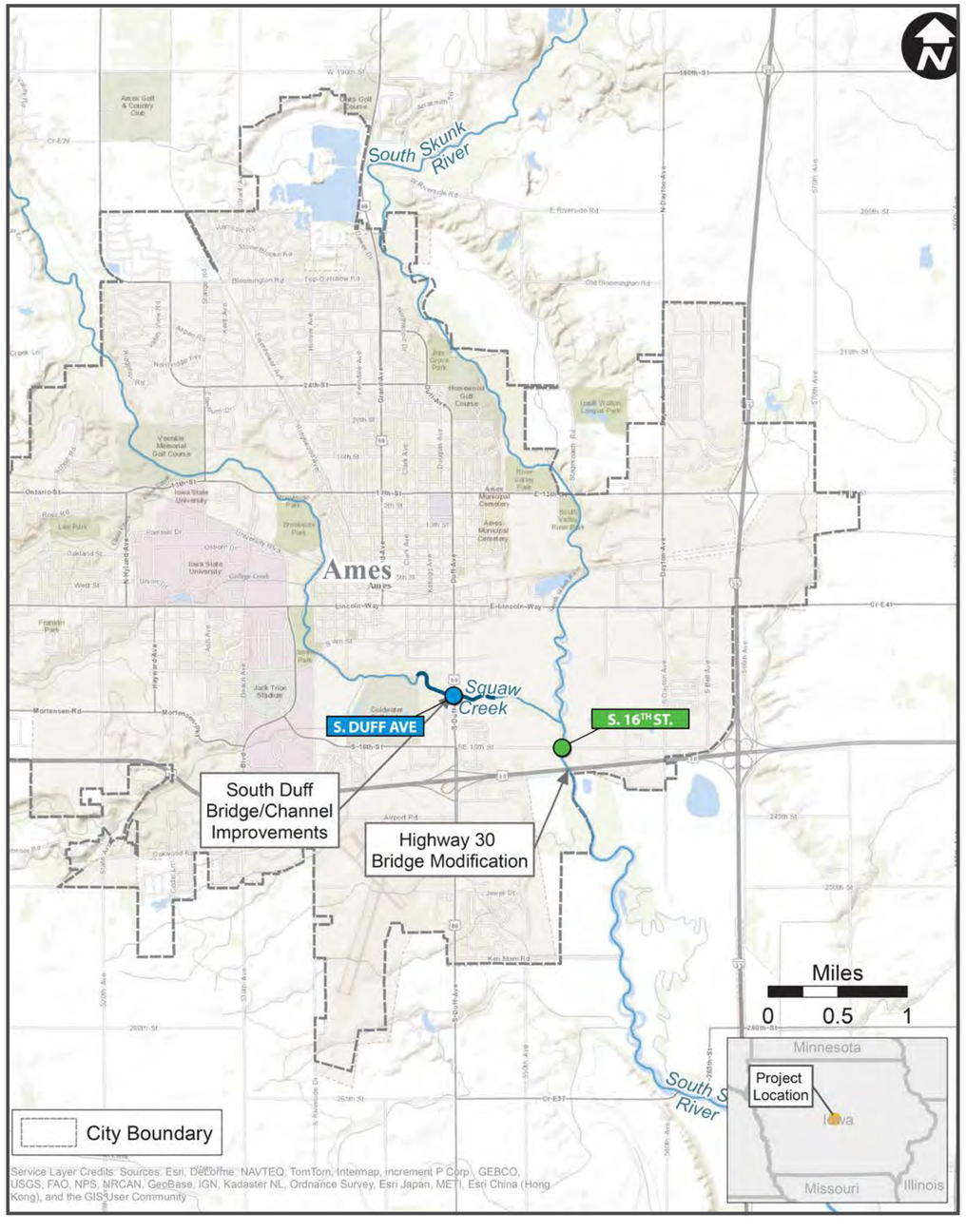
**Does it meet at least a 500-year level of protection?**
(Reduced 100-year flood height of 2.5-ft. on Skunk)

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Conveyance Improvements (South Duff Bridge Improvement & Clear Channel)

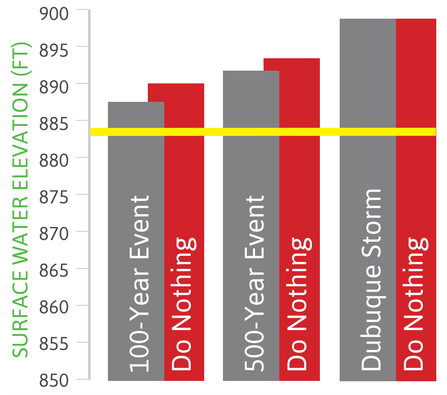
The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions.



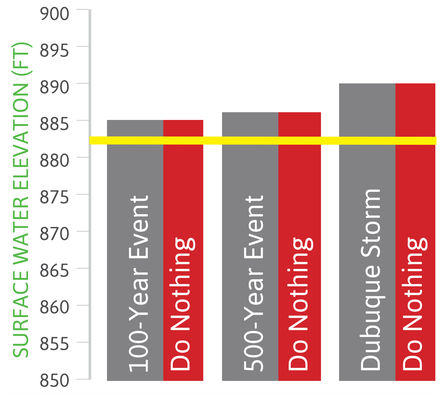

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **$4,715,000** | **$284,599** | **$2,086,900** | **7.33** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Farmland
- Surface water
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials

## Performance Criteria

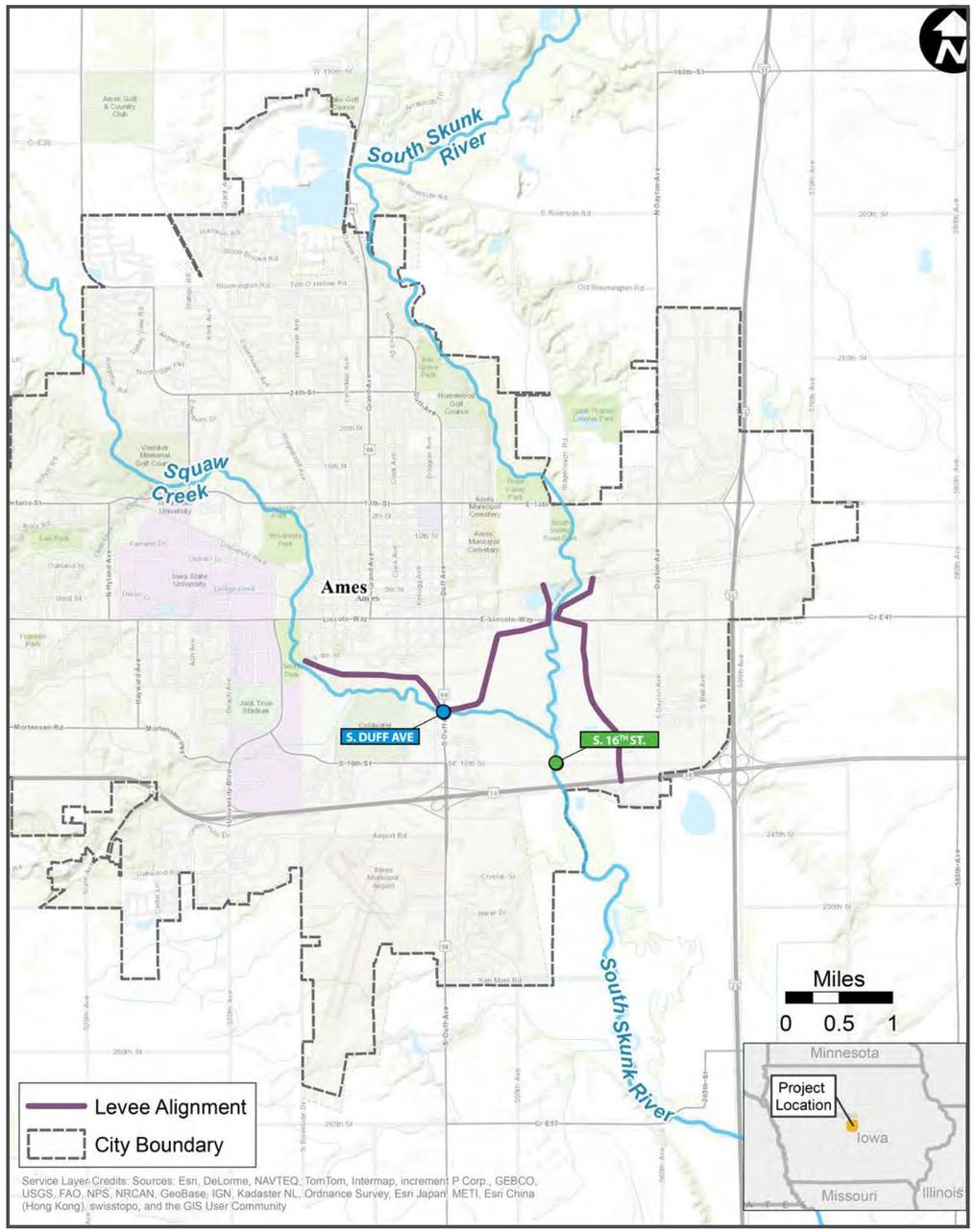
**Does it meet at least a 500-year level of protection?**
(Reduced 100-year flood height of 2-ft on Squaw)

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Levee Protection to 100-Year

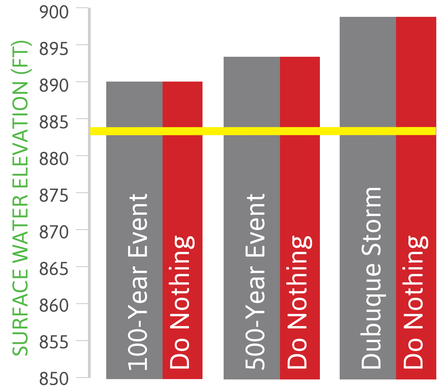
The Levees alternatives evaluates protection to the 100-year flood level protecting property areas along Skunk River and Squaw Creek by constructing a levee (berm/floodwall) combination.



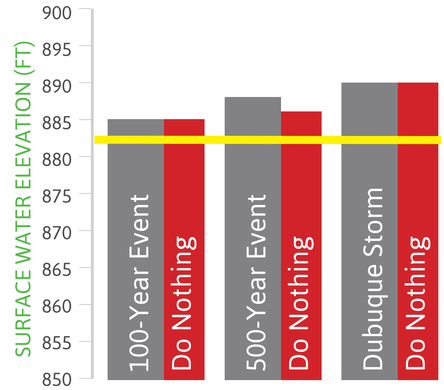

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **Skunk River $4,818,000** | **Skunk River $290,817** | **Skunk River $121,400** | **Skunk River 0.42** |
| **Squaw Creek $6,079,000** | **Squaw Creek $366,931** | **Squaw Creek $174,600** | **Squaw Creek 0.48** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials
- Environmental justice

## Performance Criteria

**Does Skunk River meet at least a 500-year level of protection?**
(The alternative meets the 100-year protection on both Squaw and Skunk)

**Do the benefits outweigh the costs?**

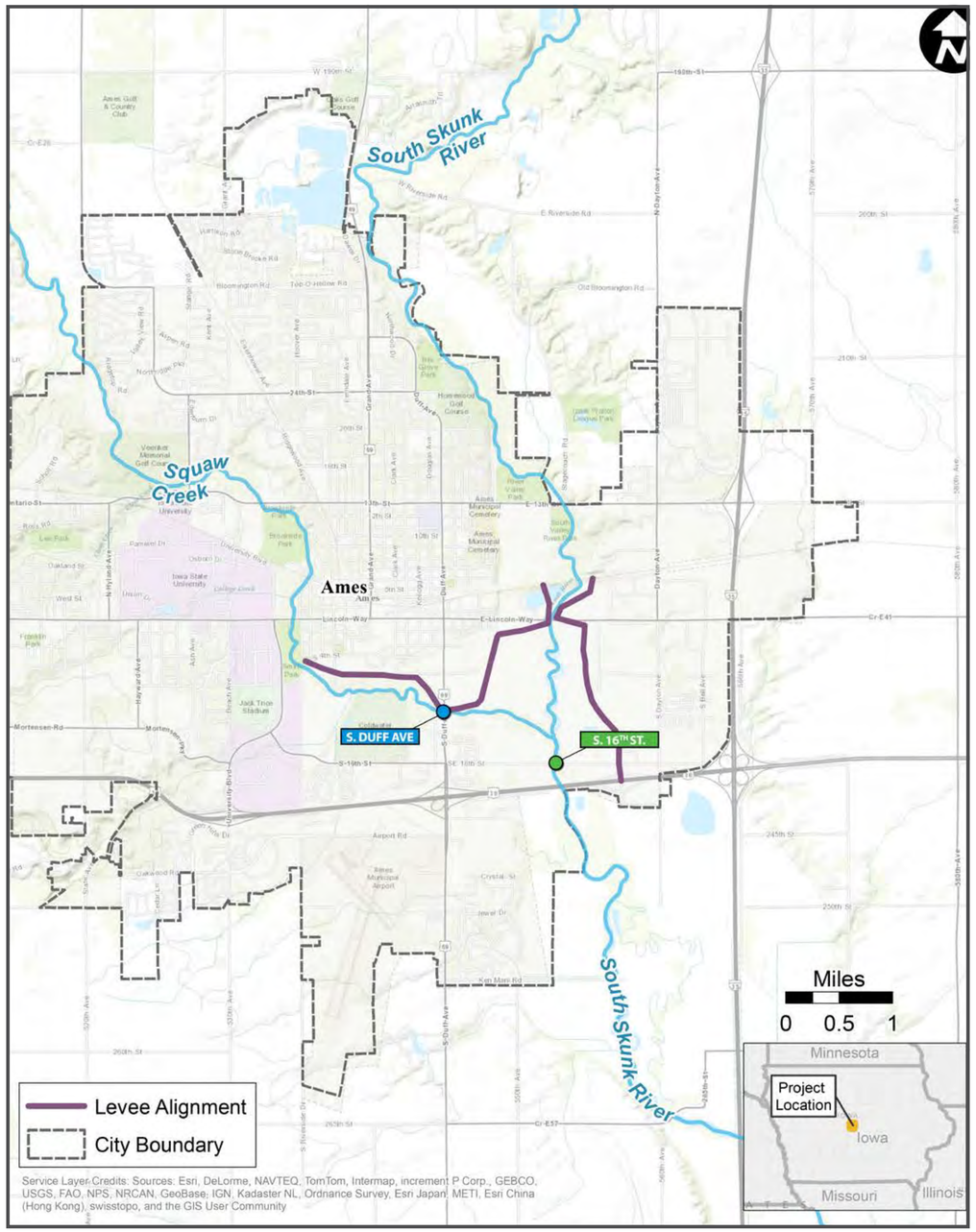
**Is this alternative free of major environmental impacts?**

CITY OF ames

City of Ames
Flood Mitigation Study

# Levee Protection to 500-Year

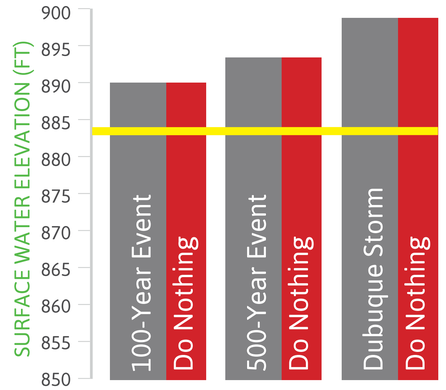
The Levees alternatives evaluates protection to the 500-year flood level protecting property areas along Skunk River and Squaw Creek by constructing a levee (berm/floodwall) combination.



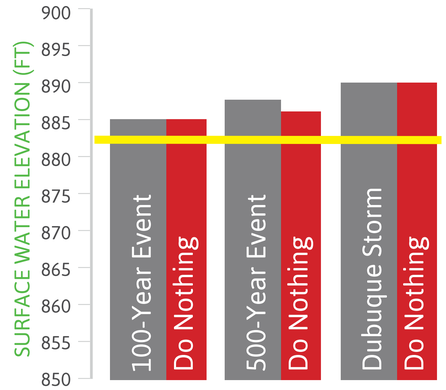

## Benefit Cost Analysis

| Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR |
|---|---|---|---|
| **Skunk River $5,333,000** | **Skunk River $321,902** | **Skunk River $198,100** | **Skunk River 0.62** |
| **Squaw Creek $7,668,000** | **Squaw Creek $462,844** | **Squaw Creek $174,600** | **Squaw Creek 0.38** |

## Hydraulic Performance




**SQUAW CREEK UPSTREAM OF S. DUFF AVE.**




**SKUNK RIVER UPSTREAM OF S. 16TH STREET**

**= No Damage**

## Environmental Concerns

- Land use
- Threatened & endangered species
- Transportation
- Cultural resources – historical & archaeological
- Socio-economic resources
- Regulated materials
- Environmental justice

## Performance Criteria

**Does it meet at least a 500-year level of protection?**

**Do the benefits outweigh the costs?**

**Is this alternative free of major environmental impacts?**

# Environmental Concerns

| Environmental Concerns | Alternatives / Strategies | | | | | | |
|---|---|---|---|---|---|---|---|
| | Conservation Measures in the Watershed | Centralized Flood Storage | Regional Flood Storage | Floodplain Storage | Diversion | Conveyance Improvements | Levees along Skunk River and Squaw Creek |
| **Land Use** | Impacts to Agricultural land. (1,326 acres) | Impacts to residential & agricultural land uses NW of Ames. Residential, agricultural and Public Lands NE of Ames & Story City. Housing developments in Western Story County and Eastern Boone County. Scattered farm residences in both counties. (10,660 acres) | Impacts to residential developments, cemeteries, and agricultural land. (7,355 acres) | Impacts to residential area (ISU housing), recreation land, parks and conservation land, and agricultural land uses. (709 acres) | Impacts to small areas of residential and commercial, southern edge of Ames Municipal Airport, recreation, conservation, and agricultural land. (1,370 acres) | Impacts to small areas of commercial land adjacent to South Duff Road Bridge, open space, agricultural land adjacent to US 30 bridge. (70 acres) | Impacts to commercial and agricultural land. (10 acres) |
| **Farmland** | Impacted. | Impacted. | Impacted. | Impacted. | Impacted. | Impacted. | No impact. |
| **Parks, Recreation Areas & Conservation Areas** | No impact. | Impacts to Story City Park, River Bend Municipal Golf Course, 12 conservation and recreation areas between Ames and Story City. | Impacts to the Bob Pyle Marsh WMA. | Impacts to Skunk River Greenbelt WMA, Crooked Bend WMA, Bear Creek Area, and Soper's Mill County Park, Veenker Memorial Golf Course, part of the Ames High Prairie State Preserve, the Furman Aquatic Park in Ames, and the ISU Stable Run Disc Golf Course. | Would divide the Ames Golf and Country Club and the Ada Hayden Heritage Park by creating a channel through these areas. | No impact. | No impact. |
| **Wetlands** | Would increase existing wetland conservation areas in partnership with the Iowa Dept of Agriculture and Land Stewardship. | Impacts to approximately 840 acres. | Impacts to approximately 800 acres. | Impacts to approximately 540 acres. | Impacts to approximately 10 acres. | No impact. | No impact. |
| **Surface Water** | No impact. | Impacts to approximately 15 miles of Skunk River and approximately 7.5 miles of Squaw Creek. | Impacts to approximately 5.5 miles of Skunk River; approximately 5.3 miles of the Keigley Branch of the Skunk River; approximately 3.0 miles of Bear Creek, and approximately 2.8 miles of Long Dick Creek. This alternative would also flood approximately 10.5 miles of Squaw Creek, approximately 2.7 miles of Montgomery Creek, and approximately 2.6 miles of Onion Creek. | Impacts to approximately 6.5 miles of Squaw Creek and approximately 2.5 miles of Skunk River. | No impacts to existing streams; however construction of these diversions would create a total of 17 miles of new stream channel. Construction of these diversions would affect flow in both the Skunk River and Squaw Creek. | Impacts to short stretches of stream channel near the South Duff Bridge and the Highway 30 Bridge during construction. | No impact. |
| **Threatened & Endangered Species** | No impact. | Potential impacts. | Potential impacts. | Potential impacts. | Potential impacts. | Potential impacts. | Potential impacts. |
| **Cultural Resources – Historical & Archaeological** | No impact. | Impacts to 93 archaeological sites and 17 historic structures with the construction of SR-1, and 17 archaeological sites and 46 historic structures with the construction of SC-1. | Impacts to 18 archaeological sites and 22 historic structures. | Impacts to 66 archaeological sites and 5 historic structures. | Impacts to 9 archaeological sites and 7 historic structures. | Impacts to 3 archaeological sites and 2 historic structures. | Impacts to 3 archaeological sites and 24 historic structures. |
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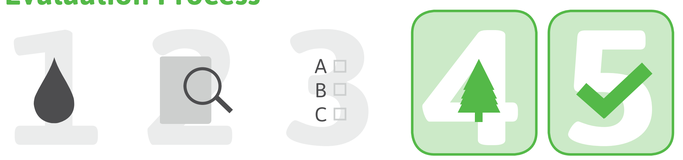
| **Environmental Justice** | No impacts. | Impacts to minorities, low-income, elderly and LEP populations. | No impacts. | Impacts to minorities, low-income, elderly and LEP populations. | Impacts to minorities, low-income, elderly and LEP populations. | No impact. | Impacts to minorities, low-income, elderly and LEP populations. |
| **Transportation** | No impacts. | Impacts to US 69, Broad Street in Story City, 130th, 150th, 170th, 180th, and 190th Streets, as well as local roads with the construction of SR-1. Construction of SC-1 would affect 140th, 150th, 160th, 170th, and 180th Streets. Potential impacts to airspace at the Ames Municipal Airport. | Impacts to 100th, 110th, 120th, 130th, 140th, 150th, and 160th Streets, as well as local roads. Potential impacts to airspace at the Ames Municipal Airport. | Impacts to 150th, 160th, 170th, and 190th Streets. Would also require raising the following roads 5 feet and modifying bridges/culverts at these locations: Boone County Road 160 at Squaw Creek, Story County Road 170 at the Skunk River, and 13th Street in Ames at Squaw Creek. Potential impacts to airspace at the Ames Municipal Airport. | Would cut across several roads in Ames, including US 30, Lincoln Way, South Duff Avenue, George Washington Carver Avenue, 180th Street, 520th Avenue, and 530th Avenue. Bridges would need to be constructed, or in some cases, reconstructed. Potential impacts to the UPRR tracks and airspace at the Ames Municipal Airport. | Temporary impacts to roads within the Project Area. Would also require the lengthening the Hwy 30 Bridge over the Skunk River and the South Duff Bridge over Squaw Creek. Impacts to the approach lighting at the southern end of the runway at Ames Municipal Airport and potential impacts to the airspace. | Temporary impacts to roads within the Project Area. Potential impacts to the UPRR tracks and airspace at the Ames Municipal Airport. |
| **Noise** | Construction of any alternatives selected would be temporary and intermittent. It is not anticipated that any acceptable noise levels would be generated by construction of the selected alternatives. | | | | | | |
| **Regulated Materials** | No impacts. | 15 leaking UST's within 1 mile of SR-1. 1 leaking UST is within the proposed footprint of SR-1. | 15 leaking UST's, 1 Iowa contaminated site and 1 non-NPL Superfund site. | 10 leaking UST sites, 1 non-NPL Superfund site, and 1 Iowa contaminated site within 1 mile of the 13th Avenue site in Ames. | 5 leaking USTs within 1 mile. | 31 leaking UST sites, 2 non-NPL Superfund site, and 6 no leaking USTs within the proposed footprint s are within 1 mile. | 45 leaking UST sites, 6 non-NPL Superfund sites, and 6 Iowa contaminated sites are within 1 mile. 1 leaking UST is located within the footprint of the Squaw Creek levee. |
| **Air Quality** | No impacts. | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. | Would generate minor amounts of emissions from construction equipment and fugitive dust from soil disturbance. | No impacts. |
| **Is this alternative free of major environmental impacts?** | ☑ | ☒ | ☒ | ☒ | ☒ | ☑ | ☑ |

**Key:** ☑ = Yes; ☒ = No

Evaluation Process



# Get Involved!

## We want to hear from you:

- Complete a comment form today
- Visit us at **www.cityofames.org** and click the Flood Mitigation Study link
- Email us at **amesfloodstudy@cityofames.org**
- Send mail to:

  **City of Ames**

  **Attn: John Dunn**

  **300 E. 5th Street**

  **Ames, IA 50010**

Evaluation Process

# Comment Guidelines

- Come up to the podium one person at a time.
- State and spell your name.
- You have 5 minutes to speak, as to ensure that everyone gets the opportunity to be heard.
- Please allow everyone to comment once before commenting a second time.
- Be kind and courteous to all.

CITY OF ames

# City of Ames Flood Mitigation Study

## Welcome!

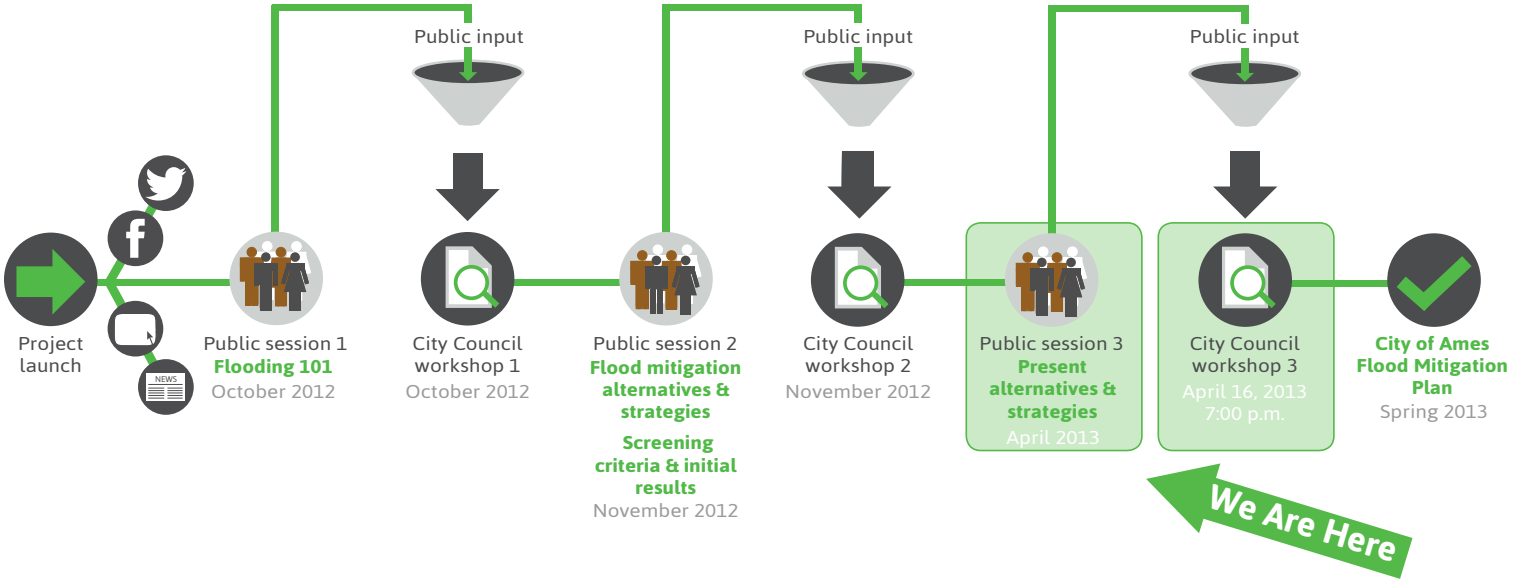
The purpose of this meeting is to discuss the City of Ames Flood Mitigation Study, present the detailed screening evaluation of flood mitigation alternatives and strategies for the Ames Community, and gather feedback on the strategies to present to City Council.

## City of Ames Flood Mitigation Study

The Ames community's location at the confluence of Squaw Creek and South Skunk River has created challenges with flooding over the years. Major floods occurred in 1965, 1975, 1990, twice in 1993, 1996, 2007, 2008, and 2010. The most recent flood was severe and affected many residents and businesses. The flood of 2010 motivated the Ames City Council to pursue the Ames Flood Mitigation Study. The goal of this study is to develop a list of alternatives and strategies to reduce the impact of future flooding on the greater Ames community.

## The Study Process

Information gathered from the public throughout the entire Study Process was used to identify the best alternatives and strategies. As the timeline indicates below, this is your third opportunity to participate in this study.




## Get Involved!

We want to hear from you:

- Complete a comment form today
- Visit us at ***www.cityofames.org*** and click the Flood Mitigation Study link
- Email us at: ***amesfloodstudy@cityofames.org***
- Send mail to:
  City of Ames
  Attn: John Dunn
  300 E. 5th Street
  Ames, IA 50010

| Alternative/Strategy | | Description | Benefit Cost Analysis | | | | Performance Criteria | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Construction Costs | Annual Cost (including O&M) | Annual Benefits | BCR | Does it meet at least a 500-year level of protection? | Do the benefits outweigh the cost? | Is this alternative free of major environmental impacts? |
| **Conservation Measures in the Watershed** | | The Conservation Measures in the Watershed alternative evaluates small detention sites that could contribute to flood reduction, and the construction of wetlands administered under the Iowa Department of Agriculture and Land Stewardship Conservation Reserve Enhancement Program. | **$2,025,000** | **$122,230** | **$0** | **0.00** | ☒ (Note 1) | ☒ | ☑ |
| **Centralized Flood Storage** | | The Centralized Storage alternative includes the evaluation of Squaw Creek Dry Detention facility and Ames Lake Reservoir. | **$198,243,000** | **$11,966,036** | **$3,250,900** | **0.27** | ☑ (Note 2) | ☒ | ☒ |
| **Regional Flood Storage** | | The Regional Flood Storage alternative includes the evaluation of 14 storage sites. | **$145,339,000** | **$8,777,727** | **$3,217,000** | **0.37** | ☒ (Note 3) | ☒ | ☒ |
| **Floodplain Storage** | | The Floodplain Storage alternative achieves additional floodplain storage by raising 3 roads by 5 feet, and modifying 3 bridges/culverts. | **$41,000,000** | **$2,474,778** | **$2,786,900** | **1.13** | ☒ (Note 4) | ☑ | ☒ |
| **Diversion 1** | | The Diversion 1 alternative includes diverting flood waters around Ames by diverting Squaw Creek at Cameron School Road to the Skunk River via the Ada Hayden Reservoir. | **$49,243,000** | **$2,972,329** | **$3,042,700** | **1.02** | ☒ (Note 5) | ☑ | ☒ |
| **Diversion 2** | | The Diversion 2 alternative includes diverting flood waters around Ames by diverting Squaw Creek upstream from Cameron School Road, to the Skunk River downstream from the Ames Municipal Airport. | **$1,095,000,000** | **$66,094,687** | **$3,192,300** | **0.05** | ☒ (Note 6) | ☒ | ☑ |
| **Conveyance Improvements** | **Clear Channel** | The Conveyance Improvements alternative involves the clearing or excavating of river channel improvements and/or the removal of bridge obstructions. | **$2,943,000** | **$177,641** | **$2,436,700** | **13.72** | ☒ (Note 7) | ☑ | ☒ |
| | **US Hwy 30 Bridge Improvement** | | **$7,740,000** | **$467,190** | **$2,097,300** | **4.49** | ☒ (Note 8) | ☑ | ☑ |
| | **South Duff Bridge Improvement & Clear Channel** | | **$4,715,000** | **$284,599** | **$2,086,900** | **7.33** | ☒ (Note 9) | ☑ | ☑ |
| **Levee Protection 100-Year** | | The Levees alternatives evaluates protection to the 100-year flood level protecting property areas along Skunk River and Squaw Creek by constructing a levee (berm/floodwall) combination. | **Skunk River $4,818,000**<br>**Squaw Creek $6,079,000** | **Skunk River $290,817**<br>**Squaw Creek $366,931** | **Skunk River $121,400**<br>**Squaw Creek $174,600** | **Skunk River 0.42**<br>**Squaw Creek 0.48** | ☒ (Note 10) | ☒ | ☑ |
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**Key:** ☑ = Yes; ☒ = No

## Study Progress To Date

The City of Ames hosted Public Meeting 1 and 2 in 2012 to present the study and gather input from the greater Ames community. As of March 31, 2013 the City of Ames Flood Mitigation Study website had 1,095 unique visitors, generating 2,151 hits, 540 online meeting views, and 173 online comment form submissions. Thank you for your feedback!

Several flood management alternatives and strategies have been evaluated by the study team and have received input from the public. These alternatives and strategies were then screened based on a set evaluation criteria. Based on feasibility and input from the public, the detailed analysis is presented at this final stage of the study. The study will end with a presentation of the best alternatives and strategies to City Council on April 16, 2013 at 7:00 p.m.

NOTES
[1]Provide no flood level reduction.
[2]Skunk River only; 100-year level on Squaw.
[3]100-year level on Squaw; 100-year level on Skunk.
[4]Reduced 100-year flood height of 2-ft on Squaw.
[5]Reduced 100-year flood height of 5-ft on Squaw.
[6]Reduced 100-year flood height of 5-ft on Squaw; 100-year protection on Skunk.
[7]Reduced 100-year flood height of 1-ft on Squaw.
[8]Reduced 100-year flood height of 2.5-ft on Skunk.
[9]Reduced 100-year flood height of 2-ft on Squaw.
[10]The alternative meets the 100-year protection on both Squaw and Skunk.

# Environmental Concerns

| Environmental Concerns | Alternatives / Strategies | | | | | | |
|---|---|---|---|---|---|---|---|
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| **Is this alternative free of major environmental impacts?** | ☑ | ☒ | ☒ | ☒ | ☒ | ☑ | ☑ |

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