Staff Report

2010 FLOOD MITIGATION REPORT

September 14, 2010

PREFACE

While floods have been a recurring part of Ames' history for generations, the August 2010 flooding was by many measures the heaviest to impact our community in memory. Exceptionally high levels of rainfall in a short period of time led not only to record flooding along Squaw Creek and the Skunk River, but to flash flooding across the entire community.

Following an event such as this, it is natural to ask questions such as "Why did this happen?" and "What could be done to prevent such damage in the future?" In an effort to begin answering these questions, on August 24 the City Council directed staff to review with them the process followed after the Floods of 1993. That information is summarized in this report, along with other steps that have been taken in past years to forecast, mitigate or deal with the effects of flooding. Further, staff has endeavored to describe the impact of the 2010 floods upon both public facilities and private property. Finally, the report summarizes potential actions, options, resources, opportunities and issues that could be addressed to recover from this year's floods and to mitigate the impacts of future flooding.

ACTIONS TAKEN FOLLOWING 1993 FLOOD

- **FLOOD PLAIN MANAGEMENT STUDY**

Following the floods of 1993, the City of Ames, Iowa State University, Story County, and the Iowa Department of Transportation jointly commissioned Snyder and Associates of Ankeny, Iowa to complete a Comprehensive Flood Plain Management Study for the City. That study was completed in 1996, and a copy of the executive summary is attached. (See **Attachment I.**) Within the study, several potential strategies were identified and evaluated to "mitigate" or lessen the impact of future flooding. (See **Attachment II.**) Those options included the following:

Channel Widening
Channel Straightening
Bridge Channel Clearing
Upstream Detention (2 reservoirs)
Levee Construction
Floodproofing Individual Properties
Flood Plain Zoning Regulations

After a thorough benefit-cost analysis, the study's final recommendations supported private flood proofing of vulnerable buildings (e.g., construction of

flood walls around individual structures) and modifying the City's flood plain development regulatory standards.

The study also recommended that the federal Flood Insurance Rate Maps (FIRM) for the City be updated. These are the maps that define the flood boundaries and base flood elevations that are established by the Federal Emergency Management Administration (FEMA). **After review and approval by the US Army Corps of Engineers and the Iowa Department of Natural Resources, those updated FIRM maps were issued in 2004.** Since that time, there have been two revisions to the FIRM panels, with the latest being effective as of February, 2008.

In 1994, Snyder and Associates also completed a flood mitigation study for Iowa State University. That study included analysis of Hilton Coliseum, Scheman Building, Maple-Willow-Larch Residence Hall Complex, Lied Recreation Facility, and University Village Residence Complex. Flood proofing of the Lied Recreation Facility and the University Village levee were determined to not be economically justified. **The benefit/cost analyses concluded that it was economically justified for structure flood proofing at Hilton Coliseum and the Scheman Building, as well as for a Maple-Willow-Larch levee.** Minor improvements were installed at Hilton and Scheman, along with a flood wall constructed at Maple-Willow-Larch which actually did provide adequate protection during the August 2010 flood.

- **BUYOUTS**

Following the flooding of 1993, the City of Ames was ultimately awarded approximately $1.7 million dollars in FEMA Hazard Mitigation Grant Funds and CDBG Hazard Mitigation Funds. Those monies were used to voluntarily buy out single family properties located in the flood way and flood way fringe which were damaged as a result of the flood waters. Approximately 32 homes that were eligible for buy-outs were identified in the South Riverside, South Russell, South Hazel, and South Maple Avenue neighborhoods. **Between 1993 and 1995, 27 homes were purchased and demolished, along with the Masonic Temple Lodge** that previously stood west of Howe's' Welding on South Duff Avenue. When the City became an entitlement community in 2004, one of the goals was to use CDBG funds to pursue purchasing the remaining five residential properties as they became available. **In 2008-09, two additional properties were purchased. Three of the original 32 homes remain in place, and there are potentially three to five more that could become eligible after the 2010 flooding.**

As another outgrowth of the floods of 1993, and based upon the recommendations of the 1996 Flood Plain Management Study, in 1997 the City was awarded approximately $1.9 million dollars in Hazard Mitigation Grant Funds through the then-Iowa Emergency Management Division for the construction of floodwalls and the installation of backwater prevention valves for 55 businesses located in the floodplain (along the South Duff commercial corridor). **However, there were no businesses that chose to participate in this program.** The program was ultimately closed out. In 2001, funds were de-

obligated back to the State due to area businesses not being able to meet the federal and state benefit-cost requirements.

- **WATER WELL IMPROVEMENTS**

Many of the city's potable supply wells are subject to flooding during extreme flood events. During flood events, it is common to lose power to the wells. In 1993, the water treatment plant was plagued by erratic flow rates when the telephone control lines to the Southeast Wells became submerged and wells were randomly starting and stopping. City staff had to go out into the flood waters in a small boat to de-energize the motors to prevent wells from operating. To prevent this sort of problem and to minimize potential damage to equipment, the more recent practice has been to shut down these portions of the electrical distribution system.

In addition, staff successfully applied for a FEMA Hazard Mitigation Grant to relocate the controls for the two ISU wells in 2008. These wells are located in below-ground pits near Squaw Creek and are frequently subjected to flooding. The FEMA grant was to relocate the existing electronic controls and communications equipment into new control panels that would be placed above ground, limiting the dollar impact caused when the pits flood. Due to equipment production delays, the new control panels were received on Monday, August 9, 2010. Unfortunately, the waters came up on Wednesday, August 11, and all of the electronics in the well pits were flooded and destroyed. Staff is working with its grant coordinator to revise the project to include replacement of the destroyed equipment.

As a part of its Vulnerability Assessment completed after 9-11-2001, staff evaluated the need for providing redundant standby power for the City's wells. This would help mitigate against any disaster that compromised the electrical distribution system, including floods. To achieve this, however, there are multiple challenges that would need to be overcome. In order to power wells in the flood plain, the standby engine itself would need to be placed in the flood plain. Fuel for the engine would be problematic. Constructing underground fuel storage tanks in the flood plain adjacent to a drinking water well is less than ideal. The engine could be fired by natural gas, but in the event of a natural disaster such as a tornado, it is conceivable that the natural gas system would be compromised as well. Cost estimates for this type of standby system range from $300,000 to $500,000 per assembly, with two assemblies (one for the Southeast Wells and one for the Sports Complex wells) being preferred.

- **NEW FLOOD PLAIN DEVELOPMENT STANDARDS**

The City of Ames Land Use Policy Plan (LUPP) acknowledges the impact that urban development can have on all natural systems, including drainage basins and flood-prone areas. This awareness is stated in various goals and objectives of the LUPP. Specifically, Goal 2 on page 15 of the Plan emphasizes the need to "guide the character, location, and compatibility of growth with the area's natural resources and rural areas," and speaks to achieve that goal by "seeking a development process that achieves greater conservation of natural resources and compatibility between development and the environment." Goal 3 states that "Ames seeks to be compatible

with its ecological systems in creating an environmentally sustainable community" and intends to achieve that by "maintaining and enhancing the value of its stream corridors as drainageways and flood management areas. . ." The Plan particularly stresses the tendency to develop in flood-prone areas, most notably along the South Duff corridor, and states that while Ames has more stringent in-filling standards than the State, these standards do not prevent development. It notes that additional development of this area will occur without the alternative of more suitable sites. (LUPP pg. 79)

Flood-prone areas are identified in the Plan under the "Environmentally Sensitive Areas" land use designation. The plan states that the designation involves "flood-prone areas, wetlands, waterbodies and designated natural resources that should be protected from detrimental use." It continues that these areas "may or may not be suitable for development. In the event that development is determined to be appropriate, special requirements may be necessary to ensure environmental compatibility." (LUPP pg. 32)

Current standards for development within flood-prone areas are contained in the City's Flood Plain Zoning Regulations. The City's floodplain regulations address allowed uses in the floodplain and also impose standards on development within the floodplain. The standards reflect a common approach to regulating floodplain development, which is to avoid new structures in the floodway, and to protect new structures allowed in the floodway fringe by requiring that structures be either flood-proofed or elevated above the 1% chance base flood elevation. **The required elevation under FEMA for new buildings is equal to the base flood elevation, but the State has imposed an additional one-foot freeboard requirement for high risk buildings. This is based upon the assumption that up to one foot increase in flood water depth will result once the entire floodway fringe is filled in. Following the 1993 Flood, the Ames City Council adopted a three-foot elevation requirement to ensure two additional feet of freeboard.**

Chapter 9 of the Municipal Code regulates development activities that occur in the special flood hazard area—areas that have a 1.0% chance of flooding in any given year (commonly but mistakenly referred to as the 100-year flood plain). The locations of these special flood hazard areas were determined by FEMA and adopted into the City's ordinance in February 2008.

A map generated from the City's Geographic Information System (GIS) showing the base flood elevation, floodway, and floodway fringe, as well as the area inundated by the recent flooding, is included as **Attachment III**. Please note that 20% of the total acres within the City of Ames are located within a flood hazard area and would be impacted by any further regulations adopted by the City Council to mitigate future flood damage.

- **FLOOD WARNING EARLY ALERT SYSTEM**

Iowa Code Chapter 28E allows for state and local governments to enter into cooperative agreements so that joint services can be provided at a reasonable cost. As a direct outgrowth of the 1993 floods, in March of 1994 a 28E intergovernmental agreement was

signed by the City of Ames, Story County, Iowa State University, and the Iowa Department of Transportation. Paragraph 1 from the agreement summarizes the intention behind the agreement as follows:

> The purpose of the agreement is to cooperate in the installation and operation of apparatus that will provide an improved flood warning system in the area of Ames, Iowa. The system is to serve the interests of the parties and projection of their respective facilities and is not to be used as a public warning system. The parties do not undertake any duty to warn the public of impending flood. The parties do not warrant the accuracy, timeliness, or any other aspect of the information provided by the system; and the use of the information by any of the parties shall be at its own risk.

The agreement called for the construction of four new river gauges, "several" weather stations to provide real-time verification of rainfall amounts, the purchase and installation of a new computer hardware/software system, and the development of a revised hydraulic model of Squaw Creek and a new model for South Skunk River. The parties agreed that the administrator of the cooperative effort would be the Director of Water and Pollution Control for the City. The system is operated and maintained by the City of Ames.

The 28E agreement calls for the costs of the system to be paid using the following formula: City of Ames – 40%; Iowa State University – 40%; Story County – 10%; Iowa DOT – 10%. The cost to install the system in 1995 was estimated at $125,500. In 2004, much of the telecommunications equipment was replaced at a cost of approximately $30,000. The cost to operate and maintain the system for FY 2009/10 was $15,500. Payroll for hourly City employees for work directly related to the early warning system is included in the operating and maintenance expenses.

THE 2010 FLOOD

- **CURRENT LOCAL REGULATIONS**

The City of Ames participates in the National Flood Insurance Program. This participation allows property owners to obtain insurance to cover losses due to floods. This coverage is available whether the property lies within the special flood hazard area or not. Because of its participation, the City is required to adopt and enforce flood plain regulations that are approved by the federal government. These regulations are found in Chapter 9 of the Ames Municipal Code and are designed to minimize loss of life and property damage in the event of flooding events.

Development activities include not only construction of buildings, but also interior remodeling of buildings, grading, filling, and excavating. In the floodway fringe, most activities can occur provided they meet the development standards of the ordinance. These standards require the elevation or floodproofing of a structure to a height three feet above the base flood elevation (the height of the water in a 1.0% flooding event). Structures used for residential purposes must elevate – floodproofing is not an option.

The three-foot standard is relatively rare in Iowa. Ames established this standard following the 1993 floods. Three other communities and one county have established this level of elevation while other communities require 18 inches or 2 feet. One city has established 1-foot above the 0.2% flood event (500-year flood).

In the floodway, structures are generally not allowed. Other activities, such as grading, filling, and excavating may be allowed through the issuance of a conditional use permit by the Zoning Board of Adjustment. An applicant will need to perform a hydraulic study to ensure that there will be no increase in the base flood elevation.

A third category is the general floodway. This in an area that is expected to be inundated during a flood event. However, the 2008 flood study which defined the extent of the flood hazard area was not done in enough detail to delineate between the floodway and floodway fringe. Within this area, any development will be treated as if it were in the floodway. Structures may be allowed but will require a more complete study to delineate the floodway from the floodway fringe.

Within the special flood hazard areas, if a structure suffers damage so that the costs of repair are equal to or greater than 50% of the market value of the structure, then the structure must be brought into compliance with the regulations. Likewise, if a structure is improved so that the cost of the improvements are equal to or greater than 50% of the value of the structure, or if the original floor area is increased by 25% or more, the structure must be brought into compliance with the regulations.

Our regulations calculate loss as if each flood was a separate, discrete event. A structure that suffers a 40% loss this year followed by a 40% loss in a following year is allowed to rebuild without having to be brought into compliance with the regulations. The NFIP allows a cumulative or repetitive loss standard to be applied. One such approach is that of Story County which requires a structure to be brought into compliance if the structure suffers loss on two separate occasions during a ten-year period for which the cost of repairs for each event equals or exceeds 25%, on average, of the market value of the structure.

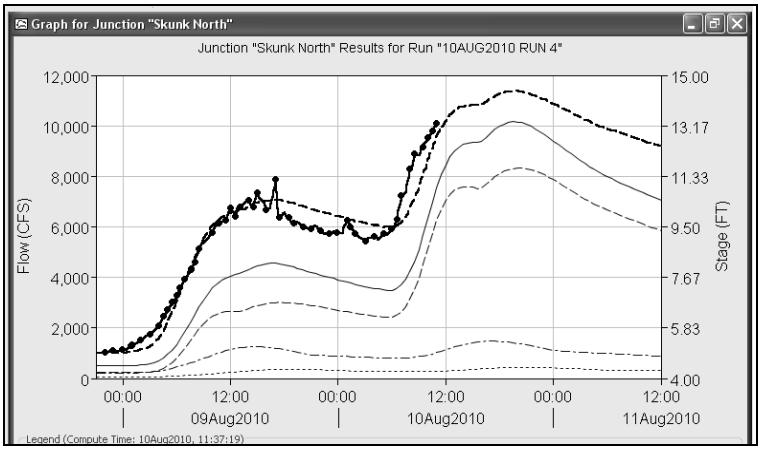
The City's mechanism to ensure development is compliant with the requirements of the flood plain regulations is the flood plain development permit. This permit is required for any development activity in the special flood hazard area.

- **MAGNITUDE OF 2010 FLOODING**

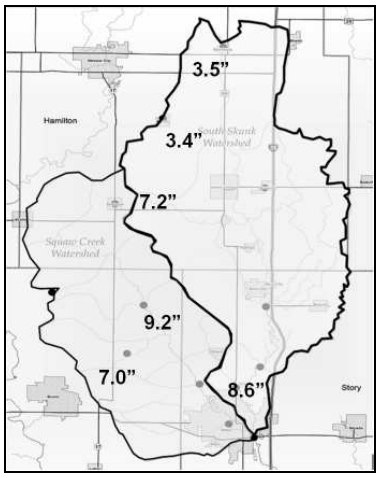
For the flood events of August 2010, modeling began in the early morning hours of Monday, August 9 and was on-going nearly continuously for 96 hours through three consecutive storm events. The rainfall event that ultimately led to the record flooding began at approximately 6:00 pm on Tuesday, August 10, and continued until about 2:00 am on Wednesday morning. The first river predictions from this rainfall were made at 11:00 pm Tuesday evening and were updated approximately every 2½ - 3 hours throughout the event. The first predictions after the rainfall had ended were reported to

the Emergency Operations Center at 5:35 am Wednesday morning. A comparison of the 5:35 am estimates to the actual crests is shown below.

Gage Location	City Prediction	Actual Crest
Squaw Creek at Lincoln Way	18.5’	18.13’
Skunk River at N. Riverside Drive	18.8’	19.55’
Skunk River at Highway 30	27.0’	26.72’



Screen capture from the flood modeling software on August 10, 2010. The upper dashed line shows the predicted levels for the Skunk River near Ada Hayden Park. The upper line with the dots reflects the actual stream levels.



Five-day rainfall totals in Skunk and Squaw river basins from August 7 through August 11.

The following data presents comparisons of flood crest levels at the US Geological Survey’s three stream gauges near Ames:

<u>Squaw Creek at Lincoln Way</u>

18.54’	June 9, 1993
18.13’	**August 11, 2010**
15.97’	June 17, 1990
15.85’	May 30, 2008
15.29	June 17, 1996
14.50	June 4, 1918

Skunk River at Riverside Drive (near Ada Hayden Park)

21.93'	June 9, 2008
20.89'	June 17, 1996
19.82'	April 26, 2007
19.55'	**August 11, 2010**
19.23'	August 16, 1993
18.90'	May 20, 1944

Skunk River at Highway 30

26.72'	**August 11, 2010**
25.57'	June 27, 1975
25.52'	June 9, 1993
25.40'	June 17, 1990
25.13'	June 17, 1996
24.70'	May 30. 2008

As part of the 2010/11 budget, all of the 28E partners have agreed to participate in an upgrade to the flood warning early alert system. The City's budget includes $34,000 to replace the system's field data-loggers and communications software. Additionally, $20,000 was included for an update to the predictive hydraulic model to account for changes in the watershed since the models were last calibrated in the late 1990's.

During the spring of 2010, staff from the Water and Pollution Control Department began researching current state-of-the-art flood predictive software packages. Packages are now available that would allow modeling to occur continuously in near-real time, as opposed to the discrete models that are currently being run. The intervals between when rain falls up in the basins and when the rivers crest in Ames are generally between 12 and 18 hours. The existing predictive capability offers between 6 and 12 hours of advance warning. Having a model that runs in real time could increase that advance warning interval by as much as two more hours. Also, the more sophisticated flood warning packages make use of radar estimated precipitation integrated with ground-truth stations to develop more precise estimates of rainfall across the basins. The systems are capable of importing actual river stages to self-calibrate for each individual storm event. Most significantly, the newest generation packages offer the ability to integrate the hydraulic models with high resolution flood inundation maps, allowing a graphical representation of areas that potentially may be impacted. The model results can be spooled out to a secure web server, making the predictions instantly available to all 28E funding partners. Staff has received preliminary estimates that place the cost for this type of capability at between $150,000 and $400,000, depending on how detailed the flood inundation mapping becomes and whether there is interest to expand the model to areas outside of Ames. Pending the concurrence of the other 28E partners, staff anticipates preparing a Hazard Mitigation Grant application to move forward with this type of system upgrade in lieu of the budgeted upgrade to the existing system.

- **DAMAGE TO PRIVATE PROPERTIES**

Attachment IV reflects the areas and properties that were impacted by flood. It should be emphasized that not all of the damaged properties are shown on this attachment because not all of the damage to private structures have been reported to the City's Inspection Division.

- **AVAILABILITY OF FINANCE ASSISTANCE FOR DAMAGED PRIVATE PROPERTIES**

As outlined in Attachment IV, the "structural damage" section of this report, there are residential properties (both owner-occupied and rental), commercial businesses, and mobile homes that sustained substantial damage from the 2010 flood event.

To date, the following forms of financial assistance have been made available to the City of Ames:

A. FEMA's Individuals and Households Program (IHP)

The Individuals and Households Program (IHP) provides assistance to individuals and households affected by a disaster to enable them to address necessary expenses and serious needs which cannot be met through other forms of disaster assistance or insurance. Forms of housing assistance under IHP include temporary housing, repair, replacement, and semi-permanent/permanent housing construction. This program is being administered by FEMA for Ames/Story County.

B. Iowa Finance Authority's Owner-occupied Assistance for Homeowners (IHI)

Grant funds from the State of Iowa's "Iowans Helping Iowans" Disaster Assistance Program to help residents whose homes were damaged from the floods were made available. This program is designed to help only owner-occupied households which have first qualified for FEMA assistance with either down payment or rehabilitation assistance. The City of Ames will receive up to $500,000 and City staff will be administering this program.

C. Iowa Department of Economic Development's Business Assistance (IHI)

The Iowa Department of Economic Development (IDED), under the State's "Iowans Helping Iowans" Disaster Assistance Program, will provide financial assistance to businesses located in presidentially-declared disaster areas eligible for individual assistance and that have been damaged or destroyed by the natural disasters of 2010. Financial assistance of $5,000 to $50,000 for working capital to ensure the business's survival is available. Residential landlords and home-based businesses are not considered eligible businesses for purposes of this program. IDED will be the administrator of this program.

D. Iowa Homeland Security & Emergency Management Division's Hazard Mitigation Grant Program (HMGP)

There is an opportunity for the City to apply for Hazard Mitigation Grant Program (HMGP) buy-out grant funds through the Iowa Homeland Security & Emergency Management Division. Approximately $32 million dollars may be available to the State of Iowa. HMGP funds will be available for those eligible hazard mitigation project types that will reduce or eliminate losses from future natural disasters, including but not limited to:

- Construction of tornado safe rooms (Multi-functional community or school safe room projects are highly encouraged)
- Acquisition, structural relocation, or elevation of buildings located in a special flood hazard area
- Structural and non-structural retrofitting of existing public buildings, facilities, or utilities to protect against wind, ice, or flood hazards
- Minor structural hazard control or protection projects such as storm water management (e.g., culverts, floodgates, retention basins)
- Localized flood control projects, such as floodwall systems, that are designed specifically to protect critical facilities and do not constitute a section of a larger flood control system

The State will consider all eligible HMGP project types **except** back-up power generation and severe weather warning systems at this time. The State will publish a follow-on notice if funding for back-up power generation and warning systems becomes available in the future. Applicants with proposed projects located in a FEMA-identified Special Flood Hazard Area (SFHA) are eligible for funding only if the jurisdiction in which the project is located is participating in the National Flood Insurance Program (NFIP). There is no NFIP participation requirement for projects located outside of the SFHA.

Home Land Security is accepting all eligible applications as long as funding is still available and the grant application period has not closed. The State Hazard Mitigation Officer will determine the disaster in which all applications will be funded under, based on the remaining available funds.

This is a cost share grant program which means that awarded grants will be funded as follows:

- Federal (FEMA) share of total eligible costs – 75% maximum
- Non Federal share of total eligible costs – 25%
    - State of Iowa – 10%
    - Local – 15% (The City is waiting to hear if our regular CDBG allocation can be used as a local match.)

Funds for program administration and demolition are included as part of the grant application and award and are based on the projected cost of administering the program and projected costs for demolition.

The first step would be for the City to send in a "Notice of Interest" (NOI) listing properties which have been identified as part of a potential acquisition project. The State strongly encourages early submission of NOIs. The timeframe from the submittal of the NOI to receipt of funds could take approximately one year.

- **IMPACT OF FLOOD ON CITY INFRASTRUCTURE**

Water Distribution
The record flooding on August 11, 2010, caused erosion around a large water main, leading it to break. There is also the possibility that a falling tree caused or added to the damage. This main carries water from the east side of town to the west side and the break caused the water towers on both pressure zones to drain. The towers being drained caused low pressure on the overall system, leading to flood waters likely infiltrating our system. This sudden reversal of flow caused unusual force on the system and created ten other main breaks throughout the system.

Because the system was compromised, the City was required to issue a Boil Water Advisory. Additionally, the utility had to impose immediate and severe restrictions on water use throughout the community. Businesses and residents alike were asked to limit water use to essential health and human safety needs, requesting that uses such as showering, flushing, laundry, and dish washing be stopped. The Mayor also banned all outside watering. These volume restrictions were needed so that the system, including the towers, could be refilled and pressurized. The restrictions were kept in place while the entire system was flushed through the fire hydrants. Following system flushing, 173 bacteria tests were taken throughout the community. A boil water order was in place until 4:00 pm August 15, 2010, when all tests came back showing that no bacteria was present.

Restaurants were asked to voluntarily close during this time unless their preparation, serving and cleaning needs could be met with alternative potable water (boiled or bottled) and sanitary facilities.

As a possible future mitigation measure, an update to the water distribution system model could be performed to evaluate the need to reinforce existing stream crossings and/or construct additional stream crossings to add redundancy to the distribution network. It should be noted that the existing distribution system meets or exceeds all recognized design criteria. This evaluation would be looking at the potential benefits of moving beyond current design standards to provide a higher level of service.

Storm Water Drainage System
Storm water conveyance systems are generally designed and installed to handle rainfall events that would statistically occur between every 2 to 100 years, depending on the

specific facility and location. Typical design return periods in Iowa for inlets and piping vary from 2-10 years, with 5 years being most common. For culverts, design periods of 25-50 years are typical, depending on the type and level of service for the roadway. For detention basins, 25-100 years are common.

Ninety percent of the annual rainfall events recorded at the NWS Coop rainfall gauge in Ames, Iowa for the period of record from 1960-2006 are less than or equal to 1.25 inches. (This computation is based only on those rainfall events that generate measurable runoff. Rainfall events less than 0.1 inch were subtracted from the total for calculation of occurrence frequency.) For all rainfall events in the total period of record (100 years for most stations in Iowa), the 90% occurrence depth is 1 inch or less.

For the Ames data, 90.6% of the rainfall events (greater than 0.1 inch) had a depth of 1.25 inches or less. This is termed the "90% cumulative occurrence frequency," and is the rainfall depth recommended for determining the WQv (water quality volume) for Iowa. It should also be noted that, for the rainfall frequency for Ames, the average annual rainfall for the period from 1960 to 2006 was 31.58 inches, and the mean rainfall depth (P6) was 0.62 inches.

For 2010, between April and August, the Ames area had received over 38 inches of rainfall. This does not take into consideration the snow that fell and melted prior to April. Staff has received numerous inquiries questioning the capacity of the storm sewer system. The large rainfall events (over 2 inches at a time) led to flash flooding, including within the street network, since our storm sewer system is designed for much smaller or more steady (over longer period) rainfall events. Within a short period of time after the intense rainfall has stopped, most locations will return to normal. Following the intense rainfall events and ensuing pooling through the community in August, staff has received many more requests to analyze locations throughout the community where residents are concerned about continuing wetter conditions in their neighborhoods.

Sanitary Sewer Collection System

During the flooding events, numerous sanitary sewer pipes within the system exceeded their hydraulic capacity. Inflow/Infiltration (I and I, or I/I) is the potential reason that caused the system to exceed its capacity. Included in the 2010-2015 Capital Improvements Plan is a program to conduct a multi-year Sanitary Sewer System Evaluation (SSSE). This evaluation is a comprehensive and systematic program for identifying the defects that could contribute to inflow/infiltration in our sanitary sewer system, prioritizing those defects, and establishing rehabilitation costs so that repairs can then be included in the Capital Improvements Plan. An SSSE program typically consists of the following tasks: data collection, sewer televising, smoke testing, manhole inspection, and sump pump inspection. Not only will the SSSE identify and correct sources of I/I, it will also identify areas of aging infrastructure in need of repair to prevent unexpected failures and emergency repairs. This evaluation will also analyze the benefit/cost of the current Footing Drain Grant Program and make a recommendation on how much longer this program may be beneficial to the community.

The SSSE is included over a 6-year program as follows:

Phase 1: Inflow Identification - Manhole inspection, smoke testing, and manhole rehabilitation (2010/11) ($500,000)
Phase 2: Flow monitoring (2011/12) ($60,000)
Phase 3: Sewer video inspection of areas with greatest measured infiltration (2012/13 and 2013/14) ($1,000,000)
Phase 4: Video inspection of remaining sewers to identify structural defects (2014/15 and 2015/16) ($1,000,000)

Staff is currently writing a Request for Proposals, from which several consultants will be interviewed before recommending to City Council the hiring of a preferred consultant. The contract will be established for Phase I of the program, with contract extensions into future years following the CIP program phasing.

Stream Stabilization

In 2007, Mimi Wagner with Iowa State University completed an Urban Stream Assessment for Worle, College, Clear, and Onion Creeks. This study established baseline information about the condition and function of the four Squaw Creek tributaries and their riparian areas within the city limits of Ames. The study specifically focused on stream bank condition, channel stability, culvert discharge, and riparian vegetation.

Recent rainfall events caused a significant amount of additional stream instability and erosion. Consequently, staff recommends that the Urban Stream Assessment be updated with consideration given to including Squaw Creek stability within that study.

Bridges and Trails

Staff has completed a preliminary review of all road bridges and trail/park bridges within the City. In regards to road bridges, it was found that some locations have minor scouring underneath the structure. Some bridge locations showed moderate bank failures on the upstream side. Some trail/park bridges showed moderate bank stabilization issues on the upstream side and one bridge has severe damage and has been closed.

Electric System

Initial impacts to Electric Services and its customers from the flood were quite limited. Fast rising flood waters around an apartment building on Toronto covered the transformer that serves the building. Crews de-energized the transformer as a safety precaution for people and equipment. Sandbagging and pumps allowed power to be restored later in the evening on Tuesday. The retention of water in the area was caused by a plugged culvert under Union Pacific tracks. Timely maintenance by UP in the future is the best solution to this specific problem.

As the waters continued to rise on Wednesday morning, the system experienced a small number of storm-related outages. Crews remained in a stand-by mode and de-energized services where equipment was likely to become submerged – places like

Brookside Park and Hunziker Sports Complex, or where sectionalizing switches would be hard to access if the water came up any higher. Loss of power had little effect on customers at that point. (It is worth noting that several well pumps feeding the water plant are served from the line that serves the sports complex.) As the day progressed, additional shut-offs were made to several apartment buildings on South 5th Street, Riverside Manor on S. 4th Street, and parts of the Shady Grove and Meadowlane mobile home parks on South Duff Avenue and South Dayton Place. The power was cut in anticipation of floodwaters entering critical electrical equipment, and extensive efforts were made to notify owners prior to loss of service. Loss of electric service caused a major inconvenience to residents and other nearby apartments served by the same feeder/transformer. Also de-energized were businesses along South Duff Avenue.

As water crested, Electric Services continued to have 24-hour crew coverage and was able to restore service to nearly all homes, apartments and businesses in a timely manner. For those that received internal water damage which could have affected internal wiring, a process of electrician/City Inspections/reconnect was communicated to customers. Overall, loss of electric service was limited to a small number of customers (estimated 125 meters, approximately 80% of whom had power outages lasting less than 48 hours), and became a secondary concern to most of them as flood waters became more of a concern.

Staff is studying how service is provided in areas impacted by flooding. Consideration is being given to raising equipment height, installing remote switching, and pre-positioning people and equipment to reduce or eliminate the need to disconnect service to our customers.

Streets and Parks
The staff is in the process of identifying the damage caused by the flood to our streets and park systems.

- **AVAILABILITY OF FINANCIAL ASSISTANCE FOR DAMAGED PUBLIC INFRASTRUCTURE**

A. FEMA's Public Assistance Program

This section summarizes the FEMA Public Assistance Process for Iowa's Severe Storms and Flooding in 2010 that could help pay for the damage sustained by the City's infrastructure.

Ames became part of Presidential Disaster Declaration FEMA-1930-DR-IA for the incident period beginning June 1, 2010. This means that our July 18 wind storm will be included. An applicant briefing was held with Iowa Homeland Security on August 18, and the Public Assistance Program kick-off meeting for the City was held on September 3. Under the FEMA Public Assistance Program, the City is eligible for financial assistance to provide reimbursement for expenses incurred during emergency response, as well as for repair to damaged public facilities caused by the severe storms

and flooding. Funding under the program is 75% Federal, 10% State, and 15% Local. FEMA Public Assistance is designated by eligible work categories that include:

Emergency Work
- A. Emergency Debris Removal
- B. Emergency Protective Measures

Permanent Work
- C. Roads & Bridges System
- D. Water Control Facilities
- E. Building & Equipment
- F. Utilities
- G. Parks, Recreation and Other

Funding will also be available for hazard mitigation work to reduce the potential for future damage to facilities from a disaster event. The 15% local match can also include in-kind contributions, and the City will receive credit against the local match for the many documented volunteers who worked in response to the disaster. Accurate estimates of the total eligible costs under the program will become available in the coming months.

POSSIBLE NEXT STEPS

In summary, the City should consider implementing the following steps to aide in recovery from this summer's flood and to mitigate the impact of future flooding. Partial funding for many of these initiatives will hopefully be available from state and federal disaster relief funds.

- Invite ISU, Story County and IDOT to join with the City in again commissioning a comprehensive Flood Plain Management Study. The results of this study will serve as a basis for establishing flood mitigation priorities and regulatory changes.

- Submit a Notice of Interest to apply for Hazard Mitigation Grant Program funding for potential acquisition of additional flood-prone properties.

- Conduct additional engineering evaluations of the following areas:
  - -City-wide Sanitary Sewer Inflow & Infiltration
  - -Water Distribution System stream crossings
  - -Updated stream bank assessment
  - -City-wide low point drainage needs

- Contact the existing 28E funding partners for the flood warning early alert system to determine their interest in pursuing an expansion to the system. If there is interest, submit a Notice of Interest to apply for a Hazard Mitigation Grant

Program funding to update and expand the system. Contact additional communities in Story County that have been impacted by flooding of the South Skunk River, such as Story City and Cambridge, to see if there is interest in expanding the system beyond Ames.

- Evaluate individual projects to mitigate future flooding impact on public facilities and infrastructure.

It should be emphasized that accomplishing these actions will take months, and in many cases, years to complete.