SELECTION OF ALTERNATIVES

The scope of this project includes a wide range of potential alternatives to be examined. In addition, citizen comments led to the addition of several alternatives. The alternatives included the following:

A. Channel Straightening/Widening
B. Channel Widening
C. Bridge Channel Clearing
D. Upstream Detention - Squaw Creek
E. Construction of Levees
F. Building Floodproofing

Throughout the study process, public opinion was sought on the improvements most likely to alleviate the flooding problem. Between the input of the public and the Ames Flood Task Force, a final list of alternatives was developed. Each alternative was evaluated hydraulically using the calibrated HEC-2 models for Skunk River and Squaw Creek. The results of the hydraulic analysis and an outline of the positives and negatives for each alternative are discussed below.

A. CHANNEL STRAIGHTENING/WIDENING

The combination of channel straightening and channel widening was proposed for the stretch of Skunk River from the confluence with Squaw Creek to E. Lincoln Way. A typical channel straightening diagram is shown in Figure 6-1. A typical channel widening is shown in Figure 6-2. Figure 6-3 displays the location of the proposed channel straightening/widening. Channel straightening would eliminate the meanders from this stretch of stream allowing for the smoother flow of flood waters through this area. The channel was analyzed assuming it would be widened approximately 48% at the time the channel was straightened. The estimated project cost would be approximately $1,200,000 with annual maintenance costs of $40,000. The maintenance costs are high due to the requirement for continual monitoring for erosion in addition to the large expenditures required to maintain the facility after a major flood event.

The hydraulic analysis concluded this alternative would reduce the water surface profile for the COE 100-year flood 2" to 5" upstream from the improvements. The amount of reduction would be correspondingly smaller for smaller storm events. The construction costs are very high when considering the amount of water surface elevation reduction the improvements would achieve. This alternative would increase the channel velocity thus increasing chances for severe streambank erosion. Corps of Engineers and IDNR approval would be difficult to obtain for this reason. In addition, this portion of the Skunk River is on the State of Iowa's protected streams list. This means no modifications to the channel could occur without a variance from the IDNR. A variance is granted only if there is no adverse affect to the public and there are no alternatives to the improvements. A variance would likely not be granted for this alternative.

In order to complete construction of this alternative, the entire channel would need to be cleared of all trees and vegetation causing an extreme environmental impact on the area. As environmental concerns play a large role in the decision making process, this is an important issue. In general, this alternative would be difficult to complete given the status as a protected stream and would give little benefit to the City of Ames. This alternative should not be considered for further analysis.

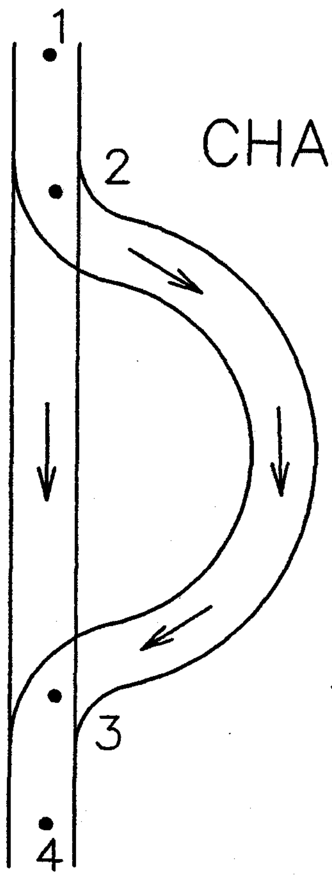
CHANNEL STRAIGHTENING SUMMARY

LOCATION	PROJECT COST
US Highway 30 to E. Lincoln Way	$1,200,000

Positives
- Decreased Water Surface Elevations. (2-5 inches)

Negatives
- Velocity Increase May Cause Erosion.
- High Maintenance to Control Channel.
- COE and IDNR Approvals Difficult to Obtain.
- Little Decrease in Water Depth.
- Negative Environmental Impact

CHANNEL STRAIGHTENING



$$\text{SLOPE} = \frac{\text{LENGTH BETWEEN } 2+3}{\text{DROP BETWEEN } 2+3}$$

POSITIVE

1) DECREASED WATER SURFACE ELEVATION.

NEGATIVE

1) VELOCITY INCREASE MAY CAUSE EROSION.
2) CORPS OF ENGINEERS AND DEPARTMENT OF NATURAL RESOURCES APPROVAL DIFFICULT TO OBTAIN.
3) HIGH COST FOR WATER SURFACE ELEVATION DECREASE.
4) ENVIRONMENTAL IMPACT ON FLOOD PLAIN.

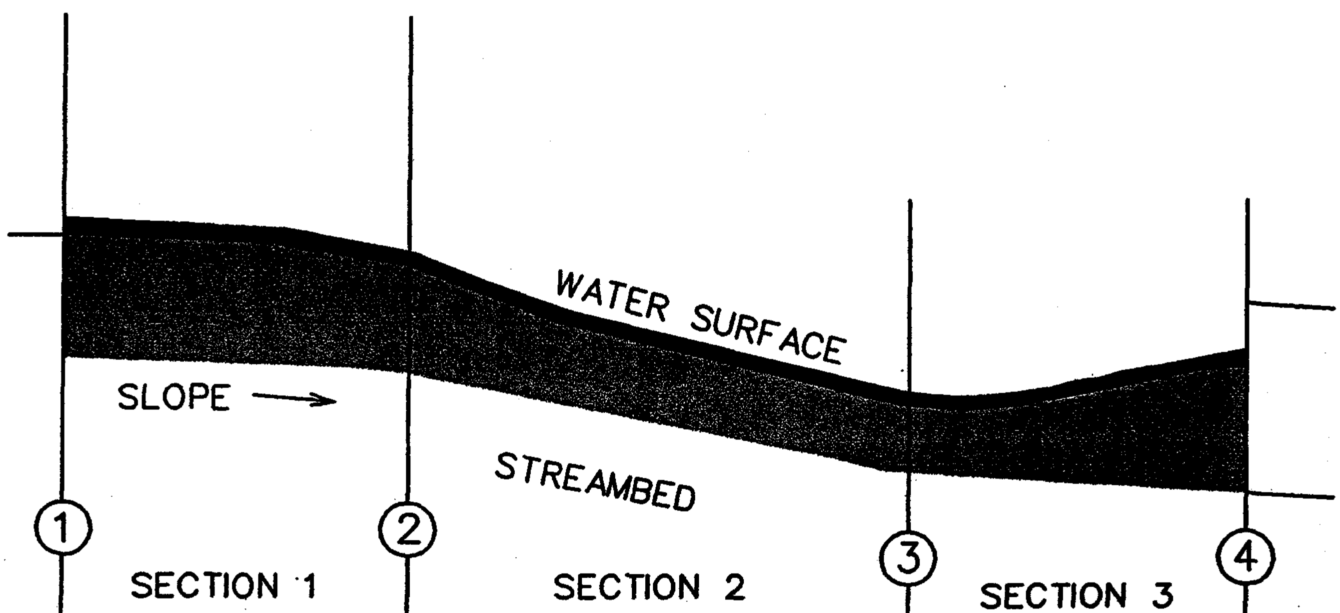
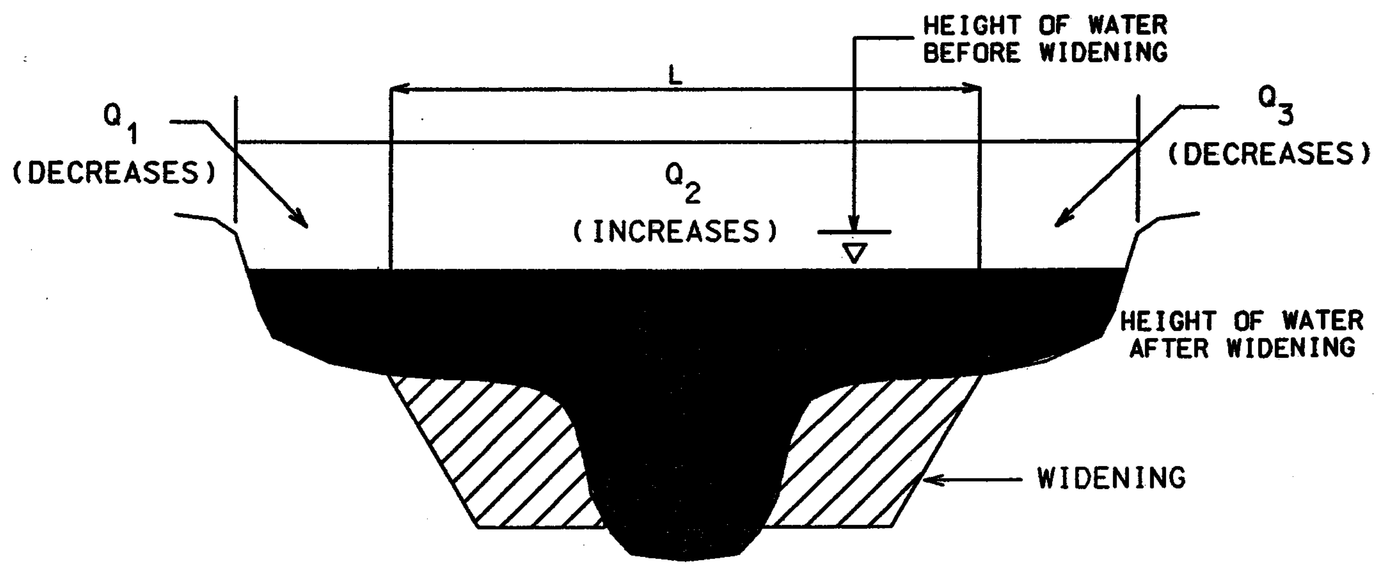


FIGURE 6-1

CHANNEL WIDENING



- BY INCREASING THE STREAM CHANNEL WIDTH THE CHANNEL AREA INCREASES. SINCE MORE FLOW WILL BE CARRIED IN CHANNEL AREA WHICH HAS A LOWER ROUGHNESS COEFFICIENT THE WATER SURFACE ELEVATION WILL DECREASE.

POSITIVES
- LOW EROSIVE VELOCITIES
- LOWER WATER SURFACE ELEVATIONS

NEGATIVES
- POTENTIAL SILTING DUE TO LOWER VELOCITIES
- HIGH MAINTENANCE COSTS
- ENVIRONMENTAL IMPACT

FIGURE 6-2

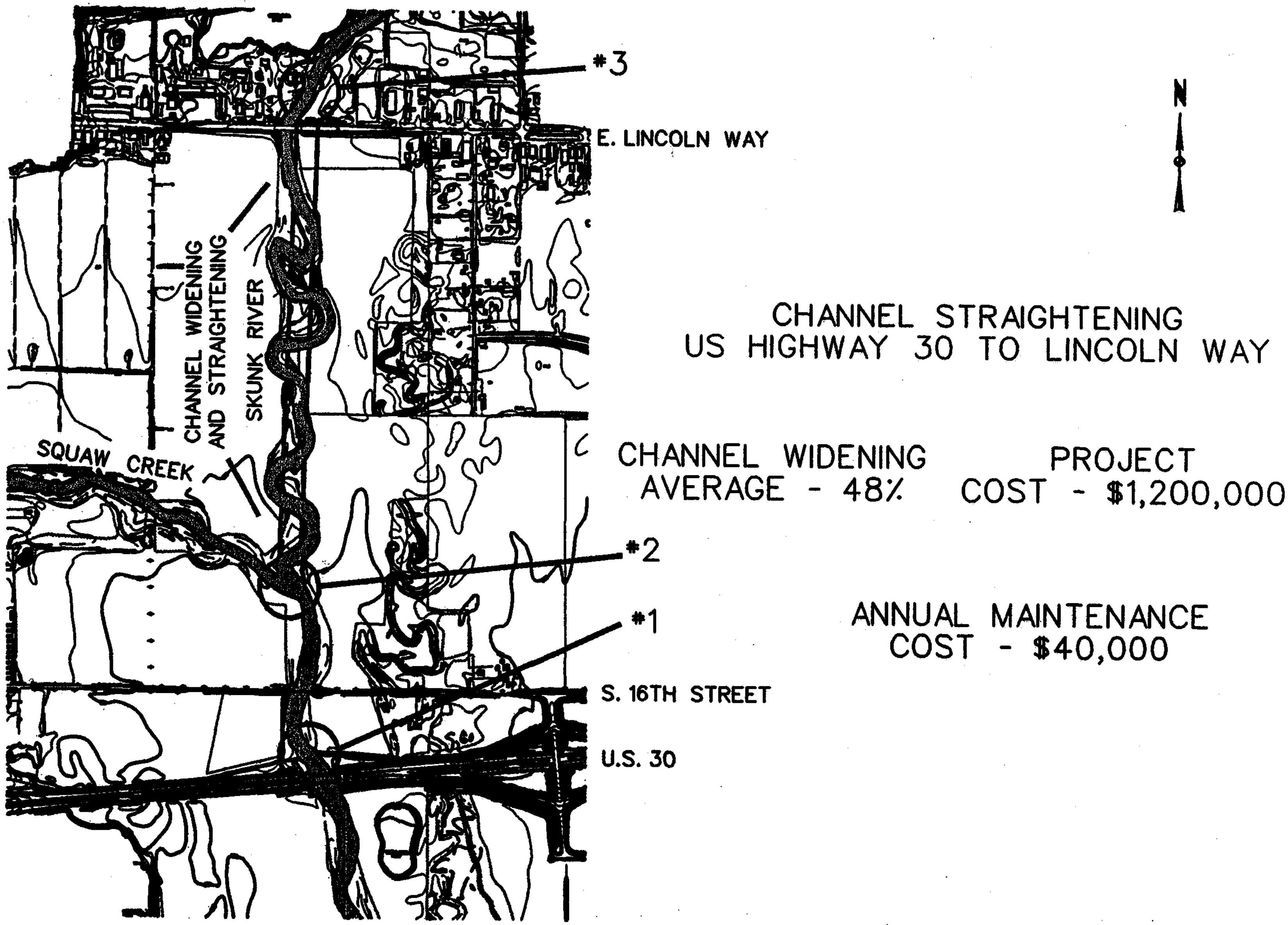

#3
E. LINCOLN WAY
N
CHANNEL WIDENING AND STRAIGHTENING
SKUNK RIVER
SQUAW CREEK
#2
#1
S. 16TH STREET
U.S. 30
CHANNEL STRAIGHTENING
US HIGHWAY 30 TO LINCOLN WAY
CHANNEL WIDENING
AVERAGE - 48%
PROJECT
COST - $1,200,000
ANNUAL MAINTENANCE
COST - $40,000

FIGURE 6-3

B. CHANNEL WIDENING

Channel widening was proposed in three locations: South of US Highway 30, S. Duff Avenue to S. 4th Street (Figure 6-4), and S. 4th Street to 6th Street (Figure 6-5). The increase of stream channel width increases the total channel area. This means a larger portion of the flow will be carried in the channel which has a lower roughness coefficient than the overbank areas. Therefore, the water surface elevation for the channel will decrease. The analysis of each alternative was completed with the calibrated HEC-2 model using the COE 100-year flood discharges.

The average channel widening south of US Highway 30 was 48% of the existing channel. The widening led to a maximum water surface elevation decrease of 25". This was south of Ames in a predominately agricultural area where there is little threat to the general public. The reduction of water surface elevation was only 2" at the confluence with Squaw Creek in the city limits of Ames. The estimated project cost for this alternative is approximately $5,000,000 with annual maintenance of $75,000.

The average channel widening from S. Duff Avenue to S. 4th Street was 37% of the existing channel. The widening led to a maximum decrease in water surface elevation of 16" upstream of S. 4th Street. The estimated project cost for this alternative is approximately $900,000 an the annual maintenance would be $25,000.

The average channel widening from S. 4th Street to Sixth Street is 27% of the existing channel. The widening showed a maximum decrease in water surface elevation of 16" upstream of Sixth Street. The estimated project cost for this alternative is $500,000 with annual maintenance of $25,000.

Widening of the channel would lead to lower erosive velocities in the channel due to the increase in channel area. The lower velocities could increase the channel silting thus requiring high maintenance in order to keep the largest amount of channel capacity. In order to complete these improvements, the channel would be cleared of all vegetation causing an extreme impact on the area environment.

While these improvements may cause a substantial decrease in the water surface elevation for the COE 100-year flood, they do not eliminate the potential for flooding should the same event occur again. Should the channel become clogged with debris, the benefit of widening the channel would be lost. This alternative should not be considered for further analysis.

CHANNEL WIDENING SUMMARY

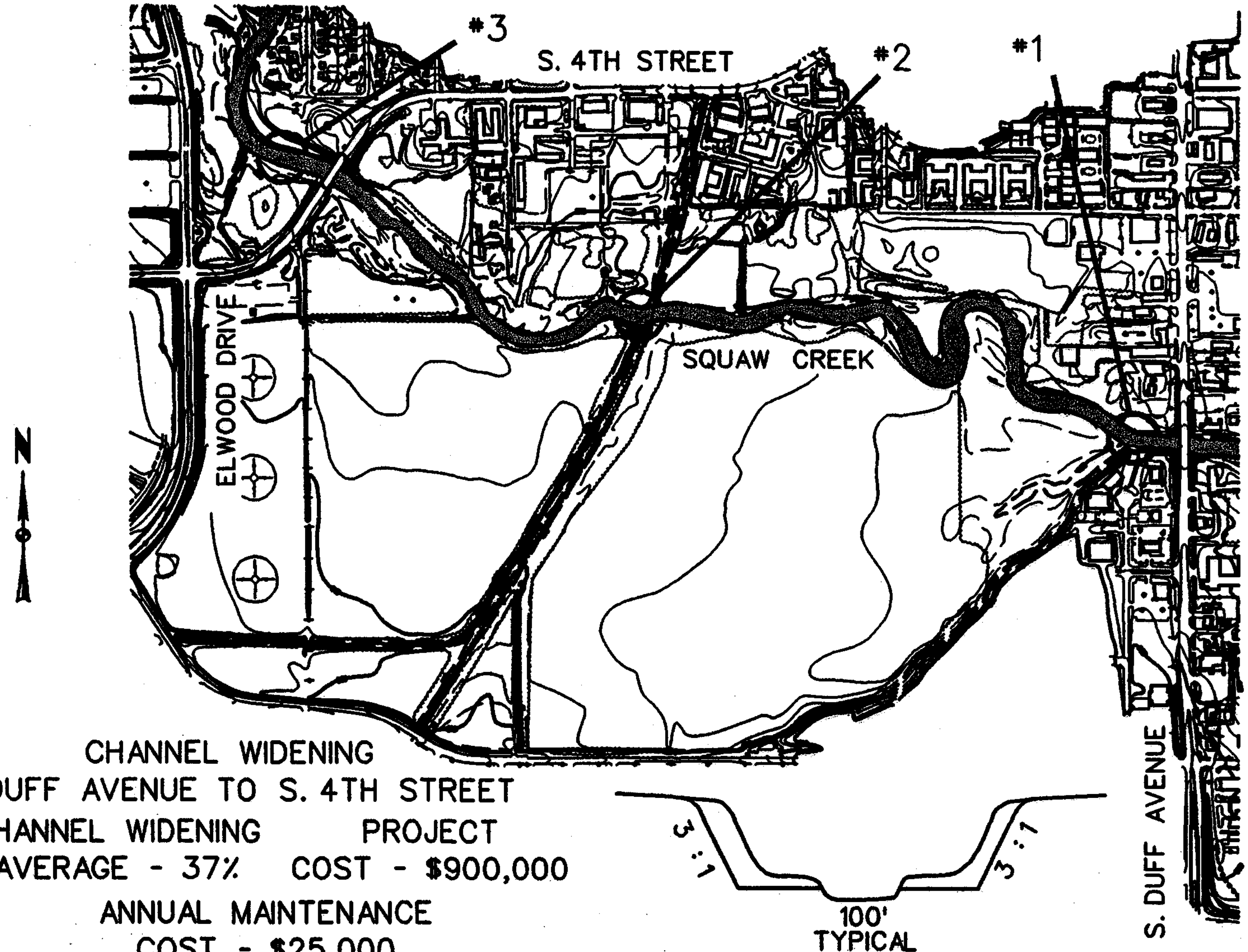
LOCATION	PROJECT COST
S. of US Highway 30	$5,000,000
S. Duff to S. 4th	$900,000
S. 4th to 6th	$500,000

Positives

- Decreased Water Surface Elevations.
- Low Erosive Velocities.

Negatives

- Potential Silting Due to Lower Velocities.
- High Maintenance to Control Channel.
- COE and IDNR Approvals Difficult to Obtain.
- Negative Environmental Impact



CHANNEL WIDENING
S. DUFF AVENUE TO S. 4TH STREET
CHANNEL WIDENING AVERAGE - 37%
PROJECT COST - $900,000
ANNUAL MAINTENANCE COST - $25,000

FIGURE 6-4

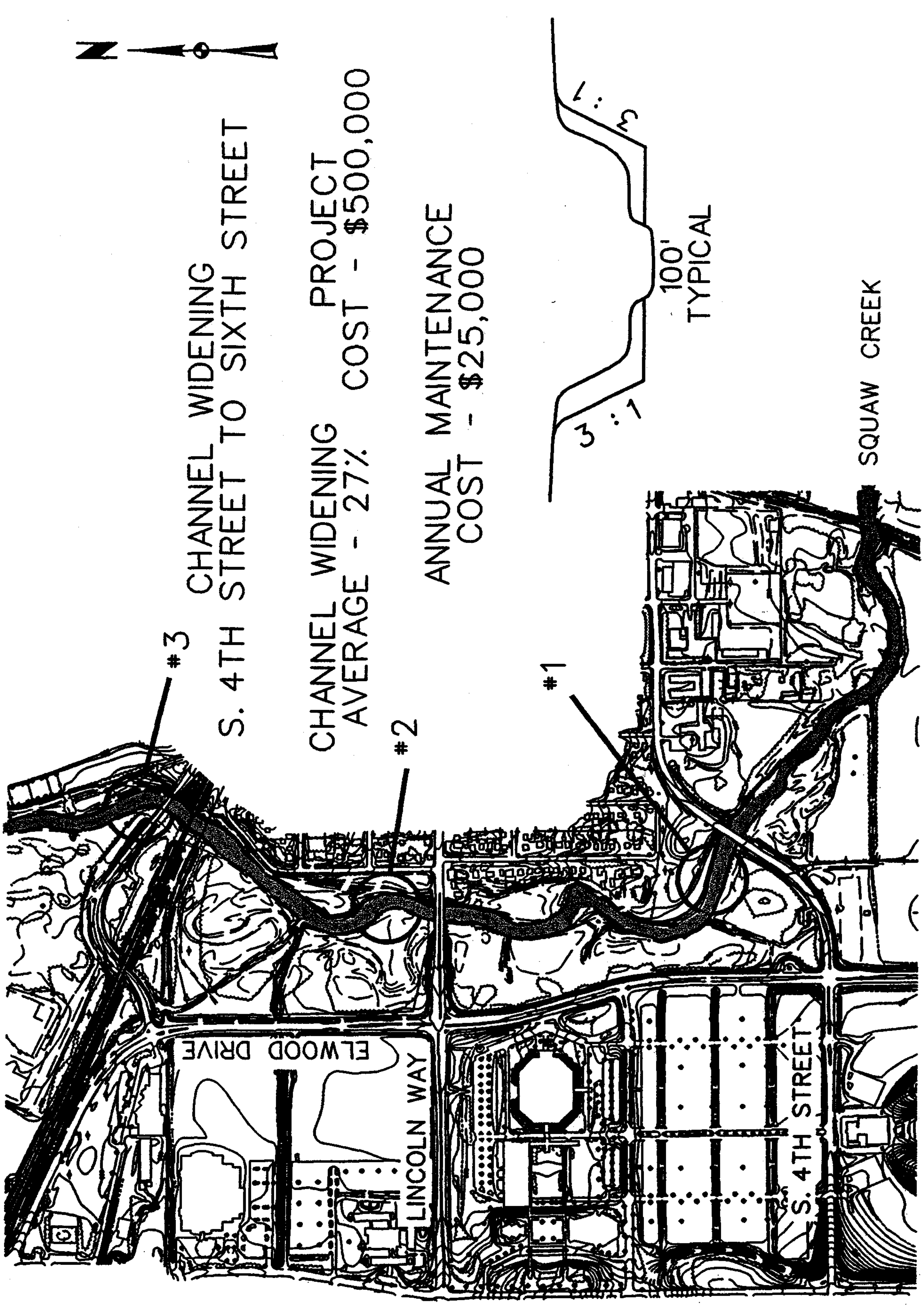

CHANNEL WIDENING
S. 4TH STREET TO SIXTH STREET
CHANNEL WIDENING PROJECT
AVERAGE - 27% COST - $500,000
ANNUAL MAINTENANCE
COST - $25,000
3 : 1
3 : 1
100'
TYPICAL
SQUAW CREEK
#1
#2
#3
ELWOOD DRIVE
LINCOLN WAY
S. 4TH STREET

FIGURE 6-5

C. BRIDGE CHANNEL CLEARING

A typical bridge channel clearing diagram is shown in Figure 6-6. Three bridge locations within the City of Ames seemed to have the most difficulty conveying the COE 100-year flood flow. They are the US Highway 30 bridge (Figure 6-7), the S. Duff Avenue bridge (Figure 6-8), and the Stange Road bridge (Figure 6-9). This alternative includes clearing existing debris from the channel around the bridge structure and excavating earth deposited from past flood events. This does not include actually lengthening the bridge structure. The Highway 30 and S. Duff Avenue bridges were analyzed assuming bridge structure lengthening as well.

The US 30 bridge capacity was increased 15%. This caused a maximum decrease in the upstream water surface elevation of 2". The estimated project cost would be $100,000 with annual maintenance of $10,000. The lengthening of this bridge would cause a maximum decrease in the upstream water surface elevation of 2". The bridge would cost an additional $1,500,000 to complete.

The S. Duff Avenue bridge capacity was increased 56%. This caused a maximum decrease in the upstream water surface elevation of 2". The estimated project cost is $60,000 with annual maintenance of $10,000. The lengthening of this bridge would cause a maximum decrease in the upstream water surface elevation of 2". The bridge would cost an additional $700,000 to complete.

The Stange Road bridge capacity was increased 16%. This caused a maximum decrease in the upstream water surface elevation of 4". The estimated project cost is $60,000 with annual maintenance of $10,000. Stange Road Bridge lengthening was not considered in this analysis. The existing bridge has adequate capacity for the design flood flows.

Each of these improvement would reduce the backwater depth behind the bridge by a small amount. This is due to the increased flow through the bridge caused by the additional cross sectional area of conveyance. The alternatives are relatively inexpensive to construct initially although the maintenance costs are high to assure the channel does not silt back in, especially after a large flood event. Due to the slight advantages gained by these alternatives they should not be considered for further analysis. However, the bridges should be continually inspected to assure there are no severe debris blockages that would cause additional flooding. Each bridge should be inspected and cleared, if necessary, after each flood event.

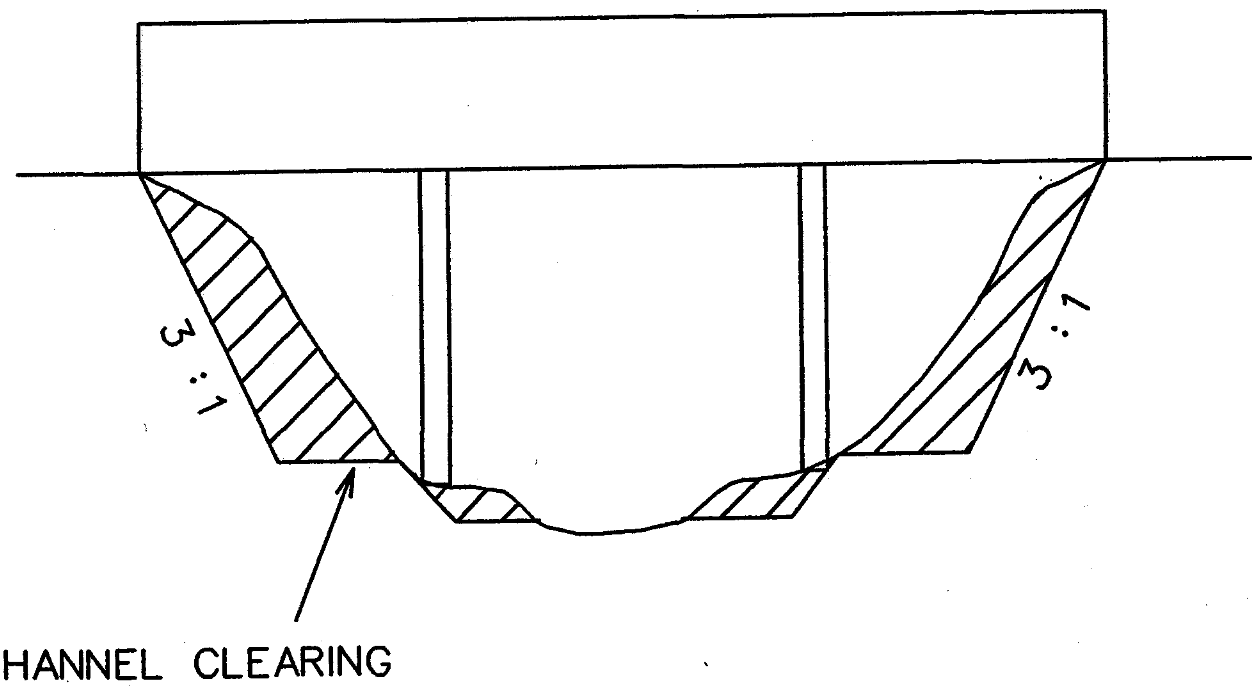
BRIDGE CHANNEL CLEARING SUMMARY

LOCATION	PROJECT COST (WITH BRIDGE)	PROJECT COST (WITHOUT BRIDGE)
US Highway 30	$1,500,000	$100,000
S. Duff Avenue	$ 700,000	$60,000
Stange Road	N/A	$60,000

Positives
- Reduce Backwater Depth.
- Increase Flow Through Bridge.
- Relatively Inexpensive to Construct.

Negatives
- High Maintenance to Control Silt.
- Little Decrease in Backwater.

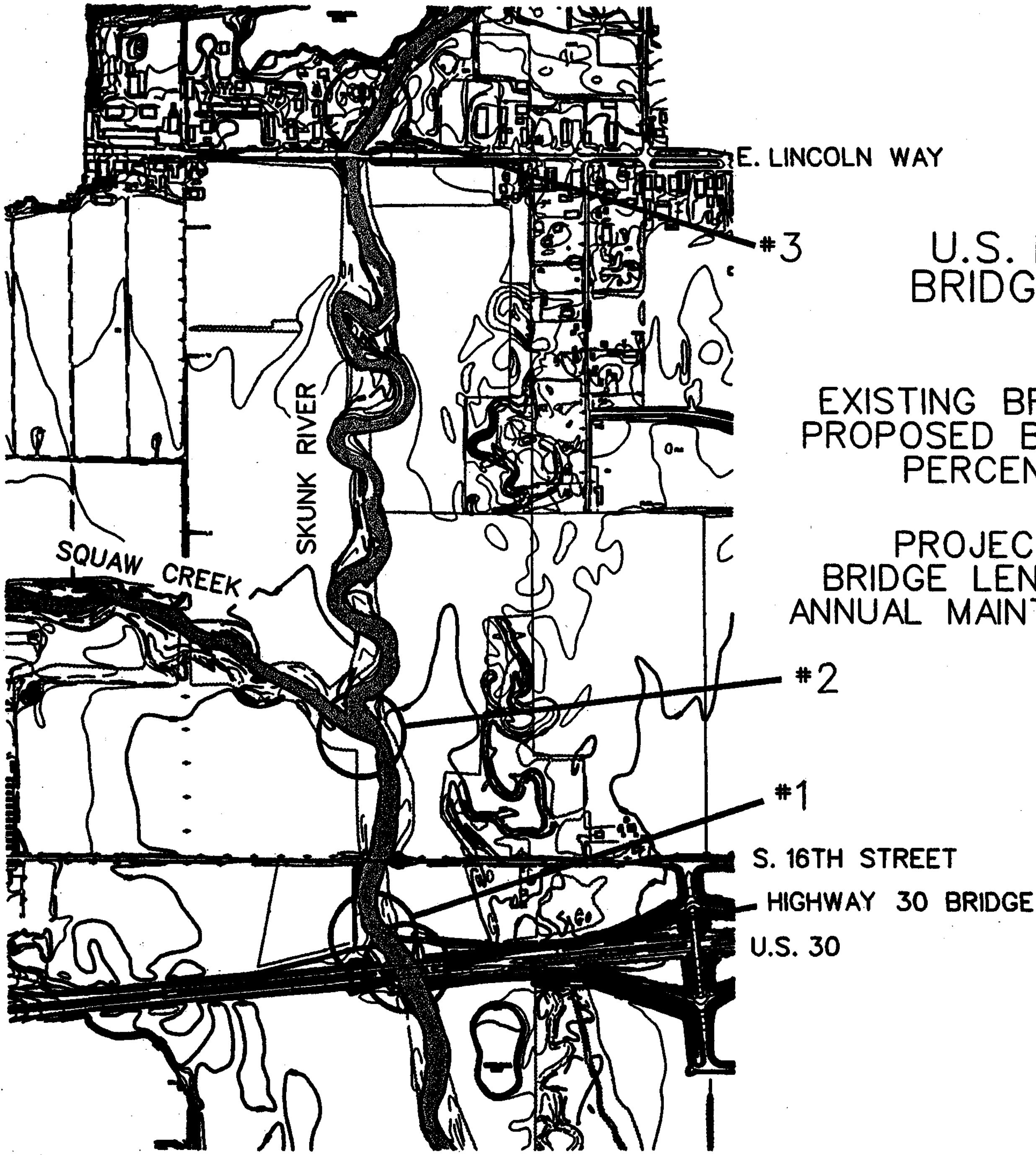
BRIDGE CHANNEL CLEARING



POSITIVE
1) REDUCE BACK WATER DEPTH.
2) INCREASED FLOW THROUGH BRIDGE.
3) RELATIVELY INEXPENSIVE.

NEGATIVE
1) LITTLE DECREASE IN BACK WATER.
2) MAY SILT BACK - HIGH MAINTENANCE COST.

FIGURE 6-6

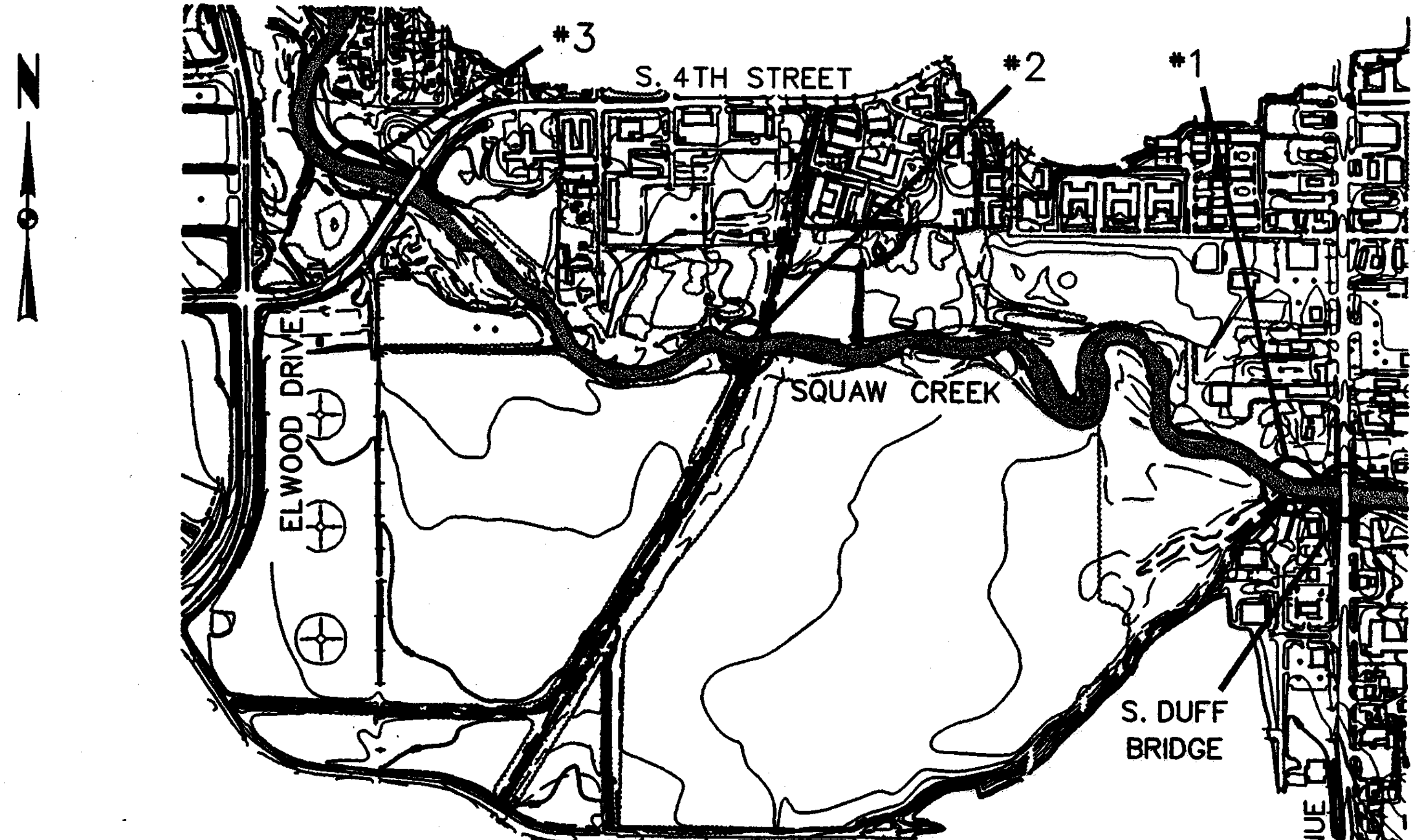


U.S. HIGHWAY 30
BRIDGE EXCAVATION

EXISTING BRIDGE AREA - 4,190S.F.
PROPOSED BRIDGE AREA - 4,810S.F.
PERCENT INCREASE - 15%

PROJECT COST - $100,000
BRIDGE LENGTHENING - $1,500,000
ANNUAL MAINTENANCE COST - $10,000

FIGURE 6-7



S. DUFF AVENUE BRIDGE EXCAVATION

EXISTING BRIDGE AREA - 1,980S.F.
PROPOSED BRIDGE AREA - 3,090S.F.
PERCENT INCREASE - 56%

PROJECT COST - $60,000
BRIDGE LENGTHENING - $700,000
ANNUAL MAINTENANCE COST - $10,000

FIGURE 6-8

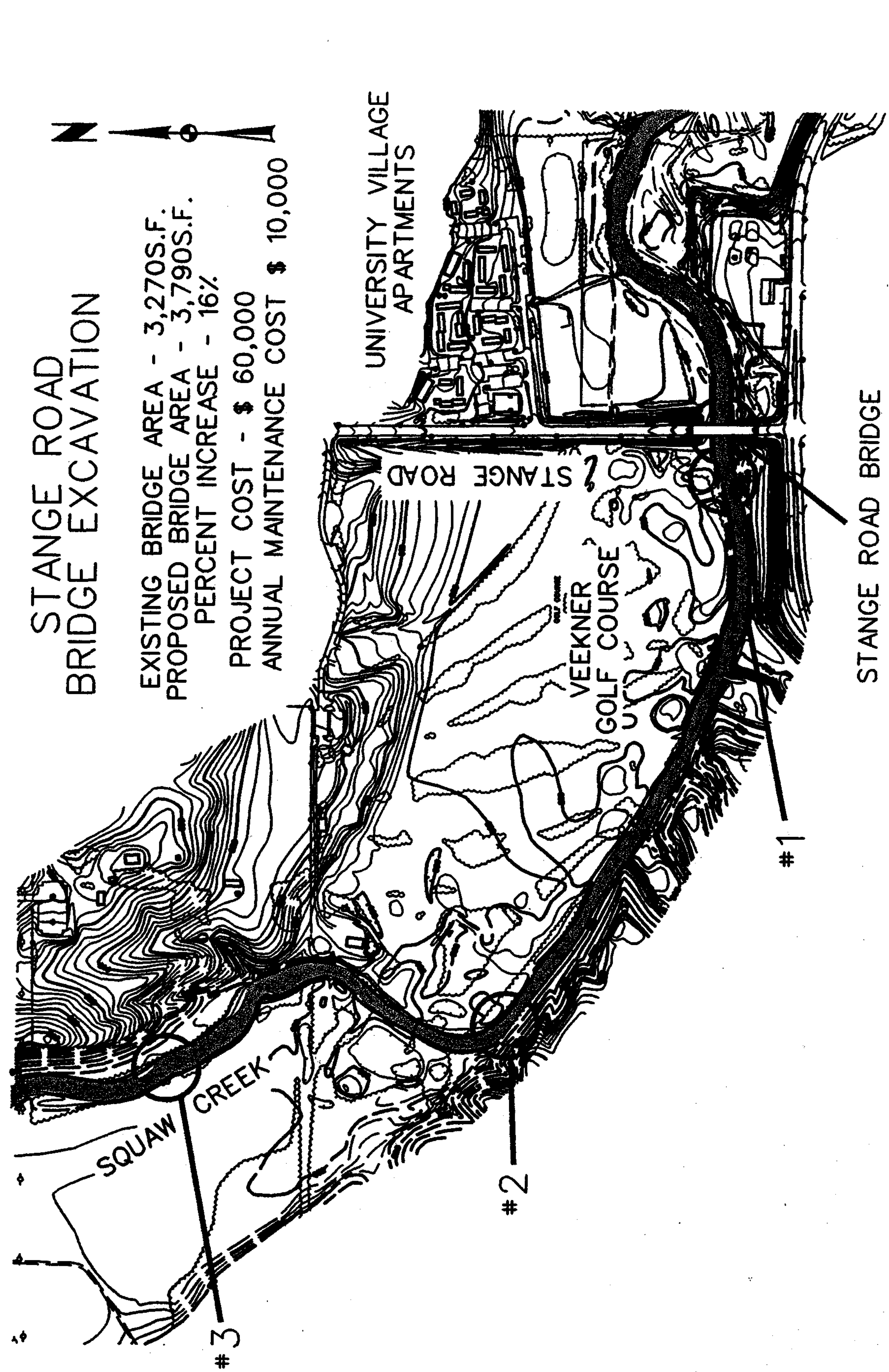

STANGE ROAD
BRIDGE EXCAVATION
EXISTING BRIDGE AREA - 3,270S.F.
PROPOSED BRIDGE AREA - 3,790S.F.
PERCENT INCREASE - 16%
PROJECT COST - $ 60,000
ANNUAL MAINTENANCE COST $ 10,000
UNIVERSITY VILLAGE
APARTMENTS
STANGE ROAD
VEEKNER
GOLF COURSE
STANGE ROAD BRIDGE
SQUAW CREEK
#1
#2
#3

FIGURE 6-9

D. UPSTREAM DETENTION - SQUAW CREEK

Two detention sites were analyzed on Squaw Creek to determine the effects on water surface elevations for the 1993 flood event downstream from the structures. Only dry detention sites were reviewed. The reservoirs are shown in Figure 6-10. The HEC-1 model developed by ISU was used to determine the decrease in discharge obtained for each detention site individually as well as in combination. Figure 6-11 graphically shows the effects on the downstream water surface profile. These discharge results are detailed below.

Individually, the detention sites could decrease the discharge 6,000-7,000 cfs for the July 1993 flood event. The reduced discharges were input into the calibrated HEC-2 hydraulic model. The lower discharges correspond to a decrease of approximately 1.5' in water surface elevation at the Lincoln Way gage station on Squaw Creek. In combination, the detention basins would decrease the discharge about 10,000 cfs and drop the downstream water surface elevation approximately 2' at the Lincoln Way gage station on Squaw Creek. The construction cost of these detention sites would be $18.5 million for the southern site and $17.5 million for the northern site.

The outlet works of these detention sites were developed to determine the effects of reducing the water surface elevation down to the existing 100-year flood elevation. The analysis did not attempt a complete design of the structures including analyzing the effects of the Probable Maximum Precipitation (PMP). A much more detailed design would be required to determine the exact benefits of these detention sites.

1. POSITIVE ASPECTS

These detention sites would drastically reduce the water surface elevations for the 1993 flood event which would subsequently reduce the damages caused by the high water. Iowa State University alone had more than $4 million in damage which could have been prevented with the detention facilities. The presence of these facilities would also diminish the potential of flash flooding along Squaw Creek.

The discharge reduction would have the additional effect of reducing flood insurance rates for properties adjacent to the channel. The 100-year water surface profile would be dramatically reduced thus removing a large amount of area from the floodplain. Locations not within the floodplain are not required to purchase flood insurance.

2. NEGATIVE ASPECTS

In general, detention sites of this magnitude are extremely expensive to plan, design, and construct. The cost of a single detention site is nearly twice as much as the entire amount of damage that occurred in 1993. A large part of the cost of these sites is the land requirements. Nearly four square miles would be required for both detention basins.

These sites would have high costs of maintenance to keep all parts of the detention facility in working order. Once the structure is constructed, the City would be responsible for the maintenance throughout the life of the structure.

The July 1987 COE "General Reevaluation Report" indicated the IDNR, the City of Ames, and the public all were opposed to the construction of any detention facility on either Skunk River or Squaw Creek. In general, the government officials felt the expenditures were too great for the benefits obtained. The public had a negative outlook due to the environmental implications of the construction. While the COE determined there were economically justified alternatives, both public and governmental bodies opposed the construction.

This alternative should not be considered for additional analysis due to the highly negative reaction of past suggested detention sites and the high project costs. The reaction to previously evaluated detention alternatives suggests detention would not be accepted today.

UPSTREAM DETENTION SUMMARY

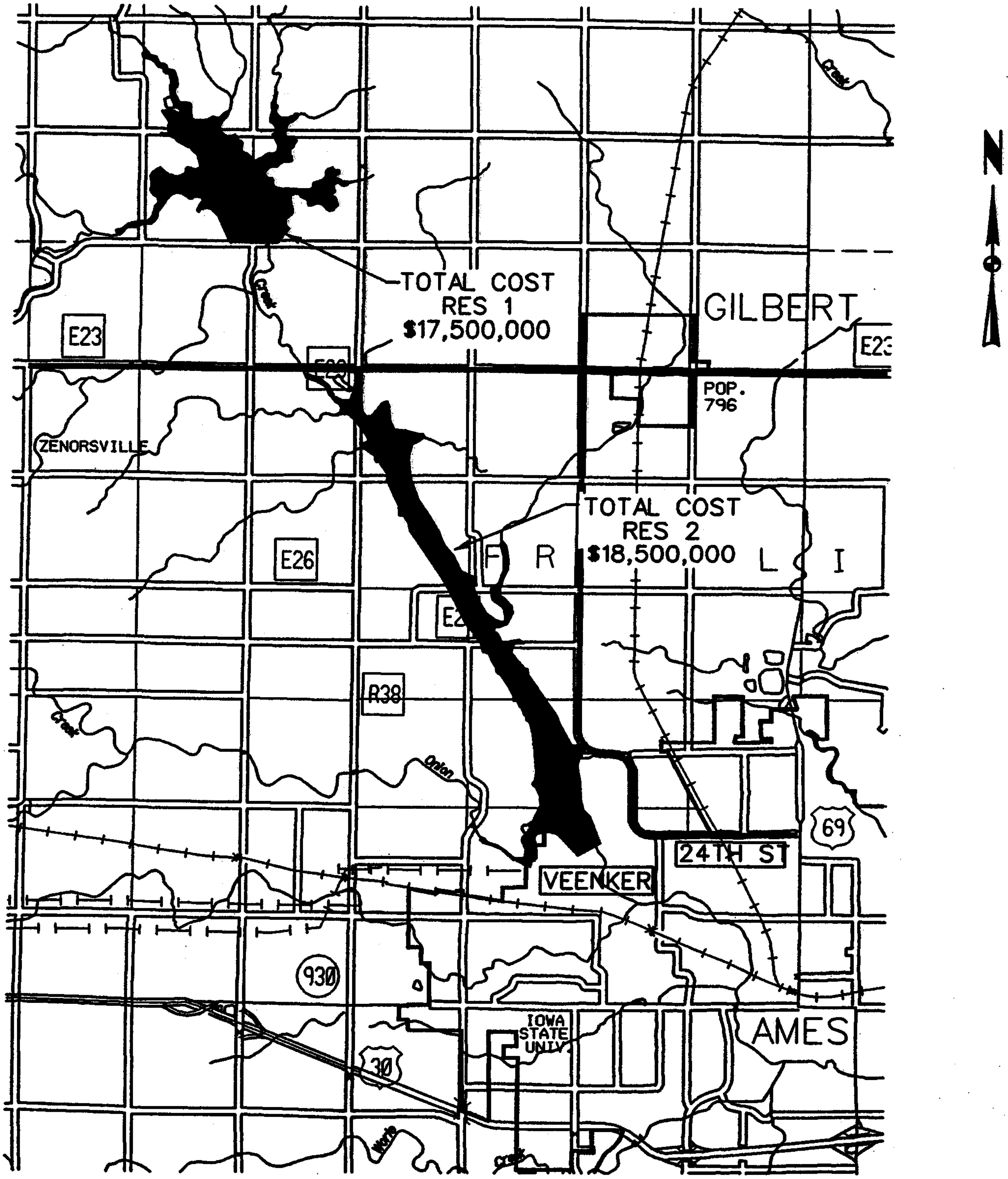
LOCATION	PROJECT COST
Reservoir 1	$17,500,000
Reservoir 2	$18,500,000

Positives
- Decrease Water Surface Elevations.
- Can Eliminate Flash Flooding Potential.
- Reduces Flood Insurance Rates.

Negatives
- High Maintenance Costs.
- Extremely Expensive.
- Large Amount of Land Required (Easements)
- Previously Unacceptable to Public.
- Negative Environmental Impact.

DETENTION DISCHARGE SUMMARY

Frequency	Discharge, CFS (No Detention)	DISCHARGE, CFS RES1	RES2	Both
100 yr.	16,200	10,945	10,965	9,240
500 yr.	24,240	17,220	18,500	14,710



AMES FLOOD TASK FORCE
SQUAW CREEK DETENTION SITES

FIGURE 6-10

SQUAW CREEK
EFFECTS OF UPSTREAM DETENTION

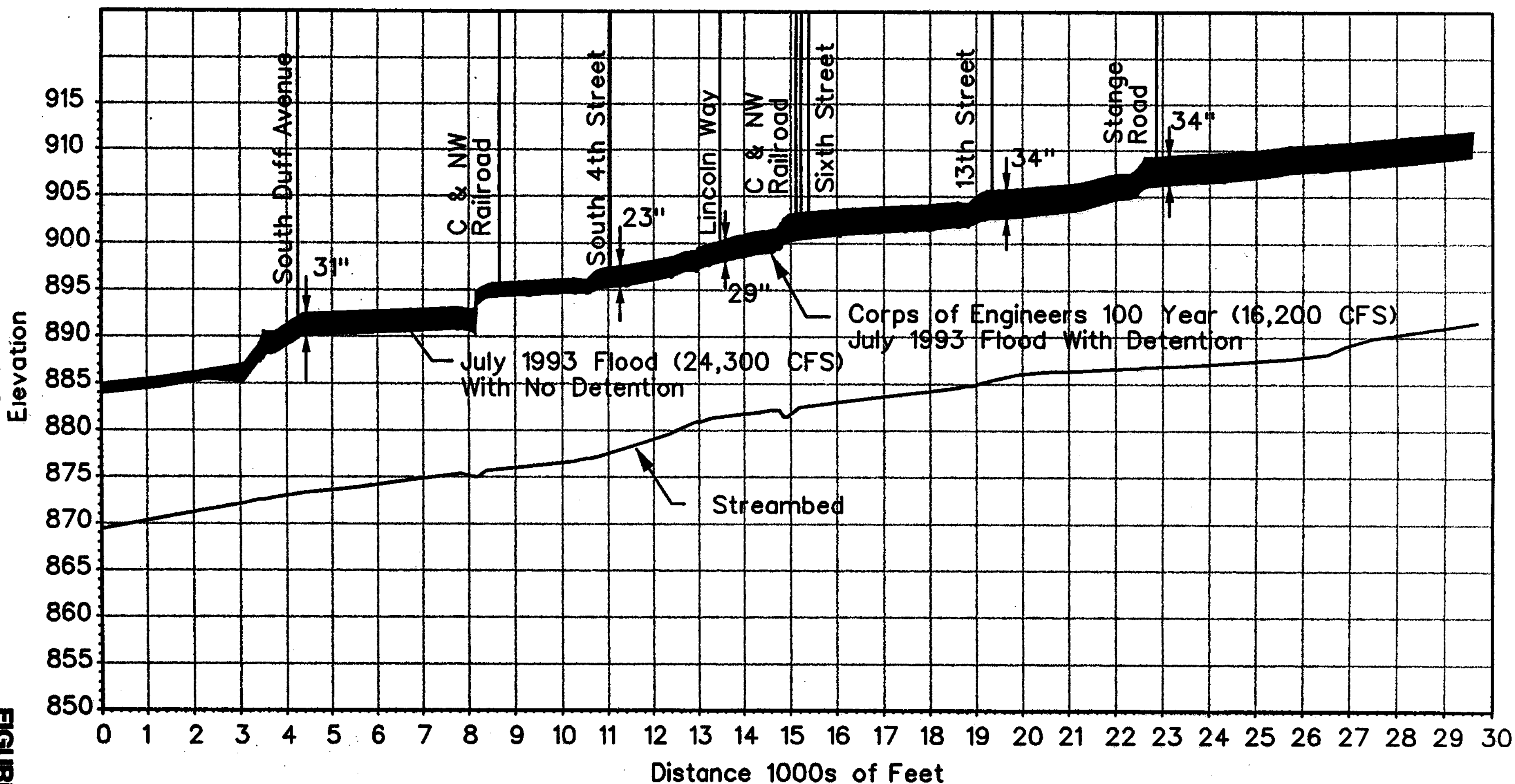


FIGURE 6-11

E. CONSTRUCTION OF LEVEES

Five potential levee locations were analyzed as flood prevention alternatives. The locations are as follows:

1. University Village - Squaw Creek
2. S. Duff Avenue/S. 5th Street - Squaw Creek/Skunk River
3. Arrasmith Trail - Skunk River
4. S. 4th Street - Squaw Creek
5. ISU - Maple-Willow-Larch

In addition, the Dayton Avenue Road was designed at an elevation that would prevent flooding from the 100-year flood discharge. The 100-year flood discharge was increased to the new COE level as a part of this study. The roadway elevation was reviewed to determine if the revised 100-year flood discharge overtops Dayton Avenue.

The construction of levees would eliminate the area behind the levee from the floodplain assuming the levee height was higher than the 100-year flood elevation. Levees have to meet several requirements to be certified by FEMA. The levee must have 3' of freeboard throughout the length of the structure. The upstream end of the levee must have 3.5' of freeboard. Within 100' of any bridge or culvert, 4' of freeboard is required. Freeboard is graphically displayed in Figure 6-12. Freeboard is the distance from the design high water elevation to the overtop elevation of the structure. The embankment should be protected from possibility of erosion. Interior drainage should be studied to determine the effects behind the levee.

1. UNIVERSITY VILLAGE LEVEE

The University Village levee was reviewed as a part of the Study of Flood Damage Mitigation Measures prepared by Snyder & Associates for Iowa State University. This study only looked at short range solutions. Snyder & Associates recommended further study during any long range studies completed at a later date. Therefore, the University Village levee was analyzed as a part of the Ames Flood Study.

The alignment of the levee is shown in Figure 6-13. After a careful review of the flood damage caused by the 1993 flood, this alignment was eliminated from further consideration. In 1993, the flood waters overtopped Stange Road. In order to protect the University Village Apartments from the effects of the 1993, Stange Road would need to be raised or a floodwall would need to be built to keep the flow from overtopping the road. The project cost for the levee when combined with the costs of the floodwall or raised roadway are far in excess of the benefits obtained from these improvements. In 1993, this area sustained approximately $160,000 in damage. The levee alone would cost an estimated $500,000 to design and construct. Annual maintenance costs would be $10,000.

2. S. DUFF AVENUE/S. 5TH STREET LEVEE

The alignment for the S. Duff Avenue/S. 5th Street levee was determined based on the COE 1987 "General Reevaluation Report". In this report, a levee and gatewell system was proposed to protect the area from Walnut Avenue at S. 5th Street to just east of the S. Duff Business area. Figure 6-14 displays the levee alignment. Due to the recent development of an apartment complex, the COE alignment is no longer feasible. The levee alignment was modified to extend west to the existing pedestrian walkway. This system requires a large amount of interior drainage storage as there would be no pump system. This levee alignment would open up nearly 40 acres of previous floodplain for development.

The levee evaluation was based on the revised COE 100-year flood elevation protection level with three feet of freeboard. This is approximately the revised COE 500-year flood elevation. The revised COE 500-year flood elevation is approximately the same as the 1993 flood level.

The S. Duff Avenue/S. 5th Street levee would protect 51 businesses and apartments that would currently be inundated by the 500-year flood event. These structures accounted for more than $2.0 million in damage for the 1993 flood event. The estimated project cost for this levee is $3.4 million. The annual maintenance costs would be $20,000.

A hydraulic analysis completed for this alternative indicated the COE 100-year water surface profile for Squaw Creek would increase a maximum of 4" upstream from this levee. This would have a negative impact on structures upstream not protected by the levee. The Skunk River analysis showed this levee would cause no increases in the water surface profile for the COE 100-year flood.

3. ARRASMITH TRAIL LEVEE

The Arrasmith Trail levee is located north of Ames as shown on Figure 6-15. This area has been subject to repeated flooding over the last several years. There currently exists an earthen levee along the north side of Skunk River. This levee is heavily wooded. This levee does offer some protection from Skunk River flooding to structures located north of the levee. These structures include General Filter and Sargent Metal. There does, however, exist a drainage channel running into Skunk River from the north. There is little protection to property owners from this channel. Story County is currently developing plans to increase the size of the culvert underneath Arrasmith Trail to help ease backwater and roadway overtopping due to the side channel. The scope of this study did not include reviewing affects from the side channel in this area. Snyder & Associates did use available information to develop an estimated cost to construct a levee as shown in Figure 6-15. This levee would not protect all property owners in this area. This analysis included construction of the levee as shown to prevent a flood similar to the 1993 flood for causing flood damage.

The hydraulic analysis completed for the alternative indicated no increase in the COE 100-year flood discharge. This would be expected since the earth fill for the majority of the levee is already in place. The elevation of the levee would protect to the 1993 flood event.

This area received an estimated $85,000 in damage from the 1993 flood. The estimated project cost is $100,000. The annual maintenance costs would be $10,000.

4. S. 4TH STREET LEVEE

The owner of Riverside Manor nursing home at 1204 S. 4th Street commented on the problem of flow overtopping S. 4th Street east of the bridge and running into the nursing home and apartments. He asked Snyder & Associates to investigate the potential for placing a levee across the ground where the City bought out several homes on the north side of S. 4th Street. The levee alignment would keep floodwaters from overtopping S. 4th Street east of the bridge. Floodwater would still overflow the roadway west of the bridge.

The analysis was completed using the calibrated HEC-2 model for Squaw Creek. The results of this analysis indicate the upstream water surface elevations would increase as a result of the levee. The 100-year flood elevations would increase approximately 0.2′ while the 500-year flood elevations would increase approximately 0.3′.

The Ames Flood Plain Ordinance states an improvement must cause not greater than 0.1′ of water surface elevation increase upstream from the improvement site. The S. 4th Street levee in the location proposed does not meet this requirement. Individual site flood protection measures such as an earthen berm or building floodproofing could diminish the threat of flood damage for the affected structures without causing increases in upstream water surface elevations.

5. MAPLE-WILLOW-LARCH

The ISU Flood Mitigation Study completed by Snyder & Associates, Inc. recommended the construction of a ring dike/floodwall system immediately adjacent to Maple-Willow-Larch. The study recommended constructing the levee one foot above the 1993 flood elevation. Storm sewer modifications and a pump station were included as a part of these improvements. The estimated construction cost for this project was $518,600 in June of 1994.

6. DAYTON AVENUE AS A LEVEE

An analysis was completed to determine if a 100-year flood event would overtop Dayton Avenue. This is shown in Figure 6-16. This roadway was designed to protect against the effective 100-year flood event when the road was initially constructed. The 100-year flood discharge will be revised upward based on the hydrologic information discussed in Chapter 3. The increase in discharge will cause corresponding increases in water surface elevation.

The City of Ames completed a survey of the top of the roadway. There are no culverts passing underneath Dayton from east to west. The low point of the "levee" is at the intersection with US 30. The shoulder of US 30 dips to an elevation 882.1. The COE 100-year flood elevation at this point is 881.9. Snyder & Associates would recommend sandbagging in this location to prevent premature overtopping of Dayton Avenue.

The top of Dayton Avenue runs from elevation 882.1 at US 30 to elevation 886.6 at +/- 500' south of SE 5th Street. The 100-year flood profile is elevation 881.9 at US 30 to elevation 884.33 at +/- 500' south of SE 5th Street. The property east of Dayton Avenue is protected to the new 100-year flood level by a range of 0.2'-0.4' along the south end of Dayton Avenue.

The existence of Dayton Avenue does not eliminate the potential for flooding even if the roadway is not overtopped by the flood waters. The internal drainage on the east side of Dayton Avenue can not be easily drained away during a flood event. These flood waters may pond and cause flood damage to businesses and mobile homes along this area. A larger culvert with an outlet control gate could be constructed under US 30 to alleviate this problem. This gate would require yearly maintenance to assure proper function during a flood event. The flood control outlet is critical since the flood waters on the south side of US 30 could backup through this culvert and cause flooding without the gate.

7. BENEFITS OF LEVEES

A levee system would give many benefits to the property behind the levee. All buildings encompassed by the levee would be directly protected from a flood elevation up to the design level (top of levee). Clearly, as with all protection measures, buildings in the floodplain can not be protected from all storm events. A levee would, however, allow the property owner additional time to prepare for a major flood event, as well as provide a "peace of mind" during smaller flood events. The warning system currently proposed would still be a valuable tool to determine the potential for levee overtopping. The reliance on the warning system would be reduced for these protected areas.

Another benefit would be the reduced need for flood insurance. Flood insurance is required for all properties within the 100-year flood boundary. All the area behind the levee could be eliminated from this requirement. These property owners may still elect to purchase flood insurance to cover the potential for levee failure.

As stated previously, the S. Duff Avenue/S. 5th Street levee would protect land which is currently within the floodplain and not likely to be developed without expensive fill. The levee would open this ground up for development. The additional land would increase in value leading to an increased tax base for the City of Ames.

8. NEGATIVES OF LEVEES

Levee systems are generally very expensive to design, construct, and maintain. The construction of a levee is a lifetime commitment of resources by the City of Ames. These expenses would likely be absorbed by the entire community. The levee, however, would give the most benefit to those who own the property behind the levee.

Currently, the COE is undergoing a philosophical change from the construction of levees toward responsibility of the property owner. A levee would have to be the last possible alternative prior to COE acceptance. This would make COE and IDNR approval especially difficult. No state or federal funding could be expected for any levee construction.

Backwater can be developed upstream from the levee system. This would create an additional flood hazard for those upstream properties not protected by the levee. This would be a major obstacle during the public hearing and approval process.

Environmental considerations also play an important part of the evaluation. In order to construct the levee, the vegetation including all trees would be cleared. This would have an adverse effect on wildlife in the area. No trees would be allowed on the levee as they cause structural deficiencies in the embankment.

9. LEVEE CONCLUSIONS

The S. Duff Avenue/S. 5th Street and Arrasmith Trail levees will be continued for further analysis based on their potential for benefits. A benefit/cost ratio will help determine the economic justification for these alternatives. This analysis is completed in Chapter 7. The University Village Apartments should not be examined further due to the large cost to construct the improvements versus the small amount of damages sustained in 1993. A benefit/cost ratio for the Maple-Willow-Larch levee has previously been completed by Snyder & Associates, Inc.

LEVEE SUMMARY

LOCATION	PROJECT COST
University Village	$ 500,000
S. Duff Avenue/S. 5th Street	$3,400,000
Arrasmith Trail	$ 100,000
Maple-Willow-Larch	$ 520,000 (1994)

Positives
- Provides Protection to Buildings.
- Warning System Minimized.
- May Reduce Flood Insurance Rates.

Negatives
- High Maintenance Costs.
- Extremely Expensive to Construct.
- Can Cause Backwater Upstream.
- Some Negative Environmental Impact.

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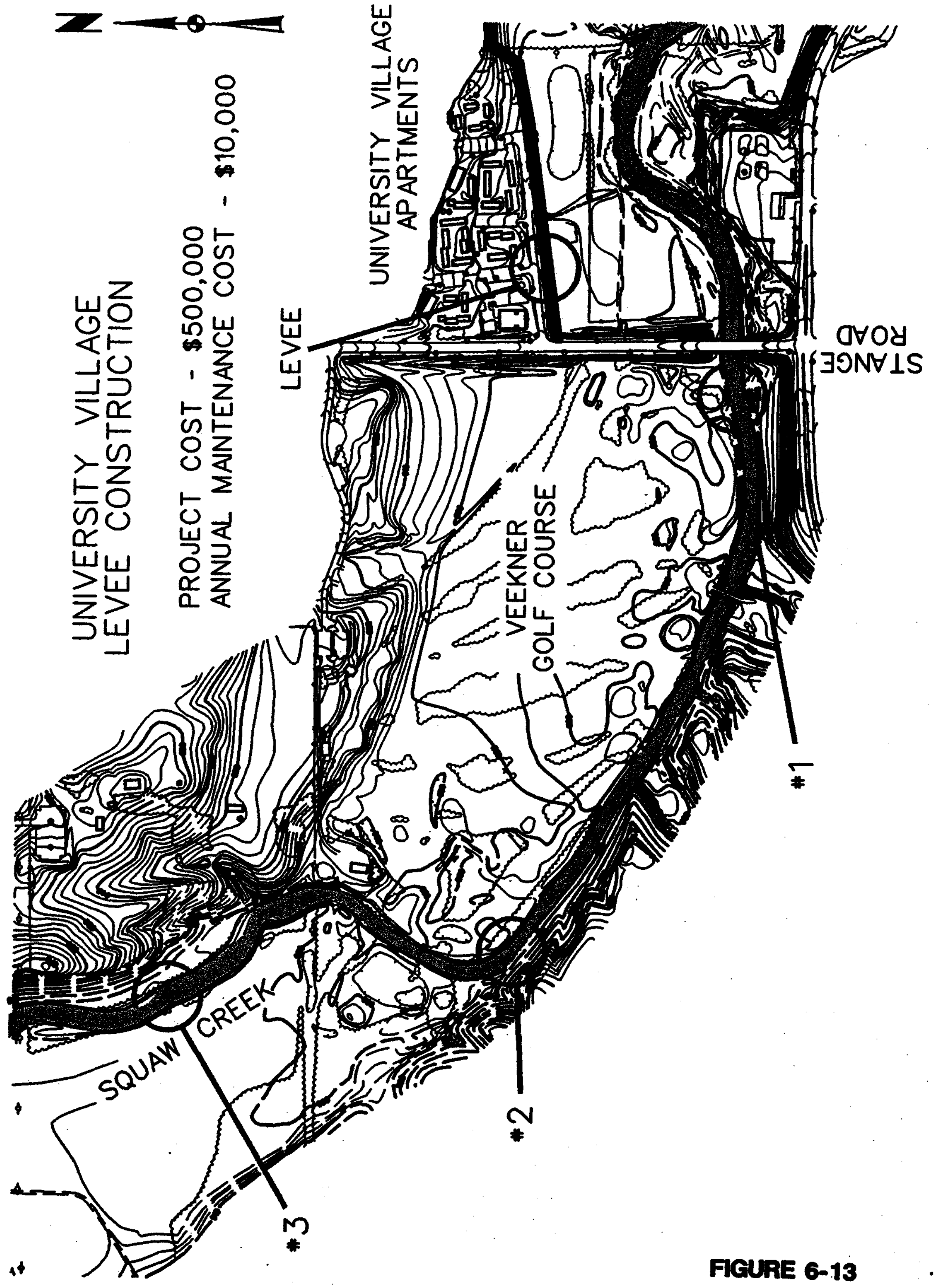
UNIVERSITY VILLAGE
LEVEE CONSTRUCTION
PROJECT COST - $500,000
ANNUAL MAINTENANCE COST - $10,000
N
LEVEE
UNIVERSITY VILLAGE
APARTMENTS
STANGE
ROAD
VEEKNER
GOLF COURSE
SQUAW CREEK
#1
#2
#3

FIGURE 6-13

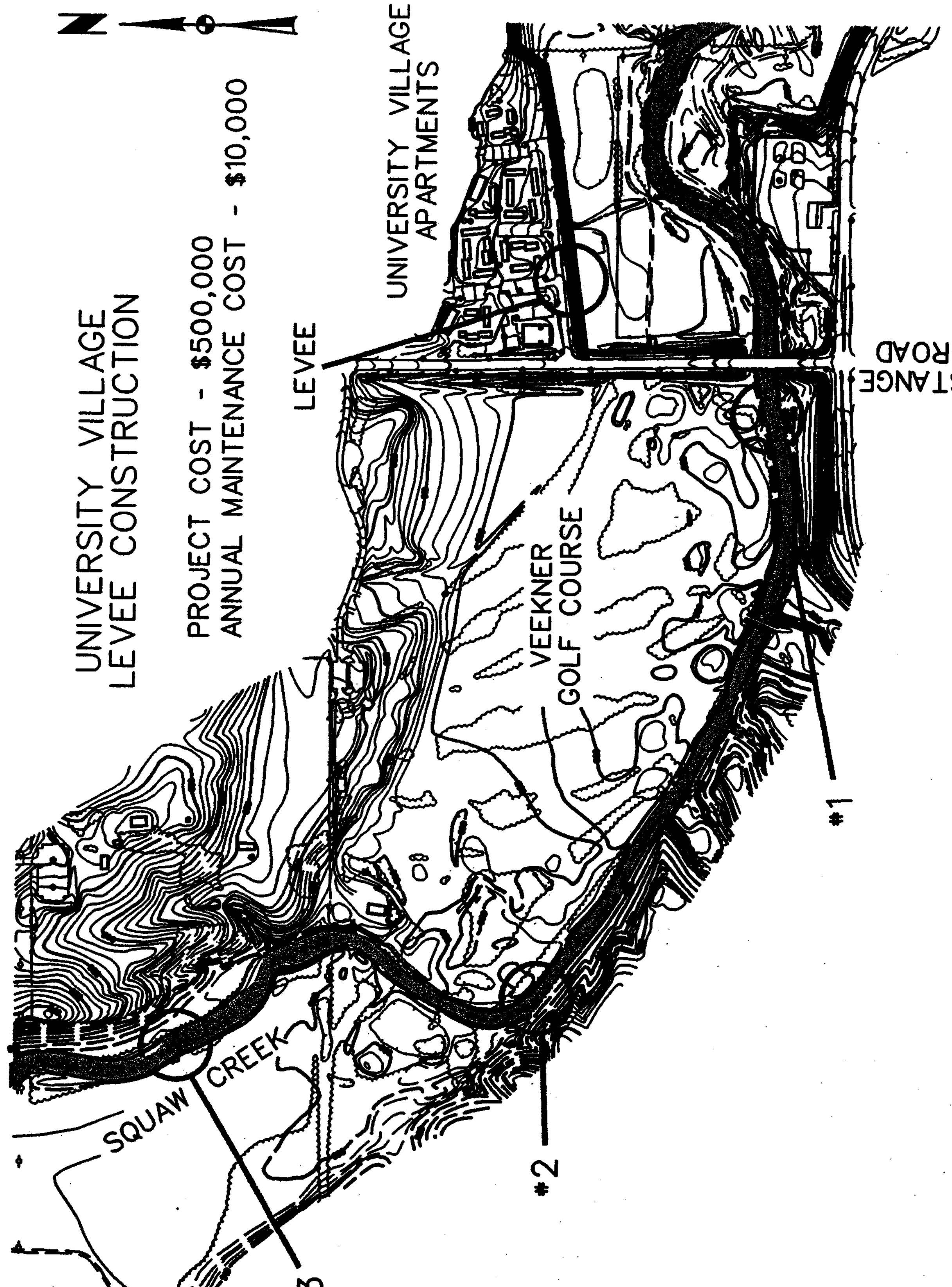
UNIVERSITY VILLAGE
LEVEE CONSTRUCTION
PROJECT COST - $500,000
ANNUAL MAINTENANCE COST - $10,000
LEVEE
UNIVERSITY VILLAGE
APARTMENTS
STANGE
ROAD
VEEKNER
GOLF COURSE
#1
#2
#3
SQUAW CREEK

FIGURE 6-13

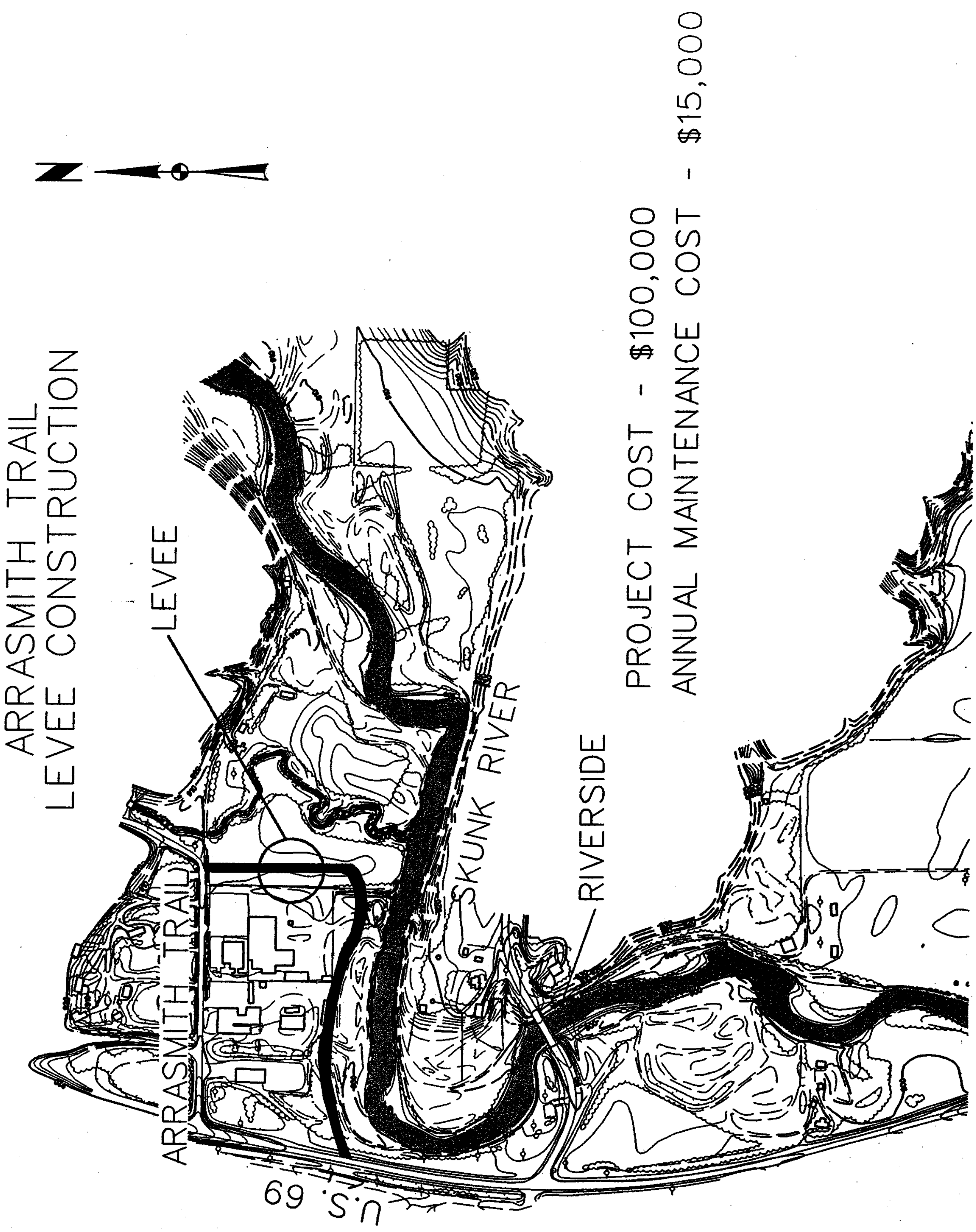
ARRASMITH TRAIL
LEVEE CONSTRUCTION
LEVEE
SKUNK RIVER
RIVERSIDE
ARRASMITH TRAIL
U.S. 69
PROJECT COST - $100,000
ANNUAL MAINTENANCE COST - $15,000

FIGURE 6-15

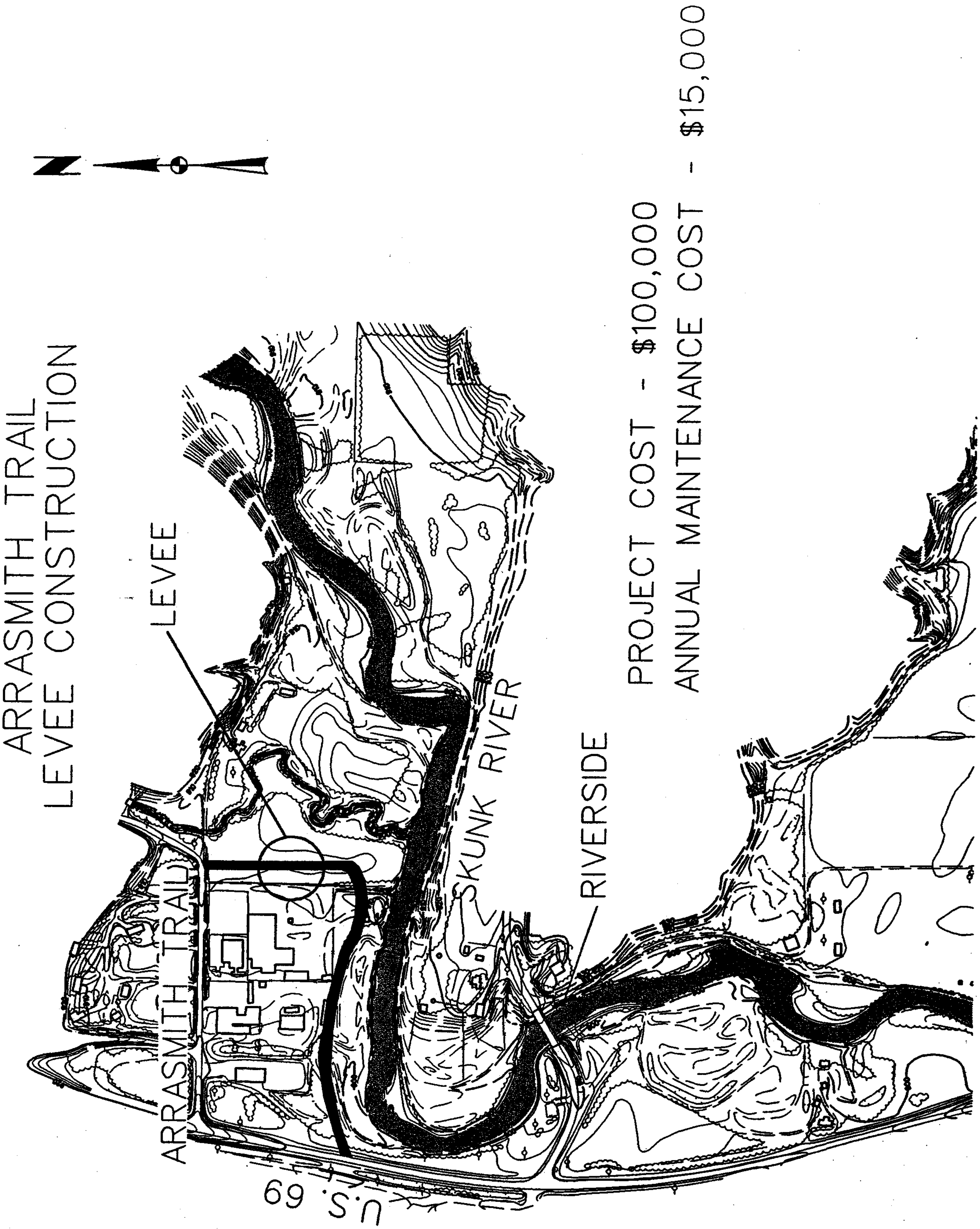
ARRASMITH TRAIL
LEVEE CONSTRUCTION
LEVEE
PROJECT COST - $100,000
ANNUAL MAINTENANCE COST - $15,000
SKUNK RIVER
RIVERSIDE
ARRASMITH TRAIL
U.S. 69

FIGURE 6-15

F. BUILDING FLOODPROOFING

Floodproofing is a combination of structural changes and adjustments to properties subject to flooding primarily for the reduction of flood damages. Floodproofing measures could include relocation, floodwalls, site levees, sealants, closures, and utility protection.

Relocation - The only technique for completely preventing future flood damage. This method involves moving a building out of a flood area to a new location where there is no threat of flooding.

Floodwalls - This method is sometimes practical for areas with low to moderate flooding depths and velocities. Floodwalls are designed to keep the water away from a building and are constructed of materials such as reinforced concrete. They are more expensive than site levees, but if properly designed, do not require as much concern with continued inspection and maintenance. Since some designs have openings for access to the building, they often require closures and human presence to make sure they are in place prior to flooding. Figure 6-17 shows a typical floodwall schematic. Figure 6-18 displays floodwall protection for a window well.

Site Levees - A possible technique in areas of shallow and moderate flooding depths with low velocities. This is a method of creating a barrier of compacted soil to keep the water away from a building. It can be one of the least expensive techniques. It can be attractively landscaped. Its construction, however, requires great care and there must be continued maintenance to prevent its failure.

Sealants - Sometimes referred to as dry floodproofing. This method can be used only in areas of very shallow flooding to completely seal a home against flood water, because of the tremendous pressures that water can exert against a structure protected by this method. The method can only be used on brick veneer or masonry construction in good structural condition. This method can only be used when the flood levels don't exceed two or three feet and flood velocities are negligible. Figure 6-19 shows a typical sealant detail.

Closures - Often used in conjunction with other techniques such as floodwalls and levees. Closures involve techniques for protecting gaps that have been left open for day-to-day convenience, such as walks, doors, and driveways. Figure 6-20 shows a typical drop-in closure.

Utility Protection - Often very costly damage to utilities such as heating, air conditioning, electrical, and plumbing systems occurs during floods. Simple and relatively low-cost measures can usually prevent damage to these systems, which are essential to the habitability of a structure.

All floodproofing measures are recommended to be constructed to prevent damage from the 1993 flood. This flood corresponds to the 500-year flood. Protection to the 100-year flood is a mandatory part of FEMA requirements. The majority of the buildings along the Skunk River/Squaw Creek floodplain would require 1-4 feet of floodproofing protection.

Section 9.5.2 (b) of the Ames City Ordinance requires all new or substantially improved residential structures be elevated one foot above the base (100-year) flood elevation on compacted fill. Floodproofing of existing residential structures below the base flood elevation does not relieve the residential property owner of flood insurance responsibilities. Non-residential property owners may construct buildings below the base flood elevation. Under this circumstance, the non-residential building must be floodproofed to one foot above the base flood elevation. These non-residential floodproofing measures must be certified by a licensed professional engineer. All property owners are allowed to floodproof beyond one foot above the base flood elevation (i.e., protection to the 500-year flood). This could reduce flood insurance rates for all property owners. Individual property owners are responsible for submitting the data to FEMA via the City of Ames.

The type of construction commonly found in Ames would dictate either a combination of floodwalls and closures or sealants and closures be used. Floodwalls would be used in areas where there is greater than 2' of flood protection required. Structures with lower flood elevation but with building construction not compatible with sealants such as Morton Building construction would also require floodwalls. Sealants would be useful in areas of low flooding (less than 2') and where construction is compatible with sealants, such as brick facade. A complete analysis of each building type has not been completed as a part of this study. Individual property owners should determine their requirements on a case by case basis.

Similar projects completed in Ames suggest the average construction cost to build a floodwall to be $20 per square foot. This does not include the cost of closures which are estimated to cost approximately $66 per square foot. For the S. Duff Avenue/S. 5th Street area, this would correspond to approximately $1.8 million to protect all buildings up to the 500-year flood level.

1. FLOODPROOFING BENEFITS

Floodproofing will provide each building with flood protection assuming all required closures have been placed. These measures are relatively inexpensive to construct as well. This is evidenced by comparing the cost of floodproofing all structures along S. Duff Avenue/S. 5th Street ($1.8 million) to the cost of constructing a levee to protect the same buildings ($3.4 million).

The cost of flood insurance to these structures would be reduced substantially with the construction of floodproofing. This floodproofing is required to be certified by a structural engineer. The following example illustrates a typical insurance reduction. The insurance rates quoted are for an area within a Flood Insurance Study (FIS) district which includes the entire City of Ames. Structures where a FIS has not been completed would have higher rates.

		Building	Contents
1.	Insurance coverage of building and contents	$85,000	$115,000
2.	Building has no basement and was built prior to 1980.		
3.	Pre-floodproofing		
	Annual insurance rates would be:	$0.50/100	$0.75/100
	Annual insurance premiums would be:	$425	$863
4.	Post-floodproofing (assuming protection at 3' above base flood)		
	Annual insurance rates would be:	$0.20/100	$0.25/100
	Annual insurance premiums would be:	$170	$288

The floodproofing would result in a total reduction of $830 in annual premiums.

2. FLOODPROOFING NEGATIVES

All viable floodproofing measures for this area require some type of closure system at entryways. This closure system would require a human presence to put the system in place. The threat of flooding would need to be constantly monitored so the closures could be placed in the threat of a flood.

3. BUILDING DATA

a. S. Duff Avenue/S. 5th Street Area

Building data for structures within the S. Duff Avenue/S. 5th Street area has been summarized in Tables 6-1 and 6-2. These tables contain a summary of all buildings within the Skunk River and Squaw Creek floodplains affected by the 500-year flood frequency and lower. The information in the summary includes the location/address, building construction, water entry elevation, 100- and 500-year water surface elevations, and an estimate of the 1993 flood damage. In the event of a predicted flood event, these buildings would be the first to be warned.

The tables also contain a cost of floodproofing for each building. The estimated cost of floodproofing was developed for each structure in the S. Duff Avenue/S. 5th Street area. Floodproofing costs for other areas outside of S. Duff Avenue/S. 5th Street were not calculated except for the ISU Center which was completed in an earlier study. The S. Duff Avenue/S. 5th Street floodproofing costs were developed for ease of comparison to the levee alternative. In order to compare the two alternatives directly, project costs for each were determined.

b. Areas Outside S. Duff Avenue/S. 5th Street

The buildings outside the S. Duff Avenue/S. 5th Street area have been summarized in Tables 6-3 through 6-7. These tables do not include mobile homes. These tables contain a summary of all buildings within the Skunk River and Squaw Creek floodplains affected by the 500-year flood frequency and lower. The information in the summary includes the location/address, building construction, water entry elevation, 100- and 500-year water surface elevations, and the 1993 flood damage. In the event of a predicted flood event, these buildings would be the first to be warned.

c. Total and Partial Floodproofing

The floodproofing alternative was analyzed using two different values for the construction costs. The first one assumed all buildings along the S. Duff Avenue/S. 5th Street corridor would be floodproofed. This is referred to as "Total Floodproofing" in all tables. Under this scenario, all the flood damages could be counted as benefits. The second method assumed only those buildings where the flood damages were greater than the cost of the floodproofing would be floodproofed. This is referred to as "Partial Floodproofing" in all tables. Only the flood damages from those buildings to be floodproofed could be counted as benefits.

TABLE 6-1
SUMMARY OF BUILDINGS TO BE PROTECTED BY FLOODPROOFING MEASURES
AMES FLOOD TASK FORCE
SOUTH DUFF AVENUE

LOCATION/ADDRESS	BUILDING TYPE	WATER ENTRY ELEVATION	100-YEAR DISCHARGE 16,200 CFS	500-YEAR DISCHARGE 24,300 CFS	1993 DAMAGES	COST OF FLOODPROOFING 100 YEAR	COST OF FLOODPROOFING 500 YEAR	PARTIAL FLOODPROOFING Partial Damage	PARTIAL FLOODPROOFING Partial Floodproofing
902 S. Duff - ZZZZ Best Auto Sales	Concrete Slab w/ Metal Walls	886.0	887.3	889.3	$50,000	$23,550	$31,600	$50,000	$31,600
710 S. Duff - Ames Rental	Concrete Slab w/ Metal Walls	884.9	887.3	889.3	$50,000	$48,400	$68,900	$0	$0
520 S. Duff - Big Earl's Goldmine	Concrete Slab w/ Brick Walls	885.1	887.3	889.3	$35,000 *	$49,600	$70,600	$0	$0
813 S. Duff - Story County	Concrete Slab w/ Block Walls	887.6	888.0	890.6	$60,000 *	$63,200	$90,400	$0	$0
535 S. Duff - Ziebart Tidy Car	Concrete Slab w/ Block Walls	887.7	888.0	890.6	$30,000 *	$32,600	$47,200	$0	$0
715 S. Duff - Masonic Temple	Concrete Slab w/ Block Walls	887.4	888.0	890.6	$60,000 *	$36,000	$52,000	$60,000	$52,000
716 S. Duff - O'Malley & McGee's	Block Foundation w/ Wooden Walls	887.1	887.3	889.3	$60,000 *	$29,200	$42,400	$60,000	$42,400
538 S. Duff - Save U More	Concrete Slab w/ Brick Walls	886.8	887.3	889.3	$110,000 *	$111,350	$161,200	$0	$0
538 S. Duff - J4 Rollaway	Conrete Slab w/ Metal Walls	886.9	887.3	889.3	$10,000 *	$44,500	$64,000	$0	$0
435 S. Duff - Century 21	Concrete Slab w/ Metal Walls	887.4	888.0	890.6	$20,000 *	$14,750	$22,000	$0	$0
111 S. 5th - The Fox Lounge	Concrete Slab w/ Wooden Walls	887.6	888.0	890.6	$20,000 *	$20,700	$30,400	$0	$0
429 S. Duff - Kitchens by Design	Concrete Slab w/ Brick Walls	887.5	888.0	890.6	$20,000 *	$38,550	$55,600	$0	$0
421 S. Duff - Linn-Mar Miniture Golf	Concrete Slab w/ Wooden Walls	887.7	888.0	890.6	$10,000 *	$22,400	$32,800	$0	$0
426 S. Duff -	Concrete Slab w/ Block Walls	887.2	888.0	890.6	$5,000 *	$36,000	$52,000	$0	$0
507 S. Duff - Centruy Cinema	Block Walls	887.1	888.0	890.6	$50,000 *	$40,250	$82,500	$0	$0
816 S. Duff - Iowa Glass	Concrete Slab w/ Metal Walls	887.4	887.3	889.3	$0	$0	$27,500	$0	$0
705 S. Duff - Quality Motors	Concrete Slab w/ Block Walls	888.0	888.0	890.6	$50,000 *	$0	$47,200	$50,000	$47,200
710 S. Duff - Ames Rental	Concrete Slab w/ Block Walls	887.3	887.3	889.3	$50,000	$0	$13,900	$50,000	$13,900
538 S. Duff - Honda of Ames	Concrete Slab w/ Brick Walls	887.4	887.3	889.3	$50,000	$0	$36,000	$50,000	$36,000
412 S. Duff - Phillips 66	Concrete Slab w/ Block Walls	887.7	887.3	889.3	$10,000	$0	$27,500	$0	$0
906 S. Duff - Burke Marketing	Concrete Slab w/ Metal Walls	888.1	887.3	889.3	$50,000 *	$0	$29,200	$50,000	$29,200
806 S. Duff - McDonald Supply	Concrete Slab w/ Block Walls	888.2	887.3	889.3	$5,000	$0	$41,100	$0	$0
118 SE 5th - American Auto	Concrete Slab w/ Metal Walls	888.5	887.3	889.3	$10,000 *	$0	$27,500	$0	$0
107 S. 5th - The Associates	Concrete Slab w/ Brick Walls	888.8	888.0	890.6	$20,000 *	$0	$20,700	$0	$0
400 S. Duff - Ames Home Furniture	Concrete Slab w/ Brick Walls	888.3	887.3	889.3	$10,000	$0	$53,000	$0	$0
811 S. Duff - Howe Welding	Concrete Slab w/ Concrete Walls	889.3	888.0	890.6	$100,000	$0	$33,450	$100,000	$33,450
316 S. Duff - University Inn	Councrete Foundation w/ Brick Walls	888.9	887.3	889.3	$10,000	$0	$93,800	$0	$0
531 S. Duff - Ruttles	Concrete Slab w/ Wooden Walls	889.9	888.0	890.6	$15,000	$0	$24,100	$0	$0
505 S. Duff - 20th Centry Bowling	Concrete Slab w/ Block Foundation	889.5	888.0	890.6	$750,000	$0	$76,000	$750,000	$76,000
316 S. Duff - Barnabees	Concrete Slab, Brick Walls	888.8	887.3	889.3	$5,000	$0	$62,350	$0	$0
551 S. Duff - Happy Joes	Floodwall	891.5	888.0	890.6	$50,000	$0	$0	$50,000	$0
409 S. Duff - Arby's	Concrete Foundation w/ Brick Walls	890.2	888.0	890.6	$10,000	$0	$23,250	$0	$0
325 S. Duff - Perkins	Concrete Slab w/ Concrete Walls	890.8	888.0	890.6	$5,000	$0	$0	$5,000	$0
309 S. Duff - Hardees	Concrete Slab w/ Block Walls	891.3	888.0	890.6	$5,000	$0	$0	$5,000	$0
202 SE 5th - Kritz-Davis Electric	Concrete Foundation w/ Metal Walls	889.5	887.3	889.3	$5,000	$0	$0	$5,000	$0
					TOTAL LOSS $1,800,000	$611,050	$1,540,150	$1,285,000	$361,750

*Estimated

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04/12/96

TABLE 6-2
SUMMARY OF FLOOD WATER ENTRY ELEVATIONS
AMES FLOOD TASK FORCE
SOUTH 5TH STREET

LOCATION/ADDRESS	BUILDING TYPE	WATER ENTRY ELEVATION	100-YEAR DISCHARGE 16,200 CFS	500-YEAR DISCHARGE 24,300 CFS	1993 DAMAGES	TOTAL FLOODPROOFING COST 100 YEAR	TOTAL FLOODPROOFING COST 500 YEAR	PARTIAL FLOODPROOFING Partial Damage	PARTIAL FLOODPROOFING Partial Floodproofing
301 South 5th Street - South Meadow Apts.	Concrete Foundation w/ Block Walls	887.4	890.1	892.5	$1,000 *	$0	$0	$1,000	$0
321 South 5th Street - South Meadow Apts.	Concrete Foundation w/ Block Walls	887.4	890.3	892.8	$1,000 *	$0	$0	$1,000	$0
407 South 5th Street - South Meadow Apts.	Concrete Foundation w/ Block Walls	887.3	890.3	892.8	$1,000 *	$0	$0	$1,000	$0
225 South 5th - Apartments	Concrete Slab w/ Wood Walls	888.6	890.1	892.5	$25,000 *	$23,250	$34,000	$0	$0
419 Walnut Avenue - Apartments	Concrete Foundation w/ Brick Walls	888.8	890.5	893.0	$1,000 *	$0	$0	$1,000	$0
Walnut Aptartments - Garage	Concrete Slab w/ Wood Walls	888.2	890.5	893.0	$1,000 *	$0	$0	$1,000	$0
620 S. 4th Street	Concrete Foundation w/ Brick & Wood Walls	886.8	890.8	893.2	$1,000 *	$0	$0	$1,000	$0
421 South 5th Street - South Meadow Apts.	Concrete Foundation w/ Block Walls	890.1	890.5	893.0	$1,000 *	$0	$0	$1,000	$0
217 South 5th - Apartments	Concrete Slab w/ Wood Walls	888.8	889.1	891.5	$25,000 *	$23,250	$34,000	$0	$0
227 South 5th - Apartments	Concrete Slab w/ Wood Walls	889.9	890.1	892.5	$25,000 *	$23,250	$34,000	$0	$0
229 South 5th - Apartments	Concrete Slab w/ Wood Walls	889.7	890.1	892.5	$25,000 *	$32,600	$47,200	$0	$0
207 S. 5th Street - Century Apts.	Block Foundation w/ Wood Walls	889.4	889.1	891.5	$25,000 *	$0	$23,250	$25,000	$23,250
209 South 5th - Apartments	Concrete Slab w/ Wood Walls	889.4	889.1	891.5	$25,000 *	$0	$23,250	$25,000	$23,250
211 South 5th - Apartments	Concrete Slab w/ Wood Walls	889.3	889.1	891.5	$25,000 *	$0	$23,250	$25,000	$23,250
River Birch Apts. - Garage	Concrete Slab w/ Wood Walls	889.2	888.1	890.5	$1,000 *	$0	$0	$1,000	$0
219 South 5th - Apartments	Concrete Slab w/ Wood Walls	889.7	889.1	891.5	$25,000 *	$0	$23,250	$25,000	$23,250
429 Walnut Avenue - Apartments	Concrete Foundation w/ Brick Walls	891.2	890.5	893.0	$25,000 *	$0	$29,200	$0	$0
				TOTAL LOSS	$233,000	$102,350	$271,400	$108,000	$93,000

* ESTIMATED

TABLE 6-3
SUMMARY OF BUILDINGS TO BE PROTECTED BY FLOODPROOFING
AMES FLOOD TASK FORCE
SOUTH 4TH @ SQUAW CREEK

LOCATION/ADDRESS	BUILDING TYPE	WATER ENTRY ELEVATION	100-YEAR DISCHARGE 16,200 CFS	500-YEAR DISCHARGE 24,300 CFS	1993 DAMAGE
328 South Russell - House	Block Foundation w/ Wood Walls	893.3	894.9	896.8	$10,000 *
1204 S. 4th Street - Riverside Manor	Block Foundation w/ Brick Walls	891.4	894.7	896.3	$20,000 *
443 Maple - (Vacant House)	Concrete Foundation w/ Wood Walls	890.4	894.6	896.1	$5,000 *
457 Maple - House	Block Basement w/ Wood Walls	890.2	894.6	896.1	$10,000 *
Maplewood Apt.	Block Basement w/ Brick Walls	894.2	894.7	896.3	$20,000 *
439 Maple - Apartment	Concrete Foundation w/ Wood Walls	894.0	894.6	896.1	$20,000 *
313 South Russell - House	Block Foundation w/ Wood Walls	896.6	895.2	897.3	$5,000 *
South Riverside - House	Brick Foundation w/ Wood Walls	896.9	895.4	897.7	$5,000 *

* Estimated

TOTAL LOSSES $95,000

TABLE 6-4
SUMMARY OF BUILDINGS TO BE PROTECTED BY FLOODPROOFING MEASURES
AMES FLOOD TASK FORCE
IOWA STATE CENTER

LOCATION/ADDRESS	BUILDING TYPE	WATER ENTRY ELEVATION	100-YEAR DISCHARGE 16,200 CFS	500-YEAR DISCHARGE 24,300 CFS	1993 DAMAGES
Scheman Building	Cast in place concrete walls	896.4	897.0	899.1	$900,000
Hilton Coliseum	Earthen berms with glass entry doors	896.5	897.0	899.1	$2,137,000
Maple-Willow-Larch	Full height window walls	897.4	897.7	900.0	$983,000
Recreation/Athletic Center	Masonry walls	898.1	898.3	900.7	$115,900
University Village	Concrete foundations w/ wood frames	907.5	904.7	907.5	$159,400

Total Losses $4,295,300

TABLE 6-5
SUMMARY OF BUILDINGS TO BE PROTECTED BY FLOODPROOFING
AMES FLOOD TASK FORCE
DAYTON AVENUE

LOCATION/ADDRESS	BUILDING TYPE	WATER ENTRY ELEVATION	100-YEAR DISCHARGE 20,200 CFS	500-YEAR DISCHARGE 26,500 CFS	1993 DAMAGE
1803 SE 16th - House	Block Foundation w/ Wooden Walls	880.9	883.2	884.4	$10,000 *
1214 S Dayton Rd. - National Gas Co.	Concrete Slab w/ Metal Walls	882.0	883.8	885.0	$5,000 *
1418 S Dayton Rd. - Super 8 Lodge	Concrete Foundation w/ Wooden Walls	884.0	883.7	884.9	$50,000 *
1208 S Dayton Rd. - Eagle Grove Crane	Concrete Slab w/ Metal Walls	883.8	883.8	885.0	$5,000 *
SE 16th Street - House	Block Foundation w/ Wooden Walls	883.8	882.7	883.9	$10,000 *
1605 South Dayton Road - Comfort Inn	Concrete Foundation w/ Wood & Brick Walls	884.2	882.7	883.9	$20,000 *

* Estimated

Total Losses $100,000

TABLE 6-6
SUMMARY OF BUILDINGS TO BE PROTECTED BY FLOODPROOFING MEASURES
AMES FLOOD TASK FORCE
EAST LINCOLN WAY

LOCATION/ADDRESS	BUILDING TYPE	WATER ENTRY ELEVATION	100-YEAR DISCHARGE 9,780 CFS	500-YEAR DISCHARGE 11,100 CFS	1993 DAMAGE
South Evans Upholstery	Concrete Floor w/ Block Basement	885.1	886.1	886.7	$10,000 *
709 NE 2nd - Freidrich Construction	Concrete Slab w/ Metal Walls	887.3	889.1	889.9	$85,000 *
Friedrich Construction - South Building	Concrete Slab w/ Metal Walls	887.0	887.7	888.2	$100,000 *
722 East Lincoln Way - Accurate Auto Trim	Concrete Slab w/ Block Walls	886.0	886.1	886.7	$20,000 *
716 East Lincoln Way - House	Block Basement	886.0	886.1	886.7	$10,000 *
722 East Lincoln Way - Accurate Auto Trim	Concrete Slab w/ Metal Walls	886.0	886.1	886.7	$10,000 *

* Estimated

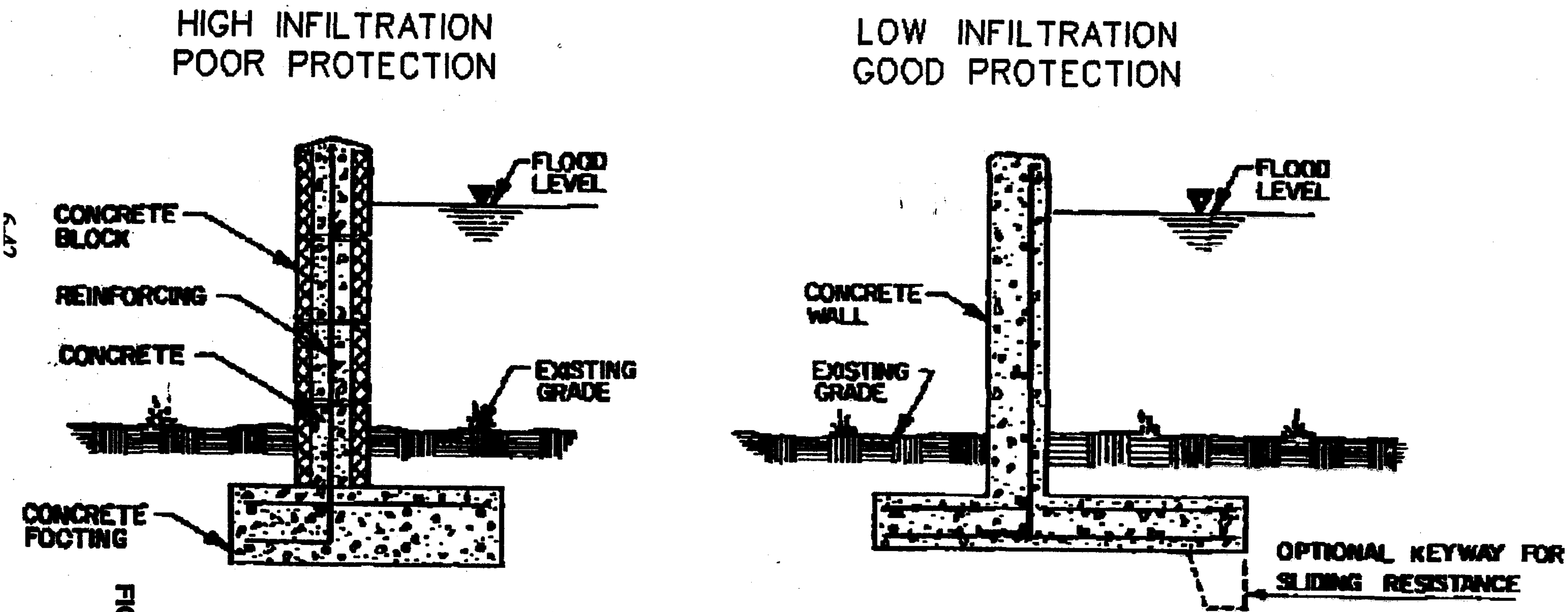
TOTAL LOSSES $235,000

TABLE 6-7
SUMMARY OF BUILDINGS TO BE PROTECTED BY FLOODPROOFING MEASURES
AMES FLOOD TASK FORCE
ARRASMITH TRAIL

LOCATION/ADDRESS	BUILDING TYPE	WATER ENTRY ELEVATION	100-YEAR DISCHARGE 9,780 CFS	500-YEAR DISCHARGE 11,100 CFS	1993 DAMAGES
Storage Bldg.	Concrete Slab w/ Metal Walls	905.5	906.6	907.1	$30,000 *
600 Arrasmith Trail - General Filter	Block Walls	906.3	906.6	907.1	$30,000 *
General Filter	Concrete Slab w/ Metal Walls	906.9	906.6	907.1	$20,000 *
650 Arrasmith Trail - Sargent Metal	Concrete Footing w/ Metal Walls	908.6	906.6	907.1	$0 *
600 Arrasmith Trail - General Filter	Block Walls	909.1	906.6	907.1	$0 *
General Filter	Concrete Foundation w/ Metal Walls	907.2	906.6	907.1	$5,000 *

* Estimated

Total Losses $85,000



CONCRETE FLOODWALL

FIGURE 6-17

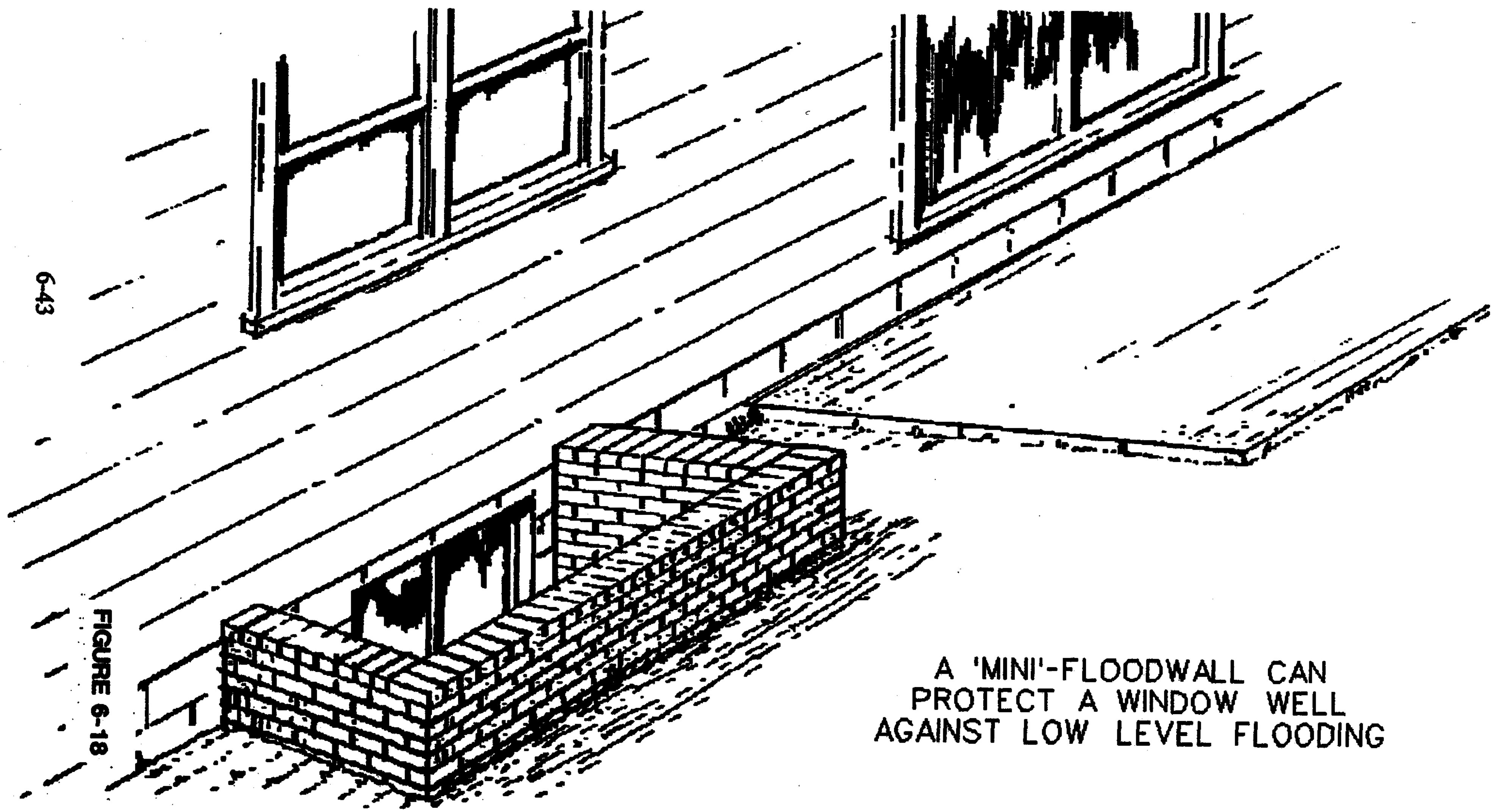

A 'MINI'-FLOODWALL CAN
PROTECT A WINDOW WELL
AGAINST LOW LEVEL FLOODING

FIGURE 6-18

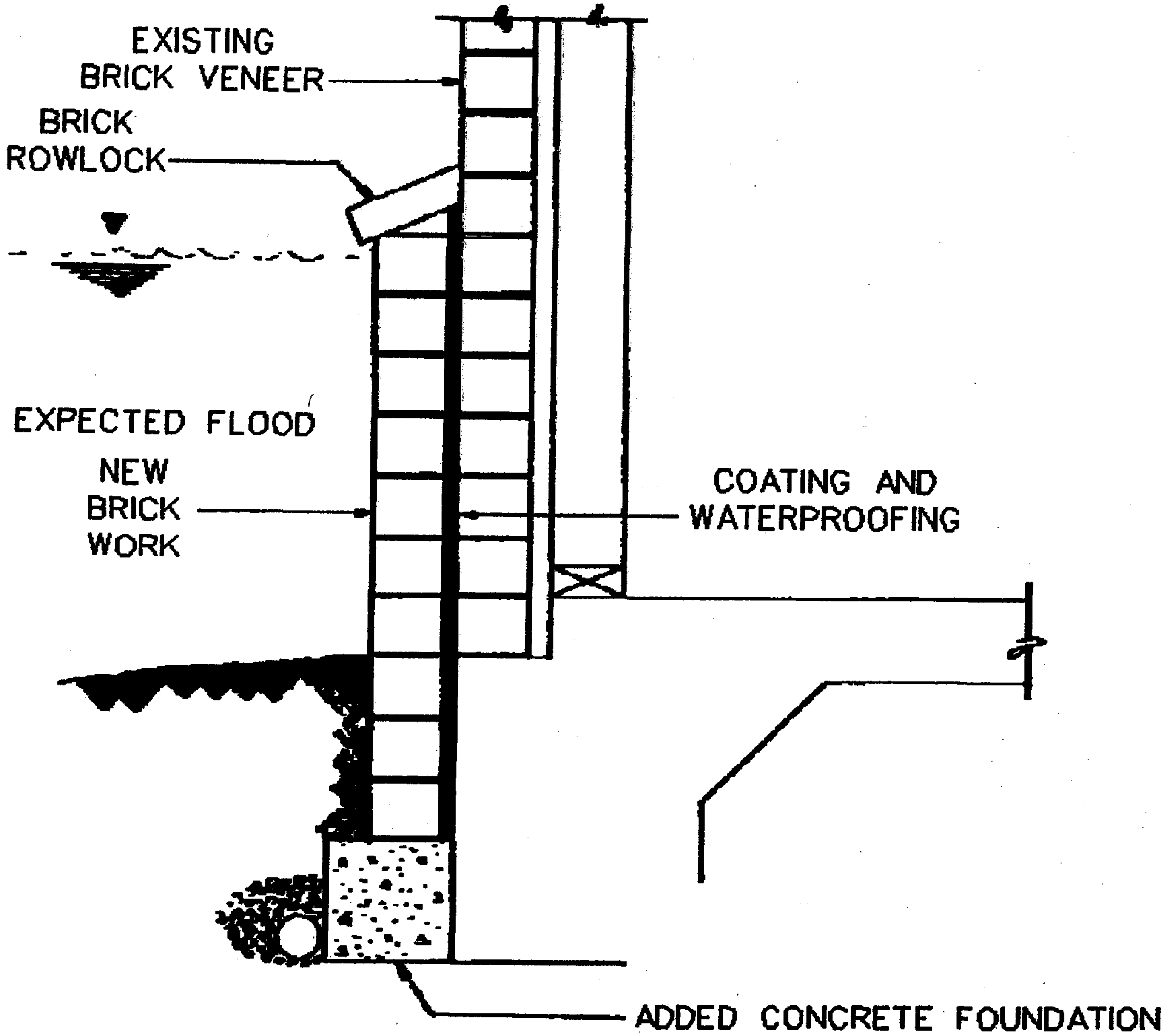
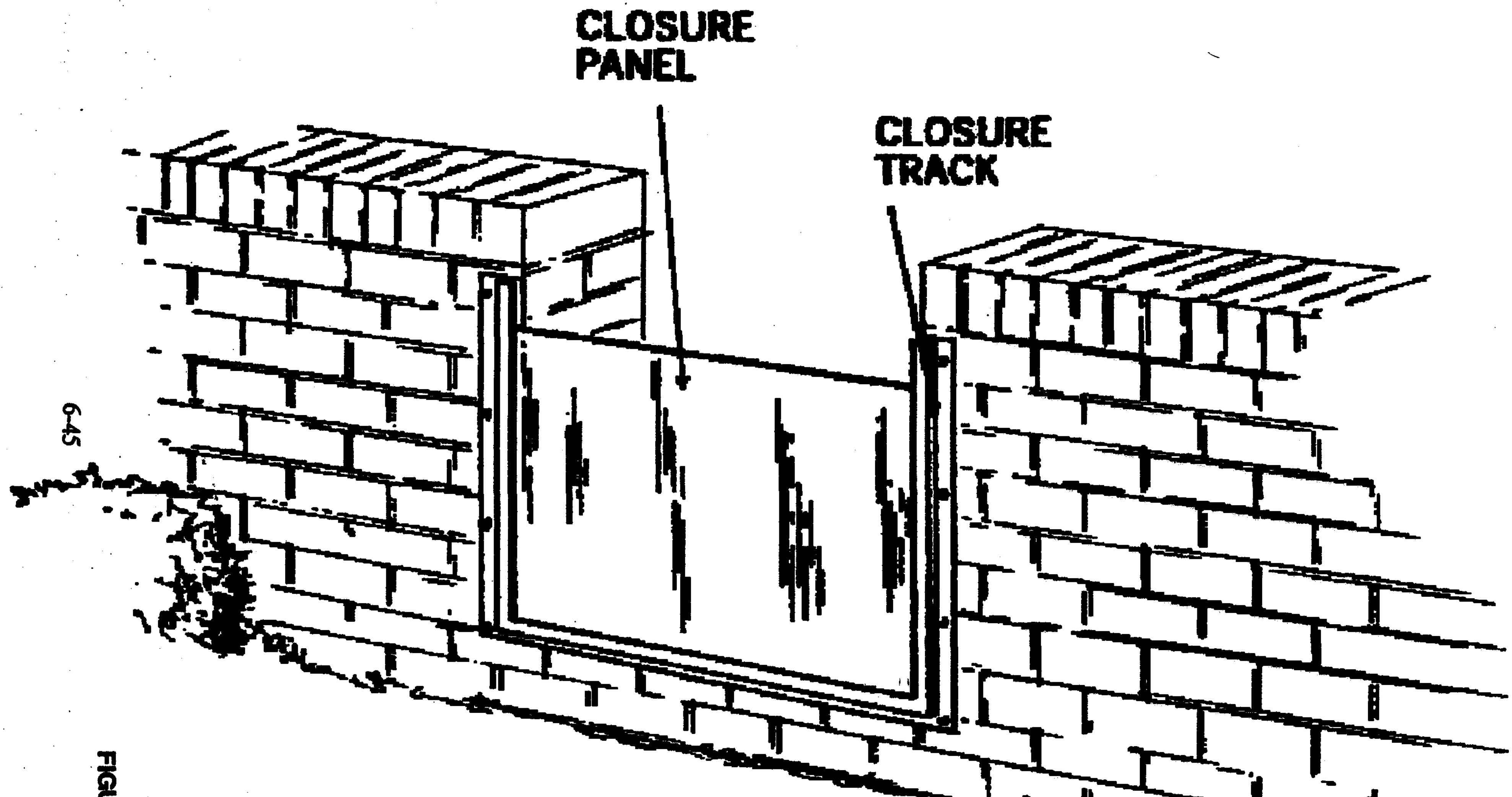

EXISTING
BRICK VENEER
BRICK
ROWLOCK
EXPECTED FLOOD
NEW
BRICK
WORK
COATING AND
WATERPROOFING
ADDED CONCRETE FOUNDATION

FIGURE 6-19



DETAIL OF A DROP-IN CLOSURE

FIGURE 6-20

G. MITIGATION ALTERNATIVES SUMMARY

A summary of the protection effective assessment for each mitigation alterative is shown in Table 6-8. The Arrasmith Trail levee, the S. Duff/S. 5th Street levee, and floodproofing alternatives were those deemed to provide the best protection to a flood similar to the 1993 event.

TABLE 6-8
SUMMARY OF ALTERNATIVES
AMES FLOOD TASK FORCE

ALTERNATIVE	LOCATION	PROJECT COST	1993 DAMAGE SAVINGS	POSITIVES	NEGATIVES	PROTECTION EFFECTIVE ASSESSMENT
Channel Widening	1. S. of US Highway 30	$5,000,000	-----	• Low erosive velocities. • Lower water surface elevations.	• Potential silting due to lower velocities. • High maintenance costs to control channel. • Negative environmental impact.	LOW
	2. S. Duff Avenue to S. 4th Street	$900,000	-----			
	3. S. 4th Street to 6th Street	$500,000	-----			
Channel Straightening	1. US Highway 30 to Lincoln Way	$1,200,000	-----	• Decreased water surface elevations. (2 - 4 inches)	• Velocity increase may cause erosion. • High Maintenance to control channel. • Corps of Engineers and IDNR approvals difficult to obtain. • Little decrease in water depth. • High construction costs per benefit obtained. • Negative environmental impact.	LOW
Bridge Channel Clearing	1. US Highway 30	$100,000	-----	• Reduce backwater depth. • Increased flow through bridge. • Relatively inexpensive to construct.	• Little decrease in backwater. • High maintenance to control silt.	LOW
	2. S. Duff Avenue	$60,000	-----			
	3. Stange Road	$60,000	-----			
Levee Construction	1. University Village	$500,000	$159,400	• Provides protection to buildings. • Warning system minimized. • May reduce flood insurance rates.	• Expensive to construct. • Expensive to maintain. • Can cause backwater upstream. • Some negative environmental impact.	LOW
	2. S. Duff Avenue / S. 5th Street	$3,400,000	$2,033,000*			MEDIUM
	3. Arrasmith Trail	$100,000	$85,000			MEDIUM
	4. Maple-Willow-Larch	$520,000 (1994)	$983,000			MEDIUM
Upstream Detention	1. Reservoir 1	$17,500,000	ISU - $6,500,000 S. Duff\S.5th - $2,033,000* Other - $500,000*	• Decreased water surface elevations. • Can eliminate flash flooding. • Reduces flood insurance rates.	• Extremely expensive. • Large amount of land required (easements). • High maintenance. • Previously unacceptable to public. • Negative environmental impact.	LOW
	2. Reservoir 2	$18,500,000	ISU - $6,500,000 S. Duff\S.5th - $2,033,000* Other - $500,000*			
Regulation		N/A	-----	• Reduces flood insurance rates. • Some areas are removed from floodplain.	• Some areas are added to floodplain.	HIGH
Floodproofing - Floodwall S. Duff ISU Facilities		•$20 per square foot •$750,000 to protect all buildings. •$1,200,000 for all ISU Center Facilities	S. Duff\S.5th - $2,033,000* ISU - $4,300,000	• Provides protection to buildings. • Relatively inexpensive. • May reduce flood insurance rates.	• Labor required to seal entrances during flooding.	HIGH

* Based on interview information. Additional information received since interviews indicates these values may be conservative.