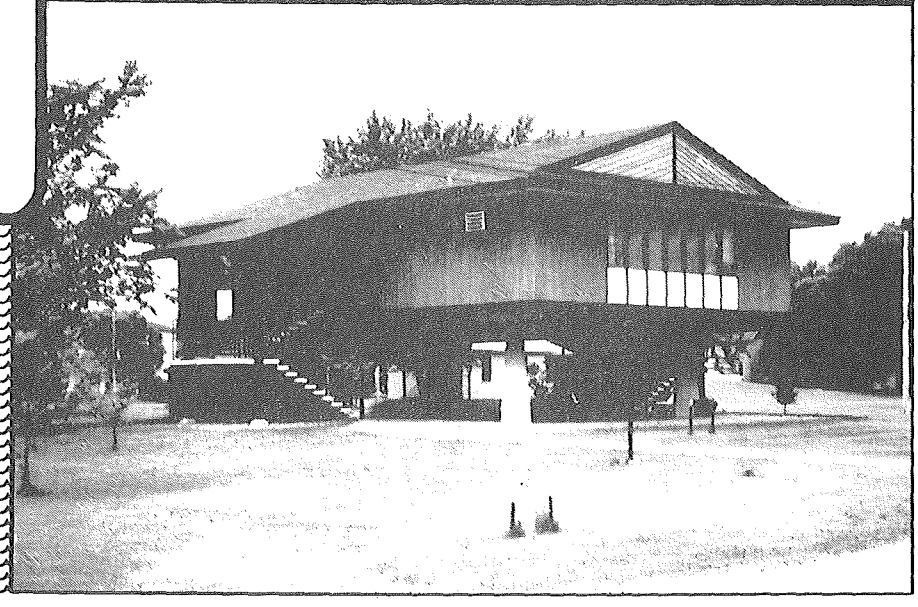
FLOODPLAIN MANAGEMENT

A Handbook for Local Officials



Minnesota

Department of
Natural Resources
Division of Waters

MINNESOTA
DEPARTMENT of NATURAL RESOURCES
Division of Waters

A Handbook for Local Officials

St. Paul, Minnesota
October 1984

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Austin Daily Herald: 1.3
Barr Engineering Co.: 5.1, 6.7 (entire page)
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U.S. Army Corps of Engineers: 1.1, Chapter 3 title page; Chapter 6 title page (middle); 6.3, 6.6

ACKNOWLEDGEMENTS

Much has been written about floodplain management during the past several years. Numerous excellent brochures, training manuals, and newsletters have been written by various federal and state agencies and private organizations. During the preparation of this Handbook, the authors reviewed numerous documents, in particular, similar workbooks prepared by other states. To save time and expense, ideas, paragraphs and entire sections were used from these documents. In particular, we wish to thank:

- Colorado Department of Natural Resources:
  "Colorado Flood Proofing Manual"

- Pennsylvania Department of Community Affairs:
  "Regulating Floodplain Development - A
  Handbook for Local Officials"

- Wisconsin Department of Natural Resources
  "Floodplain/Shoreland Management - A
  Guide for Local Zoning Officials"

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FLOODPLAIN MANAGEMENT — AN INTRODUCTION

4 counties hit by new storm

By DOUG HENNES
Staff Writer

RED WING — Under skies which apparently don't recognize the word "quit" when it comes to rain, beleaguered southeastern Minnesota residents Saturday tried to recover from the severe thunderstorms rocking their area.

The efforts of citizens were dampened immeasurably by showers which continued to fall throughout the day, threatening to cause even greater flooding.

Goodhue, Wabasha, Winona and Houston counties suffered the brunt of the storms which invaded the hilly Mississippi River Valley Friday night and dumped up to 8 inches of rain by Saturday morning. Those four counties and four others — Dodge, Olmsted, Mower and Fillmore — were under a flash flood watch until 6 a.m. today.

IN ITS WAKE, the deluge left two persons missing, washed out numerous county roads, heavily damaged crops and forced the evacuation of Elba citizens and about 600 campers from Whitewater State Park there.

According to a National Weather Service spokesman at Minneapolis-St. Paul International Airport, Red Wing was hardest hit by rains, soaking up 7.78 inches in a 24-hour period ending at 8 a.m. Saturday. Most of that total fell after 10 p.m. Friday.

Those heavy rains were blamed for the disappearance of two men — James Zimmerman, 34, of rural Cannon Falls, and Leo McKenna, 72, of White Rock — in separate incidents. Both are presumed drowned.

Storm disrupts power in metro area. Page 1, City Life Section.

Goodhue County Sheriff Dale Grote said Zimmerman's pickup truck was swept by a wall of water 5 feet high from County Road 1 near White Rock about seven miles southwest of Red Wing and flung into swollen Belle Creek.

THE PICKUP WAS carried about 150 yards in the creek, rolling over several times and throwing out Zimmerman and his 25-year-old wife who "miraculously escaped," Grote said.

"She was swept downstream about half a mile," he said, "before being carried into a cornfield which was 4 to 5 feet under water. Then she was stopped by a barbed-wire fence, picked her-

See Storm, Page 2

9 swept to deaths in floods

By NANCY LIVINGSTON and DON AHERN
Staff Writers

ROCHESTER - Torrential rains that began Wednesday night in Rochester sent turbulent flood waters six feet deep swirling through the southeast part of the city causing the deaths of at least nine persons, police said.

THE BODIES of three wheelchair patients and a nurse's aide were recovered from an elevator in the flooded basement of the National Health Enterprises nursing home on the banks of the Zumbro River. Three cars and their drivers plunged into the Zumbro River from a flooded bridge and the occupants are feared drowned. Two boaters on Zumbro Lake also were reported missing.

Police Sgt. Orrin Knutson said one of the cars which was washed away in the river carried a woman. Another car had two to five passengers and the third had an undetermined number of persons.

Flash-flooding knocked out power and telephone service to parts of Rochester, blocked roads to the city and forced the evacuation of more than 4,000 persons. The Mayo Clinic in downtown Rochester was not affected, however.

"We have some real concern about how many we're going to find dead," said Olmsted County Sheriff Charles Vennard.

The Minnesota National Guard at the request of Gov. Rudy Perpich is assisting in the search for victims. Gov. Perpich went to Rochester this afternoon to assess the situation and declare an emergency so that the area eventually can be declared a federal disaster area, making it eligible for federal aid.

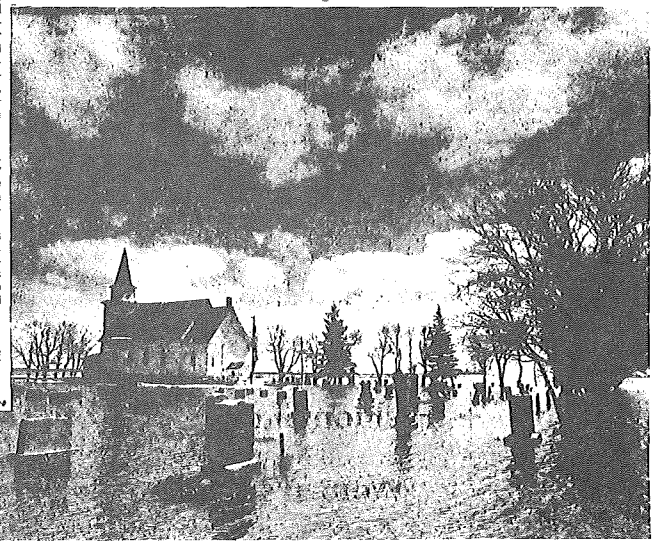
THE OLMSTED County deputy coroner, Paul Belau, said the four persons who drowned in the elevator apparently were trying to escape the rising floodwater. Belau said the ride about 1:15 this morning pushed the button to go up, but the elevator went down instead, trapping the victims in the flooded basement.

Hoist-to-house rescue operations continued in southeast Rochester today. Twenty persons stranded on the roof of a truck stop were rescued by boat early this morning. The National Weather Service said seven inches of rain in less than six hours flooded Rochester and the swollen Zumbro River continued to rise at the rate of one foot an hour today. The river was expected to crest at eight feet over flood stage, a depth of 20 feet.

See Flood, Page 2

St. Paul Dispatch METRO FINAL
Thursday, July 6, 1978
Single Copy Price—20c

Boats save stranded in



Staff Photo by Darlene Pfister

Flood waters of the Red River surrounded Nora Lutheran Church near Perley, Minn., Tuesday. Perley is about 30 miles north of Fargo-Moorhead, where the river had fallen to 33.9 fee

4-8-78

Oslo anticipating rival to 1897 flood

By SYLVIA LANG
Staff Writer

Oslo in northwestern Minnesota braced itself Friday against floodwaters reaching levels established during the Great Flood of 1897.

Gov. Rudy Perpich and officials from Minnesota and North Dakota are scheduled to arrive in Oslo at noon today to assess the situation.

North Dakota officials have asked President Carter to declare from 17 to 20 counties disaster areas because of Red River Valley flooding.

The Red River at Oslo swelled to 36.6 feet Friday — the "precise level at which the Red crested during the Great Flood," according to Bob Henrick of the National Weather at Fargo, N.D.

And the river was rising. "It should crest out at 37 or 37.5 feet Wednesday," Henrick predicted.

Don Flaagan, a teacher and city councilman in Oslo, said 150 junior and senior high school students were recruited Thursday and Friday to help lay sandbags against flooding.

The U.S. Army Corps of Engineers also was assisting Oslo residents in preventative operations Friday, including bringing in gravel and stockpiling it along the river with bulldozers.

Flaagan said farm homes are particularly vulnerable. Water has gotten into basements, and roads are flooded, Flaagan noted. "I think we're okay in town, but we're concerned about a number of farmsteads."

Dikes which farmers had put up in 1975 are holding "quite well," said Flaagan, but have "broken loose in a few places. We had some of the kids helping get those spots back in shape."

Flaagan said evacuations weren't anticipated "at this point. However, we'll have to see what happens if the river continues to rise. From what the Corps of Engineers has said, the water level will still go up another two feet."

In other sites along the flooded Red River Valley, covering western Minnesota and eastern North Dakota, Fargo was "pretty well out of the woods" Friday, according to the weather service's Henrick.

The Red at Fargo was at 31.4 feet — still 14 feet above flood stage, but down almost a foot from Thursday and continuing to fall, Henrick said.

At Halstad, the Red crested at 37.5.

Thousands of acres still under Red River flood

Associated Press

Major flooding continued Tuesday in the Red River Basin of eastern North Dakota and western Minnesota.

East Grand Forks, Minn.

The flood crest of the Red River was approaching Halstad, Minn., where the river level at 7 p.m. was 35.4 feet—more than 11 feet over flood stage.

recent cold weather prolonged the spring ice breakup in the Red Lake River Basin in northwest Minnesota.

Consequently, alternate periods of thawing and freezing reduced the

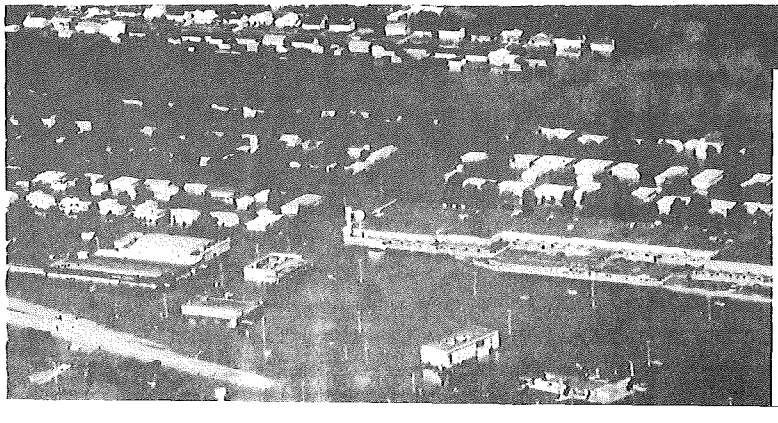
day the river would crest from 43 to 46 feet at Grand Forks, but yesterday predicted a lower crest of 41 to 42 feet "by week's end."

"Temperatures and precipitation patterns over the next week to 10

"I think we're in very good shape," said Grand Forks Mayor Cyril O'Neill. "We feel a crest of 48.5 wouldn't put us in any dire shape, although we would have to do some sandbagging."

Thur., July 6, 1978 St. Paul Dispatch

Zumbro floods Rochester



Guard called as Red River flooding threatens homes

Tribune News Services

East Grand Forks, Minn.
One hundred Minnesota National Guardsmen arrived in this northwestern community Sunday as the flooding Red River threatened to flow into major residential areas.

Gov. Rudy Perpich called out the guard shortly before midnight Saturday at the request of local authorities.

The river swelled to 44.9 feet yesterday, almost 17 feet above flood stage in East Grand Forks and its sister city, Grand Forks, N.D.

Keith Blessum, a Fargo, N.D., meteorologist, predicted the river would rise to 45.4 feet today and would crest at 47 feet Thursday.

Witnesses said the water level was to the top edge of dikes in several sections of the two cities yesterday, including areas heavily populated with housing up to the dikes.

Grand Forks is augmenting the dike in Central Park with earth fill to 49 feet, said Mayor C.P. O'Neill. In the city's Riverside Park area the dike is being raised to 47½ feet with sandbags.

"We haven't made any preparation to evacuate people," said O'Neill. "That will be up to them. We are protecting areas, not individual homes."

Work crews are using clay to raise dikes in East Grand Forks, said Mayor Louis Murray.

"If the crest gets up to 47 or 48 feet, only God knows what will

Flood continued on page 5A

CHAPTER I

FLOODPLAIN MANAGEMENT — AN INTRODUCTION

Minnesota is the land of 10,000 lakes and 95,000 miles of streams and rivers. These lakes and watercourses are confined within their banks throughout most years. Periodically, these waterbodies reclaim the valley bottoms resulting in the flooding of low-lying lands. This flooding normally results from heavy summer thunderstorms, or a combination of snowmelt and spring rains.

Major flooding has occurred in every river basin in the state: most recently in 1965 and 1969 on the Minnesota and Mississippi Rivers; 1975, 1978, and 1979 on the Red River of the North; and 1978 on the Zumbro River, causing $50 million in damages in the City of Rochester. This flooding has resulted in tremendous social and economic losses to individuals, communities and the taxpayers as a whole. Various Federal and State agencies and local governments have developed policies and programs to alleviate floods and flood related losses, but, nevertheless, flood damages have continued to increase, and lives continue to be lost due to flooding.

Figure 1.1 July, 1978 Rochester, MN. Flood

The most current figures available for Minnesota indicate an average annual direct flood loss of $60 million. Average annual direct flood loss figures of this type have historically included only: 1) the direct loss to the individual homeowner, business and agricultural interests (e.g., structural and contents damage, damage to motor vehicles, crop loss, etc.); 2) the damage to community infrastructure (storm sewers, roads, bridges, etc.); and 3) the costs associated with the flood fight and clean up. There has developed nationwide an increased awareness that the indirect losses due to flooding are very dramatic and these losses affect individuals who do not directly live in the floodplain.

The indirect losses related to flooding include: 1) lost profits to businesses closed during flooding; 2) wage losses and unemployment benefits; 3) federally subsidized flood insurance payments via the National Flood Insurance Program (NFIP); 4) income tax deductions for flood losses not covered by insurance; 5) low interest disaster relief loans; and 6) the cost to federal and state agencies and local government in implementing disaster relief programs. The taxpayers are burdened with a significant portion of the cost of responding to unwise flood plain development. These indirect costs may, in fact, equal or exceed the direct costs.

Until the late 1960's, the primary method of reducing flood damage consisted of building structural flood control projects such as dikes, levees, and floodwalls. In spite of these structural projects, average annual flood losses in Minnesota continued to increase because of unwise floodplain development.

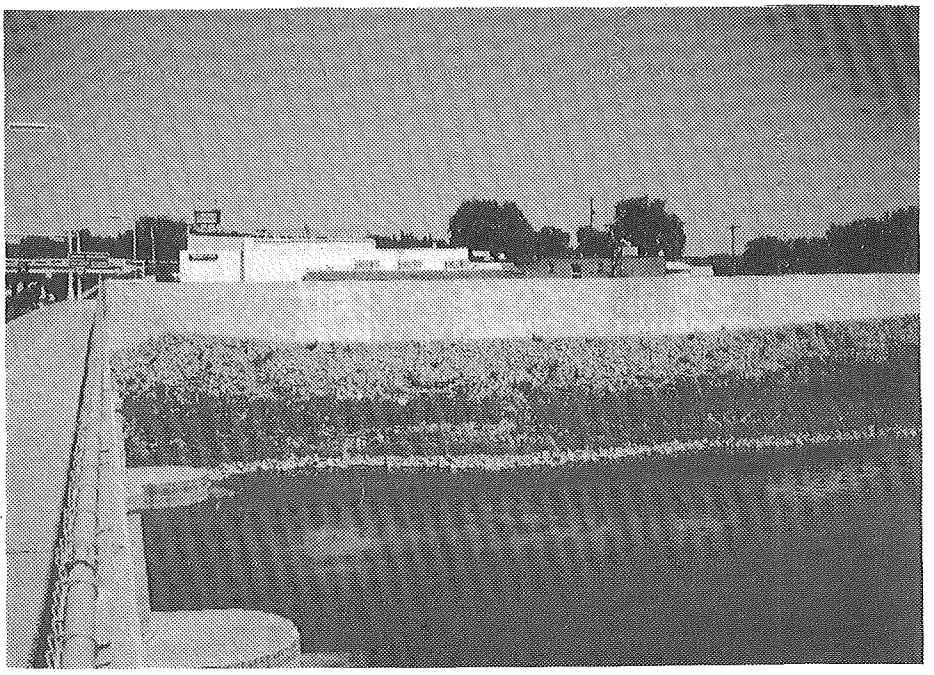


Figure 1.2 This concrete floodwall in Mankato is an example of structural flood control measures.

Figure 1.3 Non-structural flood loss reduction techniques include floodproofing, improved flood warning and response and acquisition/relocation.

MINNESOTA'S FLOODPLAIN MANAGEMENT PROGRAM

In 1969, the Minnesota Legislature enacted a State Flood Plain Management Act (Minnesota Statutes, Chapter 104). This Act and sound floodplain management principles stress the need for a comprehensive approach to solving flood problems by emphasizing nonstructural measures, such as floodplain zoning regulations, flood insurance, floodproofing, and flood warning and response planning. By law, Minnesota's flood prone communities are required to: 1) adopt floodplain management regulations when adequate technical information is available to identify floodplain areas; and 2) enroll and maintain eligibility in the National Flood Insurance Program (NFIP) so that the people of Minnesota may insure themselves from future losses through the purchase of flood insurance. The Department of Natural Resources (DNR) is the state agency with overall responsibility for implementation of the State Flood Plain Management Act.

At the state level, the DNR has promulgated minimum standards for floodplain management entitled "Statewide Standards and Criteria for Management of Flood Plain Areas of Minnesota" (old citation: Minn. Reg. NR85-92; new citation Reg. 1983 Parts 6120.5000 - 6120.6200). These standards have two direct applications: 1) all local floodplain management regulations adopted after June 30, 1970 must be compliant with these standards; and 2) all State agencies and local units of government must comply with Minnesota Regulations, in the construction of structures, roads, bridges or other facilities located within floodplain areas delineated by local ordinance. Local floodplain regulatory programs, administered by county government predominately for the unincorporated areas of a county, and by municipal government for the incorporated areas of a county, must be compliant with federal and state floodplain management standards. Both federal and state standards identify the 100-year floodplain as the minimum area necessary for regulation at the local level. These regulations are intended to protect new development and modifications to existing development from flood damages when locating in a flood prone area cannot be avoided. As of 1984, 270 communities in Minnesota administer compliant floodplain management regulations.

SAMPLE FLOOD PLAIN ZONING ORDINANCE For LOCAL UNITS Of GOVERNMENT

MINNESOTA STATE REGULATIONS

Rules and Regulations of

THE DEPARTMENT OF NATURAL RESOURCES

(Formerly Department of Conservation)

Relating to

STATEWIDE STANDARDS AND CRITERIA
FOR MANAGEMENT OF FLOOD PLAIN AREAS
OF MINNESOTA

Cite the rules and regulations as:
(for example)
Minn. Reg. NR 85

1970

new citation:
Minn. Reg. 1983
Parts 6120.5000–6120.6200

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DOCUMENT SECTION, DEPARTMENT OF ADMINISTRATION
Room 140 Centennial Office Building, St. Paul, Minnesota 55101

NATIONAL FLOOD INSURANCE PROGRAM

The National Flood Insurance Program (NFIP) is a relatively recent federal program. Throughout much of this century, the federal government has been actively involved in flood control, however only since 1968 has there been a strong federal initiative in floodplain management. An excerpt from the 1979 U.S. Water Resource Council report on "A Unified National Program for Flood Plain Management" summarizes the events leading to the NFIP:

> Congressional acceptance of limited Federal responsibility for flood control began in 1927 following major floods on the Mississippi River. It subsequently expanded geographically to nationwide scope and functionally to include coastal hurricane flooding. Earlier, in 1890, Congress had accepted Federal responsibility for flood forecasting and warning. Beginning with the Flood Control Act of 1936, the Congress accepted national responsibility, and the Corps of Engineers was assigned responsibility for flood control engineering works and later for flood plain information services. In the early 1930's, Congress created the Tennessee Valley Authority as a regional resource development agency.
>
> Flood control, through the construction of dams and reservoirs, was included among its duties. In the late 1930's, Congress expanded Bureau of Reclamation authority to include building reservoirs for flood control purposes. In the 1940's, the Congress authorized the Department of Agriculture to construct 11 specifically authorized projects for flood control, and in the 1950's the department was authorized to carry out a nationwide program for upstream watershed projects.
>
> Despite these programs and rapidly rising Federal expenditures for flood control, flood losses continued to rise rapidly. Federal programs continued to rely predominantly on engineering works for modifying floods, although the Tennessee Valley Authority had initiated a local floodplain management assistance program in the early 1950's and the 1960 Flood Control Act had authorized the Corps of Engineers to provide States and localities with information needed to regulate flood plain lands. Thus it was, that in its review of Federal programs, the Task Force on Federal Flood Control Policy in 1966 urged a policy that emphasized modification of susceptibility to flooding and the impacts of flooding.

In 1968, Congress created the NFIP to make flood insurance available to property owners, at federally subsidized rates, provided the community agrees to adopt local regulations to protect lives and future development from flooding. The NFIP is often characterized as employing a carrot-stick approach in its program implementation. The incentive, or "carrot", is the availability of low-cost flood insurance for residents of a participating community. The stipulation, or "stick", of participation is that communities must agree to regulate/restrict future floodplain development.

National Flood Insurance Program

FLOOD DISASTER PROTECTION ACT OF 1973
Public Law 93-234, Approved December 31,1973

HOUSING AND URBAN DEVELOPMENT ACT OF 1969
Public Law 91-152, Approved December 24, 1969

HOUSING AND URBAN DEVELOPMENT ACT OF 1968
Public Law 90-448, Approved August 1, 1968

FEDERAL EMERGENCY MANAGEMENT AGENCY

COMMUNITY PARTICIPATION IN THE NFIP

Community participation in the NFIP is divided into two phases, the emergency phase and the regular program phase. Several steps are required to first "join" the emergency phase of the NFIP and then be converted to the regular program.

The Federal Emergency Management Agency (FEMA), which administers the regulatory aspects of the NFIP, formally notifies a community that it has special flood hazard areas (SFHA) by issuing a Flood Hazard Boundary Map (FHBM). The FHBM shows the approximate boundaries of the 100-year floodplain in that community. This map does not contain 100-year flood elevations or floodway/flood fringe delineations.

In Minnesota, most FHBM's were initially published during the early to mid-1970's identifying over 600 flood prone communities in the state. As of 1984, over 460 Minnesota of these communities are participating in the NFIP.

A community must join (participate in) the NFIP before residents can purchase a flood insurance policy. The community must submit an application to FEMA for initial participation. Historically, the application had to include a resolution passed by the city council or county board stating that the community will act in good faith to regulate future flood plain development. Recently, FEMA has been requiring local adoption of a floodplain management ordinance. Community eligibility in Minnesota is generally established by municipal government for incorporated areas and county government for unincorporated areas.

Upon application approval by FEMA, the community enters the emergency phase of the NFIP. "Emergency phase" does **not** mean the community is in a state of emergency. It means that the community has become eligible for the sale of subsidized flood insurance despite the fact that the community's actual degree of flood hazard has not been determined in detail.

The next step in this process is for FEMA to hire an engineering contractor, either a private consultant or another federal agency, to prepare a flood insurance study (FIS) for a particular community. Using detailed engineering methods, the study contractor will determine the following for selected stream reaches and lakes:

1) Flood profiles which establish the 100-year flood elevations for selected flood hazard areas within the community;
2) A floodplain map which delineates the community's flood hazard areas;
3) Floodway/flood fringe delineations for selected stream reaches; and
4) Insurance rate zones which reflect the risks associated with the community's flood hazard areas.

A series of review periods follow the release of the data contained in the preliminary draft of the FIS, including publication of the 100-year flood elevations twice in the community's official newspaper. After the end of this review period, the community must within 6 months upgrade its floodplain regulations, by ordinance, to incorporate these additional data and include more stringent land use regulations. The community is then converted to the regular phase of the NFIP and residents become eligible for additional flood insurance at rates reflecting the actual degree of flood hazard determined in the FIS.

Additional information on the National Flood Insurance Program may be found in the FEMA pamphlet "Questions and Answers" included in this workbook or by calling FEMA's toll free number 1-800-638-6620.

WHY A FLOODPLAIN MANAGER'S HANDBOOK

Land use regulatory programs are a long-term approach to reducing flood damage by controlling new and redevelopment within the floodplain. In Minnesota, local government has been given the primary responsibility to insure that new floodplain development is compliant with local ordinances, which by necessity are compliant with minimum state and federal standards.

The process by which a community adopted a floodplain ordinance was typically accomplished without significant training. Sufficient assistance was provided to the community for the initial ordinance adoption. However, limited training and assistance have been provided since that time to assist the individual communities in the day-to-day administration of their ordinance.

The first comprehensive statewide training program for local officials was conducted by the DNR in the summer of 1981. Many communities have adopted floodplain ordinances since that time and as would be expected, staff and elected officials turnover has also occurred statewide. Strong support was received from a 1983 survey of community officials by DNR for further state-sponsored training and education. For these reasons, the DNR is pursuing an ongoing training program.

It was decided that the handbook prepared by the DNR for the first series of training workshops was in need of updating and refinement. This new handbook hopefully will fulfill three major objectives.

TRAINING DOCUMENT - This Handbook is intended to be used as a training document during future DNR workshops as well as individually initiated training sessions. New community staff or those not able to attend a workshop will hopefully gain a basic understanding of floodplain management concepts by reviewing this handbook.

ADMINISTRATIVE GUIDE - The major portion of this workbook is intended to assist the local community in the day-to-day administration of their floodplain ordinance. Chapters within this handbook will specify responsibilities of various individuals within the community, including the zoning administrator, Board of Adjustment and Planning Commissions. Step-by-step procedures for a typical floodplain development proposal from the initial request to either approval and construction or permit denial and appeal will be highlighted. Required record keeping will be stressed.

RESOURCE GUIDE - Finally, this handbook is intended to provide guidance on where to look for assistance in virtually any type of floodplain related question or problem. This includes existing publications as well as public and private organizations.

This handbook utilizes a three-ring binder to enable easy updating. Individual pages or entire sections will be added or updated as the need is identified.

Users are strongly encouraged to provide comments on the adequacy of this handbook. Suggested improvements on general readability, accuracy, need for clarification or additional topics will be reviewed for inclusion in future editions.

Flood Profile

Encroachment

datum

watershed
discharge

Floodplain
management

NFIP

Flood Crest

Base Flood Elevation

RFPE

FREEBOARD

FLOODPLAIN

FLOODWAY/FLOOD FRINGE

fema

FIRM

Flood Frequency

DNR

Cross Section

CHAPTER II

DEFINITIONS

Base Flood - The flood having a one-percent change of being equaled or exceeded in any given year. Base flood is synonymous with the term "regional" or "100-year" flood.

Cross Section - Horizontal view of a stream channel and overbank areas, taken perpendicular to the channel.

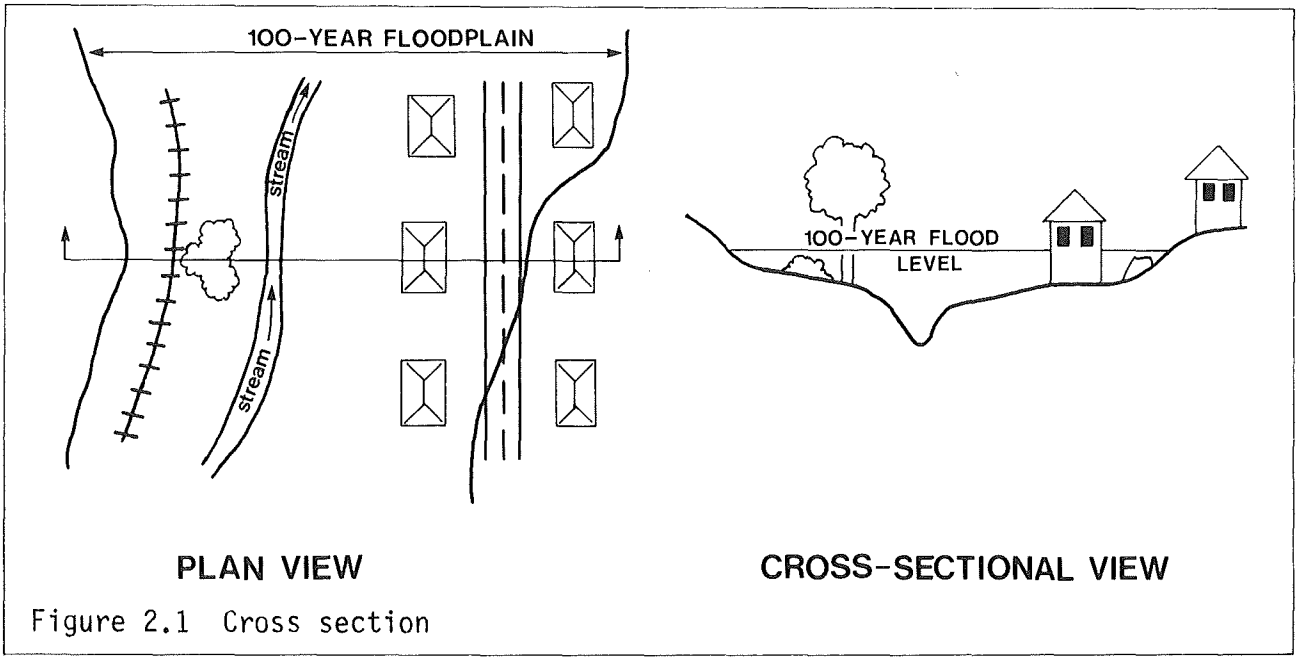


Figure 2.1 Cross section

Datum- An established (or assumed) reference point or elevation - most commonly Mean Sea Level (MSL). All elevations in a flood insurance study refer to a vertical distance above MSL.

Discharge - The volume of water moving past a particular stream cross section per unit of time, usually expressed as cubic feet per second.

Encroachment- The obstruction of floodplains which result in the restriction of flow areas needed by streams to discharge flood waters during flood conditions. This "encroachment" of the natural stream overflow area results in increased flood levels.

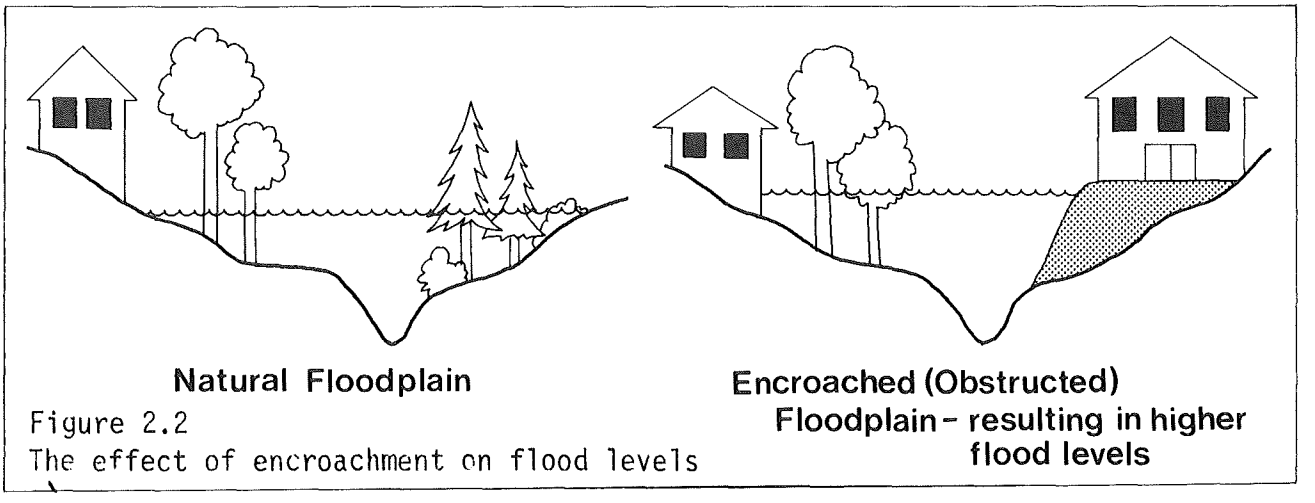


Figure 2.2
The effect of encroachment on flood levels

Flood Crest - The maximum level reached by flood waters at a particular location along the stream.

Flood Frequency - This term refers to the probability of a flood of a certain magnitude occurring in a given time period. The larger the flood, the less frequent a flood of that magnitude is expected to occur.

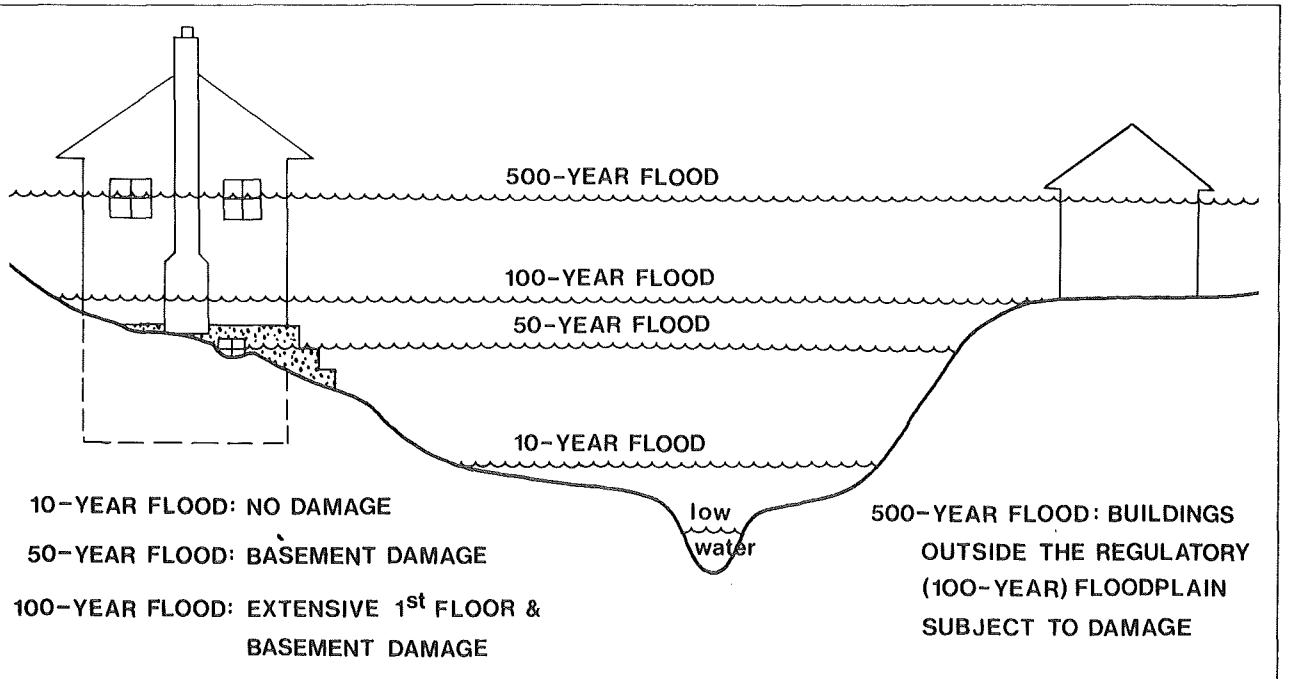


Figure 2.3 Depth of flooding vs. various flood frequencies

Flood frequency can also be referred to in terms of **Probability of Occurrence**, which is the percent chance a flood of a given frequency will be equaled or exceeded in any given year. For example, a 100-year frequency flood is also called the "1%-chance" flood, since it has a 1% chance of occurring or being exceeded during any given year. This terminology avoids the misconception that a 100-year flood can only happen once in 100 years. It is possible for a 100-year flood to occur three years in a row, and then not to occur at all for the next 300 years.

The commonly used flood frequencies and percent chance of occurrence comparisons are:

Flood Frequency	% Chance of Occurrence
10-year flood	10% chance per year
50-year flood	2% chance per year
100-year flood	1% chance per year
500-year flood	.2% chance per year

Flood Profile - A graphical representation showing the water elevation at various locations along a stream during a specific flood event. The flood insurance study text contains a flood profile for each stream studied in detail for the 10, 50, 100 and 500-year flood events.

Floodplain - Floodplains are lowland areas adjoining lakes and rivers which are susceptible to inundation of water during a flood. For land use regulatory purposes, the floodplain is normally the area covered by the 100-year flood and it is usually divided into two zoning districts, the floodway and flood fringe.

Floodway- The floodway is the river channel and the adjacent land areas which must be reserved in an open character in order to discharge the base flood.

Flood Fringe - That portion of the 100-year floodplain outside of the floodway. Most new floodplain development must be located in the flood fringe, with any structure elevated or floodproofed to the regulatory flood protection elevation.

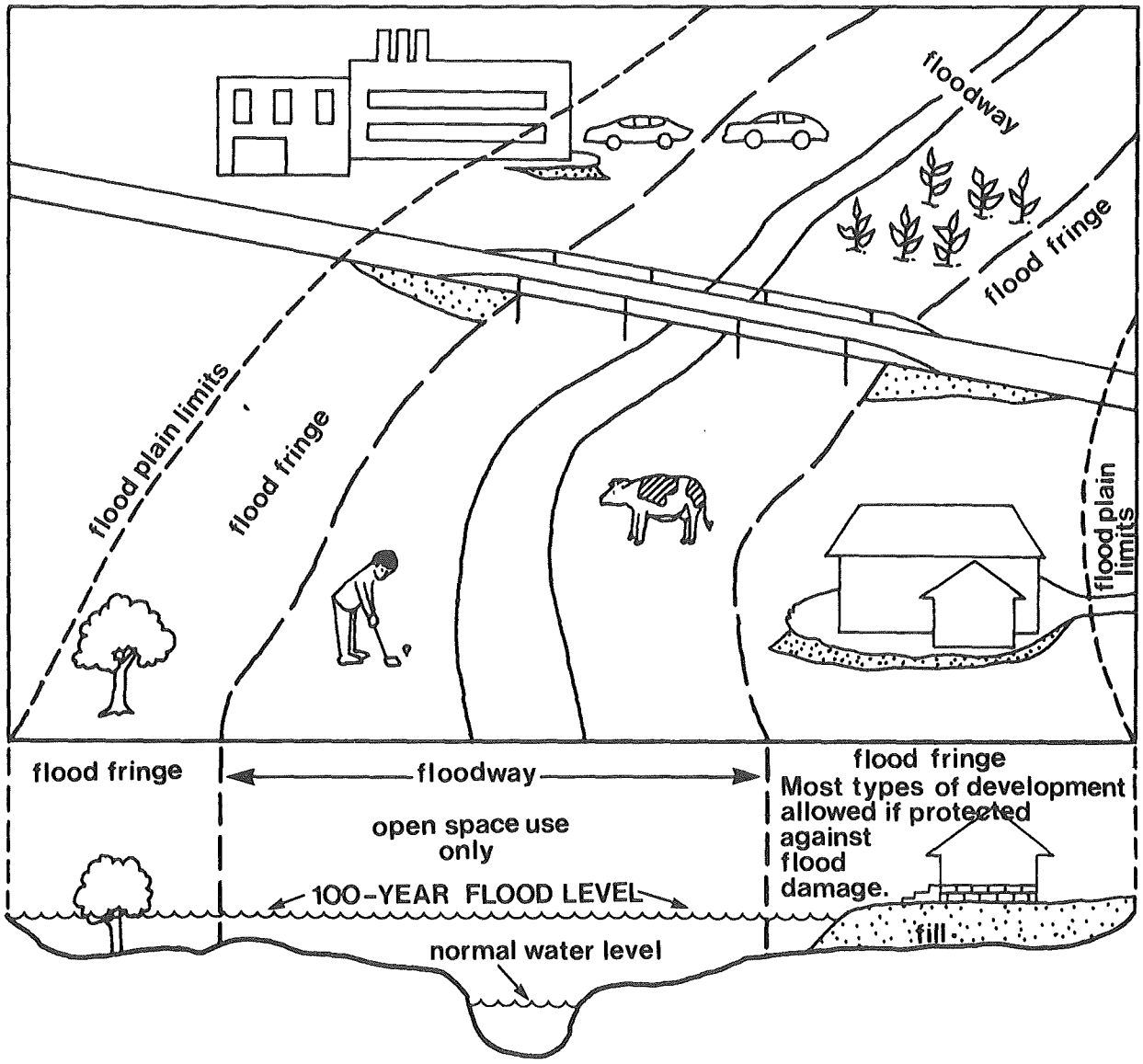


Figure 2.4 The floodway and flood fringe

Floodproofing - Involves any combination of structural provisions, changes or adjustments to properties and structures subject to flooding, primarily for the purpose of reducing or eliminating flood damages. The most common method of floodproofing a structure is to raise it on fill to a height equal to or above the regulatory flood protection elevation.

Freeboard - A factor of safety usually expressed in feet above a certain flood level. For example, a community might require a structure's lowest floor to be placed at 1' above the 100-year flood level. Freeboard compensates for the many unknown factors (e.g., waves, ice, debris, etc.) that may increase flood levels beyond the calculated level. Another example of freeboard is found in Minnesota regulations which require, at a minimum, that properly designed and constructed (permanent) levees have at a minimum three feet of freeboard above the 100-year flood in order to remove the area behind the levee from the floodplain designation.

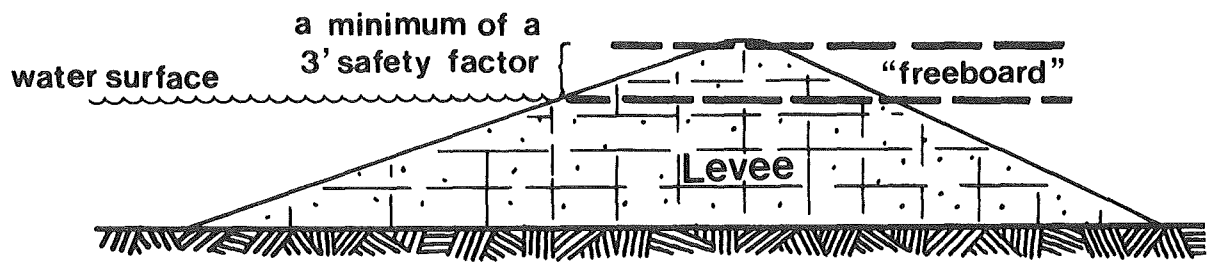


Figure 2.5 Freeboard

Regulatory Flood Protection Elevation - the minimum elevation established by local ordinance for which all new floodplain development must be protected against flood damage. At a minimum, this is an elevation no lower than the 100-year flood elevation plus any increase in flood levels resulting from the designation of flood fringe areas. The DNR strongly encourages all communities to also include at least 1' of freeboard in their local ordinance.

Watershed - The total land area above (upstream) a given point along or adjacent to a waterbody that contributes drainage of surface water to that point.

COMMONLY USED ACRONYMS

BFE - Base Flood Elevation

CAM - Community Assessment Meeting

CAPE - Community Assistance and Program Evaluation meeting

CAV- Community Assistance Visit

DNR- Minnesota Department of Natural Resources

FBFM - Flood Boundary and Floodway Map

FEMA - Federal Emergency Management Agency

FHBM - Flood Hazard Boundary Map

FIA - Federal Insurance Administration

FIRM - Flood Insurance Rate Map

NFIP - National Flood Insurance Program

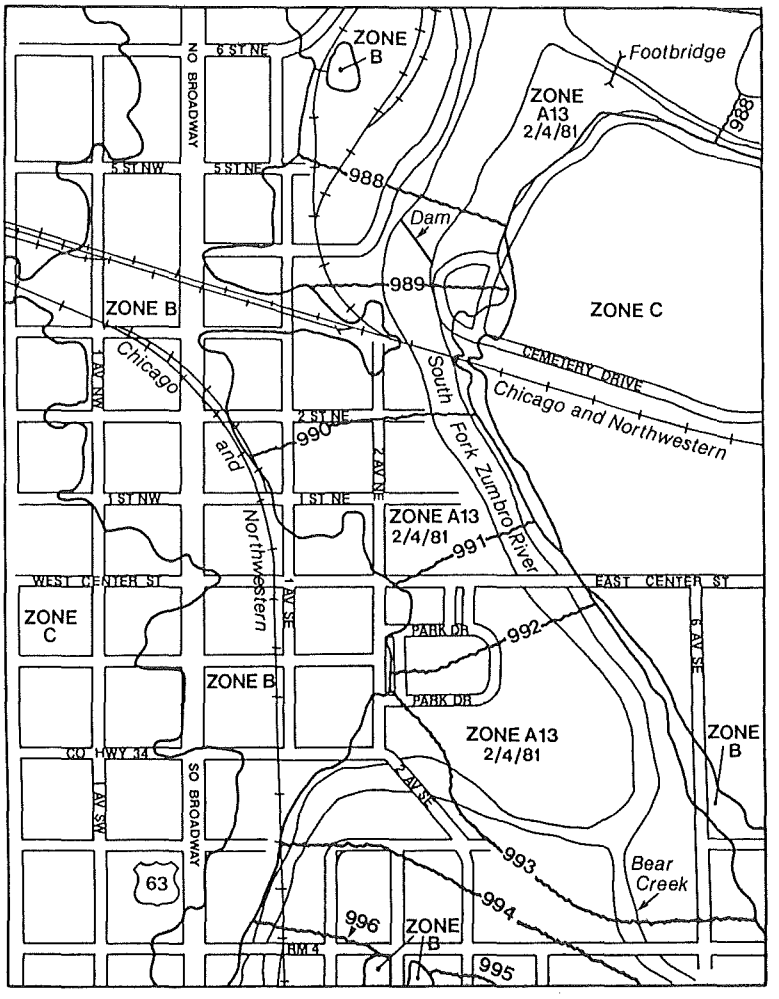
NOHW - Natural Ordinary High Water level

RFPE - Regulatory Flood Protection Elevation

SBC- State Building Code

SFHA - Special Flood Hazard Areas

USING FLOOD INSURANCE STUDY DATA



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CITY OF
ROCHESTER,
MINNESOTA
OLMSTED COUNTY

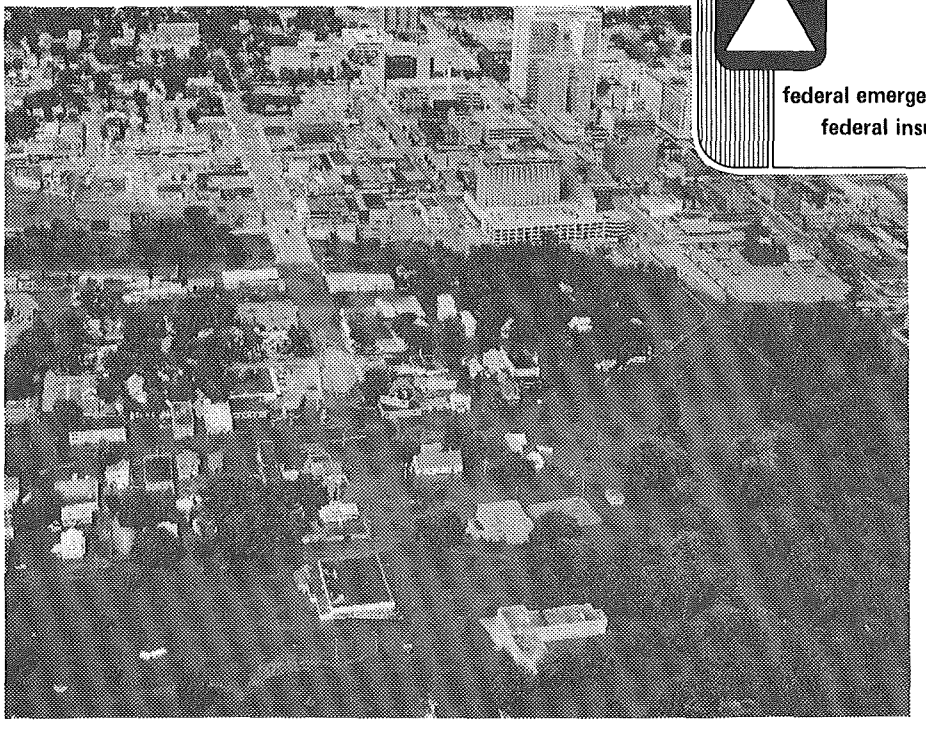
PANEL 5 OF 9

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
275246 0005 B

MAP REVISED:
FEBRUARY 4, 1981

federal emergency management agency
federal insurance administration



CHAPTER III

USING FLOOD INSURANCE STUDY DATA

Achieving the goals and objectives of floodplain management, including the proper administration of a floodplain ordinance, is dependent on community officials and local lending institutions being able to correctly interpret the floodplain maps and supporting documentation in the flood insurance study.

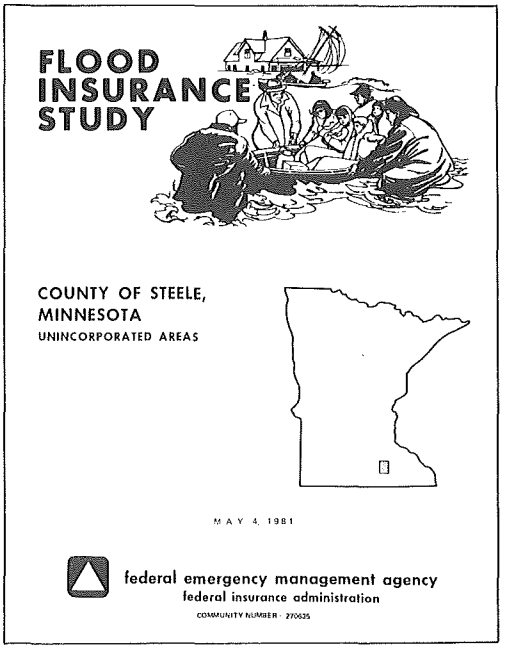
This chapter will cover the technical data which serve as the basis of nearly all floodplain management ordinances in Minnesota. A community is required to adopt a floodplain ordinance following completion of a flood insurance study (FIS) by the Federal Emergency Management Agency (FEMA). The FIS establishes that portion of a community subject to floodplain regulatory control and provides the necessary data in which to regulate future floodplain development.

In addition, lending institutions granting a federally insured or subsidized loan **must** use the FIS, specifically the flood insurance rate map to determine if the subject structure is located within the designated 100-year floodplain. If the structure is located within the floodplain, the lending institution must require the party securing the loan to purchase flood insurance as a condition of the loan.

The primary items of use to local officials in a typical FIS include:

1) Flood Insurance Rate Map (FIRM);
2) Flood Boundary Floodway Map (FBFM);
3) FIS text
   -Flood profiles
   -Floodway Data Table

This chapter will first review the process by which an FIS is developed. This chapter will continue with a discussion of the above-noted components of an FIS; important features will be explained and highlighted using actual examples. The chapter will conclude with a discussion of approximate study areas and sources of additional information.



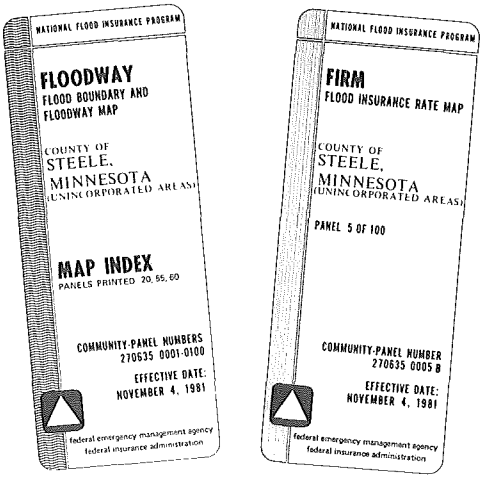


Figure 3.1 A typical flood insurance study and associated maps.

IDENTIFYING AND MAPPING THE FLOODPLAIN

There are a number of different techniques that can be used to map floodplains. These include approximate methods such as the analysis of soils, vegetation, physiography and floods of record and detailed hydrologic and hydraulic investigations. The type of mapping needed by a community will depend on many things, but, most importantly, it will depend upon the ultimate use of the map.

For regulating floodplain development, a map developed through hydrologic and hydraulic analyses is preferable. The advantage of this method is that the analysis will develop flood elevations for various frequency floods. These elevations are then the basis for regulating future floodplain development.

However, where it is too costly to perform hydrologic/hydraulic investigations and where adequate historic flood data are lacking, other types of approximate maps are used. Communities utilizing these approximate maps are encouraged to incorporate ordinance provisions which require that the floodplain data be developed when considering individual permit applications.

Since the National Flood Insurance Program uses hydrologic and hydraulic analyses in preparing flood insurance studies, it maybe helpful for those involved in the administration of floodplain management ordinances compliant with NFIP requirements to have a general understanding of how these maps are developed.

Simply stated, the science of **hydrology** is used to determine the amount of water flowing in a river or stream for a given frequency flood event. This involves calculating the amount of runoff that can be expected to drain from the surrounding watershed. The principles of **hydraulics** are applied to help determine how the river or stream channel will handle the flow and to what extent the excess water will spread over the floodplain when the flood is at its peak. Specialized computer programs are used to perform most hydrologic and hydraulic computations.

The following subsections give a brief description of the procedures involved in applying these techniques in the preparation of floodplain maps.

Step 1 — Calculating Flood Flows (Hyrdologic Evaluation)

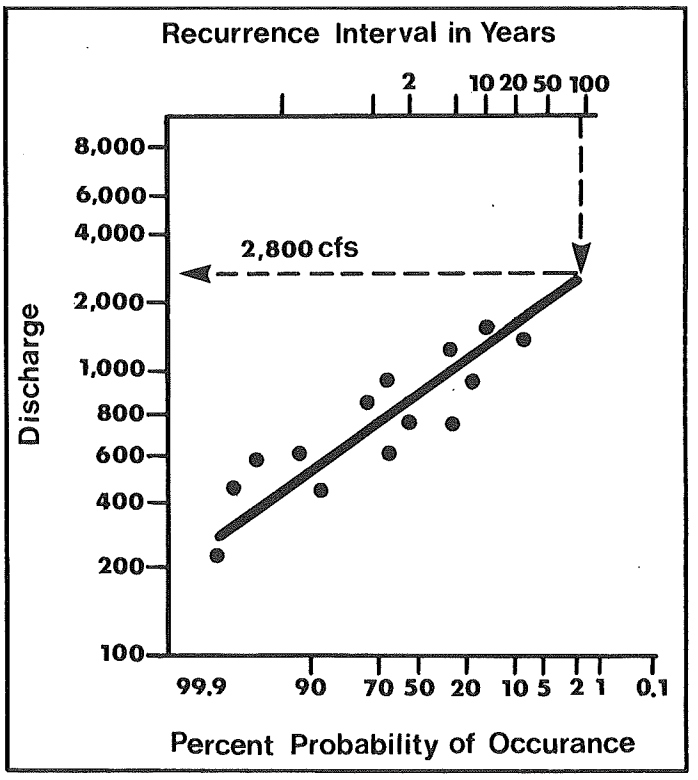
There are various techniques that can be used to estimate flood flows. Preferred techniques use statistical analysis of actual stream gauge data. If stream gauge data are not available, other methods which consider the measurable characteristics of the drainage basin can be applied, depending on the size of the watershed.

Stream Records

The data collected from rivers and streams that have stream gauging stations can be used to compute flow in the stream for a 100-year flood. This can be done by using the highest peak flow each year in a statistical analysis. Data points are plotted on a special type of graph paper (log-probability) and a line is drawn through these data points. From that graph the flow for a particular frequency flood can be determined. The flow is usually given in the number of cubic feet of water that passes a given location in one second, abbreviated cfs.

On the accompanying chart each dot represents the highest peak flow for a given year for a sample stream. Each dot is placed on the chart based on its recurrence interval, which is basically the number of recorded years divided by the number of times over the recorded period that the particular flow has been equalled or exceeded. A line is drawn through the center axis of the dots and is used to project a given flow. Based on this line, the flow for a 100-year flood would be 2,800 cfs.

Figure 3.2 Discharge vs. frequency curve



Estimating Flow-Ungaged Streams

When stream gauge records are not available or are incomplete, flood peaks must be estimated. Numerous equations and basin modeling techniques for estimating the flood peak have been developed. Their applicability varies over a wide range. Thus, it is important for the engineer to choose the procedure that best fits the size and locality of the drainage basin. Techniques for large watersheds are usually based on gauged stream data from nearby watersheds that have been correlated to physical characteristics of the drainage basin.

Step 2 — Preparing Field Measurements

Once the flow is known, the particular slope and shape (cross section) of the stream channel and adjoining floodplain are determined at numerous points. A cross section is a graphic picture of a section of the stream and adjoining floodplain cut at right angles to the direction of flow. Cross section elevation data are either obtained through field survey or aerial photogrammetric methods. Measurements of man-made encroachments such as dams, bridges and culverts are also obtained.

Figure 3.3 Cross section data are usually obtained by field surveys

Step 3 — Estimating Resistance to Flow

The resistance to the flow is needed to complete the data required to calculate the height of water. This resistance to flow, or roughness factor, is determined by analyzing the character of the landscape. For example, a wooded floodplain would tend to hold back the water, causing a higher flood level than a grassed floodplain. A smooth, concrete-lined channel will obviously convey water with less resistance than a channel strewn with large rocks and fallen trees. Man-made objects such as buildings, fences, highways and bridges will also have an effect on resistance to the flow.

Step 4 — Calculating Flood Elevations (Hydraulic Evaluation)

All of the above factors, flood flow, channel and floodplain configurations, man-made and natural obstructions and roughness coefficients are used to compute flood depths **at each cross section.** These factors are coded for input into a computer program developed by the U.S. Army Corps of Engineers (HEC-II) which performs the actual computations. The computer model is calibrated using historic highwater and flood flow data, when available.

Step 5 — Preparing the Flood Profile

The flood elevations for each cross section are then plotted on a profile and the points are connected. A profile is a graphic picture of a section of the stream as if it were cut length wise down the centerline giving a side view. The profile is related to the map by the cross sections used in the computer model.

Step 6 — Delineating the Floodplain

The last step is to translate the height of the flood at each cross-section onto a topographic map. The flood elevation for each cross section is plotted on both sides of the stream and the points are connected by lines following contours to show the boundary of the floodplain.

The reliability of the floodplain delineation is dependent on the accuracy of the data used to calculate the elevation and accuracy of the topography and features shown on the floodplain map. For example, if the topographic map has 5-foot contour intervals and the flood elevation was calculated to the nearest one foot, a judgement has to be made where that elevation is located on the map.

TYPES OF FLOODPLAIN DELINEATIONS

Before discussing specific items on floodplain mapping, it is important to understand the types of floodplain delineations. Prior to the start of each FIS, a meeting is held with community officials to discuss existing flooding problems and possible future floodplain development activity. Those streams and lakes with existing or proposed floodplain development would usually be studied by **detailed** engineering methods. Those lakes and stream reaches with little or no development potential were studied by less-costly **approximate** methods. As a result, an FIS may contain two separate types of floodplain delineations; these being:

1) Floodplain delineations based on **detailed** engineering methods. The end result is a floodplain delineation that represents a projected flood height or stage stated in feet above mean sea level datum. The projected flood height or stage is calculated using a detailed hydrologic and hydraulic model of the watercourse or lake in question.

2) Floodplain delineations based on **approximate** study techniques. The approximate floodplain delineation is determined using the best available data, in lieu of performing a detailed engineering study. These data may be from soils mapping, experienced high water profiles, aerial photographs of previous floods, or other appropriate sources. There are no associated 100-year flood **elevations** with approximate floodplain delineations unlike detailed study areas.

FLOODPLAIN MAPPING

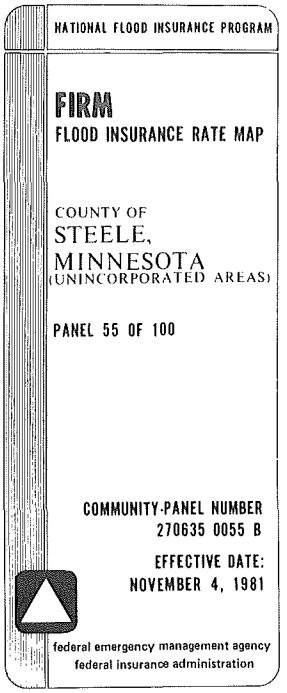
The Flood Insurance Study (FIS) usually contains two separate maps, the:

1) Flood Insurance Rate Map (FIRM)
2) Flood Boundary and Floodway Map (FBFM)

All FIS's will contain a FIRM, but only those FIS's with detailed study stream reaches where a floodway has been designated will contain a FBFM. These two map types contain several similarities and differences as highlighted by the following table:

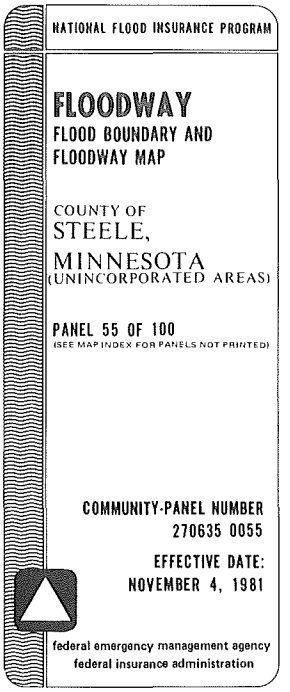
Following Data Included	FIRM	FBFM
Approximate 100-year flood delineations	Yes	Yes
100-year (detailed study) flood delineation	Yes	Yes
500-year flood delineations	Yes	Yes
Base flood elevations	Yes	No
Flood insurance rate zones	Yes	No
Cross section locations	No	Yes
Floodway/Flood fringe delineation	No	Yes
Elevation reference marks	Yes	Yes

The FIRM is primarily intended for use by lenders and insurance agents. The FBFM is primarily used by community officials in administering their floodplain zoning ordinance. However, community officials should also maintain a current copy and refer to the FIRM because:



1) The FBFM for a particular community may not contain all map panels which have flood hazard delineations. FEMA will publish FBFM panels for only those panels where a floodway has been designated. The FIRM will contain all panels with flood hazard delineations, whether they are approximate or detailed study areas.

2) As conditions change, or new data become available, FEMA will often republish the appropriate FIRM. The FBFM is less frequently (if ever) updated. It is therefore always a good idea to check the most current FIRM.



The following 10 pages review important features of the maps and tables found in most flood insurance studies, including:

1) Map Index
2) Flood Insurance Rate Map
3) Flood Boundary Floodway Map
4) Floodway Data Table
5) Flood Profile

MAP INDEX

Many communities, including all Minnesota Counties, are geographically large enough so that the entire community will not fit on one map panel. These communities are therefore divided into two or more "panels"; each panel is given a unique panel number. Whenever a community requires more than one panel, a "Map Index" for both the FIRM and FBFM is prepared.

The Map Index will show the entire community boundary, highlighting prominent features within the community including major highways, railroads, streams and lakes. The Map Index will show how the community was divided into the various panels.

1 - **PANELS PRINTED:** FEMA prints only those panels having flood hazard areas; those panel numbers printed are indicated on the title block.

2 - **PANELS NOT PRINTED:** Those panels having **no** flood hazard areas are indicated by an asterik "*".

3 - **MAP INDEX DATE:** The date shown on the title block reflects the most recent revision. As changes occur within a community which result in a change in flood elevations or floodplain delineations, FEMA republishes only those map panels affected. The revised panel(s) is given a new map effective date for the date it was officially revised. It is therefore possible that a given community would have two or more effective map panel dates. The map index will show the most recent map effective date.

4 - **MAP PANEL NUMBER:** Each panel is given a unique number consisting of three parts:

Example: 2706355 0055 B
(a) (b) (c)

(a) community number
(b) panel number
(c) panel suffix

As indicated above, individual panels will be revised as needed. With each revision, the panel suffix will be increased.

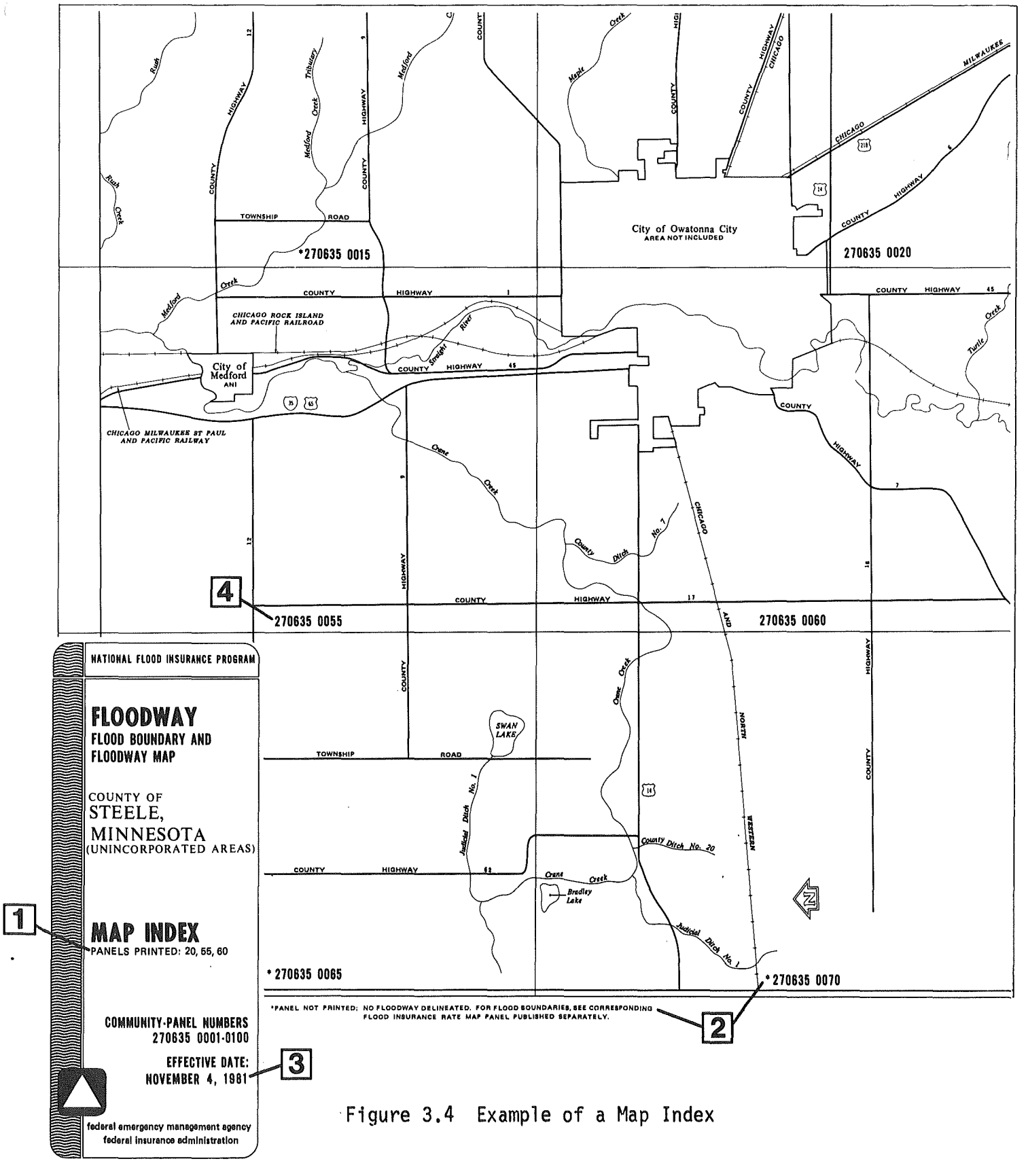


Figure 3.4 Example of a Map Index

FLOOD INSURANCE RATE MAP

(FIRM)

1 - **TITLE BLOCK:** Includes the community and county name and community identification number and the panel number.

2 - **MAP DATES:** Several dates may be listed, including:

Initial Identification - date of first Flood Hazard Boundary Map

Flood Insurance Rate Map Effective - date the community was converted to the regular program of the NFIP which normally corresponds to the date of initial FIRM.

Flood Insurance Rate Map Revision - date of subsequent revisions to the FIRM. This date refers only to that panel.

3 - **NORTH ARROW:** Directional point of reference. Caution, some maps are **not** oriented with north oriented toward the top of the page.

4 - **MAP SCALE:** Two different scales may have been used for community's with more than one map panel.

5 - **100-YEAR FLOODPLAIN:** Designated by the dark shaded areas (insurance zones A, A1-A30, AO, AH)

6 - **500-YEAR FLOODPLAIN:** Designated by the lighter shaded areas (Insurance Zone B).

7 - **BASE FLOOD ELEVATION (BFE):** The water surface elevation of the base flood (100-year flood) at that point of the stream.

8 - **FLOOD INSURANCE RATE ZONES:** Zone designations which reflect relative flood risks. The zone designation is required when writing a flood insurance policy and determining the policy premium.

9 - **ZONE BREAK LINE:** These lines separate different flood insurance rate zones within the 100-year floodplain.

10 - **APPROXIMATE FLOODPLAIN AREAS:** 100-year floodplain areas determined using approximate methodologies. No base flood elevations will be shown in approximate floodplain areas. These areas are classified as (unnumbered) Zone A.

11 - **ELEVATION REFERENCE MARKS:** Using these elevation benchmarks, a survey can determine the exact elevation of a particular structure or property. The surveyed elevation, when compared to the actual BFE, will determine whether the property in question is within the 100-year floodplain.

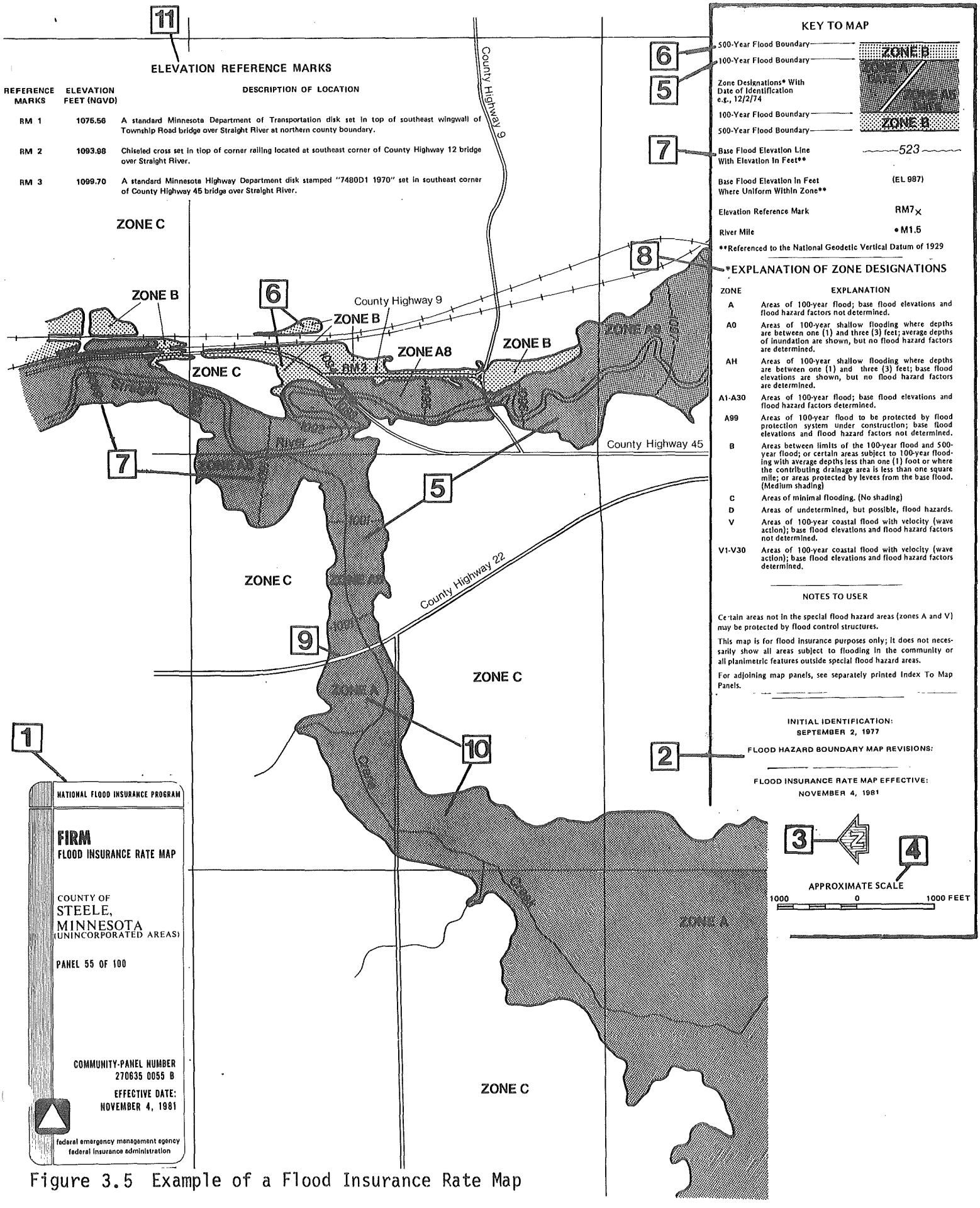


Figure 3.5 Example of a Flood Insurance Rate Map

FLOOD BOUNDARY AND FLOODWAY MAP
(FBFM)

1 - **TITLE BLOCK**: Includes the community and county name, panel and community number and the map date.

2 - **NORTH ARROW**:

3 - **MAP SCALE**: Caution, the FBFM often has a different scale than the FIRM for that particular community.

The 100-year floodplain (detailed study stream reaches) has been divided into two land use zoning districts - Floodway and Floodway Fringe.

4 - **FLOODWAY**: The non-shaded areas adjacent to a stream or shoreline between the heavy dashed lines. The floodway must remain in open space uses to allow for the unobstructed passage of the 100-year flood waters.

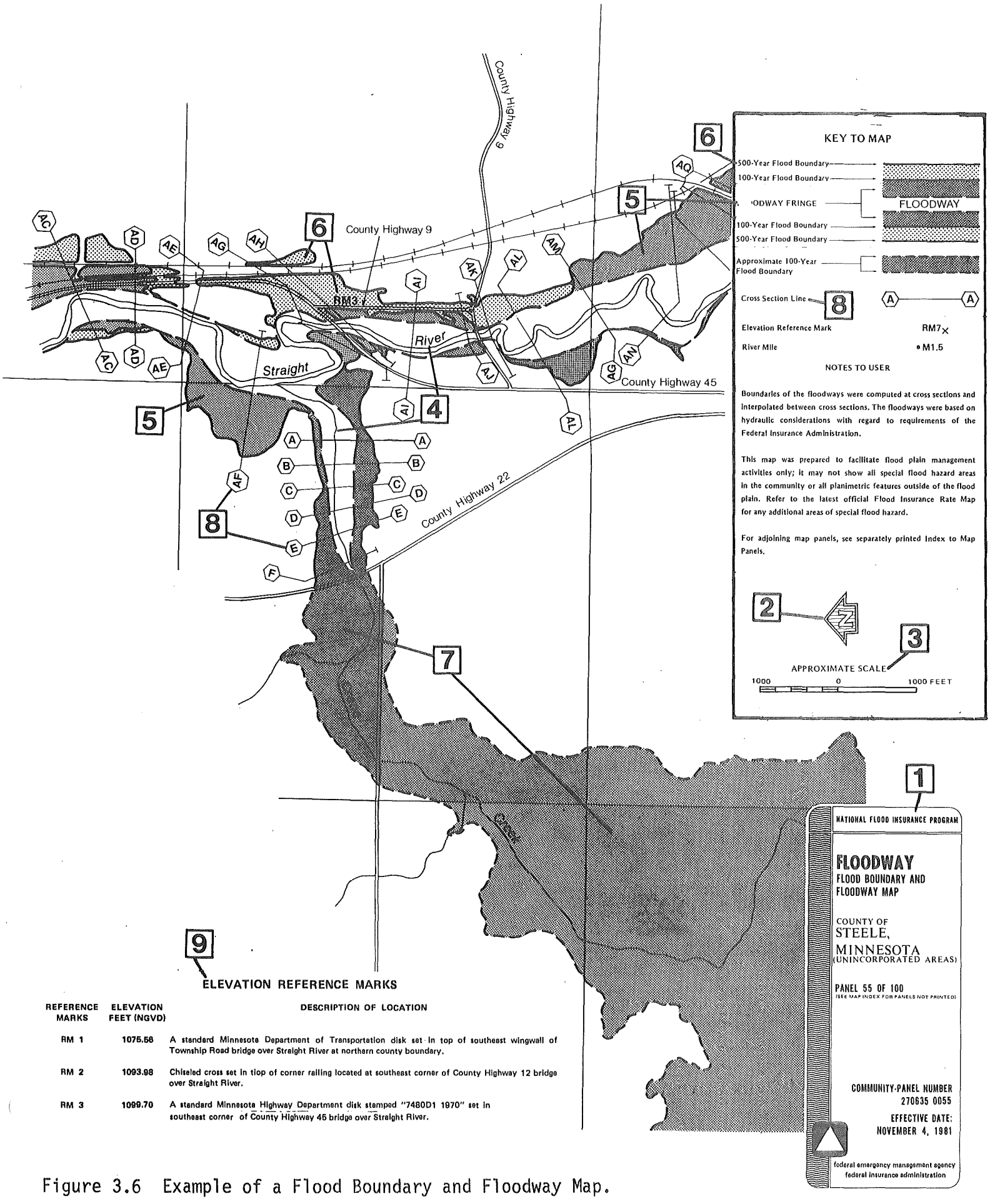
5 - **FLOODWAY FRINGE**: Shaded areas landward of the floodway but still within the 100-year floodplain. The floodway fringe may be developed in the future provided all new structures are elevated or floodproofed to the RFPE. (The term floodway fringe is synonymous with the term flood fringe used throughout this work book).

6 - **500-YEAR FLOODPLAIN**: Lighter shaded areas adjacent to, but outside of the 100-year floodplain.

7 - **APPROXIMATE FLOODPLAIN AREAS**: 100-year floodplain areas determined using approximate methodologies. The limits of the approximate floodplain on the FBFM are shown as small dashed lines.

8 - **CROSS SECTION LINE**: These lines represent the surveyed cross sections used in the computer model of the stream in calculating 100-year flood elevations. These cross sections can be used to relate a specific point on the FBFM to the Flood Profile and Floodway Data Table (discussed later in this chapter).

9 - **ELEVATION REFERENCE MARKS**: Similar to those shown on the FIRM.



ELEVATION REFERENCE MARKS

REFERENCE MARKS	ELEVATION FEET (NGVD)	DESCRIPTION OF LOCATION
RM 1	1075.56	A standard Minnesota Department of Transportation disk set in top of southeast wingwall of Township Road bridge over Straight River at northern county boundary.
RM 2	1093.88	Chiseled cross set in top of corner railing located at southeast corner of County Highway 12 bridge over Straight River.
RM 3	1099.70	A standard Minnesota Highway Department disk stamped "7480D1 1970" set in southeast corner of County Highway 45 bridge over Straight River.

Figure 3.6 Example of a Flood Boundary and Floodway Map.

FLOODWAY DATA TABLE

The Floodway Data Table found in the FIS text is prepared for stream reaches with a designated floodway. This table includes the computed 100-year flood elevation at each cross section as well as the associated stage increase resulting from the designation of a floodway. **Both** of these pieces of data are needed to determine the proper building elevation within the 100-year floodplain.

1 - **COMMUNITY AND STREAM IDENTIFIER**

2 - **FLOODING SOURCE**: Each line (row) represents data for a particular cross section. Each cross section in this table is also shown on the Flood Boundary and Floodway Map and the Flood Profile. STREAM DISTANCE corresponds to the horizontal scale shown on the Flood Profile.

FLOODWAY: These three columns provide specific data on the designated floodway.

3 - **WIDTH**: Total width of the floodway, which can also be scaled from the FBFM.

4 - **AREA**: Cross sectional area of the floodway.

5 - **VELOCITY**: The **average** water velocity throughout the entire cross section which usually is lower than the flow velocity within the channel.

BASE FLOOD WATER SURFACE ELEVATION: Tabulation of the actual computed 100-year flood elevation at each cross section.

6 - **REGULATORY**: Most Floodway Data Tables do not contain this column. If this column is present, it may indicate another waterbody has the controlling influence on flood elevations for that particular reach. In our example, 100-year flood elevations for the downstream reach of Crane Creek are determined by the Straight River, not Crane Creek. Therefore, when present, the REGULATORY column should be used instead of the "without floodway" column.

7 - **WITHOUT FLOODWAY**: These elevations correspond to the 100-year flood levels shown on the flood profiles and the FIRM.

8 - **WITH FLOODWAY**: These elevations represent the 100-year flood elevations assuming the entire flood fringe is filled (i.e., developed) to the 100-year flood level.

9 - **INCREASE**: This last column represents the rise in the 100-year flood elevation or stage increase resulting from the floodway designatior. This value is needed to determine the proper building elevation within the 100-year floodplain.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
STRAIGHT RIVER								
AA	21,681	370	2913	5.1	1087.6	1087.6	1088.0	0.4
AB	22,631	541	3855	3.9	1088.5	1088.5	1088.9	0.4
AC	23,581	426	3374	4.4	1089.0	1089.0	1089.3	0.3
AD	24,341	407	2965	5.1	1089.4	1089.4	1089.7	0.3
AE	25,101	387	3277	4.6	1090.1	1090.1	1090.4	0.3
AF	26,431	563	3318	4.5	1091.0	1091.0	1091.3	0.3
AG	28,860	370	2739	4.4	1092.8	1092.8	1092.9	0.1
AH	29,492	425	2843	4.2	1094.4	1094.4	1094.4	0.0
AI	30,301	435	3666	3.3	1095.0	1095.0	1095.1	0.1
AJ	31,053	164	2074	5.8	1095.2	1095.2	1095.2	0.0
AK	31,329	165	2162	5.6	1095.5	1095.5	1095.6	0.1
AL	32,231	650	4585	2.6	1096.5	1096.5	1096.5	0.0
AM	33,331	650	4365	2.7	1096.7	1096.7	1096.9	0.2
AN	34,751	989	6750	1.8	1097.1	1097.1	1097.3	0.2
CRANE CREEK								
A	1180	491	4357	0.6	1091.4	1088.4	1088.7	0.3
B	1480	417	3528	0.5	1091.4	1088.5	1088.8	0.3
C	1780	366	2955	0.4	1091.4	1088.6	1088.9	0.3
D	2080	322	2491	0.4	1091.4	1088.7	1089.0	0.3
E	2380	279	2064	0.3	1091.4	1089.0	1089.3	0.3
F	2750	96	1097	0.2	1091.4	1089.0	1089.3	0.3

[1]FEET ABOVE COUNTY BOUNDARY

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

COUNTY OF STEELE, MN
(UNINCORPORATED AREAS)

FLOODWAY DATA

STRAIGHT RIVER & CRANE CREEK

Figure 3.7 Example of a Floodway Data Table 3.15

FLOOD PROFILE

The flood profile, found at the back of the flood insurance study text for all detailed study stream reaches, is a graphical representation of flood depths along the stream reach. This profile can be thought of as a horizontal view of a section of the stream taken along the middle of the channel.

1 - **COMMUNITY IDENTIFICATION BLOCK**

2 - **STREAM IDENTIFIER**

3 - **LEGEND**

4 - **VERTICAL SCALE:** Elevation in feet above mean sea level (MSL).

5 - **HORIZONTAL SCALE:** Stream distance in feet or miles, measured along the center of the channel from a known reference point.

6 - **STREAM BED:** The lowest surveyed point in the stream channel.

7 - **CROSS SECTION:** Location of surveyed cross sections used in the hydraulic analysis. The actual 100-year flood elevation at each cross section is also shown in the Floodway Data Table. Each cross section on the profile is also shown on the Flood Boundary Floodway Map.

8 - **FLOOD PROFILE:** Each line represents the flood elevation for a specific flood frequency (i.e. 10-year, 50-year, 100-year and 500-year) at that particular point along the stream.

9 - **IDENTIFIABLE LANDMARKS**

10 - **FLOOD INSURANCE ZONES:** These zones correspond to those shown on the applicable Flood Insurance Rate Map (FIRM) and are used for flood insurance premium rating purposes.

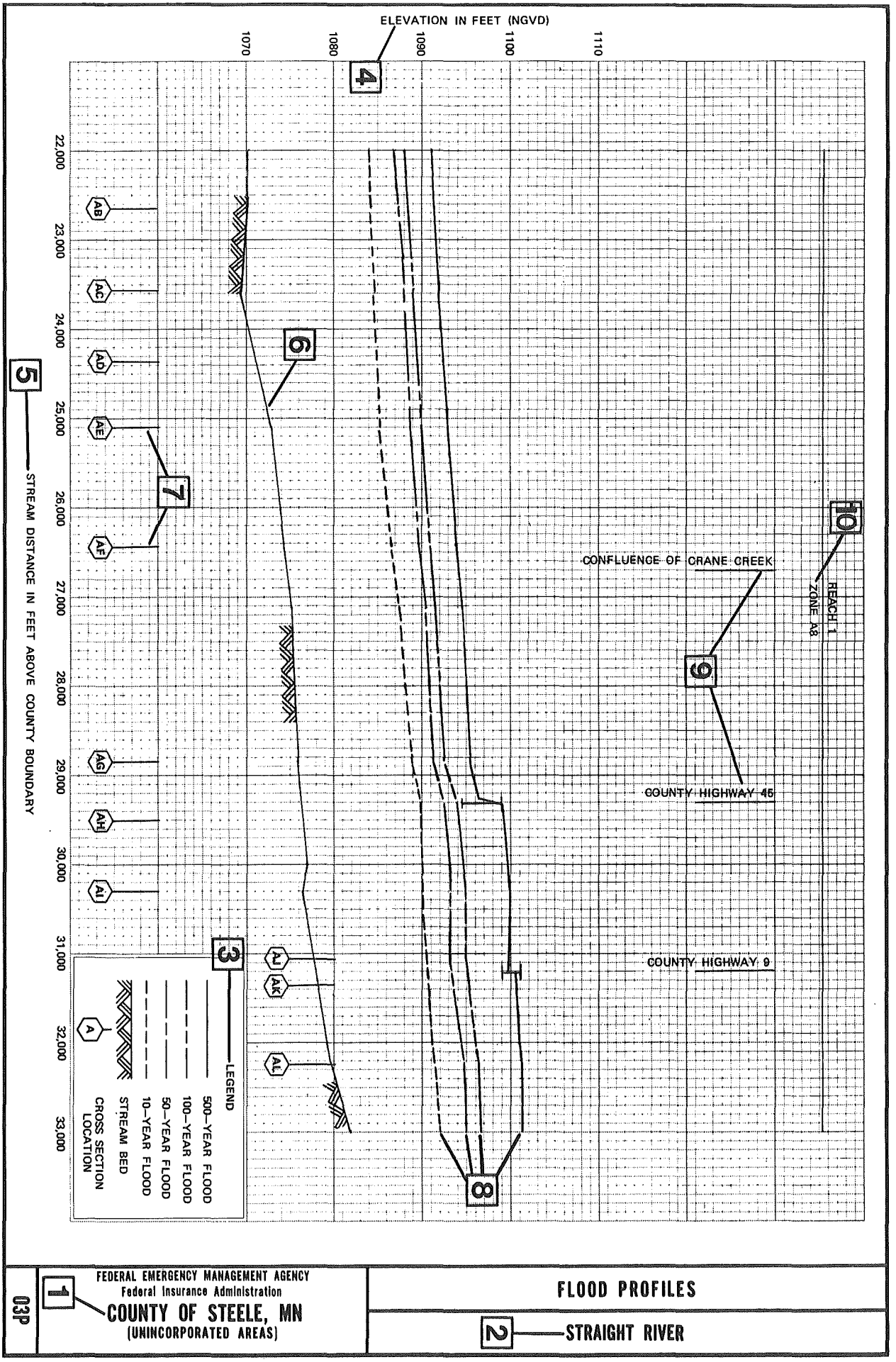


Figure 3.8 Example of a Flood Profile

FLOOD DELINEATIONS

Two delineations on the flood insurance rate map and flood boundary floodway map are of particular importance:

1) line indicating the outward extent of the 100-year floodplain; and

2) line separating the floodway district from the flood fringe district

These two lines (delineations) are determined by different techniques and have different implications for regulatory purposes. It may therefore be helpful to review how these lines are determined during a typical flood insurance study.

100-Year Flood Boundary

As previously outlined in this chapter, the study consultant develops a computer model of a river to obtain 100-year flood elevations at each cross section. The computer model is based on land conditions as they exist at the time of the study. The entire collection of cross sections define a **base condition** flood profile for the entire river reach studied.

In mapping the outer limits of the floodplain, the 100-year flood elevation is compared to the actual ground contour. The flood boundary is located at the point where the flood level intersects the gound surface of the same elevation (see Figure 3.9).

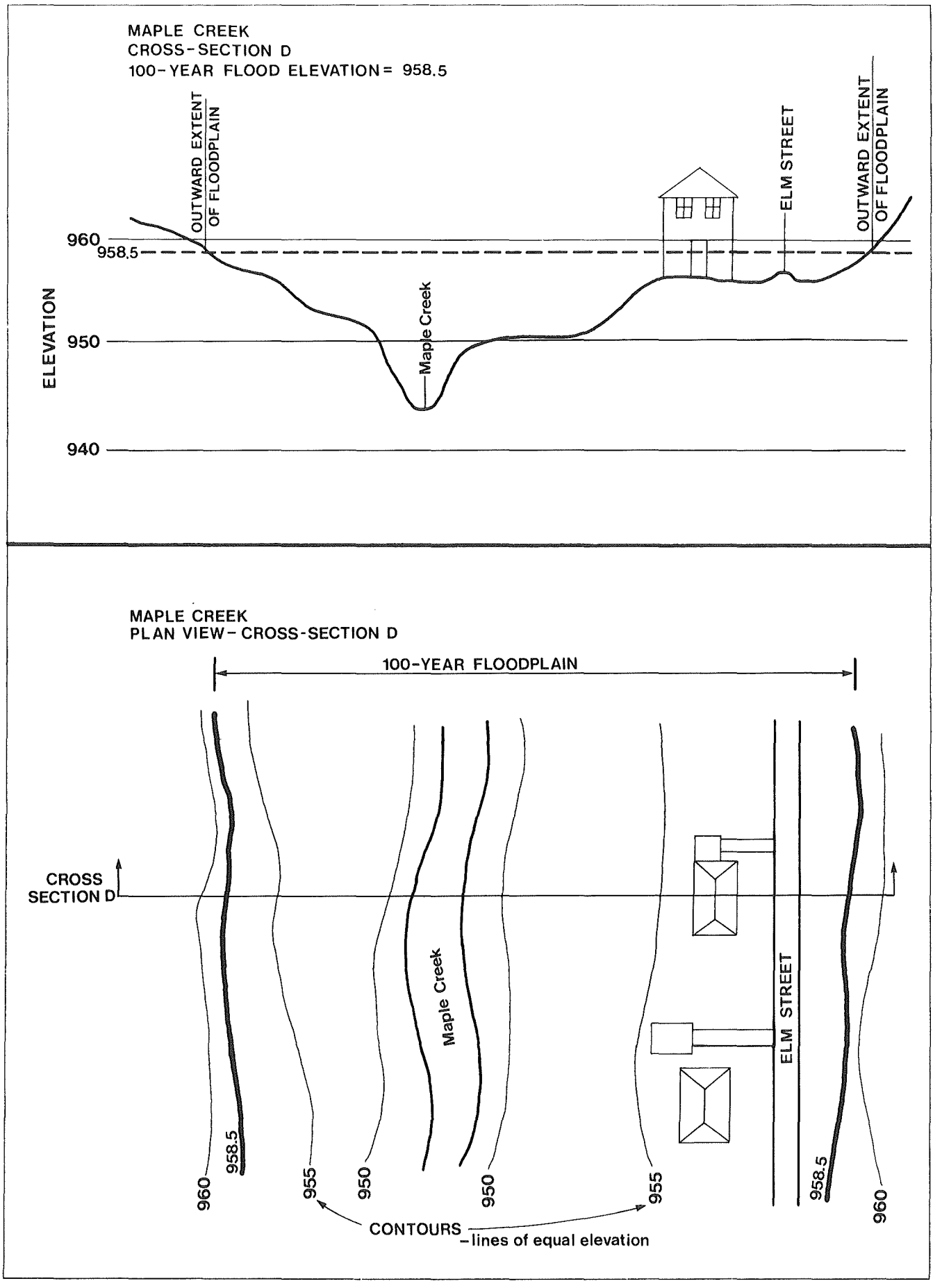


Figure 3.9 100-year flood boundary delineation

Floodway/Flood Fringe Delineation

The manner in which the floodway and flood fringe districts are delineated on the map is quite different than that for the 100-year floodplain boundary determination. The actual floodway/flood fringe line is not dependent on the ground elevation a given point along the cross section; rather it is a distance from a known reference point, such as the centerline of a road or the stream bank (see Figure 3.10).

To be discussed in greater detail in Chapter 4, the floodplain ordinance will require the floodway district to remain in open spaces uses. Future development can occur in the flood fringe district if properly protected against flood damages. The selection of floodway and flood fringe district is accomplished in conjunction with the preparation of the FIS. Community officials have a major voice in the original floodway/flood fringe selection. Usually, community officials request that areas of existing and potential development are placed in the flood fringe district; city parks, nature areas and other open space areas are typically placed in the floodway.

The FIS consultant uses this information on existing or proposed floodplain development to draw a preliminary floodway/flood fringe line. The 100-year flood profile is calculated by determining the amount of cross sectional area needed to pass the 100-year flood discharge. With the designation of flood fringe areas, the associated cross sectional area is assumed to be no longer available to convey the floodwaters downstream. The consultant modifies the "base condition" computer model described above by removing the area designated as flood fringe from each cross section. This determines the incremental increase in water surface elevation above the 100-year flood level necessary to compensate for the cross sectional area designated as flood fringe. State standards generally limit this stage increase to one-half foot.

Minor adjustments may be necessary for the floodway/flood fringe delineation to be compliant with state and federal standards. There is no guarantee that all existing development or potential new development sites will be placed in the flood fringe district.

To again emphasize the differences identified above:

1) the 100-year floodplain boundary is based on the elevation of the 100-year flood and the actual ground elevation.

2) the floodway/flood fringe delineation can be thought of as a horizontal distance from the center of the channel; its location is not related to ground elevations.

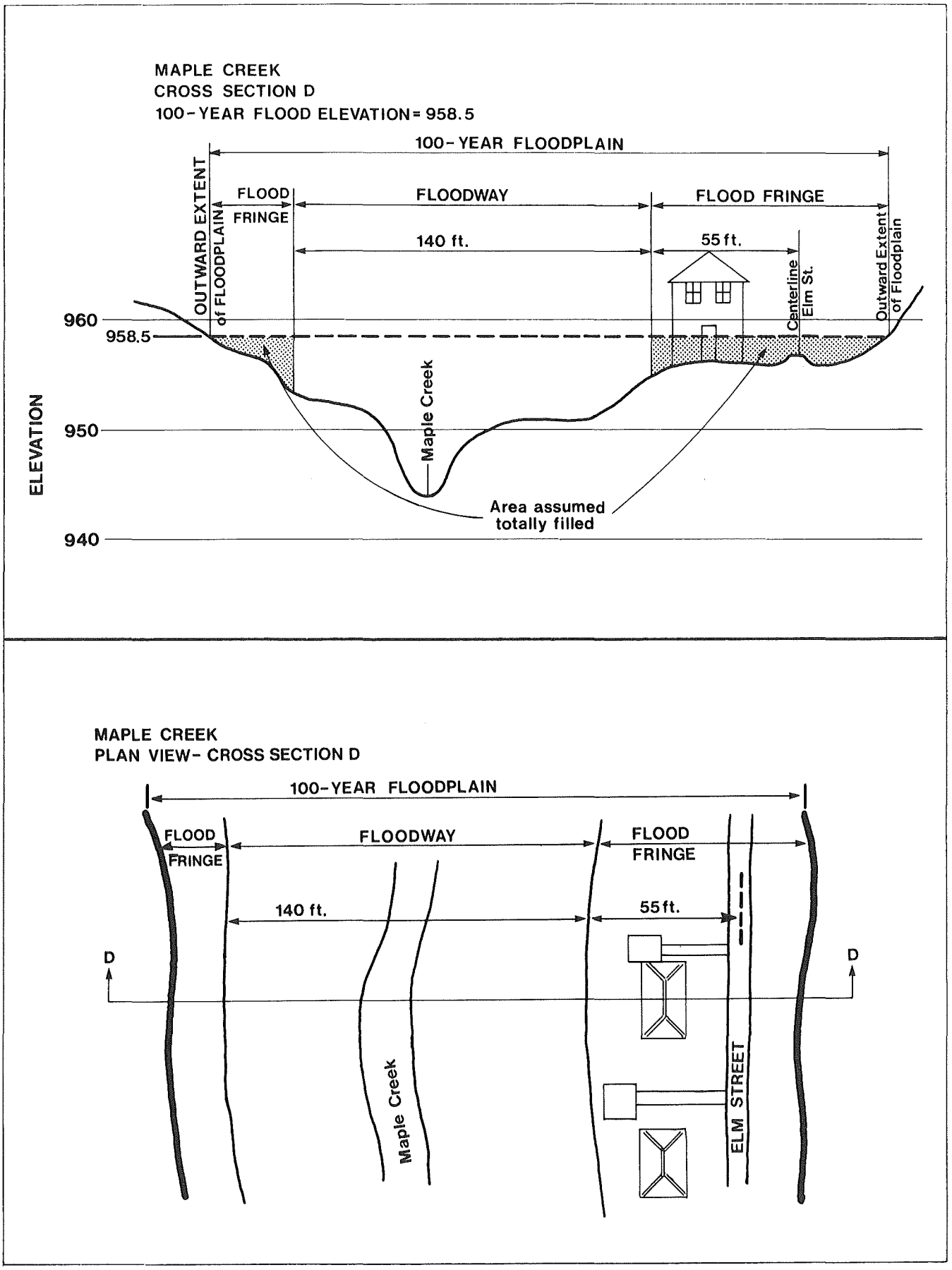
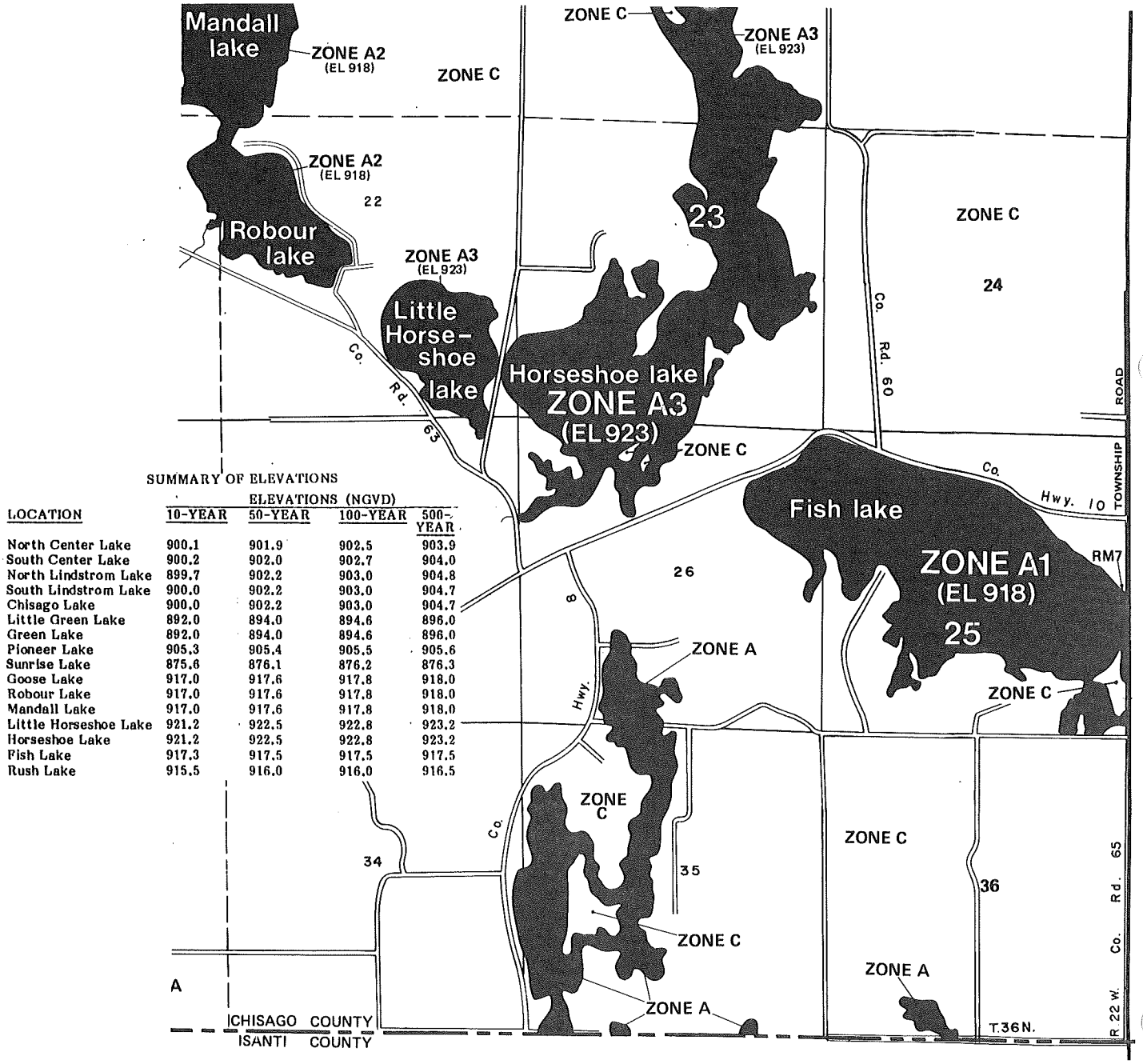


Figure 3.10 Floodway/flood fringe delineation

LAKES

Data for lakes studied by detailed methods are displayed differently on the flood maps and in the FIS text than are stream data. First, on the Flood Insurance Rate Map, the 100-year flood elevation for lakes is shown directly below the flood insurance zone designation, rounded to the nearest whole foot. On the Flood Boundary and Floodway Map, the floodplain for a detailed study lake is usually **not** divided into a floodway/flood fringe districts. The exception may occur if the lake is actually a wide point in a river; in this situation, the lake may have a designated floodway.

There will not be a flood profile or floodway data table entry for lake data. Instead, a Table of Lake Elevations will be included in the Flood Insurance Study text. This table will contain flood elevation data for various frequency floods for all lakes studied by detailed methods for that community.



SUMMARY OF ELEVATIONS

LOCATION	ELEVATIONS (NGVD) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
North Center Lake	900.1	901.9	902.5	903.9
South Center Lake	900.2	902.0	902.7	904.0
North Lindstrom Lake	899.7	902.2	903.0	904.8
South Lindstrom Lake	900.0	902.2	903.0	904.7
Chisago Lake	900.0	902.2	903.0	904.7
Little Green Lake	892.0	894.0	894.6	896.0
Green Lake	892.0	894.0	894.6	896.0
Pioneer Lake	905.3	905.4	905.5	905.6
Sunrise Lake	875.6	876.1	876.2	876.3
Goose Lake	917.0	917.6	917.8	918.0
Robour Lake	917.0	917.6	917.8	918.0
Mandall Lake	917.0	917.6	917.8	918.0
Little Horseshoe Lake	921.2	922.5	922.8	923.2
Horseshoe Lake	921.2	922.5	922.8	923.2
Fish Lake	917.3	917.5	917.5	917.5
Rush Lake	915.5	916.0	916.0	916.5

Figure 3.11 Example of detailed lake data in a FIS

APPROXIMATE STUDY AREAS

Approximate floodplain areas are those areas not studied by the detailed hydrologic/hydraulic methods during the FIS. These areas are shown as "unnumbered A Zones" on the FIRM and "approximate 100-year flood zones" on the FBFM. The FIS will not contain specific 100-year flood elevations for approximate study areas nor will there be a floodway/flood fringe designation on the FBFM.

The lack of specific flood data in certain areas may cause additional burdens to those wishing to develop approximate floodplain areas. Communities can allow development within an approximate study area through the conditional use permit process. These flood zones are commonly referred to as a "General Floodplain District" in a floodplain ordinance.

Original Determination

In nearly all situations, the approximate flood boundaries shown on the FIRM were originally developed for the Flood Hazard Boundary Map (FHBM). A handful of consulting engineering companies (none from Minnesota) were under contract with FEMA to develop and publish FHBM's nationwide. During the 1970's and early 1980's roughly 20,000 FHBM's have been published. Limited data, often nothing more than USGS quadrangle mapping, were used in the preparation of the original FHBMs.

As previously mentioned, often only a portion of the streams and lakes in a community are studied by detailed methods during many FIS's. For those areas not studied, the approximate flood delineations shown on the FHBM are usually transferred directly onto the FIRM. The FIS contractor may have performed limited field and data review of these areas and revised the delineation as appropriate.

Implications for Zoning Decisions

With any development proposal, the local zoning official must determine whether the proposed activity is located within a designated floodplain. The first step in making this determination would be to locate the proposed development on the community's FIRM/official zoning map. If the structure is clearly within an approximate 100-year floodplain, the developer should be instructed to secure a conditional use permit. A community's conditional use permit process is worded such that procedures are spelled out for determining the 100-year flood elevation, the floodway/flood fringe boundary and the regulatory flood protection elevation for the site.

There will no doubt be borderline situations where the development is not clearly in, or out, of the approximate floodplain. There may also be situations where the approximate floodplain boundary does not appear reasonable.

In these situations, the codes administrator should make a good faith effort in reviewing all available data prior to reaching a decision. Neither the DNR nor FEMA will second guess the local codes administrator who makes a reasonable approximate floodplain boundary determination based on historic flood data, site inspection, soils mapping or other appropriate data.

Additional Data Sources

The FIS text will **sometimes** identify the methodology used for delineating approximate floodplain boundaries. This reference is usually found in Section 4.1 of the text, "Flood Boundaries." Typcial examples are highlighted below:

- "For areas studied by approximate methods, the boundary for the 100-year flood was taken directly from the Flood Hazard Boundary Map for Steele County."

- "Approximate flood boundaries for Nine Mile Creek were interpolated using topographic maps reduced to a scale of 1:4800, with a contour interval of two feet."

- "Approximate delineation were made utilizing soils maps ... the published Flood Hazard Boundary Map and the USGS flood prone area maps."

The FIS text should be consulted to get an indication of the source(s) of data from which the approximate flood zones were delineated. Unfortunately, the references in the FIS text are typically as vague as the examples above.

Other sources of data may be available, four types are highlighted below.

Soils Mapping

In many areas of Minnesota, lands subject to periodic flooding and certain soil type exhibit a close correlation. The Soil Convervation Service has published "Soil Surveys" for approximately half of all Minnesota counties. Several Minnesota counties use soil data for many zoning and building activity related decisions. For example, Anoka County has adopted, as part of their zoning ordinance, specific soil classifications to designate floodplain areas as stated below:

> "The areas delineated in the maps specified in Section 3.02 A as an unnumbered A Zone shall be considered a general delineation of the area subject to the "Regional Flood" or "Base Flood" and shall be subject to field evaluation based on the specific soil conditions present. The general floodplain boundary may be expanded or reduced as may be justified by the presence or absence of soils, in or adjacent to the mapped area, that may be subject to flooding. For purposes of this evaluation, those soils delineated by the Soil Conservation Service (USDA), in their report "Soil Survey of Anoka County, Minnesota" (September, 1977) and identified by the following soil mapping unit name and mapping symbol shall be considered as being the lateral extent of the General Floodplain District:

MAPPING UNIT NAME	MAP SYMBOL
Alluvial	Af
Becker	Ba
Cathro	Cb
Duelm	Dp
Glencoe	Gc
(etc.)	

Historic Highwater Levels

One of the better sources of additional data are historic flood records. Newspaper reports, county engineer's records and "old-timers" recollections, such as the depth of flooding over a particular roadway, can often be used to accurately determine areas inundated by previous floods.

Another good source of historic flood data for larger streams and rivers are the Corps of Engineer's Water Surface Profiles. These profiles graphically show flood elevations for selected river reaches for one or more flood events.

Historic flood data should be used with caution; few flood events equal or exceed a 100-year flood. Just because an area of land has not previously flooded does not necessarily indicate it will not flood in the future.

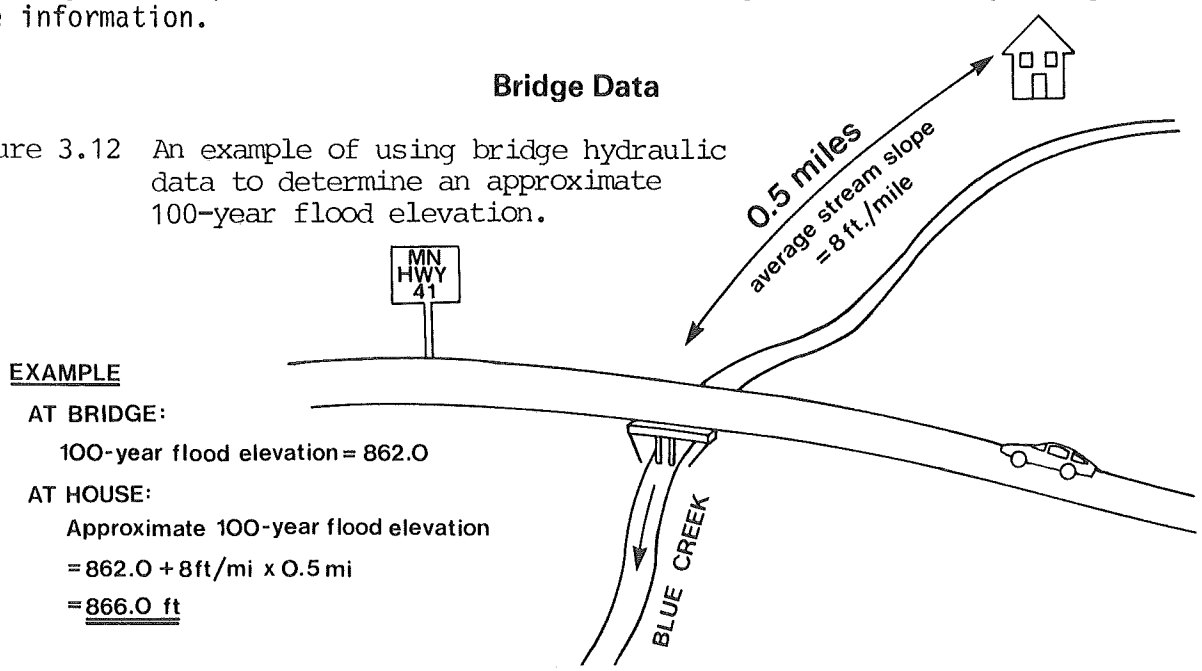
Stormwater Management Plans/Watershed District Studies

Another good source of data is available from hydrologic investigations not related to the NFIP. These reports include stormwater management plans, watershed management plans and flood control reports prepared by private consultants and other regional and federal governmental agencies. In many cases, these reports contain the available flood data for selected streams and rivers and can be used for regulatory purposes.

Where a complete flood profile containing 100-year flood elevations is available for approximate floodplain areas, these data should probably be adopted into the community's floodplain ordinance. Please consult your DNR Area Hydrologist for more information.

Bridge Data

Figure 3.12 An example of using bridge hydraulic data to determine an approximate 100-year flood elevation.



A hydrologic/hydraulic investigation is usually performed for new or replacement bridges and culverts. The bridge plans will often include 50-and 100-year flood discharge and elevation data for the area immediately adjacent to the bridge. The DNR and Minnesota Department of Transportation are currently inventorying these data for bridges throughout the state. This joint project should be completed by 1985.

Bridge hydraulic data can be very useful in rural areas where no other data are available. Flood elevations can, in most instances, be extrapolated a short distance up or downstream using a constant river slope. If a particular development proposal is located in/near an approximate floodplain area in the vicinity of a bridge crossing, these data may be available; please consult the DNR or Department of Transportation.

FLOODPLAIN REGULATIONS

ZONING ORDINANCE

ORDINANCE NO. 46

CHAMPLIN

$5.00

MINNESOTA STATE REGULATIONS

Rules and Regulations of

THE DEPARTMENT OF NATURAL RESOURCES

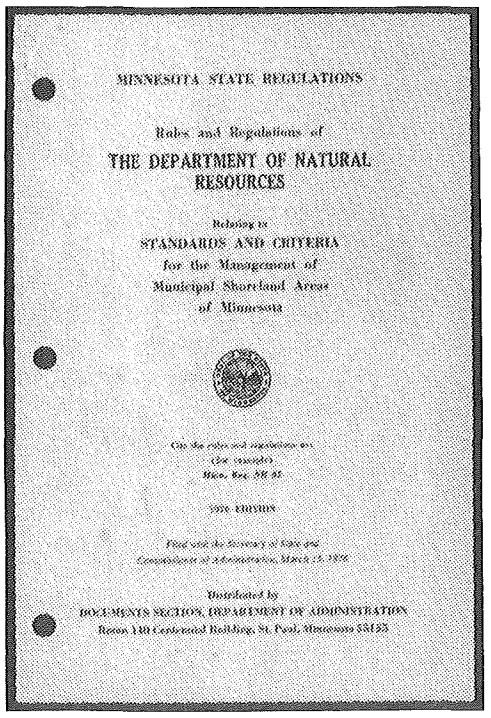
Relating to

STANDARDS AND CRITERIA

for the Management of

Municipal Shoreland Areas

of Minnesota



FLOOD-PROOFING REGULATIONS

MINNESOTA STATE REGULATIONS

Rules and Regulations of

THE DEPARTMENT OF NATURAL RESOURCES

(Formerly Department of Conservation)

Relating to

STATEWIDE STANDARDS AND CRITERIA

FOR MANAGEMENT OF FLOOD PLAIN AREAS

OF MINNESOTA

(See the rules and regulations as:
(for example)
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CHAPTER IV

FLOODPLAIN REGULATIONS

Land use regulations are the cornerstone of all floodplain management programs. Regulatory controls provide a long-term approach to flood damage reduction. These controls require new building activity in the floodplain to be constructed in a manner which should eliminate future flood-related damages, and protect the public health and safety.

Once new, unprotected floodplain development has been substantially halted, other flood loss reduction techniques can be utilized on existing floodplain development. These techniques for existing buildings include floodproofing, improved flood warning and response, structural flood control measures and the relocation of flood prone buildings. All of the above techniques are more effective at long-term damage reduction if done in coordination with a strong land use regulatory program. After all, a net loss would result if ten flood prone structures were purchased and relocated and at the same time a community allowed a dozen new homes subject to damage to be built elsewhere in the floodplain.

This chapter will review the **minimum** state and federal land use regulatory standards applicable in floodplain areas. It must be remembered that each community has the option to adopt and enforce regulations more restrictive than these minimum standards, of which many Minnesota cities and counties have elected to do. Therefore when reviewing this chapter, it may be helpful to refer to the actual language of your community's floodplain ordinance.

Looking ahead, Chapter 5 will discuss the day-to-day administration of a typical floodplain ordinance. The duties and responsibilities of various individuals within the community will be highlighted. Suggestions, helpful forms and procedures which may be utilized by local administrators have also been included.

LEGISLATIVE AUTHORITY AND MANDATES

Existing state enabling legislation has long given local governmental units the discretionary authority to plan and regulate a broad category of land use development activities. This authority has included local adoption of comprehensive land use plans, official maps, zoning and subdivision ordinances and building codes. The respective legislation for county and municipal government, M.S. Chapter 394 and 462, respectively, state that local governmental bodies are **not** required to plan and zone. If they do, the community must limit these activities to the activities identified in the enabling legislation and follow the prescribed procedures for adoption and administration of regulatory controls.

The State Flood Plain Management Act (M.S. Chapter 104) **mandates** the local adoption of floodplain regulations when adequate technical data are available to identify the 100-year floodplain. The state Flood Plain Management Act, coupled with the minimum state standards found in "Statewide Standards and Criteria for Management of Flood Plain Areas of Minnesota", identify the specific allowable land uses and development standards applicable (only) to floodplain areas. Many communities will have previously adopted zoning and subdivision ordinances and building codes; the community's adoption of specific floodplain management regulations at a later date only amends and builds upon these existing codes and ordinances. When adopting floodplain regulations, a community must follow the prescribed procedures in the respective enabling legislation for adoption and enforcement of these controls.

(Note: This chapter will not discuss the authorities of certain classes of towns to plan and zone. Because of the way community eligibility is established and maintained for the NFIP, county government must insure floodplain regulations are adopted and enforced properly for the unincorporated areas of the county - except for Hennepin and Ramsey Counties. Municipalities must adopt floodplain regulations for incorporated areas. The DNR is very cautious in having towns adopt floodplain regulations. This issue is beyond the scope of this workbook and should be referred to the your DNR area hydrologist for further consultation.)

UNDERLYING ORDINANCE

Zoning regulations may control a broad category of activities, such as the use of land or buildings within respective (zoning) districts of a community. The example below shows where a hypothetical community has been divided into two districts (R-1 and C-1) before the community adopted its floodplain zoning ordinance. The associated zoning ordinance text will specify what uses of land or structures are permissible in each district and may regulate the size, bulk, setback and density of structures in these respective districts.

It is fair to say many existing ordinances were adopted to provide for the safe and orderly development and functioning of the community, but little specific attention was given to flooding conditions or floodplain management principles. Therefore the goal of state mandated floodplain ordinance adoption is to: 1) shore-up the gaps in local regulatory programs where they exist; and 2) use existing enabling legislation for ordinance adoption and enforcement procedures.

TYPICAL ZONING MAP
BEFORE AND AFTER ADDITION OF FLOOD REGULATIONS
USING A TWO DISTRICT APPROACH

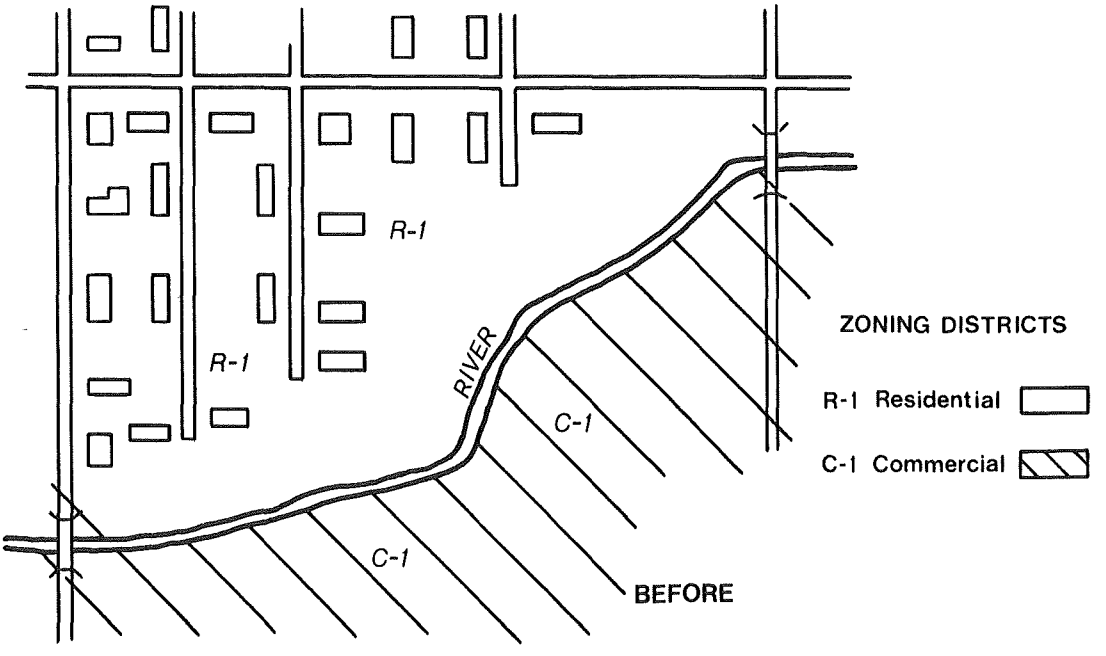


Figure 4.1

It must be kept in mind that minimum state and federal floodplain standards only require revised or new local regulatory programs to insure: 1) all new floodplain development is properly protected against flood damage; 2) the health and safety of floodplain occupants is insured; and 3) floodway areas are devoted to essentially open spaces uses so that floodplain encroachments do not increase flood levels above acceptable limits to the detriment of others. These concepts will be discussed in greater detail later in this chapter.

OVERLAY DISTRICT

The following diagram shows our hypothetical community's zoning district boundaries after it has adopted its regulatory floodplain district boundary as an overlay district. In this case, the community has taken its 100-year floodplain and divided it into floodway and flood fringe districts. The floodway and flood fringe districts are super-imposed over the existing (underlying) zoning use districts and the existing zoning ordinance text must be revised to incorporate the appropriate land use and flood protection standards mentioned above.

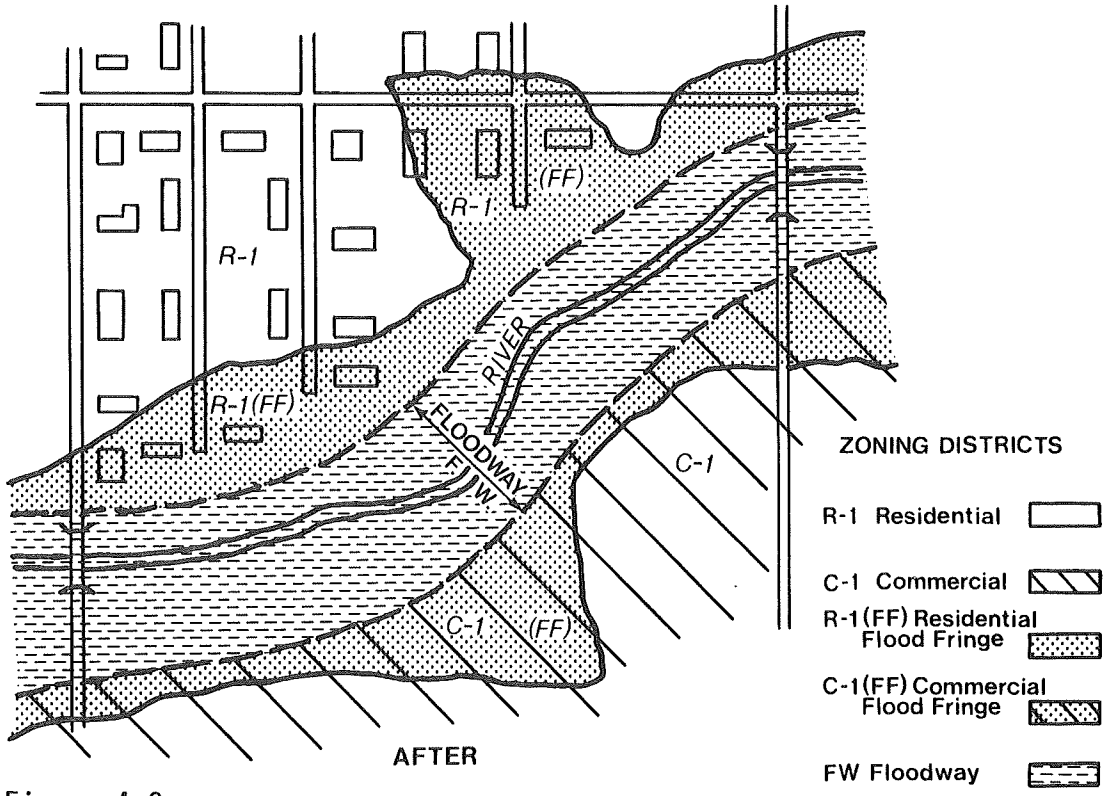


Figure 4.2

Communities which do not have existing underlying zoning regulations in effect at the time they adopt floodplain controls are only required to meet state and federal minimum standards for floodplain management (following the same procedures for ordinance adoption and enforcement procedures specified in the respective enabling legislation). At the time of adoption, a community would have to decide whether it wishes to proceed to adopt regulations addressing only floodplain development issues or adopt broader community-wide regulations addressing such issues as density, use of land, setbacks, height and bulk limitations.

The DNR takes an active role in assisting communities to adopt floodplain regulations compliant with minimum state and federal standards. DNR coordinates its review of floodplain ordinances with the Federal Emergency Management Agency to insure all federal standards are also met. The Flood Plain Management Act does require that the Commissioner of Natural Resources to give prior approval of all locally adopted or amended floodplain regulations after June 30, 1970.

PROPERTIES REGULATED BY A FLOODPLAIN ORDINANCE

The first step in regulating floodplain development is to establish a regulatory jurisdiction and determine when a proposed activity is within the jurisdiction of the ordinance. All communities in Minnesota have identified their regulatory floodplain to encompass the area inundated by the 100-year flood. A community may choose to transfer its floodplain boundaries directly onto the official zoning map or adopt the flood insurance study and maps by reference and declare them to be a part of the official zoning map of the community.

It is not always an easy matter to determine whether a particular structure or property is located in the floodplain. The property may be situated very close to the outer limits of the floodplain and the flood outline map may be of insufficient scale or detail to provide for an accurate determination. In such cases, it is the responsibility of the local official reviewing permit applications to determine whether or not the property is located in the floodplain. If the proposed activity is located in the floodplain, then provisions of the ordinance, such as building (lowest floor) elevation and use requirements, would apply.

When a dispute arises over the exact floodplain boundary, the actual elevation of the property must be compared to the 100-year flood elevation shown on the flood profile or FIRM adopted by local ordinance. Minnesota floodplain management standards state, "Where a conflict exists between the floodplain limits on the official zoning map and actual field conditions, the flood elevations shall be the governing factor in locating the regulatory floodplain limits". For those areas where a detailed engineering study has been performed, the actual ground elevation and lowest floor elevation may have to be surveyed and compared to the 100-year flood elevation shown on the FIRM.

For those areas where 100-year flood elevations have not been provided to the community (approximate study areas), the location of the property would have to be compared against the delineated floodplain boundaries and the best available information. The local zoning official can require the developer or building permit applicant to follow a technical study process to determine a 100-year flood elevation in approximate study areas. Approximate study areas are commonly referred to as a "General Floodplain District" in local ordinance and development proposals are subject to a conditional use permit review process. As time permits, the DNR will assist a community in this technical review process if supplied with the supporting data, e.g., surveyed cross sections. Once a 100-year flood elevation is established, it is again a matter of comparing that elevation with the actual ground elevation for the property in question.

Floodway/Flood Fringe Determination

When a development proposal is determined to be located in the regulatory floodplain, it will then be necessary to determine whether the property is located in the floodway or flood fringe district. This is extremely important because floodplain controls normally distinguish between allowable uses in floodway and flood fringe districts.

A community's official zoning map and flood insurance study, specifically the flood boundary and floodway map (FBFM), should normally be used in making a floodway/flood fringe boundary determination. The actual location of the floodway can be measured in the field by using a distance scaled off the zoning map or FBFM from a known point of reference, such as a street or top of river bank. Where the exact location of the floodway is desired, the original hydraulic model developed for the flood insurance study should be consulted. This information is available from the DNR. In approximate study areas, the floodway/flood fringe boundaries are determined on a case-by-case basis via the conditional use permit process.

REGULATORY FLOOD PROTECTION ELEVATION

All floodplain ordinances in Minnesota will include the term Regulatory Flood Protection Elevation (RFPE). The RFPE represents the elevation to which new floodplain development must be elevated or floodproofed. For example, all new residential structures must be elevated on fill such that the lowest floor, including basement, is no lower than the RFPE. Since the RFPE represents an elevation at a specific location along a stream, the RFPE must be determined for each and every floodplain development proposal.

The RFPE is determined as follows:

RFPE = 100-year flood elevation
+ stage increase to the 100-year flood level due to the designation of flood fringe areas
+ 1 foot of freeboard *

* Optional, but strongly recommeded; check the specific language in your ordinance.

Example

A single family home is going to be constructed in the flood fringe of Crooked Creek at cross section D. The RFPE is determined as follows:

CROSS SECTION		BASE FLOOD ELEV. with floodway	without floodway	Increase
A				
B				
C				
D		978.1	977.7	0.4
E				
BIG COUNTY		FLOODWAY DATA		
		CROOKED CREEK		

100-year flood elevation = 977.7
stage increase = 0.4
freeboard = 1.0
RFPE = 979.1

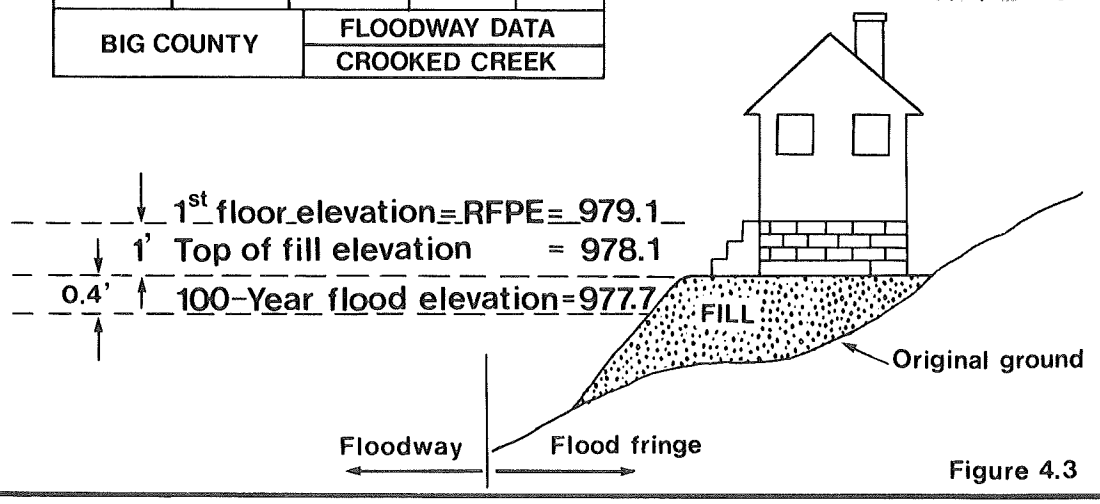


Figure 4.3

FLOODPLAIN USES

Floodplain regulations use and build upon existing administrative and quasi-judicial review processes where found in established local ordinances. The complexity of the review process and the review procedure used are often dictated by the location of the proposed development (high risk vs low risk areas) and the construction method used (elevation on fill vs. the riskier floodproofing technique). The adequacy of established review procedures, such as building/use permits, conditional use permits and variances, must be addressed when a floodplain ordinance is adopted.

Certain land uses and construction methods are deemed perfectly acceptable on their face for floodplain areas. Therefore, a floodplain zoning ordinance may use the standard zoning convention of identifying these uses as "permitted uses" within the floodplain. Obviously, floodway and flood fringe areas must be treated differently and will have different sets of permitted uses. For floodplain permitted uses, the community must require a building/use permit prior to: the erection, addition or alteration of any building, structure, or portion thereof; the use or change of use of a structure, building or land; the extention or change of a nonconforming structure or use of land; and the placement of fill or excavation of land.

Certain uses and construction methods for the floodplain are not accepted on face value as appropriate, but also on face value cannot be positively ruled as inappropriate. A special review process could demonstrate adequate precautions can be taken, subject to specified standards and criteria in local ordinance, to insure compliance according to the intent of the ordinance. The conditional/special use permit is the standard convention found in many zoning ordinances. The following activities in the respective floodplain districts are traditionally treated as conditional uses:

1) Floodway - fill, storage of materials and equipment and structures accessory to certain specified uses;

2) Flood Fringe - where floodproofing a structure is proposed in lieu of elevating a building on fill to the RFPE; and

3) General Floodplain District (approximate study areas) - any activity which requires fill, obstructions, structures or storage of materials and equipment.

Floodplain regulations must address certain additional topics, such as land subdivision, nonconformities, variances, manufactured homes, certification of compliance, record keeping, and violations. The remaining portion of this section will discuss the regulatory strategy for floodway and flood fringe areas and the above-noted additional topics.

For regulatory purposes, the 100-year floodplain is divided into two districts, the **floodway** and **flood fringe**. These districts were originally determined along with the 100-year flood elevations during the flood insurance study process. These districts should be shown on either the community's official zoning map or the flood boundary and floodway map found in the FIS.

As previously discussed in Chapter 3, floodway/flood fringe districts were designated only for detailed study stream reaches. For regulatory purposes, approximate study areas (shown as "unnumbered" A Zones on the Flood Insurance Rate Map) are generally classified as **" General Floodplain Districts "**. While all counties will have designated general floodplain districts, many cities will not, because all floodplain areas were studied in detail.

Floodway District

The floodway district is a high hazard area adjacent to the stream channel and is considered the minimum area necessary to convey floodwater downstream. The floodway is generally subject to faster flowing water and greater flood depths.

From a "use" standpoint, floodway use restrictions often change or restrict uses previously allowed in the underlying zoning district. Only open space type activities are allowed. This is necessary to insure that encroachment from new development (e.g., roads, parking areas, loading areas, structures and storage of materials and equipment) do not further obstruct flood flows. Those open space activities specified in the underlying ordinance consistent with this standard can be allowed in the floodway.

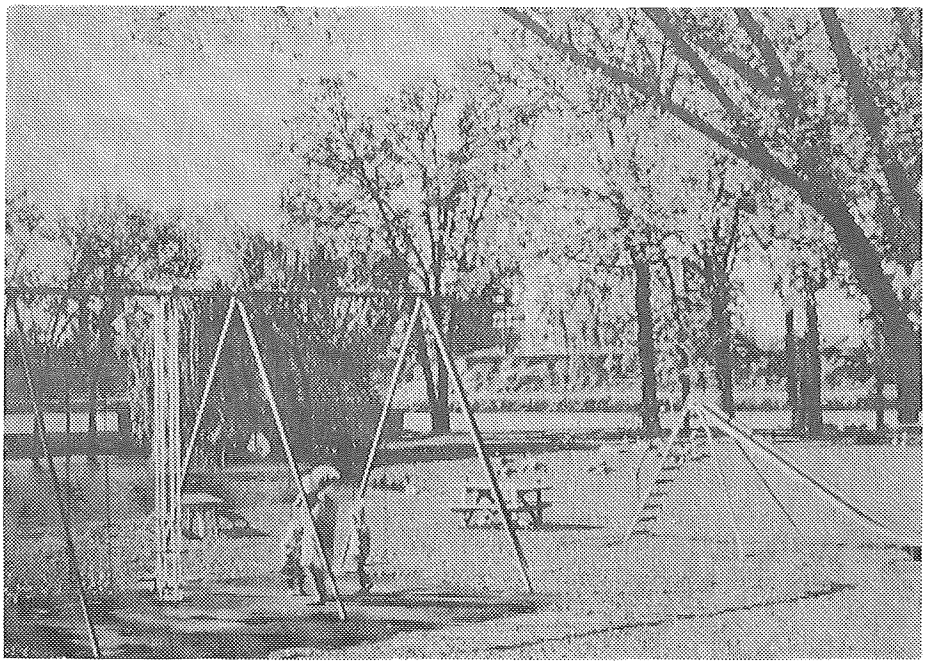


Figure 4.4 A community park is an appropriate open space use in a floodway district.

Permitted Uses

Open space uses having a low flood damage potential and which do not obstruct flood flows can be permitted uses in the floodway district. The following uses can be permitted in the floodway provided they are not prohibited by the underlying ordinance use district classifications and provided they do not include structures, fill, or storage of materials or equipment.

1) Agricultural - general farming, pasture, horticulture, and sod farming.
2) Industrial/Commercial - loading areas, parking areas, and airport landing strips.
3) Recreation - tennis courts, parks, picnic ground, ball fields, nature preserves, target ranges and recreational trails. (A golf course, while an open space use, can suffer significant flood related damages and is therefore not necessarily an appropriate use within the floodplain.)
4) Residential - lawns, gardens, parking and play areas.

Conditional Uses

Conditional uses involving fill, structures or storage of materials in the floodway must receive special attention, prior to approval to prevent the obstruction of the floodway. In addition, these uses are generally more susceptible to flood damage than the permitted uses listed above. As a result, a determination should be made as to the appropriateness of the proposed use and its need to be located in the floodway. Examples of potential conditional uses in the floodway include:

1) Structures accessory to open space uses
2) Placement of fill
3) Sand and gravel operations
4) Marinas, docks, piers and other water control structures
5) Railroads, streets, and pipelines
6) Storage yards for materials or equipment.

Standards for Floodway Conditional Uses

All Uses - The critical determination for floodway conditional uses is whether the use obstructs flood flows such that flood elevations increase. The amount of the increase in flood heights caused by a proposed use in the floodway is based not just on the effect of the single use acting alone. The ordinance must assume that other land owners within the stream reach have the same right to develop within the floodway. An accessory structure or small amount of fill may not cause a measurable increase, but the cumulative effect of many landowners taking similar actions may be substantial.

Accessory Structures (temporary or permanent)- Structures designed for human habitation are not permitted because of the high velocities and depths of inundation generally occurring within the floodway district. Structures permitted as conditional uses must be accessory to an open space type use (not commercial, manufacturing, residential, etc.) and have a low damage potential, must be situated so as to minimize obstruction to flood flows, and must be floodproofed in accordance with the State Building Code or in its absence, the floodproofing standards stated in the local ordinance. Communities with relatively narrow floodways are encouraged to prohibit structures entirely within the floodway district since adequate alternative building sites should be available elsewhere in the community.

Figure 4.5 This park shelter, located in a floodway district, was constructed in a manner which minimizes potential flood damage and obstruction of flood flows.

Fill - The intent of this provision is to minimize filling to preserve the flow capacity of the floodway. Fill may be used for the purposes of landscaping or to fill localized depressions to create level terrain for a listed conditional use. It is not intended, however, that fill measurably obstruct the flow of flood waters.

Storage of Material and Equipment - Storage of materials that are buoyant, flammable, or otherwise injurious if transported by flood waters is prohibited, for health and safety reasons. Storage of materials and equipment not having these characteristics is permissible if the materials and equipment are readily removable from the area within the time available following a flood warning.

Flood Fringe District

The flood fringe district is a lower hazard area within the 100-year floodplain but outside of the floodway zone. The flood fringe generally consists of floodwater storage and "backwater" areas and is often characterized by lower water depths and velocities than the floodway district.

The flood fringe regulations need not change the allowable uses specified by the underlying ordinance. The goal of flood fringe regulations is to insure that a use in the flood fringe district is protected to the RFPE and the health and safety of the occupants are insured.

Communities may allow new, or additions to, residential, commercial and industrial buildings within the flood fringe district. The new development must be elevated on fill, or otherwise protected against flood damage, to the RFPE. Fill may also be permitted for elevating access roads and accessory uses, such as parking lots and storage areas.

Permitted Uses

The following uses are permitted within the flood fringe district provided they are not prohibited by the underlying ordinance:

1) Any permitted use in the floodway;
2) Accessory structures constructed in conformance with the standards for the floodway, i.e., elevated or floodproofed to the RFPE; and
3) Residences and other principal structures constructed on fill so that the lowest floor including basement, is at or above the RFPE.

The finished fill elevation must be no lower than the RFPE (or 1' lower if 1' of freeboard is contained in the definition of RFPE) and should extend at that elevation for at least 15 feet beyond all sides of the building. Residential structures must have road access to the structure no lower than 2' below the RFPE, unless a variance in granted by the community (see discussion later on variances).

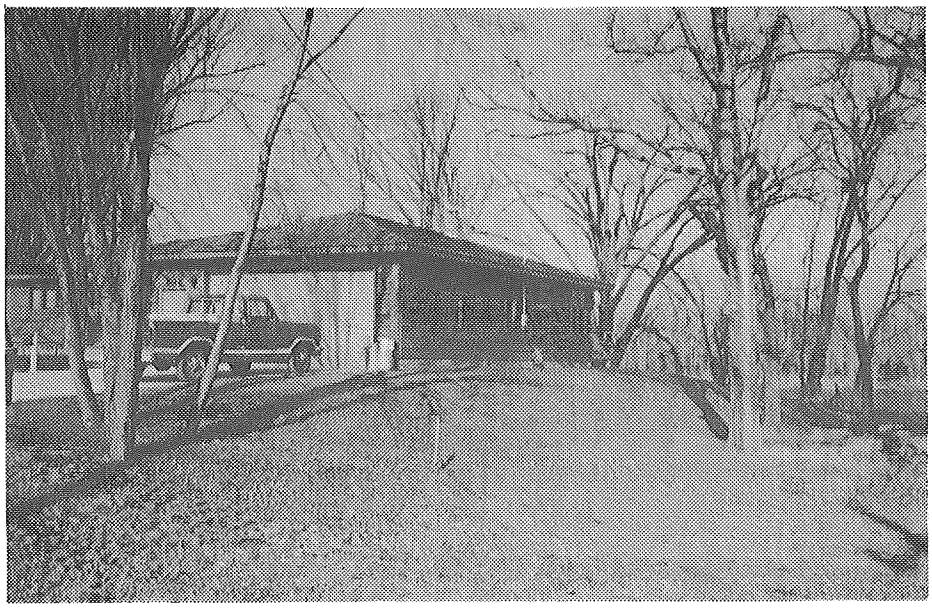


Figure 4.6 Residential homes can be considered permitted uses in a flood fringe district if elevated on fill to the RFPE.

Conditional Uses

Conditional uses in the flood fringe involve alternate flood damage prevention methods. Different standards apply as to the type of structure.

Residences - For residential structures, other methods of **elevating** the first floor (including basements) above the RFPE may be authorized where existing streets, utilities or small lot sizes preclude the use of fill. This primarily involves use of piling or concrete support columns to elevate the residence. This type of building activity must be done in accordance with the State Building Code or, in its absence, the floodproofing standards adopted by local ordinance (see following discussion on access requirements).

Residential basements **below** the RFPE are generally discouraged but may in certain circumstances be allowed. However, residential basements in floodplain areas pose special problems; this topic is discussed in depth later in this chapter.

Non-residential Structures - Commercial, manufacturing and industrial buildings are usually elevated on fill so that their lowest floor is at or above the RFPE. These type of structures may also be flood proofed to the RFPE to the FP-1 of FP-2 classification as a conditionial use. Accessory land uses, such as storage yards and parking lots may be at elevation lower than the RFPE provided adequate warning time is available to safely remove materials.

The community will have many issues to resolve during the conditional use process when reviewing a floodproofing proposal. First, and foremost, is whether the floodproofing design specifications are adequate. Once a design is agreed upon, a certification procedure must establish that the building is constructed as designed. A floodproofing design plan may require lead time to put in place contingency measures (closure of openings, relocations of damagable items, etc.); community officials must assess the adequacy of existing flood forecasting and warning capabilities. Provisions may have to be placed on the permit to limit certain activities below the RFPE. Periodic inspections may be necessary to insure that all the floodproofing provisions are adequately maintained. Chapter VI of this workbook will be devoted exclusively to floodproofing.

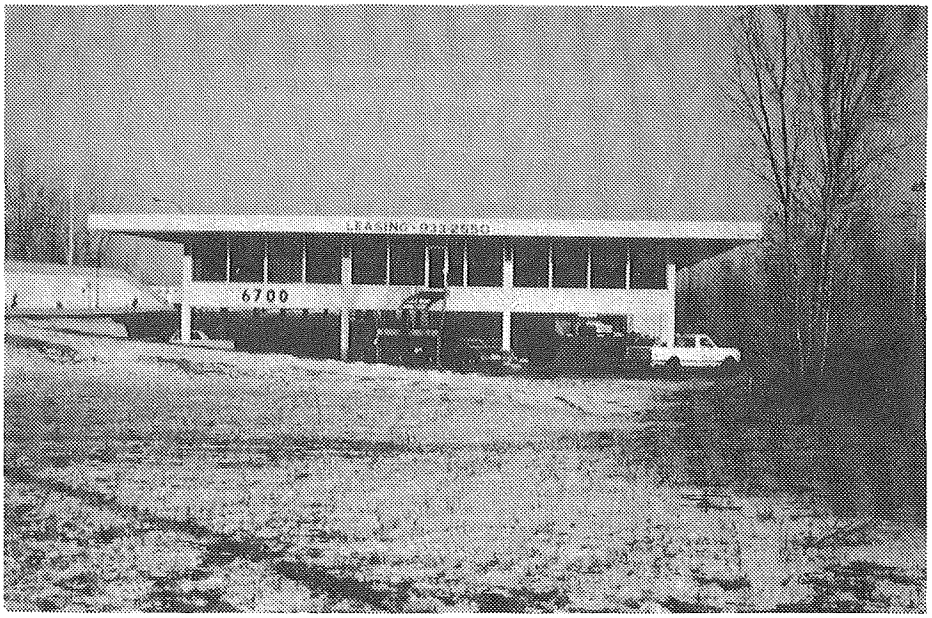


Figure 4.7 Commercial structures located in the flood fringe district which are floodproofed to the RFPE in lieu of elevating on fill are classified as conditional uses.

General Floodplain Districts

The general floodplain district corresponds to the approximate study areas discussed in Chapter 3. Areas are designated as General Floodplain Districts primarily because sufficient data are not available to define the RFPE and to divide the floodplain into floodway and flood fringe districts.

Permitted uses listed for the general floodplain district are those generally listed for the floodway district. All other uses are conditional uses. An engineering analysis must be performed to determine if the proposed use lies within the floodway or flood fringe district. This analysis will also provide the RFPE which is needed to determine the proper building elevation.

NONCONFORMING USES

Existing structures or uses of land or structures that do not meet all of the standards of an ordinance are called "nonconformities". Most zoning regulations recognize the right of landowners to continue to use and occupy structures and land that existed prior to the adoption of the ordinance. The commonly used term is that a nonconformity is "Grandfathered In" when the regulations are adopted. This right extends only to the structure and land as they exist when an ordinance is adopted and does not give the landowner the absolute right to extend or enlarge the structure or intensify the use. One of the long term aims of zoning is to eliminate nonconformities either by making a structure conforming or by having a nonconforming use of land or a structure replaced by a conforming use.

The zoning enabling legislation for municipalities does not mention the subject of nonconformities. Municipalities **may** regulate nonconformities if they so choose. This would fall under the umbrella of a local unit of government's "implied powers" to protect the public health, safety, and general welfare (often called the "police powers" of local units of government).

The enabling legislation for county planning and zoning activities (M.S. Chapter 394) does contain specific language pertaining to the regulation of nonconformities. This statute defines nonconformity as:

> "Any legal use, structure or parcel of land already in existence, recorded, or authorized before the adoption of official controls or amendments thereto that would not have been permitted to become established under the terms of the official controls as now written, if official controls had been in effect prior to the date it was established, recorded, or authorized."

Minnesota Statutes, Section 394.36 does mandate the following minimum restrictions for nonconformities in unincorporated areas:

> Subdivision 1. Any nonconformity including the lawful use or occupation of land or premises existing at the time of the adoption of an official control hereunder may be continued, except as regulated, terminated or acquired by the board (county commissioners) as provided in subdivisions 2 or 3, although such use or occupation does not conform to the provisions thereof, but if such nonconformity or occupancy is discontinued for a period of more than one year, or any nonconforming building or structure is destroyed by fire or other peril to the extent of 50 percent of its market value, any subsequent use or occupancy of the land or premises shall be a conforming use or occupancy.

Subd. 2. The board may by ordinance adopt such regulations not contrary to law as it deems desirable or necessary to classify, regulate and control, reduce the number or extent of and provide for the gradual elimination of nonconformities to conform with the official controls of the county or terminate within a reasonable time as specified in the official controls. The board may by ordinance impose upon nonconformities additional regulations relating to appearance, signs, lighting, hours of operation and other aesthetic performance characteristics including but not limited to noise, heat, glare, vibrations and smoke.

Subd. 3. A nonconformity that is determined by the board to be detrimental to the achievement of the goals and objectives of the comprehensive plan may be acquired by the board by purchase.

As discussed earlier, state and federal floodplain standards build upon existing regulatory programs, and **do** require that communities, both cities and counties, regulate floodplain nonconformities. These standards allow legally established floodplain nonconformities to be "grand fathered" at the time of ordinance adoption. However, state and federal standards mandate that the expansion, intensification of use and reconstruction after damage of nonconformities be done in a manner to prevent future flood damages and obstruction to flood flows.

The long term goal of regulating existing floodplain nonconformities is to: 1) preserve and reestablish the open space characteristics of the floodway by discouraging the longevity of existing "use" nonconformities; and 2) eliminate or upgrade "structure" nonconformities that are not properly elevated on fill or floodproofed to the RFPE.

Floodway/Flood Fringe Nonconformities

Different regulatory provisions apply depending on whether the nonconformity is located in the floodway or flood fringe district. Within the **floodway** district, the **use** (i.e., the use of a principal or accessory structure for residential, commercial or industrial purposes) is prohibited. Therefore greater restrictions are placed or nonconformities in the floodway than in the flood fringe district. The following actions are **prohibited**:

1) Any **addition** to a structure in the floodway district, unless the addition is to an accessory structure to an open space type use.

2) **Reconstruction** of a residential, commercial or industrial structure damaged to greater than 50% of its value at the time of loss unless the structure is relocated **outside** of the floodway.

3) An itensification of use that increases the flood damage potential, potential for loss of life or increases the stage of the 100-year flood.

Greater flexibility normally exists for nonconformities within the flood fringe district. In the **flood fringe**, the existing use is normally permissible, but the **structure** itself is not in compliance with the applicable standards for elevating or flood proofing to the RFPE, road access, on-site sewage treatment/water supply, etc. Therefore, any type of addition, alteration, reconstruction or intensification of use is generally allowed provided the proposed activity does **not** increase the flood damage potential of the structure or the potential for loss of life. Specifically, within the flood fringe district:

1) Any addition to a nonconforming structure must be elevated on fill or floodproofed to the RFPE in accordance with the provisions of the local unit of government's floodplain management ordinance;

2) Most local government floodplain controls require the **entire** structure to be permanently changed to a conforming structure when the cumulative improvements to a nonconforming structure exceed 50% of its value (at the time of its becoming a nonconforming structure);

3) An intensification of use must not increase the flood damage potential of the original use; and

4) Any structure destroyed to greater than 50% of its value at the time of loss may be reconstructed provided the entire structure and/or use of land complies with the standards of the ordinance.

It should also be remembered that a structure may be nonconforming with other zoning provisions in the regulations underlying the floodplain ordinance (e.g., height, area, setback, use, etc.). Communities may require some or all of these underlying provisions to be met when a floodplain nonconformity is expanded, reconstructed, intensified, etc. Additionally, a community's underlying nonconformity regulations may be more restrictive than that generally permissible for floodplain areas. For example, a community may choose to not allow an alteration, reconstruction or intensification of use of **any** nonconformity - floodplain and non floodplain. The approach for nonconformities is similar to the entire structuring of the floodplain ordinance - that is, only revise underlying regulations to the degree necessary to incorporate minimum state and federal standards. Where the underlying ordinance is more restrictive, it remains in effect.

Maintenance and Repairs

Minimum state floodplain standards for nonconformities do not apply to normal maintenance and repairs or repairs or alterations necessary to keep a structure in a safe and habitable condition. Therefore, the following activities are permissible without regard to flood damage potential.

Normal Repairs and Maintenance:

- -Residing
- -Reroofing
- -Installation of storm windows
- -Painting
- -Repairs to plumbing, electrical systems, etc.
- -Insulation
- -Installation of replacement heating or air conditioning unit

Repairs and alterations necessary to keep a structure in a safe and habitable condition:

- -Installation of indoor plumbing
- -Rewiring/updating to comply with electrical codes
- -Installation of central air conditioning
- -Structural alterations necessary for the safety of the building or that prevent flood damages
- -Alterations, repair, or maintenance **reasonably** done under emergency conditions to preserve or protect life or property.

While these repair and maintenance activities are permitted, local officials are encouraged to stress to their constituents floodproofing techniques may be available to prevent future damage. For example, heating and air conditioning units may be elevated on platforms or bracings above the RFPE. Non water-damageable materials should be used in spaces below the RFPE, e.g., clay tile instead of carpeting.

SUBDIVISION OF LAND IN THE FLOODPLAIN

Land subdivision is the process of dividing a lot, tract, or parcel of land into two or more lots, tracts or parcels for the purpose of sale or development. Local units of government in Minnesota have been given the authority by the State Legislature to control the subdivision of land through the adoption of local subdivision regulations. The purpose of subdivision regulations is to promote the public health, safety, and general welfare, and to provide for the orderly, economic, and safe development of land within a community. Subdivision regulations may address the size, location, grading and improvement of lots, structures, public areas, streets, roads, trails, walkways, curbs and gutters, water supply, storm drainage, lighting, sewers, electricity, gas, and other utilities; the planning and design of sites; access to solar energy; and the protection and conservation of flood plains, shorelands, soils, water, vegetation, energy, air quality, and geologic and ecologic features.

The State of Minnesota enabling legislation allowing local units of government to adopt subdivision regulations does not mandate the adoption of subdivision controls by local units of government. This enabling legislation is contained in Minnesota Statute, Chapters 462 for municipalities and 394 for counties. While Chapter 394 does not give specific guidance to counties, Chapter 462 does require minimum administrative and regulatory language when a municipality decides to voluntarily adopt subdivision regulations. This minimum language includes the formal platting of certain subdivisions and provisions regarding the content of applications for proposed subdivisions, the preliminary and final review and approval or disapproval of applications and the coordination of such reviews with affected political subdivisions and state agencies.

Generally, when a local unit of government decides to adopt subdivision regulations, they have considerable latitude as to the standards to be adopted, and the administrative procedures which the local unit of government will follow in review and approval of subdivision proposals. A local unit of government's platting criteria, for the preparation of the map or drawing of the subdivision or resubdivision of land, must be in accordance with the platting requirements of Minnesota Statute, Chapter 505.

Subdivision controls provide the community an opportunity to insure that new residential, commercial, and other development will be consistent with the community's comprehensive plan, zoning ordinance, and official map. A very important additional benefit of the subdivision review and approval process is that it should insure that each lot within the subdivision is capable of having a buildable site compliant with all associated zoning and building code regulations of the community. The fact that a tract of land has been divided by a metes-and-bounds description, unapproved registered land survey or unapproved plat does not mean that a local unit of government is obligated to issue a building/use permit for development of individual lots within that tract of land.

State and federal floodplain management standards require local government to regulate the subdivision of land in the 100-year floodplain. When a community adopts floodplain regulations it must either adopt legally enforceable subdivision regulations, or amend existing regulations to meet minimum state and federal standards. The minimum jurisdiction of these regulations must be for the following subdivisions (unless the community's existing subdivision ordinance is more inclusive):

> "Subdivision" means improved or unimproved land or lands which are divided for the purpose of ready sale or lease, or divided successively within a five year period for the purpose of sale or lease, into three or more lots or parcels of less than five acres each, contiguous in area and which are under common ownership or control".

Floodplain Subdivision Criteria

Lots in an approved subdivision, including subdivisions adjacent to, or partially within a designated floodplain, should ideally require no further improvements to be buildable. For floodplain management purposes, the following items require special attention during the subdivision review process:

1) Each lot must contain a buildable site outside of the floodway district. This may be accomplished by intentionally laying out lot boundaries so each lot contains areas of natural high ground or by filling a portion of each lot to the RFPE where sufficient natural high ground is not available;

2) Streets and driveways must be elevated to no lower than two feet below the RFPE to insure that homes remain accessible during times of flooding. Fill for streets and driveways must be located outside of the floodway;

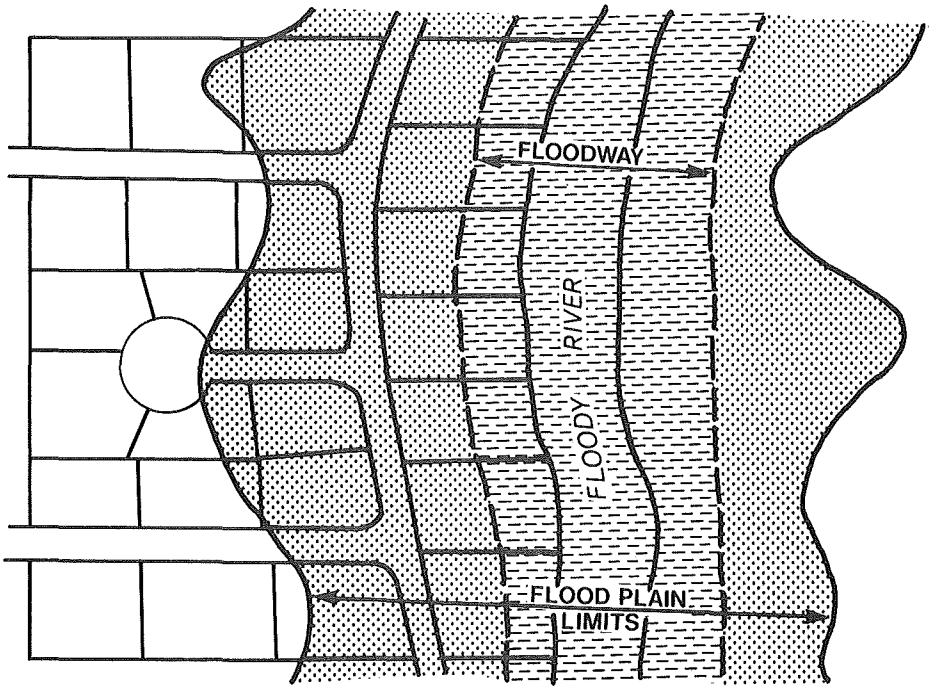
3) Water supply and sewage disposal facilities must be protected to insure continued service during times of flooding. Fill used to elevate an onsite sewage treatment system must be located outside of the floodway district. At a minimum, the sewage treatment system must be constructed in compliance with the Minnesota Pollution Control Agency's minimum standards for on-site sewage treatment systems (WPC-40);

4) Areas subject to fast moving floodwaters should be adequately protected against erosion.

5) Site drainage must be maintained. A flood insurance study will often only show flood boundaries for a major waterway crossing the property under consideration. Structures, roadways, sewage treatment systems, and fill must be located and designed to take into consideration waterways and small ditches not identified as floodplain areas.

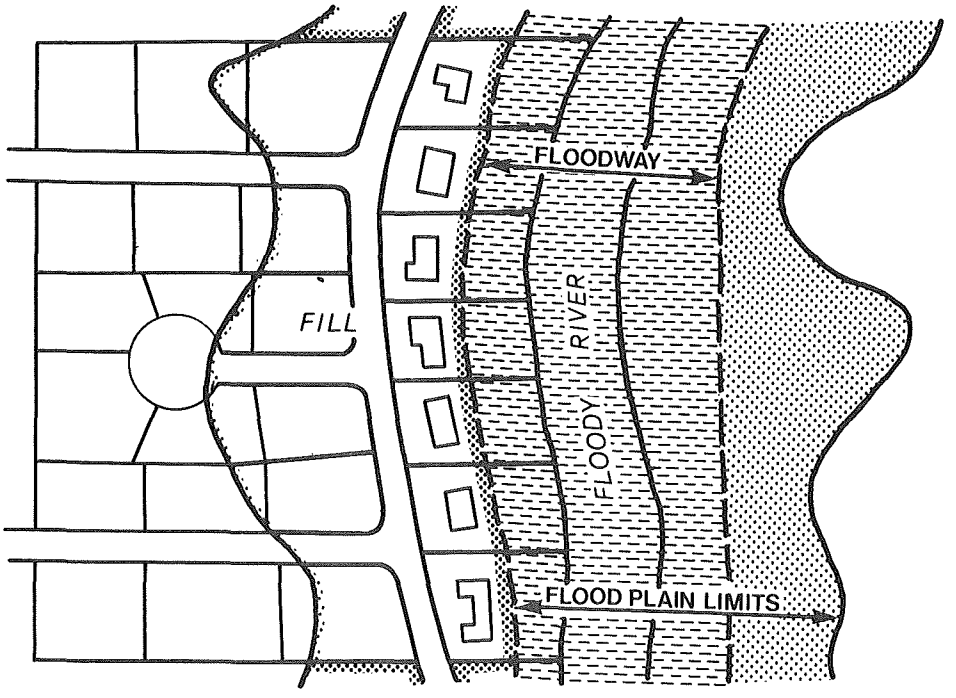
6) In approximate study areas (General Floodplain District), the community must determine the RFPE and floodway/flood fringe district boundaries prior to giving preliminary plat approval. The community can require the subdivider to provide the necessary hydrologic/hydraulic data or the community may decide to assume this responsibility. This must be done to insure that each lot is capable of having an adequate building site outside of the floodway above the RFPE and adequate vehicular access will be provided.

TYPICAL FLOOD PLAIN SUBDIVISION
BEFORE AND AFTER SITE PREPARATION



BEFORE

BUILDING SITES AND STREETS HAVE BEEN ELEVATED BY FILL



AFTER

Figure 4.8

Development Standards within Subdivisions

The following discussion identifies additional specific standards which will apply to all subdivisions and should be addressed during the subdivision review process:

1) Even though a subdivided area may be filled to the RFPE prior to final subdivision approval, restrictions remain:

   a) No portion of a residential structure may be located below the RFPE, unless the community has been granted a "basement exception" by FEMA. For those communities with a basement exception, the basement area below the RFPE must be flood proofed FP-1 (watertight - without human intervention) and the first (habitable) floor must be at or above the RFPE.

   b) Non residential buildings should generally have their lowest floor, including basement floor, elevated to or above the RFPE. As an alternative, these buildings may be flood proofed to the FP-1 or FP-2 classification.

      A community cannot waive these requirements when individual building/use permits are applied for after subdivision approval has been given and the subdivision has been officially recorded.

2) The floodway area must remain free of obstructions that would impede the flow of floodwaters. Therefore, activities such as accessory structures (i.e., garages, storage buildings, etc.) and fill (other than filling depressional areas) for lawns, patios, tennis courts, etc., must be located outside of the floodway.

3) A community may opt to approve a subdivision proposal where the individual building sites have not been filled to the RFPE prior to final plat approval and recording (this is not the recommended approach). Note: the streets in the subdivision must be in place to the specified flood protection elevation prior to final plat approval or the community must have received a sufficient (monetary) guarantee to insure their construction prior to issuance of any individual building permits. With this approach, the subdivision may be recorded and the individual lots sold. The builder would be required to comply with the requirements of the floodplain ordinance for lowest floor elevation, onsite sewage treatment systems, fill around the building (15'), access, etc.

Therefore, it seems prudent for the community to require prior to final plat approval that sufficient recorded statements be placed on the deeds specifying that certain floodplain management standards must be met prior to the issuance of future building permits. This may still be appropriate even though local officials have thoroughly reviewed the subdivision proposal and have determined all of the development/floodplain standards can be reasonably met. Remember, there may be sufficient area on all lots to place a small amount of fill to elevate a slab on grade home to the RFPE, but potential buyers may not know they cannot have a basement or they cannot place fill on the floodway portion of their lot for some accessory activity they had envisioned. Local officials may deem it appropriate to place restrictions on each deed specifically stating which future activities are prohibited.

Platting Standards

To aid in the review of a proposed subdivision and to aid potential purchasers of the individual lots, certain information should be placed on the preliminary and final plats. This should include:

1) Regulatory Flood Protection Elevations should be clearly labelled on the plat (in Mean Sea Level Datum). Flood Insurance Studies provide flood elevations in National Geodetic Vertical Datum, 1929 Adjustment (NGVD 1929); a vertical adjustment factor may be required if an alternative datum is used for the plat.

2) A statement should be provided that the lowest floor including basement of all residential structures must be elevated on fill to the RFPE. For communities with a basement exception from FEMA, the statement should specify the type of floodproofing allowed.

3) The floodway and flood fringe boundaries should be clearly identified on the plat. The outer limit of the floodplain as identified by the contour line representing the 100-year elevation must be based on a vertical elevation survey, where: 1) it is obvious any of the proposed building sites lies within the 100-year floodplain; or 2) community officials cannot make this determination without a vertical elevation survey. Where it is obvious that all building sites lie sufficiently outside of the 100-year floodplain, the outer limit of floodplain boundaries can be derived from best available topographic mapping such as a United States Geological Survey topographic map,

4) Where the access roads lies within the floodplain, centerline elevations at distances not to exceed 100' apart and low spots in the road.

5) Specification for on-site water supply and sewage treatment systems, such as the minimum elevations for the bottom of drainfield trenches, holding tanks, mound systems or (watertight) well casings, located in the floodplain should be specified.

MANUFACTURED HOMES

Manufactured homes are a special category of structure which can be located either on an individual lot of record or in a "mobile home" park. Special restrictions will apply to certain categories of manufactured homes. In order to maintain consistency with the language contained within FEMA guidelines, this section will be primarily concerned with what is more commonly referred to as mobile homes.

Mobile Homes on Individual Lots of Record

Mobile homes are treated like any other structure when placed on individual lots of record within the floodplain. The structure must be located outside of the floodway district and properly elevated on fill to the RFPE. Road access, no lower than two feet below the RFPE, must be provided.

A community must utilize the conditional use permit process to evaluate a proposal to use a method other than fill, such as "stilts" or masonry walls, to elevate a mobile home to the RFPE. At a minimum, the community must insure that the proposal is compliant with the Floodproofing Regulation of the State Building Code (SBC). The "Floodproofing Regulations" of the SBC (Sec. 612.2.3) specify standards for the spacing, orientation, bracing and foundations of support columns and walls.

New Mobile Home Parks and Expansions to Existing Mobile Home Parks

New mobile home parks and expansions to existing mobile home parks in the floodplain are subject to many of the same review criteria as new subdivisions. The community must require a development/use permit for a new mobile home park or park expansion, and prior to issuing such approval must insure that all of the following standards are met:

1) All individual mobile home sites (pads) must be of sufficient size, vertical elevation and configuration to insure the structure will be capable of being placed at the RFPE, outside of the floodway;

2) Road access to the park/park expansion and the individual pads must be no lower than two feet below the RFPE;

3) All utilities must be protected against possible flood related damage; and

4) Proper site drainage must be provided.

Quite obviously, the ideal approach is to require the mobile home park/park subdivision to be elevated on fill to the RFPE during site development. The community would be assured proper road access is provided and each mobile home will be placed above the RFPE. If proper road access is not provided during site development, the developer would be required to secure a variance from the community (communities should use extreme caution in granting such a variance). If the pads are not elevated on fill to the RFPE, the community will be required to develop a review procedure to insure **each** mobile home placement/replacement is properly elevated. As the pad decreases in elevation below the RFPE, the review procedure will be more complex to insure the standards stated previously in this section for elevation on stilts, masonry walls, etc. are met.

Existing Mobile Home Parks

Upon adoption of the floodplain ordinance, that portion of a mobile home park located in the floodplain below the RFPE that does not meet the standards previously stated for new mobile home parks is a "nonconformity". The mobile home park use is "grandfathered" at such time as the floodplain ordinance is adopted, subject to certain restrictions.

Replacement mobile homes, mobile homes placed on vacated or previously unoccupied pads or mobile homes destroyed to over 50% of their value (from fire, flood, wind, etc.) are not allowable unless the floor elevation is at or above the RFPE and the mobile home is located outside of the floodway. Where existing pads are below the RFPE, the community must develop a (permit) review process to insure the mobile home is placed outside of the floodway at the proper elevation.

In addition to the above-stated elevation and location requirements, mobile home park owners should be required to develop a flood emergency plan before allowing replacement mobile homes in the floodplain. The plan should account for the severity of flooding and realistically assess the flood warning time typically available. The plan must also address the availability of evacuation routes and the time required to safely evacuate all occupants. Replacement mobile homes should be allowed only if sufficient flood warning time and evaucation routes are available.

The park owner should also be required to notify mobile home owners that their individual pad is located in the 100-year floodplain. It should be explained that their mobile home will not be insurable for flood insurance unless the mobile home is anchored with tie-downs acceptable to FEMA.

Repairs to Existing Mobile Home Parks

Repair, reconstruction or improvement of the streets, utilities and pads, exceeding 50% of the value, of a mobile home park constitutes a substantial improvement to that park. If the proposed activity is determined to constitute a substantial improvement, the **entire** park must be upgraded to a conforming use following the repair, reconstruction or improvements. Standards for substantial improvements are similar to those for new parks and expansions to existing mobile home parks.

For existing mobile home parks where the repair, reconstruction or improvement of the streets, pads and utilities equals or exceeds 50% of the value before the repair, reconstruction or improvement has commenced, FEMA requires that:

1) Stands or lots are elevated on compacted fill or on pilings so that the lowest floor of the mobile home will be at or above the base flood level;

2) adequate surface drainage and access for a hauler are provided; and

3) in the instance of elevation on pilings, lots are large enough to permit steps, piling foundations are placed in stable soil no more than ten feet apart, and reinforcement is provided for pilings more than six feet above the ground level.

Mobile Home Tie-Down Requirements

As stated earlier, mobile homes in a designated floodplain are not insurable under the NFIP unless tie-downs are constructed compliant with FEMA standards. These standards have been imposed due to the buoyancy of mobile homes. Mobile homes, if dislodged from their foundation during a flood, may damage structures with which they collide or may block a bridge or culvert opening.

Current FEMA Tie-Down Requirements require that:

1) Over-the-top ties be provided at each of the four corners of the mobile home, with two additional ties per side at intermediate locations, except that on mobile homes less than 50 feet in length one tie per side is required;

2) Frame ties be provided at each corner of the home with five additional ties per side at intermediate points, except that on mobile homes less than 50 feet in length four ties per side are required;

3) All components of the anchoring system be capable of carrying a force of 4,800 pounds; and

4) All additions to a mobile home be similarly anchored.

REGULATIONS/FLOOD INSURANCE — THE RELATIONSHIP

It must be recognized that the NFIP has set the 100-year flood level as the standard for protection of new buildings and substantial improvements. When new buildings are constructed in accordance with design standards acceptable to FEMA, continued flood insurance availability and generally affordable insurance premiums are assured.

A key element in determining flood insurance premiums in regular program communities is to compare the lowest floor, including basement, to the 100-year flood level. The greater a building's lowest floor is below the 100-year flood level (unless an acceptable method of floodproofing is employed), the higher insurance premiums become, to the point of being prohibitive.

A community's floodplain ordinance is reviewed by state and federal officials prior to adoption to insure that only permissable flood protection standards are stated, from both a "regulatory" and "insurance" standpoint.

- For new structures and substantial improvements, the lowest floor, including basements, must be elevated on fill to the RFPE;

- Non residential structures and substantial improvements can, as an alternative, be flood proofed to the FP-1 or FP-2 classification, and

- Residential basements below the RFPE can only be permitted in communities with a formal basement exception from FEMA, provided at a minimum, the basement is flood proofed watertight (FP-1).

The only way floodplain building standards can be legally varied is if the community grants a variance to its floodplain ordinance. If a community was to grant such a variance, two ramifications occur:

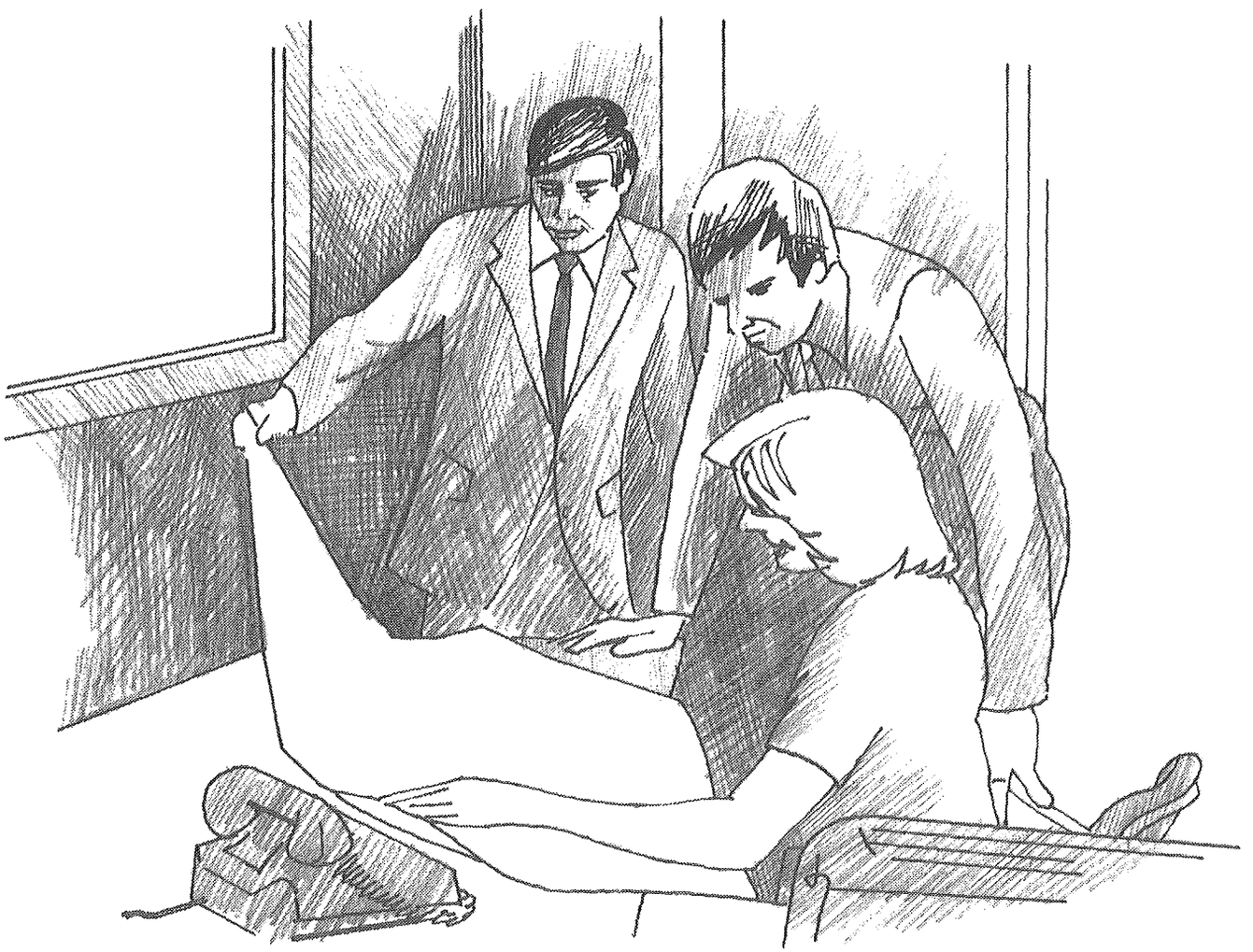
First, the variance approval does not affect how the NFIP will rate the flood insurance policy. Remember, the premium is largely dependent on the building's lowest floor (for insurance purposes) and the 100-year flood level. For example, a community grants a variance to allow a "wet" flood proofed commercial building (FP-3 or FP-4). The basement floor is 7' below the 100-year flood level and the basement is properly designed against flood damage and is used to store movable items. The floor immediately above is higher than the RFPE and is used for business purposes. Because wet floodproofing is not an acceptable flood protection method to the NFIP, the lowest floor "for insurance purposes" is the basement floor, 7' below the 100-year flood level.

Another example, a community **without** a formal basement exception grants a variance for a residential basement. The basement is floodproofed FP-1 to the RFPE, and is not used for human habitation. Regardless of the variance being granted, the lowest floor for insurance purposes is the basement floor.

This hypothetical community may have legitimately granted these variances, but they will not be credited for insurance purposes. It is important for community officials to inform potential developers of this ramification prior to permit approval.

Second, the granting of numerous variances could jeopardize a community's eligibility in the NFIP. While all communties are expected to enforce regulations as written, both the state and FEMA realize certain circumstances require granting the developer relief from the provisions of the ordinance. (See variance discussion, Chapter V). FEMA and the state will closely monitor all variances granted by a community. If it is determined the variance procedure is being misused, the **community's** eligibility in the NFIP could be suspended. Because of this potential ramification, local officials are encouraged to submit all variance applications to FEMA and DNR for comment sufficiently in advance of final action.

ORDINANCE ADMINISTRATION



CHAPTER V

ORDINANCE ADMINISTRATION

No ordinance can be effective at achieving its stated goals and objectives unless the local community properly administers and enforces the provisions of the ordinance. For floodplain management, the local community has the primary responsibility to insure that new floodplain development is properly elevated or floodproofed. While the DNR and FEMA have oversight responsibilities, these two agencies have limited involvement in the day-to-day decision-making process at the local level.

To accomplish the goals of the floodplain management ordinance, the local community must establish a mechanism to administer the newly adopted ordinance. For those communities with previously established zoning and subdivision ordinances, these mechanisms should already be in place.

The primary means of administering the floodplain ordinance is through a land use permit system and subdivision review process. The zoning administrator has the primary responsibility to review development proposals to insure compliance with local ordinance. Land subdivision, conditional uses, variances and disputes arising from decisions made by the zoning administrator will require action by the Board of Adjustment, Planning Commission or other locally established board. Local enforcement and certification procedures also have to be established to insure that the actual construction activity is in compliance with all land use and building permit requirements.

This chapter will discuss the day-to-day administration of the floodplain ordinance. Responsibilities of various community staff and elected officials will be highlighted. Helpful suggestions and sample forms and procedures are also included.

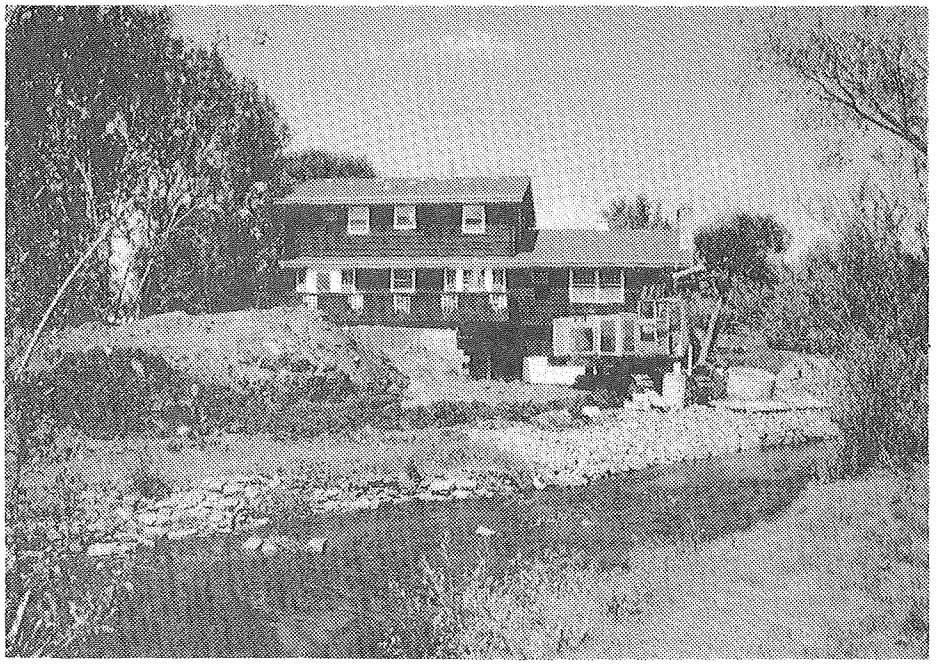


Figure 5.1 Community officials should carefully review all floodplain development proposals to insure compliance with their ordinance.

THE ZONING ADMINISTRATOR

The zoning administrator is the community employee responsible for administering the zoning ordinance. Counties and larger cities with sufficient ongoing development activities will often have one or more full-time zoning administrators. In smaller cities, the building inspector, city administrator, city clerk or other community employee often must wear several hats, including that of zoning administrator.

The zoning administrator is responsible for administering the zoning ordinance **as it is written**. Approval for certain activities not explicitly allowed as a permitted use by the ordinance must come from the board of adjustment and appeals, planning commission or other governing body - not the zoning administrator. General administrative responsibilities of the zoning administrator include:

1) Reviewing and evaluating permit applications and plans;

2) Issuing building/use permits to applicants demonstrating full compliance with the provisions of the ordinance;

3) Inspecting construction activity for permit compliance;

4) Receiving requests for appeals, variances and conditional use permits to be heard by the appropriate governing body;

5) Issuing certificates of zoning compliance where it is demonstrated that a development is constructed in compliance with all applicable provisions of the ordinance; and

6) Keeping records of all applications, plans, notices of hearings, certificates of compliance and occupancy and other important documents.

Specific development review responsibilities of the zoning administrator in regard to the floodplain ordinance include:

1) Determining whether the proposed development is located in the 100-year floodplain; if so

2) Determining whether the proposed development is located in the floodway or flood fringe district;

3) Determining the appropriate regulatory flood protection elevation (RFPE); and

4) Insuring the development is designed in accordance with the access, elevation, floodproofing, occupancy or other requirements of the **adopted** community ordinance.

PERMIT PROCESS

Permit Application

Anyone planning to develop a floodplain area must first apply for a **building/use permit**. The ordinance usually specifies the types of data which the applicant must provide to the zoning administrator. The applicant is usually required to complete a permit application form (sample form is presented in Appendix D).

A standard application has two basic parts. The first part is an administrative form which serves as an official record of pertinent facts, including:

1) Name and address of the applicant, engineer, architect and developer
2) Brief description of the proposed development, including proposed use
3) Location of the development
4) Final permit action
5) Inspection record

The second part of the application should be a map or diagram clearly illustrating the location of the project and all other pertinent features, including:

1) Property lines

2) All proposed principal structures, parking and storage areas and accessory structures

3) Building setbacks

For floodplain management considerations, the following should also be included on the map or diagram:

4) Location of the stream channel and/or lake bed

5) 100-year floodplain boundary

6) Designated floodway

7) 100-year flood elevation and RFPE

8) Proposed building and grade elevations for all structures

9) The elevation of all existing or proposed access roads

10) A description of any floodproofing measures to be included in building design, and a specific statement identifying how floodproofed spaces are to be used and/or occupied

11) A description of any accessory uses of land (e.g., storage, parking, etc.) located below the RFPE.

An important function of the zoning administrator is to assist the applicant with their permit applications so that all forms are as complete and accurate as possible. This helps avoid processing delays while saving the applicant, and taxpayers, time and money.

Permit Application Review

Reviewing a permit application is one of the most important responsibilities of the zoning administrator. Many zoning administrators use a permit review checklist to assist in determiring if the proposed project meets **all** criteria of the ordinance. This checklist should include factors such as:

Is the application complete?

The zoning administrator cannot properly review an application which is not complete. The application should include a thorough description of the proposed development, and provide enough data to determine if the project will comply with all ordinance provisions. If additional data are needed, the zoning administrator should request it from the applicant as soon as possible.

Is the project located in the floodplain?

The zoning administrator must first determine if the proposed project is located in a floodplain area. This determination is critical in that the provisions of the floodplain ordinance only apply to those buildings, obstructions, and uses of land located in the designated floodplain. If this determination is not obvious when using the available zoning and floodplain maps, an on-site inspection or survey will be necessary. As indicated in Chapter IV of this workbook, the elevation of the property in question compared to the 100-year flood elevation is the determining factor. The community, as a service to its residents, may perform the required site survey, or the community may require the applicant to obtain the services of a registered land surveyor to make this determination.

As a result of an on-site inspection or survey, the zoning administrator may find the zoning map inaccurately includes a property in the floodplain. If this is the case, the zoning administrator should file a map amendment request to the city council or planning commission before proceeding with the assumption the property is not in the floodplain (See Chapter IX).

In borderline situations, where the map scale and the closeness of the proposed development to the flood boundary prevent an easy determination, the zoning administrator may determine based on site inspection or field survey that the development is or is not located in the floodplain. If the determination is "yes", the floodplain ordinance applies to this development proposal, and if "no", the ordinance does not apply. In either case, a map revision is not necessarily required. The ordinance administrator has the authority to make the determination in borderline cases. A developer or landowner can always appeal the decision to the board of adjustment and appeals.

If the project is located in the floodplain, is it located in the flood fringe or floodway district?

As discussed in Chapter III, if the development is located in a detailed study reach for the community's flood insurance study, the floodway/flood fringe district should be shown on the community's official zoning map or the FEMA Flood Boundary and Floodway Map. If the development proposal is located in an approximate study area (general floodplain district), this determination must be made as specified in the conditional use section of the community's ordinance. The applicant is usually responsible for providing the information necessary for the planning commission/governing body to make this determination.

Is the proposed development a permitted, conditional or prohibited use?

The community's ordinance should specify various permitted and conditional uses within the floodway, flood fringe and general floodplain districts. The zoning administrator must determine from the permit application whether the proposed development is a permitted, conditional or prohibited use and act accordingly.

Are adequate measures being taken to safeguard occupants and the structure from future flood damage?

For residential structures, the community's ordinance will require the lowest floor, including basement, to be elevated on fill to, or above, the RFPE. Commercial and industrial development must be elevated on fill or "dry" flood-proofed to the RFPE. Other considerations include access, setback requirements, and the location of accessory land uses such as storage of materials or equipment, loading and parking areas, etc.

Have all other applicable permits been obtained?

Quite often, more than one permit is required to complete a certain project. It is the applicant's responsibility to insure that all applicable local, state and federal permits for the proposed project are acquired. The zoning administrator should issue the community's land use permit only after making a "good faith" effort to determine that the applicant has secured all additional required permits.

Acting on a Permit Application

Following a complete review of the permit application for the permitted use or conditional/special use permit, the zoning administrator has four basic options:

1) Approve the permit

2) Approve the permit on the condition certain modifications are made to comply with the ordinance

3) Forward the permit application to the appropriate governing body to evaluate request for a conditional use permit, variance, etc.

4) Deny the permit

If the permit request is approved, a land use permit is issued to the property owner. If denied, the zoning administrator should explain the reasons for denial to the applicant. When denied a permit, the property owner has the right to appeal the decision to the board of adjustments and appeals (appeals will be discussed later in this chapter).

ENFORCEMENT

Even though an individual obtains all applicable land use and building permits, it does not necessarily guarantee that the development will be constructed in conformance with all provisions of the approved permit. The local community can insure that the construction activity is in compliance through periodic inspections and the ultimate issuance of a certificate of compliance and occupancy. As mentioned in the previous section on permit application review, the sooner a code violation is identified, the easier and less costly it will be to modify the construction activity.

The actual inspection function may vary considerably from community to community or due to the complexity of the development. In smaller communities without a full-time building inspector, the zoning administrator will probably assume the responsibility for construction compliance. In other communities with both a zoning administrator and building inspector, the building inspector usually assumes all inspection responsibilities. However, in this situation, the building department and the planning and zoning department must maintain open communication. The inspection person(s) must not only insure compliance with construction standards (e.g., flood proofing, site grading, plumbing, heating and electrical codes), but he/she must also check for the proper zoning type standards, such as setback, elevation, limitations of use and occupancy, etc., as specified on the use permit.

Inspections

Inspections should be scheduled for key stages of construction and should be done in a timely manner to avoid construction delays. The size, scope and complexity of a development project will dictate the number and extent of inspections required. An addition to a residential structure would require fewer inspections than would a major new subdivision or commercial development. To monitor floodplain construction activities, up to four separate inspections may be required.

Before issuing a land use permit.

If the zoning administrator is not familiar with the development site, an inspection prior to issuing a permit can prevent future problems. If a question exists whether the property is located in the floodplain, a visual inspection of the site may be sufficient to make this determination. Additionally, an inspection prior to permit issuance should help resolve any questions relating to the intent of the developer and possible conflicts with the zoning ordinance.

Following development lay-out, just before construction is scheduled to commence.

This inspection should detect any errors in location. Errors detected at this stage should be relatively easier to correct. For example, an accessory structure, which had been "staked out" in the floodway district could possibly be interchanged with a proposed parking area located outside the floodway. These type of modifications are much easier to implement before construction begins than after the building is erected.

When the footings have been set in place, but not covered.

This is a critical inspection for **all** floodplain development. The footings should be surveyed to insure that the finished elevation of the low floor is above the regulatory flood protection elevation. The developer should give the zoning administrator or building inspector adequate notice when construction reaches this stage so an inspection can be scheduled. A verified elevation of the footings can be used later in making the additional inspections required prior to issuance of the certificate of occupancy.

An error in the footing elevation should be easily corrected at this stage. Compacted fill could be used to elevate the footings or additional rows of block could be required to properly elevate the lowest floor to the RFPE.

Footings or a slab on-grade placed too low and not detected until the project is completed has serious consequences for both the community and the owner. The building will be a nonconformity which, as discussed in chapter IV, results in restrictions being imposed on future additions and modifications to the structure. Additionally, flood insurance premiums are significantly higher for buildings not properly elevated.

Project Completion

The final inspection is the basis for the certificate of compliance. This inspection should insure that all permit conditions and building codes have been met. This is often the last opportunity for the building official to correct any deficiencies.

Certificate of Zoning Compliance

New buildings or additions are not to be occupied until a "Certificate of Zoning Compliance" is issued to the landowner. This certificate declares that the particular building or project was completed in full compliance with the city or county zoning ordinance and other applicable laws and regulations.

Before the certificate can be issued, all errors in construction or installation of equipment must be corrected. In floodplain areas, the applicant must submit a certification by a registered professional engineer, architect or surveyor that the finished construction conforms to the fill and low floor elevation requirement as well as appropriate floodproofing standards. Normally the applicant is responsible to obtain the required survey data, however, as a service to its residents, the city or county engineer or surveyor may survey the finished fill and low floor elevation.

Any uncorrected error, including 1st floor below the RFPE, is a violation, and the zoning administrator must act accordingly.

Violations

Violations of floodplain regulations require the same action by local officials as violations of other established zoning and building codes provisions. Any violation should be resolved as quickly as possible; minor deficiencies, often easily corrected at the start of construction, may be very costly to correct once the project is completed. Community officials must realize that a community's eligibility in the NFIP is dependent upon the community making a good faith effort to enforce the floodplain ordinance.

The local community may be held liable for issuing a permit not compliant with the local ordinance or not following prudent inspection/certification and enforcement procedures. For instance, even through a new residential structure built in the floodplain with a basement below the RFPE may be compliant with the issued building permit, it would not be compliant with most local ordinances. This violation of the local floodplain regulations may not be detected until the next flood event when the basement area is subject to substantial damage.

Hopefully most violations involve only minor deviations from the approved plans or specifications. The contractor or owner should be informed immediately and given an opportunity to make the necessary corrections. If the matter is not corrected within a reasonable period of time, a written notice of noncompliance should be given to the permit holder. If this does not bring compliance, the zoning administrator or building official should issue a stop work order and/or take action to impose a penalty for code violation.

RECORD KEEPING

Record keeping is an extremely important part of the zoning administrator's responsibility in administering the community's land use programs. All official actions must be completely documented so that the planning and zoning commission, board of adjustment and appeal and possibly even the courts, can make well informed decisions. Aside from the fact that good records of permit applications and decisions should be kept for the community's own purposes, it is a requirement for continued eligibility in the NFIP.

Specifically, the following documents must be kept on file and open for public inspection:

1) A complete copy of all ordinances and maps, including all ordinance and map amendments.

2) A complete set of the most recent flood insurance study, including FIS text, FIRM and FBFM.

3) A project file should be maintained for each development permit application. This file should contain:

   -The permit application

   -The permit review checklist

   -Copies of all pertinent correspondence relating to the project

   -Any appeal, conditional use permit or variance proceedings, including notice of the hearing, hearing minutes, and the written decision and conditions attached thereto

   -Documentation of inspections

   -Subdivision data (if necessary)

   -A copy of the certificate of compliance

4) A record of the fill and floor elevations (including basement) for all new or substantially improved structures in a designated floodplain area. For floodproofed structures, the elevation to which the structure has been floodproofed must be obtained and recorded.

FEMA Annual Report

Much of the above data are required for two additional reports required by the NFIP. The first involves an **annual report** to be submitted to FEMA. Information to be included on a form issued by FEMA includes:

1) Information on physical changes, including community boundary changes.

2) Copies of any amendments to the floodplain management ordinance enacted during the previous year.

3) Report of the number of building permits and variances requested and approved, both for the entire community and for structures located in identified 100-year floodplain.

4) Estimates of population and structures in flood hazard areas as a proportion of the community totals.

It is suggested that each community develop a system of "Tabbing" or special recording of floodplain development permits. One means might use a special suffix for the permit application number such as:

Permit # 84-32FP

Thereafter, anyone reviewing the permit application, such as the building inspector, would automatically realize that this particular structure is located in a special flood hazard area.

Communities which issue numerous building permits each year may also want to maintain a separate tabulation of floodplain development. Such a tabulation may look like:

Permit No./Date	Address	Use	100-Yr. Flood Elev.	RFPE	Certified Elev. 1st Flr.	Certified Elev. low flr.	Date Constr.	Variance or Cond'l Use?

This form should also satisfy the NFIP requirement to maintain a record of low floor and floodproofed protection elevations as identified above. Additionally, data from a form such as this would be used in completing FEMA's annual report.

Elevation Certificate

The Federal Insurance Administration (FIA) now requires that an "Elevation Certificate" be submitted, in many circumstances, when a **new** application for flood insurance is submitted to the National Flood Insurance Program (NFIP). The current Elevation Certificate (shown on bottom of page) is intended to document and certify: 1) the flood and building floor elevations used to calculate flood insurance premiums for the policy (where the elevation rating method is used, by comparing the lowest floor to the 100-year flood level); and 2) that the building to be insured is built in compliance with local floodplain management regulations - a prerequisite for the building to be insurable under the NFIP.

OMB 3067-0077
Expires: June 1984

FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM

ELEVATION CERTIFICATE

This form is to be used for 1) New/Emergency Program construction in Special Flood Hazard Areas; 2) Pre-FIRM construction after September 30, 1982; 3) Post-FIRM construction; and, 4) Other buildings rated as Post-FIRM rules

BUILDING OWNER'S NAME _____ ADDRESS _____

PROPERTY LOCATION (Lot and Block numbers and address if available) _____

I certify that the information on this certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. code, Section 1001.

SECTION I ELIGIBILITY CERTIFICATION (Completed by Local Community Permit Official or a Registered Professional Engineer, Architect, or Surveyor)

COMMUNITY NO	PANEL NO	SUFFIX	DATE OF FIRM	FIRM ZONE	DATE OF CONSTR	BASE FLOOD ELEV (In AO Zone use depth)	BUILDING IS 1) New/Emergency 2) Pre-FIRM Reg 3) Post-FIRM Reg

YES ☐ NO ☐ It is intended that the building described above *will be* constructed in compliance with the community's flood plain ordinance. The certifier may rely on community records. The lowest floor (including basement) will be at an elevation of _____ ft. NGVD. Failure to construct the building at this elevation may place the building in violation of the community's flood plain management ordinance.

YES ☐ NO ☐ The building described above has been constructed in compliance with the community's flood plain management ordinance based on elevation data and visual inspection or other reasonable means.
If NO is checked, attach copy of variance issued by the community.

YES ☐ NO ☐ The mobile home located at the address described above has been tied down (anchored) in compliance with the community's flood plain management ordinance, or in compliance with the NFIP Specifications.

MOBILE HOME MAKE	MODEL	YR. OF MANUFACTURE	SERIAL NO.	DIMENSIONS X

(Community Permit Official or Registered Professional Engineer, Architect, or Surveyor)

NAME _____ ADDRESS _____

TITLE _____ CITY _____ STATE _____ ZIP _____

SIGNATURE _____ DATE _____ PHONE _____

SECTION II ELEVATION CERTIFICATION (Certified by a Local Community Permit Official or a Registered Professional Engineer, Architect, or Surveyor.)

FIRM ZONE A1-A30: I certify that the building at the property location described above has *the lowest floor* (including basement) at an elevation of _____ feet, NGVD (mean sea level) and the average grade at the building site is at an elevation of _____ feet, NGVD.

FIRM ZONES V, V1-V30: I certify that the building at the property location described above has *the bottom of the lowest floor beam* at an elevation of _____ feet, NGVD (mean sea level), and the average grade at the building site is at an elevation of _____ feet, NGVD.

FIRM ZONES A, A99, AH and EMERGENCY PROGRAM: I certify that the building at the property location described above has the lowest floor elevation of _____ feet, NGVD. The elevation of the highest adjacent grade next to the building is _____ feet, NGVD.

FIRM ZONE AO: I certify that the building at the property location described above has the lowest floor elevation of _____ feet, NGVD. The elevation of the highest adjacent grade next to the building is _____ feet, NGVD.

SECTION III FLOODPROOFING CERTIFICATION (Certification by a Registered Professional Engineer or Architect)

I certify to the best of my knowledge, information, and belief, that the building is designed so that the building is watertight, with walls substantially impermeable to the passage of water and structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy that would be caused by the flood depths, pressures velocities, impact and uplift forces associated with the base flood.

YES ☐ NO ☐ In the event of flooding, will this degree of floodproofing be achieved with human intervention? (Human intervention means that water will enter the building when floods up to the base flood level occur unless measures are taken prior to the flood to prevent entry of water (e.g., bolting metal shields over doors and windows).

YES ☐ NO ☐ Will the building be occupied as a residence?

If the answer to both questions is *YES*, the floodproofing cannot be credited for rating purposes and the actual lowest floor must be completed and certified instead. Complete both the elevation and floodproofing certificates.

FIRM ZONES A, A1-A30, V1-V30, AO and AH: Certified Floodproofed Elevation is _____ feet, (NGVD).

THIS CERTIFICATION IS FOR ☐ SECTION II ☐ BOTH SECTIONS II AND III (Check One)

CERTIFIER'S NAME _____ COMPANY NAME _____ LICENSE NO. (or Affix Seal)

TITLE _____ ADDRESS _____ ZIP _____

SIGNATURE _____ DATE _____ CITY _____ STATE _____ PHONE _____

The insurance agent should attach the original copy of the completed form to the flood insurance policy application, the second copy should be supplied to the policyholder and the third copy retained by the agent
INSURANCE AGENTS MAY ORDER THIS FORM

FEMA Form 81-31, SEP 83 REPLACES FEMA FORM 81-31, APR 82, WHICH IS OBSOLETE.

Figure 5.2 Elevation Certificate

This certificate is only required for property located in the mapped 100-year floodplain area. The Elevation Certificate must be signed by a local community permit official or a registered professional engineer, architect or surveyor.

There has been some confusion as to when the Elevation Certificate must accompany an application for flood insurance. The Elevation Certificate has been required since October 1, 1982, in the following circumstances:

1) In Regular Program communities, where the start of construction or substantial improvement for the structure to be insured was after the date of the community's initial Flood Insurance Rate Map (FIRM) or December 31, 1974, whichever is the later of the two dates. This is called Post-FIRM construction and the elevation rating procedure must be used;

2) In Emergency Program communities, for all structures where the start of construction or substantial improvement was after September 30, 1982, and the structure is located in Zone A (special flood hazard area) on the community's current Flood Hazard Boundary Map (FHBM); or

3) In Regular Program Communities, for all Pre-FIRM construction where the applicant uses the optional Post-FIRM elevation rating procedure. Normally, flood insurance applicants with a Pre-FIRM structure will use the more affordable Pre-FIRM, standardized rates and the elevation certificate is not required.

Whether or not local building officials decide to complete the Elevation Certificate for their constituents is at the discretion of the community. It is likely that flood insurance applicants will contact community officials because: 1) the community's current FIRM/FHBM should be on file in the community; and 2) the majority of the information requested on the Elevation Certificate, especially for Regular Program communities, is shown on the FIRM/FHBM or should be on file with the building permit forms and/or certificates of occupancy/compliance. Community officials are encouraged to make sure a current copy of the FIRM/FHBM is on file in the community and building permit/certificate of compliance forms contain all information required by the local floodplain regulations.

Questions concerning the Elevation Certificate should be directed to the NFIP at 1785 Bloomingdale Road, Glendale Heights, Illinois 60137, phone: (312)462-7607.

APPEALS AND VARIANCES

Permit officers are responsible for insuring that all proposed construction and development activities are undertaken within the requirements specified by ordinance. If prepared correctly, an ordinance will be specific enough to guide a zoning administrator in making determinations of conformity. An ordinance which lacks such detail and clarity may leave the interpretation of the provisions up to the discretion of the permit officer. This could lead to problems. However, no matter how well an ordinance is written, situations will arise where an applicant may wish to **appeal** a decision of a permit officer or to request a **variance** from the strict application of certain provisions of the ordinance. Both municipal and county zoning enabling legislation in Minnesota require as a prerequisite to adoption of land use controls that a board of adjustment be established to resolve these issues. It is important for permit officers to understand the differences between these two types of situations and the role they should play in seeing that these matters are properly handled.

Appeals

Land use ordinances must include a provision allowing citizens the right to appeal a decision of a zoning administrator to a higher authority. An appeal usually occurs when an applicant, who is denied a building permit feels that the permit officer either made an error in applying the requirements of the ordinance (e.g., the property is not within the floodplain), or misinterpreted certain aspects of the ordinance.

Appeals are handled by the board of adjustment which is specifically established to deal with these matters. It is the responsibility of this body to review the facts of the case and to take official action.

For communities with pre-existing land use controls, a board of adjustment would have already been established in accordance with the procedures in the respective enabling legislation. If a community has just a floodplain ordinance, a board of adjustment must be established at the time the floodplain ordinance is adopted.

The zoning administrator should be in a position to inform the person filing the appeal about the appeals procedure. The applicant should submit, in writing, his or her explanation of the situation in as clear and concise a manner as possible. The zoning administrator should make sure the appeal letter gets to the chairman of the board of adjustment promptly. In addition, the zoning administrator should appear at the hearing to present testimony on the facts and to answer any questions the board members may have. After a decision is reached, the permit officer is responsible for seeing that it is carried out.

Variances

Zoning and other land use control ordinances contain a variance procedure which, under special circumstances, can provide relief from the strict application of the ordinance. Regulations must be applied uniformly and consistently in every situation. In other words, the permit officer has absolutely no discretion in modifying the provisions of the ordinance. Like appeals, variances are handled by the board of adjustment.

A request for a variance usually arises when an application for a zoning or building permit is rejected by the permit officer because the proposed activity does not meet all the requirements of the ordinance. However, a request for a variance can also come about by a direct request from a prospective applicant when it is clear, in advance, that the requirements of the ordinance are going to pose a hardship in his or her particular instance. The applicant then makes application to the board for a variance.

The zoning administrator should attend the hearing and offer whatever assistance is needed. If a variance is granted, the zoning administrator must insure that the variance is carried out under the conditions decided upon by the board.

Enabling Legislation

The respective enabling legislation for municipalities Chapter 462 and Counties Chapter 394 specify the minimum criteria in which a board of adjustment may grant a variance. These are as follows:

> §462.357, Subdivision 6 (2) - The board of adjustment has the power "To hear requests for variances from the literal provisions of the ordinance in instances where their strict enforcement would cause undue hardship because of circumstances unique to the individual property under consideration, and to grant such variances only when it is demonstrated that such actions will be in keeping with the spirit and intent of the ordinance. "Undue hardship" as used in connection with the granting of a variance means the property in question cannot be put to a reasonable use if used under conditions allowed by the offical controls, the plight of the landowner is due to circumstances unique to his property not created by the landowner, and the variance, if granted, will not alter the essential character of the locality. Economic considerations alone shall not consititute an undue hardship if reasonable use for the property exists under the terms of the ordinance. Undue hardship also includes, but is not limited to, inadequate access to direct sunlight for solar energy systems. Variances shall be granted for earth sheltered construction as defined in section 116J.06, Subdivision 2, when in harmony with the ordinance. The board of appeals and adjustments or the governing body as the case may be, may not permit as a variance any use that is not permitted under the ordinance for property in the zone where the affected person's land is located. The board or governing body as the case may be, may permit as a variance the temporary use of a one family dwelling as a two family dwelling. The board or governing body as the case may be may impose conditions in the granting of variances to insure compliance and to protect adjacent properties.

§394.27, Subdivision 7, states, "The board of adjustment shall have the exclusive power to order the issuance of variances from the terms of any official control including restrictions placed on nonconformities. Variances shall only be permitted when they are in harmony with the general purposes and intent of the official control in cases when there are practical difficulties or particular hardship in the way of carrying out the strict letter of any official control and when the terms of the variance are consistent with the comprehensive plan. "Hardship" as used in connection with the granting of a variance means the property in question cannot be put to a reasonable use if used under the conditions allowed by the official controls; the plight of the landowner is due to circumstances unique to his property not created by the landowner; and the variance, if granted, will not alter the essential character of the locality. Economic considerations alone shall not constitute a hardship if a reasonable use for the property exits under the terms of the ordinance. Variances shall be granted for earth sheltered construction as defined in section 116J.06, subdivision 2, when in harmony with the official controls. No variance may be granted that would allow any use that is prohibited in the zoning district in which the subject property is located. The board of adjustment may impose conditions in the granting of variances to insure compliance and to protect adjacent properties and the public interest. The board of adjustment may consider the inability to use solar energy systems a "hardship" in the granting of variances.

Floodplain Variances

These respective statutory provisions, plus any additional provisions a community may have adopted by ordinance or charter for the granting of variances, must be met prior to issuance of a variance in a floodplain area. In addition to the above, NR 91 also states, "variances may be used to modify permissible methods of flood protection, **no** variance shall provide for a lesser degree of flood protection than stated in these standards".

Because of the wording of NR 91 and the wording of the enabling legislation preventing "use" variances, very few activities qualify for variances to the **floodplain** management provisions of local ordinance. A variance can be granted **only** to those actions which modify the type of flood protection measure employed and **not** the flood protection standard itself. Therefore, certain variance requests on their face are automatically excluded: 1) a request to not elevate and/or floodproof a regulated activity to the RFPE; 2) a request to allow a use not allowable as a permitted or conditional use in the floodplain; 3) **any** use in the floodway which would result in a measurable increase in the stage of the 100-year flood.

The most common legitimate requests for a variance include:

1) A platted, undeveloped lot of record where the depth of flooding over an existing road grade makes it impracticable to provide elevated road access to the site. The development proposal in all other aspects would be compliant with the flood protection standards of the floodplain ordinance. The intent of the floodplain ordinance is to insure the public health and safety of the occupants of the proposed use. This includes providing (elevated) road access to the site to insure proper egress to the area. This is necessary for residents to evacuate the area if required and for the community to provide public services, police, fire, emergency vehicles, etc. These objectives cannot be ignored with the granting of a variance.

The board of adjustment may determine these public health and safety objectives can be met with an access road elevation lower than that required by local ordinance, or alternate, non road type access is available. This decision must be based on the depth of flooding over the access route, flow velocity and the duration of flooding. In flash flood areas, the decision often is dependent on the flood forecasting capability of the community and its ability to provide timely warnings and monitor evacuation of the area.

With the granting of this type of variance, the community must clearly spell-out and deed register those conditions required of the occupant to insure their safety. This could include actions such as: 1) when an occupant must evacuate; 2) when the structure can be reoccupied; and 3) the condition of the building when it is evacuated (e.g., gas/electric service shut-off, building security, etc.). The hearing record should also clearly spell-out how the community will provide emergency services and who is responsible for these actions.

Figure 5.3 Lack of proper access during times of flooding can severely limit the ability of a community to provide essential services.

2) The use of a flood protection technique not permissible in the floodplain ordinance. For example, federal standards do not allow "wet" floodproofing of non-residential spaces. In addition, some communities have adopted ordinance language more stringent than state and federal standards and do not allow any floodproofing in the community. As a result, an applicant may request to floodproof a building to the RFPE with a technique not permitted by local ordinance. The community must determine prior to granting this type of variance that the building and its contents will **not** be subject to flood damage during the 100-year flood and the buildings occupants are safe. In all cases, the building's design must be designed and certified by a registered professional engineer or architect. In addition, the following conditions must be met:

a) Proper road access is provided as described above;
b) Proper flood warning time exists to implement any required floodproofing measures (e.g. intentionally flooding wet floodproofed spaces, removal of damageable contents, placement of bulkheads/closures, etc.);
c) Proper conditions are placed on the variance permit to insure the floodproofing measures are implemented in a timely fashion. This could include annual inspections/exercises or limitations on the use and occupancy of spaces; and
d) Limit the use and occupancy of a space below the RFPE so that a use is not allowed inconsistent with the type of floodproofing being employed.

It should be noted that variances may be requested to the underlying, non floodplain type provisions of local ordinance(s). Variance requests to dimensional standards such as setbacks, height limitations, bulk and area requirements must meet the statutory tests for variance approval but are not normally germain to state and federal floodplain mamagement standards. Notice of hearings or decisions need not be submitted to the area hydrologist, as discussed below.

DNR Notification

Hearings - State floodplain management standards require the local unit of government to submit a notice of hearings for all applications for variances to the Commissioner of Natural Resources at least 10 days before the hearing by the board of adjustment. The notice materials submitted should be of sufficient detail to locate the subject property and structures involved on the community's flood insurance study maps. In addition, the application materials must clearly specify the variance requested in relation to the requirements of the ordinance and the applicant's justification for the variance. These materials should be submitted directly to the respective DNR area office. The area hydrologist will provide the appropriate DNR response. If a DNR response is provided, these comments should be formally entered into the hearing record.

Notice of Decision - A local unit of government must submit to the area hydrologist a notice of the decision within 10-days of the **approval** of a variance request. This notice of approval, if at all possible, should include a copy of the minutes of the meeting of board of adjustment. These minutes should summarize the findings of the board of adjustment, including the justification for granting the variance. The minutes should also state any conditions attached to the granting of the variance.

Community officials are cautioned about the need for preparing an adequate hearing record. The hearing record documents the findings and actions of the board of adjustment and is of extreme importance should an interested party appeal the decision. The DNR has no approval authority over the issuance of floodplain ordinance variances. The DNR does have standing to appeal local variances and, if the DNR would question the variance approved, a copy of the hearing record would be requested.

Record Keeping

FEMA requires that a community: 1) maintain a record of all variance actions to the floodplain management standards, including a justification for their issuance; and 2) provide the number of variances issued to the floodplain management ordinance on the FEMA annual report. FEMA also requires that "a community shall notify the applicant in writing over the signature of a community official that: 1) the issuance of a variance to construct a structure below the 100-year flood level will result in increased premium rates for flood insurance coverage up to amounts as high as $25 for $100 of insurance coverage; and 2) such construction below the 100-year flood level increases risks to life and property." Such notification shall be maintained with a record of all applicable variance actions to the floodplain management standards of local ordinances.

CONDITIONAL USES

Definition/Enabling Legislation

There are uses of land that on their face cannot be determined to be generally appropriate for the zoning use district in which they are located. A special review procedure, called a special/conditional use permit, may demonstrate that the development proposal (possibly with specific conditions attached to the community's approval) is compatible with existing adjacent development and the community's comprehensive plan and local ordinance.

The county "Planning Development, Zoning" statute in M.S. §394.22 defines a conditional use as:

> Subd. 7. "Conditional use" means a land use or development as defined by ordinance that would not be appropriate generally but may be allowed with appropriate restrictions as provided by official controls upon a finding that (1) certain conditions as detailed in the zoning ordinance exist, and (2) the use or development conforms to the comprehensive land use plan of the county and (3) is compatible with the existing neighborhood.

While the "Municipal Planning Act" in M.S. Chapter 462 and the Flood Plain Management Act in M.S. Chapter 104 do not define the term "conditional use", the above definition is also applicable to the discussion of conditional uses in municipalities. Both Chapters 394 and 462 allow the governing body the **discretionary** authority to designate by ordinance, certain types of development as conditional uses. However, the State floodplain management program **requires** that certain categories of activities in the floodplain be allowed only after the granting of a conditional use permit.

The respective enabling legislation for cities and counties do require for conditional uses that certain ordinance language be adopted and specific review procedures be followed:

- Those activities permissible as a conditional use must be listed in local ordinance;
- The standards and criteria for granting a conditional use must be clearly stated in local ordinance;
- The governing body may be the review and granting authority or the governing body may delegate this authority;
- A public hearing must be held prior to the approval of a conditional use;
- Prior to approval, the applicant must show that the standards and criteria stated in the ordinance are satisfied; and
- The approval authority must, when ordering the issuance of a conditional use permit, impose restrictions or conditions necessary to protect the public interest and insure the intent of the ordinances is met.

Activities Requiring a Conditional Use Permit

As was stated in Chapter IV, the following activities in the floodplain require the issuance of a conditional use permit:

1) Floodway District - fill, storage of materials and equipment and structures accessory to certain specified open space uses;

2) Flood Fringe District - floodproofing a structure in lieu of elevating a building on fill to the RFPE; and

3) General Floodplain District - any activity which requires fill, obstructions, structures or storage of materials and equipment.

The conditional use permit procedure is appropriate because of the potential for these uses to obstruct flood flows or increase flood damage potential (to the development itself or neighboring properties) if proper flood protection techniques are not followed. Advantages of the conditional use process are the following:

- It provides a mechanism to obtain additional data needed to thoroughly evaluate the development proposal;

- It allows for a thorough review of a development proposal against the standards and criteria stated in local ordinance. A "judgement" that a development is compliant with a set of standards and criteria is often subject to interpretation, especially where complex hydrologic/hydraulic data may be under consideration. This decision is best made by the governing body or quasi-judicial body such as the planning commission instead of the permit official;

- It allows for the input of adjoining property owners who could be impacted by improper floodplain development; and

- It allows the community to specify conditions to its approval, such as limitation of the use or occupancy of the structure and adjoining lands, modifications to original building design, etc.

It must be remembered that most communities treat a floodplain zoning district as an overlay zoning district. Therefore, an activity which was a permitted use prior to floodplain ordinance adoption may have to be a conditional use after adoption of floodplain controls (e.g., a commercial building in a commercially zoned district that is being floodproofed to the RFPE in lieu of elevation on fill). Conversely, there are activities which would have been permissible as a permitted use in the floodplain (e.g., a church properly elevated on fill to the RFPE where the pre-existing underlying zoning district has specified this activity as a conditional use (e.g., a church in a residentially zoned district). If the underlying zoning is more restrictive than the floodplain ordinance provisions, the former takes precedence; a conditional use permit is still required, but the standards and criteria germane to floodplain conditional uses are probably not applicable. Lastly, a floodproofed church in a residentially zoned district would likely require a conditional use permit from both the floodplain and underlying zoning ordinance provisions.

The Review Process

The review process for a floodplain conditional use involves up to three basic steps. These steps are: 1) data gathering; 2) weighing the accumulated data/information and the development proposal itself against the standards and criteria specified in local ordinance; and 3) determining whether to grant without conditions, grant with conditions or deny the application.

Data Gathering

General Floodplain District (GFPD) - As stated above, virtually any development proposal within a GFPD should go through the conditional use process. The process should determine: 1) the regulatory flood protection elevation; and 2) the floodway/flood fringe districts at the site. Once this determination is made, the zoning administrator can refer to the main body of the ordinance to identify appropriate standards and permissible uses in the floodway and flood fringe districts.

Most communities have specified during the adoption of their floodplain ordinance that the developer is responsible to generate the above data for the conditional use review process. The following field data are generally needed to make the site evaluation:

1) **A typical valley cross-section(s)** showing the channel of the stream, elevation of land areas adjoining each side of the channel, cross-sectional areas to be occupied by the proposed development, and known high water information.

2) **Plan View** showing elevations or contours of the ground; pertinent structure, fill, or storage elevations; size, location, and spatial arrangement of all proposed and existing structures on the site; location and elevations of streets; photographs showing existing land uses and vegetation upstream and downstream; and soil type.

3) **Profile** showing the slope of the bottom of the channel or flow line of the stream for at least 500 feet in both directions from the proposed development.

The above data are used to determine the RFPE and floodway/flood fringe district. The floodway/flood fringe analysis must allow for an "equal degree of encroachment" on both sides of a stream channel. The resultant stage increase in the 100-year flood level should not exceed 0.5' or result in an increase in flood damage potential in adjacent, upstream or downstream areas.

The local reviewing authority is not expected to have technical expertise in the fields of hydrology and hydraulics. It is surmised that prior to approval, comments will be solicited from the community's technical staff (if available), the DNR or FEMA and adjacent landowners who may be very knowledgeable about local flooding conditions. The community's approval authority must decide to accept or deny the above-noted hydrologic/hydraulic analyses which are normally submitted by the developer's technical consultant; this decision will be aided by the comments provided by the community's technical support staff, local citizens and outside agencies.

Floodway and Flood Fringe Districts - Conditional uses involving fill, storage of materials or equipment, accessory structures to open spaces uses in the floodway district or the floodproofing of buildings in the flood fringe district may require additional data for proper review. The review authority has the discretion to request the following types of information from the developer prior to taking action on the proposal:

1) Hydrologic/hydraulic data including:

   - effect of fill or other obstructions in the floodway on increasing the 100-year flood profile;

   - flood flow velocities;

   - rate of rise and fall of a "typical" flood event; or

   - duration of flooding at the site;

2) Specifications for the building(s) floodproofing design, including water supply and sanitary facilities, to be certified by a registered professional engineer or architect;

3) A contingency plan prepared by a registered professional engineer or architect identifying those floodproofing measures requiring human intervention. The plan must specify when floodproofing measures must be put in place, who will be responsible for their implementation and a periodic maintenance and practice exercise schedule; and

4) A signed statement by the property owner indicating the intended future use of the proposed structure and land. This statement should include whether any space below the RFPE is intended to be used for human habitation or for storage or processing of materials that would in time of flooding be flammable, explosive, or potentially injurious to human, animal or plant life.

Depending upon the complexity of the development proposal, the review authority may accept as sufficient the supporting hydrologic/hydraulic data and supporting information received from the applicant or request additional information. Prior to accepting this information, a community may solicit the advice of its own technical staff or advice from state and federal agencies.

As will be noted in the following subsection on DNR notification, DNR must receive notification of a hearing to consider an application for a conditional use. A community may solicit DNR assistance in advance in determining whether floodway/flood fringe boundaries have been properly identified or whether sufficient supporting information has been submitted for final review of the development proposal. A "Conditional Use Evaluation" sheet has been included in Appendix D as an aid in determining data/information needs for review of conditional use permit applications.

Compliance with State Standards and Criteria

Once the reviewing authority has received, reviewed and accepted all required technical data and supporting information supplied by the applicant, a decision must be made to grant, grant with conditions or deny the application. The community's floodplain ordinance must specify those standards and criteria which must be adhered to when determining a development proposed is suitable for the intended site. (Note: as discussed earlier, the underlying zoning use district may have stipulated additional standards and criteria applicable to that underlying use district).

Specific standards and criteria for various uses in the floodway and flood fringe district are highlighted in Chapter IV. Listed below are additional concerns applicable for all floodplain conditional uses:

The danger to life and property due to increased flood heights or velocities caused by encroachments.

The danger that materials may be swept onto other lands or downstream to the injury of others.

The ability of the proposed water supply and sanitation systems to prevent flood related disease, contamination, and unsanitary conditions.

The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner.

The importance of the services provided by the proposed facility to the community.

The requirements of the facility for a waterfront location.

The availability of alternative locations not subject to flooding for the proposed use.

The compatibility of the proposed use with existing development and development anticipated in the forseeable future.

The relationship of the proposed use to the comprehensive plan and floodplain management program for the area.

The safety of access to the property in times of flood for ordinary and emergency vehicles.

The expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters expected at the site.

The complexity of the flood protection measures proposed in relation to the amount of flood warning time available.

The capability of the community to insure all conditions placed on the approval will be implemented by the permittee.

The impact on the permittee and the community should the approved flood protection measures fail due to improper design, floods occurring which exceed the level of protection provided or because the permittee fails to install required contingency measures.

These standards and criteria relate to protecting the public's health and safety and guarantee that there will be no increase in flood damage potential in the community. The record of the public meeting must clearly demonstrate that the technical data, supporting information and conditions attached to the application approval are consistent with the standards and criteria for the respective development. A "Project Evaluation Worksheet" is included in Appendix D as an aid in determining compliance with stated standards and criteria.

Conditions Which May Be Placed on Conditional Use Approval

As was stated earlier, a community must place sufficient conditions on the granting of a conditional use application to protect the public interest and insure ordinance compliance. The type and extent of these conditions will vary depending on the complexity of the development proposal and the potential harm should the flood protection measure fail or the permittee violate the conditions placed in the community's approval.

The following is a list of conditions which may be appropriate:

- Limitations on the use or the period of use, occupancy or operation of a structure and its adjoining lands. This is necessary to guarantee that, at a minimum, spaces below the RFPE will be devoted to the storage of non-hazardous and non-damageable materials or equipment and not be used for human habitation;

- Regularly scheduled inspections (annually, semi-annually, etc.) or other assurances to guarantee the conditions placed on the community's approval have not been violated by the permittee. This will substantiate compliance with any limitations on the use of the property identified above and also whether required contingency floodproofing devices remain accessible and in working order;

- Require sufficient practice exercises to insure all floodproofing contingency measures and evacuation plans are capable of being installed or implemented;

- Require sufficient deed recorded statements notifying potential purchasers or tenants of the property of the degree of flood protection provided and the floodproofing contingency measures and evacuation actions necessary should flooding occur; and

- Upon completion of the project, require the applicant to submit a document and/or plan certified by a registered professional engineer or architect that the as-built condition of the development is compliant with the design plans and specifications approved by the community. This document and/or plan must demonstrate how contingency flood protection measures will be implemented and that all limitations on the use of the structure and/or land have been met.

All conditions specified by the local approving authority must be clearly identified in written form and be included in the conditional use permit. This should insure that the permittee is fully cognizant of the restrictions and conditions placed on the community's approval. This documentation should be used in future inspections of the project and used to resolve any disputes.

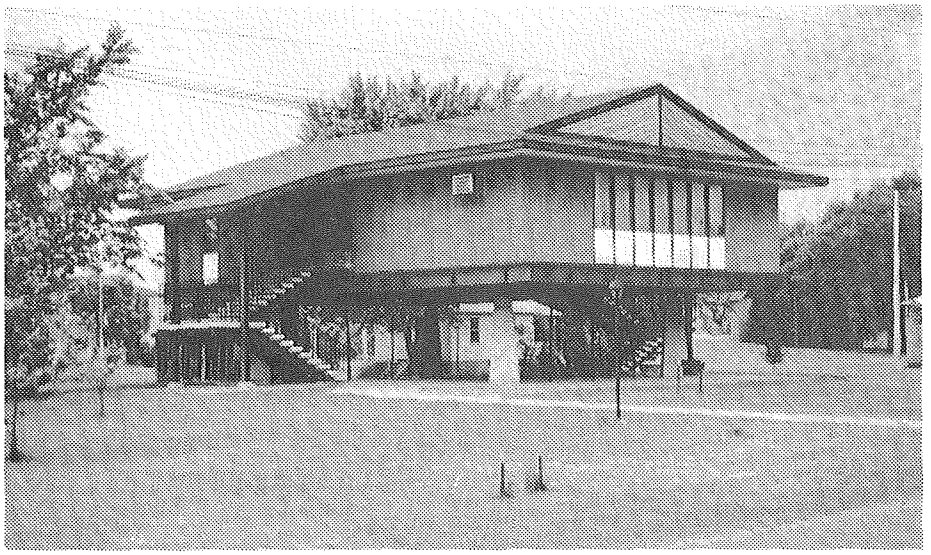
DNR Notification

Notification requirements and record keeping for conditional use permits are similar to those for variances. State floodplain management standards require the local unit of government to submit a notice of hearing for all conditional uses to the Commissioner of Natural Resources at least 10 days before the scheduled hearing. If the DNR is being specifically asked to review the technical adequacy of the conditional use application, additional time should normally be provided. The notice should include the time, date, purpose and location of the public hearing, along with a copy of the supporting information available to the community (e.g., floodway/flood fringe or encroachment analyses, development plans, proposed floodproofing design, etc.) All materials should be submitted directly to the appropriate DNR area office for review and comment.

The local unit of government must submit to their DNR area hydrologist a notice of decision within 10-days of the **granting** of a conditional use permit. This notice should include a copy of all conditions placed on the granting of the permit by the local review authority.

The community must keep a record of the conditional use application, including all pertinent supporting documents and findings of the approval authority. It is important that the record clearly demonstrate the facts and findings of the approval authority and justify the issuance or denial of the conditional use application. As with variances, any future appeal of the community's decision will likely center on the supporting documentation, testimony and findings generated during the review process.

FLOODPROOFING



CHAPTER VI

FLOODPROOFING

The purpose of this chapter is to provide guidance on administering floodproofing regulations at the local level. The effective floodproofing of new and existing buildings can play an integral part in a community's overall effort at flood damage reduction.

Floodproofed structures should not be considered as safe as structures elevated on fill since they may be subject to damage due to improper design, impact from floating debris, or from floods of a greater magnitude than the 100-year flood. These structures also often have access problems during floods. For these reasons, floodproofed structures should be permitted only after a careful evaluation of the site and the proposed use of the structure.

Each community's ordinance will specify those structures which can be floodproofed, as a conditional use, and the appropriate floodproofing classification. For example, many communities allow, as an alternative to elevating on fill, **new** commercial and industrial buildings to be floodproofed to the FP1/FP2 classification (this classification scheme will be discussed later in this chapter).

Many Minnesota cities and counties have adopted floodproofing standards more restrictive than minimum state and federal standards. The local ordinance should be reviewed before any permit is issued authorizing floodproofing as an alternate approach to elevating a building on fill.

CHECK THE SPECIFIC LANGUAGE OF YOUR ORDINANCE!

The review of the adequacy of a floodproofing proposal must be based on a set of use and building standards. The U.S. Army Corps of Engineers' **Floodproofing Regulations** has been adopted by reference into the State Building Code (SBC). All Minnesota cities and counties administering the SBC, by default, are also administering the Corps' Floodproofing Regulations. Communities not administering the SBC must adopt, by reference, the U.S. Army Corps of Engineers' Floodproofing Regulations or similar standards in order to allow floodproofing as a conditional use.

The intent of this chapter is not to turn zoning administrators and other local officials into floodproofing experts; rather, the objective is to assist community officials in understanding the basic concepts of floodproofing and in administering their own ordinance as it relates to floodproofing activities.

CONCEPT OF FLOODPROOFING

Floodproofing is a composite body of techniques and approaches for preventing flood damage to the structure and contents of buildings in flood hazard areas. Examples of floodproofing include the placement of levees, dikes, or walls around individual structures; watertight closures for windows, doors and other openings; wall reinforcement to resist lateral pressure and debris flow; elevation of a building on pilings or fill; use of membranes, paint or other substances to reduce water seepage into buildings; and the installation of check valves at sewer and utility locations to prevent entrance of flood waters.

Floodproofing is the technique of building new structures in the floodplain (or modifying existing structures) in such a way that the structures are, by their design and composition, afforded protection against floodwater and floating debris. Thus, floodproofing enables development in low-hazard areas of the floodplain normally where:

1) there is only moderate flooding with low flood stages against the building, low velocity and short duration;

2) a structural flood control project is not feasible;

3) structures essential to activities dependent on riverine locations need some degree of protection; or

4) a higher degree of protection than that provided by a flood control project is desired.

A decision to use a particular floodproofing method to reduce flood damages must be based on the characteristics and use of the individual structure. It is important to understand that these techniques are not a guaranteed solution, but rather their success depends on how they relate to the structural condition of a building, local soil characteristics, and the type of flooding that will occur.

CLASSIFICATION OF FLOODPROOFING

The various floodproofing techniques commonly used can be categorized by two classification schemes. The first scheme identifies the amount of human action required to implement the floodproofing measures prior to a flood event. The second classification pertains to whether the interior building spaces are kept free of floodwater or whether the building is intentionally flooded to equalize water pressure.

These two classification schemes are then used to classify the floodproofed structure (FP1-FP4). This classification is based on the level of protection afforded the particular building against a 100-year or 1% chance flood.

Human Intervention

Specific floodproofing measures are classified as permanent, contingent, or emergency. **Permanent** measures are typically incorporated into the design of new structures and do not require any advance flood warning or availability of persons to initiate action. Permanent floodproofing, such as elevation on pilings or columns, is always in place and reduces the element of human error. **Contingent** or partial floodproofing measures, such as prefitted window and door closures, require some type of human action to make the floodproofing measures operational at the time a flood warning is announced. Contingent measures require someone to be at the site during the flood warning and that an adequate flood warning plan exists for the community . **Emergency** floodproofing measures, such as sandbagging, are made operational during an actual flood event. Emergency measures are temporary and should be carried out according to a pre-arranged plan. Table **6.1** gives a summary of the classification of specific floodproofing measures.

Table 6.1

Classification	Definition	Examples
Permanent	Do not require any action to initiate. Usually incorporated into the design of the building.	- continuous, reinforced walls, floor. etc/ - water closures - flood walls - levees - elevation of structure
Contingent	Require human action to initiate at time of flood warning	- removable flood shields - watertight doors - movable flood walls - removal of contents
Emergency	Measures used and initiated at the time of flooding	- sandbagging - temporary levees

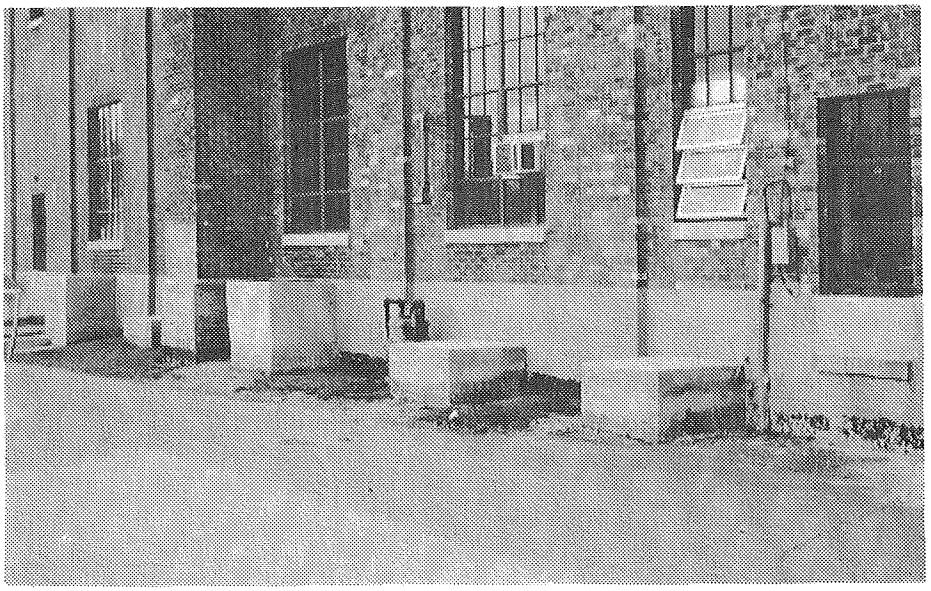


Figure 6.1 Permanent floodproofing

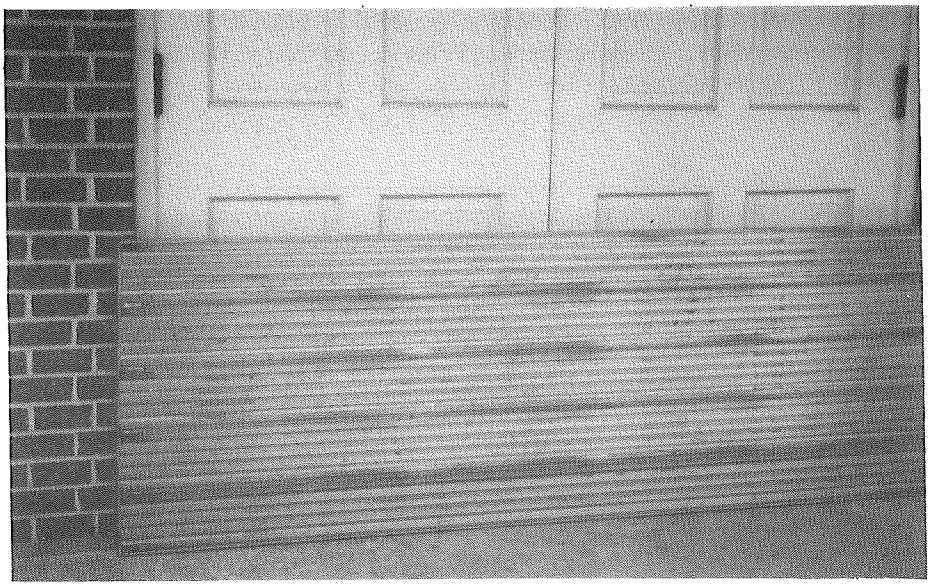


Figure 6.2 Contingent floodproofing

Figure 6.3 Emergency floodproofing

Dry vs. Wet Floodproofing

Floodproofing measures are also categorized as employing either **dry** floodproofing or **wet** floodproofing techniques. Dry floodproofing can employ a number of techniques to prevent water from entering a building during a flood. Wet floodproofing techniques provide for the intentional flooding of interior spaces to offset the lateral water pressures against the walls and foundation of a building during a flood. These two methods are not applicable in all building situations; their strengths and weaknesses will be highlighted below.

Dry Floodproofing

Five factors need to be accounted for when dry floodproofing is proposed for an existing or new structure:

1. All outside walls must be capable to resist the lateral pressures exerted by the floodwaters;

2. The floor must be capable to resist the upward pressure exerted by the floodwaters and saturated soil conditions;

3. The building must have enough mass (weight) to prevent flotation;

4. The walls and floors must be watertight and all openings below the flood level (if any) must be closed and made watertight; and

5. The building must be able to withstand the impact of floating debris.

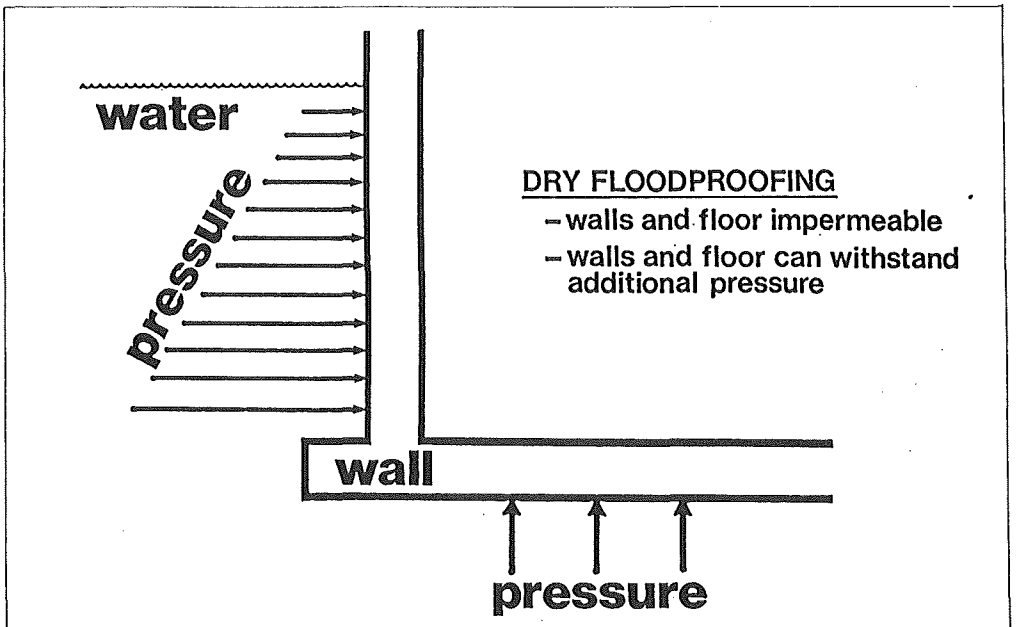


Figure 6.4 Dry floodproofing

Dry floodproofing measures should be designed by an experienced structural engineer who can prepare the best design to take into account the expected flood levels, velocities, soil conditions and the particular building design. If the dry floodproofing is done incorrectly, the walls or floor may collapse during a flood, causing more damage than if the building were allowed to flood.

Dry floodproofing is generally most feasible when incorporated into the design for a new building. Certain measures can be incorporated during construction, including use of reinforced walls and floor, subsurface drainage, impermeable membrane or sealant for all surfaces below the expected flood levels and sewer backup valves. These measures are more difficult to install in existing buildings.

It can be extremely difficult to dry floodproof an existing building where the depth of flooding is greater than two feet above the lowest floor, including basement. The difficulty arises when trying to offset uplift and lateral water pressures. Reinforcing outside walls and/or use of subsurface drainage can be used with extreme care to offset the additional pressure. Use of a low level berm or elevating a building on fill or pilings are alternate dry floodproofing techniques for existing buildings.

Wet Floodproofing

Most of the expense and dangers involved in dry floodproofing result from the tremendous pressure exerted against a building by the unequal water levels inside and out. For an existing building, wet floodproofing is usually the easiest and cheapest method to alleviate this problem of major structural failure. Damage potential could still exist for the buildings contents and utilities.

Wet floodproofing provides for the equalization of water pressure by allowing water on the inside of the building to reach the same level as the floodwaters on the outside of the building. Obviously, the internally flooded areas should be capable of being flooded without serious damage. Items difficult to evacuate should be permanently moved to higher levels. A waterproofed floodwall should be constructed around items which are not relocated, such as a furnace or water heater. All utilities would also have to be raised above the anticipated flood levels.

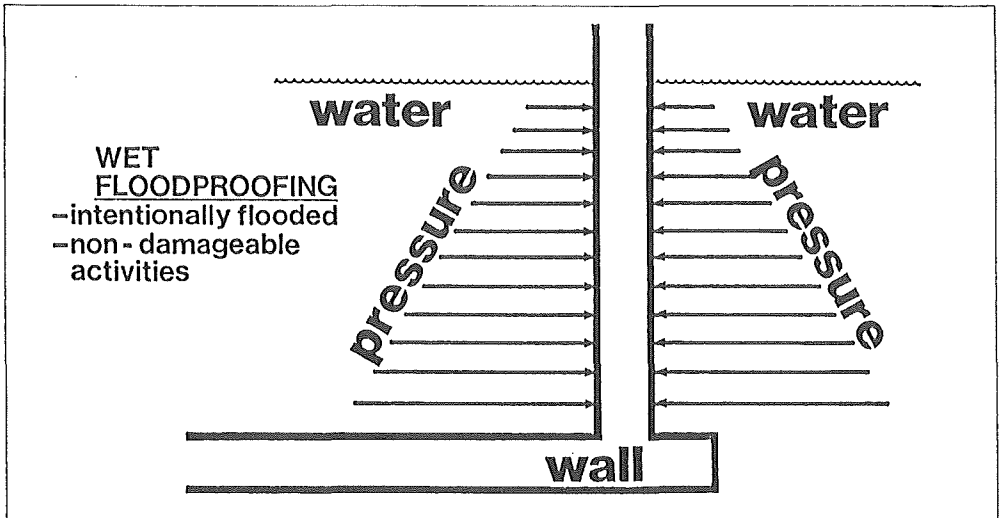


Figure 6.5 Wet floodproofing

Wet floodproofing severely limits the use of the interior spaces to primarily storage of materials easily evacuated. Wet floodproofed residential basement spaces should obviously **never** be converted into habitable space such as a bedroom, kitchen or a family recreation room.

Wet floodproofing is rarely utilized in new construction. In addition to restrictions on the use of internally flooded spaces, current FEMA standards (the minimum state and federal floodproofing standards will be discussed later in this chapter) would allow wet floodproofing only through the variance procedure. Several other more suitable flood loss reduction techniques are usually available for new construction. While wet floodproofing should rarely be permitted for **new** construction, it is often the only viable flood damage reduction technique for **existing** floodplain development.

CLASSIFICATION OF FLOODPROOFED STRUCTURES

In classifying floodproofed structures, the classification is based on the **level of protection** against the 1% chance flood and the **method of floodproofing**. The following floodproofing categories are found in the State Building Code (SBC).

Floodproofing Category	Human Intervention	Wet or Dry Floodproofing
FP1	No	Dry
FP2	Yes	Dry
FP3	No	Wet
FP4	Yes	Wet

Briefly, the local floodplain ordinance will specify which of these floodproofing options (FP1-FP4) are allowed for various building types and uses. For example, new residential construction is normally a permitted use if elevated on fill above the RFPE; floodproofing of residential structures, other than elevation on columns, pilings, etc., is usually not permitted. Only those communities with a formal "Basement Exception" from FEMA may allow residential basements and they must be floodproofed to the FP1 classification. Federal standards will require new or substantially improved commercial or industrial construction to be floodproofed to the FP1 or FP2 classification.

The owner of an **existing** building in the floodplain may wish to alter or modify the structure to generally implement various floodproofing measures to reduce future damages. These activities are permissible and may apply wet or dry floodproofing techniques as appropriate for the building design and use. Caution should be exercised in those situations when the floodproofing measures, in combination with all other modifications or alterations (for example in a complete building rehabilitation) exceed 50% of the market value of the structure. FEMA would require these substantial improvements to meet the dry floodproofing standards for new construction identified above.

Example

Two basement walls of a single family residence are destroyed during a flood. The first floor of this hypothetical house is one foot below the RFPE. As part of the reconstruction, the owner decides to dry floodproof the basement by reinforcing all walls and the floor and permanently block all low openings. This action does not constitute a substantial improvement.

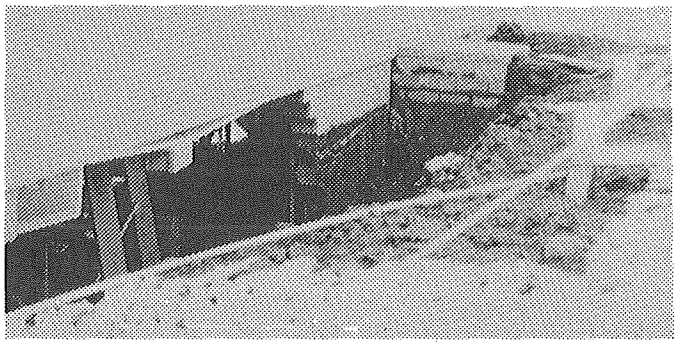


Figure 6.6 Flood-damaged basement

Assume within this particular community that a building permit is required for this work. The building code official should require that the specific construction details of the floodproofing be accomplished in accordance with the Floodproofing Regulations. In addition, the building permit, in accordance with the SBC, should prohibit the use of the basement area for human habitation, such as a bedroom. The basement should more properly be used to house the furnace, hot water heater, freezer, etc. and to store non-hazardous materials.

Even though this individual has substantially reduced the flood damage potential for his/her residence, the house remains a nonconforming structure. The first floor remains below the RFPE and the community's ordinance does not allow floodproofed residential basements as a permitted or conditional use unless the community has received a basement exception.

LIMITATIONS

Any floodplain development entails a certain element of risk. The most failsafe approach would not allow any floodplain development. This may not be a practical alternative in many, if not most, communities. The **best** method of protecting floodplain development is by elevating the lowest floor of the building to above the RFPE on fill material. Even this method is subject to risk due to the possibility of flood events occurring greater than a 100-year flood or flood flows increasing over time resulting from urbanization of the watershed. Floodproofing, as a means of building protection, has additional limitations which limit its effectiveness in many situations.

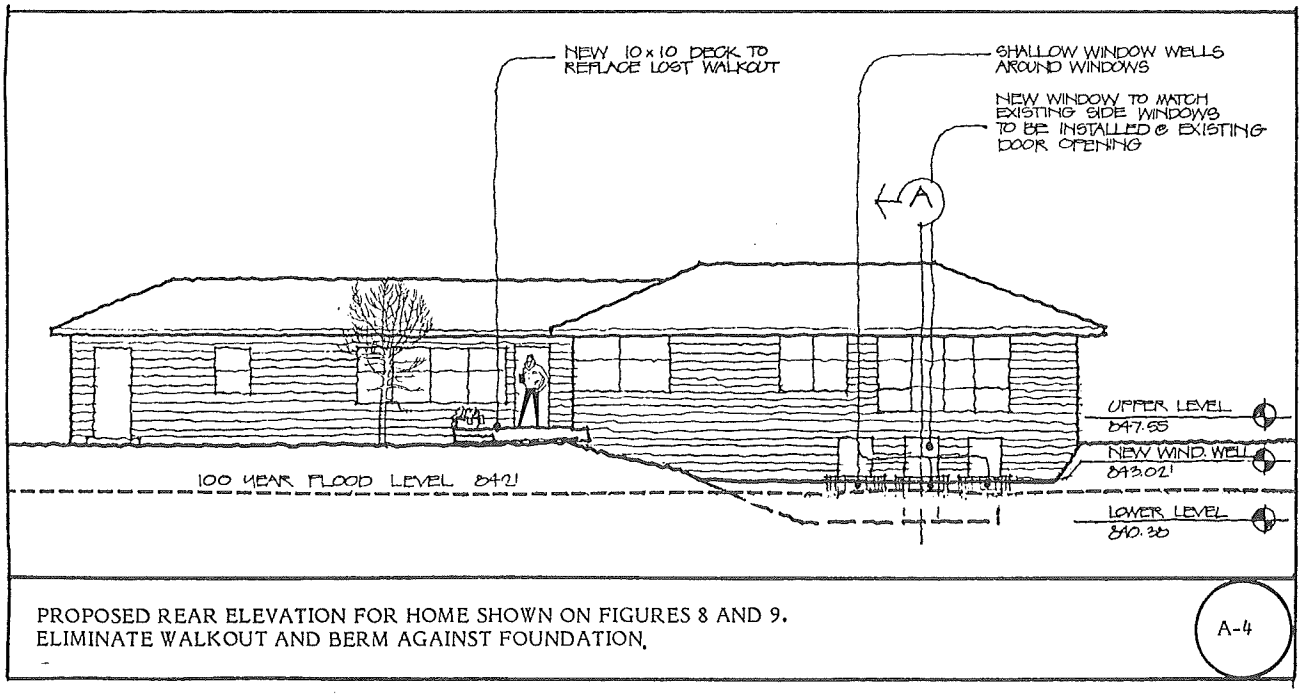
The engineering and construction aspects of various floodproofing techniques can become complex. For example the consequences of failure can be significantly higher when floodproofing an existing building than if the building were allowed to flood. Floods in excess of the design flood, inadequately reinforced walls and floors, human error and lack of sufficient warning time to implement contingency measures are examples of potential causes of structural failure.

Many floodproofing applications require some form of human intervention to implement the floodproofing methods. Someone must therefore always be available during times of potential flooding. This is especially true in rapid-rise or flash flood situations. Knowledge and experience in implementing required contingency floodproofing measures may be lost with a change of building ownership or staff turnover.

Many floodproofing measures require periodic maintenance, such as sewer backup valves, closures, sump pumps, floodwalls and low level berms. The infrequent use of these items may suggest a low priority for maintenance. For example, experience in portions of Minnesota where manual sewer backup valves have been installed indicate these devices require periodic use to maintain their effectiveness. Unfortunately, many were found to be rusted in the open position and could not be closed prior to an actual flood event and therefore provided no flood protection.

Floodproofed buildings should not be occupied during times of flooding due to the safety factor involved with possible failure. Additionally it is often difficult to provide emergency access to floodproofed buildings not adjacent to high ground.

Finally, it is more difficult to administer and monitor floodproofed building activity than a building which is simply elevated on fill. The additional conditions placed on the use/building permit requires periodic inspection during construction and in the years following construction. For example, the SBC does not allow "habitable" living areas below the RFPE. Even though a community with a basement exception may allow a residential floodproofed basement on the condition it is used for utilities and storage only, the local community has a responsibility to insure this space is not converted to an extra bedroom or recreation area. This monitoring of use restrictions of floodproofed areas is difficult, if not impossible to accomplish.



PROPOSED REAR ELEVATION FOR HOME SHOWN ON FIGURES 8 AND 9.
ELIMINATE WALKOUT AND BERM AGAINST FOUNDATION.

A-4

Figure 6.7 Floodproofing measures designed by a competent engineer or architect can significantly reduce the flood damage potential.

STATE BUILDING CODE

The State Building Code (SBC) by virtue of adopting the U.S. Army Corps of Engineer's "Floodproofing Regulations" requires that all new structures and their mechanical systems (electrical, plumbing, heating, ventilation, air conditioning, and fire protection) in the area subject to the code meet minimum building standards. These standards are intended to safeguard life, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, and the location and maintenance of structures and equipment. The Building Code Division of the Department of Administration develops and promulgates the code and amendments thereto and assists the municipal building code officials in code administration.

The SBC is a free standing document from a community's floodplain zoning ordinance. Standing by itself it would allow either wet or dry floodproofing, provided the floodproofing classification (FP1-FP4) is consistent with the proposed use of the structure. Those communities enforcing the SBC that adopt floodplain regulations which allow for floodproofing of structures must meet the floodproofing standards in the SBC. We have seen that FEMA's regulations do not allow wet floodproofing of new or substantially improved non-residential structures and allow only the floodproofing of residential basement where a basement exception has been received by the community. Therefore, the zoning ordinance text must stipulate that certain wet floodproofing options allowable in the SBC are not permissible in the community.

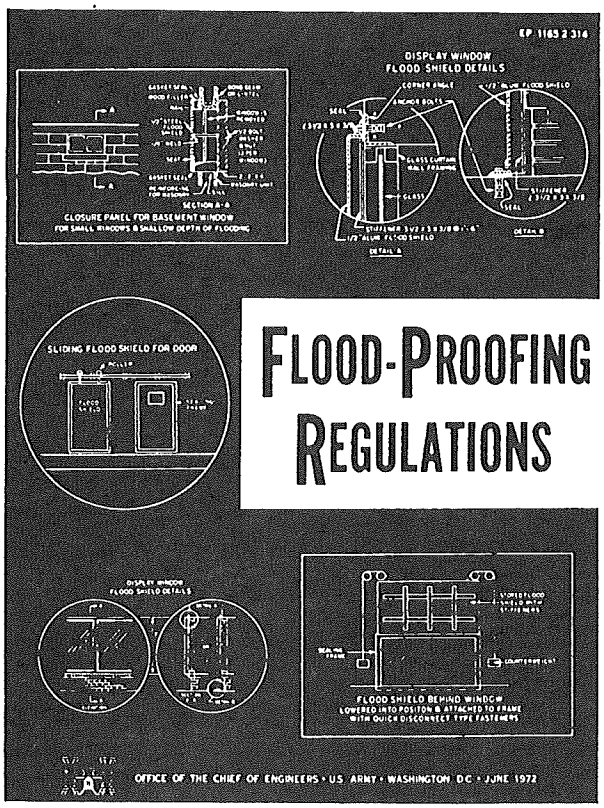
The SBC is enforced at the local level by state-certified building officials who are appointed by the local governing body. Inspections of buildings and reviews of building plans are made by the local building official to insure conformance with the code. If necessary, the building official should consult engineers, architects, state and federal agencies, and the State Building Code Division for assistance in the review of plans and interpretation of data.

Floodproofing Regulations

"Floodproofing Regulations", the model code referred to previously, was adopted by reference and made part of the State Building Code by Minnesota Regulations SBC 203. Also contained in SBC 203 are amendments that adapt the model code to the terminology and requirements of the State floodplain management program. The floodproofing provisions of the State Building Code apply only to those municipalities that have adopted the code and have designated floodplain areas on their official zoning map. Floodproofing provisions of the State Building Code are intended to provide a means of insuring that structures, permitted to be built within the floodplain by local zoning ordinances, are adequately floodproofed. In addition, they provide a basis for insuring that alterations, additions or repairs to nonconforming structures will upgrade the structures to meet adequate floodproofing standards.

The main body of the Floodproofing Regulations, chapters 5 through 13, provide specific guidance on most aspects of floodproofing design and construction. Chapter headings are:

Waterproofing
Structural Requirements
Closure of Openings
Internal Flooding and Drainage
Flooring
Walls and Ceilings
Contents of Buildings and Structures
Electrical
Mechanical



Each chapter typically begins by stating objectives and general performance standards for that particular aspect of floodproofing. The standards may vary depending on the floodproofing method being employed and the degree of watertightness desired. Each chapter then provides greater detail on appropriate building materials, construction techniques, specific electrical and mechanical requirements, etc.

The architect/engineer and local building code officals have been given fairly broad discretion in the application of the Floodproofing Regulations to the actual building design, as illustrated by the following example.

Example

Chapter 9 "Flooring", governs the design and use of various types of floors and floor coverings. The chapter begins by providing basic guidelines (performance standards) to determine if a particular floor is subject to flood-related damage:

> Section 900.2 Basis For Restriction: Floor systems and flooring materials are restricted according to their vulnerability to flood water. For the purpose of these Regulations, vulnerability of a given floor or floor material may result from one or more of the following:
>
> (1) Normal suspended-floor adhesives specified for above grade use are water-soluble or are not resistant to alkali or acid in water, including ground seepage and vapor.
>
> (2) Flooring material contains wood or paper products.
>
> (3) Flooring material is not resistant to alkali or acid in water.
>
> (4) Sheet type floor coverings (linoleum, rubber, vinyl) restrict evaporation from non-W1 slabs.
>
> (5) Flooring material is imprevious bud dimensionally unstable.

The chapter continues by developing a floor classification scheme: Class 1 through Class 5. Class 1 type flooring requires essentially dry space while Class 5 floors can be used in semi-closed or outside areas with full exposure to floodwaters. Classes 2,3 and 4 type flooring range between the above two extremes.

The chapter concludes by listing various flooring materials and indicating an appropriate class. For example, carpeting and linoleum are Class 1 while clay tile is considered Class 4.

The important point to remember is that the listing of materials and respective classes is provided only as an **aid** to architects and building officials. New products, or different application techniques may require special consideration. As stated in this chapter:

> "The following chart is intended as an **aid** to the Owner, Architect/Engineer and the Building Official in assessing the vulnerability of typical materials with respect to the criteria stated in 900.2. In disputes arising over the merits of particular materials or methods of construction, the Building Official shall be guided by and decided on the basis of those criteria."

In summary, we recommend that local building code officials carefully review the Floodproofing Regulations whenever a floodproofed building is proposed. Certain provisions are mandatory, such as the level of flood protection. For many other provisions, such as allowable building materials, more discretion is granted to architects/engineers and local codes officials to use their best judgement than may at first appear.

MINIMUM STATE AND FEDERAL FLOODPLAIN MANAGEMENT STANDARDS

State and federal regulations have established minimum standards for permitted floodproofing activities in the designated floodplain. As earlier stated, many Minnesota cities and counties have adopted ordinances more restrictive than the minimum standards.

The discussion of minimum state and federal standards is complicated by the conflicting standards found in the state and federal regulations. Further complications have resulted from the changing policy and interpretation of these rules during the last several years. Finally, even though a community may legally grant a variance from these standards, the flood insurance implications may severely limit the practicality of this approach.

If after reading this section (and chapter) on floodproofing, questions still remain in regard to your particular situation, please do not hesitate to contact the DNR or FEMA.

Residential Structures

As previously stated, new residential structures elevated with their lowest floor, including basement, above the RFPE in the flood fringe district are permitted uses. Alternate methods of elevating a residence, such as piling or masonry walls, are allowed as a conditional use.

Residential Basement Construction

The specific wording of the current National Flood Insurance Program (NFIP) rules and regulations dated October 26, 1976 does **not** allow a community outright to permit the construction of residential floodproofed basements below the 100 year flood level. The NFIP has established a nationwide "basement exception" process where, if a community is successful in getting a basement exception, floodproofed basements would be permissible and the floodproofing would be credited for flood insurance premium rating purposes. In the absence of a formal community basement exception, the NFIP rules when read literally would require a community to grant a variance to its floodplain ordinance prior to granting a permit for a floodproofed basement.

Many Minnesota communities during the 1978-1983 period were allowed to adopt floodplain regulations which permitted "dry" floodproofed basements (FP1/FP2) in the absence of a formal basement exception. The given community's approval must be via the conditional use permit review process with the following standards met: 1) the basement area must not be used for human habitation; 2) the building must be designed and certified by a registered professional engineer or architect; and 3) the permit applicant must be informed that, in the absence of a formal community basement exception, flood insurance premiums could be prohibitively expensive.

Until recently, this alternate conditional use permit review procedure (in the absence of a basement exception or variance) was deemed acceptable by the Federal Emergency Management Agency (FEMA) in Minnesota. This was so because: 1) FEMA was, but no longer is, proposing an amendment to the October 26, 1976 rules and regulations to permit residential basement construction; and 2) in the interim period until such time as a rule revision was effectuated, FEMA accepted the conditional use permit process as being sufficiently flexible to provide a thorough case-by-case review of residential basement proposals.

Because FEMA is no longer willing to accept the conditional use permit review procedure and is no longer considering a rule revision to allow residential basement construction outright (and credit floodproofing for insurance rating purposes), the Department of Natural Resources strongly recommends communities **not** to grant conditional use permits for residential basement construction in the absence of a formal community basement exception. Further, communities which presently have adopted floodplain ordinances which allow for residential basement construction as a conditional use are encouraged to amend said ordinances at the earliest possible date and delete this provision until a basement exception is received.

Commercial and Industrial Buildings

State and federal regulations are more lenient in regard to floodproofing commercial and industrial buildings. These structures may be floodproofed to the FP-1/FP-2 classification as a conditional use. The floodproofing methods must be designed and certified by a registered professional engineer or architect.

Accessory Structures

Accessory structures constructed in the floodplain also require flood protection. Due to the generally lower degree of flood risk, more latitude in building design and construction is generally afforded accessory structure.

There is no specific language in the Minnesota Floodplain Management Regulations in regard to permitted floodproofing classifications for accessory structures. As specified in the Sample Floodplain Ordinance developed by the DNR, accessory structures are permitted in the flood fringe district provided they are compliant with the SBC. Accessory structures to open space uses are permitted in the floodway district provided they do not adversely affect flood elevations.

General design standards for accessory structure are similar to standards for principal structures:

-only damage resistant materials can be used below the RFPE;
-all structures must be anchored to resist flotation;
-storage of bouyant, flammable or other hazardous materials are normally prohibited;
-storage of non-hazardous material and equipment is permissible if readily removable from the floodplain in the time allowed after a flood forecast;
-human habitation is not allowed; and
-gas, electrical and other services must be elevated or floodproofed.

Example

A detached garage is a frequent example of an accessory structure built in the floodplain. The preferred construction technique is elevating the garage on fill to the RFPE. However, in many situations this approach is not practicable, especially in previously developed residential areas. Most local floodplain ordinances permit garage construction in the floodplain if floodproofed in accordance with the SBC.

As stated earlier, the Floodproofing Regulations grant local building code officials certain latitude in applying the regulations to actual building design and construction. This has resulted in various communities applying different design specifications for floodproofed structures. One southeast Minnesota city does not permit any portion of a floodproofed garage below the RFPE to be constructed using wood. Instead, concrete blocks are used, as illustrated below.

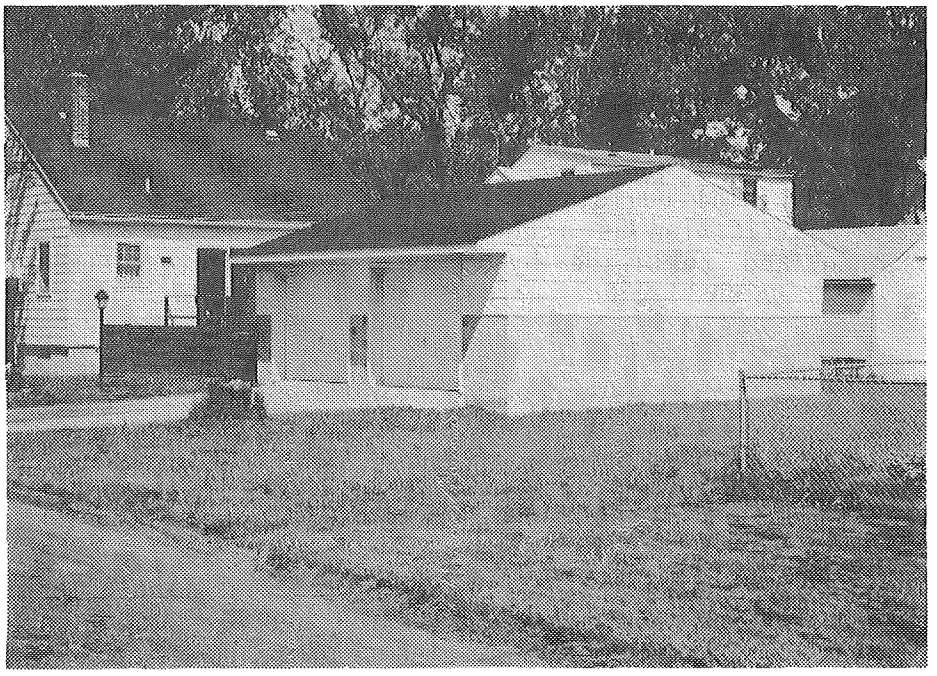


Figure 6.8 Floodproofed garage

A northwestern Minnesota community allows the use of treated lumber in the construction of a floodproofed garage. In this second community, it is reasoned that treated lumber will not be damaged if submerged for short periods of time. Other provisions of the SBC, such as the secure anchoring of the building to the foundation, are enforced similarly between the two communities.

One approach is not necessarily better than the other. It is recommended that a community interpret and enforce the Floodproofing Regulations, consistently and reasonably, in a manner in which they are most comfortable.

DATA NEEDS

By their very nature, a conditional use or variance requires special attention by the community before a permit can be issued. In order to evaluate the particular floodproofing proposal, the local governing board, i.e., board of adjustment or planning commission, will need additional information not normally required for other types of building activity. This additional information primarily includes the characteristics of the likely flood event affecting the property and the specific characteristics of the building site.

Flooding Characteristics

The characteristics of the likely flood event will greatly influence which alternate floodproofing measures are appropriate, if any. The flooding characteristics which should be considered include:

- the rate of rise and fall of floodwaters
- amount of warning time realistically available
- duration of flooding
- occurrence of floating debris or ice
- depth and velocity of floodwaters

Along a stream which rises quickly following a heavy rainstorm and where little or no warning of impending floods is available, a floodproofing technique which requires human intervention is probably **not** feasible. This would be especially true for facilities which do not have personnel on-site 24 hours per day or on standby to implement the floodproofing measures.

Any floodproofing proposal requiring human intervention should have a **written** plan of action. This plan of action should include specific details concerning:

- who is responsible for implementing the floodproofing measures;
- when the plan is put into effect;
- the amount of warning time required to fully implement the floodproofing plan
- the specific steps to be taken and by whom;
- a regularly-scheduled practice drill

Most floodproofed buildings will not be occupied during times of flooding. Depending on the effect of this "down-time" to the community, a floodproofing technique other than elevation on fill with "dry" access, may not be an appropriate proposal.

Any building **not** elevated on fill in the floodplain may be subject to damage by floating debris or ice. The distance from the building to the stream channel and the depth and velocity of floodwaters at the building site are factors involved in estimating the degree of risk. Any building with exposed walls or building supports below the 100-year flood level would have to be designed to withstand the potential impact loadings.

Building Site

In addition to the flooding characteristics, the local community should closely evaluate the particular building site when reviewing a request for a floodproofed building. Specific items of concern include:

- soil characteristics;
- groundwater table, both normal and during times of flooding;
- depth of flooding
- access

Soil characteristics are important factors in building design to account for erosion, sedimentation, infiltration and seepage. One of the most important soil characteristics is permeability, a measure of the ability of water to flow through a particular soil. Permeability, to a large degree, controls the amount and rate of surface water infiltration and the zone of saturation.

Groundwater and seepage are major concerns when floodproofing is being considered. The occurrence of a high groundwater table can be a significant component of the hydrostatic forces that develop during flooding and must be considered in the structural design of footings, foundations and basement walls. Structures below the ground level must also prevent seepage into the building unless wet floodproofing is being accomplished.

The depth of flooding as compared to the proposed low floor elevation is also important when designing a dry floodproofed building. As the flood depths increase, so must the strength of the walls and foundation be increased. Additionally, provisions for closing any openings below the anticipated flood levels must be included in the building design.

Finally, available/proposed access to the building must be evaluated prior to the granting of a permit. Of particular concern is the ability to provide emergency egress and ingress and police and fire protection during times of flooding.

RELATED DNR PROGRAMS

The Minnesota floodplain management program is one of four significant water resource programs impacting land and water development activities administered by the DNR. It is important to understand the interrelationship of these programs to effectively administer the provisions of the floodplain management program. This chapter will review the legislative authority, goals and objectives, general provisions and interrelationships of these programs.

SHORELAND MANAGEMENT PROGRAM

The Minnesota Legislature passed the Shoreland Management Act in 1969 to provide guidance for the wise development of shorelands of protected waters. This Act strives to preserve and enhance the quality of surface waters, preserve the economic and natural environmental values of shorelands and provide for the wise utilization of water and related land resources of the state. To further this purpose, the Commissioner of Natural Resources promulgated model standards and criteria for the subdivision, use, and development of shoreland in unincorporated areas of the state. These standards: a) designate the minimum acceptable lot size and length of water frontage suitable for a building site; b) regulate the placement of structures in relation to shorelines and roads; c) designate types of land uses; d) regulate changes in bottom contours of lakes; e) preserve natural shorelands through the restriction of land uses; f) establish procedures for variances from the minimum standards and criteria; and h) include a model ordinance. These standards were promulgated in 1970 as "Minn. Reg. Cons 70-77 (new citation: Minn. Rule 1983 Parts 6120.0100 - 6120.2100), Rules and Regulations of the Department of Conservation Relating to Statewide Standards and Criteria for the Management of Shoreland Areas of Minnesota".

The definition of shoreland for purposes of these standards is as follows:

> Shoreland means land located within the following distances from the ordinary high water elevation of protected waters: 1) land within 1000 feet from the ordinary high water elevation of a lake, pond or flowage; and 2) land within 300 feet of a river or stream or the landward extent of a floodplain delineated by ordinance on such a river or stream, whichever is greater.

The legislation required counties to adopt shoreland management ordinances incorporating the above-noted minimum state standards or more restrictive standards by July 1, 1972. Currently 85 counties administer shoreland ordinances; Hennepin and Ramsey Counties were excluded from the adoption requirement since both counties are virtually 100% incorporated. Municipalities were not covered in the original legislation.

In 1973, the legislature amended the Shoreland Management Act to include municipalities. In March of 1976, the Commissioner of Natural Resources promulgated Rules and Regulations relating to "Standards and Criteria for the Management of Municipal Shoreland Areas of Minnesota" (new citation: Minn. Rule 1983 Parts 6120.2500 - 6120.3900). Since then, DNR staff have been reviewing existing land use controls of municipalities to identify deficiencies in relation to minimum state standards. As the Act requires, each city is then given one year to upgrade its controls to meet or exceed state standards. Currently about 80 municipalities of the 300 that have lakeshore have adopted state approved ordinances.

WILD AND SCENIC RIVERS AND ASSOCIATED PROGRAMS

The Wild & Scenic Rivers program in Minnesota is an outgrowth of three legislative and one congressional action (Figure 1).

The Lower St. Croix River National Scenic Riverway (Taylors Falls to the Mississippi River) was designated through the Lower St. Croix River Act of the 92nd Congress (Public Law 92-560) in 1972. This act resulted in a comprehensive management plan, developed cooperatively by the U.S. Department of Interior and the States of Wisconsin and Minnesota. In 1973, the Minnesota Legislature formally recognized the federal designation by stating "The preservation of this unique scenic and recreational asset is in the public interest and will benefit the citizens of Minnesota". This legislative action directed the Commissioner of Natural Resources to promulgate rules that address permitted and non-permitted uses of land within the riverway corridor. These rules specify minimum acreage, frontage and setback requirements for the permitted uses. Performance criteria were also included in the rule to manage all activities in the riverway, consistent with the intent of the Act. The rules for the Lower St. Croix Riverway (MN Regs. NR 2200 new citation: Minn. Rules 1983 Parts 6105.0300 - 6105.0550) were promulgated in March of 1976. All cities and counties within the designated riverway district were required to adopt land use controls consistent with the rules. The DNR must approve local ordinances and assist in their administration.

In 1973, the Legislature established the Minnesota Wild and Scenic Rivers Act in M.S., §104.31. This act declares that certain Minnesota rivers and their shorelands possess outstanding scenic, recreational, natural, historical, and scientific values and it is in the interest of present and future generations that the state preserve and protect these rivers. In furtherance of this policy, the Commissioner was authorized to promulgate rules relating to the designation and management of these rivers. The format of these rules is similar to the Lower St. Croix rule, with the exception that permitted and non-permitted uses are specified according to the particular designation of a river as either: 1) wild; 2) scenic; or 3) recreational. The rules were promulgated in April of 1974 (new citation: Minn. Rules 1983 Parts 6105.0010 - 6105.0250). All of the Rum River, the majority of the Kettle and Cannon Rivers, and portions of the North Fork of the Crow, Minnesota and Mississippi Rivers have been designated. Specific management plans for each designation have been prepared. As with the Lower St. Croix River, local communities within the designated river districts must adopt and administer state approved land use controls. Additional rivers are presently under study for preparation of detailed management plans, although specific wild, scenic or recreational designations of these rivers is considered as one of several management alternatives.

In addition to the state level program, similar management plans have evolved through the efforts of local governments along the Mississippi River headwaters and the middle Minnesota River. These two plans have the same goal as the Wild & Scenic Rivers Act. The Mississippi Headwaters Board and Management Plan was formally authorized in M.S.§116B and the River Bend Management Plan was adopted by a joint powers agreement for six counties along the Minnesota River in 1982.

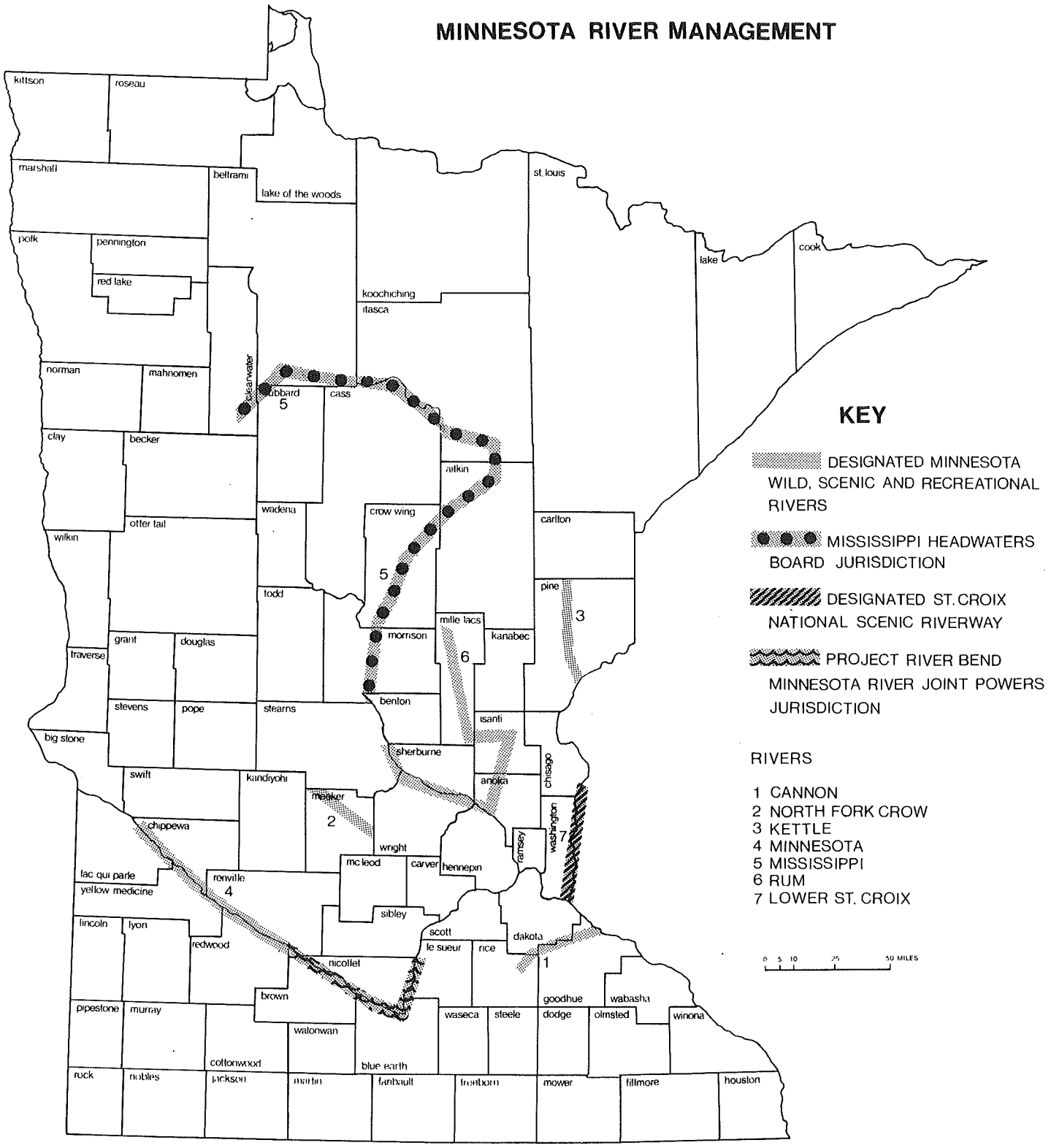

MINNESOTA RIVER MANAGEMENT
kittson
roseau
marshall
beltrami
lake of the woods
st. louis
lake
cook
polk
pennington
red lake
koochiching
itasca
norman
mahnomen
clearwater
hubbard
5
cass
clay
becker
aitkin
wadena
crow wing
carlton
otter tail
wilkin
5
todd
pine
3
mille lacs
grant
douglas
morrison
kanabec
traverse
6
stevens
pope
stearns
benton
isanti
big stone
sherburne
swift
kandiyohi
anoka
chisago
meeker
2
chippewa
wright
washington
7
ramsey
lac qui parle
mcleod
carver
hennepin
renville
4
yellow medicine
sibley
lincoln
lyon
scott
dakota
redwood
le sueur
rice
nicollet
1
brown
goodhue
wabasha
pipestone
murray
waseca
steele
dodge
olmsted
winona
watonwan
cottonwood
blue earth
rock
nobles
jackson
martin
faribault
freeborn
mower
fillmore
houston
KEY
DESIGNATED MINNESOTA WILD, SCENIC AND RECREATIONAL RIVERS
MISSISSIPPI HEADWATERS BOARD JURISDICTION
DESIGNATED ST. CROIX NATIONAL SCENIC RIVERWAY
PROJECT RIVER BEND MINNESOTA RIVER JOINT POWERS JURISDICTION
RIVERS
1 CANNON
2 NORTH FORK CROW
3 KETTLE
4 MINNESOTA
5 MISSISSIPPI
6 RUM
7 LOWER ST. CROIX
0 5 10 25 50 MILES

Figure 7.1

PROTECTED WATERS PERMITS PROGRAM

M.S. Chapter 105 authorizes the Commissioner of the Department of Natural Resources to regulate activities which change the course, current or cross-section of protected waters. The earliest state effort in protected waters regulation dates back to 1937. The current rules, 6 MCAR 1.5020-1.5028, provide for the orderly and consistent review of permit applications by the DNR in order to conserve and utilize the water resources of the state in the best interests of its people. Decisions on permit applications are also guided by the goals and objectives of programs such as shoreland, floodplain, scenic rivers and water surface use management, boat and water safety, protected species management, etc.

A protected waters inventory has recently been completed by the DNR which maps the waters of the state which are subject to this program. Each county has a map showing protected waters and wetlands where a DNR permit must be secured prior to the alteration of the water resource. The protected waters permit program is administered primarily through the DNR Division of Waters' regional and area hydrologists.

INTERRELATIONSHIPS

Each of the programs described above was designed to function independently of the other programs. This is necessary to maintain the individual integrity of each program. There are, however, relationships among the programs that need to be recognized when a specific development proposal is being considered.

The floodplain, shoreland and/or scenic river ordinances adopted by local government generally contain a statement regarding compliance with more restrictive provisions of other sections of the ordinance, separate ordinances or codes. These statements insure continuity of local controls. Floodplain and shoreland ordinances can co-exist as separate ordinances or as combined provisions of a single ordinance. The same is true where Wild & Scenic Rivers management plan provisions have been adopted by ordinance.

As in most any setting where one or more set of regulations are involved, the most restrictive provisions are applicable when inconsistencies exist among the various regulations. This is true whether the discrepancy involves an allowable use, district boundaries, setback requirements or other building standards.

Area of Jurisdiction

The greatest confusion with these programs is often in regard to the area of jurisdiction along rivers and streams and around lakes. The shoreland district boundary extends 300' back from both banks of a stream or river. If a regulatory floodplain district has been established by local ordinance, the shoreland district extends to the limit of the floodplain district in those areas where the floodplain extends greater than 300 feet on either side of the channel. The shoreland district also extends 1000 feet from the shoreline of a lake. However, the shoreland district around a lake does not extend to the limit of the floodplain where the floodplain extends greater than 1000' from a lake.

The scenic rivers program designates regulatory districts up to 1320 feet back from the banks of a designated river. This designation attempts to include those areas possessing outstanding scenic recreational, natural historic or scientific values but may not exceed the 1320' distance. Unlike the shoreland management program, the scenic river regulatory district is not expanded when the limit of the designated floodplain is beyond that of the scenic rivers district.

Mapping of District Boundaries

Floodplain, shoreland and scenic rivers management ordinances are most often adopted as overlay districts to an underlying ordinance. The ordinance will adopt by reference one or more maps or other supporting documentation which establish the various overlay district(s) boundaries. However, many shoreland ordinances do not reference a map, instead, they establish the boundary district in the text of the ordinance.

It is easy to see how it may be difficult to effectively administer both a shoreland and floodplain management program as well as the underlying ordinance. For any development proposal near a stream or lake, the local zoning administrator may have to review the zoning district map, the floodplain maps, the map or ordinance text designating the shoreland district and possible mapping for other regulatory programs. To further complicate matters, the various map sets will often use different bases at varying scales.

It is strongly recommended that those communities administering more than one land use regulatory program develop a single zoning map showing **all** district boundaries. The base map should ideally be of sufficient scale and detail such that district boundary determinations can be easily made.

Two mapping techniques could be used to accomplish this objective. The first involves delineating all district boundaries on a single base map. Each set of district boundaries would have to be carefully transferred from its present map to the new map. The boundaries should be adjusted to reflect the more restrictive standards of another program. For example, the shoreland management district boundaries should be drawn to the outward extent of floodplain in those areas where the floodplain extends beyond 300' on either side of a stream or river channel.

The second mapping technique utilizes overlays to a single base map. Each overlay would contain the district boundaries for one land use program: floodplain, shoreland, underlying zoning as well as any other appropriate district boundaries or setback requirements. The review of any development proposal using a base map and overlays involves: 1) locating the site on the base map; and 2) reviewing each overlay in succession to determine applicable regulatory programs. Figure 7.2 illustrates these two mapping techniques.

Shoreland/Floodplain Management

The importance of floodplain management as compared to shoreland management differs in regard to lakes and streams. The primary goal of floodplain management is flood loss reduction. Floodplain management is most critical along streams and rivers; unregulated riverine development can obstruct flood flows and increase the potential for loss of life and property. Whereas, shoreland management usually takes precedence around lakes where multiple management objectives are critical (e.g., over-crowding of the shoreline and water surface, shoreline aesthetics, water quality, placement of structures above potential highwater elevations, etc.)

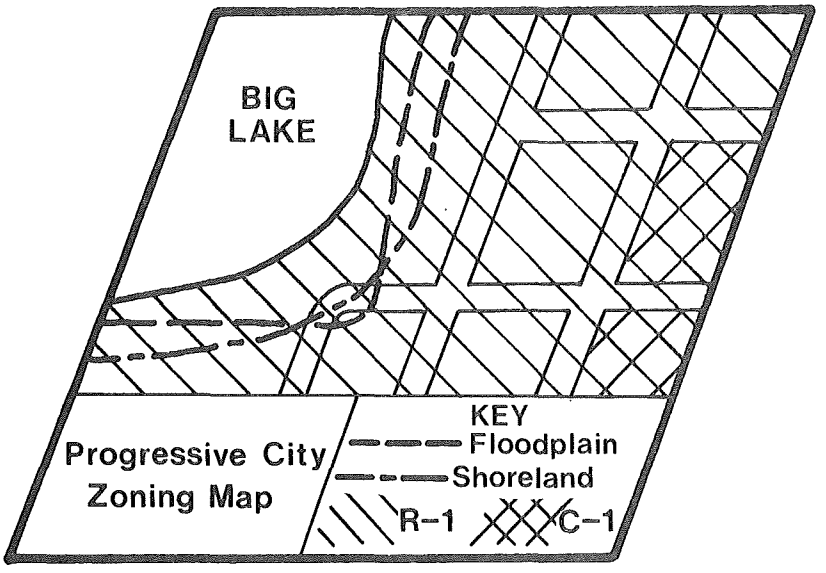


Figure 7.2a. Zoning Map with all district boundaries

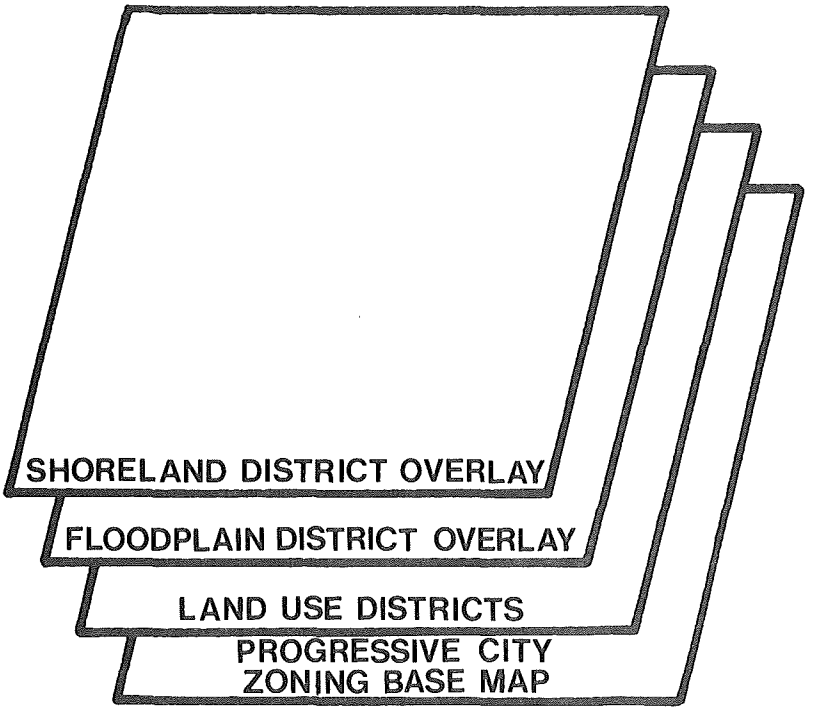


Figure 7.2b. Base map with overlay for each Land Use Program

Lakes

Development proposals which are compliant with the standard provisions of a shoreland management ordinance for lakeshore properties will usually also satisfy the principle floodplain management considerations. The shoreland ordinance will require:

1) a building setback (75 to 200 ft.) from the ordinary highwater level; **and**

2) the lowest floor (including basement floor) of any building to be elevated at least three feet above the highest known water level or, in the absence of a highest known water level, three feet above the ordinary high water elevation.

Since the areal extent of the floodplain around lakes in Minnesota is usually not extensive nor do most lakes exhibit a considerable "bounce" due to a heavy rainfall, the above provisions should, in many cases, be sufficient to insure adequate flood protection.

However, 100-year flood elevations must be used where they exceed the lowest floor elevation requirement of a shoreland ordinance. Unfortunately, 100-year flood elevations are available for very few lakes. Therefore, the floodplain management ordinance will classify low-lying land around lakes as a general floodplain district. As such, the conditional use process must be used to determine an appropriate lowest floor elevation at or above the 100-year flood level for any development proposal in a general floodplain district. At a minimum, the conditional use process should **reasonably** demonstrate that the requirements of the shoreland ordinance equal or exceed the 100-year flood level, even though the 100-year flood level may not be calculated. Historic water level measurements or "old-timers" recollections can serve as the basis for this determination.

One concern not germane to lakes that is applicable to rivers is the designation of floodway and flood fringe districts. The conveyance of floodwaters is not a concern for lakes (except at the outlet). For floodplain management purposes, all areas landward of the OHW on lakes can usually be considered flood fringe, while all areas below the shoreline (OHW) are considered undevelopable.

One note of caution, the above discussion applies to "typical" lakes which have sufficient outlet capacity to minimize lake level fluctuations. Landlocked lakes and lakes influenced by "backwater" affects of a river can experience significant water level fluctuations. A more detailed study may be required to determine an appropriate RFPE then relying solely on the building/lowest floor requirements of a shoreland ordinance.

Rivers

The consequences of flooding along rivers can be more severe than flooding around lakes. In addition, the unwise development and construction activity in the floodplain of rivers can have significant adverse impact on other property owners. For these reasons, floodplain management provisions are critical for areas along streams and rivers.

For any development proposal in a designated riverine floodplain, both an RFPE and floodway/flood fringe districts will have to be determined. These data are available for stream reaches studied in detail in a published flood insurance study; otherwise these data must be determined through the conditional use permit process.

In many instances, especially for the larger streams and rivers, the floodway delineation will exceed the shoreland setback requirement. Conversely, the shoreland setback must be used for building setbacks where it extends landward of the floodway boundary. It must also be remembered that the shoreland district may even extend beyond the limit of the 100-year floodplain. Where the floodplain is less than 300' from either bank of the stream channel, a development proposal need only be concerned with provisions in the shoreland management ordinance.

The shoreland and floodplain management districts are usually treated as overlay districts to the underlying ordinance. Restrictions are placed on allowable **uses** only in the floodway district. It is therefore very important to accurately locate the floodway district since the floodplain ordinance would prohibit non-open space uses in the floodway even though the shoreland ordinance would not expressly prohibit residential or commercial development.

Protected Waters Permits/Floodplain Management

In many instances, permit applications for altering the course, current, or cross-section of rivers and lakes are an outgrowth of a proposed land use activity located primarily above the OHW of the waterbody. For this reason, applications to the Division of Waters are also sent to the local unit of government, hopefully ending up in the zoning office for review and comment as appropriate. Since the review of any permit application by the Division of Waters includes consideration of consistencies with local floodplain, shoreland

and scenic rivers ordinances, input from local planning and zoning officials regarding the status of local ordinance approvals, denials and concerns is relevant. Advising developers and shoreland residents of mutual authorities and coordination among local government planning and zoning staff and DNR area hydrologists can reduce confusion by the public and increase efficiencies in managing the water and related land resources.

Certain activities require review under both the community's floodplain ordinance and the state protected waters permit program. Before a floodplain management concern is realized, the proposed activity must be located in a designated floodplain. Certain activities requiring a DNR protected waters permit involving small wetlands or drainage ditches, and which are not mapped as floodplain, do not require review under the floodplain ordinance.

Activities requiring both a DNR protected waters permit and review under the local community's floodplain management ordinance include:

1) Most stream crossings, including bridges and culverts which either replace an existing crossing or constitute a new crossing. The effect of the new bridge or culvert must be analyzed to assess the impact on flood stages. If an existing crossing is replaced with a bridge or culvert having a larger or smaller waterway opening, the 100-year flood profile will usually be different. If the bridge is located in a detail studied stream reach, the flood insurance study and associated maps should be updated to reflect the revised profiles. Where a new or replacement bridge or culvert increases flood levels, the potential for increased flood damages should be assessed.

2) Stream channel modifications, including placement of riprap or fill in the stream channel, requires approval from the DNR's permit program and from the community's floodplain management ordinance. Fill, development or other activities in or near a stream channel may adversely affect flood elevations. Fill in lakebeds or changes to the natural shoreline of lakes below the 100-year flood level do not usually impact the flooding potential but, never-the-less do require reivew under the communty's floodplain management program unless the community has adopted shoreline regulations which address this issue.

3) The construction of marinas, docks, piers, boat rental facilities and other water-front facilities require that a DNR permit be issued prior to construction. Where these facilities could result in the blockage of flowing water in rivers or at lake inlets and outlets, the community must review the proposal for compliance with their floodplain ordinance. The community must insure that any building is adequately floodproofed or elevated above the RFPE and that obstructions do not increase flood levels.

Most other activities requiring a DNR protected waters permit do not have direct floodplain management concerns.

CHAPTER IX

MAP & ORDINANCE REVISIONS

Conditions within a given community or watershed may change. A community's development priorities may change, new roads and bridges will be constructed, and the urbanization of rural areas will occur. New data to better define the potential flood threat may become available. A recently completed flood control project may significantly alter the extent of the regulatory floodplain in a particular community. Finally, although hopefully not a frequent occurrence, the original flood maps and profiles may be in error. For these reasons, it is expected that the floodplain maps, flood profiles and floodplain ordinances may periodically be amended.

The circumstances behind map or ordinance amendments are usually unique. Each requires special attention by the appropriate local, state and federal agencies. However, all requests for amendments must follow basic guidelines and procedures. By understanding these beforehand, much time and expense can usually be saved.

Except for a Letter of Map Amendment (LOMA), all requests for a map or ordinance amendment should be initiated by the community. Neither FEMA nor the DNR will officially respond to a request forwarded to us by an individual. Assistance will be offered to that individual by providing available background data or detailing the types of analyses required; however, before an amendment proposal is reviewed by the DNR, the local community must first give a tentative approval to the proposal.

LETTER OF MAP AMENDMENT (LOMA)

The Letter of Map Amendment (LOMA) is a special category of amendment. The name itself is misleading. A more appropriate title might be a "Letter of Flood Insurance Waiver", since a LOMA does **not** amend the community's official zoning map.

The LOMA procedure was established by FEMA to facilitate the determination (by FEMA) as to whether or not a structure or proposed structure is located in a Special Flood Hazard Area (SFHA) shown on a FIRM or FHBM. If FEMA decides that a structure is not in a SFHA, the federal mandatory flood insurance purchase requirement is removed for that structure. The local lending institution, may on its own, still require the purchase of flood insurance as a condition of the loan.

A LOMA is **not** issued for unimproved land since flood insurance is available only for structures and their contents (please refer to the following section on "conditional" LOMA's).

A request for a LOMA may be sent directly to FEMA (address given at the end of this section) without review by the DNR. Remember, a LOMA does **not** amend the community's official zoning map, an action which requires both FEMA and DNR approval. Rather, a LOMA should be thought of simply as a **Letter of Flood Insurance Waiver**.

Data Needs

All requests for LOMAs must be supported by sufficient technical or scientific data to demonstrate that the property is not subject to inundation by the 100-year flood. This consists of proving that both the lowest floor elevation (including basement) and the lowest grade adjacent to the structure are at or above the base flood elevation. The following documentation should be submitted to aid FEMA in processing each LOMA request.

1. **A copy of the recorded deed or recorded plat**, indicating both the legal description of the property and the official recordation information (deed or plat book volume and page number) and bearing the seal of the Recorder of Deeds. If the property is not recorded on a plat map, actual copies of the deed, tax map, or other suitable maps are required to aid FEMA in accurately locating the property.

2. **A topographical map**, certified by a registered professional engineer or licensed land surveyor, indicating structure location, ground elevations, and the elevations of both the lowest finished grade adjacent to the structure and the lowest floor (including basement). In event no basement exists, it should be so stated.

3. Data to substantiate the **base flood elevation** (100-year elevation) should be provided from an authoritative source such as the U.S. Army Corps of Engineers, U.S. Geological Survey, Soil Conservation Service, or other federal agency, state and local water resource or planning department, a FEMA flood insurance study, or technical data prepared by a registered engineer.

4. A **signed statement** by a registered professional engineer or licensed land surveyor asserting the accuracy of the information submitted.

5. In certain instances, **additional data** may be required by FEMA in order to make a determination. This may consist of certifications by registered engineers or land surveyors as to the type of structure and whether it is elevated on posts, piers, or pilings, hydraulic calculations on the flooding condition, and development plans indicating dates and extent of fill placement.

Criteria

As previously stated, individuals furnishing technical data which indicate that both the lowest floor (including basement) and lowest adjacent grade elevations of a structure are at or above the base flood elevation can have the federal flood insurance purchase requirement waived. There is one exception to this rule. Structures located on natural (non-fill) high ground can be removed from the SFHA if it can be proven that only the lowest adjacent grade elevation was above the BFE when the area was originally mapped. The area should then not have been included in the SFHA. Under this scenario, the lowest floor elevation is not considered. Structures that have been elevated above the 100-year flood level by the placement of fill after the date of the FHBM/FIRM must have both lowest floor (including basement) and lowest adjacent grade elevations at or above the BFE in order to receive a LOMA.

Special Considerations

Floodways

The federal requirement for flood insurance will **not** be waived if a structure is located within an officially designated or anticipated regulatory floodway. The floodway is the channel of a stream and adjacent floodplain that must be reserved to efficiently carry the floodwaters. Appeals of floodway designations should be directed to community officials since the floodway is designated and adopted by the community.

Elevated Structures

Buildings which have the lowest floor elevated on posts, piers or pilings above the base flood level in the SFHA will not be removed from the Special Flood Hazard Area, and therefore, from the flood insurance purchase requirement if any portion of the structure (i.e., posts or piers) is still in the Special Flood Hazard Area and below the base flood level.

Sheet Flow Areas

In areas of sheet flow flooding where the flooding depth ranges from one foot to three feet, LOMA's can only be issued if it can be demonstrated that the structure has been elevated with the lowest adjacent grade and lowest floor (including basement) above the sheet flow depth specified on the FIRM.

Conditional Letters of Map Amendment

The federal requirement for flood insurance does not apply to unimproved land, since flood insurance is available only for structures and their contents. However, if construction is proposed on land within a Special Flood Hazard Area, a Conditional Letter of Map Amendment can be issued provided that the proposed structural information meets the same criteria set forth herein for a LOMA. After construction is completed, certified as-built information must be submitted to FEMA for the purpose of obtaining a LOMA. The information required for a Conditional LOMA is basically the same as that for a LOMA.

Property owners and developers should note that a Conditional LOMA merely provides a comment on the proposed plan and does not amend the map or waive the insurance purchase requirement. It also does not relieve federal agencies of the need to comply with Executive Order 11988 on Floodplain Management in carrying out their responsibilities for providing federally undertaken, financed or assisted construction and improvements or in their regulating and licensing activities.

FEMA Evaluation and Response

Upon receipt and evaluation of the required data by FEMA, the individual making the inquiry will be notified of the findings. Should a review of the evidence indicate a structure is, or will be elevated properly to the 100-year flood level, a LOMA or conditional LOMA, respectively, will be issued with copies going to the FEMA servicing agent, the DNR and the community. The time required for FEMA to review requests for LOMA's will generally depend upon the quality and completeness of the data submitted. Requests are usually evaluated within two to four weeks of the receipt of all technical data required to review the case.

RECOMMENDED MAP OR ORDINANCE
AMENDMENT PROCEDURE

IDENTIFICATION OF NEED TO AMEND MAP OR ORDINANCE

Individual, developer or community staff identifies need for map/ordinance amendment

- flood control project is completed
- new development proposed
- floodplain maps are in error

↓

INITIAL COMMUNITY REVIEW

Community identifies required action:

- Floodway boundary revision
- Ordinance (language) revision
- floodplain district amendment

Community decides whether their overall interests are served by an amendment

- If yes: proceed with amendment process
- If no: notify individual-state reasons-no further action required.

↓

INITIAL DNR CONTACT

Community contacts DNR area hydrologist to review:

- procedures
- data availability
- study needs
- level of DNR assistance

↙ **OR** ↘

DATA GATHERING AND ANALYSIS

Developer/community performs all technical analyses

- retain engineer/surveyor
- obtain FIS/computer data from the DNR
- obtain additional survey data, as needed
- consultant performs analysis and submits results to client/community

↓ (1)

DNR performs technical analyses

- DNR requests needed survey data from community
- DNR performs analyses.

↓ (2)

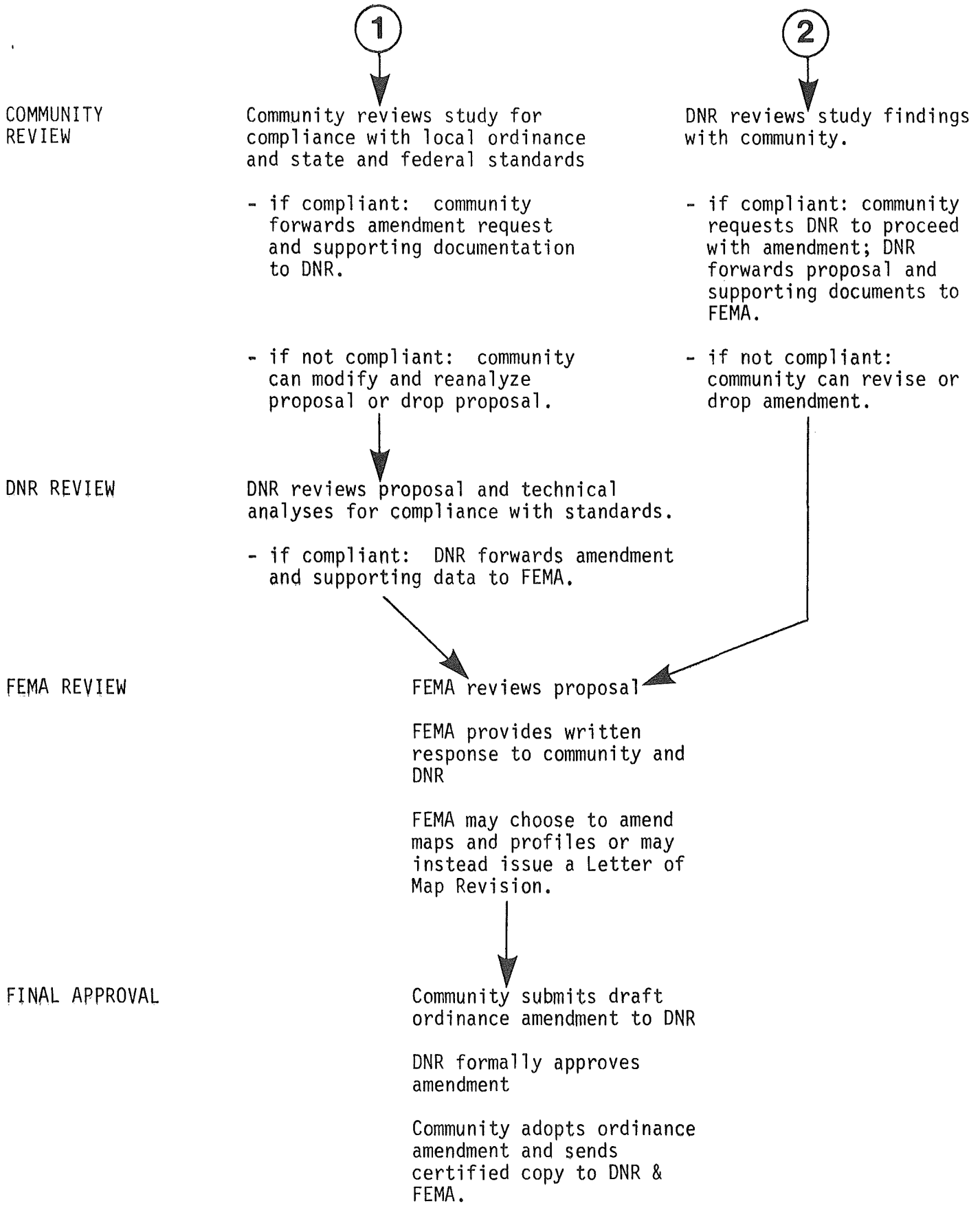

1
2
COMMUNITY REVIEW
Community reviews study for compliance with local ordinance and state and federal standards
- if compliant: community forwards amendment request and supporting documentation to DNR.
- if not compliant: community can modify and reanalyze proposal or drop proposal.
DNR reviews study findings with community.
- if compliant: community requests DNR to proceed with amendment; DNR forwards proposal and supporting documents to FEMA.
- if not compliant: community can revise or drop amendment.
DNR REVIEW
DNR reviews proposal and technical analyses for compliance with standards.
- if compliant: DNR forwards amendment and supporting data to FEMA.
FEMA REVIEW
FEMA reviews proposal
FEMA provides written response to community and DNR
FEMA may choose to amend maps and profiles or may instead issue a Letter of Map Revision.
FINAL APPROVAL
Community submits draft ordinance amendment to DNR
DNR formally approves amendment
Community adopts ordinance amendment and sends certified copy to DNR & FEMA.

Figure 9.1

Technical Data/Analysis Requirements

All floodplain zoning map and flood profile revisions will require supporting documentation. Zoning boundary revisions normally constitute a revision to the outer boundary of the 100-year floodplain or revisions to the floodway/flood fringe districts within the 100-year flood boundary. The required documentation includes:

1) site-specific topographic data;
2) current zoning map and/or flood insurance study maps with proposed district boundary changes clearly highlighted;
3) details of the proposed development activities;
4) hydrologic/hydraulic analysis work report with computer input/output.

The individual property owner or developer requesting a district boundary amendment ordinarily supplies the required survey data and analyses. Each community certainly has the option of obtaining and submitting these data for its citizens. In most instances, however, the individual must hire a licensed surveyor and/or engineer to obtain the necessary technical data.

Under special circumstances, the DNR or FEMA may be able to provide limited technical assistance. In those cases where neither the local community nor individual requesting a map change have the capability or resources to perform the hydrologic/hydraulic analysis, the DNR will assist as time permits. The applicant will be required to supply additional survey data as needed, but all subsequent computer modeling and analyses would be performed by DNR staff. The DNR will not normally provide this service where extensive modifications are proposed or a major development project is being planned. Contact your area hydrologist when this type of assistance may be required.

Before any flood profile or floodway reanalysis in a detail study reach is performed, the DNR should be contacted. The DNR can provide, in nearly all circumstances, background data and computer models developed during the original flood insurance study. These data provide the basis for further reanalysis.

100-YEAR FLOOD PROFILE (BFE) REVISIONS

Changes to the 100-year flood elevations occur less frequently than do modifications to the mapping adopted into ordinance. Since all new development activity in the floodplain must be constructed above the 100-year flood level, it is very important that the 100-year flood profile in a community be as accurate a representation of the flood threat as possible. Underestimation of the potential flood threat will lower the level of protection of future development. An overly conservative 100-year flood profile will result in increased construction costs for new development.

The flood insurance study process included a 90-day base flood elevation (BFE) review/appeal period. Hopefully during this review period, any errors or discrepancies with the original BFE determinations were resolved. However as stated above, conditions within the community or watershed may change which can result in higher or lower flood levels and discrepencies in flood level determinations may not have been discovered and resolved during the appeal period.

The specific action which may require a modification to the BFE's include:

- New data or improved analysis techniques become available to better define the 100-year flood profile.

- Conditions within the watershed may change. Urbanization of a watershed will normally increase downstream flood discharges and flooding. Conversely, if sound stormwater management practices are employed during upstream development, the downstream flood threat may actually decrease.

- Site specific changes, such as a bridge replacement, may affect the severity of flooding for a short reach of a river. If a bridge which caused excessive back-up of water during high flows is removed or replaced with a bridge having a larger waterway opening, the flood profiles should be amended accordingly.

- An error in the original hydrologic/hydraulic analysis is identified.

Data and Study Needs

A complete reanalysis is usually required to revise the 100-year profile. Normally this involves obtaining and modifying the original hydrologic/hydraulic computer models developed during the flood insurance study for that community. These models and supporting documentation can be obtained through your DNR Area Hydrologist.

Less frequent, a flood threat analysis independent of the FIS is performed for a particular community or watershed. For example, a city or watershed district may commission a private consultant to prepare a comprehensive stormwater management plan. The results of this study may conflict with the previously published FIS. The newer study may serve as the basis for a flood profile revision if it provides a **better** indication of potential flooding. This usually implies that better mapping, additional historic information or improved analysis techniques were used.

The agency or consultant performing a profile reanalysis will normally "package" all required data in a study report for submission to DNR and FEMA for review. Specific data items may include one or more of the following:

- narrative description of the proposed revision, and why the change is needed and the study methodology employed;
- revised analysis, including a complete summary of all technical analyses performed;
- revised floodplain mapping, including revised floodplain delineations and the location of any additional cross sections used in the reanalysis;
- revised floodway data table and flood profiles.

The DNR will normally play a more active role in resolving errors found in the original study. In most other situations where a flood profile revision is proposed, the community/developer/individual is usually responsible for obtaining the required data. An FIS restudy by FEMA is a third possibility when extensive changes to the profile or mapping is required; however this option usually requires several years to complete.

FLOODPLAIN ZONING MAP AMENDMENTS

An accurate delineation of the floodplain is beneficial to all communities with a floodplain ordinance. The floodplain zoning map is the primary tool for local officials to determine which properties are located in the floodplain. An accurate, up-to-date map should result in fewer boundary disputes, thereby easing overall ordinance administration.

Of secondary importance, but of concern to local residents, accurate flood delineations on the Flood Insurance Rate Map should assist lenders, insurance agents and their constituents in determining if flood insurance is needed. Structures located in the floodplain should usually be covered by flood insurance; whereas those individuals living and working outside the floodplain should normally not be burdened with the expense and inconvenience of purchasing a flood insurance policy.

Amendments to the floodplain zoning map usually occur because:

- The original 100-year elevation is accurate, but the floodplain delineation is in error. Better topographic data may become available to re-delineate the floodplain.
- A portion of the floodplain is filled to the RFPE and is contiguous to land above the RFPE.
- The 100-year flood profile is revised.
- The floodway/flood fringe delineation is revised. Within certain constraints, floodway/flood fringe alignments may take several forms. The actual alignment in many cases is a community decision which may change as development needs are realized.

- A structural flood control project is constructed which meets or surpasses minimum state and federal standards for removing area from the regulatory floodplain.

To reiterate a point made earlier, a FEMA issued LOMA does **not** amend a community's floodplain zoning map. For land use regulatory purposes, the floodplain district boundaries can be modified **only** through a LOMR/republication of the FIRM and the ordinance amendment process where the revised data are formally adopted as part of the community's floodplain ordinance.

Data Needs

The data requirements for map amendments will vary depending upon the circumstances of the requested change. This is best illustrated using four examples of typical changes.

Example 1

Three years after the completion of its FIS, a community obtains two-foot contour mapping for the entire city. The published 100-year flood elevations are assumed to be still valid. The community proceeds to delineate the flood plain boundaries onto the new mapping. In several areas, it is realized that property originally included in the floodplain more properly should be shown outside the 100-year floodplain, and, vice versa.

New, improved community mapping with a properly delineated 100-year floodplain boundary could serve as the basis for a map amendment. Certain restrictions would apply for "new" fill areas (see examples 2 & 3 below).

The floodway/flood fringe delineation is not normally revised under this scenario. This delineation is a horizontal distance from a known reference point, such as the stream bank or roadway centerline, and is **not** related to the ground elevation. The only exception would be where the floodway/flood fringe delineation is coincidental with the 100-year flood boundary.

Example 2

A twenty acre parcel of land located in the floodplain is subdivided and filled to the RFPE. The parcel is contiguous to high ground thereby providing access during times of flooding. The subdivision is developed with single family residences, constructed without basements, in compliance with all provisions of local ordinance.

The following data would be required for a map amendment:

- A topographic map, community zoning map or the FIRM with the revised floodplain delineation. The map, or other supporting documentation, must contain appropriate 100-year flood elevations and regulatory flood protection elevations and sufficient topographic data to clearly show the final "as-built" fill elevations.

- Low floor elevations for all structures in the proposed map amendment area.

- Certification by a registered professional engineer or licensed surveyor as to the accuracy of the above data.

If one or more lots within this hypothetical subdivision are undeveloped at the time of the map amendment, the community must provide assurances that future development of these vacant lots will be compliant with all provisions of the communities floodplain ordinance, i.e. no residential basements. This is best accomplished by covenents recorded with the deed stipulating those development actions which will not be permissible below the RFPE.

Example 3

A five-acre industrial/commercial park has been filled to the RFPE. This area, though not contiguous to high ground, has vehicular access during the 100-year flood with flood elevations less than two feet below the RFPE. Most buildings are constructed with their lowest floor at, or above, the RFPE, however, a few structures have basement areas floodproofed to the FP1/FP2 classification in accordance with local ordinance.

Even though access is still possible during the 100-year flood, the area is **not** contiguous to high ground and, coupled with existing basement areas below the RFPE, should therefore not be removed from the floodplain designation.

Example 4

A structural flood control project, consisting of levees and internal drainage facilities is constructed in a particular community. The community wishes to remove the floodplain designation from those areas behind the levee system. The following data would be required:

- Map delineating the residual floodplain with 100-year flood elevations. This would include direct stream flooding and potential interior drainage flooding;
- 100-year and standard project flood profiles with the project in place;
- Top of levee elevations;
- Operations and maintenance plan; and
- Certification by the sponsoring agency, e.g., the Corps of Engineers, that the flood control project provides adequate protection against the 100-year and is compliant with all state and federal standards.

FLOODPLAIN ORDINANCE (TEXT) AMENDMENTS

While the previously discussed revisions also involve an ordinance amendment, this section refers only to the standards specified by the ordinance. Unlike flood profile and map amendments, this category of amendments does not require extensive background documentation.

A differentiation is made between substantive and non-substantive ordinance text amendments. Examples of **substantive** changes include:

1) changes to permitted uses
2) allowing dry floodproofing of commercial structures as a conditional use
3) revisions to administrative procedures

These types of substantive amendments require approval by the DNR prior to adoption. A draft copy of the amendment should be forwarded to your DNR area hydrologist for review, comment and approval before final adoption.

Non-substantive ordinance amendments do not generally require prior DNR approval. Examples include:

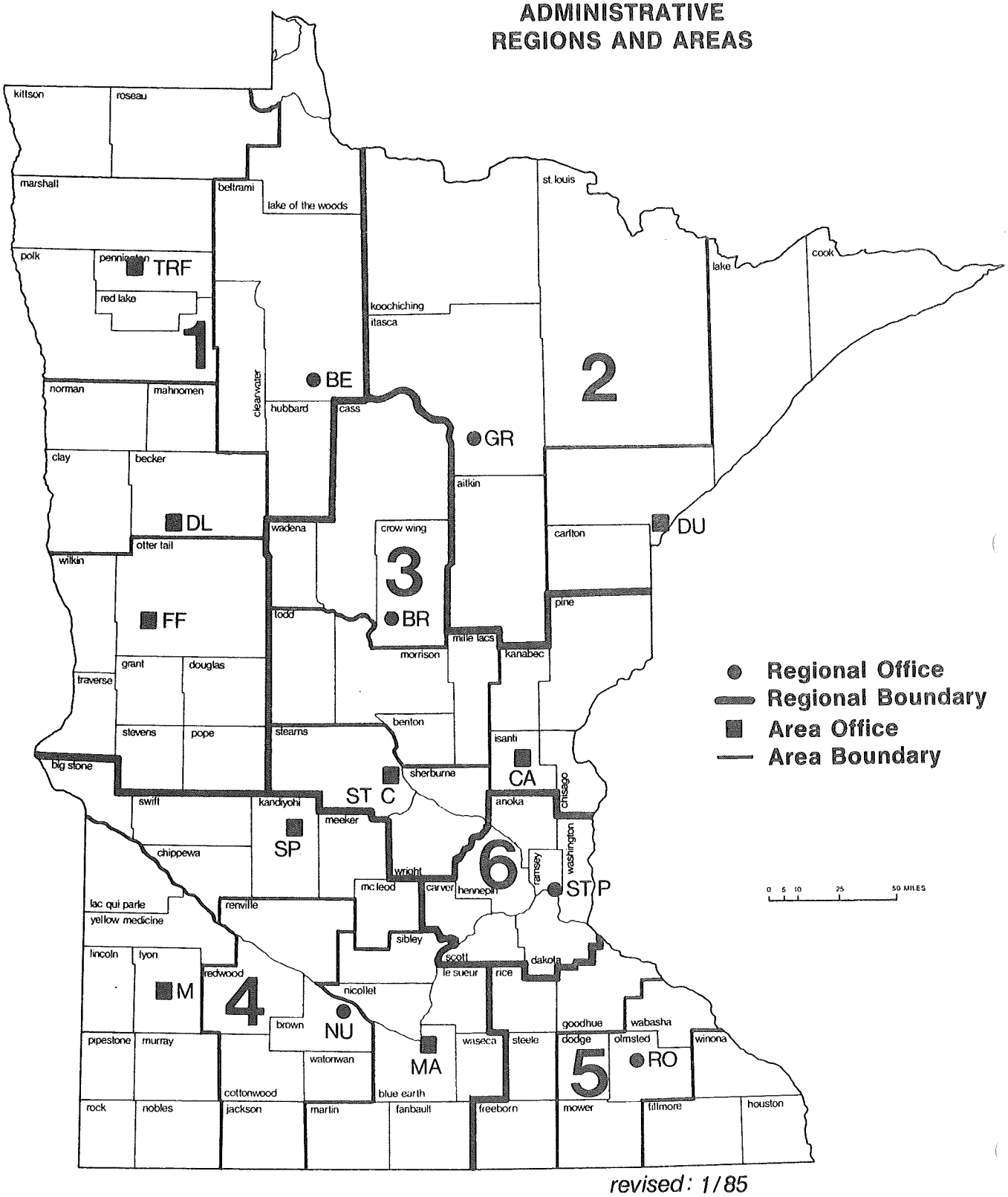
1) recodification
2) grammatical error corrections
3) minor points of clarification

For both types of text amendments, two certified copies of the published ordinance should be forwarded to the DNR.

APPENDIX A

DIVISION OF WATERS

ADMINISTRATIVE REGIONS AND AREAS



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REGION 1

DNR - Division of Waters
2115 Birchmont Beach Road NE
Bemidji, MN 56601
(218) 755-3973

DNR - Division of Waters
P. O. Box 502
Thief River Falls, MN 56701
(218) 681-7789

DNR - Division of Waters
P. O. Box 823
Detroit Lakes, MN 56501
(218) 847-1579

DNR - Division of Waters
1221 Fir Avenue East
Fergus Falls, MN 56537
(218) 739-7576

REGION 2

DNR - Division of Waters
1201 East Highway 2
Grand Rapids, MN 55744
(218) 327-1716

DNR - Division of Waters
French River Hatchery
10029 North Shore Drive
Duluth, MN 58804
(218) 723-4786

REGION 3

DNR - Division of Waters
424 Front Street, Box 648
Brainerd, MN 56401
(218) 828-2605

DNR - Division of Waters
915 South Highway 65
Cambridge, MN 55008
(612) 689-2832

DNR - Division of Waters
3725 12th St. North
P. O. Box 370
St. Cloud, MN 56302
(612) 255-4278

REGION 4

DNR - Division of Waters
Box 756, Highway 15 South
New Ulm, MN 56073
(507) 354-2196

DNR - Division of Waters
P. O. Box 457
232 Lake Avenue South
Spicer, MN 56488
(612) 796-2161

DNR - Division of Waters
79 Navaho Avenue
P. O. Box 491
Mankato, MN 56001
(507) 389-6713

REGION 5

DNR - Division of Waters
2300 Silver Creek Road, NE
Rochester, MN 55901
(507) 285-7430

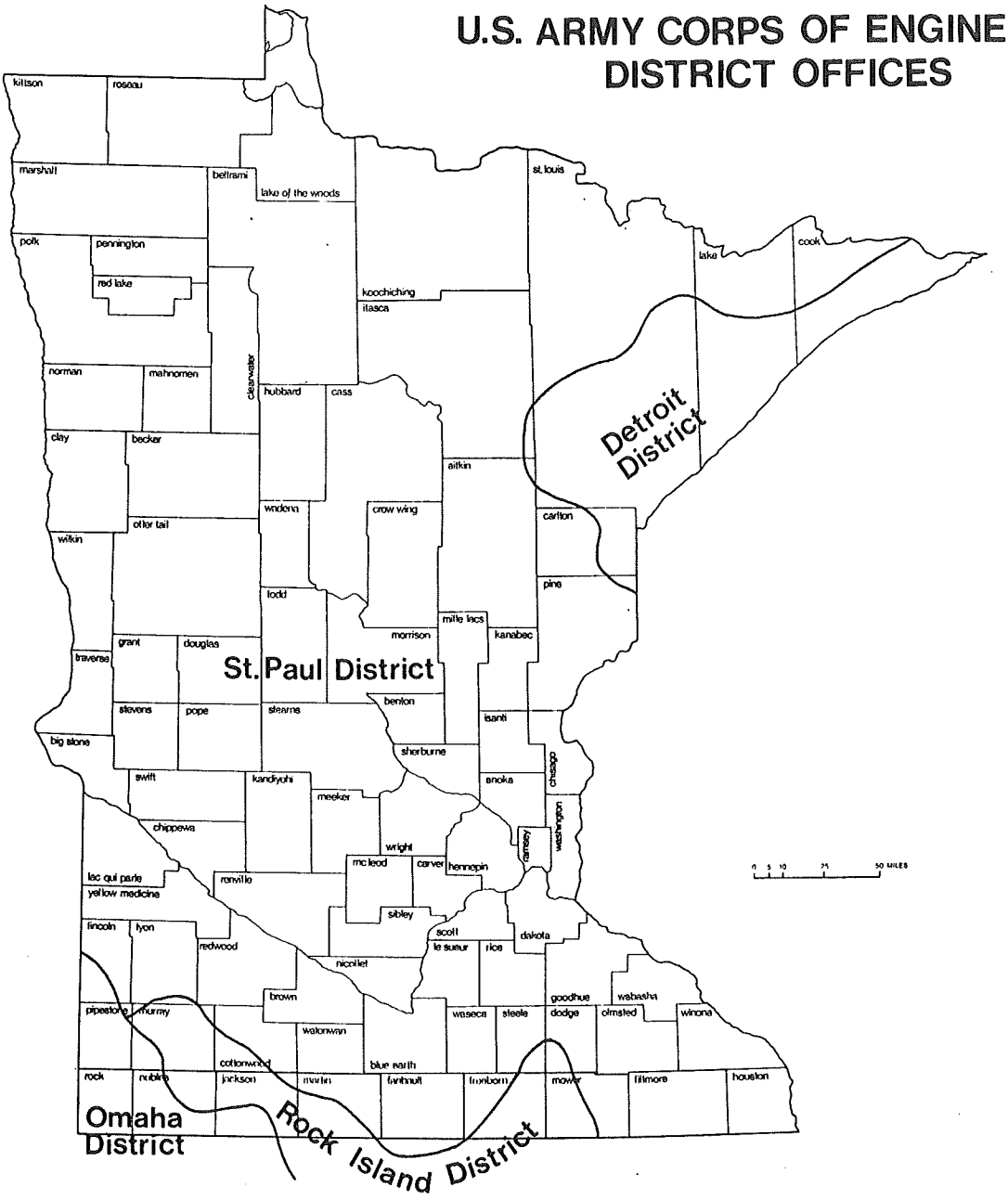
REGION 6

DNR - Division of Waters
1200 Warner Road
St. Paul, MN 55106
(612) 296-7523

CENTRAL OFFICE

DNR - Division of Waters
Box 32
500 Lafayette Road
St. Paul, MN 55146
(612) 296-4800

U.S. ARMY CORPS OF ENGINEERS
DISTRICT OFFICES



St. Paul District
1135 U.S. Post Office
& Custom House
St. Paul, MN 55101-1479
(612) 725-7501

Detroit District
P. O. Box 1027
Detroit, MI 48231
(313) 226-6413

Omaha District
6014 U.S. Post Office
& Court House
Omaha, NE 68102-4978
(402) 221-4596

Rock Island District
P. O. Box 2004
Rock Island, IL 61204-2004
(309) 788-6361

OTHER FEDERAL AGENCIES

National Weather Service
FAA Building
6301 34th Avenue South
Minneapolis, MN 55450
(612)725-6090

U.S. Geological Survey
702 U.S. Post Office and Custom House
St. Paul, MN 55101
(612) 725-7841

U.S. Department of Agriculture
Soil Conservation Service
200 Federal Building
316 North Robert Street
St. Paul, MN 55101
(612) 725-7675

Federal Emergency Management Agency
300 South Wacker Drive
24th Floor
Chicago, IL 60606
(312) 353-1500

OTHER STATE AGENCIES

Department of Public Safety
Division of Emergency Services
Room B5, Capitol Building
St. Paul, MN 55155
(612) 296-2233

Department of Energy and Economic Development
900 American Center Building
150 E. Kellogg Blvd.
St. Paul, MN 55101
(612) 296-5120

APPENDIX B

BIBLIOGRAPHY

Minnesota DNR

Brochures:

"Reducing Flood Damages by Acquisition and Relocation: The Experiences of Four Minnesota Communities."
"Before You Buy or Build in the Floodplain: What You Should Know."
"Flood Hazard Mitigation Planning: What It Is and What It Can Do For Your Community."
"Urban Stormwater Management: Another Alternative for Reducing Flood Damages."
"Floodplain Management in Minnesota."

Informational Sheets:

"Post This In Your Home"
"Preparing to Evacuate"
"It's Clean Up Time"

Technical Report No. 7, "Procedures and Requirements for Flood Hazard Evaluation", April 1980.

"Floodproofing Administrative Manual for Minnesota", prepared by the U.S. Army Corps of Engineers, 1977.

FEDERAL EMERGENCY MANAGEMENT AGENCY

Brochures:

"Questions and Answers - National Flood Insurance Program."
"How to Read a Flood Insurance Rate Map."
"In the Event of a Flood - Suggestions to Help Minimize the Loss of Life and Property."
"Flood - Are You Protected from the Next Disaster?"

"Flood Emergency and Residential Repair Handbook."
"Economic Feasibility of Floodproofing - Analysis of a Small Commercial Building", June, 1979.
"Flash Flood Awareness Packet", April, 1983.
"Elevated Residential Structures - Reducing Flood Damage Through Building Design: A Guide Manual", February, 1977.

U.S. ARMY CORPS OF ENGINEERS

Brochures:

"Floodplain - Handle with Care!"
"Guidelines for Reducing Flood Damages".

"Floodproofing Regulations", June, 1972.
"Floodproofing: Example of Raising a Private Residence", March, 1977.
"Floodproofing Primer: A Dollar and Cents Guide for Home Improvements That Reduce Flood Damage:, January, 1979.
"Community Handbook on Flood Warning and Preparedness Programs", Research Report 81-R06, August, 1981.
"Implementation Aspects of Flood Warning and Preparedness Planning Alternatives",
Research Report 81-R07, August 1981.
"Effectiveness of Flood Warning and Preparedness Alternatives", Research Report 81-R08, August, 1981.

U.S. WATER RESEARCH COUNCIL

"Cooperative Flood Loss Reduction - A Technical Manual for Communities and Industry", June, 1981.
"Floodplain Management Handbook", September, 1981.
"State and Local Acquisition of Floodplains and Wetlands: A Handbook on the Use of Acquisition in Floodplain Management", September, 1981.
"A Unified National Program for Floodplain Management", September, 1979.

Natural Hazards Research and Applications Information Center

"Regulation of Flood Hazard Areas to Reduce Flood Losses, Volume 3", 1982.
"Strengthening State Floodplain Management", 1982.
"Innovation in Local Floodplain Management, A Summary of Community Experience", 1982.
"Floodplain Regulations and the Courts: 1970-1981", 1982.

National Science Foundation

"A Report on Flood Hazard Mitigation", September, 1980.

MOVIES & SLIDE SHOWS

Available from the Minnesota DNR, Division of Waters, 500 Lafayette Road, St. Paul, MN 55146 (612) 296-4800.

-- Federal Emergency Management Agency, Flood Hazard Management: Three Stories, 17 minute slide-tape shows, stories about flooding events in three different counties in U.S. where significant flooding has taken place. Explains how FEMA through the NFIP becomes involved in flood plain policy and assists community after flooding.

-- U.S. Army Corps of Engineers, 1978 Rochester, MN Flood, 20 minute slide - tape show. Gives brief overview of Rochester's flood history. Details July flood event of 1978 and its impact on the city.

-- U.S. Army Corps of Engineers, East Grand Forks, Flood Emergency Plan of Action, 15 minute slide - tape show, 1981. Describes East Grand Forks' flood emergency plan of action. Also demonstrates local, state and federal agency interactions in times of flooding.

-- Minnesota DNR, Managing Minnesota Floodplains, 20 minute slide-tape show. 1983. Gives introduction to Minnesota's flooding problems associated with floodplain development. Describes the floodplain management policies which have been developed in response to these problems.

-- National Weather Service, Flash Flood - Myth or Reality, 15 minute slide-show. Demonstrates common misconceptions about flash floods. Explains correct actions to take during dangerous situations which may arise during flash flooding.

-- National Weather Service, Flash Flood Preparedness, 15 minute slide-show. Demonstrates devastating effects of flash floods and importance of developing flash flood preparedness plans. Emphasis is on NWS & community interaction for developing a flood warning system for citizens.

-- U.S. Army Corps of Engineers, It Doesn't Have to Happen, 22 minute color movie.

Available from National Weather Service, North Central Flood Forecast Center, 6301 34th Avenue South, Minneapolis, MN 55450:

Watch Along the Watershed. Color, sound, 20 minutes.
Illustrates flood warning system for the Susquehana River in Pennsylvania. Efforts were initiated by private industry and extended by civil defense and county units.

Available from the U.S. Army Corps of Engineers, St. Paul District, 1135 U.S. Post Office and Custom House, St. Paul, MN 55101:

Rivers, Floods and People. Color, Sound, 11 minutes. Shows how flood-fighting can minimize flooding, but more importantly, how wise use of the floodplain can let it serve both man and its natural purpose. 1974.
Waiting for the Next One. Color, sound, 10 minutes. Depicts the 1979 Red River of the North flood.

Video-tapes (for 3/4 inch video cassette players)
"The 1979 Flood of the Red River," 25 minutes
"The 1979 Flood of Grand Forks-East Grand Forks," 25 minutes
"The 1978 Flood in Rochester", 10 minutes.

Slide-tape shows (for single projector, program slide show programmer, 1000 hertz tone)
"Urban Flooding" (Grand Forks-East Grand Forks and Fargo-Moorhead areas)
"The Aftermath of Floods" (Red River of the North)

The Mouse That Roared. Color, sound, 12 minutes. Depicts the 1969 Souris River Flood at Minot.

The Other Side of the River. Color, sound, 27 minutes. Depicts the 1965 flooding of the Upper Mississippi River Basin.

Minnesota River. Color, sound. Depicts 1965 Minnesota River Flood.

APPENDIX C

MINNESOTA STATUTES 1971
as amended by the 1973 session
of the 68th Legislature

Drainage and Waters

CHAPTER 104
FLOOD PLAIN MANAGEMENT

104.01 TITLE; LEGISLATIVE FINDINGS; POLICY AND PURPOSE. Subdivision 1. Sections 104.01 to 104.07 may be cited as the flood plain management act.

Subd. 2. The legislature finds and declares that: (a) A large portion of the state's land resources is subject to recurrent flooding by overflow of streams and other watercourses causing loss of life and property, disruption of commerce and governmental services, unsanitary conditions, and interruption of transportation and communications, all of which are detrimental to the health, safety, welfare, and property of the occupants of flooded lands and the people of this state; and (b) The public interest necessitates sound land use development as land is a limited and irreplaceable resource, and the flood plains of this state are a land resource to be developed in a manner which will result in minimum loss of life and threat to health, and reduction of private and public economic loss caused by flooding.

Subd. 3. It is the policy of this state and the purpose of sections 104.01 to 104.07 to reduce flood damages through flood plain management, stressing nonstructural measures such as flood plain zoning and flood proofing, and flood warning practices. It is the policy of this state and the purpose of sections 104.01 to 104.07 not to prohibit but to guide development of the flood plains of this state consistent with the enumerated legislative findings to provide state coordination and assistance to local governmental units in flood plain management, to encourage local governmental units to adopt, enforce and administer sound flood plain management ordinances, and to provide the commissioner of natural resources with authority necessary to carry out a flood plain management program for the state and to coordinate federal, state, and local flood plain management activities in this state.

Subd. 4. In furtherance of the policy stated in subdivision 3, the legislature further declares that flood plain management ordinances are to be given primary consideration in the reduction of flood damage in Minnesota and that alternative methods for reducing flood damage may not be carried out before adoption of flood plain management ordinances by local governmental units. Structural projects which have the purpose of controlling floods are to be considered only as elements of a flood plain management program.

[1969 c 590 s 1; 1969 c 1129 art 10 s 2; 1973 c 351 s 1; 1973 c 412 s 10]

104.02 DEFINITIONS. Subdivision 1. For the purposes of sections 104.01 to 104.07 the terms defined in this section have the meanings given them.

Subd. 2. "Regional flood" means a flood which is representative of large floods known to have occurred generally in Minnesota and reasonably characteristic of what can be expected to occur on an average frequency in the magnitude of the 100 year recurrence interval.

Subd. 3. "Flood plain" means the areas adjoining a watercourse which has been or hereafter may be covered by the regional flood.

Subd. 4. "Floodway" means the channel of the watercourse and those portions of the adjoining flood plains which are reasonably required to carry and discharge the regional flood.

Subd. 5. "Flood fringe" means that portion of the flood plain outside of the floodway.

Subd. 6. "Local governmental unit" means a county, city, village, or borough.

Subd. 7. "Commissioner" means the commissioner of natural resources.

[1969 c 590 s 2; 1969 c 1129 art 3 s 1]

104.03 FLOOD PLAINS; COMMISSIONER'S DUTIES; USES OF FLOOD PLAINS. Subdivision 1. The commissioner shall (a) collect and distribute information relating to flooding and flood plain management; (b) coordinate local, state and federal flood plain management activities to the greatest extent possible, and to this end shall encourage the United States army corps of engineers and the United States soil conservation service to make their flood control planning data available to local governmental units for planning purposes, in order to allow adequate local participation in the planning process and in the selection of desirable alternatives; (c) assist local governmental units in their flood plain management activities within the limits of available appropriations and personnel in cooperation with the office of local and urban affairs and the state planning officer; (d) do all other things, within his lawful authority, which are necessary or desirable to manage the flood plains for beneficial uses compatible with the preservation of the capacity of the flood plain to carry and discharge the regional flood. In cooperation with local governmental units, the commissioner shall conduct, whenever possible, periodic inspections to determine the effectiveness of local flood plain management programs, including an evaluation of the enforcement of and compliance with local flood plain management ordinances.

Subd. 2. In places where the flood plain has been delineated by ordinance in the manner required by sections 104.01 to 104.07, no major alteration to a structure in existence on the effective date of the ordinance, and no new fill, structure, deposit, or other flood plain use that is unreasonably hazardous to the public or that unduly restricts the capacity of the flood plain to carry and discharge the regional flood shall be permitted after the effective date of the ordinance delineating the flood plains. As used in this subdivision, major alterations of existing structures shall not include repair or maintenance and shall not include repairs, maintenance or alterations to structures made pursuant to the authority of any other authorized agency of the state or federal government and provided further that this subdivision shall not apply to alterations, repair or maintenance reasonably done under emergency circumstances to preserve or protect life or property. This subdivision applies to alterations to existing structures and to new fill, structures, deposits, or other flood plain uses by the state and its agencies.

Subd. 3. When emergency flood protection measures are constructed, the affected local governmental unit shall submit to the commissioner a plan outlining their use as a part of a future comprehensive flood emergency program. The plan shall be submitted within the following time limits: As to those measures constructed before May 20, 1973, the plan shall be submitted within 120 days after May 20, 1973, as to those measures constructed on or after May 20, 1973, within 120 days after construction. The commissioner shall review the plan and, in so doing, shall consult with the state office of civil defense and other state and federal agencies as appropriate. Following his review, the commissioner shall accept, require modification, or reject the plan. If required modifications are not made, or if the plan is rejected, the commissioner shall order the removal of the emergency protection measures.

[1969 c 590 s 3; 1973 c 351 s 2, 3]

104.04 FLOOD PLAIN MANAGEMENT ORDINANCES. Subdivision 1. In accordance with the provisions of sections 104.01 to 104.07, the rules and regulations which the commissioner may promulgate pursuant to sections 104.01 to 104.07, and applicable laws authorizing local governmental units to adopt flood plain management ordinances, local governmental units shall adopt, administer, and enforce flood plain management ordinances, which shall include but not be limited to the delineation of flood plains and floodways, the preservation of the capacity of the flood plain to carry and discharge regional floods, the minimization of flood hazards, and the regulation of the use of land in the flood plain. The ordinances shall be based on adequate technical data and competent engineering advice and shall be consistent with local and regional comprehensive planning.

Subd. 2. No later than June 30, 1970, every local governmental unit shall submit a letter of intent to comply with sections 104.01 to 104.07, on a form provided by the commissioner including any existing flood plain management ordinances, to the commissioner for his review. The letter of intent shall list the watercourses within the boundaries of the local governmental unit in the order of the degree of flood damage potential associated with each watercourse and shall include a description of the type of information that is available for each, such as high watermarks and topographic maps.

Subd. 3. When the commissioner determines that sufficient technical information is available for the delineation of flood plains and floodways on a watercourse, he shall notify affected local governmental units that this technical information is available. Within six months after receiving this notice, each local governmental unit shall prepare or amend its flood plain management ordinance in conformance with the provisions of sections 104.01 to 104.07, and shall submit the ordinance to the commissioner for his review and approval before adoption. The commissioner shall approve or disapprove the proposed ordinance within 120 days after receiving it. If the commissioner disapproves the proposed ordinance he shall return it to the local governmental unit with a written statement of his reasons for disapproval. Within 90 days thereafter, the local governmental unit shall resubmit an amended proposed ordinance for his further review and approval before adoption. The local governmental unit shall adopt a flood plain management ordinance within 90 days after approval by the commissioner. A flood plain management ordinance adopted by a local governmental unit after June 30, 1970, is invalid unless it is approved by the commissioner. A local governmental unit may adopt a flood plain management ordinance in the absence of notification by the commissioner that the required technical data is available, provided that any such ordinance is submitted to the commissioner prior to its adoption for his approval. Nothing in sections 104.01 to 104.07 limits the power of a local governmental unit or town to adopt or continue in force a flood plain management ordinance which is more restrictive than that which may be required pursuant to sections 104.01 to 104.07.

Subd. 4. Flood plain management ordinances may be amended by a local governmental unit upon the approval of the commissioner.

Subd. 5. If a local governmental unit fails to adopt a flood plain management ordinance within the time allowed, the commissioner shall adapt an ordinance, which meets the minimum standards established pursuant to section 104.05, to the local governmental unit. The commissioner shall hold at least one public hearing on the proposed ordinance in the manner provided in sections 394.26 or 462.357, as applicable, after giving notice as provided in sections 394.26 or 462.357. The ordinance shall be effective for the local governmental unit on the date and in accordance with such regulations relating to compliance as the commissioner shall prescribe. The ordinance shall be enforced as provided in sections 394.37 or 462.362, as applicable. The penalties provided in sections 394.37 or 462.362 apply to violations of the ordinance so adopted by the commissioner.

Subd. 6. The cost incurred by the commissioner in adapting a flood plain management ordinance to the local governmental unit pursuant to subdivision 5 shall be paid by the local governmental unit upon submission to the local governmental unit of an itemized statement of these costs by the commissioner. If the local governmental unit fails to pay these costs within 90 days after the commissioner's statement is received, the commissioner shall file a copy of the statement of these costs with the county auditor within which the local governmental unit lies for collection by special tax levy. The county auditor, upon receiving a statement from the commissioner, shall include the amount of the state's claim in the tax levy for general revenue purposes of the local governmental unit. Upon completion of the tax settlement following this levy, the county treasurer shall remit the amount due to the state to the commissioner for deposit in the state treasury.

[1969 c 590 s 4; 1973 c 351 s 4, 5, 6]

104.05 RULES AND REGULATIONS. In the manner provided by Minnesota Statutes 1967, Chapter 15, the commissioner shall promulgate rules and regulations necessary to carry out the purposes of sections 104.01 to 104.07, including but not limited to the following: (a) criteria for determining the flood plain uses which may be permitted without creating an unreasonable public hazard or unduly restricting the capacity of the flood plain to carry and discharge the regional flood; (b) variance procedures; (c) the establishment of criteria for alternative or supplemental flood plain management measures such as flood proofing, subdivision regulations, building codes, sanitary regulations, and flood warning systems.

[1969 c 590 s 5]

104.06 NECESSARY USE. The commissioner in promulgating guidelines pursuant to section 104.05 and local governmental units in preparing flood plain management ordinances shall give due consideration to the needs of an industry whose business requires that it be located within a flood plain.

[1969 c 590 s 6]

104.07 ENFORCEMENT AND PENALTIES. Every structure, fill, deposit, or other flood plain use placed or maintained in the flood plain in violation of a flood plain management ordinance adopted under or in compliance with the provisions of sections 104.01 to 104.07 is a public nuisance and the creation thereof may be enjoined and the maintenance thereof abated by an action brought by the commissioner of natural resources or a local governmental unit. A person who violates any of the provisions of sections 104.01 to 104.07 is guilty of a misdemeanor. Each day during which such violation exists is a separate offense.

[1969 c 590 s 7; 1969 c 1129 art 3 s 1]

104.08 FLOOD INSURANCE. Subdivision 1. It is the policy of the state of Minnesota that all local governmental units subject to recurrent flooding participate in the national flood insurance program, Public Law 90-448, and acts amendatory thereof or supplementary thereto, so that the people of Minnesota may have the opportunity to indemnify themselves from future flood losses through the purchase of this insurance.

Subd. 2. Within 90 days after May 20, 1973, the commissioner shall prepare a list of local governmental units having areas subject to recurrent flooding and shall notify each local governmental unit included on the list of his findings. If a local governmental unit objects to the commissioner's findings, it shall submit evidence supporting its objections within 45 days after receiving the commissioner's notification. Thereafter the commissioner shall accept or reject the findings of each local governmental unit submitting evidence, shall prepare an amended list of local governmental units having areas subject to recurrent flooding, and shall notify each local governmental unit of its inclusion on the amended list.

Subd. 3. Within 120 days after receiving notice of inclusion on the amended list, each local governmental unit shall apply for participation in the national flood insurance program in the manner prescribed by federal laws and regulations.

[1973 c 351 s 7]

(Note: Other sections of Minnesota Statutes 1971, Chapter 104, as amended, concerning the Lower St. Croix River, and Wild and Scenic Rivers, are not reproduced in this pamphlet because they have only incidental relationship to flood plain management.)

APPENDIX D

6120.5000 DEFINITIONS.

Subpart 1. **Scope of terms.** For the purposes of these rules, certain terms or words used herein shall be interpreted as follows.

Subp. 2. **Building code.** "Building code" means a collection of regulations adopted by a local governing body setting forth standards for the construction, addition, modification, and repair of buildings and other structures for the purpose of protecting the public health, safety, and general welfare.

Subp. 3. **Channel.** "Channel" means a natural or artificial depression of perceptible extent, with definite bed and banks to confine and conduct flowing water either continuously or periodically.

Subp. 4. **Commissioner.** "Commissioner" means the commissioner of natural resources.

Subp. 5. **Encroachment lines.** "Encroachment lines" means the lateral limits or lines drawn along each side and generally parallel to a stream or another body of water, which delineates the floodway and within which the flood-carrying capacity of the stream or other body of water is to be preserved. Their location, if along a stream, should be such that the floodway between them will effectively carry and discharge a flood not less than the regional flood.

Subp. 6. **Equal degree of encroachment.** "Equal degree of encroachment" means a method of determining the location of encroachment lines so that floodplain lands on both sides of a stream are capable of conveying a proportionate share of flood flows. This is determined by considering the effect of encroachment on the hydraulic efficiency of the floodplain along both sides of a stream for a significant reach.

Subp. 7. **Flood.** "Flood" means a temporary rise in stream flow or stage which results in inundation of the areas adjacent to the channel.

Subp. 8. **Flood frequency.** "Flood frequency" means the average frequency, statistically determined, for which it is expected that a specific flood stage or discharge may be equalled or exceeded. By strict definition, such estimates are designated "exceedence frequency," but in practice the term "frequency" is used. The frequency of a particular stage or discharge is usually expressed as having a probability of occurring once within a specified number of years. See also recurrence interval in subpart 20.

Subp. 9. **Flood fringe.** "Flood fringe" means that portion of the floodplain outside of the floodway.

Subp. 10. **Flood peak.** "Flood peak" means the highest value of stage or discharge attained during a flood event; thus peak stage or peak discharge.

Subp. 11. **Floodplain.** "Floodplain" means the areas adjoining a watercourse which has been or hereafter may be covered by the regional flood.

Subp. 12. **Floodplain management.** "Floodplain management" means the full range of public policy and action for ensuring wise use of the floodplains. It includes everything from collection and dissemination of flood control information to actual acquisition of floodplain lands, construction of flood control measures, and enactment and administration of codes, ordinances, and statutes regarding floodplain land use.

Subp. 13. **Floodplain regulations.** "Floodplain regulations" means the full range of codes, ordinances, and other regulations relating to the use of land and construction within floodplain limits. The term encompasses zoning ordinances, subdivision regulations, and sanitary and building codes.

Subp. 14. **Flood profile.** "Flood profile" means a graph or a longitudinal plot of water surface elevations of a flood event along a reach of a stream or river.

Subp. 15. **Floodproofing.** "Floodproofing" means a combination of structural provisions, changes or adjustments to properties and structures subject to flooding primarily for the reduction or elimination of flood damages to properties, water and sanitary facilities, structures, and contents of buildings in a flood hazard area.

Subp. 16. **Flood stage.** "Flood stage" means, as commonly used by the U.S. Weather Bureau and others, that stage, at a particular river gauge, where overflow of the natural banks of the stream results in significant flood damage in any portion of the reach for which the gauge is a representative index.

Subp. 17. **Floodway.** "Floodway" means the channel of the watercourse and those portions of the adjoining floodplains which are reasonably required to carry and discharge the regional flood.

Subp. 18. **Local governmental unit.** "Local governmental unit" means a county, city, village, or borough.

Subp. 19. **Reach.** "Reach" means the hydraulic engineering term used to describe longitudinal segments of a stream or river influenced by a natural or man made obstruction. In an urban area, the segment of a stream or river between two consecutive bridge crossings would typically constitute a reach.

Subp. 20. **Recurrence interval.** "Recurrence interval" means the average interval of time, based on a statistical analysis of actual or representative stream flow records, which can be expected to elapse between floods equal to or greater than a specified stage or discharge. The recurrence interval is generally expressed in years. See also flood frequency in subpart 8.

Subp. 21. **Regional flood.** "Regional flood" means a flood which is representative of large floods known to have occurred generally in Minnesota and reasonably characteristic of what can be expected to occur on an average frequency in the magnitude of the 100-year recurrence interval.

Subp. 22. **Rural areas.** "Rural areas" means all areas not included under urban areas, such as agricultural, forest, and undeveloped areas.

Subp. 23. **Standard project flood.** "Standard project flood" means the flood that may be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Such floods are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Subp. 24. **Subdivision regulations.** "Subdivision regulations" means regulations and standards established by a local unit of government with authority granted under a state enabling law, for the subdivision of land in order to secure coordinated land development.

Subp. 25. **Urban areas.** "Urban areas" means the area within the present corporate limits plus the adjoining areas that are or could be under the statutory extraterritorial zoning jurisdiction of any city, village, or borough.

Subp. 26. **Watercourse.** "Watercourse" means a channel in which a flow of water occurs either continuously or intermittently in a definite direction. The term applies to either natural or artificially constructed channels.

Subp. 27. **Zoning ordinanace.** "Zoning ordinance" means an ordinance adopted by a local unit of government, with authority from state enabling legislation, which under the police power divides local governmental areas into districts and, within each district, regulates the use of land.

Statutory Authority: *MS s 104.05*

6120.5100 POLICY.

The following standards and criteria establishing minimum floodplain management standards are promulgated in accordance with the authority granted in Minnesota Statutes 1969, section 104.05 and apply to land adjacent to all watercourses of the state except as herein provided.

Statutory Authority: *MS s 104.05*

6120.5200 SCOPE.

These standards and criteria for the management of flood-prone areas and private and governmental uses located therein pertain to all watercourses, both intrastate and interstate, where the drainage area of the watercourse is over two square miles and where the commissioner finds a watercourse having a drainage area under two square miles has significant flood hazard.

Statutory Authority: *MS s 104.05*

6120.5300 SEVERABILITY.

The provisions of these rules shall be severable and the invalidity of any lettered paragraph, subparagraph, or subdivision thereof shall not invalidate any other lettered paragraph or subparagraph, subdivision, or any other part.

Statutory Authority: *MS s 104.05*

6120.5400 LOCAL DUTIES.

In accordance with Minnesota Statutes 1969, chapter 104, local governmental units shall:

A. submit to the commissioner for his review a list of available flood data, floodplain maps, and degree of flood damage potential for each watercourse having flood hazards;

B. adopt or amend a floodplain management ordinance which meets these minimum standards and criteria for floodplain management, upon the determination of the commissioner that sufficient technical information is available for the delineation of floodplains and floodways on a watercourse;

C. submit proposed floodplain management ordinances to the commissioner for his review and approval before adoption;

D. administer and enforce floodplain management ordinances upon adoption; and

E. submit to the commissioner for approval any amendments to floodplain management ordinances before adoption.

Statutory Authority: *MS s 104.05*

6120.5500 COMMISSIONER'S DUTIES.

The commissioner shall:

A. Establish statewide standards for management of floodplain areas which apply to private and governmental uses located therein.

B. Determine the availability of sufficient technical information for the delineation of floodplains and floodways on a watercourse.

C. Upon request, assist the local governmental unit in the drafting of a floodplain management ordinance which meets the provisions of Minnesota Statutes 1969, chapter 104 and the minimum standards set forth herein. This assistance may include, but not be limited to, creation of specific guidelines to be used locally in the formulation of reasonable regulations and other floodplain management practices based on sound technical data and consistent with state standards and community land use needs.

D. Review and approve floodplain management ordinances prior to adoption by the local governmental unit.

E. Where sufficient information is not available, cooperate to the fullest practical extent with appropriate federal agencies and local governmental units in securing adequate technical information which can be used for the delineation of floodplains and floodways along the state's watercourses.

F. Periodically review and upgrade floodplain management criteria based on new hydrologic, hydraulic, and other technical methodologies.

G. Disseminate to local governmental units, whenever available, technical information including information of federal programs involving floodplain areas, educational materials, and other material useful in carrying out a floodplain management program.

H. Survey the enforcement of floodplain management ordinances.

I. Coordinate federal, state, and local floodplain management activities in the state.

Statutory Authority: *MS s 104.05*

6120.5600 TECHNICAL STANDARDS AND REQUIREMENTS FOR FLOODPLAIN EVALUATION.

Subpart 1. **Scope.** Except as otherwise provided herein, or as new hydrologic and hydraulic techniques of nationwide scope and acceptance are developed and deemed acceptable by the commissioner, any federal, state, or local agency, any of their consultants, or any private consultants involved in the esablishment and/or implementation of floodplain management studies or programs in Minnesota shall comply with technical standards prescribed in all applicable sections of these standards and criteria.

Subp. 2. **Flood frequency techniques for delineation of floodplain.** The regional flood shall serve as the basis for delineation of the floodplain and floodway for regulatory purposes.

The basic method of flood frequency analysis in the determination of regional flood flows shall be the log, Pearson Type III distribution (with log, normal as a special case) as described in the Federal Water Resources Council Bulletin 15, A Uniform Technique for Determining Flood Flow Frequencies, December 1967.

In those instances where inadequate stream flow data exists to allow use of the method outlined in the preceding paragraph, the commissioner may use or authorize use of other acceptable hydrologic methods or techniques.

Subp. 3. **Determination of extreme flooding events.** Whenever the commissioner finds that sufficient technical information is available to estimate the magnitude of floods larger than the regional flood (such as the standard project flood) this information shall be made available by the commissioner to the local unit of government for use by the public as general information.

Subp. 4. **Standards for technical hydrologic and hydraulic techniques in flood hazard evaluation.** In order to provide uniformity in the analysis of flood hazards and the effects of various artificial and natural obstructions to flood flows within floodplain areas the commissioner will adopt and require use of a uniform system for the analysis of technical factors including:

A. minimum required survey data needed to provide adequate vertical and horizontal ground control elevations and distances for the channel of a stream or river and the adjoining floodplain area;

B. referencing of bench marks used for vertical control data; and

C. procedures for computation of water surface profiles and analysis of backwater effects in floodplain areas.

Statutory Authority: *MS s 104.05*

6120.5700 MINIMUM FLOODPLAIN MANAGEMENT STANDARDS FOR LOCAL ZONING ORDINANCES.

Subpart 1. **In general.** The standards contained in this part apply to the amendment or creation of local floodplain zoning ordinances.

To provide for comprehensive floodplain management, supplemental measures as contained in part 6120.5900 shall be enacted consistent with these standards.

These standards and criteria are considered to provide only a minimum degree of flood protection for floodplain developments. Local governmental units may enact local floodplain regulations which exceed these standards.

Subp. 2. **Minimum mapping standard.** All mapping used to delineate floodplain zoning districts shall include the following properly identified regulatory districts: floodplains, floodways, and flood fringe areas. Where adequate information is available the limits of the area subject to inundation by floods larger than the regional flood, as provided in part 6120.5600, subpart 3, shall be designated for public information purposes.

Local ordinances may superimpose the floodplain zoning districts on the prior official zoning map or the ordinance may adopt, by reference, a supplemental official map providing the supplemental map is approved by the commissioner.

The floodplain limits on the zoning map shall correspond to the actual area subject to inundation, not street or property lines, unless use of the latter would include all areas subject to inundation.

Subp. 3. **Delineation of the floodplain.** Delineation:

A. The delineation of the floodplain shall be based on the flood protection elevation as set forth in subpart 5.

B. Procedures for floodplain determination shall conform to technical standards established in part 6120.5600, subparts 2 and 4. Each local floodplain zoning ordinance must include a floodplain map conforming to the standards established in subpart 2.

C. In special instances and upon approval of the commissioner, the use of other techniques such as maps indicating limits of past flooding, detailed soil maps, and/or aerial photographic interpretation may initially serve as a basis for the delineation of floodplains for regulatory purposes provided that:

(1) the affected floodplains are generally undeveloped;

(2) the associated text of the zoning ordinance provides for a special permit use procedure to determine the effects of proposed construction upon flood stages and flood flows and to establish the flood protection elevation; and

(3) the local unit of government has initiated a program to ultimately obtain regional flood data.

D. Where a conflict exists between the floodplain limits illustrated on the official zoning map and actual field conditions, the flood elevations shall be the governing factor in locating the regulatory floodplain limits.

Subp. 4. **Delineation of the floodway.** Local government floodplain zoning ordinances shall designate a floodway. Exceptions may be allowed by the commissioner for those conditions listed in subpart 3, item C. A portion of the floodplain, outside of the immediate channel of a watercourse, shall be selected and designated as the floodway by a local governmental unit upon approval of the commissioner. The selection must be based on an evaluation of the flood hazard for the area which may be involved or affected by such designation and must conform to the following standards:

A. The limits of the floodway shall be designated so that permissible encroachments on the floodplain will not cause an increase in stage of the regional flood of more than 0.5 feet in any one reach or for the cumulative effect

of several reaches of a watercourse. If the increase in flood stage will materially increase the flood damage potential, the commissioner may require that such increases be less than 0.5 feet. The commissioner may authorize increases greater than 0.5 feet where studies show that further increases in flood stages will not materially increase the flood damage potential.

B. The limits of the floodway shall be based on a uniform degree of encroachment for a significant reach on both sides of a watercourse. Variances from this part may be authorized by the commissioner when topography, existing development patterns, and comprehensive land use plans justify a modified approach.

C. The floodway shall be determined consistent with minimum standards for technical hydrologic and hydraulic techniques and mapping standards contained in parts 6120.5600, subpart 4 and 6120.5700, subpart 2.

Subp. 5. **Flood protection elevations.** The flood protection elevations shall correspond to a point not less than one foot above the water surface profile associated with the regional flood plus any increases in flood stages attributable to encroachments on the floodplain established under subpart 4, item A. The flood protection elevations shall be clearly lettered at identifiable positions on the official zoning district map consistent with the water surface profile of the regional flood, or the profile shall be attached to and made part of the official zoning district map.

Statutory Authority: *MS s 104.05*

6120.5800 ZONING: LAND USES PERMITTED IN FLOODWAY AND FLOOD FRINGE AREAS.

Subpart 1. **Certification of compliance.** No vacant flood plain land shall be occupied or used and no building hereafter erected, altered, or moved shall be occupied until the applicant submits to the appropriate local official a certification by a registered professional engineer, land surveyor, or other qualified person designated by the local governing body that the finished fill and building floor elevations or other flood protection measures are in compliance with appropriate flood plain zoning provisions and other flood plain regulations.

Subp. 2. **Removal of lands from a flood plain district.** The floodplain designation on official zoning maps shall not be removed from floodplain areas adjacent to and outside of floodways unless it can be shown that the areas are filled to an elevation at or above the flood protection level and are contiguous to other lands lying outside the floodplain district or unless flood control measures which meet the standards of part 6120.5900, subpart 6, items B, subitem (1) and D are constructed and operative.

Subp. 3. **Permitted uses within the floodway or between levels.** Local zoning ordinances may designate specified uses as permitted or special permit uses provided such uses have a low flood damage potential and will not materially obstruct flood flows or increase velocities or stages of the regional flood. However, uses that are likely to cause pollution of waters, as defined in Minnesota Statutes 1969, section 115.01, are prohibited unless adequate safeguards approved by the state water pollution control agency are provided. All other uses are prohibited including storage of any potentially hazardous materials which if subject to flooding may become buoyant, flammable, explosive, or may be injurious to human, animal, or plant life. Permitted uses must not be detrimental to the uses permitted in adjoining districts. The following uses may be permitted within the floodway or between levees:

A. Uses having a low flood damage potential including agricultural uses, recreational uses, parking lots, loading areas, storage yards, airport landing strips, certain sand and gravel operations, water control structures, navigation facilities, and other open space uses.

B. Structures accessory to the above uses and commercial excavation and stockpiling of materials may be permitted if:

(1) structures are not intended for human habitation;

(2) structures will have a low flood damage potential;

(3) structures or stockpiles of materials, if permitted, will be constructed and placed so as to offer a minimal obstruction to the flow of flood waters;

(4) structures will be firmly anchored to prevent flotation; and

(5) service facilities within these structures, such as electrical and heating equipment, will be at or above the flood protection elevation for the site as described in part 6120.5700, subpart 5, or adequately floodproofed as provided in part 6120.5900, subpart 3, item D.

C. Channel and harbor connections to public waters, constructed under authority of Minnesota Statutes 1969, chapter 105, which can be shown will not cause material increases in flood stages within the floodplain and which will not increase the flood hazard to properties adjacent to the floodplain.

D. Public utility facilities and water oriented industries which must be adjacent to watercourses provided that the development is located in such a manner that it will not significantly alter flood flows, heights, or velocities of the regional flood. Whenever necessary, compensating measures shall be required to be undertaken to offset any adverse effects of allowing the use within the floodway and to keep increases in stages of the regional flood within the limits specified in part 6120.5700, subpart 4, item A.

Subp. 4. **Development of flood fringe areas adjacent to and outside of floodways.** Development:

A. General provisions. All floodplain developments within designated flood fringe areas shall be compatible with local comprehensive plans.

Floodplain developments shall not adversely affect the efficiency or unduly restrict the capacity of the channels or floodways of any tributaries to the main stream, drainage ditches, or any other drainage facilities or systems.

B. Residential areas. The finished surface of the first floor or basement floor of any residential building or structure to be erected, constructed, reconstructed, altered, or moved on the floodplain shall ordinarily be placed on fill at or above the flood protection elevation. The fill shall be at or above the elevation associated with the regional flood plus any increase in the water surface elevation due to floodplain encroachment as described in part 6120.5700, subpart 4, item A. The fill shall extend at such elevation at least 15 feet beyond the limits of any structure or building erected thereon. Where existing streets or utilities are at elevations which make strict compliance with this provision impractical, the commissioner may authorize use of floodproofing or other measures or methods to provide protection to the flood protection elevation. Floodproofing or other protective measures may be allowed only upon issuance of a special use permit by the local governmental unit.

C. Commercial areas. Commercial buildings or structures generally are to be constructed on fill with no first floor or basement floor below the flood protection elevation. Accessory land uses such as yards, railroad tracks, and parking lots may be at lower elevations. However, in the absence of an adequate local flood warning system, no area shall be designed for use by the public which would be inundated to a depth greater than two feet or subjected to flood velocities greater than four feet per second upon the occurrence of the regional flood.

D. Manufacturing and industrial areas. Manufacturing and industrial buildings, structures, and appurtenant works shall be protected to the flood protection elevation. Measures shall be taken to minimize interference with normal plant operations especially for streams having protracted flood durations.

Certain accessory land uses such as yards, railroad tracks, and parking lots may be at lower elevations subject to requirements of item C. Local ordinances shall give due consideration to needs of industries whose businesses require that they be located in a floodplain area.

E. Public utilities, roads, and bridges. Public utility facilities, roads, railroad tracks, and bridges within the floodplain should be designed to minimize increases in flood elevations and should be compatible with existing local comprehensive floodplain development plans. When failure or interruption of these public facilities would result in danger to the public health or safety or where such facilities are essential to the orderly functioning of the area, protection to the flood protection elevation shall be provided. Where failure or interruption of service would not endanger life or health, a lesser degree of protection may be provided for minor or auxiliary roads, railroad tracks, or utilities.

F. Storage of materials. Materials that, in time of flooding, are buoyant, flammable, explosive, or could be injurious to human, animal, or plant life shall be stored at or above the flood protection elevation, floodproofed, or protected by structural measures consistent with the standards set forth herein. Furthermore, storage of materials likely to cause pollution of the waters, as defined in Minnesota Statutes 1969, section 115.01, if subject to flooding are prohibited unless adequate safeguards approved by the state water pollution control agency are provided.

Subp. 5. **Nonconforming uses of the floodplain.** Local floodplain management ordinances may, where appropriate, provide for the gradual elimination of nonconforming uses within the floodway. Any addition or modification to a lawful nonconforming use shall be in conformance with the provisions of these standards and criteria and shall not increase the flood damage potential or increase the degree of obstruction to flood flows.

Nonconforming uses within the flood fringe may be continued provided that such uses will not have an unduly adverse effect on flood flows, velocities, or stages associated with the regional flood. Any addition or modification to a lawful nonconforming use within the flood fringe shall be in conformance with the provisions of these standards and criteria. Where applicable, provisions shall be made to allow the proposed modifications and additions to be protected to the flood protection elevation by an approved use of supplemental floodplain management measures as outlined in part 6120.5900.

Statutory Authority: *MS s 104.05*

6120.5900 SUPPLEMENTAL STANDARDS AND CRITERIA FOR FLOODPLAIN MANAGEMENT.

Subpart 1. **In general.** Supplemental measures for floodplain management should be included in local governmental comprehensive floodplain management programs and adopted or provided in addition to local zoning ordinances when sufficient technical data and resources are available for their effectuation. All local governmental units shall provide for control of the development and use of floodplains in flood hazard areas by adopting the following specific regulations and measures where practical to supplement and complement floodplain zoning ordinances and provide comprehensive floodplain management.

Subp. 2. **Subdivision regulations.** Local government floodplain subdivision regulations shall regulate floodplain land subdivision in order to promote the public health, safety, and general welfare; promote wise use of floodplain lands; assure that floodplain lands are suitable for building sites and public improvements; provide for adequate drainage of the subdivided area; provide for ingress and egress to all lands involved; promote proper surveying, legal description, and monumenting of subdivided land; and establish procedures for vacating, correcting, and revising plats. The subdivision regulations shall

establish standards for protection of roads, sewers, water supply, and other facilities from floods. In addition the regulations shall provide that:

A. the floodplain, floodway, and flood fringe areas as determined by standards set forth in part 6120.5600, subpart 4, be clearly labeled on the plat;

B. subdivision of lands within floodplain areas may not be approved if the cost of providing governmental services would impose an unreasonable economic burden on the local government unit; and

C. restrictive deed covenants shall be filed with the final plat and shall provide that the floodplain area be left essentially in the state shown on the plat, establish finished elevations of buildings, structures, and private streets and roads, and require that additions or modifications to these facilities will not violate any provisions of the floodplain zoning ordinances or supplemental regulations.

Subp. 3. **Building codes.** Building codes shall provide for the control of the design, construction, addition, and modification of buildings or structures placed in floodplain areas under authorized floodplain management ordinances. Floodplain building codes shall provide for necessary construction measures to protect health, safety, and welfare and to reduce the damaging effects and hazards of floods subject to the following standards:

A. The degree of flood protection required for building construction by building codes shall be based on the flood protection elevation described in part 6120.5700, subpart 5, and on flood velocities and duration of the regional flood for the particular area.

B. Whenever feasible and compatible with floodplain zoning ordinances and other regulations, all new buildings or structures located, constructed, or reconstructed in the floodplain shall conform to the following provisions:

(1) The first floors or basement floors of the buildings or structures shall be at or above the flood protection elevation in accordance with parts 6120.5700, subpart 5 and 6120.5800.

(2) Those portions of buildings, structures, and appurtenances located below the flood protection elevation shall be adequately floodproofed as provided in item D.

C. Alterations or additions to existing buildings or structures may be permitted if such will:

(1) decrease the flood damage potential of the building or structure;

(2) not increase the degree of obstruction to flood flows;

(3) provide for adequate protection of the building or structure to the flood protection elevations where applicable, in accordance with the provisions of part 6120.5700, subpart 5; and

(4) not endanger human life.

D. Where floodproofing is incorporated into new buildings or structures, and into alterations or additions to existing nonconforming structures, floodproofing measures shall be provided to the flood protection elevations described in part 6120.5700, subpart 5, and designed to withstand flood velocities, depths, durations, forces, and any other factors associated with the regional flood. A plan or document certified by a registered professional engineer or architect that the floodproofing measures are adequately designed to withstand regional flood conditions shall be submitted to the local government unit for approval before authorization is granted for the proposed work. Where this is not practical because of the particular circumstances, the commissioner may authorize other methods to determine the adequacy of floodproofing measures. Authorized floodproofing measures may include such provisions as anchorage of structures to prevent flotation, installation of watertight barriers over openings, reinforcement of walls to resist water pressures, use of materials

to reduce wall seepage, construction or modification of water supply and waste disposal systems to prevent entry of flood waters, placement of essential utilities above the flood protection elevation, and installation of pumping facilities for internal and subsurface drainage.

Subp. 4. **Sanitary regulations.** In addition to all applicable state rules, regulations, requirements and laws, and local laws, local sanitary regulations shall:

A. Require the floodproofing of proposed water supply systems in floodplain areas to prevent entry of flood waters by means of floodproofing techniques consistent with subpart 3, item D.

B. Control the location, construction, or modification of private and public liquid or solid waste treatment and disposal facilities in floodplain areas so that:

(1) No new construction, addition, or modification to existing sewage, industrial waste, or other waste disposal systems shall be permitted within the floodplain unless emergency plans and procedures for action to be taken in the event of flooding are prepared, filed with, and approved by the state water pollution control agency.

(2) Emergency plans and procedures established consistent with item B, subitem (1) must provide for measures to prevent introduction of any pollutant or toxic material into the flood waters.

(3) Public or municipal collection and treatment facilities are used where available and where feasible.

(4) There shall be no disposal of garbage or solid waste materials within any floodplain areas, except at those disposal sites approved by the state water pollution control agency provided there will be no further encroachment on the floodway.

Subp. 5. **Warning signs and public information regulations.** Local governmental regulations shall provide for adequate floodplain warning and public informational services as follows:

A. In urban areas the limits of the areas which have been or would be inundated by the regional flood or by experienced floods of greater magnitude shall be delineated in the field at reasonable intervals by means of firmly placed markers of a sufficient size to be easily read from a distance of 20 feet.

The markers shall record the maximum known depth of flooding or height to the flood protection elevation, whichever is greater, as well as the zoned land use classification of the area involved.

The local government unit may prescribe the shape, size, lettering, and installation instructions for floodplain markers.

The cost of preparing and installing floodplain markers in future subdivided areas should be borne by the subdivider and the markers shall be installed prior to the sale of lots and construction of any buildings or structures.

Provisions should be made to monument bench marks for vertical control data as provided in part 6120.5600, subpart 4.

B. To fulfill the intent of Minnesota Statutes 1969, section 104.03, every local governmental unit with flood hazard areas and a floodplain management program shall submit to the commissioner by March 30 an annual report outlining and summarizing the previous year's activity and progress in floodplain management activities on a form to be provided by the commissioner. The report shall include information as to:

(1) progress in the acquisition of technical floodplain information, including a summary of any flood crest elevations, cross sectional data and maps or illustrative material prepared by or for the local governmental unit;

(2) progress in floodplain management program administration, including a summary of zoning permits issued, subdivision plats approved, building permits issued, variances granted, enforcement action, etc.; and

(3) flood warning and information sources, including a summary of flood warning systems established or implemented, emergency plans prepared, and public informational reports and studies concerning various aspects of local floodplain management.

Subp. 6. **Measures for flood control.** When local floodplain management plans provide for structural works for flood control, such as levees, floodwalls, channel improvements, and reservoirs, all structural works or land treatment practices shall be consistent with the following statewide standards and criteria for floodplain management practices:

A. Any proposed work in the beds of public waters, as defined in Minnesota Statutes 1969, chapter 105, which will change the course, current, or cross-section of public waters of the state shall be subject to the provisions of Minnesota Statutes 1969, chapter 105, and other applicable statutes.

B. The minimum height and structural design of any dikes, levees, floodwalls, or similar structural works in place, or proposed to be placed in the floodplain shall be based on the flood profile of the regional flood confined between the structures subject to the following:

(1) For urban areas the minimum authorized height and design of proposed structural works shall be at least three feet above the elevation of the regional flood, as confined by the structures, or shall be at the elevation of the standard project flood, whichever provides the greater protection from flooding.

(2) Increases in upstream flood stages which would result from construction of dikes, levees, floodwalls, or similar structures for protection of urban areas and for agricultural uses in rural areas shall not increase the stage of the regional flood in excess of amounts listed in part 6120.5700, subpart 4, item A, and shall be reflected in the flood protection elevations for the upstream reach.

(3) Modifications and additions to existing structural works shall be regulated to assure that the proposed work will provide a means of decreasing the flood damage potential in the area and will provide the most reasonable protection of properties in heavily populated floodplain areas consistent with these standards and criteria. Any existing structural work which potentially threatens public health or safety shall be modified or reconstructed in order to meet the standards contained herein within a reasonable period of time based on agreement between the local government unit and the commissioner.

C. Flood protection elevations and floodway limits which reflect proposed measures for flood control shall not be effective until such measures are constructed and operative unless the proposed measures will increase flood heights in a given reach.

D. Floodplain development landward of any levee or floodwall shall provide for interior drainage including designation of ponding areas to protect against flooding from interior drainage.

Statutory Authority: *MS s 104.05*

6120.6000 REGULATION OF PUBLIC USES.

In accordance with Minnesota Statutes 1969, sections 104.03 and 104.05, all state agencies and local units of government, in the construction of buildings, structures, roads, bridges, or other facilities located within floodplain areas delineated by local ordinances shall comply with the standards set out in these administrative rules.

Statutory Authority: *MS s 104.05*

6120.6100 VARIANCE FROM STANDARDS.

Local governmental units may permit variances to the provisions of their floodplain management ordinances where it appears that by reason of exceptional circumstances the strict enforcement of the local ordinance would cause undue hardship and strict conformity with the standards would be unreasonable, impractical, and not feasible under the circumstances. Variances granted by local governmental units must be consistent with the general purpose of these standards and the intent of applicable state and national laws and programs. Although variances may be used to modify permissible methods of flood protection, no variance shall provide for a lesser degree of flood protection than stated in these standards.

Statutory Authority: *MS s 104.05*

6120.6200 GENERAL ADMINISTRATION OF FLOODPLAIN MANAGEMENT ORDINANCES.

Subpart 1. **Procedures.** Local governmental units shall provide for the administration and enforcement of their floodplain management ordinances. To aid the commissioner in evaluating the effectiveness of local administration and enforcement, as provided in Minnesota Statutes 1969, section 104.03, the zoning administrator or other officer designated by the local governing body shall submit to the commissioner a copy of any application for a variance or special permit use where a hearing is to be held to consider such application. The commissioner shall receive at least ten days' notice of the hearing. Such notice shall specify the time, place, and subject matter of the hearing and shall be accompanied by such supporting information as is necessary to indicate the nature and effect of the proposed use. A copy of all decisions granting a variance or special permit to the provisions of the local floodplain management ordinance shall be forwarded to the commissioner within ten days of such action.

Subp. 2. **Technical assistance.** The local governmental unit may request technical assistance from the commissioner in evaluating requests for variances or special permits to the local floodplain management ordinance. Such assistance shall be provided by the commissioner within the limits of available appropriations and personnel.

Statutory Authority: *MS s 104.05*