

Flood Damage Reduction:



What Minnesota Has Done and Still Needs To Do...



**Minnesota Department
of Natural Resources
DNR Waters**

**Flood Damage
Reduction Program**



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Flood Damage Reduction:

What Minnesota Has Done and Still Needs To Do...

by DNR Waters Hydrologists
St. Paul, Minnesota

December, 2001



**Minnesota
Department of Natural Resources
Waters**

“Helping people ensure the future of our water resources”

Kent Lokkesmoe, Director

Preface

*The taste of sand in your mouth, the sight of an ocean in your back yard,
and the pain of leaving your home not knowing when you could return.....*

Jamie Holmstrom

from 1997 The Red River Valley Flood



Though the flooding in Minnesota in 2001 in some areas was often as serious as or worse than 1997, investments made in flood mitigation by the Legislature through the Waters Division of the Minnesota Department of Natural Resources greatly reduced the damage. The state was much better prepared for the historic floods of 2001. For example, the flood mitigation project built for the city of Oslo in 1984 at a cost of \$2 million dollars, prevented almost 31 million in damages since construction. This kind of project is a powerful testimonial for spending money to protect the safety of citizens and economic stability of their communities in the state.

Since the Flood Damage Reduction Grant Assistance Program was established by the State Legislature in 1987, communities across Minnesota have experienced less damage from floods than they would otherwise have expected. Working in partnership with local, state and federal resources, incidents of repetitive loss to structures and communities are going down, but numerous mitigation projects remain to be done throughout the state.

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Ginger Sisco
Toby McAdams, editors

Climatic Conditions = Flood Recipe

The 1997 spring flooding along the upper reaches of the Minnesota River and Red River of the North broke most existing flood records in Minnesota. The Federal Emergency Management Agency's (FEMA) public infrastructure (to roads, bridges, public buildings, etc.) damage total for Minnesota from the flood was approximately \$300 million. Before the water receded, 59 of Minnesota's 87 counties were declared federal disaster areas. The American Red Cross reported that 23,263 families were affected by the massive floods. Total flood damage and associated economic impacts were estimated to be as high as \$1.5 billion.

State flood recovery funding in 1997 was \$125 million, federal flood recovery funding was \$574 million, and private funding for recovery was \$132 million, totaling over \$830 million.

In the spring of 2001, flooding of historic proportions occurred again. This time, 51 counties and two tribal governments declared local emergencies. In 20 of the counties, help was sought for 9,100 damaged businesses and private homes. Of those buildings, 1,096 homes were damaged, including 16 destroyed; 83 businesses were damaged, four destroyed. Local initial damage assessments were set at \$35 million.

Climatic conditions leading up to the floods of 1997 and 2001 were the same:



Breckenridge, 1997

* Significant autumn precipitation - In the fall of 1996, more than six inches of rain saturated the soil in northwestern Minnesota before winter began. In November 2000, rains exceeded the historical average by two inches in many locations, filling the upper portions of the soil before winter freeze.

* Heavy winter snowfall - In 1996-97 nearly all of Minnesota received more than 50 inches of snowfall. Wide swaths of the state got close to 100 inches, far surpassing the historical average of 36 in the west and 50 inches in the eastern side of the state. Mid-November 2000 snows blanketed the state, and snow cover lasted into spring. Snowfall passed the average by two feet in western Minnesota and was more than 18 inches above average in the southern portion.



Red River Valley, 1997



Park shelter in Breckenridge, 1997

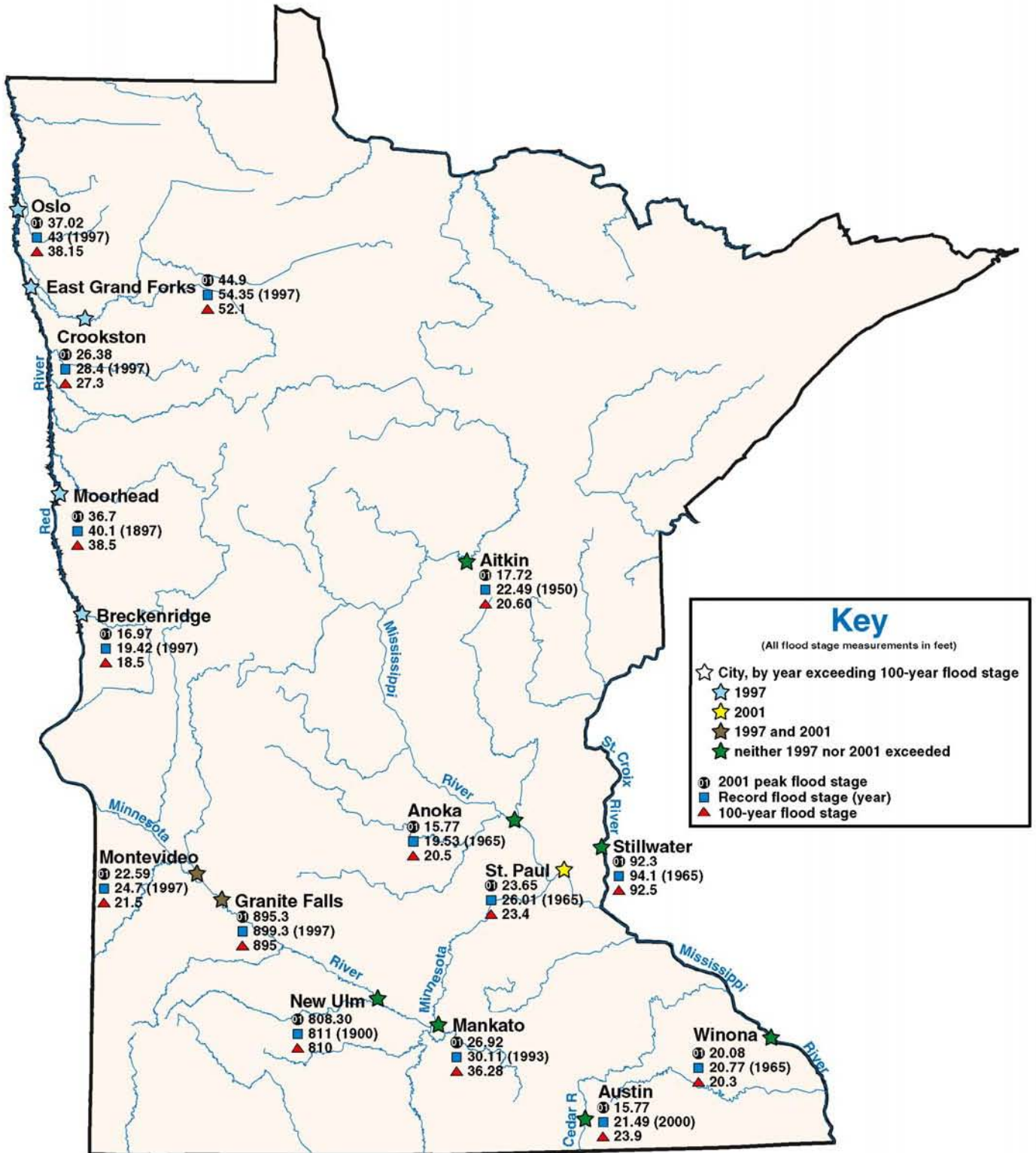
* Less-than-ideal snowmelt scenario - In spring 1997, colder than average winter temperatures did not allow much snow melt. Then in April sleet and rain storms dumped another two to three inches of rain on much of the state before the heavy snow had started to melt. The winter of 2000-2001 had very few mid and late-winter melting days. January was mild but not warm enough to melt snow, February was cold with temperatures four to eight degrees below normal, and March temperatures were three degrees below normal. The snow pack gradually diminished in depth, but snow water content did not change and melt water stayed on the landscape.

* April weather - In 1997 warm weather in mid-April on top of the early April sleet and rain hastened the snow melt. In 2001, by the end of April, precipitation surpassed the historical average by more than four inches in southwestern, central and east central Minnesota exceeding six inches of precipitation from April 1-23. By April 30, some areas set all time records of precipitation surpassing seven inches.



Breckenridge, 1997

Minnesota Flood Stage History



Existing Floodplain Management

Throughout the history of development in this country, communities have grown up near bodies of water to support economic development and transportation needs. People are attracted to the natural beauty of water. With climatic conditions of snowfall, rainfall and snowmelt, coupled with the presence of people in floodplains around our 12,000 lakes and 92,000 miles of rivers and streams, statewide floodplain zoning regulations were instituted in 1970.



House on fill in Bayport

A flood of the magnitude of what is described as the “100-year flood”, that is a flood with a one percent chance of being equaled or exceeded in any given year, occurred on the Mississippi River in 1965 and 1969. 100-year floods have since occurred in various parts of the state in 1972, 1975, 1978, 1979, 1987, 1993, 1997 and most recently in 2001. In addition to snowmelt floods, severe thunderstorms can occur several times a year causing flooding and damage to crops and communities.

Local government floodplain regulations reflect the belief that people and their structures should not be located in high hazard areas. The result is that all new construction should not be flooded unless it experiences a very severe event, definitely greater than a 100-year event.



House being moved out of the floodplain in Breckenridge

More than 400 cities and counties in Minnesota enforce floodplain zoning ordinances that state that no new buildings shall be placed in the path of floodwaters and that buildings that are substantially damaged by flooding shall not be rebuilt in the floodplain unless the structure meets the flood protection standard set in the local ordinance. In the 100-year floodplain, the number of flood-prone buildings statewide has been reduced from nearly 20,000 in 1970 to approximately 10,000 in 2001.



Townhouse with tuck-under garage that opens during the flood

Flood Insurance Reduces State's Responsibility

Congress created the National Flood Insurance Program (NFIP) in 1968 to make flood insurance available to property owners, at federally subsidized rates, provided the community agreed to regulate and restrict future flood plain development. The NFIP encourages property owners to take responsibility for their financial future in the event of a flood, rather than relying solely on government disaster assistance.

In Minnesota, state and federal flood damage reduction dollars reach far more communities and residents when people are protected by the National Flood Insurance Program. After flooding occurs, those with NFIP insurance receive payments from that program to rebuild and do not depend on mitigation programs of the state and federal government. In an acquisition/relocation area of a federally-declared disaster area, a non-insured homeowner could be offered the full pre-flood market value of the home the same as an insured homeowner. If a federal disaster is not declared following a flood, uninsured home owners are entirely on their own.



Breckenridge, 1997

For residents and businesses in a community to be eligible for federally subsidized flood insurance, their community must apply to the Federal Emergency Management Agency (FEMA) to participate in the National Flood Insurance Program. This requires that the community adopt a floodplain management ordinance commensurate with the level of floodplain mapping provided to the community by the FEMA. In Minnesota, 87 counties and approximately 850 cities are eligible to enroll in the NFIP. Of these, 85 counties and 430 cities have enrolled. (Note: a city enrolls in the NFIP for incorporated areas and a county enrolls for all unincorporated areas located outside of cities in a given county. Hennepin and Ramsey counties are almost entirely incorporated and do not participate in the NFIP.) In excess of 90 percent of Minnesota residents live in communities that participate in the NFIP.



Business in Breckenridge, 1997

If a home or business located in a 100-year floodplain mapped by the NFIP is financed by a federally guaranteed loan, the lender must require flood insurance as a condition of the loan. Most communities in Minnesota that need to participate in the program do participate, but historically, less than half of the homes in the 100-year floodplain have flood insurance coverage. This percentage increased dramatically in 1997 in the Red River and Minnesota River valleys because of early flood warnings and media coverage.

Most cities have taken some responsibility for flood mitigation. Homeowners can ensure that their homes can be rebuilt following a climatic disaster. But there is much more prevention work that must be undertaken to prepare the state against the inevitable floods. Local units of government are not able financially to take on major flood mitigation projects. They must seek funding partners.

The DNR Flood Damage Reduction Grant Assistance Program

The Flood Damage Reduction Grant Assistance Program (FDR) was established by the 1987 Minnesota Legislature to provide technical and financial assistance to local government units for reducing the extent of flood damages. It is administered by the Waters Division of the Minnesota Department of Natural Resources. Under this program the state makes cost-share grants for up to 50 percent of the cost of flood mitigation projects.

Currently two classes of grants are available. Small grants for projects with a total cost of less than or equal to \$300,000 (maximum state share \$150,000) are made directly by the DNR from general funds appropriated by the legislature. These are competitive, and are limited to available funds. Cities, counties, towns, watershed districts and watershed management organizations, lake improvement districts, soil and water conservation districts, and joint powers organizations composed of any of these units may apply. Small projects and studies are covered through this grant program.

Large grant requests for projects with a total cost greater than \$300,000 are received and prioritized by



the DNR and presented to the governor and the legislature for consideration in a capital bonding bill.

In addition to partnering directly with local units of government, FDR grants can be used to leverage financial and technical assistance from other agencies. DNR Waters and local units of government have partnered with the U.S. Army Corps of Engineers on federal flood control projects as well as projects in the Federal Section 14, 22, and 205 Programs. FDR funds can also be used to leverage acquisition and hazard mitigation funding from the Federal Emergency Management Agency (FEMA) through the State Division of Emergency Management following a disaster.

The ravages of flooding have disastrous effects on both people's lives and their communities. Participation in the FDR program enables communities to break the tremendously expensive and repetitive damage/repair cycle and is extremely cost-effective. An example is Henderson on the Minnesota River, where a levee constructed in 1997 at a cost of 1.9 million has averted 5.2 million dollars of damages. The FDR program is very popular with the state's communities.



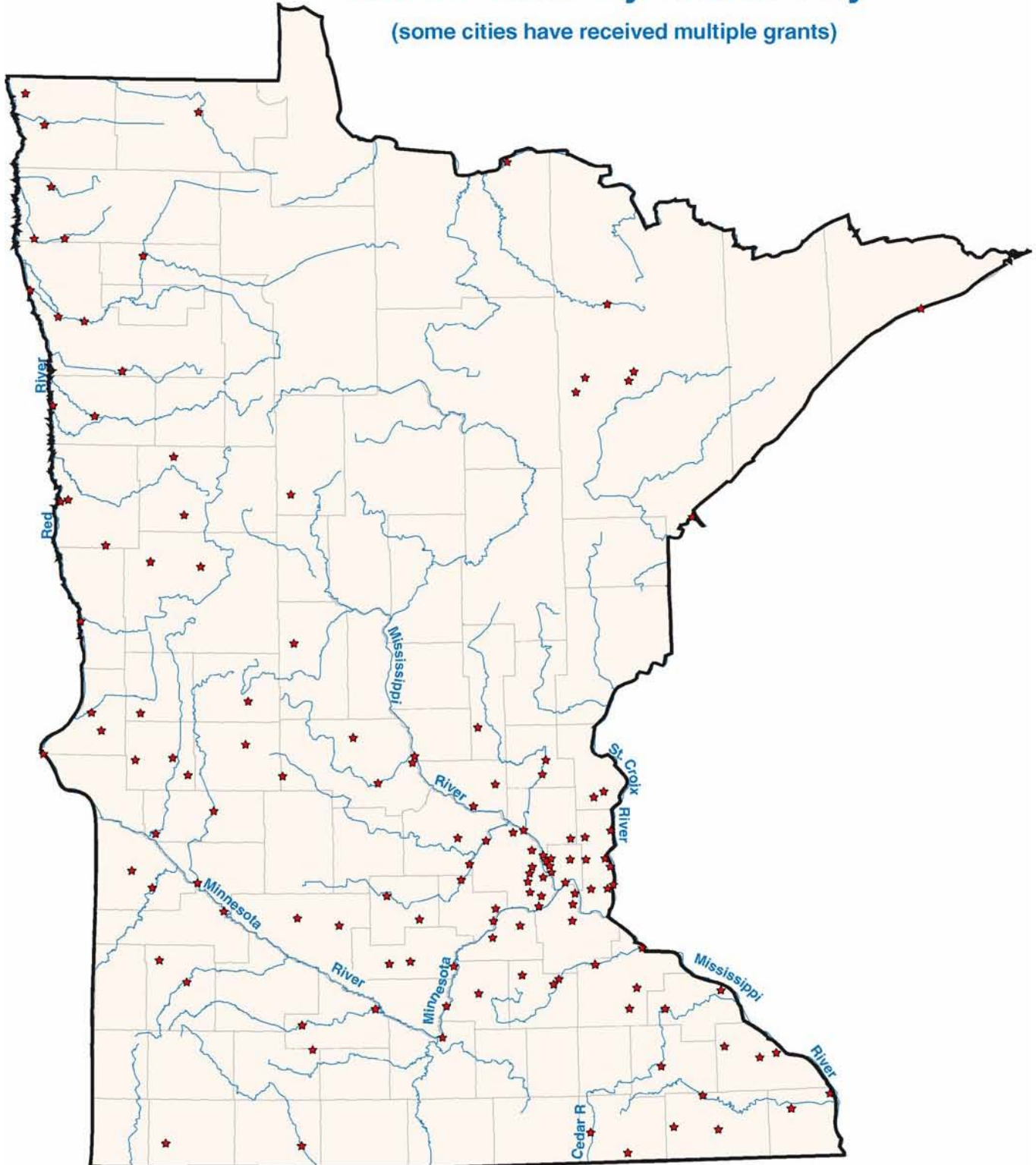
Orchard Estates in Dilworth during the 1997 Flood



A small levee now protects Orchard Estates

Flood Damage Reduction Projects Since 1987 by Grant City

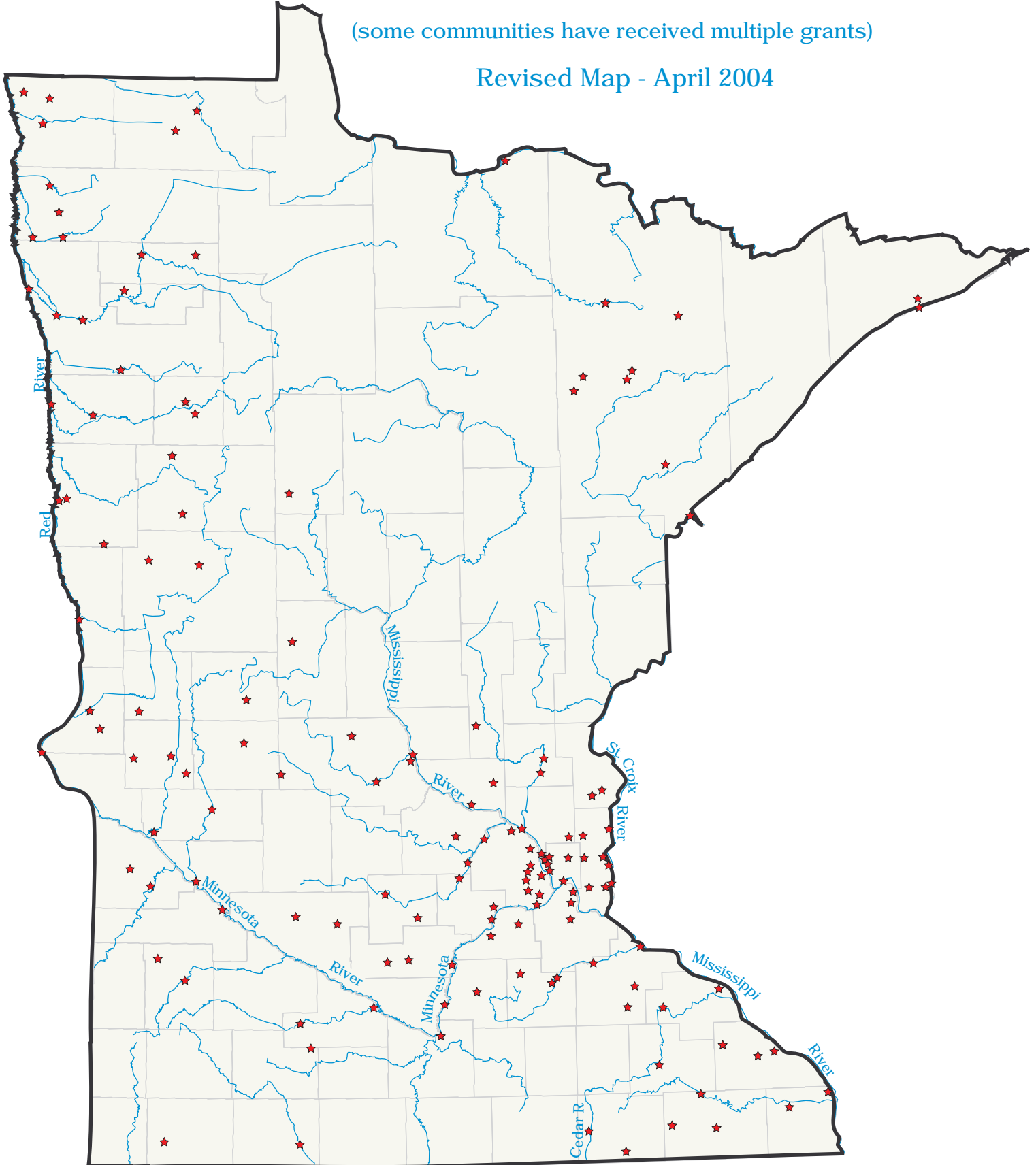
(some cities have received multiple grants)



Flood Damage Reduction Projects Since 1987

(some communities have received multiple grants)

Revised Map - April 2004



Partners in Flood Damage Reduction Projects

DNR Waters always teams with partners in flood damage reduction projects using both its base level funding from the general fund and any bonding monies that have been appropriated. Without these funds, DNR could not provide the non-federal match dollars that trigger access to the Federal Emergency Management Agency (FEMA) funds in a presidentially-declared disaster. Here are DNR Waters' primary partners:



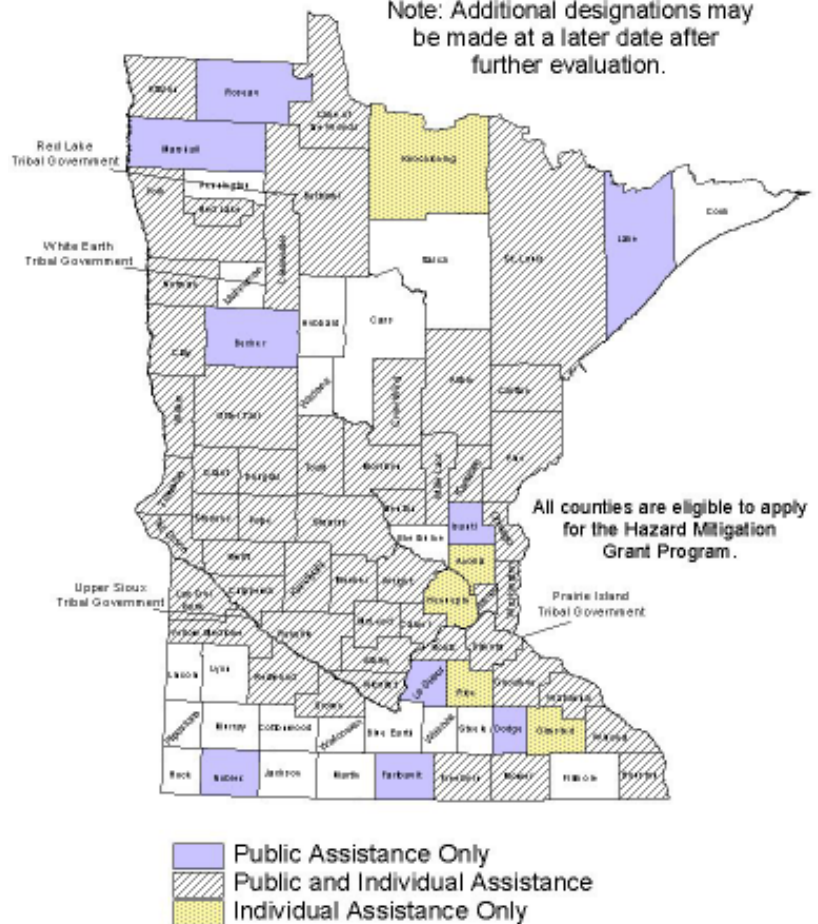
Minnesota Department of Public Safety, Division of Emergency Management (DEM)

This division convenes the state's Minnesota Recovers Disaster Task Force following a presidentially-declared disaster. Task force members include state and federal agencies that provide services in a disaster. DEM also manages the Hazard Mitigation Grant Program (HMGP) with funds from the Federal Emergency Management Agency (FEMA). HMGP funds are available when the president declares a disaster. They are used by communities for damage to infrastructure like sewer, water and electricity, and damages to individuals. The HMGP funds up to 75 percent of a project's cost and the other 25 percent must come from non-federal sources such as DNR Waters, the Department of Trade and Economic Development, a city or county, or a home or business owner. As Terri Smith, Hazard Mitigation Administrator at the Division of Emergency Management, describes it, "We're effective because of the relationships we have. We play a financial and coordinating role. None of the participating agencies have the tools alone. As partners, we figure out the best way to serve our communities."

FEMA-1370-DR-MN

Current eligible counties as of July 17, 2001.

Note: Additional designations may be made at a later date after further evaluation.



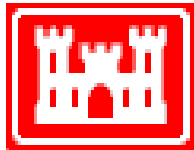


Minnesota Department of Trade and Economic Development (DTED)

DTED acts as the liaison between the communities and agencies like the Division of Emergency Management and DNR Waters who take the lead on flood control structures. Louie Jambois, DTED community finance director, says, “We are one of the core members of the Minnesota Recovery Task Force. We aren’t experts in flood control, but we have money and relationships with communities so we can act in a coordinating role as project funding packages are put together from several sources.” While DTED receives federal community development block grant money (CDBG) annually, it also receives recovery block grant funds with a presidential disaster declaration. CDBG funds are flexible and can be used for planning, new housing projects, project administration, waste water treatment - a broad range of flood mitigation strategies.



New pump to keep the city of Breckenridge dry



U. S. Army Corps of Engineers

In 1936, with the Flood Control Act, Congress assigned the Corps of Engineers to take responsibility for flood control engineering works and later floodplain information services. According to Judy DesHarnais, since 1986, the Corps of Engineers has been required to use its federal dollars as a cost-share partner with state and local sources. Most of the projects are structural such as levees and floodwalls. Federal funding comes through three sources: a project authorized by Congress, the Continuing Authorities Program, and Flood Control and Coastal Emergency Funding following a presidential disaster declaration. It is not unusual for FEMA to hire the Corps to help in the case of a presidential disaster declaration. The Corps has an ongoing relationship with agencies involved in flood mitigation and sends a project manager to the Minnesota Recovery Task Force when it is convened.



Winona flood control structure built in the 1950s with help from the Corps (shown in 2001)



Levees protected Perley in 1997

Local Landowners

These are critical players in small projects, like ring dikes, because they see the project's immediate value. The average cost of a farmstead ring dike is approximately \$30,000 (50 percent state share is \$15,000). Each ring dike is designed to protect a farmstead residence and its related structures for storing crops, cattle, and production equipment. It has been estimated that the value of a single grain storage structure, when full from a season's harvest, or the value of a single cattle-related facility, will often exceed the cost of the ring dike construction.



Ring dikes in the Red River Valley during the 1997 flood

The Unique Role of the Minnesota Department of Natural Resources in Flood Mitigation

Among all the agencies that play a role in flooding and disasters, the DNR has some distinct differences from its partners.

DNR money is focused on mitigation - on the prevention of future damages from disastrous events.

The DNR gets money to communities for flood damage reduction quickly. As compared to federal programs, the state DNR programs work quickly to get money to communities who have a plan to mitigate flood damages.

The DNR does not fund any clean-up work. It focuses entirely on reducing the impacts of future flooding disasters.

Local Units of Government (LUGs)

These partners can be city or county government, but they can also be nonprofits such as Nature Conservancy and Ducks Unlimited.

LUGs know the community and its needs. Every project must have a local sponsor. They know their community. They also coordinate all the work done at a local level, pay the bills, and submit documentation to the other funding partners.



A small levee protects homes in the town of Dayton, at the confluence of the Crow and Mississippi Rivers

DNR Flood Mitigation Projects - Invest now to save later

Many communities have taken initial steps to protect their homes and businesses from flood damage. They have floodplain ordinances, and some home and business owners have purchased flood insurance. But many communities can look at their own flooding histories and can predict that a catastrophic event will occur unless further preventive steps are taken. One frequently used step is to begin removing structures from harm's way by removing all structures from the floodplain. Other flood mitigation projects, like levees and floodwalls, are expensive. They often require partnerships, but these projects have a proven record of high value to the communities where they are built.

Here are some cities whose recent flood mitigation projects averted million of dollars of catastrophic damage in the spring floods of 2001. These projects are working to bring communities to at least the point where the 100-year or 1% chance event will cause minimal damages.

Montevideo

Montevideo sits at the confluence of the Minnesota and Chippewa rivers. When high water comes, the Chippewa River floods over its banks and backwater from the Minnesota River affects public, commercial and residential structures within the city of Montevideo. Historically, Montevideo has had devastating floods in 1952, 1969, 1997 and 2001 and significant floods dating back to 1881. Federal aid has been available to the city in 1952, 1957, 1969, 1993 and 1997.

Emergency levees were constructed protecting portions of the city after the 1952 flood and were raised and strengthened during the 1969 and 1997 flood fights. The flood of 1997 was the highest in recorded history, reaching nearly 11 feet above flood stage.

Flood Stage: 14.0 feet

Highest Known Stage: 24.7 feet (1997)

2001 Stage: 22.59 feet



1997 Damages: “We had five feet of water in the house - even the ceiling got soaked,” said DuWayne Larson, resident of Montevideo. “It stunk so bad, there was no way I was going to live in that. Then we got the animals swimming in - mice, rats, muskrats, snakes. I decided: That’s enough of this. I never realized what water could do.”

Smith Addition in 2001. Red dots show houses removed after the 1997 flood.



Smith Addition, Spring 2001

After three inches of water drained from the house, Jerry Tilden said it took at least 1,000 hours of work to get the house cleaned up, carpets, a furnace, electrical wiring replaced, costing at least \$30,000. “We worked 14 to 16 hours a day for seven straight weekends,” Tilden said. “And we must have had 300 Salvation Army volunteers in this neighborhood.” *Star Tribune*, June 22, 1997

The flood of 1997 was the highest in recorded history. Damage was extensive as was the flood fighting effort. Approximately \$688,000 was expended by the city in flood fighting and clean up costs alone.

The area of greatest devastation was in a housing area called Smith Addition in the floodplain along the Chippewa River. As the Minnesota River crested, it rushed overland, inundated the neighborhood and eventually mingled with the flood waters of the Chippewa River. Only two of the 125 houses in Smith Addition were habitable after flood waters receded.

Cost of Recovery & Remediation: \$7.4 million since 1997 by all partners.

2001 Situation: Between 1997 and 2001, 80 to 85 of the 125 homes in the Smith Addition were acquired, relocated or demolished. “This spring, with only 40 homes left in the area, we were able to spend less staff and National Guard time evacuating Smith Addition families,” said Steve Jones, Montevideo City Manager. “That freed up people to work on the dike and other projects protecting more of the homes and businesses in our town of 5,000.”

Instead of postponing damage, buyouts prevented damage because the structures were gone. Open space was created, restoring part of the flood plain to the natural state which allows more floodwater storage.

“The flood mitigation projects made a big difference,” said Jones. “It’s in the millions of dollars. There was much less damage this spring.”

The devastation of the 2001 floods in the Smith Addition area has convinced more families to take the buyout, and that will require more funding from the city and its partners. “DNR is one of the best partners we’ve had. We will continue to need their dollars and federal help for Smith Addition buyouts because a small city like Montevideo can’t afford to do it without help from partners,” said Jones.

In March 2001, a feasibility study was completed by the US Army Corps of Engineers. The recommended project includes improvements to the existing levee system with updated internal drainage features. Homes will be acquired and removed or relocated to accommodate the improved levee system. The estimated total cost is \$7 million. Federal cost share is about 65 percent.



Corps will improve this levee along Gravel Road

East Grand Forks

In 1997, the city of East Grand Forks was swallowed up by a 230-year flood, 26 feet above its flood stage. It looked like a water world; water was everywhere. There was no sewer, no electricity, no clean water. Debris, stench, crushed homes, houses knocked off their foundations were everywhere. The water was filled with garbage, raw sewage, fuel oil. The smell was horrific.

Starting over seemed like an impossible, painful task. "How do you put it all back together? We have nothing to go home to. We just don't know. It's so hard," said a woman in a church shelter.



This billboard is usually 13 feet above ground

Flood Stage: 28.0 feet

Highest Known Stage: 54.35 feet (1997)

2001 Stage: 44.8 feet

1997 Damages: East Grand Forks' story in 1997 was bleak. A record eight blizzards dumped nearly 100 inches of snow on the city. The spring thaw left residents battling the rising Red River day and night for 15 days before the dikes gave way April 18. A 54.4-foot crest defeated the dikes and overwhelmed the city, forcing evacuation of its residents. Much of the city escaped to Crookston, where the population doubled in a 72-hour period.

Of the 2,301 residential properties in East Grand Forks before the flood, only 27 had no damage - 687 had at least 80 percent damage. The flood wiped out 38 percent, \$56.6 million, of the value of the city's residential property.



Every home in the Sherlock Park neighborhood was flooded

Only two of the town's public schools weren't knocked out by the flood, and all 1,250 child-care positions were eliminated. A conservative estimate of the flood's cost was \$400 million for a town whose total annual budget was just \$4 million.



Levee broke, 1997



Building invisible floodwall, 1998



Floodwall in place



Moving damaged homes out f the floodplain

Work done: The Minnesota Recovers Disaster Task Force partners bought more than 600 structures; rehabilitated commercial and residential properties; rebuilt and restored municipal drinking water treatment and distribution systems; rebuilt and restored sanitary treatment and collection systems; and rebuilt and restored municipal electricity distribution systems.

Cost of Recovery & Remediation: More than \$100 million coordinated by the Minnesota Recovers Disaster Task Force.

2001 Situation: In 2001, the fight was easier because so many homes had been cleared from low-lying areas.



Sherlock Park neighborhood will become the Red River State Recreation Area

And instead of calling out armies of volunteers to raise dikes with sandbags, the city deployed heavy equipment to shape stronger clay barriers earlier. (Past flood fighting experience had shown that packed clay holds up better than sandbags.) Topographic mapping of the area and painful experience had taught the city which areas needed specific kinds of defenses.

East Grand Forks Mayor Lynn Stauss said, “ In ’97, we were fighting right along with the level of the river. In 2001 we stayed two feet ahead of it, so we didn’t have to panic.”



Large levee in front of Sunshine Terrace

When Governor Ventura visited East Grand Forks in spring 2001, he said, “You can see the results of good, solid investment in permanent dikes and the invisible wall that protects East Grand Forks’ new downtown. You all are very well prepared....I like the permanent protection, because then you don’t have to face it year in and year out. In the long run, this is cheaper and safer.” (Star Tribune, April 14, 2001)

At this time, there is a US Army Corps of Engineers project in progress. The city will be protected by huge levees. The invisible floodwall and the levees on either side of the wall are only the first phase of the project. The total cost is expected to be \$137 million; \$61.5 million will be the non-federal share of which \$25 million has already been spent. (The total cost for the federal project authorized in the 1998 Omnibus Bill (federal legislation) for both Grand Forks, ND and East Grand Forks, MN is \$410 million.)

Breckenridge

This Minnesota community on the North Dakota/Minnesota border sits on three river banks. Significant flooding has occurred in the Breckenridge area in 1952, 1969, 1978, 1979, 1986, 1989, twice in 1997 and 2001.

Flood Stage: 10.0 feet

Highest Known Stage: 19.42 feet (1997)

2001 Stage: 16.97 feet

1997 Damages: The Red River and its tributaries spilled over their banks and flowed freely overland through much of Wilkin County, in western Minnesota on the North Dakota border. Breckenridge is the county seat. The first 1997 flood came when a higher-than-predicted crest overran the emergency levees on the Ottertail River, and the second flood came when overland flooding washed in from south of town, where no levees existed. These two floods caused \$20-25 million in damages to Breckenridge; 90 percent of its structures were damaged.



Overland flooding in the Red River Valley

Work done: Since the catastrophic flooding of 1997, Breckenridge has completed major flood mitigation projects. It has been buying out and demolishing homes in the flood plain. It put in 14 interior pump structures, 3 1/2 miles of dike, a couple of miles of floodwall, relocated the sanitary sewer lift station, and protected the water treatment plant.

Stan Thurlow, director of the Housing and Flood Recovery Office for Breckenridge is considered the moving force behind the city's new 130 units of housing, which replaced the 132 that were destroyed in the flood. He has also put together aid packages of all kinds to allow families to afford to move into new houses and stay in Breckenridge.



A flooded out business in 1997



Access to the city in 1997

Cost of Recovery & Remediation: \$21 million since 1993 from all partners

2001 Situation: When the floods of 2001 came this spring with the third or fourth highest water depth in the city's history, not one resident was flooded. Without the mitigation work done following the floods of 1997, the damage would have been \$5-10 million. The city knew where to fight it, how to fight it, and what the more difficult problems would be.



New housing units constructed after the 1997 flood

“After 1997 our flood mitigation problems were insurmountable. This town owes a huge debt to its partners,” said Thurlow. “It was impossible to find the millions of dollars needed on our own. The DNR was the key to matching funds from the Corps of Engineers. It helped with upfront costs because its money is so flexible.”

In order to stop the chronic flooding problems that have plagued this community for years, Breckenridge completed a feasibility study in September 2000 using US Army Corps of Engineers funding. The city, with assistance from the State of Minnesota had already constructed a section of floodwall along Minnesota Avenue and levees from the Red River to Main Street along Highway 75, and improved the southside levee system to North 8th Street. But more is needed.

Today, the city is enrolled in the U.S. Army Corps of Engineers specifically authorized Flood Control Projects program which requires financial participation from DNR and the city. The completed project will include the construction of a diversion channel, levees

and floodwall. Four combination interior drainage and pump stations along with closures at Minnesota Avenue, Nebraska Avenue, the Main Street bridge on the north and south ends would be required as part of this project. Construction of this project will stop a chronic flooding problem. A project cooperation agreement and construction are scheduled for 2002 but are dependent on obtaining Congressional appropriations for this specific project.



Monument at the headwaters to the Red River



A small invisible floodwall protects downtown Breckenridge

Moorhead

In a typical winter, Moorhead residents will have 39 inches of snow. In 1997, 117 inches fell setting the stage for the flood of the century.

City officials knew a flood was coming. They cleaned ditches for weeks in advance of the flood, in hopes of keeping flood waters channeled so they would flow through the city. They had surveyed for low spots and built dikes. But when the flood waters rose over the 100-year mark and stayed there for days, the city was close to a major disaster.

They began to have mechanical failures; storm sewer gates leaked and failed. When the water backed up through the storm sewer system, they made heavy steel plates to put on the manhole covers and parked heavy garbage trucks on them to hold them in place. Two weeks before the floodwaters came, a high volume pump arrived which had been purchased weeks before just in case they might have need for heavy, fast pumping. They set it up at the waste water plant to pump water from the pond to the river.

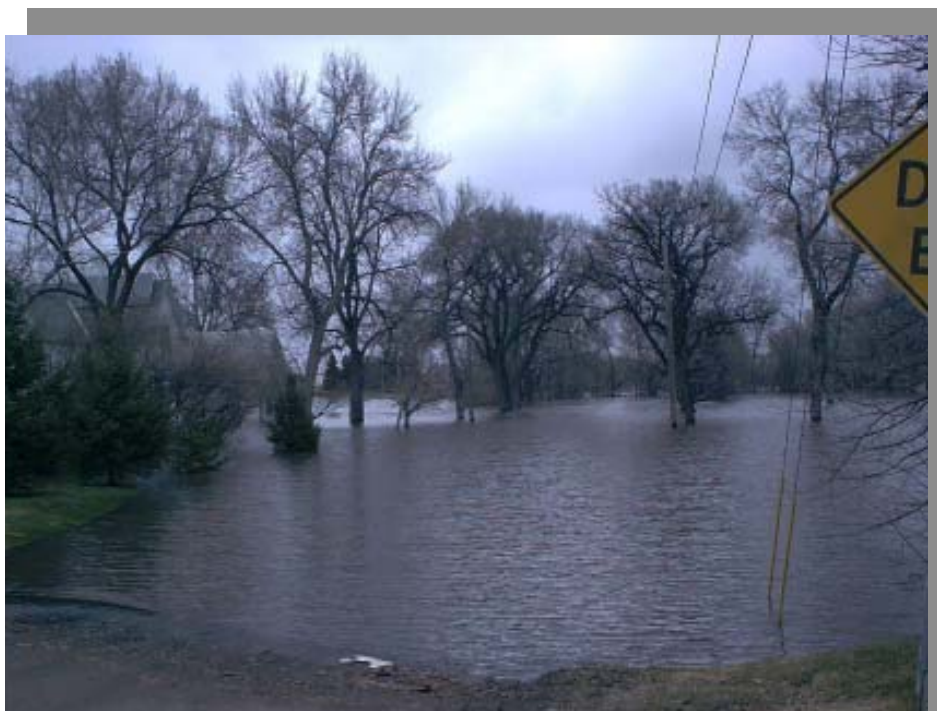
“We came within six inches of going over protective dikes,” said Bob Martin, Moorhead’s public works director. “We are all flat in this area; we had no high ground to escape to.”

Flood Stage: 17.00feet

Highest Known Stage: 39.57 feet (1997)

2001 Stage: 36.7 feet

Work done: Moorhead has acquired 16 homes located in the 100-year flood plain. It raised the level of the levees in Horn Park and Woodlawn Park to protect homes. It has installed gate valves on storm sewers and sanitary sewer connections to prevent river water rushing through the storm sewers from infiltrating the sanitary sewers. Sewer backup presented serious health hazards during the 1997 floods. The city installed rubber seals and isolation valves on homes remaining in the flood plain, and installed a concrete liner to effectively and safely move flood water through the city without damage.



Flooded areas around Moorhead in 1997

“We had some real close calls especially in 1997,” said Martin. “We were close to losing sanitary services to half the community. We have since reconstructed our dikes and done a lot of work on sewer improvements for protection.”

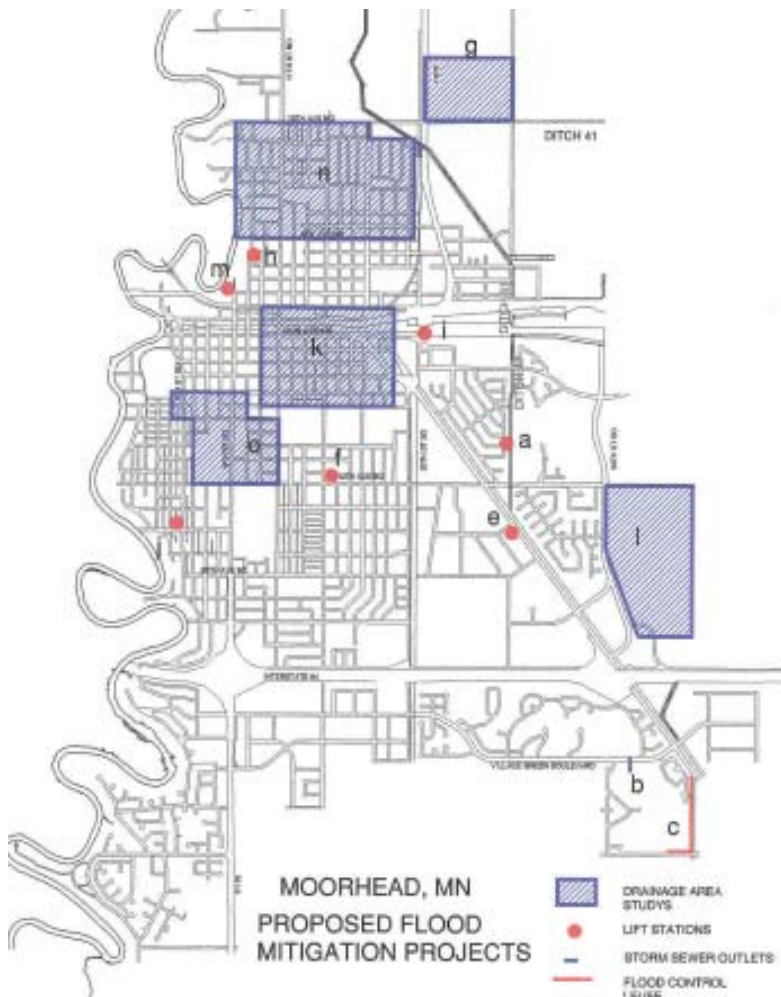
Cost of Recovery & Remediation: \$3.9 million since 1993 from all partners.

2001 Situation: “The flood in the spring of 2001 was a significant event, one of our top three floods, but there was no comparison on the strain, the ease with which we handled it,” said Martin. “We didn’t have big surprises and recurrences of old problems. The storm sewer and sanitary sewer systems had very little damage. We knew our vulnerable points, and we were able to prioritize and to give people notice about how to prepare. In 1997, it was very close. We had our hands full.”



The floods both in 2000 and 2001 did very little damage to this community which was devastated in 1997. Work is ongoing on the construction of a \$6 million levee to protect a residential neighborhood in the southeast section of the city from overland flooding from agricultural land.

“The partnerships with DTED, DNR, DEM and the Corps make it possible for a city our size to fund the mitigation projects we need. Those partners are flexible. They work well together and are extremely helpful and make the process easier for us,” said Martin.



On-going planning to protect Moorhead from floods

Red River Mediation Projects

Though discussion of the flooding in 1997 and 2001 often concentrates on the details of what happened in individual cities along the Red River, many more thousands of people living near rivers, streams, creeks and wetlands in rural areas of northwestern Minnesota were impacted as the land became saturated with water. The Red River basin has been transformed during the past 100 years from a prairie community to a renowned agricultural mecca. As land use intensifies, the runoff from the watershed has increased.

Local watershed districts are responsible for local policies and projects. Members of their boards are appointed officials. When the need for flood mitigation projects arises in a watershed district, the decision making process is complex, involving numerous conflicting - and often long-held - points of view among people in a large geographical area. Solutions have to be long-term and sustainable, both economically and environmentally.

A mediation process brought together landowners with federal, state and local officials. One result has been agreement and funding for four major projects.

Hay Creek Project

Restoration of Hay Creek and a 3,000-acre wetland is the goal of the Hay Creek Project. Hay Creek used to be a 6 1/2 mile straight deep ditch; it will become a 10 mile, shallow meandering channel providing up to 500 acres of wildlife habitat bounded by setback levees. The Norland Impoundment will catch its own runoff and that of Hay Creek, creating a 3,000 acre wetland with a combination of gate-controlled and ungated water storage.

Thief River Storage and Diversion Project

The goal of this project is to provide flood damage reduction in the Thief River Basin while protecting and enhancing the natural resources of the basin. It has



Thief River Impoundment

three components: diversion channels, floodwater storage and land use changes that increase the quality and attractiveness of the natural resources.

Agassiz Valley Water Management Project

This project covers 2,560 acres in Marshall and Polk counties. It combines flood flow reduction, while at the same time, providing environmental enhancement features.

North Ottawa Impoundment Project

Flood damage reduction is the primary purpose of the impoundment. It will reduce damage throughout the Rabbit River Watershed to agricultural land and to the cities of Wahpeton and Breckenridge. The impoundment will provide feeding and resting areas for migrating birds, will improve water quality, and will help maintain stream flow.

The mediator for the four projects is Jody Horntvedt, University of Minnesota Extension Educator. “It is a huge effort, a new way of working for many of the people involved,” said Horntvedt. “We spent a lot of time building trust. People are very postured with long-held points of view. We have flood damage reduction people, agricultural people, environmental people, local landowners. We have to find common ground and get it out on the table for discussion.”

Cost that resulted from the mediation process: \$34.3 million is expected to be spent on these 4 projects in a five to six year period.



In addition to finding common ground and agreement on the flood mitigation projects, Horntvedt says one of the greatest rewards from this process for everyone involved is the development of best management practices for project teams for the future to address problems. “In the future, we will start differently. There will be guidelines for who will be at the meeting and what is expected of them. We will set goals. There will be criteria for what we will consider and how we will weight the proposals. We will build a different level of trust. We need this kind of discipline because it can take years to work through these projects.”



Site of Future North Ottawa Impoundment

Twin Cities Metro Area

The highest flood waters in the Twin Cities occurred in 1965 and 1969 when the Mississippi River rose to 26.01 feet and to 24.52 feet respectively. Though third highest, the floods of 2001 were significant both in their crest numbers and in the fact that the river crested twice. Late in April it was 23.6 feet, and earlier in the month it had reached 23.5 feet. Flood stage is 14 feet.

Places like Holman Field in downtown St. Paul, located alongside the Mississippi River, were closed for weeks after the swollen river rolled over the runways. Neighboring Harriet Island was one of four St. Paul city parks closed due to flooding. Dikes were built in low lying areas along Interstate Hwy. 35W at Burnsville. Roads and bridges along the Minnesota River were closed.

Flood Stage: 14.0 feet

Highest Known Stage: 26.01 feet (1965)

2001 Stage: 23.65 feet



Upper Landing, St. Paul



Holman Field, St. Paul



Samples of projects around the Twin Cities metropolitan area include:

Minneapolis - 60th and 1st and 43rd and Park flood basins

This \$10-12 million project includes storm sewer improvement, acquisition of 71 properties, design and construction of two flood control ponds, and design and construction of the Diamond Lake outlet to Legion Lake.

St. Anthony

Floodproofing of residences, acquisition of flood-prone structures and the creation of storm water retention areas and conveyance systems has been underway for projects expected to cost \$9 million (the state's contribution is \$4.5 million).



Wet storage pond at 60th & 1st Ave. in Minneapolis

St. Paul - Hoyt Ave.

A total of 33 structures have been acquired and removed in addition to creating a multi-purpose flood water storage pond at a cost of nearly \$2 million in state funding. Total project cost is more than \$4 million.



Dry storage pond after an hour of heavy rain

Inver Grove Heights

Inver Grove Heights is using FDR grants along with other development funds to acquire houses and businesses located in the floodplain. Structures will be removed and the land purchased will be kept in permanent open space and the city intends to develop a park in this area.

Columbia Heights - Tyler Place and Prestemon Park

A \$864,000 stormwater management system has been constructed. DNR paid half of the cost.

Other Minneapolis Projects

Projects are proposed for the City of Minneapolis to alleviate chronic flooding problems. The acquisition and removal of 24 homes and the construction of a storm water retention basin is expected to cost \$13 million.

Other Flood Damage Reduction (FDR) Projects

DNR's FDR funds have also been used to leverage projects planned and constructed by the federal government, to protect property in cities such as Chaska, Stillwater, Marshall, Houston, Henderson, Oslo, and others. In other cities such as Chokio, Crookston, Warren, Breckenridge, and Dawson, permanent facilities are being planned to protect these cities from frequent flooding. FDR funding cost shares on a 50/50 basis with the Army Corps of Engineers to do the planning studies for small projects (Section 205). The Corps share of constructing these projects ranges from 50 to 65% of the total project's cost. Brief descriptions of some of the projects still to be built are as follows:

Dawson's flood damage reduction plan consists of a levee around the sewage treatment plant, a levee or floodwall along the Lac Qui Parle River, raising streets, and interior flood control features.

Other large projects involve funding from DTED, DEM/FEMA and from the local communities themselves. Some of these include the following:

Granite Falls suffers from over bank flooding of the Minnesota River which affects public, commercial and residential structures. The city had requested a Section 205 (small flood damage reduction) study which was



April, 2001



August, 2001

Downtown flooding in Granite Falls, 2001

In **Crookston**, the recommended plan consists of two downstream high-flow channels, levees providing protection from the 100-year flood events for the neighborhoods of Woods Addition, Thorndale and Riverside/Downtown and flood plain management techniques for areas not protected by permanent levees. Other phases to protect floodplain areas not covered under present federal programs will be studied and, if feasible, constructed later.

For **Warren**, the completed project will include an off-channel flood water retarding structure (reservoir) and 4.1 miles of floodway that includes 1.2 miles of dike. The reservoir is located approximately 10 miles upstream from the city of Warren while the floodway is located around the east and south sides of Warren.



Floodwaters in Granite Falls, 2001

recently completed by the U.S. Army Corps of Engineers. Unfortunately, the study concluded no project was feasible for participation by the federal government. Protection will have to be provided through state and local funds. The completed FDR project will involve the acquisition and removal of residential structures along Minnesota Avenue and 15th Avenue along with the acquisition and/or relocation of the commercial buildings along Prentice Avenue.

Chokio has purchased land and is constructing an upstream flood detention impoundment, repairing or modifying the existing channel downstream of the impoundment through the city, and improving the storm sewer system within the city.



Chokio

Ada has completed a project which includes the repair and rebuilding of previously constructed levee loops on the northeast and south side of the city. Storm sewer improvements, outlets, and pumping stations have reconfigured and added to control internal drainage during flooding events.

Oakport Township, which is located just north of Moorhead, had requested a Section 205 (small flood damage reduction) study which was recently com-



pleted by the U.S. Army Corps of Engineers. Unfortunately, the study concluded no project was feasible for participation by the federal government. The township and DNR Waters are investigating a proposed project which includes levees, interior flood control and a control structure in Oakport Slough which protects the township to a frequency of flooding to be determined.



Elevated home in Afton

Lake St. Croix Beach/St. Mary's Point/Afton: These St. Croix communities are working to determine the best options to address their recurrent flooding. They've already completed some levees and house elevations. They are considering permanent pumping stations, flap gates on drainage pipes, road elevations, and bank stabilization.

Austin has been battling flooding from the Cedar River for many years. They've been purchasing homes and removing them from the floodplain for a number of years. So far, they've removed 163, but more are planned with recent grants from DTED, FEMA and MN DNR.



Levee closure across a road opening in Afton

Cost Share Distributions

All MN DNR FDR Program grants involve some cost share dollars. But some types of projects have special cost share distributions. Here are some of the typical kinds of funding splits. In all cases, the MN DNR share can be less than or equal to the share shown.

1. Standard Grants

50% MN DNR 50% Local*

2. Post-Federally declared Disaster FEMA Grants

75% FEMA (HMGP) 12.5% MN DNR 12.5% Local*

3. Federal Corps of Engineers Projects

50-65% Corps 17.5-25% State 17.5-25% Local*

4. 2% Median Household Projects

In 1999, the Legislature passed an appropriation and rider language to provide state funds to pay the local share that exceeded 2% of the median household income of the community for the following cities: East Grand Forks, Warren, Breckenridge, Ada, Crookston, and Oakport. Additional legislative action is needed with any new appropriations.

* Local share can come from Local Units of Government, other State Agencies like DTED, from private agencies or from private landowners.

Minnesota Residents Still Need Protection

The level of funding in 1997 was extraordinary because of the resources made available after the presidential disaster declaration. The work done in advance of the spring floods of 2001 has demonstrated how effective use of funds for mitigation can reduce loss in the face of flooding.

The goal of flood mitigation projects is long term protection of the local economies. These projects save valuable city infrastructure like sewage plants and prevent hundreds of hours of labor and expenditure of general-fund dollars in city budgets to fight floods.

DNR flood mitigation funding in the future will be spent first to purchase more of the older homes remaining in the floodplains around the state. People must be moved out of harm's way. And second, the funding will be spent on comprehensive flood mitigation projects to bring flood protection to all of Minnesota's communities that need it.

Because of the large number of rivers and lakes in Minnesota, there are dozens of flood mitigation projects - large and small - waiting for funding. No community can fund big, expensive flood mitigation projects on its own. The partnership of federal, state and local dollars makes it possible. Our weather history shows that floods will occur. Additional funding, spent efficiently and effectively through smart partnerships, will protect the health and safety of Minnesotans in communities across the state.

Future Program Needs for the FDR Program

All of the significant known community flooding problems in Minnesota could be resolved with an investment of \$40 to \$50 Million.



*Henderson is protected during the
2001 flood by a Corps levee*



**Minnesota
Department of Natural Resources
Waters**

"Helping people ensure the future of our water resources"