

# Flood Mitigation Plan

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Plainfield Charter Township

**Adopted September 17, 2007**

September 2007

2050667

U.S. Department of Homeland Security  
Region V  
536 South Clark Street, Floor 6  
Chicago, IL 60605



**FEMA**

NOV 05 2007

Mr. Matt Schnepf  
State Hazard Mitigation Officer  
Homeland Security and Emergency Management Division  
Michigan State Police  
4000 Collins Rd  
Lansing, MI 48910

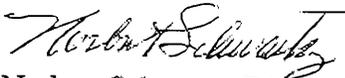
Dear Mr. Schnepf:

We have completed the Flood Mitigation Assistance (FMA) Program review of the Plainfield Township Flood Mitigation Plan. The plan does meet the criteria for a Flood Mitigation Assistance Plan and is **approved**.

The approval of this plan ensures the continued availability of the Flood Mitigation Assistance Program. All requests for funding, however, will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted.

Please pass on our congratulations to the community on completing this significant action. If you or the community has any questions, please contact Jonathan (J.P.) Marsch at (312) 408-5226.

Sincerely,

  
Norbert Schwartz, Director  
Mitigation Division

**Plainfield Charter Township Flood Mitigation Plan**

(For official community use, and to meet the local planning requirements of the Disaster Mitigation Act of 2000)

Adopted by the Plainfield Charter Township Board of Trustees on September 17, 2007.

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11. Rogue River
12. Packer Drive

September 17, 2007

Interested Parties:

The Plainfield Charter Township Flood Mitigation Plan was adopted by the Plainfield Charter Township Board of Trustees on September 17, 2007. This plan has been developed with the cooperation of County and Township officials, the State of Michigan, affected businesses, and interested members of the public. The plan provides the process for evaluation of land use and development in Plainfield Charter Township from a hazard mitigation perspective, which will protect lives and property in the community. This correspondence serves notice that it is my expectation that all future development decisions in Plainfield Charter Township will consider flood hazard vulnerability reduction as a standard business practice. The intent of the flood hazard mitigation plan is not to limit development, but to ensure that all development avoids the possibility of damage from flood hazards to the extent practicable.

Questions and concerns related to content and use of this plan should be directed to Plainfield Charter Township Community Development Department, Attention Floodplain Manager.

Sincerely,

Mr. George Meek, Plainfield Charter Township Supervisor

## I. PREFACE

Flood hazard mitigation is any action taken before, during, or after a disaster to permanently eliminate or reduce the long-term risk to human life and property from natural flood hazards. It is an essential element of emergency management, along with preparedness, response, and recovery. There is a cyclical relationship between the four phases of emergency management. A community prepares for a disaster, and then responds when it occurs. Following the response, there is a transition into the recovery process, during which mitigation measures are evaluated and adopted. This, in turn, improves the preparedness posture of the community for the next incident, and so on. When successful, mitigation will lessen the impacts to such a degree that succeeding incidents will remain incidents and not become disasters.

Flood hazard mitigation strives to reduce the impact of floods on people and property through the coordination of resources, programs, and authorities so that, at the very least, communities do not contribute to the increasing severity of the problem by allowing repairs and reconstruction to be completed in such a way as to simply restore damaged property as quickly as possible to pre-disaster conditions. Such efforts expedite a return to "normalcy"; however, replication of pre-disaster conditions results in a cycle of damage, reconstruction, and damage again.

Hazard mitigation is needed to ensure that such cycles are broken, that post-disaster repairs and reconstruction take place after damages are analyzed, and that sounder, less vulnerable conditions are produced. Through a combination of regulatory, administrative, and engineering approaches, losses can be limited by reducing susceptibility to damage. Hazard mitigation provides the mechanism by which communities and individuals can break the cycle of damage, reconstruction, and damage again.

Recognizing the importance of reducing community vulnerability to flooding, Plainfield Charter Township is actively addressing the issue through the development and subsequent implementation of this plan. The many benefits to be realized from this effort - protection of the public health and safety, preservation of essential services, and prevention of property damage to mention just a few - will help ensure that Plainfield Charter Township remains a vibrant, safe, and enjoyable place in which to live, raise a family, and conduct business.

## II. ACKNOWLEDGEMENTS

This plan is the culmination of our interdisciplinary and interagency planning effort that required the assistance and expertise of numerous agencies, organizations, and individuals. Without the technical assistance and contributions of time and ideas of these agencies, organizations and individuals, this plan could not have been completed. Following is a list of key contributors to the plan:

Eric Brandt	Annis, Annis, and Visser
Jim Breuker	Michigan State Police Emergency Management Division
Todd Brunsink*	Township Business Owner
Larry Dells*	Township Resident
Peter Elam, Chair*	Plainfield Charter Township Floodplain Manager
Al DeWitt	Plainfield Charter Township Water Department
William Fischer	Plainfield Charter Township Planner
Wayne Harrall*	Kent County Road Commission
Robert Homan*	Plainfield Charter Township Manager
Richard Kehn*	Township Resident
David Kloote	Plainfield Charter Township Building Inspector
Vic Matthews*	Plainfield Charter Township Planning Commission
George Meek*	Plainfield Charter Township Supervisor
Matt Occhipinti*	Michigan Department of Environmental Quality
Kurt Overmyer	Kent County Health Department
David Peterson*	Plainfield Charter Township Fire Chief
Mary Reading*	Kent County Health Department
Thomas Smith	Prein&Newhof-Township Engineer
Lt. Jack Stewart*	Kent County Sheriff Department
James Stover	Plainfield Charter Township Treasurer
Les Thomas	Michigan Department of Environmental Quality
Norm Van De Roer	Kent County DPW
Robert VanderMale	Prein&Newhof-Township Engineer
Priscilla Walden	Plainfield Charter Township Office Administrator
Mark Walton	National Weather Service

\* Members of core planning team

### III. EXECUTIVE SUMMARY

The Plainfield Charter Township Flood Mitigation Plan was created for the purpose of improving the health, safety, and economic interests of the Plainfield Charter Township residents and businesses by reducing the impacts of flooding through hazard mitigation planning, awareness, and implementation. The plan serves as the foundation for flood hazard mitigation activities and actions within Plainfield Charter Township. Implementation of recommendations will reduce loss of life, destruction of property, and economic losses due to flooding. The plan provides a path toward continuous, proactive reduction of vulnerability to hazards which result in repetitive and oftentimes severe social, economic and physical damage. The ideal result is full integration of hazard mitigation concepts into day-to-day governmental and business functions and management practices.

This plan employs a broad perspective in examining flood mitigation activities and opportunities in Plainfield Charter Township. Emphasis is placed on hazards which have resulted in threats to the public health, safety and welfare, as well as the social, economic and physical fabric of the community. The plan analyzes and addresses flood hazards from a historical perspective, evaluated for potential risk, and considered for possible mitigative action. The plan also lays out the legal basis for planning and the tools to be used for its implementation.

A summary of the goals and objectives for the Flood Mitigation Plan is provided in Appendix A. Appendix B follows with a summary of the Action Plan.

**IV. HAZARD MITIGATION ADOPTION RESOLUTION**



PLAINFIELD CHARTER TOWNSHIP  
KENT COUNTY, MICHIGAN

**RESOLUTION NO. 07-41**

At the regular meeting of the Plainfield Charter Township Board, held at the Township Offices, 6161 Belmont Avenue NE, within the Township, on the 17<sup>th</sup> day of September 2007, at 7:30PM, the following resolution was offered by Member Heindrichs and supported by Member Hagedorn.

WHEREAS, Plainfield Charter Township, Michigan has experienced repetitive flood events that have damaged commercial, residential and public properties, displaced citizens and businesses, closed streets and bridges dividing the community both physically and emotionally, and presented general public health and safety concerns;

WHEREAS, Plainfield Charter Township, Michigan has prepared a *Flood Mitigation Plan* that outlines the Township's option to reduce overall damage and impact from flood hazards; and

NOW, THEREFORE, THE TOWNSHIP BOARD RESOLVES AS FOLLOWS.

1. The *Flood Mitigation Plan* is adopted as the official plan of Plainfield Charter Township.
2. The Township Manager is charged with supervising the implementation of the *Flood Mitigation Plan*'s recommendations within the funding limitations as provided by the Board or other sources.
3. The Township Manager shall ensure that action items recommended by the *Flood Mitigation Plan* are addressed and updated regularly.
4. The Township Manager shall regularly report to the Township Board of Trustees on progress toward implementation of the *Flood Mitigation Plan*.

AYES: Meek, Morrow, Stover, Borek, Hagedorn, Heindrichs and Parris

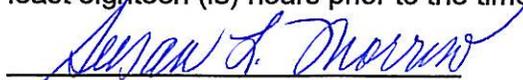
NAYS: none

ABSENT: none

  
\_\_\_\_\_  
Susan L. Morrow, MMC, Clerk  
Plainfield Charter Township

**CERTIFICATION**

I, Susan L. Morrow, the duly qualified and elected Clerk of Plainfield Charter Township hereby certify that the foregoing is a true and complete copy of a resolution adopted by the Plainfield Township Board at a regular meeting held on September 17, 2007, and that public notice of said meeting was given pursuant to Act No. 267, Public Acts of Michigan, 1976, including, in the case of a special or rescheduled meeting, notice by publication or posting at least eighteen (18) hours prior to the time set for the meeting.

  
\_\_\_\_\_  
Susan L. Morrow, MMC, Clerk  
Plainfield Charter Township

## V. PURPOSE

Plainfield Charter Township Flood Hazard Mitigation Plan was created to protect the health, safety, and economic interests of residents by reducing the impacts of flood hazards through hazard mitigation planning, awareness, and implementation. Flood hazard mitigation is any action taken to permanently eliminate or reduce the long-term risk to human life and property from flood hazards. It is an essential element of emergency management along with preparedness, response and recovery.

This plan serves as the foundation for flood hazard mitigation activities within the community. Implementation of the plan's recommendations will reduce injuries, loss of life, and destruction of property due to flood hazards. The plan provides a path toward continuous, proactive reduction of vulnerability to floods which result in repetitive and often severe social, economic and physical damage. The ideal end-state is total integration of flood hazard mitigation activities, programs, capabilities and actions into normal, day-to-day governmental functions and management practices.

This document complies with the local hazard mitigation planning requirements of the Disaster Mitigation Act of 2000. A regional hazard mitigation plan was prepared covering Kent County, Ottawa County, and the City of Grand Rapids. However, it was not developed to meet the planning criteria of the Flood Mitigation Assistance Grant Program. This flood mitigation plan builds upon that planning effort with a focus on flood hazard and directly serving the specific interests of Plainfield Charter Township.

## VI. PLAN DEVELOPMENT PROCESS

Based on safety concerns due to the historic flooding frequency along the Grand River and the potential availability of Flood Mitigation Assistance Program funds, it was decided to proceed with the development of a township flood hazard mitigation plan. Key persons including local residents and business representatives, Township officials, County officials, and State Officials composed a flood hazard mitigation planning team. This team was extensively involved with plan development throughout the entire process and was supplemented by the participation of other township, county and state officials, as needed. A list of participants is included in the acknowledgement on page vi. Other documentation of meetings and planning activities is provided in pages 3 through 6.

A process was also discussed and developed at that meeting for plan development and review, including the posting of draft plans on the township web site and the provision of other opportunities for the public to review and comment on the plan.

A copy of an initial draft plan was submitted to members of the Township Board of Trustees, and was available to the Township Planning Commission, and the Zoning Board of Appeals and other interested parties for their review and feedback. Subsequent versions of the draft plan were immediately posted on the main page of the Plainfield Charter Township website with requests for input from the public, after each substantial revision of the plan (at least two versions were posted for public comment).

This flood mitigation plan made extensive use of existing data, documents, and research, including the existing "Pre-Hazard Mitigation Plan for Kent County, Ottawa County, and City of Grand Rapids (revised March 2006), the U.S. Census of Population and Housing (2000), the Michigan Hazard Analysis (EMD-PUB 103), the Local Hazard Mitigation Planning Workbook (EMD-PUB 207), data and maps from township and county sources, topographic maps from the REGIS, records and reports from the National Climatic Data Center, the National Weather Service, the Michigan Department of Environmental Quality, and the Plainfield Charter Township Department of Building and Zoning. These documents were referenced at meetings, provided at team members request, and used as a starting point in the development of several sections of this plan. References are listed in Appendix E.

Requests for information were extended to township residents, and all pertinent township, county, regional, and state agencies, who were also invited to review the draft plans and provide feedback. Involved agencies included the Township Building and Zoning Department, Fire Department, Water Department, Managers Office, Board of Trustees, Zoning Board of Appeals, and the Planning Commission. Various County and State Departments were also involved. In addition, key officials in the eight adjacent townships and cities were directly notified of the development of this flood mitigation plan, and provided with copies of the draft plan for review and comment before it was finalized. The adjacent municipalities include Ada Township, Algoma Township, Alpine Township, Cannon Township, Grand Rapids Township, City of Grand Rapids, City of Rockford, and City of Walker.

A significant amount of information was exchanged through emails, phone calls, and unscheduled meetings. A meeting of the expanded local planning team included discussion of flood hazard conditions and potential mitigation strategies, and evaluation of them for feasibility, appropriateness, and effectiveness. Information gathered through public surveys was also presented to the planning team for consideration. Selected strategies were then assembled into a prioritized list of action items to be implemented or supported by the Township through this plan. These action items were further distributed to various officials who were unable to attend the full discussion sessions of this expanded planning team, and comments were incorporated in the development of a revised and expanded list of mitigation actions that now appear at the end of this document.

Since floods affect many residents of the Township, it was a high priority to get the citizens involved in the planning, designing and implementing flood mitigation strategies. Opportunities for public input into the plan were as follows:

- Initial Public Meeting Regarding the Flood Mitigation Project
- Comprehensive Public Surveys to provide input
- Three volunteers from the community, with property interests in flood hazard zone, played an important role on the planning team – two residents and one business owner
- Project updates were provided on the Plainfield Charter Township web site for review and response.
- A Public Meeting to provide input on the draft Flood Mitigation Plan

Flood hazard mitigation concerns and activities had already been discussed as a part of the regional mitigation planning effort involving Kent and Ottawa Counties, which includes Plainfield Charter Township.

Feedback from local officials was obtained through special meetings and meetings with the extended planning team. In addition, opportunities for feedback were provided to the general public, including a final call for public input on March 3, 2007.

Copies of drafts of this plan were available for perusal at the township offices and posted on the Plainfield Charter Township website with a link on the township's main page leading to the plan itself. Besides the website, notice of the availability of draft plan materials was given through a newspaper announcement (an advertisement in the area's local newspaper, the Grand Rapids Press – Northview Advance, included in Appendix F), and announcements at board and commission meetings.

The expanded planning team reviewed the draft flood mitigation plan and provided comments. The team agreed on revisions to the various mitigation alternatives proposed in the draft plan (a summary of the action plan was provided on the web site as well). With this input, the draft plan was converted into the final plan adopted by the Township Board of Trustees on September 17, 2007.

Timeline of dates/meetings pertinent to flood mitigation public input and plan development:

May 10, 2005	Notice of Availability of Flood Mitigation Assistance Program Funds for Fiscal Year 2005
May 20, 2005	Meeting between Plainfield Charter Township officials and Engineering Consultant to review FMAP grant details.
May 31, 2005	Submit Letter of Interest to the MDEQ.
June 15, 2005	Invitation to submit formal application for FMAP grant.
June 29, 2005	Meeting between Plainfield Charter Township officials and Engineering Consultant to review outline for scope of work related to FMAP Grant.
July 1, 2005	Submit Application for FMAP grant for development of a Flood Mitigation Plan.
October 11, 2005	Notification of FMAP grant approval and receipt of FMAP Grant Agreement for \$18,267, with a FMAP contribution of \$13,700 (75%).
January 19, 2006	Meeting of township board to review grant requirements and approve the pursuit of a Flood Mitigation Assistance planning grant. An approved plan must be in place to obtain future Flood Mitigation Assistance project grants.
January 26, 2006	Organizational Meeting with Plainfield Charter Township Manager, Township Planner, Township Floodplain Manager and Consulting Engineers.
February 3, 2006	Status update meeting with Plainfield Charter Township Manager, Township Planner, Township Floodplain Manager and Consulting Engineers.
March 1, 2006	Pre-meeting planning session at Plainfield Charter Township. Township officials and their consultant met to provide an update on the project, and to develop the agenda and plan for the upcoming public meeting.
March 2, 2006	Survey of elevation data completed.
March 16, 2006	Public information meeting regarding Flood Mitigation Planning program. General information was provided to the 50 residents in attendance according to the <i>Grand Rapids Press</i> article on March 17, 2006. Officials from the fire department, police department, planning department and building department also attended. Residents provided

comment on flooding, flood mitigation, Township ordinances, and the program. This input was recorded for use by the planning groups.

- May 24, 2006 First team meeting at Township Hall. Meeting focused on introductions, the mitigation plan process, and goals and expectations for the project.
- July 20, 2006 Meeting with Plainfield Floodplain Manager and consultant, and Mark Walton of the National Weather Service regarding level sensor equipment.
- July 21, 2006 Meeting with Plainfield leadership and residents on the planning team regarding preparation of a revised public survey to obtain a greater response from those who live in the floodplain.
- August 2, 2006 Team meeting at Township Hall with a focus on individual presentations by team members on their roles and thoughts on flood mitigation. Development and prioritization of Goals, Objectives and Activities.
- September 13, 2006 Article in the *Grand Rapids Press* regarding the flood mitigation plan.
- September 20, 2006 Team meeting at Township Hall with a focus on finalizing the goals and objectives and discussions of mitigation activities.
- September 28, 2006 Special Meeting with the Health Department and Township officials to discuss mitigation activities and the Health Departments role.
- October 5, 2006 Special Meeting with Township residents on planning team to discuss the mitigation activities.
- October 24, 2006 Distribution of Draft Action Plan to Planning Team for comment.
- November 3, 2006 Distribution of Draft Flood Mitigation Plan to Planning Team for comment.
- December 2006 Continued review and selection of action items to be adopted by township through final version of its 2006 Flood Mitigation Plan.
- December 5, 2006 Posting of Draft Flood Mitigation Plan on Township website for public input, and updates each time new versions are developed and distributed.

January 3, 2006	Announcement in the Grand Rapids Press-Advance of plan availability and upcoming adoption, as well as website and other means of viewing and returning comments on the plan.
January 10, 2007	Public hearing and meeting for summary of Flood Mitigation Plan and opportunity for public comment.
March 16, 2007	Finalize analysis and select/prioritize feasible hazard mitigation strategies for the final plan.
March 16, 2007	Submit Plan to Michigan State Police/Emergency Management and Home Security Division for review.
March 2007	Submit Plan to FEMA for review.
September 17, 2007	Public hearing and meeting of the Plainfield Charter Township Board of Trustees to Officially Adopt the Flood Mitigation Plan.

The Plainfield Charter Township Flood Hazard Mitigation Plan examines flood mitigation activities and opportunities. This plan focuses on flood hazards, which have had significant impact on the community in the past. The planning process followed in the development of the Plainfield Charter Township Flood Hazard Mitigation Plan consisted of the following steps:

- 1) Identification of hazards and risks.
- 2) Identification and definition of goals and objectives.
- 3) Identification of alternatives for solving problems.
- 4) Selection of evaluation criteria.
- 5) Selection of alternatives (feasible mitigation strategies).
- 6) Preparation of a draft plan.
- 7) Preparation of the final plan.
- 8) Implementation of the plan.
- 9) Monitoring and periodic revision of the plan

## VII. COMMUNITY PROFILE

This section provides some information on Plainfield Charter Township and its residents and resources. Physical and social conditions of the township provide information about what resources need protection from the various hazards that are identified in this analysis. By comparing population, geological, and land use information with profile information about known hazards, areas of vulnerability will be identified and prioritized, and actions will be directed to address those township conditions that appear to have the greatest need for hazard mitigation.

Plainfield Charter Township completed a Community Profile Report dated September 2004. The following is a summary of information from the report.

### A. Overview

Plainfield Charter Township is located in Kent County, north of the City of Grand Rapids on the western side of Michigan's Lower Peninsula. The Township coordinates are approximately 42 degrees north latitude, and 86 degrees west longitude. Other larger urban areas are Holland (15 miles), Muskegon (25 miles), Kalamazoo (50 miles), and Lansing (70 miles). The 2000 U.S. Census reported that the Township has a population of 30,195.

Map 1 shows the main roads and waterways in the Township. The locations of critical facilities and infrastructure were considered for planning purposes, but the exact locations of important utilities, pipelines, etc. were withheld from this public document.

### B. Land Use and Development Trends

The area is primarily suburban, with commercial development as well as residential developments located throughout the Township. Map 2 shows the existing Township zoning.

The township has experienced strong, steady growth over the past 30 years. The annual average rate of growth from 1970 to 2000 was 2.61%, or a compounded annual rate of 1.95%. The 1990 census documented 24,946 residents, and the 2000 census reported 30,195 residents - an increase of 21% in 10 years. Due to the natural features and location just north of the large metropolitan area of Grand Rapids, development pressure is expected to continue.

The current rate and pattern of growth indicates that the community's population could exceed 48,000 people within 25 years with an eventual population of 86,000. Since residential development typically demands more in services than offsetting revenues, the Township should be prepared for the cost implications this growth could create.

The topography includes primarily gently rolling, small hills. Other adjacent

communities include Alpine Township to the west, Cannon Township to the east and Algoma Township to the north. Parts of Alpine and Cannon Township can also be considered a suburbanizing part of the Grand Rapids metropolitan area while Algoma and other portions of Alpine and Cannon Township are more rural.

Soils can be identified on Map 3. Some soils are not well suited for individual septic systems and therefore may threaten groundwater or surface water quality due to lack of proper filtration. In addition, the soil composition determines the stability and suitability for structural development. There are 6 general soil associations in the Township: Plainfield-Oshtemo-Spinks, Ithaca-Rimer-Perrington, Marlette-Perrington-Matea, Marlette-Chelsea-Boyer, Chelsea-Plainfield-Boyer, and Houghton-Cohoctah-Ceresco. Two of these are found largely along the Grand River and Rouge River. The Plainfield-Oshtemo-Spinks is a gently rolling, well-drained, sandy and loamy soil and is characteristic of the gravel mining operations in the Township. Houghton-Cohoctah-Ceresco is a nearly level, poorly drained, mucky and loamy soil formed of herbaceous organic material or loamy alluvial deposits.

Wetlands play a critical role in regulating the movement of water through a watershed. They are characterized by water saturation in the root zone or above the soil surface for a period of time during the year. Wetlands store precipitation and surface water and slowly release the water into rivers, streams, groundwater and the atmosphere. They also improve water quality by acting as a filter for sediments and organic matter. In Plainfield Charter Township, the wetlands exist near the Grand River and Rouge River corridors, and in other low-lying places in the township. Wetlands can be identified on Map 4.

### C. People

The 30,195 township residents listed in the 2000 U.S. Census were noted to have the following general characteristics:

- The median age was 35.1 years.
- Approximately 30% of the Township population was between the ages of 25 and 44. These age groups symbolize a demand for single family housing and family-oriented commercial services.
- Approximately 9% of the population was over 65 years old, and 43% were under 18 years old.
- 95.7% of the townships residents reported themselves as white, and 1.2% identified themselves as "Black or African American."
- There are more female residents (51.1%) than male (48.9%); however males outnumber females between the ages of 0 to 19. Females outnumber males in every other age group except 40 to 44 year group.
- The Township's average household size is 2.73 persons.

- Children under 14 account for 25% of the population.
- Approximately 28% of the Township population over 25 years of age have the equivalent of a high school education and 28% of the population has a bachelor's degree or higher.
- The Township Population is year-round, not seasonal.
- Approximately 69% of the Township population are homeowners.
- 8% of population between the ages of 5 and 20 had disabilities; 15.8% between the ages of 21 and 64 had disabilities; and 38% over the age of 64 had disabilities
- 4.2% of individuals and 1.5% of families reported having incomes below poverty level in the Township.

#### D. Labor Force

About 74% of the population age 16 and over within the Township were employed at the beginning of year 2000. The unemployment rate of the Township's workforce was only 2.1% but has increased since that 2000 Census.

Of those who are employed, 31.4% were in management and professional occupations. Service and sales/office occupations made up 12.3% and 29.5% of workforce, respectively. Construction and maintenance operations made up 9.4% and production and transportation made up 17.0%.

Plainfield Charter Township is largely a bedroom community. About 850 acres of commercial and industrial land use are home to several large employers and institutions including the public schools which provide employment for area residents.

#### E. Housing

The 2000 Census of Population and Housing reported that Plainfield Charter Township contains 11,456 housing units with a total residential SEV value of \$598,823,200 (nominally ½ the average market value). Thus the average market value of a housing unit in Plainfield Charter Township was \$104,543.

Approximately 80% of the Township SEV values was residential property in 2004, 16% was commercial, 4 % was industrial and less than 1% was agricultural. From 1998 through the 2004 assessment, residential property value grew at an annualized rate of 8.1%, commercial real estate property grew at 6.2% and industrial real estate property grew at 7.3%.

About 72% of the township's housing units are single-family detached structures, and 7.8% of the housing units are in the form of attached units; with 1 to 4 units per structure. There were 1,232 high-density multiple-family structures reported in the 2000 census, or

10.8% of housing units. Finally, 1,090 (9.5%) housing units were classified as mobile homes. Such units are scattered in 5 mobile home parks throughout the Township.

Only 99 of 7,571 owner-occupied units in the township were valued at less than \$50,000, and 53 were valued at more than half a million dollars. The median value of owner-occupied houses was reported as \$135,300, which is 17% higher value than the state median value of \$115,600. Renter-occupied units with cash rent varied significantly with the highest percentage of 46.3% between \$500 and \$749 per month, and a median monthly gross rent reported as \$607, or 11% greater than the Michigan median of \$546.

The Township had 61 persons (0.2% of the total) who were reported as living within group quarters in 2000, none of whom were classified as living in institutionalized group quarters (such as prisons, nursing homes, psychiatric facilities, etc). Those who lived in group quarters in the township all lived in non-institutionalized group quarters.

The age of housing varies from the historic to the newly-built. More than 21% of the housing units were over 40 years old in 2000, while 24% were less than 10 years old. A fairly smooth distribution of housing units across intermediate age categories was reported.

## F. Population concentrations:

The following are structures of population concentration in Plainfield Charter Township:

- Group homes: Ambrose Retirement Home, Northwood Hills and Porter Hills Retirement Home
- Large apartment buildings: Pine Ridge, Rolling Pines, Franklin Mill, Hidden Valley, Royal Glen, Northview and Sawkaw Apartments/Condominiums.
- High Schools: Rockford High School, Comstock Park High School, Northview High School.
- Middle Schools and Elementary Schools: Highlands, West Oakview, Crossroads, North Oakview, Mill Creek, Roguewood, Belmont, Pine Island, Rockford Freshmen Center, Crestwood, Northview Alternative.
- Stadiums: Fifth Third Ball Park
- Recreational Facilities: AJ's Fun Place, DNR Boat Landing, Rockford Rowing Club.
- Trailer Parks: Northern Estates (North and South), Leisure Meadows, Spring Valley, Hilltop, Brookhaven, and Woodland Estates.

## G. Utilities

Public utilities are critical to the quality of life and growth management in the Township. This includes water supply, wastewater collection, gas and electric service.

Plainfield Charter Township supplies its residents, as well as residents from Algoma Township, Alpine Township, Grand Rapids Township and the City of Walker, with a water supply of adequate quantity and quality. The source of water is groundwater from three wellfields near Plainfield Avenue and Northland Drive. The Township provides

filtration, lime softening and chlorine disinfection at its Water Treatment Plant located near the wellfields. The firm pumping capacity of the water treatment plant is 16 mgd; however, the average water system demand is only about 3 mgd during winter months and 10.5 mgd during summer, high demand months. The Township has developed a Wellhead Protection Plan to provide protection against contamination of the water supply.

Plainfield Charter Township also has an effective wastewater collection system. Currently the wastewater is collected and transmitted to the Grand Rapids Wastewater Treatment Plant operated by the City of Grand Rapids. Plainfield Charter Township is a member of the North Kent Sewer Authority, which is in the process of constructing their own Wastewater Treatment Facility (PARCCSIDE Clean Water Plant to be operational in 2008 with an 8 mgd capacity). The Township serves the densely developed areas including nearly all the Township area south of the Grand River and west of the Beltline. New extensions are typically added in response to residence requests due to failing septic systems. Approximately 9,000 residences are currently connected to the Plainfield Charter Township wastewater collection system, while about 2,000 homes are served by individual septic tank systems.

Most of the developed areas of the Township are served with energy and communication systems. This includes broadband internet access, cable television, electricity, natural gas and telephone. Some more remote areas have on-site fuel oil or LPG tanks for heating and cooking instead of natural gas.

## H. Environment

Besides the Grand River meandering through the Township, there are a few other waterways of significance that were evaluated for flood impacts in this analysis. Map 1 shows the Township's overall riverine system. Also, Neighborhood Location Maps are included in Appendix H which provide detail of the residential floodplain areas at Abrigador Trail, Bailey Park, Coit, Grand Isle Court, Indian, Jupiter, Konkle, Mall, Packer, Riverbank, Rogue River, Rudy, Walnut Park and Willow Drive.

## I. Services

Community services fill an important role in the Township. Services promote community pride, provide cultural events, supplement civic engagement, and provide recreational opportunities. The Township has many recreational areas including a public trail and several golf courses. Schools provide educational experiences for children.

The Township does not have any institutions of higher learning within its limits. However, Grand Valley University, Calvin College, Aquinas College, Cornerstone University, Grand Rapids Community College and other smaller institutions are within a short distance from the Township.

The Township has several school districts within its limits. The Rockford Public School System extends into the northeast corner and center of the Township. This includes 4 school facilities. Comstock Park Public Schools is located in the western area of the

Township an has three facilities within Township limits. Northview Schools serve the area south of the Grand River, the most densely populated portion of the Township. Northview has 6 facilities within the Township. Kenowa Hills School District also encompasses a small area on the west side of the Township; however, they have no facilities within Plainfield Charter Township.

Plainfield Charter Township also has two libraries that are part of the Kent District Library. These are the Comstock Park Public Library and the Plainfield Public Library. These provide educational activities for various age groups, Internet access, books and other information materials.

Eleven recreational areas comprising 40 acres are maintained by Plainfield Charter Township. These areas provide opportunities for boating, camping, fishing, golfing, hiking, picnicking, snowmobiling, walking, and other competitive sports. In addition, the Michigan Department of Natural Resources operates one park in the Township and owns the Rogue River access site. These are shown in Map 5.

## J. Geographical Features:

Major Rivers: Rogue River (Trout Stream and Natural River) and Grand River.

Major Streams: Mill Creek, Scott Creek, Barkley Creek, Bear Creek, Hidden Creek, Whitney Creek, Stiles Creek, Crescent Creek, Strawberry Creek, York Creek, Waddell Creek.

Lakes: Freska Lake, Little Pine Island Lake, Mead Lake, Scott Lake, Clear Bottom Lake, Versluis Lake, Coit Ave Gravel Pond, Duck Lake, Mirror Lake, Dean Lake and Mud Lake.

Watersheds: All of Plainfield Charter Township lies within the Grand River regional watershed. Subwatersheds in Plainfield Charter Township include Mill Creek, Rogue River and Bear Creek.

## K. Critical Infrastructure and Facilities

Plainfield Charter Township has several critical facilities within its boundaries. These include:

- Roads, railroads and bridges: US Highway 131, State Highway M-44 and M-44 Connector (Plainfield Avenue), 10 Mile Road, Marquette Railroad and White Pine Trail (former rail bed), Northland Bridge and Jupiter Bridge on Grand River, North Park Street Bridge on Grand River, Packer Bridge, Rogue River Road Bridge, Childsdale Bridge, and West River Road Bridge over the Rogue River.
- Dams, power stations, water treatment facilities, sanitary lift stations etc: Secluded Lake Dam, Plainfield Charter Township Water Treatment Plant on Woodfield Court. Sanitary Lift Stations at Mill Creek, Northern Estates, Belmont, Brewer

Avenue, Four Mile, Bell, Rahn, Hidden Valley, Summit Park, Ten Mile, Balsam and Grand Oaks, and Sanitary Lift Stations in floodplain or adjacent to Forest Ridge, Coit, Northland Dr, Rogue River Bridge, Stiles Creek.

- Community Medical Facilities: Metropolitan, corner of Belding Road and Wolverine Boulevard, and Spectrum Health, 5378 Plainfield Ave NE, Grand Rapids, MI
- Fire Stations: Station #1 - 6145 Belmont Ave NE, Belmont, MI 49306, and Station #3 - 4343 Plainfield Ave NE, Grand Rapids, MI 49525
- Government Buildings:
  - General Offices, 6161 Belmont Avenue NE, Belmont MI 49306
  - Building and Grounds Facility, 5205 Plainfield Ave NE, Grand Rapids, MI 49306
  - Water Treatment Plant and Maintenance Bldg, 5220 Woodfield Ct. NE, Grand Rapids, MI 49525
  - Community Center, 5255 Grand River Dr NE, Grand Rapids, MI 49525
  - Future 63<sup>rd</sup> District Court at 4 Mile and East Beltline
- Public Works Yard: Kent County Transfer Station, 3100 10 Mile Road NE, Rockford, MI 49341
- Ambulance: Rockford Ambulance at intersection of Jupiter Avenue and West River Road.
- Clean Water Treatment Plant: Proposed PARCCSIDE treatment plant serving Alpine Township, Cannon Township, Courtland Township, Plainfield Charter Township and the City of Rockford.

#### L. Emergency Warning Coverage:

The Townships has Sirens at 11 different locations.

## VIII. IDENTIFICATION OF HAZARDS AND RISK

In Plainfield Charter Township, it is evident that one of the primary hazards to residents is flooding. However, a Flood Mitigation Plan must include an analysis of all hazards in the community.

### A. Hazards

The Hazards were chosen based on historical occurrence, guidance by the State of Michigan Emergency Management Division, internet research and public input. Hazards for Plainfield Charter Township are described as follows:

#### 1. Extreme Temperature

Plainfield Charter Township enjoys a relatively comfortable climate year round thanks to the moderating influence of nearby Lake Michigan. However, the entire area does experience significant extremes in temperature. Coupled with high humidity in summer and high winds in winter, the effects of these temperature extremes are exacerbated and place human health and property at increased risk.

Temperatures above 100 degrees and lower than -20 degrees have been recorded in the area. Statistical analysis indicates 15 days of 90+ degree days and 12 days of less than 0 degrees will be experienced each year in Kent County.

#### 2. Thunderstorm Hazards (Hail, Lightning and Wind)

Thunderstorms probably produce the most frequently recurring natural hazards to Plainfield Charter Township. Lightning, heavy rain, hail, strong winds and the potential to spawn devastating tornadoes can kill, injure and destroy. Even moderate thunderstorms disrupt and inconvenience modern life.

#### 3. Tornado

Tornadoes occur in Michigan every year with grim regularity. NOAA places most of Michigan's lower peninsula in the high-risk category, and Kent County is 3<sup>rd</sup> on the list of tornadoes by County. Damage from these violent storms ranges from minor to devastating. Deaths and property loss are frequent by-products of these vicious winds. Injuries also occur after a tornadoe, during rescue and clean-up efforts.

Plainfield Charter Township has had periodic tornado's. The most recent was in 2001, when the tornado touched down at the corner of Jupiter and Belmont, uprooting several trees (a memorial part has since been located there rather than replanting the trees). This tornado was classified on the Fujita Scale as an F1, which is the second least damaging type classified as "moderate damage".

The most destructive tornado in West Michigan history was an F5 ("incredible

damage”) on April 3, 1956. Seventeen people died, 200 were injured and over 700 families lost their homes though it is not known if any of these were Plainfield Charter Township residents. On April 11, 1965, an F4 (“devastating damaging”) tornado touched down in the Grand Rapids area killing 5 people, injuring 142 people, and causing between \$500,000 and \$5,000,000 in damages.

#### 4. Drought

Plainfield Charter Township is near one of the world’s largest bodies of fresh water but is still vulnerable to drought throughout the area. Even the mild droughts experienced in Michigan can cause significant hazards in a variety of ways. Besides economic losses related to drought, the likelihood of brush and forest fires becomes an immediate concern.

In Plainfield Charter Township, drought conditions are more severe in than the neighboring communities because the general soil makeup differs. While Alpine and Cannon and other neighboring communities have predominantly clay soils, Plainfield Charter Township has predominantly sandy soils and gravels. Thus, there is dramatic impact on water use during periods of drought as well as more brush and forest fires.

#### 5. Severe Winter Weather (Snow, Ice and Blizzard)

West Michigan is in the crosshairs of one of the biggest snow machines in the country - Lake Michigan. Significant snowfalls and strong winds become an ever-present danger to all residents of Plainfield Charter Township. Deep, drifting snows frequently affect the entire area and disrupt normal life. Snow plowing, snow removal, vehicle damage from snow and ice caused accidents, and damage from ice storms have a significant economic impact.

#### 6. Earthquake

Earthquake hazard remains low for Plainfield Charter Township. The United States Geological Survey predicts a 2% probability of an earthquake occurring in the next 50 years which is capable of peak acceleration of 4%g (gravity). This might cause damage and possible collapse of buildings constructed before 1940.

Earthquakes likely to have been felt in Plainfield Charter Township include a February 25, 1925 event that was centered in the St. Lawrence River Region in Canada (Intensity V), a September 4, 1944 event that was also centered in the St. Lawrence River region, and an August 9, 1947 event that is believed to have been centered in south-central Michigan (Intensity VI).

#### 7. Wildfire

Wildfire in Kent County tends to occur in open areas of unmaintained grassland and dry cropland. These surface fires are common along roadways due to the nearly continuous presence of ignition sources from passing vehicles and cigarettes.

While such areas are not very common in Plainfield Charter Township, the Township is more susceptible to wildfire than neighboring communities due to the sandy and gravel soils. Over the past five years, the fire department has responded to an average of seventeen brush and grass fires per year.

## 8. Urban and Structural Fire

Structural fires may occur in any structure, so it is logical that fire hazard increases as the concentration of structures increases. Structural loss is proportional to population concentration. Plainfield Charter Township is somewhat densely populated. The Township fire department has responded to an average of thirty-six structural fires over year over the past five years.

## 9. Other Fire

Other types of fire may occur in places of opportunity, but generally the risk of other fires, such as scrap tires or landfills, is low throughout the area. The Township has no active landfills at present. The Township fire department has responded to an average of twelve miscellaneous fire per year over the past five years.

## 10. Dam Failure Flooding

Kent County has fourteen notable dams. Three dams are rated as low hazard, seven are rated as significant hazard and four are rated as high hazard. Plainfield Charter Township has one dam, the Secluded Lake Dam, within its borders. The Childsdale Dam, formerly located on the Rogue River in Plainfield Charter Township, failed in September of 1986 due to a flood. It was not rebuilt.

Kent County could expect loss of life due to hazard posed by some dams. The Ada dam is located on a tributary of the Grand River and could have an impact on Plainfield Charter Township resident if it failed.

## 11. Riverine Flooding

Riverine flooding tends to occur in December through June and is a combination of frozen ground, high snow pack and sudden, heavy rainfall. Regular riverine floods occur, the largest of which have caused significant economic impact. Floodplain maps show the locations prone to flooding. Some areas of Plainfield Township are flooded on an annual basis.

## 12. Electrical Failure

Electrical infrastructure failure may occur anywhere in Plainfield Charter Township where local events or distant events can affect the stability of the grid.

### 13. Communication Failure

Loss of communication infrastructure may occur anywhere in Plainfield Charter Township. Communication is essential to the health and safety of residents. More study is necessary to ensure reliability. The Township is taking the initial steps to work with private enterprise in the creation of a wireless network across the Township. A Cell Tower Master Plan for such facilities covers most areas.

### 14. Water System Failure

The Plainfield Charter Township water system has periodic main breaks that must be repaired. Loss of a functional Plainfield Charter Township water system infrastructure would most likely be secondary to loss of electrical power. Single point interruptions are avoided with looped mains and linked systems. Redundancy and backup components help assure outages can be quickly remedied. With adequate back up electrical supply, loss of the water system caused by a natural disaster is unlikely.

### 15. Sanitary Sewer Failure

Loss of sanitary sewer infrastructure can lead to significant environmental, health and safety risks, and public health crisis by encouraging the unchecked growth of pathogens. Flooding of structures in low-lying areas may occur as a result of interrupted lines or loss of lift stations. With adequate back up electrical supply, loss of the lift station operation caused by a natural disaster is unlikely. However, the system may also be overwhelmed by extreme precipitation.

### 16. Natural Epidemic

Communicable disease is a threat to all Plainfield Charter Township residents. Disease is more easily transmitted in areas of concentrated population, such as public gathering areas, schools, businesses, etc. Activities such as disease outbreak monitoring, vaccinations, education and other mitigation programs help safeguard public health.

### 17. Hazardous Material Release

The potential release of hazardous materials exists wherever that material may be located. Higher potential for release coincides with storage sites at fixed facilities and along transportation routes such as major roadways and rail lines. Highly traveled corridors include the M37 - Plainfield Avenue connector and the US 131 - West River connector.

### 18. Transportation Accident

Unsurprisingly, transportation accidents occur more frequently in high traffic areas across the entire Kent County area, including Plainfield Charter Township. Many

roads are rural in character. The County and Township struggle to provide resources to improve these roads in step with growth.

#### 19. Nuclear Power Plant

Plainfield Charter Township does not have a nuclear power plant within its boundaries. The southwestern portion of the Township lies a few miles outside the 50 mile zone of concern for the Palisades Nuclear Power Plant in Covert.

#### 20. Intentional Acts

Intentional human acts, such as terrorism, crime, civil disturbances and others, pose various degrees of hazard to the entire area.

#### 21. Landslides

Landslides can be a critical hazard in some areas. However, in Plainfield Charter Township, the terrain does not lend itself to the existing of a landslides on any regular basis.

### B. Evaluation Measures and Benchmark Factors

The analysis was prepared following the “Pre-Hazard Mitigation Plan for Kent County, Ottawa County and the City of Grand Rapids” (rev. 2006) as a basis. By their very nature, each natural hazard event is unique and will vary in intensity and impact. Therefore, a range of benchmark factors have been assigned to more accurately reflect the potential impact of these hazards.

A set of 12 evaluation measures and 48 corresponding benchmark factors were used to evaluate hazards. The benchmark factors included matching weighting values of 10, 7, 4 and 1 point for each evaluation measure. The evaluation measures also were weighted by importance and are described as follows in order of priority:

#### 1. Historical Occurrence

Historical occurrence measures the frequency with which a particular hazard occurs in the Plainfield Charter Township area. The more frequently a hazard event occurs, the more potential there is for damage and negative impact on the community. The specific benchmark factors used in the historical occurrence analysis are: Excessive Occurrence 10 pts; High Occurrence 7 pts; Medium Occurrence 4 pts; Low Occurrence 1 pt.

#### 2. Seriously Affected Population

Seriously affected population refers to the number of people in the Plainfield Charter Township area who can expect to be directly affected by a particular hazard event, either because they receive physical injury, property damage, economic

hardship, or their day to day activities are severely disrupted because of severe damage to their community of residence or work. Specific benchmark factors used in the severely affected population impact analysis are:

Significant Population Affected 10 pts; High Population Affected 7 pts; Medium Population Affected 4 pts; Low Population Affected 1 pt.

### 3. Collateral Damage

Collateral damage refers to the possibility of a particular hazard event causing secondary damage and impacts. For example, blizzards and ice storms cause power outages, which can cause loss of heat, which can lead to hypothermia and possible death or serious injury. Generally, the more collateral damage a hazard event causes, the more serious the threat the hazard is to a community. The specific benchmark factors used in the collateral damage analysis are: High Possibility, 10 pts; Good Possibility 7 pts; Some possibility 4 pts; No Possibility 1 pt.

### 4. Population Impact

Population impact refers to the number of casualties (deaths and injuries) that can be expected if a particular hazard event occurs. Specific benchmark factors used in the population impact analysis are: High impact 10 pts; Medium Impact 7 pts; Low Impact 4 pts; No Impact 1 pt.

### 5. Economic Effects

Economic effects are the monetary damages incurred from a hazard event, and include both public and private damage. Direct physical damage costs, as well as indirect impact costs such as lost business and tax revenue, are included as part of the total monetary damages. Specific benchmark factors used in the economic impact analysis are: Significant Effects 10 pts; Medium Effects 7 pts; Low Effects 4 pts; Minimal Effects 1 pt.

### 6. Affected Area

Each hazard affects a geographical area. For example, a blizzard might affect the entire Plainfield Charter Township area, while a flood might only affect a few areas of a community. Although size of the affected area is not always indicative of the destructive potential of the hazard, generally the larger the affected area, the more problematic the hazard event is on a community. The specific benchmark factors used in the affected area analysis are: Large area 10 pts; Small Area 7 pts; Multiple Sites 4 pts; Single Site 1 pt.

### 7. Duration

Duration refers to the time period the hazard event is actively present and causing damage (often referred to as the “time on the ground”). Duration is not always

indicative of the damage potential of a hazard event, however, in most cases the longer an event is “active” and causing damage, the greater the total damages will be. Specific benchmark factors used in the duration analysis are: Long Duration 10 pts; Medium Duration 7 pts; Short Duration 4 pts; Minimal Duration 1 pt.

## 8. Availability of Warnings

Availability of warnings indicates the ease with which the public can be warned of a hazard. This measure does not address the availability of warning systems in a community. Rather, it looks at the overall availability of warning in general for a particular hazard event. For example, a community might receive warning that a flood will occur within 24 hours, but receive no warning when a large fire occurs. Generally, hazards that have little or no availability of warning tend to be more problematic for a community from a population protection and response standpoint. The specific benchmark factors used in the availability of warning analysis are: Warning Unavailable 10 pts; Warning Generally Not Available 7 pts; Warning Sometimes Available 4 pts; Warning Available 1 pt.

## 9. Speed of Onset

Speed of onset refers to the amount of time it typically takes for a hazard event to develop. Speed of onset is an important evaluation measure because the faster an event develops, the less time local governments have to warn the potentially impacted population of appropriate protective actions. The specific benchmark factors used in the speed of onset analysis are: Minimal or No Warning 10 pts; Less than 12 Hours 7 pts; 12-24 Hours 4 pts; Greater than 24 Hours 1 pt.

## 10. Seasonal Pattern

Seasonal pattern refers to the time of the year in which a particular hazard event can reasonably be expected to occur. Some hazard events can occur at any time of the year, while others occur primarily during one particular season. Oftentimes, hazard patterns coincide with peak tourism seasons and other times of temporary population increases, greatly increasing the vulnerability of the population to the negative impacts of certain hazard events. The specific benchmark factors used in the seasonal pattern analysis are: Year-round Occurrence 10 pts; Three Season Occurrence 7 pts; Two Season Occurrence 4 pts; One Season 1 pt.

## 11. Predictability

Predictability refers to the ease with which a particular hazard event can be predicted, in terms of time of occurrence, location, and magnitude. Predictability is important because the more predictable a hazard event is, the more likely it is a community will be able to warn the potentially impacted population and take other preventative measures to minimize loss of life and property. The specific benchmark factors used in the predictability analysis are: Unpredictable 10 pts; Somewhat Predictable 7 pts; Predictable 4 pts; Highly predictable 1 pt.

## 12. Mitigative Potential

Mitigative potential refers to the relative ease with which a particular hazard event can be mitigated against through the application of structural or non-structural (or both) mitigative measures. Generally, the easier a hazard event is to mitigate against, the less of a future threat it may pose to a community in terms of loss of life and property. The specific benchmark factors for the mitigative potential analysis are: Impossible to Mitigate 10 pts; Difficult to Mitigate 7 pts; Possible to Mitigate 4 pts; Easy to Mitigate 1 pt.

### C. Hazard Scoring

To rank the hazards from the greatest threat to lowest threat, each corresponding benchmark factor was assigned a specific point value of 10, 7, 4, or 1 point, based on each factor's relative severity and negative impacts. The more severe the potential impact from a hazard event, the more points that hazard will receive.

Next, each evaluation measure was assigned a "weight." The purpose of weighing the 12 measures is to stress which measures are deemed most important. The weighting has been done for all 12 measures, with the most important measure receiving a weight of 12, and the least important measure receiving a weight of 1. When the point value of a particular benchmark factor is multiplied by the weight, the measure receives more emphasis (points) than the other measures that are not assigned such a high weight. This way, the resulting quantitative analysis accurately reflects those area deemed most important. The following is a list of the measures and their assigned weight:

Historical Occurrence:	12
Seriously Affected Population:	11
Collateral Damage:	10
Population Impact:	9
Economic Effects:	8
Affected Area:	7
Duration:	6
Availability of Warning:	5
Speed of Onset:	4
Seasonal Pattern:	3
Predictability:	2
Mitigative Potential:	1

The quantitative result (score) for each hazard is obtained by multiplying each measure's benchmark factor point value by the weight. That gives the total score for that particular measure. Then the points for all the measures are summed for each hazard, giving each natural hazard a total hazard score. Table 1 shows the results of the Hazard analysis.

The process used in the analysis included reviewing the evaluation measures to verify their validity for the Township. Benchmark factors were then reviewed and modified for the Township as necessary. Following revisions to the benchmarking factors, Riverine flooding was determined to be one of the top 2 hazards for Plainfield Charter Township.

Thus, hazard mitigation for riverine flooding is considered a high priority. Dam Failure is ranked as the 14<sup>th</sup> greatest hazard to the Township, but is related to riverine flooding and will also be addressed in this flood mitigation plan.

PLAINFIELD CHARTER TOWNSHIP FLOOD MITIGATION PLAN

Table 1 – Hazard Score

	Historic Occurrence	Affected Area	Speed of Onset	Population Impact	Economic Effects	Duration	Seasonal Pattern	Predictability	Collateral Damage	Availability of Warnings	Mitigative Potential	Seriously Affected Population	Total Score
<b>Weight</b>	12	7	4	9	8	6	3	2	10	5	1	11	
Severe Winter Weather	84	70	16	36	56	42	12	8	100	20	7	110	<b>561</b>
Riverine Flooding	120	49	4	36	80	42	30	14	100	20	4	44	<b>543</b>
Electrical Failure	84	49	28	9	56	42	30	14	40	35	7	110	<b>504</b>
Tornado	12	49	40	63	80	6	21	14	100	20	7	44	<b>456</b>
Communications Failure	12	49	40	9	56	24	30	20	70	50	7	77	<b>444</b>
Thunderstorm & Wind Storms	120	28	28	18	32	6	21	8	70	20	7	77	<b>435</b>
Intentional Acts	84	28	16	36	56	6	30	8	40	20	7	77	<b>408</b>
Hazardous Materials Release	84	28	40	36	56	24	30	20	40	20	4	11	<b>393</b>
Transportation Accident	120	7	40	36	56	6	30	20	40	20	7	11	<b>393</b>
Structural Fire	120	7	40	36	56	6	30	20	40	20	4	11	<b>390</b>
Natural Epidemic	12	70	4	90	80	60	30	8	10	5	1	11	<b>381</b>
Nuclear Power Plant Accident	12	7	40	9	56	42	30	20	100	35	7	11	<b>369</b>
Extreme Temperature	48	70	4	36	8	42	12	8	70	5	10	44	<b>357</b>
Dam Failure	12	7	28	36	80	42	30	14	70	20	4	11	<b>354</b>
Water System Failure	12	70	28	9	56	24	30	20	40	20	7	11	<b>327</b>
Earthquake	12	28	40	36	56	6	30	14	40	50	4	11	<b>327</b>
Sanitary Sewer Failure	12	70	28	9	56	42	12	14	40	20	7	11	<b>321</b>
Drought	12	70	4	9	80	60	12	8	40	5	10	11	<b>321</b>
Wildfire	120	7	40	9	8	6	12	20	40	35	4	11	<b>312</b>
Other Fire	12	7	40	36	32	6	30	20	40	35	7	11	<b>276</b>
Landslide	12	7	28	9	8	6	21	8	70	35	7	11	<b>222</b>

Note: Score basis from Pre-Hazard Mitigation Plan for Kent County, Ottawa County, and City of Grand Rapids with specific modifications for Plainfield Charter Township by officials and Planning Team.

The following two sections of the Plainfield Charter Township Flood Mitigation Plan provide a more detailed analysis of the Townships flood hazards, and an assessment of the impacts of flood hazards. Sections D and E provide a general overview description and various general information that becomes more specific to Kent County and finally to Plainfield Charter Township itself. The flood hazard analysis identifies the types and extent of historic and potential hazard effects, specific locations of vulnerability and higher risks (where these are able to be pinpointed) from significant hazards, estimates of probability/frequency of hazard occurrence, a description of existing programs at the federal, state, and local level that address hazard concerns, and finally, lists of potential hazard mitigation actions that were then evaluated for local implementation by the township in the Flood Mitigation Action Plan.

#### D. Riverine flooding

Riverine flooding is defined as the periodic occurrence of overbank flows of rivers and streams resulting in partial or complete inundation of the adjacent floodplain. Riverine floods are generally caused by prolonged, intense rainfall, snowmelt, ice jams, dam failures, or any combination of these factors. Such overbank flows are natural events that may occur on a regular basis. Riverine floods occur on river systems whose tributaries may drain large geographic areas and encompass many independent river basins. Floods on large river systems may continue for several days. Many areas of Michigan are subject to riverine flooding.

Flash flooding differs from riverine flooding in extent and duration. Flash floods are brief, heavy flows on small streams or in normally dry creeks. Flash floods are normally due to locally-intense thunderstorms resulting in significant rainfall. Flash floods are typically characterized by high velocity water, often carrying large amounts of debris.

Every year, more homes in the United States are damaged by floods than any other natural disaster. Across the country, and throughout much of Kent County, flooding is the most common form of natural hazard. According to National Flood Insurance Program (NFIP), the risk of flood is much greater than the risk of fire. For structures located in the 100-year floodplain, there is a 26 percent chance of experiencing a flood during the life of a 30 year mortgage compared to a 4 percent chance of experiencing a fire. Even for structures located in the 500-year floodplain, there is a 6 percent chance of flood compared to a 4 percent chance of fire.

Several areas of Plainfield Charter Township are considered high risk locations for riverine flooding; this is especially true along the Grand River. Riverine flooding occurs when there is an increased amount of water in a stream or river channel, and the river overflows its banks onto the floodplain. (A floodplain is the area of land adjoining a lake, river or other watercourse which will be inundated by a flood.) Much riverine flooding occurs in the early spring as a result of excessive rainfall and/or the combination of rainfall and snowmelt. Ice jams also can create riverine flooding problems in winter and early spring.

However, flooding does not only occur when a river or lake overflows its banks. Most

urban flooding is simply the combination of excessive rainfall and/or snowmelt, saturated ground, and inadequate drainage. To illustrate this point, the National Flood Insurance Program (NFIP) reports that almost 25 percent of all flood insurance claims come from properties that are not located in a "special flood hazard area," also known as the 100-year floodplain. The 100-year floodplain is "an area of land that would be inundated by a flood having a 1 percent chance of occurring in any given Year." Most 100-year floodplains are located along rivers and lakes.

Almost annually, flooding occurs along the Grand River in Plainfield Charter Township, where homes have been built in a floodplain area. Flooding in other locations has also caused road blockages and inundation of homes in the spring and early fall, depending on the weather, the water levels of the river, and local drainage conditions. Major flooding of the Grand River occurred at least five times in the past 10 years, in 1997, 1999, 2000, 2001 and 2004.

## 1. Historically Significant Flood over the past 30 years

### September 1986

In September 1986, a slow moving storm system moved across the middle of the Lower Peninsula. In a 24 hour period, this storm produced rainfall amounts ranging from 8 to 17 inches over an area 60 miles wide and 180 miles long. In Plainfield Charter Township, emergency spillways were destroyed and the Childsdale Dam was breached. Around the state, flooding from the storm caused thousands of people to be evacuated and caused over \$30 million in damage. At the time, it was considered the worst flood in Michigan in 50 years. Thirty counties were included in a Governors Disaster Declaration and Presidential Major Disaster Declaration. The flood in Plainfield Charter Township is estimated to be about a 15-year event.

### February 1997

This 1997 flood along the Grand River was caused by an ice jam. On February 25, 1997, the Grand River crested at 15 feet at the Comstock Park gauge (Flood State is 12.0 feet), causing flooding of low-lying areas placing Abriador Trail underwater and flooding of about 13 homes along that street. Portions of other streets were also underwater, but primarily resulted in yard flooding.

### April 27, 1999

Heavy rains fell countywide as 3.75 inches fell in 24 hours. On April 27, the Grand River at Comstock Park crested at 13.2 feet.

### May 18-20, 2000

Flash flooding occurred during the morning hours of the 18th across Kent County as a result of as much as 5 inches of rainfall between 9 p.m. EST on the 17th and 2 a.m. EST on the 18<sup>th</sup>. The heaviest band of rain fell in a band from Grand Haven east to Rockford, which included Plainfield Charter Township. The Grand River

crested at 14.5 feet (about a 6-year flood frequency) on May 24 at the Comstock Park gauge, placing Abrigador and Konkle under water.

Feb 9-12, 2001

Extensive flooding began on the 9th as a result of the combination of heavy rain and melting snow. There were many reports of standing water in low lying areas and poor draining areas. The event transitioned into a river flood event across the area with a peak level in Plainfield Charter Township on February 13, 2001. Approximate forecast points on 8 different rivers were above flood stage. However, no lives were lost, and only minor property damage occurred. The Grand River crested in Plainfield Charter Township on February 13 with about a 3-year flood frequency. In the spring of 2001, there was additional, less-severe flooding in the area.

March 9, 2004

The Grand River at Comstock Park gauge crested at 13.3 feet, flooding low-lying areas nearby. This represents 1.3 feet above flood stage.

May 20-June 20th 2004

Heavy rain and thunderstorms plagued all of Southern Michigan with 5" and 6" totals during May 20-24. The great influx of water caused river levels to swell quickly, resulting in widespread flooding and producing flooding along many area rivers. The Grand River at Comstock Park gaging station crested at 16.5 feet on May 27, which is 4.5 feet above flood stage and the fourth highest on record. This level represented approximately a 15-year event frequency for the Township.

The flooding damaged many homes, business and infrastructure along the Grand River, Flat River, Rogue River and Thornapple River. The National Weather Service's advanced flood warnings provided adequate time to take some action to reduce flood impacts. Approximately 150 houses were damaged or impacted as well as several area businesses. And while the peak flooding occurred at the end of May, floodwaters did not recede in some locations until the middle of June. This added to the financial consequences to some businesses within the floodplain. As an example, the fairways on the Grand Island Golf Course were under water until between June 15th and 20<sup>th</sup> due in part to additional rainfall events (over 1 inch) through the middle of June.

Damage assessments were conducted by the State Emergency Management Office and Federal Emergency Management Agency. The Red Cross and Salvation Army each mobilized to provide services for the flood victims.

Governor Granholm issued a disaster declaration for 24 counties in Michigan, including Kent on June 3<sup>rd</sup>, and requested federal assistance. On July 1, President George Bush issued a Presidential Disaster Declaration for 19 of the 24 counties, including Kent. This provided federal disaster funds for families and businesses impacted by the flood. Over 110 Kent County victims requested FEMA disaster

assistance and received over \$87,000 in aid.

## 2. Current flood risks and vulnerabilities

A river gauge exists on the Grand River at Comstock Park that is used to monitor the levels of waters. The water levels at this gauge provide an indicator of the safety and comfort of residents who live on Willow Drive and Abridador Trail and to a lesser extent Konkle Drive, Riverbank and Coit Avenue. This manual staff gauge is a located on Abridador Trail and does not provide (24-hour) real time data. At this point, the flood stage is pinpointed at a 12.0 foot water level. At that level, minor flooding begins in low-lying areas along the river banks. This level has been reached or exceeded about 8 times since 1994. At approximately 10 feet (Comstock Park gauge) , Abridador Drive and Willow Drive begin to flood. Konkle Drive begins to flood at a gauge level of approximately 12 feet.

Figure 1 shows flood levels for recorded historic flood events based on the Comstock Park and Grand Rapids gauges on the Grand River. The top 10 known historic crests since 1991 for Plainfield Charter Township at Comstock Park Gauge Point on the Grand River are shown in Table 2. The location of the Comstock Park Gauge is shown on Map 6.

Table 2  
Largest 10 Measured Flood Levels in past 15 years

No.	Level	Date
1.	16.6 feet	May 27, 2004
2.	15.0 feet	February 25, 1997
3.	14.5 feet	May 21, 2000
4.	13.8 feet	April 23, 1993
5.	13.6 feet	February 13, 2001
6.	13.3 feet	February 26, 1994
7.	13.3 feet	March 9, 2004
8.	13.2 feet	April 27, 1999
9.	13.0 feet	June 22, 1996
10.	12.9 feet	January 17, 2005

Note: Flood Stage is 12 feet. Gauge information is from the National Weather Service station based in Grand Rapids.

Neighborhood Location Maps 1 through 12 shows the parcels in the floodplain areas along the Grand River and Rogue River.

A survey had been performed at 47 residential structures on Abridador Trail, 14 structures located on Konkle Drive, and 17 structures on Willow Drive. First Floor elevation were obtained; however specific information for all the private residences in the area will not be revealed in this document. Such information can be obtained from the Plainfield Charter Township Planning Department. Table 3 below provides some information regarding the frequency of flooding of structures based on the first floor elevations.

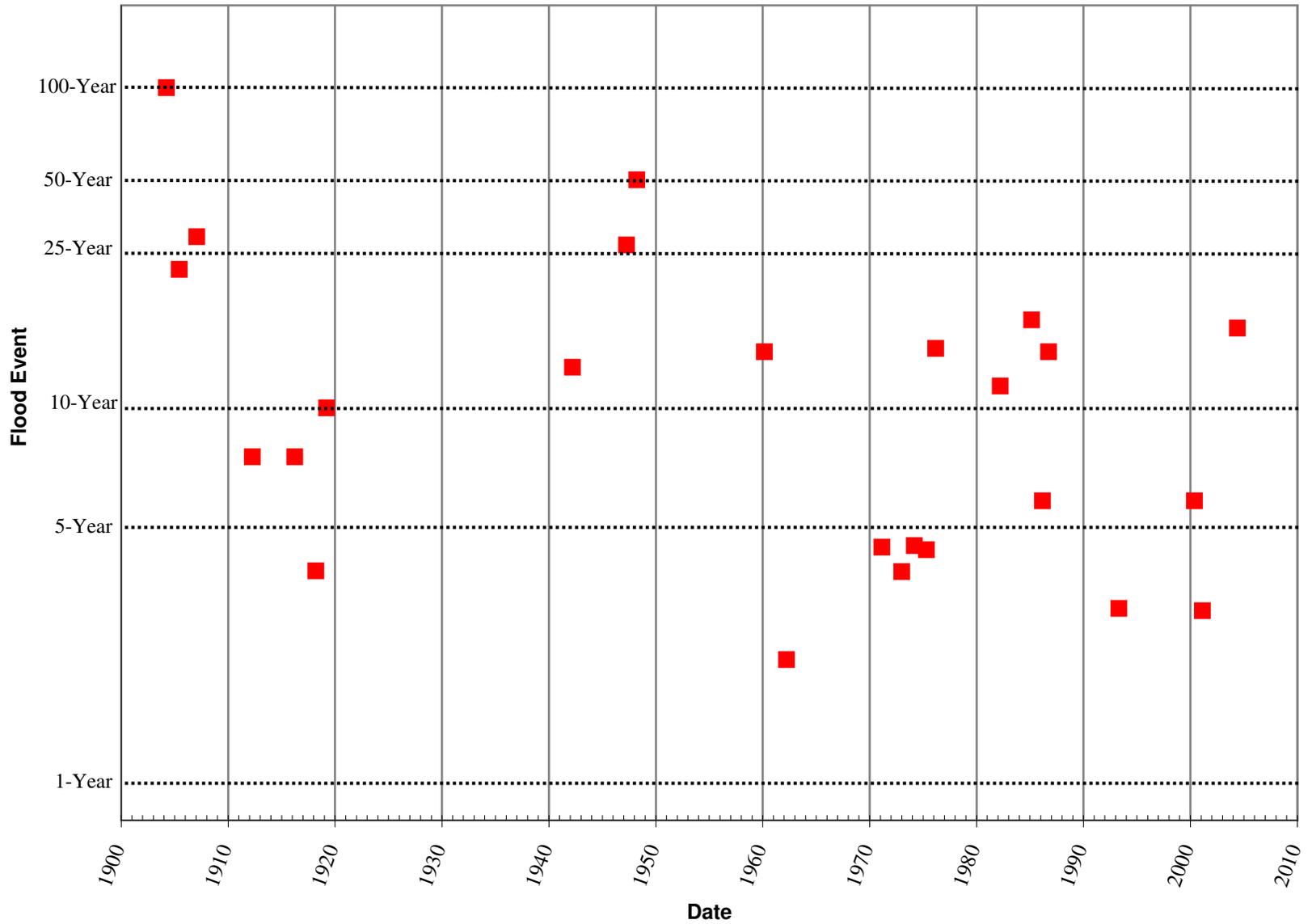
Table 3  
% of Structures Flooded for Various Frequency Events

	5-Year	10-Year	25-Year	50-Year	100-Year
	20% frequency	10% frequency	4% frequency	2% frequency	1% frequency
Abrigador Trail	21%	42%	90%	98%	100%
Konkle Drive	13%	53%	73%	93%	100%
Willow Drive	0%	0%	53%	94%	100%

In addition to Willow Drive, Abrigador Trail, Konkle Drive, Riverbank Drive, and Coit Avenue, some additional areas of flooding were identified in Plainfield Charter Township. About once a year, the yards, basements and sometimes first floors are flooded on these streets. During years with more inclement weather and drainage conditions, some basements have completely filled with water.

A golf course in this area of the township has also suffered repeated damage to its land, including complete destruction caused by the forces of floodwaters.

**Plainfield Charter Township Flood Mitigation Plan**  
**Figure 1 - Significant Historic Flood Events in Plainfield Charter Township**



### 3. Flood Overview

One reason flooding is so common is because it is a natural occurrence. Flooding does not become a disaster until people put themselves and objects of value into the way of this natural processes. When left undisturbed, the land that surrounds a waterway serves as natural flood and erosion control system by providing temporary storage of floodwaters, reducing the velocity of the water, and minimizing the amount of sediment that can accumulate downstream. Floodplains also help maintain water quality by filtering nutrients and impurities from stormwater runoff.

Even a home or business that is not in a 100-year floodplain or that is near a lake or river can be flooded. Many floods are caused by rain storms, melting snow, water backup due to inadequate or overloaded drainage systems, sewer lift system failure, or a combination of these events. No matter the cause, the solution to flooding is not always an easy one. Sometimes it is not feasible to construct pipes or ditches to direct all the water into rivers and lakes. The more the land is altered to mitigate flooding, the more the natural flood protection measures are disturbed.

### 4. Primary Causes of Flooding

#### a. Riverbank Overflow

Nationally, riverine flooding is the most common form of flooding. Many flood events in Kent County are also caused by high river levels, especially in the areas along the Grand River. According to a Michigan State University Climatology Program source for Years 1970 through 2000, average annual rainfall in Grand Rapids is 37.1 inches as provided in Table 4. Average annual snowfall is approximately 71 inches.

Riverine Flooding in the spring is often the result of rapid snowmelt, and is compounded when the snowmelt is accompanied by rainfall. Snowmelt runoff is especially hazardous when there is frozen ground that cannot absorb the melting snow. During the winter and spring months, ice jams are often the cause of flooding. Ice jams are hazardous for property owners located upstream of the dam due to the backwater, and for property owners located downstream of the dam who may experience flooding when the dam breaks loose. During the summer months, riverine flooding typically follows extended periods of heavy rain or very intense rainfalls.

Table 4 - Monthly Mean Precipitation in Grand Rapids

Month	Mean Monthly Rainfall (inches)
January	2.03
February	1.54
March	2.59
April	3.48
May	3.35
June	3.67
July	3.56
August	3.78
September	4.43
October	2.80
November	3.35
December	2.70
Annual Average	37.12

*(Source: MSU Climatology Program data from 1971 - 2000)*

Covering the ground with streets, buildings, parking lots and other impervious surfaces also increases riverine flooding by increasing stormwater runoff. Because the impervious covered ground does not absorb the stormwater, more water flows directly into nearby rivers. These impacts can be mitigated by proper stormwater management. Plainfield Charter Township has experienced significant development over the past 30 years; therefore, the Township must ensure that stormwater management policies are adequate to maintain or reduce flood levels.

b. Ice Jams

Cold winters like those we experience in Plainfield Charter Township can produce thick river ice and the potential for ice jams. An ice jam develops when chunks of snow and ice build up along a river. As the ice buildup increases, water passes more slowly, and flooding develops behind the dam of ice. Water levels can also rise rapidly when temperatures rise and result in snowmelt runoff or rain, thus adding more water to the river behind an ice jam.

In the spring, or when temperatures rise, the ice buildup will thaw and break up, and may unleash all of the dammed up water in a short period of time. When this occurs, flooding can rapidly result downstream from the ice jam. The combination of ice, debris, and water released from the ice jam can cause tremendous physical damage to homes and other structures.

c. Inadequate Drainage/Storage of Water (Detention/Retention Ponds, Culverts, Sewers)

Water collects in low-lying areas until it can evaporate, drain away, or infiltrate into the ground. Flooding occurs when water stays on the surface for long periods of time and/or collects in inappropriate volumes. Man-made lakes and retention ponds are quite popular and potentially useful in many new residential developments, but if they are inadequately designed or constructed, the low-lying area may continue to accumulate water and flood the nearby properties. Some areas with inadequate drainage may require a network of culverts or an engineered sewer system to provide adequate drainage for collected waters.

## 5. The Impact of Land Development

Continued development in the 100-year floodplain or tributary areas increases the potential for flood damage to homes, business and infrastructure. Flooding can be particularly significant in the lower reaches of a large watershed, such as for the Grand River in Plainfield Charter Township. Development in tributary areas without the knowledge or implementation of stormwater management techniques, can disrupted the ability of natural land areas such as open fields, woodlands, marshes and wetlands to absorb water, as well as the drainage infrastructure to properly carry and disperse water flow.

Developed areas will also have more impermeable surfaces that generate high volumes of stormwater runoff. If detention or retention is not provided, rivers will rise to higher levels and the impact of flooding will becomes more severe. The proximity of inhabitants and structures to flood waters increases the potential for personal injury and property damage during floods. Thus, controlling floodplain development is critical to reducing flood-related damages. Although there are state and local floodplain regulations designed to manage new development in flood prone areas, floodplain development in many communities continues to increase, resulting in corresponding increases in potential flood-related damages.

Mitigation of flood hazards rests with the Township since it controls the direction of land development through the master plan, zoning ordinance, and building codes. Proper land use management and strict enforcement of zoning ordinances and building codes can make communities safer from flood hazards and help reduce the high costs of flood losses. Plainfield Charter Township has a stormwater ordinance which requires developers to mitigate the affects of

development; however, this ordinance should be reviewed relative to retention and detention basins as well as wetland protection. This alternative was considered for the Mitigation Action Plan.

## 6. Existing Programs for Flood Hazards

### a. National Weather Service Doppler Radar

The National Weather Service has a modernized program which improves the quality and reliability of weather forecasting. The basis of this improvement is Doppler Weather Surveillance Radar, which detects severe weather events that threaten life and property - including weather events that can lead to flooding. Most important, the lead-time and accuracy of warnings for severe weather have improved significantly.

### b. National Weather Service Flood Watches and Warnings

The National Weather Service issues *flood watches* and *flood warnings* when conditions are right for flooding. A flood watch indicates meteorological conditions are conducive to flooding. People in the watch area are instructed to stay tuned to local radio or television stations for updates on flooding and weather conditions. When flooding is imminent, a flood warning is issued. The warning will identify the anticipated time, level and duration of flooding. People in areas that will be flooded are instructed to take appropriate protective actions, which can include evacuation of family members and removal or elevation of valuable personal property.

State and local government agencies are warned of flood watches and warnings by the Law Enforcement Information Network (LEIN) or National Oceanic and Atmospheric Administration (NOAA) weather radio and the Emergency Managers Weather Information Network (EMWIN). Public warning is provided through the Emergency Alert System (EAS). The National Weather Service stations in Michigan transmit information directly to radio and television stations, which in turn pass the warning on to the public. The National Weather Service also provides detailed warning information on the Internet, through the Interactive Weather Information Network (IWIN) and "[weather.gov](http://weather.gov)."

### c. Severe Weather Awareness Week

Each spring, the Department of State Police Emergency Management Division, in conjunction with the Michigan Severe Weather Awareness Committee, sponsors a Severe Weather Awareness Week. This public information campaign focuses on severe weather hazards such as tornadoes, thunderstorms, lightning, hail, high winds, and flooding. Informational materials on flooding and the other severe weather hazards are disseminated to schools, hospitals, nursing homes, other interested community groups and facilities, and the general public.

d. Michigan Flood Hazard Regulatory Authorities

**Subdivisions of Land Act, 288 P.A. 1967, as amended.**

The Subdivisions of Land Act governs the subdivision of land in Michigan. The Act requires review at the local, county and state levels to ensure the land being subdivided is suitable for development. For flood hazards, a proposed subdivision is reviewed by the County Drain Commissioner for proper drainage and to manage stormwater runoff, and for floodplain impacts by the Department of Environmental Quality, Land and Water Management Division.

Provisions of the Act and its Administrative Rules require that the floodplain limits be defined and prescribe minimum standards for new developments for residential purposes and occupancy, within or *affected* by a floodplain. Restrictive deed covenants are filed with the final plat which stipulate that any building used, or capable of being used, for residential purposes and occupancy, within or affected by the floodplain, shall meet the following conditions (R 560.304 Buildings with areas affected by floodplains):

1. Be located on a lot having a minimum buildable site of 3,000 square feet of its area at its natural grade above the elevation line defining the floodplain limit. The buildable site shall exclude all setbacks and easements. (This requirement may be waived if the building site is to be filled and the lowest floor, including the basement, is to be constructed above the floodplain elevation.)
2. Be served by streets within the proposed subdivision having surfaces not lower than one foot below the elevation defining the floodplain limits.
3. Have lower floors, excluding basements, not lower than the elevation defining the floodplain limits.
4. Have openings into the basement not lower than the elevation defining the floodplain limits.
5. Have basement walls and floors, if below the elevation defining the floodplain limits, watertight and designed to withstand hydrostatic pressures.
6. Be equipped with a positive means of preventing sewer backup from sewer lines and drains which serve the building.
7. Be properly anchored to prevent flotation.

**Floodplain Regulatory Authority, found in Water Resources, Part 31 of the Natural Resources and Environmental Act, 451 P.A. 1994, as amended.**

The floodplain regulatory portion of Act 451 restricts residential occupation of high risk flood hazard areas and ensures that other occupations do not obstruct flood flows. A permit is required from the Department of Environmental Quality for any occupation or alteration of the 100-year floodplain. In general, construction and fill may be permitted in the portions of the floodplain that are not floodway, provided local ordinances and building standards are met. (A floodway is the channel of a river or stream and those portions of the floodplain adjoining the channel which are reasonably required to carry and discharge a 100-year flood. These are areas of moving water during floods.) New residential construction is specifically prohibited in the floodway. Non-residential construction may be permitted in the floodway, although a hydraulic analysis may be required to demonstrate that the proposed construction will not harmfully affect the stage-discharge characteristics of the watercourse.

The Act does not apply to watersheds that have a drainage area of less than two square miles. Those small watersheds are considered to be local drainage systems, and do not fall under the Floodplain Regulatory Authority.

**Soil Erosion and Sedimentation Control, Part 91 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended.**

This portion of the Act seeks to control soil erosion and protect the waters of the state from sedimentation. A permit is required for all earth changes that disturb one or more acres of land, as well as those earth changes that are within 500 feet of a lake or stream. The Act itself does not specifically address flood hazards, however, if sedimentation is not controlled, it can clog streams, block culverts, and result in continual flooding and drain maintenance problems. In Kent County, the enforcing agent is located in the Drain Commissioners office.

**Inland Lakes and Streams, Part 301 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended.**

This portion of the Act regulates all construction, excavation, and commercial marina operations on the States inland waters. It ensures that proposed actions do not adversely affect inland lakes, streams, connecting waters and the uses of all such waters. Structures are prohibited that interfere with the navigation and/or natural flow of an inland lake or stream. Though reduction of flooding is not a specific goal of this Act, minimizing restrictions on a stream can help to reduce flooding conditions.

**Wetlands Protection, Part 303 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended.**

This portion of the Act requires a permit from the Department of Environmental Quality for any dredging, filling, draining or alteration of a wetland. This permitting process helps preserve, manage, and protect wetlands and the public functions they provide - including flood and storm water runoff control. The hydrologic absorption and storage capacity of the wetland allows wetlands to serve as natural floodwater and sedimentation storage areas. The Act recognizes that the elimination of wetland areas can result in increased downstream flood discharges and an increase in flood damage. Permits for wetland alterations are generally not issued unless there is no feasible alternative and the applicant can demonstrate that the proposal would not have a detrimental impact upon the wetland functions.

**Natural Rivers Program, Part 305 of the Natural Resources and Environmental Protection Act, 451 P.A. 1994, as amended.**

The Natural Rivers Act was originally passed in 1970, and has been incorporated as Part 305 of the Natural Resources and Environmental Protection Act. The purpose of this program is to establish and maintain a system of outstanding rivers in Michigan, and to preserve, protect, and enhance their multi-faceted values. Through the natural rivers designation process, a Natural River District is established (typically 400 feet either side of the riverbank) and a zoning ordinance is adopted. Within the Natural River District, permits are required for building construction, land alteration, platting of lots, cutting of vegetation, and bridge construction. Not all of the zoning ordinances on the natural rivers have the same requirements, but they all have building setback and vegetative strip requirements. Although the purpose is not solely to reduce flood losses, by requiring building setbacks (in many cases prohibiting construction in the 100-year floodplain), flood hazard mitigation benefits can be realized.

**The Drain Code, 40 P.A. 1956, as amended.**

The Drain Code of 1956, commonly known as Act 40, establishes laws relating to the laying out and consolidation of drainage districts, and the maintenance of drains, sewers, pumping equipment, bridges, culverts, fords, and other structures and mechanical devices to ensure that the drains function properly. The Drain Code also provides for the development of flood control and water management projects, the creation of water management districts and subdistricts, and for flood control and drainage projects within drainage districts. As a means to obtain funding for drain and water management projects, this Act provides for the assessment and collection of taxes, the investment of funds, and the deposit of funds for future maintenance of drains. Also, it authorizes public corporations to impose taxes for the payment of assessments in anticipation of which bonds are issued, provides for the issuance of bonds by drainage districts and for the pledge of the full faith and credit of counties for payment of the bonds; it authorizes counties to impose taxes when necessary to pay principal and interest on bonds for which full faith and credit is pledged, validates certain acts and bonds, and prescribes

penalties.

Drainage districts and drains are established by petition of the affected landowners and/or municipalities. County drains, with a special assessment district entirely within the County, are administered by the locally elected County Drain Commissioner. Inter-county drains, with a special assessment district in more than one county, are administered by a drainage board which consists of the drain commissioners of the affected counties, and is chaired by the Director of the Michigan Department of Agriculture (MDA) or an MDA Deputy Director.

**Manufactured Housing Commission Act, 96 P.A. 1987, as amended.**

The Michigan Manufactured Housing Commission Act and its implementing Administrative Rules regulate the placement of manufactured homes and establish construction criteria. Manufactured homes are prohibited from being placed within a floodway, as determined by the Department of Environmental Quality. In addition, manufactured homes sited within a floodplain must install an approved anchoring system to prevent the home from being moved from the site by floodwaters (or high winds), and be elevated above the 100 year flood level.

**Local River Management Act, 253 P.A. 1964.**

Enacted in 1964, the Local River Management Act provides for the coordination of planning between local units of government in order to carry out a coordinated water management program. Implementation of the water management program occurs via the establishment of watershed councils. These councils conduct studies on watershed problems, water quality, and the types of land uses occurring within the watershed. Watershed councils have the authority to develop River Management Districts for the purpose of acquisition, construction, operation and the financing of water storage and other river control facilities necessary for river management. The provision allows the acquisition of land adjacent to the river for the purpose of management aids in regulating development of land prone to flooding.

e. Floodplain Service Program

The need to identify a flood hazard area before construction is essential to the goal of flood hazard mitigation. The Department of Environmental Quality regularly provides floodplain information to public and private interests as part of its Floodplain Service Program under the Land and Water Management Division. The goal of the program is to provide 100-year floodplain information to interested parties so that informed purchase or development decisions can be made. The MDEQ may also provide information on land and water "interface" permit requirements and on building requirements relating to construction in flood hazard areas.

f. National Flood Insurance Program

For many years, the response to reducing flood damages followed a structural approach of building dams and levees and making channel modifications. However, this approach did not slow the rising cost of flood damage, nor could individuals purchase insurance to protect themselves from flood damage costs. It became apparent that a different approach was needed.

The National Flood Insurance Program (NFIP) was instituted in 1968 to make flood insurance available in those communities agreeing to regulate future floodplain development. As a participant in the NFIP, a community must adopt regulations that: 1) require any new residential construction within the 100-year floodplain to have the lowest floor, including the basement, elevated above the 100-year flood elevation; 2) allow non-residential structures to be elevated or dry floodproofed (the floodproofing must be certified by a registered professional engineer or architect); and 3) require anchoring of manufactured homes in floodprone areas. The community must also maintain a record of all lowest floor elevations or the elevations to which buildings in flood hazard areas have been floodproofed. In return for adopting floodplain management regulations, the federal government makes flood insurance available to the citizens of the community. In 1973, the NFIP was amended to mandate the purchase of flood insurance as a condition of any federally regulated, supervised or insured loan on any construction or building within the 100-year floodplain.

Plainfield Charter Township has NFIP-eligibility status. Therefore, residents and business owners are eligible to purchase flood insurance through the NFIP. Officials from FEMA and the MDEQ have estimated that only 15 percent of all flood-prone structures in Michigan that are eligible to purchase flood insurance actually have flood insurance.

g. Flood Mitigation Assistance Program

With the passage of the National Flood Insurance Reform Act of 1994, Congress authorized the establishment of a federal grant program to provide financial assistance to states and local communities for flood mitigation planning and activities. The Federal Emergency Management Agency (FEMA) has designated this the Flood Mitigation Assistance Program (FMAP). The FMAP funds can be used to fund activities that reduce the risk of flood damage to structures insurable under the National Flood Insurance Program. In Michigan, the FMAP is administered jointly by the Department of State Police and the Department of Environmental Quality, and cost-shared on a 75 percent federal, 25 percent local basis.

Three types of FMAP grants are available: 1) *planning grants* to assist local communities in developing flood mitigation plans; 2) *project grants* to fund eligible flood mitigation projects, with emphasis on repetitively or

substantially-damaged structures insured under the NFIP; and 3) *technical assistance grants* to assist the State in providing technical assistance to applicants in applying for the program or implementing approved projects. Plainfield Charter Township secured a Flood Mitigation Assistance Program Planning Grant for the development of this Flood Mitigation Plan.

h. Pre-Disaster Mitigation Program (PDMP)

This program was established by the Disaster Mitigation Act of 2000 as a state-administered, cost-sharing program that provides funding for mitigation planning and cost-effective mitigation projects that help reduce injuries, loss of life, and damage and destruction of property. FEMA will contribute up to 75% of the cost of approved activities. The remaining 25% must be provided by non-federal sources. (Note: Unless by a special appropriation of the Michigan Legislature, no state funding will be used for the 25% non-federal match.) Contributions of other state agencies may be used as an in-kind contribution toward the 25% match.

Communities applying for PDMP funds for "brick and mortar" type projects must have a FEMA approved hazard mitigation plan in place. Communities without such plans in place will only be eligible for funding to complete a FEMA-approved hazard mitigation plan.

i. Flood Management and Mitigation Education

The MDEQ Land and Water Management Division, has developed guidance documents aimed at local officials involved in floodplain management and flood hazard mitigation. These guidebooks are used as textbooks in training workshops and as a reference for day-to-day activities. One of these publications, *Floodplain Management for Local Officials*, covers topics including floodplain construction and building code requirements, the duties and responsibilities of the building code inspector under the NFIP and the Construction Code Act, and flood-resistant building techniques and materials. This publication is available by contacting Land and Water Management Division.

The Emergency Management and Homeland Security Division (EMHSD), Department of State Police, has developed the *Local Hazard Mitigation Planning Workbook* for local officials. This guidance document provides an overview of a planning process that communities can follow to help reduce their vulnerability to a wide array of natural, technological and human-made hazards - including riverine flooding.

Both the Land and Water Management Division and Emergency Management and Homeland Security Division regularly conduct floodplain management and flood hazard mitigation training courses and workshops for state and local officials. The Land and Water Management Division also conducts regular community assistance visits as part of its administrative duties under

the National Flood Insurance Program. Such visits are a form of training aimed at improving a community's implementation of floodplain management practices. In addition, the Land and Water Management Division continuously conducts flood hazard workshops for lenders, Realtors, building officials, engineers, citizens and any other interested parties.

j. Road Infrastructure Flood Mitigation Committee

Following the September, 1986 floods, the Michigan Department of Transportation (MDOT) formed a flood mitigation committee to determine ways to lessen damage to road infrastructure caused by riverine flooding. The committee consisted of representatives from the County Road Association of Michigan, the Federal Highway Administration, the Department of Environmental Quality, and MDOT. One of the primary purposes of the committee was to identify reasons for failed stream crossings and damaged roads during a flood event, and make recommendations for achieving more flood-resistant stream crossings. The committee published its findings and recommendations in a report that is used today as a reference guide for officials involved in road infrastructure design and maintenance.

As a result of one of the committee's recommendations, the Department of Environmental Quality regularly sponsors workshops and seminars on stream crossing design and erosion control practices. These workshops are geared toward design engineers at the state, county and local levels, in addition to private consultants and county drain commissioners.

k. State and Federally-Assisted Relocation of Flood-prone Properties

The State of Michigan has been very pro-active in its initiation and participation in the acquisition and relocation of flood-prone properties, in both pre- and post-disaster situations.

Typically properties are purchased by the local unit of government using federal Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDMP), and Flood Mitigation Assistance Program funds. In Michigan, these programs are administered by the Michigan State Police Emergency Management and Homeland Security Division.

l. Other State and Federally-Assisted Flood Hazard Mitigation Programs

The State of Michigan has used a variety of federal funding sources to assist in the implementation of flood hazard mitigation projects. Those funding sources have included: 1) the Hazard Mitigation Grant Program (HMGP); the Pre-Disaster Mitigation Program (PDMP); 3) the Flood Mitigation Assistance Program (FMAP); 4) the Public Assistance Grant Program (PAGP); 5) the Individual and Family Grant Program (IFGP); 6) Community Development Block Grants (CDBG); and 7) Farmers Home Administration (FmHA) loans. State and local funds have been used to match these federal sources of

funding.

m. Local Efforts and Strategies

Since the occurrence of the significant flooding events, residents, local units of government and Kent County have taken a variety of actions to reduce flooding problems across the County.

For decades, the national philosophy of how to limit flood damage was limited to the construction of flood-control projects, such as dams and levees. However, this approach did not eliminate flood risks in the long-term, because it did not discourage unwise development and land use practices.

The Kent County Drain Commission has been actively involved in reducing flooding threats throughout the County. Past mitigation activities have addressed some flooding in a few locations in the township. However, many flood mitigation activities are very site specific, so even though a few areas are more flood-resistant, others are still at risk from flooding. Therefore, a variety of mitigation measures are still needed.

The benefits of a regional approach to water drainage and flood issues becomes clear when it is recognized that development leads to an accumulation of changes in the speed and nature of drainage and surface water runoff. Plainfield Charter Township is located in the Lower Grand River Watershed, where a 319 Project was completed to evaluate such issues and monitor/improve the conditions of the Grand River and its tributaries. A description of this coordinative regional watershed research project follows:

**The Lower Grand River Watershed 319 Project**

The Grand River Watershed is the largest watershed with one common river in the State of Michigan. The Watershed is separated into two parts, the "Lower Grand River Watershed" and the "Upper Grand River Watershed". The Lower Grand River Watershed covers ten counties including Kent County.

A Section 319 Watershed Management Planning Grant was awarded by the Michigan Department of Environmental Quality (MDEQ) to facilitate the development of a watershed management plan for the Lower Grand River Watershed. The grant was awarded to the Grand Valley Metro Council for the completion of a management plan. Many communities are participating in the development of this plan.

More than a century ago the Grand River was deteriorating, its banks filled with mills and factories and its water with logs and dams. In its history the river has been abused with waterpower, river dependent industries, large increases in population, stripping of the forests, discharges of chemical, and discharges of sewage wastes.

In 1905, the Grand Rapids Evening Press predicted that by the year 2005 the Grand River would be more a sewer than a river. They were wrong. Today, we have the technology and the knowledge to change the future of not only the river, but the watershed as a whole. Many programs have been initiated to study the Grand River Basin and to propose, as well as put into action, numerous plans for its management. Unfortunately, many more are still needed. If the Grand River is to be restored to what the Grand River Times in 1837 called "one of the most important and delightful [rivers] to be found in the country" with "clear, silver-like water winding its way through a romantic valley" it is going to take a lot of hard work and dedication.

The best way to limit flood losses is to avoid building in flood hazard areas. Unfortunately, this is not always an easy or viable option to realize, especially when economic and political pressures make development in floodplains attractive for some landowners, developers, and speculators. Methods must be found to mitigate the impacts of development and reduce flood losses while still allowing property owners some reasonable use of their land. Flood protections can involve a variety of changes to a structure and property. These changes can vary in complexity and cost. A few of these changes, as well as other mitigation and protection options are listed below.

1) Encourage the Purchase of National Flood Insurance

Because almost no property is 100 percent safe from flooding, residents of Plainfield Charter Township should consider purchasing flood insurance from the National Flood Insurance Program (NFIP). This is especially necessary for those homes and businesses located in a flood hazard area. Most homeowners and business insurance policies will not cover losses in the event of a flood. That means that most often all cleanup, replacement and repair costs will be out-of-pocket expenses for the flood victim.

People who own a home or business in a flood hazard area often assume incorrectly that if their property suffers damage from a flood, the federal government will provide financial assistance to recover from the flood. Before a community is eligible for federal disaster assistance, it must be declared a federal disaster area. Federal disaster assistance declarations are issued in less than 50 percent of flooding incidents. Also, federal disaster assistance is typically provided in the form of a loan that must be repaid with interest. Flood insurance pays even if a disaster is not declared. The premium for an NFIP policy, averaging a little more than \$300 a year, is usually less expensive than interest on federal disaster loans. Furthermore, if a property owner in the 100-year floodplain is uninsured and receives federal disaster assistance after a flood, he *must purchase flood insurance to remain eligible for future disaster relief.*

This stipulation is outlined in The National Flood Insurance Reform Act. The Act requires individuals who have a home or business in the

100-year floodplain, who have received federal disaster assistance for flood disaster losses to real or personal property, to purchase and maintain flood insurance coverage for as long as they occupy the building. If flood insurance is not purchased and maintained, future disaster assistance will *be denied*. If the structure is sold, the current owner is required to notify the buyer of the property of the need to purchase and maintain flood insurance. If the buyer is not notified, suffers uninsured flood losses, and receives disaster assistance, the seller may be required to repay the federal government any federal disaster assistance the buyer received.

The Flood Disaster Protection Act of 1973 and the National Flood Insurance Reform Act of 1994 also mandate the purchase of flood insurance as a condition of federal or federally related financial assistance for acquisition and/or construction of buildings in the 100-year flood plain of *any* community. The Act prohibits federal agency lenders, such as the Small Business Administration (SBA), Federal Housing Administration (FHA), Veterans Administration (VA) or Government-Sponsored Enterprises for Housing (Freddie Mac and Fannie Mae) from making, guaranteeing, or purchasing a loan secured by improved real estate or mobile homes in the 100-year floodplain, unless flood insurance has been purchased, and is maintained during the term of the loan.

Plainfield Charter Township should continue to work with insurance companies to educate their residents on the benefits of NFIP.

2) Update/Complete/Create Flood Insurance Rate Maps for All Communities

Flood Insurance Rate Maps (FIRMS) are developed by FEMA and illustrate the extent of flood hazard in a community. Using engineering studies that analyze records of streamflow and rainfall, topography, hydrologic and hydraulic data, and other information gathered from the community (such as what areas have a history of flooding), FEMA is able to determine the 100-year floodplain boundaries and elevations. These maps are called "rate maps" because they are used by the National NFIP to determine the premium that will be paid by a property owner. Properties located in high flood risk areas are subject to higher premium rates than those properties that are located outside of the 100-year floodplain. This differential rate structure provides significant financial incentive to builders and homeowners locate structures in less hazardous areas.

It is important for communities to have accurate, up to date FIRMs for several reasons. Most importantly, FIRM help planners determine what areas of the community are at risk of flooding, and what potential impacts from flooding could be. This knowledge provides communities with clear boundaries and guidelines upon which to base floodplain

management ordinances. Another reason FIRMs are important is that they allow property owners and potential property buyers to determine whether or not a property is located in a high risk flood area. When a property owner is aware of the potential flood hazard and high cost of flood insurance, they may be less inclined to develop the property in a hazardous manner. Finally, until a community has an official FIRM it cannot fully participate in the NFIP. This initial phase of a community's participation in the NFIP is known as the Emergency Phase. During this phase, communities are only eligible for limited flood insurance coverage.

Kent County is currently updating the FIRMs with DFIRMS (Digital Flood Insurance Rate Maps) that are in draft form awaiting final FEMA approval. Every community in the County is participating in the National Flood Insurance Program, and therefore all property owners and residents in the County are eligible to purchase flood insurance.

FIRMs (and DFIRMs) when developed do not necessarily document all floodplains. Floodplains along smaller water bodies, both lakes and streams, are not always mapped. Significant floodplain exists, and extensive flooding has occurred along streams which FIRMs show no related floodplain. Since no other mapping is currently available for Kent County, FIRMs are extensively utilized by the decision makers working for/with local units of government. Because some of these maps are incomplete, local units of government or property owners are given the false impression that floodplains do not exist in those areas. This is one reason why floodplains have been, and still are being, filled or occupied by structures. More extensive floodplain mapping is needed to assist local units and property owners. In addition, it is important to keep the FIRMs up to date because as a community grows, and more open space is converted to developed land, flood hazard areas will change.

### 3) Enforce NFIP standards/Community Floodplain Regulations

According to the Department of Environmental Quality Land and Water Management Division, voluntary community participation in the National Flood Insurance Program (NFIP) has had a positive impact on floodplain management activities in Michigan. This is partly because in order for a community to participate in the NFIP, the community must agree to enforce certain types of land use regulations. These regulations must:

- (a) Require that new construction and substantial improvements in flood prone areas be designed and anchored to prevent floatation, collapses or lateral movement, be constructed with materials and utility equipment resistant to flood damage, and be constructed by methods and practices that minimize flood damages.

- (b) Require, where flood elevation data are available, that:
- i) All new construction and substantial improvements of residential structures located in mapped floodplain areas have the lowest floor (including basement) elevated to or above the 100-year flood level.
  - ii) All new construction and substantial improvements of nonresidential structures in flood hazard areas have the lowest floor (including basement) elevated or floodproofed to or above the 100-year flood level. Floodproofing must be certified by a registered professional engineering or architect.
- (c) Require anchoring of mobile homes in flood prone areas.
- (d) Maintain a record of all lowest floor elevations or the elevations of floodproofing when the building is located in a mapped flood hazard area.

Probably the best way to integrate these regulations into a community land use plan and manage floodplain development is through the zoning ordinance and the establishment of *a floodplain zoning district*. This district may be an established zoning district or may be used as an overlay zone. The objectives of this regulation should be:

- To control filling, grading, dredging and other development which may increase flood damage;
- To prevent the removal of vegetation in the floodplain;
- To prevent the unnatural diversion of flood waters or increase flood hazards;
- To slow stormwater runoff;
- To preserve wetland areas and prevent excessive sedimentation; and
- To prevent the encroachment of development on stream and river channels.

Permitted uses in the floodplain should not obstruct flood flows or have a high damage potential; for example recreational and agricultural uses, private drives, lawns and open spaces, or public rights-of-way.

It must be remembered that these requirements are of no value in

reducing flood losses if the local office or department responsible for inspecting and enforcing the floodplain regulations for the communities in the County does not enforce them.

4) Limit Impervious Surfaces/Maintain Greenspace

Flooding is becoming significant in portions of Kent County where development has outstripped the ability of natural land areas such as open fields, woodlands, marshes and wetlands to absorb water, and the drainage infrastructure and to properly carry and disperse water flow. Limiting of impervious surfaces can be regulated through the floodplain management regulations and/or zoning ordinances.

5) Acquire Flood Prone Structures and Property

Communities may consider purchasing homes or businesses that have suffered repetitive flood losses. When funds are available, communities may receive Federal Hazard Mitigation Grant assistance to cover 75 percent of the purchase price of the property. Under the requirements of this grant, structures must be removed, the homeowner must volunteer to sell the structure, and the acquired properties must be maintained as open space. A home or business owner may not want to leave their home or property, other mitigation measures may be cost prohibitive or may not significantly reduce flood damage.

With property acquisition, land can be purchased and structures can either be relocated off the high risk flood areas or the structures may be demolished. The acquired lands may then be used for public recreation or green space.

In Plainfield Charter Township, there are many structures located in the flood hazard zone. Standards (criteria) for acquiring property were based upon significant housing issues that arose during the planning team discussions. These criteria include but are not limited to the following (in no specific order):

- **Housing Condition** - The conditions of these structures are highly variable. Based upon Township Assessor records, there is a higher rate of below average structural condition.
- **Public Utilities**
  - Some of these areas are served by public water or sewer while others are not. In general, reinvestment into these properties is somewhat dependent upon the availability of these utilities.
  - Wells and septic systems in the floodplain are

under the jurisdiction of the County Health Department. Failure of wells and septic systems is a concern due to environmental hazards and housing occupancy.

- **Frequency of Flooding** – Elevation of the structure will resulting frequency of flooding will be considered.
- **Access to the Property** – Structures with limited access would be given a higher priority for voluntary acquisition.
- **Other Utilities** – The vulnerability of other utilities to flood damage will be considered.
- **Vulnerability to other Natural Disasters** – Some structures may be vulnerable to natural disasters than others.

These criteria were primarily used to designate which structures would be included in the voluntary flood acquisition program for the Township. Structures within the flood hazard area on the following streets would be considered for acquisition: Abrigador Trail, Bailey Park, Canright Street, Coit Avenue, Filkins Drive, Forest Ridge Avenue, Grand River Drive, Grand River Court, Konkle Drive, Indian Drive, Lovers Lane, Mall Avenue, Packer Drive, Plainfield Avenue, Purchase Street, Ripley Street, Riverbank Drive, Rogue River Road, Rudy Street, Verta Drive, Walnut Park Drive, West River Drive, and Willow Drive would be considered for a long term acquisition program. Table 5 estimates the number of structures on each street and the 2006 State Equalized Value.

Table 5  
Total Structures and SEV Value for Streets in Floodplain

Street Name	No. Structures	Total 2006 SEV
Abrigador Trail	49	\$ 2,300,000
Bailey Park	1	\$ 70,400
Canright Street	1	\$ 41,400
Coit Avenue	5	\$ 587,600
Filkins Drive	2	\$ 138,000
Forest Ridge Avenue	2	\$ 174,400
Konkle Drive (Golf Course)	5	\$ 163,800
Konkle/Karcher	7	\$ 288,600
Konkle by Jupiter Bridge	5	\$ 250,600
Indian Drive	4	\$ 209,000
Lovers Lane	2	\$ 139,771
Mall Avenue	4	\$ 322,700
Packer Drive	3	\$ 311,200
Plainfield Avenue	1	\$ 124,700
Purchase Street	6	\$ 478,100
Ripley Street	5	\$ 395,549
Riverbank Drive	21	\$ 1,214,000
Rogue River Road	4	\$ 324,800
Rudy Street	1	\$ 41,800
Verta	2	\$ 132,300
Walnut Park Drive	5	\$ 397,000
West River Drive	16	\$ 1,229,800
Willow Drive	59	\$ 3,272,400
Total	210	\$12,607,920

6) Elevate Flood Prone Structures

When structures are already located in flood hazard areas, elevating these structures above the reach of floodwaters is a technique often used to reduce flood damage. Elevation of structures, if done properly and in appropriate sites, can be a useful option for flood loss reduction.

Township-wide public input during the process indicated that residents would prefer to have an assistance program available to elevate structures within flood hazard areas. The structure elevation program will include all streets within the flood hazard area: Abrigador Trail, Bailey Park, Canright Street, Coit Avenue, Filkins Drive, Forest Ridge Avenue, Grand River Drive, Grand River Court, Konkle Drive, Indian Drive, Lovers Lane, Mall Avenue, Packer Drive, Plainfield Avenue, Purchase Street, Ripley Street, Riverbank Drive, Rogue River Road, Rudy Street, Verta Drive, Walnut Park Drive, West River Drive, and Willow Drive

7) Install or Maintain Stream Buffers

Buffer areas are the lands next to a river, lake or other body of water that are covered with trees, shrubs, or other vegetation and groundcover. Buffer areas are an important element in flood control because the vegetation reduces and filters runoff through interception and detention. Plants and trees also help to slow down runoff, enabling water be absorbed into the ground more easily. When less runoff reaches the river or lake, the volume of water that contributes to the flood is also reduced. Buffer areas also stabilize stream slopes to help prevent erosion. Zoning ordinances are a tool that can be used to ensure that riverine areas are properly buffered from development.

8) Insure that Detention/Retention Ponds and Man-made Lakes are Properly Designed

Neighborhood developments with waterfront homes are being constructed more frequently in Kent County in recent years. If properly designed, these homes on man-made lakes can provide scenic beauty and recreation. But in some cases these lakes can create a new flooding problem where none existed before. Flooding to homes on these lakes could result in thousands of dollars in damage to the homes and belongings. Strict oversight and engineering must be ensured when developing a community on a natural or man-made lake.

Finally, if unsure whether or not a home or business is at risk from flooding, the local unit of government or the Michigan Department of Environmental Quality Land and Water Management Division Floodplain Management Office may be able to provide assistance.

## 7. Potential Actions for Consideration

The following actions and strategies were considered by the Plainfield Charter Township Flood Mitigation Planning Team. Several of these alternatives were suggestions provided with the public surveys. Team members rated the importance and need of each alternative and the results were tabulated to pare down the list. With the prioritization listing, alternatives were selected for comparison using evaluation criteria, as described in the action plan section that appears later in this document.

Each hazard has a list of associated mitigation strategies. In front of each strategy are boldface letters that represent specific groups or organizations that are pertinent to implementing the described mitigation-related activity. Up to three categories are listed for each mitigation strategy. The following is list of the code letters and what they refer to:

- B** Business owners & managers (including site developers and builders and government administrators whose activities are similarly associated with the selection, design, and operation of specific sites performing economic or community functions)
- C** Public Citizens and those who provide educational services or marketing campaigns to them
- E** Emergency management coordinators and related persons (LEPCs, incident commanders, etc.)
- F** First-responders (law enforcement, fire fighters, medical services, other response services at all levels)
- I** Insurance agencies & industry, including the NFIP
- L** Elected officials and Legislators
- N** Non-profit organizations and government departments which support them or have similar concerns (welfare provision, environmental protection, etc.)
- O** Building Officials and other inspection, regulation, and code enforcement Officials (health, fire, etc.)
- P** Planning departments, consultants, officials, engineers, and others involved in similar activities guiding long-term development patterns and conditions in a community, a larger area, or at development sites
- R** Researchers, engineers, architects, etc. involved in the study and design of human environments and support infrastructure: also includes public works, utility providers, and others dealing with infrastructure design, development and maintenance (Road Commissioners, Drain Commissioners, etc.)

Potential Actions:

- N,P,R Accurate identification and mapping of flood-prone areas.
- L,P,R Flood plain management - planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
- P,R Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
- B,C,R Dry floodproofing of structures within known flood areas (strengthening walls, sealing openings, use of waterproof compounds or plastic sheeting on walls).
- B,C,R Wet floodproofing of structures (controlled flooding of structures to balance water forces and discourage structural collapse during floods).
- B,C,R Elevation of flood-prone structures above the 100-year flood level.
- P,R Construction of elevated or alternative roads that are unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
- B,C,R Government acquisition or relocation of structures within floodplain or floodway areas.
- B,C,O Public awareness of the need for permits (MDEQ Part 31) for building in floodplain areas.
- C Inclusion of safety strategies for flooded areas in driver education classes and materials.
- N,P,R Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.)
- N,R Dredging and clearance of sediment and debris from drainage channels.
- N,P,R Protection (or restoration) of wetlands and natural water retention areas.
- L,O Enforcement of basic building code requirements related to flood mitigation.

- L,P,R      Formation of a watershed council.
- B,E,R      Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- B,C,I      Obtaining insurance.
- E,L,P      Participating in the Community Rating System (CRS) to lower insurance rates.
- N,P,R      Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, wetlands protection and restoration).
- R          Higher engineering standards for drain and sewer capacity.
- L,P,R      Drainage easements (allowing the planned and regulated public use of privately owned land for temporary water retention and drainage).
- L,P,R      Installing (or re-routing or increasing the capacity of) storm drainage systems.
- L,N,P      Farmland and open space preservation.
- B,C,O      Elevating mechanical and utility devices above expected flood levels.
- N,P,R      Improved/updated floodplain mapping.
- L,O,P      Real estate disclosure laws.
- C,E,R      Public education and flood warning systems.
- E,N,R      Monitoring of water levels with stream gauges and trained monitors. Increased coverage and use of NOAA Weather Radio.
- E,L,O      Training for local officials on flood fighting, floodplain management, floodproofing, etc.
- B,C,O      Anchoring of manufactured homes to a permanent foundation, but preferably these structures would be readily movable if necessary or else permanently relocated outside of flood prone areas.
- F          Road closures and traffic control in flooded areas.
- E,F        Trained, equipped, and prepared search and rescue teams.
- B,C,O      Control and securing of debris, yard items, or stored objects (including oil,

gasoline, and propane tanks, and paint and chemical barrels) in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs.

- B,R Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure that drainage infrastructure is not impeded.
- N,P,R Employing techniques of erosion control in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
- P,R Increasing functioning and capacity of sewage lift stations and treatment plants (installation, expansion, and maintenance), including possible separation of combined storm/sanitary sewer systems, if appropriate.
- N,P Purchase or transfer of development rights - to discourage development in floodplain areas. Stormwater management ordinances or amendments.
- N,P,R Wetlands protection regulations and policies.
- L,N,P Regional/watershed cooperation.
- B,C,R Use of check valves, sump pumps and backflow preventers in homes and buildings.
- C Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.
- B,C,O Keep ice removal trucks ready in case of flood during freezing weather
- P,B Eliminate the jog at Millcreek Street Railroad Crossing, where overflows always happen
- P, Improve conveyance in York Creek, or provide alternative relief.
- P,R,O Construct Grand River spillway diversion with storage
- P,R Discuss possible modification to the 6<sup>th</sup> Street Dam with the MDEQ and City of Grand Rapids

Some alternatives are already being addressed by the Township, the County, or other agencies, and are not included in this Action Plan. For a list of those strategies that were selected for implementation in this plan, please refer to the Action Plan section at the end of this document.

## E. Dam Failures

The collapse or failure of an impoundment may result in downstream flooding. Dam failures may also result in loss of life and extensive property damage for miles downstream from the dam. Failure of a dam does not only occur during flood events, it

can also result from poor operation, lack of maintenance and repair, and vandalism. Such failures can be catastrophic because they occur unexpectedly, with no time for evacuation. Michigan has experienced over 260 dam failures in its history.

In Michigan, all dams over 6 feet high that create an impoundment with a surface area of more than 5 acres are regulated by Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act (451 P.A. 1994), as amended. This statute requires the Michigan Department of Environmental Quality (MDEQ) to rate each dam as either a *low*, *significant*, or *high* hazard potential. This rating system is based solely on the potential downstream impact if the dam were to fail, and is not based on the physical condition of the dam.

The potential downstream impact is figured by assessing the population concentration and economic activities located downstream from the dam. Dams assigned the low hazard potential rating are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property. Dams assigned the *significant* hazard potential rating are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure. Dams assigned the *high* hazard potential classification are those where failure or misoperation will probably cause loss of human life.

Dam owners are required to maintain an emergency action plan (EAP) for *significant* and *high* hazard potential dams. Owners are also required to coordinate with local emergency management officials to assure consistency with local emergency operations plans.

## 1. Historically Significant Local Dam Failures

There are earthen dams that require maintenance or dams that have had water seepage in Kent County. However, one outright dam failure did occur in Plainfield Charter Township in the September 10, 1986 flood. Between 8 and 13 inches of rain occurred in the area, which likely exceeded a 100-year flood frequency. The Childsdale Dam on the Rogue River breached and has not been reconstructed.

## 2. Existing Programs for Dam Failures

Both the Federal Energy Regulatory Commission (FERC) and the Michigan Department of Environmental Quality (MDEQ) classify and regulate dams in Michigan.

The Dam Safety Act was passed following a September 1986 flood in central, Lower Michigan. During this event, 11 dams failed and 19 others were threatened with failure. Approximately 1,500 people were evacuated from areas downstream of the dams as a result. One of the dams that failed was the Childsdale Dam on the

Rogue River in Plainfield Charter Township. The intent of the Dam Safety Act is to ensure that dams are built and maintained with the proper engineering and inspection for the safety of the public and the environment.

The MDEQ Dam Safety Program administers the provisions of Part 307 and Part 315 of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Part 315, Dam Safety, provides for the inspection of dams. This statute requires the MDEQ to rate each dam as either low, significant, or high hazard potential, according to the potential downstream impact if the dam were to fail. Dams over 6 feet in height that create an impoundment with a surface area of more than 5 acres are regulated by this statute. The MDEQ identified and rated over 2,400 dams statewide, 56 in Kent County, but only one within Plainfield Charter Township (Secluded Lake Dam). Dam owners are required to maintain an Emergency Action Plans (EAP) for significant and high hazard potential dams. Owners of these dams are also required to coordinate with local emergency management officials to assure consistency with local emergency operations plans. Approximately 240 dams in Michigan come under state regulations requiring EAPs, but none in Plainfield Charter Township.

Part 307 of The Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, regulates the construction and maintenance of dams specifically as they relate to inland lakes.

The FERC licenses water power projects (including dams) that are developed by non-federal entities, including individuals, private firms, states and municipalities. Under provisions of the Federal Power Act and federal regulations, the licensee of the project must prepare an EAP. This plan must include a description of actions to be taken by the licensee in case of an emergency. Inundation maps showing approximate expected inundation areas must also be prepared. Licensees must conduct a functional exercise at certain projects, in cooperation with local emergency management officials. There are four dams regulated by FERC in Kent County; however, none of these are located in Plainfield Charter Township.

### 3. Potential Actions for Consideration

Several actions and strategies were considered by the Plainfield Charter Township Flood Mitigation Planning Team. Some of these actions, listed below, were selected for implementation as described in the Action Plan..

Each hazard has a list of associated mitigation strategies. In front of each strategy are boldface letters that represent specific groups or organizations that are pertinent to implementing the described mitigation-related activity. Up to three categories are listed for each mitigation strategy. Here is list of the code letters and what they refer to:

**B** Business owners & managers (including site developers and builders and government administrators whose activities are similarly associated with

the selection, design, and operation of specific sites performing economic or community functions)

- C Public Citizens and those who provide educational services or marketing campaigns to them
- E Emergency management coordinators and related persons (LEPCs, incident commanders, etc.)
- F First-responders (law enforcement, fire fighters, medical services, other response services at all levels)
- I Insurance agencies & industry, including the NFIP
- L Elected officials and Legislators
- N Non-profit organizations and government departments which support them or have similar concerns (welfare provision, environmental protection, etc.)
- O Building Officials and other inspection, regulation, and code enforcement Officials (health, fire, etc.)
- P Planning departments, consultants, officials, engineers, and others involved in similar activities guiding long-term development patterns and conditions in a community, a larger area, or at development sites
- R Researchers, engineers, architects, etc. involved in the study and design of human environments and support infrastructure: also includes public works, utility providers, and others dealing with infrastructure design, development and maintenance (Road Commissioners, Drain Commissioners, etc.)

Potential Actions:

- B,E,R Ensuring consistency of dam Emergency Action Plan (EAP) with the local Emergency Operations Plan (EOP).
- C,E,L Garnering community support for removal or repair of dams in disrepair.
- B,P,R Regulate development in the dam's hydraulic shadow (where flooding would occur if there was a severe dam failure).
- B,E,N Public awareness and warning systems.
- B,C,I Obtaining insurance.
- E,N,O Greater local support for/assistance with dam inspections and enforcement of the Dam Safety Program (Part 315 of the Natural Resources and Environmental Protection Act) requirements and goals.

- B,C,E Increased coverage and use of NOAA Weather Radio
- B,E,N Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.
- B,P,R Constructing emergency access roads to dams.
- B,N,R Pump and flood gate installation/automation.
- B,I,L Real estate disclosure laws that identify a home's location within a dam's hydraulic shadow.
- E,F Trained, equipped, and prepared search and rescue teams.
- C Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.

Some of these alternatives have been addressed by the township, the county, or other agencies, and were therefore not included in the Action Plan.

## **IX. Flood Hazard Mitigation Goals**

Based upon an analysis of flood hazards affecting, or possibly affecting the township, broad goals for hazard mitigation were developed. These should be achieved through the implementation of specific actions by Township staff and/or its flood hazard mitigation partners.

The following broad goals for flood hazard mitigation have received agreement as being worthy of support:

1. **SAFETY:** Provide for the safety of community residents and visitors from the effects of flood hazards that pose a risk to residents. In particular, efforts will focus on providing improved warning, response and recovery time.
2. **MITIGATION:** Enhance the resident's quality of life through mitigation activities designed to minimize damage to public and private property, or to public services.
3. **PREVENTION/REGULATION:** Maintain and enhance township resident's quality of life by managing potential impacts of flood hazards through the Master Plan, planning, zoning, permitting, and other regulatory measures related to land use, development, ecology, and infrastructure.
4. **EDUCATION:** Maintain a positive community image / enhance community confidence through educational activities.

In order to help achieve these broad goals for hazard mitigation, the following specific actions and efforts are described to address specific areas of vulnerability and concern in the township. Some of these actions cannot be achieved by one agency acting alone, but will require the cooperation and funding from other agencies and sources. Each action is described in terms of the problem it addresses, the benefits and costs of its implementation, the lead person or agency who will oversee its implementation, potential sources of funding and/or other resources needed to achieve its implementation, and any available details about the projects nature and location.

## X. Identification of Alternatives for Solving Problems

The project team provided an initial prioritization of alternatives to determine an initial group of alternatives for consideration. Each team member provide a score for each potential action from 1 to 5 with 1 being the most important and 5 being the least important. The results were compiled and those with larger numerical scores were not considered.

- Accurate identification and mapping of flood-prone areas.
- Improved/updated floodplain mapping.
- Trained, equipped, and prepared search and rescue teams.
- Public awareness and warning systems.
- Elevating mechanical and utility devices above expected flood levels.
- Monitoring of water levels with stream gauges and trained monitors.
- Flood plain management - planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use and capital improvements planning) and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
- Install a water level sensor in the Township to provide early warning for floods via forecast.
- Back-up generators for pumping and lift stations in sanitary sewer systems, and other measures (alarms, meters, remote controls, switchgear upgrades) to ensure that drainage infrastructure is not impeded.
- Road closures and traffic control in flooded areas.
- Elevation of flood-prone structures above the 100-year flood level.
- Encourage residents to develop a Family Disaster Plan which includes the preparation of a Disaster Supplies Kit.
- Greater local support for/assistance with dam inspections and enforcement of the Dam Safety Program (Part 315 of the Natural Resources and Environmental Protection Act) requirements and goals.
- Public education and flood warning systems.
- Higher engineering standards for drain and sewer capacity.
- Increased coverage and use of NOAA Weather Radio
- Regulate development in the dam's hydraulic shadow (where flooding would occur if there was a severe dam failure).
- Construction of elevated or alternative roads that are unaffected by flooding, or making roads more flood-resistant through better drainage and/or stabilization/armoring of vulnerable shoulders and embankments.
- Acceptable land use densities, coverage and planning for particular soil types and topography and involving drain commissioners, hydrologic studies, etc. in these analyses and decisions.
- Use of check valves, sump pumps and backflow preventers in homes and buildings.
- Control of securing of debris, yard items, or stored objects (including oil, gasoline, and propane tanks, and paint and chemical barrels) in floodplains that may be swept away, damaged, or pose a hazard when flooding occurs.
- Wetlands protection regulations and policies.
- Real estate disclosure laws.
- Developing site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other appropriate sites.

- Government acquisition or relocation of structures within floodplain or floodway areas.
- Public awareness of the need for permits (MDEQ Part 31) for building in floodplain areas. Inclusion of safety strategies for flooded areas in driver education classes and materials. Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.)
- Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, wetlands protection and restoration).
- Training for local officials on flood fighting, floodplain management, floodproofing, etc.
- Farmland and open space preservation.
- Construct Grand River spillway diversion with storage.
- Employing techniques of erosion control in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
- Provide Flood Warning Signage for frequently flooded streets.

Some of the action items were combined (such as those included in Education Program development). The Actions were then compared using the evaluation criteria developed by the team and described in the next section. Some additional ideas for actions were suggested and were included in the evaluation. Evaluation criteria and prioritization are discussed in the next section.

## XI. Evaluation Criteria Used to Select and Prioritize Alternatives

A broad range of alternative mitigation strategies were considered for each hazard (as described in the previous hazard analysis section of this document). A list of possible criteria for selection and prioritization of actions was prepared as follows:

- Is the project technically feasible?
- Is the project environmentally sound and does it cause no permanent, significant environmental concerns?
- What is the administrative capacity to implement and maintain the project?
- Does the project provide the greatest protection to public facilities?
- Is the project acceptable to those participating or primarily impacted?
- Does the project provide benefit to the greatest number of residents and structures?
- Is the project Non-discriminatory (EO 12898-Compliant)?
- Are the costs for implementation less than the cost of repetitive repairs?
- Does the project result in an equitable distribution of essential public services?
- Is the project politically feasible?
- Does the project support one or more elements of the community's Comprehensive Plan?
- Is the project beneficial to the community's economy?
- Can the project be implemented using local resources only?

Team members provided a score from 1 to 5 for each possible criteria, with 1 the highest priority and 5 the lowest. Results were as follows:

Rank	Goals	Average
1	Is the project technically feasible?	1.13
2	Is the project environmentally sound and cause no permanent, significant environmental concerns?	1.25
3	Does the project provide the greatest protection to public facilities?	2.00
4	Are the costs for implementation less than the cost of repetitive repairs?	2.00
5	Is the project acceptable to those participating or primarily impacted?	2.10
6	What is the administrative capacity to implement and maintain the project?	2.25
7	Does the project provide benefit to the greatest number of residents and structures?	2.38
8	Is the project Non-discriminatory (EO 12898-Compliant)?	2.63
9	Does the project result in an equitable distribution of essential public services?	2.63
10	Is the project politically feasible?	2.75
11	Does the project support one or more elements of the community's Comprehensive Plan?	3.25
12	Is the project beneficial to the community's economy?	3.38
13	Can the project be implemented using local resources only?	4.88

The top 5 evaluation criteria were chosen for evaluation. The mitigation alternatives would ultimately be evaluated for selection and prioritization based on the following criteria:

- Is the project technically feasible?
- Is the project environmentally sound and cause no permanent, significant environmental concerns?
- Does the project provide the greatest protection to public facilities?
- Is the project acceptable to those participating or primarily impacted?
- Are the costs for implementation less than the cost of repetitive repairs?

It should be noted that while the costs for implementation and for repetitive repairs was not given the highest ranking, it is a critical item in the determination by FEMA for need when funds are to be distributed. The Planning Team understands the critical need for funding to meet goals and objectives, and the need to specifically identify why the project is beneficial and necessary.

## **XII. Selection of Alternatives (Feasible Mitigation Strategies)**

Township representatives then reviewed the list of alternatives and compared them against the established evaluation criteria to come up with the list of the most desired alternatives for each community goal. Appendix D provides the comparison for each alternative. The selected alternatives are presented in the following section.

### XIII. Recommended Mitigation Actions

The following recommended actions are selected for the goals and objectives that were presented earlier. Each recommended action is addressed similarly and includes the following analysis components:

- Description of the problem
- Description of the action
- Lead manager assigned
- Schedule to initiate action
- Potential sources of technical assistance
- Potential sources of financial assistance
- Priority of mitigation actions

The mitigation strategies that were selected using these criteria are presented in this action plan section of the document. This action plan section takes selected actions, lists them in priority order, and describes their specific applications to the township, including information on which lead agency (or agencies) will be involved in implementing or monitoring implementation of each task, a suggested time schedule for implementation, likely implementation partners and potential sources of funding. Selected mitigation actions are prioritized according to the degree of need for the specific mitigation action, the amount of political support for implementing it, and the degree of coordination/overlap it involves with existing programs, efforts, community goals, and the activities of community departments and partnering agencies.

Numbers refer to township priorities, from most important (1) to least important (5). Items rated with a 1 are intended for action as soon as resources permit, while actions with lower numbers typically refer to longer term projects of lower priority. All those items listed here are considered important, with the numbers allowing finer distinctions between these general assessments of priority.

**Priority 1:** Develop written flood response and recovery plan

**Project location and detail:** Currently there is no written flood response plan locally, county-wide or region-wide. The development of such a plan will better prepare officials for response and recovery and will provide improved response time. This plan shall be reviewed and integrated into the Township Master Plan.

**Lead agency or agencies to implement and/or monitor project:** Kent County Sheriff's Department

**Suggested time schedule for implementation:** Year 2008

**Likely implementation partners:** Plainfield Charter Township Fire Department

**Potential sources of funding/assistance:** FEMA's Pre-Disaster Mitigation Program and Flood Mitigation Assistance Program will likely provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources

(funding through donation such as non-profits group, homeowners, charities, etc).

**Priority 1:** Purchase and install a river level gauge for the Jupiter Bridge

**Project location and detail:** NOAA has an internet web site which keeps real time water elevations at gauge sites along the Grand River. A gauge will be purchased and located at the Jupiter Bridge which would be used to obtain more accurate flood levels for residents nearby. Information from this gauge and gauges upstream and downstream will be used to predict peak water levels in advance, providing additional evacuation time. A second gauge may also be installed if feasible.

**Lead agency or agencies to implement and/or monitor project:** Plainfield Charter Township.

**Suggested time schedule for implementation:** Year 2007

**Likely implementation partners:** The National Weather Service / NOAA

**Potential sources of funding/assistance:** NA

**Priority 1:** Purchase generator for Water Treatment Plant

**Project location and detail:** While the Plainfield Charter Township Water Treatment Plant has dual power sources, they do not have a permanent generator. Response time during a power failure could be significant due to the potentially limited (non-flooded) roadways. For improved reliability of water supply during a flood or other emergency, a permanent generator will be purchased.

**Lead agency or agencies to implement and/or monitor project:** Plainfield Charter Township Water Department

**Suggested time schedule for implementation:** Year 2008

**Likely implementation partners:** NA

**Potential sources of funding/assistance:** FEMA's Hazard Mitigation Grant Program could provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources (funding through donation such as non-profits group, homeowners, charities, etc). Some County Local Emergency Planning Committee (LEPC) also offer grants which can be used to purchase a generator.

**Priority 2:** Raise Roads that are currently in the Grand River floodplain.

**Project location and detail:** This project includes raising the south approach to the Northland Drive Bridge and raising West River Drive where these roads are flooded during a 1% flood frequency event.

**Lead agency or agencies to implement and/or monitor project:** Kent County Road Commission/MDOT

**Suggested time schedule for implementation:** This is a medium to long term initiative given the requirements for a feasibility study, potentially significant costs, and requirements for floodplain permit including compensating cut. These projects should be considered over the next 10 to 20 years.

**Likely implementation partners:** Township staff

**Potential sources of funding/assistance:** FEMA's Pre-Disaster Mitigation Program, Hazard Mitigation Grant Program and Flood Mitigation Assistance Program will likely provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources (funding through donation such as non-profits group,

homeowners, charities, etc).

**Priority 2:** Develop a voluntary acquisition program.

**Project location and detail:** This project includes development of a program to acquire homes and remove structures. Streets considered for this program include Abrigador Trail, Bailey Park, Canright Street, Coit Avenue, Filkins Drive, Forest Ridge Avenue, Grand River Drive, Grand River Court, Konkle Drive, Indian Drive, Lovers Lane, Mall Avenue, Packer Drive, Plainfield Avenue, Purchase Street, Ripley Street, River Point Drive, Riverbank Drive, Rogue Lane, Rogue River Road, Rudy Street, Walnut Park Drive, West River Drive, and Willow Drive. Each structure which is volunteered for acquisition will be evaluated based on Housing Conditions, the existence of Public Utilities, the Frequency of Flooding, Access to the Property, and Vulnerability to other utilities and to Natural Disasters. This project aims to protect lives and avoid repetitive property damages and other costs.

Approximately 210 residential structures on 21 streets could be considered for the acquisition program due to their location in the floodplain. This includes 49 Abrigador Trail, 21 structures on Riverbank and 59 structures on Willow Drive, many of which suffer repeated flood damages, isolation and inaccessibility due to road flooding and closure, lost utility services, and/or well and septic contamination (due to repeated flooding events in the area).

The program includes evaluation of homes that have been volunteered for acquisition. The evaluation will consider several criteria (as described on page 45) including: housing condition, availability public utilities, frequency of flooding, access to the property, vulnerability of other utilities, and vulnerability to other natural disasters. In the near future, the Township anticipates acquiring 1 to 2 homes per year. However, this could increase or decrease in the future based on the number of volunteers, available funding and other factors.

**Lead agency or agencies to implement and/or monitor project:** Plainfield Charter Township will identify which residents will volunteer for an acquisition. With that information, a designated authority representing Plainfield Charter Township will begin the application process for federal hazard mitigation funds to acquire and remove structures. This authority will continue to implement and monitor progress in this initiative.

**Suggested time schedule for implementation:** This is a long-term initiative with an immediate start date, beginning with the submission of application with appropriate resolutions as required, during early 2008, in time for PDMP deadlines.

**Likely implementation partners:** Kent County Emergency Management Coordinator, Kent County Planning Department, Michigan State Police Emergency Management and Homeland Security Division, Township staff from departments, boards, and commissions

**Potential sources of funding/assistance:** FEMA's Pre-Disaster Mitigation Program and Hazard Mitigation Grant Program will likely provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources (funding through donation such as non-profits group, homeowners, charities, etc.).

**Priority 2:** Develop a Floodplain Public Education Program

**Project location and detail:** Project includes providing educational opportunities for Township residents and businesses through various media. Brochures will be prepared periodically for distribution. A section in the Township newsletter will provide information, as well as a link on the Township website. In addition, periodic meetings may

be held with residents to discuss a topic. Topics may cover a broad range of floodplain issues (erosion control), watershed issues (understanding frequency of flooding), safety issue (anchoring propane tanks), repairing of damaged property, or Family Disaster Planning.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor, or other designated township representative.

**Suggested time schedule for implementation:** This is a long-term project that will be initiated in 2008.

**Likely implementation partners:** Township Staff, County Health Department, FEMA, Michigan State Police Emergency Management and Homeland Security Division.

**Potential sources of funding/assistance:** Federal Pre-Disaster Mitigation Program, Hazard Mitigation Grant Program, or Flood Mitigation Assistance Program.

**Priority 2:** Use available mechanisms to elevate flood-prone houses to protect lives and avoid repetitive damages.

**Project location and detail:** Twenty-one streets within the floodplain have structures which could be elevated for residences have indicated they have a lesser desire to volunteer for the acquisition program. Though first floor elevations are not known at this time, it is believed that Willow Drive, Coit Avenue, and Riverbank, as well as some others, are at higher elevations than structures on Abriador, Konkle and others, and each has utilities. Township residents can volunteer for the elevation program and may be selected if financial assistance is provided by FEMA. Once these residents have been identified, the Township will apply for grant funding. Additional details are described on page 49.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor or other designated township representative

**Suggested time schedule for implementation:** This is a long-term project that will be initiated in 2008 or as funding becomes available.

**Likely implementation partners:** Township and County Departments, Michigan State Police Emergency Management and Homeland Security Division, Kent County Emergency Management Coordinator, Kent County Planning Department, Township staff from departments, boards, and commissions

**Potential sources of funding/assistance:** FEMA's Pre-Disaster Mitigation Program and Hazard Mitigation Grant Program will likely provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources (funding through donation such as non-profits group, homeowners, charities, etc).

**Priority 2:** Purchase Flood Warning Signage for Frequently Flooded Streets.

**Project location and detail:** Due to the size of the Grand River watershed and relatively slow water surface level changes over time, for most flood event, there is time to warn residents. Information from river gauges upstream and downstream predict peak water levels in advance, and signs could be placed on streets that are likely to be flooded. Thus, this project includes the purchase of portable signs for use during floods.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor or other designated township representative

**Suggested time schedule for implementation:** This project will be initiated in 2008 or as funding becomes available.

**Likely implementation partners:** Township and County Departments, Michigan State Police

Emergency Management and Homeland Security Division, Kent County Emergency Management Coordinator.

**Potential sources of funding/assistance:** FEMA's Pre-Disaster Mitigation Program and Hazard Mitigation Grant Program will likely provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources (funding through donation such as non-profits group, homeowners, charities, etc.). This would likely be completed in conjunction with other projects.

**Priority 3:** Obtain an emergency watercraft for the Township for search and recovery operations.

**Project location and detail:** The County Sheriff has the only watercraft available during floods for search and recovery. In order to dramatically improve response time, the Township Fire Department will obtain their own watercraft.

**Lead agency or agencies to implement and/or monitor project:** Plainfield Charter Township Fire Department.

**Suggested time schedule for implementation:** Year 2008

**Likely implementation partners:** Kent County Sheriff's Department

**Potential sources of funding/assistance:** Assistance to Fire Fighter Grant –Vehicle Acquisition Program

**Priority 3:** Development of a Rescue and Recovery Training Program

**Project location and detail:** The Township Fire Department Staff and County Sheriffs office will provide a detailed training program for staff regarding rescue and recovery. This will include both presentations and field training which corresponds to the information prepared in the "Written Flood Response and Recovery Plan."

**Lead agency or agencies to implement and/or monitor project:** Township Fire Department and County Sheriff's Office

**Suggested time schedule for implementation:** Project will be initiated in 2009 or as funding becomes available.

**Likely implementation partners:** Township officials

**Potential sources of funding/assistance:** FEMA's Pre-Disaster Mitigation Program and Hazard Mitigation Grant Program will likely provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources (funding through donation such as non-profits group, homeowners, charities, etc.).

**Priority 3:** Provide backup power at all public water pumping stations and sewer lift stations.

**Project location and detail:** While these facilities not located in the floodplain are not subject to flood damage, response times for a power failure can be significant due to roadway flooding. There are also a limited number of Grand River crossings which can impede traffic during periods of flooding. This project calls for adding backup power provisions at all Booster Stations and Lift Stations.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor and representatives.

**Suggested time schedule for implementation:** Project will be initiated in 2008 or as funding becomes available.

**Likely implementation partners:** NA

**Potential sources of funding/assistance:**

**Priority 3:** Convert cleared spaces along Abridador Trail, Konkle Drive, Riverbank Drive and Willow Drive into parkland, open space, and water retention areas (including the removal of existing roadways) to enhance the conveyance and storage capacity of the Grand River area and thus mitigate flooding potential and severity elsewhere along the river.

**Project location and detail:** Vacant land and land in the same vicinity as project to acquire and remove residential structures.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor or other designated township representative.

**Suggested time schedule for implementation:** Following implementation of acquisition/removal projects.

**Likely implementation partners:** Township and County Departments, Michigan State Police Emergency Management Division, Grand Valley State University (Water research and environmental restoration groups) Kent County Emergency Management Coordinator, Kent County Planning Department, Township staff from departments, boards, and commissions.

**Potential sources of funding/assistance:** FEMA's Pre-Disaster Mitigation Program and Hazard Mitigation Grant Program will likely provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources (funding through donation such as non-profits group, homeowners, charities, etc.).

**Priority 3:** Coordinate with Red Cross to ensure adequate shelters are available following a major flood.

**Project location and detail:** While Plainfield Township does not have a Red Cross shelter, there is a shelter at the offices of the Greater Grand Rapids Red Cross at 1050 Fuller Avenue, Grand Rapids. Other shelters exist in Holland, Kalamazoo, Muskegon, and Big Rapids. The Township will coordinate with each of the Grand Rapids Area shelters to be sure adequate facilities are available for Township residents following a flood.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor and representatives.

**Suggested time schedule for implementation:** Project will be initiated in 2007

**Likely implementation partners:** Red Cross

**Potential sources of funding/assistance:** NA

**Priority 4:** Determine and provide physical identification of flood level on structures in the floodplain

**Project location and detail:** The Township would establish a Flood Level Identification Program to determine flood elevations at each structure in the flood hazard area. This program would consist of locating and identifying the floodplain elevation at each structure in the floodplain. This information will encourage residents to elevate their structures and will provide information for prioritizing structures for the voluntary acquisition and elevation programs.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor and representatives.

**Suggested time schedule for implementation:** Project will be initiated in 2008

**Likely implementation partners:** NA

**Potential sources of funding/assistance:** NA

**Priority 4:** Pursue the possibility of adding a gate at the 6<sup>th</sup> Street Dam to lower flood hazard levels.

**Project location and detail:** The 6th Street dam holds back the Grand River in downtown Grand Rapids. The dam ensures a minimum water depth and may be considered critical to local businesses and fisherman. There are advantages to lowering water levels behind the dam. One of the specific benefits is the reduction of flood levels in Plainfield Charter Township. Plainfield Charter Township will pursue the possibility of modifying the dam with the owner (City of Grand Rapids) as well as the MDEQ.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor and representatives.

**Suggested time schedule for implementation:** Project will be initiated in 2008

**Likely implementation partners:** NA

**Potential sources of funding/assistance:** NA

**Priority 4:** Study structural improvements options to channel water into storage areas and relief drains. Study various locations and alternatives.

**Project location and detail:** This project entails studying structural improvements that would allow relief for waterways during flood events in Plainfield Charter Township.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor and representatives.

**Suggested time schedule for implementation:** Project will be initiated within the next 5 years.

**Likely implementation partners:** Drain Commissioner, MDEQ, FEMA.

**Potential sources of funding/assistance:** FEMA's Pre-Disaster Mitigation Program and Hazard Mitigation Grant Program will likely provide 75% of total project funds, with the remaining 25% match to be provided from local departments and/or private sources (funding through donation such as non-profits group, homeowners, charities, etc.).

**Priority 4:** Approve new real estate disclosure laws for floodplain areas.

**Project location and detail:** Currently there are no requirements for home owners to disclose information regarding the location of a home within a floodplain. The intent is to require disclosure along with educational information to a buyer prior to their purchase. The Township will look into the legalities of disclosure laws and promote the creation of a law with local representatives.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor and representatives.

**Suggested time schedule for implementation:** Project will be initiated in 2007

**Likely implementation partners:** NA

**Potential sources of funding/assistance:**

**Priority 4:** Update stormwater ordinance regarding issues such as detention, retention & wetlands preservation.

**Project location and detail:** The stormwater ordinance is lacking some information regarding floodplains and stormwater systems. The Township should update the ordinance to include

updated information on detention and retention basins and wetlands preservation among other items.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor and representatives.

**Suggested time schedule for implementation:** Project will be initiated in 2008

**Likely implementation partners:** Kent County Drain Commissioner, MDEQ

**Priority 5:** Develop erosion control program for homes in the Grand River and Rogue River floodplain and floodway.

**Project location and detail:** Erosion can be a problem for property owners in the floodplain and especially the floodway. This project attempts to reduce the frequency and magnitude of erosion and sedimentation for property owners. A program should be developed which includes evaluation of the Township's erosion control and stormwater management policies, and assistance for home owners on how to employ techniques of erosion control (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).

**Lead agency or agencies to implement and/or monitor project:** Kent County Road Commission

**Suggested time schedule for implementation:** Project will be initiated in 2007

**Likely implementation partners:** Plainfield Charter Township, Kent County Drain Commissioner, MDEQ

**Potential sources of funding/assistance:**

**Priority 5:** Promote the formation of a Township Floodplain Management Council

**Project location and detail:** This project was intended to benefit Plainfield Charter Township residents who are affected by flood hazard in Plainfield Charter Township. A floodplain management council can be formed with the intent of providing a forum from which residents can protect their own interests. This council might provide an opportunity to educate other residents and an opportunity to work toward completion of mitigation projects. The Township would promote the development of a group that should be made up of Township residents, interested parties and staff.

**Lead agency or agencies to implement and/or monitor project:** Township supervisor and representatives.

**Suggested time schedule for implementation:** Project will be initiated in 2007

**Likely implementation partners:** none

**Potential sources of funding/assistance:**

**Priority 5:** Continue DPW maintenance program on manholes including providing gaskets and bolts on manholes in the floodplain to reduce inflow.

**Project location and detail:** The DPW has been working to reduce potential sources of inflow to the wastewater collection system. During floods, water can enter the collection system through leaky manholes. The DPW has been adding gaskets when they do not exist and bolts when missing.

**Lead agency or agencies to implement and/or monitor project:** Kent County Department of Public Works

**Suggested time schedule for implementation:** Project will be initiated in 2007

**Likely implementation partners:** Plainfield Charter Township

**Potential sources of funding/assistance:** Plainfield Charter Township

**APPENDIX A. SUMMARY GOALS AND OBJECTIVES**

# Plainfield Charter Township Flood Mitigation Plan

## Goals

1. SAFETY : Provide for the safety of community residents and visitors from the effects of flood hazards that pose a risk to residents. In particular, efforts will focus on providing improved warning, response and recovery time.
  - *Provide adequate rescue and recovery equipment, including monitoring of nearby flood levels and accessing flood level forecasts*
  - *Provide adequate warning time to residents in affected areas*
  - *Provide improved and maintained access for emergency vehicles*
  - *Provide and maintain a written flood response and recovery plan.*
  - *Provide improved access/escape routes for residents during flooding*
  
2. MITIGATION: Enhance the resident's quality of life through mitigation activities designed to minimize damage to public and private property, or to public services.
  - *Adopt a program that encourages public and private structural improvements and provides funding assistance so that structures meet NFIP regulation.*
  - *Establish on-going, voluntary acquisition, elevation & land-use programs*
  - *Provide a reliable backup power source at all critical facilities*
  
3. PREVENTION/REGULATION: Maintain and enhance township resident's quality of life by managing potential impacts of flood hazards through the Master Plan, planning, zoning, permitting, and other regulatory measures related to land use, development, ecology, and infrastructure.
  - *Continue working with Local, State and Federal government programs to protect the environment including, but not limited to, soil erosion, stormwater runoff, buildings, and natural river preservation.*
  - *Update and/or adopt zoning policies and regulatory ordinances to encourage structural improvements in the flood hazard zone. In addition, update Master Plan and all other amenity or infrastructure plans or policies.*
  - *Adopt housing and property maintenance and unsafe structure ordinances that encourage the elevation of existing "healthy" structures and removal of dilapidated and/or unsafe structures.*
  
4. EDUCATION: Maintain a positive community image / enhance community confidence through educational activities.
  - *Communicate with residents via various media (web, brochures, etc.) regarding issues related to flooding.*
  - *Provide public education opportunities regarding flood hazards and related issues.*
  - *Organize a Township Floodplain Group or Council.*

## APPENDIX B. SUMMARY ACTION PLAN

## Plainfield Charter Township Flood Mitigation Plan

### **Flood Mitigation Action Plan**

The following action plan is recommended to meet the goals and objectives developed by the FMP Team and community. Each recommended action is detailed in the FMP report, including a description of the problem and action, lead manager assigned, schedule for action, potential sources for technical and financial assistance, and priority of the action.

#### Priority 1:

- Develop written flood response and recovery plan
- Add a flood gage at the Jupiter Bridge for early warning (using predictive capabilities), evacuation, and protection of personal property.
- Purchase Generator for WTP to ensure continued supply of water during a flood

#### Priority 2

- Raise Roads that are within the floodplain to improve emergency traffic flow during flood events. Traffic issues are a very high priority due to the limited number of river crossings available during a flood.
- Develop and implement a voluntary acquisition program. On a voluntary basis, streets will be prioritized for eventual house acquisition based on non-availability of utilities, frequency of flooding of the first floor, health hazard/quality of construction, and whether in floodway.
- Develop a Public Education Program. This program would provide information to residents located near the floodplain on watershed issues (understanding frequency of flooding), safety issue (anchoring propane tanks), repairing of damaged property, and Family Disaster Planning.
- Develop an elevation program. Homes will be prioritized for eventual elevation if they have available utilities, and are not a health hazard.
- Purchase Flood Warning Signs for Frequently Flooded Streets

#### Priority 3

- Purchase watercraft for rescue and recovery and to assess and verify damage.
- Rescue and Recovery Training Program for Township Fire Department Staff and County Sheriffs office.
- Provide backup power at all public water pumping stations and sewer lift stations. While these facilities not located in the floodplain are not subject to flood damage, response times for a power failure can be significant due to roadway flooding.
- Convert cleared spaces along Abrigador Trail, Konkle Drive, Riverbank Drive and Willow Drive into parks, open space and water retention areas to enhance the conveyance and storage capacity of the Grand River area and thus mitigate flooding potential and severity elsewhere along the river.
- Coordinate with Red Cross to ensure adequate shelters are available following a major flood.
- Identify and enforce existing building and zoning regulations to limit and manage new construction and alterations in floodplains

#### Priority 4

- Determine and provide physical identification of flood level on structures in the floodplain.
- Pursue the possibility of adding a flood gate at the 6<sup>th</sup> Street Dam to lower flood hazard levels.
- Study structural improvements options to channel water into storage areas and relief drains. Study various locations and alternatives.
- Approve new real estate disclosure laws for floodplain areas.
- Update stormwater ordinance regarding issues such as detention, retention & wetlands preservation.
- Determine and provide physical identification of flood level on structures

#### Priority 5

- Develop erosion control program for homes in the Grand River floodplain and floodway
- Form a Township Floodplain Management Council
- Continue DPW maintenance program on manholes including providing gaskets and bolts on manholes in the floodplain to reduce inflow.

**APPENDIX C. PHOTOGRAPHS**

May 27, 2004 Flooding



Soccer Fields in Park off of West River Drive



Park off of West River Drive looking west

May 27, 2004 Flooding



Looking east down road off of Konkle



Karcher looking towards Grand River

May 27, 2004 Flooding



Jupiter Boathouse looking southwest



I96 bridge taken from Riverside Park looking north

May 27, 2004 Flooding



Houses on west end of park looking west



Grand Isle Driving Range

May 27, 2004 Flooding



Grand Isle Golf Course



Forest Ridge Ave looking north

May 27, 2004 Flooding



Elmdale by the river looking west



Building on Northland looking south

May 27, 2004 Flooding



Jupiter Bridge



New sign for boat traffic near Jupiter Bridge

May 27, 2004 Flooding



Jupiter Bridge looking southwest



Jupiter Boathouse looking southwest

May 27, 2004 Flooding



North Park Street Bridge taken from Legion Hall parking lot



Northland Drive Bridge looking southwest

**APPENDIX D. EVALUATION TABLES FOR ALTERNATIVE MITIGATION STRATEGIES**

**Select Feasible Mitigation Strategies**  
**Evaluation Table for Alternative Mitigation Strategies**

GOAL:1. SAFETY : Provide for the safety of community residents and visitors from the effects of flood hazards that pose a risk to residents. In particular, efforts will focus on providing improved warning, response and recovery time.	EVALUATION CRITERIA					
OBJECTIVE(S): <ul style="list-style-type: none"> <li>• Provide adequate rescue and recovery equipment including monitoring of nearby flood levels and access to level forecasts</li> <li>• Provide adequate warning time to residents in affected areas</li> <li>• Provide improved and maintain access for emergency vehicles</li> <li>• Provide and maintain a written flood response and recovery plan.</li> <li>• Provide improved access/escape routes for residents during flooding</li> </ul>	Technically Feasible?	Is the project environmentally sound and cause no permanent, significant environmental concerns?	Does the project provide the greatest protection to public facilities?	Acceptable to Community/ Potential Participants?	Cost-Benefit	Sum
RANGE OF ALTERNATIVE SOLUTIONS:						
ALTERNATIVE 1 - Add a flood gage at the Jupiter Bridge for early warning (using predictive capabilities), evacuation, and protection of personal property.	5	5	3	5	5	23
ALTERNATIVE 2 - Purchase watercraft for rescue and recovery and to assess and verify damage.	5	5	2	4	3	19
ALTERNATIVE 3 - Develop written flood response and recovery plan	5	5	2	5	5	22
ALTERNATIVE 4 - Raise Roads that are within the floodplain to improve emergency traffic flow during flood events. Traffic issues are a very high priority due to the limited number of river crossings available during a flood.	3	4	5	5	3	20
ALTERNATIVE 5 - Rescue and Recovery Training Program for Township Fire Department Staff and County Sheriffs office.	4	5	2	5	3	19
ALTERNATIVE 6 - Coordinate with Red Cross to ensure adequate shelters are available following a major flood.	4	5	1	4	5	19
ALTERNATIVE 7 - Purchase Flood Warning Signage for Frequently Flooded Streets.	4	5	1	5	5	20

**Select Feasible Mitigation Strategies**  
**Evaluation Table for Alternative Mitigation Strategies**

GOAL:2. MITIGATION: Enhance the resident's quality of life through mitigation activities designed to minimize damage to public and private property, or to public services.	EVALUATION CRITERIA					
OBJECTIVE(S): <ul style="list-style-type: none"> <li>• Adopt a program that encourages structural improvements and provides funding assistance so that structures meet NFIP regulation.</li> <li>• Establish an on-going, voluntary acquisition, elevation &amp; land-use programs</li> <li>• Provide a reliable backup power source at all critical facilities</li> </ul>	Technically Feasible?	Is the project environmentally sound and cause no permanent, significant environmental concerns?	Does the project provide the greatest protection to public facilities?	Acceptable to Community/ Potential Participants?	Cost-Benefit	Sum
RANGE OF ALTERNATIVE SOLUTIONS:						
ALTERNATIVE 1 - Develop and implement acquisition program. On a voluntary basis, streets will be prioritized for eventual house acquisition based on availability of utilities, frequency of flooding of the first floor, health hazard/quality of construction, and whether in floodway.	5	5	5	2	3	20
ALTERNATIVE 2 - Purchase Generator for WTP to ensure continued supply of water during a flood	5	5	5	5	2	22
ALTERNATIVE 3 - Develop an elevation program. Homes will be prioritized for eventual elevation if they have available utilities, and are not a health hazard.	5	5	3	4	3	20
ALTERNATIVE 4 - Convert cleared spaces along Abridador Trail, Konkle Drive, Riverbank Drive and Willow Drive into parkland, open space and water retention areas to enhance the conveyance and storage capacity of the Grand River area and thus mitigate flooding potential and severity elsewhere along the river.	4	2	3	5	5	19
ALTERNATIVE 5 - Design structural improvements to channel water into storage areas and relief drains. Study alternative locations and alternatives.	4	4	3	5	2	18
ALTERNATIVE 6 - Develop erosion control program for homes in the Grand River floodplain and floodway	4	5	1	5	2	17
ALTERNATIVE 7 - Replace all manholes in the floodplain with gasketed bolt-down covers to reduce inflow.	3	4	5	3	2	17
ALTERNATIVE 8 - Provide backup power at all Booster Stations and Lift Stations. While facilities are not located in the floodplain are not subject to damage, response times for a power failure can be significant due to roadway flooding.	5	3	5	4	2	19
ALTERNATIVE 9 - Pursue the possibility of adding a flood gate at the 6 <sup>th</sup> Street Dam to lower flood hazard levels.	3	4	2	5	4	18

**Select Feasible Mitigation Strategies**  
**Evaluation Table for Alternative Mitigation Strategies**

GOAL:3. PREVENTION/REGULATION: Maintain and enhance township resident's quality of life by managing potential impacts of flood hazards through the Master Plan, planning, zoning, permitting, and other regulatory measures related to land use, development, ecology, and infrastructure.	EVALUATION CRITERIA					
OBJECTIVE(S): <ul style="list-style-type: none"> <li>• Continue working with Local, State and Federal government programs to protect the environment including but not limited too soil erosion, stormwater run-off, building, and Natural River.</li> <li>• Update and/or adopt zoning and regulatory ordinances to encourage structural improvements in the flood hazard zone. In addition, update Master Plan and all other amenity or infrastructure plans or policies.</li> <li>• Adopt housing and property maintenance and unsafe structure ordinances that encourage the repair or improvements of dilapidated structures.</li> </ul>	Technically Feasible?	Is the project environmentally sound and cause no permanent, significant environmental concerns?	Does the project provide the greatest protection to public facilities?	Acceptable to Community/ Potential Participants?	Cost-Benefit	Sum
RANGE OF ALTERNATIVE SOLUTIONS:						
ALTERNATIVE 1- Identify and enforce existing building and zoning regulations to limit and manage new construction and alterations in floodplains	5	5	3	1	5	19
ALTERNATIVE 2 - Update stormwater ordinance regarding issues such as detention, retention & wetlands preservation.	4	5	2	3	4	18
ALTERNATIVE 3 - Approve new real estate disclosure laws for floodplain areas.	3	5	2	4	4	18

**Select Feasible Mitigation Strategies**  
**Evaluation Table for Alternative Mitigation Strategies**

GOAL:4. EDUCATION: Maintain a positive community image / enhance community confidence through educational activities.	EVALUATION CRITERIA					
OBJECTIVE(S): <ul style="list-style-type: none"> <li>• Communicate with residents regarding issues related to flooding</li> <li>• Provide public education regarding flood hazards and related issues</li> <li>• Develop ordinances, programs and regulations with input from residents</li> </ul>	Technically Feasible?	Is the project environmentally sound and cause no permanent, significant environmental concerns?	Does the project provide the greatest protection to public facilities?	Acceptable to Community/ Potential Participants?	Cost-Benefit	Sum
RANGE OF ALTERNATIVE SOLUTIONS:						
ALTERNATIVE 1 - Develop Public Education Program. This program would provide information to residents located near the floodplain such as regarding watershed issues (understanding frequency of flooding), safety issue (anchoring propane tanks), repairing of damaged property, and Family Disaster Planning.	4	5	3	4	4	20
ALTERNATIVE 2 - Determine and provide physical identification of flood level on structures in the floodplain.	4	5	2	4	3	18
ALTERNATIVE 3 - Form a local watershed/floodplain council	4	4	1	5	3	17

## APPENDIX E. REFERENCES

1. “Pre-Hazard Mitigation Plan - Kent County, Ottawa County and the City of Grand Rapids”, rev. March 2006
2. “Plainfield Charter Township Community Profile Report”, September 2004.
3. “Local Hazard Mitigation Planning Workbook” (EMD-PUB 207), February 2003.
4. “U.S. Census of Population and Housing”, 2000)
5. “State and Local Mitigation Planning how-to-guide” (FEMA 386-1), September 2002.
6. “Michigan Hazard Analysis” (EMD-PUB 103),
7. “Plainfield Charter Township Draft Master Plan”, September 2006.

**APPENDIX F. NEWSPAPER ANNOUNCEMENT**



## PLAINFIELD CHARTER TOWNSHIP NOTICE OF PUBLIC HEARING

### **DATE OF HEARING:**

January 10, 2007. A public hearing of the Plainfield Charter Township Flood Hazard Mitigation Plan Draft will be held at the Township Offices, 6161 Belmont Avenue NE, Belmont, Michigan 49306, beginning at 7:00 pm.

### **PROJECT SUMMARY:**

Plainfield Charter Township is presenting the Flood Hazard Mitigation Plan draft for public information and comment.

The Plainfield Charter Township Flood Hazard Mitigation Plan has been developed with cooperation of County and Township officials, the State of Michigan, affected businesses, and interested members of the public. The plan provides the process for evaluation of land use and development along the Grand and Rogue Rivers in Plainfield Township from a hazard mitigation perspective, which will protect lives and property in the community. The intent of the flood hazard mitigation plan is not to limit development, but to ensure flood hazard vulnerability reduction is a standard business practice of the Township.

Any interested party may review or examine the document at the Township Offices, 6161 Belmont Avenue NE, Belmont, Michigan 49306, any weekday, Monday through Friday, from 8:30 am to 4:00 pm. The draft document may also be viewed at <http://www.plainfieldchartertp.org>. Also, any interested party may submit written comments concerning the Flood Mitigation Plan until the date and time of the public hearing. The Township will provide necessary and reasonable auxiliary aids and services at the meeting for individuals with disabilities upon adequate notice to Susan L. Morrow, Township Clerk, in writing or by calling (616) 364-8466.

Peter Elam, Staff Planner  
616-364-8466

**APPENDIX G. GENERAL MAPS**

**APPENDIX H. NEIGHBORHOOD LOCATION MAPS**