1.0 INTRODUCTION

1.1 Background

The *West Branch DuPage River Watershed Plan* (2006 Plan) was approved by the DuPage County Stormwater Management Planning Committee (Committee) and adopted by the DuPage County Board in February 2006. The 2006 Plan was prepared in accordance with the standards and criteria established by the Committee in the *DuPage County Stormwater Management Plan,* adopted September 1989 and the *DuPage County Countywide Stormwater and Flood Plain Ordinance* (DPCSFPO), adopted October 1991 (last revised March 2008). The stated goal of the adopted watershed plan is to integrate flood control programs with aquatic restoration to provide a comprehensive plan for the management and protection of the water resources in the West Branch DuPage River Watershed.

The focus of the 2006 Plan was to outline engineering/environmental projects that could be incorporated into the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup that allowed the County and its partner agencies to significantly improve the West Branch DuPage River Watershed through the implementation of specific restoration and enhancement projects. Some benefits of the 2006 Plan projects, constructed in conjunction with the CERCLA cleanup, include improved water quality, expanded natural areas, and introduction and restoration of wildlife habitat for a four-mile stretch of stream extending from the Garys Mill Road bridge crossing downstream to the Warrenville Road bridge crossing. The 2006 Plan was not intended to address any flooding issues along the main stem or any of the tributaries of the West Branch DuPage River. As such, flood control projects addressing flooding issues along the West Branch DuPage River and its tributaries have been included into separate watershed plans. This addendum represents an addition to the 2006 Plan with the purpose of incorporating flood control projects, with water quality enhancements extending an additional three miles from the 2006 Plan's scope along the West Branch DuPage River main stem.

1.2 Purpose and Objectives

Recent storm events, including the September 2008 event, caused widespread flooding in areas where County flood control facilities did not exist. These flood events resulted in damages to properties in several communities within the West Branch DuPage River Watershed, including the City of Warrenville, whose residents suffered extensive damages during the September 2008 storm. Overbank flooding along the West Branch DuPage River main stem damaged residential and commercial structures and resulted in a significant amount of structural and content damage. As a result of overbank flooding, roadways were directly impacted with major delays in emergency response time, travel time and damage to the roadway itself. Indirect damages such as public services (e.g. police, public works, and fire department) and public health (e.g. sanitary sewer backups, flooded septic fields, water quality degradation) were also incurred. The objective of this addendum is to identify proposed improvements along the West

Branch DuPage River between Roosevelt Road to just upstream of Fawell Dam that will reduce the impacts of future overbank flooding in a manner that is consistent with the adopted goal of the 2006 Plan.

1.3 Relationship to the Watershed Plan

This addendum is consistent with the goals of the 2006 Plan. This addendum follows the structure of the 2006 Plan and includes updates to the watershed characteristics (e.g. land use, hydrology and hydraulics), identification of flooding and drainage problems, and solutions to the identified problems within the study area identified above. Once approved and adopted by the Committee and the DuPage County Board, the addendum will be incorporated into the West Branch DuPage River Watershed Plan for future implementation of the recommended alternative.

2.0 WATERSHED CHARACTERISTICS

2.1 West Branch DuPage River

The West Branch DuPage River Watershed is located in approximately the western third of DuPage County and is part of the Des Plaines River Watershed (Figure ES-1). The headwaters originate in Cook County where the waterway flows generally north to south into and through DuPage County. Overall, the West Branch DuPage River Watershed encompasses approximately 128 square miles at the confluence with the East Branch DuPage River (confluence near Bolingbrook in Will County). The main channel of the West Branch DuPage River has a total length of 32 miles and an average slope of approximately 0.06%.

2.2 Study Limits

This addendum to the 2006 Plan focuses on a seven (7) mile reach from Roosevelt Road to just upstream of Fawell Dam (Figure ES-1). The primary municipal and governmental agency stakeholders within the study limits are unincorporated DuPage County, City of Warrenville, Forest Preserve District of DuPage County, City of Naperville and City of West Chicago. The total reach length for the study area is seven (7) miles with an average slope of approximately 0.075%. Approximately 100 square miles contribute runoff to the West Branch DuPage River at the downstream end of the study limits near Fawell Dam. There are eight (8) major bridge crossings within the study limits including: Garys Mill Road, Mack Road, Williams Road, Butterfield Road, Warrenville Road, Ferry Road, I-88 Tollway and Diehl Road. There are ten (10) tributaries contributing flow to the West Branch DuPage River main stem located upstream of Fawell Dam: Klein Creek, Winfield Creek, Kress Creek, Ferry Creek, Spring Brook #1 and Tributaries #1-5. The base flow within the study limits is approximately 75 cfs. The 100-year (1% annual chance) regulatory peak discharge taken from the current FEMA Flood Insurance Study varies from 2,700 cfs at Roosevelt Road (upstream limit of study) to 4,600 cfs immediately upstream of Fawell Dam (downstream limit of study).

Flow Rates at Roosevelt Road	
Storm Event	**Flow Rate**
10-Year	1,700 cfs
50-Year	2,400 cfs
100-Year	2,700 cfs
Flow Rates Upstream of Fawell Dam	
Storm Event	**Flow Rate**
10-Year	2,900 cfs
50-Year	4,100 cfs
100-Year	4,600 cfs

Table 2-1: Flow Rates

There are two in-stream dams within the study reach; Warrenville Grove Dam, located upstream of Warrenville Road, and McDowell Grove Dam, located within the McDowell Grove Forest Preserve. These two dams are low-head dams which are included in the hydraulic model and do not impact flood elevations. Currently, DuPage County Stormwater Management Division (SMD) is working with various partners to modify these in-stream dams to address specific water quality issues at these locations. Fawell Dam is also included in the hydraulic computer models. The models include the entire watershed, so that the improvements along the stretch of West Branch DuPage River through the City of Warrenville are also analyzed upstream and downstream to ensure no adverse impacts to adjacent reaches. Fawell Dam is an in-stream structure, and analysis shows that it is not the cause of flooding of structures in the City of Warrenville. Fawell Dam is just one of many structures and hydraulic components that contribute to the 100-year base flood profile. The flood pool from Fawell Dam is contained within the McDowell Grove Forest Preserve and extends to 2,000-ft downstream of Diehl Road Bridge as shown in the FEMA Flood Insurance Study (FIS) profiles for the 10-, 50-, 100- and 500-yr flood elevations included as Figure 2-1. This study showed that increasing flows out of Fawell Dam is not necessary for providing relief from flooding in the City of Warrenville; proposed improvements upstream of Fawell Dam will provide relief from flooding in the City of Warrenville.

In the hydrologic and hydraulic model used for this study, land use and land cover for the West Branch DuPage River Watershed have been updated from the 1990 land use conditions to the land use conditions that prevailed in 2003. The table below summarizes the change in the land cover characteristics that occurred over this 13-year period for the entire West Branch DuPage River Watershed.

	1990 LAND USE		**2003 LAND USE** (supplemented in 2006)	
LAND COVER CATEGORY	Square Miles	% Watershed	Square Miles	% Watershed
Impervious Cover	25.43	20.1%	28.14	22.0%
Grass, Flat Slope	28.53	22.5%	40.40	31.6%
Grass, Moderate Slope	26.71	21.1%	22.10	17.3%
Grass, Steep Slope	10.06	7.9%	13.77	10.8%
Forest	14.04	11.1%	13.51	10.6%
Agricultural	21.94	17.3%	9.87	7.7%
TOTAL	**126.71**		**127.79**	

Table 2-2: Land Use Comparison

Within the study limits, the majority of the watershed is comprised of residential development. In addition, there is a large concentration of commercial development along I-88 with smaller commercial land use areas along other major arterial roads. There is a significant area of open space owned by the Forest Preserve throughout the studied reach.

For further discussion regarding geology and soils, groundwater resources, existing wetlands, riparian zones, and existing evaluation of water quality please refer to the text from the 2006 Plan.

3.0 HYDROLOGIC AND HYDRAULIC ANALYSIS

3.1 Previous Studies

There have been numerous studies performed in support of the watershed planning effort related to the West Branch DuPage River Watershed. These studies were prepared following the guidelines established in Chapter 3 of the DuPage County Stormwater Management Plan (September 1989). Specifically, the hydrologic and hydraulic methods employed have met the minimum plan standards. The hydrology has been based upon the results of a continuous hydrologic modeling tool and the stream system hydraulics has been evaluated using a fully dynamic hydraulic modeling tool. The table below summarizes the reports and studies that have been completed or are under development.

Item	Waterway Name	Report Type	Year Prepared
1	West Branch Tributary #4	Watershed Plan	1993
2	Winfield Creek	Watershed Plan	1994
3	Klein Creek	Watershed Plan	1994
4	Steeple Run	Watershed Plan	1997
5	Ferry Creek	Watershed Plan	1999
6	West Branch Tributary #1	Watershed Plan	2002
7	Kress Creek	Watershed Plan	2005
8	West Branch DuPage River	Watershed Plan	2006
9	Klein Creek	Addendum to Watershed Plan	2010

Table 3-1: West Branch DuPage River Watershed Plans and Addendums

This watershed plan update is an addendum to the 2006 Plan (item 8 in the table above). This addendum is limited to describing the hydrologic and hydraulic tasks associated with this update to the watershed plan and therefore does not include a discussion of the hydrologic and hydraulic modeling tasks that supported the 2006 Plan. Copies of the studies listed above are available at the SMD.

3.2 Hydrologic and Hydraulic Methods

For watershed planning, it is necessary to analyze flooding not only as it has occurred in the past, but also as it will occur under alternative future conditions. Records of stream flow and flooding cover limited time periods and represent the watershed response under the development and waterway conditions that prevailed at that time. Computer simulation is used to calculate runoff hydrographs (input to the hydraulic model) and simulate the elevations, flows, and velocities associated with a flood wave as it travels through open channel waterways and storm sewer networks. The hydrologic and hydraulic models ultimately are combined to evaluate the frequency and depth of flows in the post-development watershed and to evaluate the effectiveness of various alternatives to limit flood damages.

3.2.1 Hydrologic Model

The Hydrologic Simulation Program, FORTRAN (HSPF) has been used to perform the continuous hydrologic simulation. HSPF uses available land characteristic data (e.g., land cover, soil) and time-variable meteorological data (e.g., precipitation, temperature, solar radiation) to perform a hydrologic budget calculation of runoff, by simulating the rainfall-runoff-evaporation process including snow accumulation and melt. The output generated for use by DuPage County from the HSPF simulation is time series files (TSFs). These time series files contain the land surface runoff associated with various land covers and precipitation gages for various discrete events. The table below summarizes the time series files used to perform the evaluation associated with this addendum.

Time Series File (TSF)	Description	Simulation Period	Number of Storm Events
TSFLNG08.MPN	Historical Series	3/3/49 – 9/22/08	157
LOCAL0908DR2WB.DTSF	Calibration Event	9/3/08 – 9/22/08	1

Table 3-2: Time Series Files

3.2.2 Hydraulic Model

The hydraulic analysis was performed using the Full EQuations (FEQ) model, which is a fully dynamic flood routing tool in the form of a computer program developed by Delbert Franz of Linsley, Kraeger Associates Ltd and supported by the United States Geological Survey (USGS). FEQ is capable of solving the full dynamic equations of motion for one-dimensional unsteady flow in open channels and through control structures. FEQ can analyze flood plain encroachment, on-line and off-line storage, diversions, bridges, culverts, dams, weirs, and other stream impediments. FEQ uses TSFs from the hydrologic model described above as input, coupled with measurements of the waterway cross sections, bridge characteristics, hydraulic controls, and characterization of the waterway roughness coefficients. The waterway characteristics input to the FEQ model were developed through extensive field surveys. These field surveys and their input to the FEQ model are thoroughly documented in unpublished

records available in DuPage County files. A companion program called Full Equations UTiLities (FEQUTL) was used to develop tabular input for use by FEQ related to the hydraulic characteristics of cross sections as well as the hydraulic rating information for hydraulic control structures. The following versions of FEQ and FEQUTL were used to perform the analyses related to this addendum:

- FEQ version 10.69
- FEQUTL version 5.96

3.3 Watershed Model Updates

The watershed planning model that was used as the basis for this study was provided by the SMD. The model is actually a collection of models comprised of the West Branch DuPage River main stem and associated tributaries. The main stem is described explicitly in the model input, while the tributaries have been modeled separately from the main stem model by DuPage County staff and various consultants. The inflows for the tributaries are included as direct input to the West Branch DuPage River main stem watershed planning model. This discussion is limited to describing modifications made to the West Branch DuPage River main stem model within the study limits.

The West Branch DuPage River main stem FEQ model provided by DuPage County included 21 reservoirs (level pool and linear reservoirs), 120 branches, 336 exterior nodes, and 72 significant hydraulic controls (e.g., bridges, culverts, weirs, expansions/contractions) including dynamic operations of Fawell Dam and eight (8) separately modeled tributary inflows. The tributaries include: West Branch Tributary #4; Kress Creek; Winfield Creek; Klein Creek; Spring Brook #1; Ferry Creek; Steeple Run; and West Branch Tributary #1.

3.3.1 Baseline Model

In order to have a solid basis for making planning decisions, a baseline model that reflects current watershed conditions was developed. The West Branch DuPage River main stem FEQ model was reviewed for inconsistencies with current watershed conditions. Additional survey data was obtained at selected locations in the summer of 2010 and updates were made to the FEQ input and associated reference tables. A summary of the modifications are provided in Table 3-3: Baseline Model Modifications below.

MODIFICATION LOCATION	DESCRIPTION OF MODIFICATION
Ferry Road Bridge	Added new bridge at this location. Developed bridge rating using WSPRO98 (version 251000) and FEQUTL: WSPROQZ & WSPROT14.
Warrenville Grove Dam	Dam representation was reviewed and modified to reflect current conditions (recently constructed notch in dam) using FEQUTL: EMBANKQ.
McDowell Grove Dam	Dam representation was reviewed and modified to reflect current conditions (recently constructed notch in dam) using FEQUTL: EMBANKQ.
Wetland Mitigation South of Army Trail Road	Added storage associated with a wetland mitigation area near Army Trail Road.
Channel Roughness Coefficients (Butterfield Road to McDowell Grove Dam Access Road)	Manning's channel roughness coefficients were reviewed in the field between Butterfield Road and the McDowell Grove Dam Access Road along the main stem of the West Branch DuPage River. Roughness values were updated where necessary and revised table input developed using FEQUTL: FEQX.
I-88 Near Winfield Road Subbasin Modifications	The subbasin delineation associated with I-88 near Winfield Road was reviewed and revised to reflect the diversion of flow from a small portion of the Cress Creek watershed to the West Branch DuPage River as a result of I-88 tollway's construction in 2005.
Williams Road Bridge	Revised bridge characteristics to reflect surveyed conditions. Updated bridge rating using WSPRO98 (version 21000) and FEQUTL: WSPROQZ & WSPROT14.
Warrenville Road Bridge	Revised bridge characteristics to reflect surveyed conditions. Updated bridge rating using WSPRO98 (version 21000) and FEQUTL: WSPROQZ & WSPROT14.
I-88 Tollway	Revised bridge characteristics to reflect surveyed conditions. Updated bridge rating using WSPRO98 (version 21000) and FEQUTL: WSPROQZ & WSPROT14.
Diehl Road Bridge	Revised bridge characteristics to reflect surveyed conditions. Updated bridge rating using WSPRO98 (version 21000) and FEQUTL: WSPROQZ & WSPROT14.
Cantera Ponds	Revised the cross-section geometry to eliminate the Cantera ponds from the conveyance calculations. Revised table input developed using FEQUTL: FEQX.

NOTE: The modifications to the West Branch DuPage River main stem associated with the CERCLA clean-up have not been incorporated into the FEQ model. These modifications will involve reshaping the cross section geometry and assessing the cross-section roughness coefficients, once the project is completed.

Table 3-3: Baseline Model Modifications

An updated FEQ schematic is included as Figure 3-1. The model was also updated to run using FEQ version 10.69 and the Tributary Area Block was updated to include 2003 land cover totals.

In summary, the baseline main stem model includes the 2003 land use conditions, stream system modifications that were permitted and constructed as of August 2010 (except for stream cross-section modifications associated with the CERCLA clean-up sites), and updates associated with stream system changes that have occurred since the original field survey

(vegetation changes and the addition of Ferry Road bridge). The inflows from the eight (8) tributaries have been updated to include the 2003 land use, as well as all approved watershed planning projects associated with adopted tributary watershed plans.

3.3.2 Model Verification

The West Branch DuPage River Watershed was originally calibrated by DuPage County and documented in the report entitled "Hydraulic Evaluation of the HSPF Model for the West Branch DuPage River Watershed", dated January 2003. To verify that the FEQ model is still providing simulation results that approximate reality, an evaluation was performed using precipitation, high water marks, and stream gage data associated with the event that occurred on September 12-14, 2008. This rainfall event was selected since it was an event of local interest and it produced high recorded stages at both the West Branch near West Chicago (North Ave) and the West Branch near Warrenville USGS streamflow recording gages.

To reflect stream system characteristics that prevailed in September 2008 the following modifications were made to the baseline model.

McDowell Grove Dam	Dam representation was modified. The recently constructed notch in the dam was removed for the 2008 event model.
Warrenville Grove Dam	Dam representation was modified. The recently constructed notch in the dam was removed for the 2008 event model.
Warrenville Road Bridge	Channel bottom elevations under Warrenville Road were modified to show siltation in the west cell.

Table 3-4: Verification Model Modifications

To accurately simulate runoff and peak elevations the DuPage County, 35 local precipitation rain gages were used to represent the spatial variation and distribution of the rainfall for the September 2008 event (Figure 3-2). Thiessen polygons (Figure 3-3) and precipitation data generated at the local gages are used to develop and assign factors (FAC values) to individual branches within the Tributary Area Block of the FEQ input. The TSF LOCAL0908DR2WB.DTSF containing land surface runoff information associated with the September 2008 event was created by Conservation Design Forum specifically for this evaluation.

High water mark data was collected by the City of Warrenville at 10 locations along the main stem (Figure 3-4). The FEQ simulated peak elevations were compared with the surveyed high water mark data. The results show that differences between the simulated and recorded values is less than or equal to 0.3 foot at 80% of the locations with high water marks. Table 3-5 below provides a summary of the results. Based upon the degree of accuracy when surveying high water marks after a storm, these results indicate that the West Branch DuPage River model bears close resemblance to reality and has the degree of calibration needed for a watershed plan study.

September 2008 High Water Mark Table[1]			
Location	**No.**	**Recorded**	**Simulated**
Fawell Dam	0	690.9[2]	690.7
D/S Diehl Rd	1	691.3	691.4
D/S I-88 Rd	2	691.3	691.6
Forest View Road & River Road	3	693.2	693.0
Rogers Road & River Road	4	693.5	693.2
U/S Warrenville Rd	5	694.4	694.3
2nd Street	6	695.7	695.5
Warrenville Gage (USGS 05540095)	7	696.6[3]	696.0
Iroquois Court	8	700.5	700.5
West Chicago Gage (USGS 05539900)	9	730.0[3]	729.3

Table 3-5: High Water Marks

[1]All High Water Marks are from the City of Warrenville except for those where otherwise noted.
[2]High Water Mark from DuPage County
[3]High Water Marks from USGS

In addition, the simulated hydrographs were compared to the recorded gage records at the West Chicago and Warrenville USGS gages (Figure 3-5). The comparison indicated that the shapes of the hydrographs and the timing of the peak stages correlate. The peak stage elevations at West Chicago and Warrenville gages are within 0.2% of the measured stage. The peak flows at West Chicago gage are within 12% and at Warrenville gage within 17% of the recorded flows. It is important to note that flow at the gages is not a direct measurement. Measured stages are converted to flow utilizing the gage rating curve. The comparison of simulate stages verses the measured stages recorded at the gages is a more reliable comparison. Overall the close correlation of the verification model with the recorded high water marks and USGS gage records reveal that the West Branch DuPage River main stem model is simulating hydrologic and hydraulic conditions of the reach in a manner that is useful for evaluating flood reduction measures within the study area.

3.3.3 Alternatives Analysis

The baseline model was used to identify homes that are eligible for floodproofing and buyout. In addition, the baseline model was used to evaluate various structural alternatives for reducing flood heights in the vicinity of identified flood-prone areas. The baseline model was modified to create the alternative models. Descriptions of each of the alternatives and the associated modifications to the FEQ model are included in the chapter titled, “Alternatives Development and Evaluation.”

4.0 ECONOMIC ANALYSIS

The DEC-2 computer program, developed by DuPage County, was used in this study to perform the economic analysis associated with the West Branch DuPage River Watershed Plan Addendum. DEC-2 has the ability to calculate the economic damages to residential and commercial structures as well as associated economic damages along a stream for all of the storm events in DuPage County's historical period of storm events (1949 - 2008).

The categories of damages considered in this study include: residential and commercial structural damages; content damages; associated damages; and emergency services. Associated damages are classified as damages to automobiles, landscaping, emergency living expenses, lost wages, and other miscellaneous costs associated with flooding of residential structures. Emergency services include the cost of public agencies such as police, fire protection, and public works to provide public safety during flood events and are assumed to be five percent (5%) of the residential damages. Traffic damages are not being quantified in terms of dollar damages in this study; however, the overtopping of major roads was identified in the baseline and alternative scenarios models.

Residential and commercial structures identified as at risk of flooding were surveyed for input into DEC-2. Surveyed structures include: (1) those located within the 100-year floodplain limits on the 2004 DuPage County Countywide DFIRM; (2) structures identified as having flooded due to overbank flooding in the September 2008 flood event per the City of Warrenville's damage assessment; and (3) structures located outside the mapped 100-year flood plain in flood risk areas depicted on Figure ES-2. Flood risk areas are those areas below or within a foot of the 100-year flood plain elevation and not currently mapped as floodplain on the DFIRM. These areas may have been subjected to flooding in the September 2008 flood if flood proofing measures had not been undertaken by the City of Warrenville. These measures included sandbagging at various overbanking locations, including:

- River Road at Forest View Avenue
- River Road at Rogers Avenue

The economic model field survey included obtaining the first floor elevation, low water entry elevation, zero damage elevation and, if for a residential structure, the structure type (e.g., ranch, raised ranch, split level with basement, two-story without a basement, etc.). This data, along with the structure value, contents value, and river station, were entered into DuPage County's DEC-2 economic computer program. Structure values were obtained from DuPage County's 2009 tax assessment information. Content values for residential structures are assumed to be thirty percent (30%) of the structure value. Commercial content values were determined initially through interviews with the business personnel and have been adjusted for inflation. Associated damages are assumed to begin 0.5 foot below the low entry elevation.

Other input into the DEC-2 model includes damage curves that relate flood depth with the percent damage for structure and content damage for each structure type. In addition, peak stage data generated using FEQ for the 1948-2008 period of record is used as input to DEC-2. This input is generated using the FINDPEAK program at specific locations along the waterway, which correspond to the residential and commercial structure locations.

The output from DEC-2 provides the resulting structure and content damages associated with each residential and commercial structure for each storm event in the historic period of record. Actual damages are expected to be higher than reported since traffic damages were not quantified. Road crossings that were overtopped during the September 2008 flood include River Road, Warrenville Road, Williams Road, Butterfield Road, and Mack Road.

The City of Warrenville's damage assessment of the September 2008 flood shows approximately 50 structures reporting some degree of flood damage. Local drainage systems collecting runoff from upland areas, sewer backups, groundwater seepage or localized flooding that is not directly a result from overbank flooding are not included in this study. The focus of the watershed plan addendum is to identify and address sources of overbank flooding. We are aware that flooding from high groundwater can be as significant as overbank flooding. However, it is the main priority of the Stormwater Management Planning Committee to reduce flood damages caused by surface flooding.

This study considered voluntary buyouts of residential structures that are shown to be severely damaged or have repetitive damage claims in the DEC-2 analysis. To be eligible for the buyout under current DuPage County criteria, the depth of flooding at the structure must exceed 1.0 foot for at least one storm event or exceed 0.5 feet for two or more storm events during the historical period of record, assuming all recommended projects for a given alternative are constructed. These criteria were established by the Committee through the approval of the Countywide Buyout Plan on April 5, 1994.

A summary of the benefits of the preferred alternative is reported in the Recommendation section of this report. Benefits are calculated as the baseline damages minus the residual damages for the alternative.

5.0 Identification of Significant Watershed Problems

5.1 Sources of identification

The study limits for this watershed plan addendum were a result of flooding and drainage complaints identified from various sources. There are many types of drainage and flooding problems that vary in severity and degree of damage. The following is a list describing the typical drainage and flooding problems experienced by residents and businesses within the study area:

- Overbank Flooding: When the main channel is flowing at capacity, the overbanks are used for storm water storage. The inundation of the overbanks can cause road closures, flooding of structures located in the overbanks, and disruption of property use due to inundated yards.

- Storm Sewer Backup: Malfunctioning or absent flap gates to storm sewers that outlet directly to the main stem may cause flooding for areas that are hydraulically connected to the floodplain but not adjacent to the floodplain.

- Overland Flow: Poorly defined overland flow routes within residential areas can cause structural flooding and inundated yards.

- Overtopping of Bridges and Roads: Various bridges in the study area are overtopped at the bridge or at the approach section and hinder or limit the movement of traffic and emergency vehicles.

- Sanitary Sewer Backup: Infiltration into sanitary sewers from ground water can exceed the capacity of the system and cause sanitary sewers to back up into homes and businesses.

There were three main sources from which the identification of flooding problem areas were collected. One source was from public input of those who experienced or witnessed the September 2008 flooding. This was collected through the Illinois Emergency Management Agency's Damage Assessment provided by the City of Warrenville. The second source came from DuPage County and City of Warrenville staff accounts and records of the September 2008 flood event. Their eyewitness accounts and surveyed water surface elevations helped verify reported damages from residents along with identifying additional areas of concern. The third source was through the FEQ model developed by DuPage County and used to develop watershed plans and flood plain mapping. This model was used to help verify both the public input and County and City records. This watershed plan addendum focuses on solutions that minimize the impact of overbank flooding.

5.1.1 Public Input

Public input was used to identify flood damages and to help verify the results of the FEQ model. Residents and business owners within the study limits have reported flooding and drainage problems to the City of Warrenville and DuPage County through the following means:

- Drainage Complaints: The City of Warrenville and DuPage County receive drainage complaints from their respective constituents.

- Municipal Investigations: The City of Warrenville conducted a flood damage assessment after the 2008 storm.

- Public Meetings: Both the City of Warrenville and DuPage County have provided forums and opportunities for residents and business owners affected by flooding along the West Branch DuPage River main stem within the study limits to voice their opinions and give a description of the flooding experienced or observed. These opportunities include Warrenville's City Council, Stormwater Management Planning Committee, public forums, etc. The County has participated in School District, City Council and committee meetings at the City of Warrenville.

- Post-Storm Surveys: After the 2008 September storm event, the City of Warrenville canvassed the watershed to observe the nature of flooding occurring and to conduct a high water mark survey. The County has incorporated this survey information into their GIS database.

5.1.2 Modeling

DuPage County has developed an FEQ model of the entire watershed of the main stem of the West Branch DuPage River, including the inflows from each of the eight (8) tributaries to the main stem. The FEQ model output showed that flooding occurs in the study limits due to three main factors:

- Bridge Design: Various bridges over the main stem within the study limits restrict runoff from flowing downstream. The increase in flood elevations upstream of restricted bridges can be considered a major source of flood damages.

- Channel Capacity: Channel geometry in various locations within the study limits restricts the conveyance capacity of the river. Geometric restrictions such as silt, sharp turns, and development within the floodway increase flood elevations.

- Overgrowth: The vegetation in the overbanks for the main stem has drastically increased from when the first watershed model was originally developed. The increase in vegetation is reflected in the hydraulic calculations by an increase in Manning's "n"

values or the roughness coefficient. An increase in roughness reduces the conveyance of the reach and will increase the flood elevations.

The model helped to quantify the observed problems from the field and identify the cause of flooding in some areas.

5.2 Location and Description of Flooding

The significant flooding problems within the studied area have been identified and described in the following damage description list. For simplicity, the study limits have been broken down into five (5) reaches. This is not an exhaustive list of every area that has been impacted by flooding, but represents those areas that have been identified as particularly vulnerable to the flooding events that have occurred in the past. The listed areas are those that have been repeatedly impacted by flood waters and can be helped by implementing flood control and water quality projects along the West Branch DuPage River main stem.

Flooding descriptions are based on the September 2008 storm event.

REACH 1 – Upstream of Fawell Dam to Ferry Road (Figure 5-1)

1. **1A: Ferry Road near River Road** – Ferry Road flooded near River Road causing the closure of Ferry Road. Flood waters from the West Branch DuPage River backed up onto Ferry Road through a tollway pond with a missing flap gate located north of I-88 adjacent to the west banks of the river.

REACH 2 – Ferry Road to Warrenville Road (Figure 5-2)

1. **2A: Bower Elementary School** – Bower Elementary School flooded due to the overtopping of the protective berm located along the west bank of the West Branch DuPage River and the absence of backflow preventers on the interior drainage system. The design elevation for the berm was approximately 692.50'. The low point of the protective berm has settled to an elevation of 690.89' or approximately 1.1' below the current base flood elevation.

2. **2B: River Road at Forest View Avenue** – Approximately 35 single family homes were spared from flood damages due to the City of Warrenville's sandbagging efforts at this location. Flood waters were reported to be 0.5' above the overtopping elevation on Forest View Avenue.

3. **2C: River Road at Rogers Avenue** – Approximately 35 single family homes were spared from flood damages due to the City of Warrenville sandbagging efforts at this location. (Please note that the 35 homes mentioned in 2C are the same homes listed in 2B, rather than additional homes.) Flood waters were reported to be greater than two (2) feet above the overtopping elevation just north of Rogers Avenue.

4. **2D: River Road near Warrenville Road** – Overbank flooding damaged three (3) buildings and impacted four (4) properties. For two (2) of the structures, flooding occurred because of their relatively low elevations and lack of flood protection. The third was impacted by the extremely high flood elevations.

5. **General Reach Flooding** – A significant portion of River Road was overtopped by flood waters. This caused structural damage to three (3) homes along River Road and the closure of River Road, which prevented complete emergency access to 10 properties. In addition, the sandy/gravely soils in the area were easily infiltrated by the flood waters causing basement flooding at numerous buildings outside of the mapped flood zones. A local underdrain system may be necessary to handle groundwater but is not within the parameters of this study.

REACH 3 – Warrenville Road to Butterfield Road (Figure 5-3)

1. **3A: Warrenville Road Corridor** – The Warrenville Road Bridge appears to be restrictive for large flood flows. There is approximately one foot of head loss through the bridge. A combination of the restrictive bridge and channel capacity at this location impacts four (4) businesses on three (3) properties. The western bridge approach section overtopped, causing the closure of Warrenville Road.

2. **3B: 2nd Street Corridor** – Five (5) properties experienced flooding due to the high flood waters. The backwater, due to approximately one (1) foot head loss at the Warrenville Road Bridge, extends through this stretch where the impact is an approximate 0.9' increase in water surface elevation at Main Street.

3. **3C: Main Street and Batavia Road** – Five (5) properties experienced structural flooding due to high flood waters. The backwater, due to approximately one (1) foot head loss at the Warrenville Road Bridge, extends through this stretch where the impact is an approximate 0.9' increase in water surface elevation at Main Street.

4. **3D: Riverview Drive Corridor** – Five (5) properties experienced structural flooding due to the high flood waters. Residential and emergency access was completely cut off to five (5) residences due to the closing of Riverview Drive. The backwater, due to approximately one (1) foot head loss at the Warrenville Road Bridge, extends through this stretch where the impact is an approximate 0.5' increase in water surface elevation at this location.

REACH 4 – Butterfield Road to Mack Road (Figure 5-4)

1. **4A: Butterfield Road –** West Branch DuPage River flood waters overtopped the eastern approach section of Butterfield Road, obstructing an important emergency access route.

2. **4B: Williams Road Bridge** – The Williams Road Bridge appears to be restrictive for moderate and large flood flows. Head losses are approximately 1.5' during moderate flows and 0.3' for large flood flows. A combination of the restrictive bridge and channel

capacity at this location increases flood elevations upstream, impacting two (2) properties. The approach to the bridge on the north side of the river was overtopped, causing the closure of Williams Road.

3. **4C: Emerald Green Corridor** – Flood waters came to within two (2) inches of flooding 10 multifamily structures (approximately 30 individual units). The impact of the restriction at the Williams Road Bridge extends through this stretch resulting in an approximate 0.2' increase in water surface elevation at this location.

4. **4D: Iroquois Court** – Twelve (12) homes sustained flood damages and approximately 20 homes were completely cut off from residential and emergency access due to the high flood waters. The impact of the constriction at the Williams Road Bridge extends through this stretch and causes an approximate 0.2' increase in water surface elevation at this location.

5. **4E: Forestview Drive** – Approximately nine (9) homes sustained flood damages and approximately 17 residences were completely cut off from residential and emergency access due to the high flood waters. The backwater, due to the Williams Road Bridge, extends through this stretch and causes an approximate 0.15' increase in water surface elevations.

REACH 5 – Mack Road to Roosevelt Road (Figure 5-5)

1. **5A: Mack Road** – West Branch DuPage River flood waters overtopped the western approach section of Mack Road, causing the closure of Mack Road. One (1) structure was flooded due to the high water elevations.

6.0 ALTERNATIVES DEVELOPMENT AND EVALUATION

The alternatives were evaluated through the use of the West Branch DuPage River Watershed Planning FEQ model and runoff generated through the use of HSPF. Included in the evaluation, an economic evaluation was performed using DEC-2 which relates flood elevations generated using FEQ to specific residential and commercial structure elevation data in order to compute dollar damages. The objective of this addendum is to identify proposed improvements along the main stem of the West Branch DuPage River between Roosevelt Road to just upstream of Fawell Dam to reduce the impacts of future overbank flooding in a manner that is consistent with the adopted goals of the 2006 Plan. Tables 7-1 and 7-2 include the economic model summary of benefits and damages. The following five alternatives were evaluated:

Alternative 1: No Action
Take no action beyond what is already planned and in the permitting process.

Alternative 2: Buyouts/Flood Proofing
Buy out damaged residential structures that meet the County's voluntary buyout criteria, and flood proof other residential and commercial structures to the fullest extent possible. It is assumed that DuPage County will be responsible for buying out residential structures and individual property owners will be responsible for constructing flood proofing improvements, with the County assisting in the design of flood proofing measures.

Alternative 3: Upstream Storage (Figure 6-1)
Reduce peak flood flows in the West Branch DuPage River by constructing a flood control facility upstream of the identified flood prone areas. The reduction in peak flows would lower water surface elevations throughout the study area and therefore reduce flood damages. Buy out remaining damaged residential structures that continue to meet the County's buyout criteria and encourage property owners to flood proof remaining residential and commercial structures at the owners' expense.

Alternative 4: Conveyance/Flood Protection
Improve conveyance capacity in the West Branch DuPage River by constructing structural improvements to reduce water surface elevations and flood damages within the identified flood prone areas. Increase the level of protection for structures located within or near the identified flood prone areas by constructing flood protection improvements (e.g., flood control berms). Any increase in downstream flows or water surface elevations due to proposed improvements will be mitigated within the project reach. The remaining damaged residential structures that continue to meet the County's buyout criteria will be bought out, while the remaining residential and commercial structures will be flood proofed at the owners' expense. The following is a list and description of structural and flood protection improvements included in Alternative 4.

1. **Bower Elementary Berm Improvements** (Figure 6-2) **–** Flood protection for identified flooding area 2A. Raise the Bower Elementary School Berm approximately 2.0-ft above the floodplain elevation to 694.00-ft. The 2.0-ft elevation was chosen to allow for berm settlement and a reasonable factor of safety for freeboard. In addition to the re-constructed berm, it is advised that the school district re-install the flap gates in the interior drainage system. These were not present during the September 2008 floods, which added to the damages experienced by the school. Without the presence of the flap gates, the berm construction will not protect the school. An aggressive maintenance schedule for the flap gates should be developed and adhered to by the school district to prevent failure during future flooding events.

2. **River Road Improvements** (Figure 6-3) – Flood protection for identified flooding areas 2B and 2C. Reconstruct 2,000 feet of River Road to protect 55 at-risk properties. The River Road profile, from approximately Forestview Drive past Rogers Avenue, will be raised approximately one (1) foot above the September 2008 flood elevation to 694.00-ft. The one (1) foot elevation was chosen to allow for a reasonable factor of safety.

3. **Warrenville Road Bridge Reconstruction** (Figure 6-4) – Flood protection for identified flooding areas 3A-D. Reconstruct the Warrenville Road Bridge to eliminate the upstream increase in water surface elevation due to the current head loss and channel restrictions. The reconstructed bridge will have an approximate 225-ft span and the low chord is proposed to be raised approximately 1.25-ft. Also included in the improvement is to expand and realign the channel to more effectively convey floodwaters. Included in this option are the buyout of two (2) commercial properties, the reconfiguration of the channel approach and overbanks to reduce the energy loss at the bridge, and flood proofing measures to protect two (2) remaining commercial properties at the Warrenville Road–Batavia Road intersection.

4. **Williams Road Bridge Reconstruction** (Figure 6-5) – Flood protection for identified flooding areas 4A-E. The City of Warrenville is currently in the design phase to replace the Williams Road Bridge which will include raising the low chord elevation by approximately 4.25-ft and an increase in the span of the bridge by approximately 10-ft. The design will significantly reduce the 1.5’ and 0.3’ head loss through the bridge for moderate and large flow rates, respectively. Deviation from the bridge as proposed at the time of writing this addendum will require the model to be revised and analyzed for any potential increases to flows and elevations.

5. **Reach 4 Protective Berm Improvements** (Figure 6-5)

    a. <u>Emerald Green Flood Control Berm</u> – Flood protection for identified flooding area 4C. Construct an approximate 1.5’ flood control berm in the rear yards of multifamily homes to an elevation of two (2) feet above the 2008 flood elevation. The berm will be approximately 2,300’ in length beginning 600’ upstream of Williams Road and extending in the upstream direction. The two (2)

feet elevation was chosen to allow for berm settlement and a reasonable factor of safety. In addition to berm construction, an interior drainage system will be constructed that provides a positive outlet to the West Branch DuPage River. Backflow preventers will be incorporated into the system to prevent flood waters from backing into the properties.

b. Iroquois Court Flood Control Berm – Flood protection for identified flooding area 4D. Construct an approximate 3.0' flood control berm in the rear yards of single family homes to an elevation of two (2) feet above the 2008 flood elevation. The berm will be approximately 1,800' in length beginning 500' upstream of Williams Road and extending in the upstream direction. The two (2) feet elevation was chosen to allow for berm settlement and a reasonable factor of safety. In addition to berm construction, an interior drainage system will be constructed that provides a positive outlet to the West Branch DuPage River. Backflow preventers will be incorporated into the system to prevent flood waters from backing into the properties.

c. Forestview Drive Flood Control Berm – Flood protection for identified flooding area 4E. Construct an approximate three (3) feet flood control berm in the rear yards of single family homes to an elevation two (2) feet above the 2008 flood elevation. The berm will be approximately 2,000' in length beginning 3,000' upstream of Williams Road and extending in the upstream direction. The two (2) feet elevation was chosen to allow for berm settlement and a reasonable factor of safety. In addition to berm construction, an interior drainage system will be constructed that provides a positive outlet to the West Branch DuPage River. Backflow preventers will be incorporated into the system to prevent flood waters from backing into the properties.

Alternative 5: Conveyance/Flood Protection with Water Quality and River Restoration

Alternative 5 includes all the improvements found in Alternative 4 (Figure ES-3), and includes the City of Warrenville's Main Street – Manning Avenue Storm Sewer System Control Structure Project. The design and permitting of this project is currently underway by the City. The project is a local storm sewer system improvement involving a shut-off valve and pumping operation. The costs of this project are anticipated as part of the City of Warrenville's costs. There are additional water quality improvements proposed in Alternative 5 that align with the 2006 Plan's goal of improving the water quality of the main stem (Figure 6-6). The proposed water quality improvements included in Alternative 5 involve the removal of non-native invasive species along the banks of the river and cutting back the incised banks of the river to create greater stormwater storage areas. The banks will be lowered to just above the normal water elevation and will be vegetated with bottom land wetland/riparian vegetation. The benefits of these proposed riparian environment restoration improvements to the watershed of the West Branch DuPage River are an important component of stream quality. Generally, a riparian environment consists of a habitat with moderate or a well-balanced supply of moisture, vegetative communities, and associated fauna. In attempting to define and implement a program to

enhance the effectiveness of riparian environments in DuPage County, the Morton Arboretum reviewed extensive research on riparian environments. Based on this research, they defined a riparian environment as follows: "Land interface between aquatic and upland ecosystems bordering or adjacent to perennial and intermittent waterways that provide flood management, habitat, water quality enhancement, or other amenities dependent on the proximity to water." The Morton Arboretum's report further defines riparian environments to include the following functions:

1. Reducing flood flow rates, velocities, and volumes.
2. Preventing erosion and promoting bank stability of streams, lakes, ponds, or wetland shorelines.
3. Controlling sediment from upland areas thus reducing the impact of urbanization on stream habitat and water quality by filtering and assimilating nutrients discharged from surrounding uplands.
4. Insulating and moderating daily and seasonal stream temperature fluctuations by maintaining cooler instream temperatures for areas with overhanging vegetation.
5. Serving as important sites for denitrification, which reduces development of algal blooms and subsequent depressed levels of dissolved oxygen instream.
6. Providing an effective mechanism for treatment of contaminated surface runoff.
7. Providing habitat corridors for both aquatic and terrestrial fauna and flora.
8. Providing recreational and aesthetic values for human use.

In addition to the functions listed in the Morton Arboretum's report, a number of physical, chemical and biological processes operate concurrently in constructed and natural wetlands to provide contaminant removal such as:

- Dense growing species with large stem surface areas provide the greatest area for stormwater contact and enhance the contaminant removal efficiencies.
- Contaminants are removed via plant uptake. Contaminants that are also essential plant nutrients, such as nitrate, ammonium and phosphate, are readily taken up by wetland/riparian plants.
- Microorganisms provide a measurable amount of contaminant uptake and storage.
- Microbial metabolism also removes inorganic nitrogen, such as nitrate and ammonium.
- The most important chemical removal process in wetland soils is sorption, which results in short-term retention or long-term immobilization of several contaminants. Sorption is a broadly defined term for the transfer of ions (molecules with positive or negative charges) from the solution phase (water) to the solid phase (soil), which includes adsorption and precipitation reactions.

In 2009, the DuPage River Salt Creek Workgroup members funded a bioassessment suvey of the West Branch DuPage River and associated report, entitled Biological and Water Quality Study of the West Branch DuPage River. The bioassessment was done as a follow-up to similar work performed in 2006 to determine if any watershed improvements were evident as a result of

ongoing restoration work and educational efforts. According to that report, "Habitat quality in the West Branch DuPage [River] mainstem improved markedly in 2009 compared to 2006 owing to the restoration project associated with the removal of thorium contaminated sediments in [the] reach [upstream of the Warrenville Grove Forest Preserve]." Similarly, macroinvertebrate communities present in restored areas result in higher Macroinvertebrate Index of Biotic Integrity (MIBI) scores: "For the West Branch mainstem as a whole, macroinvertebrate communities sampled in 2009 (45.3 +/- 17.9 SD) were similar to 2006 (41.9 +/- 17.0 SD). However, for the reach downstream from Kress Creek a trend (paired t-test, p=0.08) of improvement was detected with mean index scores increasing from 51.5 in 2006 to 59.7 in 2009. Given the recent completion of the restoration work within the reach, a non-significant trend toward improvement may functionally be considered significant." As restoration work outlined in the 2006 Plan has proven successful in restoring habitat and aquatic life, this addendum recommends expanding restoration work to an additional three rivermiles, from the Warrenville Road bridge crossing to just upstream of the Fawell Dam.

The 2010 impaired waters list, prepared by Illinois Environmental Protection Agency (IEPA) as mandated by §303(d) of the Clean Water Act, lists two stretches of waterway (assessment units) located in this addendum's project area as not supporting aquatic life use. The first, IL_GBK-05, originates at the Geneva Road crossing of West Branch DuPage River and continues downstream approximately 10.5 rivermiles until the bridge crossing at the McDowell Grove Forest Preserve. The second, IL_GBK-02, originates that the bridge crossing at the McDowell Grove Forest Preserve and continues downstream approximately 9.4 rivermiles until the confluence with the East Branch DuPage River.

Alternative 5, with the inclusion of water quality and river restoration improvements, will be able to improve the water quality issues within the project area as identified in the 2010 impaired waters list with proven restoration work as shown from the 2009 bioassessment survey. Therefore Alternative 5 not only proposes flood control projects but the rehabilitation of the river for the improvement of its water quality. Any increase in downstream flows and/or water surface elevations due to the proposed improvements will be mitigated within McDowell Grove Forest Preserve or by obtaining flood easements on the affected properties.

7.0 RECOMMENDATION

Each of the alternatives developed for the West Branch DuPage River were evaluated using the economic data generated using the DEC-2 program and the following factors:

- Conformance with the 2006 Plan
- Conformance with the requirements established in the DuPage County Stormwater Management Plan
- Conformance with local, state and federal regulations
- Level of flood protection provided
- Environmental impacts (wetlands and habitat considerations)
- Water quality enhancement opportunities
- Comments from the public
- Capital cost

The alternatives analysis was presented to the Committee on September 7, 2010, and the Committee approved Alternative 5 (arbitrarily named Alternative 4 at the time) as the preferred alternative. Alternative 5 maximizes benefits while reducing costs to individual stakeholders through cost sharing opportunities. Watershed benefits include a reduction in flood damages and an improvement of the main stem West Branch DuPage River through stream enhancements such as stabilization and the establishment of native vegetation. Watershed improvements are made in a holistic manner by including river restoration in an effort to improve water quality as part of a larger conveyance and flood protection project. The inclusion of these water quality improvements will also provide partnership opportunities with the Forest Preserve and other public entities so that the improvements can be performed over a larger scale and at a reduced cost. Various grant opportunities are available through the state and federal government to cost share on the proposed Alternative 5 enhancements to the waterway. (Copies of the September 7, 2010 presentation and the full draft addendum were posted on the County's website for review during the 30-day public comment period.) The flood profile comparison between the baseline condition and the preferred alternative 5 within the study limits for the September 1987 storm event can be found as Figure 7-1.

The benefits computed by the economic model of the preferred alternative (Alternative 5) are shown in Table 7-1 below. For example, there are 47 residential structures that experience structural flooding in the baseline condition. The preferred alternative reduces the number of residential structures that are damaged from 47 to 3.

ECONOMIC MODEL RESULTS COMPARISON				
Model	**Total # of Residential Structures Damaged[1]**	**# of Residential Structures Eligible for Buyout**	**# of Residential Associated Damage Only**	**Total # of Commercial Structures Damaged**
Baseline	***47***	25	35	6
Preferred Alternative	***3***	3	2	0

Table 7-1: Economic Model Results Comparison

[1]Excludes Properties with Associated Only Damages.

Below in Table 7-2 is a summary of the calculated damages from the economic model for the baseline and preferred alternative conditions.

ECONOMIC MODEL COST OF DAMAGES COMPARISON				
Model	**Total Damages**	**Total Structural Damage**	**Total Contents Damage**	**Total Associated Damages**
Baseline	***$ 7,035,980***	$ 3,207,688	$ 2,326,097	$ 1,502,194
Preferred Alternative	***$ 189,079***	$ 9,244	$ 3,721	$ 176,114

Table 7-2: Economic Model Cost of Damages Comparison

In addition to the significant reduction to the amount of structures that show structural flood damage in the preferred alternative economic model, there is also an increase in the level of flood protection for those properties considered at risk of overbank flooding from the West Branch. Structures at risk of overbank flooding are being provided a higher level of flood protection through the proposed improvements of flood control berms and the raising of River Road's profile in the preferred alternative. Table 7-3 below shows the comparison of flood risk properties from the baseline to preferred alternative conditions. The structures below did not sustain structural or contents damage in the economic model.

FLOOD RISK PROPERITIES COMPARISON			
Model	**Total # of Structures**	**# of Surveyed Structures**	**# of Structures using County 2-ft Topo**
Baseline	***90***	76	14
Preferred Alternative	***5***	5	0

Table 7-3: Flood Risk Properties

A summary of the total cost for each alternative with a breakdown of the responsible agency for the cost is found in Table 7-4 below.

PRELIMINARY FUNDING ANALYSIS					
Alternative	**TOTAL COST ESTIMATE**	**County Stormwater**	**County Division of Transportation**	**City of Warrenville**	**Government Grant/Private Partnership**
Alternative 1: No Action	$0	--	--	--	--
Alternative 2: Buyouts[1]/ Flood proofing	$5,350,000	$5,350,000	--	--	--
Alternative 3: Upstream Storage	$150,000,000	$150,000,000	--	--	--
Alternative 4: Conveyance/ Flood Protection	$13,220,175	$6,775,000[2]	$3,915,175	$2,530,000[3]	--
Alternative 5: Conveyance/ Flood Protection with Water Quality and River Restoration	$18,335,175	$6,490,000[2]	$3,915,175	$2,530,000[3]	$5,400,000

Table 7-4: Preliminary Funding Analysis

[1]Cost of buyouts includes purchase price only; excludes cost of appraisal, survey, closing costs, demolition, land restoration or other related costs.

[2]Cost increased since draft plan addendum dated October 5, 2010, due to requests during public comment period by residents to extend the flood control berms. Total cost estimate for Alternate 4 was $12.9 million and total cost estimate for Alternate 5 was $17.9 million.

[3]Cost does not include City of Warrenville's Main Street – Manning Avenue Storm Sewer System Drainage Control Structure Project.

In September 2010, the County Board approved a 5-year bond initiative that allocated $5.5 million for the implementation of the West Branch DuPage River Watershed Plan Addendum's recommended alternative. Other sources of funding are still necessary for the remaining cost. Government grants and private partnerships are expected to be pursued to make up the difference. Design engineering is anticipated to be contracted in February 2011, and construction is projected to begin in Fall 2012. In general the proposed sequencing of construction activity for the completion of all the proposed improvements in Alternative 5 is as follows:

1. Negotiate easements and land acquisition.
2. Secure public and/or private funding
3. Final Design and Permitting of Alternative 5
4. Construct Overbank Channel Cuts
5. Construct Main Street – Manning Avenue Storm Sewer System Drainage Control Structure Project
6. Construct River Restoration Improvements
7. Construct Bower School Berm Improvements
8. Construct River Road Improvements
9. Reconstruct Williams Road Bridge
10. Construct Residential Flood Control Berms
11. Reconstruct Warrenville Road Bridge

The proposed sequencing above has the flexibility to perform various tasks in parallel or the option to break the project up into phases. For instance, final design of the improvements could begin while easements, land acquisition, buyouts and funding are being secured. The overbank channel cuts could be broken into phases during final design by performing only the necessary overbank cuts required to mitigate for each specific project. The following is a list of the proposed projects with a brief description of project dependencies.

Overbank and Channel Cuts – Overbank and channel cuts proposed south of Warrenville Road can begin as soon as funding comes available and permits are secured. Overbank and channel cuts north of Warrenville Road can be constructed prior to the Warrenville Road Bridge Reconstruction after it is demonstrated that these improvements will not negatively impact upstream water surface elevations.

River Restoration – River restoration should be included in the design and permitting of the overbank and channel cut projects. River restoration should be performed following the construction of the overbanks and channel.

Bower School Berm – Construction of the Bower School Berm back to the original design elevations should not be dependent on other watershed improvements. If the berm is designed and constructed with additional freeboard a minimal amount of channel cuts will be required to compensate for the wider berm base.

River Road Improvements – Construction should be performed after or in concurrence with downstream channel cuts. The required channel cuts required to mitigate for the floodplain fill is significantly less than the overall anticipated channel cuts, therefore; this project can begin with just a portion of the channel and overbank work complete. A cost savings may be realized by using the excavated material from the river banks to build up the River Road profile prior to placing the sub-base and pavement.

Main Street - Manning Avenue Storm Sewer System Drainage Control Structure Project – Construction should be performed after or in concurrence with downstream channel cuts. The required channel cuts required to mitigate for the floodplain fill is less than the overall anticipated channel cuts, therefore; this project can begin with just a portion of the compensatory storage necessary for the project being operational.

Williams Road Bridge Re-Construction – Construction should be performed as soon as the City of Warrenville secures approval from IDOT and a permit is secured. This work is not dependant on other proposed watershed improvements as required compensatory storage is being proposed by the City in conjunction with another local project.

Residential Flood Control Berms – Construction should be performed after or in concurrence with the Williams Road Bridge improvements. The new bridge will mitigate for any minor flood profile increases that may otherwise occur with the berm improvements. Final design can begin as soon as design funding is available and should be coordinated with easement and land acquisition efforts. A cost savings may be realized if this project is constructed at the same time as the overbank and channel cuts. Depending on the soils encountered the cuts can be used to construct the earthen berms.

Warrenville Road Bridge Re-Construction – Construction should be performed as soon as funding comes available to DuPage County Division of Transportation and properties and/or easements are secured. Overbank and channel cuts downstream of Warrenville Road should be performed prior to reconstructing the bridge as these improvements will compensate for the lowering of upstream flood elevations. Final design can begin as soon as design funding is available.