

## Memorandum

To: Bassett Creek Watershed Management Commission  
From: Barr Engineering Co.  
Subject: Item 6C: Flood Control Project Long Term Maintenance and Replacement Evaluation  
BCWMC March 20, 2014 Meeting Agenda  
Date: March 12, 2014  
Project: 23270051.34 2014

## Flood Control Project Long Term Maintenance and Replacement Evaluation

At their November 20, 2013 meeting, the Bassett Creek Watershed Management Commission (BCWMC) directed the BCWMC Engineer to evaluate the costs associated with long term maintenance and replacement needs for the Bassett Creek Flood Control Project, and to review historic documents and agreements for the flood control project. This memorandum summarizes the evaluation and outlines information that was included in historic documents related to the maintenance of the flood control project.

The summaries are listed according to the descriptions outlined in the Engineer's original scope:

1. Estimated Cost to Replace the Flood Control Project
2. Estimated Maintenance and Repair Costs for Flood Control Project
3. Located and Reviewed Existing Agreements for the Flood Control Project

## Background

The flood control project was built between 1981 and 1996 by the Corps of Engineers, the Minnesota Department of Transportation (MnDOT) and by the BCWMC with financial assistance from the Federal Water Resources Development Act, the State of Minnesota's Flood Damage Reduction Act, Hennepin County and through assessments on watershed property owners. Figure 1 shows the location of the flood control project features.

At their October and November 2013 meetings, the BCWMC discussed long term maintenance and eventual replacement of the flood control project components. During that discussion, the BCWMC expressed interest in developing a plan for the funding and scheduling of future maintenance and replacement of the flood control project, with the intent to incorporate this into the Watershed Management Plan update. The purpose of this memo is to 1) estimate replacement costs for the flood control project 2) summarize costs for annual maintenance, long-term maintenance, significant

rehabilitation, and replacement of the flood control project after reaching the design life for each structure, and 3) locate and review existing agreements for the flood control project.

## **1. Estimated Cost to Replace the Bassett Creek Flood Control Project**

Figure 1 shows the location of the flood control project features. The cost to replace each feature of the flood control project was determined by updating the original construction cost using the Engineering News-Record (ENR) Construction Cost Index from the date of construction completion of each feature to the present (2014).

The life expectancy of each feature of the flood control project was determined based on a review of the design and inspection files for each feature, and experience with similar flood control projects. The typical design life of the structures varies from 50 to 100 years. The design life was assumed to be 50 years for this study. Since the individual flood control structures were constructed between the years of 1979 to 1996, most of the features, conservatively, have about 20 to 30 years of performance remaining until significant rehabilitation or replacement is necessary. Table 1 summarizes the current replacement cost for the flood control project.

## **2. Estimated Maintenance and Repair Costs for Flood Control Project**

The following sections explain cost estimating methodology for the flood control project. Estimates were not prepared for road crossings that were replaced as part of the flood control project since the current (2004) Watershed Management Plan requires that the city where the crossing is located is responsible for future maintenance and replacement. Table 2 summarizes the operation and maintenance costs at 1- and 5-year intervals for the flood control project, as well as the costs associated with a major rehabilitation and replacement at the end of the structure's design life.

### **2.1 Flood Control Project Structures Upstream of Bassett Creek Tunnel**

The cost to operate and maintain project features at 1- and 5-year intervals was determined by updating original operations and maintenance costs using the ENR Construction Cost Index from the date of construction to present. Repairs included in the 1-year operation and maintenance period consist of:

- inspection
- sediment removal
- erosion repair
- riprap replacement
- sod and vegetation replacement
- miscellaneous maintenance items

Repairs included as part of the 5-year operation and maintenance consist of the items included in the 1-year operation and maintenance with the addition of the following items;

- joint repair
- crack repair
- structural concrete patching

- culvert scour
- handrail replacement
- riprap/gabion repair

The cost to perform major rehabilitation of structures at the end of their design life was assumed to be 25 percent of the 2014 replacement cost based on experience with similar project structures. Examples of major flood control structure rehabilitation include, but are not limited to, the following items:

- partial demolition and replacement of structure
  - saw-cutting
  - shot-creting
  - dowling
  - concrete placement
  - invert repair
- gate structure rehabilitation (Wisconsin Avenue structure)
  - replacing mechanical components

However, several road crossing construction costs were provided as a lump sum cost, since individual construction costs for each feature were not available. To estimate individual construction costs for these lump sum projects, previous inspection notes and photos from each feature were reviewed and percentages of the lump sum costs were estimated by comparing feature size and constructability.

## 2.2 Bassett Creek Tunnel

Five-year inspections and operations and maintenance costs were estimated only for the double box conduit and inlet structure. Being relatively shallow and experiencing temperature extremes near the entrance of the double box conduit inlet structure, the double box portion of the tunnel may need more frequent maintenance than deeper sections of the Bassett Creek tunnels.

For Bassett Creek tunnels Phases 1, 2, and 3, five-year operation and maintenance costs were estimated using costs for similar tunnel rehabilitation projects completed within the past 5 years. Repairs included in the 5-year operation and maintenance period for the tunnels consist of:

- surficial joint repair
- hairline crack repair
- minor sediment removal
- surficial concrete spall patching
- exposed rebar repair

Costs associated with a significant rehabilitation were determined similar to the 5-year operation and maintenance estimates, using similar tunnel rehabilitation projects completed within the last five years. Repairs included as part of significant rehabilitation for the Bassett Creek tunnels consist of the following items;

- deep joint repair

- hole and fracture repair
- structural concrete patching
- major sediment removal
- cementitious void fill behind tunnel liner

Depending upon the condition of the tunnel, severity of the defects and construction cost to replace a structure, significant rehabilitation may be feasible to extend the design life of the structure rather than replacement. There may be instances where the severity of defects may be extensive enough to warrant total replacement of the structure and the maximum estimated budget amount may be referenced for that scenario.

### **3. Located and Reviewed Existing Agreements for the Flood Control Project**

Historic documents, including construction agreements, meeting minutes and memoranda regarding maintenance of the flood control project features were reviewed to document the process that resulted in the maintenance policies outlined in the 2004 Watershed Management Plan.

The agreements reviewed included:

- Local Cooperative Agreement between the Department of the Army and the City of Minneapolis for Flood Protection, June 1986
- Agreements between the City of Minneapolis and each of the eight other member cities of the Bassett Creek Watershed Commission to share in the cost of the flood control project, dated June or July 1986
- Agreement between the State of Minnesota and the City of Minneapolis to construct the 2<sup>nd</sup> Street North tunnel, December 1977
- Agreement between the State of Minnesota and the City of Minneapolis to construct the 3<sup>rd</sup> Avenue North Tunnel, May 1988

The minutes reviewed included:

- Commission meetings, 1999 through 2004
- Policy Advisory Committee and Technical Advisory Committee meeting minutes, 2001 through 2003

The agreements indicate that the cities with flood control project features—Minneapolis, Golden Valley, Crystal and Plymouth—are responsible for maintenance of the flood control project features prior to the policies adopted by the BCWMC at a special meeting on November 13, 2001. The BCWMC decided that rather than return about one million dollars remaining after the construction of the flood control project, an Emergency Repair Fund and a Long Term Maintenance Fund would be implemented. The policies that were adopted by the BCWMC at the special 2001 meeting are outlined in Section 5.2.2.1 of the 2004 Watershed Management Plan.

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## Conclusions

Costs for replacement of the flood control project were updated using the original construction costs and ENR Construction Cost Indices. Since the design life of the structures vary from 50 to 100 years, no immediate replacement is warranted. The operation and maintenance costs at 1- and 5-year intervals for the flood control project, as well as the costs associated with a major rehabilitation or replacement at the end of the structure's design life were estimated using recent similar project costs and updates from ENR Construction Cost Indices. The current policies relating to maintenance of the flood control project outlined in the 2004 Watershed Management Plan were developed by the BCWMC during preparation of the 2004 Watershed Management Plan and were adopted by the BCWMC in November 2001.

### Attachments:

Figure 1 - Flood Control Feature Location

Table 1 - Bassett Creek Flood Control Project Replacement Costs

Table 2 - Summary of Annual/Periodic Operation and Maintenance Requirements & Costs



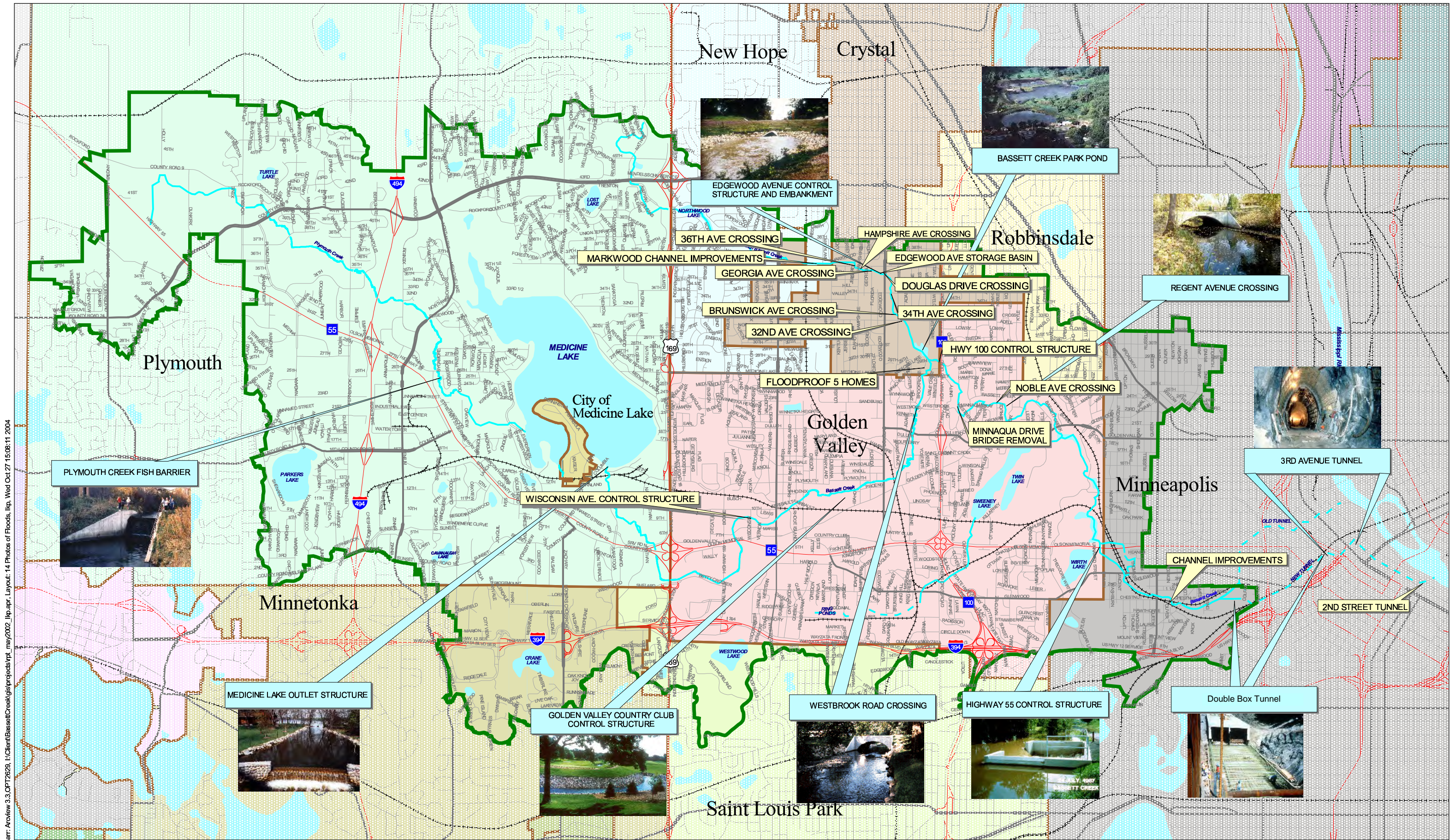


Figure 1

**FEATURES OF THE BASSETT CREEK  
FLOOD CONTROL PROJECT**

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**Table 1 Bassett Creek Flood Control Project Replacement Costs**

<b>Feature</b>	<b>Location</b>	<b>Constructed</b>	<b>Partners</b>	<b>Cost<sup>1,2</sup></b>
Phase I Tunnel: 2nd Street Tunnel	Minneapolis	1979	BCWMC Mn/DOT COE	\$12,000,000 <b>[\$39,760,000]</b>
Golden Valley Flood Control Project Regent Avenue Crossing Noble Avenue Crossing Highway 100 Control Structure 32nd Avenue Crossing Brunswick Avenue Crossing 34th Avenue Crossing Edgewood Ave Control Structure & Embankment Edgewood Avenue Storage Basin Georgia Avenue Crossing 36th Avenue Crossing Hampshire Avenue Crossing Markwood Channel Improvements Floodproofing Five Homes	Golden Valley Golden Valley Golden Valley Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal Crystal	1981-1984	BCWMC COE City of Golden Valley City of Crystal	\$1,600,000 <b>[\$3,980,000]</b>
Douglas Drive Crossing	Crystal	1987	BCWMC City of Crystal Hennepin County	\$100,000 <b>[\$220,000]</b>
Wisconsin Avenue Control Structure	Golden Valley	1987	BCWMC City of Golden Valley	\$100,000 <b>[\$220,000]</b>
Highway 55 Control Structure	Golden Valley	1987	BCWMC COE City of Minneapolis Mn/DNR	\$85,000 <b>[\$190,000]</b>
Plymouth Creek Fish Barrier	Plymouth	1987	BCWMC City of Plymouth Hennepin County Mn/DNR	\$60,000 <b>[\$130,000]</b>
Phase 2 Tunnel: Third Ave. Tunnel	Minneapolis	1990	BCWMC COE City of Minneapolis Mn/DNR Mn/DOT	\$2,800,000 <b>[\$5,740,000]</b>
Phase 3 Tunnel: Box Culvert Double Box Culvert Channel Improvements	Minneapolis	1992	BCWMC COE City of Minneapolis Mn/DNR Mn/DOT	\$13,400,000 <b>[\$26,360,000]</b>
Markwood /Edgewood Area Modifications Control Structure Edgewood Avenue Basin Markwood Channel Improvements	Crystal	1992	BCWMC COE City of Crystal Mn/DNR	\$500,000 <b>[\$100,000]</b>
Westbrook Road Crossing	Golden Valley	1993	BCWMC COE City of Golden Valley Mn/DNR	\$200,000 <b>[\$370,000]</b>
Golden Valley Country Club Control Structure	Golden Valley	1994	BCWMC COE City of Golden Valley Mn/DNR	\$450,000 <b>[\$810,000]</b>
Bassett Creek Park Pond	Crystal	1995	BCWMC COE City of Crystal Mn/DOT Mn/DNR	\$1,300,000 <b>[\$2,360,000]</b>
Medicine Lake Outlet Structure	Plymouth	1996	BCWMC City of Plymouth Hennepin County Mn/DNR	\$100,000 <b>[\$180,000]</b>

<sup>1</sup> Original Construction Costs<sup>2</sup> [2014 dollars]

Table 2  
Summary of Annual/Periodic Operation and Maintenance Requirements & Costs  
Bassett Creek Flood Control Project, MN  
March 12, 2014

	Annual Operation & Maintenance			Five Year Operation & Maintenance		Significant Rehabilitation of Structure <sup>(6)</sup>	End of Design Life	
	Annual Inspection & Report <sup>(1)</sup>	Debris Removal <sup>(2)</sup>	Brushing & Tree Removal <sup>(3)</sup>	Five-Year Inspection & Report <sup>(4)</sup>	General Maintenance & Repairs <sup>(5)</sup>		Estimated Year of Replacement <sup>(7)</sup>	Replacement of Structure <sup>(9)</sup>
<b>Minneapolis</b>								
A Tunnel								
1 Phase 1 - Second Street Tunnel (Mn/DOT)					\$439,100	\$5,030,400	2029	\$61,944,784
2 Phase 2 - 3rd Avenue Tunnel (BCWMC)					\$150,900	\$1,728,400	2040	\$12,378,834
3 Phase 3 - Double Box Conduit and Inlet Structure				\$13,900	\$524,600	\$6,010,500	2042	\$60,309,774
<b>Minneapolis Subtotal:</b>				<b>\$13,900</b>	<b>\$1,114,600</b>	<b>\$12,769,300</b>		<b>\$134,633,400</b>
<b>Golden Valley</b>								
B Golden Valley Country Club Embankment	\$1,500	\$1,800	\$1,800		\$14,600	N.A	2031	N.A.
Golden Valley Country Club Control Structure	\$1,500	\$1,800	\$1,800		\$14,600	\$491,521	2044	\$1,966,083
C Hwy 55 Control Structure	\$1,500	\$1,800			\$14,600	\$115,295	2044	\$461,180
D Wisconsin Avenue Control Structure	\$1,500	\$1,800			\$14,600	\$108,547	2037	\$434,189
E Road Crossings								
1 Regent Avenue	\$700	(8)			(8)	\$123,964	2031	\$495,854
2 Noble Avenue	\$700	(8)			(8)	\$123,964	2031	\$495,854
3 Westbrook Road	\$700	(8)			(8)	\$217,982	2043	\$871,929
<b>Golden Valley Subtotal:</b>	<b>\$8,100</b>	<b>\$7,200</b>	<b>\$3,600</b>		<b>\$58,400</b>	<b>\$1,181,272</b>		<b>\$4,725,089</b>
<b>Crystal</b>								
F Edgewood Embankment and Control Structures	\$1,500	\$1,800	\$4,400		\$14,600	\$95,039	2031	\$380,155
G Markwood Channel & Culverts	\$1,500	(8)			(8)	\$61,982	2031	\$247,927
H Hwy 100 Control Structure & BC Park Pond	\$1,500	\$1,800	\$1,800		\$117,100	\$975,180	2031	\$3,900,720
I Road Crossings								
1 32nd Avenue	\$700	(8)			(8)	\$95,039	2031	\$380,155
2 Brunswick Avenue	\$700	(8)			(8)	\$95,039	2031	\$380,155
3 34th Avenue	\$700	(8)			(8)	\$95,039	2031	\$380,155
4 Georgia Avenue	\$700	(8)			(8)	\$78,510	2031	\$314,041
5 36th/Hampshire Avenue	\$700	(8)			(8)	\$157,021	2031	\$628,082
6 Douglas Drive	\$700	(8)			(8)	\$108,547	2037	\$434,189
<b>Crystal Subtotal:</b>	<b>\$8,800</b>	<b>\$3,500</b>	<b>\$6,100</b>		<b>\$131,700</b>	<b>\$1,761,395</b>		<b>\$7,045,580</b>
<b>Plymouth</b>								
J Medicine Lake Outlet Structure	\$1,500	\$1,800	\$1,800			\$115,879	2046	\$463,515
K Plymouth Creek Fish Barrier	\$1,500	\$1,800	\$1,800			\$64,142	2037	\$256,566
<b>Plymouth Subtotal:</b>	<b>\$1,500</b>	<b>\$1,800</b>	<b>\$1,800</b>			<b>\$180,020</b>		<b>\$720,081</b>
<b>Total Bassett Creek Flood Control Project Costs</b>	<b>\$18,400</b>	<b>\$12,500</b>	<b>\$11,500</b>	<b>\$13,900</b>	<b>\$1,304,700</b>	<b>\$15,890,000</b>		<b>\$147,120,000</b>

(1) Inspection & report; Inspection at tunnel only includes inlet structure and approach channel

(2) BCMWC Responsible for Maintenance. Work assumed to be performed by City and reimbursed by BCWMC.

(3) BCMWC Responsible for Maintenance. Work assumed to be performed by City and reimbursed by BCWMC.

(4) Five year inspection required for above-water portion of Bassett Creek Tunnel

(5) General Maintenance includes: sediment removal, erosion repair, riprap replacement, sod & vegetation and other misc. maintenance items.  
Does not include gate at Wisconsin Ave. (Note: Bassett Creek Park Pond is assumed to be dredged every 10 years at cost of \$230,000 assuming a type 1 material and \$500,000 for a type 2 material that requires disposal in a landfill)  
Lowering the middle pool (if approved by Corps, Coast Guard, DNR etc.) could decrease dewatering costs up to \$45,000.

(6) Includes all items in 1-year and 5-year O & M repairs plus void fill in Minneapolis tunnels, partial structure demo and replacement, Wisconsin Avenue gate upgrades for construction costs in 2014.  
(assume one repair project per project feature in addition to 5-yr maintenance)

(7) Assumes a 50 year life of project

(8) Assumes City shall be responsible for maintenance of all road crossings and the Markwood channel modifications and storm sewer components.

(9) Cost includes total replacement of structure at the end of design life assuming 3% inflation and construction technology, means, and methods remain as they are today (2014).