Item 5A.
BCWMC 4-20-23
Appendices
Separate

BARR

Feasibility Report for Bassett Creek Main Stem Restoration, Regent Avenue to Golden Valley Road (2024 CR-M)—DRAFT

Golden Valley, Minnesota

Prepared for
Bassett Creek Watershed Management Commission

April 2023

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
952.832.2600
www.barr.com

Feasibility Report for the 2024 Bassett Creek Main Stem Restoration Regent Avenue to Golden Valley Road

April 2023

Contents

1 Executive Summary 1
1.1 Background 1
1.2 General Project Description and Site Characteristics 1
1.3 Recommendations 4
2 Background and Objectives 5
2.1 Goals and Objectives 7
2.1.1 Scope 7
2.1.2 Stream Stabilization 7
2.1.3 Considerations 7
2.2 Background 8
2.2.1 Reach Description 8
3 Site Characteristics 9
3.1 Bassett Creek Watershed 9
3.2 Stream Characteristics 11
3.3 Site Access and Easements 11
3.4 Wetlands 11
3.5 Cultural and Historical Resources 13
3.6 Environmental Review 15
3.7 Threatened and Endangered Species Review 16
3.8 Tree Survey 17
3.9 Drone Flight 19
3.10 Topography and Utilities 19
4 Stakeholder and Public Engagement 20
4.1 Project Kickoff Meeting with BCWMC Staff and City of Golden Valley Representatives 20
4.2 Technical Stakeholder / Agency Meeting 20
4.3 Public Stakeholder Input-Gathering 20

4.3.1 Virtual Story Map and Online Survey with Residents 20
4.3.2 Open House 21
4.3.3 Virtual Meeting with Dakota Community Members 21
5 Potential Improvements 22
5.1 Description of Potential Improvements 22
5.1.1 Hard Armoring and Bioengineering Stream Stabilization Techniques 22
5.1.2 Stream Stabilization Techniques Evaluated 23
5.2 Concepts Evaluated 25
6 Project Modeling Results and Potential Impacts 35
6.1 Hydrologic, Hydraulic, and Water Quality Modeling 35
6.1.1 BCWMC XPSWMM Model Review 35
6.1.2 Anticipated Pollutant Removals 37
6.2 Easement Acquisition 38
6.3 Permits Required for Project 38
6.3.1 Section 404 Permit 38
6.3.2 Minnesota Pollution Control Agency (MPCA) Permits 39
6.3.3 Minnesota Wetland Conservation Act 39
6.3.4 Environmental Assessment Worksheet 40
6.3.5 Public Waters Work Permit 40
6.3.6 City of Golden Valley Permits 40
6.4 Other Project Impacts 40
6.4.1 Tree Loss 40
6.4.2 Water Quality Impacts 41
6.4.3 Utility Considerations 41
7 Project Cost Considerations 42
7.1 Opinion of Cost 42
7.2 Funding Sources 43
7.3 Project Schedule 43
8 Recommended Option 45
9 References 46

List of Tables

Table 1-1	Total TP and TSS Reductions and Tree Removals	3
Table-3-1	Summary of Desktop Delineated Wetlands	13
Table 3-2	Summary of Tree Survey with City of Golden Valley Tree Definitions	18
Table 3-3	Summary of Tree Survey by Species	18
Table 5-1	Potential Stream Stabilization Measures	23
Table 5-2	Open House Concept Alternatives Summary	25
Table 5-3	Scoring Methodology for Stream Restoration Areas	31
Table 5-4	Proposed Restoration Areas (areas shown in Figure 5-1 through Figure 5-4)	32
Table 6-1	Summary of BCWMC XPSWMM Model for Project Area	35
Table 6-2	Pollutant Reduction by Proposed Option	38
Table 7-1	Bassett Creek Main Stem Stream Restoration Project Options Cost Summary	43

List of Figures

Figure 1-1	Project Location	2
Figure 2-1	Existing Conditions and Erosion Extents	6
Figure 3-1	Bassett Creek Main Stem Watershed Land Use	10
Figure 3-2	Hydric Soils and Wetlands	12
Figure 3-3	Cultural, Historical, and Enviro Review	14
Figure 5-1	Proposed Stream Restoration—Areas Main Stem	27
Figure 5-2	Proposed Stream Restoration—Areas Main Stem	28
Figure 5-3	Proposed Stream Restoration—Areas Main Stem	29
Figure 5-4	Proposed Stream Restoration—Areas Main Stem	30
Figure 6-1	Reviewed XPSWMM Model Locations	36

List of Appendices, Attachments, or Exhibits

Appendix A	Site Visit Photos
Appendix B	Blanding’s Turtle Flyer
Appendix C	Open House Materials
Appendix D	Restoration Table
Appendix E	Erosion Rates
Appendix F	Tree Loss Summary
Appendix G	Cost Estimates

Certification

click here to add certification text

date

Jessica Olson, PE
PE #: 43102

Date

Abbreviations

BANCS	Bank Assessment for Non-Point Source Consequences of Sediment
BCWMC	Bassett Creek Watershed Management Commission
BWSR	Minnesota Board of Water and Soil Resources
BEHI	Bank Erosion Hazard Index
CIP	capital improvement program
CSW	construction stormwater
CWA	Clean Waters Act
EAW	Environmental Assessment Worksheet
FAA	Federal Aviation Administration
IPaC	Information, Planning, and Conservation System
LGU	local government unit
LUST	leaking underground storage tank
MCBS	Minnesota County Biological Sites
METC	Metropolitan Council
MnDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
NBS	near bank stress
NHIS	Natural Heritage Information System
NRCS	Natural Resources Conservation Act
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
OSA	Office of the State Archaeologist
ROW	right-of-way
PWI	public water inventory
RMP	resource management plan
SHPO	State Historic Preservation Office
SNA	scientific natural areas
TP	total phosphorus
TRPD	Three Rivers Park District
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WCA	Wetland Conservation Act
WMA	Wildlife Management Areas

1 Executive Summary

1.1 Background

The Bassett Creek Watershed Management Commission's (BCWMC) current Capital Improvement Program (CIP) (Table 5-3 in the 2015-2025 Bassett Creek Watershed Management Plan, as revised) includes the Bassett Creek Main Stem Channel Restoration from Regent Avenue North to Golden Valley Road (CIP 2024-CR-M). At their August 2022 meeting, the Commission approved the BCWMC Engineer's proposal to conduct a feasibility study for the Main Stem Channel Restoration.

As is required for BCWMC CIP projects, a feasibility study must be completed prior to the BCWMC holding a hearing and ordering the project. This feasibility study examines methods to stabilize and restore areas of erosion within the corridor, as well as improve aquatic and riparian habitats. The Commission Engineer investigated three options during this feasibility study. The three options developed were based on restoring areas ranked low to high using prioritization metrics provided by the City of Golden Valley and the Commission Engineer.

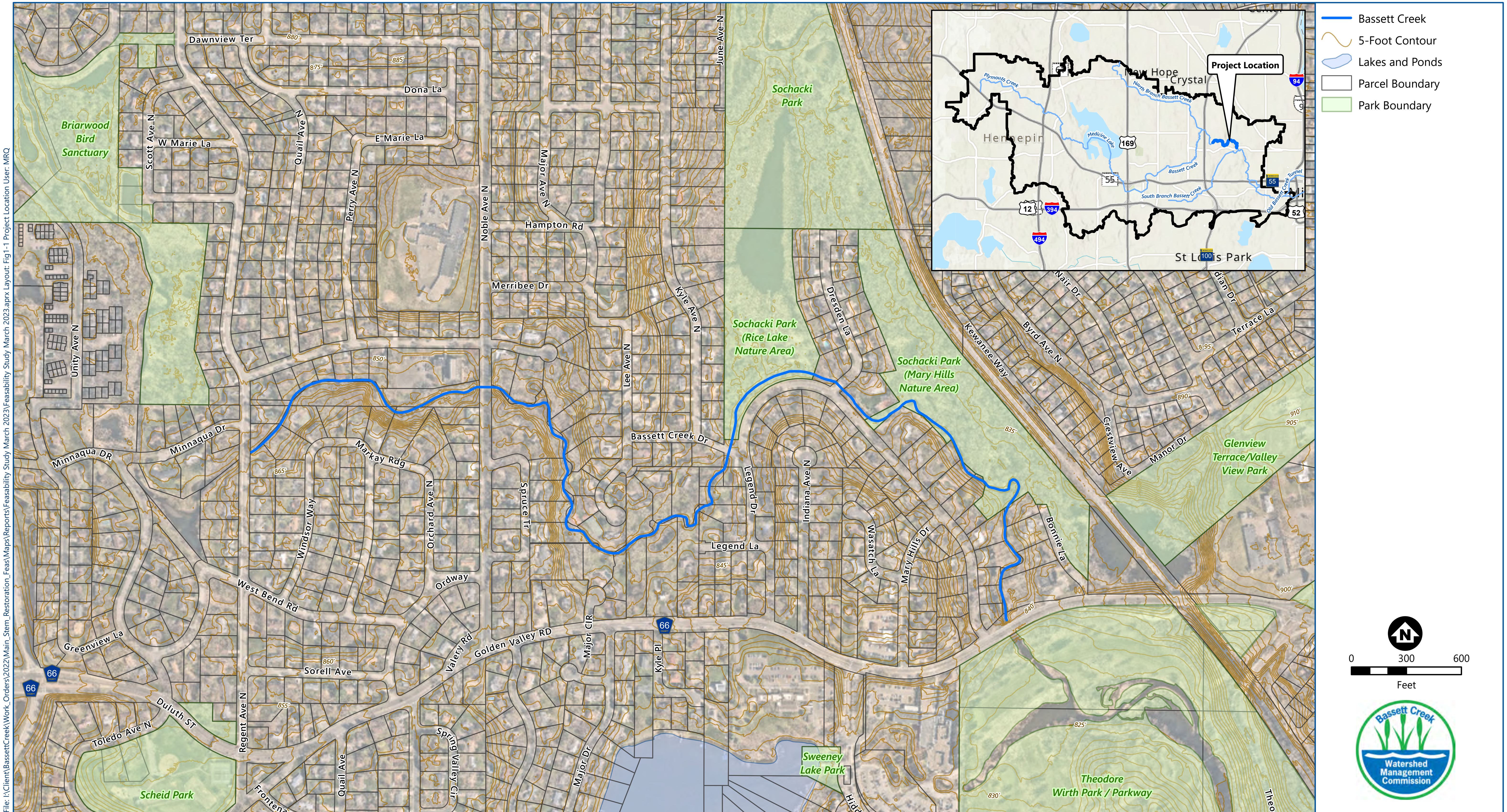
If ordered, the BCWMC will utilize the BCWMC CIP funds to implement the proposed project. The source of these funds is an ad valorem tax levied by Hennepin County over the entire Bassett Creek watershed on behalf of the BCWMC. In addition to BCWMC CIP funds, Golden Valley plans to contribute channel maintenance funds ($200,000) and Capital Improvement Program funds ($100,000) toward project implementation.

1.2 General Project Description and Site Characteristics

The Bassett Creek Main Stem Restoration project area is located along Bassett Creek between Regent Avenue North and Golden Valley Road. The project will focus on restoring eroding stream banks and improving aquatic and riparian habitats (Figure 1-1).

The approximately 7,000-foot reach is located on a combination of privately owned and publicly owned properties, including portions of land owned by Golden Valley, and operated in partnership with Three Rivers Park (TRPD) through the Sochacki Park Joint Powers Agreement. The creek maintains a steady base flow year-round and meanders through neighborhoods and wooded backyards and alongside a wooded reach of Sochacki Park. Erosion of the stream banks varies along the reach from mild to severe, with eroding bank heights varying from 2.5 to approximately 8 feet.

The 7,000-foot reach was broken into four separate reaches for mapping purposes. Reach 1 is located between Regent Avenue North and Noble Avenue, Reach 2 is between Noble Avenue and Bassett Creek Drive, Reach 3 is between Bassett Creek Drive and Station 56+00, and Reach 4 is between Station 56+00 and Golden Valley Road (Figure 5-1).



PROJECT LOCATION
Main Stem
Restoration Feasibility Study
BCWMC

FIGURE 1-1

The measures identified for potential implementation consist of the following:

- Stream bank grading and vegetation establishment
- Removal of trees and invasive vegetation (e.g., buckthorn)
- Stabilizing channels that carry parking lot runoff
- Installing a variety of stream stabilization measures to reduce erosion, including riprap, root wads and toe wood, coir logs, rock or log j-hook vanes and cross vanes, fascines, and live stakes
- Further investigation of degraded pipe outfalls and repairing/replacing outfalls and associated pipes as needed
- Identifying opportunities to install small structural BMPs upstream of outfalls
- Establishing new vegetation in areas disturbed by construction
- Further investigation of degraded pipe outfalls and repairing/replacing outfalls and associated pipes as needed
- Protecting existing utility infrastructure
- Identifying opportunities to install small structural BMPs upstream of outfalls

This study identifies 79 unique locations for stabilization, which have been grouped into 40 restoration areas within the approximate 7,000-foot assessed reach. The restoration areas are ranked from low to high priority. Figure 5-1 shows the potential restoration areas, and Table 5-4 details the proposed restoration methods for each area.

Water quality improvements resulting from the project range from 31.8 to 82.4 pounds per year of total phosphorus reductions and 63,500 to 165,000 pounds per year of total suspended solids reduction (Section 6.0). Tree removals also vary by option (Table 1-1).

Table 1-1 Total TP and TSS Reductions and Tree Removals

Option Description	Project Cost Estimate(1,4)	Annualized Cost(2)	TP Loading		TSS Loading		Tree Loss(5)
			Load Reduction (lb/yr)	Cost/lb/yr Reduced(3)	Load Reduction (lb/yr)	Cost/lb/yr Reduced(3)	
Option 1. High-ranked restoration areas	$982,000 ($835,000–$1,277,000)	$62,000	41.8	$1,483	83,524	$0.74	37
Option 2. High- and medium-ranked restoration areas	$1,685,000 ($1,433,000–$2,191,000)	$108,000	64.8	$1,667	132,205	$0.82	62

Option Description	Project Cost Estimate(1,4)	Annualized Cost(2)	TP Loading		TSS Loading		Tree Loss(5)
			Load Reduction (lb/yr)	Cost/lb/yr Reduced(3)	Load Reduction (lb/yr)	Cost/lb/yr Reduced(3)	
Option 3. All proposed restoration areas	$2,118,000 ($1,801,000–$2,754,000)	$136,000	82.4	$1,650	164,820	$0.83	82

(1) A Class 4 screening-level opinion of probable cost, as defined by the American Association of Cost Engineers International (AACE International), has been prepared for these options. The opinion of probable construction cost provided in this table is based on the Commission Engineer's experience and qualifications and represents our best judgment as experienced and qualified professionals familiar with the project. The cost opinion is based on project-related information available to the Commission Engineer at this time and includes a conceptual-level design of the project. It includes 20% project contingency and 30% for planning, engineering, design, and construction administration. The lower bound is assumed at -15%, and the upper bound is assumed at +30%.

(2) Assumed to be 15% of the total project cost for annual maintenance, plus replacement cost associated with major repairs and the initial project cost distributed evenly over a 30-year project lifespan.

(3) Annualized cost divided by estimated annual pollution load reduction.

(4) Costs do not include easements or construction access routes

(5) Tree loss is defined as the loss of healthy hardwood deciduous trees that are 6 inches or greater in diameter, softwood deciduous trees that are 12 inches or greater in diameter, and coniferous trees that are 4 inches or greater in diameter

1.3 Recommendations

The Bassett Creek Main Stem Restoration Project (CIP 2024-CR-M) will provide water quality improvement by 1) repairing actively eroding sites and 2) preventing erosion at other sites by installing preemptive measures to protect existing stream banks. Overall, this project will reduce erosion, total suspended solids, and phosphorous loading. The project is consistent with the goals (Section 4.1) and policies (Section 4.2.5) for stream restoration and protection in the 2015-2025 BCWMC Watershed Management Plan.

As part of the feasibility study, the Commission Engineer evaluated three restoration options for eroding areas ranked from low to high throughout the creek corridor. If funding allows, we recommend implementing option 3—completing all proposed restoration areas of high, medium, and low priority—but this option comes at a higher cost. Therefore, if a lower-cost project is desired, we recommend implementing (at a minimum) option 1—completing high-priority areas—and completing medium-to-low-ranked areas as the budget allows. Once an option is selected, we recommend that the opinion of cost identified in this study be used to develop a levy request for this project and that it proceed to the design and construction phase.

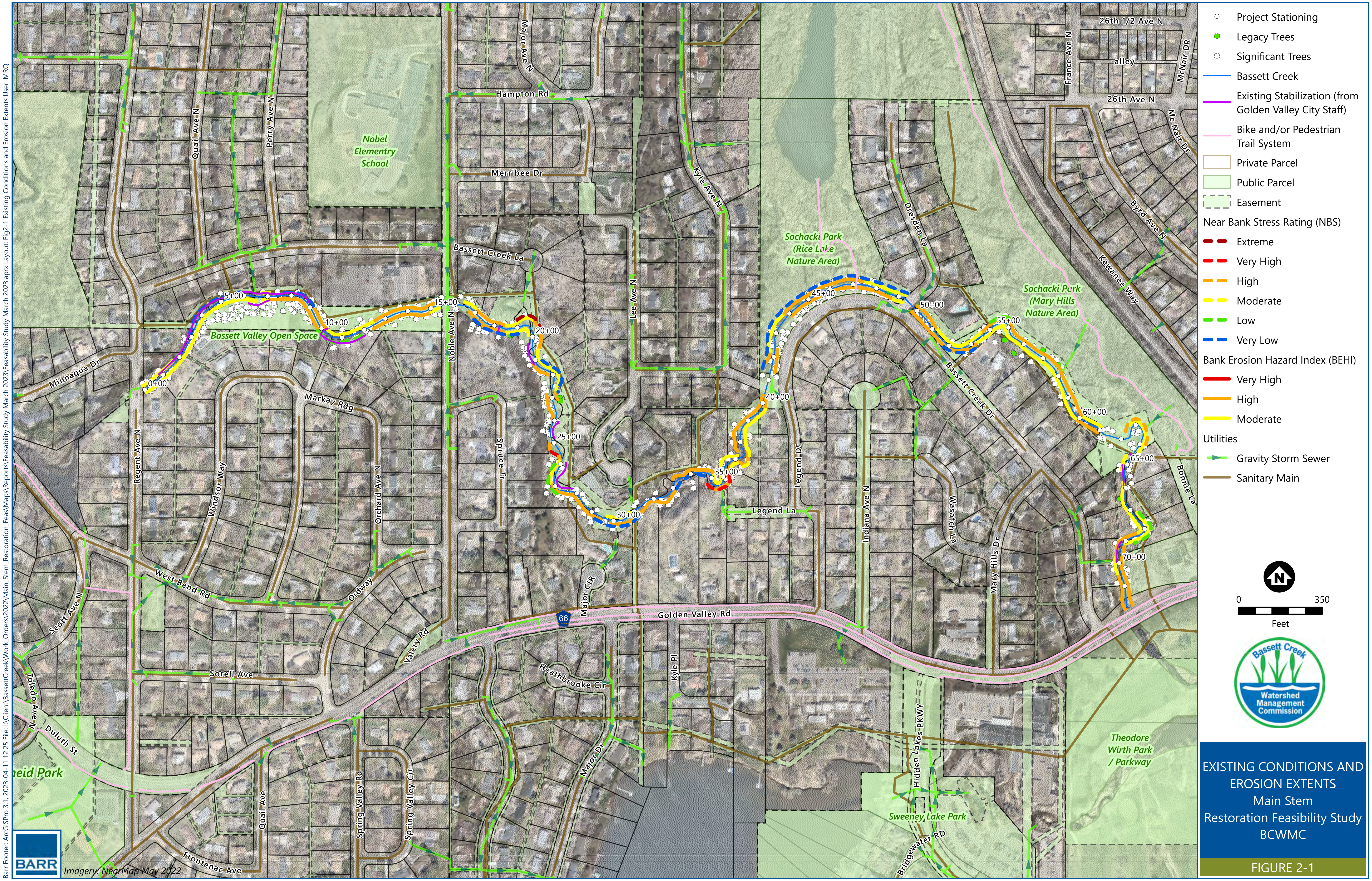
2 Background and Objectives

The BCWMC 2015 Watershed Management Plan (Plan) addresses restoring stream reaches damaged by erosion or affected by sedimentation (1). Section 3.4 of the BCWMC Plan describes the issue and the benefits of stream restoration, and Section 4.2.5 describes the Commission's policies related to streambank restoration and stabilization. The Plan's 10-year Capital Improvement Program (CIP) includes streambank restoration and stabilization projects.

This feasibility study follows the protocols developed by the U.S. Army Corps of Engineers (USACE) and the BCWMC for projects included in the 2009 BCWMC Resource Management Plan (RMP) (2) Although this project is not included in the RMP, it is in close proximity and similar to other RMP projects.

This study examines the feasibility of restoring sites along the Main Stem of Bassett Creek in Golden Valley from Regent Avenue North to Golden Valley Road (see Figure 2-1). The City of Golden Valley conducts annual creek inventories and determined that this 7,000-foot-long reach of the creek has significant erosion. This project is included in the BCWMC current CIP (2024-CR-M).

Restoration of sites along this reach is proposed to be included as a group for design and construction in the BCWMC's 2024 CIP.



EXISTING CONDITIONS AND EROSION EXTENTS
Main Stem
Restoration Feasibility Study
BCWMC

FIGURE 2-1

2.1 Goals and Objectives

The objective of this study is to review the feasibility of implementing measures to protect and improve Bassett Creek, including stabilizing eroding stream banks and re-establishing desirable vegetation on this reach of Bassett Creek and to provide conceptual designs and opinions of costs of measures that could potentially be used at each of the selected erosion sites.

2.1.1 Scope

The City of Golden Valley conducts an annual creek inventory, which identified significant erosion in the 7,000-foot reach between Regent Avenue and Golden Valley Road. The eroded reach is scheduled to be repaired in the winter of 2024-2025 as part of the BCWMC CIP (2024-CR-M). Prior to the BCWMC holding a hearing and ordering a CIP project, a feasibility study must be completed. The purpose of this work is to complete a feasibility study to identify potential stream restoration concepts along the reach.

The first major component of the feasibility study was to complete field investigations to evaluate and prioritize unstable segments of the creek within the 7,000-foot reach. The Commission Engineer conducted field investigations in the Fall of 2022, including a creek walk, tree survey, and drone flight. During the same time frame, we also performed desktop analyses that included wetland delineations, cultural and historical assessments, and environmental review.

The Commission Engineer utilized data gathered from the field and desktop analyses to develop concept stream restoration options. This report presents the options, including an evaluation of erosion prevention; the advantages and disadvantages of each option; cost estimates; life expectancy analysis; pollutant removals and annualized pollutant reduction cost estimates; and permitting requirements.

2.1.2 Stream Stabilization

The goals of the stream stabilization project include the following:

- Reducing sediment loading and associated nutrient and contaminant loading to Bassett Creek and improving downstream water quality by stabilizing eroding banks
- Preserving natural features along Bassett Creek and contributing to natural habitat quality and species diversity by planting native vegetation in eroded areas and areas disturbed by project construction activities
- Preventing future channel erosion along the creek and subsequent degradation of water quality downstream by establishing a stable channel cross section and profile

2.1.3 Considerations

- Avoid floodplain impacts; several residences are located near the creek, so it is critical that the proposed project does not increase flood elevations that impact these properties.
- Maintain existing floodplain storage by ensuring that project features do not increase flood elevations.

- Seek opportunities to enhance vegetation and habitat within the reach, including in riparian areas adjacent to stream bank restoration areas.
- Utilize soft armoring (bioengineering) techniques as much as possible and where feasible.
- Protect adjacent utilities (sanitary and storm) and infrastructure (streets, trails, bridges).
- Minimizing tree removals

2.2 Background

2.2.1 Reach Description

This reach of the Bassett Creek Main Stem (Figure 2-1) extends approximately 7,000 feet from Regent Avenue North to Golden Valley Road. The reach flows through a combination of privately owned properties and publicly owned properties, including portions of land owned by Golden Valley, and operated in partnership with Three Rivers Park District (TRPD) through the Sochacki Park Joint Powers Agreement. Land use immediately adjacent to most of the reach is residential.

The Commission Engineer and Golden Valley staff walked the reach in October 2022 and identified 40 eroding segments. The total length of the streambank identified for restoration and stabilization is approximately 3,975 feet on the right bank (looking downstream) and 3,395 feet on the left bank (looking downstream). Photos of each of the erosion sites are found in Appendix A. The Commission Engineer selected the restoration areas based on those deemed to be the most critical for meeting the BCWMC goals and objectives while providing a cost-effective benefit.

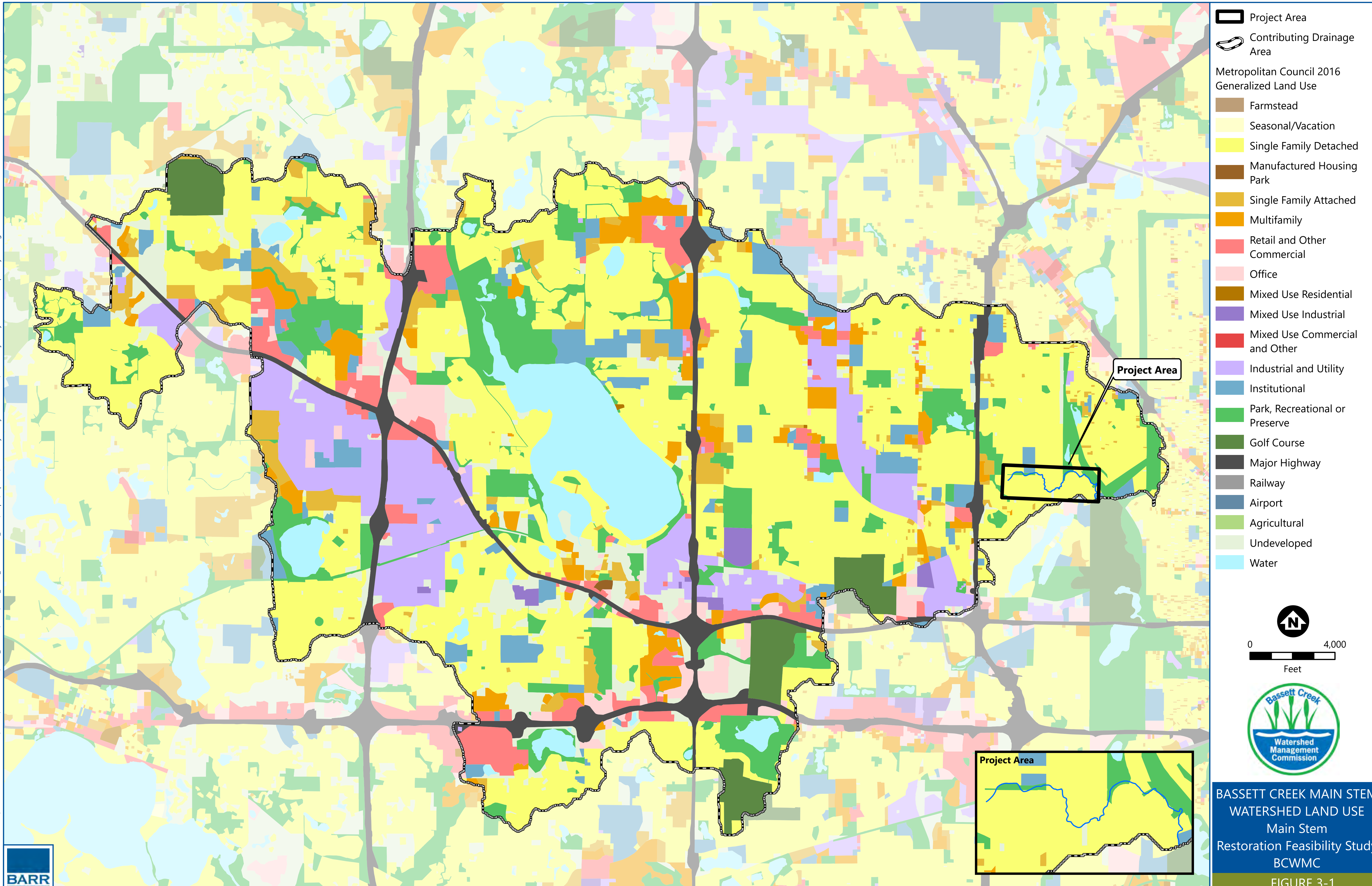
Stream bank erosion is a natural process that occurs at some rate on all stream channels. However, the natural erosion rate can be accelerated by local and regional changes in land use and hydrology. The bank erosion and bank failures present throughout the project area appear to be caused by a combination of natural stream erosion processes, problems associated with changing watershed hydrology, direct historical impacts on the stream channel, and effects of riparian land use. The sediment load from the erosion and scour increases phosphorus loads to downstream water bodies, decreases the clarity of water in the stream, destroys aquatic habitats, increases sedimentation in downstream wetlands and lagoons in Theodore Wirth Park, and reduces the flow capacity of the channel.

Stable stream channels are often said to be in a state of “dynamic equilibrium” with their watersheds, adjusting to changes in the watershed hydrology. It may take many years or decades for a stream to fully adjust to a rapid change in watershed hydrology. The use of stormwater best management practices (BMPs) helps reduce the impact of development projects on streams. Nonetheless, development and land-use alterations fundamentally change the hydrology of the watershed. These changes to hydrology often include increased magnitude and frequency of high-flow events, which subsequently increase erosion rates.

3 Site Characteristics

3.1 Bassett Creek Watershed

The watershed area tributary to this reach of Bassett Creek is approximately 20,400 acres and includes about 80% of Bassett Creek watershed. The upstream watershed drains all or portions of Crystal, Golden Valley, Medicine Lake, Minnetonka, New Hope, Plymouth, Robbinsdale, and St. Louis Park. Existing land use includes approximately forty-five percent single-family residential; sixteen percent commercial/industrial; thirteen percent parks and recreation; six percent undeveloped land, six percent open water; five percent institutional; and highway over the remaining land area (Figure 3-1).



BASSETT CREEK MAIN STEM WATERSHED LAND USE
Main Stem Restoration Feasibility Study
BCWMC
FIGURE 3-1

3.2 Stream Characteristics

This entire project reach of the Bassett Creek Main Stem (Figure 2-1) extends for approximately 7,000 feet from Regent Avenue North to Golden Valley Road. The stream is relatively shallow in most places except for occasional deep pools. The riparian vegetation in this reach varies depending on adjacent land use. Most of the reach is adjacent to the backyards of private residential properties. In residential areas, there can be turf grass or woods to the top of the bank. The reach adjacent to Sochacki Park is primarily unmanaged woody vegetation. The project area also includes multiple pedestrian and street bridge crossings.

The Commission Engineer walked the entire project reach with Golden Valley staff to further investigate the scale and severity of the erosion problems for this feasibility study. Throughout the field investigation, the Commission Engineer photographed and assessed erosion using the Bank Erosion Hazard Erosion Index (BEHI) method (3), which estimates a streambank's susceptibility to erosion through evaluation of multiple elements, including bank height, bank angle, root depth and density, surface vegetation, and soil type. The Commission Engineer also utilized drone technology to capture the erosion along the creek reach.

In addition to a site walk and drone flight, the Commission Engineer completed a desktop evaluation of Near-Bank Stress (NBS) (3) along the reach, focusing on the Level II method, which evaluates the stream's radius of curvature in relation to the estimated channel bankfull width.

3.3 Site Access and Easements

Access to most of the restoration areas will require coordination with private property owners since most of the sites are adjacent to private residential properties with minimal easements. Outreach to and coordination with landowners regarding easements will be during project design, primarily by City of Golden Valley staff. The required number of construction access points will depend on the final selected areas for restoration and easements granted by landowners.

3.4 Wetlands

The Commission Engineer completed a Level 1 desktop wetland assessment for the project area in October 2022. The level 1 review was completed for a 50 ft buffer from the Bassett Creek channel. The review included an assessment of multiple years of aerial imagery in addition to hydric soil indicators from the Natural Resources Conservation Service (NRCS) Web Soil Survey, LiDAR topography data, United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI), and the Minnesota Department of Natural Resources (MnDNR) Public Water Inventory (PWI) (Figure 3-2).

- Project Stationing
- Bassett Creek
- Erosion (from Golden Valley City Staff)

Wetlands (National Wetlands Inventory)

- Freshwater Emergent Wetland
- Freshwater Forested Wetland
- Freshwater Pond
- Freshwater Shrub Wetland
- Lake
- Riverine

Hydric Soil Rating

- Non-Hydric (0%)
- Predominantely Non-Hydric (1-32%)
- Predominantely Hydirc (66-99%)
- Hydric (100%)

N

0 350

Feet

Bassett Creek Watershed Management Commission

HYDRIC SOILS AND WETLANDS
Main Stem Restoration Feasibility Study
BCWMC

FIGURE 3-2

BARR

According to the NRCS webs soil survey, the soils within the project area are classified as Suckercreek fine sandy loam and Urban land-Lester complex. The Suckercreek fine sandy loam soils are predominantly hydric soils (4). The USFWS NWI identified a large wetland complex located on the northeastern side of the wetland area. The NWI wetland is classified as a floodplain forest (PFO1A). In addition, this segment of Bassett Creek is classified as a Public Watercourse by the MnDNR (PWI 27032a). The nearest public water basin is located 0.07 miles downstream from the project area in Theodore Wirth Park, P-2706500.

The Level 1 review identified 9.75 acres of aquatic resources within the project area (Table-3-1). This includes 4.64 acres of Bassett Creek and approximately 5.06 acres of floodplain forest. Two shallow marsh wetlands were identified around the creek channel that appear to have been disconnected oxbows. A field wetland delineation would be required to confirm these wetland boundaries. The field wetland delineation would need to be completed according to the USACE 1987 Wetland Delineation Manual, the Regional Supplement to the USACE Wetland Delineation Manual, and the requirements of the Minnesota Wetland Conservation Act (WCA) of 1991.

Table-3-1 Summary of Desktop Delineated Wetlands

Plant Community	Cowardin Classification	Acres
Riverine	R2UBH	4.64
Floodplain Forest	PFO1A	5.06
Shallow Marsh	PEMCH	0.005
	Total	**9.75**

3.5 Cultural and Historical Resources

The Commission Engineer completed a cultural resources literature review of the project area and within a 1-mile buffer in October 2022. The literature review was directed toward identifying previously recorded archaeological sites, historic structures, and other cultural resources. The Commission Engineer requested data from the Minnesota State Historic Preservation Office (SHPO) to identify previously recorded archaeological sites and historic structures located within one mile of the project area. We also reviewed the Minnesota Office of the State Archaeologist (OSA) Portal for archaeological sites (Figure 3-3).

- Project Stationing
- Bassett Creek
- Erosion (from Golden Valley City Staff)
- Archaeological Site
- Historical Site

What's in my Neighborhood (MPCA)

- Multiple Programs
- Hazardous Waste
- Investigation and Cleanup
- Tanks

0 350
Feet

Bassett Creek Watershed Management Commission

BARR

CULTURAL, HISTORICAL, AND ENVIRONMENTAL REVIEW OF PROJECT AREA
Main Stem Restoration Feasibility Study
BCWMC

FIGURE 3-3

Data provided by the Minnesota SHPO indicates that within one mile of the project area, 388 historic architectural resources have been documented. These consist primarily of houses but also include several schools, churches, bridges, apartment buildings, and various commercial and industrial buildings. The OSA Portal, as well as data from the Minnesota SHPO, identified three previously recorded archaeological sites within one mile of the project area; each is pre-contact (pre-European settlement) in nature.

Two of the previously recorded cultural resources appear to be within or directly adjacent to the project area. Archaeological Site 21HE0290 consists of a pre-contact projectile point recovered in 1989 from Bassett Creek, behind the house at 3830 Bassett Creek Drive. The site is located in an area of bank erosion within the project area. The site has not been evaluated for National Register of Historic Places (NRHP) eligibility. Historic architectural resources HE-RBC-1476 is located directly adjacent to the project area. It consists of a house at 3145 Grimes Avenue North. An NRHP finding has not been determined for this property.

The project area does not appear to have been previously surveyed for archaeological resources. If the project constitutes an undertaking subject to Section 106 of the National Historic Preservation Act, additional work to identify significant cultural resources may be required. In other words, if the project includes federal involvement (e.g., funding or permitting), then a federal agency may require an archaeological survey. Because the project will include some level of federal review and/or permitting, the Commission Engineer recommends conducting an archaeological survey.

3.6 Environmental Review

As part of our desktop environmental review, the Commission Engineer reviewed historical imagery and Minnesota Pollution Control Agency's (MPCA's) What's In My Neighborhood database (Figure 3-3). Historical aerial imagery shows the surrounding area as primarily residential. Prior to residential use, the area was undeveloped. Historical aerial images were reviewed from as early as 1937. Sochacki Park, located approximately 750 feet north of the creek, is built on a former landfill containing building demolition debris. Based on a review of historical aerial images, there are no indications of dumping or landfill activity within the project area.

A review of MPCA's What's In My Neighborhood database identified five historical leak sites that are located near Bassett Creek:

- The Stone Residence leaking underground storage unit (LUST) (LS0009538) is located approximately 230 feet east of the creek. An unknown volume of fuel oil was released in July 1996, and the site was closed in August 1996. According to the WIMN database, no groundwater contamination occurred as a result of this leak. Gravity storm sewers serving the neighborhood outfall to Bassett Creek; however, based on the age of the release, the lack of groundwater contamination, and the closure status, it is unlikely contamination from this release will impact the creek.

- The Noble Elementary School LUST (LS0021641) is located approximately 560 feet north of the creek. An unknown volume of fuel oil was released and reported in November 2021. A soil gas investigation was performed in August 2022. The WIMN database does not specify whether groundwater contamination is present at this Site. Gravity storm sewers along the Noble Avenue outfall to Bassett Creek could provide a conduit to the creek. Based on the distance from the creek, it is unlikely contamination from this fuel oil release will impact the creek unless it is via the storm sewer. A file request is warranted to identify the exact location of the leak and evaluate the potential for contamination in the storm sewer. The leak site was closed on March 2, 2023; however, the site was referred to the MPCA's Site Assessment Program due to the presence of non-petroleum contamination. Based on the unknown source, nature, and extent of the non-petroleum contamination, the potential exists for non-petroleum impacts at or near the creek.

- The Hidden Lakes LUST (LS0010894), Courage Center LUST (LS0019181), and Minneapolis Clinic of Neurology LUST (LS0006029) are located between 600 – 1,200 feet southwest of Bassett Creek. An unknown volume of fuel oil was released at each site between December 1992 and July 2013. Groundwater contamination was identified in connection to the Minneapolis Clinic of Neurology LUST but not the Hidden Lakes or Courage Center LUSTs. The sites were closed in January 1997 (Minneapolis Clinic of Neurology), June 1998 (Hidden Lakes), and August 2013 (Courage Center). Storm sewers serving the area do not outfall to Bassett Creek. Based on the age of the releases, distance to the creek, and closure status, it is unlikely contamination from these releases will impact the creek.

3.7 Threatened and Endangered Species Review

The Commission Engineer completed a desktop review for federal and state-listed species and associated habitats that may be found in the project area to evaluate potential impacts on listed species. The federal government protects federally listed species under the Endangered Species Act and requires consideration of the impacts on these species for projects involving federal permits. State-listed species are protected under Minnesota's Endangered and Threatened Species Law, and the impacts on these species must be considered for state-level permitting requirements. We completed the desktop review in October 2022 using a combination of data available from the USFWS and the MnDNR, as further described below.

Federal Listed Species

The Commission Engineer queried the USFWS Information, Planning, and Conservation System (IpaC) website to identify federally listed species that may occur within the project area. The IpaC identified one federally listed species and one candidate species potentially occurring in the project area: the northern long-eared bat (Myotis septentrionalis) and the monarch butterfly (Danaus plexippus) (5).

The northern long-eared bat is currently listed as an endangered species. The monarch butterfly is listed as a candidate species and is not legally protected under the Endangered Species Act. No avoidance or minimization measure would be required for the monarch butterfly.

No designated critical habitat for any federally listed species is located within the project area.

The northern long-eared bat hibernates in caves during the winter and utilizes forested areas for roosting and foraging during the bat's active season of April through September. Suitable roost trees for this species have trunks measuring greater than 3 inches in diameter at breast height with loose, peeling bark or crevices. The concept plans for this project propose removing less than ten trees exceeding 3 inches in diameter at breast height (6). According to data provided by the MnDNR, there are no known occupied roost trees or hibernacula located within the project area. The nearest known hibernacula are located over 14 miles southeast of the project area. However, because the project occurs within the range of the northern long-eared bat and will require tree removal, impacts on the northern long-eared bat cannot be completely discounted. To avoid direct impacts on the northern long-eared bat, it is recommended that tree removal occurs during the inactive period (October 15 – early April). Consultation with USFWS would be required If tree removal were to occur during the northern long-eared bat's active season (mid-April – October 14).

State Listed Species

Through a license agreement (LA-898) with the MnDNR for access to the Natural Heritage Information System (NHIS) database, the Commission Engineer queried the NHIS database in October 2022 to determine if any rare species could potentially be affected by the proposed project. The NHIS review identified one state-listed threatened species as occurring within one mile of the project area, the Blanding's turtle (*Emydoidea blandingii*).

The Blanding's turtle habitat includes shallow, slow-moving waters with abundant vegetation such as grassy marsh, mesic prairies, slow-moving rivers, and shallow lakes and ponds. Adult turtles prefer shallow water during the active season and prefer deeper water, at least 3 feet deep, for overwintering. Nesting occurs in open areas with sandy soils within 900 feet of a wetland or waterbody (7). The main stem of Bassett Creek may provide suitable summer habitat for the Blanding's turtle. However, it is unlikely for the turtle to utilize the stream as overwintering habitat since it is generally less than 3 feet deep during the winter months. The project area is located in a wooded plant community that would not be considered suitable nesting habitat for the Blanding's turtle. It is unlikely for the project to adversely impact the Blanding's turtle; therefore, no minimization measures are proposed. The Blanding's turtle flyer should be distributed to all contractors working on site (Appendix B).

Additional Sensitive Resources

According to GIS data obtained from the MnDNR, there are no Minnesota County Biological Survey (MCBS) Sites located within one mile of the proposed project site. Additionally, no state-owned wildlife management areas (WMA), Scientific Natural Areas (SNA), or native plant communities are present within one mile of the proposed project area.

3.8 Tree Survey

The Commission Engineer conducted a tree survey under leaf-off conditions in November of 2022. A Minnesota state-licensed landscape architect with extensive tree identification and survey experience collected tree location, species, general health, and diameter (at approximately 4.5' from the ground) data for trees greater than four inches in diameter within the survey limits. The survey area included a 40' buffer on either side of the stream centerline, additional proposed grading areas beyond the 40' centerline, and construction access routes.

Based on the survey data collected, trees were classified in accordance with the City of Golden Valley tree ordinance (8). See Table 3-2 for a breakdown of tree classification by the ordinance definitions within the survey limits. The survey showed that approximately 25% of the trees 4" and greater in diameter in the survey area are box elder, 13% are buckthorn, 12% are ash, and approximately 10% are silver maple. The remaining 14% consist of species such as basswood, aspen, ironwood, hackberry, red maple, mulberry, oak, spruce, and willow. See Table 3-3 for full species count survey results. The Commission Engineer observed during the tree survey that a larger percentage of trees under 4" in diameter that were not recorded were buckthorn. Section 6.4.1 discusses the anticipated tree impacts from the proposed project.

Table 3-2 Summary of Tree Survey with City of Golden Valley Tree Definitions

Tree Type	Count	Significant Tree	Count	Legacy Tree	Count
Hardwood Deciduous	196	6" ≤ Diameter < 30"	295	Diameter ≥ 30"	1
Softwood Deciduous	453	Diameter ≥ 12"	381	–	–
Coniferous	–	4" ≤ Diameter < 24"	13	Diameter ≥ 24"	–

Table 3-3 Summary of Tree Survey by Species

Tree Species	Count	Species Percent of Total Survey
Apple/Spp.	16	1.2%
Ash/Black	4	0.3%
Ash/Green	154	11.6%
Ash/White	5	0.4%
Basswood/American	89	6.7%
Birch/Paper	2	0.2%
Birch/River	18	1.4%
Box Elder	331	25.0%
Buckeye	8	0.6%
Buckthorn	175	13.2%
Burning Bush	1	0.1%
Canada Plum	1	0.1%
Catalpa	1	0.1%
Cedar/White	2	0.2%
Cherry/Black	2	0.2%
Cherry/Spp.	16	1.2%
Cottonwood	57	4.3%

Tree Species	Count	Species Percent of Total Survey
Elm/American	95	7.2%
Elm/Siberian	32	2.4%
Hackberry	50	3.8%
Honey Locust	1	0.1%
Honeysuckle/Tatarian	1	0.1%
Ironwood	34	2.6%
Kentucky Coffeetree	1	0.1%
Maple/Amur	1	0.1%
Maple/Red	11	0.8%
Maple/Silver	135	10.2%
Maple/Sugar	2	0.2%
Mulberry	24	1.8%
Oak/Bur	11	0.8%
Oak/Pin	7	0.5%
Oak/Swamp White	1	0.1%
Oak/White	1	0.1%
Pine/Austrian	2	0.2%
Spruce/Sp.	3	0.2%
Spruce/Black	6	0.5%
Walnut/Black	18	1.4%
Willow/Black	8	0.6%
Total	**1,326**	**100%**

3.9 Drone Flight

The Commission Engineer collected aerial imagery and videos using a drone (DJI Phantom 4 Pro v.2) and Litchi software in accordance with Federal Aviation Administration (FAA) rules and regulations. Videos largely followed the creek's thalweg (main flow path) with short flights to get closer to areas of interest when trees/vegetation prohibited view or access. Golden Valley staff obtained permission from property owners prior to accessing their property for take-off, landing, and flight navigation/line-of-sight needs.

3.10 Topography and Utilities

An important consideration for stream restoration is the existing topography and proximity to utilities. The topography we used for this feasibility study was LiDAR from 2011, while utility information was provided by the City of Golden Valley. Utilities reviewed as part of this feasibility study include storm sewer, sanitary sewer, water main, and utility towers. Information about private utilities would need to be obtained and considered during the design phase.

4 Stakeholder and Public Engagement

4.1 Project Kickoff Meeting with BCWMC Staff and City of Golden Valley Representatives

A virtual project kickoff meeting with BCWMC (administrator, the Commission Engineer), TRPD staff, and City of Golden Valley staff occurred on September 30, 2022. At this meeting, we reviewed the project scope and schedule, reviewed key tasks, and identified data needs. Discussions also included preferences regarding preliminary stream stabilization and water quality improvement concepts.

4.2 Technical Stakeholder / Agency Meeting

A technical stakeholder meeting was held virtually on December 5, 2022. Attendees included representatives from the City of Golden Valley, BCWMC (administrator), TRPD, USACE, MPCA, Metropolitan Council (METC), and MnDNR. The attendees reviewed the restoration techniques and design concepts for the Bassett Creek Main Stem project and provided technical and permitting feedback. Items discussed included:

- Review of the project schedule and meeting objectives.
- Review of the erosion sites and other creek deficiencies.
- Review of water quality issues.
- Review and discussion of the design concepts.
- Discussion of permit requirements for potential wetland and stream impacts.
- Discussion of potential habitat improvements.
- Discussion of threatened and endangered species.

The meeting provided an opportunity to review the project site and discuss options, considering ideal restoration scenarios and practical aspects of maintenance and construction. The MnDNR and USACE encouraged the incorporation of a variety of different restoration methods throughout the reach; they also encouraged holding a virtual preliminary review meeting with the agencies (with "screen shares") to discuss construction plans before they are officially submitted for permits. Additional specific outcomes of the discussion are incorporated into the appropriate sections below.

4.3 Public Stakeholder Input-Gathering

4.3.1 Virtual Story Map and Online Survey with Residents

The Commission Engineer worked with Golden Valley staff to develop a virtual story map (Link: Bassett Creek Restoration Project Story Map) highlighting the project investigation and restoration concepts; the story map was posted on the Golden Valley website on November 16, 2022. The story map includes a map highlighting the project area, photos of eroding portions of the creek, descriptions of erosion, and descriptions and example photos of stabilization measures.

The story map also included a survey and interactive map, allowing the public to respond to a series of questions related to their interactions with the creek, as well as their values and concerns related to the proposed project. Fifteen individuals responded to the survey; responses included comments related to maintaining and enhancing wildlife habitat as well as the creek's beauty and scenery. Project-related concerns included the potential for tree removal, property damage, flood risk, utility impacts, and the ability to provide input during the design process. A summary of comments and responses is included in Appendix C.

4.3.2 Open House

A public open house was held at Golden Valley's Brookview Community Center on March 1, 2023; 30 members of the public attended the meeting. During the meeting, preliminary design concepts were presented to local residents and users of Bassett Creek, as seen in Appendix C. Attendees asked questions and shared observations about the creek. Attendees voiced support for the project and offered varying opinions on restoration concepts; some prefer the look and functionality of riprap, while others prefer bioengineering techniques that incorporate habitat benefits. Other discussion topics included tree removal, site access, utility protection, and project costs.

4.3.3 Virtual Meeting with Dakota Community Members

As part of the feasibility study, there will be one meeting with Dakota Community members. As of April 2023, the meeting has not occurred yet but is in the planning process.

5 Potential Improvements

5.1 Description of Potential Improvements

As described in Section 1.2, the project along the 2024 Bassett Creek Main Stem Restoration reach would consist of a variety of stream stabilization measures to address erosion problems. Figure 2-1 shows the identified potential stream restoration areas, and Table 5-1 lists the potential stream stabilization measures for each area. There are several stream restoration techniques that can be used, although not all of them would be practicable or applicable to the stream erosion problems on Bassett Creek. The techniques discussed below and included in the conceptual design are among commonly used techniques. Those included in the concept design were selected for their functionality and the expectation that most contractors have had experience with the installation of the technique. The final design will determine the most appropriate measures to use at each individual site to meet the objectives of all parties involved. The final design could include techniques not included in these concept designs.

5.1.1 Hard Armoring and Bioengineering Stream Stabilization Techniques

Techniques for stream stabilization generally fall into two categories: hard armoring and bioengineering (also known as soft armoring). Hard armoring techniques include the use of engineered materials such as stone (riprap or boulders), gabions, and concrete to stabilize slopes and prevent erosion. Bioengineering techniques employ biological and ecological concepts to control erosion, using vegetation or a combination of vegetation and construction materials, including logs and boulders. Techniques that do not use vegetative material but are intended to achieve stabilization of natural flow patterns and create in-stream habitat, such as boulder or log vanes, are generally included under the umbrella of bioengineering.

Hard armoring and bioengineering techniques present different challenges, costs, and benefits for stream stabilization design. Hard armoring methods are viewed as standard and time-tested and typically have a longer life span due to the permanence of the materials used. Hard armoring is usually effective in preventing erosion where it is installed; however, placement must consider downstream impacts, understanding that the armoring may push the erosive stresses downstream. Hard armoring typically requires little maintenance; however, if the armoring fails, maintenance or replacement can be expensive, particularly if the armoring materials need to be removed from the site.

Bioengineering techniques maintain more of a stream’s natural function and provide better habitat and a more natural appearance than hard armoring. With bioengineering, if vegetation is well-established, this approach can also be self-maintaining. Due to the biodegradation of construction materials and variable vegetation establishment success, it is typically assumed that bioengineering installations have a shorter life span and may need more frequent (if less expensive) maintenance, particularly as the vegetation is becoming established. Compared to hard armoring, the success of bioengineering techniques is more dependent on the skill of the designer and installer and the unique site and stream characteristics—sometimes making bioengineering construction more expensive. In some instances, bioengineering is not appropriate due to anticipated high velocities, proximity to infrastructure, and/or site conditions that are not conducive to vegetation establishment.

Technical stakeholders for this feasibility study, including the USACE, expressed a preference for bioengineering over hard armoring for stream stabilization where possible. In addition, the current BCWMC Watershed Management Plan (see Section 4.2.5 of Reference (1) states: "recognizing their benefits to biodiversity and more natural appearance, the BCWMC will strive to implement stream and streambank restoration and stabilization projects that use soft armoring techniques (e.g., plants, logs, vegetative mats) as much as possible and wherever feasible." The BCWMC also recognizes that in some cases, soft armoring techniques can require significant tree removal, which can have negative consequences, depending on the type and condition of trees in the project area. Therefore, the BCWMC seeks to balance soft armoring with preserving desirable tree species.

5.1.2 Stream Stabilization Techniques Evaluated

We evaluated several techniques for stabilizing the streams within the project area. J-hook vanes or boulder cross vanes could be used to stabilize the channel bed and introduce flow variability and an improved riffle/pool sequence. The use of grading, root wads, toe wood, fascines, coir logs, and the establishment of vegetation on eroding banks will stabilize these areas from further sediment loss and improve habitat within the pools that have become overly shallow. The deeper pools will improve habitat, especially during winter months. Vegetation establishment in the stream banks will include enhanced buffers with native vegetation that have deeper roots to reduce erosion and improve riparian habitat. Table 5-1 summarizes the stream stabilization techniques evaluated for this feasibility study. Additional stabilization techniques may be reviewed and implemented as part of the design phase.

Table 5-1 Potential Stream Stabilization Measures

Design Element	Purpose	Ecological Benefit
J-hook Vanes 	Logs and/or boulders installed in the stream bed to route flows away from outer banks and toward the center of the channel	Scour pools develop downstream of the low end of the vane near the center of the channel, while sediment and debris build up near the high end of the vane, protecting the bank and providing habitat diversity for aquatic species.
Cross Vanes 	Boulders buried in the stream bed and extending entirely across the stream ("cross vanes") to achieve one or more of the following goals: re-direct flows away from banks, encourage sediment deposition in selected areas, and control stream bed elevations	Scour pools develop over time downstream of the center of the vane, which provide habitat diversity for species that prefer pools to faster flowing in-channel habitat.

Design Element	Purpose	Ecological Benefit
Root Wads 	Tree trunks with the root ball attached, installed either singly (root wads) or in conjunction with additional large woody debris and/or riprap to increase bank roughness and resistance to erosion, re-direct flows away from banks, and provide a bench for the establishment of riparian vegetation	Creates undercut/overhanging bank habitat features
VRSS/Toe Wood Bank Stabilization 	Soil lifts created with a combination of root wads and long-lasting, biodegradable fabric and vegetated to stabilize steep slopes and encourage the establishment of root systems for further stabilization	Creates undercut/overhanging bank habitat features and vegetated floodplain bench/riparian habitat
Riprap Toe with Bank Grading and Vegetation Establishment 	Riprap placed along the toe of the streambank prevents undermining of the bank. Vegetating the bank provides surface protection while establishing root systems, and grading to a flatter slope makes the streambank less susceptible to erosion.	Vegetation placed above the riprap enhances riparian habitat and provides shading of the creek.
Vegetated Riprap 	Vegetated riprap incorporates habitat enhancement with hard armoring to stabilize steep slopes.	Creates vegetated riparian habitat and enhances biological connectivity between the channel and riparian area.
Fascines and Coir Logs	Fascines and coir logs can be placed along the toe of a stream bank in low-velocity areas to help establish vegetation and associated rooting systems to stabilize the stream bank.	Creates vegetated riparian habitat and adds roughness to dissipate energy at the toe of the slope.

Design Element	Purpose	Ecological Benefit
		
Vegetated Buffer 	Established along a stream bank or overbank area to stabilize bare soils and increase resistance to fluvial erosion	Using trees, shrubs, and a seed mix of grass and forbs provides a diverse array of vegetation strata and habitat types. Allows for more naturalized aesthetics, with emphasis on native species.

5.2 Concepts Evaluated

Three design alternatives were presented at a public open house on March 1, 2023 (Table 5-2).

Table 5-2 Open House Concept Alternatives Summary

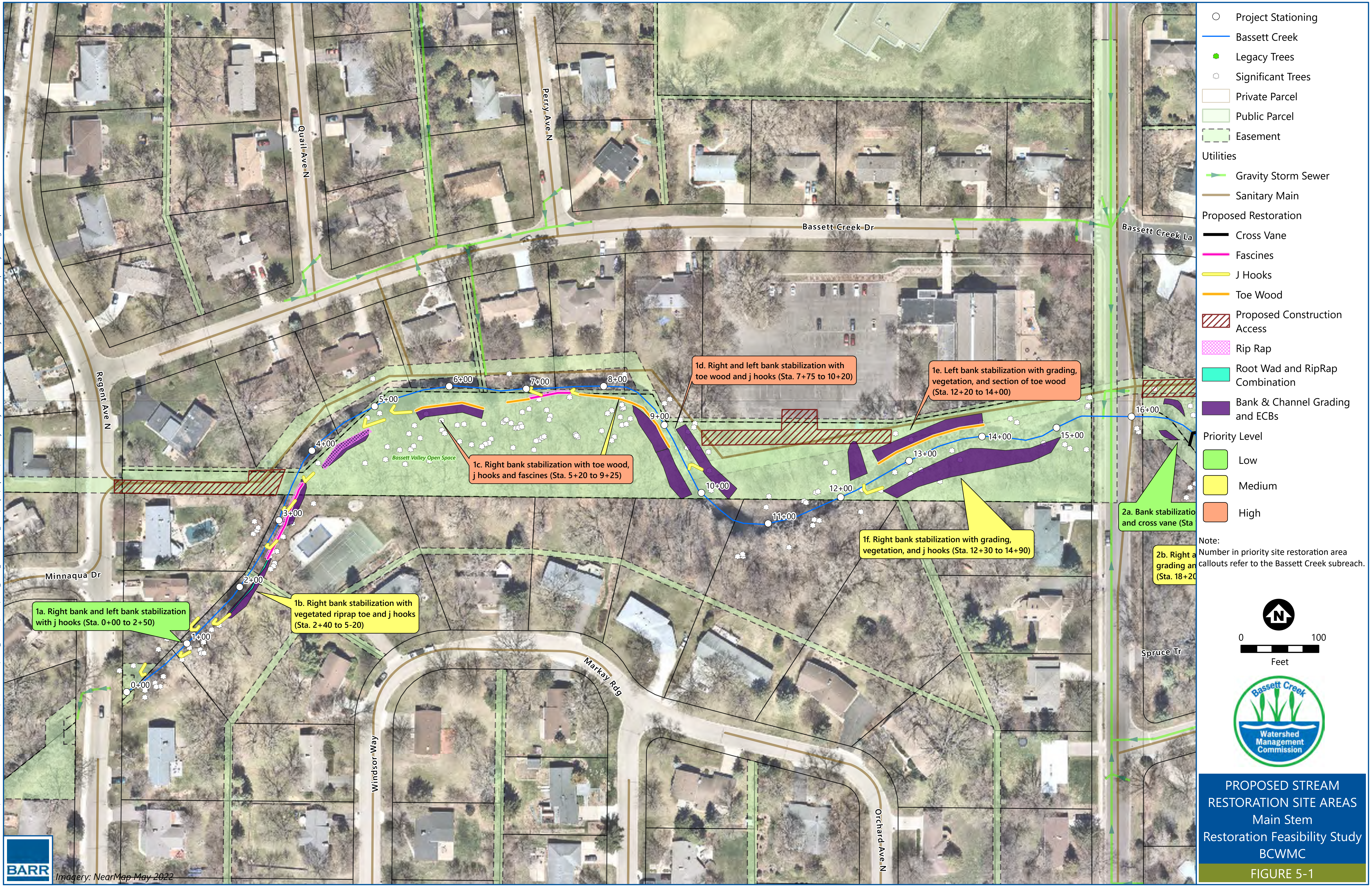
Alternative	Description
Alternative 1—In-Stream Structures	Stream stabilization using primarily in-channel structures with minimal grading, riprap, and vegetation establishment. Alternative 1 prioritizes minimal land disturbance and tree removal.
Alternative 2—Toe Stabilization with Bioengineering Methods	Stream stabilization using bioengineering techniques with minimal in-stream structures and riprap; it also includes moderate grading and vegetation establishment. Alternative 2 differs from Alternative 1 with additional overbank grading and few in-stream structures.
Alternative 3—Bank Grading with Riprap and Vegetation Establishment	Stream stabilization using bank grading, riprap, and vegetation establishment with minimal in-stream structures and bioengineering. Alternative 3 differs from Alternative 2 and 1 with more land disturbance, fewer in-stream structures, less bioengineering, and more hard armoring.

Further details of each alternative and other materials used at the public open house are presented in Appendix C.

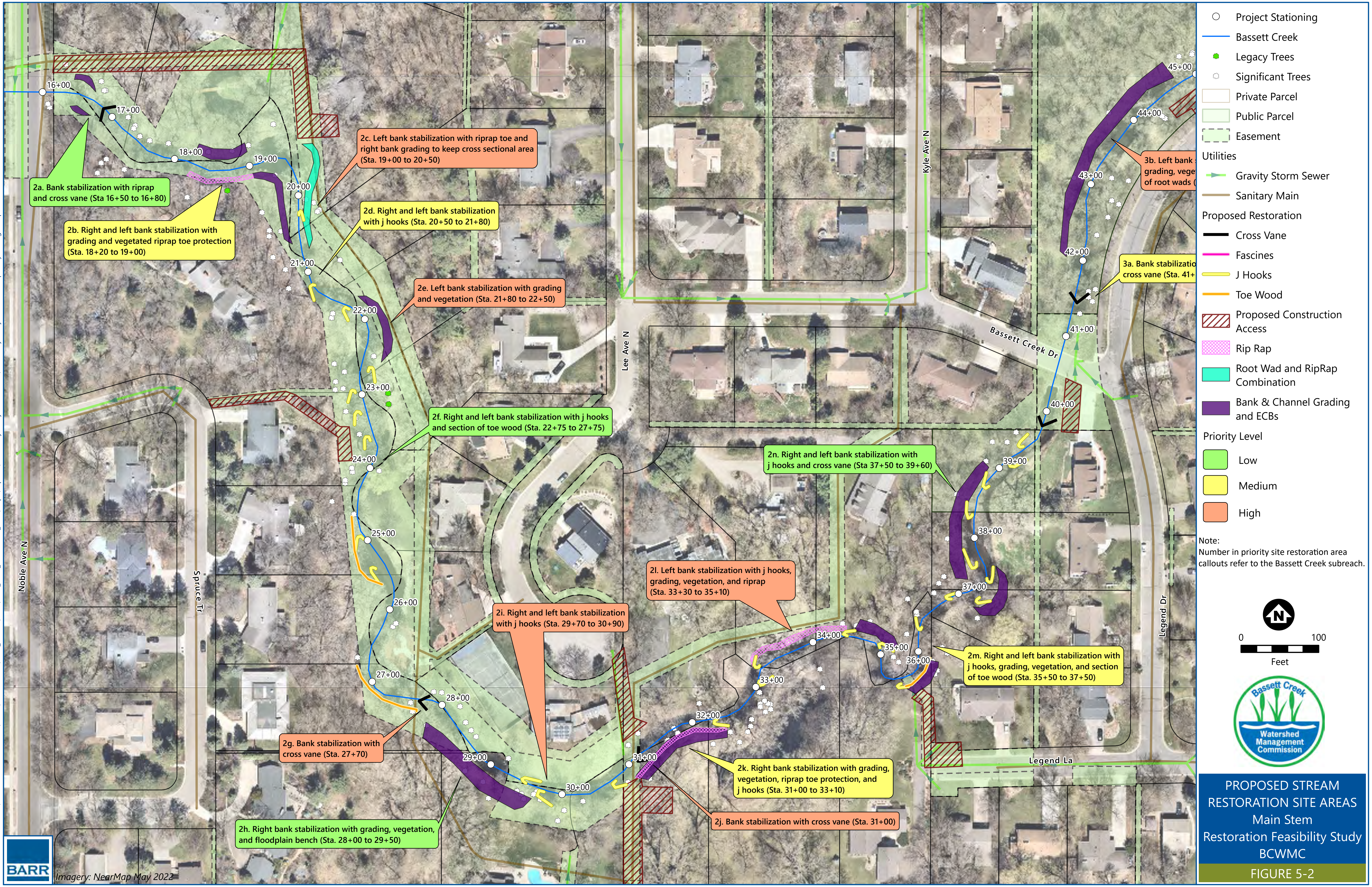
Utilizing feedback obtained from residents during the open house, the Commission Engineer developed a recommended restoration concept that incorporates elements of all three alternatives. Recommended restoration measures along the reach include in-stream structures, toe stabilization, bioengineering methods, bank grading, riprap, and vegetation establishment.

The recommended restoration concept includes 79 unique stabilization locations to address varying erosion concerns, including bank sloughing, toe erosion, streambank undercutting, tributary erosion, and scour associated with existing infrastructure. Each individual proposed stream repair reach varies from 50 to 300 feet in length. The individual proposed repair segments were grouped together into 40 restoration areas shown in Figure 5-1 through Figure 5-4. Restoration areas are made of multiple individual stream stabilization locations that are grouped together based on proximity and methods of stabilization. To better organize the various stream restoration areas, they are labeled based on one of four broader reaches:

- Reach 1 is from Regent Avenue North to Noble Avenue
- Reach 2 is from Noble Avenue to the intersection of Bassett Creek Drive and Legend Drive
- Reach 3 is from the intersection of Bassett Creek Drive and Legend Drive to stream station 56+00 (southeast of the intersection of Dresden Lane and Bassett Creek Drive)
- Reach 4 is from stream station 56+00 to Golden Valley Road. The recommended restoration concept would result in approximately 7,370 linear feet of bank stabilization, which includes approximately 3,395 feet of stabilization on the left bank (looking downstream) and 3,975 feet of stabilization on the right bank (looking downstream).

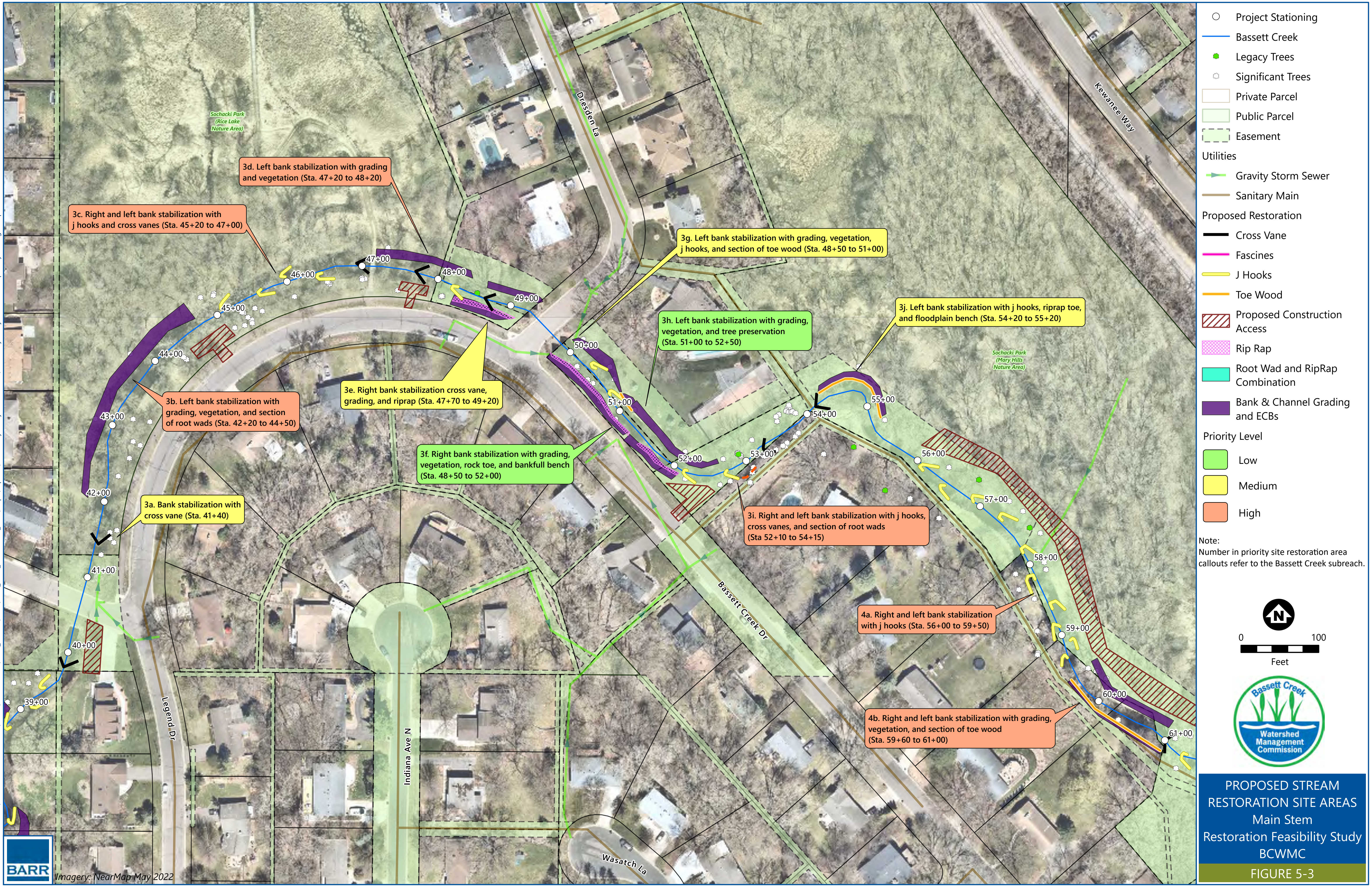


Barr Footer: ArcGISPro 3.1, 2023-04-13 09:09 File: I:\Client\BassettCreek\Work_Orders\2022\Main_Stem_Restoration_Feas\Maps\Reports\Feasability Study March 2023\Feasability Study March 2023.aprx Layout: Fig5 Proposed Stream Restoration Site Areas User: MRQ

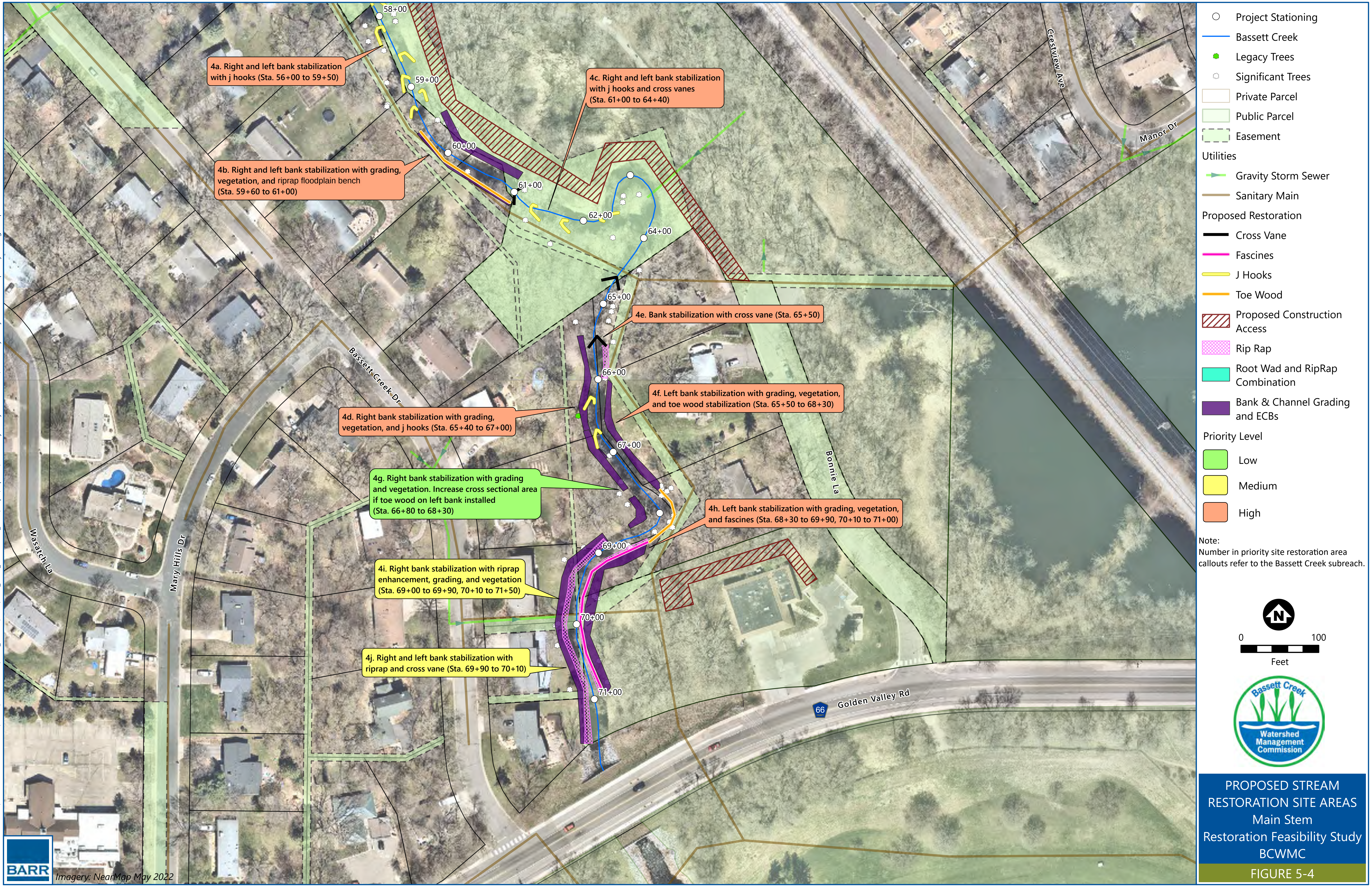


PROPOSED STREAM RESTORATION SITE AREAS
Main Stem
Restoration Feasibility Study
BCWMC
FIGURE 5-2

Barr Footer: ArcGISPro 3.1, 2023-04-13 09:09 File: I:\Client\BassettCreek\Work_Orders\2022\Main_Stem_Restoration_Feas\Maps\Reports\Feasability Study March 2023\Feasability Study March 2023.aprx Layout: Fig5 Proposed Stream Restoration Site Areas User: MRQ



Sochacki Park (Rice Lake Nature Area)
Sochacki Park (Mary Hills Nature Area)
Dresden La
Kewanee Way
Legend Dr
Indiana Ave N
Bassett Creek Dr
Wasatch La
39+00
40+00
41+00
42+00
43+00
44+00
45+00
46+00
47+00
48+00
49+00
50+00
51+00
52+00
53+00
54+00
55+00
56+00
57+00
58+00
59+00
60+00
61+00
3a. Bank stabilization with cross vane (Sta. 41+40)
3b. Left bank stabilization with grading, vegetation, and section of root wads (Sta. 42+20 to 44+50)
3c. Right and left bank stabilization with j hooks and cross vanes (Sta. 45+20 to 47+00)
3d. Left bank stabilization with grading and vegetation (Sta. 47+20 to 48+20)
3e. Right bank stabilization cross vane, grading, and riprap (Sta. 47+70 to 49+20)
3f. Right bank stabilization with grading, vegetation, rock toe, and bankfull bench (Sta. 48+50 to 52+00)
3g. Left bank stabilization with grading, vegetation, j hooks, and section of toe wood (Sta. 48+50 to 51+00)
3h. Left bank stabilization with grading, vegetation, and tree preservation (Sta. 51+00 to 52+50)
3i. Right and left bank stabilization with j hooks, cross vanes, and section of root wads (Sta 52+10 to 54+15)
3j. Left bank stabilization with j hooks, riprap toe, and floodplain bench (Sta. 54+20 to 55+20)
4a. Right and left bank stabilization with j hooks (Sta. 56+00 to 59+50)
4b. Right and left bank stabilization with grading, vegetation, and section of toe wood (Sta. 59+60 to 61+00)
Project Stationing
Bassett Creek
Legacy Trees
Significant Trees
Private Parcel
Public Parcel
Easement
Utilities
Gravity Storm Sewer
Sanitary Main
Proposed Restoration
Cross Vane
Fascines
J Hooks
Toe Wood
Proposed Construction Access
Rip Rap
Root Wad and RipRap Combination
Bank & Channel Grading and ECBs
Priority Level
Low
Medium
High
Note:
Number in priority site restoration area callouts refer to the Bassett Creek subreach.
N
0
100
Feet
Bassett Creek Watershed Management Commission
BARR
Imagery: NearMap May 2022
PROPOSED STREAM RESTORATION SITE AREAS
Main Stem
Restoration Feasibility Study
BCWMC
FIGURE 5-3



4a. Right and left bank stabilization with j hooks (Sta. 56+00 to 59+50)
4b. Right and left bank stabilization with grading, vegetation, and riprap floodplain bench (Sta. 59+60 to 61+00)
4c. Right and left bank stabilization with j hooks and cross vanes (Sta. 61+00 to 64+40)
4d. Right bank stabilization with grading, vegetation, and j hooks (Sta. 65+40 to 67+00)
4e. Bank stabilization with cross vane (Sta. 65+50)
4f. Left bank stabilization with grading, vegetation, and toe wood stabilization (Sta. 65+50 to 68+30)
4g. Right bank stabilization with grading and vegetation. Increase cross sectional area if toe wood on left bank installed (Sta. 66+80 to 68+30)
4h. Left bank stabilization with grading, vegetation, and fascines (Sta. 68+30 to 69+90, 70+10 to 71+00)
4i. Right bank stabilization with riprap enhancement, grading, and vegetation (Sta. 69+00 to 69+90, 70+10 to 71+50)
4j. Right and left bank stabilization with riprap and cross vane (Sta. 69+90 to 70+10)
58+00
59+00
60+00
61+00
62+00
64+00
65+00
66+00
67+00
69+00
70+00
71+00
Bassett Creek Dr
Mary Hills Dr
Wasatch La
Bonnie La
Crestview Ave
Manor Dr
Golden Valley Rd
66
Imagery: NearMap May 2022
BARR
Project Stationing
Bassett Creek
Legacy Trees
Significant Trees
Private Parcel
Public Parcel
Easement
Utilities
Gravity Storm Sewer
Sanitary Main
Proposed Restoration
Cross Vane
Fascines
J Hooks
Toe Wood
Proposed Construction Access
Rip Rap
Root Wad and RipRap Combination
Bank & Channel Grading and ECBs
Priority Level
Low
Medium
High
Note:
Number in priority site restoration area callouts refer to the Bassett Creek subreach.
N
0
100
Feet
Bassett Creek Watershed Management Commission
PROPOSED STREAM RESTORATION SITE AREAS
Main Stem Restoration Feasibility Study
BCWMC
FIGURE 5-4

Due to the extensive length of recommended stabilization measures, the Commission Engineer assigned a numeric score for the various restoration locations based on the prioritization metrics noted below. The metrics are a combination of elements provided by Golden Valley staff and further developed by the Commission Engineer. Table 5-3 provides a summary of the scoring system used for this feasibility analysis.

Table 5-3 Scoring Methodology for Stream Restoration Areas

Golden Valley Prioritization Metric	Weight for Scoring
Severity of existing erosion	Varied based on Bank Erosion Hazard Index (BEHI) score. Moderate=1, High=2, Very high= 3
Public ownership/easement	2 points if construction occurs on public land, public easement, and/or platted easement
Protection of existing structures/infrastructure (within 25 feet of streambank)	15 points if protecting sanitary sewer structures and 5 points if protecting other infrastructure or structures (storm sewer and other utilities, streets, trails, bridges, driveways)
Impact on surrounding areas	1 point if the site requires minimal to no channel or bank grading
Potential for future erosion	Varied, based on summing BEHI and NBS values as described below. Moderate BEHI=1, High BEHI=2, Very high BEHI= 3, Very low NBS=1, Low NBS=2, Moderate NBS=3, High NBS= 4, Very high NBS=5
Opportunity for habitat creation or restoration	1 point if upland or stream habitat creation, based on stream restoration technique
Maintaining healthy trees, native significant trees	1 point if protecting significant trees
Vegetation establishment	1 point if vegetation establishment is part of stream restoration
Ease of construction access	2 points if construction access can be primarily through public property and/or easements and feasible based on site conditions (i.e., no overly steep slopes, extensive tree removal, etc.)
Consider proximity/possibility for other improvements	1 point if near flood control project inspection areas

Specific details related to the exact locations of restoration and prioritization rankings are presented in Appendix D. Using the scoring criteria described above, each restoration area was given a ranking value of low, medium, or high based on the average score of the individual stream reaches within each restoration area. The rankings were typically determined as follows:

- Low: Average score below 12
- Medium: Average score between 12 and 15.9
- High: Average score of 16 and above

After the scores and rankings were determined, engineering judgment and City input were used to manually adjust rankings. As a result of scoring and prioritization, the recommended restoration concept includes 20 high, 12 medium, and 8 low-priority restoration areas. If funding is available, the Commission Engineer recommends restoring all identified erosion areas. However, if costs for completing all of the restoration areas are prohibitive, the Commission Engineer recommends restoring areas based on their priority ranking. Estimated construction costs are presented in Section 7.1. Table 5-4 summarizes the restoration areas and proposed stabilization measures, the priority rankings for each restoration area, and the photo numbers for each restoration area (photos are in Appendix A).

Table 5-4 Proposed Restoration Areas (areas shown in Figure 5-1 through Figure 5-4)

Restoration Areas and Proposed Stabilization Measures	Priority	Photo numbers[1]
1a. Right bank and left bank stabilization with j hooks (Sta. 0+00 to 2+50)	Low	1, 2
1b. Right bank stabilization with grading, vegetated riprap toe, and j hooks (Sta. 2+40 to 5+20)	Medium	3
1c. Right bank stabilization with toe wood, j hooks, and fascines (Sta. 5+20 to 9+25)	High	4
1d. Right and left bank stabilization with toe wood and j hooks (Sta. 7+75 to 10+20)	High	5, 6
1e. Left bank stabilization with grading, vegetation, and section of toe wood (Sta. 12+20 to 14+00)	High	7, 8
1f. Right bank stabilization with grading, vegetation, and j hooks (Sta. 12+30 to 14+90)	Medium	9
2a. Bank stabilization with riprap and cross vane (16-50 to 16+80)	Low	10
2b. Right and left bank stabilization with grading and vegetated riprap toe protection (Sta. 18+20 to 19+00)	Medium	11
2c. Left bank stabilization with riprap toe and right bank grading to keep cross-sectional area (Sta. 19+00 to 20+50)	High	12, 13
2d. Right and left bank stabilization with j hooks (Sta. 20+50 to 21+80)	Medium	14, 15
2e. Left bank stabilization with grading and vegetation (Sta. 21+80 to 22+50)	High	16
2f. Right and left bank stabilization with j hooks and section of toe wood (Sta. 22+75 to 27+75)	Low	17, 18
2g. Bank stabilization with cross vane (Sta. 27+70)	High	19
2h. Right bank stabilization with grading, vegetation, and floodplain bench (Sta. 28+00 to 29+50)	Low	20
2i. Right and left bank stabilization with j hooks (Sta. 29+70 to 30+90)	High	21, 22
2j. Bank stabilization with cross vane (Sta. 31+00)	High	23
2k. Right bank stabilization with grading, vegetation, riprap toe protection, and j hooks (Sta. 31+00 to 33+10)	Medium	24

Restoration Areas and Proposed Stabilization Measures	Priority	Photo numbers[1]
2l. Left bank stabilization with j hooks, grading, vegetation, and riprap (Sta. 33+30 to 35+10)	High	25
2m. Right and left bank stabilization with j hooks, grading, vegetation, and section of toe wood (Sta. 35+50 to 37+50)	Medium	26, 27
2n. Right and left bank stabilization with j hooks and cross vane (Sta 37+50 to 39+60)	Low	28, 29
3a. Bank stabilization with cross vane (Sta. 41+40)	Medium	
3b. Left bank stabilization with grading, vegetation, and section of root wads (Sta. 42+20 to 44+50)	High	30
3c. Right and left bank stabilization with j hooks and cross vanes (Sta. 45+20 to 47+00)	High	31
3d. Left bank stabilization with grading and vegetation (Sta. 47+20 to 48+20)	High	32
3e. Bank stabilization with cross vanes (Sta. 47+70 to 48+70)	Medium	33
3f. Right bank stabilization with grading, vegetation, rock toe, and bankfull bench (Sta. 48+50 to 52+00)	Low	34
3g. Left bank stabilization with grading, vegetation, j hooks, and section of toe wood (Sta. 48+50 to 51+00)	Medium	35
3h. Left bank stabilization with grading, vegetation, and tree preservation (Sta. 51+00 to 52+50)	Low	36
3i. Right and left bank stabilization with j hooks, cross vanes, and section of root wads (Sta 52+10 to 54+15)	High	37, 38, 39
3j. Left bank stabilization with j hooks, riprap toe, and floodplain bench (Sta. 54+20 to 55+20)	Medium	40
4a. Right and left bank stabilization with j hooks (Sta. 56+00 to 59+50)	High	41
4b. Right and left bank stabilization with grading, vegetation, and section of toe wood (Sta. 59+60 to 61+00)	High	42
4c. Right and left bank stabilization with j hooks and cross vanes (Sta. 61+00 to 64+40)	High	43
4d. Right bank stabilization with grading, vegetation, and j hooks (Sta. 65+40 to 67+00)	High	44
4e. Bank stabilization with cross vane (Sta. 65+50)	High	45
4f. Left bank stabilization with grading, vegetation, and toe wood stabilization (Sta. 65+50 to 68+30)	High	46, 47
4g. Right bank stabilization with grading and vegetation. Increase cross-sectional area if toe wood on left bank installed (Sta. 66+80 to 68+30)	Low	48
4h. Left bank stabilization with grading, vegetation, and fascines (Sta. 68+30 to 69+90, 70+10 to 71+00)	High	49, 50

Restoration Areas and Proposed Stabilization Measures	Priority	Photo numbers[1]
4i. Right bank stabilization with riprap enhancement, grading, and vegetation (Sta. 69+00 to 69+90, 70+10 to 71+50)	Medium	51
4j. Right and left bank stabilization with riprap and cross vane (Sta. 69+90 to 70+10)	Medium	

1. Photos are located in Appendix A
2. Right and left bank refer to looking downstream

Using the summary above, three options were developed. The first option is completing stream restoration solely in areas that ranked high, the second option is completing stream restoration in high and medium-ranked areas, and the third option is completing stream restoration in all 40 ranked areas.

6 Project Modeling Results and Potential Impacts

This section discusses the results of the hydrologic, hydraulic, and water quality modeling and provides information on potential project impacts, including permitting requirements.

6.1 Hydrologic, Hydraulic, and Water Quality Modeling

Hydrologic and hydraulic information is available for the approximately 7,000-foot reach. For this analysis, the Commission Engineer utilized the BCWMC 2021 XP-SWMM model, which is the most current version of the jurisdictional model. We used the model to evaluate the Atlas 14, 2-, 10-year, and 100-year, 24-hour design storm events to estimate flood elevations, flows, and velocities. In addition to reviewing the hydrologic and hydraulic model results for the project area, we completed an analysis to estimate potential pollutant reductions for the proposed three options.

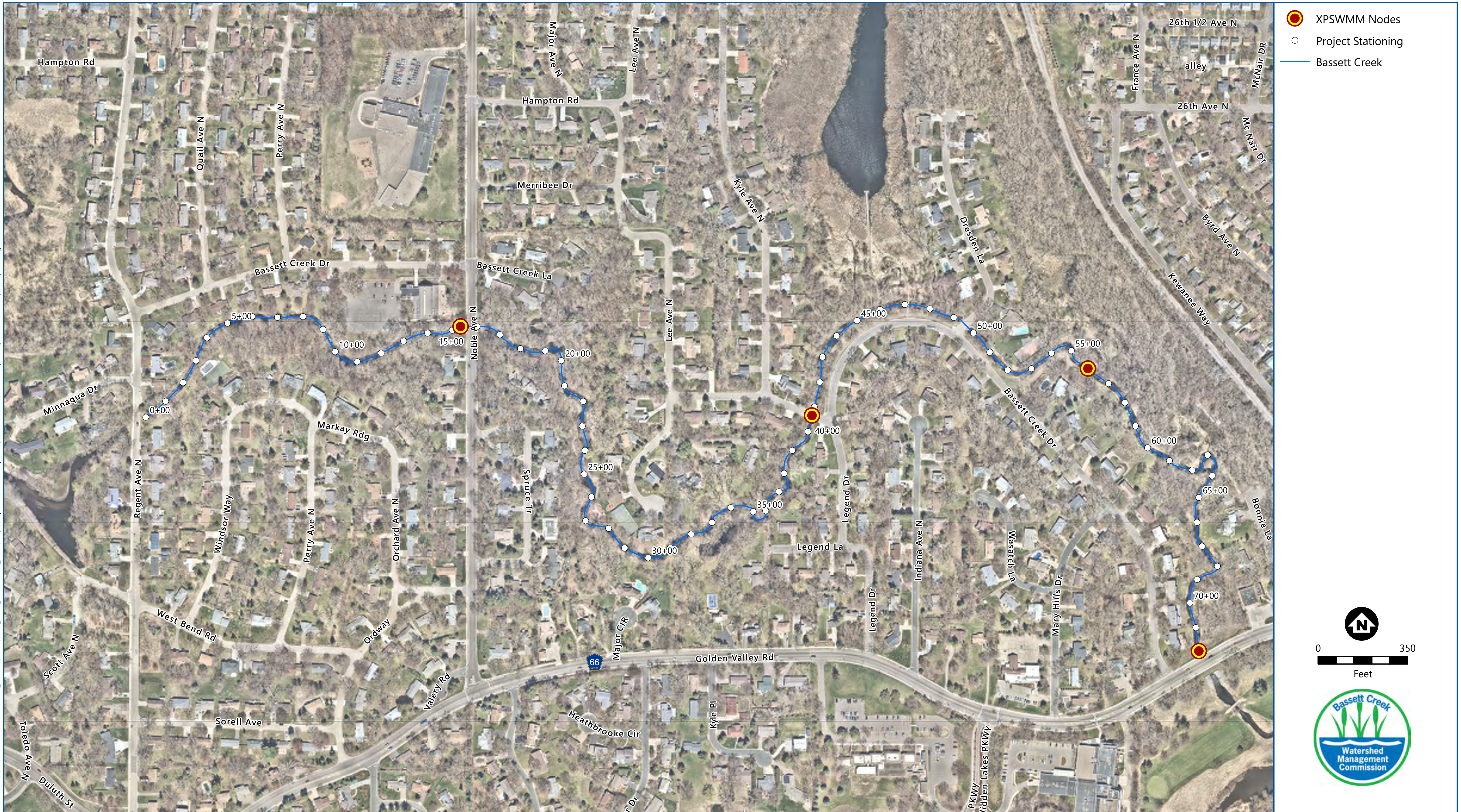
6.1.1 BCWMC XPSWMM Model Review

The Commission Engineer reviewed the XPSWMM model to understand the peak flow rates, velocities, elevations, and total drainage area throughout the project area. A summary of the model results is provided for the downstream-most point of the four project reaches described in Section 5.2 (Table 6-1, Figure 6-1).

Table 6-1 Summary of BCWMC XPSWMM Model for Project Area

Stream Location	Peak Flow Rates (cubic ft/second)	Peak Velocity (ft/second)	Peak Water Surface Elevation	Drainage Area (acres)
Noble Avenue	2-yr: 386 10-yr: 627 100-yr: 1334	2-yr: -2.6 10-yr: 3.7 100-yr: -6.1	2-yr: 836.6 10-yr: 837.5 100-yr: 840	19,698
Intersection of Bassett Creek Drive and Legend Drive	2-yr: 385 10-yr: 623 100-yr: 1329	2-yr: 4.0 10-yr: 5.6 100-yr: 10.6	2-yr: 831.2 10-yr: 833.0 100-yr: 837.0	19,747
Station 56+00, near Sochacki Park	2-yr: 387 10-yr: 654 100-yr: 1344	2-yr: 2.5 10-yr: 2.4 100-yr: 2.3	2-yr: 828.9 10-yr: 829.8 100-yr: 833.9	20,240
Golden Valley Road	2-yr: 387 10-yr: 661 100-yr: 1361	2-yr: -2.2 10-yr: -2.2 100-yr: -2.1	2-yr: 827.3 10-yr: 828.9 100-yr: 833.7	20,399

Final design efforts will require additional refinements to the XP-SWMM modeling and a review of the final design water surface profile to ensure the project does not impact adjacent property and does not increase flood elevations. Similarly, the stability thresholds for the proposed features should be reviewed to ensure the final design will be stable. The constructed improvements should be incorporated into the next update of the BCWMC XP-SWMM model after project completion.



REVIEWED XPSWMM MODEL LOCATIONS
Main Stem
Restoration Feasibility Study
BCWMC

FIGURE 6-1

6.1.2 Anticipated Pollutant Removals

The Commission Engineer estimated the pollutant (total phosphorus (TP) and total suspended solids (TSS)) removals that would result from the proposed Bassett Creek Main Stem Restoration Project using approaches developed by Rosgen et al. (3) and Minnesota Board of Water and Soil Resources (BWSR) (9).

The proposed stabilization measures will result in reduced stream bank erosion and, therefore, reduced sediment and phosphorus loading to the Main Stem of Bassett Creek and all downstream water bodies, including the Mississippi River and Lake Pepin. The existing stream bank erosion rate (in units of feet per year) for each stabilization location was estimated based on a field assessment method known as the Bank Assessment for Non-Point Source Consequences of Sediment (BANCS) model (3)**.**

The BANCS model uses two erosion-estimation tools to develop risk ratings: BEHI and NBS. The BEHI rating evaluates the susceptibility of a segment of stream bank to erosion as a result of multiple processes: surface erosion, fluvial entrainment (movement of material that becomes suspended in the channel during high flows), and mass erosion (wasting). The NBS rating characterizes the energy distribution against a segment of stream bank; disproportionate energy distribution in the near-bank region can accelerate bank erosion. The BEHI and NBS estimation tools are applied in a field assessment for each segment of stream bank potentially contributing sediment to the stream channel. The Commission Engineer performed BEHI assessments for multiple segments of the Main Stem project area during site visits in October 2022 and completed NBS ratings using aerial imagery from Google Earth dated 2022.

The field-determined BEHI and NBS ratings for the Main Stem project area are shown in Figure 2-1 and in tabular form in Appendix E. Approximately 42% of the eroding right banks (looking downstream) are in the moderate BEHI category, 56% are in the high BEHI category, and 1% are in the very high BEHI category. Approximately 46% of the left eroding banks (looking downstream) are in the moderate BEHI category, and 54% are in the high BEHI category. The majority of the right and left banks are either a very low or low NBS category, with four reaches rated higher than a low NBS category.

To convert BEHI and NBS ratings into a stream bank erosion rate estimate, the BANCS model relies on measured bank erosion data to develop relationships applicable to various hydrologic and geologic conditions. No such relationship is currently available for Minnesota; this feasibility study uses relationships developed from data collected in sedimentary and metamorphic geologic regions in North Carolina (Figure 5-34 of (3)). Appendix E shows the estimated bank erosion rate for each stabilization location; estimated erosion rates range from 0.008 to 0. 7 feet per year.

The estimated total sediment load from bank erosion is calculated using the approximate dimensions of the eroding stream banks at each restoration area. The effects of stabilization options on water quality are estimated based on the assumption that each stabilization measure successfully addresses erosion at the site and brings erosion to a low rate, representative of a stable stream in this geologic setting. For this analysis, we assumed a stable low erosion rate means there would be no change in NBS, and the BEHI erosion would be improved to half of the erosion rate of a moderate BEHI score. Appendix E shows the resulting estimated sediment load reduction for all proposed restoration areas. We calculated the corresponding reduction of TSS and TP loads using an estimation tool developed by BWSR (9). The BWSR tool assumes that all eroded sediment becomes TSS, which is conservative because eroded sand and gravel are typically not suspended but transported as bedload. The BWSR tool also assumes that the TP load is equivalent to 1.0 pound of TP per ton of eroded sediment.

The total reduction in pollutant loading resulting from stabilization depends on the total linear feet of channel selected for stabilization. Table 6-2 summarizes the pollutant loading reductions based on the approximate length of restoration.

Table 6-2 Pollutant Reduction by Proposed Option

Restoration Length, by Option	Total Suspended Solids Reduction (lb/yr)	Total Phosphorus Reduction (lb/yr)
Option 1: 3,830 linear feet[1] – High priority areas only	83,524	41.8
Option 2: 5,425 linear feet[1] – High and medium priority areas	132,205	64.8
Option 3: 7,370 linear feet[1] – High, medium, and low priority areas	164,820	82.4

1. Linear feet = sum of right and left bank that is repaired

6.2 Easement Acquisition

In general, most of the project reach is adjacent to easements or City of Golden Valley property that can be used for construction access. However, there is limited access available between Noble Avenue and Bassett Creek Drive (Reach 2). Therefore, coordination with residents is required for construction access and temporary construction easement acquisition in this reach.

6.3 Permits Required for Project

The proposed project is expected to require the following permits/approvals, regardless of the selected concept:

- Clean Water Act Section 404 and Section 401 Water Quality Certification
- Construction Stormwater General Permit from the MPCA
- Compliance with the Minnesota Wetland Conservation Act
- Environmental Assessment Worksheet (potentially required, see paragraph 6.3.4 for more detail)
- Public Waters Work Permit from the MnDNR
- Stormwater Management Permit from the City of Golden Valley
- Right-of-Way Management Permit from the City of Golden Valley

6.3.1 Section 404 Permit

The USACE regulates the placement of fill into wetlands if they are hydrologically connected to a Water of the United States in accordance with Section 404 of the Clean Water Act (CWA). In addition, the USACE may regulate all proposed wetland alterations if any wetland fill is proposed. The MPCA may be involved in wetland mitigation requirements as part of the CWA Section 401 water quality certification process for the 404 Permit.

The BCWMC developed its Resource Management Plan (RMP) with the goal of completing a conceptual-level USACE permitting process for proposed projects. The RMP was submitted to the USACE in April 2009 and revised in July 2009. This feasibility study follows the protocols for projects within the BCWMC RMP.

The USACE 404 permit requires a Section 106 review for historic and cultural resources. The results of the archeological reconnaissance study are included in Section 3.0. If the State Historic Preservation Office (SHPO) requests more detailed information, a Phase I Archaeological Survey may need to be completed. A Phase I Archaeological Survey can be completed in 45 days or less during a frost-free period. The USACE staff anticipates that the 404 permit review and approval process could require 120 days to complete. These projects may fit under the USACE Nationwide Permit 13 for bank stabilization or Nationwide Permit 27 for restoration, or a Regional General Permit. Verification of the USACE Nationwide Permit requirements and comparison to the proposed project features/impacts will be necessary during the project design phase to determine which permit is most applicable. Coordination with the USACE will help to confirm specific requirements related to the project.

6.3.2 Minnesota Pollution Control Agency (MPCA) Permits

Construction of the proposed project will require a National Pollutant Discharge Elimination System/State Disposal System Construction Stormwater (CSW) General Permit issued by the MPCA. The CSW permit will require the preparation of a SWPPP that explains how stormwater will be controlled within the project area during construction.

Based on the findings of the desktop review of the MPCA's "What's In My Neighborhood?" database (see Section 3.6), it is not anticipated that environmental impacts such as contaminated soil and debris will be encountered during stream restoration activities; therefore, it is not anticipated that the project will require minimization measures for disposing of contaminated soil. In the unlikely event that environmental impacts are encountered during the creek restoration earthwork, contaminated materials will need to be handled and managed appropriately. The response to the discovery of contamination typically includes entering the MPCA's voluntary program. A construction contingency plan could be prepared for the project in accordance with MPCA guidance. This would include specifying Initial procedures for handling potentially impacted materials, collecting analytical samples, and working with the MPCA to determine a method for managing impacted materials.

6.3.3 Minnesota Wetland Conservation Act

The Minnesota Wetland Conservation Act (WCA) regulates the filling and draining of wetlands and excavation within Type 3, 4, and 5 wetlands—and may regulate any other wetland type if fill is proposed. The WCA is administered by local government units (LGUs), which include cities, counties, watershed management organizations, soil and water conservation districts, and townships. The City of Golden Valley is the LGU for the entire project area. The Minnesota Board of Water and Soil Resources (BWSR) oversees administration of the WCA statewide.

As described in Minnesota rules 8420, the WCA is applicable to the types of wetland impacts that could be a part of this project, and a permit related to wetland impacts may be required; however, the LGU will have the final determination.

6.3.4 Environmental Assessment Worksheet

The Minnesota Environmental Policy Act of 1973 (MEPA) established the Environmental Quality Board (EQB), which oversees the formal environmental review process for the state of Minnesota. An Environmental Assessment Worksheet (EAW) is a screening tool used to determine whether a full environmental impact statement is needed. Minnesota Rules 4410.4300 (Mandatory EAW Categories) identifies triggers that would require a project proposer to prepare an EAW. Minnesota Rules 4410.4300 Subp. 27A requires an EAW for projects that will change or diminish the course, current, or cross-section of one acre or more of any public water or public waters wetland. For this mandatory EAW category, the responsible government unit (RGU) would be the MnDNR or the LGU for the project. Since the project is primarily a stream restoration project, the MnDNR may be able to waive the requirement for an EAW. Further coordination with the MnDNR would be needed to determine if an EAW would be required before issuing a Public Waters Work Permit.

6.3.5 Public Waters Work Permit

The MnDNR regulates projects constructed below the ordinary high water level of public waters, watercourses, or wetlands, which alter the course, current, or cross-section of the water body. Public waters regulated by the MnDNR are identified on published PWI maps. Bassett Creek is a public watercourse, so the proposed work may require an MnDNR public waters work permit.

6.3.6 City of Golden Valley Permits

The City of Golden Valley requires Stormwater Management Permits for land-disturbing activities that remove soils or vegetation, including but not limited to clearing, digging, dredging, draining, or filling. This permit is also required for projects within floodplains or adjacent to water bodies. The City of Golden Valley will require a Stormwater Management Permit for the proposed project.

In addition, the City of Golden Valley requires a Right-of-Way (ROW) permit for excavations and obstructions within the public right-of-way, streets, easements, and parks. The City of Golden Valley requires a ROW permit for the proposed project.

6.4 Other Project Impacts

6.4.1 Tree Loss

The estimated tree removals resulting from the implementation of the proposed project depend on the proposed restoration length (i.e., which design option is selected). Appendix F includes a summary of the estimated healthy tree removal by species. Tree removal estimates for each estimate are:

- Option 1: 37 trees
- Option 2: 62 trees

- Option 3: 82 trees

The number of trees removed could be reduced by protecting trees during construction.

6.4.2 Water Quality Impacts

The proposed stabilization measures will result in a reduction of the sediment and phosphorus loading to Bassett Creek and all downstream water bodies, including the Mississippi River and Lake Pepin. We estimated total suspended sediment and total phosphorus loadings prior to and after stabilization using BEHI and NBS ratings from the field, described in further detail in Section 6.1.2

6.4.3 Utility Considerations

One of the important considerations for implementing this stream restoration project is the stream's proximity to infrastructure, such as sanitary and storm sewer lines. Throughout the 7,000-foot reach, sanitary lines are present, crossing the creek channel and running along creek banks. If the sanitary line were to break, there is the potential for a release of sewage into the creek, which would drastically decrease the creek's water quality.

7 Project Cost Considerations

7.1 Opinion of Cost

The cost estimate is a Class 4 feasibility-level cost estimate as defined by the American Association of Cost Engineers International (AACE International) and uses the assumptions listed below and detailed in the following sections.

- The cost estimate assumes a 20% construction contingency.
- Costs associated with design, permitting, and construction observation (collectively "engineering") are assumed to be 30% of the estimated construction costs (excluding contingency).
- Construction easements may be necessary to construct the project; however, the costs were not estimated as part of this study
- Additional work may be required to determine if cultural and/or historical resources are present at any project site.

The Class 4 level cost estimates have an acceptable range of between -15% to -30% on the low range and +20% to +50% on the high range (10). Based on the development of concepts and initial vetting of the concepts by the City of Golden Valley, BCWMC, and MnDNR, it is not necessary to utilize the full range of the acceptable range for the cost estimate. We assume the final costs of construction may range between -15% and +30% of the estimated construction budget. The assumed contingency for the project (20%) incorporates the potential high end of the cost estimate range.

Table 7-1 summarizes the feasibility-level total construction cost estimates, the 30-year annualized total construction cost estimates, and the annualized costs per pound of TSS and TP removed for the Main Stem Restoration Project. Table 7-1 presents the cost for each of the prioritized preferred options described in Section 5.2. Appendix G provides detailed cost-estimate tables for all options.

Table 7-1 Bassett Creek Main Stem Stream Restoration Project Options Cost Summary

Option Description	Project Cost Estimate(1,4)	Annualized Cost(2)	TP Loading		TSS Loading	
			Load Reduction (lb/yr)	Cost/lb/yr Reduced(3)	Load Reduction (lb/yr)	Cost/lb/yr Reduced(3)
Option 1. High-ranked restoration areas	$982,000 ($835,000–$1,277,000)	$62,000	41.8	$1,483	83,534	$0.74
Option 2. High- and medium-ranked restoration areas	$1,685,000 ($1,433,000–$2,191,000)	$108,000	64.8	$1667	132,205	$0.82
Option 3. All proposed restoration areas	$2,118,000 ($1,801,000–$2,754,000)	$136,000	82.4	$1,650	163,820	$0.83

(1) A Class 4 screening-level opinion of probable cost, as defined by the American Association of Cost Engineers International (AACE International), has been prepared for these options. The opinion of probable construction cost provided in this table is based on the Commission Engineer's experience and qualifications and represents our best judgment as experienced and qualified professionals familiar with the project. The cost opinion is based on project-related information available to the Commission Engineer at this time and includes a conceptual-level design of the project. It includes 20% project contingency and 30% for planning, engineering, design, and construction administration. The lower bound is assumed at -15%, and the upper bound is assumed at +30%.
(2) Assumed to be 15% of the total project cost for annual maintenance, plus replacement cost associated with major repairs and the initial project cost distributed evenly over a 30-year project lifespan.
(3) Annualized cost divided by estimated annual pollution load reduction.
(4) Costs do not include easements or construction access routes

7.2 Funding Sources

The BCWMC will utilize the BCWMC CIP funds to implement these projects. The source of these funds is an ad valorem tax levied by Hennepin County over the entire Bassett Creek watershed on behalf of the BCWMC. In addition to BCWMC CIP funds, Golden Valley plans to contribute channel maintenance funds ($200,000) and capital improvement funds ($100,000) toward project implementation.

7.3 Project Schedule

The BCWMC will hold a public hearing in September 2023 on this project. Pending the outcome of the hearing, the BCWMC will consider officially ordering the project, entering into an agreement with the City of Golden Valley to design and construct the project, and certifying to Hennepin County a final 2024 tax levy for this project.

The construction work would likely begin in winter 2024/2025, as tree removal should occur in the period from October 15 to early April, outside of the northern long-eared bat's active season (mid-April – October 14). Additionally, excavation during the winter would be appropriate to complete the major earthwork during periods with less frequent runoff events. Final construction and restoration will be completed in the spring/summer of 2025.

For project construction to occur in the winter of 2024/2025, project design should begin in the winter of 2023/2024 or spring of 2024. If project construction is scheduled for winter 2024/2025, summer 2024 bidding is recommended. This will give contractors adequate scheduling time to complete the project at a reasonable price. In the intervening time, the City would gather public input, prepare the final design, and obtain permits.

8 Recommended Option

The Commission Engineer and City recommend implementing option 1 with the level of funding that is currently available and option 2 or 3 – completing restoration in all high, medium, and low priority areas if additional funding is obtained through the CIP or grants. All three options propose using a combination of stream stabilization methods discussed in Section 5.2. The three options for restoration are based on a low, medium, and high prioritization ranking of restoration areas. The highest priority areas are included in the first option, the medium and high are included in the second, and all of the areas are included in the third. Restoration areas were prioritized based on criteria provided by the City of Golden Valley and additional criteria from the Commission Engineer (see Section 5.2). All three options would effectively stabilize eroding banks, preserve the natural beauty of Bassett Creek, contribute to habitat improvements, reduce the chance of potential future erosion, and protect existing infrastructure. If funding is available, the Commission Engineer and City recommend implementing option 2 or 3 for several reasons, including: economies of scale (larger projects can result in lower unit costs), efficiencies related to working with a single contractor for all site work, practicality of limiting site disturbance to a single project timeline, simplified permitting for a single project rather than multiple projects, and addressing all erosion that has been identified in the reach at the same time.

Section 7.1 summarizes the costs of the three prioritized recommended concepts. Option 3 comes at a higher cost than other options. Therefore, if funding is not available and a lower-cost project is desired, we recommend implementing (at a minimum) option 1—completing high-priority areas—and completing medium- to low-ranked areas as budget allows.

9 References

1. **Bassett Creek Watershed Management Commission.** 2015 Watershed Management Plan. September 2015.

2. —. Resource Management Plan for Basset Creek Watershed Management Commission Proposed Water Quality Improvement Projects 2010 - 2016. 2009.

3. **Rosgen, D.L.** *Watershed Assessment of River Stability and Sediment Supply (WARSSS).* Fort Collins, CO : Wildland Hydrology Books, 2006.

4. **United States of Agriculture and Natural Resources Conservation Service.** Web Soil Survey. *Web Soil Survey.* [Online] https://websoilsurvey.nrcs.usda.gov/app/.

5. **U.S. Fish and Wildlife Service.** *Information for Planning and Consultation.* [Online] https://ipac.ecosphere.fws.gov/.

6. **Minnesota Department of Natural Resources.** Rare Species Guide- Myotis Septentrionalis. [Online] https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01150.

7. —. Environmental Review Fact Sheet Series- Blanding's Turtle. [Online] https://files.dnr.state.mn.us/natural_resources/animals/reptiles_amphibians/turtles/blandings_turtle/factsheet.pdf.

8. **City of Golden Valley.** *Golden Valley Code of Ordinances.* Code 1988, § 4.32(2).

9. **Minnesota Board of Water and Soil Resources (MN BWSR).** Pollution Reduction Estimator - Water Erosion - Excel Version. [http://www.bwsr.state.mn.us/elinkupdate/Pollution_Reduction_Calculator_Manual.pdf]. 2010.

10. **Peter Christensen, CCE and Larry R Dysert, CCC.** *Cost Estimate Classification System.* s.l. : AACE, Inc, 2005. AACE International Recommended Practices. No. 18R-97.