CITY OF MISSOULA

2018 | Storm Water Facility and Operations Plan Project

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EXECUTIVE SUMMARY

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Executive Summary

The City of Missoula Storm Water Facility and Operations Plan Project provides guidance for the newly formed Storm Water Utility, created in September 2016. It presents an evaluation of the existing and future staffing needs of the Utility, a Utility operations and management plan, and a preliminary capital improvements plan. The information and costs presented in this report will assist the City in planning for operational and organizational needs of the Utility and help establish near term infrastructure improvement priorities.

The primary objectives of the Plan included:

1. Gathering and analyzing background data related to storm water and identifying existing codes and rules related to the Storm Water Utility;
2. Evaluating the City's storm water management practices for the purpose of making recommendations for Storm Water Utility staffing and equipment;
3. Assessing existing levee system operations and maintenance practices with the goal of maintaining regulatory compliance of the levees; and
4. Identifying known capital improvement needs.

This report focuses on a near term priorities plan for operational needs of the Storm Water Utility and capital infrastructure improvements to the storm water system over a five year period from Fiscal Year 2019 through Fiscal Year 2023. Recommendations pertaining to operations and management of the Utility presented in this report were developed based on this five year schedule. .

The Storm Water Facility and Operations Plan Project report is organized into four chapters corresponding to the objectives summarized above. The following summary is presented in four sections consistent with the four chapters of this report.

1. Existing Background Information

The City of Missoula Storm Water Facility and Operations Plan Project commenced with gathering background information pertaining to the City's storm water infrastructure and Utility. Efforts included collecting documentation related to the Utility and performing a preliminary and cursory condition assessment of the infrastructure by visiting potential project sites identified by the City.

Chapter 1 summarizes the existing information which includes standard drawings, municipal codes, subdivision regulations, planning data, floodplain mapping and reports, operational costs, Geographical Information System mapping data, and U. S. Army Corps of Engineers levee inspection reports.

The City of Missoula's Storm Water System consists of sumps, inlets, gravity storm drain lines, natural drainages, detention facilities, and outfalls. The Storm Water System is predominantly composed of infiltration sumps, also referred to as drywells. Field visits to the seven selected sites indicated that maintenance is the primary need due to the City's limited capability given current lack of staffing and budget. Natural drainages and culverts are plugged, infrastructure is lacking, and in some areas existing infrastructure is displaying signs of failure requiring improvements and repairs. Detailed survey, modeling, and further study are required for preliminary design of the appropriate improvements.

2. Development of Storm Water Utility Management Recommendations

A primary objective of this report is to provide recommendations for full staffing levels, equipment needs, standard operating procedures, and anticipated costs for the operation and management of the Storm Water Utility. Recommendations are based on the City of Missoula's goal towards a sustainable operation of the Storm Water Utility. Chapter 2 presents a review of administrative and maintenance needs of the Utility over the five year planning period and offers budgetary guidance on specific program staffing and equipment to meet those needs.

Based on the identified requirements to operate and maintain the City's storm water infrastructure, the analysis concluded that the Storm Water Utility could support nine positions, with two of those positions shared (denoted by an asterisk*) with Public Works Utilities. Table 2.2.1 provides a summary of the staffing recommendations.

Table 2.2.1- Staffing Assessment

Position Title	No. of Positions	Responsibility
Utility Superintendent	1.0	Reports to Public Works Director. Has overall responsibility for the Storm Water Utility including planning, management of staff, budget development and management, asset management, and compliance with permits and regulations.
Administrative Assistant	1.0	Assists with the daily operation of the Storm Water Utility by providing general administrative and clerical support.
Regulatory Compliance Specialist	1.0	Responsible for the monitoring, execution, and documentation associated with the 6 minimum control measures required by the MS4 Permit, levee inspections, high hazard dam inspections, and any other storm water regulatory compliance requirements.
GIS Technician *	0.5	Responsible for management and analysis of GIS data and preparation of mapping and exhibits.
Utility Billing Clerk *	0.3	Responsible for utility billing.
Field Maintenance Technician	4.0	Responsible for the inspection, operation and maintenance of the City's storm water system, levees, detention basins, and roadside ditches.

A detailed description of each position, operation and maintenance tasks associated with each position, assumptions used to develop operating costs associated with those tasks, and the timing of adding staff over the five year period are presented in Chapter 2. The Operations and Maintenance Budget developed from this analysis is included in Table 2.2.2 in Chapter 2 and presents the budget for each fiscal year through 2023 by the following categories:

- Utility management, administration and permit compliance;
- Storm water system operations; and
- Levee system operation and maintenance.

Summaries of the recommended FY19 through FY23 Storm Water Budget and Capital Improvement Plan are included in Chapter 4 and at the end of the Executive Summary.

Chapter 2 presents a description of anticipated equipment that will be required by the Storm Water Utility during its initial five year startup period. Equipment needs are based on normal, routine maintenance of the system, and do not include items needed for large scale repairs or capital improvements. Recommended equipment includes computer equipment, cellular phones, service trucks, a vactor truck, tractor and rotary mower, sprayer, backhoe, small tools, safety equipment, and temporary traffic control devices and signage.

The goal of the Utility is to inspect and maintain each Utility asset at least once every five years, or as needed to address localized issues. Chapter 2 presents a detailed discussion of the anticipated staff time required for identified maintenance activities. Activities include sump, inlet, manhole, and pretreatment device maintenance; sump replacement; managing vegetation on and adjacent to levees; herbicide applications; mowing; animal control; flood fight contingency; levee system general maintenance; and special maintenance.

Chapter 2 also presents a thorough review and analysis of the City Municipal Code, Standard Specifications, Design Criteria, Subdivision Regulations, and Administrative Rules as they pertain to the Storm Water Utility and requirements of the City's MS4 Permit. The discussion points out potential discrepancies between the various documents and provides recommended modifications.

3. Missoula Levee System Operations and Maintenance Plan

Chapter 3 provides an analysis of the City's operation and maintenance procedures for the Missoula levee systems. The purpose of this task was to review current practices for compliance with the Operation and Maintenance Manual(s) for the Missoula levee systems and for compliance with other U.S. Army Corps of Engineers (USACE) guidelines.

The City of Missoula owns and operates five flood control systems: the Grant Creek Levee, Clark Fork Area 3 Levee, Clark Fork Area 5 Levee, Pattee Creek Levee, and the South Missoula Storm Drain Systems. Field observations with City staff were conducted as part of this Project.

Chapter 3 presents a summary of the regulatory oversight of the levees by both USACE and FEMA. Requirements for certification and FEMA accreditation are presented. The analysis determined that

FEMA had sufficient documentation for the Flood Insurance Study for Missoula, updated in 2015 to accredit the Clark Fork Levees, the Grant Creek Levee, and the 2004 South Missoula Storm Drainage Project.

The levee system operations and maintenance plan, presented in Chapter 3 includes recommendations for additional mapping and drawings as well as other documentation needed as part of maintaining the levee system's certification. Continued levee certification helps to reduce citizen flood insurance rates. Recommendations for additional mapping include levee property boundaries, center line, utility penetrations, location of utilities within 200 feet, levee footprint, limits of all riprap, existing access points, and boundaries of required vegetation-free zones.

The 2016 USACE Inspection Report and the field observations conducted as part of this Project noted a common problem with the control of trees and woody growth on all the City's levee systems where a vegetation-free zone is required. While managed vegetation is allowed adjacent to the levees, regulation requires a vegetation-free zone, free of trees and woody growth on the levee prism. Although the turfed areas seem to be consistently mowed, there are areas where volunteer trees have taken hold due to lack of maintenance. There are areas where trees and other landscaping have been intentionally planted for aesthetic purposes. Because the USACE strictly limits landscape plantings and vegetation, the presence of this vegetation resulted in a Minimally Acceptable rating in the USACE Inspection Report. Recommendations for maintenance activities at each levee are provided to help maintain the vegetation-free zone.

Staffing and equipment needs, over and above those needed for typical utility operations, for the operation and maintenance of the levee system were included in the operations and maintenance opinion of cost presented in Chapter 2 and included at the end of the Executive Summary.

Chapter 3 also presents a plan for future levee recertification, when notified by FEMA that recertification is required, including a flowchart describing the recommended approach to certification, shown in Figure 3.10.1-1. It is important to note that there is no set path through the process and as information is acquired, currently unknown deficiencies may be identified that require the City to modify their approach. The steps identified in the flowchart and discussed in detail in Chapter 3 include:

1. Mapping and data collection,
2. Assessment of available information,
3. Freeboard analysis,
4. Identification of levee openings requiring closure devices,
5. Analysis of needed embankment protection,
6. Analysis of embankment and foundation stability,
7. Analysis of potential embankment settlement,
8. Hydrologic analysis of potential flooded area, and
9. Update of the Flood Control Work O&M Manual and Emergency Action Plan.

4. Capital Improvements Plan

Chapter 4 presents a five-year Capital Improvements Plan (CIP) and includes infrastructure projects, levee improvement recommendations, and operations and management recommendations. The objectives of the Capital Improvements Plan are:

1. To improve the effectiveness of expenditures by the City of Missoula on improvements to its Storm Water Utility;
2. To identify and prioritize projects that will improve the efficiency and operation of the City's Storm Water Utility and further regulatory requirement obligations;
3. To assist the City of Missoula in forming a stable financial plan for future improvements and to identify potential funding sources for capital improvements projects; and
4. To help the City provide guidance to its personnel in operational and maintenance efforts.

For each of the identified projects, Chapter 4 presents a description and need for the project and evaluates and ranks each project using a systematic process based on criteria including public safety, regulatory compliance, operational benefits, water quality improvement, and cost. Information was gathered and organized for each project to provide a basis for ranking the project and developing conceptual planning cost estimates.

The Capital Improvements Plan is presented in Table 4.4.1 and shown below. The table lists the capital improvements projects in order of priority based on score. The highest potential score for a project is 390 and the lowest is 78.

Cost estimates were developed for the projects based on standards developed by the American Association of Cost Engineers (AACE). The AACE published the limits of confidence associated with different AACE-defined levels of cost estimates. (*Cost Estimate Classification System – As Applied in Engineering Procurement, and Construction for the Process Industries*, AACE, 2005) The cost estimates presented in this Plan are categorized by AACE as a Class 4 Estimate based on the following description:

> *Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 15% complete.*

Class 4 estimates are typically prepared for preliminary budget approval, such as a Capital Improvements Plan and by definition have an expected accuracy range of -15% to +30% depending on the complexity of the project and level of definition of the project.

Cost estimates for general conditions, engineering costs, and specific project components were developed using average costs from actual projects in Missoula and other municipal projects in Montana over the last five years. A contingency of 25 percent was used. A summary of the total recommended budget for the Storm Water Division is presented in Table 4.4.2.

Table 4.4.1 – Recommended Capital Improvements Plan

Project Rank	Project	Priority Ranking Score	Base Cost FY2018	Adjusted Cost with Escalation				
				FY2019	FY2020	FY2021	FY2022	FY2023
1a	Upper Gharrett / South Hills Dr Drainage Improvements - Design	259	$48,450	$49,904				
1b	Upper Gharrett / South Hills Dr Drainage Improvements - Construction	259	$438,500		$465,205			
	Debt service - SRF			*$4,039*	*$41,693*	*$41,693*	*$41,693*	*$41,693*
2	Mullan Road Corridor Storm Water Drainage Master Plan	232	$60,000	$61,800				
	Debt service - other			*$8,003*	*$8,003*	*$8,003*	*$8,003*	*$8,003*
3	Linda Vista Storm Water Drainage Study	208	$60,000		$63,654			
	Debt service - other				*$8,243*	*$8,243*	*$8,243*	*$8,243*
4	Caras Park Outfall Pretreatment Retrofit Project - Phase 2	208	$451,570			$493,443		
	Debt service - SRF					*$39,939*		
5	Highpark Drainage System Improvements	207	$391,490			$427,792		
	Debt service - SRF					*$34,625*	*$34,625*	*$34,625*
6a	Hillside Streets Inlet Grate Replacement Project	206	$160,888			$175,807		
	Debt service - SRF					*$14,230*	*$14,230*	*$14,230*
6b	Hillside Streets Inlet Grate Replacement Project	206	$160,888				$181,081	
	Debt service - SRF						*$14,657*	*$14,657*
6c	Hillside Streets Inlet Grate Replacement Project	206	$160,888					$186,513

Project Rank	Project	Priority Ranking Score	Base Cost FY2018	Adjusted Cost with Escalation				
				FY2019	FY2020	FY2021	FY2022	FY2023
	Debt service - SRF							*$15,096*
7	City of Missoula Storm Water Facility and Operations Plan - Phase 2	203	$200,000				$225,102	
	Debt service - other						*$29,152*	*$29,152*
8	Missoula Levee Geotechnical Inspection and Recertification	199	$582,876				$656,032	
	Debt service - SRF						*$53,099*	*$53,099*
9	Grant Creek Levee	197	$275,843					$319,777
	Debt service - SRF							*$25,883*
10	Hillview Heights Storm Water Drainage Upgrades	184	$99,100					$114,884
	Debt service - SRF							*$9,299*
11	Grantland #13 Subdivision Storm Drain Study	176	$60,000					*$69,556*
	Debt service - other							$9,008
	TOTAL PROJECT COST		**$3,150,493**	**$111,704**	**$528,859**	**$1,097,041**	**$1,062,215**	**$690,731**
	TOTAL DEBT SERVICE - SRF			*$12,043*	*$57,940*	*$146,734*	*$203,702*	*$262,988*
	TOTAL DEBT SERVICE - OTHER			*$8,003*	*$16,247*	*$16,247*	*$45,399*	*$54,406*
	TOTAL DEBT SERVICE (combined)		**$823,709**	**$20,046**	**$74,187**	**$162,981**	**$249,101**	**$317,395**
	TOTAL ALL CIP COSTS		**$4,314,258**	**$131,749**	**$603,045**	**$1,260,022**	**$1,311,316**	**$1,008,125**

1. Escalation Costs are based on a 3% annual adjustment.
2. Adjusted escalation cost is value based upon indicated fiscal year.
3. Hillside Streets Inlet Grate Replacement Project is distributed as an annual cost over a 10-year period; FY2021 –FY2031

Table 4.4.2 – Summary of Recommended Budget for Missoula Storm Water Utility

Activity	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Utility Management, Administration & Permit Compliance	$411,600	$420,100	$506,000	$511,000	$558,300
Storm Water System Operation and Maintenance	$3,100	$79,500	$435,200	$336,900	$571,700
Levee System Operation and Maintenance	$28,600	$55,800	$72,200	$91,700	$112,700
Administration, Operation and Maintenance Total	**$443,300**	**$555,400**	**$1,013,400**	**$939,600**	**$1,242,700**
Capital Improvements Infrastructure Budget	$131,800	$603,100	$1,260,100	$1,311,400	$1,008,200
Storm Water Utility Total	**$575,100**	**$1,158,500**	**$2,273,500**	**$2,251,000**	**$2,250,900**

CHAPTER 1

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Chapter 1
Existing System Background Information

The City of Missoula formed their Storm Water Utility in September 2016. In order to define the staff size and scope of responsibilities of the new Utility, the City undertook the City of Missoula Storm Water Facility and Operations Planning Project. As an initial step, background information and documentation related to the Storm Water Utility was compiled and reviewed. The background information provides a basis for definition of the new Utility by identifying the City's current level of infrastructure maintenance activities and current regulatory responsibilities.

A stakeholder meeting was conducted with a focus on all relevant storm water rules, criteria, codes, and other resources that provide guidance about the role and responsibilities of the Storm Water Utility. The background information was provided by the City of Missoula and is summarized in this Chapter. This Chapter may serve as a clearinghouse for data available for the Storm Water Utility.

To develop a greater understanding of the condition of the existing system, on-site review of a select number of potential project sites occurred. The sites, identified by the City, were selected based on a history of on-going issues. The site visits provided insight into the issues the Storm Water Utility faces related to deferred maintenance and aging infrastructure. Conversations with maintenance personnel provided greater detail into system operations and associated challenges.

1.1 Owner Provided Information

The City of Missoula provided the following information as part of the information gathering process for these planning efforts.

1.1.1 Storm Water Standard Drawings

The City of Missoula has a database of standard drawings for storm water infrastructure that is available to the public. This information is useful for engineers and contractors in design of projects throughout the city and provides standard installation of infrastructure across Missoula. The standard drawings provided on the city website include sumps, manholes, inlets, and storm water pollution prevention facilities. A map of the existing storm water system infrastructure can be viewed on their website at the following link:
https://portal.ci.missoula.mt.us/arcgis/apps/Viewer/index.html?appid=83e3b1856f524c92a325db67ea31deb4.

1.1.2 Missoula Municipal Code

The City of Missoula Municipal Code Title 13 references public services; specifically, chapters 13.26 and 13.27 reference Missoula Valley Water Quality Ordinance and Storm Water Utility, Rates, and Regulations. Title 15 references Building development; specifically chapter 15.65 references Grading, Drainage, Erosion Control, and Storm Water Pollution Prevention Plan (SWPPP). Information presented in these documents provides guidelines and regulations for Missoula regarding storm water.

- Title 13.26 describes standards and regulations for drinking water, recreation, and other beneficial uses in the Missoula Valley to protect the public's health, safety, and general welfare. The Missoula Valley Water Quality Ordinance is intended as a health ordinance to protect the Missoula Valley aquifer and surface waters from contamination and is effective within five miles of the Missoula city limits.

- Title 13.27 describes specifications, design standards, administrative rules, and a rate schedule for the regulation and operation of the Missoula storm water utility. The full purpose and intent of this ordinance is provided in detail in Title 13.27.020.

- Title 15.65 of the Missoula Municipal Code provides design standards for erosion control, preservation of natural drainage systems, flood mitigation, site grading, and protection of property. The standards set forth are minimums for the quantity and quality of site grading and the control of storm water runoff. The standards are in compliance with the U.S. Environmental Protection Agency, State of Montana, Montana Department of Environmental Quality, Missoula County Air Pollution Control, and Missoula County Health Department.

1.1.3 Missoula Subdivision Regulations

The City of Missoula has established regulations for subdivisions entitled, *Missoula City Subdivision Regulations,* were adopted on June 28, 2010 and are located on their website at the following link: https://www.ci.missoula.mt.us/268/City-Laws-Regulations. These regulations include design standards located in Article 3. Helpful standards for storm water management are included in section 3-040 referring to design standards on grading, drainage, and erosion control.

The City of Missoula Municipal Code Title 20 references zoning for the City. Storm water design criteria not included within Title 20 are referenced to the Montana Department of Environmental Quality (MDEQ) Circular 8.

1.1.4 Planning Data

The City of Missoula completed a long range transportation plan in March of 2017 titled *Activate Missoula 2045*. This report provides projected traffic growth and transportation needs for Missoula. Included in Table 7 of this document are population projections, which estimate that Missoula's population will increase 48% from 90,097 to 133,329 by 2045. In addition, the City's Planning Department updates the Urban Fringe Development Yearbook on an annual basis in order to help

predict where development is going to occur. Projected population and development data may assist in the planning efforts for future storm water facilities and their anticipated locations.

1.1.5 Floodplain Mapping and Reports

The City of Missoula website has information on the FEMA floodplain maps and reports. These maps and reports are useful for determining where the floodplain is located, what land is potentially affected, and base flood elevations at various locations. The City website has links to floodplain resources, including organizational resources and FEMA panels for land within city limits.

1.1.6 Storm Water Facility Operational Costs

As part of this planning process, the City of Missoula provided documentation from recent years on the operational costs associated with the existing storm water facilities. This operational information includes work performed, number of staff, associated hours, and costs to perform the work.

1.1.7 Geographic Information System (GIS) Mapping Data

All existing City of Missoula GIS information, including shapefiles for storm water infrastructure was provided electronically. Review of this information revealed that existing infrastructure in various locations throughout the City has not been inventoried and as a result, the City's GIS system lacks information. Much of the system is known, but lack of recorded infrastructure data potentially creates problems for future development as well as maintenance of the system.

1.1.8 LIDAR Data

As part of the effort to collect existing data, it was discovered that LiDAR data exists for approximately 40 square miles of the area within and around the City of Missoula. LiDAR, which stands for Light Detection and Ranging is a topographic surveying method that measures distance to a target by illuminating that target with a pulsed laser light and measuring the reflected pulses with a sensor. The data was collected for a study entitled *Miller Creek – Missoula Montana Lidar Project* completed in 2002 by the Federal Highways Administration, Western Federal Lands Office. The data may be available from the Western Federal Lands Office for use by the City. Because the data is 15 years old, modifications to topography over time should be taken into account. The LiDAR data may be a useful data source to facilitate preliminary assessment of storm water runoff patterns in the City.

1.1.9 USACE Levee Inspection Data

The City of Missoula has a series of United States Army Corps of Engineers (USACE) levees located along Grant Creek, Pattee Creek, and the Clark Fork River. In August of 2016, the USACE performed a routine inspection of the levees and provided reports indicating the condition of each levee and any recommended maintenance or improvements. Out of the four levees located in Missoula, three of them received "minimally acceptable" scores. Only the Pattee Creek levee received an acceptable score. The routine inspection performed on the Clark Fork levees in September of 2015 also scored these levees as "minimally acceptable".

The USACE has also developed an Emergency Employment of Army and Other Resources Civil Emergency Management Program manual that describes disaster preparedness, hazard mitigation, implementation of the program, rehabilitation and inspection, and emergency operations in the event of an emergency flooding event. The City of Missoula has taken this document into consideration and developed their own Operations and Maintenance (O&M) Manual and Emergency Action Plan (EAP) for the South Missoula Storm Drain System, Upper and Lower Clark Fork Levees, and the Grant Creek Levee.

The O&M Manual and EAP documents were developed and finalized in 2014. These documents can be obtained from the Storm Water Utility and are not included with this report due to size. The documents include descriptions of the infrastructure in place to convey storm water throughout the southern portion of Missoula and the operation and function of the levees along the Clark Fork River and Grant Creek. Descriptions include infrastructure and operation, location, and regulations that must be met. Additionally, this document provides a current emergency contact list, outlines emergency actions during a flood event, hazard mitigation and response, maintenance procedures and responsibilities (distribution of these items), allowable construction on or near a flood control works, forms for inspection and incident reports, and historical flood information.

1.2 Existing System Condition Assessment

The City of Missoula's Storm Water System consists of sumps, inlets, gravity storm drain lines, natural drainages, detention facilities, and outfalls as illustrated in the City of Missoula System Overview Map located in Appendix C. The Storm Water System is predominantly composed of infiltration sumps, also referred to as drywells. The infiltration sumps are generally located in soil types that are conducive to infiltration. Other components include storm water collection infrastructure installed as part of a subdivision or installed due to poor soil conditions prohibiting the use of infiltration sumps. In many instances, the inlets and series of pipes and culverts also utilize natural drainages to convey runoff. The piped systems discharge to detention areas, natural drainages or at outfalls located on the creeks and rivers around Missoula.

A cursory condition assessment was performed as part of this planning effort and was limited in scope. City of Missoula staff in conjunction with the consulting engineering team visited select sites included on a City-provided list of needed projects. The attendees of the site visits included two engineers from Morrison-Maierle, City of Missoula Storm Water Superintendent, Storm Water Administrative Assistant IV, Wastewater Collections Manager, and Street Maintenance Superintendent. The selected sites from the provided Capital Improvements List included the following:

- Lincoln Hills Storm Water Drainage Upgrades
- Grantland #13 Subdivision Storm Drain Study
- Mullan Road Corridor Storm Drain Master Plan
- Highpark Drainage System Improvements
- Hillview Heights Storm Water Drainage Maintenance and Upgrades
- Linda Vista Storm Water Drainage Study
- Higgins Outfall

Maintenance was observed to be a primary deficiency at all locations visited. The City currently has limited capability to perform maintenance on the storm water system due to a lack of staffing and budget. Therefore, maintenance typically occurs in response to residential complaints. Observations from the site visits documented the presence of plugged culverts, structural integrity deficiencies, filled in drainage ditches, and in some cases, a lack of required infrastructure. It can be concluded that many areas of the City's storm water system require maintenance to become fully functional again. In order to fully define the extent of needed infrastructure and maintenance, detailed survey, modeling, and studying of findings is required.

Chapter 4 presents more detailed information about the specific site deficiencies and provides recommendations and cost estimates for a Capital Improvement Plan.

1.3 Additional Data Requirements

As of the date of this memorandum, the City has provided all data requested and all data available on the Storm Water Utility.

CHAPTER 2

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Chapter 2
Storm Water Utility Management

With the recent formation of the City of Missoula Storm Water Utility in 2016, an assessment of staffing and equipment needs is an essential component of the planning process to enable the Utility to efficiently and effectively meet regulatory requirements. This Chapter analyzes Storm Water operations and management needs and offers recommendations for staffing and equipment for Fiscal Years 2019 through 2023. The needs and associated recommendations are divided into three categories: utility management, administration, and permit compliance; system operations; and levee system operation and maintenance. The basis of the recommendations is outlined in this Chapter and budget recommendations are presented.

2.1 Introduction

2.1.1 Operations and Management Analysis

As part of the formation of the City of Missoula's Storm Water Utility, Municipal Code was modified to add a Storm Water Utility, Rates and Regulations (City of Missoula, 2016). Paragraph 13.27.070 of the Municipal Code mandates that the Public Works Director will determine the total annual cost of operation and maintenance of the storm water system. Additionally, the Public Works Director will develop an operating plan. While the complete list of items required for the Operation Cost Determination is listed in Paragraph 13.27.070 (City of Missoula, 2016), this Chapter focuses on the following costs:

- Costs of administration and implementation of the Storm Water Utility;
- Establishment of reasonable operating and capital reserves to meet unanticipated or emergency storm water management requirements;
- Operation and maintenance of the storm water system;
- Monitoring, surveillance, and inspection of storm water systems;
- Water quality monitoring and water quality programs;
- Inspection and enforcement activities;
- Billing and administrative costs;
- Permitting;
- Staffing;
- Equipment;
- Outside contractors; and
- Other expenses related to the Storm Water Utility.

The Storm Water Utility was initially formed to meet the regulatory requirements of the City's Small Municipal Separate Storm Water System (MS4) permit (Montana Department of Environmental Quality, 2017). The MS4 Permit pertains to the management of storm water with respect to water quality. However, the responsibilities of the Storm Water Utility include other aspects of the City's storm water infrastructure, including operation and maintenance of the City's levees, detention features, and certain roadside ditches. Therefore, the operation cost determination discussed in this section considers these responsibilities as well.

The purpose of this analysis is to develop recommendations for program staffing, equipment, and operational procedures based on the City's historic practices and storm water systems of similar size in Montana and elsewhere. The recommendations presented in this section focus on support of the required Minimum Control Measures (MCMs) included in the City's MS4 Permit as incorporated in the City's Small MS4 Storm Water Management Program (SWMP). The recommendations also support resources needed to manage, operate, and maintain the City's storm water infrastructure. A copy of the Small MS4 Storm Water Management Program is located in Appendix A.

2.1.2 Review of City Storm Water Rules and Regulations

City ordinances, administrative rules, and other documentation were reviewed as part of this analysis. The documents were reviewed with respect to the City's ability to comply with MS4 permit requirements and recommendations developed in this facility plan. The scope of this analysis does not include preparation of new or revised ordinances, administrative rules, standards, or other guidance documents.

2.1.3 Assumptions and Clarifications

The recommendations for staffing and equipment presented in this Chapter are based on enabling the Storm Water Division to perform all operation and maintenance activities associated with the storm water system. Currently, the City's Wastewater Utility, Streets Division, and Parks and Recreation Department fulfill some of the duties of the Storm Water Utility. For example, the Wastewater Department currently performs video inspection of gravity storm sewers when overflow occurs and removes debris or plugs that develop in the lines. The staffing recommendations presented herein assume that the Storm Water Utility will eventually assume that responsibility. Transition of these responsibilities will be determined by the City's approach to funding the utility and therefore will not likely be immediate, but occur incrementally as the Utility's budget is built up by revenue generated through the storm water rates.

Information and documents used in the development of this Chapter are listed in Section 2.9 - References.

2.2 Summary of Findings

Based on requirements to operate and maintain the City's Storm Water Utility and levee systems listed in Section 2.1.1, the Operations and Management Analysis conducted concluded that the Storm Water Utility could support nine positions within the City; with two of those positions shared with other Public Works Utilities. Table 2.2.1 - Staffing Assessment below provides a summary of the staffing recommended.

Table 2.2.1 - Staffing Assessment

Position Title	No. of Positions	Responsibility
Utility Superintendent	1.0	Reports to Public Works Director. Has overall responsibility for the Storm Water Utility including planning, management of staff, budget development and management, asset management, and compliance with permits and regulations.
Administrative Assistant	1.0	Assists with the daily operation of the Storm Water Utility by providing general administrative and clerical support.
Regulatory Compliance Specialist	1.0	Responsible for the monitoring, execution, and documentation associated with the 6 minimum control measures required by the MS4 Permit, levee inspections, high hazard dam inspections, and any other storm water regulatory compliance requirements.
GIS Technician	0.5	Responsible for management and analysis of GIS data and preparation of mapping and exhibits.
Utility Billing Clerk	0.3	Responsible for utility billing.
Field Maintenance Technician	4.0	Responsible for the inspection, operation and maintenance of the City's storm water system, levees, detention basins, and roadside ditches.

2.2.1 Operations Budget

The Operations and Maintenance Budget developed as part of this analysis is presented in Table 2.2.2. A detailed discussion of each task, and the assumptions used to develop operating costs are discussed in subsequent paragraphs.

Table 2.2.2 – Operations and Maintenance Budget

Item	Unit Price*	Unit	FY2019† Quantity	FY2019† Total	FY2020† Quantity	FY2020† Total	FY2021† Quantity	FY2021† Total	FY2022† Quantity	FY2022† Total	FY2023† Quantity	FY2023† Total
UTILITY MANAGEMENT, ADMINISTRATION & REGULATORY COMPLIANCE												
Staff Working Time												
Utility Superintendent	$44	hour	1928	$87,377	1928	$89,998	1928	$92,698	1928	$95,479	1928	$98,344
Administrative Assistant	$24	hour	1928	$47,660	1928	$49,090	1928	$50,563	1928	$52,080	1928	$53,642
Regulatory Compliance Specialist	$36	hour	1928	$71,490	1928	$73,635	1928	$75,844	1928	$78,119	1928	$80,463
GIS Technician (1/2 position)	$36	hour		$0		$0	964	$37,922	964	$39,060	964	$40,231
Utility Billing Clerk (1/3 position)	$24	hour	643	$15,887	643	$16,363	643	$16,854	643	$17,360	643	$17,881
Computer Equipment	$3,000	each	1	$3,090		$0	2.5	$8,195		$0	4	$13,911
MS4 Permit Compliance Requirements												
MCM 1 Public Education and Outreach	$20,000	lump	1	$20,600	1	$21,218	1	$21,855	1	$22,510	1	$23,185
MCM 2 Public Involvement and Participation	$10,000	lump	1	$10,300	1	$10,609	1	$10,927	1	$11,255	1	$11,593
MCM 3 Illicit Discharge Detection and Elimination	$10,000	lump	1	$10,300	1	$10,609	1	$10,927	1	$11,255	1	$11,593
MCM 4 Construction Site Storm Water Management	$15,000	lump	1	$15,450	1	$15,914	1	$16,391	1	$16,883	1	$17,389
MCM 5 Post-Construction Storm Water Management	$10,000	lump	1	$10,300	1	$10,609	1	$10,927	1	$11,255	1	$11,593
MCM 6 Pollution Prevention and Good Housekeeping	$10,000	lump	1	$10,300	1	$10,609	1	$10,927	1	$11,255	1	$11,593
MT DEQ Permit Fees - MS4 Permit and Outfall Permit	$11,000	lump	1	$11,330	1	$11,670	1	$12,020	1	$12,381	1	$12,752
Training, Certification, Licensing & Travel Expenses	$6,000	lump	1	$6,180	1	$6,365	1	$6,556	1	$6,753	1	$6,956
Safety Gear and Equipment	$5,000	lump	1	$5,150	1	$5,305	1	$5,464	1	$5,628	1	$5,796
Staff Vacation and Holiday Time												
Utility Superintendent	$44	hour	152	$6,889	152	$7,095	152	$7,308	152	$7,527	152	$7,753
Administrative Assistant	$24	hour	152	$3,757	152	$3,870	152	$3,986	152	$4,106	152	$4,229
Regulatory Compliance Specialist	$36	hour	152	$5,636	152	$5,805	152	$5,979	152	$6,159	152	$6,344
GIS Technician (1/2 position)	$36	hour		$0		$0	76	$2,990	76	$3,079	76	$3,172
Utility Billing Clerk (1/3 position)	$24	hour	51	$1,252	51	$1,290	51	$1,329	51	$1,369	51	$1,410
Field Maintenance Technician 1	$36	hour		$0		$0	152	$5,979	152	$6,159	152	$6,344
Field Maintenance Technician 2	$36	hour		$0		$0	152	$5,979	152	$6,159	152	$6,344
Field Maintenance Technician 3	$36	hour		$0		$0		$0		$0	152	$6,344
Field Maintenance Technician 4	$36	hour		$0		$0		$0		$0	152	$6,344
Subtotal				**$342,949**		**$350,055**		**$421,622**		**$425,830**		**$465,203**
Contingency - utility mgmt, admin and reg comp	20%			$68,590		$70,011		$84,324		$85,166		$93,041
Total Utility Management, Administration & Regulatory Compliance				**$411,539**		**$420,065**		**$505,947**		**$510,995**		**$558,243**

Item	Unit Price*	Unit	FY2019† Quantity	FY2019† Total	FY2020† Quantity	FY2020† Total	FY2021† Quantity	FY2021† Total	FY2022† Quantity	FY2022† Total	FY2023† Quantity	FY2023† Total
STORM WATER SYSTEM OPERATION AND MAINTENANCE												
Equipment												
Service Truck	$30,000	each		$0		$0	1	$32,782		$0	1	$34,778
Vactor Truck (from Wastewater)	$10,000	each		$0		$0	1	$10,927		$0		$0
Utility Tractor (75 hp)	$40,000	each		$0		$0	1	$43,709		$0		$0
Rotary Mower	$2,000	each		$0		$0	1	$2,185		$0		$0
Equipment Debt Service	calculated	lump		$0		$0	1	$14,565	1	$14,565	1	$20,359
Fuel	$3	gallon	480	$1,483	480	$1,528	1920	$6,294	1920	$6,483	2400	$8,347
Vehicle Maintenance	$250	quarterly	4	$1,030	4	$1,061	16	$4,371	16	$4,502	20	$5,796
Temporary Traffic Control Devices and Signage	$8,000	lump		$0		$0	1	$8,742	1	$9,004	1	$9,274
Sump, Inlet and Manhole Maintenance												
Field Maintenance Technician 1	$36	hour		$0		$0	1336	$52,556	1336	$54,132	1416	$59,095
Field Maintenance Technician 2	$36	hour		$0		$0	1336	$52,556	1336	$54,132	1416	$59,095
Field Maintenance Technician 3	$36	hour		$0		$0		$0		$0	1624	$67,776
Field Maintenance Technician 4	$36	hour		$0		$0		$0		$0	1624	$67,776
Equipment and Materials	$5,000	lump		$0		$0	1	$5,464	1	$5,628	1	$5,796
Sump Replacement (Contract)	$60,000	lump		$0	1	$63,654	1	$65,564	1	$67,531	1	$69,556
Mowing (20 acres 6 times per year)												
Field Maintenance Technician 2	$36	hour		$0		$0	192	$7,553	192	$7,780	192	$8,013
Materials	$100	day		$0		$0	24	$2,623	24	$2,701	24	$2,782
Miscellaneous Maintenance												
Field Maintenance Technician 1	$36	hour		$0		$0	488	$19,197	488	$19,773	512	$21,368
Field Maintenance Technician 2	$36	hour		$0		$0	296	$11,644	296	$11,993	320	$13,355
Equipment	$10,000	lump		$0		$0	1	$10,927	1	$11,255	1	$11,593
Materials	$10,000	lump		$0		$0	1	$10,927	1	$11,255	1	$11,593
Subtotal				**$2,513**		**$66,243**		**$362,585**		**$280,734**		**$476,353**
Contingency - storm water system operation and mainte	20%			$503		$13,249		$72,517		$56,147		$95,271
Total Storm Water System Operation and Maintenance				**$3,016**		**$79,491**		**$435,103**		**$336,881**		**$571,623**

Item	Unit Price*	Unit	FY2019† Quantity	FY2019† Total	FY2020† Quantity	FY2020† Total	FY2021† Quantity	FY2021† Total	FY2022† Quantity	FY2022† Total	FY2023† Quantity	FY2023† Total
LEVEE SYSTEM OPERATION & MAINTENANCE												
Levee Tree Removal												
Contract Work	$9,600	acre	1.0	$9,888	1.5	$15,277	1.5	$15,735	2	$21,610	2	$22,258
Field Maintenance Technician 3	$36	hour		$0		$0		$0		$0	176	$7,345
Field Maintenance Technician 4	$36	hour		$0		$0		$0		$0	176	$7,345
Equipment and Materials	varies	lump		$0		$0		$0		$0	1	$6,812
Tree removal, congested area, 12 inch diameter	$530	Each		$0	30	$16,868	30	$17,374	30	$17,896	30	$18,432
Levee Herbicide Applications												
Field Maintenance Technician 1	$36	hour		$0		$0	24	$944	24	$972		$0
Field Maintenance Technician 2	$36	hour		$0		$0	24	$944	24	$972		$0
Field Maintenance Technician 3	$36	hour		$0		$0		$0		$0	48	$2,003
Field Maintenance Technician 4	$36	hour		$0		$0		$0		$0	48	$2,003
Tank and Sprayer	$8,000	each		$0		$0		$0	1	$9,004		$0
Equipment and Materials	varies	lump		$0		$0	1	$825	1	$876	1	$1,858
Levee System General Maintenance												
Field Maintenance Technician 1	$36	hour		$0		$0	80	$3,147	80	$3,241		$0
Field Maintenance Technician 2	$36	hour		$0		$0	80	$3,147	80	$3,241		$0
Field Maintenance Technician 3	$36	hour		$0		$0		$0		$0	80	$3,339
Field Maintenance Technician 4	$36	hour		$0		$0		$0		$0	80	$3,339
Equipment and Materials	$3,000	lump		$0		$0	1	$3,278	1	$3,377	1	$3,478
Levee Pest Management	$3,500	lump	1	$3,605	1	$3,713	1	$3,825	1	$3,939	1	$4,057
Flood Fight Reserve Operations	$10,000	lump	1	$10,300	1	$10,609	1	$10,927	1	$11,255	1	$11,593
Subtotal				**$23,793**		**$46,467**		**$60,147**		**$76,384**		**$93,863**
Contingency - levee system operation and maintenance	20%			$4,759		$9,293		$12,029		$15,277		$18,773
Total Levee System Operation and Maintenance				**$28,552**		**$55,761**		**$72,177**		**$91,660**		**$112,635**
UTILITY OPERATIONS AND MAINTENANCE TOTAL				**$443,106**		**$555,317**		**$1,013,226**		**$939,537**		**$1,242,501**

* = Unit Price is based on 2017 dollars.

† = FY20xx cost values have been escalated at 3% per year.

2.3 Results and Conclusions

2.3.1 Immediate Staffing Needs

The Storm Water Utility currently employs two staff members: Utility Superintendent and Administrative Assistant[1]. To adequately fulfil the responsibilities of the Storm Water Utility, the following positions are required:

- Regulatory Compliance Specialist, and
- Billing Clerk (shared resource).

The addition of personnel would double the staff of the Storm Water Utility. It is not advisable (nor likely) that the additional positions be filled at the same time. It is recommended that the Storm Water Utility fill these positions over the course of Fiscal Year 2019.

2.3.2 Near Term Staffing Needs

The addition of field crews to perform the maintenance activities described in Section 2.4.2.5 is recommended in Fiscal Year 2021. This will allow the Utility time to generate adequate revenue to support the additional staff. It is recommended that hiring for the second field crew be deferred until Fiscal Year 2023 or later. As discussed in the Assumptions and Clarifications, there will be a period where responsibilities are transitioned from other City Public Works Utilities. Therefore, the need for a second field crew should be evaluated on a yearly basis.

2.3.3 Skill Set Diversity

The Storm Water Utility will support a relatively small staff, and the skill sets needed for operation and maintenance are varied. Because the resource pool is small, the most efficient strategy for managing workloads and responsibilities is to maintain a cross-trained staff. Defined roles and responsibilities for each position should be flexible, and staff should have the expectation that work assignments will be given based on needs of the Storm Water Utility, rather than job description.

2.3.4 Near Term Operational Priorities

It is assumed that the City's current approach to maintenance of storm water facilities will continue until the Utility is adequately staffed. Starting in FY 2021 when the first maintenance crew is budgeted to start, it is recommended that the next few years of operations be dedicated to maintenance that has been deferred, and to establish routine activities. Priority should be given to inspection and maintenance of the sumps, and getting the levee systems into compliance with USACE criteria.

[1] Based on discussions with the City, the administrative assistant currently assists with the responsibilities that would be associated with the Regulatory Compliance Specialist position.

2.4 Operations and Storm Water Utility Staffing

2.4.1 Staffing and Equipment Costs

Personnel and equipment costs for operation were provided by the City at the project meeting held August 14, 2017. The rates provided in the following table reflect expenses typically incurred by the City's Wastewater Utility, and were noted to be current as of July 2017. It is understood that the rates provided by the City include all overhead costs associated with labor. The equipment and personnel costs provided by the City are included in Table 2.4.1 below.

Table 2.4.1 – Equipment and Personnel Costs Provided by City

Equipment		Personnel	
Item	**Hourly Rate**	**Item**	**Hourly Rate**
Jet Truck	$150	Manager	$44
Easement Machine (CCTV)	$100	Technician	$36
Service Truck	$60	Administrative Assistant	$24
Vactor Truck	$200		
TV Van	$100		

For the purposes of this planning effort, the cost data provided to the City was applied to the equipment and personnel associated with the Storm Water Utility as shown in Table 2.4.2.

Table 2.4.2 - Cost for Collection or Storm Maintenance

Equipment		Personnel	
Item	**Hourly Rate**	**Item**	**Hourly Rate***
Jet Truck	$150	Utility Superintendent	$44
Easement Machine (CCTV)	$100	Administrative Assistant	$24
Service Truck	$60	Regulatory Compliance Specialist	$36
Vactor Truck	$200	GIS Technician	$36
TV Van	$100	Utility Billing Clerk	$24
		Field Maintenance Technician 1	$36
		Field Maintenance Technician 2	$36
		Field Maintenance Technician 3	$36
		Field Maintenance Technician 4	$36

* Hourly rates presented in Table 2.4.2 are costs to the City – not salary amounts. The rates include anticipated salaries and the overhead costs that will be incurred by the City for each employee.

2.4.2 Utility Management and Administration

2.4.2.1 Utility Superintendent

The City currently employs a Storm Water Superintendent who works under the general supervision of the Public Works Director. For a fully staffed Storm Water Utility, the Superintendent performs a variety of administrative and supervisory responsibilities associated with the operation of the Storm Water Utility which includes, but is not limited to, the following:

- Coordinates the activities of the Utility;
- Makes work assignments and defines duties for employees;
- Monitors progress of work assignments;
- Purchases materials, supplies, outside services, equipment rental;
- Assists the Public Works Director in hiring, training, disciplining and evaluating employees;
- Has overall responsibility for the maintenance and operation of the City's storm water and levee infrastructure;
- Has overall responsibility for compliance of the MS4 Permit;
- Operates the Utility within the established budget;
- Assists the Public Works Director with planning and organizing the Utility;
- Assists with the planning of future short term and long term needs of the Utility;
- Assists in the preparation of a budget for the Utility and compiles project lists for the Capital Improvement Program (CIP);
- Represents the Utility at various City meetings and elsewhere;
- Reviews and responds to public complaints;
- Monitors, authors and proposes new Ordinances and/or Administrative Rules, as necessary for storm water program compliance with Federal and State laws and requirements;
- Provides technical assistance and consults with other Public Works Utilities; and
- Supervises and oversees compliance with Federal, State and local storm water quality standards.

To fulfill the responsibilities of the Storm Water Superintendent, one Full Time Equivalent (FTE) employee is required. The position is budgeted at a manager level position at a rate of $44 per hour. At 2,080 hours per year, the total yearly cost is $91,520.

2.4.2.2 Administrative Assistant

The Storm Water Utility currently employs an administrative assistant who reports to the Utility Superintendent. The administrative assistant (the official City job classification will be Storm Water

Utility Administrative Assistant II) assists with the daily operation of the Storm Water Utility. Responsibilities generally include, but are not limited to, the following[2]:

- Provides general administrative and clerical support including but not limited to mailing, scanning, faxing and copying;
- Maintains electronic and hard copy filing systems for the Storm Water Utility's documentation;
- Performs data entry and scans and manages documents on the network;
- Manages Accounts Receivable and Accounts Payable for the Storm Water Utility;
- Assists in compiling project documentation including project budgets as well as monitors and tracks expenses related to the Capital Improvement Program (CIP);
- Manages Storm Water Utility calendar for division activities in support of operations, maintenance and regulatory compliance;
- Frontline telephone and in-office point-of-contact; responsible for logging and fielding complaints and directing persons to appropriate department and staff to resolve citizen concerns;
- Assists in the preparation and modification of documents including correspondence, reports, enforcement notices, drafts, memos and emails;
- Transcribe and / or proof certain regulatory documents for the Storm Water Utility;
- Schedules and coordinates meetings, appointments and travel arrangements for Storm Water Utility staff;
- Contributes to Storm Water Utility activities for MS4 permit compliance, to include all Minimum Control Measures (MCMs) and Best Management Practices (BMPs);
- Assists in documenting Storm Water Utility activities for compliance reporting and data tracking; and
- Maintains office and field supplies for the Storm Water Utility.

One FTE employee is required to fulfill the responsibilities of administrative assistant. The position is budgeted at an administration level position at a rate of $24 per hour. At 2,080 hours per year, the total yearly cost is $49,920.

2.4.2.3 Regulatory Compliance Specialist

The Storm Water Utility was developed based on the City's need to comply with its MS4 permit. The terms of the permit outline six minimum control measures that need to be implemented by the City on an annual basis. The City's efforts to implement the minimum control measures must also be documented and provided to the state. Additionally, other storm water infrastructure and facilities have Federal and / or State inspection, documentation, and reporting requirements, for example the Missoula levee system, the high hazard dam at Playfair Park, and the National Flood Insurance Program (NFIP) Community Rating System (CRS) for flood insured properties within Missoula. To meet these requirements, a position for a Regulatory Compliance Specialist is

[2] With the current staffing level, the Administrative Assistant fulfills some of the responsibilities of the Regulatory Compliance Specialist. As the Storm Water Utility develops, the roles and responsibilities of the 2 positions will need to be distinct.

recommended. The responsibilities for the Regulatory Compliance Specialist would include efforts associated with the MT DEQ MS4 permit compliance, levee certification compliance, high hazard dam compliance, and any other storm water regulatory compliance.

- Develops and distributes educational materials and performs outreach to citizens;
- Provides opportunities for citizens to participate in the storm water program development and implementation. Publicizes and facilitates public hearings and/or encourages citizen representatives on a storm water management panel;
- Implements the City's plan to detect and eliminate illicit discharges to the storm water system;
- Implements and acts to enforce the City's erosion and sediment control program for construction activities;
- Implements and acts to enforce the City's program to address discharges of post-construction storm water runoff from new development and redevelopment areas;
- Implements the City's program of pollution prevention and good housekeeping with the goal of preventing or reducing pollutant runoff from municipal operations;
- Prepares, collects, and manages documentation supporting permit compliance
- Prepares reports necessary for permit compliance;
- Ensures levee inspections are performed and documented as required;
- Monitors, compiles, and reports on levee maintenance work;
- Monitors, compiles, and reports on high hazard dam maintenance work; and
- Coordinates with Missoula Valley Water Quality District.

One FTE employee is required to fulfill the responsibilities of Regulatory Compliance Specialist. The position is budgeted at a technical level position at a rate of $36 per hour. At 2,080 hours per year, the total yearly cost is $74,880.

2.4.2.4 GIS Technician

Data for the Storm Water Utility's infrastructure will be stored in the City's Geographical Information System (GIS). The storm water system is not sufficiently large to justify a staff member dedicated full time for data management. Therefore, the work assignments and salary costs for a GIS Technician will be shared with other Public Works Utilities. Responsibilities of the GIS Technician may include the following:

- Develops protocols for data management;
- Identifies data gaps;
- Conducts quality control of information received from others;
- Incorporates information received from others into the City's GIS;
- Distributes information requested by others;
- Provides technical support for the implementation and operation of GIS projects. Installs and tests GIS web software and maintains the GIS web server;
- Prepares GIS databases, maps, database reports, and specialized queries in support of various projects;
- Performs GIS analysis, modeling, and reporting to support decision making;

- Generates, maintains, and disseminates GIS layers;
- Operates and maintains GIS software and web-based applications;
- Designs GIS enterprise database and enforces data standards; and
- Trains users on new and existing GIS and Environmental Systems Research Institute (ESRI) products.

One-half FTE GIS Technician is assumed at a technician rate of $36 per hour. The total yearly cost to the Storm Water Utility is $37,440. It is understood that that the GIS Technician will be a shared resource with the remaining costs incurred by other Public Works Utilities.

2.4.2.5 Field Maintenance Technicians

Maintenance of the storm water systems is required for compliance the MT DEQ MS4 permit. Maintenance of the levee systems is required for compliance with Public Law (Department of the Army, Corps of Engineer, 1955) and Part 208 – Flood Control Regulations (Code of Federal Regulations, 2001). Field maintenance technicians are needed to operate and maintain the City's storm water infrastructure and levees. Field maintenance technicians will not necessarily be dedicated entirely to storm water maintenance; it is anticipated that technicians could assist with other maintenance activities within the City. An appropriate portion of technician salaries and equipment costs would be funded through the City's Storm Water Utility. The analysis conducted with this study estimated the manpower needed to operate the Storm Water Utility. The estimates herein do not include that portion of effort that will be expended on other City projects.

From discussions with the City, a field crew will be comprised of two field maintenance technicians. Maintenance responsibilities pertaining to the field maintenance technicians operating under the Storm Water Utility include, but are not limited to, the following:

- Clean and maintain storm water utility sumps, inlets and manholes;
- Replace storm water utility sumps, inlets and manhole structures – directly or by contract;
- Maintain, repair and / or replace storm water inlet grates and manhole covers for safety requirements;
- Perform televised inspections of storm water pipe lines;
- Maintain developed roadside ditches that are components of the storm water utility system infrastructure;
- Operate and maintain storm water utility infrastructure facilities and structures as per manufacturer's warranty requirements, industry standards and / or as necessary to ensure continued functionality;
- Operate and maintain the Missoula levee system as per U.S. Army Corps of Engineers (USACE);
- Establish and maintain sod / turf on levee crown and slopes, as required for levee certification;
- Control and manage burrowing animals within the Missoula levee system;
- Maintain levee crown and access, via road and / or trail;

- Inspect private storm water facilities for required maintenance activities and reports on neglected required maintenance;
- Manage removal of trees and woody growth on the levee prism as required for levee certification;
- Perform or contract herbicide application for riprap along Missoula levee system riverward face, as required for levee certification;
- Operate and maintain storm water outfall structures;
- Assist with construction site inspection and enforcement for compliance with City issued Storm Water Pollution Prevention Plan (SWPPP) permit;
- Flood fight operations training, knowledge, skills and abilities;
- Training, knowledge, skills and abilities to perform all duties and work in a safe, hazard-free manner; and
- Operate and maintain hand tools and power equipment necessary to perform above duties.

The analysis provided herein suggests that the Storm Water Utility has justification to employ up to four field maintenance technicians (two field crews). Field maintenance technicians have been budgeted at a rate of $36 per hour. At 2,080 hours per year per employee, the total yearly average cost per field maintenance technician is $74,880. A complete field crew would cost approximately $149,760 per year.

2.4.2.6 Utility Billing Clerk

According to City staff, the Storm Water Utility will need to incur the partial cost of a billing clerk. The billing clerk position is a shared resource between Public Works Utilities. Therefore, a one-third FTE employee has been budgeted for the cost of a billing clerk. The position is budgeted at an administrative assistant level position at a rate of $24 per hour. At approximately 693 hours per year, the total yearly cost to the Storm Water Utility is estimated to be $16,632.

2.5 MS4 Permit Compliance

The following budgetary items pertain to activities associated with and directly related to the Montana Department of Environmental Quality (MDEQ) Municipal Separate Storm Sewer System (MS4) Permit compliance. As part of the requirements the MDEQ MS4 Permit, the City of Missoula prepared the Small MS4 Storm Water Management Program (SWMP). The SWMP outlines specific requirements for permit compliance, which include six Minimum Control Measures (MCMs). The MCMs each have detailed tasks, which must be completed to be compliant with the MS4 Permit. A copy of the SWMP is located in Appendix A.

The following budgetary items were provided by the City for the preparation of this analysis. The budgetary amounts represent costs associated with materials, equipment, consulting services, and outsourced work necessary to meet the requirements of the MS4 Permit. According to the City, the amounts for each item were derived from cost estimates and quotes solicited from local vendors as well as costs incurred by other Montana MS4 permittee cities.

Table 2.5.1- Budget for MS4 Permit Compliance

Activity	Required Task	Annual Amount
MCM 1	Public Education and Outreach	$20,000
MCM 2	Public Involvement and Participation	$10,000
MCM 3	Illicit Discharge Detection and Elimination	$10,000
MCM 4	Construction Site Storm Water Management	$15,000
MCM 5	Post-Construction Storm Water Management	$10,000
MCM 6	Pollution Prevention and Good Housekeeping	$10,000

The budget for MS4 Permit compliance will be utilized to perform the MCM work outlined below; additional and detailed information regarding the MCM requirements may also be found in the current Montana Department of Environmental Quality *General Permit for Storm Water Discharges Associated with Small Municipal Separate Storm Sewer Systems*.

MCM 1- Public Education and Outreach. Required to implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities about the impacts of storm water discharges on local water bodies and the steps that can be taken to reduce storm water pollution an determine the appropriate best management practices (BMPs) and measurable goals for this minimum control measure.

Funds for this MCM will include, but not be limited to providing public education regarding storm water pollution in-class to school children of various grades, strategically located public signage, brochures and fliers, internet and social media messaging, as well as traditional newspaper, radio and television advertising. (U.S. Environmental Protection Agency, 2005. Fact Sheet 2.3)

MCM 2 - Public Involvement and Participation. Required to follow public notice requirements of storm water regulations and to allow for public opportunities to play an active role in both the development and implementation of the storm water program. The City must utilize alternative advertising venues to ensure all sectors of the community are encouraged to participate. A program must be developed that is inclusive, diverse, and aggressive, to allow for broader public support, shorter implementation schedules, a diverse base of expertise, as well as a conduit to other programs.

Funds for this MCM will involve tasks such as facilitation of public meetings and contacting and working with developers, architects and engineers, contractors and the public on the continuing development of the Storm Water Utility. (U.S. Environmental Protection Agency, 2005. Fact Sheet 2.4)

MCM 3 - Illicit Discharge Detection and Elimination. Required to maintain storm water system map showing the accurate location of all storm water infrastructure and the names and locations of all water bodies that may receive storm water discharge. Through ordinance or other regulatory mechanism, the City must prohibit non-storm water discharges from the MS4 and implement enforcement procedures and actions. The City is also required to execute and maintain a plan to detect and address non-storm water discharges, including illegal dumping within the MS4. This MCM also requires the City to educate public employees, businesses, and the general public about the hazards associated with illegal

discharges and improper disposal of waste. The MS4 must also work with these groups to determine BMPs and measurable goals for this MCM.

Funds for this MCM will assist and be in support of the Missoula Valley Water Quality District (MVWQD) which executes the requirements of this MCM on the behalf of the City. (U.S. Environmental Protection Agency, 2005. Fact Sheet 2.5)

MCM 4 - Construction Site Storm Water Management. Required to develop, implement, and enforce a program to reduce pollutants in storm water runoff from construction activities by having an ordinance or other regulatory mechanism requiring the implementation of proper erosion and sediment controls for other construction wastes. Procedures for construction site plan review to consider water quality impacts along with procedures for construction site inspection and enforcement of required control measures and sanctions to endure compliance (established by ordinance or other regulatory mechanism), and to establish procedures for the receipt and consideration of information submitted by the public. The MS4 is also required to determine the appropriate BMPs and measurable goals for the MCM.

Funds for this MCM will be utilized to educate the construction and contracting community, both actively - by providing training and certification in Montana's Storm Water Pollution Prevention Program, as well as proper BMP selection, installation, and maintenance, and other hands-on training, and passively – by way of brochures, fliers, mailers and other media venues. (U.S. Environmental Protection Agency, 2005. Fact Sheet 2.6)

MCM 5 - Post-Construction Site Storm Water Management in New and Redevelopment. Required to implement and enforce a program to reduce pollutants in post-construction runoff within the MS4 from new development and redevelopment projects by developing and implementing strategies that include a combination of structural and/or non-structural BMPs. The City must also have an ordinance(s) that requires the implementation of post-construction runoff controls that ensure adequate long-term operation and maintenance of the post-construction BMPs selected and utilized. The MS4 is required to determine appropriate BMPs and measurable goals for the MCM.

Funds for this MCM will allow for the education and training of developers, contractors, and other responsible parties on the proper selection and on-going maintenance of long-term storm water BMPs, such as those in large commercial project sites, apartment complexes, educational campuses, or those used for development of subdivisions. (U.S. Environmental Protection Agency, 2005. Fact Sheet 2.7)

MCM 6 - Pollution Prevention/Good Housekeeping. Required to examine and alter internal actions and operations to ensure a reduction in the amount and type of pollution that:

1) Collects on streets, parking lots, open spaces and storage and vehicle maintenance areas and is discharged into local waterways; and
2) Results from actions such as;
    a. environmentally damaging land development,
    b. flood management practices, and
    c. poor maintenance of storm water infrastructure.

This MCM is meant primarily to improve or protect waterbodies by altering municipal and facility operations and may result in cost savings for the MS4 by avoiding costly repairs of storm water infrastructure from damage caused by age and neglect. The MS4 is required to develop and implement an operation and maintenance program with the ultimate goal of preventing or reducing pollutant runoff from municipal operations. This MCM requirement includes employee training on how to incorporate pollution prevention/good housekeeping techniques into municipal operations such as park and open space maintenance, fleet and facilities maintenance, new construction and land disturbances, and storm water infrastructure maintenance. The MS4 is required to determine appropriate BMPs and measurable goals for the MCM.

Funds for this MCM will provide for regular, on-going, specialized training of city employees and staff, both permanent and seasonal, who work in positions that have the potential to influence, cause and/ or remediate storm water pollution within the MS4. (U.S. Environmental Protection Agency, 2005. Fact Sheet 2.8)

2.6 Equipment Recommendations

The following is a list of anticipated equipment that will be required by the Storm Water Utility during its initial five-year startup period. Equipment needs are based on normal, routine maintenance of the system and do not include items needed for large scale repairs or capital improvements. As the Storm Water Utility grows, the need for larger equipment, such as a backhoe and other construction equipment, should be re-evaluated.

2.6.1 Computer Equipment

The purchase of computers for new administration staff and field maintenance technicians will be needed. For budgeting purposes, the following has been assumed:

- Computer equipment will be replaced on a 4-year rotation;
- 1 computer will be purchased in FY 2019 for a regulatory compliance specialist;
- 2 computers will be purchased in FY 2021 for field maintenance technicians;
- 0.50 computers will be purchased in FY 2021 for the GIS Technician. The cost for this equipment will be distributed between other Public Works Utilities;
- 2 computers will be purchased in FY 2023 for field maintenance technicians; and
- 2 computers will be purchased in FY 2023 to replace existing equipment.

The Storm Water Utility has expressed the need to equip field maintenance technicians with rugged laptop computers suitable for field use. Computers will be used to access online mapping, construction record drawings, and work orders.

2.6.2 Cellular Phones

Storm Water Utility staff will need to be equipped with a mobile phone.

2.6.3 Service Truck

The City purchased a service truck for the Storm Water Utility in 2017. The operating budget for Fiscal Years 2021 and 2023 includes $30,000 each year for the purchase of additional service trucks for field crew use. It is anticipated that one service truck will be required for every two field maintenance technicians. It is recommended that additional service trucks be acquired as staffing increases.

Service trucks should be equipped with a truck bed tool box for storage and transport of supplies.

2.6.4 Vactor Truck

The City plans to transfer use of a vactor truck from the Wastewater Utility to the Storm Water Utility. The truck will be used to remove silt and debris from storm water inlets, sumps and pretreatment devices. The operations budget assumes that the cost to the Storm Water Utility will be $10,000 with the purchase in FY 2021.

2.6.5 Tractor and Rotary Mower

If the Storm Water Utility is to assume responsibility for mowing levees, ditches, and flood control facilities, it will need adequate mowing equipment. The proposed budget includes $40,000 for the purchase of a 75 HP utility tractor and $2,000 for a rotary mower. It is assumed that the equipment will be purchased in Fiscal Year 2021.

2.6.6 Sprayer

The Storm Water Utility may want to consider purchase of a Skid Sprayer for herbicide and insecticide applications. The sprayer should have a capacity of 200 to 500 gallons and should be equipped with a hose of at least 300 feet. A suitable sprayer would be skid mounted, and sized to be transported in a service truck.

The sprayer is needed for the application of herbicide on the riprap of the City's levee systems. In accordance with USACE criteria, the riprap must be kept clear of trees and woody growth. Generally, herbicide application will be needed once per year with a second application as necessary.

The sprayer could also be used for the application of liquid fertilizers and insecticides.

Figure 2.6.6-1: Example Skid Sprayer

The costs for skid sprayers range from $4,000 to $8,000. Costs are influenced by the size and type of pump provided. It is assumed that the equipment will be purchased in Fiscal Year 2022.

2.6.7 Backhoe

The purchase of a backhoe for use by the Storm Water Utility was considered but is not recommend within the next five years. Field maintenance technicians are not expected to make extensive repairs to storm water piping within the budget planning period. The anticipated need does not yet merit the purchase of this equipment. It will likely be more cost effective to borrow equipment from the Wastewater Utility or to rent it as needed.

Sump replacement is the primary maintenance activity that would require a backhoe. As discussed in paragraph 2.7.3, the City has decided to conduct this work effort through a contractor.

2.6.8 Small Hand Tools

The Storm Water Utility will need to begin to acquire small hand tools for general operation and maintenance activities.

2.6.9 Safety Gear and Equipment

Many activities of the Storm Water Utility require staff to work in and around traffic. Occasionally, staff will come into contact with dangerous materials and hazardous conditions. Therefore, each staff member will have to be provided with Occupational Safety and Health Administration (OSHA) approved and required Personal Protective Equipment (PPE); retroreflective safety coats, jackets, rain gear, vests, gloves, hard hats, safety glasses, hearing protection, etc. The PPE will wear, get damaged through the course of work, become dirty, faded, etc. and will need to be regularly maintained and replaced, at cost to the Storm Water Utility.

In addition, all Storm Water Utility Staff will need to comply with City protocols for safety. Each employee will need to be properly trained in safety protocols. A budget of $5,000 per year is recommended for safety gear and equipment and the associated training.

2.6.10 Temporary Traffic Control Devices and Signage

With staff spending significant amounts of time working upon Missoula public surface infrastructure (curb/gutters, sidewalks, trails, alleys, roadways, streets, etc.) in both vehicular (motorized) and pedestrian (non-motorized) traffic, temporary traffic control devices (candles, cones, lights, etc.) and traffic management signage are necessities. This equipment, as it is used outside in all elemental exposure, will require regular maintenance and replacement when it becomes dirty, faded or damaged by daily handling and both indirect and direct traffic contact. Occasionally, this equipment will even need upgrades as technology, materials and / or federal (Federal Highway Administration [FHWA], Manual on Uniform Traffic Control Devices [MUTCD], etc.) or state (Montana Department of Transportation [MDT], etc.) requirements change. This equipment will need to be regularly maintained and replaced, at cost to the Storm Water Utility. The cost for these devices and signage are included in the budget, estimated at $8,000 per year, starting in 2021 when the first field crew is hired.

2.7 System Operations

2.7.1 Description of Assets

According to the City's GIS information, the City's storm water infrastructure includes the following:

City of Missoula owned:

- Sumps – 4,375,
- Inlets – 1,182,
- Manholes – 490, and
- Pipes – 1835 (163,639 feet or 31 miles).

MDT owned/City maintained:

- Sumps – 612,
- Inlets – 306,
- Manholes – 178, and
- Pipes – 533 (72,053 feet or 13. miles).

According to discussions with the City, it is estimated that as much as 10 percent of the system is not included in the City's GIS. The manpower estimates discussed herein are based on the known system. However, 10 percent is within the level of accuracy used for this planning level document. Even if the storm water assets are underestimated by 10 percent, the additional infrastructure would not justify the need for additional field maintenance technicians.

It is the goal of the Storm Water Utility to inspect and maintain each asset at least once every five years, or as needed to address localized issues. With that goal in mind, the following sections summarize anticipated efforts and production rates.

2.7.2 Sump, Inlet, Pipe, Manhole, and Pretreatment Device Maintenance

Much of the City's storm water runoff drains to sumps. These structures are inlets that are not connected to a water system. The sumps have an open bottom that allows the captured runoff to infiltrate into the ground. Sediment, trash, and debris accumulate in the sumps over time. As this occurs, the bottom of the sump becomes clogged, the infiltration rate significantly decreases, and the sump no longer functions to remove surface water. Therefore, sumps must be routinely inspected and maintained.

To estimate the staffing required to maintain storm water structures, no distinction will be made between sumps, inlets, pipes and manholes. Sumps comprise most of the system. Therefore, this analysis estimates the level of effort needed for sump maintenance and applies it to all 9,500 structures within the storm water system, with the goal of inspecting every structure once every five years.

- With 9,500 structures on a five-year maintenance schedule, 1,900 structures will need to be inspected every year.

- Staffing for a typical work year is based on 2,080 hours, or 260 days. With 9 days subtracted for holidays and 10 days subtracted for vacation time, there are a total of 241 production days available each year per FTE. 1,900 structures divided by 241 production days yields a necessary production rate of 8 structures per day.
- With a 2-person crew working at a rate of 8 structures per day, the total labor required for 9,500 structures would be 19,200 man-hours over a five-year period.
- The City suspects that up to 10 percent of its storm water infrastructure is not mapped. This equates to an additional 500 structures, 1,000 man-hours and $36,000 in labor costs. Because the amount of unmapped infrastructure is unknown, the costs and projections have not been included in Table 2.2.2. If the City starts to identify additional infrastructure, then the second field crew would need to be hired sooner than anticipated by this report. This would be needed to meet the goal of inspecting all structures every 5 years.

An average production rate of 8 structures per day may be achievable. Generally, one structure will need to be located, inspected, and cleaned every hour. However, the actual rate required for each structure will vary greatly. Factors that may impact maintenance time include the following:

- The amount of sediment and debris that has accumulated,
- The ability of the field crews to locate a structure,
- Travel time to the structure,
- Ease of access,
- Weather conditions / temperature, and
- The ability of field maintenance technicians to open structures.

While production rates will vary, it is a reasonable prediction that there is sufficient infrastructure to devote one field crew entirely to the maintenance of sumps, manholes, inlets, pipes, and pretreatment devices.

The budget for field maintenance technicians to conduct this maintenance is based on the following assumptions:

- An average rate of $36.00 per hour,
- 1 service truck,
- 1 vactor truck, and
- $5,000 per year for miscellaneous material and equipment.

It should be noted that cleaning operations are limited by the single vactor truck owned by the Storm Water Utility. The analysis shows that the vactor truck could be in use full time (including down time for maintenance.) The Storm Water Utility cannot dedicate additional staff to this effort without adding (either by purchase or rental) a second vactor truck.

2.7.3 Sump Replacement

The City must routinely replace dry sumps when they become structurally deficient or no longer function properly. The City provided a budgetary amount of $60,000 per year for this effort. Initially, the work is to be performed through the services of a contractor.

2.7.4 Storm Water Utility Miscellaneous Maintenance

The Storm Water Utility has responsibility to operate and maintain several other storm water assets with no set routine maintenance. These assets include the Grit Chamber, High Park Drainage Basin, Cattail Park, and various roadside ditches that convey storm water. The operating budget includes line items for miscellaneous maintenance projects and work that cannot be anticipated. Once the City begins hiring field maintenance technicians in FY 2021, some effort will be dedicated to work that has not yet been anticipated. The budget assumes approximately 780 hours per year for this effort with $10,000 for equipment and $10,000 for materials.

2.7.5 Tree Clearing and Removal

Trees and woody growth have been allowed to grow within the defined prism of several of the City's levees. Most of the growth has occurred on the river side slope of the Clark Fork Area 3, Clark Fork Area 5, and Grant Creek Levees. The Pattee Creek Levee, and system at Playfair Park are clear of trees and woody growth. In accordance with USACE criteria for the operation and maintenance of levees, the trees will need to be removed, and must be done so prior to any levee certification efforts[3]. The following discussion assumes that any vegetation removal conducted would occur with consideration and within the constraints of other State and Federal regulations regarding water quality, wildlife habitat and the Federal Endangered Species Act, if applicable. Federal Endangered Species Act consultation with the United States Fish and Wildlife Service occurs between federal agencies. The City would work through the United States Army Corps of Engineers if consultation is advised or required. To estimate the cost of this effort, the City's GIS information was used to determine the general area. The riverside slope of the Clark Fork Area 3 and Clark Fork Area 5 were measured[4], and an estimated 9 acres was used for this staffing analysis. It was also assumed that the tree clearing efforts would be divided equally over a period of 5 years. Costs associated with this effort assumed cutting and chipping of light trees less than 6 inches in diameter, grubbing, and removal of stumps.

While most trees on the riverside slope are less than 6 inches in diameter, a line item was included to remove individual trees up to 12 inches in diameter. This may include volunteer trees or the removal

[3] Certification is a statement that the levee systems are operated in accordance with the Operation & Maintenance Manual. The trees present at the time of this report are an indication that the current level of maintenance is not in compliance. Before any levee can be certified, the trees must be removed.

[4] Tree clearing and removal for the Grant Creek Levee System is to be a separate capital improvement project. Details are provided in Chapter 4. Staffing estimates associated with Chapter 2 assume that the work will be completed using a contractor.

of landscaping features that violate the USACE's criteria. For this effort, a quantity of 30 trees per year was assumed.

CostWorks Version 16.01 was used as the basis for estimating costs, crew sizes, and daily crew output.

- Cutting, chipping, grubbing, and removal of light trees:
    - A total of 9 acres will be cleared over 5 years. The average yearly quantity was assumed to be 1.8 acres.
    - To cut and chip light trees up to 6 inches, CostWorks provided a cost of $4,425 per acre. Grubbing[5] and removal of stumps is estimated at $1,975 per acre. The combined cost is estimated at $6,400 per acres. Because the work will be done on the levee slopes, and because site access may be limited, the unit price was increased 50 percent. This yielded a total budgetary unit price of $9,600. With 1.8 acres of clearing each year, the base budget for this effort was estimated at $17,280.
    - It was assumed that this effort would be done by contract for Fiscal Years 2019 through 2023 using a combination of contractors and field maintenance technicians.
    - It is assumed that the overall cost of the work would generally be the same for a contractor or City staff. 352 man-hours were estimated for two field maintenance technicians. It was also estimated that 40 percent of the total cost ($5,280) would be incurred by materials and equipment costs.
    - The total amount of labor effort needed for tree clearing is estimated to be 44 man-days, or 0.18 FTE's.

2.7.6 Herbicide Applications

Once the riprapped areas have been cleared of trees and woody growth, routine maintenance must be conducted so that the growth does not return. The estimate for operations and maintenance includes the cost to apply herbicide once per year to the riprap. Since tree clearing and removal is to be phased over five years, herbicide application increases each year to account for the cumulative number of trees cleared.

- Herbicide Application would begin in Fiscal Year 2021. The area for application would be that cleared of trees in Fiscal Year 2020.
- It is estimated that riprap on the Clark Fork Area 3 and Clark Fork Area 5 Levees can be applied in 3 days with a crew of 2 people.
- The total amount of labor effort needed for herbicide application is 6 man-days, or 0.025 FTE's.

[5] Grubbing of stumps removes the root ball of the tree, and may damage the levee. The city should consult with the USACE prior to conducting tree removal. It may be more appropriate to chemically treat the small stumps rather than grubbing. For the purposes of estimating staffing requirements, grubbing offers a more conservative estimate.

The application of pesticides and herbicides is regulated by the State of Montana (State of Montana, 2017). Administrative Rule 4.10.201 requires that an individual who applies pesticides for hire or contract must be a licensed commercial applicator. If the Storm Water Utility desires to perform this type of work, then at least one field maintenance technician on the field crew needs to be licensed.

The applied herbicide(s) needs to be suitable for aquatic applications. Montana Administrative Rule 4.10.311 (State of Montana, 2017) restricts ingredients deemed harmful to the environment.

2.7.7 Mowing

Most of the levees and flood control facilities are integrated into the City's parks. As a result, the City Parks and Recreation Department is currently responsible for mowing operations. A conservative assumption would be that the Storm Water Utility will eventually incur the cost of mowing – either as a charge from the Parks and Recreation Department, using a commercial lawn care company, or using City staff. The staffing required to conduct the effort assumes a total mowing area of 20 acres, and that 6 mowings will be conducted each year.

- It is anticipated that mowing and vegetation control will be conducted in the Clark Fork Area 3 Levee, Clark Fork Area 5 Levee, Grant Creek Levee, Pattee Creek Levee, High Park Drainage Basin, and other open space areas associated with the storm water management system for City.
- Mowing will be conducted using a tractor and rotary mower. It is assumed that mowing operations for the areas listed above will require approximately 4 days, and will be conducted 6 times per year.
- The total amount of labor effort needed for mowing is 192-man hours, or 0.10 FTE's.
- $100 per day was budgeted for equipment and material.

An argument could be made that Parks and Recreation Department should continue mowing operations. They have the manpower and equipment needed, and most of the levees are adjacent to park land. The current practice likely offers the most cost-efficient approach. However, it is important to note that the Parks and Recreation Department manages the turf as it would a park and does not account for the more stringent requirements of levee turf maintenance. While the turf is mowed and is allowable in a vegetation-free zone, the criteria to maintain this zone (U.S. Army Corps of Engineers, 2014) is not met because trees and woody growth are present.

The USACE strictly limits landscape plantings and vegetation. The criteria for vegetation management is provided in ETL 1110-2-583 (U.S. Army Corps of Engineers, 2014). The criteria states that a vegetation-free zone needs to be maintained around all levees:

> *The vegetation-free zone is a three-dimensional corridor surrounding all levees, floodwalls, embankment dams, and critical appurtenant structures in all flood damage reduction systems.*

The document states that the primary purpose is to provide a reliable corridor of access to and along the levee. The corridor must be kept free of obstructions and must provide unobstructed space needed for construction of temporary flood control structures.

Maintenance by the Storm Water Utility should promote a distinction in maintenance practices between levees and parks. In addition, it would provide the opportunity for Storm Water Utility staff to be on all levees at least once per month during the growing season. A mower would cover every square foot of the turf, allowing staff to spot maintenance deficiencies sooner than would be observed with the four required annual maintenance inspections.

2.7.8 Animal Control

The Storm Water Utility is responsible for monitoring and removing burrowing animals near the levee system. Burrows remove material from the levee and have been known to cause levee failures. The recommended operations budget includes a nominal amount of $3,500 per year to address burrowing animals. It is assumed that this will be done through a contract with a specialized company

2.7.9 Flood Fight Reserve Operations

The City assists the Missoula County Disaster and Emergency Services (DES), with conducting the Emergency Action Plan for the South Missoula Storm Drain System, Upper and Lower Clark Fork River Levees, and the Grant Creek Levee. When a flood event occurs, the special procedures outlined in the Operations and Maintenance Manual for the levee systems must be enacted. These efforts may include levee patrols, sandbagging, public outreach, post flood inspections, etc. Flood events do not typically occur each year, but it is recommended that the Storm Water Utility develop a reserve of funds to conduct a minor flood fight. The operations budget accounts for $10,000 per year with the assumption that a minor flood fight will be needed about every 5 years.

Flood fight activities are conducted as a joint effort of several City Departments and other governmental agencies in the Missoula area with the Missoula County DEQ being the lead agency The $10,000 budget is not the entire cost of a flood fight. It is a budgetary amount intended to fund the Storm Water Utility's portion of the cost.

2.7.10 Levee System General Maintenance

The operating budget includes line items for general maintenance associated with the levee systems beginning in FY 2021 when the first field maintenance technicians are hired. Between FY 2021 and FY 2023, an annual budget of 480 man-hours (0.25 FTE's) and approximately $3,000 per year for equipment and materials has been established.

2.8 Review of City Storm Water Rules

The review of the City Storm Water Rules includes a discussion of the storm water rules and regulations required by the City's MS4 Permit followed by an analysis of other storm water regulations and ordinances set forth by the City of Missoula

2.8.1 MCM-1 Public Education and Outreach

No ordinances are required.

2.8.2 MCM-2 Public Involvement and Participation

No ordinances are required.

2.8.3 MCM-3 Illicit Discharge Detection and Elimination

Requirement: To the extent allowable under State or local law, effectively prohibit, through ordinance or other regulatory mechanism, non-storm water discharges into the regulated storm water system and implement appropriate enforcement procedures and actions.

Compliance: Section 13.27.200 of City's Municipal Code defines and prohibits discharges to the storm water system unless authorized by a separate MPDES permit (City of Missoula, 2016). Section 13.26.080 of City's Municipal Code states that it is unlawful for any person to: A. Cause contamination or to place, cause to be placed, or allow to remain in place any substance in a location where it is likely to cause contamination. (City of Missoula, 1994)

Review Comment: Section 13.27.200 of the Municipal Code is ambiguous about enforcement procedures. An "Authorized enforcement agent" is defined, but the agent's roles and authority are not discussed within the code. The Water Quality District has been enforcing illicit discharge in the City. Those efforts should continue and be solidified through an Interlocal Agreement or MOU.

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Requirement: Solicit assistance from neighboring MS4s as necessary to detect and eliminate illicit discharges that may originate within the neighboring MS4 and formalize in cooperative agreements, i.e. memoranda of understanding.

Compliance: Section 13.27.090 of City's Municipal Code authorizes the City to coordinate storm water-related activities with the Missoula Valley Water Quality District. The MS4 Permit stipulates that a formal agreement must exist, and the Municipal Code authorizes the City to enter into such an agreement. To meet this requirement, the City has entered into an Interlocal Agreement with the County of Missoula, Montana Department of Transportation and the University of Montana (City of Missoula, Montana, 2010).

Review Comment: Compliance has been met.

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Requirement: The City is required to develop an Enforcement Response Plan (ERP). Specific requirements for the ERP are listed in the MS4 Permit (Montana Department of Environmental Quality, 2017, p. 17)

Compliance: The City has authority to develop the ERP in accordance with Section 13.27 of the Municipal Code.

Review Comment: Compliance has been met. A copy of the ERP can be found on the Storm Water Utility's website: http://www.ci.missoula.mt.us/2138/Storm-Water-Division. The Water Quality District has also adopted an Enforcement Response Plan which is available on the City's website.

2.8.4 MCM-4 Implementation of Proper Erosion Control

Requirement: In accordance with the MS4 Permit, the City must have an ordinance or other regulatory mechanism requiring the implementation of proper erosion and sediment controls, and controls for other wastes, on applicable construction sites.

Compliance: Chapter 15.65 of the Municipal Code requires erosion control measures to be designed, approved, and installed as a conditional Grading, Drainage, Erosion Control and Storm Water Pollution Prevent Plan (SWPPP) (City of Missoula, 2009).

Compliance: Chapter 12.18.0505.H states that all solid waste / refuse shall be picked up / swept up and placed in a trash receptacle. No food, trash, or other solid waste / refuse shall be washed or deposited into any storm drain.

Compliance: Chapter 13.27.320 requires that owner or operator of a facility is required to report suspected releases of pollutants into the MS4.

Review Comments: The City's Municipal Code seems to comply. The City should consider requiring permits and SWPPPs for smaller construction projects below the typical thresholds for square footage or slope of disturbed area that are within the immediate vicinity of stream channels.

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Requirement: The City is to have sanctions to ensure compliance (established in the ordinance or other regulatory mechanism).

Compliance: Compliance is assured by Chapter 15.65 of the Missoula Municipal Code. Paragraph 15.65.130.6 states that if the City finds a site to be in non-compliance, a Notice of Violation will be issued. The violation is to be corrected within 24-hours. Failure to take corrective action will result in suspension of the Permit. Failure to act will result in a fine equal to the Permit Fee. Each day a violation continues constitutes a new violation.

Review Comments: The municipal codes provide for adequate sanctions regarding violations.

2.8.5 MCM-5 Post-Construction

Requirement: Have an ordinance or other regulatory mechanism requiring the implementation of post-construction runoff controls to the extent allowable under State, Tribal, or local law.

Compliance: Section 15.65.120 states that "Unless an adequate storm sewer exists or is provided, all surface run-off in addition to that normally present before development shall be retained on-site or released from the site in a manner which shall not substantially increase the peak run-off normally present before development."

Review Comments: A "substantial increase" is ambiguous language and cannot be enforced. The language should be revised to be more specific. The section would also seem to suggest that if an adequate storm sewer exists, then no retention or release criteria apply.

2.8.6 MCM-6 Pollution Prevention/Good Housekeeping

No ordinances are required.

2.8.7 Additional Comments Regarding Title 13.27 of the Missoula Municipal Code

Title 13.27 describes specifications, design standards, administrative rules and a rate schedule for the regulation and operation of the Missoula Storm Water Utility. The full purpose and intent of this ordinance is provided in detail in Title 13.27.020.

2.8.7.1 Operation Cost Determination

Paragraph 13.27.070 requires the Public Works Director to determine a total annual cost of operation and maintenance of the storm water system. Section 2.2 through 2.7 provide the analysis to meet the requirements.

The paragraph also requires the Public Works Director to develop operating plans for the system. That effort was not completed as part of this analysis.

2.8.8 Additional Comments Regarding Title 15.65 of the Missoula Municipal Code

The following section assesses storm water within the Missoula Municipal Code.

2.8.8.1 Levees

Chapter 15.65 of the Municipal Code establishes the requirements for grading plans for new development. However, a review of the document found no mention of the special requirements for design, review, and construction near levee systems. It is recommended that the City add additional requirements to the information provided with a Grading Permit when construction activities are near levee systems. Changes to the municipal code could include the following:

- Discuss the need for review of project near levees;
- Establish a distance from a levee for which review is needed by the City and the U.S. Army Corps of Engineers;
- Establish a formal permitting process and permitting fees;
- Establish the requirement for the Permittee to provide construction record drawings;

- Establish the information required to be submit for review and approval. Information may include, but is not limited to, drawings, specifications, geotechnical analyses, foundation calculations, construction schedules, flood contingency plans, subsurface investigations, vicinity map, stability analysis for excavations, design for excavation support systems, design of dewatering systems, etc.; and
- Refer to applicable design standards for work near levees.

2.8.8.2 Best Management Practices

Chapter 15.65 of the Municipal Code does not address management of storm water quality above what is required for sedimentation and erosion control during construction. While the code meets the requirements of MCM-4, the language to require post-management for runoff water quality purposes is lacking.

With that said, the predominant practice of using dry sumps to dispose of storm water runoff is inherently a post-construction best management practice. There is some ambiguity in the municipal code that would preclude a development from incorporating post-construction BMP's. Section 15.65.120 Plan Requirements and Design Standards states the following:

> *Unless an adequate storm sewer exists or is provided, all surface run-off in addition to that normally present before development shall be retained on-site or released from the site in a manner which shall not substantially increase the peak run-off normally present before development.*

Taken in context with other sections of the code, if an adequate storm sewer exists or is provided, there is no need to retain surface runoff and manage peak discharges. In addition, without the use of a dry sump, there is no water quality benefit. Therefore, in areas of the city where storm waters exist, the code may provide a loophole for post-construction management. The ambiguity could be removed by deleting "*Unless an adequate storm sewer exists or is provided*."

There is also some ambiguity in the last sentence. A "substantial" increase cannot be measured. A developer who must pay for storm water improvements will have a different definition of the word than the city reviewer. The language could be changed to say, "no increase." The language could also be revised to define a level of service. Restrictions on peak runoff rates typically establish the basis of comparison on specific rainfall events. As written, the language would imply that the engineer would have to check all rainfall events to prove compliance.

The Article 3, paragraph 3-040.3.A of City's subdivision regulations (City of Missoula, 2010) provides requires the following for major subdivisions:

> *Major subdivisions that are located outside the designated drainage area must install storm drains or deliver storm water runoff to the nearest suitable drainage channel or storm drain main line. Discharge intensity is limited to ten-year, one-hour storm events. The plan must be approved by the city engineer.*

2.8.8.3 Paragraph 15.65.100 General Requirements for Multifamily, Commercial and Industrial parcels.

This paragraph states the following:

> *A minimum of one (1) eight foot (8') sump or dry well shall be installed per every ten thousand square feet (10,000 SF) of impervious area including but not limited to paved areas, sidewalks, roofs, etc. Additional drainage facilities may be required if soil permeability indicates a slow percolation rate.*

The criterion establishes a minimum number of dry sumps based on impervious area. Since most of the City's drainage utilizes dry sumps, the City may wish to adjust the criteria to define a minimum level of service and require an engineering approach to the design. For example, the criteria could limit the total tributary area (not just the impervious area) to a certain value. Not all dry sumps are in streets and parking lots. The criteria could also establish a design rainfall event and a minimum allowable time for infiltration.

2.8.8.4 Paragraph 15.65.100.3

This paragraph states the following:

> *Alternative drainage systems may be considered with approval from City Engineer.*

This language is ambiguous. There is no definition of an "alternative drainage system" and no associated criteria for approval by the City Engineer. If ever disputed by a developer, this paragraph would be difficult to enforce.

2.8.8.5 Paragraph 15.65.110 Submittal Requirements

This paragraph states the following:

> *Plans for grading, drainage and erosion control shall be approved by Development Services staff, where required, prior to any on-site grading. The following information shall be submitted by the applicant for a Building and/or Zoning Compliance Permit for all new construction and/or additions including but not limited to structures, driveways, streets and parking. The site plan and grading plans may be on one sheet. A Grading and Drainage Plan to scale not to exceed one inch (1") equals 40 feet;*

This paragraph states that erosion control plans must be submitted for new construction and/or additions. The language could be interpreted to exclude projects were re-development occurs.

2.8.8.6 Paragraph 15.65.120 Plan Requirements and Design Standards.

This paragraph states the following:

> *Five (5) copies of the submitted plans for the proposed grading, drainage, erosion control and Storm Water Pollution Prevention Plan (SWPPP) shall be submitted to the Development Services at the time of the application for zoning compliance permit and/or building permit which requires site grading as described in Title 15.64. The submitted plans shall be in conformance with Title 12, Title 15, Title 20, or as required by any Federal, State, and/or Local agency.*

Title 15.64 was repealed. The reference should be changed to "Title 15.65."

2.8.9 City of Missoula Standard Specifications

A search for standard specifications on the City's web page found a document titled Storm Water Specification and Design Standards (City of Missoula, 2016). A review of the document found that the content included neither technical specifications nor details for construction. The document seemed to be a reiteration of Chapter 15.65 of the Municipal Code.

The City currently has no dedicated technical specifications or details for storm water infrastructure. It is assumed that some standards exist, but may not be documented on the City's web page for general access. The few standards that are readily available are integrated with the standards associated with roads and streets. As the Storm Water Utility grows, it is recommended that these standards be developed, maintained and enforced by the Storm Water Utility.

Standards to be developed for the storm water infrastructure may include the following:

- Precast concrete structures (curb inlets, junction boxes, dry sumps);
- Metal castings (grated inlets, manhole covers, etc.);
- Trenching;
- Storm water pipes;
- Drainage pipes;
- Street repairs (for trenching);
- Riprap / stone protection;
- Seeding and sodding / surface restoration;
- Sedimentation and erosion control; and
- CCTV inspections.

The City will also need to develop standards for storm water best management practices. While the design and construction of these facilities can be site specific, there should be commonality with the major features. This need mainly pertains to long-term maintenance of the facilities. If the City embraces water quality management above the minimum requirements of the MS4 permit, then there is a potential for numerous BMP's to be constructed around the city. These may be a requirement for new development, or projects undertaken by the City.

There are many design strategies and proprietary products on the market for storm water BMPs. If the choices are not somehow limited, the City could find itself trying to maintain a large number of facilities that require unique equipment, operational practices, and maintenance requirements. Standardization will help to minimize maintenance and operation costs. Items relating to BMP's that could be standardized include the following:

- Engineered fill,
- Underdrain piping,
- Aggregate (for underdrains and pipe bedding),
- Plants,
- Flow control structures,
- Preferred proprietary products, and
- Operation and maintenance procedures.

2.8.10 Design Criteria

2.8.10.1 References

Criteria for the design of storm water infrastructure and storm water management is scattered through the municipal code and the subdivision regulations. Three locations were found:

Section 15.65.120 Plan Requirements and Design Standards states the following:

> *Unless an adequate storm sewer exists or is provided, all surface run-off in addition to that normally present before development shall be retained on-site or released from the site in a manner which shall not substantially increase the peak run-off normally present before development.*

Subdivision Regulations, Article 3, Paragraph 3-040.1

> *The objective of this section is to provide minimum standards for site grading and the control of storm water runoff, both quantity and quality. This section creates submittal and development standards for erosion and sedimentation control, preservation of natural drainage systems, flood mitigation, site grading, and protection of property.*

Subdivision Regulations, Article 3, Paragraph 3-040.2.B

> *Suitable drainage facilities for any surface run-off affecting the subdivision. These facilities must be located in the street rights-of-way, subject to the approval of the city engineer, or in perpetual easements of appropriate widths. Design of such drainage facilities must be based upon local soil factors, topography, natural drainages, gullies and swales, aesthetics, and capacity for proper disposal of excess water. Drainage facilities must be designed to handle both upstream and local drainage.*

Subdivision Regulations, Article 3, Paragraph 3-040.3.A

Major subdivisions that are located outside the designated drainage area must install storm drains or deliver storm water runoff to the nearest suitable drainage channel or storm drain main line. Discharge intensity is limited to ten-year, one-hour storm events. The plan must be approved by the city engineer.

Subdivision Regulations, Article 3, Paragraph 3-040.3.B

Swales, storm waters or some accepted method of storm water management are required, taking into account the character of the area, density of development, and adjoining properties. The subdivider must extend the storm drain if the subdivision is located within 500 feet of an existing storm drain facility.

Subdivision Regulations, Article 3, Paragraph 3-040.3.C

Unless an adequate storm sewer exists or is provided, all surface run-off in addition to that normally present before subdivision must be retained on site or released from the site in a manner that will not substantially increase the peak run-off normally present before subdivision. Restrictive covenants may be required to mitigate adverse effects of property drainage. Mitigation may involve the installation of drainage structures or the connection to an existing storm drainage system. Drainage easements across adjoining land to the nearest drainage way may be required.

Subdivision Regulations, Article 5, Paragraph 5-020.11.B

All drainage facilities are subject to the approval of the city engineer and when installed or constructed must be in conformance with the applicant's approved drainage plan for the affected basin where the subdivision is situated. Suitable drainage facilities must be provided for any surface runoff affecting the subdivision. These facilities must be located in the street rights-of-way or in perpetual easements of appropriate widths, subject to the approval of the city engineer. Design of such drainage facilities must be based upon local soil factors, topography, natural drainages, gullies and swales, aesthetics, and capacity for proper disposal of excess water. Drainage facilities must be designed to handle both the subdivision and the adjacent drainage basin.

Subdivision Regulations, Article 5, Paragraph 5-020.11.C

Description and calculations of the proposed storm drainage plan for a 10- year frequency one-hour storm and a 100-year frequency one-hour storm on-site and a method to mitigate adverse impacts for a 100-year frequency one-hour storm. Drainage must be retained on site or released from the site in a manner that will not substantially increase the peak run off normally present before subdivision. All drainage plans for the subdivision must provide for conveyance, treatment, and disposal. A complete grading and drainage plan must include accurate dimensions,

courses, and elevations, showing the proposed grades and drainage improvements, existing and proposed contours, graded slopes, and indicating approval by the city engineer.

2.8.10.2 Summary of Design Criteria

Storm water runoff systems (dry sumps, pipes, ditches, and swales) are to be designed to convey a ten-year, one-hour storm event.

Storm water runoff should be retained on site (no discharge). This strategy fits within the City's practice of utilizing dry sumps to infiltrate runoff.

If the runoff is not retained, then it should be discharged at pre-development rates.

The use of dry sumps is required for multifamily, commercial, and industrial parcels.

All plans and design calculations are subject to approval by the City Engineer.

2.8.10.3 Potential Discrepancies

A stated objective of the Subdivision Design Standards is to provide minimum standards for both quantity and quality of storm water runoff. After the initial statement (Article 3, Paragraph 3-040.1), water quality is not specifically mentioned in the standards. The water quality standards must be inferred from other language. If a subdivider submitted a set of plans, there is nothing in the standards that would allow a City plan reviewer to definitively state that water quality standards for runoff have been met.

The subdivision design standards (Article 3, Paragraph 3-040.3.A) are different from the submittal requirements (Paragraph 5-020.11.C). The submittal requirements introduce the requirement to management storm water to a 100-year frequency. As written, management of the 100-year frequency one-hour storm is not a standard design requirement, but it is a submittal requirement.

The design standards for storm water facilities and requirements for on-site storm water management are outlined only in the Subdivision Regulations. For projects that do not fit the definition of a subdivision, the standards for design and storm water management may not apply.

Engineering methodologies for analysis are not defined. Engineering parameters and calculations to show compliance with regulations are at the discretion of the engineer of record. The regulations seem to rely heavily on the engineering judgement of the City Engineer to assess compliance.

2.8.11 Administrative Rules

The following administrative rules are pertinent to storm water facilities and are addressed in this section.

2.8.11.1 Rule 108 – Utility Plan Submittal Required Prior to Excavation Permit

Purpose: Establish the procedures for City staff to administer the Public Works Department's requirement regarding utility plan submittal. The requirement states that private utility companies will submit utility plans for review and approval by the City of Missoula Engineering Division prior to obtaining excavation permits. The intent of this requirement is to reduce future conflicts between private and public underground utilities with future planned development.

Applicability: All City staff responsible for utility plan review, approval, issuing permits, and performing inspections.

Discussion**:** City of Missoula is experiencing significant growth. This growth results in private utility and public infrastructure improvement conflicts caused by crowded rights-of-way and easements. Therefore, the City Public Works Department has implemented the following Policy: The City Engineering Division will not issue excavation permits for any mainline, primary, secondary or cable construction, that is located within a public right-of-way or public utility easement, without an approved set of plans. This plan review by City Engineering will reduce future conflicts between private and public underground utilities along with future expansion of public infrastructure such as sanitary waters, storm waters and roadways. Also, although excavation permits are not required, any significant (3 or more spans) pole line installation/replacement projects located in the public right-of-way will need to be approved before construction. (City of Missoula, 2007)

2.8.11.2 Rule 618 - Television Inspections (City of Missoula, 2012)

Supplements Rule 661 is summarized below and outlines technical specifications for conducting television inspections.

2.8.11.3 Rule 661 – Tests and Inspections for Infrastructure Improvements (City of Missoula, 2007)

Requirement for new construction only. Does not require or provide guidance to City staff for routine television inspection of lines.

Storm Water Utility will need to develop protocols for new construction projects to ensure that this information is provided by the Engineer, reviewed by the Storm Water Utility, and the documentation is properly managed.

Storm Water Utility needs to develop its own policy for routine television inspection of storm water pipes. At a minimum, storm water pipes below levees should be inspected every five years.

Other pipes within the system can be inspected at the discretion of the Storm Water Utility. It may be desirable to set a frequency of inspection (i.e., all pipe to be inspected every 10 years), or it may be suitable to conduct television inspections on an as-needed basis.

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CHAPTER 3

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Chapter 3
Levee System Operations and Maintenance

A priority for the City of Missoula Storm Water Utility is the need to develop defined operations and maintenance practices and procedure for the levee systems within the City. The levees provide critical flood protection to existing property, structures, and infrastructure. Several of the levees are considered jurisdictional and require certification and accreditation. To maintain accreditation of the levees, operations and routine maintenance must occur. This Chapter reviews regulatory requirements, provides operational recommendations to maintain the levees, and presents a plan for future recertification.

3.1 Purpose of Operation and Maintenance Review

As part of the Project, a review of the City's operation and maintenance procedures for the Missoula levee systems was made. The purpose of this task was to review current practices for compliance with the Operation and Maintenance Manual(s) for the Missoula levee systems and for compliance with other U.S. Army Corps of Engineers (USACE) guidelines. Activities under this task included the following:

- Review existing operations and maintenance information and prior inspection reports;
- Assist City with the identification of maintenance deficiencies;
- Assist City with the development of a working budget for levee operations and maintenance to include administration, on-going required maintenance, known capital improvement needs, and recertification[1]; and
- Prepare recommendations for City to improve the Missoula levee system operation and maintenance with recommendations including, but not limited to:

    - Identification of outstanding maintenance items, including those that risk future recertification efforts;
    - Assessment of the City's current method of documenting maintenance activities and USACE requirements; and
    - Assessment of the City's current document management practices and USACE requirements

[1] The working budget is provided in Chapter 2.

3.1.1 Missoula Levee System Overview

The City of Missoula owns and operates five flood control systems. These systems include the Grant Creek Levee, Clark Fork Area 3 Levee, Clark Fork Area 5 Levee, Pattee Creek Levee, and the South Missoula Storm Drain Systems. The locations of the facilities are shown in Figure 3.1.1-1. The Orchard Homes Levee, which is also depicted in the figure, is part of the overall flood control strategy for the City, but is not operated by the City.

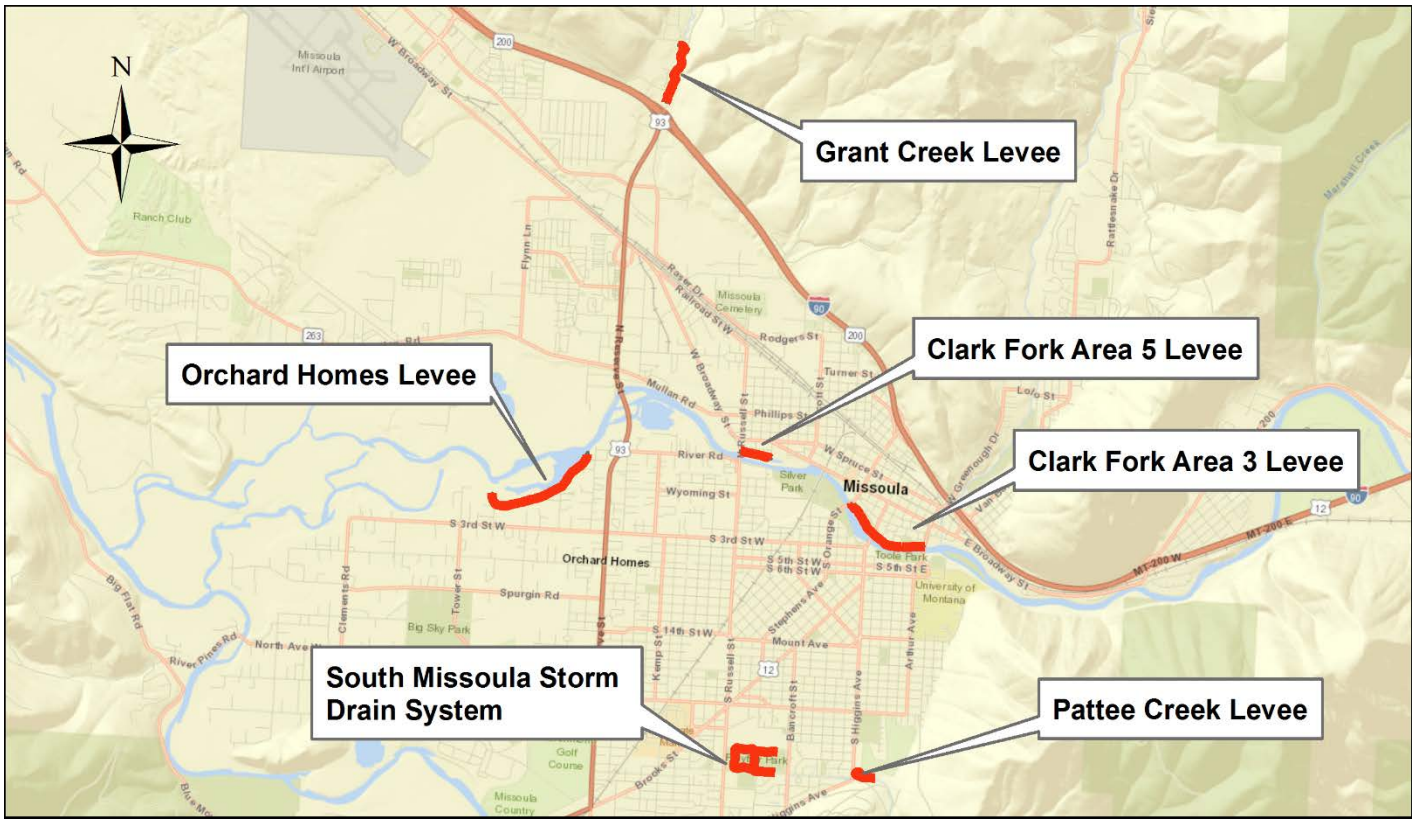
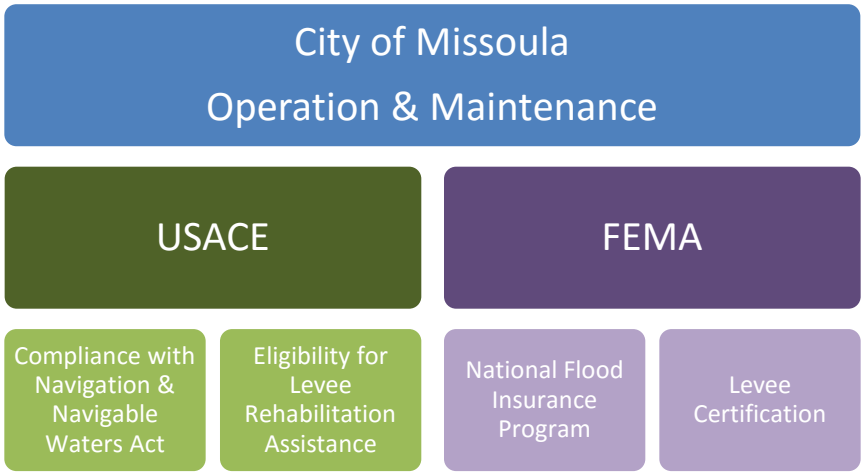


Figure 3.1.1-1 – Missoula Levee Systems

3.1.2 Regulatory Oversight for Levees

There is often confusion about the different roles and responsibilities of the U.S. Army Corps of Engineers (USACE) and Federal Emergency Management Agency (FEMA) regarding the day-to-day operation, inspection, and oversight of levees. A simple way to view the relationship is that the USACE has oversight responsibilities while FEMA has a vested interest. The role of the USACE is to make sure that the levee systems are operated and maintained in accordance with the law. The role of FEMA is to quantify the flood risk associated with levee systems.



The regulatory need for operation and maintenance of a levee system is mainly driven by two laws. The first is Public Law 84-99 (33 U.S.C. 701n) Flood Control and Coastal Emergencies (herein referred to as PL 84-99). If a levee or other feature is damaged because of a flood event, then the City of Missoula could receive federal funding to make repairs. The USACE is the federal agency that verifies that levee systems are eligible under this law.

The second law is Code of Federal Regulations (CFR) Title 44: Emergency Management and Assistance, Part 65 – Identification and Mapping of Special Hazard Areas (Code of Federal Regulations 44 CFR 65). The legislation outlines the requirements for levee certification and accreditation. One of the requirements is that the levee system be operated in accordance with the Operations and Maintenance Manual. FEMA is the federal agency that implements this piece of legislation.

There is a third piece of legislation that serves as the basis for all operation and maintenance activities. It is Part 208 of the Navigation and Navigable Waters Act (Code of Federal Regulations, 2001). This document details the minimum requirement for operation and maintenance of all federal levee systems. To meet the requirements of PL 84-99 and 44 CFR 65, a levee system must be operated in accordance with this act.

3.1.3 U.S. Army Corps of Engineers

3.1.3.1 Compliance with Navigation and Navigable Waters Act

For federal levees (such as the Clark Fork levees where federal funds were used for construction) the USACE provides oversight for compliance with Part 208 of the Navigation and Navigable Waters Act (Code of Federal Regulations, 2001). Most of Part 208 dictates the responsibilities of

the local sponsor[2]. The USACE is to provide the federal government with the assurance that the local sponsor is following the letter of the law. It accomplishes this primarily through the annual inspection and the semiannual reports.

General requirements outlined in Part 208 for the local sponsor include the following:

- Prior to construction of the federal levees, the City of Missoula would have had to provide an assurance that the system would be maintained in accordance with applicable regulations and in accordance with the provided Operations and Maintenance Manual. This is a written document signed by the ranking public official at the time. It pledges the City's commitment to maintenance and is typically incorporated into the Operation and Maintenance Manual for the system.
- The local sponsor is required to form a committee consisting of or headed by an official designated as the "Superintendent."
- The local sponsor must keep a reserve of materials ready for an emergency.
- The local sponsor must prohibit encroachments that will adversely affect the efficient operation or maintenance of the project works.
- No improvement shall be passed over, under, or through the walls, levees, improved channels, or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without approval by the USACE.
- The local sponsor must submit a semiannual report covering inspection, maintenance, and operation activities.
- The local sponsor must conduct maintenance measures or repairs that the USACE deems necessary. These deficiencies are noted in the annual inspection report.
- The local sponsor must conduct its own maintenance inspection at least once per quarter.
- The USACE must provide an operations and maintenance manual for the system
- The USACE must provide a review of proposed improvements and approval as appropriate.
- The USACE must identify maintenance deficiencies.

3.1.3.2 Eligibility for Levee Rehabilitation Program

The USACE may provide assistance under Public Law 84-99 (33 U.S.C. 701n) Flood Control and Coastal Emergencies. If a levee or other feature is damaged because of a flood event, then the City of Missoula could receive federal funding to make repairs. However, to receive federal funding, the levee system must have an eligible status. The USACE oversees the operations and maintenance to determine if the system is eligible for rehabilitation assistance. This includes both federal levees such as the Clark Fork Levees, and non-federal levees such as the Grant Creek Levee. Each year, the USACE conducts an annual inspection of the levee system to determine if the system has been maintained in accordance with established criteria.

[2] A Local Sponsor is "...a legally constituted public body with full authority and capability to perform the terms of its agreements, and to pay damages, if necessary, in the event of failure to perform." For the purposes of this memorandum, the local sponsor refers to the City of Missoula.

- The only purpose of the annual inspection conducted by the USACE is to determine eligibility for rehabilitation under Public Law 84-99.
- Inspection results generally have no direct impact on accreditation status.
- If a maintenance deficiency is given a "U" Rating, then it must be repaired by the next annual inspection, or the system will be at risk for eligibility.

3.1.4 Federal Emergency Management Agency (FEMA)

FEMA administers the National Flood Insurance Program (NFIP) which identifies risks associated with flooding, and then provides insurance to help mitigate the financial burden of flood damage. Flooding risks are shown on FEMA's Flood Insurance Rate Maps. Areas that are protected by accredited levees are given a special risk classification. Properties within these areas are still considered to be at risk from flooding, but the insurance rates account for the protection provided by the levee system.

- For a levee to be accredited, a registered, professional engineer must certify that the levee system meets the minimum requirements of Code of Federal Regulations (CFR) Title 44: Emergency Management and Assistance, Part 65 – Identification and Mapping of Special Hazard Areas (Code of Federal Regulations 44 CFR 65).
- The certification effort is the responsibility of the local sponsor of the levee system. Neither the USACE nor FEMA will certify existing levee systems. Once FEMA has received the certification documents, a review of the information will be made. If FEMA accepts the certification document, then they will accredit the levee system and show the area protected by levee on the flood insurance rate maps.
- FEMA has established its own minimum performance criteria. Performance standards of FEMA and the USACE overlap in many areas but are not necessarily the same. For example, the USACE may design a levee system for a 500-year flood event. However, the 100-year flood event is the focus of FEMA's certification process.
- Certification and accreditation is a requirement by FEMA, not the USACE. FEMA determines when a levee needs to be certified. All official correspondence regarding certification would be through FEMA.
- The USACE does not certify existing levee systems. They would need to be authorized and funded to perform this work. They will typically issue a letter to the local sponsor that states that they will not certify a levee system. The letter is neither an indictment of the condition of the levee, nor is it a notification that the levee needs to be certified. The letter is only an attempt to curb any expectations of the local sponsor that the USACE will provide the service.
- FEMA neither inspects levee systems, nor continually checks for compliance with their standards. Once a levee is accredited, it typically remains so until recertification is required.
- The local floodplain administrator (City of Missoula) is responsible for managing the national flood insurance program in its community. If the condition of the levee were to change so that the risk indicated on the FIRM was no longer accurate, then it would be the City's responsibility to notify FEMA.
- The USACE does not report levee conditions to FEMA. The inspections made by the USACE are intended to be used by the USACE. The information is public and would be available to FEMA if requested.

3.2 Levee Certification

3.2.1 Definition

Certification: The engineering analysis and documentation effort that confirms compliance. Certification by a registered professional engineer does not constitute a warranty or guarantee of performance, expressed or implied. Certification of data is a statement that the data is accurate to the best of the certifier's knowledge. Certification of analyses is a statement that the analyses have been performed correctly and in accordance with sound engineering practices. Certification of structural works is a statement that the works are designed in accordance with sound engineering practices to provide protection from the base flood. Certification of ''as built'' conditions is a statement that the structure(s) has been built according to the plans being certified, is in place, and is fully functioning. (Code of Federal Regulations 44 CFR 65.2)

Accreditation: FEMA's acceptance of the certification documents.

3.2.2 Requirement for Certification / Accreditation

Levee certification and accreditation is a requirement of the National Flood Insurance Program. FEMA is the governmental agency through which certification is required. While the USACE designed and oversees maintenance and operation of the levees, it does not have any responsibility or direct involvement in the certification process.

As the designer of the original levee system, it is often assumed that the USACE can provide all the documentation needed for certification. While a great deal of information is available, the USACE rarely has everything needed by FEMA. In additional, the USACE may only work on projects that are funded by Congress. Even though the USACE may have engineers qualified to certify levee systems, they typically only certify systems for federal facilities where there is no Local Sponsor.

Most communities initially assume that the USACE will conduct the effort. As the result, the USACE has been proactive in communicating its position, and will generally issue a letter to the Local Sponsor stating that they will not provide the certification. It should be noted that a letter of this nature, originating from the USACE and not FEMA, does not constitute a requirement for certification. It only gives notice that should certification be required, then the USACE will not be responsible for the process.

The need to certify or recertify a levee system is at the discretion of FEMA. The effort is typically done with a remapping effort of the community. A representative from FEMA should contact the City's Floodplain Administrator well in advance to provide ample warning. Then FEMA will issue a letter to the City stating the levee systems have been classified as Provisionally Accredited Levees (PAL). The City will then be asked to enter into an agreement with FEMA that commits the City to the certification process and establishes the schedule in which to do so.

It is at the City's discretion to undertake the certification process. However, if the levees are not certified (and subsequently accredited), then the Flood Insurance Rate Maps will reflect the flood risk as if the levee(s) does not exist. The protected area will be mapped as floodplain, and development within the flooding zone will be insured as if the levee afforded no protection.

3.2.3 Clark Fork Levees

According to the Flood Insurance Study for the City of Missoula (Federal Emergency Management Agency, 2015), the Clark Fork Levees are certified. Paragraph 2.4 Flood Protection Measures states the following:

> *Flood protection measures on the Clark Fork in the areas studied by detailed methods consist of the following: …*
>
> > *…A certified levee on the north bank of the Clark Fork within the city limits from Madison Street to Orange Street.*
> >
> > *…A certified levee on the north bank of the Clark Fork within the city limits from the California Pedestrian Bridge to Russell Street.*

3.2.4 Grant Creek Levee

The paragraph also includes a discussion of the Grant Creek Levee and states that this system is also certified.

> *An approximately 3000-foot-long certified levee on the west bank of Grant Creek within city limits was constructed north of Interstate 90. This levee was approved in a LOMR and protects the Cottonwood condominiums and the Rocky Mountain Elk Foundation from the 1- percent annual chance flood event.*

Figure 3.2.2-1 shows an excerpt from the Flood Insurance Rate Map. The mapping calls out the Grant Creek Levee, and shows the protected area as a Zone X. There is also a note that states the area is protected by a levee system and states that the levee is acreddited.

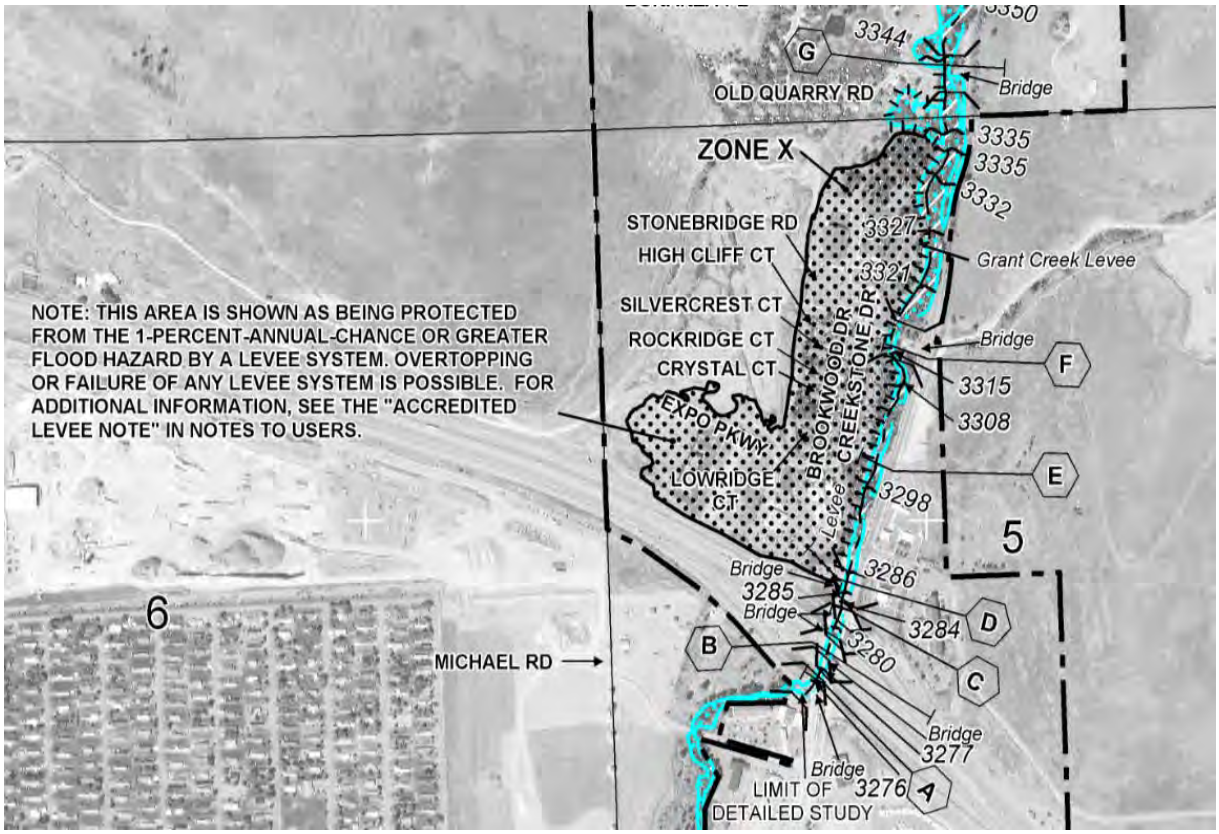


Figure 3.2.2-1 – Flood Insurance Rate Mapping for Grant Creek

3.2.5 Pattee Creek Levee

The Pattee Creek levee is neither mentioned in the Flood Insurance Study nor shown on the Flood Insurance Rate Maps. Paragraph 2.4 of the Flood Insurance Study does discuss the 2004 South Missoula Storm Drainage Project, of which the Pattee Creek Levee is a component:

> *The 2004 South Missoula Storm Drainage Project provides protection for the 1-percent annual chance flood event for the South Hills neighborhood. Most of the remaining parcels within the Special Flood Hazard Area are limited to City parks and open space.*

While the discussion does not specifically mention certification, it does state that the project provides protection for the 1-percent annual chance flood. As shown in Figure 3.2.3-2, the Flood Insurance Rate Map acknowledges the flood protection benefits of the project and shows flooding on the riverward side of the levee.

Figure 3.2.3-2– Flood Insurance Rate Mapping for Pattee Creek

3.2.6 Conclusions

The Flood Insurance Study for Missoula was updated in 2015. At the time of the update, FEMA had sufficient documentation to accredit the Clark Fork Levees, the Grant Creek Levee, and the 2004 South Missoula Storm Drainage Project. This is confirmed by statements within the Flood Insurance Study and how the flood risk was mapped on the Flood Insurance Rate Maps.

3.3 Asset Management

The flood control projects owned and operated by the City of Missoula are a system of assets that need to be managed like any other City-owned utility. Like water supply and sanitary sewer systems, flood protection systems have many different components. Each component has a unique set of maintenance requirements, and the condition and maintenance record must be documented. This Technical Memorandum outlines some initial steps that could be undertaken to better manage the levees as a utility.

3.4 Field Observations

Field observations of the levee systems were conducted on August 16, 2017. The project team accompanied City staff on a routine maintenance inspection of the Pattee Creek, Clark Fork, and Grant Creek Levee Systems.

3.5 Drawings and Mapping

3.5.1 Background

With any utility system, the staff that operates and maintains the system must have a clear understanding of the systems components. They must know where each component is located, how it is to be operated, how it is to be maintained, and how it functions within the context of the overall system. The basis for this understand is drawings and mapping.

As part of this Project, the City provided the following drawing and mapping information:

Table 3.5.1 – Levee Drawing and Mapping Information

System	Location in GIS	Construction Record Drawings
Grant Creek Levee	✓	Not provided
Pattee Creek Levee	✓	Not provided
Clark Fork Levee Area 3	✓	✓
Clark Fork Levee Area 5	✓	✓

For all levee systems, the general location and the name of each is included in the City's GIS information. No other information seems to be included in GIS.

The City also provided the original construction record drawings for the Clark Fork Levee Systems. Drawings were scanned, and it is unknown if the City is in possession of the hard copy originals.

No other information was provided or found for the Grant Creek or Pattee Creek Levees, for new improvements to any of the levee systems, or for encroachments to any of the levee systems.

3.5.2 Property Boundaries

The City can only conduct operation and maintenance activities within the limits of its property, right-of-way, or established easements. The information reviewed as part of this Project did not provide a clear indication of property ownership. The construction record drawings for the Clark Fork Levees do show properties and easements associated with original construction. However, the information shown is graphical in nature, and the drawings could not be used to establish boundaries to an acceptable accuracy.

It is recommended that the City research its property holdings associated with the levee systems. It will be desirable to obtain copies of all deeds, easements, rights-of-way, cooperative agreements, or any other document that convey property rights. The information contained within these documents should be incorporated into the City's GIS and should include the following information:

- Location (shown as a polyline)
- Type or description (i.e. deed, easement, right-of-way, etc.)
- Date
- Parties to the agreement with contact information

3.5.3 Levee Center Line

The City's GIS information should provide the design centerline of the levee. The alignment should be survey grade and should precisely match the centerline depicted on the construction record drawings.

With the centerline, a feature for levee stationing should also be developed. Stationing in GIS should precisely match the stationing shown on the construction record drawings.

3.5.4 Utility Penetrations

All utilities that pass under, through, or over the levee should be shown on the mapping. Information should include, but is not limited to, the following:

- Location (shown as a polyline)
- Owner (with contact information)
- Material
- Size and shape
- Depths or inverts
- Date of installation
- Data of last CCTV inspection

3.5.5 Utilities

Utility failures, such as a water main break or a collapsed pipe, can jeopardize a levee system. Therefore, it is recommended that levee mapping show all utilities, including electrical, gas, water, sewer, and cable that are within 200 feet of the levee. This information is needed more for reference than for normal operation and maintenance. Information should include, but is not limited to, the following:

- Location (shown as a polyline)
- Owner (with contact information)
- Material
- Size and shape
- Depths or inverts
- Date of installation

3.5.6 Levee Footprint

Many of the operation and maintenance requirements are based on the physical limits of the levee embankment. Specifically, the limits of the levee prism are needed to establish the Vegetation-Free Zone discussed below. Therefore, it is recommended that the City develop mapping that shows the limits of the embankment as it was originally designed. The information should be obtained from the construction record drawings. Where construction record drawings are not available, the extents can be approximated using a survey.

The information to be mapped should include the following:

- Location (shown as a polygon)

3.5.7 Riprap

The limits of all riprap protection should be incorporated into the City's GIS. This information will help to ensure that all riprapped areas are maintained, and that no area is forgotten over time. Mapping will also calculate the areas that can be used to track unit costs for maintenance. Information should include, but is not limited to, the following:

- Location (shown as a polygon)
- Date of installation or last overlay
- Stone size
- Measured Area

3.5.8 Access Points

It is recommended that the City's GIS identify all points of allowable access to the levee systems. Maintenance crews will need to know where the top of the levee can be accessed for maintenance and flood fight activities. Information should include the following:

- Location (shown as points)
- Gated or open access

3.5.9 Vegetation-Free Zone

The boundaries of the vegetation-free zone as discussed in paragraph 3.7 should be incorporated into the City's GIS. The mapping will help maintenance crews understand the limits for this zone that requires special procedures.

3.5.10 Permitting Boundary

Special requirements exist for construction near levee systems. Plans and specifications for projects need to be reviewed and approved by the City and USACE. It is recommended that the City develop mapping that shows the extent for which reviews need to be completed. A general rule of thumb is to review all projects within 500 feet landward of the levee centerline and all projects within 300 feet riverward of the levee center line.

3.6 Documentation

3.6.1 Semiannual Report

All operation and maintenance activities associated with the levee systems need to be documented. The primary means for documentation of activities is the semiannual report. The semiannual report is a requirement of Navigation and Navigable Water Act (Code of Federal Regulations, 2001). The law requires submission of a report twice per year to the USACE. The report is to document the inspection, operation, and maintenance of the flood control works. Each report is to be prepared by

the Superintendent and submitted to the District Engineer at the USACE to arrive on or before April 1 and October 1 of each year. The report should include the following items:

- Logs of operation
- Dated copies of inspection checklists
- Permanent repairs, description, and date completed
- Public comment and instances of public cooperation, where applicable

3.6.2 Other Documents

Other documents that must be kept readily available include the following:

- Operation & maintenance manuals
- Emergency action plans
- Construction record drawings
- Construction record drawing for approved encroachments
- Maintenance records
- Photographs
- Levee certification documents
- Project review correspondence from the USACE
- USACE Periodic Inspections
- USACE Annual Inspections
- Quarterly maintenance reports
- Deeds, easements, rights-of-way, and cooperative agreements

The life span of a levee system is not defined. Levee systems can be operated and maintained indefinitely. The reliability of the system depends greatly on the operation and maintenance practices that have occurred in the past. Therefore, it is critical to document and retain as much institutional knowledge as possible. The city should develop a robust and detailed archival process for documents. Is recommended that all documents be retained in perpetuity.

3.6.3 Security

For this study, the construction record drawings for the levee systems were accessed using a URL printed in the Flood Control Works Operations and Maintenance Manual and Emergency Action Plan. The URL's provided direct access to drawings, and no registration or password was required. While the information is public, it is recommended that the City refrain from posting detailed drawings to the internet. The drawings provide detailed information on the City's critical infrastructure. Access to the information should be restricted to the extent that the law allows. At a minimum, steps should be taken that would allow the City to know who has accessed the information. Any public document that lists a URL should be revised to exclude the link, and the electronic files should be removed from the City's FTP site.

3.7 Vegetation-Free Zone

The 2016 USACE Inspection Report and the field observations conducted as part of this Project noted a common problem with the control of trees and woody growth on all the City's levee systems. While the turfed areas seem to be consistently mowed, there are areas where volunteer trees have taken hold due to lack of maintenance. There are areas where trees and other landscaping have been intentionally planted for aesthetic purposes.

Figure 3.7-1 – Example Vegetation Free Zone

The USACE strictly limits landscape plantings and vegetation. The criteria for vegetation management is provided in ETL 1110-2-583 (U.S. Army Corps of Engineers, 2014). The criteria states that a vegetation-free zone needs to be maintained around all levees:

> *The vegetation-free zone is a three-dimensional corridor surrounding all levees, floodwalls, embankment dams, and critical appurtenant structures in all flood damage reduction systems.*

The document states that the primary purpose is to provide a reliable corridor of access to and along the levee. The corridor must be kept free of obstructions, and must provide unobstructed space needed for construction of temporary flood control structures.

"Vegetation-free" is terminology used in the USACE guidance documents. The term is a misnomer in that a levee is required to be vegetated if not armored. Turf is an acceptable vegetation in the vegetation-free zone.

The document also states that the vegetation-free zone serves a secondary purpose.

> *…it provides distance between root systems and levees, floodwalls, embankment dams, and appurtenant structures, thereby moderating reliability risks associated with the following two situations: potential piping and seepage due to root penetration; and structural damage (a hole in the ground, surrounded by an area of disturbed earth) resulting from a wind-driven tree overturning. Though not adequate for all situations, this 15-ft zone does provide a measure of risk reduction…*

The extents and management requirements of the vegetation-free zone are as follows:

- The vegetation-free zone applies to all vegetation except grass.
- The vegetation-free zone must be both wide and tall enough to accommodate all likely access requirements.
- The minimum height of the corridor shall be eight feet, measured vertically from any point on the ground.

- The minimum width of the corridor shall be the width of the levee, floodwall, or embankment dam, including all critical appurtenant structures, plus 15 feet on each side, measured from the outer edge of the outermost critical structure.
- No vegetation, other than approved grasses, may penetrate the vegetation-free zone.

In addition to criteria for vegetation management identified in ETL 1110-2-583 (U.S. Army Corps of Engineers, 2014), the USACE has issued guidance in the Interim Policy for Determining Eligibility Status of Flood Risk Management Projects for the Rehabilitation Program Pursuant to Public Law (P.L.) 84-99 (U.S. Army Corps of Engineers, 2014). Paragraph 3 Part f of this policy references that vegetation management will not be considered in making an eligibility determination.

It should be understood that eligibility in the P.L. 84-99 program does not guarantee funding for rehabilitation assistance, if requested. Eligibility only allows the Local Sponsor to make a request for funding assistance. Once a request is made, the USACE will evaluate the nature of the damage and the manner in which the damaged area was maintained. If documentation shows that maintenance deficiencies have not been addressed in the damaged area, the USACE could deny funding.

The Interim Policy does not absolve a Local Sponsor from managing vegetation in accordance with established guidelines. The policy offers Local Sponsors some protection from the strict “pass or fail” approach to P.L. 84-99 eligibility. Previously, an entire system could have been rendered ineligible with a single tree. With the Interim Policy, the USACE will not deny eligibility for vegetation control deficiency.

The 2016 USACE Annual Inspection cited deficiencies relating to the vegetation-free zone on all levee systems. The rating provided by the USACE for this type of deficiency was Minimally Acceptable. To receive an Acceptable rating, the USACE stated that the vegetation-free zones needed to be maintained in accordance with ETL 1110-2-583. The USACE inspection reports do not specifically mandate tree removal. The report stated that removal was necessary to receive a better rating.

ETL 1110-2-583 defines the minimum vegetation-free zone as limited to the levee prism and allows for managed vegetation adjacent to the levee as illustrated below:

NOTE: *While the U.S. Army Corps of Engineers (USACE) published requirements in PL 84-99 state a "Vegetation-Free Zone is required", there also exists an opportunity to manage vegetation on the Missoula levee system through the U.S. Army Corps of Engineers - System Wide Improvement Framework or SWIF. The City of Missoula - Storm Water Utility will work to prepare a SWIF request and submit the application to the U.S. Army Corps of Engineers seeking to allow a vegetation management plan that may allow the City to maintain some vegetation on the levees. The Storm Water Utility will develop a plan for managed vegetation to support local wildlife habitat and that will provide for water quality improvements.*

.

The USACE recognizes that levee sponsors like the City of Missoula may want to engage at the local level to address certain levee system issues in a more long-term, comprehensive approach identifying solutions that optimize resources; prioritize improvements and corrective actions based on risk; and coordinate overlapping or competing programs and requirements. SWIFs are useful when a long-term, holistic approach is desired to address levee system deficiencies as well as operation and maintenance deficiencies; when broader improvements involve multiple levee segments / systems; or when additional time and coordination are needed to consider complex topics, like endangered species habitat or for cultural and heritage concerns, while meeting requirements for levee safety. According to the U.S. Army Corps of Engineers, a SWIF may include a vegetation variance request that recognizes regional differences and still be closely synchronized to align with other USACE levee policies.

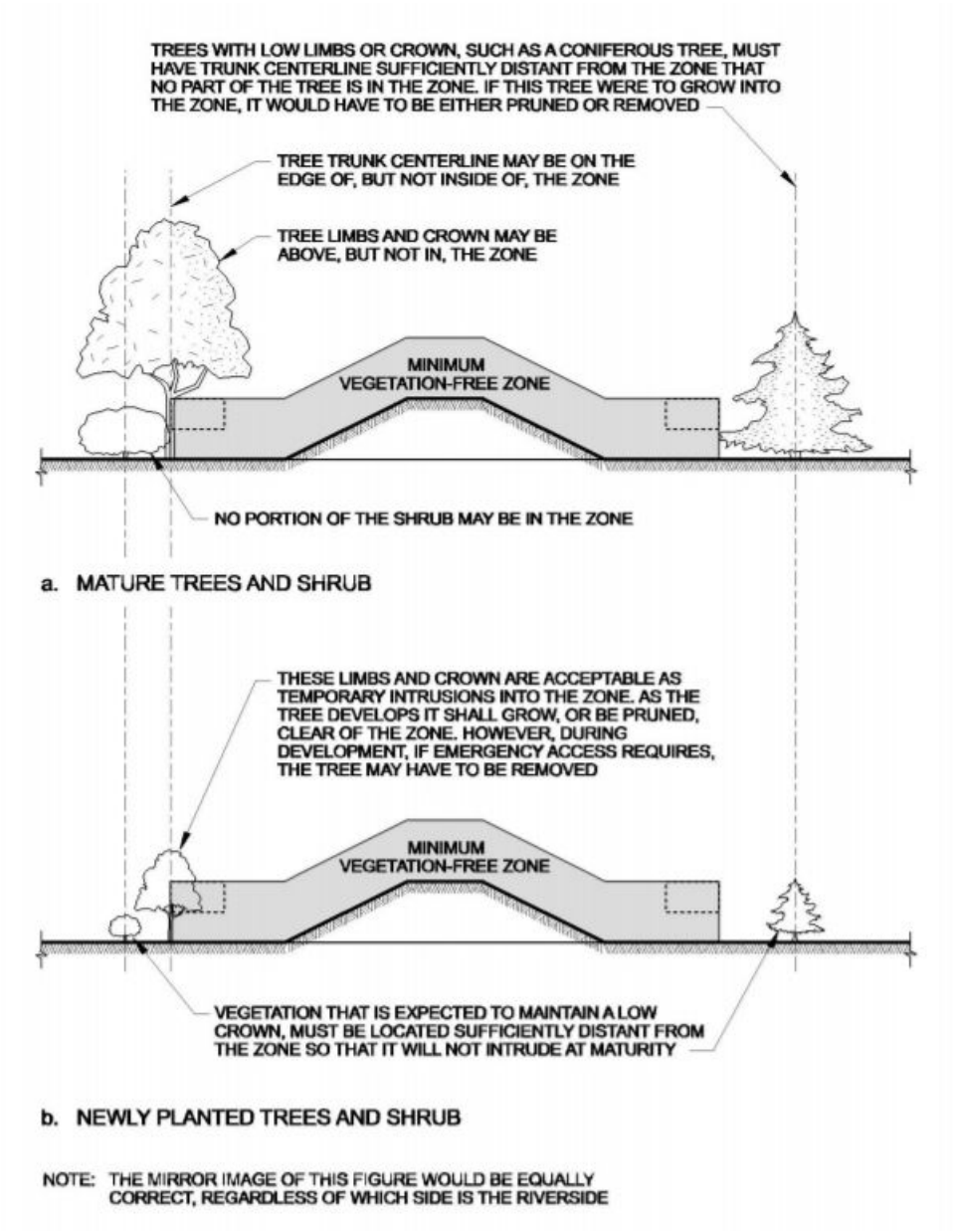


Figure 3.7-2 – Proper Application of the Vegetation-Free Zone

The trees on the levee slope of the Clark Fork Levees have grown to a point where all access is prohibited, and the slope of the levee can no longer be observed for inspection. If left unaddressed, the problem will worsen. While the USACE's Interim Policy provides some leniency for trees and woody growth as a determination for eligibility, the presence of the trees creates another problem: vegetation limits the ability to access or observe the levee. If the levee cannot be observed, proper inspection is hindered. Vegetation limits the ability to observe problems with armoring, erosion, burrowing animals, floodwalls, outfalls, etc. The trees can prevent observation of deficiencies that do matter for eligibility in P.L. 84-99.

There are two primary obstacles to maintaining a vegetation-free zone. The first is that the physical extents of the zone are not established. The limits are not marked in the field, and it is easy for personnel

to overlook areas that need to be maintained. Conditions around levees often change over time. In some instances, the levee prism is not obvious.

It is recommended that the City develop mapping to define the vegetation-free zone. The construction record drawings for each levee system can be used to define the footprint of the levee prism. Once the design footprint has been determined, it can be offset 15 feet on the landward and riverward sides to define the zone. Mapping should be provided to all maintenance personnel responsible for maintaining the zone. All trees, stumps, brush, and woody growth need to be removed from the limits of the zone.

The second obstacle to properly maintaining the zone is public perception. Currently, the Clark Fork and Grant Creek Levees are an integral part of City parks. The areas are heavily used by a citizenry that values the aesthetics afforded by the trees. At many locations, landscaping has been intentionally planted by the Parks and Recreation Department.

For the City to properly maintain its levee systems, the vegetation-free zones need to be free of trees and woody growth. While the value of the trees to the community cannot be easily dismissed, the criteria for levee maintenance is uncompromising. The City may wish to conduct a series of public meetings to educate the public on the importance of levee maintenance and the consequences for inaction. Those consequences may include the following:

- Loss of eligibility in the PL 84-00 Program. The City would no longer be eligible for funding assistance when the levee is damaged from flooding. The full expense of repairs would be incurred by the City.
- Loss of accreditation in the FEMA Flood Insurance Program. For a levee system to be accredited, the City must certify that the system is properly operated and maintained in accordance with the minimum criteria. If the vegetation-free zones are not maintained, then accreditation is at risk. If accreditation is suspended, then FEMA will not recognize the levee as providing any flood protection. The homes and businesses within the protected area would be mapped within the floodplain and would be subject to higher insurance rates and possible mortgage restrictions.

3.7.1 Pattee Creek Levee

The Pattee Creek Levee is a relatively short earthen levee. The system has no features other than a turfed, earthen embankment. In general, the levee appeared to be in good condition.

At the time of the inspection, turf on the levee appeared to be stressed. The condition of the turf may have been a result of the hot, dry summer weather and/or poor soil conditions. Options to improve the condition of the turf include over-seeding, fertilizing, and occasional watering. A soils test is recommended to determine an effective fertilization strategy and if soil amendments are needed.

A chain-link fence has been constructed along the riverward toe. According to City staff, the fence was constructed by others. Storm water runoff seems to naturally flow along the riverward toe of the embankment. There were signs of debris accumulation on the fence and minor erosion. It is recommended that the fence be relocated so that the posts are at least 15 feet from the toe. The rationale is like the USACE's requirement for a root-free zone to keep trees and woody growth 15 feet away from the toe. If fence posts are uprooted during a flood event, a scour hole can develop.

If the fence cannot be removed, then it should be regularly monitored, and any signs of erosion should be immediately repaired. The grass along the fence line should be maintained, and the City should refrain from applying herbicide to minimize maintenance. If the turf is killed, then erosion will likely become a bigger issue.

At the time of the observation, the vegetation on the levee was more than 12-inches tall, and in violation of ETL 1110-2-583 (U.S. Army Corps of Engineers, 2014). It is recommended that mowing of this levee system be conducted at least once per month during the growing season. USACE criteria states that turf is to be mowed to a height of 3 to 6 inches. Given the current condition of the turf, the City may want to cut the grass at the highest allowable height.

3.7.2 Clark Fork Area 3 and Area 5 Levees

The following deficiencies were noted in the 2016 USACE Inspection Report. At the time of the field observation, the deficiencies had not been addressed.

Station 6+00 to 26+00: Several large trees were observed within the levee section. The USACE recommended that trees be removed.

Station 25+00: The USACE noted the remains of three trees that had been recently removed. The USACE advised that the abandoned tree debris (assumed to be the stumps) be removed.

Station 18+00: An area of heavy brush was noted on the riverward slope. The USACE implied that the growth needed to be removed.

Station 5+00: The USACE noted approximately 100 feet of erosion that was encroaching on the levee. It was stated that the area had been previously repaired. The USACE recommend repair of the scour.

At the time of observation, the trees that were noted by the USACE had grown to a point where the riverward slope of the levees could neither be accessed nor observed. Therefore, it was not possible to provide any other maintenance recommendations other than tree clearing. Once the trees are cleared, a thorough inspection should be conducted to identify maintenance deficiencies.

The Clark Fork River is a highly used recreational feature for residents and tourists. The City parks adjacent to the levee offer easy public access to the river. To access the river, pedestrians must cross the levee. At several locations along the Clark Fork Levees, pedestrian traffic has created a path through the trees. The vegetation has been worn away and the riprap displaced to accommodate foot traffic. As a result, these foot paths create areas on the levee where neither vegetation nor riprap control erosion. While it is not the intent to discourage access to the river, these foot paths represent a maintenance deficiency and potential risk to the levee system. Once the trees have been cleared, the City should establish engineered access points for the public and should discourage all other encroachment on the levee slope.

It was also observed that the City has lost access to a portion of the levee system between Bess Reed Park and Kiwanis Park. Access has been denied because of an apartment building and duplex

that have constructed fencing. Construction records show that the two structures existed prior to construction of the floodwall. Sufficient, but limited, property was acquired to construct the floodwall. The drawings suggest that the entire backyard for the duplex is controlled by the City.

The property owners have assumed that their property rights extend to the floodwall, have constructed fencing, and added landscaping without consideration to USACE criteria, or the City's need for access to the floodwall. The situation does not comply with the requirement of the vegetation-free zone and is likely a violation of Section 208 of the Code of Federal Regulations that states:

> *No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities* (Code of Federal Regulations, 2001).

To ensure operation and maintenance of the system in accordance with federal regulations, the City needs to reclaim the property rights along the floodwall. To accomplish this, the legal description will need to be acquired and the limits of the property staked by a surveyor. Most importantly, the City will need to discuss the issue with the property owners and tenants so that there is a clear understanding as to why the action is required.

3.7.3 Operations and Maintenance Budget

The operations and maintenance budget for the City's levee systems is presented in Chapter 2.

3.8 Information Required for Certification Analysis

The following information is required to perform an analysis for certification:

- Top of levee surveys
- In-place gradation tests for riprap at key locations
- Geotechnical borings and laboratory tests

3.9 Current Deficiencies

Remove trees and woody growth from levee.

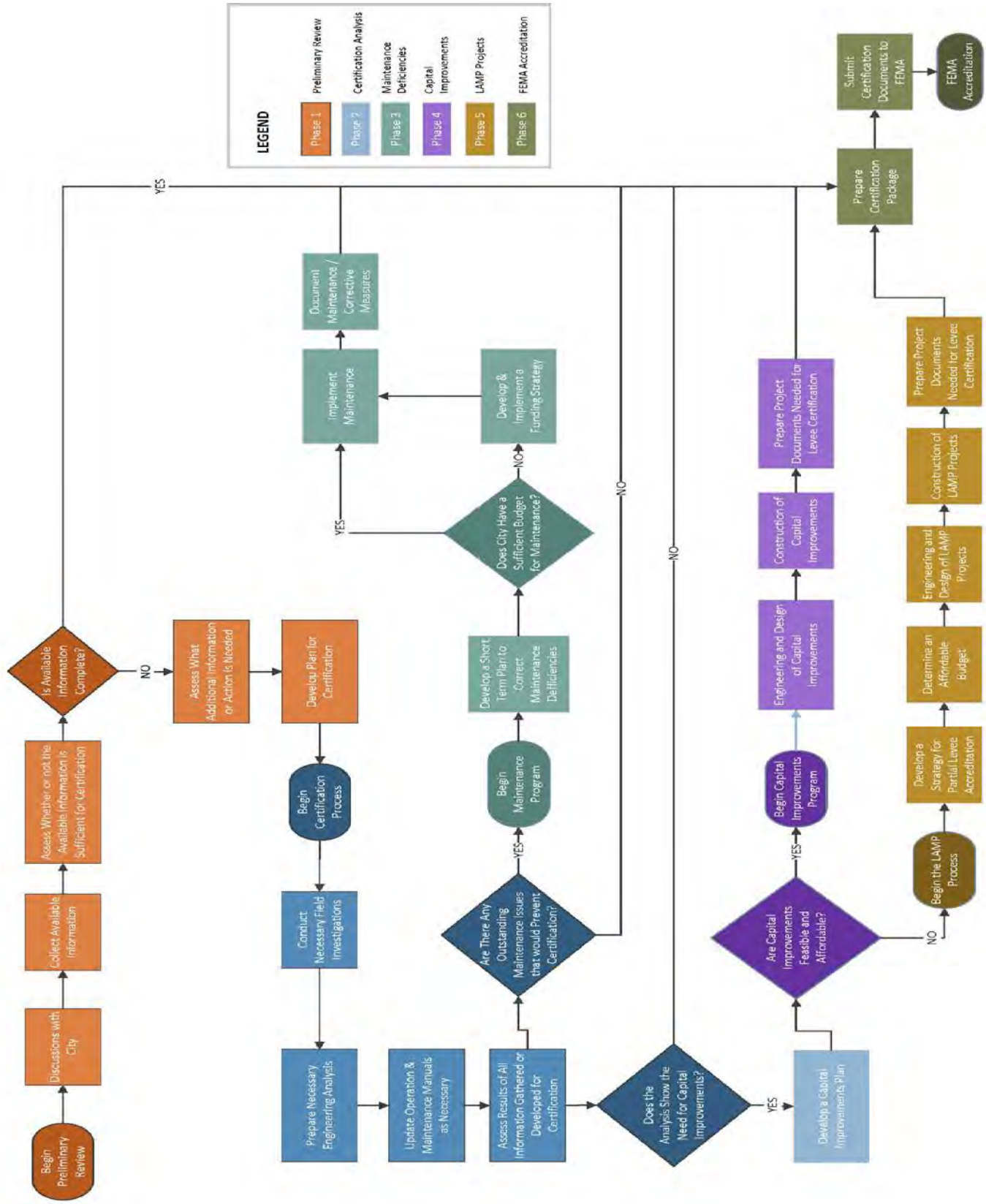
3.10 Plan for Recertification

3.10.1 Introduction

There is no set path through the certification/recertification process. The initial approach and scope are largely defined by the information that is available and the information that needs to be acquired. As the certification process unfolds, unknown deficiencies may be revealed that require the City stop, regroup, and formulate a new strategy. The approach described herein is based on the readily available information. As information is collected and developed, the scope of the certification may need to be adapted to address the unknowns.

This initial evaluation is a prudent and necessary first step in the certification process. However, it must be done with forethought to the entire certification process. The recommended approach to the certification process is depicted in the flowchart shown in Figure 3.10.1-1. The initial phase of the certification process is the Preliminary Review of information which is the focus of this levee certification evaluation project.

Figure 3.10.1-1 Missoula Levees Recertification/Accreditation Approach



3.10.2 Definition

Certification by a registered professional engineer does not constitute a warranty or guarantee of performance, expressed or implied. Certification of data is a statement that the data is accurate to the best of the certifier's knowledge. Certification of analyses is a statement that the analyses have been performed correctly and in accordance with sound engineering practices. Certification of structural works is a statement that the works are designed in accordance with sound engineering practices to provide protection from the base (1-percent-annual-chance) flood. Certification of ''as built'' conditions is a statement that the structure(s) has been built according to the plans being certified, is in place, and is fully functioning. (Code of Federal Regulations 44 CFR 65.2)

3.10.3 Mapping and Data Collection

At the beginning of the certification process, the City and the engineer who prepares the levee certification documents (Engineer) should agree on basic data collection standards. This effort needs to define the coordinate systems and datum used for data collection. Data associated with the levee system will have been developed by many agencies over many years. It is not likely that all surveys and mapping will have utilized a common coordinate system and/or datum. The following table should be completed by the City prior to determining the standards to be used.

Table 3.10.3 – Mapping Information

Data Source	Coordinate System	Datum
USACE Construction Record Drawings	TBD	TBD
USACE Operation & Maintenance Drawings	TBD	TBD
City GIS Mapping	TBD	TBD
FEMA Flood Insurance Rate Maps	Map project	North American Vertical Datum 1988

It is recommended that the coordinate system for certification use the City's current data collection practices. It would be advantageous to have new information integrate seamlessly into the City's GIS databases.

It is recommended that the datum used for certification be North American Vertical Datum 1988. This is the datum used on the Flood Insurance Rate Maps.

3.10.4 Assessment of Available Information

The Federal Emergency Management Agency (FEMA) certification and accreditation process is, at its basic level, an exercise in documentation. Certification is the presentation of information to FEMA to prove that the minimum criteria has been met. It is an assurance to FEMA that the City of Missoula understands its risk and has a plan to manage it.

The level of effort required to complete the certification process is based largely on the information that is missing and must be developed. This plan for recertification represents the first step in the certification process to determine what information is available, if it meets the minimum requirements, and what additional information needs to be collected or developed. For the Preliminary Review effort, the following paragraphs describe the criteria that was considered.

3.10.5 Freeboard

3.10.5.1 Criteria

For levees to be recognized by FEMA, evidence that adequate design and operation and maintenance systems are in place to provide reasonable assurance that protection from the base flood exists must be provided. Riverine levees must provide a minimum freeboard of three feet above the water-surface level of the base flood. An additional one foot above the minimum is required within 100 feet in either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted. An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required (Code of Federal Regulations).

3.10.5.2 Top of Levee Survey

It is recommended that the top of each levee system be surveyed by a registered land surveyor. Minimum requirements for the survey should include the following:

- Collect grade elevations at regular interval along the top of the levee. Maximum spacing will be at the discretion of the engineer of record, but should generally be between 25 and 100 feet.
- Capture defined changes in grade.
- Define roadway embankments that cross the levee.
- Define gaps in the levee.
- The Survey should provide a signed and sealed drawing of each levee plan and profile. The baseline for all drawings should be the respective levee center line. Drawings should utilize levee stationing from the original construction drawings.

3.10.5.3 Base Flood Elevations

Base flood elevations to be used in the freeboard analysis should be obtained from FEMA. It is recommended that the Engineer use the hydraulic models that were developed in conjunction with the Flood Insurance Rate Maps. If models are not available, then the flood profiles shown in the Flood Insurance Study could be used as an alternative source. However, the information would be less accurate than the models. The profile for the base flood will need to be plotted with the top of levee survey. The Engineer will need to compare the top of the levee to the base flood.

3.10.5.4 Criteria Evaluation

If any levee system does not meet the minimum freeboard requirements, then the City should be made aware immediately. If a system does not have sufficient freeboard at any location, it cannot be certified. There is little value in the continuation of the certification process until the City decides if it wants to raise the levee or continue the mapping effort using FEMA's Analysis and Mapping Procedures for Non-Accredited Levee Systems.

3.10.6 Closures

3.10.6.1 Criteria

All openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice. (Code of Federal Regulations).

3.10.6.2 Gaps

Construction record drawings show no closures that need to be made during a flood event. The certification documents will need to state that no closures exist, and the criteria is met.

3.10.6.3 Drainage Structures

Drainage structures that pass below the levee must be equipped with a closure device to isolate the flooding source from the landward area of protection. Typically, the closure is a redundant system that includes a flap gate at the end of the pipe, and a sluice gate that assures a watertight closure. The City's GIS mapping of the storm sewer system shows the following:

- Four (4) drainage structures on the Clark Fork Levee
- No (0) drainage structures through the Pattee Creek Levee
- No (0) drainage structures through the Grant Creek Levee

During the site reconnaissance conducted as part of this study, only one outfall along the Clark Fork Levee was observed. The outfall had no apparent closure device. Discussions with City staff confirmed that two of four outfalls have gates valves: Clay Street outfall has both gate and flap and Caras Park outfall has a gate.

Without closure structures on all of the drainage pipes, the criteria for Closures is not met. Therefore, the system cannot be certified until closures for the remaining two outfalls are designed and installed.

3.10.7 Embankment Protection

3.10.7.1 Criteria

An engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee

embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to:

Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes. (Code of Federal Regulations)

The Engineer will need to prepare and document an analysis to show that no appreciable erosion will take place during a flood event. Typically, this analysis compares the computed river velocities to the land cover on the riverward side of the levee. Hydraulic models provided by FEMA should be used as the source for velocities. The Engineer will need to investigate of the land cover.

3.10.7.2 Turfed Areas

Where velocities are sufficiently low to preclude the need for armoring, turf is typically used as the land cover. However, the turf will need to be healthy and provide a uniform cover. The Engineer will need to assess the turf and may need to make recommendations for improvements.

3.10.7.3 Armored Areas

Where velocities merit armoring, riprap protection is needed. The adequacy of the riprap to protect against river flow velocities should be evaluated using an accepted methodology such as those described in Section 7-6 of Engineer Manual (EM) 1110-2-1913 (U.S. Army Corps of Engineers) and Chapter 3 of EM 1110-2-1601 (U.S. Army Corps of Engineers).

The Clark Fork Levee Systems currently utilize stone slope protection. When field reconnaissance was conducted for this study, the riverward slope had a heavy growth of trees. The limited access prevented observation of the existing stone armoring. To determine if this criterion is met, the trees must first be cleared so that all the riprap can be observed.

Two considerations must be given to the existing armoring. First, the Engineer must be satisfied that the armoring covers the appropriate areas and that the coverage is uniform. There can be no gaps in the armoring where erosion can occur. Second, the rock must be at the appropriate gradation. Rock deteriorates over time due to freeze-thaw action. The rate of deterioration is influenced by the environment and type of stone used. It appears a granite material was used to armor the levee. Granite is highly durable, and there may not be a need for an overlay. However, the Engineer should conduct in-place gradation tests at key locations to verify that riprap is still of appropriate size and gradation. Results should be documented and incorporated in the certification report.

3.10.8 Embankment and Foundation Stability

3.10.8.1 Criteria

Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability.

An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the U.S. Army Corps of Engineers (COE) manual, ''Design and Construction of Levees'' (EM 1110–2–1913, Chapter 6, Section II), may be used.

The factors that shall be addressed in the analyses include: Depth of flooding, duration of flooding, embankment geometry and length of seepage path at critical locations, embankment and foundation materials, embankment compaction, penetrations, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms). (Code of Federal Regulations)

3.10.8.2 General

The stability of the levee embankments and foundations need to be evaluated with regards to slope stability and underseepage. Specifically, the criteria stated above requires the analyses to "… demonstrate that seepage into or through the levee foundation embankment will not jeopardize embankment or foundation stability" under the base flood elevation (1% chance of being equaled or exceeded = 100-year flood elevation), which includes underseepage beneath the levee and stability for long term steady state seepage (fully developed flood surface) per E.M. 1110-2-1913 ((U.S. Army Corps of Engineers).

3.10.8.3 Required Information

Information required to conduct the embankment and foundation stability analysis includes the following:

- Topographic information (the City's existing mapping should be sufficient)
- Top of levee surveys
- Base flood elevations
- Subsurface Information
- Levee system construction record drawings

3.10.8.4 Slope Stability Methodology

Slope stability analyses will need to be performed to evaluate the stability of the levee embankments under long-term, steady-state seepage during the base flood event. The analyses should be completed in accordance with the procedures outlined in the Engineering Manual EM 1110-2-1913 (U.S. Army Corps of Engineers). FEMA does not require rapid drawdown analyses

for levee certification. However, rapid drawdown analyses can be performed if the Engineer considers it an appropriate evaluation parameter along with long-term, steady-state seepage. Allowable factors of safety for slope stability are provided in EM 1110-2-1913.

3.10.8.5 Underseepage Methodology

Underseepage could jeopardize the stability of a levee embankment or its foundation. Therefore, underseepage analyses will need to be performed for each levee system to evaluate the potential for piping beneath the levee embankment during the base flood. Underseepage analyses should be performed in accordance with EM 1110-2-1913.

3.10.9 Settlement

3.10.9.1 Criteria

An Engineering analyses must be submitted that assesses the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum standards set forth in paragraph (b)(1) of this section.

This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundations soils, and age of compaction methods. In addition, detailed settlement analysis using procedures such as those described in the COE manual, "Soil Mechanics Design – Settlement Analysis" (EM 110-2-1904) must be submitted. (Code of Federal Regulations)

3.10.9.2 Design Criteria

As part of the FEMA levee certification, settlement analyses will be required to evaluate the potential and magnitude of future losses of freeboard because of settlement. Settlement analyses should be performed in general accordance with the procedures outlined in the USACE Engineering Manual EM-1110-1-1904 (U.S. Army Corps of Engineers).

3.10.10 Interior Drainage

3.10.10.1 Criteria

An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior flood waters (Code of Federal Regulations).

3.10.10.2 Compliance

The City did not provide any hydrologic or hydraulic calculations for interior drainage. As part of the certification process, this analysis for each system would likely need to be developed by an engineer.

3.10.10.3 Criteria

Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system.

3.10.10.4 Compliance

The Operation and Maintenance Manual provides some discussion of flood warning systems and triggers for action. However, much of the instruction is ambiguous with no specific information to implement the plan. For example, the manual provides good detail on how the Pattee Creek Levee is to be operated:

Pattee Creek Flows During Large Flood Events (90 cfs to 195 cfs):

> *During larger flow events in Pattee Creek, of a magnitude of a 10-year event to a 100-year event, water will exit the Grit Chamber only through the large outlet box that is connected to an 8 feet wide by 3 feet high concrete box, and continue through the 48 inch diameter pipe on the south side of Pattee Creek Drive…During large flood events, the valve on the large outlet box (S524-V2) at the Grit Chamber should remain open, and the valve on the small outlet box (S524-GV3) at the Grit Chamber should be closed...*

The example text is indicative of the ambiguity throughout the entire manual. At first glance, the narrative appears to be detailed and complete. However, there is not sufficient information in this statement to implement the plan. The challenge is that there is no way for a person to know when a large flood event is occurring. While the manual explains that the valves must be operated when flows in Pattee Creek exceed 90 cfs, there are no gages on Pattee Creek that allow measurement of flow.

To meet this criterion, the emergency action plan will need to be updated for each system. Specific and measurable triggers will need to be developed and/or documented.

3.10.10.5 Criteria

A formal plan of operation including specific actions and assignments of responsibility by individual name or title.

3.10.10.6 Compliance

The City has a documented Operations and Maintenance Manual that includes instructions for specific actions. To meet the requirements of this criterion, the manual will need to be updated to document assignments of responsibility by individual name and/or title.

3.10.10.7 Criteria

Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes. No more than one year shall elapse between either the inspections or the operations.

3.10.10.8 Compliance

Inspection of the interior drainage systems is not discussed in the Operations and Maintenance Manual. For those systems that incorporate interior drainage infrastructure, a plan would need to be developed and documented within the manual.

3.10.11 Operation & Maintenance Manuals

3.10.11.1 Criteria

Levee systems must be maintained in accordance with an officially adopted maintenance plan and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner. All maintenance activities must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance. This plan must document the formal procedures that ensure that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum, maintenance plans shall specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance (Code of Federal Regulations 65.10(d)).

3.10.11.2 Documentation

The operation and maintenance activities for all of the City's flood protection projects are documented in the City of Missoula Flood Control Works Operation and Maintenance Manual and Emergency Action Plan (City of Missoula, 2012). The document meets one of the criteria for certification by describing the maintenance activities to be performed. It would be sufficient to meet the requirements of certification with a few revisions.

3.10.11.3 Deficiencies

Official Acceptance: There is no indication within the document that it has been officially adopted by the City. There should be documentation of official acceptance (i.e., City Ordinance or Resolution) on behalf of the City, and it should be incorporated into the Manual.

Designation of Responsibility: The Manual states the activities that are required but does not assign responsibility. The Manual should clearly state what City Department is responsible for operation and maintenance of the flood protection systems. It is understood that the Storm Water Utility will have these responsibilities. The Manual should state it. It is recommended the narrative

be written so that the Storm Water Utility Superintendent, City Engineer, or Public Works Director has the responsibility.

Frequency of Maintenance: While the Manual provides a description of activities that need to be completed, it does not state how often the activities are to be performed. For example, Paragraph VI.D.3 states the mowing requirements for the Grant Creek Levee.

> *Mowing– All project areas which use landscape sod cover for erosion protection can be mowed as required…*

The language, "can be mowed as required", suggests that mowing is optional, and the frequency of mowing is not defined. As a result, there is no way to demonstrate that the requirements for mowing have been met. The following example language provides the required level of detail to meet the certification requirement:

> *Mowing – The Storm Water Utility Superintendent shall ensure that all areas within the project right-of-way are mowed and kept free of woody growth. At a minimum, mowing shall be conducted once per month between the months of May and October. Mowing shall generally occur at the beginning of each month unless weather conditions are prohibitive. Areas that are not accessible to mowing equipment shall be cleared by hand.*

The example statement does not change the requirements for mowing that are currently practiced. However, it does define who is responsible and the frequency the activity is to be performed. In general, the Operations and Maintenance Manual should be updated to describe the "who, what, when and where" for every maintenance activity.

3.11 References

Code of Federal Regulations. (1999). *Title 44 - Emergency Management and Assistance, Part 65 - Identification and Mapping of Special Hazard Areas.* Washington, D.C.: National Archives and Records Administration.

Code of Federal Regulations. (1999). *Title 44 - Emergency Management and Assistance, Section 65.1, Purpose of Part.* Washington, D.C.: National Archives and Records Administration. Retrieved from http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title44/44cfr65_main_02.tpl

Code of Federal Regulations. (1999). *Title 44 - Emergency Management and Assistance, Section 65.10, Mapping of Areas Protected by Levee Systems.* Washington, D.C.: National Archives and Records Administration.

Code of Federal Regulations. (2001, July 1). Part 208 - Flood Control Regulations. *Title 33 - Navigation and Navigable Waters*.

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Federal Emergency Management Agency. (2015, July 6). Flood Insurance Study. *Missoula County, Montana and Incorporated Areas*. Washington, D.C.

U.S. Army Corps of Engineers. (1990). *EM 1110-1-1904, Engineering and Design-Settlement Analysis.* Engineering Manual, Washington DC.

U.S. Army Corps of Engineers. (1994). *EM 1110-2-1601, Hydraulic Design of Flood Control Structures.* Engineering Manual, Department of the Army, Washington, D.C.

U.S. Army Corps of Engineers. (2000). *EM 1110-2-1913, Design and Construction of Levees.* Engineering Manual, Department of the Army, Wachington, D.C.

U.S. Army Corps of Engineers. (2014, April 30). Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures. Washington, DC.

U.S. Army Corps of Engineers, Kansas City District. (2006, April). *Construction Guidance (Seepage)*. Retrieved February 2010, from http://www.nwk.usace.army.mil/GeoTech/guidance.cfm

CHAPTER 4

BURNS McDONNELL

Morrison Maierle
engineers ▪ surveyors ▪ planners ▪ scientists

Chapter 4
Capital Improvements Plan

A Capital Improvements Plan (CIP) is a resource and budgeting tool that documents needs and identifies projects with associated costs, prioritization, and funding sources. The City of Missoula's existing storm water infrastructure is in need of improvements and the City has initiated a Capital Improvements Planning process to prioritize specific projects as part of the City of Missoula Storm Water Facility and Operations Planning Project. A list of previously identified storm water utility projects established by the City in 2008 was provided as a basis for this Chapter. This Capital Improvements Plan does not include an assessment of infrastructure projects outside of that provided list.

This Chapter provides the need for each of the identified projects, a description of the improvements, and an evaluation and ranking of each project using a systematic process based on criteria deemed important to the City of Missoula. Information was gathered and organized for each project to provide a basis for ranking the project and developing conceptual planning cost estimates. The estimates are for cursory budgeting purposes only. More detailed estimates of probable cost of each project can only be developed through a detailed design process when the project extents and specific components are better defined.

The intent of this Capital Improvements Plan is to provide a tool for the City of Missoula to plan financial and maintenance budgets for its newly established Storm Water Utility. The final draft of this CIP will be reviewed and approved by City staff and council. The information within this document is current as of April 2018. It should be noted that the Capital Improvements Plan is always subject to change as priorities, budget, and infrastructure needs change.

Conceptual Cost Estimates are included to provide supporting information for the projects described within this CIP.

A City of Missoula Storm Water System Overview Map is included in Appendix C.

4.1. Objectives

The City of Missoula has identified objectives of the Capital Improvements Plan as follows:

1. To improve the effectiveness of expenditures by the City of Missoula on improvements to its Storm Water Utility.
2. To identify and prioritize projects that will improve the efficiency and operation of the City's Storm Water Utility and further regulatory requirement obligations.
3. To assist the City of Missoula in forming a stable financial plan for future improvements and to identify potential funding sources for capital improvements projects.

4. To help the City provide guidance to its personnel in operational and maintenance efforts.

4.2. Ranking Criteria

The systematic ranking process used to prioritize the identified projects assigns a numeric rank to each of eleven ranking criteria which are weighted based on the City's determination of significance. The ranking criteria were selected and weighted in a collaborative effort with the City of Missoula. The total project score is the sum of the rank multiplied by the weighted factor for each criterion with a highest possible score of 390 and lowest possible score of 78.

Tables 4.2.1 and 4.2.2 provide a description of the possible score assignments and a description of each criterion, respectively.

Table 4.2.1 – Project Ranking Guidance

Rank	Description
1	Project does not meet criterion
2	Project minimally meets any requirements of the criterion
3	Project generally meets the criterion
4	Project meets a majority of the requirements of the criterion
5	Project meets and exceeds all requirements of the criterion

Table 4.2.2 – Project Criteria Summary

Criterion	Description	Weighting Factor
Public Safety	The risk of the infrastructure to public safety.	12
Regulatory Compliance	The ability of the facility to consistently and reliably meet the established standards set forth by the city, state, and federal government.	11
Area of Influence of Improvement	The location of the improvement in relation to the rest of the system as well as the number of individuals served. Improvements near an outfall (larger service area) or affecting a portion of the system carrying larger flows receive a higher score. Improvements that affect a greater number of people also receive higher scores.	10
Operational Benefits	Effort reduction for City staff in day to day operations and the ease of operation. Features that require less maintenance or operational oversight score high.	9
Coordination with other Infrastructure Projects	Assesses the level of coordination with water and wastewater utility projects. Projects that address multiple utilities would rank higher.	8
Water Quality	Projects that offer measureable improvements to water quality such as sediment reductions.	7
Cost Leveling	The overall cost of the project and timing of the improvements in relation to other projects to ensure cost to residents is kept reasonable for any given year. A default value will be assigned to this criterion unless it is determined it would be beneficial to advance or defer a project to another fiscal year.	6
Local Economic Effect	Assesses the potential effect of the project on the local economy in terms of keeping money locally through capital purchase and/or employment of local citizens.	5
Reliability	The expected service life of the infrastructure.	4
Support of Project Growth	The ability of a project to support projected growth. For example, a new storm collector line to an undeveloped portion of town would support additional growth in that area at a future date.	3
Facility Flexibility	The ability of a project to adapt to future conditions which may necessitate facility expansions or unanticipated conditions.	2
Potential for Failure	The potential of failure for the components being improved. This allows components which may not serve as large an area to be weighted higher if they are near failure.	1

It should be noted that the project ranking and scoring within this Capital Improvements Plan are inherently open to differences of opinion. Input from the consultant and the City have been taken into account in the scoring of the projects. Some projects may become more feasible and practical in the

future due to currently unforeseen factors. This Capital Improvements Plan is intended to help guide the City of Missoula's decision making regarding capital improvements projects, funding, and maintenance over the next five years with refinements to the order of projects occurring based on changing conditions. These conditions could be affected by updated regulations, failed infrastructure that may take priority, or funding opportunities that may advance a project.

4.3. Projects

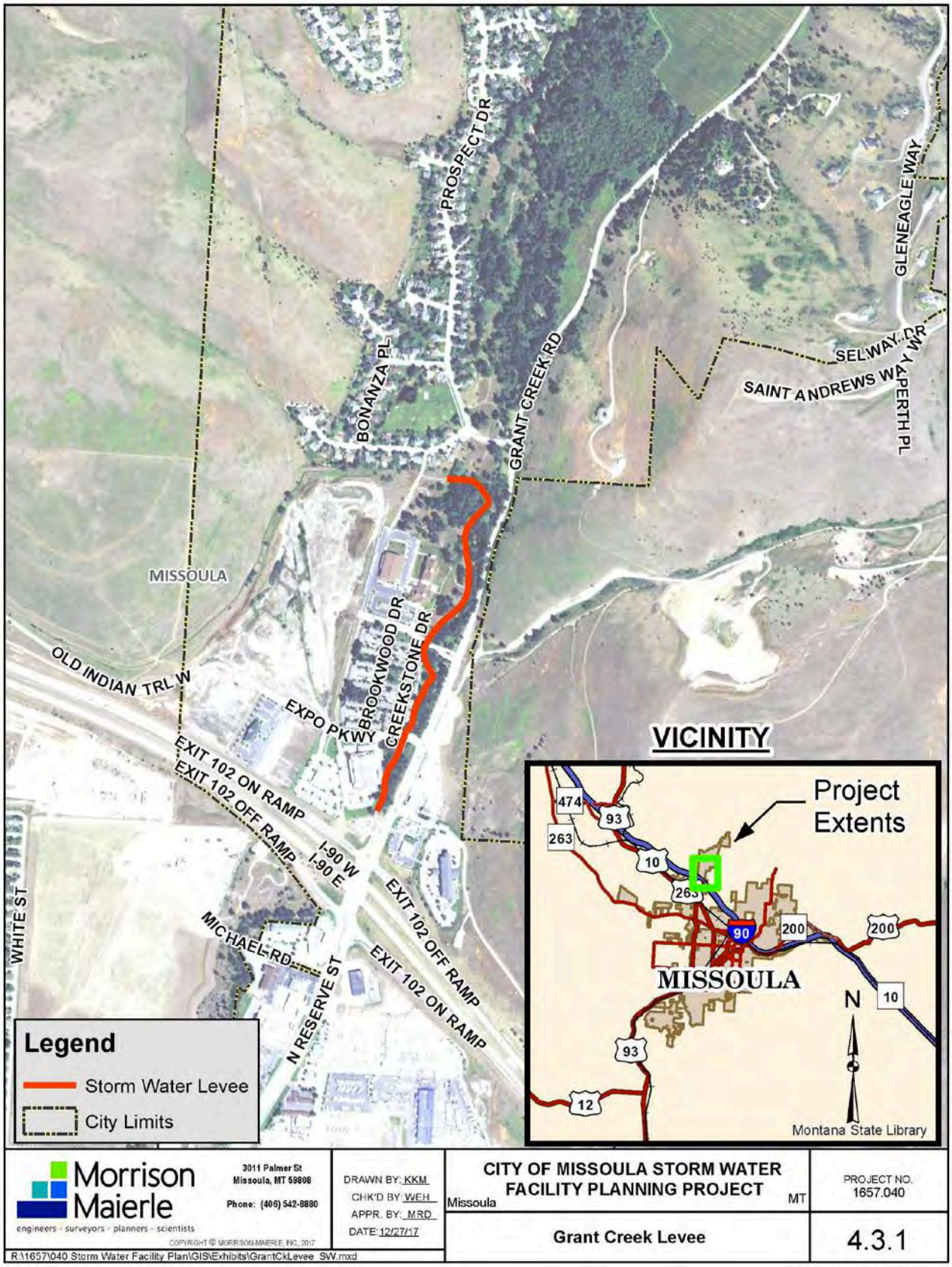
The following is the list of projects provided by the City of Missoula Storm Water Utility. The list also includes the relevant section within this Chapter:

- 4.3.1 Grant Creek Levee
- 4.3.2 Grantland #13 Subdivision Storm Water Drainage Study
- 4.3.3 Mullan Road Corridor Storm Water Drainage Master Plan
- 4.3.4 Highpark Drainage System Improvements
- 4.3.5 Hillview Heights Storm Water Drainage Upgrades
- 4.3.6 Linda Vista Storm Water Drainage Upgrades
- 4.3.7 Hillside Streets Inlet Grate Replacement Project
- 4.3.8 Caras Park Outfall Pretreatment Retrofit Project – Phase 2
- 4.3.9 Missoula Levee System Geotechnical Inspection and Recertification
- 4.3.10 Storm Water Facility and Operations Plan – Phase 2
- 4.3.11 Upper Gharrett Drainage Improvements
- Storm Water Infrastructure Location Verification (GPS/GIS)
- Higgins Outfall
- Moose Can Gully Detention Structure Security

Site visits with City staff were conducted for many of the projects listed; however, limited budget precluded site visits to all project locations. City staff provided information for the remainder of the projects. Project sites not visited include Moose Can Gully Detention Structure Security, Hillside Streets Inlet Grate Replacement Project, and Caras Park Outfall Pretreatment Retrofit Project – Phase 2.

All of the projects listed above are included in the Capital Improvements Plan list except for the Moose Can Gully Detention Structure Security Project, Higgins Outfall Project and Storm Water Infrastructure Location Verification Projects. According to City staff, the Moose Can Gully structure is not a financially significant project and will be addressed as maintenance. The Higgins outfall serves a relatively small area and water quality is unknown. Therefore, the Higgins Outfall project is deferred for further discussion and until additional water quality information is obtained. The Storm Water Infrastructure Location Verification includes inventorying infrastructure and will be the responsibility of staff. Effort for the inventory is accounted through routine maintenance and is not part of the Capital Improvements Plan. All remaining projects are described in more detail below.

4.3.1 Grant Creek Levee



Description

The Grant Creek Levee Project includes clearing of debris on the Grant Creek Levee to restore capacity of Grant Creek and reduce flooding risk to adjacent commercial and residential properties. In addition, this project follows guidance provided by the United States Army Corps of Engineers (USACE) for levee maintenance.

Project Need

A very dense population of cottonwood trees and vegetation lines the main channel of Grant Creek. According to inspection reports by the USACE (December 14, 2016), the density of vegetation increases the risk of levee failure and flooding that could occur, especially during higher flow events. Increased potential for failure of this levee could be detrimental to areas located adjacent to the Grant Creek floodplain. As the levee exists today, it has been designated “minimally acceptable” by the USACE. This levee must meet regulatory standards as set forth by the USACE and is on the verge of unsatisfactorily meeting these standards.

Consequences of no action would include continued risk of increased flooding, continued unsatisfactory ratings from USACE, and increased costs due to deferred maintenance associated with vegetative growth.

Site Specific Information

The Grant Creek drainage runs north to south to the Clark Fork River. The Grant Creek Levee is located approximately 0.3 miles north of the North Reserve Street/Grant Creek Road exit. The levee is located adjacent to the Rocky Mountain Elk Foundation and residential homes. The latitude and longitude of the project location is 46°55’3” N and 114°1’55” W.

According to the USACE Inspection Reports, the levee is approximately 3,100 feet in length and approximately 200 feet to the west of Grant Creek Road. The levee is 12 feet in top width with 2-3H:1V side slopes.

The USACE Seattle District performed a levee inspection on August 11, 2016. It was determined that this levee was “minimally acceptable” and required attention. Recommendations provided to the City of Missoula by the USACE included the removal of cottonwood trees and reduction of vegetation within the levee prism.

Figure 4.3.1-1 Grant Creek looking downstream from Prospect Dr. Bridge

Figure 4.3.1-2 Grant Creek Levee illustrating dense vegetation

Proposed Project Recommendations

During the initial site visit for this Project, it was observed that several large trees had fallen along Grant Creek and several appeared to be on the verge of falling. Large, fallen trees can obstruct the flow in the creek and cause a rise in flood elevation. These trees also introduce the risk of scour in the channel and adjacent levee. Left unattended, fallen trees can cause the levee to overtop or can cause a breach through loss of material. It is recommended that all cottonwood trees and existing vegetation located within the prism of the levee be removed; however, due to the significant number of trees present, this project assumes that the work will be limited to trees that are ready to fall and

are already dead. Removal of healthy trees could occur over a longer duration of time and are not included in this project nor is the removal of downed trees located in the creek bottom. It is recommended that the proposed work be performed by a Contractor.

This project also includes clearing of trees immediately up and downgradient of the bridge on Prospect Drive. Numerous permits may be required including, but not limited to, USACE 404 and 408 permits, 310 permit, SPA 124 permit, Floodplain permit, and 318 permit. All work performed for this project must be in accordance with any required permits. The removal of vegetation should adhere to the USACE standards listed in ETL 1110-2-583.

The estimated overall conceptual cost for this project is $275,843. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.1 – Grant Creek Levee Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	2	12	24
Regulatory Compliance	2	11	22
Area of Influence of Improvement	4	10	40
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	3	8	24
Water Quality	1	7	7
Cost Leveling	1	6	6
Local Economic Effect	3	5	15
Reliability	4	4	16
Support of Project Growth	1	3	3
Facility Flexibility	1	2	2
Potential for Failure	2	1	2
Project Total	**197**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 2

The Grant Creek Levee is a public safety feature protecting adjacent and downstream areas from flood events. The levee currently functions and does not present immediate imminent danger to the public in its current state. However, routine inspections performed by the USACE graded the structure as minimally acceptable. This structure does not pose imminent public safety risk, but the structure is considered a public safety structure that needs improvements.

Regulatory Compliance: 2

This levee has received a minimally acceptable grade from routine inspections performed by the USACE in 2015 and 2016; however, the structure is not considered out of compliance. Because this structure received notice from a regulatory agency that improvements are recommended but the structure is considered in compliance, a score of two is awarded.

Area of Influence of Improvement: 4

This project protects adjacent land and a large area of land located downgradient from flooding. This area potentially stretches from the Rocky Mountain Elk Foundation building to Mullan Road along Grant Creek.

Operational Benefits: 4

Accomplishment of this project will be a significant step towards reducing day-to-day operations of the levee.

Coordination with other Infrastructure Projects: 3

This project is located in an area where coordination with other infrastructure projects such as water or sewer are not applicable.

Water Quality: 1

The Grant Creek Levee Project involves minimal water quality improvements.

Cost Leveling: 1

The total cost of this project combined with the ranking resulted in too many high cost projects during the same Fiscal Year. This project was deferred to Fiscal Year 2023 to level the cost for that timeframe.

Local Economic Effect: 3

This project provides potential work for a local contractor. A relatively large amount of trees and a significant amount of vegetation are recommended for removal within the levee prism by the USACE.

Reliability: 4

There are no records provided indicating that this levee has ever experienced overtopping. Accomplishing this project will increase the reliability of the levee in the protection of flooding.

Support of Projected Growth: 1

The proposed improvements to the Grant Creek Levee do not provide any additional protection for flooding.

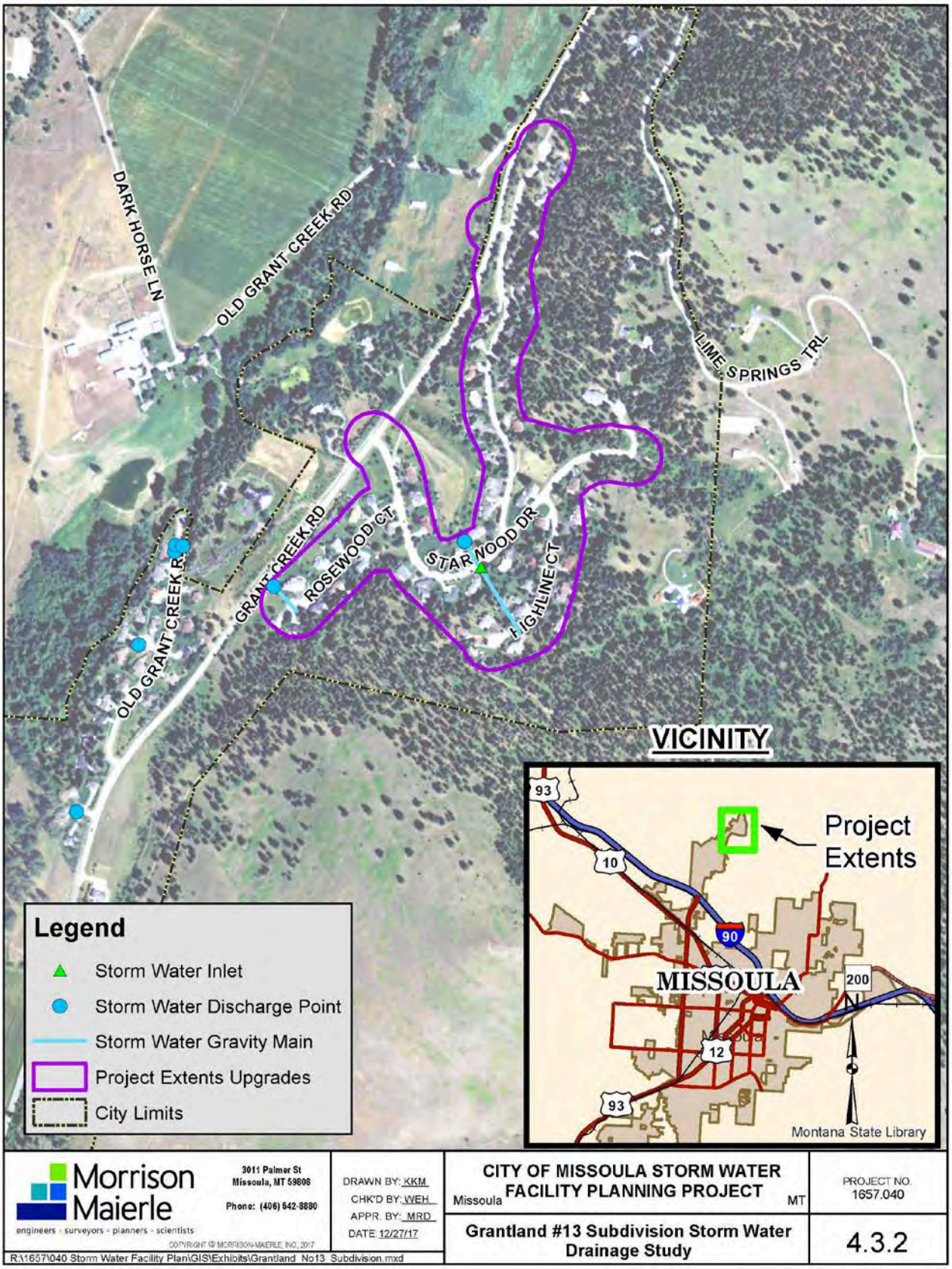
Facility Flexibility: 1

The proposed improvements allow the levee to improve from a minimally acceptable score, but it is likely that the proposed work will need to be done again in the future due to on-going maintenance.

Potential for Failure: 2

There are no records provided indicating overtopping of this levee and the levee continues to function in its current state. The amount of trees and vegetation increase the potential for failure; however, no immediate risk was identified.

4.3.2 Grantland #13 Subdivision Storm Water Drainage Study



Description

This project involves the analysis of runoff patterns and back slope easements within the Grantland #13 Subdivision. The Grantland #13 Subdivision Storm Water Drainage Study will identify necessary improvements to prevent on-going issues associated with storm water runoff. Recommended improvements may include curbing, armoring, and infrastructure related to managing storm water runoff.

Project Need

The Grantland #13 Subdivision experiences storm water runoff issues. During larger storm events, water sheets across the roads and subsequently onto residential property resulting in flooding. Much of the subdivision lacks curb and gutter to direct runoff and many of the open channel ditches have been filled in by residents for additional parking and landscaping. City staff indicated that maintenance has never been performed for the entire system and that minimal maintenance has occurred on portions of the system on an as-needed basis. As a first phase, a study of the overall subdivision storm system is required to evaluate the capacity of the current facility and identify needed infrastructure improvements to address existing problems. A future phase of this project would include installation and repair of infrastructure recommended in the Study. The future phase work is not identified in the Capital Improvements Plan as those improvements are not yet determined.

If a study was not performed, runoff would continue to sheet across roads onto residential property creating flooding and property damage risk and the City would continue to receive complaints during large runoff events. A Study is required to identify infrastructure improvements to prevent flooding of property and to protect public safety.

Site Specific Information

The Grantland #13 Subdivision is located on the north side of Missoula and is approximately 2.3 miles north along Grant Creek Road from the North Reserve/Grant Creek Road exit off of Interstate 90. The subdivision includes Starwood Drive, Rosewood Court, Highline Court, Pinehill Court, and Parkwood Drive. The latitude and longitude of the project location is 46°56’35” N and 114°0’43”.

This project area includes approximately 60 residential lots and homes located on a hillside. The City has open drainage easements/back slope easements, but the exact locations are unknown and require review. Through discussions with City staff, it is unknown whether the existing facility requires replacement, upsizing, or new infrastructure (i.e. armoring, culverts, curb and gutter, or additional capacity).

Figure 4.3.2-1 Rosewood Court filled in drainage ditch

Figure 4.3.2-2 Drainage ditch with beehive grate inlet

Proposed Project Recommendations

It is recommended that the City perform a study of the project area to analyze the functionality of the system and to determine any infrastructure improvements that would be required. Upon completion of this study, infrastructure improvements would be implemented to provide a sufficient storm water system.

The estimated cost for Phase 1 of this project is $60,000. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.2 – Grantland #13 Subdivision Storm Water Drainage Study Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	1	12	12
Regulatory Compliance	2	11	22
Area of Influence of Improvement	2	10	20
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	3	8	24
Water Quality	2	7	14
Cost Leveling	3	6	18
Local Economic Effect	2	5	10
Reliability	3	4	12
Support of Project Growth	1	3	3
Facility Flexibility	1	2	2
Potential for Failure	3	1	3
Project Total	176		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 1

The proposed study provides low impact on public safety and the on-going issues and complaints received by the City do not warrant a significant threat to the public.

Regulatory Compliance: 2

The problems identified in this subdivision do not cause the storm water system to unsatisfactorily meet any set regulations. However, the City would like to address complaints provided by residents of the subdivision, and any proposed infrastructure improvements would need to be in compliance with City standards.

Area of Influence of Improvement: 2

This subdivision includes approximately 60 residential lots with homes and the area of influence is considered relatively small.

Operational Benefits: 4

The proposed study would identify deficiencies with the existing storm water system and provide recommendations for routine maintenance of infrastructure improvements to provide a functional system.

Coordination with other Infrastructure Projects: 3

This project has the potential to coordinate with other infrastructure projects such as water and sewer.

Water Quality: 2

This project primarily involves storm water management with minimal water quality improvements associated with the management of the storm water.

Cost Leveling: 3

In consideration of the schedule of projects, the total cost of this project does not require this project to advance or defer to a different fiscal year.

Local Economic Effect: 2

The proposed study will provide recommendations requiring increased maintenance, subsequently requiring additional personnel. The maintenance would likely be relatively low.

Reliability: 3

Findings from the proposed study will contribute to a functioning system requiring only routine maintenance.

Support of Projected Growth: 1

The proposed study will not consider the potential for growth in the subdivision.

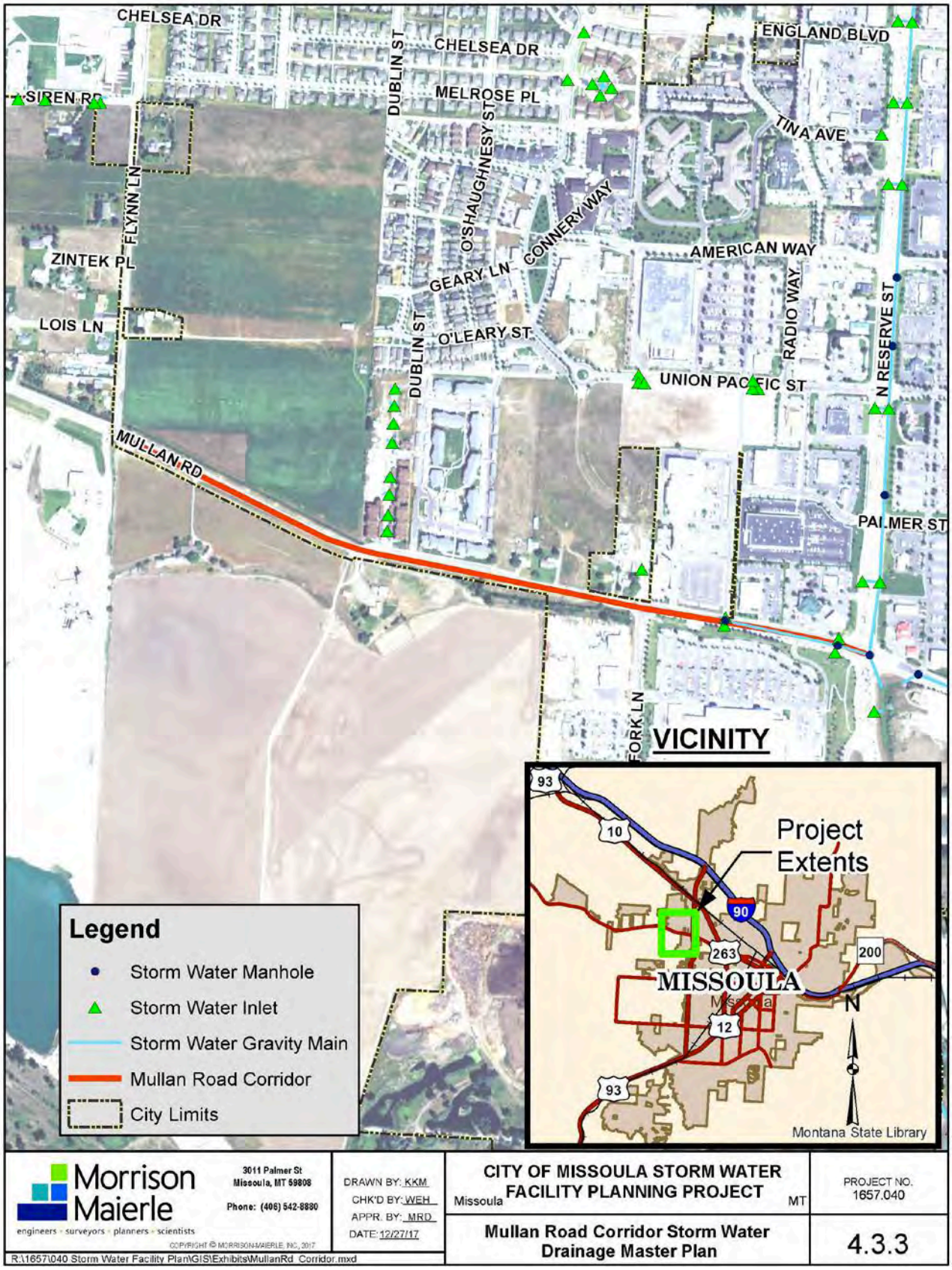
Facility Flexibility: 1

The proposed study will contribute to a functioning existing system with no consideration of growth.

Potential for Failure: 3

The City of Missoula receives complaints about the existing storm water system. These complaints are received during large storm events or high runoff events.

4.3.3 Mullan Road Corridor Storm Water Drainage Master Plan



Description

This project involves the development of a Storm Water Drainage Master Plan for the Mullan Road corridor. It includes analysis of the Mullan Road corridor and adjoining land areas, definition of the extent of the drainage basin, identification of deficiencies in the existing drainage, development of alternatives for improvements. The Master Plan will provide recommendations for phased improvements within this corridor with consideration of storm water needs related to future development of the adjacent and surrounding areas along Mullan Road.

Project Need

Mullan Road Corridor is a relatively new area of development within the City of Missoula. This area is lacking in storm water infrastructure particularly along the south side of the road. The north side of the road has limited storm water infrastructure, but it does not extend past the 4100 Condominiums and Mullan Reserve Apartments. Due to the deficiency in storm water infrastructure along this corridor, pavement failure and potholes are becoming evident along the south.

Flynn-Lowney irrigation ditch runs east to west along the south side of Mullan Road and then transitions to the north side downstream of the 4100 Condominiums. Without proper storm water infrastructure, much of the runoff finds its way to the ditch where sediment is deposited, creating an issue for the irrigators.

If a storm drain master plan is not implemented for the Mullan Road corridor, pavement failure and potholes will increase in number. In addition, the Flynn-Lowney irrigation ditch will continue to receive sediment, resulting in a potential reduction in flow capacity as well as increased maintenance. Additionally, a storm drain master plan for this road corridor would provide guidance for future development.

Site Specific Information

The project area includes approximately 0.55 miles within the right-of-way along Mullan Road approximately 0.25 miles from the Mullan/Reserve Street intersection west to Flynn Lane. The project start and end latitude and longitude are 46°53’8” N, 114°2’39” W and 46°53’15” N, 114°3’19” W, respectively. This segment of Mullan Road is classified as Montana Department of Transportation (MDT) Urban Route U-8123. Typically, maintenance of urban routes falls under the purview of the local municipality. It may be necessary to coordinate with MDT on their roles and responsibilities associated with this planning effort.

Within the past year, development along this road has significantly increased, including the construction of the Tollefson Apartments, Tract 3 Hailing Farms Apartments, and another phase of the 4100 Condominiums. Near-term development includes the connection of Mary Jane Boulevard to Mullan Road as development continues to the west.

It is likely that the soils in this area consist of clay and will require storm water retention/detention systems instead of the typical sump used throughout Missoula.

Figure 4.3.3-1 South side of Mullan Road looking west

Figure 4.3.3-2 South side of Mullan Road looking east

Proposed Project Recommendations

It is recommended that this corridor of roadway and the adjacent properties be analyzed to develop a storm water management plan. This plan would provide recommendations for the installation of infrastructure to accommodate future development of the area.

The estimated cost of this project is $60,000. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.3 – Mullan Road Corridor Storm Water Drainage Master Plan Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	2	12	24
Regulatory Compliance	2	11	22
Area of Influence of Improvement	4	10	40
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	3	8	24
Water Quality	2	7	14
Cost Leveling	3	6	18
Local Economic Effect	2	5	10
Reliability	4	4	16
Support of Project Growth	5	3	15
Facility Flexibility	5	2	10
Potential for Failure	3	1	3
Project Total	**232**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 2

Mullan Road corridor's lack of storm water infrastructure poses a low threat to public safety. The corridor has a relatively low population density; however, recent development has elevated this number and a lack of infrastructure poses a small threat to the public during large storm events.

Regulatory Compliance: 2

The problems identified along this road corridor do not lead to unsatisfactorily meeting any set regulations. Any proposed infrastructure improvements will need to be in compliance with City standards.

Area of Influence of Improvement: 4

This road corridor provides access to a relatively low population currently. Recent development has elevated the population and future development will increase this number even more. In the near future development is expected in the area between the 4100 Condominiums and Flynn Lane.

Operational Benefits: 4

The proposed study to develop a storm drain master plan will provide specific guidance on the development of this corridor. A score of four is awarded due to the increased ability to plan for this area.

Coordination with other Infrastructure Projects: 3

This project has the potential to coordinate with other infrastructure projects such as water and sewer.

Water Quality: 2

This project primarily involves storm water management with minimal water quality improvements associated with the management of the storm water.

Cost Leveling: 3

In consideration of the schedule of projects, the total cost of this project does not require this project to advance or defer to a different fiscal year.

Local Economic Effect: 2

The proposed study will be performed by an engineering consultant. This project will allow for a local consultant to perform the study and create future infrastructure jobs for potential local contractors to perform.

Reliability: 4

The proposed study to develop a storm drain master plan will develop a plan that is reliable for development that exists as well as future development.

Support of Projected Growth: 5

The purpose of the storm drain master plan is to provide infrastructure improvements to deal with the storm water system presently.

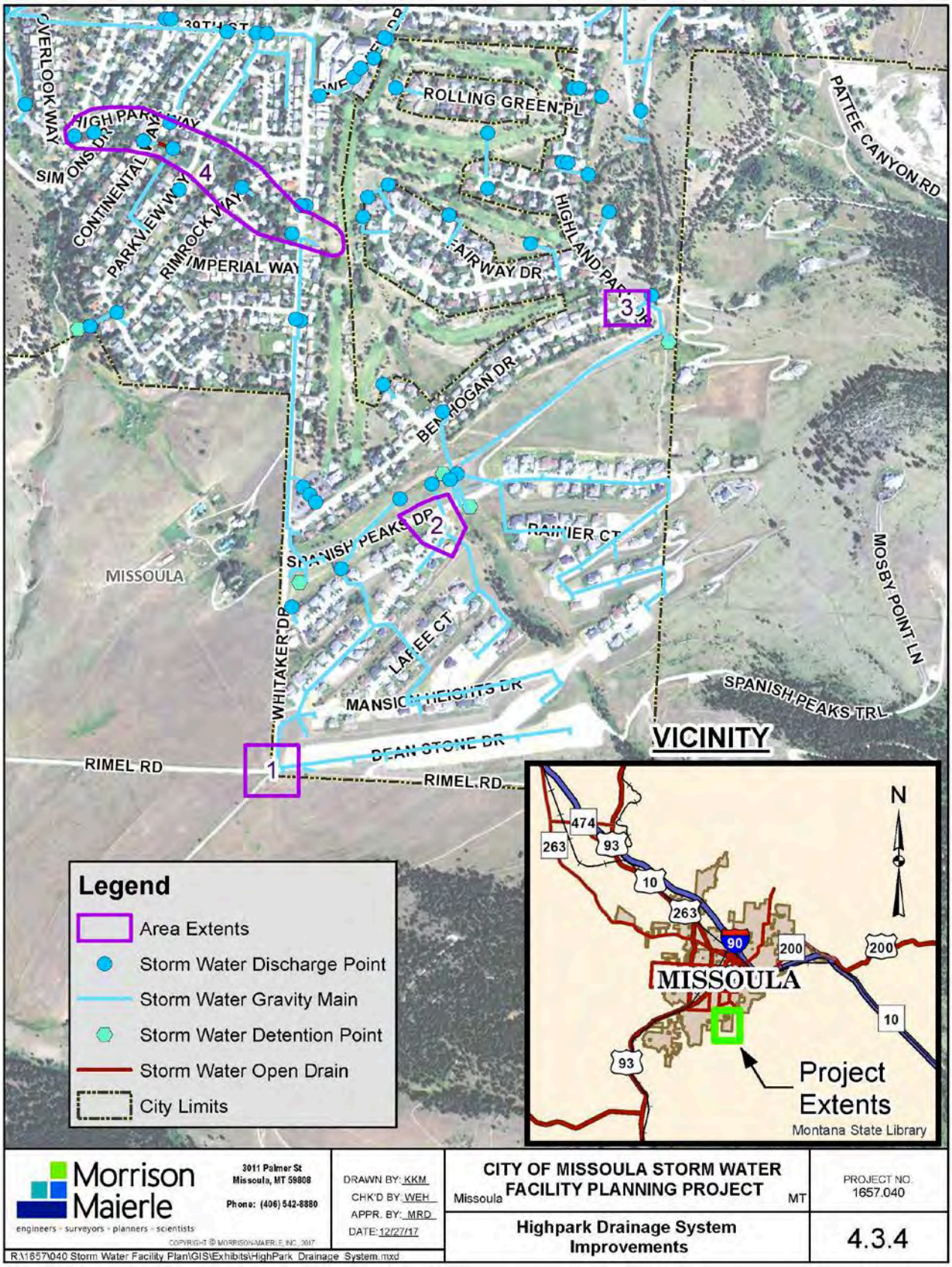
Facility Flexibility: 5

The purpose of the storm drain master plan is to provide infrastructure improvements to deal with the storm water system presently and in the future. Any unforeseen changes before implementation of the proposed infrastructure can be modified as needed.

Potential for Failure: 3

The existing storm water system lacks the necessary infrastructure to properly convey runoff and poses a potential threat during a large storm event.

4.3.4 Highpark Drainage System Improvements



Description

This project includes infrastructure improvements in three separate areas as well as a study of the storm water system in a fourth area. This project will address known issues related to storm water infrastructure and assess whether or not other improvements are necessary. The recommended study area includes the area between Whitaker Drive and Simons Drive.

Project Need

The Highpark drainage system includes four areas requiring infrastructure improvements. The first of these experiences erosion at an intersection of an unpaved and paved road. The second area experiences on-going issues with probable spring water resulting in asphalt failure and continuous flow of water. The third area lacks adequate conveyance of storm water near the end of a pavement section. A fourth area experiences an issue with runoff where City staff previously installed a beehive grate system to convey storm water across a road and into an open drainage channel. It is likely that monitoring and research at this location are required to effectively determine a solution.

If this project is not implemented, continual issues with asphalt deterioration, erosion, and potential ponding and flooding risks will remain and likely worsen over time. The longer these issues remain unaddressed, the higher the likelihood for these problems to worsen and new problems to develop.

Site Specific Information

Area 1: The first infrastructure project is located at the intersection of Rimel Road and Whitaker Drive, which is experiencing erosion of the asphalt pavement and other areas. Storm water runoff is directed down the hill onto Rimel Road and flows to this intersection where it is then dispersed onto Whitaker Drive and Rimel Road. The City is currently using rubber stops to direct water down Rimel Road into a drainage ditch that continues along the road and down the hill. The latitude and longitude are 46°49’12”N and 114°0’12”W.

Area 2: The second infrastructure project is located at the intersection of Mansion Heights Drive and Dean Stone Drive, which is experiencing pavement failure and typically displays moisture. The pavement failure is likely attributed to the constant exposure to moisture. It has been noted by City staff that the appearance of water at this location is not seasonal but is found year round. Water in this area is likely a result of a spring. The latitude and longitude are 46°49’31”N and 113°59’58”W.

Area 3: This infrastructure improvement is located at the intersection of Ben Hogan Drive and Highland Park Drive, which lacks adequate conveyance of runoff. The pavement ends approximately 120 feet past the intersection considered the end of Ben Hogan Drive. Direction of water past the intersection increases the probability of runoff ending up on adjacent residents’ property. Topography at the intersection is unfavorable for shifting the flow of water down Highland Park Drive and damage to the residence to the northeast of the intersection is possible. The latitude and longitude are 46°49’46”N and 113°59’39”W.

Area 4: This area is located along a natural drainage channel between Simons Drive and Whitaker Drive where runoff crosses Simons Drive approximately 100 feet from the intersection with High Park

Way. The drainage at Simons Drive has historically displayed issues with the flow of storm water runoff crossing Simons Drive. Runoff is directed into this drainage system from the east of Whitaker Drive. This system consists of a series of open channels, inlets, and pipes to convey water through the residential area. At this particular location, City staff installed a beehive grate to collect water and direct it through a piped system on the other side of the street. The beehive grate appears to have resolved issues by directing flow across the road. However, it is apparent that makeshift check structures have been installed by area residents indicating ongoing issues with the conveyance of runoff. A study of this drainage is required to assess the adequacy of the system and the potential need for additional improvements.

Figure 4.3.4-1 Highpark Area 4

Figure 4.3.4-2 Highpark Area 1

Figure 4.3.4-3 Highpark Area 2

Proposed Project Recommendations

It is recommended that infrastructure improvements be performed at the Area 1, 2 and 3 described above. It is also recommended that a study be performed on the drainage that runs from Whitaker Drive to Simons Drive to determine any deficiencies with the drainage and any potential improvements that need to be implemented. The study would also review and verify water rights are assigned to the water usage on the drainage ditch as it appears many homes are pumping surface water from the drainage.

The overall cost for this project is $391,400. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.4 – Highpark Drainage System Improvements Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	2	12	24
Regulatory Compliance	2	11	22
Area of Influence of Improvement	3	10	30
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	3	8	24
Water Quality	3	7	21
Cost Leveling	1	6	6
Local Economic Effect	4	5	20
Reliability	4	4	16
Support of Project Growth	1	3	3
Facility Flexibility	1	2	2
Potential for Failure	3	1	3
Project Total	**207**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 2

The proposed infrastructure improvements and study pose a minimal to average threat to public safety.

Regulatory Compliance: 2

The problems identified for this project do not lead to unsatisfactorily meeting any set regulations. Any proposed infrastructure improvements will need to be in compliance with City standards.

Area of Influence of Improvement: 3

The proposed improvements and study are limited to street intersections and a relatively small area located near the natural drainage between Whitaker Drive and Simons Drive. Due to their being four areas relative to this project, a score of three is awarded.

Operational Benefits: 4

City of Missoula performs maintenance at all four areas now on an as-needed basis. All of these areas are a concern and are checked after large storm events and whenever an issue becomes evident. Performing infrastructure improvements at three locations and a study at the last will likely reduce maintenance.

Coordination with other Infrastructure Projects: 3

This project has the potential to coordinate with other infrastructure projects such as water and sewer.

Water Quality: 3

The improvements will provide meaningful water quality benefits. In particular, Area 1 currently exhibits significant erosion and sediment issues. The implementation of this project will improve these water quality issues.

Cost Leveling: 1

The total cost of this project combined with similar ranked projects resulted in too many high cost projects at the same time. This project was deferred to Fiscal Year 2021 to level the cost for that timeframe.

Local Economic Effect: 4

The proposed infrastructure improvements and study will require an engineering consultant and contractor(s). This will allow for a local consultant and contractor to be selected and will also allow local vendors to supply materials.

Reliability: 4

Field engineered design at the proposed study location and regular maintenance and makeshift infrastructure have been implemented at all four locations. This project will reduce maintenance and provide recommendations for appropriate infrastructure, resulting in a reliable storm water system.

Support of Projected Growth: 1

The proposed study and infrastructure improvements do not propose to consider the potential for growth in the area.

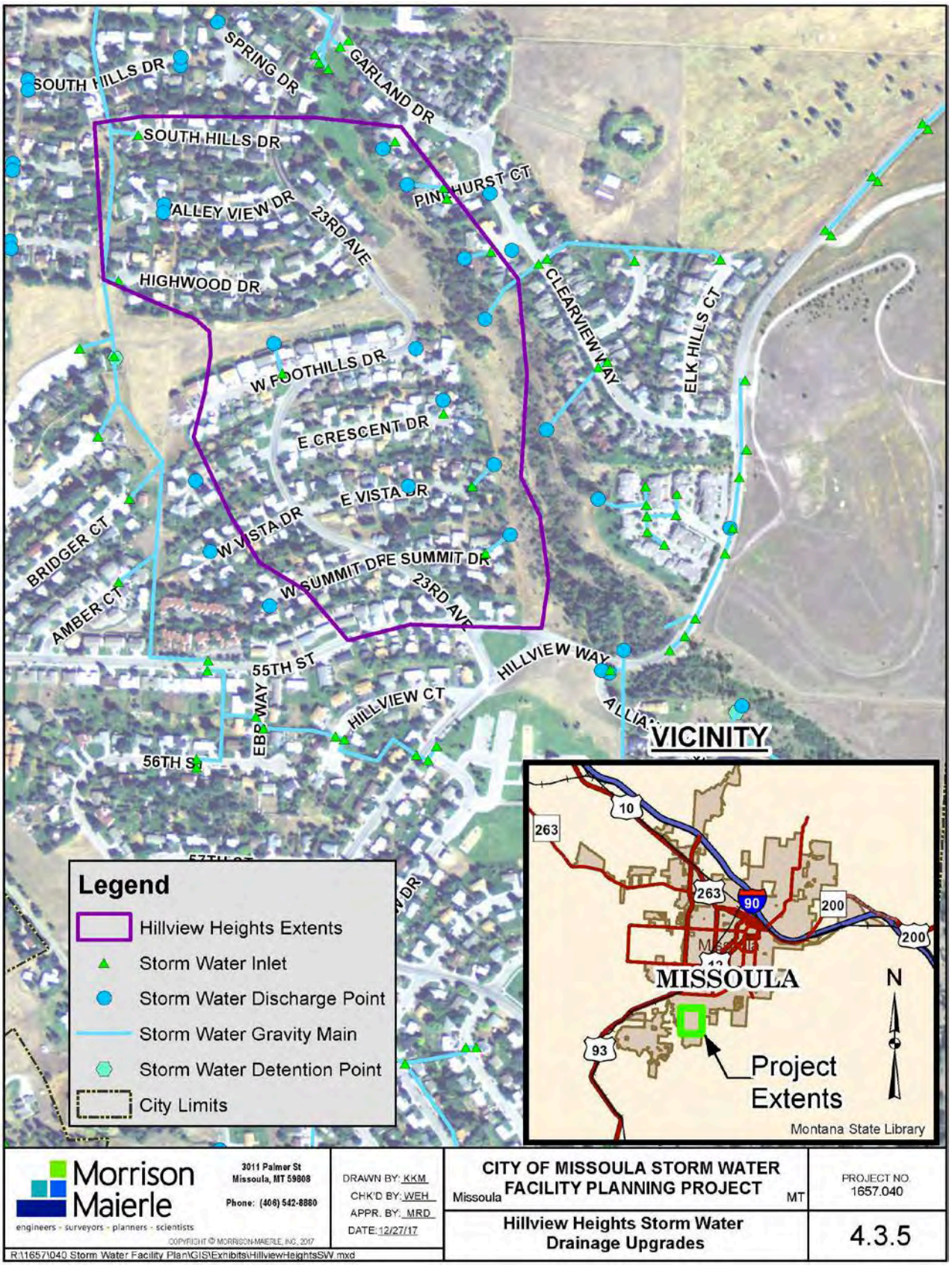
Facility Flexibility: 1

This project's purpose is to fix known issues at the four locations, but the proposed study and improvements do not plan for any potential changing conditions.

Potential for Failure: 3

Due to the maintenance performed and the close watch on these areas failure has not occurred, but without addressing these problem areas the issues will continue to worsen, increasing the likelihood of failure.

4.3.5 Hillview Heights Storm Water Drainage Upgrades



Description

This project consists of infrastructure improvements in the Hillview Heights area of Missoula. This project will improve the lack of storm water infrastructure in the area to better convey runoff.

Project Need

The project area is missing essential storm water infrastructure to allow the existing storm water system to function properly. The lack of curb and gutter and a sufficient number of inlets causes water to fan out onto residents' property and creates a potential for flooding and erosion problems.

Without implementation of this project, the storm water system within this area will continue to function inadequately, allowing the continuation of flooding risk and erosion problems that could potentially worsen over time. This could result in a higher threat to public safety and increased costs for repairs or improvement at a later date.

Site Specific Information

The Hillview Heights proposed storm water infrastructure is located along 23rd Avenue between Foothills Drive and Garland Drive. The east side of 23rd Avenue near the intersection with Highwood Drive lacks curb and gutter. Runoff follows the catch curb and gutter until it ends; however, there are no curb inlets or sumps located along 23rd Avenue within the project limits. Without curb inlets or curb cuts, runoff cannot reach the natural drainage channel located to the east, which flows to the piped system located near the intersection of Garland Drive and 23rd Avenue.

Figure 4.3.5-1 Looking south on 23rd Avenue just past Foothills Court

Proposed Project Recommendations

It is recommended that infrastructure improvements be made along 23rd Avenue. Curb cuts or curb inlets and piping should be installed to allow runoff along the street to reach the natural drainage to the east. Curb and gutter should also be installed along the described length of 23rd Avenue to direct runoff away from residents' property.

The estimated cost for this project is $99,100. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.5 – Hillview Heights Storm Water Drainage Upgrades Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	2	12	24
Regulatory Compliance	2	11	22
Area of Influence of Improvement	2	10	20
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	3	8	24
Water Quality	1	7	7
Cost Leveling	3	6	18
Local Economic Effect	2	5	10
Reliability	4	4	16
Support of Project Growth	1	3	3
Facility Flexibility	1	2	2
Potential for Failure	2	1	2
Project Total	**184**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 2

The proposed upgrades to the storm drainage system in this area and the system that exists pose a minimal threat to public safety.

Regulatory Compliance: 2

The problems identified in this area do not lead to unsatisfactorily meeting any set regulations. Any proposed infrastructure improvements will need to be in compliance with City standards.

Area of Influence of Improvement: 2

The proposed improvements are limited to a relatively small area located along 23rd Avenue.

Operational Benefits: 4

Maintenance for this area has been minimal and on an as-needed basis. It is known that proper storm water infrastructure is lacking and proposed improvements would provide an adequate storm water system requiring routine maintenance.

Coordination with other Infrastructure Projects: 3

This project has the potential to coordinate with other infrastructure projects such as water and sewer.

Water Quality: 1

The Hillview Heights Project involves minimal water quality improvements.

Cost Leveling: 3

In consideration of the schedule of projects, the total cost of this project does not require this project to advance or defer to a different fiscal year.

Local Economic Effect: 2

The proposed infrastructure improvements will require a contractor. This will allow for a local contractor to perform the work and local vendors to supply materials. The amount of construction and materials are relatively low.

Reliability: 4

Proposed infrastructure improvements will improve the existing storm water system resulting in a more reliable.

Support of Projected Growth: 1

This project does not account for potential growth in the area as much of the area is already developed as a residential neighborhood.

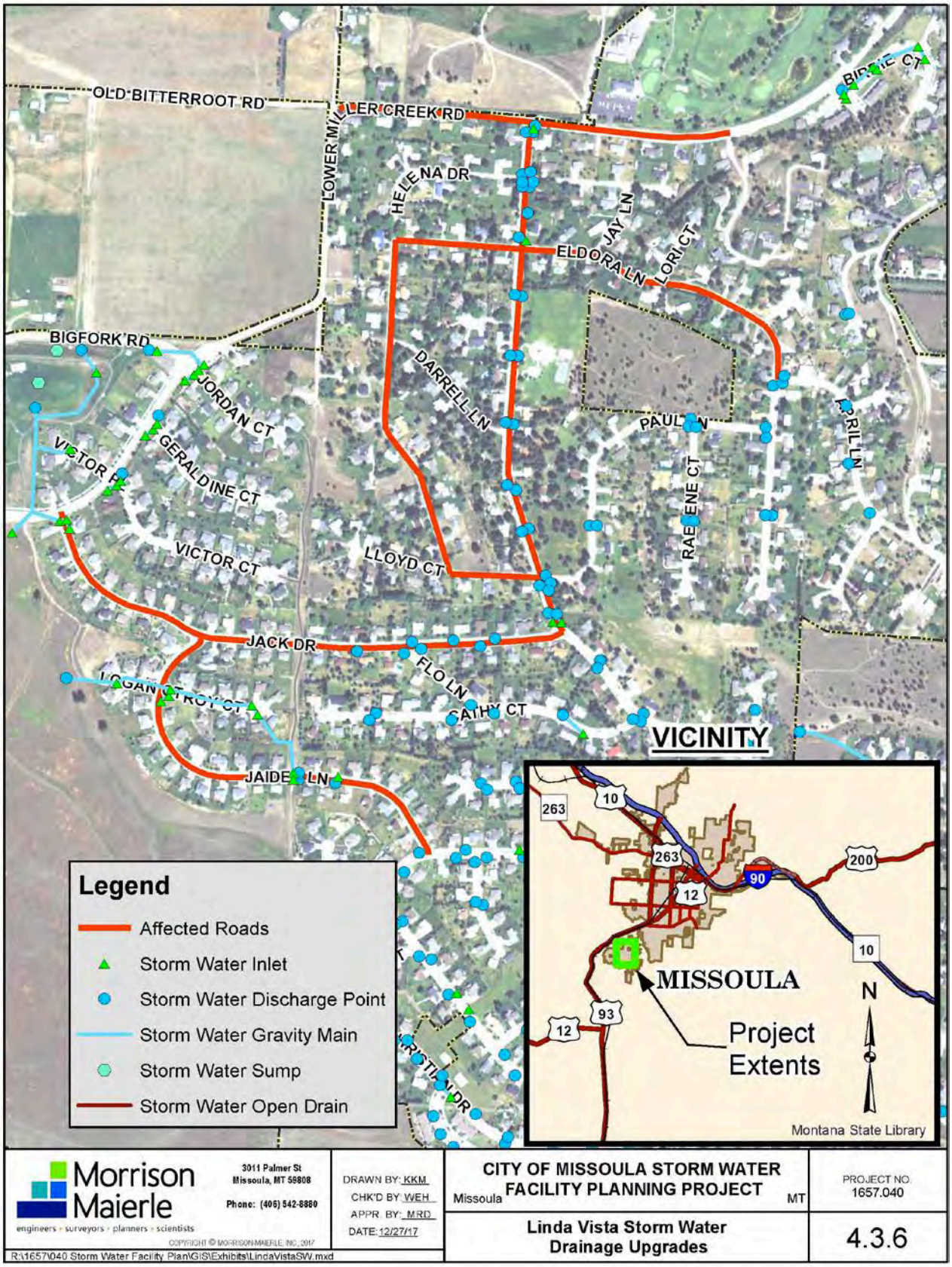
Facility Flexibility: 1

The purpose of this project is to improve the existing storm water system by installing appropriate infrastructure that is lacking. The proposed improvements do not account for potential growth or changing conditions.

Potential for Failure: 2

The lack of storm water infrastructure along 23rd avenue is a known issue, and larger storm events result in increased volumes of water in the street that cannot escape to the natural drainage to the east. The City has not seen any significant failures of the existing system.

4.3.6 Linda Vista Storm Water Drainage Upgrades



Description

This project includes a study to determine the hydraulic deficiencies with the system. This project will address known issues and will recommend infrastructure improvements to properly convey storm water within the Linda Vista Drainage from Jack Drive to Lower Miller Creek Road.

Project Need

The Linda Vista Drainage experiences issues with conveyance of storm water and the functionality of the existing infrastructure. According to City staff, work has been performed on the system within this area, but there are still on-going issues. Many of the streets within this area lack curb and gutter, and many culverts are plugged, which results in runoff onto residential properties. A study is required to determine the hydraulic capacity of the existing infrastructure and to adequately size the needed improvements.

If the project is not implemented, the on-going issues with storm water conveyance will continue with the potential for the problems to worsen over time and for new problems to develop as a result.

Site Specific Information

The project area encompasses Linda Vista Boulevard from Jaiden Lane to Lower Miller Creek Road and is bounded to the west by Helena Drive. The streets west of Linda Vista Boulevard do not have curb and gutter north of Lloyd Court. According to City staff, the culvert located underneath Linda Vista Boulevard between Jack Drive and Helena Drive continuously plugs and requires routine maintenance.

Recently, the City purchased the vacant lot to the north of the Lower Miller Creek Road and Linda Vista Boulevard Intersection adjacent to the Linda Vista Golf Course. From discussions with City staff, conveyance of runoff to this lot from the Linda Vista drainage would be ideal and could provide a detention/retention area for storm water or potential future treatment before discharge into the Bitterroot River.

Figure 4.3.6-1 Plugged culvert between Jack Dr. and Helena Dr.

Proposed Project Recommendations

It is recommended that the City perform maintenance on the storm water system in this area. Upon completion, a study would be performed on the area bounded by Jaiden Lane, Lower Miller Creek Road, Linda Vista Boulevard, and Helena Drive.

The estimated cost for this project is $60,000. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.6 – Linda Vista Storm Water Drainage Upgrades Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	3	12	36
Regulatory Compliance	2	11	22
Area of Influence of Improvement	2	10	20
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	3	8	24
Water Quality	2	7	14
Cost Leveling	3	6	18
Local Economic Effect	2	5	10
Reliability	4	4	16
Support of Project Growth	2	3	6
Facility Flexibility	2	2	4
Potential for Failure	2	1	2
Project Total	**208**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 3

The proposed study area poses some threat to public safety due to the risk of flooding although the existing system is moderately functional.

Regulatory Compliance: 2

This project identifies a plan to minimize runoff and flooding issues. Although there are benefits to the reduction in flooding, there are no regulatory compliance issues associated with this project.

Area of Influence of Improvement: 2

The proposed study will encompass a relatively small area bounded by Lower Miller Creek Road, Linda Vista Boulevard, and Jaiden Lane.

Operational Benefits: 4

Maintenance is performed in this area on an as needed basis. The proposed study will recommend infrastructure improvements that will result in a reduction of maintenance

Coordination with other Infrastructure Projects: 3

This project has the potential to coordinate with other infrastructure projects such as water and sewer.

Water Quality: 2

This project primarily involves storm water management with minimal water quality improvements associated with the management of the storm water.

Cost Leveling: 3

In consideration of the schedule of projects, the total cost of this project does not require it to advance or defer to a different fiscal year.

Local Economic Effect: 2

The proposed study will require an engineering consultant, which allows for a local consultant to be selected. The findings from the study will propose recommendations for infrastructure improvements allowing for selection of a local contractor to perform the improvements and a local vendor to supply materials.

Reliability: 4

The existing storm water infrastructure functions without many complaints. However, the City has knowledge of a lack of storm water infrastructure.

Support of Projected Growth: 2

The purpose of this study is to determine any inadequacies with the existing storm water system in this area. The City has recently purchased a new lot to the north of Lower Miller Creek Road adjacent the Linda Vista Golf Course. Due to this recent purchase, the City would like to look at the potential for piping inlets and conveying storm water to this lot.

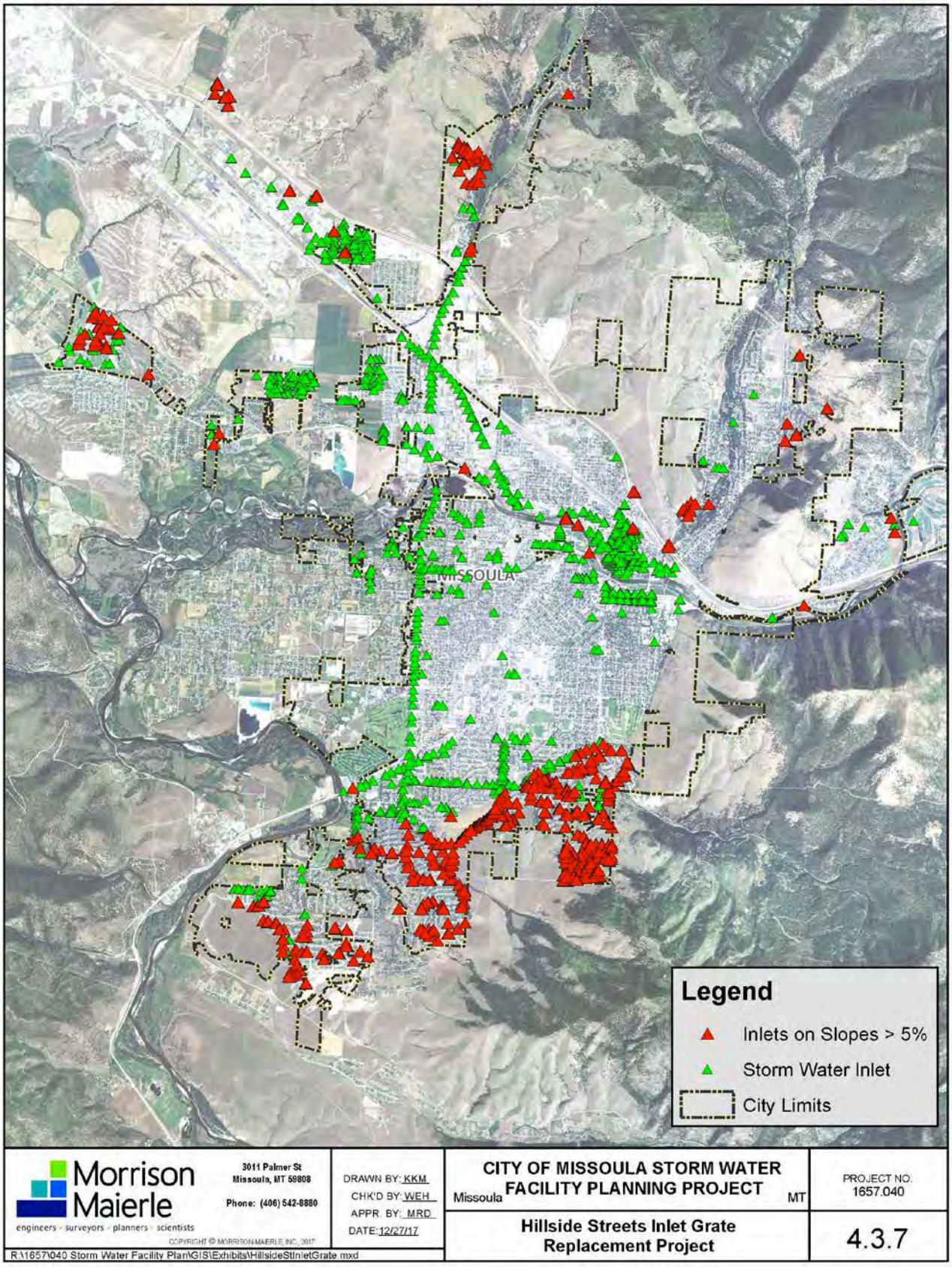
Facility Flexibility: 2

The recent purchase of the vacant lot to the north of Lower Miller Creek Road has potential to allow for added storm water facilities. Utilization of this lot could allow for adaptation to changing conditions for this system.

Potential for Failure: 2

The storm water system present in this area functions without many complaints from residents. There is known lack of storm water infrastructure, and plugging of some culverts has been an issue.

4.3.7 Hillside Streets Inlet Grate Replacement Project



Description

This project includes new infrastructure in all areas of Missoula located on grades steeper than 5 percent. Existing inlet grates in these areas will be replaced with vaned grates to intercept more runoff and collect it into the City's existing storm water system.

Project Need

The existing inlets utilized by the City of Missoula are flat grates installed flush to the pavement. Runoff on these steep grades travels at high velocities, bypassing the grates so that much of the runoff is not collected into the storm water system. This creates a multitude of potential problems, including increased probability for flooding/ponding and sediment deposition at downgradient ends of systems and other undesirable locations and impacts the capacity of the road during runoff events.

If this project is not implemented, water will continue to bypass grates on these steeper streets, resulting in a considerable volume of water not captured by the storm water system.

Site Specific Information

The City of Missoula is located within a valley where development has occurred on the hillsides surrounding the valley floor. Much of these residential areas, including those in the Rattlesnake, Grant Creek, and South Hills are located on slopes greater than 5 percent.

Proposed Project Improvements

Based on GIS query data, a total of 636 storm water inlets meet the criteria being located on slopes greater than 5%. For the purposes of this planning effort, it was assumed that 25% of the 636 inlet grates would not need to be replaced. Of the 477 inlet grates needing replacement, it was assumed that a third would be a simple grate replacement, a third would include modifications to the existing sump, and a third would be a total replacement of the inlet and sump. The levels are further defined below.

To account for the variance in site conditions for these inlets, a series of construction cost levels were identified. Level 1 includes inlet grate replacement costs for materials only. Level 2 includes inlet grate and frame replacement costs as well as rotation of the top sump casting ring to place the inlet within the flowline of the curb or drainage. Level 3 includes inlet grate and frame replacement costs, installation of a new sump, and infrastructure replacement (i.e. curb and gutter, sidewalk, asphalt, utilities, etc.). Level 1 work is assumed to be performed by City staff. Levels 2 and 3 are assumed to be performed by a contractor. The City would ideally hire a contractor on an "on-demand" basis to perform level 2 and level 3 work for a period of 3 years.

The estimated cost for this project is: $1,608,800. To reduce the cost impact of this project, it is recommended to phase this project over a 10-year period. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.7 – Hillside Streets Inlet Grate Replacement Project Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	1	12	12
Regulatory Compliance	1	11	11
Area of Influence of Improvement	5	10	50
Operational Benefits	2	9	18
Coordination with other Infrastructure Projects	5	8	40
Water Quality	2	7	14
Cost Leveling	5	6	30
Local Economic Effect	1	5	5
Reliability	5	4	20
Support of Project Growth	1	3	3
Facility Flexibility	1	2	2
Potential for Failure	1	1	1
Project Total	**206**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 1

The replacement of inlet grates on slopes steeper than five percent poses a minimal threat to public safety.

Regulatory Compliance: 1

The problem of water bypassing grates does not lead to unsatisfactorily meeting any set regulations.

Area of Influence of Improvement: 5

The proposed replacement of flat inlet grates with vaned grates improves the performance of approximately 477 inlets, a significant portion of the existing inlets in Missoula.

Operational Benefits: 2

Implementation of vaned grates over flat grates would intercept a greater volume of runoff but will also increase the probability for collecting trash that will result in plugging of grates.

Coordination with other Infrastructure Projects: 5

A score of five is awarded to advance this project to Fiscal Year 2021. This timing allows for coordination of the replacement grates with other infrastructure projects.

Water Quality: 2

This project primarily involves storm water management with some water quality improvements associated with the management of the storm water.

Cost Leveling: 5

A score of five is awarded to advance this project to Fiscal Year 2021. In consideration of the schedule of projects, the City believe it is appropriate to initiate the 10-year replacement schedule at this time.

Local Economic Effect: 1

The replacement of inlet grates will likely be performed by City staff and procurement of the vaned grates will likely be unable to be purchased through a local vendor.

Reliability: 5

Inlet grates are a material with a considerably long service life. Vaned grates will likely require an increase in maintenance to remain unplugged but will be a reliable infrastructure improvement for capturing flow.

Support of Projected Growth: 1

This project focuses on increasing the capture of surface runoff on steeper slopes. It does not account for projected growth of Missoula.

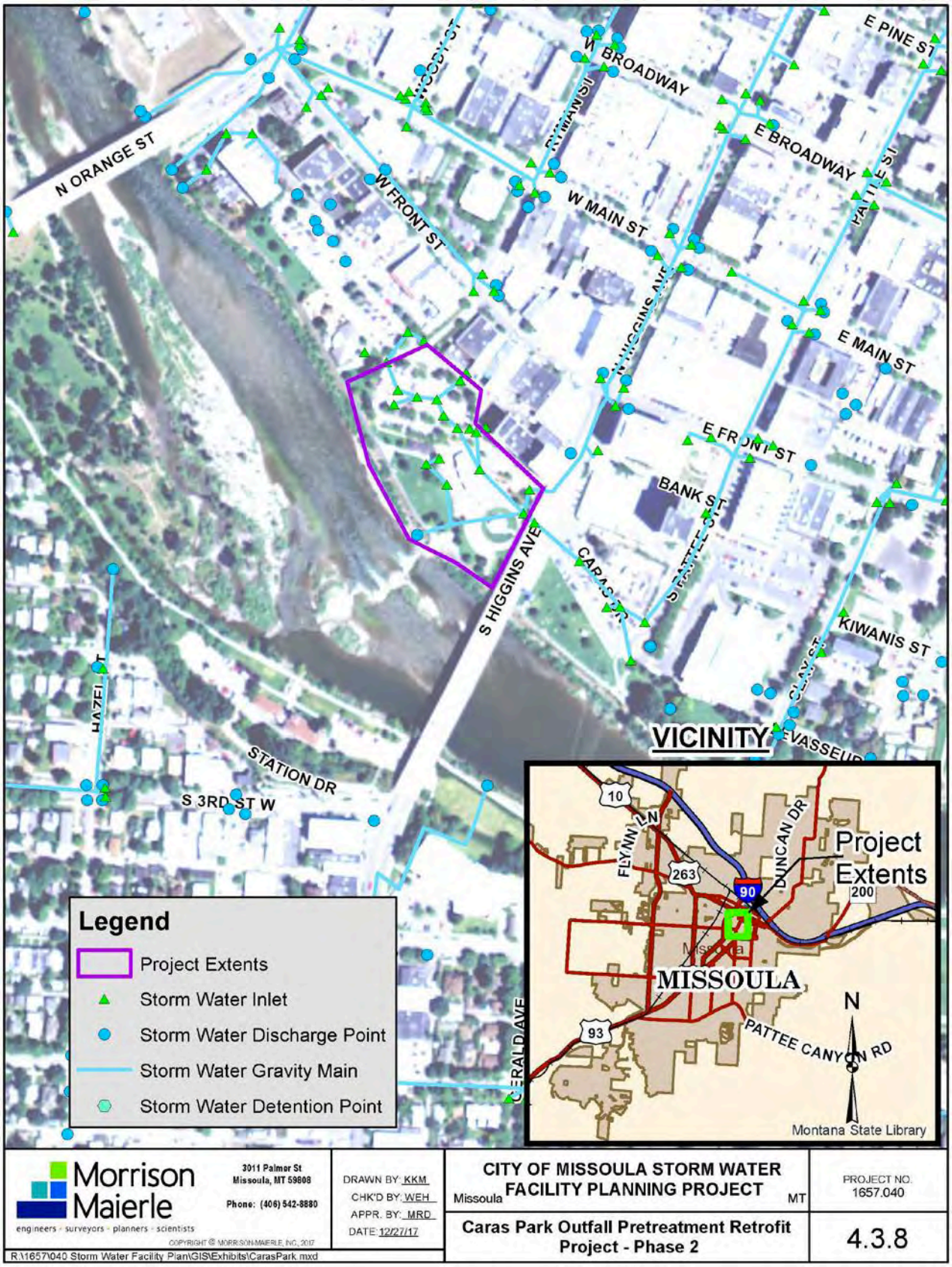
Facility Flexibility: 1

The purpose of the project is to increase the capture of runoff on slopes steeper than 5 percent. This project does not account for potential changing conditions in the future.

Potential for Failure: 1

Grates have a long service life and have not contributed to failure of the storm water utility.

4.3.8 Caras Park Outfall Pretreatment Retrofit Project – Phase 2



Description

This project involves additional infrastructure for treatment of storm water runoff at the Caras Park Outfall. This is the second phase of the project and provides additional storm water quality treatment to this outfall.

Project Need

The Caras Park Outfall is identified as having water quality treatment needs based on discharge monitoring results. The outfall treatment project was initiated to treat the storm water runoff of this high profile discharge located next to Brennan's Wave. . In anticipation of impending regulations set forth in the U.S. Clean Water Act, Small Municipal Separate Storm Sewer System (MS4), and the Montana Pollutant Discharge Elimination System (MPDES) regarding water quality treatment on storm water outfalls, the City of Missoula proactively installed Phase 1 of this project in 2017. Phase 1 included installation of a Hydrodynamic Separator (HDS) Unit, which is a storm water treatment device that removes pollutants, such as hydrocarbons, from urban runoff to provide enhanced gravity separation downstream. Phase 2 involves installation of an infiltration gallery to discharge first flush events in the ground rather than discharge into the Clark Fork River.

If this project is not implemented, Missoula will continue to discharge first flush events into the Clark Fork River at a location that is heavily used by the public, resulting in exposure to contaminants during runoff events. In addition, increasing regulations will likely require this water quality improvement.

Site Specific Information

Caras Park is located in Downtown Missoula west of the Higgins Street Bridge and directly south of the Wilma Theater. Caras Park is a heavily used public area making it difficult for project coordination and installation of necessary storm water treatment infrastructure. Phase 1 was completed in the Fall of 2017. The project location latitude and longitude are 46°52'9"N and 113°59'48"W.

Figure 4.3.8-1 Caras Park Outfalll to Clark Fork River near Brennan's Wave

Proposed Project Recommendations

It is recommended that additional treatment infrastructure be installed to further treat storm water runoff prior to discharge into the Clark Fork River. Phase 2 includes installation of infiltration basins or chambers to further treat effluent from the hydrodynamic separator. Runoff from most storm events would be discharged into the ground rather than the river, which would provide a greater degree of treatment to the storm water. Installation of this infrastructure would bring the City closer to meeting MS4 requirements for the treatment of storm water.

The estimated cost for this project is $451,570. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.8 – Caras Park Outfall Pretreatment Retrofit Project – Phase 2 Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	2	12	24
Regulatory Compliance	2	11	22
Area of Influence of Improvement	3	10	30
Operational Benefits	2	9	18
Coordination with other Infrastructure Projects	3	8	24
Water Quality	5	7	35
Cost Leveling	3	6	18
Local Economic Effect	3	5	15
Reliability	4	4	16
Support of Project Growth	1	3	3
Facility Flexibility	1	2	2
Potential for Failure	1	1	1
Project Total	**208**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 2

This project will increase the treatment for storm water before it is released into the Clark Fork River. The Clark Fork River is used largely by the public for recreation with the location of this outfall located in a high use area. Although released containment pose a health concern, the overall public safety risk is relatively low.

Regulatory Compliance: 2

It is anticipated that regulatory standards for storm water outfalls will be increased over time. Although this outfall is considered in compliance, this project advances efforts to preemptively treat outfalls prior to forthcoming regulations.

Area of Influence of Improvement: 3

Caras Park outfall accounts for much of the downtown area of Missoula and discharges into a widely used river for recreation by the public.

Operational Benefits: 2

Without any treatment system in place, maintenance associated with this outfall remained very minimal. Installation of the treatment infrastructure included in Phase 2 of this project will increase the maintenance of this system slightly.

Coordination with other Infrastructure Projects: 3

This project has the potential to coordinate with other infrastructure projects such as water and sewer.

Water Quality: 5

This project involves a significant water quality improvements including minimizing bacteria and controlling storm water temperature through the treatment of first flush runoff events within this downtown drainage area.

Cost Leveling: 3

In consideration of the schedule of projects, the total cost of this project does not require it to advance or defer to a different fiscal year.

Local Economic Effect: 3

The proposed infrastructure improvements included with Phase 2 will require an engineering consultant and contractor. This will allow for selection of a local consultant and contractor and provides local vendors with an opportunity to provide materials for the project.

Reliability: 4

The proposed storm water treatment infrastructure will be a reliable treatment system that will require routine maintenance to remain functional.

Support of Projected Growth: 1

The purpose of this project is to treat the storm water captured with the existing system that is discharged at the outfall. Projected growth is not considered with this project.

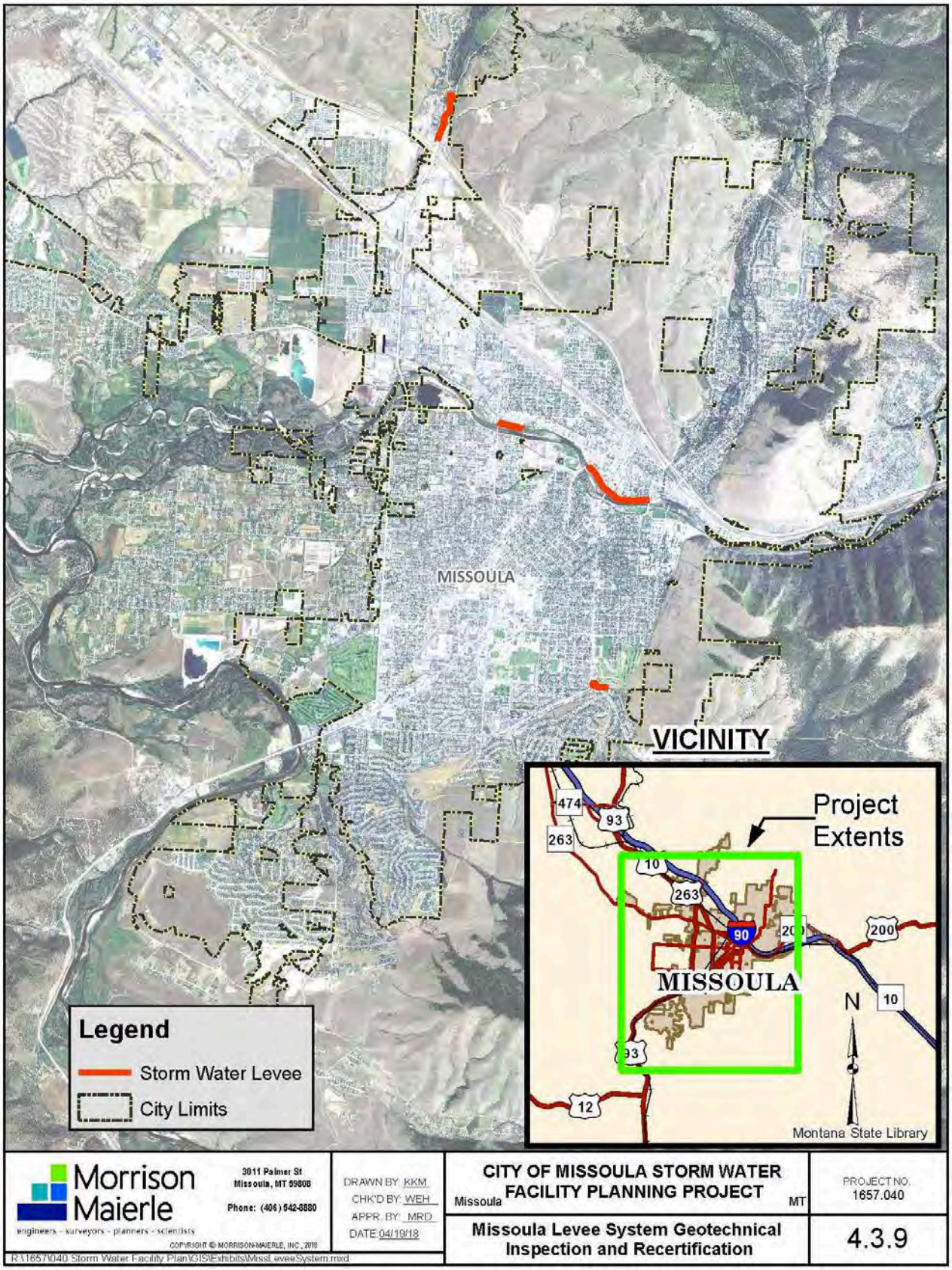
Facility Flexibility: 1

This project does not take into consideration potential changing conditions.

Potential for Failure: 1

The proposed storm water treatment infrastructure is reliable with a long service life.

4.3.9 Missoula Levee System Geotechnical Inspection and Recertification



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R:\1657\040 Storm Water Facility Plan\GIS\Exhibits\MissLeveeSystem.mxd

DRAWN BY: KKM
CHK'D BY: WEH
APPR. BY: MRD
DATE: 04/19/18

CITY OF MISSOULA STORM WATER FACILITY PLANNING PROJECT
Missoula MT

PROJECT NO. 1657.040

Missoula Levee System Geotechnical Inspection and Recertification

4.3.9

Description

This project involves recertification of jurisdictional levees with the City of Missoula.

Project Need

Regulatory requirements set forth by FEMA will require certification of the levee systems. This project involves procedures set forth by regulatory requirements to achieve certification. This project is necessary to maintain the integrity of the levees and to comply with federal regulation.

Proposed Project Recommendations

The City anticipates that FEMA will require certification of the levee systems in the near future. The schedule for the certification process was not known at the time of this report. Therefore, it was assumed that the funding would need to be incurred in 2022.

The cost for certification was estimated based on past experience. Burns & McDonnel completed certification of the North Kansas City Levee Unit in 2013. For that project, the total amount expended for the certification effort was $708,000 and included 32,900 feet of levee ($21.52 per foot). To establish an initial budget, the unit rate of $21.52/foot was applied to the total length of levees in Missoula (18,900 feet), and the amount was escalated from 2013 dollars to 2018 dollars by an annual amount of 3 percent. The result is a unit rate of $25.70/foot of levee in 2018 dollars.

The costs for certification assume that the levees can be successfully certified. Costs to correct major deficiencies that would preclude certification cannot be anticipated. Therefore, 20 percent contingency has been added to address the inaccuracies of the cost opinion and to anticipate additional maintenance if required.

The cost for certification occurs as a lump sum in Fiscal Year 2022. Budget for Fiscal Year 2022 is therefore double that of a normal year. The City may want to distribute the cost of certification over multiple budget periods.

The costs for levee certification provided herein are for budgetary purposes. The tasks and associated costs for levee certification are further evaluated in Chapter 3.

The estimated cost for this project is $582,876. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.9 – Missoula Levee System Geotechnical Inspection and Recertification Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	2	12	24
Regulatory Compliance	2	11	22
Area of Influence of Improvement	4	10	40
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	3	8	24
Water Quality	1	7	7
Cost Leveling	1	6	6
Local Economic Effect	3	5	15
Reliability	4	4	16
Support of Project Growth	1	3	3
Facility Flexibility	2	2	4
Potential for Failure	2	1	2
Project Total	**199**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 2

The Missoula Levees are a public safety feature protecting adjacent and downstream areas from flood events. The levee currently functions and does not warrant immediate imminent danger to the public in its current state. However, routine inspections performed by the USACE provides the structure with a minimally acceptable grade. This structure does not pose imminent public safety risk, but the structure is considered a public safety structure that needs improvements.

Regulatory Compliance: 2

This levee has received a minimally acceptable grade from routine inspections performed by the USACE; however, the structure is not considered out of compliance. Because this structure received notice from a regulatory agency that improvements are recommended but the structure is considered in compliance, a score of two is awarded.

Area of Influence of Improvement: 4

The levees protect adjacent land and a large area of land located downgradient from flooding.

Operational Benefits: 4

This project provides information necessary to maintain the levee.

Coordination with other Infrastructure Projects: 3

This project is located in an area where coordination with other infrastructure projects such as water or sewer are not applicable.

Water Quality: 1

The levee recertification efforts involves minimal water quality improvements.

Cost Leveling: 1

This total cost of this project combined with the ranking resulted in several high cost projects during the same fiscal year. This project was deferred to Fiscal Year 2022 to level the cost for that timeframe.

Local Economic Effect: 3

This project provides potential work for a consultant.

Reliability: 4

This project provides information to support long-term reliability of the levees.

Support of Projected Growth: 1

This project does not apply to projected growth.

Facility Flexibility: 2

The proposed improvements allow the levee to improve from a minimally acceptable score.

Potential for Failure: 2

The amount of trees and vegetation on the levees increase the potential for failure, however no immediate risk was identified.

4.3.10 Storm Water Facility and Operations Planning – Phase 2

Description

The Storm Water Facility and Operations Planning – Phase 2 is a continuation of the Storm Water Facility and Operations Planning Project – Phase 1. The Phase 2 study is a master plan that will provide an in depth analysis of Missoula's entire storm water facility to provide guidance and recommendations for the Storm Water Utility. The study will prepare the City for current and future regulations and provide a comprehensive basis for planning and prioritizing storm water projects.

Project Need

The Phase 1 Storm Water Facility and Operations Planning Project addressed immediate needs for the Storm Water Utility including operations guidance, levee guidance, and a 5-year Capital Improvements Plan. Phase 2 will focus on Storm Water Utility needs in a comprehensive manner. The Phase 2 plan will include a system-wide condition assessment, surveying and GIS database update, flow measurement, basin delineation and definition of basin characteristics, system-wide modeling of the storm water infrastructure within the city, assessment of design standards and recommendations for code revisions, and analysis of alternatives for water quality projects, green infrastructure, and MS4 permit compliance. A model of the entire city would provide a tool for design of future projects.

The City of Missoula is also aware of missing and unknown components within its storm water infrastructure system. In order to provide a complete and accurate GIS database of the entire system, these items need to be identified and mapped. The storm water database includes sumps, storm water pipes, outfalls, inlets, and levees. Inaccuracies and omissions within this database creates management, maintenance, and planning challenges for the City.

Proposed Project Recommendations

It is recommended that the City perform a comprehensive Storm Water Facility Plan including creation of a system-wide hydraulic model, which will serve as a highly effective tool in future studies and design of proposed storm water infrastructure projects.

The estimated cost for this project is $200,000. A detailed cost estimate is provided in Appendix B.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.10 – City of Missoula Storm Water Facility and Operations Planning – Phase 2 Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	2	12	24
Regulatory Compliance	2	11	22
Area of Influence of Improvement	5	10	50
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	1	8	8
Water Quality	2	7	14
Cost Leveling	1	6	6
Local Economic Effect	2	5	10
Reliability	4	4	16
Support of Project Growth	4	3	12
Facility Flexibility	2	2	4
Potential for Failure	1	1	1
Project Total	**203**		

A brief description of the scoring for each criterion is summarized below:

Public Safety: 2

Analyzing the entire storm water utility will provide the city with in depth detail of its system and could lead to discoveries of problems that could pose a threat to public safety.

Regulatory Compliance: 2

Completion of this project would help of the City meet regulations set forth by the MS4 permit and the USACE for Missoula's levee system. In addition, this project would establish or refine recommendations for the City of Missoula Storm Water Standards. However, completion of this effort is not a direct requirement of the MS4 permit.

Area of Influence of Improvement: 5

This project would perform an in-depth analysis of the entire storm water system.

Operational Benefits: 4

Phase 2 proposes a system-wide model of the Storm Water Utility, including baseline information, basin delineation, and runoff patterns. This will provide the City the information necessary to manage the system.

Coordination with other Infrastructure Projects: 1

A score of one is awarded resulting in a delay of this project until Fiscal Year 2022. The planning efforts are deferred until immediate capital improvement needs can be implemented.

Water Quality: 2

The Phase 2 Storm Water Facility and Operations Planning Project will incorporate content and recommendations related to water quality improvements within the Storm Water Utility. The Project will include assessments within the planning efforts; however, implementation may be deferred until a later date. A score of 2 was awarded because the water quality improvements are limited to planning and not implementation.

Cost Leveling: 1

A score of one is awarded to delay this project to Fiscal Year 2022. In consideration of the schedule of projects, the City believes it is appropriate to delay this effort.

Local Economic Effect: 2

The level of effort required to perform Phase 2 will require a consultant. This allows for a local consultant to be hired.

Reliability: 4

Upon completion of Phase 2, the City will have an in-depth Facility Plan with problem areas identified and proposed recommendations that will provide a reliable and functioning storm water utility. Constantly changing conditions keep this criterion from meeting all requirements.

Support of Projected Growth: 4

A system-wide plan of the storm water utility will allow the City to identify the existing infrastructure at a new development location subsequently allowing the City to determine what new infrastructure is required and how it will be connected to the existing system.

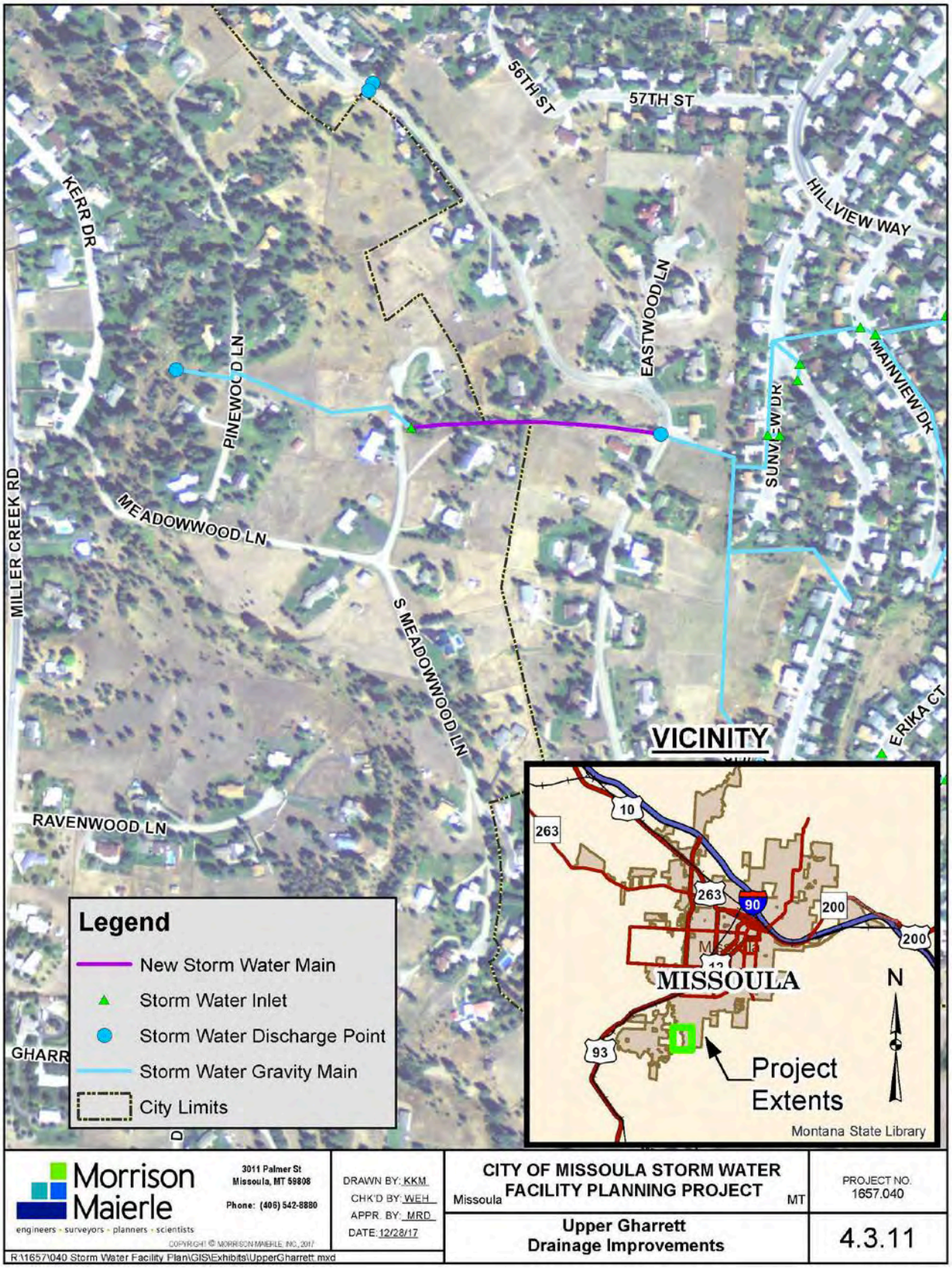
Facility Flexibility: 2

This project would include system-wide model of the storm water utility, allowing the City to quickly identify its infrastructure in particular locations. Any changing conditions that may require infrastructure improvements or repairs are better served from this information. The project would also involve guidance for planning.

Potential for Failure: 1

This project poses a minimal potential for failure. An in-depth analysis of the system has not been performed and upon completion, the City will have a plethora of knowledge on its storm water utility. The storm water utility has known issues but in general has been functioning.

4.3.11 Upper Gharrett Drainage Improvements



Description

The Upper Gharrett Drainage Improvements will address on-going issues with extensive erosion. The erosion affects the natural drainage way, the downgradient storm system, and private property in the Ravenwood neighborhood. This project will reduce the amount of sediment deposition downstream, reduce maintenance for the city, improve public safety, improve storm flow conveyance, prevent loss of sanitary sewer infrastructure, mitigate flooding, and allow the City to meet the MS4 permit requirements.

Project Need

According to City staff, significant erosion and storm water conveyance issues occur in the Ravenwood neighborhood, particularly after large runoff events. Observations by affected homeowners suggest that the culvert located upstream is undersized, resulting in large amounts of sediment being washed downstream. Deposition of the sediment creates flow obstructions and unwanted deposition in residents' property. In addition, an existing sanitary sewer main which crosses the channel is exposed, presenting a risk of damage or main break.

Over the past twelve years, this issue has continued with maintenance typically required after large runoff events. Excessive runoff from upstream streets has caused down cutting of the gulley in excess of 6 feet, creating a public safety hazard. Localized flooding has occurred resulting in floodplain designation. The amount of runoff that this drainage receives likely exceeds the capacity.

Erosion will continue to affect adjacent property owners and could potentially create additional issues (i.e. loss of property and foundation/stability issues) if improvements are not implemented. Down cutting of the channel will continue, deepening the ravine, resulting in increased risk to public safety, additional exposure of the sanitary sewer main crossing, sediment will continue to be deposited downstream, and reactive maintenance will continue for the City. In addition, the amount of sediment transported results in increased risk associated with not meeting MS4 requirements.

Figure 4.3.11-1 Erosion deposition after runoff event

Proposed Project Recommendations

It is recommended that this project be implemented in fiscal year 2019. This project has undergone final engineering design by Territorial Landworks. The design involves conversion of open channel drainage to piped runoff conveyance to eliminate erosion issues. Approximately 1,600 lineal feet of 24-inch storm main will be installed, along with catch basins at turning points in the alignment to allow runoff entering the drainage further downstream to enter the system. All eroded areas outside of the drainage easement boundary will be re-graded to reduce the public safety risk and prevent continued erosion issues.

The estimated cost for this project is $438,500 for construction and $48,450 for design resulting in a project total of $486,950. A detailed cost estimate is not included for this project as engineering design has been completed by Territorial Landworks, and the City has all information required to implement this project.

Project Score

The project was assigned numeric scores according to the ranking criteria summarized above in Section 2. The table below summarizes the score for each criterion and the overall project score.

Table 4.3.11 – Upper Gharrett Drainage Improvements Ranking Summary

Project Scoring Criterion	Score	Weighted Factor	Weighted Score
Public Safety	5	12	60
Regulatory Compliance	2	11	22
Area of Influence of Improvement	3	10	30
Operational Benefits	4	9	36
Coordination with other Infrastructure Projects	3	8	24
Water Quality	4	7	28
Cost Leveling	3	6	18
Local Economic Effect	3	5	15
Reliability	4	4	16
Support of Project Growth	1	3	3
Facility Flexibility	1	2	2
Potential for Failure	5	1	5
Project Total	**259**		

Public Safety: 5

The erosion issues involved with this project create a significant public safety risk that is evident with the estimated six-foot deep gully. Due to the observed safety risk that exists and the potential for increased risk, this criterion is awarded a score of five.

Regulatory Compliance: 2

The problems identified for this project do not lead to unsatisfactorily meeting any set regulations. Proposed improvements have already gone through engineering design and likelihood of any permits outside of what may be required by the City are low.

Area of Influence of Improvement: 3

This project affects essentially five homeowners located adjacent to the existing open channel drainage. However, the drainage conveys water that is collected from the streets located upstream.

Operational Benefits: 4

City of Missoula performs maintenance in this area as a reactive effort triggered by requests from residents, particularly after large storm events. Proposed infrastructure improvements will likely reduce any maintenance required by the City.

Coordination with Other Infrastructure Projects: 3

This project is located in an area where coordination with other infrastructure projects such as water or sewer are not applicable.

Water Quality: 4

The current condition results in significant erosion due to the unstable nature of the terrain. Implementation of this project will result in measurable reduction of sediment and significant improvement of water quality.

Cost Leveling: 3

In consideration of the schedule of projects, the total cost of this project does not require this project to advance or defer to a different fiscal year.

Local Economic Effect: 3

The implementation of the design allows for a local contractor to be selected and local vendors to supply materials.

Reliability: 4

This project improves the conveyance of runoff collected from streets located upstream from the drainage. The proposed improvements will provide reliable flow conveyance that will likely eliminate or drastically reduce erosion issues.

Support of Projected Growth: 1

This project will add beehive inlets in the restored and re-contoured drainage, which will allow for adjacent surface drainage to enter the new storm water pipe. This will provide for existing conditions and allow for some future impervious development to occur however the support of project growth is nominal.

Facility Flexibility: 1

This project does not take into consideration potential changing conditions.

Potential for Failure: 5

The existing issues experienced create significant safety risks and observed down cutting and erosion illustrate failure of the system in place. Ignoring these issues will only increase the likelihood for catastrophic failure that could result in loss of property and houses experiencing foundation and stability issues. Continued erosion will also further compromise a sanitary sewer main that crosses this drainage which is already washed-out and exposed.

4.4. Cost Estimates and Prioritization

The City of Missoula provided a list of capital improvements projects that was refined and further defined, resulting in the recommended projects described above. The table below lists the capital improvements projects in order of priority based on score. The highest potential score for a project is 390 and the lowest is 78.

Cost estimates were developed for the projects based on standards developed by the American Association of Cost Engineers (AACE). The AACE established definitions commonly used in cost estimating and collected and published the limits of confidence associated with different AACE-defined levels of cost estimates. (*Cost Estimate Classification System – As Applied in Engineering Procurement, and Construction for the Process Industries*, AACE, 2005) The cost estimates presented in this Plan are categorized by AACE as a Class 4 Estimate based on the following description:

> *Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 15% complete, and would comprise at a minimum the following: plant capacity, block schematics, indicated layout, process flow diagrams (PFDs) for main process systems, and press and utility equipment lists*.

Class 4 estimates are typically prepared for preliminary budget approval, such as a Capital Improvements Plan and by definition have an expected accuracy range of -15% to +30% depending on the complexity of the project and level of definition of the project.

Estimates for general conditions, engineering costs, and specific project components were developed using average costs from actual projects in Missoula and other municipal projects in Montana over the last five years. A contingency of 25 percent was used.

Based on the anticipated budget required for operation of the Missoula storm water facility outlined in Chapter 2, the projects listed below have been broken down for implementation for years one through five. The anticipated funding for each year with corresponding infrastructure projects and operations and maintenance costs are provided in more detail below.

Table 4.4.1 – Recommended Capital Improvements Plan

Project Rank	Project	Priority Ranking Score	Base Cost FY2018	Adjusted Cost with Escalation				
				FY2019	FY2020	FY2021	FY2022	FY2023
1a	Upper Gharrett / South Hills Dr Drainage Improvements - Design	259	$48,450	$49,904				
1b	Upper Gharrett / South Hills Dr Drainage Improvements - Construction	259	$438,500		$465,205			
	Debt service - SRF			*$4,039*	*$41,693*	*$41,693*	*$41,693*	*$41,693*
2	Mullan Road Corridor Storm Water Drainage Master Plan	232	$60,000	$61,800				
	Debt service - other			*$8,003*	*$8,003*	*$8,003*	*$8,003*	*$8,003*
3	Linda Vista Storm Water Drainage Study	208	$60,000		$63,654			
	Debt service - other				*$8,243*	*$8,243*	*$8,243*	*$8,243*
4	Caras Park Outfall Pretreatment Retrofit Project - Phase 2	208	$451,570			$493,443		
	Debt service - SRF					*$39,939*		
5	Highpark Drainage System Improvements	207	$391,490			$427,792		
	Debt service - SRF					*$34,625*	*$34,625*	*$34,625*
6a	Hillside Streets Inlet Grate Replacement Project	206	$160,888			$175,807		
	Debt service - SRF					*$14,230*	*$14,230*	*$14,230*
6b	Hillside Streets Inlet Grate Replacement Project	206	$160,888				$181,081	
	Debt service - SRF						*$14,657*	*$14,657*
6c	Hillside Streets Inlet Grate Replacement Project	206	$160,888					$186,513

Project Rank	Project	Priority Ranking Score	Base Cost FY2018	Adjusted Cost with Escalation				
				FY2019	FY2020	FY2021	FY2022	FY2023
	Debt service - SRF							*$15,096*
7	City of Missoula Storm Water Facility and Operations Plan - Phase 2	203	$200,000				$225,102	
	Debt service - other						*$29,152*	*$29,152*
8	Missoula Levee Geotechnical Inspection and Recertification	199	$582,876				$656,032	
	Debt service - SRF						*$53,099*	*$53,099*
9	Grant Creek Levee	197	$275,843					$319,777
	Debt service - SRF							*$25,883*
10	Hillview Heights Storm Water Drainage Upgrades	184	$99,100					$114,884
	Debt service - SRF							*$9,299*
11	Grantland #13 Subdivision Storm Drain Study	176	$60,000					*$69,556*
	Debt service - other							$9,008
	TOTAL PROJECT COST		**$3,150,493**	**$111,704**	**$528,859**	**$1,097,041**	**$1,062,215**	**$690,731**
	TOTAL DEBT SERVICE - SRF			*$12,043*	*$57,940*	*$146,734*	*$203,702*	*$262,988*
	TOTAL DEBT SERVICE - OTHER			*$8,003*	*$16,247*	*$16,247*	*$45,399*	*$54,406*
	TOTAL DEBT SERVICE (combined)		**$823,709**	**$20,046**	**$74,187**	**$162,981**	**$249,101**	**$317,395**
	TOTAL ALL CIP COSTS		**$4,314,258**	**$131,749**	**$603,045**	**$1,260,022**	**$1,311,316**	**$1,008,125**

1. Escalation Costs are based on a 3% annual adjustment.
2. Adjusted escalation cost is value based upon indicated fiscal year.
3. Hillside Streets Inlet Grate Replacement Project is distributed as an annual cost over a 10-year period; FY2021 - FY2031.

Table 4.4.2 – Summary of Recommended Budget for Missoula Storm Water Utility

Activity	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Utility Management, Administration & Permit Compliance	$411,600	$420,100	$506,000	$511,000	$558,300
Storm Water System Operation and Maintenance	$3,100	$79,500	$435,200	$336,900	$571,700
Levee System Operation and Maintenance	$28,600	$55,800	$72,200	$91,700	$112,700
Administration, Operation and Maintenance Total	**$443,300**	**$555,400**	**$1,013,400**	**$939,600**	**$1,242,700**
Capital Improvements Infrastructure Budget	$131,800	$603,100	$1,260,100	$1,311,400	$1,008,200
Storm Water Utility Total	**$575,100**	**$1,158,500**	**$2,273,500**	**$2,251,000**	**$2,250,900**

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